TG8000
Multiformat Test Signal Generator

User Manual

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Multiformat Test Signal Generator

User Manual

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Important safety information

This manual contains information and warnings that must be followed by the user for safe operation and to keep the product in a safe condition.

To safely perform service on this product, additional information is provided at the end of this section. (See page xiv, *Service safety summary*.)

General safety summary

Use the product only as specified. Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. Carefully read all instructions. Retain these instructions for future reference.

Comply with local and national safety codes.

For correct and safe operation of the product, it is essential that you follow generally accepted safety procedures in addition to the safety precautions specified in this manual.

The product is designed to be used by trained personnel only.

Only qualified personnel who are aware of the hazards involved should remove the cover for repair, maintenance, or adjustment.

Before use, always check the product with a known source to be sure it is operating correctly.

This product is not intended for detection of hazardous voltages.

Use personal protective equipment to prevent shock and arc blast injury where hazardous live conductors are exposed.

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

When incorporating this equipment into a system, the safety of that system is the responsibility of the assembler of the system.

To avoid fire or personal injury

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

Do not use the provided power cord for other products.

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

Do not disable the power cord grounding connection.

Power disconnect. The power cord disconnects the product from the power source. See instructions for the location. Do not position the equipment so that it is difficult to disconnect the power cord; it must remain accessible to the user at all times to allow for quick disconnection if needed.

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

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

Do not operate without covers. Do not operate this product with covers or panels removed, or with the case open. Hazardous voltage exposure is possible.

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

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

Disable the product if it is damaged. Do not use the product if it is damaged or operates incorrectly. If in doubt about safety of the product, turn it off and disconnect the power cord. Clearly mark the product to prevent its further operation.

Before use, inspect voltage probes, test leads, and accessories for mechanical damage and replace when damaged. Do not use probes or test leads if they are damaged, if there is exposed metal, or if a wear indicator shows.

Examine the exterior of the product before you use it. Look for cracks or missing pieces.

Use only specified replacement parts.

Do not operate in wet/damp conditions. Be aware that condensation may occur if a unit is moved from a cold to a warm environment.

Do not operate in an explosive atmosphere.

Keep product surfaces clean and dry. Remove the input signals before you clean the product.

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

Slots and openings are provided for ventilation and should never be covered or otherwise obstructed. Do not push objects into any of the openings.

Provide a safe working environment. Always place the product in a location convenient for viewing the display and indicators.

Avoid improper or prolonged use of keyboards, pointers, and button pads. Improper or prolonged keyboard or pointer use may result in serious injury.

Be sure your work area meets applicable ergonomic standards. Consult with an ergonomics professional to avoid stress injuries.

Use only the Tektronix rackmount hardware specified for this product.

Service safety summary

The *Service safety summary* section contains additional information required to safely perform service on the product. Only qualified personnel should perform service procedures. Read this *Service safety summary* and the *General safety summary* before performing any service procedures.

To avoid electric shock. Do not touch exposed connections.

Do not service alone. Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

Disconnect power. To avoid electric shock, switch off the product power and disconnect the power cord from the mains power before removing any covers or panels, or opening the case for servicing.

Use care when servicing with power on. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

Verify safety after repair. Always recheck ground continuity and mains dielectric strength after performing a repair.

Terms in this manual

These terms may appear in this manual:

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

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

Symbols and terms on the product

These terms may appear on the product:

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

When this symbol is marked on the product, be sure to consult the manual to find out the nature of the potential hazards and any actions which have to be taken to avoid them. (This symbol may also be used to refer the user to ratings in the manual.)

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

CAUTION
Refer to Manual

Protective Ground
(Earth) Terminal

Compliance information

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

EMC compliance

EC declaration of conformity – EMC

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

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

- Environment E2 – commercial and light industrial
- Part 1 Emission
  - EN 55022:2006. Class B radiated and conducted emissions
  - EN 55103-1:2009 Annex A. Radiated magnetic field emissions
- Part 2 Immunity
  - IEC 61000-4-2:2001. Electrostatic discharge immunity
  - IEC 61000-4-3:2007. RF electromagnetic field immunity
  - IEC 61000-4-4:2004. Electrical fast transient / burst immunity
  - IEC 61000-4-5:2005. Power line surge immunity
  - IEC 61000-4-6:2006. Conducted RF Immunity
  - IEC 61000-4-11:2004. Voltage dips and interruptions immunity
  - EN 55103-2:2009 Annex A. Radiated magnetic field immunity
  - EN 55103-2:2009 Annex B. Balanced ports common mode immunity

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

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

European contact.

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

EMC compliance

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

European contact.

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

1 To ensure compliance with the EMC standards listed here, high quality shielded interface cables should be used.

2 Peak in-rush current: up to 3 A.

Australia / New Zealand declaration of conformity – EMC

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

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

Safety compliance

This section lists the safety standards with which the product complies and other safety compliance information.

EC declaration of conformity – low voltage

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

Low Voltage Directive 2006/95/EC.

- EN 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.

U.S. nationally recognized testing laboratory listing

- UL 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.

Canadian certification

- CAN/CSA-C22.2 No. 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.

Additional compliances

- IEC 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.

Equipment type

Test and measuring equipment.

Safety class

Class 1 – grounded product.

Pollution degree descriptions

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

- Pollution Degree 1. No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.
- Pollution Degree 2. Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.

- Pollution Degree 3. Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.
- Pollution Degree 4. Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.

Pollution degree rating

Pollution Degree 2 (as defined in IEC 61010-1). Rated for indoor, dry location use only.

IP rating

IP20 (as defined in IEC 60529).

Measurement and overvoltage category descriptions

Measurement terminals on this product may be rated for measuring mains voltages from one or more of the following categories (see specific ratings marked on the product and in the manual).

- Category II. Circuits directly connected to the building wiring at utilization points (socket outlets and similar points).
- Category III. In the building wiring and distribution system.
- Category IV. At the source of the electrical supply to the building.

NOTE. *Only mains power supply circuits have an overvoltage category rating. Only measurement circuits have a measurement category rating. Other circuits within the product do not have either rating.*

Mains overvoltage category rating

Overvoltage category II (as defined in IEC 61010-1).

Environmental considerations

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

Product end-of-life handling

Observe the following guidelines when recycling an instrument or component:

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

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

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

Restriction of hazardous substances

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

Preface

This manual describes how to install and operate the TG8000 Multiformat Test Signal Generator.

Supported products

The information in this manual applies to the following Tektronix products:

- TG8000 mainframe (includes the replaceable Power Supply module)
- AG7 Audio Generator module
- AGL7 Analog Genlock module
- ATG7 Analog Test Generator module
- AVG7 Analog Video Generator module
- AWVG7 Analog Wideband Video Generator module
- BG7 Black Generator module
- DVG7 Digital Video Generator module
- GPS7 GPS Synchronization and Timecode module
- HD3G7 HD 3 Gb/s SDI Video Generator module
- HDLG7 HD Dual Link Generator module
- HDVG7 HDTV Digital Video Generator module
- SDI7 Dual Channel SD/HD/3G SDI Video Generator module

About this manual

This manual is composed of the following sections:

- *Getting Started* shows you how to configure and install your TG8000 system and provides an Incoming Inspection procedure. The section also describes the mainframe options and how to install modules.
- *Operating Basics* provides an overview of the front-panel controls and rear-panel connections.
- *Modules* provides operating information for each of the modules that can be added to the TG8000 mainframe.

Product documentation

The following table lists the user documents for the TG8000 and its related modules:

Table i: TG8000 Multiformat Test Signal Generator documentation

Document	Tektronix Part Number	Description	Availability		
			Print	Web	CD
User Manual	071-3036-xx (English) 071-3037-xx (Japanese) 071-3038-xx (Russian)	Describes how to install, operate, and configure the instrument	✓	✓ ✓ ✓	✓ ✓ ✓
PC Tools Technical Reference	077-0684-xx	Describes how to use the PC tools software that is supplied with the instrument		✓	✓
Specifications and Performance Verification	077-0685-xx	Lists the product specifications and provides procedures for verifying the performance of the instrument		✓	✓
Programmer Manual	077-0686-xx	Provides programming information for the mainframe and related modules		✓	✓
Service Manual	077-0687-xx	Describes how to service the mainframe to the module level (such as circuit boards and fuses) and provides information about servicing generator modules		✓	
Declassification and Security Instructions	077-0688-xx	Describes how to clear or sanitize the data storage (memory) devices in the product for customers with data security concerns.		✓	
Release Notes	077-0689-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 (ECO422D) 077-0877-xx (ECO8000 / ECO8020)	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.		✓	✓

Getting started

Getting started

This section contains the following information to get you started using the TG8000 generator:

- Product description
- List of instrument accessories and options
- Initial product inspection procedure
- Installation instructions (mainframe and modules)
- Functional check procedures

Product description

The TG8000 Multiformat Test Signal Generator is a multiformat TV signal generator platform supporting both analog and digital video standards. The TG8000 consists of a mainframe and up to four plug-in modules. The modules are either signal generators or they provide special functions, such as genlock capability.

Key features

The TG8000 and the available modules provide the following features:

- Simultaneous generation of HDTV/SDTV synchronization signals and test signals in a variety of formats
- Modular architecture with up to four generators or special function modules
- Analog genlock function dealing with NTSC or PAL black burst signal, HDTV trilevel sync signal, and CW signals (AGL7)
- Synchronization with the GPS timing signal (GPS7)
- Timecode generator with VITC (GPS7 and BG7), with LTC (GPS7), and with ATC (HDVG7) when a GPS7 module is installed
- Timecode generator with ATC (HD3G7 and SDI7) with or without a GPS7 module
- Dual link SDI generator and converter (HDLG7)
- 3 Gb/s SDI video generator (HD3G7 and SDI7 with Option 3G)
- 3 Gb/s SDI video converter (HD3G7)
- Independent setting of amplitudes, frequencies, and audio clicks of 16 channel embedded audio signal (DVG7 and HDVG7)
- Independent setting of amplitudes, frequencies, and audio clicks of embedded audio signal (up to 32 channels) (HD3G7 and SDI7)

- Circle, logo, and text overlays on test signals (AVG7, AWVG7, DVG7, HDVG7, SDI7)
- Zone plate signals (HD3G7 and SDI7)
- Moving picture generation function by scrolling the active area of the signal (AVG7, AWVG7, DVG7, HD3G7, HDLG7, HDVG7, and SDI7)
- User-defined ancillary data payload (HD3G7 and SDI7)
- Reference generator performance level
- Ethernet interface for remote control, upgrading the instrument firmware, and downloading or copying various user data such as test signal files, logo files, and preset files
- General Purpose Interface (GPI) port for recalling instrument presets and outputting alarm signals
- USB port for upgrading the instrument firmware and backing up or restoring user data such as test signal files, logo files, and preset files
- User replaceable Power Supply module

Contents of the *TG8000 and TG700 Software Library and Documentation DVD*

A signal library, software application packages, and product documentation for both the TG8000 and TG700 generators are included in the *TG8000 and TG700 Software Library and Documentation DVD*, which is provided as a standard accessory with the product. You can use the contents of the DVD to execute the following operations:

- Upload and download files such as signal files, logo files, and preset files
- Download signals from the signal library to the generator mainframe
- Create a logo (logo file) to be inserted into the test signal
- Create a frame picture file using the generation of a picture or test pattern

Module compatibility between the TG8000 and TG700 mainframes

Each of the modules that was designed to operate in the Tektronix TG700 TV Signal Generator Platform will also operate in the TG8000 mainframe.

GPS7 module. The adjustment of the mainframe oscillator depends on the mainframe in which the GPS7 module is installed:

- **TG8000 mainframe:** You need to set only the internal frequency of the mainframe oscillator. (See page 3-100, *GPS7 module oven calibration procedures*.)
- **TG700 mainframe:** You need to set the internal frequency of the mainframe oscillator and characterize the mainframe oscillator frequency as a function of voltage. Refer to the TG700 User Manual for more information (Tektronix part number 071-1970-XX).

SDI7 module. The behavior of the Moving Picture function depends on the mainframe in which the SDI7 module is installed:

- **TG8000 mainframe:** 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."
- **TG700 mainframe:** When Moving Picture is enabled, the circle and text overlays remain static and the logo overlay moves regardless of the signal type (standard test signal or "frame (.BMP) picture").

Accessories

The following table lists the standard and optional accessories provided with the TG8000 mainframe and modules.

Table 1-1: Standard and optional accessories

Accessory	Std.	Opt.	Tektronix part number
TG8000 Multiformat Test Signal Generator User Manual (English) Japanese and Russian language versions are available in PDF format on the product DVD.	•		071-3036-xx
TG8000 Multiformat Test Signal Generator Software Library and Product Documentation DVD	•		063-4440-xx
Rackmounting hardware	•		351-1137-00
Power cord (See page 1-4, *International power cord options*.)	•		Varies by option
Blank rear panel		•	614-1051-00
GPS antenna		•	SPG8000ANT

Options and upgrades

Mainframe and module options

The following table lists the options that can be ordered with the TG8000 mainframe and modules.

Table 1-2: Instrument and module options

Option	Description	Instrument/module
3G	When you order Option 3G, an option key is provided which enables 3G-SDI signal generation on the module for which the option is specified.	SDI7
D1	When you order Option D1, a Calibration Test Data Report is provided with the instrument and/or module for which the option is specified.	TG8000 mainframe, AG7, AGL7, ATG7, AVG7, AWVG7, GPS7, HD3G7, HDLG7, HDVG7, SDI7
BK	When you order Option BK, two serial digital black signal outputs are added to the module.	DVG7, HDVG7
CB	When you order Option CB, 10 field ID and NTSC/PAL color bars signals can be output from the BLACK3 and BLACK4 outputs.	BG7

International power cord options

All of the available power cord options listed below include a lock mechanism except as otherwise noted.

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

Firmware and hardware upgrades

Firmware upgrades. Tektronix releases product updates to add new features and to fix problems with the software or firmware. You can find the latest firmware for your product at the Tektronix Web site (www.tektronix.com/downloads). (See page 2-51, *How to upgrade the instrument firmware*.)

Hardware upgrades. You can order any of the modules listed at the front of this manual to install in the TG8000 generator mainframe. (See page xxi, *Supported products*.) In addition, you can order a replacement Power Supply module for the TG8000 mainframe by purchasing a TG800UP PW upgrade.

Initial product inspection

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

1. Inspect the shipping carton for external damage, which may indicate damage to the instrument.
2. Remove the TG8000 generator from the shipping carton, and then check that the instrument has not been damaged in transit. Prior to shipment the instrument is thoroughly inspected for mechanical defects. The exterior should not have any scratches or impact marks.

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

3. Verify that the shipping carton contains the basic instrument, all modules you ordered, the standard accessories and any optional accessories that you ordered listed in the table. (See Table 1-1.)

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

To install the mainframe

This section provides installation information for the TG8000 mainframe.

Module installation

The TG8000 mainframe is shipped with the generator modules that you ordered already installed and configured. You can add or remove modules as necessary for your application. (See page 1-10, *Module installation and removal*.)

Rackmount installation

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

The TG8000 is configured at shipment for use in an equipment rack. Refer to the *Rackmount Slides and Rails Kit Instructions*, Tektronix part number 071-2746-XX, that was supplied with the instrument for instructions on how to install the rackmounting hardware.

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

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

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

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

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

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

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

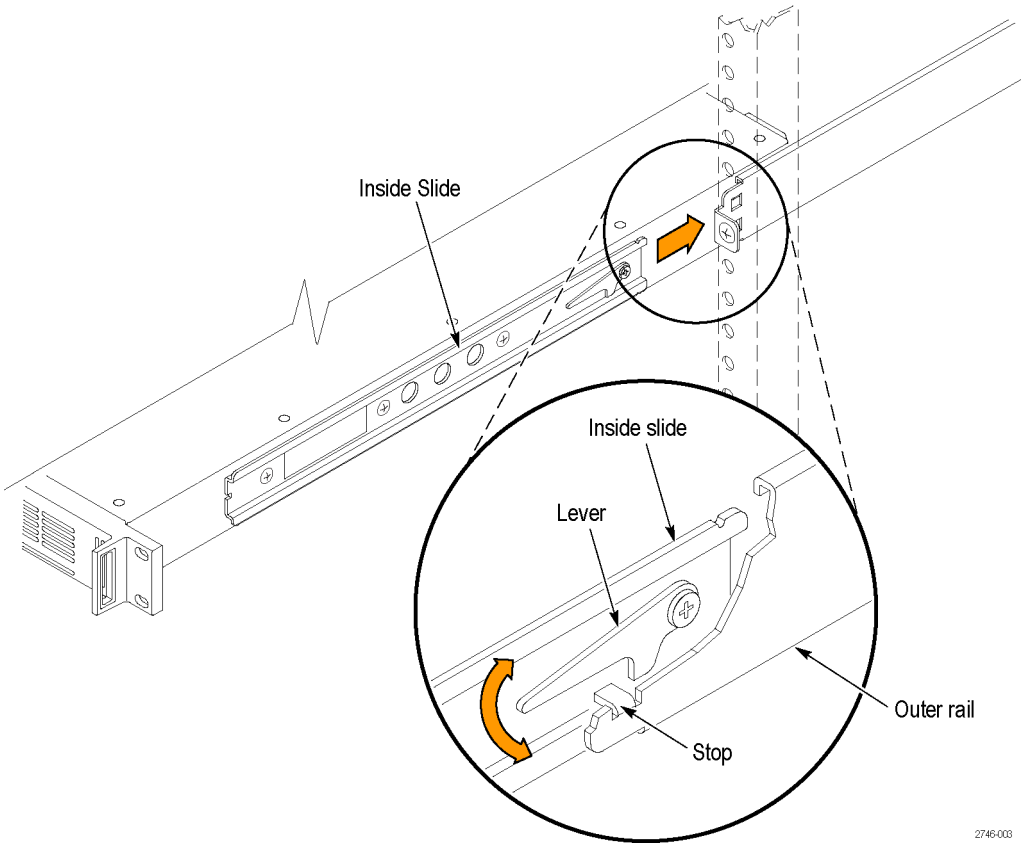


Figure 1-1: Installing or removing the instrument into or from the rack

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

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

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

Environmental operating requirements

Check that the location of your installation has the proper operating environment as listed in the following table. (See Table 1-3.)

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

Table 1-3: TG8000 environmental requirements

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

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

For complete specifications for the instrument, refer to the *TG8000 Specifications and Performance Verification Technical Reference* provided on the DVD that shipped with your instrument.

Power connection

The TG8000 operates from a single-phase power source with the neutral conductor at or near earth ground. The line conductor is fused for over-current protection. A protective ground connection through the grounding conductor in the locking power cord is essential for safe operation.

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

AC power requirements. Check that your location provides the proper electrical power requirements as listed in the following table. (See Table 1-4.)

Table 1-4: AC line power requirements

Parameter	Description
Line Voltage Range	100 - 240 VAC ***WARNING.*** *To reduce the risk of fire and shock, ensure that the mains supply voltage fluctuations do not exceed 10% of the operating voltage range.*
Line frequency	50/60 Hz
Maximum power	120 VA

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

After connecting the power, make sure that the fan on the rear panel is working. If the fan is not working, turn off the power by disconnecting the power cable from the AC power source, and then contact your local Tektronix Field Office or representative.

Module installation and removal

The following procedures describe how to install and remove modules from the TG8000 mainframe. A screwdriver with a #1 Phillips tip is the only tool you need to install or remove a module.

CAUTION. *To prevent damage to the mainframe and module, always remove the power cord before installing or removing a module.*

To prevent instrument problems, be sure to upgrade the instrument firmware to the latest version before you install a new module. If you install a module with newer firmware than the version installed in the instrument mainframe, the instrument may not boot up. (See page 2-51, How to upgrade the instrument firmware.)

To prevent component damage

CAUTION. *Electrostatic discharge (ESD) can damage components on the module and mainframe. To prevent ESD or other component damage, follow the guidelines below when installing, removing or handling a module.*

- Wear a grounded antistatic wrist strap to discharge the static voltage from your body while installing or removing modules from the TG8000 mainframe.
- Transport and store modules in a static-protected bag or container.
- Do not slide the module over any surface.
- Handle modules as little as possible.
- Do not touch module components or connector pins.
- Do not use any devices capable of generating or holding a static charge in the work area where you remove, install, or handle modules.
- Avoid handling modules in areas that have a floor or work-surface covering capable of generating a static charge.
- Do not remove the module circuit board assembly from the shield. The shield is an important stiffener which prevents damage to surface-mount components.

To install a module

To install a module into an empty slot in the mainframe, perform the following procedure:

1. Unplug the power cord from the power connector on the rear panel of the mainframe.
2. Use the following guidelines to select the slot where you will install the module. The following figure shows a sample module configuration with the associated slot numbers.
   - For AGL7 and GPS7 modules, only one of these modules can be installed in the TG8000 mainframe at a time, and it must be installed only in slot 1. All other modules may be installed in any slot location.

NOTE. *When installing a GPS7 module into an existing TG8000 mainframe, it is suggested that you calibrate the mainframe oscillator oven as part of the installation and qualification process. (See page 2-46, CAL OVEN submenu (GPS7 module only).)*

Although the GPS7 module will operate only in slot 1, you can use the GPS7 module to test diagnostics in each of the four mainframe slots. Refer to the TG8000 Specifications and Performance Verification Technical Reference for more information.

   - For the AG7, ATG7, AVG7, AWVG7, BG7, DVG7, HD3G7, HDLG7, HDVG7, and SDI7 modules, up to four of the modules can be installed in the TG8000 mainframe.
   - The TG8000 Power Supply module is user replaceable and must be installed only in the position shown in the following figure. The TG8000 Power Supply module cannot be installed in a TG700 mainframe.

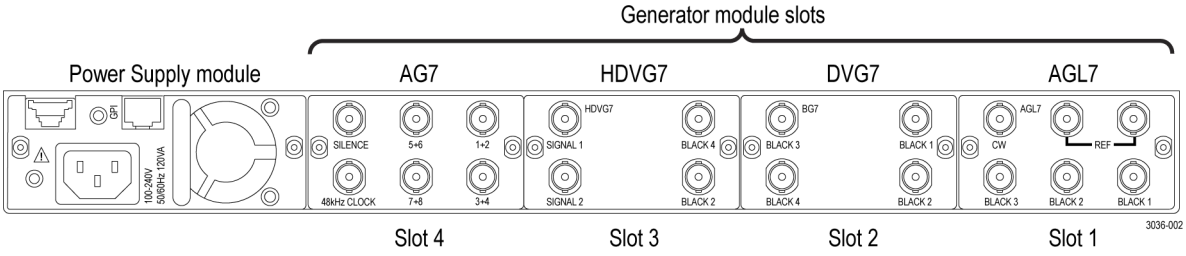


Figure 1-2: TG8000 slot numbering

3. Use a screwdriver with a #1 Phillips tip to loosen the two screws of the blank panel attached to the slot you want to use, and then pull it away from the instrument. Save the blank panel for future use. (See Figure 1-3.)

   If you are installing a new module into a slot that already contains a module, remove the existing module. (See page 1-14, *To remove a module*.)

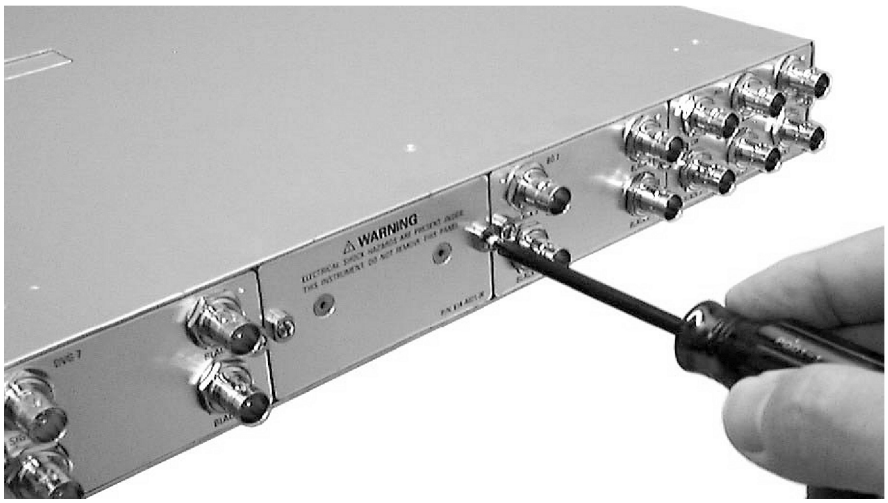


Figure 1-3: Removing the blank panel

CAUTION. *Be careful not to damage the parts and cables inside of the module when you insert the module into the mainframe.*

4. Insert the module into the slot, paying attention to the module orientation. (See Figure 1-4.) Push the module into the slot until the connector board of the module is firmly engaged with the Main board of the mainframe.

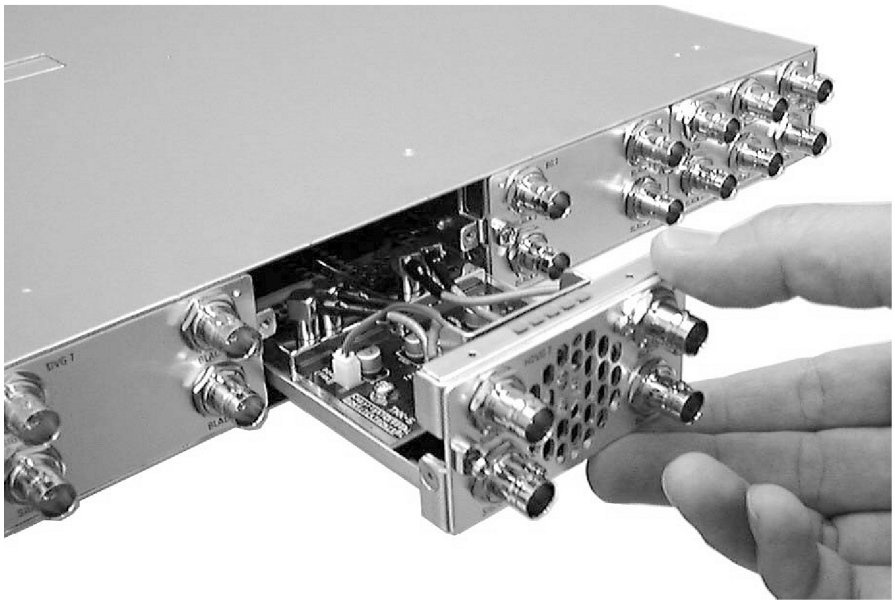


Figure 1-4: Installing a module

5. Tighten the two screws to secure the module to the mainframe. (See Figure 1-5.)

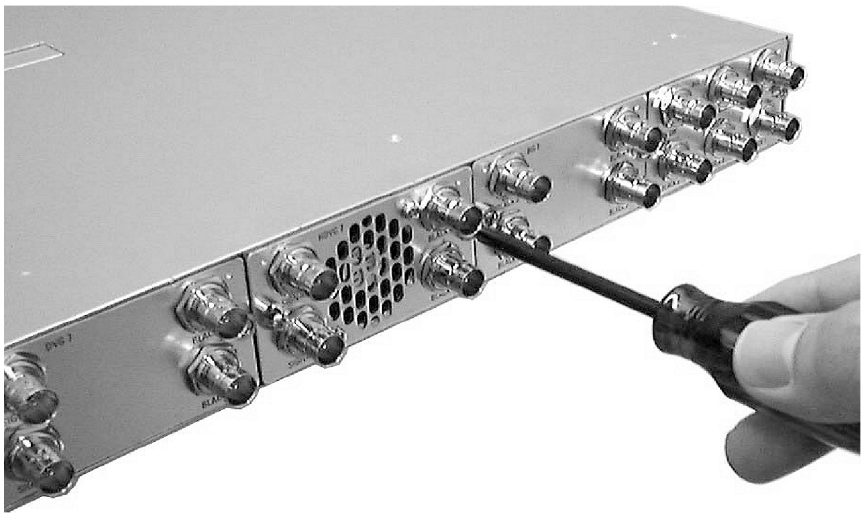


Figure 1-5: Securing a module

To remove a module

To remove a module from the mainframe, perform the following procedure:

CAUTION. *To facilitate module removal, attach terminations or BNC cables to the module connectors. The connector may be damaged if too much force is applied to it during module removal.*

1. Unplug the power cord from the power connector on the mainframe rear panel.
2. Attach 75 Ω terminations or BNC cables to the BNC connectors on the module to be removed. Module removal becomes easier if the terminations or cables are attached to the connectors at the left and right ends.
3. Use a screwdriver with a #1 Phillips tip to loosen the two screws securing the module to the mainframe.

CAUTION. *Be careful not to damage the parts and cables inside of the module when you remove the module from the mainframe.*

4. Pull the module slowly toward you while supporting the terminations or BNC cables attached to the connectors. (See Figure 1-6.)

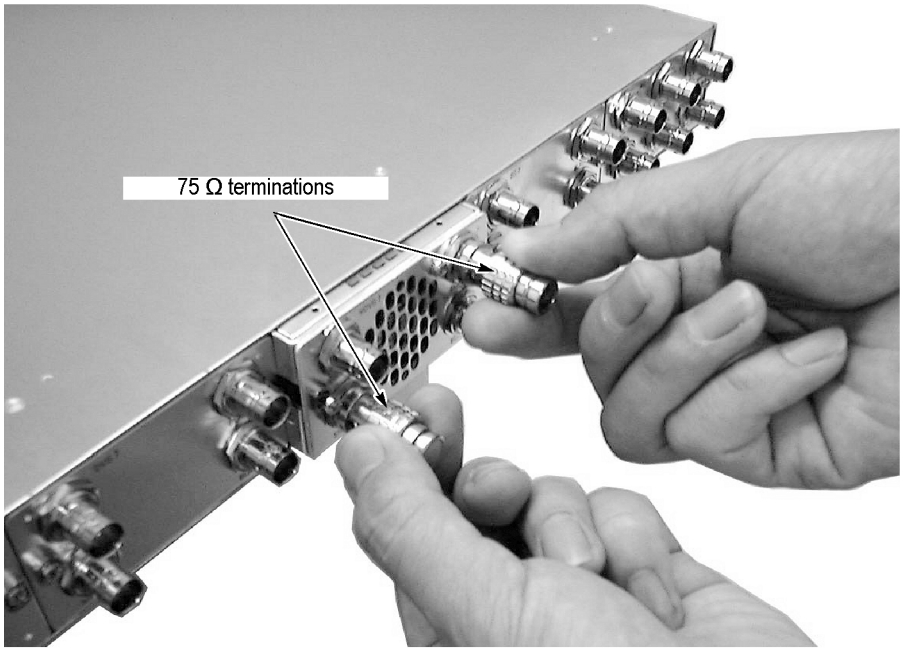


Figure 1-6: Removing a module

5. If this empty slot will not be used, you must attach a blank panel to the mainframe to control instrument cooling and EMI emissions.
   a. Align the blank panel with the open slot of the mainframe.
   b. Tighten the two screws to secure the blank panel to the mainframe.

   A blank panel is available as an optional accessory for the TG8000 mainframe. Refer to *Accessories*. (See page 1-3.)
6. If you want to install another module into the slot from which the module is removed, perform *Installing a Module* starting at step 4. (See page 1-10, *Module installation and removal*.)

Functional checks

Use the following procedures to check that the TG8000 modules installed in your instrument are functional.

AG7 module functional check

Use the following procedure to check that the AG7 Audio Generator module is functional:

Required equipment.

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

Procedure.

1. Install the module into the TG8000 mainframe. (See page 1-10.)
2. Power on the TG8000 mainframe by connecting it to the power source. The initialization process for all installed modules is executed.
3. Check that no error messages appear on the LCD display.
4. Warm up the instrument for 20 minutes.
5. Press the front-panel **MODULE** button until the AG7 main menu as shown below appears.

6. Connect the **1+2** connector to the digital audio monitor using the 75 Ω BNC cable.

7. Set the digital audio monitor to display the status for the audio data.
8. Check that any CRC error does not appear on the monitor.
9. Change the BNC cable from the **1+2** connector to the **3+4** connector, and check that no CRC errors appear on the monitor.
10. Change the BNC cable from the **3+4** connector to the **5+6** connector, and check that no CRC errors appear on the monitor.
11. Change the BNC cable from the **5+6** connector to the **7+8** connector, and check that no CRC errors appear on the monitor.
12. Change the BNC cable from the **7+8** connector to the **SILENCE** connector, and check that no CRC errors appear on the monitor.
13. Connect the **48 kHz CLOCK** connector to the oscilloscope CH1 input using the 75 Ω BNC cable and 75 Ω termination.
14. Check that the appropriate clock signal is displayed on the screen.

AGL7 module functional check

Use the following procedure to check that the AGL7 Analog Genlock module is functional:

Required equipment.

- TV signal generator
- NTSC/PAL waveform monitor
- HDTV waveform monitor
- 75 Ω BNC cable
- 75 Ω termination

Procedure.

1. Install the module into the TG8000 mainframe. (See page 1-10.)
2. Power on the TG8000 mainframe by connecting it to the power source. The initialization process for all installed modules is executed.
3. Check that no error messages appear on the LCD display.
4. Warm up the instrument for 20 minutes.

Genlock function.

5. Press the front-panel **MODULE** button until the AGL7 main menu shown below appears.

```
AGL7 [1] : GENLOCK : STATUS
    Internal
```

6. Press the up (▲) or down (▼) arrow button to select **GENLOCK** from the main menu and then press the **ENTER** button.
7. Press the left (◄) or right (►) arrow button to select Internal and then press the **ENTER** button.
8. Check that **INT.REF** indicator at the right side of the front panel lights. This shows that the instrument is using the internal reference signal.
9. Connect one of the TV signal generators output connectors to the AGL7 **REF** connector, using the 75 Ω BNC cable. Terminate the other side of the **REF** connector with the 75 Ω termination.
10. Press the left (◄) or right (►) arrow button to select the menu item corresponding to the input signal and then press the **ENTER** button.
11. Check that **EXT.REF** indicator at the right side of the front panel lights. This shows that the instrument is locked to the input signal.
12. Disconnect the BNC cable from the REF connector.
13. Check that **EXT.REF** indicator at the right side of the front panel blinks. This shows that the external reference signal is not being input to the REF connector.

Black signal outputs.

14. Press the front-panel **BACK** button.
15. Press the up (▲) or down (▼) arrow button to select **SELECT OUTPUT** from the main menu.
16. Press the left (◄) or right (►) arrow button to select **BLACK 1**, then press the **ENTER** button. The SELECT FORMAT submenu shown below appears.

```
AGL7 [1] : BLACK 1 : SELECT FORMAT
    NTSC
```

17. Press the left (◄) or right (►) arrow button to select **NTSC** or **PAL** for your waveform monitor and then press the **ENTER** button.

```
AGL7 [1] : BLACK 1 : NTSC
    Black Burst
```

18. Press the left (◄) or right (►) arrow button to select **Black Burst**, then press the **ENTER** button.
19. Connect the **BLACK 1** connector to the NTSC/PAL waveform monitor using the 75 Ω BNC cable.
20. Set the waveform monitor to view the black burst signal.
21. Check that the appropriate black burst signal is displayed.
22. Press the **BACK** button twice to display the **SELECT OUTPUT** menu.
23. Press the left (◄) or right (►) arrow button to select **BLACK 2,** then press the **ENTER** button.
24. Repeat steps 17 and 18.
25. Connect the **BLACK 2** connector to the NTSC/PAL waveform monitor using the 75 Ω BNC cable.
26. Set the waveform monitor to view the black burst signal.
27. Check that the appropriate black burst signal is displayed.
28. Press the **BACK** button twice to display the **SELECT OUTPUT** menu.
29. Press the left (◄) or right (►) arrow button to select **BLACK 3** and then press the **ENTER** button. This displays the SELECT FORMAT submenu.
30. Press the left (◄) or right (►) arrow button to select **1080 60i** and then press the **ENTER** button.
31. Connect the **BLACK 3** connector to the HDTV waveform monitor using the 75 Ω BNC cable.
32. Check that the appropriate HDTV trilevel sync signal is displayed.

ATG7 module functional check

Use the following procedure to check that the ATG7 Analog Test Generator module is functional:

Required equipment.

- NTSC/PAL waveform monitor
- 75 Ω BNC cable
- 75 Ω terminator

Procedure.

1. Install the module into the TG8000 mainframe. (See page 1-10, *Module installation and removal*.)
2. Power on the TG8000 mainframe by connecting it to the power source. The initialization process for all installed modules is executed.

3. Check that no error messages appear on the display.
4. Warm up the instrument for 20 minutes.

SIGNAL output.

5. Use the 75 Ω BNC cable to connect the **SIGNAL** connector to one of the input connectors on the waveform monitor rear panel.
6. Use the 75 Ω terminator to terminate the other loop through connector on the waveform monitor rear panel.
7. Press the front-panel **MODULE** button until the ATG7 main menu shown below appears.

```
ATG7 [x] : STATUS : NTSC No Setup
    SMPTE Color Bars
```

8. Press the front-panel **FORMAT** button and use the left (◄) or right (►) arrow button to select **NTSC** or **PAL**.
9. Press one of the front-panel test signal buttons (for example **COLOR BAR**) to output a signal.
10. Set the waveform monitor to view the signal.
11. Check that the signal appears as expected. For example, if you selected a color bars signal in step 7, check that the color bars signal appears.

BLACK 1 and BLACK 2 outputs.

12. Disconnect the BNC cable from the **SIGNAL** connector, and then connect it to the **BLACK 1** connector.
13. Press the up (▲) or down (▼) arrow button to select **SELECT OUTPUT** from the main menu.
14. Press the left (◄) or right (►) arrow button to select **BLACK 1**.
15. Press the front-panel **ENTER** button. The SELECT FORMAT submenu shown below appears.

```
ATG7 [x] : BLACK 1 : SELECT FORMAT
    NTSC
```

16. Press the left (◄) or right (►) arrow button to select **NTSC** or **PAL**.
17. Press the **ENTER** button. The SELECT SIGNAL submenu shown below appears.

```
ATG7 [x] : BLACK 1 : SELECT SIGNAL
    Black Burst
```

18. Press the left (◄) or right (►) arrow button to select **Black Burst.** Press the **ENTER** button to enable the selection.
19. Set the waveform monitor to view the blanking area of the signal.
20. Check that the appropriate black burst signal is displayed.
21. Move the BNC cable from the **BLACK 1** connector to the **BLACK 2** connector.
22. Press the front-panel **BACK** button twice to return to the main menu.
23. Repeat steps 14 through 20 to check the BLACK 2 output.

BARS output.

24. Move the BNC cable from the **BLACK2** connector to the **BARS** connector.
25. Press the **BACK** button twice to return to the main menu.
26. Press the left (◄) or right (►) arrow button to select **BARS**.
27. Press the **ENTER** button. The SELECT FORMAT submenu appears.
28. Press the left (◄) or right (►) arrow button to select **NTSC** or **PAL**.
29. Press the **ENTER** button. The SELECT SIGNAL submenu appears.
30. Press the left (◄) or right (►) arrow button to select **100% Color Bars**. Press the **ENTER** button to enable the selection.
31. Set the waveform monitor to view the color bars signal.
32. Check that the appropriate color bars signal appears.

AVG7 module functional check

Use the following procedure to check that the AVG7 Analog Video Generator module is functional:

Required equipment.

- Waveform monitor
- 75 Ω BNC cable

Procedure.

1. Install the module into the TG8000 mainframe. (See page 1-10.)
2. Power on the TG8000 mainframe by connecting it to the power source. The initialization process for all installed modules is executed.
3. Check that no error messages appear on the LCD display.
4. Warm up the instrument for 20 minutes.

5. Press the front-panel **MODULE** button until the AVG7 main menu shown below appears.

6. Press the **FORMAT** button and use the left (◄) or right (►) arrow button to select a format, and then press the **ENTER** button.
7. Press one of the front-panel test signal buttons (for example **COLOR BAR**) to output a signal.
8. Press the **BACK** button to display the main menu.
9. Press the up (▲) or down (▼) arrow button to select **VIDEO** from the main menu and then press the **ENTER** button. The VIDEO submenu shown below appears.

10. Press the left (◄) or right (►) arrow button to select **CH1/2/3: Composites** and then press the **ENTER** button.
11. Connect the upper (or lower) **CH 1** connector to the waveform monitor using the 75 Ω BNC cable.
12. Set the waveform monitor to view the signal.
13. Check that the signal appears as expected. For example, if you selected a color bar signal in step 7, check that the color bar signal appears.
14. Disconnect the BNC cable from the **CH 1** connector, and then connect the BNC cable to the **CH 2** connector.
15. Check that the signal appears as expected.
16. Disconnect the BNC cable from the **CH 2** connector, and then connect the BNC cable to the **CH 3** connector.
17. Check that the signal appears as expected.
18. Disconnect the BNC cable from the **CH 3** connector, and then connect the BNC cable to the **CH 1** connector.
19. Press the test signal button again to output the another test signal in the same signal set.
20. Check that the signal on the waveform monitor changes. You need not perform this check for the CH 2 and CH 3 connectors.
21. Repeat steps 11 through 20 for the lower (or upper) output channels.

AWVG7 module functional check

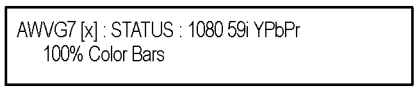
Use the following procedure to check that the AWVG7 Analog Wideband Video Generator module is functional:

Required equipment.

- HDTV waveform monitor
- Three 75 Ω BNC cables
- Three 75 Ω terminators

Procedure.

1. Install the module into the TG8000 mainframe. (See page 1-10.)
2. Power on the TG8000 mainframe by connecting it to the power source. The initialization process for all installed modules is executed.
3. Check that no error messages appear on the LCD display.
4. Warm up the instrument for 20 minutes.
5. Press the front-panel **MODULE** button until the AWVG7 main menu shown below appears.



6. Press the **FORMAT** button and use the left (◄) or right (►) arrow button to select a format, then press the **ENTER** button.
7. Press one of the front-panel test signal buttons (for example **COLOR BAR**) to output a signal.
8. Use the 75 Ω BNC cables to connect the upper (or lower) **CH 1**, **CH 2**, and **CH 3** connectors to the **CH A**, **CH B**, and **CH C** inputs of the waveform monitor respectively.
9. Use the 75 Ω terminators to terminate the other loop-through connectors on the waveform monitor real panel.
10. Press the **CH A** button on the waveform monitor, and set the waveform monitor to view the signal.
11. Check that the signal appears as expected. For example, if you selected a color bar signal in step 7, check that the color bar signal appears.
12. Press the **CH B** button on the waveform monitor.
13. Check that the signal appears as expected. For example, if you selected a color bar signal in step 7, check that the color bar signal appears.
14. Press the **CH C** button on the waveform monitor.

15. Check that the signal appears as expected. For example, if you selected a color bar signal in step 7, check that the color bar signal appears.
16. Press the **CH A** button on the waveform monitor.
17. Press the test signal button again to output another test signal in the same signal set.
18. Check that the signal on the waveform monitor changes. You do not need to perform this check for the CH 2 and CH 3 connectors.
19. Disconnect the BNC cable from the upper (or lower) **CH 1**, **CH 2**, and **CH 3** connectors, and then connect the BNC cables to the lower (or upper) **CH 1**, **CH 2**, and **CH 3** connectors.
20. Repeat steps 10 through 18 for the lower (or upper) output channels.

BG7 module functional check

Use the following procedure to check that the BG7 Black Generator module is functional:

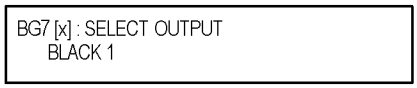
Required equipment.

- NTSC/PAL waveform monitor
- HDTV waveform monitor
- 75 Ω BNC cable

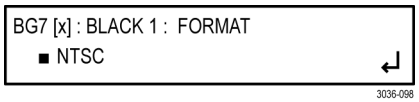
Procedure.

1. Install the module into the TG8000 mainframe. (See page 1-10.)
2. Power on the TG8000 mainframe by connecting it to the power source. The initialization process for all installed modules is executed.
3. Check that no error messages appear on the LCD display.
4. Warm up the instrument for 20 minutes.
5. Set the TG8000 to the factory default settings:
   a. Press the front-panel **MODULE** button until **TG8000 : PRESET** is displayed.
   b. Press the front-panel **ENTER** button to enter the PRESET menu.
   c. Press the left (◄) or right (►) arrow button to select **Factory Default**.
   d. Press the front-panel **ENTER** button to load the factory default presets.
   e. When the presets have finished loading, press the **BACK** button to exit the PRESET menu.

6. Press the front-panel **MODULE** button until the BG7 main menu shown below appears.



7. Press the front-panel **ENTER** button. The BLACK FORMAT menu selection shown below appears.



8. Press the left (◄) or right (►) arrow button to select **NTSC** or **PAL** and then press the **ENTER** button to enable the selection.
9. Connect the **BLACK 1** connector to the NTSC/PAL waveform monitor using the 75 Ω BNC cable.
10. Set the waveform monitor to view the blanking area of the signal.
11. Check that the appropriate black burst signal is displayed.
12. Press the left (◄) or right (►) arrow button to select **1080 59.94i** and then press the **ENTER** button to enable the selection.
13. Disconnect the BNC cable from the NTSC/PAL waveform monitor, and then reconnect it to the HDTV waveform monitor.
14. Check that the appropriate HDTV trilevel sync signal is displayed.
15. Repeat steps 6 through 14 for the **BLACK 2**, **BLACK 3**, and **BLACK 4** outputs.

DVG7 module functional check

Use the following procedure to check that the DVG7 Digital Video Generator module is functional:

Required equipment.

- Serial digital waveform monitor
- 75 Ω BNC cable

Procedure.

1. Install the module into the TG8000 mainframe. (See page 1-10.)
2. Power on the TG8000 mainframe by connecting it to the power source. The initialization process for all installed modules is executed.
3. Check that no error messages appear on the LCD display.
4. Warm up the instrument for 20 minutes.

5. Press the front-panel **MODULE** button until the DVG7 main menu shown below appears.

6. Press the FORMAT button and use the left (◄) or right (►) arrow button to select a format, then press the **ENTER** button.
7. Press one of the front-panel test signal buttons (for example **COLOR BAR**) to output a signal.
8. Connect the **SIGNAL 1** connector to the serial digital waveform monitor using the 75 Ω BNC cable.
9. Set the waveform monitor to view the signal.
10. Check that the signal appears as expected. For example, if you selected a color bar signal in step 7, check that the color bar signal appears.
11. Disconnect the BNC cable from the **SIGNAL 1** connector, and then connect the BNC cable to the **SIGNAL 2** connector.
12. Check that the signal appears as expected.

GPS7 module functional check

Use the following procedure to check that the GPS7 GPS Synchronization and Timecode module is functional.

NOTE. *Depending on which other modules are present and what formats they generate, you may get a clock conflict message. If this occurs, press the ENTER button to accept the change and continue the test. This may happen at multiple steps in one or several of the functional tests.*

Required equipment.

- GPS antenna feed with good signal level
- SDI video signal source (can be external, or a DVG7 or HDVG7 module in either a reference instrument or the mainframe under test)
- NTSC black source (can be a second TG8000 or TG700 mainframe with a BG7 or GPS7 module)
- WFM8300 or equivalent with Option CPS
- Voltmeter
- LTC/GPIO breakout adapter cable (Tektronix part number 012-1717-XX)
- Female XLR connector, three wires, and one 9-pin DSUB male header with solder cups, assembled as described in the LTC Output test

- BNC-to-banana-plug adapter
- (2) 75 Ω coaxial terminators (Tektronix part number 011-0163-XX)
- (2) BNC T connectors
- (3) 1 meter BNC cables

Procedure.

1. Install the module into the TG8000 mainframe. (See page 1-10.)
2. Power on the TG8000 mainframe by connecting it to the power source. The initialization of all the installed modules is executed.
3. Check that no error messages appear on the LCD display.
4. Warm up the instrument for 20 minutes.
5. Run the GPS7 module diagnostics:
   a. Press the **MODULE** button until **GPS7** appears.
   b. Use the up (▲) or down (▼) arrow button to select **DIAGNOSTICS**.
   c. Press the **ENTER** button.
   d. Use the left (◄) or right (►) arrow button to scroll through the menu. Take note of any errors or warnings.
6. Load the factory preset:
   a. Press the **MODULE** button until **TG8000** appears.
   b. Press **ENTER** to select **Preset**.
   c. If needed, use the up (▲) or down (▼) arrow button to select **Recall**.
   d. Press the left (◄) arrow button until **Factory Preset** appears.
   e. Press the **ENTER** button to load the preset.
7. When loading is complete, press the **BACK** button to exit the Factory Default menu.

DC antenna output power voltage.

1. Connect the BNC-to-Banana-plug adapter to the voltmeter.
2. Connect the BNC T to the adapter.
3. Connect a 75 Ω BNC cable to the other end of the BNC T connector.
4. Connect the other end of the cable to the antenna input on the rear of the module.

5. Set the antenna power to 3.3 V:
   a. Press the **MODULE** button to navigate to the **GPS7** module.
   b. Use the up (▲) or down (▼) arrow button to select **GPS SETUP**.
   c. Press the **ENTER** button.
   d. Use the up (▲) or down (▼) arrow button to select **Antenna Power**.
   e. Use the left (◄) or right (►) arrow button to select **3.3 V**.
   f. Press the **ENTER** button.
6. Check that the voltmeter shows between 3.3 V and 4 V.
7. Use the left (◄) arrow to set the antenna voltage to 5 V.
8. Press the **ENTER** button.
9. Check that the voltmeter shows between 5 V and 6 V.

Antenna current and fault thresholds.

1. Connect the BNC-to-Banana-plug adapter to the voltmeter.
2. Connect the BNC T to the adapter.
3. Set the antenna power to 5 V:
   a. Press the **MODULE** button to navigate to the **GPS7** module.
   b. Use the up (▲) or down (▼) arrow button to select **GPS SETUP**.
   c. Press the **ENTER** button.
   d. Use the up (▲) or down (▼) arrow button to select **Antenna Power**.
   e. Use the left (◄) or right (►) arrow button to select **5 V**.
   f. Press the **ENTER** button.
4. Connect a 75 Ω BNC cable to the other end of the BNC T connector.
5. Connect the other end of the cable to the antenna input on the rear of the module.
6. Check that the LED located between the DSUB connector and the antenna input on the rear panel of the module is flashing green. Green indicates an open circuit.
7. Apply a 75 Ω terminator to the BNC T and check that the voltage is between 4.5 V and 5 V.
8. Check that the LED on the module back panel is a steady green. This indicates a nominal load.
9. Connect the second BNC T and 75 Ω terminator to the antenna system to exceed the allowed antenna current.

10. Check that the LED on the module rear panel is a steady red. This indicates a short circuit.
11. Remove the terminators and the connection to the voltmeter.

Lock to GPS through antenna.

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

1. Set the antenna voltage as needed by the antenna in the test system.
2. Navigate to the signal quality menu:
   a. Press the **MODULE** button to navigate to the **GPS7** module.
   b. Use the up (▲) or down (▼) arrow button to select **STATUS** from the GPS7 module menu.
   c. Use the left (◄) or right (►) arrow button to select **Signal Quality**.
3. Connect the GPS input signal feed to the antenna input on the rear of the module.
4. Check that the signal quality changes from *No Signal* to *Low Signal* to *Acquiring satellites* to *Adjusting phase* to *Locked*.

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

5. Make sure that the instrument has been running for at least 20 minutes before performing the next step.
6. Enter the Diagnostics menu and check for "fine" status. This indicates the GPS is operating at the maximum stability:
   a. Use the up (▲) or down (▼) arrow button to select **DIAGNOSTICS**.
   b. Press the **ENTER** button.
   c. Use the left (◄) or right (►) arrow button to select **TUNE** and check that the instrument shows **Fine** on the right side of the display.
7. Press the **BACK** button to exit the Diagnostics menu.

Black output and frame pulse.

1. Connect an SDI signal, like one from a DVG7 or HDVG7 module, to the SDI A input of a WFM8300, and select that input as the active input on the waveform monitor.
2. Connect a cable from the Black 1 output on the GPS7 module to the reference input of the WFM8300. Terminate the loop through on the monitor with a 75 Ω terminator.
3. Press the **EXT REF** button on the WFM8300.
4. Set the HD trilevel sync rate to Integer on the GPS7 module:
   a. Use the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.
   b. Use the left (◄) or right (►) arrow button to select **HD TRI-LEVEL SYNC RATE**.
   c. Press the **ENTER** button.
   d. Use the left (◄) or right (►) arrow button to select **Integer (60, 50, 30, 25, 24)**.
   e. Press the **ENTER** button.
   f. Press the **BACK** button to exit the HD Tri-level Sync Rate submenu.
5. Set Black 1 to NTSC on the GPS7 module:
   a. Use the left (◄) or right (►) arrow button to select **Black 1**.
   b. Press the **ENTER** button.
   c. Use the up (▲) or down (▼) arrow button to select **FORMAT**.
   d. Use the left (◄) or right (►) arrow button to select **NTSC**.
   e. Press the **ENTER** button.
6. Check that the WFM8300 shows NTSC as the reference input.
7. Use the left (◄) or right (►) arrow button to select **1080 60i** in the Select Format menu.
8. Press the **ENTER** button.
9. Check that the WFM8300 shows a 1080 60i signal on the reference input.
10. Disconnect the Black 1 signal from the module and the WFM8300.
11. Connect the Black 2 signal from the module to the reference input of the WFM8300.

12. Set Black 2 to a 1080 50i signal on the GPS7 module:
    a. Press the **BACK** button to exit the Black 1 submenu.
    b. Use the left (◄) or right (►) arrow button to select **Black 2**.
    c. Press the **ENTER** button.
    d. Use the left (◄) or right (►) arrow button to select **1080 50i**.
    e. Press the **ENTER** button.
13. Check that the WFM8300 shows a 1080 50i signal on the reference input.
14. Use the left (◄) arrow button to select **PAL**.
15. Press the **ENTER** button.
16. Use the left (◄) arrow button to select **Black Burst**.
17. Press the **ENTER** button.
18. Check that the WFM8300 shows PAL on the reference input.
19. Press the **BACK** button to exit the PAL submenu.
20. Press the **BACK** button again to exit the Select Format submenu.
21. Disconnect the Black 2 signal from the module and the WFM8300.
22. Connect the Black 3 signal from the module to the reference input of the WFM8300.
23. Set Black 3 to a PAL signal on the GPS7 module:
    a. Use the right (►) arrow button to select **Black 3**.
    b. Press the **ENTER** button.
    c. Use the right (►) arrow button to select **PAL**.
    d. Press the **ENTER** button.
24. Check that the WFM8300 shows PAL on the reference input.
25. Use the left (◄) or right (►) arrow button to select **1080 24p**.
26. Press the **ENTER** button.
27. Check that the WFM8300 shows 1080 24p on the reference input.
28. Press the **BACK** button to exit the Select Formats menu.

Black output VITC.

1. Connect a cable from the Black 1 output on the module to the CMPST A input on the WFM8300, and terminate the loop through with a 75 Ω terminator. Activate the input by pressing the C input button on the front panel of the monitor.
2. On the WFM8300, press the CONFIG button and select VITC as the timecode source.
3. On the TG8000, press the **MODULE** button until **GPS7** appears.
4. Use the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.
5. Use the left (◄) or right (►) arrow button to select **Black 1**.
6. Press the **ENTER** button.
7. Use the up (▲) or down (▼) arrow button to select **FORMAT**.
8. Use the left (◄) or right (►) arrow button to select **NTSC**.
9. Press the **ENTER** button.
10. Use the up (▲) or down (▼) arrow button to select **Timecode**.
11. Press the **ENTER** button.
12. Use the left (◄) or right (►) arrow button to select **Time of Day** as the Timecode Source.
13. Press the **ENTER** button.
14. Use the up (▲) arrow to select the **VITC** submenu and press the **ENTER** button to select **VITC 1**.
15. Press the right (►) arrow to select **Output : Enable**.
16. Press the **ENTER** button.
17. Use the down (▼) arrow to select **Line number**.
18. Press the left (◄) arrow to select **Line number: 14**.
19. Check that the time of day is correctly updating on the WFM8300 Timecode display.
20. Repeat the procedure for Black 2 and Black 3 signals.

LTC output.

1. Connect the LTC/GPIO breakout adapter cable to the LTC/GPI DSUB on the back of the GPS7 module.
2. Construct an adapter by soldering wires between a female XLR and a 9-pin DSUB male header with solder cups, with this pin out:
   a. XLR pin 1 to DSUB pin 1.
   b. XLR pin 2 to DSUB pin 2.
   c. XLR pin 3 to DSUB pin 3.
3. Connect the LTC 1 output on the breakout cable to the XLR adapter you just made.
4. Connect the DSUB end of the adapter you just made to the remote connector on the WFM8300.
5. Configure the WFM8300 to use LTC as the Timecode source.
6. Configure the LTC 1 output of the GPS7 module for 30 fps drop frame:
   a. Press the **MODULE** button until **GPS7** appears.
   b. Use the up (▲) or down (▼) arrow button to select **SELECT LTC**.
   c. Press the **ENTER** button to select **LTC 1**.
   d. Use the up (▲) or down (▼) arrow button to select **Format**.
   e. Use the left (◄) or right (►) arrow button to select **30 fps drop frame**.
   f. Press the **ENTER** button.
   g. Use the up (▲) or down (▼) arrow button to select **Source**.
   h. Use the left (◄) or right (►) arrow button to select **Time of Day**.
   i. Press the **ENTER** button.
7. Check that the time of day is correctly updating on the WFM8300 timecode display.
8. Repeat this procedure for LTC 2 at 30 fps.
9. Repeat this procedure for LTC 3 at 25 fps.
10. Repeat this procedure for LTC 4 at 24 fps.

GPI output.

1. Check that the antenna signal is connected to the antenna input of the module and that the instrument shows the signal is locked:
   a. Press the **MODULE** button until **GPS7** appears.
   b. Use the up (▲) or down (▼) arrow button, if needed, to select **STATUS**.
   c. Check that the top line of the status display shows **Locked**.
2. Connect the GPI 1 output to the voltmeter:
   a. Connect the BNC-to-Banana-plug adapter to the voltmeter.
   b. Connect the LTC/GPIO breakout adapter cable to the LTC/GPI DSUB on the back of the GPS7 module.
   c. Connect the GPI 1 connector on the breakout cable to the BNC-to-Banana-plug adapter.
3. Configure the GPI 1 output to be asserted on unlock:
   a. Press the **MODULE** button until **GPS7** appears.
   b. Use the up (▲) or down (▼) arrow button to select **SELECT GPIO**.
   c. Use the left (◄) or right (►) arrow button to select **Output 1**.
   d. Press the **ENTER** button.
   e. Use the left (◄) or right (►) arrow button to select **Loss of lock**.
   f. Press the **ENTER** button.
4. Check that the voltage on the GPI 1 output measures between 4.5 V and 5.5 V.
5. Disconnect the antenna input. After 15 seconds, check that the GPI 1 output is below 0.5 V.
6. Repeat this procedure for the GPI 2 output.

GPI input.

1. Configure the GPS7 GPI input to reset the program time:
   a. Press the **MODULE** button until **GPS7** appears.
   b. Use the up (▲) or down (▼) arrow button to select **SELECT GPIO**.
   c. Use the left (◄) or right (►) arrow button to select **Input 1**.
   d. Press the **ENTER** button.
   e. Use the left (◄) or right (►) arrow button to select **Reset Program Time**.
   f. Press the **ENTER** button.
   g. Press the **BACK** button to exit the Select GPIO menu.
2. Press the up arrow to select the **STATUS** display.
3. If needed, use the left (◄) or right (►) arrow button to display **Program Time**.
4. Write down the program time.
5. Connect the LTC/GPIO breakout adapter cable to the LTC/GPI DSUB on the back of the GPS7 module.
6. Attach a 75 Ω terminator to the GPI input for 2 seconds, and then remove it.
7. Look at the program time now and compare it to the program time you wrote down before. The time on the display should have reset to the default start time of 00:00:00.00 and now be counting again.

Genlock.

1. Set the Reference Source to Internal.
   a. Use the up (▲) or down (▼) arrow button to select **REFERENCE**.
   b. Press the **ENTER** button.
   c. If needed, use the up (▲) or down (▼) arrow button to select **SOURCE**.
   d. Use the left (◄) or right (►) arrow button to select **Internal**.
   e. Press the **ENTER** button.
2. Check that the **INT** indicator at the right side of the front panel lights. This shows that the instrument is using the internal reference signal.
3. Use the left (◄) or right (►) arrow button to select **NTSC Burst**.
4. Press the **ENTER** button.
5. Check that the **INT** indicator is not lit and the **EXT** indicator is flashing. This shows that the is not locked to any reference signal.

6. Press the **BACK** button to exit the Reference Source menu.
7. Connect the NTSC signal generator output to the **BLACK 1 / REF IN** connector using a 75 Ω BNC cable.
8. Set the NTSC signal generator to output an NTSC signal.
9. Check that the **EXT** indicator lights. This shows that the instrument is using the external reference signal.
10. Disconnect the test setup.

HD3G7 module functional check

Use the following procedure to check that the HD3G7 HD 3 Gb/s SDI Video Generator module is functional.

Required equipment.

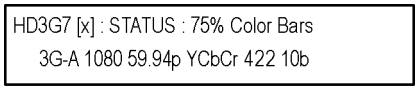
- HD-SDI video signal generator
- 3 Gb/s waveform monitor
- Two 1 m (3 ft) BNC to BNC high-bandwidth cables

Procedure.

1. Install the module into the TG8000 mainframe. (See page 1-10.)
2. Power on the TG8000 mainframe by connecting it to the power source. The initialization of all the installed modules is executed.
3. Check that no error messages appear on the LCD display.

Generator function.

4. Press the front-panel **MODULE** button until the HD3G7 main menu shown below appears.

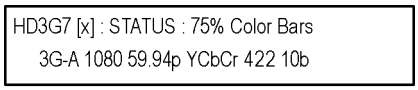


5. Press the down (▼) arrow button to select **Output Mode**, and then use the left (◄) or right (►) arrow button to select the desired output mode. When the desired output mode is displayed, press the **Enter** button to confirm it. This example will use the 3G-Level A (1920 × 1080) output mode.
6. Press the **FORMAT** button and use the left (◄) or right (►) arrow button to select **1080 50p**, then press **ENTER**.
7. Press the **COLOR BAR** button and select a signal to output.
8. Press the **BACK** button to exit the COLOR BARS menu.

9. Connect the **SIGNAL 1** connector to the HDTV waveform monitor using the 75 Ω BNC cable.
10. Press the up (▲) arrow button to display the **DIAGNOSTICS** menu.
11. Press the **ENTER** button.
12. Press the right (►) arrow to scroll through the Diagnostics readouts.
13. Check that the PLL Status **Flex1** reading and the DDS Status **DDS1 Phase** reading show **Lock**.
14. Press the right (►) arrow button to display the **CRC Errors** submenu and monitor the CRC error counts for five seconds.
15. Press the right (►) arrow button to scroll through the menus and check that the voltage readings show **(OK)**.
16. Set the waveform monitor to view the signal.
17. Check that the signal appears as expected. Check for errors on the video session screen of the waveform monitor.
18. Disconnect the BNC cable from the **SIGNAL 1** connector, and then connect the BNC cable to the **SIGNAL 2** connector.
19. Press the **FORMAT** button and use the left (◄) or right (►) arrow button to select **1080 59.94p**, then press **ENTER**.
20. Check that the signal appears as expected on the waveform monitor and check for errors on the video session screen.

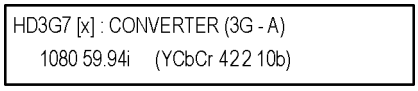
Converter function.

21. Set the HDTV video generator as indicated below:
    - Output signal: Ramp
    - Format: 1080 59.94i
22. Press the front-panel **MODULE** button until the HD3G7 main menu shown below appears.



23. Connect the output connector on the HDTV video generator to the **HD SDI IN** connector on the HD3G7 using the 75 Ω BNC cable.
24. Connect the **SIGNAL 1** output connector on the HD3G7 to an SDI input connector on the waveform monitor using a 75 Ω BNC cable.
25. Press the **FORMAT** button and use the left (◄) or right (►) arrow button to select **1080 59.94p**, and then press the **ENTER** button.

26. Press the **OTHER** button to select the converter mode.
27. Press the **BACK** button to return to the **STATUS** menu, which should now look like the one below:



28. Check that the **STATUS** display shows **1080 59.54i** as the input.
29. Press the up (▲) arrow button to display the **DIAGNOSTICS** menu.
30. Press the **ENTER** button to access the DIAGNOSTICS menu, and then use the left (◄) or right (►) arrow button (if necessary) to navigate to the **DIAGNOSTICS : PLL STATUS** page.
31. Check that the **Jit** reading shows **Lock**.
32. Press the right (►) arrow button to display the **CRC Errors** submenu and monitor the CRC error counts for five seconds.
33. If there are CRC errors, press the right (►) arrow button until you see the **Clear CRC Errors** menu, and then press the **ENTER** button to clear the errors.
34. Press the right (►) arrow button to scroll through the menus and check that the voltage readings show **(OK)**.
35. Check that a 1080 59.94p ramp signal is displayed on the waveform monitor.

HDLG7 module functional check

Use the following procedure to check that the HDLG7 HD Dual Link Video Generator module is functional.

Required equipment.

- HDTV digital video generator
- HDTV waveform monitor
- Three 75 Ω BNC cables

Procedure.

1. Install the module into the TG8000 mainframe. (See page 1-10.)
2. Power on the TG8000 mainframe by connecting it to the power source. The initialization of all the installed modules is executed.
3. Check that no error messages appear on the LCD display.
4. Warm up the instrument for 20 minutes.

Generator function.

5. Press the front-panel **MODULE** button until the HDLG7 main menu shown below appears.

6. Press the **FORMAT** button and use the left (◄) or right (►) arrow button to select the **1080 59.94p** format, and then press the **ENTER** button.
7. Press the **COLOR BAR** button to select **SMPTE RP219 Color Bars**, and then press the **BACK** button to return to the main menu.
8. Connect the upper **LINK A** connector to the **INPUT A** connector on the HDTV waveform monitor using a 75 Ω BNC cable.
9. Connect the upper **LINK B** connector to the **INPUT B** connector on the HDTV waveform monitor using the 75 Ω BNC cable.
10. Set the waveform monitor to view the INPUT A signal.
11. Check that the appropriate color bars signal is displayed.
12. Set the waveform monitor to view the INPUT B signal.
13. Check that the appropriate color bars signal is displayed.
14. Change the BNC cable from the upper **LINK A** connector to the lower **LINK A** connector.
15. Change the BNC cable from the upper **LINK B** connector to the lower **LINK B** connector.
16. Repeat steps 10 through 13 for the lower LINK A and LINK B connectors.

Converter function.

17. Set the HDTV digital video generator as indicated below:
    - Output signal: 100% Color Bars
    - Format: 1080 59.94i
18. Connect the output connector on the HDTV digital video generator to the **HD SDI IN** connector on the HDLG7 using the 75 Ω BNC cable.
19. Press the **FORMAT** button and use the left (◄) or right (►) arrow button to select **1080 59.94p**, and then press the **ENTER** button.
20. Press the **OTHER** button to select the converter mode.
21. Set the waveform monitor to view the INPUT A signal.
22. Check that the appropriate color bars signal is displayed.

23. Set the waveform monitor to view the INPUT B signal.
24. Check that the appropriate color bars signal is displayed.
25. Change the BNC cable from the lower **LINK A** connector to the upper **LINK A** connector.
26. Change the BNC cable from the lower **LINK B** connector to the upper **LINK B** connector.
27. Repeat steps 21 through 24 for the upper LINK A and LINK B connectors.

HDVG7 module functional check

Use the following procedure to check that the HDVG7 HDTV Digital Video Generator module is functional:

Required equipment.

- HDTV waveform monitor
- 75 Ω BNC cable

Procedure.

1. Install the module into the TG8000 mainframe. (See page 1-10.)
2. Power on the TG8000 mainframe by connecting it to the power source. The initialization process for all installed modules is executed.
3. Check that no error messages appear on the LCD display.
4. Warm up the instrument for 20 minutes.
5. Press the front-panel **MODULE** button until the HDVG7 main menu shown below appears.

6. Press the **FORMAT** button and use the left (◄) or right (►) arrow button to select a format, then press **ENTER**.
7. Press one of the front-panel test signal button (for example **COLOR BAR**) to output a signal.
8. Connect the **SIGNAL 1** connector to the HDTV waveform monitor using the 75 Ω BNC cable.
9. Set the waveform monitor to view the signal.
10. Check that the signal appears as expected. For example, if you selected a color bar signal in step 7, check that the color bar signal appears.

11. Disconnect the BNC cable from the **SIGNAL 1** connector, and then connect the BNC cable to the **SIGNAL 2** connector.
12. Check that the signal appears as expected.

SDI7 module functional check

Use the following procedure to check that the SDI7 Dual Channel SD/HD/3G SDI Video Generator module is functional.

Required equipment.

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

Procedure.

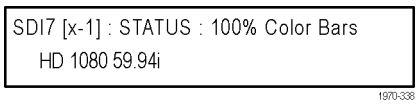
1. Install the SDI7 module into the TG8000 mainframe. (See page 1-10.)
2. Power on the TG8000 mainframe by connecting it to the power source. The initialization of all the installed modules is executed.
3. Check that no error messages appear on the LCD display.
4. Use the mainframe UTILITY menu to determine if Option 3G is enabled on the SDI7 module. Some of the steps in this procedure depend on whether the option is enabled or not.
   a. Press the**MODULE** button until **TG8000 : PRESET** is displayed.
   b. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY**, and then press the **ENTER** button.
   c. Press the up (▲) or down (▼) arrow button until **TG8000 : UTILITY : OPTIONS ENABLED** is displayed.
   d. The second line of the display indicates the option status:
      - **SDI7[slot number] None** indicates that Option 3G is not enabled
      - **SDI7[slot number] 3G** indicates that Option 3G is enabled

NOTE. *If more than one SDI7 module is installed in the mainframe, use the left (◄) or right (►) arrow button to display the option status of the desired SDI7 module.*

If Option 3G is not enabled and you have the option key, you can enter the option key to enable the option. *(See page 3-247, To enter the option key on the SDI7 module.)*

   e. Press the **BACK** button to return to the mainframe menu.

5. Press the front-panel **MODULE** button until the SDI7 main menu for channel 1 appears as shown in the following figure.



NOTE. *The SDI7 module provides two channels of output. The display indicates which SDI7 channel is selected. For example, a display of SDI7[3-1] indicates that the SDI7 module is installed in slot 3 and that channel 1 is selected. A display of SDI7[3-2] indicates that channel 2 is selected.*

Press the MODULE button to advance from channel 1 to channel 2. You can press the left (◄) or right (►) arrow button to switch between channels 1 and 2 of the selected SDI7 module when the STATUS menu is displayed as shown above.

6. Press the down (▼) arrow button to select **OUTPUT MODE**, and then use the left (◄) or right (►) arrow button to select the appropriate output mode for your SDI7 module as listed below. When the desired output mode is displayed, press the **ENTER** button to confirm the selection.
   - Option 3G enabled: select the **3G-Level A (1920 × 1080)** output mode.
   - Option 3G not enabled: select the **HD 1080 59.94i** output mode.
7. Press the **FORMAT** button and use the left (◄) or right (►) arrow button to select the appropriate format for your SDI7 module as listed below. When the desired format is displayed, press the **ENTER** button to confirm the selection.
   - Option 3G enabled: select the **1080 50p** format.
   - Option 3G not enabled: select the **1080 50i** format.
8. Press the **COLOR BAR** button and select a signal to output.
9. Press the **BACK** button to exit the COLOR BARS menu.
10. Connect the **SIGNAL 1A** connector to the HDTV waveform monitor using the 75 Ω BNC cable.
11. Set the waveform monitor to view the signal.
12. Check that the signal appears as expected. Check for errors on the video session screen of the waveform monitor.
13. Disconnect the BNC cable from the **SIGNAL 1A** connector, and then connect the BNC cable to the **SIGNAL 1B** connector.

14. Press the **FORMAT** button and use the left (◄) or right (►) arrow button to select the appropriate format for your SDI7 module as listed below. When the desired format is displayed, press the **ENTER** button to confirm the selection.
    - Option 3G enabled: select the **1080 59.94p** format.
    - Option 3G not enabled: select the **1080 59.94i** format.
15. Check that the signal appears as expected on the waveform monitor and check for errors on the video session screen.
16. Press the **BACK** button to exit the OUTPUT MODE submenu.
17. Repeat steps 5 through 16 for Channel 2 of the SDI7 module. To test channel 2, connect the SIGNAL 2A and SIGNAL 2B outputs to the waveform monitor.
18. Press the up (▲) arrow button to display the **DIAGNOSTICS** menu.
19. Press the **ENTER** button.
20. Press the right (►) arrow to scroll through the Diagnostics readouts.
21. Check that the PLL Status **Flex0** and **Flex1** readings show **Lock**.
22. Check that the DDS Status **DDS0 Phase** and **DDS1 Phase** readings show **Lock**.
23. Press the right (►) arrow button to scroll through the menus and check that the voltage readings show **(OK)**.

NOTE. *The SDI7 module provides additional diagnostics for checking the DDR2 and SRAM memory that can be accessed only in factory mode. See the TG8000 Service Manual for information on using the factory mode.*

Operating basics

Operating basics

This section introduces you to the basics of operating the TG8000. Common module functions are discussed here, while module-specific functions are discussed in the module-specifc sections of this manual. This section contains the following topics:

- Front-panel controls
- Rear-panel connectors
- About the frame reset signals
- Note for format settings

Front panel controls

The following figure shows the locations of the front-panel controls. A brief discussion of each feature follows the illustration.

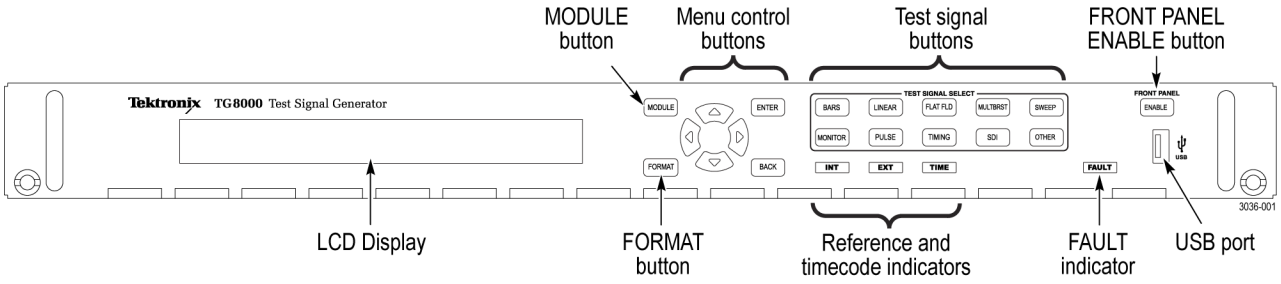


Figure 2-1: TG8000 front panel

LCD display

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

You can adjust the contrast of the LCD display using the UTILITY submenu. (See page 2-27, *UTILITY submenu*.)

MODULE button

Use the MODULE button to select the mainframe or installed module to control. Repeatedly pressing this button scrolls through the main menu, which shows the mainframe and the installed modules. Select the one you want to control.

FORMAT button

When an ATG7, AVG7, AWVG7, DVG7, HD3G7, HDLG7, HDVG7, or SDI7 module is selected (active), use the FORMAT button to change the video format for the output signal. Pressing this button displays the menu to allow you to select a format for the active module.

Menu control buttons

Use these buttons to control the menu display. (See page 2-22, *Mainframe menus*.)

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

ENTER button. Use the ENTER button to enable the selected menu item.

BACK button. Use the BACK button to disable the selected menu item and return to the previous menu item.

Test signal buttons

Use these buttons to select the output test signals. Each of these 10 buttons represents a signal set, or group of the same type of test signals. You scroll through the test signals in a signal set by repeatedly pressing the test signal button.

You can change the signal assignment using the SIGNAL KEY ASSIGN submenu. (See page 2-36, *SIGNAL KEY ASSIGN submenu*.)

FRONT PANEL ENABLE button

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

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

Refer to *UTILITY Submenu* for more information about the settings the period until the front panel times out. (See page 2-27.)

USB port

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

(See page 2-51, *How to upgrade the instrument firmware*.)
(See page 2-65, *How to transfer user files using FTP*.)

LED indicators

The front panel includes the following LED indicators:

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

Table 2-1: States of the INT and EXT reference indicators

	GPS7 module installed			AGL7 module installed			No timing module installed		
Reference source	**Status**	**EXT LED state**	**INT LED state**	**Status**	**EXT LED state**	**INT LED state**	**Status**	**EXT LED state**	**INT LED state**
Internal	Good	Off	Solid green	Good	Off	Solid green	Good	Off	Solid green
Internal	Warming up	Off	Blinking green	Warming up	Off	Blinking green	Warming up	Off	Blinking green
GPS	Good	Solid green	Off	NA	Off	Off	NA	Off	Off
GPS	FOM not reach to "GPO signal warning"	Solid amber	Off	NA	Off	Off	NA	Off	Off
GPS	"GPO Loss of Lock"	Solid red	Solid green	NA	Off	Off	NA	Off	Off
Genlock	Good	Solid green	Off	Good	Solid green	Off	NA	Off	Off
Genlock	"Near Loss of Genlock"	Solid amber	Off	"Near Loss of Genlock"	Solid amber	Off	NA	Off	Off
Genlock	"No Genlock Detected"	Solid red	Solid green	"Loss of Lock"	Solid red	Solid green	NA	Off	Off

TIME (timecode) LED indicator. The TIME (timecode) LED indicates the status of the timecode function. The state of the TIME LED depends on whether a GPS7 module is installed in the mainframe. The following table shows the states of the TIME LED for the different mainframe timecode signal configurations.

Table 2-2: States of the TIME (timecode) LED indicator

	GPS7 module installed		No GPS7 module installed	
Selected timecode source	**Timecode status**	**TIME LED state**	**Timecode Status**	**TIME LED state**
Internal	GPS7 installed	Off	NA	Off
Internal	"Program Time" selected	Off	NA	Off
External (GPS, VITC, or LTC)	"Time of Day" selected	Solid green	NA	Off
External (LTC only)	SMPTE standard	Solid green	NA	Off
External (LTC only)	Outside SMPTE standard	Solid yellow	NA	Off
External (GPS, VITC, or LTC)	Missing, discontinuous, badly timed, wrong FPS in External Time source	Solid red	NA	Off

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

Table 2-3: States of the FAULT LED indicator

Instrument condition	Example(s)	FAULT LED state	User actions
A fault condition exists that has the potential to damage the instrument hardware	▪ The fan has stopped turning ▪ The internal temperature of the instrument is too high	Blinking red	1. A flashing FAN FAULT message appears on the LCD display. Press the ENABLE button to dismiss the fault message. 2. Check the instrument rear panel to verify that the fan is operating. 3. The flashing FAN FAULT message will reappear in 30 seconds if the fault condition still exists. The FAULT LED will continue to blink red unless the fan restarts. 4. Unplug the instrument from the power source and contact Tektronix customer support.
A fault condition exists that renders the instrument unusable	▪ The fan speed is out of range ▪ The power supply operation is out of range	Solid red	1. If the instrument is still on, navigate to the UTILITY > DIAGNOSTICS menu. 2. Scroll through the diagnostic readouts and look for voltage “Warn” messages. 3. Unplug the instrument from the power source and contact Tektronix customer support.
A fault condition exists, but the instrument is still usable	▪ The clock PLL is out of range	Solid amber	1. Navigate to the UTILITY > DIAGNOSTICS menu. 2. Scroll through the diagnostic readouts and look for a “PLL UL” (unlocked) message. 3. When you are ready to have the instrument serviced, unplug the instrument from the power source and contact Tektronix customer support.
Normal	▪ The instrument is operating properly ▪ The instrument is turned off	Off	None

Rear panel connectors

The following figure shows the locations of the TG8000 mainframe and module connectors on the rear panel. A brief discussion of each connector follows the illustration.

> ***CAUTION.*** *If power is applied to the mainframe, be sure to terminate any unused outputs on any of the modules using 75 Ω terminators.*

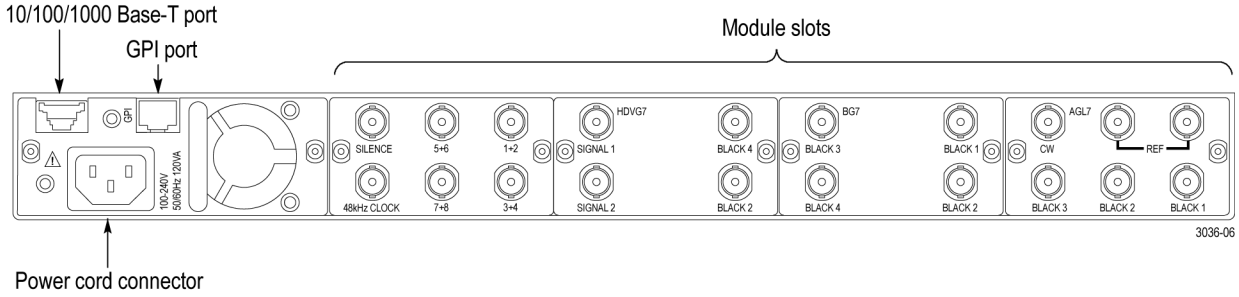


Figure 2-2: TG8000 rear panel

Power connector

The TG8000 is designed to operate from a single-phase power source with the neutral conductor at or near earth ground. Only the line conductor is fused for over-current protection. A protective ground connection through the grounding conductor in the power cord is essential for safe operation.

> ***WARNING.*** *Injury or death can occur as the result of electrical shock. To avoid electrical shock, do not connect power to the TG8000 when the top cover is off. Dangerous potentials are present on the Power circuit board.*

The TG8000 operates from an AC line frequency of 50/60 Hz, over the range of 100 - 240 VAC (±10%), without the need for configuration. (See Table 1-4 on page 1-9.)

10/100/1000 BASE-T port

Use this port to connect to your local Ethernet network. You can control the TG8000 mainframe and all installed modules remotely through the port. Also, you can upload and download various files such as signal files, logo files, and preset files through the port.

General Purpose Interface (GPI) port

You can use the GPI port to recall one of the seven available instrument presets and output an alarm signal. (See page 2-49, *How to use the mainframe General Purpose Interface (GPI)*.)

AG7 module connectors

The AG7 Audio Generator module is equipped with six BNC connectors as described below. (See Figure 2-3.)

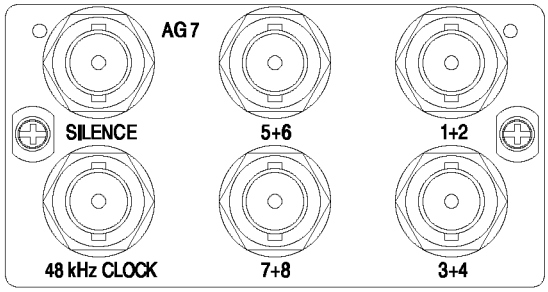


Figure 2-3: AG7 module connectors

- **1+2:** Outputs channels 1 and 2 of the selected AES/EBU serial digital audio signal.
- **3+4:** Outputs channels 3 and 4 of the selected AES/EBU serial digital audio signal.
- **5+6:** Outputs channels 5 and 6 of the selected AES/EBU serial digital audio signal.
- **7+8:** Outputs channels 7 and 8 of the selected AES/EBU serial digital audio signal.
- **SILENCE:** Outputs a silence signal (DAR signal).
- **48 kHz CLOCK:** Outputs a 48 kHz clock signal. The clock output level can be set as described below.

Setting the clock output level. Use jumper **J452** on the AG7 module to set the output level of the 48 kHz clock signal. (See Figure 2-4.)

Install the jumper on pins 3+4 of J452 (factory-default position) to set the clock output level to CMOS compatible. Install the jumper on pins 1+2 of J452 to set the clock output level to 1V.

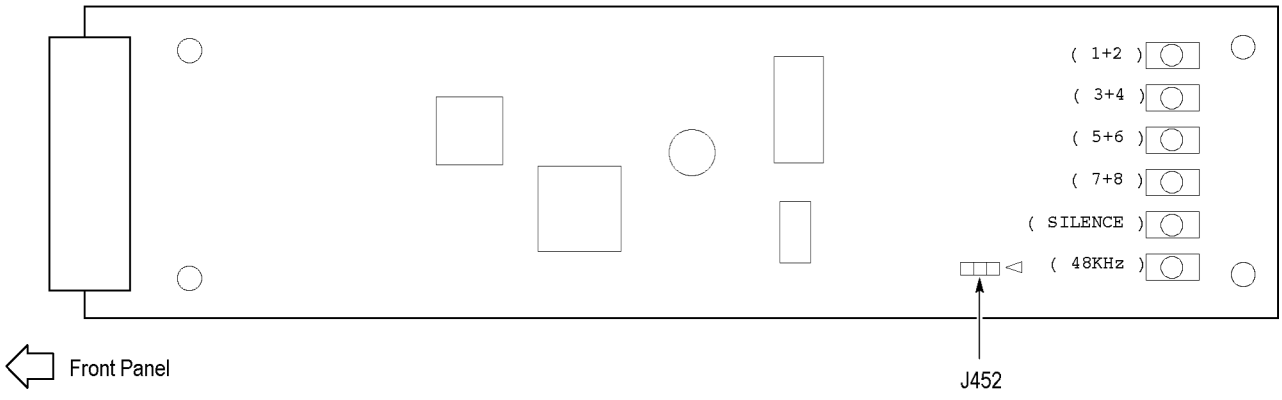


Figure 2-4: Location of J452 on the AG7 module

AGL7 module connectors

The AGL7 Analog Genlock module is equipped with six BNC connectors as described below. (See Figure 2-5.)

