Service Manual

Tektronix

HDVG1
HDTV Digital Video Generator

071-0594-51

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- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

Warranty 2

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use.

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

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

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

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

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

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

Symbols and Terms   **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.*

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.

Symbols on the Product. The following symbols may appear on the product:

⚠	⚡	▣	⏚
CAUTION Refer to Manual	WARNING High Voltage	Double Insulated	Protective Ground (Earth) Terminal
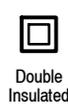
Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

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, disconnect the mains power by means of the power cord or, if provided, the power switch.

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.

To avoid electric shock, do not touch exposed connections.

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.

The symbol shown to the left indicates that this product complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). For information about recycling options, check the Support/Service section of the Tektronix Web site (www.tektronix.com).

Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive. This product complies with the RoHS Directive requirements expect for the presence of hexavalent chromium in the surface coating of the aluminum chassis parts, assembly hardware, and 63/37 tin/lead solder used in the fabrication of the circuit boards.

Preface

You have purchased this optional service manual for the HDVG1 HDTV Digital Video Generator module. To optimize troubleshooting capability, you should also purchase the service manual for the TG2000 Platform mainframe.

About This Manual

This manual contains information for servicing the HDVG1 HDTV Digital Video Generator module to a module level. The information is designed only for qualified service technicians, with moderate experience in analog circuits, digital circuits, and television technology.

This manual is composed of the following sections:

- *Specifications* provides instrument specifications tables.

- *Operating Information* provides basic operating information.

- *Theory of Operation* is an overview of the module's design.

- *Performance Verification* contains procedures to perform the operation tests.

- *Maintenance* contains installation, removal and replacement, and trouble-shooting instructions.

- *Option* contains a description of available option for the HDVG1 Generator module.

- *Diagram* contains interconnect diagram showing the connections between the HDVG1 Generator module, the mainframe, and other modules.

- *Replaceable Parts list* the part numbers for replacement parts that you can order. Exploded view illustrations help you to identify the parts.

Related Manuals

The following documents are related to the HDVG1 Generator module.

■ The *TG2000 Signal Generation Platform Service Manual* describes how to service the mainframe to the module level, and includes a troubleshooting disk that is required for all module and mainframe troubleshooting. This optional manual must be ordered separately, and is recommended before beginning any troubleshooting.

■ The *TG2000 Signal Generation Platform User Manual* describes how to use the TG2000 Platform. It also contains information about SCPI commands, programming structure, and status and events for the TG2000 Signal Generation Platform. Some of this information applies to all generator modules, including the HDVG1 Generator module.

■ The *HDVG1 HDTV Digital Video Generator User Manual* contains operating information and information about SCPI commands for the HDVG1 Generator module.

Specifications

Specifications

This section contains a general product description of the HDVG1 Generator module followed by the operating specifications of the module.

Product Description

The HDVG1 Generator module is an HDTV test signal generator which provides 1.485 Gb/s serial digital video signals in various formats. The module contains the following features:

- Produces custom test signals using SDP2000 software package

- Three serial digital video outputs

- Signal parameters such as active video gain and chroma/luma gain are adjustable in real-time from the front panel.

- Rear-panel trigger output, used to trigger an oscilloscope or other video equipment

- Overlay of circles, text, or logo on the video signal

- Up to 8 channels of Embedded Audio

- Full remote control using GPIB or RS-232C interface

Embedded Audio. The HDVG1 Generator module can generate video signals with 20-bit or 24-bit embedded digital audio with a sample rate of 48 kHz. Multiple user-selectable frequencies and amplitudes are available with channel and status independence.

Characteristics

This section contains the specifications for the HDVG1 Generator module.

Specifications are only valid when the module is installed in a TG2000 Platform mainframe. For installation instructions, refer to *Module Installation* on page 2--2.

For a list of environmental specifications, refer to the *TG2000 Signal Generation Platform Service Manual*.

Table 1- 1: Electrical specifications (typical)

Characteristics	Description
Serial Connector	
Number of Outputs	3 (BNC)
Signal Amplitude	800 mV typical, into 75 Ω load
Data Rate	1.485 Gbps or 1.485/1.001 Gbps nominal
Overshoot	$\leq$ 10%
Rise and Fall Times	$\leq$ 270 ps (Measured at 20% and 80% points)
DC Offset (Ac coupled)	0.0 V $\pm$ 0.5 V (Into DC termination)
Jitter	$\leq$ 135 ps p-p (Alignment jitter)
Return Loss (75 Ω, AC coupled)	$\geq$ 15 dB, 5 MHz to 742.5 MHz $\geq$ 10 dB, 742.5 MHz to 1.485 GHz
Trigger Output	
Connector	BNC
Amplitude	TTL compatible if unterminated
Rise Time	$\leq$ 10 ns
Output Impedance	75 Ω
Typical Power Consumption	+5 Volts: 14.0 Watts -5 Volts: 1.0 Watts -2 Volts: 1.0 Watts Battery: 30 μA maximum

Certification and Compliances

The certification and compliances for the HDVG1 Generator module are listed in Table 1–2 .

Table 1‑2: Certifications and compliances

Category	Standards or description
EC Declaration of Conformity – EMC	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Union:
	EN 55022 Class B Radiated and Conducted Emissions
	EN 55103-1 Emissions: Annex A Magnetic Loop Antenna

	EN 55103-2 Immunity:
	    EN 61000-4-2 Electrostatic Discharge Immunity
	    EN 61000-4-3 Radiated RF Electromagnetic Field Amplitude Modulated
	    EN 61000-4-4 Electrical Fast Transient Immunity
	    EN 61000-4-5 Surge Immunity
	    EN 61000-4-6 Conducted RF Common Mode Immunity
	    EN 61000-4-11 Power Line Interruption Immunity
	    Annex A Magnetic Immunity

Australia/New Zealand Declaration of Conformity - EMC	Complies with EMC provision of Radiocommunications Act per the following standard(s): AS/NZS 2064.1/2 Industrial, Scientific, and Medical Equipment: 1992
FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits.
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 73/23/EEC, amended by 93/68/EEC
	EN 61010-1:1993 Safety requirements for electrical equipment for measurement control and laboratory use.
Safety	Complies with the following safety standards:
	UL3111-1[1] Standard for electrical measuring and test equipment.
	CAN/CSA C22.2 No. 1010.1[1] Safety requirements for electrical equipment for measurement, control, and laboratory use.
	IEC61010-1[1] Safety requirements for electrical equipment for measurement, control, and laboratory use.

[1] **UL3111-1, CSA C22.2 No. 1010.1, and IEC61010-1 Safety Certification Compliance Altitude (maximum operating) : 2000 meters**

Operating Information

Installation

This section contains instructions for installing the HDVG1 Generator module into the TG2000 Platform mainframe and instructions for operating the module. Listed below are the major topics in this section.

- Preventing component damage

- Module installation, including signal sets and output configuration

- Signal backup and module removal

Preventing Component Damage

CAUTION. Electrostatic discharge (ESD) can damage components on this module and mainframe. To prevent ESD or other component damage, follow the steps below when installing, removing, or handling modules:

1. Wear a grounded antistatic wrist strap to discharge the static voltage from your body while installing or removing modules from the TG2000 Platform mainframe.

2. Transport and store modules in a static-protected bag or container.

3. Do not slide the module over any surface.

4. Handle modules as little as possible.

5. Do not touch module components or connector pins.

6. Do not use any devices capable of generating or holding a static charge in the work area where you remove, install, or handle modules.

7. Avoid handling modules in areas that have a floor or work-surface covering capable of generating a static charge.

8. Do not remove the module circuit board assembly from the shield. The shield is an important stiffener which prevents damage to surface-mount components.

Module Installation

A T-10 torx tip screwdriver is the only tool you need to install the module. A T-10 torx tip is supplied with the module.

Hardware Installation   To install the module into the TG2000 Platform mainframe, perform these steps:

1. Set the TG2000 Platform mainframe rear-panel power switch to off.

2. Unplug the power cord.

3. Select the slot you will use to install the module. Table 2‑1 lists the slot restrictions. Figure 2‑1 shows a sample configuration with slot numbers.

Table 2‑1: Module slot assignments

Module	Slots in which the module can be installed
AGL1 Genlock module	Slot 2 or 3
AVG1 Generator module	Slots 2 through 10
AWVG1 Generator module	Slots 2 through 10
BG1 Generator module	Slots 2 through 10
Clock module	Slot 1
CPU module	Slot 11
DVG1 Generator module	Slots 2 through 10
GP1 GPIB Interface module	Slot 10
HDVG1 Generator module	Slots 2 through 10
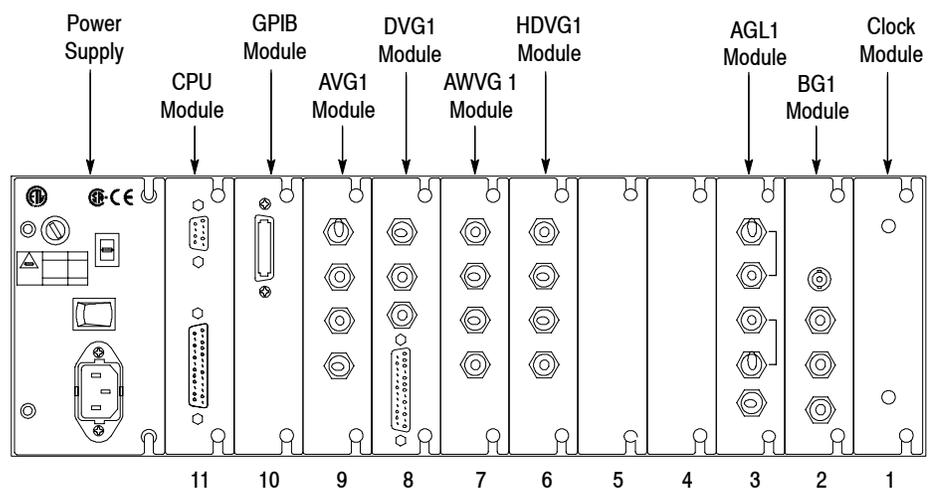
Figure 2‑1: TG2000 Platform mainframe rear panel, showing slot numbering

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WARNING. *To avoid a shock hazard, always remove the power cord before removing the top cover. Failure to remove the power cord can result in serious injury or death.*

4. Refer to Figure 2‑2 and remove or loosen all screws to remove the top cover.

Top cover

Loosen screws (12)

Top cover
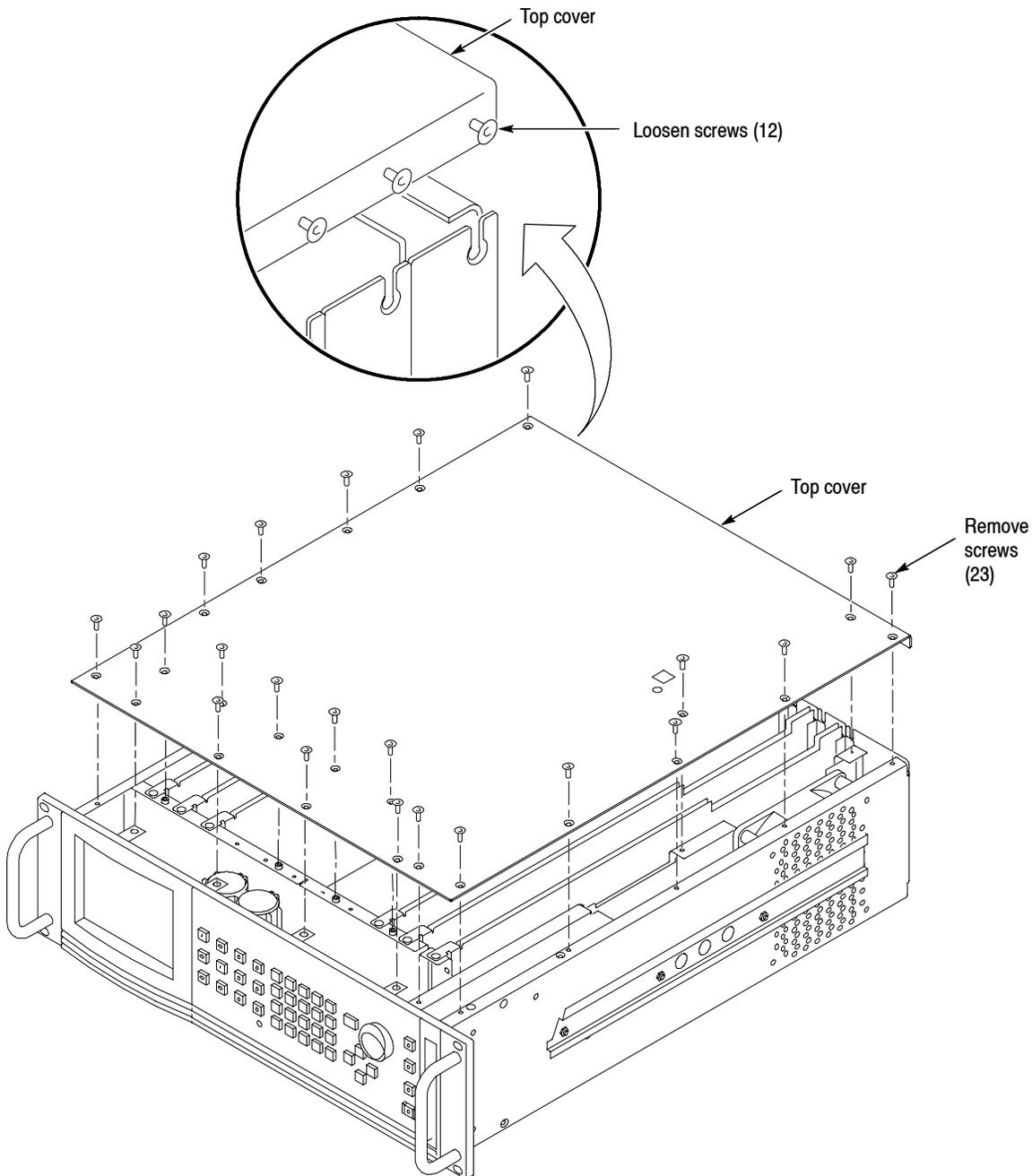
Remove
screws
(23)

Figure 2‑2: Top cover removal

5. Remove the appropriate rear panel as shown in Figure 2-3. Loosen, but do not remove the bottom screw. You will use it later to secure the module.

