Service Manual

Tektronix

**AWVG1
Wideband Video Generator**

070-9302-00

$C\,\epsilon$

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

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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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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 and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

Preface

This optional service manual is for the AWVG1 Wideband 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 AWVG1 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:

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.*

- *Adjustment Procedures* 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* informs you that there are no options available for the AWVG1 Generator module at this time.

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

- *Diagrams* contains interconnect diagrams showing the connections between the AWVG1 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 AWVG1 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 AWVG1 Generator module.

- The *AWVG1 Wideband Video Generator User Manual* contains operating information and information about SCPI commands for the AWVG1 Generator module.

Manual Conventions

The following list of naming and typographical conventions are used throughout this manual:

- The words *Push* or *Press* are used to indicate actions performed on buttons on the TG 2000 Signal Generation Platform.

- The words *Select* or *Choose* are used to indicate actions performed on menu selections.

- The word *Touch* is used to indicate actions performed on the touch screen display.

- Boldface type is used to indicate an item on which you perform an action.

- Italicized type is used to refer to a section or procedure in this manual, or to another publication.

The following list includes examples of how these conventions are used:

- Push the **Measure** button on the TG 2000 Platform mainframe.

- Use the knob to select **Video Standard**, and then press the **Select** button.

- Touch **Video** on the touch screen display.

- Refer to the *AWVG1 Wideband Video Generator User Manual* for more information.

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

AWVG1 Wideband Video Generator Service Manual

Specifications

Specification

This section provides an introduction to, and specifications and certifications for, the AWVG1 Wideband Video Generator module. The AWVG1 Generator module is installed in the TG 2000 Signal Generation Platform mainframe.

This section also contains the specifications and certifications for the AWVG1 Wideband Video Generator module. Refer to the *TG 2000 Signal Generation Platform User Manual* for a list of environmental specifications.

Product Description

The AWVG1 Generator module generates wideband analog signals for use in television systems. This 30 MHz bandwidth generator is capable of 12-bit precision. Although this module can produce composite color signals, its primary function is to provide zone plate and sweep signals. Test signal libraries for these types of signals are provided with the module user manual.

The AWVG1 Generator module is a single-channel generator, which outputs either the internally generated signal, or an analog video signal from the rear-panel input, on its three output connectors. The rear-panel input is provided for convenience of operation so that the output signal can be switched between an internally generated signal and an external signal, such as signals output by the AVG1 Generator module. There is no provision for power-off loop-through of the external signal.

For internally generated signals, output signal data is obtained from either the fast access memory or the zone plate generator. The basic signal contains luminance information only, so burst is generated and multiplexed in at the appropriate time.

The memory architecture for this module is run-length encoded. This allows signals that have redundancy to occupy a smaller space, and more complex signals to occupy the same space. For signals with no redundancy, there is enough memory for 30 unique lines of signal data.

The AWVG1 Generator module provides the following signal types: line and field sweeps with front-panel control of frequency markers (fixed and variable) and variable start and stop frequencies, zone plates, multipulses, multibursts, pulse and bars.

Electrical Specifications

All specifications listed in this section are guaranteed unless labeled *typical* in the Characteristics column. Typical specifications are provided for your convenience, but are not guaranteed.

Table 1–1: AWVG1 Generator module outputs

Characteristics	Description
Amplitude Errors	
Absolute Amplitude	$\leq \pm 1\%$ at 700 mV (outputs 2 and 3 relative to output 1)
Relative Amplitude	$\leq \pm 0.5\ \%$ (outputs 2 and 3 relative to output 1)
Delay Errors, typical	
Output to Output Delay	≤ 1 ns
Group Delay	≤ 3 ns to 20 MHz ≤ 5 ns to 30 MHz
SCH Phase Accuracy	$\leq \pm 1.25$ ns ($\pm 1.6°$ @ 3.58 MHz, and $\pm 2°$ @ 4.43 MHz)
Frequency Response	$\pm 1\%$ to 20 MHz $\pm 2\%$ to 28 MHz $\pm 3\%$ to 30 MHz
Pulse Ringing, typical	2T5 pulse $\leq 0.5\%$ peak 1T5 pulse $\leq 1.0\%$ peak T/2–5 pulse $\leq 1.0\%$ peak
Line Time Distortion	$\leq 0.5\%$ peak (measured with field square wave)
Field Time Distortion	$\leq 0.5\%$ peak (measured with field square wave)
K Factor 2T5 Pulse	$\leq 0.5\%$ peak
Pulse/Bar Ratio, typical	1:1 within 1.0% (measured with 2T pulse or T pulse)
DC Offset	≤ 10 mV
In-band Signal/Noise Ratio	≥ 60 dB to 6 MHz (unweighted, as measured on the VM700) No spurs above 55 dB, 6 to 30 MHz
Out-of-band Signal/Noise Ratio	≥ 50 dB from 30 MHz to 300 MHz
Synchronous noise, typical	≤ 2 mV peak
Return Loss/Output Impedance	≥ 35 dB to 30 MHz (75 Ω)

Table 1–2: AWVG1 Generator module switcher input

Characteristics	Description
Amplitude Error	≤ ± 1% (output 1 relative to input)
Frequency Response	± 2% to 6 MHz (output 1 relative to input) ± 4% to 30 MHz (output 1 relative to input)
DC Offset	≤ 10 mV (output 1 relative to input)
Luminance Linearity Error	≤ 0.5%
Differential Gain	≤ 0.5%
Differential Phase	≤ 0.5°
In-band Signal/Noise Ratio	≥ 60 dB to 6 MHz (unweighted, as measured on the VM700) No spurs above 55 dB, 6 to 30 MHz
Out-of-band Signal/Noise Ratio	≥ 50 dB from 30 MHz to 300 MHz
Crosstalk to Output	
From External Source	≤ –60 dB to 6 MHz ≤ –40 dB to 30 MHz
From Internal Source	≤ –60 dB to 6 MHz ≤ –40 dB to 30 MHz
Input Impedance, typical	75 Ω
Input Return Loss	≥ 40 dB to 6 MHz ≥ 35 dB to 30 MHz
Power Consumption	+5 Volts: 8.25 Watts typical -5 Volts: 7.5 Watts typical -2 Volts: 1.2 Watts typical +15 Volts: 0.75 Watts typical -15 Volts: 0.45 Watts typical Battery: 30 µA typical

Certifications

Table 1–3: Certifications and compliances

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

Operating Information

Installation

This section contains instructions for installing the AWVG1 Generator module into the TG 2000 Platform mainframe. Listed below are the starting page numbers for the major topics in this section.

■ Preventing component damage (page 2–1)

■ Module installation, including signal set installation (page 2–2)

■ Instrument backup and restore (page 2–8)

■ Signal backup and module removal (page 2–9)

Preventing Component Damage

⚠️ *CAUTION. Electrostatic discharge (ESD) can damage components on this module and mainframe. To prevent ESD or other component damage, use the following precautions when installing, removing, or handling modules:*

■ 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.

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

■ Do not slide the module over any surface.

■ Handle modules as little as possible.

■ Do not touch module components or connector pins.

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

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

■ Do not remove the module circuit board assembly from the shield. The shield provides important support and protection for the 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
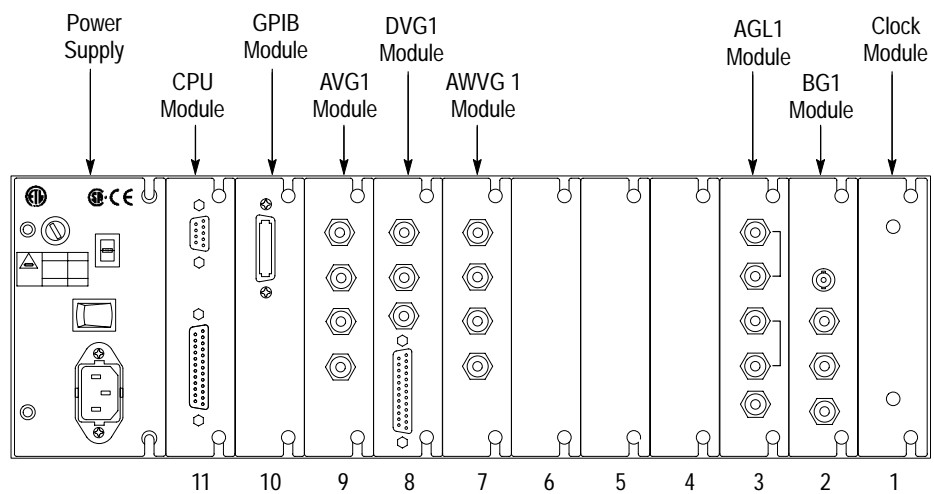
Figure 2–1: TG 2000 Platform mainframe rear panel, showing slot numbering

> **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.
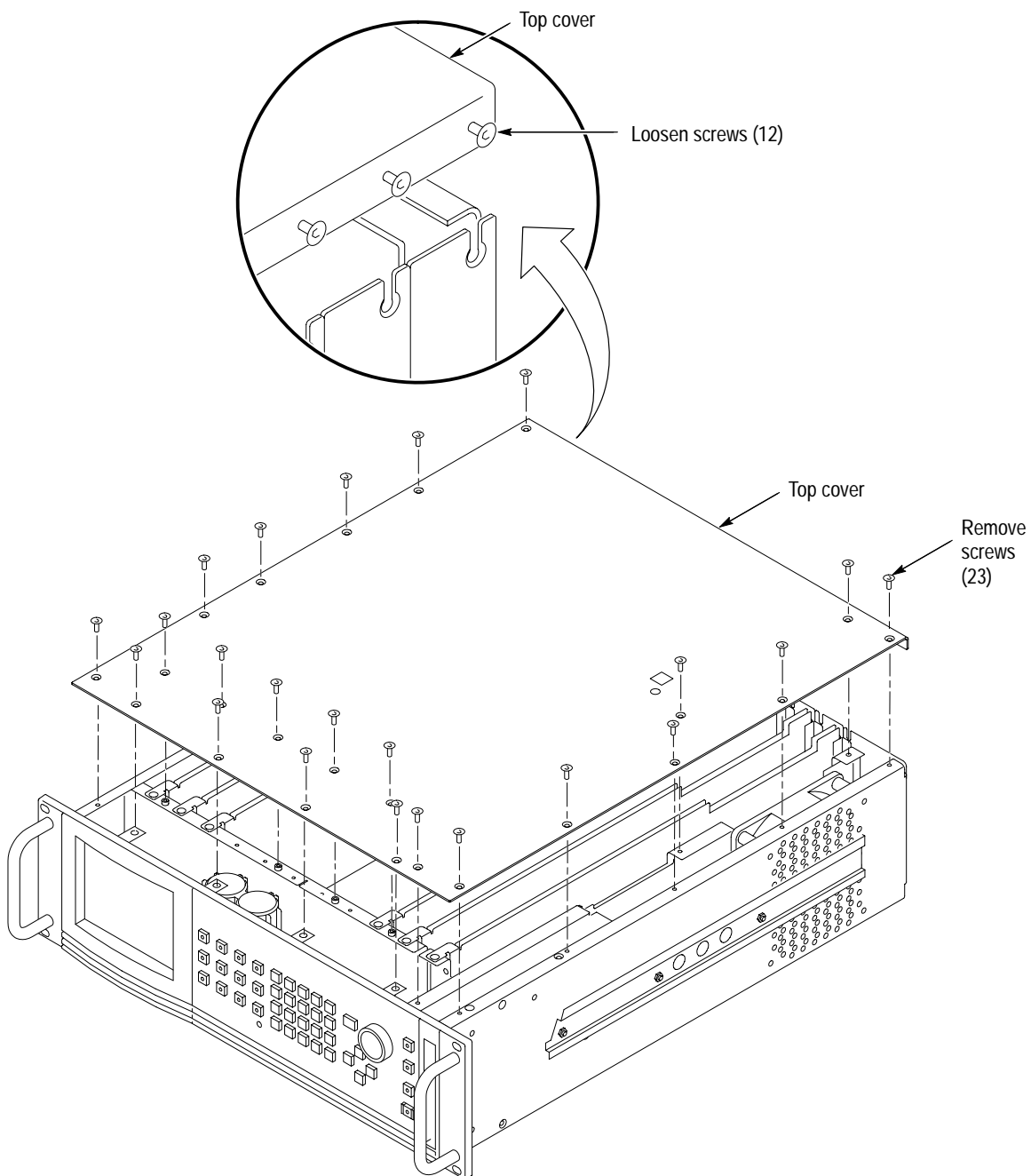
Figure 2–2: Top cover removal

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
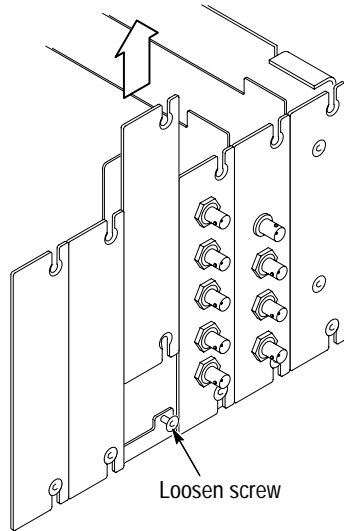
Figure 2–3: Removing the rear panel

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.
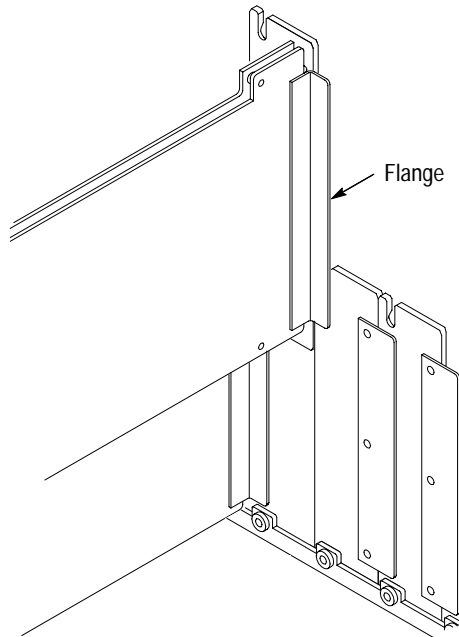
Flange

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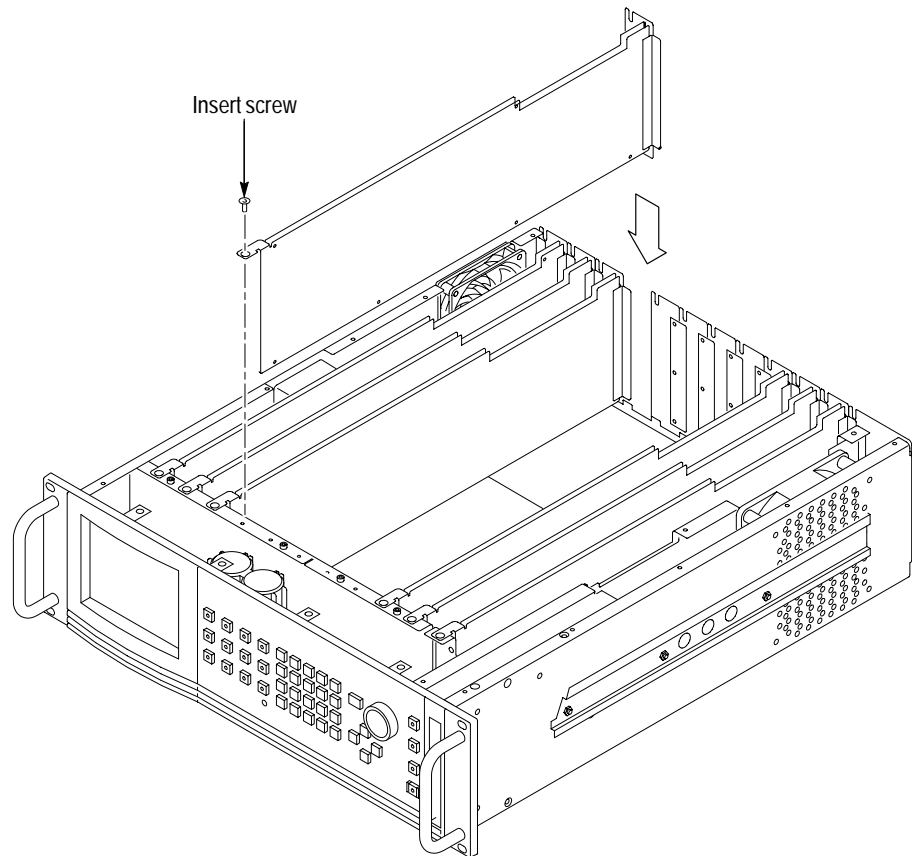
Figure 2–5: Installing the module

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.
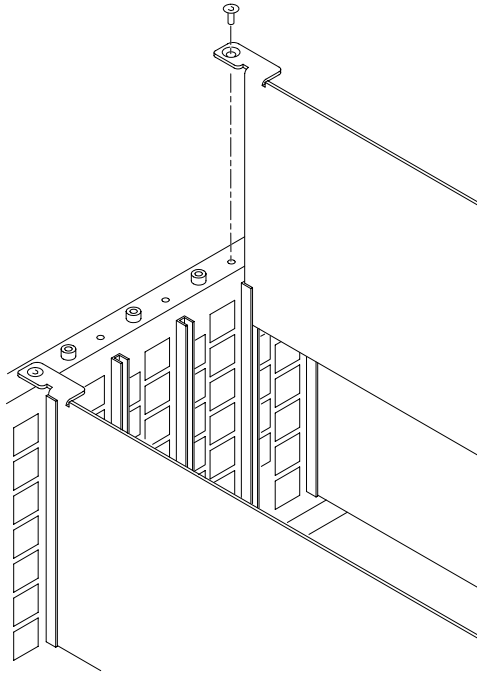
Figure 2–6: Top screw

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 2–8).

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. To install signal sets from the disk to the default destination, perform these steps:

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 file you want to load and push the **Select** button.

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. To install signal sets from the floppy disk to a non-default destination, perform these steps:

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 file you want to load and push the **Select** button.

