Service Manual

Tektronix

**DVG1
Digital Video Generator**

070-9300-00

CE

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If you have not already purchased Service Assurance for this product, you may do so at any time during the product's warranty period. Service Assurance provides Repair Protection and Calibration Services to meet your needs.

Repair Protection extends priority repair services beyond the product's warranty period; you may purchase up to three years of Repair Protection.

Calibration Services provide annual calibration of your product, standards compliance and required audit documentation, recall assurance, and reminder notification of scheduled calibration. Coverage begins upon registration; you may purchase up to five years of Calibration Services.

Service Assurance Advantages

- Priced well below the cost of a single repair or calibration

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- Eliminates unexpected service expenses

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For more information or to order Service Assurance, contact your Tektronix representative and provide the information below. Service Assurance may not be available in locations outside the United States of America.

Name	VISA or Master Card number and expiration
Company	date or purchase order number
Address	Repair Protection (1,2, or 3 years)
City, State, Postal code	Calibration Services (1,2,3,4, or 5 years)
Country	Instrument model and serial number
Phone	Instrument purchase date

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General Safety Summary

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

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the *General Safety Summary* in other system manuals for warnings and cautions related to operating the system.

To Avoid Fire or Personal Injury

Connect and Disconnect Properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

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

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

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

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

Use Proper Fuse. Use only the fuse type and rating specified for this product.

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

Wear Eye Protection. Wear eye protection if exposure to high-intensity rays or laser radiation exists.

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:

WARNING	Protective Ground	CAUTION	Double
High Voltage	(Earth) Terminal	Refer to Manual	Insulated

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.

Preface

You have purchased this optional service manual for the DVG1 Digital Video Generator module. To optimize troubleshooting capability, you should also purchase the service manual for the TG 2000 Platform mainframe. The service manual for the mainframe is shipped in a binder that is large enough to hold the module service manuals. Each module manual begins with a tab so that you can locate it after you add it to the binder.

About This Manual

This manual contains information for servicing the DVG1 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 necessary to verify that the module is meeting the requirements listed in the *Specifications.*

- *Adjustments* contains procedures to adjust the module to return it's operation to within specifications.

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

- *Options* describes the options available for this module.

- *Replaceable Electrical Parts* for the module level are included in the Replaceable Mechanical Parts list.

- *Diagrams* contains interconnect diagrams showing the connections between the DVG1 Generator module, the mainframe and other modules.

- *Replaceable Mechanical Parts* lists 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 DVG1 Generator module:

- The *TG 2000 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 *TG 2000 Signal Generation Platform User Manual* describes how to use the TG 2000 Platform. It also contains information about SCPI commands, programming structure, and status and events for the TG 2000 Signal Generation Platform. Some of this information applies to all generator modules, including the DVG1 Generator module.

- The*DVG1 Digital Video Generator User Manual* contains operating information and information about SCPI commands for the DVG1 Generator module.

Contacting Tektronix

Product Support	For application-oriented questions about a Tektronix measurement product, call toll free in North America: 1-800-TEK-WIDE (1-800-835-9433 ext. 2400) 6:00 a.m. – 5:00 p.m. Pacific time
	Or, contact us by e-mail: tm_app_supp@tek.com
	For product support outside of North America, contact your local Tektronix distributor or sales office.
Service Support	Contact your local Tektronix distributor or sales office. Or, visit our web site for a listing of worldwide service locations.
	http://www.tek.com
For other information	In North America: 1-800-TEK-WIDE (1-800-835-9433) An operator will direct your call.
To write us	Tektronix, Inc. P.O. Box 1000 Wilsonville, OR 97070-1000

Specifications

Specifications

This section contains a general product description of the DVG1 Generator module followed by the operating specifications of the module. All specifications listed here are guaranteed unless labeled "typical" in the Characteristics column. Typical specifications are provided for your convenience, but are not guaranteed.

Product Description

The DVG1 Generator module is an 8-bit or 10-bit precision, digital video test signal generator for NTSC composite digital and for 525-line and 625-line component digital signals. The DVG1 Digital Video Generator module contains the following features:

- Digital video test signals in serial and parallel form

- Three video outputs (two serial BNC outputs and one parallel DB25 output)

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

- User-defined video signals that require clock rates up to 36 MHz

- Signal parameters adjustable in real time from the front panel

- EDH supported on serial outputs

- Overlay of circles or text on the video signal

- SDI Test Capabilities

- Embedded Audio

Embedded Audio. The DVG1 Generator module can generate video signals with 20-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 DVG1 Generator module. Table 1–1 lists the electrical specifications, and Table 1–2 lists the EMC compliance specifications. All specifications are guaranteed unless labeled "typical." Typical specifications are provided for your convenience, but are not guaranteed.

Specifications are only valid when the module is installed in a TG 2000 Platform mainframe. For installation instructions, refer to *Module Installation* on page 2–2.

For a list of environmental specifications, refer to the *TG 2000 Signal Generation Platform Service Manual*.

Table 1–1: Electrical specifications

Characteristics	Description
Encoding Format, typical	Positive binary linear PCM
Maximum Clock Frequency	36 MHz + 1%
Resolution	10 bit; 8 bit also supported
Output Timing Offset Adjustment Range, typical	Added to genlock offset timing, offsets relative to internal clock and frame reset. Adjustable to any point in the video frame.
Parallel Connector, typical	25-pin D-type, female contacts
Pinout	Parallel, 11 balanced signal pairs: 10 data, 1 clock
Output Logic Levels	10K ECL compatible
Receiver Termination	110 Ω ± 10 Ω
Serial Connector	BNC connector
Signal Amplitude	800 mV ± 10% into 75 Ω load
Data Rate, typical	143, 270, and 360 Mbs
Overshoot	≤ 10%. Measured at 20% and 80% points; shall not differ by more than 0.5 ns
Rise and Fall Times	0.4 ns to 1.5 ns, Into DC termination
DC Offset (AC coupled)	0 V ± 0.5 V
Jitter	≤ ± 0.25 ns p-p, for all jitter frequencies above 10 Hz
Jitter, typical	Typically ≤ 20 ps RMS
Return Loss/Output Impedance	≥ 15 dB, 5 MHz to 360 MHz. 75 Ω, AC coupled

Table 1–1: Electrical specifications (cont.)

Characteristics	Description
SDI Test Parameters, typical	
Output Amplitude Accuracy	$\pm$ 2%@ 800 mv, self calibrated after warmup and outputs terminated with 75 Ω
SDI Test Parameters:	
Output Amplitude Range	–90% to +15% in 1% increments relative to 800 mV
Variable SDI Data Slew Rate	
Range	At 800 mV amplitude, slew rate adjustment allows rise times in the range 820 ps to 7 ns (measured from 20% to 80%)
Range, typical	Slew rate is adjustable from 5% to 125% of nominal in 1% steps. Rise and fall times are dependant on slew rate and amplitude.
SDI Jitter	Calibrated jitter may be added to the serial video output. The jitter waveform is sinusoidal, with variable amplitude and frequency.
Intrinsic Jitter	$\leq \pm$ 0.25 ns, for jitter frequencies above 10 Hz
Intrinsic Jitter, typical	Typically $\leq$ 20 ps RMS
Amplitude Range	0 to 15 ns range, $\pm$ 10% at 2 ns
Frequency	0.1 Hz to 10 MHz
Trigger Output, typical	
Amplitude	TTL compatible if unterminated
Rise Time	$\leq$ 10 ns
Output Impedance	75 Ω
Power Consumption	+5 Volts: 5.75 Watts typical -5 Volts: 4.25 Watts typical -2 Volts: 0.6 Watts typical +15 Volts: 0 Watts typical -15 Volts: 0.75 Watts typical Battery: 30 μA maximum

Certifications

Table 1–2: Certifications and compliances

Characteristics	Description
EMC Compliance	Meets the intent of Directive 89/336/EEC 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.
FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits

Standards Conformance

The DVG1 conforms to the following standards:

■ EBU Tech. 3267: ITU-R BT.601 and BT. 656

■ SMPTE 125M, 244M, 259M, 267M, 272M, RP 165, and RP 178

Operating Information

Installation

This section contains instructions for installing the DVG1 Generator module into the TG 2000 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 TG 2000 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 TG 2000 Platform mainframe, perform these steps:

1. Set the TG 2000 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
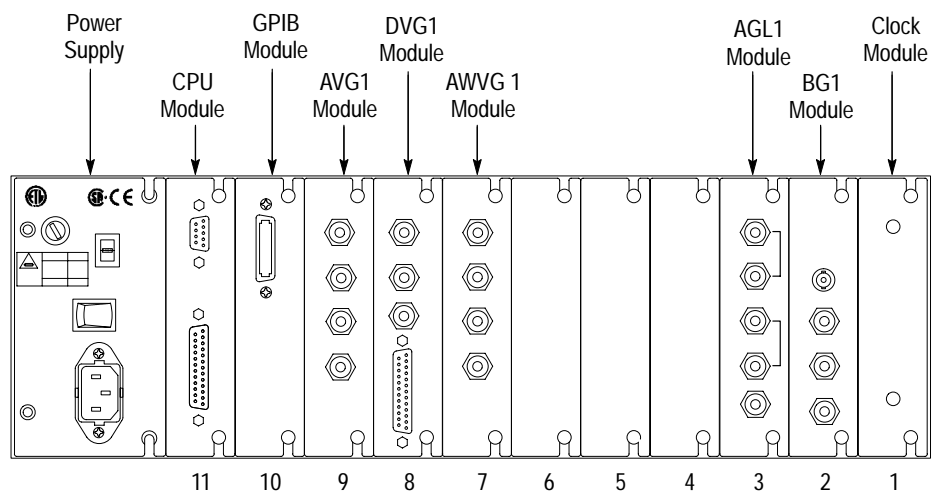
Figure 2–1: TG 2000 Platform mainframe rear panel, showing slot numbering

> **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.
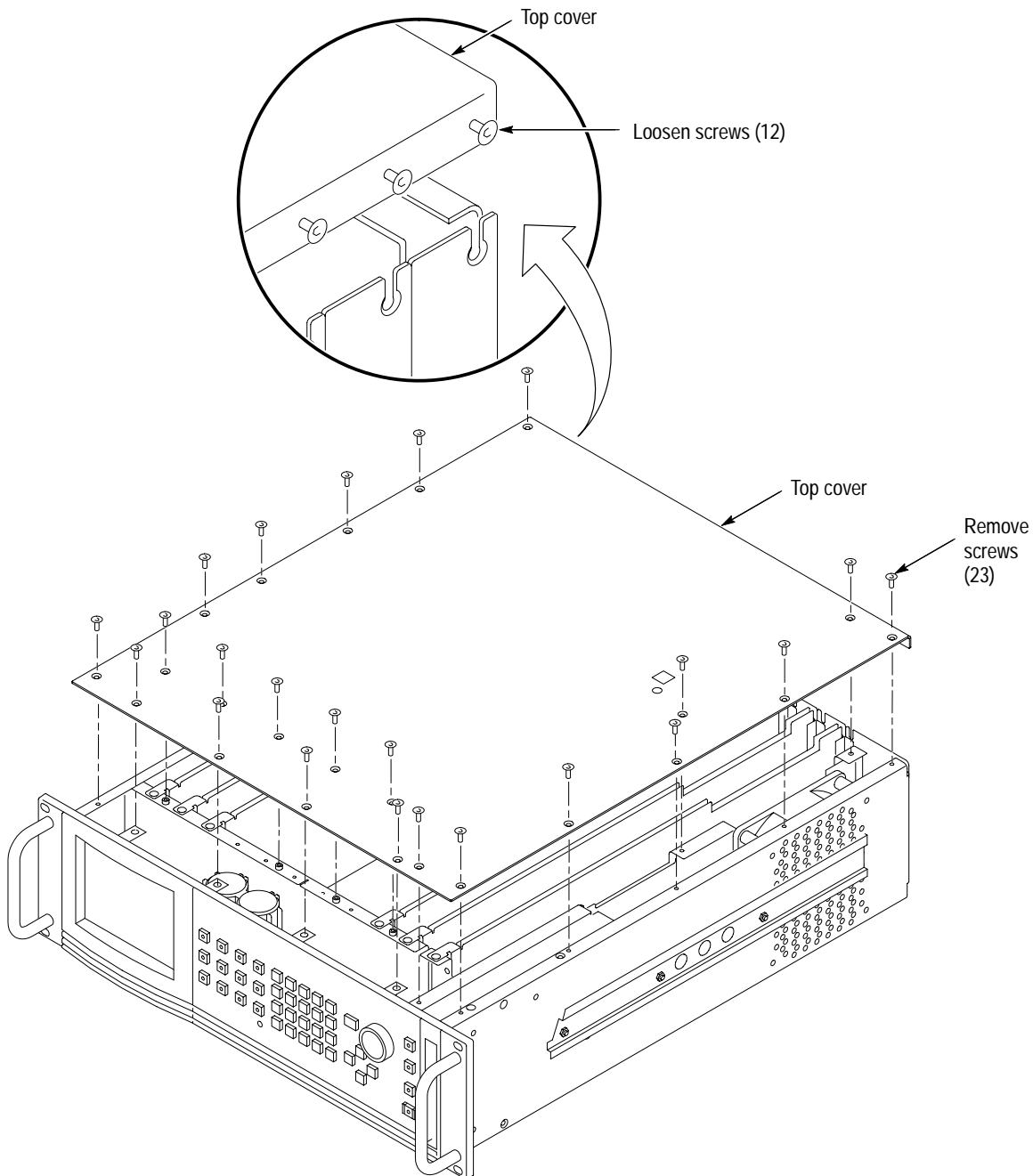
Figure 2–2: Top cover removal

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
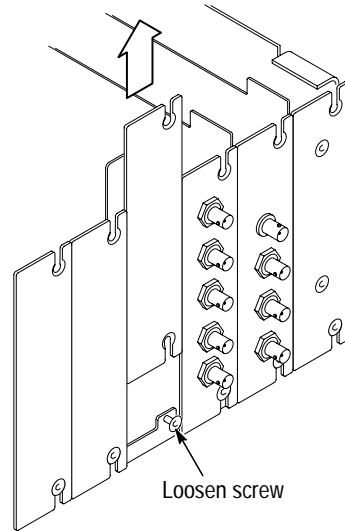
Figure 2–3: Removing the rear panel