Loosen screw
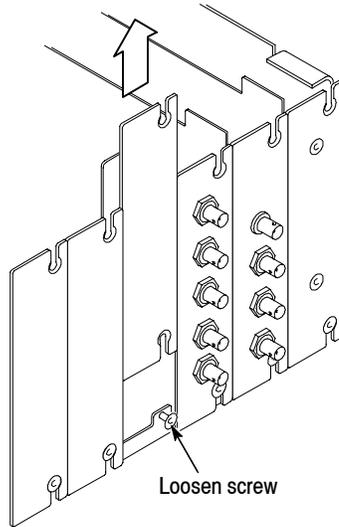
Figure 2- 3: Removing the rear panel

6. While ensuring correct alignment of the module flange as shown in Figure 2-4, lower the module into the desired slot as shown in Figure 2-5.
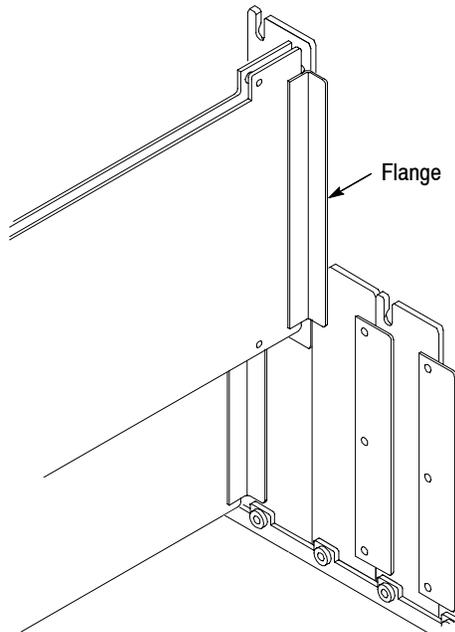
Flange

Figure 2- 4: Module flange
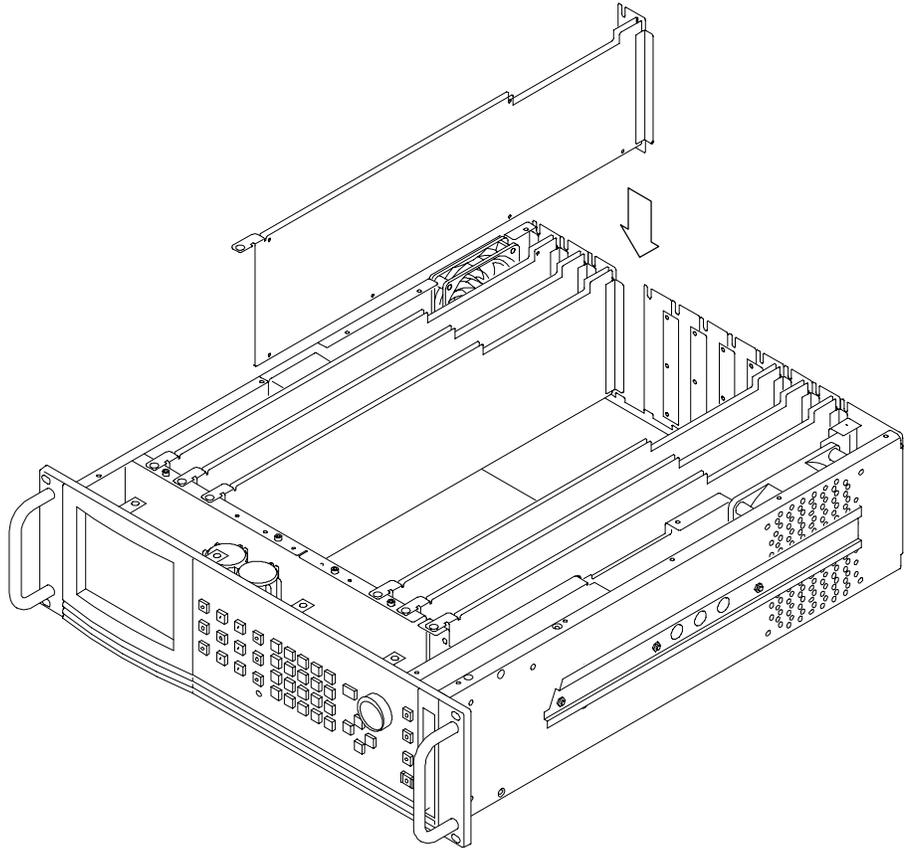
Figure 2‑5: Installing the module

7. Ensure that the connectors on the Backplane board and the module exactly match before seating the module.

⚠ *CAUTION. The connectors must exactly match before you attempt to press the module firmly in place. If the connectors do not match you could bend a pin that could damage the module, mainframe, or both when power is applied.*

8. Press down evenly on the module until it is firmly in place.

9. Refer to Figure 2‑6 and insert and tighten the top screw, which comes with your module, and tighten the rear panel screw.
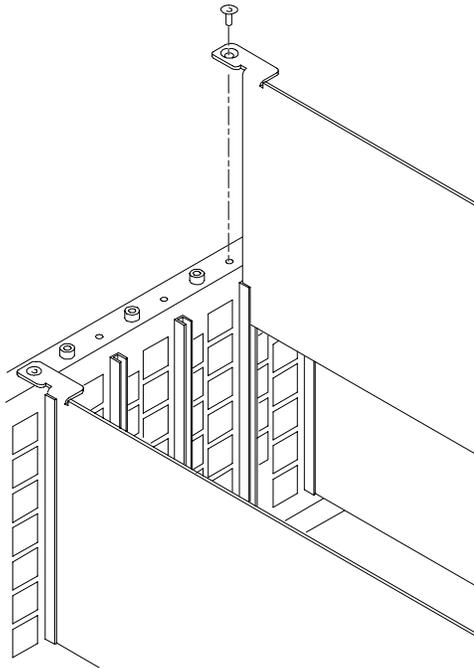
Figure 2‑6: Top screw

10. Reinstall the top cover and insert and tighten all top cover screws.

11. Plug in the instrument power cord. Power on the mainframe by setting the rear-panel power switch to ON and pressing the front-panel power switch. Wait for the instrument to perform self tests.

12. If you previously moved or removed a module and backed up the instrument, perform *Instrument Restore from Backup* now (page 4‑12).

Signal Set Installation If this module was installed in the TG2000 Platform mainframe at the factory, signal sets are already installed. If a generator module is ordered separately, the user must install signal sets when installing the module. If you need to install signal sets, use one of the two following procedures: *Installing Signals to the Default Destination* or *Installing Signals to a Non-default Destination.* To replace signal sets, refer to the *TG2000 Signal Generation Platform User Manual*.

Installing Signals to the Default Destination.

1. Insert the test signal disk into the TG2000 Platform mainframe disk drive.

2. Push the **DISK** button.

3. Touch **Add Signals** when the Disk menu appears.

4. Touch **Select Source**.

5. Move the browse ring to the .DNL you want to load and push the **Select** key.

6. Select all of the signal sets at the module level and push the **Select** button.

7. Touch **Quit/Load**. The previous menu appears.

8. Touch **Quit/Load** again. The Add Signals window reappears, showing the module as the selected destination.

NOTE. The Add Signals window shows the amount of Kbytes selected (Total Tagged) and the amount available on the module. If the tagged total is greater than the amount available, the signal sets will not load.

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9. Touch **Start Load**. The signal sets are automatically loaded into the module. A pop-up menu tells you when the transfer is complete.

Installing Signals to a Non-default Destination.

1. Insert the test signal disk into the TG2000 Platform mainframe disk drive.

2. Push the **DISK** button.

3. Touch **Add Signals** when the Disk menu appears.

4. Touch **Select Source**.

5. Move the browse ring to the .DNL you want to load and push the **Select** key.

6. Move the browse ring to a particular test signal and push the **Select** button.

7. Touch **Quit/Load**. The previous menu appears.

8. Touch **Quit/Load** again. The Add Signals window reappears.

NOTE. The Add Signals window shows the amount of Kbytes selected (Total Tagged) and the amount available on the module. If the tagged total is greater than the amount available, the signal sets will not load.

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9. Touch **Select Destination**.

10. Move the cursor to the signal's field and place the cursor where you want the test signal to be installed. Be sure to chose a destination that is one level above the source. Press the **Select** key.

11. Touch **Start Load**. A pop-up menu tells you when the transfer is complete.

Signal and Logo Backup and Module Removal

Before removing a generator module, you should save the signal sets and logos to a disk. The module will lose its signal memory 30 seconds after you remove it from the platform. You will need a blank, DOS formatted 3.5 inch disk.

Signal Backup Save the signal sets as follows:

1. Insert a DOS formatted disk into the platform's disk drive.

2. Push the **Disk** button and touch **Save Signals to Disk**.

3. Touch **Select Source** and select the **HDVG1**. Use the cursor arrows to select the HDVG1 module in the signals column.

4. Select **Quit/Save**.

5. Touch **Select Destination**. If desired, create a new directory for the signals by selecting **New Dir** and entering a DOS compatible name.

6. Create a new file by touching **New File**.

7. Select **Quit/Save** to complete the transfer of signal sets to the disk.

8. Touch **Start Save**. Saving signals may take several minutes, depending on the number and size of test signals.

Logo Backup Save the logos as follows:

1. Push the **Test Signals** button.

2. Touch **Module Parameters**.

3. Touch **Logo Overlay**.

4. Touch **File Utils**.

5. Touch **Save Logo to Disk**.

6. Touch **Select Source**.

7. Select the logo you want to save a disk file.

8. Touch **Quit /Save**.

9. Touch **Select Destination**. If desired, create a new directory for the logos by selecting **New Dir** and entering a DOS compatible name.

10. Create a new file by touching **New File**. (The original logo name is preserved inside the logo file.)

11. Touch **Quit**/**Save** to begin the save process.

12. Repeat for each logo you want to save.

Module Removal   To remove the module, follow these steps:

1. Turn off the platform by pressing the front-panel **On**/**Standby** switch and switching the rear panel power switch to off.

2. Unplug the power cord.

⚠

WARNING. *To avoid a shock hazard always unplug the power cord before removing the top cover. Failure to unplug the power cord can result in serious injury or death.*

3. Remove all top-cover screws and remove the top cover. See Figure 2–2 on page 2–3.

4. Remove the appropriate rear panel as shown in Figure 2–3 on page 2–4. Loosen, but do not remove the bottom screw. You will use it later to secure the rear panel.

5. Refer to Figure 2–6 on page 2–6 and remove the top screw.

6. Remove the module. To leave the slot empty, proceed to step 8 of this procedure.

7. To install a module in the empty slot, proceed to *Module Installation* on page 2–2.

8. To ensure proper cooling and adherence to EMI shielding requirements, install a blank panel to cover any empty slots in the rear panel. A spare blank panel is included in the TG2000 Platform mainframe accessories kit.

9. Tighten the screws on the blank rear panel.

10. Reinstall the top cover and insert and tighten all top cover screws.

Functional Overview

This section provides an overview of the HDVG1 Generator module. If you are not familiar with the operation of the TG2000 Signal Generation Platform, refer to the *TG2000 Signal Generation Platform User Manual* before reading this section.

Figure 2‑7 shows the menu structure for basic module operations.
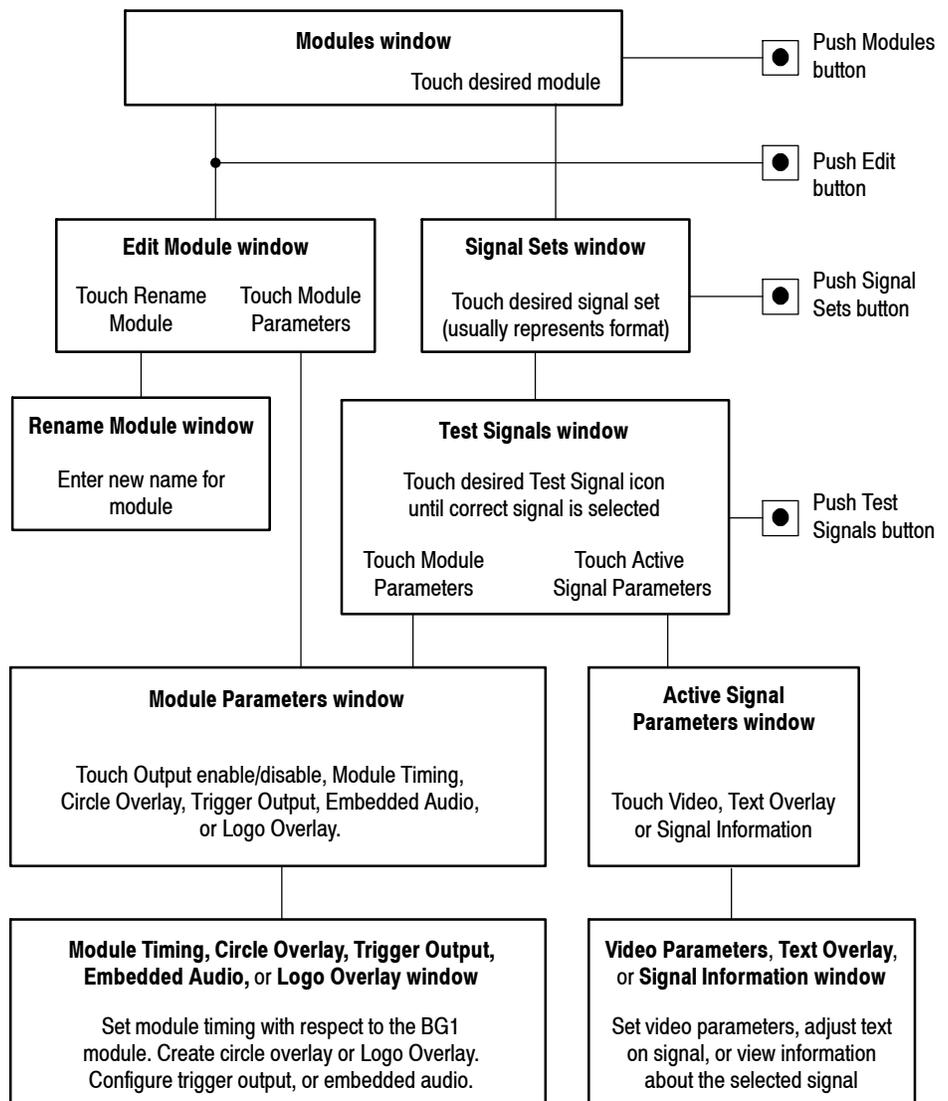
Figure 2‑7: Menu structure for the HDVG1 Generator module

Outputs   The HDVG1 Generator module has four outputs: three serial outputs and one trigger output.

