SONY
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Service Manual

AWG2040

Arbitrary Waveform Generator

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Tektronix

AWG2040
Arbitrary Waveform Generator

070-8963-02

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 the Safety
Summary prior to performing service.

WARRANTY

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.

THIS WARRANTY IS GIVEN BY TEKTRONIX IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. TEKTRONIX AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TEKTRONIX' RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. TEKTRONIX AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER TEKTRONIX OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

Preface

This is the service manual for the AWG2040 Arbitrary Waveform Generator. The manual contains information needed to service the AWG2040 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 contains a brief description of each manual section.

- *Specifications* — contains a description of the AWG2040 and its characteristics.

- *Operating Information* — includes general information and operating instructions at the level needed to safely power on and service the AWG2040.

- *Theory of Operation* — contains circuit descriptions that support general service to the module level.

- *Performance Verification* — contains a collection of procedures for confirming that the AWG2040 functions properly and meets warranted limits.

- *Adjustment Procedures* — contains a collection of procedures for adjusting the AWG2040 to meet warranted limits.

- *Maintenance* — contains information and procedures for performing preventive and corrective maintenance of the AWG2040. These instructions include cleaning, module removal and installation, and fault isolation to the module.

- *Options* — contains information on servicing any of the factory-installed options that your AWG2040 includes.

- *Electrical Parts List* — contains a statement referring you to *Mechanical Parts List*, where both electrical and mechanical modules are listed. See below.

- *Diagrams* — contains block diagrams and an interconnection diagram useful in isolating failed modules.

- *Mechanical Parts List* — includes a table of all replaceable modules, their descriptions, and their Tektronix part numbers.

Manual Conventions

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

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

- Instructions for menu selection follow this format: **FRONT PANEL BUTTON Main Menu Button Side Menu Button**. For example, "Press **UTILITY Misc Config... Reset to Factory O.K.**"

- 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 AWG2040 front panel and menus. Front panel names are all upper-case letters; for example, **MODE MENU, CH 1**, etc.

- Instruction steps are numbered unless there is only one step.

Modules

Throughout this manual, any replaceable component, assembly, or part of the AWG2040 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 AWG2040 is a module.

Safety

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

Finding Other Information

Other documentation for the AWG2020 Arbitrary Waveform Generator includes:

- The *AWG2040 User Manual* contains a tutorial to quickly describe how to operate the AWG2040. It also includes an in-depth discussion on how to more completely use AWG2040 features.

- The *AWG2000 series Programmer Manual* explains how to control the AWG2040 with a computer through the GPIB or RS-232-C interface.

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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.

Only qualified personnel should perform service procedures.

Injury Precautions

Use Proper Power Cord   To avoid fire hazard, use only the power cord specified for this product.

Avoid Electric Overload   To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

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.

Do Not Operate Without Covers   To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Use Proper Fuse   To avoid fire hazard, use only the fuse type and rating specified for this product.

Do Not Operate in Wet/Damp Conditions   To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in Explosive Atmosphere   To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Product Damage Precautions

Use Proper Power Source   Do not operate this product from a power source that applies more than the voltage specified.

Provide Proper Ventilation   To prevent product overheating, provide proper ventilation.

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

Safety Terms and Symbols

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:

DANGER
High Voltage

Protective Ground
(Earth) Terminal

ATTENTION
Refer to
Manual

Double
Insulated

Certifications and Compliances

CSA Certified Power Cords   CSA Certification includes the products and power cords appropriate for use in the North America power network. All other power cords supplied are approved for the country of use.

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

Use Caution When Servicing the CRT

To avoid electric shock or injury, use extreme caution when handling the CRT. Only qualified personnel familiar with CRT servicing procedures and precautions should remove or install the CRT.

CRTs retain hazardous voltages for long periods of time after power is turned off. Before attempting any servicing, discharge the CRT by shorting the anode to chassis ground. When discharging the CRT, connect the discharge path to ground and then the anode. Rough handling may cause the CRT to implode. Do not nick or scratch the glass or subject it to undue pressure when removing or installing it. When handling the CRT, wear safety goggles and heavy gloves for protection.

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.

X-Radiation

To avoid x-radiation exposure, do not modify or otherwise alter the high-voltage circuitry or the CRT enclosure. X-ray emissions generated within this product have been sufficiently shielded.

Introduction

This manual contains information needed to properly service the AWG2040 Arbitrary Waveform Generator, as well as general information critical to safe and effective servicing.

To prevent personal injury or damage to the AWG2040, consider the following before attempting service:

- The procedures in this manual should be performed only by a qualified service person

- Read the *Safety Summary* found at the beginning of this manual

- Read *Preparation for Use* in section 2, *Operating Information*

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

Adjustment Interval

Generally, the manual adjustments described in section 5, *Adjustment Procedures*, should be done every 12 months. In addition, adjustment is recommended after module replacement.

Strategy for Servicing

Throughout this manual, the term module, refers to any field-replaceable component, assembly or part of the AWG2040.

This manual contains all the information needed for periodic maintenance. (Examples of such information are procedures for checking performance and for readjustment.)

Further, it 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 6 *Maintenance*. To remove and replace any failed module, follow the instructions in *Removal and Installation Procedures*, also part of section 6. After isolating a faulty module, replace it with a fully-tested module obtained from the factory. Section 10, *Mechanical 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 equipped to service the AWG2040. Tektronix technicians train on Tektronix products; they have access to the latest information on improvements to the AWG2040 as well as the latest new options.

Warranty Repair Service

Tektronix warrants this product for one year from date of purchase. (The warranty appears on the back of the title page in this manual.) Tektronix technicians provide warranty service at most Tektronix service locations worldwide. The Tektronix product catalog lists all service locations worldwide.

Repair or Calibration Service

The following services can be purchased to tailor repair and/or calibration of the AWG2040 to fit your requirements.

At-depot Service — Tektronix offers several standard-priced adjustment (calibration) and repair services:

- A single repair and/or adjustment

- Calibrations using equipment and procedures that meet the traceability standards specific to the local area

- Annual maintenance agreements that provide for either calibration and repair or calibration only of the AWG2040

Of these services, the annual maintenance agreement offers a particularly cost-effective approach to service for many owners of the AWG2040.

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. Tektronix ships an updated and tested exchange module from the Beaverton, Oregon service center, typically within 24 hours. 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 Description

The AWG2040 is a portable arbitrary waveform generator capable of generating both arbitrary waveforms and standard function waveforms. Key features include:

- Arbitrary waveform generation from waveform data files that you:

    - Create using the graphical waveform editor

    - Generate from equations you create using the equation editor

    - Transfer from GPIB or RS-232-C interfaces

    - Directly transfer from a Tektronix TDS Digitizing Oscilloscope, 2200 Series, 2400 Series or 11000 Series Digital Storage Oscilloscope (DSO), DSA Series Digitizing Analyzer, RTD710A Transient Digitizer, AFG2020 Arbitrary Function Generator, or from another AWG2000 Series Arbitrary Waveform Generator

- Continuous generation of arbitrary waveform data files you specify in a sequence file

- Stepped arbitrary waveform generation of waveform data files and/or sequence files you specify in an autostep file (Autostep mode)

- Point clock rate from 1 kHz to 1.024 GHz

- Continuous, triggered, burst or gated trigger modes

- Waveform advance and autosteop modes

- Internal waveform memory of 1 M words × 8 bits (4 M bytes, Option 01)

- Internal catalog memory of 4 M bytes (10 M bytes, Option 01)

- Waveform file storage in internal nonvolatile memory (512 K) or on external disk

- Tow waveform marker

- Rear-panel waveform output in digital format (Option 03)

- Editing in frequency domain (floating point processor, Option 09)

- Sample waveform library and sample GPIB programming examples on disk

- Standard function waveforms

- Internal diagnostic/calibration

Nominal Traits

This subsection contains a collection of tables that list the various *nominal traits* that describe the AWG2040 Arbitrary Waveform Generator. Electrical and mechanical traits are included.

Nominal traits are described not by equipment performance and limits but by such things as memory capacity.

Electrical Characteristics

Characteristics	Description
Arbitrary Waveforms	
Memory	
Waveform	1 M x 8 bits
	4 M x 8 bits (Option 01)
Data Points of Waveform	32 to multiple of 32 up to memory length
Marker	1 M x 2 bits
	4 M x 2 bits (Option 01)
NVRAM	0.5 M bytes
Catalog Memory	4 M bytes
	10 M bytes (Option 01)
Clock Generator	
Frequency Range	1.000 000 kHz to1.024 000 GHz
Resolution	7 digits
Reference Oscillator	
Nominal Frequency	16.77721 MHz
Main Output	
DA Converter	
Resolution	8 bits
Amplitude	
Range	20 mV to 2 V into 50 Ω
Resolution	1mV
Offset	
Range	−1.000 V to +1.000 V into 50 Ω
Resolution	5 mV
Impedance	50 Ω

Electrical Characteristics

Characteristics	Description	Performance Test
Operating Modes		
Continuous	Generates the waveform or sequence continuously.	Check Cont Mode. Page 4-12
Triggered	Output quiescent until triggered by an GPIB, external, or manual trigger; then generates a waveform or sequence only one time.	Check Triggered Mode. Page 4-13
Gated	Same as **Continuous** mode, except waveforms or sequences are output for the duration of the gated signal.	Check Gated Mode. Page 4-15
Burst	Output quiescent until triggered by an GPIB, external, or manual trigger; then generates a waveform or sequence up to 65536 times.	Check Burst Mode. Page 4-18
Waveform Advance	Output quiescent until triggered by an GPIB, external, or manual trigger; then generates the waveform/sequence in the sequence file one time and waits the trigger for the next waveform output.	Check Waveform Advance Mode. Page 4-19
Autostep	Output quiescent until triggered by an GPIB, external, or manual trigger; then generates the waveform/sequence in the autostep file. When an autostep signal is received from the rear panel or the command is given manually, the instrument moves to the next waveform or sequence waveform in the autostep file. The output parameters (amplitude, offset, etc.) are changed.	Check Autostep Mode. Page 4-21
Slave	Receive the master clock signal higher than 650 MHz from the **Master** AWG2040 for the parallel operation.	Check Slave Mode. Page 4-23

Filters

Type	Low pass filter with Bessel characteristics	
	100 MHz	
	50 MHz	
	20 MHz	
	10 MHz	

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Electrical Characteristics

Characteristics	Description
Auxiliary Output	
MARKER	
Level	−2.0 V to 2.0 V into 50 Ω (Hi/Lo)
Resolution	0.10 V
Number of Marker	2
Connector	BNC
BUSY	
Level	Positive polarity TTL pulse
Output Resistance	51 Ω
Connector	SMB
SYNC	
Level	Positive polarity TTL pulse
Output Resistance	51 Ω
Connector	SMB
SYNC	
Level	100K ECL compatible
Connector	SMB

Electrical Characteristics

Characteristics	Description	Performance Test
Digital Data Out (Option 03)		
Output Signal	Data (D0 to D7), Clock	Digital Data Out. Checks Page 4-46
Level	100K ECL compatible	
Connector	SMB	

Electrical Characteristics

Characteristics	Description
Auxiliary Input	
TRIGGER	
Threshold Level	−5 V to 5 V
Resolution	0.1 V
Impedance	1 kΩ, 50 Ω
Connector	BNC
STOP TRIGGER	
Threshold Level	TTL
Impedance	10 kΩ
Connector	SMB
AUTO STEP TRIGGER	
Threshold Level	TTL
Impedance	10 kΩ
Connector	SMB
EXTERNAL CLOCK	
Impedance	50 Ω, AC Coupling
Connector	SMB
SLAVE CLOCK	
Threshold Level	100K ECL
Impedance	50 Ω, terminated to −2.0 V
Display	
CRT	
Display Area	13.2 cm (5.2 inches) horizontally by 9.9 cm (3.9 inches) vertically
Resolution	640 (H) x 480 (V) pixels

Electrical Characteristics

Characteristics	Description
Function Generator	
Waveform Shape	Sine, Triangle, Square, Ramp, Pulse
Output Parameter	
Frequency	1.000 000 Hz to 10.000 00 MHz
Amplitude	20 mV to 2 V into 50 Ω, can be set in 1 mV increments
Offset	−1.000 V to 1.000 V into 50 Ω, can be set in 1 mV increments
Polarity	Normal, Invert
Duty	0% to 100%, Pulse only, can be set in 1% increments
Operating Mode	**Continuous** mode
Auxiliary Output	
Marker	2 V into 50 Ω, generated at the starting point of the waveform. The duty ratio for the pulse is 10%.
AC Power Source	
AC Line Power	
Fuse Rating	6 A first blow, 250 V, UL198G (3AG) or 5 A (T), 250 V, IEC127
Battery	
Type	Li3 V, 650 mAH
Mechanical Characteristics	
Net Weight	
Standard	10.5 kg
Size	
Height	164 mm (6.4 inches.) with feet
Width	362 mm (14.3 inches.) with handle
Length	491 mm (19.25 inches.) with front cover 576 mm (22.2 inches.) with handle extended

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Warranted Characteristics

This section will describe the warranted characteristics of the AWG2040. These can be divided into two main categories: electrical characteristics and environmental characteristics.

Performance Conditions

The electrical characteristics are valid under the following conditions:

1) The instrument must have been calibrated at an ambient temperature between +15°C to +25°C.

2) The instrument must be in an environment whose limits are described in Environmental Characteristics.

3) All tolerance limits apply after a 20 minute warm up and an execution of the self calibration.

4) The instrument is operating at an ambient temperature between +10°C to +40°C, unless otherwise noted.

Electrical Characteristics

Characteristics	Description	Performance Test
Clock Generator		
Stability	± 1 ppm/year (15°C to 25°C)	
Accuracy	± 1 ppm	Check Clock Frequency Accuracy. Page 4-26
Phase noise	−75 dBc/Hz at 1 GHz (10 kHz offset)	
Jitter	20 ps−rms at 1 GHz (calculated from the phase noise from 100 Hz to 200 kHz)	
Main Output		
DA Converter		
DNL	within 0.5 bit	
INL	within 1 bit	
Output Volts	−2.0 V to +2.0 V into 50 Ω	
Amplitude	No offset	Check Amplitude Accuracy. Page 4-27
DC Accuracy	± (1% of amplitude + 2 mV)	

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Electrical Characteristics

Characteristics	Description	Performance Test
Main Output (Continued)		
Offset	Waveform data; 7F, No Filter, Amplitude 20 mV	Check Offset Accuracy. Page 4-29
Accuracy	± (1% of offset + 5 mV)	
Reverse Power Protection	Up to 0.4 W	
Pulse Response	Clock 1 GHz, Waveform Data; 00 and FF, No Filter, No offset (measured in the 500 MHz BW)	Pulse Response Checks. Page 4-31
Rise Time	2.5 ns maximum (when the amplitude is greater than 1.0 V)	
	1.5 ns maximum (when the amplitude is smaller than and equal to 1.0 V)	
Aberration	within ±10% (when the amplitude is greater than 1.0 V)	
	within ±7% (when the amplitude is smaller than and equal to 1.0 V)	
Flatness	within ±3% (After 50 ns from rise/fall edges)	
Sine Wave Characteristics	Clock 1 GHz, Waveform Point 32, Frequency 31.25 MHz, Amplitude 1.0 V, No Filter, No offset.	Sine Wave Checks. Page 4-33
Harmonics	−45 dBc maximum (DC to 400 MHz)	
Noise	−50 dBc maximum (DC to 400 MHz)	
Phase Noise	−90 dBc/Hz at 10 kHz offset	
Auxiliary Output		
MARKER		AUX Output Checks. Page 4-34
Level	−2.0 V to +2.0 V into 50 Ω	
	−4.0 V to +4.0 V into 1M Ω	
Accuracy	within ±0.1 V ±5% of setting	
BUSY		
Delay	within 60 ns from the external trigger (see Td4 in Figure 1-1)	
	within 150 ns of the end of waveform output (see Td7 in Figure 1-1)	
SYNC		
Delay	within 60 ns from the external trigger (see Td3 in Figure 1-1)	
Digital Data Out (Option 03)		
Skew Between Data	within ±250 ps	

Electrical Characteristics

Characteristics	Description	Performance Test
Auxiliary Input		
TRIGGER		External Trigger Input Checks. Page 4-40
Accuracy	$\pm$ (5% of Level + 0.1 V)	
Pulse Width	10 ns minimum (with an amplitude of 0.2 V)	
Sensitivity	0.2 Vp-p minimum (with a square wave of 1 MHz)	
Maximum Input Volts	$\pm$ 10 V (DC + peak AC) when an input impedance of 1 kΩ is selected $\pm$ 5 V (DC + peak AC) when an input impedance of 50 Ω is selected	
Delay	To marker from trigger (see Td2 in Figure B-1)	
Internal Clock	Within (45 ns + 3 clocks) (at 650 MHz or greater) Within 60 ns (at less than 650 MHz)	
External Clock	Within (45 ns + 3 clocks)	External Trigger Input Checks. Page 4-40
Jitter		
Internal Clock	Within $\pm$ 0.5 clocks (at 650 MHz or greater) Within $\pm$ 0.8 ns (at less than 650 MHz)	
External Clock	Within $\pm$ 0.5 clocks	
Trigger Hold Off	500 ns maximum	External Trigger Input Checks. Page 4-40
STOP TRIGGER		
Pulse Width	100 ns minimum	
Maximum Input Volts	0 V to +5 V (DC + peak AC)	
Delay	100 ms maximum	
AUTO STEP TRIGGER		
Pulse Width	100 ns minimum	
Maximum Input Volts	0 V to +5 V (DC + peak AC)	
Delay	100 ms maximum	

Electrical Characteristics

Characteristics	Description	Performance Test
Auxiliary Input (Continued)		
EXTERNAL CLOCK		External Clock In Check. Page 4-44
Sensitivity	400 mVp-p (−4.0 dBm)	
Maximum Input Volts	1.0 Vpp (+4.0 dBm), DC ± 20 V	
SLAVE CLOCK		
Maximum Input Volts	−2.0 V to 0.0 V	
Frequency Range	650 MHz to 1.0 GHz	

Function Generator

Frequency Accuracy	± 1 ppm
Sine Wave Characteristics	
Flatness	within ± 1 dB (100 kHz reference)

Figure 1-1: Trigger Delay

Electrical Characteristics
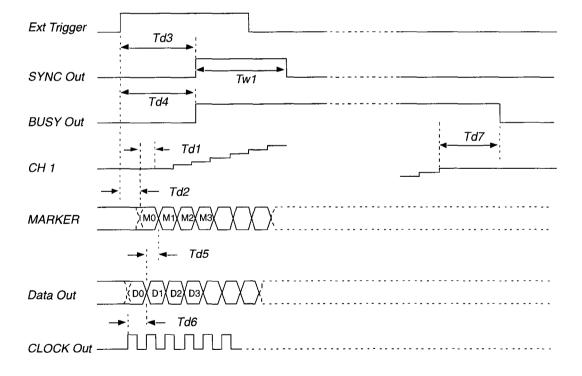
Characteristics	Description
AC Power Source	
Voltage	
Range	
90 VAC to 250 VAC	48 Hz to 63 Hz
90 VAC to 127 VAC	48 Hz to 440 Hz
Maximum Power Consumption	300 W
Maximum Current	4 A
Grounding Impedance	The impedance for the chassis ground and power plug ground pins is 0.1 Ω at 30 A.
Primary Circuit Dielectric Voltage withstand Test	1500 Vrms, 50 Hz for 15 seconds, without breakdown.

Environmental Characteristics

Characteristics	Description
Temperature	
Operating	+10°C to +40°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 approx. 4.5 km (15 000 ft). Maximum operating temperature decreases 1°C each 300 m above 1.5 km.
Non operating	To approx. 15 km (50 000 ft).

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Environmental Characteristics

Characteristics	Description
Dynamics	
Vibration	
Operating	0.33 mmp-p, 10 to 55 Hz, 15minutes
Shock	
Non operating	294 m/s^2 (30 G), half−sine, 11 ms duration.
Safety	
Third Party Certification	UL1244
	CSA C22.2 No.231
	IEC 1010−1
Electromagnetic Compatibility	
United States	Meets FCC CFR 47, Part 15, Subpart B, Class A
Europe	
Emissions	
Enclosure	EN55022 Class B
AC Main	EN60555−2 Power Line Harmonics and EN55022 Class B
Immunity	
Enclosure	IEC 801−3 Electromagnetic Field Radiation, 3 V/m, 27 MHz to 500 MHz
	IEC 801−2 ESD, 8 kV
AC Main	IEC 801−4, 1 kVpk, 5/50 ns Tr/Th, 5 kHz
Germany	Meets Vfg243
Installation Requirements	
Power Consumption (Fully Loaded)	300 watts max. Maximum line current is 4 Arms at 50 Hz, 90 V line.
Surge Current	30 A peak for < 5 line cycles, after product has been off for at least 30 s.
Cooling Clearance	
Top	7.5 cm(3 inches)
Side	15 cm(6 inches)
Rear	7.5 cm(3 inches)

Typical Characteristics

This section describes the typical characteristics for the AWG2040. These values represent typical or average performance and are not guaranteed.

Characteristics	Description
Filters	
Rise Time	
10MHz	35 ns
20MHz	17 ns
50MHz	7.0 ns
100MHz	3.5 ns
Delay	Delay from marker (see Td1 in Figure 1–1)
10MHz	42 ns
20MHz	22 ns
50MHz	12 ns
100MHz	7.0 ns
Through	2.5 ns
Auxiliary Output	
MARKER	
Rise/Fall Time	within 1 ns (at 1 Vpp)
Marker Skew	within 250 ps
SYNC	
Signal Duration	100 ns (see Tw1 in Figure 1-1)
Auxiliary Input	
EXTERNAL CLOCK	
Delay	13 ns from external clock to marker
Digital Data Out (Option 03)	
Delay	
Data to Marker	2.0 ns (see Td5 in Figure 1-1)
Clock to Data	2.5 ns (see Td6 in Figure 1-1)
Power Supply	
Battery	
Back Up Time	4 years

Operating Information

Preparation for Use

This subsection describes how to prepare the AWG2040 Arbitrary Waveform Generator for use. The information describes these items:

- Proper operating environment
- Checking power cord and line voltage configurations
- Checking the fuse
- Power-on and power-off cycles

Operating Environment

To ensure proper AWG2040 operation and long life, note these environmental requirements.

Operating Temperature

The AWG2040 operates in an environment with an ambient air temperature between +10° C and +40° C. The AWG2040 storage temperature ranges from −20° C to +60° C. After storage at temperatures outside the operating limits, allow the AWG2040 chassis to stabilize at a safe operating temperature before applying power.

Ventilation Requirements

Air drawn in and exhausted through the cabinet side and bottom panels cools AWG2040 internal circuits. To ensure proper cooling, allow the following clearances:

Top and back	7.5 cm (3 in.)
Left and right	15 cm (6 in.)

The feet on the bottom of the AWG2040 cabinet provide the required clearance when it is set on a flat surface. The top of the AWG2040 does not require ventilation clearance.

CAUTION

To prevent temporary shutdown of the AWG2040, do not restrict air flow through the chassis. If the AWG2040 shuts down unexpectedly, improve ventilation around the AWG2040 and wait a few minutes to allow it to cool down; then switch the power on again.

Supplying Power

Before installing the AWG2040, note these precautions:

WARNING

To avoid equipment failure and potential fire or personal shock hazards, do not exceed the maximum rated operating voltage of 250 V between the voltage-to-ground (earth) and either pole of the power source. The AWG2040 operates from a single-phase power source and has a three-wire power cord with a two-pole, three-terminal grounding plug. Also, before making connection to the power source, be sure the AWG2040 has a suitable two-pole, three-terminal grounding-type plug.

To avoid personal shock hazard, do not contact conductive parts. All accessible conductive parts are directly connected through the grounding conductor of the power cord to the grounded (earthing) contact of the power plug. The AWG2040 is safety Class 1 equipment (IEC designation).
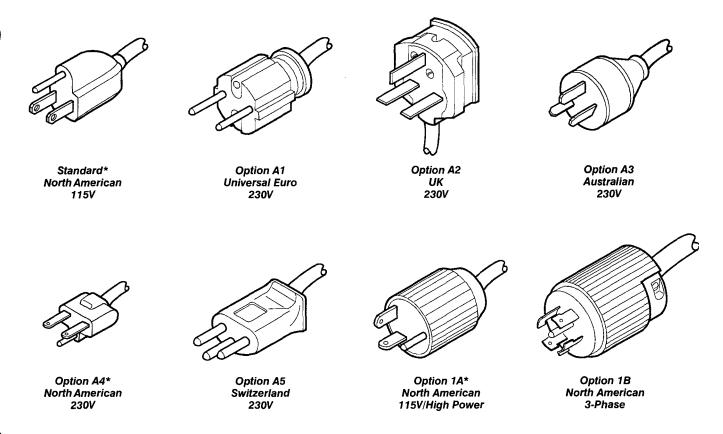
To avoid personal shock hazard, do not defeat the grounding connection. Insert the power input plug only in a mating receptacle with a grounding contact where earth ground has been verified by a qualified service person. Also, for electrical-shock protection, make the grounding connection before making connection to the AWG2040 input or output terminals.

Power Cord Information

The AWG2040 ships with the required power cord as ordered by the customer. Table 2-1 gives the color-coding of the conductors in the power cord. Figure 2-1 shows information on the available power cords.

Table 2-1: Power-cord Conductor Identification

Conductor	Color	Alternate Color
Ungrounded (Line)	Brown	Black
Grounding (Neutral)	Light Blue	White
Grounding (Earthing)	Green/Yellow	Green

Standard*	Option A1	Option A2	Option A3
North American	Universal Euro	UK	Australian
115V	230V	230V	230V

Option A4*	Option A5	Option 1A*	Option 1B
North American	Switzerland	North American	North American
230V	230V	115V/High Power	3-Phase

*Canadian Standards Association certification
includes these power plugs for use in the
North American power network*

Figure 2-1: Optional Power Cords

Rear Panel Controls

Section 1, *Specifications*, lists the line voltage and frequency ranges over which the AWG2040 operates.

Figure 2-2 shows the rear panel controls for the AWG2040.
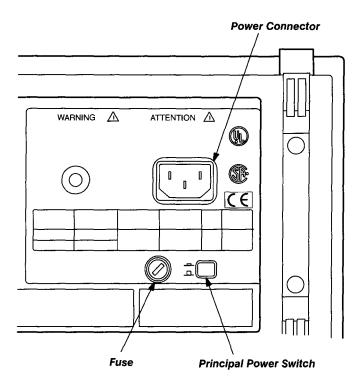
Figure 2-2: Rear Panel Controls

Fuse Type and Rating

The AWG2040 uses the same fuse for the entire operating line voltage range. There are two types of fuses provided. Here is the fuse type and rating.

Table 2-2: Fuse Type and Rating

Fuse	Fuse Part Number	Fuse Cap Part Number
0.25 inch × 1.25 inch (UL 198G, 3AG): 6 A FAST, 250 V	159−0239−00	200−2264−00
5 mm × 20 mm (IEC 127): 5 A (T), 250 V	159−0210−00	200−2265−00

| **WARNING** |

To avoid electrical shock, always unplug the power cord from the socket before checking the line fuse.

To check the fuse, remove the fuse holder on the rear panel. Refer to Figure 2-2 for the location of the fuse holder. To remove the fuse holder, turn it counter-clockwise with a screwdriver while pushing it in. Then remove the fuse from the fuse holder.

Applying and Interrupting Power

Consider the following information when you power on or power off the AWG2040 or when external power loss occurs.

Power-on Cycle

At power-on, the start-up diagnostics and calibration check the AWG2040 operation. The start-up diagnostics and calibration take about 20 seconds. If all diagnostic/calibration items complete without error, the AWG2040 displays *PASS* on the screen and then changes to the SETUP menu.

If the diagnostics detect an error, the AWG2040 displays *FAIL* and the error code. To exit the diagnostics menu, press any key; then the system displays the SETUP menu. See section 6 *Maintenance*, for information on diagnostics and fault isolation.

NOTE

If the ambient temperature goes outside the specified operating temperature range, an error occurs during the calibration at power-on. If this happens, power off the AWG2040 and wait until the chassis temperature is appropriate, then switch the power on again.

Power-off Cycle

CAUTION

To prevent loss of internally stored adjustment constants, DO NOT power off the AWG2040 when doing any of the adjustments described in section 5, Adjustment Procedures.

Wait for the AWG2040 to finish the operation when doing internal calibration or adjustments or saving waveform or sequence files. Improper power-off or unexpected loss of power to the AWG2040 can result in the corruption of data stored in nonvolatile memory.

Memory Backup Power

A lithium battery maintains internal nonvolatile memory, allowing the AWG2040 to retain waveform and sequence files if AC power is lost. This battery has a shelf life of about three years. Partial or total loss of stored information at power-on may indicate that the battery needs to be replaced.

WARNING

To avoid risk of fire or explosion, replace the AWG2040 battery with a lithium battery having the part number listed in section 10 Mechanical Parts List. *This battery is a safety-controlled part.*

To avoid risk of fire or explosion, do not recharge, rapidly discharge, or disassemble the battery; and do not incinerate the battery or heat it above 100° C. Also, dispose of used batteries promptly. Small quantities of used batteries can be disposed of in normal refuse. Keep lithium batteries away from children.

Installed Options

Your AWG2040 may include one or more options. To determine which options are installed, power on the AWG2040 and look at the display during the power-on sequence. The AWG2040 lists the installed options after Options, near the top of the display.

Table 2-1 of this subsection gives information about line cord options. Section 7, *Options*, lists other options and optional accessories. For further information and prices of options, see your Tektronix Products catalog or contact a Tektronix Field Office.

Instructions for Operation

Before servicing the AWG2040, read the following operating instructions. These instructions are at the level appropriate for servicing the AWG2040. The user manual contains complete operator instructions.

In addition, section 4, *Performance Verification*, includes instructions for making the front-panel settings required to check AWG2040 characteristics.

How to Power On

To power-on the AWG2040, follow these steps:

1. Set the PRINCIPAL POWER SWITCH (on the back of the AWG2040) to the ON position. This switch is the main power switch; it routes power to the standby circuit in the AWG2040.

2. Then, press the ON/STBY (standby) switch on the front (lower-left corner) of the AWG2040. This switch applies power to the remaining circuits of the AWG2040. Allow at least 20 minutes for the AWG2040 to warm up.

| WARNING |

To avoid personal shock hazard, turn off both the ON/STBY switch and the PRINCIPAL POWER SWITCH before servicing. The PRINCIPAL POWER SWITCH on the rear panel is the true power disconnect switch. The ON/STBY (standby) switch simply toggles operation on and off. When connected to a power source and when the PRINCIPAL POWER SWITCH is on, the internal power supplies and much of the other circuitry of the AWG2040 remain energized regardless of the setting of the ON/STBY switch.

To avoid personal shock hazard, set the PRINCIPAL POWER SWITCH off before connecting or disconnecting the line cord to or from the power source.

Internal Diagnostics Routines

At power-on, the AWG2040 performs internal start-up diagnostics. These diagnostics check internal circuit function and report any failures. In addition, you can initiate internal diagnostics; these diagnostics differ from the start-up diagnostics in that they do more extensive memory checking.

The AWG2040 also contains internal calibration routines, which check internal circuit function and adjust calibration constants. Run these calibration routines at power-on or whenever the AWG2040 undergoes a temperature change. For instance, run the calibration routines after the AWG2040 warms up at power-on. This warmup period and subsequent calibration assures AWG2040 operation at optimum performance levels.