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. Push the **Select** button.

11. Touch **Start Load**. A popup menu tells you when the transfer is complete.

Instrument Backup and Restore

You may be required to remove a module from the TG 2000 Platform mainframe during service. Before you remove a generator module from the mainframe, you should save its signal sets to disks. A generator module will lose its signal memory 30 seconds after removal from the mainframe.

See *Signal Backup* on page 2–9 for a procedure to backup only the signal set.

Required Equipment

You will need blank, DOS formatted 3.5 inch disks. You will need approximately one disk for each installed module and one disk for the CPU.

Instrument Backup

To save signal sets and instrument settings, perform the following procedure:

1. Insert the Troubleshooting disk supplied with the *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 message 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 message will tell you to insert a new 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.

Instrument Restore from Backup

To restore signal sets and instrument settings, perform 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. 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 **tgrstore.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.

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, using the following procedure:

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 **AWVG1**. Use the cursor arrows to select the AWVG1 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, use the following procedure:

1. Turn off the TG 2000 Platform mainframe by pressing the front-panel **On/Standby** switch and switching the rear panel power switch to off.

> ⚠ *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.*

2. Unplug the power cord.

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 2–8).*

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 AWVG1 Generator module.

Figure 2–7 shows the module's menu structure.
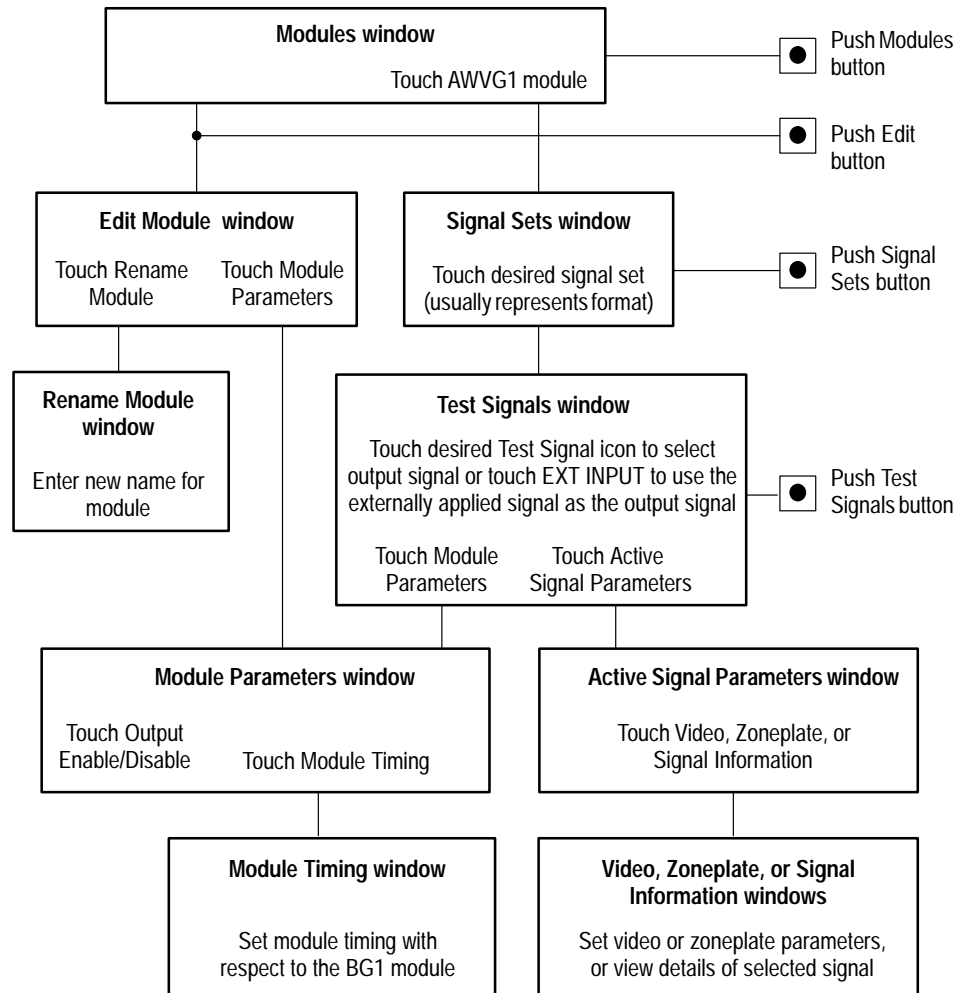
Figure 2–7: Basic menu structure for the AWVG1 Wideband Video Generator module

The TG 2000 Platform mainframe buttons shown in Figure 2–7 access menus for the active module. To access menus for other modules, you must first make a different module active by pushing the **Modules** button, and then touching the module name on the TG 2000 Platform mainframe display.

Outputs

The three BNC output connectors for this module all supply the same output signal. For information on how to select the output signal, refer to *Select the Output Signal* on page 2–15.

Input

The BNC input connector is compensated for 75 Ω. This input is provided so that you can use the output of another module (such as the AVG1 Generator module) as the output signal for the AWVG1 Generator module. To do this, you must select External Input as the AWVG1 Generator module output signal. For information on how to do this, refer step 7 of *Select the Output Signal* on page 2–17.

Online Help

Push the front-panel **HELP** button to display a help window. The help window describes the AWVG1 Generator module window you were using when you pushed HELP.

If a help window is longer than the display, you can scroll through the help text using the Navigation arrow keys. To exit the help window, touch Quit.

Operating Procedures

This section is organized into the following main topics:

- Power on the mainframe and select the module

- Select the output signal

- Active signal parameters

- Module parameters

Refer to Figure 2–7 on page 2–11 for information on how to access the appropriate windows for these procedures.

Equipment Hookup

No special test equipment is necessary for the procedures described in this section. However, if you want to view the signals on a monitor, connect the module's signal output to a television monitor. Use a 75 Ω cable and a 75 Ω termination to make this connection.

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 *AWVG1 Wideband Video Generator Service Manual*.

NOTE. When the platform is shipped from the factory, the module is named AWVG1:X where X represents the slot number in which the module is installed. However, you can edit the module name by selecting the module and then pushing the Edit button. The TG 2000 Signal Generation Platform User Manual *provides more information.*

5. Since you have just powered on the mainframe, the Modules window (shown below) is displayed. To select the module at other times, push the front-panel **Modules** button to access this window.
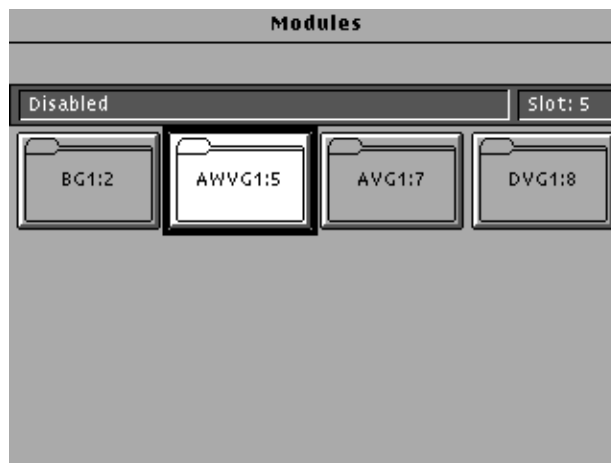
6. Touch the module icon on the display (or push the **Signal Sets** button if the desired icon is already highlighted). The installed signal sets for the module appear. Selections you make after this will pertain to the AWVG1 Generator module.

Select the Output Signal

You can select any of the AWVG1 Generator module signals that are loaded in your instrument to be the output signal, supplied on the three rear-panel outputs. To select the output signal, follow these steps:

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.
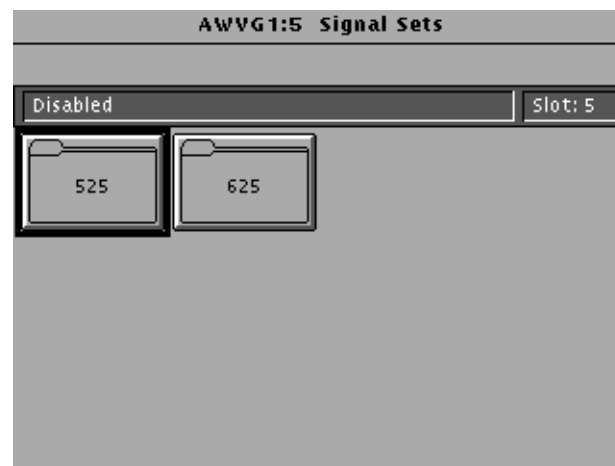
2. Touch the desired signal set on the display. The Test Signals window for the selected signal set appears. In the following example, 525 is selected.
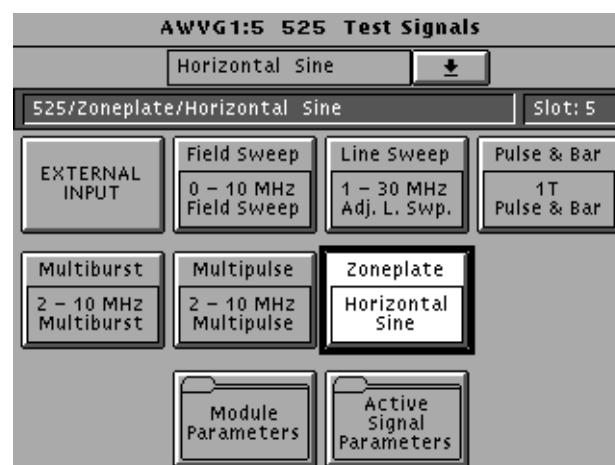
3. Each test signal icon in the Test Signals window represents one or more signals that the module can generate. In this example, the Zoneplate test signal icon is selected, and the Horizontal Sine signal is being generated.

4. To change to another zone plate signal, use one of the following methods:

    a. Touch the **Zone Plate** repeatedly to browse through all available signals.

    b. Touch the combo box below the window title (or rotate the Navigation knob) to display a list of all the signals for the selected icon, as shown in the following example. (_Horizontal Sine is a user-generated signal.)
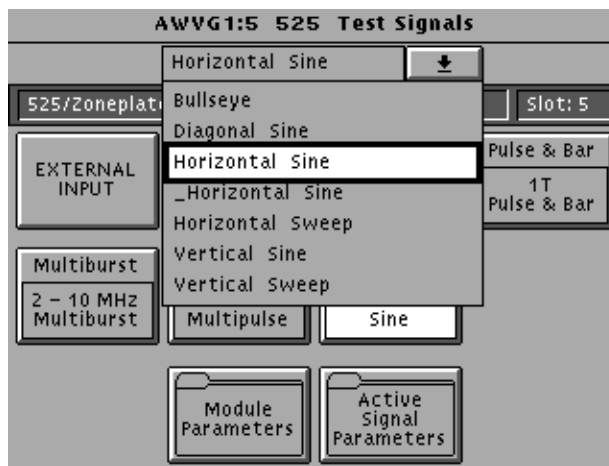
    c. To select a signal from the list, rotate the Navigation knob to move the cursor to that signal, and then press the front panel **Select** key. In the following example, the selected output signal is Horizontal Sine, but the cursor has been moved to Vertical Sine. Pressing the **Select** key will select Vertical Sine as the output signal.
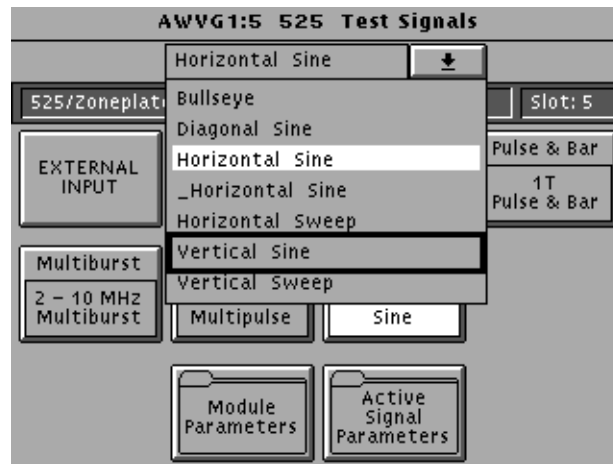
5. To change to a different signal type, such as Multiburst, touch the corresponding icon on the display. Then select the signal as shown in step 4.

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.

7. If you want to use the signal on the rear-panel input as the output signal, touch the **EXTERNAL INPUT** icon to highlight it. For example, you can connect a coaxial cable from the output of the AVG1 Generator module to the input of the AWVG1 Generator module, and then select EXTERNAL INPUT. This will supply the AVG1 Generator module signal as the output on the AWVG1 Generator module.

Active Signal Parameters

The following windows are accessed through the Active Signal Parameters window. 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 AWVG1 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.

Signal Information

You can view detailed information about the selected signal. In the Active Signal Parameters window, touch **Signal Information**. View the signal information, as shown in the following illustration.

```
           AWVG1:5  Signal Information

 625/Pulse & Bar/1T  Pulse & Bar          Slot: 5

 Comments:          20T modulated and 1T pulse, 100   ↑
 nS T
 Signal Path:
  N5:/625/Pulse & Bar/1T  Pulse & Bar|1.1.cmp
 Origin:            Tek Generated
 Create Date:       Jun-26-1997 10:18:00
 Format Name:       PAL-BG
 Aspect Ratio:      4/3
 Sample Frequency:  72.000000000 MHz
 Line Length:       64.0000 us
 Active Video Length: 52.6000 us                       ↓

                                          Quit
```
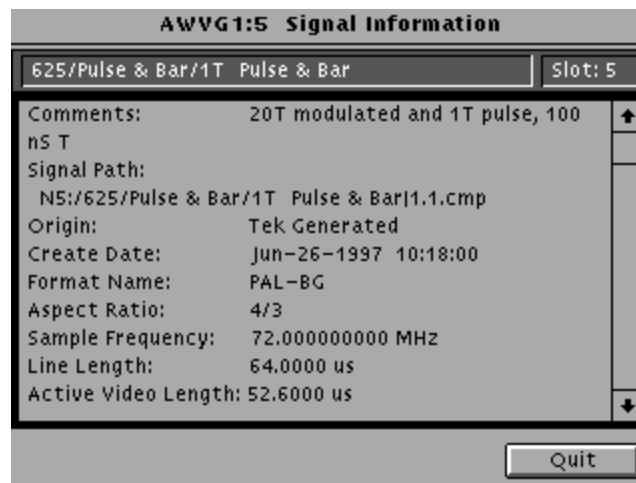
Video Parameters

By making and saving changes to the video parameters, you can create a new signal that is based on the selected signal. Changes you make affect only the new signal. In the Active Signal Parameters window, touch **Video**.

Zone Plate Test Signal

By making and saving changes to the zone plate parameters, you can create a new signal that is based on the selected signal. Changes you make affect only the new signal. In the Active Signal Parameters window, touch **Zone Plate**.

Module Parameters

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

To enter the Module Parameters window for the AWVG1 Generator module, follow these steps:

1. Push the **Modules** button.

2. Ensure that the module is highlighted.

3. Push the **Edit** button.

4. Touch **Module Parameters** at the bottom of the screen. The Module Parameters window appears.

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, follow these steps:

1. Select the 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.

4. Touch the **Output** icon to toggle the state of the module's output signal.

5. Touch **Quit** to exit.

Timing   You can set the horizontal and vertical timing of the AWVG1 Generator module with respect to the BG1 Generator module, using the Module Parameters window. Changes you make to timing affect all signals for the AWVG1 Generator module.

1. In the Module Parameters window, touch the module timing icon.

2. Set the horizontal timing of this module with respect to the BG1 Generator module as follows:

    a. Touch **H Feel** to select **Coarse**. (A front-panel knob increment is now equal to a full cycle of the sample clock, typically 72 MHz.) Rotate the navigation knob to select the approximate value; rotate the knob counter-clockwise to advance the timing, or clockwise to delay the timing.

    b. Touch **H Feel** to select **Fine**. (Knob increments are now subclock cycles.) Rotate the knob to select the final value.

    c. To enter a specific value, use the keypad to key in the value, and then press the **Select** key. (The default is 0.000 μsec.)

3. Set the vertical timing of this module with respect to the BG1 Generator module by performing the following steps. (The default is 0 lines.)

    a. Touch **Vertical** on the display.

    b. Rotate the Navigation knob counter-clockwise to advance the timing or clockwise to delay the timing.

    c. To enter a specific value, use the keypad and then press the **Select** key.

NOTE. When you enter more than 1 line of horizontal advance or delay, the vertical timing is advanced or delayed.

4. If you want to set horizontal and vertical values to zero, touch **Reset All**.

5. When you have made all desired changes, touch **Quit** to exit the Timing window.

6. Touch **Quit** to exit the Module Parameters window. All changes are saved.

Theory of Operation

Theory of Operation

The AWVG1 module generates wideband analog signals for use in television systems. This 30 MHz bandwidth generator is capable of 12-bit precision. The primary function of the AWVG1 Generator module is to provide zone plate and sweep signals. The block diagram for the AWVG1 Generator module is shown in Figure 3–1.
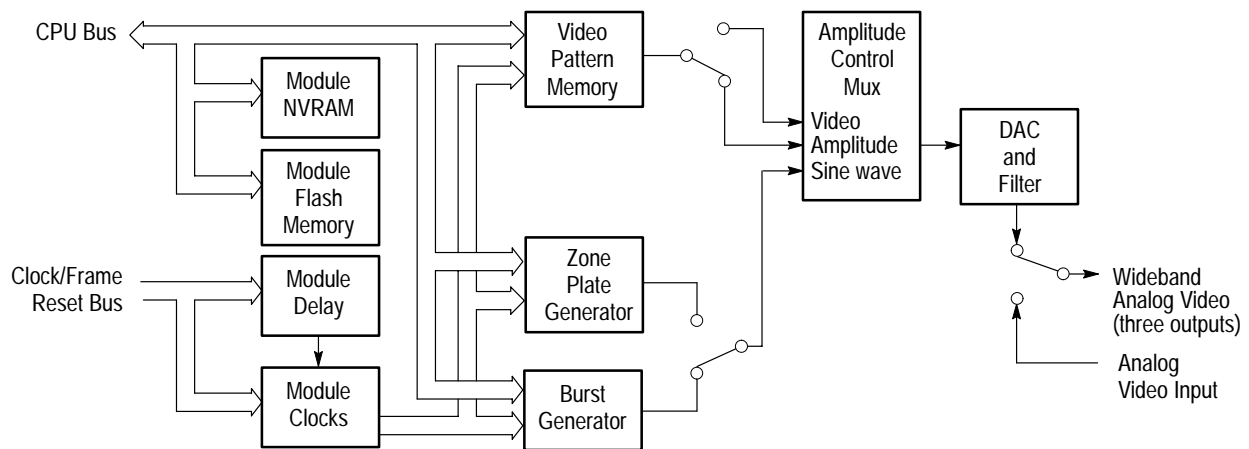
Figure 3–1: Simplified block diagram of the AWVG1 Generator module

Outputs and Memory

The AWVG1 Generator module makes sweep and multiburst up to 30 MHz. Although capable of producing a limited range of composite color signals. The main function of the AWVG1 Generator module is to provide high-frequency analog monochrome video test patterns. The output of this module is a single video channel, synchronized to a frame sync pulse from the mainframe. All three of the 75 Ω BNC outputs are driven by this video signal, or by video from the terminated 75 Ω BNC input. There is no provision for power-off loop-through.