Serial Outputs. Outputs 1, 2 and 3 are serial signal outputs (BNC).

Trigger Output. The trigger output (BNC) can be used to trigger an oscilloscope or other video equipment.

Online Help   Push the front-panel **HELP** button to display a help window. The help window describes the window you were using when you pushed HELP.

Operating Procedures

This section is organized into the following main topics:

- Power on the mainframe and select the module

- Select the output signal

- Active signal parameters

- Module parameters

Refer to Figure 2-7 on page 2-11 for the menu structure.

Power On and Select the 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, power on the mainframe, and select the module by following these steps:

1. Set the rear-panel power switch to the **ON** position.

2. Press the front-panel **POWER** switch if necessary.

3. Wait for a few seconds as the mainframe executes confidence tests on the mainframe and modules. Check for any error messages that might appear.

4. When self tests are complete, the instrument displays icons representing the generator modules. If an installed module is not represented, refer to *Troubleshooting Procedures*, starting on page 5-9.

NOTE. *The illustrations in these procedures show the factory default name (HDVG1:X where X represents the slot number in which the module is installed). However, because you can rename the module, your icons may display a different name. Refer to the* TG2000 Signal Generation Platform User Manual *for information about editing the module name.*

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5. Since you have just powered on the platform, the Modules window is displayed. To open this window at other times, push the **Modules** button.
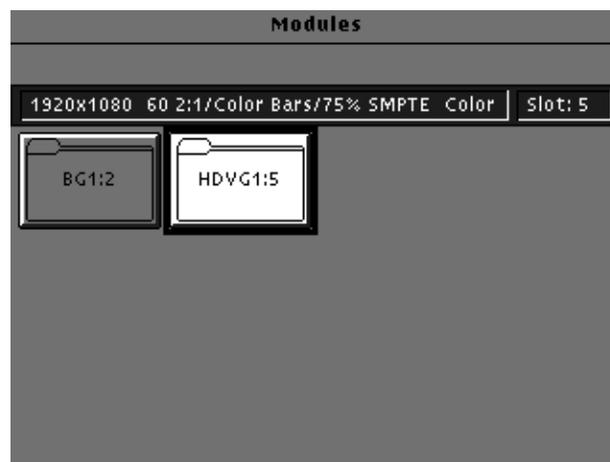
6. Touch the module icon on the display (or push the **Signal Sets** button if the desired icon is already highlighted). The installed signal sets for the module appear. Selections you make after this will pertain to the HDVG1 Generator module.

Select the Output Signal

The output signal is supplied on the three rear-panel serial outputs. Use the following procedure to select the module's output test signal. You can select any of the HDVG1 signals that are loaded in your instrument.

1. Push the **Signal Sets** button to open the window shown below. Check that there is an icon for each installed signal set. If your signal sets are not installed, refer to *Signal Set Installation* on page 2-6.
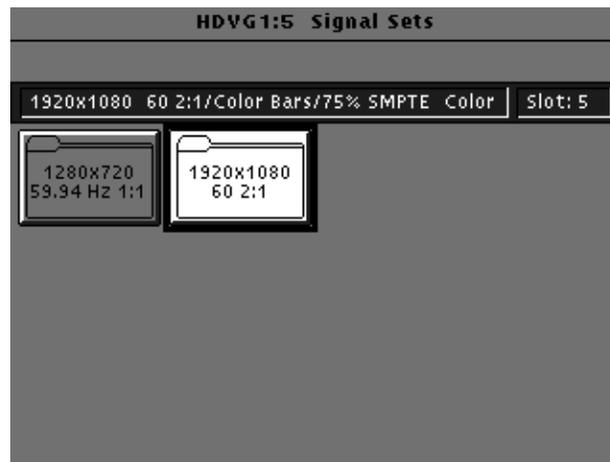
2. Touch the desired signal set on the display. The Test Signals window for the selected signal set appears. In the following example, 1920X1080 60 2:1 is selected.
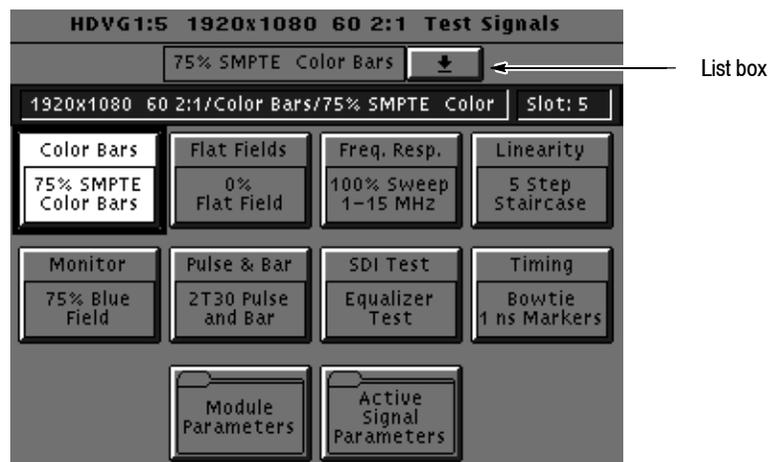
3. Each test signal icon in the Test Signals window represents one or more signals that the module can generate. In this example, the Color Bar test signal icon is selected, and the 75% SMPTE Color Bars signal is being generated.

4. To change to another Color Bar signal, touch the **Color Bar** repeatedly to browse through all available signals. You can also display the complete list of test signals available under a selected test-signal icon by touching the list box or by rotating the Navigation knob, and then select a signal by pressing the front-panel **Select** button.

5. To change to a different signal type, such as Linearity, touch the corresponding icon on the display. Then select the signal as shown in step 4.

6. To select the output signal using the List window, display the list of test signals by pushing the front-panel **List** button. Use the Navigation arrow keys to highlight the module and signal, and then push the **Select** button.

Active Signal Parameters

The following procedures discuss windows that are accessed through the Active Signal Parameters window, shown below. Changes that you make to parameters in any of these windows affect only the active signal.

To enter the Active Signal Parameters window for the HDVG1 Generator module, follow these steps:

1. Select the module, if not already selected.

2. Push the **Test Signals** button.

3. Touch **Active Signal Parameters** at the bottom of the screen. The Active Signal Parameters window appears, as shown below.

Video Parameters   You can adjust the signal parameters of the currently selected (active) test signal by modifying the parameters and then saving the signal with a new name. There are no factory defaults. Factory signals may be reinstalled, if needed.

NOTE. To modify and save a Tektronix generated signal, you must rename it. When you rename and save a signal, both the original and the modified signals are saved. If you modify any signal that was shipped on the factory disks, the platform adds an underscore to the front of the name.

You can change the signal parameters in the Video Parameters window, shown below. This is accessed through the Active Signal Parameters window, shown on page 2--17. Different signals may display a different list in this window. Use the Navigation arrow keys to select the parameter you want to change. Detailed information can be found in the *HDVG1 HDTV Digital Video Generator User Manual*.
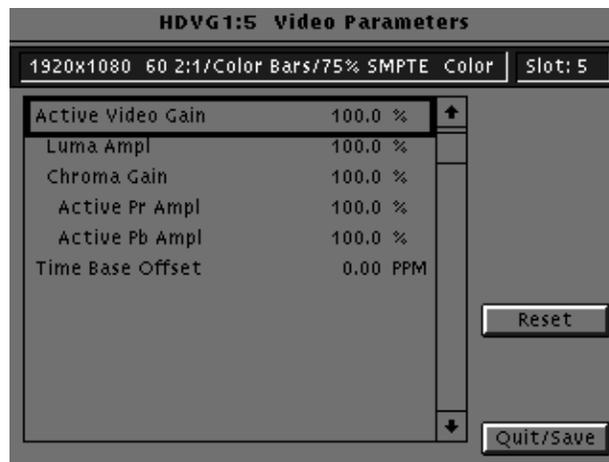
Text Overlay   You can enter text that overlays your displayed test signal. When turning text on or off, you are turning text on or off for all test signals that have overlaid text. Touching **Reset** returns the text, horizontal and vertical to previously saved values.

Text Overlay is controlled through the Signal Text window, shown below. Access this window by touching **Text Overlay** in the Active Signal Parameters window, shown on page 2--17. Detailed information about adding and position-ing overlaid text can be found in the *HDVG1 HDTV Digital Video Generator User Manual*.
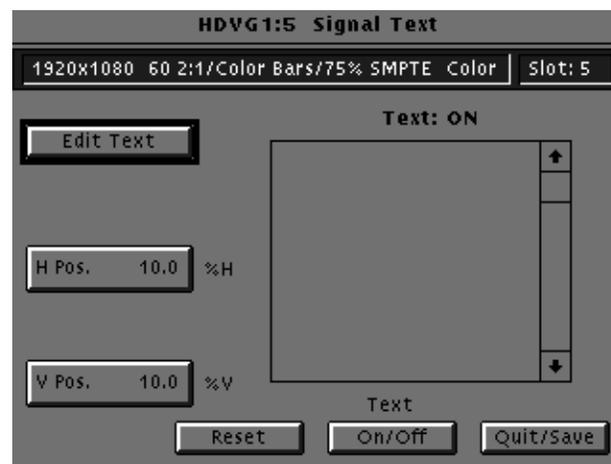
Signal Information   You can view detailed information about the selected signal in the Signal Information window, accessed through the Active Signal Parameters window shown on page 2--17.

```
       HDVG1:5  Signal Information

 1920x1080  60 2:1/Color Bars/75% SMPTE  Color  |  Slot: 5

 Comments:                                            ↑
 Signal Path:
  N5:/1920x1080  60 2:1/Color Bars/75% SMPTE  Color
 Bars|1.1.cmp
 Origin:            Tek Generated
 Create Date:       Mar-03-1999 15:17:04
 Format Name:       1920X1080 60Hz 2:1 Interlace
 Aspect Ratio:      16/9
 Sample Frequency:  74.250000000 MHz
 Time Base Offset:  0.00 PPM
 Line Length:       2200 samples                      ↓

                                          [  Quit  ]
```
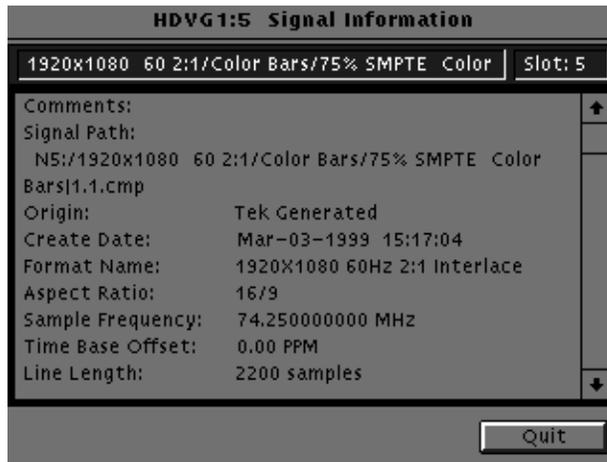
Module Parameters

The following pages discuss windows that are accessed through the Module Parameters window, shown below. Changes that you make to parameters in any of these windows affect the entire module.

To enter the Module Parameters window for the HDVG1 Generator module, follow these steps:

1. Select the HDVG1 Generator module, if not already selected.

2. Push the **Test Signals** button.

3. Touch **Module Parameters** at the bottom of the screen. The Module Parameters window appears, as shown below.
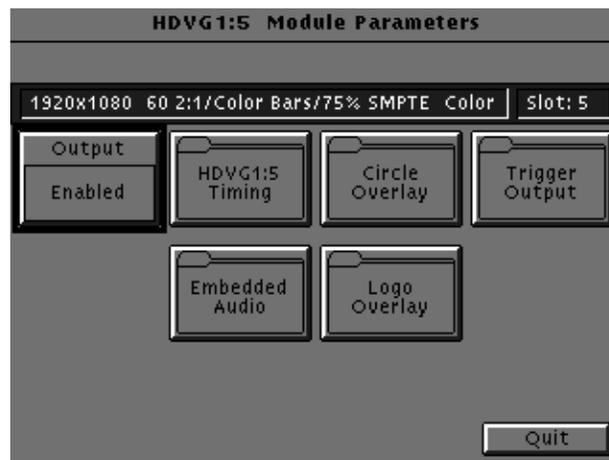
4. Another way to access this window is as follows:

    a. Push the **Modules** button.

    b. Ensure that the module is highlighted.

    c. Push the **Edit** button.

    d. Touch **Module Parameters**.