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.
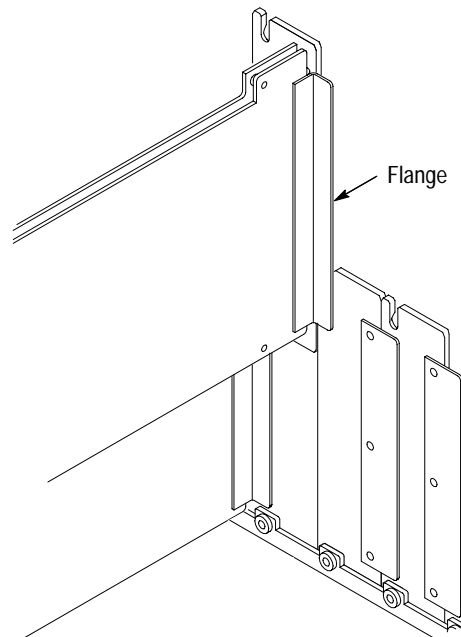
Flange

Figure 2–4: Module flange
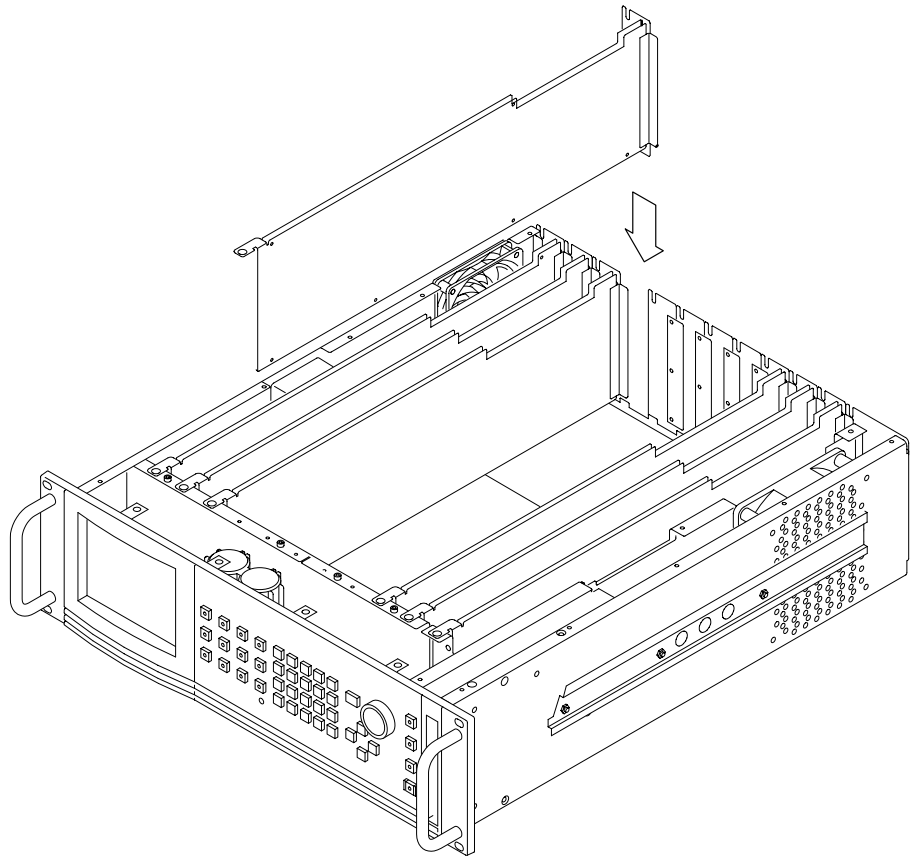
Figure 2–5: Installing the module

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.
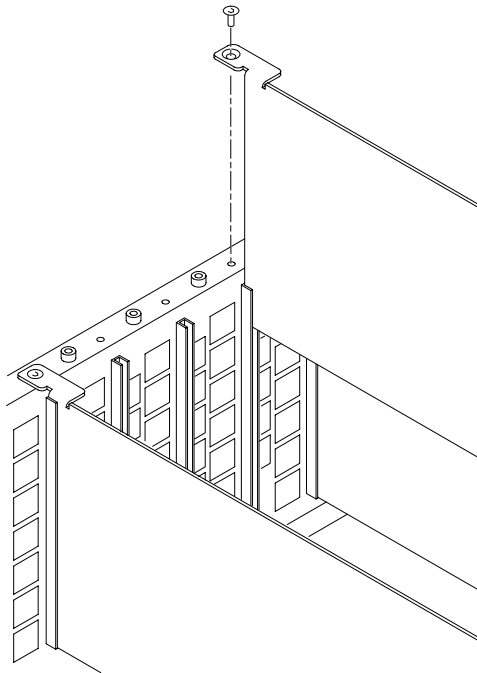
Figure 2–6: Top screw

NOTE. If you have the SDI option and you want to reconfigure the outputs, refer to Configuring The Output *in this section and then perform step 10. If you do not want to reconfigure the output, perform step 10 now.*

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 4–15).

Signal Set Installation   If this module was installed in the TG 2000 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 *TG 2000 Signal Generation Platform User Manual*.

Installing Signals to the Default Destination.

1. Insert the test signal disk into the TG 2000 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.

---

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

Installing Signals to a Non-default Destination.

1. Insert the test signal disk into the TG 2000 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.

---

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 popup menu tells you when the transfer is complete.

Output Configuration   If you ordered the TG 2000 Signal Generation Platform with the SDI Option S1, the DVG1 Generator module is shipped from the factory with Output 1 as the standard output and Output 2 as SDI. This configuration is shown at the top of Figure 2–7. If your platform does not include Option S1, it is configured with both outputs as standard as shown in the middle of Figure 2–7.

You can configure the DVG1 Generator module outputs to suit your needs; refer to Figure 2–7. If you configure the outputs, be sure to change the settings of switch S1 to match. Refer to *Switch Settings* on page 2–9.
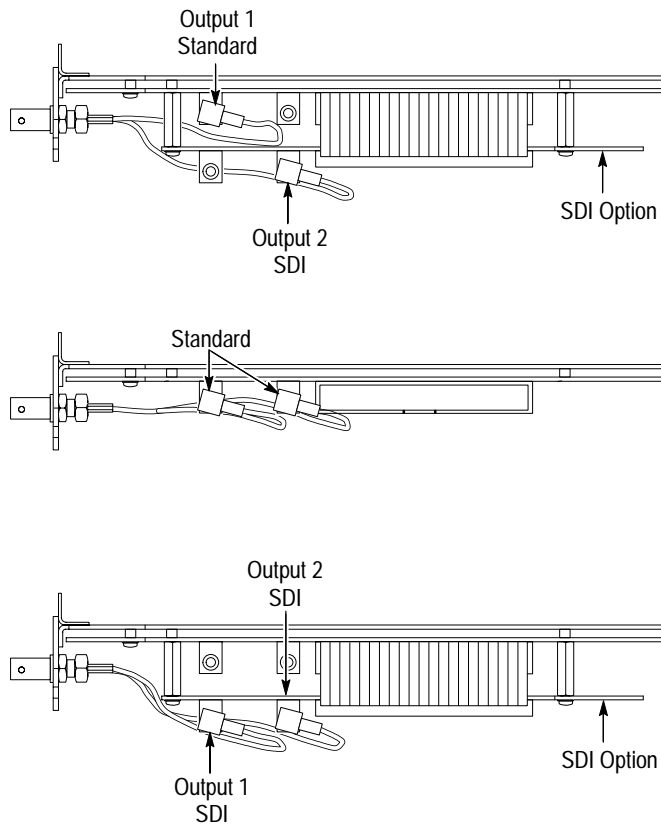
Figure 2–7: Module output configurations

Switch Settings   The default settings for switch S1 are:

- Without option S1 installed, position 4 open and all other positions closed.

- With option S1 installed (connected to output 2), positions 2 and 4 open, and positions 1 and 3 closed.

You should change the Switch S1 settings if you configure the outputs. Refer to Table 2–2 for the settings.

Table 2–2: S1 switch settings

Criteria	Switch position	Set condition to:
Output 1 connected to option S1	1	Open (1)
Output 1 not connected to option S1		Closed (0)
Output 2 connected to option S1	2	Open (1)
Output 2 not connected to option S1		Closed (0)
Always	3	Closed (0)
Enable option S1 (if present)	4	Open (1)
Disable option S1		Closed (0)

Signal Backup and Module Removal

Before removing a generator module, you should save the signal sets 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 **DVG1**. Use the cursor arrows to select the DVG1 module in the signals column.

4. Select **Quit/Save**.

5. Touch **Select Destination** and choose **A:**. 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 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.

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.

⚠ **CAUTION.** *The module will lose its signal memory 30 seconds after you remove it from the TG 2000 Platform mainframe. Before removing the module, be sure you have performed* Instrument Backup *(page 4–4).*

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 TG 2000 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 DVG1 Generator module. If you are not familiar with the operation of the TG 2000 Signal Generation Platform, refer to the *TG 2000 Signal Generation Platform User Manual* before reading this section.

Figure 2–8 shows the menu structure for basic module operations.

```
┌─────────────────────────────────────┐        ● Push Modules
│          Modules window             │            button
│        Touch desired module         │
└─────────────────────────────────────┘
                                                ● Push Edit
                                                    button

┌──────────────────────┐   ┌──────────────────────┐
│  Edit Module window  │   │  Signal Sets window  │        ● Push Signal
│                      │   │                      │            Sets button
│ Touch     Touch      │   │ Touch desired signal │
│ Rename    Module     │   │ set (usually         │
│ Module    Parameters │   │ represents format)   │
└──────────────────────┘   └──────────────────────┘

┌──────────────────────┐   ┌──────────────────────────┐
│ Rename Module window │   │   Test Signals window    │        ● Push Test
│                      │   │                          │            Signals button
│ Enter new name for   │   │ Touch desired Test Signal│
│ module               │   │ icon until correct signal│
└──────────────────────┘   │ is selected              │
                           │                          │
                           │ Touch Module  Touch Active│
                           │ Parameters    Signal      │
                           │               Parameters  │
                           └──────────────────────────┘

┌─────────────────────────────────┐   ┌──────────────────────┐
│   Module Parameters window      │   │   Active Signal       │
│                                 │   │  Parameters window    │
│ Touch Output    Touch Module    │   │                       │
│ enable/disable, Timing, Circle  │   │ Touch Video, Text     │
│ EDH             Overlay, Trigger│   │ Overlay or Signal     │
│ enable/disable, Output, SDI     │   │ Information           │
│ or Video Res    (optional), or  │   │                       │
│ to toggle these Embedded Audio  │   └──────────────────────┘
│ settings                        │
└─────────────────────────────────┘

┌─────────────────────────────────┐   ┌──────────────────────┐
│ Module Timing, Circle Overlay,  │   │ Video Parameters,     │
│ Trigger, SDI (optional), or     │   │ Text Overlay, or      │
│ Embedded Audio window           │   │ Signal Information    │
│                                 │   │ window                │
│ Set module timing with respect  │   │                       │
│ to the BG1 module or create     │   │ Set video parameters, │
│ circle overlay. Configure       │   │ adjust text on signal,│
│ trigger output, SDI, or         │   │ or view information   │
│ embedded audio.                 │   │ about the selected    │
└─────────────────────────────────┘   │ signal                │
                                       └──────────────────────┘
```

Figure 2–8: Menu structure for the DVG1 Generator module

Outputs   The DVG1 Generator module has four outputs: two serial outputs, one parallel output, and one trigger output.

Serial Outputs. Outputs 1 and 2 are serial signal outputs (BNC) and can be configured for either standard or SDI signal outputs if the option S1 is installed.

Parallel Output. Output 3 is a parallel signal output. The connector is a 25-pin connector with female contacts. The pin assignments for the parallel output are shown in Table 2–3.

Table 2–3: Parallel output connector pin assignments

Pin number	8-bit system mode	10-bit system mode
1	Clock	Clock
2	System ground A	System ground A
3	Data 7 (MSB)	Data 9 (MSB)
4	Data 6	Data 8
5	Data 5	Data 7
6	Data 4	Data 6
7	Data 3	Data 5
8	Data 2	Data 4
9	Data 1	Data 3
10	Data 0	Data 2
11		Data 1
12		Data 0
13	Cable shield	Cable shield
14	Clock return	Clock return
15	System ground B	System ground B
16	Data 7 return	Data 9 return
17	Data 6 return	Data 8 return
18	Data 5 return	Data 7 return
19	Data 4 return	Data 6 return
20	Data 3 return	Data 5 return
21	Data 2 return	Data 4 return
22	Data 1 return	Data 3 return
23	Data 0 return	Data 2 return
24		Data 1 return
25		Data 0 return

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

For information on configuring the outputs, refer to page 2–8.

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 (with subheads in alphabetical order)

- Module parameters (with subheads in alphabetical order)

Refer to Figure 2–8 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* in the *DVG1 Digital Video Generator Service Manual*.

NOTE. The illustrations in these procedures show the factory default name (DVG1: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 TG 2000 Signal Generation Platform User Manual *for information about editing the module name.*

---

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.
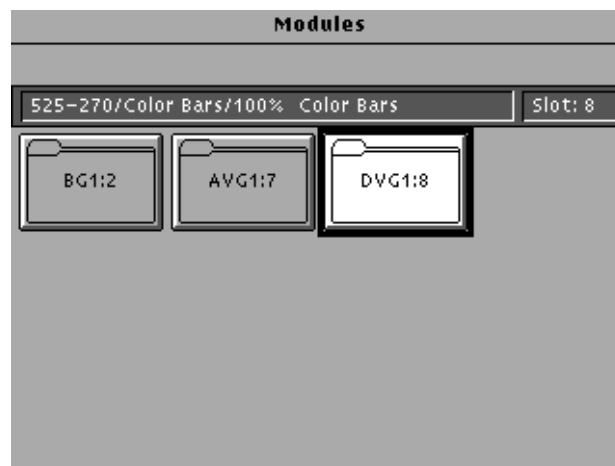
6. Touch the the module icon on the display (or push the **Signal Sets** button if the desired icon is already highlighted). The installed signal sets for the module appear. Selections you make after this will pertain to the DVG1 Generator module.