All video output is from a single 12-bit D/A, clocked at 72 MHz. Immediately upstream from the D/A, video data is clocked at 36 MHz with a 2:1 interleave. The output of the zone plate generator is interleaved 2:1. The two halves of a Qualcomm Q2334 dual DDS chip are used to produce 2:1 interleaved subcarrier samples. The video data is clocked out of static RAM with the same 2:1 interleave. The amplitude and envelope shaping for zone plate and burst are controlled by two TMC2272 digital multiplier chips.

Video patterns are stored in RAM. The video pattern is constructed from video segments selected by the line sequence memory, and lines selected by the frame sequence memory. The video segments are 32 samples long, at a 72 MHz sample rate (44 nS per segment). The memory holds only 1.82 mS of video, so segments must be repeated to complete a video frame. This three-level indirection scheme saves memory, so the CPU can make quicker pattern changes and cursor moves. There is no separate memory for cursors, so video that is covered up by the cursor must be replaced when the cursor moves.

Sequence of Video Segments, Lines, and Frames

The video data in the AWVG1 Generator module is arranged in segments. Segments consist of 16 sample pairs (32 samples clocked out to the D/A at 72 MHz). Lines consist of video segments pointed to by data in the line sequence memory. Line and frame length are determined by counters in the sequencer FPGA.

The frame length must be an integer number of color frames (1050 lines/frame for NTSC, 2500 lines/frame for PAL). Two-field frames are allowed only if the DDS burst is not used. Integer multiples of the color frame length may be used to accommodate ghost cancellation reference signals, or very short motion sequences (16384 lines maximum, 15 NTSC frames, 6 PAL frames).

The line length is adjustable in 1/36 MHz (27.8 nS) increments, but the length of a video segment is 16/36 MHz (444 nS). To handle the partial segment, the sequencer FPGA uses a special porch wait state.

During the porch wait state, the address sequence hangs for one to four (never zero) 36 MHz cycles. The last sample pair is repeated at the D/A, so the video must make a smooth transition to a steady DC level before the last sample pair. This constrains the video to a steady output for up to 138.9 nS. The Tektronix SDP200 software places this in the front porch, back porch, or sync tip region of video lines. For non-video signals, some horizontal blanking time is still needed for the porch wait state.

Performance Verification

Performance Verification

Perform the following procedures to verify that your AWVG1 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, perform verification procedures once a year. Before performing any verification procedures, complete all relevant maintenance procedures outlined in the *Maintenance* section of this manual.

Required Equipment

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

Table 4–1: Equipment required for Performance Verification

Equipment	Example or Tektronix equivalent
Digital Multimeter	Tektronix DM5120 Digital Multimeter
Video Measurement Set	Tektronix VM700T Series Video Measurement Set
Spectrum Analyzer	Tektronix 2712 Spectrum Analyzer
Peak Detector Amplifier	015-0408-00
Peak Detector Head	015-0413-00
Return Loss Bridge, Low Band	A57T from Wide Band Engineering
Return Loss Bridge, 75 Ω	011-0103-00
BNC Termination, 75 Ω	011-0102-01
BNC Termination, 75 Ω feed-through	011-0055-01

Table 4–1: Equipment required for Performance Verification (cont.)

Equipment	Example or Tektronix equivalent
75 Ω Low-Loss BNC Cables	012-0074-00
DC Block	015-0221-00
AVG1 Generator module	
AWVG1 Generator module	

Test Software

You will need the following test signal files to perform these procedures:

Test signal files
awvgtest.dnl
vm_test.dnl (from the *AVG1 Analog Video Generator Service Manual* test signal disk)
dc_level.dnl (from the *AVG1 Analog Video Generator Service Manual* test signal disk)

Preparation for Performance Verification

Before you begin the Performance Verification procedures, follow the instructions for power on, instrument warm up, and loading test signals described in this section.

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

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

1. Push the **Presets** button.

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

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

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

5. Use the navigation arrows to move the cursor to the new preset. Press the **Select** button.

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

Instrument Backup　　Determine whether you will be replacing signals (see *Loading Test Signals,* on page 4–4). 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.

After completing the Performance Verification procedures, you can restore your backup signals using the backup disks. Alternatively, you can restore the standard AWVG1 test signals, using the Test Signals disks that were shipped with the *AWVG1 Wideband Video Generator User Manual.*

To perform *Instrument Backup*, use the following procedure:

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 **tgbackup.seq**, 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 **tgbackup.seq**, using 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 Test Signals

Some of the procedures described in this section will require you to replace TG 2000 Platform mainframe signals

If you have more than one AWVG1 Generator module loaded, you may have enough memory capacity to add all of these signals at once to the AWVG1 Generator module. To do this, use the *Add Signals* procedure

If you do not have sufficient memory to add the signals, you must replace the AWVG1 Generator module signals with the required test signal for each step as you go through the *Performance Verification* procedure. To do this, use the *Replace Signals* procedure on page 4–5.

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

1. Insert the 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 arrows to select the .dnl file you want to add. (For example, the awvgtest.dnl file is specified for checking DC level, the first Performance Verification procedure.)

6. Press the **Select** button.

7. When the new window opens, use the navigation arrows to move the cursor to the AWVG1 folder on the right side of the display.

8. Press the **Select** button.

9. Touch **Quit/Load**.

10. Touch **Quit/Load** again to return to the Add Signals window.

11. Touch **Select Destination**.

12. Use the right navigation arrow to move the cursor to the AWVG1 folder on the right side of the display.

13. Press 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 4–5.

15. Touch **Start Load**.

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

17. Touch **Quit**.

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

1. To save the instrument signals and settings, perform *Instrument Backup* on page 4–3.

NOTE. If you are using only standard signals and settings in your operating environment, you do not need to perform the Instrument Backup. Restore the standard signals and settings using the test signal disks shipped with the module user manual.

---

2. Insert the 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 arrows to select the .dnl file you want to add. (For example, the awvgtest.dnl file is specified for checking DC level, the first Performance Verification procedure.)

6. Press the **Select** button.

7. When the Replace screen appears, use the right navigation arrow to move the cursor to the AWVG1 folder.

8. Press the **Select** button.

9. Touch **Quit/Load**.

10. Touch **Start Replace**.

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

Performance Verification Procedures

The remainder of this chapter provides the following Performance Verification procedures (page references indicate the page on which the procedures begin):

- *Output Amplitude and DC Offset* (page 4–7)

- *Output Frequency Response* (page 4–8)

- *Field Time Distortion, Line Time Distortion, and K-Factor* (2T5 Pulse) (page 4–10)

- *Output Signal to Noise Ratio up to 6 MHz (In-Band)* (page 4–14)

- *External Input Signal to Noise Ratio up to 6 MHz (In-Band)* (page 4–16)

- *Output and External Input Signal to Noise Ratio above 6 MHz (In-band and Out-of-band) and Crosstalk* (page 4–19)

- *Input and Output Return Loss* (page 4–22)

- *External Input Gain and DC Offset* (page 4–30)

- *External Input Linearity, Differential Gain, Differential Phase* (page 4–25)

- *External Input Frequency Response* (page 4–32)

A sample Test Record is provided at the end of this chapter. You can make copies of this record so that you can record test results and file them with your organization's records.

NOTE. These procedures were created using the instruments indicated in each procedure. If you use other instruments, adapt the procedures as necessary to make the Performance Verification measurements.

Output Amplitude, and DC Offset

Use this procedure to verify the output relative and absolute amplitude and DC offset. Absolute and relative amplitudes are calculated by measuring two DC levels at each output. Offsets are measured directly.

Test Equipment Required.

- 75 Ω feed-through termination (precision 75Ω is required for absolute amplitude measurements)

- Digital multimeter (for example, a Tektronix DM5120 digital multimeter)

- Coaxial cable or meter leads

Initial Equipment Configuration.

- Connect the 75 Ω feed-through termination to the top output of the AWVG1 Generator module under test.

- Connect the digital multimeter to the 75 Ω feed-through termination at the output of the AWVG1 Generator module under test.

Test Signals.

Load the **awvgtest.dnl** test signal file into the TG 2000 Signal Generation Platform (see *Loading Test Signals* on page 4–4), and then select the **DC zero volts** test signal as follows:

1. Press the **Modules** button on the TG 2000 Platform mainframe.

2. Select the AWVG1 Generator module under test.

3. Touch **CW DC VM TEST** on the display.

4. Touch **DC Levels** until the **DC zero volts** signal is selected.

Procedure.

1. The value displayed on the digital multimeter is the DC offset. This value should be within ± 10 mV of zero. Record the value in Table 4–2 on page 4–8.

2. Move the 75 Ω feed-through termination from the top to the middle and bottom outputs of the AWVG1 Generator module under test, recording the values from the digital multimeter in Table 4–2 on page 4–8.

3. Move the 75 Ω feed-through termination to the top output of the AWVG1 Generator module under test.

4. Touch **DC Levels** until the **DC 700mV** signal is selected.

5. Subtract the DC offset from the value displayed on the digital multimeter to calculate the absolute amplitude. This value should be within ± 7 mV of 700 mV (1% of 700 mV). Record the value in Table 4–2.

6. Move the 75 Ω feed-through termination from the top to the middle and bottom outputs of the AWVG1 Generator module under test, recording the values from the digital multimeter in Table 4–2.

Table 4–2: DC offset and relative and absolute amplitude error

Output	DC offset	Absolute amplitude	Relative amplitude
Top			-----
Middle			
Bottom			

7. Relative amplitude error for the middle and bottom outputs is calculated relative to the absolute amplitude of the top output. The difference in absolute amplitude between the top output and the middle or bottom output should be within ± 3.5 mV of zero (0.5% of 700 mV).

Output Frequency Response

Use this procedure to verify output amplitude flatness over the bandwidth. Continuous sinewave signals (700 mV$_{pp}$ centered on ± 350 mV$_{dc}$) are measured with a peak-to-peak detector relative to the 0.1 MHz reference signal. Amplitude measurements are relative to the 0.1 MHz, 700.0mV$_{pp}$ signal.

Test Equipment Required.

■ Digital multimeter (for example, a Tektronix DM5120 digital multimeter)

■ Peak-to-peak detector amplifier

■ Peak-to-peak detector head

■ 75 Ω coaxial cables

Initial Equipment Configuration.

■ Connect the peak-to-peak detector head directly to the top output of the AWVG1 Generator module under test.

■ Connect the peak-to-peak detector head to the peak detector amplifier + Input.

■ Connect the peak-to-peak detector amplifier output to the digital multimeter.

Test Signals.

Load the **awvgtest.dnl** test signal file into the TG 2000 Signal Generation Platform (see *Loading Test Signals* on page 4–4), and then select the CW test signals as follows:

1. Select the AWVG1 Generator module under test.

2. Push the **Signal Sets** button.

3. Touch **CW DC VM Test** on the display.

4. Touch **CW < 1 MHz** on the display until the **SW 0.10MHz 700.0mVpp** signal is selected.

NOTE. Measure the 0.1 MHz value often during this procedure. The peak-to-peak detector head is sensitive to temperature changes.

Procedure.

1. Record the 0.1 MHz value in Table 4–3.

2. Touch **CW 1MHz to 9.99MHz** on the display, and then touch **SW 1.00MHz 700.0mVpp**.

3. Read the peak-to-peak output from the digital multimeter, and then subtract the 0.1 MHz peak detector reading. The result of this subtraction should be within limits shown in Table 4–3.

Table 4–3: Output frequency response - 1 MHz to 9.99 MHz

Frequency	Requirement	Output relative to 0.1 MHz		
		Top	Middle	Bottom
0.1 MHz	— —			
1 MHz	(± 1% of 700 mVp-p) ± 7 mV			
2.5 MHz	(± 1% of 700 mVp-p) ± 7 mV			
5 MHz	(± 1% of 700 mVp-p) ± 7 mV			
7.5 MHz	(± 1% of 700 mVp-p) ± 7 mV			

4. Touch **CW 10MHz to 19.99MHz**, and then touch the signals shown in Table 4–4. Record the results in Table 4–4 as you proceed.

Table 4–4: Output frequency response - 10 MHz to 19.99 MHz

		Output relative to 0.1 MHz		
Frequency	Requirement	Top	Middle	Bottom
10 MHz	($\pm$ 1% of 700 mVp-p) $\pm$ 7 mV			
12.5 MHz	($\pm$ 1% of 700 mVp-p) $\pm$ 7 mV			
15 MHz	($\pm$ 1% of 700 mVp-p) $\pm$ 7 mV			
17.5 MHz	($\pm$ 1% of 700 mVp-p) $\pm$ 7 mV			

5. Touch **CW 20MHz to 30MHz**, and then touch the signals shown in Table 4–5. Record the results in Table 4–5 as you proceed.

Table 4–5: Output frequency response - 20 MHz to 30 MHz

		Output relative to 0.1 MHz		
Frequency	Requirement	Top	Middle	Bottom
20 MHz	($\pm$ 1% of 700 mVp-p) $\pm$ 7 mV			
22.5 MHz	($\pm$ 2% of 700 mVp-p) $\pm$ 14mV			
25 MHz	($\pm$ 2% of 700 mVp-p) $\pm$ 14mV			
28 MHz	($\pm$ 2% of 700 mVp-p) $\pm$ 14mV			
30 MHz	($\pm$ 3% of 700 mVp-p) $\pm$ 21mV			

Field Time Distortion, Line Time Distortion, and K-Factor (2T5 Pulse)

Use this procedure to check the field time distortion, line time distortion, and K-factor (using a 2T5 pulse). The VM700T measures the field time distortion with a 50Hz field rate squarewave (PAL format). The PAL VM700 Field Square Wave test signal includes vertical interval test signals (lines 17 18 330 331, per CCIR567-2). The line time distortion is measured using the 10µSec bar portion of the vertical interval test signals. The K-factor is measured with the 2T5 pulse portion of the vertical interval test signals.

Test Equipment Required.

- Video measurement set (for example, a Tektronix VM700T)

- 75 Ω coaxial cable (BNC male on each end)

- 75 Ω termination

Initial Equipment Configuration.

■ Use a 75 Ω coaxial cable to connect the top output of the AWVG1 Generator module under test to channel A on the video measurement set.

■ Attach a 75 Ω termination to the channel A loop-through on the video measurement set.

Test Signals.

Load the test signals from file **awvgtest.dnl** into the TG2000 Platform main-frame (see *Loading Test Signals* on page 4–4), and then select the PAL **VM700 Field Square Wave** test signal as follows:

1. Press the **Modules** button on the TG 2000 Platform mainframe.

2. Select the AWVG1 Generator module under test.

3. Touch **CW DC VM Test** on the display.

4. Touch **PAL** on the display until the **VM700 Field Square Wave** signal is selected.

Measurement setup.

1. On the VM700T front panel, push the **Source A** button to select the A channel.

2. On the VM700T front panel, push the **Waveform** button, and then push the **Menu** button.

3. On the display, touch **Sync**, and then touch **Sync A**.

4. Touch **Change Sampling** until *Synchronous* is displayed (a 3-way toggle). The display should show a video waveform with *625 line PAL* displayed in the lower left corner.

NOTE. The VM700T may lose sync if it is not in PAL mode (Loss of sync will be displayed). To autodetect the video format, use the following substeps:

   a. On the front panel, push the **Measure** button.

   b. If the video measurements submenu is not displayed, touch **Video Options**, and then touch **Video**.

   c. Use the knob and touch screen to select **Video_Standard**.

   d. Push **Waveform**.

5. On the VM700T front panel, push the **Waveform** button, and then push the **Menu** button.

6. On the display, touch **Filter Select**, and then touch **No Filter**.

7. On the VM700T front panel, push the **Waveform** button, and then push the **Menu** button.

8. On the display, touch **Clamp Couple**, and then touch **DC Coupling**.

Procedure: Field time distortion.

1. On the VM700T front panel, push **Measure**, then check that the video measurements menu is displayed on the touch screen. If not, touch **Video** to select the video measurement menu.

2. Use the knob and touch screen to select **Two_Field**.

3. On the VM700T front panel, push the **Menu** button, and then touch **Average Num**.

4. Use the knob to set the average number to 32.

5. On the VM700T front panel, push **Average** until the LED is lit.

6. The display should show a field time distortion number within $\pm 0.5\%$ of zero.

7. Repeat steps 1 through 6 for the middle and bottom outputs, moving the 75 Ω coaxial cable from the top to the middle and bottom outputs as you proceed.

---

*NOTE. Push the **Average** button twice on the VM700T each time you move the cable to another output. This will clear the average saved in the VM700T and enable Average again.*

---

8. Move the 75 Ω coaxial cable from the bottom output to the top output.

Procedure: Line time distortion.

1. On the VM700T front panel, push **Measure**, and then check that the video measurements menu is displayed on the touch screen. If not, touch **Video** to select the video measurement menu.

