Service Manual

Tektronix

TG700
TV Signal Generator Platform

TG700 TV Signal Generator Platform
AG7 Audio Generator
AGL7 Analog Genlock Module
ATG7 Analog Test Generator
AVG7 Analog Video Generator
AWVG7 Analog Wideband Video Generator
BG7 Black Generator
DVG7 Digital Video Generator
HDLG7 HD Dual Link Video Generator
HDVG7 HDTV Digital Video Generator

070-A800-57

Warning
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

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This volume contains the following service manuals:

- TG700 TV Signal Generator Platform Service Manual
- AG7 Audio Generator Service Manual
- AGL7 Analog Genlock Module Service Manual
- ATG7 Analog Test Generator Service Manual
- AVG7 Analog Video Generator Service Manual
- AWVG7 Analog Wideband Video Generator Service Manual
- BG7 Black Generator Service Manual
- DVG7 Digital Video Generator Service Manual
- HDLG7 HD Dual Link Video Generator Service Manual
- HDVG7 HDTV Digital Video Generator Service Manual

Service Manual

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TV Signal Generator Platform

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

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

Warranty 15

Tektronix warrants that the products that it manufactures and sells will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If a product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

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

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

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General Safety Summary

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

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

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

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

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

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

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

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

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

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

No Power Switch. The power supply cord is considered the disconnecting device; disconect the main power by means of the power cord.

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.*

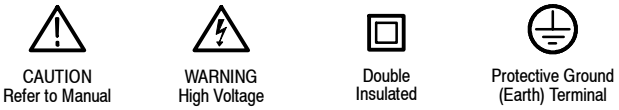
Terms on the Product. These terms may appear on the product:

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:



Service Safety Summary

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

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

Disconnect Power. To avoid electric shock, disconnect the mains power by means of the power cord or, if provided, the power switch.

Use Care When Servicing With Power On. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

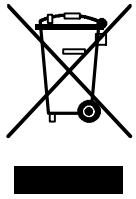
Environmental Considerations

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

Product End-of-Life Handling

Observe the following guidelines when recycling an instrument or component:

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



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

Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive. This product is known to contain lead, cadmium, and hexavalent chromium.

Preface

This is the service manual for the TG700 TV Signal Generator Platform. This manual contains information needed to service a TG700 to the module level.

Manual Structure

This manual is divided into sections, such as *Specifications* and *Theory of Operation*. Further, some sections are divided into subsections, such as *Product Description* and *Removal and Installation Procedures*.

Sections containing procedures also contain introductions to those procedures. Be sure to read these introductions because they provide information needed to do the service correctly and efficiently. The following are brief descriptions of each manual section.

- *Specifications* contains a description of the TG700 and the characteristics that apply to it.
- *Theory of Operation* contains circuit descriptions that support service to the module level.
- *Performance Verification* contains procedures for confirming that a TG700 functions properly and meets warranted characteristics.
- *Adjustment Procedures* contains procedures for adjusting a TG700 to meet warranted characteristics.
- *Maintenance* contains information and procedures for performing preventive and corrective maintenance for a TG700. These instructions include cleaning, module removal and installation, and fault isolation to the module level.
- *Options* contains a description of available options for the TG700.
- *Diagrams* contains a block diagram and an interconnect diagram.
- *Replaceable Parts List* includes a table of all replaceable modules, their descriptions, and their Tektronix part numbers.

Manual Conventions

This manual uses certain conventions with which you should become familiar.

Some sections of the manual contain procedures for you to perform. To keep those instructions clear and consistent, this manual uses the following conventions:

- Names of front panel controls and menus appear in the same case (initial capitals, all uppercase, etc.) in the manual as is used on the TG700 front panel and menus.
- Instruction steps are numbered unless there is only one step.
- **Bold** text refers to specific interface elements that you are instructed to select, click, or clear.

  Example: Press the **ENTER** button to access the PRESET submenu.
- *Italic* text refers to document names or sections. Italics are also used in NOTES, CAUTIONS, and WARNINGS.

  Example: The *Diagrams* section, beginning on page 9-1, includes a block diagram and an interconnect diagram.

Modules

Throughout this manual, any replaceable component, assembly, or part of the TG700 is referred to generically as a module. In general, a module is an assembly (like a circuit board), rather than a component (like a resistor or an integrated circuit). Sometimes a single component is a module. For example, the chassis of the TG700 is a module.

Safety

Symbols and terms related to safety appear in the *General Safety Summary* and *Service Safety Summary* near the beginning of this manual.

Finding Other Information

Other documentation for the TG700 includes:

- The *TG700 TV Signal Generator Platform User Manual* (Tektronix part number 070-A799-XX) contains a tutorial to quickly describe how to operate the TG700. It also includes an in-depth discussion on how to more completely use the TG700 features.

Introduction

This manual contains information needed to properly service the TG700 TV Signal Generator Platform, as well as general information critical to safe and effective servicing.

To prevent personal injury or damage to the TG700, consider the following before attempting service:

- The procedures in this manual should be performed only by a qualified service person.
- Read the *General Safety Summary* and the *Service Safety Summary,* beginning on page v.

When using this manual for servicing be sure to follow all warnings, cautions, and notes.

Performance Check Interval

Generally, the performance check described in section 3, *Performance Verification*, should be done every 12 months. In addition, a performance check is recommended after module replacement.

If the TG700 does not meet performance criteria, repair is necessary.

Strategy for Servicing

Throughout this manual, the term “module” refers to any field-replaceable component, assembly, or part of the TG700.

This manual contains all the information needed for periodic maintenance of the TG700 (examples of such information are procedures for checking performance).

Further, the manual contains all information for corrective maintenance down to the module level. To isolate a failure to a module, use the fault isolation procedures found in *Troubleshooting*, part of section 5, *Maintenance*. To remove and replace any failed module, follow the instructions in *Removal and Installation Procedures*, also part of section 5. After isolating a faulty module, replace it with a fully-tested module obtained from the factory. Section 8, *Replaceable Parts List,* contains part number and ordering information for all replaceable modules.

Tektronix Service Offerings

Tektronix provides service to cover repair under warranty as well as other services that may provide a cost-effective answer to your service needs.

Whether providing warranty repair service or any of the other services listed below, Tektronix service technicians are well trained to service the TG700. They have access to the latest information on improvements to the TG700 as well as the latest new options.

Warranty Repair Service

Tektronix warrants this product for one year from date of purchase. The warranty appears after the title page in this manual. Tektronix technicians provide warranty service at most Tektronix service locations. The Tektronix product catalog lists all worldwide service locations or you can visit our Web site for service information: www.tektronix.com.

Self Service

Tektronix supports repair to the module level by providing Module Exchange.

Module Exchange. This service reduces down-time for repair by allowing you to exchange most modules for remanufactured ones. Each module comes with a 90-day service warranty.

For More Information. Contact your local Tektronix service center or sales engineer for more information on any of the repair or adjustment services just described.

Specifications

Product Overview

The TG700 TV Signal Generator Platform is a multiformat TV signal generator platform supporting both analog and digital video standards. The TG700 consists of a mainframe and up to four plug-in modules. The modules are either signal generators or they provide special functions, such as genlock capability.

Key Features

The TG700 and the available modules provide the following features:

- Simultaneous generation of HDTV/SDTV multi format synchronized signal and test signal
- Modular architecture with up to four generators or special function modules
- Analog genlock function dealing with NTSC or PAL black burst signal, HDTV trilevel sync signal, and CW signals (AGL7).
- Independent setting of amplitudes, frequencies, and audio clicks of 16 channel embedded audio signal (DVG7 and HDVG7)
- Circle, logo, and text overlays on test signals (DVG7 and HDVG7)
- Moving picture generation function by scrolling the active area of the signal (DVG7 and HDVG7)
- Reference generator performance level
- Ethernet interface for remote control and downloading various files such as signal files, logo files, and preset files

A signal library and various application software are included in the attachment CD-ROM to execute the following operations:

- Upload and download files such as signal files, logo files, and preset files
- Download the signals from the signal library to the TG700
- Create a logo (logo file) to be inserted into the test signal
- Create a frame picture file using the generation of a picture or test pattern

Specifications

Tables 1-1 through 1-3 list the electrical, environmental, and mechanical characteristics of the TG700 mainframe. For the specifications of a specific generator module or other module, refer to the module User manual. Table 1-4 lists the certification and compliances.

The performance requirements listed in the electrical characteristics portion of these specifications apply over an ambient temperature range of 0 °C to +50 °C. The rated accuracies are valid when the instrument is calibrated at an ambient temperature range of +20 °C to +30 °C, after a warm-up time of 20 minutes.

Electrical Characteristics

Table 1-1: Electrical characteristics

Characteristic	Performance requirements	Reference information
The number of modules that can be installed	Maximum 4	Only a limited number of some modules can be installed in a TG700 mainframe: AGL7 Maximum 1 AVG7 Maximum 2 AWVG7 Maximum 2 HDVG7 Maximum 2
Clock		
Stability	< 1 ppm/year	
AC power source		
Rating voltage		100 V to 240 VAC
Voltage range		85 V to 250 VAC
Frequency range		48 Hz to 63 Hz
Maximum power		100 W
Maximum current		1.2 A
Heat Dissipation		
Maximum power		100 W maximum. Maximum line current is 1.2 A rms at 50 Hz
Surge current		≤ 40 A peak for equal or less than 5 line cycles, after the instrument has been turned off for at least 30 seconds.

Environmental Characteristics

Table 1-2: Environmental characteristics

Characteristic	Description
Temperature	
Operating	0 °C to +50 °C
Nonoperating	-20 °C to +60 °C
Relative Humidity	
Operating	20% to 80% (No condensation) Maximum wet-bulb temperature 29.4 °C
Nonoperating	5% to 90% (No condensation) Maximum wet-bulb temperature 40.0 °C
Altitude	
Operating	To 4.5 km (15,000 feet) Maximum operating temperature decreases 1 °C each 300 m above 1.5 km.
Nonoperating	To 15 km (50,000 feet)
Vibration	
Operating	2.65 m/s^2 (0.27 G_{rms}), 5 to 500 Hz, 10 min, three axes
Nonoperating	22.3 m/s^2 (2.28 G_{rms}), 5 to 500 Hz, 10 min, three axes
Shock	
Nonoperating	294 m/s^2 (30 G), half-sine, 11 ms duration
Clearance	
Side	5 cm
Rear	5 cm

Mechanical Characteristics

Table 1-3: Mechanical characteristics

Characteristic	Description
Dimensions	
Height	44 mm
Width	438 mm
Depth	559 mm
Weight[1]	
Net	Approximately 5.5 kg (mainframe only, without rack rail)

1 **Total weight of the TG700 will vary depending on the number and type of modules installed.**

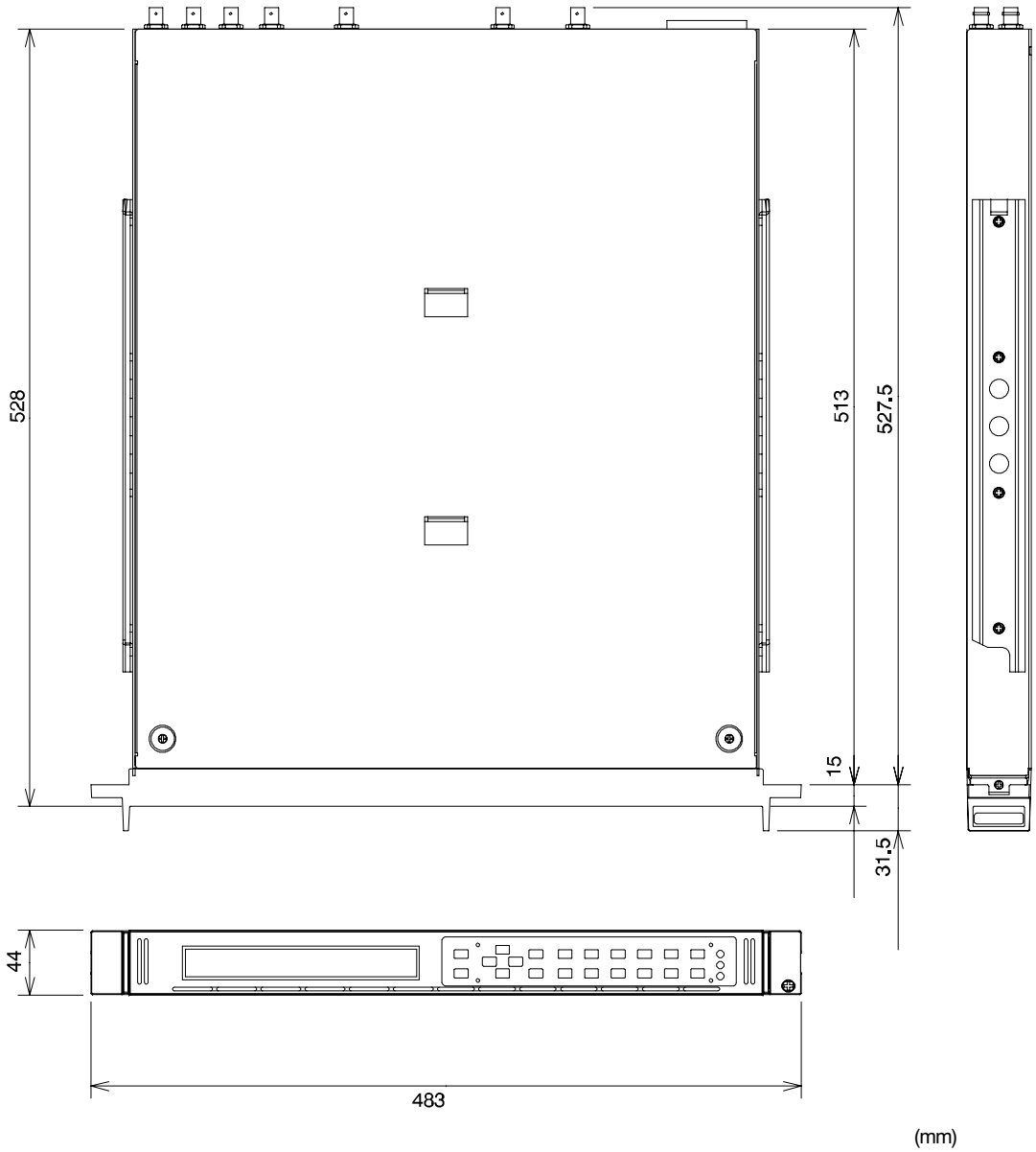


Figure 1-1: TG700 dimensions

Certifications and Compliances

Table 1-4: Certifications and compliances

Category	Standard or description
EC Declaration of Conformity - EMC	Meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EN 55103-1 Emissions: EN 55022 Class B — Radiated and Conducted Emissions EN 55103-1 Annex A — Magnetic Field Emissions EN 55103-1 Annex B — Power Line Inrush Current EN 61000-3-2 — AC Power Line Harmonic Current Emissions EN 61000-3-3 — Line Voltage Alteration and Flicker EN 55103-2 Immunity: EN 61000-4-2 — Electrostatic Discharge Immunity EN 61000-4-3 — RF Electromagnetic Field Amplitude Modulated EN 61000-4-4 — Electrical Fast Transient/Burst Immunity EN 61000-4-5 — AC Mains Surge Immunity EN 61000-4-6 — Conducted RF Immunity EN 61000-4-8 — Power Frequency Electromagnetic Field Immunity EN 61000-4-11 — Mains Voltage Dip & Interruption Immunity EN 55103-2 Annex A — Magnetic Field Immunity High-quality shielded cables must be used to ensure compliance to the above listed standards.
Australia/New Zealand Declaration of Conformity - EMC	Complies with EMC provision of Radiocommunications Act per the following standard(s): AS/NZS 3548 — Industrial, Scientific, and Medical Equipment: 1992
EC declaration of conformity- Low voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Union: Low Voltage Directive 73/23/EEC, amended by 93/69/EEC EN 61010-1/A2:1995 — Safety requirements for electrical equipment for measurement control and laboratory use.
U.S. nationally recognized testing laboratory listing	UL 3111-1 — Standard for electrical measuring and test equipment.
Canadian certification	CAN/CSA C22.2 No.1010.1 — CSA safety requirements for electrical and electronic measuring and test equipment.

Table 1-4: Certifications and compliances (cont.)

Category	Standard or description
Installation (Overvoltage) Category	Terminals on this product may have different installation (overvoltage) category designations. The installation categories are: CAT III Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location. CAT II Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected. CAT I Secondary (signal level) or battery operated circuits of electronic equipment.
Pollution Degree	A measure of the contaminates that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated. Pollution Degree 2 Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.
IEC Characteristics	Equipment type: Test and Measuring Installation Category II (as defined in IEC 61010-1, Annex J) Pollution Degree 2 (as defined IEC 61010-1) Safety Class I (as defined in IEC 61010-1, Annex H)–grounded product

Theory of Operation

Theory of Operation

This section describes the basic operation of the major circuit blocks or modules in the TG700. The Diagrams section, beginning on page 7-1, includes a block diagram and an interconnect diagram. Figure 7-1 shows the modules and functional blocks of the TG700. Figure 7-2 shows how the modules interconnect.

A10 Main Board

The A10 Main board consists of the following seven blocks.

CPU & Memory This block consists of CPU, 32 MB flash memory, and 16 MB RAM. The CPU controls the front panel, LCD display, and installed modules. It also controls execution of remote commands and downloading and uploading of signal files through the Ethernet interface. The flash memory holds the firmware data and signal data output from modules. For the Option FP another 32 MB flash memory is added, to hold frame picture data.

D/A Converter The block converts the digital data received from the AGL7 Analog Genlock module to analog voltage.

Oscillator This block generates four clock signals and supplies them to the installed modules: a 54 MHz master clock signal, a 14.43 MHz clock signal for D2, a 74.25 MHz or a 74.25/1.001 MHz clock signals for HD, and a 12.288 MHz clock signal for Audio. The master clock signal is generated from the 13.5 MHZ OCXO with high accuracy. The frequency is controlled by the 16 bit D/A converter.

Frame Pulse Generator This block generates three frame pulses used for multi format signal generation.

Module I/F This block provides the interface between the TG700 and the installed modules. It provides CPU related signals such as data bus and address bus, clock signals, power, and other control signals to the modules.

DC/DC Converter This block converts the +5 V power, supplied by the Power Supply module, to –5 V, 3.3V, 8 V, and 12 V.

Network Interface This block controls the Ethernet interface. The TG700 has a 10 BASE-T port on the rear panel.

Power Supply Module

The Power Supply module derives the +5 V power supply voltages from the AC line and supplies it to the A10 Main board.

Performance Verification

Performance Verification

This section provides procedures to verify the performance and functionality of the TG700.

Preparation for Performance Verification

Do the following before starting the performance verification procedures:

Power On Default Settings

Before you begin the performance verification procedures, make sure that the required instrument settings are saved in the Power On Default preset.

If the instrument settings are saved in the Power On Default preset, you can recall the settings after the performance verification procedures are completed by turning off and on the power.

Warm up

The TG700 and test equipment must have had a warm-up period of at least 20 minutes.

Equipment Required

Table 3-1 lists the equipment required for this procedure.

Table 3-1: Equipment required for Performance Verification

Item	No.	Minimum requirement	Recommended equipment
Analog genlock module	1		Tektronix AGL7
Frequency counter	1	Frequency range: 0.1 Hz to 1250 MHz Precision: 8 digits or higher	ANRITSU MF 1603A
75 Ω BNC cable	1	Length: 42 inches	Tektronix part number 012-0074-00
75 Ω feed-through terminator	1		Tektronix part number 011-0103-02

Calibration Data Report

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

Table 3-2: TG700 calibration data report

Serial Number:	Cal Date:	Temperature:	Humidity:

Step	Function Tested	Minimum	Cal Data	Maximum
1.	Subcarrier Frequency	3.5795418 MHz		3.5795490 MHz

Performance Verification Procedures

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

WARNING. *Dangerous electric shock hazards exist inside the TG700 mainframe. Only qualified service personnel should perform these procedures.*

Subcarrier Frequency

This test verifies the subcarrier frequency accuracy of black burst signals. The following equipment is required for the test:

- Frequency counter
- 75 Ω BNC cable
- 75 Ω feed-through terminator

Perform the following procedure to verify the subcarrier frequency accuracy of black burst signals.

1. Use the 75 Ω BNC cable and the 75 Ω feed-through terminator to connect the BLACK 1 connector on the AGL7 Generator module to the INPUT A connector on the frequency counter as shown in Figure 3-1.

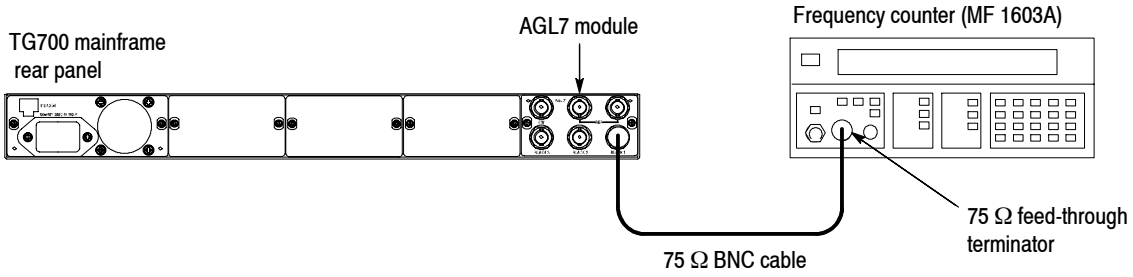


Figure 3-1: Equipment connection for verifying subcarrier frequency

2. Set the frequency counter to the frequency measurement mode (if necessary), and then set the Gate Time to < 2s.

3. Output the NTSC subcarrier calibration signal as follows:

   a. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode.

   b. Press the **MODULE** button to display the AGL7 main menu.

   c. Press the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.

   d. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button to access the OUTPUT submenu.

   e. Press the left (◀) or right (▶) arrow button to select **CAL**, and then press the **ENTER** button to access the SIGNAL submenu.

   f. Press the left (◀) or right (▶) arrow button to select **NTSC Subcarrier (1Vp-p)**, and then press the **ENTER** button.

4. Set the frequency counter to trigger on the input, and then verify that the displayed frequency is within the range of 3.5795418 MHz to 3.5795490 MHz.

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

Adjustment Procedures

Adjustment Procedures

This section contains information needed to adjust the TG700.

The only adjustment in the TG700 is for the master clock frequency.

Requirement for Adjustment

Before proceeding, note the following requirement.

Warm-Up Period

The TG700 requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. Adjustment done before the operating temperature has stabilized may cause errors in performance.

In addition, the signal generator requires appropriate warm-up time to meet the frequency accuracy.

Equipment Required

Table 4-1 lists the equipment required to adjust the master clock frequency.

Table 4-1: Equipment required

Item	No.	Minimum requirement	Recommended equipment
Analog genlock module	1		Tektronix AGL7
Signal generator	1	Frequency: 10 MHz ± 0.05 ppm Amplitude: 8 dBm	Agilent 8648A option 1E5
75 Ω BNC cable	1	Length: 42 inches	Tektronix part number 012-0074-00
50 Ω-to-75 Ω minimum loss attenuator	1		Tektronix part number 011-0057-01

Master Clock Frequency Adjustment

Procedure Perform the following procedure to adjust the master clock frequency.

Initial Setups.

Signal Generator:

Frequency . . . . . 10.000000 MHz
Output Level . . . . . 8 dBm

Procedure.

1. Use the 75 Ω BNC cable and the 50 Ω-to-75 Ω minimum loss attenuator to connect the CW connector on the AGL7 Genlock module to the output connector on the signal generator as shown in Figure 4-1.

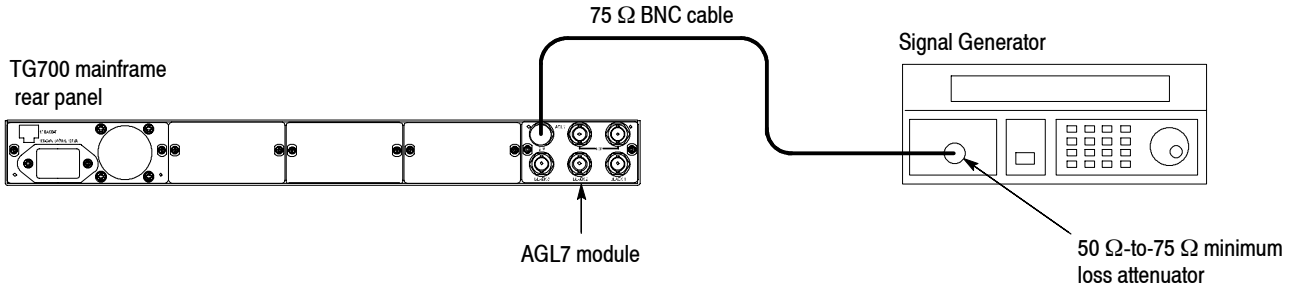


Figure 4-1: Equipment connection for adjusting master clock frequency

2. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode.
3. Set the genlock source to CW of the AGL7 Genlock module as follows:
   a. Press the **MODULE** button to display the AGL7 main menu.
   b. Press the up (▲) or down (▼) arrow button to select **GENLOCK**, and then press the **ENTER** button to access the GENLOCK submenu.
   c. Press the left (◀) or right (▶) arrow button to select **CW**, and then press the **ENTER** button.
   d. Press the **CANCEL** button to return the AGL7 main menu.

4. Press the **MODULE** button until the TG700 main menu is displayed.
5. Press the up (▲) or down (▼) arrow button to select **UTILITY**, and then press the **ENTER** button to access the UTILITY submenu.
6. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**, and then press the **ENTER** button.
7. Verify that the message **CALIBRATION result = 0xxxxx** is displayed.

   This completes the master clock frequency adjustment procedures.

Maintenance

Maintenance

This section contains the information needed to do periodic and corrective maintenance on the TG700. The following subsections are included:

- *Preparation* — Introduction plus general information on preventing damage to internal modules when doing maintenance.
- *Inspection and Cleaning* — Information and procedures for inspecting the TG700 and cleaning its external and internal modules.
- *Removal and Installation Procedures* — Procedures for the removal of defective modules and replacement of new or repaired modules.
- *Troubleshooting* — Information for isolating and troubleshooting failed modules. Included are instructions for operating the TG700's internal diagnostic routines and troubleshooting trees.

Related Maintenance Procedures

The following sections contain information and procedures related to maintenance.

- Section 2, *Theory of Operation*, contains a circuit description at the module or block level.
- Section 3, *Performance Verification*, contains procedures that may be useful in isolating problems to modules by testing the TG700 performance.
- Section 4, *Adjustment Procedures*, addresses after repair adjustment and the interval between periodic adjustments. It contains a procedure for adjusting the master clock frequency of the TG700.
- Section 7, *Diagrams*, contains a block diagram using individual modules as blocks and an interconnect diagram showing connections between the modules.
- Section 8, *Replaceable Parts List,* lists all field replaceable modules by part number.

Preparation

Before servicing this product, read the *Safety Summary* and *Introduction* at the front of the manual and the ESD information below.

CAUTION. *Static discharge can damage any semiconductor component in the TG700.*

Preventing ESD

When performing any service which requires internal access to the TG700, adhere to the following precautions to avoid damaging internal modules and their components due to electrostatic discharge (ESD).

1. Minimize handling of static-sensitive modules.
2. Transport and store static-sensitive modules in their static protected containers or on a metal rail. Label any package that contains static-sensitive modules.
3. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these modules. Do service of static-sensitive modules only at a static-free work station.
4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.
5. Handle circuit boards by the edges when possible.
6. Do not slide the modules over any surface.
7. Avoid handling modules in areas that have a floor or work-surface covering capable of generating a static charge.

Inspection and Cleaning

Inspection and Cleaning describes how to inspect for dirt and damage. It also describes how to clean the exterior and interior of the TG700. Inspection and cleaning are done as preventive maintenance. Preventive maintenance, when done regularly, may prevent TG700 malfunction and enhance its reliability.

Preventive maintenance consists of visually inspecting and cleaning the TG700 and using general care when operating it.

How often preventative maintenance should be performed depends on the severity of the environment in which the TG700 is used. A proper time to perform preventive maintenance is just before TG700 adjustment.

General Care

The top cover helps keep dust out of the TG700, and is needed to meet EMI and cooling requirements. The top cover should be in place when operating the TG700.

Inspection and Cleaning Procedures

Inspect and clean the TG700 as often as operating conditions require. The collection of dirt on components inside can cause them to overheat and breakdown. (Dirt acts like an insulating blanket, preventing efficient heat dissipation.) Dirt also provides an electrical conduction path that could cause a TG700 failure, especially under high-humidity conditions.

CAUTION. *Avoid the use of chemical cleaning agents that might damage the plastics used in this TG700. Use only deionized water when cleaning the menu buttons or front-panel buttons. Use an ethyl alcohol solution as a cleaner and rinse with deionized water.*

Inspection — Exterior. Inspect the outside of the TG700 for damage, wear, and missing parts, using Table 5-1 as a guide. A TG700 that appears to have been dropped or otherwise abused should be checked thoroughly to verify correct operation and performance. Immediately repair defects that could cause personal injury or lead to further damage to the TG700.

Table 5-1: External inspection check list

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

Cleaning Procedure — Exterior. To clean the TG700 exterior, perform the following steps:

1. Remove loose dust on the outside of the TG700 with a lint free cloth.
2. Remove remaining dirt with a lint-free cloth dampened in a general purpose detergent-and-water solution. Do not use abrasive cleaners.
3. Clean the light filter protecting the monitor screen with a lint-free cloth dampened with a gentle, general purpose detergent-and-water solution.

CAUTION. *To prevent getting moisture inside the* TG700 *during external cleaning, use only enough liquid to dampen the cloth or applicator.*

Inspection — Interior. To access the inside of the TG700 for inspection and cleaning, refer to the *Removal and Installation Procedures* in this section.

Inspect the internal portions of the TG700 for damage and wear, using Table 5-2 as a guide. Defects found should be repaired immediately.

CAUTION. *To prevent damage from electrical arcing, ensure that circuit boards and components are dry before applying power to the TG700*

Table 5-2: Internal inspection check list

Item	Inspect for	Repair action
Circuit boards	Loose, broken, or corroded solder connections. Burned circuit boards. Burned, broken, or cracked circuit-run plating.	Remove failed module and replace with a fresh module.
Resistors	Burned, cracked, broken, blistered condition.	Remove failed module and replace with a fresh module.
Solder connections	Cold solder or rosin joints.	Resolder joint and clean with isopropyl alcohol.
Capacitors	Damaged or leaking cases. Corroded solder on leads or terminals.	Remove damaged module and replace with a fresh module from the factory.
Semiconductors	Loosely inserted in sockets. Distorted pins.	Firmly seat loose semiconductors. Remove devices that have distorted pins. Carefully straighten pins (as required to fit the socket), using long-nose pliers, and reinsert firmly. Ensure that straightening action does not crack pins, causing them to break off.
Wiring and cables	Loose plugs or connectors. Burned, broken, or frayed wiring.	Firmly seat connectors. Repair or replace modules with defective wires or cables.
Chassis	Dents, deformations, and damaged hardware.	Straighten, repair, or replace defective hardware.

Cleaning Procedure — Interior. To clean the TG700 interior, perform the following steps:

1. Blow off dust with dry, low-pressure, deionized air (approximately 9 psi).
2. Remove any remaining dust with a lint-free cloth dampened in ethyl alcohol and rinse with warm deionized water. (A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards.)

STOP*. If, after performing steps 1 and 2, a module is clean upon inspection, skip the remaining steps.*

3. If steps 1 and 2 do not remove all the dust or dirt, the TG700 may be spray washed using a solution of ethyl alcohol by performing steps 4 through 8.
4. Gain access to the parts to be cleaned by removing easily accessible shields and panels (see *Removal and Installation Procedures*).
5. Spray wash dirty parts with the ethyl alcohol and wait 60 seconds for the majority of the alcohol to evaporate.
6. Use hot deionized water to thoroughly rinse them.
7. Dry all parts with low-pressure, deionized air.
8. Dry all components and assemblies in an oven or drying compartment using low-temperature circulating air.

Lubrication. There is no periodic lubrication required for the TG700.

Removal and Installation Procedures

This subsection contains procedures for removal and installation of almost all mechanical and electrical modules. Any electrical or mechanical module, assembly, or part listed in Section 8 of this manual is a module.

Preparation

WARNING. *Before performing this or any other procedure in this manual, read the* Safety Summary *found at the beginning of this manual. Also, to prevent possible damage to the TG700's components, read* Preventing ESD *in this section.*

This subsection contains the following items:

- Preparatory information that you need to properly perform the procedures that follow.
- List of tools required to remove and disassemble all modules.
- Two module locator diagrams for finding the External modules (see Figure 5-2) and Internal modules (see Figure 5-3), in the TG700.
- Procedures for removal and reinstallation of the electrical and mechanical modules.
- A disassembly procedure for removal of all the major modules from the TG700 at one time and for reassembly of those modules into the TG700. Such a complete disassembly is normally only done when completely cleaning the TG700. (Instructions for doing the actual cleaning are found under *Inspection and Cleaning* at the beginning of this section.)
- Module disassembly procedures.

WARNING. *Before performing any procedure in this subsection, disconnect the power cord from the line voltage source. Failure to do so could cause serious injury or death.*

General Instructions

Read these general instructions before removing a module.

First read over the *Summary of Procedures* that follows to understand how the procedures are grouped. Then read *Equipment Required* for a list of the tools needed to remove and install modules in the *TG700*.

If you are removing a module for service, begin by performing the *Access Procedure* (page 5-12). By following the instructions in that procedure, you remove the module to be serviced while removing the minimum number of additional modules.

Summary of Procedures

The procedures are described in the order in which they appear in this section. In addition, you can look up any procedure for removal and reinstallation of any module in the *Table of Contents* of this manual.

- The *Access Procedure* on page 5-12 first directs you to the procedure(s) (if any) that are required to access the module to be serviced, then it directs you to the procedure to remove that module.

Table 5-3: Summary of procedures

Procedure	Module		Page
Procedures for External Modules	■ Line cord ■ Top cover	■ Front-panel unit ■ Front-panel assembly	5-13
Procedures for Internal Modules	■ A10 Main board ■ Power supply module		5-18

Equipment Required. Most modules in this TG700 can be removed with a screwdriver handle mounted with a #2 Phillips tip. *Use this tool whenever a procedure step instructs you to remove or install a screw unless a different size screwdriver is specified in that step.* All equipment required to remove and reinstall each module is listed in the first step of its procedure.

Table 5-4: Tools required for module removal

Item No.	Name	Description	Tektronix part number
1	Screwdriver handle	Accepts Phillips-driver bits	
2	#1 Phillips tip	Phillips-driver bit for #1 size screw heads	
3	#2 Phillips tip	Phillips-driver bit for #2 size screw heads	
4	7mm Nut Driver	Socket or driver for 7mm nuts	

TG700 Orientation

In this manual, procedures refer to “front,” “rear,” “top,” etc. of the TG700. Figure 5-1 shows how the sides are referenced.

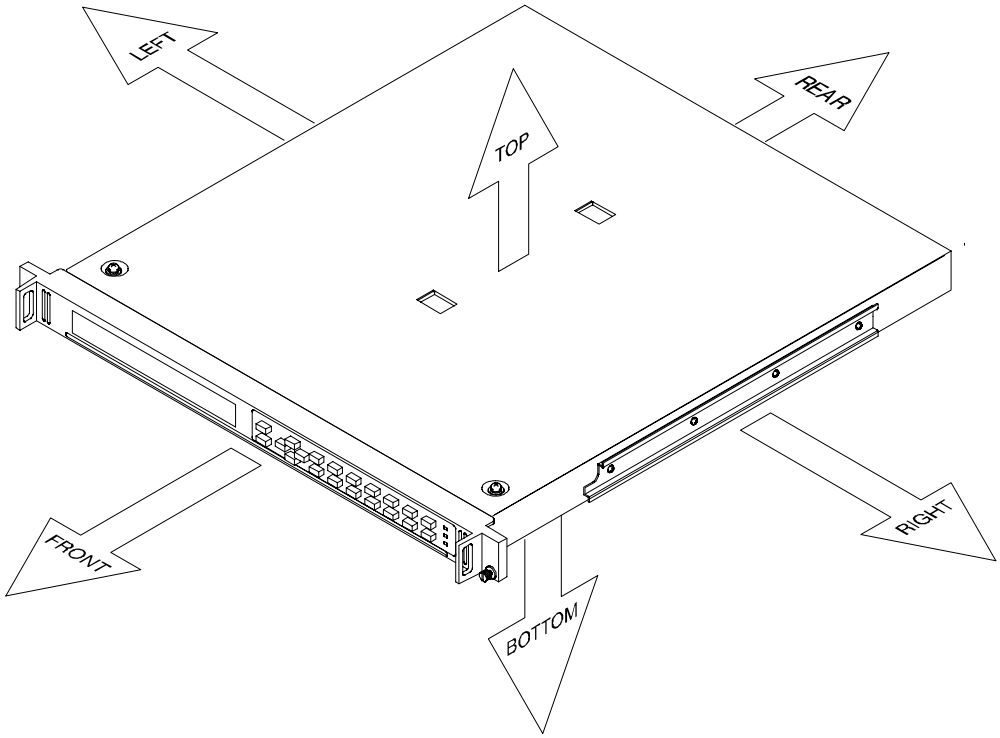


Figure 5-1: TG700 orientation

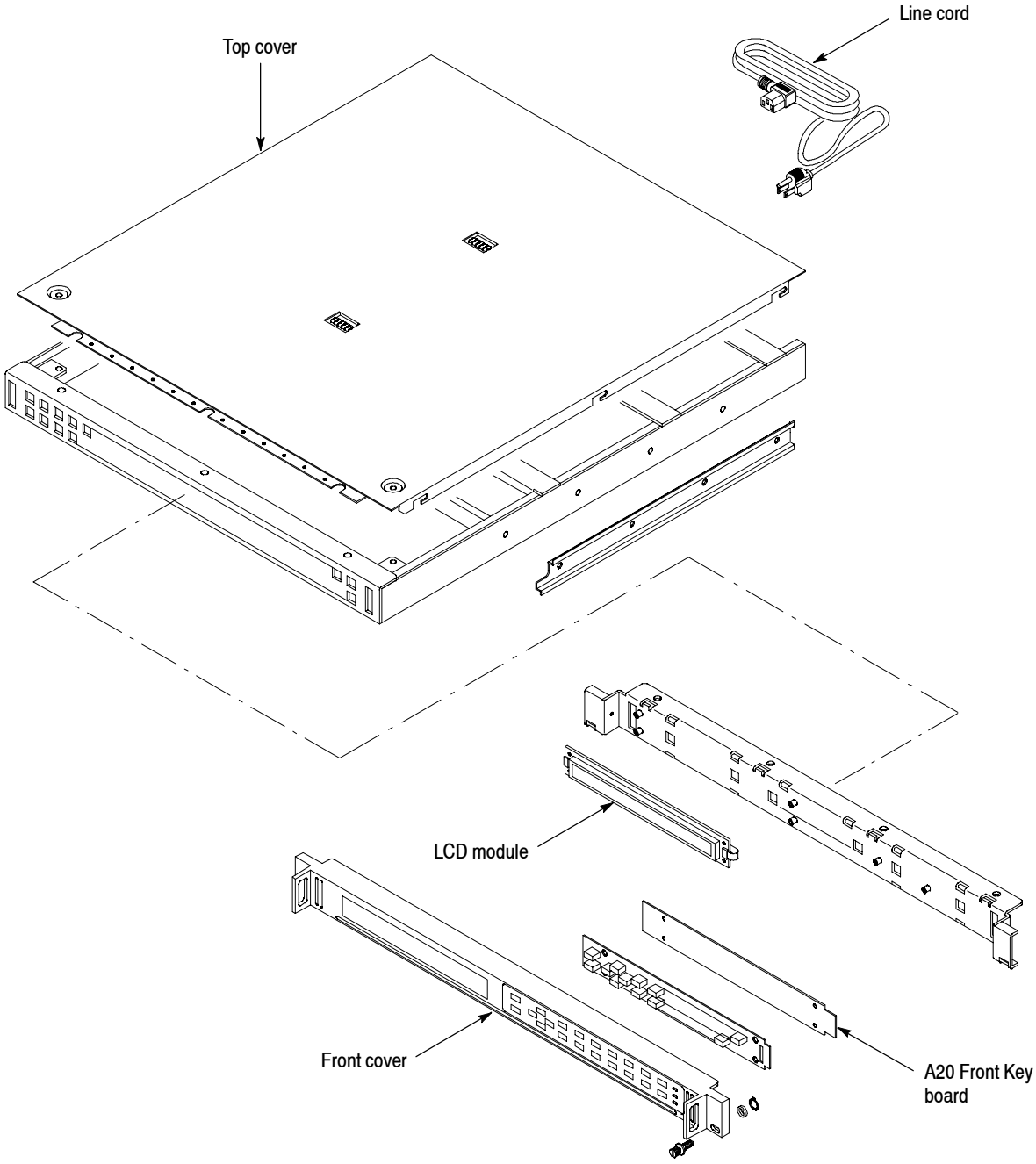


Figure 5-2: External modules

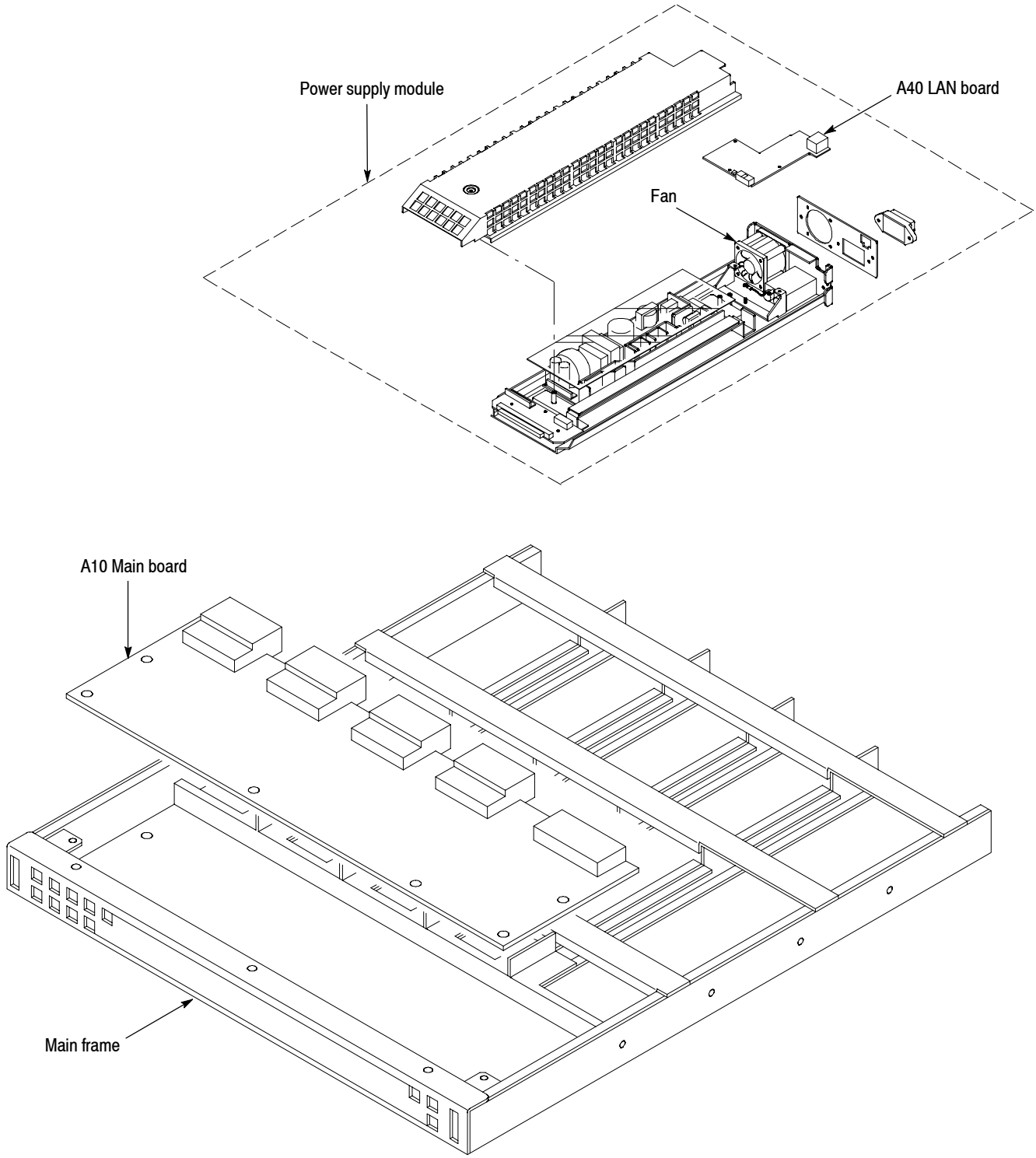


Figure 5-3: Internal modules

Access Procedure

When you have identified the module to be removed for service, read *General Instructions* found on page 5-8. Then use the flowchart in Figure 5-4 to determine which procedures to use for removing the module. The removal procedures end with installation instructions.

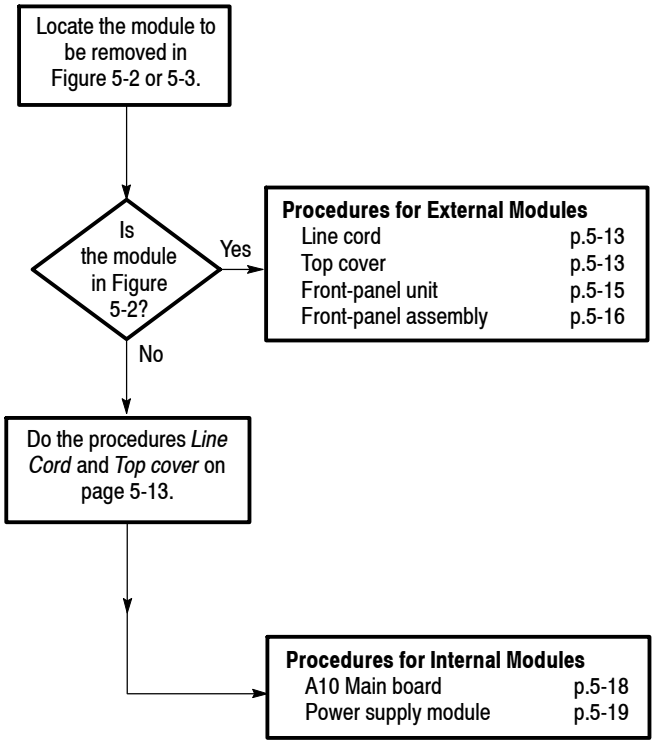


Figure 5-4: Guide to removal procedures

Procedures for External Modules

Do the *Access Procedure* (page 5-12) before doing any procedure in this group. This group contains the following procedures:

- *Line Cord*
- *Top Cover*
- *Front-Panel Unit*
- *Front-Panel Assembly*

Line Cord

1. *Assemble equipment and locate modules to be removed:* You need no equipment. Locate the line cord in the location diagram *External Modules*, Figure 5-2, page 5-10.
2. *Orient the instrument:* Set the TG700 so its bottom is down on the work surface and its rear is facing you.
3. *Remove the line cord:* Find the line cord on the rear panel. Grasp the plug and pull the line cord and clamp away to complete the removal. Reverse procedure to reinstall.

Top Cover

1. *Assemble equipment and locate modules to be removed:*
   a. You need a screwdriver with a #2 Phillips tip (items 1 and 3).
   b. Locate the modules to be removed in the locator diagram *External modules*, Figure 5-2, page 5-10.
2. *Orient the instrument:* Set the TG700 so its bottom is down on the work surface and its rear is facing you.
3. *Remove the top cover:*
   a. Use a screwdriver with a #2 Phillips tip to remove the two screws securing the front of the top cover to the TG700.
   b. Slide the top cover toward the rear and then lift it off the TG700. See Figure 5-5, page 5-14.
4. *Reinstall top cover:*
   a. Perform step 3 in reverse order to reinstall the top cover.
   b. Plug the line cord into its receptacle on the rear panel. This completes the TG700 reassembly.

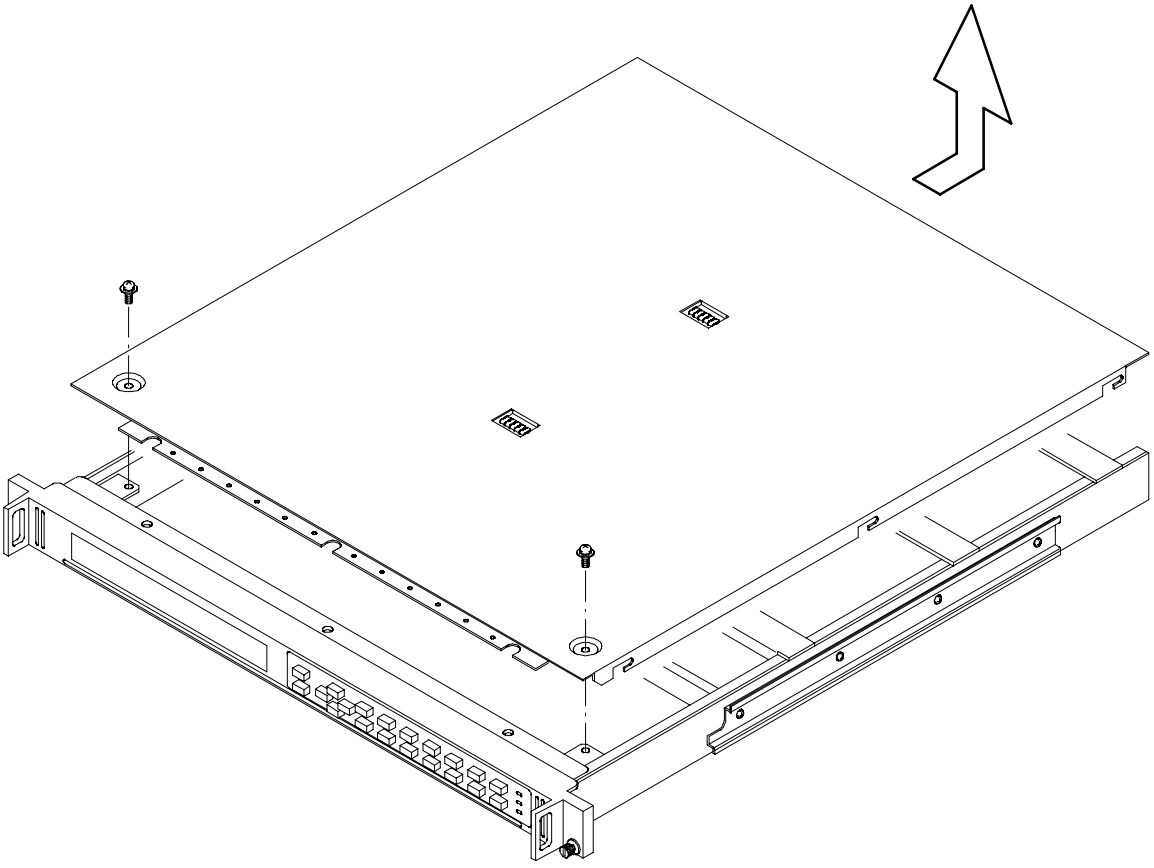


Figure 5-5: Top cover removal

Front-Panel Unit

1. *Assemble equipment and locate modules to be removed:*
   a. You need a screwdriver with a #2 Phillips tip (items 1 and 3).
   b. Locate the module to be removed in the locator diagram *External modules*, Figure 5-2, page 5-10.
2. *Orient instrument:* Set the TG700 so its bottom is down on the work surface and its front is facing you.
3. *Remove front-panel unit:* See Figure 5-6.
   a. Use a screwdriver with a #2 Phillips tip to remove the three screws securing the front-panel unit to the top of the chassis.
   b. Set the TG700 so its top is down on the work surface and its front is facing you.
   c. Use a screwdriver with a #2 Phillips tip to remove the four screws securing the front-panel unit to the bottom of the chassis.
   d. Set the TG700 so its bottom is down on the work surface and its front is facing you.
   e. Unplug the cables at J710, J720, and J725 on the A10 Main board.
   f. Grasp the front-panel unit and pull it forward.
4. *Reinstallation:* Perform step 3 in reverse order to reinstall the front-panel unit.

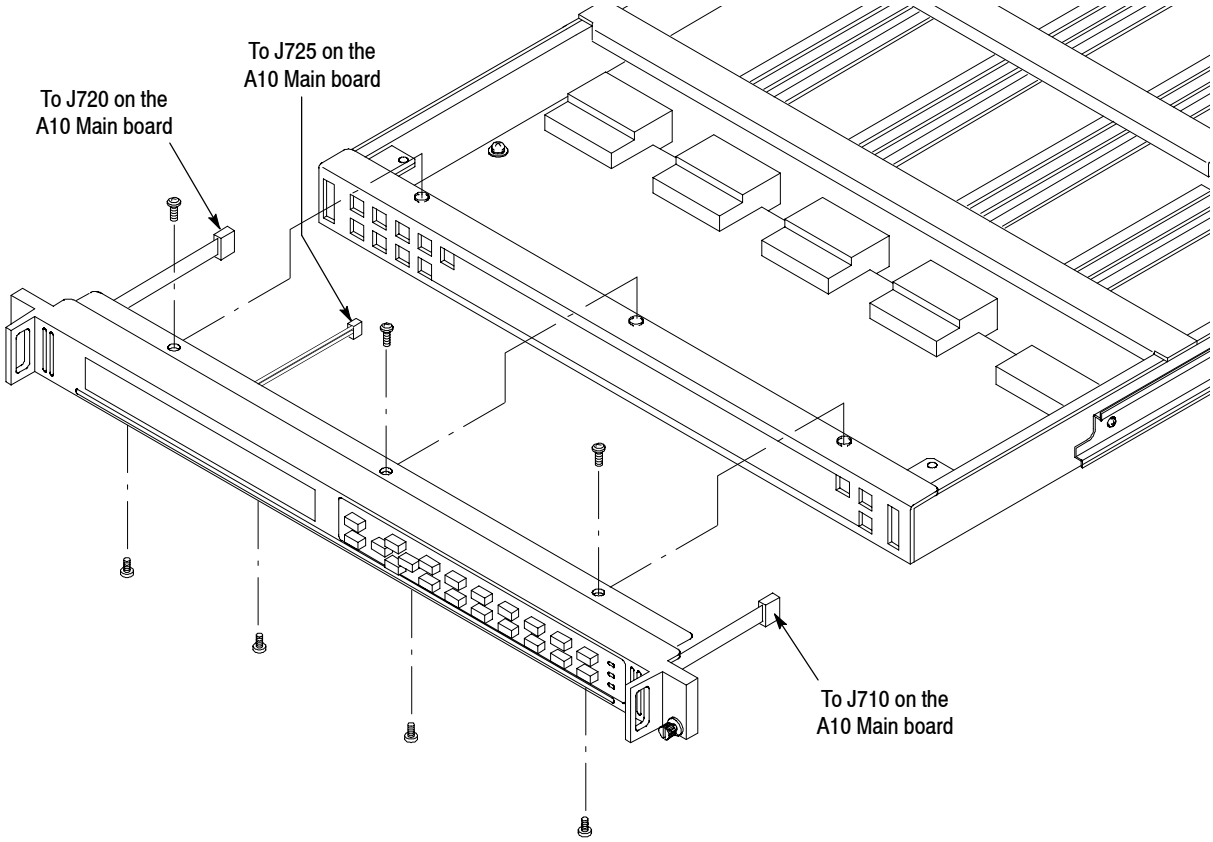


Figure 5-6: Front-panel unit removal

Front-Panel Assembly

1. *Assemble equipment and locate modules to be removed:*
   - **a.** You need a screwdriver with a #2 Phillips tip (items 1 and 3).
   - **b.** Locate the module to be removed in the locator diagram *External modules*, Figure 5-2, page 5-10.
2. *Remove the Front Cover:* See Figure 5-7.
   - **a.** Use a screwdriver with a #2 Phillips tip to remove the two screws securing the front cover to the left and right sides of the front frame.
   - **b.** Grasp the front cover and pull it forward.
3. *Remove the A20 Front Key board:* See Figure 5-7.
   - **a.** Use a screwdriver with a #2 Phillips tip to remove the four screws securing the A20 board to the front cover.

b. Lift the board away.

4. *Remove the LCD module:* See Figure 5-7.

a. Use a screwdriver with a #2 Phillips tip to remove the four screws securing the LCD module to the front frame.

b. Lift the board away.

5. Now hand disassemble the front-panel assembly components using Figure 5-7 as a guide. Reverse the procedure to reassemble.

6. *Reinstallation:* Perform steps 2 through 5 in reverse order to reinstall the front-panel assembly.

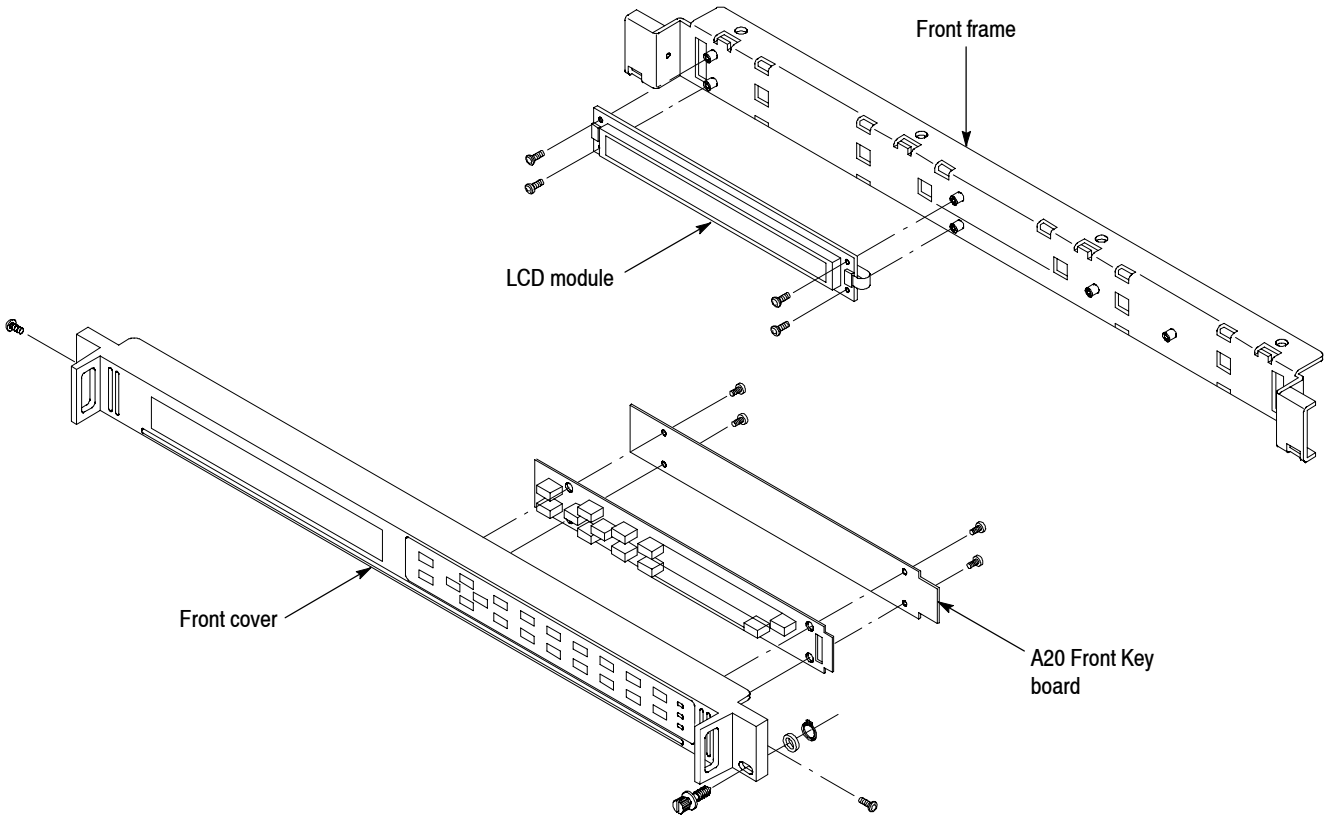


Figure 5-7: Disassembly of front-panel assembly

Procedure for Internal Modules

Perform the *Access Procedure* (on page 5-12) before doing any procedure in this group. The procedures are:

- *A10 Main Board*
- *Power Supply Module*

A10 Main Board

1. *Assemble equipment and locate modules to be removed:*
   a. You need a screwdriver with a #2 Phillips tip (items 1 and 3).
   b. Locate the module to be removed in the locator diagram *Internal modules,* Figure 5-3, page 5-11.
2. *Orient the instrument:* Set the TG700 so its bottom is down on the work surface and its right side is facing you.
3. *Remove the A10 Main board:* See Figure 5-8.
   a. Unplug these cables:
      - The cables from the LCD module at J720 and J725.
      - The cable from the A20 Front Key board at J710.
   b. Use a screwdriver with a #2 Phillips tip to remove the eight screws securing the A10 Main board to the chassis.
   c. Lift the board up and away from the chassis to complete the removal.
4. *Reinstallation*: Do step 3 in reverse order to reinstall the A10 Main board.

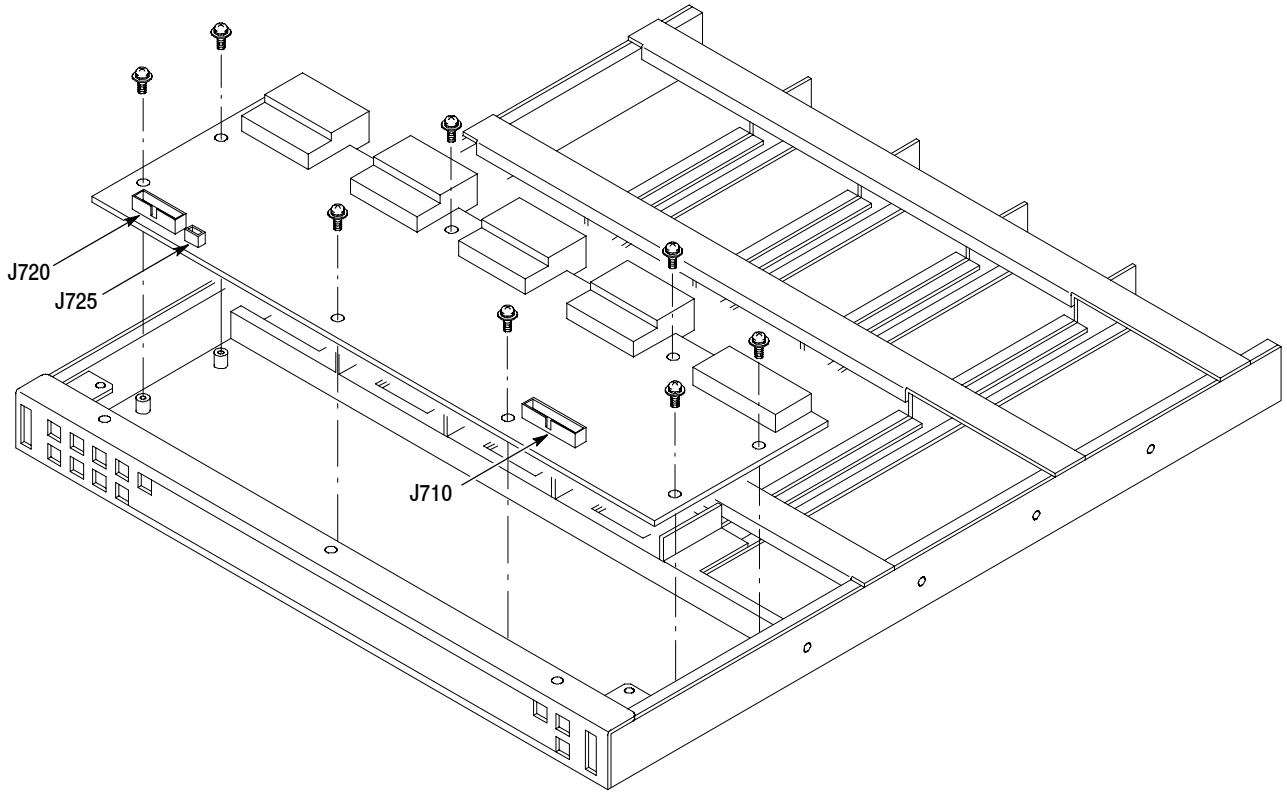


Figure 5-8: A10 Main board removal

Power Supply Module

This procedure describes how to remove these modules:

- *A40 LAN board*
- *Fan*
- *RFI filter*

1. *Assemble equipment and locate modules to be removed:*
   a. You need screwdrivers with #1 and #2 Phillips tips (items 1, 2, and 3), and a 7mm nut driver (item 4).
   b. Locate the module to be removed in the locator diagram *Internal modules,* Figure 5-3, page 5-11.
2. *Orient the instrument:* Set the TG700 so its bottom is down on the work surface and its back is facing you.

3. *Remove the power supply module:*

   a. Use a screwdriver with a #1 Phillips tip to loosen the two screws securing the power supply module to the mainframe.

   b. Pull the module slowly in a horizontal direction back from the mainframe.

4. *Remove the **A40 LAN board***: See Figure 5-9.

   a. Use a screwdriver with a #2 Phillips tip to remove the screw securing the top cover to the chassis.

   b. Lift the cover up and away from the chassis to complete the removal.

   c. Unplug the cable from the fan at J120 on the A40 LAN board.

   d. Unplug the cable from the A30 POWER CONNECT board at J110 on the A40 LAN board. When reconnecting this cable, make sure that it is completely within the cable guide.

   e. Use a screwdriver with a #2 Phillips tip to remove the three screws securing the A40 LAN board to the chassis.

   f. Lift the board up and away from the chassis to complete the removal.

5. *Remove the **Fan***: See Figure 5-9.

   a. Unplug the fan's power cable from J120 on the A40 LAN board.

   b. Use a screwdriver with a #2 Phillips tip to remove the four screws securing the fan to the chassis.

   c. Lift the fan up and away from the chassis to complete the removal.

6. *Remove the **RFI filter***: See Figure 5-9.

   a. Unplug the two cables from the RFI filter.

   b. Use a 7mm nut driver to remove the nut securing the ground lead to the chassis.

   c. Use a screwdriver with a #2 Phillips tip to remove the two screws securing the RFI filter to the chassis.

   d. Pull the RFI filter away.

7. *Reinstallation*:

   a. Perform steps 4 through 6 in reverse order to install all the modules.

   b. Perform step 3 in reverse order to reinstall the power supply module.

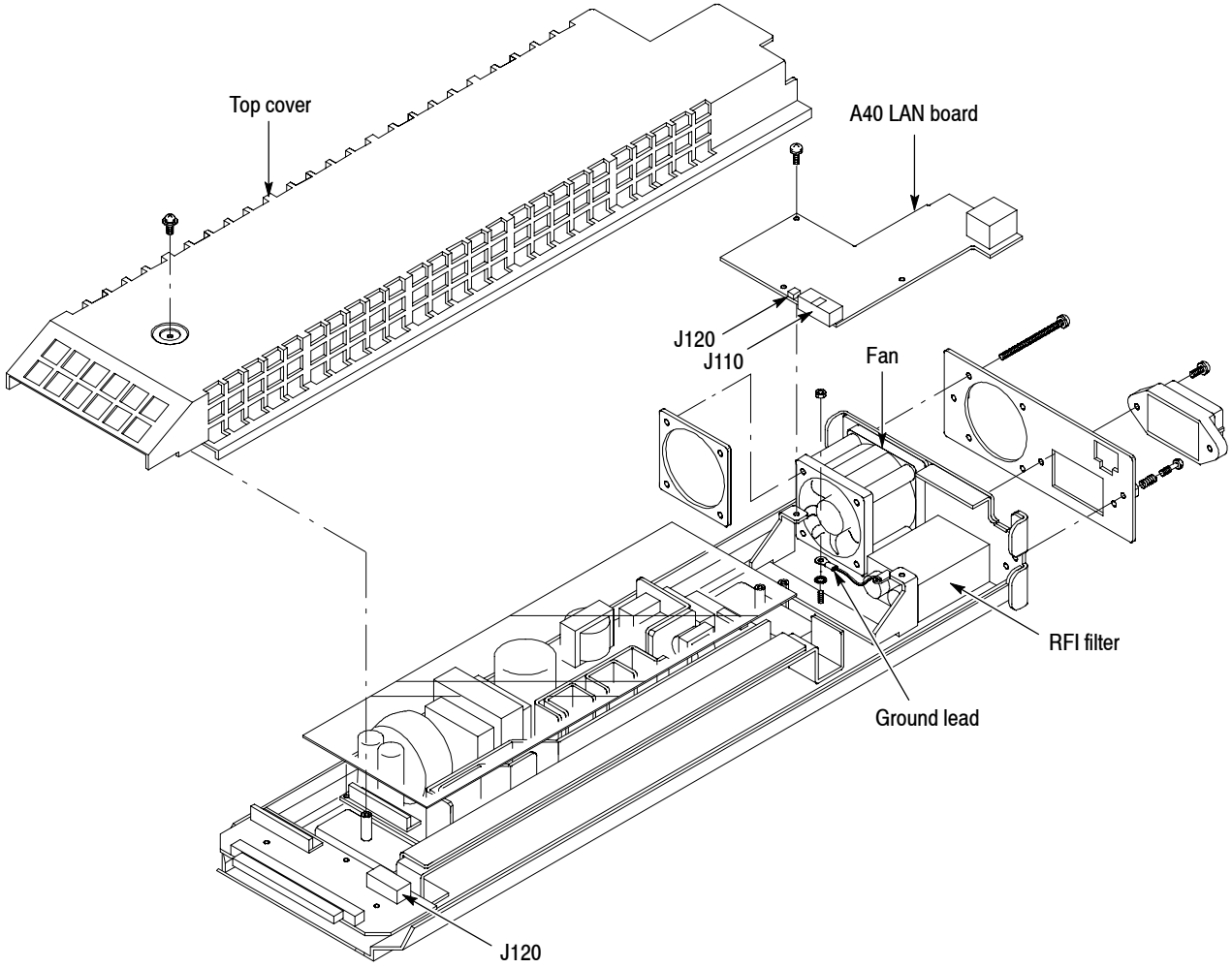


Figure 5-9: A40 LAN board, fan, and RFI filter removal

Troubleshooting

This section contains information about diagnostics and troubleshooting trees designed to isolate faulty modules in the TG700.

Diagnostics

The TG700 has internal diagnostics that verify memory functionality. These diagnostics execute read/write tests for the signal memory of the following modules:

- HDVG7
- DVG7
- BG7 Option CB

CAUTION. *When you execute the diagnostics, be sure to save the current instrument settings to a preset, and then recall the settings after the diagnostics is completed.*

Perform the following procedures to execute the diagnostics:

1. Power on (plug in) the TG700 with the **FRONT PANEL ENABLE** button pressed. This starts up the instrument in Factory mode.
2. Wait until initialization of the mainframe and installed modules is completed. Check that no error messages appear on the display.
3. Press the up (▲) and down (▼) arrow button to select **UTILITY**, and then press the **ENTER** button to access the UTILITY submenu.
4. Press the up (▲) and down (▼) arrow button to select **DIAGNOSTICS**, and then press the **ENTER** button to access the DIAGNOSTICS submenu.
5. Press the left (◀) or right (▶) arrow button to select **Memory**, and then press the **ENTER** button to execute the memory test.
6. Check that the message **Pass:All Install Module(s)** is displayed on the display.

   If the message **Fail: "a module name" Diag error** is displayed, replace the module.

Troubleshooting Trees

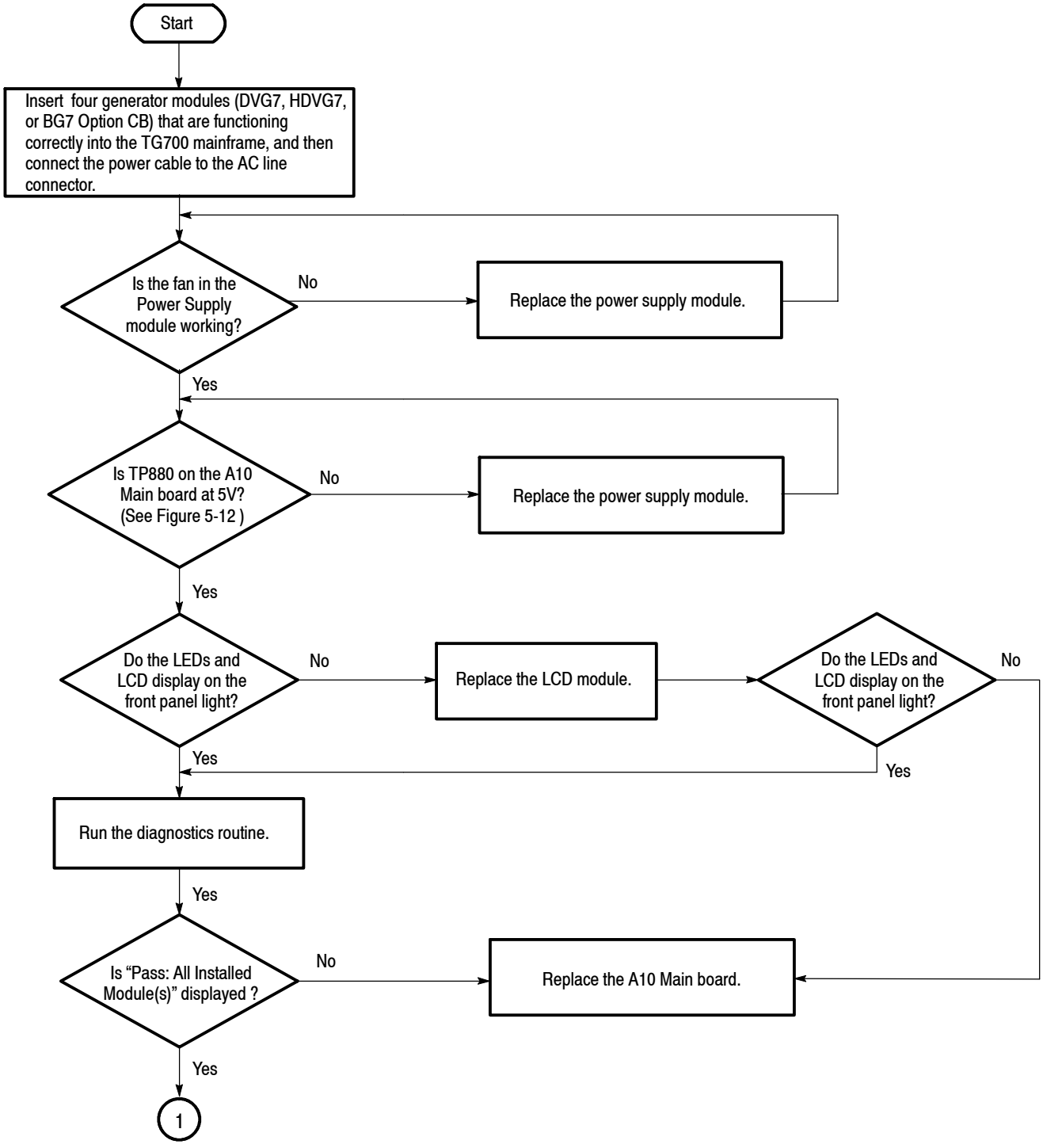


Figure 5-10: Troubleshooting procedure (1)

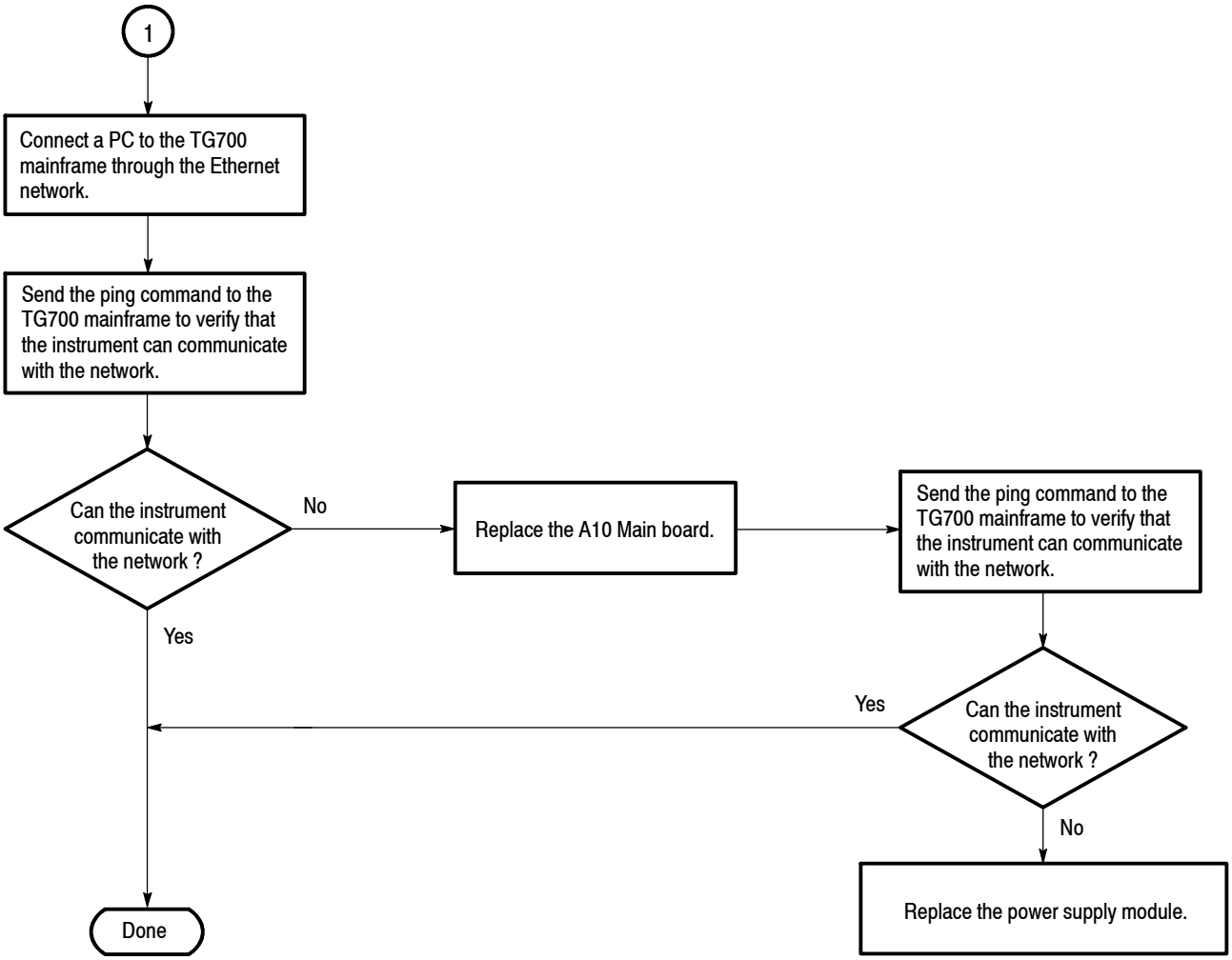


Figure 5-11: Troubleshooting procedure (2)

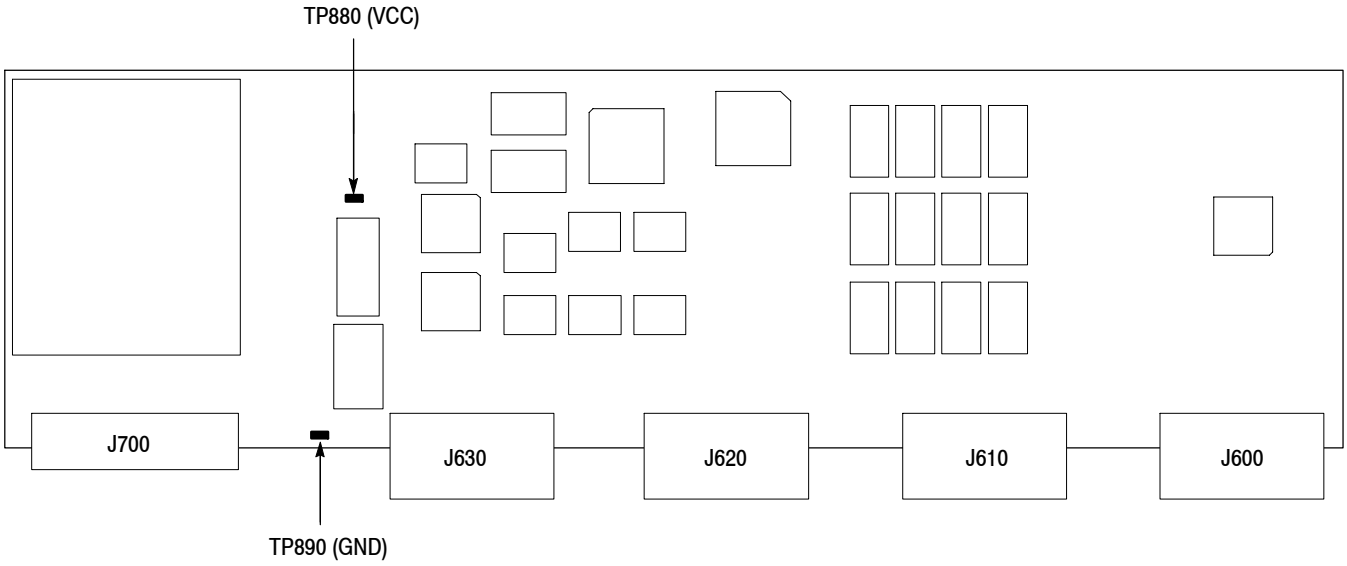


Figure 5-12: A10 Main board (view from top)

Options

Options

This section describes options that are available for the TG700.

The following options are available:

- Option FP (Frame picture feature)
- Option D1 (Test data report)

Option FP Description

Frame picture generation feature will be provided with your TG700 and frame pictures and test patterns can be generated when this option is specified.

Option D1 Description

A calibration data test result report will be provided with the TG700 when this option is specified.

Diagrams

Diagrams

This section contains the following diagrams:

- Block diagram of the TG700
- Interconnect diagram of the TG700

The Block diagram shows the modules and functional blocks in the TG700. The Interconnect diagram shows how the modules in the TG700 connect together.