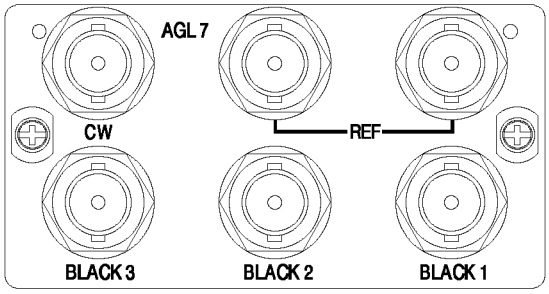


Figure 2-5: AGL7 module connectors

- **REF**: Input loopthrough connectors for an external reference signal, which can be NTSC/PAL black burst or HDTV trilevel sync signals. The signal input requires proper external termination.
- **CW**: Internally terminated input connector for CW (Continuous Wave) signals: 1, 3.58, 4.43, 5, and 10 MHz.

  You can configure the CW connector to output a 48 kHz word clock signal: (See page 2-8, *Changing the Input/Output configuration*.)
- **BLACK 1:** Outputs the selected black burst signal.

NOTE. *You cannot output HDTV trilevel sync signals from the BLACK 1 connector.*

- **BLACK 2:** Outputs the selected black burst or HDTV trilevel sync signal.
- **BLACK 3:** Outputs the selected black burst or HDTV trilevel sync signal.

Alarm output. You can configure the BLACK 1, BLACK 2, or BLACK 3 connector to output an alarm. When an alarm condition is detected, the output signal from the selected connector turns off for about 60 ms.

The AGL7 module alarm output is available only when the GPI ALARM OUTPUT menu item is set to Enable. (See page 2-49, *How to use the mainframe General Purpose Interface (GPI)*.)

Changing the Input/Output configuration. The CW connector is configured at the factory to be an input for CW signals. You can reconfigure the connector to output a 48 kHz word clock signal by changing the position of an internal cable.

CAUTION. *To prevent damage to the mainframe and the module, be sure to disconnect the power cord before removing the module.*

To output a 48 kHz word clock signal from the CW connector:

1. Disconnect the coaxial cable from the connector labeled **J040** on the AGL7 module. (See Figure 2-6.)
2. Reconnect the cable to the connector labeled **J960** on the AGL7 module.
3. Place the **48 kHz CLOCK** label provided with the module on the rear panel below the CW connector.

NOTE. *The word clock signal automatically follows the format of the Black 1 signal.*

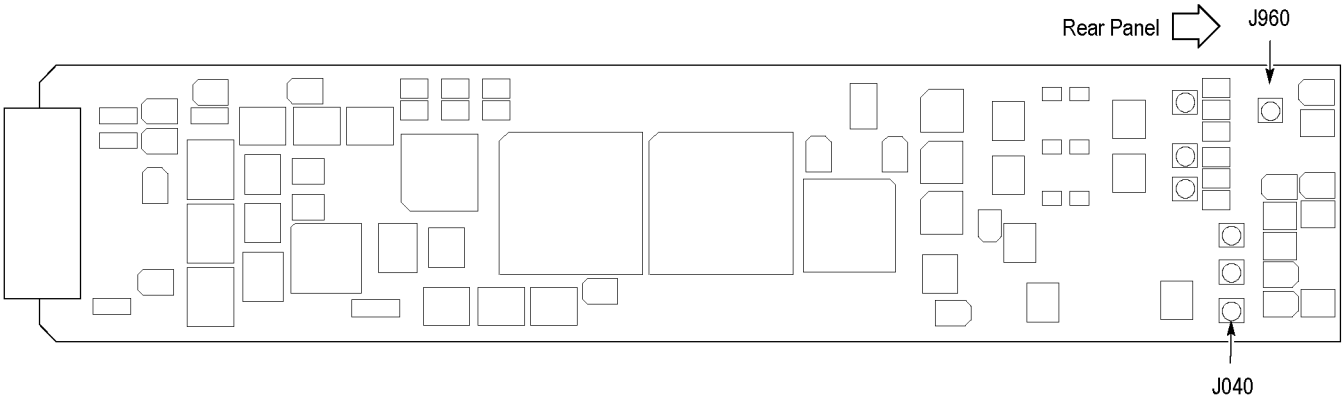


Figure 2-6: Location of J040 and J960 on the AGL7 module

ATG7 module connectors

The ATG7 Analog Test Generator module is equipped with four BNC connectors as described below. (See Figure 2-7.)

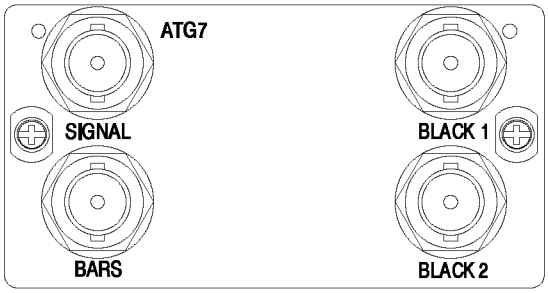


Figure 2-7: ATG7 module connectors

- **BLACK 1:** Outputs the selected black burst, timing pulse, or subcarrier signal.
- **BLACK 2:** Outputs the selected black burst, timing pulse, or subcarrier signal.
- **SIGNAL:** Outputs the signal selected using the front-panel test signal buttons. (See Table 3-5 on page 3-20.)
- **BARS:** Outputs the selected black burst or color bars signal.

AVG7 module connectors

The AVG7 Analog Video Generator module is equipped with three pairs of BNC connectors as described below. (See Figure 2-8.)

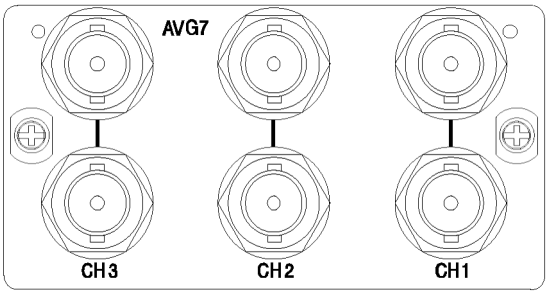


Figure 2-8: AVG7 module connectors

NOTE. *Each pair of connectors (CH 1, CH 2, and CH 3) output the same signal.*

- **CH 1:** Outputs the selected analog component or composite video signal.
- **CH 2:** Outputs the selected analog component or composite video signal.
- **CH 3:** Outputs the selected analog component or composite video signal.

AWVG7 module connectors

The AWVG7 Analog Wideband Video Generator module is equipped with three pairs of BNC connectors as described below. (See Figure 2-9.)

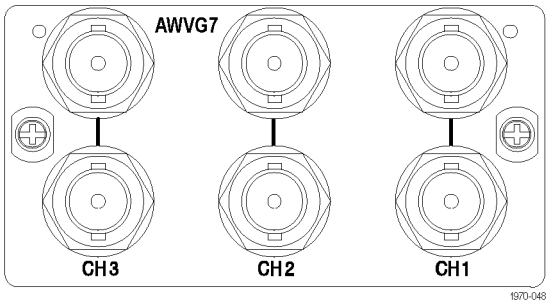


Figure 2-9: AWVG7 module connectors

NOTE. *Each pair of connectors (CH 1, CH 2, and CH 3) output the same signal.*

- **CH 1:** Outputs the selected analog component video signal.
- **CH 2:** Outputs the selected analog component video signal.
- **CH 3:** Outputs the selected analog component video signal.

BG7 module connectors

The BG7 Black Generator module is equipped with four BNC connectors as described below. (See Figure 2-10.)

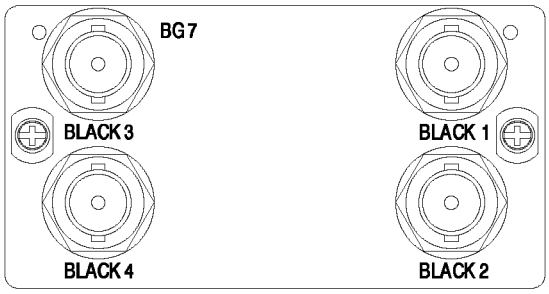


Figure 2-10: BG7 module connectors

- **BLACK 1:** Outputs the selected black burst or HDTV trilevel sync signal.
- **BLACK 2:** Outputs the selected black burst or HDTV trilevel sync signal.
- **BLACK 3:** Outputs the selected black burst or HDTV trilevel sync signal. Option CB enables this connector to also output a 10 field ID or color bars signal.
- **BLACK 4:** Outputs the selected black burst or HDTV trilevel sync signal output. Option CB enables this connector to also output a 10 field ID or color bars signal.

DVG7 module connectors

The standard DVG7 Digital Video Generator module is equipped with two BNC connectors to output serial digital video signals. Option BK adds two additional BNC connectors to output serial digital black signals. (See Figure 2-11.)

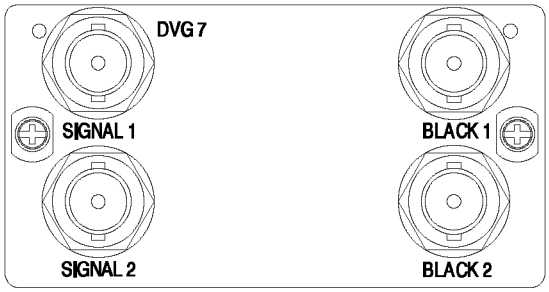


Figure 2-11: DVG7 module connectors (Option BK)

- **SIGNAL 1:** Outputs the selected serial digital video signal.
- **SIGNAL 2:** Outputs the selected serial digital video signal.
- **BLACK 1:** Outputs the selected serial digital black signal (Option BK only).
- **BLACK 2:** Outputs the selected serial digital black signal (Option BK only).

NOTE. *The SIGNAL 1 and SIGNAL 2 connectors output the same test signal, and the BLACK 1 and BLACK 2 connectors output the same black signal.*

GPS7 module connectors

The GPS7 GPS Synchronization and Timecode module is equipped with four BNC connectors and one 15-pin, D-sub connector as described below. (See Figure 2-12.)

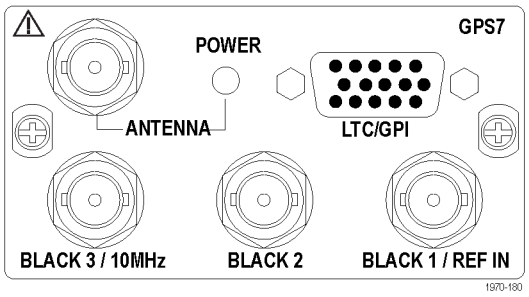


Figure 2-12: GPS7 module connectors

- **ANTENNA:** Input connector for a GPS antenna. The antenna input must meet specific requirements. (See page 3-102, *GPS antenna requirements*.)

  You can use the GPS7 module menu to enable this connector to provide 3.3 V or 5 V DC power to the antenna. When the connector is configured to provide power to the antenna, the rear-panel 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 will still pass through the RF signal, which will allow the GPS to function.
  - Displays solid green if the current load of the antenna is within the nominal range.

- **LTC/GPI:** 15 pin, D-sub connector that carries four differential LTC signals, one ground closure input, and two ground closure outputs. You can use the menus to independently set the format and timing of the four LTC signals and to select the function of the ground closure input and outputs.

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

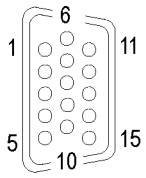
  The LTC/GPI connector provides full functionality when you use the LTC DSUB-to-XLR breakout cable that is available as an optional accessory with the GPS7 module. The LTC/GPI connector provides partial functionality when you use a standard RGBHV (VGA-to-BNC) breakout cable. (See Table 2-4.)

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

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

Table 2-4: GPS7 module LTC/GPI connector pin assignments

Pin #	Function	VGA cable
1	GP01	Red BNC
2	GP02	Green BNC
3	GPI	Blue BNC
4	No connection	
5	LTC4N	
6	Ground	Ground
7	LTC3N	Ground
8	LTC2N	Ground
9	No connection	
10	LTC1N	Ground
11	No connection	
12	LTC3P	
13	LTC2P	H BNC
14	LTC1P	V BNC
15	LTC4P	



- **BLACK 1 / REF IN:** Outputs the selected black burst or HDTV trilevel sync signal. You can also configure this connector to receive analog video, HD tri-level sync, or CW signals for use as a Genlock reference. The GPS7 module will sync with CW signals at 1, 3.58, 4.43, 5, or 10 MHz. (Earlier GPS7 modules do not have the reference input capability. On these modules, the connector is labeled **BLACK 1**.)
- **BLACK 2:** Outputs the selected black burst or HDTV trilevel sync signal. You can configure this output connector to turn off if certain errors are detected. The output will remain off as long as the error occurs. Use this function to trigger a downstream ECO to switch to backup.
- **BLACK 3 / 10 MHz:** Outputs the selected black burst or HDTV trilevel sync signal. You can also configure this connector to output a 10 MHz sine wave. (This connector is labeled **10 MHz / BLACK 3** on earlier GPS7 modules.)

NOTE. *You can use the menus to independently set the format and timing of the three black outputs and to enable VITC to be applied to the output signal.*

For HD trilevel sync signals, the BLACK 1, 2, and 3 outputs are a group that must all output either integer or non-integer rates. (See page 3-124, GPS7 module HD TRI-LEVEL SYNC RATE submenu.)

HD3G7 module connectors

The HD3G7 3 Gb/s SDI Video Generator module provides four BNC connectors as described below. (See Figure 2-13.)

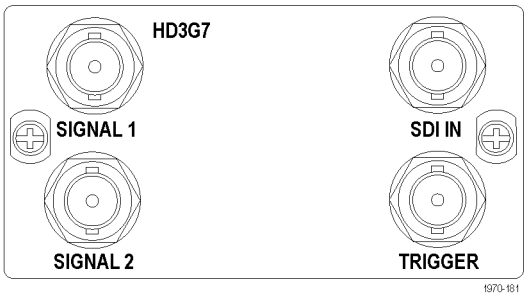


Figure 2-13: HD3G7 module connectors

- **SIGNAL 1:** Outputs the selected HD-SDI serial digital video test signal or an upconverted version of the input signal on the SDI IN connector.
- **SIGNAL 2:** The Signal 2 output can be configured to output a test pattern, where it produces the same output as the Signal 1 output, or to output a Black signal in the same format as the Signal 1 output. (See page 3-201, *HD3G7 module SECONDARY OUTPUT submenu*.)
- **SDI IN:** Input connector for an HD-SDI (4:2:2) video signal that you want to be upconverted.
- **TRIGGER:** Outputs a selected signal. The available choices for output are: system clock (148.5 MHz), frame/field pulse (once per video frame or field), or a line pulse (once per video line).

  When an interlaced format is selected, the frame/field pulse selection produces a frame-rate square wave trigger output which is low during field one and high during field two. The frame pulse selection produces the once per field pulse for all other formats.

NOTE. *When the SECONDARY OUTPUT selection is set to Test Pattern the SIGNAL 1 and SIGNAL 2 connectors output the same test signal.*

HDLG7 module connectors

The HDLG7 HD Dual Link Video Generator is equipped with five BNC connectors as described below. (See Figure 2-14.)

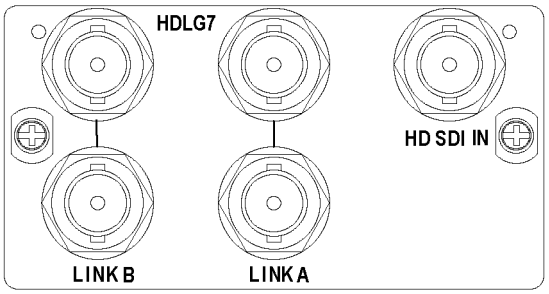


Figure 2-14: HDLG7 module connectors

- **HD SDI IN:** Input connector for an HD-SDI (4:2:2) video signal that you want to be upconverted.

NOTE. *Each pair of connectors (LINK A and LINK B) output the same signal.*

- **LINK A:** Outputs the selected HD-SDI dual-link video test signal or an upconverted version of the signal on the HD SDI IN connector.
- **LINK B:** Outputs the selected HD-SDI dual-link video test signal or an upconverted version of the signal on the HD SDI IN connector.

HDVG7 module connectors

The standard HDVG7 Digital Video Generator module is equipped with two BNC connectors to output serial digital video signals. Option BK adds two additional BNC connectors to output serial digital black signals. (See Figure 2-15.)

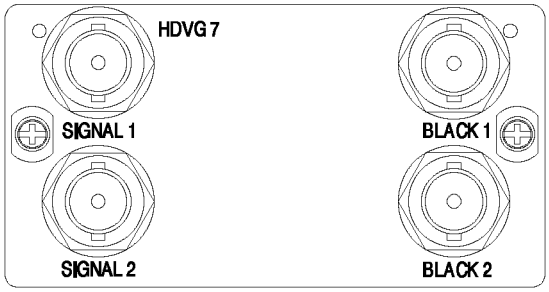


Figure 2-15: HDVG7 module connectors (Option BK)

NOTE. *The SIGNAL 1 and SIGNAL 2 connectors output the same test signal, and the BLACK 1 and BLACK 2 connectors output the same black signal.*

- **SIGNAL 1:** Outputs the selected serial digital video signal.
- **SIGNAL 2:** Outputs the selected serial digital video signal.
- **BLACK 1:** Outputs the selected serial digital black signal (Option BK only).
- **BLACK 2:** Outputs the selected serial digital black signal (Option BK only).

SDI7 module connectors

The SDI7 Dual Channel SD/HD/3G SDI Video Generator module provides five BNC connectors as described below. (See Figure 2-16.)

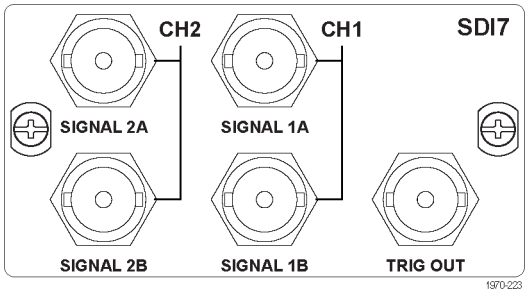


Figure 2-16: SDI7 module connectors

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

- **SIGNAL 1A:** Outputs the selected SDI serial digital video test signal for channel 1.
- **SIGNAL 1B:** This output can be configured to output one of the following signals: Test Pattern, Black, Black (No Audio), Black (Mute Audio), Test Pattern (No Audio), or Test Pattern (Mute Audio).

  When set to any of the Test Pattern selections, the Signal 1A and Signal 1B connectors will output the same test signal. When set to any of the Black selections, the Signal 1B black signal is the same format and sample structure as the Signal 1A output. (See page 3-275, *SDI7 module main menu*.)
- **SIGNAL 2A:** Outputs the selected SDI serial digital video test signal for channel 2.
- **SIGNAL 2B:** This output can be configured to output one of the following signals: Test Pattern, Black, Black (No Audio), Black (Mute Audio), Test Pattern (No Audio), or Test Pattern (Mute Audio).

  When set to any of the Test Pattern selections, the Signal 2A and Signal 2B connectors will output the same test signal. When set to any of the Black selections, the Signal 2B black signal is the same format and sample structure as the Signal 2A output.(See page 3-275, *SDI7 module main menu*.)

- **TRIG OUT:** This output can be configured to output one of the following signals: system clock (148.5 MHz), frame/field pulse (once per video frame or field), line pulse (once per video line), or pixel clock. (See page 3-309, *SDI7 module TRIGGER OUTPUT submenu*.)

  When an interlaced format is selected, the frame/field pulse selection produces a frame-rate square wave trigger output which is low during field one and high during field two. The frame pulse selection produces the once per field pulse for all other formats.

  The frame/field pulse and the line pulse signals are derived from the signal format of the selected trigger source (channel 1 or channel 2).

  The rate of the pixel clock depends on the signal format of the selected trigger source (channel 1 or channel 2):

  - 27 MHz for SD formats
  - 74.25 or 74.18 MHz for HD formats and most 3G formats (where 74.25 MHz is for integer frame rates and 74.18 MHz is for non-integer frame rates such as 59.94, 29.97, and 23.98 fps)
  - (Option 3G only) 148.5 MHz for signal formats such as 50p and 60p; 148.35 MHz for signal formats such as 59.94p.

Frame reset signals

The TG8000 uses the three frame reset signals described below to output different video formats simultaneously.

FRAME RESET 1

This frame reset signal 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
1035 59.94i	1080 59.94i	
1080 23.98p	1080 59.94p [1]	
	720 59.94p	

FRAME RESET 2

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

1035 60i	24 fps LTC
1080 24p	25 fps LTC
1080 24sF	30 fps LTC [2]
1080 30p	
1080 60p [1]	
1080 60i	
720 60p	

[1] HD3G7, HDLG7, and SDI7 with Option 3G only.

[2] Not drop frame

Frame reset signal 1 is not synchronized with frame reset signals 2 or 3 unless a GPS7 module is installed. When a GPS7 module is installed, the frame reset signal 1 synchronization is related to the frame reset signals 2 and 3 through the GPS7 epoch timing.

You can see which of the three frame reset signals are used by each output of each module by using the FRAME RESET STATUS submenu. (See page 2-26, *FRAME RESET STATUS submenu*.)

Fan fault alarm

CAUTION. *If the fan on the rear panel stops operating properly, the internal components of the instrument could be damaged due to overheating. To prevent this damage, disconnect the power cable from the AC power source.*

The TG8000 displays the following warning message if the fan on the rear panel stops operating properly. If this warning message appears, disconnect the power cable from the AC voltage line and contact your local Tektronix Field Office or representative.

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When the warning message appears, the LCD backlight flashes on and off and the front-panel buttons are disabled. If the beeper is enabled in the UTILITY submenu, the instrument will beep periodically for the duration of a fan fault condition. (See page 2-27, *UTILITY submenu*.) If the GPI Alarm Output is enabled and the GPI Fan Fault alarm is enabled, the GPI interface triggers a ground closure when a fan fault is detected.

You can operate the buttons temporarily (for approximately 30 seconds) by pressing the FRONT PANEL ENABLE button until the button illuminates. During the 30 seconds, you can use the UTILITY menu to view the diagnostics to see if there are additional hardware failures such as voltages and temperatures. After 30 seconds, the fan fault alarm will retrigger if the fan fault condition still exists and the front panel buttons will be disabled again. In this case, you should disconnect the AC power source and contact Tektronix to obtain repair service.

Mainframe menus

Main menu

When you power on the TG8000 and the initializing process for all of the installed module is completed, the top menu item of the mainframe main menu appears on the LCD display. The mainframe main menu allows you to access submenus to set the various system settings. The following figure shows the mainframe main menu. Press the up (▲) or down (▼) arrow button to scroll through the available menu selections in the main menu.

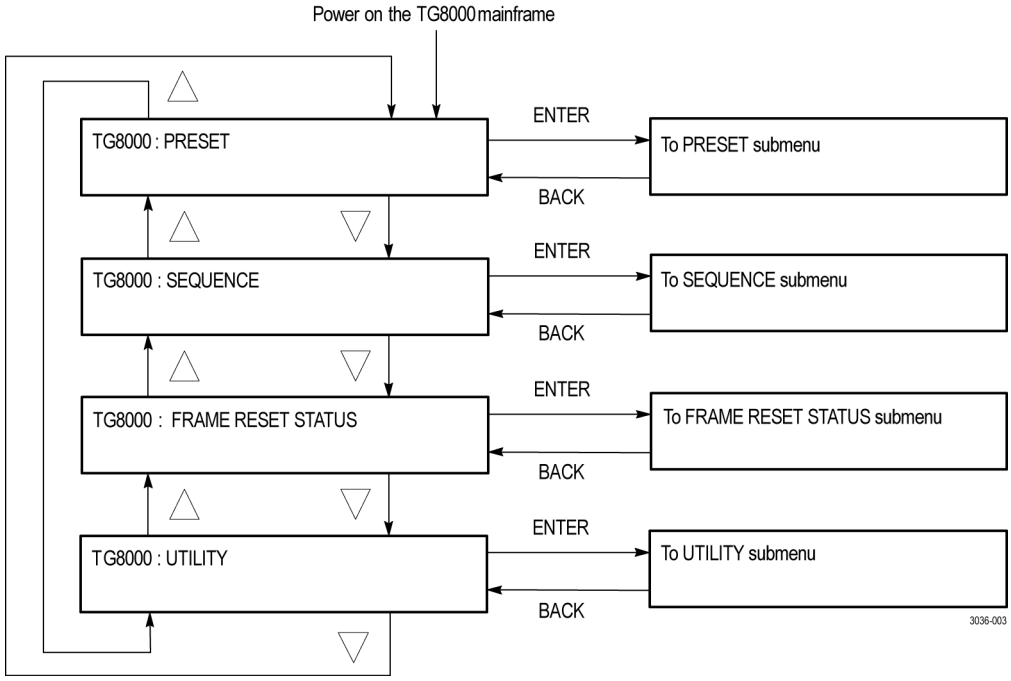


Figure 2-17: Mainframe main menu

PRESET. Recalls instrument settings saved as a preset, or saves the current instrument settings as a preset. When you select this menu item and then press the ENTER button, you access the PRESET submenu. (See page 2-23.)

SEQUENCE. Selects and executes a sequence program loaded into the TG8000. Select this menu item and press the ENTER button, to access the SEQUENCE submenu. (See page 2-25.)

FRAME RESET STATUS. Displays the status of the frame reset signals. Select this menu item and press the ENTER button to access the FRAME RESET STATUS submenu. (See page 2-26.) Refer to *Frame Reset Signals* for detailed information about the frame reset signals. (See page 2-20.)

UTILITY. Sets the system related settings such as network parameters, signal sets assignment to the front-panel test signal buttons, and enabling options. Select this menu item and press the ENTER button, to access the UTILITY submenu. (See page 2-27.)

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 right (►) arrow button to scroll through the menu items. (See Figure 2-18.)

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 TG8000 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. The following settings are not affected by the factory default: front-panel timeout, and network parameters.

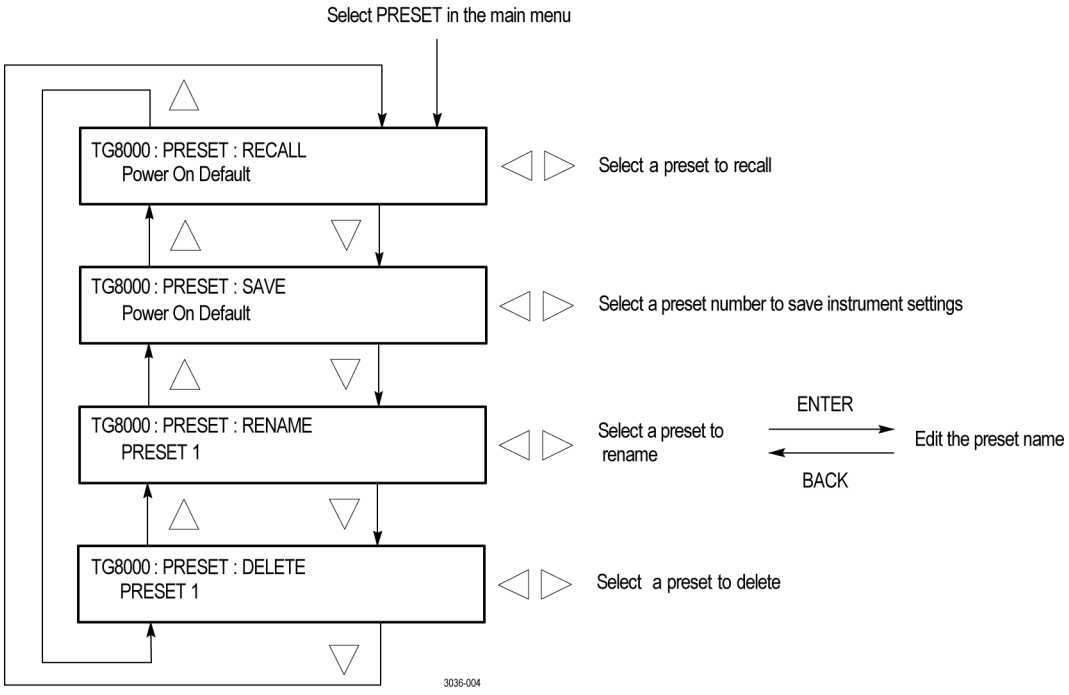


Figure 2-18: PRESET submenu

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 2.
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.

SEQUENCE submenu

Use this menu to select and run a sequence that is already loaded into the TG8000. (See Figure 2-19.) A sequence is a series of generator settings defined using the Tcl language and SCPI commands. The TG8000 loads a sequence and runs the command and settings in the order dictated by the sequences file.

Refer to the *TG8000 Programmer Manual* for more information about using sequences.

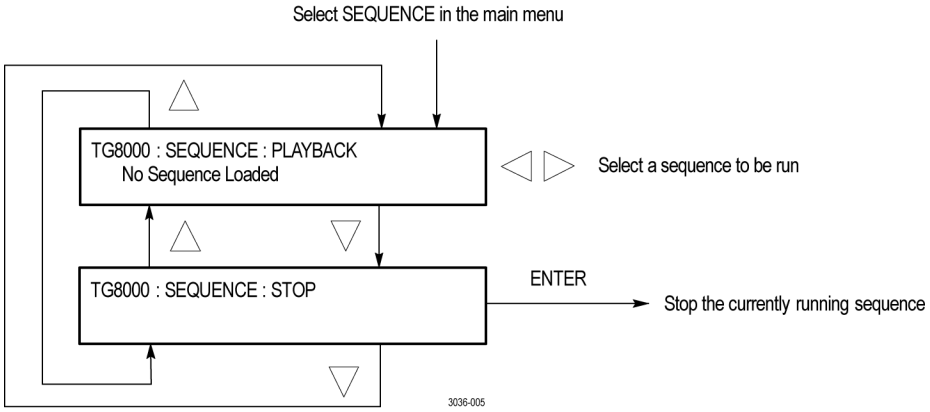


Figure 2-19: SEQUENCE submenu

PLAYBACK. Selects and runs a sequence. Use the left (◄) or right (►) arrow button to select the sequence you want to run, and then press the ENTER button to run the sequence.

If no sequence is loaded into the instrument, the message "No Sequence Found" is displayed on the second line.

STOP. Stops the currently running sequence. When you select the menu item and then press the ENTER button, the sequence is stopped.

FRAME RESET STATUS submenu

Use this menu to display which of the three frame reset signals is used by the output of the installed modules. Refer to *Frame Reset Signals* for detailed information about the frame reset signals. (See page 2-20.)

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

NOTE. *The character after the module name represents the output connector of the module. For example,* ***B1*** *represents the* ***BLACK 1*** *connector.*

When the TG8000 is genlocked using either an AGL7 or GPS7 module, 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 TG8000 is genlocked using the AGL7 module and that FRAME RESET 1 is being used by the genlock function.

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 installed modules.

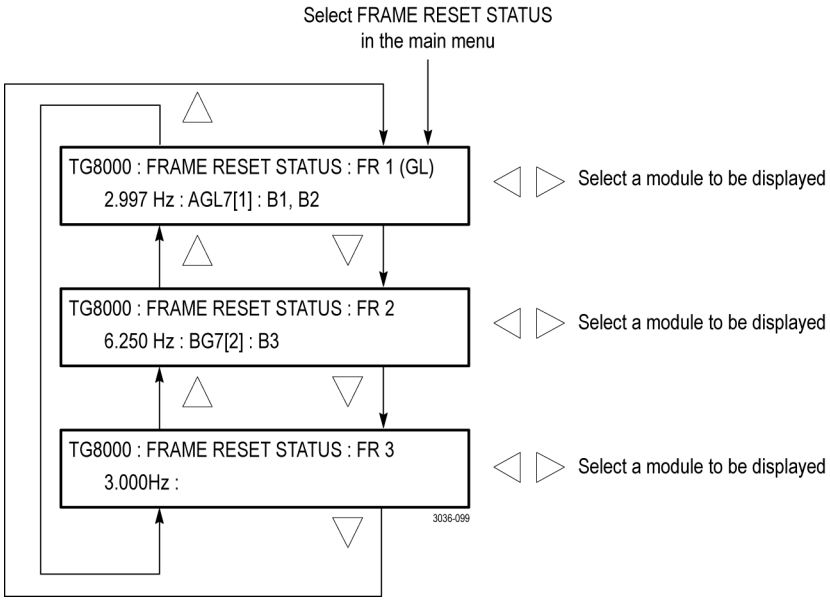


Figure 2-20: FRAME RESET STATUS submenu

For each of the frame reset signals, if two or more modules are using the same frame reset signal, use the left (◄) or right (►) arrow button to select which modules are displayed.

FRAME RESET 1. Displays the module(s) and output(s) using the 2.997 Hz frame reset signal.

FRAME RESET 2. Displays the module(s) and output(s) using the 6.250 Hz frame reset signal.

FRAME RESET 3. Displays the module(s) and output(s) using the 3.000 Hz frame reset signal.

UTILITY submenu

Use this menu to set the system-related settings such as the contrast of the LCD display and the network parameters or to enable module options. Use the up (▲) or down (▼) arrow button to scroll through the menu items. The following figures show the UTILITY submenu.

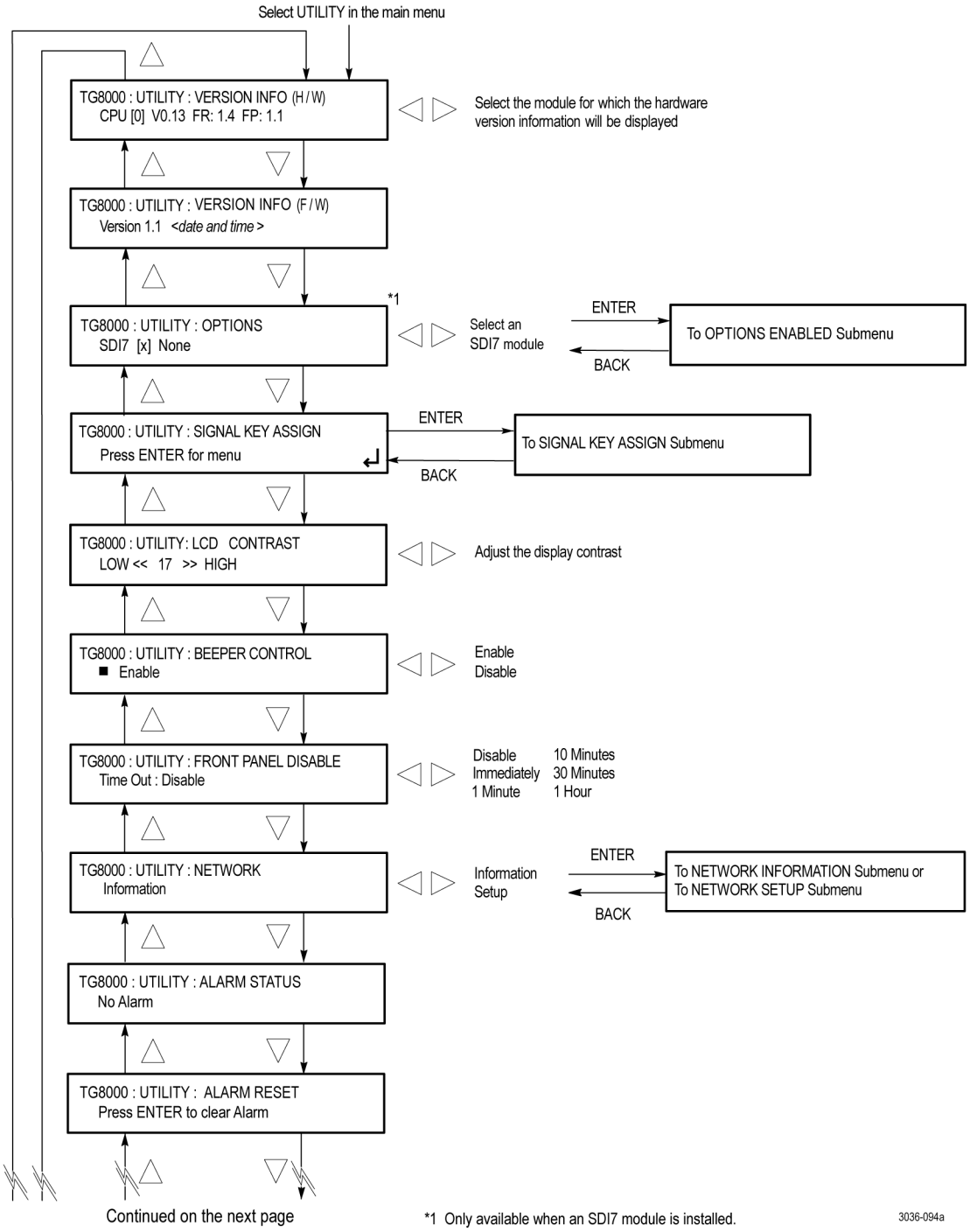


Figure 2-21: UTILITY submenu

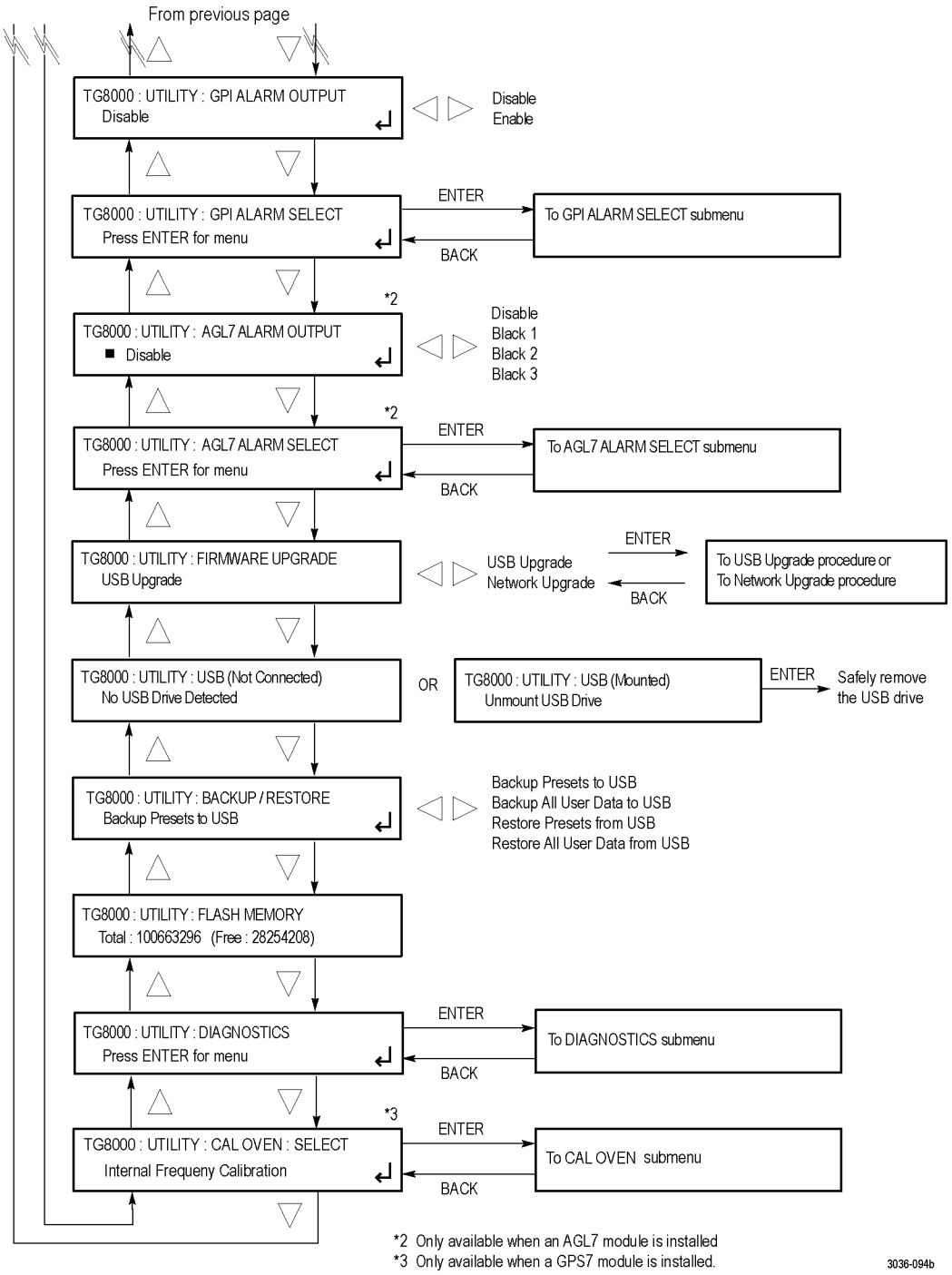


Figure 2-22: UTILITY submenu (Continued)

VERSION INFO (H/W). Displays the hardware version of the mainframe (CPU), the FPGA (Frame), and the Front Panel board (FP). Use the left (◄) or right (►) arrow button to select the module for which you want to display the hardware version.

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

OPTIONS. This menu item is available only if an SDI7 module is installed in the mainframe. Displays the status of whether Option 3G is enabled or not: SDI7[slot number] None is displayed if Option 3G is not enabled; SDI7[slot number] 3G is displayed if Option 3G is enabled.

If more than one SDI7 module is installed in the mainframe, use the left (◄) or right (►) arrow button to display the option status of another SDI7 module.

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 2-34, *OPTIONS submenu (SDI7 module only)*.)

SIGNAL KEY ASSIGN. Assigns signal sets to the front-panel test signal buttons and assigns a frame picture file created by the Frame Picture Generator to the OTHER test signal button. Select this menu item, and then press the **ENTER** button to access the SIGNAL KEY ASSIGN submenu. (See page 2-36.)

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 enable or disable the beeper.

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: **Disable**, **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 Disable), 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 about 1 second to restart the time-out counter and enable the front-panel buttons.

The FRONT PANEL ENABLE button is illuminated when the front-panel buttons are enabled.

NETWORK. Displays the current network parameters of the mainframe or sets the network parameters for the 10/100/1000 BASE-T port on the mainframe. Use the left (◄) or right (►) arrow button to toggle between **Information** and **Setup**.

When you select Information and press the ENTER button, you will access the NETWORK INFORMATION submenu. (See page 2-37.) When you select Setup and press the ENTER button, you will access the NETWORK SETUP submenu. (See page 2-38.)

ALARM STATUS. Displays the name of the highest severity mainframe alarm currently in effect. When no alarm is active, the message **No Alarm** is displayed. Alarms must be enabled in the GPI ALARM SELECT submenu or the AGL7 ALARM SELECT submenu (when an AGL7 module is installed) before they will appear in the Alarm Status display after an alarm has been triggered.

If multiple alarms have been triggered, only the name of the highest severity alarm is displayed. From low (1) to high (5) severity, the following alarm names may appear:

1. **No Alarm:** No errors have been detected.
2. **Genlock: Near Loss of Lock:** The frequency of the genlock signal and the internal reference signal have shifted considerably, and the TG8000 is near loss of lock. If this message appears, check the frequency of the genlock signal or the internal reference signal of the TG8000.
3. **Genlock: Loss of Lock:** The TG8000 cannot lock to the genlock signal.
4. **Genlock: No Signal:** A genlock signal is not connected.
5. **Fan Fault:** The fan on the rear panel has stopped operating properly.

NOTE. *The ALARM STATUS submenu does not update after you enter the UTILITY menu. Therefore, if a new alarm occurs while you are looking at this submenu, you will not see the new alarm until you exit and reenter the UTILITY menu.*

ALARM RESET. Resets all of the mainframe alarms that have been triggered. Press the ENTER button to clear the triggered alarms. If the condition(s) that triggered the alarm(s) still exists, the alarm(s) will come back immediately.

GPI ALARM OUTPUT. Enables or disables the GPI interface from triggering a ground closure when an enabled GPI alarm is triggered. Use the left (◄) or right (►) arrow button to enable or disable the GPI alarm output. Use the GPI ALARM SELECT menu item to select which GPI alarms to enable.

GPI ALARM SELECT. Selects which GPI alarms are enabled or disabled. When the GPI ALARM OUTPUT menu selection is set to Enabled, the GPI interface triggers a ground closure when an enabled GPI alarm is triggered. Select GPI ALARM SELECT, and then press the **ENTER** button to access the GPI ALARM SELECT submenu. (See page 2-40, *GPI ALARM SELECT submenu*.)

AGL7 ALARM OUTPUT. This menu item is available only when an AGL7 module is installed in the mainframe. Enables or disables the AGL7 module from blanking one of the black outputs to trigger a downstream Electronic Change Over (ECO) unit when an enabled AGL7 alarm is triggered. Use the left (◄) or right (►) arrow button to disable the AGL7 module alarm output or to select which AGL7 connector will output the alarm signal (BLACK 1, BLACK 2, or BLACK 3). Use the AGL7 ALARM SELECT menu item to select which AGL7 alarms to enable.

AGL7 ALARM SELECT. This menu item is available only when an AGL7 module is installed in the mainframe. When the AGL7 ALARM OUTPUT menu selection is set to Enabled, the AGL7 module blanks one of the black outputs when an enabled AGL7 alarm is triggered. Select AGL7 ALARM SELECT, and then press the **ENTER** button to access the AGL7 ALARM SELECT submenu. (See page 2-41, *AGL7 ALARM SELECT submenu*.)

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 page 2-51, *How to upgrade the instrument firmware*.)

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 the drive is initially 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 to or from a connected 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 2-63, *How to backup/restore presets and user data using a USB drive*.)

FLASH MEMORY. Displays the total amount of flash memory that is installed in the mainframe and displays the amount of memory that remains free (available). The flash memory is used by the test signal files that you install in the mainframe. When the amount of available memory is low, you may need to delete test signals from memory before you can install new test signals.

DIAGNOSTICS. Displays the results of diagnostic tests or executes the diagnostic routines for the mainframe and installed modules. Use the up (▲) or down (▼) arrow button to display diagnostic results or to choose to run the diagnostic routines. When diagnostic results are displayed, use the left (◄) or right (►) arrow button to select between the various diagnostic results. When you select **DIAGNOSTICS** and then press the **ENTER** button, you access the DIAGNOSTICS submenu. (See page 2-42, *Mainframe DIAGNOSTICS submenu*.)

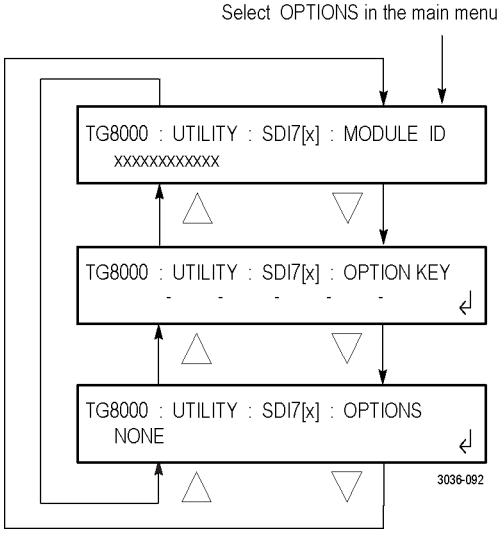
CAL OVEN. This menu item is available only when a GPS7 module is installed in the mainframe. Calibrates the frequency of the mainframe internal oscillator without removing the instrument from service. This menu item appears only when the mainframe has software version 5.1 or above installed and when there is GPS7 module installed in the mainframe. Select CAL OVEN, and then press the **ENTER** button to access the CAL OVEN submenu. (See page 2-46.)

OPTIONS submenu (SDI7 module only)

This submenu is available only if an SDI7 module is installed in the mainframe.

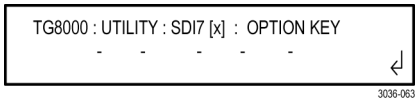
Use this menu to view the unique module ID of the selected SDI7 module, to view or enter the option key for Option 3G, and to view the status of whether the 3G option has been enabled. The following figure shows the OPTIONS submenu.

NOTE. *If you ordered Option 3G as an upgrade to the SDI7 module, you must enter the option key to enable the option.*



MODULE ID. Displays the unique ID of the selected SDI7 module. You will need to provide this ID number when you order Option 3G.

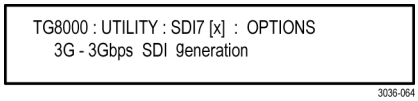
OPTION KEY. Displays the option key assigned to the selected SDI7 module. When Option 3G is not enabled, the option key string is blank as shown below.



To enter an 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 **ENTER** button to confirm the selections.

OPTIONS. Displays the enabled options for the selected SDI7 module: **None** is displayed if Option 3G is not enabled, **3G – 3Gbps SDI generation** is displayed when Option 3G has been enabled as shown below.



SIGNAL KEY ASSIGN submenu

Use this menu to assign signal sets to a specific front-panel test signal button and to assign a frame picture file created by the Frame Picture Generator to the OTHER test signal button. The following figure shows the SIGNAL KEY ASSIGN submenu.

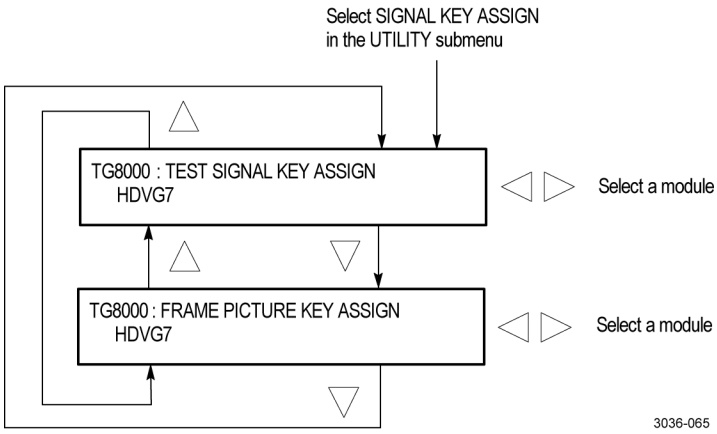


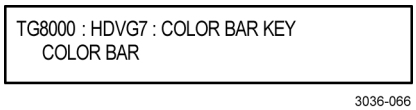
Figure 2-23: SIGNAL KEY ASSIGN submenu

TEST SIGNAL KEY ASSIGN. Assigns signal sets to a specific front-panel test signal button. The mainframe is shipped from the factory with signal sets corresponding to each button name already assigned. For example, when you press the **COLOR BAR** test signal button, the three types of color bars signals (100% Color Bars, 75% Color Bars, and SMPTE Color Bars) are available for output.

Perform the following steps to assign signal sets to a specific test signal button:

1. Use the left (◄) or right (►) arrow button to select the module to which you want to assign signal sets, and then press the **ENTER** button.

   This will display the following submenu to assign signal sets. The first line shows the name of the test signal button, and second line shows the name of the assigned signal set.



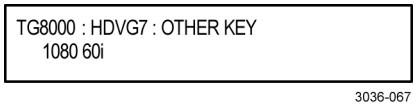
2. Use the up (▲) or down (▼) arrow button to select the test signal button to which you want to assign a signal set (for example **COLOR BAR KEY**).
3. Use the left (◄) or right (►) arrow button to select the signal set you want to assign to the selected test signal button (for example **COLOR BAR**).
4. Press the **ENTER** button to assign the signal set to the selected test signal button.
5. Repeat steps 2 to 4 until all signal set assignments are completed.

FRAME PICTURE KEY ASSIGN. Assigns frame picture files downloaded to the TG8000 to the OTHER test signal button. This operation is required to output the frame picture files as a picture (natural picture or test pattern).

Perform the following steps to assign a frame picture file to the OTHER test signal button:

1. Use the left (◄) or right (►) arrow button to select the module to which you want to assign a frame picture file, and press the **ENTER** button.

   This will display the following submenu. The second line shows the folder name that was created when the frame picture file was downloaded to the TG8000 mainframe.



2. Use the left (◄) or right (►) arrow button to select the folder in which the frame picture file is saved.
3. Press the **ENTER** button to assign the frame picture file to the OTHER button.

Refer to the *TG8000 PC Tools Technical Reference* for detailed information about creating a frame picture file and downloading the file from a PC to the TG8000 mainframe.

NETWORK INFORMATION submenu

Use this menu to display all of the current network parameters. Use the left (◄) or right (►) 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 INFORMATION submenu.

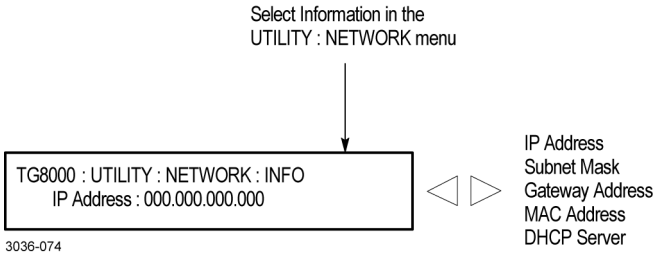


Figure 2-24: NETWORK INFORMATION submenu

NETWORK SETUP submenu

Use this menu to set the network parameters for the 10/100/1000 BASE-T port on the TG8000, which will be used when you remotely control the TG8000 using a PC and when you transfer files between the TG8000 and a PC. Refer to *Connecting to a Network* for detailed information about connecting the TG8000 to a PC. (See page 2-47.) Use the up (◄) or right (►) arrow button to scroll through the menu items. The following figure shows the NETWORK SETUP submenu.

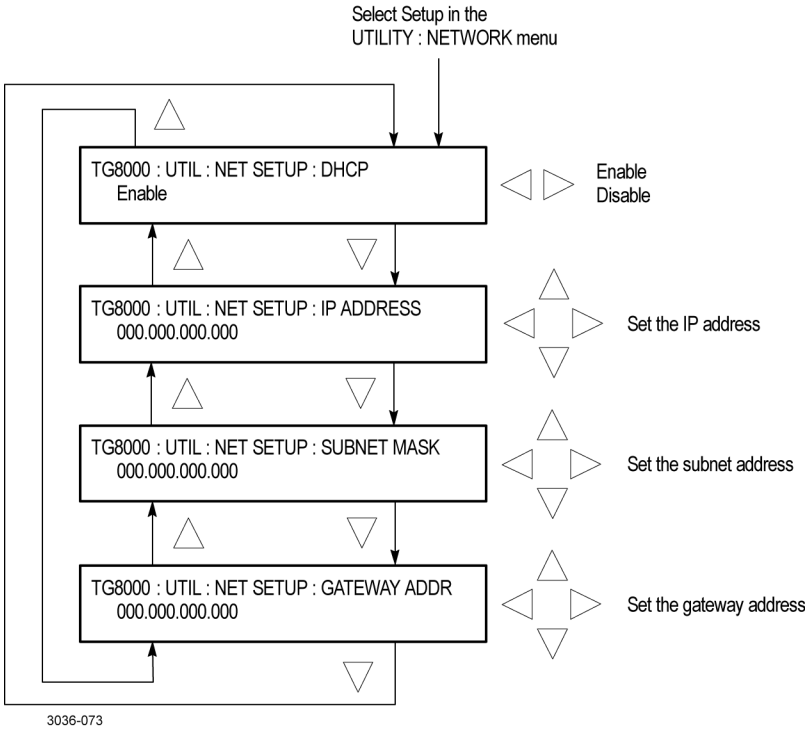


Figure 2-25: NETWORK SETUP submenu

DHCP. Enables or disables the TG8000 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 address values in each of the following menu items.

NOTE. *Under some network environments, the TG8000 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 TG8000. 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 TG8000 becomes invalid.*

SUBNET MASK. Sets the subnet address of the TG8000. 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 TG8000. 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.

GPI ALARM SELECT submenu

Use this submenu to select which GPI alarms are enabled or disabled. When the GPI ALARM OUTPUT menu selection is set to Enabled, the GPI interface triggers a ground closure when an enabled GPI alarm is triggered. The following figure shows the GPI ALARM SELECT submenu.

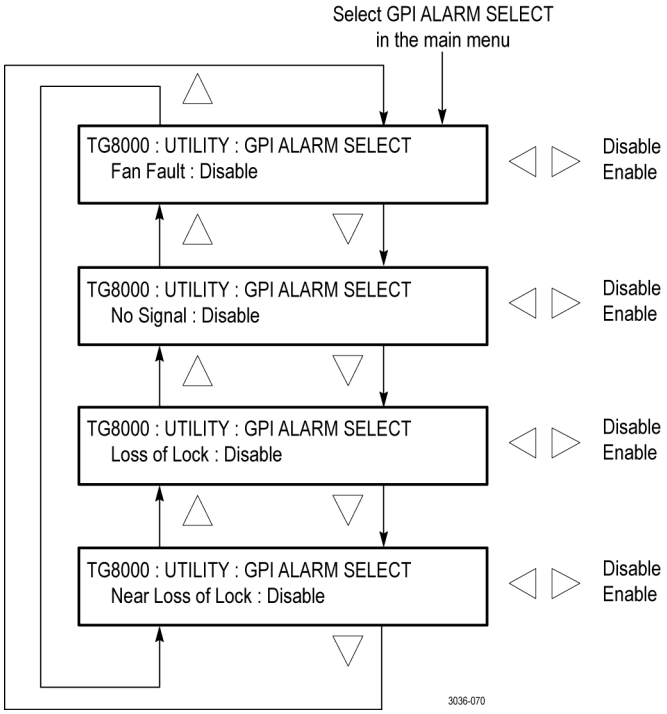


Figure 2-26: GPI ALARM SELECT submenu

For each of the following alarms, use the left (◄) or right (►) arrow button to select between **Enable** and **Disable**, and then press the **ENTER** button to implement the selection.

Fan Fault. Enables or disables a GPI alarm signal when a fan fault is detected.

No Signal. This menu item appears only when an AGL7 or GPS7 module is installed. Enables or disables a GPI alarm signal when no genlock signal is detected.

Loss of Lock. This menu item appears only when an AGL7 or GPS7 module is installed. Enables or disables a GPI alarm signal when a loss of genlock condition is detected.

Near Loss of Lock. This menu item appears only when an AGL7 or GPS7 module is installed. Enables or disables a GPI alarm signal when a loss of genlock condition is detected. This can happen when the frequency of the input signal is too far from the correct frequency.

AGL7 ALARM SELECT submenu

This menu item appears only when an AGL7 module is installed. Use this submenu to select which AGL7 alarms are enabled or disabled. When the AGL7 ALARM OUTPUT menu selection is set to Enabled, the AGL7 module blanks one of the black outputs when an enabled AGL7 alarm is triggered. The following figure shows the AGL7 ALARM SELECT submenu.

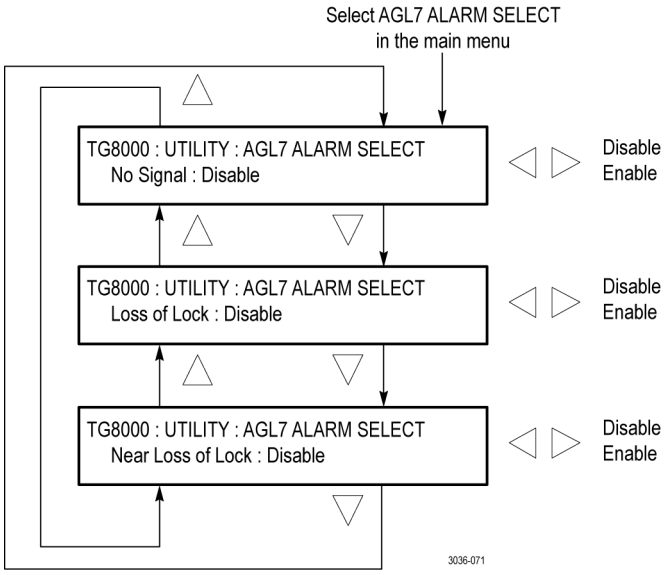


Figure 2-27: AGL7 ALARM SELECT submenu

For each of the following AGL7 alarms, use the left (◄) or right (►) arrow button to select between **Enable** and **Disable**, and then press the **ENTER** button to implement the selection.

No Signal. Enables or disables an AGL7 alarm signal when no genlock signal is detected.

Loss of Lock. Enables or disables an AGL7 alarm signal when a loss of genlock condition is detected.

Near Loss of Lock. Enables or disables an AGL7 alarm signal when a loss of genlock condition is detected. This can happen when the frequency of the input signal is too far from the correct frequency.

Mainframe DIAGNOSTICS submenu

Use this menu to view diagnostic readouts and to execute the diagnostic routines for the mainframe and installed modules. The following figure shows the DIAGNOSTICS submenu.

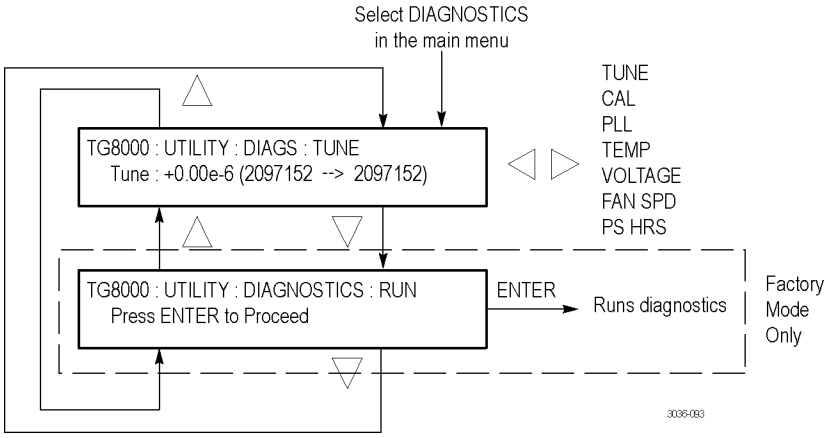


Figure 2-28: Mainframe DIAGNOSTICS submenu

TUNE. Displays how far the TG8000 system is deviating from the calibrated internal frequency of the mainframe 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 ±0.1 e-6, then you should consider calibrating the internal frequency of the instrument. This can be performed while the instrument is in service with no disruption to the operation. (See page 2-46, *CAL OVEN submenu (GPS7 module only)*.)

The first part of the Tune readout indicates the fractional amount of deviation from the calibrated frequency. For example, if you use a GPS7 or AGL7 module 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 TG8000 system 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 an AGL7 or GPS7 module is installed and the signal reference setting is not configured as INTERNAL.*

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 TG8000 system 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.

CAL. Displays the tuning control word for the calibrated frequency of the mainframe oscillator and how far the TG8000 system is deviating from the calibrated frequency to achieve a lock to the internal reference.

The first part of the CAL 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 CAL readout values will typically change. Over the life of the oscillator oven, the expected frequency drift is ±2.5 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. This can be performed while the instrument is in service with no disruption to the operation. (See page 2-46, *CAL OVEN submenu (GPS7 module only)*.)

PLL. Displays the frequency in MHz and the lock status for each of the mainframe clocks used to drive the video outputs. All of the clocks should show a status of locked (LK) during normal instrument operation.

TEMP. Displays the current temperatures of the mainframe and CPU in °C followed by their status. 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 current voltage readings for the various mainframe and module slot voltages. 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 readings include the status of the RTC (Real Time Controller) battery power level. The following readouts 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.

CAUTION. *The RTC battery should be replaced before it loses power. The RTC battery powers non-volatile memory that contains system information such as the network configuration settings and the real time clock settings. This information is accessed only when the instrument is powered on and initializes.*

FAN SPD. Displays the current fan speed 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.

PS HRS. Displays the number of hours that the power supply has been active. The instrument uses a log to track the number of hours that the power supply has been powering the instrument. For critical applications, you may want to replace the power supply periodically to prevent down time.

The expected life of the power supply 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). Use these guidelines to help you decide when to replace the power supply.

RUN. Runs the diagnostic routines for the mainframe and the installed modules. The instrument must be in Factory mode in order to access this menu selection.

CAUTION. *Before you execute the diagnostic routines, be sure to save the current instrument settings to a preset. After the diagnostics are completed, reboot the instrument and then recall the saved settings. You do not need to reboot the instrument if you run the diagnostics while the instrument is in normal mode.*

Press the **ENTER** button to execute the diagnostic routines.

The GPS7 module has its own diagnostics submenu; running the mainframe diagnostics here does not run the GPS7 diagnostics. (See page 3-146, *GPS7 module DIAGNOSTICS submenu*.) If all of the diagnostic routines are completed without any errors, the instrument will display "Pass".

If a diagnostic error is displayed, contact your local Tektronix Field Office or representative.

NOTE. *The front-panel buttons are disabled until the diagnostic routines are completed.*

CAL OVEN submenu (GPS7 module only)

Use this menu to set the internal frequency of the mainframe internal oscillator. This may be done without removing the instrument from service, allowing you to compensate for oven drift while the instrument is in its operating environment. This menu only appears when there is a GPS7 module installed.

The mainframe oscillator is calibrated by storing the current frequency of the oscillator while it is locked to a GPS or a reference video signal. This stored frequency value is used when the instrument boots up and when there is a loss of signal lock and the instrument is configured to switch to internal timing.

NOTE. *Perform the mainframe internal frequency calibration at least once a year to compensate for oscillator drift. With a GPS7 module installed, this calibration can be done while the instrument is in service.*

If your GPS7 module is installed in a TG700 mainframe, you need to also characterize the oscillator frequency as a function of voltage. Refer to the TG700 User Manual for more information (Tektronix part number 071-1970-XX).

The following figure shows the CAL OVEN submenu. You can find a complete internal frequency calibration procedure in the *Oven Calibration Procedures* section. (See page 3-100.)

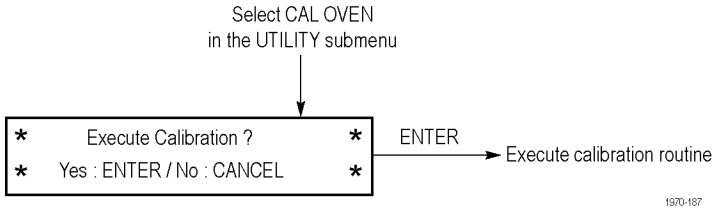


Figure 2-29: Internal frequency calibration menu

Press the **ENTER** button to execute the oscillator frequency calibration routine or press the **BACK** button to exit the menu.

CAUTION. *To prevent an incorrect oscillator frequency from being stored as the calibrated value, be sure that the instrument is locked to one of the following signal sources before you run the internal frequency calibration routine: Rubidium clock, GPS antenna (GPS7 module only), or the master sync signal of your video installation. To run the gain calibration, the instrument must be locked to a GPS reference.*

How to connect the generator to a network

The TG8000 has a 10/100/1000 BASE-T port on the rear panel that allows you to use a PC to remotely control the instrument and to upload and download files such as signal or logo files.

This section provides instructions for connecting the TG8000 to a single PC or to a network, and for setting the network parameters on 10/100/1000 BASE-T port.

Refer to the *TG8000 PC Tools Technical Reference* for detailed information about how to upload and download files using the 10/100/1000 BASE-T port.

Connecting the TG8000 to your PC(s)

The TG8000 uses the rear-panel 10/100/1000 BASE-T port to communicate with a PC or network. Use one of the following two methods to connect the TG8000 to your PC(s): (See Figure 2-2 on page 2-6.)

- If you are connecting the TG8000 directly to a single PC, use a crossover Ethernet cable to connect between the 10/100/1000 BASE-T port on the TG8000 and the Ethernet port on the PC.

  If you need to construct your own crossover cable, use the following figure to change the pin connections on a straight cable to produce a crossover cable. (See Figure 2-30.)

- If you are connecting the TG8000 to your local Ethernet network, use a straight Ethernet cable to connect between the 10/100/1000 BASE-T port on the TG8000 and the Ethernet hub port of your local network. By connecting to an Ethernet network, you can access the TG8000 using any PC on the network.

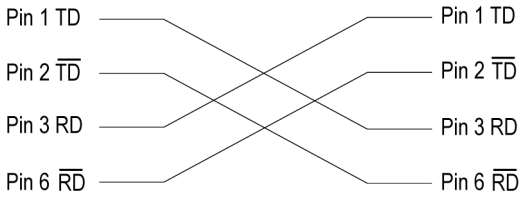


Figure 2-30: Pin connections for a crossover Ethernet cable

Setting Ethernet network parameters

Use the NETWORK SETUP submenu to set the network parameters for the TG8000 mainframe.

Accessing the NETWORK SETUP submenu.

Perform the following procedure to access the NETWORK SETUP submenu:

1. Press the front-panel **MODULE** button repeatedly to display the mainframe main menu.
2. Use the up (▲) or down (▼) arrow button to select **UTILITY**, and then press the **ENTER** button. This accesses the UTILITY submenu.

3. Use the up (▲) or down (▼) arrow button to select **Network**.
4. Use the left (◄) or right (►) arrow button to select **Setup**. This accesses the NETWORK SETUP submenu. (See Figure 2-25 on page 2-38.)

Setting the parameters on a network with a DHCP server. If your network has a DHCP server, use the NETWORK SETUP submenu to enable the TG8000 to function as a DHCP client. When the TG8000 is connected to the network and DHCP service is enabled, the TG8000 obtains the necessary network addresses automatically from the DHCP server.

NOTE. *Under some network environments, the TG8000 may not be able to get the IP address automatically from a DHCP server. In this case, you need to enter the appropriate address value in each submenu item.*

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

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

1. If you connect the TG8000 directly to a single PC:
   a. Set the **IP ADDRESS** parameter to be the same IP address as the PC's address except for the last number. The last number must be different than the last number in the PC's IP address.
   b. Set the **SUBNET MASK** parameter to be the same net mask (subnet mask) used by the PC. Do not enter a number if the PC does not have a net mask.
   c. You do not need to enter a **GATEWAY ADDR** if you are directly connected to a single PC.
2. If you connect the TG8000 to your local Ethernet network, see the *Caution* note below.

⚠ ***CAUTION.*** *To prevent communication conflicts on your Ethernet network, ask your local network administrator for the correct numbers to enter in the NETWORK PARAMETERS submenu if you connect the TG8000 to your local Ethernet network.*

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

How to use the mainframe General Purpose Interface (GPI)

The TG8000 mainframe provides a dedicated RJ-45 connector on the rear panel to serve as a General Purpose Interface (GPI). With the mainframe GPI, you can recall one of the seven available presets and output an alarm signal.

This section describes how to use the mainframe GPI and its available features.

Pin assignments of the GPI connector

The following figure shows the pin assignments of the GPI connector. Use pins 1, 2, and 3 to input signals for recalling a preset. Use pin 4 to output an alarm signal. Frame ground is used for the ground return. When using a shielded LAN cable (shielded twisted pair cable), you can use the shield of the cable as ground.

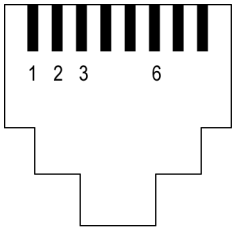


Table 2-5: Pin assignments of the mainframe GPI connector

Pin number	Function	Level
1, 2, and 3	Input	High > 2.4 V or open (connected to an internal 10 kΩ pull-up resistor) Low < 0.8 V or ground (input impedance: 10 kΩ) Timing: Ignores pulses < 40 ms and always detects pulses > 60 ms
6	Output	Low < 0.4 V or ground (when sinking 100 mA; maximum on-resistance 4 Ω)

Recalling a preset

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

Table 2-6: Signal level combinations and the corresponding preset for the mainframe GPI

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

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

NOTE. *Since the signal transition cannot be detected on the edge of the signal, the signal level needs to be held low for about 0.5 seconds before the preset signal is recognized. The time required to change the instrument settings depends on the contents of the selected preset.*

Outputting an alarm signal

The TG8000 can output an alarm signal from pin 6 on the GPI port connector when an internal error occurs. Since the output signal is an active low; the signal level for pin 6 goes from High to Low when any errors occur.

In addition, you can specify a BLACK output on the AGL7 module as an alarm output. When an enabled AGL7 alarm occurs, the output signal from the selected connector turns off for about 60 ms.

NOTE. *The AGL7 hardware must be at Version 3.x or above to support outputting an alarm signal.*

The alarm signal is output when one of the following internal errors occurs:

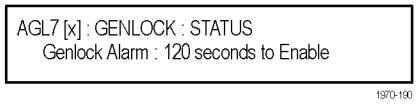
- The fan stops working (GPI alarm only).

NOTE. *The following genlock alarms are available only when an AGL7 or GPS7 module is installed.*

- A genlock signal is not connected.
- The TG8000 does not lock to a genlock signal.
- The frequency of the genlock signal and the internal reference shift considerably, and the TG8000 is near loss of lock. The threshold for near loss of lock is approximately 2×10^{-6} from the ends of the tune range.

The alarm signal output can be enabled using the GPI ALARM OUTPUT and AGL7 ALARM OUTPUT menu items in the UTILITY submenu. (See page 2-40.) (See page 2-41.)

NOTE. *After the instrument is powered on, it takes about three minutes to detect a stable error signal (this time is required to stabilize the temperature in the temperature-controlled oven in the internal reference oscillator). You can see the remaining time before the alarm becomes effective in the AGL7 main menu as shown below.*



How to upgrade the instrument firmware

NOTE. *It is recommended that you always upgrade the instrument firmware before you install a new module.*

You can use the UTILITY menu to upgrade the firmware installed in the instrument using one of the following two methods:

- **USB upgrade:** Install the upgrade using a USB drive that is connected to the instrument.
- **Network upgrade:** Install the upgrade using a PC that has an Ethernet network connection to the instrument.

CAUTION. *To prevent the loss of your user created files during a firmware upgrade, be sure to backup all user data to a USB drive as instructed in the upgrade procedures.*

During the firmware upgrade process, all files created or installed by the user are deleted. The deleted files include presets, signal files, frame picture files, logo files, sequence files, and for the SDI7 module, can also include text and font files. At the end of the upgrade process, the standard set of factory installed signal files, logo files, and SDI7 module font files are restored. After the upgrade is complete, you can then restore the backed up data from the USB drive.

Before you begin the upgrade

You do not need to upgrade the firmware if your instrument has the latest firmware version already installed. Perform the following steps to determine if the firmware on your instrument needs to be upgraded:

1. Power on the instrument.
2. Verify the current firmware version installed on the instrument:
   a. Press the **MODULE** button to select **TG8000 : PRESET**.
   b. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY**, and then press the **ENTER** button.
   c. Press the up (▲) or down (▼) arrow button to select **VERSION INFO (F/W)**.
   d. In the second line of the display readout, note the version of the installed firmware.

Instrument firmware version number	

3. Verify the latest version of firmware at the Tektronix Web site:
   a. Use the Web browser on a PC to navigate to the following Tektronix Web site:

      `http://www.tektronix.com/downloads`

   b. On the Downloads Finder Web page, search by model number (such as TG8000) and filter by software and software type to locate the firmware-upgrade package for the instrument.
   c. Note the latest version number of the firmware-upgrade package(s).

Web site firmware version number	

4. If the latest firmware version at the Web site is the same as the version on your instrument, you do not need to upgrade the firmware and no action is required.
5. If the latest firmware version at the Web site is newer than the version on your instrument, you should upgrade the firmware.
6. Download the latest firmware version to your PC.
7. After the software package is downloaded, click on the self-extracting archive to extract the following files into the directory of your choice: transfer.exe and firmware.pkg. There may also be a readme.txt file.

NOTE. *If the firmware upgrade package contains a readme.txt file, be sure to read the file before you attempt to upgrade the firmware on your instrument.*

If you are performing the upgrade using a network connection, the transfer.exe and firmware.pkg files must be located in the same directory on the PC.

To perform the upgrade, you can use either the USB upgrade procedure or the network upgrade procedure. The time required to complete the upgrade is about 10 minutes.

CAUTION. *During the upgrade process, once the instrument has started to erase internal flash memory, DO NOT remove power from the instrument. If you do so, the instrument flash memory will be corrupted. The instrument will have to be sent to a Tektronix factory service center to have the system firmware restored.*

If power to the instrument is lost before it begins erasing the internal flash memory, you can restart the firmware upgrade after the instrument reboots.

To prevent loss of your user files, be sure to use the ***Backup All User Data to USB*** *option as instructed during the upgrade procedure.*

To upgrade the firmware using a USB drive

1. Connect a USB drive to the PC that contains the latest TG8000 firmware.
2. On the PC, navigate to the USB drive.
3. In the root directory of the USB drive, create a directory named:

   `TgUpgrd`

CAUTION. *To prevent an upgrade failure, the upgrade files must be located in a folder named "TgUpgrd" in the root directory of the USB drive. The folder name is case sensitive.*

4. Open the TgUpgrd directory and copy the firmware.pkg file (from the extracted archive) to the USB device.

   The USB drive should have a directory path of `TgUpgrd\firmware.pkg`.

NOTE. *For a USB upgrade, you do not need to copy the transfer.exe file from the extracted archive to the USB drive.*

5. Safely remove the USB device from the PC and insert it into the USB port on the front panel of the instrument.
6. If necessary, power on the instrument.
7. Press the **MODULE** button to select **TG8000 : PRESET**.
8. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY**, and then press the **ENTER** button.

9. Verify the status of the USB drive:

   a. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY : 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.

10. Back up the user created files:

   a. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY : BACKUP/RESTORE**.

   b. Press the left (◄) or right (►) arrow button to select **Backup All User Data to USB**, and then press the **ENTER** button to start the backup process.

   c. 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.

   d. 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.

   e. 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.

   f. When the backup 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 fills up before the backup operation completes, an error message is displayed. Press the ENTER or BACK button to clear the error message. (See page 2-64, Memory requirements.)*

11. After the backup operation is complete, press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY : FIRMWARE UPGRADE**.

12. Press the left (◄) or right (►) arrow button to select **USB Upgrade**, and then press the **ENTER** button to start the upgrade process.

13. A warning message is displayed asking you to verify the upgrade operation. The old and new firmware version numbers are displayed. Press the **ENTER** button to proceed or press the **BACK** button to cancel the operation.

NOTE. *If the instrument displays a message indicating that a USB device containing the firmware was not detected, verify that the USB drive is properly mounted and has the correct directory path (TgUpgrd\firmware.pkg).*

14. A second confirmation message is displayed to remind you that the upgrade will delete all user-created files on the instrument.

CAUTION. *If you did not backup your user files as described in step 10, it is recommended that you press the **BACK** button to cancel the upgrade and then backup your user files before performing the upgrade. You will restore the user files after the upgrade.*

15. Press the **ENTER** button to proceed with the upgrade or press the **BACK** button to cancel the upgrade.
16. Monitor the progress of the upgrade operation:
    a. During the upgrade process, the display shows the progress of the upgrade and shows messages such as “Reading Firmware Data” and “Erasing Application FS Partition”. This may take a several minutes.
    b. When the upgrade has completed, the message “Tektronix Generator Booting” is displayed while the instrument reboots before the menu display returns to normal.

CAUTION. *If your instrument has a AGL7 module installed, make note of the following steps. If you interrupt the initialization of the AGL7 module during the upgrade, the AGL7 module will be inoperable and will have to be returned to Tektronix for service.*

If you do not reboot the instrument a second time, the AGL7 module will not be fully upgraded.

    c. **AGL7 module only:** If your instrument has a AGL7 module installed, you will see the message “Initializing AGL7” displayed for several minutes during the reboot. Do not interrupt this process.
    d. **AGL7 module only:** After the instrument reboots, cycle power again to complete the AGL7 upgrade.

17. After the upgrade process is complete and the instrument reboots, restore the user created files:

    a. Press the **MODULE** button to select **TG8000 : PRESET**.

    b. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY**, and then press the **ENTER** button.

    c. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY : BACKUP/RESTORE**.

    d. Press the left (◄) or right (►) arrow button to select **Restore All User Data from USB**, and then press the **ENTER** button to start the restore process.

    e. 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.

    f. 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.

    g. 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.

    h. When the 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 flash memory on the instrument fills up before the restore operation completes, an error message is displayed. Press the ENTER or BACK button to clear the error message. (See page 2-64, Memory requirements.)*

18. Unmount the USB drive:

    a. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY : USB <status>**. The USB status should be **Mounted**

    b. 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 **TG8000 : UTILITY : USB (Not mounted)**.

    c. Remove the USB drive from the instrument.

19. If your TG8000 includes an HDLG7 module, proceed with the following steps to complete the upgrade:

CAUTION. *While upgrading, do not press the front panel buttons or cycle the instrument power. Doing so can corrupt the module memory and FPGA image.*

a. Power on the TG8000.

b. Press the **MODULE** button until the name of the HDLG7 module you are upgrading appears.

c. Press and hold the **ENTER** button until "Upgrade FPGA" appears.

d. Press the **ENTER** button to upgrade the module.

e. The upgrade will take approximately three minutes. After it is complete, remove power from the TG8000 and then reapply power to reboot the system.

NOTE. *If you are upgrading the FPGA of multiple HDLG7 modules, you need to upgrade them separately and reboot the instrument after each upgrade. For example, if you have three HDLG7s, the FPGA upgrade process sequence will be: select and upgrade a module, then reboot, then select and upgrade another module, then reboot, select and upgrade the final module, then reboot. You do not need to upgrade the modules in any particular order.*

20. Verify that the firmware version in the instrument is the same version you just installed:

a. Press the **MODULE** button to select **TG8000 : PRESET**.

b. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY**, and then press the **ENTER** button.

c. Press the up (▲) or down (▼) arrow button to select **VERSION INFO (F/W)**.

d. In the second line of the display readout, verify that the CPU (0) version number is the same version number as the upgrade file you installed.

To upgrade the firmware using an Ethernet network

1. Connect the TG8000 generator and a PC to your local Ethernet network. (See page 2-47, *How to connect the generator to a network*.)
2. Download the upgrade files to the PC. (See page 2-52, *Before you begin the upgrade*.)
3. Power on the instrument.
4. Insert a USB drive into the USB port on the front panel of the instrument.
5. Press the **MODULE** button to select **TG8000 : PRESET**.
6. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY**, and then press the **ENTER** button.
7. Verify the status of the USB drive:
   a. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY : 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.
8. Back up the user created files:
   a. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY : BACKUP/RESTORE**.
   b. Press the left (◄) or right (►) arrow button to select **Backup All User Data to USB**, and then press the **ENTER** button to start the backup process.
   c. 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.
   d. 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.
   e. 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.
   f. When the backup 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 fills up before the backup operation completes, an error message is displayed. Press the ENTER or BACK button to clear the error message. (See page 2-64, Memory requirements.)*

9. After the backup operation is complete, prepare the instrument for the firmware upgrade:

   a. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY : FIRMWARE UPGRADE**.

   b. Press the left (◄) or right (►) arrow button to select **Network Upgrade**, and then press the **ENTER** button. This puts the instrument in upgrade mode and makes it ready to receive the upgrade files through the 10/100/1000 BASE-T port.

   c. A second confirmation message is displayed to remind you that the upgrade will delete all user-created files on the instrument.

CAUTION. *If you did not backup your user files as described in step 8, it is recommended that you press the **BACK** button to cancel the upgrade and then backup your user files before performing the upgrade. You will restore the user files after the upgrade.*

   d. Press the **ENTER** button to proceed with the upgrade or press the **BACK** button to cancel the upgrade.

10. From the instrument display, note the current IP address of the instrument.

11. Perform the firmware upgrade:

   a. On the PC, double-click the **transfer.exe** file to launch the transfer program.

   b. Type the IP address or DNS name of the instrument you are upgrading, and then press **Enter**. This starts the firmware upgrade process.

CAUTION. *To prevent upgrade failure, do not close the transfer.exe window until the transfer utility asks for another IP address.*

When the firmware upgrade completes, the instrument should reboot.

c. The transfer utility displays done when the software upgrade completes and asks for the address of another instrument. When the software upgrade completes, the instrument should reboot.

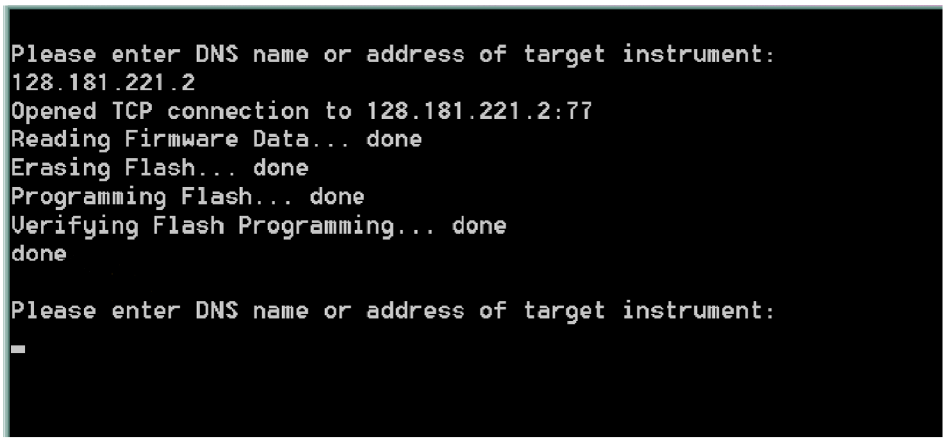


Figure 2-31: Example transfer.exe window after the network upgrade is complete

d. If the instrument did not reboot at the completion of the firmware upgrade, remove and reapply power to the instrument to cause it to reboot.

e. While the instrument reboots, the message "Tektronix Generator Booting" is displayed before the menu display returns to normal.