User Interface

The AWG2040 uses a combination of front-panel buttons, keys, a knob, and on-screen menus to control generator functions. Some front-panel controls select menus and manipulate menu items. Others enter values and units, allow manual triggering, and turn on/off AWG2040 output. On-screen graphics show various aspects of the current AWG2040 configuration.

On-screen menus set all AWG2040 functions except manual triggering and output control. Main menus provide access to lower-level nested submenus. Buttons in the center of the front panel select the main menus.

When you select a menu, the display shows the items controlled by that menu and numeric values currently in effect. Buttons around the display select lower-level menus, change menu selections, modify numeric values and units, and execute functions.

Display

Figure 2-3 contains two examples of AWG2040 displays. To see the first display on the AWG2040, press **Edit** in the MENU column; then press **New Waveform** in the side menu. The second display shows an example of the message area. Text after the illustration describes each display feature.

Status Area — The status of the AWG2040 always appears in the status line. Status information includes the interface status (refer to programmer manual), operating mode status, trigger status (refer to user manual), and busy icon (a clock) which appears while loading or saving waveform or sequence files.

Date & Time Display — This area displays the date and time set in the UTILITY menu. The date and time display can be set to on or off.

Error Display Area — If an error occurs during operation, this area displays an error message.

Side Menu Label — This area displays a label that matches the bottom menu that was selected.

Side Menu — When you select an item from the bottom menu, the corresponding side menu appears on the right side of the screen. To select an item, input numerals, or execute functions, push the soft button corresponding to the side menu item.

Button Operation — This area includes an explanation of front panel operation.

Knob Icon — The knob icon appears next to an item that is selected. To change the value of the item use the general purpose knob or press the numeric and units keys.

Message Area — This area displays messages for the user.

Bottom Menu — Pushing any button of the MENU column or the F.G button displays the corresponding bottom menu in the lower part of the screen. To select an item from a bottom menu, push the corresponding soft button.

Scan by Zenith

Status Area — GPIB | Triggered mode | Waiting for Trigger

Error Display Area — Undo Buffer empty.

Date & Time Display — 11-Nov-93 11:11:30

1:********●L 128 △767 R 895

1024 pts Value 0.0000 Value 0.0000

Operation — Side Menu Label

1.0079

Cut

Copy to Buffer

Paste from Buffer — Side Menu

-1.0000

Draw...

MARKER1 0

MARKER2 0

More
1 of 3

Bottom Operation — CURSOR : Switch Cursor

| Select/ Open | Operation | Zoom | Setting | Undo | Standard Waveform | Close/ Write |

GPIB Triggered mode Stopped

11-Nov-93 11:12:00

Catalog : Memory Free : 3853KB

Name	Type	Size	Date & Time	Comment	●	Knob Icon
SAMPLE-1	WFM	2996	93-11-11 11:14			
SAMPLE-2	WFM	2996	93-11-11 11:15			
SAMPLE-3	WFM	2996	93-11-11 11:15			
SAMPLE-4	EQU	218	93-11-11 11:17			
SAMPLE-5	SEQ	944	93-11-11 11:18			
SAMPLE-6	AST	306	93-11-11 11:21			
SAMPLE-7	WFM	2996	93-11-11 11:16			

Message Area — Are you sure you want to delete "SAMPLE-1.WFM" ?

Cancel

O.K.

Bottom Menu —

| Rename | Comment | Copy | Delete | Delete All | | Lock On Off |

Figure 2-3: Display Features

Menus

The AWG2040 operation is primarily controlled by means of menus that correspond to the SETUP, MODE, EDIT, LOAD/SAVE and UTILITY buttons in the MENU column. To display one of these main menus on the screen, push the corresponding button. The button LED indicates which menu is currently selected. Refer to the User Manual for more details concerning these menus. The F.G button under the MENU column selects function generator operation.

■ **SETUP Menu** — The SETUP menu sets the following waveform output parameters: clock source and frequency, waveform or sequence file selection, filter, amplitude, offset, and marker level.

■ **MODE Menu** — This menu sets the operation output mode. The operation modes are the trigger modes (Cont, Triggered, Gated, and Burst) and the modes which display a waveform in sequence for each trigger (Waveform Advance and Autostep modes). This menu also has an item for setting the system configure to either slave or non−slave.

■ **EDIT Menu** — The EDIT menu allows you to edit an existing file saved in internal memory or to create a new file. To modify files in internal memory, use one of the fiver editors, depending on the waveform file type: waveform edit, equation edit, sequence edit, autostep edit and split join waveform edit. Instrument with Option 09 installed have an FFT editor to permit editing in the frequency domain and a convolution editor to operate the waveforms convolution in high speed.

■ **LOAD/SAVE Menu** — Here are the functions for this menu:

■ LOAD menu — loads files from the AWG2040 floppy disk drive or nonvolatile internal memory into internal memory.

■ SAVE menu — saves files from the AWG2040 internal memory onto a floppy disk or into nonvolatile internal memory.

■ **UTILITY Menu** — Use this menu to rename or delete files saved in the floppy disk or internal nonvolatile memory, to set the parameters of GPIB or RS-232-C, to set AWG2040 date and time, to change display brightness, to set the catalog order, to set the system configure, to set the hardcopy port and format, to check interface status, and to execute internal diagnosis and calibration routines.

Waveform Files

The AWG2040 generates waveform output from four different types of waveform files:

■ *Waveform data file (filename.WFM).* This is the basic waveform data file. It contains the waveform data that the AWG2040 loads into memory and reads when generating waveform output. The data in this kind of file can be created using the waveform editor, generated from equations made using the equation editor, transferred in over an interface, or directly transferred in from certain Tektronix instruments. In addition, the waveform editor displays the data in a waveform data file in three formats: graphical, table, and timing.

■ *Waveform equation file (filename.EQU).* The waveform equation file contains equations that express waveform characteristics. Compilation of the waveform equation file generates a waveform data file. The AWG2040 generates the waveform output from this file.

■ *Waveform sequence file (filename.SEQ).* The waveform sequence file specifies a series of waveform data files. When the AWG2040 executes a waveform sequence file, it sequentially generates waveforms from each waveform data file, in the order specified.

■ *Waveform autostep file (filename.AST).* The waveform autostep file specifies a series of waveform data files and/or waveform sequence files. When the AWG2040 executes a waveform autostep file, it generates the waveform for the first file specified when a trigger signal is received. Then it waits for a trigger to generate the waveform, or it waits for a step signal to advance the next specified file. The autostep file includes output conditions.

Waveform Storage and I/O

The AWG2040 has both internal memory and internal nonvolatile memory (NVRam) for waveform file storage. The AWG2040 generates waveforms from files residing in internal memory. To save a file that is in internal memory, copy it to nonvolatile memory or floppy disk. Only nonvolatile memory retains files at power-off.

The AWG2040 also has a floppy-disk drive for loading files from floppy disk into internal memory or internal nonvolatile memory and for saving files from either memory to floppy disk. The disk drive accepts 3.5-inch MS-DOS-formatted floppy disks.

Loading Files

The following steps explain how to load files from a floppy disk into internal memory.

1. Push the **LOAD/SAVE** button in the MENU column.

2. Turn the disk so the side with the arrow is on top; insert the disk into the AWG2040 floppy disk drive.

```
 GPIB                          Continuous mode              Stopped
```

Catalog : Memory				Free : 3867KB	Load
Name	Type	Size	Date & Time	Comment	
					Load

Destination →

					Load All

Catalog : Disk \   Free : 1020KB

Name	Type	Size	Date & Time	Comment	
*AM	EQU	822	93-11-18 09:30	AMPLITUDE MODULATION	
*AM	WFM	64102	93-11-18 09:30		
*D_EXP	EQU	744	93-11-18 09:33	DOUBLE EXPONENTIAL PULSE	
*D_EXP	WFM	20582	93-11-18 09:33		
*FM	EQU	744	93-11-18 09:28	FREQUENCY MODULATION	
*FM	WFM	65638	93-11-18 09:28		
*GAUSS_P	EQU	666	93-11-18 09:33	GAUSSIAN PULSE	
*GAUSS_P	WFM	614	93-11-18 09:33		Change
*LIN_SWP	EQU	744	93-11-18 09:33	LINEAR FREQUENCY SWEEP	Directory

Source →

Device	Load	Save			Auto Load
Disk					Off

Figure 2-4: LOAD Menu

3. Push the **Device** button along the bottom menu to select **Disk**. The menu in Figure 2-4 appears.

4. Select the **Load All** button along the side menu to load all files in the root directory on the disk into the AWG2040 internal (volatile) memory. Or, turn the general-purpose knob to highlight the file you want to load and select **Load**. The display indicates which file it is loading. When loading is complete, the clock icon disappears.

5. Push the floppy drive button and remove the disk from the floppy drive.

6. Push any button in the MENU column (other than LOAD/SAVE) to exit the menu.

Setting Output Parameters

The SETUP menu allows you to set various output parameters for outputting a waveform or sequence waveform. To set the output parameters, select a waveform or sequence file (that is already loaded into the internal memory) as the active file.

When you select a file, the AWG2040 changes to the output parameters associated with the file and displays these parameters on the SETUP menu. If you modify the displayed output parameters and later save the file, the modified output parameters are saved with the file. (if the file is locked, you cannot modify the file contents.)

The following steps go through the process of selecting a file and modifying individual output parameters.

1. Push the **SETUP** button in the MENU column. The SETUP menu in Figure 2-5 appears.
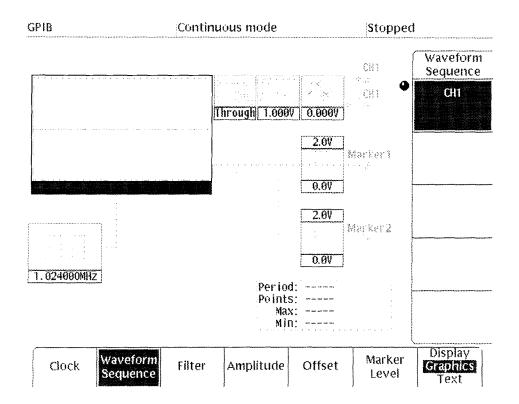
Figure 2-5: SETUP Menu

2. Select **Waveform Sequence** from the bottom menu.

3. Turn the general purpose knob to highlight a file in the displayed list of files; these are the files currently in internal memory. Then, push **ENTER** to select the file; the AWG2040 changes to the output parameters associated with the file you selected.

4. After the file is selected, push the front panel **VALUE** button. Now you can modify output waveform parameters.

5. Setting individual parameters:

   Push the **SETUP** button in the MENU column (if the button is not selected). Now select the appropriate item from the bottom menu; then use the numeric keys or general purpose knob to modify the parameter setting.

The following explains each item in the bottom menu.

■ **Clock** — This item sets the clock source and clock frequency. The clock source can be set to either internal or external.

The clock period is the time between the data points for the waveform created. Therefore, the product of the clock period and the number of waveform points is the waveform or sequence period. For example, if the clock frequency is 1 GHz (period of 1 ns) and there are 128 waveform points, the waveform period is displayed as 128 ns.

■ **Filter** — This item selects a filter that restricts the frequency band for the output. Choose a 100, 50, 20, 10 MHz filter, or you can select Through (no filter).

■ **Ampl** — This selection sets the voltage value for the 8-bit, full-scale, output amplitude on the vertical scale. The amplitude can be set in steps of 1 mV within the range from 20 mV to 2 V into 50 Ω.

■ **Offset** — This item sets the offset level of the output waveform. The offset can be set in steps of 1 mV within the range ±1 V into 50 Ω

Operation Mode Settings

The MODE menu initiates the waveform output with the output conditions set using the SETUP menu.

1. Push the **MODE** button in the MENU column. The MODE menu in Figure 2-6 appears.

2. Select the operation mode from the bottom menu. The operation modes are Cont, Triggered, Gated, Burst, Waveform Advance, and Autostep.

   In all modes except Cont, the trigger or gate signal source can be the external signal applied to the TRIGGER INPUT connector or can be generated by pushing the front panel TRIGGER MANUAL button. The following text describes the individual modes.

   ■ **Cont Mode** — When you push the Cont button, the AWG2040 immediately outputs the specified waveform or sequence waveform, continuously.

GPIB   Continuous mode   Running

CH1

Waveform

GAUSS_P.WFM

GAUSS_P.WFM

Cont	Triggered	Gated	Burst	Waveform Advance	Autostep	Slave
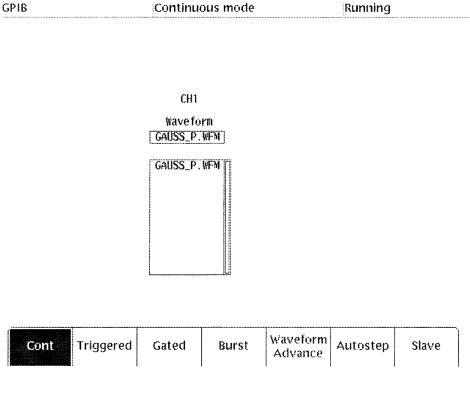
Figure 2-6: MODE Menu

■ **Triggered Mode** — In triggered mode, the AWG2040 outputs the specified waveform or sequence waveform once, when a trigger occurs.

■ **Gated Mode** — In gated mode, the gate signal controls the waveform or sequence output.

As long as the front panel MANUAL button is pushed, (or the gating signal is true) the AWG2040 outputs the specified waveform or sequence. When the MANUAL button is released (or the gating signal is false), the waveform output stops. When the MANUAL button is pushed again, the output resumes from the level at which the waveform or sequence output stopped.

■ **Burst Mode** — With a trigger applied in burst mode, the AWG2040 outputs the number of waveforms or sequences set by the burst count; when completed, the waveform output stops.

■ **Waveform Advance Mode** — When a sequence file has been designated in the SETUP menu, Waveform Advance mode is used to advance a waveform in sequence each time a trigger is received.

In this mode, the first waveform is output when a trigger signal is received. The next waveform is output when the next trigger signal is received. The next waveform is not started at the moment a trigger is received while waveform output is in progress, but rather at the completion of the previous waveform.

In this way, waveforms are output one by one in sequence each time a trigger signal is received. the number of times set with **Repeat** in the sequence editor will be ignored and each waveform will be output once only. When a trigger signal is received while output of the last waveform is in progress, the output stops at the end point of that waveform and then the process begins again from output of the first waveform.

■ **Autostep Mode** — Use Autostep mode to start an Autostep file created with the EDIT menu Autostep editor. An Autostep file stores a program that specifies a waveform or sequence file (including output parameters) for each step.

Each time a step signal is received, the display advances one waveform and the AWG2040 output waveform when trigger signal is received. In this mode the output parameters for each waveform change as well. The operating mode for each step can be set with the waveform output conditions to either **Continuous** or **Step**.

The Autostep mode step signal can be generated from the AUTO STEP IN connector or by pressing the **Next Step** button in the **Config...** sub–menu. Just as in other operating modes, the Autostep mode trigger signal can be generated from the external trigger signal or by pressing the front panel MANUAL button.

Continuous — In this mode, the programmed **Step:1** waveform is output over and over again when a trigger signal is received. When the step signal is received, output of the **Step:1** waveform stops at once and then the **Step:2** waveform is prepared for output. The waveform is started at the moment a trigger is received.

In this way, the current waveforms advance one by one in sequence each time a step signal is received. When a step signal is received while output of the last waveform in the step is in progress, the output stops at the point and then the process begins again from the **Step:1** waveform.

Step — When a trigger signal is received, the **Step:1** waveform is output once; when the step signal is received, the **Step:2** waveform is prepared. The operation are same as **Continuous** mode except for outputting a waveform continuously.

3. Set the trigger (gate) conditions for the external trigger (gate) source.

The external trigger (gate) signal is input from the TRIGGER INPUT connector on the front panel. The input impedance is 1 kΩ or 50 Ω selectable and the maximum input voltage is $\pm$10 V at 1 kΩ

When an operating mode other than Cont is selected, the AWG2040 displays a side menu for selecting the trigger (gate) conditions for the external trigger (gate) source. The following describes each of these items.

■ **Slope** — This item sets the slope for external trigger signals. To select a positive or negative slope, push the side menu Slope button. For a positive slope, the AWG2040 applies the trigger at the rising edge of the external trigger signal; for a negative slope, the trigger is applied at the falling edge of the external trigger signal.

■ **Polarity (Gated Mode)** — This item sets the polarity for the gate that outputs the waveform or sequence based on the level of the external gate signal. To set the polarity, push the side menu **Polarity** button. For a positive polarity, the AWG2040 outputs the waveform or sequence waveform while the gate signal level is higher than the gate level parameter set with the side menu Level item. For negative polarity, waveform output occurs while the gate signal level is lower.

■ **Level** — This item sets the external trigger (gate) signal level. To set this parameter, push the side menu Level button, then use the numeric keys or the general purpose knob to change the value. The trigger (gate) level can be set in steps of 0.1 V within the range from −5.0 V to 5.0 V.

Theory of Operation

Theory of Operation

This section describes the basic operation of the major circuit blocks or modules in the AWG2040. Section 9, *Diagrams*, includes a block diagram and an interconnect diagram. Figure 9–1 shows the modules and functional blocks of the AWG2040 with Option 01, 03 and 09 installed. Figure 9–2 shows how the modules interconnect.

Module Overview

The module overview describes the basic operation of each functional circuit block.

The AWG2040 Arbitrary Waveform Generator is a portable, single-channel instrument with normal and invert output. The AWG2040 reads the digital waveform data loaded into its waveform memory. The point rate clock determines the rate at which the data is read. The AWG2040 converts the data from digital to analog format and outputs the resulting arbitrary waveform.

Clock Oscillator (A10, Clock Board)

The clock generator supplies a point rate clock that is adjustable from 1 kHz to 1.024 GHz for reading data from the internal waveform memory.

When an external clock source is selected, the external clock signal is passed directly through to the Clock board and used for reading waveform data in memory.

Trigger Circuit (A14, Trigger Board)

This board contains trigger circuit, additional DRAMs and AWG board control circuit. The external trigger signal is provided from the connector on the front panel.

A20, AWG Board

This board is a core of the AWG2040. This board contains four Memory boards, shift registers, clock control circuitry, 1 GHz DAC and optional digital data out circuitry.

This AWG board receives system clocks from the Clock board and generated analog signal is sent to the Output board.

Digital-to-Analog Converter (DAC) (A20, AWG Board)

This functional block is a 8-bit high-speed digital-to-analog converter. It converts the digital data from the waveform memory into analog signals.

Waveform Memory (A60/A61, Memory Board)

This functional block contains the RAM memory that hold the waveform digital data. There are 8 bits for waveform data and 2 bits for waveform markers.

Analog Processing (A22, Output Board)

This analog processing block amplifies the analog signals from the DAC to the necessary amplitude. If an offset is specified, this circuit adds that offset and outputs the result at the output connector. This circuit also contains low pass filters, attenuators, calibration circuit and Marker drivers. The four output connectors (CH1 normal, CH1 invert, Marker1 and Marker2) are connected to this board. Its output impedance is 50 Ω.

CPU and Memory (A6, CPU Board)

The CPU board contains the GPIB interface, RS-232-C interface, FDD interface, front panel interface, video display circuitry, 68000 CPU, DRAM, EPROM, SRAM and bus timing circuitry.

This functional block directs operation of all internal circuits based on front panel control operation and commands received over the GPIB or RS-232-C interface. Data in memory is retained by a lithium battery on the A16 Backplane board.

$$\text{CAUTION}$$

To avoid losing waveform data files stored in NVRam, save the files to a floppy disk before removing the A6 CPU board or A16 Backplane board. Then, restore the files from floppy disk to AWG2040 NVRam after reinstalling the board(s).

GPIB (A6, CPU Board)

This functional block is the General Purpose Interface Bus (GPIB) interface driver, which controls communication with external devices over the parallel interface. The GPIB connector is on the rear panel.

RS-232-C (A6, CPU Board)

This functional block is the RS-232-C interface circuit which controls serial communication with external devices over the RS-232-C interface. The RS-232-C interface connector is on the rear panel.

Display Control (A6, CPU Board)

The display control block processes the test and waveform information based on commands from the processor. The block sends the text and waveform information to the display monitor as video signals, with vertical and horizontal sync control.

A16, Backplane Board

The backplane has five slots and a lithium battery. This board receives power from Power Supply and sends power to the AWG board and card boards. Commands are also transmitted via this board.

Monitor Display

The monitor display consists of the raster scan CRT and its driver. This receives the sync and video signal from the CPU board and +15 Vdc power from the power supply. The monitor displays video on a 17.8 cm (7 in.) CRT screen. The display resolution is 480 × 640 pixels.

Front Panel (A12, Keyboard)

The front panel contains a scan rubber button matrix, LEDs, a rotary encoder and so on, for entering selections. User selections from the front panel are sent to the processor. This interface is compatible with TDS series oscilloscope. Commands from the processor control the LED in the buttons.

Bezel Switch

The buttons at the bottom and side of the display are bezel switch. This is a flexible circuit which is sealed on the chassis.

Floppy Disk Drive

The 3.5-inch floppy disk drive supports both 2DD and 2HD MS-DOS formats.

Low Voltage Power Supply

The power supply provides +5 V, −4.6 V, −2 V, +15 V and −15 V. This features voltage switching and remote switching the ON/STBY switch on the bezel.

The power supply receives filtered line power from AUX boards and sends five regulated voltage to the back plane board.

The remote switching signal which is generated on the bezel is sent to the front panel then to the CPU board. The signal is transformed on the CPU board and sent to the power supply via the backplane board. Software shutdown is also available.

AUX Power Board

The AUX Power board consists of a main power switch, a fuse and an AC line filter.

Fan

This is a brushless DC fan which draws approximately 0.5 A from +12 Vdc. The fan prevents heat build-up inside the cabinet; it pulls air into the right (floppy-disk) side of the AWG2040 and exhausts it out the left side.

Options

The following four options which modify AWG2040 operation are available.

- **Option 01: 4 M words waveform memory**
  This option expands the waveform memory to 4 M words. This option requires 4 M words memory boards and trigger board with 8 M byte DRAM.

- **Option 03: Digital Data Out**
  This option directly outputs the digital data in the waveform memory without passing it through the digital-to-analog converter. This option is installed on the AWG board.

- **Option 09: Floating Point Processor**
  This option is a card dedicated to floating point processing. It provides the capability to edit in the frequency domain and it speeds up internal calculations.

For more information about these and other options, see section 7, *Options*.

Performance Verification

Before Verification

This subsection describes the verification procedures in this section, indicates when to use the procedures, and gives conventions used in their structure. The procedures in this section are:

■ Self Tests

■ Performance Tests

Preparation

These procedures verify the AWG2040 Arbitrary Waveform Generator functionality. Which procedure to do depends on your goal:

■ To quickly confirm that the AWG2040 functions correctly and was adjusted properly, do the procedures under *Self Tests*, which begin on page 4-3.

   Advantages: These procedures are short, require no external equipment, and perform extensive functional and accuracy testing. Use them to quickly determine if the AWG2040 is suitable for putting into service, such as when it is first received.

■ For a more extensive confirmation of performance, do the *Performance Tests*, beginning on page 4-7 after doing the *Self Tests*.

   Advantages: These procedures involve direct checking of warranted specifications. They require more time and suitable test equipment. (See *Equipment Required* on page 4-8.

Before starting any of these procedures, read *Instructions for Operation* in section 2 of this manual. These instructions briefly describe the AWG2040 front-panel controls and menu system. The user manual contains detailed information on operating the AWG2040.

Conventions

Throughout the procedures in this section, the following conventions apply:

■ Each test procedure uses the following general format:

   ■ Title of Test

   ■ Equipment Required

   ■ Prerequisites

   ■ Procedure

■ Each procedure consists of as many steps, substeps, and subparts as required to do the test. Steps, substeps, and subparts are sequenced as follows:

    1. First Step

        a. First Substep

            ■ First Subpart

            ■ Second Subpart

        b. Second Substep

    2. Second Step

■ Instructions for menu selection follow this format: **FRONT PANEL BUT-TON   Main Menu Button   Side Menu Button**. For example, "Press **UTILITY   Misc   Config...   Reset to Factory   O.K.**"

■ Where instructed to use a front-panel button, key, or knob, or select from the MENU column, or from a bottom or side menu, the name of the item appears in boldface type: "push **MODE,** " or "select **Triggered** in the bottom menu."

Self Tests

This subsection describes how to use AWG2040 internal self-test routines. No equipment is required to do these procedures. The self tests include these internal routines:

■ Diagnostics

This self-test procedure uses internal routines to verify that the AWG2040 functions, and passes the internal circuit tests.

■ Calibration

The second procedure checks the AWG2040 internal calibration constants and changes them if needed.

Diagnostics

The internal diagnostic routines check AWG2040 characteristics such as amplitude, offset, trigger level, clock, filters and attenuation.

The AWG2040 automatically performs the internal diagnostics at power-on; you can also run the internal diagnostics using the menu selections described in this procedure. The difference between these two methods of initiating the diagnostics is that the menu method does more detailed memory checking than the power-on method.

Equipment Required: None.

Prerequisites: Power on the AWG2040 and allow a twenty-minute warmup period before doing this procedure.

Procedure:

1. *Verify that internal diagnostics pass:* Do the following substeps to verify passing internal diagnostics.

   a. *Display the diagnostics menu and select all tests:* Push **UTILITY Diag/Cal Diagnostics xxxx All**. See the menu in Figure 4-1.

   The list on the left shows the tests available for diagnostics. In addition to selecting all of the tests shown for diagnostics, you can select only the test(s) you want to run using the general purpose knob. In Figure 4-1, the symbol to the left of Cpu indicates that test is one of the tests selected. The Interactive Test area is reserved for manufacturing at the factory.

	Diagnostics	Result	Code	
GPIB		Continuous mode		Stopped

Diagnostics	Result	Code
*Cpu	Pass	
*Clock	Pass	
*Display	Pass	
*FPP	Pass	
*FrontPanel	Pass	
*Trigger	Pass	
*Setup CH1	Pass	
*Waveform Memory CH1	Pass	

Diag/Cal

Diagnostics

All

Calibration
Setup

Interactive
Test
Front Panel

Execute

Disk	NVRam	GPIB	RS232C	Date Time	Misc	Diag/Cal
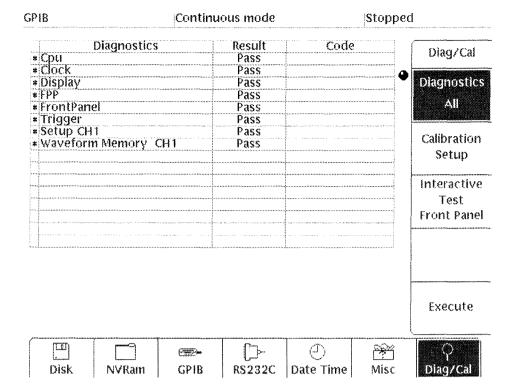
Figure 4-1: Diagnostics Menu

b. *Run the diagnostics*: Select **Execute** from the side menu. This executes all the AWG2040 diagnostics automatically.

c. *Wait*: The internal diagnostics do an extensive verification of AWG2040 functions. While this verification progresses, the screen displays the clock icon. When finished, the resulting status appears on the screen.

d. *Confirm that no failures are found*: Verify that no failures are found and reported on-screen. If the diagnostics displays FAIL as the result of any test, use the instructions in section 6, *Troubleshooting,* to identify the faulty module. If the diagnostics display an error code, contact your nearest representative.

2. *Return to regular service*: Push a button (other than UTILITY) in the MENU column to exit the diagnostic menu.

NOTE

The interactive tests on the Diagnostics screen are for manufacturing use at the factory.

Calibration

The AWG2040 includes internal calibration routines that check electrical characteristics such as amplitude, offset and attenuation and adjust internal calibration constants as necessary. This procedure describes how to do the internal calibration.

Equipment Required: None.

Prerequisites: Power on the AWG2040 and allow a 20 minute warmup period at an ambient temperature between +15 °C and +25 °C before doing this procedure.

Procedure:

1. *Verify that internal adjustments pass:* Do the following substeps to verify passing of internal adjustments.

   a. *Display the calibration menu*: Push **UTILITY   Diag/Cal   Calibration**. See the menu in Figure 4-2.

   The list on the left shows the tests available for calibration. You can select only the Setup CH1 test.

GPIB	Continuous mode	Stopped	
Calibration	Result	Code	Diag/Cal
*Setup CH1	Pass		Diagnostics All
			Calibration Setup
			Interactive Test Front Panel
			Execute

| Disk | NVRam | GPIB | RS232C | Date Time | Misc | Diag/Cal |
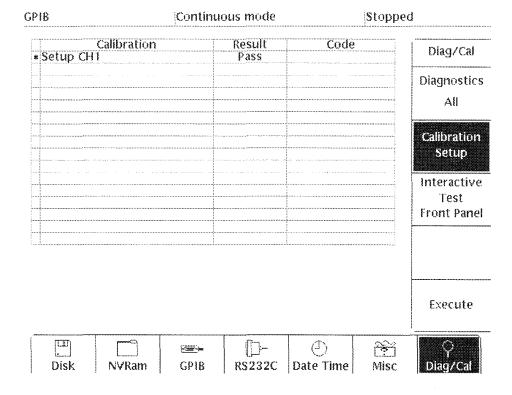
Figure 4-2: Calibration Menu

b. *Run the adjustments routine*: Select **Execute** from the side menu. This executes the AWG2040 calibration routines automatically.

c. *Wait*: The internal calibration does an exhaustive verification of proper AWG2040 function. While this verification progresses, the clock icon appears on screen. When finished, the resulting status will appear on the screen.

d. *Confirm that no failures are found*: Verify that no failures are found and reported on-screen. If the calibration displays FAIL as the result, use the instructions in section 6, *Troubleshooting,* to identify the faulty module. If an error code is displayed, contact our nearest representative.

2. *Return to regular service*: Push any button (other than UTILITY) in the MENU column to exit the calibration menu.

NOTE

When the AWG2040 *is powered off while the calibrations is executed, the calibration data in the memory may be loss.*

Performance Tests

This subsection contains a series of procedures for checking that the AWG2040 Arbitrary Waveform Generator performs as warranted.

The procedures are arranged in nine logical groupings, presented in the following order:

- Operating Mode Checks

- Clock Frequency Check

- Amplitude and Offset Accuracy Checks

- Pulse Response Checks

- Sine Wave Checks

- AUX Output Checks

- External Trigger Input Checks

- External CLOCK IN Check

- Digital Data Out Checks

These procedures extend the confidence level provided by the internal diagnostic and calibration routines described on page 4-3.

Prerequisites

The tests in this subsection comprise an extensive, valid confirmation of performance and functionality, when the following requirements are met:

- You must have performed and passed the calibration procedure described in *Self Tests*, the previous subsection.

- The AWG2040 must have passed the calibration procedure mentioned above or must have been adjusted using the adjustment procedure in section 5 at an ambient temperature between $+15°C$ and $+25°C$, must have been operating for a warm−up period of at least 20 minutes, and must be operating at an ambient temperature between $10°C$ and $+40°C$.

NOTE

For operation to specified accuracy, allow the AWG2040 to warm up at least 20 minutes before doing the performance tests.

■ Load all the files from the Performance Check/Adjustment disk (063-1707-00) that is provided as a standard accessory into AWG2040 internal memory. For instructions on loading files, see *Loading Files* on page 2-12 in the *Instructions for Operation* subsection in section 2.

Related Information

Read *Preparation* and *Conventions* on page 4-1. Also, if you are not familiar with operating the AWG2040, read the subsection, *Instructions for Operation,* in section 2 before doing any of these procedures.