Select the Output Signal

The output signal is supplied on the two rear-panel serial outputs. To configure the outputs, refer to page 2–8. Use the following procedure to select the module's output test signal. You can select any of the DVG1 signals that are loaded in your instrument. You can also configure the outputs if you have the SDI option installed; refer to page 2–8.

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.
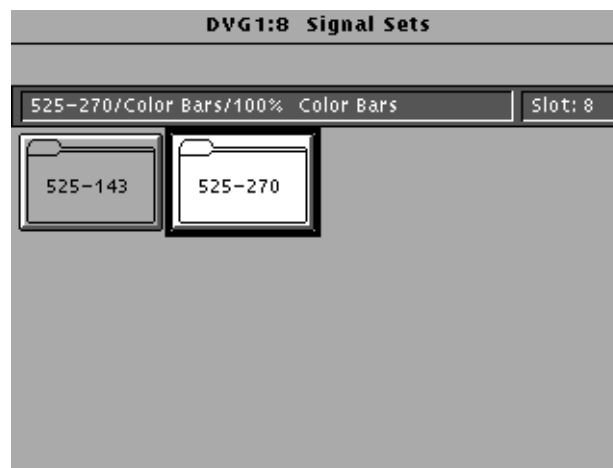
2. Touch the desired signal set on the display. The Test Signals window for the selected signal set appears. In the following example, 525–270 is selected.

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 100% 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 DVG1 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.

Audio Mute   You can mute the selected signal in the Video Parameters window, accessed through the Active Signal Parameters window, shown on page 2–19.
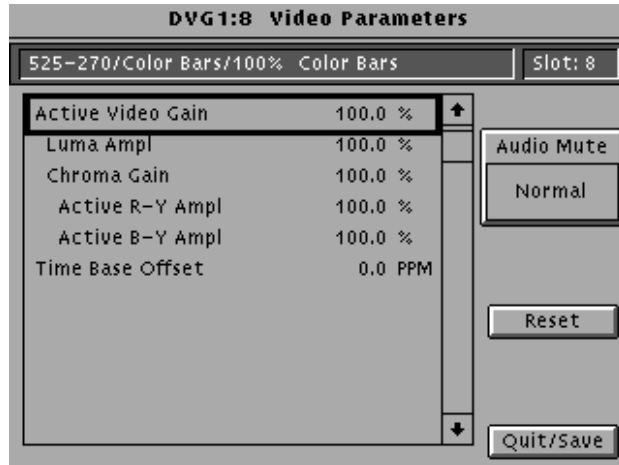
Signal Information   You can view detailed information about the selected signal. in the Signal Information window, accessed through the Active Signal Parameters window, shown on page 2–19.
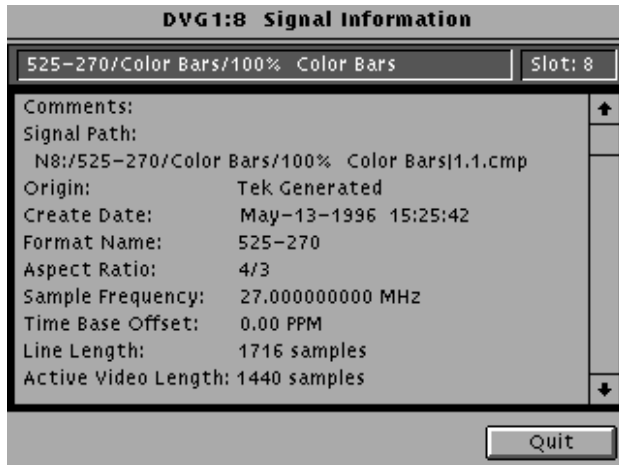
Text Overlay　　You can enter text that overlays your displayed test signal. When turning text on or off, you are turning text on or off for all test signals that have overlaid text. Touching **Reset** returns the text, horizontal and vertical to previously saved values.

You can enter and position text, follow these steps in the Signal Text window, accessed through the Active Signal Parameters window, shown on page 2–19. The Signal Text window is shown in the following illustration.
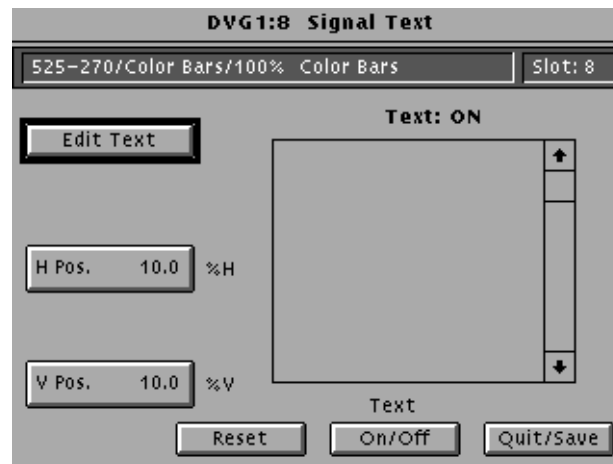
Video Parameters   You can adjust the signal parameters of the currently selected (active) test signal by modifying the parameters and then saving the signal with a new name. There are no factory defaults.

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, accessed through the Active Signal Parameters window, shown on page 2–19. Different signals may display a different list in this window. Use the Navigation arrow keys to select the parameter you want to change.
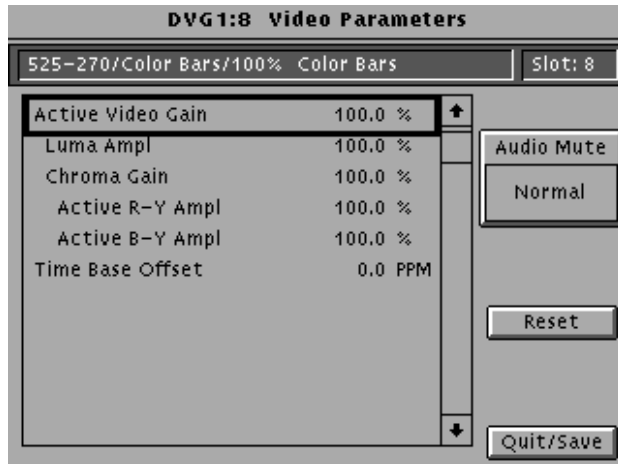
Module Parameters

The following procedures 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 DVG1 Generator module, follow these steps:

1. Select the DVG1 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.
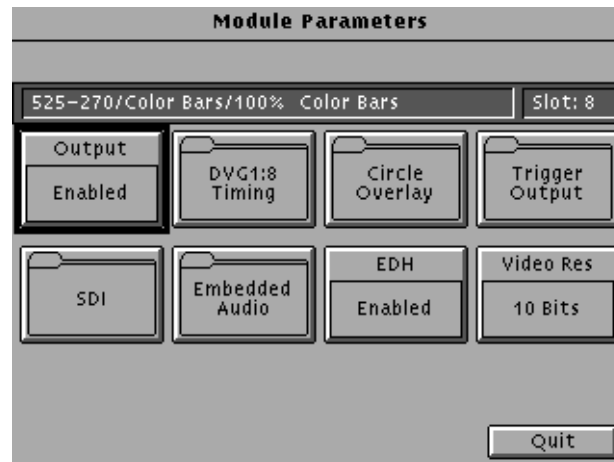
4. Another way to access this window is as follows:

    a. Push the **Modules** button.

    b. Ensure that the module is highlighted.

    c. Push the **Edit** button.

    d. Touch **Module Parameters**.

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 2–23. The Circle Overlay window is shown in the following illustration. Touch **On/Off** to turn on the circle overlay.
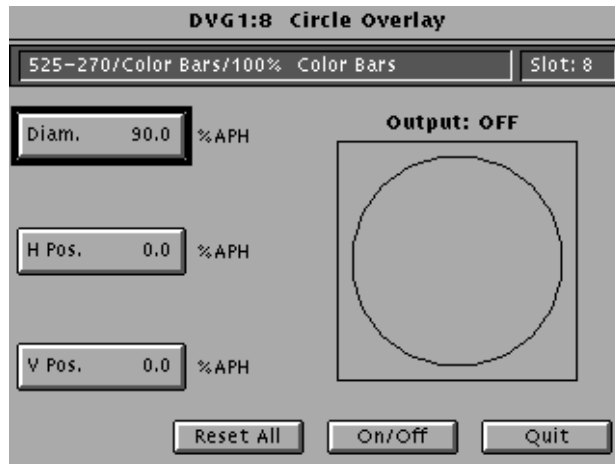
If you want to reset the values, touch **Reset All**. This will set the diameter, horizontal, and vertical to 90%, 0, and 0 respectively.

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 at the bottom of the Module Parameters window (shown on page 2–23).

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. To mute (silence) the audio on a signal-by-signal basis, refer to *Audio Mute* on page 2–20.

Error Detection Handling (EDH) Enable/Disable   In the Module Parameters window, shown on page 2–23, touch the EDH icon to toggle the state of the error and detection handling feature on the serial outputs.

SDI Parameters (Option S1)   You can adjust slew rate, amplitude, jitter frequency, and jitter amplitude of the SDI option (when installed). You can adjust these parameters in the SDI Parameters window, accessed through the Module Parameters window, shown on page 2–23. Touch **Reset** if you want to change all entries to their default values.
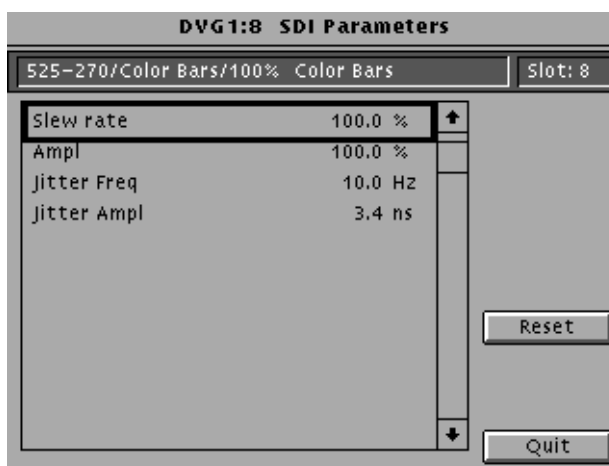
Timing You can set the horizontal and vertical timing of this module with respect to the BG1 Generator module. Changes you make to timing affect all signals for the DVG1 Generator module. In the Module Parameters window, shown on page 2–23, touch the module timing icon.

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

```
                      DVG1:8  Timing

  ┌──────────────────────────────────────┐  ┌─────────┐
  │ 525-270/Color Bars/100%  Color Bars   │  │ Slot: 8 │
  └──────────────────────────────────────┘  └─────────┘


  ┌──────────────────────────────┐
  │ Horizontal:      0.0000       │  usec
  └──────────────────────────────┘


  ┌──────────────────────────────┐
  │ Vertical:            0        │  lines
  └──────────────────────────────┘


                    ┌───────────┐        ┌───────────┐
                    │ Reset All │        │   Quit    │
                    └───────────┘        └───────────┘
```

Trigger Output   You can generate three types of Trigger signals to the rear panel BNC. In the Module Parameters window, shown on page 2–23, 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.
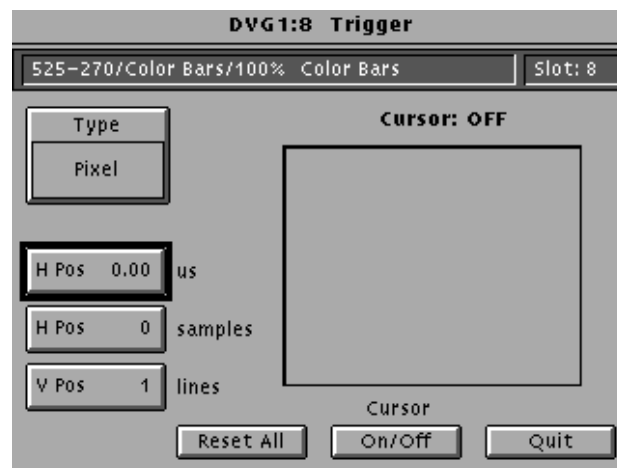
Video Resolution   In the Module Parameters window, shown on page 2–23, touch the **Video Res** icon to select 10 bit or 8-bit resolution.

Theory of Operation

Theory of Operation

This discussion provides an overview of the DVG1 Generator module. For information about the TG 2000 Platform mainframe, refer to the *TG 2000 Signal Generation Platform Service Manual*.

The DVG1 Generator module is a 10-bit precision, digital video test signal generator for NTSC composite digital and for 525- and 625-line component digital signals. Three channels of data are multiplexed into parallel and serial data streams out of two physical memories as shown in Figure 3–1. Output signal data for each channel is stored in fast access 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 and text characters.

For component digital operation, C_B and C_R data are multiplexed in the component data memory and then further multiplexed with the Y data to produce the correct Rec. 601/656 pixel sample formatting. The multiplex switching causes the data mux to output the data sequence in the following form: $Y–C_B–Y–C_R$.

The coprocessor serves several functions. It adds embedded audio data and error detection check words for both component and composite signals, and also provides the TRS-ID (timing reference signal and identification) for composite signals.