⚠ ***CAUTION.*** *If your instrument has a AGL7 module installed, make note of the following steps. If you interrupt the initialization of the AGL7 module during the upgrade, the AGL7 module will be inoperable and will have to be returned to Tektronix for service.*

If you do not reboot the instrument a second time, the AGL7 module will not be fully upgraded.

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f. **AGL7 module only:** If your instrument has a AGL7 module installed, you will see the message "Initializing AGL7" displayed for several minutes during the reboot. Do not interrupt this process.

g. **AGL7 module only:** After the instrument reboots, cycle power again to complete the AGL7 upgrade.

12. After the upgrade process is complete and the instrument reboots, restore the user created files:

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

a. Press the **MODULE** button to select **TG8000 : PRESET**.

b. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY**, and then press the **ENTER** button.

c. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY : BACKUP/RESTORE**.

d. Press the left (◄) or right (►) arrow button to select **Restore All User Data from USB**, and then press the **ENTER** button to start the restore process.

e. 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.

f. 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.

g. 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.

h. When the 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 flash memory on the instrument fills up before the restore operation completes, an error message is displayed. Press the ENTER or BACK button to clear the error message.* *(See page 2-64, Memory requirements.)*

13. Unmount the USB drive:

    a. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY : USB <status>**. The USB status should be **Mounted**

    b. 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 **TG8000 : UTILITY : USB (Not mounted)**.

    c. Remove the USB drive from the instrument.

14. If your TG8000 includes an HDLG7 module, proceed with the following steps to complete the upgrade:

CAUTION. *While upgrading, do not press the front panel buttons or cycle the instrument power. Doing so can corrupt the module memory and FPGA image.*

    a. Power on the TG8000.

    b. Press the **MODULE** button until the name of the HDLG7 module you are upgrading appears.

    c. Press and hold the **ENTER** button until "Upgrade FPGA" appears.

    d. Press the **ENTER** button to upgrade the module.

    e. The upgrade will take approximately three minutes. After it is complete, remove power from the TG8000 and then reapply power to reboot the system.

NOTE. *If you are upgrading the FPGA of multiple HDLG7 modules, you need to upgrade them separately and reboot the instrument after each upgrade. For example, if you have three HDLG7s, the FPGA upgrade process sequence will be: select and upgrade a module, then reboot, then select and upgrade another module, then reboot, select and upgrade the final module, then reboot. You do not need to upgrade the modules in any particular order.*

How to backup/restore presets and user data using a USB drive

You can use the UTILITY menu to backup or restore the instrument presets and all user data using a USB drive that is connected to the instrument. (See page 2-27, *UTILITY submenu*.) You can use the backup and restore functions to duplicate settings and signal files between different TG8000 generators.

How the backup and restore operations work

During the backup operation, files are copied to a directory named "TgBackup" 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 TG8000 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, HDVG7/PRESET/MSTATE0.01) will be copied or created.

NOTE. *The preset file names use the format MSTATEX.YY. 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. 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 the SDI7 module, 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 UTILITY 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.

To backup/restore presets or user data using a USB drive

1. Connect a USB drive to the TG8000 generator.
2. Press the **MODULE** button to select **TG8000 : PRESET**.
3. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY**, and then press the **ENTER** button.
4. Verify the status of the USB drive:
   a. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY : 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.
5. Press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY : BACKUP/RESTORE**.
6. 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**
7. Press the **ENTER** button to start the selected backup or restore operation.
8. 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.

9. 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 2-64, Memory requirements.)*

10. After the backup or restore operation is complete, press the up (▲) or down (▼) arrow button to select **TG8000 : UTILITY : USB (Mounted)**.

11. 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 **TG8000 : UTILITY : USB (Not mounted)**.

12. Remove the USB drive from the instrument.

How to transfer user files using FTP

When the TG8000 generator is connected to an Ethernet network, you can use an FTP client to drag and drop user files to or from the generator. Perform the following steps to transfer files to or from the instrument using FTP:

1. Connect the TG8000 generator to your local Ethernet network. (See page 2-47, *How to connect the generator to a network*.)

2. On a computer connected to the same network as the TG8000 generator, open an FTP client such as Windows Explorer.

3. In the Windows Explorer command box, enter "ftp://*IP address*", where IP address is the network address assigned to the TG8000 generator.

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

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

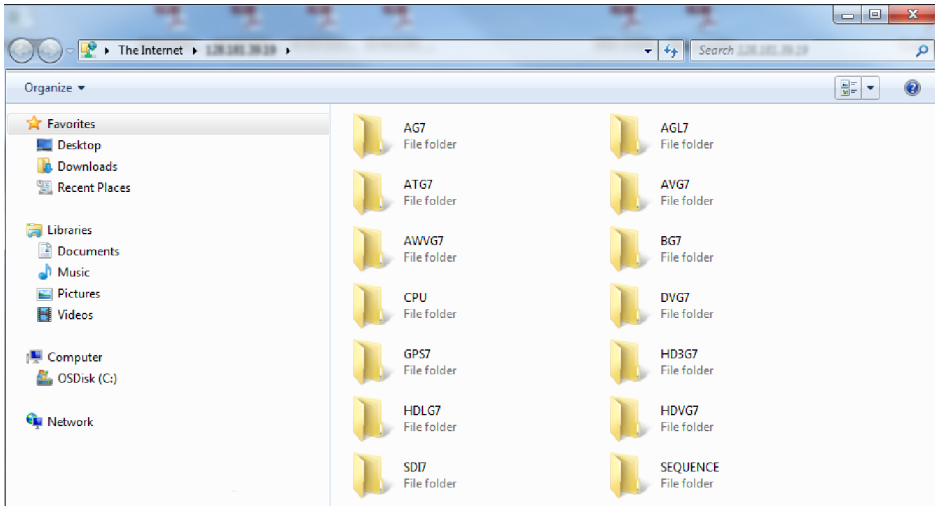

Figure 2-32: Example FTP view of the instrument file structure

5. Use Windows Explorer to drag and drop user files to or from the TG8000 generator.

NOTE. *If the flash memory on the instrument fills up before the copy operation completes, an error message similar to the one below is displayed. Click* ***OK*** *to clear the error message.* *(See page 2-64, Memory requirements.)*

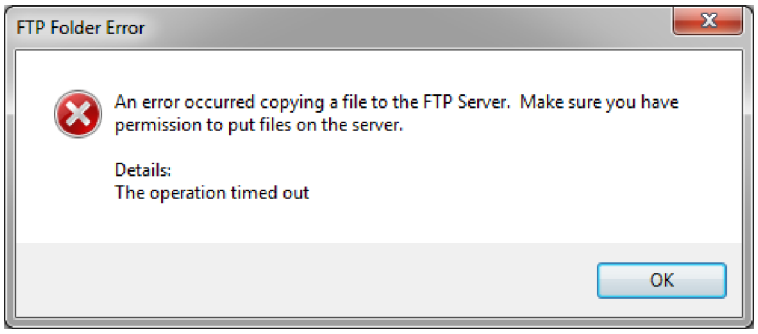

Figure 2-33: Example FTP error message when flash memory is full

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

Inspection and cleaning

Inspect and clean the instrument as often as your operating conditions require. The collection of dirt can cause instrument overheating and operational failure. Dirt acts as an insulating blanket, preventing efficient heat dissipation. Dirt also provides an electrical conduction path that can cause an instrument failure, especially under high-humidity conditions.

CAUTION. *Avoid the use of chemical cleaning agents that might damage the plastics used in this instrument. Use only deionized water when cleaning the front-panel controls. Use a 75% isopropyl alcohol solution as a cleaner, and rinse with deionized water.*

Avoid the use of high-pressure compressed air when cleaning dust from the interior of this instrument. High-pressure air can cause electrostatic discharge (ESD). Instead, use low-pressure compressed air (about 9 psi).

Exterior inspection

Using the following table as a guide, inspect the outside of the instrument for damage, wear, and missing parts. You should thoroughly check instruments that appear to have been dropped or otherwise abused to verify correct operation and performance. Immediately repair defects that could cause personal injury or lead to further damage to the instrument.

Table 2-7: External inspection check list

Item	Inspect for	Repair action
Cabinet and front panel	Cracks, scratches, deformations, damaged hardware	Replace defective module
Front-panel buttons	Missing or damaged	Repair or replace missing or defective buttons
Connectors	Broken shells, cracked insulation, deformed contacts, and dirt in connectors	Replace defective modules; clear or wash out dirt
Accessories	Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors	Replace damaged or missing items, frayed cables, and defective modules

Exterior cleaning

Perform the following steps when you clean the exterior of the instrument:

WARNING. *To avoid injury or death, unplug the power cord from line voltage before cleaning the instrument. Avoid getting moisture inside the instrument during external cleaning. Use only enough liquid to dampen the cleaning cloth.*

1. Remove loose dust on the outside of the instrument with a lint-free cloth.
2. Remove remaining dirt with a lint-free cloth dampened with a 75% isopropyl alcohol-and-water solution. Do not use abrasive cleaners.
3. Clean the monitor screen with a lint-free cloth dampened with a 75% isopropyl alcohol-and-water solution.

Modules

AG7 Audio Generator module

This section describes the module-specific functions of the AG7 Audio Generator module. Refer to the following locations for additional information about the module:

- *AG7 module connectors* for a description of the rear-panel connectors. (See page 2-7.)
- *AG7 module functional check* for a basic procedure to check that the module is functional. (See page 1-15.)
- *TG8000 Specifications and Performance Verification Technical Reference* for module specifications and for a detailed procedure to verify that the module is functioning as specified.
- *TG8000 Programmer Manual* for information about the commands to remotely control the module.

AG7 module product description

The AG7 Audio Generator module can output serial digital audio signals that comply with the AES/EBU standard. The module contains the following features:

- 8 channels (4 AES/EBU audio pairs) of serial digital audio outputs with 24 or 20 bits resolution
- Adjustable frequencies, amplitudes, and audio clicks in every channel
- Silence and 48 kHz clock (word clock) outputs
- Full remote control using Ethernet interface

The module also supports the following audio frequencies:

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	4800 Hz	15000 Hz
250 Hz	4000 Hz	5000 Hz	16000 Hz
300 Hz	1200 Hz	6000 Hz	20000 Hz
400 Hz	1500 Hz	1600 Hz	

How to operate the AG7 module

After the AG7 module is installed in the mainframe, and the mainframe is installed in the rack or other location where it will be used, use the following procedure to access each function of the module:

1. Connect the power cord to the power connector on the rear panel, and then plug the cord into the AC electric power source. Electric power is supplied to the mainframe.
2. Wait until the power-on initialization process is complete, and then check that there are no error messages on the display.
3. After the initialization process, the mainframe main menu appears as shown below.

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4. Press the front-panel **MODULE** button until the AG7 module main menu appears as shown below.

5. Use the front-panel arrow buttons to navigate and select items in the main menu and submenus. (See page 3-3, *AG7 module main menu*.)

AG7 module main menu

Use the AG7 module main menu to perform the following tasks:

- Select the audio channel whose parameters are to be changed
- Select the audio data resolution
- Select the frame reset signal to be synchronized
- Select the timing offset for the audio signal outputs

Use the up (▲) or down (▼) arrow button to scroll through the main menu. The following figure shows the AG7 module main menu.

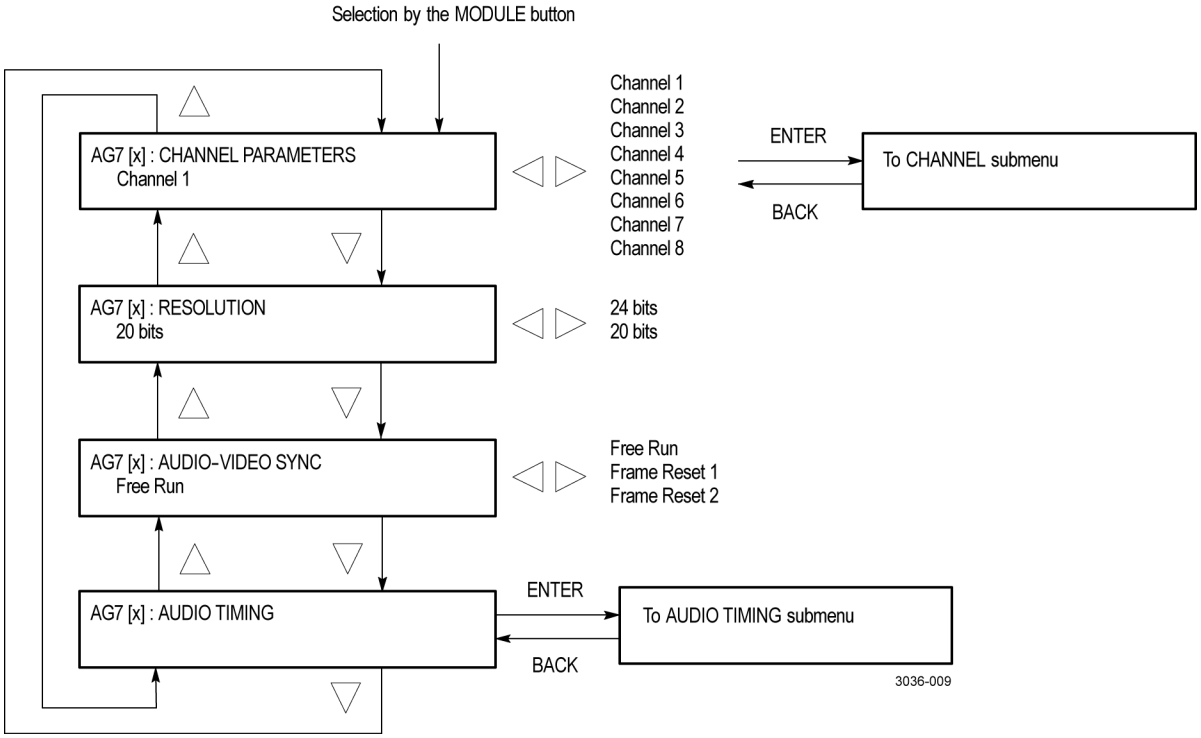

Figure 3-1: AG7 module main menu

CHANNEL PARAMETERS. Selects the 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 selection.

Press the front-panel **ENTER** button to access the **CHANNEL PARAMETERS** submenu where you can set frequency, amplitude, and audio click insertion. (See page 3-4.)

RESOLUTION. Sets the resolution of the serial digital audio signal data. Use the left (◄) or right (►) arrow button to make the selection. The choices are **24 bits** or **20 bits**. Press the **ENTER** button to enable the selection.

AUDIO-VIDEO SYNC. 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**, and **Frame Reset 2**. 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.*

AUDIO TIMING. Sets the timing offset of the audio signal outputs relative to the genlock signal or the internal reference signal. Select this menu item and press the **ENTER** button to access the **AUDIO TIMING** submenu. (See page 3-6, *AG7 module AUDIO TIMING submenu*.)

AG7 module CHANNEL PARAMETERS submenu

Use this menu to set the frequency, amplitude, and audio click of the selected audio channel. Use the up (▲) or down (▼) arrow button to scroll through the menu items. The following figure shows the CHANNEL PARAMETERS submenu.

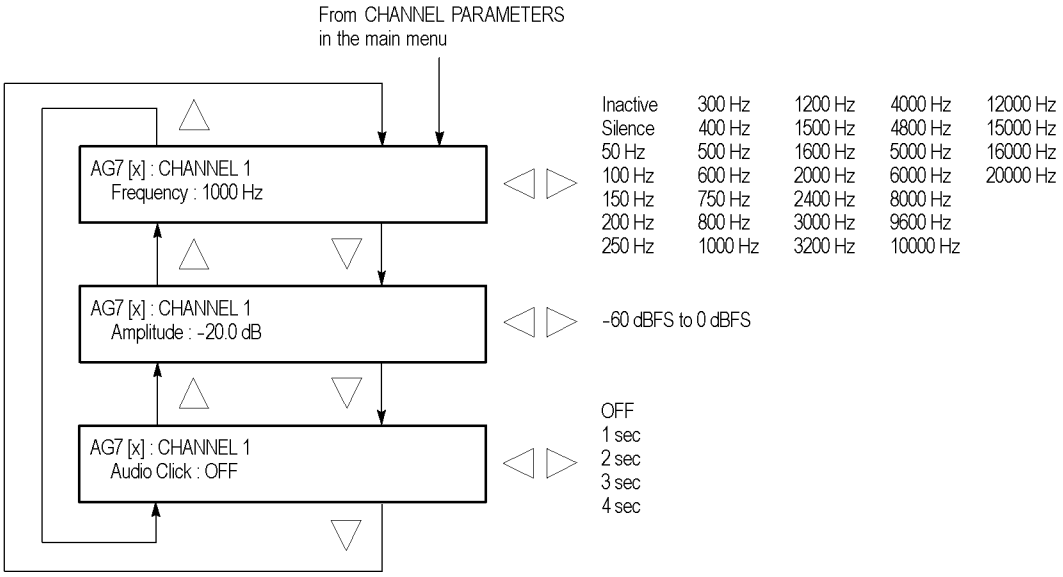

Figure 3-2: AG7 module CHANNEL PARAMETERS submenu

Frequency. Sets the audio signal frequency for the selected audio channel. Use the left (◄) or right (►) arrow button to make 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. Press the **ENTER** button to enable the selection.

Amplitude. Sets the audio signal amplitude for the selected audio channel. Use the left (◄) or right (►) arrow button to set the value. You can 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 in the FREQUENCY menu is output continuously. Audio Click makes it easy to identify any of the four output channels.

AG7 module AUDIO TIMING submenu

Use this menu to adjust the timing offset of the audio signal outputs relative to the internal reference signal (frame reset signal).

NOTE. *The AUDIO TIMING delay can be adjusted only if a valid subframe pulse is present and the AUDIO-VIDEO SYNC selection in the AG7 main menu is set to Frame Reset 1 or Frame Reset 2.*

The following figure shows the AUDIO TIMING submenu.

Figure 3-3: AG7 module AUDIO TIMING submenu

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

NOTE. *You can reset the timing offset to zero by pressing the left (◄) or right (►) arrow buttons simultaneously.*

AG7 module factory default settings

The following table shows the factory default settings for the AG7 module. These settings are recalled when you select **Factory Default** from the **PRESET : RECALL** menu item in the mainframe main menu.

Table 3-1: AG7 module factory default settings

Menu item name	Settings
CHANNEL 1 to CHANNEL 8	
Frequency	1000 Hz
Amplitude	-20.0 dBFS
Audio Click	OFF
RESOLUTION	20 bits
AUDIO-VIDEO SYNC	Free Run
AUDIO TIMING	
Delay or Advance	0.0 msec

AGL7 Analog Genlock module

This section describes the module-specific functions of the AGL7 Analog Genlock module. Refer to the following locations for additional information about this module:

- *AGL7 module connectors* for a description of the rear-panel connectors. (See page 2-8.)
- *AGL7 module functional check* for a basic procedure to check that the module is functional. (See page 1-16.)
- *TG8000 Specifications and Performance Verification Technical Reference* for module specifications and for a detailed procedure to verify that the module is functioning as specified.
- *TG8000 Programmer Manual* for information about the commands to remotely control the module.

AGL7 module product description

The AGL7 Analog Genlock module provides genlock function for the mainframe and installed modules. It is equipped with two reference inputs, the loopthrough inputs and the terminated CW input. The AGL7 module can genlock the following signals:

- NTSC black burst signal: burst lock or sync lock
- PAL black burst signal: burst lock and sync lock
- HDTV trilevel sync signal
- CW: 1, 3.58 (NTSC sub-carrier), 4.43 (PAL sub-carrier), 5, and 10 MHz
- Alarm output capability (The AGL7 hardware must be at Version 3.x or above to support outputting an alarm signal.)

NOTE. *The AGL7 module alarm output is available only when the GPI ALARM OUTPUT menu item is set to Enable. (See page 2-49, How to use the mainframe General Purpose Interface (GPI).)*

PAL-M and PAL-N are not supported by the AGL7, ATG7, and BG7 modules.

There are three rear-panel output connectors that can output black burst signals and HDTV trilevel sync signals.

How to operate the AGL7 module

After the AGL7 module is installed in the mainframe, and the mainframe is installed in the rack or other location where it will be used, use the following procedure to access each function of the module:

1. Connect the power cord to the power connector on the rear panel, and then plug the cord into the AC electric power source. Electric power is supplied to the mainframe.
2. Wait until the power-on initialization process is complete, and then check that there are no error messages on the display.
3. After the initialization process, the mainframe main menu appears as shown below.

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4. Press the front-panel **MODULE** button until the AGL7 module main menu appears as shown below.

5. Use the front-panel arrow buttons to navigate and select items in the main menu and submenus. (See page 3-9, *AGL7 module main menu*.)

AGL7 module main menu

Use the AGL7 module main menu to select the genlock source and the output whose parameters are to be changed.

Use the up (▲) or down (▼) arrow button to scroll through the main menu. The following figure shows the AGL7 module main menu.

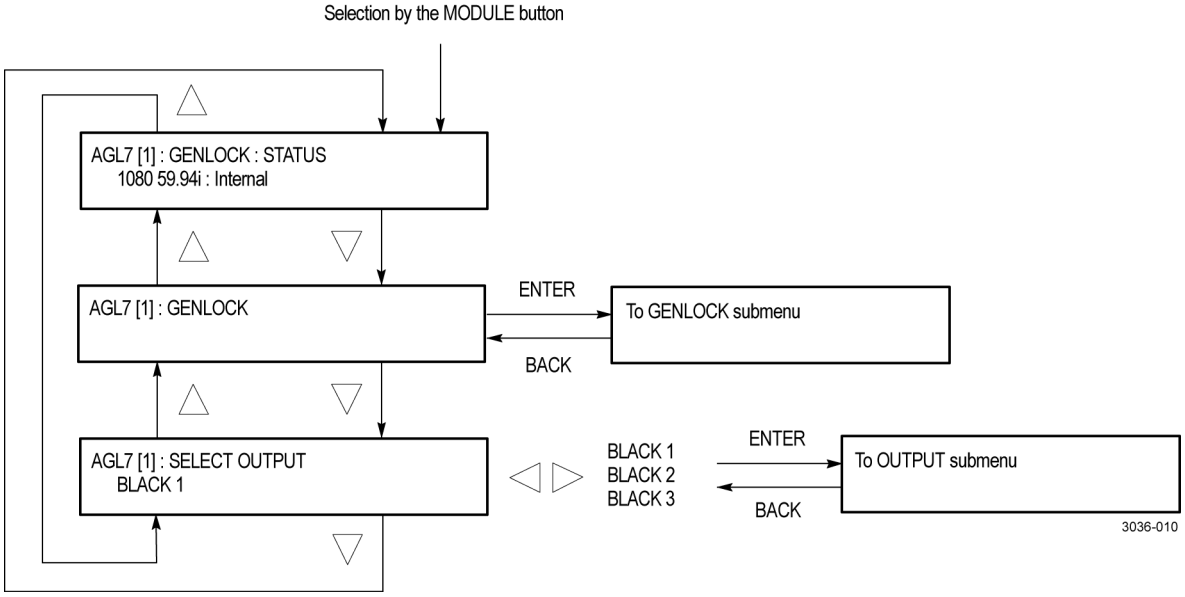

Figure 3-4: AGL7 module main menu

STATUS. Displays the genlock source and status. The following status messages may appear: **Locked**, **Loss of Lock**, and **No signal**.

GENLOCK. Selects the genlock source and sets the timing offset of the genlock signal relative to the internal reference signal. When you select this menu item and press the ENTER button, you will access the GENLOCK submenu. (See page 3-10.)

SELECT OUTPUT. Selects the output for you to change the signal format, output signal, and timing offset relative to the internal reference signal (frame reset signal). Use the left (◄) or right (►) arrow button to select **BLACK 1**, **BLACK 2**, or **BLACK 3**. When you select any of these and press the ENTER button, you will access the OUTPUT submenu to set the parameters of the selected output. (See page 3-12.)

AGL7 module GENLOCK submenu

Use this menu to select the genlock source for the mainframe and the installed modules, set the timing offset, and set the instrument actions when lock is lost. Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the GENLOCK submenu.

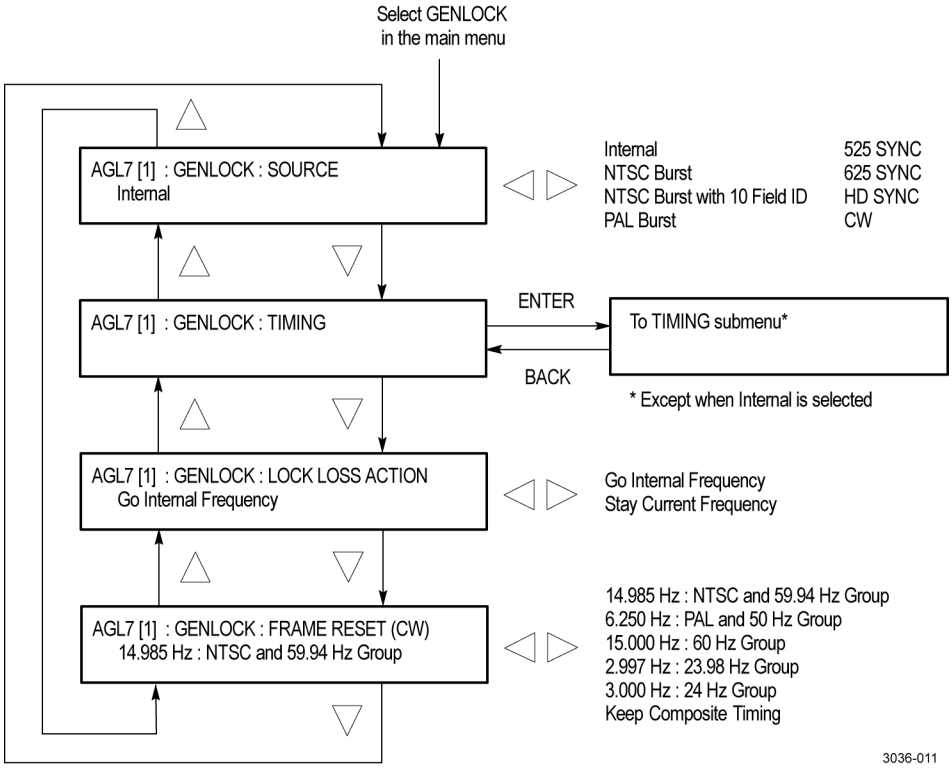

Figure 3-5: AGL7 module GENLOCK submenu

SOURCE. Selects the signal source to genlock the mainframe and the installed modules. Use the left (◄) or right (►) arrow button to select the genlock source, and then press the **ENTER** button to confirm the selection. Select from the following genlock sources:

- **Internal:** Uses the internal reference signal.
- **NTSC Burst:** Burst locks to an NTSC black burst signal applied to the REF connector.
- **NTSC Burst with 10 Field ID:** Burst locks to an NTSC black burst with 10 Field ID signal applied to the REF connector.
- **PAL Burst:** Burst locks to a PAL black burst signal applied to the REF connector.
- **525 SYNC:** Sync locks to an NTSC black burst signal applied to the REF connector.

- **625 SYNC:** Sync locks to a PAL black burst signal applied to the REF connector.
- **HD SYNC:** Locks to an HDTV trilevel signal applied to the REF connector.
- **CW:** Locks to the 1, 3.58, 4.43, 5, or 10 MHz continuous wave signal applied to the CW connector.

TIMING. Adjusts the timing offset of the input signal relative to the internal reference signal (frame reset signal). When you select this menu item and press the ENTER button, you will access the TIMING submenu. (See page 3-14.)

LOCK LOSS ACTION. Sets the way the AGL7 module reacts when a loss of genlock state occurs (for example, genlock source is absent or incompatible). Use the left (◄) or right (►) arrow button to select the action, and then press the **ENTER** button to confirm the selection. Select from the following actions:

- **Go Internal Frequency:** Switches automatically to the internal reference and blinks the EXT.REF indicator.
- **Stay Current Frequency:** Maintains the current state.

FRAME RESET (CW). Selects the frame reset signal frequency to be used when a CW signal is applied to the CW connector. Use the left (◄) or right (►) arrow button to select the frequency, and then press the **ENTER** button to confirm the selection. Select from the following frequencies:

- **6.250 Hz : PAL and 50 Hz Group:** Uses the Frame Reset 2 signal with a frequency of 6.250 Hz.
- **2.997 Hz : NTSC, 59.94, 23.98 Group:** Uses the Frame Reset 1 signal with a frequency of 2.997 Hz.
- **3.000 Hz : 60 and 24 Hz Group:** Uses the Frame Reset 3 signal with a frequency of 3.000 Hz.
- **Keep Composite Timing:** Keeps the synchronization shock small by using the previous NTSC or PAL timing whenever possible, even if you change the genlock source to CW while the instrument is genlocked to a NTSC or PAL black burst signal. The frame frequency is the same as the NTSC or PAL frequency that was previously used. Use a 5 MHz, 10 MHz, 3.58 MHz (for NTSC), or 4.43 MHz (for PAL) signal as a CW signal source.

AGL7 module OUTPUT submenu

Use this submenu to set the signal format and the timing offset for the output selected in the SELECT OUTPUT menu item. Use the up (▲) or down (▼) arrow button to change the menu items. The following figure shows the OUTPUT submenu.

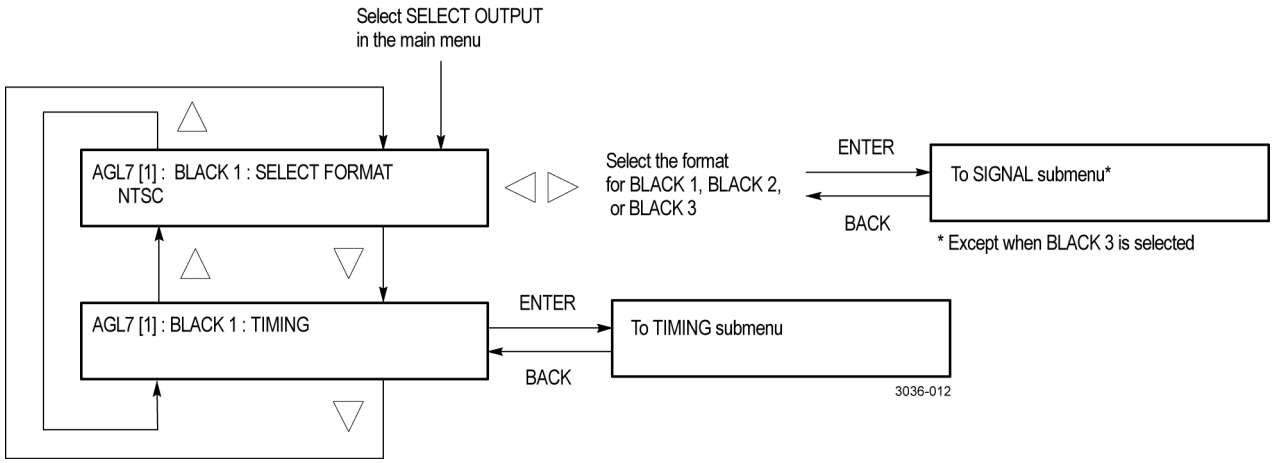

Figure 3-6: AGL7 module OUTPUT submenu

SELECT FORMAT. Selects the format for the signal output from the BLACK 1, BLACK 2, or BLACK 3 connector. Use the left (◄) or right (►) arrow button to select the format. The available choices described below depend on which output connector you select.

NOTE. *When you change signal format, synchronization shock occurs.*

- When **BLACK 1** is selected, the formats listed below are available. Press the **ENTER** button to confirm the selection and to access the SIGNAL submenu where you will select a black burst signal. (See page 3-13.)

  NTSC
  NTSC No Setup
  PAL

- When **BLACK 2** is selected, the formats listed below are available. Press the **ENTER** button to confirm the selection and to access the SIGNAL submenu where you will select a black burst signal. (See page 3-13.)

  NTSC
  NTSC No Setup
  PAL
  HD SYNC (Same as BLACK 3)

- When **BLACK 3** is selected, the formats listed below are available. Press the **ENTER** button to confirm the selection and to enable the selected trilevel sync signal or the black burst signal when Black Burst (Same as BLACK2) is selected.

  1080 60i
  1080 59.94i
  1080 50i
  1080 24sF
  1080 23.98sF
  1080 30p
  1080 29.97p
  1080 25p
  1080 24p
  1080 23.98p
  720 60p
  720 59.94p
  720 50p
  Black Burst (Same as BLACK 2)

TIMING. Adjusts the timing offset for the output signals relative to the internal reference signal (frame reset signal). When you select this menu item and press the **ENTER** button, you will access the TIMING submenu where you will select the timing offset. (See page 3-14.)

You cannot set the timing offset under the following conditions:

- When HD SYNC (Same as BLACK 3) is selected as a format for the BLACK 2 output.
- When Black Burst (Same as BLACK 2) is selected as a format for the BLACK 3 output.

AGL7 module SIGNAL submenu

Use this menu to select the black burst signal for the NTSC, NTSC No Setup, and PAL formats. Use the left (◄) or right (►) arrow button to select the black burst signal, and then press the **ENTER** button to confirm the selection. The following figure shows the SIGNAL submenu.

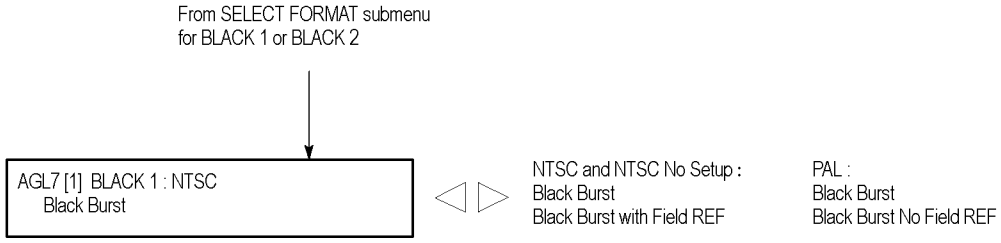

Figure 3-7: AGL7 module SIGNAL submenu

The available choices described below depend on which format you select:

- When the **NTSC** or **NTSC No Setup** format is selected, the signals listed below are available:

  Black Burst
  Black Burst with Field REF

- When the **PAL** format is selected, the signals listed below are available:

  Black Burst
  Black Burst with No Field REF

AGL7 module TIMING submenu

Use this menu to adjust the timing offset of the input and output signals relative to the internal reference signal (frame reset signal). Use the up (▲) or down (▼) arrow button to scroll through the menu.

The TIMING submenu uses the same menu structure for both input and output signals, except for the menu items displayed in the first line. The following figure shows the TIMING submenu.

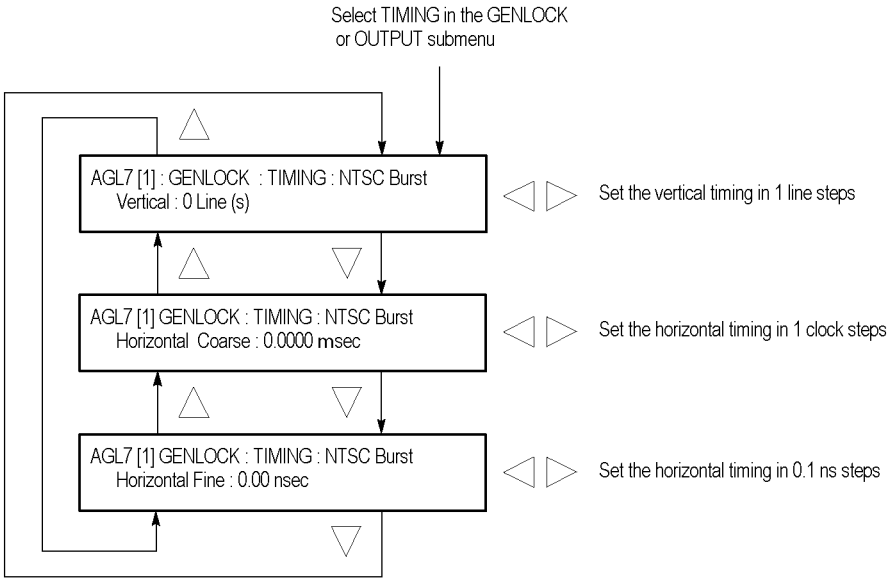

Figure 3-8: AGL7 module TIMING submenu

Vertical. Use the left (◄) or right (►) arrow button to adjust the vertical offset. The range of the timing adjustment depends on the selected signal format. (See Table 3-2.) (See Table 3-3.)

Horizontal coarse. Use the left (◄) or right (►) arrow button to adjust the coarse horizontal offset. The range of the timing adjustment depends on the selected signal format. (See Table 3-2.) (See Table 3-3.)

Horizontal fine. Use the left (◄) or right (►) arrow button to adjust the fine horizontal offset. The range of the timing adjustment depends on the selected signal format. (See Table 3-2.) (See Table 3-3.)

NOTE. *You can reset the timing offset to zero by pressing the left (◄) or right (►) arrow buttons simultaneously.*

Table 3-2: Timing adjustment ranges for AGL7 input signals

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

Table 3-3: Timing adjustment ranges for AGL7 output signals

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	± 7.00
1080 59.94i	± 562	± 29.6593	± 7.00
1080 50i	± 562	± 35.5556	± 7.00
1080 24sF	± 562	± 37.0370	± 7.00
1080 23.98sF	± 562	± 37.0741	± 7.00
1080 30p	± 562	± 29.6296	± 7.00
1080 29.97p	± 562	± 29.6593	± 7.00
1080 25p	± 562	± 35.5556	± 7.00
1080 24p	± 562	± 37.0370	± 7.00
1080 23.98p	± 562	± 37.0741	± 7.00

Table 3-3: Timing adjustment ranges for AGL7 output signals (cont.)

Format name	Line settings	Coarse settings (µs)	Fine settings (ns)
720 60p	± 375	± 22.2222	± 7.00
720 59.94p	± 375	± 22.4444	± 7.00
720 50p	± 375	± 26.6667	± 7.00

AGL7 module factory default settings

The following table shows the factory default settings of the AGL7 module. These settings are recalled when you select **Factory Default** from the **PRESET : RECALL** menu item in the mainframe main menu.

Table 3-4: AGL7 module factory default settings

Menu item name	Settings
GENLOCK : SOURCE	Internal
GENLOCK : TIMING	
Vertical	0 Line(s)
Horizontal Coarse	0.0000 ms
Horizontal Fine	0.00 nsec
GENLOCK : LOCK LOSS ACTION	Go Internal Frequency
GENLOCK : FRAME RESET (CW)	14.985 Hz : NTSC and 59.94 Hz Group
OUTPUT : BLACK 1	
FORMAT	NTSC
SIGNAL	Black Burst
OUTPUT : BLACK 2	
FORMAT	NTSC
SIGNAL	Black Burst
OUTPUT : BLACK 3	
FORMAT	1080 59.94i
SIGNAL	Trilevel Sync
BLACK x : TIMING	
Vertical	0 Line(s)
Horizontal Coarse	0.0000 ms
Horizontal Fine	0.00 nsec

ATG7 Analog Test Generator module

This section describes the module-specific functions of the ATG7 Analog Test Generator module. Refer to the following locations for additional information about this module:

- *ATG7 module connectors* for a description of the rear-panel connectors. (See page 2-10.)
- *ATG7 module functional check* for a basic procedure to check that the module is functional. (See page 1-18.)
- *TG8000 Specifications and Performance Verification Technical Reference* for module specifications and for a detailed procedure to verify that the module is functioning as specified.
- *TG8000 Programmer Manual* for information about the commands to remotely control the module.

ATG7 module product description

The ATG7 Analog Test Generator module is an analog test signal generator that provides NTSC/PAL analog composite signals. The ATG7 module provides the following features:

- SIGNAL output connector, which outputs test signals selected from the front-panel test signal buttons. You can overlay ID text on this video signal output.
- BARS output connector, which outputs NTSC (with or without setup) and PAL color bars signals, black burst signals, and other video test signals. You can overlay ID text on this video signal output.
- BLACK 1 and BLACK 2 output connectors, which output NTSC (with or without setup) and PAL black burst signals, composite sync and composite blanking signals, NTSC (with or without setup) and PAL subcarrier signals, H/V drive signals, and other video signals.
- Individual format and timing control for each output.
- Full remote control using Ethernet interface.

NOTE. *PAL-M and PAL-N are not supported by the AGL7, ATG7 and BG7 modules.*

How to operate the ATG7 module

After the ATG7 module is installed in the mainframe, and the mainframe is installed in the rack or other location where it will be used, use the following procedure to access each function of the module:

1. Connect the power cord to the power connector on the rear panel, and then plug the cord into the AC electric power source. Electric power is supplied to the mainframe.
2. Wait until the power-on initialization process is complete, and then check that there are no error messages on the display.
3. After the initialization process is complete, the mainframe main menu appears as shown below.

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4. Press the front-panel **MODULE** button until the ATG7 module main menu appears as shown below.

5. Select the signal format and the test signal that you want to output from the SIGNAL connector. (See page 3-19, *To select an output signal on the ATG7 module*.)
6. Use the front-panel arrow buttons to navigate and select items in the main menu and submenus to select the signal format and test signal you want to output from the BLACK 1, BLACK 2, and BARS connectors, and to set the other output parameters.

Refer to *ATG7 Module Main Menu* for detailed information about the main menu and the submenu items. (See page 3-21.)

To select an output signal on the ATG7 module

The SIGNAL connector on the ATG7 module provides the capability to output test signals assigned to the front-panel test signal buttons. To output a signal from the connector, you need to select a signal format and an output signal as described below.

To select the signal format

Perform the following steps to select the signal format:

1. If the ATG7 module menu is not displayed, press the front-panel **MODULE** button until the ATG7 module main menu appears as shown below.

```
ATG7 [x] : STATUS : NTSC
    SMPTE Color Bars
```

2. Press the **FORMAT** button. The menu display changes as follows:

```
ATG7 [x] : SELECT FORMAT
    NTSC (Current)
```

3. Use the left (◄) or right (►) arrow button, or press the **FORMAT** button repeatedly, to select one of the signal formats, and then press the **ENTER** button to confirm the selection.

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

To select the test signal

All of the signal sets that are available in the module are already assigned to the corresponding test signal buttons. When the ATG7 module is selected and you press any of the front-panel test signal buttons, the selected signal in the signal set is output on the SIGNAL connector. (See Figure 3-9.)

For example, when you press the **COLOR BAR** test signal button, a signal in the Color Bars signal set is output. Press the left (◄) or right (►) arrow button, or press the COLOR BAR test signal button repeatedly to select a different signal from the Color Bars signal set.

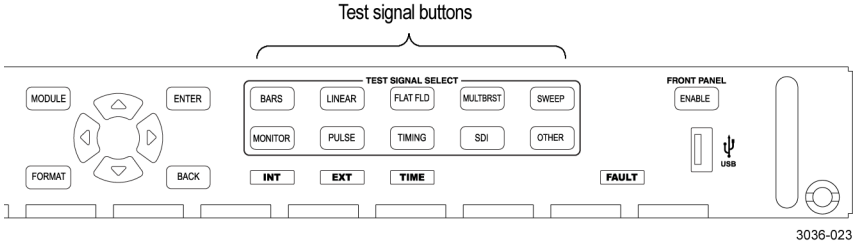

Figure 3-9: Front-panel test signal buttons

The following table lists the ATG7 signal sets that are assigned to the test signal buttons and shows the test signals that are available in each signal set. The list of available signals changes depending on the selected signal format.

Table 3-5: ATG7 module signal sets assigned to the test signal buttons

Button name	Signal set	Signals in the signal set
NTSC and NTSC No Setup formats		
COLOR BAR	Color Bars	100% Color Bars, 75% Color Bars, SMPTE Color Bars
LINEARITY	Linearity	5 Step, 10 Step, Modulated 5 Step, Modulated Pedestal, Modulated Ramp, Ramp, Shallow Ramp
FLAT FIELD	Flat Fields	0% Flat Field (NTSC format only), 10% Flat Field, 40% Flat Field, 50% Flat Field, 100% Flat Field, Field Square Wave, Black Burst, Black Burst with Field Ref
MULTIBURST	Multiburst	100% Multiburst, 60% Multiburst, Multipulse
SWEEP	Sweep	100% Sweep, 60% Sweep, Chroma Frequency Response
MONITOR	Monitor	100% Red Field, 75% Red Field, 2 Level Pedestal & Pluge, 4 Level Pedestal & Pluge, Convergence Pattern, Grey Window, White Window, Safe Area, Monitor Setup
PULSE BAR	Pulse & Bar	Window 2T Pulse & Bar, Sin X/X
OTHER	Other	FCC Composite, FCC Multiburst, NTC7 Combination, NTC7 Composite, Matrix 1, SNG Color Bars
PAL format		
COLOR BAR	Color Bars	100% Color Bars, 75% Color Bars, 100% Color Bars Over Red, 75% Color Bars Over Red
LINEARITY	Linearity	5 Step, 10 Step, Modulated 5 Step, Modulated 10 Step, Modulated Pedestal, Modulated Ramp, Ramp, Shallow Ramp
FLAT FIELD	Flat Fields	40% Flat Field, 50% Flat Field, 100% Flat Field, Field Square Wave, Black Burst, Black Burst with No Field Ref, Field Square Wave
MULTIBURST	Multiburst	100% Multiburst, 60% Multiburst, Multipulse
SWEEP	Sweep	100% Sweep, 60% Sweep
MONITOR	Monitor	100% Red Field, 75% Red Field, 2 Level Pedestal & Pluge, 4 Level Pedestal & Pluge, Convergence Pattern, Grey Window, White Window, Safe Area, Monitor Setup Matrix
PULSE BAR	Pulse & Bar	2T Pulse & Bar, Sin X/X
OTHER	Other	CCIR 17, CCIR 18, CCIR 330, CCIR 331, UK ITS 1, UK ITS 2, UK 1 Line ITS, ITS Matrix 1

ATG7 module main menu

Use the ATG7 module main menu to perform the following tasks:

- Set the text overlay on the SIGNAL output
- Set the timing offset on the SIGNAL output
- Set the APL settings on the SIGNAL output
- Set the output parameters for the BLACK 1, BLACK 2, and BARS outputs using the SELECT OUTPUT submenu. (See page 3-23.)

Use the up (▲) or down (▼) arrow button to scroll through the main menu. The following figure shows the ATG7 module main menu.

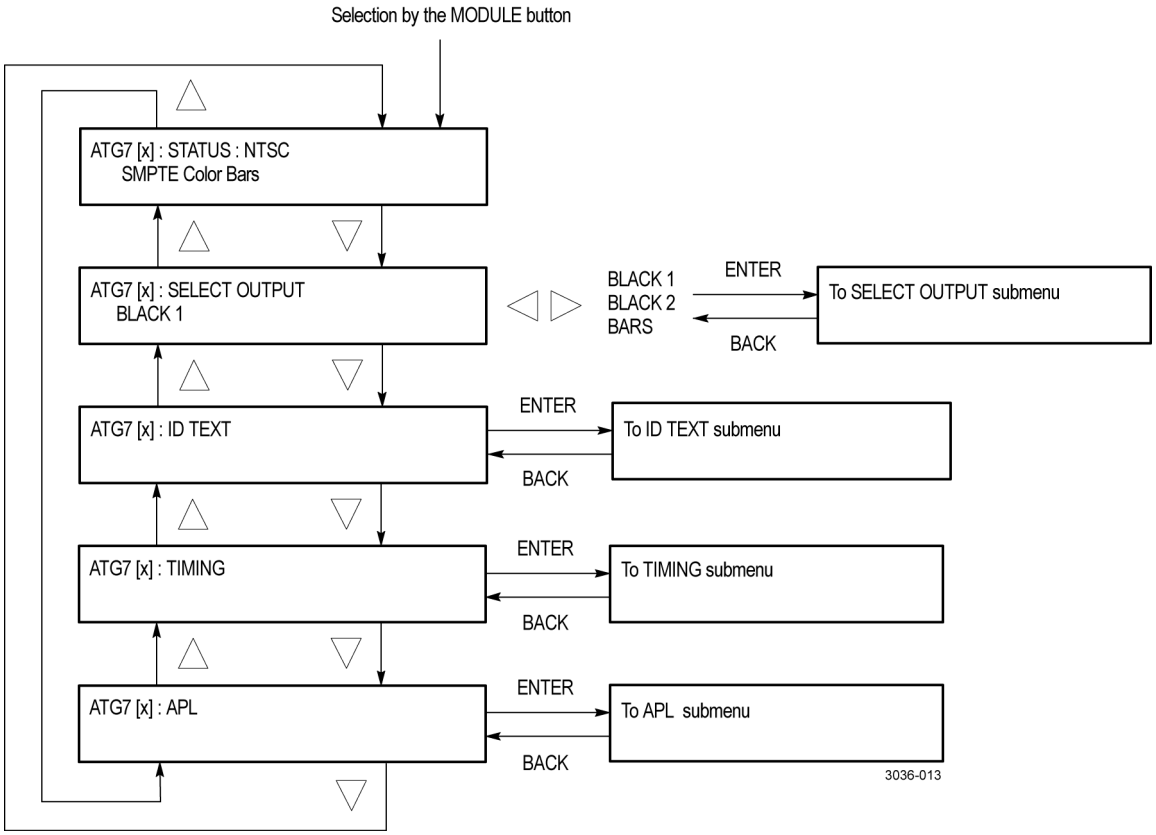

Figure 3-10: ATG7 module main menu

STATUS. Displays the current video standard and the selected signal for the SIGNAL output.

SELECT OUTPUT. Selects the output whose parameters will be set. Use the left (◄) or right (►) arrow button to make the selection. The choices are **BLACK 1**, **BLACK 2**, or **BARS**. Select any of the items, and then press the **ENTER** button to access the SELECT OUTPUT submenu. (See page 3-120.)

ID TEXT. Sets a text that is overlaid on the test signal output from the SIGNAL connector. Select this menu item, and then press the **ENTER** button to access the ID TEXT submenu. (See page 3-25.)

TIMING. Sets the timing offset of the SIGNAL output relative to the internal reference signal (frame reset signal). Select this menu item, and then press the **ENTER** button to access the TIMING submenu. (See page 3-26.)

APL. Sets the APL and Bounce features available for the test signal output from the SIGNAL connector. Select this menu item, and then press the **ENTER** button to access the APL submenu. (See page 3-27.)

ATG7 module SELECT OUTPUT submenu

Use this menu to set the video format, signal, and timing offset for the BLACK 1, BLACK 2, or BARS output. You can also use this menu to set the ID text overlay for the BARS output. The following figure shows the SELECT OUTPUT submenu.

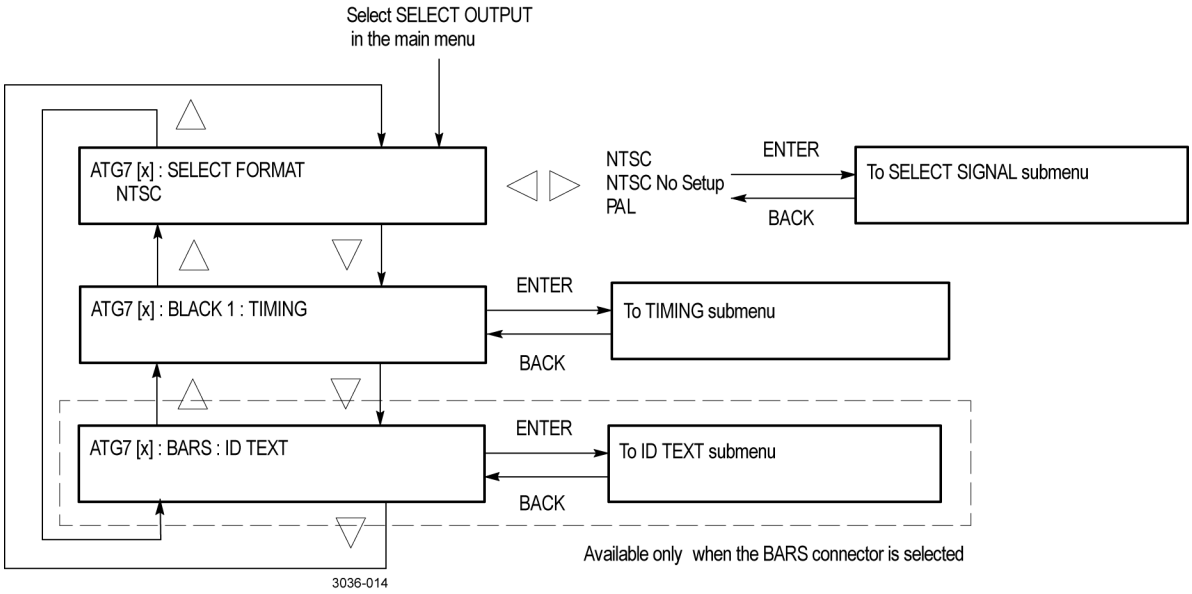

Figure 3-11: ATG7 module SELECT OUTPUT submenu

SELECT FORMAT. Selects the video format for the selected output. Use the left (◄) or right (►) arrow button to select **NTSC**, **NTSC No Setup**, or **PAL**.

NOTE. *When you change the video format, synchronization shock will occur; the video format changes immediately at the output as you change the format selection.*

Select the format you want, then press the front-panel **ENTER** button to access the SELECT SIGNAL submenu, where you select the output signal to use. (See page 3-24.)

TIMING. Sets the timing offset of the selected output relative to the internal reference signal (frame reset signal). Select this menu item and press the **ENTER** button, to access the TIMING submenu. (See page 3-26.)

ID TEXT. Sets a text that is overlaid on the test signal output from the BARS connector. Select this menu item and press the **ENTER** button to access the ID TEXT submenu. (See page 3-25.)

ATG7 module SELECT SIGNAL submenu

Use this menu to select an output signal for the BLACK 1, BLACK 2, or BARS connector. The following figure shows the SELECT SIGNAL submenu.

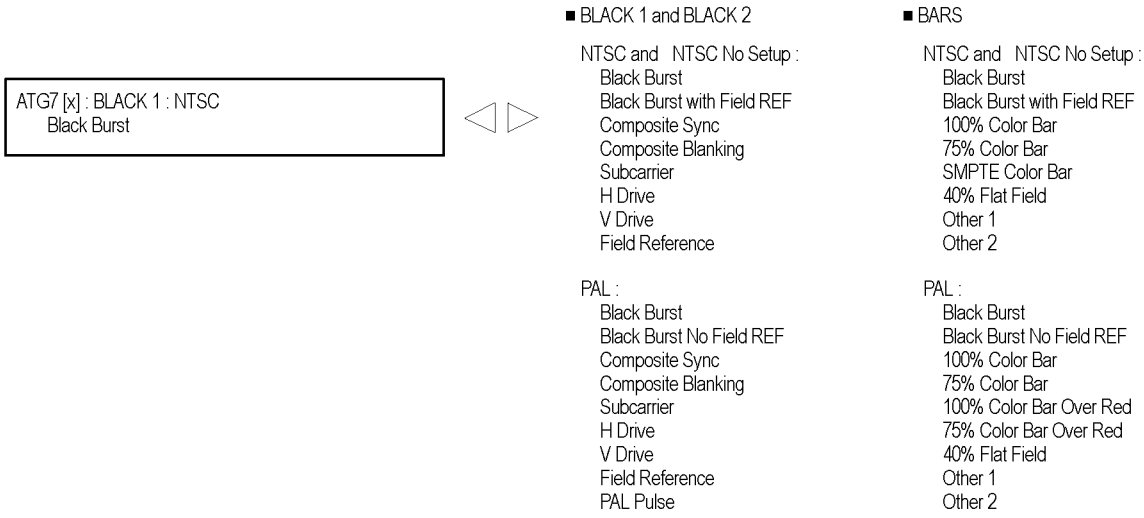

Figure 3-12: ATG7 module SELECT SIGNAL submenu

Use the left (◄) or right (►) arrow button to scroll through the selections. Press the **ENTER** button to enable the selected signal.

Which signals are available depend on the selected output connector and the video format. The following table lists the available signals for each output connector and video format.

Table 3-6: Test signals in the ATG7 module SELECT SIGNAL submenu

Format	Test signals
BLACK1 and BLACK 2 connectors	
NTSC and NTSC No Setup	Black Burst, Black Burst with Field REF, Composite Sync, Composite Blanking, Subcarrier, H Drive, V Drive, Field Reference
PAL	Black Burst, Black Burst No Field REF, Composite Sync, Composite Blanking, Subcarrier, H Drive, V Drive, Field Reference, PAL Pulse
BARS connector	
NTSC and NTSC No Setup	Black Burst, Black Burst with Field REF, 100% Color Bar, 75% Color Bar, SMPTE Color Bar, 40% Flat Field, Other 1 (SNG Color Bars), Other 2 (Monitor Setup Matrix)
PAL	Black Burst, Black Burst No Field REF, 100% Color Bar, 75% Color Bar, 100% Color Bar Over Red, 75% Color Bar Over Red, 40% Flat Field, Other 1 (4 Level Pedestal & Pluge), Other 2 (Monitor Setup Matrix)

ATG7 module ID TEXT submenu

Use this menu to edit text that is overlaid on the signal for the SIGNAL and BARS outputs, and to set the display position of the text. Use the up (▲) or down (▼) arrow button to scroll through the menu. The following table shows the ID TEXT submenu.

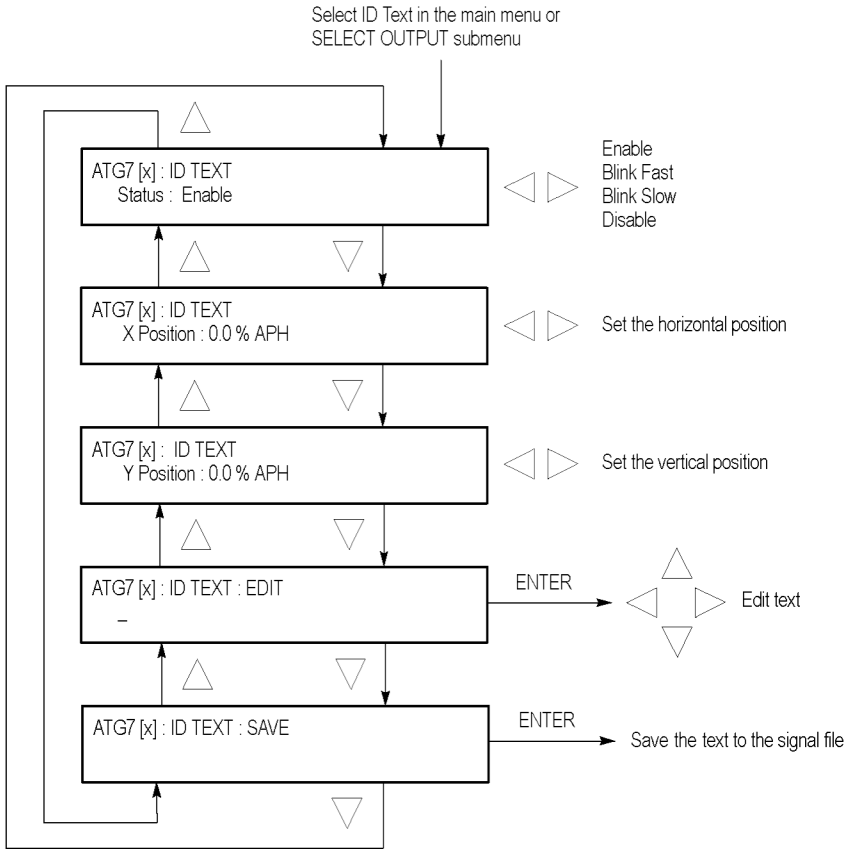

Figure 3-13: ATG7 module ID TEXT submenu

Status. Sets the blinking mode of the text 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.

- **Enable:** Turns on the blinking function of the overlay.
- **Blink Fast:** Sets the overlay to blink at approximately 0.5 second intervals.
- **Blink Slow:** Sets the overlay to blink at approximately 1.0 second intervals.
- **Disable:** Turns off the blinking function of the overlay.

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 100.0% in 1% steps.

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 100.0% in 1% steps.

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 18 characters for the 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.
5. Use the left (◄) or right (►) arrow button to select **SAVE**, and then press the **ENTER** button to save the text and its position to the signal file being output.

SAVE. Saves the text and its position to the signal file currently being output. Press the **ENTER** button to save them to the signal file.

ATG7 module TIMING submenu

Use this menu to adjust the timing offset of the selected output relative to the internal reference signal (frame reset signal). Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the TIMING submenu.

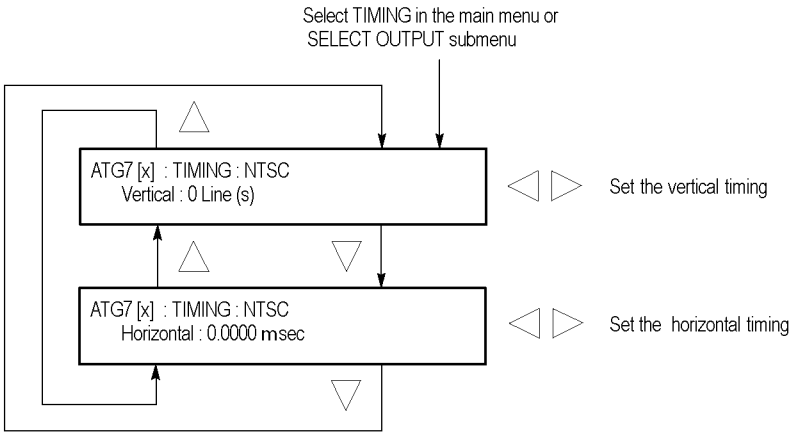

Figure 3-14: ATG7 module TIMING submenu

Vertical. Sets the vertical timing offset. Use the left (◄) or right (►) arrow button to change the timing offset. You can set the value from -1/2 color frame to +1/2 color frame in 1 line steps.

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

NOTE. *You can reset the timing offset to zero by pressing the left (◄) or right (►) arrow buttons simultaneously.*

The ATG7 horizontal timing can only be adjusted in clock cycle increments. You can match the AGL7 or GPS7 module timing to the ATG7 module by adjusting the fine timing controls on the AGL7 or GPS7 module.

ATG7 module APL submenu

Use this menu to set the APL and Bounce features for the test signal output from the SIGNAL connector. Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the APL submenu.

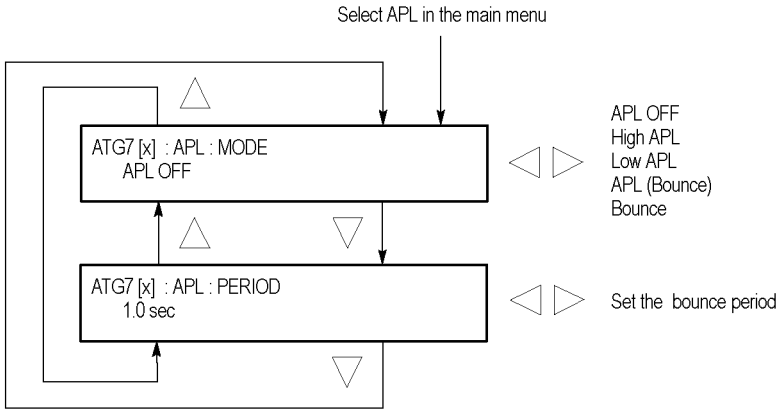

Figure 3-15: ATG7 module APL submenu

MODE. Sets the output mode of the APL signal. Use the left (◄) or right (►) arrow button to select the mode, and then press the **ENTER** button to confirm the selection. The choices are:

- **APL OFF:** Outputs the selected signal without making any changes.
- **High APL:** Divides the video lines of the selected signal into 5 lines (for NTSC) or 4 lines (for PAL) and changes the lines except the last line to the 100% flat field signal, and then outputs them.
- **Low APL:** Divides the video lines of the selected signal into 5 lines (for NTSC) or 4 lines (for PAL) and changes the lines except the last line to the 0% flat field signal, and then outputs them.

- **APL (Bounce):** Outputs the High APL signal and Low APL signal alternately for the period set in the PERIOD menu item.
- **Bounce:** Outputs the 100% flat field signal and 0% flat field signal alternately (regardless of the selected signal) for the period set in the PERIOD menu item.

PERIOD. Sets the time interval between two signals when they are output in APL (Bounce) or Bounce mode. Use the left (◄) or right (►) arrow button to change the interval. You can set the value from 0.5 seconds to 2.0 seconds in 0.5 second steps.

ATG7 module factory default settings

The following table shows the factory default settings for the ATG7 module. These settings are recalled when you select **Factory Default** from the **PRESET : RECALL** menu item in the mainframe main menu.

Table 3-7: ATG7 module factory default settings

Menu item name		Settings
STATUS (Shows the signal format and signal name output from the SIGNAL connector)		NTSC SMPTE Color Bars
OUTPUT : BLACK 1 and BLACK 2		
	FORMAT	NTSC
	SIGNAL	Black Burst
OUTPUT : BARS		
	FORMAT	NTSC
	SIGNAL	SMPTE Color Bar
ID TEXT		
	Status	Disable
TIMING		
	Vertical	0 Line(s)
	Horizontal	0.0000 msec
APL		
	Mode	APL OFF
	Period	1.0 sec

AVG7 Analog Video Generator module

This section describes the module-specific functions of the AVG7 Analog Video Generator module. Refer to the following locations for additional information about this module:

- *AVG7 module connectors* for a description of the rear-panel connectors. (See page 2-10.)
- *AVG7 module functional check* for a basic procedure to check that the module is functional. (See page 1-20.)
- *TG8000 Specifications and Performance Verification Technical Reference* for module specifications and for a detailed procedure to verify that the module is functioning as specified.
- *TG8000 Programmer Manual* for information about the commands to remotely control the module.

AVG7 module product description

The AVG7 Analog Video Generator module is an analog video signal generator which provides analog composite and component video signals in various formats. The module contains the following features:

- Supports the following system formats: NTSC, NTSC no setup, PAL, 525 GBR, 525 YPbPr, 525 Beta, 625 GBR, and 625YPbPr.
- Six analog composite or component video outputs.
- Outputs a frame picture created by the Frame Picture Generator application.
- Overlay of circle, text, or logo on the video signal.
- Generates a moving picture by scrolling the active picture area of the output test signal.
- Full remote control using Ethernet interface.

How to operate the AVG7 module

After the module is installed in the mainframe, and the mainframe is installed in the rack or other location where it will be used, use the following procedure to access each function of the module:

1. Connect the power cord to the power connector on the rear panel, and then plug the cord into the AC electric power source. Electric power is supplied to the mainframe.
2. Wait until the power-on initialization process is complete, and then check that no error messages appear on the display.
3. After the initialization process is complete, the mainframe main menu appears as shown below.

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4. Press the front-panel **MODULE** button until the AVG7 module main menu appears as shown below.

5. Select the signal format and the signal you want to output. (See page 3-31, *To select an output signal on the AVG7 module*.)
6. Use the front-panel arrow buttons to navigate and select items in the main menu and submenus.

Refer to *AVG7 module main menu* for detailed information about the main menu items and the submenu items. (See page 3-36.)

To select an output signal on the AVG7 module

To output a signal from the AVG7 module, you need to select a signal format and output signal as described below.

To select the signal format

Perform the following steps to select the signal format:

1. If the AVG7 module menu is not displayed, press the front-panel **MODULE** button until the AVG7 module main menu appears as shown below.

2. Press the **FORMAT** button. The menu display changes as follows:

3. Use the left (◄) or right (►) arrow button, or press the **FORMAT** button repeatedly, to select one of the signal formats, and then press the **ENTER** button to confirm the selection.

NOTE. *When you change signal format, synchronization shock occurs.*

4. If you change the signal format while a test signal is being output, the instrument starts loading all of the signal sets for the selected format and displays the following message "**Now Loading...**". When you see the message, "**Done (Press BACK)**", press the **BACK** button.

To select the test signal

All of the signal sets that are available in the module are already assigned to the corresponding test signal buttons. When the AVG7 module is selected and you press any of the front-panel test signal buttons, the selected signal in the signal set is output. (See Figure 3-16.)

For example, when you press the **COLOR BAR** test signal button, a signal in the Color Bars signal set is output. Press the left (◄) or right (►) arrow button, or press the COLOR BAR test signal button repeatedly to select a different signal from the Color Bars signal set.

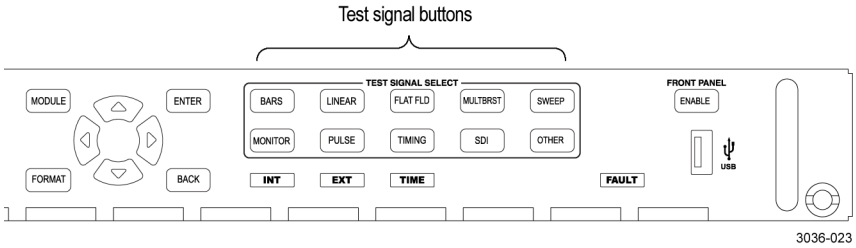

Figure 3-16: Front-panel test signal buttons

You can download a frame picture file (created by the Frame Picture Generator) to the mainframe and output the picture from the AVG7 module. Refer to the *TG8000 PC Tools Technical Reference* for detailed information on how to create, download, and output a frame picture.

The following table lists the AVG7 signal sets that are assigned to the test signal buttons and shows the test signals that are available in each signal set. The list of available signals changes depending on the selected signal format.

Table 3-8: AVG7 module signal sets assigned to the test signal buttons

Button name	Signal set	Signals in the signal set
NTSC and NTSC No Setup formats		
COLOR BAR	Color Bars	100% Color Bars, 75% Color Bars, SMPTE Color Bars
LINEARITY	Linearity	10 Step, 5 Step, Modulated 5 Step, Modulated Pedestal, Modulated Ramp, Shallow Ramp, Ramp
FLAT FIELD	Flat Fields	Black Burst, Black Burst with Field ref, 0% Flat Field (NTSC only), 10% Flat Field, 40 % Flat Field, 50% Flat Field, 100% Flat Field, Field Square Wave
MULTI BURST	Multiburst	100% Multiburst, 60% Multiburst, Multipulse
SWEEP	Sweep	60% Sweep, 100% Sweep, Chroma Frequency Response
MONITOR	Monitor	Convergence Pattern, Gray Window, 100% Red Field, 2 Level Pedestal & Pluge, 4 Level Pedestal & Pluge, 75% Red Field, Monitor Setup, White Window, Safe Area
PULSE BAR	Pulse & Bar	Window 2T Pulse & Bar, Sin X/X

Table 3-8: AVG7 module signal sets assigned to the test signal buttons (cont.)

Button name	Signal set	Signals in the signal set
TIMING	—	—
SDI	—	—
OTHER	Other	FCC Composite, FCC Multiburst, Matrix 1, NTSC Combination, NTC7 Composite, SNG Color Bars
PAL-1 format		
COLOR BAR	Color Bars	100% Color Bars, 75% Color Bars, 100% Color Bars Over Red, 75% Color Bars Over Red
LINEARITY	Linearity	5 Step, Modulated 5 Step, Modulated Ramp, Ramp
FLAT FIELD	Flat Fields	Black Burst, 50% Flat Field, 100% Flat Field, Field Square Wave
MULTI BURST	Multiburst	60% Multiburst, Multiplus
SWEEP	Sweep	100% Sweep
MONITOR	Monitor	Convergence Pattern, Grey Window, White Window, 2 Level Pedestal & Pluge, 4 Level Pedestal & Pluge, 75% Red Field
PULSE BAR	Pulse & Bar	Window 2T Pulse & Bar, Sin X/X
TIMING	—	—
SDI	—	—
OTHER	Other	CCIR 17, CCIR 18, CCIR 330, CCIR 331, UK ITS 1, UK ITS 2
PAL-2 format		
COLOR BAR	Color Bars	100% Color Bars, 75% Color Bars
LINEARITY	Linearity	10 Step, 5 Step, Modulated 10 Step, Modulated 5 Step, Modulated Ramp, Shallow Ramp, Ramp, Modulated Pedestal
FLAT FIELD	Flat Fields	Black Burst, 50% Flat Field, 100% Flat Field, Field Square Wave
MULTI BURST	Multi Burst	100% Multiburst, 60% Multiburst
SWEEP	Sweep	100% Sweep, 60% Sweep
MONITOR	Monitor	Convergence, Monitor Setup Matrix, 100% Red Field, 75% Red Field, White Window, Safe Area
PULSE BAR	Pulse & Bar	2T Pulse & Bar, Sin X/X
TIMING	—	—
SDI	—	—
OTHER	Other	ITS Matrix 1, UK 1 Line ITS
525 Beta format		
COLOR BAR	Color Bars	100% Color Bars, 75% Color Bars
LINEARITY	Linearity	5 Step, Modulated Ramp, Ramp, Oversize Ramp, Shallow Ramp Matrix, Valid Ramp, Valid 5 Step

Table 3-8: AVG7 module signal sets assigned to the test signal buttons (cont.)

Button name	Signal set	Signals in the signal set
FLAT FIELD	Flat Fields	Black, 0% Flat Field, 100% Flat Field, 50% Flat Field, Field Square Wave
MULTI BURST	Multi Burst	60% Multiburst
SWEEP	Sweep	60% Sweep
MONITOR	Monitor	Convergence Pattern, Grey Window, White Window, 2 Level Ped. & Pluge, 4 Level Ped. & Pluge, 75% Red Field, Chroma Noise
PULSE BAR	Pulse & Bar	2T Pulse & Bar, TPulses
TIMING	Timing	50% Bowtie, 100% Bowtie
SDI	—–	—–
OTHER	Other	Test Matrix
525 GBR format		
COLOR BAR	Color Bars	100% Color Bars, 75% Color Bars
LINEARITY	Linearity	5 Step, Shallow Ramp, Oversize Ramp, Shallow Ramp Matrix, Luminance Ramp
FLAT FIELD	Flat Fields	0% Flat Field, 100% Flat Field, 50% Flat Field, Field Square Wave
MULTI BURST	Multi Burst	60% Multiburst
SWEEP	Sweep	100% Line Sweep 5.5 MHz, 100% Line Sweep 8 MHz
MONITOR	Monitor	Convergence Pattern, Grey Window, 2 Level Ped. & Pluge, White Window, 4 Level Ped. & Pluge
PULSE BAR	Pulse & Bar	2T Pulse & Bar
TIMING	Timing	Bowtie
SDI	—–	—–
OTHER	—–	—–
525 YPbPr format		
COLOR BAR	Color Bars	100% Color Bars, 75% Color Bars
LINEARITY	Linearity	5 Step, Ramp, Oversize Ramp, Shallow Ramp Matrix, Valid Ramp, Valid 5 Step, Modulated Ramp
FLAT FIELD	Flat Fields	Black, 0% Flat Field, 100% Flat Field, 50% Flat Field, Field Square Wave
MULTI BURST	Multi Burst	60% Multiburst
SWEEP	Sweep	60% Sweep
MONITOR	Monitor	Convergence Pattern, Grey Window, White Window, 2 Level Ped. & Pluge, 4 Level Ped. & Pluge, 75% Red Field, Chroma Noise
PULSE BAR	Pulse & Bar	2T Pulse & Bar, T Pulses
TIMING	Timing	50% Bowtie, 100% Bowtie

Table 3-8: AVG7 module signal sets assigned to the test signal buttons (cont.)

Button name	Signal set	Signals in the signal set
SDI	—	—
OTHER	Other	Test Matrix
625 YPbPr format		
COLOR BAR	Color Bars	100% Color Bars, 75% Color Bars, 100% Color Bars Over Red, 75% Color Bars Over Red
LINEARITY	Linearity	5 Step, Modulated Ramp, Ramp, Oversize Ramp, Shallow Ramp Matrix, Valid 5 Step, Valid Ramp
FLAT FIELD	Flat Fields	0% Flat Field, 100% Flat Field, 50% Flat Field, Field Square Wave
MULTI BURST	Multi Burst	60% Multiburst
SWEEP	Sweep	60% Sweep
MONITOR	Monitor	Convergence Pattern, Grey Window, White Window, 2 Level Ped. & Pluge, 4 Level Ped. & Pluge, 100% Red, 75% Red
PULSE BAR	Pulse & Bar	2T Pulse & Bar, T Pulses
TIMING	Timing	50% Bowtie, 100% Bowtie
SDI	—	—
OTHER	Other	Test Matrix
625 GBR format		
COLOR BAR	Color Bars	100% Color Bars, 75% Color Bars
LINEARITY	Linearity	Oversize Ramp, Luminance Ramp, Shallow Ramp, Shallow Ramp Matrix, 5 Step
FLAT FIELD	Flat Fields	0% Flat Field, 50% Flat Field, 100% Flat Field, Field Square Wave
MULTI BURST	Multi Burst	60% Multiburst
SWEEP	Sweep	100% Sweep
MONITOR	Monitor	Convergence Pattern, Grey Window, 2 Level Ped. & Pluge, White Window, 4 Level Ped. & Pluge
PULSE BAR	Pulse & Bar	Window 2T Pulse & Bar
TIMING	Timing	Bowtie
SDI	—	—
OTHER	—	—

AVG7 module main menu

Use the AVG7 module main menu to perform the following tasks:

- Set the logo, text, or circle overlay on the output signal.
- Set the timing offset on the output signal.
- Set the APL settings on the output signal.
- Scroll the active picture area of the output signal.

Use the up (▲) or down (▼) arrow button to scroll through the main menu. The following figure shows the AVG7 module main menu.

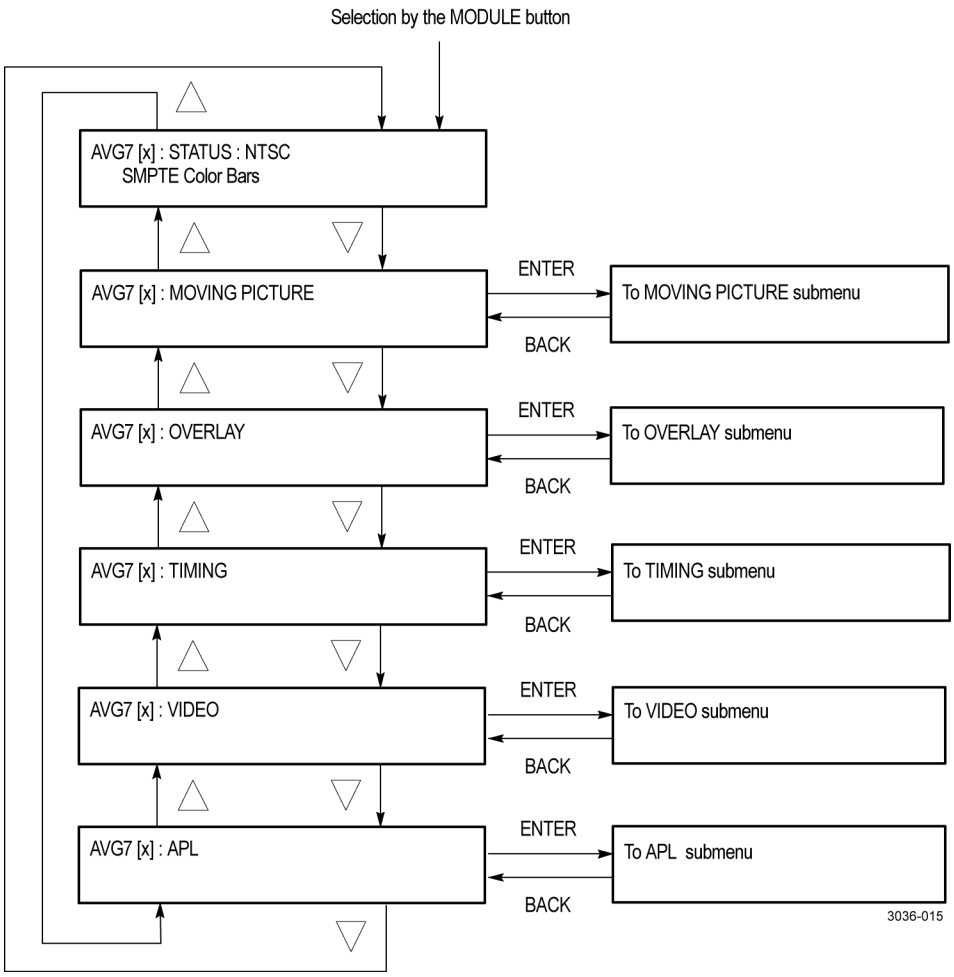

Figure 3-17: AVG7 module main menu

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 MOVING PICTURE submenu. (See page 3-37.)

OVERLAY. Selects an item (logo, text, or circle) to overlay 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 OVERLAY submenu. (See page 3-38.)

TIMING. Sets the timing offset of the output signals relative to the internal reference signal (frame reset signal). Select this menu item, and then press the **ENTER** button to access the TIMING submenu. (See page 3-43.)

VIDEO. Sets the output channel configuration when a composite signal is being output and enables or disables the signal output from CH 1, CH 2, and CH 3. Select this menu item, and then press the **ENTER** button to access the VIDEO submenu. (See page 3-44.)

APL. Sets the APL and Bounce features available for the signal output. When you select this menu item and then press the **ENTER** button, you will access the APL submenu. (See page 3-46.)

AVG7 module MOVING PICTURE submenu

Use this menu to scroll the active picture area of the output signal up/down, left/right, or randomly. Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the MOVING PICTURE submenu.

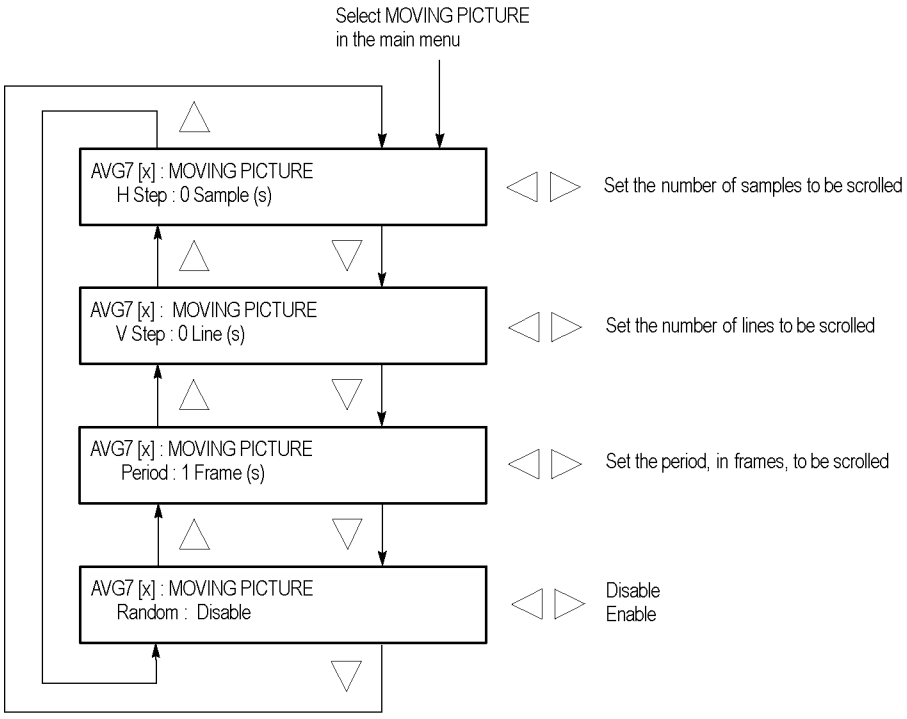

Figure 3-18: AVG7 module MOVING PICTURE submenu

H 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 change the value. You can set the value from -60 to +60 in 4-sample steps.

V 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 change the value. You can set the value from -15 to +15 in 1-line steps.

Period. Sets the time interval between occurrences of the scrolling. Use the left (◄) or right (►) arrow button to change the value. You can 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.

AVG7 module OVERLAY submenu

Use this menu to select an item (logo, ID Text, or circle) 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. The following figure shows the OVERLAY submenu.

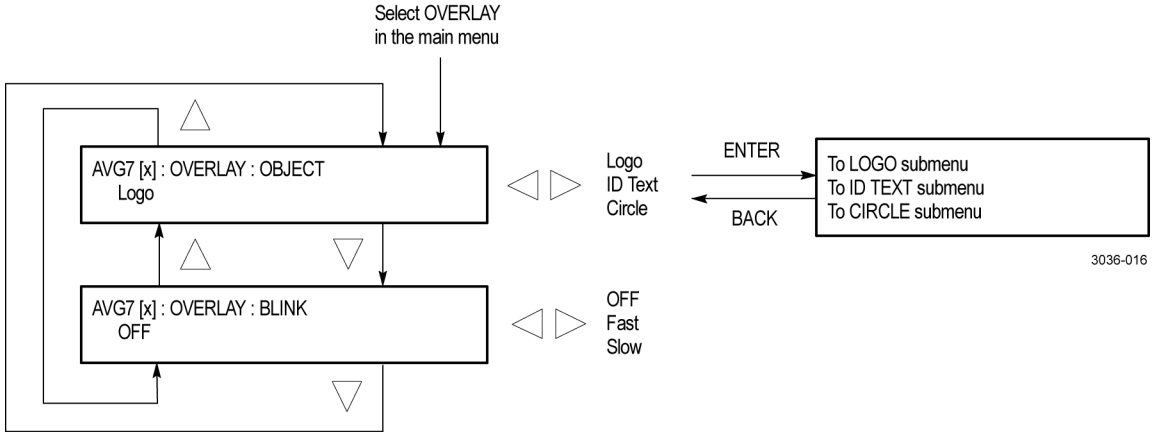

Figure 3-19: AVG7 module OVERLAY submenu

OBJECT. Selects an item to overlay on the output test signal. Use the left (◄) or right (►) arrow button to select one of the following overlays, and then press the ENTER button to access the submenu for setting the parameters of that overlay.