Equipment Required

The following equipment is required to check the performance of the AWG2040.

Table 4-1: Test Equipment

Item Description	Minimum Requirements	Example	Purpose
Precision termination	Impedance: 50 Ω, 0.1% Connectors: BNC	Tektronix Part 011-0129-00	Signal termination.
Adapter	Connectors: BNC female-to-dual banana	Tektronix Part 103-0090-00	Signal interconnection.
Adapter	Connectors: BNC female-to-N male	Tektronix Part 103-0045-00	Signal interconnection.
BNC dual input (TEE) adapter	Connectors: BNC	Tektronix Part 103-0030-00	Signal interconnection.
Adapter	Connectors: BNC female-to-female	Tektronix Part 103-0028-00	Signal interconnection.
DC Block	Impedance: 50 Ω Frequency: 10 kHz to 21 GHz Connectors: N male-to-female	Tektronix Part 015-0509-00	DC block.
BNC cable (3 required)	Impedance 50 Ω Connectors: BNC Length: 43 inches	Tektronix Part 012-0057-01	Signal interconnection.
SMB cable (2 required)	Impedance 50 Ω Connectors: SMB Length: 100 cm	Tektronix Part 012-1458-00	Signal interconnection.
SMB−BNC cable (2 required)	Impedance 50 Ω Connectors: SMB to BNC Length: 100 cm	Tektronix Part 012-1459-00	Signal interconnection.
Test oscilloscope	Bandwidth: >500 MHz	Tektronix TDS500 Series Digitizing Oscilloscope or 2400 Series Digitizing Oscilloscope	Checks output signals. Used in many procedures.
Spectrum analyzer	Frequency range: to 1.8 GHz Dynamic range: 80 dB	Tektronix 497P or 2712	Checks output signals.

Table 4-1: Test Equipment (Cont.)

Item Description	Minimum Requirements	Example	Purpose
Frequency counter	Frequency range: 1 MHz to 100 MHz Accuracy: <0.2 ppm	Tektronix DC 5010 Programmable Universal Counter/Timer with Option:Precision time base[*]	Used to check clock frequency.
Digital multimeter	DC volts range: 0.05 V to 10 V Accuracy: ±0.1%	Fluke 8842A	Used throughout the checks to measure voltage.
Function generator	Output voltage: −7 V to 7 V	Tektronix FG 5010 Programmable Function Generator[*]	Used to input the trigger signal.
RF signal generator	Frequency range: 245 MHz to 1050 MHz	Tektronix SG 504 Signal Generator[*]	Used to input the external clock signal.
Performance Check disk	Must use example listed	Tektronix Part 063-1707-00	Used throughout the checks to provide waveform files.

[*] Requires a TM 5000 Series Power Module Mainframe

Table 4-2: Additional Test Equipment for Optional Check (Slave Mode)

Item Description	Minimum Requirements	Example	Purpose
Waveform generator	Must use example equipment (Optional test)	Tektronix AWG2040 Arbitrary Waveform Generator	Checks Slave mode and Master clock Test

Table 4-3: Additional Test Equipment for Option 03

Item Description	Minimum Requirements	Example	Purpose
ECL termination	Frequency: DC to 10 GHz	Tektronix Part 015-0558-00	Used to check digital data output
Adapter	Connectors: BNC male-to-SMA female	Tektronix Part 015-0572-00	Used to check digital data output
Adapter	Connectors: SMA male-to-SMA male	Tektronix Part 015-1011-00	Used to check digital data output
Adapter	Connectors: SMA female-to-SMA female	Tektronix Part 015-1012-00	Used to check digital data output
Adapter	Connectors: BNC female-to-SMA male	Tektronix Part 015-1018-00	Used to check digital data output
DC power supply	Output voltage: −2.45 V	Tektronix PS 5010 Programmable DC Power Supply[*]	Used to check digital data output

[*] Requires a TM 5000 Series Power Module Mainframe

Performance Check/Adjustment Files

Table 4-4 lists the waveform files on the Performance Check/Adjustment disk (063-1707-00) that are used in these performance tests, the AWG2040 front-panel settings that each file sets up, and the performance test that uses each file.

NOTE

The files on the Performance Check disk are locked (the files names are displayed with *), so the data in these files cannot be changed unless the lock is opened. The file data includes not only waveform data, but also output parameters.

When you select a file with the Waveform Sequence item, the AWG2040 output parameters change to those specified in the file, and the waveform output reflects waveform data in the file. After selecting a file, do not change an output parameter with the SETUP menu unless a procedure instructs you to do so. During the procedures, if you are unsure that the AWG2040 settings still match the file's settings, select the waveform again using the Waveform Sequence item on the SETUP menu.

Table 4-4: File List for Performance Check/Adjustment Disk

No.	File Name	EDIT Menu		SETUP Menu				Marker Setup	Usage
		Wfm Shape	Wfm Point	Clock	Filter	Ampl	Offset		
1	MODE.WFM		1024	1.024 GHz	Through	1 V	0 V		Cont Mode, Triggered Mode, Gated Mode, Burst Mode, Slave Mode
2	MODE_ADV.SEQ ADV-1.WFM		1024	1 MHz	Through	1 V	0 V		Waveform Advance Mode
	ADV-2.WFM		1024	1 MHz	Through	1 V	0 V		
3	MODE_AST.AST Step: 1 AST-1.WFM		1024	500 kHz	Through	1 V	0 V		Autostep Mode
	Step: 2 AST-2.WFM		1024	1 MHz	Through	1 V	0 V		
4	PULSE.WFM		1024	1 GHz	Through	1 V	0 V		Pulse Response

Table 4-4: File List for Performance Check/Adjustment Disk (Cont.)

No.	File Name	EDIT Menu		SETUP Menu				Marker Setup	Usage
		Wfm Shape	Wfm Point	Clock	Filter	Ampl	Offset		
5	SINE.WFM		32	1 GHz	Through	1 V	0 V		Sine Wave Characteristic
6	MARKER−L.WFM		1024	1 GHz	Through	1 V	0 V	Marker1,2: Low level	AUX Output
7	MARKER−H.WFM		1024	1 GHz	Through	1 V	0 V	Marker1,2: High level	AUX Output
8	MARKER.WFM		1024	1 GHz	Through	1 V	0 V	Marker1,2: Pulse, 1 Period Low: 512 points, 0 V High: 512 points, 2 V	AUX Output
9	TRIGGER.WFM		1024	1 GHz	Through	1 V	0 V	Marker1,2: Pulse, 1 Period Low: 1 point, 0 V High: 1023 points, 2 V	Trigger Input
10	DOUT.WFM		1024	100 MHz					Digital Data Output

Operating Mode Checks

These procedures check operation of the Cont, Triggered, Gated, Burst, Waveform Advance, Autostep, and Slave modes. Slave mode are optional test.

Check Cont Mode

Electrical Characteristic Checked: Operating mode, Continuous, on page 1-4.

Equipment Required: A 50 Ω coaxial cable and an oscilloscope.

Prerequisites: The AWG2040 must meet the prerequisites listed on page 4-7.

Procedure:

1. *Install the test hookup and set test equipment controls:*

    a. *Hook up the oscilloscope:* Connect the AWG2040 CH1 output connector through the coaxial cable to the CH1 vertical input connector on the oscilloscope (see Figure 4-3).
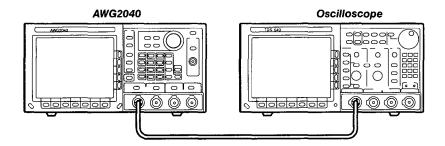
Figure 4-3: Cont Mode Initial Test Hookup

    b. *Set the oscilloscope controls:*

Vertical	CH1
CH1 coupling	DC
CH1 scale	0.2 V/div.
CH1 input impedance	50 Ω
Horizontal	
Sweep	500 ns/div.
Trigger	
Source	CH1
Coupling	DC
Slope	Positive
Level	+100 mV
Mode	Auto

2. *Set the AWG2040 controls and select the waveform file:*

    a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Reset to Factory   O.K.**

    b. *Select the file:*

- Push **SETUP   Waveform Sequence**.

- Turn the general purpose knob to display the list of waveform files and highlight the **MODE.WFM** file.

- Push **ENTER** to select the file. This button is located to the lower-right of the numeric keypad.

3. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

4. *Check against limits:* Check that the amplitude of the sine wave displayed on the oscilloscope is 5 vertical divisions and that 2 horizontal divisions of the waveform are displayed.

5. Repeat this procedure, connecting the oscilloscope to the AWG2040 $\overline{CH1}$ output connector, and turning on the $\overline{CH1}$ output.

6. *End procedure:* Disconnect the oscilloscope.

Check Triggered Mode

Electrical Characteristic Checked: Operating mode, Triggered, on page 1-4.

Equipment Required: Two 50 Ω coaxial cables, a function generator, and an oscilloscope.

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7.

Procedure:

1. *Install the test hookup and set test equipment controls:*

    a. *Hook up the oscilloscope:* Connect the AWG2040 CH1 output connector through the coaxial cable to the CH1 vertical input connector on the oscilloscope.

    b. *Hook up the function generator:*

- Connect the AWG2040 TRIGGER INPUT connector though a coaxial cable to the function generator output connector (see Figure 4-4).
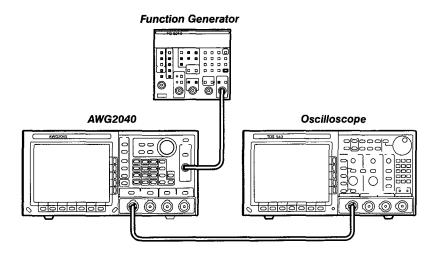
Figure 4-4: Triggered Mode Initial Test Hookup

c. *Set the oscilloscope controls:*

Vertical	CH1
CH1 coupling	DC
CH1 scale	0.2 V/div.
CH1 input impedance	50 Ω

Horizontal	
Sweep	500 ns/div.

Trigger	
Source	CH1
Coupling	DC
Slope	Positive
Level	+100 mV
Mode	Auto

d. *Set the function generator controls:*

Function	Square
Mode	Continuous

Parameter	
Frequency	100 kHz
Amplitude	4 V
Offset	2 V

Output	Off

2. *Set AWG2040 controls and select the waveform file:*

a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Reset to Factory   O.K.**

b. *Modify the AWG2040 default settings:*

■   Push **MODE   Triggered   Slope** to select Positive slope.

c. *Select the file:*

- Push **SETUP Waveform Sequence**.

- Highlight the **MODE.WFM** file using the general purpose knob.

- Push **ENTER** to select the file.

3. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

4. *Check triggered mode with manual triggering:* Push the AWG2040 **MANUAL TRIGGER** button and check that when the button is pushed, the oscilloscope displays a one-cycle sine wave.

5. *Check triggered mode with external triggering:*

   a. *Enable function generator output:* Turn on the function generator output.

   b. *Check triggering:* Check that for each trigger supplied by the function generator, the oscilloscope displays a one-cycle sine wave.

6. *End procedure:* Turn off the function generator output, and disconnect the function generator and oscilloscope.

Check Gated Mode

Electrical Characteristic Checked: Operating mode, Gated, on page 1-4.

Equipment Required: Three 50 Ω coaxial cables, an adapter (BNC T male to 2 female), a function generator, and an oscilloscope.

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7.

Procedure:

1. *Install test hookup and set test equipment controls:*

   a. *Hook up the oscilloscope:* Connect the AWG2040 CH1 output connector through the coaxial cable to the CH1 vertical input connector on the oscilloscope. And attach the adapter (BNC T male to 2 female) to AWG2040 TRIGGER INPUT and connect through the coaxial cable to the CH2 vertical input connector on the oscilloscope.

   b. *Hook up the function generator:* Connect the adapter on TRIGGER INPUT through the coaxial cable to the function generator output connector (see Figure 4-5).
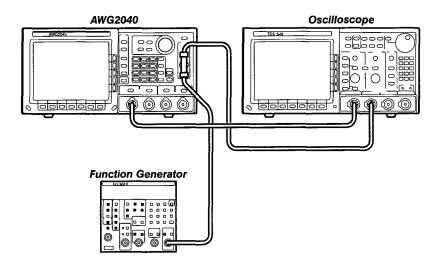
Figure 4-5: Gated Mode Initial Test Hookup

c. *Set oscilloscope controls:*

Vertical	CH1, CH2
CH1, CH2 coupling	DC
CH1 scale	0.5 V/div.
CH2 scale	2 V/div.
CH1 input impedance	50 Ω
CH2 input impedance	1 MΩ

Horizontal	
Sweep	1 µs/div.

Trigger	
Source	CH1
Coupling	AC
Slope	Positive
Level	0 V
Mode	Auto

d. *Set function generator controls:*

Function	Square
Mode	Continuous
Parameter	
Frequency	1 Hz
Amplitude	4.0 V
Offset	2.0 V
Output	Off

2. *Set the AWG2040 controls and select the waveform file:*

a. *Initialize AWG2040 controls:* Push **UTILITY Misc Config... Reset to Factory O.K.**

b. *Modify the AWG2040 default settings:*

- Push **MODE   Gated   Polarity** to highlight Positive.

c. *Select the file:*

- Push **SETUP   Waveform Sequence**.

- Highlight the **MODE.WFM** file, using the general purpose knob.

- Push **ENTER** to select the file.

3. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

4. *Check gated mode with manual trigger:* Push and hold the AWG2040 **MANUAL TRIGGER** button, and check that the oscilloscope continuously displays a sine wave while the **MANUAL TRIGGER** button is pushed.

5. *Check gated mode with gate signal:*

a. Change the oscilloscope horizontal sweep setting to 200 ms/div.

b. Set the oscilloscope trigger source to CH2.

c. *Apply gate signal:* Turn function generator output on.

d. *Check gated mode with positive gate signal:* Check that the oscilloscope displays a sine wave while the function generator gate signal amplitude is 1 V or greater (see Figure 4-6). Gated level is set to 1 V.
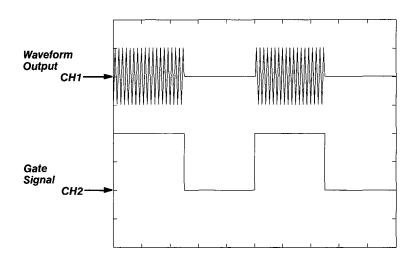
Figure 4-6: Relationship between 1 Volt or Greater Gate Signal and Waveform Output Signal

e. *Change the AWG2040 trigger polarity to negative:* Push **MODE   Polarity** to change the polarity to Negative.

f. *Check gated mode with a negative gate signal:* Check that the oscilloscope displays a sine wave while the function generator gate signal amplitude is 1 V or less.

6. *End procedure:* Turn the function generator output off and disconnect the function generator and oscilloscope.

Check Burst Mode

Electrical Characteristic Checked: Operating mode, Burst, on page 1-4.

Equipment Required: A 50 Ω coaxial cable and an oscilloscope.

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7.

Procedure:

1. *Install test hookup and set test equipment controls:*

   a. *Hook up the oscilloscope:* Connect the AWG2040 CH1 output connector through the coaxial cable to the CH1 vertical input connector on the oscilloscope (see Figure 4-7).
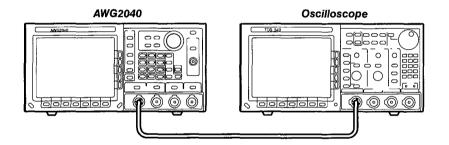
Figure 4-7: Burst Mode Initial Test Hookup

   b. *Set oscilloscope controls:*

Vertical	CH1
CH1 coupling	DC
CH1 scale	0.5 V/div.
CH1 input impedance	50 Ω
Horizontal	
Sweep	500 ns/div.

Trigger

Source	CH1
Coupling	AC
Slope	Positive
Level	0 V
Mode	Auto

2. *Set the AWG2040 controls and select the waveform file:*

a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Reset to Factory   O.K.**

b. *Modify the AWG2040 default settings:*

   ■ Push **MODE   Burst   Burst Count** to highlight Burst Count.

   ■ Input the burst count of 60 000, using the numeric key.

   ■ Push **ENTER** to enter the burst count.

c. *Select the file:*

   ■ Push **SETUP   Waveform Sequence**.

   ■ Highlight the **MODE.WFM** file, using the general purpose knob.

   ■ Push **ENTER** to select the file.

3. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

4. *Check Burst mode with manual trigger:* Push the AWG2040 **MANUAL TRIGGER** button, and check that the oscilloscope momentarily (about 60 ms) displays a sine wave after the **MANUAL TRIGGER** button is pushed.

5. *End procedure:* Disconnect the oscilloscope.

Check Waveform Advance Mode

Electrical Characteristic Checked: Operating mode, Waveform Advance, on page 1-4.

Equipment Required: A 50 Ω coaxial cable and an oscilloscope.

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7.

Procedure:

1. *Install test hookup and set test equipment controls:*

a. *Hook up the oscilloscope:* Connect the AWG2040 CH1 output connector through the coaxial cable to the CH1 vertical input connector on the oscilloscope (see Figure 4-8).

AWG2040   **Oscilloscope**
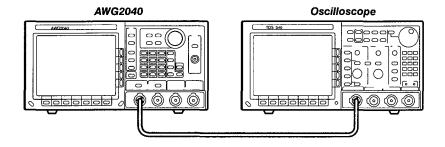
Figure 4-8: Waveform Advance Mode Initial Test Hookup

b. *Set oscilloscope controls:*

Vertical	CH1
CH1 coupling	DC
CH1 scale	0.2 V/div.
CH1 input impedance	50 Ω
Horizontal	
Sweep	200 μs/div.
Trigger	
Source	CH1
Coupling	DC
Slope	Positive
Level	+100 mV
Mode	Normal

2. *Set the AWG2040 controls and select the waveform file:*

   a. *Initialize AWG2040 controls:* Push **UTILITY**   **Misc**   **Config...**   **Reset to Factory**   **O.K.**

   b. *Set AWG2040 controls:*

   ■ Push **MODE**   **Waveform Advance**   **Slope** to highlight Positive.

   c. *Select waveform file:*

   ■ Push **SETUP**   **Waveform Sequence**.

   ■ Highlight the **MODE_ADV.SEQ** file using the general purpose knob.

   ■ Push **ENTER** to select the file.

3. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

4. *Check waveform advance mode with manual triggering:* Repeatedly push the AWG2040 **MANUAL TRIGGER** button, and check that the oscilloscope alternately displays two different frequency sine waves at each manual trigger.   *single Seq only*   *See 2.1b*

5. *End procedure:* Disconnect the oscilloscope.

Check Autostep Mode

Electrical Characteristic Checked: Operating mode, Autostep, on page 1-4.

Equipment Required: Two 50 Ω coaxial cables (BNC connector), a 50 Ω coaxial cable (SMB–BNC connector), an adapter (BNC T male to 2 female), a function generator, and an oscilloscope.

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7.

Procedure:

1. *Install test hookup and set test equipment controls:*

   a. *Hook up the oscilloscope:*

   - Connect the AWG2040 CH1 output through a BNC coaxial cable to the oscilloscope CH1 vertical input connector.

   b. *Hook up the function generator:*

   - Attach the adapter (BNC T male to 2 female) to the AWG2040 TRIGGER INPUT connector.

   - Connect the function generator output through a BNC coaxial cable to the adapter on the AWG2040 TRIGGER INPUT connector.

   - Connect the AWG2040 rear-panel AUTO STEP IN connector through a coaxial cable (SMB–BNC connector) to the adapter on the AWG2040 TRIGGER INPUT connector (see Figure 4-9).
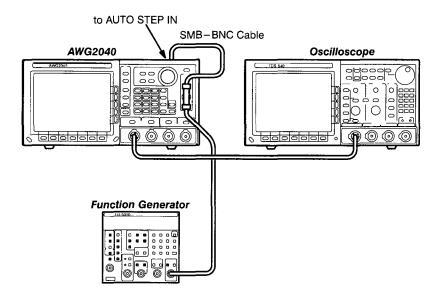
Figure 4-9: Autostep Mode Initial Test Hookup

c. *Set the oscilloscope controls:*

Vertical	CH1
CH1 coupling	DC
CH1 scale	0.2 V/div.
CH1 input impedance	50 Ω

Horizontal	
Sweep	500 µs/div.

Trigger	
Source	CH1
Coupling	DC
Slope	Positive
Level	+100 mV
Mode	Normal

d. *Set function generator controls:*

Function	Square
Mode	Continuous

Parameter	
Frequency	1 Hz
Amplitude	4.0 V
Offset	2.0 V

Output	Off

2. *Set the AWG2040 controls and select the waveform file:*

   a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...
       Reset to Factory   O.K.**

   b. *Modify AWG2040 default settings:*

   ■ Push **MODE   Autostep   Slope** to highlight Negative.

   ■ Push **Config...** from the side menu to display its sub–menu.

   ■ Push **Run** from the sub–menu to highlight the **Continuous**.

   ■ Select **Select Autostep File** from the sub–menu to choose from
       the file list for CH1.

   ■ Turn the general purpose knob to highlight the **MODE_AST.AST**
       file.

   ■ Push **O.K.**

3. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED
    above the CH1 output connector is on.

4. *Check autostep mode with external triggering:*

   ■ Turn the function generator output on.

   ■ Check that the oscilloscope alternately displays two different
       frequency sine waves with periods of 1 ms and 0.5 ms.

5. *End procedure:* Turn the function generator output off and disconnect the function generator and oscilloscope.

Check Slave Mode

This procedure checks AWG2040 operation of the slave mode.

NOTE

This Slave Operation check has been factory verified. The check is performed only as necessary.

Electrical Characteristic Checked: Operating mode, Slave, on page 1-4.

Equipment Required: Three 50 Ω coaxial cables (BNC connector), two 50 Ω coaxial cables (SMB–SMB connector), an oscilloscope, a function generator, and an AWG2040(X) .

NOTE

The (X) of AWG2040(X) means an additional AWG2040 Arbitrary Waveform Generator.

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7.

Procedure:

1. *Install test hookup and set test equipment controls:*

   a. *Hook up the oscilloscope:*

   ■ Connect the AWG2040 CH1 output through a BNC coaxial cable to the oscilloscope CH1 vertical input connector.

   ■ Connect the AWG2040(X) CH1 output through a BNC coaxial cable to the oscilloscope CH2 vertical input connector.

   b. *Hook up the function generator:*

   ■ Connect the function generator output through a BNC coaxial cable to the AWG2040(X) TRIGGER INPUT connector.

   c. *Hook up the AWG2040(X) and AWG2040 :*

   ■ Connect the AWG2040 rear-panel MASTER CLOCK OUT connector through a coaxial cable (SMB–SMB connector) to the AWG2040(X) rear-panel SLAVE CLOCK IN connector.

■ Connect the AWG2040 rear−panel SLAVE CLOCK IN connector
through a coaxial cable (SMB−SMB connector) to the
AWG2040(X) rear−panel MASTER CLOCK OUT connector (see
Figure 4-10).

to SLAVE CLOCK IN   to MASTER CLOCK OUT   to SLAVE CLOCK IN

to MASTER CLOCK OUT

SMB−SMB Cable

Under Test
AWG2040

AWG2040 (x)

Oscilloscope

Function Generator
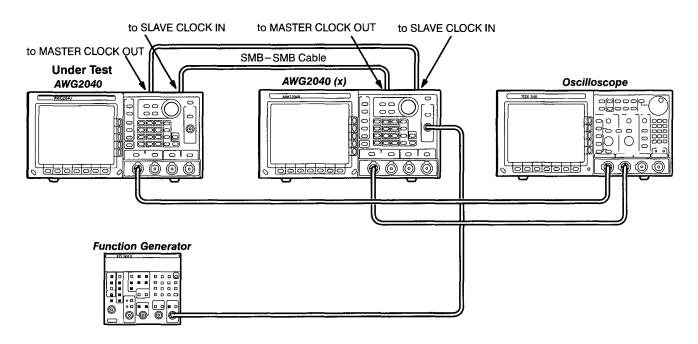
Figure 4-10: Slave Mode Initial Test Hookup

d. *Set the oscilloscope controls:*

Vertical	CH1, CH2
CH1, CH2 coupling	DC
CH1, CH2 scale	0.2 V/div.
CH1, CH2 input impedance	50 Ω
Horizontal	
Sweep	500 ns/div.
Trigger	
Source	CH1
Coupling	DC
Slope	Positive
Level	+100 mV
Mode	Auto

e. *Set function generator controls:*

Function	Square
Mode	Continuous

Parameter
Frequency   100 kHz
Amplitude   4.0 V
Offset   2.0 V

Output   Off

2. *Set the AWG2040(X) controls and select the waveform file:*

    a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Reset to Factory   O.K.**

    b. *Modify the AWG2040(X) default settings:*

        ■ Push **MODE   Triggered**.

    c. *Select waveform file:*

        ■ Push **SETUP   Waveform Sequence**

        ■ Turn the general purpose knob to highlight the **MODE.WFM** file.

        ■ Push **ENTER** to select the file.

3. *Set the AWG2040 controls and select the waveform file:*

    a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Reset to Factory   O.K.**

    b. *Modify the AWG2040 default settings:*

        ■ Push **MODE   Slave**.

    c. *Select waveform file:*

        ■ Push **SETUP   Waveform Sequence**

        ■ Turn the general purpose knob to highlight the **MODE.WFM** file.

        ■ Push **ENTER** to select the file.

4. *Check slave mode operation:*

    ■ *Turn on the AWG2040(X) and AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

    ■ *Enable the function generator output:* Turn on the function generator output.

    ■ Check that the oscilloscope CH1 and CH2 displays same sine wave.

    ■ *Disable the function generator output:* Turn off the function generator output.

    ■ *Turn off the AWG2040(X) and AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is off.

5. *Change the test hookup of the function generator:*

    ■ Disconnect the BNC coaxial cable from the AWG2040(X) TRIGGER INPUT connector. And connect it to the AWG2040 TRIGGER INPUT connector.

6. *Check master clock output:*

■ *Modify the AWG2040(X) current setting:* Push **MODE   Slave**.

■ *Modify the AWG2040 current setting:* Push **MODE   TRIGGERED**.

■ *Turn on the AWG2040(X) and AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

■ *Enable the function generator output:* Turn on the function generator output.

■ Check that the oscilloscope CH1 and CH2 displays same sine wave.

7. *End procedure:* Turn off the function generator output and disconnect the function generator,oscilloscope, and AWG2040(X).

Clock Frequency Check

These procedures check the accuracy of the AWG2040 clock frequency.

Check Clock Frequency Accuracy

Electrical Characteristic Checked: Clock Generator, Accuracy, on page 1-9.

Equipment Required: A 50 Ω coaxial cable and a frequency counter.

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7.

Procedure:

1. *Install test hookup and set test equipment controls:*

    a. *Hook up frequency counter:* Connect the AWG2040 CH1 output connector through a BNC coaxial cable to the input connector on the frequency counter (see Figure 4-11).
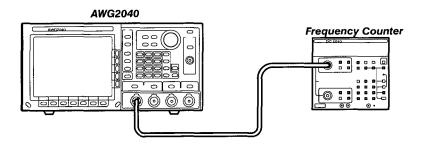
Figure 4-11: Clock Frequency Accuracy Initial Test Hookup

b. *Set frequency counter controls:*

CHANNEL A
Termination	50 Ω
Slope	+
Attenuation	X5
Coupling	AC

FREQ A

2. *Set AWG2040 controls and select the waveform:*

a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Re-set to Factory   O.K.**

b. *Select the waveform in the F.G. menu:* Push **F.G.**, Sine wave is selected as default waveform.

c. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

3. *Check clock frequency accuracy:* Check that the frequency counter reading is in the range 10 MHz ±10 Hz.

4. *End procedure:* Disconnect the frequency counter.

Amplitude and Offset Accuracy Checks

These procedures check the accuracy of the AWG2040 waveform output; amplitude and offset.

NOTE

The amplitude and offset accuracy checks are structured as a continuous test. After Check Gain Accuracy, *the next test uses the control settings from the last test and uses the next step in the sequence file.*

Check Amplitude Accuracy

Electrical Characteristic Checked: Main Output, Amplitude, DC Accuracy, on page 1-9.

Equipment Required: A 50 Ω coaxial cable, a 50 Ω precision terminator, a BNC (female)-to-dual banana adapter, and a digital multimeter (DMM).

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7

Procedure:

1. *Install the test hookup and set test equipment controls:*

   a. *Hook up DMM:* Connect the AWG2040 CH1 output through a 50 Ω coaxial cable, a 50 Ω precision terminator, and an adapter (BNC–to–dual banana) to the DMM INPUT connector (see Figure 4-12).
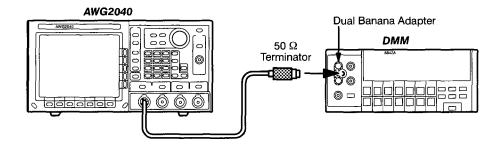
Figure 4-12: Amplitude Accuracy Initial Test Hookup

   b. *Set DMM controls:*

Mode	VDC
Range	Auto
Input	Front

2. *Set the AWG2040 controls:*

   a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Reset to Factory   O.K.**

   b. *Set the AWG2040 controls:*

   - Push **F.G.   Pulse   Duty.**

   - Turn the general purpose knob to set the value for 100.

   - Push **ENTER.**

   c. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

3. *Check amplitude accuracy:*

   a. *Set the AWG2040 amplitude:*

   - Push **Amplitude.**

   - *Enter numeric value of 20:* Push 2 and 0 key in this order.

   - Push **kHz/ms/mV** key.

   b. *Operate the AWG2040 control and note the reading on DMM :*

   - Set the Polarity to Normal on the AWG2040 side menu and note the value displayed on the DMM.

- Set the Polarity to Invert on the AWG2040 side menu and note the value displayed on the DMM.

c. *Check the difference of the two values:*

- Check that the difference of the two values is in the range of 20 mV ± 2.2 mV.

d. *Set the AWG2040 amplitude:*

- *Enter numeric value of 200:* Push 2, 0, and 0 key in this order.

- Push **kHz/ms/mV** key.

e. *Operate the AWG2040 control and note the reading on DMM :*

- Set the Polarity to Normal on the AWG2040 side menu and note the value displayed on the DMM.

- Set the Polarity to Invert on the AWG2040 side menu and note the value displayed on the DMM.

f. *Check the difference of the two values:*

- Check that the difference of the two values is in the range of 200 mV ± 4 mV.

g. *Set the AWG2040 amplitude:*

- *Enter numeric value of 2:* Push 2 key.

- Push **Hz/s/V** key.

h. *Operate the AWG2040 control and note the reading on DMM :*

- Set the Polarity to Normal on the AWG2040 side menu and note the value displayed on the DMM.

- Set the Polarity to Invert on the AWG2040 side menu and note the value displayed on the DMM.

i. *Check the difference of the two values:*

- Check that the difference of the two values is in the range of 2 V ± 0.022 V.

4. *Check* $\overline{CH1}$*:* Repeat the *Amplitude Accuracy Checks* for the AWG2040 $\overline{CH1}$.

5. *End procedure:* Retain the test hookup and control settings.

Check Offset Accuracy

Electrical Characteristic Checked: Main Output, Offset, Accuracy, on page 1-10.

Equipment Required: A 50 Ω coaxial cable, a 50 Ω precision terminator, a BNC (female)-to-dual banana adapter, and a digital multimeter (DMM).

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7

Procedure:

1. *Use the test hookup from previous check.*

2. *Set the AWG2040 controls:*

   a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Reset to Factory   O.K.**

   b. *Set the AWG2040 controls:*

      ■ Push **F.G.   Sine   Amplitude**.