Enable/Disable the Output Signal

If you disable the module output, it releases all system resources used by this module. To disable the module output, select the module and then touch the **Output** icon in the Module Parameters window shown on page 2-21.

Timing

You can set the horizontal and vertical timing of this module with respect to the BG1 Generator module. Changes you make to timing affect all signals for the HDVG1 Generator module. In the Module Parameters window, shown on page 2-21, touch the module timing icon.

Touch **Reset All** if you want to return horizontal and vertical timing to the defaults.

```
                    HDVG1:5  Timing


   1920x1080  60 2:1/Color Bars/75% SMPTE  Color     Slot: 5


   Horizontal:      0.0000    usec



   Vertical:            0     lines




                  Reset All          Quit
```
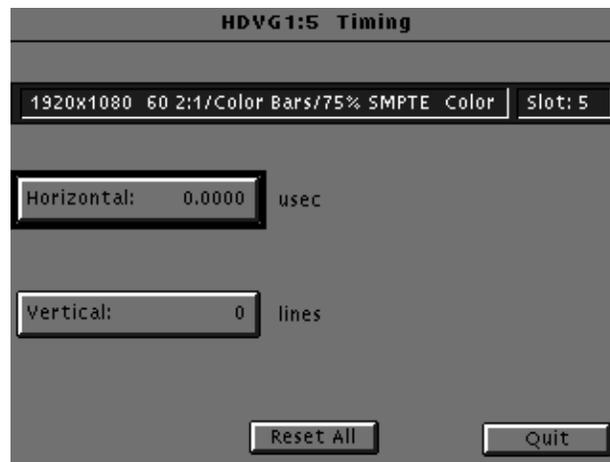
Circle Overlay   You can create a circle that is overlaid on the output test signal. The circle overlay parameters will affect all test signals from this module. Entered values are constant, regardless of which test signal or video standard you use.

You can define a circle overlay in the Circle Overlay window, accessed through the Module Parameters window, shown on page 2‑21. The Circle Overlay window is shown in the following illustration. Touch **On/Off** to turn on the circle overlay.
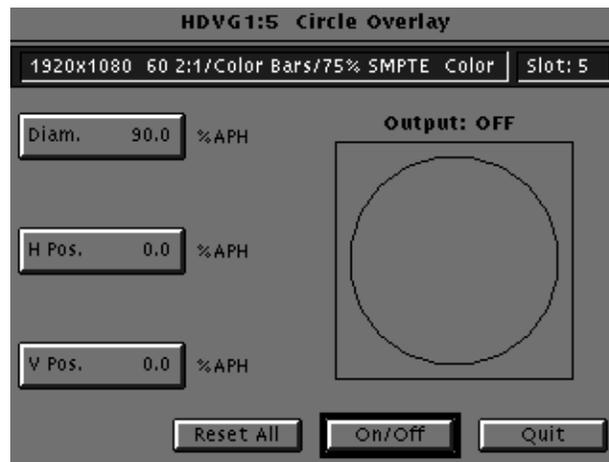
If you want to reset the values, touch **Reset All**. This will set the diameter, horizontal, and vertical to 90%, 0, and 0 respectively.

Trigger Output   You can generate three types of Trigger signals to the rear panel BNC. In the Module Parameters window, shown on page 2–21, touch **Trigger** to enter the Trigger window, shown below. Turn on the cursor by touching the **On/Off** on the display. Touch **Reset All** if you want to set all the parameters to the default settings (H Pos to zero and V Pos to 1).

NOTE. Triggers are active throughout the line. However, cursors are only active during active video.
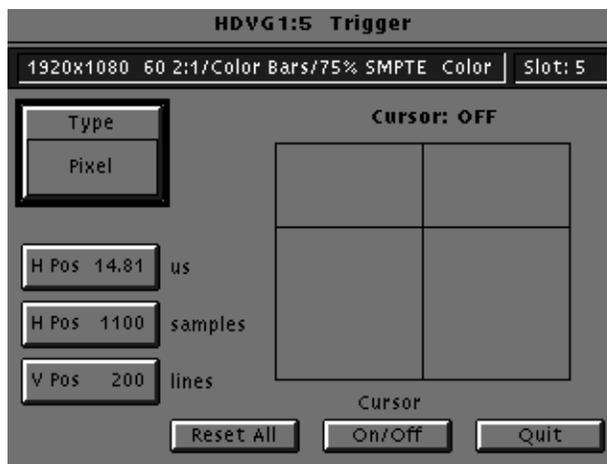
Embedded Audio   You can turn embedded audio on or off, select which channel groups to enable, and which of the enabled groups to send first. You can also adjust the frequency and amplitude of the embedded audio signal. Changes you make affect all signals for this module. Detailed information can be found in the HDVG1 HDTV Digital Video Generator User Manual.

Logo Overlay   You can provide a logo that is overlaid on the output test signal. The logo overlay parameters will affect all test signals from this module. Entered values are constant, regardless of which test signal or video standard you use.

You can define a logo overlay in the Logo Overlay window, accessed through the Module Parameters window, shown on page 2-21. The Logo Overlay window is shown in the following illustration. Touch **On/Off** to turn on the logo overlay.

You can also save logos to a floppy disk, add logos to the module, and delete logos from the module using the File Utilities window.
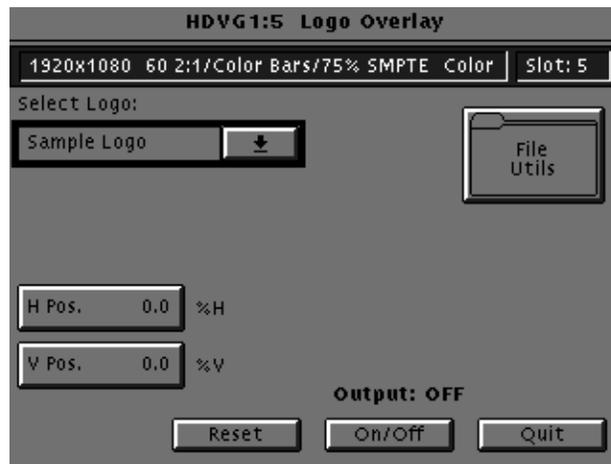
If you want to reset the values, touch **Reset**. This will set the horizontal and vertical position to 0.

Theory of Operation

Theory of Operation

This discussion provides an overview of the HDVG1 Generator module. For information about the TG2000 Platform mainframe, refer to the *TG2000 Signal Generation Platform Service Manual*.

The HDVG1 Generator module is a 10-bit precision, digital video test signal generator for HDTV digital signals. Output signal data is stored in fast access memory (Line Memory) which has been loaded from the NVRAM over the CPU bus. An overlay data modifier (which is actually an integral part of the fast access memory) inserts data from the overlay memory into the fast access memory data stream to create circular patterns, cursors, text characters, and logo.

For HDTV signal generation, Cb and Cr data are multiplexed in the data memory and then further multiplexed with the Y data to produce the HDTV formatting. The multiplex switching causes the data mux to output the data sequence in the following form: Y--Cb--Y--Cr.

The Audio Coprocessor adds embedded audio data.

The coprocessor output containing all the added data is serialized for the module serial output. There are three serial outputs.
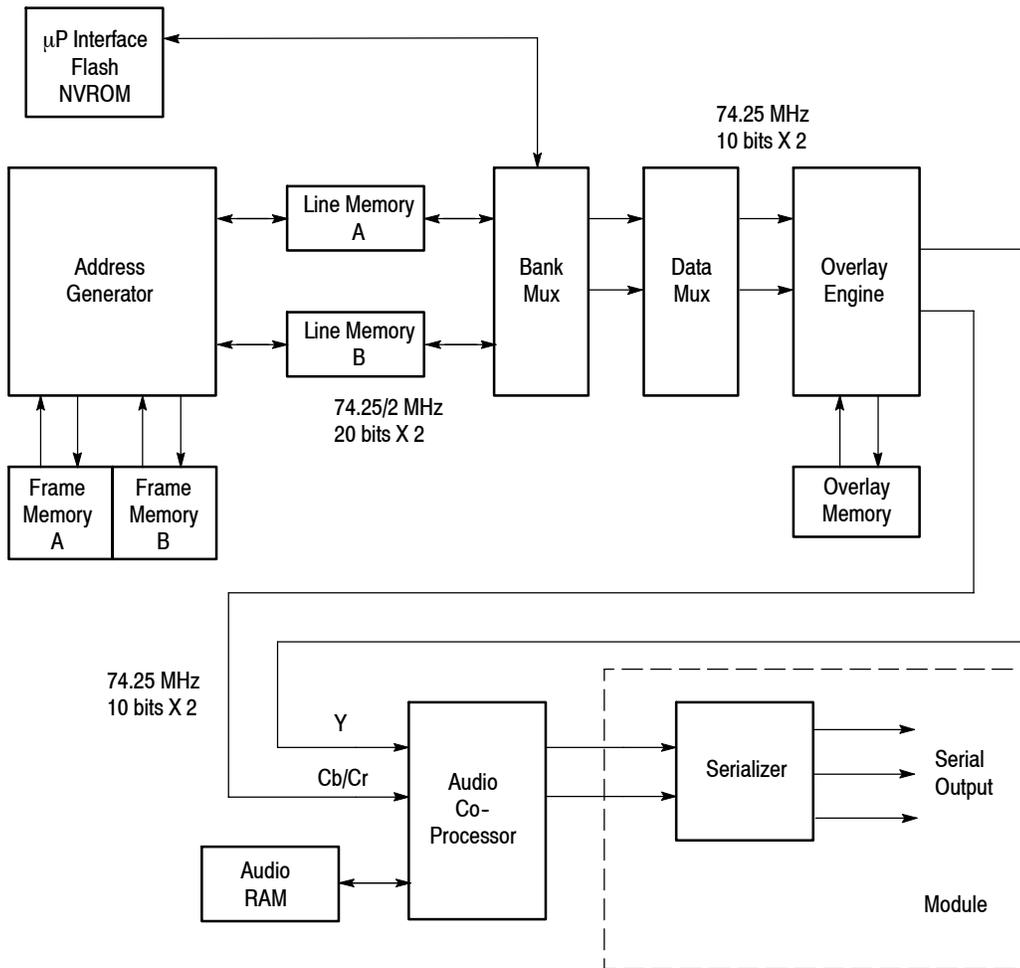
Figure 3- 1: Simplified block diagram of the HDVG1 Generator module

Signal Memory

The HDVG1 module uses two levels of memory to generate signals in real time (See Figure 3–2). Each level of memory puts constraints on the maximum complexity of a signal that can be generated.

The Line Memory holds the actual sample points which define the signal. The Line holds approximately 1M samples for Y, 512K samples for Cb, and 512K samples for Cr (1048576 samples total). The equation to determine the maximum number of unique video lines that can be stored in the Line Memory is as follows:

1048576 samples / # of samples per line = # of unique video lines

1080I . . . . 1048576 samples / 2200 per line = 476 unique video lines
720P . . . . 1048576 samples / 1650 per line = 632 unique video lines

The Frame Memory contains a series of pointers which control the order in which the video lines that are stored in Line Memory are used to produce HDTV signals. The maximum number of pointers is 174762. The equation to determine the maximum length (in seconds) of a video sequence is:

Line length $\times$ 174762 = maximum sequence length (in seconds)

1080I . . . . [1 / (30*1125)] $\times$ 174762 = 5.1 seconds [155 Frames]
720P . . . . [1 / (60*750)] $\times$ 174762 = 3.8 seconds [233 Frames]

NOTE. *The limit on number of unique video lines means that HDVG1 Generator module cannot generate an arbitrarily complex full frame image (i.e., it cannot replicate a captured video image). The lines consumed by the logo are not included in the unique line counts, nor are the lines consumed by overlaid text.*
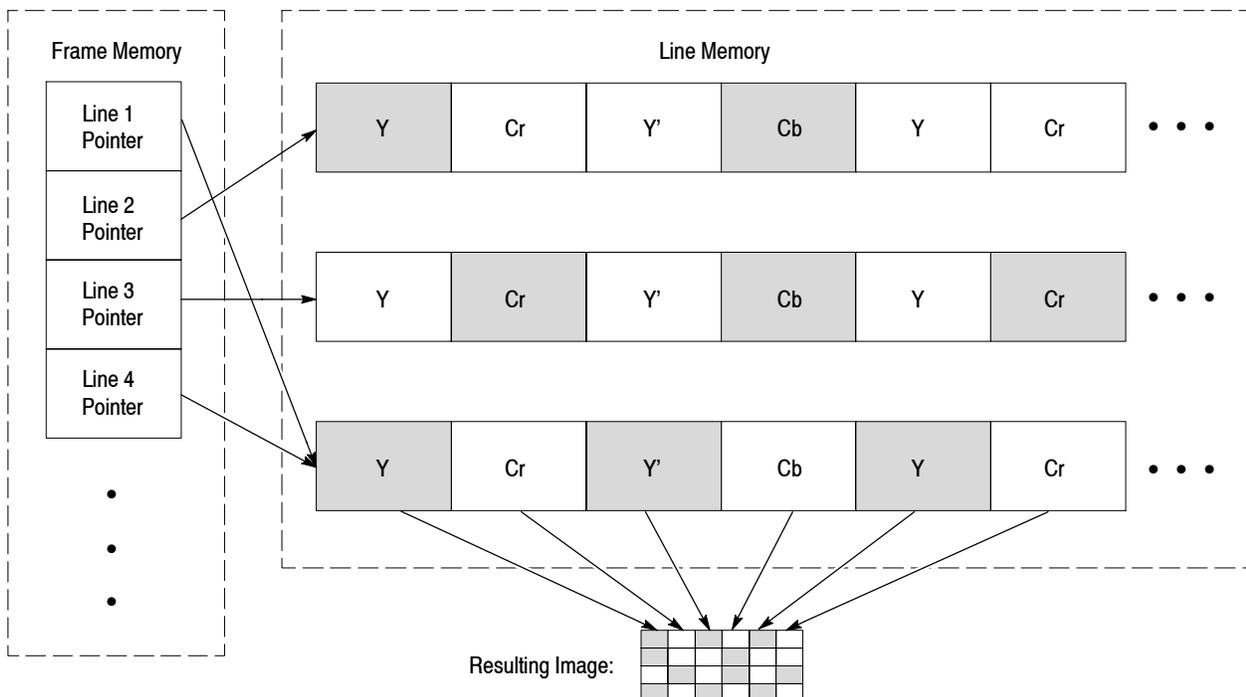
Figure 3‑2: Signal memory layout

Embedded Audio

The HDVG1 can generate video signals with embedded digital audio. The embedded signal is 24 (or 20) bit audio data with a sample rate of 48 kHz. The data can be made up of multiple frequencies and amplitudes, with channel and status independence. The supported audio frequencies are listed in Table 3-1.