- **Logo:** Opens the LOGO submenu where you can select a logo to overlay the output signal in a specified position. (See page 3-39.)
- **ID Text:** Opens the ID TEXT submenu where you can edit the text to overlay the output signal in a specified position. (See page 3-40.)
- **Circle:** Opens the CIRCLE submenu where you can specify a circle size and position to overlay the output signal. (See page 3-42.)

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.

- **OFF:** Turns off 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.

AVG7 module 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 LOGO submenu.

NOTE. *To display a logo using the LOGO submenu, you need to create a logo file (.lgo) and download it to the LOGO folder of the module. Refer to the TG8000 PC Tools Technical Reference for detailed information about how to create a logo file and download it to the TG8000.*

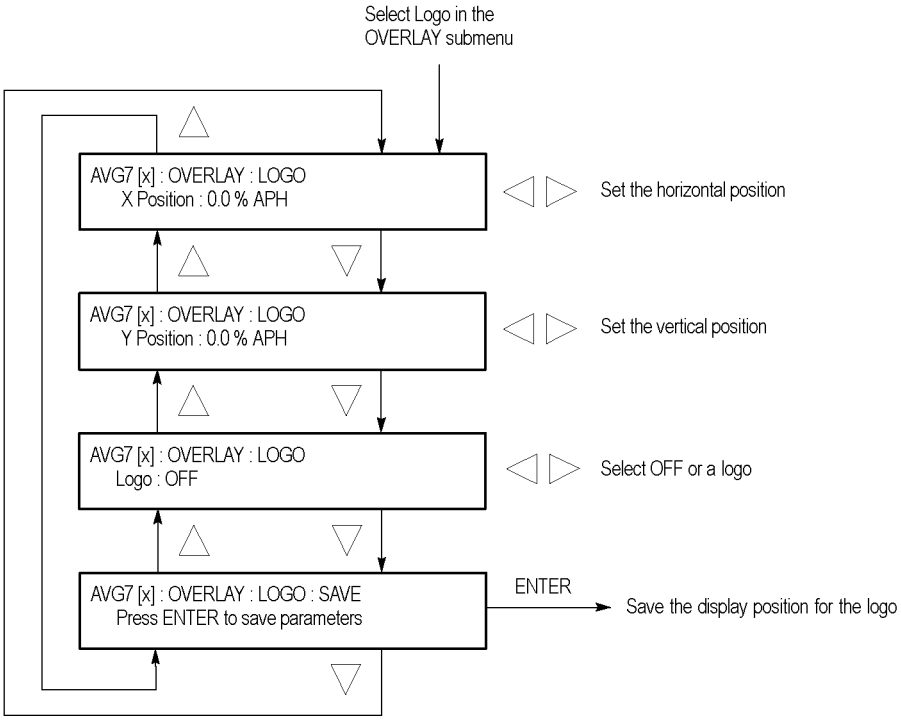

Figure 3-20: AVG7 module LOGO submenu

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 0.0% in 0.1% steps.

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 0.0% in 0.1% steps.

Logo. Selects the logo you want to display. Use the left (◄) or right (►) arrow button to select **OFF** or a logo file name. Press the **ENTER** button confirm the selection. When you select OFF, the logo overlay is disabled.

SAVE. Saves the display position for the logo to the logo file. Press the **ENTER** button to save the current settings.

AVG7 module ID TEXT submenu

Use this menu to edit the text that is overlaid on the output test signal and to set the display position of the text. Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the ID TEXT submenu.

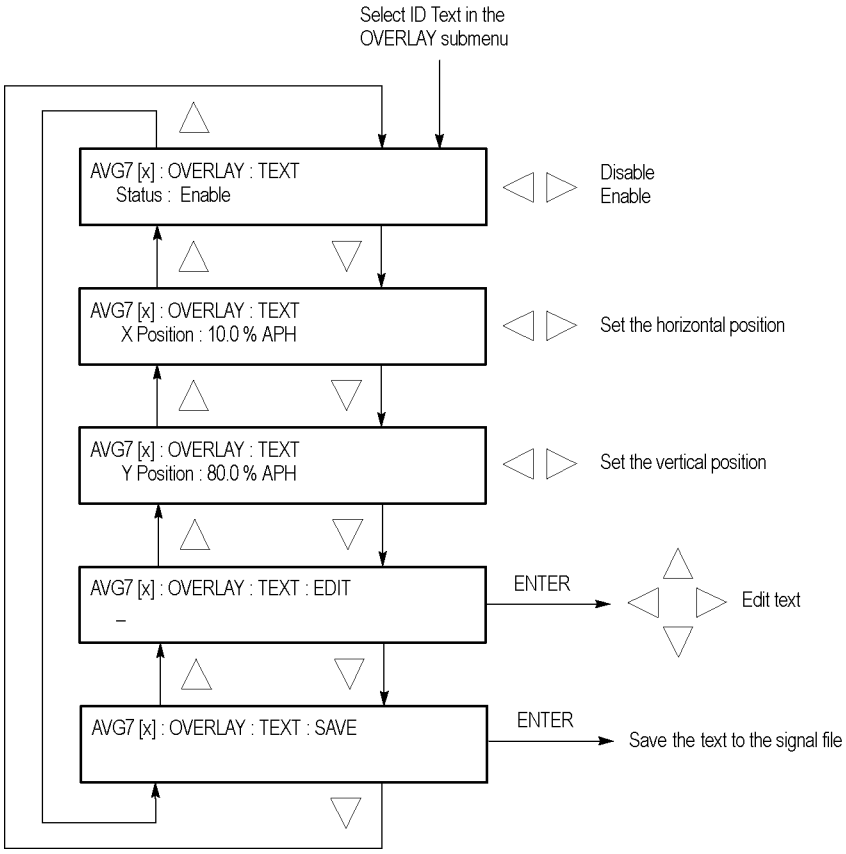

Figure 3-21: AVG7 module ID TEXT submenu

Status. Enables or disables the text overlay. Use the left (◄) or right (►) arrow button to select between **Enable** and **Disable**, and then press the **ENTER** button to confirm the selection.

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 100.0% in 1% steps.

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 100.0% in 1% steps.

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.
5. Use the left (◄) or right (►) arrow button to select **SAVE**, and then press the **ENTER** button to save the text and its position to the signal file.

SAVE. Saves the text and its position to the signal file currently being output. Press the **ENTER** button to save the text and its position to the signal file.

AVG7 module CIRCLE submenu

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

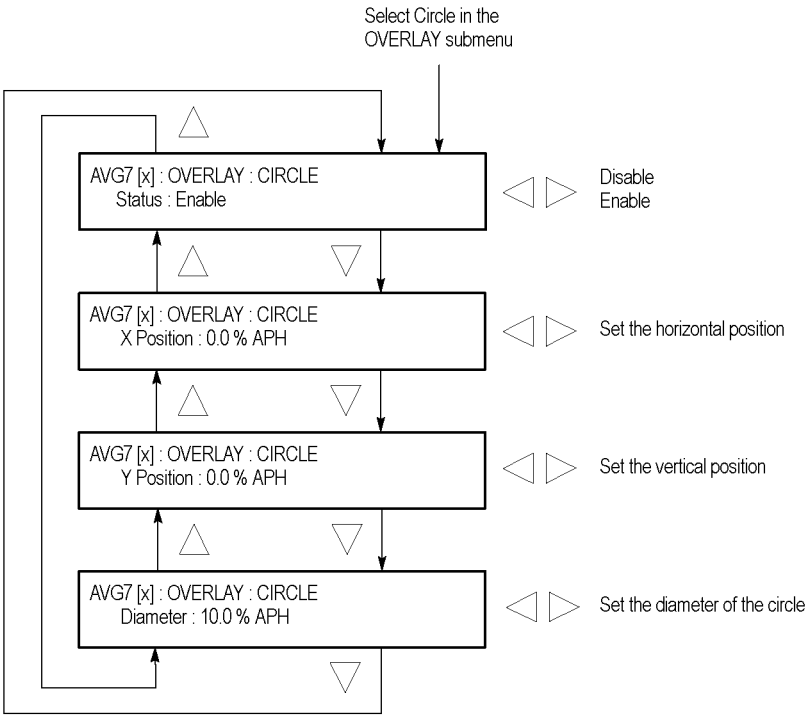

Figure 3-22: AVG7 module CIRCLE submenu

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.

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 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 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 1% steps.

AVG7 module TIMING submenu

Use this menu to adjust the timing offset of the output signal relative to the internal reference signal (frame reset signal). Use the up (▲) or down (▼) arrow button to scroll through the menu items. The following figure shows the TIMING submenu.

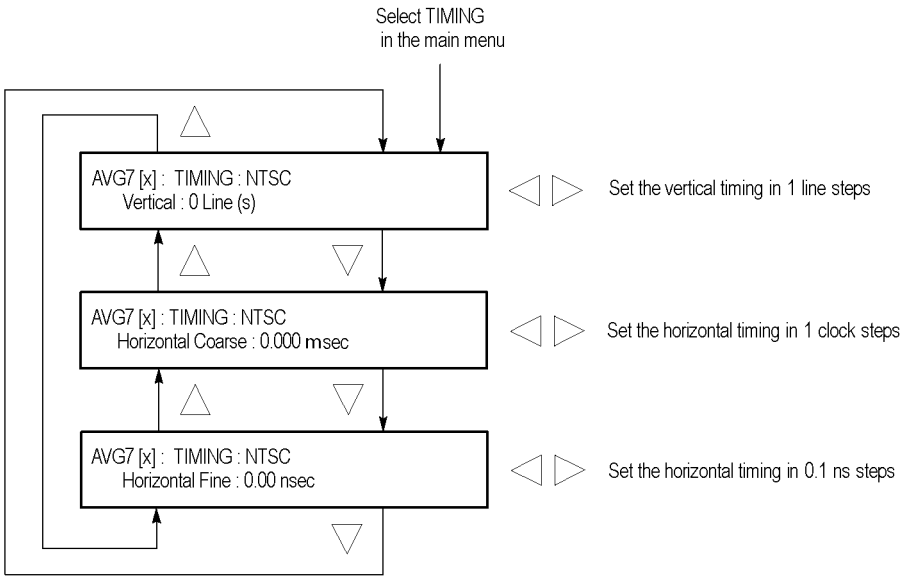

Figure 3-23: AVG7 module TIMING submenu

NOTE. *You can reset the timing offset to zero by pressing the left (◄) or right (►) arrow buttons simultaneously.*

Vertical. Sets the vertical timing offset. Use the left (◄) or right (►) arrow button to change the timing offset. You can set the value from -1 to +1 frame of the selected signal format in 1 line steps.

Horizontal coarse. Use the left (◄) or right (►) arrow button to adjust the coarse horizontal offset. You can set the value from -1 to +1 line of the selected signal format in 1 clock (18.5 ns) steps.

Horizontal fine. Use the left (◄) or right (►) arrow button to adjust the fine horizontal offset. You can set the value from -10 ns to +10 ns in 0.1 ns steps.

AVG7 module VIDEO submenu

Use this menu to perform the following tasks:

- Set the output channel configuration when a composite signal is being output.
- Enable or disable the signal output of each channel.
- Set whether a sync signal is multiplexed with the B and R signals when a GBR signal is being output.

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

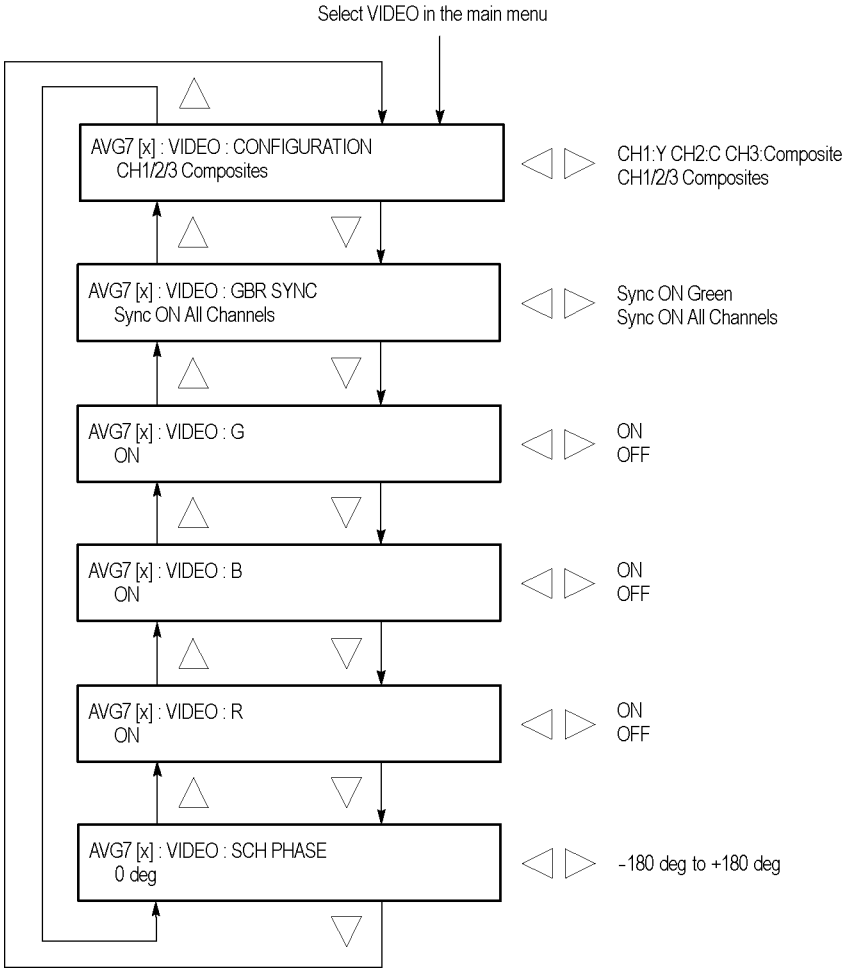

Figure 3-24: AVG7 module VIDEO submenu

CONFIGURATION. Sets the configuration of the output channels. Use the left (◄) or right (►) arrow button to select between **CH1:Y CH2:C CH3:Composite** and **CH1/2/3 Composites**. When you select CH1:Y CH2:C CH3:Composite, a Y signal, C signal, and composite signal are output from the CH 1, CH 2, and CH 3 connectors respectively. When you select CH1/2/3:Composites, a composite signal is output from each output connector. Press the **ENTER** button to confirm the selection. This menu item appears only when a composite signal is being output.

GBR SYNC. Sets whether or not a sync signal is multiplexed with the B signal and R signal when a GBR signal is being output. Use the left (◄) or right (►) arrow button to select between **Sync ON Green** and **Sync ON All Channels**. When you select Sync ON All Channels, a sync signal is multiplexed with the G, B, and R signals. Press the **ENTER** button to confirm the selection. This menu item appears only when a GBR signal is being output.

G/Y. Turns the CH 1 signal output on or off for a component signal, or turns the Y signal on or off for a composite signal. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. Press the **ENTER** button to confirm the selection. The signal name displayed depends on the video format of the currently selected signal (YPbPr component, GBR component, or composite) and the output channel configuration.

B/Pb/B-Y. Turns the CH 2 signal output on or off for a component signal, or turns the B-Y signal on or off for a composite signal. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. Press the **ENTER** button to confirm the selection. The signal name displayed depends on the video format of the currently selected signal (YPbPr component, GBR component, or composite) and the output channel configuration.

R/Pr/R-Y. Turns the CH 3 signal output on or off for a component signal, or turns the R-Y signal on or off for a composite signal. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. Press the **ENTER** button to confirm the selection. The signal name displayed depends on the video format of the currently selected signal (YPbPr component, GBR component, or composite) and the output channel configuration.

SCH PHASE. Use the left (◄) or right (►) arrow button to adjust the SCH phase for a composite signal. You can set the value from -180 degrees to +180 degrees in 1 degree steps. This setting is not saved as a preset.

NOTE. *If you try to set the SCH phase over +180 degrees, the value jumps to -179 degrees. Also, if you try to set the SCH phase under -180 degrees, the value jumps to +179 degrees.*

AVG7 module APL submenu

Use this menu to set the APL and Bounce parameters for the test signal outputs. Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the APL submenu.

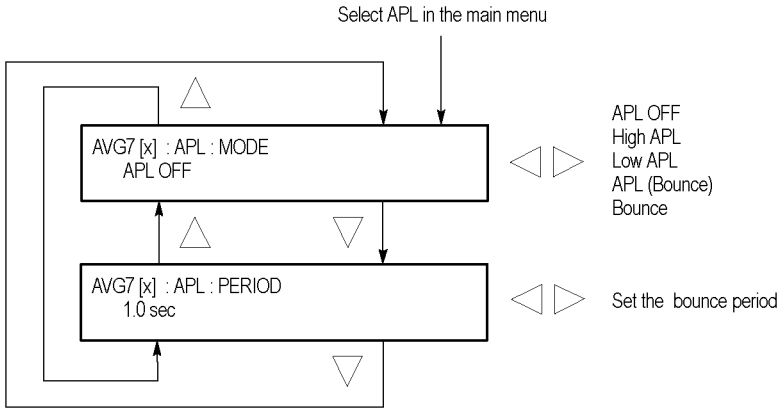

Figure 3-25: AVG7 module APL submenu

MODE. Sets the output mode of the APL signal. Use the left (◄) or right (►) arrow button to select the mode, and then press the **ENTER** button to confirm the selection. The choices are:

- **APL OFF:** Outputs the selected signal without making any changes.
- **High APL:** Divides the video lines of the selected signal into 5 lines (for NTSC) or 4 lines (for PAL) and changes the lines except the last line to the 100% flat field signal, and then outputs them.
- **Low APL:** Divides the video lines of the selected signal into 5 lines (for NTSC) or 4 lines (for PAL) and changes the lines except the last line to the 0% flat field signal, and then outputs them.
- **APL (Bounce):** Outputs the High APL signal and Low APL signal alternately for the period set in the PERIOD menu item.
- **Bounce:** Outputs the 100% flat field signal and 0% flat field signal alternately (regardless of the selected signal) for the period set in the PERIOD menu item.

PERIOD. Sets the time interval between two signals when they are output in APL (Bounce) or Bounce mode. Use the left (◄) or right (►) arrow button to change the interval. You can set the value from 0.5 seconds to 2.0 seconds in 0.5 second steps.

AVG7 module factory default settings

The following table shows the factory default settings for the AVG7 Generator module. These settings are recalled when you select **Factory Default** from the **PRESET : RECALL** menu item in the mainframe main menu.

Table 3-9: AVG7 module factory default settings

Menu item name		Settings
STATUS		NTSC SMPTE Color Bars
MOVING PICTURE		
	H Step	0 Sample(s)
	V Step	0 Line(s)
	Period	1 Frame(s)
	Random	Disable
OVERLAY : OBJECT		Logo
OVERLAY : BLINK		OFF
OVERLAY : LOGO		
	Logo	OFF
OVERLAY : ID TEXT		
	Status	Disable
OVERLAY : CIRCLE		
	Status	Disable
	X Position	0.0% APH
	Y Position	0.0% APH
	Diameter	90% APH
TIMING		
	Vertical	0 Line(s)
	Horizontal Coarse	0.0000 ms
	Horizontal Fine	0.00 ns
VIDEO		
	CONFIGURATION	CH1/2/3 Composites
	GBR SYNC	Sync ON All Channels
	G/Y	ON
	B/Pb/B-Y	ON
	R/Pr/R-Y	ON
	SCH PHASE	0 deg
APL		
	MODE	APL OFF
	PERIOD	1.0 s

AWVG7 Analog Wideband Video Generator module

This section describes the module-specific functions of the AWVG7 Analog Wideband Video Generator module. Refer to the following locations for additional information about this module:

- *AWVG7 module connectors* for a description of the rear-panel connectors. (See page 2-11.)
- *AWVG7 module functional check* for a basic procedure to check that the module is functional. (See page 1-22.)
- *TG8000 Specifications and Performance Verification Technical Reference* for module specifications and for a detailed procedure to verify that the module is functioning as specified.
- *TG8000 Programmer Manual* for information about the commands to remotely control the module.

AWVG7 module product description

The AWVG7 Analog Wideband Video Generator module is a 30 MHz bandwidth video signal generator, which provides wideband analog component video signals for HDTV systems. The module provides the following features:

- Supports the following system formats: 1080/60i, 1080/59.94i, 1080/50i, 1080/24sF, 1080/23.98sF, 1080/30p, 1080/29.97p, 1080/25p, 1080/24p, 1080/23.98p, 720/60p, 720/59.94p, 720/50p, 720/24p, and 720/23.98p.

NOTE. *Signals for the following system formats are preinstalled in the mainframe: 1080/60i, 1080/59.94i, 1080/24sF, 1080/23.98sF, 720/60p, and 720/59.94p.*

Signals for additional system formats are included on the TG8000 SW Library and Documentation DVD that is supplied as a standard accessory. Refer to the TG8000 PC Tools Technical Reference for detailed information on how to download signal files from the DVD to the TG8000.

- Six analog component video outputs.
- Outputs a frame picture created by the Frame Picture Generator application.
- Overlay of circle, text, or logo on the video signal.
- Generates a moving picture by scrolling the active picture area of the output test signal.
- Full remote control using Ethernet interface.

How to operate the AWVG7 module

After the module is installed in the mainframe, and the mainframe is installed in the rack or other location where it will be used, use the following procedure to access each function of the module:

1. Connect the power cord to the power connector on the rear panel, and then plug the cord into to the AC electric power source. Electric power is supplied to the mainframe.
2. Wait until the power-on initialization process is complete, and then check that no error messages appear on the display.
3. After the initialization process is complete, the mainframe main menu appears as shown below.

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4. Press the front-panel **MODULE** button until the AWVG7 module main menu appears as shown below.

5. Select the signal format and the signal you want to output. (See page 3-50, *To select an output signal on the AWVG7 module*.)
6. Use the front-panel arrow buttons to navigate and select items in the main menu and submenus.

Refer to *AWVG7 module main menu* for detailed information about the main menu items and the submenu items. (See page 3-52.)

To select an output signal on the AWVG7 module

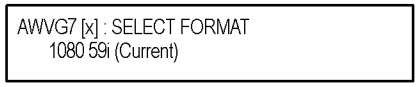
To output a signal from the AWVG7 module, you need to select a signal format and output signal as described below.

To select the signal format

Perform the following steps to select the signal format:

1. If the AWVG7 module menu is not displayed, press the front-panel **MODULE** button until the AWVG7 module main menu appears as shown below.

2. Press the **FORMAT** button. The menu display changes as follows:



3. Use the left (◄) or right (►) arrow button, or press the **FORMAT** button repeatedly, to select one of the signal formats, and then press the **ENTER** button to confirm the selection.

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

4. If you change the signal format while a test signal is being output, the instrument starts loading all of the signal sets for the selected format and displays the message "**Now Loading...**". When you see the message, "**Done (Press BACK)**", press the **BACK** button.

To select the test signal

All of the signal sets that are available in the module are already assigned to the corresponding test signal buttons. When the AWVG7 module is selected and you press any of the front-panel test signal buttons, the selected signal in the signal set is output. (See Figure 3-26.)

For example, when you press the **COLOR BAR** test signal button, a signal in the Color Bars signal set is output. Use the left (◄) or right (►) arrow button, or press the COLOR BAR test signal button repeatedly to select a different signal from the Color Bars signal set.

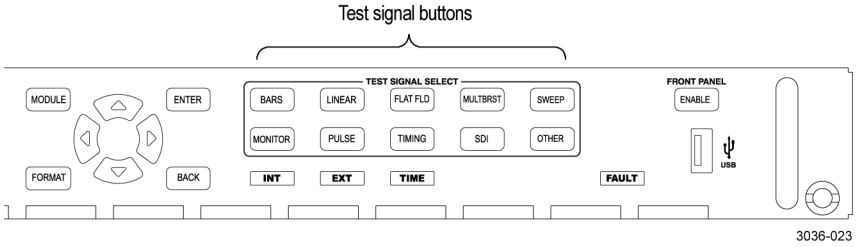


Figure 3-26: Front-panel test signal buttons

You can download a frame picture file (created by the Frame Picture Generator) to the mainframe and output the picture from the AWVG7 module. Refer to the *TG8000 PC Tools Technical Reference* for detailed information on how to create, download, and output a frame picture.

The following table lists the AWVG7 signal sets that are assigned to the test signal buttons and shows the test signals that are available in each signal set.

Table 3-10: AWVG7 module signal sets assigned to the test signal buttons

Button name	Signal set	Signals in the signal set
COLOR BAR	Color Bars	100% Color Bars, 75% Color Bars
LINEARITY	Linearity	10 Step, 5 Step, Ramp, Shallow Ramp, Valid Ramp [1]
FLAT FIELD	Flat Fields	0% Flat Field, 100% Flat Field, 50% Flat Field
MULTI BURST	Multi Burst	Multiburst 1-10 MHz, Multiburst 10-20 MHz, Multiburst 20-30 MHz
SWEEP	Sweep	100% Sweep 1-15 MHz, 100% Sweep 1-30 MHz
MONITOR	Monitor	75% Blue Field, Convergence, 75% Green Field, 75% Red Field
PULSE BAR	Pulse & Bar	2T30 Pulse & Bar
TIMING	Timing	Bowtie 1 ns Marker
SDI	—	—
OTHER	—	—

1 The Valid Ramp signal is available in YPbPr format only.

AWVG7 module main menu

Use the AWVG7 module main menu to perform the following tasks:

- Set the logo, text, or circle overlay on the output signal.
- Set the timing offset on the output signal.
- Scroll the active picture area of the output signal.
- Set whether a sync signal is multiplexed with the B and R signals when a GBR signal is being output.
- Enable or disable the output signal on the CH1, CH2, and CH3 connectors.

Use the up (▲) or down (▼) arrow button to scroll through the main menu. The following figure shows the AWVG7 module main menu.

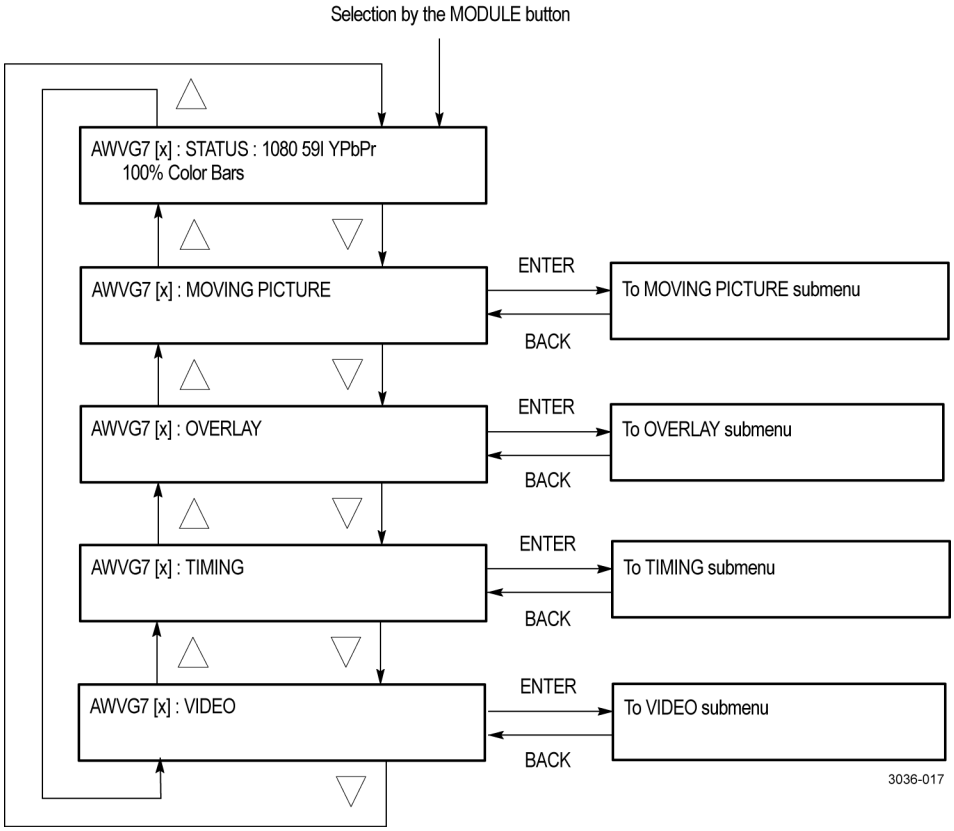


Figure 3-27: AWVG7 module main menu

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 MOVING PICTURE submenu. (See page 3-53.)

OVERLAY. Selects an item (logo, text, or circle) to overlay 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 OVERLAY submenu. (See page 3-54.)

TIMING. Sets the timing offset of the output signals relative to the internal reference signal (frame reset signal). Select this menu item, and then press the **ENTER** button to access the TIMING submenu. (See page 3-59.)

VIDEO. Sets whether or not a sync signal is multiplexed with the B and R signal when a GBR signal is being output and enables or disables the signal output from CH 1, CH 2, and CH 3. Select this menu item, and then press the **ENTER** button to access the VIDEO submenu. (See page 3-61.)

AWVG7 module MOVING PICTURE submenu

Use this menu to scroll the active picture area of the output signal up/down, left/right, or randomly. Use the up (▲) or down (▼) arrow button to scroll the menu. The following figure shows the MOVING PICTURE submenu.

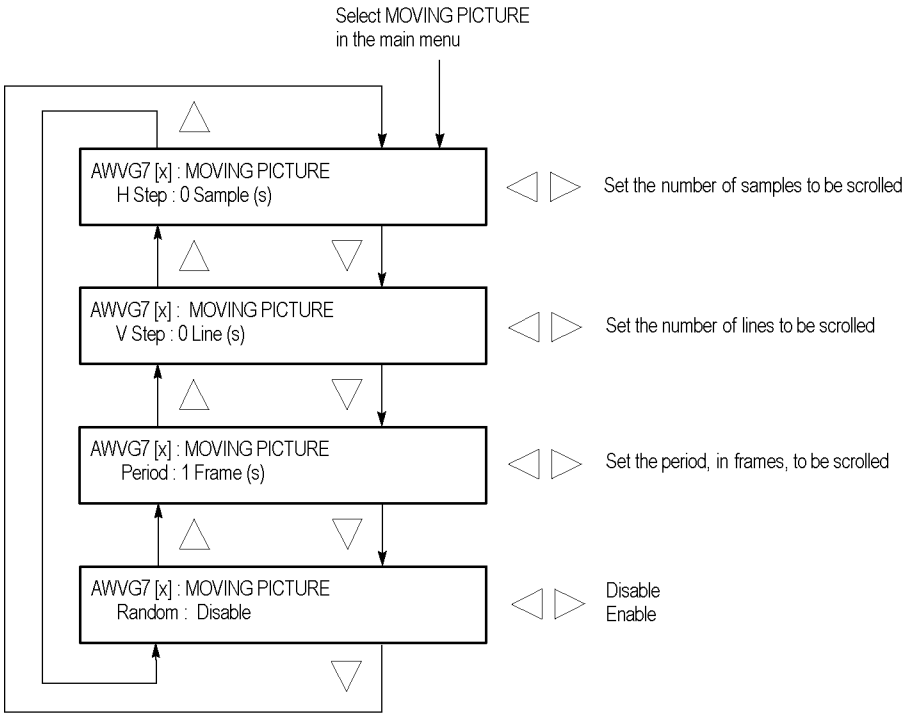


Figure 3-28: AWVG7 module MOVING PICTURE submenu

H 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 change the value. You can set the value from -60 to +60 in 4-sample steps.

V 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 change the value. You can set the value from -15 to +15 in 1-line steps.

Period. Sets the time interval between occurrences of the scrolling. Use the left (◄) or right (►) arrow button to change the value. You can 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.

AWVG7 module OVERLAY submenu

Use this menu to select an item (logo, ID Text, or circle) 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. The following figure shows the OVERLAY submenu.

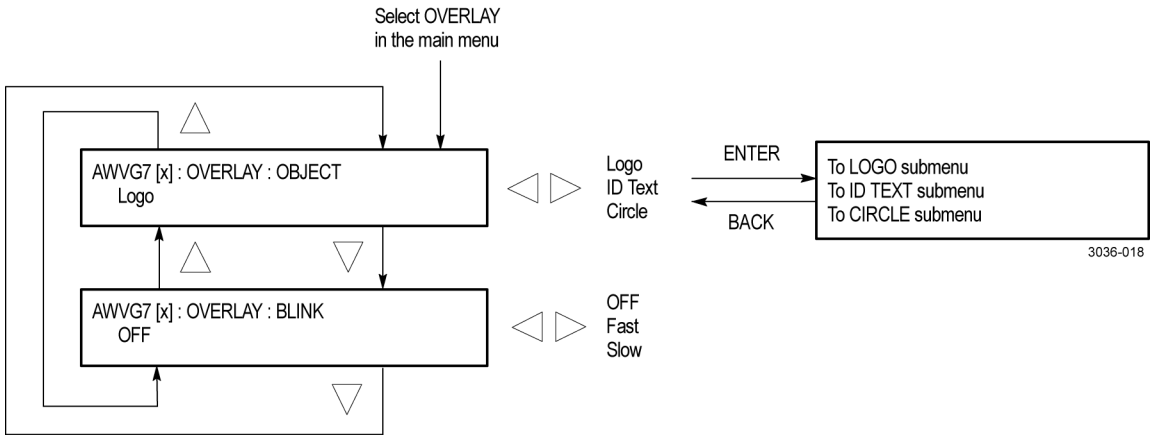


Figure 3-29: AWVG7 module OVERLAY submenu

OBJECT. Selects an item to overlay on the output test signal. Use the left (◄) or right (►) arrow button to select one of the following overlays, and then press the ENTER button to access the submenu for setting the parameters of that overlay.

- **Logo:** Opens the LOGO submenu where you can select a logo to overlay the output signal in a specified position. (See page 3-55.)
- **ID Text:** Opens the ID TEXT submenu where you can edit the text to overlay the output signal in a specified position. (See page 3-56.)
- **Circle:** Opens the CIRCLE submenu where you can specify a circle size and position to overlay the output signal. (See page 3-58.)

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.

- **OFF:** Turns off 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.

AWVG7 module 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 LOGO submenu.

NOTE. *To display a logo using the LOGO submenu, you need to create a logo file (.lgo) and download it to the LOGO folder of the module. Refer to the TG8000 PC Tools Technical Reference for detailed information about how to create a logo file and download it to the TG8000.*

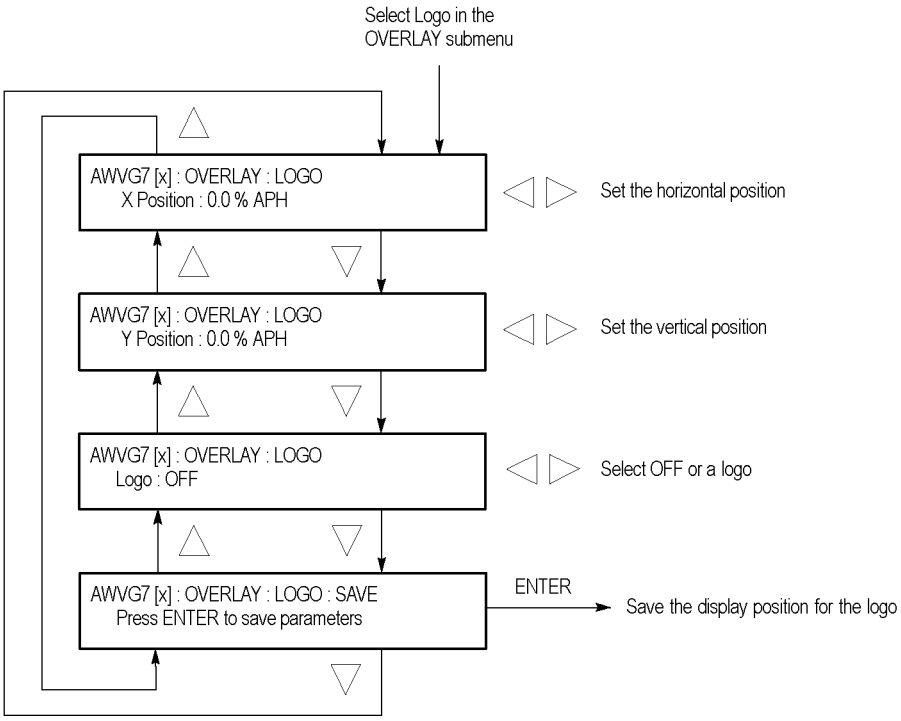


Figure 3-30: AWVG7 module LOGO submenu

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 0.0% in 0.1% steps.

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 0.0% in 0.1% steps.

Logo. Selects the logo you want to display. Use the left (◄) or right (►) arrow button to select **OFF** or a logo file name. Press the **ENTER** button confirm the selection. When you select OFF, the logo overlay is disabled.

SAVE. Saves the display position for the logo to the logo file. Press the **ENTER** button to save the current settings.

AWVG7 module ID TEXT submenu

Use this menu to edit the text that is overlaid on the output test signal and to set the display position of the text. Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the ID TEXT submenu.

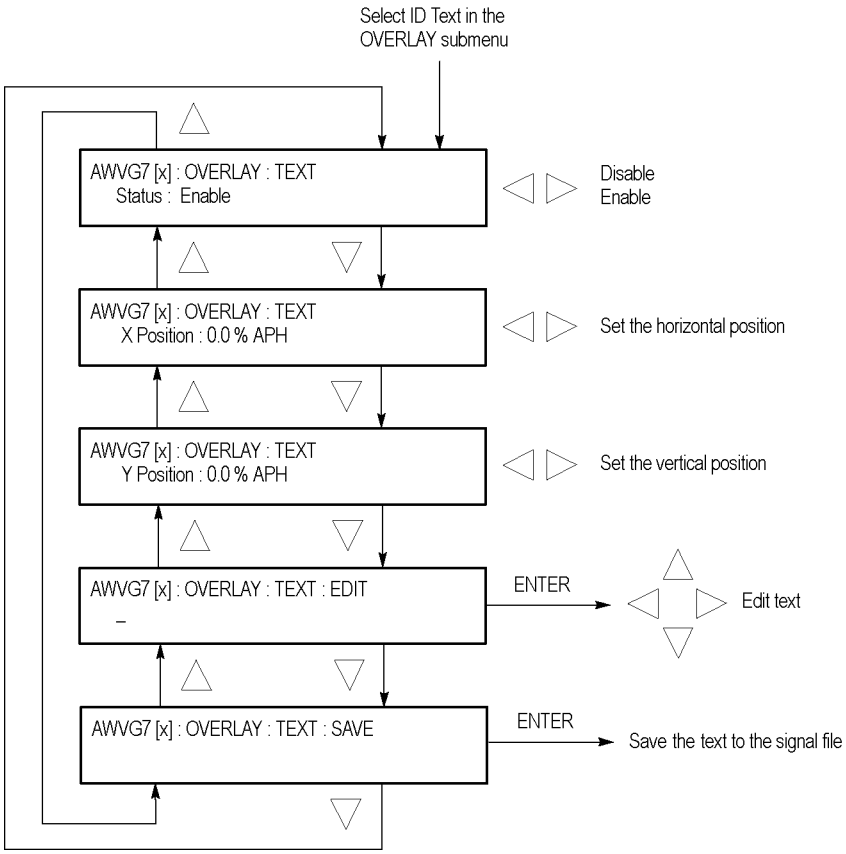


Figure 3-31: AWVG7 module ID TEXT submenu

Status. Enables or disables the text overlay. Use the left (◄) or right (►) arrow button to select between **Enable** and **Disable**, and then press the **ENTER** button to confirm the selection.

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 100.0% in 1% steps.

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 100.0% in 1% steps.

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.
5. Use the left (◄) or right (►) arrow button to select **SAVE**, and then press the **ENTER** button to save the text and its position to the signal file.

SAVE. Saves the text and its position to the signal file currently being output. Press the **ENTER** button to save the text and its position to the signal file.

AWVG7 module CIRCLE submenu

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

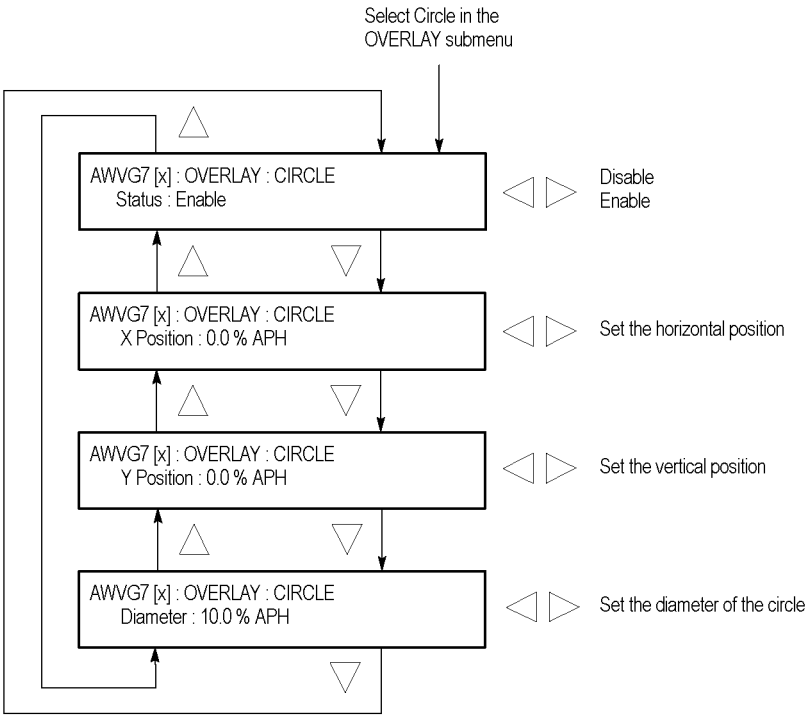


Figure 3-32: AWVG7 module CIRCLE submenu

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.

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 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 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 1% steps.

AWVG7 module TIMING submenu

Use this menu to adjust the timing offset of the output signal 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 TIMING submenu.

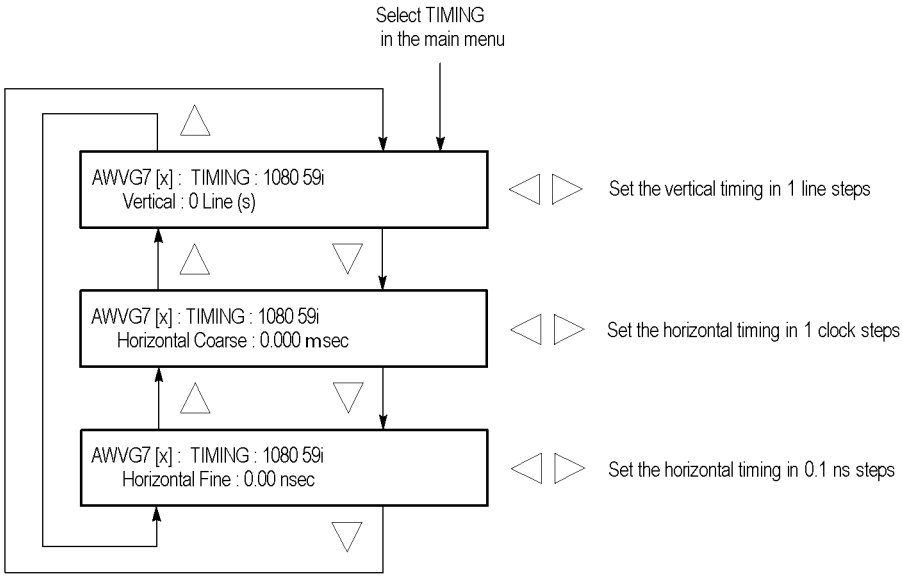


Figure 3-33: AWVG7 module TIMING submenu

NOTE. *You can reset the timing offset to zero by pressing the left (◄) or right (►) arrow buttons simultaneously.*

The adjustment range of the timing offset settings depends on the selected signal format. (See Table 3-11 on page 3-60.)

Vertical. Sets the vertical timing offset. Use the left (◄) or right (►) arrow button to change the timing offset. You can set the value from -1 to +1 frame of the selected signal format in 1 line steps.

Horizontal coarse. Use the left (◄) or right (►) arrow button to adjust the coarse horizontal offset. You can set the value from -1 to +1 line of the selected signal format in 1 clock (18.5 ns) steps.

Horizontal fine. Use the left (◄) or right (►) arrow button to adjust the fine horizontal offset. You can set the value from -10 ns to +10 ns in 0.1 ns steps.

Table 3-11: Timing adjustment ranges for AWVG7 module output signals

Signal format	Line settings	Coarse settings (µs)	Fine settings (ns)
1080 60i YPbPr/GBR	± 562	± 29.6296	± 10.00
1080 59i YPbPr/GBR	± 562	± 29.6593	± 10.00
1080 50i YPbPr/GBR	± 562	± 35.5556	± 10.00
1080 24sF YPbPr/GBR	± 562	± 37.0370	± 10.00
1080 23sF YPbPr/GBR	± 562	± 37.0741	± 10.00
1080 30p YPbPr/GBR	± 562	± 29.6296	± 10.00
1080 29p YPbPr/GBR	± 562	± 29.6593	± 10.00
1080 25p YPbPr/GBR	± 562	± 35.5556	± 10.00
1080 24p YPbPr/GBR	± 562	± 37.0370	± 10.00
1080 23p YPbPr/GBR	± 562	± 37.0741	± 10.00
720 60p YPbPr/GBR	± 375	± 22.2222	± 10.00
720 59p YPbPr/GBR	± 375	± 22.4444	± 10.00
720 50p YPbPr/GBR	± 375	± 26.6667	± 10.00
720 30p YPbPr/GBR	± 375	± 53.3333	± 10.00
720 29p YPbPr/GBR	± 375	± 45.9770	± 10.00
720 25p YPbPr/GBR	± 375	± 44.4444	± 10.00
720 24p YPbPr/GBR	± 375	± 55.5556	± 10.00
720 23p YPbPr/GBR	± 375	± 55.6111	± 10.00

AWVG7 module VIDEO submenu

Use this menu to perform the following tasks:

- Enable or disable the signal output from the CH 1, CH 2, and CH 3 connectors.
- Set whether a sync signal is multiplexed with the B and R signals when a GBR signal is being output.

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

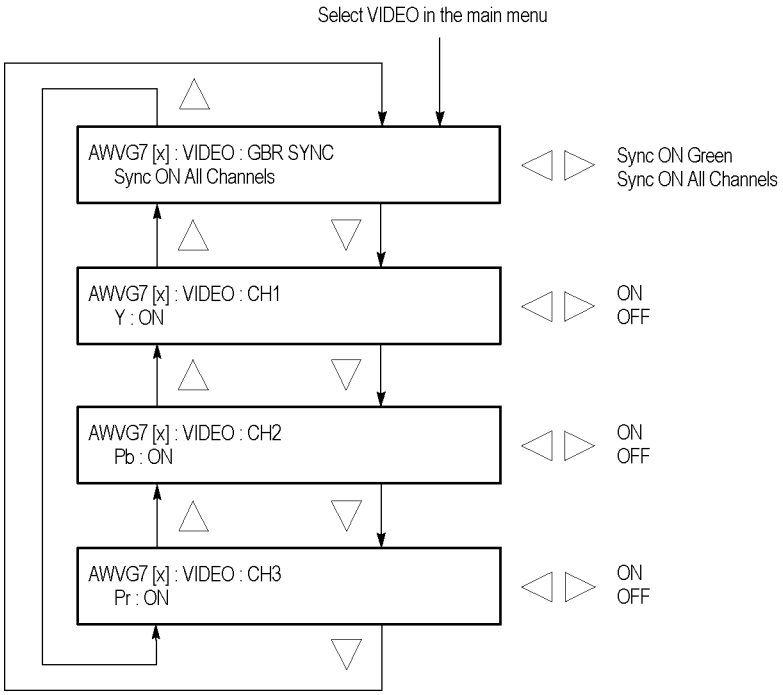


Figure 3-34: AWVG7 module VIDEO submenu

GBR SYNC. Sets whether a sync signal is multiplexed with the B signal and R signal when a GBR signal is being output. Use the left (◄) or right (►) arrow button to select between **Sync ON Green** and **Sync ON All Channels**. When you select Sync ON All Channels, a sync signal is multiplexed with the G, B, and R signals. Press the **ENTER** button to confirm the selection. This menu item appears only when a GBR signal is being output.

CH 1. Turns the CH 1 signal output on or off. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. Press the **ENTER** button to confirm the selection. The signal name that is displayed before the ON/OFF status depends on the format of the currently selected signal (YPbPr component or GBR component).

CH 2. Turns the CH 2 signal output on or off. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. Press the **ENTER** button to confirm the selection. The signal name that is displayed before the ON/OFF status depends on the format of the currently selected signal (YPbPr component or GBR component).

CH 3. Turns the CH 3 signal output on or off. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. Press the **ENTER** button to confirm the selection. The signal name that is displayed before the ON/OFF status depends on the format of the currently selected signal (YPbPr component or GBR component).

AWVG7 module factory default settings

The following table shows the factory default settings for the AWVG7 module. These settings are recalled when you select **Factory Default** from the **PRESET : RECALL** menu item in the mainframe main menu.

Table 3-12: AWVG7 module factory default settings

Menu item name		Settings
STATUS		1080 59i YPbPr 100% Color Bars
MOVING PICTURE		
	H Step	0 Sample(s)
	V Step	0 Line(s)
	Period	1 Frame(s)
	Random	Disable
OVERLAY : OBJECT		Logo
OVERLAY : BLINK		OFF
OVERLAY : LOGO		
	Logo	OFF
OVERLAY : ID TEXT		
	Status	Disable
OVERLAY : CIRCLE		
	Status	Disable
	X Position	0.0% APH
	Y Position	0.0% APH
	Diameter	90.0% APH
TIMING		
	Vertical	0 Line(s)
	Horizontal Coarse	0.000 ms
	Horizontal Fine	0.00 ns
VIDEO		
	GBR SYNC	Sync ON All Channels
	Y	ON
	Pb	ON
	Pr	ON

BG7 Black Generator module

This section describes the module-specific functions of the BG7 Black Generator module. Refer to the following locations for additional information about this module:

- *BG7 module connectors* for a description of the rear-panel connectors. (See page 2-11.)
- *BG7 module functional check* for a basic procedure to check that the module is functional. (See page 1-23.)
- *TG8000 Specifications and Performance Verification Technical Reference* for module specifications and for a detailed procedure to verify that the module is functioning as specified.
- *TG8000 Programmer Manual* for information about the commands to remotely control the module.

BG7 module product description

The BG7 Black Generator module is a multiformat black generator with the following features:

- Four outputs for NTSC (with or without setup) or PAL black burst and HDTV trilevel sync signals.
- Individual format and timing control for each output.
- Black burst with field ID and NTSC/PAL color bars signals output (Option CB).
- Full remote control using Ethernet interface.
- Timecode generator with VITC when a GPS7 module is installed (the BG7 module hardware must be version 1.2 or above).

NOTE. *PAL-M and PAL-N are not supported by the AGL7, ATG7 and BG7 modules.*

How to operate the BG7 module

After the module is installed in the mainframe, and the mainframe is installed in the rack or other location where it will be used, use the following procedure to access each function of the module:

1. Connect the power cord to the power connector on the rear panel, and then plug the cord into the AC electric power source. Electric power is supplied to the mainframe.
2. Wait until the power-on initialization process is complete, and then check that there are no error messages on the display.
3. After the initialization process is complete, the mainframe main menu appears as shown below.

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4. Press the front-panel **MODULE** button until the BG7 module main menu appears as shown below.

5. Use the front-panel arrow buttons to navigate and select items in the main menu and submenus.

Refer to *BG7 module main menu* for detailed information about the main menu items and submenu items. (See page 3-65.)

BG7 module main menu

Use the BG7 module main menu to perform the following tasks:

- Select an output to format.
- Set the HD trilevel sync rate for all of the BLACK outputs.
- Set the format of the selected output.
- Select the test signal for the BLACK 3 and BLACK 4 outputs (Option CB only).
- Set the timing offset for the selected output.
- Set timecode parameters for the selected output when a GPS7 module is installed. The BG7 module hardware must be version 1.2 or above and the mainframe must have software version 5.1 or above installed.

The following figure shows the BG7 module main menu.

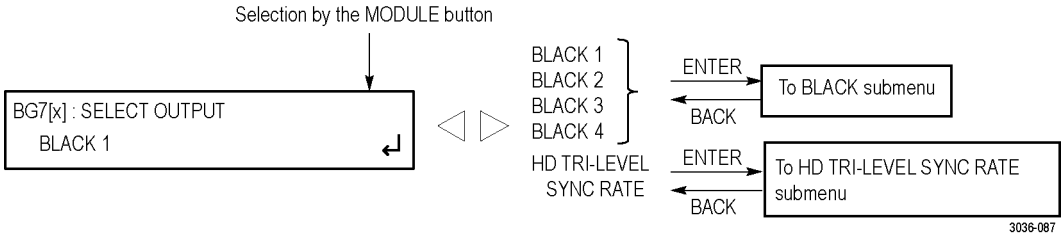


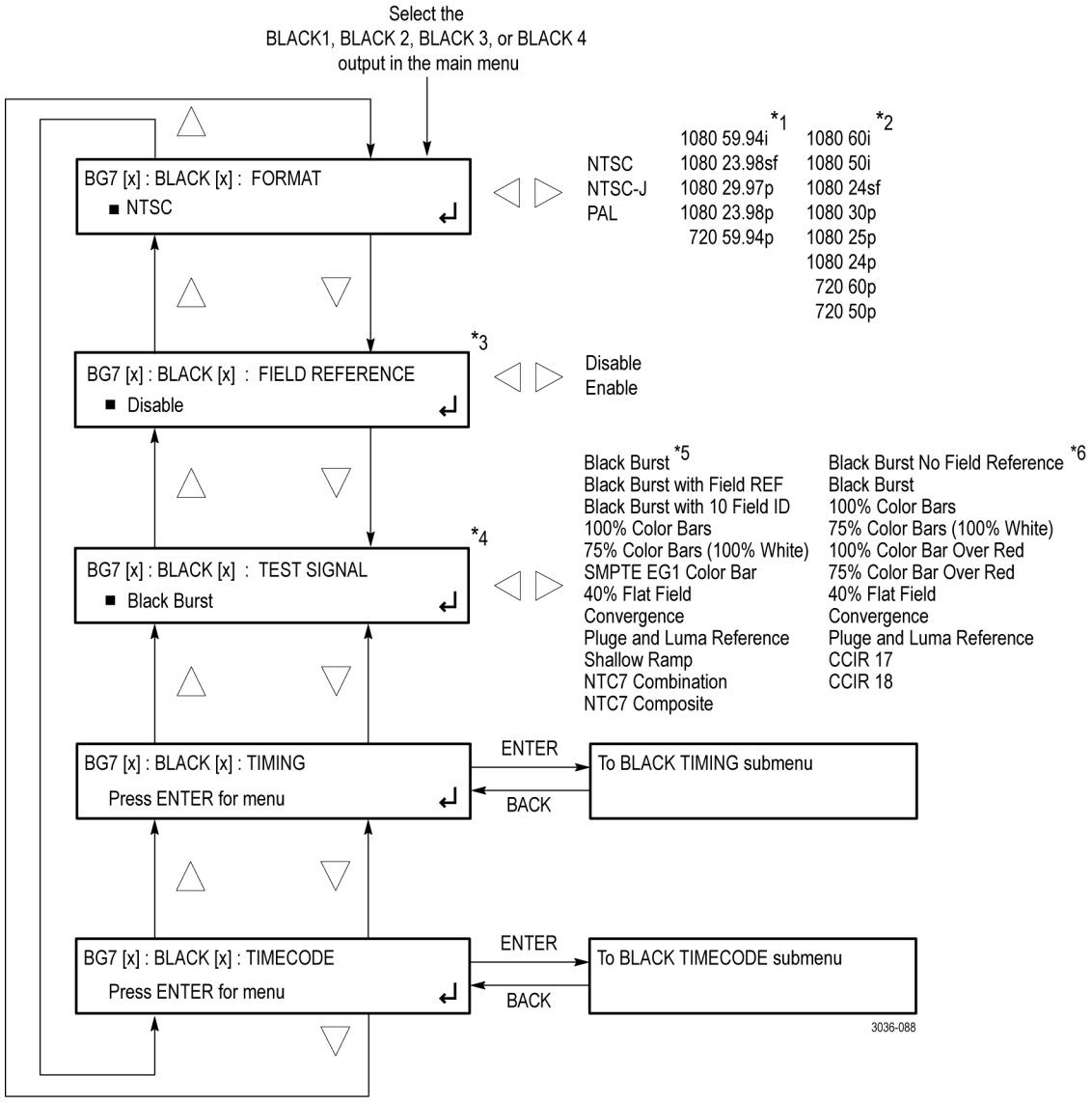
Figure 3-35: BG7 module main menu

SELECT OUTPUT. Selects which BLACK output to configure for signal format, timing, and timecode parameters or selects the HD trilevel sync rate for the four BLACK outputs.

Use the left (◄) or right (►) arrow button to select the output you want to configure (BLACK 1, BLACK 2, BLACK 3, BLACK 4, or HD TRI-LEVEL SYNC RATE), and then press the **ENTER** button to access the BLACK submenu (See page 3-120.) or the HD TRI-LEVEL SYNC RATE submenu (See page 3-69.).

BG7 module BLACK submenu

Use this menu to set the signal format, timing, and timecode parameters for the selected output. The following figure shows the BLACK submenu.



*1 These menu items appear only when the HD tri-level sync is set to non-integer.

*2 These menu items appear only when the HD tri-level sync is set to integer.

*3 This menu item appears only when a non-HD format is set as the signal format for the selected BLACK output. With Option CB, this menu item appears only for the BLACK 1 and BLACK 2 outputs.

*4 This menu item appears only for the BLACK 3 and BLACK 4 outputs and only for non-HD formats.

*5 These test signals are available only when the format is set to NTSC OR NTSC-J and Option CB is installed.

*6 These test signals are available only when the format is set to PAL NTSC-J and Option CB is installed.

Figure 3-36: BG7 module BLACK submenu

FORMAT. Use the left (◄) or right (►) arrow button to select from the 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.*

Table 3-13: BG7 module output signal formats

Non-integer HD trilevel sync rate [1]	Integer HD trilevel sync rate [1]
NTSC	NTSC
NTSC-J	NTSC-J
PAL	PAL
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 signal formats available in this submenu depend on the HD trilevel sync rate setting (non-integer or integer), which is set using the Select Output selection in the BG7 module main menu. (See page 3-65, *BG7 module main menu*.)

FIELD REFERENCE. Use the left (◄) or right (►) arrow button to **Enable** or **Disable** the field reference in the output signal. Press the **ENTER** button to confirm the selection.

NOTE. *The Field Reference menu item is available only when a non-HD format is set as the signal format of the selected BLACK output. With Option CB, this menu item appears only for the BLACK 1 and BLACK 2 outputs.*

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).

NOTE. *The Test Signal menu item appears only with Option CB, only for the BLACK 3 and BLACK 4 outputs, and only when a non-HD format is set as the signal format of the selected BLACK output.*

Table 3-14: BG7 module Option CB test signals (BLACK 3 and BLACK 4 outputs only)

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 TIMING submenu, which allows you to set the timing offset for the selected black signal output. (See page 3-69, *BG7 module TIMING submenu*.)

TIMECODE. Press the **ENTER** button to access the TIMECODE submenu, which allows you to set timecode parameters for the selected BLACK output. (See page 3-71, *BG7 module TIMECODE submenu (GPS7 module only)*.)

NOTE. *The TIMECODE menu item is available only when a GPS7 module is installed, and only when a non-HD format is set as the signal format of the selected BLACK output.*

The BG7 module hardware must be version 1.2 or above.

BG7 module HD TRI-LEVEL SYNC RATE submenu

Use this submenu to select whether an integer or non-integer clock will be used for the HD tri-level sync rate for the BLACK outputs. Use the left (◄) or right (►) arrow button to select **Integer (60, 50, 30, 25, 24)** or **Non-Integer (59.94, 29.97, 23.98)**. Press the **ENTER** button to confirm the selection.

NOTE. *The clock rate selected here affects which signal formats are available for the BLACK outputs.*

The following figure shows the HD TRI-LEVEL SYNC-RATE submenu.

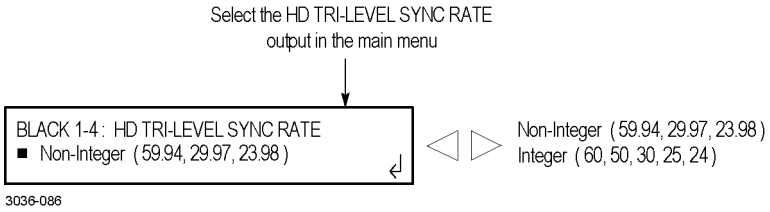


Figure 3-37: BG7 module HD TRI-LEVEL SYNC RATE submenu

BG7 module TIMING submenu

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. The following figure shows the TIMING submenu.

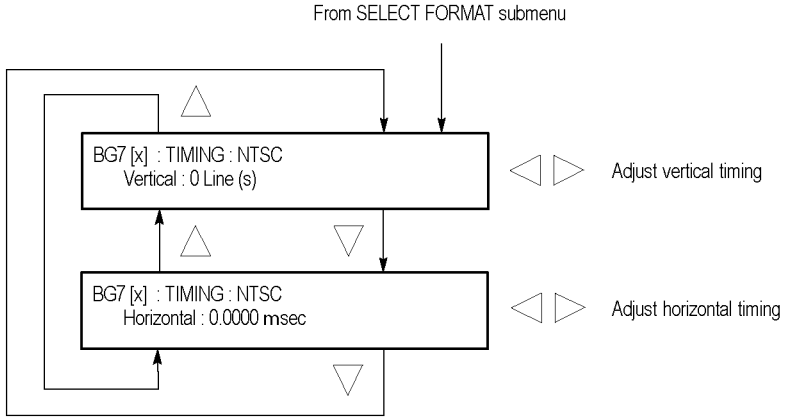


Figure 3-38: BG7 module TIMING submenu

NOTE. *You can reset the timing offset to zero by pressing the left (◄) or right (►) arrow buttons simultaneously.*

The horizontal timing can only be adjusted in clock cycle increments. You can match the timing of the AGL7 module to the BG7 module by adjusting the fine timing controls on the AGL7 module.

- **Vertical:** Use the left (◄) or right (►) arrow button to adjust the vertical timing. For NTSC and PAL, you can adjust the timing by ± ½ a color frame. For HDTV trilevel sync signals, you can adjust the timing by ± ½ a field or frame (progressive or interlaced signals, respectively). (See Table 3-15.)
- **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 for NTSC or PAL, 13.5 ns for HDTV).

Table 3-15: Timing adjustment ranges for BG7 output signals

Format name	Vertical line settings	Horizontal time settings (µs)
NTSC/NTSC-J	± 525	± 63.5556
PAL	± 1250	± 64.0000
1080 60i	± 562	± 29.6296
1080 59.94i	± 562	± 29.6593
1080 50i	± 562	± 35.5556
1080 24sF	± 562	± 37.0370
1080 23.98sF	± 562	± 37.0741
1080 30p	± 562	± 29.6296
1080 29.97p	± 562	± 29.6593
1080 25p	± 562	± 35.5556
1080 24p	± 562	± 37.0370
1080 23.98p	± 562	± 37.0741
720 60p	± 375	± 22.2222
720 59.94p	± 375	± 22.2444
720 50p	± 375	± 26.6667

BG7 module TIMECODE submenu (GPS7 module only)

Use this submenu to set timecode parameters for the selected output. This menu is present only if GPS7 module is installed.

NOTE. *To display the TIMECODE submenu, the BG7 module hardware must be version 1.2 or above and the mainframe must have software version 5.1 or above installed.*

This submenu is available only when NTSC, NTSC No Setup, or PAL is the selected signal format. This submenu is not available when the selected signal format is HD SYNC.

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

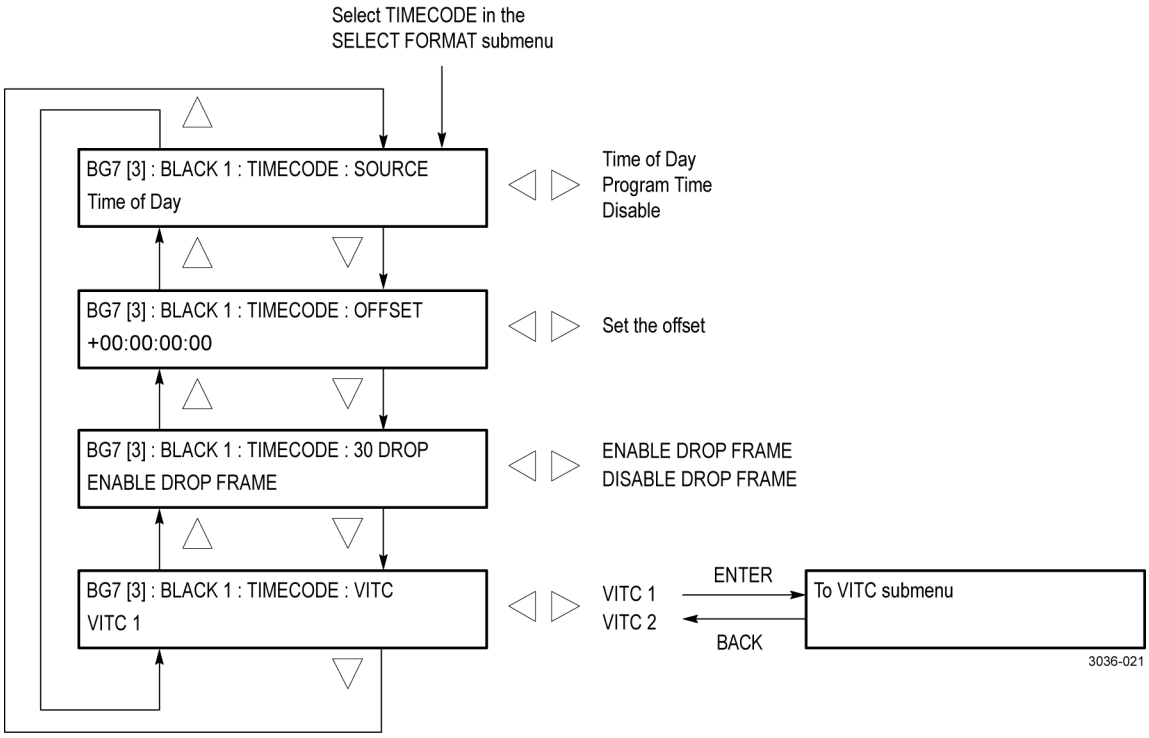


Figure 3-39: BG7 module TIMECODE submenu

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

- **Time of Day:** Uses the time of day as determined from the GPS antenna.
- **Program Time:** Uses the program time counter as the timecode.
- **Disable:** Disables the timecode function for the BG7 module.

OFFSET. Use this menu item to set a time offset for the BG7 module outputs from the timecode input from the GPS7 module. You can enter a time offset of up to ±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.

30 DROP. Use the left (◄) or right (►) arrow button to enable or disable the 30 Drop mode. Use this mode to correct for frame-rate error in NTSC-rate signals or to allow the timecode to run continuously and drift away from the correct time.

VITC. Allows inserting the same VITC signal on 1 or 2 lines of the vertical interval. 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 3-73.)

BG7 module VITC submenu (GPS7 module only)

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

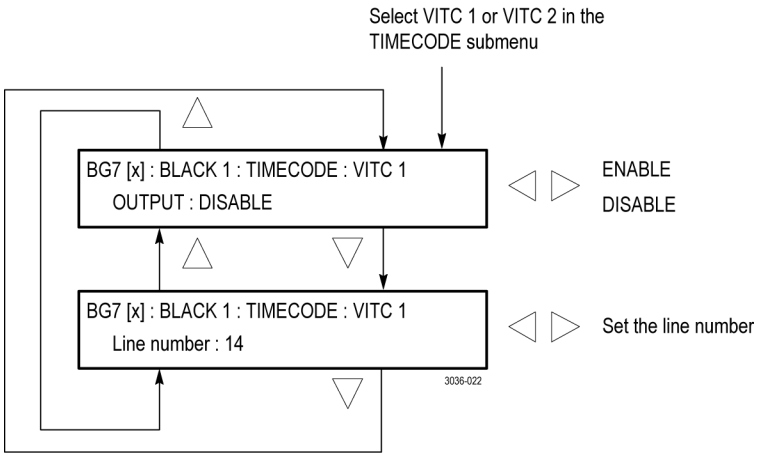


Figure 3-40: BG7 module VITC submenu

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 **ENABLE** or **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.

BG7 module factory default settings

The following table shows the factory default settings for the BG7 module. These settings are recalled when you select **Factory Default** from the **PRESET : RECALL** menu item in the mainframe main menu.

Table 3-16: BG7 module factory default settings

Menu item name		Settings
OUTPUT : BLACK 1 to BLACK 4		
	Format	NTSC
	SIGNAL	Black Burst
OUTPUT : HD TRI-LEVEL SYNC RATE		Non-integer
FIELD REFERENCE [1]		Disable
TEST SIGNAL [1]		Black Burst
TIMING		
	Vertical	0 Line(s)
	Horizontal	0.0000 msec
TIMECODE [2]		
	SOURCE	Disable
	30 DROP	Enable Drop Frame
VITC [2]		
	OUTPUT	Disable
	VITC 1	Line 14
	VITC 2	Line 16

[1] The TEST SIGNAL menu item replaces the FIELD REFERENCE menu item on the BLACK 3 and BLACK 4 outputs when the BG7 module has Option CB installed.

[2] The TIMECODE and VITC menu items are present only when a GPS7 module is also installed in the mainframe.

DVG7 Digital Video Generator module

This section describes the module-specific functions of the DVG7 Digital Video Generator module. Refer to the following locations for additional information about this module:

- *DVG7 module connectors* for a description of the rear-panel connectors. (See page 2-12.)
- *DVG7 module functional check* for a basic procedure to check that the module is functional. (See page 1-24.)
- *TG8000 Specifications and Performance Verification Technical Reference* for module specifications and for a detailed procedure to verify that the module is functioning as specified.
- *TG8000 Programmer Manual* for information about the commands to remotely control the module.

DVG7 module product description

The DVG7 Digital Video Generator module is a digital video generator that provides NTSC composite digital signals and 525/625 component digital signals. The module provides the following features:

- Two serial digital video outputs.
- Two serial digital black outputs (Option BK only).
- Overlay of circle, text, or logo on the video signal.
- Moving picture by scrolling the active picture area of the output signal.
- Up to 16 channels of 24- or 20-bit embedded digital audio with a sample rate of 48 kHz.
- Full remote control using Ethernet interface.

How to operate the DVG7 module

After the module is installed in the mainframe, and the mainframe is installed in the rack or other location where it will be used, use the following procedure to access each function of the module:

1. Connect the power cord to the power connector on the rear panel, and then plug the cord into the AC electric power source. Electric power is supplied to the mainframe.
2. Wait until the power-on initialization process is complete, and then check that no error messages appear on the display.
3. After the initialization process is complete, the mainframe main menu appears as shown below.

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4. Press the front-panel **MODULE** button until the DVG7 module main menu appears as shown below.

5. Select the signal format and the test signal you want to output. (See page 3-77, *To select an output signal on the DVG7 module*.)
6. Use the front-panel arrow buttons to navigate and select items in the main menu and submenus.

Refer to *DVG7 module main menu* for detailed information about the main menu items and the submenu items. (See page 3-79.)

To select an output signal on the DVG7 module

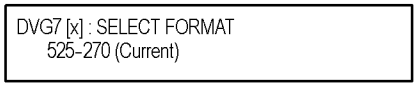
To output a signal from the DVG7 module, you need to select a signal format and output signal as described below.

To select the signal format

Perform the following steps to select the signal format:

1. Press the front-panel **MODULE** button until the DVG7 module main menu appears as shown below.

2. Press the **FORMAT** button. The menu display changes as follows:



3. Use the left (◄) or right (►) arrow button, or press the **FORMAT** button repeatedly, to select one of the signal formats, and then press the **ENTER** button to confirm the selection.

NOTE. *When you change signal format, synchronization shock occurs.*

4. If you change the signal format while a test signal is being output, the instrument starts loading all of the signal sets for the selected format and displays the message "**Now Loading...**". When you see the message, "**Done (Press BACK)**", press the **BACK** button.

To select the test signal

All of the signal sets that are available in the module are already assigned to the corresponding test signal buttons. When the DVG7 module is selected and you press any of the front-panel test signal buttons, the selected signal in the signal set is output. (See Figure 3-41.) For example, when you press the **COLOR BAR** test signal button, a signal in the Color Bars signal set is output.

Use the left (◄) or right (►) arrow button, or press the COLOR BAR test signal button repeatedly to select a different signal from the Color Bars signal set.

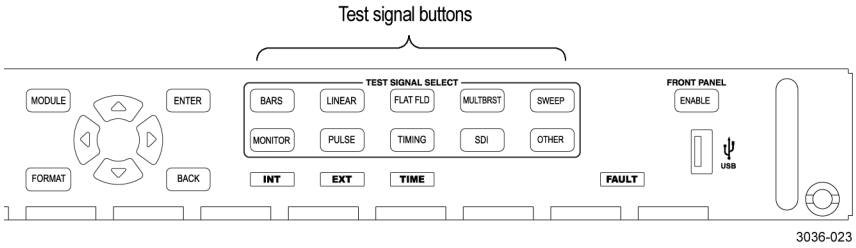


Figure 3-41: Front-panel test signal buttons

You can download a frame picture file (created by the Frame Picture Generator) to the mainframe and output the picture from the DVG7 module. Refer to the *TG8000 PC Tools Technical Reference* for detailed information on how to create, download, and output a frame picture.

The following table lists the signal sets that are assigned to each test signal button and shows the test signals that are available in each signal set. The list of available signals changes depending on the selected signal format.

Table 3-17: DVG7 module signal set assigned to the test signal buttons

Button name	Signal set	Signals in the signal set
525-270 format		
COLOR BAR	Color Bars	100% Color Bars, 75% Color Bars, SMPTE Color Bars
LINEARITY	Linearity	10 Step, 3 Channel Ramp, 5 Step, B-Y Valid Ramp, Limit Ramp, Modulated Ramp, Oversize Ramp, R-Y Valid Ramp, Shallow Ramp, Shallow Ramp Matrix, Valid Ramp, Y Valid Ramp
FLAT FIELD	Flat Fields	0% Flat Field, 100% Flat Field, 50% Flat Field, Field Square Wave
MULTI BURST	Multi Burst	60% Multiburst, Multipulse
SWEEP	Sweep	100% Sweep, 60% Sweep, SinX/X
MONITOR	Monitor	2 Level Ped. & Pluge, 4 Level Ped. & Pluge, Convergence Pattern, Gamut Test, Grey Window, White Window
PULSE BAR	Pulse & Bar	2T Pulse and Bar, T Pulses
TIMING	Timing	2.5 MHz Bowtie, 500 kHz Bowtie, Active Picture Timing, Co-Siting Pulse

Table 3-17: DVG7 module signal set assigned to the test signal buttons (cont.)

Button name	Signal set	Signals in the signal set
SDI	SDI Test	Equalizer Test, PLL Test, SDI Matrix
OTHER	Other	Chroma Freq. Resp., Color Palette, FCC Composite, FCC Multiburst, NTC7 Combination, NTC7 Composite
625-270 format		
COLOR BAR	Color Bars	100% Colour Bars, 75% Colour Bars, 100% Colour Bars Over Red, 75% Colour Bars Over Red
LINEARITY	Linearity	10 Step, 3 Channel Ramp, 5 Step, B-Y Valid Ramp, Limit Ramp, Modulated Ramp, Oversize Ramp, R-Y Valid Ramp, Shallow Ramp, Shallow Ramp Matrix, Y Valid Ramp
FLAT FIELD	Flat Fields	0% Flat Field, 100% Flat Field, 50% Flat Field, Field Square Wave
MULTI BURST	Multi Burst	60% Multiburst
SWEEP	Sweep	100% Sweep, 60% Sweep, SinX/X
MONITOR	Monitor	100% Red Field, 2 Level Ped. & Pluge, 4 Level Ped. & Pluge, 75% Red Field, Convergence Pattern, Gamut Test, Grey Window, White Window
PULSE BAR	Pulse & Bar	2T 4T 10T Pulse & Bar, 2T 4T 20T Pulse & Bar
TIMING	Timing	2.5 MHz Bowtie, 500 kHz Bowtie, Active Picture Timing, Co-Siting Pulse
SDI	SDI Test	Equalizer Test, PLL Test, SDI Matrix
OTHER	Other	CCIR 17, CCIR 18, CCIR 330, CCIR 331, CCIR 331 G2

DVG7 module main menu

Use the DVG7 module main menu to perform the following tasks:

- Set the logo, text, or circle overlay on the output signal.
- Set the timing offset on the output signals.
- Scroll the active picture area of the output signal.
- Enable or disable the output and set parameters for each embedded audio group.
- Enable or disable the video output signal.

Use the up (▲) or down (▼) arrow button to scroll through the main menu. The following figure shows the DVG7 module main menu.

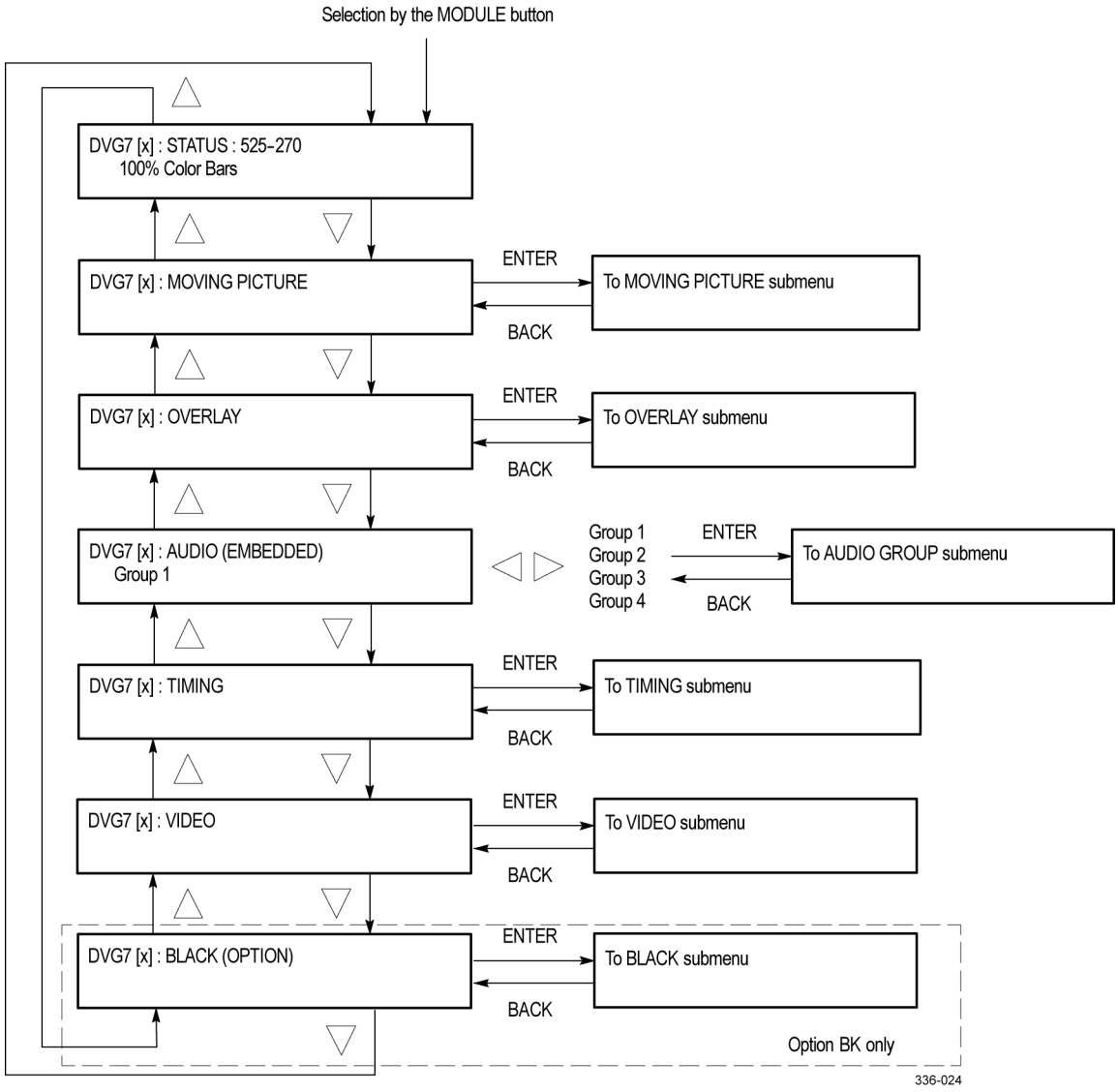


Figure 3-42: DVG7 module main menu

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 MOVING PICTURE submenu. (See page 3-82.)

OVERLAY. Selects an item (logo, text, or circle) to overlay 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 OVERLAY submenu. (See page 3-83.)

AUDIO (EMBEDDED). Sets the parameters for the embedded audio on the output test signals. Use the left (◄) or right (►) arrow button to select **Group 1**, **Group 2**, **Group 3**, or **Group 4**. Select any of the items, and then press the **ENTER** button to access the AUDIO GROUP submenu. (See page 3-234.)

TIMING. Sets the timing offset of the serial digital video outputs relative to the internal reference signal (frame reset signal). Select this menu item, and then press the **ENTER** button to access the TIMING submenu. (See page 3-91.)

VIDEO. Enables or disables the Y, Pb, or Pr component of the output serial digital video signals, the EDH (Error Detection Handling) insertion, and the output mode for an audio/video timing measurement. You can also set the resolution of the output serial digital video signals. Select this menu item, and then press the **ENTER** button to access the VIDEO submenu. (See page 3-92.)

BLACK (OPTION). This menu selection is available only with Option BK, and sets the parameters of the serial digital black signals output from the **BLACK 1** and **BLACK 2** connectors. Select this menu item, and then press the **ENTER** button to access the BLACK submenu. (See page 3-94.)

DVG7 module MOVING PICTURE submenu

Use this menu to scroll the active picture area of the serial digital video signal up/down, left/right, or randomly. Use the up (▲) or down (▼) arrow button to scroll the menu. The following figure shows the MOVING PICTURE submenu.

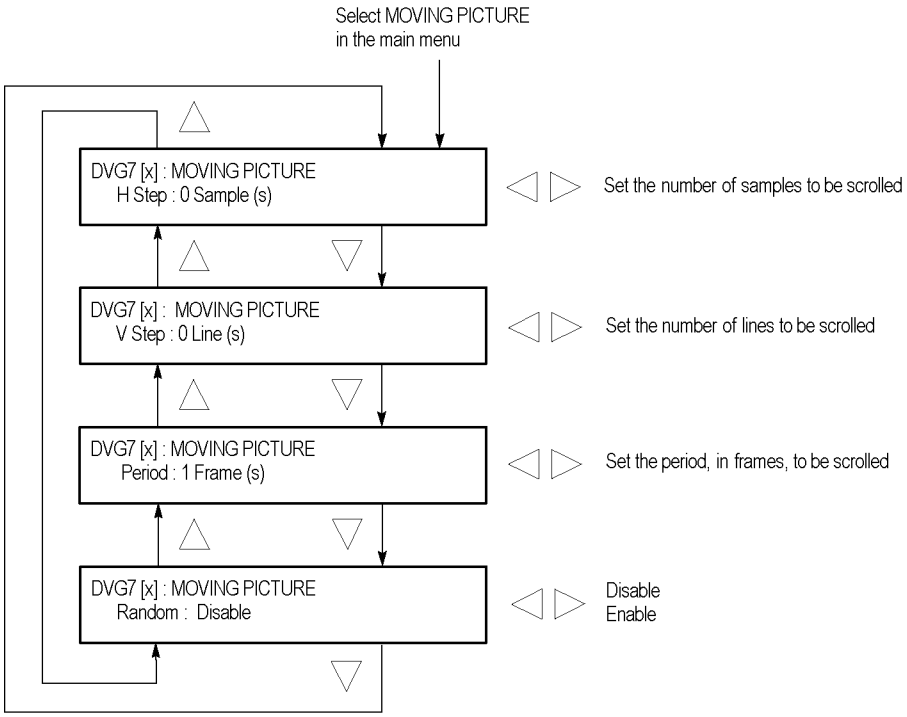


Figure 3-43: DVG7 module MOVING PICTURE submenu

H 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 change the value. You can set the value from -252 to +252 in 4-sample steps.

V 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 change the value. You can 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 change the value. You can 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.

DVG7 module OVERLAY submenu

Use this menu to select an item (logo, ID Text, or circle) 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. The following figure shows the OVERLAY submenu.