      ■ Turn the general purpose knob to set the amplitude for 0.020 V.

   c. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

3. *Check offset accuracy:*

   a. *Set the AWG2040 offset:*

      ■ Push **Offset**.

      ■ *Enter numeric value of 0:* Push 0 key.

      ■ Push **Enter** key.

   b. *Check the reading on DMM:* Check that the value is in the range of 0 V ± 5 mV.

   c. *Set the AWG2040 offset:*

      ■ *Enter numeric value of 1:* Push 1 key.

      ■ Push **Hz/s/V** key.

   d. *Check the reading on DMM:* Check that the value is in the range of 1 V ± 0.015 V.

   e. *Set the AWG2040 offset:*

      ■ *Enter numeric value of −1:* Push −1 key.

      ■ Push **Hz/s/V** key.

   f. *Check the reading on DMM:* Check that the value is in the range of −1 V ± 0.015 V.

4. *Check* $\overline{CH1}$: Repeat the *Offset Accuracy Checks* for the AWG2040 $\overline{CH1}$.

5. *End procedure:* Disconnect the DMM and 50 Ω terminator.

Pulse Response Checks

This procedure checks the pulse response characteristics of the AWG2040 output waveforms at amplitudes of 0.5 and 1 V.

Electrical Characteristic Checked: Main Output, Pulse Response, on page 1-10.

Equipment Required: A 50 Ω coaxial cable and an oscilloscope.

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7.

Procedure:

1. *Install test hookup and set test equipment controls:*

   a. *Hook up the oscilloscope:* Connect the AWG2040 CH1 output connector through the coaxial cable to the CH1 vertical input connector on the oscilloscope (see Figure 4-13).
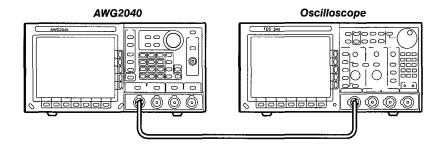
Figure 4-13: Pulse Response Initial Test Hookup

   b. *Set oscilloscope controls:*

Vertical	CH1
Coupling	DC
Scale	0.2 V/div.
Input impedance	50 Ω
Horizontal	
Sweep	1 ns/div.
Trigger	
Source	CH1
Coupling	AC
Slope	Positive
Level	0 V
Mode	Auto

2. *Set the AWG2040 controls and select the waveform file:*

   a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Reset to Factory   O.K.**

    b. *Select waveform file:*

- Push **SETUP   Waveform Sequence**.

- Turn the general purpose knob to select the **PULSE.WFM** file.

- Push **ENTER**.

3. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

4. *Check pulse response at 1 V amplitude:*

    a. *Check rise time:* Check that the rise time of the waveform displayed on the oscilloscope from the 10% point to the 90% point is 1.5 ns or less.

    b. *Check aberrations:*

- Set oscilloscope sweep to 20 ns/div.

- Check that the aberrations of the displayed waveform are within ± 7 %.

    c. *Check flatness:*

- Set oscilloscope sweep to 200 ns/div.

- Check that the flatness of the displayed waveform is within ± 3 % after 50 ns from the rising edge.

5. *Check pulse response at 2 V amplitude:*

    a. *Change the oscilloscope controls:*

Vertical	CH1
CH1 scale	0.5 V/div.
Horizontal	
Sweep	1 ns/div.

    b. *Change the AWG2040 controls:*

- Push **SETUP   Ampl** to change the amplitude for CH1.

- Press the numeric key **2** and press the units key **V** to select an amplitude of 2 V.

    c. *Repeat substeps 4NO TAG through c, checking to the follow limits:*

Rise time	2.5 ns, maximum
Aberrations	± 10 %, maximum
Flatness	± 3 %, maximum

6. *Check pulse response for $\overline{CH1}$):* Repeat this Pulse Response Check procedure using the AWG2040 $\overline{CH1}$ output and selecting the waveform and setting controls for $\overline{CH1}$.

7. *End procedure:* Disconnect the oscilloscope.

Sine Wave Checks

This procedure checks the sine wave characteristics of the AWG2040 output waveforms.

Electrical Characteristic Checked: Main Output, Sine Wave Characteristics, on page 1-10.

Equipment Required: A 50 Ω coaxial cable, a DC block, an adapter (N male to BNC female), and a spectrum analyzer.

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7

Procedure:

1. *Install test hookup and set test equipment controls:*

    a. *Hook up the spectrum analyzer:* Connect the AWG2040 CH1 output connector through the coaxial cable, adapter, and DC Block to the input connector on the spectrum analyzer (see Figure 4-14).
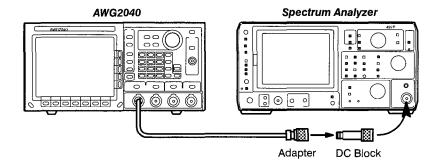
Figure 4-14: Sine Wave Initial Test Hookup

    b. *Set spectrum analyzer controls:*

Center frequency	200 MHz
Span	50 MHz/div
Vertical	10 dB/div
Reference level	0 dBm
RF attenuation	20 dB
Video filter	3 kHz
Resolution BW	1 MHz
Storage mode	Peak

2. *Set the AWG2040 controls and select the waveform file:*

    a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Reset to Factory   O.K.**

b. *Select waveform file:*

■ Push **SETUP** **Waveform Sequence**.

■ Turn the general purpose knob to highlight the **SINE.WFM** file.

■ Push **ENTER**.

3. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

4. *Check harmonics and noise level:*

a. *Check harmonics level:*

■ Check that the harmonics level of the spectrum displayed on the spectrum analyzer from 0 Hz to 400 MHz is −45 dBc or less.

b. *Check noise Level:*

■ Check that the noise level of the spectrum displayed on the spectrum analyzer from 0 Hz to 400 MHz is −50 dBc or less.

5. *End procedure:* Disconnect the spectrum analyzer.

AUX Output Checks

This procedure checks the level and waveform of the MARKER Out signal, the delay time from trigger signal to SYNC output, and the delay time from trigger signal to BUSY output.

Electrical Characteristic Checked: Auxiliary Output, Marker Level, SYNC Delay, BUSY Delay on page 1-10.

Equipment Required: Three 50 Ω coaxial cable (BNC connector), a 50 Ω coaxial cable (SMB−BNC connector), an adapter (BNC female−female), an adapter (BNC T male to 2 female), an adapter (BNC female to dual banana), a 50 Ω precision terminator, an oscilloscope, a digital multimeter (DMM), and a function generator.

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7.

Procedure:

1. *Install test hookup and set test equipment controls:*

a. *Hook up the DMM:* Connect the AWG2040 MARKER1 output through a 50 Ω coaxial cable, a 50 Ω precision terminator, and an adapter (BNC−to−dual banana) to the DMM input connector (see Figure 4-15).

AWG2040

Figure 4-15: Marker Level Initial Test Hookup

    b. *Set DMM controls:*

Mode	VDC
Range	Auto
Input	Front
Output	Off

2. *Set the AWG2040 controls and select the waveform file:*

    a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Reset to Factory   O.K.**

    b. *Select waveform file:*

      ■ Push **SETUP   Waveform Sequence**.

      ■ Turn the general purpose knob to highlight the **MARKER–L.WFM** file.

      ■ Push **ENTER**.

3. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

4. *Check MARKER1 output low level:*

    a. *Set MARKER1 level to −2 V:*

      ■ Push **SETUP   Marker Level   Marker 1 Low**.

      ■ *Enter numeric value of −2:* Push − and 2 key in this order.

      ■ Push **Hz/s/V** key.

    b. *Check MARKER1 low level:*

      ■ Check that the value displayed on the DMM is in the range of −2.0 V ± 0.2 V.

    c. *Set MARKER1 level to 1.9 V:*

      ■ *Enter numeric value of 1.9:* Push 1, . , and 9 key in this order.

      ■ Push **Hz/s/V** key.

    d. *Check MARKER1 low level:*

- Check that the value displayed on the DMM is in the range of 1.9 V ± 0.2 V.

5. *Change hookup: Disconnect the BNC coaxial cable from the MARKER1 output connector and connect the cable to the MARKER2 output connector.*

6. *Check MARKER2 output low level:*

   a. *Set MARKER2 level to −2 V:*

     - Push **SETUP   Marker Level   Marker 2 Low**.

     - *Enter numeric value of −2:* Push − and 2 key in this order.

     - Push **Hz/s/V** key.

   b. *Check MARKER2 low level:*

     - Check that the value displayed on the DMM is in the range of −2.0 V ± 0.2 V.

   c. *Set MARKER2 level to 1.9 V:*

     - *Enter numeric value of 1.9:* Push 1, . , and 9 key in this order.

     - Push **Hz/s/V** key.

   d. *Check MARKER2 low level:*

     - Check that the value displayed on the DMM is in the range of 1.9 V ± 0.2 V.

7. *Check MARKER2 output High level:*

   a. *Select waveform file:*

     - Push **SETUP   Waveform Sequence**.

     - Turn the general purpose knob to highlight the **MARKER−H.WFM** file.

     - Push **ENTER**.

   b. *Set MARKER2 level to −1.9 V:*

     - Push **SETUP   Marker Level   Marker 2 High**.

     - *Enter numeric value of −1.9:* Push −, 1, . , and 9 key in this order.

     - Push **Hz/s/V** key.

   c. *Check MARKER2 High level:*

     - Check that the value displayed on the DMM is in the range of −1.9 V ± 0.2 V.

   d. *Set MARKER2 level to 2 V:*

     - *Enter numeric value of 2:* Push 2 key.

     - Push **Hz/s/V** key.

e. *Check MARKER2 High level:*

■ Check that the value displayed on the DMM is in the range of 2.0 V ± 0.2 V.

8. *Change hookup: Disconnect the BNC coaxial cable from the MARKER2 output connector and connect the cable to the MARKER1 output connector.*

9. *Check MARKER1 output High level:*

a. *Set MARKER1 level to −1.9 V:*

■ Push **SETUP   Marker Level   Marker 1 High**.

■ *Enter numeric value of −1.9:* Push −, 1, . , and 9 key in this order.

■ Push **Hz/s/V** key.

b. *Check MARKER1 High level:*

■ Check that the value displayed on the DMM is in the range of −1.9 V ± 0.2 V.

c. *Set MARKER1 level to 2 V:*

■ *Enter numeric value of 2:* Push 2 key.

■ Push **Hz/s/V** key.

d. *Check MARKER1 High level:*

■ Check that the value displayed on the DMM is in the range of 2.0 V ± 0.2 V.

10. *Change the hookup:*

a. *Disconnect the BNC coaxial cable, terminator, and adapter (BNC− to−dual banana) from the DMM input connector.*

b. *Hook up the oscilloscope:* Connect the AWG2040 MARKER1 output connector through the coaxial cable to the CH1 vertical input connector on the oscilloscope (see Figure 4-16).
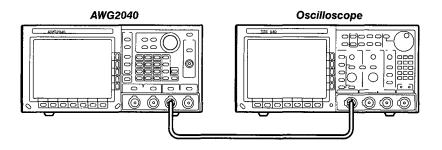
Figure 4-16: Marker Waveform Initial Test Hookup

c. *Set oscilloscope controls:*

Vertical	CH1
CH1 Coupling	DC
CH1 Scale	1 V/div.
CH1 Input Impedance	50 Ω
CH2 Scale	2 V/div.
CH2 Input Impedance	1 MΩ

Horizontal	
Sweep	200 ns/div.

Trigger	
Source	CH1
Coupling	AC
Slope	Positive
Level	0 V
Mode	Auto

11. *Set the AWG2040 controls and select the waveform file:*

   a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Reset to Factory   O.K.**

   b. *Select waveform file:*

   ■ Push **SETUP   Waveform Sequence**.

   ■ Turn the general purpose knob to highlight the **MARKER.WFM** file.

   ■ Push **ENTER**.

12. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

13. *Check MARKER1 output waveform:*

   a. Check the oscilloscope display for a 1 μs, 2 Vp-p square wave.

14. *Change hookup:* Disconnect the BNC coaxial cable to the MARKER1 output connector and connect the cable to the MARKER2 *output connector.*

15. *Check MARKER2 output waveform:*

   a. Check the oscilloscope display for a 1 μs, 2 Vp-p square wave.

16. *Change the hookup and set test equipment controls:*

   a. *Hook up the oscilloscope:*

   ■ Attach the adapter (BNC T male to 2 female) to the AWG2040 TRIGGER INPUT connector.

   ■ Disconnect the BNC coaxial cable on the AWG2040 MARKER2 output connector and connect it to the adapter (BNC T male to 2 female) on the AWG2040 TRIGGER INPUT connector.

■ Connect the SYNC OUT connector on the rear panel of AWG2040 through the coaxial cable (BNC-SMB) to the CH2 vertical input connector on the oscilloscope.

b. *Hook up the function generator:*

■ Connect the function generator output through a BNC coaxial cable to the adapter on the AWG2040 TRIGGER INPUT connector (see Figure 4-17).
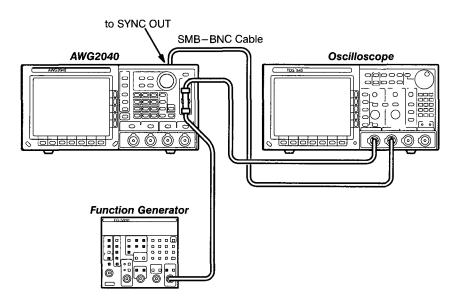
Figure 4-17: SYNC Delay Initial Test Hookup

c. *Set oscilloscope controls:*

Vertical	CH1
CH1 Coupling	DC
CH1 Scale	2 V/div.
CH1 Input Impedance	1 MΩ
CH2 Coupling	DC
CH2 Scale	2 V/div.
CH2 Input Impedance	1 MΩ
Horizontal	
Sweep	20 ns/div.

d. *Set function generator controls:*

Function	Square
Mode	Continuous
Parameter	
Frequency	100 kHz
Amplitude	4.0 V
Offset	2.0 V

17. *Set the AWG2040 controls:* Push **MODE   Triggered**.

18. *Check SYNC delay:* Check that the SYNC rising edge (Channel 2) is delayed by 60 ns or less to the trigger rising edge (Channel 1)..

19. *Change hookup:* Disconnect the coaxial cable to the SYNC OUT connector and connect the cable to the BUSY OUT connector on the rear panel of *AWG2040* .

20. *Check BUSY delay:* Check that the BUSY rising edge (Channel 2) is delayed by 60 ns or less to the trigger rising edge (Channel 1).

21. *End procedure:* Turn the function generator output off and disconnect the function generator and oscilloscope.

External Trigger Input Checks

This procedure checks the external trigger level accuracy, delay time trigger to marker, and trigger holdoff of the AWG2040.

Electrical Characteristic Checked: Auxiliary Input, TRIGGER, Accuracy,Delay, Trigger Hold Off, on page 1-11.

Equipment Required: Three 50 Ω coaxial cable (BNC connector), an adapter (BNC T male to 2 female), an adapter (BNC female to dual banana), an oscilloscope, a digital multimeter (DMM), and a function generator.

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7.

Procedure:

1. *Install test hookup and set test equipment controls:*

    a. *Hook up oscilloscope:* Connect the AWG2040 CH1 output connector through a BNC coaxial cable to the CH1 vertical input connector on the oscilloscope .

    b. *Hook up DMM:*

       ■ Attach the adapter (BNC T male to 2 female) to AWG2040 **TRIGGER INPUT**

       ■ Connect the adapter (BNC T male to 2 female) through a coaxial cable and adapter (BNC–to–dual banana) to the DMM input connector.

    c. *Hook up function generator:* Connect the adapter (BNC T male to 2 female) on TRIGGER INPUT through a coaxial cable to the function generator output (see Figure 4-18).
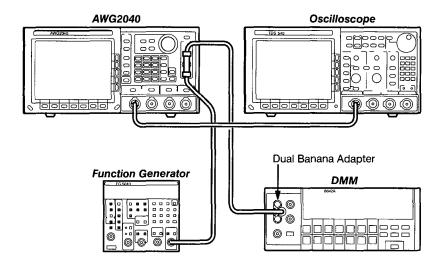
Figure 4-18: Trigger Input Initial Test Hookup

d. *Set oscilloscope controls:*

Vertical	CH1 CH2
CH1 Coupling	DC
CH1 Scale	1 V/div.
CH1 Input Impedance	50 Ω
Horizontal	
Sweep	20 ns/div.
Trigger	
Source	CH1
Coupling	AC
Slope	Positive
Level	0 V
Mode	Auto

e. *Set DMM controls:*

Mode	VDC
Range	Auto
Input	Front

f. *Set function generator controls:*

Function	Square
Mode	Continuous
Parameter	
Frequency	100 kHz
Amplitude	0 V
Offset	−1 V
Output	On

2. *Set AWG2040 controls and select the AWG2040 waveform file:*

a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Reset to Factory   O.K.**

b. *Modify AWG2040 default settings:*

■ Push **MODE   Gated   Polarity** to highlight Positive.

■ Select **Level** from the side menu, and turn the general purpose knob to select 0 V. (You can also use the numeric and units keys to select 0 V; then push **ENTER.**)

c. *Select waveform file:*

■ Push **SETUP   Waveform Sequence.**

■ Turn the general purpose knob to highlight the **TRGGER.WFM** file.

■ Push **ENTER.**

3. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

4. *Check external trigger level accuracy:*

a. *Adjust oscilloscope controls:* Press and hold the AWG2040 **MANUAL TRIGGER** button and adjust the oscilloscope vertical and horizontal position to display the waveform from the AWG2040. Release the **MANUAL TRIGGER** button.

b. *Check external trigger level accuracy:*

■ Gradually increment the function generator offset level until a waveform is displayed on the oscilloscope.

■ Check that the value displayed on the DMM is within 0 V ± 0.1 V when the waveform is first displayed.

c. *Modify AWG2040 settings:*

■ Select **Level** from the side menu, and turn the general purpose knob to select 5 V. (You can also use the numeric and units keys to select 5 V; then push **ENTER.**)

d. *Check external trigger level accuracy:*

■ Gradually increment the function generator offset level until a waveform is displayed on the oscilloscope.

■ Check that the value displayed on the DMM is within 5 V ± 0.1 V when the waveform is first displayed.

e. *Modify AWG2040 settings:*

■ Select **Level** from the side menu, and turn the general purpose knob to select −5 V. (You can also use the numeric and units keys to select −5 V; then push **ENTER.**)

f. *Check external trigger level accuracy:*

- Decrement the function generator offset level under −6V.

- Gradually decrement the function generator offset level until a waveform is displayed on the oscilloscope.

- Check that the value displayed on the DMM is within −5 V ± 0.1 V when the waveform is first displayed.

5. *Change the hookup and set test equipment controls:*

a. *Hook up the oscilloscope:*

- Disconnect the BNC coaxial cable from the adapter (BNC female to dual banana) on the DMM output connector and connect it to the CH1 vertical input connector on the oscilloscope.

- Connect the *AWG2040* MARKER1 output connector through the BNC coaxial cable to the CH2 vertical input connector on the oscilloscope(see Figure 4-19).
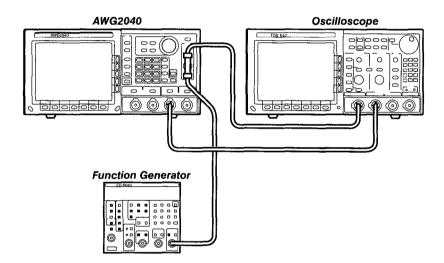
Figure 4-19: Trigger to Marker Delay Initial Test Hookup

b. *Set oscilloscope controls:*

Vertical	CH1 CH2
CH1 Scale	2 V/div.
CH1 Input Impedance	1 MΩ
CH2 Scale	1 V/div.
CH2 Input Impedance	50 Ω
Horizontal	
Sweep	20 ns/div.

6. *Set AWG2040 controls and select the AWG2040 waveform file:*

a. *Modify AWG2040 settings:*

■ Push **MODE   Triggered**.

b. *Select waveform file:*

■ Push **SETUP   Waveform Sequence**.   T R I G G E R . W F M

■ Turn the general purpose knob to highlight the ~~MARKER.WFM~~ file.

■ Push **ENTER**.

7. *Change the function generator controls:*

a. Change the amplitude to 1 V.

8. *Check Trigger to Marker delay:*

a. Check that the time TRIGGER rising edge to the MARKER1 rising edge is 48 ns or less.

9. *Change the oscilloscope controls:*

a. Change the oscilloscope sweep to 500 ns/div.

b. Change the function generator to 800 kHz.

10. *Check trigger holdoff:*

a. Gradually increment the function generator frequency from 800 kHz until the MARKER1 one period waveform during the TRIGGER two period waveform are displayed on the oscilloscope.
Decrease until the pulse just appears again

b. Check that the time MARKER1 falling edge to rising edge is 500 ns or less.

11. *End procedure:* Turn off the function generator output and disconnect the function generator and oscilloscope.

Approved by [signature]
Conformed
with Bud Hayes 951020

External CLOCK IN Check

This procedure checks the AWG2040 response to an external CLOCK IN signal.

Electrical Characteristic Checked: Auxiliary Input, EXTERNAL CLOCK, Sensitivity, on page 1-12.

Equipment Required: A 50 Ω coaxial cable (BNC connector), a 50 Ω coaxial cable (SMB–BNC connector), an adapter (BNC female–female), an oscilloscope, a RF signal generator.

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7

Procedure:

1. *Install test hookup and set test equipment controls:*

a. *Hook up oscilloscope:* Connect the AWG2040 CH1 output connector through a BNC coaxial cable to the CH1 vertical input connector on the oscilloscope .

b. *Hook up RF signal generator:* Connect the AWG2040 rear-panel **EXT CLOCK IN** connector through an adapter (BNC female–female) and a coaxial cable (SMB–BNC) to the output head of the RF signal generator (see Figure 4-20).
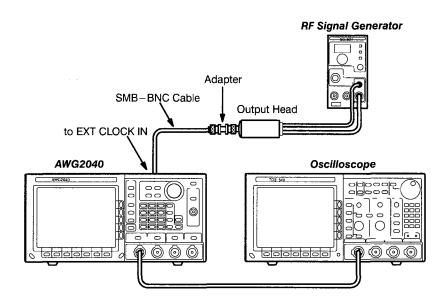
Figure 4-20: External CLOCK IN Initial Test Hookup

c. *Set oscilloscope controls:*

Vertical	CH1
Coupling	DC
Scale	0.2 V/div.
Input Impedance	50 Ω
Horizontal	
Sweep	500 ns/div.
Trigger	
Source	CH1
Coupling	DC
Slope	Positive
Level	+100 mV
Mode	Auto

d. *Set RF signal generator controls:*

Frequency	1024 MHz
Amplitude	0.4 Vpp
Power	On

2. *Set AWG2040 controls and select the AWG2040 waveform file:*

a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Re-set to Factory   O.K.**

b. *Select waveform file:*

- Push **SETUP   Waveform Sequence**.

- Turn the general purpose knob to highlight the **MODE.WFM** file.

- Push **ENTER**.

c. *Modify AWG2040 controls:* Push **SETUP   Clock   Source   External**

3. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

4. *Check external clock operation:*

a. *Check the output:* Check that the oscilloscope displays a sine wave with vertical 5 divisions and horizontal 2 divisions.

5. *End procedure:* Turn off the RF signal generator output and disconnect the RF signal generator and oscilloscope.

Digital Data Out Checks (Option 03)

This procedure checks the AWG2040 Digital Data Out at the rear panel. This check requires that the AWG2040 has Option 03 installed.

Electrical Characteristic Checked: Digital Data Out, on page 1-5.

Equipment Required: Two 50 Ω coaxial cable (SMB–BNC connector), an adapter (BNC male to SMA female), an adapter (SMA male to SMA male), an adapter (SMA female to SMA female), an adapter (BNC female to SMA male), an adapter (BNC female to dual banana), an ECL terminator, a DC power supply, an oscilloscope.

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7

Procedure:

1. *Install test hookup and set test equipment controls:*

a. *Hook up oscilloscope:* Connect the CLOCK output connector of AWG2040 DIGITAL OUT through the BNC–SMA coaxial cable, adapter (BNC female to SMA male), adapter (SMA female to SMA female), ECL terminator, adapter (SMA male to SMA male), adapter (BNC male to SMA female) to the CH1 vertical input connector on the oscilloscope.

b. *Hook up DC power supply:* Connect the ECL terminator BIAS IN through the BNC–SMB coaxial cable and adapter (BNC female to dual banana) to DC power supply (see Figure 4-21).
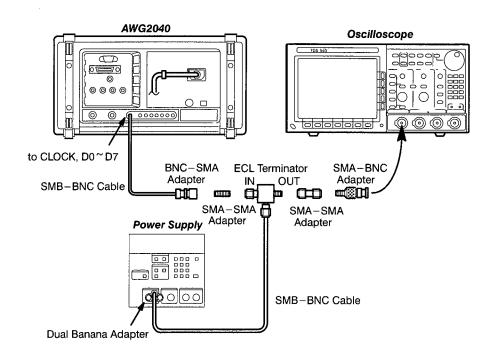
Figure 4-21: Digital Data Out Initial Test Hookup

c. *Set oscilloscope controls:*

Vertical	CH1
CH1 Coupling	DC
Scale	50 mV/div.
Input Impedance	50 Ω

Horizontal	
Sweep	5 ns/div

Trigger	
Source	CH1
Coupling	DC
Slope	Positive
Level	+100 mV
Mode	Auto

d. *Set DC power supply controls:*

Parameter	
Voltage	−2.45 V
Output	On

2. *Set AWG2040 controls and select waveform file:*

a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Reset to Factory   O.K.**

b. *Select waveform file:*

■ Push **SETUP   Waveform Sequence**.

■ Turn the general purpose knob to highlight the **DOUT.WFM** file.

■ Push **ENTER**.

3. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

4. *Check the digital data output signals:*

   a. *Check the clock output:*

   ■ Check that the oscilloscope displays a square wave with vertical 2 division and horizontal 2 division.

5. *Check the digital data output signals:*

   a. *Change connection:* Disconnect the cable (BNC–SMB) to CLOCK output and connect it to D0 output connector.

   b. *Check the digital data output:*

   ■ Check that the oscilloscope displays square wave with vertical 2 division and horizontal 4 division.

   c. *Check another digital data output:*

   ■ Repeat the same procedure as step a and b to check the D1 to D7 output signals.

6. *End procedure:* Turn off the DC power supply output and disconnect the DC power supply and oscilloscope.

Floating Point Processor Check (Option 09)

This procedure checks the AWG2040 floating point processor. This check requires that the AWG2040 has Option 09 installed.

Equipment Required: None.

Prerequisites: The AWG2040 meets the prerequisites listed on page 4-7.

Procedure:

1. *Check that floating point processor test in internal diagnostics passes:*

   a. *Run the AWG2040 internal diagnostics:* Push the AWG2040 **ON/STBY** switch two times so that the AWG2040 runs the power-on diagnostics.

   b. *Check the FPP test results:* When the AWG2040 finishes the FPP test, check that the test result is Pass.

This completes the performance tests for the AWG2040.

Adjustment Procedures

Before Adjustments

This section contains information needed to manually adjust the AWG2040 Arbitrary Waveform Generator.

The *Adjustment Procedures* section consists of two subsections:

- *Before Adjustments*

  This general information about adjusting the AWG2040 and about the Performance Check/Adjustment disk files.

- *Adjustments*

  Procedures for manually adjusting the AWG2040 assembly.

Use the *Adjustments* subsection to return the AWG2040 to conformance with performance specified in section 1, *Specifications*. This procedure is not required to verify AWG2040 performance; for performance verification procedures see section 4, *Performance Verification*.

Adjustment Interval — Generally, these adjustments should be done every 12 months.

Adjustment After Repair — After the removal and replacement of a module due to electrical failure, do the adjustment procedures in this section.

Requirements for Performance

Before doing the adjustments, note the following requirements.

- Personnel

  Only trained service technicians should perform these procedures.

- Access to Adjustments

  The cabinet must be removed and additional ventilation must be provided when making the adjustments in this procedure. See *Adjustment Instructions* in this subsection for detailed information.

- Warmup Period

  This AWG2040 requires a 20 minute warmup period in a +15 °C to +25 °C environment before it is adjusted. Adjustments done before the operating temperature has stabilized may cause errors in performance.

- Internal Calibration

  Calibrate the AWG2040 using the internal calibration routine. See the subsection, *Self Tests*, in section 4 for instructions.

- Performance Check/Adjustment Files

  These adjustment procedures require loading a file from the Performance Check/Adjustment disk included with this manual. See *Adjustment Instructions* in this subsection for information about this file.

- Test Equipment

  Table 5-1 lists all test equipment required to adjust the AWG2040.

Equipment Required

Table 5-1 lists the test equipment required to adjust the AWG2040.

Table 5-1: Test Equipment

Item Description	Minimum Requirements	Example	Purpose
BNC cable (2 required)	Impedance: 50 Ω Connectors: BNC Length: 43 inches	Tektronix Part 012-0057-01	Signal interconnection
Adapter	Connectors: BNC female-to-dual banana	Tektronix Part 103-0090-00	Signal interconnection.
Precision termination	Impedance: 50 Ω, 0.1% Connectors: BNC	Tektronix Part 011-0129-00	Signal termination.
Test oscilloscope	Bandwidth: >500 MHz	Tektronix TDS500 Series Digitizing Oscilloscope or 2400 Series Digitizing Oscilloscope	Checks output signals. Used in many procedures.
Digital multimeter	DC volts range: 0.05 V to 10 V Accuracy: ±0.1%	Fluke 8842A	Used to measure voltage.
Frequency counter	Frequency range: 1 MHz to 100 MHz Accuracy: <0.2 ppm	Tektronix DC5010 Programmable Universal Counter/Timer with Option:Precision time base*	Used to check clock frequency.
Performance Check / Adjustment disk	Must use example listed	Tektronix Part 063-1707-00	Used throughout the adjustment to provide waveform files.
Fan			Used to cool the AWG2040

*
Requires a TM 5000 Series Power Module Mainframe

Adjustment Instructions

The following instructions describe preparing the AWG2040 for adjustment, loading the adjustment file required for these procedures, and making adjustments.

Providing Access

> ⌇ **CAUTION** ⌇

To avoid damaging the eject button, make sure a floppy disk is NOT in the floppy disk drive before removing the cabinet.

Before doing the adjustments, remove the AWG2040 rear cover and cabinet. See section 6, *Maintenance*, for instructions on removing the cabinet and replacing it after adjustment.

> ⌇ **CAUTION** ⌇

To prevent damaging the ICs that have a heatsink, on the bottom side of the A20 AWG board, do not touch the heat sink when you remove or install the cabinet or during adjustment. These ICs are packaged in a thin ceramic and can be easily cracked or broken by even the slightest touch of the heat sink.

Cooling

> ⌇ **CAUTION** ⌇

To prevent damage to the AWG2040 due to over-heating, do not do these adjustment procedures without providing additional cooling, as described below.

With the rear cover and cabinet removed, the AWG2040 assembly does not cool properly while power is applied. Preventing heat build-up requires a separate fan to supplement ventilation. Place the fan so it blows air ONTO the center (or around the heatsinks) of the A20 AWG board, as shown in Figure 5-1. A protection circuit may shut down the AWG2040 if an IC is overheating.
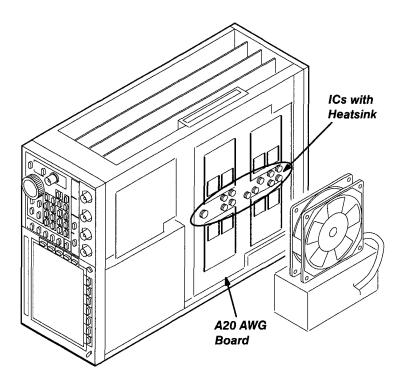
Figure 5-1: Cooling the AWG2040

Performance Check/Adjustment Files

Table 5-2 lists the waveform file on the Performance Check/Adjustment disk that is required to do the adjustments. The table lists the front-panel settings that the file sets up and the adjustment procedures that use the file.