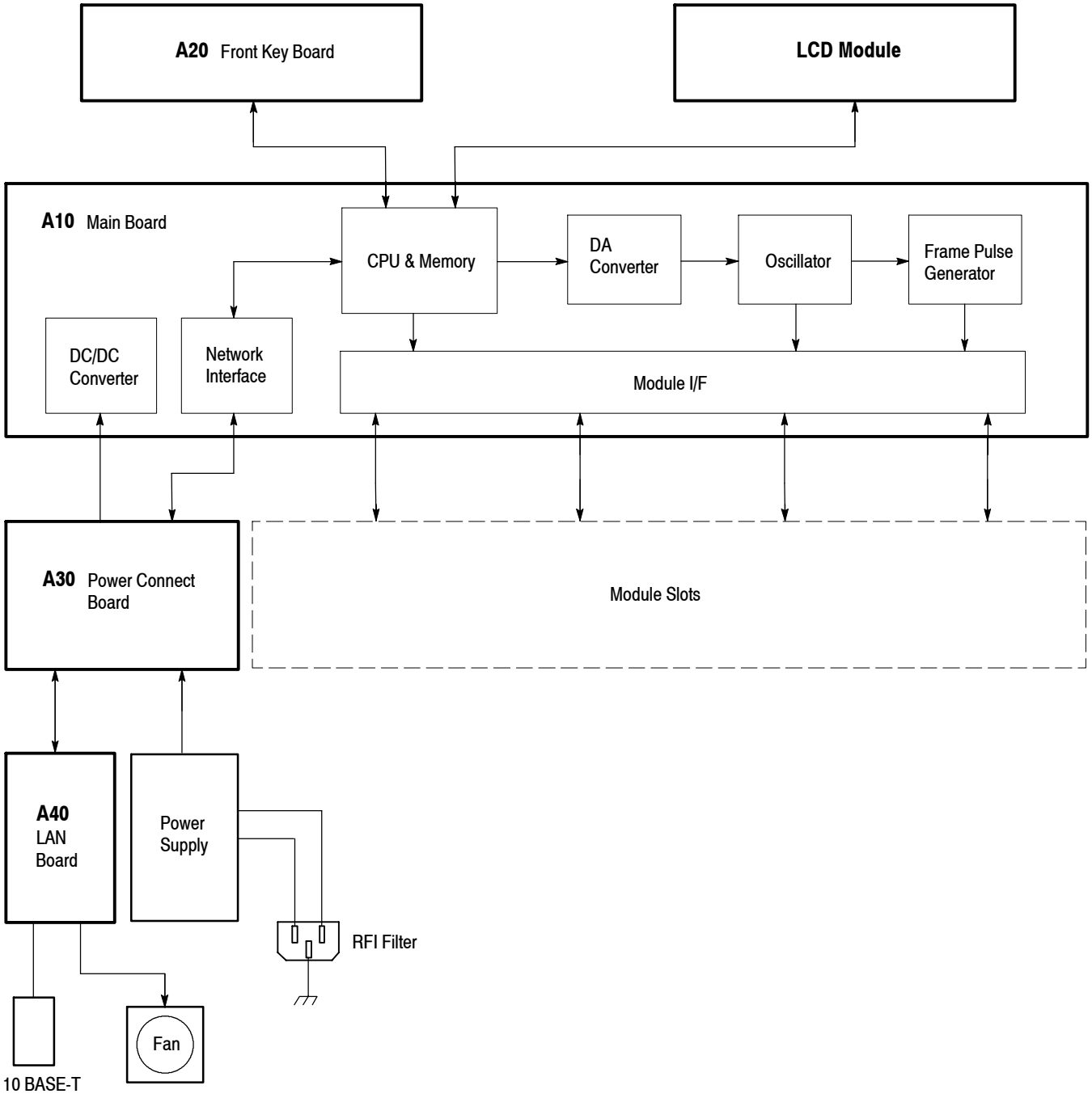


Figure 7-1: TG700 block diagram

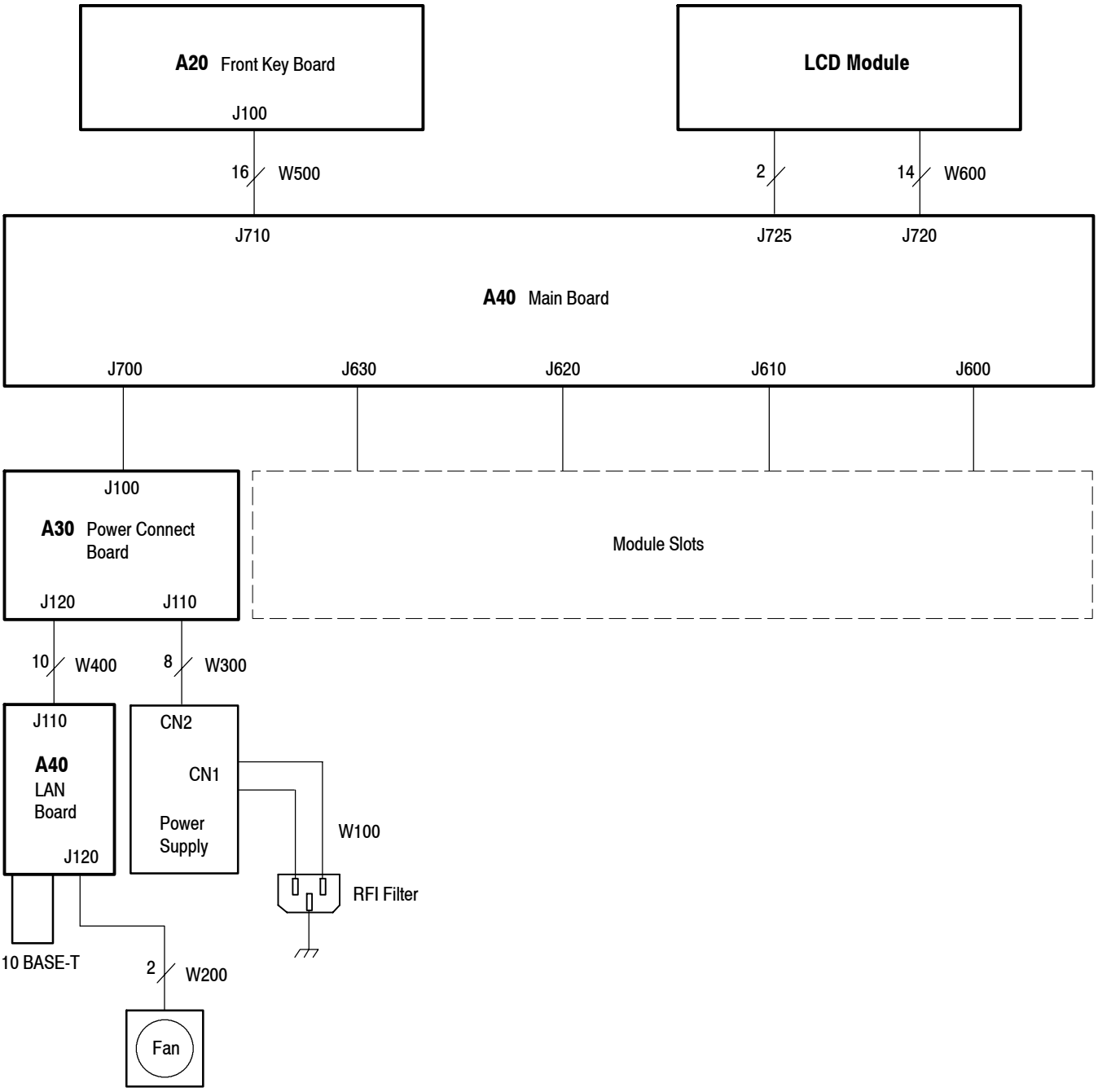


Figure 7-2: TG700 Interconnect diagram

Replaceable Parts List

Replaceable Parts List

This section contains a list of the replaceable modules for the TG700 mainframe. Use this list to identify and order replacement parts.

Parts Ordering Information

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

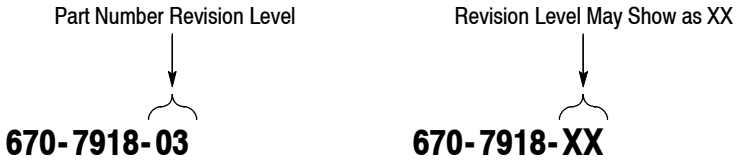
Changes to Tektronix products are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest improvements. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number (see Part Number Revision Level below)
- 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.

Part Number Revision Level

Tektronix part numbers contain two digits that show the revision level of the part. For most parts in this manual, you will find the letters XX in place of the revision level number.



When you order parts, Tektronix will provide you with the most current part for your product type, serial number, and modification (if applicable). At the time of your order, Tektronix will determine the part number revision level needed for your product, based on the information you provide.

Module Servicing

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

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

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

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

Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the TG700. 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.

Abbreviations

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

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
8-1-1	390-A086-03			1	CABINET,TOP:ASSY
-2	211-A245-00			2	SCREW,MACHINE;M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER
-3	348-A128-00			15	SHLD GASKET,ELEK:FINGER TYPE,5.1MMX6.4MM W,BE-CU [97-645-02]
-4	351-0104-03			1	SL SECT,DWR EXT:12.625 L,W/O HARDWARESAFETY
-5	212-A041-00			8	SCREW,MACHINE;M4X8MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER
-6	211-A245-01			7	SCREW,MACHINE;M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER
-7	161-0216-00			1	CABLE ASSY,PWR,:3,18 AWG,2.5M L,BLACK,SAFETY CONTROLLED (STANDARD ACCESSORY)

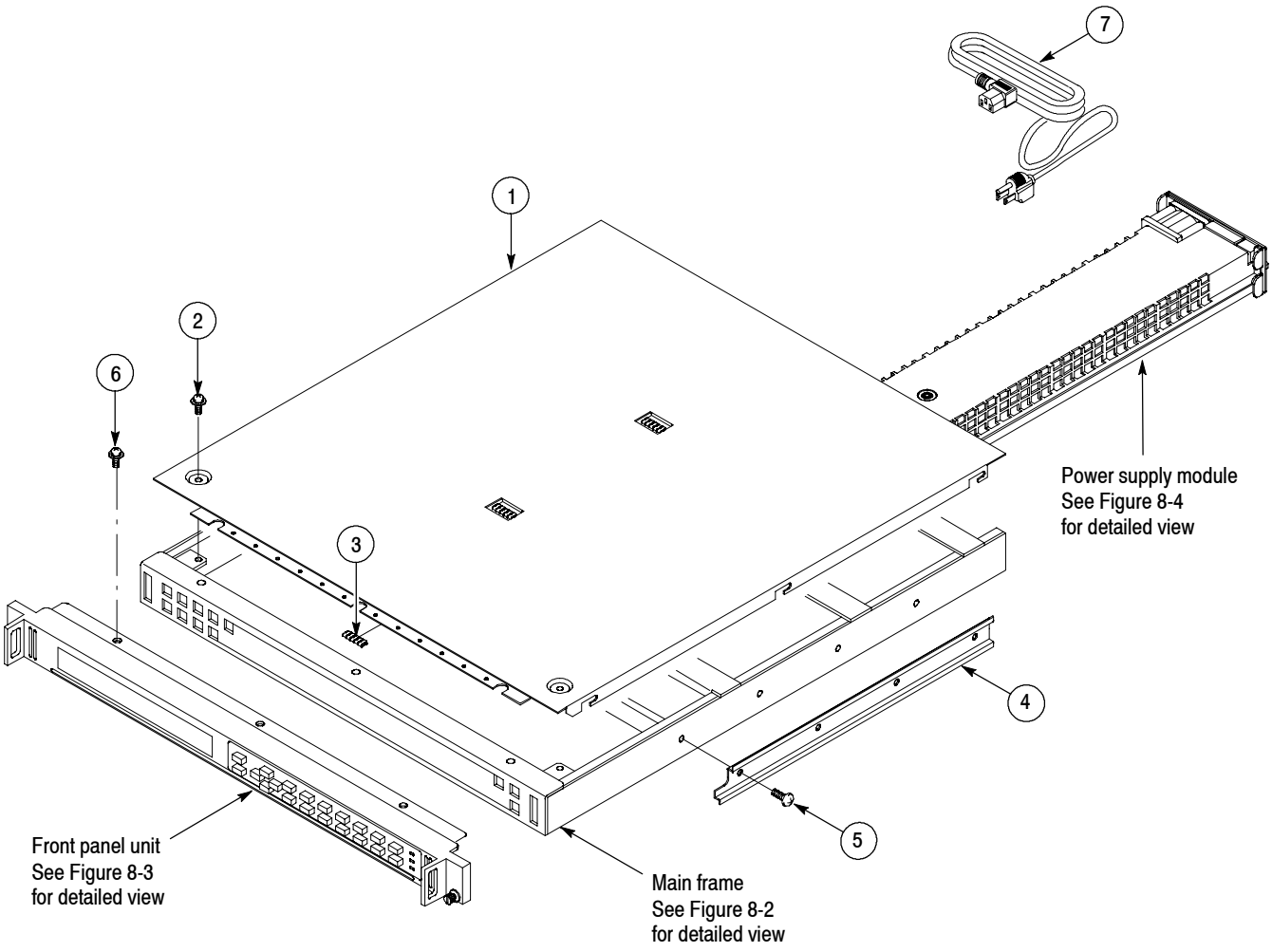


Figure 8-1: Main chassis

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
8-2	116-0586-03			1	EXCHANGE MODULE:TG700
	116-1099-03			1	EXCHANGE MODULE:TG700-FP
8-2-1	441-A262-00			1	CHASSIS,MAIN:ASSY
-2	671-5802-02			1	CIRCUIT BD ASSY:A10 MAIN,389-B031-XX WIRED
	671-5803-02			1	CIRCUIT BD ASSY:A10 MAIN,OPT,389-B031-XX WIRED
-3	211-A245-01			8	SCREW,MACHINE:M3X6MM L,PNH,STL,N1 PL,CROSS REC,W/KOGATAMARU&LOCK WASHER
-4	348-A130-00			96 CM	GASKET,SHIELD:CONDUCTIVE URETHANE FORM STRIP,5MM WX0.5MM T,WITHOUT ADHESIVE
-5	348-A132-00			24 CM	GASKET,SHIELD:CONDUCTIVE URETHANE FORM STRIP,7MM WX1MM T, W/ADHESIVE
-6	348-A132-00			42 CM	GASKET,SHIELD:CONDUCTIVE URETHANE FORM STRIP,7MM WX1MM T, W/ADHESIVE
-7	348-A559-51			1	MARKER,IDENT:MKD WARNING
-8	334-1378-03			1	MARKER,IDENT:MKD SERIAL NO.
-9	348-A133-00			20 CM	GASKET,SHIELD:CONDUCTIVE URETHANE FORM STRIP,5.5MM WX13MM T, W/ADHESIVE

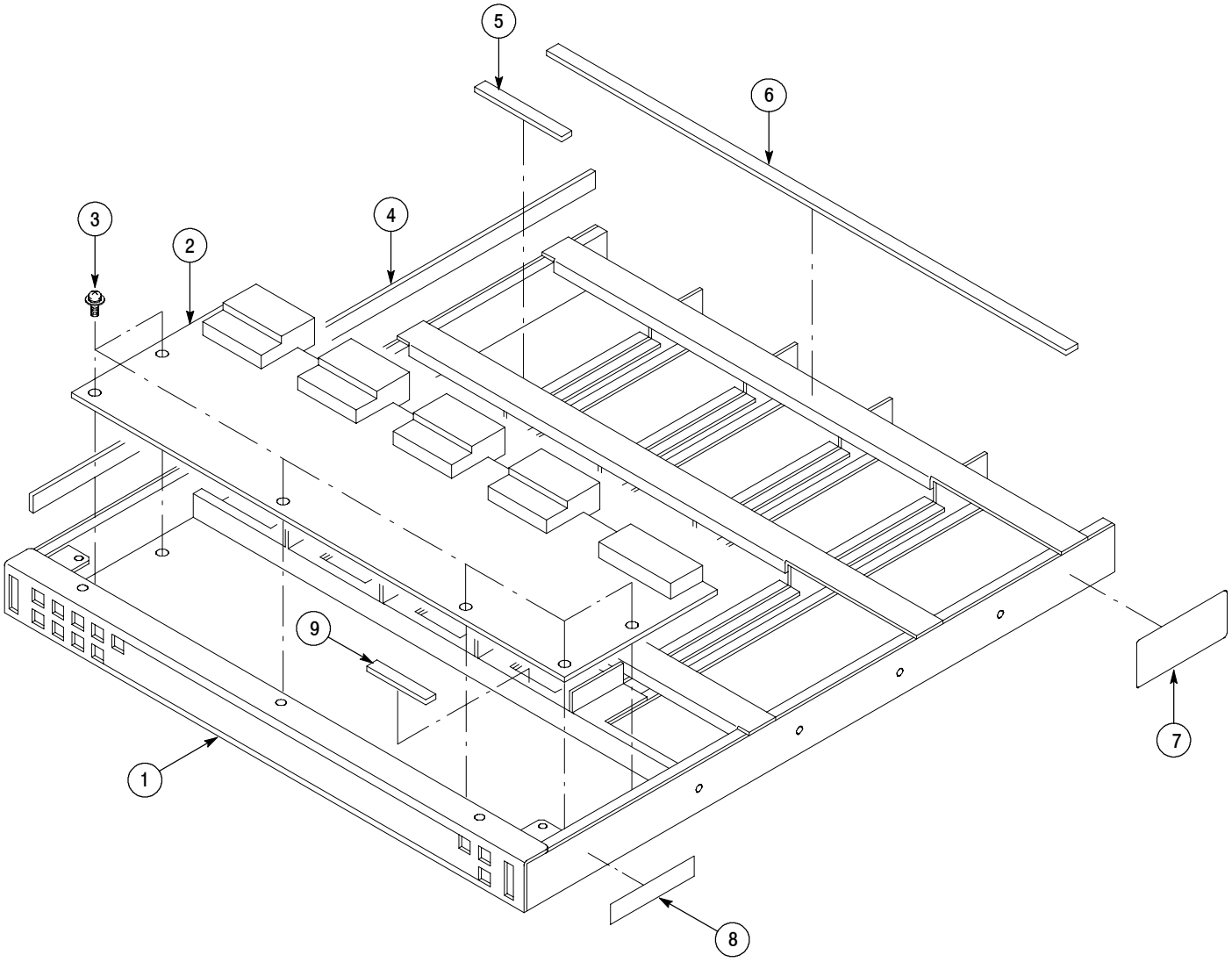


Figure 8-2: Main frame

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
8-3-1	426-A165-00			1	FRAME,FRONT:ASSY
-2	119-B053-01			1	LCD MODULE:LCD W/CONN
-3	211-A245-01			4	SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU & LOCK WASHER
-4	200-A513-01			1	COVER,FRONT:PC,CONDUCTIVE COATED,TG700
-5	378-A047-01			1	FILTER,LCD:ACRYLIC,TG700
-6	333-A400-01			1	PANEL,FRONT:LEXAN,TG700
-7	213-A245-00			1	THUMBSCREW:10-32UNFX21.6MM L,10.3MM OD HD,STL,W/NYLON WASHER
-8	361-A174-00			1	SPACER,8MM ODX3MM L,POLYACETATE,HIROSUGI KEIKI,CZ-503
-9	354-A054-00			1	RING,RETAINING:EXT TYPE-E,U/O 3.0 MM DIA GROOVE,SST [1110201-11040]
-10	260-A147-00			1	SWITCH,RUBBER:SILICON,TG700
-11	213-1127-00			4	SCREW,TPG:M3X8MM L,PNH,STL,BLK ZN PL,CROSS REC [PTP3X8ZB]
-12	213-1127-00			2	SCREW,TPG:M3X8MM L,PNH,STL,BLK ZN PL,CROSS REC [PTP3X8ZB]
-13	174-B790-00			1	CA ASSY,SP,ELEC:16,28AWG,20CM L,FLAT
-14	174-B791-00			1	CA ASSY,SP,ELEC:14,28AWG,15CM L,FLAT
-15	671-B082-00			1	CIRCUIT BOARD ASSY:A20 FRONT KEY,389-B032-XX WIRED
-16	348-A120-00			33 CM	GASKET SHIELD:CONDUCTIVE URETHANE FORM,2MMX4MM,W/ADHESIVE [E02S040020]
-17	348-A132-00			8 CM	GASKET,SHIELD:CONDUCTIVE URETHANE FORM STRIP,7MMWX1MMT,W/ADHESIVE TAPE

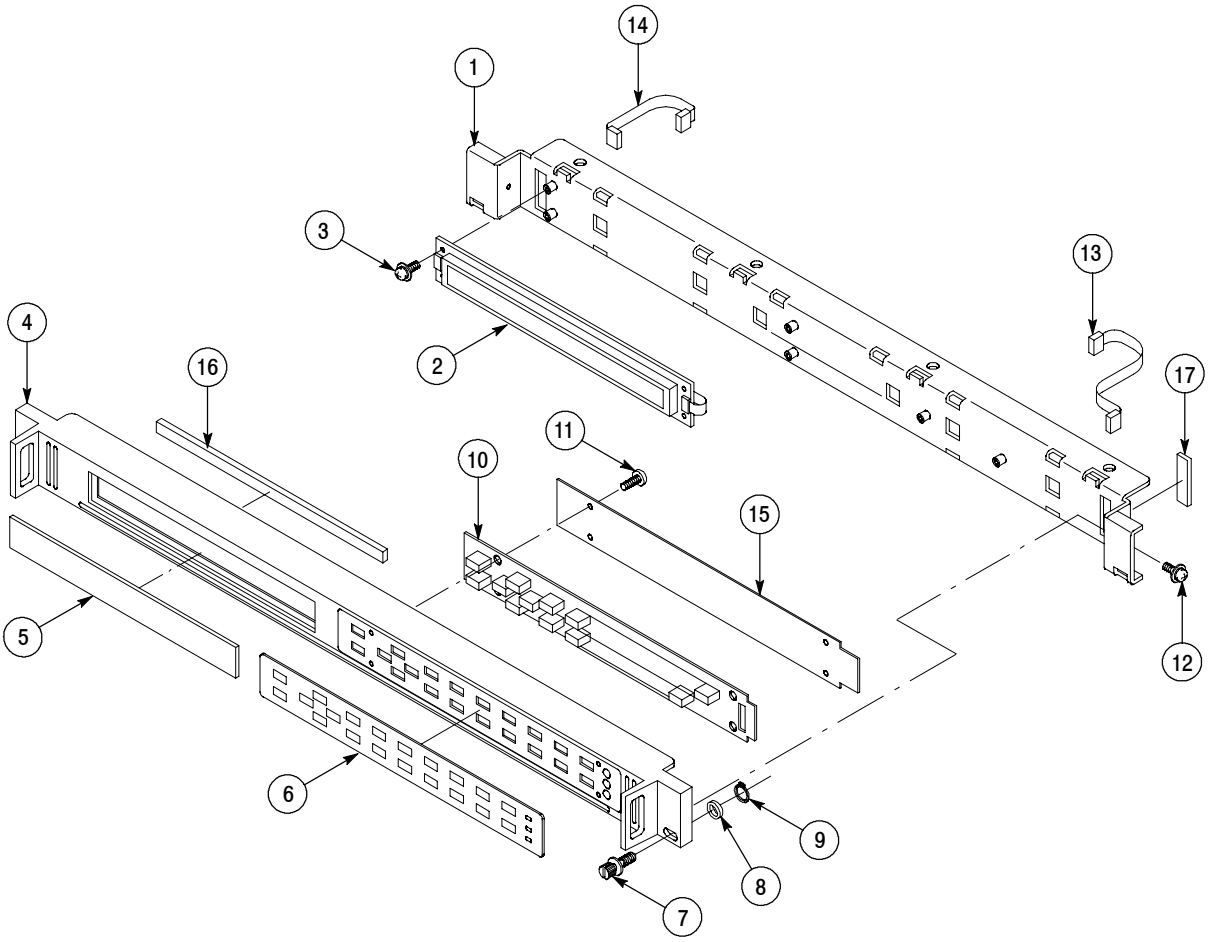


Figure 8-3: Front-panel unit

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
8-4	650-A810-00			1	COMPONENT KIT POWER SUPPLY W/CARTON,TG700
8-4-1	441-A263-00			1	CHASSIS,P/S:ASSY
-2	333-A041-00			1	PANEL,REAR:POWER SUPPLY,AL
-3	211-A256-00			4	SCREW,MACHINE:M3X40MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU & LOCK WASHER
-4	131-4131-00			1	CONN,PLUG,ELEC:MALE W/LOCKING ADPTR,EXT MTG
-5	211-A266-00			2	SCREW,MACHINE:M3X12MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU & LOCK WASHER
-6	213-1129-00			2	SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,NI PL,CROSS REC & SLOTTED [322401-05]
-7	214-4946-00			2	SPRING,CONICAL:VXI MOUNTING SCREW,0.26 MM SUS304,5.4MML
-8	119-B143-00			1	FILTER,RFI:3A,250VAC,0.5MA,0.150HM,50/60HZ [ZUB2203H-F]
-9	119-B059-00			1	FAN,TUBE AXIAL:119-B055-00 W/CONN,10CML
-10	220-A172-01			1	NUT,PLATE:POWER SUPPLY FAN,AL
-11	220-0193-00			1	NUT,PLAIN,HEX:M4X7MM HEX,STL,ZN-C
-12	210-0008-00			1	WASHER,LOCK:#8 INTL,0.02 THK,STL CD PL
-13	119-B054-00			1	POWER SUPPLY:INPUT 85-264VAC,OUTPUT 5VDC,20A [LEA100F-5]
-14	342-A142-01			1	INSULATOR,PLATE:POWER SUPPLY,PC
-15	671-B083-00			1	CIRCUIT BOARD ASSY:A30 POWER CONNECT,389-B033-XX WIRED
-16	211-A245-01			11	SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU & LOCK WASHER
-17	200-A514-00			1	COVER,TOP:POWER SUPPLY,AL
-18	174-C019-00			1	CA ASSY,SP,ELEC:0-N 9-N,10CM L
-19	174-B789-00			1	CA ASSY,SP,ELEC:10,28AWG,30CM L,FLAT
-20	174-B788-00			1	CA ASSY,SP,ELEC:8,18AWG,10CM L,2-N
-21	671-B084-51			1	CIRCUIT BOARD ASSY:A40 LAN CONNECT,389-B034-XX WIRED
-22	334-1378-03			1	MARKER,IDENT:MKD SERIAL NO. FOR SONY/TEK

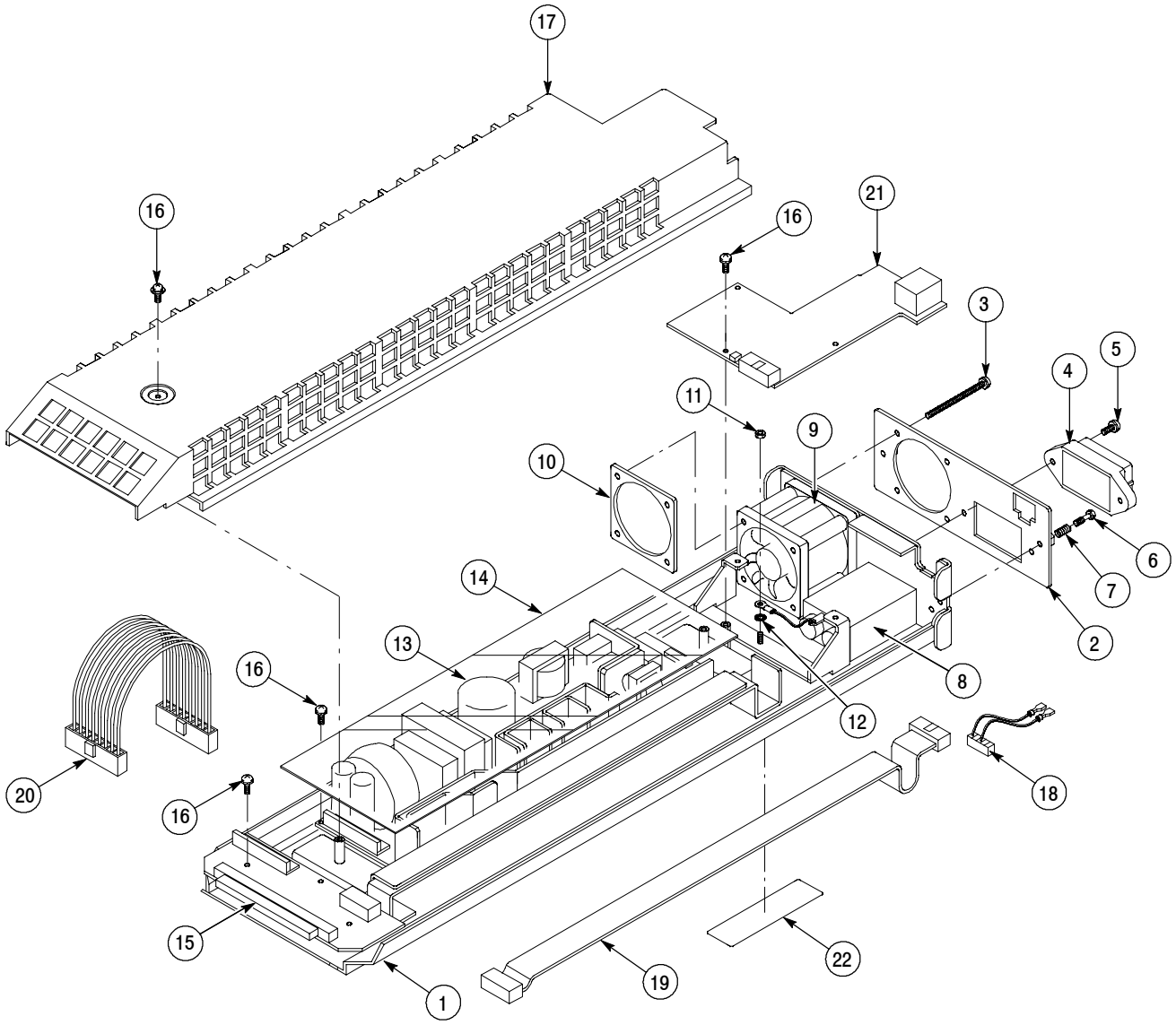


Figure 8-4: Power supply module

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
8-5	614-A021-00			1	PANEL,BLANK ASSY TG700,W/GASKET&LOCK SCREW
8-5-1	333-A411-00			1	CHASSIS,MODULE BLANK:ASSY
-2	214-4946-00			2	SPRING,CONICAL:VXI MOUNTING SCREW,0.26MM SUS304,5.4MM L
-3	213-1129-01			2	SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,NI PL,CROSS REC & SLOTTED
-4	348-A128-00			2.5 CM	SHLD GASKET,ELEC:FINGER TYPE,5.1 MM LX6.4MM W,BE-CU [97-645-05]

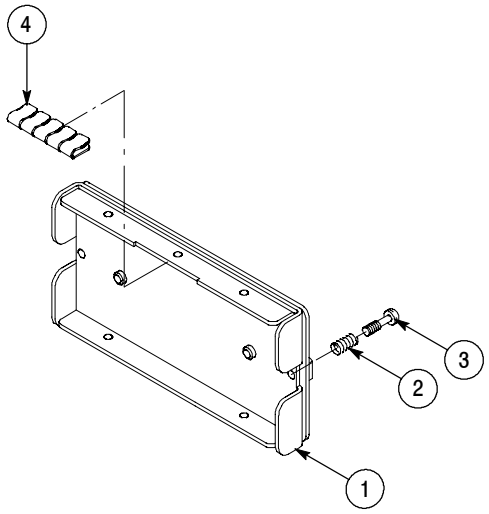


Figure 8-5: Blank panel

Replaceable parts list

Component number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
					STANDARD ACCESSORIES
	351-0859-00			1	TRK SL OUT SECT:STATIONARY & INTERMEDIATESAFETY CONTROLLED
	062-A249-XX			1	SOFTWARE PACKAGE:S/W(CD-R).SAMPLE WAVEFORM,APPLI
	070-A799-XX			1	MANUAL,TECH:USERS
	161-0216-00			1	CABLE ASSY,PWR,:3,18 AWG,2.5M L,BLACK (STANDARD ONLY)
					OPTIONAL ACCESSORIES
	614-A021-00			1	BLANK PANEL
	070-A800-XX			1	MANUAL,TECH:SERVICE,TG700

Service Manual

Tektronix

AG7
Audio Generator

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

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Preface

This is the service manual for the AG7 Audio Generator module. This manual contains information needed to service an AG7 Generator module to the module level.

Manual Structure

This manual is divided into sections, such as *Specifications* and *Theory of Operation*. Further, some sections are divided into subsections, such as *Product Description* and *Removal and Installation Procedures*.

Sections containing procedures also contain introductions to those procedures. Be sure to read these introductions because they provide information needed to do the service correctly and efficiently. The following are brief descriptions of each manual section.

- *Specifications* contains a description of the AG7 Generator module and the characteristics that apply to it.
- *Theory of Operation* is an overview of the module's design.
- *Performance Verification* contains procedures to perform the operation tests.
- *Maintenance* contains removal and replacement, and troubleshooting instructions.
- *Option* contains a description of the available option for the AG7 Generator module.
- *Diagram* contains an interconnect diagram showing the connections between the AG7 Generator module and the mainframe.
- *Replaceable Parts List* 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 AG7 Generator module.

- The *TG700 TV Signal Generator Platform User Manual* (Tektronix part number 070-A799-XX) describes how to use the TG700 mainframe and all modules. It also contains information about remote commands and programming structure for the TG700 mainframe and all modules.
- The *TG700 TV Signal Generator Platform Module Installation Instructions* (Tektronix part number 070-A824-XX) describes how to install and remove the modules, and how to upgrade the firmware of the mainframe.

Specifications

Specifications

This section contains a general product description of the AG7 Generator module followed by the operating specifications of the module.

Product Description

The AG7 Generator module is designed to be installed in the TG700 TV Signal Generator Platform.

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

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

The module also supports the following audio frequencies:

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

Electrical Characteristics

Tables 1–1 through 1–4 list the electrical characteristics of the AG7 Generator module.

Table 1-1: AES/EBU serial digital audio outputs

Characteristic	Performance requirements	Reference information
Connector	4	BNC
Number of channels	8	1+2, 3+4, 5+6, and 7+8
Quantized resolution	20 or 24 bits	User selectable
Audio tone		
Frequency	Silence to 20 kHz	31 discrete settings
Level	0 to -60 dBFS in 1 dB steps	
Pre-emphasis		None
Output level	1 ± 0.1 V	Measured across 75 Ω.
Required receiver termination	75 Ω ± 10%	
Jitter	Within ± 20%	
Rise and fall times	Between 30 ns and 44 ns	Measured from the 10% to 90% points.

Table 1-2: SILENCE output

Characteristic	Performance requirements	Reference information
SILENCE		Same signal as AES/EBU Serial Digital Audio “Silence”.
Connector		BNC
Output level	1 ± 0.1 V	Measured across 75 Ω.
Required receiver termination	75 Ω ± 10%	
Jitter	Within ± 20%	
Rise and fall times	Between 30 ns and 44 ns	Measured from the 10% to 90% points.

Table 1-3: 48 kHz CLOCK output

Characteristic	Performance requirements	Reference information
48 kHz CLOCK		Reference Clock for AES/EBU Serial Digital Audio.
Connector		BNC

Table 1-3: 48 kHz CLOCK output (cont.)

Characteristic	Performance requirements	Reference information
Output level		User selectable by the internal jumper. Level 1 is selected at the factory.
Level 1	CMOS compatible	High > 2.1 V, Low < 0.8 V
Level 2	1 ± 0.1 V	Measured across 75 Ω.

Table 1-4: Output timing

Characteristic	Performance requirements	Reference information
Range	± 160 ms	Relative to the frame reset signal.
Resolution	1 μs	

Environmental Characteristics

Table 1–5 lists the environmental characteristics of the AG7 Generator module.

Table 1-5: Environmental characteristics

Characteristic	Description
Temperature	
Operating	0 °C to +50 °C
Nonoperating	-20 °C to +60 °C
Relative Humidity	
Operating	20% to 80% (No condensation) ; Maximum wet-bulb temperature 29.4 °C
Nonoperating	5% to 90% (No condensation) ; Maximum wet-bulb temperature 40.0 °C
Altitude	
Operating	To 4.5 km (15,000 feet) Maximum operating temperature decreases 1 °C each 300 m above 1.5 km.
Nonoperating	To 15 km (50,000 feet)
Vibration	
Operating	3.04 m/s^2 (0.31 G_{rms}), 5 to 500 Hz, 10 min, three axes
Nonoperating	23.3 m/s^2 (2.38 G_{rms}), 5 Hz to 500 Hz, 10 min, three axes
Shock	
Nonoperating	294 m/s2 (30 G), half-sine, 11 ms duration

Theory of Operation

Theory of Operation

This section describes the basic operation of the major circuit blocks in the AG7 Generator module.

For information about the TG700 mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

Bus Interface This block provides the communication between the mainframe and the module circuit.

Audio Memory This block contains 20/24 bits audio data for all of the serial audio outputs.

Audio Data Controller and 48 kHz Decoder The block is a part of the FPGA. It receives audio data from the Audio Memory and encodes these data to serial audio data stream that comply with the AES/EBU standard. It also generates 48 kHz clock signal.

Channel Buffers (1+2, 3+4, 5+6, 7+8, and Silence) These blocks receive the digital audio data from the FPGA and set the output amplitude to the specified level.

48 kHz Clock Buffer The block outputs 48 kHz clock signal. The output level of the clock signal can be set to either a CMOS compatible level or 1V. This feature is available through jumper J452 on the circuit board.

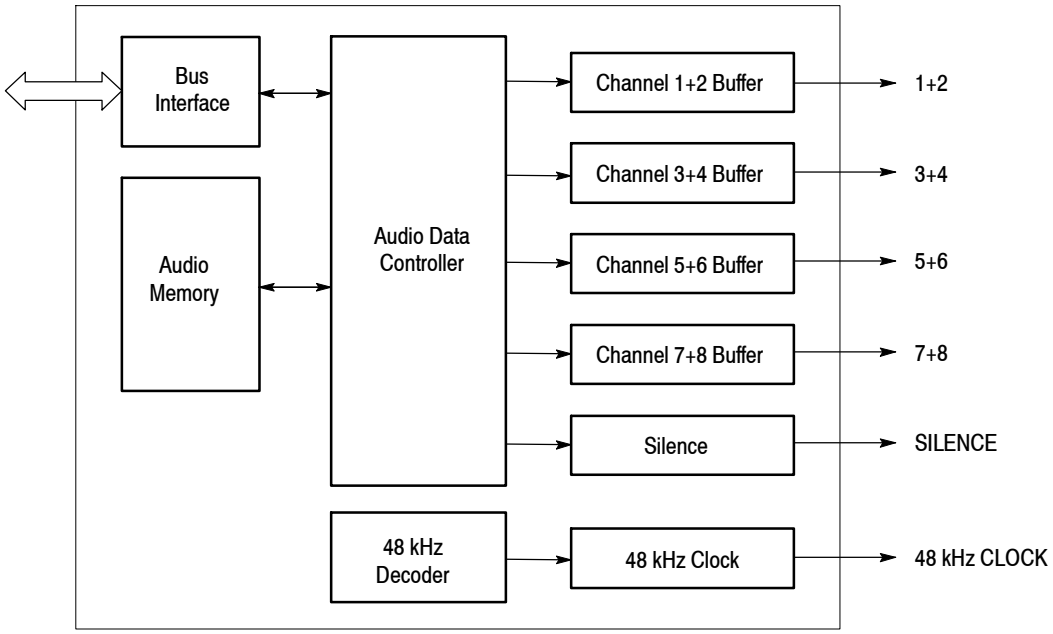

Figure 2-1: Simplified block diagram of the AG7 Generator module

Performance Verification

Performance Verification

This section provides procedures that verify the performance and functionality of the AG7 Generator module.

Preparation for Performance Verification

Perform the following before starting the performance verification procedures:

Power On Default Settings

Before you begin the performance verification procedures, make sure that the required instrument settings are saved in the Power On Default preset.

If the instrument settings are saved in the Power On Default preset, you can recall the settings after the performance verification procedures is completed by turning off and on the power.

Warm up

The AG7 Generator module and test equipment must have had a warm-up period of at least 20 minutes.

Equipment Required

Table 3–1 lists the equipment required for the procedures.

Table 3-1: Equipment required for performance verification

Item	No.	Minimum requirements	Recommended equipment
Digital Audio Monitor	1		Tektronix 764
Oscilloscope	1	Bandwidth: 200 MHz or higher	Tektronix TDS540D
75 Ω BNC cable	1	Length: 42 inches	Tektronix part number 012-0074-00
75 Ω feed-through terminator	1		Tektronix part number 011-0103-02
75 Ω coaxial terminator	1		Tektronix part number 011-0102-01

Calibration Data Report

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

Table 3- 2: AG7 calibration data report

Serial Number:	Cal Date:	Temperature:	Humidity:

Step	Function Tested	Minimum	Cal Data	Maximum
1.	AES/EBU Serial Digital Audio Output Level			
	1+2	900 mV	mV	1100 mV
	3+4	900 mV	mV	1100 mV
	5+6	900 mV	mV	1100 mV
	7+8	900 mV	mV	1100 mV
2.	SILENCE Output Level	900 mV	mV	1100 mV
3.	48 kHz Clock Output Level (CMOS compatible)			
	High	2.1V	OK	
	Low		OK	0.8V

Performance Verification Procedures

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

Performance verification procedures can be performed individually if desired.

WARNING. *Dangerous electric shock hazards exist inside the TG700 mainframe. Only qualified service personnel should perform these procedures.*

Serial Digital Audio Outputs

This test verifies that serial digital audio signals are output correctly from the 1+2, 3+4, 5+6, 7+8, and SILENCE connectors. The following equipment is required for this test:

- Oscilloscope
- Digital audio monitor
- 75 Ω BNC cable
- 75 Ω feed-through terminator
- 75 Ω coaxial terminator

Perform the following procedure to verify that serial digital audio signals are output correctly from the 1+2, 3+4, 5+6, 7+8, and SILENCE connectors.

1. Use the 75 Ω BNC cable and the 75 Ω feed-through terminator to connect the 1+2 connector on the AG7 Generator module to the oscilloscope CH1 input as shown in Figure 3–1.

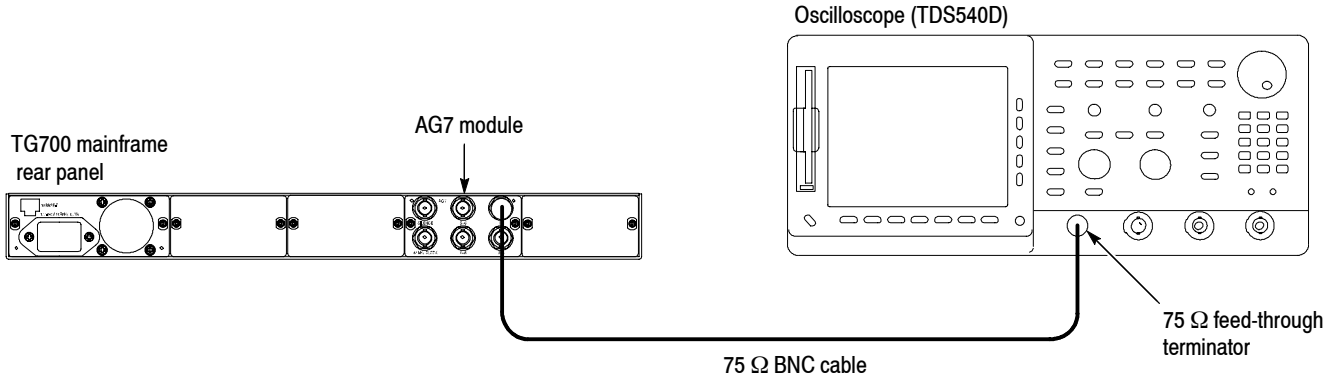

Figure 3- 1: Initial equipment connection for verifying the serial digital audio outputs

2. Set the oscilloscope settings as indicated below:

Vertical . . . . . 200 mV/div
Horizontal . . . . . 100 ns/div
Acquire menu . . . . . Sample
Trigger position . . . . . 50 %
Trigger slope . . . . . Rising Edge
Input impedance . . . . . 1 MΩ
Measure . . . . . Amplitude

3. Recall the Factory Default preset as follows:

a. Press the **MODULE** button to display the TG700 main menu.

b. Use the up (▲) or down (▼) arrow button to select **RECALL**.

c. Use the left (◀) or right (▶) arrow button to select **Factory Default**.

d. Press the **ENTER** button to recall the factory default settings.

4. Use the oscilloscope to measure that the signal amplitude is within the range of 900 mV to 1100 mV.

5. Change the BNC cable connection from the 1+2 connector to the 3+4 connector on the AG7 Generator module and repeat step 4.

6. Change the BNC cable connection from the 3+4 connector to the 5+6 connector on the AG7 Generator module and repeat step 4.

7. Change the BNC cable connection from the 5+6 connector to the 7+8 connector on the AG7 Generator module and repeat step 4.

8. Change the BNC cable connection from the 7+8 connector to the SILENCE connector on the AG7 Generator module and repeat step 4.

9. Change the BNC cable connection from the SILENCE connector to the 1+2 connector on the AG7 Generator module.

10. Disconnect the BNC cable and the 75 Ω terminator from the oscilloscope CH1 input connector, and then connect the BNC cable to the CH1–2 BNC connector on the digital audio monitor rear panel as shown in Figure 3–2.

11. Use the 75 Ω coaxial terminator to terminate the other loop through to the CH1–2 BNC connector on the digital audio monitor rear panel.

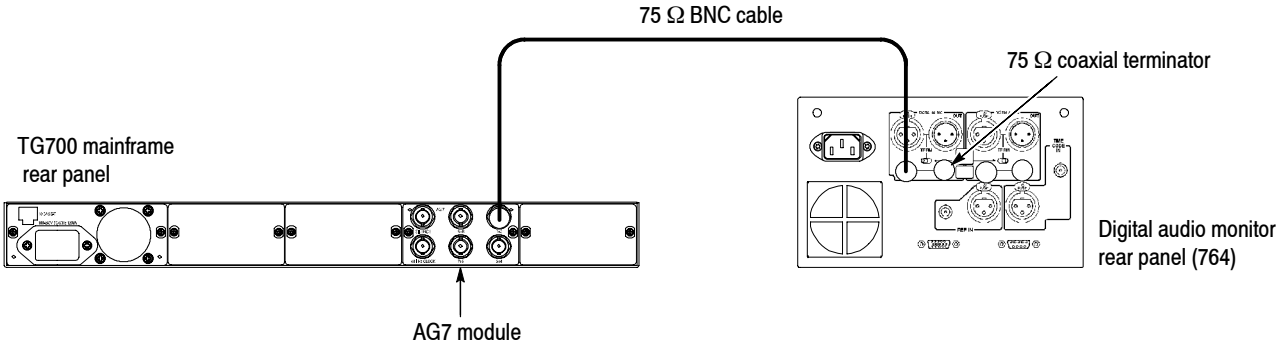

Figure 3-2: Second equipment connection for verifying the serial digital audio outputs

12. On the digital audio monitor front panel, press the **MENU** button to display the menu.
13. Select the **Input** item from the menu, and select **CH1–2 input: BNC–unbalanced** item from the submenu.
14. On the digital audio monitor front panel, press the **CLEAR** button to clear the menu.
15. On the digital audio monitor front panel, press the **CH STATUS** button to display **CHANNEL STATUS** view.
16. In the view, check CRC errors are not displayed.
17. On the digital audio monitor front panel, press the **Audio View** button.
18. Verify that the digital audio monitor bar graphs show both Channel 1 and Channel 2 at –20 dBfs.
19. Change the BNC cable connection from the 1+2 connector to the 3+4 connector on the AG7 Generator module and repeat step 12 to step 18.
20. Change the BNC cable connection from 3+4 connector to 5+6 connector on the AG7 Generator module and repeat step 12 to step 18.
21. Change the BNC cable connection from 5+6 connector to 7+8 connector on the AG7 Generator module and repeat step 12 to step 18.
22. Change the BNC cable connection from 7+8 connector to SILENCE connector on the AG7 Generator module and repeat step 12 to step 18.

48 kHz Clock Output

This test verifies that 48 kHz clock signal are output correctly from the 48 kHz CLOCK connector. The following equipment is required for this test:

- Oscilloscope
- 75 Ω BNC cable
- 75 Ω feed-through terminator

Perform the following procedure to verify that 48 kHz clock signal is output correctly from the 48 kHz CLOCK connector.

1. Use the 75 Ω BNC cable and the 75 Ω feed-through terminator to connect the 48 kHz CLOCK connector on the AG7 Generator module to the oscilloscope CH1 input as shown in Figure 3–3.

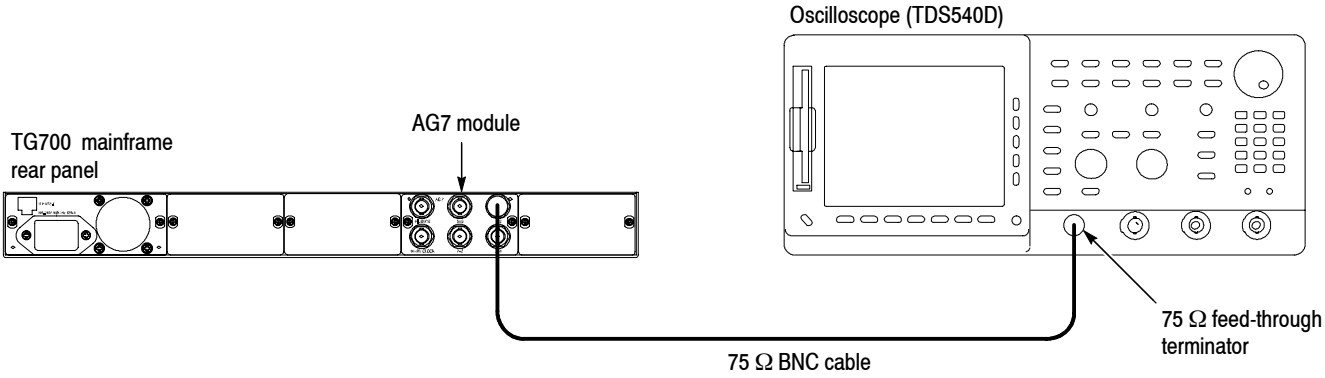

Figure 3- 3: Equipment connection for verifying the 48 kHz clock output

2. Set the oscilloscope settings as indicated below:

   Vertical . . . . . 500 mV/div
   Horizontal . . . . . 10 µs/div
   Record Length 1000
   Acquire menu . . . . . Sample
   Trigger position . . . . . 50 %
   Trigger slope . . . . . Rising Edge
   Input impedance . . . . . 1 MΩ
   Measure . . . . . Amplitude

3. Use the oscilloscope to measure that the signal amplitude is as follows:

   Low: < 0.8 V
   High: > 2.1 V

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

Maintenance

Maintenance

This section contains instructions and procedures for maintaining the AG7 Generator module. For information on servicing the mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

The following information can be found in this section:

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

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

Preparation

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

Servicing Prerequisites

Ensure 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 instrum

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.*

Inspecting and Cleaning Procedures

Clean the mainframe and modules often enough to prevent dust or dirt from accumulating. Refer to *Inspecting and Cleaning Procedures* in the *TG700 TV Signal Generator Platform Service Manual*.

Performance Verification

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

Repackaging Instructions

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

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

Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the AG7 Generator module.

Tools Required

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

Table 4-1: Required tools

Name	Description	Tektronix part number
Screwdriver handle	Accepts Phillips-driver bits	
#1 Phillips tip	Phillips-driver bit for #1 size screw heads	
#2 Phillips tip	Phillips-driver bit for #2 size screw heads	
Nut driver, 11 mm	Special nut driver for removing the BNC connectors of the AG7 module	003-A042-00

Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section in the *TG700 TV Signal Generator Platform Module Installation Instructions* to remove the AG7 Generator module from the mainframe.
2. Disconnect these cables:
   - The cable from J400 at 1+2 connector.
   - The cable from J410 at 3+4 connector.
   - The cable from J420 at 5+6 connector.
   - The cable from J430 at 7+8 connector.
   - The cable from J440 at SILENCE connector.
   - The cable from J450 at 48 kHz CLOCK connector.

3. Use a screwdriver with a #2 Phillips tip to remove the four screws securing the AG7 circuit board to the chassis.
4. Lift the circuit board up and away from chassis, and then place it on a static free surface.
5. Use the 11 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
6. Perform steps 2 through 5 in reverse order to replace the connector.

Replacing the chassis

Perform the following procedure to replace the chassis:

1. Perform steps 1 through 4 in *Replacing the Rear-Panel Connectors* on page 4–5.
2. Use the 11 mm nut driver to remove the nuts from each of the rear-panel connectors.
3. Set the replacement chassis on a firm, flat, static-free work surface.
4. Apply the rear panel to the chassis, and then install all the connectors to the chassis.
5. Carefully place the AG7 circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the four screws securing the circuit board to the chassis.
7. Reconnect all the cables to the rear-panel connectors.

Troubleshooting

This section contains instructions and procedures for troubleshooting the AG7 Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to *Troubleshooting* in the *TG700 TV Signal Generator Platform Service Manual*.

Equipment Required

The equipment listed in Table 4–2 is required for troubleshooting.

Table 4-2: Equipment required for troubleshooting

Equipment description	Minimum requirements/example
Screwdriver handle	Accept Phillips-driver bits
#1 Phillips tip	Phillips-driver bit for #1 size screw heads
TG700 mainframe	A TG700 mainframe that is functioning correctly

Backing up the instrument settings

Before you begin the trouble shooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◀) or right (▶) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

Troubleshooting Trees

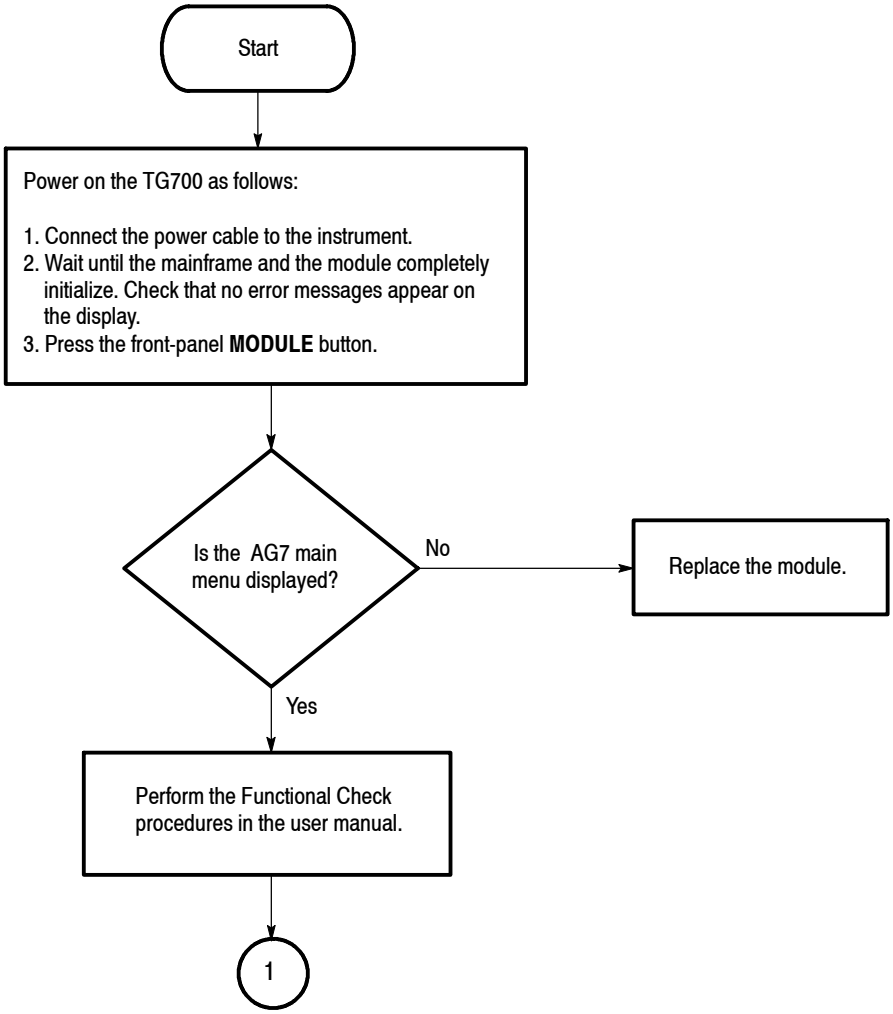

Figure 4-1: Troubleshooting procedure (1)

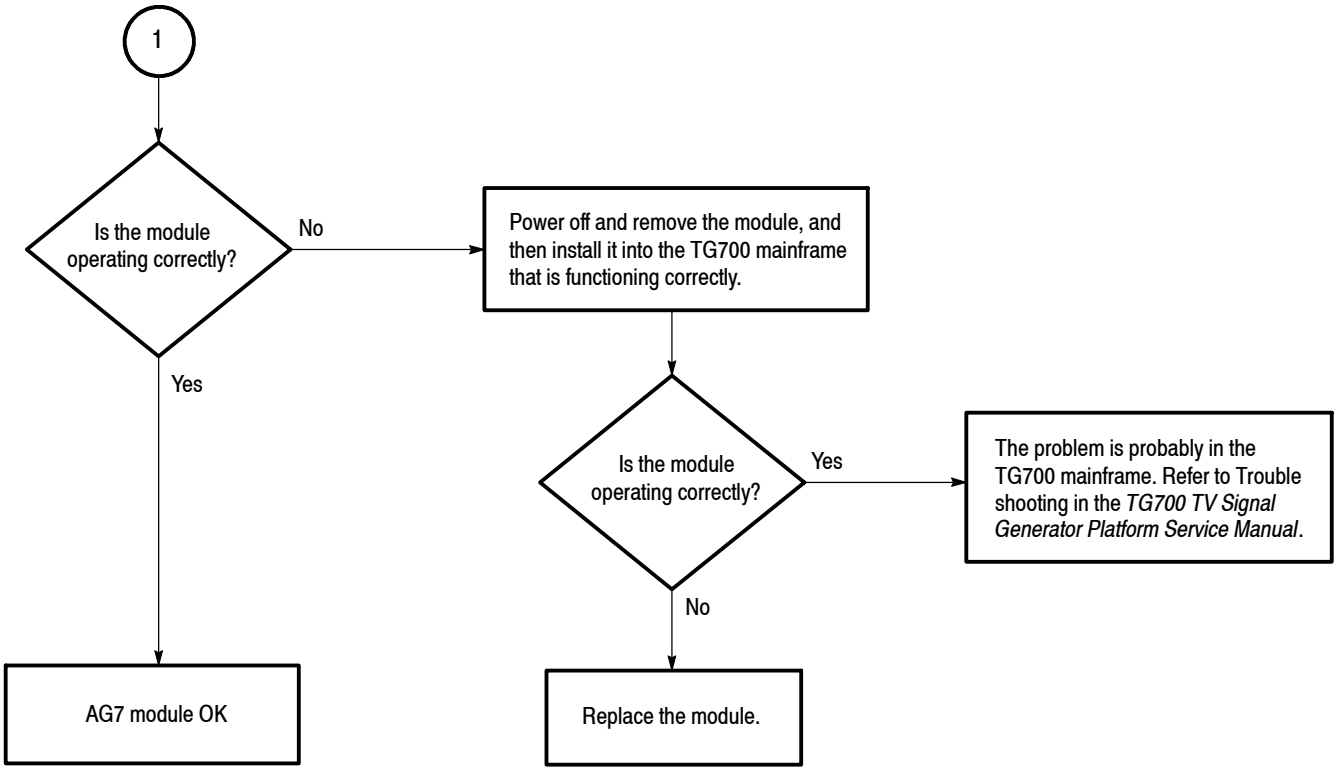

Figure 4- 2: Troubleshooting procedure (2)

Option

Option

This section describes the option that is available for the AG7 Generator module.

The following option is available.

- Option D1 (Test data report)

Option D1 Description

A calibration data test result report will be provided with the AG7 Generator module when this option is specified.

Diagram

Diagram

Figure 6–1 shows the AG7 Generator module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 TV Signal Generator Platform Service Manual*.

A block diagram of the AG7 Generator module is located in the *Theory of Operation* section, beginning on page 2–1.

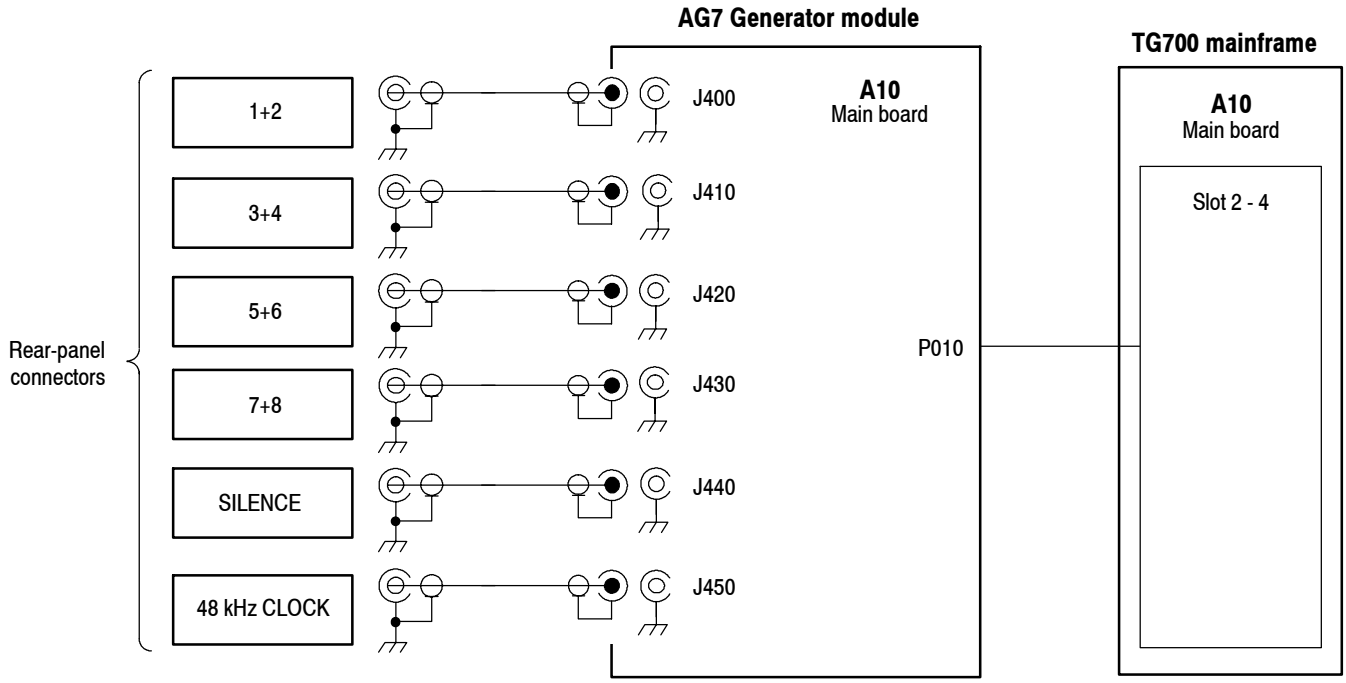

Figure 6- 1: AG7 Generator module connections

Replaceable Parts List

Replaceable Parts List

This section contains a list of the replaceable modules for the AG7 Generator module. Use this list to identify and order replacement parts.

Parts Ordering Information

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

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

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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

Module Servicing

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

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

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

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

Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the AG7 Generator module. 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.

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

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
7-1	116-A001-01			1	EXCHANGE MODULE:AG7
7-1-1	441-A267-03			1	CHASSIS,MODULE AG7:ASSY
-2	333-A404-00			1	PANEL,REAR:AG7,AL
-3	214-4946-00			2	SPRING,CONICAL:VXI MOUNTING SCREW,0.26 MM SUS304,5.4 MML
-4	213-1129-01			2	SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,N1 PL,CROSS REC & SLOTTED
-5	348-A128-00			2.5 CM	SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02]
-6	131-6383-00			6	CONN,RF JACK:BNC,50OHM,FEMALE,STR,SNAP IN/PNL MTG,12.5MM MLG [MCF3]
-7	211-A245-01			4	SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER
-8	174-A278-00			6	CA ASSY,RF:75 OHM COAX,120MM L,BLACK [QQB-0120-0]
-9	334-1378-03			1	MARKER,IDENT:MKD SERIAL NO.
					STANDARD ACCESSORIES
	070-A824-XX			1	MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS
	062-A249-XX			1	SOFTWARE PACKAGE:S/W(CD-R)
					OPTIONAL ACCESSORIES
	070-A800-XX			1	MANUAL,TECH:SERVICE,TG700
	003-A042-00			1	NUTDRIVER,BOX:11MM HEX,BNC RETAINING NUT,MODIFIED 14.5MM

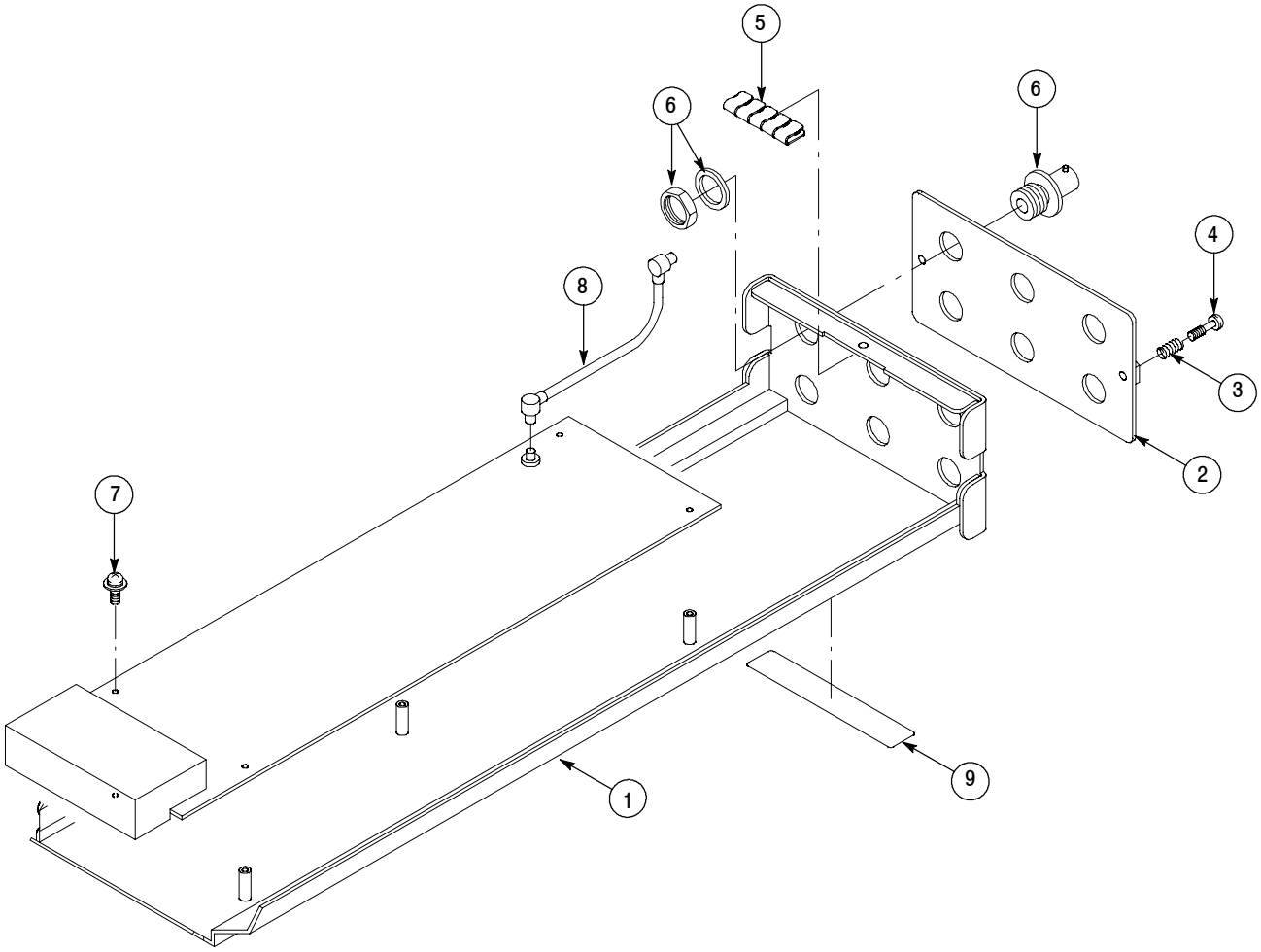

Figure 7-1: AG7 Generator module exploded view

Service Manual

Tektronix

AGL7
Analog Genlock Module

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

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Preface

This is the service manual for the AGL7 Analog Genlock module. This manual contains information needed to service an AGL7 Genlock module to the module level.

Manual Structure

This manual is divided into sections, such as *Specifications* and *Theory of Operation*. Further, some sections are divided into subsections, such as *Product Description* and *Removal and Installation Procedures*.

Sections containing procedures also contain introductions to those procedures. Be sure to read these introductions because they provide information needed to do the service correctly and efficiently. The following are brief descriptions of each manual section.

- *Specifications* contains a description of the AGL7 Genlock module and the characteristics that apply to it.
- *Theory of Operation* is an overview of the module's design.
- *Performance Verification* contains procedures to perform the operation tests.
- *Adjustment Procedures* contains procedures for adjusting a AGL7 Genlock module to meet warranted characteristics.
- *Maintenance* contains installation, removal and replacement, and trouble-shooting instructions.
- *Option* contains a description of the available option for the AGL7 Genlock module.
- *Diagram* contains an interconnect diagram showing the connections between the AGL7 Genlock module and the mainframe.
- *Replaceable Parts List* 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 AGL7 Genlock module

- The *TG700 TV Signal Generator Platform User Manual* (Tektronix part number 070-A799-XX) describes how to use the TG700 mainframe and all modules. It also contains information about remote commands and programming structure for the TG700 mainframe and all modules.
- The *TG700 TV Signal Generator Platform Module Installation Instructions* (Tektronix part number 070-A824-XX) describes how to install and remove the modules, and how to upgrade the firmware of the mainframe.

Specifications

Specifications

This section contains a general product description of the AGL7 Genlock module followed by the operating specifications of the module.

Product Description

The AGL7 Genlock module is designed to be installed in the TG700 TV Signal Generator Platform.

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

- NTSC black burst signal: burst lock or sync lock
- PAL black burst signal: burst lock and sync lock
- HDTV trilevel sync signal
- CW: 1, 3.58 (NTSC sub-carrier), 4.43 (PAL sub-carrier), 5, and 10 MHz

In addition, there are three signal output connectors provided on the rear panel which can output black burst signals and HDTV trilevel sync signals.

Electrical Characteristics

Tables 1–1 and 1–3 list the electrical characteristics of the AGL7 Genlock module.

Table 1-1: Genlock function

Characteristic	Performance requirements	Reference information
Input configuration	75 Ω loop through	REF inputs
	75 Ω terminated	CW input
Return loss	> 40 dB	5 MHz
	> 35 dB	5 MHz to 30 MHz
Input requirements		
Reference inputs	NTSC/PAL black burst or Trilevel sync	
Amplitude	± 6 dB	
S/N ratio	> 40 dB	
SCH phase	± 40 °	
CW input	1, 3.58, 4.43, 5, or 10 MHz CW	
Input range	1 to 2.5 Vp-p	
Pull-in range	Subcarrier frequency ± 15 Hz	
Jitter		
Burst lock	< 0.5°	
Sync lock	< 1 ns	

Table 1-2: Black burst signal and HDTV trilevel sync signal outputs

Characteristic	Performance requirements	Reference information
Connector	BNC	
Number of outputs	3	BLACK1, BLACK2, and BLACK3
Configuration		
BLACK1	Black burst	BLACK1 always generates Black burst.
BLACK2	Black burst or Trilevel sync	When the trilevel sync signal is selected, the signal to be the same signal as BLACK 3 is output.
BLACK3	Black burst or Trilevel sync	When the black burst is selected, the signal to be the same signal as BLACK 2 is output.
Burst amplitude accuracy	± 2%	
Sync amplitude accuracy	± 2%	
Sync rise time		
NTSC		140 ns
PAL		250 ns
Return loss	< 30 dB to 30 MHz	
Timing offset		
Range	Full color frame	
Resolution	< 0.5 ° of sub carrier	

Table 1-3: Word clock signal output* (J320101 and above)

Characteristic	Performance requirements	Reference information
Connector	BNC	Same connector as CW
Frequency	48 kHz	
Level	CMOS compatible	Without termination
Impedance	75 Ω ± 10%	

*** This output is enabled when the configuration of the CW connector is changed.**

Environmental Characteristics

Tables 1–4 lists the environmental characteristics of the AGL7 Genlock module.

Table 1-4: Environmental characteristics

Characteristic	Description
Temperature	
Operating	0 °C to +50 °C
Non-operating	-20 °C to +60 °C
Relative Humidity	
Operating	20% to 80% (No condensation) ; Maximum wet-bulb temperature 29.4 °C
Non-operating	5% to 90% (No condensation) ; Maximum wet-bulb temperature 40.0 °C
Altitude	
Operating	To 4.5 km (15,000 feet) Maximum operating temperature decreases 1 °C each 300 m above 1.5 km.
Non-operating	To 15 km (50,000 feet)
Vibration	
Operating	3.04 m/s^2 (0.31 G_{rms}), 5 to 500 Hz, 10 min, three axes
Non-operating	23.3 m/s^2 (2.38 G_{rms}), 5 Hz to 500 Hz, 10 min, three axes
Shock	
Non-operating	294 m/s2 (30 G), half-sine, 11 ms duration

Theory of Operation

Theory of Operation

This section describes the basic operation of the major circuit blocks in the AGL7 Genlock module.

For information about the TG700 mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

Analog Genlock

The Analog Genlock consists of the following blocks.

Bus Interface This block provides the communication between the mainframe and the module circuit.

Amp & Restorer This block consists of amplifiers to adjust the amplitude of the signal from REF or CW input and restorer to recover the DC component of the signal.

Sync Separator The sync separator separates the sync signals such as H sync, V sync, or composite sync from the conditioned REF signal if the signal contains the sync.

A/D Converter The A/D converter digitizes the analog input signal to 10 bits digital data for genlock operation. This data is read by the CPU in the mainframe and used to control the master oscillator frequency.

Genlock Controller This block controls the A/D converter, memory, and sync separator to obtain correct digital data.

Black Burst Generator

The Black Burst Generator consists of the following blocks:

Black Burst Generator This block generates NTSC or PAL black burst digital data.

Trilevel Sync Generator This block generates trilevel sync digital data.

D/A Converter & Amp This block consists of a D/A converter, two amplifiers, and a filter. It converts the digital data from the black burst generator or trilevel sync generator to an analog signal and re-constructs the signal for output. The “D/A Converter & Amp 3” also has a wide bandwidth filter for the HDTV trilevel sync signal.

Word Clock Generator This block generates a 48 kHz word clock signal.

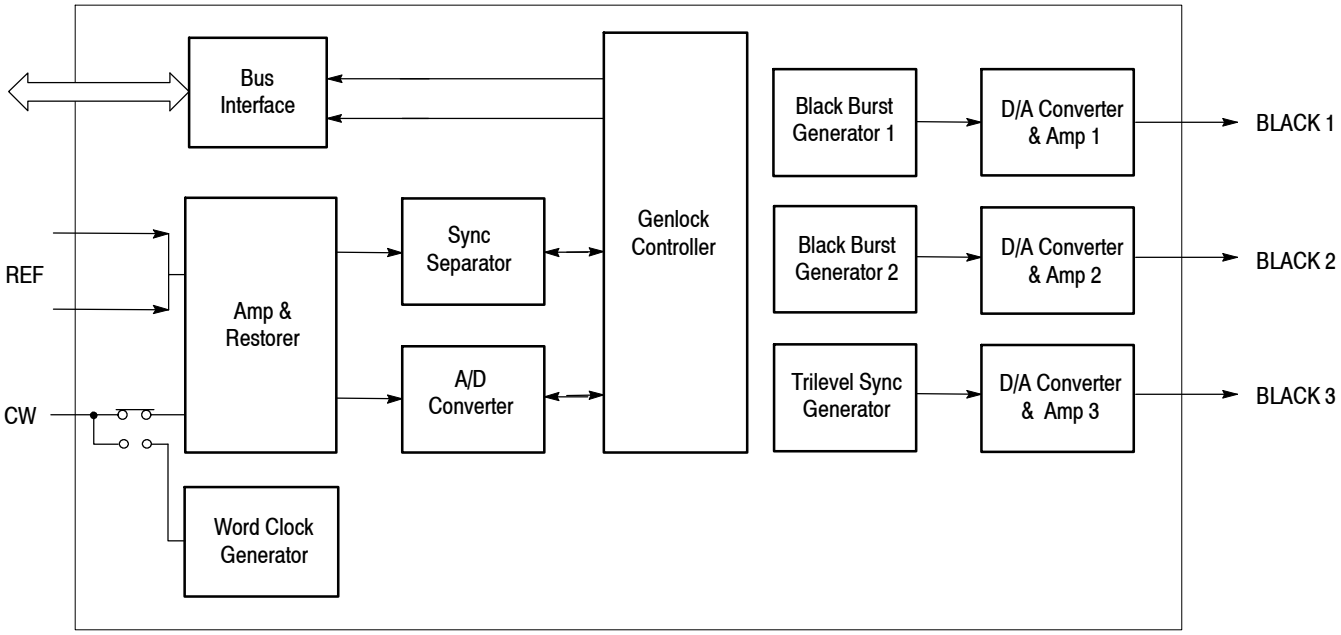

Figure 2-1: Simplified block diagram of the AGL7 Genlock module

Performance Verification

Performance Verification

This section provides procedures that verify the performance and functionality of the AGL7 Genlock module.

Preparation for Performance Verification

Perform the following before starting the performance verification procedures:

Power On Default Settings

Before you perform the performance verification procedures, make sure that the required instrument settings are saved in the Power On Default preset.

If the instrument settings are saved in the Power On Default preset, you can recall the settings after completing the performance verification procedures by turning the power off and on.

Warm up

The AGL7 Genlock module and test equipment must have had a warm-up period of at least 20 minutes.

Equipment Required

Table 3–1 lists the equipment required for the procedures.

Table 3-1: Equipment required for performance verification

Item	No.	Minimum requirement	Recommended equipment
Oscilloscope	1	Bandwidth: 200 MHz or higher	Tektronix TDS540D
Video measurement set	1		Tektronix VM700T Option 01/11
Waveform vector monitor	1		Tektronix 1765
TV signal generator	1		Tektronix TG700 with AGL7 Analog Genlock module
Frequency counter	1	Frequency range: 0.1 Hz to 1250 MHz Precision: 7 digits or higher	ANRITSU MF 1603A
75 Ω BNC cable	4	Length: 42 inches	Tektronix part number 012-0074-00
75 Ω feed-through terminator	1		Tektronix part number 011-0103-02
75 Ω coaxial terminator	2		Tektronix part number 011-0102-01

Calibration Data Report

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

Table 3- 2: AGL7 calibration data report

Serial Number:	Cal Date:	Temperature:	Humidity:

Step	Function Tested	Minimum	Cal Data	Maximum
	Black Output (NTSC)			
1.	Blanking Level			
	BLACK 1	-50 mV	mV	+50 mV
	BLACK 2	-50 mV	mV	+50 mV
	BLACK 3	-50 mV	mV	+50 mV
2.	Burst Amplitude			
	BLACK 1 (Peak to Peak Value)	280.0 mV	mV	291.4 mV
	BLACK 2 (Peak to Peak Value)	280.0 mV	mV	291.4 mV
	BLACK 3 (Peak to Peak Value)	280.0 mV	mV	291.4 mV
3.	Sync Amplitude			
	BLACK 1	280.0 mV	mV	291.4 mV
	BLACK 2	280.0 mV	mV	291.4 mV
	BLACK 3	280.0 mV	mV	291.4 mV
4.	Subcarrier Frequency	3.5795444 MHz		3.5795464 MHz
	Tri-Level Sync Output			
4.	Blanking Level			
	BLACK 2	-50 mV	mV	+50 mV
	BLACK 3	-50 mV	mV	+50 mV
5.	Sync Amplitude plus			
	BLACK 2	294.0 mV	mV	306.0 mV
	BLACK 3	294.0 mV	mV	306.0 mV
6.	Sync Amplitude minus			
	BLACK 2	294.0 mV	mV	306.0 mV
	BLACK 3	294.0 mV	mV	306.0 mV

Performance Verification Procedures

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

WARNING. *Dangerous electric shock hazards exist inside the TG700 mainframe. Only qualified service personnel should perform these procedures.*

Genlock Function

This test verifies that the genlock function is operating correctly. The following equipment is required for the test:

- TV signal generator (TG700 mainframe with AGL7 module)
- Waveform vector monitor
- Four 75 Ω BNC cables
- Three 75 Ω coaxial terminators

Perform the following procedure to verify that the genlock function is functioning correctly.

1. Use a 75 Ω BNC cable to connect the CW connector on the AGL7 Genlock module to the BLACK 2 connector on the TV signal generator (AGL7 module) as shown in Figure 3–1.
2. Use a 75 Ω BNC cable to connect the REF connector on the AGL7 Genlock module to the BLACK 1 connector on the TV signal generator (AGL7 module) as shown in Figure 3–1.
3. Use a 75 Ω BNC cable to connect the other REF connector on the AGL7 Genlock module to the A connector on the waveform vector monitor as shown in Figure 3–1.
4. Use a 75 Ω BNC cable to connect the BLACK 1 connector on the AGL7 Genlock module to the B connector on the waveform vector monitor rear panel as shown in Figure 3–1.
5. Use the 75 Ω coaxial terminators to terminate the A and B loop through connectors on the waveform vector monitor rear panel.