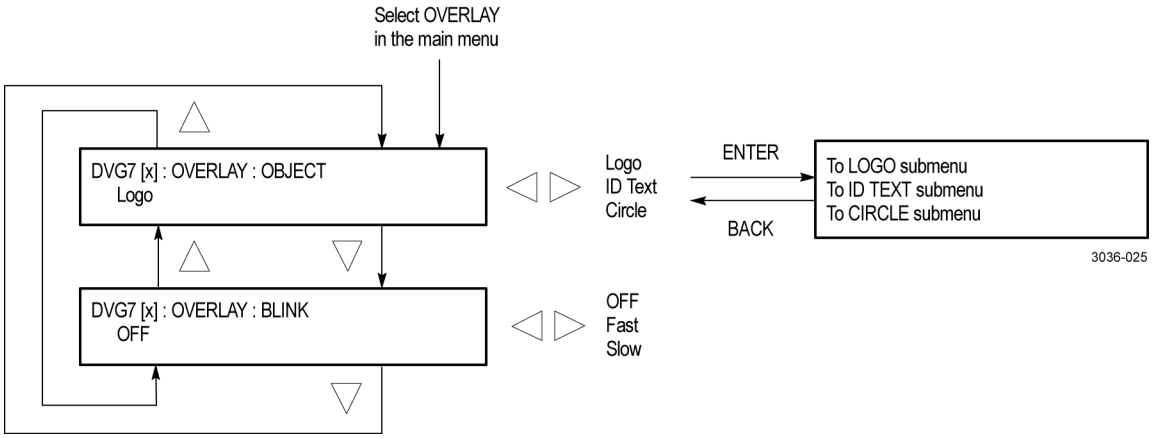


Figure 3-44: DVG7 module OVERLAY submenu

OBJECT. Selects an item to overlay on the output test signal. Use the left (◄) or right (►) arrow button to select one of the following overlays, and then press the ENTER button to access the submenu for setting the parameters of that overlay.

- **Logo:** Opens the LOGO submenu where you can select a logo to overlay the output signal in a specified position. (See page 3-84.)
- **ID Text:** Opens the ID TEXT submenu where you can edit the text to overlay the output signal in a specified position. (See page 3-85.)
- **Circle:** Opens the CIRCLE submenu where you can specify a circle size and position to overlay the output signal. (See page 3-87.)

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.

- **OFF:** Turns off 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.

DVG7 module 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 LOGO submenu.

NOTE. *To display a logo using the LOGO submenu, you need to create a logo file (.lgo) and download it to the LOGO folder of the module. Refer to the TG8000 PC Tools Technical Reference for detailed information about how to create a logo file and download it to the TG8000.*

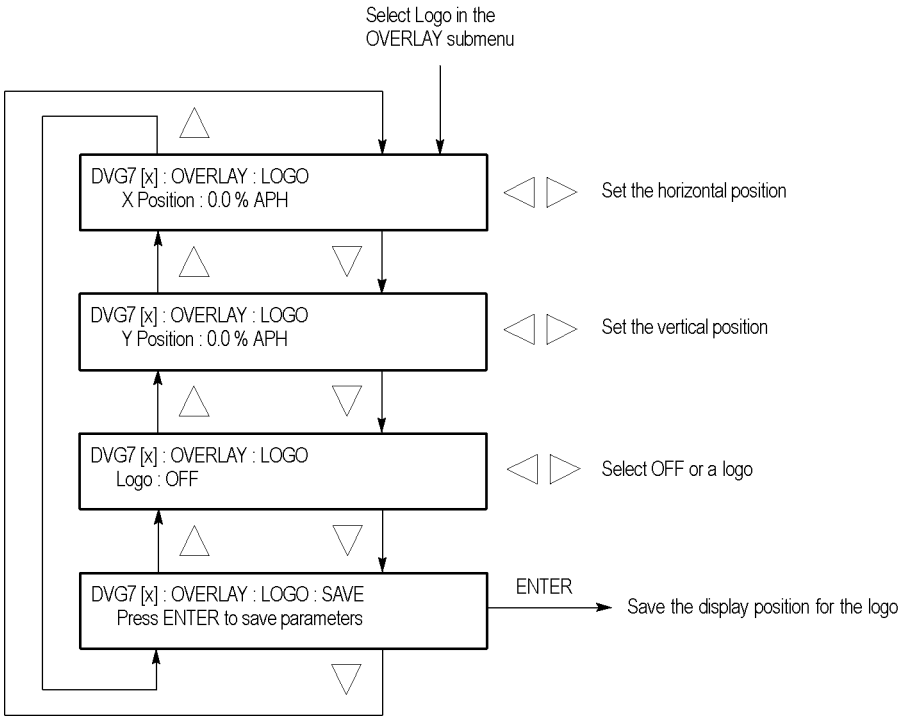


Figure 3-45: DVG7 module LOGO submenu

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 0.0% in 0.1% steps.

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 0.0% in 0.1% steps.

Logo. Selects the logo you want to display. Use the left (◄) or right (►) arrow button to select **OFF** or a logo file name. Press the **ENTER** button confirm the selection. When you select OFF, the logo overlay is disabled.

SAVE. Saves the display position for the logo to the logo file. Press the **ENTER** button to save the current settings.

DVG7 module ID TEXT submenu

Use this menu to edit the text that is overlaid on the output test signal and to set the display position of the text. Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the ID TEXT submenu.

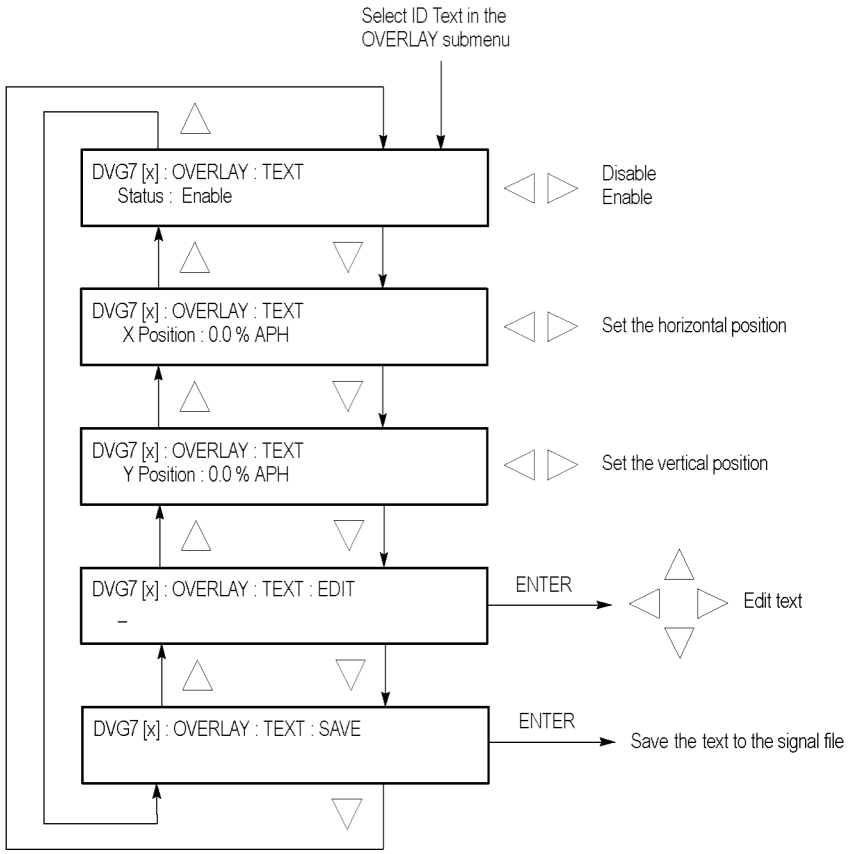


Figure 3-46: DVG7 module ID TEXT submenu

Status. Enables or disables the text overlay. Use the left (◄) or right (►) arrow button to select between **Enable** and **Disable**, and then press the **ENTER** button to confirm the selection.

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 100.0% in 1% steps.

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 100.0% in 1% steps.

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.
5. Use the left (◄) or right (►) arrow button to select **SAVE**, and then press the **ENTER** button to save the text and its position to the signal file.

SAVE. Saves the text and its position to the signal file currently being output. Press the **ENTER** button to save the text and its position to the signal file.

DVG7 module CIRCLE submenu

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

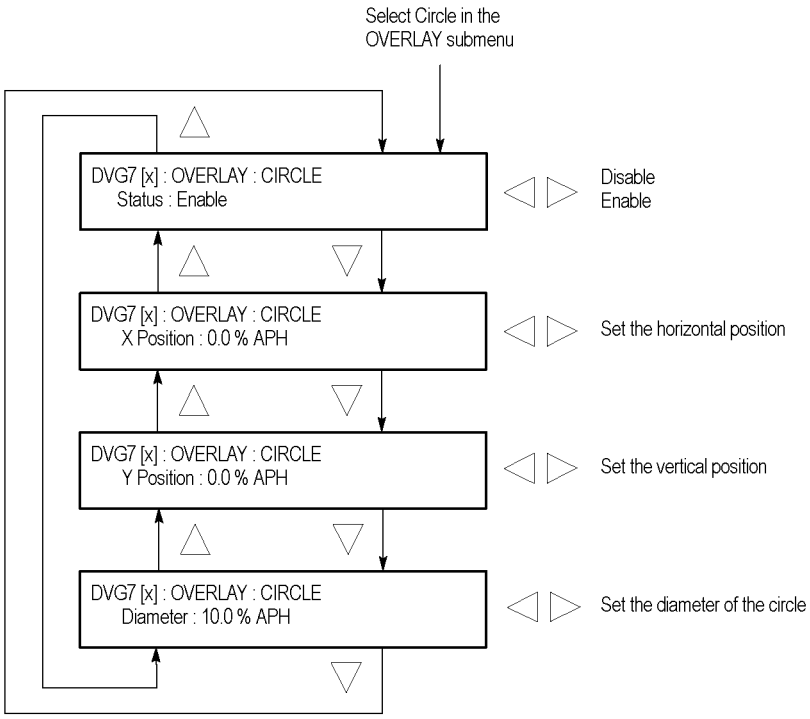


Figure 3-47: DVG7 module CIRCLE submenu

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.

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 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 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 1% steps.

DVG7 module AUDIO GROUP submenu

Use this menu to perform the following tasks:

- Enable or disable the embedded audio of the selected audio group.
- Select which audio channel to enable.
- Set the emphasis status bits, sampling alignment status bits, and sample bits of the selected audio group.

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

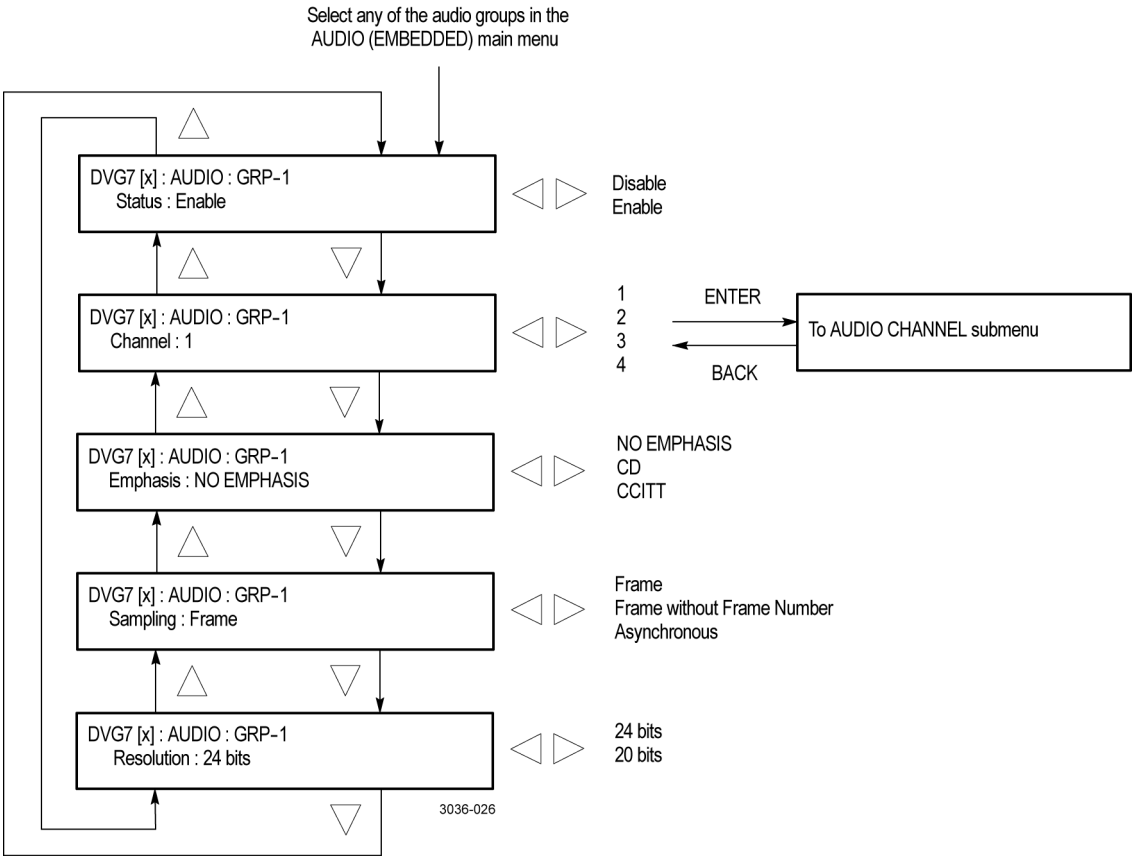


Figure 3-48: DVG7 module AUDIO GROUP submenu

Status. Enables or disables the generation of embedded audio for the selected audio group. Use the left (◄) or right (►) arrow button to select between **Enable** and **Disable**. Press the **ENTER** button to confirm the selection.

Channel. Selects the audio channel for which you will change the parameters. Use the left (◄) or right (►) arrow button to select **1**, **2**, **3**, or **4**. Select any audio channel, and then press the **ENTER** button to access the AUDIO CHANNEL submenu. (See page 3-89.)

Emphasis. Sets the emphasis status bits for the selected audio group. Use the left (◄) or right (►) arrow button to select **NO EMPHASIS**, **CD**, or **CCITT**. Press the **ENTER** button to confirm the selection.

Sampling. Sets the sampling alignment status bits for the selected audio group. Use the left (◄) or right (►) arrow button to select **Frame**, **Frame without Frame Number**, or **Asynchronous**. Press the **ENTER** button to confirm the selection.

Resolution. Sets the resolution of the audio signal data for the selected audio group. Use the left (◄) or right (►) arrow button to select between **24 bits** and **20 bits**. Press the **ENTER** button to confirm the selection.

DVG7 module AUDIO CHANNEL submenu

Use this menu to set the frequency, amplitude, and audio click of the embedded audio signal for the selected audio channel. Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the AUDIO CHANNEL submenu.

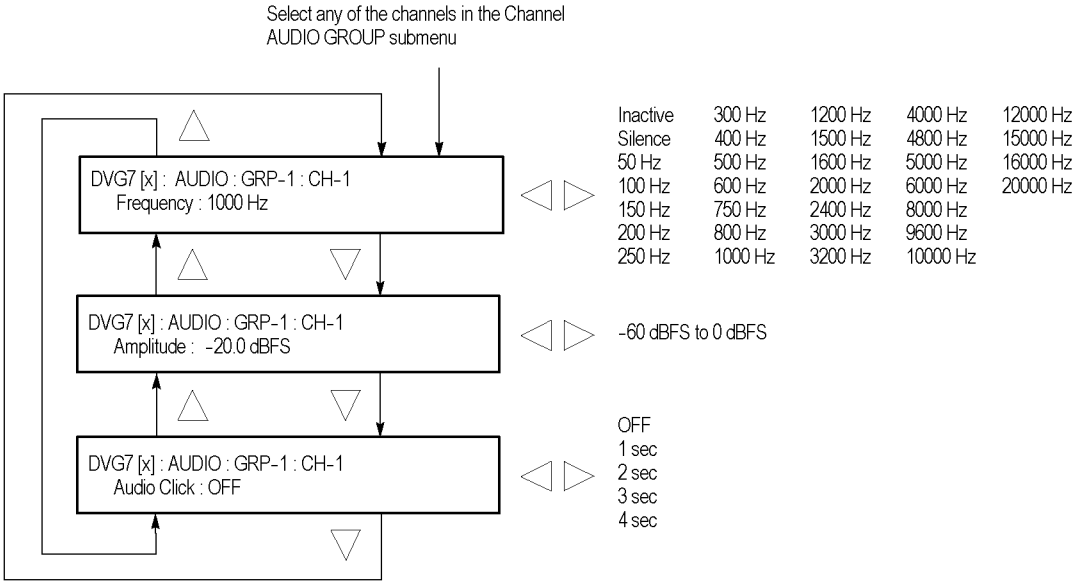


Figure 3-49: DVG7 module AUDIO CHANNEL submenu

Frequency. Sets the audio signal frequency of the selected audio channel. Use the left (◄) or right (►) arrow button to select the frequency. The selection items are as follows:

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, the audio data output is disabled. Press the **ENTER** button to confirm the selection.

Amplitude. Sets the audio signal amplitude of the selected audio channel. Use the left (◄) or right (►) arrow button to set the amplitude. You can 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 second 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 second; the click occurs during this silence.

When Audio Click is **OFF**, the Audio Tone selected in the FREQUENCY menu is output continuously. Audio Click makes it easy to identify any channel(s) of the four output channels.

DVG7 module 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 TIMING submenu.

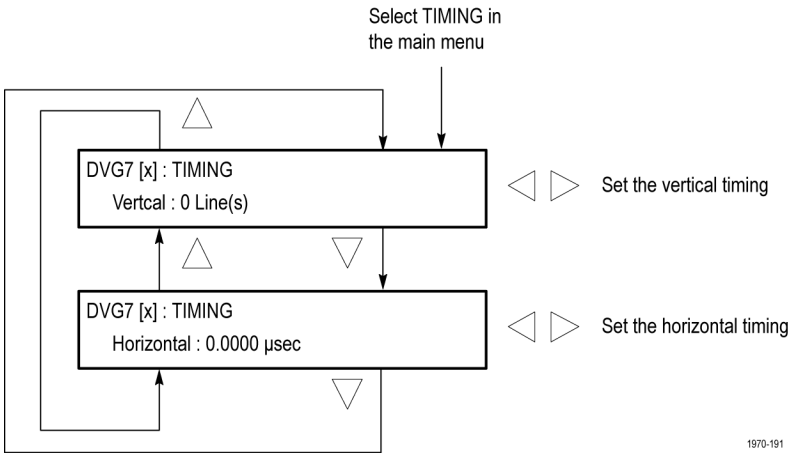


Figure 3-50: DVG7 module TIMING submenu

Vertical. Sets the vertical timing offset. Use the left (◄) or right (►) arrow button to change the timing offset. You can set the value within 1/2 frame for 525-270 and 625-270 formats.

Horizontal. Sets the horizontal timing offset. Use the left (◄) or right (►) arrow button to change the timing offset. You can set the value from -1 to +1 line in 1-clock (37.0 ns for 525-270 and 625-270 formats) steps.

NOTE. *You can reset the timing offset to zero by pressing the left (◄) or right (►) arrow buttons simultaneously.*

DVG7 module VIDEO submenu

Use this menu to perform the following tasks:

- Turn each serial digital video component (Y, Pb, or Pr) on or off individually.
- Turn the insertion of the EDH (Error Detection and Handling) on or off.
- Set the resolution of the serial digital video signals to 8 or 10 bits.
- Turn the output mode for an audio/video timing measurement on or off.

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

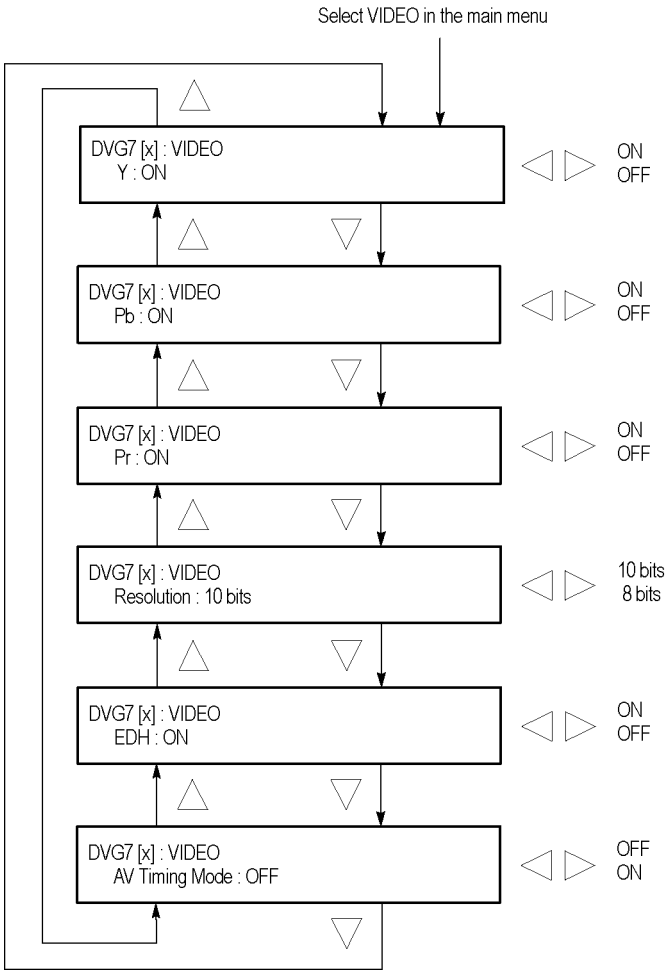


Figure 3-51: DVG7 module VIDEO submenu

Y. Turns the Y component of the serial digital video signals on or off. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. Press the **ENTER** button to confirm the selection.

Pb. Turns the Pb component of the serial digital video signals on or off. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. Press the **ENTER** button to confirm the selection.

Pr. Turns the Pr component of the serial digital video signals on or off. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. Press the **ENTER** button to confirm the selection.

Resolution. Sets the resolution of the serial digital video signals. Use the left (◄) or right (►) arrow button to select between **10 bits** and **8 bits**. Press the **ENTER** button to confirm the selection.

EDH. Turns the insertion of the EDH (Error Detection and Handling) information on or off on the serial digital video signals. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. Press the **ENTER** button to confirm the selection.

AV timing mode. Turns the output mode for an audio/video timing measurement on or off. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. Press the **ENTER** button to confirm the selection.

When you turn this mode on, the specified audio and video signals are synchronously on for 0.5 second and off for 4.5 seconds. With this signal, you can measure the time delay that accumulates between the audio and video content of the television signal during signal transport. The time delay can be measured by a video analyzer with the serial digital video signal or by an oscilloscope with the analog audio and video signals extracted from the serial digital video signal.

The following settings are recommended for the audio and video signals when you use this mode:

- Audio signal (CH1 and CH2 of Group 1): 10000 Hz, -20 dBFS
- Video signal: 100% Flat Field

NOTE. *The AV Timing Mode setting is not saved as a preset.*

DVG7 module BLACK submenu (Option BK Only)

Use this menu to set the output parameters of the serial digital black signals output from the BLACK 1 and BLACK 2 connectors.

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

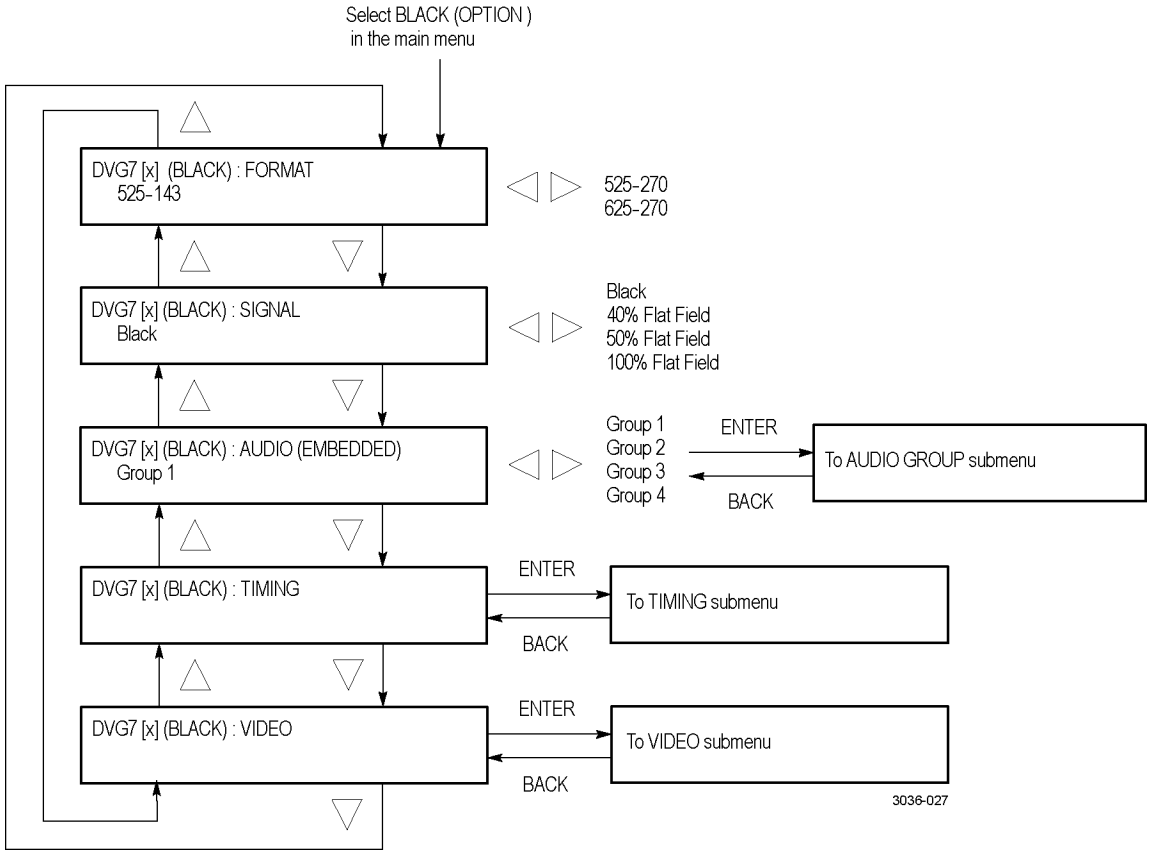


Figure 3-52: DVG7 module BLACK submenu (Option BK only)

FORMAT. Selects the format of the output serial digital black signals. Use the left (◄) or right (►) arrow button to select **525-270** or **625-270**. Press the **ENTER** button to confirm the selection.

SIGNAL. Selects the serial digital black signal to output. Use the left (◄) or right (►) arrow button to select between **Black** (serial digital black), **40% Flat Field**, **50% Flat Field**, and **100% Flat Field**. Press the **ENTER** button to confirm the selection.

AUDIO (EMBEDDED). Sets the parameters for embedded audio on the serial digital black signals. Use the left (◄) or right (►) arrow button to select **Group 1**, **Group 2**, **Group 3**, or **Group 4**. Select any of the groups, and then press the **ENTER** button to access the AUDIO GROUP submenu. (See page 3-88.)

TIMING. Sets the timing offset of the serial digital black outputs relative to the internal reference signal (frame reset signal). Select this menu item, and then press the **ENTER** button to access the TIMING submenu. (See page 3-91.)

VIDEO. Sets the resolution and EDH insertion of the serial digital black signals. Select this menu item, and then press the **ENTER** button to access the VIDEO submenu. (See page 3-92.)

DVG7 module factory default settings

The following table shows the factory default settings for the DVG7 Generator module. These settings are recalled when you select **Factory Default** from the **PRESET : RECALL** menu item in the mainframe main menu.

Table 3-18: DVG7 module factory default settings

Menu item name		Settings
STATUS		525-270 SMPTE Color Bars
MOVING PICTURE		
	H Step	0 Sample(s)
	V Step	0 Line(s)
	Period	1 Frame(s)
	Random	Disable
OVERLAY : OBJECT		Logo
OVERLAY : BLINK		OFF
OVERLAY : LOGO		
	Logo	OFF
OVERLAY : ID TEXT		
	Status	Disable
OVERLAY : CIRCLE		
	Status	Disable
	X Position	0.0% APH
	Y Position	0.0% APH
	Diameter	90% APH
AUDIO : GRP-1 to GRP-4		
	Status	Disable
	Emphasis	No Emphasis
	Sampling	Frame
	Resolution	20 bits

Table 3-18: DVG7 module factory default settings (cont.)

Menu item name		Settings
AUDIO : GRP-1 : Ch-1 to CH-4		
	Frequency	1000 Hz
	Amplitude	-20.0 dBFS
	Audio Click	OFF
TIMING		
	Vertical	0 Line(s)
	Horizontal	0.0000 µs
VIDEO		
	Y	ON
	Pb	ON
	Pr	ON
	Resolution	10 bits
	EDH	ON
	AV Timing Mode	OFF
Option BK		
(BLACK) FORMAT		525-270
(BLACK) SIGNAL		Black
(BLACK) AUDIO : GRP-1 to GRP-4		
	Status	Disable
	Emphasis	No Emphasis
	Sampling	Frame
	Resolution	20 bits
(BLACK) AUDIO : CH-1 to CH-4		
	Frequency	1000 Hz
	Amplitude	-20.0 dBFS
	Audio Click	OFF
(BLACK)TIMING		
	Vertical	0 Line(s)
	Horizontal	0.0000 µs
(BLACK)VIDEO		
	Resolution	10 bits
	EDH	ON

GPS7 GPS Synchronization and Timecode module

This section describes the module-specific functions of the GPS7 GPS Synchronization and Timecode module. Refer to the following locations for additional information about this module:

- *GPS7 module connectors* for a description of the rear-panel connectors. (See page 2-12.)
- *GPS7 module functional check* for a basic procedure to check that the module is functional. (See page 1-25.)
- *TG8000 Specifications and Performance Verification Technical Reference* for module specifications and for a detailed procedure to verify that the module is functioning as specified.
- *TG8000 Programmer Manual* for information about the commands to remotely control the module.

GPS7 module product description

The GPS7 GPS Synchronization and Timecode module provides the following features:

- Integrated GPS receiver that can serve as the system timing reference
- Three analog black video outputs for NTSC, PAL, or trilevel HD sync signals
- REF IN input (shared with the BLACK 1 output connector) to apply analog video, trilevel HD sync, or CW signals to use as a generator lock (Genlock) reference. Earlier GPS7 modules do not have the Genlock features.

NOTE. *The menus and menu discussions in this manual represent the newest features and software available, including all Genlock features and the REF IN input. Earlier instruments without the REF IN input have similar menu structures but not identical menu content.*

- Timecode output available as VITC on the black outputs and from four independent LTC outputs
- LTC input (shared with LTC output connector) to use as an optional time reference
- Timecode reference to time-of-day from the GPS receiver, internal source, VITC on the reference input, or to a program time counter for elapsed-time timecode
- Simple Network Time Protocol (NTP) Server functionality to respond to time requests over the Ethernet interface
- 3.3 V or 5 V DC power output available for the GPS antenna
- One General Purpose Interface (GPI) input that allows you to remotely reset the program time, reacquire the GPS position, or to force a jam sync
- Two General Purpose Interface (GPI) outputs that allow you to send an alarm signal when the GPS signal quality falls below a user-selectable level, when there is a loss of lock on the GPS signal or incoming black signal with VITC, or at a user-selected time
- Ability to schedule GPS clock changes for Daylight Savings Time (DST) and for leap seconds
- Ability to configure how the instrument responds when there is a loss of lock to the GPS signal, and how the instrument responds when the signal is recovered
- Ability to configure how the instrument responds when there is a loss of lock from the black signal input
- Ability to configure how the instrument synchronizes to an incoming VITC signal when VITC is selected as the time-of-day reference

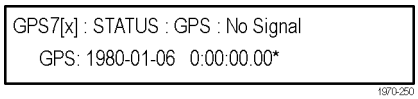
How to operate the GPS7 module

After the module is installed in the mainframe, and the mainframe is installed in the rack or other location where it will be used, use the following procedure to access each function of the module:

1. Connect the power cord to the power connector on the rear panel, and then plug the cord into the AC electric power source. Electric power is supplied to the mainframe.
2. Watch the display for messages during the boot process. Messages are displayed for a few seconds. If a serious error is detected during boot, the module menus will not be displayed.
3. After the initialization process is complete, the mainframe main menu appears as shown below:

3036-008

4. Press the front-panel **MODULE** button until the GPS7 module main menu appears. It will look similar to what is shown below:



1970-250

5. Configure the GPS7 module as required for your installation. (See page 3-100, *To configure the GPS7 module*.)
6. Use the front-panel arrow buttons to navigate and select items in the main menu and submenus.

Refer to *GPS7 module main menu* for detailed information about the main menu items and the submenu items. (See page 3-111.)

NOTE. *Configure your GPS7 for your installation before putting it into service. (See page 3-100, To configure the GPS7 module.) After you have configured the module, save the configuration as the power-on preset so that if power is lost, the GPS7 will power-on in the correct configuration. (See page 2-23, PRESET submenu.)*

To configure the GPS7 module

When you first receive your GPS7 module, there are a few things you need to do, and a few things you should know, before putting it into service. This section includes information about the following:

- Performing an internal frequency calibration
- Understanding the GPS antenna system
- Understanding signal quality
- Understanding time flow
- Configuring module settings

GPS7 module oven calibration procedures

If you are installing a GPS7 module into an existing TG8000 mainframe, it is suggested that you calibrate the mainframe oscillator oven as part of the installation and qualification process. If you have received your GPS7 module already installed in a mainframe, you can set the internal frequency after putting the module in its operating environment and allowing it to reach a stable operating condition.

Information about the Oven Calibration menu is available in the *GPS7 module CAL OVEN submenu* section. (See page 2-46.)

NOTE. *Perform the mainframe internal frequency calibration at least once a year to compensate for oscillator drift. With a GPS7 module installed, this calibration can be done while the instrument is in service.*

If your GPS7 module is installed in a TG700 mainframe, you need to also characterize the oscillator frequency as a function of voltage. Refer to the TG700 User Manual for more information (Tektronix part number 071-1970-XX).

WARNING. *Dangerous electric shock hazards exist inside the TG8000 mainframe. Only qualified service personnel should perform these procedures. Failure to use appropriate precautions can result in injury or death.*

To calibrate the internal frequency. Perform the following procedure to set the internal frequency of the mainframe internal oscillator. This adjustment stores the current frequency of the oscillator while it is locked to a GPS signal. It is stored for used when the instrument is set to **Internal** mode. This procedure can be done without any disruption to operation and is best performed in the operating environment of the instrument.

1. Connect the power cord to the TG8000 mainframe.
2. Check for error messages as the instrument starts.
3. Connect a GPS signal to the rear of the module.
4. Allow the instrument to warm up for a minimum of 20 minutes.
5. Press the **MODULE** button until **GPS7 : STATUS** appears.
6. Check that the signal status shows **Locked**.
7. Check that signal lock indicator displays **Fine**:
   a. Press the up (▲) arrow button to select **DIAGNOSTICS**.
   b. Press the **ENTER** button.
   c. Press the right (►) arrow button to select **TUNE**.
   d. Check that **Fine** is showing on the right side of the LCD display.
8. Press the **MODULE** button until **TG8000** appears.
9. Press the up (▲) arrow button to select **UTILITY**.
10. Press the **ENTER** button.
11. Press the up (▲) arrow button to select **CAL OVEN : SELECT**.
12. Press the **ENTER** button to access the **Internal Frequency Calibration** submenu.
13. Press the **ENTER** button to start the calibration. The instrument will display the stored calibration value.
14. Press the **ENTER** button.
15. Press the **BACK** button to exit the calibration menu when the calibration is complete.

GPS antenna requirements

The GPS7 module requires an external antenna to receive signals from satellites. You must set up an antenna system to provide the GPS signal as an input to the module. You can configure the instrument to provide 3.3 V or 5 V DC power for the antenna.

WARNING. *Prevent risk of shock or fire by ensuring that the GPS antenna is protected from lightning strikes when it is mounted outside a building or facility. The GPS7 module and TG8000 mainframe do not have isolation protection from lightning, so the facility installation must provide suitable protection for the GPS antenna external to the TG8000 mainframe. Failure to use appropriate precautions can result in injury or death.*

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

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

GPS antenna system

Antenna systems vary depending on the operating environment and on safety and regulatory requirements. A simplified typical system is shown in the following figure to help you with planning and understanding the trade-offs of one set up versus another. (See Figure 3-53.)

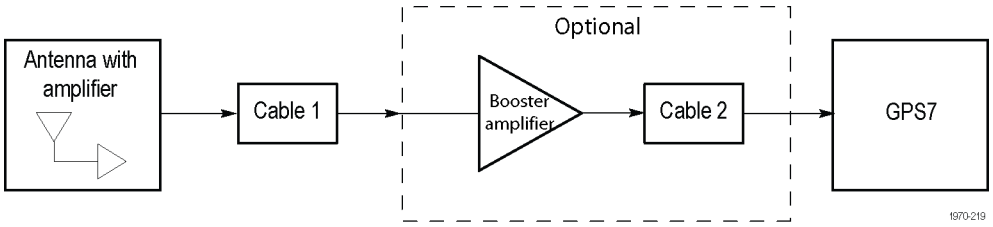


Figure 3-53: Simplified GPS antenna system

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

In a simple system without the optional booster, Cable 1 connects the antenna to the GPS7. The length of this cable is limited by its attenuation at the GPS carrier frequency of 1575 MHz. The GPS7 should have a signal that is 18 dB or greater above the ambient level. For example, for a 35 dB antenna, the allowed cable loss is 35 – 18 = 17 dB. (See Figure 3-53.)

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

A booster amplifier can be added if more length is needed, as shown in the optional block in the signal path system. (See Figure 3-53.)

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

Although the GPS7 input and most of the other components are 50 Ω, either 50 Ω or 75 Ω cables can be used in most installations. The reflections from the impedance mismatch will not cause significant changes in the system because the signal is narrow band and the cable loss is usually many dBs. However, you should not mix short cable lengths of different impedances, as this might create reflections with the potential to cause signal degradation.

Amplification. The GPS7 provides either 3.3 V or 5 V DC power to drive the amplified antenna and booster amplifier. The power is carried on the same coax as the GPS signal, and can be turned off if the antenna is powered by a separate supply. When you are designing the antenna system, check the voltage and current requirements of the components to insure compatibility.

The location of the booster amplifier is important. It needs to be before the second length of cable shown in the simplified antenna system diagram. If the booster amplifier is placed just *before* the GPS7, then the signal will have been attenuated too far and the output may be noisy. If you cannot put the optional booster amplifier in the middle of a long run of cable, then put it near the antenna rather than near the GPS7 end.

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

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

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

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 3-145, *GPS7 module GPO submenu*.)

You can see the description of the FOM in the GPS7 **STATUS** menu. The following table lists the figures of merit and their descriptions.

Table 3-19: Figures of merit for signal quality

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 3-19: Figures of merit for signal quality (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.

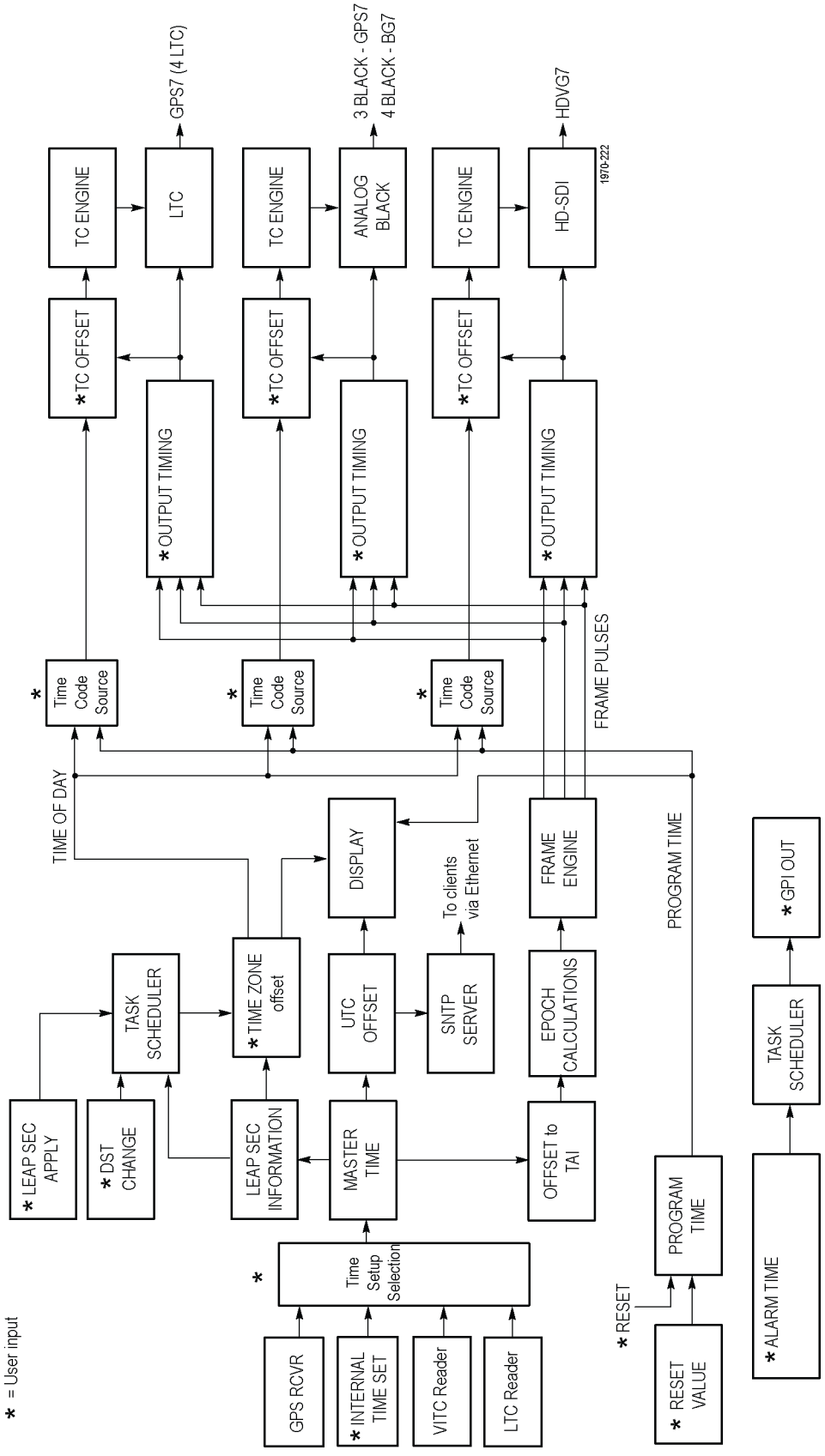


Figure 3-54: Time flow block diagram

GPS RCVR. 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 *. 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 GPS7 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 GPS7 reference source is set to INTERNAL, NTSC, PAL or HD SYNC, the LTC signal applied to the LTC 1 input can be used at 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. 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. 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 GPS7 module 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. 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 GPS7 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 GPS7 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 GPS7 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 GPS7. 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. The GPS7 includes an implementation of the Simple Network Time Protocol, using the network interface of the TG8000 mainframe. The NTP server is automatic; when the Master time is set to GPS and the GPS7 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 GPS7 module 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 GPS7 module has three analog sync outputs. Each output can be configured as NTSC or PAL black burst (with optional VITC insertion) or HD trilevel sync. The BG7 module has four analog sync outputs which can be similarly configured.

HD-SDI. The standard HDVG7 module has one HD-SDI test signal generator (with two outputs), for which ancillary timecode (ATC) can be added. If Option BK is available, then there are two independent HD-SDI test signal generators available.

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 GPS7 module has two General Purpose Interface (GPI) outputs, either of which may be configured to begin when the program time matches a specified alarm time.

To configure GPS7 module settings

Understanding the capabilities, operating environment, antenna system, and other requirements of the GPS7 module can help you decide how to configure it to best meet the needs of your specific applications. The GPS7 menu trees and menu descriptions can help you configure the module. (See page 3-111, *GPS7 module main menu*.)

GPS7 module main menu

Use the GPS7 module main menu to perform the following tasks:

- View the status of the module and signal
- View diagnostics results for the module
- Select the LTC output or GPI input and output
- Set the antenna voltage, time-of-day, and other time related parameters
- Generate a Black 1, Black 2, or Black 3 signal
- Set the timing reference source (Internal, Genlock, or GPS signal)
- Set the Genlock Timing
- Set the Time Of Day source (Internal, VITC input, or GPS signal)

NOTE. *Earlier GPS7 modules do not have the REF IN input connector (shared with the BLACK 1 output connector). Modules without REF IN do not support Genlock.*

Menus illustrated in this manual represent the newest features. GPS7 modules without the REF IN input have similar menu structures but not identical menu content.

Use the up (▲) or down (▼) arrow button to scroll through the main menu. The following figure shows the GPS7 module main menu.

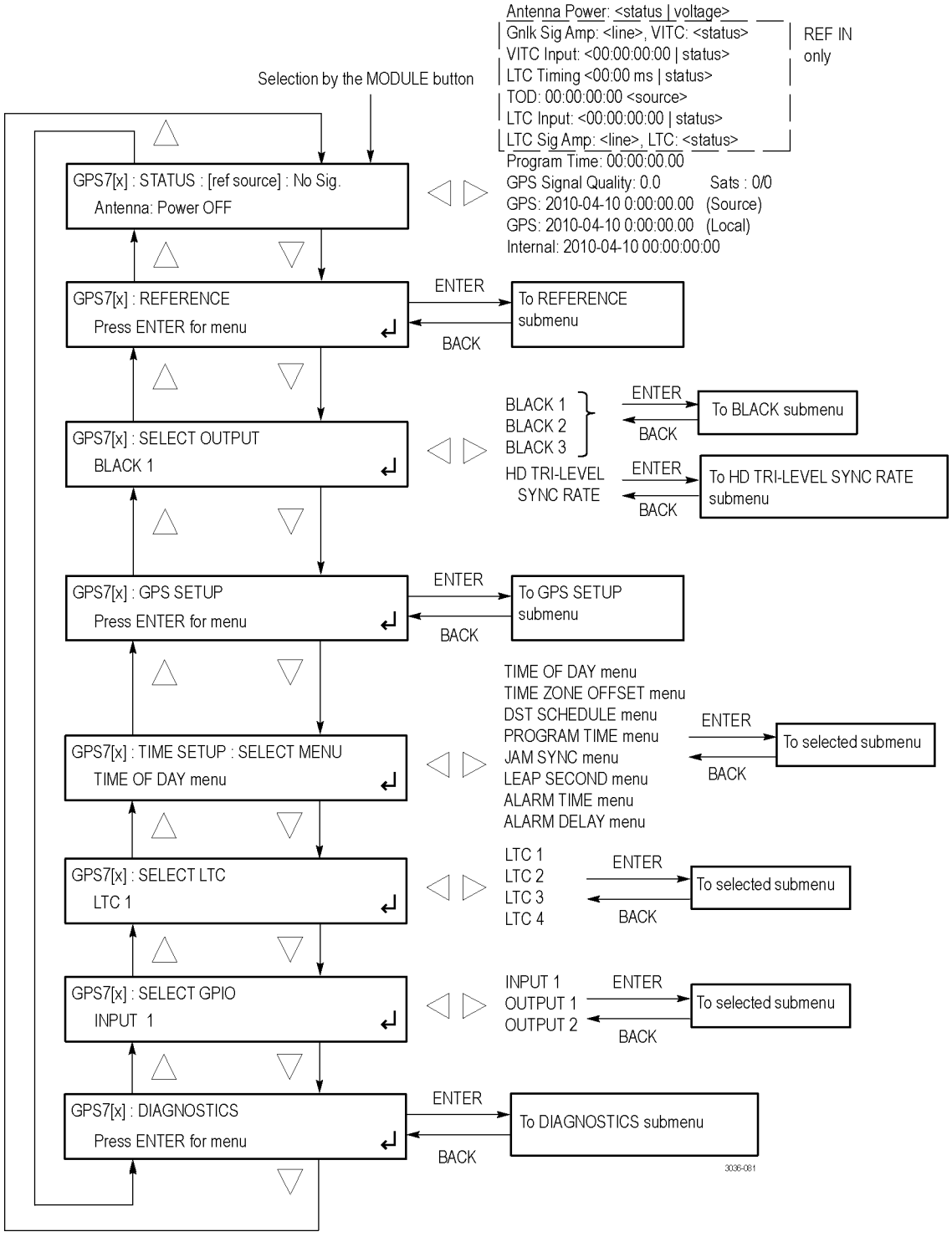


Figure 3-55: GPS7 module main menu

STATUS. Displays the status of the GPS7 module.

The top line displays the selected timecode reference and signal presence. When the internal reference frequency is used as the timecode reference, the top line displays **Internal**.

NOTE. *When GPS is set as the timecode reference, the top line includes the Figure of Merit (FOM) rating for the relative strength of the GPS signal. (See page 3-104, Figures of Merit (FOM).)*

The bottom line displays the additional status of the GPS7 module. Use the left (◄) or right (►) arrow button to view the following status displays:

- Genlock amplitude and VITC line number
- Date and time of the currently used timecode reference
- LTC timing and status

NOTE. *The LTC Timing Status screen shows the relationship between the LTC frame and either the genlock video or the internal frame pulse used to latch the LTC time-code into the system. If the LTC input rate and the genlock video input rate are compatible, then the LTC Timing Status screen will show the timing relationship between the LTC frame and the video.*

If the LTC input rate and genlock video input rate are not compatible, then the LTC Timing Status screen will show the timing between the LTC input and the internal frame pulse used to register the incoming time. Depending on which internal frame rate has been allocated, the LTC Timing readout may be stable, or may cycle though several possible values. Regardless, if the display is stable or cycling, this number has limited utility, since it is not related to the normal LTC-to-video relationship. If the instrument is in internal reference mode, then the LTC Timing Status readout and messages are disabled.

The LTC Timing Status screen shows the time between the reference datums and one of the following three messages:

12M OK: Indicates that the timing is within the window described in SMPTE 12M.

OK: Indicates that the timing is within the window that the GPS7 is able to consistently assign the time code to the correct video frame.

Warning: Indicates that the timing is near the threshold between frames. The time code may be assigned to the adjacent video frame, or may shift one frame if the timing changes slightly.

If the LTC timing is slewing, it indicates that the LTC and the selected reference (Internal, GPS, or Video Genlock) are not synchronous. In this case, the time code will shift when it crosses the threshold from one frame to another. This can be avoided by not using the "follow" mode for the time synchronization. Instead, use the "Synchronize Once" or "Synchronize now" modes.

- LTC time display and status
- LTC signal amplitude and status
- Time of day and the reference source
- UTC, local, and internal time displays
- Program time counter
- GPS signal quality and the number of satellites detected versus satellites usable

NOTE. *Signal quality is an indicator of how well the GPS signal is being received. It is a sum of the correlation for each of the satellites. It can be used to evaluate the antenna and connecting cable, but it can take a while for the receivers to recognize which satellites are available and stabilize at the final level.*

- Antenna power status: **Power OFF**, **Open**, **Short**, or **Nominal**.

NOTE. *A shorted GPS antenna will not damage the GPS7 module. If a splitter is used on the antenna, it may appear as a short at DC but will still pass through the RF signal, which will allow the GPS to function.*

The status will read Open if no antenna is connected or if the current load is less than expected because a splitter or DC block is being used.

REFERENCE. Selects the timing reference and the response for a loss of lock to the timing reference. Select this menu item, and then press the **ENTER** button to access the REFERENCE submenu. (See page 3-116.)

SELECT OUTPUT. Selects which BLACK output to configure for signal format, timing, and timecode parameters or selects the HD trilevel sync rate for the three BLACK outputs. Use the left (◄) or right (►) arrow button to select the output you want to configure (BLACK 1, BLACK 2, BLACK 3, or HD TRI-LEVEL SYNC RATE), and then press the **ENTER** button to access the BLACK submenu (See page 3-120.) or the HD TRI-LEVEL SYNC RATE submenu (See page 3-124.).

GPS SETUP. Sets GPS signal parameters and sets the level at which a warning message will be generated if the GPS signal quality deteriorates. Select this menu item, and then press the **ENTER** button to access the GPS SETUP submenu. (See page 3-128.)

TIME SETUP. Provides access to several submenus for setting timing parameters for the module. Use the left (◄) or right (►) arrow button to select one of the following submenus, and then press the **ENTER** button to access the selected submenu.

- **TIME OF DAY menu:** Use this submenu to set the module time of day reference. (See page 3-130.)
- **TIME ZONE OFFSET menu:** Use this submenu to set the time zone offset for your location. (See page 3-133.)
- **DST SCHEDULE menu:** Use this submenu to configure how the module handles Daylight Saving Time. (See page 3-134.)
- **PROGRAM TIME menu:** Use this submenu to configure the program time parameters. (See page 3-136.)
- **JAM SYNC menu:** Use this submenu to set parameters for the Jam Sync function. (See page 3-137.)
- **LEAP SECOND menu:** Use this submenu to configure how the module handles leap seconds. (See page 3-138.)
- **ALARM TIME menu:** Use this submenu to configure a time-based alarm. (See page 3-139.)
- **ALARM DELAY menu:** Use this submenu to configure a time to defer reporting errors so that brief errors are ignored. (See page 3-140.)

SELECT LTC. Selects which LTC output to configure for timecode parameters. Use the left (◄) or right (►) arrow button to select the output you want to configure (LTC 1, LTC 2, LTC 3, or LTC 4), and then press the **ENTER** button to access the LTC submenu for the selected output. (See page 3-142.)

SELECT GPIO. Sets how the GPS7 General Purpose Interface (GPI) is configured. Use the left (◄) or right (►) arrow button to select the GPI input or output you want to configure (INPUT 1, OUTPUT 1, or OUTPUT 2), and then press the **ENTER** button to access the GPI submenu for the selected input or output.

When you select INPUT 1, you will access the GPI submenu. (See page 3-144.) When you select OUTPUT 1 or OUTPUT 2, you will access the GPO submenu for the selected output. (See page 3-145.)

DIAGNOSTICS. Allows access to the outputs of several diagnostics. Select this menu item, and then press the **ENTER** button to enter the DIAGNOSTICS submenu. (See page 3-146.)

GPS7 module REFERENCE submenu

Use this submenu to select the timing reference and the response for a loss of lock to the timing reference. The following figure shows the REFERENCE submenu.

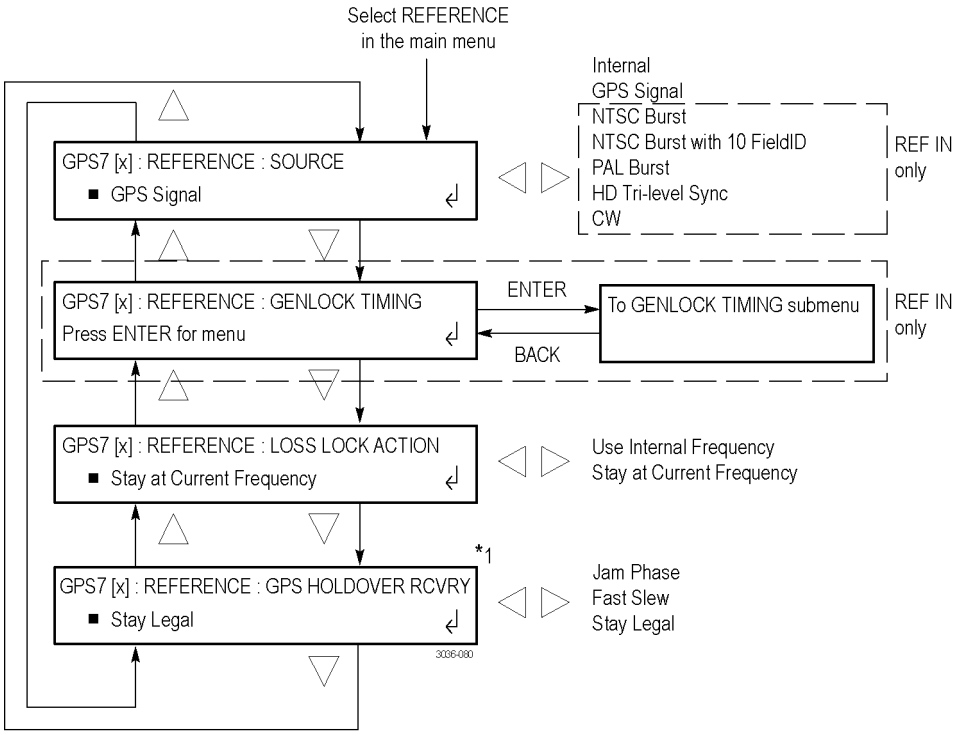


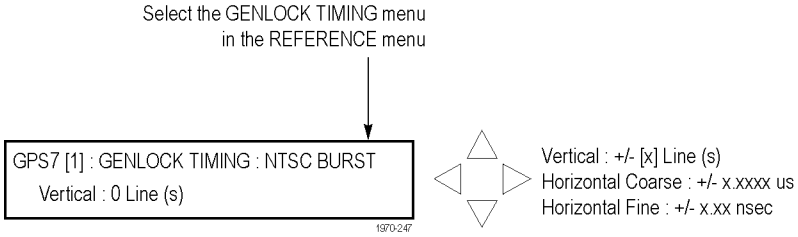
Figure 3-56: GPS7 module REFERENCE submenu

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:** Uses the GPS signal input as the timing reference.
- **NTSC Burst:** Uses the NTSC black burst signal applied to the **BLACK 1 / REF IN** connector as the timing reference.
- **NTSC Burst with 10 Field ID:** Uses the NTSC black burst with 10 Field ID signal applied to the **BLACK 1 / REF IN** connector as the timing reference.
- **PAL Burst:** Uses the PAL black burst signal applied to the **BLACK 1 / REF IN** connector as the timing reference.
- **HD Tri-Level Sync:** Uses the HDTV trilevel signal applied to the **BLACK 1 / REF IN** connector as the timing reference.
- **CW:** Uses the 1, 3.58, 4.43, 5, or 10 MHz continuous wave signal applied to the **BLACK 1 / REF IN** connector as the timing reference.

GENLOCK TIMING. Adjusts the timing offset of the input signal relative to the internal reference signal. Press the **ENTER** button to access the GENLOCK TIMING submenu shown below.

NOTE. *GENLOCK TIMING is only available when the REFERENCE SOURCE is set to NTSC Burst, NTSC Burst with 10 FieldID, PAL BURST, HD TRI-LEVEL SYNC, or CW.*



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 3-20.)

- **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 µsec 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 3-20: Timing adjustment ranges for GPS7 input signals

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

LOSS LOCK ACTION. 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. 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 µs.*

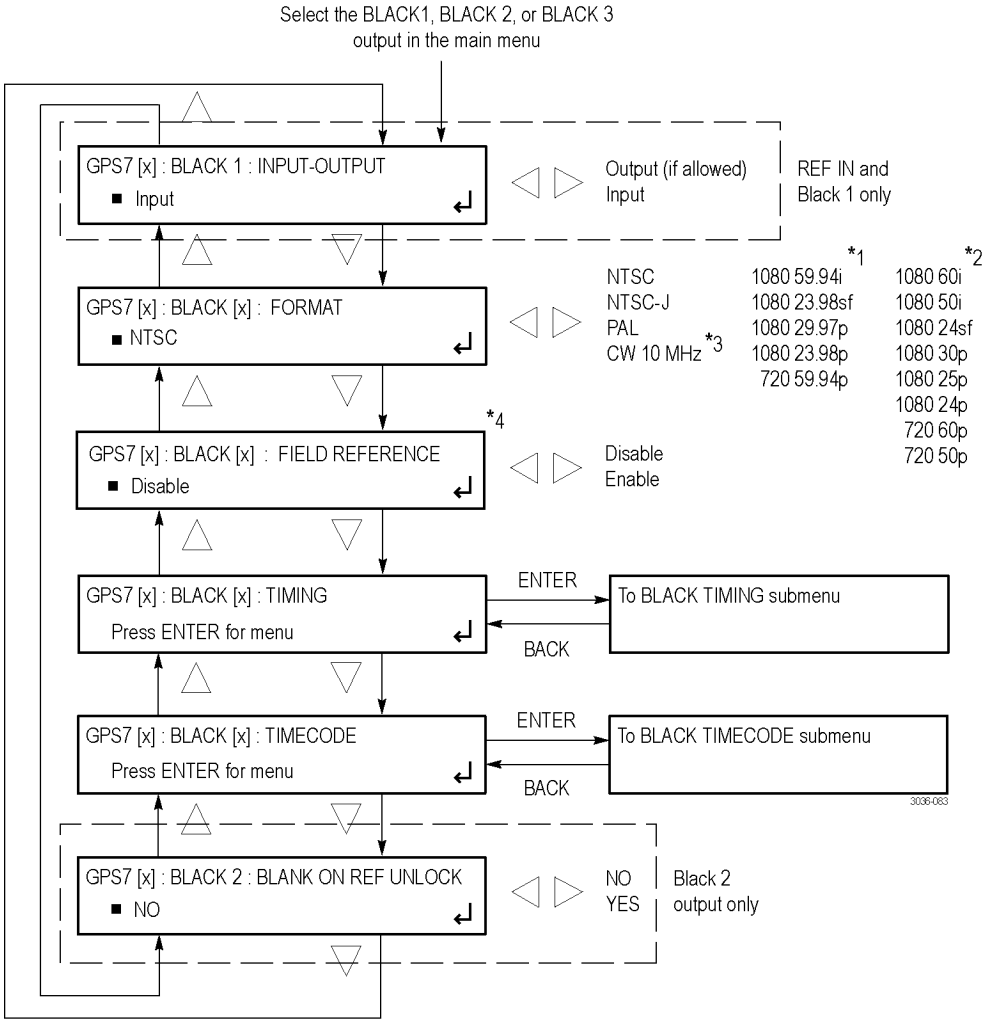
- **Stay Legal:** Adjusts the module timing to match the recovered GPS signal while staying within the specified frequency offset and frequency rate of change specifications for NTSC and PAL reference signals.

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 µs 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.

GPS7 module BLACK submenu

Use this submenu to configure the selected black output for signal format, timing, and timecode parameters. The following figure shows the BLACK submenu.



*1 These menu items appear only when the HD tri-level sync is set to non-integer.
*2 These menu items appear only when the HD tri-level sync is set to integer.
*3 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.
*4 These menu items are available only for non-HD formats.

Figure 3-57: GPS7 module BLACK submenu

INPUT-OUTPUT. Use the left (◄) or right (►) arrow button configure the **BLACK 1** connector as an **INPUT** or an **OUTPUT (if allowed)**. This connector is forced to be an input if the TIMING REFERENCE SOURCE is set to a Genlock signal or if VITC is the TIME OF DAY reference.

NOTE. *If a reference signal is connected to the BLACK 1 / REF IN connector, you should configure this connector as an input so that the GPS7 module does not output a video signal if the Reference Source is changed to GPS or internal.*

This might occur when using the GPS7 module in a dual-configuration where the module is being switched between being a slave via genlock to incoming video or a master source using the GPS reference.

This menu selection is available only when BLACK 1 is selected for configuration and the GPS7 module has the ***BLACK 1 / REF IN*** *connector.*

FORMAT. Use the left (◄) or right (►) arrow button to select from the signal formats in the following table. Press the **ENTER** button to confirm the selection.

Table 3-21: GPS7 module output signal formats

Common	Non-integer HD trilevel sync rate [1]	Integer HD trilevel sync rate [1]
NTSC	1080 59.94i	1080 60i
NTSC-J	1080 23.98sf	1080 50i
PAL	1080 29.97p	1080 24sf
CW 10 MHz [2]	1080 23.98p	1080 30p
	720 59.94p	1080 25p
		1080 24p
		720 60p
		720 50p

[1] The signal formats available in this submenu depend on the HD trilevel sync rate setting (non-integer or integer), which is set using the Select Output selection in the GPS7 module main menu. (See page 3-111, *GPS7 module main menu*.)

[2] The CW 10 MHz format is available on the BLACK 3 output only.

FIELD REFERENCE. Use the left (◄) or right (►) arrow button to **Enable** or **Disable** the field reference in the output signal. Press the **ENTER** button to confirm the selection.

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

BLACK TIMING. Press the **ENTER** button to access the BLACK TIMING submenu shown below.

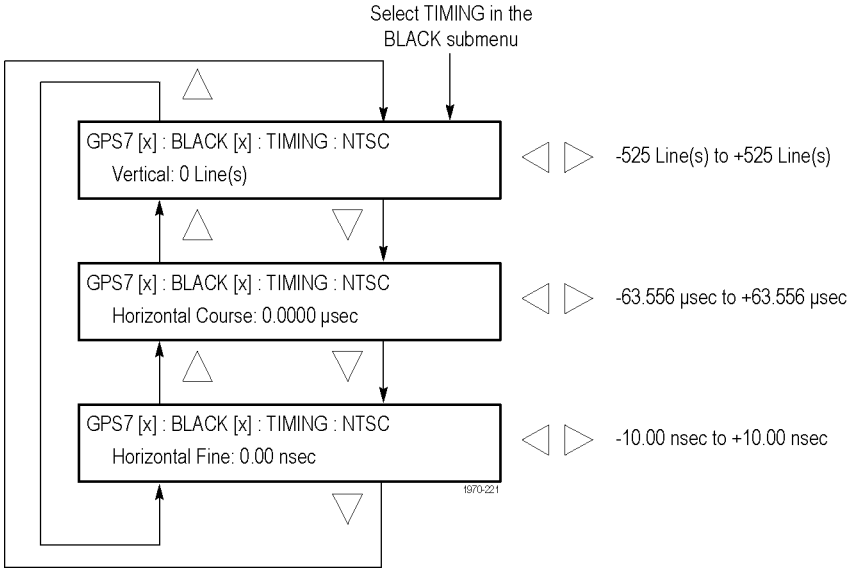


Figure 3-58: GPS7 module BLACK TIMING submenu

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.

- **Vertical:** Use the left (◄) or right (►) arrow button to adjust the vertical timing. For NTSC and PAL, you can adjust the timing by ± ½ a color frame. For HDTV trilevel sync signals, you can adjust the timing by ± ½ a field or frame (progressive or interlaced signals, respectively). (See Table 3-22.)
- **Horizontal Coarse:** Use the left (◄) or right (►) arrow button to set the horizontal coarse timing. For NTSC, PAL, and HDTV trilevel sync signals, you can adjust the timing by ± 1 µs.
- **Horizontal Fine:** Use the left (◄) or right (►) arrow button to set the horizontal fine timing. For NTSC and PAL signals, you can adjust the timing by ±10.00 ns. For HD trilevel sync signals, you can adjust the timing by ± 7.00 ns.

Table 3-22: Timing adjustment ranges for GPS7 output signals

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	± 7.00
1080 59.94i	± 562	± 29.6593	± 7.00
1080 50i	± 562	± 35.5556	± 7.00
1080 24sF	± 562	± 37.0370	± 7.00

Table 3-22: Timing adjustment ranges for GPS7 output signals (cont.)

Format name	Line settings	Coarse settings (µs)	Fine settings (ns)
1080 23.98sF	± 562	± 37.0741	± 7.00
1080 30p	± 562	± 29.6296	± 7.00
1080 29.97p	± 562	± 29.6593	± 7.00
1080 25p	± 562	± 35.5556	± 7.00
1080 24p	± 562	± 37.0370	± 7.00
1080 23.98p	± 562	± 37.0741	± 7.00
720 60p	± 375	± 22.2222	± 7.00
720 59.94p	± 375	± 22.4444	± 7.00
720 50p	± 375	± 26.6667	± 7.00

BLACK TIMECODE. Use this menu to set timecode parameters for the selected BLACK output. Press the **ENTER** button to access the TIMECODE submenu. (See page 3-125.)

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

BLANK ON GPS UNLOCK. Use the left (◄) or right (►) arrow button to turn **ON** or **OFF** the blanking function on the BLACK 2 output when a loss of lock to the GPS signal is detected. When turned on, the BLACK 2 output will be blanked as long as the loss of lock condition occurs. This purpose of this function is to trigger a change-over. If configured to blank on loss of lock, this output should not be used for normal reference applications.

NOTE. *This submenu is available only when BLACK 2 is the selected output.*

GPS7 module HD TRI-LEVEL SYNC RATE submenu

Use this submenu to select whether an integer or non-integer clock will be used for the HD tri-level sync rate for the BLACK outputs. Use the left (◄) or right (►) arrow button to select **Integer (60, 50, 30, 25, 24)** or **Non-Integer (59.94, 29.97, 23.98)**. Press the **ENTER** button to confirm the selection.

NOTE. *The clock rate selected here affects which signal formats are available for the BLACK outputs.*

The following figure shows the HD TRI-LEVEL SYNC-RATE submenu.

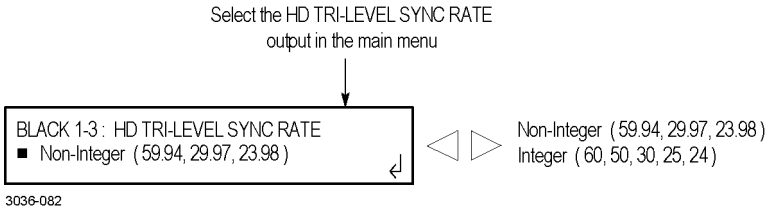


Figure 3-59: GPS7 module HD TRI-LEVEL SYNC RATE submenu

GPS7 module TIMECODE submenu

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

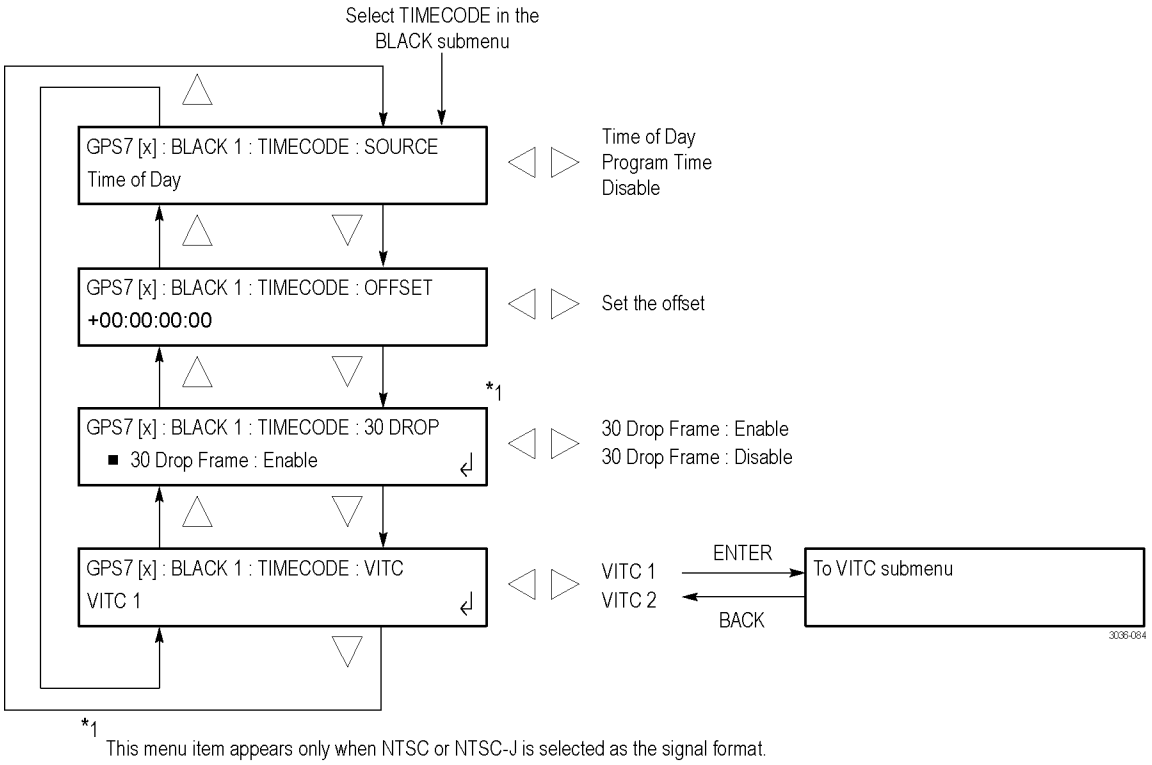


Figure 3-60: GPS7 module TIMECODE submenu

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

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

- **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.
- **Disable:** Disables the timecode function for the selected Black output.

NOTE. *In addition to enabling the timecode source, at least one line must be specified and enabled to carry VITC using the 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 ±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 selection 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. 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 3-127.)

GPS7 module VITC submenu

Use this menu to enable or disable the output of a VITC on the selected line. Use the up (▲) or down (▼) arrow button to change the menu items. The following figure shows the VITC submenu.

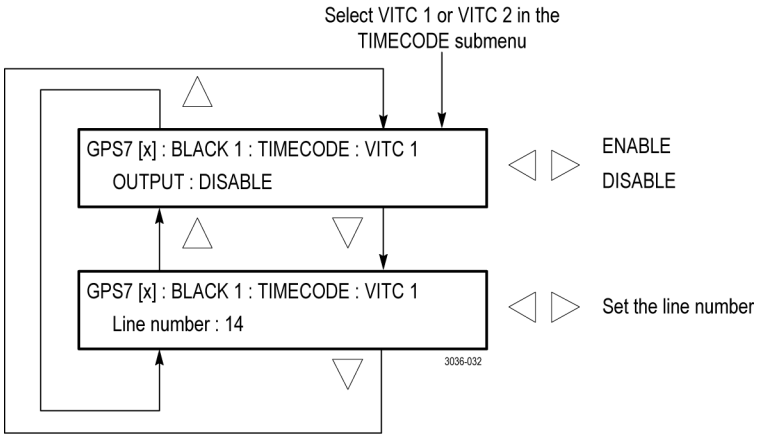


Figure 3-61: GPS7 module VITC submenu

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 **ENABLE** or **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.

GPS7 module GPS SETUP submenu

Use this menu to set the GPS operating parameters and set the level at which a warning message will be generated if the GPS signal quality deteriorates. Use the up (▲) or down (▼) arrow button to change the menu items. The following figure shows the GPS SETUP submenu.

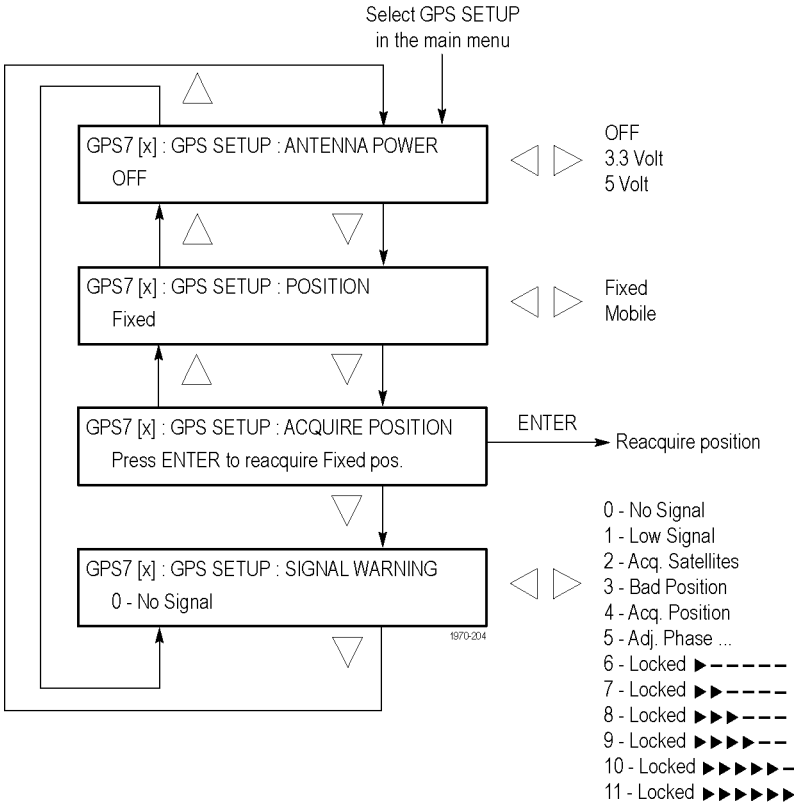


Figure 3-62: GPS7 module GPS SETUP submenu

ANTENNA POWER. The ANTENNA 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 ANTENNA 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.

POSITION. 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 POSITION. Press the **ENTER** button to erase the saved position, and then acquire and save a new averaged position. Note that the 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.*

SIGNAL WARNING. 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, see the GPO submenu. (See page 3-145, *GPS7 module GPO submenu*.) Use the left (◄) or right (►) arrow button to select the FOM (quality of the GPS signal) value that will trigger warning indicators. (See page 3-104, *Figures of Merit (FOM)*.)

GPS7 module TIME OF DAY submenu

Use this menu to set the source for the time of day setting and to set the date and time that will be used when the GPS reference is set to internal. The following figure shows the TIME OF DAY submenu.

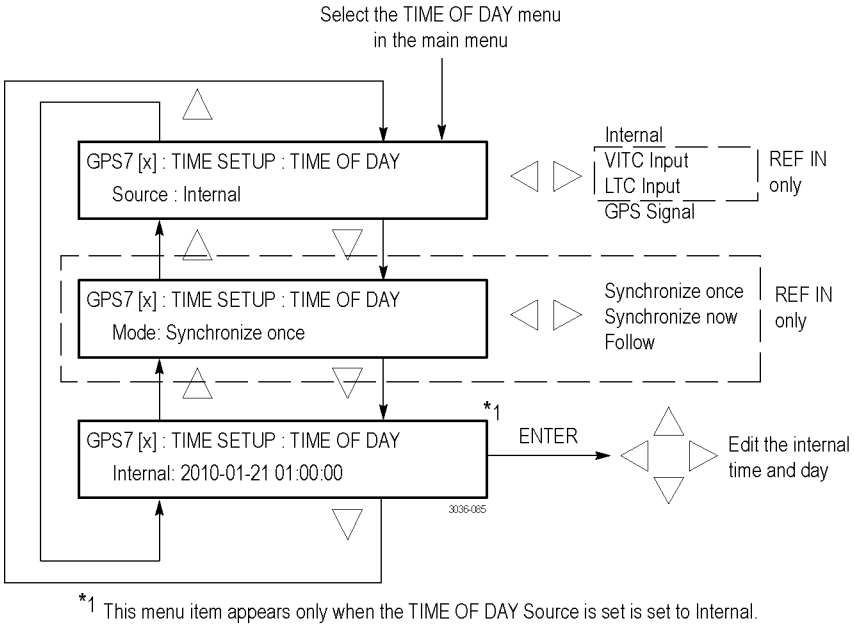


Figure 3-63: GPS7 module TIME OF DAY submenu

Source. Use the left (◄) or right (►) arrow button to select the timecode reference.

- **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.)*

- **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. *The VITC and LTC inputs are not available on earlier GPS7 modules that do not have the Black 1 / REF IN input connector.*

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 selection is only available when the function of the LTC connector is set to Input.
- **GPS Signal:** If GPS Signal is selected, the time from the GPS receiver is used to derive the time of day. This selection is only available if GPS Signal is the selected Reference Source.

Mode. When VITC or LTC is the Time of Day source, Use the left (◄) or right (►) arrow button to select the synchronization mode.

- **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 selection to manually enter the date and time and to activate the time-of-day change. (See page 3-132, *How to set the time-of-day in Internal mode*.)

How to set the time-of-day in Internal mode. Perform the following steps to set the Time of Day in Internal mode.

1. Set the Time of Day source to Internal:
   a. From the GPS7 module main menu, use the up (▲) or down (▼) arrow button to select **TIME SETUP : SELECT MENU**.
   b. Use the left (◄) or right (►) arrow button to select **TIME OF DAY menu**, and then press the **ENTER** button.
   c. In the TIME OF DAY submenu, use the left (◄) or right (►) arrow button to select **Source: Internal**. Press the **ENTER** button to confirm the selection.
2. Use the up (▲) or down (▼) arrow button to select **INTERNAL: <time>**.
3. Press the **ENTER** button to enter the date and time edit mode.
4. 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.
5. 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 Internal mode time-of-day setting.*

6. Press the **ENTER** 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.

GPS7 module TIME ZONE OFFSET submenu

Use this menu to set the time zone offset for your location in reference to UTC. 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. The date and time digits take the following form: HH:MM.

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. The following figure shows the TIME ZONE OFFSET submenu.

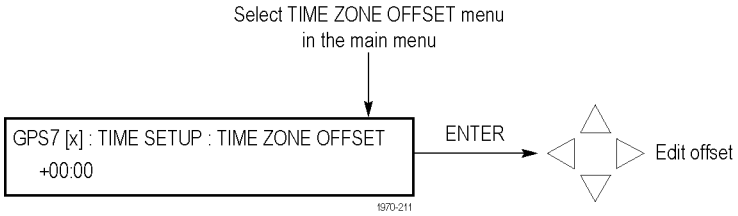


Figure 3-64: GPS7 module TIME ZONE OFFSET submenu

NOTE. *When 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.*

GPS7 module DST SCHEDULE submenu

Use this menu to schedule when Daylight Savings Time changes are implemented. Use the up (▲) or down (▼) arrow button to change the menu items. The following figure shows the DST SCHEDULE submenu.

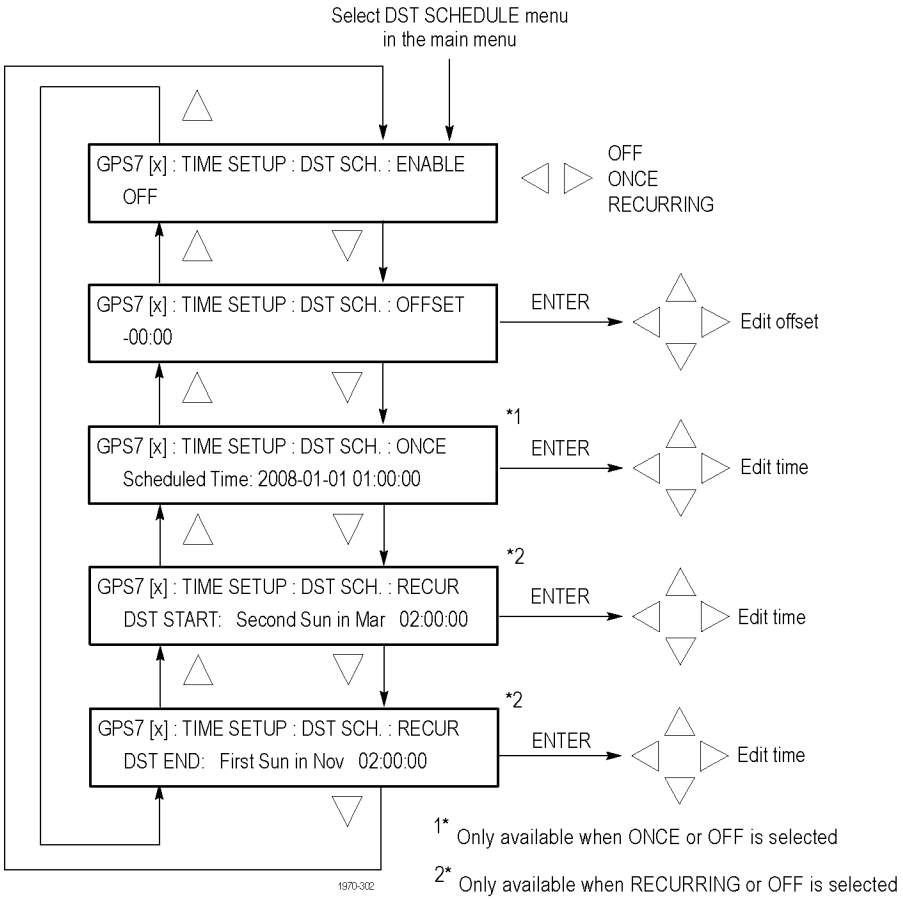


Figure 3-65: GPS7 module DST SCHEDULE submenu

ENABLE. Use the left (◄) or right (►) arrow button to set the DST schedule function to **OFF**, **ONCE**, or **RECURRING**. Use ONCE 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." Use RECURRING 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 selection 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. This selection appears only when you set DST Schedule function to OFF or 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.*

NOTE. *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. There are two Recurring selections: DST Start and DST End. These selections appear only when you set the DST Schedule function to OFF or RECURRING. 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.

GPS7 module PROGRAM TIME submenu

Use this menu to set the initial value for the Program Time counter. The following figure shows the PROGRAM TIME submenu.

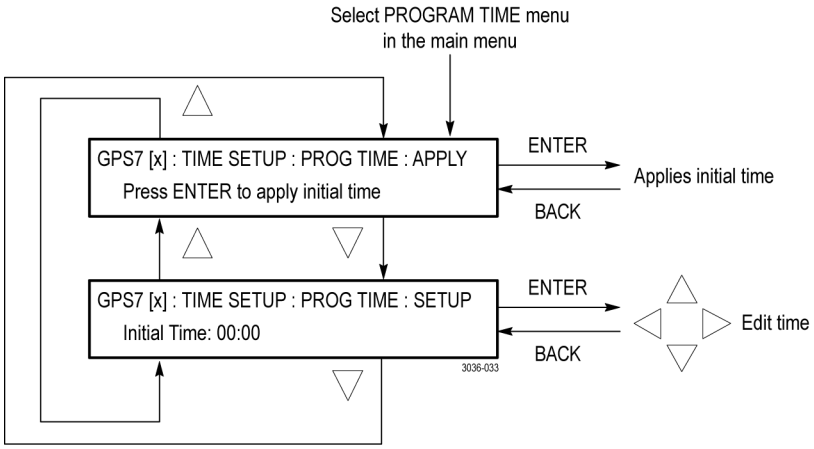


Figure 3-66: GPS7 module PROGRAM TIME submenu

APPLY. Press the **ENTER** button to immediately apply the initial program time entered in the SETUP parameter below.

SETUP. Press the **ENTER** button, and then 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.

GPS7 module JAM SYNC submenu

Use this menu to set parameters for the Jam Sync function. Use the function to immediately synchronize the module timecode with the selected time source for each output or to regularly schedule a synchronization. Use the up (▲) or down (▼) arrow button to change the menu items. The following figure shows the JAM SYNC submenu.