For instructions on loading files, see *Loading Files* on page 2-12 in the *Instructions for Operation* subsection of section 2.

After loading the files, press the button on the floppy disk drive and remove the floppy disk.

NOTE

The files on the Performance Check/Adjustment disk are locked (the files names are displayed with *), so the data in these files cannot be changed unless the lock is opened. The file data includes not only waveform data, but also output parameters.

NOTE

When you select a file with the Waveform Sequence item, the AWG2040 output parameters change to those specified in the file, and the waveform output reflects waveform data in the file. After selecting a file, do not change an output parameter with the SETUP menu unless a procedure instructs you to do so. During the procedures, if you are unsure that the AWG2040 settings still match the file's settings, select the waveform again using the Waveform Sequence item on the SETUP menu.

Table 5-2: File List for Performance Check/Adjustment Disk

No.	File Name	EDIT Menu		SETUP Menu				Usage
		Wfm Shape	Wfm Point	Clock	Filter	Ampl	Offset	
1	SIN32.WFM		32	800 MHz	Through	1 V	0 V	Delay line adjustment
2	DC0V.WFM		1024	1 GHz	Through	20 mV	0 V	DC calibration
3	SQUARE.WFM		1024	1 GHz	Through	1 V	0 V	HF calibration, Filter calibration

Adjustments

This subsection describes how to do direct adjustment of AWG2040 circuits. Before doing these adjustments, read *Before Adjustments*, preceding this subsection.

Clock Frequency

This procedure adjusts R200 on the Clock board (A10) for the clock frequency of the AWG2040.

Equipment Required: A 50 Ω coaxial cable and a frequency counter.

Prerequisites: The AWG2040 must meet the prerequisites listed on page 5-1.

Procedure:

1. *Install test hookup and set test equipment controls:*

   a. *Hook up frequency counter:* Connect the AWG2040 CH1 output connector through a BNC coaxial cable to the input connector on the frequency counter (see Figure 5-2).
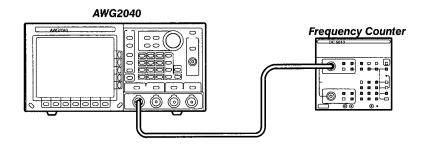
Figure 5-2: Clock Frequency Initial Test Hookup

   b. *Set frequency counter controls:*

   CHANNEL A
       Termination   50 Ω
       Slope   +
       Attenuation   X5
       Coupling   AC

   FREQ A

2. *Set AWG2040 controls and select the waveform:*

   a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Re-set to Factory   O.K.**

   b. *Select the waveform in the F.G. menu:* Push **F.G.**, Sine wave with 10 MHz is selected as default waveform.

   c. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

3. *Adjust clock frequency:* Adjust R200 on the Clock board (A10) so that the counter reading is in the range of 10 MHz ±10 Hz. See Figure 5-3 for adjustment location.

4. *End procedure:* Disconnect the frequency counter.
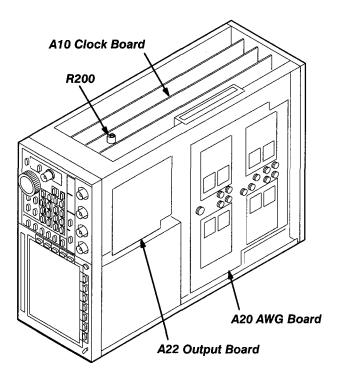
Figure 5-3: Boards and R200 Location for Clock Frequency

Delay Line

This procedure adjusts DL180 and DL182 on the AWG (A22) board.

Equipment Required: A 50 Ω coaxial cable and an oscilloscope.

Prerequisites: The AWG2040 must meet the prerequisites listed on page 5-1.

Procedure:

1. *Install the test hookup and set test equipment controls:*

   a. *Hook up the oscilloscope:*

      ■ Connect the AWG2040 CH1 output connector through the coaxial cable to the CH1 vertical input connector on the oscilloscope (see Figure 5-4).
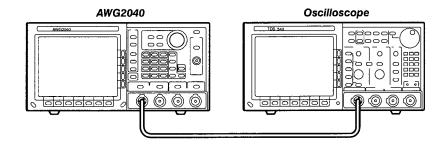
Figure 5-4: Delay Line Initial Test Hookup

   b. *Set the oscilloscope controls:*

Vertical	CH1
CH1 coupling	DC
CH1 scale	0.5 V/div.
CH1	
input impedance	50 Ω
Horizontal	
Sweep	10 ns/div.
Trigger	
Source	CH1
Coupling	DC
Slope	Positive
Level	0 V
Mode	Auto

2. *Set the AWG2040 controls and select the waveform file:*

   a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Reset to Factory   O.K.**

   b. *Select the file:*

      ■ Push **SETUP   Waveform Sequence.**

      ■ Turn the general purpose knob to display the list of waveform files and highlight the **SIN32.WFM** file.

      ■ Push **ENTER** to select the file. This button is located to the lower-right of the numeric keypad.

c. *Set AWG2040 controls:*

■ Push **SETUP Frequency.**

■ Turn the general purpose knob to set the clock to 800 MHz.

3. *Turn on the AWG2040 CH1 output:* Push the **CH1** button so that the LED above the CH1 output connector is on.

4. *Adjust delay lines:*

a. *Adjust oscilloscope display:* Adjust the horizontal and vertical position to display the sine waveform on the center screen in the proper position.

b. *Adjust DL180 and DL182:* Adjust DL180 and DL182 so that no bit errors occur on the CH1 waveform. See Figure 5-5 for adjustment location.

NOTE

Adjust points DL180 and DL182 are at the same angle.
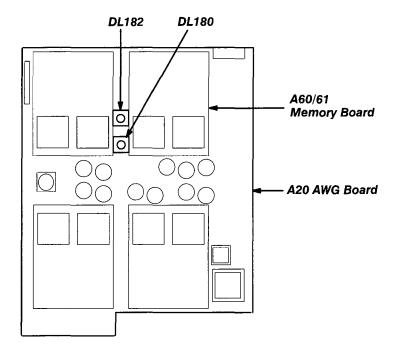
Figure 5-5: DL180 and DL182 locations

c. *Change the AWG2040 frequency:* Turn the general purpose knob to increase the clock frequency by 100 MHz.

d. *Readjust DL180 and DL182:* Readjust DL180 and DL182 so that no bit errors do occur on the CH1 waveform.

e. *Repeat adjustment:* Repeat substep 4c and 4d at the clock frequency from 800 MHz to1 GHz and 1.024 GHz.

5. *Check for bit error on the waveform:* Check that no bit errors occur on the waveform when changing the clock frequency from 500 MHz through 1.024 GHz.

6. *End procedure:* Disconnect the oscilloscope.

DC Calibration

Equipment Required: A strap jumper, a 50 Ω coaxial cable, a 50 Ω precision terminator, a BNC (female)-to-dual banana adapter, and a digital multimeter (DMM)

Prerequisites: The AWG2040 must meet the prerequisites listed on page 5-1.

Procedure:

1. *Install the test hookup and set test equipment controls:*

   a. *Hook up DMM:* Connect the AWG2040 CH1 output through a 50 Ω coaxial cable, a 50 Ω precision terminator, and a adapter (BNC-to-dual banana) to the DMM INPUT connector (see Figure 5-6).
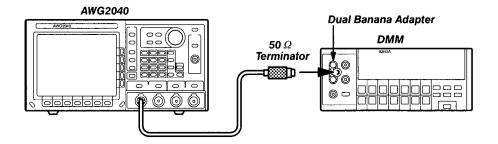
Figure 5-6: DC Calibration Initial Test Hookup

   b. *Hook up AWG2040:* Connect TP520 (OFFSET DAC) and TP700 (AGND) with a strap jumper (see Figure 5-7).
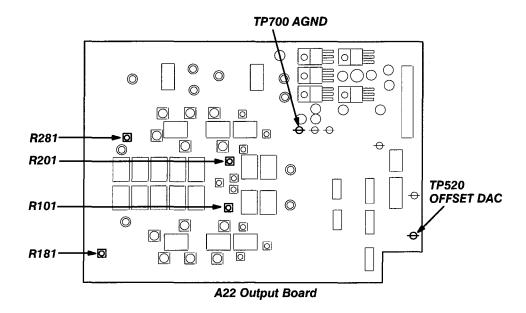
Figure 5-7: Adjustment locations for DC Calibration

c. *Set DMM controls:*

Mode	VDC
Range	Auto
Input	Front

2. *Set the AWG2040 controls:*

a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Config...   Reset to Factory   O.K.**

b. *Set the AWG2040 controls:*

■ Push **Amplitude**.

■ *Enter numeric value of 20:* Push **2** and **0** key in this order.

■ Push **kHz/ms/mV** key.

c. *Select the file:*

■ Push **SETUP   Waveform Sequence**.

■ Turn the general purpose knob to display the list of waveform files and highlight the **DC0V.WFM** file.

■ Push **ENTER** to select the file. This button is located to the lower-right of the numeric keypad.

d. *Enable AWG2040 output:* Push the **CH1** and **CH1** button so that the LEDs above the CH1 and CH1 output connector are on.

3. *Adjust R181:* Adjust R181 so that the DMM reading is within 0 V ± 5 mV.

4. *Modify the AWG2040 hookup:* Disconnect the BNC coaxial cable on the AWG2040 CH1 input connector and connect it to the $\overline{\text{CH1}}$ input connector.

5. *Adjust R281:* Adjust R281 so that the DMM reading is within 0 V ± 5 mV.

6. *Modify the AWG2040 controls:*

   a. Push **Amplitude**.

   b. *Enter numeric value of 1.7:* Push **1**, **.** (decimal point), and **7** key in this order.

   c. Push **Hz/s/V** key.

7. *Adjust R201:* Adjust R201 so that the DMM reading is within 0 V ± 5 mV.

8. *Modify the AWG2040 hookup:* Disconnect the BNC coaxial cable on the AWG2040 $\overline{\text{CH1}}$ input connector and connect it to the CH1 input connector.

9. *Adjust R101:* Adjust R101 so that the DMM reading is within 0 V ± 5 mV.

10. *Remove the strap jumper:* Remove the strap jumper on TP520 (OFFSET DAC) and TP700 (AGND).

11. *Execute Calibration with the AWG2040 menu:*

    a. Push **UTILITY   Diag/Cal   Calibration Setup   Execute**

12. *End procedure:* Disconnect the DMM.

HF Calibration

Equipment Required: Two 50 Ω coaxial cable and an oscilloscope.

Prerequisites: The AWG2040 must meet the prerequisites listed on page 5-1.

Procedure:

1. *Install the test hookup and set test equipment controls:*

   a. *Hook up the oscilloscope:*

      ■ Connect the AWG2040 CH1 output connector through the coaxial cable to the CH1 vertical input connector on the oscilloscope.

   ■ Connect the AWG2040 $\overline{\text{CH1}}$ output connector through the coaxial cable to the CH2 vertical input connector on the oscilloscope (see Figure 5-8).

AWG2040   *Oscilloscope*
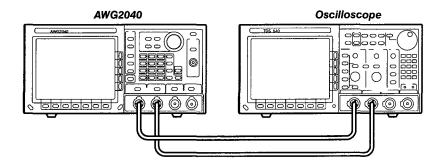
Figure 5-8: Hookup for HF Calibration

b. *Set oscilloscope controls:*

Vertical   CH1, CH2
    CH1, CH2 coupling   DC
    CH1, CH2 scale   0.2 V/div.
    CH1, CH2 input impedance 50 Ω

Horizontal
    Sweep   1 ns/div.

Trigger
    Source   CH1
    Coupling   DC
    Slope   Positive
    Level   0 V
    Mode   Auto

2. *Set the AWG2040 controls and select the waveform file:*

a. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Reset to Factory   O.K.**

b. *Select the file:*

■ Push **SETUP   Waveform Sequence**.

■ Turn the general purpose knob to display the list of waveform files and highlight the **PULSE.WFM** file.

■ Push **ENTER** to select the file.

c. *Set the AWG2040 controls:*

■ Push **Amplitude**.

■ *Enter numeric value of 1.414:* Push **1**, **.** (decimal point), **4**, **1**, and **4** key in this order.

■ Push **Hz/s/V** key.

3. *Enable AWG2040 output:* Push the CH1 and $\overline{CH1}$ output button.

4. *Adjust CH1and CH1 HF compensation:*

   a. *Preadjust R253 on the Output board (A22):* Preadjust R253 for a midpoint between CW and CCW.

   b. *Adjust oscilloscope display:* Adjust the horizontal and vertical position to display the rising edge of the waveforms.

   c. *Adjustment:* Adjust C251 and C253 on the Output board (A22) so that the aberration of the waveform is within ± 10 % (less aberration is preferable) and the rise time is less than 2.5 ns. See Figure 5-9 for adjustment location.

   d. *Adjustment:* Adjust R253 for the best pulse wave symmetry between CH1 and CH1.

A22 Output Board
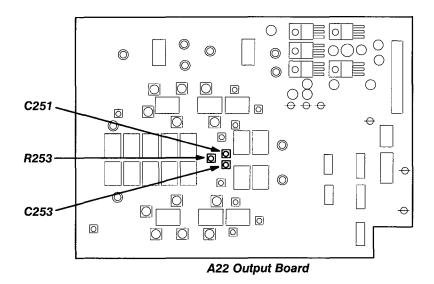
Figure 5-9: Adjustment locations for HF Calibration

5. *Change AWG2040 amplitude:*

   a. *Enter numeric value:* Push **1** and **Hz/s/V** key in this order to set 1 V amplitude.

6. *Check CH1and CH1 HF compensation:*

   a. *Check HF compensation:* Check that the rise time is less than 1.5 ns and aberration is within ± 7 %.

   b. *Readjustment:* If necessary, repeat substep 2b and 4c through 4f for readjustment. And repeat step 5 and 6 to re–check.

7. *End procedure:* Retain the test hookup and control settings.

Filter Calibration

Equipment Required: Two 50 Ω coaxial cables and an oscilloscope.

Prerequisites: The AWG2040 must meet the prerequisites listed on page 5-1.

Procedure:

1. *Install the test hookup and set test equipment controls:*

   a. *Use test hookup and control settings from the previous adjustment.*

   b. *Modify the oscilloscope controls:*

   Horizontal
       Sweep   2 ns/div.

2. *Set the AWG2040 controls:*

   a. *Set amplitude:*

   - Push **SETUP   Amplitude**.

   - Push **1** and **Hz/s/V** key in this order to set 1 V amplitude.

   b. *Filter setting:*

   - Push **Filter   100 MHz**.

3. *Adjust CH1and $\overline{CH1}$ filter characteristics:*

   a. *Adjust oscilloscope display:* Adjust the horizontal and vertical position to display the rising edge of the waveform.

   b. *Adjust 100 MHz filter:*

   - Adjust C311, C313, and C315 so that the rise time is less than 3.5 ns for CH1 (normal) output. See Figure 5-10 for adjustment location.

   - Adjust C411, C413, and C415 so that the rise time is less than 3.5 ns for $\overline{CH1}$ (invert) output. See Figure 5-10 for adjustment location.

NOTE

The filter adjustment may need to be repeated between CH1 (normal) and $\overline{CH1}$ (invert) because of interaction.

A22 Output Board
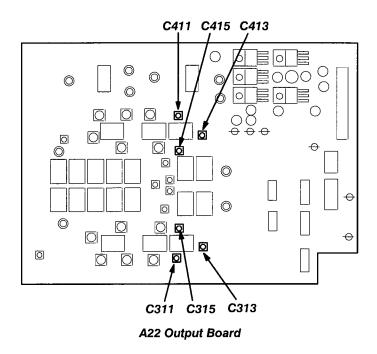
Figure 5-10: Adjustment locations for Filter Calibration

c. *Adjust other filters:*

■ Repeat substep 3 to change AWG2040 filter settings and oscilloscope sweep time, and adjust the rise time for each filter listed in table below. See Figure 5-11 for adjustment location..

Table 5-3: Filter Specification

Filter	Adjustable Parts		Rise time
	CH1 (normal)	$\overline{\text{CH1}}$ (invert)	
50 MHz	L320, L322	L420, L422	< 7 ns
20 MHz	L330, L332	L430, L432	< 17 ns
10 MHz	L340, L342	L440, L442	< 35 ns

4. *End procedure:* Disconnect the oscilloscope.

A22 Output Board
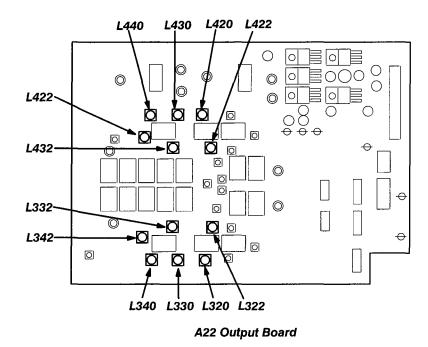
Figure 5-11: Adjustment locations for Filter Calibration

End Adjustment Procedures

This is the end of the *Adjustments*. Follow these steps to restore the AWG2040 to service:

1. *Initialize AWG2040 controls:* Push **UTILITY   Misc   Reset to Factory   O.K.**

2. *Equipment power-down:*

   ■ Turn off oscilloscope power.

   ■ Push the **ON/STBY** button on the AWG2040 to toggle off operating power.

   ■ Push the **PRINCIPAL POWER** switch on the back of the AWG2040 to turn off main power.

   ■ Unplug the AWG2040 power cord from the line source.

3. *Disk removal:* Remove Performance Check/Adjustment disk from AWG2040 floppy disk drive.

4. Install the AWG2040 cabinet and rear panel. See section 6, *Maintenance*, for instructions on replacing the cabinet.

5. *Internal calibration:* Calibrate the AWG2040 using the internal calibration routine. See the subsection, *Self Tests*, in section 4 for instructions.

Maintenance

Before Maintenance

This section contains the information needed to do periodic and corrective maintenance on the AWG2040 Arbitrary Waveform Generator. Specifically, the following subsections are included:

■ *Before Maintenance* — General information on preventing damage to internal modules when doing maintenance.

■ *Inspection and Cleaning* — Information and procedures for inspecting the AWG2040 and cleaning its external and internal modules.

■ *Removal and Installation Procedures* — Procedures for removing defective modules and replacing new or repaired modules.

■ *Repackaging* — Information for packaging the AWG2040 properly for shipment.

■ *Troubleshooting* — Information for isolating failed modules. Included are instructions for the AWG2040 internal diagnostic routines and troubleshooting flowcharts for fault isolation. Most of the flowcharts use the internal diagnostic routines to speed fault isolation to a module.

Prerequisites

Before doing any of the procedures in the *Maintenance* section, note the following:

■ Only trained service technicians should perform these procedures.

■ Read the *Safety Summary* located near the beginning of this manual.

■ Read the *Strategy for Servicing* in the front matter before servicing the AWG2040.

■ Read section 2, *Operating Information*, before servicing the AWG2040.

Preventing ESD

⦚ **CAUTION** ⦚

Static discharge can damage any semiconductor component in the AWG2040.

Precautions

When performing service which requires internal access to the AWG2040, follow these 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. Do not remove the AWG2040 cabinet unless you have met precaution number 3, above. Consider all internal modules static-sensitive.

5. Do not allow anything capable of generating or holding a static charge on the work station surface.

6. Handle circuit boards by the edges when possible.

7. Do not slide the modules over any surface.

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

9. Do not use high-velocity compressed air when cleaning dust from modules.

Susceptibility to ESD

Table 6-1 lists the relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

Table 6-1: Relative Susceptibility to Static-discharge Damage

Semiconductor Classes	Relative Susceptibility Levels[1]
MOS or CMOS microcircuits or discrete circuits, or linear microcircuits with MOS inputs (most sensitive)	1
ECL	2
Schottky signal diodes	3
Schottky TTL	4
High-frequency bipolar transistors	5
JFET	6
Linear microcircuits	7
Low-power Schottky TTL	8
TTL (least sensitive)	9

[1]Voltage equivalent for levels (voltage discharged from a 100 pF capacitor through resistance of 100 Ω):

1 = 100 to 500 V	6 = 600 to 800 V
2 = 200 to 500 V	7 = 400 to 1000 V (est.)
3 = 250 V	8 = 900 V
4 = 500 V	9 = 1200 V
5 = 400 to 600 V	

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Inspection and Cleaning

This subsection describes how to determine whether the AWG2040 needs cleaning, and how to do the cleaning. Inspection and cleaning are preventive maintenance procedures. When done regularly, preventive maintenance may prevent AWG2040 malfunction and enhance reliability.

Preventive maintenance consists of visually inspecting and cleaning the AWG2040 and using general care when operating it.

How often to do maintenance depends on the severity of the environment in which the AWG2040 operates.

General Care

The cabinet helps keep dust out of the AWG2040 and is a major component of the instrument cooling system. The cabinet should normally be in place when operating the AWG2040. The AWG2040 front cover (optional accessory) protects the front panel and display from dust and damage. Install it when storing or transporting the instrument.

Inspection and Cleaning Procedures

Inspect and clean the AWG2040 as operating conditions require. The collection of dirt on components inside can cause them to overheat and break down. (Dirt acts as an insulating blanket, preventing efficient heat dissipation.) Dirt also provides an electrical conduction path that can cause an instrument failure, especially under high-humidity conditions.

WARNING

To avoid personal injury or death due to electric shock, unplug the power cord from the line voltage source before cleaning the AWG2040.

⌇ *CAUTION* ⌇

To prevent damaging the plastics used in the AWG2040 do not use chemical cleaning agents. Use only deionized water when cleaning the menu buttons or front-panel buttons. Use a 75% isopropyl alcohol solution as a cleaner, and rinse with deionized water. Before using any other type of cleaner, consult your Tektronix Service Center or representative.

To prevent damaging AWG2040 components, do not use high-pressure compressed air when cleaning dust from the interior of the AWG2040. (High pressure air can cause electrostatic discharge.) Instead, use low pressure compressed air (about 9 psi).

Inspection — Exterior

Inspect the outside of the AWG2040 for damage, wear, and missing parts, using Table 6-2 as a guide. If the AWG2040 appears to have been dropped or otherwise abused, check it thoroughly to verify correct operation and performance. Repair any defects that may cause personal injury or lead to further damage to the AWG2040.

Table 6-2: External Inspection Check List

Item	Inspect For	Repair Action
Cabinet, front panel, and cover	Cracks, scratches, deformations, damaged hardware or gaskets.	Replace defective module.
Front-panel knobs	Missing, damaged, or loose knobs.	Repair or replace missing or defective knobs.
Connectors	Broken shells, cracked insulation, and deformed contacts. Dirt in connectors.	Replace defective modules. Clear or wash out dirt.
Carrying handle, cabinet, feet	Correct operation.	Replace defective module.
Accessories	Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors.	Replace damaged or missing items, frayed cables, and defective modules.

Cleaning Procedure — Exterior

WARNING

*To avoid potential electric shock hazard or damage to the
AWG2040 circuits, do not allow any moisture inside the AWG2040
during external cleaning; use only enough liquid to dampen the
cloth or applicator.*

1. Remove loose dust on the outside of the AWG2040 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 either isopropyl alcohol or, preferably, a gentle, general-
   purpose detergent-and-water solution.

Inspection — Interior

To access the inside of the AWG2040 for inspection and cleaning, refer to
the *Removal and Installation Procedures* in this section.

Inspect the internal portions of the AWG2040 for damage and wear, using
Table 6-3 as a guide. Repair any defects immediately.

CAUTION

*To prevent damage from electrical arcing, ensure that circuit
boards and components are dry before applying power to the
AWG2040.*

Table 6-3: 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 modules and replace with a new module.
Resistors	Burned, cracked, broken blistered condition.	Replace failed module and replace with a new module.
Solder connections	Cold solder or rosin joints.	Resolder joint and clean with isopropyl alcohol.

Table 6-3: Internal Inspection Check List (Cont.)

Item	Inspect For	Repair Action
Capacitors	Damaged or leaking cases. Corroded solder on leads or terminals.	Remove damaged module and replace with a new 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

If, after doing steps 1 and 2, a module is clean upon inspection, skip the remaining 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 isopropyl alcohol (75% solution), and rinse with a warm deionized water. (A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards.)

3. If steps 1 and 2 do not remove all the dust or dirt, the AWG2040 may be spray washed using a solution of 75% isopropyl alcohol by doing step 4 through 8.

4. Gain access to the parts to be cleaned by removing easily accessible shields and panels (see *Removal and Installation Procedures* in this section).

5. Spray wash dirty parts with the isopropyl alcohol, and wait 60 seconds for the majority of the alcohol to evaporate.

6. Use hot (120° F to 140° F) 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 (125° F to 150° F) circulating air.

Lubrication

There is no periodic lubrication required for the AWG2040.

Removal and Installation Procedures

This subsection describes how to remove and install the mechanical and electrical modules in the AWG2040.

Preparation

This subsection contains the following:

- This preparatory information needed to properly do the procedures that follow

- A list of equipment required in removing modules

- Module locator diagrams for finding each module in the AWG2040

- Procedures for removing and reinstalling electrical and mechanical modules

WARNING

To avoid possible personal injury or damage to AWG2040 components, read the Preparation for Use *subsection in section 2, and* Preventing ESD *in the subsection,* Before Maintenance. *Before doing this or any other procedure in this manual, read the* Safety Summary *found near the beginning of this manual.*

To avoid possible personal injury, disconnect the power cord from the line voltage source before doing any procedures in this section.

List of Mechanical Parts

Section 10, *Mechanical Parts List*, lists all mechanical parts in the AWG2040.

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General Instructions

NOTE

Read these general instructions before removing a module.

First read over the *Summary of Procedures* that follows to understand how the procedures are organized. Then read *Equipment Required* to find out the tools needed to remove and install modules.

To remove a module, begin by doing the *Access Procedure* (on page 6-13). By following the instructions in that procedure, you can remove the desired module without unnecessarily removing other modules.

Summary of Procedures

The *Access Procedure* on page 6-13 identifies the procedure for removing each module. These categories separate the procedures based on their location in the AWG2040.

■ *Procedures for External Modules* on page 6-16 describes how to remove modules which can be removed without internal access to the AWG2040.

■ *Procedures for Internal Modules* on page 6-27 describes how to remove modules which require internal access to the AWG2040.

Equipment Required

The removal of most modules in the AWG2040 requires only a screwdriver handle mounted with a size T-15, Torx screwdriver 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. The first step of a module procedure lists all equipment required to remove and reinstall the module.

Table 6-4: Equipment Required

Name	Description	Part Number
Screwdriver handle	Accepts Torx-driver bits	003-0524-00
T-8 Torx tip	Torx-driver bit for T-8 size screw heads	003-0964-00
T-9 Torx tip	Torx-driver bit for T-9 size screw heads	003-0965-00
T-10 Torx tip	Torx-driver bit for T-10 size screw heads	003-0815-00
T-15 Torx tip	Torx-driver bit for T-15 size screw heads	003-0966-00
#1 Phillips tip	Phillips-driver bit for #1 size screw heads	003-0335-00
Flat-bladed screwdriver	Screwdriver for removing standard-headed screws	
Hex wrench, 0.050 inch	Standard tool	
Hex wrench, $\frac{1}{16}$ inch	Standard tool	
Needle-nose pliers	Standard tool	
Nut driver, $\frac{1}{2}$ inch	Standard tool	
Nut driver, $\frac{1}{4}$ inch	Standard tool	
Nut driver, $\frac{5}{16}$ inch	Standard tool	
Nut driver, 5 mm	Standard tool	
Open-end wrench $\frac{1}{2}$ inch	Standard tool	
Soldering iron	Standard tool	

AWG2040 Orientation

In this manual, procedures refer to "front," "back," "top," etc. of the
AWG2040. Figure 6-1 shows how the sides are referenced.
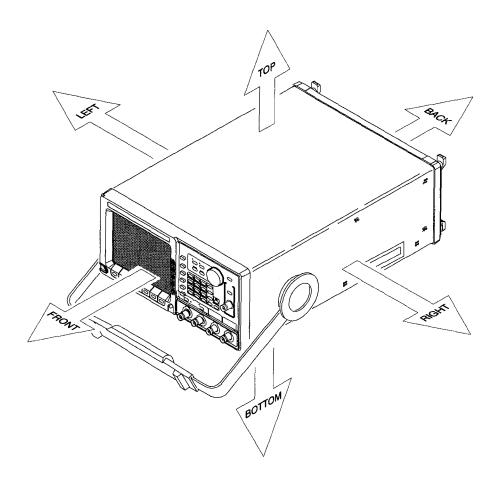
Figure 6-1: AWG2040 Orientation

Access Procedure

When you have identified the module to be removed for service, read *General Instructions* found earlier in this section. Then use the flowchart in Figure 6-2 to determine which procedures to use for removing the module. The removal procedures end with reinstallation instructions.

Locate the module to
be removed in
Figure 6-3 or 6-4.

Is the
module in
Figure 6-3?   Yes

To remove:	Go to page:
Front-panel Knob	6-17
Line Fuse and Line Cord	6-18
Rear Cover and Cabinet	6-19
EMI Gaskets	6-21
Front Cover, Trim Ring, and Menu Buttons	6-21
Front-panel Module	6-23

No

Make sure a floppy
disk is not in the
floppy-disk drive.

To remove:	Go to page:
A22 Output board, A20 AWG board	6-28
A60/A61(Option 01) Memory board	6-32
Connector Module	6-34
Fan and Fan Frame	6-36
Rear Shield Cover	6-38
Power Supply Module	6-40
AUX Power Board and AC Inlet	6-42
Monitor Module and CRT Frame	6-44
Circuit boards	6-47
A6 CPU	6-47
A10 Clock	6-47
A14 Trigger board	6-47
A7 Floating Point Processor board (Option 09)	6-47
A16 Backplane board	6-50
Lithium battery	6-52
Floppy-disk Drive Module	6-54

Do the procedure, *Rear Cover and Cabinet* on page 6-19, removing the rear cover and cabinet.

Figure 6-2: Guide to Removal Procedures

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Cabinet

Rear Cover

Fuse Cap

Line Fuse

Line Cord

CRT Filter

Front-panel
Module

Menu Buttons

Floppy-disk Drive Bezel

Front-panel Knob

EMI Gasket

Front Cover (Optional)

Trim Ring
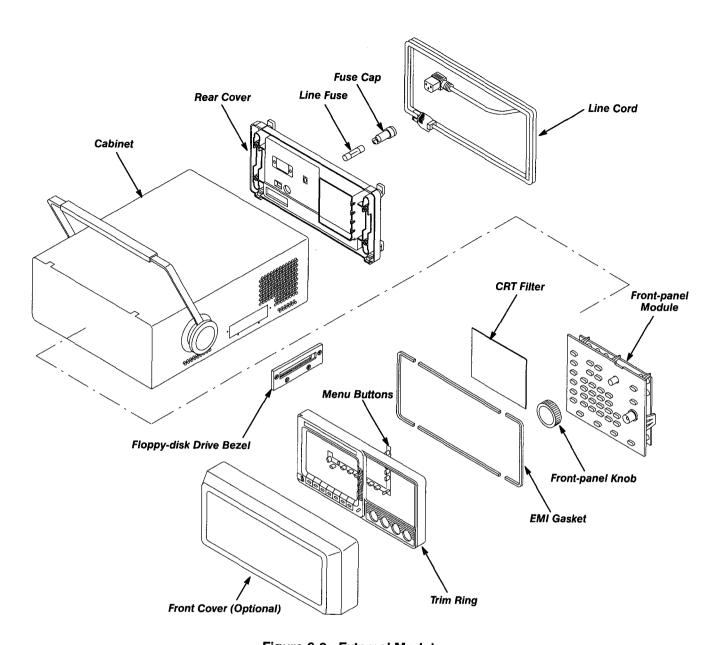
Figure 6-3: External Modules

A7 Floating Point Processor Board
(Option 09)

Rear Panel

A6 CPU Board

Fan Frame

Fan

Power Supply Module

A10 Clock Board

A14 Trigger Board

Monitor Module

AUX Power

Rear Panel

AC Inlet

CRT Frame

Rear Shield
Cover

Floppy Disk
Drive Cover

Front Panel

Floppy Disk Drive

Shield

Board
Support

Board Support

A16 Backplane Board

A20 AWG Board

Connector Module

A60 Memory Board

Shield

A22 Output Board

A60 Memory Board

Figure 6-4: Internal Modules

Procedures for External Modules

Do the *Access Procedure* (page 6-13) before doing any procedure in this group.