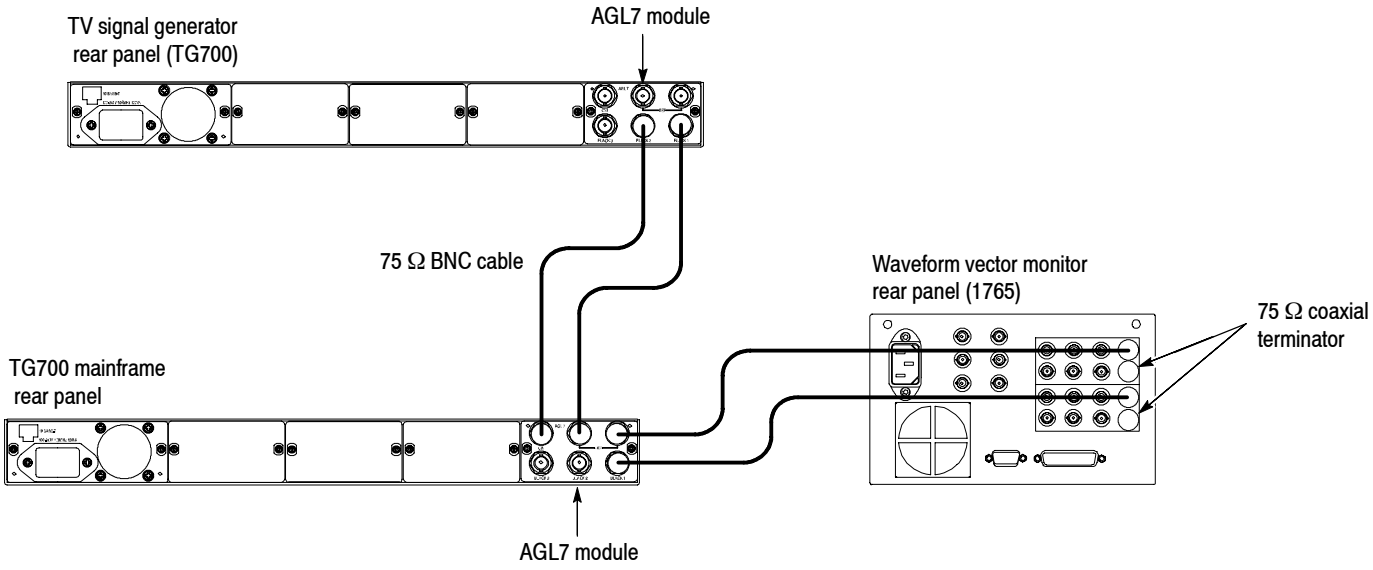

Figure 3- 1: Equipment connections for verifying the genlock function

6. Set the TV signal generator (AGL7 module) settings as indicated below:

Signal format . . . . . PAL
Test signal . . . . . Black Burst

7. Set the waveform vector monitor settings as indicated below:

CONFIG . . . . . REFERENCE
NTSC EXTREF: A
PAL EXTREF :B
DISPLAY . . . . . VECTOR
INPUT . . . . . CH-A and CH-B
OVERLAY . . . . . ON
EXT REF . . . . . OFF

8. Press the **GAIN** menu button on the waveform vector monitor front panel to display the Gain menu.

9. In the Gain menu, select X5 and VARIABLE.

10. Align the PAL burst vector with the compass rose of the display.

11. Recall the Factory Default preset as follows:

a. Press the **MODULE** button to display the TG700 main menu.

b. Press the up (▲) or down (▼) arrow button to select **RECALL**.

c. Press the left (◀) or right (▶) arrow button to select **Factory Default**.

d. Press the **ENTER** button to recall the factory default settings.

12. Set the genlock source and output signal of the AGL7 Genlock module as follows:

a. Press the **MODULE** button to display the AGL7 main menu.

b. Press the up (▲) or down (▼) arrow button to select **GENLOCK**, and then press the **ENTER** button to access the GENLOCK submenu.

c. Press the left (◀) or right (▶) arrow button to select **PAL Burst**, and then press the **ENTER** button.

d. Press the **CANCEL** button to return the module main menu.

e. Press the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.

f. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button to access the OUTPUT submenu.

g. Press the left (◀) or right (▶) arrow button to select **PAL**, and then press the **ENTER** button to access the SIGNAL menu.

h. Press the left (◀) or right (▶) arrow button to select **Black Burst**, and then press the **ENTER** button.

i. Press the **CANCEL** button to return the module main menu.

13. Verify that the displayed vector display is locked and the **EXT.REF** LED on the TG700 mainframe front panel lights.

14. Press the left (◀) or right (▶) arrow button to select **NTSC Burst**, and then press the **ENTER** button.

15. Verify that the vector display is unlocked.

16. Press the left (◀) or right (▶) arrow button to select **625 SYNC**, and then press the **ENTER** button.

17. Verify that the vector display is locked.

18. Change the signal format setting of the TV signal generator (AGL7 module) to NTSC.

19. Change the AGL7 Genlock module settings as follows:

a. Press the left (◀) or right (▶) arrow button to select **NTSC Burst**, and then press the **ENTER** button.

b. Press the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.

c. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button to access the OUTPUT submenu.

d. Press the left (◀) or right (▶) arrow button to select **NTSC**, and then press the **ENTER** button to access the SIGNAL menu.

e. Press the left (◀) or right (▶) arrow button to select **NTSC Burst**, and then press the **ENTER** button.

f. Press the **CANCEL** button to return the module main menu.

20. Verify that the displayed vector display (CH-B) is locked and the **EXT.REF** LED on the TG700 mainframe front panel lights.

21. Press the left (◀) or right (▶) arrow button to select **PAL Burst**, and then press the **ENTER** button.

22. Verify that the vector display is unlocked.

23. Press the left (◀) or right (▶) arrow button to select **525 SYNC**, and then press the **ENTER** button.

24. Verify that the vector display is locked.

25. Output NTSC subcarrier signal from the TV signal generator (AGL7 module) as follows:

a. Press and hold the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons on the TV signal generator (TG700) simultaneously until **TG700 Preset** appears in the display, then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode.

b. Press the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.

c. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button to access the OUTPUT submenu.

d. Press the left (◀) or right (▶) arrow button to select **CAL**, and then press the **ENTER** button to access the SIGNAL submenu.

e. Press the left (◀) or right (▶) arrow button to select **NTSC Subcarrier (1Vp-p)**, and then press the **ENTER** button.

26. Press the left (◀) or right (▶) arrow button to select **CW**, and then press the **ENTER** button.

27. Verify that the displayed vector display is locked and the **EXT.REF** LED on the TG700 mainframe front panel lights.

28. Change the BNC cable connection from BLACK 2 connector to BLACK 3 connector on the TV signal generator (AGL7 module).

29. Set the TV signal generator (AGL7 module) so that 1080 59.94i trilevel sync signal is output from the BLACK 3 connector.

30. Press the left (◀) or right (▶) arrow button to select **HD SYNC**, and then press the **ENTER** button.

31. Verify that the displayed vector display is locked and the **EXT.REF** LED on the TG700 mainframe front panel lights.

Trilevel Sync Outputs

This test verifies the blanking level and sync amplitude of trilevel sync signals. The following equipment is required for the test:

- Oscilloscope
- 75 Ω BNC cable
- 75 Ω feed-through terminator

Perform the following procedure to verify the blanking level and sync amplitude of trilevel sync signals.

1. Use the 75 Ω BNC cable and the 75 Ω feed-through terminator to connect the BLACK 2 connector on the AGL7 Genlock module to the oscilloscope CH1 input as shown in Figure 3-2.

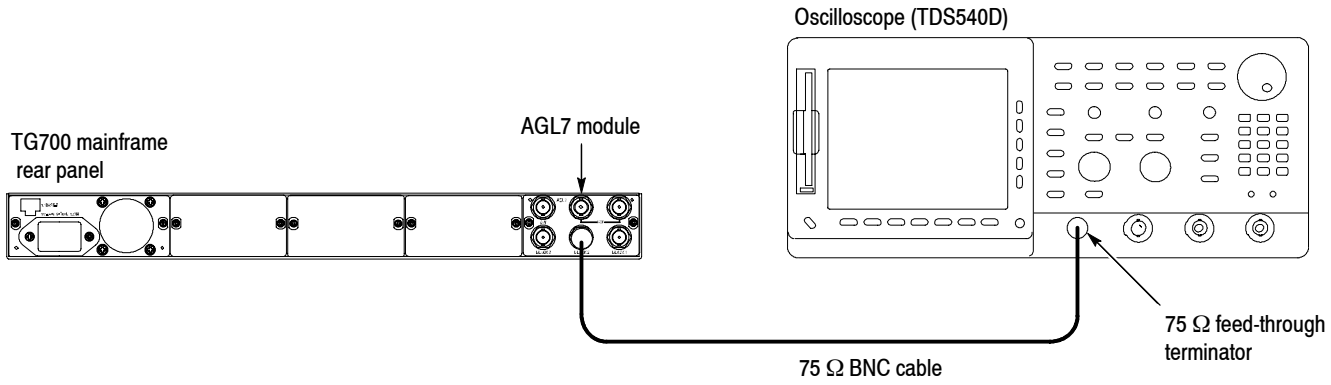

Figure 3-2: Equipment connection for verifying the trilevel sync outputs

2. Select the **HD SYNC (SAME AS BLACK3)** signal for BLACK 2 as follows:

   a. Press the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.

   b. Press the left (◀) or right (▶) arrow button to select **BLACK 2**, and then press the **ENTER** button to access the OUTPUT submenu.

   c. Press the left (◀) or right (▶) arrow button to select **HD SYNC (SAME AS BLACK3)**, and then press the **ENTER** button.

   d. Press the **CANCEL** button to return the module main menu.

3. Set the oscilloscope settings as indicated below:

   Vertical . . . . . 50 mV/div
   Vertical offset . . . . . 0 V
   Horizontal . . . . . 500 ns/div
   Horizontal position . . . . Center
   Trig Position . . . . . 50 %
   Trig slope . . . . . Rising Edge
   Acquire menu . . . . . Average 32

4. Verify that the blanking level is within the range of +50 mV to -50 mV.

5. Change the oscilloscope vertical scale to 10mV/div.

6. Align the blanking level with the center graticule line on the oscilloscope.

7. Change the oscilloscope vertical offset to 300 mV.

8. Verify that the high level of the signal (sync amplitude plus) is within the range of +0.6 div to -0.6 div to the center graticule (except for ringing of the rising edge).

9. Change the oscilloscope vertical offset to -300 mV.

10. Verify that the low level of the signal (sync amplitude minus) is within the range of +0.6 div to -0.6 div to the center graticule (except for ringing of the falling edge).

11. Change the BNC cable connection from BLACK 2 connector to the BLACK 3 connector on the AGL7 Genlock module and repeat steps 4 through 10.

Black Burst Outputs

This test verifies the blanking level, burst amplitude, and sync amplitude of black burst signals. The following equipment is required for the test:

- Oscilloscope
- Video measurement set
- 75 Ω feed-through terminator
- 75 Ω terminator

Perform the following procedure to verify the blanking level, burst amplitude, and sync amplitude of black burst signals.

Use the equipment connection and controls from the previous test.

1. Move the BNC cable connection from BLACK 3 connector to the BLACK 1 connector on the AGL7 Genlock module.
2. Select the **NTSC Black Burst** signal for BLACK 2 and BLACK 3 as follows:
   a. Press the left (◀) or right (▶) arrow button to select **BLACK 2**, and then press the **ENTER** button to access the OUTPUT submenu.
   b. Press the left (◀) or right (▶) arrow button to select **NTSC**, and then press the **ENTER** button to access the SIGNAL submenu.
   c. Press the left (◀) or right (▶) arrow button to select **Black Burst**, and then press the **ENTER** button.
   d. Press the **CANCEL** button to return the module main menu.
   e. Press the left (◀) or right (▶) arrow button to select **BLACK 3**, and then press the **ENTER** button to access the OUTPUT submenu.
   f. Press the left (◀) or right (▶) arrow button to select **BB (SAME AS BLACK2)**, and then press the **ENTER** button.
   g. Press the **CANCEL** button to return the module main menu.

3. Set the oscilloscope settings as indicated below:

   Vertical . . . . . 50 mV/div
   Vertical offset . . . . . 0 V
   Horizontal . . . . . 1 µs/div
   Horizontal position . . . . Center
   Trig position . . . . . 10 %
   Acquire menu . . . . . Average 32
   Measure menu . . . . . Mean
   Trig type . . . . . Video
   Trig standard . . . . . NTSC
   Trig source CH1
   Trig polarity . . . . . Negative
   Trig field . . . . . Odd Field
   Trig line 2
   Trig mode . . . . . MONO (2 Field)

4. Verify that the blanking level is within the range of +50 mV to –50 mV.

5. Move the BNC cable connection from the BLACK 1 connector to the BLACK 2 connector on the AGL7 Genlock module and repeat step 4.

6. Move the BNC cable connection from the BLACK 2 connector to the BLACK 3 connector on the AGL7 Genlock module and repeat step 4.

7. Move the BNC cable connection from the BLACK 3 connector to the BLACK 1 connector on the AGL7 Genlock module.

8. Disconnect the BNC cable from the 75 Ω feed-through terminator on the oscilloscope's input, and then connect the BNC cable to the CHAN A connector on the video measurement set as shown in Figure 3–3.

9. Use the 75 Ω coaxial terminator to terminate the other loop through to the CHAN A connector on the video measurement set.

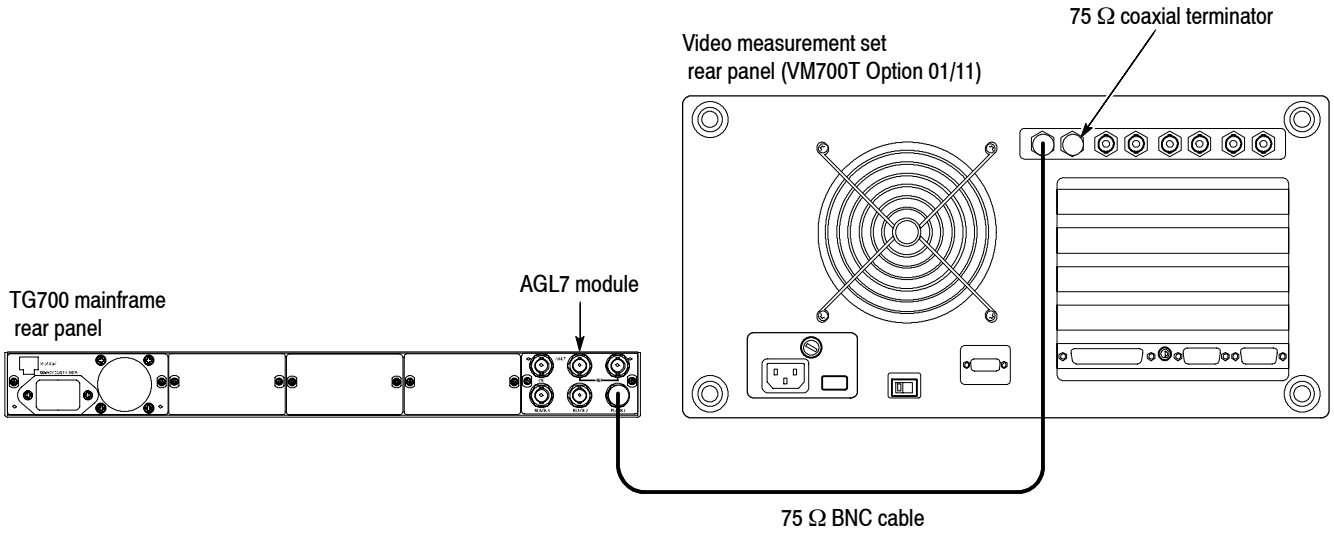

Figure 3- 3: Equipment connection for verifying burst and sync amplitude

10. Press the **Measure** button on the video measurement set to open the Measure mode display.

11. Touch the **Mode** soft key to set the instrument to Analog mode, and then touch the **H_Timing** soft key.

12. Press the **Menu** button to display the H_Timing main menu.

13. Touch the **Average** soft key and rotate the front-panel knob to set the value to 32.

14. Touch the **RS-170A** soft key.

15. Press the **Select Line** button and rotate the front-panel knob set the measurement line to 100 (Field=1 Line=100).

16. Verify that the burst and sync amplitude are within the range of 280.0 mV to 291.4 mV.

17. Move the BNC cable connection from the BLACK 1 connector to the BLACK 2 connector on the AGL7 Genlock module and repeat step 16.

18. Move the BNC cable connection from the BLACK 2 connector to the BLACK 3 connector on the AGL7 Genlock module and repeat step 16.

Subcarrier Frequency

This test verifies the subcarrier frequency accuracy of black burst signals. The following equipment is required for the test:

- Frequency counter
- 75 Ω BNC cable
- 75 Ω feed-through terminator

Perform the following procedure to verify the subcarrier frequency accuracy of the black burst signals.

1. Use the 75 Ω BNC cable and the 75 Ω feed-through terminator to connect the BLACK 1 connector on the AGL7 Genlock module to the INPUT A connector on the frequency counter as shown in Figure 3–4.

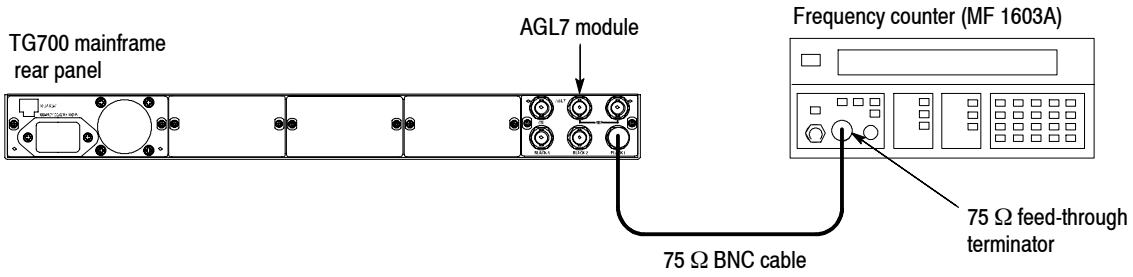

Figure 3-4: Equipment connection for verifying subcarrier frequency

2. Set the frequency counter to the frequency measurement mode (if necessary), and then set the Gate Time to < 2s.
3. Output the NTSC subcarrier calibration signal as follows:
   a. Press and hold the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously until **TG700 Preset** appears in the display, then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode.
   b. Press the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.
   c. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button to access the OUTPUT submenu.
   d. Press the left (◀) or right (▶) arrow button to select **CAL**, and then press the **ENTER** button to access the SIGNAL submenu.
   e. Press the left (◀) or right (▶) arrow button to select **NTSC Subcarrier (1Vp-p)**, and then press the **ENTER** button.

f. Press the **CANCEL** button to return the module main menu.

4. Set the frequency counter to trigger on the input, and then verify that the displayed frequency is within the range of 3.5795444 MHz to 3.5795464 MHz.

48 kHz Clock Output (Serial Number J320101 and Above Only)

This test verifies that the 48 kHz clock signal is output correctly from the CW (48 KHz CLOCK) connector. The following equipment is required for the test:

- Oscilloscope
- 75 Ω BNC cable

Perform the following procedure to verify that the 48 kHz clock signal is output correctly from the CW (48 KHz CLOCK) connector.

1. Disconnect the power cable from the TG700 mainframe.

2. Remove the AGL7 Genlock module from the TG700 mainframe.

3. Change internal cabling to output the 48 kHz clock signal from the CW connector:

a. Disconnect the coaxial cable from the connector labeled **J040** on the circuit board. See Figure 3–5.

b. Reconnect the cable to the connector labeled **J960** on the circuit board. See Figure 3–5.

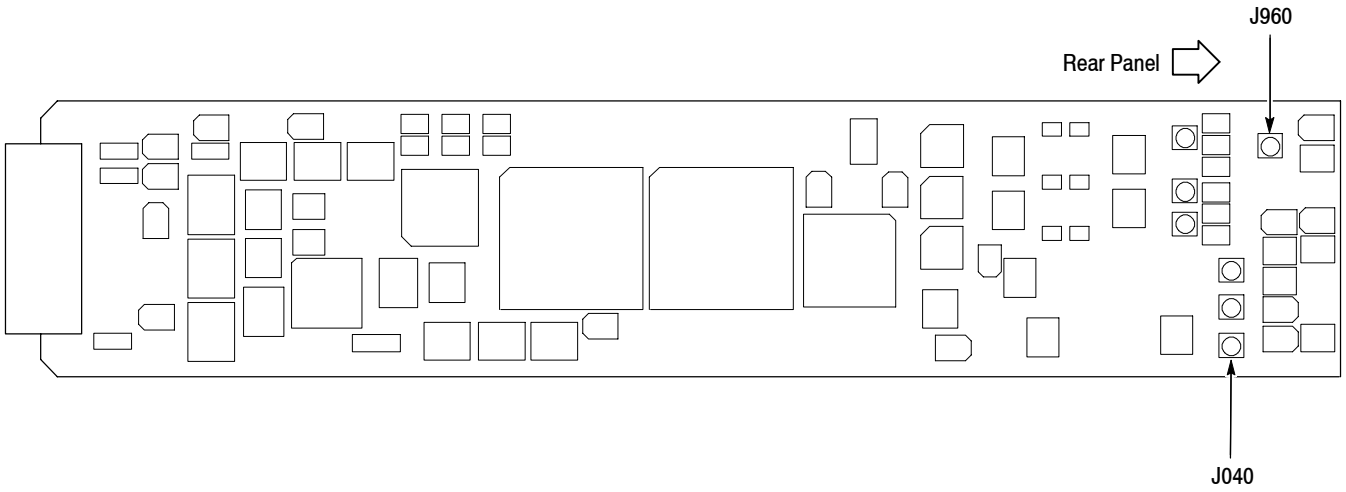

Figure 3- 5: Location of the J040 and J960 connectors

4. Install the AGL7 Genlock module into the TG700 mainframe.

5. Connect the power cable to the TG700 mainframe.

6. Use the 75 Ω BNC cable to connect the CW (48 kHz CLOCK) connector on the AGL7 Genlock module to the oscilloscope CH1 input as shown in Figure 3–6.

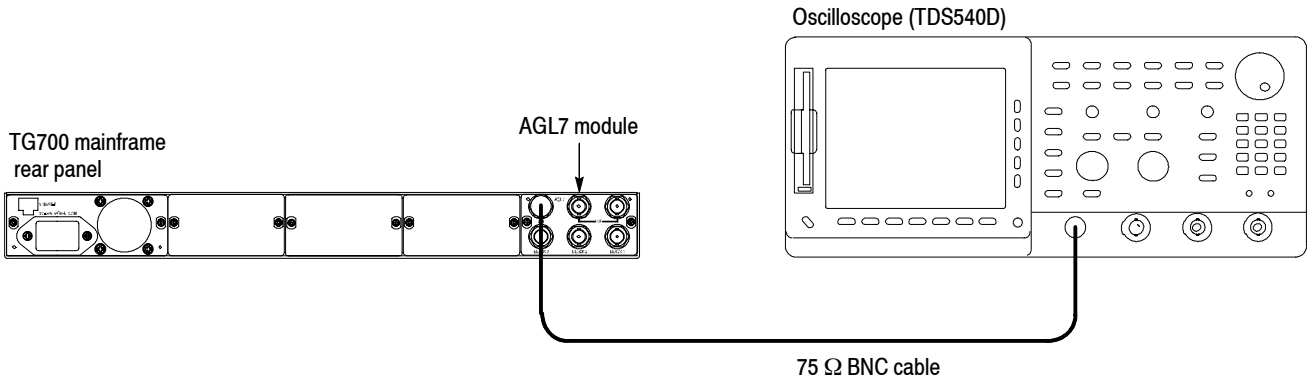

Figure 3- 6: Equipment connection for verifying the 48 kHz clock output

7. Set the oscilloscope settings as indicated below:

   Vertical . . . . . 1 V/div
   Horizontal . . . . . 10 µs/div
   Horizontal position . . . . Center
   Trig position . . . . . 50 %
   Trig slope . . . . . Rising Edge
   Acquire menu . . . . . Sample
   Input impedance . . . . . 1 MΩ
   Measure . . . . . High and Low

8. Use the oscilloscope to measure that the signal amplitude is as follows:

   Low: < 0.8 V
   High: > 2.1 V

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

Adjustment Procedures

Adjustment Procedures

This section contains information needed to adjust the AGL7 Genlock module.

Adjustments in the AGL7 Genlock module are for the output offset, output gain, and clock timing.

Requirements for Adjustment

Before doing the adjustment, note the following requirements.

Personnel This procedure is only to be performed by trained service technicians.

Warm-Up Period The AGL7 Genlock module requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. Adjustment done before the operating temperature has stabilized may cause errors in performance.

Access When adjusting the output offset, output gain, and clock timing, you need to remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

Equipment Required

Table 4–1 lists the equipment required to adjust the output offset, output gain, and clock timing.

Table 4-1: Equipment required

Item	No.	Minimum requirement	Recommended equipment
TV signal generator platform	1		Tektronix TG700
Digital multimeter	1	5 1/2 digits	FLUKE 8842A
Oscilloscope	1	Bandwidth: 500 MHz or higher	Tektronix TDS754D with two P6139A probes
75 Ω BNC cable	1	Length: 42 inches	Tektronix part number 012-0074-00
75 Ω coaxial terminator	1		Tektronix part number 011-0102-03
BNC T connector	1		Tektronix part number 103-0030-00
BNC female to dual banana adapter	1		Tektronix part number 103-0090-00

Output Offset and Gain Adjustment

Preparation

To perform the output offset and gain adjustment, you must first remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

After you have removed the top cover, find the variable resistors on the AGL7 circuit board. See Figure 4–1.

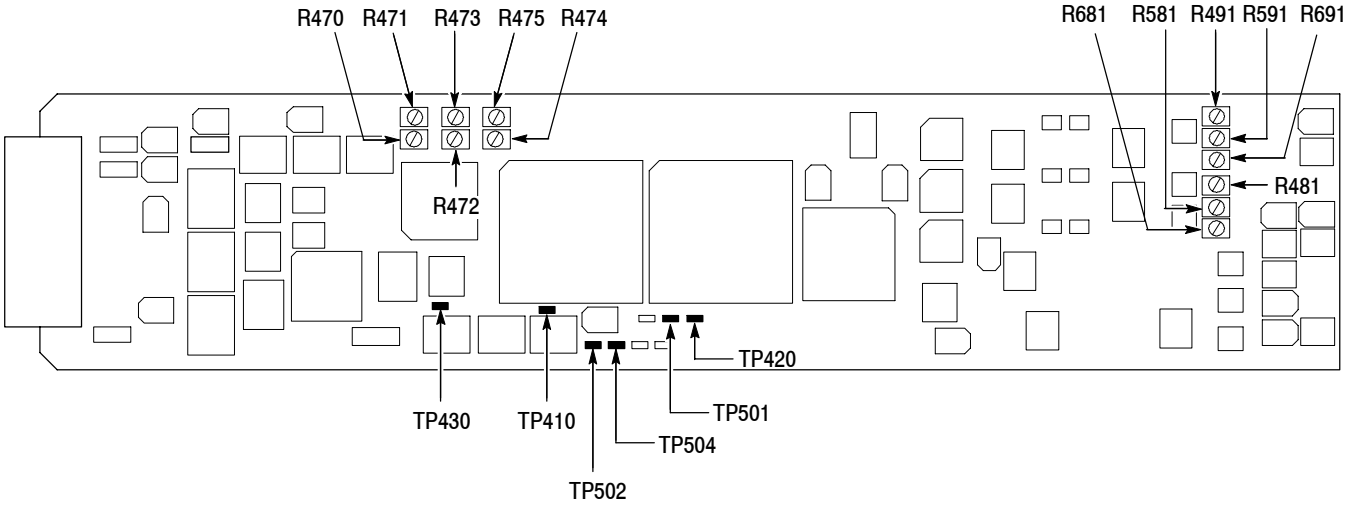

Figure 4- 1: AGL7 circuit board view

Procedure

WARNING. *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable, BNC T connector, 75 Ω coaxial terminator, and BNC female-to-dual banana adapter to connect the BLACK 1 connector on the AGL7 Genlock module to the INPUT connector on the digital multimeter as shown in Figure 4–2.

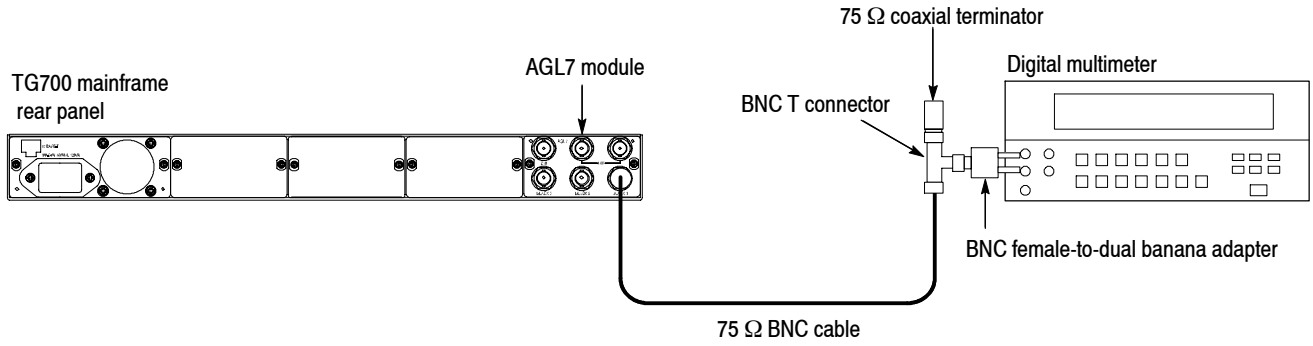

Figure 4-2: Equipment connection for adjusting the output offset and gain

2. Press and hold the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously until **TG700 Preset** is displayed, then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode.

3. Select the DAC Offset (0V DC) calibration signal for BLACK 1 through BLACK 3 as follows:

   a. Press the **MODULE** button to display the **AGL7** main menu.

   b. Press the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.

   c. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button.

   d. Press the left (◀) or right (▶) arrow button to select **CAL**, and then press the **ENTER** button.

   e. Press the left (◀) or right (▶) arrow button to select **DAC Offset (0V DC)**, and then press the **ENTER** button.

   f. Press the **CANCEL** button twice.

   g. Repeat parts c through f of this step to select the calibration signal for BLACK 2.

   h. Press the left (◀) or right (▶) arrow button to select **BLACK 3**, and then press the **ENTER** button.

   i. Press the left (◀) or right (▶) arrow button to select **Black Burst (Same as BLACK2)**, and then press the **ENTER** button.

   j. Press the **CANCEL** button to return the AGL7 main menu.

4. Locate variable resistor R691 on the AGL7 circuit board. See Figure 4–1.

5. Adjust R691 so that the output offset is 0 V ± 1 mV.

6. Move the BNC cable connection from the BLACK 1 connector to the BLACK 2 connector on the AGL7 Genlock module.

7. Locate variable resistor R491 on the AGL7 circuit board. See Figure 4–1.

8. Adjust R491 so that the output offset is 0 V ± 1 mV.

9. Move the BNC cable from the BLACK 2 connector to the BLACK 3 connector on the AGL7 Genlock module.

10. Locate variable resistor R591 on the AGL7 circuit board. See Figure 4–1.

11. Adjust R591 so that the output offset is 0 V ± 1 mV.

12. Select the DAC Gain (1.000V DC) calibration signal for BLACK 1 through BLACK 3 as follows:

    a. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button.

    b. Press the left (◀) or right (▶) arrow button to select **CAL**, and then press the **ENTER** button.

    c. Press the left (◀) or right (▶) arrow button to select **DAC Gain (1.000V DC)**, and then press the **ENTER** button.

    d. Press the **CANCEL** button twice to return the AGL7 main menu.

    e. Repeat parts a through d of this step to select the calibration signal for BLACK 2. BLACK 3 uses the previous setting (Same as BLACK2).

13. Locate variable resistor R681 on the AGL7 circuit board. See Figure 4–1.

14. Adjust R681 so that the output gain is 1 V ± 1 mV.

15. Move the BNC cable from the BLACK 1 connector to the BLACK 2 connector on the AGL7 Genlock module.

16. Locate variable resistor R481 on the AGL7 circuit board. See Figure 4–1.

17. Adjust R481 so that the output gain is 1 V ± 1 mV.

18. Move the BNC cable from the BLACK 2 connector to the BLACK 3 connector on the AGL7 Genlock module.

19. Locate variable resistor R581 on the AGL7 circuit board. See Figure 4–1.

20. Adjust R581 so that the output gain is 1 V ± 1 mV.

Clock Timing Adjustment (Board Number 671-B089-XX and 671-B279-00 Only)

Preparation

To perform the clock timing adjustment, you must first remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

After you have removed the top cover, find the variable resistors on the AGL7 circuit board. See Figure 4–1.

Procedure

WARNING. *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Select the NTSC **Black Burst** signal for BLACK 1 and BLACK 2 and **1080/59.94i** signal for BLACK 3 as follows:
   a. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button.
   b. Press the left (◀) or right (▶) arrow button to select **NTSC**, and then press the **ENTER** button.
   c. Press the left (◀) or right (▶) arrow button to select **Black Burst**, and then press the **ENTER** button.
   d. Press the **CANCEL** button twice to return the AGL7 main menu.
   e. Repeat parts a through d of this step to select the NTSC Black Burst signal for BLACK 2.
   f. Press the left (◀) or right (▶) arrow button to select **BLACK 3**, and then press the **ENTER** button.
   g. Press the left (◀) or right (▶) arrow button to select **1080/59.94i**, and then press the **ENTER** button.
   h. Press the **CANCEL** button to return the AGL7 main menu.
2. Set the horizontal fine timing for BLACK 1 through BLACK 3 to 0.00 ns as follows:
   a. Press the up (▲) or down (▼) arrow button to select **GENLOCK** and then press the **ENTER** button.
   b. Press the left (◀) or right (▶) arrow button to select **INTERNAL**, and then press the **ENTER** button.

c. Press the **CANCEL** button to return the AGL7 main menu.

d. Press the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.

e. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button.

f. Press the up (▲) or down (▼) arrow button to select **TIMING**, and then press the **ENTER** button.

g. Press the up (▲) or down (▼) arrow button to select **Horizontal Fine**, and then press the left (◀) or right (▶) arrow button to set the timing to 0.00 ns.

h. Press the **CANCEL** button twice to return the AGL7 main menu.

i. Repeat parts e through h of this step to set the horizontal fine timing for BLACK 2 and BLACK 3 to 0.00 ns.

3. Attach the two P6139A probes to the oscilloscope CH1 and CH2 inputs.

4. Locate test points TP410, TP420, TP430, TP501, TP502, and TP504 on the AGL7 circuit board. See Figure 4–1.

5. Locate variable resistors R470, R471, R472, R473, R474, and R475 on the AGL7 circuit board. See Figure 4–1.

6. Turn all the variable resistors completely counterclockwise.

7. Connect the probe tip from the oscilloscope CH1 input to TP501.

8. Connect the probe tip from the oscilloscope CH2 input to TP430.

9. Set the oscilloscope settings as indicated below:

Vertical . . . . . 500 mV/div
Vertical position . . . . . -3.0 div
Horizontal . . . . . 2 ns/div
Trigger source CH1
Trigger level 1.5V
Trigger slope . . . . . Rising Edge

10. Adjust R470 so that the CH2 signal is delayed by 4 ± 0.5 ns from the CH1 signal. See Figure 4–3.

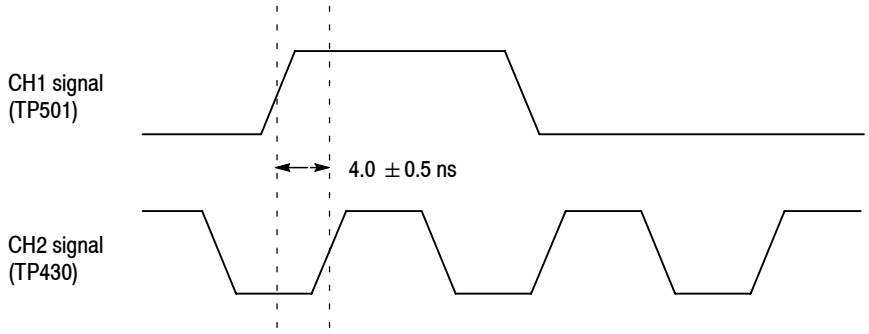

Figure 4-3: Timing relationship between CH1 and CH2 signals

11. Move the CH1 probe from TP501 to TP502.

12. Change the horizontal fine timing of the BLACK 3 output from –7.0 ns to + 7.0 ns and verify that the CH2 signal moves at least 13.5 ns.

13. If the CH2 signal moves less than 13.5 ns, turn R471 to its center position and then perform the following steps:

a. Move the CH1 probe from TP502 to TP501.

b. Set the horizontal fine timing of BLACK 3 output to 0.00 ns.

c. Adjust R470 so that the CH2 signal is delayed by 4 ± 0.5 ns from the CH1 signal.

d. Change the horizontal fine timing of the BLACK 3 output from –7.0 ns to + 7.0 ns and verify that the CH2 signal moves at least 13.5 ns.

If the CH2 signal still moves less than 13.5 ns, turn R471 completely clockwise and then repeat steps a through d.

14. Change the CH2 probe connection from TP430 to TP410.

15. Adjust R472 so that the CH2 signal is delayed by 8 ± 0.5 ns from the CH1 signal.

16. Change the CH1 probe connection from TP502 to TP504.

17. Change the horizontal fine timing of the BLACK 1 output from –10.0 ns to + 10.0 ns and verify that the CH2 signal moves at least 18.5 ns.

18. If the CH2 signal moves less than 18.5 ns, turn R473 its center position and then perform the following steps:

a. Change the CH1 probe connection from TP504 to TP502.

b. Set the horizontal fine timing of BLACK 1 output to 0.00 ns.

c. Adjust R472 so that the CH2 signal is delayed by 8 ± 0.5 ns from the CH1 signal.

d. Change the horizontal fine timing of the BLACK 1 output from –10.0 ns to + 10.0 ns and verify that the CH2 signal moves at least 18.5 ns.

If the CH2 signal still moves less than 18.5 ns, turn R473 completely clockwise and then repeat steps a through d.

19. Change the CH2 probe connection from TP410 to TP420.

20. Adjust R474 so that the CH2 signal is delayed by 8 ± 0.5 ns from the CH1 signal.

21. Change the CH1 probe connection from TP504 to TP502.

22. Change the horizontal fine timing of the BLACK 2 output from –10.0 ns to + 10.0 ns and verify that the CH2 signal moves at least 18.5 ns.

23. If the CH2 signal moves less than 18.5 ns, turn R475 its center position and then perform the following steps:

a. Change the CH1 probe connection from TP502 to TP504.

b. Set the horizontal fine timing of BLACK 2 output to 0.00 ns.

c. Adjust R474 so that the CH2 signal is delayed by 8 ± 0.5 ns from the CH1 signal.

d. Change the horizontal fine timing of the BLACK 2 output from –10.0 ns to + 10.0 ns and verify that the CH2 signal moves at least 18.5 ns.

If the CH2 signal still moves less than 18.5 ns, turn R475 completely clockwise and then repeat steps a through d.

Maintenance

Maintenance

This section contains instructions and procedures for maintaining the AGL7 Genlock module. For information on servicing the mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

The following information can be found in this section:

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

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

Preparation

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

Servicing Prerequisites

Ensure 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.

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, checking performance, 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.*

Inspecting and Cleaning Procedures

Clean the mainframe and modules often enough to prevent dust or dirt from accumulating. Refer to *Inspecting and Cleaning Procedures* in the *TG700 TV Signal Generator Platform Service Manual*.

Performance Verification

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

Repackaging Instructions

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

1. Attach a tag to the instrument showing: the owner, complete address and phone number of someone at your firm who can be contacted, the instrument serial number, and a description of the required service.
2. Package the instrument in the original packaging materials. If the original packaging materials are not available, follow these directions:
   a. Obtain a corrugated cardboard carton with 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.

Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the AGL7 Genlock module.

Tools Required

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

Table 5-1: Required tools

Name	Description	Tektronix part number
Screwdriver handle	Accepts Phillips-driver bits	
#1 Phillips tip	Phillips-driver bit for #1 size screw heads	
#2 Phillips tip	Phillips-driver bit for #2 size screw heads	
Nut driver, 14 mm	Special nut driver for removing the BNC connectors of the AGL7 module	003-A041-00

Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section in the *TG700 TV Signal Generator Platform Module Installation Instructions* to remove the AGL7 Genlock module from the mainframe.
2. Disconnect the cables at J000 (REF), J002 (REF), J040 (CW), J930 (BLACK 1), J830 (BLACK 2), and J880 (BLACK 4) on the AGL7 circuit board.
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

Replacing the chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the six screws securing the AGL7 circuit board to the chassis.
3. Lift the circuit board up and away from chassis, and then place it on a static free surface.
4. Set the replacement chassis on a firm, flat, static-free work surface.
5. Carefully place the circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the five screws securing the circuit board to the chassis.
7. Apply the rear panel to the chassis, and then install all the rear-panel connectors to the chassis.

Troubleshooting

This section contains instructions and procedures for troubleshooting the AGL7 Genlock module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to *Troubleshooting* in the *TG700 TV Signal Generator Platform Service Manual*.

Equipment Required

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

Table 5-2: Equipment required for troubleshooting

Equipment description	Minimum requirements/example
Screwdriver handle	Accept Phillips-driver bits
#1 Phillips tip	Phillips-driver bit for #1 size screw heads
TG700 mainframe	A TG700 mainframe that is functioning correctly

Backing up the instrument settings

Before you begin the troubleshooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◀) or right (▶) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

Troubleshooting Trees

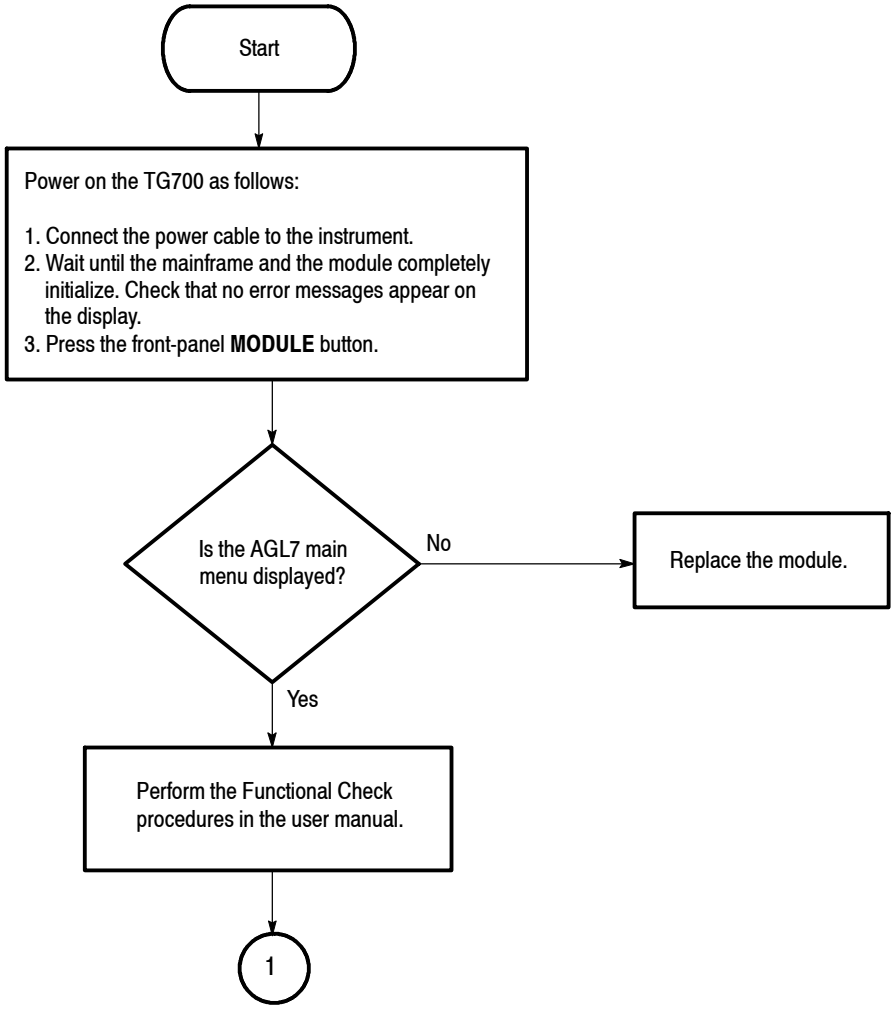

Figure 5- 1: Troubleshooting procedure (1)

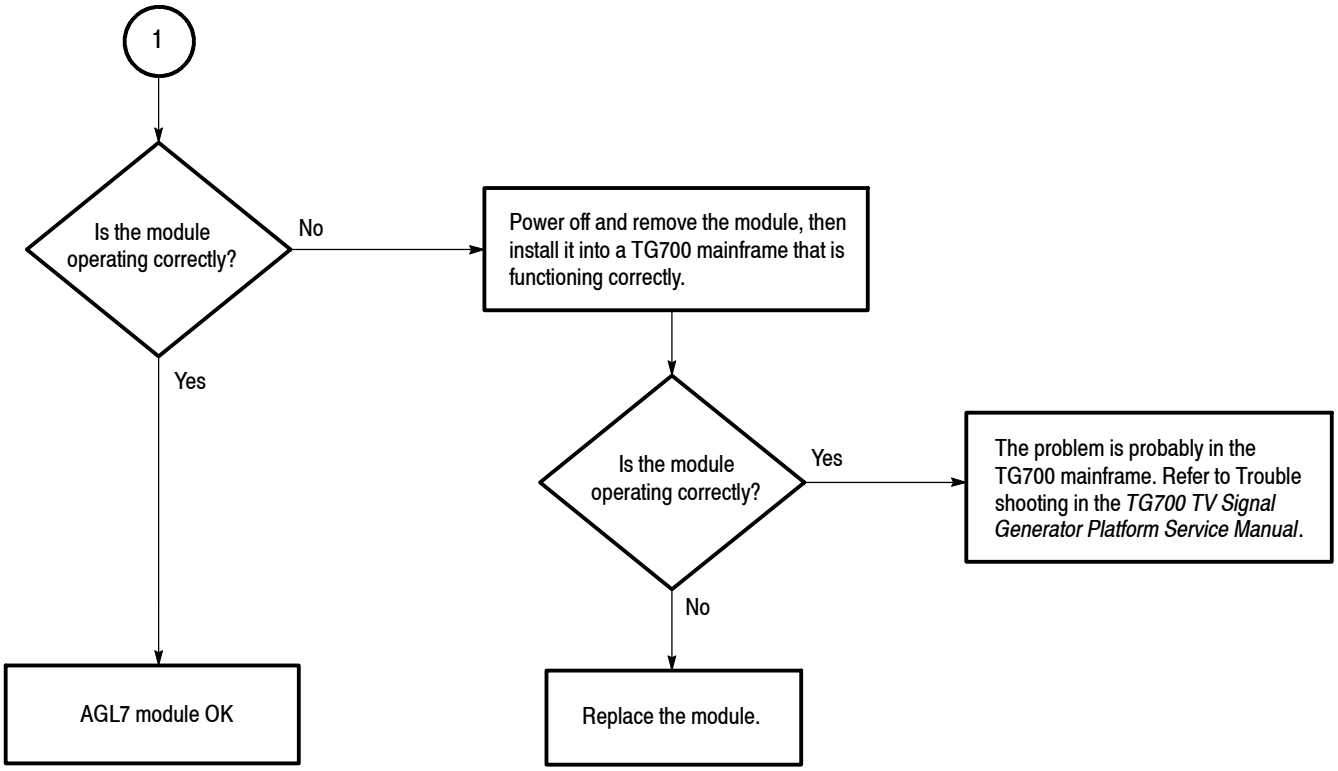

Figure 5- 2: Troubleshooting procedure (2)

Option

Option

This section describes the option that is available for the AGL7 Genlock module.

The following option is available.

- Option D1 (Test data report)

Option D1 Description

A calibration data test result report will be provided with the AGL7 Genlock module when this option is specified.

Diagram

Diagram

Figure 7-1 shows the AGL7 Genlock module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 TV Signal Generator Platform Service Manual*.

A block diagram of the AGL7 Genlock module is located in the *Theory of Operation* section, beginning on page 2-1.

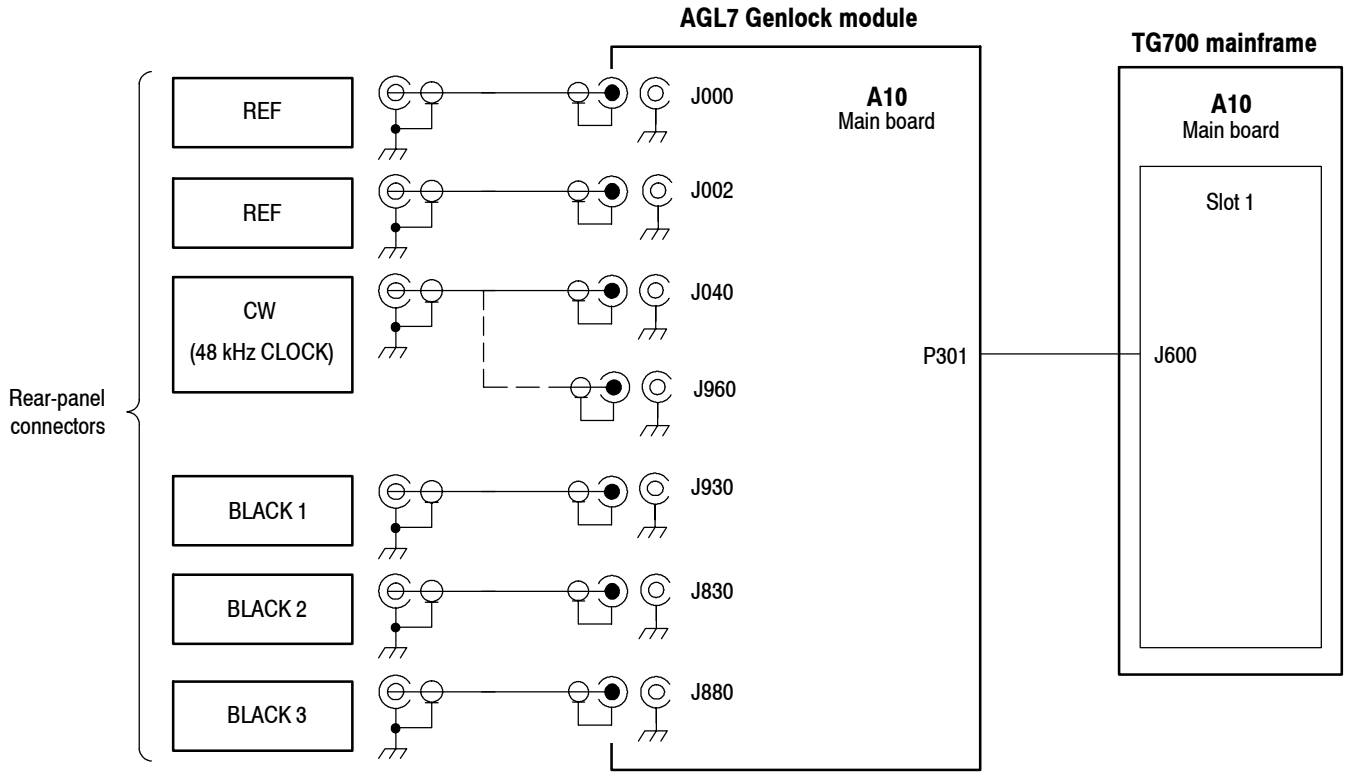

Figure 7-1: AGL7 Genlock module connections

Replaceable Parts List

Replaceable Parts List

This section contains a list of the replaceable modules for the AGL7 Genlock module. Use this list to identify and order replacement parts.

Parts Ordering Information

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

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

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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

Module Servicing

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

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

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

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

Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the AGL7 Genlock module. 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.

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

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
8-1	116-1125-00			1	EXCHANGE MODULE:AGL7
8-1-1	441-A269-02			1	CHASSIS,MODULE AGL7:ASSY
-2	333-A405-00			1	PANEL,REAR:AGL7,AL
-3	214-4946-00			2	SPRING,CONICAL:VXI MOUNTING SCREW,0.26 MM SUS304,5.4 MML
-4	213-1129-01			2	SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,N1 PL,CROSS REC & SLOTTED
-5	348-A128-00			2.5 CM	SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02]
-6	174-B847-00			6	CABLE ASSY,RF:75OHM COAX(RG179),7.5CM L,BNC TO MCX
-7	211-A245-01			5	SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER
-8	334-1378-03			1	MARKER,IDENT:MKD SERIAL NO.
-9	342-A146-00			1	INSULATOR,PLATE:HEAT CONDUCTOR,RUBBER,20MMX20MMX100MM THK [TC1000-TKC]
					STANDARD ACCESSORIES
	070-A824-XX			1	MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS
	062-A249-XX			1	SOFTWARE PACKAGE:S/W(CD-R)
					OPTIONAL ACCESSORIES
	070-A800-XX			1	MANUAL,TECH:SERVICE,TG700
	003-A041-00			1	NUTDRIVER,BOX:14MM HEX,BNC RETAINING NUT,MODIFIED 19MM

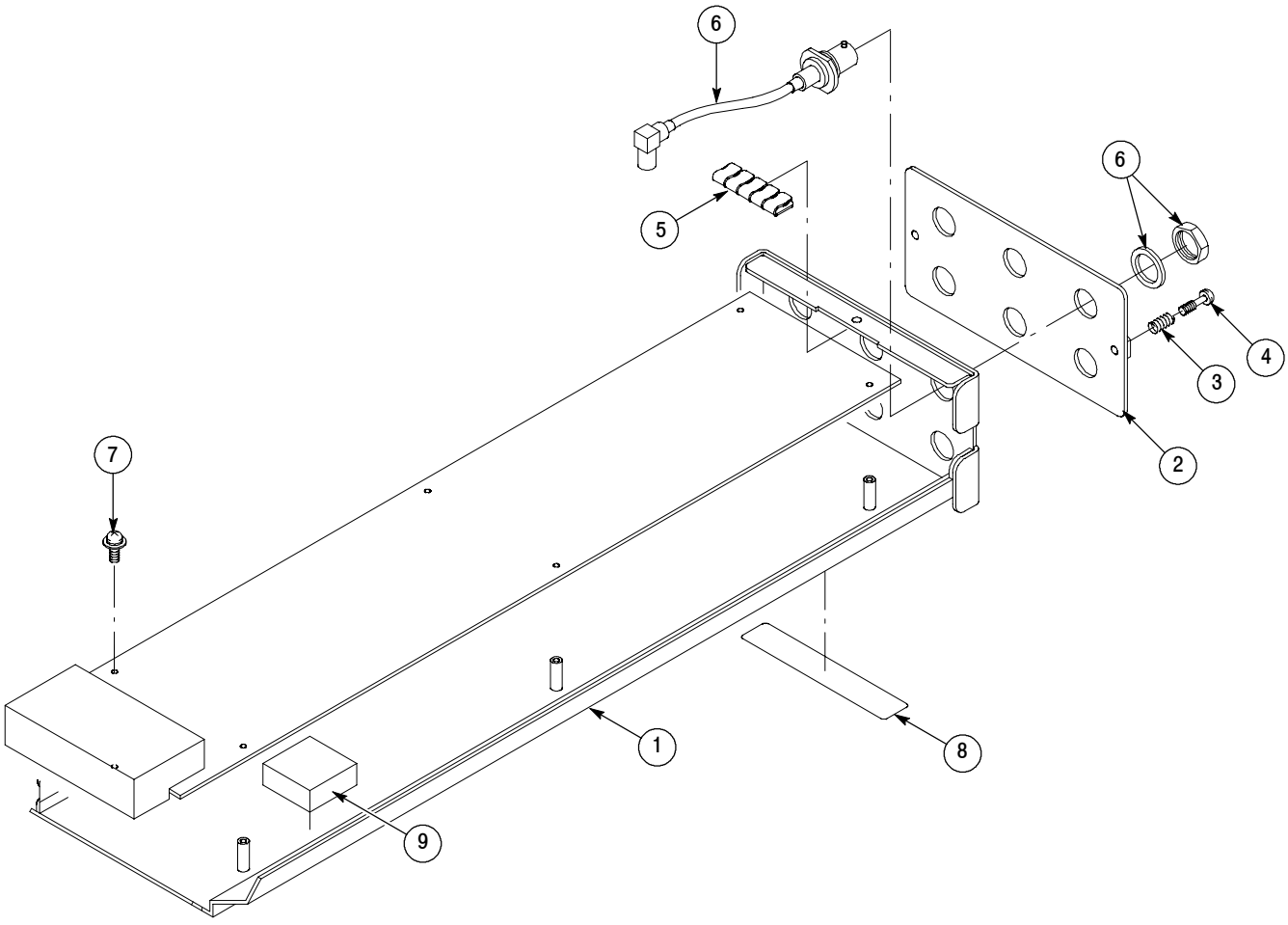

Figure 8- 1: AGL7 Genlock module exploded view

Service Manual

Tektronix

ATG7
Analog Test Generator

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

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Preface

This is the service manual for the ATG7 Analog Test Generator module. This manual contains information needed to service an ATG7 Generator module to the module level.

Manual Structure

This manual is divided into sections, such as *Specifications* and *Theory of Operation*. Further, some sections are divided into subsections, such as *Product Description* and *Removal and Installation Procedures*.

Sections containing procedures also contain introductions to those procedures. Be sure to read these introductions because they provide information needed to do the service correctly and efficiently. The following are brief descriptions of each manual section.

- *Specifications* contains a description of the ATG7 Generator module and the characteristics that apply it.
- *Theory of Operation* is an overview of the module's design.
- *Performance Verification* contains procedures to perform the operation tests.
- *Adjustment Procedures* contains procedures for adjusting an ATG7 Generator module to meet warranted characteristics.
- *Maintenance* contains installation, removal and replacement, and trouble-shooting instructions.
- *Option* contains a description of the available option for the ATG7 Generator module.
- *Diagram* contains an interconnect diagram showing the connections between the ATG7 Generator module and the mainframe.
- *Replaceable Parts List* 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 ATG7 Generator module.

- The *TG700 TV Signal Generator Platform User Manual* (Tektronix part number 070-A799-XX) describes how to use the TG700 mainframe and all modules. It also contains information about remote commands and programming structure for the TG700 mainframe and all modules.
- The *TG700 TV Signal Generator Platform Module Installation Instructions* (Tektronix part number 070-A824-XX) describes how to install and remove the modules, and how to upgrade the firmware of the mainframe.

Specifications

Specifications

This section contains a general product description of the ATG7 Generator module followed by the operating specifications of the module.

Product Description

The ATG7 Generator module is designed for installation in the TG700 TV Signal Generator Platform.

The module is an analog test signal generator that provides NTSC/PAL analog composite signals. PAL-M and PAL-N are not supported by the AGL7, ATG7 and BG7 modules. The ATG7 Generator module contains the following features:

- SIGNAL output:

  Outputs test signals selectable from the front-panel test signal buttons

  Overlay ID text on the video signal

- BARS output:

  Outputs NTSC (with or without setup) /PAL color bar signals, black burst signals, and other test signals (Other 1 and Other 2)

  Overlay ID text on the video signal

- BLACK 1 and BLACK 2 outputs:

  Outputs NTSC (with or without setup)/PAL black burst signals, composite sync signal, composite blanking signal, NTSC (with or without setup)/PAL subcarrier signals, H/V drive signals, color frame ID signal, and PAL pulse signal

- Individual format and timing control for each output

- Full remote control using Ethernet interface

Electrical Characteristics

Tables 1–1 through 1–4 list the electrical characteristics of the ATG7 Generator module.

Table 1-1: Black burst and timing pulse outputs

Characteristic	Performance requirements	Reference information
Connector	BNC	
Number of outputs	2	BLACK 1 and BLACK 2
Output impedance, typical	75 Ω	
Black burst output signals		
NTSC and NTSC No Setup		Black Burst Black Burst with Field REF
PAL		Black Burst Black Burst with No Field REF
Timing pulse output		
Amplitude accuracy	1.0 V ± 0.1 V	
Rise time		
NTSC and NTSC No Setup	140 ns ± 20 ns	
PAL	250 ns ± 20 ns	
Output signals		
NTSC and NTSC No Setup		Composite Sync Composite Blanking Subcarrier H Drive V Drive Color Frame ID
PAL		Composite Sync Composite Blanking Subcarrier H Drive V Drive Color Frame ID PAL Pulse

Table 1-2: Color bars signal output

Characteristic	Performance requirements	Reference information
Connector	BNC	
Number of outputs	1	BARS
Output impedance, typical	75 Ω	
Output signals		
NTSC and NTSC No Setup		SMPTE Color Bar 100% Color Bar 75% Color Bar 40% Flat Field Black Burst Black Burst with Field REF Other 1 Other 2
PAL		100% Colour Bar 75% Colour Bar 100% Colour Bar Over Red 75% Colour Bar Over Red 40% Flat Field Black Burst Black Burst No Field REF Other 1 Other 2
ID text	Maximum 18 characters	
Luminance amplitude accuracy	± 1%	Measured at 700 mV.
Chrominance to luminance gain	± 2%	Chrominance is measured at red portion of the 75% Colour Bar Over Red signal.

Table 1-3: Test signal output

Characteristic	Performance requirements	Reference information
Connector	BNC	
Number of outputs	1	SIGNAL
Output impedance, typical	75 Ω	
ID text	Maximum 18 characters	
Luminance amplitude accuracy	± 1%	Measured at 700 mV.
Chrominance to luminance gain	± 1%	
Frequency response	± 1%	To 5 MHz
Chrominance to luminance delay	≤ 10 ns	Measured at 500 kHz and 4.43 MHz.
Linearity	< 1%	< 0.5% (typical); measured at 5 step signal.
Differential gain error	< 0.5%	Measured at modulated 5 step signal.
Differential phase error	< 0.5°	Measured at modulated 5 step signal.
Field tilt	< 0.5%	
Line tilt	< 0.5%	

Table 1-4: Common outputs characteristics

Characteristic	Performance requirements	Reference information
Return loss	≥ 36 dB	To 6 MHz
Burst amplitude accuracy	± 2%	
Sync amplitude accuracy	± 2%	
Blanking level	0 mV ± 50 mV	
SCH phase accuracy	0 ° ± 5 °	
Timing offset		
Range	Full color frame	
Resolution	54 MHz clock resolution	≃ 18.5 ns

Environmental Characteristics

Tables 1–5 lists the environmental characteristics of the ATG7 Generator module.

Table 1-5: Environmental characteristics

Characteristic	Description
Temperature	
Operating	0 °C to +50 °C
Non-operating	-20 °C to +60 °C
Relative Humidity	
Operating	20% to 80% (No condensation) ; Maximum wet-bulb temperature 29.4 °C
Non-operating	5% to 90% (No condensation) ; Maximum wet-bulb temperature 40.0 °C
Altitude	
Operating	To 4.5 km (15,000 feet) Maximum operating temperature decreases 1 °C each 300 m above 1.5 km.
Non-operating	To 15 km (50,000 feet)
Vibration	
Operating	3.04 m/s^2 (0.31 G_{rms}), 5 Hz to 500 Hz, 10 min, three axes
Non-operating	23.3 m/s^2 (2.38 G_{rms}), 5 Hz to 500 Hz, 10 min, three axes
Shock	
Non-operating	294 m/s2 (30 G), half-sine, 11 ms duration

Theory of Operation

Theory of Operation

This section describes the basic operation of the major circuit blocks in the ATG7 Generator module.

For information about the TG700 mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

Bus Interface This block provides the communication between the mainframe and the module circuit.

Black Burst Generator This block generates NTSC or PAL black burst digital data.

BARS Generator This block generates digital data for color bars, black burst, and other signals.

SIGNAL Generator This block generates digital data for the test signals assigned to the front-panel buttons.

D/A Converter & Amp This block consists of a D/A converter, two amplifiers, and a filter. It converts the digital data from the black burst generator, BARS generator, and SIGNAL generator to analog signal and re-construct the signal for output.

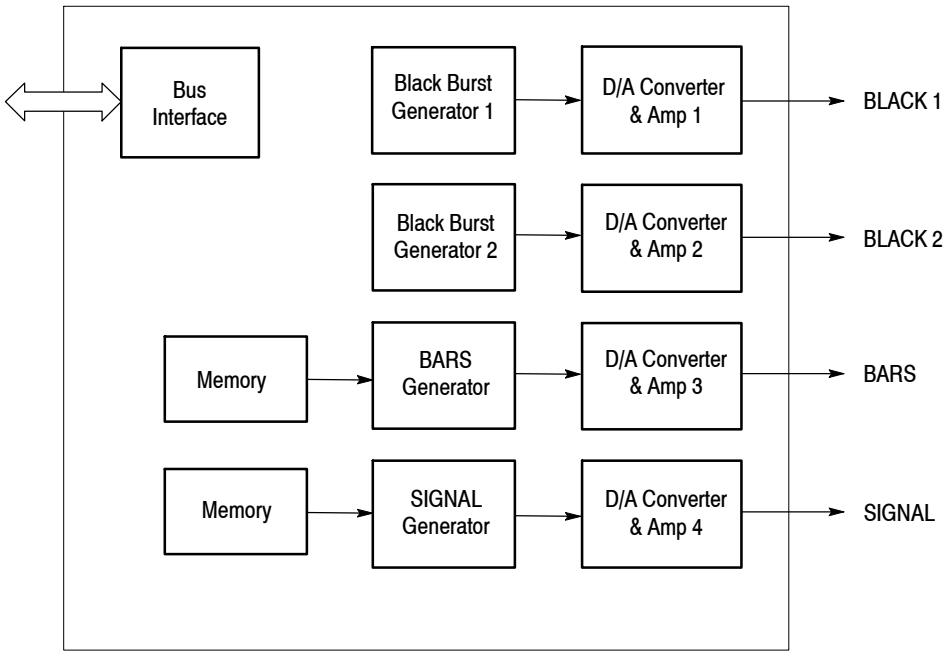

Figure 2- 1: Simplified block diagram of the ATG7 Generator module

Performance Verification

Performance Verification

This section provides procedures that verify the performance and functionality of the ATG7 Generator module.

Preparation for Performance Verification

Perform the following before starting the performance verification procedures:

Power On Default Settings

Before you perform the performance verification procedures, make sure that the required instrument settings are saved in the Power On Default preset.

If the instrument settings are saved in the Power On Default preset, you can recall the settings after completing the performance verification procedures by removing and reapplying the power.

Warm up

The ATG7 Generator module and test equipment must have had a warm-up period of at least 20 minutes.

Equipment Required

Table 3–1 lists the equipment required for the procedures.

Table 3-1: Equipment required for performance verification

Item	No.	Minimum requirement	Recommended equipment
Oscilloscope	1	Bandwidth: 200 MHz or higher	Tektronix TDS540D
Video measurement set	1		Tektronix VM700T Option 01/11
75 Ω BNC cable	1	Length: 42 inches	Tektronix part number 012-0074-00
75 Ω feed-through terminator	1		Tektronix part number 011-0103-02
75 Ω coaxial terminator	1		Tektronix part number 011-0102-01

Calibration Data Report

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

Table 3- 2: ATG7 calibration data report

Serial Number:	Cal Date:	Temperature:	Humidity:

Step	Function Tested	Minimum	Cal Data	Maximum
	SIGNAL Output (Tested format : NTSC)			
1.	Luminance Amplitude (Measured on 75% Color Bars signal)	707.2 mV	mV	721.0 mV
2.	Chrominance to Luminance Gain Ratio (Measured on FCC Composite signal)	-1.0 %	%	1.0 %
3.	Chrominance to Luminance Delay (Measured on FCC Composite signal)	------	ns	10 ns
4.	Differential Phase and Gain (Measured on Modulated 5 Step signal)			
	Gain	------	OK	0.5 %
	Phase	------	OK	0.5 °
	SIGNAL Output (Tested format : PAL)			
5.	Luminance Amplitude (Measured on 75% Colour Bars signal)	693.0 mV	mV	707.0 mV
6.	Chrominance to Luminance Gain Ratio (Measured on CCIR17 signal)	-1.0 %	%	1.0 %
7.	Chrominance to Luminance Delay (Measured on CCIR17 signal)	------	ns	10 ns
8.	Differential Phase and Gain (Measured on Modulated 5 Step signal)			
	Gain	------	OK	0.5 %
	Phase	------	OK	0.5 °
9.	Luminance Linearity Error (Measured on 5 Step signal)	------		1.0 %
10.	Frequency Response (to 5.0 MHz) (Measured on 100% Multiburst signal)	-1.0 %	OK	1.0 %
	BARS Output (Tested format : PAL)			
11.	Luminance Gain (Measured on 75% Colour Bar Over Red signal)	693.0 mV	mV	707.0 mV
12.	Chrominance Gain (Measured on 75% Colour Bar Over Red signal)	650.6 mV	mV	677.0 mV

Table 3-2: ATG7 calibration data report (Cont.)

Step	Function Tested	Minimum	Cal Data	Maximum
	BLACK 1 and BLACK 2 Outputs			
13.	Timing Pulse Amplitude			
	BLACK 1 (Peak to Peak value)	900 mV	mV	1100 mV
	BLACK 2 (Peak to Peak value)	900 mV	mV	1100 mV
	SIGNAL, BARS, BLACK 1, and BLACK2 Outputs (Common function)			
14.	Blanking Level			
	SIGNAL	-50 mV	mV	50 mV
	BARS	-50 mV	mV	50 mV
	BLACK 1	-50 mV	mV	50 mV
	BLACK 2	-50 mV	mV	50 mV
15.	Burst Amplitude			
	SIGNAL (Peak to Peak value)	280 mV	mV	291.4 mV
	BARS (Peak to Peak value)	280 mV	mV	291.4 mV
	BLACK 1 (Peak to Peak value)	280 mV	mV	291.4 mV
	BLACK 2 (Peak to Peak value)	280 mV	mV	291.4 mV
16.	Sync Amplitude			
	SIGNAL	280 mV	mV	291.4 mV
	BARS	280 mV	mV	291.4 mV
	BLACK 1	280 mV	mV	291.4 mV
	BLACK 2	280 mV	mV	291.4 mV

Performance Verification Procedures

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

WARNING. *Dangerous electric shock hazards exist inside the TG700 mainframe. Only qualified service personnel should perform these procedures.*

Timing Pulse Outputs (BLACK 1 and BLACK 2)

This test verifies the pulse amplitude of the H drive signal from the BLACK 1 and BLACK 2 outputs. The following equipment is required for the test:

- Oscilloscope
- 75 Ω BNC cable
- 75 Ω feed-through terminator

Perform the following procedure to verify that the pulse amplitude of the H drive signal from the BLACK 1 and BLACK 2 outputs.

1. Use the 75 Ω BNC cable and the 75 Ω feed-through terminator to connect the BLACK 1 connector on the ATG7 Generator module to the oscilloscope CH1 input as shown in Figure 3–1.

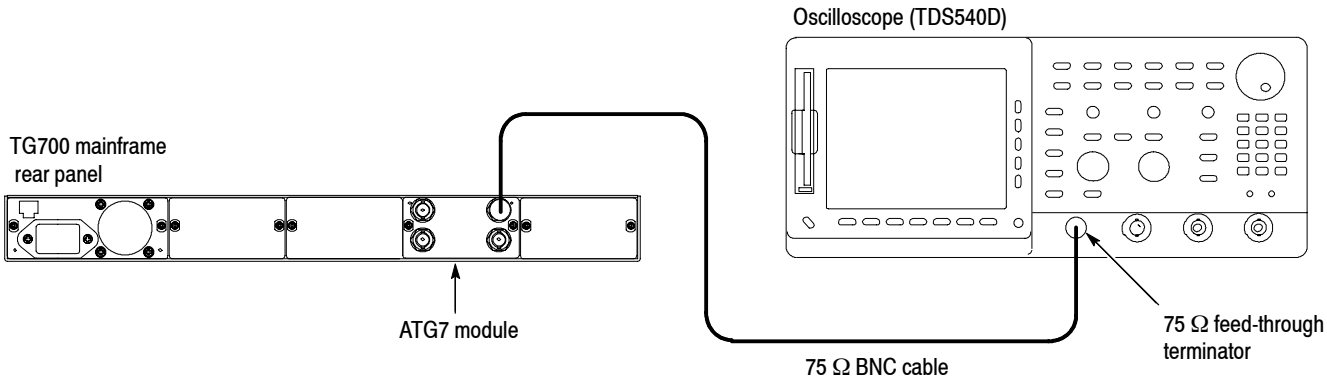

Figure 3- 1: Equipment connection for verifying pulse amplitude

2. Recall the Factory Default preset as follows:

   a. Press the **MODULE** button to display the TG700 main menu.

   b. Press the up (▲) or down (▼) arrow button to select **RECALL**.

   c. Press the left (◀) or right (▶) arrow button to select **Factory Default**.

   d. Press the **ENTER** button to recall the factory default settings.

3. Select the **H Drive** signal for BLACK 1 and BLACK 2 as follows:

   a. Press the **MODULE** button to display the ATG7 main menu.

   b. Press the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.

   c. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button.

   d. Press the left (◀) or right (▶) arrow button to select **NTSC**, and then press the **ENTER** button.

   e. Press the left (◀) or right (▶) arrow button to select **H Drive**, and then press the **ENTER** button.

   f. Press the **CANCEL** button twice to return the module main menu.

   g. Repeat parts c through f of this step to select the H Drive signal for BLACK 2.

4. Set the oscilloscope settings as indicated below:

   Vertical . . . . . 200 mV/div
   Vertical offset . . . . . 0 V
   Horizontal . . . . . 200 ns/div
   Horizontal position . . . . Center
   Trig position . . . . . 50 %
   Trig slope . . . . . Rising Edge
   Acquire menu . . . . . Average 32
   Measure menu . . . . . Pk-Pk

5. Verify that the pulse amplitude is within the range of 0.900 V to 1.100V.

6. Move the BNC cable from the BLACK 1 connector to the BLACK 2 connector on the ATG7 Generator module and repeat step 5.

Black Burst Outputs

This test verifies the blanking level, burst amplitude, and sync amplitude of black burst signals. The following equipment is required for the test:

- Oscilloscope
- Video measurement set
- 75 Ω BNC cable
- 75 Ω feed-through terminator
- 75 Ω coaxial terminator

Perform the following procedure to verify the blanking level, burst amplitude, and sync amplitude of black burst signals.

Use the equipment connection and controls from the previous test.

1. Move the BNC cable from the BLACK 2 connector to the BLACK 1 connector on the ATG7 Generator module.
2. Select the **Black Burst** signal for BLACK 1, BLACK 2, and BARS as follows:
   a. Press the **MODULE** button to display the module main menu.
   b. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button.
   c. Press the left (◀) or right (▶) arrow button to select **NTSC**, and then press the **ENTER** button.
   d. Press the left (◀) or right (▶) arrow button to select **Black Burst**, and then press the **ENTER** button.
   e. Press the **CANCEL** button twice to return the module main menu.
   f. Repeat parts b to e of this step to select the NTSC black burst signal for BLACK 2 and BARS.
3. Select the **Black Burst** signal for SIGNAL as follows:
   a. Press the **FORMAT** button to select **NTSC**, and then press the **ENTER** button.
   b. Press the **FLAT FIELD** button to select **Black Burst**.

4. Set the oscilloscope settings as indicated below:

   Vertical . . . . . 50 mV/div
   Vertical offset . . . . . 0 V
   Horizontal . . . . . 1 µs/div
   Horizontal position . . . . Center
   Trig position . . . . . 10 %
   Acquire menu . . . . . Average 32
   Measure menu . . . . . Mean
   Trig type . . . . . Video
   Trig standard . . . . . NTSC
   Trig source CH1
   Trig polarity . . . . . Negative
   Trig field . . . . . Odd Field
   Trig line 2
   Trig mode . . . . . MONO (2 Field)

5. Verify that the blanking level is within the range of –50 mV to +50 mV.

6. Move the BNC cable from the BLACK 1 connector to the BLACK 2 connector on the ATG7 Generator module and repeat step 5.

7. Move the BNC cable from the BLACK 2 connector to the SIGNAL connector on the ATG7 Generator module and repeat step 5.

8. Move the BNC cable from the SIGNAL connector to the BARS connector on the ATG7 Generator module and repeat step 5.

9. Move the BNC cable from the BARS connector to the BLACK 1 connector on the ATG7 Generator module.

10. Disconnect the BNC cable from the 75 Ω feed-through terminator on the oscilloscope's input, and then connect the BNC cable to the CHAN A connector on the video measurement set as shown in Figure 3–2.

11. Use the 75 Ω coaxial terminator to terminate the other loop through to the CHAN A connector on the video measurement set.

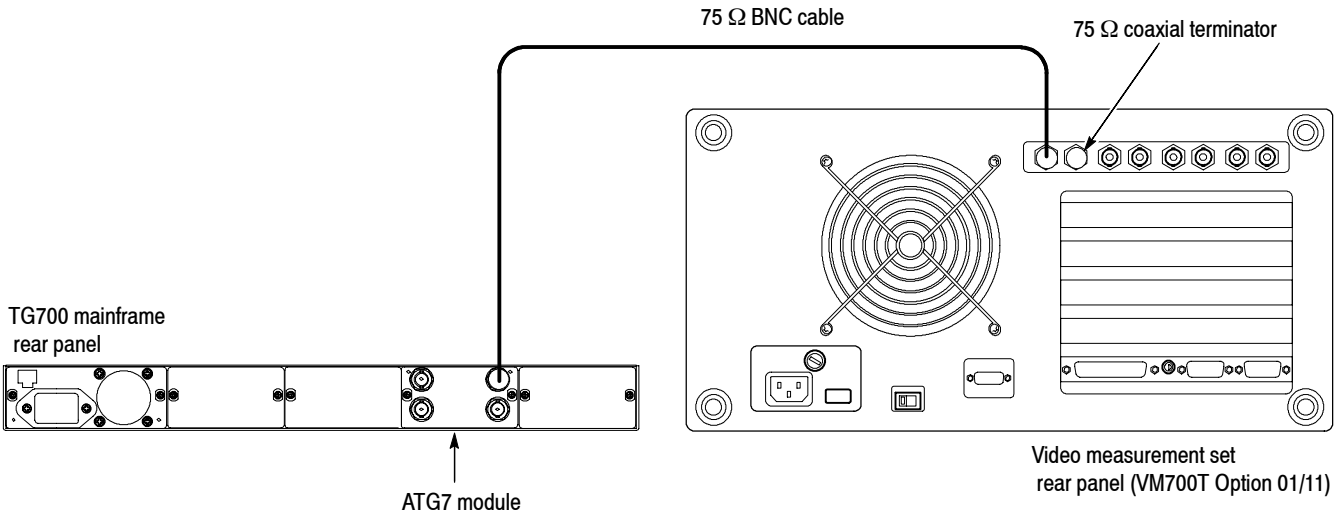

Figure 3- 2: Equipment connection for verifying burst and sync amplitude

12. Press the **Measure** button on the video measurement set to open the Measure mode display.

13. Touch the **Mode** soft key to set the instrument to Analog mode, and then touch the **H_Timing** soft key.

14. Press the **Menu** button to display the H_Timing main menu.

15. Touch the **Average** soft key and rotate the front-panel knob to set the value to 32.

16. Touch the **RS-170A** soft key.

17. Press the **Select Line** button and rotate the front-panel knob set the measurement line to 100 (Field=1 Line=100).

18. Verify that the burst and sync amplitude are within the range of 39.2 IRE to 40.8 IRE.

19. Move the BNC cable from the BLACK 1 connector to the BLACK 2 connector on the ATG7 Generator module and repeat step 18.

20. Move the BNC cable from the BLACK 2 connector to the SIGNAL connector on the ATG7 Generator module and repeat step 18.

21. Move the BNC cable from the SIGNAL connector to the BARS connector on the ATG7 Generator module and repeat step 18.

Luminance and Chrominance Gain (BARS Output)

This test verifies the luminance and chrominance gain of the 75% colour bar over red signal from the BARS output. The following equipment is required for the test:

- Video measurement set
- 75 Ω feed-through terminator
- 75 Ω coaxial terminator

Perform the following procedure to verify the luminance and chrominance gain of the 75% colour bar over red signal from the BARS output.

Use the equipment connection and controls from the previous test.

1. Select the **75% Colour Bar Over Red** signal for BARS as follows:
   a. Press the **MODULE** button to display the ATG7 main menu.
   b. Press the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.
   c. Press the left (◀) or right (▶) arrow button to select **BARS**, and then press the **ENTER** button.
   d. Press the left (◀) or right (▶) arrow button to select **PAL**, and then press the **ENTER** button.
   e. Press the left (◀) or right (▶) arrow button to select **75% Colour Bar Over Red**, and then press the **ENTER** button.
2. Press the **Measure** button on the video measurement set to open the Measure mode display.
3. Touch the **Video Standard** soft key to recognize the applied video signal as PAL.
4. In the Measure mode display, touch the **Color Bar** soft key to open the Color Bar measurement display.
5. Press the **Menu** button to display the Color Bar main menu.
6. Touch the **Average** soft key and rotate the front-panel knob to set the value to 256.
7. Press the **Select Line** button and rotate the front-panel knob set the measurement line to 100 (Field=1 Line=100).
8. Verify that the luminance gain (level) is within the range of 693.0 mV to 707.0 mV.
9. Verify that the chrominance gain (level) is within the range of 650.6 mV to 677.0 mV. Note that the chrominance gain is measured by Red.

Luminance Amplitude (SIGNAL Output)

This test verifies the luminance amplitude of the 75% color bars signal (for NTSC) and the 75% colour bars signal (for PAL) from the SIGNAL output.

- Video measurement set
- 75 Ω feed-through terminator
- 75 Ω coaxial terminator

Perform the following procedure to verify the luminance amplitude of the 75% color bars signal (for NTSC) and the 75% colour bars signal (for PAL) from the SIGNAL output.

Use the equipment connection and controls from the previous test.

NTSC Format.

1. Move the BNC cable from the BARS connector to the SIGNAL connector on the ATG7 Generator module.
2. Select the **75% Color Bars** signal for SIGNAL as follows:
   a. Press the **MODULE** button to display the ATG7 main menu.
   b. Press the **FORMAT** button to select **NTSC**, and then press the **ENTER** button.
   c. Press the **COLOR BAR** button to select **75% Color Bars**.
3. Press the **Measure** button on the video measurement set to open the Measure mode display.
4. Touch the **Video Standard** soft key to recognize the applied video signal as NTSC.
5. Press the **Menu** button, and then touch the **Average** soft key and rotate the front-panel knob to set the value to 256.
6. Touch the **Average** soft key and rotate the front-panel knob to set the value to 256.
7. Press the **Select Line** button and rotate the front-panel knob set the measurement line to 100 (Field=1 Line=100).
8. Verify that the luminance gain (level) is within the range of 707.2 mV to 721.0 mV.

PAL Format.