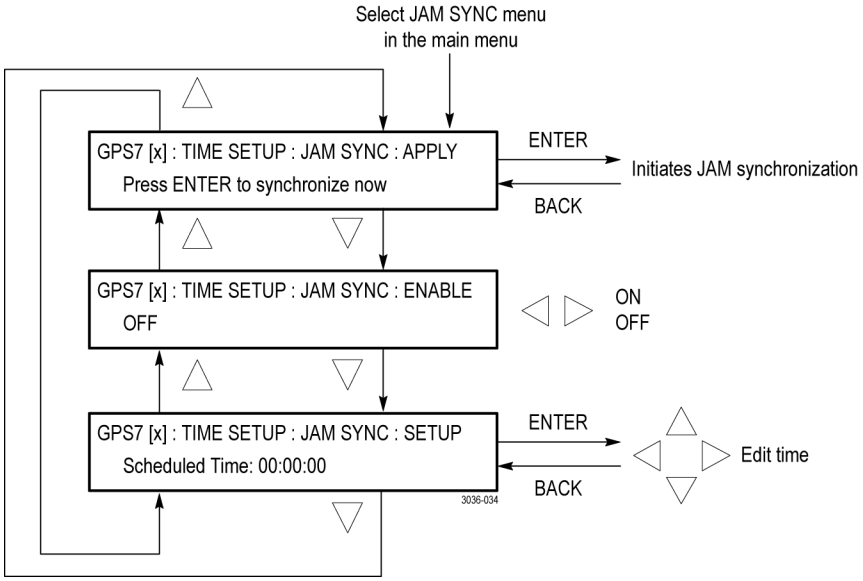


Figure 3-67: GPS7 module JAM SYNC submenu

APPLY. Press the **ENTER** button to immediately synchronize the module timecode with the GPS signal timecode.

ENABLE. Use the left (◄) or right (►) arrow button to turn **ON** or **OFF** the Jam Sync function.

SETUP. Press the **ENTER** button, and then 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. *A daily Jam Sync should be performed on systems running at non-integer frame rates.*

GPS7 module LEAP SECOND submenu

Use this menu to schedule when leap seconds are implemented. For many applications, it might be fine to apply the leap second at midnight UTC, but for some time zones this might cause a disruption, so the leap second menu allows the leap second to be deferred up to 24 hours. Use the up (▲) or down (▼) arrow button to change the menu items. The following figure shows the LEAP SECOND submenu.

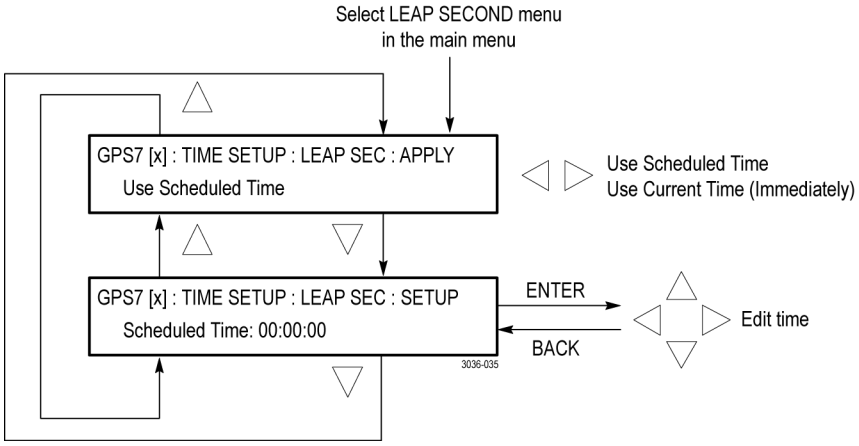


Figure 3-68: GPS7 module LEAP SECOND submenu

APPLY. Use the left (◄) or right (►) arrow button to select when a leap second will be scheduled. Select **Use Current Time (Immediately)** to apply 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. Select **Use Scheduled Time** to apply the leap second adjustment at a deferred time, as entered in the SETUP menu below.

SETUP. Press the **ENTER** button, and then 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.

NOTE. *The LEAP SECOND menu is only available when GPS is the Reference source.*

GPS7 module ALARM TIME submenu

Use this menu to schedule alarm times relative to program time. Using the GPI connector, this feature can be used to drive a light or similar indicator of alarm occurrences at a specific time in a program. Use the up (▲) or down (▼) arrow button to change the menu items. The following figure shows the ALARM TIME submenu.

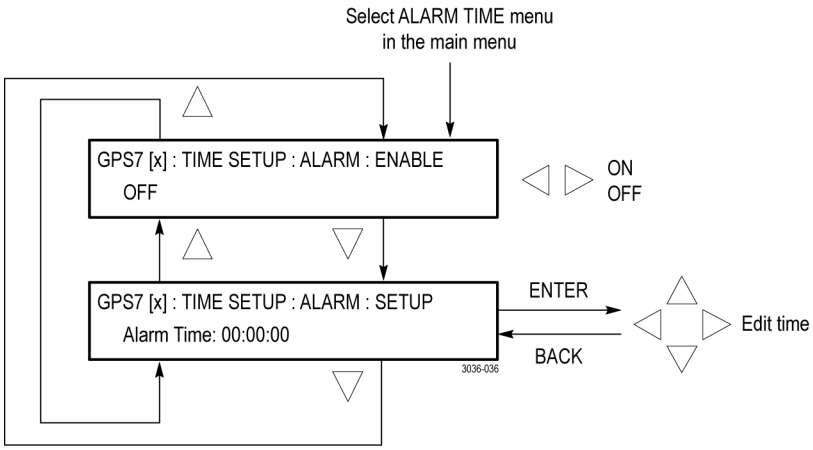


Figure 3-69: GPS7 module ALARM TIME submenu

ENABLE. Use the left (◄) or right (►) arrow button to turn **ON** or **OFF** the Alarm Time function.

SETUP. Press the **ENTER** button, and then 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 change.

GPS7 module ALARM DELAY submenu

Use this menu to set delays for warning messages. Setting a delay allows short errors and warnings to be ignored. For example, with the holdover capability, a short GPS unlock will not cause any disruption in the syncs, so there is no reason to immediately register an error and trigger an ECO to change. Use the up (▲) or down (▼) arrow button to change the menu items. The following figure shows the ALARM DELAY submenu.

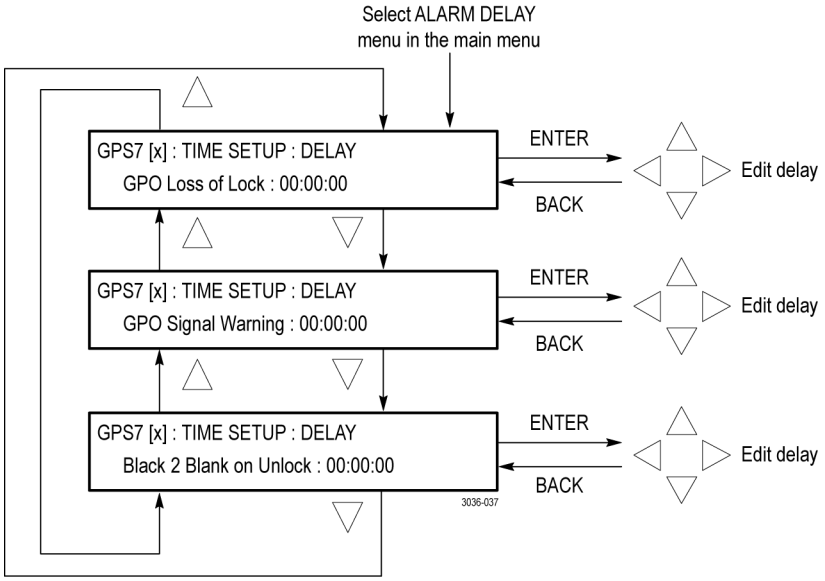


Figure 3-70: GPS7 module ALARM DELAY submenu

GPO Loss of Lock. Use this feature to set a delay between the time when loss of lock is detected and when it is reported on the GPI output. Press the **ENTER** button, and then use the left (◄) or right (►) arrow button to select a digit in the delay time before a GPO loss of lock warning message is displayed. 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.

GPO Signal Warning. Use this feature to set a delay between the time when a signal warning is detected and when it is reported on the GPI output. Press the **ENTER** button, and then use the left (◄) or right (►) arrow button to select a digit in the delay time before a GPO signal warning message is displayed. 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.

Black 2 Blank on Unlock. Use this feature to set a delay between the time when an unlock is detected and when Black 2 is blanked. Press the **ENTER** button, and then use the left (◄) or right (►) arrow button to select a digit in the delay time before the BLACK 2 output is blanked for a loss of GPS signal lock. 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. *The BLACK 2 output must be configured to be blanked before this delay will be used. (See page 3-120, GPS7 module BLACK submenu.)*

GPS7 module LTC submenu

Use this menu to configure the LTC outputs. Use the up (▲) or down (▼) arrow button to change the menu items. The following figure shows the LTC submenu.

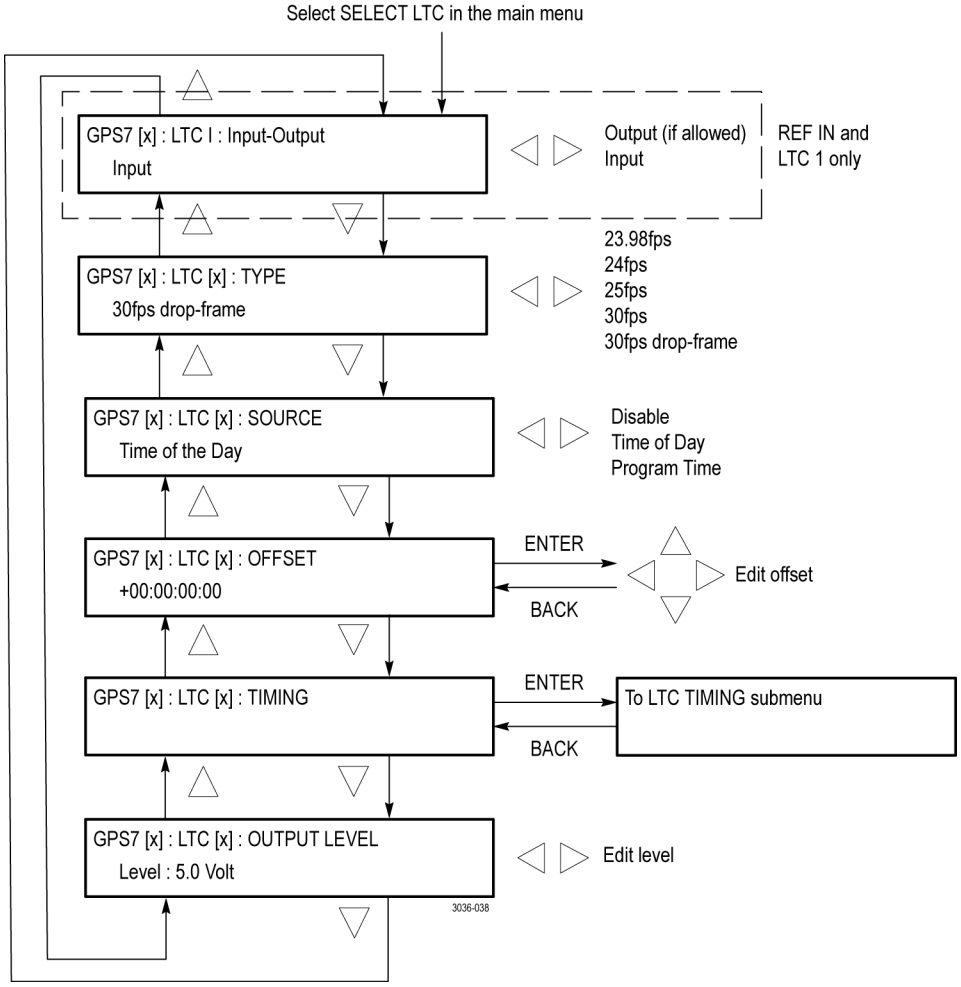


Figure 3-71: GPS7 module LTC submenu

INPUT-OUTPUT. Use the left (◄) or right (►) arrow button to set the function of LTC1 to **INPUT** or **OUTPUT (if allowed)**. When LTC is selected as the time of day reference, LTC1 is forced to be an input.

NOTE. *This selection is not available on earlier GPS7 modules that do not have the REF IN input connector.*

TYPE. Use the left (◄) or right (►) arrow button to select from the following LTC output signal formats:

Table 3-23: GPS7 module LTC output signal formats

Format	Rate	Delay range
23.98	24 fps at 23.98 Hz rate	±20.85 ms
24	24 fps at 24 Hz rate	±20.83 ms
25	25 fps at 25 Hz rate	±20.00 ms
30	30 fps at 30 Hz rate	±16.67 ms
30 DF	30 fps drop frame at 29.97 Hz rate	±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 3-144.)

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.

GPS7 module LTC TIMING submenu

Use this menu to set the delay used for all the signal formats. Use the left (◄) or right (►) arrow button to set the delay. (See Table 3-23.) Press the **ENTER** button to confirm the selection. The following figure shows the LTC TIMING submenu.

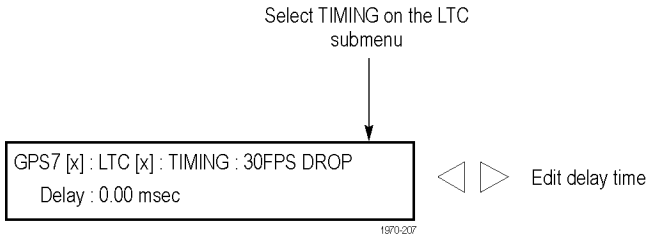


Figure 3-72: GPS7 module LTC TIMING submenu

GPS7 module GPI submenu

Use this menu to select the function that will be performed when a signal is received on the GPI input. The signal is normally pulled high by an internal resistor, and will trigger the selected function when pulled low. The following figure shows the GPI submenu.

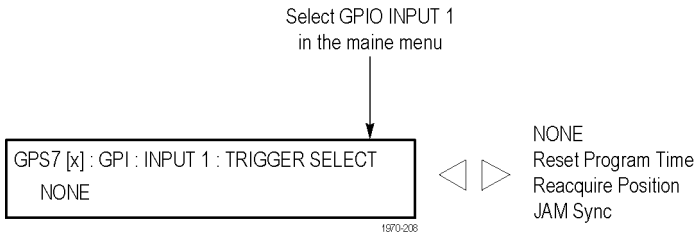


Figure 3-73: GPS7 module GPI submenu

Use the left (◄) or right (►) arrow button to select from the following settings:

- **NONE:** Disables the GPI input.
- **Reset Program Time:** Resets the Program Time counter.
- **Reacquire Position:** Reacquires the GPS signal. At least 60 readings from four satellites are required to establish and save a new averaged position.
- **Jam Sync:** When in GPS mode, performs an immediate jam sync (which can also be done from the JAM SYNC submenu). (See page 3-137.)

  When in VITC time mode, performs an immediate jam sync and sets the instrument time from the input timecode.

  Both actions require that the input timecode has been valid for 100 continuous frames. In VITC mode, this input is equivalent to executing set commands from both the Jam Sync menu and the Time of Day synchronize function.

GPS7 module GPO submenu

Use this menu to select which alarm will trigger a signal output on the selected GPI output. The output is an open collector with a weak pull up, so when it is asserted, the output will be low. The following figure shows the GPO submenu.

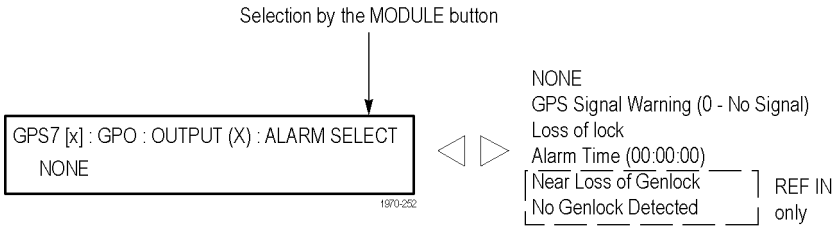


Figure 3-74: GPS7 module GPO submenu

Use the left (◄) or right (►) arrow button to select from the following settings:

- **NONE:** Disables the selected GPI output.
- **GPS Signal Warning (<Figure of Merit level>):** Output goes high when the GPS signal quality reaches the warning level set in the GPS SETUP submenu. (See page 3-128.) Refer to *GPS Signal Quality (Figure of Merit)* for more information about GPS signal quality levels. (See page 3-104.)
- **Loss of Lock:** Output goes low when a GPS or genlock loss of lock occurs. A loss of lock alarm is triggered when the GPS signal falls below the user defined threshold after the delay time has been exceeded.
- **Alarm Time:** A time of day or counter alarm is triggered for one second when the specified time is reached on the specified counter.
- **Near Loss of Genlock:** Output goes low when the genlock frequency is near the end of the oven oscillator tuning range. This can happen if the input signal is too far from the correct frequency. This could also indicate that the oven oscillator is near its end of life and the instrument needs to be serviced.
- **No Genlock Detected:** Output goes low when no Genlock signal is detected.

NOTE. *The GPIO alarms are active for the currently selected reference. For example, GPS specific alarms assert only if GPS is the selected reference and the same for Genlock specific alarms. If the selected reference is Internal, then only the Alarm Time output can be used.*

GPS7 module DIAGNOSTICS submenu

Use this menu to view operation parameters for the GPS7 module. Because many sync sources are never turned off, it makes sense to check them periodically. These menus allow access to some internal nodes to forewarn of impending problems. Module diagnostics provide status information only and do not affect operating behavior. The following figure shows the DIAGNOSTICS submenu.

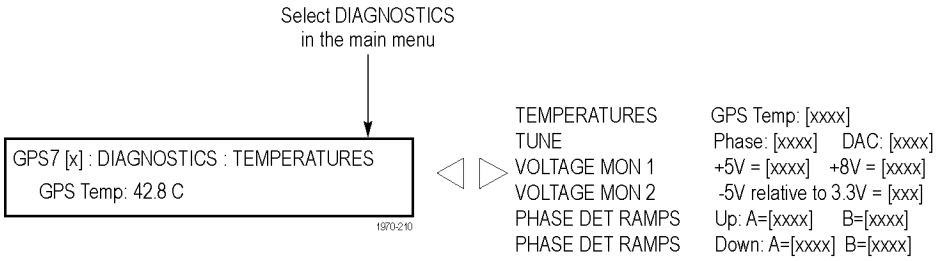


Figure 3-75: GPS7 module DIAGNOSTICS submenu

TEMPERATURES. This diagnostic displays the temperature of the GPS7 module.

TUNE. This diagnostic displays the following:

- Phase – 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.
- DAC – The DAC code that is tuning the oscillator. Useful for checking if a unit is getting close to the end of the oven oscillator tune range.
- GPS lock indicator – Displays the GPS lock state. When **Boot** is displayed, it means the function is still in special modes needed to get started. When **Coarse** is displayed, it means the function is still tracking significant changes in the timing. When **Fine** is displayed, it means the function has stabilized to the point that the loop only needs to make small changes.

VOLTAGE MON 1. This diagnostic measures internal voltage supplies. If these supplies are outside the nominal range, **Warning** appears, which means that the instrument should be serviced.

VOLTAGE MON 2. This diagnostic measures a voltage divider between a positive and negative supply. If this diagnostic result is outside the nominal range, **Warning** appears, which means that the instrument should be serviced.

PHASE DET RAMPS. This diagnostic monitors voltage ramps used in the phase detector. If these voltage ramps are outside the nominal range, **Warning** appears, which means that the instrument should be serviced.

NOTE. *The following diagnostics (ADC BUS, GENLOCK INPUT, LTC POS INPUT, and LTC NEG INPUT) are available only in modules with the BLACK 1 / REF IN connector.*

ADC BUS. This diagnostic displays the condition of the Genlock input circuit:

- 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) (-).

NOTE. *For all bits to move, the correct signal must be applied.*

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:

- Min (Raw) – The minimum raw ADC values of the positive LTC input.
- Max (Raw) – The maximum raw ADC values of the positive LTC input.

LTC NEG INPUT. This diagnostic displays the following:

- Min (Raw) – The minimum raw ADC values of the negative LTC input.
- Max (Raw) – The maximum raw ADC values of the negative LTC input.

GPS7 module factory default settings

The following table shows the factory default settings for the GPS7 module. These settings are recalled when you select **Factory Default** from the **PRESET : RECALL** menu item in the mainframe main menu.

Table 3-24: GPS7 module factory default settings

Menu item name	Submenu item name	Settings
REFERENCE		
	SOURCE	GPS Signal
	LOSS LOCK ACTION	Stay at current frequency
	HOLDOVER RECOVERY	Stay legal

Table 3-24: GPS7 module factory default settings (cont.)

Menu item name	Submenu item name	Settings
SELECT OUTPUT		
Black 1 Black 2 Black 3	INPUT-OUTPUT (Black 1 only)	Output (if allowed) ***NOTE.*** *INPUT-OUTPUT selection for Black 1 is not available on earlier GPS7 modules without the REF IN input connector.*
	FORMAT	NTSC
	Field Reference	Disable ***NOTE.*** *This setting appears for non-HD formats only.*
	TIMING (offset)	Vertical: 0 lines Horizontal Coarse: 0 µs Horizontal Fine: 0 ns
	TIMECODE	Source: Disable Offset: + 00:00:00:00 30 Drop: Enable 30 Drop Frame VITC VITC 1 Output: Disable Line Number: 14 VITC 2 Output: Disable Line Number: 16
	BLANK ON REFERENCE UNLOCK (Black 2 only)	No
HD TRI-LEVEL SYNC RATE		Non-integer
GPS SETUP		Antenna Power: Off Position: Fixed Acquire Position: Press Enter to reacquire Fixed Position Signal Warning (threshold) : 6 – Locked >- - - - -

Table 3-24: GPS7 module factory default settings (cont.)

Menu item name	Submenu item name	Settings
TIME SETUP		
	SELECT MENU	TIME OF DAY menu Source: GPS Signal Internal: 2008-01-01 00:00:00
		TIME ZONE OFFSET menu + 00:00
		DST SCHEDULE menu Enable: Off
		PROGRAM TIME menu Setup: Initial Time: 00:00:00
		JAM SYNC menu Enable: ON
		LEAP SECOND menu Setup: Scheduled Time: 00:00:00
		ALARM TIME menu Enable: Off Setup: Alarm Time: 00:00:00
		ALARM DELAY menu GPO Loss of Lock: 00:00:10 GPO Signal Warning: 00:00:10 Black 2 Blank On Unlock: 00:00:10
SELECT LTC		
LTC 1 LTC 2 LTC 3 LTC 4	INPUT-OUTPUT (LTC 1 only)	Output (if allowed) ***NOTE.*** *INPUT-OUTPUT selection for LTC 1 is not available on earlier GPS7 modules without the REF IN input connector.*
	TYPE	30 fps drop frame
	SOURCE	Time of Day
	OFFSET	+ 00:00:00:00
	TIMING	Delay: 0.00 ms
	OUTPUT LEVEL	Level: 2.0 Volt
SELECT GPIO		
	INPUT 1	Trigger Select: None
	OUTPUT 1 OUTPUT 2	Alarm Select: None

HD3G7 HD 3 Gb/s SDI Video Generator module

This section describes the module-specific functions of the HD3G7 HD 3 Gb/s SDI Video Generator module. Refer to the following locations for additional information about this module:

- *HD3G7 module connectors* for a description of the rear-panel connectors. (See page 2-15.)
- *HD3G7 module functional check* for a basic procedure to check that the module is functional. (See page 1-35.)
- *TG8000 Specifications and Performance Verification Technical Reference* for module specifications and for a detailed procedure to verify that the module is functioning as specified.
- *TG8000 Programmer Manual* for information about the commands to remotely control the module.

HD3G7 module product description

The HD3G7 HD 3 Gb/s SDI Video Generator module can be operated in either of the following two modes:

- Generator: The module can output 3 Gb/s SDI and 1.5 Gb/s HD-SDI video test signals in a variety of formats, including both Level A and Level B mapping structures for 3G-SDI signals. (See page 3-153, *To select the Generator mode on the HD3G7 module*.)
- Converter: The module can convert a number of HD-SDI input signal formats to a variety of 3G-SDI output signal formats, with up to 32 channels embedded digital audio and ancillary data copied from input signal to output signal. (See page 3-155, *To select the Converter mode on the HD3G7 module*.)

The module provides the following features:

- Two serial digital outputs for 1.5 Gb/s and 3 Gb/s signals.
- One HD-SDI input for use as the converter input.
- One clock/frame/line trigger output.
- Generates test signals in many formats, with both 3G-SDI Level A and Level B mapping structures supported.
- Standard test signals, including SMPTE color bars and SDI pathological test patterns.
- Zone plate test signals, with full control of all parameters.
- Generates a moving picture by scrolling the active picture area of the output test signal.
- Up to 32 channels of 24-bit embedded digital audio with a sample rate of 48 kHz.
- AV Timing mode.
- Timing adjustment anywhere in the frame for the output. The clock resolution is 6.75 ns (1/148.5 MHz) for fast progressive signals (50p, 59.94p, and 60p). Clock resolution for other signals is 13.5 ns.
- Timecode generator with ATC-LTC or ATC-VITC.
- Full remote control using Ethernet interface.
- SMPTE 352M payload identifier.
- User-defined ancillary data packet.

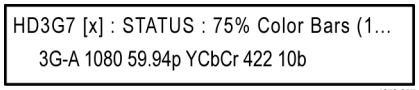
How to operate the HD3G7 module

After the module is installed in the mainframe, and the mainframe is installed in the rack or other location where it will be used, use the following procedure to access each function of the module:

1. Connect the power cord to the power connector on the rear panel, and then plug the cord into the AC electric power source. Electric power is supplied to the mainframe.
2. Wait until the power-on initialization process is complete, and then check that no error messages appear on the display.
3. After the initialization process is complete, the mainframe main menu appears as shown below:

3036-008

4. Press the front-panel **MODULE** button until the HD3G7 module main menu appears as shown below:



1970-257

5. Select the frame rate using the **FORMAT** button, or select the test signal using the test signal front panel buttons, such as **COLOR BARS** or **LINEARITY**. To learn how to set the instrument to convertor mode, refer to the following page. (See page 3-153, *To select an output signal on the HD3G7 module*.)
6. Use the front-panel arrow buttons to navigate and select items in the main menu and submenus. For example, when the **OUTPUT MODE** menu is displayed, pressing the left (◄) or right (►) arrow button allows you to select between output modes such as Level A, Level B, HD, etc.

   Refer to *HD3G7 module main menu* for detailed information about the main menu items and the submenu items. (See page 3-178.)

NOTE. *In addition to the factory installed signal sets, there are enhanced signal sets available for the HD3G7 module. These signal sets are located on the TG8000 SW Library and Documentation DVD that was supplied with your instrument. (See page 3-164, To install the HD3G7 module enhanced signal sets.)*

To select an output signal on the HD3G7 module

The HD3G7 module has two modes of operation: converter or generator. To select an output signal, perform the appropriate procedure below for your selected mode of operation.

To select the Generator mode on the HD3G7 module

Use this mode to generate either 3 Gb/s SDI or 1.5 Gb/s HD-SDI video test signals.

1. Select the output mode for the signal. (See page 3-156, *To select the output mode on the HD3G7 module*.)
2. Select the signal format for the output signal. (See page 3-157, *To select the signal format on the HD3G7 module*.)
3. Select the sample structure and depth for the output signal. (See page 3-157, *To select the sample structure and depth on the HD3G7 module*.)
4. Select the test signal that you want to generate. (See page 3-158, *To select the test signal on the HD3G7 module*.)

Table 3-25: HD3G7 module Generator mode – 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 3-26: HD3G7 module Generator mode – 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 3-27: HD3G7 module Generator mode – 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 3-28: HD3G7 module Generator mode – 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 3-29: HD3G7 module Generator mode – 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 3-30: HD3G7 module Generator mode – 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 3-31: HD3G7 module Generator mode – 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 3-32: HD3G7 module Generator mode – 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 3-33: HD3G7 module Generator mode – 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					

To select the Converter mode on the HD3G7 module

Use this mode to convert an HD-SDI signal to a 3G-SDI signal.

1. Choose a compatible input and output from the following three tables, and then connect the input signal to the **SDI IN** connector on the HD3G7 module.
2. Configure the output mode, signal format, and sample structure as described on the following pages. (See page 3-156, *To select the output mode on the HD3G7 module*.)
3. Press the **OTHER** test signal button to initiate the converter mode.

NOTE. *Press any other test signal button to cancel the converter operation and return the instrument to generator mode.*

Table 3-34: HD3G7 module Converter mode – 3G Level A 1920 × 1080 formats

HD Input Signal			1080i			1080p					1080i			1080psf				
			59.94	50	60	23.98	24	25	29.97	30	50	59.94	60	23.98	24	25	29/97	30
Output Format			59.94i	50i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
Output sample structure																		
YCbCr	4:4:4	12b	Not available															
		10b																
YCbCr	4:2:2	12b																
		10b									X	X	X					
GBR	4:4:4	12b	Not available															
		10b																
GBR+A		10b																

Table 3-35: HD3G7 module Converter mode – 3G Level B (1920 × 1080)

HD Input Signal			1080i			1080p					1080i			1080psf				
			59.94	50	60	23.98	24	25	29.97	30	50	59.94	60	23.98	24	25	29/97	30
Output Format			59.94i	50i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
Output sample structure																		
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

Table 3-35: HD3G7 module Converter mode – 3G Level B (1920 × 1080) (cont.)

HD Input Signal			1080i			1080p					1080i			1080psf				
			59.94	50	60	23.98	24	25	29.97	30	50	59.94	60	23.98	24	25	29/97	30
Output Format			59.94i	50i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
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

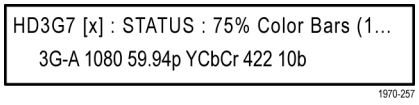
Table 3-36: HD3G7 module Converter mode – 3G Level B (2×HD 1920 × 1080)

HD Input Signal			1080i			1080p					1080i			1080psf				
			59.94	50	60	23.98	24	25	29.97	30	50	59.94	60	23.98	24	25	29/97	30
Output Format			59.94i	50i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
Output sample structure																		
YCbCr	4:2:2	10b	X	X	X	X	X	X	X	X				X	X	X	X	X

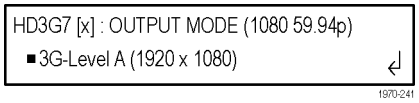
To select the output mode on the HD3G7 module

You can select how the generated 1.5 Gb/s or 3 Gb/s serial data stream is constructed. This selection is available in the HD3G7 **OUTPUT MODE** submenu. Perform the following steps to select the output mode:

1. Press the front-panel **MODULE** button until the HD3G7 module main menu appears as shown below.



2. Press the down (▼) arrow button to access the output mode menu, as shown below:



Note the dot at the start of the second line and the return symbol at the end of the second line. The dot indicates that this is the currently selected output mode, and the return symbol indicates that you can press the **ENTER** button to select a new displayed output mode.

3. Use the left (◄) or right (►) arrow button to scroll through the available output modes:

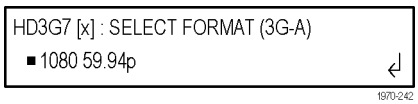
   3G–Level A (1920 × 1080)
   3G-Level A (1280 × 720)
   3G–Level A (2K × 1080)
   3G–Level B (1920 × 1080)
   3G–Level B (2K × 1080)
   3G–Level B (2×HD 1080)
   3G-Level B (2×HD 720)
   HD (1920 × 1080)
   HD (1280 × 720)

4. Press the **ENTER** button to select the desired output mode. Note that the dot will appear in front of the output mode on the display, to indicate that it is now the selected output mode.

To select the signal format on the HD3G7 module

Perform the following steps to select the signal format:

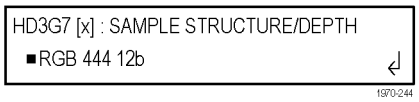
1. Press the **FORMAT** button. The menu display changes as follows:



2. Use the left (◄) or right (►) arrow button, or press the **FORMAT** button repeatedly, to select one of the signal formats, and then press the **ENTER** button to confirm the selection. The dot will appear at the left of the second line to indicate that the format has been selected.
3. Press the **BACK** button to exit FORMAT mode.

To select the sample structure and depth on the HD3G7 module

There are several sample structures to choose from when the output mode is set to a non-fast-progressive format. Press the down (▼) arrow button to navigate to the sample structure/depth selection shown below:



Press the left (◄) or right (►) arrow buttons to scroll through the available sample structures:

3G non-fast progressive formats (1080 line)

- RGB 444 12b
- RGB 444 10b
- RGBA 444 10b
- YCbCr 444 12b
- YCbCr 444 10b
- YCbCrA 444 10b
- YCbCr 422 12b
- YCbCrA 422 12b (Level B mapping only)

3G non-fast progressive formats (1080 line)

3G fast progressive format (1080 line)

- YCbCr 422 10b

3G formats (720 line)

- RGB 444 10b
- RGBA 444 10b
- YCbCr 444 10b
- YCbCrA 444 10b

2×HD formats (1080 and 720 line)

- YCbCr 422 10b

2K line formats

- XYZ 444 12b
- RGB 444 12b

HD format

- YCbCr 422 10b

When the desired sample structure is displayed, press the **ENTER** button to select it.

To select the test signal on the HD3G7 module

All of the signal sets that are available in the module are already assigned to the corresponding test signal buttons. (See Table 3-37.) When the HD3G7 module is selected and you press any of the front-panel test signal buttons, the selected signal in the signal set is output. (See Figure 3-76.)

For example, when you press the **COLOR BAR** test signal button, a signal in the Color Bars signal set is output. Use the left (◄) or right (►) arrow button, or press the **COLOR BAR** test signal button repeatedly to select a different signal from the Color Bars signal set.

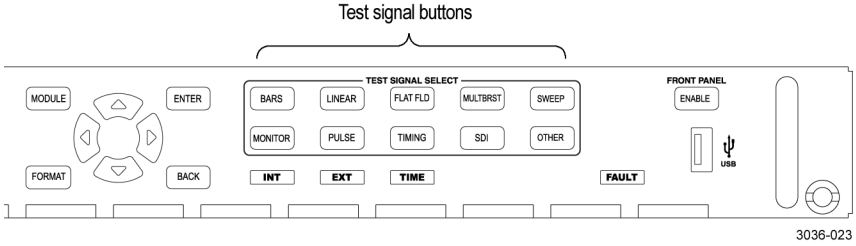


Figure 3-76: Front-panel test signal buttons

The following table lists the signal set assigned to each test signal button and the signals that can be selected in the signal set when the module is in generator mode.

Table 3-37: HD3G7 module signal sets assigned to the test signal buttons

Button name	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.
	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.
	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 HD3G7 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.
	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.
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.

Table 3-37: HD3G7 module signal sets assigned to the test signal buttons (cont.)

Button name	Signals in the signal set	Description
	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.
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 page 3-164, *To install the HD3G7 module enhanced signal sets*.)
	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 page 3-164, *To install the HD3G7 module enhanced signal sets*.)
	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 page 3-164, *To install the HD3G7 module enhanced signal sets*.)
	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 page 3-164, *To install the HD3G7 module enhanced signal sets*.)

Table 3-37: HD3G7 module signal sets assigned to the test signal buttons (cont.)

Button name	Signals in the signal set	Description
	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 page 3-164, *To install the HD3G7 module enhanced signal sets*.)
	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. (See page 3-164, *To install the HD3G7 module enhanced signal sets*.)
MULTIBURST	——	No test signals are currently available for the MULTIBURST signal set.
SWEEP	Circle, Diagonal Sine, H Sine, H Sweep, V Sine, V Sweep, Custom-1, Custom-2	Zone plate test signal with real-time parametric controls. (See page 3-165, *HD3G7 module zone plate signals*.)
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.
	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.

Table 3-37: HD3G7 module signal sets assigned to the test signal buttons (cont.)

Button name	Signals in the signal set	Description
	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 3-37: HD3G7 module signal sets assigned to the test signal buttons (cont.)

Button name	Signals in the signal set	Description
PULSE BAR	2T Pulse and Bar	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.
	Color Pulses	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.
TIMING	Co-siting Pulse	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.
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.
OTHER	——	For 3G output formats only. Use this button to select the converter mode of operation. Press any other test signal button to return to generator mode operation.(See page 3-155, *To select the Converter mode on the HD3G7 module*.)

To install the HD3G7 module enhanced signal sets

In addition to the factory installed signal sets, there are enhanced signal sets available for the FLAT FIELD button on the HD3G7 module. These signals are located on the *TG8000 SW Library and Documentation DVD* that was supplied with your instrument.

Perform the following steps to install the enhanced signal sets:

1. Install the *TG8000 SW Library and Documentation DVD* into the DVD drive on your computer.
2. Using the DVD browser, navigate to the following directory: Test Signals > HD3G7 Signal Library > Enhanced Signal Set.

   The Enhanced Signal Set directory contains the following files:

   - Monochrome Fields.xml — includes all monochrome flat fields from 0% to 100% in 10% increments.
   - Color Fields.xml — includes color fields for six primary and secondary colors at both 100% and 75% values.
   - SMPTE RP431-2 Color Patches.xml — includes full field patterns for each of the Black-White and Black-Dark Gray steps, plus the "–1" and "–2" color patches.
3. Use FTP to locate and copy the desired signal set file(s) from the DVD to the HD3G7/SIGNAL directory on your TG8000 generator. Instructions for using FTP are located in the *How to transfer files using FTP* section of this manual. (See page 2-65.)

NOTE. *If you load the Monochrome Fields.xml and Color Fields.xml enhanced signal sets on your TG8000 generator, you can delete the Flat Fields.xml file from the HD3G7/SIGNAL directory, since it contains a duplicate copy of a subset of the Monochrome Fields.xml and Color Fields.xml patterns.*

4. After you load the new signal set file(s) on the TG8000 generator, you must either reboot the TG8000 or perform the following SCPI command before the new signals will be available:

   OUTPut[1/2]:SYNThesizer:SIGNal:BUILd

   This command rebuilds the XML signal library and will detect any newly added signals.

To reinstall the factory default signal sets. To reinstall the factory default signal sets, perform the previous procedure to install the signal set files from the following directory on the *TG8000 SW Library and Documentation DVD*: Module Test Signal Library > HD3G7 Signal Library > Standard Signal Set.

After you reinstall the standard signal sets, delete the enhanced signal set file(s) from the HD3G7/SIGNAL directory, and then reboot the instrument.

HD3G7 module zone plate signals

Zone plate video test patterns, or simply “zone plates”, have become important tools for the evaluation of modern 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.

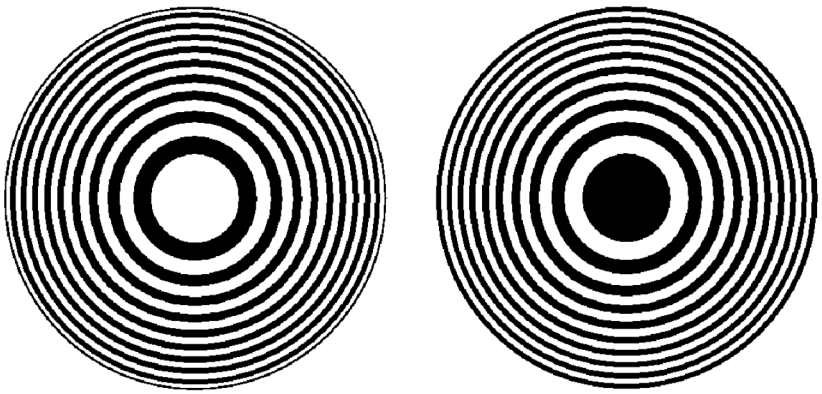


Figure 3-77: Optical zone plates (enlarged)

The HD3G7 module 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 select a zone plate signal on the HD3G7 module

Perform the following steps to select a zone plate signal for output:

1. Press the **SWEEP** test signal button to enter the zone plate signal menu. Once you enter the zone plate signal menu, the HD3G7 generator module will start to output the displayed zone plate signal. The dot in front of the signal name, on the second line of the display, indicates the selected default signal.
2. Use the left (◄) or right (►) arrow button to select a zone plate signal from the provided six standard zone plate signals (Circle, Diagonal, Horizontal Sine, Horizontal Sweep, Vertical Sine, or Vertical Sweep), or from the two user-defined signals (Custom-1 Zoneplate or Custom-2 Zoneplate).

   The zone plate signal whose name is displayed will continue to be output until a different signal is selected, even if you press the **BACK** button.

   If you select a different signal, such as a color bar signal, and then press the **SWEEP** button again, the last displayed zone plate signal will be shown as the default and will again be the output signal.

To modify a zone plate signal on the HD3G7 module

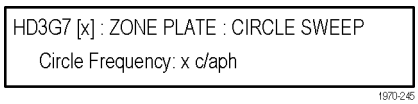
There are times when a specific test case requires a modified zone plate signal. By making and saving changes to the zone plate parameters you can create a new signal that is based on the selected signal, and then save that new signal. Changes you make affect only the new signal; the standard zone plate 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 (below) and zone plate pattern dependent parameters. (See page 3-170, *HD3G7 module zone plate dependent parameters*.)

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

1. Press the **SWEEP** button to enter the zone plate signal menu.
2. 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).

3. 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:



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

4. 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.*

5. 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.

6. When you are done altering parameters, scroll to the **Save As:** selection, at the bottom of the menu and use the left (◄) or right (►) arrow button to select **User Custom 1** or **User Custom 2**.

7. Press the **ENTER** button to save the modified signal.

HD3G7 module 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 HD3G7 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 HD3G7 Generator module 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 3-38.) 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 3-38: HD3G7 module zone plate pattern control parameters

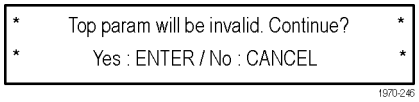
Zone plate signal	Pattern control parameter	Parameter definition
Circle	Circle Frequency (maximum c/aph)	The circle frequency is actually the equivalent of the maximum vertical sinusoid frequency at the very top and bottom of the screen (see the discussion of the K_Y 2 parameter). Adjusting the circle 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 KX and KY 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 MHz/2 = 37.125 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_Y 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_Y 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_Y 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_Y2/K_Y)/2). For example, in a standard with 1080 lines per field, a vertical sweep frequency of 2160 c/aph2 would result in one complete frequency sweep down the picture.

HD3G7 module 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:



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 3-78.)

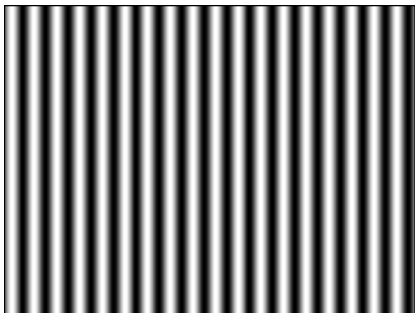


Figure 3-78: A "K_X-only" zone plate

K_X^2 parameter

Display name: KX^2 (H Sweep.)

Units: c/aph per active picture height (c/aph^2)

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:

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

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 3-79.)

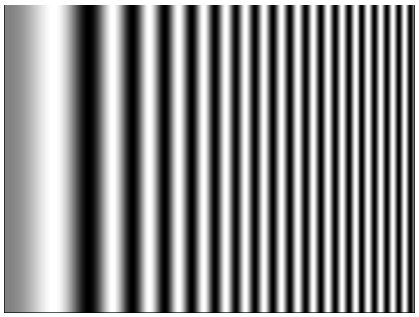


Figure 3-79: A "K_X^2-only" zone plate

K_{XY} parameter

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

Units: c/aph per active picture height (c/aph^2)

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 HD3G7 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 3-80.)

Figure 3-80: A "K_Y-only" zone plate

K_Y^2 parameter

Display name: KY^2 (V Sweep).

Units: c/aph per active picture height (c/aph^2)

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 3-81.)

Figure 3-81: A "K_Y^2-only" zone plate

K parameter

Display name: K (Phase)

Units: cycles

The $K_\varnothing$ 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 $K_\varnothing$. 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 $K_\varnothing = 0.25$, the pattern will begin in the upper left corner of the screen as white; when $K_\varnothing = –0.25$, 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 KY 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: KT^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 YCbCr 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_T2) 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_T2) 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**.

How to use zone plate signals on the HD3G7 module

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 HD3G7 generator module'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 × 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.

HD3G7 module main menu

Use the HD3G7 module main menu to perform the following tasks:

- Set the video signal output mode.
- Scroll the active picture area of the output signal.
- Change the sample structure and color space.
- Control the Embedded Audio characteristics: frequency, amplitude, click rate, and sampling rate.
- Set the timing offset of the outputs relative to an internal reference signal or an external reference signal.
- Enable or disable the Timecode and set the timecode parameters.
- Enable or disable the discrete components of the video output signal.
- Enable or disable the user-defined ancillary data payload and set the payload structure.
- Enable or disable the SMPTE 352M Payload identifier.
- Set the line, frame, or clock rate as a trigger for an external instrument, such as an oscilloscope.
- Select between a test signal or a black signal for the secondary (SIGNAL 2) output.
- View diagnostics, operation parameters, and CRC error counts from the video input.
- Access output calibration (only available when in factory mode).

Use the up (▲) or down (▼) arrow button to scroll through the main menu. The following figures show the HD3G7 module main menu.

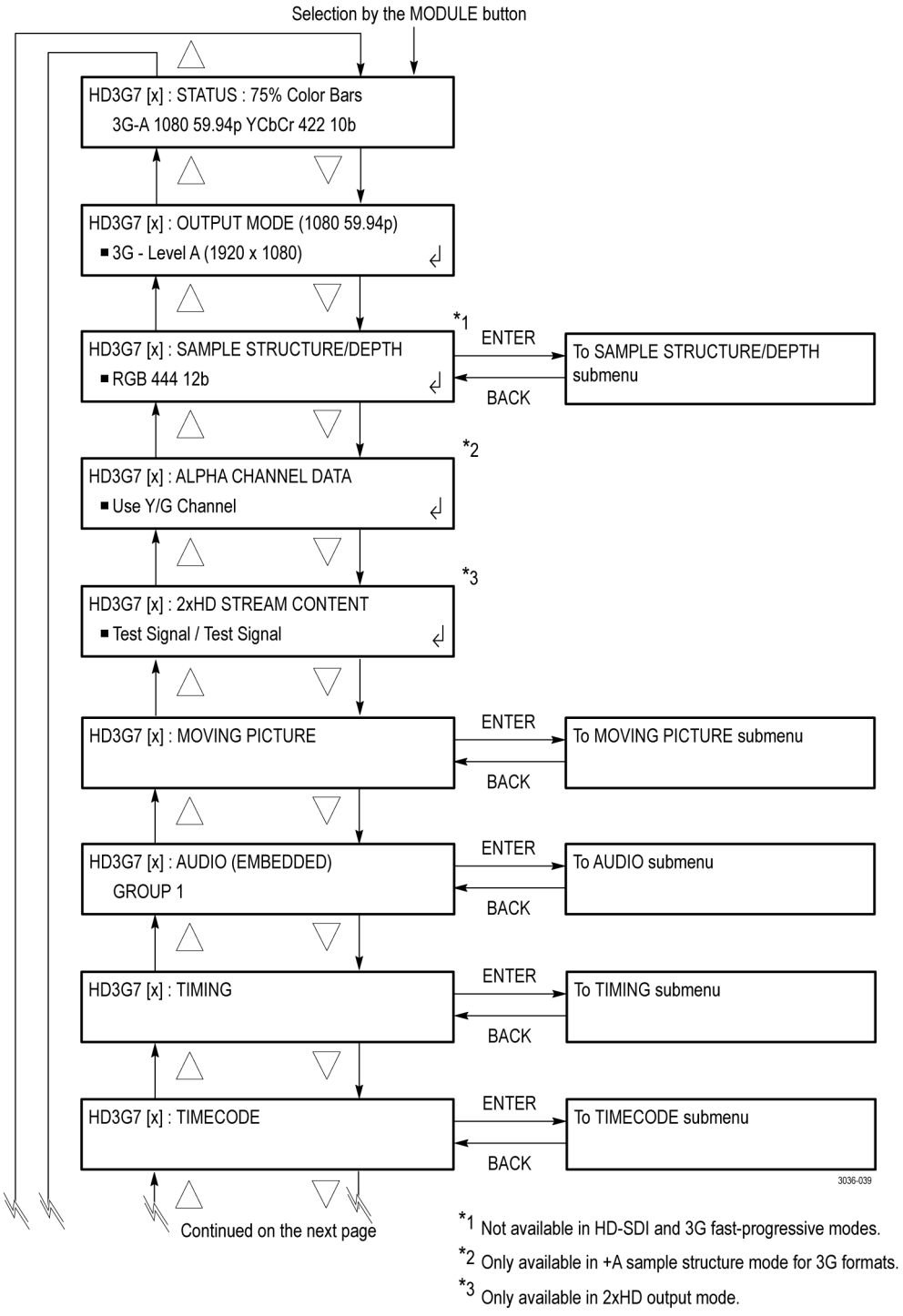


Figure 3-82: HD3G7 module main menu

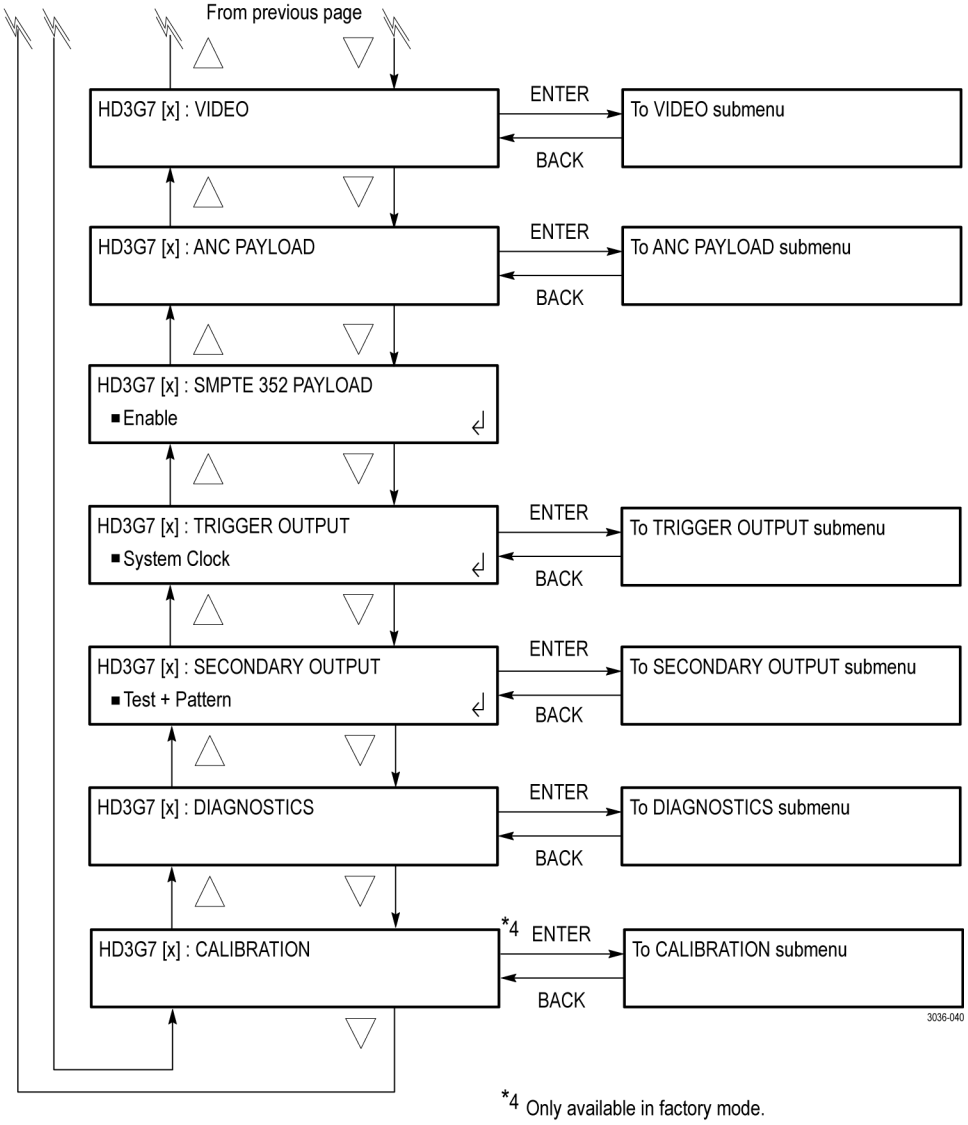


Figure 3-83: HD3G7 module main menu (Continued)

STATUS. Displays the instrument operating mode, output signal format, and output sample structure. (See page 3-183, *HD3G7 module STATUS menu*.)

OUTPUT MODE. Selects the mapping format of the output signal to **Level A** (direct image format mapping), **Level B** (SMPTE 372M dual link mapping), as described by SMPTE 425, or **HD-SDI**.

Within Level A and Level B there are also selections for 1920 × 1080, 2K × 1080, and 1280 × 720 (Level A only) formats. Also, for Level B only, there are selections for 2×HD 1920 × 1080 and 2×HD 1280 × 720 formats. The 2×HD mode produces two standard HD streams in the same format (e.g. 1080). Select between Test Signal/Test Signal or Test Signal/Black for the two streams. (See page 3-184, *HD3G7 module OUTPUT MODE submenu*.)

SAMPLE STRUCTURE/DEPTH. 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 non-fast progressive formats (1080 line)

- RGB 444 12b
- RGB 444 10b
- RGBA 444 10b
- YCbCr 444 12b
- YCbCr 444 10b
- YCbCrA 444 10b
- YCbCr 422 12b
- YCbCrA 422 12b (Level B mapping only)

3G fast progressive format (1080 line)

- YCbCr 422 10b

3G formats (720 line)

- RGB 444 10b
- RGBA 444 10b
- YCbCr 444 10b
- YCbCrA 444 10b

2×HD formats (1080 and 720 line)

- YCbCr 422 10b

2K line formats

- XYZ 444 12b
- RGB 444 12b

HD format

- YCbCr 422 10b

ALPHA CHANNEL DATA. 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. This menu item appears only when the sample structure is set to "+A" for 3G signal formats. 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. Selects the content for the first and second HD signals on link A and link B. This menu item appears only when the signal format is set to 2×HD. 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.

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 **MOVING PICTURE** submenu. (See page 3-185, *HD3G7 module MOVING PICTURE submenu*.)

AUDIO (EMBEDDED). Sets the parameters for embedded audio on the serial digital signals. Use the left (◄) or right (►) arrow button to select **Group 1**, **Group 2**, **Group 3**, or **Group 4**. Once the group is selected, press the **ENTER** button to access the **AUDIO GROUP** submenu. (See page 3-186, *HD3G7 module AUDIO (EMBEDDED) submenu*.)

If Level B mapping is selected, all four groups are available in both Link A and Link B, for a total of eight groups.

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 **TIMING** submenu. (See page 3-189, *HD3G7 module TIMING submenu*.)

TIMECODE. Use this menu to set timecode parameters for the selected output. Press the **ENTER** button to access the **TIMECODE** submenu. (See page 3-190, *HD3G7 module 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. Select this menu item, and then press the **ENTER** button to access the **VIDEO** submenu. (See page 3-192, *HD3G7 module VIDEO submenu*.)

ANC PAYLOAD. Use this menu to define and control the user-defined ANC payload insertion. Press the **ENTER** button to access the **ANC Payload** submenu. (See page 3-194, *HD3G7 module ANC PAYLOAD submenu*.)

SMPTE 352 PAYLOAD. 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 signal stream. In most cases the SMPTE 352M payload setting should be* ***Enable****.*

TRIGGER OUTPUT. Allows you to select a line rate, frame rate, or the module system clock as a trigger for an external instrument, such as an oscilloscope. (See page 3-201, *HD3G7 module TRIGGER OUTPUT submenu*.)

SECONDARY OUTPUT. Use the left (◄) or right (►) arrow button to select between a Test Signal or a Black output for the secondary (bottom) BNC connector. (See page 3-201, *HD3G7 module SECONDARY OUTPUT submenu*.)

DIAGNOSTICS. Allows access to the outputs of several diagnostics, shows operation parameters for the module, and allows you to clear the counts of CRC errors that are detected in the input signal. This menu provides status information only and does not affect operating behavior. Select this menu item, and then press the **ENTER** button to enter the DIAGNOSTICS submenu. (See page 3-202, *HD3G7 module DIAGNOSTICS submenu*.)

CALIBRATION. Provides a variety of special signals to help measure amplitude and rise time, and allows you to adjust serial output amplitude. This menu is accessible in factory mode only. (See page 3-204, *HD3G7 module CALIBRATION submenu*.)

HD3G7 module STATUS menu

Displays the instrument operating mode, output signal format, and output sample structure. Examples of the STATUS display are shown below for each of the operating modes (generator and converter).

Generator Mode: The following figure shows an example STATUS display when the module is in generator mode.

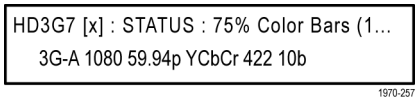
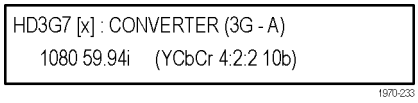


Figure 3-84: HD3G7 module STATUS menu in generator mode

- **75% Color Bars (100% White):** Indicates the name of the signal currently being generated.
- **3G-A:** Indicates the 3 Gb/s signal and the level currently being generated.
- **1080 59.94p:** Indicates the output format.
- **YCbCr 4:2:2 10 bits:** Indicates the output sampling structure.

Converter Mode: The following figure shows an example STATUS display when the module is in the converter mode.



- **Converter (3G-A):** Indicates that the incoming HD SDI video stream is being converted.

- **1080 59.94i:** Indicates the incoming signal format. If there is no input or the format is not the correct rate, the following messages will appear on the second line of the LCD: “No Input Signal” or “Input Signal Error (Check FORMAT)”.
- **YCbCr 4:2:2 10b:** Indicates the output sampling structure.

HD3G7 module OUTPUT MODE submenu

Select Level A or Level B as the serial link multiplexing method, or select HD mode. Use the left (◄) or right (►) arrow button to select from the Level A, Level B or HD choices listed below. Press the ENTER button to confirm the selection. The following figure shows the OUTPUT MODE submenu.

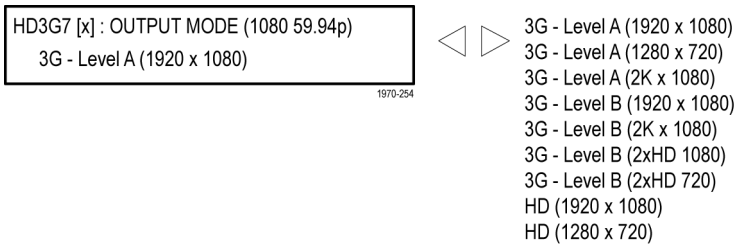


Figure 3-85: HD3G7 module OUTPUT MODE submenu

Level A. 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.

Level B. 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.

2K × 1080. Available in both Level A and Level B mapping, this selection provides 2048 × 1080 resolution signals, primarily for digital cinema applications.

2×HD. Available in Level B mapping, 2×HD signals provide two standard SMPTE 292 HD streams in the same format (for example 1080i 59.94). Select between Test Signal/Test Signal or Test Signal/Black for the two streams.

HD. Available when the HD mode is selected. The output is a 1.485 Gb/s SMPTE 292 compliant signal.

HD3G7 module 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.

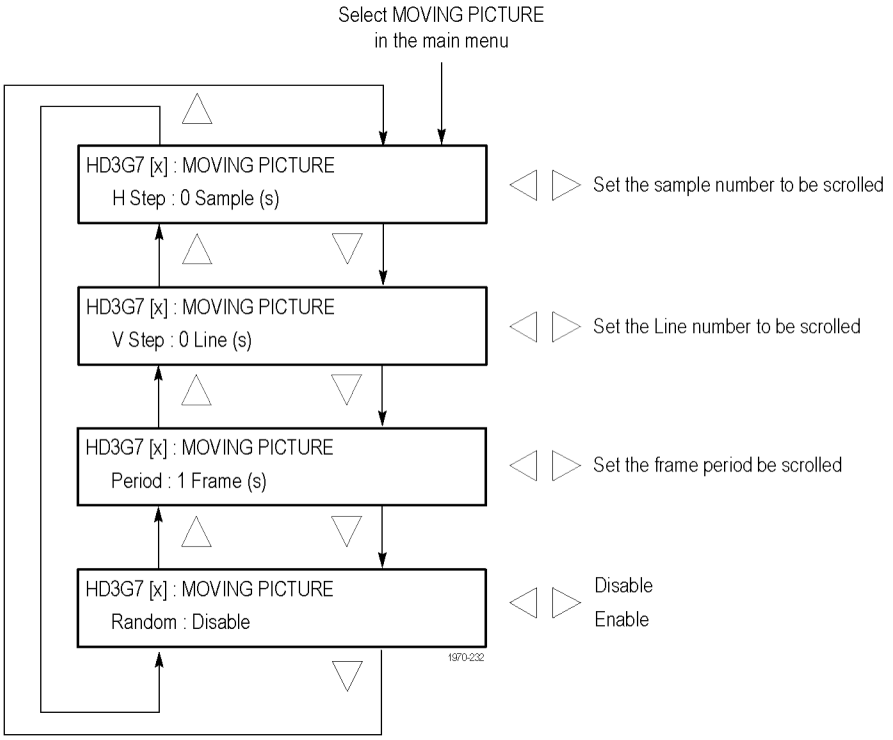


Figure 3-86: HD3G7 module MOVING PICTURE submenu

NOTE. *Moving picture mode is not available with zone plate signals. However, zone plate signals may be defined with motion in the zone plate parameters. (See page 3-166, To modify a zone plate signal on the HD3G7 module.)*

H 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.

V 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.

HD3G7 module AUDIO (EMBEDDED) submenu

Use this menu to select the audio group. For HD-SDI and 3G Level A mapping, you may select audio group 1, 2, 3, or 4. For 3G Level B mapping, 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. The following figure shows the AUDIO (EMBEDDED) Audio Group submenu. (See Figure 3-87.)

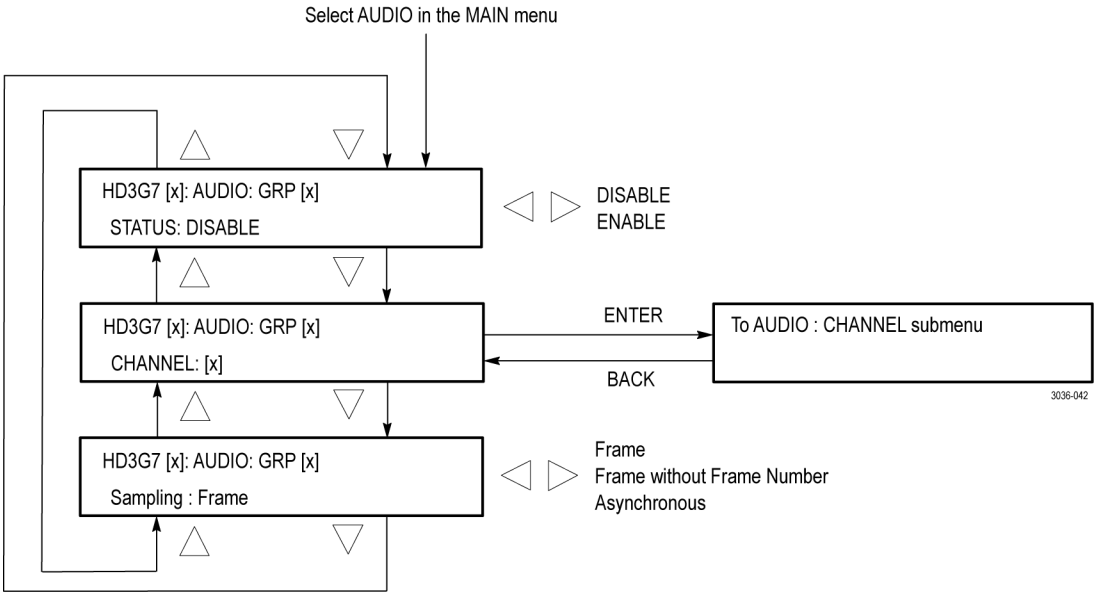


Figure 3-87: HD3G7 module AUDIO (EMBEDDED) submenu

STATUS. Use this menu to enable or disable the embedded audio output for the selected 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 channel 1, 2, 3, or 4, and then press the **ENTER** button to enter the AUDIO : CHANNEL submenu. The CHANNEL submenu allows you to set the frequency, amplitude, click rate, and channel origin ID for the selected audio channel. The following figure shows the AUDIO : CHANNEL submenu.

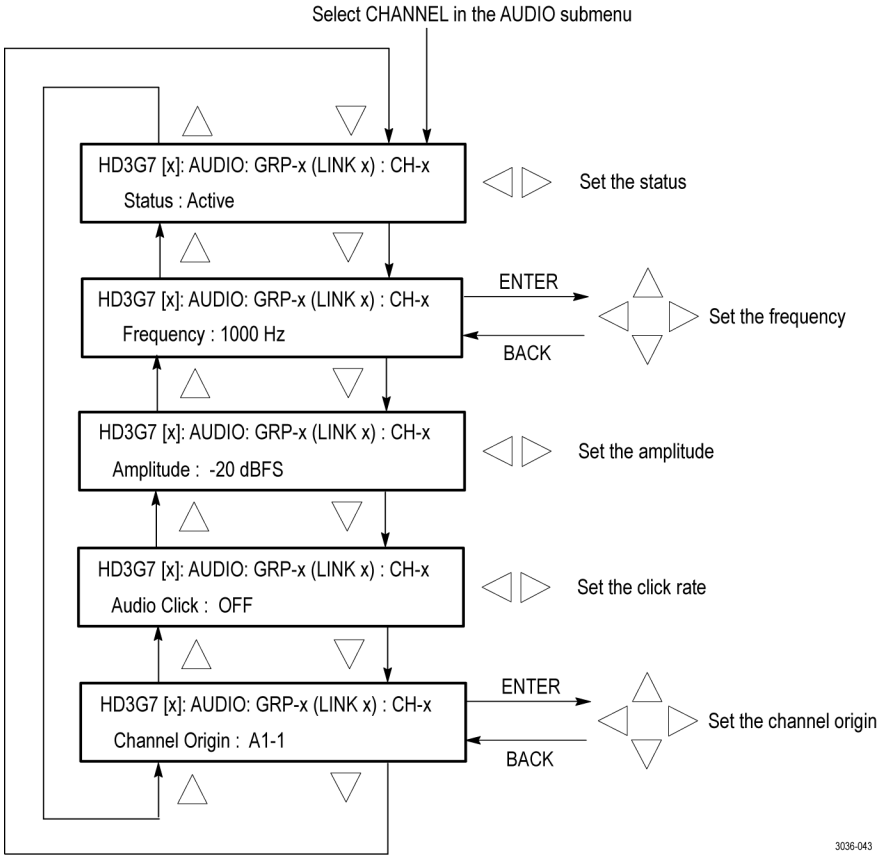


Figure 3-88: HD3G7 module AUDIO : CHANNEL submenu

- **Status:** Use this menu to set the status of the individual 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 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 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 it.
- **Audio Click:** Use this menu 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 to set a channel origin ID of up to four ASCII characters. 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 Channel Origin ID.

Sampling. Use this menu 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.

HD3G7 module 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 TIMING submenu.

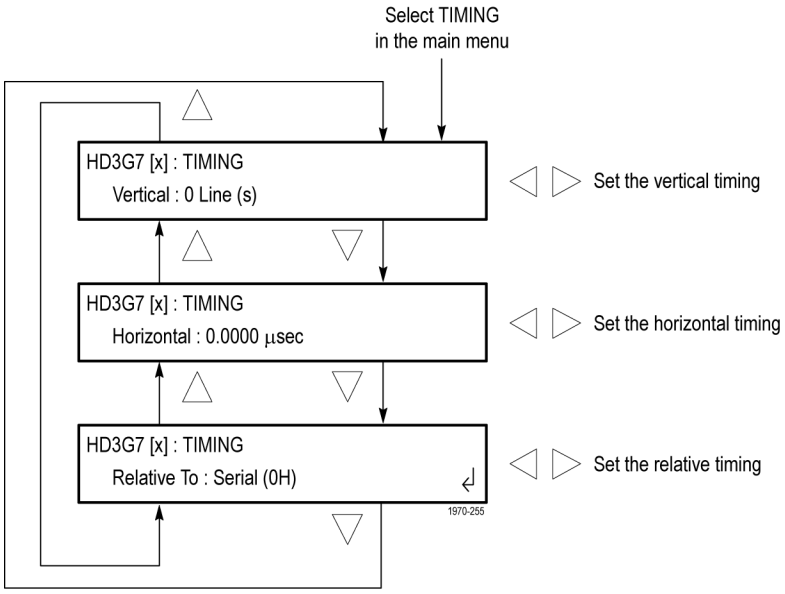


Figure 3-89: HD3G7 module TIMING submenu

Vertical. Sets the vertical timing offset. Use the left (◄) or right (►) arrow button to change the timing offset. You can set the value from –1/2 to +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. Use the left (◄) or right (►) arrow button to change the timing offset. 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) 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).

HD3G7 module TIMECODE submenu

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

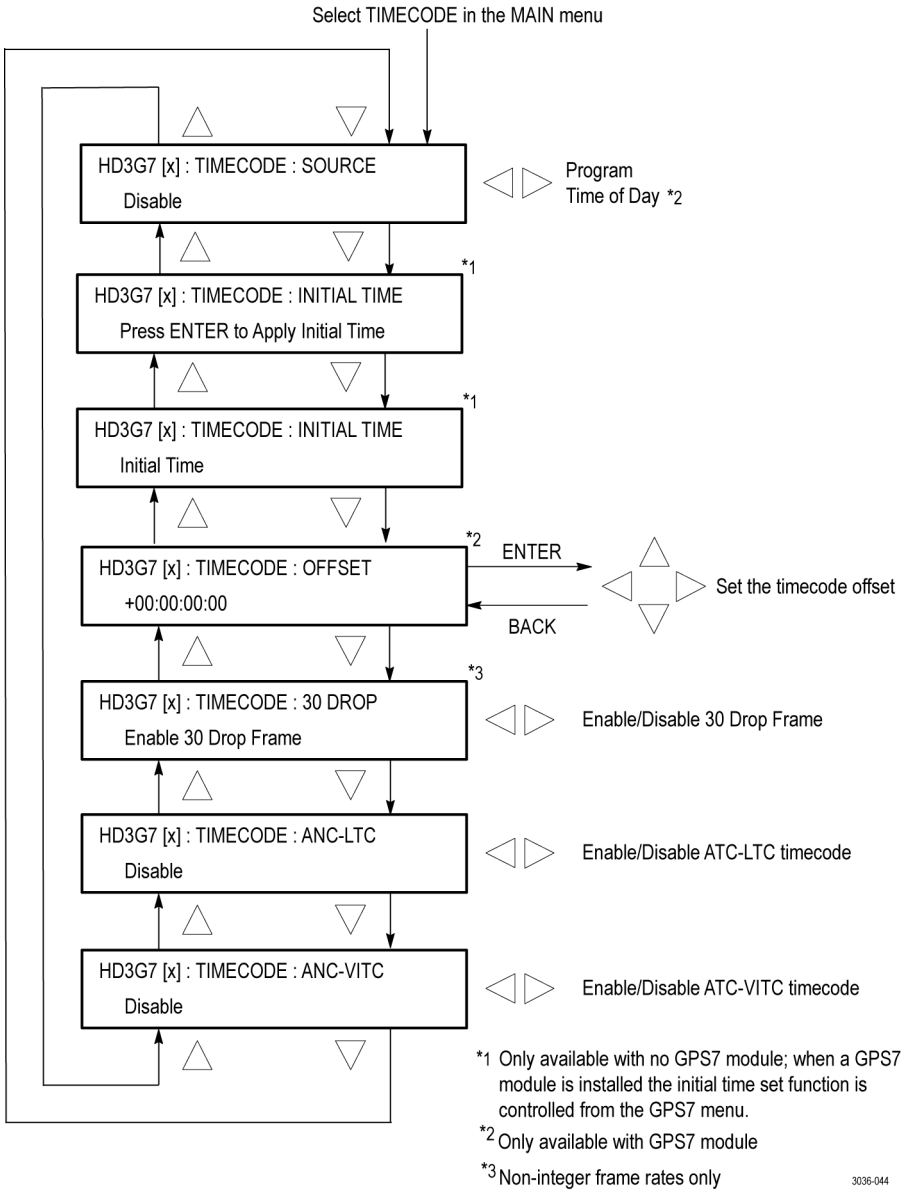


Figure 3-90: HD3G7 module TIMECODE submenu

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 GPS7 module. This selection is available only if a GPS7 module is installed in the instrument.

Press ENTER to apply initial time. Press the **Enter** button to apply the initial time. Initial time is set in the next menu item. This selection is available only when there is no GPS7 module installed in the instrument. When a GPS7 module is installed, it controls this function.

Initial Time. Use this menu selection to set the Initial Time. 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 time. Press the **ENTER** button to confirm the time. This selection is available only when there is no GPS7 module installed in the instrument. When a GPS7 module is installed it controls this function.

Offset. Use this menu selection to set a Timecode Offset for the HD3G7 module outputs. This is an offset from the timecode input from a GPS7 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 selection is available only when a GPS7 module is installed in the instrument.

30 DROP. Use this menu to enable or disable the 30 Drop Frame. 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 selection is available only for non-integer frame rates.

ATC-LTC. Use this menu selection to enable or disable the Ancillary Linear Time Code. 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 selection to enable or disable the Ancillary Vertical Interval Time Code. Use the left (◄) and right (►) arrow buttons to select between **Enable** and **Disable**, and then press the **ENTER** button to confirm the selection.

HD3G7 module VIDEO submenu

Use this menu to turn each serial digital video component on or off individually (generator mode only), and to disable the edge filter and the AV Timing mode. Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the 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 when a parameter has been changed in this menu.*

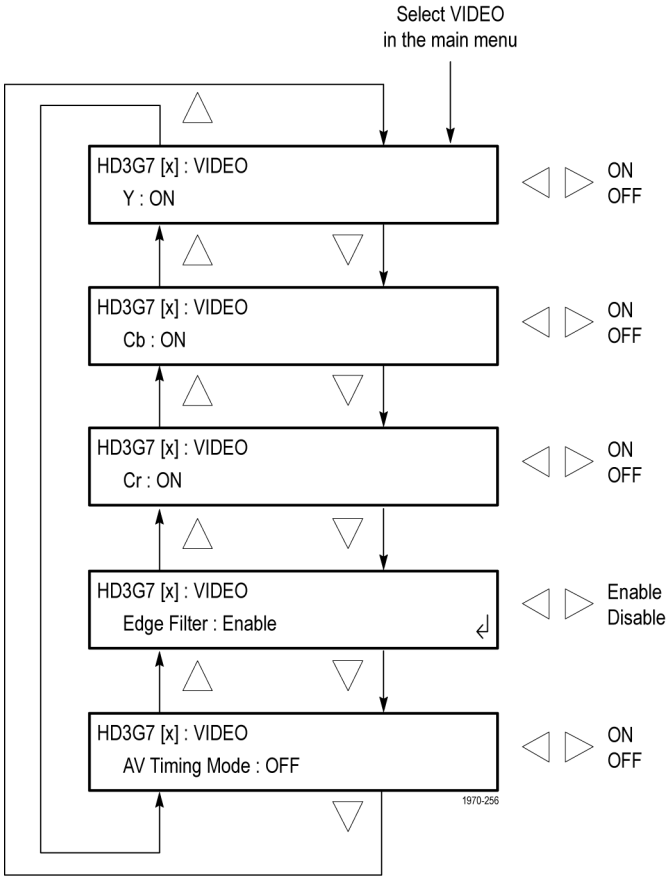


Figure 3-91: HD3G7 module VIDEO submenu

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 **ON** and **OFF**. 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 **ON** and **OFF**. 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 **ON** and **OFF**. 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.

NOTE. *Software versions of the HD3G7 module prior to V5.5 included a 2K TEST SIGNAL KEY ASSIGN menu to select projector-specific test patterns that had no edge filtering. With software version V5.5, this functionality has been replaced by the Edge Filter submenu, which can be applied to any test signal.*

AV Timing Mode. Turns the AV Timing Mode on or off. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. 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.

HD3G7 module 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 HD3G7 module addresses User Data Words 000 through 254.

The following figures show the ANC PAYLOAD submenu.

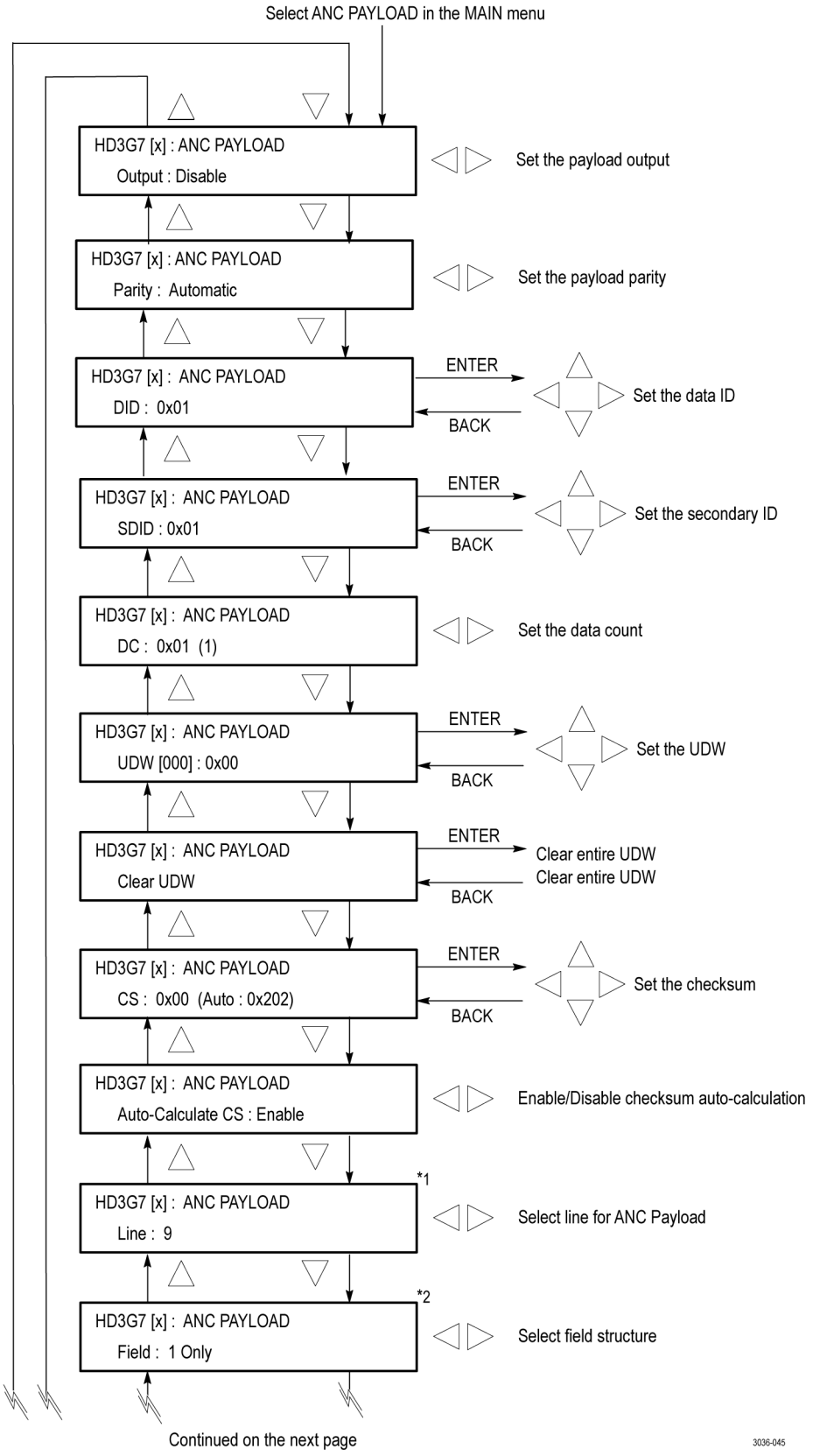


Figure 3-92: HD3G7 module Ancillary Payload submenu

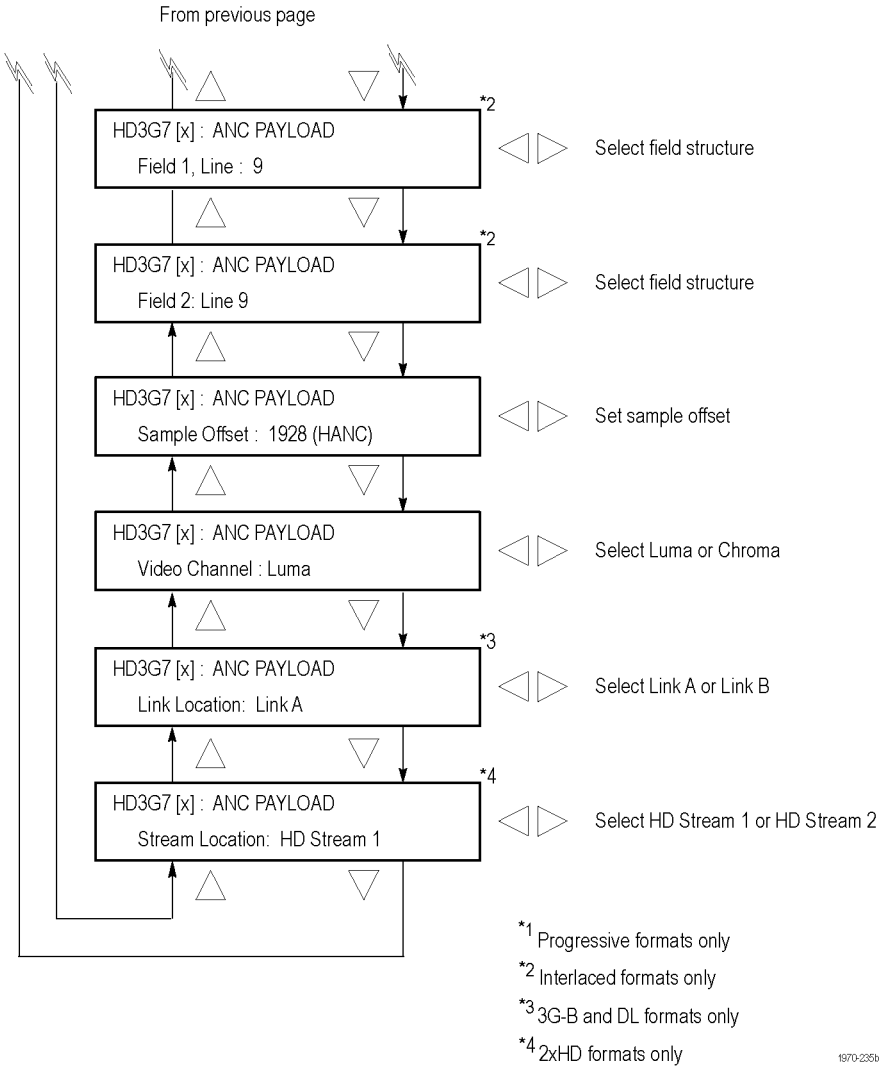


Figure 3-93: HD3G7 module Ancillary Payload submenu (Continued)

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

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 selection 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 selection 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 : CANCEL	*

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 selection 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 selection 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 selection to set the line to carry the ancillary data payload. Use the left (◄) and right (►) arrow buttons to set the line number. This menu selection is available only in progressive formats.

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

Field 1: Line. Use this menu selection 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 selection is available only in interlaced formats.

Field 2: Line. Use this menu selection 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 selection is available only in interlaced formats.

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

Video Channel. Use this menu selection 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 selection 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 selection 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 selection is available only in 2×HD formats.

NOTE. *This is an example only. Inserting an AFD packet will not affect the video produced by the HD3G7 module.*

HD3G7 module ancillary data payload example

As an example, one of the ancillary data payloads that can be easily generated by the HD3G7 module 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:

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 HD3G7 module 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:

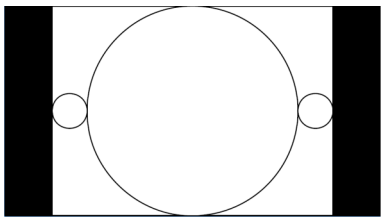


Figure 3-94: AFD code “1001” for a 16:9 coded frame

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.

HD3G7 module TRIGGER OUTPUT submenu

Use this menu to select line rate, frame rate, or the system clock of the module to trigger an external instrument. The following figure shows the TRIGGER OUTPUT submenu.

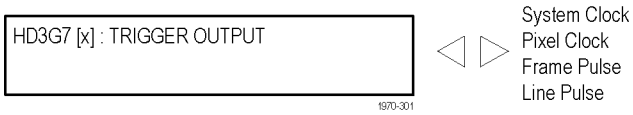


Figure 3-95: HD3G7 module TRIGGER OUTPUT submenu

System Clock. The system clock is a low-jitter clock signal, which runs at the parallel clock rate for 3G formats or twice the parallel clock rate for HD formats.

Pixel Clock. The pixel clock is an internal parallel rate clock (a low frequency clock related to the pixel rate of the video signal).