Coprocessor output containing all the added data is serialized for the module serial output. There are two serial outputs, either one of which may be routed (internal connector selection) through the SDI (serial digital interface) option, where the parameters of the serial digital data stream may be modified. Available waveform modifications include: amplitude and risetime control, and jitter amplitude and frequency.
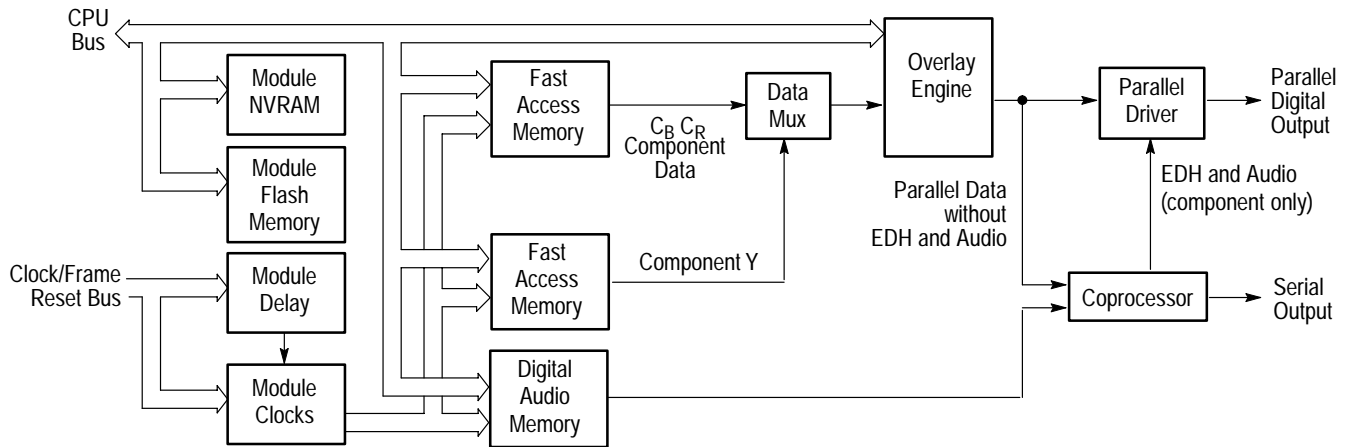
Figure 3–1: Simplified block diagram of the DVG1 Digital Video Generator module

Signal Memory

The DVG1 module uses two levels of RAM to generate signals in real time. Each level of memory puts constraints on the maximum complexity of a signal that can be generated. See Table 3–1. For these constraints, a sampling rate of 27 MHz is assumed.

The Line RAM holds the actual sample points which define the signal. The Line RAM will hold 128K (131072) samples. The following equation determines the maximum number of unique video lines that can be stored in the Line RAM:

131072 samples / # of samples per line = # of unique video lines

The Frame RAM contains a series of pointers which control the order in which the video lines that are stored in Line RAM are used to produce composite video signals. The maximum number of pointers is 43690. The following equation determines the maximum length of a video sequence for a given line time:

video sequence length (in seconds) = line time (in seconds) X 43690

Table 3–1: Signal memory summary for the DVG1 Generator module

Video format	Maximum unique lines	Maximum sequence length
27 MHz 525-line Component	76 lines @ 1716 samples	2.7 seconds
27 MHz 625-line Component	72 lines @ 1728 samples	2.7 seconds
36 MHz 525-line Component	58 lines @ 2228 samples	2.7 seconds
36 MHz 625-line Component	56 lines @ 2304 samples	2.7 seconds
4 F_{SC} 525-line Composite	144 lines @ 910 samples	2.7 seconds

Embedded Audio

The DVG1 can generate video signals with embedded digital audio. The embedded signal is 20 bit (24 bit in the future) 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 3–2.

Table 3–2: 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	

SDI Test Capabilities

The standard DVG1 Generator module serial VITS may be programmed as part of the signal definition (using the SDP2000 Signal Development Program). The DVG1 Generator module with Option S1 installed provides additional SDI test capabilities, which are described on page 7–1.

A block diagram for the Option S1 is shown in Figure 3–2.
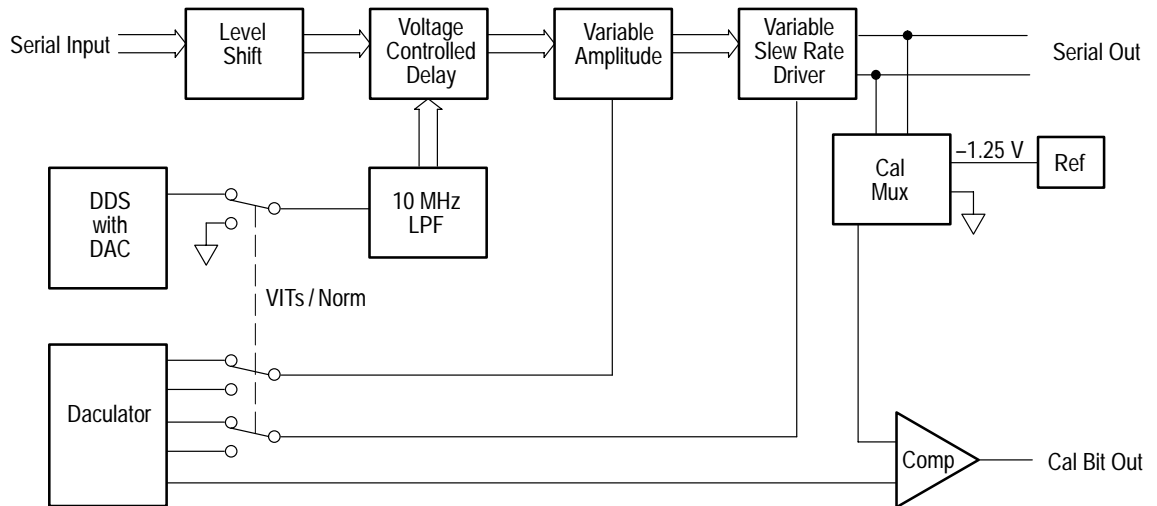
Figure 3–2: Option S1 block diagram

Performance Verification

Performance Verification

Perform the following procedure to verify that your DVG1 Generator module is meeting the requirements listed in the *Specifications* section. If, after performing this procedure, you determine that the module is not meeting specifications, proceed to *Adjustments* on page 5–1, or purchase a calibration service through your Tektronix representative.

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

Verification Interval

To ensure correct instrument operation, verification procedures should be performed once a year. Before performing any verification procedures, complete all relevant maintenance procedures outlined in the *Maintenance* section of this manual.

Required Equipment

Test Equipment

Table 4–1 lists the equipment required for this procedure.

Table 4–1: Equipment required for Performance Verification

Equipment	Example or Tektronix P/N
High Precision Oscilloscope	Tektronix DSA602A Digital Signal Analyzer oscilloscope with 11A72 and 11A34 Modules
Digital Waveform Monitor	Tektronix 1730D Digital Waveform Monitor
Serial Digital Monitor	Tektronix WFM601i Serial Digital Monitor
BNC Termination, 75 Ω	011-0102-01
BNC Termination, 75 Ω feed-through	011-0103-02
75 Ω Low-Loss BNC Cables	012-0159-00
24-inch Coaxial Cable, 50 Ω	012-1342-XX
Minimum Loss Pad, 50-75 Ω	011-0057-01

Test Software

You will need the test signal **dvg.dnl**, which is included on the DVG1 Service disk, supplied with this manual. Refer to *Loading the Test Signal* on page 4–5.

Preparation for Performance Verification

Follow all instructions for power on, instrument warmup, loading test signals, loading DSA602A presets (if applicable), and self calibration.

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 4–2

- Set up the test equipment, page 4–3

- Create a preset of the current instrument state, page 4–3

- Recall the factory preset, page 4–4

- Load the test signals, page 4–5

- Load the DSA setups, page 4–6

- Perform Self Cal, page 4–7

- Complete the *Performance Verification* procedure, page 4–8

- Restore signals, page 4–15

- Recall preset, page 4–16

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

1. Connect the TG 2000 Platform mainframe to an AC power source that is appropriate for your system.

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* on page 6–11.

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

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

Equipment Setup   Set the test equipment as follows:

1. TG 2000 Signal Generation Platform setup

    a. Push the **Modules** button.

    b. Touch **BG1:X**.

    c. Touch the desired television format.

    d. Touch **Black + Frm Ref**.

    e. Touch **Module Parameters**.

    f. Touch **Output** to toggle to enabled.

    g. Push the **Modules** button.

    h. Touch **DG1:X**.

2. WFM 601i Serial Digital Monitor setup

    a. Display   Parade

    b. Video In   Ch1/Ch2/Ch3

    c. Sweep   Line

    d. Menu   all off

3. Oscilloscope (DSA602A Digital Signal Analyzer) setup

    a. Install the 11A34 module in the left slot.

    b. Install the 11A72 module in the middle slot.

    c. Leave the right slot empty.

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 Loading the Test Signal on page 4–5). 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 DVG1 test signals instead, using the DVG1 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 *TG 2000 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.

Loading the Test Signal   You will need to load the test signal called dvgtest.dnl. This file is included on the DVG1 Service disk, which is supplied with this manual.

If you have enough memory capacity to add this signal to the DVG1 Generator module, use the *Add Signals* procedure on page 4–5. Otherwise, use the *Replace Signals* procedure on page 4–6.

Add Signals. To add the test signal, perform the following steps:

1. Insert the DVG1 Service disk supplied with this manual into the TG 2000 Platform mainframe disk drive.

2. Push the **Disk** button on the TG 2000 Platform mainframe.

3. Touch **Add Signals** on the display.

4. Touch **Select Source**.

5. Use the **Navigation** arrow to select the **dvg.dnl** file. This file is used throughout the *Performance Verification* procedure.

6. Press the **Select** button.

7. When the new window opens, use the **Navigation** arrow to move the cursor to the **DVG1** folder on the right side of the display.

8. Push the **Select** button.

9. Touch **Quit/Load**.

10. Touch **Quit/Load**.

11. Touch **Select Destination**.

12. Use the right **Navigation** arrow to move the cursor to the **DVG1** folder on the right side of the display.

13. Push the **Select** button.

14. Touch **Quit/Load**. The Add Signals window reappears, showing the amount of Kbytes selected (Total Tagged) and the amount of space available on the module (Free). If the tagged total is greater than the free amount, the signal sets will not load. Use the *Replace Signals* procedure on page 4–6.

15. Touch **Start Load**.

16. When the load is complete, touch **OK**.

17. Touch **Quit**.

This completes the *Add Signals* procedure.

Replace Signals. To replace the test signals, perform the following steps:

1. To save the instrument signals and settings, perform *Instrument Backup* on page 4–4.

NOTE. If you are using only standard signals and settings, then you can use the *DVG1 Test Signal disks that were shipped with the* DVG1 Digital Video Generator User Manual *to restore the signals at the end of the* Performance Verification *procedure. In this case, you do not need to perform the Instrument Backup.*

---

2. Insert the DVG1 Service disk supplied with this manual into the TG 2000 Platform mainframe disk drive.

3. Push the **Disk** button on the TG 2000 Platform mainframe.

4. Touch **Replace Signals** on the display.

5. Use the **Navigation** arrow to select the **dvg.dnl** file. This file is used throughout the *Performance Verification* procedure.

6. Push the **Select** button.

7. When the Replace screen appears, use the right **Navigation** arrow to move the cursor to the **DVG1** folder.

8. Push the **Select** button.

9. Touch **Start Replace**.

10. Touch **OK** to remove all current signals and replace them with the new selections. If you are prompted to disable the active signal, touch **OK**.

11. When the load is complete, touch **OK**, and then touch **Quit**.

Recall DSA 602A Digital Signal Analyzer Settings

These procedures require certain DSA 602A Digital Signal Analyzer settings, which are provided on the DVG1 Service disk (included with this manual). The files have the extension **.fpb**. To recall the setting files, follow these steps:

1. Insert the DVG1 Service disk in the DSA 602A Digital Signal Analyzer disk drive.

2. Leave the disk in the disk drive while performing the *Performance Verification* Procedure.

3. When the procedure instructs you to recall a DSA 602A setup, do the following:

   a. Press the **Utility** button until the Directory Ops icon is displayed.

  b. Touch **Directory Ops**.

  c. Press the **Store/Recall** button.

  d. Touch **Recall Setting**.

  e. Touch **Disk** at the top of the Recall Setting window.

  f. Select the file to recall from the displayed list. The DSA 602A configures itself to the specified setting.

Perform Self Cal and Select the Module

When you perform self cal, the original calibration file is replaced by the new one.

1. Perform the Module Self Cal by performing the following steps:

  a. Terminate the DVG1 Generator module outputs 1 and 2 in 75 Ω.

  b. Push the **Utilities** button.

  c. Touch the following on the TG 2000 Signal Generation Platform:

   ■ **Module Self Cal**

   ■ **DVG1:X Self Cal**

   ■ **Start Cal**

  d. When the Self Cal completes, the display returns to the Modules window. This may take 2 to 5 minutes, depending on the module. (An error message indicates a failed self cal: refer to *Troubleshooting* in this manual or contact your Tektronix representative for assistance.)

2. Push the **Modules** button.

3. Touch **DVG1:X** on the display.

Performance Verification Procedures

Be sure you have performed the *Preparation for Performance Verification* before proceeding. If you perform an instrument backup, be sure to follow the instructions on page 4–15 to restore the signals after completing performance verification.

Performance verification procedures can be performed individually if desired.

Perform the following procedure to verify that your DVG1 Generator module is meeting the requirements listed in the *Specifications* section. If, after performing this procedure, you determine that the module is not meeting specifications, proceed to *Adjustments* on page 5–1, or purchase a calibration service through your Tektronix representative.

> **WARNING.** *Dangerous electric shock hazards exist inside the TG 2000 mainframe. Only qualified service personnel should perform these procedures.*

Resolution   This step checks the resolution specification (8 and 10 bit resolution are supported).

Test Equipment Required:

- Serial Digital Monitor (This procedure was prepared using the Tektronix WFM 601i.)

- 75 Ω precision coaxial cable

Procedure:

1. Using the 75 Ω coaxial cable described above, connect the DVG1 Generator module Output 1 to the WFM601i Serial B Input.

2. Select the **75% Full Field** test signal as follows:

    a. Push the Signal Sets button on the TG 2000 Signal Generation Platform.

    b. Touch **525-270** on the display.

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

3. Select **Serial B** on the WFM 601i.

4. Check for **Signal Present**, **525 lines**, and **10 bits** on the WFM 601i.

5. Touch **Module Parameters** on the TG 2000 Signal Generation Platform.

6. Touch **Video Res** to toggle to **8 bits** on the DVG1 Generator module.

7. Check for **8 bits** on the WFM 601i.

8. On the TG 2000 Signal Generation Platform, touch **8 bit/10 bit** to toggle back to **10 bits**.

Serial Connector Checks   This step checks the Serial Connector specifications: Signal Amplitude, Overshoot, Rise and Fall Times, DC Offset, and Jitter.