This group contains the following procedures:

- Front-panel Knob

- Line Fuse and Line Cord

- Rear Cover and Cabinet

- EMI Gaskets

- Front Cover, Trim Ring, and Menu Buttons

- Front-panel Module

Front-panel Knob

1. *Assemble equipment and locate modules to be removed:* You will need a $\frac{1}{16}$-inch hex wrench to do this procedure. Find the front-panel knob on the front panel in the locator diagram, *External Modules*, Figure 6-3.

2. *Orient instrument:* Set the AWG2040 with the bottom down on the work surface and the front facing you (see Figure 6-5).

3. *Remove front cover:* If the optional front cover is installed, grasp the front cover by the left and right edges and snap it off of the trim ring. (When reinstalling, align and snap back on.)

4. *Remove knob:* Loosen the setscrew securing the knob using the $\frac{1}{16}$-inch hex wrench. Pull the knob toward you to remove it.

5. *Reinstallation:* Place the knob onto the shaft, and tighten the setscrew using the $\frac{1}{16}$-inch hex wrench.
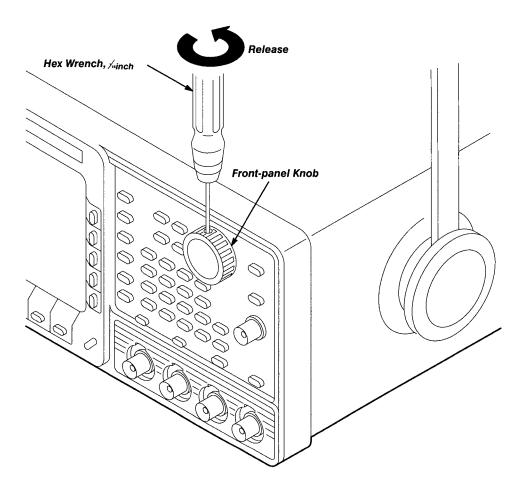
Figure 6-5: Front-panel Knob Removal

Line Fuse and Line Cord

1. *Assemble equipment and locate modules to be removed:* You will need a flat-bladed screwdriver to do this procedure. Locate the line fuse and line cord in the locator diagram, *External Modules,* Figure 6-3.

2. *Orient instrument:* Set the AWG2040 with the bottom down on the work surface and the back facing you. If you are servicing the line fuse, do the next step; if you are servicing the line cord, skip to step 4.

3. *Remove line fuse:* Find the fuse cap on the rear panel. See Figure 6-6. Now, remove the fuse cap by turning it counter-clockwise using a flat-bladed screwdriver, and remove the line fuse. Reverse the procedure to reinstall.

4. *Remove line cord:* Find the line cord on the rear cover. See Figure 6-6. Now, remove the line-cord retaining clamp by first unplugging the line cord from the line cord receptacle (1). Next, grasp both the line cord and the retaining clamp and rotate it 90 degrees, counter-clockwise (2). Pull the line cord and clamp away to complete the removal (3). Reverse the procedure to reinstall.

5. *Reinstallation:* Do steps 3 and 4 in reverse order to reinstall the line cord, and then the line fuse.
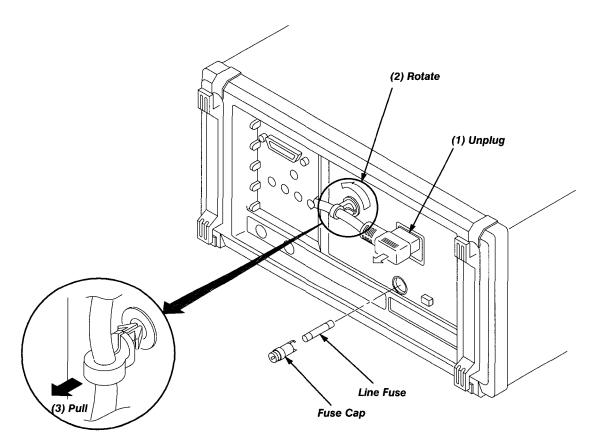
Figure 6-6: Line Fuse and Line Cord Removal

Rear Cover and Cabinet

1. *Assemble equipment and locate modules to be removed:*

   a. You will need a screwdriver with size T-9 and T-15 Torx tips to do this procedure.

   b. Make sure the AWG2040 front cover (optional accessory) is installed. If it is not, install it by snapping the edges of the front cover over the trim ring.

   c. Locate the rear cover and cabinet in the locator diagram, *External Modules*, Figure 6-3.

2. *Orient instrument:* Set the AWG2040 face down, with the front cover on the work surface and the instrument bottom facing you (see Figure 6-7).

3. *Disconnect line cord:* Do the *Line Fuse and Line Cord* procedure on page 6-18, removing only the line cord.

4. *Remove rear cover:* Using a screwdriver with a size T-15 Torx tip, remove the four screws securing the rear cover to the instrument. Lift off the rear cover.

5. *Orient instrument:* Set the AWG2040 face down, with the front cover on the work surface and right side facing you.

6. *Remove floppy disk drive bezel:* Using a screwdriver with a size T-9 Torx tip, remove the four screws securing the floppy-disk drive bezel to the cabinet. Lift off the floppy-disk drive bezel.

7. *Remove cabinet:*

> **CAUTION**

To prevent damaging the eject button, make sure floppy disk is not inserted in the floppy disk drive, before removing the cabinet from the AWG2040.

To prevent damaging the ICs that have a heat sink on the bottom of the A20 AWG board, do not touch the heat sink when you remove or install the cabinet, or do other servicing. These ICs are packaged in a thin ceramic and can be cracked or broken by the slight touch.

   a. Using a screwdriver with a size T-15 Torx tip, remove the screw securing the left side of the cabinet to the instrument.

   b. Grasp the right and left edges of the cabinet toward the back.

   c. Pull upward to slide the cabinet off the instrument. Take care not to bind or snag the cabinet on internal cabling as you remove it.

8. *Reinstall cabinet and rear cover:*

a. Do steps 3 through 7 in reverse order to reinstall the cabinet.

b. Take care not to bind or snag the cabinet on internal cabling; re-dress cables as necessary.

c. When sliding the cabinet, be sure that the front edge of the cabinet aligns with the groove containing the four EMI shields on the trim ring.

d. When reinstalling the four screws at the rear panel, tighten them to a torque of 16 kg-cm (6 in-lbs).

e. See the procedure, *Line Fuse and Line Cord,* on page 6-18 to rein-stall the line cord. This completes the AWG2040 reassembly.
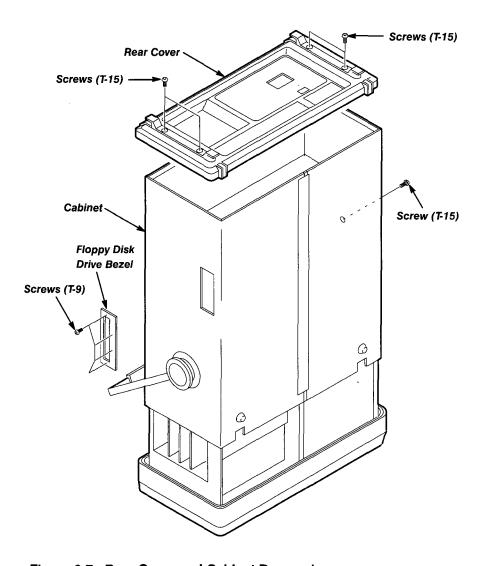
Figure 6-7: Rear Cover and Cabinet Removal

EMI Gaskets

1. *Remove front cover and trim ring:* Do the *Front Cover, Trim Ring, and Menu Buttons* procedure on page 6-21, removing only the front cover and trim ring.

CAUTION

To prevent exceeding the environmental characteristics for EMI, carefully follow the instructions given when reinstalling the EMI gaskets and/or the AWG2040 cabinet.

2. *Remove EMI gaskets:*

   a. You will need a needle-nose pliers to do this part of the procedure.

   b. Locate the EMI gaskets in the locator diagram, *External Modules*, in Figure 6-3.

   c. Use a pair of needle-nose pliers to remove the four sections of EMI gaskets from the groove in the trim ring.

3. *Reinstall EMI gaskets:* Press the EMI gaskets back into the groove in the trim ring.

Front Cover, Trim Ring, and Menu Buttons

1. *Assemble equipment and locate modules to be removed:* No tools are needed. Locate the modules to be removed in the locator diagram, *External Modules*, in Figure 6-3.

2. *Orient instrument:* Set the AWG2040 with the back down on the work surface and bottom facing you (see Figure 6-8).

3. *Remove front cover:* If the optional front cover is installed, grasp the front cover by the left and right edges and snap it off the trim ring. (When reinstalling, align and snap back on.)

4. *Remove front-panel knob:* Do the *Front-panel Knob* procedure, on page 6-17.

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Trim Ring : when removing the trim ring, grasp its back edge and vigorously flex it upward before pulling it forward.

Trim Ring

Menu Buttons
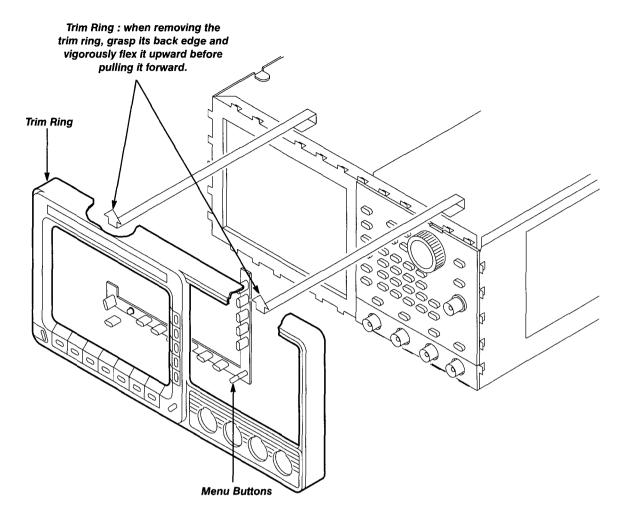
Figure 6-8: Front Cover, Trim Ring, and Menu Button Removal (Front Cover not Shown)

CAUTION

To prevent contaminating AWG2040 parts, do not touch the carbon contact points on the menu buttons installed in the trim ring. Also, do not touch the contacts on the flex circuit exposed when you remove the trim ring.

5. *Remove trim ring:* Grasp the trim ring by the top edge and pry it up and lift it forward to snap it off of the trim ring. If servicing the menu buttons, lift them out of the trim ring. (When reinstalling, reinsert the menu buttons, align the trim ring to the chassis and press it back on.)

6. *Reinstallation:* Do steps 3–5 in reverse order to reinstall the menu buttons, trim ring and the front cover, following the reinstallation instructions found in each step.

Front-panel Module

NOTE

This procedure includes removal and reinstallation instructions for the front-panel module and front-panel buttons. Unless either of those modules are being serviced, do not do step 6, "Further disassembly of Front-panel Module."

1. *Assemble equipment and locate modules to be removed:*

   a. You will need a flat-bladed screwdriver and a 0.05-inch and $\frac{1}{16}$-inch hex wrench to do this procedure.

   b. Locate the modules to be removed in the locator diagram, *External Modules*, in Figure 6-3.

   c. Do the procedure, *Front Cover, Trim Ring, and Menu Buttons*, steps 1 ~ 6 (immediately preceding this procedure).

2. *Remove front-panel knob:* Do the *Front-panel Knob* procedure, on page 6-17.

3. *Remove front cover, trim ring, and menu buttons:* Do the *Front Cover, Trim Ring, and Menu Buttons* procedure on page 6-21 removing only the module(s) you want to service.

4. *Orient instrument:* Set the AWG2040 with the bottom down on the work surface and the front facing you.

5. *Remove front-panel module:*

   a. As shown in Figure 6-9, release the snap at the right of the front-panel module using a flat-bladed screwdriver. Lift the front-panel module out of the chassis until you can reach the interconnect cable.

   b. Disconnect the ribbon interconnect cable at J101 and flexible board connector at JP301 on the A12 Keyboard assembly. Disconnect the interconnect cable at the TRIGGER INPUT connector.

   c. Finally, lift the front-panel module out of the chassis to complete the removal.
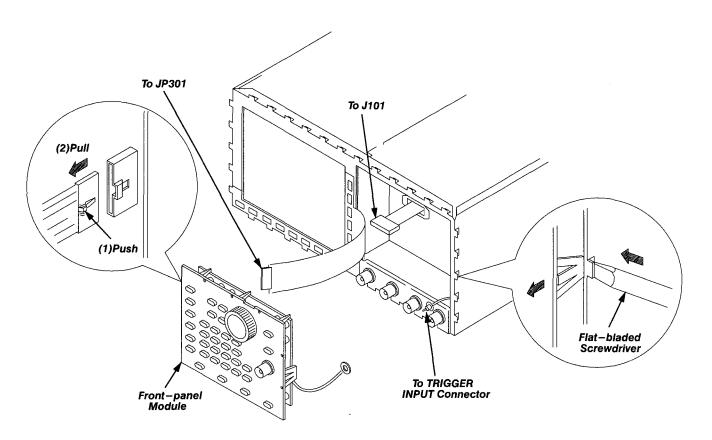
Figure 6-9: Front-panel Module Removal

6. *Further disassembly of front-panel module:* If the front-panel module or the front-panel buttons are to be serviced, do the following substeps:

   a. Remove the front-panel knob from the front-panel module using the method described in the procedure, *Front-panel Knob,* on page 6-17.

   b. Remove the setscrew completely from the extension using the 0.05-inch hex wrench, and then remove the extension from the shaft of the rotary switch.

   c. As shown in Figure 6-10, release the four hooks, and then remove the A12 Keyboard from the chassis.

6-24

Maintenance

Hooks

A12 Keyboard

Hooks
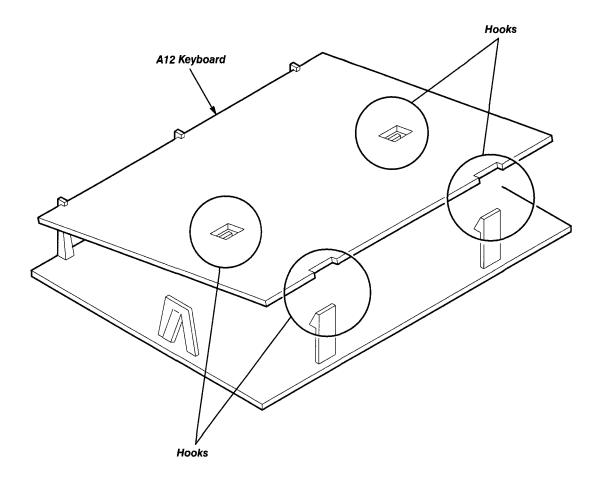
Figure 6-10: A12 Keyboard Removal

d. Now hand disassemble the front-panel module components using Figure 6-11 as a guide. Reverse the procedure to reassemble.

Scan by Zenith
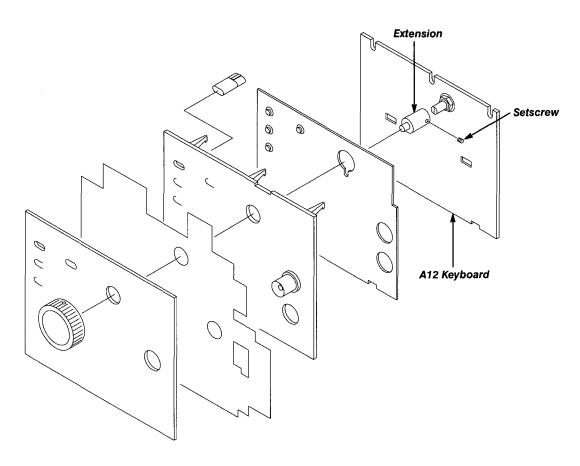
Figure 6-11: Disassembly of Front-panel Module

7. *Reinstallation:* If the front-panel module was further disassembled in step 6, then reverse substeps 6a   through 6d to reassemble, using Figure 6-11 as a guide. Then do the substeps in step 3 in reverse order, reversing the order of the items in each substep. Last, reinstall the trim ring and, if desired, the front cover, referring to the procedure, *Front Cover, Trim Ring, and Menu Buttons* (page 6-21).

Procedures for Internal Modules

Do the *Access Procedure* (on page 6-13) before doing any procedure in this group.

This part contains the following removal and installation procedures; the procedures are presented in the order listed:

- A22 Output Board, A20 AWG Board (Standard and Option 03: Add Digital Data Out)

- A60 Memory Board (A61: Option 01)

- Connector Module

- Fan and Fan Frame

- Rear Shield Cover

- Power Supply Module

- AUX Power Board and AC Inlet

- Monitor Module and CRT Frame

- Circuit Boards:

    - A6 CPU Board

    - A10 Clock Board

    - A14 Trigger Board

    - For Option 09: A7 Floating Point Processor Board

- A16 Backplane Board

- Lithium Battery

- Floppy Disk Drive Module

A22 Output Board, A20 AWG Board (Standard, Option 03)

1. *Assemble equipment and locate modules to be removed:*

   a. You will need a screwdriver with a size T-10 and T-8 (needed for only AWG board) Torx tip to do this procedure.

   b. Locate the modules to be removed in the locator diagram, *Internal Modules*, Figure 6-4.

2. *Orient instrument:* Set the AWG2040 with the top down on the work surface and the right side facing you. If you are not servicing the A22 Output board, skip to step 4.

3. *Remove A22 Output board:*

   a. Disconnect the eleven interconnect cables at J100, J102, J104, J106, J200, J202, J204, J205, J206, J207 and J210 on the A22 Output board. See Figure 6-14.

   b. Using a screwdriver with a size T-10 Torx tip, remove the five screws attaching the A22 Output board to the chassis.

   c. Lift the A22 Output board up and away from the chassis to complete the removal.
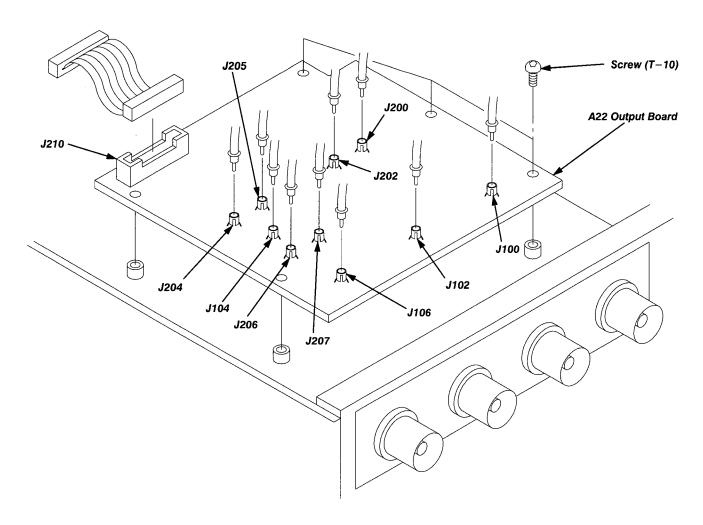
Figure 6-12: A22 Output Board Removal

4. *Orient instrument:* Set the AWG2040 with the top down on the work surface and the left side facing you.

5. *Remove A20 AWG board:* If the AWG2040 does not include Option 03 which adds the Digital Data Output, skip to b in the step 5.

    a. Using a screwdriver with a size T-8 Torx tip, remove the four screws attaching the Bracket on the A20 AWG board to the chassis.
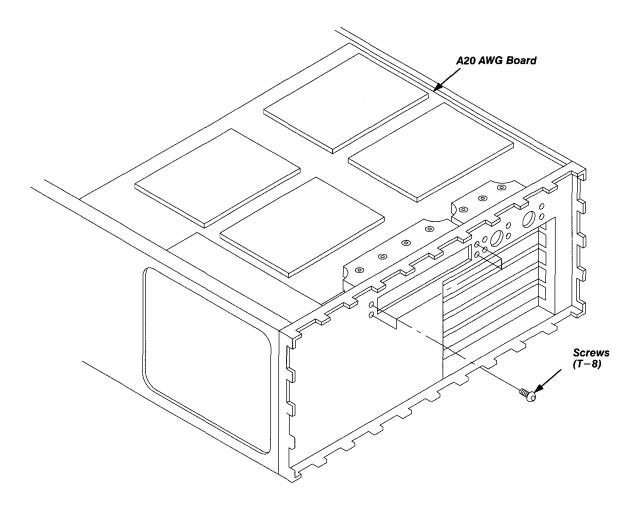
Figure 6-13: Screw Removal for Attaching the Bracket to the Chassis (Option 03)

b.   Disconnect the eleven interconnect cables at J200, J202, J204, J205, J206, J207, J210, J310, J311, J320 and J710 on the A20 AWG board.

The W15 on the A20 AWG board is connected with the J15 connector on the A16 Backplane board. To disconnect the J15 connector, release the latch on W15 plug and pull upward to remove it.

c.   Using a screwdriver with a size T-8 Torx tip, remove the six screws attaching the bracket on the A20 AWG board to the chassis.

d.   Using a screwdriver with a size T-10 Torx tip, remove the nine screws attaching the A20 AWG board to the chassis.

e.   Lift the A20 AWG board up and away from the chassis to complete the removal.
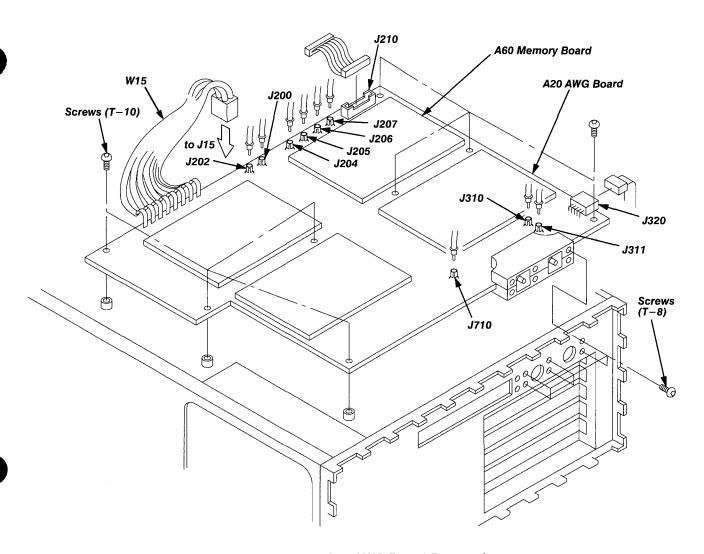
Figure 6-14: A20 AWG Board Removal

6. *Reinstallation:* Do substeps 5b through 5e in reverse order to reinstall the A20 AWG board. If the AWG2040 includes Option 03, also do substep 5a. Do substeps 3a through 3c in reverse order to reinstall the A22 Output board.

A60 Memory Board, A61 Memory Board (Option 01)

1. *Assemble equipment and locate modules to be removed:*

   a. You will need needle-nose pliers to do this procedure.

   b. Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.

2. *Orient instrument:* Set the AWG2040 with the top down on the work surface and the left side facing you (see Figure 6-15).

3. *Remove memory board:*

CAUTION

To prevent damaging the ICs that have heat sink on the bottom of the A20 AWG board, do not touch the heat sink when you remove or install the memory board. These ICs are packaged in a thin ceramic and can be easily cracked or broken by a slight touch.

   a. Using needle-nose pliers, release the retainer latch securing the memory board to the A20 AWG board. Then, lift the memory board slightly upward. Release the another retainer latch using the same procedure.

   b. Lift the memory board out of the AWG board to complete the removal.

   c. Repeat 3a and 3b to remove the other memory board.

4. *Reinstallation:* Align the connector and two holes of the memory board with the connector and the two retainers on the AWG board, and Install the memory board by pushing it down until latched.

**A60 Memory Board
(A61 Option 01)**

A20 AWG Board
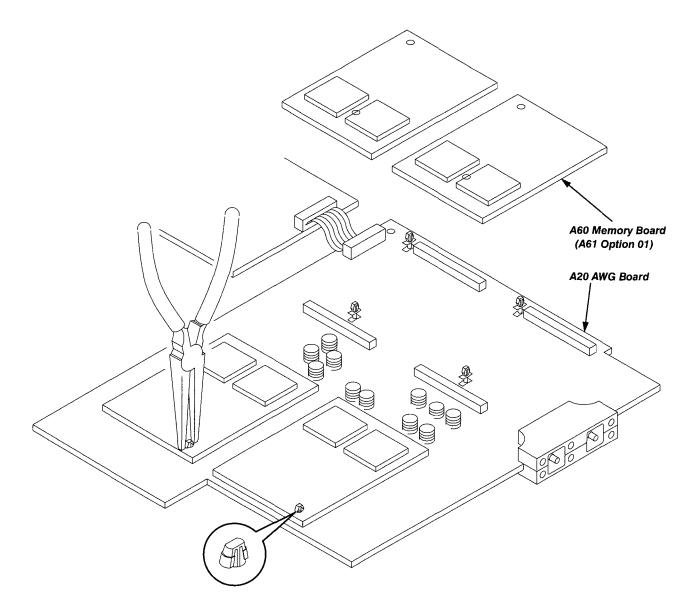
Figure 6-15: A60 Memory Board, A61 Memory Board (Option 01) Removal

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Connector Module

1. *Assemble equipment and locate modules to be removed:*

   a. You will need a screwdriver with a size T-9 Torx tip and a ½-inch nut driver to do this procedure.

   b. Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.

2. *Remove front-panel knob:* Do the *Front-panel Knob* procedure, on page 6-17.

3. *Remove front cover, trim ring, and menu buttons:* Do the *Front Cover, Trim Ring, and Menu Buttons* procedure on page 6-21.

4. *Orient instrument:* Set the AWG2040 with the top down on the work surface and the right side facing you.

5. *Remove connector module:*

   a. Disconnect the interconnect cables at the CH1 and $\overline{CH1}$ Waveform Output connectors, and Marker1 and Marker2 Output connectors.

   b. Using the screwdriver with a size T-9 Torx tip, remove the four screws attaching the connector module to the chassis. See Figure 6-16.

6. *Remove BNC connector:*

   a. To remove a BNC connector, remove the nut attaching the BNC connector to the panel using a ½-inch nut driver, and then remove the BNC connector from the panel.

7. *Reinstallation:*

   a. *Install BNC connector:* Do substep 6a, reversing the order of the items in the substep.

   b. *Install connector module:* Install the connector module by doing substeps 5a through 5b in reverse order.
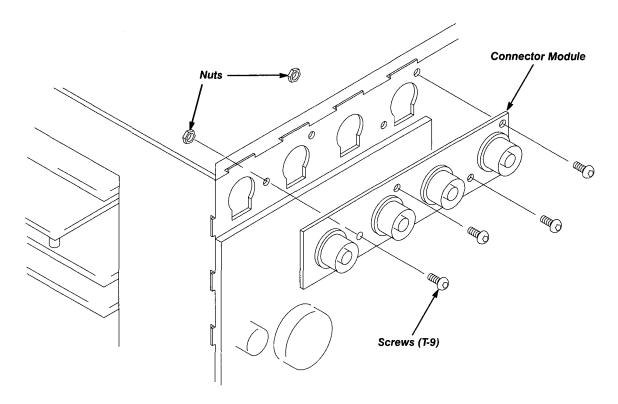
Figure 6-16: Connector Module Removal

Fan and Fan Frame

1. *Assemble equipment and locate modules to be removed:*

   a. No tools are needed to do this procedure.

   b. Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.

2. *Orient instrument:* Set the AWG2040 with the bottom down on the work surface and the left side facing you.

3. *Remove fan and fan frame:*

   a. Disconnect the ribbon interconnect cable from J3 of the power supply module. See Figure 6-17.

   b. As shown in Figure 6-17, slide (2) in the direction indicated by arrow (1) while pushing it, and then remove the fan and fan frame.

   c. Release the four hooks securing the fan, separate the fan and fan frame.
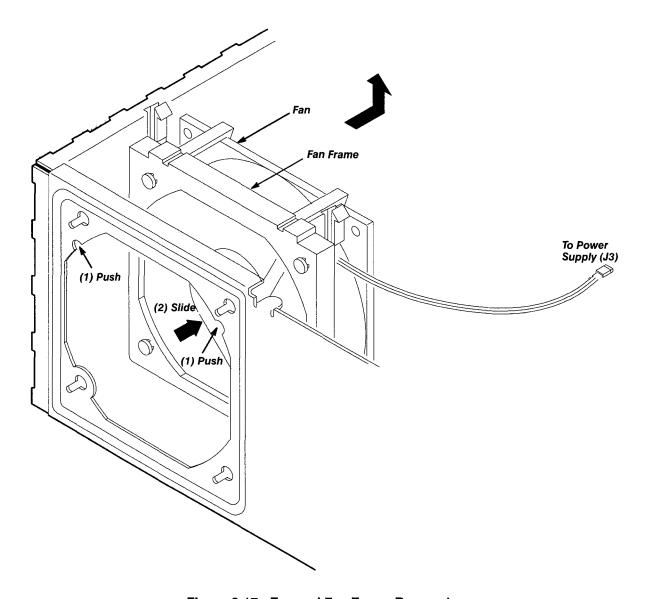
Figure 6-17: Fan and Fan Frame Removal

4. *Reinstallation:*

    a. Secure the fan to the fan frame.

    b. Connect the cable (J3) to power supply module.

    c. Align the four protrusions of the fan frame with the holes of the chassis, slide the fan and fan frame to the lower left, and then install them.

Rear Shield Cover

1. *Assemble equipment and locate modules to be removed:*

    a. You will need a screwdriver with a size T-9 Torx tip, a size T-15 Torx tip, a $^1/_4$-inch nut driver and a 5 mm nut driver to do this procedure.

    b. Locate the modules to be removed in the locator diagram, *Internal Modules*, Figure 6-4.

2. *Orient instrument:* Set the AWG2040 with the bottom down on the work surface and the back facing you.

3. *Remove rear shield cover:*

    a. Disconnect the ribbon interconnect cable from J30 on the A6 CPU board. See Figure 6−18.

    b. Using a screwdriver with a size T-9 Torx tip, remove the ten screws securing the rear shield cover to the chassis from the back side.

    c. Using a $^1/_4$-inch nut driver, remove the IEEE STD 488 PORT cover by removing the two spacer posts.

    d. Grasp the serial interface connector, pull the rear shield cover toward you taking care not to damage the cable, and then remove the rear shield cover.

4. *Remove serial interface connector:* Use a 5 mm nut driver to remove the nut attaching the serial interface connector to the rear shield cover, then remove the connector.