Table 3-1: Supported embedded audio frequencies

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

Performance Verification

Performance Verification

Perform the following procedure to verify that your HDVG1 Generator module is meeting the requirements listed in the *Specifications* section.

NOTE. All values checked in this procedure represent typical characteristics and are not absolutely guaranteed.

Required Equipment

Test Equipment   Table 4-1 lists the equipment required for this procedure.

Table 4-1: Equipment required for Performance Verification

Item	No.	Required precision	Recommended equipment
Digital Television Waveform Monitor	1		Tektronix WFM1125 Option 0C or 0D
HDTV Picture Monitor	1		Sony HDM1220J
Digital Audio Monitor	1		Tektronix 764
Oscilloscope	1	Bandwidth: 200 MHz or higher	Tektronix TDS740D
Sampling oscilloscope with head	1	Bandwidth: 6 GHz or higher	Tektronix 11801C with SD-22
75 Ω coaxial cable	5		Tektronix part number 012-0159-01
50 Ω BNC to SMA adapter	2		Tektronix part number 015-1018-00
75 Ω BNC terminator	4		Tektronix part number 011-0102-00
75 Ω Signal Adapter	2	$\div$ 5	Tektronix AMT75

Calibration Data Report

Photocopy this form and use it to record the performance test results.

Table 4‑2: HDVG1 Calibration Data Report

Serial Number:	Cal Date:	Temperature:	Humidity:

Step	Function Tested	Minimum	Cal Data	Maximum
1.	Serial Output Rise Time (20% to 80% amplitude points)			
	Output 1		ps	270 ps
	Output 2		ps	270 ps
	Output 3		ps	270 ps
2.	Serial Output Fall Time (20% to 80% amplitude points)			
	Output 1		ps	270 ps
	Output 2		ps	270 ps
	Output 3		ps	270 ps
3.	Trigger Output Level into 75Ω			
	Low		OK	0.25V
	High	1.00V	OK	

Preparation for Performance Verification

Follow all instructions for power on, instrument warm-up, and loading test and logo signals. The **1920X1080 60 2:1** signal set is used in this procedure.

Overview This is a list of the steps that you will follow while preparing for and performing the *Performance Verification* procedure:

- Power on and warm up, page 4-3

- Create Preset, page 4-3

- Recall the Factory Preset, page 4-4

- Complete the *Performance Verification* procedure, page 4-5

Power On and Warm Up Power on and warm up the mainframe as follows:

1. Connect the TG2000 Platform mainframe to an AC power source.

2. Set the rear-panel power switch to the ON position.

3. Press the front-panel POWER switch if necessary.

4. Wait for a few seconds as the mainframe executes confidence tests on the mainframe and modules. Check to see if any error messages appear.

5. When the self tests are complete, the instrument will display icons representing each of the installed generator modules. If an installed module is not represented on the display, proceed to *Troubleshooting Procedures* on page 5-9.

6. Allow 20 minutes of warm-up time before performing *Performance Verification*.

7. During warm-up time, you can perform the remaining preparation steps.

Create Preset Before beginning the *Performance Verification* procedure, create a preset to save your instrument settings as follows:

1. Push the **Presets** button.

2. Touch **Presets** on the display.

3. Touch **Create** on the display.

4. Touch letters on the display to spell out a name for the new preset, and then touch **OK**.

5. Use the **Navigation** arrows to move the cursor to the new preset. Press the **Select** key.

6. Touch **Save To**. Your current instrument settings are saved to the new preset.

Instrument Backup   Determine whether you will replace signals or add signals (refer to *Signal Set Installation* on page 2-6). If you will replace signals, perform the following *Instrument Backup* first. During this procedure, you create disks that you will use to restore the module signals after you finish the *Performance Verification* procedure. You need blank 3.5 inch disks, DOS formatted, approximately one disk for each module.

If you do not wish to perform the backup, you can choose to restore the standard HDVG1 test signals instead, using the HDVG1 Test Signals disks that were shipped with the module's user manual.

To perform *Instrument Backup*, follow these steps:

1. Insert the Troubleshooting disk supplied with *TG2000 Signal Generation Platform Service Manual* into the mainframe disk drive and push the front-panel **Sequences** button.

2. Touch **File Utilities** on the display, and then touch **Add Sequences from Disk**.

3. Select the **tgbackup.seq** sequence file, and then touch **Start Load**.

4. When you see the message, "The Load is Complete", touch **OK**.

5. Touch **Quit**, and then touch **Quit** again.

6. Touch **Sequences** and then select the **tgbackup.seq** file to run (use the touch screen and the **Select** key). Be sure this file name appears in the box at the top of the window.

7. Touch **Run**. A popup menu will tell you how many disks are needed. Touch **Quit**.

8. When you see the message, "Insert a Floppy Disk", remove the troubleshooting disk and insert a blank formatted disk. Touch **Quit**.

9. After each backup disk is complete, a popup menu will tell you to insert a disk. Replace the completed disk with a new disk, and touch **Quit**.

10. After the last backup disk is complete, touch **Quit** and then **Quit** again.

Recall the Factory Preset   Recall the Factory Preset as follows:

1. Push the **Presets** button.

2. Touch **Presets** on the display.

3. Use the **Navigation** arrows to move the cursor to the **Factory** preset. Press the **Select** button.

4. Touch **Recall**. The instrument is set to factory presets.

Performance Verification Procedures

Be sure you have performed the *Preparation for Performance Verification* before proceeding.

Performance verification procedures can be performed individually if desired.

⚠ **WARNING.** *Dangerous electric shock hazards exist inside the TG2000 mainframe. Only qualified service personnel should perform these procedures.*

SDI Output Correctness and Digital Audio Output Check

Equipment required	Five 75 Ω coaxial cables
	Four 75 Ω terminators
	WFM1125 Digital TV Waveform Monitor Option 0C or 0D
	HDM1220J HDTV Picture Monitor
	764 Digital Audio Monitor

Connections. Refer to Figure 4-1 for connections.

Use the 75 Ω coaxial cables to make the following connections:

- Connect OUTPUT 1 connector on the HDVG1 Generator module to the CHA connector on the digital TV waveform monitor rear panel.

- Connect Pr, Pb, and Y ANALOG OUT connectors on the digital TV waveform monitor rear panel to INPUT A R/P_R, B/P_B, G/Y connectors, respectively, on the HDTV picture monitor rear panel.

- Connect AUDIO CHA connector on the digital TV waveform monitor rear panel to CH1-2 BNC connector on the digital audio monitor rear panel.

Use the 75 Ω terminators to make following connections:

- Terminate the other loop through to R/P_R, B/P_B, and G/Y connectors on the HDTV picture monitor rear panel.

- Terminate the other loop through to CH1-2 BNC connector on the digital audio monitor rear panel.
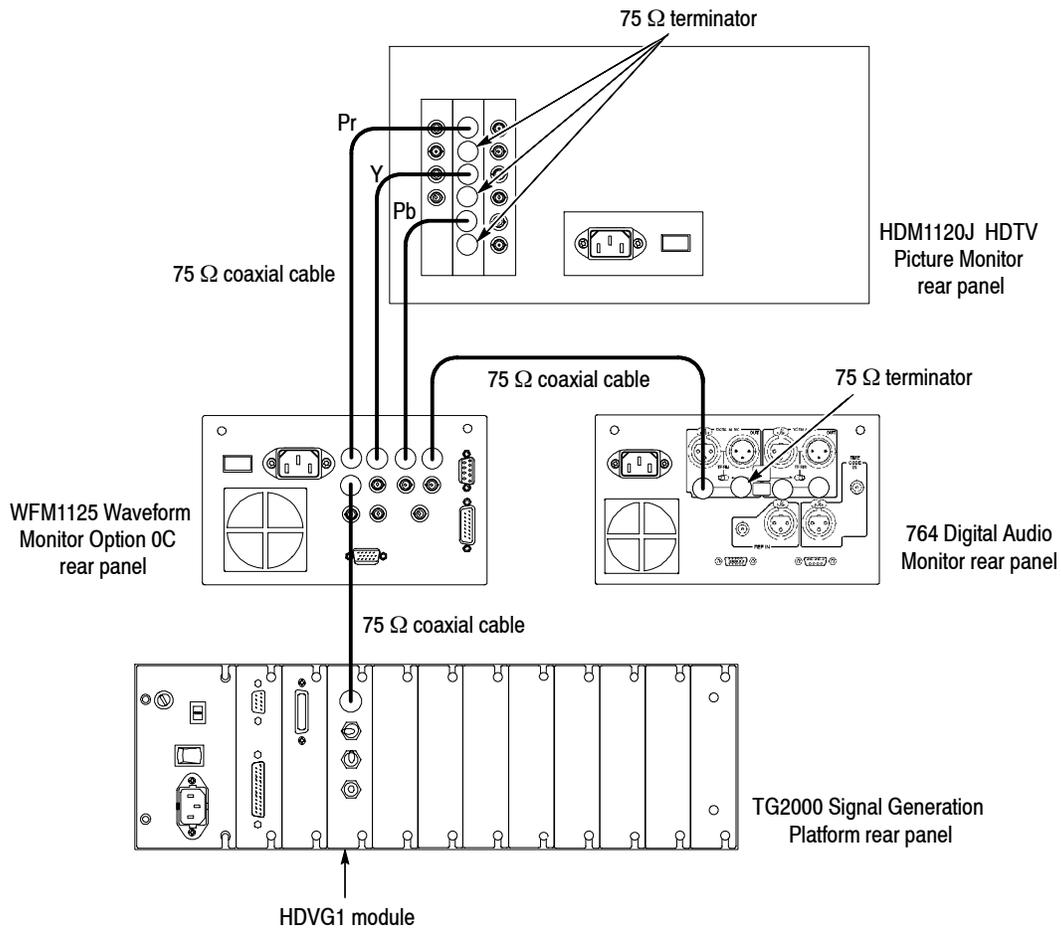
Figure 4- 1: SDI correctness and digital audio output check connection

Setup. Set the digital TV waveform monitor as indicated below:

Input . . . . CH A
Display . . . . Parade
Format . . . . 240M/274M (for SMPTE 274M) (Opt 0C)
Interlaced/Progressive . . . . Interlaced (Opt 0D)

Procedure.

1. Select the **75% SMPTE Color Bars** signal as follows:

    a. Push the **Signal Sets** button on the TG2000 Signal Generation Platform.

    b. Touch **1920X1080 60 2:1** on the display. Load from floppy if necessary.

    c. Touch **Color Bars** on the display until the **75% SMPTE Color Bars** signal is selected.

  2. Enter the text and turn on the text overlay as follows:

    a. Touch **Active Signal Parameters** on the display.

    b. Touch **Text Overlay** on the display.

    c. Touch **Edit Text** on the display.

    d. In the text entry window, touch the **o**, **v**, **e**, **r**, **l**, **a**, **y**, and **OK** in that order.

    e. Touch **Text On/Off** to turn on the text overlay.

    f. Save the text overlay when prompted.

  3. Set the audio frequency for the channel 1 and channel 2 to 1 kHz as follows:

    a. Press the **Test Signal** button on the TG2000 Signal Generation Platform.

    b. Touch **Module Parameters** on the display.

    c. Touch **Embedded Audio** on the display.

    d. Touch **Group1** on the display.

    e. Touch the list box for the channel 1. A list box appears for you to select the desired frequency.

    f. Select 1000 Hz using the cursor keys and the **Select** button.

    g. Perform steps c and d for the channel 2.

  4. Check the displayed waveform and CRC error:

    a. Confirm that the waveform and "overlay" text are correctly displayed on the digital TV waveform monitor.

    b. Check that the CRC ERROR LED on the digital TV waveform monitor does not light.

  5. Check the digital audio:

    a. On the digital audio monitor front panel, press the **MENU** button to display the menu.

    b. Select the **Input** item from the menu, and select **CH1--2 input: BNC--unbalanced** item from the submenu.

    c. On the digital audio monitor front panel, press the **CLEAR** button to clear the menu.

  d. On the digital audio monitor front panel, press the **CH STATUS** button to display **CHANNEL STATUS** view.

  e. In the view, check CRC errors are not displayed.

  f. On the digital audio monitor front panel, press the **Audio View** button.

  g. Check that the digital audio monitor bar graphs show both Channel 1 and Channel 2 at −20 dBfs.