Test Equipment Required:

- Oscilloscope (This procedure was prepared using the Tektronix DSA 602A Digital Signal Analyzer.)

- 50 Ω precision coaxial cable

- 75 Ω coaxial cable

- 75 Ω feed-through termination

- 50-to-75 Ω min loss pad

Procedure: Signal Amplitude, Overshoot, Undershoot, Rise Time, Fall Time, and DC Offset

1. Using the 50 Ω coaxial cable and min loss pad, connect the DVG1 Generator module Output 1 to Channel 1 on the 11A72 module of the oscilloscope.

2. Select the **Luminance Ramp** test signal as follows:

    a. Push the Signal Sets button on the TG 2000 Signal Generation Platform.

    b. Touch **525-143-1** on the display.

    c. Touch **Linearity** on the display until the **Luminance Ramp** signal is selected.

3. Recall the **DVG_Ampl** preset in the DSA 602A Digital Signal Analyzer.

4. Check amplitude:

    a. Select the oscilloscope cursors at the top of the screen. Set the cursors for horizontal bars at 400 mV and –400 mV.

    b. Using the cursors, check for amplitude between 720 mV and 880 mV.

5. Check overshoot and undershoot:

    a. On the oscilloscope, push the Measure button.

    b. Check for overshoot less than 10%.

    c. Check for undershoot less than 10%.

    d. Check for risetime between 0.4 nS and 1.5 nS.

6. Check fall time and DC offset:

    a. Change the trigger to Slope –.

    b. Press **Measure**.

    c. Touch **Fall** twice.

    d. Check for Fall Time between 0.5 nS and 1.5 nS.

    e. Check for DC offset between –500 mV to +500 mV (read Mid).

7. Move the 50 Ω cable to the DVG1 Generator module Output 2.

8. Repeat steps 4 through 6 for the DVG1 Generator module Output 2.

Procedure: Jitter

1. Using the 50 Ω cable and 50 to 75 Ω min loss pad, reconnect the DVG1 Generator module Output 1 to Channel 1 on the 11A72 module of the DSA 602A Digital Signal Analyzer.

2. Using a 75 Ω cable and 75 Ω feed-through termination, connect the BG1 Generator module 27 MHz Clock to the Channel 1 on the 11A34 module of the DSA 602A Digital Signal Analyzer.

3. Recall the **DVG_ClkJ** preset in the DSA 602A Digital Signal Analyzer.

4. Press **Measure** twice.

5. Delay until 10 traces have plotted (10 "hits" on the screen readout).

6. Check for peak-to-peak jitter < 500 pS.

7. Move the 50 Ω cable and min. loss pad to the DVG1 Generator module Output 2 and repeat steps 4 through 6.

Option S1   This procedure checks the performance of the Option S1 (SDI signal).

Test Equipment Required:

- Oscilloscope (This procedure was prepared using the Tektronix DSA 602A Digital Signal Analyzer.)

- 50 Ω precision coaxial cable

- 75 Ω coaxial cable

- 50-to-75 Ω min loss pad

Procedure: Variable SDI Output Amplitude Range and Accuracy

1. Configure the Option S1 board so that the SDI signal is on the DVG1 Generator module Output 2 (this is the factory configuration; see page 2–8).

2. On the DVG1 Generator module, note the positions on Switch S1 so that you can return to the proper settings at the end of this procedure. Set Switch S1, positions 1, 2, and 4 to OPEN (1).

3. Use the 50 Ω cable and min. loss pad to connect the DVG1 Generator module Output 2 to Channel 1 on the 11A72 module of the DSA 602A Digital Signal Generator.

4. Recall the **DVG_Ampl** preset in the DSA 602A Digital Signal Analyzer.

5. Recall SDI Equalizer signal on the DVG1 Generator module as follows:

   a. Push the Signal Sets button and touch **525-143** on the display.

   b. Touch **Color Bars**.

   c. Touch **Module Parameters**.

   d. Touch **SDI** and then set the **Slew Rate** and **Amplitude** to **100%**.

6. On the oscilloscope, touch cursors to call up Horizontal Bars at 400 mV and –400 mV.

7. Select the oscilloscope cursors and use them to check Δ Amplitude on the oscilloscope for 800 mV, ± 16 mV.

8. Move the connector on the Option 01 board from J2 to J1.

9. Check Δ Amplitude on the oscilloscope for 800 mV, ± 16 mV.

10. Set the TG 2000 Signal Generation Platform amplitude to 60% as follows:

    a. Push the **Test Signals** button.

    b. Touch **Module Parameters** on the display, and then touch **SDI**.

      c. Use the Navigation arrow to highlight **Amplitude**, and then push the **Select** button.

      d. On the front-panel numeric keypad, press **60** and **Enter**.

11. Adjust the oscilloscope cursors to the top and bottom of the waveform.

12. Check Δ Amplitude on the oscilloscope for 480 mV, ± 16 mV.

13. Set the TG 2000 Signal Generation Platform amplitude to 10%.

14. Adjust the oscilloscope cursors to the top and bottom of the waveform.

15. Check Δ Amplitude on the oscilloscope for 80 mV, ± 16 mV.

16. Set the TG 2000 Signal Generation Platform **Amplitude** to **115%**.

17. Adjust the oscilloscope cursors to the top and bottom of the waveform.

18. Check **Δ Amplitude** on the oscilloscope for **920 mV**, ± 18.4 mV.

19. Leave the **Amplitude** at **115%** for the next check.

Procedure: Variable SDI Data Slew Rate (Variable Data Rise/Fall Time)

1. Recall the **DVG_Rise** preset in the DSA 602A Digital Signal Analyzer.

2. Set the **Slew rate** to **100%**. The **Amplitude** should be set to **115%**, continuing from the previous step.

3. Check that the **Rise time** on the oscilloscope is between **0.6 nS** and **1.0 nS**.

4. Set the oscilloscope **Trigger** to **Slope–**.

5. Press **Measure** and touch **Fall** twice.

6. Check that the **Fall time** on the oscilloscope is between **0.6 nS** and **1.0 nS**.

7. Set the DVG1 Generator module **Amplitude** to **100%** and the **Slew rate** to **125%**.

8. Check that the **Fall time** on the oscilloscope is **<820 pS**.

9. Set the oscilloscope **Trigger** to **Slope+**.

10. Press **Measure** and touch **Rise** twice.

11. Check that the **Rise time** on the oscilloscope is **<820 pS**.

12. Set the DVG1 Generator module **Amplitude** to **25%** and the **Slew rate** to **5%**.

13. On the oscilloscope, set the **Main Vertical Size** to **50 mV/div**.

14. Check that the **Rise time** on the oscilloscope is **>2.0 nS**.

15. Set the oscilloscope **Trigger** to **Slope–**.

16. Press **Measure** and touch **Fall** twice.

17. Check that the **Fall time** on the oscilloscope is **>2.0 nS**.

18. Touch **Reset** on the TG 2000 Signal Generation Platform display.

Procedure: Variable SDI Jitter Amplitude Range

1. Using a 50 Ω cable through a 50-to-75 Ω min loss pad, connect the DVG1 Generator module Output 2 to the Channel 1 input on the 11A72 module of the DSA 602A Digital Signal Analyzer.

2. Recall the **DVG_JitA** preset in the DSA 602A Digital Signal Analyzer.

3. Set the DVG1 Generator module **Jitter Frequency** to **2 MHz**, and the **Jitter Amplitude** to **5 nS**.

4. On the oscilloscope, press **Measure** twice to clear histogram.

5. Wait for 100 hits and check the reading for **Pk-Pk 1.40 nS** ±.20 nS.

6. Set the DVG1 Generator module **Jitter Amplitude** to **10 nS**.

7. On the oscilloscope, press **Measure** twice to clear histogram.

8. Wait for 100 hits and check the reading for **Pk-Pk 2.70 nS** ±.20 nS.

9. Set the DVG1 Generator module **Jitter Amplitude** to **15 nS**.

10. On the oscilloscope, press **Measure** twice to clear histogram.

11. Wait for 100 hits and check the reading for **Pk-Pk 4.00 nS** ±.20 nS.

12. Set the DVG1 Generator module **Jitter Amplitude** to **0 nS**.

13. On the oscilloscope, press **Measure** twice to clear histogram.

14. Wait for 100 hits and check the reading for **Pk-Pk <300 pS**.

Procedure: Variable SDI Jitter Frequency

1. Recall the **DVG_JitF** preset in the DSA 602A Digital Signal Analyzer.

2. Turn the Horizontal Histogram on (if not already on).

3. Set the TG 2000 Signal Generation Platform **Jitter Amplitude** to 2 nS.

4. Set the oscilloscope **Main Size** according to the first entry in Table 4–2 (2 μS/div).

5. Set the oscilloscope **Window Position** according to the first entry for Null value in Table 4–2 (18.950 μS).

6. Set the DVG1 Generator module **Jitter Frequency** according to the first entry in Table 4–2 (52,734 Hz).

7. Touch **Measure** twice, and then wait for 100 hits.

8. Check for peak-to-peak reading of < 1 ns on the oscilloscope.

9. Set the oscilloscope **Window Position** according to the first entry for Jitter value in Table 4–2 (9.4728 μS).

10. Touch **Measure** twice, and then wait for 100 hits.

11. Check for a peak-to-peak reading of > 3 nS on the oscilloscope.

12. Repeat steps 4 through 11 for each table entry in Table 4–2.

Table 4–2: Checking Variable SDI Jitter Frequency (143 MHz)

Entry	Main size	Window position		Jitter frequency
		Null (1/f)	Jitter (1/2f)	f
1	2 μS/div	18.950 μS	9.4728 μS	52,734 Hz
2	1 μS/div	9.4728 μS	4.7370 μS	105,468 Hz
3	1 μS/div	4.7370 μS	2.3628 μS	210,937 Hz
4	1 μS/div	2.3628 μS	1.1820 μS	421,875 Hz
5	1 μS/div	1.1820 μS	588.6 nS	843,750 Hz
6	100 nS/div	588.6 μS	295.2 nS	1.6875 MHz
7	100 nS/div	295.2 nS	142.2 nS	3.375 MHz
8	100 nS/div	142.2 nS	71.9 nS	6.75 MHz

13. Return Switch S1 to the previous settings. (Refer to Step 2 on page 4–12. Configuration information is also provided on page 2–9.)

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.

Adjustment Procedures

Adjustments

Perform this procedure if the *Performance Verification* procedure has indicated that adjustments are necessary to return the instrument to specifications.

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

Required Equipment

Test Equipment
Table 4–1 lists the equipment required for the *Performance Verification* procedure.

Table 5–1: Equipment required for Performance Verification

Equipment	Example or Tektronix P/N
High Precision Oscilloscope	Tektronix DSA602 Digital Signal Analyzer oscilloscope with 11A72 and 11A34 Modules
Serial Digital Monitor	Tektronix WFM601i Serial Digital Monitor
75 Ω Low-Loss BNC Cable	012-0074-00

Test Software
You will need the test signal called **dvg.dnl**. This file is included on the DVG1 Service disk, which is supplied with this manual.

Preparation for Adjustments

Follow all instructions for power on, instrument warmup, self cal, and loading the test signals.

Overview   This is the sequence that you will follow while preparing for and performing the *Adjustments* procedure:

- Install the Extender Board, page 5–2.

- Power on and warm up, page 5–2.

- Create a preset of the current instrument state, page 5–3.

- Recall the Factory preset, page 5–3.

- Load the test signals, page 5–3.

- Load the DSA602A setups, page 5–4.

- Perform Self Cal, page 5–4.

- Complete the *Adjustments* procedure, page 5–5.

- Restore signals, page 5–6.

- Recall the preset you created, page 5–7.

Install the Extender Board   These procedures require that you adjust components on the DVG1 Generator module. To provide access to these components during the procedure, you must first install an extender board, which can be ordered from Tektronix. To install the extender board, use the following procedure:

1. Remove the DVG1 Generator module using *Module Removal* on page 2–10. It is important to use this procedure because it includes instructions for backing up the signals.

2. Install the extender board into the mainframe, being careful to match the connectors on the Backplane board.

3. Install the DVG1 Generator module on the extender board.

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

1. Connect the TG 2000 Platform mainframe to an AC power source that is appropriate for your system.

2. Set the rear-panel rocker 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* on page 6–11.

6. Allow 20 minutes of warm-up time before performing *Self Cal* or *Adjustments*. During warm-up time, you can perform the remaining preparation steps.

Create Preset Before beginning the *Adjustments* 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.

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** key.

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

Loading Test Signals The *Adjustments* procedure requires you to load test signals in the DVG1 Generator module.

If you have more than one DVG1 Generator module loaded, or if you have the optional memory upgrade installed, you may have enough memory capacity to add these signals. To do this, use the *Add Signals* procedure on page 4–5.

If you do not have enough memory, you must replace the module signals. To do this, use the *Replace Signals* procedure on page 4–6.

Recall DSA 602A Digital Signal Analyzer Settings

These test procedures require a number of DSA 602A Digital Signal Analyzer settings. These settings are in a directory called *DSA602A* on the DVG1 Service disk included with this manual. The files have the extension *.fpb*.

To recall the setting files, perform the following steps:

1. Insert the DVG1 Service disk in the DSA 602A Digital Signal Analyzer disk drive.

2. Leave the disk in the disk drive while performing the Performance Verification Procedure.

3. When the Performance Verification procedure instructs you to recall a DSA 602A setup, do the following:

   a. Press the **Utility** button until the Directory Ops icon is displayed.

   b. Touch **Directory Ops**.

   c. Press the **Store/Recall** button.

   d. Touch **Recall Setting**.

   e. Touch **Disk** at the top of the Recall Setting window.

   f. Select the file to recall from the displayed list. The DSA 602A configures itself to the specified setting.

Perform Self Cal

When you perform Self Cal, you replace the original calibration file with a new one.