1. Select the **75% Colour Bars** signal for SIGNAL as follows:
   a. Press the **FORMAT** button to select **PAL**, and then press the **ENTER** button.
   b. Press the **COLOR BAR** button to select **75% Colour Bars**.
2. Press the **Measure** button on the video measurement set to open the Measure mode display.
3. Touch the **Video Standard** soft key to recognize the applied video signal as PAL.
4. In the Measure mode display, touch the **Color Bar** soft key to open the Color Bar measurement display.
5. Press the **Menu** button, and then touch the **Average** soft key and rotate the front-panel knob to set the value to 256.
6. Press the **Select Line** button and rotate the front-panel knob set the measurement line to 100 (Field=1 Line=100).
7. Verify that the luminance gain (level) is within the range of 693.0 mV to 707.0 mV.

Chrominance to Luminance Gain and Delay (SIGNAL Output)

This test verifies the chrominance to luminance gain and delay of the FCC composite signal (for NTSC) and the CCIR17 signal (for PAL) from the SIGNAL output.

- Video measurement set
- 75 Ω feed-through terminator
- 75 Ω coaxial terminator

Perform the following procedure to verify the chrominance to luminance gain and delay of the FCC composite signal (for NTSC) and the CCIR17 signal (for PAL) from the SIGNAL output.

Use the equipment connection and controls from the previous test.

NTSC Format.

8. Select the **FCC Composite** signal for SIGNAL as follows:
   a. Press the **FORMAT** button to select **NTSC**, and then press the **ENTER** button.
   b. Press the **OTHER** button to select **FCC Composite**.
9. Press the **Measure** button on the video measurement set to open the Measure mode display.
10. Touch the **Video Standard** soft key to recognize the applied video signal as NTSC.
11. In the Measure mode display, touch the **ChromLum GainDelay** soft key to open the chrominance to luminance gain and delay measurement display.
12. Press the **Menu** button, and then touch the **Average** soft key and rotate the front-panel knob to set the value to 256.
13. Press the **Select Line** button and rotate the front-panel knob set the measurement line to 100 (Field=1 Line=100).
14. Verify that the chrominance gain is 100 % ±1 %.
15. Verify that the chrominance delay is within the range of –10 ns to + 10 ns.

PAL Format.

16. Select the **CCIR 17** signal for SIGNAL as follows:
   a. Press the **FORMAT** button to select **PAL**, and then press the **ENTER** button.

b. Press the **OTHER** button to select CCIR 17.

17. Press the **Measure** button on the video measurement set to open the Measure mode display.

18. Touch the **Video Standard** soft key to recognize the applied video signal as PAL.

19. In the Measure mode display, touch the **ChromLum GainDelay** soft key to open the chrominance to luminance gain and delay measurement display.

20. Press the **Menu** button, and then touch the **Average** soft key and rotate the front-panel knob to set the value to 256.

21. Press the **Select Line** button and rotate the front-panel knob set the measurement line to 100 (Field=1 Line=100).

22. Verify that the chrominance gain is 100 % ±1 %.

23. Verify that the chrominance delay is within the range of –10 ns to + 10 ns.

Differential Phase and Gain (SIGNAL Output)

This test verifies the differential phase and gain of the modulated 5 step signal from the SIGNAL output.

- Video measurement set
- 75 Ω feed-through terminator
- 75 Ω coaxial terminator

Perform the following procedure to verify the differential phase and gain of the modulated 5 step signal from the SIGNAL output.

Use the equipment connection and controls from the previous test.

NTSC Format.

24. Select the **Modulated 5 Step** signal for SIGNAL as follows:

a. Press the **FORMAT** button to select **NTSC**, and then press the **ENTER** button.

b. Press the **LINEARITY** button to select **Modulated 5 Step**.

25. Press the **Measure** button on the video measurement set to open the Measure mode display.

26. Touch the **Video Standard** soft key to recognize the applied video signal as NTSC.

27. In the Measure mode display, touch the **DGDP** soft key to open the differential gain and phase measurement display.

28. Press the **Menu** button, and then touch the **Average** soft key and rotate the front-panel knob to set the value to 256.

29. Press the **Select Line** button and rotate the front-panel knob set the measurement line to 100 (Field=1 Line=100).

30. Verify that the p-p/max value of the differential gain is less than or equal to 0.5 %.

31. Verify that the pk-pk value of the differential phase is less than or equal to 0.5 degree.

PAL Format.

32. Press the **FORMAT** button to select **PAL**, and then press the **ENTER** button.

33. Press the **Measure** button on the video measurement set to open the Measure mode display.

34. Touch the **Video Standard** soft key to recognize the applied video signal as PAL.

35. In the Measure mode display, touch the **DGDP** soft key to open the differential gain and phase measurement display.

36. Press the **Menu** button, and then touch the **Average** soft key and rotate the front-panel knob to set the value to 256.

37. Press the **Select Line** button and rotate the front-panel knob set the measurement line to 100 (Field=1 Line=100).

38. Verify that the p-p/max value of the differential gain is less than or equal to 0.5 %.

39. Verify that the pk-pk value of the differential phase is less than or equal to 0.5 degree.

Luminance Linearity Error (SIGNAL Output)

This verifies the luminance linearity error of the 5 step signal from the SIGNAL output.

- Video measurement set
- 75 Ω feed-through terminator
- 75 Ω coaxial terminator

Perform the following procedure to verify the luminance linearity error of the 5 step signal from the SIGNAL output.

Use the equipment connection and controls from the previous test.

1. Press the **LINEARITY** button to select **5 Step**.
2. Press the **Measure** button on the video measurement set to open the Measure mode display.
3. In the Measure mode display, touch the **Luminance Non Linearity** soft key to open the luminance non linearity measurement display.
4. Press the **Menu** button, and then touch the **Average** soft key and rotate the front-panel knob to set the value to 256.
5. Press the **Select Line** button and rotate the front-panel knob set the measurement line to 100 (Field=1 Line=100).
6. Verify that p-p value of the luminance non linearity is within the range of –1.0 % to 1.0 %.

Frequency Response (SIGNAL Output)

This verifies the frequency response of the multiburst signal from the SIGNAL output.

- Video measurement set
- 75 Ω feed-through terminator
- 75 Ω coaxial terminator

Perform the following procedure to verify the frequency response of the multiburst signal from the SIGNAL output.

Use the equipment connection and controls from the previous test.

1. Press the **MULTIBURST** button to select **100% Multiburst**.
2. Press the **Measure** button on the video measurement set to open the Measure mode display.
3. In the Measure mode display, touch the **Multiburst** soft key to open the multiburst measurement display.

4. Press the **Menu** button, and then touch the **Average** soft key and rotate the front-panel knob to set the value to 256.
5. Press the **Select Line** button and rotate the front-panel knob set the measurement line to 100 (Field=1 Line=100).
6. Verify that the amplitude is within the range of – 0.08 dB to + 0.08 dB (0.5 MHz to 4.8 MHz).

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

Adjustment Procedures

Adjustment Procedures

This section contains information needed to adjust the ATG7 Generator module.

Adjustment in the ATG7 Generator module are for the output offset and output gain.

Requirements for Adjustment

Before doing the adjustment, note the following requirements.

Personnel This procedure is only to be performed by trained service technicians.

Warm-Up Period The ATG7 Generator module requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. Adjustment done before the operating temperature has stabilized may cause errors in performance.

Access When adjusting the output offset and output gain, you need to remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

Equipment Required

Table 4–1 lists the equipment required to adjust the output offset, output gain, and luminance gain.

Table 4-1: Equipment required

Item	No.	Minimum requirement	Recommended equipment
TV signal generator platform	1		Tektronix TG700
Digital multimeter	1	5 1/2 digits	FLUKE 8842A
75 Ω BNC cable	1	Length: 42 inches	Tektronix part number 012-0074-00
75 Ω coaxial terminator	1		Tektronix part number 011-0102-03
BNC T connector	1		Tektronix part number 103-0030-00
BNC female to dual banana adapter	1		Tektronix part number 103-0090-00

Output Offset and Gain Adjustment

Preparation

To perform the output offset and gain adjustment, you must first remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

After you have removed the top cover, find the variable resistors on the ATG7 circuit board. See Figure 4–1.

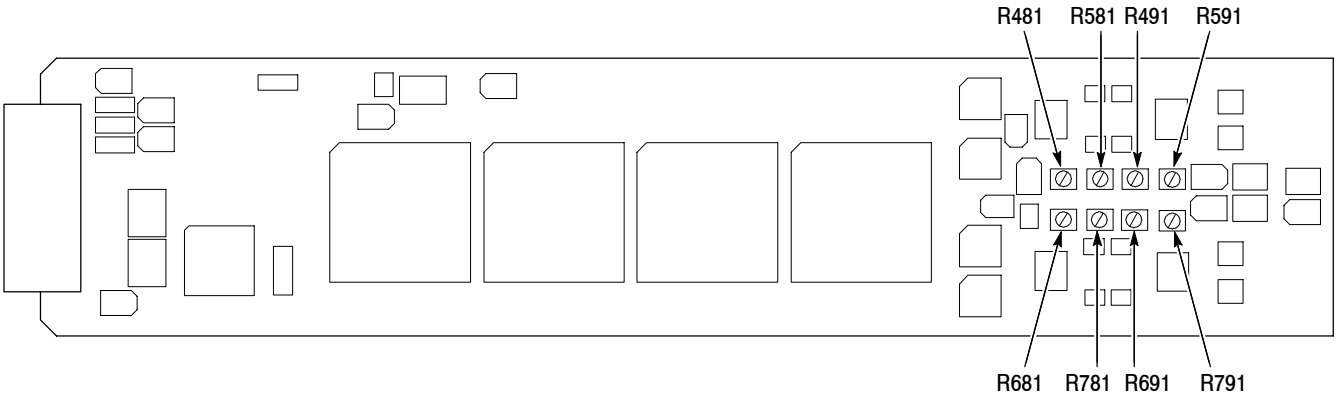

Figure 4-1: ATG7 circuit board view

Procedure

WARNING. *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable, BNC T connector, 75 Ω coaxial terminator, and BNC female-to-dual banana adapter to connect the BLACK 1 connector on the ATG7 Generator module to the INPUT connector on the digital multi meter as shown in Figure 4–2.

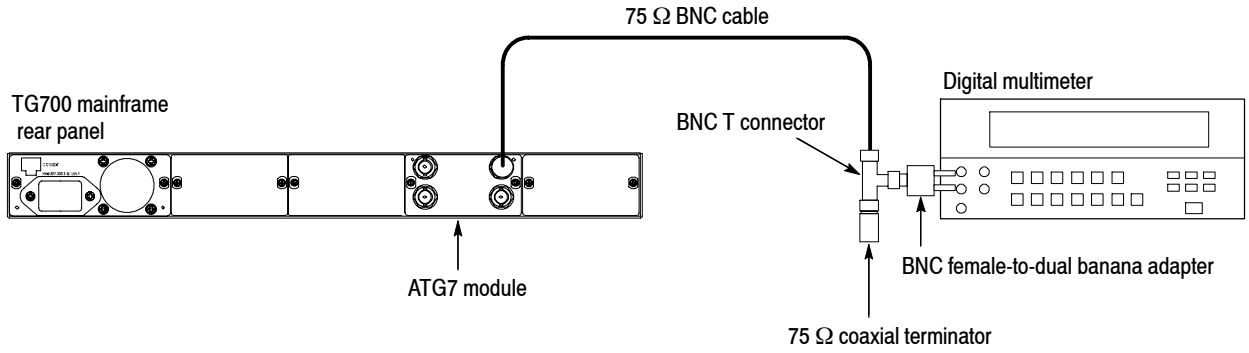

Figure 4-2: Equipment connection for adjusting the output offset and gain

2. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode.
3. Select the DAC Offset (0V DC) calibration signal for BLACK 1, BLACK 2, SIGNAL, and BARS as follows:
   a. Press the **MODULE** button to display the **ATG7** main menu.
   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.
   c. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button.
   d. Press the left (◀) or right (▶) arrow button to select **CAL : DAC Offset (0V DC)**, and then press the **ENTER** button.
   e. Press the **CANCEL** button.
   f. Repeat parts c through e of this step to select the calibration signal for BLACK 2, SIGNAL, and BARS.
4. Locate variable resistor R491 on the ATG7 circuit board. See Figure 4–1.
5. Adjust R491 so that the output offset is 0 V ± 1 mV.
6. Move the BNC cable from the BLACK 1 connector to the BLACK 2 connector on the ATG7 Generator module.
7. Locate variable resistor R591 on the ATG7 circuit board. See Figure 4–1.
8. Adjust R591 so that the output offset is 0 V ± 1 mV.
9. Move the BNC cable from the BLACK 2 connector to the SIGNAL connector on the ATG7 Generator module.
10. Locate variable resistor R691 on the ATG7 circuit board. See Figure 4–1.

11. Adjust R691 so that the output offset is 0 V ± 1 mV.

12. Move the BNC cable from the SIGNAL connector to the BARS connector on the ATG7 Generator module.

13. Locate variable resistor R791 on the ATG7 circuit board. See Figure 4-1.

14. Adjust R791 so that the output offset is 0 V ± 1 mV.

15. Select the DAC Gain (1.000V DC) calibration signal for BLACK 1, BLACK 2, SIGNAL, and BARS as follows:

a. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button.

b. Press the left (◀) or right (▶) arrow button to select **CAL : DAC Gain (1.000V DC)**, and then press the **ENTER** button.

c. Press the **CANCEL** button.

d. Repeat parts a through c of this step to select the calibration signal for BLACK 2, SIGNAL, and BARS.

16. Locate variable resistor R481 on the ATG7 circuit board. See Figure 4-1.

17. Adjust R481 so that the output gain is 0.7 V ± 1 mV.

18. Move the BNC cable from the BLACK 1 connector to the BLACK 2 connector on the ATG7 Generator module.

19. Locate variable resistor R581 on the ATG7 circuit board. See Figure 4-1.

20. Adjust R581 so that the output gain is 0.7 V ± 1 mV.

21. Move the BNC cable from the BLACK 2 connector to the SIGNAL connector on the ATG7 Generator module.

22. Locate variable resistor R681 on the ATG7 circuit board. See Figure 4-1.

23. Adjust R681 so that the output gain is 0.7 V ± 1 mV.

24. Move the BNC cable from the SIGNAL connector to the BARS connector on the ATG7 Generator module.

25. Locate variable resistor R781 on the ATG7 circuit board. See Figure 4-1.

26. Adjust R781 so that the output gain is 0.7 V ± 1 mV.

Maintenance

Maintenance

This section contains instructions and procedures for maintaining the ATG7 Generator module. For information on servicing the mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

The following information can be found in this section:

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

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

Preparation

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

Servicing Prerequisites

Ensure 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.

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.*

Inspecting and Cleaning Procedures

Clean the mainframe and modules often enough to prevent dust or dirt from accumulating. Refer to *Inspecting and Cleaning Procedures* in the *TG700 TV Signal Generator Platform Service Manual*.

Performance Verification

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

Repackaging Instructions

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

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

Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the ATG7 Generator module.

Tools Required

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

Table 5-1: Required tools

Name	Description	Tektronix part number
Screwdriver handle	Accepts Phillips-driver bits	
#1 Phillips tip	Phillips-driver bit for #1 size screw heads	
#2 Phillips tip	Phillips-driver bit for #2 size screw heads	
Nut driver, 14 mm	Special nut driver for removing the BNC connectors of the ATG7 module	003-A041-00

Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

Replacing the Rear-Panel Connectors

To replace the rear-panel connector:

1. Use the *Removing a Module* section in the *TG700 TV Signal Generator Platform Module Installation Instructions* to remove the ATG7 Generator module from the mainframe.
2. Disconnect the cables at J830 (BLACK 1), J880 (BLACK 2), J930 (SIGNAL) and J980 (BARS) on the ATG7 circuit board.
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

Replacing the chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the five screws securing the ATG7 circuit board to the chassis.
3. Lift the circuit board up and away from chassis, and then place it on a static free surface.
4. Set the replacement chassis on a firm, flat, static-free work surface.
5. Carefully place the circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the five screws securing the circuit board to the chassis.
7. Apply the rear panel to the chassis, and then install all the rear-panel connectors to the chassis.

Troubleshooting

This section contains instructions and procedures for troubleshooting the ATG7 Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to *Troubleshooting* in the *TG700 TV Signal Generator Platform Service Manual*.

Equipment Required

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

Table 5-2: Equipment required for troubleshooting

Equipment description	Minimum requirements/example
Screwdriver handle	Accept Phillips-driver bits
#1 Phillips tip	Phillips-driver bit for #1 size screw heads
TG700 mainframe	A TG700 mainframe that is functioning correctly

Backing up the instrument settings

Before you begin troubleshooting, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◀) or right (▶) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

Troubleshooting Trees

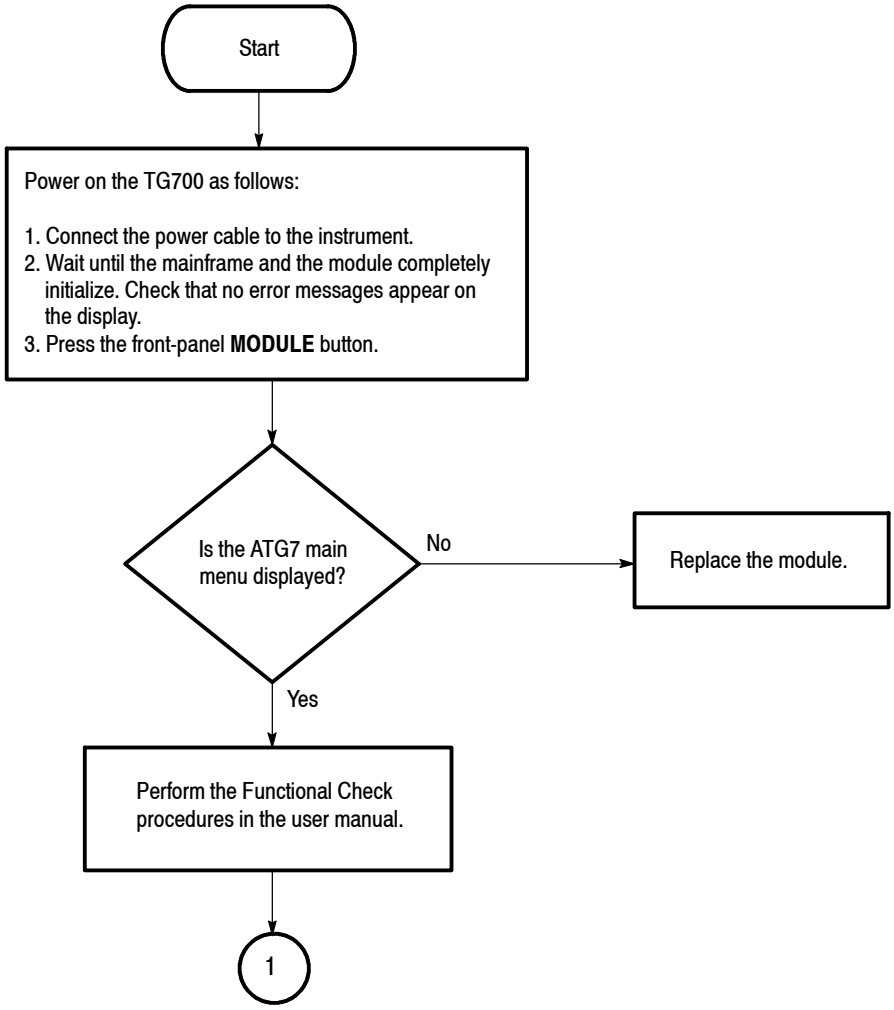

Figure 5- 1: Troubleshooting procedure (1)

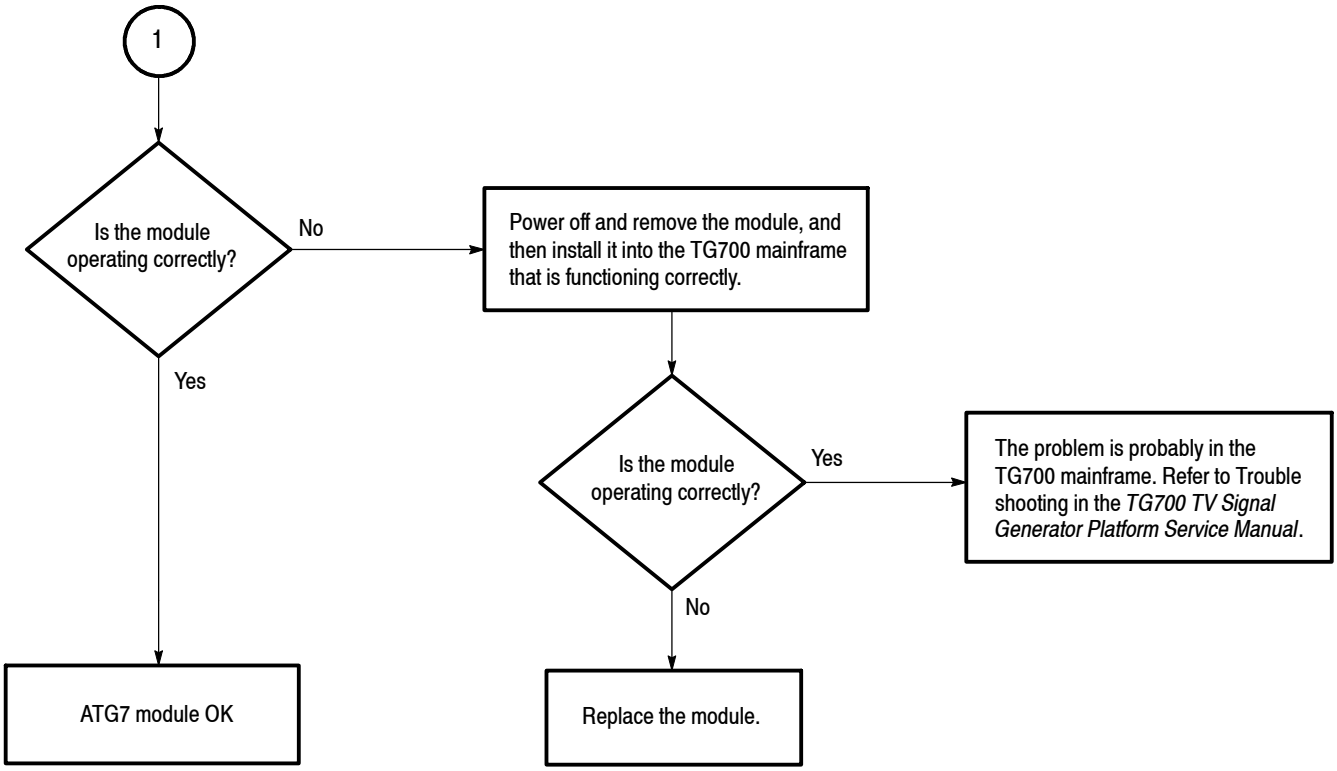

Figure 5- 2: Troubleshooting procedure (2)

Option

Option

This section describes the option that is available for the ATG7 Generator module.

The following option is available.

- Option D1 (Test data report)

Option D1 Description

A calibration data test result report comes with the ATG7 Generator module when you specify this option.

Diagram

Diagram

Figure 7–1 shows the ATG7 Generator module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 TV Signal Generator Platform Service Manual*.

A block diagram of the ATG7 Generator module is located in the *Theory of Operation* section, beginning on page 2–1.

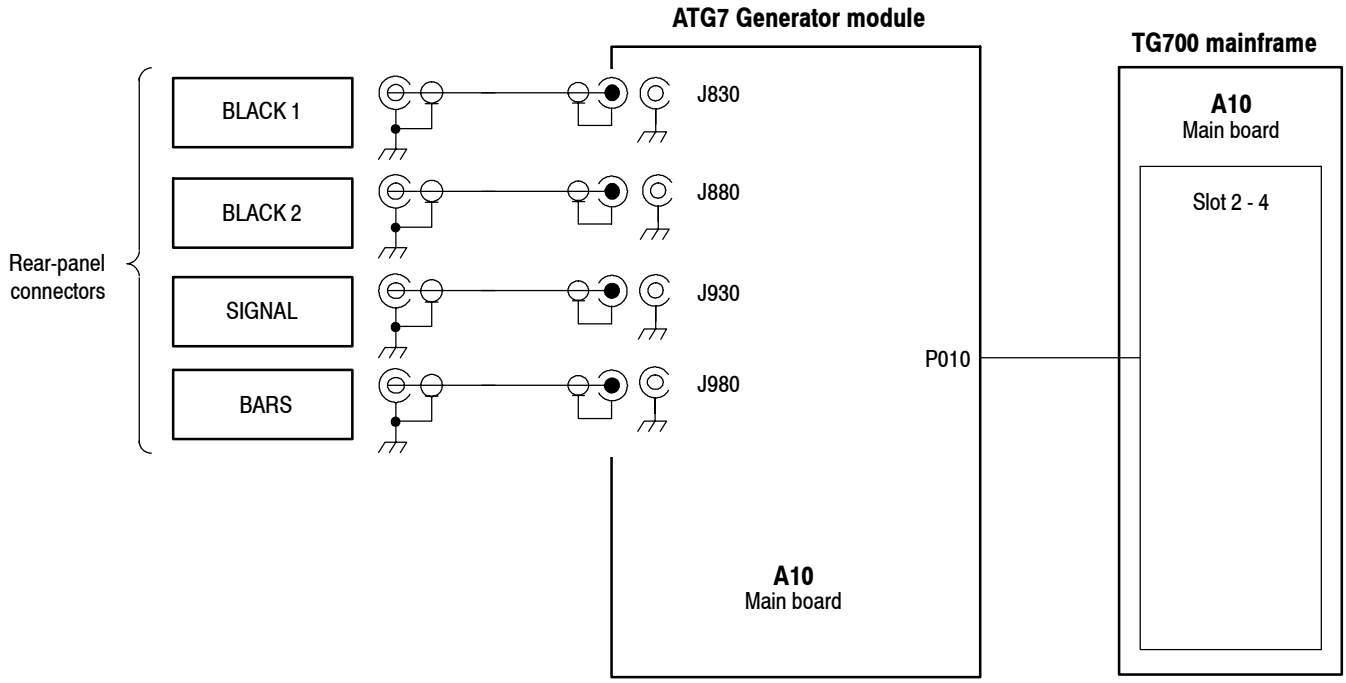

Figure 7-1: ATG7 Generator module connections

Replaceable Parts List

Replaceable Parts List

This section contains a list of the replaceable modules for the ATG7 Generator module. Use this list to identify and order replacement parts.

Parts Ordering Information

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

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

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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

Module Servicing

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

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

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

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

Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the ATG7 Generator module. 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.

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

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
8-1	116-A014-00			1	EXCHANGE MODULE:ATG7
8-1-1	441-A269-02			1	CHASSIS,MODULE AGL7:ASSY
-2	333-A427-00			1	PANEL,REAR:ATG7,AL
-3	214-4946-00			2	SPRING,CONICAL:VXI MOUNTING SCREW,0.26 MM SUS304,5.4 MML
-4	213-1129-01			2	SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,N1 PL,CROSS REC & SLOTTED
-5	348-A128-00			2.5 CM	SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02]
-6	174-B851-00			4	CABLE ASSY,RF:75OHM COAX(RG179),5.5CM L,BNC TO MCX
-7	211-A245-01			5	SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER
-8	334-1378-03			1	MARKER,IDENT:MKD SERIAL NO.
					STANDARD ACCESSORIES
	070-A824-XX			1	MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS
	062-A249-XX			1	SOFTWARE PACKAGE:S/W(CD-R)
					OPTIONAL ACCESSORIES
	070-A800-XX			1	MANUAL,TECH:SERVICE,TG700
	003-A041-00			1	NUTDRIVER,BOX:14MM HEX,BNC RETAINING NUT,MODIFIED 19MM

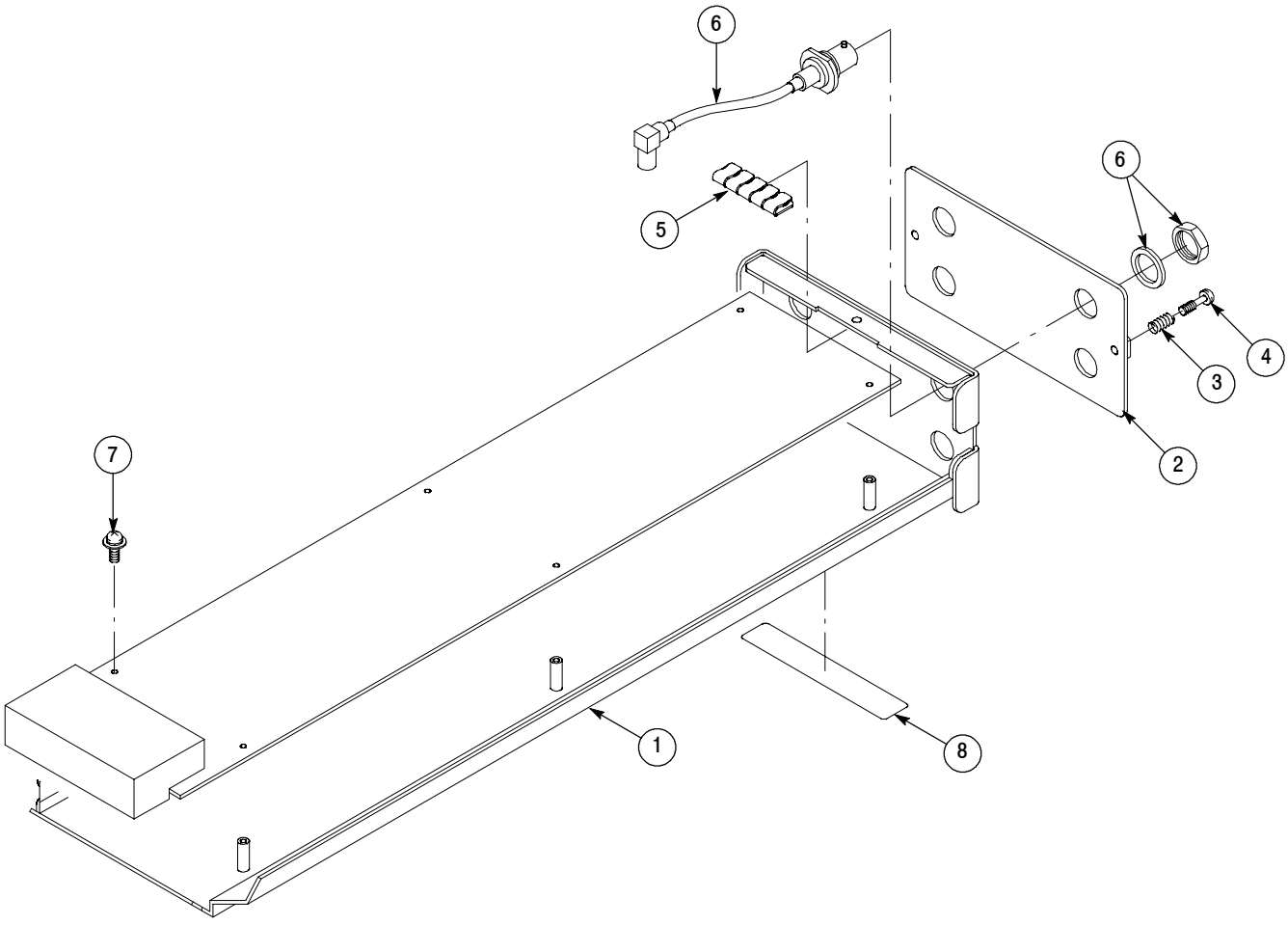

Figure 8- 1: ATG7 Generator module exploded view

Service Manual

Tektronix

AVG7
Analog Video Generator

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

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Preface

This is the service manual for the AVG7 Analog Video Generator module. This manual contains information needed to service an AVG7 Generator module to the module level.

Manual Structure

This manual is divided into sections, such as *Specifications* and *Theory of Operation*. Further, some sections are divided into subsections, such as *Product Description* and *Removal and Installation Procedures*.

Sections containing procedures also contain introductions to those procedures. Be sure to read these introductions because they provide information needed to do the service correctly and efficiently. The following are brief descriptions of each manual section:

- *Specifications* contains a description of the AVG7 Generator module and the characteristics that apply to it.
- *Theory of Operation* is an overview of the module's design.
- *Performance Verification* contains procedures to perform the operation tests.
- *Adjustment Procedures* contains procedures for adjusting an AVG7 Generator module to meet warranted characteristics.
- *Maintenance* contains installation, removal and replacement, and troubleshooting instructions.
- *Option* contains a description of the available option for the AVG7 Generator module.
- *Diagram* contains an interconnect diagram showing the connections between the AVG7 Generator module and the mainframe.
- *Replaceable Parts List* 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 AVG7 Generator module:

- The *TG700 TV Signal Generator Platform User Manual* (Tektronix part number 070-A799-XX) describes how to use the TG700 mainframe and all modules. It also contains information about remote commands and programming structure for the TG700 mainframe and all modules.
- The *TG700 TV Signal Generator Platform Module Installation Instructions* (Tektronix part number 070-A824-XX) describes how to install and remove the modules, and how to upgrade the firmware of the mainframe.

Specifications

Specifications

This section contains a general product description of the AVG7 Generator module followed by the operating specifications of the module.

Product Description

The AVG7 Analog Video Generator module is designed to be installed in the TG700 TV Signal Generator Platform. The TG700 platform must be running version 3.1 or later firmware.

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

- Supports the following system formats:

  NTSC, NTSC no setup, PAL, 525 GBR, 525 YPbPr, 525 Beta, 625 GBR, 625YPbPr

- Six analog composite or component video outputs
- Outputs a frame picture created by the Frame Picture Generator application (TG700 Option FP required)
- Overlay of circle, text, or logo on the video signal
- Generates a moving picture by scrolling the active picture area of the output test signal
- Full remote control using Ethernet interface

Electrical Characteristics

Tables 1–1 through 1–3 list the electrical and environmental characteristics of the AVG7 Generator module.

Table 1-1: Output channels

Characteristic	Performance requirements	Reference information
Channel 1 (CH 1)		
Number of outputs	2	
Output signals	Y, G, or composite	Each component of a composite signal can be turned On or Off using the VIDEO submenu.
Channel 2 (CH 2)		
Number of outputs	2	
Output signals	B-Y, Pb, B, C, or composite	Each component of a composite signal can be turned On or Off using the VIDEO submenu.
Channel 3 (CH 3)		
Number of outputs	2	
Output signals	R-Y, Pr, R, or composite	Each component of a composite signal can be turned On or Off using the VIDEO submenu.

Table 1-2: Common output characteristics

Characteristic	Performance requirements	Reference information
Amplitude error		
Absolute amplitude	≤ 1%	Measured at 700 mV.
Channel gain matching	≤ 0.5%	Measured at 700 mV, relative to CH 1.
Chrominance luminance gain error	≤ 1%	Measured at 700 mV, relative to 500 kHz.
Delay error		
Chrominance to luminance delay, typical		≤ 2.5 ns on a composite output.
Channel to channel delay	≤ 1 ns	Relative to CH 1
Group delay, typical		≤ 5 ns to 5 MHz
SCH phase error, typical		≤ 1.25 ns (± 1.6° at 3.58 MHz and ± 2° at 4.43 MHz)

Table 1-2: Common output characteristics (cont.)

Characteristic	Performance requirements	Reference information
Frequency response	Flat within 0.5% peak from 0.5 MHz to 5 MHz.	Typically ≤ 5% to 8 MHz at 700 mV, measured with a 1 m coaxial cable and peak detector.
Line time distortion	≤ 0.5%	Measured with FCC composite signal.
Field time distortion	≤ 0.5%	Measured with field square wave.
K factor 2T5 pulse	≤ 0.5%	
Pulse/bar ratio, typical		1:1 within 0.5% with 2T5 pulse and bar signal.
DC offset	≤ 10 mV	
Differential gain	≤ 0.5%	
Differential phase	≤ 0.5°	
Return loss	≥ 40 dB to 6 MHz	

Environmental Characteristics

Table 1-3: Environmental characteristics

Characteristic	Description
Temperature	
Operating	0 °C to +50 °C
Non-operating	-20 °C to +60 °C
Relative humidity	
Operating	20% to 80% (No condensation) ; Maximum wet-bulb temperature 29.4 °C
Non-operating	5% to 90% (No condensation) ; Maximum wet-bulb temperature 40.0 °C
Altitude	
Operating	To 4.5 km (15, 000 feet) Maximum operating temperature decreases 1 °C each 300 m above 1.5 km.
Non-operating	To 15 km (50, 000 feet)
Vibration	
Operating	2.65 m/s^2 (0.27 G_{rms}), 5 Hz to 500 Hz, 10 min, three axes
Non-operating	22.36 m/s^2 (2.28 G_{rms}), 5 Hz to 500 Hz, 10 min, three axes
Shock	
Non-operating	588 m/s^2 (60 G), half-sine, 11 ms duration

Theory of Operation

Theory of Operation

This section describes the basic operation of the major circuit blocks in the AVG7 Generator module.

For information about the TG700 mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

Bus Interface This block provides the communication between the mainframe and the module circuit.

Line Memory Line memory holds the actual sample points which define a digital signal.

Address Generator This block consists of a frame delay, an MPU interface, a sequencer, an SDRAM controller, and a blanking data generator. It interfaces the Frame Memory and the Line Memory and controls the output sequence of the video data in these memories.

Frame Memory Frame memory contains a series of pointers that control the order the video lines stored in the Line Memory are used to produce digital signals.

Overlay Controller This block consists of an MPU interface and an overlay controller. It inserts data from the Overlay Memory into the Line Memory data stream to create circular patterns, ID text, and logo.

Overlay Memory Overlay memory generates timings to multiplex the line memory data and the overlay data used for a circle, ID text, and logo overlay.

D/A Converter & Amp This block consists of a D/A converter, two amplifiers, and a filter. It converts the digital data from the Overlay Controller to analog signal and re-construct the signal for output.

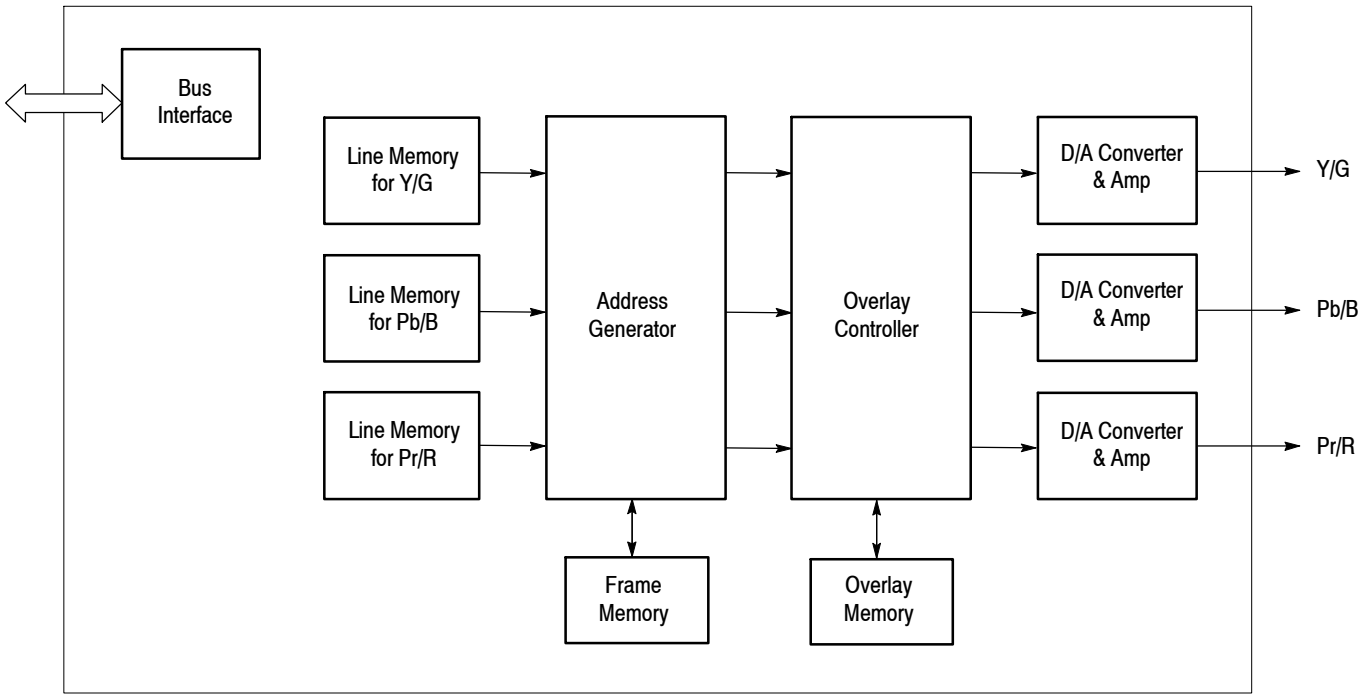

Figure 2- 1: Simplified block diagram of the AVG7 Generator module

Performance Verification

Performance Verification

This section provides procedures that verify the performance and functionality of the AVG7 Generator module.

Preparation for Performance Verification

Perform the following before starting the performance verification procedures:

Power On Default Settings

Before you perform the performance verification procedures, make sure that the required instrument settings are saved in the Power On Default preset.

If the instrument settings are saved in the Power On Default preset, you can recall the settings after completing the performance verification procedures by removing and reapplying the power.

Warm up

The AVG7 Generator module and test equipment must have had a warm-up period of at least 20 minutes.

Equipment Required

Table 3–1 lists the equipment required for the procedures.

Table 3-1: Equipment required for performance verification

Item	No.	Minimum requirement	Recommended equipment
Oscilloscope	1	Bandwidth: 1 GHz or higher	Tektronix TDS784D
Video measurement set	1		Tektronix VM700T Option 01/11
Digital multimeter	1	5 1/2 digits	FLUKE 8842A
Peak detector amplifier	1		Tektronix part number. 015-0408-00 and TM500 series power supply
Peak detector head	1		Tektronix part number 015-0413-00
Color picture monitor	1		SONY BVMD14H5J and BKM129X
Test signal generator	1		Tektronix ATG7
75 Ω BNC cable	3	Length: 72 inches	Tektronix part number 012-0159-01
75 Ω BNC cable	1	5C-2V, 1 m	Canare DH5C01-S-SA
75 Ω feed-through termination	1		Tektronix part number 011-0103-02
75 Ω coaxial termination	1		Tektronix part number 011-0102-01

Table 3- 1: Equipment required for performance verification (Cont.)

Item	No.	Minimum requirement	Recommended equipment
75 Ω signal adapter	2	Bandwidth: 1 GHz Amplitude precision: -3 dB	Tektronix AMT75
BNC T connector	1		Tektronix part number 103-0030-00
BNC female-to-dual banana adapter	1		Tektronix part number 103-0090-00
BNC female-to-female connector	1		Canare BCJ-J

Calibration Data Report

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

Table 3- 2: AVG7 calibration data report

Serial Number:	Cal Date:	Temperature:	Humidity:

Step	Function Tested	Minimum	Cal Data	Maximum
1.	Absolute Amplitude			
	CH 1 Output	693.0 mV	mV	707.0 mV
	CH 2 Output	693.0 mV	mV	707.0 mV
	CH 3 Output	693.0 mV	mV	707.0 mV
2.	Channel Gain Matching (Relative to CH 1)			
	CH 2 Output	------	%	0.5%
	CH 3 Output	------	%	0.5%
3.	DC Offset			
	CH 1 Output (GBR)	-10 mV	mV	10 mV
	CH 2 Output (GBR)	-10 mV	mV	10 mV
	CH 3 Output (GBR)	-10 mV	mV	10 mV
	CH 2 Output (YPbPr)	-10 mV	mV	10 mV
	CH 3 Output (YPbPr)	-10 mV	mV	10 mV
4.	Channel-to-Channel Delay (Relative to CH 1)			
	CH 2 Output	-1.0 ns	ns	1 ns
	CH 3 Output	-1.0 ns	ns	1 ns

Table 3-2: AVG7 calibration data report (Cont.)

Step	Function Tested	Minimum	Cal Data	Maximum
5.	Frequency Response (Measured on DAC test signal)			
	CH 1 Output (Peak value from 0.5 MHz to 5 MHz)	-3.5 mV	mV	3.5 mV
	CH 2 Output (Peak value from 0.5 MHz to 5 MHz)	-3.5 mV	mV	3.5 mV
	CH 3 Output (Peak value from 0.5 MHz to 5 MHz)	-3.5 mV	mV	3.5 mV
6.	Chrominance to Luminance Gain Ratio (Measured on DAC test signal)			
	CH 1 Output ≤1.0%	-1.0%	%	1.0%
	CH 2 Output ≤1.0%	-1.0%	%	1.0%
	CH 3 Output ≤1.0%	-1.0%	%	1.0%
7.	Line Time Distortion (Measured on NTSC: FCC Composite signal)			
	CH 1 Output ≤0.5% (Peak to Peak value)	------	%	0.5%
	CH 2 Output ≤0.5% (Peak to Peak value)	------	%	0.5%
	CH 3 Output ≤0.5% (Peak to Peak value)	------	%	0.5%
8.	Field Time Distortion (Measured on Field Square Wave signal of all composite outputs)			
	CH 1 Output ≤0.5% (Peak to Peak value)	------	%	0.5%
	CH 2 Output ≤0.5% (Peak to Peak value)	------	%	0.5%
	CH 3 Output ≤0.5% (Peak to Peak value)	------	%	0.5%
9.	K Factor 2T5 Pulse (Measured on CCIR17 & FCC Composite signal)			
	CH 1 Output (K-2T) ≤0.5% (Peak to Peak value)	------	%	0.5%
	CH 2 Output (K-2T) ≤0.5% (Peak to Peak value)	------	%	0.5%
	CH 3 Output (K-2T) ≤0.5% (Peak to Peak value)	------	%	0.5%
	CH 1 Output (K-PB) ≤0.5% (Peak to Peak value)	------	%	0.5%
	CH 2 Output (K-PB) ≤0.5% (Peak to Peak value)	------	%	0.5%
	CH 3 Output (K-PB) ≤0.5% (Peak to Peak value)	------	%	0.5%
10.	Differential Phase and Gain (Measured on Modulated 5 Step signal)			
	CH 1 Output (DG) ≤0.5%	------	%	0.5%
	CH 2 Output (DG) ≤0.5%	------	%	0.5%
	CH 3 Output (DG) ≤0.5%	------	%	0.5%
	CH 1 Output (DP) ≤0.5°	------	°	0.5°
	CH 2 Output (DP) ≤0.5°	------	°	0.5°
	CH 3 Output (DP) ≤0.5°	------	°	0.5°

Performance Verification Procedures

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

WARNING. *Dangerous electric shock hazards exist inside the TG700 mainframe. Only qualified service personnel should perform these procedures.*

DC Offset and Amplitude Error

This test verifies the DC offset and amplitude error of the channel outputs. The following equipment is required for the test:

- Digital multimeter
- BNC female-to-dual banana adapter
- BNC T connector
- 75 Ω coaxial termination
- 75 Ω BNC cable

Perform the following procedure to verify the output offset and gain of the channel outputs:

1. Use the 75 Ω BNC cable, BNC T connector, 75 Ω coaxial termination, and BNC female-to-dual banana adapter to connect the upper CH 1 connector on the AVG7 Generator module to the INPUT connector on the digital multimeter as shown in Figure 3–1.

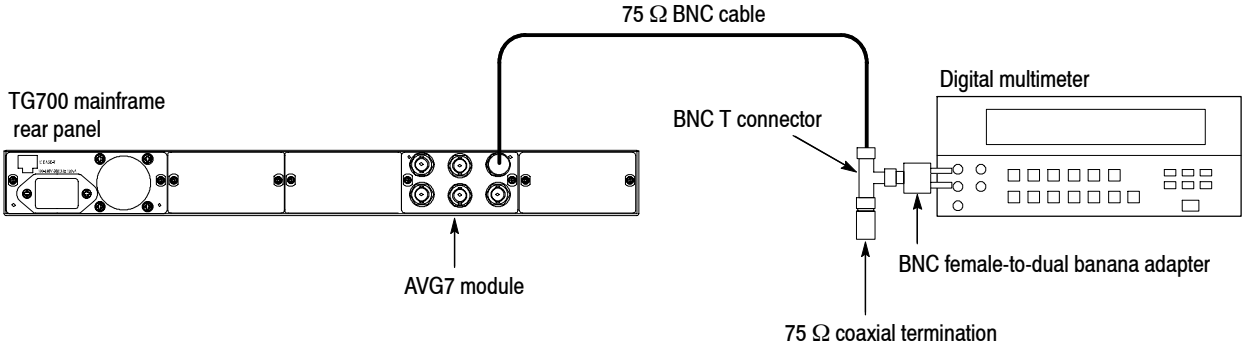

Figure 3- 1: Equipment connection for verifying the DC offset and amplitude error

2. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode. Continue holding down the **FRONT PANEL ENABLE** button until the "TG700 start up with Factory Mode." message appears.

3. Select the DAC Gain (GBR) : 0 mV calibration signal as follows:

   a. Press the **MODULE** button to display the **AVG7** main menu.

   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.

   c. Press the left (◀) or right (▶) arrow button to select **DAC Gain (GBR)**, and then press the **ENTER** button.

   d. Press the left (◀) or right (▶) arrow button to select **0mV**, and then press the **ENTER** button.

4. Verify that the output offset is within the range of -10 mV to 10 mV. Note this value as **CH1_DC0**.

5. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AVG7 Generator module.

6. Verify that the output offset is within the range of -10 mV to 10 mV. Note this value as **CH2_DC0**.

7. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module.

8. Verify that the output offset is within the range of -10 mV to 10 mV. Note this value as **CH3_DC0**.

9. Move the BNC cable from the upper CH 3 connector to the upper CH 1 connector on the AVG7 Generator module.

10. Press the left (◀) or right (▶) arrow button to select **700.397mV**, and then press the **ENTER** button.

11. Read the value on the digital multimeter, and note this value as **CH1_DC1**.

12. Verify that **CH1_DC1-CH1_DC0** is within the range of 693.0 mV to 707.0 mV. Note this value as **CH1_V1**.

13. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AVG7 Generator module.

14. Read the value on the digital multimeter, and note this value as **CH2_DC1**.

15. Verify that **CH2_DC1-CH2_DC0** is within the range of 693.0 mV to 707.0 mV. Note this value as **CH2_V1**.

16. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module.

17. Read the value on the digital multimeter, and note this value as **CH3_DC1**.

18. Verify that **CH3_DC1–CH3_DC0** is within the range of 693.0 mV to 707.0 mV. Note this value as **CH3_V1**.

19. Verify that the amplitude errors of the CH 2 and CH 3 outputs meet the following relationships:

    $\text{CH 2 amplitude error} = ((\text{CH2\_V1}/\text{CH1\_V1}) - 1) \times 100 \leq \pm 0.5\%$
    $\text{CH 3 amplitude error} = ((\text{CH3\_V1}/\text{CH1\_V1}) - 1) \times 100 \leq \pm 0.5\%$

20. Move the BNC cable from the upper CH 3 connector to the upper CH 2 connector on the AVG7 Generator module.

21. Select the **DAC Gain (YPbPr) : 0 mV** calibration signal for CH 2 and CH 3 as follows:

    a. Press the **CANCEL** button to display the **CALIBRATION** menu.

    b. Press the left (◀) or right (▶) arrow button to select **DAC Gain (YPbPr)**, and then press the **ENTER** button.

    c. Press the left (◀) or right (▶) arrow button to select **0mV**, and then press the **ENTER** button.

22. Verify that the output offset is within the range of –10 mV to 10 mV.

23. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module.

24. Verify that the output offset is within the range of –10 mV to 10 mV.

Channel-to-Channel Delay

This test verifies the time delay among the channel outputs. The following equipment is required for the test:

- Oscilloscope
- Test signal generator
- Two 75 Ω signal adapters
- 75 Ω feed-through termination
- Three 75 Ω BNC cables

Perform the following procedure to verify the time delay among the channel outputs:

1. Use the 75 Ω BNC cable and the 75 Ω signal adapter to connect the upper CH 1 connector on the AVG7 Generator module to the CH 1 input connector on the oscilloscope as shown in Figure 3–2.
2. Use the 75 Ω BNC cable and the 75 Ω signal adapter to connect the upper CH 2 connector on the AVG7 Generator module to the CH 2 input connector on the oscilloscope as shown in Figure 3–2.
3. Use the 75 Ω BNC cable and the 75 Ω feed-through termination to connect the BLACK 1 connector on the test signal generator to the CH 3 input connector on the oscilloscope as shown in Figure 3–2.

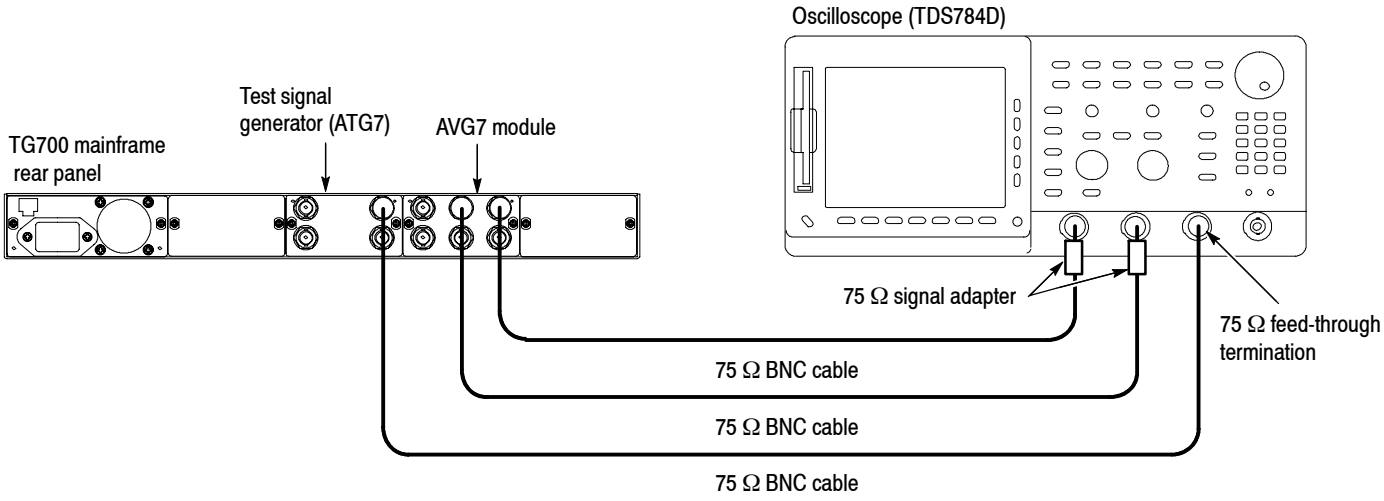

Figure 3-2: Equipment connection for verifying the channel-to-channel delay

4. Set the oscilloscope settings as indicated below:

Vertical scale . . . . . CH 1 and CH 2: 5 mV/div, CH 3: 1.00 V/div
Bandwidth . . . . . 250 MHz (CH 1 and CH 2)
Vertical offset . . . . . 0 mV (CH 1 and CH 2)
Horizontal scale . . . . . 20 µs/div
Horizontal delay time . . 50 ns/div
Delayed runs time . . . . . 6.468 µs (Delayed Only)
Trigger position 50%
Trigger source . . . . . CH 3
Trigger type . . . . . Edge
Acquire menu . . . . . Average 64
Repetitive Signal: OFF
CH 3 waveform . . . . . OFF

5. Use the **CH 2 Vertical Position** knob on the oscilloscope to align the CH 2 trace to the CH 1 trace with no signal input.

6. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode. Continue holding down the **FRONT PANEL ENABLE** button until the "TG700 start up with Factory Mode." message appears.

7. Set the test signal generator (ATG7 module) settings as indicated below:

   Output selection . . . . . BLACK 1
   Signal format . . . . . NTSC
   Test signal . . . . . Field Reference

8. Select the **Field Square Wave** signal as follows:

   a. Press the **MODULE** button to display the **AVG7** main menu.

   b. Press the **FORMAT** button to select **NTSC**, and then press the **ENTER** button.

   c. Press the **FLAT FIELD** button to select **Field Square Wave**.

9. Use the **CH 1 Vertical Position** and **CH 2 Vertical Position** knobs on the oscilloscope to align the blanking level of the CH 1 signal to the blanking level of the CH 2 signal at the center of the screen.

10. Change the oscilloscope settings as follows:

    Vertical offset . . . . . -143 mV (CH 1 and CH 2)
    Horizontal delay time . . 2.00 ns/Div
    Delay runs time . . . . . 6.224 µs

11. Use the vertical cursors to perform the timing measurement and verify that the time delay between the CH 1 waveform and the CH 2 waveform is within 1 ns.

12. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module.

13. Return the oscilloscope settings as follows:

    Vertical offset . . . . . 0 mV (CH 1 and CH 2)
    Delay runs time . . . . . 6.468 µs (Delayed Only)

14. Repeat steps 9 through 11.

Frequency Response

This test verifies the frequency response of the DAC test signal from the CH 1, CH 2, and CH 3 outputs. The following equipment is required for the test:

- Oscilloscope
- Peak detector
- Peak detector head
- Test signal generator
- 75 Ω feed-through termination
- Three 75 Ω BNC cables

Perform the following procedure to verify the frequency response of the DAC test signal from the CH 1, CH 2, and CH 3 outputs:

1. Use the two 75 Ω BNC cables, peak detector head, and BNC female-to-female connector to connect the upper CH 1 connector on the AVG7 Generator module to the +INPUT connector on the peak detector amplifier as shown in Figure 3–3.
2. Use the 75 Ω BNC cable to connect the OUTPUT connector on the peak detector amplifier to the CH 1 input connector on the oscilloscope as shown in Figure 3–3.
3. Use the 75 Ω BNC cable and the 75 Ω feed-through termination to connect the BLACK 1 connector on the test signal generator to the CH 2 input connector on the oscilloscope as shown in Figure 3–3.

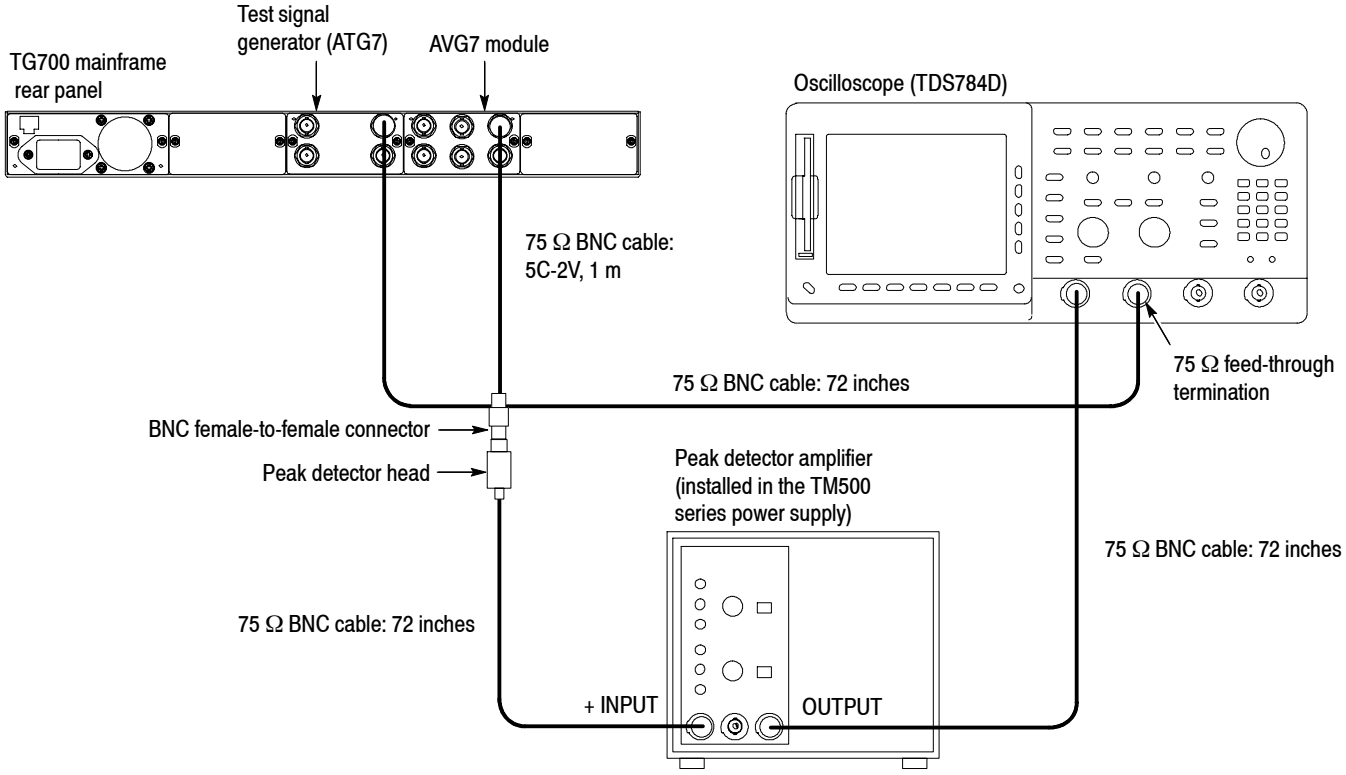

Figure 3- 3: Equipment connection for verifying the frequency response

4. Set the oscilloscope settings as indicated below:

   Vertical scale . . . . . CH 1: 2 mV/div, CH 2: 1.00 V/div
   Bandwidth . . . . . 20 MHz (CH 1)
   Horizontal scale . . . . . 2 ms/div
   Trigger position 10%
   Trigger source . . . . . CH 2
   Trigger type . . . . . Edge
   Acquire menu . . . . . Peak Detect

5. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode. Continue holding down the **FRONT PANEL ENABLE** button until the "TG700 start up with Factory Mode." message appears.

6. Set the test signal generator (ATG7 module) settings as indicated below:

   Output selection . . . . . BLACK 1
   Signal format . . . . . NTSC
   Test signal . . . . . Field Reference

7. Select the 525 GBR signal format as follows:

   a. Press the **MODULE** button to display the AVG7 main menu.

   b. Press the **FORMAT** button to select **525 GBR**, and then press the **ENTER** button.

   c. Press the **COLOR BAR** button.

8. Select the DAC Test calibration signal as follows:

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

   b. Press the left (◀) or right (▶) arrow button to select **DAC Test**, and then press the **ENTER** button.

   c. Press the **ENTER** button again to confirm the signal output.

9. Select the Sync ON All Channels mode as follows:

   a. Press the up (▲) or down (▼) arrow button to select **VIDEO**, and then press **ENTER** button to access the VIDEO submenu.

   b. Press the up (▲) or down (▼) arrow button to select **GBR SYNC**.

   c. Press the left (◀) or right (▶) arrow button to select **Sync ON All Channels**, and then press the **ENTER** button.

10. Turn the LEVEL knob on the peak detector amplifier so that the green LED light.

11. Verify that the differences between the maximum amplitude and minimum amplitude from 500 kHz to 5 MHz are less than or equal to 3.5 mV. See Figure 3–4.

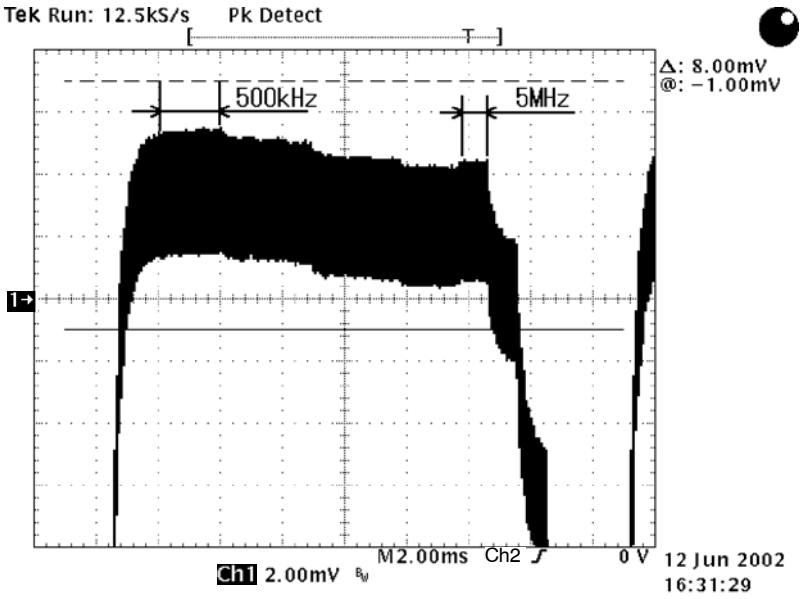

Figure 3- 4: Verifying the signal amplitudes from 500 kHz to 5 MHz

12. Move the peak detector head from the upper CH 1 connector to the upper CH 2 connector on the AVG7 Generator module and repeat steps 10 and 11.

13. Move the peak detector head from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module and repeat steps 10 and 11.

14. Move the peak detector head from the upper CH 3 connector to the lower CH 1 connector on the AVG7 Generator module and repeat steps 10 and 11.

15. Move the peak detector head from the lower CH 1 connector to the lower CH 2 connector on the AVG7 Generator module and repeat steps 10 and 11.

16. Move the peak detector head from the lower CH 2 connector to the lower CH 3 connector on the AVG7 Generator module and repeat steps 10 and 11.

Line Time Distortion

This test verifies the line time distortion of the FCC composite signal from the CH 1, CH 2, and CH 3 outputs. The following equipment is required for the test:

- Video measurement set
- 75 Ω feed-through termination
- 75 Ω coaxial termination

Perform the following procedure to verify the line time distortion of the field square wave signal from the CH 1, CH 2, and CH 3 outputs:

1. Use the 75 Ω BNC cable to connect the upper CH 1 connector on the AVG7 Generator module to the CHAN A connector on the video measurement set as shown in Figure 3–5.
2. Use the 75 Ω coaxial termination to terminate the other loopthrough to the CHAN A connector on the video measurement set.

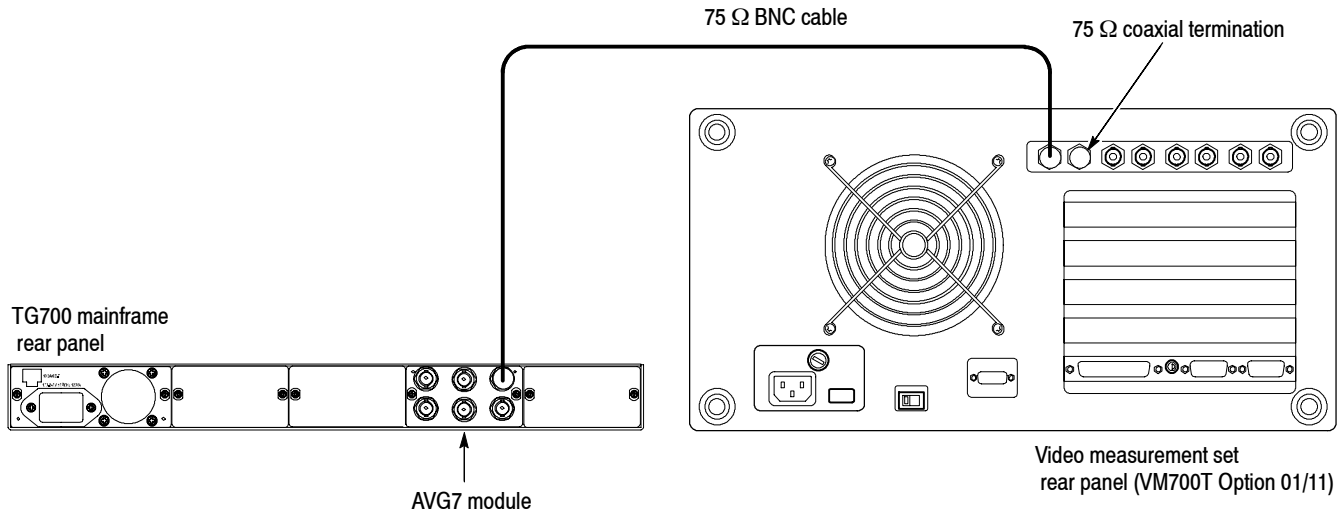

Figure 3- 5: Equipment connection for verifying the line time distortion

3. Select the FCC Composite signal as follows:
   a. Press the **MODULE** button to display the AVG7 main menu.
   b. Press the **FORMAT** button to select **NTSC**, and then press the **ENTER** button.
   c. Press the **OTHER** button to select **FCC Composite**.
4. Press the **Measure** button on the video measurement set to open the Measure mode display.
5. Touch the **Video Standard** soft key to recognize the applied video signal as NTSC.
6. In the Measure mode display, touch the **Bar LineTime** to open the Bar & LineTime measurement display.
7. Press the **Menu** button to display the Bar & LineTime main menu.
8. Touch the **Average** soft key and rotate the front-panel knob to set the value to 256.

9. Press the **Select Line** button and rotate the front-panel knob to set the measurement line to 17 (Field=1 Line=17).
10. Verify that the line time distortion is less than or equal to 0.5%.
11. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AVG7 Generator module and repeat step 10.
12. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module and repeat step 10.

Field Time Distortion

This test verifies the field time distortion of the field square wave signal from the CH 1, CH 2, and CH 3 connectors. The following equipment is required for the test:

- Video measurement set
- 75 Ω feed-through termination
- 75 Ω coaxial termination

Perform the following procedure to verify the field time distortion of the field square wave signal from the CH 1, CH 2, and CH 3 outputs:

Use the equipment connection and controls from the previous test.

1. Move the BNC cable from the upper CH 3 connector to the upper CH 1 connector on the AVG7 Generator module.
2. Select the Field Square Wave signal as follows:
   a. Press the **MODULE** button to display the AVG7 main menu.
   b. Press the **FORMAT** button to select **NTSC**, and then press the **ENTER** button.
   c. Press the **FLAT FIELD** button to select **Field Square Wave**.
3. Press the **Measure** button on the video measurement set to open the Measure mode display.
4. Touch the **Video Standard** soft key to recognize the applied video signal as NTSC.
5. In the Measure mode display, touch the **Two Field** to open the Two Field measurement display.
6. Press the **Menu** button to display the Two Field main menu.
7. Touch the **Average** soft key and rotate the front-panel knob to set the value to 256.

8. Press the **Select Line** button and rotate the front-panel knob to set the measurement line to 17 (Field=1 Line=17).
9. Verify that the field time distortion is less than or equal to 0.5%.
10. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AVG7 Generator module and repeat step 9.
11. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module and repeat step 9.

K Factor

This test verifies the K factor of the CCIR17 signal from the CH 1, CH 2, and CH 3 outputs. The following equipment is required for the test:

- Video measurement set
- 75 Ω feed-through termination
- 75 Ω coaxial termination

Perform the following procedure to verify the K factor of the CCIR17 signal from the CH 1, CH 2, and CH 3 outputs:

Use the equipment connection and controls from the previous test.

1. Move the BNC cable from the upper CH 3 connector to the upper CH 1 connector on the AVG7 Generator module.
2. Select the CCIR17 signal as follows:
   a. Press the **MODULE** button to display the AVG7 main menu.
   b. Press the **FORMAT** button to select **Pal 1**, and then press the **ENTER** button.
   c. Press the **OTHER** button to select **CCIR17**.
3. Press the **Measure** button on the video measurement set to open the Measure mode display.
4. Touch the **Video Standard** soft key to recognize the applied video signal as PAL.
5. In the Measure mode display, touch the **K_Factor** to open the K Factor measurement display.
6. Press the **Menu** button to display the K Factor main menu.
7. Touch the **Average** soft key and rotate the front-panel knob to set the value to 256.

8. Press the **Select Line** button and rotate the front-panel knob to set the measurement line to 17 (Field=1 Line=17).
9. Verify that the K-2T value and K-PB value are within the range of –0.5% to +0.5%.
10. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AVG7 Generator module and repeat step 9.
11. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module and repeat step 9.

Differential Phase and Gain

This test verifies the differential phase and gain of the modulated 5 step signal from the CH 1, CH 2, and CH 3 outputs. The following equipment is required for the test:

- Video measurement set
- 75 Ω feed-through termination
- 75 Ω coaxial termination

Perform the following procedure to verify the differential phase and gain of the modulated 5 step signal from the CH 1, CH 2, and CH 3 outputs:

Use the equipment connection and controls from the previous test.

1. Move the BNC cable from the upper CH 3 connector to the upper CH 1 connector on the AVG7 Generator module.
2. Select the Modulated 5 Step signal as follows:
   a. Press the **FORMAT** button to select **NTSC**, and then press the **ENTER** button.
   b. Press the **LINEARITY** button to select **Modulated 5 Step**.
3. Select the CH1/2/3: Composites video configuration of the AVG7 Generator module as follows:
   a. Press the up (▲) or down (▼) arrow button to select **CONFIGURATION**, and then press the **ENTER** button to access the CONFIGURATION submenu.
   b. Press the left (◀) or right (▶) arrow button to select **CH1/2/3: Composites**, and then press the **ENTER** button.

4. Set the Y video signal to off as follows:

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

   b. Press the left (◀) or right (▶) arrow button to select **OFF**, and then press the **ENTER** button.

5. Press the **Measure** button on the video measurement set to open the Measure mode display.

6. Touch the **Video Standard** soft key to recognize the applied video signal as NTSC.

7. In the Measure mode display, touch the **DGDP** soft key to open the differential gain and phase measurement display.

8. Press the **Menu** button, and then touch the **Average** soft key and rotate the front-panel knob to set the value to 256.

9. Touch the **Acquire** soft key to access the Acquire submenu, and then make the following settings:

   Auto Scan . . . . . OFF
   Manual Steps 5
   Ref Packet . . . . . 15.2 µ Sec
   1 st Step . . . . . 19.3 µ Sec
   Last Step . . . . . 51.3 µ Sec
   Measure Cycle 10
   Block Mode . . . . . ON
   Block Mode Start F1 21
   Block Lines 11
   Block Step 24

10. Touch the **Reference** soft key to access the Reference submenu, and then touch the **Store (1) Reference**.

11. Touch the **Relative to Ref.** soft key to access the Relative to Reference submenu, and then touch the **Use (1) Reference**.

12. Verify that the current Differential Gain value (p-p/max) and Differential Phase value (pk-pk) are less than or equal to 0.02%.

13. Set the **Y** video signal to on as follows:

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

   b. Press the left (◀) or right (▶) arrow button to select **ON**, and then press the **ENTER** button.

14. Verify that the p-p/max value of the differential gain is less than or equal to 0.5%.

15. Verify that the pk-pk value of the differential phase is less than or equal to 0.5 degree.

16. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AVG7 Generator module and repeat steps 14 and 15.

17. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module and repeat steps 14 and 15.

18. Move the BNC cable from the upper CH 3 connector to the upper CH 1 connector on the AVG7 Generator module.

19. Select the Modulated 5 Step signal in PAL format as follows:

a. Press the **FORMAT** button to select **Pal 1** or **Pal 2**, and then press the **ENTER** button.

b. Press the **LINEARITY** button to select **Modulated 5 Step**.

20. Set the Y video signal to off as follows:

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

b. Press the left (◀) or right (▶) arrow button to select **OFF**, and then press the **ENTER** button.

21. Press the **Measure** button on the video measurement set to open the Measure mode display.

22. Touch the **Video Standard** soft key to recognize the applied video signal as PAL.

23. In the Measure mode display, touch the **DGDP** soft key to open the differential gain and phase measurement display.

24. Press the **Menu** button, and then touch the **Average** soft key and rotate the front-panel knob to set the value to 256.

25. Touch the **Acquire** soft key to access the Acquire submenu, and then make the following settings:

Auto Scan . . . . . OFF
Manual Steps 5
Ref Packet . . . . . 14.5 µ Sec
1 st Step . . . . . 18.8 µ Sec
Last Step . . . . . 51.3 µ Sec
Measure Cycle 10
Block Mode . . . . . ON
Block Mode Start F1 23
Block Lines 12
Block Step 26

26. Repeat steps 10 through 17.

Color Bars Signal Check

This test verifies that the 75% color bars signal is normally output from all of the channels. The following equipment is required for the test:

- Color picture monitor
- Three 75 Ω BNC cables
- Three 75 Ω coaxial termination

Perform the following procedure to verify that the 75% color bars signal is normally output from all of the channels.

1. Use the 75 Ω BNC cable to connect the upper CH 1 connector on the AVG7 Generator module to the Y/G IN connector on the color picture monitor as shown in Figure 3–6.

2. Use the 75 Ω BNC cable to connect the upper CH 2 connector on the AVG7 Generator module to the P_B/B IN connector on the color picture monitor as shown in Figure 3–6.

3. Use the 75 Ω BNC cable to connect the upper CH 3 connector on the AVG7 Generator module to the P_R/R IN connector on the color picture monitor as shown in Figure 3–6.

4. Use the 75 Ω coaxial termination to terminate the Y/G OUT, P_B/B OUT, and P_R/R OUT connectors on the color picture monitor.

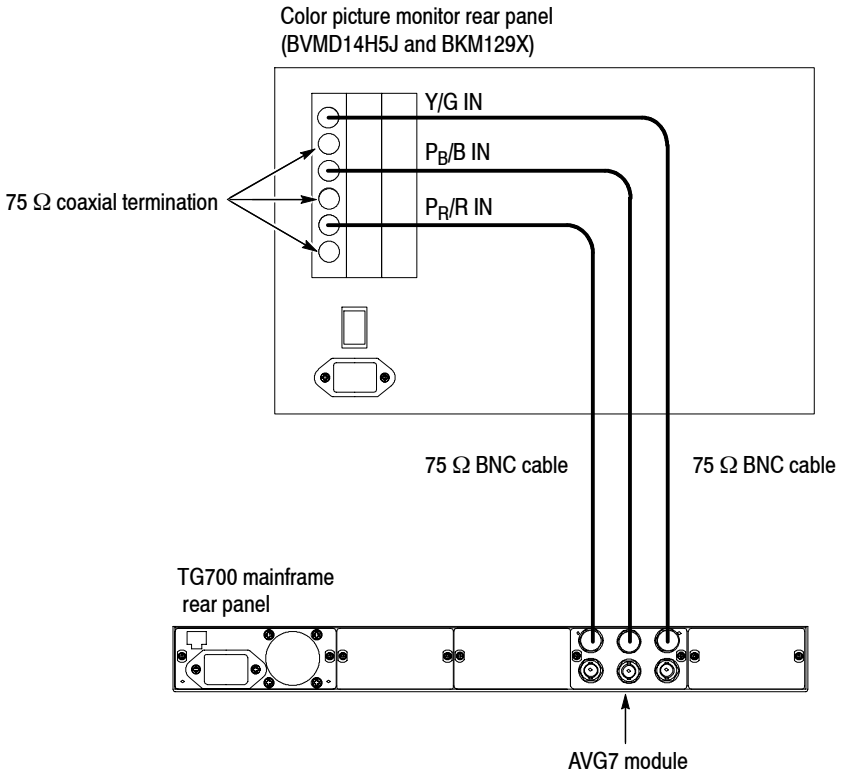

Figure 3- 6: Equipment connection for checking the color bars signal

5. Set the display setting of the color picture monitor to the GBR mode.
6. Select the 75% Color Bars signal as follows:
   a. Press the **MODULE** button to display the AVG7 main menu.
   b. Press the **FORMAT** button to select **525 GBR**, and then press the **ENTER** button.
   c. Press the **COLOR BAR** button to select **75% Color Bars**.
7. Select the Sync ON All Channels mode as follows:
   a. Press the up (▲) or down (▼) arrow button to select **VIDEO**, and then press **ENTER** button to access the VIDEO submenu.
   b. Press the up (▲) or down (▼) arrow button to select **GBR SYNC**.
   c. Press the left (◀) or right (▶) arrow button to select **Sync ON All Channels**, and then press the **ENTER** button.
8. Verify that the color bars signal is displayed normally.

9. Move the BNC cable from the upper CH 1 connector to the lower CH 1 connector, from the upper CH2 connector to the lower CH 2 connector, and from the upper CH 3 connector to the lower CH 3 connector on the AVG7 Generator module and repeat step 8.

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

Adjustment Procedures

Adjustment Procedures

This section contains information needed to adjust the AVG7 Generator module.

Adjustment in the AVG7 Generator module are for the output offset and gain, frame timing and clock timing, group delay, frequency response, and interchannel delay.

Requirements for Adjustment

Before doing the adjustment, note the following requirements:

Personnel This procedure is only to be performed by trained service technicians.

Warm-Up Period The AVG7 Generator module requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. Adjustment done before the operating temperature has stabilized may cause errors in performance.

WARNING. *To avoid potential shock, use caution when removing the TG700 mainframe top cover with power connected.*

Access When adjusting the AVG7 Generator module, remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

NOTE*. If the serial number of your instrument is B010600 and above, replace the resistor and capacitor numbers in the figures and procedures as follows:*
R6xxx → R6xxx_1 (for example, R651A → R651A_1)
R7xxx → R6xxx_2 (for example, R751A → R651A_2)
R8xxx → R6xxx_3 (for example, R851A → R651A_3)
C6xxx → R6xxx_1 (for example, C604B → C604B_1)
C7xxx → R6xxx_2 (for example, C704B → C604B_2)
C8xxx → R6xxx_3 (for example, C804B → C604B_3)

Equipment Required

Table 4–1 lists the equipment required to adjust the output offset and gain, frame timing and clock timing, group delay, frequency response, and interchannel delay.

Table 4- 1: Equipment required

Item	No.	Minimum requirement	Recommended equipment
TV signal generator platform	1		Tektronix TG700
Test signal generator	1		Tektronix ATG7
Oscilloscope	1	Bandwidth: 1 GHz or higher Function: Mask testing	Tektronix TDS784D Option 2C
Digital multimeter	1	5 1/2 digits	FLUKE 8842A
Peak detector amplifier	1		Tektronix part number 015-0408-00 and TM500 series power supply
Peak detector head	1		Tektronix part number 015-0413-00
Probe	2	X 10	Tektronix P6139A
75 Ω BNC cable	3	Length: 72 inches	Tektronix part number 012-0159-01
75 Ω BNC cable	1	5C-2V, 1 m	Canare DH5C01-S-SA
75 Ω feed-through termination	1		Tektronix part number 011-0103-02
75 Ω coaxial termination	1		Tektronix part number 011-0102-03
75 Ω signal adapter	2	Bandwidth: 1 GHz Amplitude precision: -3 dB	Tektronix AMT75
BNC T connector	1		Tektronix part number 103-0030-00
BNC female to dual banana adapter	1		Tektronix part number 103-0090-00
Flat blade screwdriver for adjusting C604B, C704B, and C804B	1	Bit shape: 2.2X0.4 mm	Murata KMDR010
BNC female-to-female connector	1		Canare BCJ-J

Output Offset and Gain Adjustment

Preparation

To perform the output offset and gain adjustment, you must first remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

After you have removed the top cover, find the variable resistors on the AVG7 circuit board. See Figure 4–1.