6. Check that the correct color bar and "overlay" text are displayed on the HDTV picture monitor.

7. Change the coaxial cable connection from OUTPUT 1 connector to OUTPUT 2 connector on the HDVG1 Generator module and repeat step 4 and step 5.

8. Change the coaxial cable connection from OUTPUT 2 connector to OUTPUT 3 connector on the HDVG1 Generator module and repeat step 4 and step 5.

Eye Pattern Check

Equipment required	Two 75 Ω coaxial cables
	One AMT75
	Two SMA-to-BNC adapters
	Sampling oscilloscope with sampling head

Connections. Refer to Figure 4−2 for connections.

Use the AMT75, 75 Ω coaxial cables, and SMA-to-BNC adaptors to make the following connections:

NOTE. Some sampling oscilloscopes do not automatically adjust their readouts to account for the ÷5 attenuation of the AMT75. You must remember to account for this attenuation while viewing the oscilloscope readouts if you are using an oscilloscope of this type.

- Connect the OUTPUT 1 connector on the HDVG1 Generator module to the AMT75 and then to the CH1 input connector on the oscilloscope sampling head.

- Connect the OUTPUT 2 connector on the HDVG1 Generator module to the TRIGGER INPUTS DIRECT connector on the oscilloscope sampling head.
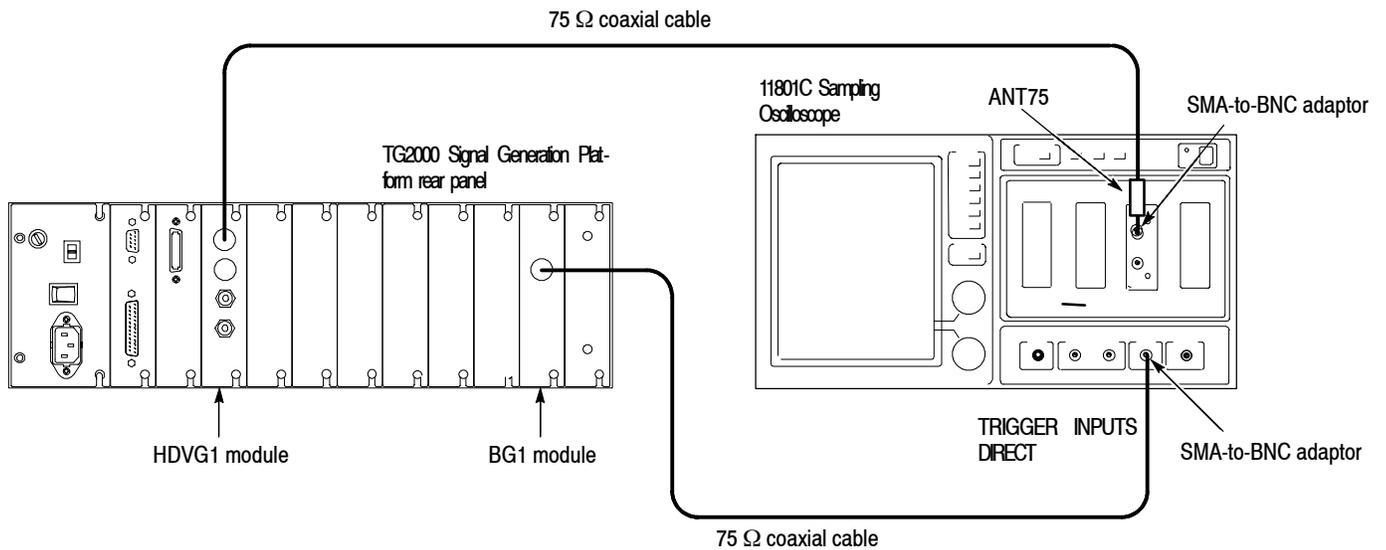
Figure 4‑2: Eye pattern check connection

Setup. Set the sampling oscilloscope as indicated below:

Vertical	CH1
Coupling	AC
Scale	20 mV/div
Horizontal	
Sweep	200 ps/div
Trigger	
Source	External Direct
Coupling	AC
Slope	Positive
Level	0 V
Mode	Auto
Display mode	Color Grading or Infinite

procedure.

1. Select the **75% SMPTE Color Bars** signal as follows:

   a. Push the **Signal Sets** button on the TG2000 Signal Generation Platform.

   b. Touch **1920X1080 60 2:1** on the display.

   c. Touch **Color Bars** on the display until the **75% SMPTE Color Bars** signal is selected.

2. Check that OUTPUT 1 eye pattern displayed on the sampling oscilloscope is fully open. Figure 4-3 shows an example of the eye pattern for an acceptable output signal
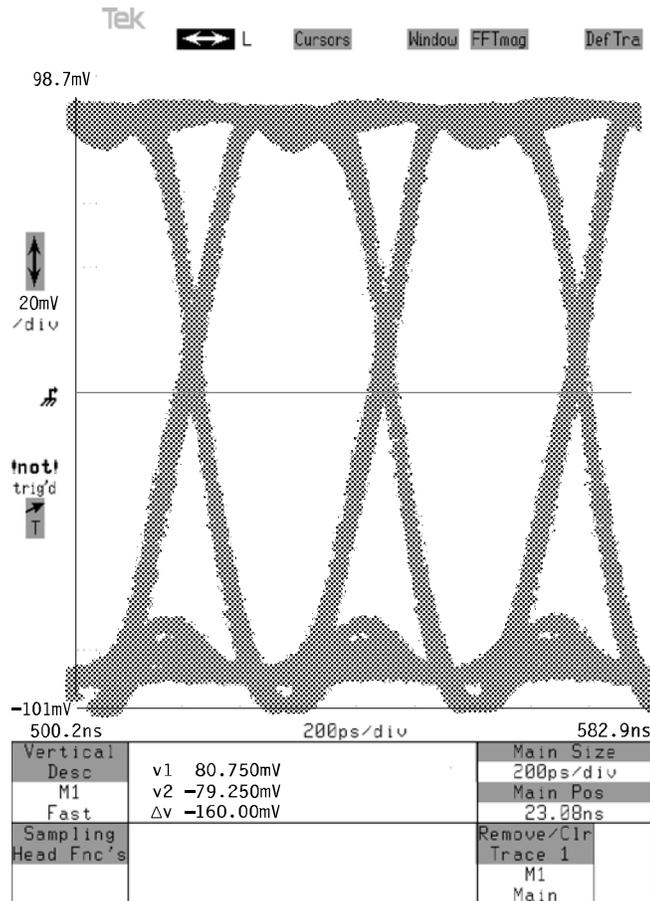
Figure 4- 3: Example of eye pattern for an acceptable output signal

3. Use the sampling oscilloscope measurement functions to perform the amplitude, rise and fall time measurement and check that these values are as follows.

Amplitude : approximately 800 mV
Rise and fall time : < 270 ps (20% to 80%)
Alignment jitter : < 135 ps

4. Change the cable connection on the HDVG1 Generator Module.

    a. Disconnect the coaxial cable from OUTPUT 1 connector on the HDVG1 Generator module.

b. Disconnect the coaxial cable from OUTPUT 2 connector on the HDVG1 Generator module, and then connect it to OUTPUT1 connector on the HDVG1 Generator module.

c. Connect the coaxial cable disconnected in step 4.a. to OUTPUT 2 connector on the HDVG1 Generator module.

5. Check that OUTPUT 2 eye pattern displayed on the sampling oscilloscope is fully open (see Figure 4-3) and repeat step 3.

6. Disconnect the coaxial cable from OUTPUT 2 connector on the HDVG1 Generator module, and then connect it to OUTPUT 3 connector on the HDVG1 Generator module.

7. Check that OUTPUT 3 eye pattern displayed on the sampling oscilloscope is fully open (see Figure 4-3) and repeat step 3.

Trigger Output Check

Equipment required	75 Ω coaxial cable
	75 Ω terminator
	Oscilloscope

Connections. Refer to Figure 4-4 for connections.

Use the 75 Ω coaxial cable and 75 Ω terminator to make the following connections:

■ Connect the TRIG OUT connector on the HDVG1 Generator Module to the oscilloscope CH1 input connector.
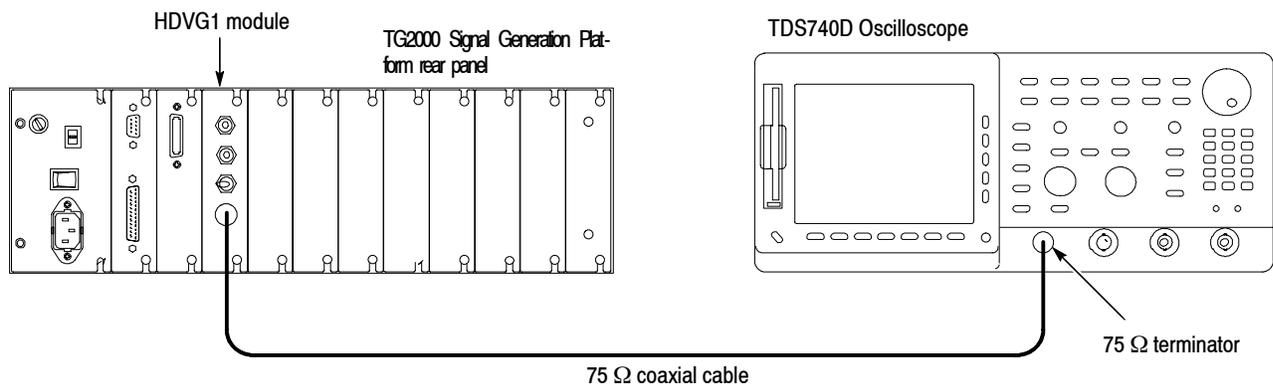
Figure 4-4: Trigger output check connection

Setup. Set the oscilloscope as indicated below:

```
Vertical . . . . . . . . . . . . . . . . . . . . . . . .   CH1
    Coupling . . . . . . . . . . . . . . . . . . . .   DC
    Scale . . . . . . . . . . . . . . . . . . . . . .   0.2 V/div
Horizontal
    Sweep . . . . . . . . . . . . . . . . . . . . . .   1 μs/div
Trigger
    Coupling . . . . . . . . . . . . . . . . . . . .   AC
    Slope . . . . . . . . . . . . . . . . . . . . . .   Positive
    Level . . . . . . . . . . . . . . . . . . . . . .   0 V
    Mode . . . . . . . . . . . . . . . . . . . . . .   Auto
```

procedure.

1. Select the **75% SMPTE Color Bars** signal as follows:

   a. Push the **Signal Sets** button on the TG2000 Signal Generation Platform.

   b. Touch **1920X1080 60 2:1** on the display.

   c. Touch **Color Bars** on the display until the **75% SMPTE Color bars** signal is selected.

2. Generate the trigger signal as follows:

   a. Touch **Module Parameters** on the display.

   b. Touch **Trigger** on the display.

   c. Touch **Type** to select **Horizontal**, **Vertical**, or **Pixel**.

3. Use the oscilloscope measurement functions to perform the trigger output signal amplituide and rise and fall time measurement and check that these values are as follows.

   Amplitude:
     Low : < 0.25 V
     High : > 1.0 V

   Rise and fall time : < 10 ns

Instrument Restore from Backup

If you performed an instrument backup before beginning the *Performance Verification* procedure, restore the signals by following these steps:

1. Insert the Troubleshooting disk supplied with this manual into the mainframe disk drive and press the front-panel **Sequences** key.

2. Select the **tgrstore.seq** file, and then touch **Start Load**.

3. When you see the message, "The Load is Complete", touch **OK**.

4. Touch **Quit**, and then touch **Quit** again.

5. Touch **Sequences** and then select the **tgbackup.seq** file to run (use the touch screen and the **Select** key). Be sure this file name appears in the box at the top of the window.

6. Touch **Run**. Insert any of the backup disks that you created when you performed the *Instrument Backup* procedure. Touch **Quit.**

7. Insert another disk and touch **Quit** each time you are prompted. (You can insert the disks in any order.)

8. When the Restore Complete window appears, turn the mainframe power off and then on again to cycle power.

Recall Preset   Recall the preset you created as follows:

1. Push the **Presets** button.

2. Touch **Presets** on the display.

3. Use the **Navigation** arrows to move the cursor to the preset that you created before beginning the *Performance Verification* procedure. Press the **Select** key.

4. Touch **Recall**. Your instrument settings are recalled.

This completes the *Performance Verification* procedure. If you require further assistance, contact your nearest Tektronix Service Center.

Maintenance

Maintenance

This section contains instructions and procedures for maintaining the HDVG1 Generator module. For information on servicing the mainframe, refer to the *TG2000 Signal Generation Platform Service Manual*.

The following information can be found in this section:

- Preparation   page 5‒1

- Inspection and Cleaning (preventive maintenance)   page 5‒3

- Repackaging instructions   page 5‒3

- Removal and replacement procedures   page 5‒7

- Troubleshooting procedures   page 5‒9

If the instrument does not function properly, troubleshooting and corrective measures should be taken immediately to prevent additional problems.

NOTE. Contact your local Tektronix representative for information on where to return your instrument if it requires repair during the warranty period.

Preparation

Please read and follow these preparation instructions before attempting to perform any maintenance or service to the instrument.

Servicing Prerequisites   Make sure of the following before beginning any instrument service:

- The maintenance or service of this instrument must be performed by qualified service personnel only.

- Read the *Service Safety Summary* located at the beginning of this manual before attempting to perform any maintenance or service to the instrument.