2. Use the knob and touch screen to select **Bar Line-Time**.

3. On the VM700T front panel, push the **Menu** button.

4. On the display, touch **ITS Search** and the VM700T will search for a line that has an appropriate pulse-and-bar signal.

5. Touch **Average Num** on the VM700T, and then use the knob to set the average number to 32.

6. On the VM700T front panel, push **Average** until the LED is lit.

7. Check that the displayed values for both line time distortion and bar tilt are within ±0.5% of zero.

8. Repeat steps 1 through 7 for the middle and bottom outputs, moving the coaxial cable from the top to the middle and bottom outputs as you proceed.

---

*NOTE. Push the **Average** button twice on the VM700T each time you move the cable to another output. This will clear the average saved in the VM700T and enable Average again.*

---

9. Move the 75 Ω coaxial cable from the bottom output to the top output.

Procedure: K-factor.

1. On the VM700T front panel, push **Measure**, then check that the video measurements menu is displayed on the touch screen. If not, touch **Video** to select the video measurement menu.

2. Use the knob and touch screen to select **K_Factor**.

3. On the VM700T front panel, push the **Menu** button.

4. On the display, touch **ITS Search** and the VM700T will search for a line that has an appropriate pulse-and-bar signal.

5. Touch **Average Num** on the VM700T front panel, and then use the knob to set the average number to 32.

6. On the VM700T front panel, push **Average** until the LED is lit.

7. The display should show the following K-factor numbers within the ranges noted:

- K-2T within ±0.8% of zero

- K-PB within ±0.8% of zero

- HAD within ±10 nsec of 200 nsec (2T5 pulse width)

8. Repeat steps 1 through 7 for the middle and bottom outputs, moving the coaxial cable from the top to the middle and bottom outputs as you proceed.

*NOTE. Push the **Average** button twice on the VM700T each time you move the cable to another output. This will clear the average saved in the VM700T and enable Average again.*

Output Signal to Noise Ratio up to 6 MHz (In-Band)

Use this procedure to verify the output signal to noise ratio up to 6 MHz. The VM700T calculates the rms signal to noise ratio for 0.1 to 6 MHz from a luminance ramp signal. PAL or NTSC signals can be used for this measurement. NTSC is shown.

Test Equipment Required.

- Video measurement set (for example, a Tektronix VM700T)

- Two 75 Ω coaxial cables (BNC male on each end)

- Two 75 Ω terminations

Initial Equipment Configuration.

- Use a 75 Ω coaxial cable to connect the top output of the AWVG1 Generator module under test to channel A on the video measurement set.

- Attach a 75 Ω termination to the channel A loop-through on the video measurement set.

Test Signals.

Load the test signals from file **awvgtest.dnl** into the TG 2000 Signal Generation Platform (see *Loading Test Signals* on page 4–4), and then select the **VM700 Lum. Ramp** test signal as follows:

1. Push the **Modules** button on the TG 2000 Platform mainframe.

2. Select the AWVG1 Generator module under test.

3. Touch **CW DC VM Test** on the display.

4. Touch **NTSC** on the display until the **VM700 Lum. Ramp** signal is selected.

Measurement Setup.

1. On the VM700T front panel, push the **Source A** button to select the A channel.

2. On the VM700T front panel, push the **Waveform** button, and then push the **Menu** button.

3. On the display, touch **Sync**, and then touch **Sync A**.

4. Touch **Change Sampling** until *Synchronous* is displayed (a 3-way toggle). The display should show a video waveform with *525 line NTSC* displayed in the lower left corner.

NOTE. The VM700T may lose sync if it is not in NTSC mode (Loss of sync will be displayed). To autodetect the video format, use the following substeps:

    a. On the front panel, push the **Measure** button.

    b. If the video measurements submenu is not displayed, touch **Video Options**, and then touch **Video**.

    c. Use the knob and touch screen to select **Video_Standard**.

    d. Push **Waveform**.

5. On the VM700T front panel, push the **Waveform** button, and then push the **Menu** button.

6. On the display, touch **Filter Select**, and then touch **No Filter**.

7. On the VM700T front panel, push the **Waveform** button, and then push the **Menu** button.

8. On the display, touch **Clamp Couple**, and then touch **DC Coupling**.

9. On the VM700T front panel, push **Waveform**, and then push **Select Line**.

10. On the touch screen, touch **Field 1 or 2** and **Field 3 or 4** so that both are lit.

11. Turn the knob to select any non-blanked line (lines 21–250).

Procedure.

1. On the VM700T front panel, push the **Measure** button.

2. If the video measurements submenu is not displayed, touch **Video**.

3. Use the knob and touch screen to select **Noise_Spectrum**. The display should show a noise spectrum.

4. On the VM700T front panel, push **Menu**.

5. On the touch screen, touch **Filters Selection**, and then touch **Tilt Null**. Deselect all other filters.

6. Repeat steps 1 through 4.

7. Touch **Average Num** on the VM700T front panel, and then use the knob to set the average number to 32.

8. On the VM700T front panel, push **Average** until the LED is lit.

9. The noise level displayed is the 0.1 MHz to 6 MHz rms noise calculated by the VM700T. Check that this value is less than –60 dB rms.

10. Repeat steps 1 through 9 for the middle and bottom outputs, moving the coaxial cable from the top to the middle and bottom outputs as you proceed.

---

*NOTE. Push the **Average** button twice on the VM700T each time you move the cable to another output. This will clear the average saved in the VM700T and enable Average again.*

External Input Signal to Noise Ratio up to 6 MHz (In-Band)

Use this procedure to verify the input signal to noise ratio up to 6 MHz. The VM700T calculates the rms signal to noise ratio for 0.1 to 6MHz from a luminance ramp signal. PAL or NTSC signals can be used for this measurement. This procedure was created using an NTSC signal.

Test Equipment Required.

- Video measurement set (for example, a Tektronix VM700T)

- Two 75 Ω coaxial cables (BNC male on each end)

- Two 75 Ω terminations

- 75 Ω back-terminated signal source of video test signals (for example, another AWVG1 Generator module or an AVG1 Generator module, needed to drive the AWVG1 Generator module module under test)

Initial Equipment Configuration.

- Use a 75 Ω coaxial cable to connect the external input of the module under test to the output of the 75 Ω back-terminated signal source (for example, another AWVG1 Generator module or an AVG1 Generator module).

- Use a 75 Ω coaxial cable to connect the top output of the AWVG1 Generator module under test to channel A on the video measurement set.

- Attach a 75 Ω termination to the channel A loop-through on the video measurement set.

Select the external input on the AWVG1 Generator module under test as follows:

1. Select the module under test.

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

3. Touch **EXTERNAL INPUT** on the display.

Test Signals.

If the signal source is an AWVG1 Generator module, load the test signals from file **awvgtest.dnl** into the TG 2000 Signal Generation Platform (see *Loading Test Signals* on page 4–4), and then use the following steps to select the **VM700 Lum. Ramp** signal:

1. Push the **Modules** button on the TG 2000 Platform mainframe.

2. Select the AWVG1 Generator module under test.

3. Touch **CW DC VM Test** on the display.

4. Touch **NTSC** on the display until the **VM700 Lum. Ramp** signal is selected.

If the signal source is an AVG1 Generator module follow equivalent steps in the *AVG1 Analog Video Generator Service Manual* to select the **Ramp** signal**.** (This signal is available in the **vm_test.dnl** test signal file included with the AVG1 Generator module service manual).

Measurement Setup.

1. On the VM700T front panel, push the **Source A** button to select the A channel.

2. On the VM700T front panel, push the **Waveform** button, and then push the **Menu** button.

3. On the display, touch **Sync**, and then touch **Sync A**.

4. Touch **Change Sampling** until *Synchronous* is displayed (a 3-way toggle). The display should show a video waveform with *525 line NTSC* displayed in the lower left corner.

NOTE. The VM700T may lose sync if it is not in NTSC mode (Loss of sync will be displayed). To autodetect the video format, use the following substeps:

---

    a. On the front panel, push the **Measure** button.

    b. If the video measurements submenu is not displayed, touch **Video Options**, and then touch **Video**.

    c. Use the knob and touch screen to select **Video_Standard**.

    d. Push **Waveform**.

5. On the VM700T front panel, push the **Waveform** button, and then push the **Menu** button.

6. On the display, touch **Filter Select**, and then touch **No Filter**.

7. On the VM700T front panel, push the **Waveform** button, and then push the **Menu** button.

8. On the display, touch **Clamp Couple**, and then touch **DC Coupling**.

9. On the VM700T front panel, push **Waveform**, and then push **Select Line**.

10. On the touch screen, touch **Field 1 or 2** and **Field 3 or 4** so that both are lit.

11. Turn the knob to select any non-blanked line (lines 21–250).

Procedure: Measure the noise spectrum.

1. On the front panel, push the **Measure** button.

2. If the video measurements submenu is not displayed, touch **Video**.

3. Use the knob and touch screen to select **Noise_Spectrum**. The display should show a noise spectrum.

4. On the VM700T front panel, push **Menu**.

5. On the touch screen, touch **Filters Selection**, and then touch **Tilt Null**. Deselect all other filters.

6. Repeat steps 1 through 4.

7. Touch **Average Num** on the VM700T front panel, and then use the knob to set the average number to 32.

8. On the VM700T front panel, push **Average** until the LED is lit.

9. The noise level displayed is the 0.1 MHz to 6 MHz rms noise calculated by the VM700T. Check that this value is less than –60 dB rms.

10. Repeat steps 1 through 9 for the middle and bottom outputs, moving the coaxial cable from the top to the middle and bottom outputs as you proceed.

---

*NOTE. Push the **Average** button twice on the VM700T each time you move the cable to another output. This will clear the average saved in the VM700T and enable Average again.*

Output and External Input Signal to Noise Ratio above 6 MHz (In-band and Out-of-band) and Crosstalk

Use this procedure to verify the signal to noise ratio above 6 MHz and crosstalk for the output and external input.

Above 6 MHz, the signal to noise ratio is specified as the spurious amplitudes relative to a 700mV$_{pp}$ sinewave. A spectrum analyzer is used to search for spurious content in a typical video signal (ramp). A 700mV$_{pp}$ sinewave signal is used to establish a 0 dB reference level for comparison with the spurious amplitudes.

Crosstalk is the unwanted signal from an external source while the external input is deselected. The measurement for checking crosstalk from an external input uses a 700mV$_{pp}$ sinewave as an external input signal. Then the output amplitude of the sinewave is measured while the external input is deselected.

Test Equipment Required.

■ Spectrum analyzer (for example, a Tektronix 2712)

■ DC block (used to protect the spectrum analyzer input)

■ 50 Ω to 75Ω termination

■ 75 Ω coaxial cables (BNC male on each end)

■ 75 Ω termination

■ AWVG1 Generator module (drives the input for crosstalk measurements)

Initial Equipment Configuration.

- Attach the DC block to the spectrum analyzer input.

- Attach the 50 Ω end of the 50 Ω to 75 Ω converter to the DC block at the spectrum analyzer input.

- Use a 75 Ω coaxial cable to connect the top output of the AWVG1 Generator module under test to the 75 Ω end of the 50 Ω to 75 Ω converter at the spectrum analyzer input.

- Attach a 75 Ω termination to the external input of the AWVG1 Generator module under test.

Test Signal.

Load the test signals from file **awvgtest.dnl** into the TG 2000 Signal Generation Platform (see *Loading Test Signals* on page 4–4), and then select the **30.00 MHz 700.0mVpp** test signal as follows:

1. Push the **Modules** button on the TG 2000 Platform mainframe.

2. Select the AWVG1 Generator module under test.

3. Touch **CW DC VM Test** on the display.

4. Touch **CW 20MHz to 30MHz** on the display until the **SW 30.00MHz 700.0mVpp** signal is selected.

Measurement Setup.

1. With the **SW 30.00MHz 700.0mVpp** signal selected, configure the spectrum analyzer for the following parameters:

   - 25MHz center frequency

   - 5MHz span/div

   - 120KHz resolution bandwidth (or select **Auto** if you are using a Tektronix 2712 spectrum analyzer)

NOTE. After setting the reference level in the next step, ensure that the spectrum analyzer settings described in step 1 are current.

---

2. Also on the spectrum analyzer, adjust the reference level to the peak of the 30 MHz signal. The reference level will normally be near –6.6 dBm.

Procedure: Output S/N measurement (In-band).

1. Touch **NTSC** on the TG 2000 Signal Generation Platform display until the **VM700 Lum. Ramp** signal is selected.

2. Check that any spurious content in the 6 MHz to 30MHz range is below –55 dB.

Procedure: Output S/N measurement (Out-of-band).

1. Change the center frequency of the spectrum analyzer to the frequencies listed below, checking that any spurious content in the 30MHz to 300MHz range is below –50dB. (Do not change the SPAN/DIV setting.)

   - 75MHz

   - 125MHz

   - 175MHz

   - 225MHz

   - 275MHz

2. Change the center frequency on the spectrum analyzer to 25 MHz.

Procedure: External Input S/N and Crosstalk from internal source measurements.

1. Touch **EXTERNAL INPUT** on the TG 2000 Signal Generation Platform display to select the external input for the AWVG1 Generator module under test.

2. To verify the External Input S/N part of the measurement, check on the spectrum analyzer that there are no spurs above –50dB from 6 to 30 MHz. For the Crosstalk part of the measurement, check that spurious content from 0 to 6MHz is below –60dB. Check that spurious content in the 6 to 30 MHz range is below –40dB.

3. Repeat *Procedure: Output S/N measurement (Out-of-Band)* for the 30 to 300 MHz range of the External Input S/N measurement, checking that spurious content is below –50dB.

Procedure: Crosstalk from external source.

1. Remove the 75 Ω termination from the external input of the AWVG1 Generator module under test.

2. Connect a 75 Ω coaxial cable from the external input of the AWVG1 Generator module under test to the top output of the driver module.

3. Push the **Modules** button on the TG 2000 Platform mainframe, and then select the module under test (if not already selected).

4. Touch **CW DC VM TEST** on the display.

5. Touch **DC Levels** until the **DC zero volts** signal is selected.

6. Push the **Modules** button.

7. Select the source module (not the module under test).

8. Touch **CW DC VM Test** on the display (if an AWVG1 Generator module is the source module).

9. Touch **CW 1MHz to 9.99MHz** on the display until **1.00 MHz 700.0mVpp** is selected.

10. Check that the 1MHz signal is less than –60dB.

11. Repeat steps 9 and 10, substituting a few other frequencies for the **1.00 MHz 700.0mVpp** test signal. Check that there are no spurious signals above –40dB for signals above 6 MHz.

Input and Output Return Loss

Use this procedure to verify the return loss for all of the outputs and the external input.

Test Equipment Required:

■ Spectrum analyzer (This procedure was prepared using a Tektronix 2712 Spectrum Analyzer.)

■ RF bridge (A57TLSCR low frequency)

■ Precision coaxial cables, two 50 Ω and one 75 Ω

■ 75 Ω male-to-male adapter

Equipment Hookup:

■ Connect a precision 50 Ω cable from the spectrum analyzer RF Input to the RF Output on the RF Bridge, as shown in Figure 4–1 on page 4–23.

■ Connect a precision 50 Ω cable from the spectrum analyzer TG Output to the RF Input on the RF Bridge.

■ Connect a 75 Ω male-to-male adapter to the RF bridge 75 Ω Test Port.
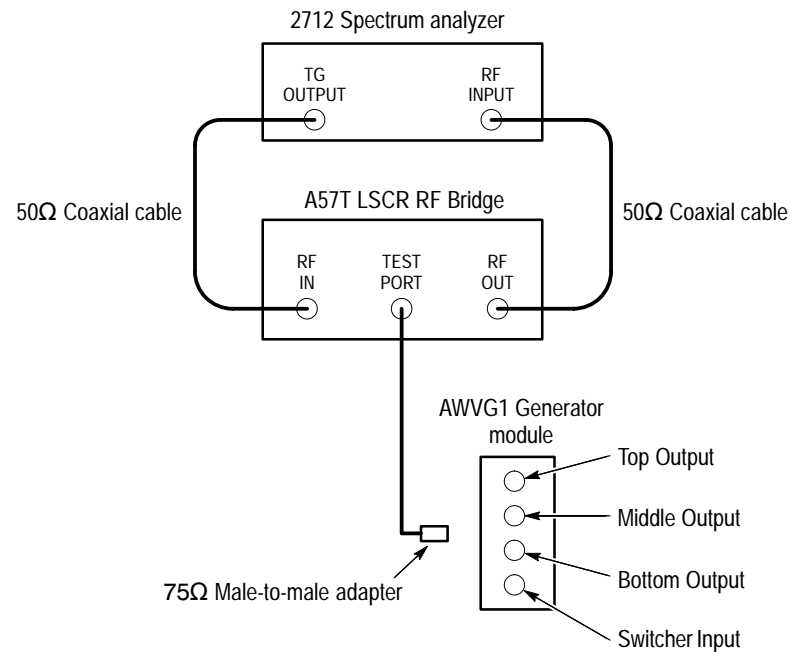
Figure 4–1: Equipment hookup for checking return loss

Test Signals.

Load the **awvgtest.dnl** test signal file into the TG 2000 Signal Generation Platform (see *Loading Test Signals* on page 4–4), and then select the **DC-zero volts** test signal as follows:

1. Press the **Modules** button on the TG 2000 Platform mainframe.

2. Select the AWVG1 Generator module under test.

3. Touch **CW DC VM TEST** on the display.

4. Touch **DC Levels** until the **DC zero volts** signal is selected.

Measurement setup.

1. Select the following on the spectrum analyzer:

   a. Select Demod/TG. Turn on the tracking generator and set the tracking generator fixed level to 0.00 dBm.

   b. Set the Span/Div to 1 MHz and the Resolution Bandwidth to 3 kHz.

   c. Set the Reference Level to the first major division down from the top of the analyzer display.

   d. Set the Vertical Scale to 10 dB.