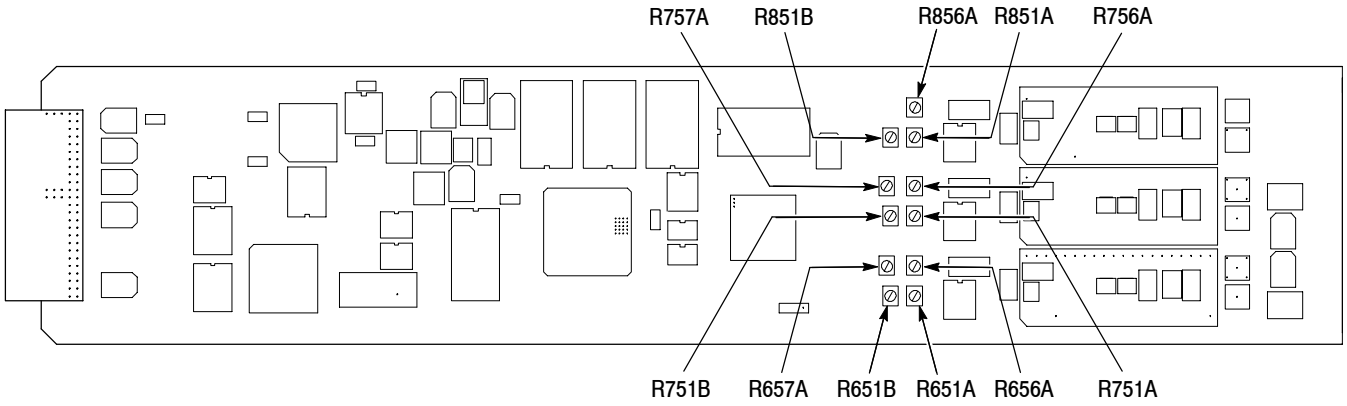

Figure 4-1: Location of the variable resistors for the output offset and gain adjustment

Procedure

WARNING. *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable, BNC T connector, 75 Ω coaxial termination, and BNC female-to-dual banana adapter to connect the upper CH 1 connector on the AVG7 Generator module to the INPUT connector on the digital multimeter as shown in Figure 4–2.

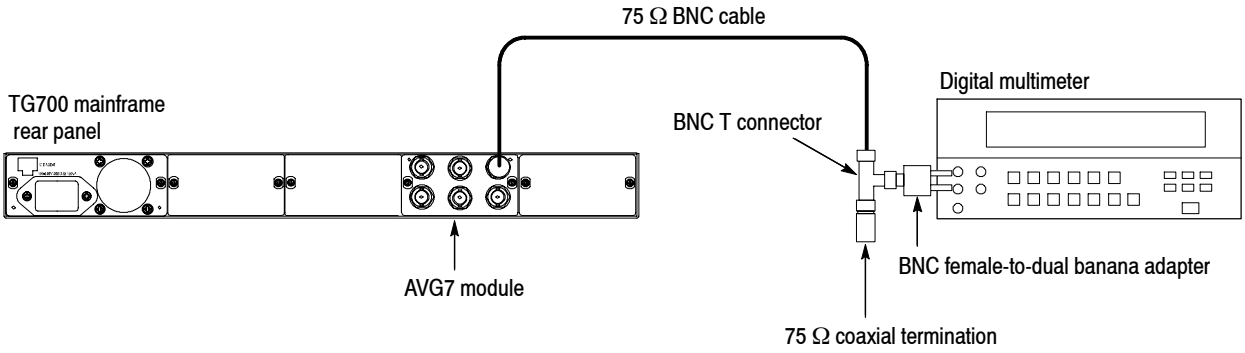

Figure 4-2: Equipment connection for adjusting the output offset and gain

2. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode. Continue holding down the **FRONT PANEL ENABLE** button until the "TG700 start up with Factory Mode." message appears.
3. Select the DAC Gain (GBR) : 0 mV calibration signal as follows:
   a. Press the **MODULE** button to display the **AVG7** main menu.
   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.
   c. Press the left (◀) or right (▶) arrow button to select **DAC Gain (GBR)**, and then press the **ENTER** button.
   d. Press the left (◀) or right (▶) arrow button to select **0mV**, and then press the **ENTER** button.
4. Locate variable resistor R856A on the AVG7 circuit board. See Figure 4–1.
5. Adjust R856A so that the output offset is 0 V ± 1 mV.
6. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AVG7 Generator module.
7. Locate variable resistor R756A on the AVG7 circuit board. See Figure 4–1.
8. Adjust R756A so that the output offset is 0 V ± 1 mV.
9. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module.
10. Locate variable resistor R656A on the AVG7 circuit board. See Figure 4–1.
11. Adjust R656A so that the output offset is 0 V ± 1 mV.

12. Move the BNC cable from the upper CH 3 connector to the upper CH 1 connector on the AVG7 Generator module.

13. Press the left (◀) or right (▶) arrow button to select **700.397mV**, and then press the **ENTER** button.

14. Locate variable resistors R851A (coarse) and R851B (fine) on the AVG7 circuit board. See Figure 4–1.

15. Adjust R851A and R851B so that the output gain is 700.4 mV ± 1 mV.

16. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AVG7 Generator module.

17. Locate variable resistors R751A (coarse) and R751B (fine) on the AVG7 circuit board. See Figure 4–1.

18. Adjust R751A and R751B so that the output gain is 700.4 mV ± 1 mV.

19. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module.

20. Locate variable resistors R651A (coarse) and R651B (fine) on the AVG7 circuit board. See Figure 4–1.

21. Adjust R651A and R651B so that the output gain is 700.4 mV ± 1 mV.

22. Move the BNC cable from the upper CH 3 connector to the upper CH 2 connector on the AVG7 Generator module.

23. Select the DAC Gain (YPbPr) : 0 mV calibration signal for CH 2 and CH 3 as follows:

- **a.** Press the **CANCEL** button to display the **CALIBRATION** menu.
- **b.** Press the left (◀) or right (▶) arrow button to select **DAC Gain (YPbPr)**, and then press the **ENTER** button.
- **c.** Press the left (◀) or right (▶) arrow button to select **0mV**, and then press the **ENTER** button.

24. Locate variable resistor R757A on the AVG7 circuit board. See Figure 4–1.

25. Adjust R757A so that the output offset is 0 V ± 1 mV.

26. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module.

27. Locate variable resistor R657A on the AVG7 circuit board. See Figure 4–1.

28. Adjust R657A so that the output offset is 0 V ± 1 mV.

Frame Timing and Clock Timing Adjustments

***NOTE**. The instrument with serial number B010600 and above does not require this adjustments.*

Preparation

To perform the frame timing and clock timing adjustment, you must first remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

After you have removed the top cover, find the test points on the AVG7 circuit board. See Figure 4–3.

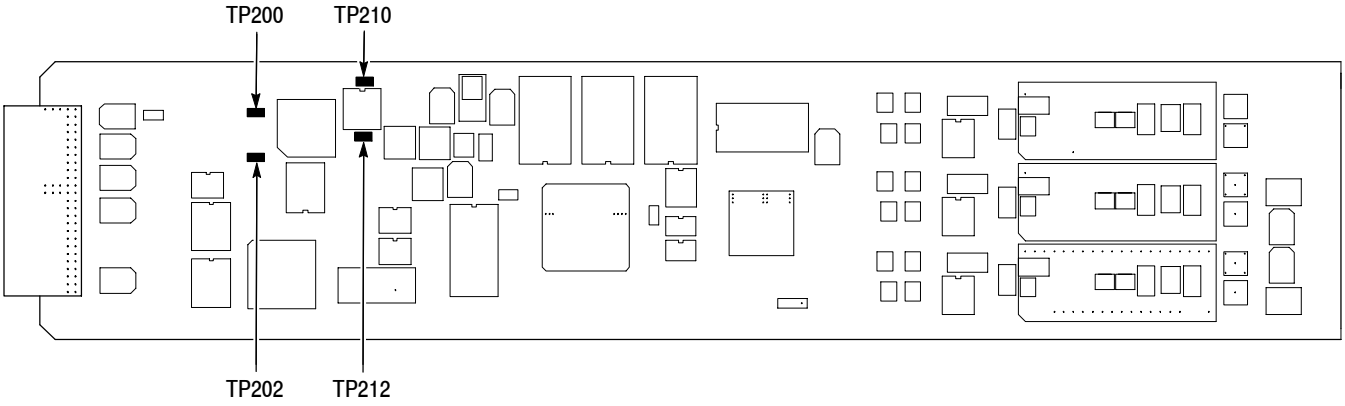

Figure 4- 3: Location of the test points for the frame timing and clock timing adjustment

Procedure

***WARNING.** To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Attach the two P6139A probes to the oscilloscope CH 1 and CH 2 inputs.
2. Locate test points TP200, TP202, TP210, and TP212 on the AVG7 circuit board. See Figure 4–3.
3. Connect the probe tip from the oscilloscope CH 1 input to TP200.
4. Connect the probe tip from the oscilloscope CH 2 input to TP210.

5. Set the oscilloscope settings as indicated below:

   Vertical scale . . . . . CH 1: 500 mV/div, CH 2: 1V/div
   Vertical position . . . . . -2.0 div
   Vertical offset . . . . . CH 1 : 3.3 V, CH 2 : 0 V
   Horizontal scale . . . . . 5 ns/div
   Horizontal length 500
   Trigger position 0%
   Trigger source . . . . . CH 1
   Trigger type . . . . . Edge
   Acquisition mode . . . . . Average 4
   Acquisition mode . . . . . Relative Signal OFF
   Measure High-Low
   setup . . . . . Min-Max

6. Check that both CH 1 and CH 2 waveforms are displayed stably and then turn off the CH 1 display.

7. Select Frame 0.0 nsec from the Frame Timing calibration menu as follows:

   a. Press the **MODULE** button to display the **AVG7** main menu.

   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.

   c. Press the left (◀) or right (▶) arrow button to select **Frame Timing**, and then press the **ENTER** button.

   d. Press the left (◀) or right (▶) arrow button to select **Frame 0.0 nsec**, and then press the **ENTER** button.

8. Save the CH 2 waveform on the oscilloscope in **Ref1**, and then display the saved waveform.

9. Select **Delay** from the Measure menu, and then set the oscilloscope to measure the time delay between the Ref1 and CH 2 waveforms.

10. Press the up (▲) or down (▼) arrow button to select **2.0 ns**.

11. While seeing the Delay Timing value on the oscilloscope, press the left (◀) or right (▶) arrow button to adjust the delay value to 2.0 ns.

12. Press the up (▲) or down (▼) arrow button to select **10.0 ns**.

13. While seeing the Delay Timing value on the oscilloscope, press the left (◀) or right (▶) arrow button to adjust the delay value to 10.0 ns.

14. Press the up (▲) or down (▼) arrow button to select **22.0 ns**.

15. While seeing the Delay Timing value on the oscilloscope, press the left (◀) or right (▶) arrow button to adjust the delay value to 22.0 ns.

16. Press the **CANCEL** button to return the CALIBRATION menu.

17. Press the left (◀) or right (▶) arrow button to select **Clock Timing**, and then press the **ENTER** button.
18. Move CH 1 probe from TP200 to TP202. Move Ch 2 probe from TP210 to TP212.
19. Press the up (▲) or down (▼) arrow button to select **Clock 0.0 nsec**, and then the **ENTER** button.
20. Save the waveform on the oscilloscope in **Ref1**.
21. Press the up (▲) or down (▼) arrow button to select **2.0 ns**.
22. While seeing the Delay Timing value on the oscilloscope, press the left (◀) or right (▶) arrow button to adjust the delay value to 2.0 ns.
23. Save the waveform on the oscilloscope in **Ref1**, and then press the up (▲) or down (▼) arrow button to select **10.0 ns**.
24. While seeing the Delay Timing value on the oscilloscope, press the left (◀) or right (▶) arrow button to adjust the delay value to 8.0 ns.
25. Save the waveform on the oscilloscope in **Ref1**, and then press the up (▲) or down (▼) arrow button to select **22.0 ns**.
26. While seeing the Delay Timing value on the oscilloscope, press the left (◀) or right (▶) arrow button to adjust the delay value to 12.0 ns.
27. Press the **CANCEL** button to return to the CALIBRATION menu.

Group Delay Adjustment

Preparation

To perform the group delay adjustment, you must first remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

After you have removed the top cover, find the variable resistors and capacitors on the AVG7 circuit board. See Figure 4–4.

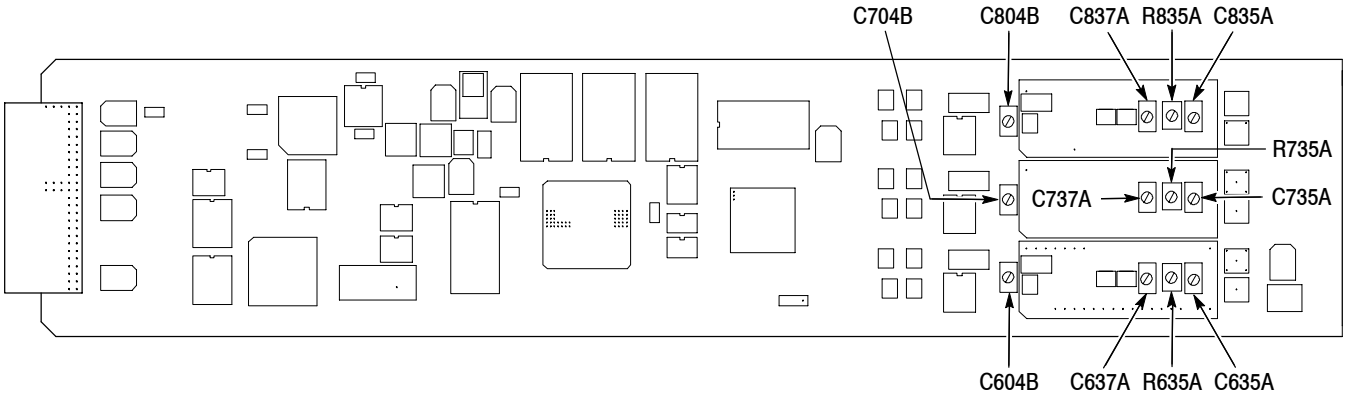

Figure 4-4: Location of the variable resistors and capacitors for the group delay adjustment

Procedure

WARNING. *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable and the 75 Ω signal adapter to connect the upper CH 1 connector on the AVG7 Generator module to the CH 1 input connector on the oscilloscope as shown in Figure 4–5.
2. Use the 75 Ω BNC cable and the 75 Ω feed-through termination to connect the BLACK 1 connector on the test signal generator to the CH 2 input connector on the oscilloscope as shown in Figure 4–5.

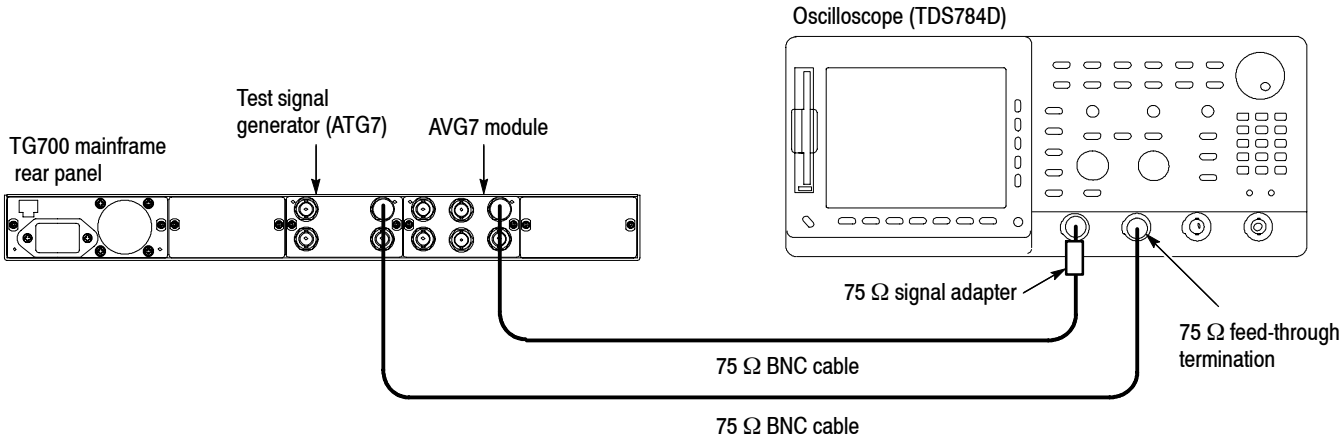

Figure 4-5: Equipment connection for adjusting the group delay

3. Set the oscilloscope settings as indicated below:

   Vertical scale . . . . . CH 1: 5 mV/div, CH 2: 1.00 V/div
   Bandwidth . . . . . 250 MHz (CH 1)
   Horizontal scale . . . . . 100 µs/div
   Horizontal delay time . . 200 ns/div
   Delayed runs time . . . . . 993.472 µs (Delayed Only)
   Trigger position 50%
   Trigger source . . . . . CH 2
   Trigger type . . . . . Edge
   DPO (InstaVu) . . . . . Variable Persistence: 500 ms
   CH 2 waveform . . . . . OFF

4. Set the test signal generator (ATG7 module) settings as indicated below:

   Output selection . . . . . BLACK 1
   Signal format . . . . . PAL
   Test signal . . . . . Field Reference

5. Select the CCIR17 signal of the AVG7 Generator module as follows:

   a. Press the **MODULE** button to display the AVG7 main menu.

   b. Press the **FORMAT** button to select PAL-1, and then press the **ENTER** button.

   c. Press the **OTHER** button to select **CCIR17**.

6. Select the CH1/2/3: Composites video configuration as follows:

   a. Press the up (▲) or down (▼) arrow button to select **CONFIGURATION**, and then press the **ENTER** button to access the CONFIGURATION submenu.

   b. Press the left (◀) or right (▶) arrow button to select **CH1/2/3: Composites**, and then press the **ENTER** button.

7. Locate variable capacitors C837A, C737A, C637A, C804B, C704B, C604B, C835A, C735A, and C635A, and variable resistors R835A, R735A, and R635A. See Figure 4–4.

8. Rotate C837A, C737A, and C637A 180° from its initial position and set R835A, R735A, and R635A to its center position.

9. Adjust C804B and C835A so that the baseline of the modulated 20T pulse signal is flat. See Figure 4–6.

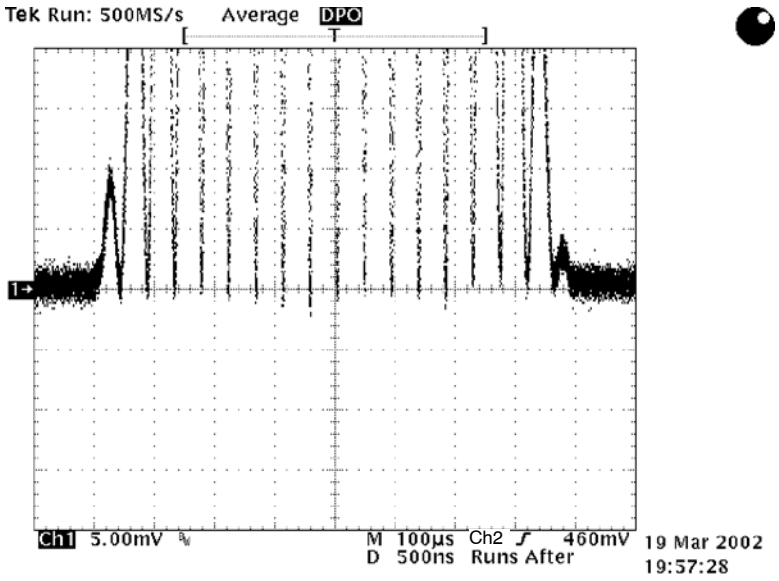

Figure 4- 6: Adjusting the baseline of the modulated 20T pulse signal

10. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AVG7 Generator module.

11. Adjust C704B and C735A so that the baseline of the modulated 20T pulse signal is flat.

12. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module.

13. Adjust C604B and C635A so that the baseline of the modulated 20T pulse signal is flat.

Frequency Response Adjustment

Preparation

To perform the frequency response adjustment, you must first remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

After you have removed the top cover, find the variable resistors and capacitors on the AVG7 circuit board. See Figure 4–7.

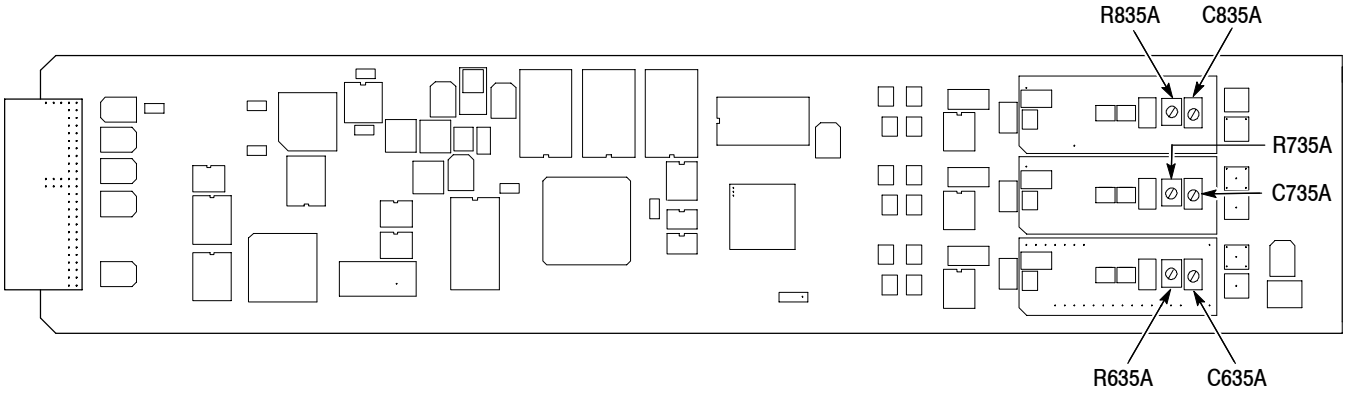

Figure 4-7: Location of the variable resistors and capacitors for the frequency response adjustment

Procedure

WARNING. *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the two 75 Ω BNC cable, peak detector head, and BNC female-to-female conector to connect the upper CH 1 connector on the AVG7 Generator module to the +INPUT connector on the peak detector amplifier as shown in Figure 4–8.
2. Use the 75 Ω BNC cable to connect the OUTPUT connector on the peak detector amplifier to the CH 1 input connector on the oscilloscope as shown in Figure 4–8.
3. Use the 75 Ω BNC cable and the 75 Ω feed-through termination to connect the BLACK 1 connector on the test signal generator to the CH 2 input connector on the oscilloscope as shown in Figure 4–8.

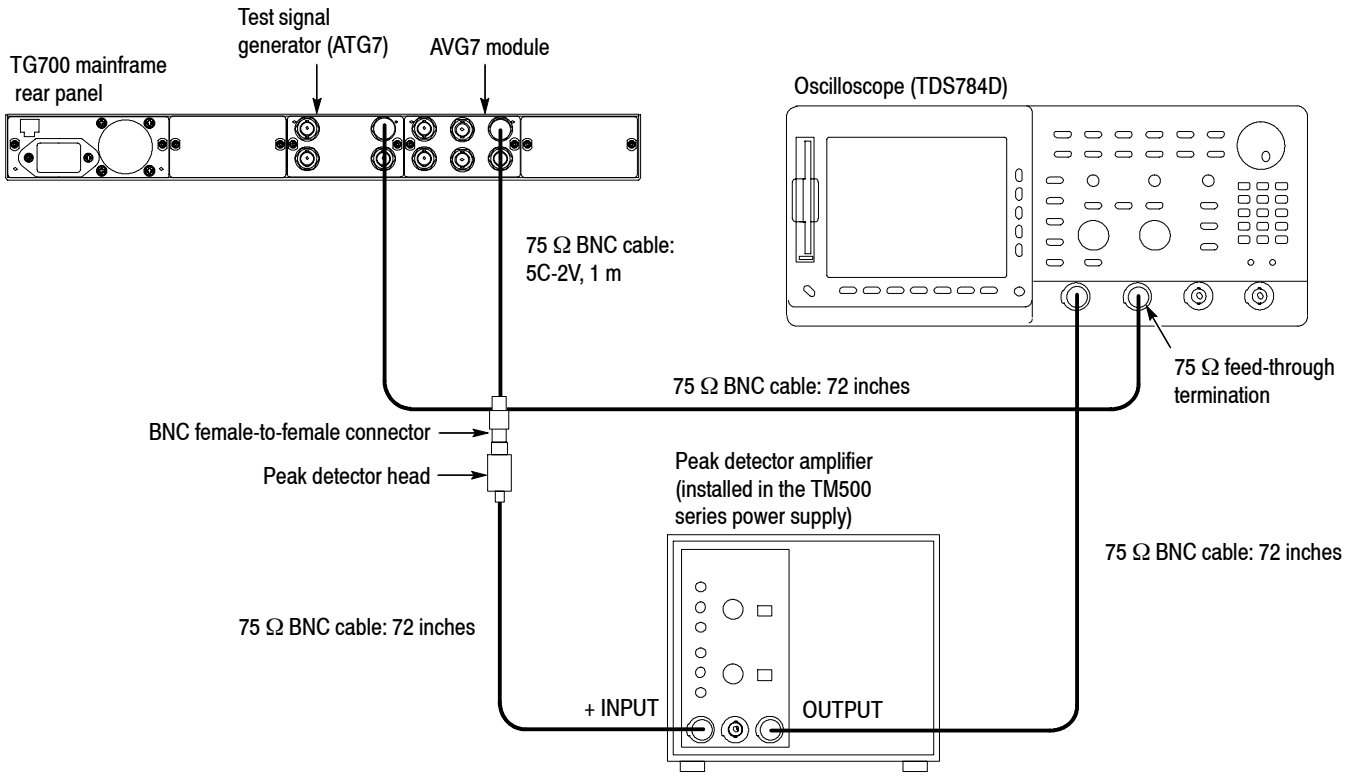

Figure 4- 8: Equipment connection for adjusting the frequency response

4. Set the oscilloscope settings as indicated below:

Vertical scale . . . . . CH 1: 2 mV/div, CH 2: 1.00 V/div
Bandwidth . . . . . 20 MHz (CH 1)
Horizontal scale . . . . . 2 ms/div
Trigger position 10%
Trigger source . . . . . CH 2
Trigger type . . . . . Edge
Acquire menu . . . . . Peak Detect

5. Set the test signal generator (ATG7 module) settings as indicated below:

Output selection . . . . . BLACK 1
Signal format . . . . . NTSC
Test signal . . . . . Field Reference

6. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to re-start the instrument in Factory mode.

7. Select the 525 GBR signal format as follows:

   a. Press the **MODULE** button to display the **AVG7** main menu.

   b. Press the **FORMAT** button to select **525 GBR**, and then press the **ENTER** button.

   c. Press the **COLOR BAR** button.

8. Select the DAC Test calibration signal as follows:

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

   b. Press the left (◀) or right (▶) arrow button to select **DAC Test**, and then press the **ENTER** button.

   c. Press the **ENTER** button again to confirm the signal output.

9. Select the Sync ON All Channels mode as follows:

   a. Press the up (▲) or down (▼) arrow button to select **VIDEO**, and then press the **ENTER** button to access the VIDEO submenu.

   b. Press the up (▲) or down (▼) arrow button to select **GBR SYNC**.

   c. Press the left (◀) or right (▶) arrow button to select **Sync ON All Channels**, and then press the **ENTER** button.

10. Locate variable capacitors C835A, C735A, and C635A, and variable resistors R835A, R735A, and R635A on the AVG7 circuit board. See Figure 4–7.

11. Turn the LEVEL knob on the peak detector amplifier so that the green LED lights.

12. Adjust C835A so that the signal amplitudes of 500 kHz and 5 MHz are at the same level. See Figure 4–9.

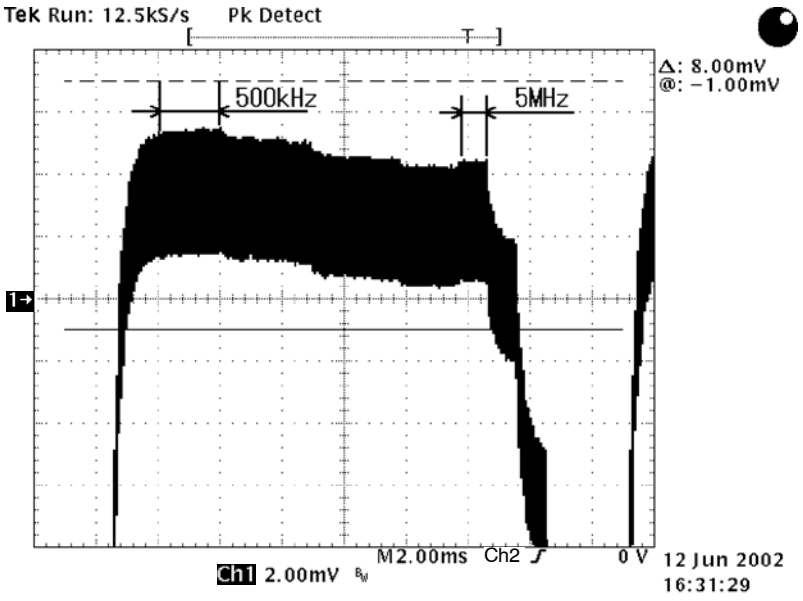

Figure 4- 9: Adjusting the signal amplitudes

13. Adjust R835A so that the signal amplitudes from 500 kHz to 5 MHz are at the same level. See Figure 4–9.

14. Readjust C835A and R835A so that the differences of the signal amplitudes from 500 kHz to 5 MHz are within 2 mV.

15. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AVG7 Generator module.

16. Adjust C735A so that the signal amplitudes of 500 kHz and 5 MHz are at the same level.

17. Adjust R735A so that the signal amplitudes from 500 kHz to 5 MHz are at the same level.

18. Readjust C735A and R735A so that the differences of the signal amplitudes from 500 kHz to 5 MHz are within 2 mV.

19. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module.

20. Adjust C635A so that the signal amplitudes of 500 kHz and 5 MHz are at the same level.

21. Adjust R635A so that the signal amplitudes from 500 kHz to 5 MHz are at the same level.

22. Readjust C635A and R635A so that the differences of the signal amplitudes from 500 kHz to 5 MHz are within 2 mV.

Interchannel Delay Adjustment

Preparation

To perform the interchannel adjustment, you must first remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

After you have removed the top cover, find the variable capacitors on the AVG7 circuit board. See Figure 4–10.

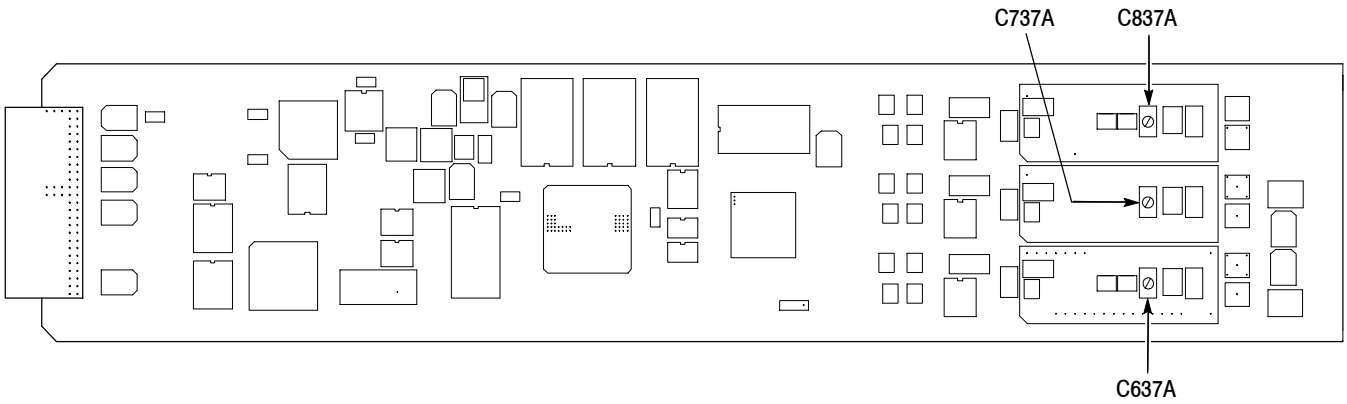

Figure 4- 10: Location of the variable capacitors for the interchannel delay adjustment

Procedure

WARNING. *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable and the 75 Ω signal adapter to connect the upper CH 1 connector on the AVG7 Generator module to the CH 1 input connector on the oscilloscope as shown in Figure 4–11.
2. Use the 75 Ω BNC cable and the 75 Ω signal adapter to connect the upper CH 2 connector on the AVG7 Generator module to the CH 2 input connector on the oscilloscope as shown in Figure 4–11.

3. Use the 75 Ω BNC cable and the 75 Ω feed-through termination to connect the BLACK 1 connector on the test signal generator to the CH 3 input connector on the oscilloscope as shown in Figure 4–11.

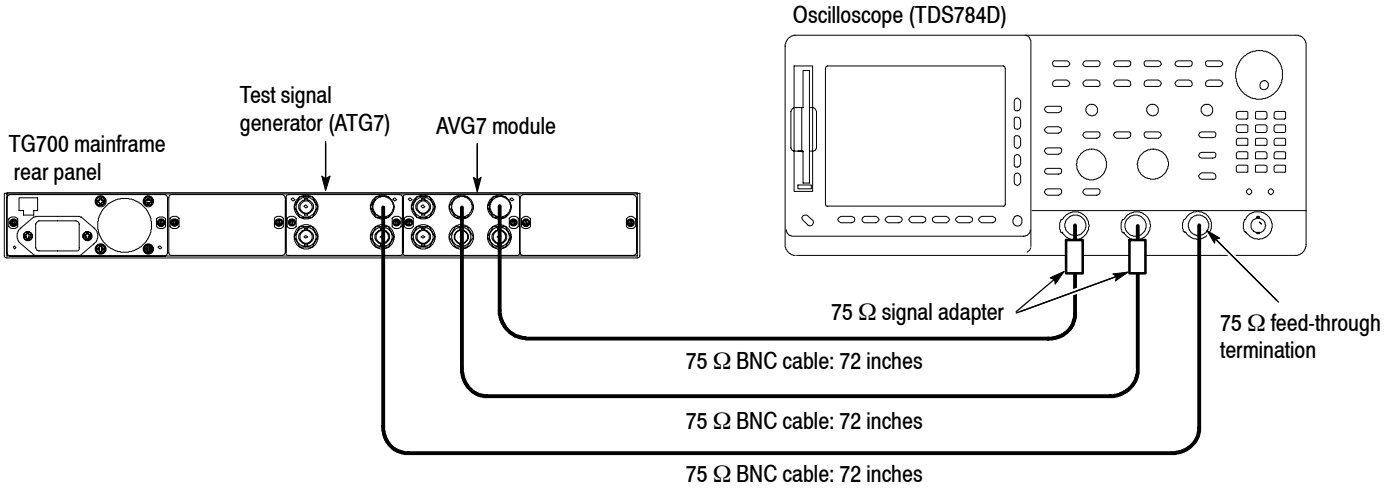

Figure 4- 11: Equipment connection for adjusting the interchannel delay

4. Set the oscilloscope settings as indicated below:

Vertical scale . . . . . CH 1 and CH 2: 5 mV/div, CH 3: 1.00 V/div
Bandwidth . . . . . 250 MHz (CH 1 and CH 2)
Vertical offset . . . . . 0 mV (CH 1 and CH 2)
Horizontal scale . . . . . 20 µs/div
Horizontal delay time . . 50 ns/div
Delayed runs time . . . . . 6.760 µs (Delayed Only)
Trigger position 50%
Trigger source . . . . . CH 3
Trigger type . . . . . Edge
Acquire menu . . . . . Average 8
Repetitive Signal: OFF
CH 3 WAVEFORM . . . . OFF

5. Set the test signal generator (ATG7 module) settings as indicated below:

Output selection . . . . . BLACK 1
Signal format . . . . . NTSC
Test signal . . . . . Field Reference

6. Use the CH 2 vertical position knob on the oscilloscope to align the CH 2 trace to the CH 1 trace with no signal input.

7. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode. Continue holding down the **FRONT PANEL ENABLE** button until the "TG700 start up with Factory Mode." message appears.

8. Select the DAC Test calibration signal as follows:

   a. Press the **MODULE** button to display the **AVG7** main menu.

   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.

   c. Press the left (◀) or right (▶) arrow button to select **DAC Test**, and then press the **ENTER** button.

   d. Press the **ENTER** button again to confirm the signal output.

9. Select the Sync ON All Channels mode as follows:

   a. Press the up (▲) or down (▼) arrow button to select **VIDEO**, and then press the **ENTER** button to access the VIDEO submenu.

   b. Press the up (▲) or down (▼) arrow button to select **GBR SYNC**.

   c. Press the left (◀) or right (▶) arrow button to select **Sync ON All Channels**, and then press the **ENTER** button.

10. Adjust R756A so that the CH 2 blanking level is aligned to the CH 1 blanking level.

11. Move the BNC cable from the CH 2 connector to the CH 3 connector on the AVG7 Generator module.

12. Adjust R656A so that the CH 3 blanking level is aligned to the CH 1 blanking level.

13. Change the oscilloscope settings as follows:

    Vertical offset . . . . . -150 mV (CH 1 and CH 2)
    Horizontal delay time . . 2 ns/div
    Delayed runs time . . . . . 6.224 µs (Delayed Only)

14. Check the time delay between the CH 1 and CH 3 signals and then perform the following steps:

    a. If the CH 1 signal is delayed from the CH 3 signal, move the BNC cable from the CH 3 connector to the CH 2 connector on the AVG7 Generator module.

    b. If the CH 3 signal is delayed from the CH 1 signal, move the BNC cable from the CH 1 connector to the CH 2 connector on the AVG7 Generator module.

15. Using the most delayed signal as a reference, adjust the following variable capacitors so that the other signals are delayed within 0.5 ns from the most delayed signal:

    CH 1 output: C837A
    CH 2 output: C737A
    CH 3 output: C637A

Frequency Response Confirmation

After you have performed the group delay adjustment, be sure to check that the frequency response meets the specifications.

Procedure

1. Use the equipment connection and controls from the frequency response adjustment on page 4–12.
2. Check that the differences of each signal amplitude from 500 kHz to 5 MHz are less than or equal to 2 mV. If necessary, readjust the following variable resistors and capacitors:

    CH 1 output: C835A and R835A
    CH 2 output: C735A and R735A
    CH 3 output: C635A and R637A

Interchannel Delay Confirmation

After you have performed the group delay adjustment, be sure to check that the interchannel delay meets the specifications.

Procedure

1. Use the equipment connection and controls from the interchannel adjustment on page 4–16.
2. Check that the time delay among the channel outputs is less than or equal to 1 ns. If necessary, readjust the following variable capacitors:

    CH 1 output: C837A
    CH 2 output: C737A
    CH 3 output: C637A

Maintenance

Maintenance

This section contains instructions and procedures for maintaining the AVG7 Generator module. For information on servicing the mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

The following information can be found in this section:

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

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

Preparation

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

Servicing Prerequisites

Ensure 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.

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. *To avoid semiconductor component damage, do not handle static sensitive parts without taking proper ESD precautions.*

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, checking performance, 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 use chemical cleaning agents; they may damage the module. Avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.*

CAUTION. *Use caution when removing the circuit board from its mounting shield. Flexing the circuit board can result in permanent damage. The mounting shield provides necessary structural support for the circuit board.*

Inspecting and Cleaning Procedures

Clean the mainframe and modules often enough to prevent dust or dirt from accumulating. Refer to *Inspecting and Cleaning Procedures* in the *TG700 TV Signal Generator Platform Service Manual*.

Performance Verification

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

Repackaging Instructions

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

1. Attach a tag to the instrument showing: the owner, complete address and phone number of someone at your firm who can be contacted, the instrument serial number, and a description of the required service.
2. Package the instrument in the original packaging materials. If the original packaging materials are not available, follow these directions:

a. Obtain a corrugated cardboard carton with 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.

Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the AVG7 Generator module.

Tools Required

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

Table 5-1: Required tools

Name	Description	Tektronix part number
Screwdriver handle	Accepts Phillips-driver bits	
#1 Phillips tip	Phillips-driver bit for #1 size screw heads	
#2 Phillips tip	Phillips-driver bit for #2 size screw heads	
Nut driver, 14 mm	Special nut driver for removing the BNC connectors of the AVG7 module	003-A041-00

Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section in the *TG700 TV Signal Generator Platform Module Installation Instructions* to remove the AVG7 Generator module from the mainframe.
2. Disconnect the cables at J830A (upper CH 1), J830B (lower CH 1), J730A (upper CH 2), J730B (lower CH 2), J630A (upper CH 3), and J630B (lower CH 3) on the AVG7 circuit board.
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

Replacing the chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the five screws securing the AVG7 circuit board to the chassis.
3. Lift the circuit board up and away from the chassis, and then place it on a static free surface.
4. Set the replacement chassis on a firm, flat, static-free work surface.
5. Carefully place the circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the five screws securing the circuit board to the chassis.
7. Apply the rear panel to the chassis, and then install all the rear-panel connectors to the chassis.

Troubleshooting

This section contains instructions and procedures for troubleshooting the AVG7 Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to *Troubleshooting* in the *TG700 TV Signal Generator Platform Service Manual*.

Equipment Required

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

Table 5-2: Equipment required for troubleshooting

Equipment description	Minimum requirements/example
Screwdriver handle	Accept Phillips-driver bits
#1 Phillips tip	Phillips-driver bit for #1 size screw heads
TG700 mainframe	A TG700 mainframe that is functioning correctly

Backing up the instrument settings

Before you begin the troubleshooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◀) or right (▶) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

Troubleshooting Trees

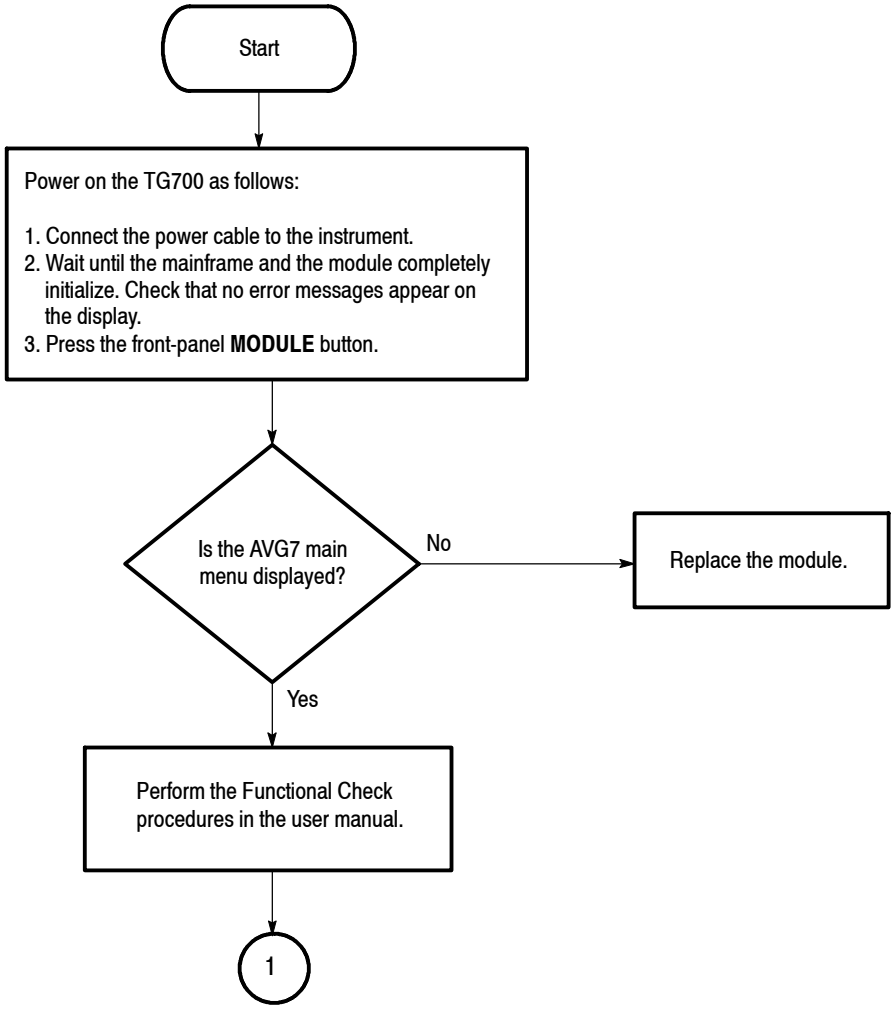

Figure 5- 1: Troubleshooting procedure (1)

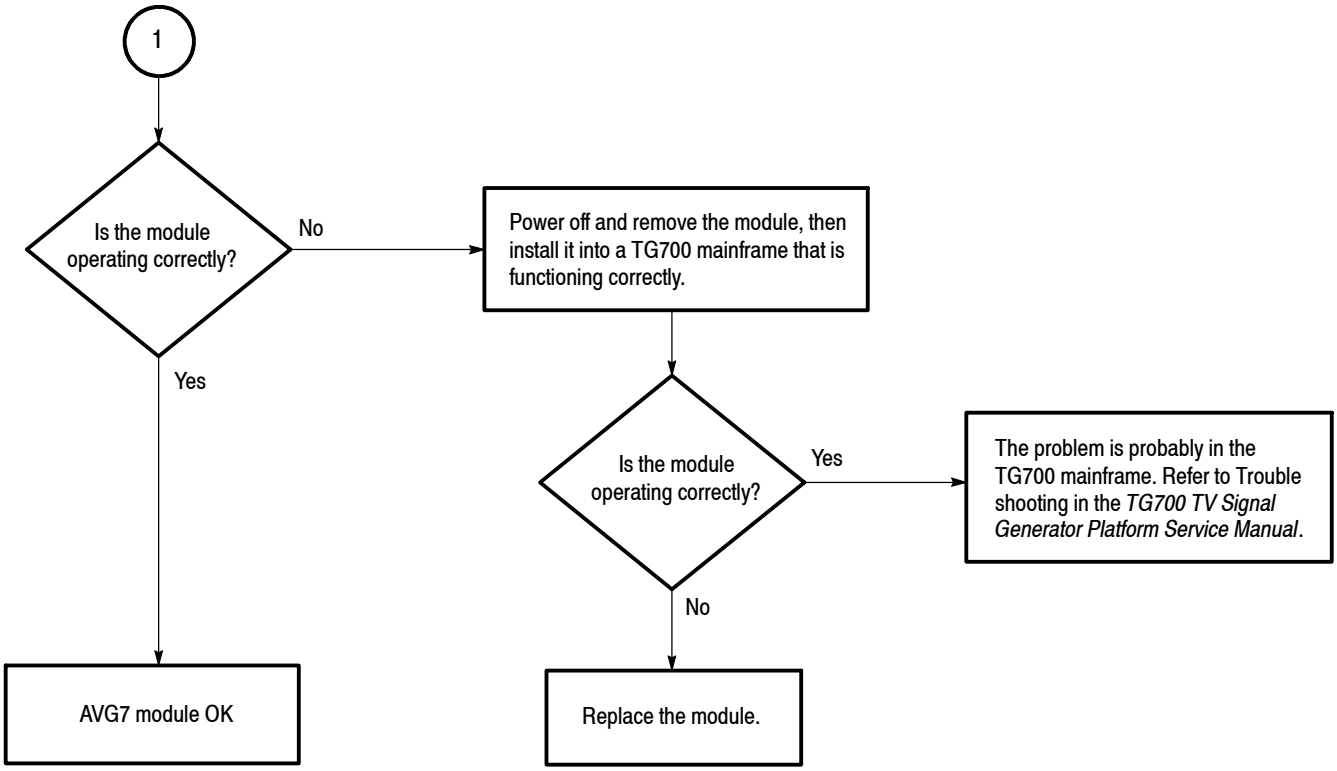

Figure 5- 2: Troubleshooting procedure (2)

Option

Option

This section describes the option that is available for the AVG7 Generator module.

The following option is available:

- Option D1 (Test data report)

Option D1 Description

A calibration data test result report comes with the AVG7 Generator module when you specify this option.

Diagram

Diagram

Figure 7-1 shows the AVG7 Generator module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 TV Signal Generator Platform Service Manual*.

A block diagram of the AVG7 Generator module is located in the *Theory of Operation* section, beginning on page 2–1.

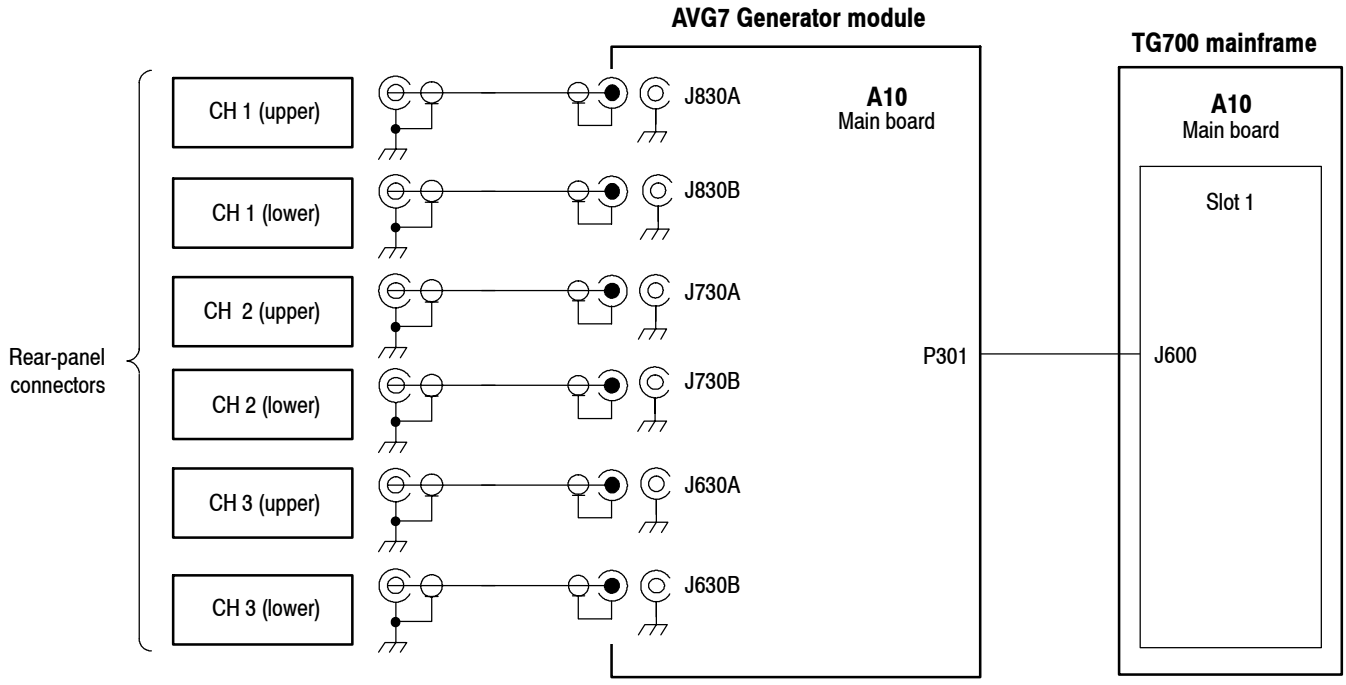

Figure 7-1: AVG7 Generator module connections

Replaceable Parts List

Replaceable Parts List

This section contains a list of the replaceable modules for the AVG7 Generator module. Use this list to identify and order replacement parts.

Parts Ordering Information

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

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

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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

Module Servicing

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

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

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

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

Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the AVG7 Generator module. Use this list to identify and order replacement parts. The following table describes each column in the replaceable 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 illustration that follows.
2	Tektronix part number	Use this part number when ordering replacement parts from Tektronix.
3 and 4	Serial number	Column three indicates the serial number at which the part was first effective. Column four indicates the serial number at which the part was discontinued. No entries indicates the part is good for all serial numbers.
5	Qty	This indicates the quantity of parts used.
6	Name & description	An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.

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

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
8-1	116-A017-00			1	EXCHANGE MODULE:AVG7
8-1-1	441-A269-02			1	CHASSIS,MODULE AGL7:ASSY
-2	333-A453-00			1	PANEL,REAR:AVG7,AL
-3	214-4946-00			2	SPRING,CONICAL:VXI MOUNTING SCREW,0.26 MM SUS304,5.4 MML
-4	213-1129-01			2	SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,N1 PL,CROSS REC & SLOTTED
-5	348-A128-00			2.5 CM	SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02]
-6	174-B851-00			6	CABLE ASSY,RF:75OHM COAX(RG179),5.5CM L,BNC TO MCX
-7	211-A245-01			5	SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER
-8	334-1378-03			1	MARKER,IDENT:MKD SERIAL NO.
					STANDARD ACCESSORIES
	070-A824-XX			1	MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS
	062-A249-XX			1	SOFTWARE PACKAGE:S/W(CD-R)
					OPTIONAL ACCESSORIES
	070-A800-XX			1	MANUAL,TECH:SERVICE,TG700
	003-A041-00			1	NUTDRIVER,BOX:14MM HEX,BNC RETAINING NUT,MODIFIED 19MM

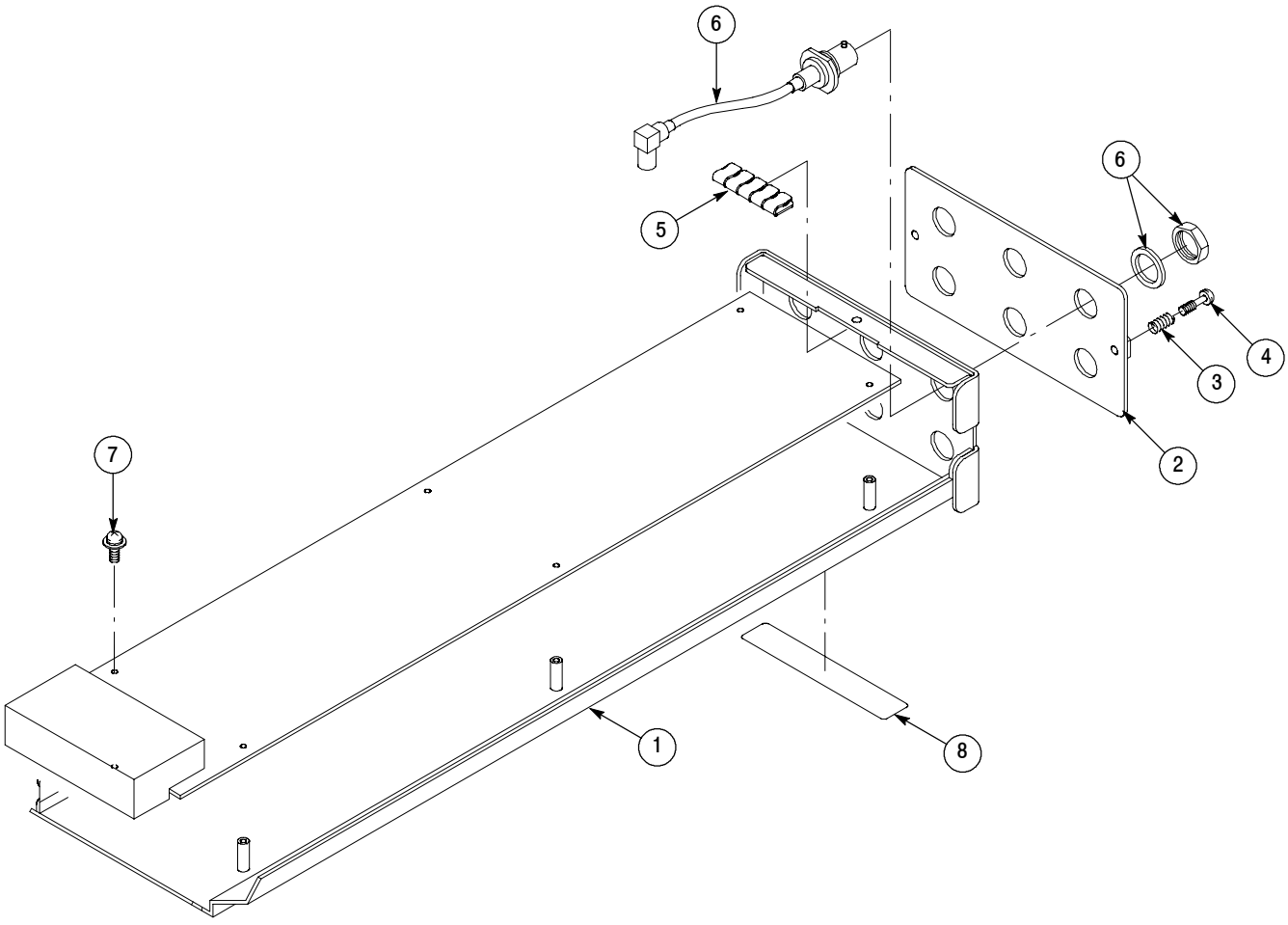

Figure 8- 1: AVG7 Generator module exploded view

Service Manual

Tektronix

AWVG7
Analog Wideband Video Generator

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

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

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Preface

This is the service manual for the AWVG7 Analog Wideband Video Generator module. This manual contains information needed to service an AWVG7 Generator module to the module level.

Manual Structure

This manual is divided into sections, such as *Specifications* and *Theory of Operation*. Further, some sections are divided into subsections, such as *Product Description* and *Removal and Installation Procedures*.

Sections containing procedures also contain introductions to those procedures. Be sure to read these introductions because they provide information needed to do the service correctly and efficiently. The following are brief descriptions of each manual section.

- *Specifications* contains a description of the AWVG7 Generator module and the characteristics that apply to it.
- *Theory of Operation* is an overview of the module's design.
- *Performance Verification* contains procedures to perform the operation tests.
- *Adjustment Procedures* contains procedures for adjusting an AWVG7 Generator module to meet warranted characteristics.
- *Maintenance* contains installation, removal and replacement, and trouble-shooting instructions.
- *Option* contains a description of the available option for the AWVG7 Generator module.
- *Diagram* contains an interconnect diagram showing the connections between the AWVG7 Generator module and the mainframe.
- *Replaceable Parts List* 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 AWVG7 Generator module:

- The *TG700 TV Signal Generator Platform User Manual* (Tektronix part number 070-A799-XX) describes how to use the TG700 mainframe and all modules. It also contains information about remote commands and programming structure for the TG700 mainframe and all modules.
- The *TG700 TV Signal Generator Platform Module Installation Instructions* (Tektronix part number 070-A824-XX) describes how to install and remove the modules, and how to upgrade the firmware of the mainframe.

Specifications

Specifications

This section contains a general product description of the AWVG7 Generator module followed by the operating specifications of the module.

Product Description

The AWVG7 Analog Wideband Video Generator module is designed to be installed in the TG700 TV Signal Generator Platform. The TG700 platform must be running version 3.0 or later firmware.

The module is a 30 MHz bandwidth video signal generator which provides wideband analog component video signals for HDTV system. The module contains the following features:

- Supports the following system formats:

  1080/60i, 1080/59.94i, 1080/50i, 1080/24sF, 1080/23.98sF, 1080/30p, 1080/29.97p, 1080/25p, 1080/24p, 1080/23.98p, 720/60p, 720/59.94p, 720/50p, 720/24p, and 720/23.98p

- Six analog component video outputs
- Outputs a frame picture created by the Frame Picture Generator application (TG700 Option FP required)
- Overlay of circle, text, or logo on the video signal
- Generates a moving picture by scrolling the active picture area of the output test signal
- Full remote control using Ethernet interface

The signals of the following system formats are pre-installed in the mainframe:

1080/60i, 1080/59.94i, 1080/50i, 1080/24sF, 1080/23.98sF, 720/60p, and 720/59.94p

The signals other than the above are included in the supplied CD-ROM, and you can output the signals by downloading them to the mainframe. Refer to the *TG700 TV Signal Generator Platform User Manual* for detailed information on how to download a signal file.

Electrical Characteristics

Tables 1–1 through 1–3 list the electrical and environmental characteristics of the AWVG7 Generator module.

Table 1-1: Output channels

Characteristic	Performance requirements	Reference information
Channel 1 (CH 1)		
Number of outputs	2	
Output signals	Y or G	
Channel 2 (CH 2)		
Number of outputs	2	
Output signals	Pb or B	
Channel 3 (CH 3)		
Number of outputs	2	
Output signals	Pr or R	

Table 1-2: Common output characteristics

Characteristic	Performance requirements	Reference information
Amplitude error		
Absolute amplitude	≤ 1%	Measured at 700 mV.
Channel gain matching	≤ 0.5%	Measured at 700 mV, relative to CH 1.
Delay error		
Channel to channel delay, typical		≤ 1 ns; relative to CH 1
Group delay, typical		≤ 3 ns to 20 MHz ≤ 5 ns to 30 MHz
Frequency response	± 1% to 20 MHz ± 2% to 28 MHz ± 3% to 30 MHz	Measured with a 1 m coaxial cable and peak detector.
Line tilt	≤ 0.5%	Measured with 100% Flat Field test signal.
Field tilt	≤ 0.5%	Measured with 100% Flat Field test signal.
Pulse/bar ratio		1:1 within 0.5% with 2T5 pulse and bar signal.
DC offset	≤ 10 mV	
Return loss	≥ 35 dB to 30 MHz	

Environmental Characteristics

Table 1-3: Environmental characteristics

Characteristic	Description
Temperature	
Operating	0 °C to +50 °C
Non-operating	-20 °C to +60 °C
Relative humidity	
Operating	20% to 80% (No condensation) ; Maximum wet-bulb temperature 29.4 °C
Non-operating	5% to 90% (No condensation) ; Maximum wet-bulb temperature 40.0 °C
Altitude	
Operating	To 4.5 km (15,000 feet) Maximum operating temperature decreases 1 °C each 300 m above 1.5 km.
Non-operating	To 15 km (50,000 feet)
Vibration	
Operating	2.65 m/s^2 (0.27 $G_{rms)}$, 5 Hz to 500 Hz, 10 min, three axes
Non-operating	22.36 m/s^2 (2.28 $G_{rms)}$, 5 Hz to 500 Hz, 10 min, three axes
Shock	
Non-operating	588 m/s^2 (60 G), half-sine, 11 ms duration

Theory of Operation

Theory of Operation

This section describes the basic operation of the major circuit blocks in the AWVG7 Generator module.

For information about the TG700 mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

Bus Interface This block provides the communication between the mainframe and the module circuit.

Line Memory Line memory holds the actual sample points which define a digital signal.

Address Generator This block consists of a frame delay, an MPU interface, a sequencer, an SDRAM controller, and a blanking data generator. It interfaces the Frame Memory and the Line Memory and controls the output sequence of the video data in these memories.

Frame Memory Frame memory contains a series of pointers that control the order the video lines stored in the Line Memory are used to produce digital signals.

Overlay Controller This block consists of an MPU interface and an overlay controller. It inserts data from the Overlay Memory into the Line Memory data stream to create circular patterns, ID text, and logo.

Overlay Memory Overlay memory generates timings to multiplex the line memory data and the overlay data used for a circle, ID text, and logo overlay.

D/A Converter & Amp This block consists of a D/A converter, two amplifiers, and a filter. It converts the digital data from the Overlay Controller to analog signal and reconstruct the signal for output.

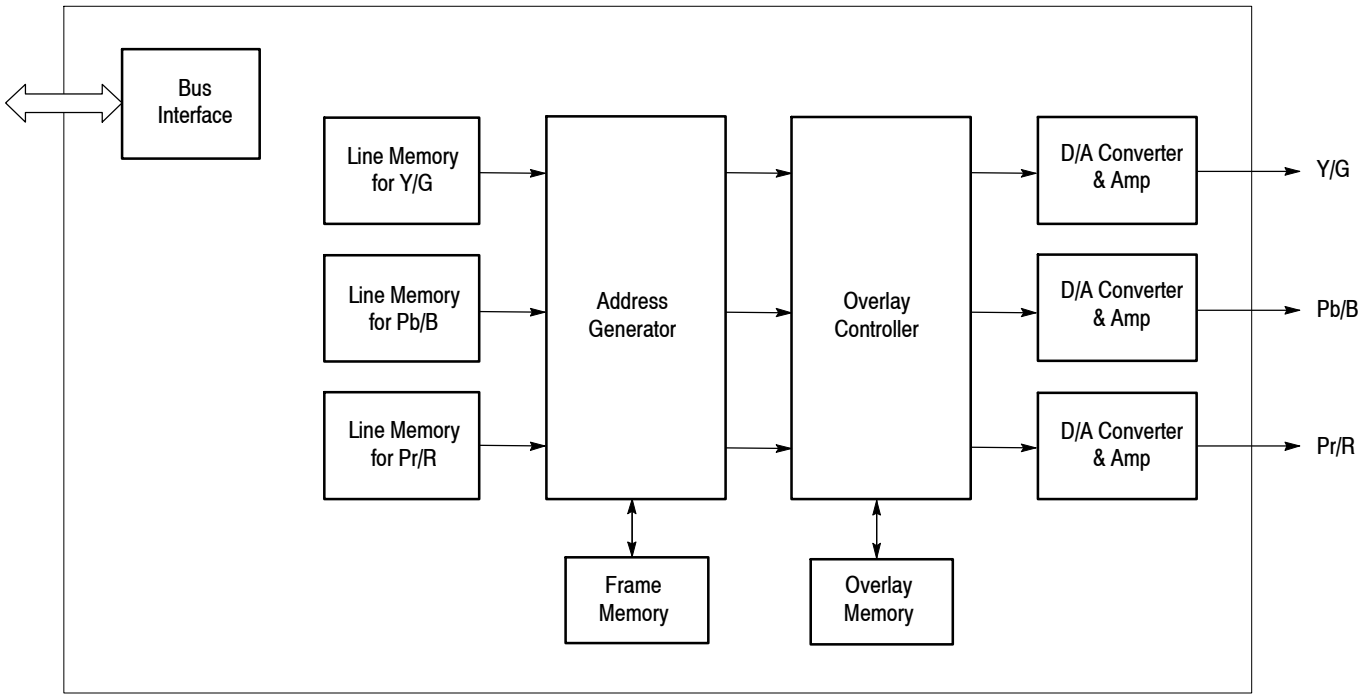

Figure 2- 1: Simplified block diagram of the AWVG7 Generator module

Performance Verification

Performance Verification

This section provides procedures that verify the performance and functionality of the AWVG7 Generator module.

Preparation for Performance Verification

Perform the following before starting the performance verification procedures:

Power On Default Settings

Before you perform the performance verification procedures, make sure that the required instrument settings are saved in the Power On Default preset.

If the instrument settings are saved in the Power On Default preset, you can recall the settings after completing the performance verification procedures by removing and reapplying the power.

Warm up

The AWVG7 Generator module and test equipment must have had a warm-up period of at least 20 minutes.

Equipment Required

Table 3–1 lists the equipment required for the procedures.

Table 3-1: Equipment required for performance verification

Item	No.	Minimum requirement	Recommended equipment
Oscilloscope	1	Bandwidth: 1 GHz or higher	Tektronix TDS784D
Digital multimeter	1	5 1/2 digits	FLUKE 8842A
Peak detector amplifier	1		Tektronix part number 015-0408-00 and TM500 series power supply
Peak detector head	1		Tektronix part number 015-0413-00
Color picture monitor	1		SONY BVMD14H5J and BKM129X
Test signal generator	1		Tektronix ATG7
75 Ω BNC cable	2	Length: 42 inches	Tektronix part number 012-0074-00
75 Ω BNC cable	1	5C-2V, 1 m	Canare DH5C01-S-SA
75 Ω feed-through termination	1		Tektronix part number 011-0103-02
75 Ω coaxial termination	3		Tektronix part number 011-0102-01

Table 3- 1: Equipment required for performance verification (Cont.)

Item	No.	Minimum requirement	Recommended equipment
75 Ω signal adapter	1	Bandwidth: 1 GHz Amplitude precision: -3 dB	Tektronix AMT75
BNC T connector	1		Tektronix part number 103-0030-00
BNC female-to-dual banana adapter	1		Tektronix part number 103-0090-00
BNC female-to-female connector	1		Canare BCJ-J

Calibration Data Report

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

Table 3- 2: AWVG7 calibration data report

Serial Number:	Cal Date:	Temperature:	Humidity:

Step	Function Tested	Minimum	Cal Data	Maximum
	Tested Format: 1080 59.94i GBR			
1.	Absolute Amplitude			
	CH 1 Output	693.0 mV	mV	707.0 mV
	CH 2 Output	693.0 mV	mV	707.0 mV
	CH 3 Output	693.0 mV	mV	707.0 mV
2.	Channel Gain Matching (Relative to CH 1)			
	CH 2 Output	-0.5%	%	0.5%
	CH 3 Output	-0.5%	%	0.5%
3.	DC Offset			
	CH 1 Output (GBR)	-10 mV	mV	10 mV
	CH 2 Output (GBR)	-10 mV	mV	10 mV
	CH 3 Output (GBR)	-10 mV	mV	10 mV
	CH 2 Output (YPbPr)	-10 mV	mV	10 mV
	CH 3 Output (YPbPr)	-10 mV	mV	10 mV

Table 3-2: AWVG7 calibration data report (Cont.)

Step	Function Tested	Minimum	Cal Data	Maximum
4.	Frequency Response (Measured on DAC Test Signal)			
	CH 1 Output (Peak value to 20 MHz)	-7.0 mV	mV	7.0 mV
	CH 1 Output (Peak value to 28 MHz)	-14.0 mV	mV	14.0 mV
	CH 1 Output (Peak value to 30 MHz)	-21.0 mV	mV	21.0 mV
	CH 2 Output (Peak value to 20 MHz)	-7.0 mV	mV	7.0 mV
	CH 2 Output (Peak value to 28 MHz)	-14.0 mV	mV	14.0 mV
	CH 2 Output (Peak value to 30 MHz)	-21.0 mV	mV	21.0 mV
	CH 3 Output (Peak value to 20 MHz)	-7.0 mV	mV	7.0 mV
	CH 3 Output (Peak value to 28 MHz)	-14.0 mV	mV	14.0 mV
	CH 3 Output (Peak value to 30 MHz)	-21.0 mV	mV	21.0 mV
5.	Line Time Distortion (Measured on 100% Flat Field signal)			
	CH 1 Output $\leq$ 0.5% (Peak to Peak value)	-----	%	0.5%
	CH 2 Output $\leq$ 0.5% (Peak to Peak value)	-----	%	0.5%
	CH 3 Output $\leq$ 0.5% (Peak to Peak value)	-----	%	0.5%
6.	Field Time Distortion (Measured on 100% Flat Field signal)			
	CH 1 Output $\leq$ 0.5% (Peak to Peak value)	-----	%	0.5%
	CH 2 Output $\leq$ 0.5% (Peak to Peak value)	-----	%	0.5%
	CH 3 Output $\leq$ 0.5% (Peak to Peak value)	-----	%	0.5%

Performance Verification Procedures

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

WARNING. *Dangerous electric shock hazards exist inside the TG700 mainframe. Only qualified service personnel should perform these procedures.*

DC Offset and Amplitude Error

This test verifies the DC offset and amplitude error of the channel outputs. The following equipment is required for the test:

- Digital multimeter
- BNC female-to-dual banana adapter
- BNC T connector
- 75 Ω coaxial termination
- 75 Ω BNC cable

Perform the following procedure to verify the DC offset and amplitude error of the channel outputs:

1. Use the 75 Ω BNC cable, BNC T connector, 75 Ω coaxial termination, and BNC female-to-dual banana adapter to connect the upper CH 1 connector on the AWVG7 Generator module to the INPUT connector on the digital multimeter as shown in Figure 3–1.

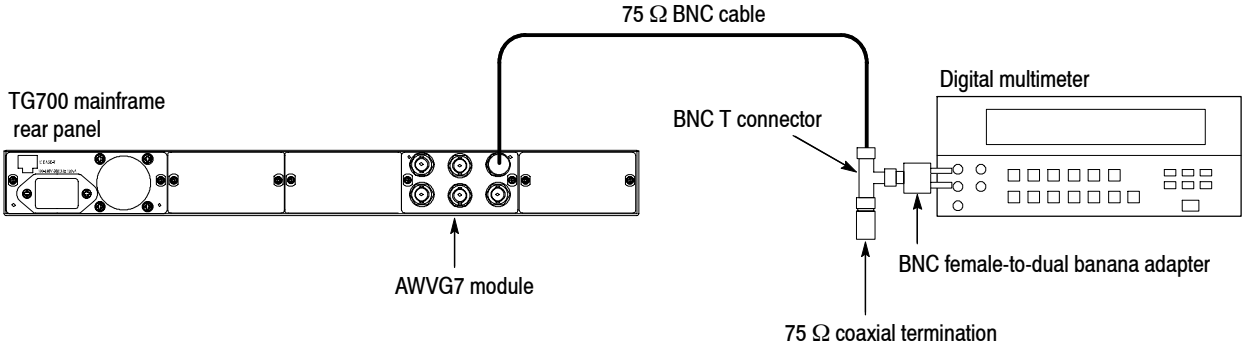

Figure 3- 1: Equipment connection for verifying the DC offset and amplitude error

2. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode. Continue holding down the **FRONT PANEL ENABLE** button until the "TG700 start up with Factory Mode." message appears.

3. Select the DAC Gain (GBR) : 0 mV calibration signal as follows:

   a. Press the **MODULE** button to display the **AWVG7** main menu.

   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.

   c. Press the left (◀) or right (▶) arrow button to select **DAC Gain (GBR)**, and then press the **ENTER** button.

   d. Press the left (◀) or right (▶) arrow button to select **0mV**, and then press the **ENTER** button.

4. Verify that the output offset is within the range of -10 mV to 10 mV. Note this value as **CH1_DC0**.

5. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AWVG7 Generator module.

6. Verify that the output offset is within the range of -10 mV to 10 mV. Note this value as **CH2_DC0**.

7. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AWVG7 Generator module.

8. Verify that the output offset is within the range of -10 mV to 10 mV. Note this value as **CH3_DC0**.

9. Move the BNC cable from the upper CH 3 connector to the upper CH 1 connector on the AWVG7 Generator module.

10. Press the left (◀) or right (▶) arrow button to select **700.397mV**, and then press the **ENTER** button.

11. Read the value on the digital multimeter, and then note this value as **CH1_DC1**.

12. Verify that **CH1_DC1-CH1_DC0** is within the range of 693.0 mV to 707.0 mV. Note this value as **CH1_V1**.

13. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AWVG7 Generator module.

14. Read the value on the digital multimeter, and then note this value as **CH2_DC1**.

15. Verify that **CH2_DC1-CH2_DC0** is within the range of 693.0 mV to 707.0 mV. Note this value as **CH2_V1**.
16. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AWVG7 Generator module.
17. Read the value on the digital multimeter, and then note this value as **CH3_DC1**.
18. Verify that **CH3_DC1-CH3_DC0** is within the range of 693.0 mV to 707.0 mV. Note this value as **CH3_V1**.
19. Verify that the amplitude errors of the CH 2 and CH 3 outputs meet the following relationships:

    $$\text{CH 2 amplitude error} = ((\text{CH2\_V1}/\text{CH1\_V1}) - 1) \times 100 \leq \pm 0.5\%$$
    $$\text{CH 3 amplitude error} = ((\text{CH3\_V1}/\text{CH1\_V1}) - 1) \times 100 \leq \pm 0.5\%$$

20. Move the BNC cable from the upper CH 3 connector to the upper CH 2 connector on the AWVG7 Generator module.
21. Select the **DAC Gain (YPbPr) : 0 mV** calibration signal for CH 2 and CH 3 as follows:
    a. Press the **CANCEL** button to display the **CALIBRATION** menu.
    b. Press the left (◀) or right (▶) arrow button to select **DAC Gain (YPbPr)**, and then press the **ENTER** button.
    c. Press the left (◀) or right (▶) arrow button to select **0mV**, and then press the **ENTER** button.
22. Verify that the output offset is within the range of -10 mV to 10 mV.
23. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AWVG7 Generator module.
24. Verify that the output offset is within the range of -10 mV to 10 mV.

Frequency Response

This test verifies the frequency response of the DAC test signal from the CH 1, CH 2, and CH 3 outputs. The following equipment is required for the test:

- Oscilloscope
- Peak detector amplifier
- Peak detector head
- Two 75 Ω BNC cables

Perform the following procedure to verify the frequency response of the DAC test signal from the CH 1, CH 2 and CH 3 outputs:

1. Use the two 75 Ω BNC cables, the peak detector head, and BNC female-to-female connector to connect the upper CH 1 connector on the AWVG7 Generator module to the +INPUT connector on the peak detector amplifier as shown in Figure 3–2.

2. Use the 75 Ω BNC cable to connect the OUTPUT connector on the peak detector amplifier to the CH 1 input connector on the oscilloscope as shown in Figure 3–2.

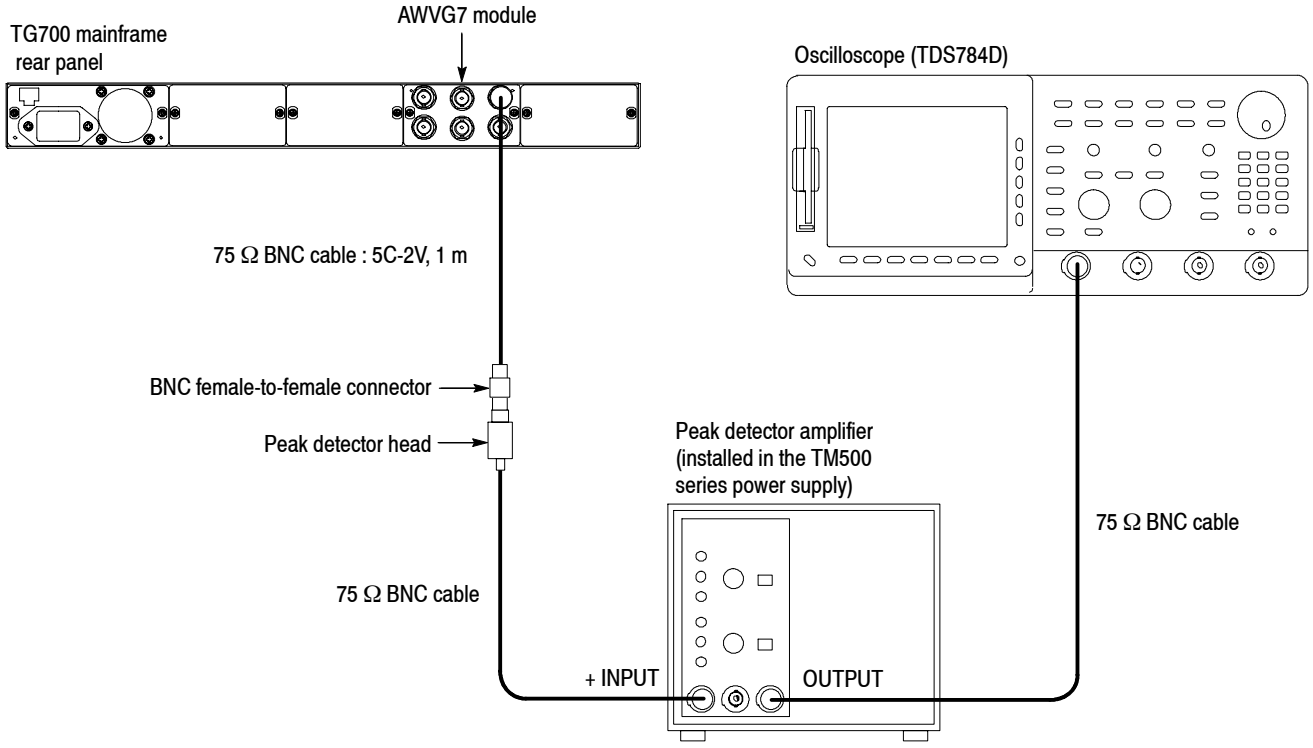

Figure 3-2: Equipment connection for verifying the frequency response

3. Set the oscilloscope settings as indicated below:

Vertical scale . . . . . CH 1: 5 mV/div
Bandwidth . . . . . 250 MHz
Horizontal scale . . . . . 5 ms/div
Trigger position 10%
Trigger source . . . . . CH 1
Trigger type . . . . . Edge
Trigger level . . . . . -50 mV
Acquire menu . . . . . Average 64

4. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode. Continue holding down the **FRONT PANEL ENABLE** button until the "TG700 start up with Factory Mode." message appears.

5. Select the DAC Test calibration signal as follows:

   a. Press the **MODULE** button to display the **AWVG7** main menu.

   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.

   c. Press the left (◀) or right (▶) arrow button to select **DAC Test**, and then press the **ENTER** button.

   d. Press the **ENTER** button again to confirm the signal output.

6. Turn the LEVEL knob on the peak detector amplifier so that the green LED lights.

7. Verify that the differences between the maximum amplitude and the minimum amplitude from 500 kHz to 20 MHz are less than or equal to 7 mV. See Figure 3–3.

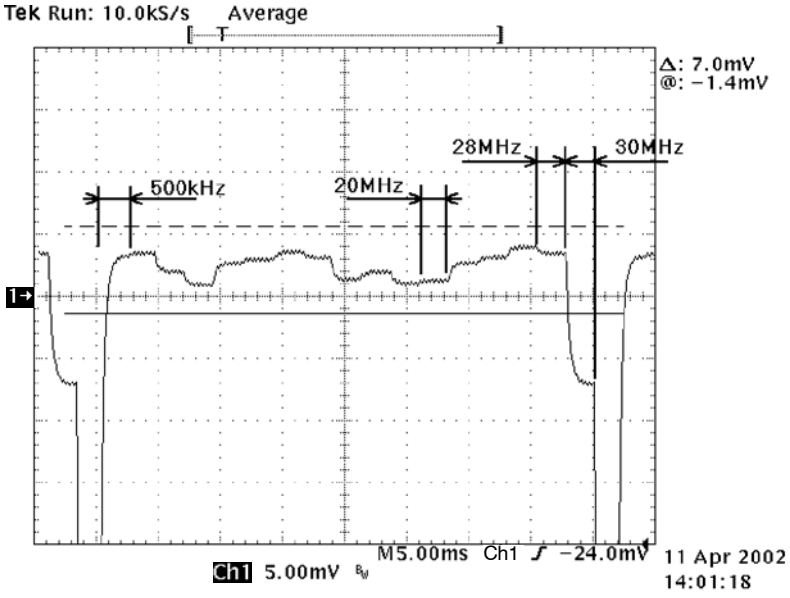

Figure 3- 3: Verifying the signal amplitudes

8. Verify that the differences between the maximum amplitude and the minimum amplitude from 500 kHz to 28 MHz are less than or equal to 14 mV. See Figure 3–3.