- Read the *Operating Information* section of this manual before attempting to perform any maintenance or service to the instrument.

Electrostatic Damage Prevention

This instrument contains electrical components that are susceptible to damage from electrostatic discharge. Static voltages of 1 kV to 30 kV are common in unprotected environments.

⚠️

CAUTION. Static discharge can damage any semiconductor component in this instrument.

Observe the following precautions to avoid static damage:

- Minimize handling of static-sensitive components.

- Transport and store static-sensitive components or assemblies in their original containers, on a metal rail, or on conductive foam. Label any package that contains static-sensitive assemblies or components.

- Discharge the static voltage from your body by wearing a wrist strap while handling these components. Servicing static-sensitive assemblies or components should only be performed at a static-free workstation by qualified personnel.

- Nothing capable of generating or holding a static charge should be allowed on the workstation surface.

- Keep the component leads shorted together whenever possible.

- Pick up components by the body, never by the leads.

- Do not slide the components over any surface.

- Avoid handling components in areas that have a floor or work surface covering capable of generating a static charge.

- Use a soldering iron that is connected to earth ground.

- Use only special antistatic, suction-type or wick-type desoldering tools.

NOTE. A 2% RMA flux content solder is recommended for making repairs in this instrument. Cleaning of rosin residue is not recommended. Most cleaning solvents tend to reactivate the rosin and spread it under components where it may cause corrosion under humid conditions. The rosin residue, if left alone, does not exhibit these corrosive properties.

Inspection and Cleaning

Preventive maintenance consists of cleaning, visual inspection, performance checking, and, if needed, readjustment. The preventive maintenance schedule established for the instrument should be based on the environment in which it is operated and the amount of use. Under average conditions, scheduled preventive maintenance should be performed every 2000 hours of operation.

General Care

Protect the module from adverse weather conditions. The module is not waterproof.

⚠ **CAUTION.** *To avoid damage to this module, do not expose it to sprays, liquids, or solvents. Do not flex the circuit board if you remove the board from its mounting shield. The circuit board can be damaged by flexing. The shield provides necessary structural support to the circuit board.*

Cleaning and Visual Inspection

Clean the mainframe and modules often enough to prevent dust or dirt from accumulating. Refer to *Cleaning* and *Visual Inspection* in the *TG2000 Signal Generation Platform Service Manual*.

Performance Verification

Check module performance after each 2000 hours of operation or every 12 months. This will help to ensure maximum performance and assist in locating defects that may not be apparent during regular operation. Performance verification procedures are included in this manual.

Repackaging Instructions

Use the following instructions to prepare your instrument for shipment to a Tektronix, Inc., Service Center:

1. Attach a tag to the instrument showing: the owner, complete address and phone number of someone at your firm who can be contacted, the instrument serial number, and a description of the required service.

2. Package the instrument in the original packaging materials. Figures 5–1 and 5–2 illustrate how to repackage the module in the original packaging materials. If the original packaging materials are not available, follow these directions:

   a. Obtain a carton of corrugated cardboard having inside dimensions six or more inches greater than the dimensions of the instrument. Use a shipping carton that has a test strength of at least 250 pounds (113.5 kg).

   b. Surround the module with a protective (anti-static) bag.

    c. Pack dunnage or urethane foam between the instrument and the carton. If using Styrofoam kernels, overfill the box and compress the kernels by closing the lid. There should be three inches of tightly packed cushioning on all sides of the instrument.

3. Seal the carton with shipping tape, industrial stapler, or both.
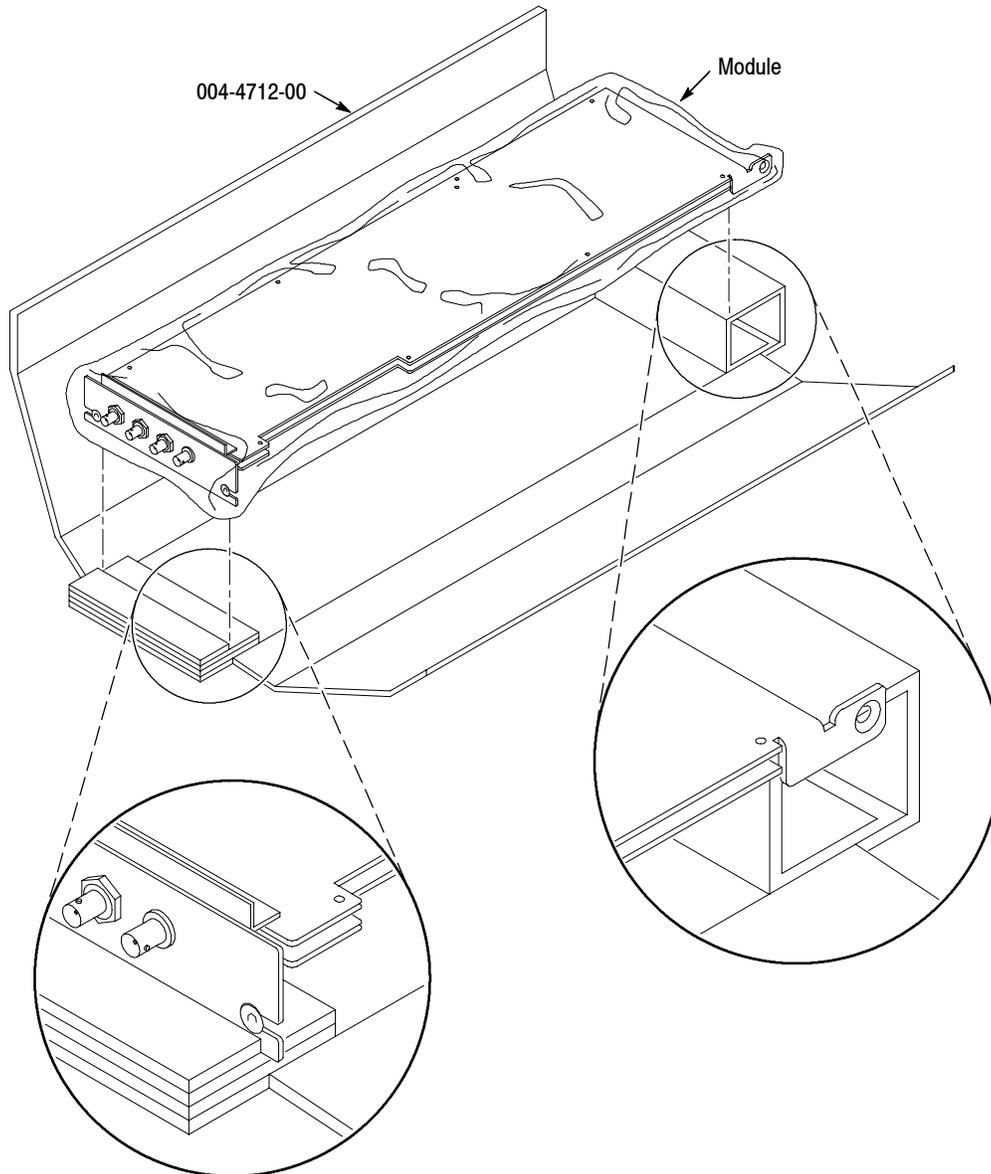
Figure 5‑ 1: Placing the module in the protective wrapping

004-4713-00
2 Each

004-4712-00

004-0828-00
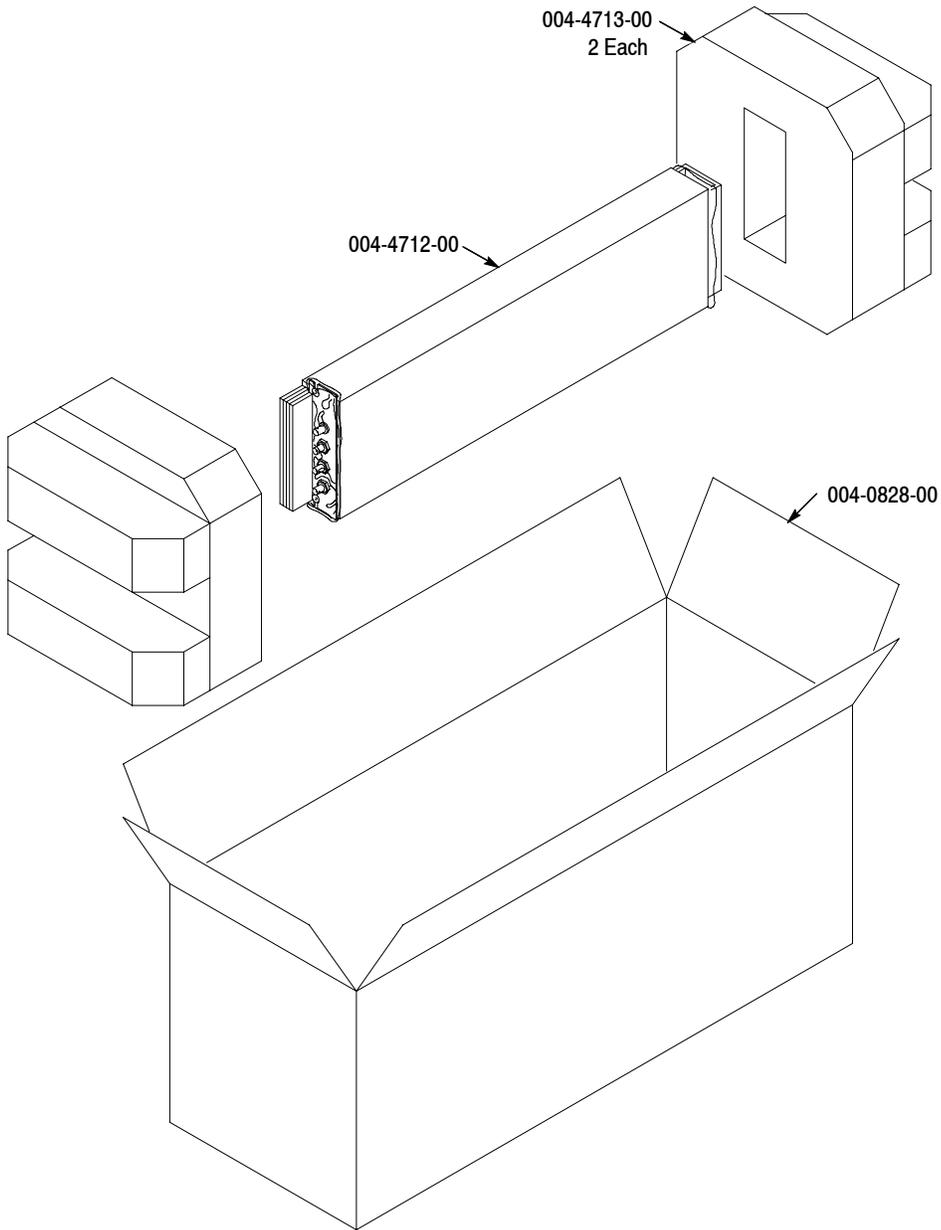
Figure 5-2: Placing the module in the shipping carton

Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the HDVG1 Generator module.

Tools Required

The following tools are required to perform the removal and replacement procedures:

Table 5-1: Required tools

Tool	Use
Torx screwdriver handle	Removing the module from the mainframe
T-10 Torx tip	Removing the module from the mainframe
9/16 inch box wrench	Removing the rear panel

Removing the Rear Panel

To remove the rear panel from a module, perform the following steps:

1. Perform *Signal Backup* and *Logo Backup* on page 2-8.

2. Use the *Module Removal* procedure on page 2-9 to remove the HDVG1 Generator module from the mainframe.

3. Remove the nuts and washers from each of the rear panel BNC connectors.

4. Lift the rear panel away from the module.

5. To replace the rear panel, position it on the module, install the lock washers and then the nuts.

6. Tighten the nuts.

7. Restore signals and logos.

Replacing the Shield

It is usually not necessary to remove the shield. If you are returning the HDVG1 Generator module to Tektronix for service, do not remove the shield. Return the entire module.

If you need to replace a damaged shield, carefully follow these instructions.

⚠ *CAUTION. The shield provides important support and protection for the surface-mount components. If you remove the shield, be sure not to flex the circuit board.*

1. Perform *Removing the Rear Panel* on page 5–7.

2. Using the T-10 Torx tip, remove the eight screws that attach the HDVG1 circuit board to the shield.

3. Using great care not to bend or flex the circuit board, pull it out until the BNC connectors clear the rear portion of the shield. Remove the circuit board from the shield and place it on a static free surface.

4. Set the replacement shield assembly (which includes a metal portion and a plastic portion) on a firm, flat, static-free work surface. Carefully place the circuit board in place on the shield.

5. Install and tighten the eight screws that you removed in step 2. Check that the circuit board is flat and is not flexed.

⚠ *CAUTION. When installing the circuit board onto the shield, make sure both the shield and the circuit board are flat. If the board is flexed or warped, it may damage sensitive surface-mount components.*

6. Reinstall the rear panel.

Replacing the Rear Panel Connectors

It is usually not necessary to replace the rear panel connectors (shown in the *Replaceable Parts List*, Figure 10-1-3 and 10-1-4). However, if a connector becomes damaged, you can replace it by performing the following steps:

1. Refer to the preceding instructions, *Replacing the Shield*, to remove the shield from the HDVG1 Generator module.

2. Disconnect the connector cables from J800 on the A10 circuit board, CN2, CN3, and CN4 on the serializer.

3. Remove the damaged connector from the real panel.

4. To replace the connector, reverse the procedure.

Troubleshooting Procedures

This section contains instructions and procedures for troubleshooting the HDVG1 Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG2000 Platform mainframe does not boot up or if the display is not working, refer to *Troubleshooting* in the *TG2000 Signal Generation Platform Service Manual*.