2. Adjust the spectrum analyzer External Attenuation Amplifier as follows:

   a. Disconnect either of the cables connected from the spectrum analyzer to the RF Bridge.

   b. Set the spectrum analyzer frequency to 5 MHz.

   c. Reconnect the cable to the RF Bridge.

   d. Note the Reference Level Readout value.

   e. Adjust the External Attenuation Amplitude (on the Input menu if using the 2712 Spectrum Analyzer) by the value in step d. The Reference Level Readout should now be 0.00 dBm.

3. Verify bridge function as follows:

   a. Connect the precision, high-frequency termination to the 75 Ω Test Port on the RF Bridge.

   b. Check that the frequency response from 0 MHz to 6 MHz is ≤ -40 dB.

   c. Remove the precision high-frequency terminator from the RF Bridge.

Procedure: Check Return Loss from 100 KHz to 30 MHz

1. Connect the Test Port of the RF Bridge to the top output on the AWVG1 Generator module, using a male-to-male 75 Ω adapter.

2. Check that the Reference Level readout on the spectrum analyzer is ≤ -40 dB from 0 to 6 MHz and ≤ -35 dB from 6 to 10 MHz.

3. On the spectrum analyzer change the center frequency to the following frequencies indicated below, checking that the Reference Level readout is ≤ -35 dB:

   ■ 15 MHz

   ■ 25 MHz

4. Repeat steps 1, 2, and 3 for the middle and bottom outputs on the AWVG1 Generator module, moving the 75 Ω male-to-male adapter from the top to the middle and bottom outputs as you proceed.

**External Input Linearity,
Differential Gain,
Differential Phase**

Use this procedure to verify the linearity, differential gain, and differential phase of the external input.

Test Equipment Required.

- Video measurement set (for example, a Tektronix VM700T)

- 75 Ω coaxial cables (BNC male on each end)

- 75 Ω termination

- 75 Ω back-terminated signal source of video test signals (for example, another AWVG1 Generator module or an AVG1 Generator module, needed to drive the module under test)

Initial Equipment Configuration.

- Use a 75 Ω coaxial cable to connect the external input of the module under test to the output of the 75Ω back-terminated signal source (for example, another AWVG1 Generator module or an AVG1 Generator module).

- Use a second 75 Ω coaxial cable to connect the top output of the AWVG1 Generator module under test to channel A on the video measurement set.

- Attach a 75 Ω termination to the channel A loop-through on the video measurement set.

Test Signal.

If the signal source is an AWVG1 Generator module, load the test signals from file **awvgtest.dnl** into the TG 2000 Signal Generation Platform (see *Loading Test Signals* on page 4–4), and then select the **VM700 Lum. Ramp** signal using the following steps:

1. Push the **Modules** button on the TG 2000 Platform mainframe.

2. Select the AWVG1 Generator module under test.

3. Touch **CW DC VM Test** on the display.

4. Touch **NTSC** on the display until the **VM700 Lum. Ramp** signal is selected.

If the signal source is an AVG1 Generator module, follow equivalent steps in the *AVG1 Analog Video Generator Service Manual* to select the **Ramp** signal (available in file **vm_test.dnl**).

Measurement setup.

1. On the VM700T front panel, push the **Waveform** button, and then push the **Menu** button.

2. On the display, touch **Sync**, and then touch **Sync A**.

3. Touch **Change Sampling** until *Synchronous* is displayed (a 3-way toggle). The display should show a video waveform with *525 line NTSC* displayed in the lower left corner.

NOTE. The VM700T may lose sync if it is not in NTSC mode (Loss of sync will be displayed). To autodetect the video format, use the following substeps:

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    a. On the front panel, push the **Measure** button.

    b. If the video measurements submenu is not displayed, touch **Video Options**, and then touch **Video**.

    c. Use the knob and touch screen to select **Video_Standard**.

    d. Push **Waveform**.

4. On the VM700T front panel, push the **Waveform** button, and then push the **Menu** button.

5. On the display, touch **Filter Select**, and then touch **No Filter**.

6. On the VM700T front panel, push the **Waveform** button, and then push the **Menu** button.

7. On the display, touch **Clamp Couple**, and then touch **DC Coupling**.

8. On the VM700T front panel, push **Waveform**, and then push **Select Line**.

9. On the touch screen, touch **Field 1 or 2** and **Field 3 or 4** so that both are lit.

10. Turn the knob to select any non-blanked line (lines 21–250).

11. Select the external input on the AWVG1 Generator module under test using the following substeps:

    a. Select the AWVG1 Generator module module under test.

    b. Push the **Test Signals** button on the TG 2000 Platform mainframe.

    c. Touch **EXTERNAL INPUT** on the display.

Procedure: Linearity.

The video measurement set compares the input and output signals, and calculates the linearity error.

1. Measure the linearity at the input to the AWVG1 Generator module under test using the following procedure:

   a. Disconnect the 75 Ω cables from the external input and top output of the AWVG1 Generator module under test. Use the BNC barrel to connect these two cables together. (This removes the module under test without changing other connections.)

   b. On the VM700T front panel, push the **Measure** button.

   c. If the video measurement menu is not displayed, touch **Video Options**, and then touch **Video**.

   d. Use the knob and touch screen to select **Luminance Nonlinearity**.

   e. On the VM700T front panel, push the **Menu** button, and then touch **Average Num**.

   f. Use the knob to set the average number to 100.

   g. On the VM700T front panel, push the **Average** button until the LED is lit.

   h. On the VM700T front panel, push the **Menu** button, and then touch **Relative to Ref**.

   i. Touch **Use (1) Reference** and **Use (2) Reference** until both are deselected.

   j. Push the **Menu** button, and then touch **Rescale**, **Reference**, and **Store (1) Reference**.

2. Measure the linearity at the output of the AWVG1 Generator module under test, relative to the input using the following procedure:

   a. Remove the BNC barrel, and connect the 75 Ω cables to the external input and top output of the AWVG1 Generator module under test.

   b. On the VM700T front panel, push **Waveform**, and check that the ramp signal is connected.

   c. On the VM700T front panel, push the **Measure** button, and then use the knob and touch screen to select **Luminance Nonlinearity**.

     d. On the VM700T front panel, push the **Menu** button, and then touch **Relative to Ref** and **Use (1) Reference**.

     e. Check that peak-peak measurement value displayed is within ±0.5% of zero.

3. Repeat steps 1 and 2 for the middle and bottom outputs, moving the cable from the top to the middle and bottom outputs as you proceed.

*NOTE. Push the **Average** button twice on the VM700T each time you move the cable to another output. This will clear the average saved in the VM700T and enable Average again.*

4. Move the cable to the top output on the AWVG1 Generator module under test.

Procedure: Differential phase and differential gain.

The differential gain and differential phase are measured with a modulated 5-step signal. This signal is included on line 18 of the **VM700 Lum. Ramp** signal from the AWVG1 Generator module. The video measurement set calculates the relative differential phase and differential gain based on the input and output DGDP measurements.

*NOTE. If the signal source is an AVG1 Generator module, select the **NTSC Mod Ramp** signal from the **vm_test.dnl** test signal file.*

1. On the VM700T front panel, push **Waveform**, then push **Select Line**, then on the touch screen select **Field 1 line 18**. This should display a video line that has a modulated 5-step signal.

2. Measure the differential phase and differential gain at the input to the AWVG1 Generator module test using the following procedure:

     a. Disconnect the 75 Ω cables from the external input and top output of the AWVG1 Generator module under test. Use the BNC barrel to connect these two cables together. (This removes the module under test without changing other connections.)

     b. On the VM700T front panel, push the **Measure** button

     c. If the video measurement menu is not displayed, touch **Video Options**, and then touch **Video**.

     d. Use the knob and touch screen to select **DGDP**.

      e. On the VM700T front panel, push the **Menu** button, and then touch **Average Num**.

      f. Use the knob to set the average number to 100.

      g. On the VM700T front panel, push the **Average** button until the LED is lit.

      h. On the VM700T front panel, push the **Menu** button, and then touch **Relative to Ref**.

      i. Touch **Use (1) Reference** and **Use (2) Reference** until both are deselected.

      j. Push the **Menu** button, and then touch **Rescale**, **Reference**, and **Store (1) Reference**.

3. Measure the differential phase and differential gain at the output of the AWVG1 Generator module under test relative to the input using the following procedure:

      a. Remove the BNC barrel, and connect the 75 Ω cables to the external input and top output of the AWVG1 Generator module under test.

      b. On the VM700T front panel, push **Waveform**, and check that the ramp signal is connected.

      c. On the VM700T front panel, push the **Measure** button, and then use the knob and touch screen to select **DGDP**.

      d. On the VM700T front panel, push the **Menu** button, and then touch **Relative to Ref** and **Use (1) Reference**.

      e. Check that the differential gain is within $\pm 0.5\%$ of zero.

      f. Check that the differential phase is within $\pm 0.5°$ of zero.

4. Repeat steps 2 and 3 for the middle and bottom outputs, moving the cable from the top to the middle and bottom outputs as you proceed.

---

*NOTE. Push the **Average** button twice on the VM700T each time you move the cable to another output. This will clear the average saved in the VM700T and enable Average again.*

External Input Gain and DC Offset

Use this procedure to verify the gain and offset of the external input. Gain and offset are calculated by measuring two DC levels at the output and at the input. For measuring levels at the input, a precision 75 Ω feed-through termination is used in place of the internal termination in the module under test.

Test Equipment Required.

- Digital multimeter (for example, a Tektronix DM5120 digital multimeter)

- 75 Ω feed-through termination (precision 75 Ω required)

- 75 Ω coaxial cables (BNC male on each end)

- BNC barrel (female on each end), or BNC T connector

- 75 Ω back-terminated signal source (for example, another AWVG1 Generator module or an AVG1 Generator module) needed to drive the module under test

Initial Equipment Configuration.

- Use a 75 Ω coaxial cable to connect the external input of the AWVG1 Generator module under test to the output of the back-terminated 75 Ω signal source (for example, another AWVG1 Generator module or an AVG1 Generator module).

- Connect the 75 Ω feed-through termination to the top output of the AWVG1 Generator module under test.

- Use a second 75 Ω coaxial cable to connect the digital multimeter to the 75 Ω feed-through termination at the output of the module under test.

Test Signal.

If the signal source is an AWVG1 Generator module, load the test signals from file **awvgtest.dnl** into the TG 2000 Signal Generation Platform (see *Loading Test Signals* on page 4–4), and then use the following steps to select the **DC zero volts** test signal:

1. Push the **Modules** button on the TG 2000 Platform mainframe.

2. Select the AWVG1 Generator module under test.

3. Touch **CW DC VM TEST** on the display.

4. Touch **DC Levels** until the **DC zero volts** signal is selected.

If the signal source is an AVG1 Generator module, follow equivalent steps in the *AVG1 Analog Video Generator Service Manual* to select the **dc000** test signal. (These signals are available in the **dc_level.dnl** test signal file included with the AVG1 Generator module service manual.)

Measurement setup.

Select the external input on the AWVG1 Generator module under test as follows:

1. Select the AWVG1 Generator module module under test.

2. Push the **Test Signals** button on the TG 2000 Platform mainframe.

3. Touch **EXTERNAL INPUT** on the display.

Procedure.

1. The value displayed on the digital multimeter is the output DC offset. Record this value in Table 4–6.

2. Touch **CW DC VM TEST** on the display.

3. Touch **DC Levels** until the **DC 700mV** signal is selected.

4. Subtract the DC offset found in step 1 from the value currently displayed on the digital multimeter to calculate the output amplitude. Record the amplitude value in Table 4–6.

Table 4–6: Gain and DC offset calculation table

Test	Output	Source	Formula
DC zero volts			From digital multimeter
DC 700mV			From digital multimeter
Amplitude			DC zero volts – DC 700mV
	Requirement	**External input**	
Offset	Zero $\pm$ 10mV		DC zero volts: Output – Source
Gain	1.00 $\pm$ 0.01		Amplitude: Output ÷ Source

5. Disconnect the 75 Ω feed-through termination from the module under test and install the BNC barrel onto the 75 Ω feed-through termination.

6. Disconnect the cable at the external input of the module under test and attach it to the BNC barrel. This removes the module under test without changing other connections.

NOTE. If you are using an AVG1 Generator module as the signal source, skip steps 7 and 8.

7. Touch **CW DC VM TEST** on the TG 2000 Platform mainframe display.

8. Touch **DC Levels** until the **DC zero volts** signal is selected.

9. The value displayed on the digital multimeter is the source DC offset. The difference between the output offset and the source offset is the offset of the external input. The value of the external input should be within ± 10 mV of zero.

10. Touch **CW DC VM TEST** on the display (touch **AVG1 AUTOTEST** if you are using an AVG1 Generator module as the signal source).

11. Touch **DC Levels** until the **DC 700mV** signal is selected (touch **DC_Pos** until **dc700** is selected if you are using an AVG1 Generator module as the signal source).

12. Subtract the source DC offset from the value displayed on the digital multimeter to calculate the source amplitude. The output amplitude divided by the source amplitude is the gain through the external input. This value should be within ± 1% of unity.

External Input Frequency Response

Use this procedure to verify external amplitude flatness over the bandwidth. Continuous sinewave signals (700 mV_{pp} centered on ± 350 mVdc) are measured with a peak-to-peak detector. The peak-to-peak detector measurements are relative to the 0.1 MHz reference signal of a characterized source. The external input frequency response is calculated from the output and source amplitude measurements.

Test Equipment Required.

- Digital multimeter (for example, a Tektronix DM5120 digital multimeter)

- Peak-to-peak detector amplifier

- Peak-to-peak detector head

- Coaxial cables

- AWVG1 Generator module to serve as a signal source for the AWVG1 Generator module under test

Initial Equipment Configuration.

■ Connect the top output of the signal source AWVG1 Generator module to the external input of the AWVG1 Generator module module under test.

■ Connect the peak-to-peak detector head directly to the top output of the AWVG1 Generator module under test.

■ Connect the peak-to-peak detector head to the peak detector amplifier + Input.

■ Connect the peak-to-peak detector amplifier output to the digital multimeter.

Test Signal.

Load the test signals from file **awvgtest.dnl** into the TG2000 Platform mainframe (see *Loading Test Signals* on page 4–4), and then select the 0.1 MHz signal using the following steps:

1. Push the **Modules** button on the TG 2000 Platform mainframe.

2. Select the AWVG1 Generator module under test.

3. Touch **CW DC VM Test** on the display.

4. Touch **CW < 1 MHz** on the display until the **SW 0.10MHz 700.0mVpp** signal is selected.

NOTE. Measure the 0.1 MHz value often during this procedure. The peak-to-peak detector head is sensitive to temperature changes.

Procedure. Output amplitude

1. Record the 0.1 MHz value in the *Output* column of Table 4–7.

2. Touch **CW 1MHz to 9.99MHz** on the display, and then touch **SW 1.00MHz 700.0mVpp**.

3. Read the peak-to-peak output from the digital multimeter, and then subtract the 0.1 MHz peak detector reading. Record the result of this subtraction in the *Output* column of Table 4–7.

4. Repeat steps 1 through 3 to select the other 700 mV$_{pp}$ CW signals shown in Table 4–7, touching the following options on the display as needed:

■ **CW 10MHz to 19.99MHz**

■ **CW 20MHz to 30MHz**

Table 4–7: External input frequency response

| Frequency | Requirement | Relative to 0.1 MHz | | Frequency Response |
		Output	Source	
0.1 MHz	— —			
1 MHz	($\pm$ 2% of unity) 1.00 ± 0.02			
2.5 MHz	($\pm$ 2% of unity) 1.00 ± 0.02			
5 MHz	($\pm$ 2% of unity) 1.00 ± 0.02			
7.5 MHz	($\pm$ 2% of unity) 1.00 ± 0.02			
10 MHz	($\pm$ 4% of unity) 1.00 ± 0.04			
12.5 MHz	($\pm$ 4% of unity) 1.00 ± 0.04			
15 MHz	($\pm$ 4% of unity) 1.00 ± 0.04			
17.5 MHz	($\pm$ 4% of unity) 1.00 ± 0.04			
20 MHz	($\pm$ 4% of unity) 1.00 ± 0.04			
22.5 MHz	($\pm$ 4% of unity) 1.00 ± 0.04			
25 MHz	($\pm$ 4% of unity) 1.00 ± 0.04			
28 MHz	($\pm$ 4% of unity) 1.00 ± 0.04			
30 MHz	($\pm$ 4% of unity) 1.00 ± 0.04			

Procedure. Source amplitude

NOTE. If the output frequency response for the source AWVG1 Generator module has already been characterized, these measurements do not need to be repeated.

1. Disconnect the AWVG1 Generator module under test from the source AWVG1 Generator module.

2. Connect the peak-to-peak detector head to the source AWVG1 Generator module.

3. Select the **SW 0.10MHz 700.0mVpp** signal again and record the value from the digital multimeter in the source column of Table 4–7.

4. Repeat steps 2 through 4 of the *Output amplitude* procedure to select the other 700 mV$_{pp}$ CW signals shown in Table 4–7. Record the results of the subtraction in the *Source* column of Table 4–7.

5. Record the results of the following equation in the *Frequency Response* column of Table 4–7. The results at each frequency should be within the limits shown in Table 4–7.

The frequency response is the ratio of the output and source amplitudes. Add 700mV to the relative measurements, then divide the output by the source measurements.

$$Frequency\ response\ =\ \frac{rel\_output\ +\ 700}{rel\_source\ +\ 700}$$

You have now completed the performance verification procedures.