5. *Remove rear panel:*

    a. Using a screwdriver with a size T-15 Torx tip, remove the one screw securing the rear panel to the chassis from the right side.

    b. You can remove the rear panel of a slot in which no board is mounted.

6. *Reinstallation:*

    a. Install the rear panel if you removed it by reversing the items in step 5.

    b. Install the serial interface connector if you removed it by reversing the items in step 4.

    c. Install the rear shield cover by doing substeps 3a through 3d in reverse order.
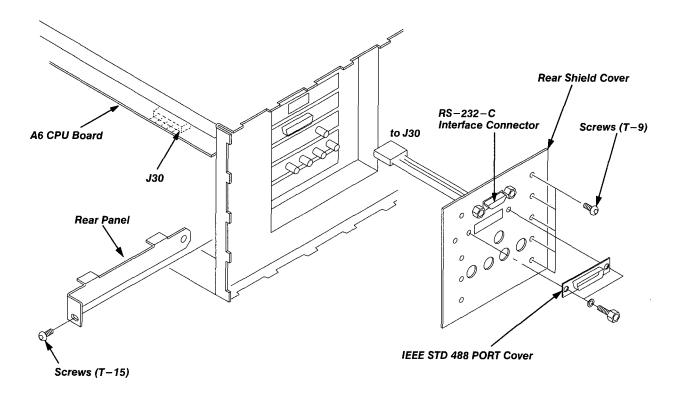
Figure 6-18: Rear Shield Cover Removal

Power Supply Module

1. *Assemble equipment and locate modules to be removed:* You will need a screwdriver with a size T-15 Torx tip to do this procedure. Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.

2. *Orient instrument:* Set the AWG2040 with the bottom down on the work surface and the left side facing you.

3. *Remove power supply module:*

    a. Disconnect the ribbon interconnect cable at J1, J3, J4, and J5 on the power supply module. See Figure 6-19.

    b. Disconnect the flat cable at J2 on the power supply module.

    c. Using a screwdriver with a size T-15 Torx tip, remove the two screws attaching the power supply module to chassis, and lift the module to complete the removal.

J1

Screws (T-15)

J5

J2

J4

J3

Power Supply Module
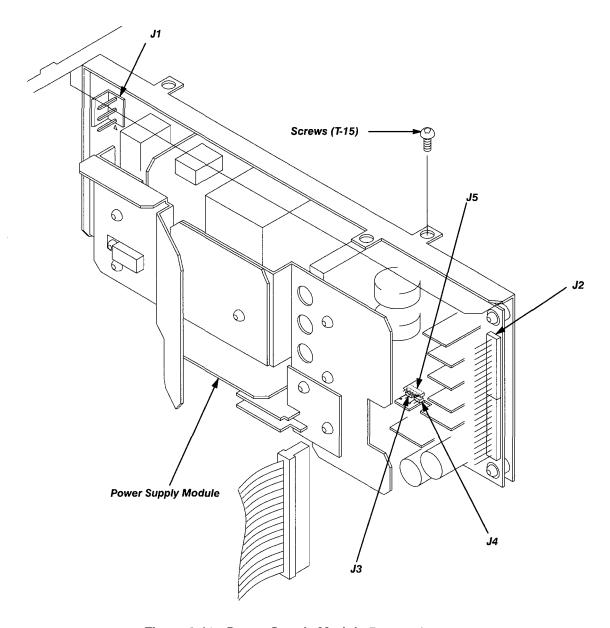
Figure 6-19: Power Supply Module Removal

4.   *Reinstallation:* Do substeps 3a through 3c in reverse order to reinstall the power supply module.

AUX Power Board and AC Inlet

1. *Assemble equipment and locate modules to be removed:*

   a. You will need a screwdriver with a size T-15 Torx tip, a $\frac{5}{16}$-inch nut driver and a soldering iron to do this procedure.

   b. Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.

2. *Remove fan and fan frame:* Do the *Fan and Fan Frame* procedure on page 6-36.

3. *Orient instrument:* Set the AWG2040 with the bottom down on the work surface and the back facing you (see Figure 6-20).

4. *Remove the power supply module:* Do the procedure, *Power Supply Module*, on page 6-40.

5. *Remove AC inlet:*

   a. Disconnect the interconnect cable at CN1 on the AUX Power board.

   b. Using a $\frac{5}{16}$-inch nut driver, remove the nut attaching the ground wire to the chassis.

   c. Using a screwdriver with a size T-15 Torx tip, remove the two screws securing the AC inlet to the chassis, and pull it out of chassis to complete the removal.

   d. Remove the two insulating tubes of cables attached to the AC inlet.

   e. Unsolder the two interconnect cables and the one ground wire attached to the AC inlet.

6. *Remove AUX Power board:*

   a. Disconnect the interconnect cable at CN2 on the AUX Power board.

   b. Remove the three screws attaching the AUX Power board to the chassis.

   c. Lift the AUX Power board up and away from the chassis to complete the removal.
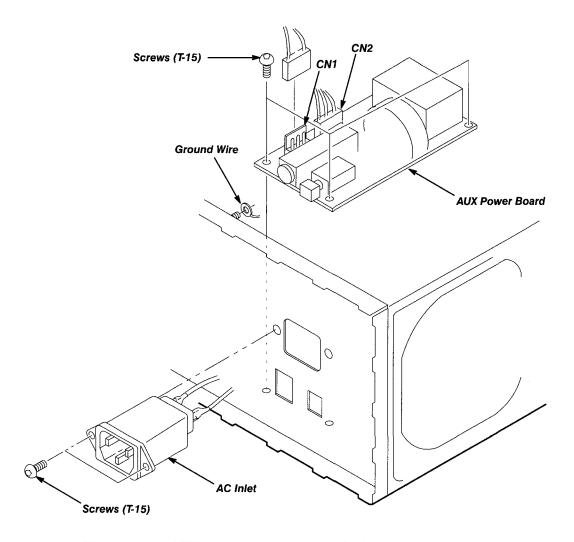
Figure 6-20: AUX Power Board and AC Inlet Removal

7. *Reinstallation:*

   a. Install the AUX Power board by doing substeps 6a and 6c in reverse order.

   b. Install the AC Inlet by doing substeps 5a through 5e in reverse order.

Monitor Module and CRT Frame

1. *Assemble equipment and locate modules to be removed:*

   a. You will need a screwdriver with a size T-15 Torx tip to do this procedure.

   b. Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.

2. *Remove front cover, trim ring, and menu buttons:* Do the *Front Cover, Trim Ring, and Menu Buttons* procedure on page 6-21.

3. *Orient instrument:* Set the AWG2040 with the bottom down on the work surface and the left side facing you.

4. *Remove monitor module:*

NOTE

Take care not to damage the CRT surface when installing or removing the monitor module.

   a. Disconnect the ribbon interconnect cable at J901 on the monitor module. See Figure 6-21

   b. Remove the five screws securing the monitor module top and bottom to the chassis.

   c. Release the snap at the right of the front-panel module and shift the assembly. Insert the screwdriver with a size T-15 Torx tip into the right hole of the chassis, and then remove the screw securing the monitor module.

   d. Lift the monitor module up and away from the chassis to complete the removal.

Screws (T-15)

J901

Monitor Module

Screw (T-15)

Screws (T-15)
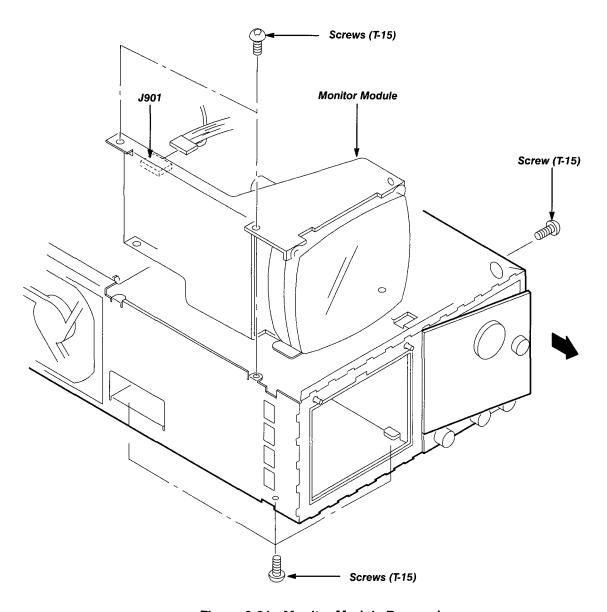
Figure 6-21: Monitor Module Removal

5. *Remove CRT frame:* Grasp the upper part of the CRT frame and take it out as shown in Figure 6-22.

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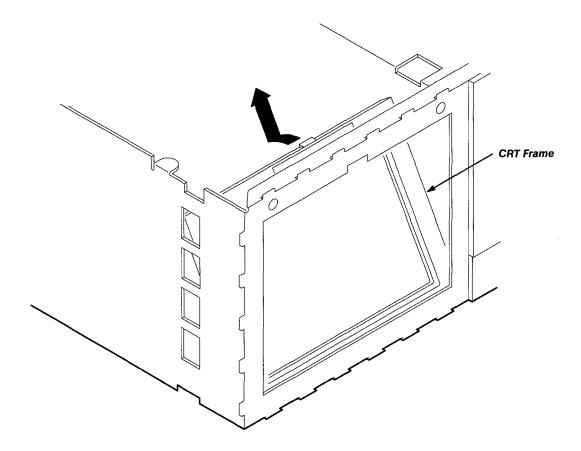
Figure 6-22: CRT Frame Removal

6. *Reinstallation:*

a. Grasp the upper part of the CRT frame, align the notch of the chassis with the protrusion of the CRT frame, and place the CRT frame in the chassis.

b. Install the monitor module by doing substeps 4a through 4d in reverse order.

Circuit Boards

This procedure describes how to remove these circuit boards:

■ A6 CPU Board

■ A10 Clock Board

■ A14 Trigger Board

■ For Option 09: A7 Floating Point Processor Board

1. *Assemble equipment and locate modules to be removed:* A screwdriver with a size T-15 Torx tip is needed; however, the maintenance kit includes an ejector that is useful in removing circuit boards from the chassis. Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.

2. *Remove the rear shield cover:* Do the procedure, *Rear Shield Cover*, on page 6-38.

3. *Orient instrument:* Set the AWG2040 with the left side down on the work surface and the bottom facing you.

4. *Remove board support:* Remove the board support upward while pushing its hook to the inside.

5. *Remove A6 CPU board:*

CAUTION

To avoid permanent loss of waveform files, note the following: A lithium battery which maintains the nonvolatile memory during power-off time is located on the A16 Backplane board. The nonvolatile memory that contains the waveforms and their setup parameter data is located on the A6 CPU board. Removing either board will cause the waveform files, sequence files, and autostep files in nonvolatile memory to be permanently lost. Before removing either the A6 CPU board or the A16 Backplane board, save the waveform files, sequence files, and autostep files in the instrument nonvolatile memory to a floppy disk. Then, after reinstalling the board(s), reload the files into nonvolatile memory.

a. Disconnect the ribbon interconnect cable at J50 and J64 on the A6 CPU board (see Figure 6-23).

b. Disconnect the flat cable at J75 on the A6 CPU board. Remove the flat cable as shown in Figure 6-23.

c. Using a screwdriver with a size T-15 Torx tip, remove the one screw securing the rear panel of the circuit board to the chassis from the right side.

   d. Grasp the upper part of the A6 CPU board, and pull upward to remove it.

6. *Remove A10 Clock board:*

   a. Disconnect the interconnect cables at J310, J311, J320 and J430 on the A10 Clock board (see Figure 6-23).

   b. Using a screwdriver with a size T-15 Torx tip, remove the one screw securing the rear panel of the circuit board to the chassis from the right side.

   c. Grasp the upper part of the A10 Clock board and pull upward to remove it.

7. *Remove A14 Trigger board:*

   a. Disconnect the interconnect cables at J108, J320, J430 and J431 on the A14 Trigger board (see Figure 6-23). If necessary, disconnect the interconnect cables at J310 and J311 on the A10 Clock board.

   b. Using a screwdriver with a size T-15 Torx tip, remove the one screw securing the rear panel of the circuit board to the chassis from the right side.

   c. Grasp the upper part of the A14 Trigger board and pull upward to remove it.

8. *Remove A7 Floating Point Processor board (Option 09):* The option adds the A7 Floating Point Processor board in the first slot from the top.

   a. Grasp the upper part of the A7 Floating Point Processor board and pull it upward to remove it (see Figure 6-23).

   b. Using a screwdriver with a size T-15 Torx tip, remove the one screw securing the rear panel of the circuit board to the chassis from the right side.

9. *Reinstallation:* Do the board removal procedures in reverse order, reversing the order of the items in each procedure.
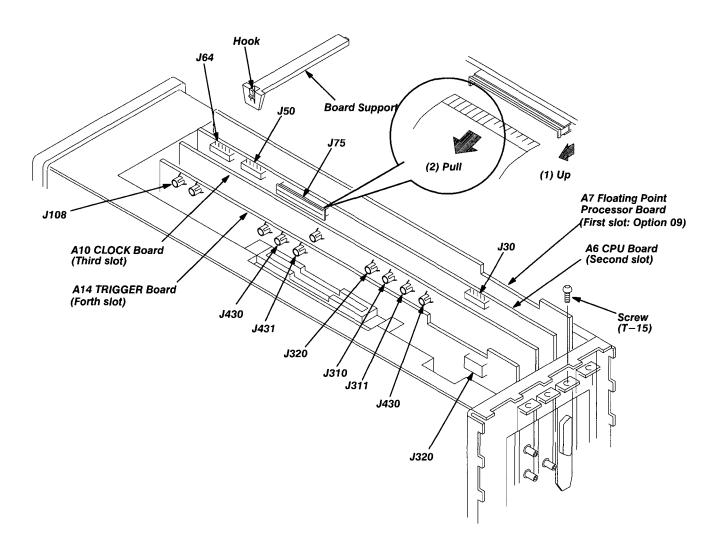
Figure 6-23: Board Removal

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A16 Backplane Board

```
~~~~~~~~~~~~
{  CAUTION  }
~~~~~~~~~~~~
```

To avoid the permanent loss of waveform files, note the following: A lithium battery which maintains the nonvolatile memory during power-off time is located on the A16 Backplane board. The nonvolatile memory that contains the waveforms and their setup parameter data is located on the A6 CPU board. Removing either board will cause the waveform files, sequence files, and autostep files in nonvolatile memory to be permanently lost. Before removing either the A6 CPU board or the A16 Backplane board, save the waveform files, sequence files, and autostep files in the instrument nonvolatile memory to a floppy disk. Then, after reinstalling the board(s), reload the files into nonvolatile memory.

1. *Assemble equipment and locate modules to be removed:*

    a. You will need a screwdriver with a size T-15 Torx tip and a flat-bladed screwdriver to do this procedure.

    b. Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.

2. *Orient instrument:* Set the AWG2040 with the left side down on the work surface and the top facing you.

3. *Remove all circuit boards:* Do the procedure, *Circuit Boards*, on page 6-47.

4. *Remove A16 Backplane board:*

    a. Disconnect the interconnect cables at J15 on the back side of the A16 Backplane board (see Figure 6-14).

    b. Remove the five screws securing the shield cover (see Figure 6-24).

    c. Grasp the shield cover, and take it out.

    d. Disconnect the ribbon interconnect cables at J8 on the A5 Backplane board (see Figure 6-24).

    e. Disconnect the flat cable at J6 on the A16 Backplane board.

    f. Remove the remaining four screws securing the A16 Backplane board to the chassis.

    g. Lift the A16 Backplane board sideways, and then take it out.

5. *Reinstallation:*

    a. *Install the A16 Backplane board:* Do substeps 4a through 4g in reverse order to install the board.

b. *Install the other boards:* Do the procedure, *Circuit Boards*, on page 6-47, in reverse order, reversing the items in each step.

Screws (T–15)

Screws (T–15)

J5

J4
J3
J2
J1

J15

J6

J10

A16 Backplane Board
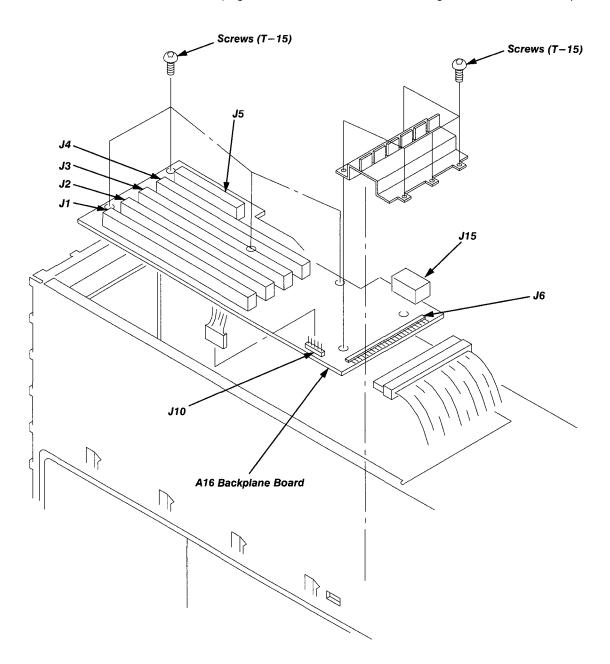
Figure 6-24: A16 Backplane Board Removal

Lithium Battery

```
┌──────────────┐
│  WARNING     │
└──────────────┘
```

To avoid the risk of fire or explosion, order a new battery from the Mechanical Parts List., section 10.

To avoid the risk of fire or explosion, do not recharge, rapidly discharge, or disassemble the battery, heat it above 100° C, or incinerate it.

Dispose of used batteries promptly. Small quantities of used batteries may be disposed of in normal refuse. Keep lithium batteries away from children.

1. *Assemble equipment and locate modules to be removed:*

   a. You will need a soldering iron to do this procedure.

   b. You will also need a replacement lithium battery having the part number listed in section 10, *Mechanical Parts List.*

   c. Locate the battery to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.

2. *Remove A16 Backplane board:* Do the *A16 Backplane Board* procedure on page 6-50.

3. *Orient board:* Set the A16 Backplane board on an insulating surface.

4. *Remove used battery:*

   a. Unsolder the tabs at the ends of the battery, taking care not to heat the battery (see Figure 6-25).

   b. Grasp the battery, and lift it away from the board.

5. *Install new battery:*

   a. Place the new battery on the board with the negative tab of the battery closest to the board edge connector.

   b. Solder the tabs to the board.

Lithium Battery
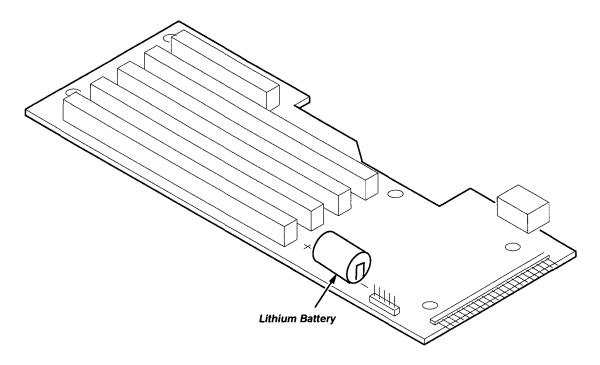
Figure 6-25: Battery Location on the A16 Backplane Board

Floppy-disk Drive Module

1. *Assemble equipment and locate modules to be removed:*

   a. You will need a screwdriver with a size T-10 Torx tip and a size #1 Phillips tip to do this procedure.

   b. Locate the modules to be removed in the locator diagram, *Internal Modules*, in Figure 6-4.

2. *Remove rear shield cover:* Do the *Rear Shield Cover* procedure on page 6-38.

3. *Remove A20 AWG board:* Do the A20 *AWG Board* procedure on page 6-28, removing only the A20 AWG board.

4. *Orient instrument:* Set the AWG2040 with the left side down on the work surface and the bottom facing you.

5. *Remove all circuit boards:* Do the procedure, *Circuit Boards*, on page 6-47.

6. *Remove floppy-disk drive module:*

   a. Using a screwdriver with a size T-10 Torx tip, remove the six screws securing the floppy-disk drive cover to the chassis (see Figure 6-26).

   b. Using a screwdriver with a size #1 Phillips tip, remove the three screws securing the floppy-disk drive to the chassis.

   c. Grasp the upper part of the floppy-disk, and pull it upward to remove it.

   d. Disconnect the flat cable of the floppy disk drive to complete removal.

7. *Further disassembly of floppy disk drive module:* If the floppy disk drive module is to be serviced, do following substeps:

   a. Using the tweezers, release the hooks of four corners for the floppy disk drive bezel, pull the bezel toward you (see Figure 6-27)

   b. Unlock the floppy disk drive door from the module, pull the door toward you. The floppy disk drive door comes with a spring.

   c. Using the needle-nose pliers, remove the eject button from the module.

8. *Reinstallation:*

   a. If the floppy disk drive module was further disassembled in step 7. then reverse substeps 7a through 7c.

   b. *Install floppy-disk drive module:* Do substeps 6a through 6d in reverse order.

   c. *Install circuit boards:* Do the procedure, *Circuit Boards*, on page 6-47, in reverse order.

d. *Install A20 AWG board:* Do the part on removing the A20 AWG board on page 6-28 in reverse order. This completes the reinstallation.

Floppy-disk Drive Cover

Flat Cable

Floppy-disk Drive

Screws (T-10)

Screws (#1)

Screws (T-10)
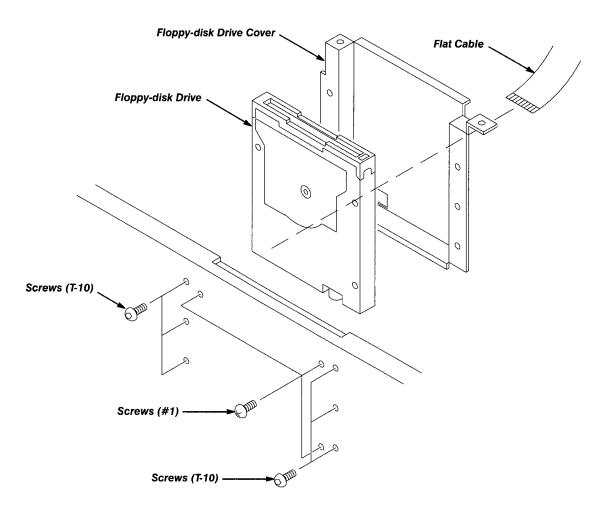
Figure 6-26: Floppy-disk Drive Module Removal

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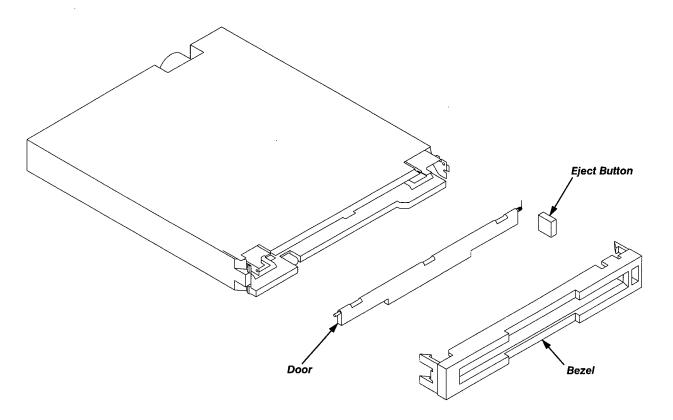
Figure 6-27: Disassembly of Floppy Disk Drive Module

Repackaging

This subsection contains information about repackaging the AWG2040 for shipment.

Repackaging Instructions

Use a corrugated cardboard shipping carton having a test strength of at least 275 pounds and with an inside dimension at least six inches greater than the AWG2040 dimensions. (If available, use the original shipping carton, which meets these requirements.)

If the AWG2040 is shipped to a Tektronix Service Center, enclose the following information:

- The owner's address
- Name and phone number of a contact person
- Type and serial number of the AWG2040
- Reason for returning
- A complete description of the service required

Seal the shipping carton with an industrial stapler or strapping tape.

Mark the address of the Tektronix Service Center and your own return address on the shipping carton in two prominent locations.

Troubleshooting

This subsection contains information and procedures designed to isolate faulty modules in the AWG2040 Arbitrary Waveform Generator. If these procedures indicate a module needs to be replaced, follow the *Removal and Installation Procedures* in the preceding subsection.

Troubleshooting Procedures

The troubleshooting procedures in this subsection consist of these flow-charts.

■ Figure 6-28: Primary Troubleshooting Procedure

■ Figure 6-30: Troubleshooting Procedure 1 — Power Supply Module

■ Figure 6-33: Troubleshooting Procedure 2 — A6 CPU Board or Front-panel Module

■ Figure 6-35: Troubleshooting Procedure 3 — Monitor Module

■ Figure 6-39: Troubleshooting Procedure 4 — Module Isolation

To use these procedures, begin with the Primary Troubleshooting Procedure. It prompts you to check various indications of AWG2040 functionality and directs you to the other troubleshooting procedures.

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AWG2040 Diagnostics

The AWG2040 has internal diagnostics that verify circuit functionality. The AWG2040 automatically executes the internal diagnostics at power-on. You can also run the internal diagnostics by using the UTILITY menu. See *Checking Diagnostics Tests* below. The difference between the two methods of running the internal diagnostics routine is that the power-on method does not do as much memory checking.

If the internal diagnostics indicate a test in the internal diagnostics failed, use the troubleshooting procedures in this subsection to determine which module to replace.

Checking Diagnostics Tests

Prerequisites — Power on the AWG2040 and allow a 20 minute warmup before doing this procedure.

1. Push the **UTILITY   Diag/Cal   Diagnostics**

2. Select **All** with the general purpose knob.

3. Select **Execute** from the side menu. This executes all the diagnostics automatically. As each test finishes, the result is displayed on the screen.

4. Check the diagnostic test results. If any test failed, go to *Troubleshooting Procedure 4 — Module Isolation* on page 6-70. The table in the flowchart shows which module is related to each diagnostic test. If the tests pass but there is still a problem, go to the *Primary Troubleshooting Procedure* on page 6-61.

Press the PRINCIPAL POWER SWITCH on the rear panel of the AWG2040.

Can you hear the fan whirling? — No → Push the ON/STBY button. Can you hear the fan now? — No → Power off and remove the cover using the Rear Cover and Cabinet removal procedure. Check all the cables coming out of the power supply module and the cabling between modules. Be sure every cable is attached securely. → Disconnect the fun cable at J3 on the power supply module and power on.

Yes (from "Can you hear the fan whirling?")

Yes (from "Push the ON/STBY button")

Perform the power supply module troubleshooting procedure 1 (page 6-63). ← No ← Is the voltage for fun power at J3 about 12 V?

Is the voltage for fun power at J3 about 12 V? — Yes → Replace the Fun (page 6-36).

With the AWG2040 power on, do the front panel lights come on and then go off a short time later? — No → Perform the front panel module troubleshooting procedure 2 (page 6-65).

Yes

Does the display seem to be working at all? — No → Power off the AWG2040 and remove the cabinet using the Rear Cover and Cabinet removal procedure. → Does the red LED on the A6 CPU board (See Figure 6-29) light? — No → Perform the monitor module troubleshooting procedure 3 (page 6-67).

Does the red LED on the A6 CPU board (See Figure 6-29) light? — Yes → Replace the A6 CPU board (page 6-47).

Yes (from "Does the display seem to be working at all?")

Does the AWG2040 respond correctly when the front panel buttons are pushed? — No → Perform the power supply module troubleshooting procedure 2 (page 6-63).

Yes

Does the AWG2040 power on and pass all the diagnostics? — No → Perform the module isolation troubleshooting procedure 4 (page 6-70).

Yes

Done.

Figure 6-28: Primary Troubleshooting Procedure

Figure 6-29: CPU Board

Use this procedure to troubleshoot the power supply module.

Is the PRINCIPAL POWER SWITCH in the on (in) position?

No → Switch the PRINCIPAL POWER SWITCH to the on (in) position?

Yes

Is line fuse ok?

No → Switch the PRINCIPAL POWER SWITCH to the off (out) position. Replace the fuse. Switch the PRINCIPAL POWER SWITCH to the on (in) position (see Figure 6-31).

Yes

Does the fuse blow again?

Yes → Disconnect the cable from J1 on the power supply module (see Figure 6-32). Replace the fuse.

No

Does the fuse blow?

Yes → Replace the AUX Power board (page 6-42) and the cables going to it.

No

Replace the power supply module (page 6-40).

Is there 90-250 VAC at J1 pins 1 and 3 on the power supply module (see Fig. 6-32)?

No → Is there 90-250 VAC at the AC Inlet?

No → Is there power at the line cord and outlet?

No → Fix the power problem.

Yes

Replace the AC Inlet (page 6-42).

Yes → Replace the AUX Power board (page 6-42).

Yes

Replace the power supply module (page 6-40).

Figure 6-30: Troubleshooting Procedure 1 — Power Supply Module

Fuse

PRINCIPAL
POWER Switch

Figure 6-31: AUX Power Board

J1

Figure 6-32: Power Supply Module

Use this procedure to determine if the A6 CPU board or the front-panel module is bad.

Turn on the PRINCIPAL POWER SWITCH.

Do all front panel LEDs turn on and then turn off a short time later?

No → Push the ON/STBY button.

Do all front panel LEDs turn on and then turn off a short time later?

No → Do the front panel LEDs turn on?

No → Is there 5 V between TP101 (GND) and TP100 (see Figure 6-34)?

Yes → Replace the front panel module (page 6-23).

No →

Yes (from "Is there 5 V") →

Yes (from "Do the front panel LEDs turn on?") →

Yes (from first diamond) ↓

Does one front panel LED turn on and then turn off, followed by the next LED until all LEDs have turned on and then turned off?

No →

Yes → The front panel module is ok.

Are all front panel cables securely installed in their sockets and are the cables ok?

No → Securely install and/or replace the front panel cables.

Yes → Replace the A6 CPU board (page 6-47).

Figure 6-33: Troubleshooting Procedure 2 — A6 CPU Board or Front-panel Module

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TP101 (GND)   TP100 (5V)

Figure 6-34: Key Board

This procedure helps you determine whether the monitor module is bad.

Do the horizontal and /or vertical sync lock ok? — Yes →

Do pins 4 and 6 of J901 have signals similar to Figure 6-37? — Yes → Replace the monitor module (page 6-44).

No ↓

Power the AWG2040 off and disconnect the cable from J901 on the monitor module (see Figure 6-36) then power back on.

↓

Do pins 4 and 6 of the cable have signals similar to Figure 6-37? — Yes → Replace the monitor module (page 6-44).

No ↓

No (from "Do the horizontal...") ↓

Power the AWG2040 off and disconnect the cable from J901 on the monitor module (see Figure 6-36) then power back on.

↓

Is pin1 of the cable at +15V? — Yes →

Does pin 9 of the cable have a video signal with the same levels as in Figure 6-38? — Yes → Replace the monitor module (page 6-44).

No ↓ (from "Is pin1...")

Do pins 2 and 4 of J50 on the A6 CPU board (see Figure 6-29) have signals similar to Figure 6-37? — No → Replace the A6 CPU board (page 6-47).

Yes ↓

Replace the cable.

Are the cables securely installed in their sockets and are the cables ok? — No → Securely install and/or replace the cables.

Yes ↓

Does J50 pin 7 on the A6 CPU board (see Figure 6-29) have a video signal with the same levels as in Figure 6-38? — No → Replace the A6 CPU board (page 6-47).

Yes ↓

Replace the cable.

Perform the power supply module troubleshooting procedure 1 (page 6-63).