Equipment Required

The equipment listed in Table 5‑2 is required for troubleshooting.

Table 5‑2: Equipment required for troubleshooting

Equipment description	Minimum requirements/example
Torx screwdriver handle	Accepts Torx-driver bits
T-10 Torx tip	Torx-driver bit for T-10 screw head
Blank disks	MS‑DOS preformatted, 3.5 inch. For instrument backup, you will need approximately one disk for each installed generator module. To write the console ring file, you will need two disks.
Troubleshooting disk	Supplied with the *TG2000 Signal Generation Platform Service Manual*
Voltmeter with probes	Accurate to two decimal places, able to measure AC voltage of 900 V_{RMS}. For example, Tektronix DM2510 Digital Multimeter

General Troubleshooting

This section contains general troubleshooting instructions and procedures to use when you begin to troubleshoot suspected faults with the HDVG1 Generator module.

Signal Backup

Before you begin any troubleshooting procedures, perform *Signal Backup* and *Logo Backup* on page 2–8. After the problem is solved, restore instrument signals from the backup disks.

CAUTION. *To prevent data loss, back up the instrument before you begin any troubleshooting procedures.*

Saving the Console Ring File to Disk

The TG2000 Platform mainframe displays module diagnostic information during instrument power up. Any error messages are written to an internal file called the console ring file. Tektronix technicians can use the information in the console ring file to help troubleshoot a malfunctioning module.

NOTE. *Write the console ring file to disk before performing troubleshooting to prevent the troubleshooting routines from overwriting the console ring file.*

Write the file as follows:

1. Load the Troubleshooting disk (supplied with the *TG2000 Signal Generation Platform Service Manual*) into the floppy drive. Press the front-panel **Sequences** button.

2. Touch **File Utilities**, and then touch **Add Sequences from Disk**.

3. Select the **consbak.seq** sequence file and then touch **Start Load**.

4. Touch **OK, Quit**, and then **Quit** again.

5. Touch **Sequences** and then select the **consbak.seq** file to run (use the **Select** key).

6. Touch **Run**. Insert a blank disk when prompted, and touch **Quit**. Label this disk #1.

7. Turn the instrument off and then back on from the front panel. Wait until the instrument has completed its power up process.

8. Write the console ring file to disk again, using a different disk. Label this disk #2.

9. Read the console ring file power up messages. If there are HDVG1 Generator module errors, refer to the *Fault Symptom Table* on page 5‑11.

10. If the TG2000 Platform does not display any power-up confidence test messages, or the CPU module fails the confidence test, refer to *Trouble-shooting* in the *TG2000 Signal Generation Platform Service Manual*.

Returning Modules to Tektronix

When you return a mainframe or module to Tektronix for repair or replacement, be sure to include the following:

- The disks containing the console ring files

- Whether or not the module passed diagnostics, the highest number reached for that module, and any error messages

- Description of the problem, including which troubleshooting flow chart you used

Fault Symptom Table

Use this fault symptom table after you have performed the preceding *General Troubleshooting*. Before proceeding, it is important to save the console ring file as indicated in *General Troubleshooting* on page 5‑10.

Locate your fault symptom in Table 5‑3 and go to the flowchart indicated.

Table 5‑3: Fault symptom table

Symptom	Flowchart
Major difficulties with module	page 5‑12
with module installed in current slot	page 5‑13
with module moved to different slot	page 5‑14
Mainframe fails to power up	page 5‑15
Signals lost after power down	page 5‑16
Wrong signal on output	page 5‑17
Missing output signal	page 5‑18

Troubleshooting Flowcharts

The troubleshooting flowcharts provide a series of steps to help you determine whether the HDVG1 Generator module is faulty. Each chart relates to an entry in Table 5-3.

Figure 5-3: Flowchart for major difficulties with module

Continuation of flowchart from page 5-12.

Use the Module Removal procedure on page 5-7 to remove the affected module.

Check for bent or damaged pins on the three Backplane board connectors (P1, P2, and P3). Carefully straighten any bent pins.

Check that all module subassemblies and socketed parts are seated properly. Reinstall the module in the same slot.

Set the rear-panel power switch to on, and then use the front-panel switch to turn the instrument on.

Watch the display for the HDVG1 Confidence Tests. Note whether the HDVG1 module passed the diagnostic. Note the highest number to appear.

Does the TG2000 recognize the HDVG1 module?

No

Yes

Does the HDVG1 module pass Confidence tests?

No

Yes

Go to flowchart on page 5-14.

TG2000 now recognizes the HDVG1 module. HDVG1 Module now passes power-up confidence tests.

Figure 5- 4: Flowchart for checking the current module installation slot

Continuation of flowchart from page 5-13.

Use the Module Removal procedure on page 5-7 to remove the affected module.

Install the HDVG1 module in a different slot.

Set the rear-panel power switch to on, and then use the front-panel switch to turn the instrument on.

Watch the display for the HDVG1 Confidence Tests. Note whether the HDVG1 module passed the diagnostic. Note the highest number to appear.

Does the TG2000 recognize the HDVG1 module?

No

Yes

Does the HDVG1 module pass Confidence tests?

No

Yes

Replace the module.

HDVG1 Module OK
Note that there may be a problem with the Backplane board. Record troubleshooting information and contact Tektronix.

Figure 5-5: Flowchart for checking the module in a different slot

Use this procedure when the TG2000 Platform mainframe fails to power up and you suspect the HDVG1 module.

↓

Set the rear-panel power switch to off, then on, and then use the front-panel switch to turn the instrument on.

Watch the display for the HDVG1 Confidence Tests. Note whether the HDVG1 module passed the diagnostic. Note the highest number to appear.

↓

Did the HDVG1 fail confidence tests? — No → The problem is probably in another module. Refer to *Troubleshooting* in the *TG2000 SIgnal Generation Platform Service Manual*.

Yes ↓

Use the Module Removal procedure on page 5-7 to remove the HDVG1 module.

Set the rear-panel power switch to off, then on, and then use the front-panel switch to turn the instrument on.

↓

Did the mainframe power up successfully? — No → The problem is probably in another module. Refer to *Troubleshooting* in the *TG2000 SIgnal Generation Platform Service Manual*.

Yes ↓

Install the HDVG1 module in a different slot.

Set the rear-panel power switch to on, and then use the front-panel switch to turn the instrument on.

Watch the display for the HDVG1 Confidence Tests. Note whether the HDVG1 module passed the diagnostic. Note the highest number to appear.

↓

Did the HDVG1 still fail confidence tests? — No → There may be a problem with the Backplane board. Record troubleshooting information and contact Tektronix.

Yes ↓

Replace the module.

Figure 5-6: Flowchart for failure to power up

Use this procedure when your module's signals are lost after powering down the mainframe from the rear-panel power switch.

Check that the backup battery wires are connected.

Turn off the rear-panel power switch and measure the backup battery voltage (+4.2 V).

Is the battery voltage ok?

No → Check Power Supply charging circuit.

Remove the cable from J2 on the Power Supply board and measure pin 7 (See Figure 5-8) for +4.7 V with rear panel power on, +0.5 V with rear-panel power off.

Is the battery charging circuit ok?

Yes → The problem is probably the backup battery, but it could be the Backplane board or the CPU module. Record troubleshooting information and contact Tektronix.

No → Refer to the TG2000 Service Manual for instructions to replace the Power Supply module.

Yes

Use the Module Removal procedure on page 5-7 to remove the faulty module.

Check that the Backplane board pins are not bent on the affected module.

Move the affected module to another slot.

Does the affected module operate in the new slot?

No → Replace the module.

Yes

There may be a problem with the Backplane board. Record troubleshooting information and contact Tektronix.

Figure 5-7: Flowchart for signals lost after power down

Figure 5‑8: Measuring the battery charging circuit

Figure 5‑9: Flowchart for wrong signal on output

Use this procedure when you do not have an output signal.

Make sure the module output is enabled.

Make sure the signal sets are installed. For example, if you ordered a module separately and added it to your TG2000 Platform mainframe, you need to load the signals from the supplied disks. Refer to Signal Set Installation on page 2-6.

Is the signal still missing?

No → HDVG1 Module OK

Yes

Replace affected module.

Figure 5-10: Flowchart for missing output signal

Option

Option

This section describes option that is available for the HDVG1 Generator module.

The following option is available.

- Option D1 ships with test result report.

Option D1 Description

A calibration data test result report will be provided with the HDVG1 Generator module when this option is specified.

Diagram

Diagram

Figure 7‑1 shows the HDVG1 Generator module and how it interconnects with the TG2000 Signal Generation Platform.

Diagrams showing mainframe component interconnections, such as power supply and clock, can be found in the *TG2000 Signal Generation Platform Service Manual*.

A block diagram of the HDVG1 Generator module is located in the *Theory of Operation* section, beginning on page 3‑1.
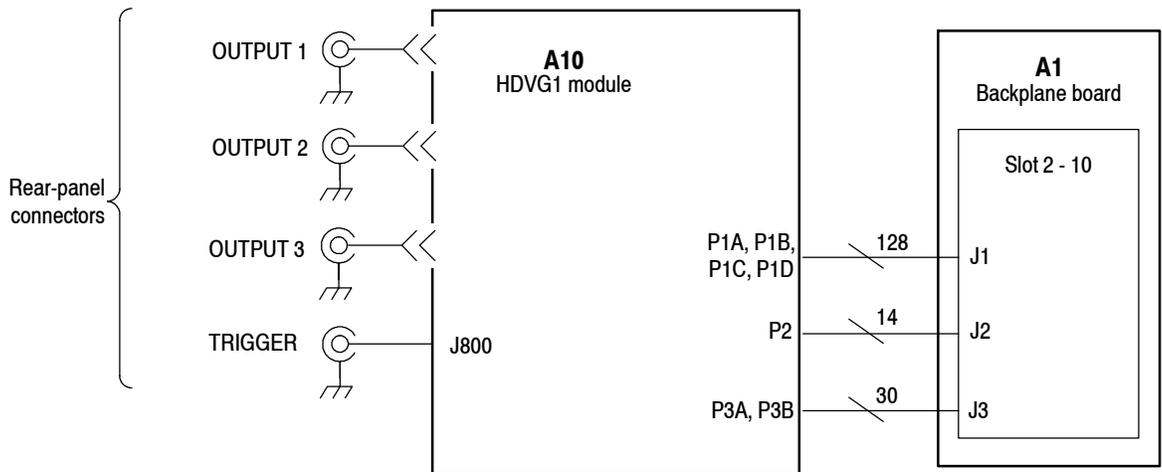

Figure 7‑1: HDVG1 Generator module connections

Replaceable Parts List

Replaceable Parts List

This section contains a list of the replaceable modules for the HDVG1 Generator module. Use this list to identify and order replacement parts.

Parts Ordering Information

Replacement parts are available through your local Tektronix field office or representative.

Changes to Tektronix products are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest improvements. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number

- Instrument type or model number

- Instrument serial number

- Instrument modification number, if applicable

If you order a part that has been replaced with a different or improved part, your local Tektronix field office or representative will contact you concerning any change in part number.

Module Servicing   Modules can be serviced by selecting one of the following three options. Contact your local Tektronix service center or representative for repair assistance.

Module Exchange. In some cases you may exchange your module for a remanufactured module. These modules cost significantly less than new modules and meet the same factory specifications. For more information about the module exchange program, call 1-800-833-9200. Outside North America, contact a Tektronix sales office or distributor; see the Tektronix Web site for a list of offices: www.tektronix.com

Module Repair and Return. You may ship your module to us for repair, after which we will return it to you.

New Modules. You may purchase replacement modules in the same way as other replacement parts.

Using the Replaceable Parts List

The following table describes each column in the parts list.

Parts List Column Descriptions

Column	Column name	Description
1	Figure & index number	Items in this section are referenced by figure and index numbers to the exploded view illustrations that follow.
2	Tektronix part number	Use this part number when ordering replacement parts from Tektronix.
3 and 4	Serial number	Column three indicates the serial number at which the part was first effective. Column four indicates the serial number at which the part was discontinued. No entries indicates the part is good for all serial numbers.
5	Qty	This indicates the quantity of parts used.
6	Name & description	An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.

Abbreviations   Abbreviations conform to American National Standard ANSI Y1.1–1972.

Replaceable parts list

| Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
10-1-1	211-0718-XX			3	SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,T-10 TORX
10-1-2	348-1302-XX			1	GASKET,SHIELD:CONDUCTIVE URETHANE FORM STRIP,W/ADHESIVE TAPE,1M L
10-1-3	174-4273-XX			3	CABLE ASSY,RF:75 OHM COAX(1.5C-XV),4CM L,BNC TO PL71-LP-1.5C
10-1-4	174-4272-XX			1	CABLE ASSY,RF:75 OHM COAX(1.5C-XV),8CM L,BNC TO PL71-LP-1.5C
10-1-5	333-4335-XX			1	PANEL,REAR:AL,HDVG1
------	116-0330-XX			1	EXCHANGE MODULE:HDVG1
					STANDARD ACCESSORIES
	071-0593-XX			1	MANUAL,TECH:USER,HDVG1
	003-1841-XX			1	T-10 TORX TIP
	211-0718-XX			2	SCREW
	063-3253-XX			1	SOFTWARE PKG:3.5 DISK,HDVG1 TEST SIGNAL
	020-2212-XX			1	TG2000 UPGRADE KIT
	-----------			1	CERTIFICATE OF CALIBRATION
					OPTIONAL ACCESSORIES
	071-0594-XX			1	MANUAL,TECH:SERVICE,HDVG1
	671-2879-XX			1	EXTENDER BOARD
	-----------			1	TEST DATA REPORT

Figure 8-1: Exploded view