Test Record

Serial number	Procedure performed by	Date of Performance Verification	Date mainframe last calibrated

Test	Passed	Failed
Self Cal		

Characteristic	AWVG1 generator module test result			
	Top	Middle	Bottom	Input
Output DC offset				
Output absolute amplitude				
Output relative amplitude				
Output frequency response				
to 19.99 MHz				
to 27.99 MHz				
to 30 MHz				
Field Time Distortion				
Line Time Distortion				
K-Factor (2T5 Pulse)				
Signal to Noise (Output)				
to 5.99 MHz				
to 29.99 MHz				
to 300 MHz				
Signal to Noise (Input)				
to 5.99 MHz				
to 29.99 MHz				
to 300 MHz				

Characteristic	Top	Middle	Bottom	Input
Crosstalk				
from Internal source				
to 6 MHz				
to 30 MHz				
from External source				
to 6 MHz				
to 30 MHz				
Return Loss				
Input DC offset				
Input amplitude error				
Input linearity				
Input differential gain				
Input differential phase				
Input frequency response				
to 6 MHz				
to 30 MHz				

Adjustment Procedures

Adjustments

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

NOTE. Allow the TG 2000 Platform mainframe to warm up for at least 20 minutes before making any adjustments to the AWVG1 Generator module.

Required Equipment

Table 5–1 lists the equipment required for the *Adjustments* procedure.

Table 5–1: Equipment required for adjustments

Equipment	Tektronix equivalent
Power Extender board	Tektronix part number 671-2879-XX
Precision Oscilloscope	Tektronix DSA602A Digital Signal Analyzer with an 11A34 module
Peak Detector Amplifier	Tektronix 015-0408-00
Peak Detector Head	Tektronix 015-0413-00
Voltmeter and probe	Tektronix DM2510 Digital Multimeter
AVG1 Generator module	Tektronix AVG1 Generator module
BNC Termination, 75 Ω	Tektronix part number 011-0102-01
BNC Termination, feed-through, 75 Ω	Tektronix part number 011-0055-01
Low-Loss BNC cables, 75 Ω	Tektronix part number 012-0074-00
BNC splitter or T-connector	Tektronix part number 103-0030-00

Preparation for Adjustment Procedures

Perform the following tasks before making adjustments to the AWVG1 Generator module:

- Back up the test signals currently loaded in your TG 2000 Platform mainframe (optional).

- Create presets of your module configuration (optional).

- Install an AVG1 Generator module (if not already installed).

- Install an extender board into the mainframe.

- Inspect the board that you will be adjusting.

- Install the AWVG1 Generator module board that you will be adjusting.

- Power on and let the instrument warm up.

- Run self cal.

- Load the test signals.

Instrument Back Up   In order to adjust an AWVG1 Generator module that is already installed in your TG 2000 Platform mainframe, you must remove the module and install an extender board (page 5–3). However, when you remove a module, you lose any test signals that are stored in memory, unless you first create back-up disks of those signals. You can then restore your signals using the back-up disks you created. Alternatively, you can restore standard AWVG1 test signals, using the Test Signals disk shipped with this manual.

Use the *Instrument Backup* procedure described on page 2–8 to create back-up disks.

Create Preset   Before beginning the adjustment procedures, create a preset file 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.

Install the AVG1 Generator Module

The adjustment procedures use signals generated by the AVG1 Generator module. If not already installed, install the AVG1 Generator module using the *Hardware Installation* procedure beginning on page 2–2.

Install the AWVG1 Generator Module Extender Board

The adjustment procedures in this section require that you make adjustments to components on the AWVG1 Generator module board. In order to provide access to these components during the procedures, you must first install an extender board. which you can order from Tektronix.

1. Disconnect all power and signal inputs to the TG 2000 Signal Generation Platform and ensure that the power switch is off.

2. Remove the AWVG1 Generator module board using the *Module Removal* procedure beginning on page 2–10.

⚠ *CAUTION. The connectors must exactly match before you attempt to press the extender board 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.*

3. Insert the extender board into the slot used for your AWVG1 Generator module. Ensure that the connectors on the mother board and the extender board exactly match before seating the extender board.

Inspect the AWVG1 Generator Module Board

Look closely at the AWVG1 Generator module circuit board and the Delay board, checking for missing parts and bad solder bridges. Note any modifications made to the circuit boards.

Install the AWVG1 Generator Module

1. Ensure that the power to the TG 2000 Signal Generation Platform and all inputs to the mainframe are disconnected.

2. Install the AWVG1 Generator module onto the extender board. Ensure that the connectors on the extender board and the module exactly match before seating the module board.

3. Install 75 Ω terminations on the top, middle, and bottom, outputs of the AWVG1 Generator module.

Power On and Warm Up   Use the following procedure to power on the TG 2000 Signal Generation
Platform.

1. Connect the TG 2000 Platform mainframe to an AC power source appropri-
   ate for your system.

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

3. Press the front-panel POWER switch.

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.

---

*NOTE. Allow 20 minutes of warm-up time before making any adjustments to the
instrument.*

Self Cal   When you perform Self Cal, you replace the original calibration file with a new
one. Use the following steps to perform the Self Cal procedure.

1. Push the **Utilities** button.

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

   a. **Module Self Cal**

   b. **AWVG1:X Self Cal** (X represents the slot number of the module under
      test)

   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.

4. Push the Modules button.

5. Touch **AWVG1:X** on the display (X represents the slot number of the
   module under test).

Loading Test Signals   The *Adjustments* procedure requires you to load test signals in the AWVG1
Generator module.

If you have more than one AWVG1 Generator module loaded, or if you have the
optional memory upgrade installed, you may have enough memory capacity to
add these signals to the AWVG1 Generator module. To do this, use the *Add
Signals* procedure. If you do not have extended memory, you must replace the
AWVG1 Generator module signals. To replace signals, use the *Replace Signals*
procedure on page 5–6.

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

1. Insert the AWVG1 Service disk (provided 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 **.dnl** file you want to add.

6. Press the **Select** button.

7. When the new window opens, use the **Navigation** arrow to move the cursor
    to the **AWVG1** folder on the right side of the display.

8. Press the **Select** button.

9. Touch **Quit/Load**.

10. Touch **Quit/Load** again to return to the Add Signals window.

11. Touch **Select Destination**.

12. Use the right **Navigation** arrow to move the cursor to the **AWVG1** folder on
    the right side of the display.

13. Press the **Select** button.

14. Touch **Quit/Load**.

15. Touch **Start Load**. (If the tagged amount will not fit in the destination, go to
    the *Replace Signals* procedure.)

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

17. Touch **Quit**.

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

NOTE. If you are using only standard signals and settings, then you can use the test signal disks that are shipped with the module user manual to restore the signals at the end of the Adjustments procedure. In this case, you do not need to perform the Instrument Backup.

1. To save the instrument signals and settings, perform the *Instrument Backup* procedure described on page 2–8.

2. Insert the AWVG1 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 **.dnl** file you want to add.

6. Press the **Select** button.

7. When the Replace screen appears, use the right **Navigation** arrow to move the cursor to the **AWVG1** folder.

8. Press 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 **Yes**.

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

Adjustment Procedures

Complete the procedures described in *Preparation for Adjustment Procedures* (page 5–2) before beginning these procedures. To properly adjust the AWVG1 Generator module, perform the procedures in this section in the sequence given.

Unless otherwise noted, all test points and components referred to in the following procedures refer to test points and components on the AWVG1 Generator module board. Refer to Figure 5–1 on page 5–7 for locations of these test points and components.

NOTE. The test signals used for the adjustment procedures are DC signals. You can use either 50 Ω or 75 Ω coaxial cables for these procedures.

Reference Voltage Adjustment

Equipment Required.

- Digital multimeter with probe

Initial Equipment Configuration.

- Connect the negative (−) probe of the digital multimeter to ground at the ground test point just above test point 129 (TP129).

Procedure.

1. Ensure that the power to the TG 2000 Signal Generation Platform is off.

2. Using the positive (+) probe, check that the voltage at pin 32 of U46 and U47 on the AWVG1 Generator module board is > 4 V.

3. Hold down the **Modules** button and cycle the power on the TG 2000 Platform mainframe.

4. Repeat step 2. The reading from the multimeter should be > 4.7 V.
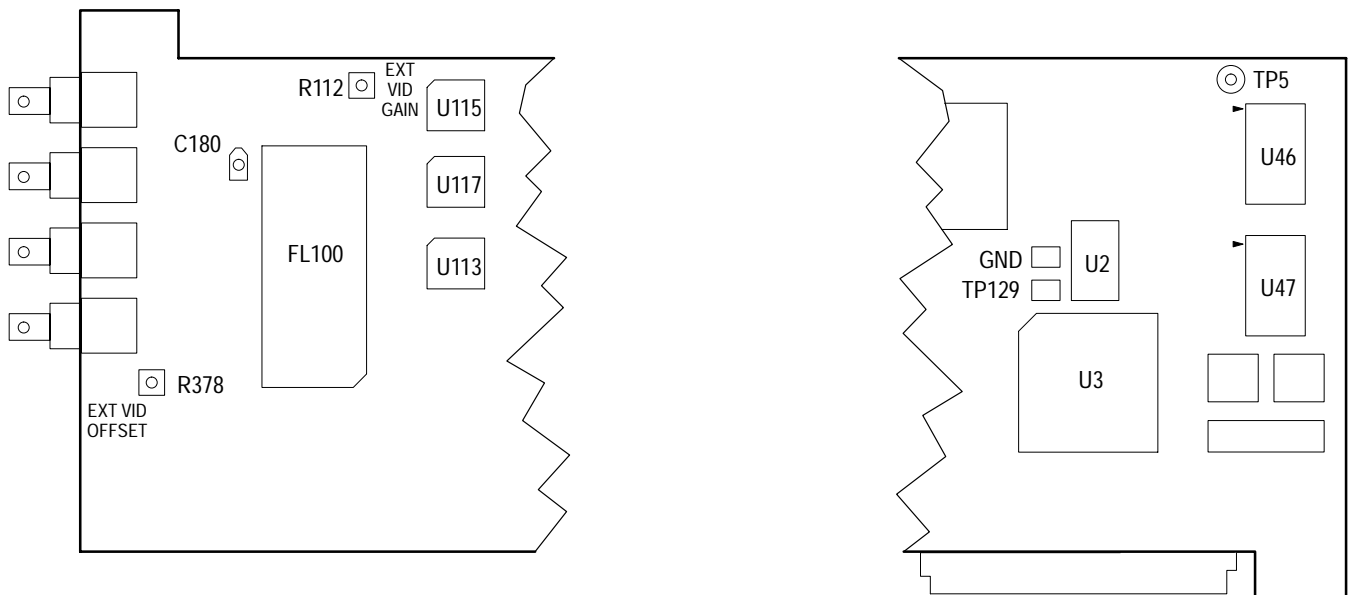
Figure 5–1: Locations of the adjustments on the AWVG1 Generator module board.

5. Connect the (+) probe to TP5 on the AWVG1 Generator module board.

6. Adjust R368 until the digital multimeter reads 1.2500 V.

7. On the TG 2000 Platform mainframe keypad, press number **1 (Reconfigure only changed modules)**.

Rerun Self Cal   Use the *Self Cal* procedure on page 5–4.

Frequency Response   **Test Equipment Required.**

■ Peak-to-peak detector head

■ Peak-to-peak detector amplifier

Initial Equipment Configuration.

■ Connect the peak-to-peak detector (+) input through the peak-to-peak detector head to the top output on the AWVG1 Generator module.

■ Connect the peak-to-peak detector output to Channel 1 on the 11A34 module.

Procedure. Frequency response coarse adjustment

1. Load **awvg1cal.dnl** test signals into the TG 2000 Platform mainframe. (See *Loading Test Signals* on page 5–5.)

2. Select the **1–30 MHz Field Sweep** signal using the following substeps:

    a. Press the **Modules** button on the TG 2000 Platform mainframe.

    b. Touch **AWVG1:X** (X represents the AWVG1 Generator module under test) on the display.

    c. Touch **NTSC** until the **Field Sweep 1–30 MHz** signal is selected.

3. Adjust the level knob on the peak-to-peak detector amplifier until the green LED lights.

4. If you are using a Tektronix DSA602A Digital Signal Analyzer, go to step 5. Otherwise, set the oscilloscope parameters as indicated in Table 5–2.

Table 5–2: Oscilloscope settings for frequency response adjustment

Setting	Parameter	Value
Vertical	Span/div	5 mV/div
	DC coupled	On
	Input	1 MΩ
	Offset	As needed
Horizontal	Span/div	2 ms/div
Trigger	Fast Trigger, –25 mV, auto mode, DC coupled	

5. Recall the frequency response settings on the digital signal analyzer.

   a. Press the **Store/Recall** button in the DSA front panel.

   b. Touch **Recall Settings**.

   c. Touch **AW_FRESP**.

6. Adjust the Offset on the oscilloscope to center the low frequency (left) end of the trace on the display.

7. Adjust C180 Comp for the flattest display.

Procedure. Frequency response fine adjustment and check

1. Press **Short CW's** on the TG 2000 Platform mainframe display until the **0.1 MHz** test signal is selected.

2. Adjust the level knob on the peak-to-peak detector amplifier until the green LED lights.

3. On the oscilloscope, adjust Offset to vertically center the trace on the display.

4. Press **Short CW's** on the TG 2000 Platform mainframe display to cycle through the four CW test signal frequencies. Watch the vertical movement of the trace on the oscilloscope to check that the frequency and amplitude limits listed in Table 5–3 are met.

Table 5–3: Frequency response amplitude limits - Short CWs

Frequency	Amplitude limits
0.1 MHz	0.0 V
15 MHz	< ± 7 mV
27.5 MHz	< ± 14 mV
30 MHz	< ± 21 mV

NOTE. The green LED on the peak-to-peak detector may go out, and red lights come on, as you cycle through the CW frequencies. Do not *readjust the level and Offset settings, except at the 0.1 MHz frequency.*

5. Readjust C180 Comp if necessary to balance the 27.5 MHz and 30 MHz traces around the 0.1 MHz trace.

6. Press **Long CW's** on the TG 2000 Platform mainframe display to cycle through the twelve CW test signal frequencies. Watch the vertical movement of the trace on the oscilloscope to check the frequency and amplitude limits listed in Table 5–4 are met.

Table 5–4: Frequency response amplitude limits - Long CWs

Frequency	Amplitude limits
0.1 MHz	0.0 V
1 to 20 MHz	< ± 7 mV
22.5 to 27.5 MHz	< ± 14 mV
28 to 30 MHz	< ± 21 mV

7. Carefully readjust C180 Comp to balance all frequencies inside the specified limits.

8. Disconnect the peak-to-peak detector head from the AWVG1 Generator module.

External Input Gain   **Test Equipment Required.**

- AVG1 Generator module

- Oscilloscope with an 11A34 module (for example, a Tektronix DSA602A Digital Signal Analyzer)

- 75 Ω feed-through termination (Tektronix part number, 011-0055-01)

- BNC cables (Tektronix part number, 012-0074-00)

Initial Equipment Configuration.

- Using BNC cable, connect the AVG1 Generator module Channel 1 output to the AWVG1 Generator module input.

- Connect a 75 Ω feed-through termination to the top output of the AWVG1 Generator module.

- Using BNC cables and a splitter or T-connector, connect the feed-through termination at the top output on the AWVG1 Generator module to Channels 1 and 3 of the 11A34 module.

Procedure.

1. If you are using a Tektronix DSA602A Digital Signal Analyzer, go to step 2. Otherwise, set the oscilloscope parameters as indicated in Table 5–5.

Table 5–5: Oscilloscope settings for the input gain adjustment

Setting	Parameter	Value
Vertical Channels 1 and 2	Span/div	2 mV/div
	Input	1 MΩ
	Bandwidth	20 MHz
	Offset	0.0 mV
Vertical Channels 3 and 4	Span/div	2 mV/div
	Input	1 MΩ
	Bandwidth	200 MHz
	Offset	700 mV
Horizontal	Span/div	2 ms/div
Trigger	Fast Trigger, –25 mV, auto mode, DC coupled	

2. Recall the input gain settings on the digital signal analyzer using the following substeps:

   a. Press the **Store/Recall** button in the DSA front panel.

   b. Touch **Recall Settings**.

   c. Touch **INP_GAIN**.

3. Load the **awvg_avg.dnl** test signals into the TG 2000 Platform mainframe. (See *Loading Test Signals* on page 5–5.)

4. Select the **dc000** signal using the following substeps:

   a. Push the **Modules** button on the TG 2000 Signal Generation Platform.

   b. Touch **AVG1:X** on the TG 2000 Platform mainframe display (X represents the slot number for the module driving the test signal), and then touch **Auto Test**.

   c. Touch **dc_pos** on the display until the **dc000** signal is selected.

5. Enable the external input on the AWVG1 Generator module using the following substeps:

   a. Press the **Modules** button on the TG 2000 Platform mainframe.

   b. Touch **AWVG1:X** on the display (X represents the slot for the module under test), and then touch **NTSC**.

   c. Touch **EXTERNAL INPUT**.

6. On the AWVG1 Generator module, adjust R378 (external video offset), until the two traces overlay each other.

7. On the TG 2000 Platform mainframe display, touch **dc_pos** until the **dc700** signal is selected.

8. On the AWVG1 Generator module, adjust R112 (external video gain), until the two traces overlay each other.

External Video Offset

1. Remove the cable from the AWVG1 Generator module input and install a 75 Ω termination.

2. If you are using a Tektronix DSA602A Digital Signal Analyzer, go to step 3. Otherwise, set the oscilloscope parameters as indicated in Table 5–5 on page 5–11.

3. Recall the input gain settings on the digital signal analyzer using the following substeps:

    a. Press the **Store/Recall** button in the DSA front panel.

    b. Touch **Recall Settings**.

    c. Touch **INP_GAIN**.

4. Select the **dc000** test signal using the following substeps:

    a. Press the **Modules** button on the TG 2000 Platform mainframe.

    b. Touch **AWVG1:X** on the display (X is slot number for the module under test).

    c. Touch **NTSC**, and then touch **DC Levels** until the **dc000** signal is selected.

5. Note the placement of the trace on the oscilloscope display.

6. Touch **EXTERNAL INPUT** on the TG 2000 Platform mainframe display.

7. Adjust R378 (external video offset) until the trace is at the same position on the oscilloscope.

---

*NOTE. Alternate between the **dc000** signal and **External Input** as you adjust the external video offset to make sure the traces lie on top of one another.*

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 AWVG1 Generator module in the same slot as it was before beginning the adjustments. Refer to *Module Installation* on page 2–2.