9. Verify that the differences between the maximum amplitude and the minimum amplitude from 500 kHz to 30 MHz are less than or equal to 21 mV. See Figure 3–3.

10. Move the peak detector head from the upper CH 1 connector to the upper CH 2 connector on the AWVG7 Generator module and repeat steps 7 through 9.

11. Move the peak detector head from the upper CH 2 connector to the upper CH 3 connector on the AWVG7 Generator module and repeat steps 7 through 9.

Field Time Distortion

This test verifies the field time distortion of the 100% flat field signal from the CH 1, CH 2, and CH 3 outputs. The following equipment is required for the test:

- Oscilloscope
- Test signal generator
- 75 Ω signal adapters
- 75 Ω feed-through terminator
- Two 75 Ω BNC cables

Perform the following procedure to verify the field time distortion of the 100% flat field signal:

1. Use the 75 Ω BNC cable and the 75 Ω signal adapter to connect the upper CH 1 connector on the AWVG7 Generator module to the CH 1 input connector on the oscilloscope as shown in Figure 3–4.

2. Use the 75 Ω BNC cable and the 75 Ω feed-through termination to connect the BLACK 1 connector on the test signal generator to the CH 2 input connector on the oscilloscope as shown in Figure 3–4.

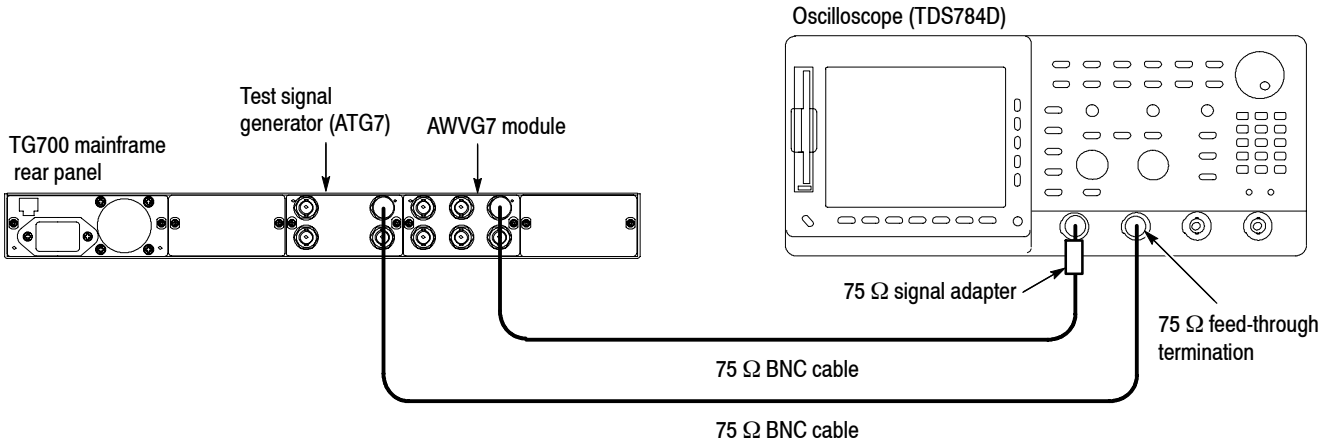

Figure 3- 4: Equipment connection for verifying the field time distortion

3. Set the oscilloscope settings as indicated below:

Vertical scale . . . . . CH 1: 5 mV/div, CH 2: 1.00 V/div
Vertical offset . . . . . 700 mV
Horizontal scale . . . . . 5 ms/div
Horizontal delay time . . 5.0 µs/div
Delayed runs time . . . . . 343.0 µs (Delayed Only)
Trigger position 50%
Trigger source . . . . . CH 2
Trigger type . . . . . Edge
Acquire menu . . . . . Average 64
CH 2 waveform . . . . . OFF
Courser . . . . . V Bars
Measure . . . . . CH 1 Mean

4. Set the test signal generator (ATG7 module) settings as indicated below:

Output selection . . . . . BLACK 1
Signal format . . . . . NTSC
Test signal . . . . . Field Reference

5. Select the 100% Flat Field signal as follows:

a. Press the **MODULE** button to display the AWVG7 main menu.

b. Press the **FORMAT** button to select **1080 59i GBR**, and then press the **ENTER** button.

c. Press the **FLAT FIELD** button to select **100% Flat Field**.

6. Place one of the vertical cursor on the portion after 4 μs of the rising edge of the line bar signal, and place the other vertical cursor on the portion before 4 μs of the falling edge of the line bar signal.
7. On the oscilloscope, select Gate:ON (Gate with V Bar Coursers) from Measure menu.
8. Read the C1 Mean value, and then note this value as V1.
9. Change the Delayed Runs Time value to 8.262 ms, and repeat step 6.
10. Read the C1 Mean value, and then note this value as V2.
11. Verify that the V1 and V2 values meet the following relationships:

    $(V1-V2) / V2 \leq 0.5\%$

12. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AWVG7 Generator module and repeat steps 6 through 11.
13. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AWVG7 Generator module and repeat steps 6 through 11.

Line Time Distortion

This test verifies the line time distortion of the 100% Flat Field signal from the CH 1, CH 2, and CH 3 outputs. The following equipment is required for the test:

- Oscilloscope
- Test signal generator
- 75 Ω signal adapters
- 75 Ω feed-through termination
- Two 75 Ω BNC cables

Perform the following procedure to verify the line time distortion of the 100% Flat Field signal.

Use the equipment connection from the previous test.

1. Move the BNC cable from the upper CH 3 connector to the upper CH 1 connector on the AWVG7 Generator module.

2. Set the oscilloscope settings as indicated below:

Vertical scale . . . . . CH 1: 5 mV/div, CH 2: 1.00 V/div
Vertical offset . . . . . 700 mV
Horizontal scale . . . . . 20 µs/div
Horizontal delay time . . 2.0 µs/div
Delayed runs time . . . . . 165.0 µs (Delayed Only)
Trigger position 50%
Record length 1000
Trigger source . . . . . CH 2
Trigger type . . . . . Edge
Acquire menu . . . . . Average 64
CH 2 waveform . . . . . OFF
Courser . . . . . V Bars
Measure . . . . . CH 1 MAX, CH 1 MIN

3. Set the test signal generator (ATG7 module) settings as indicated below:

Output selection . . . . . BLACK 1
Signal format . . . . . NTSC
Test signal . . . . . Field Reference

4. Select the 100% Flat Field signal as follows:

a. Press the **MODULE** button to display the AWVG7 main menu.

b. Press the **FORMAT** button to select **1080 59i GBR**, and then press the **ENTER** button.

c. Press the **FLAT FIELD** button to select **100% Flat Field**.

5. Place one of the vertical cursors on the portion after 1 µs of the rising edge of the line bar signal, and place the other vertical cursor on the portion before 1 µs of the falling edge of the line bar signal.

6. On the oscilloscope, select Gate:ON (Gate with V Bar Coursers) from Measure menu.

7. Read the **C1 MAX** value and **C1 MIN** value, and then verify that the differences between these values are within 3 mV.

8. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AWVG7 Generator module and repeat step 7.

9. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AWVG7 Generator module and repeat step 7.

Color Bars Signal Check

This test verifies that the 75% color bars signal is normally output from all of the channels. The following equipment is required for the test:

- Color picture monitor
- Three 75 Ω BNC cables
- Three 75 Ω coaxial termination

Perform the following procedure to verify that the 75% color bars signal is normally output from all of the channels:

1. Use the 75 Ω BNC cable to connect the upper CH 1 connector on the AWVG7 Generator module to the Y/G IN connector on the color picture monitor as shown in Figure 3–5.
2. Use the 75 Ω BNC cable to connect the upper CH 2 connector on the AWVG7 Generator module to the P_B/B IN connector on the color picture monitor as shown in Figure 3–5.
3. Use the 75 Ω BNC cable to connect the upper CH 3 connector on the AWVG7 Generator module to the P_R/R IN connector on the color picture monitor as shown in Figure 3–5.
4. Use the 75 Ω coaxial terminations to terminate the Y/G OUT, P_B/B OUT, and P_R/R OUT connectors on the color picture monitor.

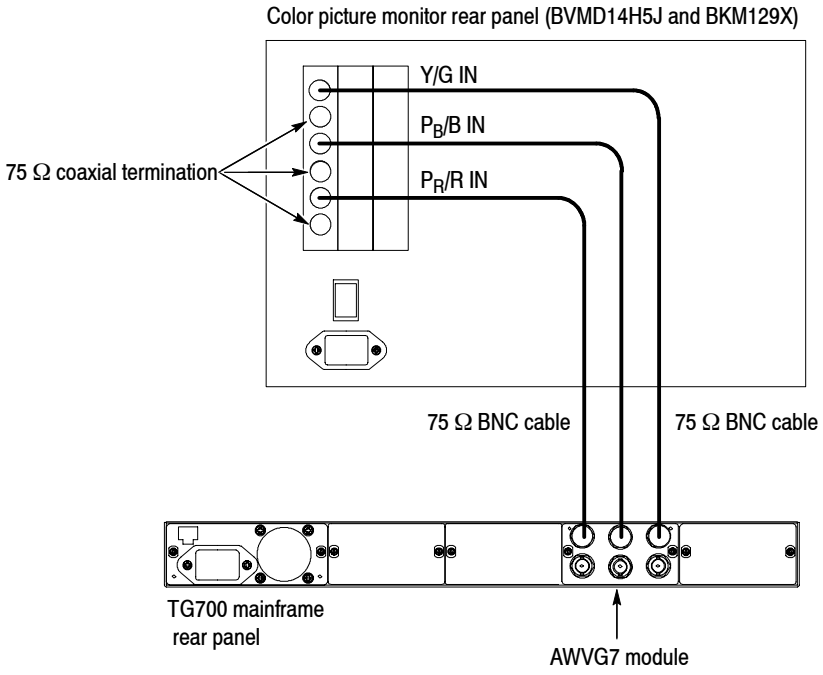

Figure 3-5: Equipment connection for checking the color bars signal

5. Set the display setting of the color picture monitor to the GBR mode.
6. Select the 75% Color Bars signal as follows:
   a. Press the **MODULE** button to display the AWVG7 main menu.
   b. Press the **FORMAT** button to select **1080 59i GBR**, and then press the **ENTER** button.
   c. Press the **COLOR BAR** button to select **75% Color Bars**.
7. Select the Sync ON All Channels mode as follows:
   a. Press the up (▲) or down (▼) arrow button to select **VIDEO**, and then press **ENTER** button to access the VIDEO submenu.
   b. Press the left (◀) or right (▶) arrow button to select **Sync ON All Channels**, and then press the **ENTER** button.
8. Verify that the color bars signal is displayed normally.
9. Move the BNC cable from the upper CH 1 connector to the lower CH 1 connector, from the upper CH 2 connector to the lower CH 2 connector, and from upper CH 3 connector to lower CH 3 connector on the AWVG7 Generator module and repeat step 8.

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

Adjustment Procedures

Adjustment Procedures

This section contains information needed to adjust the AWVG7 Generator module.

Adjustment in the AWVG7 Generator module are for the output offset and gain, frame timing and clock timing, and frequency response.

Requirements for Adjustment

Before doing the adjustment, note the following requirements:

Personnel This procedure is only to be performed by trained service technicians.

Warm-Up Period The AWVG7 Generator module requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. Adjustment done before the operating temperature has stabilized may cause errors in performance.

WARNING. *To avoid potential shock, use caution when removing TG700 mainframe top cover with power connected.*

Access When adjusting the AWVG7 Generator module, you need to remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

NOTE*. If the serial number of your instrument is B010600 and above, replace the resistor and capacitor numbers in the figures and procedures as follows:*
R6xxx → R6xxx_1 (for example, R651A → R651A_1)
R7xxx → R6xxx_2 (for example, R751A → R651A_2)
R8xxx → R6xxx_3 (for example, R851A → R651A_3)
C6xxx → R6xxx_1 (for example, C604B → C604B_1)
C7xxx → R6xxx_2 (for example, C704B → C604B_2)
C8xxx → R6xxx_3 (for example, C804B → C604B_3)

Equipment Required

Table 4–1 lists the equipment required to adjust the output offset and gain, frame timing and clock timing, and frequency response.

Table 4-1: Equipment required

Item	No.	Minimum requirement	Recommended equipment
TV signal generator platform	1		Tektronix TG700
Oscilloscope	1	Bandwidth: 1 GHz or higher Function: Mask testing	Tektronix TDS784D Option 2C
Digital multimeter	1	5 1/2 digits	FLUKE 8842A
Peak detector amplifier	1		Tektronix part number 015-0408-00 and TM500 series power supply
Peak detector head	1		Tektronix part number 015-0413-00
Probe	2	X 10	Tektronix P6139A
75 Ω BNC cable	2	Length: 72 inches	Tektronix part number 012-0159-01
75 Ω BNC cable	1	5C-2V, 1 m	Canare DH5C01-S-SA
75 Ω feed-through termination	1		Tektronix part number 011-0103-02
75 Ω coaxial termination	1		Tektronix part number 011-0102-03
BNC T connector	1		Tektronix part number 103-0030-00
BNC female-to-dual banana adapter	1		Tektronix part number 103-0090-00
BNC female-to-female connector	1		Canare BCJ-J
Flat blade screwdriver for adjusting C604B, C704B, and C804B	1	Bit shape: 0.8X0.35 mm	Murata KMDR060

Output Offset and Gain Adjustment

Preparation

To perform the output offset and gain adjustment, you must first remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

After you have removed the top cover, find the variable resistors on the AWVG7 circuit board. See Figure 4–1.

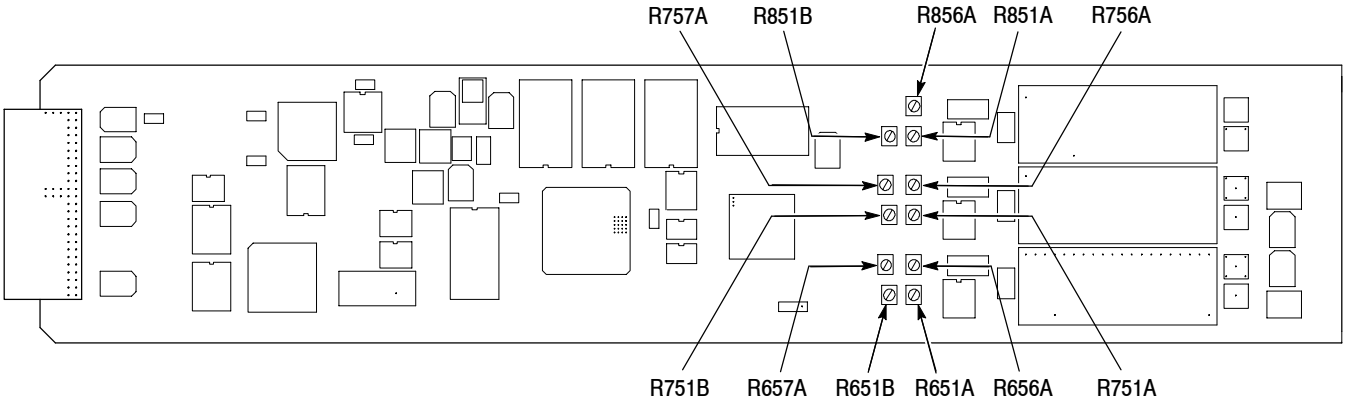

Figure 4-1: Location of the variable resistors for the output offset and gain adjustment

Procedure

WARNING. *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable, BNC T connector, 75 Ω coaxial termination, and BNC female-to-dual banana adapter to connect the upper CH 1 connector on the AWVG7 Generator module to the INPUT connector on the digital multimeter as shown in Figure 4–2.

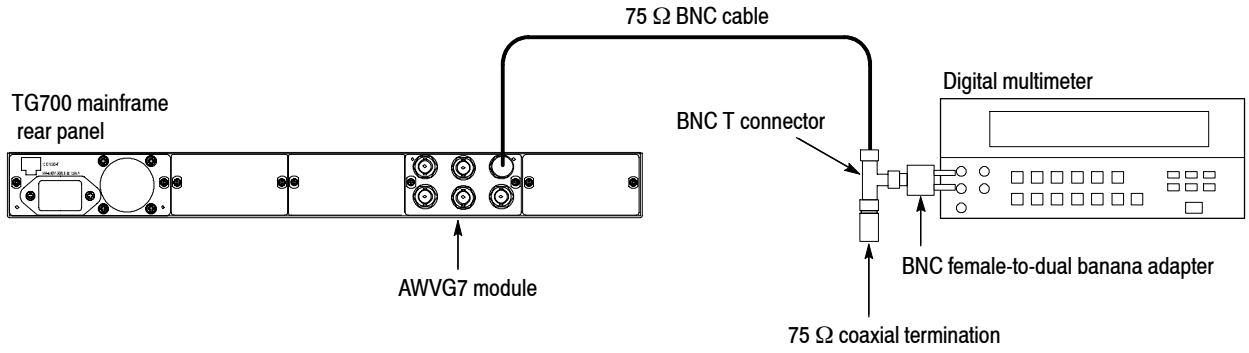

Figure 4-2: Equipment connection for adjusting the output offset and gain

2. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode. Continue holding down the **FRONT PANEL ENABLE** button until the "TG700 start up with Factory Mode." message appears.

3. Select the DAC Gain (GBR) : 0 mV calibration signal as follows:

   a. Press the **MODULE** button to display the **AWVG7** main menu.

   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.

   c. Press the left (◀) or right (▶) arrow button to select **DAC Gain (GBR)**, and then press the **ENTER** button.

   d. Press the left (◀) or right (▶) arrow button to select **0mV**, and then press the **ENTER** button.

4. Locate variable resistor R856A on the AWVG7 circuit board. See Figure 4-1.

5. Adjust R856A so that the output offset is 0 V ± 1 mV.

6. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AWVG7 Generator module.

7. Locate variable resistor R756A on the AWVG7 circuit board. See Figure 4-1.

8. Adjust R756A so that the output offset is 0 V ± 1 mV.

9. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AWVG7 Generator module.

10. Locate variable resistor R656A on the AWVG7 circuit board. See Figure 4-1.

11. Adjust R656A so that the output offset is 0 V ± 1 mV.

12. Move the BNC cable from the upper CH 3 connector to the upper CH 1 connector on the AWVG7 Generator module.

13. Press the left (◀) or right (▶) arrow button to select **700.397mV**, and then press the **ENTER** button.

14. Locate variable resistors R851A (coarse) and R851B (fine) on the AWVG7 circuit board. See Figure 4-1.

15. Adjust R851A and R851B so that the output gain is 700.4 mV ± 1 mV.

16. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AWVG7 Generator module

17. Locate variable resistors R751A (coarse) and R751B (fine) on the AWVG7 circuit board. See Figure 4–1.

18. Adjust R751A and R751B so that the output gain is 700.4 mV ± 1 mV.

19. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AWVG7 Generator module.

20. Locate variable resistors R651A (coarse) and R651B (fine) on the AWVG7 circuit board. See Figure 4–1.

21. Adjust R651A and R651B so that the output gain is 700.4 mV ± 1 mV.

22. Move the BNC cable from the upper CH 3 connector to the upper CH 2 connector on the AWVG7 Generator module.

23. Select the DAC Gain (YPbPr) : 0 mV calibration signal for CH 2 and CH 3 as follows:

a. Press the **CANCEL** button to display the **CALIBRATION** menu.

b. Press the left (◀) or right (▶) arrow button to select **DAC Gain (YPbPr)**, and then press the **ENTER** button.

c. Press the left (◀) or right (▶) arrow button to select **0mV**, and then press the **ENTER** button.

24. Locate variable resistor R757A on the AWVG7 circuit board. See Figure 4–1.

25. Adjust R757A so that the output offset is 0 V ± 1 mV.

26. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AWVG7 Generator module.

27. Locate variable resistor R657A on the AWVG7 circuit board. See Figure 4–1.

28. Adjust R657A so that the output offset is 0 V ± 1 mV.

Frame Timing and Clock Timing Adjustments

***NOTE**. The instrument with serial number B010600 and above does not require this adjustments.*

Preparation

To perform the frame timing and clock timing adjustment, you must first remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

After you have removed the top cover, find the test points on the AWVG7 circuit board. See Figure 4–3.

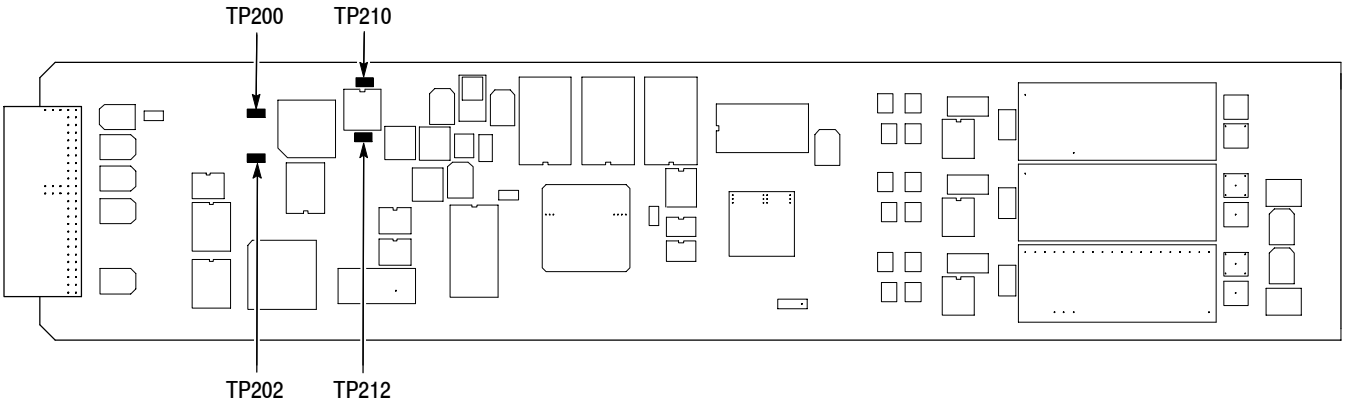

Figure 4- 3: Location of the test points for the frame timing and clock timing adjustment

Procedure

***WARNING.** To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Attach the two P6139A probes to the oscilloscope CH 1 and CH 2 inputs.
2. Locate test points TP200, TP202, TP210, and TP212 on the AWVG7 circuit board. See Figure 4–3.
3. Connect the probe tip from the oscilloscope CH 1 input to TP200.
4. Connect the probe tip from the oscilloscope CH 2 input to TP202.

5. Set the oscilloscope settings as indicated below:

   Vertical scale . . . . . CH 1: 500 mV/div, CH 2: 1V/div
   Vertical position . . . . . -2.0 div
   Vertical offset . . . . . CH 1: 3.3 V, CH 2: 0 V
   Horizontal scale . . . . . 5 ns/div
   Horizontal length 500
   Trigger position 0%
   Trigger source . . . . . CH 1
   Trigger type . . . . . Edge
   Acquisition mode . . . . . Average 4
   Acquisition mode . . . . . Relative Signal OFF
   Measure High-Low
   setup . . . . . Min-Max

6. Check that both the CH 1 and CH 2 waveforms are displayed stably, and then turn off the CH 1 display.

7. Select **Frame 0.0 nsec** from the Frame Timing calibration menu as follows:

   a. Press the **MODULE** button to display the **AWVG7** main menu.

   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.

   c. Press the left (◀) or right (▶) arrow button to select **Frame Timing**, and then press the **ENTER** button.

   d. Press the left (◀) or right (▶) arrow button to select **Frame 0.0 nsec**, and then press the **ENTER** button.

8. Save the CH 2 waveform on the oscilloscope in **Ref1**, and then display the saved waveform.

9. Select **Delay** from the Measure menu, and then set the oscilloscope to measure the time delay between the Ref1 and CH 2 waveforms.

10. Press the up (▲) or down (▼) arrow button to select **2.0 ns**.

11. While seeing the Delay Timing value on the oscilloscope, press the left (◀) or right (▶) arrow button to adjust the delay value to 2.0 ns.

12. Press the up (▲) or down (▼) arrow button to select **10.0 ns**.

13. While seeing the Delay Timing value on the oscilloscope, press the left (◀) or right (▶) arrow button to adjust the delay value to 10.0 ns.

14. Press the up (▲) or down (▼) arrow button to select **22.0 ns**.

15. While seeing the Delay Timing value on the oscilloscope, press the left (◀) or right (▶) arrow button to adjust the delay value to 22.0 ns.

16. Press the **CANCEL** button to return the CALIBRATION menu.

17. Press the left (◀) or right (▶) arrow button to select **Clock Timing**, and then press the **ENTER** button.
18. Move CH 1 probe from TP200 to TP202. Move Ch 2 probe from TP210 to TP212.
19. Press the up (▲) or down (▼) arrow button to select **Clock 0.0 nsec**, and then the **ENTER** button.
20. Save the waveform on the oscilloscope in **Ref1**.
21. Press the up (▲) or down (▼) arrow button to select **2.0 ns**.
22. While seeing the Delay Timing value on the oscilloscope, press the left (◀) or right (▶) arrow button to adjust the delay value to 2.0 ns.
23. Save the waveform on the oscilloscope in **Ref1**, and then press the up (▲) or down (▼) arrow button to select **10.0 ns**.
24. While seeing the Delay Timing value on the oscilloscope, press the left (◀) or right (▶) arrow button to adjust the delay value to 8.0 ns.
25. Save the waveform on the oscilloscope in **Ref1**, and then press the up (▲) or down (▼) arrow button to select **22.0 ns**.
26. While seeing the Delay Timing value on the oscilloscope, press the left (◀) or right (▶) arrow button to adjust the delay value to 12.0 ns.
27. Press the **CANCEL** button to return to the CALIBRATION menu.

Frequency Response Adjustment

Preparation

To perform the frequency response adjustment, you must first remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

After you have removed the top cover, find the variable capacitors on the AWVG7 circuit board. See Figure 4–4.

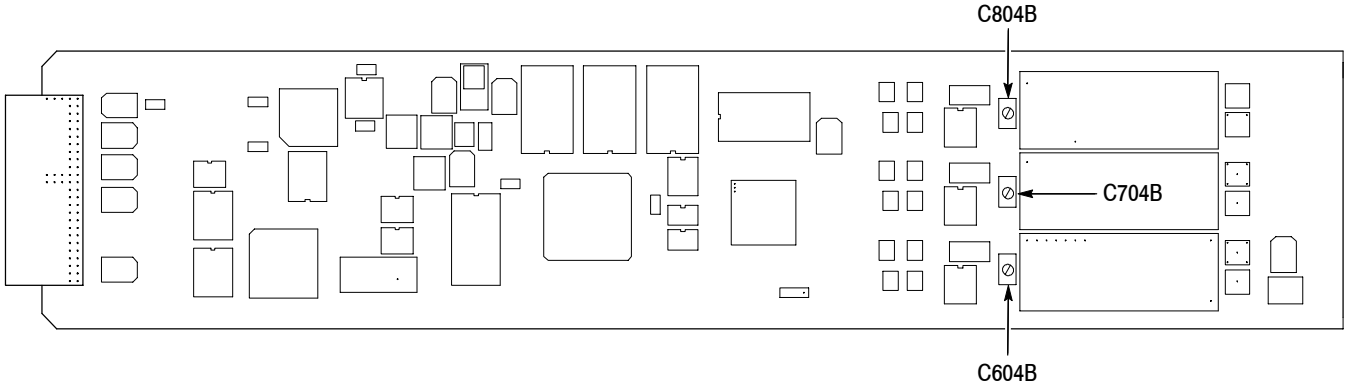

Figure 4- 4: Location of the variable capacitors for the frequency response adjustment

Procedure

WARNING. *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the two 75 Ω BNC cables, peak detector head, and BNC female-to-female connector to connect the upper CH 1 connector on the AWVG7 Generator module to the +INPUT connector on the peak detector amplifier as shown in Figure 4–5.
2. Use the 75 Ω BNC cable to connect the OUTPUT connector on the peak detector amplifier to the CH 1 input connector on the oscilloscope as shown in Figure 4–5.

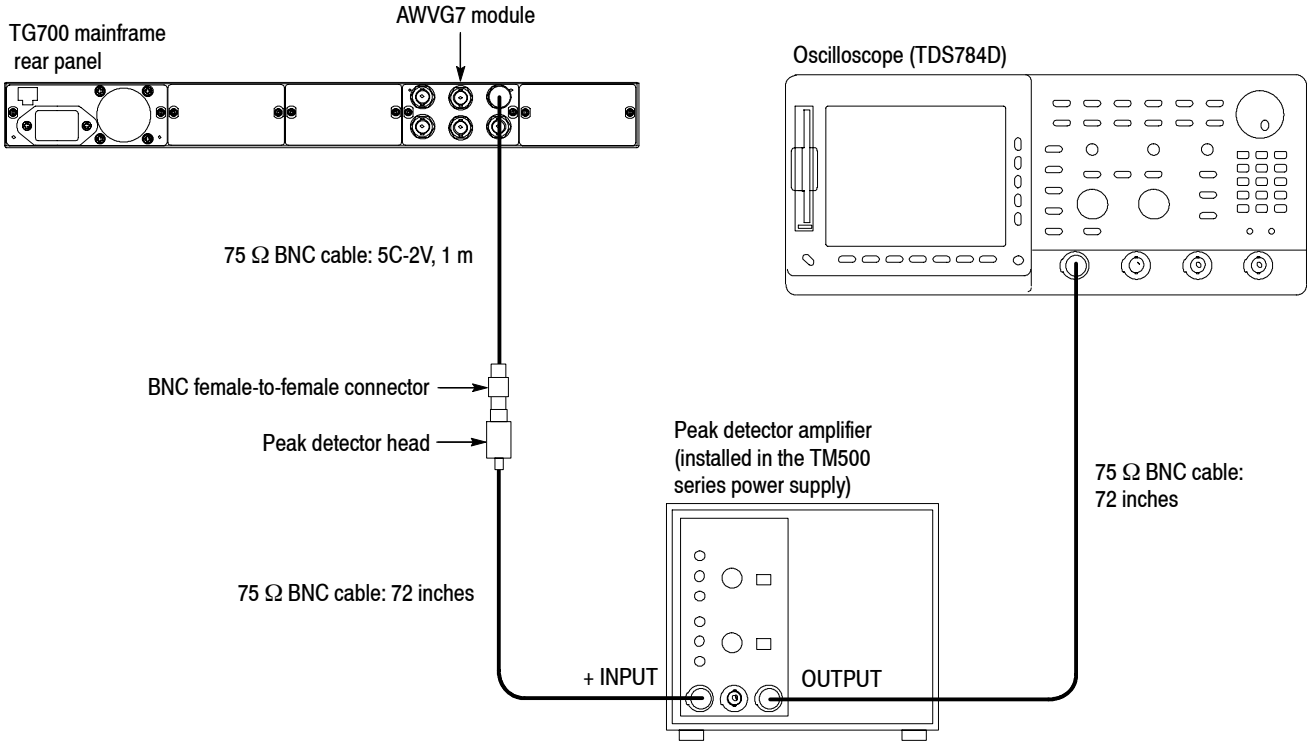

Figure 4- 5: Equipment connection for adjusting the frequency response

3. Set the oscilloscope settings as indicated below:

Vertical scale . . . . . CH 1: 5 mV/div
Bandwidth . . . . . 250 MHz
Horizontal scale . . . . . 5 ms/div
Trigger position 10%
Trigger source . . . . . CH 1
Trigger type . . . . . Edge
Trigger level . . . . . -50 mV
Acquire menu . . . . . Average 4

4. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode. Continue holding down the **FRONT PANEL ENABLE** button until the "TG700 start up with Factory Mode." message appears.

5. Select the DAC Test calibration signal as follows:

a. Press the **MODULE** button to display the AWVG7 main menu.

b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.

c. Press the left (◀) or right (▶) arrow button to select **DAC Test**, and then press the **ENTER** button.

d. Press the **ENTER** button again to confirm the signal output.

6. Locate variable capacitors C804B, C704B, and C604B on the AWVG7 circuit board. See Figure 4–4.

7. Turn the LEVEL knob on the peak detector amplifier so that the green LED lights.

8. Adjust C804B so that the amplitude changes from 500 kHz to 20 MHz are at a minimum. See Figure 4–6.

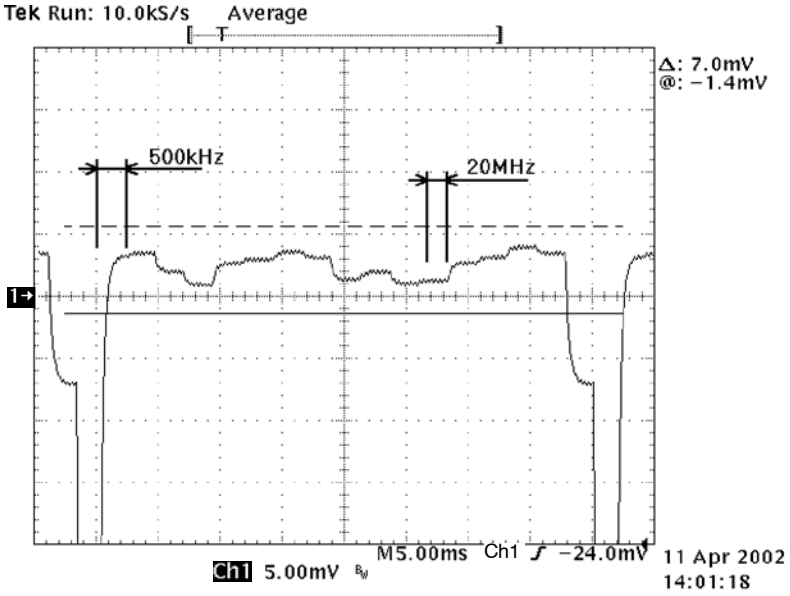

Figure 4- 6: Minimizing the amplitude changes

9. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AWVG7 Generator module.

10. Adjust C704B so that the amplitude changes from 500 kHz to 20 MHz are at a minimum.

11. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AWVG7 Generator module.

12. Adjust C604B so that the amplitude changes from 500 kHz to 20 MHz are at a minimum.

Maintenance

Maintenance

This section contains instructions and procedures for maintaining the AWVG7 Generator module. For information on servicing the mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

The following information can be found in this section:

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

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

Preparation

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

Servicing Prerequisites

Ensure 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.

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. *To avoid semiconductor component damage, do not handle static sensitive parts without taking proper ESD precautions.*

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, checking performance, 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 use chemical cleaning agents; they may damage the module. Avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.*

CAUTION. *Use caution when removing the circuit board from its mounting shield. Flexing the circuit board can result in permanent damage. The mounting shield provides necessary structural support for the circuit board.*

Inspecting and Cleaning Procedures

Clean the mainframe and modules often enough to prevent dust or dirt from accumulating. Refer to *Inspecting and Cleaning Procedures* in the *TG700 TV Signal Generator Platform Service Manual*.

Performance Verification

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

Repackaging Instructions

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

1. Attach a tag to the instrument showing: the owner, complete address and phone number of someone at your firm who can be contacted, the instrument serial number, and a description of the required service.
2. Package the instrument in the original packaging materials. If the original packaging materials are not available, follow these directions:

a. Obtain a corrugated cardboard carton with 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.

Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the AWVG7 Generator module.

Tools Required

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

Table 5-1: Required tools

Name	Description	Tektronix part number
Screwdriver handle	Accepts Phillips-driver bits	
#1 Phillips tip	Phillips-driver bit for #1 size screw heads	
#2 Phillips tip	Phillips-driver bit for #2 size screw heads	
Nut driver, 14 mm	Special nut driver for removing the BNC connectors of the AWVG7 module	003-A041-00

Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section in the *TG700 TV Signal Generator Platform Module Installation Instructions* to remove the AWVG7 Generator module from the mainframe.
2. Disconnect the cables at J830A (upper CH 1), J830B (lower CH 1), J730A (upper CH 2), J730B (lower CH 2), J630A (upper CH 3), and J630B (lower CH 3) on the AWVG7 circuit board.
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

Replacing the chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the five screws securing the AWVG7 circuit board to the chassis.
3. Lift the circuit board up and away from the chassis, and then place it on a static free surface.
4. Set the replacement chassis on a firm, flat, static-free work surface.
5. Carefully place the circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the five screws securing the circuit board to the chassis.
7. Apply the rear panel to the chassis, and then install all the rear-panel connectors to the chassis.

Troubleshooting

This section contains instructions and procedures for troubleshooting the AWVG7 Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to *Troubleshooting* in the *TG700 TV Signal Generator Platform Service Manual*.

Equipment Required

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

Table 5-2: Equipment required for troubleshooting

Equipment description	Minimum requirements/example
Screwdriver handle	Accept Phillips-driver bits
#1 Phillips tip	Phillips-driver bit for #1 size screw heads
TG700 mainframe	A TG700 mainframe that is functioning correctly

Backing up the instrument settings

Before you begin the troubleshooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◀) or right (▶) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

Troubleshooting Trees

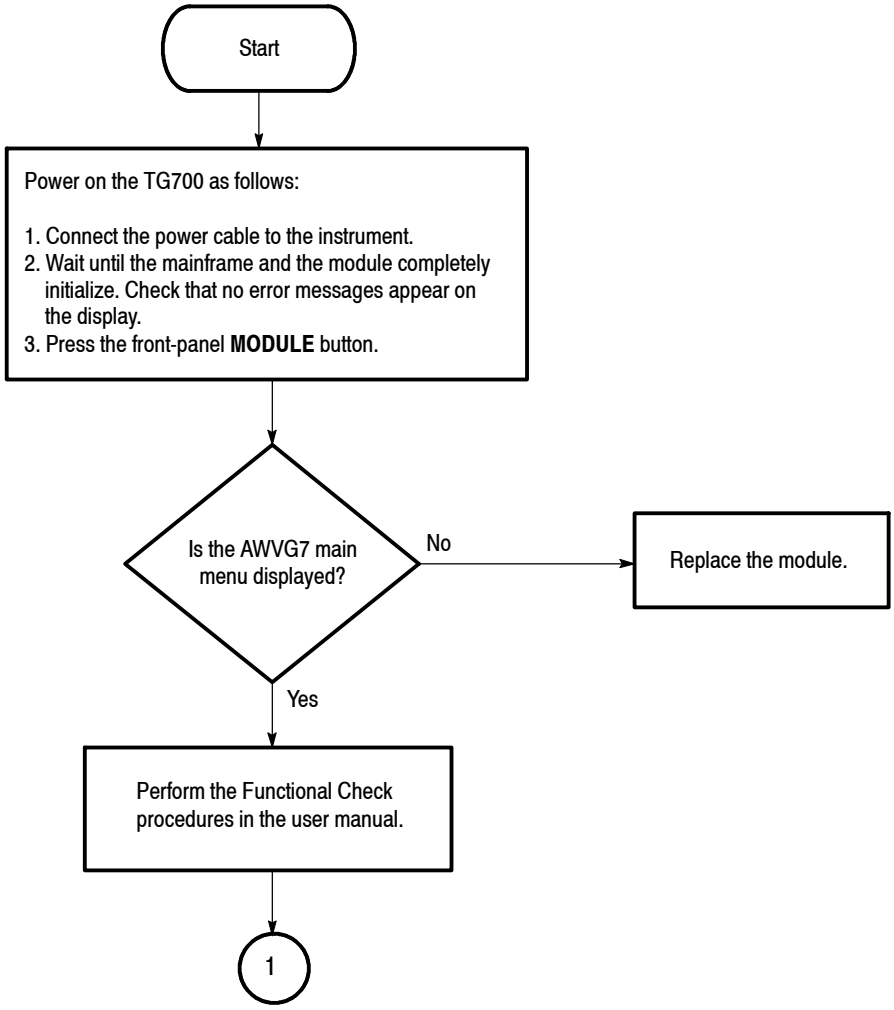

Figure 5- 1: Troubleshooting procedure (1)

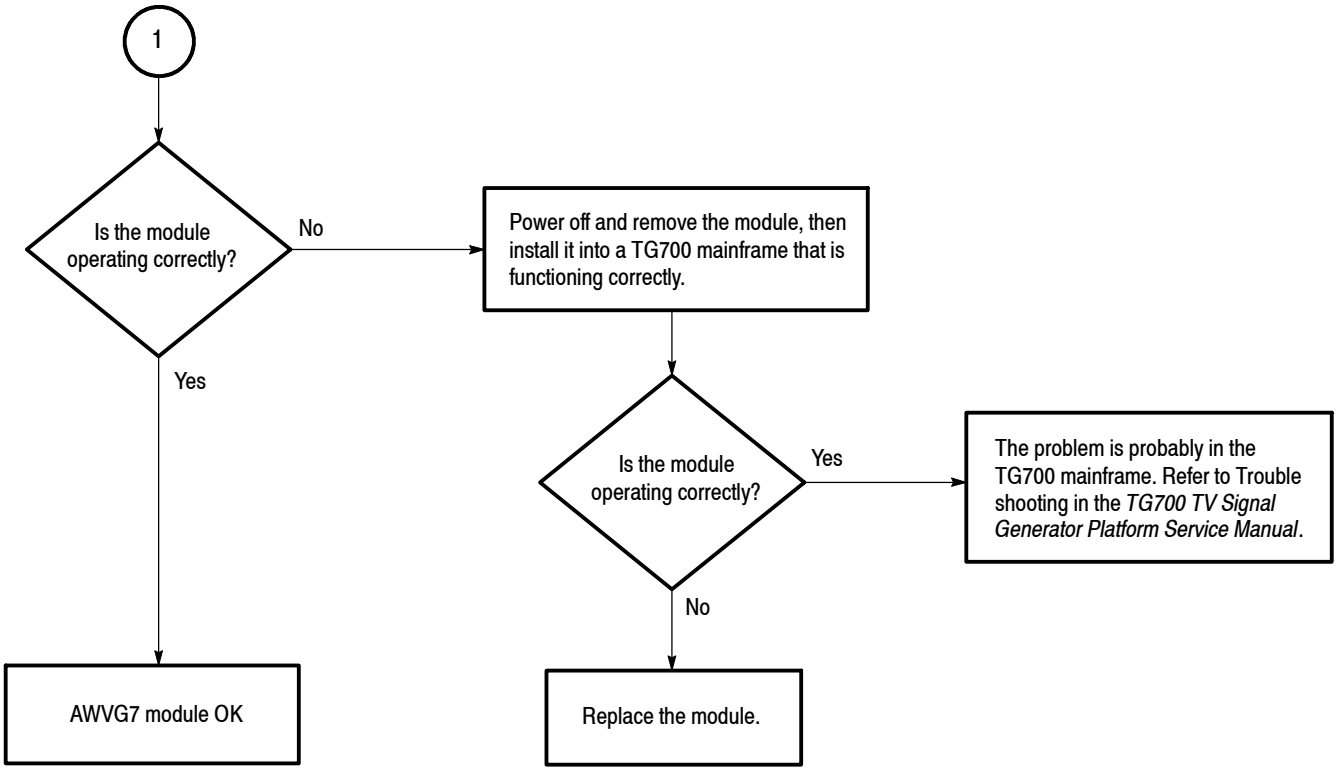

Figure 5- 2: Troubleshooting procedure (2)

Option

Option

This section describes the option that is available for the AWVG7 Generator module.

The following option is available:

- Option D1 (Test data report)

Option D1 Description

A calibration data test result report comes with the AWVG7 Generator module when you specify this option.

Diagram

Diagram

Figure 7-1 shows the AWVG7 Generator module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 TV Signal Generator Platform Service Manual*.

A block diagram of the AWVG7 Generator module is located in the *Theory of Operation* section, beginning on page 2–1.

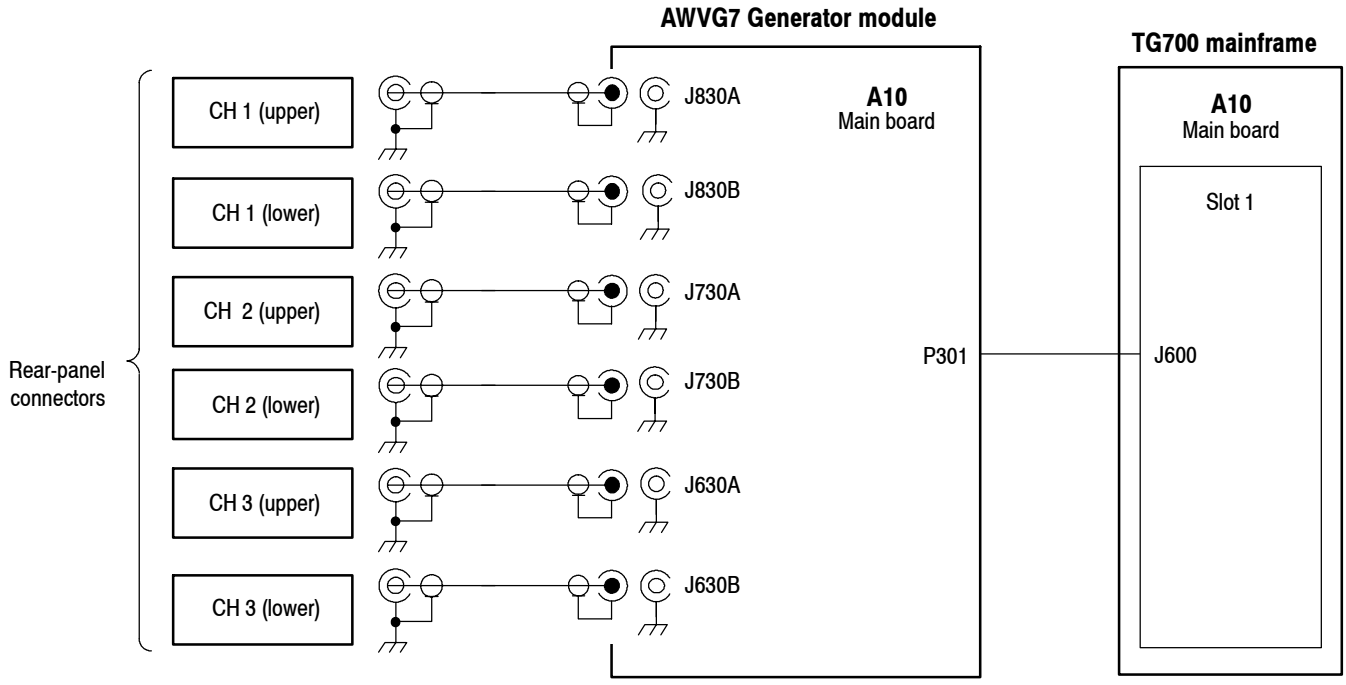

Figure 7-1: AWVG7 Generator module connections

Replaceable Parts List

Replaceable Parts List

This section contains a list of the replaceable modules for the AWVG7 Generator module. Use this list to identify and order replacement parts.

Parts Ordering Information

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

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

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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

Module Servicing

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

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

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

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

Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the AWVG7 Generator module. Use this list to identify and order replacement parts. The following table describes each column in the replaceable parts list.

Parts list column descriptions

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

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

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
8-1	116-A018-00			1	EXCHANGE MODULE:AWVG7
8-1-1	441-A269-02			1	CHASSIS,MODULE
-2	333-A454-00			1	PANEL,REAR,AL,AWVG7
-3	214-4946-00			2	SPRING,CONICAL:VXI MOUNTING SCREW,0.26 MM SUS304,5.4 MML
-4	213-1129-01			2	SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,N1 PL,CROSS REC & SLOTTED
-5	348-A128-00			2.5 CM	SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02]
-6	174-B851-00			6	CABLE ASSY,RF:75OHM COAX(RG179),5.5CM L,BNC TO MCX
-7	211-A245-01			5	SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER
-8	334-1378-03			1	MARKER,IDENT:MKD SERIAL NO.
					STANDARD ACCESSORIES
	070-A824-XX			1	MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS
	062-A249-XX			1	SOFTWARE PACKAGE:S/W(CD-R)
					OPTIONAL ACCESSORIES
	070-A800-XX			1	MANUAL,TECH:SERVICE,TG700
	003-A041-00			1	NUTDRIVER,BOX:14MM HEX,BNC RETAINING NUT,MODIFIED 19MM

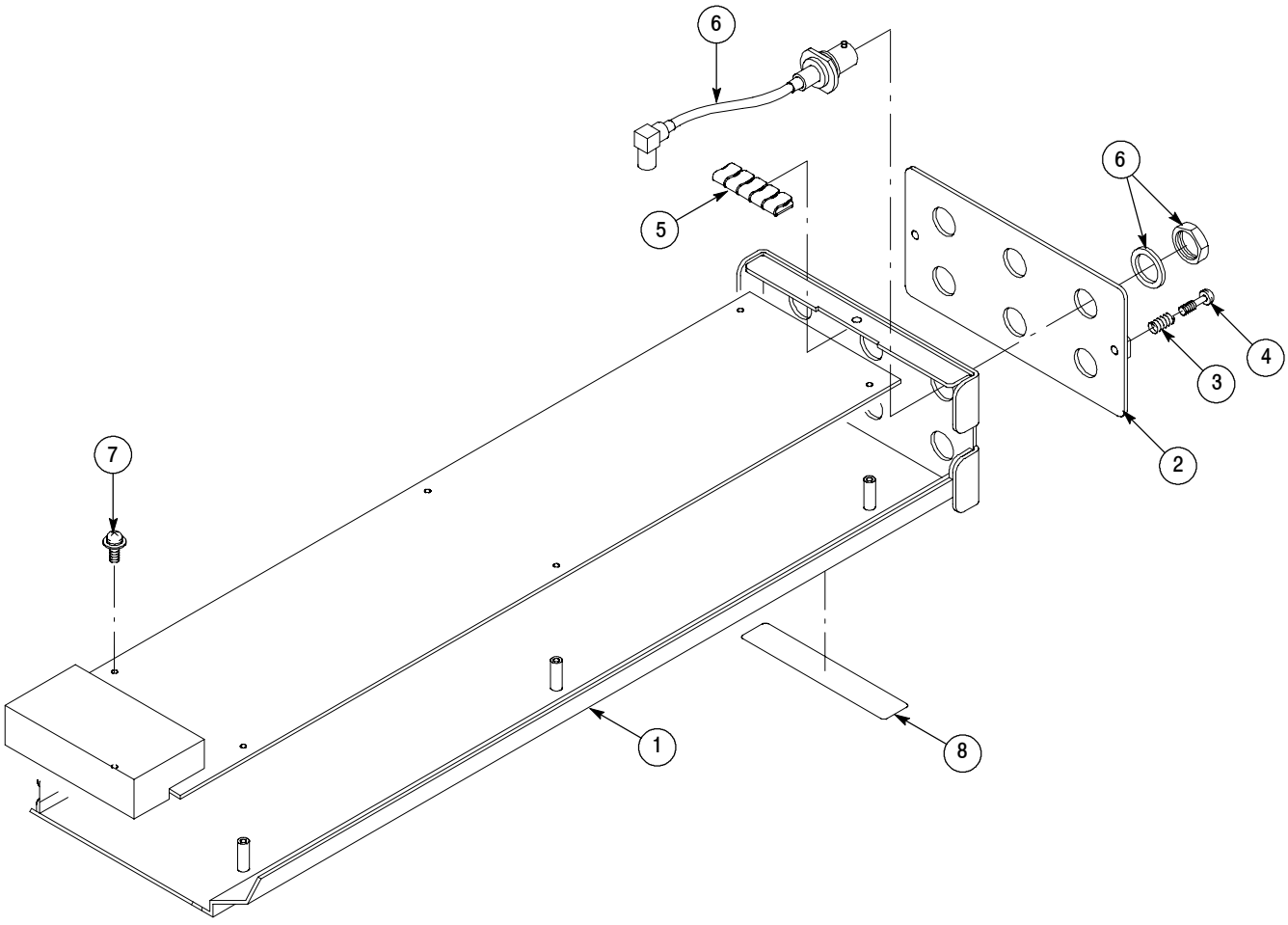

Figure 8- 1: AWVG7 Generator module exploded view

Service Manual

Tektronix

BG7
Black Generator

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

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Preface

This is the service manual for the BG7 Generator module. This manual contains information needed to service an BG7 Generator module to the module level.

Manual Structure

This manual is divided into sections, such as *Specifications* and *Theory of Operation*. Further, some sections are divided into subsections, such as *Product Description* and *Removal and Installation Procedures*.

Sections containing procedures also contain introductions to those procedures. Be sure to read these introductions because they provide information needed to do the service correctly and efficiently. The following are brief descriptions of each manual section.

- *Specifications* contains a description of the BG7 Generator module and the characteristics that apply to it..
- *Theory of Operation* is an overview of the module's design.
- *Performance Verification* contains procedures to perform the operation tests.
- *Adjustments* contains a statement explaining that no adjustment is needed for the BG7 Generator module.
- *Maintenance* contains installation, removal and replacement, and trouble-shooting instructions.
- *Options* contains a description of available options for the BG7 Generator module.
- *Diagram* contains an interconnect diagram showing the connections between the BG7 Generator module and the mainframe.
- *Replaceable Parts List* 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 BG7 Generator module.

- The *TG700 TV Signal Generator Platform User Manual* (Tektronix part number 070-A799-XX) describes how to use the TG700 mainframe and all modules. It also contains information about remote commands and programming structure for the TG700 mainframe and all modules.
- The *TG700 TV Signal Generator Platform Module Installation Instructions* (Tektronix part number 070-A824-XX) describes how to install and remove the modules, and how to upgrade the firmware of the mainframe.

Specifications

Specifications

This section contains a general product description of the BG7 Generator module followed by the operating specifications of the module.

Product Description

The BG7 Generator module is designed to be installed in the TG700 TV Signal Generator Platform.

The module is a multi format black generator with the following features:

- Four NTSC (with or without setup) /PAL black burst and HDTV trilevel sync outputs
- Individual format and timing control for each output
- Black burst with field ID and NTSC/PAL color bars signals output (Option CB)
- Full remote control using Ethernet interface

Electrical Characteristics

Tables 1–1 and 1–2 list the electrical characteristics of the BG7 Generator module.

Table 1-1: Black burst and HDTV trilevel sync outputs

Characteristic	Performance requirements	Reference information
Connector	BNC	
Number of outputs	4	BLACK1, BLACK2, BLACK3, and BLACK4
Output impedance, typical	75 Ω	
Return loss	≥ 30 dB	To 30 MHz
Burst amplitude accuracy	± 2%	NTSC and PAL
Sync amplitude accuracy		
NTSC/PAL	± 2%	
TriLevel	± 2%	
Blanking level	0 ± 50 mV	
SCH phase accuracy	0° ± 5°	
Timing offset		
Range	Full color frame	
Resolution		
NTSC/PAL	1/54 μs	≃ 18.5 ns
TriLevel	1/74.25 μs or 1/(74.25/1.001) μs	≃ 13.9 ns

Table 1-2: Color bars and black burst with field ID outputs (option CB)

Characteristic	Performance requirements	Reference information
Color bars signals		
NTSC		100% Color Bars, 75% Color Bars, SMPTE Color Bars, 40% Flat Field, SNG Color Bar, Monitor Setup Matrix
NTSC No Setup		100% Color Bars, 75% Color Bars, SMPTE Color Bars, 40% Flat Field, SNG Color Bar, Monitor Setup Matrix
PAL		100% Colour Bars, 75% Colour Bars, 100% Colour Bars Over Red, 75% Colour Bars Over Red, 40% Flat Field, SNG Color Bars, 4 Level Pluge, Monitor Setup Matrix
Black burst with field ID		Complies with SMPTE 318M
Luminance amplitude accuracy	± 1%	Measured at 700 mV.
Chrominance to luminance gain	± 2%	Chrominance is measured at red portion of the 75% Colour Bar Over Red signal.

Environmental Characteristics

Table 1–3 lists the environmental characteristics of the BG7 Generator module.

Table 1-3: Environmental characteristics

Characteristic	Description
Temperature	
Operating	0 °C to +50 °C
Nonoperating	-20 °C to +60 °C
Relative Humidity	
Operating	20% to 80% (No condensation) ; Maximum wet-bulb temperature 29.4 °C
Nonoperating	5% to 90% (No condensation) ; Maximum wet-bulb temperature 40.0 °C
Altitude	
Operating	To 4.5 km (15,000 feet) Maximum operating temperature decreases 1 °C each 300 m above 1.5 km.
Nonoperating	To 15 km (50,000 feet)
Vibration	
Operating	3.04 m/s^2 (0.31 G_{rms}), 5 to 500 Hz, 10 min, three axes
Nonoperating	23.3 m/s^2 (2.38 G_{rms}), 5 Hz to 500 Hz, 10 min, three axes
Shock	
Nonoperating	294 m/s2 (30 G), half-sine, 11 ms duration

Theory of Operation

Theory of Operation

This section describes the basic operation of the major circuit blocks in the BG7 Generator module.

For information about the TG700 mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

Bus Interface

This block provides the communication between the mainframe and the module circuit.

Sync Generator

The block creates the digital data of NTSC/PAL black burst signal or HDTV trilevel sync signal. When optional memories are added, sync generator 3 and 4 can also generate 10 field ID and NTSC/PAL color bar signals.

D/A Converter & Amp

The block consists of a D/A converter, two amplifiers, and two filters (one is for NTSC/PAL and another is for HD). The D/A converter converts the digital data from the Sync Generator to an analog signal and reconstructs the signal for output.

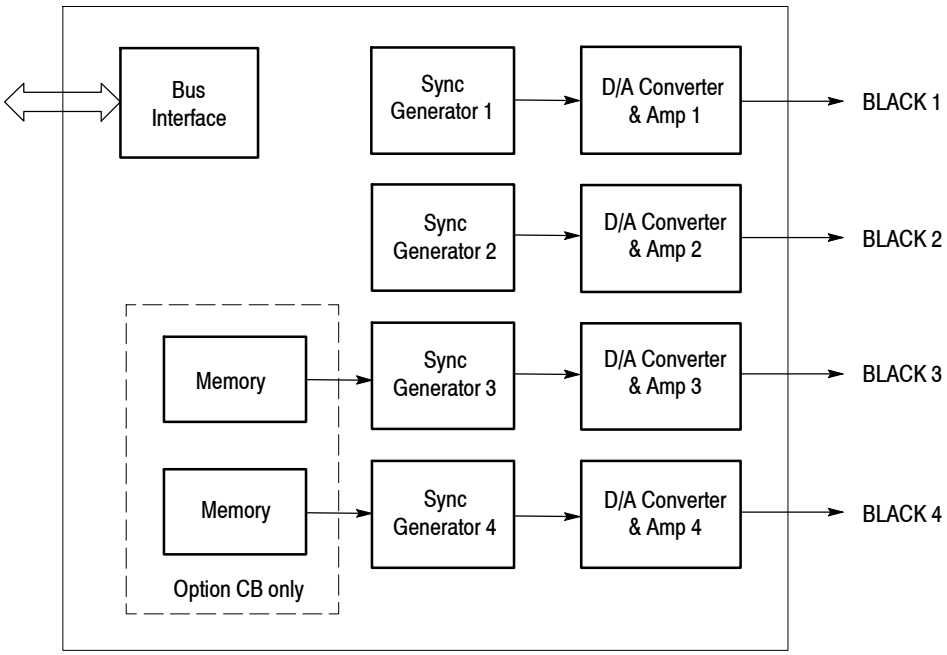

Figure 2- 1: Simplified block diagram of the BG7 Generator module

Performance Verification

Performance Verification

This section provides procedures that verify the performance and functionality of the BG7 Generator module.

Preparation for Performance Verification

Perform the following before starting the performance verification procedures:

Power On Default Settings

Before you perform the performance verification procedures, make sure that the required instrument settings are saved in the Power On Default preset.

If the instrument settings are saved in the Power On Default preset, you can recall the settings after the performance verification procedures is completed by turning the power off and back on.

Warm up

The BG7 Generator module and test equipment must have had a warm-up period of at least 20 minutes.

Equipment Required

Table 3–1 lists the equipment required for the procedures.

Table 3-1: Equipment required for performance verification

Item	No.	Minimum requirement	Recommended equipment
Oscilloscope	1	Bandwidth: 200 MHz or higher	Tektronix TDS540D
Video measurement set	1		Tektronix VM700T Option 01/11
75 Ω BNC cable	1	Length: 42 inches	Tektronix part number 012-0074-00
75 Ω feed-through terminator	1		Tektronix part number 011-0103-02
75 Ω coaxial terminator	1		Tektronix part number 011-0102-01

Calibration Data Report

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

Table 3- 2: BG7 calibration data report

Serial Number:	Cal Date:	Temperature:	Humidity:

Step	Function Tested	Minimum	Cal Data	Maximum
	Black Output (NTSC)			
1.	Blanking Level			
	BLACK 1	-50 mV	mV	+50 mV
	BLACK 2	-50 mV	mV	+50 mV
	BLACK 3	-50 mV	mV	+50 mV
	BLACK 4	-50 mV	mV	+50 mV
2.	Burst Amplitude			
	BLACK 1 (Peak to Peak Value)	280.0 mV	mV	291.4 mV
	BLACK 2 (Peak to Peak Value)	280.0 mV	mV	291.4 mV
	BLACK 3 (Peak to Peak Value)	280.0 mV	mV	291.4 mV
	BLACK 4 (Peak to Peak Value)	280.0 mV	mV	291.4 mV
3.	Sync Amplitude			
	BLACK 1	280.0 mV	mV	291.4 mV
	BLACK 2	280.0 mV	mV	291.4 mV
	BLACK 3	280.0 mV	mV	291.4 mV
	BLACK 4	280.0 mV	mV	291.4 mV
	Tri-Level Sync Output			
4.	Blanking Level			
	BLACK 1	-50 mV	mV	+50 mV
	BLACK 2	-50 mV	mV	+50 mV
	BLACK 3	-50 mV	mV	+50 mV
	BLACK 4	-50 mV	mV	+50 mV
5.	Sync Amplitude plus			
	BLACK 1	294.0 mV	mV	306.0 mV
	BLACK 2	294.0 mV	mV	306.0 mV
	BLACK 3	294.0 mV	mV	306.0 mV
	BLACK 4	294.0 mV	mV	306.0 mV

Table 3-2: BG7 calibration data report (Cont.)

Step	Function Tested	Minimum	Cal Data	Maximum
6.	Sync Amplitude minus			
	BLACK 1	294.0 mV	mV	306.0 mV
	BLACK 2	294.0 mV	mV	306.0 mV
	BLACK 3	294.0 mV	mV	306.0 mV
	BLACK 4	294.0 mV	mV	306.0 mV
	Option CB			
7.	Luminance Gain (Measured on PAL 75% Colour Bars Over Red signal)			
	BLACK 3	693.0 mV	mV	707.0 mV
	BLACK 4	693.0 mV	mV	707.0 mV
8.	Chrominance Gain (Measured on PAL 75% Colour Bars Over Red signal)			
	BLACK 3	650.6 mV	mV	677.0 mV
	BLACK 4	650.6 mV	mV	677.0 mV

Performance Verification Procedures

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

WARNING. *Dangerous electric shock hazards exist inside the TG700 mainframe. Only qualified service personnel should perform these procedures.*

Trilevel Sync Outputs

This test verifies the blanking level and sync amplitude of trilevel sync signals. The following equipment is required for the test:

- Oscilloscope
- 75 Ω BNC cable
- 75 Ω feed-through terminator

Perform the following procedure to verify that the blanking level and sync amplitude of trilevel sync signals.

1. Use the 75 Ω BNC cable and the 75 Ω feed-through terminator to connect the BLACK 1 connector on the BG7 Generator module to the oscilloscope CH1 input as shown in Figure 3–1.

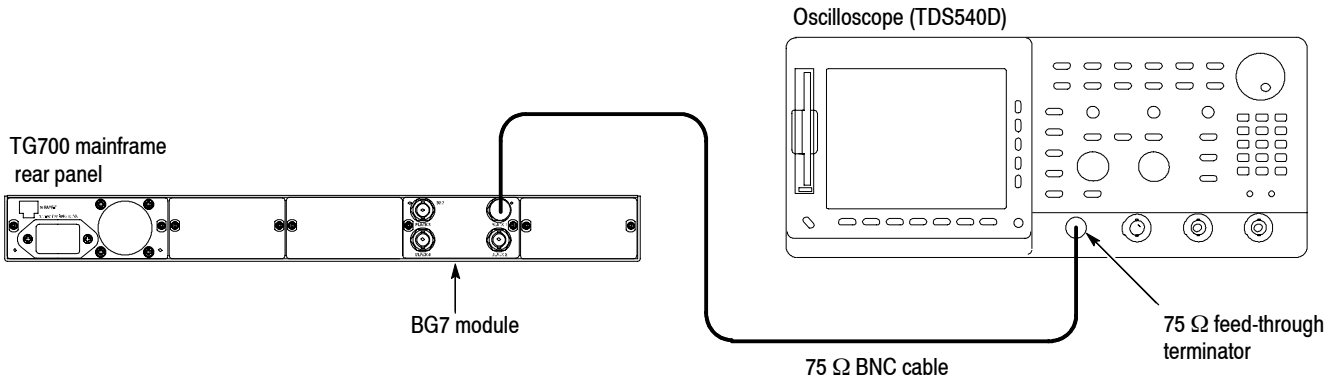

Figure 3- 1: Equipment connection for verifying the trilevel sync outputs

2. Recall the Factory Default preset as follows:
   a. Press the **MODULE** button to display the TG700 main menu.
   b. Press the up (▲) or down (▼) arrow button to select **RECALL**.

c. Press the left (◀) or right (▶) arrow button to select **Factory Default**.

d. Press the **ENTER** button to recall the factory default settings.

3. Select the **1080 59.94i** HD sync signal for BLACK 1 to BLACK 4 as follows:

a. Press the **MODULE** button to display the BG7 main menu.

b. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button.

c. Press the left (◀) or right (▶) arrow button to select **HD SYNC**, and then press the **ENTER** button.

d. Press the left (◀) or right (▶) arrow button to select **1080 59.94i**, and then press the **ENTER** button.

e. Press the **CANCEL** button twice to return the module main menu.

f. Repeat parts b through e of this step to select the 1080 59.94i HD sync signal for BLACK 2 to BLACK 4.

4. Set the oscilloscope settings as indicated below:

Vertical . . . . . 50 mV/div
Vertical offset . . . . . 0 V
Horizontal . . . . . 500 ns/div
Horizontal position . . . . Center
Trig position . . . . . 50 %
Trig slope . . . . . Rising Edge
Acquire menu . . . . . Average 32

5. Verify that the blanking level is within the range of +50 mV to –50 mV.

6. Change the oscilloscope vertical scale to 10 mV/div.

7. Align the blanking level with the center graticule line on the oscilloscope.

8. Change the oscilloscope vertical offset to 300 mV.

9. Verify that the high level of the signal (sync amplitude plus) is within the range of +0.6 div to –0.6 div to the center graticule (except for ringing of the rising edge).

10. Change the oscilloscope vertical offset to –300 mV.

11. Verify that the low level of the signal (sync amplitude minus) is within the range of +0.6 div to –0.6 div to the center graticule (except for ringing of the falling edge).

12. Change the BNC cable connection from BLACK 1 connector to the BLACK 2 connector on the BG7 Generator module and repeat steps 5 through 11.

13. Change the BNC cable connection from BLACK 2 connector to the BLACK 3 connector on the BG7 Generator module and repeat steps 5 through 11.

14. Change the BNC cable connection from BLACK 3 connector to the BLACK 4 connector on the BG7 Generator module and repeat steps 5 through 11.

Black Burst Outputs

This test verifies the blanking level, burst amplitude, and sync amplitude of black burst signals. The following equipment is required for the test:

- Oscilloscope
- Video measurement set
- 75 Ω feed-through terminator
- 75 Ω coaxial terminator

Perform the following procedure to verify that the blanking level, burst amplitude, and sync amplitude of black burst signals.

Use the equipment connection and controls from the previous test.

1. Change the BNC cable connection from BLACK 4 connector to the BLACK 1 connector on the BG7 Generator module.

2. Select the **NTSC Black Burst** signal for BLACK 1 to BLACK 4 as follows:

   a. Press the **MODULE** button to display the module main menu.

   b. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button.

   c. Press the left (◀) or right (▶) arrow button to select **NTSC**, and then press the **ENTER** button.

   d. Press the left (◀) or right (▶) arrow button to select **Black Burst**, and then press the **ENTER** button.

   e. Press the **CANCEL** button twice to return the module main menu.

   f. Repeat parts b to e of this step to select the NTSC black burst signal for BLACK 2 to BLACK 4.

3. Set the oscilloscope settings as indicated below:

   Vertical . . . . . 50 mV/div
   Vertical offset . . . . . 0 V
   Horizontal . . . . . 1 µs/div
   Horizontal position . . . . Center
   Trig position . . . . . 10 %
   Acquire menu . . . . . Average 32
   Measure menu . . . . . Mean
   Trig type . . . . . Video
   Trig standard . . . . . NTSC
   Trig source CH1
   Trig polarity . . . . . Negative
   Trig filed . . . . . Odd Field
   Trig line 2
   Trig mode . . . . . MONO (2 Field)

4. Verify that the blanking level is within the range of +50 mV to –50 mV.

5. Change the BNC cable connection from BLACK 1 connector to the BLACK 2 connector on the BG7 Generator module and repeat step 4.

6. Change the BNC cable connection from BLACK 2 connector to the BLACK 3 connector on the BG7 Generator module and repeat step 4.

7. Change the BNC cable connection from BLACK 3 connector to the BLACK 4 connector on the BG7 Generator module and repeat step 4.

8. Change the BNC cable connection from BLACK 4 connector to the BLACK 1 connector on the BG7 Generator module.

9. Disconnect the BNC cable from the 75 Ω feed-through terminator on the oscilloscope's input, and then connect the BNC cable to the CHAN A connector on the video measurement set as shown in Figure 3–2.

10. Use the 75 Ω coaxial terminator to terminate the other loop through to the CHAN A connector on the video measurement set.

11. Press the **Measure** button on the video measurement set to open the Measure mode display.

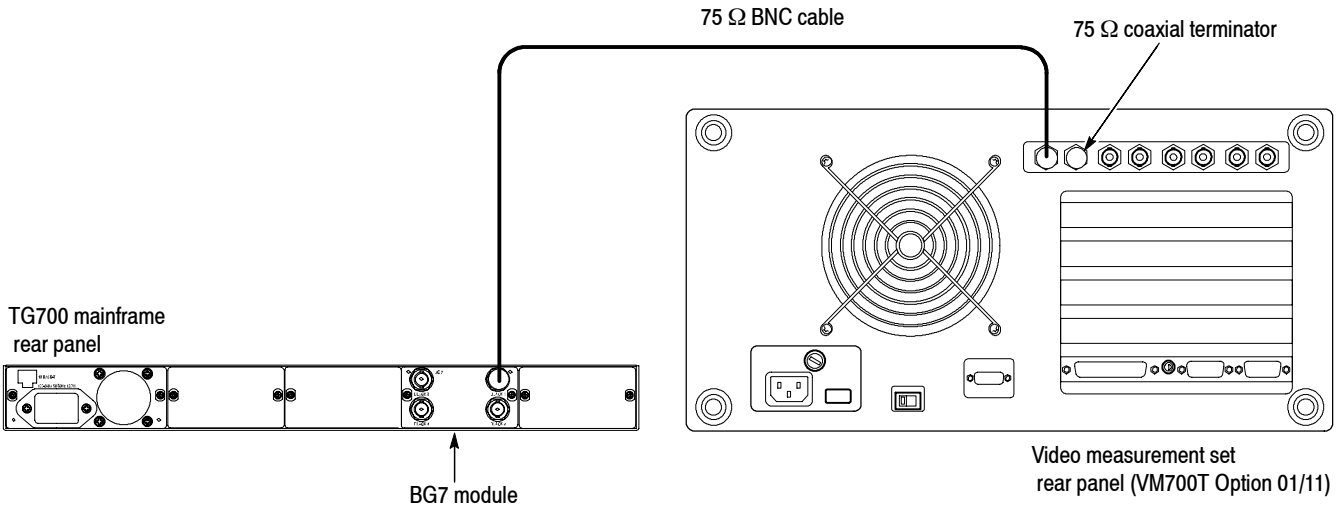

Figure 3- 2: Equipment connection for verifying burst and sync amplitude

12. Touch the **Mode** soft key to set the instrument to Analog mode, and then touch the **H_Timing** soft key.

13. Press the **Menu** button to display the H_Timing main menu.

14. Touch the **Average** soft key and rotate the front-panel knob to set the value to 32.

15. Press the **Select Line** button and rotate the front-panel knob set the measurement line to 100 (Field=1 Line=100).

16. Verify that the burst and sync amplitude are within the range of 39.2 IRE to 40.8 IRE.

17. Change the BNC cable connection from BLACK 1 connector to the BLACK 2 connector on the BG7 Generator module and repeat step 16.

18. Change the BNC cable connection from BLACK 2 connector to the BLACK 3 connector on the BG7 Generator module and repeat step 16.

19. Change the BNC cable connection from BLACK 3 connector to the BLACK 4 connector on the BG7 Generator module and repeat step 16.

Luminance and Chrominance Gain (Option CB Only). This test verifies the luminance and chrominance gain of the color bars signal.

20. Change the BNC cable connection from BLACK 4 connector to the BLACK 3 connector on the BG7 Generator module.

21. Select the **75% Colour Bars Over Red** signal for BLACK 3 and BLACK 4 as follows:

a. Press the **MODULE** button to display the BG7 main menu.

b. Press the left (◀) or right (▶) arrow button to select **BLACK 3**, and then press the **ENTER** button.

c. Press the left (◀) or right (▶) arrow button to select **PAL**, and then press the **ENTER** button.

d. Press the left (◀) or right (▶) arrow button to select **75% Colour Bars Over Red**, and then press the **ENTER** button.

e. Press the **CANCEL** button twice to return the module main menu.

f. Repeat parts b through d of this step to select the 75% Colour Bars Over Red signal for BLACK 4.

22. Press the **Measure** button on the video measurement set to open the Measure mode display.

23. Touch the **Video Standard** soft key to change the acceptable video standard for PAL.

24. In the Measure mode display, touch the **Color Bar** soft key to open the Color Bar measurement display.

25. Press the **Menu** button to display the Color Bar main menu.

26. Touch the **Average** soft key and rotate the front-panel knob to set the value to 256.

27. Press the **Select Line** button and rotate the front-panel knob set the measurement line to 100 (Field=1 Line=100).

28. Verify that the luminance gain (level) is within the range of 693.0 mV to 707.0 mV.

29. Verify that the chrominance gain (level) is within the range of 650.6 mV to 677.0 mV. Note that the chrominance gain is measured by Red.

30. Change the BNC cable connection from BLACK 3 connector to the BLACK 4 connector on the BG7 Generator module and repeat steps 28 and 29.

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

Adjustment Procedures

Adjustment Procedures

This section contains information needed to adjust the BG7 Generator module.

Adjustment in the BG7 Generator module are for the output offset, output gain, and luminance gain.

Requirements for Adjustment

Before doing the adjustment, note the following requirements.

Personnel This procedure is only to be performed by trained service technicians.

Warm-Up Period The BG7 Generator module requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. Adjustments done before the operating temperature has stabilized may cause errors in performance.

Access When adjusting the blanking, luminance, and chrominance levels, you need to remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

Equipment Required

Table 4–1 lists the equipment required to adjust the output offset, output gain, and luminance gain.

Table 4-1: Equipment required

Item	No.	Minimum requirement	Recommended equipment
TV signal generator platform	1		Tektronix TG700
Digital multimeter	1	5 1/2 digits	FLUKE 8842A
Video measurement set	1		Tektronix VM700T Option 01/11
75 Ω BNC cable	1	Length: 42 inches	Tektronix part number 012-0074-00
75 Ω coaxial terminator	1		Tektronix part number 011-0102-03
BNC T connector	1		Tektronix part number 103-0030-00
BNC female to dual banana adapter	1		Tektronix part number 103-0090-00

Output Offset and Gain Adjustment

Preparation

To perform the output offset and gain adjustment, you must first remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

After you have removed the top cover, find the variable resistors on the BG7 circuit board. See Figure 4–1.

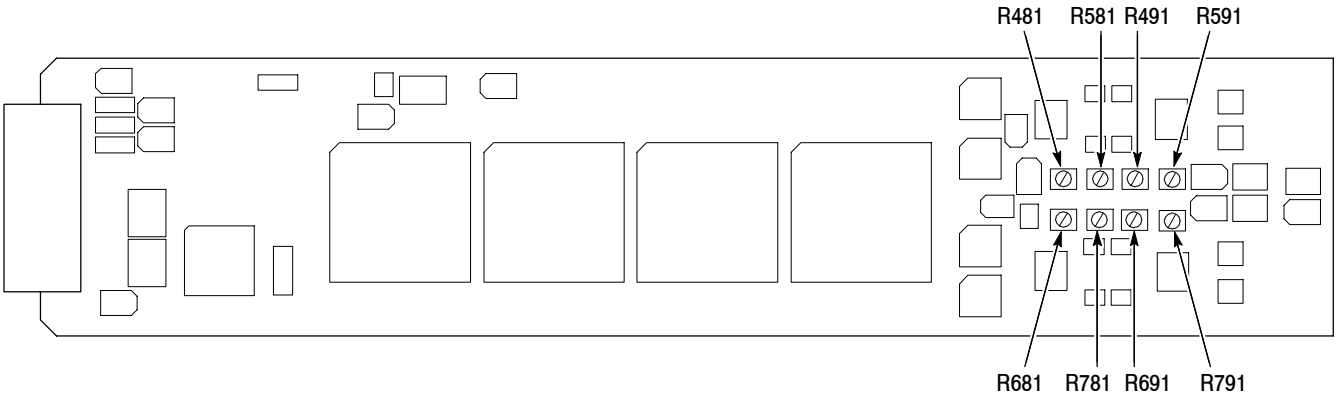

Figure 4-1: BG7 circuit board view

Procedure

WARNING. *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable, BNC T connector, 75 Ω coaxial terminator, and BNC female-to-dual banana adapter to connect the BLACK 1 connector on the BG7 Generator module to the INPUT connector on the digital multi meter as shown in Figure 4–2.

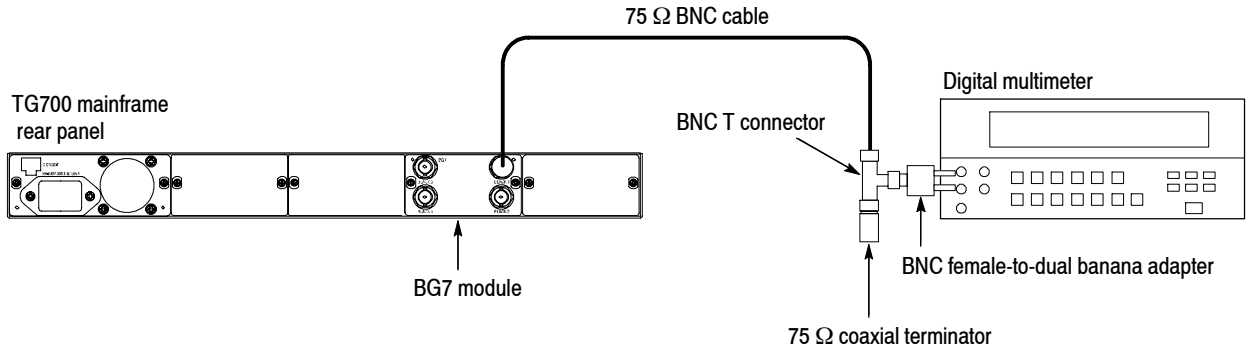

Figure 4-2: Equipment connection for adjusting the output offset and gain

2. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode.
3. Select the DAC Offset (0V DC) calibration signal for BLACK 1 through BLACK 4 as follows:
   a. Press the **MODULE** button to display the **BG7** main menu.
   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.
   c. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button.
   d. Press the left (◀) or right (▶) arrow button to select **CAL : DAC Offset (0V DC)**, and then press the **ENTER** button.
   e. Press the **CANCEL** button.
   f. Repeat parts c through e of this step to select the calibration signal for BLACK 2 through BLACK 4.
4. Locate variable resistor R491 on the BG7 circuit board. See Figure 4–1.
5. Adjust R491 so that the output offset is 0 V ± 1 mV.
6. Change the BNC cable connection from BLACK 1 connector to the BLACK 2 connector on the BG7 Generator module.
7. Locate variable resistor R591 on the BG7 circuit board. See Figure 4–1.
8. Adjust R591 so that the output offset is 0 V ± 1 mV.
9. Change the BNC cable connection from BLACK 2 connector to the BLACK 3 connector on the BG7 Generator module.
10. Locate variable resistor R691 on the BG7 circuit board. See Figure 4–1.

11. Adjust R691 so that the output offset is 0 V ± 1 mV.

12. Change the BNC cable connection from the BLACK 3 connector to the BLACK 4 connector on the BG7 Generator module.

13. Locate variable resistor R791 on the BG7 circuit board. See Figure 4–1.

14. Adjust R791 so that the output offset is 0 V ± 1 mV.

15. Select the DAC Gain (1.000V DC) calibration signal for BLACK 1 through BLACK 4 as follows:

a. Press the left (◀) or right (▶) arrow button to select **BLACK 1**, and then press the **ENTER** button.

b. Press the left (◀) or right (▶) arrow button to select **CAL : DAC Gain (1.000V DC)**, and then press the **ENTER** button.

c. Press the **CANCEL** button.

d. Repeat parts a through c of this step to select the calibration signal for BLACK 2 through BLACK 4.

16. Locate variable resistor R481 on the BG7 circuit board. See Figure 4–1.

17. Adjust R481 so that the output gain is 1 V ± 1 mV.

18. Change the BNC cable connection from the BLACK 1 connector to the BLACK 2 connector on the BG7 Generator module.

19. Locate variable resistor R581 on the BG7 circuit board. See Figure 4–1.

20. Adjust R581 so that the output gain is 1 V ± 1 mV.

21. Change the BNC cable connection from the BLACK 2 connector to the BLACK 3 connector on the BG7 Generator module.

22. Locate variable resistor R681 on the BG7 circuit board. See Figure 4–1.

23. Adjust R681 so that the output gain is 1 V ± 1 mV.

24. Change the BNC cable connection from the BLACK 3 connector to the BLACK 4 connector on the BG7 Generator module.

25. Locate variable resistor R781 on the BG7 circuit board. See Figure 4–1.

26. Adjust R781 so that the output gain is 1 V ± 1 mV.

Luminance Gain Adjustment (Option CB Only)

Preparation

To perform the luminance gain adjustment, you must first remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

After you have removed the top cover, find the variable resistors on the BG7 circuit board. See Figure 4–1.