1. Perform the Module Self Cal by performing the following steps:

   a. Push the **Utilities** button.

   b. Touch the following on the TG 2000 Signal Generation Platform:

      ■ **Module Self Cal**

      ■ **DVG1:X Self Cal**

      ■ **Start Cal**

   c. When the Self Cal is successfully completed, the display will return to the Modules window with no error message. This may take 2 to 5 minutes, depending on the module. An error message indicates a failed calibration. If the Self Cal fails, contact your Tektronix representative for assistance.

2. Touch **DVG1:X** on the display.

Adjustments

You should perform the entire procedure sequentially. Be sure you have performed the *Preparation for Adjustments* before proceeding.

If you perform an instrument backup, be sure to follow the instructions on page 5–6 to restore the signals after completing adjustments.

Adjust Signal Amplitude

Test Equipment Required :

- Oscilloscope (This procedure was prepared using the Tektronix DSA 602A Digital Signal Analyzer.)

- Serial Digital Monitor (This procedure was prepared using the Tektronix WFM 601i.)

- 50 Ω coaxial cable

- 75 Ω coaxial cable

- 50-to-75 Ω min loss pad

Procedure:

1. Use the 50 Ω cable and min. loss pad to connect the DVG1 Generator module Output 1 to the Channel 1 on the 11A72 module of the oscilloscope.

2. Select the **Luminance Ramp** test signal as follows:

    a. Push the Signal Sets button on the TG 2000 Signal Generation Platform.

    b. Touch **525-143-1** on the display.

    c. Touch **Linearity** on the display until the **Luminance Ramp** signal is selected.

3. Recall the **DVG_Ampl** preset in the oscilloscope.

4. Select Cursors and set Cursor Type to Horizontal Bars. Set the cursors for 400 mV and –400 mV.

5. Using the cursors, check for amplitude of 800 mV. Adjust R445 if needed to set the amplitude to 800 mV.

**Option S1
2 nS Jitter**

Test Equipment Required:

- Serial Digital Monitor. (This procedure was prepared using the Tektronix WFM 601i.)

- 75 Ω coaxial cable

Procedure:

1. Use a 75 Ω coaxial cables to connect the DVG1 Generator module Output 2 to the Serial A Input on the serial digital monitor.

2. Set the serial digital monitor as follows:

   a. Select Eye.

   b. Press Cursor and select Time.

3. Select the **SDI** test signal as follows:

   a. Push the Signal Sets button on the TG 2000 Signal Generation Platform.

   b. Touch **525–143** on the display.

   c. Touch **Color Bars** on the display.

   d. Touch **Module Parameters** on the display until the **SDI** signal is selected.

4. Set the DVG1 Generator module **Jitter Frequency** to **1 kHz**, and the **Jitter Amplitude** to **2 nS**.

5. Check the eye pattern on the serial digital monitor for 2 nS. Adjust **R88** if needed to set the eye pattern to 2 nS.

Remove Extender Board

1. Set the rear-panel power switch to off and disconnect the power cord from the mainframe.

2. Remove the extender board from the mainframe, and reinstall the DVG1 Generator module in the same slot as it was before installing the extender board. Refer to *Module Installation* on page 2–2.

Restore Signals

If you performed an instrument backup before beginning the *Performance Verification* procedure, use the disks you created to restore the signals now, using the procedure on page 4–15. If you did not perform an instrument backup, load the DVG1 Test Signal disks supplied with the *DVG1 Digital Video Generator User Manual*.

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 Adjustment procedure.

DVG1 Digital Video Generator Service Manual

Maintenance

Maintenance

This section contains instructions and procedures for maintaining the DVG1 Generator module. For information on servicing the mainframe, refer to the *TG 2000 Signal Generation Platform Service Manual*.

The following information can be found in this section:

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 *TG 2000 Signal Generation Platform Service Manual*.

Performance Verification and Readjustments

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 and adjustment procedures are included in this manual.

After Repair Adjustments

After replacing the module or subassembly, allow the mainframe and module to warm up for 20 minutes, and then perform the self cal as follows:

1. Push the **Utilities** button.

2. Touch the following on the TG 2000 Signal Generation Platform:

    a. **Module Self Cal**

    b. **DVG1:X Self Cal** (X represents the slot number of the replaced module)

    c. **Start Cal**

3. When the self cal is successfully completed, the display will return to the Modules window with no error message. This may take 2 to 5 minutes, depending on the module. An error message indicates a failed calibration. If the self cal fails, contact your Tektronix representative for assistance.

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 6–1 and 6–2 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.

004-4712-00
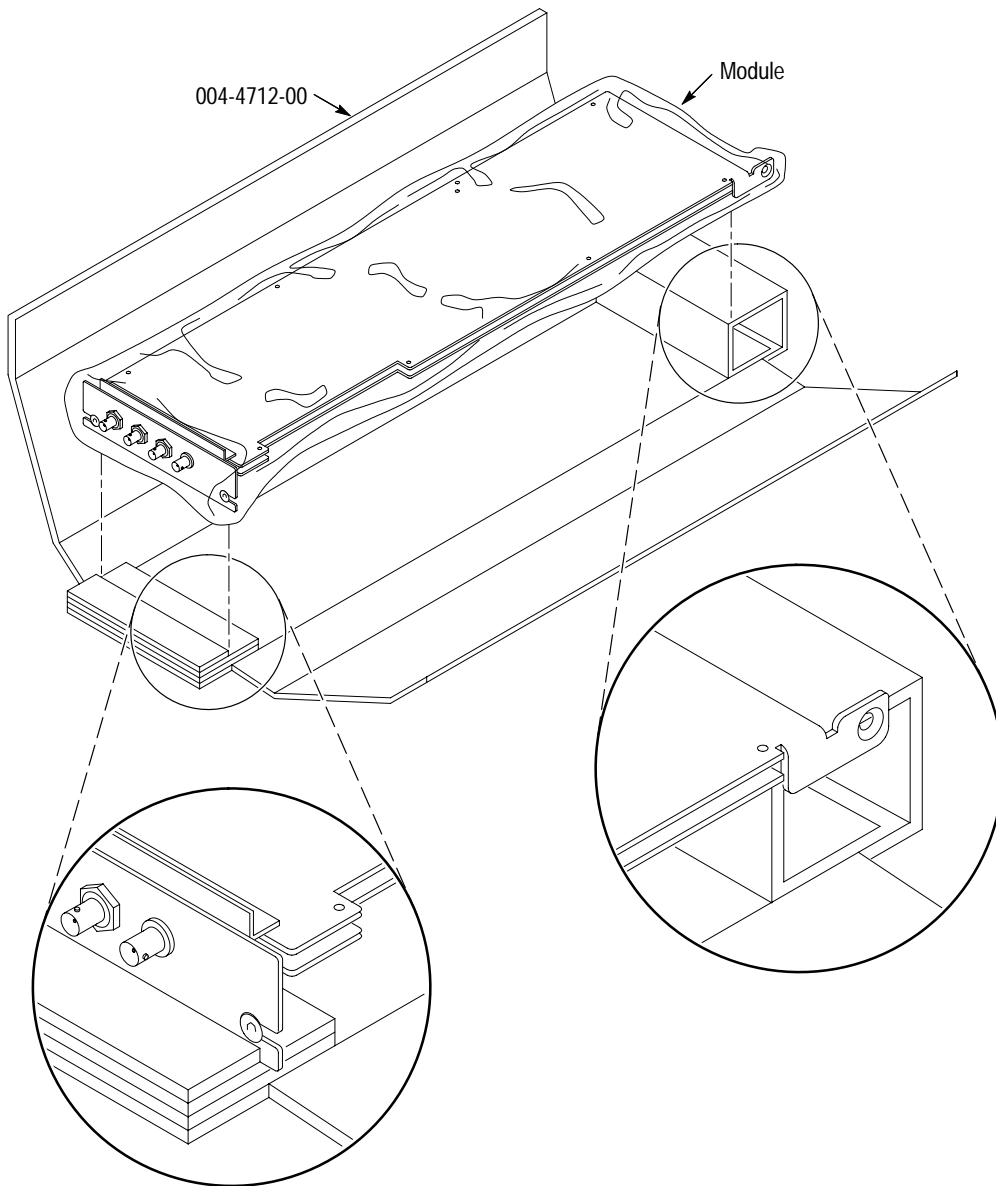
Module

Figure 6–1: Placing the module in the protective wrapping

004-4713-00
2 Each

004-4712-00

004-0828-00
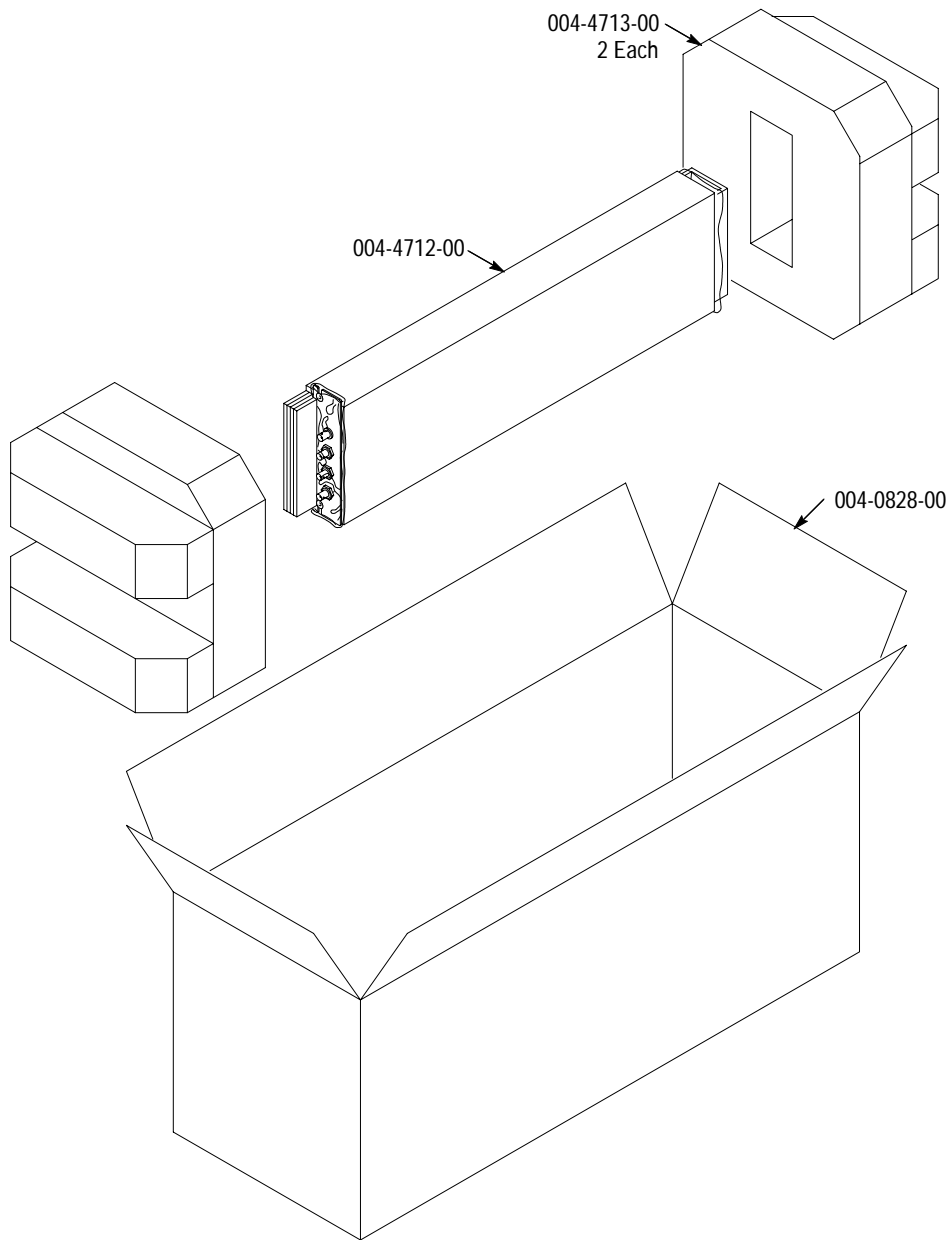
Figure 6–2: Placing the module in the shipping carton

Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the DVG1 Digital Video Generator module.

Tools Required

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

Table 6–1: 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

Replacing Subassemblies

To remove the optional SDI board from the DVG1 board, perform the following steps:

1. Perform *Signal Backup* on page 4–4.

2. Use the *Module Removal* procedure on page 2–10 to remove the DVG1 Generator module from the mainframe.

3. Remove the four screws that attach the SDI board to the DVG1 board.

4. Configure the DVG1 Generator module outputs so that the serial outputs are connected to the DVG1 board (at J14 and J15).

5. Set all four positions of switch S1 to closed (0). More information about configuration is provided on page 2–8.

Removing the Rear Panel

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

1. Perform *Signal Backup* on page 4–4.

2. Use the *Module Removal* procedure on page 2–10 to remove the DVG1 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.

Replacing the Shield

It is usually not necessary to remove the shield. If you are returning the DVG1 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 6–7.

2. Using the T-10 Torx tip, remove the eight screws that attach the DVG1 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 *Mechanical Parts List*, Figure 10–1–7). 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 DVG1 Generator module.

2. Carefully desolder the damaged connector (at J4, J13, J16, or J7) from the back side of the board.

3. To replace the connector, reverse the procedure.

Troubleshooting Procedures

This section contains instructions and procedures for troubleshooting the DVG1 Digital Video Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG 2000 Platform mainframe does not boot up or if the display is not working, refer to *Troubleshooting* in the *TG 2000 Signal Generation Platform Service Manual*.

Equipment Required

The equipment listed in Table 6–2 is required for troubleshooting.

Table 6–2: 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, and one disk for the CPU. To write the console ring file, you will need two disks.
Troubleshooting disk	Supplied with the *TG 2000 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 DVG1 Generator module.

Instrument Backup

Before you begin any troubleshooting procedures, perform *Instrument Backup* on page 4–4. 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 TG 2000 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 *TG 2000 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 DVG1 Generator module errors, refer to the *Fault Symptom Table* on page 6–13.