Restore Signals

If you performed an instrument backup before beginning the *Adjustments* procedure, restore the signals now, using the procedure on page 2–9. If you did not perform an instrument backup, load the AWVG1 Test Signal disks supplied with the *AWVG1 Wideband 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 *Adjustments* procedure. Press the **Select** key.

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

You have completed the adjustments procedures.

Maintenance

Maintenance

This section contains instructions and procedures for maintaining the AWVG1 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:

- Preparation

- Inspection and Cleaning (preventive maintenance)

- After repair adjustments

- Repackaging instructions

- Removal and replacement procedures

- Troubleshooting procedures

If the instrument does not function properly, take troubleshooting and corrective measures 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. **AWVG1: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.
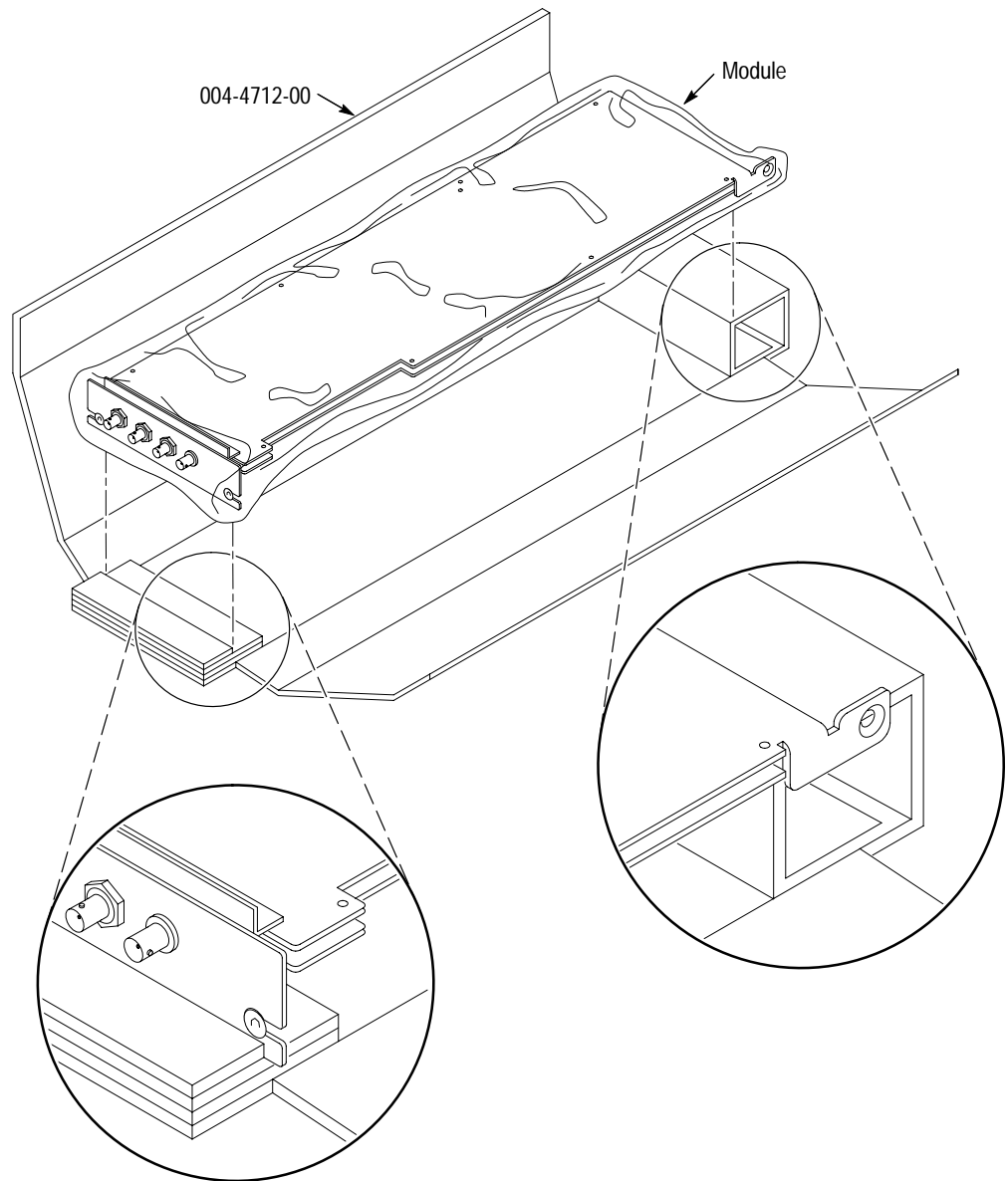
Figure 6–1: Placing the module in the protective wrapping

004-4713-00
2 Each

004-4712-00

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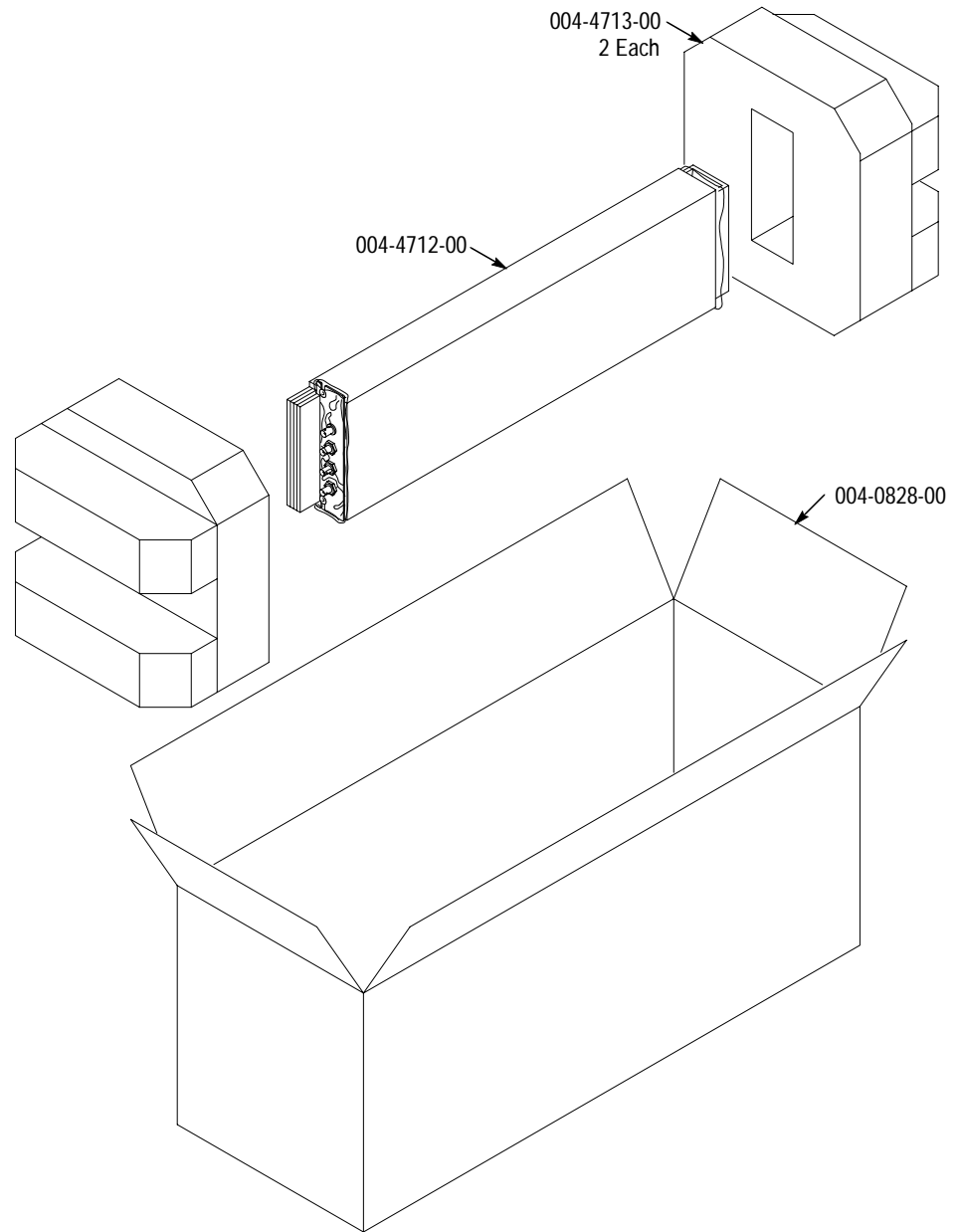
Figure 6–2: Placing the module in the shipping carton

Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the AWVG1 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
#1 point Philips tip	Removing the AWVG1 circuit board from the shield
9/16 inch box wrench	Removing the rear panel

Replacing Subassemblies

There is one subassembly (Delay circuit board) attached to the AWVG1 circuit board. To remove this board, perform the following procedure:

1. Perform *Signal Backup* on page 2–8.

2. Use the *Module Removal* procedure on page 2–10 to remove the AWVG1 Generator module from the mainframe.

3. Remove the subassembly from the AWVG1 Generator module by moving the retaining tabs away from the Delay board and swinging the board down and out. See Figure 6–3.
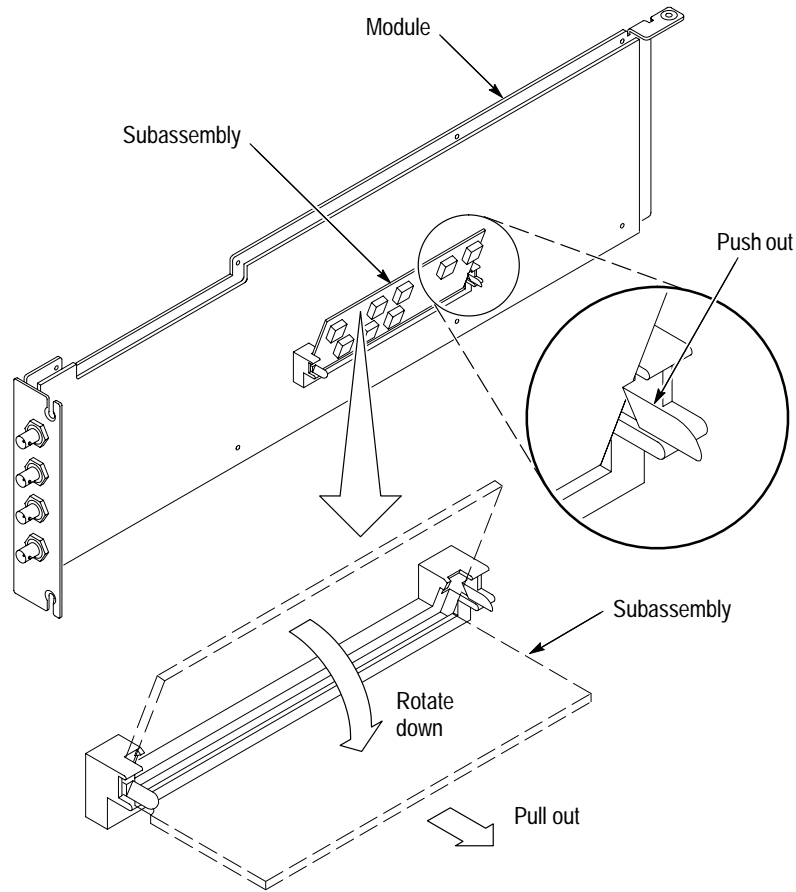
Figure 6–3: Removing a subassembly from a module

Removing the Rear Panel

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

1. Perform *Signal Backup* on page 2–8.

2. Use the *Module Removal* procedure on page 2–10 to remove the AWVG1 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 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 6–8.

2. Using the T-10 Torx tip, remove the eight screws that attach the AWVG1 Generator module circuit board to the shield.

3. Using great care not to bend or flex the circuit board, pull it out until the 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 but do not 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.

7. Position the module so that the flange hangs over the edge of the work surface, and the shield is flat on the work surface. See Figure 6–4. Tighten the eight screws that attach the shield to the circuit board.

Overhang flange
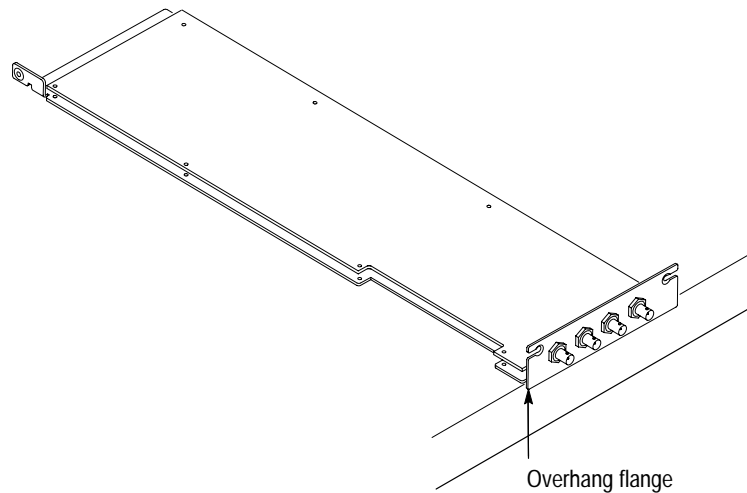
Figure 6–4: Position the shield flat on the work surface

Replacing the Rear Panel Connectors

It is usually not necessary to replace the rear panel connectors (shown in the *Replaceable Parts List*, Figure 10–1). 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 AWVG1 Generator module.

2. Carefully unsolder the damaged connector (at J1, J2, J3, or J4) from the back side of the board.

3. To replace the connector, reverse the procedure.

4. Replace the shield using the procedure described in *Replacing the Shield* on page 6–9.

Troubleshooting Procedures

This section contains instructions and procedures for troubleshooting the AWVG1 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 AWVG1 Generator module.

Instrument Backup
Before you begin any troubleshooting procedures, perform Instrument Backup on page 2–8. You will need approximately four blank, IBM-formatted disks on which to save instrument settings. (The number of disks depends on the number of installed modules and the complexity of the stored signals.)

⚠

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. The power up diagnostic information is also 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.

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. Push 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 AWVG1 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 module to Tektronix for repair or replacement, be sure to include the following:

- The disk containing the console ring file

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

- Description of the problem

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 6–11.

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
Wrong signal on output	page 6–17
Missing output signal	page 6–17
Signals lost after power down	page 6–18
Mainframe hangs up on operation of module	page 6–19
System locks up upon power up	page 6–20

Troubleshooting Flowcharts

The troubleshooting flowcharts provide a series of steps to help you determine whether the AWVG1 Generator module is faulty. Each chart relates to an entry in Table 6–3.
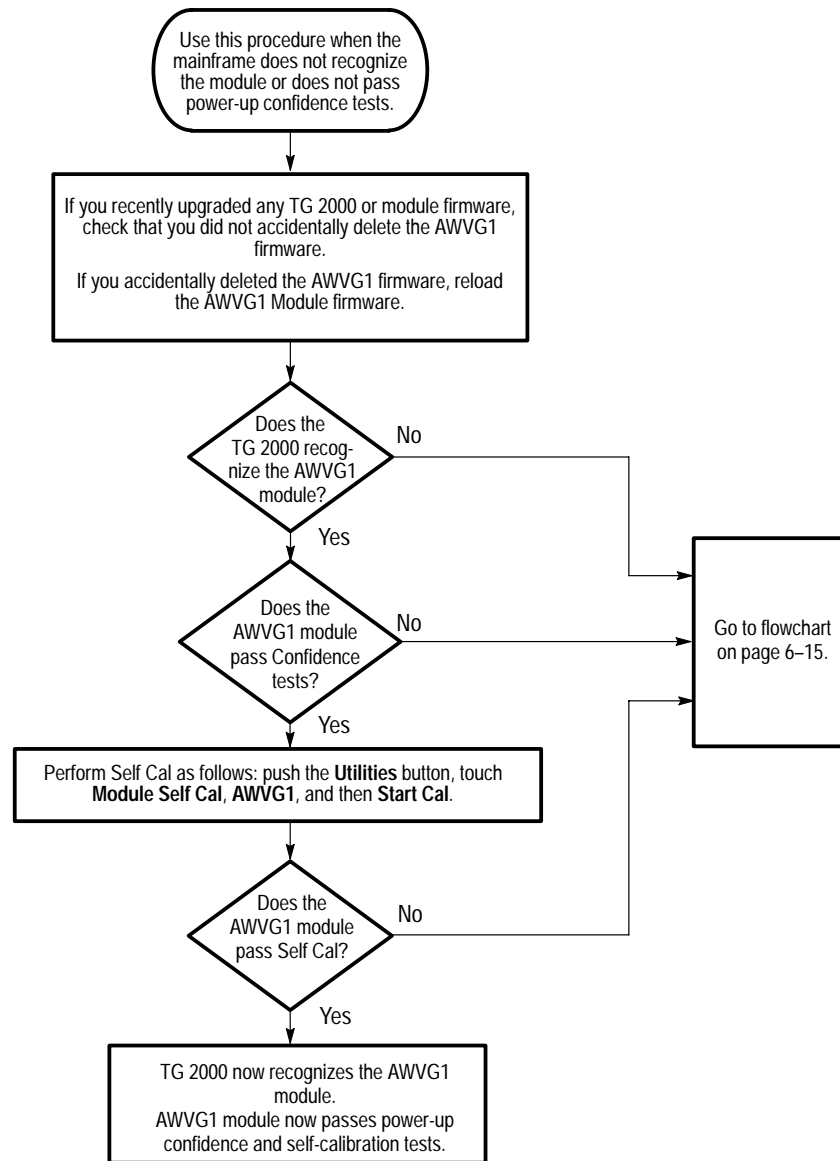
Figure 6–5: Flowchart for major difficulties with module

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

Figure 6–7: Flowchart for checking the module in a different slot

Use this procedure when
you get the wrong signal on
the output.

Make sure the correct
signal sets are installed.

Make sure you are using
the correct video standard.

Figure 6–8: Flowchart for wrong signal on output

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

Make sure the module 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.

Recycle power to run confi-
dence test and use Figure 6–5.