Procedure

WARNING. *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable to connect the BLACK 3 connector on the BG7 Generator module to the CHAN A connector on the video measurement set as shown in Figure 4–3.
2. Use the 75 Ω coaxial terminator to terminate the other loop through to the CHAN A connector on the video measurement set.

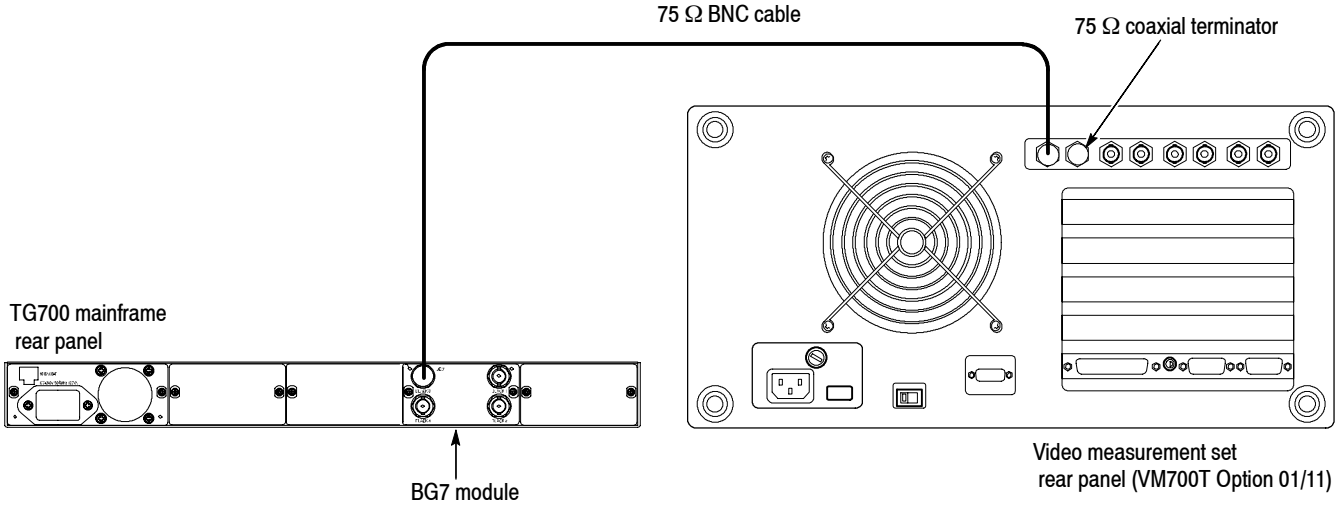

Figure 4-3: Equipment connection for adjusting luminance gain

3. Select the **75% Colour Bars** signal for BLACK 3 and BLACK 4 as follows:

   a. Press the **MODULE** button to display the BG7 main menu.

   b. Press the left (◀) or right (▶) arrow button to select **BLACK 3**, and then press the **ENTER** button.

   c. Press the left (◀) or right (▶) arrow button to select **PAL**, and then press the **ENTER** button.

   d. Press the left (◀) or right (▶) arrow button to select **75% Colour Bars**, and then press the **ENTER** button.

   e. Press the **CANCEL** button twice to return the module main menu.

   f. Repeat parts steps b through d of this step to select the 75% Colour Bars signal for BLACK 4.

4. Press the **Measure** button on the video measurement set to open the Measure mode display.

5. Touch the **Video Standard** soft key to change the acceptable video standard for PAL.

6. In the Measure mode display, touch the **Color Bar** soft key to open the Color Bar measurement display.

7. Press the **Menu** button to display the Color Bar main menu.

8. Touch the **Average** soft key and rotate the front-panel knob to set the value to 16.

9. Locate variable resistor R681 on the BG7 circuit board. See Figure 4–1.

10. Adjust R681 so that the luminance gain (White) is 700 mV ± 1.5 mV.

11. Verify that chrominance gain (Red) is within the range of 658.8 mV to 668.8 mV.

12. Change the BNC cable connection from the BLACK 3 connector to the BLACK 4 connector on the BG7 Generator module.

13. Locate variable resistor R781 on the BG7 circuit board. See Figure 4–1.

14. Adjust R781 so that the luminance gain (White) is 700 mV ± 1.5 mV.

15. Verify that chrominance gain (Red) is within the range of 658.8 mV to 668.8 mV.

Maintenance

Maintenance

This section contains instructions and procedures for maintaining the BG7 Generator module. For information on servicing the mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

The following information can be found in this section:

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

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

Preparation

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

Servicing Prerequisites

Ensure 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.

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.*

Inspecting and Cleaning Procedures

Clean the mainframe and modules often enough to prevent dust or dirt from accumulating. Refer to *Inspecting and Cleaning Procedures* in the *TG700 TV Signal Generator Platform Service Manual*.

Performance Verification

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

Repackaging Instructions

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

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

Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the BG7 Generator module.

Tools Required

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

Table 5-1: Required tools

Name	Description	Tektronix part number
Screwdriver handle	Accepts Phillips-driver bits	
#1 Phillips tip	Phillips-driver bit for #1 size screws	
#2 Phillips tip	Phillips-driver bit for #2 size screws	
Nut driver, 14 mm	Special nut driver for removing the BNC connectors of the BG7 module	003-A041-00

Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section in the *TG700 TV Signal Generator Platform Module Installation Instructions* to remove the BG7 Generator module from the mainframe.
2. Disconnect the cables at P830 (BLACK 1), J880 (BLACK 2), J930 (BLACK 3) and J980 (BLACK 4) on the BG7 circuit board.
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

Replacing the chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the six screws securing the BG7 circuit board to the chassis.
3. Lift the circuit board up and away from chassis, and then place it on a static free surface.
4. Set the replacement chassis on a firm, flat, static-free work surface.
5. Carefully place the circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the five screws securing the circuit board to the chassis.
7. Apply the rear panel to the chassis, and then install all the rear-panel connectors to the chassis.

Troubleshooting

This section contains instructions and procedures for troubleshooting the BG7 Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to *Troubleshooting* in the *TG700 TV Signal Generator Platform Service Manual*.

Equipment Required

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

Table 5-2: Equipment required for troubleshooting

Equipment description	Minimum requirements/example
Screwdriver handle	Accept Phillips-driver bits
#1 Phillips tip	Phillips-driver bit for #1 size screw heads
TG700 mainframe	A TG700 mainframe that is functioning correctly

Backing up the instrument settings

Before you begin the trouble shooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◀) or right (▶) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

Troubleshooting Trees

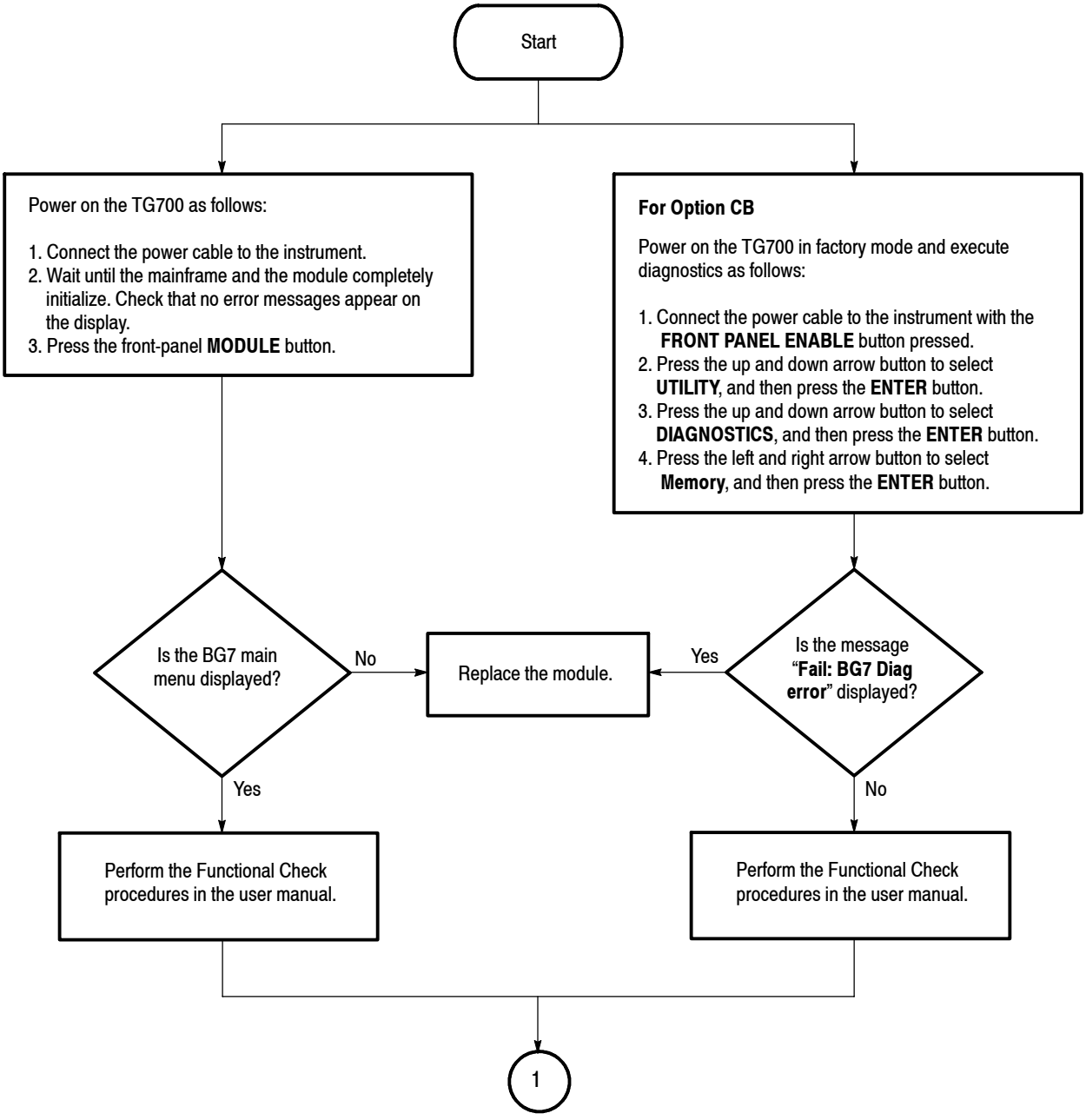

Figure 5- 1: Troubleshooting procedure (1)

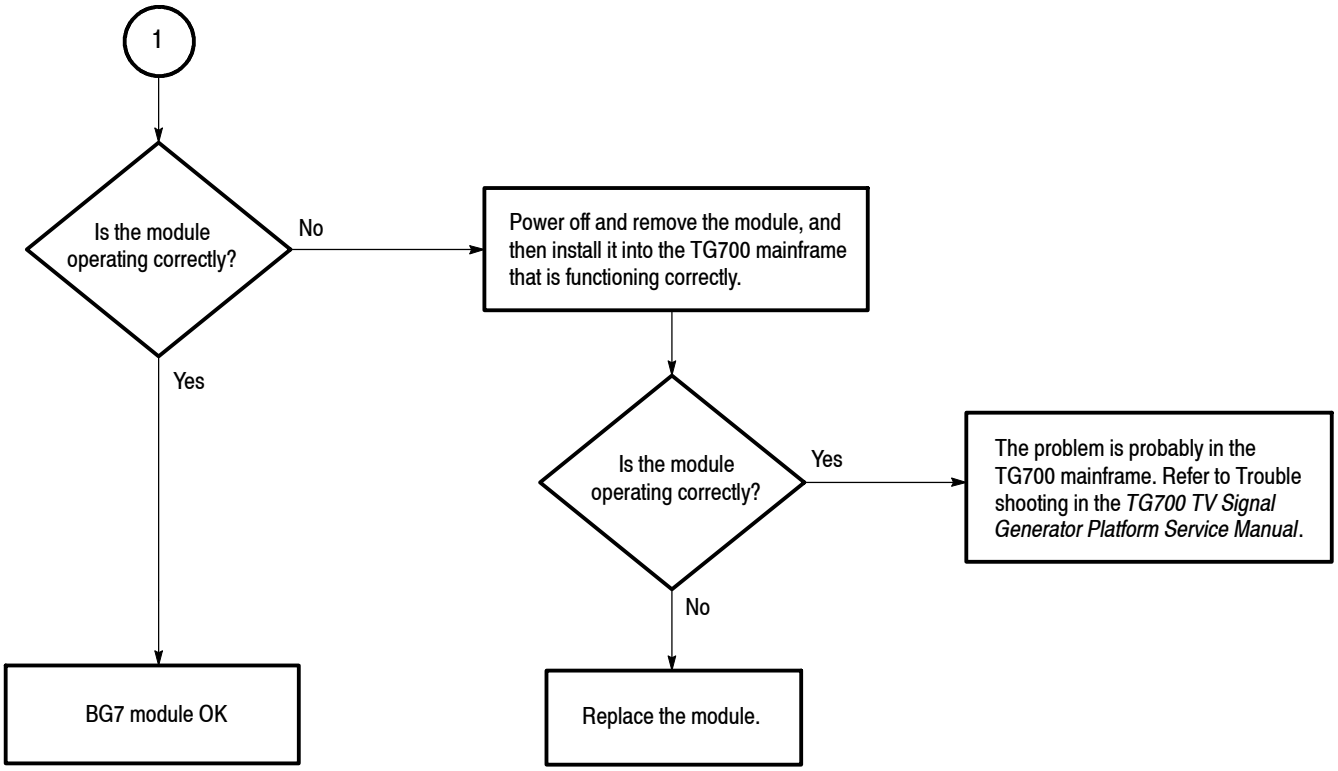

Figure 5- 2: Troubleshooting procedure (2)

Options

Options

This section describes options that are available for the BG7 Generator module.

The following options are available.

- Option CB (Adds NTSC/PAL Color Bars)
- Option D1 (Test data report)

Option CB Description

Option CB adds 10 field ID and NTSC/PAL color bar signals to the standard black burst signal. These additional signals are available from the BLACK 3 and BLACK 4 outputs only.

Option D1 Description

A calibration data test result report will be provided with the BG7 Generator module when this option is specified.

Diagram

Diagram

Figure 7-1 shows the BG7 Generator module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 TV Signal Generator Platform Service Manual*.

A block diagram of the BG7 Generator module is located in the *Theory of Operation* section, beginning on page 2–1.

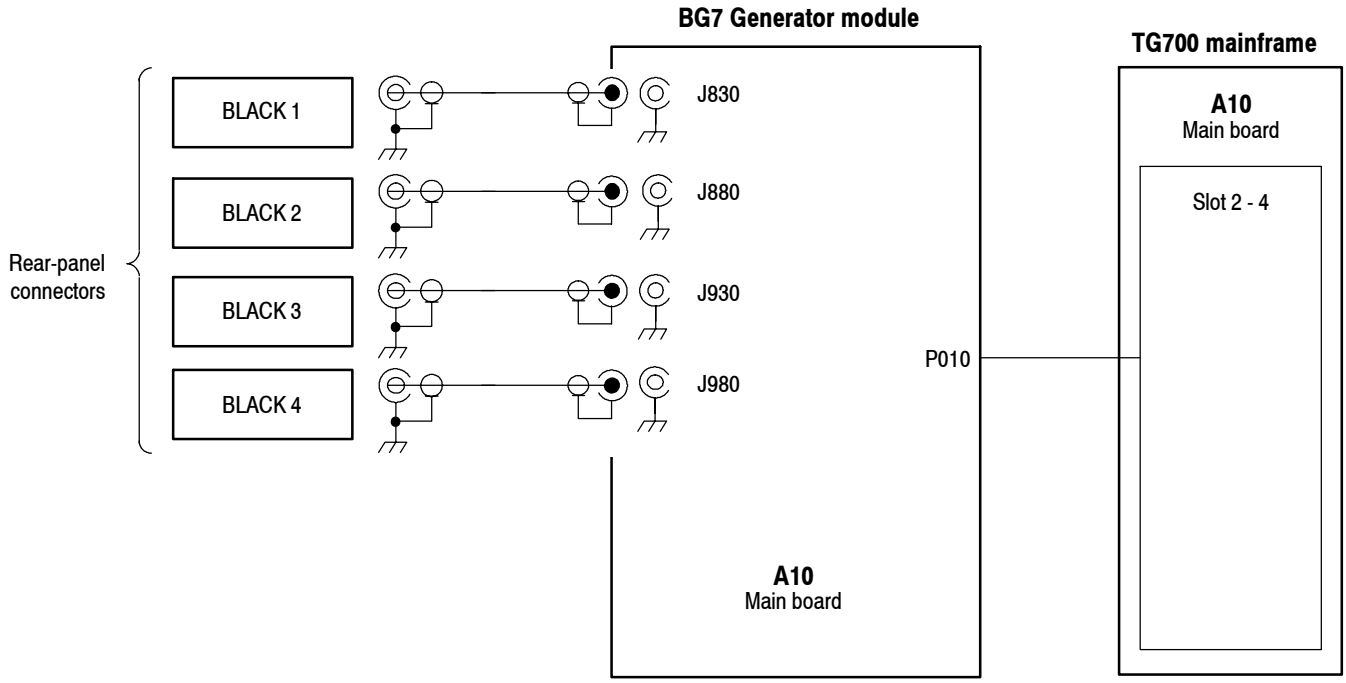

Figure 7-1: BG7 Generator module connections

Replaceable Parts List

Replaceable Parts List

This section contains a list of the replaceable modules for the BG7 Generator module. Use this list to identify and order replacement parts.

Parts Ordering Information

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

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

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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

Module Servicing

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

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

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

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

Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the BG7 Generator module. 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.

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

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
8-1	116-A003-01			1	EXCHANGE MODULE:BG7
	116-A004-01			1	EXCHANGE MODULE:BG7-CB
8-1-1	441-A269-02			1	CHASSIS,MODULE AGL7:ASSY
-2	333-A406-00			1	PANEL,REAR:BG7,AL
-3	214-4946-00			2	SPRING,CONICAL:VXI MOUNTING SCREW,0.26 MM SUS304,5.4 MML
-4	213-1129-01			2	SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,N1 PL,CROSS REC & SLOTTED
-5	348-A128-00			2.5 CM	SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02]
-6	174-B851-00			4	CABLE ASSY,RF:75OHM COAX(RG179),5.5CM L,BNC TO MCX
-7	211-A245-01			5	SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER
-8	334-1378-03			1	MARKER,IDENT:MKD SERIAL NO.
					STANDARD ACCESSORIES
	070-A824-XX			1	MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS
	062-A249-XX			1	SOFTWARE PACKAGE:S/W(CD-R)
					OPTIONAL ACCESSORIES
	070-A800-XX			1	MANUAL,TECH:SERVICE,TG700
	003-A041-00			1	NUTDRIVER,BOX:14MM HEX,BNC RETAINING NUT,MODIFIED 19MM

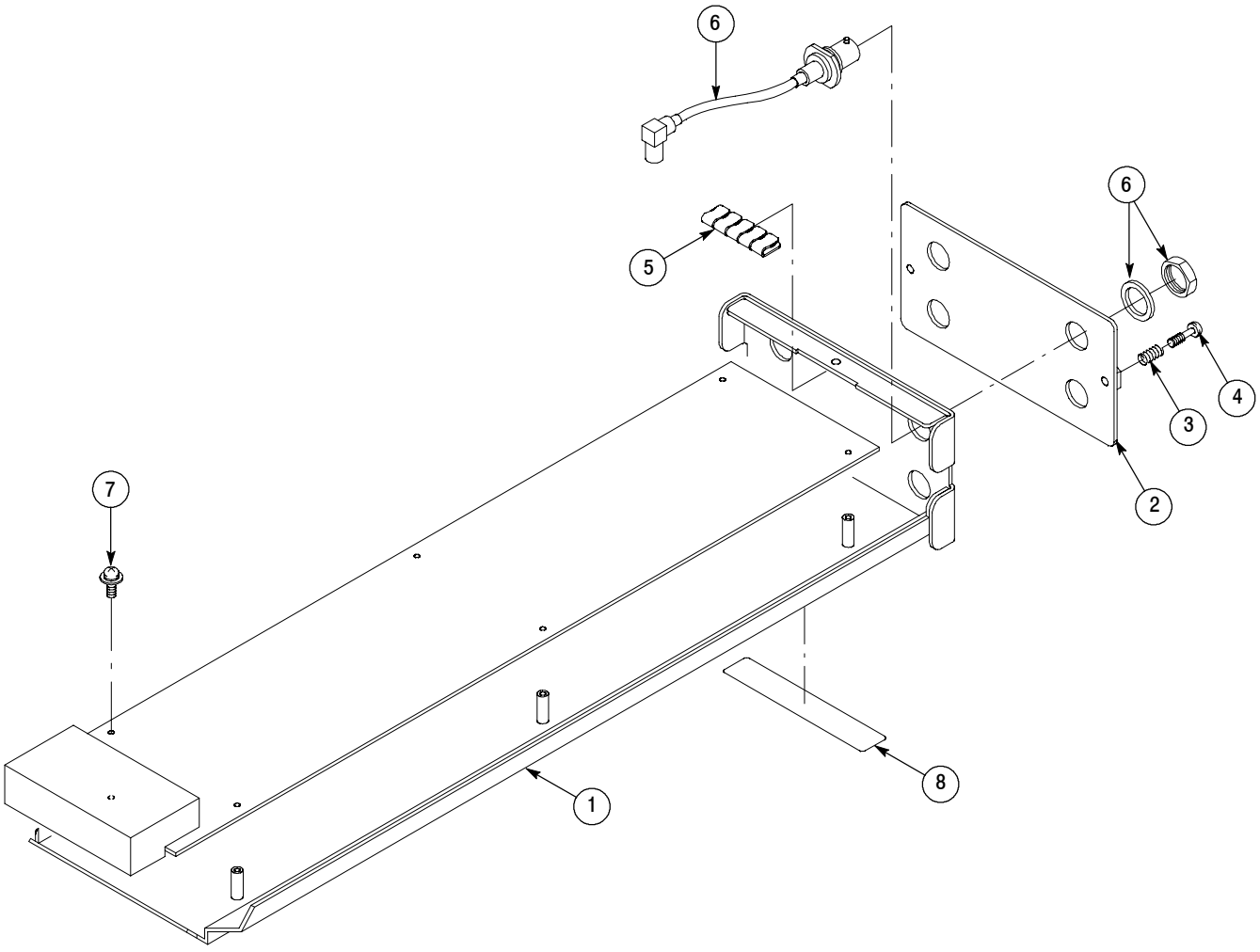

Figure 8-1: BG7 Generator module exploded view

Service Manual

Tektronix

DVG7
Digital Video Generator

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

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

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Preface

This is the service manual for the DVG7 Digital Video Generator module. This manual contains information needed to service an DVG7 Generator module to the module level.

Manual Structure

This manual is divided into sections, such as *Specifications* and *Theory of Operation*. Further, some sections are divided into subsections, such as *Product Description* and *Removal and Installation Procedures*.

Sections containing procedures also contain introductions to those procedures. Be sure to read these introductions because they provide information needed to do the service correctly and efficiently. The following are brief descriptions of each manual section.

- *Specifications* contains a description of the DVG7 Generator module and the characteristics that apply to it.
- *Theory of Operation* is an overview of the module's design.
- *Performance Verification* contains procedures to perform the operation tests.
- *AdjustmentProcedures* contains procedures for adjusting a DVG7 Generator module to meet warranted characteristics.
- *Maintenance* contains installation, removal and replacement, and trouble-shooting instructions.
- *Options* contains a description of available options for the DVG7 Generator module.
- *Diagram* contains an interconnect diagram showing the connections between the DVG7 Generator module and the mainframe.
- *Replaceable Parts List* 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 DVG7 Generator module.

- The *TG700 TV Signal Generator Platform User Manual* (Tektronix part number 070-A799-XX) describes how to use the TG700 mainframe and all modules. It also contains information about remote commands and programming structure for the TG700 mainframe and all modules.
- The *TG700 TV Signal Generator Platform Module Installation Instructions* (Tektronix part number 070-A824-XX) describes how to install and remove the modules, and how to upgrade the firmware of the mainframe.

Specifications

Specifications

This section contains a general product description of the DVG7 Generator module followed by the operating specifications of the module.

Product Description

The DVG7 Generator module is designed to be installed in the TG700 TV Signal Generator Platform.

The module is a digital video generator which provides NTSC composite digital signals and 525/625 component digital signals. The module contains the following features:

- Two serial digital video outputs
- Two serial digital black outputs (Option BK)
- Overlay of circle, text, or logo on the video signal
- Moving picture, generated by scrolling the active picture area of the output test signal
- Up to 16 channels of Embedded Audio
- Full remote control using Ethernet interface

The module can generate video signals with 24 (or 20) bit embedded digital audio with a sample rate of 48 kHz.

The following audio frequencies are supported:

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

Electrical Characteristics

Tables 1–1 through 1–3 list the electrical characteristics of the DVG7 Generator module.

Table 1-1: Serial digital video signal outputs

Characteristic	Performance requirements	Reference information
Connector	BNC	
Number of output	2	SIGNAL 1 and SIGNAL 2
Bit Rate	143 Mbps 270 Mbps	
Signal amplitude, typical		800 mV ± 10%
Rise and fall times, typical		0.4 ns to 1.5 ns, 20% to 80%
Jitter, typical		≤ 0.2 UIp-p for all jitter frequencies above 10 Hz.
Return loss	> 15 dB	5 MHz to 270 MHz

Table 1-2: Serial digital black signal outputs (Option BK only)

Characteristic	Performance requirements	Reference information
Connector	BNC	
Number of outputs	2	BLACK 1 and BLACK 2
Bit Rate	143 Mbps 270 Mbps	
Signal amplitude, typical		800 mV ± 10%
Rise and fall times, typical		0.4 ns to 1.5 ns, 20% to 80%
Jitter, typical		≤ 0.2 UIp-p for all jitter frequencies above 10 Hz.
Return loss	> 15 dB	5 MHz to 270 MHz

Table 1-3: Embedded audio

Characteristic	Performance requirements	Reference information
Number of channels	16 channels in 4 groups; 8 AES/EBU audio pairs	
Audio tones		
Frequency	Silence to 20 kHz; 31 discrete settings	
Level	-60 to 0 dBFS in 1 dB steps	
Pre-emphasis		Emphasis status bits can be inserted.

Environmental Characteristics

Table 1–4 lists the environmental characteristics of the DVG7 Generator module.

Table 1-4: Environmental characteristics

Characteristic	Description
Temperature	
Operating	0 °C to +50 °C
Non-operating	-20 °C to +60 °C
Relative Humidity	
Operating	20% to 80% (No condensation) ; Maximum wet-bulb temperature 29.4 °C
Non-operating	5% to 90% (No condensation) ; Maximum wet-bulb temperature 40.0 °C
Altitude	
Operating	To 4.5 km (15,000 feet) Maximum operating temperature decreases 1 °C each 300 m above 1.5 km.
Non-operating	To 15 km (50,000 feet)
Vibration	
Operating	3.04 m/s^2 (0.31 G_{rms}), 5 to 500 Hz, 10 min, three axes
Non-operating	23.3 m/s^2 (2.38 G_{rms}), 5 Hz to 500 Hz, 10 min, three axes
Shock	
Non-operating	294 m/s2 (30 G), half-sine, 11 ms duration

Theory of Operation

Theory of Operation

This section describes the basic operation of the major circuit blocks in the DVG7 Generator module.

For information about the TG700 mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

Bus Interface This block provides the communication between the mainframe and the module circuit.

Address Generator This block consists of a frame delay, an MPU interface, a sequencer, an SDRAM controller, and a blanking data generator. It interfaces the Frame Memory and the Line Memory and controls the output sequence of the video data in these memories.

Frame Memory The frame memory contains a series of pointers that control the order the video lines stored in Line Memory are used to produce the serial digital signals.

Line Memory The memory holds the actual sample points that define a serial digital signal.

Overlay Controller This block consists of an MPU interface and an overlay controller. It inserts data from the Overlay Memory into the Line Memory data stream to create circular patterns, ID text, and logo.

Overlay Memory The memory generates timings to multiplex the line memory data and the overlay data used for a circle, ID text, and logo overlay.

Formatter This block consists of an audio control packet generator, a data packet generator, an MPU interface, and an SRAM controller. The formatter inserts embedded audio data in serial digital signals.

Audio Memory The memory contains embedded audio data.

Serializer This block converts a 10 bits parallel data to SDI signal.

Black Generator (Option BK Only) This block generates black or gray (40% gray) signal for the BLACK 1 and BLACK 2 outputs.

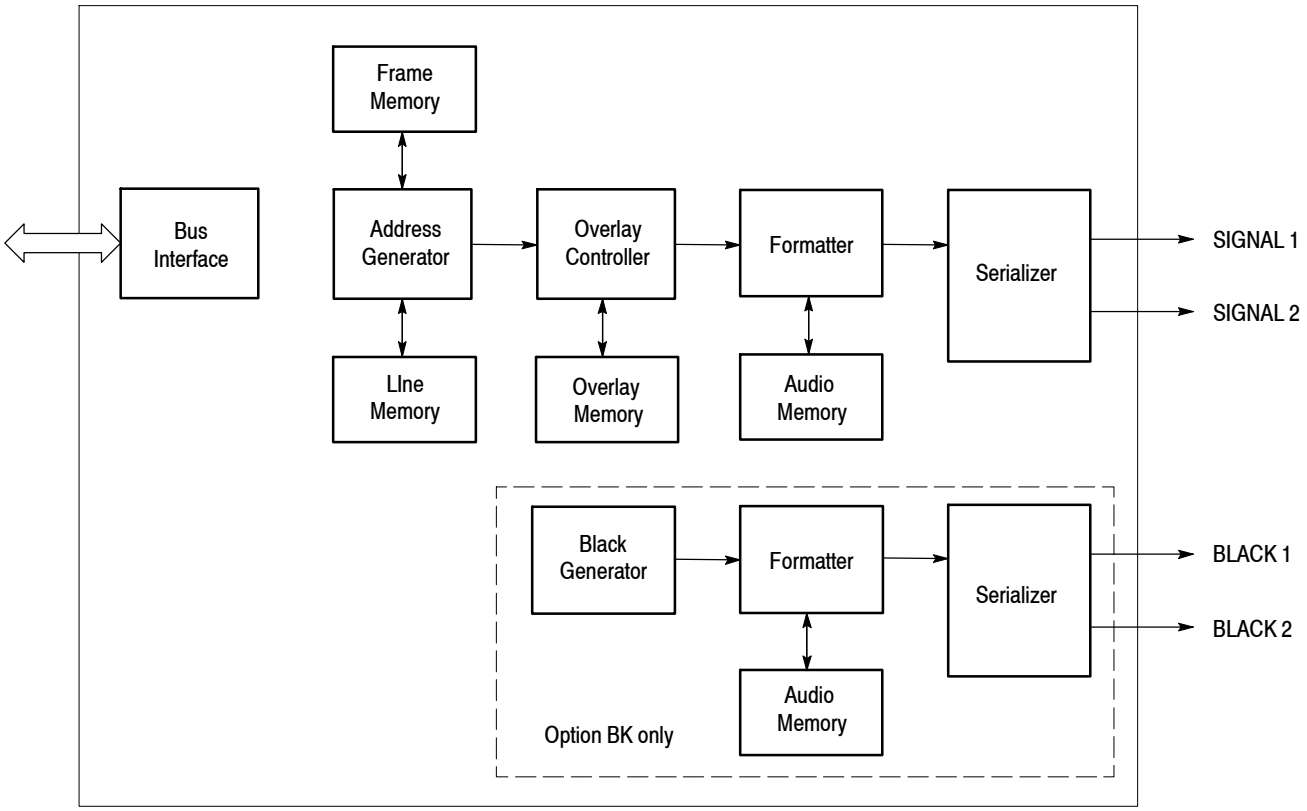

Figure 2- 1: Simplified block diagram of the DVG7 Generator module

Performance Verification

Performance Verification

This section provides procedures that verify the performance and functionality of the DVG7 Generator module.

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

Preparation for Performance Verification

Perform the following before starting the performance verification procedures:

Power On Default Settings

Before you perform the performance verification procedures, make sure that the required instrument settings are saved in the Power On Default preset.

If the instrument settings are saved in the Power On Default preset, you can recall the settings after completing the performance verification procedures

by removing and reapplying the power.

Warm up

The DVG7 Generator module and test equipment must have had a warm-up period of at least 20 minutes.

Equipment Required

Table 3–1 lists the equipment required for the procedures.

Table 3-1: Equipment required for performance verification

Item	No.	Minimum requirement	Recommended equipment
Video measurement set	1		Tektronix VM700T Option 01/11/1S
75 Ω BNC cable	1	Length: 42 inches	Tektronix part number 012-0074-00
75 Ω coaxial terminator	1		Tektronix part number 011-0102-01

Calibration Data Report

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

Table 3- 2: DVG7 calibration data report

Serial Number:	Cal Date:	Temperature:	Humidity:

Step	Function Tested	Minimum	Cal Data	Maximum
1.	Serial Output Amplitude			
	SIGNAL 1	720 mV	mV	880 mV
	SIGNAL 2	720 mV	mV	880 mV
2.	Serial Output Rise Time (20% to 80% amplitude points)			
	SIGNAL 1	0.40 ns	ns	1.50 ns
	SIGNAL 2	0.40 ns	ns	1.50 ns
3.	Serial Output Fall Time (20% to 80% amplitude points)			
	SIGNAL 1	0.40 ns	ns	1.50 ns
	SIGNAL 2	0.40 ns	ns	1.50 ns
	Option BK			
4.	Serial Output Amplitude			
	BLACK 1	720 mV	mV	880 mV
	BLACK 2	720 mV	mV	880 mV
5.	Serial Output Rise Time (20% to 80% amplitude points)			
	BLACK 1	0.40 ns	ns	1.50 ns
	BLACK 2	0.40 ns	ns	1.50 ns
6.	Serial Output Fall Time (20% to 80% amplitude points)			
	BLACK 1	0.40 ns	ns	1.50 ns
	BLACK 2	0.40 ns	ns	1.50 ns

Performance Verification Procedures

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

WARNING. *Dangerous electric shock hazards exist inside the TG700 mainframe. Only qualified service personnel should perform these procedures.*

Serial Digital Outputs

This test verifies that serial digital signals are output correctly from the SIGNAL 1 and SIGNAL 2 connectors. The following equipment is required for the test:

- Video measurement set
- 75 Ω BNC cable
- 75 Ω coaxial terminator

Perform the following procedure to verify that serial digital signals are output correctly from the SIGNAL 1 and SIGNAL 2 connectors.

1. Use the 75 Ω BNC cable to connect SIGNAL 1 connector on the DVG7 Generator module to the SDI Ch.A connector on the video measurement set rear panel as shown in Figure 3–1.
2. Use the 75 Ω coaxial terminator to terminate the other loop through to the SDI Ch.A connector on the video measurement set rear panel.

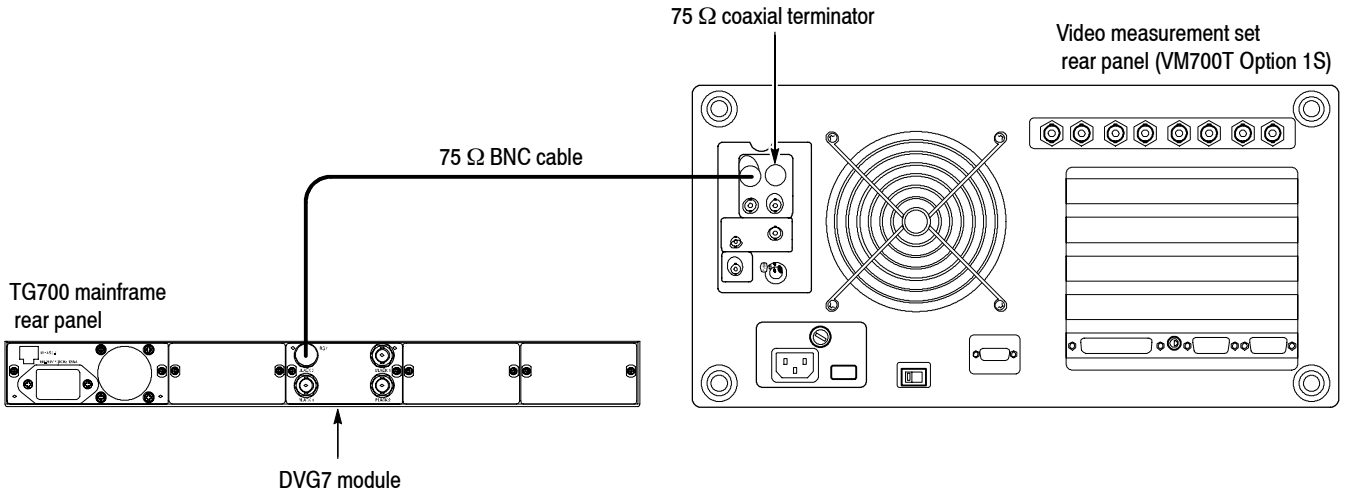

Figure 3- 1: Equipment connection for verifying the serial digital outputs

3. Recall the Factory Default preset as follows:
   a. Press the **MODULE** button to display the TG700 main menu.
   b. Press the up (▲) or down (▼) arrow button to select **RECALL**.
   c. Press the left (◀) or right (▶) arrow button to select **Factory Default**.
   d. Press the **ENTER** button to recall the factory default settings.
4. Select the **75 % Color Bars** signal as follows:
   a. Press the **MODULE** button to display the DVG7 main menu.
   b. Press the **COLOR BAR** test signal button until the **75 % Color Bars** signal is selected.
   c. Press the **CANCEL** button to return to the DVG7 main menu.
5. Turn on the circle overlay as follows:
   a. Press the up (▲) or down (▼) arrow button to select **OVERLAY**, and then press the **ENTER** button.
   b. Press the left (◀) or right (▶) arrow button to select **Circle**, and then press the **ENTER** button to access the CIRCLE OVERLAY submenu.
   c. Press the left (◀) or right (▶) arrow button to select **Enable**, and then press the **ENTER** button.
6. Turn on the embedded audio for Group 1 as follows:
   a. Press the **CANCEL** button to return the module main menu.
   b. Press the up (▲) or down (▼) arrow button to select **AUDIO (EMBEDDED)**.
   c. Press the left (◀) or right (▶) arrow button to select **Group 1**, and then press the **ENTER** button to access the AUDIO GROUP submenu.
   d. Press the left (◀) or right (▶) arrow button to select **Enable**, and then press the **ENTER** button.
   e. Press the **CANCEL** button to return the module main menu.
7. Press the **Measure** button on the video measurement set to open the Measure mode display.
8. Touch the **SDI** soft key to set the measurement set to Digital mode.
9. In the Measure mode display, touch the **SDI Format Monitor** application.
10. Verify that no error messages appears on the SDI Format Monitor display.

11. Press the Picture button to set the video measurement set to **SDI Picture** application.
12. Verify that the correct color bar and overlay circle are displayed on the SDI Picture display.
13. Press the **Measure** button on the video measurement set to open the Measure mode display.
14. In the Measure mode display, touch the **SDI Audio Format Analyzer** application.
15. Verify that no CRC error appears on the SDI Audio Format Analyzer display.
16. Move the BNC cable from the SIGNAL 1 connector to the SIGNAL 2 connector on the DVG7 Generator module.
17. Press the **Measure** button on the video measurement set to open the Measure mode display.
18. Repeat steps 9 through 15.

Serial Digital Black Outputs (Option BK Only). This test verifies that serial digital black signals are output correctly from the BLACK1 and BLACK 2 connectors.

19. Move the BNC cable from the SIGNAL 2 connector to the BLACK 1 connector on the DVG7 Generator module.
20. Select the **40 % Flat Field** signal as follows:
    a. Press the **CANCEL** button to return the module main menu.
    b. Press the up (▲) or down (▼) arrow button to select **BLACK (OPTION)**.
    c. Press the **ENTER** button to access the BLACK submenu.
    d. Press the up (▲) or down (▼) arrow button to select **SIGNAL**.
    e. Press the left (◀) or right (▶) arrow button to select **40 % Flat Field** and press the **ENTER** button.
21. Turn on the embedded audio for Group 1 as follows:
    a. Press the **CANCEL** button to return the BLACK submenu.
    b. Press the up (▲) or down (▼) arrow button to select **AUDIO (EMBEDDED)**.
    c. Press the **ENTER** button to access the AUDIO GROUP submenu for Group 1.

d. Press the left (◀) or right (▶) arrow button to select **Group 1**, and then press the **ENTER** button to access the AUDIO GROUP submenu.

e. Press the left (◀) or right (▶) arrow button to select **Enable**, and then press the **ENTER** button.

f. Press the **CANCEL** button to return the BLACK submenu.

22. Press the **Measure** button on the video measurement set to open the Measure mode display.

23. Repeat steps 9 through 15.

24. Change the BNC cable connection from BLACK 1 connector to the BLACK 2 connector on the DVG7 Generator module.

25. Press the **Measure** button on the video measurement set to open the Measure mode display.

26. Repeat steps 9 through 15.

Eye Pattern Check

This test verifies the signal level and rise/fall times of the SIGNAL 1 and SIGNAL 2 outputs. The following equipment is required for the test:

- Video measurement set
- 75 Ω BNC cable
- 75 Ω coaxial terminator

Perform the following procedure to verify the signal level and rise/fall times of the SIGNAL 1 and SIGNAL 2 outputs.

Use the equipment connection and controls from the previous test.

1. Press the **Measure** button on the video measurement set to open the Measure mode display.

2. In the Measure mode display, touch the **SDI Eye Diagram** application to open the Eye Diagram display.

3. In the Eye Diagram display, touch the **Average** soft key to set the value for Eye Persistence to **Infinity**.

4. In the Eye Diagram display, touch the **Measure** soft key to open the Measure submenu.

5. In the Measure submenu, touch the following soft keys to toggle each measurement display on: **Eye Amplitude**, **Rise\Fall Times**, and **Rise\Fall Adjusted**.

6. Verify that the eye amplitude and rise and fall times values are as follows:

Eye amplitude : 720 mV to 880 mV
Rise and fall time : 400 ps to 1500 ps

7. Change the BNC cable connection from the SIGNAL 1 connector to the SIGNAL 2 connector and change the 75 Ω terminator from the SIGNAL 2 connector to the SIGNAL 1 connector on the DVG7 Generator module.

8. Repeat step 6.

BLACK Output Eye Pattern Check (Option BK Only). This test verifies the signal level and rise/fall times of the BLACK 1 and BLACK 2 outputs.

9. Change the BNC cable connection from the SIGNAL 2 connector to the BLACK 1 connector on the DVG7 Generator module.

10. Repeat step 6.

11. Change the BNC cable connection from the BLACK 1 connector to the BLACK 2 connector on the DVG7 Generator module.

12. Repeat step 6.

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

Adjustment Procedures

Adjustment Procedures

This section contains information needed to adjust the TG700.

The only adjustment in the DVG7 Generator module is for the output level.

Requirements for Adjustment

Before doing the adjustment, note the following requirements.

Personnel This procedure is only to be performed by trained service technicians.

Warm-Up Period The DVG7 Generator module requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. Adjustment done before the operating temperature has stabilized may cause errors in performance.

Access When adjusting the output level, you need to remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

Equipment Required

Table 4–1 lists the equipment required to adjust the output level.

Table 4-1: Equipment required

Item	No.	Minimum requirement	Recommended equipment
TV signal generator platform	1		Tektronix TG700
Oscilloscope	1	Bandwidth: 1 GHz or higher	Tektronix TDS784D
75 Ω BNC cable	1	Length: 42 inches	Tektronix part number 012-0074-00
75 Ω coaxial terminator	1		Tektronix part number 011-0102-01
75 Ω signal adapter	1	Bandwidth: 1 GHz Amplitude precision: -3 dB	Tektronix AMT75

Output Level Adjustment

Preparation

To perform the output level adjustment, you must first remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

After you have removed the top cover, find the variable resistors on the DVG7 circuit board. See Figure 4–1.

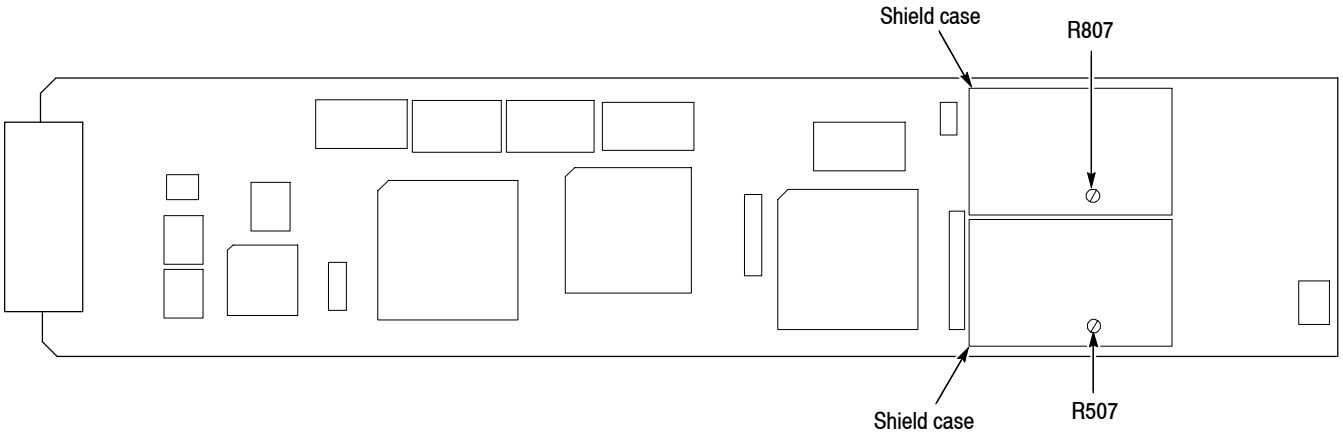

Figure 4- 1: DVG7 circuit board view

Procedure

WARNING. *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable and 75 Ω signal adapter to connect the SIGNAL 1 connector on the DVG7 Generator module to the CH1 input connector on the oscilloscope as shown in Figure 4–2.

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

2. Use the 75 Ω coaxial terminator to terminate the SIGNAL 2 connector on the DVG7 Generator module.

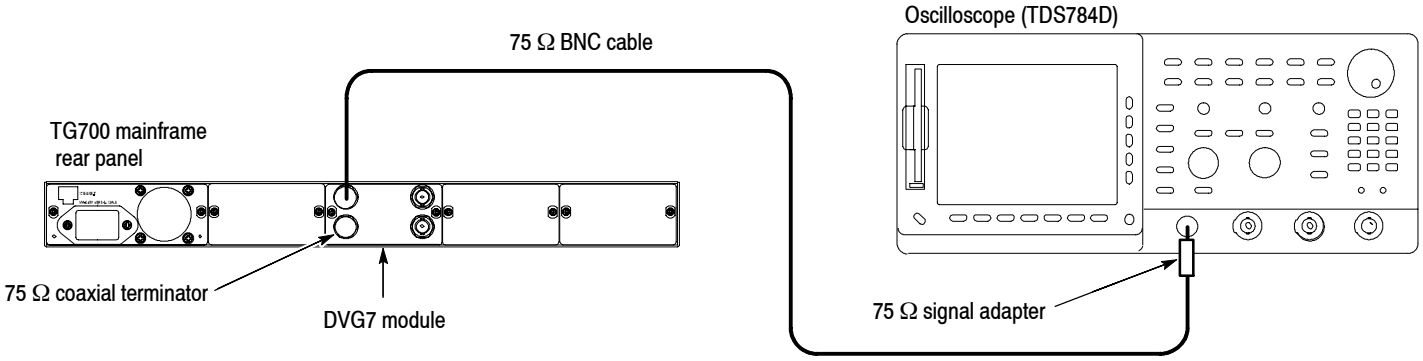

Figure 4-2: Equipment connection for adjusting the output level

3. Set the oscilloscope settings as indicated below:

Vertical . . . . . 160 mV/div
Horizontal . . . . . 1 ns/div
Record Length . . . . . 500 points in10 div
Trig Position . . . . . 50 %
Trig Source CH4
Trig Slope . . . . . Rising Edge
Acquire Menu . . . . . Sample
DPO (InstaVu) . . . . . Infinite Persistence

4. Recall the Factory Default preset as follows:

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

b. Press the left (◀) or right (▶) arrow button to select **Factory Default**.

c. Press the **ENTER** button to recall the factory default settings.

d. Press the **CANCEL** button to return the TG700 main menu.

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

a. Press the MODULE button to display the **DVG7** main menu.

b. Press the **COLOR BAR** test signal button until the **75 % Color Bars** signal is selected.

6. Turn on the "Cursor: HBars" of the sampling oscilloscope, and then set the ΔV to 800 mV.

7. Change the cursor mode to Track, and then position the cursors so that they are symmetrical about the center graticule.

8. Locate variable resistor R507 on the DVG7 circuit board. See Figure 4–1.

9. Adjust R507 so that the signal amplitude is equal to the height between the two cursors set in step 6.

BLACK Output Level Adjustment (Option BK Only).

10. Move the BNC cable from the SIGNAL 1 connector to the BLACK 1 connector and move the 75 Ω terminator from the SIGNAL 2 connector to the BLACK 2 connector on the DVG7 Generator module.

11. Select the **40 % Flat Field** signal as follows:

a. Press the **CANCEL** button to return the module main menu.

b. Press the up (▲) or down (▼) arrow button to select **BLACK (OPTION)**.

c. Press the **ENTER** button to access the BLACK submenu.

d. Press the up (▲) or down (▼) arrow button to select **SIGNAL**.

e. Press the left (◀) or right (▶) arrow button to select **40 % Flat Field** and press the **ENTER** button.

12. Locate variable resistor R807 on the DVG7 circuit board. See Figure 4–1.

13. Adjust R807 so that the signal amplitude is equal to the height between two cursors set in step 6.

This completes the output level adjustment procedures.

Maintenance

Maintenance

This section contains instructions and procedures for maintaining the DVG7 Generator module. For information on servicing the mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

The following information can be found in this section:

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

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

Preparation

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

Servicing Prerequisites

Ensure 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.

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.*

Inspecting and Cleaning Procedures

Clean the mainframe and modules often enough to prevent dust or dirt from accumulating. Refer to *Inspecting and Cleaning Procedures* in the *TG700 TV Signal Generator Platform Service Manual*.

Performance Verification

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

Repackaging Instructions

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

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

Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the DVG7 Generator module.

Tools Required

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

Table 5-1: Required tools

Name	Description	Tektronix part number
Screwdriver handle	Accepts Phillips-driver bits	
#1 Phillips tip	Phillips-driver bit for #1 size screw heads	
#2 Phillips tip	Phillips-driver bit for #2 size screw heads	
Nut driver, 14 mm	Special nut driver for removing the BNC connectors of the DVG7 module	003-A041-00

Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section in the *TG700 TV Signal Generator Platform Module Installation Instructions* to remove the DVG7 Generator module from the mainframe.
2. Disconnect the cables at P500 (SIGNAL 1) and P502 (SIGNAL 2) on the DVG7 circuit board. If Option BK is installed, also disconnect the cables at J800 (BLACK 1) and J802 (BLACK 2).
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

Replacing the chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the six screws securing the DVG7 circuit board to the chassis.
3. Lift the circuit board up and away from chassis, and then place it on a static free surface.
4. If Option BK is installed, skip this step:
   a. Use a screwdriver with a #2 Phillips tip to remove the two screws securing the rear panel to the chassis.
5. Set the replacement chassis on a firm, flat, static-free work surface.
6. If Option BK is installed, skip this step:
   a. Use a screwdriver with a #2 Phillips tip to install the two screws securing the rear panel to the chassis.
7. Use a screwdriver with a #2 Phillips tip to install the six screws securing the circuit board to the chassis.

Troubleshooting

This section contains instructions and procedures for troubleshooting the DVG7 Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to *Troubleshooting* in the *TG700 TV Signal Generator Platform Service Manual*.

Equipment Required

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

Table 5-2: Equipment required for troubleshooting

Equipment description	Minimum requirements/example
Screwdriver handle	Accept Phillips-driver bits
#1 Phillips tip	Phillips-driver bit for #1 size screw heads
TG700 mainframe	A TG700 mainframe that is functioning correctly

Backing up the instrument settings

Before you begin the troubleshooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◀) or right (▶) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

Troubleshooting Trees

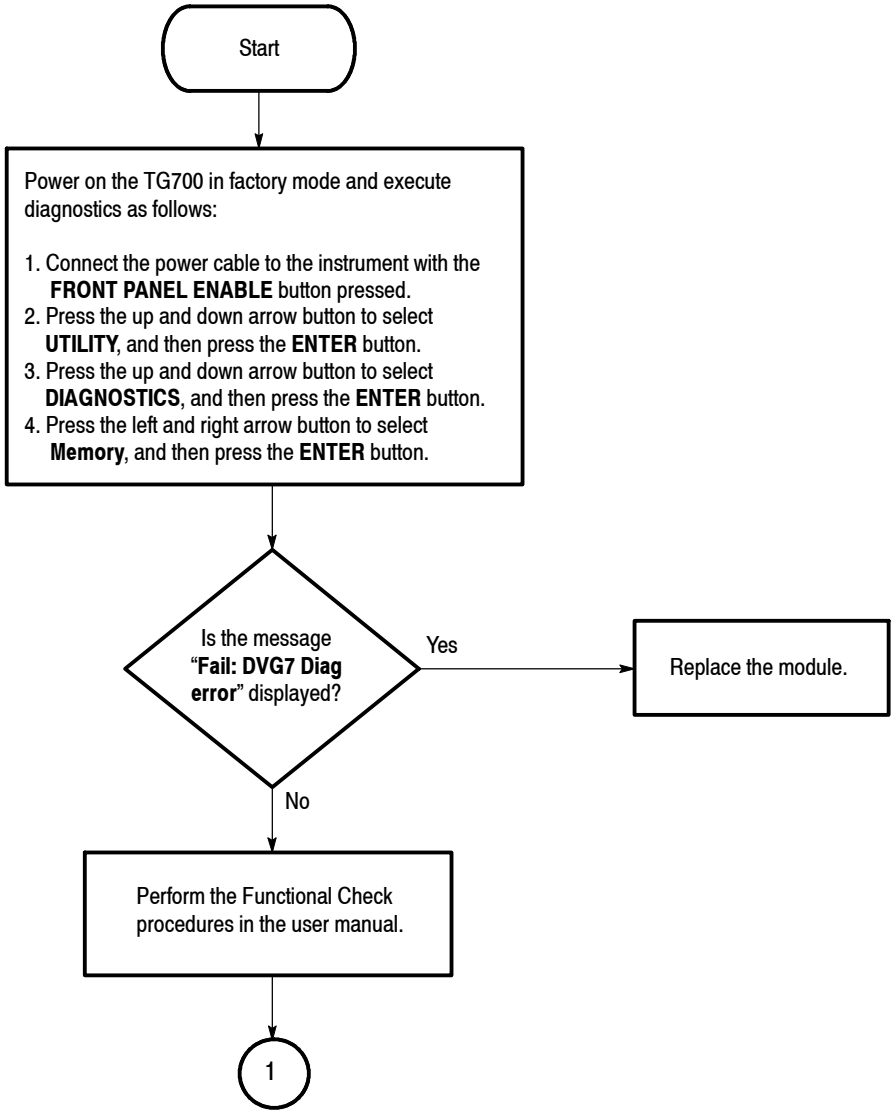

Figure 5- 1: Troubleshooting procedure (1)

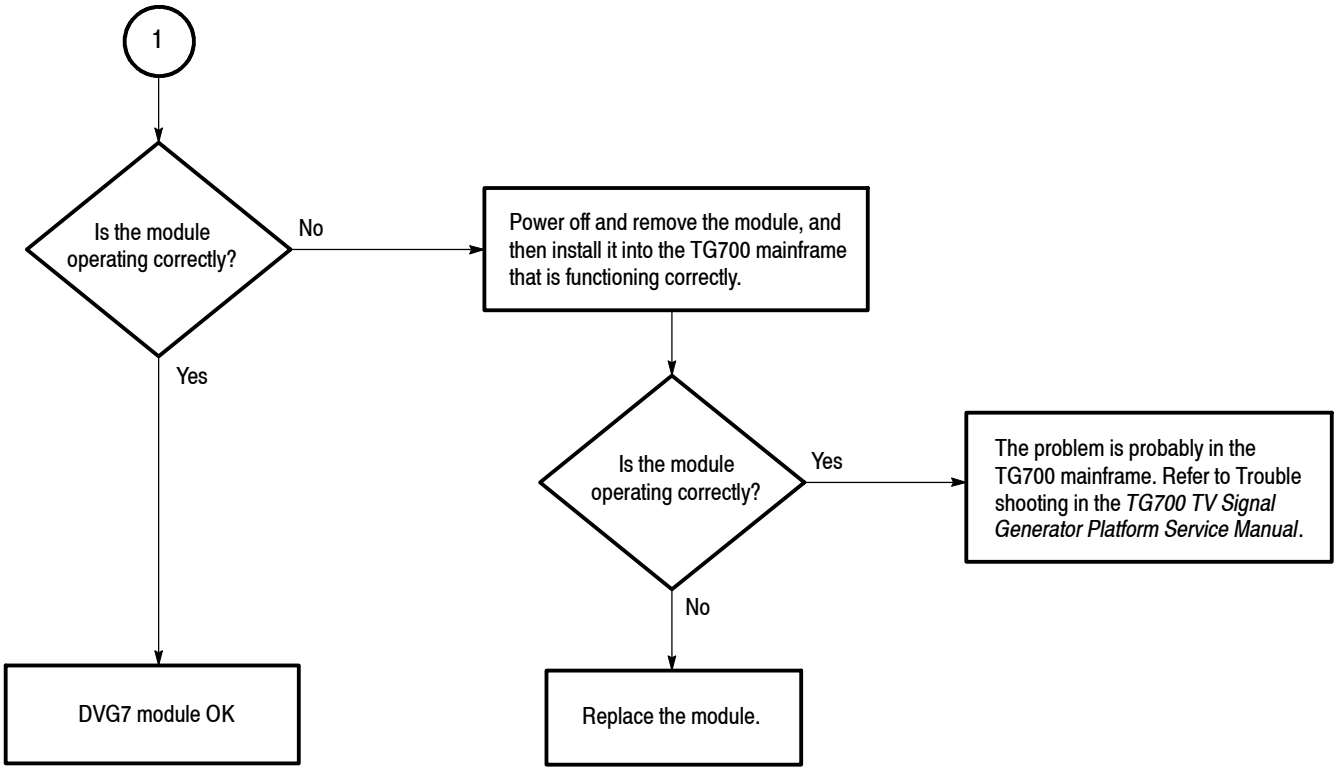

Figure 5- 2: Troubleshooting procedure (2)

Options

Options

This section describes options that are available for the DVG7 Generator module.

The following options are available:

- Option BK (Serial digital black output)
- Option D1 (Test data report)

Option BK Description

Two serial digital black signal outputs are added to the DVG7 Generator module when this option is specified.

Option D1 Description

A calibration data test result report will be provided with the DVG7 Generator module when this option is specified.

Diagram

Diagram

Figure 7-1 shows the DVG7 Generator module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 TV Signal Generator Platform Service Manual*.

A block diagram of the DVG7 Generator module is located in the *Theory of Operation* section, beginning on Page 2-1.

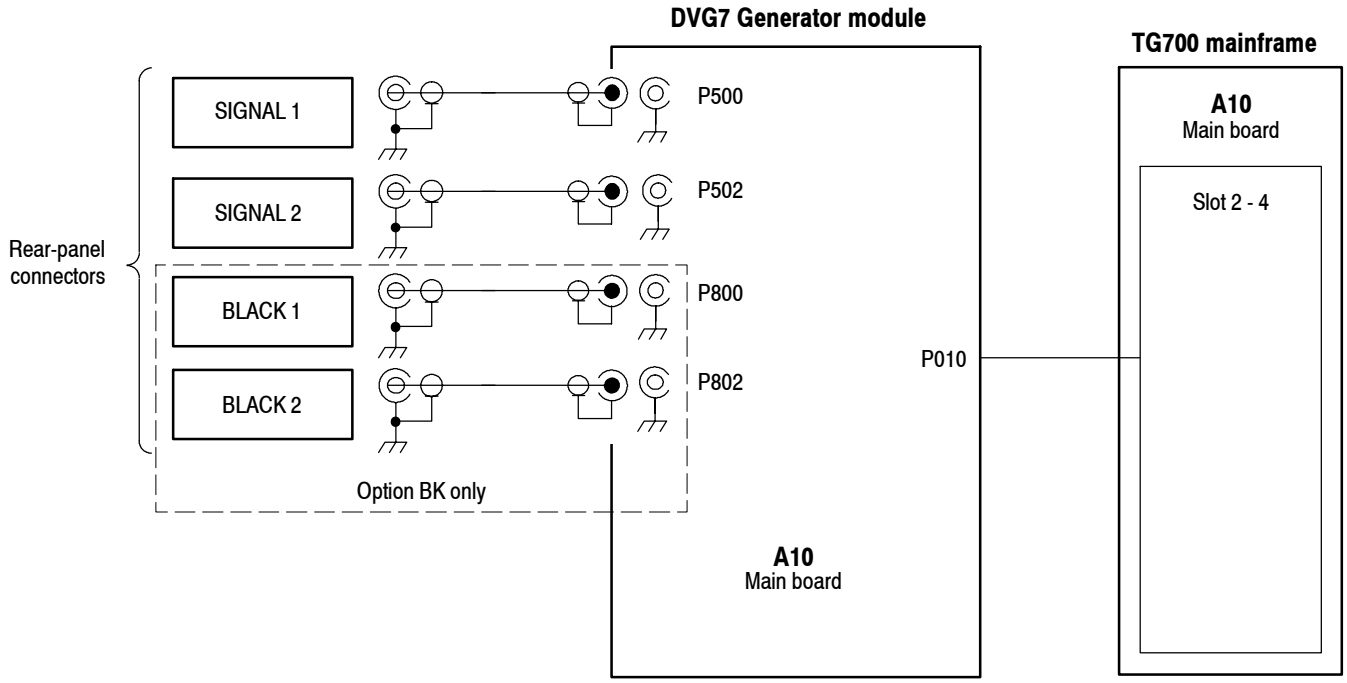

Figure 7-1: DVG7 Generator module connections

Replaceable Parts List

Replaceable Parts List

This section contains a list of the replaceable modules for the DVG7 Generator module. Use this list to identify and order replacement parts.

Parts Ordering Information

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

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

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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

Module Servicing

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

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

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

New Modules. You may purchase replacement modules 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 DVG7 Generator module. 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.

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

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
8-1	116-A005-04			1	EXCHANGE MODULE:DVG7
	116-A006-04			1	EXCHANGE MODULE:DVG7-BK
8-1-1	441-A273-03			1	CHASSIS,MODULE DVG7:ASSY
-2	333-A407-00			1	PANEL,REAR:DVG7,AL
	333-A408-00			1	PANEL,REAR:DVG7 OPTION,AL
-3	214-4946-00			2	SPRING,CONICAL:VXI MOUNTING SCREW,0.26MM
-4	213-1129-01			2	SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,NI PL,CROSS REC & SLOTTED
-5	348-A128-00			2.5 CM	SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02]
-6	174-B846-00			2	CABLE ASSY,RF:75OHM,COAX(RG179),6CM L,BNC TO PL71-LP-1.5C
	174-B846-00			4	CABLE ASSY,RF:75OHM,COAX(RG179),6CM L,BNC TO PL71-LP-1.5C (OPTION BK)
-7	211-A245-01			8	SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU & LOCK WASHER
	211-A245-01			6	SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU & LOCK WASHER (OPTION BK)
-8	334-1378-03			1	MARKER,IDENT:MKD SERIAL NO.
					STANDARD ACCESSORIES
	070-A824-XX			1	MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS
	062-A249-XX			1	SOFTWARE PACKAGE:S/W(CD-R)
					OPTIONAL ACCESSORIES
	070-A800-XX			1	MANUAL,TECH:SERVICE,TG700
	003-A041-00			1	NUT DRIVER,BOX:14MM HEX,BNC RETAINING NUT,MODIFIED 19MM

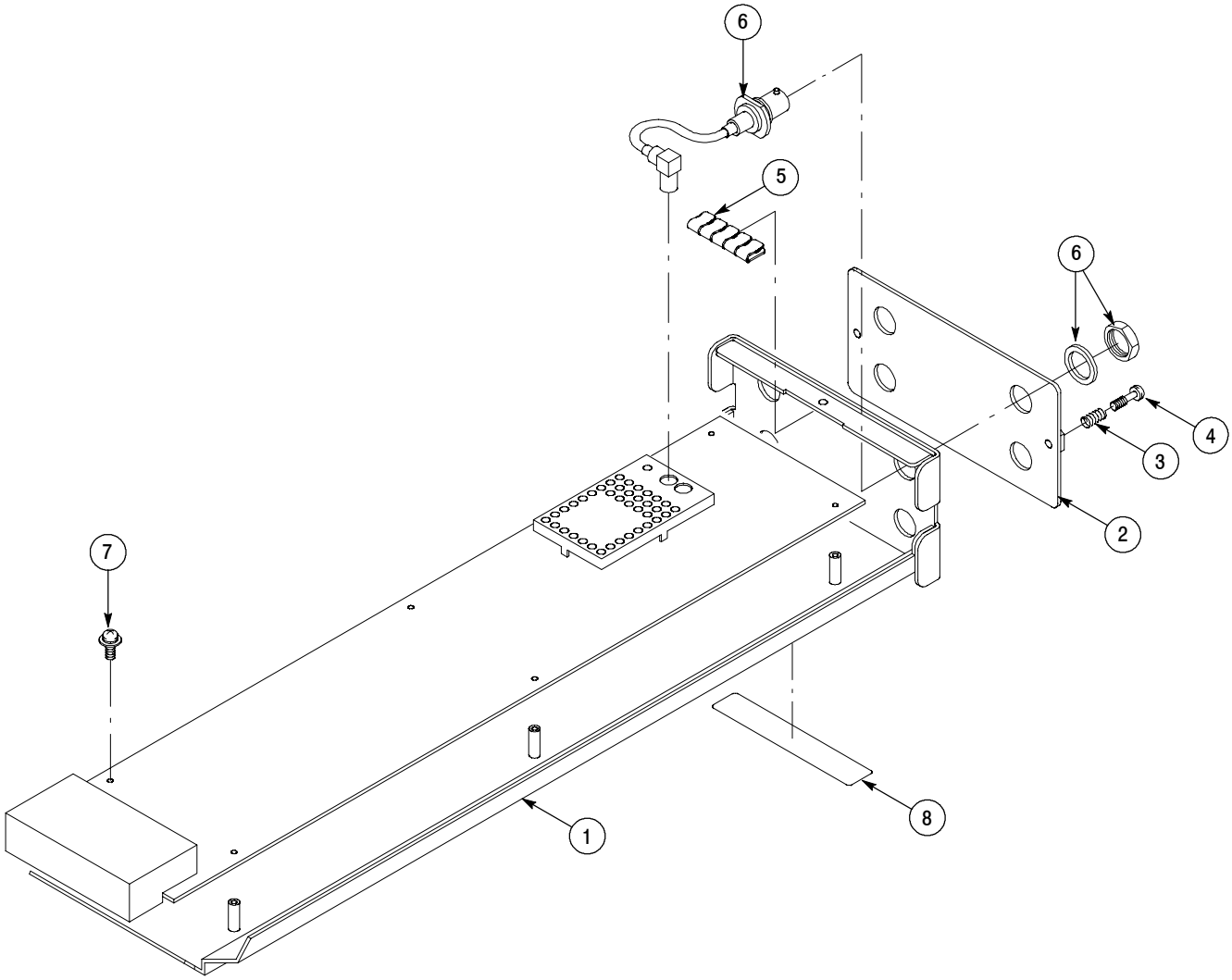

Figure 8- 1: DVG7 Generator module exploded view

Service Manual

Tektronix

HDLG7
HD Dual Link Video Generator

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

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Preface

This is the service manual for the HDLG7 HD Dual Link Video Generator module. This manual contains information needed to service an HDLG7 module to the module level.

Manual Structure

This manual is divided into sections, such as *Specifications* and *Theory of Operation*. Further, some sections are divided into subsections, such as *Product Description* and *Removal and Installation Procedures*.

Sections containing procedures also contain introductions to those procedures. Be sure to read these introductions because they provide information needed to do the service correctly and efficiently. The following are brief descriptions of each manual section.

- *Specifications* contains a description of the HDLG7 module and the characteristics that apply to it.
- *Theory of Operation* is an overview of the module's design.
- *Performance Verification* contains procedures to perform the operation tests.
- *Maintenance* contains installation, removal and replacement, and trouble-shooting instructions.
- *Option* contains a description of the available option for the HDLG7 module.
- *Diagram* contains an interconnect diagram showing the connections between the HDLG7 module and the mainframe.
- *Replaceable Parts List* 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 HDLG7 module.

- The *TG700 TV Signal Generator Platform User Manual* (Tektronix part number 070-A799-XX) describes how to use the TG700 mainframe and all modules. It also contains information about remote commands and programming structure for the TG700 mainframe and all modules.
- The *TG700 TV Signal Generator Platform Module Installation Instructions* (Tektronix part number 070-A824-XX) describes how to install and remove the modules, and how to upgrade the firmware of the mainframe.

Specifications

Specifications

This section contains a general product description of the HDLG7 module followed by the operating specifications of the module.

Product Description

The HDLG7 HD Dual Link Video Generator module is designed to be installed in the TG700 TV Signal Generator Platform.

The HDLG7 module can be operated in either of two modes of operation. In one mode, the module serves as a dual link generator, which provides standard test signals. In the other mode, it serves as a converter. The module will convert a SMPTE 292M serial digital video stream carrying a SMPTE 274M signal to a SMPTE 372M serial digital dual link video signal. Table 1-6 indicates which dual link outputs can be converted from each input format.

The HDLG7 module provides these key features:

- Two pairs of dual link outputs
- Dual link outputs include SMPTE 352 payload
- Wide variety of 1080i, 1080p, and 1080PsF output formats
- Support the following sampling structures:

  4:4:4 GBR, 4:4:4:4 GBR+A, 4:4:4 YCbCr, 4:4:4:4 YCbCr+A, 4:2:2 YCbCr, and 4:2:2:4 YCbCr+A
- Test signals; Color Bars, Linearity, Flat Field, Monitor, and Pulse Bar
- Adjustable timing offset between link A and link B outputs
- Full remote control using the Ethernet interface

Electrical Characteristics

Tables 1-1 through 1-6 list the electrical characteristics of the HDLG7 module.

Table 1-1: The 4:2:2 serial digital video signal input

Characteristic	Description
Number of inputs	1
Format	Compatible with SMPTE 292M. See Table 1-6 for supported input and output formats.
Input type	75 Ω BNC
Cable loss accommodation	0–20 dB attenuation with 1/SQRT(f) characteristic at 1/2 of serial rate.
Launch amplitude accommodation, typical	800 mV ± 10% for full specification 800 mV ± 30% up to 20 dB cable attenuation
Jitter tolerance, typical	0.35 ± 0.1 UI p-p above 1 MHz. Increases proportional to 1/f below 1 MHz.
Return loss	≥ 15 dB, 5 MHz to 750 MHz ≥ 10 dB, 750 MHz to 1.485 GHz

Table 1-2: Dual link serial video outputs

Characteristic	Description
Number of outputs	2 on each channel (link)
Format	Compatible with SMPTE 372M and SMPTE 292M
Output type	75 Ω BNC
Output level	800 mV ± 10%
Rise and fall times	270 ps maximum (20% to 80%)
Jitter, typical	135 ps maximum (0.2 UI alignment jitter)
Return loss	≥ 15 dB, 5 MHz to 750 MHz ≥ 10 dB, 750 MHz to 1.485 GHz

Table 1-3: Video signal content

Characteristic	Description
Conversion accuracy, typical	0.4%
Accuracy of synthesizer generated test signals, typical	0.2%
Timing offset of Link B in reference to Link A	± 200 ns minimum. Adjustment in steps of the clock period (13.5 ns)

Table 1-4: Synthesizer generator test signals

Characteristic	Description
Color Bars	100% Color Bars, 75% Color Bars, SMPTE HD/SD Compatible[1]
Linearity	Ramp, Valid Ramp, 5 Step Staircase
Flat Field	0% Flat Field, 10% Flat Field, 20% Flat Field, 30% Flat Field, 40% Flat Field, 50% Flat Field, 60% Flat Field, 70% Flat Field, 80% Flat Field, 90% Flat Field, 100% Flat Field
Monitor	100% Red Field, 75% Red Field, 100% Blue Field, 75% Blue Field, 100% Green Field, 75% Green Field, Convergence
Pulse bar	2T30 Pulse and Bar

1 **SMPTE HD/SD Compatible refers to SMPTE RP219 Color Bar (I/Q Even).**

Table 1-5: Embedded audio and ancillary data

Characteristic	Description
Embedded audio	Embedded audio on 4:2:2 video input is placed on the Link A video outputs as per SMPTE 372M.
Ancillary data	Embedded ancillary data on 4:2:2 video input is placed on the Link A video outputs as per SMPTE 372M.

Table 1-6: Supported input and output formats (SMPTE 274M to SMPTE 372M standards)

Input format (4:2:2 YCbCr/10 bit)	Format selection of dual link output	
1920 X 1080i 50 Hz	4:2:2 (YCbCr)/10 bit	1920 X 1080p 50Hz
	4:4:4 (YCbCr), 4:4:4:4 (YCbCrA)/10 bit	1920 X 1080i 50 Hz
	4:4:4 (YCbCr)/12 bit	1920 X 1080i 50 Hz
	4:4:4 (RGB), 4:4:4:4 (RGBA)/10 bit	1920 X 1080i 50 Hz
	4:4:4 (RGB)/12 bit	1920 X 1080i 50 Hz
	4:2:2 (YCbCr), 4:2:2:4 (YCbCrA)/12 bit	1920 X 1080i 50 Hz
1920 X 1080i 60/59.94 Hz	4:2:2 (YCbCr)/10 bit	1920 X 1080p 60/59.94Hz
	4:4:4 (YCbCr), 4:4:4:4 (YCbCrA)/10 bit	1920 X 1080i 60/59.94 Hz
	4:4:4 (YCbCr)/12 bit	1920 X 1080i 60/59.94 Hz
	4:4:4 (RGB), 4:4:4:4 (RGBA)/10 bit	1920 X 1080i 60/59.94 Hz
	4:4:4 (RGB)/12 bit	1920 X 1080i 60/59.94 Hz
	4:2:2 (YCbCr), 4:2:2:4 (YCbCrA)/12 bit	1920 X 1080i 60/59.94 Hz
1920 X 1080p/PsF 30/29.97 Hz	4:4:4 (YCbCr), 4:4:4:4 (YCbCrA)/10 bit	1920 X 1080p/PsF 30/29.97 Hz
	4:4:4 (YCbCr)/12 bit	1920 X 1080p/PsF 30/29.97 Hz
	4:4:4 (RGB), 4:4:4:4 (RGBA)/10 bit	1920 X 1080p/PsF 30/29.97 Hz
	4:4:4 (RGB)/12 bit	1920 X 1080p/PsF 30/29.97 Hz
	4:2:2 (YCbCr), 4:2:2:4 (YCbCrA)/12 bit	1920 X 1080p/PsF 30/29.97 Hz
1920 X 1080p/PsF 25 Hz	4:4:4 (YCbCr), 4:4:4:4 (YCbCrA)/10 bit	1920 X 1080p/PsF 25 Hz
	4:4:4 (YCbCr)/12 bit	1920 X 1080p/PsF 25 Hz
	4:4:4 (RGB), 4:4:4:4 (RGBA)/10 bit	1920 X 1080p/PsF 25 Hz
	4:4:4 (RGB)/12 bit	1920 X 1080p/PsF 25 Hz
	4:2:2 (YCbCr), 4:2:2:4 (YCbCrA)/12 bit	1920 X 1080p/PsF 25 Hz
1920 X 1080p/PsF 24/23.98 Hz	4:4:4 (YCbCr), 4:4:4:4 (YCbCrA)/10 bit	1920 X 1080p/PsF 24/23.98 Hz
	4:4:4 (YCbCr)/12 bit	1920 X 1080p/PsF 24/23.98 Hz
	4:4:4 (RGB), 4:4:4:4 (RGBA)/10 bit	1920 X 1080p/PsF 24/23.98 Hz
	4:4:4 (RGB)/12 bit	1920 X 1080p/PsF 24/23.98 Hz
	4:2:2 (YCbCr), 4:2:2:4 (YCbCrA)/12 bit	1920 X 1080p/PsF 24/23.98 Hz

Environmental Characteristics

Table 1-7 lists the environmental characteristics of the HDLG7 module.

Table 1-7: Environmental characteristics

Characteristic	Description
Temperature	
Operating	0 °C to +50 °C
Non-operating	–20 °C to +60 °C
Relative Humidity	
Operating	20% to 80% (No condensation); Maximum wet-bulb temperature 29.4 °C
Non-operating	5% to 90% (No condensation); Maximum wet-bulb temperature 40.0 °C
Altitude	
Operating	To 4.5 km (15,000 feet) Maximum operating temperature decreases 1 °C each 300 m above 1.5 km.
Non-operating	To 15 km (50,000 feet)
Vibration	
Operating	3.04 m/s^2 (0.31 G_{rms}), 5 Hz to 500 Hz, 10 min, three axes
Non-operating	23.3 m/s^2 (2.38 G_{rms}), 5 Hz to 500 Hz, 10 min, three axes
Shock	
Non-operating	294 m/s^2 (30 G), half-sine, 11 ms duration

Theory of Operation

Theory of Operation

This section describes the basic operation of the major circuit blocks in the HDLG7 module.

For information about the TG700 mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

Bus Interface

This block provides the communication between the mainframe and the module circuit.

Deserializer

This block contains a cable equalizer and deserializer circuit that converts the HDTV Serial Digital Input signal to a 20-bit parallel video signal with the recovered parallel clock. The circuitry also detects the presence of input signal and identifies the format and rate of the incoming signal.

Signal Processing

The Signal Processing block up-interpolates the Cb and Cr data and then color-space converts the incoming video signal to RGB. 4:4:4 YCbCr and RGB signals are available at the output of this block.

Converter Formatter

This block allows selection of the output sample structure, separating the video data into the dual link format, reinsertion of EAV/SAV data to the two output signals, and adding incoming ancillary data and embedded audio to the Link A output video signal.

Address Generator

This block consists of sample and line counters that can be frame delayed from a frame reference pulse using the MPU interface. The counter outputs are used to control the signal generation.

Signal Generator Engine

The Signal Generator Engine contains circuitry to generate the selected test signal as well as the EAV and SAV blanking data using the sample and line counts from the Address Generator.

Generator Formatter

The Generator Formatter separates the generated video into two output signals (Link A and Link B).

Link A Serializer

The Link A Serializer block transforms the selected 20-bit parallel video signal (converted or generated) to a serial digital signal and drives a 75 Ω BNC output. In addition, CRC, line numbers, and payload packet are generated and inserted within this block.

Link B Serializer

The Link B Serializer block transforms the selected 20-bit parallel video signal (converted or generated) to a serial digital signal and drives a 75 Ω BNC output. In addition, CRC, line numbers, and payload packet are generated and inserted within this block.

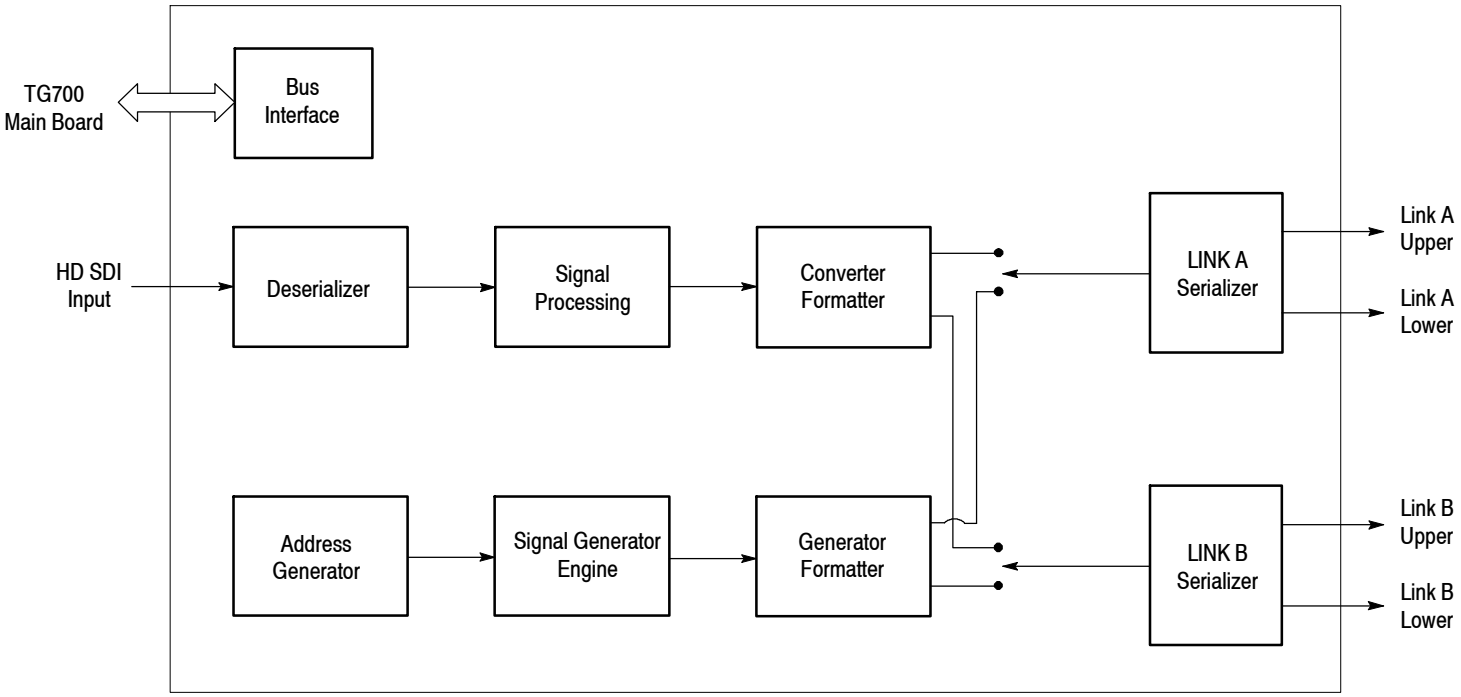

Figure 2-1: Simplified block diagram of the HDLG7 module

Performance Verification

Performance Verification

This section provides procedures that verify the performance and functionality of the HDLG7 module.