10. If the TG 2000 Platform does not display any power-up confidence test messages, or the CPU module fails the confidence test, refer to *Troubleshooting* in the *TG 2000 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 6–12.

Locate your fault symptom in Table 6–3 and go to the flowchart indicated.

Table 6–3: Fault symptom table

Symptom	Flowchart
Major difficulties with module	page 6–14
with module installed in current slot	page 6–15
with module moved to different slot	page 6–16
Mainframe fails to power up	page 6–17
Signals lost after power down	page 6–18
Missing output signal	page 6–20
Wrong signal on output	page 6–19
Jitter on the signal	page 6–20

Troubleshooting Flowcharts

The troubleshooting flowcharts provide a series of steps to help you determine whether the DVG1 Generator module is faulty. Each chart relates to an entry in Table 6–3.

```
        ┌─────────────────────────────┐
        │  Use this procedure when the │
        │  mainframe does not recognize│
        │  the module or does not pass │
        │  power-up confidence tests.  │
        └─────────────────────────────┘
                      │
                      ▼
    ┌──────────────────────────────────────┐
    │ If you recently upgraded any TG 2000  │
    │ or module firmware, check that you    │
    │ did not accidentally delete the DVG1  │
    │ firmware.                             │
    │                                       │
    │ If you accidentally deleted the DVG1  │
    │ firmware, reload the DVG1 Module      │
    │ firmware.                             │
    └──────────────────────────────────────┘
                      │
                      ▼
                ╱ Does the ╲        No
               ╱ TG 2000 recog-╲ ──────────┐
               ╲ nize the DVG1 ╱            │
                ╲  module? ╱                │
                    │ Yes                   │
                    ▼                       │
                ╱ Does the ╲     No         │
               ╱ DVG1 module ╲ ────────────┤──►  ┌──────────────┐
               ╲ pass Confidence╱          │     │ Go to flowchart│
                ╲  tests? ╱                │     │ on page 6–15. │
                    │ Yes                  │     └──────────────┘
                    ▼                      │
    ┌──────────────────────────────────────┐
    │ Perform Self Cal as follows: push the │
    │ Utilities button, touch Module Self   │
    │ Cal, DVG1, and then Start Cal.        │
    └──────────────────────────────────────┘
                    │
                    ▼
                ╱ Does the ╲      No
               ╱ DVG1 module ╲ ────────────┘
               ╲ pass Self Cal?╱
                ╲        ╱
                    │ Yes
                    ▼
    ┌──────────────────────────────────────┐
    │ TG 2000 now recognizes the DVG1       │
    │ module. DVG1 module now passes        │
    │ power-up confidence and self-         │
    │ calibration tests.                    │
    └──────────────────────────────────────┘
```

Figure 6–3: Flowchart for major difficulties with module

Continuation of flowchart from page 6–14.

Use the Module Removal procedure on page 6–7 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 DVG1 Confidence Tests. Note whether the DVG1 module passed the diagnostic. Note the highest number to appear.

Does the TG 2000 recognize the DVG1 module?

No

Yes

Does the DVG1 module pass Confidence tests?

No

Go to flowchart on page 6–16.

Yes

Perform Self Cal: push the Utilities button. Touch Module Self Cal, DVG1, and then Start Cal.

Does the DVG1 module pass Self Cal?

No

Yes

TG 2000 now recognizes the DVG1 module. DVG1 Module now passes power-up confidence and self-calibration tests.

Figure 6–4: Flowchart for checking the current module installation slot

Continuation of flowchart from page 6–15.

Use the Module Removal procedure on page 6–7 to remove the affected module.

Install the DVG1 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 DVG1 Confidence Tests. Note whether the DVG1 module passed the diagnostic. Note the highest number to appear.

Does the TG 2000 recognize the DVG1 module?

No

Yes

Does the DVG1 module pass Confidence tests?

No

Replace the module.

Yes

Perform Self Cal: push the Utilities button. Touch Module Self Cal, DVG1, and then Start Cal.

Does the DVG1 module pass Self Cal?

No

Yes

DVG1 Module OK
Note that there may be a problem with the Backplane board. Record troubleshooting information and contact Tektronix.

Figure 6–5: Flowchart for checking the module in a different slot

Use this procedure when the TG 2000 Platform mainframe fails to power up and you suspect the DVG1 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 DVG1 Confidence Tests. Note whether the DVG1 module passed the diagnostic. Note the highest number to appear.

Did the DVG1 fail confidence tests? — No → The problem is probably in another module. Refer to *Troubleshooting* in the *TG 2000 SIgnal Generation Platform Service Manua*l.

Yes

Use the Module Removal procedure on page 6–7 to remove the DVG1 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 *TG 2000 SIgnal Generation Platform Service Manua*l.

Yes

Install the DVG1 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 DVG1 Confidence Tests. Note whether the DVG1 module passed the diagnostic. Note the highest number to appear.

Did the DVG1 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 **6–6: Flowchar**t **for failur**e **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

Yes

Check Power Supply charging circuit.

Remove the cable from J2 on the Power Supply board and measure pin 7 (See Figure 6–8) for +4.7 V with rear panel power on, +0.5 V with rear-panel power off.

Use the Module Removal procedure on page 6–7 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.

Is the battery charging circuit ok?

Yes

No

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

Does the affected module operate in the new slot?

No

Replace the module.

Yes

Refer to the TG2000 Service Manual for instructions to replace the Power Supply module.

There may be a problem with the Backplane board. Record troubleshooting information and contact Tektronix.
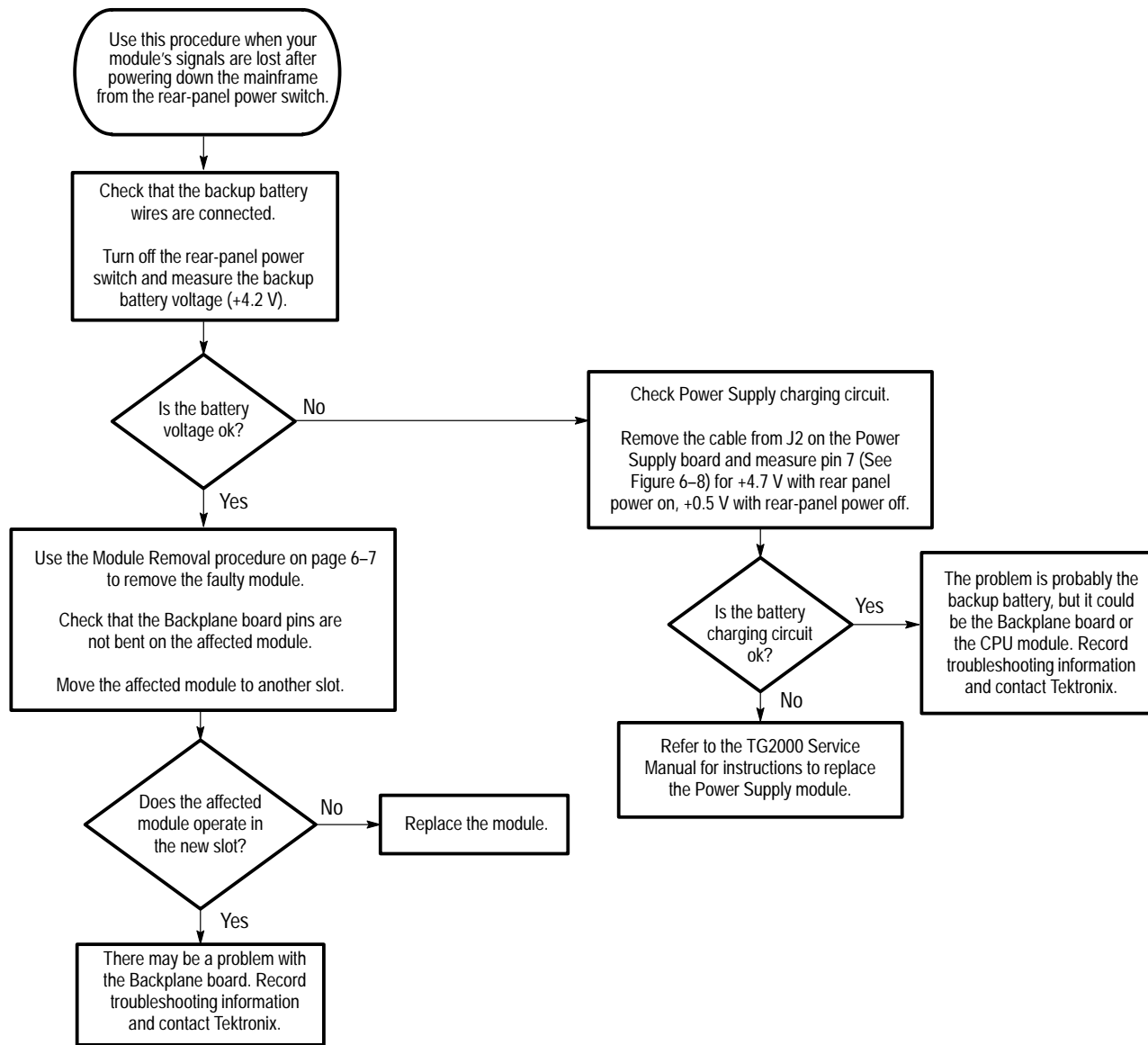
Figure 6–7: Flowchart for signals lost after power down

Figure 6–8: Measuring the battery charging circuit

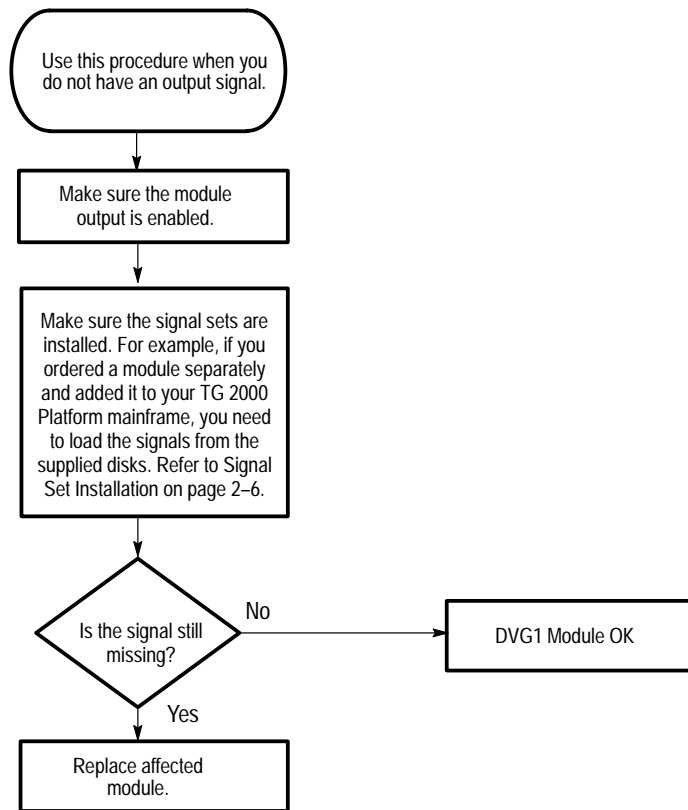**Figure 6–9: Flowchart for wrong signal on output**

     6–19

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 TG 2000
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 → DVG1 Module OK

Yes

Replace affected
module.

Figure 6–10: Flowchart for missing output signal

Use this procedure when there
is jitter on the signal.

Check that the AGL1 Module is in
internal mode: Push the
Reference button and then touch
INT/EXT to select internal.

Is the jitter still
present?

No → DVG1 Module OK

Yes

Perform the Performance
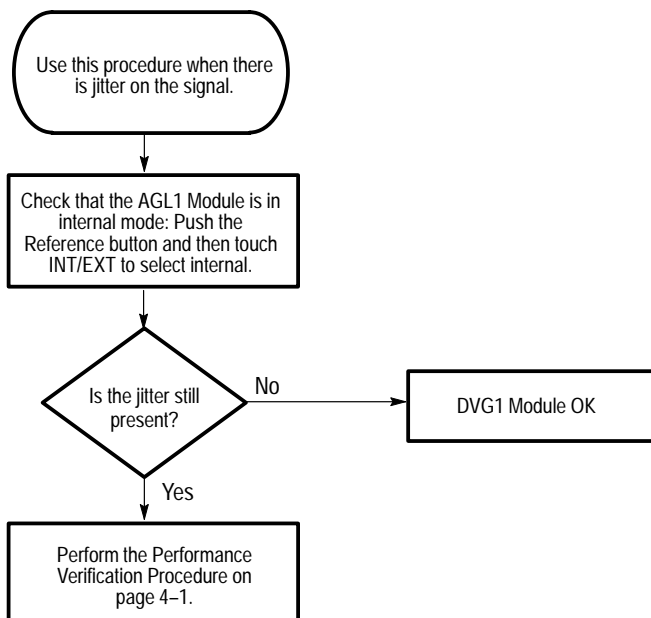Verification Procedure on
page 4–1.

Figure 6–11: Flowchart for jitter on signal

Options

Options

There is one option (SDI) and one field upgrade (memory) available for the DVG1 Generator module.

SDI Option

The DVG1 Generator module can be ordered with Option S1 (SDI test option). If you purchase this option, your module will be shipped with an SDI subassembly attached.

This option provides additional capabilities for testing the performance of the SDI components in a digital video system. The SDI test option allows you to test the limits of an SDI receiver and the integrity of an SDI transmission path.

The SDI test option adds the following capabilities:

■ Variable Serial Output Amplitude – The serial output amplitude is adjustable within a range of +15% to –90% in 1% increments. The levels are accurate within ±2%.

■ Variable SDI Data Slew Rate – Slew rate of the serial digital video signal is adjustable from 5% to 125% in 1% steps.

■ SDI Jitter – Calibrated Jitter can be added to the serial video output. The jitter waveform is sinusoidal, with variable amplitude and frequency. The jitter amplitude is variable from 0 to 15 μs; the jitter frequency is variable from 0.1 Hz to 10 MHz, in 0.1 Hz increments.