Figure 6–9: Flowchart for missing output signal

```
                    ╭─────────────────────────╮
                    │ Use this procedure when  │
                    │ your module's signals    │
                    │ are lost after powering  │
                    │ down the mainframe.      │
                    ╰─────────────────────────╯
                               │
                               ▼
```

Is more than one module affected? — No → Check that the Backplane board pins are not bent on the affected module.

Move the affected module to another slot.

(Is more than one module affected?) — Yes ↓

Check that the backup battery wires are connected.

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

Does the affected module operate in the new slot? — No → Replace the affected module.

(Does the affected module operate in the new slot?) — Yes ↓

Look for bent backplane pins or replace the Backplane board.

Is the battery voltage ok? — No → Check Power Supply charging circuit.

Remove the cable from J2 on the Power Supply board and measure pin 7 (See Figure 6–11) for +4.7 V with rear panel power on, +0.5 V with rear-panel power off.

(Is the battery voltage ok?) — Yes ↓

Check the Backplane board for bent pins.

Is the battery charging circuit ok? — Yes → The problem is likely the backup battery, but it could be the Backplane board or the CPU module.

(Is the battery charging circuit ok?) — No ↓

Replace the Power Supply module.

Figure 6–10: Flowchart for signals lost after power down

Figure 6–11: Measuring the battery charging circuit
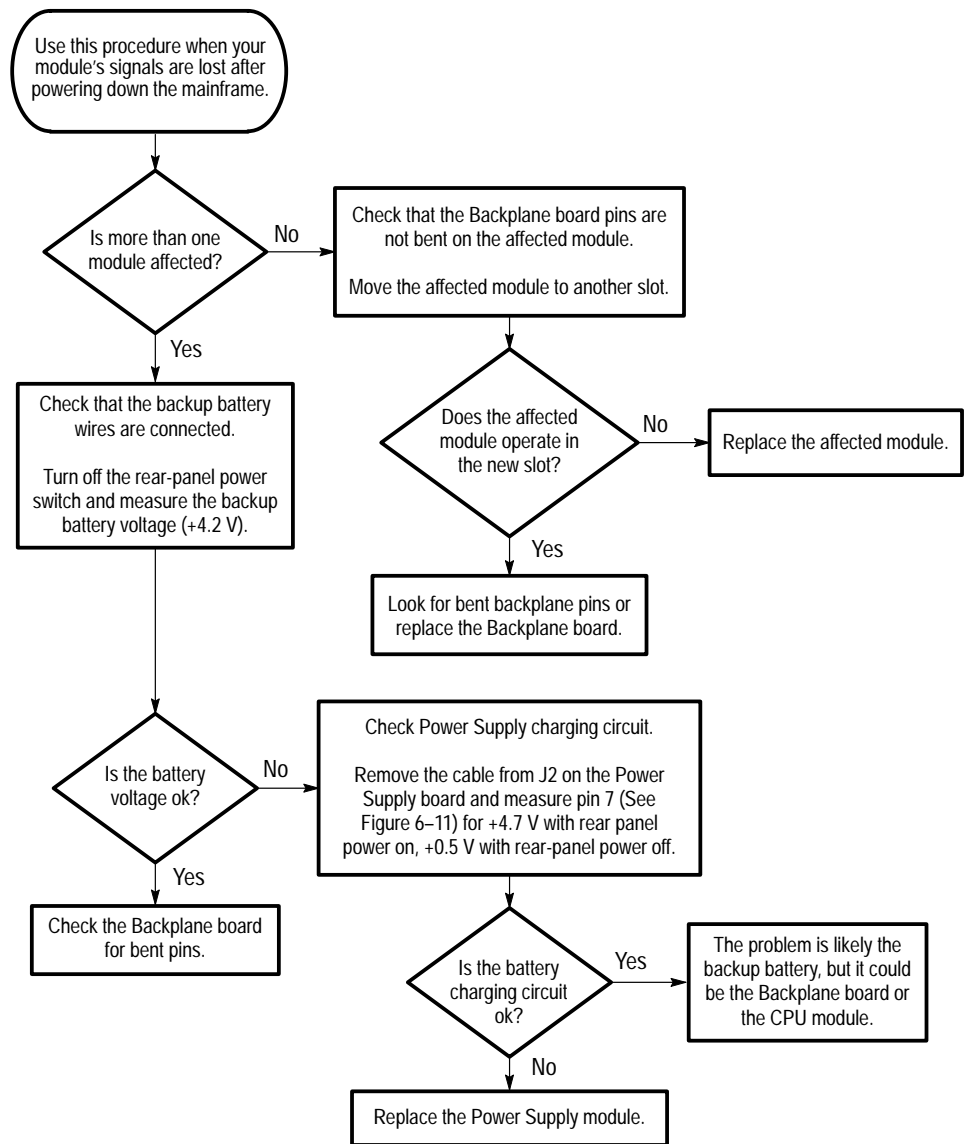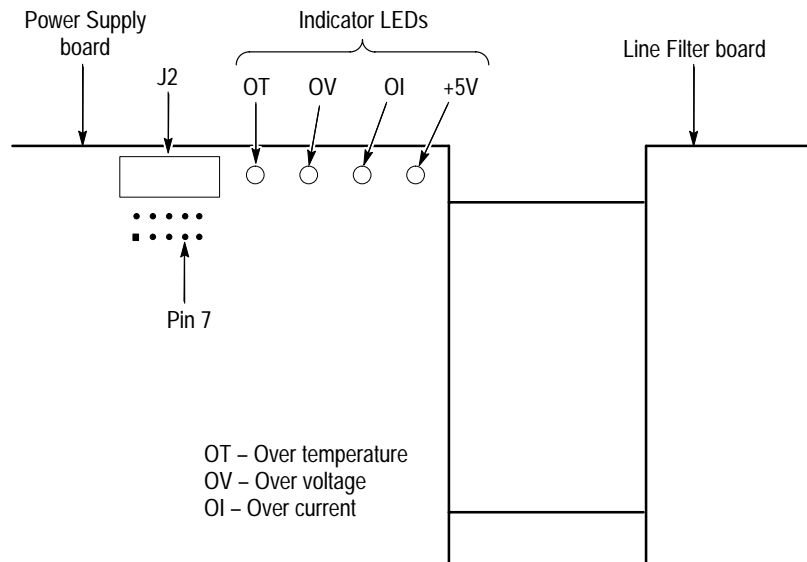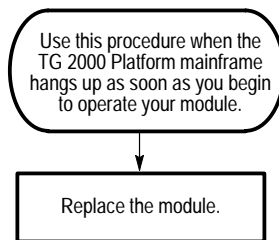

Figure 6–12: Flowchart for mainframe locking up on operation of module

Use this procedure if the mainframe locks up and you suspect the AWVG1 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 AWVG1 Confidence Tests. Note whether the AWVG1 Generator module passed the diagnostic. Note the highest number to appear.

Did the AWVG1 pass power-up tests?

Yes → Problem is probably in another module. Refer to *Troubleshooting* in the *TG 2000 SIgnal Generation Platform Service Manua*l.

No

Using the Module Removal procedure on page 2–10, remove the affected module from the mainframe.

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 lock up?

Yes → Problem is probably in another module. Refer to *Troubleshooting* in the *TG 2000 SIgnal Generation Platform Service Manual*.

No

Reinstall the AWVG1 Module in another slot. If the mainframe locks up during AWVG1 confidence tests, replace the module.
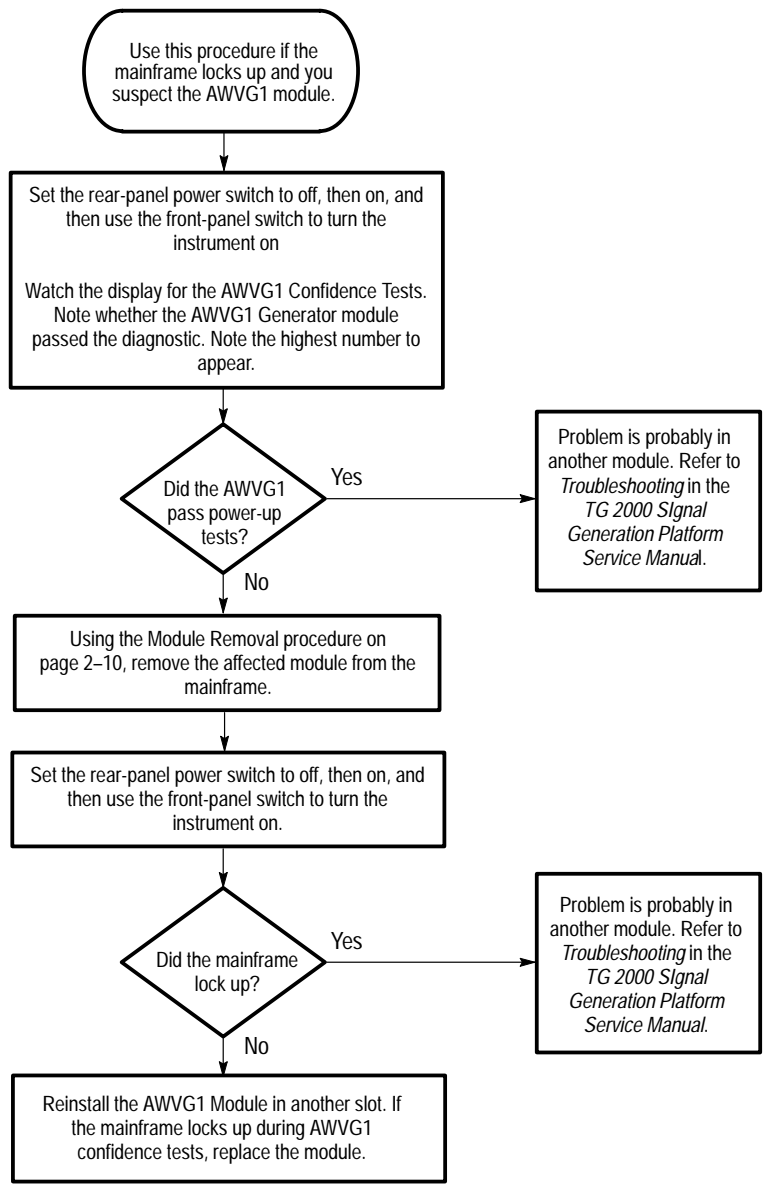
Figure 6–13: Flowchart for system locking up on power up

Options

Options

There are no options available for use with the AWVG1 Generator module.

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

Figure 9–1 shows how the AWVG1 Wideband Video Generator module 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*.

Block diagrams of the AWVG1 Wideband Video Generator module are located in the *Theory of Operation* section, beginning on page 3–1.
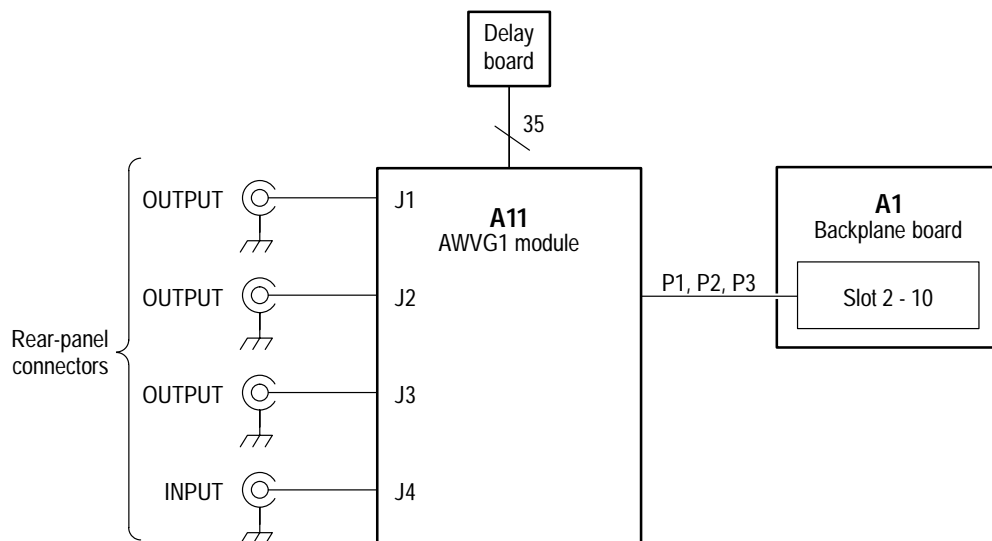

Figure 9–1: AWVG1 module connections

Replaceable Mechanical Parts

Replaceable Parts

This section contains a list of the replaceable modules for the AWVG1 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.

Change information, if any, is located at the rear of this manual.

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, extension 6630.

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

This section contains a list of the mechanical and/or electrical components that are replaceable for the . Use this list to identify and order replacement parts. 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
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
0KB01	STAUFFER SUPPLY CO	810 SE SHERMAN	PORTLAND, OR 97214–4657
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077–0001
01536	TEXTRON INC	1818 CHRISTINA ST	ROCKFORD, IL 61108

Replaceable Parts List

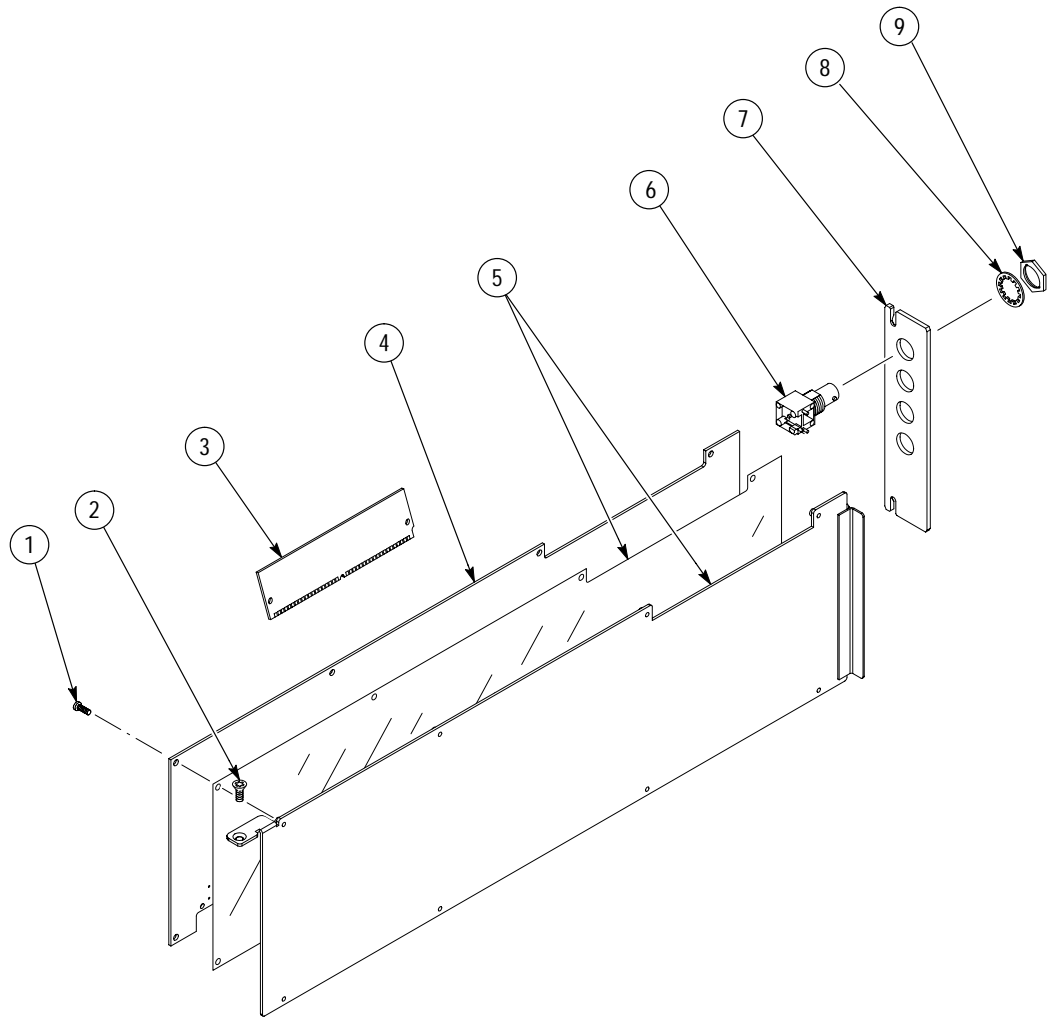| Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
10–1–1	211–0408–00			8	SCR,ASSEM WSHR:4–40 X 0.250,PNH,STL,ZINC,T–10 TORX	0KB01	211–0408–00
10–1–2	211–0725–00			2	SCREW,MACHINE:6–32 X 0.375,FLH TORX	01536	ORDER BY DESCR
10–1–3	671–3104–01			1	CKT BD ASSY:DELAY	80009	671–3104–01
10–1–4	672–0346–00			1	CIRCUIT BD ASSY:ANALOG WIDEBAND VIDEO GENERATOR	80009	672–0346–00
10–1–5	337–3942–01			1	SHIELD ELEC:ALUMINUM	80009	337–3942–01
10–1–6	131–3378–00			4	CONN,RF JACK:BNC,50 OHM	00779	227677–1
10–1–8	210–1039–00			4	WASHER,LOCK:0.521 ID,INT,0.025 THK,SST	0KB01	1224–02–00–0541C
10–1–9	220–0497–00			4	NUT,PLAIN,HEX:0.5–28 X 0.562 HEX,BRS CD PL	73743	ORDER BY DESCR
10–1–7	333–4171–00			1	PANEL,REAR:REAR PANEL,AWVGI,5.200 X 1.240,ALUM	80009	333–4171–00
					STANDARD ACCESSORIES		
	070–9051–XX			1	MANUAL,TECH:USERS,AWVG1 MODULE	80009	070–9051–XX
					OPTIONAL ACCESSORIES		
	070–9302–XX			1	MANUAL,TECH:SERVICE,AWVG1 MODULE	80009	070–9302–XX
	671–2879–XX			1	EXTENDER BOARD	80009	671–2879–XX

Figure 10–1: Exploded View