Frame / Field Pulse. The trigger pulse is produced at the field or frame rate of the video signal. In interlaced and segmented-frame formats, this produces a frame-rate square wave that is low during field one and high during field two. In progressive formats the output is high during the vertical blanking period, producing a field-rate pulse. [1]

Line Pulse. The trigger pulse output is high during the horizontal blanking period, producing a line-rate pulse. [1]

[1] The Frame/Field Pulse and Line Pulse signals are derived from the EAV and SAV XYZ byte H, V, and F bits, just prior to the parallel data entering the serializer; therefore these pulses can be used to approximate the signal timing.

HD3G7 module SECONDARY OUTPUT submenu

Use the left (◄) or right (►) arrow button to select between a Test Signal or a Black output for the secondary (Signal 2) BNC connector, and then press the **ENTER** button to confirm the selection.

NOTE. *When set for a Test Signal, the Signal 2 output is the same as the Signal 1 output. When set to Black, the black signal is the same format and sample structure as the Signal 1 output.*

HD3G7 module DIAGNOSTICS submenu

Use this menu to view operation parameters for the HD3G7 module. Module diagnostics provide status information only and do not affect operating behavior. The following figure shows the DIAGNOSTICS submenu.

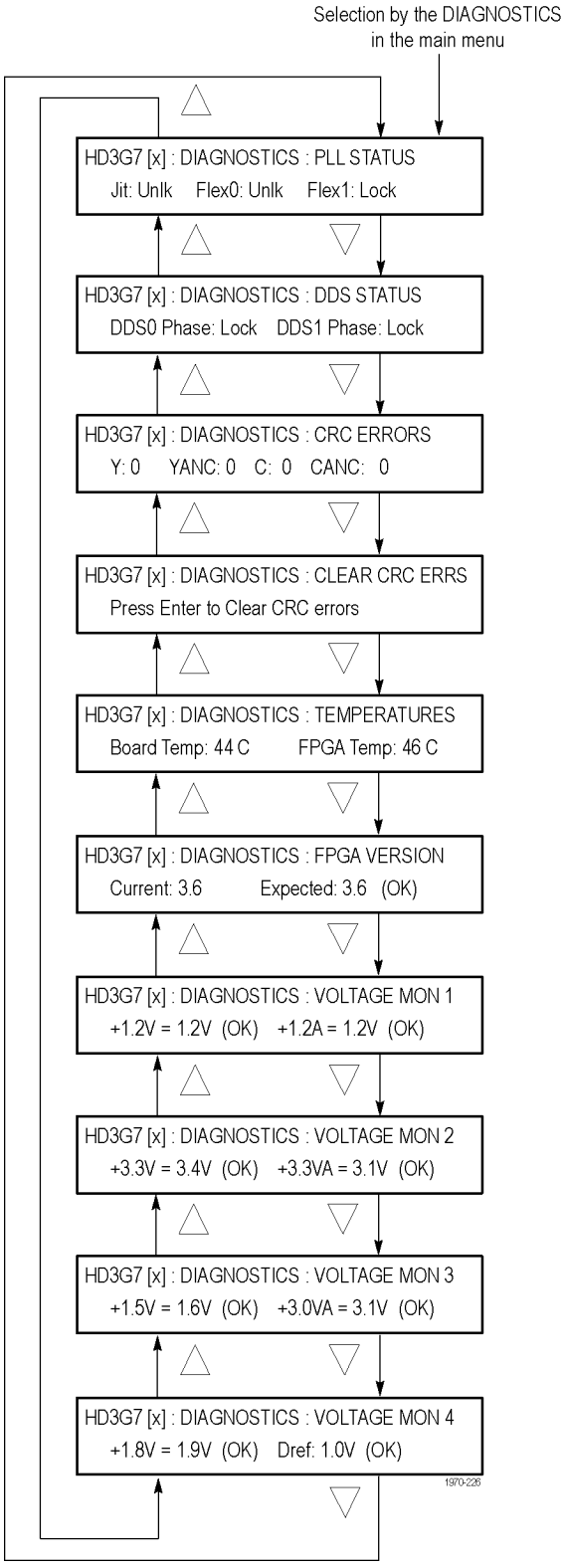


Figure 3-96: HD3G7 module DIAGNOSTICS submenu

PLL STATUS. This diagnostic displays the following:

- Jit – Indicates the condition of the jitter attenuator used to clean up the clock recovered from the input signal. The condition can be reported as **Lock** (locked) or **Unlk** (unlocked). This diagnostic readout is only valid and significant when in converter mode. If in converter mode it should read "locked". If not, there may be a problem with the input signal or the module.
- Flex0 – This circuit is not used, so the readout may show locked or unlocked. The state has no bearing on instrument operation.
- Flex1 – Indicates the state of the flexible clock generator. This readout should show **Lock** (locked) and is only valid and significant when the instrument is in generator mode. An **Unlk** (unlocked) reading might indicate a problem with the module or mainframe.

DDS STATUS. This diagnostic displays the following:

- DDS0 Phase – This circuit is not used, so the readout may show locked or unlocked. The state has no bearing on instrument operation.
- DDS1 Phase – Indicates that the flex clock circuit is correctly aligned with the internal frame pulse. This readout should show **Lock** (locked) and is only valid and significant when the instrument is in generator mode. An **Unlk** (unlocked) reading might indicate a problem with the module or mainframe. If the instrument is in converter mode, this readout is not active and may show locked or unlocked.

CRC ERRORS. This diagnostic shows how many CRC errors are detected from the input signal. If the output signal of the conversion process is not what you expect, or the jitter attenuator is having trouble locking, then you should check this readout for errors on the input.

It is normal to see errors when you are connecting or disconnecting the input, or when no input is present. When this occurs, clear the errors after the connections are made by using the **Diagnostics** > **Clear CRC Errors** submenu. After clearing the errors, monitor this readout if you have concerns about the input signal.

This diagnostic displays the following:

- Y – The number of errors detected on the Y portion of the active picture area of the input signal.
- YANC – The number of errors detected on the Y portion of the ancillary data space in the input signal.
- C – The number of errors detected on the C portion of the active picture area of the input signal.
- CANC – The number of errors detected on the C portion of the ancillary data space in the input signal.

CLEAR CRC ERRORS. Press the **ENTER** button to clear the CRC error counters.

TEMPERATURES. This diagnostic displays the temperature of the HD3G7 module board and FPGA.

FPGA VERSION. This diagnostic displays the current and expected FPGA versions. If there is a discrepancy between the two, a warning appears, which means that the FPGA firmware might need to be upgraded.

VOLTAGE MON 1. This diagnostic measures internal voltage supplies. If these supplies are outside the nominal range, a warning appears, which means that the instrument should be serviced.

VOLTAGE MON 2. This diagnostic measures internal voltage supplies. If these supplies are outside the nominal range, a warning appears, which means that the instrument should be serviced.

VOLTAGE MON 3. This diagnostic measures internal voltage supplies. If these supplies are outside the nominal range, a warning appears, which means that the instrument should be serviced.

VOLTAGE MON 4. This diagnostic measures internal voltage supplies. If these supplies are outside the nominal range, a warning appears, which means that the instrument should be serviced.

HD3G7 module CALIBRATION submenu

This menu is accessible only when the instrument is in factory mode. From this menu, you can access several special output signals and adjust the serial output levels. The special signals are unscrambled and are synchronous with the clock out of the trigger BNC. They are used to check performance or used when adjusting serial levels. See the *TG8000 Service Manual* for information on adjustments and using factory mode.

HD3G7 module factory default settings

The following table shows the factory default settings for the HD3G7 module. These settings are recalled when you select **Factory Default** from the **PRESET : RECALL** menu item in the mainframe main menu.

Table 3-39: HD3G7 module factory default settings

Menu item name	Settings
TEST SIGNAL	100% Color Bars
FORMAT	1080 59.94p
SAMPLE STRUCTURE/DEPTH	YCbCr 4:2:2 10b
OUTPUT MODE	3G-Level A (1920 × 1080)
MOVING PICTURE	
H Step	0 Sample(s)
V Step	0 Line(s)
Period	1 Frame(s)
Random	Disable
AUDIO (EMBEDDED)	
Status (Level A)	
Group 1–4	Disable
Status (Level B)	
Group 1–4 Link A	Disable
Group 1–4 Link B	Disable
Channel	
Status	Active
Frequency	1000
Amplitude	–20 dBFS
Audio Click	OFF
Channel Origin	A1-1 through A4-4
Sampling	Frame
TIMING	
Vertical	0 Line(s)
Horizontal	0.0000 µs
Relative To	Serial (0H)
TIMECODE	
Source	Program Time
30 Drop Frame	Enable
ATC-LTC	OFF
ATC-VITC	OFF

Table 3-39: HD3G7 module factory default settings (cont.)

Menu item name		Settings
VIDEO		
	Y	ON
	Cb	ON
	Cr	ON
	Edge Filter	Enable
	AV Timing Mode	OFF
ANC PAYLOAD		
	Output	Disable
	Parity	Automatic
	DID	0x101
	SDID	0x200
	DC	0x101
	UDW	0x200
	CS	0x200
	Auto-Calculate CS	Enable
	Line	9
	Field 1, Line:	9
	Field 2, Line:	9
	Start Sample	1928
	Video Channel	Luma
	Link Location	Link A
	Stream Location	HS Stream 1
SMPTE 352 PAYLOAD		Enable
TRIGGER OUTPUT		System Clock
SECONDARY OUTPUT		Test Pattern

HDLG7 HD Dual Link Video Generator module

This section describes the module-specific functions of the HDLG7 HD Dual Link Video Generator module. Refer to the following locations for additional information about this module:

- *HDLG7 module connectors* for a description of the rear-panel connectors. (See page 2-16.)
- *HDLG7 module functional check* for a basic procedure to check that the module is functional. (See page 1-37.)
- *TG8000 Specifications and Performance Verification Technical Reference* for module specifications and for a detailed procedure to verify that the module is functioning as specified.
- *TG8000 Programmer Manual* for information about the commands to remotely control the module.

HDLG7 module product description

The HDLG7 HD Dual Link Video Generator module can be operated in either of the following two modes:

- Dual link converter. The module can convert a SMPTE 292M serial digital video stream carrying a SMPTE 274M signal to a SMPTE 372M serial digital dual link video signal.
- Dual link generator. The module can output either HD SDI video test signals or projector test patterns (digital cinema 2K formats only).

Refer to the *TG8000 Specifications and Performance Verification Technical Reference* for information about which dual link outputs can be converted from each input signal format.

Refer to *To select the HDLG7 module Converter mode* for information about the available types of conversions. (See page 3-214.)

The module provides the following features:

- Two pairs of dual link outputs that include SMPTE 352 payload.
- Supports a wide variety of output formats:

  1920 × 1080i, 1920 × 1080p, 1920 × 1080PsF, 2K × 1080p, 2K × 1080PsF, and 2K × 1556PsF

- Supports the following sampling structures:

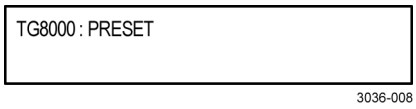
  4:4:4 GBR, 4:4:4:4 GBR+A, 4:4:4 YCbCr, 4:4:4:4 YCbCr+A, 4:2:2 YCbCr, 4:2:2:4 YCbCr+A, 4:4:4 XYZ

- Test signal buttons have two modes of operation: native YCbCr or RGB HD video test signals, and native XYZ digital cinema projector test patterns (only in 2K formats).
- Generates a moving picture by scrolling the active picture area of the output test signal.
- Adjustable timing offset between link A and link B outputs.
- Full remote control using the Ethernet interface.

How to operate the HDLG7 module

After the module is installed in the mainframe, and the mainframe is installed in the rack or other location where it will be used, use the following procedure to access each function of the module:

1. Connect the power cord to the power connector on the rear panel, and then plug the cord into the AC electric power source. Electric power is supplied to the mainframe.
2. Wait until the power-on initialization process is complete, and then check that no error messages appear on the display.
3. After the initialization process is complete, the mainframe main menu appears as shown below:



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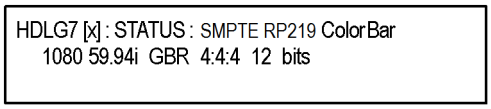
4. Press the front-panel **MODULE** button until the HDLG7 module main menu appears as shown below:



5. Configure the module to the desired operational mode (converter or generator), select the signal format, and if necessary, select the test signal. (See page 3-249, *To select an output signal on the SDI7 module*.)
6. Use the front-panel arrow buttons to navigate and select items in the main menu and submenus.

Refer to *HDLG7 Module Main Menu* for detailed information about the main menu items and the submenu items. (See page 3-216.)

To select an output signal on the HDLG7 module

The HDLG7 module has two modes of operation: converter or generator. To select an output signal, perform the appropriate procedure below for your selected mode of operation.

To select the Converter mode on the HDLG7 module

Use this mode to convert a SMPTE 292M serial digital video stream carrying a SMPTE 274M signal to a SMPTE 372M serial digital dual link video signal.

1. Connect an HD SDI signal to the **HD SDI IN** connector.
2. Select the signal format for the output signal. (See page 3-210, *To select the signal format on the HDLG7 module*.)

NOTE. *To avoid an input signal error, select the output signal format that matches the input signal. If the input signal format does not match the selected output format, the following message appears: Input Format mismatch (Check FORMAT) on the STATUS menu.*

Refer to the TG8000 Specifications and Performance Verification Technical Reference for a listing of the supported input and output format combinations for the HDLG7 module.

3. Select the converter mode to provide a dual link signal.
4. Press the front-panel arrow buttons to select the desired main menu item or submenu.

To select the Generator mode on the HDLG7 module

Use this mode to generate either HD SDI video test signals or projector test patterns (digital cinema 2K formats only).

1. Select the signal format for the output signal. (See page 3-210, *To select the signal format on the HDLG7 module*.)
2. Select the test signal that you want to generate. (See page 3-211, *To select the test signal on the HDLG7 module*.)
3. Press the front-panel arrow buttons to select the desired main menu item or submenu.

To select the signal format on the HDLG7 module

The following table lists the available signal formats.

NOTE. *Framing resynchronization occurs when the signal format is changed.*

Selecting the 1080 50p, 1080 59.94p, or 1080 60p format forces the sampling structure to be set to YCbCr 4:2:2 10 bits. Selecting a 2K 1080 or 2K 1556 format will limit the sampling structure to either RGB or XYZ 4:4:4 12 bits.

Refer to SAMPLE STRUCTURE/DEPTH for more information. (See page 3-217.)

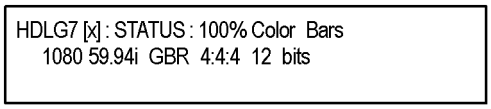
Table 3-40: HDLG7 module signal formats

1980 × 1080 format			
1080 23.98sF	1080 24sF	1080 23.98p	1080 24p
1080 25p	1080 29.97p	1080 30p	1080 50i
1080 59.94i	1080 60i	1080 50p	1080 59.94p
1080 60p			
2048 × 1556 format [1]			
2K 1556 14.99sF	2K 1556 15sF	2K 1556 17.98sF	2K 1556 18sF
2048 × 1080 format			
2K 1080 23.98sF	2K 1080 24sF	2K 1080 25sF	2K 1080 29.97sF
2K 1080 30sF	2K 1080 23.98p	2K 1080 24p	2K 1080 25p
2K 1080 29.97p	2K 1080 30p		

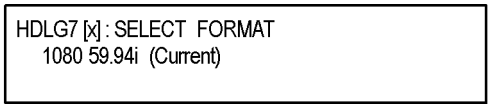
[1] No SMPTE 352M identification payload is added to the output of 2048 × 1556 format signals.

Perform the following steps to select the signal format:

1. Press the front-panel **MODULE** button until the HDLG7 module main menu appears as shown below.



2. Press the **FORMAT** button. The menu display changes to show the currently selected signal format as shown below.



3. Press the left (◄) or right (►) arrow button to select one of the signal formats, and then press the **ENTER** button to confirm the selection.

To select the test signal on the HDLG7 module

The test signals in the HDLG7 module are divided into the following two groups:

- HD SDI video test signals
- Projector test patterns (digital cinema 2K formats only)

NOTE. *Use the HDLG7 module Main menu to configure the module to output HD test signals or projector test patterns. (See page 3-216, HDLG7 module main menu.)*

All of the signal sets that are available in the module are already assigned to the corresponding test signal buttons. When the HDLG7 module is selected and you press any of the front-panel test signal buttons, the selected signal in the signal set is output. (See Figure 3-97.)

For example, when you press the **COLOR BAR** test signal button, a signal in the Color Bars signal set is output. Use the left (◄) or right (►) arrow button, or press the COLOR BAR test signal button repeatedly to select a different signal from the Color Bars signal set. Press the **BACK** button to return to the main menu.

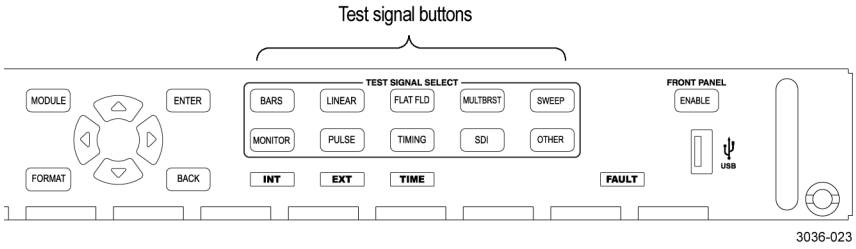


Figure 3-97: Front-panel test signal buttons

You can download a frame picture file (created by the Frame Picture Generator) to the mainframe and output the picture from the DVG7 module. Refer to the *TG8000 PC Tools Technical Reference* for detailed information on how to create, download, and output a frame picture.

The following table lists the signal set assigned to each test signal button and the signals that can be selected in the signal set when the module is configured to output HD test signals. The table also lists the native YCbCr or RGB test signals that correspond to HD SDI video test signals.

Table 3-41: HDLG7 module HD test signal set assigned to the test signal buttons

Button name	Signal set	Signals in the signal set
COLOR BAR	Color Bars	100% Color Bars, 75% Color Bars, SMPTE RP219 Color Bars [1] [2]
LINEARITY	Linearity	5 Step Staircase, Ramp, Valid Ramp [2]
FLAT FIELD	Flat Fields	0% Flat Field, 10% Flat Field, 20% Flat Field, 30% Flat Field, 40% Flat Field, 50% Flat Field, 60% Flat Field, 70% Flat Field, 80% Flat Field, 90% Flat Field, 100% Flat Field
MULTI BURST	——	——
SWEEP	——	——
MONITOR	Monitor	100% Red Field, 75% Red Field, 100% Green Field, 75% Green Field 100% Blue Field, 75% Blue Field, Convergence
PULSE BAR	Pulse & Bar	2T30 Pulse and Bar
TIMING	——	——
SDI	——	Equalizer Test, PLL Test, SDI Matrix
OTHER	——	Use this button to select the converter mode of operation and Embedded audio selection menu. (See page 3-214, *To select the Converter mode on the HDLG7 module*.)

[1] SMPTE RP219 Color Bars refers to SMPTE RP219 Color Bar (I/Q Even).

[2] Not available in 2K-format mode of operation.

The following table lists the signal set assigned to each test signal button and the signals that can be selected in the signal set when the module is configured to output projector test patterns. The table also lists the native XYZ projector test patterns that correspond to digital cinema.

Table 3-42: HDLG7 module projector test pattern set assigned to the test signal buttons

Button name	Signal set	Signals in the signal set
COLOR BAR	Color Bars	Color Bar Patch-1, Color Bar Patch-2
LINEARITY	Linearity	Step Black-White, Step Black-Dark Gray, Horizontal Gradient, Vertical Gradient
FLAT FIELD	Flat Fields	Black Flat Field, White Flat Field, Black to White Step-1, Black to White Step-2, Black to White Step-3, Black to White Step-4, Black to White Step-5, Black to White Step-6, Black to White Step-7, Black to White Step-8, Black to White Step-9, Black to White Step-10, Black to Gray Step-1, Black to Gray Step-2, Black to Gray Step-3, Black to Gray Step-4, Black to Gray Step-5, Black to Gray Step-6, Black to Gray Step-7, Black to Gray Step-8, Black to Gray Step-9, Black to Gray Step-10
MULTI BURST	——	——
SWEEP	——	——
MONITOR	Monitor	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, Grid, Checkerboard, Aspect Ratio
PULSE BAR	Pulse & Bar	Window
TIMING	——	——
SDI	SDI	Equalizer Test, PLL Test, SDI Matrix
OTHER	——	Use this button to select the converter mode of operation and Embedded audio selection menu. (See page 3-214, *To select the Converter mode on the HDLG7 module*.)

To set the gradient starting point.

When you select Horizontal Gradient or Vertical Gradient in the Linearity projector test pattern set, use the up (▲) or down (▼) arrow button to set the starting point of the gradient. The available values are as follows:

- **Horizontal Gradient:** 16 to 1913 in 1 level steps.
- **Vertical Gradient:** 16 to 2880 in 1 level steps (2048 × 1080 format); 16 to 2404 in 1 level steps (2048 × 1556 format).

To select the Converter mode on the HDLG7 module

Select from the following converter modes when you want to convert the SMPTE 292M 4:2:2 serial digital signal applied to the HD SDI IN connector into a dual link output format:

60, 59.94, or 50 Hz Progressive Formats. The HDLG7 module converts the input interlace signal (60i, 59.94i, or 50i) to a progressive signal by doubling the frame rate. The input signal is copied to both Link A and Link B, but the payload identifier is modified to indicate a dual-link signal. The results are a 4:2:2 YCbCr 10-bit signal at the faster progressive rate (60p, 59.94p, or 50p).

4:4:4 YCbCr Formats. The HDLG7 module converts the input 4:2:2 YCbCr signal to 4:4:4 YCbCr signal by up-interpolating the chroma channel data samples. This is accomplished by using several incoming data samples before and after the data samples to derive the extra sample point. If 10-bit sample structure is selected, the alpha channel is set to blanking levels or is controlled by the ALPHA CHANNEL DATA menu. If 12 bit is chosen, the addition 2 LSB bits are set to zero on the Y and co-sited Cb and Cr samples. The derived Cb and Cr samples will contain derived LSB bits.

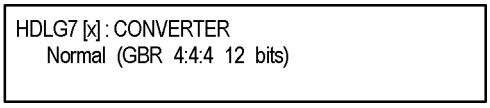
4:4:4 RGB Formats. The HDLG7 module converts the input 4:2:2 YCbCr signal to 4:4:4 YCbCr as described above. Then the signal is color-space converted using the inverse linear transform defined in SMPTE 274M. If 10-bit sample structure is selected, the alpha channel is set to blanking levels or is controlled by the ALPHA CHANNEL DATA menu. If 12 bit is chosen, the addition 2 bits (LSB) are computed from the linear transform calculations.

4:2:2 YCbCr 12 Bit Formats. The HDLG7 module converts the input 4:2:2 YCbCr signal to 4:2:2 YCbCr 12 bits by setting zeros for the additional 2 bits (LSB). The alpha channel is set to blanking levels or is controlled by the ALPHA CHANNEL DATA menu.

4:4:4 XYZ Formats. The HDLG7 module converts the input 4:2:2 YCbCr signal to 4:4:4 YCbCr and 4:4:4 RGB as described in the preceding paragraphs. Then the RGB signal is converted to XYZ by normalizing the gamma corrected RGB signal and applying the results to a RGB to XYZ color-space converter. The output of the converter is gamma corrected for digital cinema. The XYZ mode can be selected only in the 2K format mode.

Perform the following steps to select the converter mode:

1. Press the front-panel **OTHER** button. The menu display changes as follows:



2. Press the left (◄) or right (►) arrow button, or press the **OTHER** button repeatedly to select between **Normal** and **Y to GBR**.

   - **Normal**: The incoming YCbCr signal is converted to a normal dual-link output.
   - **Y to GBR**: The incoming Y data is applied to the G, B, and R outputs. This allows higher bandwidth data, such as multiburst or sweep to be placed on all three channels. If the sampling structure is for a YCbCr or XYZ output, the Y to GBR selection is not available.

3. Press the up (▲) or down (▼) arrow button to select Embedded Audio selection menu. Then use the left (◄) or right (►) arrow button to select the following:

   Link A Only: Places the incoming embedded audio on the converter mode Dual Link A output. Conforms to the SMPTE 372M standard. In the case of converting 1920×1080p/PsF 29.97/30 Hz to 2048×1080p/PsF 29.97/30 Hz with 16 channels (four groups) of embedded audio, 8 channels (two groups) will be placed on the Link A output and the other 8 channels (two groups) will be placed on the Link B output.

   Link B Only: Places the incoming embedded audio on the converted mode Dual Link B output. In the case of converting 1920×1080p/PsF 29.97/30 Hz to 2048×1080p/PsF 29.97/30 Hz with 16 channels (four groups) of embedded audio, the two lowest number embedded audio groups (groups 1 and 2) will be allowed on Link B. Groups 3 and 4 would be deleted.

   Link A & B: Places the incoming embedded audio on the converted mode Dual Link A and B outputs. In the case of converting 1920×1080p/PsF 29.97/30 Hz to 2048×1080p/PsF 29.97/30 Hz with 16 channels (four groups) of embedded audio, the two lowest number embedded audio groups (groups 1 and 2) will be allowed on both Link A and B. Groups 3 and 4 would be deleted.

4. Press the **BACK** button to return to the main menu.

NOTE. *When you select the converter mode, the 2K TEST SIGNAL KEY ASSIGN setting will automatically switch to HD Test Signal.*

HDLG7 module main menu

Use the HDLG7 module main menu to perform the following tasks:

- Set the sampling structure/pixel depth.
- Select the signal of the alpha channel.
- Set the timing offset between the Link A and Link B outputs.
- Generate a moving picture.

Use the up (▲) or down (▼) arrow button to scroll through the main menu. The following figure shows the HDLG7 module main menu.

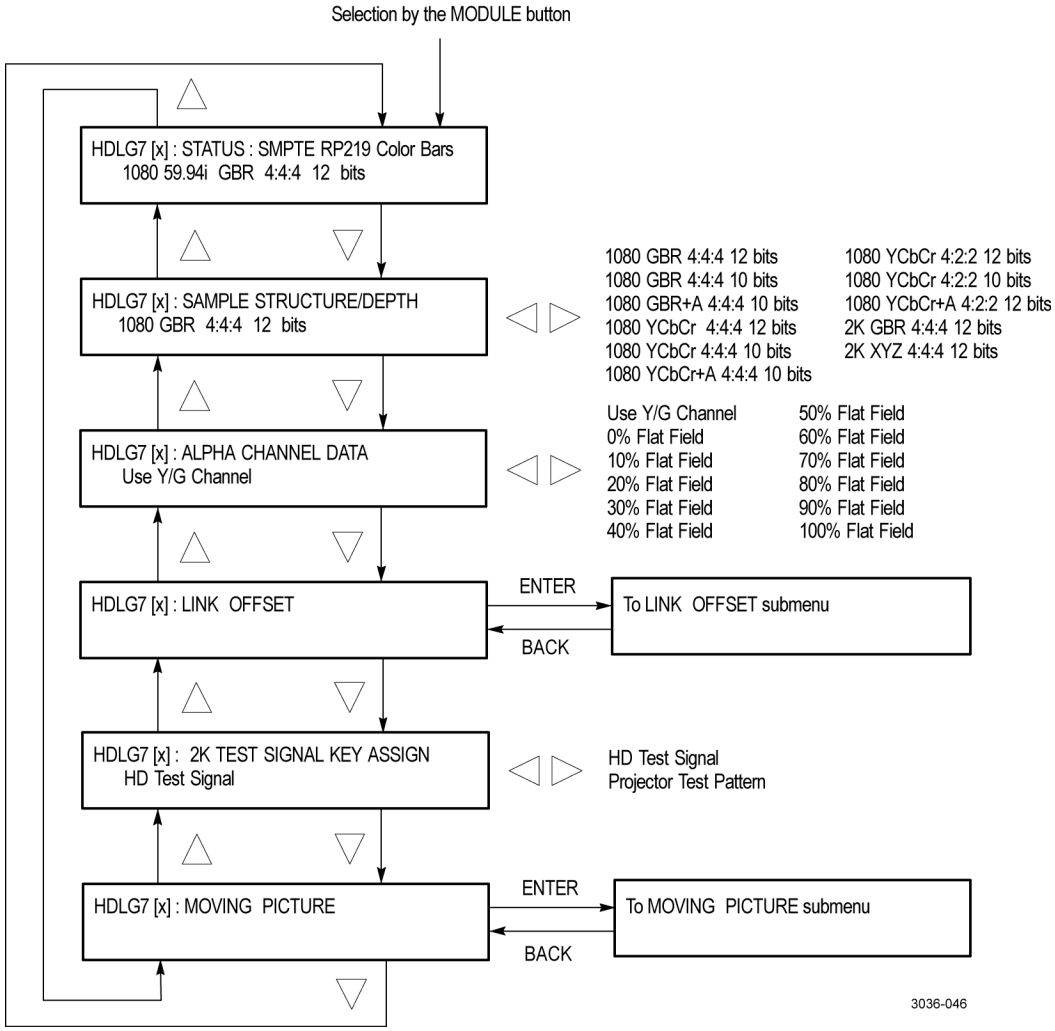


Figure 3-98: HDLG7 module main menu

STATUS. Displays the instrument operating mode, output signal format, and output sample structure. Examples of the STATUS display are shown below for each of the operating modes (converter and generator).

Converter Mode: The figure below shows an example STATUS display when the module is in the converter mode.

```
HDLG7 [x] : STATUS : CONVERTER (Normal)
    1080 60i  GBR+A  4:4:4  10  bits
```

- **CONVERTER (Normal):** Indicates that the incoming HD-SDI video stream is being converted in a normal mode. The other choice is (Y to GBR) where the incoming Y data is placed on the G, B, and R channels on the output. Y to GBR is only selectable in the GBR sampling structure.
- **1080 60i:** Indicates the incoming signal format. If there is no input or the format is not the correct rate, the following messages will appear on the second line of the LCD; "No Input Signal" or "Input Signal Error (Check FORMAT)"
- **GBR+A 4:4:4 10 bits:** Indicates the output sampling structure.

Generator Mode: The figure below shows an example STATUS display when the module is in the generator mode.

```
HDLG7 [x] : STATUS :  100% Color Bars
    1080 24sF  GBR+A  4:4:4  10  bits
```

- **100% Color Bars:** Indicates the name of the signal currently being generated. As different generator signal is selected, its name will be displayed.
- **1080 24sF:** Indicates the output format.
- **GBR+A 4:4:4 10 bits:** Indicates the output sampling structure.

SAMPLE STRUCTURE/DEPTH. Selects the sampling structure and pixel depth of the output signal. Use the left (◄) or right (►) arrow button to select from the formats listed in the table below. Press the **ENTER** button to confirm the selection.

Table 3-43: HDLG7 module sample structure/depth signal formats

1920 × 1080 formats		
1080 GBR 4:4:4 12 bits	1080 GBR 4:4:4 10 bits	1080 GBR+A 4:4:4 10 bits
1080 YCbCr 4:4:4 12 bits	1080 YCbCr 4:4:4 10 bits	1080 YCbCr+A 4:4:4 10 bits
1080 YCbCr 4:2:2 12 bits	1080 YCbCr 4:2:2 10 bits	1080 YCbCr+A 4:2:2 12 bits

Table 3-43: HDLG7 module sample structure/depth signal formats (cont.)

1920 × 1080 formats	
2K 1080 and 2K 1556 formats	
2K GBR 4:4:4 12 bits	2K XYZ 4:4:4 12 bits

NOTE. *When the 1080 50p, 1080 59.94p, or 1080 60p format is selected, the HDLG7 module forces the sampling structure to 1080 YCbCr 4:2:2 10 bits, and no other sampling structure is allowed.*

Selecting Projector Test Pattern while the format is 2K 1080 or 2K 1556 will limit the sampling structure/depth to 2K XYZ 4:4:4 12 bits.

If the current output format is 1080 23.98sF, 1080 24sF, 1080 23.98p, 1080 24p, 1080 25p, 1080 29.97p, 1080 30p, 1080 50i, 1080 59.94i, or 1080 60i, you may select 1080 YCbCr 4:2:2 10 bits as the sampling structure. However, the output signals produced on Link A and Link B are not dual-link signals. The HDLG7 module will produce two single-link outputs, with incoming ancillary and embedded audio being placed on Link A and none on Link B.

ALPHA CHANNEL DATA. Sets the alpha channel signal. Use the left (◄) or right (►) arrow button to select **Use Y/G Channel**, **0% Flat Field**, **10% Flat Field**, **20% Flat Field**, **30% Flat Field**, **40% Flat Field**, **50% Flat Field**, **60% Flat Field**, **70% Flat Field**, **80% Flat Field**, **90% Flat Field**, or **100% Flat Field**.

The alpha channel data are used only with the following sampling structures: 1080 GBR+A 4:4:4 10 bits, 1080 YCbCr+A 4:4:4 10 bits, and 1080 YCbCr+A 4:2:2 12 bits.

LINK OFFSET. Sets the timing offset of the Link B output relative to the Link A output. Select this menu item, and then press the **ENTER** button to access the LINK OFFSET submenu. (See page 3-219.)

2K TEST SIGNAL KEY ASSIGN. Selects the signal sets to be assigned to the test signal button. Use the left (◄) or right (►) arrow button to select one of the following two signal sets:

- **HD Test Signal:** Assigns standard HD video test signals to the test signal buttons. (See Table 3-41 on page 3-212.)
- **Projector Test Pattern:** Assigns digital cinema projector test patterns to the test signal buttons. These signal sets are only selectable in the 2K format. (See Table 3-42 on page 3-213.)

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 MOVING PICTURE submenu. (See page 3-219.)

HDLG7 module LINK OFFSET submenu

Use this menu to adjust the timing offset of the Link B output relative to the Link A output. The following figure shows the LINK OFFSET submenu.

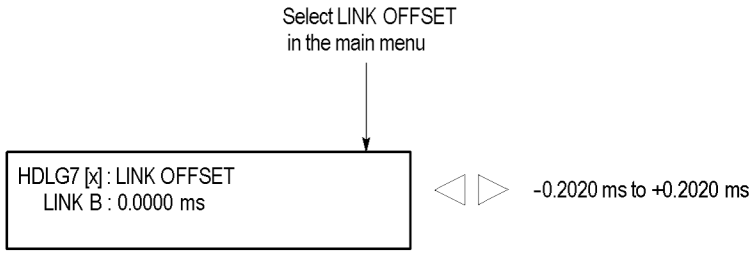


Figure 3-99: HDLG7 module LINK OFFSET submenu

Use the left (◄) or right (►) arrow button to change the value. You can set the value from -0.2020 µs to +0.2020 µs in 0.0135 µs steps.

NOTE. *You can reset the offset value to zero by pressing the left (◄) or right (►) arrow buttons simultaneously.*

HDLG7 module 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). Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the MOVING PICTURE submenu.

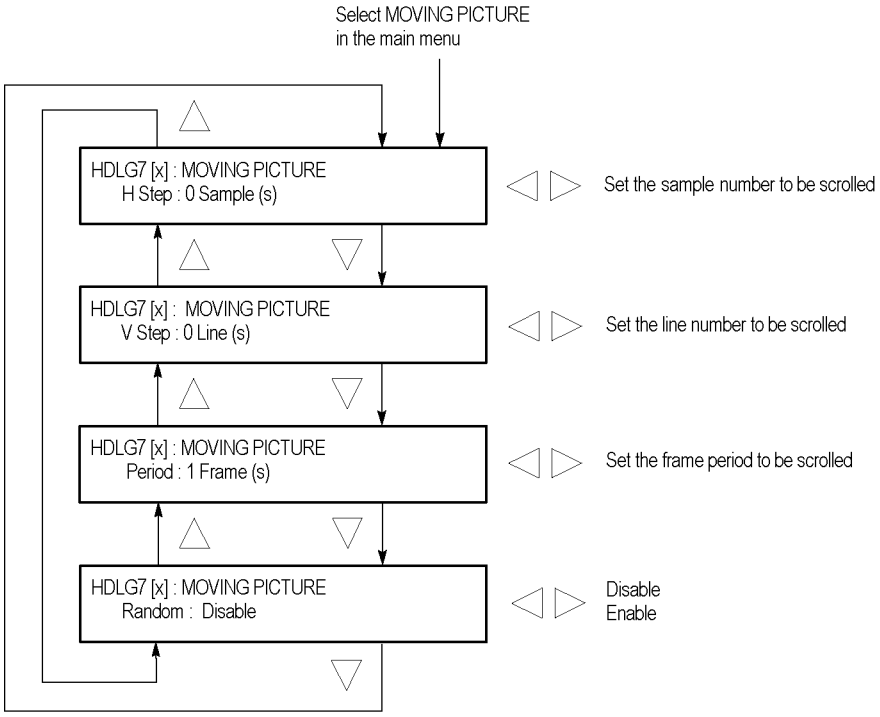


Figure 3-100: HDLG7 module MOVING PICTURE submenu

H 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 change the value. You can set the value from -252 to +252 in 4-sample steps.

V 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 change the value. You can 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 change the value. You can 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.

HDLG7 module factory default settings

The following table shows the factory default settings for the HDLG7 module. These settings are recalled when you select **Factory Default** from the **PRESET : RECALL** menu item in the mainframe main menu.

NOTE. *The factory default settings put the HDLG7 module in the Generator mode.*

Table 3-44: HDLG7 module factory default settings

Menu item name	Settings
STATUS	SMPTE RP219 Color Bars 1080 59.94i GBR 4:4:4 12 bits
SAMPLE STRUCTURE/DEPTH	1080 GBR 4:4:4 12 bits
ALPHA CHANNEL DATA	Use Y/G Channel
LINK OFFSET	0.0000 ms
2K TEST SIGNAL KEY ASSIGN	HD Test Signal
MOVING PICTURE	
H Step	0 Sample(s)
V Step	0 Line(s)
Period	1 Frame(s)
Random	Disable
Converter mode	Normal
Converter embedded audio	LINK A
2K Horizontal/Vertical Gradient offset	
Horizontal Gradient offset	16
Vertical Gradient offset	16

HDVG7 HDTV Digital Video Generator module

This section describes the module-specific functions of the HDVG7 HDTV Digital Video Generator module. Refer to the following locations for additional information about this module:

- *HDVG7 module connectors* for a description of the rear-panel connectors. (See page 2-17.)
- *HDVG7 module functional check* for a basic procedure to check that the module is functional. (See page 1-39.)
- *TG8000 Specifications and Performance Verification Technical Reference* for module specifications and for a detailed procedure to verify that the module is functioning as specified.
- *TG8000 Programmer Manual* for information about the commands to remotely control the module.

HDVG7 module product description

The HDVG7 HDTV Digital Video Generator module provides 1.485 Gb/s serial digital video signals in various formats. The module provides the following features:

- Two serial digital video outputs
- Two serial digital black outputs (Option BK)
- Supports SMPTE 274M (1080), SMPTE 240M (1035), and SMPTE 296M (720)
- Overlay of circle, text, or logo on the video signal
- Generates a moving picture by scrolling the active picture area of the output test signal
- Generates timecode with ATC when a GPS7 module is installed
- Up to 16 channels of Embedded Audio
- Full remote control using Ethernet interface

- Generates video signals with 24 (or 20) bit embedded digital audio with a sample rate of 48 kHz. The module supports the following audio frequencies.

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
400 Hz	1600 Hz	6000 Hz	

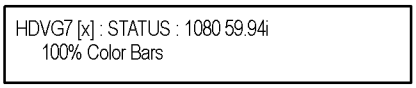
How to operate the HDVG7 module

After the module is installed in the mainframe, and the mainframe is installed in the rack or other location where it will be used, use the following procedure to access each function of the module:

1. Connect the power cord to the power connector on the rear panel, and then plug the cord into the AC electric power source. Electric power is supplied to the mainframe.
2. Wait until the power-on initialization process is complete, and then check that no error messages appear on the display.
3. After the initialization process is complete, the mainframe main menu appears as shown below.

3036-008

4. Press the front-panel **MODULE** button until the HDVG7 module main menu appears as shown below.



5. Select the signal format and the test signal you want to output. (See page 3-223, *To select an output signal on the HDVG7 module*.)
6. Use the front-panel arrow buttons to navigate and select items in the main menu and submenus.

Refer to *HDVG7 Module Main Menu* for detailed information about the main menu items and the submenu items. (See page 3-225.)

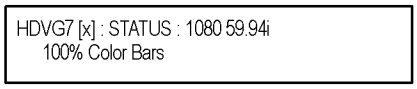
To select an output signal on the HDVG7 module

To output a signal from the HDVG7 module, you need to select a signal format and output signal as described below.

To select the signal format

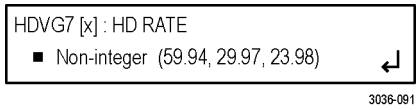
Perform the following steps to select the signal format:

1. Press the front-panel **MODULE** button until the HDVG7 module main menu appears as shown below.



2. **Option BK only:** Set the HD trilevel sync rate:

   a. Use the up (▲) or down (▼) arrow button to scroll through the main menu until HD RATE is displayed as shown below.



   b. Use the left (◄) or right (►) arrow button to select **Non-integer (59.94, 29.97, 23.98)** or **Integer (60, 50, 30, 25, 24)**, and then press the **ENTER** button to confirm the selection.

NOTE. *The HD RATE setting affects which signal formats can be selected for output (integer or non-integer).*

3. Press the **FORMAT** button to access the SELECT FORMAT submenu.

4. Use the left (◄) or right (►) arrow button, or press the **FORMAT** button repeatedly, to select one of the signal formats, and then press the **ENTER** button to confirm the selection.

NOTE. *When you change signal format, synchronization shock occurs.*

5. If you change the signal format while a test signal is being output, the instrument starts loading all of the signal sets for the selected format and displays the message "**Now Loading...**". When you see the message, "**Done (Press BACK)**", press the **BACK** button.

To select the test signal

All of the signal sets that are available in the module are already assigned to the corresponding test signal buttons. When the HDVG7 module is selected and you press any of the front-panel test signal buttons, the selected signal in the signal set is output. (See Figure 3-101.)

For example, when you press the **COLOR BAR** test signal button, a signal in the Color Bars signal set is output. Use the left (◄) or right (►) arrow button, or press the COLOR BAR test signal button repeatedly to select a different signal from the Color Bars signal set.

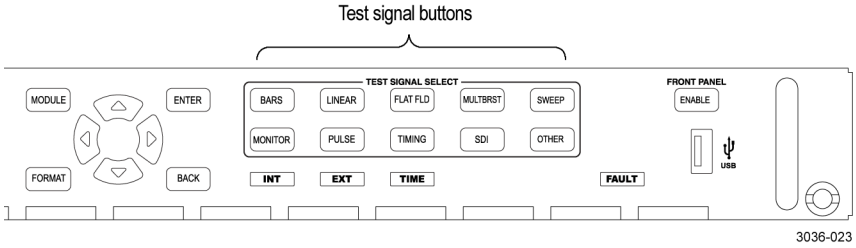


Figure 3-101: Front-panel test signal buttons

You can download a frame picture file (created by the Frame Picture Generator) to the mainframe and output the picture from the HDVG7 module. Refer to the *TG8000 PC Tools Technical Reference* for detailed information on how to create, download, and output a frame picture.

The following table lists the signal set assigned to each test signal button and shows the test signals that are available in each signal set.

Table 3-45: HDVG7 module signal set assigned to the test signal buttons

Button name	Signal set	Signals in the signal set
COLOR BAR	Color Bars	100% Color Bars, 75% Color Bars, SMPTE Color Bars
LINEARITY	Linearity	5 Step Staircase, Limit Ramp, Ramp, Shallow Ramp Matrix, Shallow Ramp Valid Ramp
FLAT FIELD	Flat Fields	0% Flat Field, 50% Flat Field, 100% Flat Field
MULTI BURST	Multiburst	Multiburst 1-10 MHz, Multiburst 10-20 MHz, Multiburst 20-30 MHz
SWEEP	Sweep	100% Sweep 1-15 MHz, 100% Sweep 1-30 MHz
MONITOR	Monitor	75% Blue Field, 75% Green Field, 75% Red Field, Convergence
PULSE BAR	Pulse & Bar	2T30 Pulse and Bar
TIMING	Timing	Bowtie 1ns Markers, Co-site Pulse
SDI	SDI Test	Equalizer Test, PLL Test, SDI Matrix
OTHER	——	——

HDVG7 module main menu

Use the HDVG7 module main menu to perform the following tasks:

- Set the logo, text, or circle overlay on the output signal.
- Set the timing offset on the output signals.
- Scroll the active picture area of the output signal.
- Enable or disable the output and set parameters for each embedded audio group.
- Enable or disable the Y, Pb, and/or Pr components on the video output signal.

Use the up (▲) or down (▼) arrow button to scroll through the main menu. The following figure shows the HDVG7 module main menu.

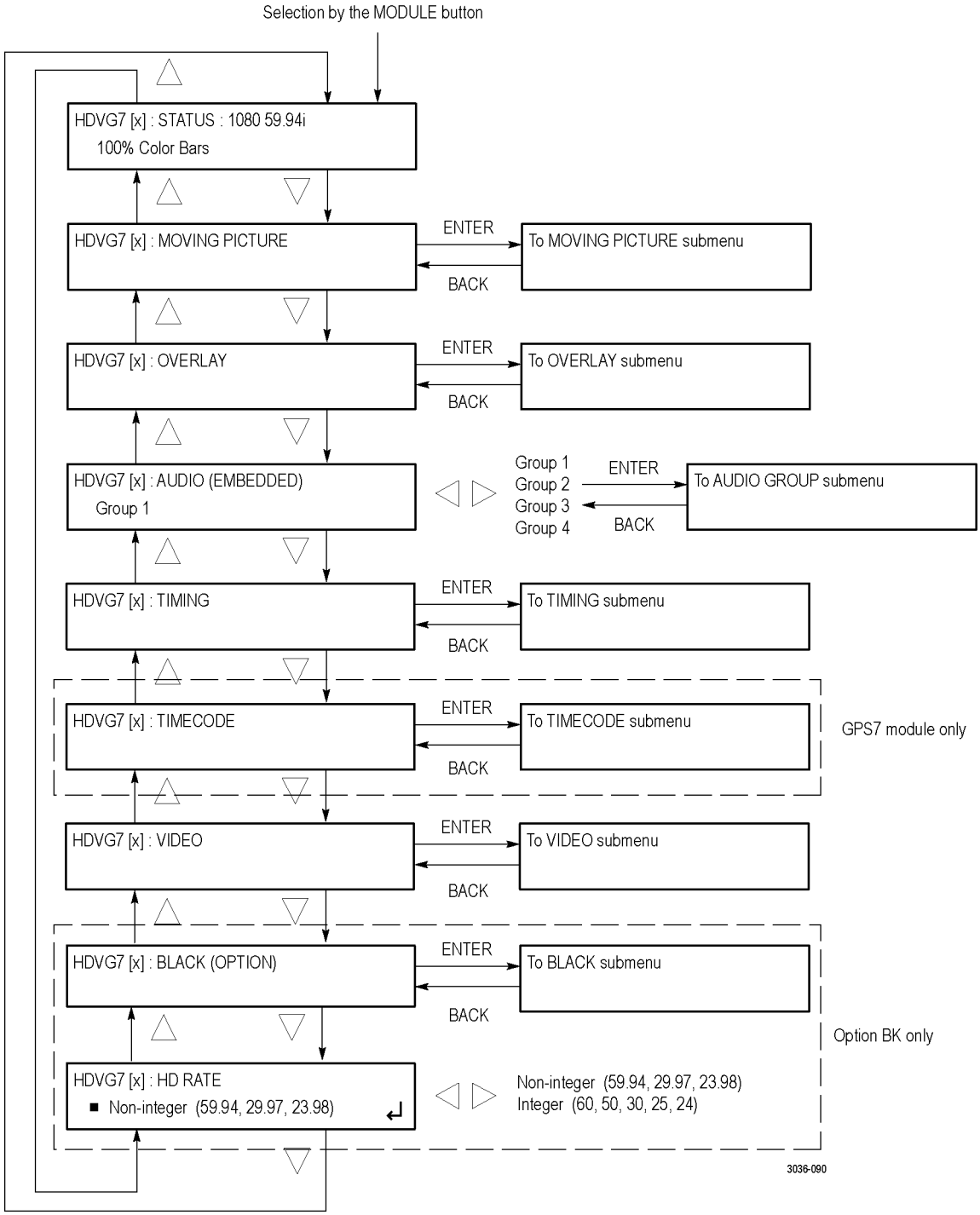


Figure 3-102: HDVG7 module main menu

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 MOVING PICTURE submenu. (See page 3-228.)

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 OVERLAY submenu. (See page 3-285.)

AUDIO (EMBEDDED). Sets the parameters for embedded audio on the output test signals. Use the left (◄) or right (►) arrow button to select **Group 1**, **Group 2**, **Group 3**, or **Group 4**. Select any of the items, and then press the **ENTER** button to access the AUDIO GROUP submenu. (See page 3-234.)

TIMING. Sets the timing offset of the serial digital video outputs relative to the internal reference signal (frame reset signal). Select this menu item, and then press the **ENTER** button to access the TIMING submenu. (See page 3-237.)

TIMECODE. Sets the timecode parameters for the module outputs when a GPS7 module is installed. To support this capability, the module hardware must be version 2.0 or above. Select this menu item, and then press the **ENTER** button to access the TIMECODE submenu. (See page 3-238.)

VIDEO. Enables or disables the Y, Pb, or Pr component of the output serial digital video signals and the output mode for audio/video timing measurement. Select this menu item, and then press the **ENTER** button to access the VIDEO submenu. (See page 3-239.)

BLACK (OPTION). This menu is only available with Option BK, and sets the parameters of the serial digital black signals output from the **BLACK 1** and **BLACK 2** connectors. Select this menu item, and then press the **ENTER** button to access the BLACK submenu. (See page 3-240.)

HD RATE. This menu item is only available with Option BK, and sets the HD trilevel sync rate for the signal 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 confirm the selection. The HD trilevel sync rate selection affects which signal formats can be output from the module (integer or non-integer).

HDVG7 module 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). Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the MOVING PICTURE submenu.

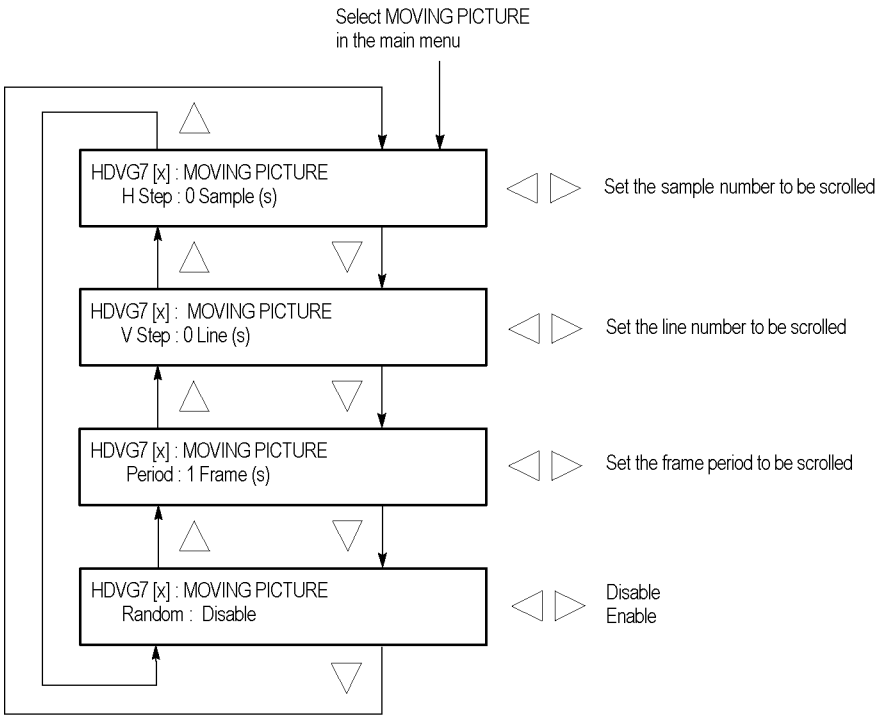


Figure 3-103: HDVG7 module MOVING PICTURE submenu

H 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 change the value. You can set the value from -252 to +252 in 4-sample steps.

V 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 change the value. You can 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 change the value. You can 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.

HDVG7 module OVERLAY submenu

Use this menu to select an item (logo, ID Text, or circle) 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. The following figure shows the OVERLAY submenu.

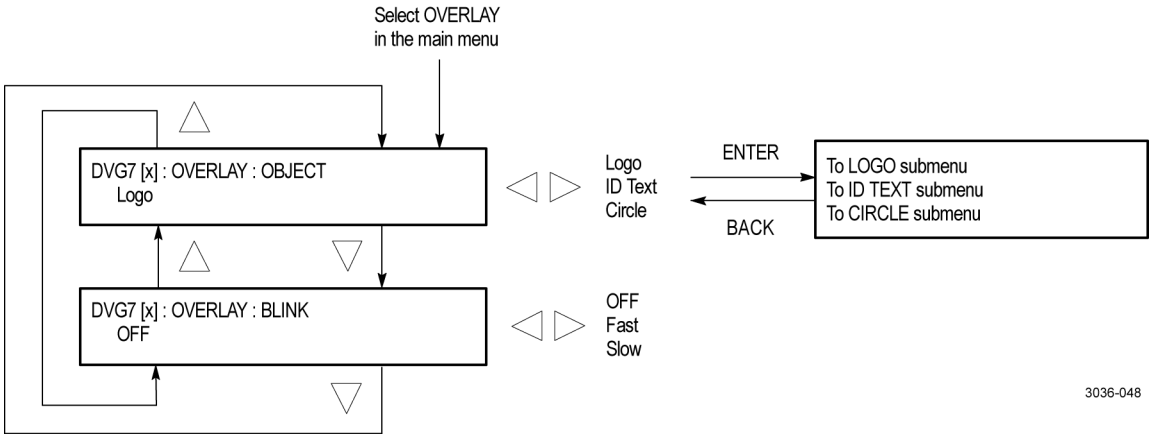


Figure 3-104: HDVG7 module OVERLAY submenu

OBJECT. Selects an item to overlay on the output test signal. Use the left (◄) or right (►) arrow button to select one of the following overlays, and then press the **ENTER** button to access the submenu for setting the parameters of that overlay.

- **Logo:** Opens the LOGO submenu where you can select a logo to overlay the output signal in a specified position. (See page 3-230.)
- **ID Text:** Opens the ID TEXT submenu where you can edit the text to overlay the output signal in a specified position. (See page 3-231.)
- **Circle:** Opens the CIRCLE submenu where you can specify a circle size and position to overlay the output signal. (See page 3-233.)

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.

- **OFF:** Turns off 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.

HDVG7 module 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 LOGO submenu.

NOTE. *To display a logo using the LOGO submenu, you need to create a logo file (.lgo) and download it to the LOGO folder of the module. Refer to the TG8000 PC Tools Technical Reference for detailed information about how to create a logo file and download it to the TG8000.*

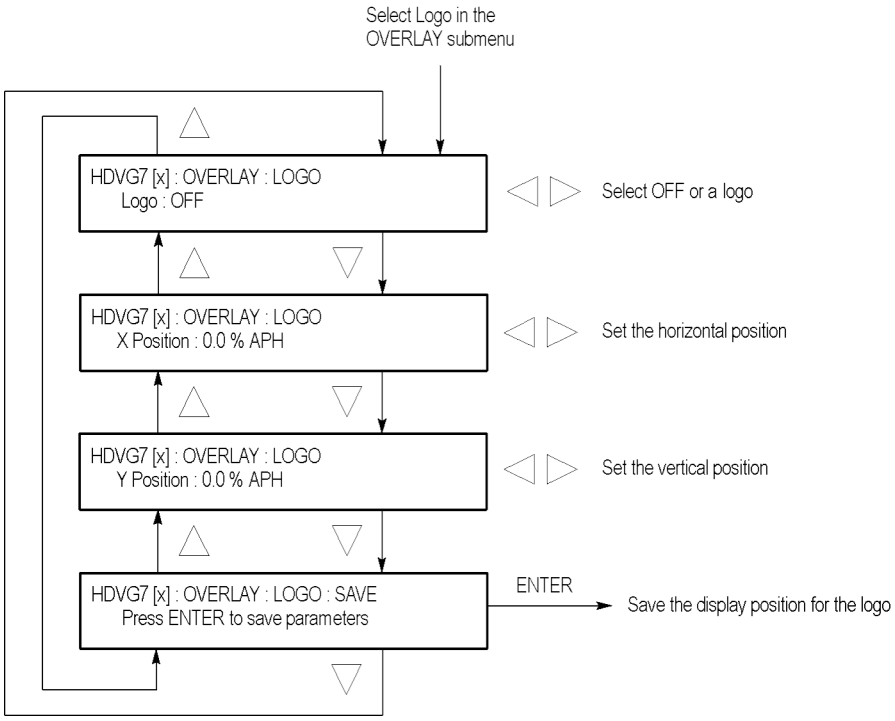


Figure 3-105: HDVG7 module LOGO submenu

Logo. Selects the logo you want to display. Use the left (◄) or right (►) arrow button to select **OFF** or a logo file name. Press the **ENTER** button confirm the selection. When you select OFF, the logo overlay is disabled.

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 0.0% in 0.1% steps.

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 0.0% in 0.1% steps.

SAVE. Saves the display position for the logo to the logo file. Press the **ENTER** button to save the current settings.

HDVG7 module ID TEXT submenu

Use this menu to edit a text overlaid on the output test signal, and to set the display position of the text. Use the up (▲) or down (▼) arrow button to change the menu items. The following figure shows the ID TEXT submenu.

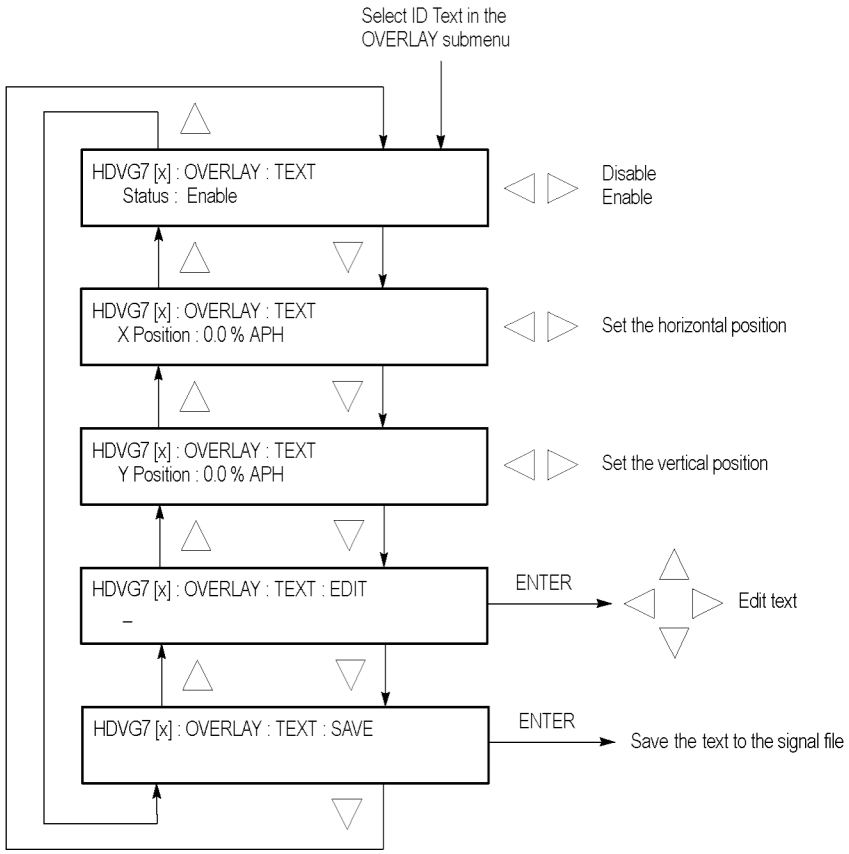


Figure 3-106: HDVG7 module ID TEXT submenu

Status. Enables or disables the text overlay. Use the left (◄) or right (►) arrow button to select between **Enable** and **Disable**, and then press the **ENTER** button to confirm the selection.

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 100.0% in 1% steps.

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 100.0% in 1% steps.

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.
5. Use the left (◄) or right (►) arrow button to select **SAVE**, and then press the **ENTER** button to save the text and its position to the signal file.

SAVE. Saves the text and its position to the signal file currently being output. Press the **ENTER** button to save the text and its position to the signal file.

HDVG7 module 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 CIRCLE submenu.

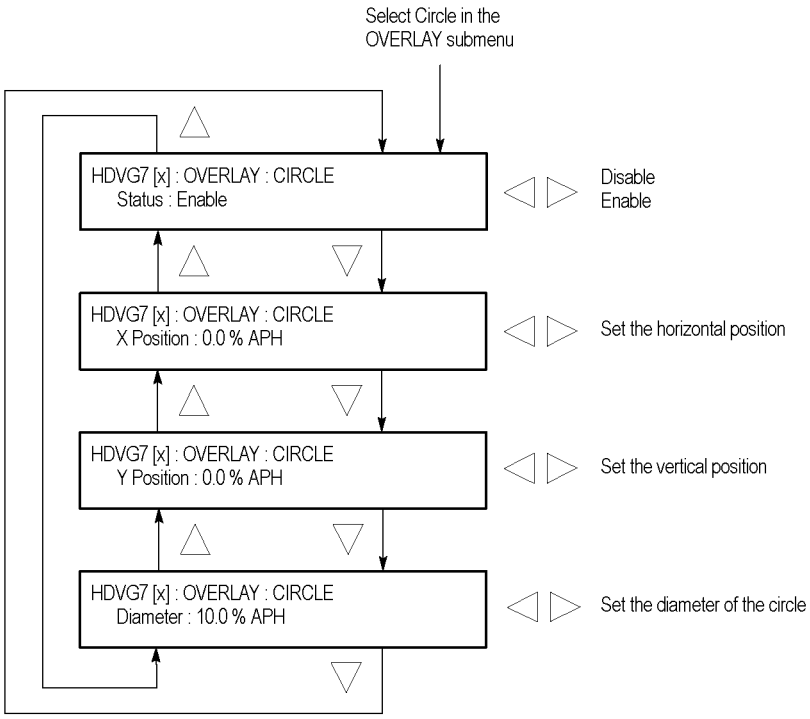


Figure 3-107: HDVG7 module CIRCLE submenu

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.

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 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 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 1% steps.

HDVG7 module AUDIO GROUP submenu

Use this menu to perform the following tasks:

- Enable or disable the embedded audio of the selected audio group.
- Select which audio channel to enable.
- Set the emphasis status bits, sampling alignment status bits, and sample bits of the selected audio group.

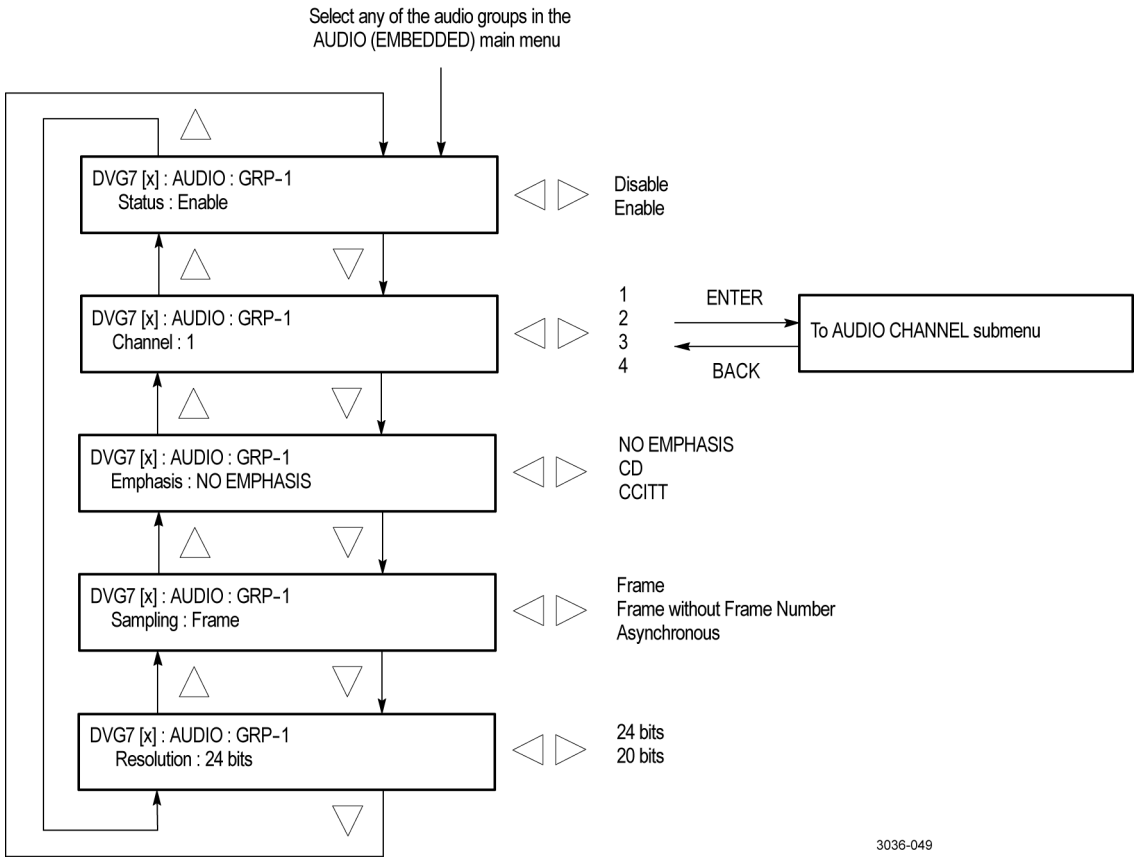


Figure 3-108: HDVG7 module AUDIO GROUP submenu

Status. Enables or disables the generation of embedded audio for the selected audio group. Use the left (◄) or right (►) arrow button to select between **Enable** and **Disable**. Press the **ENTER** button to confirm the selection.

Channel. Selects the audio channel for which you will change the parameters. Use the left (◄) or right (►) arrow button to select **1**, **2**, **3**, or **4**. Select any audio channel, and then press the **ENTER** button to access the AUDIO CHANNEL submenu. (See page 3-235.)

Emphasis. Sets the emphasis status bits for the selected audio group. Use the left (◄) or right (►) arrow button to select **NO EMPHASIS**, **CD**, or **CCITT**. Press the **ENTER** button to confirm the selection.

Sampling. Sets the sampling alignment status bits for the selected audio group. Use the left (◄) or right (►) arrow button to select **Frame**, **Frame without Frame Number**, or **Asynchronous**. Press the **ENTER** button to confirm the selection.

Resolution. Sets the resolution of the audio signal data for the selected audio group. Use the left (◄) or right (►) arrow button to select between **24 bits** and **20 bits**. Press the **ENTER** button to confirm the selection.

HDVG7 module AUDIO CHANNEL submenu

Use this menu to set the frequency, amplitude, and audio click of the embedded audio signal for the selected audio channel. Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the AUDIO CHANNEL submenu.

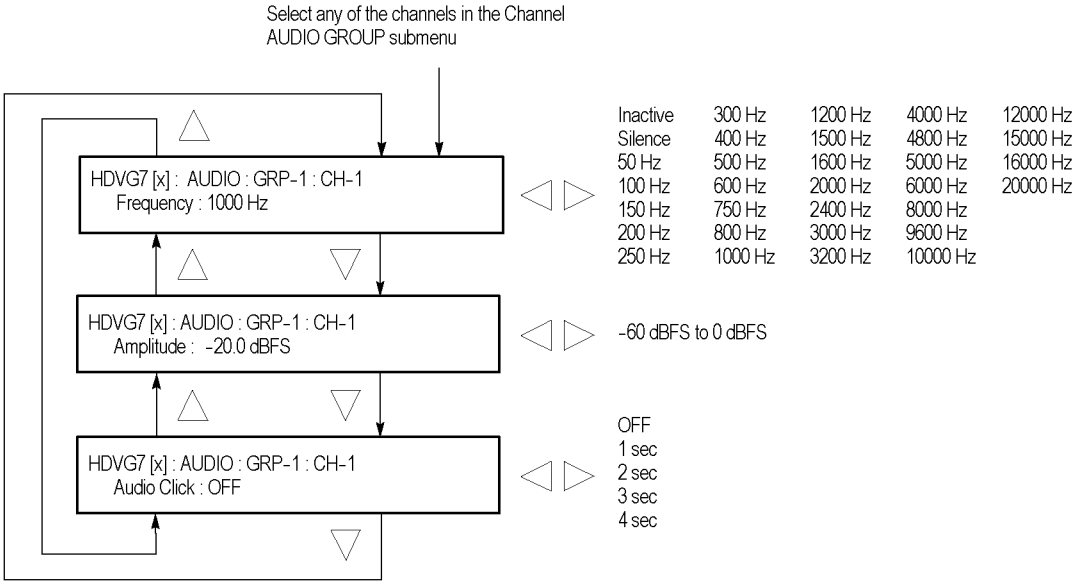


Figure 3-109: HDVG7 module AUDIO CHANNEL submenu

Frequency. Sets the audio signal frequency of the selected audio channel. Use the left (◄) or right (►) arrow button to select the frequency. The selection items are as follows:

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, the audio data output is disabled. Press the **ENTER** button to confirm the selection.

Amplitude. Sets the audio signal amplitude of the selected audio channel. Use the left (◄) or right (►) arrow button to set the amplitude. You can 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 second 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 second; the click occurs during this silence.

When Audio Click is **OFF**, the Audio Tone selected in the FREQUENCY menu is output continuously. Audio Click makes it easy to identify any channel(s) of the four output channels.

HDVG7 module 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 TIMING submenu.

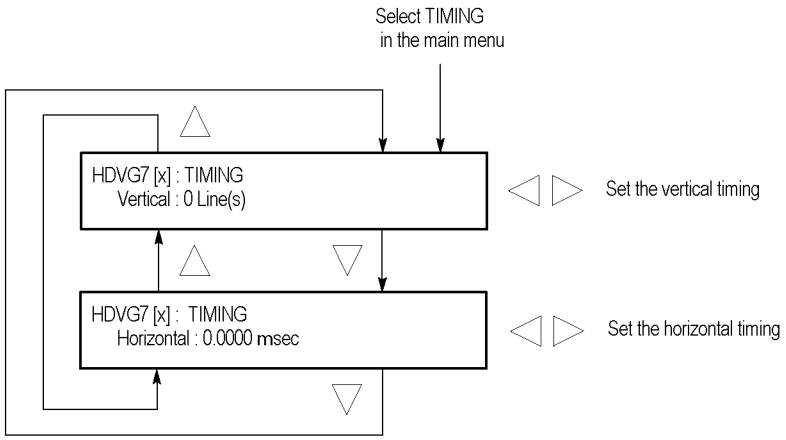


Figure 3-110: HDVG7 module TIMING submenu

Vertical. Sets the vertical timing offset. Use the left (◄) or right (►) arrow button to change the timing offset. You can set the value from -1/2 to +1/2 frame in 1-line steps.

Horizontal. (See page 3-130, *GPS7 module TIME OF DAY submenu*.)Sets the horizontal timing offset. Use the left (◄) or right (►) arrow button to change the timing offset. You can set the value from -1 to +1 line in 1-clock (13.5 ns) steps.

NOTE. *You can reset the timing offset to zero by pressing the left (◄) or right (►) arrow buttons simultaneously.*

HDVG7 module TIMECODE submenu

Use this menu to set timecode parameters for the module outputs. This menu is only available when a GPS7 module is also installed in the instrument.

NOTE. *To display the TIMECODE submenu, the HDVG7 module hardware must be version 2.0 or above.*

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

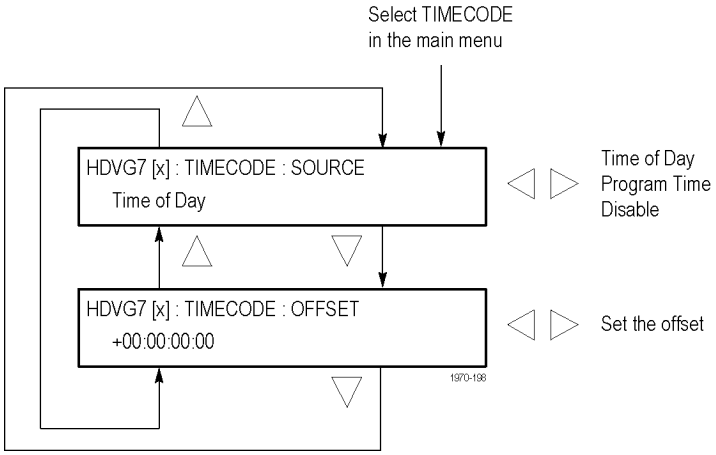


Figure 3-111: HDVG7 module TIMECODE submenu

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

- **Time of Day:** Uses the time of day as determined by the time of day menu selection. (See page 3-130.)
- **Program Time:** Uses the program time counter as the timecode.
- **Disable:** Disables the timecode function for the HDVG7 module.

OFFSET. Use this menu item to set a time offset for the HDVG7 module outputs from the timecode input from the GPS7 module. You can enter a time offset of up to ±23:59:59:29 from the selected time source (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.

HDVG7 module VIDEO submenu

Use this menu to turn each serial digital video component (Y, Pb, or Pr) on or off individually, and to turn the output mode for an audio/video timing measurement on or off. Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the VIDEO submenu.

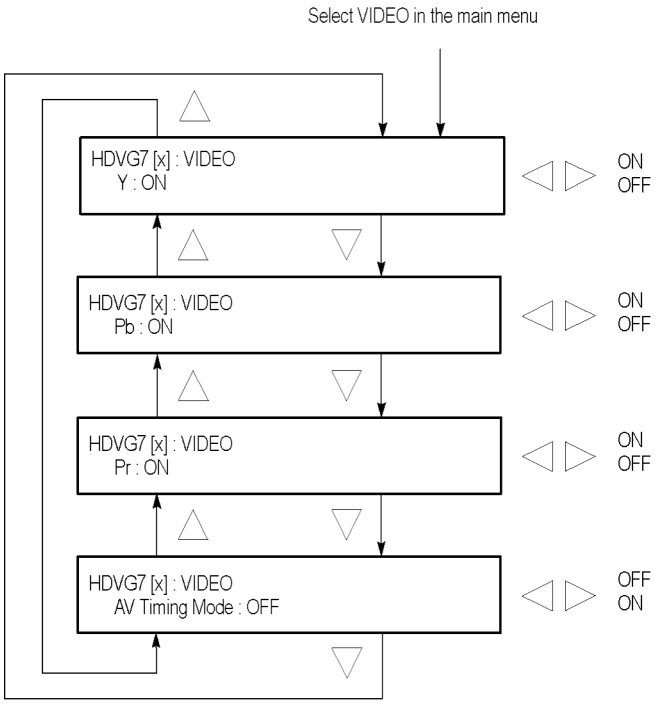


Figure 3-112: HDVG7 module VIDEO submenu

Y. Turns the Y component of the serial digital video signals on or off. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. Press the **ENTER** button to confirm the selection.

Pb. Turns the Pb component of the serial digital video signals on or off. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. Press the **ENTER** button to confirm the selection.

Pr. Turns the Pr component of the serial digital video signals on or off. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. Press the **ENTER** button to confirm the selection.

AV Timing Mode. Turns the output mode for an audio/video timing measurement on or off. Use the left (◄) or right (►) arrow button to select between **ON** and **OFF**. Press the **ENTER** button to confirm the selection.

When you turn this mode on, the specified audio and video signals are synchronously on for 0.5 second and off for 4.5 seconds. With this signal, you can measure the time delay that accumulates between the audio and video content of the television signal during signal transport. The time delay can be measured by a video analyzer with the serial digital video signal or by an oscilloscope with the analog audio and video signals extracted from the serial digital video signal.

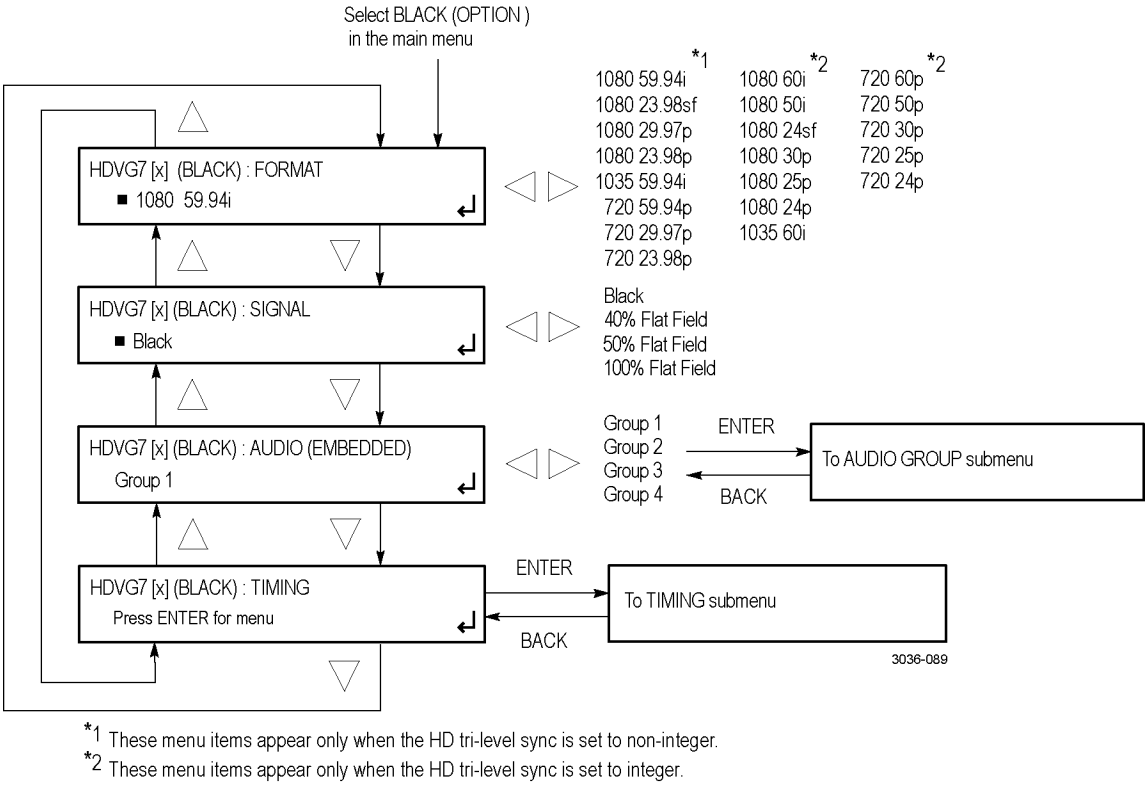
The following settings are recommended for the audio and video signals when you use this mode:

- Audio signal (CH1 and CH2 of Group 1): 10000 Hz, -20 dBFS
- Video signal: 100% Flat Field

NOTE. *The AV Timing Mode setting is not saved as a preset.*

HDVG7 module BLACK submenu (Option BK Only)

Use this menu to set the parameters of the serial digital signals output from the BLACK1 and BLACK 2 connectors. Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the BLACK submenu.



*1 These menu items appear only when the HD tri-level sync is set to non-integer.
*2 These menu items appear only when the HD tri-level sync is set to integer.

Figure 3-113: HDVG7 module BLACK submenu (Option BK only)

FORMAT. Selects the format of the output serial digital black signals. Use the left (◄) or right (►) arrow button to select from the 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.*

Table 3-46: HDVG7 module output signal formats

Non-integer HD trilevel sync rate [1]	Integer HD trilevel sync rate [1]
1080 59.94i	1080 60i
1080 23.98sf	1080 50i
1080 29.97p	1080 24sf
1080 23.98p	1080 30p
1035 59.94i	1080 25p
720 59.94p	1080 24p
720 29.97p	1035 60i
720 23.98p	720 60p
	720 50p
	720 30p
	720 25p
	720 24p

[1] The signal formats available in this submenu depend on the HD trilevel sync rate setting (non-integer or integer), which is set using the HD Rate selection in the HDVG7 module main menu. (See page 3-225, *HDVG7 module main menu*.)

SIGNAL. Selects the serial digital black signal to output. Use the left (◄) or right (►) arrow button to select between **Black** (serial digital black), **40% Flat Field**, **50% Flat Field**, and **100% Flat Field**. Press the **ENTER** button to confirm the selection.

AUDIO (EMBEDDED). Sets the parameters for embedded audio on the serial digital black signals. Use the left (◄) or right (►) arrow button to select **Group 1**, **Group 2**, **Group 3**, or **Group 4**. Select any of the groups, and then press the **ENTER** button to access the AUDIO GROUP submenu. (See page 3-234.)

TIMING. Sets the timing offset of the serial digital black outputs relative to the internal reference signal (frame reset signal). Select this menu item, and then press the **ENTER** button to access the TIMING submenu. (See page 3-237.)

HDVG7 module factory default settings

The following table shows the factory default settings for the HDVG7 module. These settings are recalled when you select **Factory Default** from the **PRESET : RECALL** menu item in the mainframe main menu.

Table 3-47: HDVG7 module factory default settings

Menu item name	Settings
STATUS	1080 59.94i SMPTE Color Bars
MOVING PICTURE	
H Step	0 Sample(s)
V Step	0 Line(s)
Period	1 Frame(s)
Random	Disable
OVERLAY : OBJECT	Logo
OVERLAY : BLINK	OFF
OVERLAY : LOGO	
Logo	OFF
OVERLAY : ID TEXT	
Status	Disable
OVERLAY : CIRCLE	
Status	Disable
X Position	0.0% APH
Y Position	0.0% APH
Diameter	90% APH
AUDIO : GRP-1 to GRP-4	
Status	Disable
Emphasis	No Emphasis
Sampling	Frame
Resolution	24 bits
AUDIO : GRP-1 : CH-1 to CH-4	
Frequency	1000 Hz
Amplitude	-20.0 dBFS
Audio Click	OFF
TIMING	
Vertical	0 Line(s)
Horizontal	0.0000 ms

Table 3-47: HDVG7 module factory default settings (cont.)

Menu item name		Settings
VIDEO		
	Y	ON
	Pb	ON
	Pr	ON
	AV Timing Mode	OFF
TIMECODE (requires GPS7 module be installed in mainframe)		
	SOURCE	Disable
Option BK		
(BLACK) FORMAT		1080 59.94i
(BLACK) SIGNAL		Black
(BLACK) AUDIO : GRP-1 to GRP-4		
	Status	Disable
	Emphasis	No Emphasis
	Sampling	Frame
	Resolution	24 bits
(BLACK) AUDIO : CH-1 to CH-4		
	Frequency	1000 Hz
	Amplitude	-20.0 dBFS
	Audio Click	OFF
(BLACK)TIMING		
	Vertical	0 Line(s)
	Horizontal	0.0000 ms
HD RATE		Non-integer

SDI7 Dual Channel SD/HD/3G SDI Video Generator module

This section describes the module-specific functions of the SDI7 Dual Channel SD/HD/3G SDI Video Generator module. Refer to the following locations for additional information about this module:

- *SDI7 module connectors* for a description of the rear-panel connectors. (See page 2-18.)
- *SDI7 module functional check* for a basic procedure to check that the module is functional. (See page 1-40.)
- *TG8000 Specifications and Performance Verification Technical Reference* for module specifications and for a detailed procedure to verify that the module is functioning as specified.
- *TG8000 Programmer Manual* for information about the commands to remotely control the module.

SDI7 module product description

The SDI7 Dual Channel SD/HD/3G SDI Video Generator module can be operated as a signal generator to output two channels of 270 Mb/s SD-SDI, 1.5 Gb/s HD-SDI, and 3 Gb/s SDI video test signals in a variety of formats, including both Level A and Level B mapping structures for 3G-SDI signals. (See page 3-249, *To select an output signal on the SDI7 module*.)

The module provides the following features:

- Two serial-digital channels, each independently configurable for 270 Mb/s, 1.5 Gb/s, or 3 Gb/s signals.
- Two SDI outputs per channel for simultaneous test signal and test/black signal output.
- One clock/frame/line trigger output.
- Generates test signals in many formats, with both 3G-SDI Level A and Level B mapping structures supported.
- Standard test signals, including SMPTE color bars and SDI pathological test patterns.
- Zone plate test signals, with full control of all parameters.
- Full frame picture display.
- Overlay of circle or logo on the video signal.
- Text overlay with support for Latin, Cryillic, Greek, and symbol character sets.

- Generates a moving picture by scrolling the active picture area of the output test signal.
- Up to 32 channels of 24-bit embedded digital audio with a sample rate of 48 kHz.
- AV Timing mode.
- Timing adjustment anywhere in the frame for the output.
- Timecode generator with ATC-LTC or ATC-VITC.
- Full remote control using Ethernet interface.
- SMPTE 352M payload identifier.
- User-defined ancillary data packet.

How to operate the SDI7 module

After the module is installed in the mainframe, and the mainframe is installed in the rack or other location where it will be used, use the following procedure to access each function of the module:

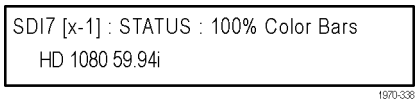
1. Connect the power cord to the power connector on the rear panel, and then plug the cord into the AC electric power source. Electric power is supplied to the mainframe.
2. Wait until the power-on initialization process is complete, and then check that no error messages appear on the display.
3. After the initialization process is complete, the mainframe main menu appears as shown below:

3036-008

4. For first-time operation only, if you ordered Option 3G as an upgrade to your existing SDI7 module, you must enter the option key that was supplied with the upgrade in order to enable the 3G software option. (See page 3-247, *To enter the option key on the SDI7 module*.)