The factory ships Option S1 with Output 1 as the standard output and Output 2 as the SDI output. If your DVG1 Generator module includes Option S1 (SDI), you can change the output configuration to suit your needs. See Figure 2–7 on page 2–8.

Memory Upgrade

A customer-installable memory upgrade is available for DVG1 Generator modules with hardware versions less than 1.3. To determine your hardware version, push the **Utilities** button and then touch **Version** on the display. On the display, note the hardware version number that corresponds to the DVG1 module.

The upgrade kit contains hardware and instructions to upgrade the memory from 256 Kb to 1 Mb. To order the upgrade kit, contact your local Tektronix field office or representative.

Replaceable Electrical Parts

Replaceable Electrical Parts

The module-level replaceable electrical parts are included in the *Replaceable Mechanical Parts* list. Since component-level repair is not supported, individual electrical components are not listed.

Diagrams

Diagrams

Figures 9–1 and 9–2 show the DVG1 Generator module and how it interconnects with the TG 2000 Signal Generation Platform.

Diagrams showing mainframe component interconnections, such as power supply and clock, can be found in the *TG 2000 Signal Generation Platform Service Manual*.

A block diagram of the DVG1 Generator module is located in the *Theory of Operation* section, beginning on page 3–1.
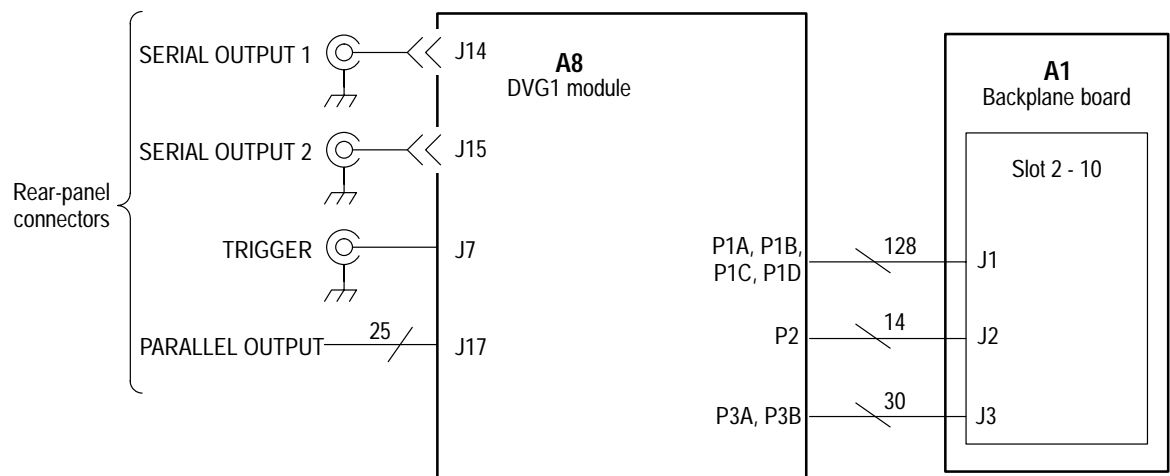
Figure 9–1: DVG1 module connections (standard)

NOTE. Figure 9–2 shows the connections with Option S1 installed as shipped. For information about using alternate connections, refer to page 2–8.
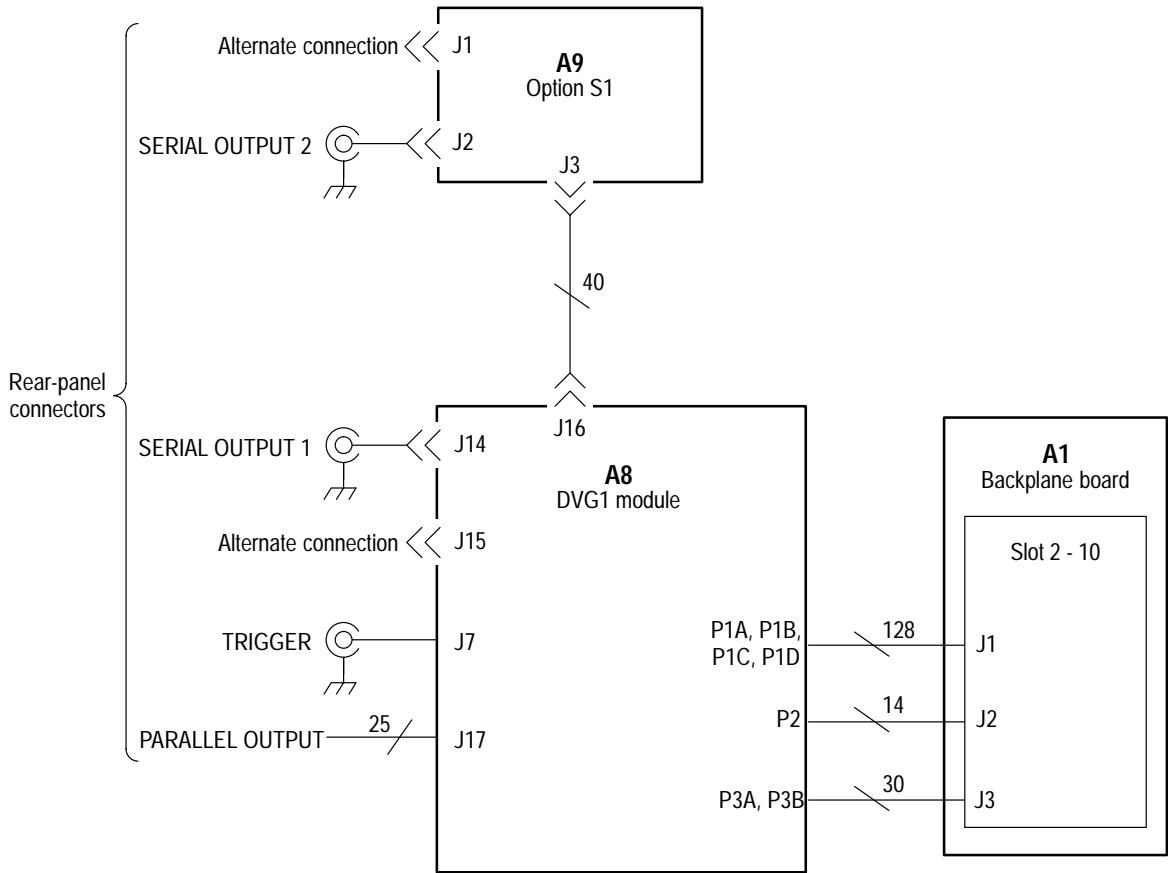
Figure 9–2: DVG1 module connections (with Option S1 installed as shipped)

Mechanical Parts List

Mechanical Parts List

This section contains a list of the replaceable modules for the DVG1 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-TEK-WIDE.

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.
7	Mfr. code	This indicates the code of the actual manufacturer of the part.
8	Mfr. part number	This indicates the actual manufacturer's or vendor's part number.

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

Mfr. Code to Manufacturer Cross Index The table titled *Manufacturers Cross Index* shows codes, names, and addresses of manufacturers or vendors of components listed in the parts list.

Manufacturers cross index

Mfr. Code	Manufacturer	Address	City, state, zip code
01536	TEXTRON INC	1818 CHRISTINA ST	ROCKFORD, IL 61108
0GZV8	HUBER & SUHNER INC	ONE ALLEN MARTIN DRIVE	ESSEX, VT 05451
0KB01	STAUFFER SUPPLY CO	810 SE SHERMAN	PORTLAND, OR 97214–4657
2J927	AMERICAN PRECISION INDUSTRIES INC	5455 SE ALEXANDER	HILLSBORO, OR 97123
00779	AMP INC.	CUSTOMER SERVICE DEPT PO BOX 3608	HARRISBURG, PA 17105–3608
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD PO BOX 76500	COLD SPRINGS, KY 41076
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077–0001

Replaceable parts list

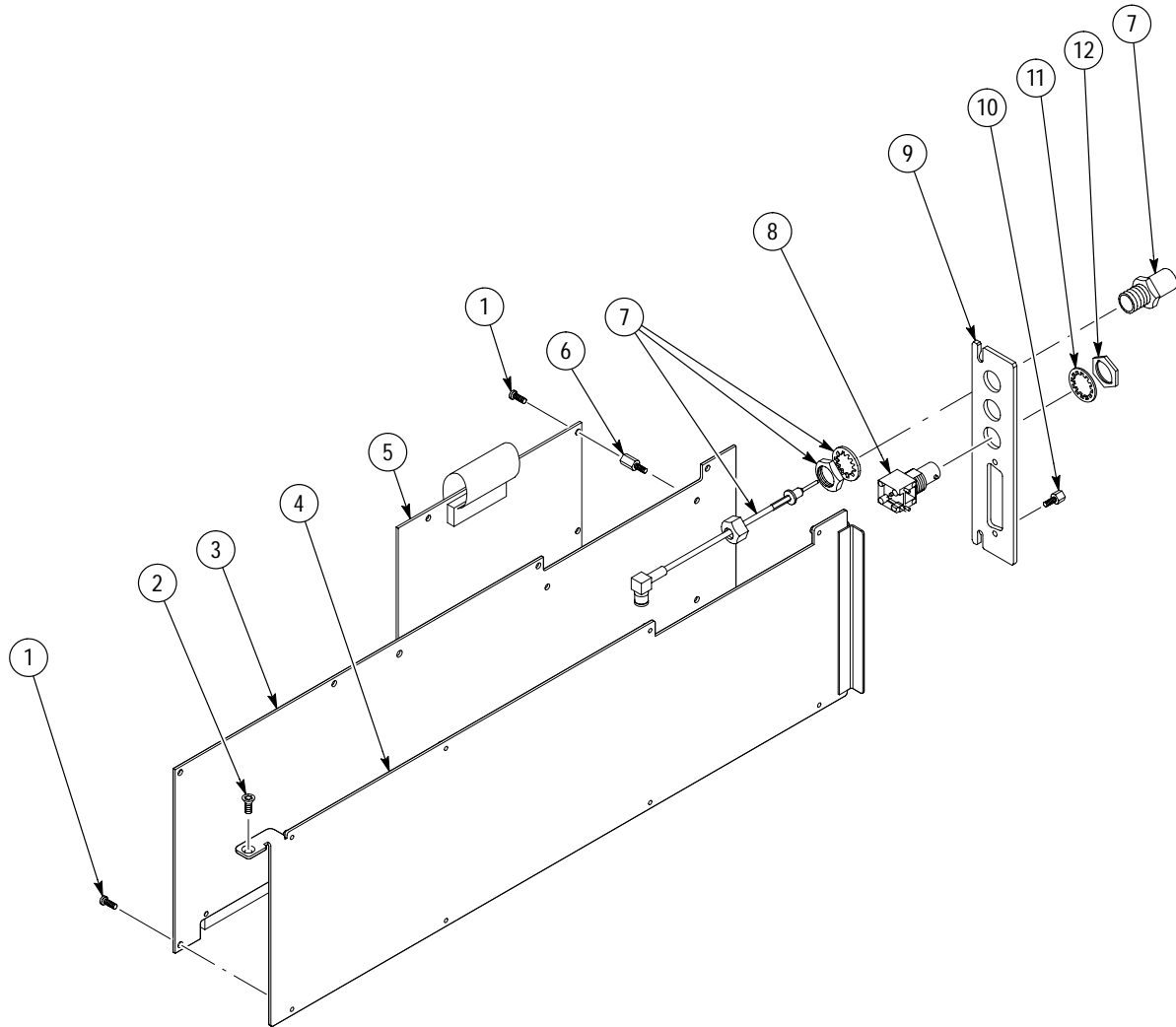| Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
10–1–1	211–0408–00			8	SCR,ASSEM WSHR:4–40 X 0.250,PNH,STL,ZINC,T–10 TORX	0KB01	211–0408–00
10–1–2	211–0725–00			2	SCREW,MACHINE:6–32 X 0.375,FLH TORX	01536	ORDER BY DESCR
10–1–3	671–2877–00	B010100	B010201	1	CIRCUIT BD ASSY:DIGITAL VIDEO GENERATOR BOARD	80009	671–2877–00
	671–2877–01	B010202	B010265	1	CIRCUIT BD ASSY:DIGITAL VIDEO GENERATOR BOARD	80009	671–2877–01
	671–2877–02	B010266	B010482	1	CIRCUIT BD ASSY:DIGITAL VIDEO GENERATOR BOARD	80009	671–2877–02
	671–2877–03	B010483		1	CIRCUIT BD ASSY:DIGITAL VIDEO GENERATOR BOARD	80009	671–2877–03
10–1–4	337–4063–01			1	SHIELD:ALUM	80009	337–4063–01
10–1–5	671–3234–00			1	CIRCUIT BD ASSY:SDI TEST OPT	80009	671–3234–00
10–1–6	129–1002–00			4	SPACER,POST:0.485 L,4–40 EXT/INT,BRS,0.188 HEX	2J927	129–1002–00
10–1–7	174–3420–00			1	CA ASSY,RF:COAX,RFD,75 OHM,BNC,REAR MT	80009	174–3420–00
10–1–6	131–3378–00			3	CONN,RF JACK:BNC,50 OHM	00779	227677–1
10–1–9	333–4168–00			1	PANEL,REAR:ALUMINUM	80009	333–4168–00
10–1–10	214–3903–01			2	SCREW,JACK:4–40 X 0.312 EXT THD,4–40 INT THD	0KB01	214–3903–01
10–1–11	210–1039–00			3	WASHER,LOCK:0.521 ID,INT,0.025 THK,SST	0KB01	1224–02–00–0541C
10–1–12	220–0497–00			3	NUT,PLAIN,HEX:0.5–28 X 0.562 HEX,BRS CD PL	73743	ORDER BY DESCR
					STANDARD ACCESSORIES		
	070–9049–XX			1	MANUAL,TECH:USER,DVG1 MODULE	80009	070–9049–XX
					OPTIONAL ACCESSORIES		
	070–9300–XX			1	MANUAL,TECH:SERVICE,DVG1 MODULE	80009	070–9300–XX
	671–2879–XX			1	EXTENDER BOARD	80009	671–2879–XX

Figure 10–1: Exploded view