Preparation for Performance Verification

Perform the following before starting the performance verification procedures:

Power On Default Settings

Before you perform the performance verification procedures, make sure that the required instrument settings are saved in the Power On Default preset.

If the instrument settings are saved in the Power On Default preset, you can recall the settings after the performance verification procedures are completed by removing and reapplying the power.

Warm up

The HDLG7 module and test equipment must have had a warmup period of at least 20 minutes.

Equipment Required

Table 3-1 lists the equipment required for the procedures.

Table 3-1: Equipment required for performance verification

Item	No.	Minimum requirement	Recommended equipment
HD-SDI video signal generator	1	1080 59.94i 100% Color Bars signal output and embedded audio capabilities	Tektronix TG700 with HDVG7 generator module
HD waveform monitor	1	HD-SDI waveform monitor with eye measurement capabilities	Tektronix WFM7100 Option PHY
75 Ω BNC cable	3	General purpose digital video male-to-male BNC connectors, 1 or 2 m long	Belden 9281 or Tektronix part number 012-0159-01
75 Ω coaxial terminator	3	Male connector, precision	Tektronix part number 011-0102-03

Calibration Data Report

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

Table 3-2: HDLG7 calibration data report

Serial Number:	Cal Date:	Temperature:	Humidity:

Step	Function Tested	Minimum	Cal Data	Maximum
1.	Serial Output Amplitude			
	Link A (top BNC)	720 mV	mV	880 mV
	Link A (bottom BNC)	720 mV	mV	880 mV
	Link B (top BNC)	720 mV	mV	880 mV
	Link B (bottom BNC)	720 mV	mV	880 mV
2.	Serial Output Rise Time (20% to 80% amplitude points)			
	Link A (top BNC)		ps	270 ps
	Link A (bottom BNC)		ps	270 ps
	Link B (top BNC)		ps	270 ps
	Link B (bottom BNC)		ps	270 ps
3.	Serial Output Fall Time (20% to 80% amplitude points)			
	Link A (top BNC)		ps	270 ps
	Link A (bottom BNC)		ps	270 ps
	Link B (top BNC)		ps	270 ps
	Link B (bottom BNC)		ps	270 ps

Functional Tests

The functional tests provide tests to check basic functionality of the inputs and general operation of the HDLG7 module before starting the performance verification procedure.

Be sure you have performed the *Preparation for Performance Verification* on page 3-1 before proceeding.

Procedure

1. Use the 75 Ω BNC cable to connect the HD SDI IN connector on the HDLG7 module to the SIGNAL 1 connector on the HD-SDI video signal generator as shown in Figure 3-1.
2. Use the 75 Ω BNC cable to connect the upper LINK A connector on the HDLG7 module to the SDI A connector on the HD waveform monitor as shown in Figure 3-1.
3. Use the 75 Ω BNC cable to connect the upper LINK B connector on the HDLG7 module to the SDI B connector on the HD waveform monitor as shown in Figure 3-1.
4. Use the 75 Ω coaxial terminator to terminate the lower LINK A connector on the HDLG7 module as shown in Figure 3-1.
5. Use the 75 Ω coaxial terminator to terminate the lower LINK B connector on the HDLG7 module as shown in Figure 3-1.
6. Use the 75 Ω coaxial terminator to terminate the SIGNAL 2 connector on the HD-SDI test signal generator as shown in Figure 3-1.

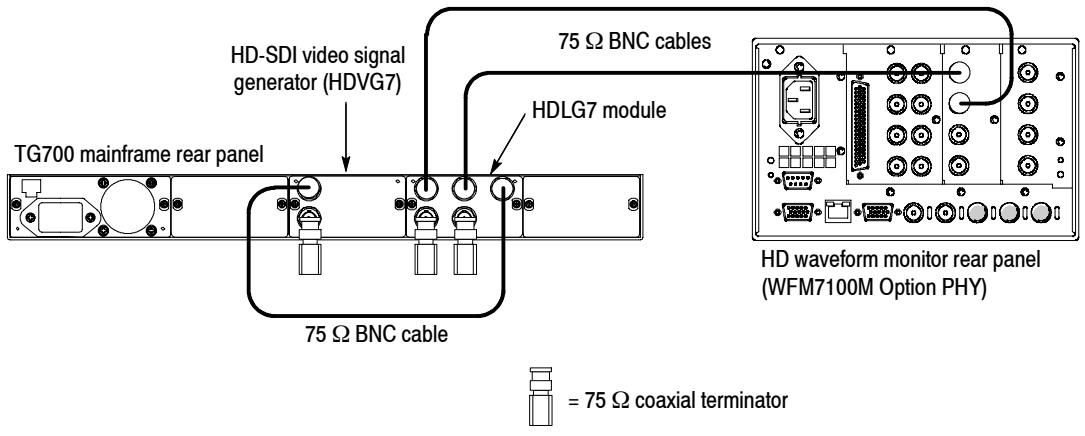

Figure 3-1: Equipment connection for the functional test

7. Set the video signal generator (HDVG7 module) settings as indicated below:

   Output signal . . . . . 100% Color Bars
   Format 1080 59.94i
   Embedded audio . . . . . Group 1 to Group 4: Enabled

8. Press the **MODULE** button repeatedly to display the HDLG7 main menu.

***NOTE**. If GENERATOR appears instead of CONVERTER, press the OTHER button, and then use the arrow buttons to select Normal.*

9. Select the **1080 59.94p** format as follows:

   a. Press the **FORMAT** button.

   b. Press the left (◀) or right (▶) arrow button to select **1080 59.94p**, and then press the **ENTER** button.

   c. Press the **CANCEL** button to return to the module main menu.

10. Select the Serial Digital Input A on the waveform monitor.

11. Check that a 100% Color Bars signal is displayed on the waveform monitor in Parade mode.

12. Set the waveform monitor to view the status of the Serial Digital Input A signal.

13. Check that the input signal is locked at the appropriate format and that no SAV Placement, Field Length, Line Length, Line Number, Y CRC, C CRC, Y Ancillary Checksum, or C Ancillary Checksum errors are occurring on the data stream.

14. Select the Serial Digital Input B on the waveform monitor.

15. Check that a 100% Color Bar signal is displayed on the waveform monitor in Parade mode.

16. Set the waveform monitor to view the status of the Serial Digital Input B signal.

17. Check that the input signal is locked at the appropriate format and that no SAV Placement, Field Length, Line Length, Line Number, Y CRC, C CRC, Y Ancillary Checksum, or C Ancillary Checksum errors are occurring on the data stream.

18. Change the BNC cable connection from the upper LINK A connector to the lower LINK A connector and change the 75 Ω coaxial terminator from the lower LINK A connector to the upper LINK A connector.

19. Change the BNC cable connection from the upper LINK B connector to the lower LINK B connector and change the 75 Ω coaxial terminator from the lower LINK B connector to the upper LINK B connector.

20. Repeat steps 10 through 17 for the lower LINK A and LINK B connectors.

21. Press the **COLOR BAR** test signal button until the **100 % Color Bars** signal is selected.

22. Press the **CANCEL** button to return to the main menu.

23. Repeat steps 10 through 17.

24. Change the BNC cable connection from the lower LINK A connector to the upper LINK A connector and change the 75 Ω coaxial terminator from the upper LINK A connector to the lower LINK A connector.

25. Change the BNC cable connection from the lower LINK B connector to the upper LINK B connector and change the 75 Ω coaxial terminator from the upper LINK B connector to the lower LINK B connector.

26. Repeat steps 10 through 17.

Performance Verification Procedures

These procedures verify that the HDLG7 module meets the warranted characteristics listed in the *Specifications* section in this manual.

Be sure you have performed the *Preparation for Performance Verification* on page 3-1 before proceeding.

WARNING. *Dangerous electric shock hazards exist inside the TG700 mainframe. Only qualified service personnel should perform these procedures.*

Serial Digital Video Outputs

This test verifies that serial digital signals are output correctly from the LINK A and LINK B connectors. The following equipment is required for the test:

- HD waveform monitor
- 75 Ω BNC cable
- 75 Ω coaxial terminator

Perform the following procedure to verify that serial digital signals are output correctly from the LINK A and LINK B connectors.

1. Use the 75 Ω BNC cable to connect the upper LINK A connector on the HDLG7 module to the SDI A input on the HD waveform monitor as shown in Figure 3-2.
2. Use the 75 Ω coaxial terminator to terminate the lower LINK A connector on the HDLG7 module as shown in Figure 3-2.

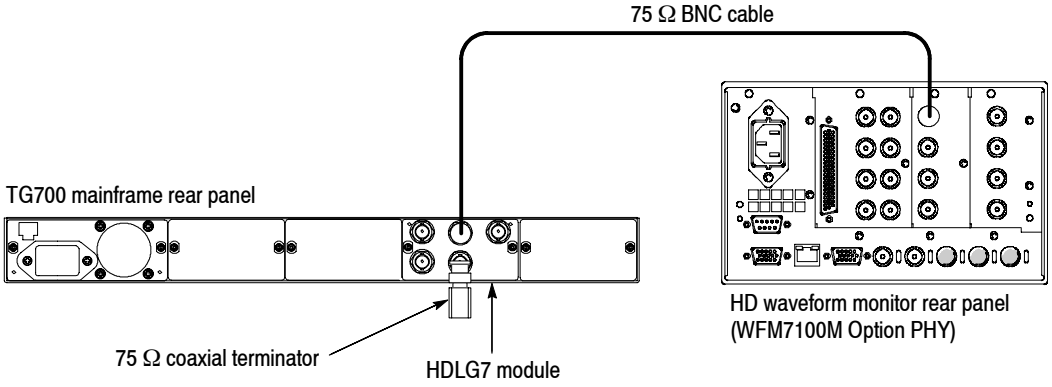

Figure 3-2: Equipment connections for verifying the serial digital video outputs

3. Recall the Factory Default preset as follows:
   a. Press the **MODULE** button to display the TG700 main menu.
   b. Press the up (▲) or down (▼) arrow button to select **RECALL**.
   c. Press the left (◀) or right (▶) arrow button to select **Factory Default**.
   d. Press the **ENTER** button to recall the factory default settings.
4. Select the **100 % Color Bars** signal as follows:
   a. Press the **MODULE** button to display the HDLG7 main menu.
   b. Press the **COLOR BAR** test signal button until the **100 % Color Bars** signal is selected.
5. Select the **1080 59.94p** format as follows:
   a. Press the **FORMAT** button.
   b. Press the left (◀) or right (▶) arrow button to select **1080 59.94p**, and then press the **ENTER** button.
   c. Press the **CANCEL** button to return to the module main menu.
6. Set the HD waveform monitor to take Eye measurements.
7. Verify the eye amplitude and rise and fall times values are as follows:

   Eye amplitude: 720 mV to 880 mV
   Rise and fall time (20% to 80%): < 270 ps
8. Change the BNC cable connection from the upper LINK A connector to the lower LINK A connector and change the 75 Ω coaxial terminator from the lower LINK A connector to the upper LINK A connector.
9. Repeat step 7.
10. Change the BNC cable connection from the lower LINK A connector to the upper LINK B connector and change the 75 Ω coaxial terminator from the upper LINK A connector to the lower LINK B connector.
11. Repeat step 7.
12. Change the BNC cable connection from the upper LINK B connector to the lower LINK B connector and change the 75 Ω coaxial terminator from the lower LINK B connector to the upper LINK B connector.
13. Repeat step 7.

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

Maintenance

Maintenance

This section contains instructions and procedures for maintaining the HDLG7 module. For information on servicing the mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

The following information can be found in this section:

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

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

Preparation

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

Servicing Prerequisites

Ensure 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.

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.*

Inspecting and Cleaning Procedures

Clean the mainframe and modules often enough to prevent dust or dirt from accumulating. Refer to *Inspecting and Cleaning Procedures* in the *TG700 TV Signal Generator Platform Service Manual*.

Performance Verification

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

Repackaging Instructions

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

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

Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the HDLG7 module.

Tools Required

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

Table 4-1: Required tools

Name	Description	Tektronix part number
Screwdriver handle	Accepts Phillips-driver bits	
#1 Phillips tip	Phillips-driver bit for #1 size screw heads	
#2 Phillips tip	Phillips-driver bit for #2 size screw heads	
Nut driver, 14 mm	Special nut driver for removing the BNC connectors of the HDLG7 module	003-A041-00

Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors, or chassis. However, if a connector or chassis becomes damaged, you can replace it.

Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section in the *TG700 TV Signal Generator Platform Module Installation Instructions* to remove the HDLG7 module from the mainframe.
2. Disconnect the cables at J911 (upper LINK A), J912 (lower LINK A), J922 (upper LINK B), J921 (lower LINK B), and J711 (HD SDI IN) on the HDLG7 circuit board.
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

Replacing the Chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the six screws securing the circuit board to the chassis.
3. Lift the circuit board up and away from chassis, and then place it on a static free surface.
4. Set the replacement chassis on a firm, flat, static-free work surface.
5. Carefully place the circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the six screws securing the circuit board to the chassis.
7. Apply the rear panel to the chassis, and then install all the rear-panel connectors to the chassis.

Troubleshooting

This section contains instructions and procedures for troubleshooting the HDLG7 module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to *Troubleshooting* in the *TG700 TV Signal Generator Platform Service Manual*.

Equipment Required

The equipment listed in Table 4-2 is required for troubleshooting.

Table 4-2: Equipment required for troubleshooting

Equipment description	Minimum requirements/example
Screwdriver handle	Accept Phillips-driver bits
#1 Phillips tip	Phillips-driver bit for #1 size screw heads
TG700 mainframe	A TG700 mainframe that is functioning correctly

Backing up the instrument settings

Before you begin the troubleshooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◀) or right (▶) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

Troubleshooting Trees

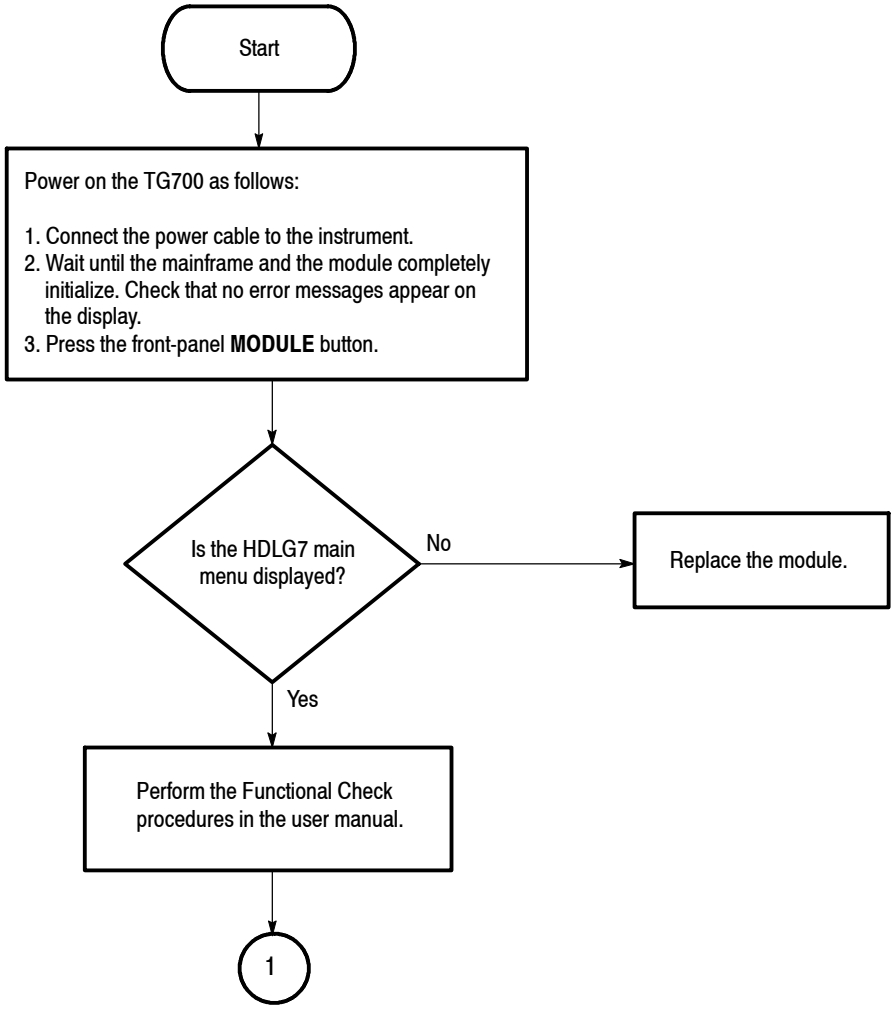

Figure 4-1: Troubleshooting procedure (1)

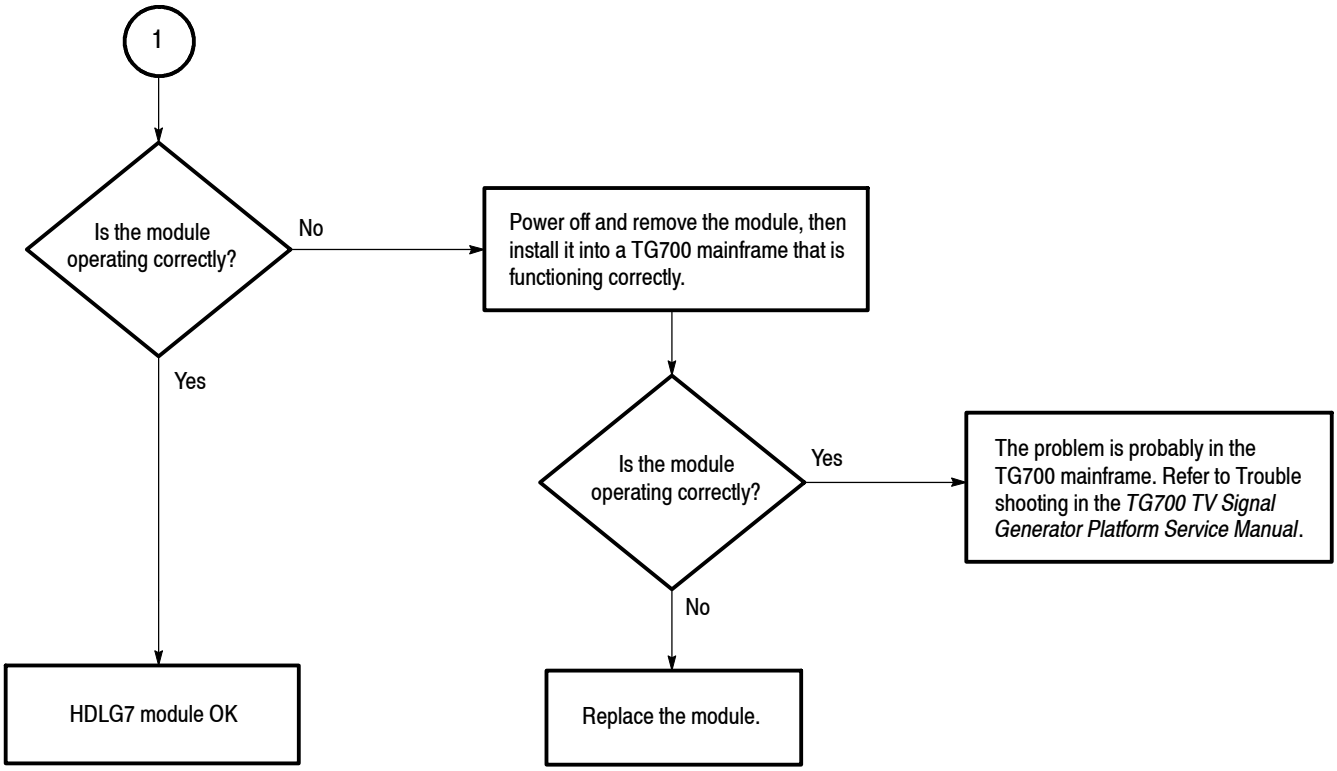

Figure 4-2: Troubleshooting procedure (2)

Option

Option

This section describes the option that is available for the HDLG7 module.

The following option is available:

- Option D1 (Test data report)

Option D1 Description

A calibration data test result report will be provided with the HDLG7 module when this option is specified.

Diagram

Diagram

Figure 6-1 shows the HDLG7 module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 TV Signal Generator Platform Service Manual*.

A block diagram of the HDLG7 module is located in the *Theory of Operation* section, beginning on page 2-1.

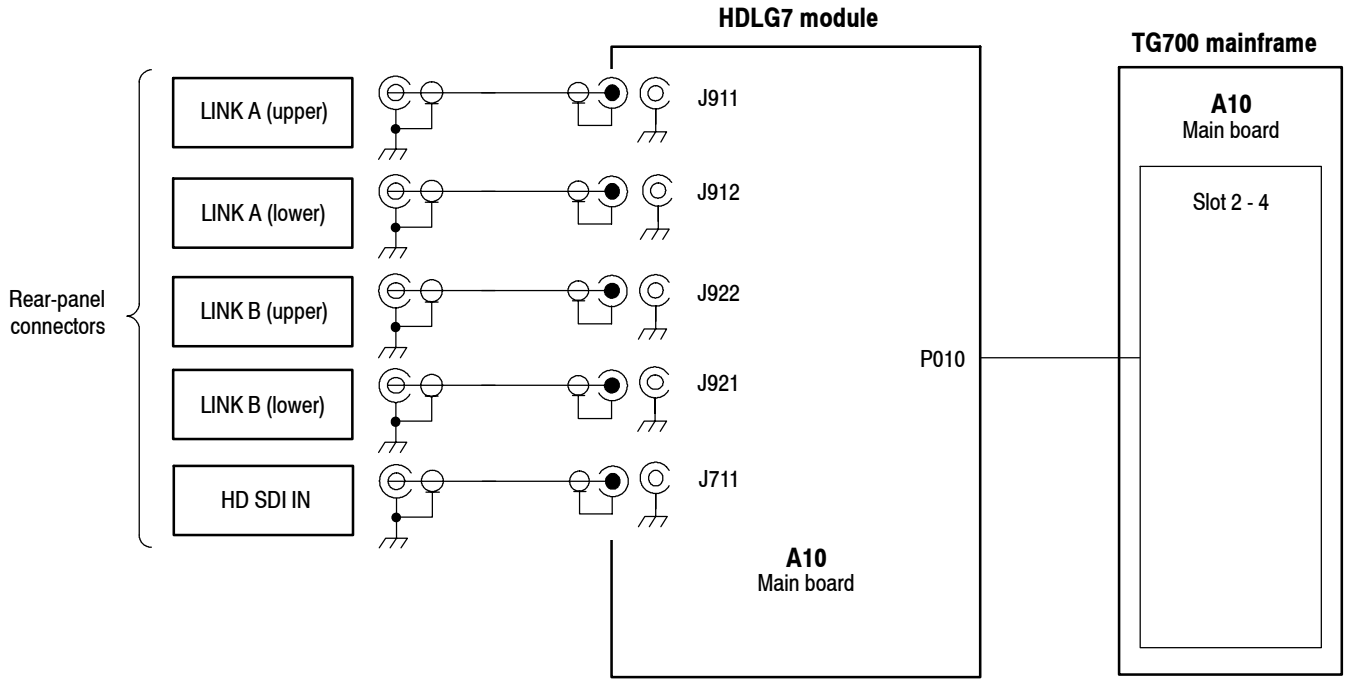

Figure 6-1: HDLG7 module connections

Replaceable Parts List

Replaceable Parts List

This section contains a list of the replaceable modules for the HDLG7 module. Use this list to identify and order replacement parts.

Parts Ordering Information

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

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

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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

Module Servicing

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

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

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

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

Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the HDLG7 module. 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.

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

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
7-1-1	441-A269-02			1	CHASSIS ASSY;MAIN,AGL7,AL,W/GASKET;SAFETY CONTROLLED
-2	333-4528-00			1	PANEL,REAR:HDLG7,SAFETY CONTROLLED
-3	214-4946-00			2	SPRING,CONICAL:VXI MOUNTING SCREW,0.26MM
-4	213-1129-01			2	SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,NI PL,CROSS REC & SLOTTED
-5	348-A156-01			1	GASKET,SHIELD;FINGER TYPE,BE-CU,8.13MM W X 2.79MM H X406.4MM L]
-6	174-5277-00			5	CABLE,RF,75 OHM;110MM,BNC TO MCX75
-7	211-A245-01			5	SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/NUT & amp;LOCK WASHER,TG700,TG700 OPT FP, AG7, AGL7, BG7, DVG7, HDVG7
-8	671-6184-00			1	CIRCUIT BD ASSY;DUAL LINK GENERATOR/CONVERTER,TESTED,WIRED 389386000
-9	334-1378-03			1	MARKER,IDENT:MKD SERIAL NO.
					STANDARD ACCESSORIES
	070-A824-XX			1	MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS
	062-A249-XX			1	SOFTWARE PACKAGE:S/W(CD-R)
					OPTIONAL ACCESSORIES
	070-A800-XX			1	MANUAL,TECH:SERVICE,TG700
	003-A041-00			1	NUTDRIVER,BOX:14MM HEX,BNC RETAINING NUT,MODIFIED 19MM

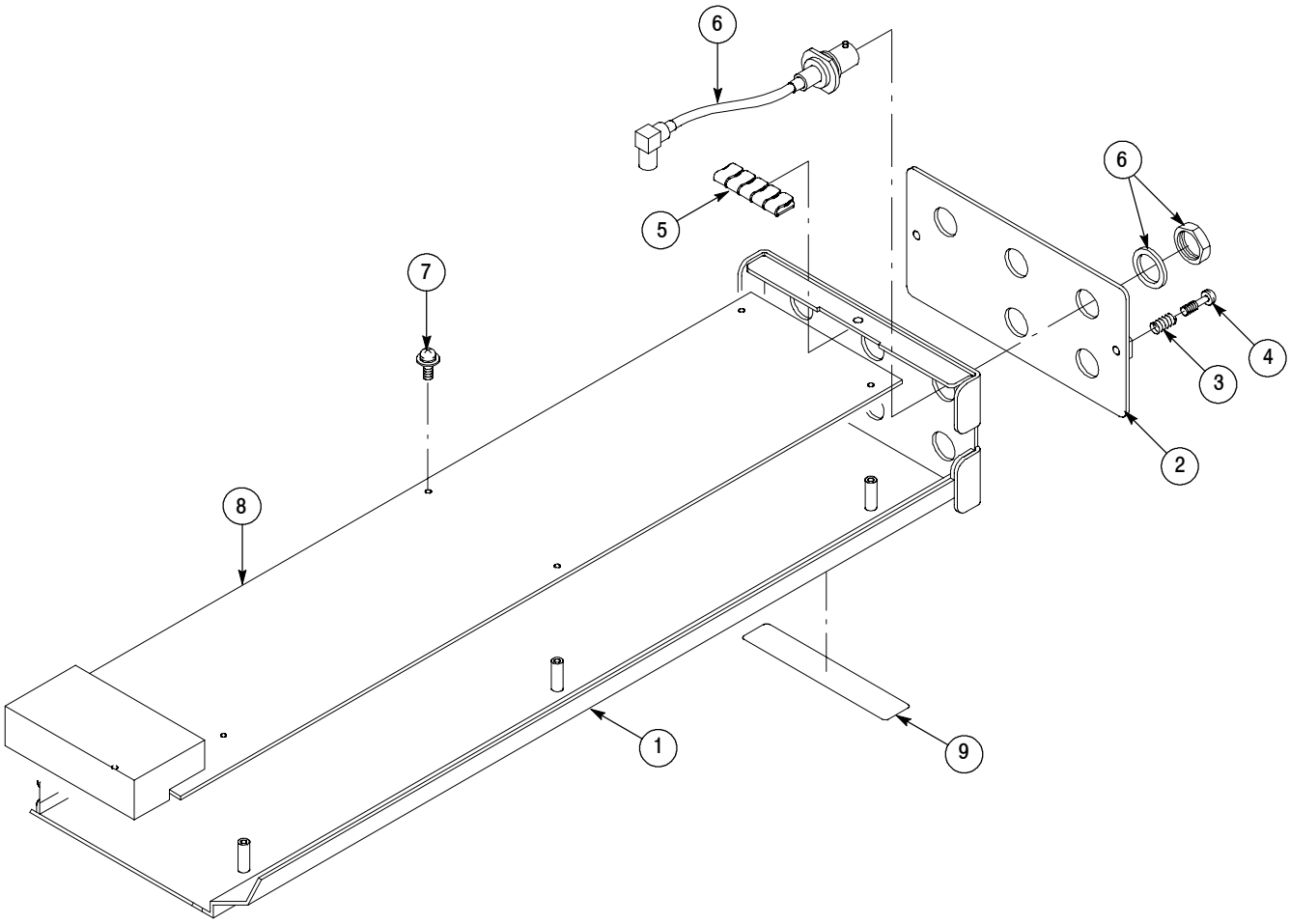

Figure 7-1: HDLG7 module exploded view

Service Manual

Tektronix

HDVG7
HDTV Digital Video Generator

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

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Preface

This is the service manual for the HDVG7 HDTV Digital Video Generator module. This manual contains information needed to service an HDVG7 Generator module to the module level.

Manual Structure

This manual is divided into sections, such as *Specifications* and *Theory of Operation*. Further, some sections are divided into subsections, such as *Product Description* and *Removal and Installation Procedures*.

Sections containing procedures also contain introductions to those procedures. Be sure to read these introductions because they provide information needed to do the service correctly and efficiently. The following are brief descriptions of each manual section.

- *Specifications* contains a description of the HDVG7 Generator module and the characteristics that apply to it.
- *Theory of Operation* is an overview of the module's design.
- *Performance Verification* contains procedures to perform the operation tests.
- *Adjustment Procedures* contains procedures for adjusting an HDVG7 Generator module to meet warranted characteristics.
- *Maintenance* contains installation, removal and replacement, and trouble-shooting instructions.
- *Options* contains a description of available options for the HDVG7 Generator module.
- *Diagram* contains an interconnect diagram showing the connections between the HDVG7 Generator module and the mainframe.
- *Replaceable Parts List* 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 HDVG7 Generator module.

- The *TG700 TV Signal Generator Platform User Manual* (Tektronix part number 070-A799-XX) describes how to use the TG700 mainframe and all modules. It also contains information about remote commands and programming structure for the TG700 mainframe and all modules.
- The *TG700 TV Signal Generator Platform Module Installation Instructions* (Tektronix part number 070-A824-XX) describes how to install and remove the modules, and how to upgrade the firmware of the mainframe.

Specifications

Specifications

This section contains a general product description of the HDVG7 Generator module followed by the operating specifications of the module.

Product Description

The HDVG7 Generator module is designed to be installed in the TG700 TV Signal Generator Platform.

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

- Two serial digital video outputs
- Two serial digital black outputs (option BK)
- Supports SMPTE 274M (1080), SMPTE 240M (1035), and SMPTE 296M (720)
- Overlay of circle, text, or logo on the video signal
- A moving picture generated by scrolling the active picture area of the output test signal
- Up to 16 channels of Embedded Audio
- Full remote control using Ethernet interface

The module can generate video signals with 24 (or 20) bit embedded digital audio with a sample rate of 48 kHz.

The following audio frequencies are supported:

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

Electrical Characteristics

Tables 1–1 through 1–3 list the electrical characteristics of the HDVG7 Generator module.

Table 1-1: Serial digital video signal outputs

Characteristic	Performance requirements	Reference information
Connector	BNC	
Number of outputs	2	SIGNAL 1 and SIGNAL 2
Bit Rate	1.485 Gbps 1.485/1.001 Gbps	
Signal amplitude, typical		800 mV
Rise and fall times, typical		≤ 270 ps, 20% to 80%
Jitter, typical		≤ 135 ps alignment jitter
Return loss	≥ 15 dB ≥ 10 dB	5 MHz to 750 MHz 750 MHz to 1.485 GHz

Table 1-2: Serial digital black signal outputs (Option BK only)

Characteristic	Performance requirements	Reference information
Connector	BNC	
Number of outputs	2	BLACK 1 and BLACK 2
Bit Rate	1.485 Gbps 1.485/1.001 Gbps	
Signal amplitude, typical		800 mV
Rise and fall times, typical		≤ 270 ps, 20% to 80%
Jitter, typical		≤ 135 ps alignment jitter
Return loss	≥ 15 dB ≥ 10 dB	5 MHz to 750 MHz 750 MHz to 1.485 GHz

Table 1-3: Embedded audio

Characteristic	Performance requirements	Reference information
Number of channels	16 channels in 4 groups; 8 AES/EBU audio pairs	
Audio tones		
Frequency	Silence to 20 kHz; 31 discrete settings	
Level	-60 to 0 dBFS in 1 dB steps	
Pre-emphasis		Emphasis status bits can be inserted.

Environmental Characteristics

Table 1–4 lists the environmental characteristics of the HDVG7 Generator module.

Table 1-4: Environmental characteristics

Characteristic	Description
Temperature	
Operating	0 °C to +50 °C
Non-operating	-20 °C to +60 °C
Relative Humidity	
Operating	20% to 80% (No condensation) ; Maximum wet-bulb temperature 29.4 °C
Non-operating	5% to 90% (No condensation) ; Maximum wet-bulb temperature 40.0 °C
Altitude	
Operating	To 4.5 km (15,000 feet) Maximum operating temperature decreases 1 °C each 300 m above 1.5 km.
Non-operating	To 15 km (50,000 feet)
Vibration	
Operating	3.04 m/s^2 (0.31 G_{rms}), 5 to 500 Hz, 10 min, three axes
Non-operating	23.3 m/s^2 (2.38 G_{rms}), 5 Hz to 500 Hz, 10 min, three axes
Shock	
Non-operating	294 m/s2 (30 G), half-sine, 11 ms duration

Theory of Operation

Theory of Operation

This section describes the basic operation of the major circuit blocks in the HDVG7 Generator module.

For information about the TG700 mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

Bus Interface This block provides the communication between the mainframe and the module circuit.

Address Generator This block consists of a frame delay, an MPU interface, a sequencer, an SDRAM controller, and a blanking data generator. It interfaces the Frame Memory and the Line Memory and controls the output sequence of the video data in these memories.

Frame Memory Frame memory contains a series of pointers that control the order the video lines stored in Line Memory are used to produce serial digital signals.

Line Memory Line memory holds the actual sample points which define a serial digital signal.

Overlay Controller This block consists of an MPU interface and an overlay controller. It inserts data from the Overlay Memory into the Line Memory data stream to create circular patterns, ID text, and logo.

Overlay Memory The memory generates timings to multiplex the line memory data and the overlay data used for a circle, ID text, and logo overlay.

Formatter This block consists of a line number and CRC generator, an audio control packet generator, a data packet generator, an MPU interface, and an SRAM controller. It inserts line numbers and embedded audio data in the serial digital signals.

Audio Memory The memory contains embedded audio data.

Serializer The serializer converts a 20 bits parallel data to SDI signal.

Black Generator (Option BK Only) This block generates black or gray (40% gray) signal for the BLACK 1 and BLACK 2 outputs.

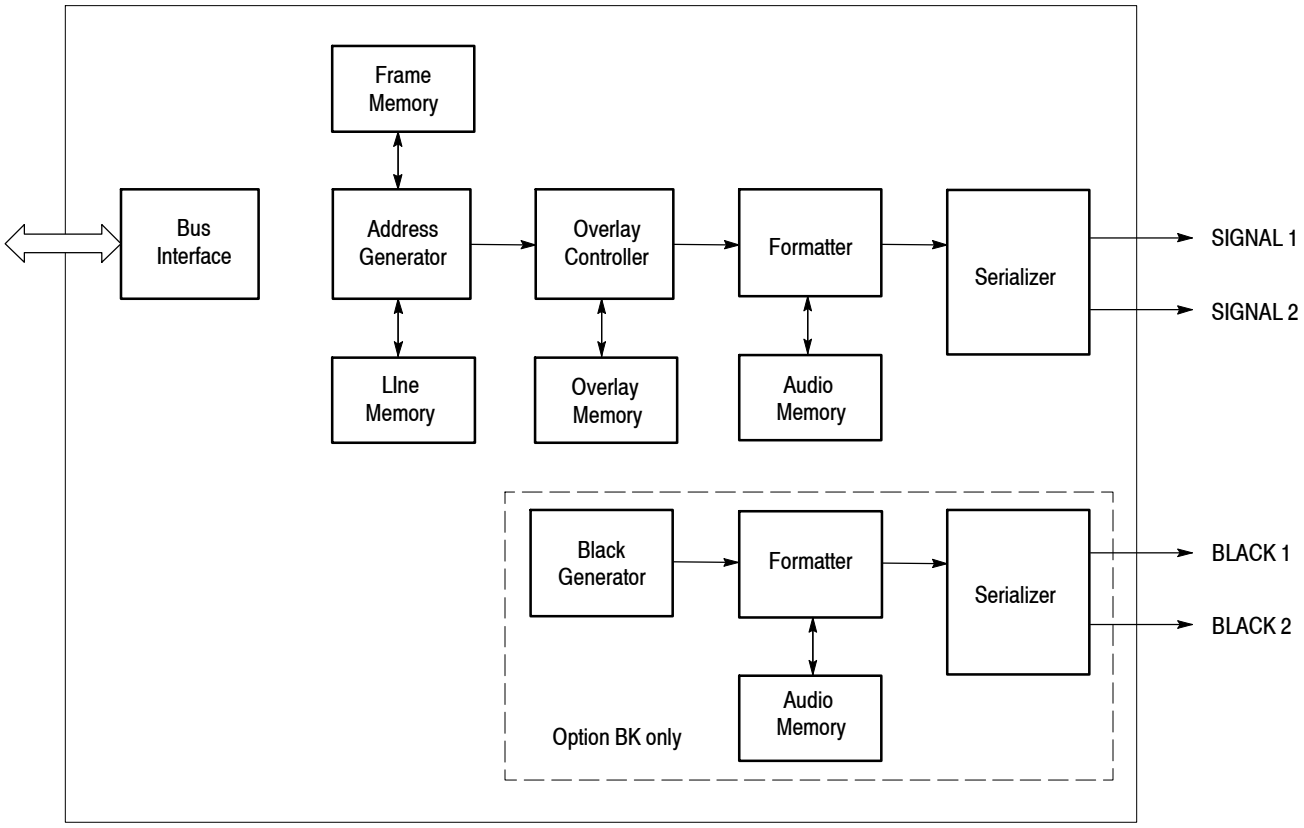

Figure 2- 1: Simplified block diagram of the HDVG7 Generator module

Performance Verification

Performance Verification

This section provides procedures that verify the performance and functionality of the HDVG7 Generator module.

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

Preparation for Performance Verification

Perform the following before starting the performance verification procedures:

Power On Default Settings

Before you perform the performance verification procedures, make sure that the required instrument settings are saved in the Power On Default preset.

If the instrument settings are saved in the Power On Default preset, you can recall the settings after the performance verification procedures are completed by removing and reapplying the power.

Warm up

The HDVG7 Generator module and test equipment must have had a warmup period of at least 20 minutes.

Equipment Required

Table 3–1 lists the equipment required for the procedures.

Table 3-1: Equipment required for performance verification

Item	No.	Minimum requirement	Recommended equipment
Digital television waveform monitor	1		Tektronix WFM1125 Option 0D
HDTV picture monitor	1		Sony HDM1220J
Digital audio monitor	1		Tektronix 764
Sampling oscilloscope	1	Bandwidth: 6 GHz or higher	Tektronix TDS820
75 Ω BNC cable	5	Length: 42 inches	Tektronix part number 012-0074-00
50 Ω BNC to SMA adapter	1		Tektronix part number 015-1018-00
75 Ω coaxial terminator	5		Tektronix part number 011-0102-01
75 Ω signal adapter	1	Bandwidth: 1 GHz	Tektronix AMT75

Calibration Data Report

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

Table 3- 2: HDVG7 calibration data report

Serial Number:	Cal Date:	Temperature:	Humidity:

Step	Function Tested	Minimum	Cal Data	Maximum
1.	Serial Output Amplitude			
	SIGNAL 1 (Typical value: 800 mV)	----------	mV	----------
	SIGNAL 2 (Typical value: 800 mV)	----------	mV	----------
2.	Serial Output Rise Time (20% to 80% amplitude points)			
	SIGNAL 1		ps	270 ps
	SIGNAL 2		ps	270 ps
3.	Serial Output Fall Time (20% to 80% amplitude points)			
	SIGNAL 1		ps	270 ps
	SIGNAL 2		ps	270 ps
	Option BK			
4.	Serial Output Amplitude			
	BLACK 1 (Typical value: 800 mV)	----------	mV	----------
	BLACK 2 (Typical value: 800 mV)	----------	mV	----------
5.	Serial Output Rise Time (20% to 80% amplitude points)			
	BLACK 1		ps	270 ps
	BLACK 2		ps	270 ps
6.	Serial Output Fall Time (20% to 80% amplitude points)			
	BLACK 1		ps	270 ps
	BLACK 2		ps	270 ps

Performance Verification Procedures

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

WARNING. *Dangerous electric shock hazards exist inside the TG700 mainframe. Only qualified service personnel should perform these procedures.*

Serial Digital Outputs

This test verifies that serial digital signals are output correctly from the SIGNAL 1 and SIGNAL 2 connectors. The following equipment is required for the test:

- Digital TV waveform monitor
- HDTV picture monitor
- Digital audio monitor
- Five 75 Ω BNC cables
- Five 75 Ω coaxial terminators

Perform the following procedure to verify that serial digital signals are output correctly from the SIGNAL 1 and SIGNAL 2 connectors.

1. Use the 75 Ω BNC cable to connect SIGNAL 1 connector on the HDVG7 Generator module to the CHA connector on the digital TV waveform monitor rear panel as shown in Figure 3–1.
2. Use the 75 Ω coaxial terminator to terminate the SIGNAL 2 connector on the HDVG7 Generator module.
3. Use the 75 Ω BNC cables to connect Pr, Pb, and Y ANALOG OUT connectors on the digital TV waveform monitor rear panel to INPUT A R/P_R, B/P_B, G/Y connectors, respectively, on the HDTV picture monitor rear panel as shown in Figure 3–1.
4. Use the 75 Ω coaxial terminators to terminate the other loop through to R/P_R, B/P_B, and G/Y connectors on the HDTV picture monitor rear panel.
5. Use the 75 Ω BNC cable to connect AUDIO CHA connector on the digital TV waveform monitor rear panel to CH1–2 BNC connector on the digital audio monitor rear panel as shown in Figure 3–1.
6. Use the 75 Ω coaxial terminator to terminate the other loop through to CH1–2 BNC connector on the digital audio monitor rear panel.

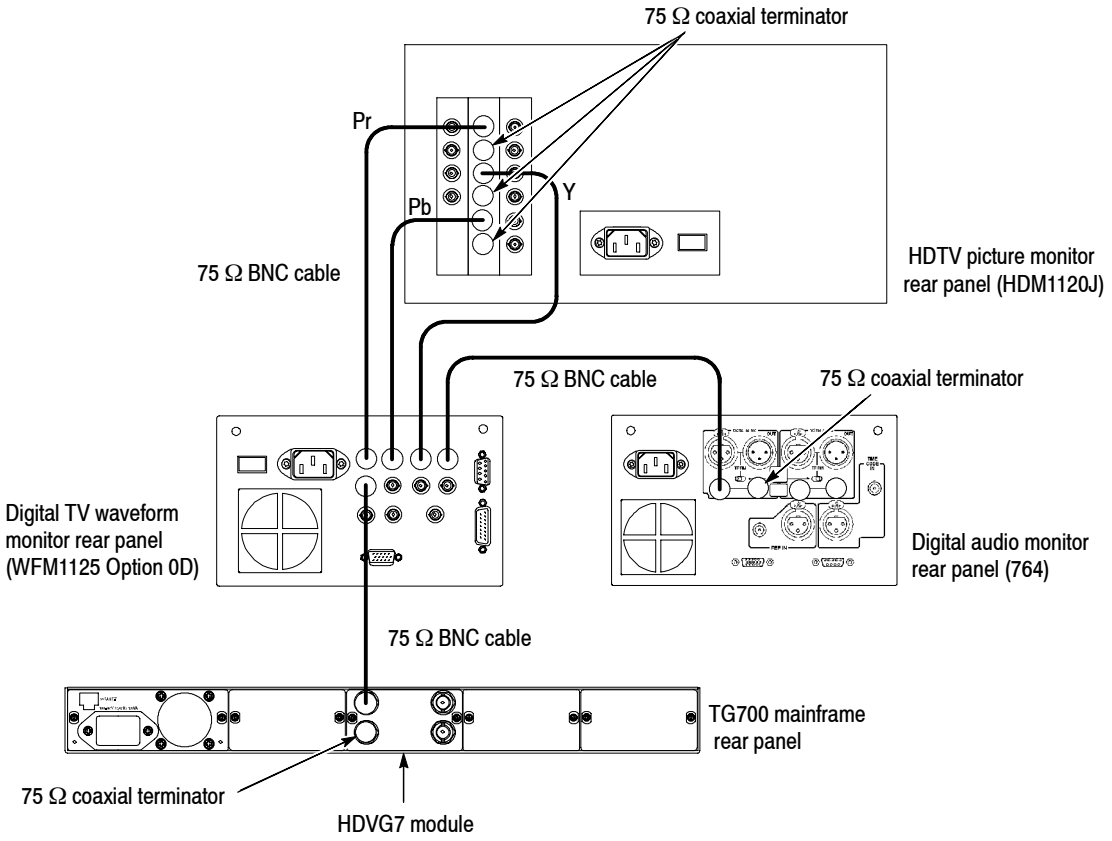

Figure 3- 1: Equipment connections for verifying the serial digital outputs

7. Set the digital TV waveform monitor settings as indicated below:

Input . . . . . CH A
Display . . . . . Parade
Format 240M/274M
Interlaced/Progressive . . Interlaced

8. Recall the Factory Default preset as follows:

a. Press the **MODULE** button to display the TG700 main menu.

b. Press the up (▲) or down (▼) arrow button to select **RECALL**.

c. Press the left (◀) or right (▶) arrow button to select **Factory Default**.

d. Press the **ENTER** button to recall the factory default settings.

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

a. Press the **MODULE** button to display the HDVG7 main menu.

b. Press the **COLOR BAR** test signal button until the **75 % Color Bars** signal is selected.

10. Turn on the circle overlay as follows:

a. Press the **CANCEL** button.

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

c. Press the left (◀) or right (▶) arrow button to select **Circle**, and then press the **ENTER** button to access the CIRCLE OVERLAY submenu.

d. Press the left (◀) or right (▶) arrow button to select **Enable**, and then press the **ENTER** button.

11. Turn on the embedded audio for Group 1 as follows:

a. Press the **CANCEL** button to return the module main menu.

b. Press the up (▲) or down (▼) arrow button to select **AUDIO (EMBEDDED)**.

c. Press the left (◀) or right (▶) arrow button to select **Group 1**, and then press the **ENTER** button to access the AUDIO GROUP submenu.

d. Press the left (◀) or right (▶) arrow button to select **Enable**, and then press the **ENTER** button.

e. Press the **CANCEL** button to return the module main menu.

12. Check the displayed waveform and CRC error:

a. Verify that the waveform and the overlay circle are correctly displayed on the digital TV waveform monitor.

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

13. Check the embedded audio:

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

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

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

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

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

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

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

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

15. Change the BNC cable connection from the SIGNAL 1 connector to the SIGNAL 2 connector and change the 75 Ω terminator from the SIGNAL 2 connector to the SIGNAL 1 connector on the HDVG7 Generator module.

16. Repeat steps 12 through 14.

Serial Digital Black Outputs (Option BK Only). This test verifies that serial digital black signals are output correctly from the BLACK 1 and BLACK 2 connectors.

17. Change the BNC cable connection from the SIGNAL 2 connector to the BLACK 1 connector and change the 75 Ω terminator from the SIGNAL 1 connector to the BLACK 2 connector on the HDVG7 Generator module.

18. Select the **40 % Flat Field** signal as follows:

a. Press the **CANCEL** button to return the module main menu.

b. Press the up (▲) or down (▼) arrow button to select **BLACK (OPTION)**.

c. Press the **ENTER** button to access the BLACK submenu.

d. Press the up (▲) or down (▼) arrow button to select **SIGNAL**.

e. Press the left (◀) or right (▶) arrow button to select **40 % Flat Field** and press the **ENTER** button.

19. Turn on the embedded audio for Group 1 as follows:

a. Press the **CANCEL** button to return the BLACK submenu.

b. Press the up (▲) or down (▼) arrow button to select **AUDIO (EMBEDDED)**.

c. Press the left (◀) or right (▶) arrow button to select **Group 1**, and then press the **ENTER** button to access the AUDIO GROUP submenu.

d. Press the left (◀) or right (▶) arrow button to select **Enable**, and then press the **ENTER** button.

e. Press the **CANCEL** button to return the BLACK submenu.

20. Verify that the waveform is correctly displayed on the digital TV waveform monitor.

21. Verify that the CRC ERROR LED on the digital TV waveform monitor does not light.

22. Verify that the digital audio monitor bar graphs show both Channel 1 and Channel 2 at –20 dBfs.

23. Verify that the correct flat field signal is displayed on the HDTV picture monitor.

24. Change the BNC cable connection from BLACK 1 connector to the BLACK 2 connector and change the 75 Ω terminator from BLACK 2 connector to the BLACK 1 connector on the HDVG7 Generator module.

25. Repeat steps 20 through 23.

Eye Pattern Check

This test verifies the signal level and eye pattern of the SIGNAL 1 and SIGNAL 2 outputs. The following equipment is required for the test:

- Sampling oscilloscope
- 75 Ω signal adapter (AMT75)
- 75 Ω BNC cable
- SMA-to-BNC adapter
- 75 Ω coaxial terminator

Perform the following procedure to verify the signal level and eye pattern of the SIGNAL 1 and SIGNAL 2 outputs.

1. Use the 75 Ω BNC cable, 75 Ω signal adapter, and SMA-to-BNC adapter to connect the SIGNAL 1 connector on the HDVG7 Generator module to the CH1 input connector on the oscilloscope as shown in Figure 3–2.

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

---

2. Use the 75 Ω coaxial terminator to terminate the SIGNAL 2 connector on the HDVG7 Generator module.

3. Set the sampling oscilloscope settings as indicated below:

   Vertical . . . . . 30 mV/div
   Horizontal . . . . . 200 ps/div
   Main Position . . . . . 700 ps
   Trig Source CH1
   Trig Level . . . . . 0 V
   Trig Slope . . . . . Rising Edge
   Acquire Menu . . . . . Normal
   DISPLAY . . . . . Variable persistence: 500 ms
   Measure . . . . . Amplitude

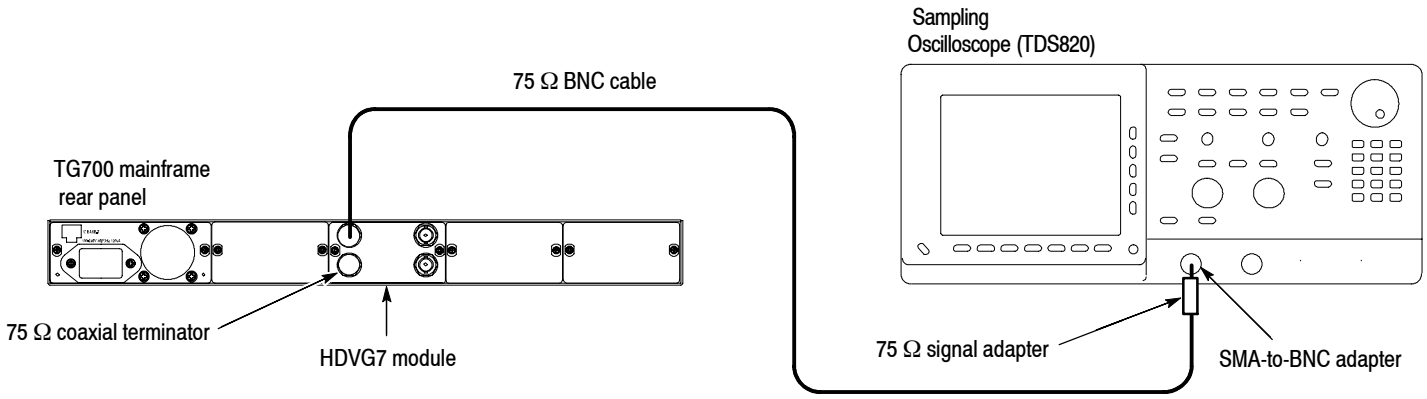

Figure 3-2: Equipment connection for verifying the output level and eye pattern

4. Verify that SIGNAL 1 eye pattern displayed on the sampling oscilloscope is fully open. Figure 3–3 shows an example of the eye pattern for an acceptable output signal.

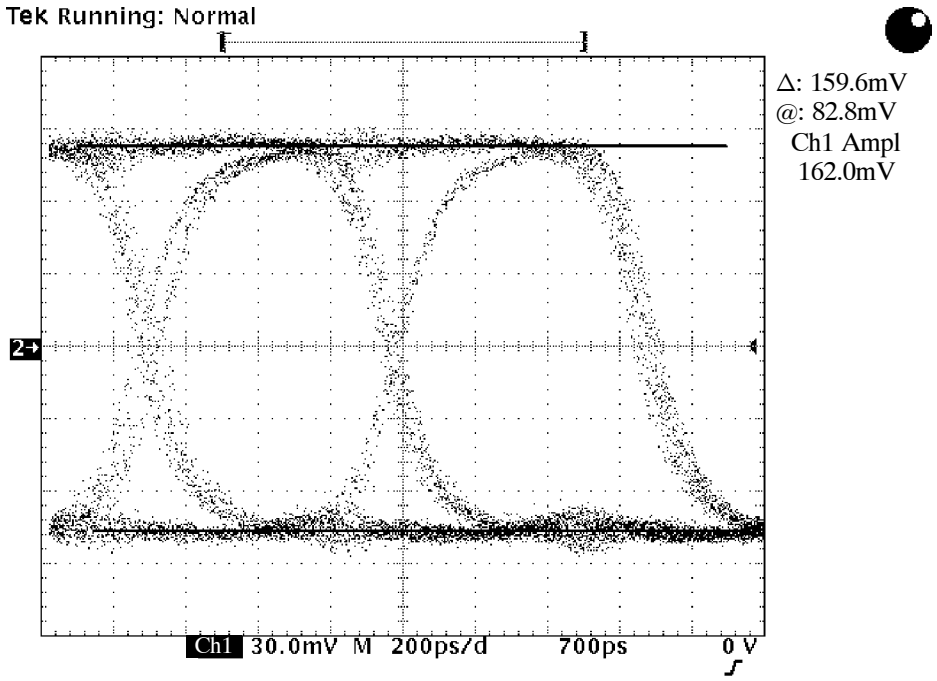

Figure 3-3: Example of eye pattern for an acceptable output signal

5. Use the sampling oscilloscope to measure that the amplitude, rise and fall time are as follows.

Amplitude : approximately 160 mV
Rise and fall time : < 270 ps (20% to 80%)

6. Change the BNC cable connection from the SIGNAL 1 connector to the SIGNAL 2 connector and change the 75 Ω terminator from the SIGNAL 2 connector to the SIGNAL 1 connector on the HDVG7 Generator module.

7. Check that SIGNAL 2 eye pattern displayed on the sampling oscilloscope is fully open (see Figure 3–3) and repeat step 5.

BLACK Output Eye Pattern Check (Option BK Only). This test verifies the signal level and eye pattern of the BLACK 1 and BLACK 2 outputs.

8. Change the BNC cable connection from the SIGNAL 2 connector to the BLACK 1 connector and change the 75 Ω terminator from the SIGNAL 1 connector to the BLACK 2 connector on the HDVG7 Generator module.

9. Check that BLACK 1 eye pattern displayed on the sampling oscilloscope is fully open (see Figure 3–3) and repeat step 5.

10. Change the BNC cable connection from the BLACK 1 connector to the BLACK 2 connector and change the 75 Ω terminator from the BLACK 2 connector to the BLACK 1 connector on the HDVG7 Generator module.

11. Check that SIGNAL 2 eye pattern displayed on the sampling oscilloscope is fully open (see Figure 3–3) and repeat step 5.

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

Adjustment Procedures

Adjustment Procedures

This section contains information needed to adjust the TG700.

The only adjustment in the HDVG7 Generator module is for the output level.

Requirements for Adjustment

Before doing the adjustment, note the following requirements.

Personnel This procedure is only to be performed by trained service technicians.

Warmup Period The HDVG7 Generator module requires a 20 minute warmup time in a +20 °C to +30 °C environment before it is adjusted. Adjustment done before the operating temperature has stabilized may cause errors in performance.

Access When adjusting the output level, you need to remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

Equipment Required

Table 4–1 lists the equipment required to adjust the output level.

Table 4-1: Equipment required

Item	No.	Minimum requirement	Recommended equipment
TV signal generator platform	1		Tektronix TG700
Sampling Oscilloscope	1	Bandwidth: 6 GHz or higher	Tektronix TDS820
75 Ω BNC cable	1	Length: 42 inches	Tektronix part number 012-0074-00
50 Ω BNC to SMA adapter	1		Tektronix part number 015-1018-00
75 Ω coaxial terminator	1		Tektronix part number 011-0102-01
75 Ω signal adapter	1	Bandwidth: 1 GHz Amplitude precision: -3 dB	Tektronix AMT75

Output Level Adjustment

Preparation

To perform the output level adjustment, you must first remove the top cover of the TG700 mainframe. For removal and installation procedures for the top cover, refer to the *TG700 TV Signal Generator Platform Service Manual*.

After you have removed the top cover, find the variable resistors on the HDVG7 circuit board. See Figure 4–1.

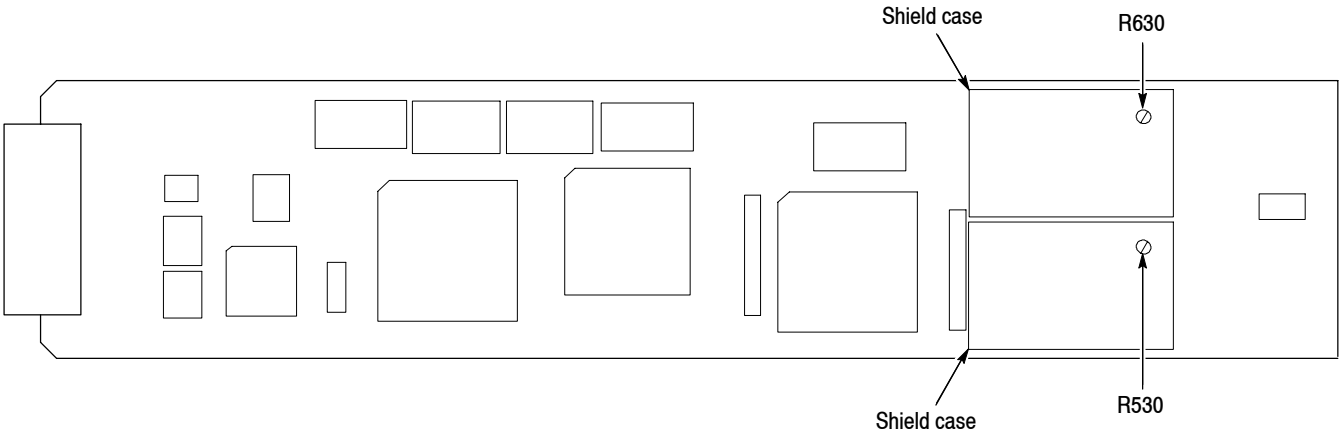

Figure 4- 1: HDVG7 circuit board view

Procedure

WARNING. *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable, 75 Ω signal adapter, and SMA-to-BNC adapter to connect the SIGNAL 1 connector on the HDVG7 Generator module to the CH1 input connector on the oscilloscope as shown in Figure 3–2.

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

2. Use the 75 Ω coaxial terminator to terminate the SIGNAL 2 connector on the HDVG7 Generator module.

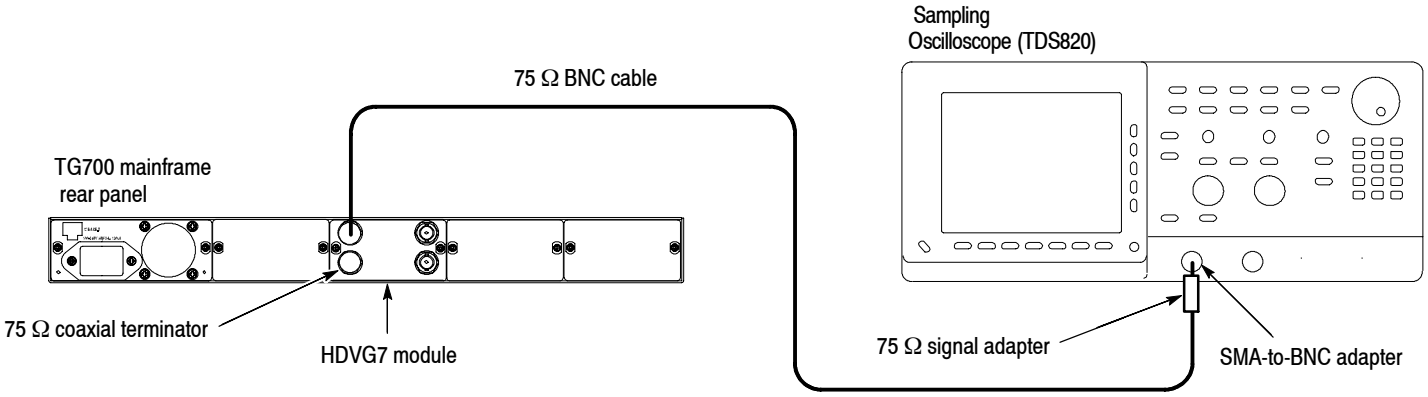

Figure 4- 2: Equipment connection for adjusting the output level

3. Set the sampling oscilloscope settings as indicated below:

Vertical . . . . . 30 mV/div
Horizontal . . . . . 200 ps/div
Trig Position . . . . . 50 %
Main Position . . . . . 700 ps
Trig Level . . . . . 0 V
Trig Slope . . . . . Rising Edge
Acquire Menu . . . . . Normal
DISPLAY . . . . . Variable persistence: 500 ms

4. Recall the Factory Default preset as follows:

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

b. Press the left (◀) or right (▶) arrow button to select **Factory Default**.

c. Press the **ENTER** button to recall the factory default settings.

d. Press the **CANCEL** button to return the TG700 main menu.

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

a. Press the MODULE button to display the **HDVG7** main menu.

b. Press the **COLOR BAR** test signal button until the **75 % Color Bars** signal is selected.

6. Turn on the “Cursor: HBars” of the sampling oscilloscope, and then set the ΔV to 159.6 mV.

7. Change the cursor mode to Track, and then position the cursors so that they are symmetrical about the center graticule.

8. Locate variable resistor R530 on the HDVG7 circuit board. See Figure 4–1.

9. Adjust the R530 so that the signal amplitude is equal to the height between the two cursors set in step 6.

BLACK Output Level Adjustment (Option BK Only).

10. Move the BNC cable connection from the SIGNAL 1 connector to the BLACK 1 connector and move the 75 Ω terminator from the SIGNAL 2 connector to the BLACK 2 connector on the HDVG7 Generator module.

11. Select the **40 % Flat Field** signal as follows:

    a. Press the **CANCEL** button to return the module main menu.

    b. Press the up (▲) or down (▼) arrow button to select **BLACK (OPTION)**.

    c. Press the **ENTER** button to access the BLACK submenu.

    d. Press the up (▲) or down (▼) arrow button to select **SIGNAL**.

    e. Press the left (◀) or right (▶) arrow button to select **40 % Flat Field** and press the **ENTER** button.

12. Locate the variable resistor R630 on the HDVG7 circuit board. See Figure 4–1.

13. Adjust the R630 so that the signal amplitude is equal to the height between the two cursors set in step 6.

    This completes the output level adjustment procedures.

Maintenance

Maintenance

This section contains instructions and procedures for maintaining the HDVG7 Generator module. For information on servicing the mainframe, refer to the *TG700 TV Signal Generator Platform Service Manual*.

The following information can be found in this section:

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

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

Preparation

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

Servicing Prerequisites

Ensure 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.

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.*

Inspecting and Cleaning Procedures

Clean the mainframe and modules often enough to prevent dust or dirt from accumulating. Refer to *Inspecting and Cleaning Procedures* in the *TG700 TV Signal Generator Platform Service Manual*.

Performance Verification

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

Repackaging Instructions

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

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

Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the HDVG7 Generator module.

Tools Required

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

Table 5-1: Required tools

Name	Description	Tektronix part number
Screwdriver handle	Accepts Phillips-driver bits	
#1 Phillips tip	Phillips-driver bit for #1 size screw heads	
#2 Phillips tip	Phillips-driver bit for #2 size screw heads	
Nut driver, 14 mm	Special nut driver for removing the BNC connectors of the HDVG7 module	003-A041-00

Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section in the *TG700 TV Signal Generator Platform Module Installation Instructions* to remove the HDVG7 Generator module from the mainframe.
2. Disconnect the cables at P500 (SIGNAL 1) and P502 (SIGNAL 2) on the HDVG7 circuit board. If Option BK is installed, also disconnect the cables at J800 (BLACK 1) and J802 (BLACK 2).
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

Replacing the Chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the six screws securing the circuit board to the chassis.
3. Lift the circuit board up and away from chassis, and then place it on a static free surface.
4. Set the replacement chassis on a firm, flat, static-free work surface.
5. Carefully place the circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the six screws securing the circuit board to the chassis.
7. Apply the rear panel to the chassis, and then install all the rear-panel connectors to the chassis.

Troubleshooting

This section contains instructions and procedures for troubleshooting the HDVG7 Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to *Troubleshooting* in the *TG700 TV Signal Generator Platform Service Manual*.

Equipment Required

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

Table 5-2: Equipment required for troubleshooting

Equipment description	Minimum requirements/example
Screwdriver handle	Accept Phillips-driver bits
#1 Phillips tip	Phillips-driver bit for #1 size screw heads
TG700 mainframe	A TG700 mainframe that is functioning correctly.

Backing up the instrument settings

Before you begin the troubleshooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◀) or right (▶) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

Troubleshooting Trees

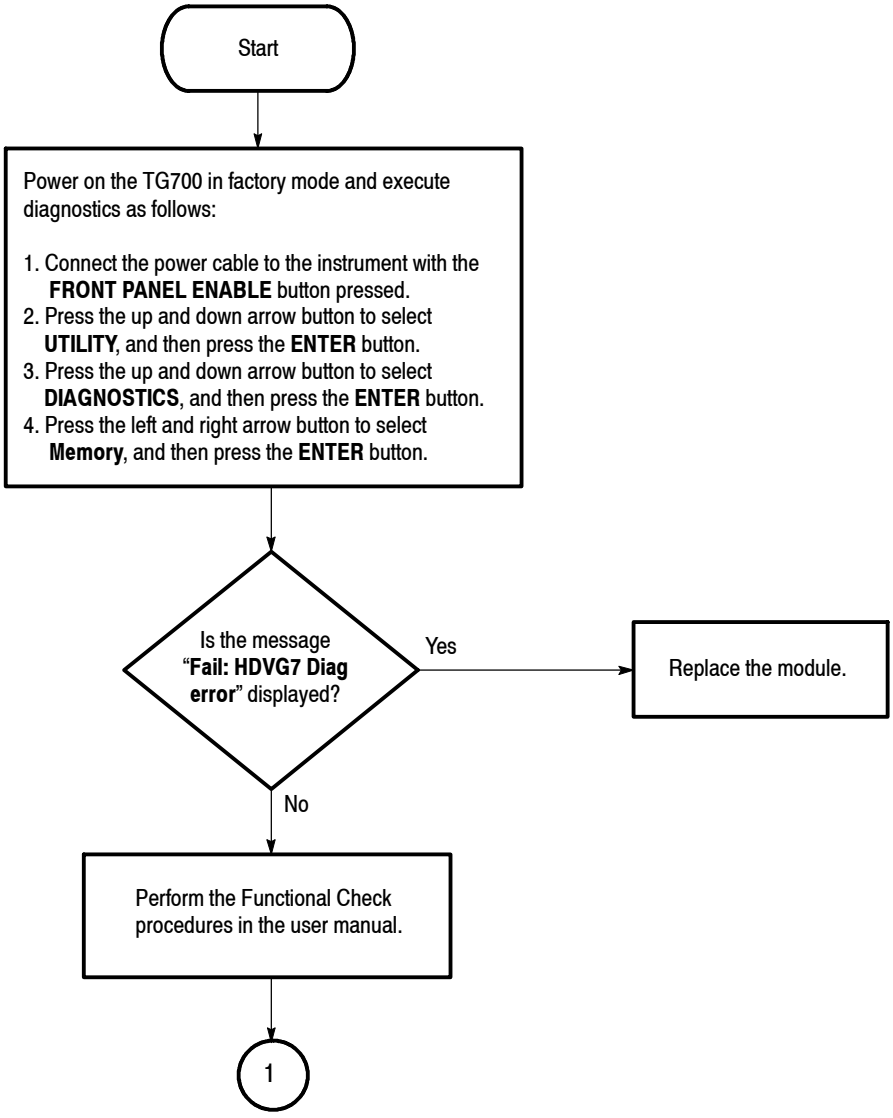

Figure 5- 1: Troubleshooting procedure (1)

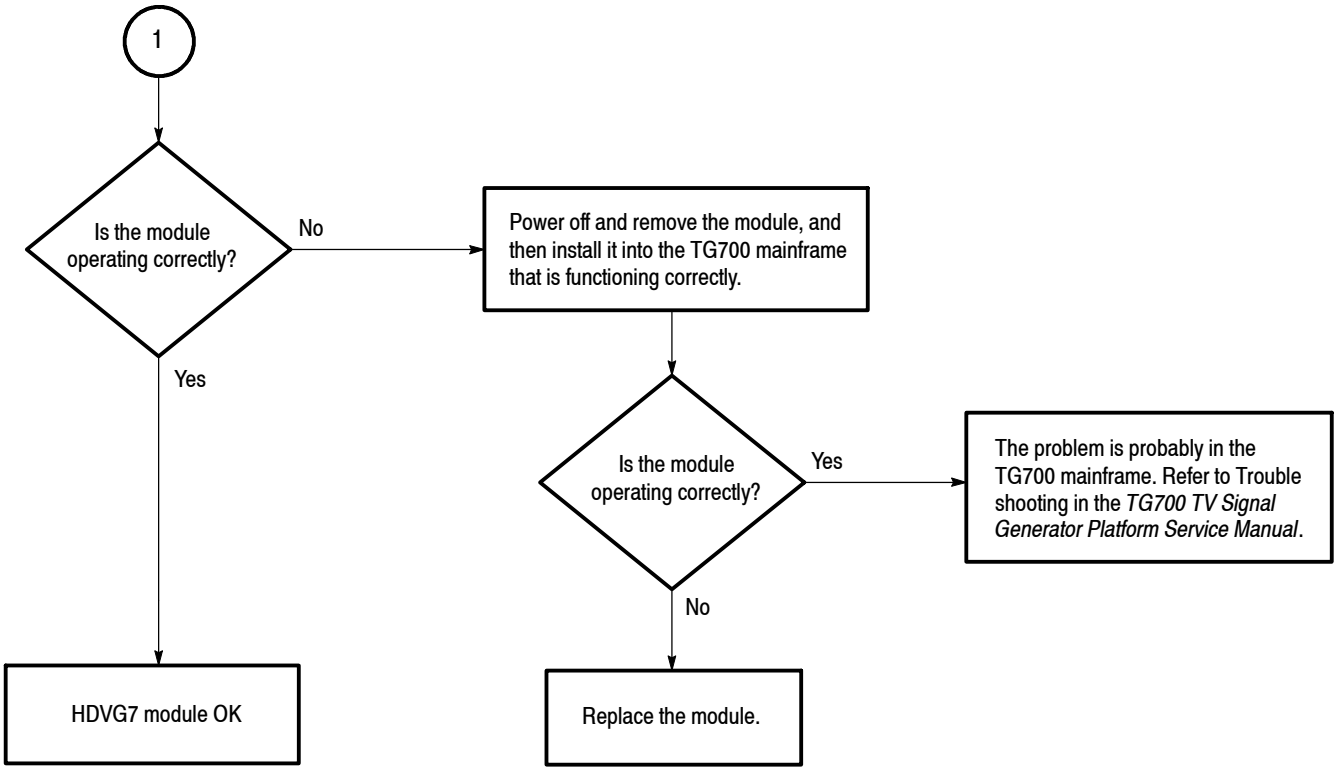

Figure 5- 2: Troubleshooting procedure (2)

Options

Options

This section describes options that are available for the HDVG7 Generator module.

The following options are available:

- Option BK (Serial digital black output)
- Option D1 (Test data report)

Option BK Description

Two serial digital black signal outputs are added to the HDVG7 Generator module when this option is specified.

Option D1 Description

A calibration data test result report will be provided with the HDVG7 Generator module when this option is specified.

Diagram

Diagram

Figure 7-1 shows the HDVG7 Generator module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 TV Signal Generator Platform Service Manual*.

A block diagram of the HDVG7 Generator module is located in the *Theory of Operation* section, beginning on page 2–1.

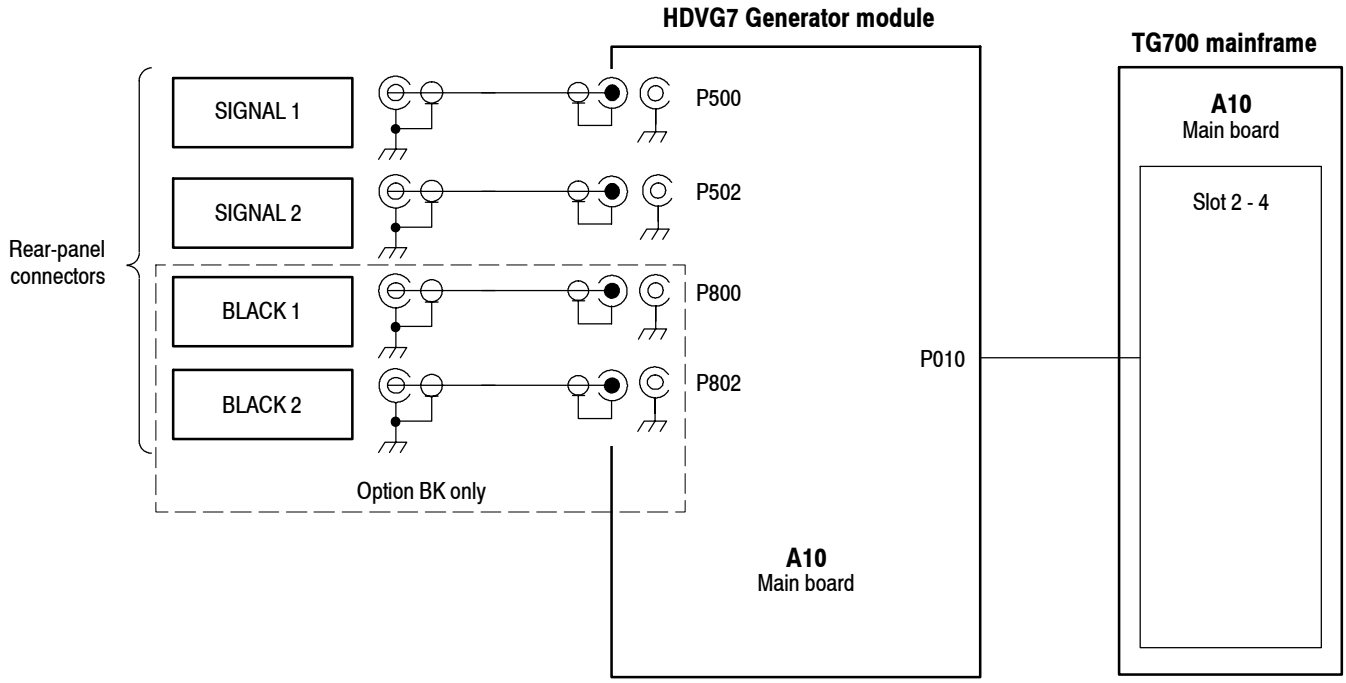

Figure 7-1: HDVG7 Generator module connections

Replaceable Parts List

Replaceable Parts List

This section contains a list of the replaceable modules for the HDVG7 Generator module. Use this list to identify and order replacement parts.

Parts Ordering Information

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

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

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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

Module Servicing

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

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

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

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

Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the HDVG7 Generator module. 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.

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

Replaceable parts list

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
8-1	116-A007-05			1	EXCHANGE MODULE:HDVG7
	116-A008-05			1	EXCHANGE MODULE:HDVG7-BK
8-1-1	441-A275-00			1	CHASSIS,MODULE HDVG7:ASSY
-2	333-A409-00			1	PANEL,REAR:HDVG7,AL
	333-A410-00			1	PANEL,REAR:HDVG7 OPTION,AL
-3	214-4946-00			2	SPRING,CONICAL:VXI MOUNTING SCREW,0.26MM
-4	213-1129-01			2	SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,NI PL,CROSS REC & SLOTTED
-5	348-A128-00			2.5 CM	SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02]
-6	174-B846-00			2	CABLE ASSY,RF:75OHM,COAX(RG179),6CM L,BNC TO PL71-LP-1.5C
	174-B846-00			4	CABLE ASSY,RF:75OHM,COAX(RG179),6CM L,BNC TO PL71-LP-1.5C (OPTION BK)
-7	211-A245-01			6	SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU & LOCK WASHER
-8	334-1378-03			1	MARKER,IDENT:MKD SERIAL NO.
-9	342-A146-00			1	INSULATOR,PLATE:HEAT CONDUCTOR,RUBBER, 20MMX20MMX10MM THK [TC1000-TCK]
	342-A146-00			2	INSULATOR,PLATE:HEAT CONDUCTOR,RUBBER, 20MMX20MMX10MM THK [TC1000-TCK]
					STANDARD ACCESSORIES
	070-A824-XX			1	MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS
	062-A249-XX			1	SOFTWARE PACKAGE:S/W(CD-R)
					OPTIONAL ACCESSORIES
	070-A800-XX			1	MANUAL,TECH:SERVICE,TG700
	003-A041-00			1	NUT DRIVER,BOX:14MM HEX,BNC RETAINING NUT, MODIFIED 19MM

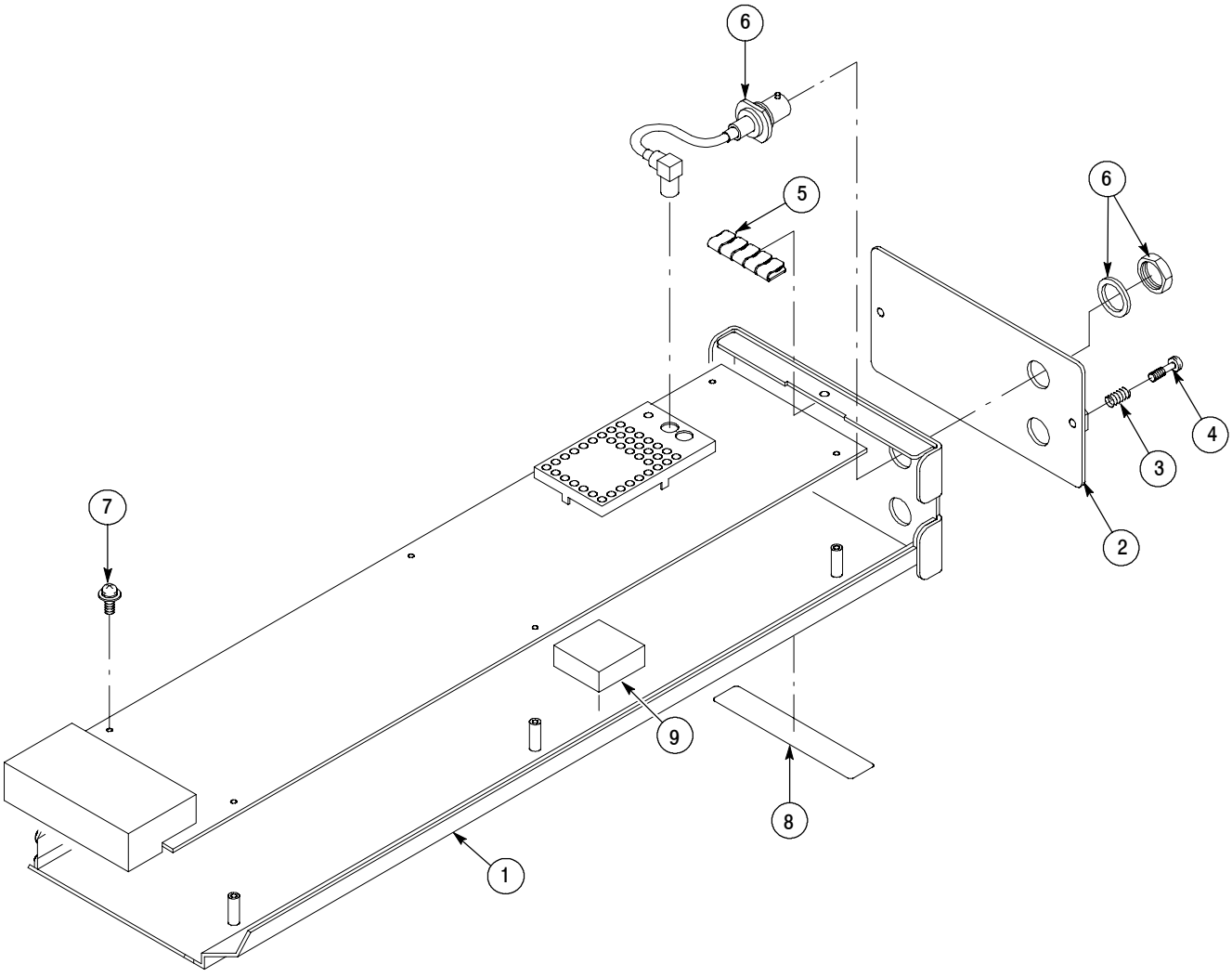

Figure 8-1: HDVG7 Generator module exploded view