NOTE. *If you ordered Option 3G at the same time you ordered the SDI7 module, the module was shipped from the factory with the option already enabled.*

5. Press the front-panel **MODULE** button until the SDI7 module main menu appears for the desired SDI7 channel (channel 1 or channel 2).



NOTE. *The SDI7 module provides two channels of output. The display indicates which SDI7 channel is selected. For example, a display of SDI7[3-1] indicates that the SDI7 module is installed in slot 3 and that channel 1 is selected. A display of SDI7[3-2] indicates that channel 2 is selected.*

Press the MODULE button to advance from channel 1 to channel 2. You can press the left (◄) or right (►) arrow button to switch between channels 1 and 2 of the selected SDI7 module when the STATUS menu is displayed as shown above.

6. Select the frame rate using the **FORMAT** button, or select the test signal using the test signal front panel buttons, such as **COLOR BARS** or **LINEARITY**.

7. Use the front-panel arrow buttons to navigate and select items in the main menu and submenus. For example, when the **OUTPUT MODE** menu is displayed, pressing the left (◄) or right (►) arrow button allows you to select between output modes such as Level A, Level B, SD, HD, etc.

   Refer to *SDI7 module main menu* for detailed information about the main menu items and the submenu items. (See page 3-275.)

NOTE. *In addition to the factory installed signal sets, there are enhanced signal sets available for the SDI7 module. These signal sets are located on the TG8000 SW Library and Documentation DVD that was supplied with your instrument. (See page 3-260, To install the enhanced signal sets on the SDI7 module.)*

To enter the option key on the SDI7 module

If you ordered Option 3G as an upgrade to your existing SDI7 module, you must enter the option key that was supplied with the upgrade in order to enable the 3G software option.

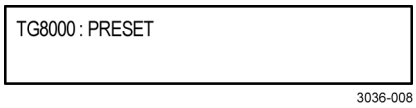
NOTE. *If you ordered Option 3G at the same time you ordered the SDI7 module, the module was shipped from the factory with the option already enabled.*

Each option key applies to only one SDI7 module. You will need to enter the option key only once. After the option key is entered, the option key stays with that SDI7 module, enabling Option 3G even when the module is moved to another TG8000 mainframe or to a TG700 mainframe that is running software version 5.6 or above.

Locate the option key document, and then perform the following steps to enter the option key:

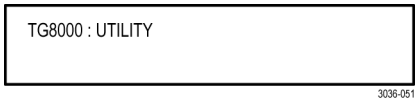
NOTE. *This procedure uses the instrument front panel to enter the option key. You can also use the TG Setup utility to remotely enter the option key. Refer to the TG8000 PC Tools Technical Reference for information about using TG Setup to enter the option key.*

1. Press the front-panel **MODULE** button until the mainframe main menu is displayed as shown below.



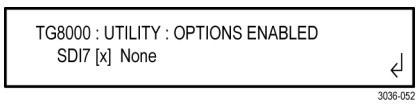
3036-008

2. Press the up (▲) or down (▼) arrow button until **TG8000 : UTILITY** is displayed, and then press the **ENTER** button.



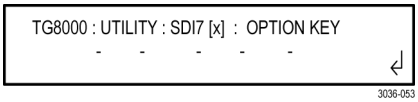
3036-051

3. Press the up (▲) or down (▼) arrow button until **TG8000 : UTILITY : OPTIONS ENABLED** is displayed. The bottom line of the display will list the slot number in which the SDI7 module is installed and will indicate whether option 3G is enabled: **None** is displayed when the option is not enabled, **3G** is displayed when the option is enabled.

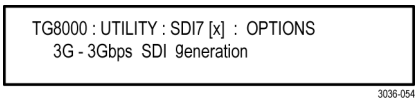


3036-052

4. If more than one SDI7 module is installed in the mainframe, use the left (◄) or right (►) arrow button to select the desired module, and then press the **ENTER** button.
5. Press the up (▲) or down (▼) arrow button until **TG8000 : UTILITY : MODULE ID** is displayed.
6. Verify that the displayed module ID matches the module ID listed on the option key document.
7. Enter the option key:
   a. Press the up (▲) or down (▼) arrow button until **TG8000 : UTILITY : OPTION KEY** is displayed. When Option 3G is not enabled, the option key string is blank as shown below.



   b. Press the **ENTER** button to enter the option key edit mode. The underscore character (_) appears under the first character of the option key.
   c. Use the up (▲) or down (▼) arrow button to select the first character of the option key.
   d. Use the left (◄) or right (►) arrow button to move the underscore character to the next character in the option key.
   e. Enter all of the option key characters, and then press **ENTER** button to confirm the selection.
   f. Press the **BACK** button twice to exit the UTILITY submenu. This returns to the top of the UTILITY submenu.
8. Verify that Option 3G is enabled:
   a. Press the**ENTER** button to enter the UTILITY submenu.
   b. Press the up (▲) or down (▼) arrow button until **TG8000 : UTILITY : OPTIONS ENABLED** is displayed.
   c. Verify that **SDI7[slot number] 3G** is displayed. This indicates that Option 3G has been enabled.



   d. Press the **BACK** button to exit the UTILITY submenu. This returns to the mainframe main menu.

To select an output signal on the SDI7 module

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 3-251, *To select the output mode on the SDI7 module*.)
2. Select the signal format. (See page 3-252, *To select the signal format on the SDI7 module*.)
3. Select the sample structure and depth. (See page 3-252, *To select the sample structure and depth for the SDI7 module (Option 3G only)*.)
4. Select the test signal that you want to generate. (See page 3-253, *To select the test signal on the SDI7 module*.)

Table 3-48: SDI7 module (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 3-49: SDI7 module (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 3-50: SDI7 module (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 3-51: SDI7 module (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 3-52: SDI7 module (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 3-53: SDI7 module (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 3-54: SDI7 module (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 3-55: SDI7 module – 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 3-56: SDI7 module – 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 3-57: SDI7 module – 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															

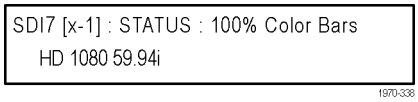
Table 3-58: SDI7 module – SD-625 (720 × 576)

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														

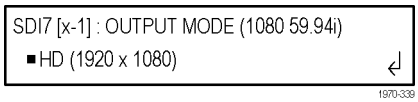
To select the output mode on the SDI7 module

You can select how the generated 270 Mb/s, 1.5 Gb/s, or 3 Gb/s serial data stream is constructed. This selection is available in the SDI7 **OUTPUT MODE** submenu. Perform the following steps to select the output mode:

1. Press the front-panel **MODULE** button until the SDI7 module main menu appears as shown below.



2. Press the down (▼) arrow button to access the output mode menu as shown below.



   Note the dot at the start of the second line and the return symbol at the end of the second line. The dot indicates that this is the currently selected output mode, and the return symbol indicates that you can press the **ENTER** button to select a new displayed output mode.

3. Use the left (◄) or right (►) arrow button to scroll through the available output modes:

   SD
   HD (1920 × 1080)
   HD (1280 × 720)
   3G–Level A (1920 × 1080) *1
   3G–Level A (1280 × 720) *1
   3G–Level A (2K × 1080) *1
   3G–Level B (1920 × 1080)*1
   3G–Level B (2K × 1080)*1
   3G–Level B (2×HD 1080) *1
   3G–Level B (2×HD 720) *1

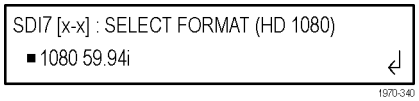
   *1 Available with Option 3G only

4. Press the **ENTER** button to select the desired output mode. Note that the dot will appear in front of the output mode on the display, to indicate that it is now the selected output mode.

To select the signal format on the SDI7 module

Perform the following steps to select the signal format:

1. Press the **FORMAT** button. The menu display changes as follows:

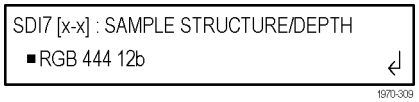


2. Use the left (◄) or right (►) arrow button, or press the **FORMAT** button repeatedly, to select one of the signal formats, and then press the **ENTER** button to confirm the selection. The dot will appear at the left of the second line to indicate that the format has been selected.

3. Press the **BACK** button to exit FORMAT mode.

To select the sample structure and depth for the SDI7 module (Option 3G only)

This menu item appears only when Option 3G is enabled. There are several sample structures to choose from when the output mode is set to a non-fast-progressive format. Press the down (▼) arrow button to navigate to the sample structure/depth selection shown below:



Press the left (◄) or right (►) arrow buttons to scroll through the available sample structures. When the desired sample structure is displayed, press the **ENTER** button to select it.

3G non-fast progressive formats (1080 line)

- RGB 444 12b
- RGB 444 10b
- RGBA 444 10b
- YCbCr 444 12b
- YCbCr 444 10b
- YCbCrA 444 10b
- YCbCr 422 12b
- YCbCrA 422 12b (Level B mapping only)

3G formats (720 line)

- RGB 444 10b
- RGBA 444 10b
- YCbCr 444 10b
- YCbCrA 444 10b

2K line formats

- XYZ 444 12b
- RGB 444 12b

To select the test signal on the SDI7 module

All of the signal sets that are available in the module are already assigned to the corresponding test signal buttons. (See Table 3-59.) When the SDI7 module is selected and you press any of the front-panel test signal buttons, the selected signal in the signal set is output. (See Figure 3-114.)

For example, when you press the **COLOR BAR** test signal button, a signal in the Color Bars signal set is output. Use the left (◄) or right (►) arrow button, or press the **COLOR BAR** test signal button repeatedly to select a different signal from the Color Bars signal set.

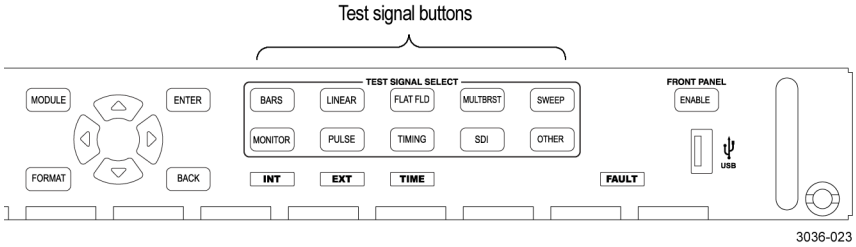


Figure 3-114: Front-panel test signal buttons

The following table lists the signal set assigned to each test signal button and the signals that can be selected in the signal set when the module is in generator mode.

Table 3-59: SDI7 module signal sets assigned to the test signal buttons

Button name	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 SDI7 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.

Table 3-59: SDI7 module signal sets assigned to the test signal buttons (cont.)

Button name	Signals in the signal set	Description
	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.
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 3-59: SDI7 module signal sets assigned to the test signal buttons (cont.)

Button name	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 page 3-260, *To install the enhanced signal sets on the SDI7 module*.)
	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 page 3-260, *To install the enhanced signal sets on the SDI7 module*.)
	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 page 3-260, *To install the enhanced signal sets on the SDI7 module*.)
	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 page 3-260, *To install the enhanced signal sets on the SDI7 module*.)
	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 page 3-260, *To install the enhanced signal sets on the SDI7 module*.)
	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. (See page 3-260, *To install the enhanced signal sets on the SDI7 module*.)

Table 3-59: SDI7 module signal sets assigned to the test signal buttons (cont.)

Button name	Signals in the signal set	Description
MULTIBURST		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. 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. 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. For 4:4:4 formats, each multiburst pattern is identical for all three channels.
	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.
SWEEP	Circle, Diagonal Sine, H Sine, H Sweep, V Sine, V Sweep, Custom-1, Custom-2	Zone plate test signal with real-time parametric controls. (See page 3-262, *SDI7 module zone plate signals*.)
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 3-59: SDI7 module signal sets assigned to the test signal buttons (cont.)

Button name	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 3-59: SDI7 module signal sets assigned to the test signal buttons (cont.)

Button name	Signals in the signal set	Description
PULSE BAR	2T Pulse and Bar	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. The type of 2T pulse depends on the signal format: ■ 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	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.
TIMING	Co-siting Pulse	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.

Table 3-59: SDI7 module signal sets assigned to the test signal buttons (cont.)

Button name	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.
OTHER	Frame Picture	Picture rendered from user-supplied BMP files stored in the PICTURE directory of the TG8000 mainframe memory. Use the left or right arrow button to select a test signal from the list. (See page 3-261, *To install custom picture files (BMP format)*.)

To install the enhanced signal sets on the SDI7 module

In addition to the factory installed signal sets, there are enhanced signal sets available for the FLAT FIELD button on the SDI7 module. These signals are located on the *TG8000 SW Library and Documentation DVD* that was supplied with your instrument.

Perform the following steps to install the enhanced signal sets:

1. Install the *TG8000 SW Library and Documentation DVD* into the DVD drive on your computer.
2. Using the DVD browser, navigate to the following directory: Test Signals > SDI7 Signal Library > Enhanced Signal Set.

   The Enhanced Signal Set directory contains the following files:

   - Monochrome Fields.xml — includes all monochrome flat fields from 0% to 100% in 10% increments.
   - Color Fields.xml — includes color fields for six primary and secondary colors at both 100% and 75% values.
   - SMPTE RP431-2 Color Patches.xml — includes full field patterns for each of the Black-White and Black-Dark Gray steps, plus the "–1" and "–2" color patches.
3. Use FTP to locate and copy the desired signal set file(s) from the DVD to the SDI7/SIGNAL directory on your TG8000 generator. Instructions for using FTP are located in the *How to transfer user files using FTP* section of this manual. (See page 2-65.)

NOTE. *If you load the Monochrome Fields.xml and Color Fields.xml enhanced signal sets on your TG8000 generator, you can delete the Flat Fields.xml file from the SDI7/SIGNAL directory, since it contains a duplicate copy of a subset of the Monochrome Fields.xml and Color Fields.xml patterns.*

4. After you load the new signal set file(s) on the TG8000 generator, you must either reboot the TG8000 or perform the following SCPI command before the new signals will be available:

   OUTPut[1/2]:SYNThesizer:SIGNal:BUILd

   This command rebuilds the XML signal library and will detect any newly added signals.

To reinstall the factory default signal sets. To reinstall the factory default signal sets, perform the previous procedure to install the signal set files from the following directory on the *TG8000 SW Library and Documentation DVD*: Test Signals > SDI7 Signal Library > Standard Signal Set.

After you reinstall the standard signal sets, delete the enhanced signal set file(s) from the SDI7/SIGNAL directory, and then reboot the instrument.

To install custom picture files (BMP format)

To install custom picture test signals, use FTP to copy the BMP picture file(s) you created to the SDI7/PICTURE directory on the TG8000. The instructions for using FTP are located in the *How to transfer user files using FTP* section of this manual. (See page 2-65.) After the BMP files are downloaded to the TG8000, press the MODULE button to select the desired SDI7 module, and then press the OTHER button to select the desired BMP file.

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.*

About SDI7 picture file generation. When generating signals from frame pictures, the SDI7 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 SDI7 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 SDI7.
- 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.

SDI7 module 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.

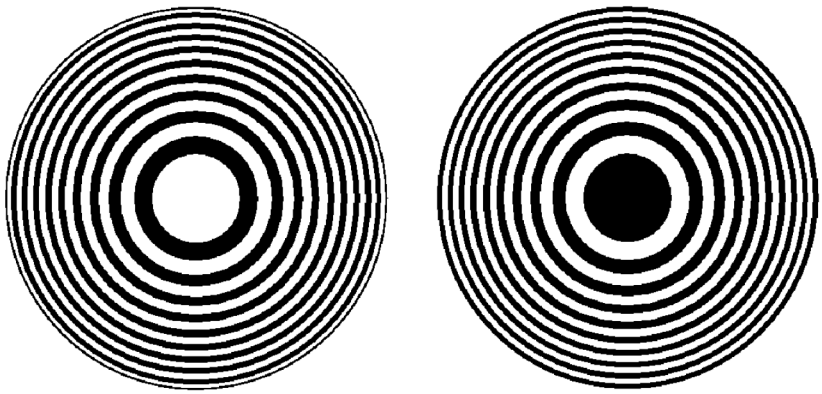


Figure 3-115: Optical zone plates (enlarged)

The SDI7 module 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 select a zone plate signal on the SDI7 module

Perform the following steps to select a zone plate signal for output:

1. Press the **SWEEP** test signal button to enter the zone plate signal menu. Once you enter the zone plate signal menu, the SDI7 generator module will start to output the displayed zone plate signal. The dot in front of the signal name, on the second line of the display, indicates the selected default signal.
2. Use the left (◄) or right (►) arrow button to select a zone plate signal from the provided six standard zone plate signals (Circle, Diagonal, Horizontal Sine, Horizontal Sweep, Vertical Sine, or Vertical Sweep), or from the two user-defined signals (Custom-1 Zoneplate or Custom-2 Zoneplate).

   The zone plate signal whose name is displayed will continue to be output until a different signal is selected, even if you press the **BACK** button.

   If you select a different signal, such as a color bar signal, and then press the **SWEEP** button again, the last displayed zone plate signal will be shown as the default and will again be the output signal.

To modify a zone plate signal on the SDI7 module

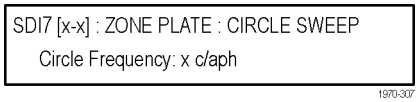
There are times when a specific test case requires a modified zone plate signal. By making and saving changes to the zone plate parameters you can create a new signal that is based on the selected signal, and then save that new signal. Changes you make affect only the new signal; the standard zone plate 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 (below) and zone plate pattern dependent parameters. (See page 3-267, *SDI7 module zone plate dependent parameters*.)

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

1. Press the **SWEEP** button to enter the zone plate signal menu.
2. 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).

3. 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:



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

4. 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.*

5. 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.

6. When you are done altering parameters, scroll to the **Save As:** selection, at the bottom of the menu and use the left (◄) or right (►) arrow button to select **User Custom 1** or **User Custom 2**.

7. Press the **ENTER** button to save the modified signal.

SDI7 module 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 SDI7 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 SDI7 Generator module 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 3-60.) 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 3-60: SDI7 module zone plate pattern control parameters

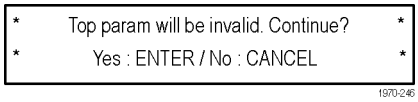
Zone plate signal	Pattern control parameter	Parameter definition
Circle	Circle Frequency (maximum c/aph)	The circle frequency is actually the equivalent of the maximum vertical sinusoid frequency at the very top and bottom of the screen (see the discussion of the K_Y 2 parameter). Adjusting the circle 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 KX and KY 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 MHz/2 = 37.125 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_Y 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_Y 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_Y 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_Y2/K_Y)/2). For example, in a standard with 1080 lines per field, a vertical sweep frequency of 2160 c/aph2 would result in one complete frequency sweep down the picture.

SDI7 module 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:



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 3-116.)

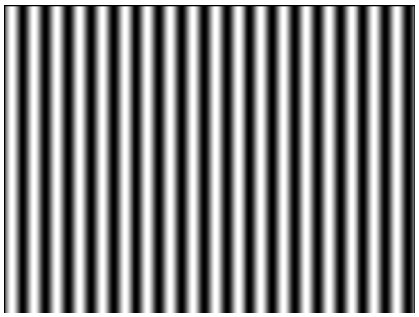


Figure 3-116: A "K_X-only" zone plate

K_X^2 parameter

Display name: KX^2 (H Sweep.)

Units: c/aph per active picture height (c/aph^2)

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:

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

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 3-117.)

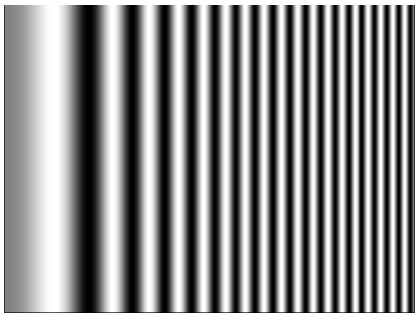


Figure 3-117: A "K_X^2-only" zone plate

K_{XY} parameter

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

Units: c/aph per active picture height (c/aph^2)

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 SDI7 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 3-118.)

Figure 3-118: A "K_Y-only" zone plate

K_Y^2 parameter

Display name: KY^2 (V Sweep).

Units: c/aph per active picture height (c/aph^2)

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 3-119.)

Figure 3-119: A "K_Y^2-only" zone plate

K parameter

Display name: K (Phase)

Units: cycles

The $K_\varnothing$ 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 $K_\varnothing$. 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 $K_\varnothing = 0.25$, the pattern will begin in the upper left corner of the screen as white; when $K_\varnothing = –0.25$, 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 KY 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: KT^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 YCbCr 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**.

How to use zone plate signals on the SDI7 module

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 SDI7 generator module'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 × 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.

SDI7 module main menu

Use the SDI7 module main menu to perform the following tasks:

- Set the video signal output mode.
- Change the sample structure and color space.
- Scroll the active picture area of the output signal.
- Set the logo, text, or circle overlay on the output signal.
- Control the embedded audio characteristics: frequency, amplitude, click rate, and sampling rate.
- Set the timing offset of the outputs relative to an internal reference signal or an external reference signal.
- Enable or disable ancillary timecode and set timecode parameters.
- Enable or disable the discrete components of the video output signal.
- Enable or disable edge filtering on the video output signal.
- Enable or disable the AV Timing mode.
- Enable or disable the user-defined ancillary data payload and set the payload structure.
- Enable or disable the SMPTE 352M video payload identifier.
- Set the line, frame, or clock rate as a trigger for an external instrument, such as an oscilloscope.
- Select between a test signal or a black signal for the secondary (SIGNAL 1B or SIGNAL 2B) output.
- View diagnostics, operation parameters, and CRC error counts from the video input.
- Access output calibration (only available when in factory mode).

Use the up (▲) or down (▼) arrow button to scroll through the main menu. The following figures show the SDI7 module main menu.

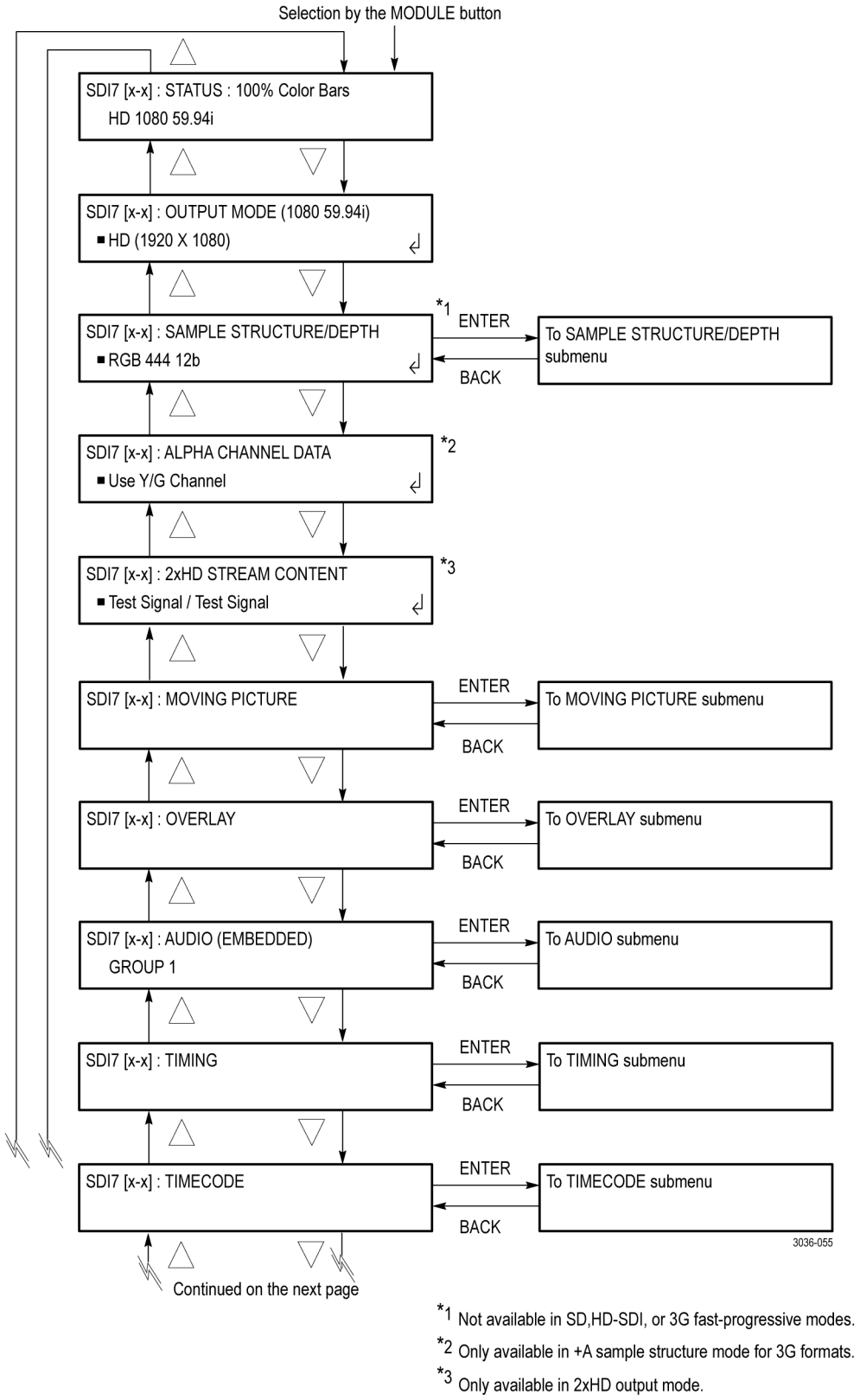


Figure 3-120: SDI7 module main menu

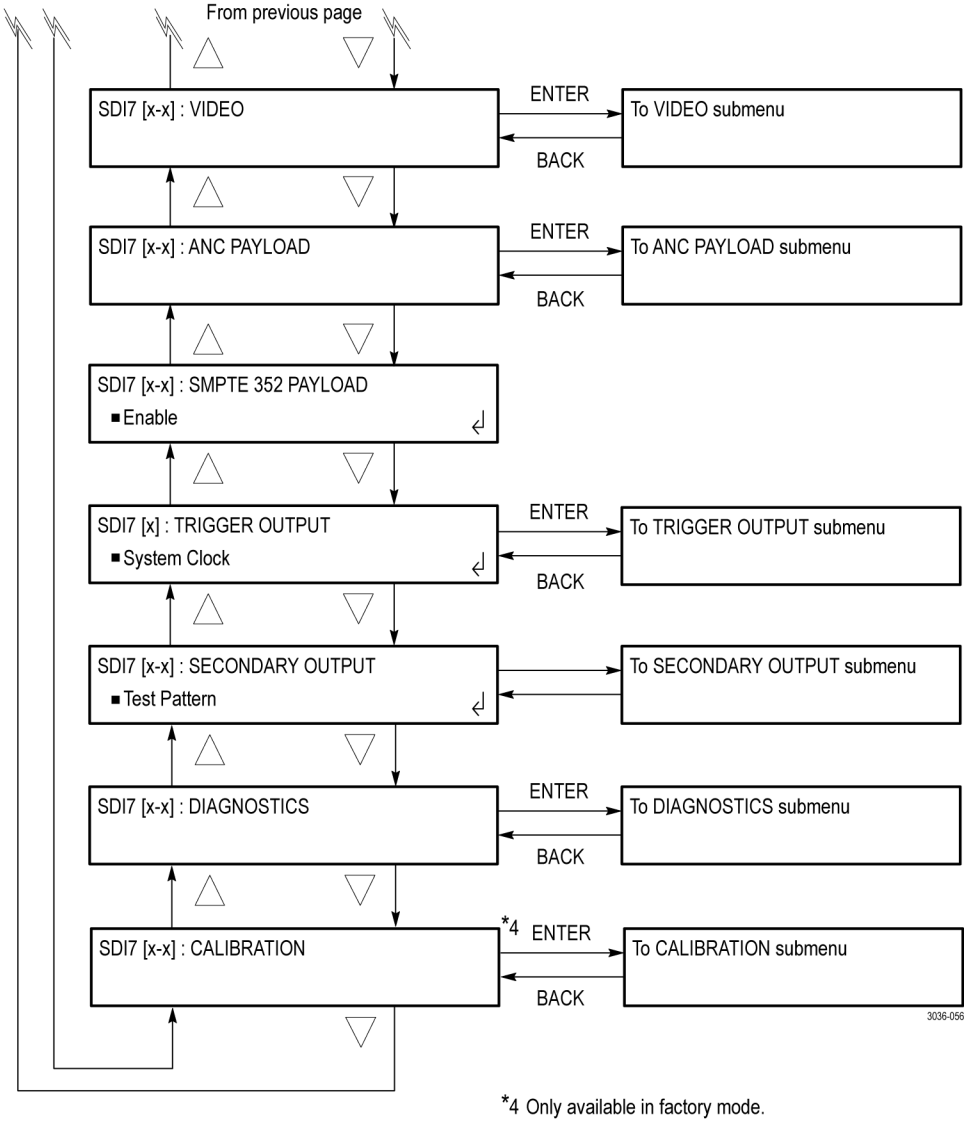


Figure 3-121: SDI7 module main menu (Continued)

STATUS. Displays the instrument operating mode, output signal format, and output sample structure. (See page 3-281, *SDI7 module STATUS menu*.)

OUTPUT MODE. Which output modes are available depend on whether Option 3G is enabled or not. When Option 3G is not enabled, only the SD and HD output modes are available.

Selects the mapping format of the output signal to **Level A** (direct image format mapping), **Level B** (SMPTE 372M dual link mapping), as described by SMPTE 425, **SD**, or **HD-SDI**.

Within Level A and Level B there are also selections for 1920 × 1080, 2K × 1080, and 1280 × 720 (Level A only) formats. Also, for Level B only, there are selections for 2×HD 1920 × 1080 and 2×HD 1280 × 720 formats. The 2×HD mode produces two standard HD streams in the same format (e.g. 1080). Select between Test Signal/Test Signal or Test Signal/Black for the two streams. (See page 3-281, *SDI7 module OUTPUT MODE submenu*.)

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 non-fast-progressive formats (1080 line)

- RGB 444 12b
- RGB 444 10b
- RGBA 444 10b
- YCbCr 444 12b
- YCbCr 444 10b
- YCbCrA 444 10b
- YCbCr 422 12b
- YCbCrA 422 12b (Level B mapping only)

3G formats (720 line)

- RGB 444 10b
- RGBA 444 10b
- YCbCr 444 10b
- YCbCrA 444 10b

2K line formats

- XYZ 444 12b
- RGB 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.

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 **MOVING PICTURE** submenu. (See page 3-283, *SDI7 module 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 OVERLAY submenu. (See page 3-285.)

AUDIO (EMBEDDED). Sets the parameters for embedded audio on the serial digital signals. Use the left (◄) or right (►) arrow button to select **Group 1**, **Group 2**, **Group 3**, or **Group 4**. Once the group is selected, press the **ENTER** button to access the **AUDIO GROUP** submenu. (See page 3-294, *SDI7 module AUDIO (EMBEDDED) submenu*.)

If Level B mapping is selected, all four groups are available in both Link A and Link B, for a total of eight groups.

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 **TIMING** submenu. (See page 3-297, *SDI7 module TIMING submenu*.)

TIMECODE. Use this menu to set timecode parameters for the selected output. Press the **ENTER** button to access the **TIMECODE** submenu. (See page 3-298, *SDI7 module 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 **VIDEO** submenu. (See page 3-300, *SDI7 module VIDEO submenu*.)

ANC PAYLOAD. Use this menu to define and control the user-defined ancillary data payload insertion. Press the **ENTER** button to access the **ANC Payload** submenu. (See page 3-302, *SDI7 module ANC PAYLOAD submenu*.)

SMPTE 352 PAYLOAD. 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.*

TRIGGER OUTPUT. Allows you to select a line rate, frame rate, the module system clock, or a pixel clock as a trigger for an external instrument, such as an oscilloscope. You can also select which SDI7 channel to use as the trigger source. (See page 3-309, *SDI7 module TRIGGER OUTPUT submenu*.)

SECONDARY OUTPUT. Use the left (◄) or right (►) arrow button to select one of the following signals for the secondary (bottom) BNC connector: **Test Pattern**, **Black**, **Black (No Audio)**, **Black (Mute Audio)**, **Test Pattern (No Audio)**, or **Test Pattern (Mute Audio)**. Press the **ENTER** button to confirm the selection.

When set to any of the Test Pattern selections for channel 1, the Signal 1A and Signal 1B connectors will output the same test signal. The same is true for the channel 2 connectors when Test Pattern is set as the Secondary Output selection for channel 2.

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

DIAGNOSTICS. Allows access to the outputs of several diagnostics, shows operation parameters for the module, and allows you to clear the counts of CRC errors that are detected in the input signal. This menu provides status information only and does not affect operating behavior. Select this menu item, and then press the **ENTER** button to enter the DIAGNOSTICS submenu. (See page 3-310, *SDI7 module DIAGNOSTICS submenu*.)

CALIBRATION. Provides a variety of special signals to help measure amplitude and rise time, and allows you to adjust serial output amplitude. This menu is accessible in factory mode only. (See page 3-313, *SDI7 module CALIBRATION submenu*.)

SDI7 module STATUS menu

Displays the output signal format, and output sample structure.

The following figure shows an example STATUS display with Option 3G enabled.

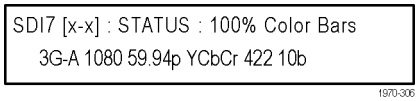


Figure 3-122: SDI7 module STATUS menu in Generator mode

- **100% Color Bars:** Indicates the name of the signal currently being generated.
- **3G-A:** Indicates the 3 Gb/s signal and the level currently being generated.
- **1080 59.94p:** Indicates the output format.
- **YCbCr 4:2:2 10 bits:** Indicates the output sampling structure.

SDI7 module OUTPUT MODE submenu

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. The following figure shows the OUTPUT MODE submenu.

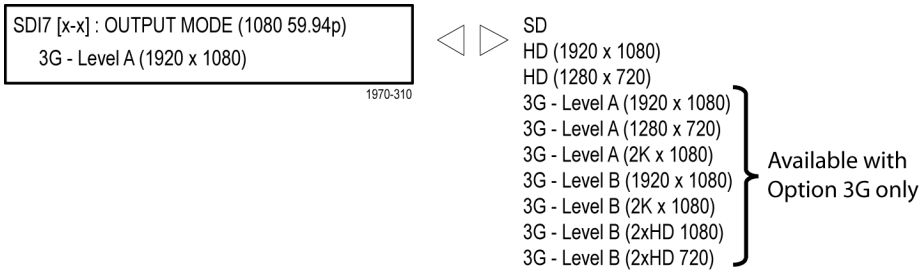


Figure 3-123: SDI7 module OUTPUT MODE submenu

SD. The output is a SMPTE 259 compliant signal that runs at 270 Mbps.

HD (1920 × 1080). The output is a 1080-line, SMPTE 274M compliant signal.

HD (1280 × 720). The output is a 720-line, SMPTE 296M compliant signal.

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.

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.

2K × 1080. (Option 3G only) Available in both Level A and Level B mapping, this selection provides 2048 × 1080 resolution signals, primarily for digital cinema applications.

2×HD. (Option 3G only) Available in Level B mapping, 2×HD signals provide two standard SMPTE 292 HD streams in the same format (for example 1080i 59.94). Select between Test Signal/Test Signal or Test Signal/Black for the two streams.

SDI7 module 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.

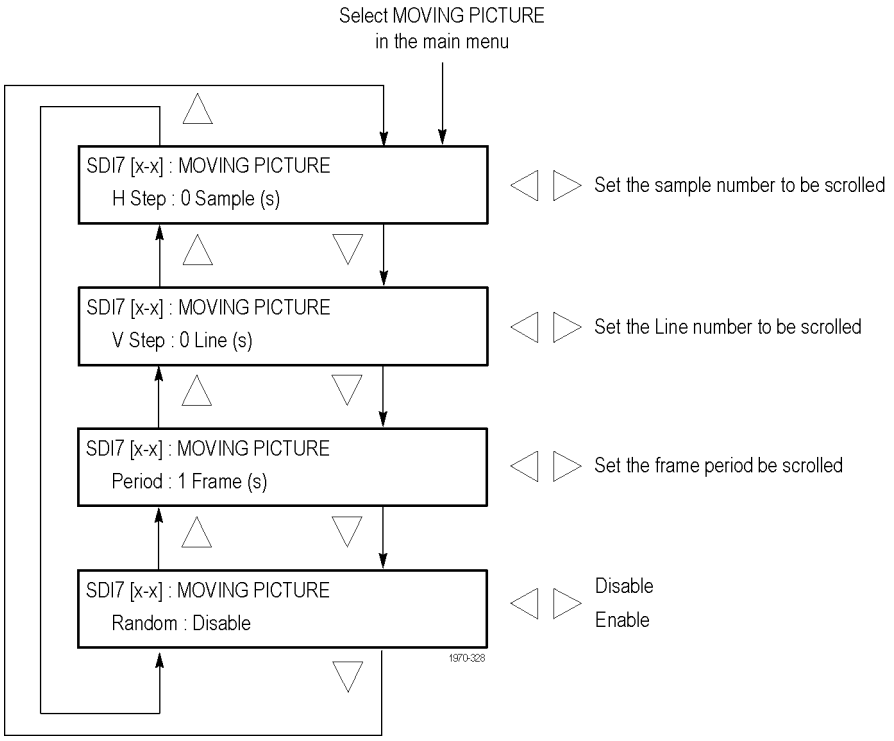


Figure 3-124: SDI7 module MOVING PICTURE submenu

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 3-263, To modify a zone plate signal on the SDI7 module.)*

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."

The Moving Picture behavior is different when the SDI7 module is installed in a TG700 mainframe. (See page 1-3, Module compatibility between the TG8000 and TG700 mainframes.)

H 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.

V 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.

SDI7 module 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 mainframe presets so that the overlay is restored on power up.*

The following figure shows the OVERLAY submenu.

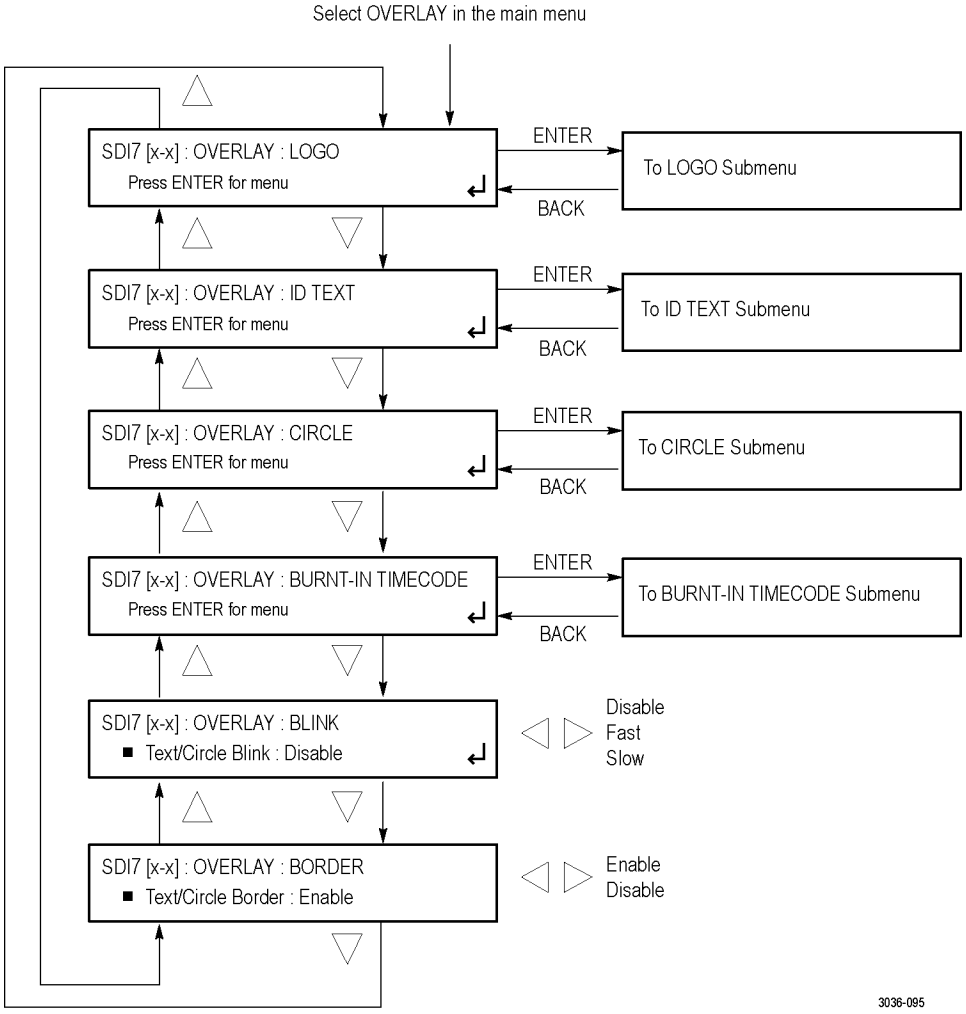


Figure 3-125: SDI7 module OVERLAY submenu

LOGO. Select this menu item, and then press the **ENTER** button to access the LOGO submenu where you can select a logo to overlay the output signal in a specified position. (See page 3-287.)

ID TEXT. Select this menu item, and then press the **ENTER** button to access the ID TEXT submenu where you can edit the text to overlay the output signal in a specified position. (See page 3-289.)

CIRCLE. Select this menu item, and then press the **ENTER** button to access the CIRCLE submenu where you can specify a circle size and position to overlay the output signal. (See page 3-293.)

BURNT-IN TIMECODE. Select this menu item, and then press the **ENTER** button to access the 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 3-293.)

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.*

SDI7 module 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 LOGO submenu.

NOTE. *To display a logo using the LOGO submenu, you need to create a logo file (.bmp) and use FTP to copy the file to the SDI7/LOGO folder on the TG8000 mainframe. The instructions for using FTP are located in the How to transfer user files using FTP section of this manual. (See page 2-65.) Refer to the TG8000 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.

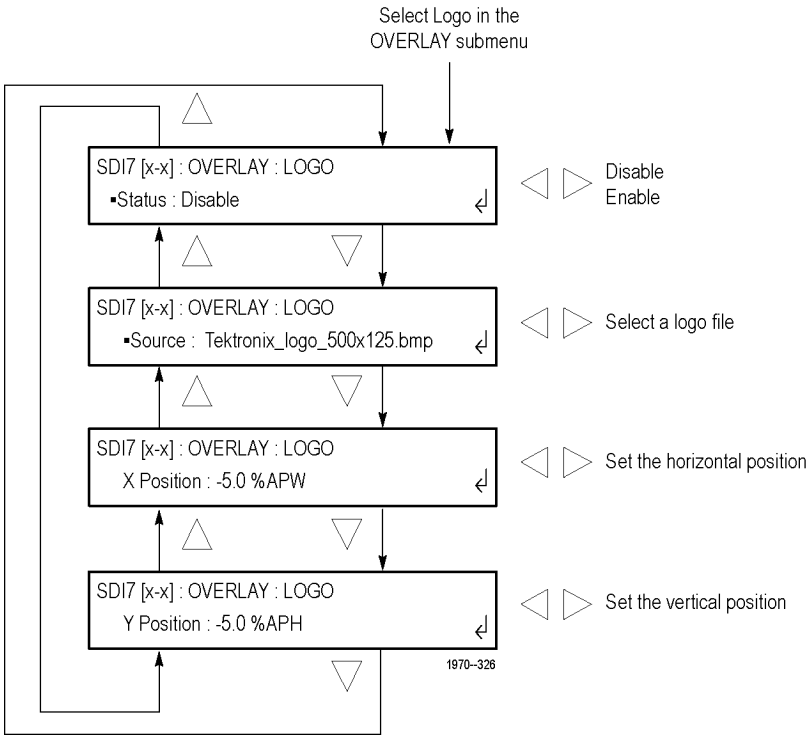


Figure 3-126: SDI7 module LOGO submenu

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.

SDI7 module 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 mainframe presets so that the overlay is restored on power up.*

Displaying Text. To display a text overlay using the ID TEXT submenu, you need to either enter a text string or create a text file (.txt) and download it to the SDI7/TEXT folder using FTP. The instructions for using FTP are located in the *How to transfer user files using FTP* section of this manual. (See page 2-65.)

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 SDI7 module 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 TG8000 mainframe memory.

The SDI7 module supports Latin, Cryillic, 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 TG8000 is rebooted for the new font to take effect. The instructions for using FTP are located in the *How to transfer user files using FTP* section of this manual. (See page 2-65.)

The original Deja Vu Sans file can be recovered from the *TG8000 SW Library and Documentation DVD* if necessary.

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

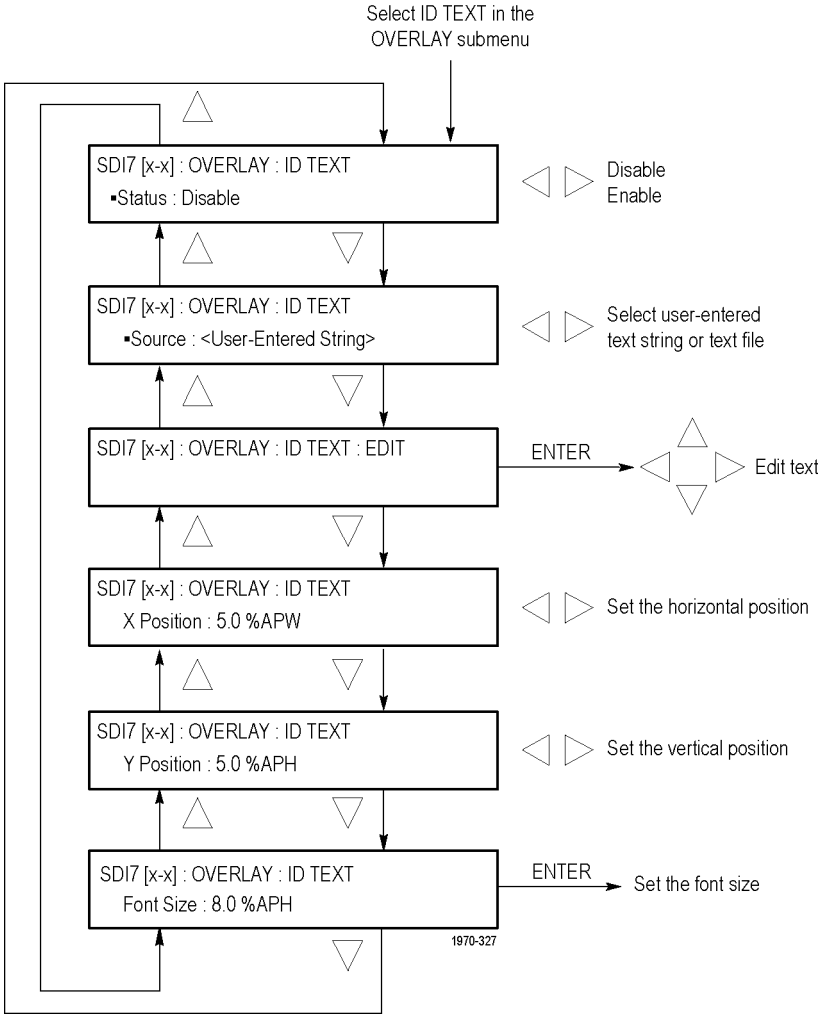


Figure 3-127: SDI7 module ID TEXT submenu

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 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.

SDI7 module 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 CIRCLE submenu.

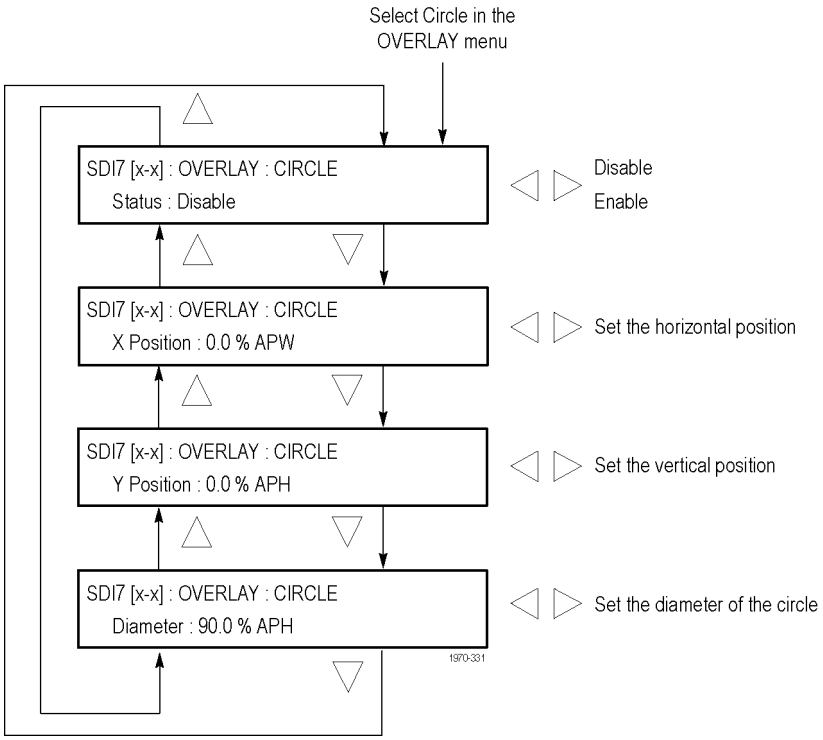


Figure 3-128: SDI7 module CIRCLE submenu

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.

SDI7 module 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 BURNT-IN TIMECODE submenu.

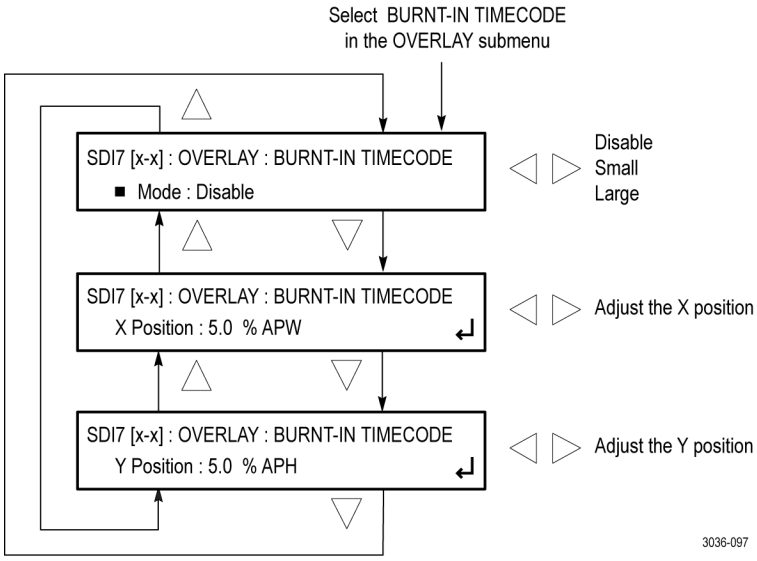


Figure 3-129: SDI7 module BURNT-IN TIMECODE submenu

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.

SDI7 module AUDIO (EMBEDDED) submenu

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. The following figure shows the AUDIO (EMBEDDED) Audio Group submenu. (See Figure 3-130.)

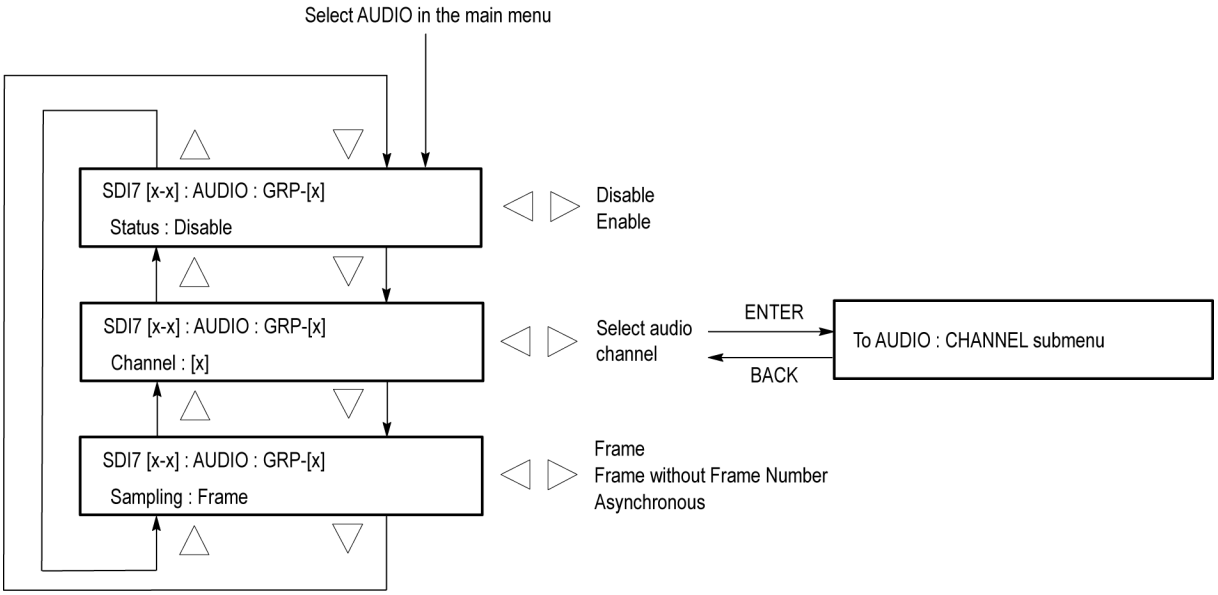


Figure 3-130: SDI7 module AUDIO (EMBEDDED) submenu

STATUS. Enables or disables 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 channel 1, 2, 3, or 4, and then press the **ENTER** button to enter the AUDIO : CHANNEL submenu. The AUDIO : CHANNEL submenu allows you to set the frequency, amplitude, click rate, and channel origin ID for the selected audio channel. The following figure shows the AUDIO : CHANNEL submenu.

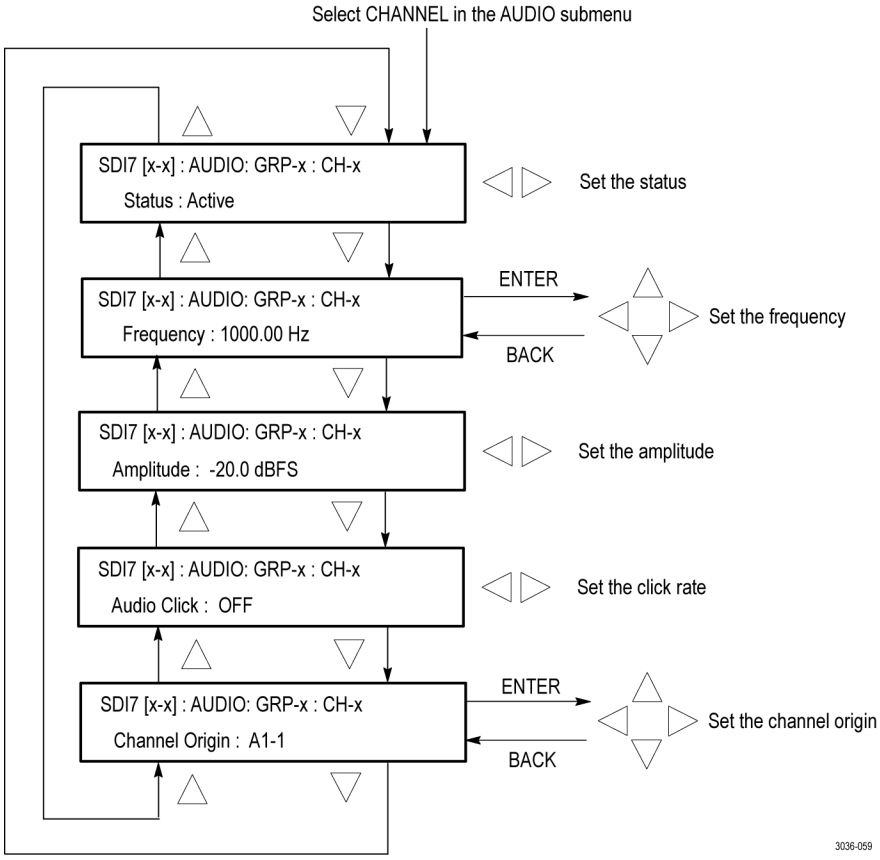


Figure 3-131: SDI7 module AUDIO : CHANNEL submenu

- **Status:** Use this menu to set the status of the individual 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 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 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 it.
- **Audio Click:** Use this menu 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 to set a channel origin ID of up to four ASCII characters. 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 Channel Origin ID.

Sampling. Use this menu 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.

SDI7 module 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 TIMING submenu.

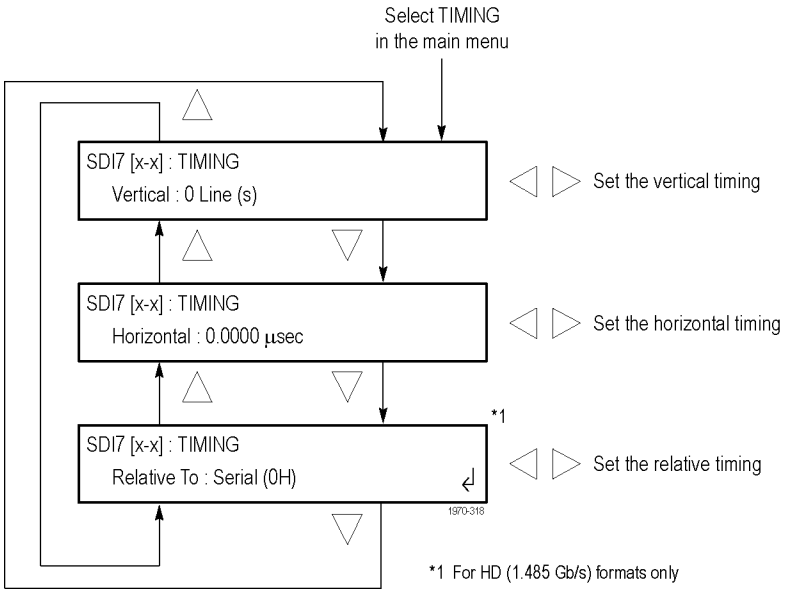


Figure 3-132: SDI7 module TIMING submenu

Vertical. Sets the vertical timing offset. Use the left (◄) or right (►) arrow button to change the timing offset. You can set the value from –½ to +½ 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. Use the left (◄) or right (►) arrow button to change the timing offset. 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).

SDI7 module 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 TIMECODE submenu.

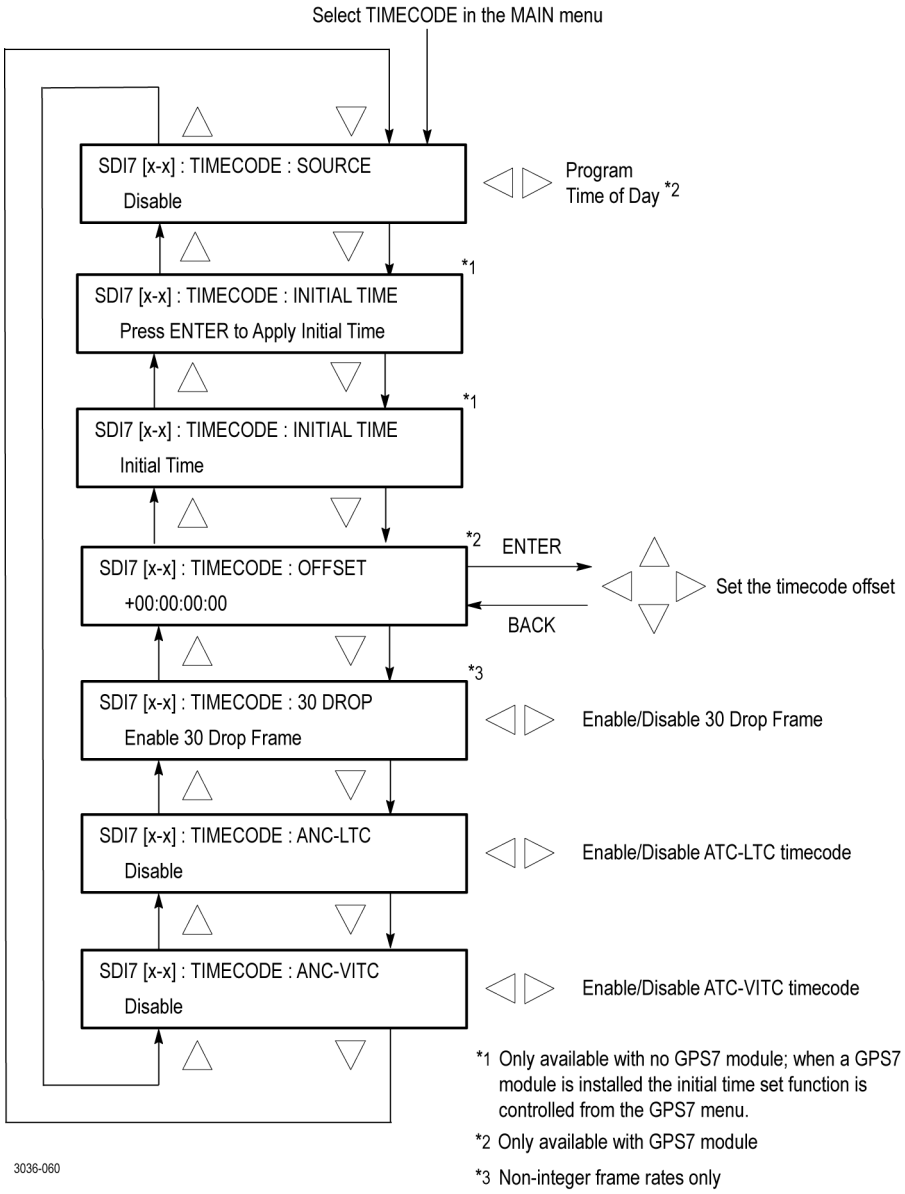


Figure 3-133: SDI7 module TIMECODE submenu

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 GPS7 module. This selection is available only if a GPS7 module is installed in the instrument.

Press ENTER to apply initial time. Press the **ENTER** button to apply the initial time. Initial time is set in the next menu item. This selection is available only when there is no GPS7 module installed in the instrument. When a GPS7 module is installed, this function is controlled from the GPS7 module main menu.

Initial Time. Use this menu selection to set the Initial Time. 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 time. Press the **ENTER** button to confirm the time. This selection is available only when there is no GPS7 module installed in the instrument. When a GPS7 module is installed, this function is controlled from the GPS7 module main menu.

Offset. Use this menu selection to set a Timecode Offset for the SDI7 module outputs. This is an offset from the timecode source (Time of Day or Program Time) from the GPS7 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 selection is available only when a GPS7 module 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 selection is available only when the frame or field rate for the current format is 29.97, 30, 59.94, or 60.

ATC-LTC. Use this menu selection to enable or disable the Ancillary Linear Time Code. 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 selection to enable or disable the Ancillary Vertical Interval Time Code. Use the left (◄) and right (►) arrow buttons to select between **Enable** and **Disable**, and then press the **ENTER** button to confirm the selection.

SDI7 module 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 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.*

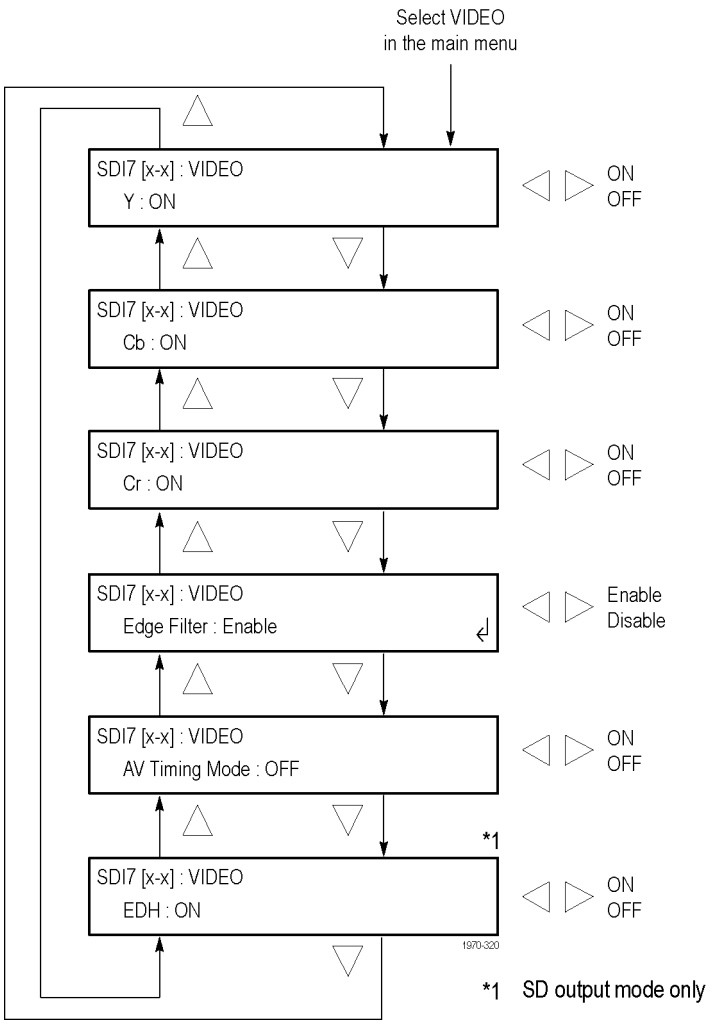


Figure 3-134: SDI7 module VIDEO submenu

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 **ON** and **OFF**. 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 **ON** and **OFF**. 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 **ON** and **OFF**. 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 **ON** and **OFF**. 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 **ON** and **OFF**. Press the **ENTER** button to confirm the selection.

SDI7 module 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 SDI7 module addresses User Data Words 000 through 254.

The following figures show the ANC PAYLOAD submenu.

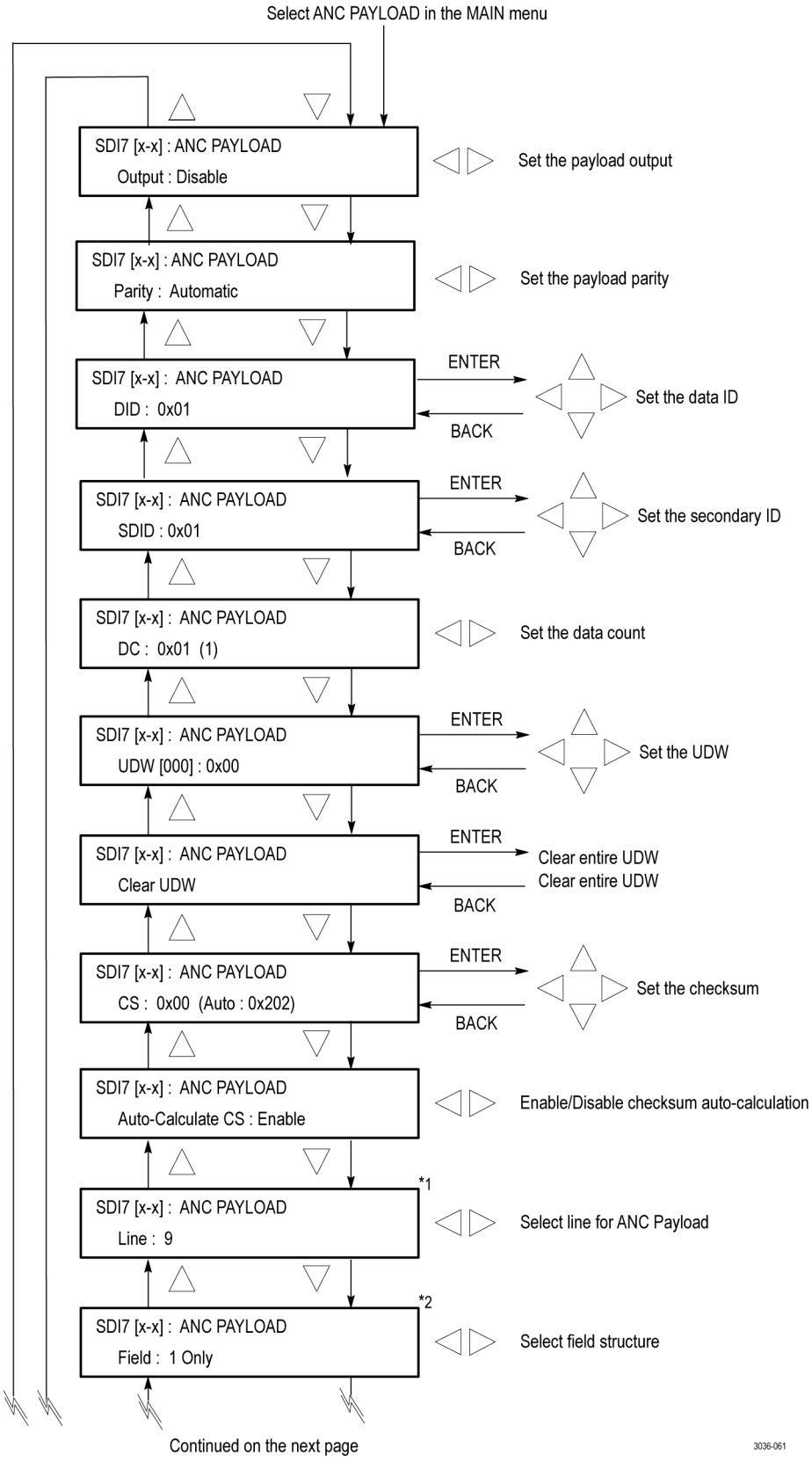


Figure 3-135: SDI7 module Ancillary Payload submenu

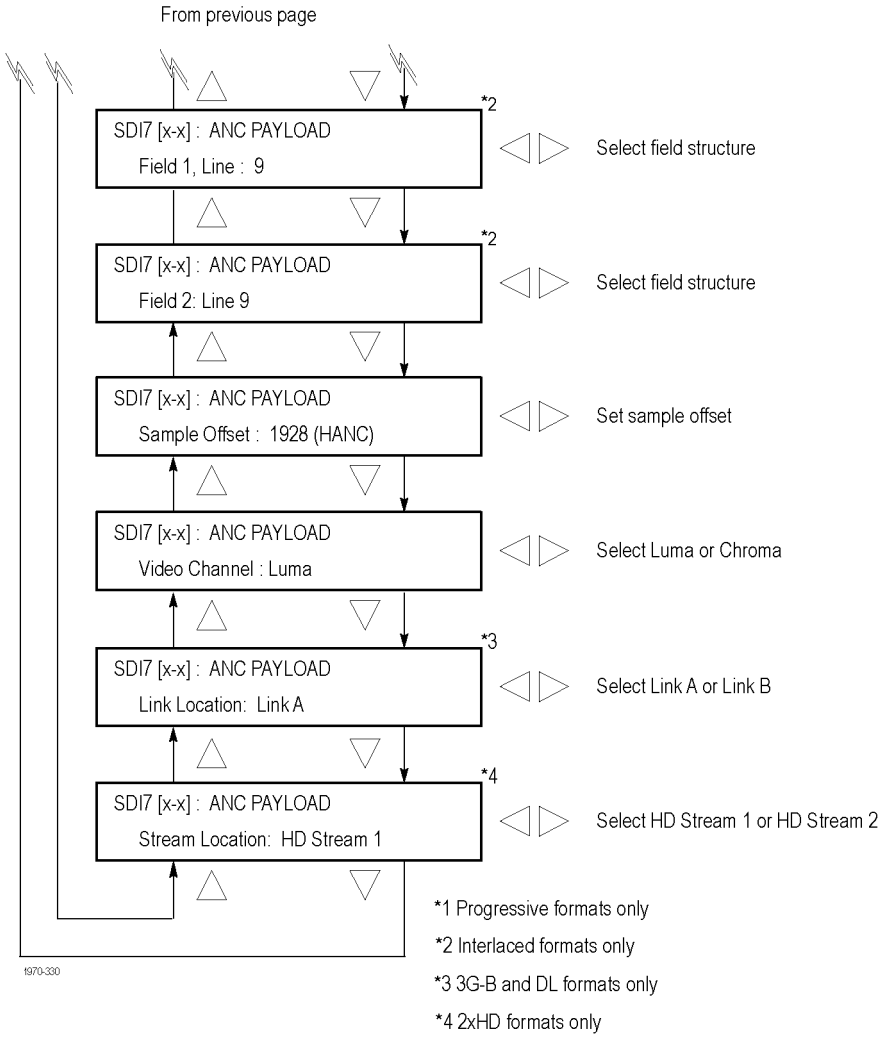


Figure 3-136: SDI7 module Ancillary Payload submenu (Continued)

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

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.

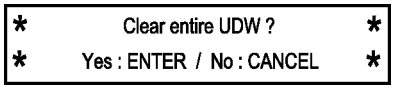
SDID. Press the **ENTER** button to edit the Secondary ID word. You can set the Secondary ID from 0x00 to 0xFF (in 8-bit mode), or from 0x000 to 0x3FF (in 10-bit mode). Use the left (◄) and right (►) arrow buttons to position the cursor, and then use the up (▲) and down (▼) arrow buttons to set the number 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 selection 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 selection to clear the entire User Data Word. Press the **ENTER** button to enter the CLEAR UDW mode, which will present the following dialog:



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 selection 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 selection 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 selection to set the line to carry the ancillary data payload. Use the left (◄) and right (►) arrow buttons to set the line number. This menu selection is available only in progressive formats.

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

Field 1: Line. Use this menu selection 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 selection is available only in interlaced formats.

Field 2: Line. Use this menu selection 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 selection is available only in interlaced formats.

Sample Offset. Use this menu selection 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 selection 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 selection 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 selection 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 selection is available only in 2×HD formats.

NOTE. *This is an example only. Inserting an AFD packet will not affect the video produced by the SDI7 module.*

SDI7 module ancillary data payload example

As an example, one of the ancillary data payloads that can be easily generated by the SDI7 module 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:

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 SDI7 module 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:

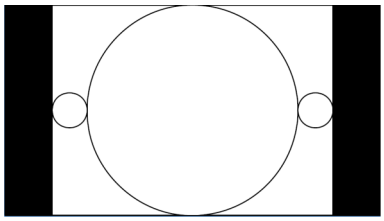


Figure 3-137: AFD code “1001” for a 16:9 coded frame

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.

SDI7 module TRIGGER OUTPUT submenu

Use this menu to select which SDI7 channel will be the trigger source and to select line rate, frame rate, pixel clock, or the system clock of the module to trigger an external instrument. The following figure shows the TRIGGER OUTPUT submenu.

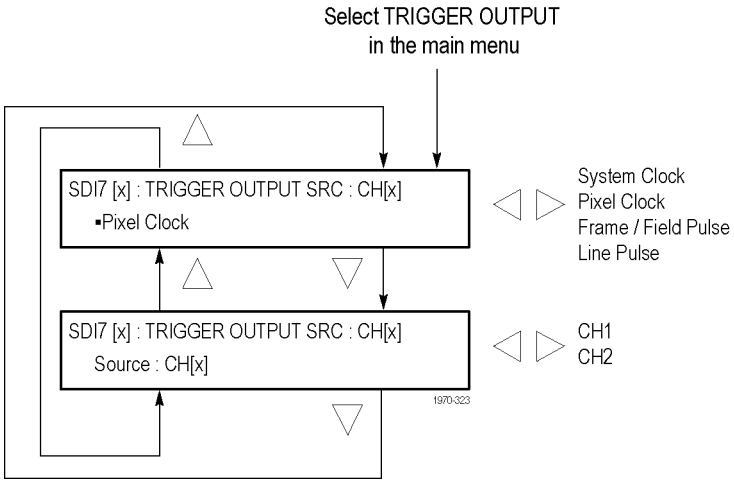


Figure 3-138: SDI7 module TRIGGER OUTPUT submenu

Source. Use the left (◄) or right (►) arrow button to select **CH1** or **CH2** as the trigger source, and then press the **ENTER** button. The signal format of the trigger output will be based on the signal format of the selected output channel.

System Clock. The system clock is a low-jitter clock signal, which runs at the parallel clock rate for 3G formats or twice the parallel clock rate for HD formats. For SD formats, the clock rate is 148.5 MHz. When this menu item is displayed, use the left (◄) or right (►) arrow button to select a different clock.

Pixel Clock. The pixel clock is an internal parallel rate clock (a low frequency clock related to the pixel rate of the video signal). When this menu item is displayed, use the left (◄) or right (►) arrow button to select a different clock.

The rate of the pixel clock depends on the format of the signal selected as the trigger source (channel 1 or channel 2):

- 27 MHz for SD formats
- 74.25 or 74.18 MHz for HD formats and most 3G formats (where 74.25 MHz is for integer frame rates and 74.18 MHz is for non-integer frame rates such as 59.94, 29.97, and 23.98 fps)
- 148.5 MHz or 148.35 MHz for 3G fast progressive formats such as 60p, 59.94p and 50p

Frame / Field Pulse. The trigger pulse is produced at the field or frame rate of the video signal. In interlaced and segmented-frame formats, this produces a frame-rate square wave that is low during field one and high during field two. In progressive formats the output is high during the vertical blanking period, producing a field-rate pulse. [1]

When this menu item is displayed, use the left (◄) or right (►) arrow button to select a different clock.

Line Pulse. The trigger pulse output is high during the horizontal blanking period, producing a line-rate pulse. [1]

When this menu item is displayed, use the left (◄) or right (►) arrow button to select a different clock.

1 The Frame/Field Pulse and Line Pulse signals are derived from the EAV and SAV XYZ byte H, V, and F bits, just prior to the parallel data entering the serializer; therefore these pulses can be used to approximate the signal timing.

SDI7 module DIAGNOSTICS submenu

Use this menu to view operation parameters for the SDI7 module. Module diagnostics provide status information only and do not affect operating behavior. The following figure shows the DIAGNOSTICS submenu. (See Figure 3-139.)

NOTE. *The SDI7 module provides additional diagnostics for checking the DDR2 and SRAM memory that can be accessed only in factory mode. See the TG8000 Service Manual for information on using the factory mode.*

PLL STATUS. This diagnostic displays the following:

- Flex0 – Indicates the state of the flexible clock generator for output channel 1 (SIGNAL 1A and SIGNAL 1B connectors). This readout should show **Lock** (locked). An **Unlk** (unlocked) reading might indicate a problem with the module or mainframe.
- Flex1 – Indicates the state of the flexible clock generator for output channel 2 (SIGNAL 2A and SIGNAL 2B connectors). This readout should show **Lock** (locked). An **Unlk** (unlocked) reading might indicate a problem with the module or mainframe.

DDS STATUS. This diagnostic displays the following:

- DDS0 Phase – Indicates that the flex clock circuit is correctly aligned with the internal frame pulse for output channel 1 (SIGNAL 1A and SIGNAL 1B connectors). This readout should show **Lock** (locked). An **Unlk** (unlocked) reading might indicate a problem with the module or mainframe.
- DDS1 Phase – Indicates that the flex clock circuit is correctly aligned with the internal frame pulse for output channel 2 (SIGNAL 2A and SIGNAL 2B connectors). This readout should show **Lock** (locked). An **Unlk** (unlocked) reading might indicate a problem with the module or mainframe.

TEMPERATURES. This diagnostic displays the temperature of the SDI7 module board and FPGA.

FPGA VERSION. This diagnostic displays the current and expected FPGA versions. If there is a discrepancy between the two, a warning appears, which means that the FPGA firmware might need to be upgraded.

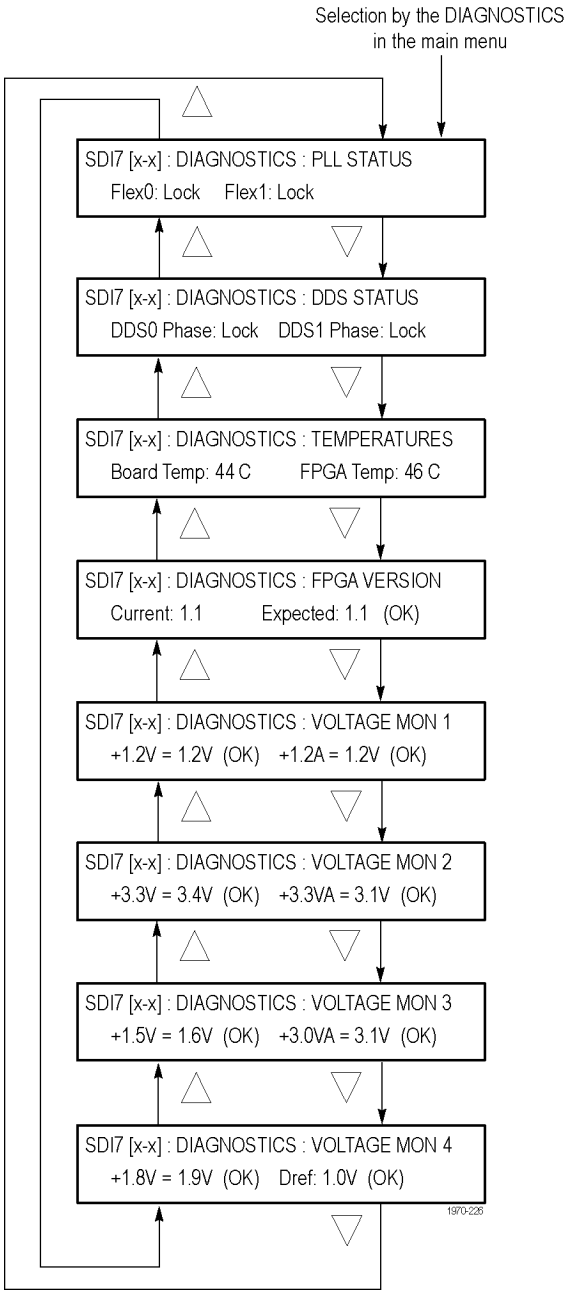


Figure 3-139: SDI7 module DIAGNOSTICS submenu

VOLTAGE MON 1. This diagnostic measures internal voltage supplies. If these supplies are outside the nominal range, a warning appears, which means that the instrument should be serviced.

VOLTAGE MON 2. This diagnostic measures internal voltage supplies. If these supplies are outside the nominal range, a warning appears, which means that the instrument should be serviced.

VOLTAGE MON 3. This diagnostic measures internal voltage supplies. If these supplies are outside the nominal range, a warning appears, which means that the instrument should be serviced.

VOLTAGE MON 4. This diagnostic measures internal voltage supplies. If these supplies are outside the nominal range, a warning appears, which means that the instrument should be serviced.

SDI7 module CALIBRATION submenu

This menu is accessible only when the instrument is in factory mode. From this menu, you can access several special output signals and adjust the serial output levels. The special signals are unscrambled and are synchronous with the clock out of the trigger BNC. They are used to check performance or used when adjusting serial levels. See the *TG8000 Service Manual* for information on adjustments and using factory mode.

SDI7 module factory default settings

The following table shows the factory default settings for the SDI7 module. These settings are recalled when you select **Factory Default** from the **PRESET : RECALL** menu item in the mainframe main menu.

Table 3-61: SDI7 module factory default settings

Menu item name		Settings
TEST SIGNAL		100% Color Bars
FORMAT		1080 59.94i
SAMPLE STRUCTURE/DEPTH		YCbCr 4:2:2 10b
OUTPUT MODE		HD (1920 × 1080)
MOVING PICTURE		
	H Step	0 Sample(s)
	V Step	0 Line(s)
	Period	1 Frame(s)
	Random	Disable
OVERLAY : LOGO		
	Status	Disable
	Source	Tektronix_logo_500x125.bmp ***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."* *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.*
	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

Table 3-61: SDI7 module factory default settings (cont.)

Menu item name	Settings
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
AUDIO (EMBEDDED)	
Status (Level A)	
Group 1–4	Disable
Status (Level B)	
Group 1–4 Link A	Disable
Group 1–4 Link B	Disable
Channel	
Status	Active
Frequency	1000
Amplitude	–20 dBFS
Audio Click	OFF
Channel Origin	A1-1 through A4-4
Sampling	Frame
TIMING	
Vertical	0 Line(s)
Horizontal	0.0000 µs
Relative To	Serial (0H)
TIMECODE	
Source	Program Time
30 Drop Frame	Enable
ATC-LTC	OFF
ATC-VITC	OFF

Table 3-61: SDI7 module factory default settings (cont.)

Menu item name		Settings
VIDEO		
	Y	ON
	Cb	ON
	Cr	ON
	Edge Filter	Enable
	AV Timing Mode	OFF
	EDH (SD output mode only)	ON
ANC PAYLOAD		
	Output	Disable
	Parity	Automatic
	DID	0x101
	SDID	0x200
	DC	0x101
	UDW	0x200
	CS	0x200
	Auto-Calculate CS	Enable
	Line	9
	Field 1, Line:	9
	Field 2, Line:	9
	Start Sample	1928
	Video Channel	Luma
	Link Location	Link A
	Stream Location	HS Stream 1
SMPTE 352 PAYLOAD		Enable
TRIGGER OUTPUT		
	Clock	System Clock
	Source	CH1
SECONDARY OUTPUT		Test Pattern

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