Replace the A6 CPU (page 6-47) or A16 Backplane board (page 6-50).

Is the problem fixed? — No → (to Replace the A6 CPU...)

Yes ↓

Done

Figure 6-35: Troubleshooting Procedure 3 — Monitor Module

J901

Figure 6-36: Monitor Module

J901 pin 4 (Horizontal Sync)
31.75 kHz Rate

J901 pin 6 (Vertical Sync)
60 Hz Rate

| Ch1 | 2.00V | Ch2 | 2.00V | M 20.0us | Ch2 | 1.60V |

Figure 6-37: Horizontal and Vertical Sync Signals

Figure 6-38: A Video Signal with White and Black Levels

This procedure assumes that the AWG2040 is running and you can read the display.

Does the display report any errors? — **No** → Select the diagnostics menu in the UTILITY menu and run all the tests (see the discussion of the diagnostics on page 6-60). → Are any failures reported? — **No** → The AWG2040 is ok.
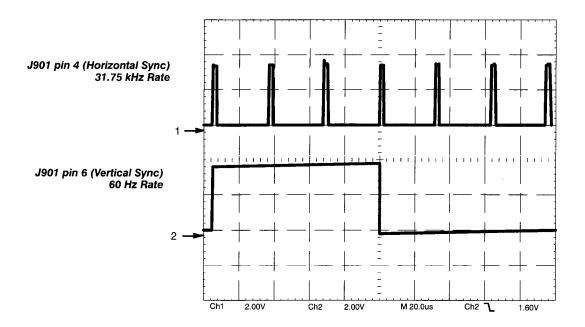
Yes

Yes

Diagnostics	Related Module
Cpu	A6 CPU board (page 6-47)
Clock	A10 Clock board (page 6-47)
Display	A6 CPU board (page 6-47)
FPP	A7 Floating Point Processor board (page 6-47)
Front Panel	Front Panel (page 6-23)
Trigger	A14 Trigger board (page 6-47)
Setup CH1	A20 AWG board (page 6-28) A60/A61 Memory board (page 6-32) A22 Output board (page 6-28)
Waveform Memory CH1	A20 AWG board (page 6-28) A60/A61 Memory board (page 6-32)

Check all cables. Be sure every cable is attached securely. Replace the module indicated in the diagnostics. Run all diagnostics.

Does the display report any errors? — **No** → Can the data be read or written from/to formatted floppy disk? — **No** → Replace the floppy-disk drive module (page 6-54).

Yes

Yes

Done.

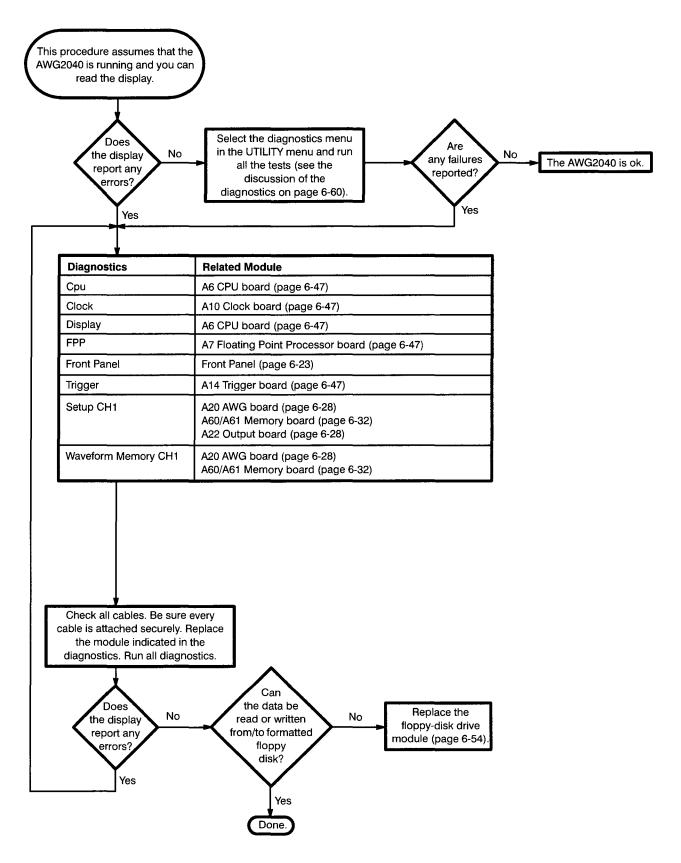**Figure 6-39: Troubleshooting Procedure 4 — Module Isolation**

Options

Options and Accessories

This section describes the various options as well as the standard and optional accessories that are available for the AWG2040 Arbitrary Waveform Generator.

List of Options

Options include:

- **Option 01** — adds 4 M words waveform memory.

- **Option 03** — makes digital waveform data available at the rear panel.

- **Option 09** — adds a FFT editor, a convolution waveform editor and floating-point processor.

- **Option 1R** — ships the waveform generator configured for installation in an instrument rack.

- **Option A1 – A5** — changes the standard power cord to one of five alternate power cord configurations.

- **Option B1** — adds the service manual and the Performance Check disk.

Each option is described more fully in the following pages.

Options A1 – A5

In place of the standard North American, 110 V, 60 Hz power cord, Tektronix ships any of five alternate power cord configurations with the waveform generator, as ordered by the customer.

Table 7-1: International Power Cords

Option	Power Cord
Option A1	Universal European — 220 V, 50 Hz
Option A2	United Kingdom — 240 V, 50 Hz
Option A3	Australian — 240 V, 50 Hz
Option A4	North American — 240 V, 60 Hz
Option A5	Switzerland — 220 V, 50 Hz

Option 01

This option expands the waveform output memory to 4M words.

Option 03

On AWG2040 arbitrary waveform generators for which Option 03 has been installed, digital data from the waveform memory is output directly to the **DIGITAL OUT** connectors on the rear panel without passing through the D/A converter.

Data Output

8–bit digital data (D0–D7) at the ECL level is output from the SMB output connectors. At the same time that the analog waveform is output, the digital data can be obtained. The output requires 50Ω –2V termination.

Clock Output

The clock at the ECL level is output from the SMB output connector. The same clock that is fed to this instrument's internal D/A converter is output. The output requires 50Ω –2V termination.

Figure 7–1 shows the digital output connectors on the rear panel.

DIGITAL OUT (ECL)

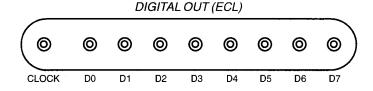CLOCK   D0   D1   D2   D3   D4   D5   D6   D7

Figure 7-1: Digital Output Connectors

Option 09 Description

This option provides increased internal calculation speed and two additional editors: an FFT editor and a convolution editor.

Option 1R Description

For Option 1R, the waveform generator is configured for installation in a 19-inch wide instrument rack. In this configuration, the floppy disk drive is mounted on the front panel. To change an AWG2040 into a rackmount version, you can order a rackmount kit.

Accessories

Standard Accessories

The following standard accessories are provided with each instrument:

Table 7-2: Standard Accessories List

Qty	Description	Part Number
1	User manual	070-8957-XX
1	Programmer manual	070-8657-XX
1	Sample Waveform Library Disk, 3.5-inch media	063-1705-XX
1	GPIB Programming Examples Disk, 3.5-inch media	063-1708-XX
1	Power cable	161-0230-01
1	Fuse (6 A, 250 V, fast-blow) (UL 198G/3AG)	159-0239-00
1	Fuse cap	200-2264-00
1	Fuse 5 A (T) (IEC127)	159-0210-00
1	Fuse cap	200-2265-00

Optional Accessories

The following optional accessories are recommended for use with the instrument:

Table 7-3: Optional Accessories List

Qty	Description	Part Number
1	Service manual	070-8963-XX
1	Performance check disk	063-1707-XX
1	Front cover	200-3232-XX
1	Accessory pouch	016-1159-XX
1	GPIB cable	012-0991-00
1	50 Ω BNC terminator	011-0049-01
1	50 Ω BNC cable	012-1342-00
1	50 Ω BNC cable (double−shielded)	012-1256-00

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Table 7-3: Optional Accessories List (Cont.)

Qty	Description	Part Number
1	50 Ω SMB cable	012-1458-00
1	50 Ω SMB–BNC cable	012-1459-00
1	50 Ω BNC Power Divider	015-0660-00
1	400 MHz BNC Low Pass Filter	015-0659-00
1	200 MHz BNC Low Pass Filter	015-0658-00
1	100 MHz BNC Low Pass Filter	015-0657-00
1	Maintenance kit (see Table 7-4)	067-1396-01

Table 7-4: Maintenance Kit Contents

Qty	Description	Part Number
1	Extender-A board (for slot 1, 2, 3, 4)	671-2331-01
1	Extender-B board (for slot 5)	671-2487-01
1	Cable kit	198-5802-00
1	Ejector	003-1315-00
1	Header	131-5537-00
1	Connector (PELTOLA-to-BNC)	131-1315-01

Electrical Part List

Electrical Parts List

The modules that make up this instrument are often a combination of mechanical and electrical subparts. Therefore, all replaceable modules are listed in section 10, *Mechanical Parts List.* Refer to that section for part numbers when using this manual.

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Diagrams

Diagrams

This section contains a block diagrams and an interconnect diagram. The block diagram shows the modules and functional blocks in an AWG2040 with Option 01 (4 M words waveform memory), Option 03 (Digital Data Out), and Option 09 (Floating Point Processor). The interconnect diagram shows how the modules in the AWG2040 connect.
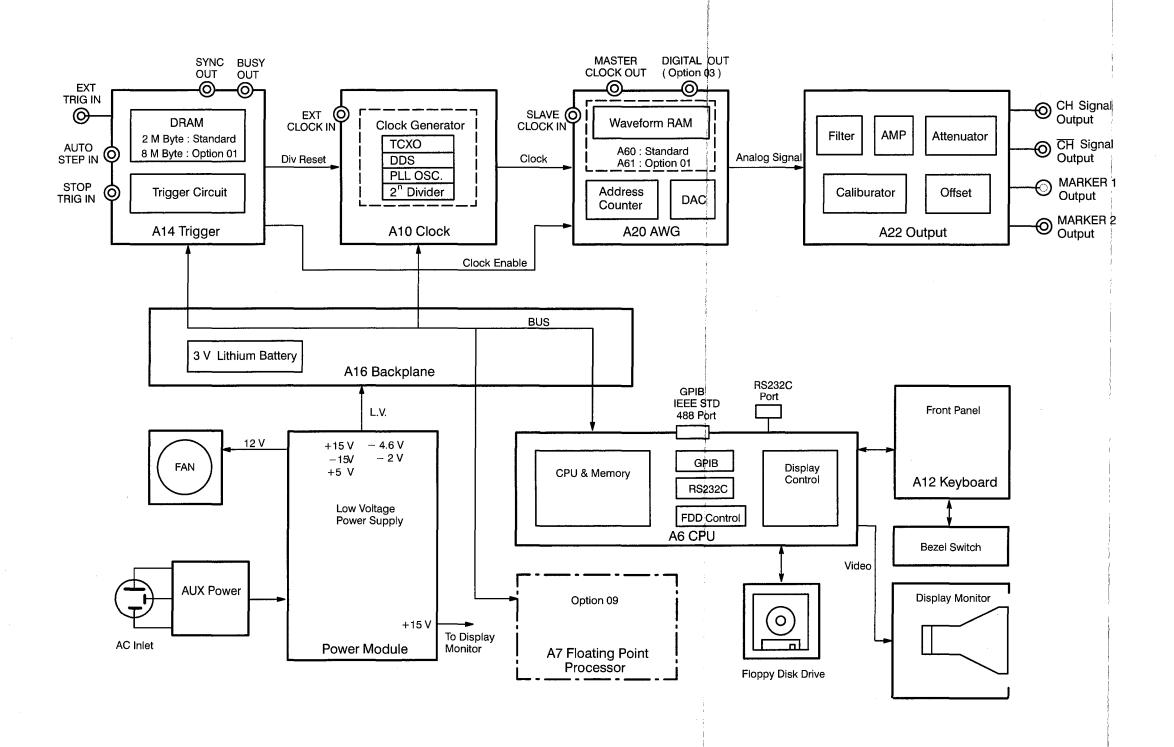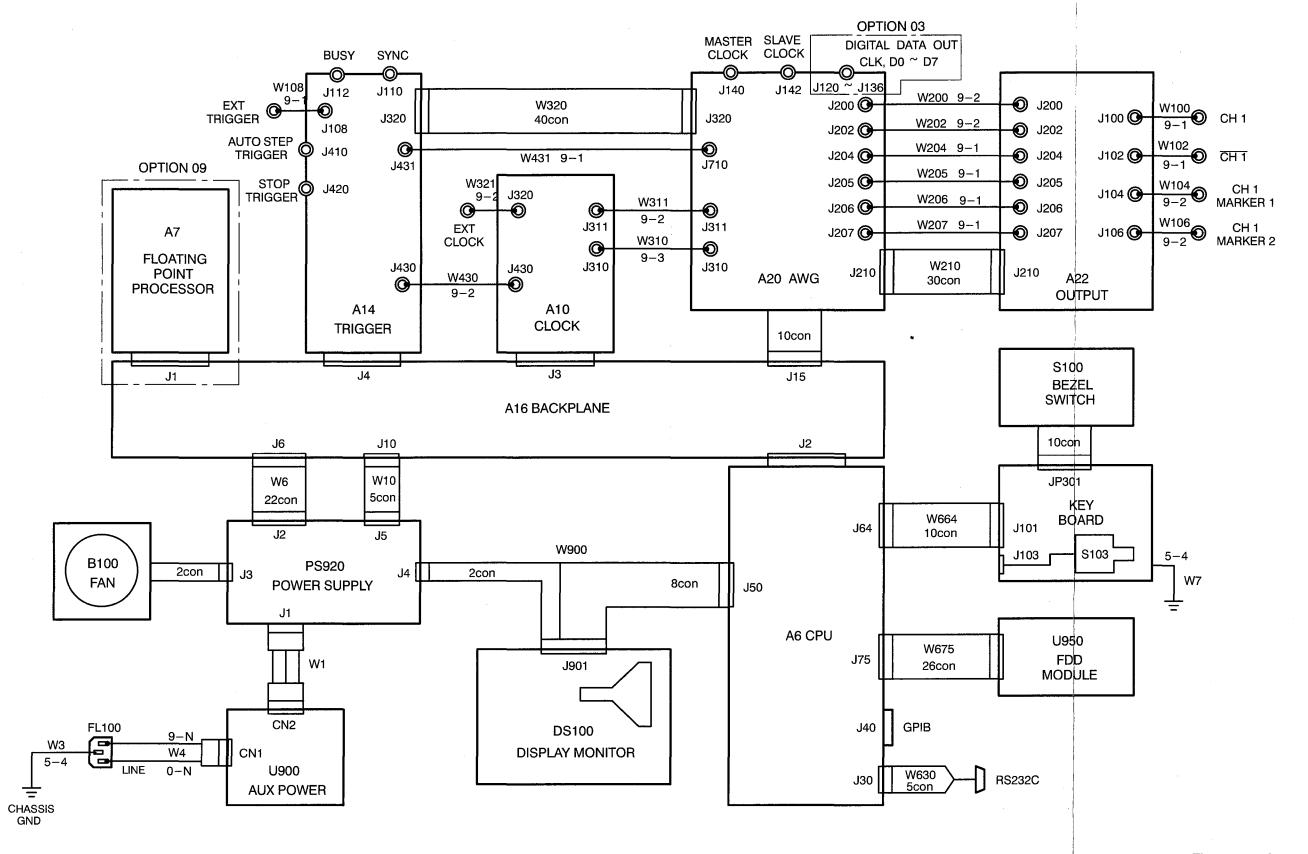
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Figure 9-1: Block Diagram of AWG2040

Figure 9-2: Interconnect Diagram

Mechanical Part List

Replaceable Mechanical Parts

This section contains a list of the replaceable mechanical components for the AWG2040. 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.
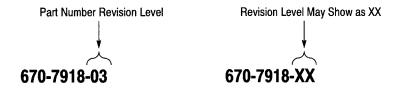
■ Part number (see Part Number Revision Level below)

■ 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.

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

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.

Part Number Revision Level

↓

⌒
670-7918-03

Revision Level May Show as XX

↓

⌒
670-7918-XX

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.

Using the Replaceable Mechanical Parts List

The tabular information in the Replaceable Mechanical Parts List is arranged for quick retrieval. Understanding the structure and features of the list will help you find all of the information you need for ordering replacement parts. The following table describes the content of each column in the parts list.

Parts List Column Descriptions

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

Abbreviations

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

Chassis Parts

Chassis-mounted parts and cable assemblies are located at the end of the Replaceable Electrical Parts List.

Mfr. Code to Manufacturer Cross Index

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

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Manufacturers Cross Index

Mfr. Code	Manufacturer	Address	City, State, Zip Code
S3109	FELLER	72 VERONICA AVE UNIT 4	SUMMERSET NJ 08873
TK0BD	TAISHO ELECTRIC IND CO LTD	5-28-16 OKUSAWA SETAGAYA-KU	TOKYO JAPAN
TK0191	SONY/TEKTRONIX	PO BOX 5209 TOKYO INTERNATIONAL	TOKYO JAPAN 100-31
TK0392	NORTHWEST FASTENER SALES INC	8058 SW NIMBUS AVENUE	BEAVERTON OR 97008
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609-3320
TK1163	POLYCAST INC	9898 SW TIGARD ST	TIGARD OR 97223
TK1287	ENOCH MFG CO	14242 SE 82ND DR PO BOX 98	CLACKAMAS OR 97015
TK1908	PLASTIC MOLDED PRODUCTS	4336 SO ADAMS	TACOMA WA 98409
TK1918	SHIN-ETSU POLYMER AMERICA INC	1181 NORTH 4TH ST	SAN JOSE CA 95112
TK2058	TDK CORPORATION OF AMERICA	1600 FEEHANVILLE DRIVE	MOUNT PROSPECT, IL 60056
TK2432	UNION ELECTRIC	15/F #1, FU-SHING N. ROAD	TAIPEI, TAIWAN ROC
TK2548	XEROX BUSINESS SERVICES DIV OF XEROX CORPORATION	14181 SW MILLIKAN WAY	BEAVERTON OR 97077
0JR05	TRIQUEST CORP	3000 LEWIS AND CLARK HWY	VANCOUVER WA 98661-2999
0KB01	STAUFFER SUPPLY	810 SE SHERMAN	PORTLAND OR 97214
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
07416	NELSON NAME PLATE CO	3191 CASITAS	LOS ANGELES CA 90039-2410
2W733	BELDEN CORPORATION	2200 US HIGHWAY 27 SOUTH PO BOX 1980	RICHMOND IN 47375-0010
24931	SPECIALTY CONNECTOR CO INC	2100 EARLYWOOD DR PO BOX 547	FRANKLIN IN 46131
6D224	HARBOR TRI-TEC A BERG ELECTRONICS COMPANY	14500 SOUTH BROADWAY	GARDENA, CA 90248
61058	MATSUSHITA ELECTRIC CORP OF AMERICA PANASONIC INDUSTRIAL CO DIV	TWO PANASONIC WAY	SECAUCUS NJ 07094
64537	KDI/TRIANGLE ELECTRONICS	60 S JEFFERSON ROAD	WHIPPANY, NJ 07981
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD	COLD SPRING KY 41076-9749
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIV	ST CHARLES ROAD	ELGIN IL 60120
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
86928	SEASTROM MFG CO INC	701 SONORA AVE	GLENDALE CA 91201-2431
98291	SEALECTRO CORP BICC ELECTRONICS	40 LINDEMAN DR	TURNBULL CT 06611-4739

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
10-1-1	343-1213-XX			1	CLAMP,PWR CORD:POLYMIDE	TK1163	ORDER BY DESC
-2	161-0230-01			1	CABLE ASSY,PWR,:3,18 AWG,92 L,SVT,TAN (STANDARD ACCESSORY)	TK2432	ORDER BY DESC
-3	334-3388-XX			1	MARKER,IDENT:MKD,SONY/TEKTRONIX CORPORATION	80009	3343388XX
-4	334-8410-XX	J300101	J300101	1	MARKER,IDENT:BLANK,POLYESTER	80009	3348410XX
-5	334-8705-XX			1	MARKER,IDENT:MKD WARRNING/FUSE DATA,PC,W/CE	80009	3348705XX
-6	334-8720-XX			1	MARKER,IDENT:MKD I/O SIGNAL CH1,POLYCARB	TK0191	334-8720-XX
-7	211-0691-XX			4	SCR,ASSEM WSHR:6-32 X 0.625,PNH,STL,T-15	0KB01	ORDER BY DESC
-8	200-3991-XX			1	COVER,REAR:HARD,POLYCARBONATE,LEXAN	TK1163	200-3991-XX
-9	390-1137-XX			1	CABINET,SCOPE:TEK BLUE,0.04 ALUM	80009	3901137XX
-10	211-0378-XX			4	SCR,ASSEM WSHR:4-40 X 0.375.PNH,STL,T9	0KB01	ORDER BY DESC
-11	200-3983-XX			1	BEZEL:FDD,AL	80009	2003983XX
-12	348-1276-XX			1	GASKET,SHIELD:CONDUCTIVE FORM STRIP	80009	3481276XX
-13	334-8708-XX	J300101	J310268	1	MARKER,IDENT:MKD AWG,HANDLE,POLYCARBONATE	TK0191	334-8708-XX
-14	260-2539-XX			1	SWITCH,SET:;ELASTOMERIC BEZEL	TK1918	260-2539-XX
-15	366-2164-XX			14	PUSH BUTTON:SMOKE TAN	80009	3662164XX
-16	354-0709-XX			1	RING,TRIM:LEXAN 940	80009	3540709XX
-17	334-8704-XX			1	MARKER,IDENT:MKD AWG2040,POLYCARBONATE	TK0191	334-8704-XX
-18	378-0404-XX			1	FILTER,LT,CRT:BULE SMOKE,112 X 145 X 1MM THK,PLASTIC	80009	3780404XX
-19	348-1289-XX			1	SHLD GSKT,ELEK:MESH TYPE,3.2MM X 4.7MM	80009	3481289XX
-20	211-0722-XX			1	SCREW,MACHINE:6-32 X 0.250,PNH,STL,T-15	0KB01	ORDER BY DESC
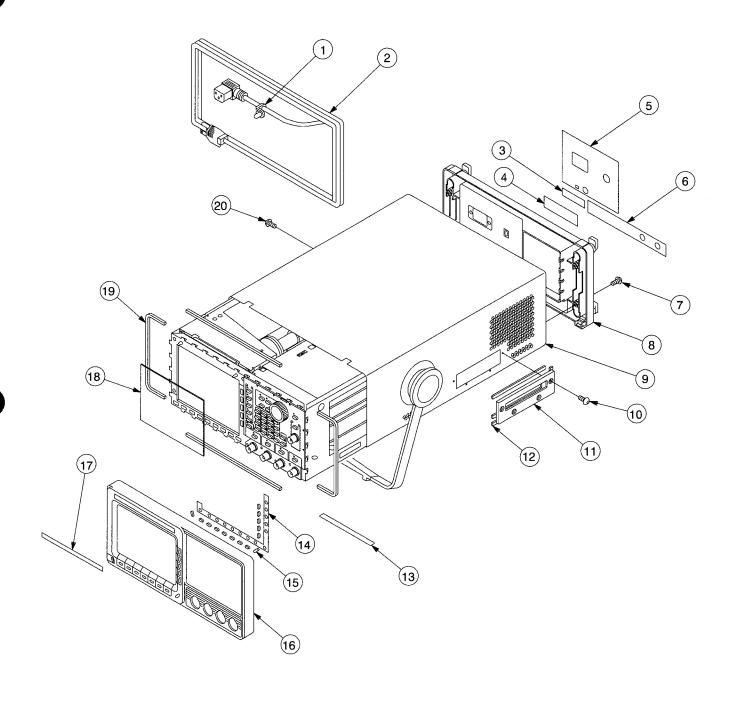
Figure 10-1: Cabinet

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Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
10-2-1	213-0882-XX			6	SCREW,TPG,TR:6-32 X 0.437,PNH,STL,T-15	0KB01	ORDER BY DESC
-2	119-4322-XX			1	FAN,TUBAXIAL:12VDC,2.4M/M,5.8MM HZO,6W,0.5A (B100)	80009	1194322XX
-3	252-0571-XX			1	PLASTIC SHEET:EXTR CHAN,5MM X 3.3MM,NYLON	80009	2520571XX
-4	342-0993-XX			1	INSULATOR,FILM:PWR SPLY,POLYCARBONATE	TK0191	342-0993-XX
-5	211-0722-XX			2	SCREW,MACHINE:6-32 X 0.250,PNH,STL,T-15	0KB01	ORDER BY DESC
-6	620-0058-XX			1	POWER SUPPLY:185W;SWITCHING,15V/4A,12V/0.5A (PS920)	80009	6200058XX
-7	213-0882-XX			3	SCREW,TPG,TR:6-32 X 0.437,PNH,STL,T-15	0KB01	ORDER BY DESC
-8	366-1480-XX			1	PUSH BUTTON:GRAY,0.328 X 0.253 X 0.43	0JR05	ORDER BY DESC
-9	----------			1	CAP,FUSEHOLDER:(P/O TABLE 2-2)		
-10	----------			1	FUSE,CARTRIDGE:(P/O TABLE 2-2)		
-11	671-3351-XX			1	CIRCUIT BD ASSY:AUX,POWER SUPPLY (A900)	80009	6713351XX
-12	213-0882-XX			2	SCREW,TPG,TR:6-32 X 0.437,PNH,STL,T-15	0KB01	ORDER BY DESC
-13	119-2683-XX			1	FILTER,RFI:50/60HZ,250VAC,6A (FL100)	TK2058	ZUB2206H-F
-14	426-2426-XX			1	FRAME,FAN MTG:POLYCARBONATE	TK1163	426-2426-XX
-15	210-0457-XX			1	NUT,PL,ASSEM WA:6-32 X 0.312,STL	TK0435	ORDER BY DESC
-16	334-3379-XX			1	MARKER,IDENT:MARKED GROUND SYMBOL	07416	ORDER BY DESC
-17	441-2055-XX			1	CHASSIS ASSY:AL	TK0191	441-2055-XX
-18	210-0586-XX			2	NUT,PL,ASSEM WA:4-40 X 0.25,STL	TK0435	ORDER BY DESC
-19	344-0472-XX			1	CLIP,CABLE:NYLON,GRAY	80009	3440472XX
-20	407-4087-XX	J300101	J310373	1	BRKT,CMPNT,BNC:ALUMINUM,5.250 X 1.050	80009	4074087XX
	407-4394-XX	J310374		1	BRKT,CMPNT,BNC:ALUMINUM,5.250 X 1.050	80009	4074394XX
-21	211-0325-XX			4	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL,T-9	0KB01	ORDER BY DESC
-22	210-0005-XX			1	WASHER,LOCK:#6 EXT,0.02 THK,STL	78189	1106-00
-23	211-0722-XX			1	SCREW,MACHINE:6-32 X 0.250,PNH,STL,T-15	0KB01	ORDER BY DESC
-24	131-1315-XX			4	CONN,RF JACK:BNC/PNL,;50 OHM,FEMALE (J100,J102,J104,J106)	24931	28JR306-1
-25	259-0086-XX			1	FLEX CIRCUIT:BEZEL BUTTON (S100)	07416	ORDER BY DESC
-26	348-1313-XX			1	GASKET,SHIELD:CONDUCTIVE URETHANE FORM	80009	3481313XX
-27	426-2436-XX			1	FRAME,CRT FLTR:POLYCARBONATE,BLACK	80009	4262436XX
-28	348-1302-XX			1	GASKET,SHIELD:CONDUCTIVE URETHANE FORM	80009	3481302XX
-29	640-0079-XX	J300101	J310242	1	DISPLAY MONITOR:7 INCH,480 X 640 PIXEL,MONO	80009	6400079XX
	640-0081-XX	J310243		1	DISPLAY MONITOR:7 INCH,480 X 640 PIXEL,MONO (DS100)	80009	6400081XX

See Figure 10-6
for detailed view
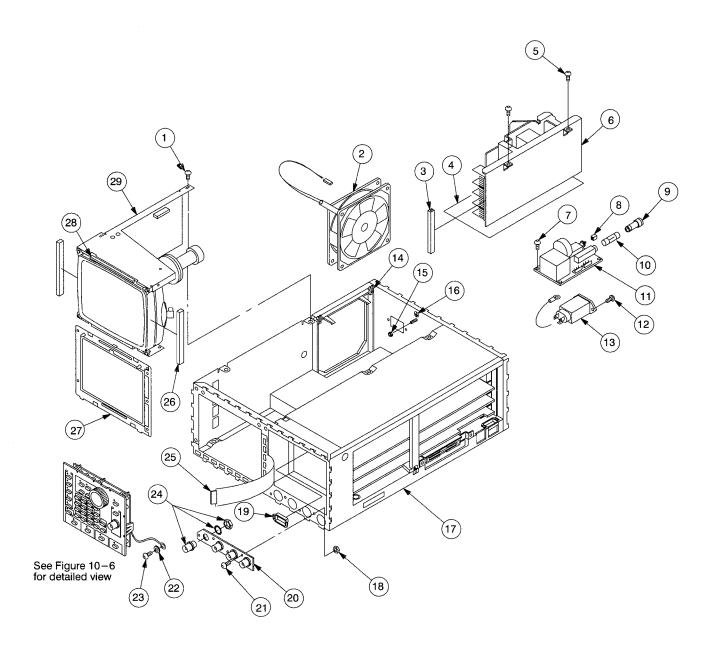
Figure 10-2: Main Chassis and CRT

Scan by Zenith

| Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
10-3-1	348-1410-XX	J300125		1	CUSHION,SENSOR:CUSHION,DRUM TEMP SEN	80009	3481410XX
-2	337-3979-XX			1	SHIELD,ELEC:REAR,AL	TK0191	337-3979-XX
-3	348-1314-XX			1	GASKET,SHIELD:FINGER RYPE,BE-CU,609.6MM L	80009	3481314XX
-4	211-0392-XX			4	SCREW,MACHINE:4-40 X 0.250,FLH82,STL,T-8	0KB01	211-0392-XX
-5	129-1051-XX			2	SPACER,POST:12.5 MM L,W/4-40 THD,AL,4.8 MM HEX	80009	1291051XX
-6	211-0378-XX			10	SCR,ASSEM WSHR:4-40 X 0.375.PNH,STL,T9	0KB01	ORDER BY DESC
-7	129-1107-XX			2	SPACER,POST:0.98 L,6-32 EXT & M3.5 INTTHD,0.25 HEX	TK1287	129-1107-XX
-8	210-0056-XX			2	WASHER,LOCK:#10 SPLIT,0.047 THK,SI BRZ	86928	ORDER BY DESC
-9	337-3970-XX			1	SHIELD,ELEC:REAR PANEL,EMI,AL	TK0191	337-3970-XX
-10	211-0392-XX			6	SCREW,MACHINE:4-40 X 0.250,FLH82,STL,T-8	0KB01	211-0392-XX
-11	255-1106-XX			1	PLASTIC CHANNEL:250 X 3.3 X 4.0MM,NYLON	80009	2551106XX
-12	252-0571-XX			1	PLASTIC SHEET:EXTR CHAN,5MM X 3.3MM,NYLON	80009	2520571XX
-13	342-0302-XX			1	INSULATOR,FILM:CHASSIS,MYLAR	80009	3420302XX
-14	337-3874-XX			1	SHIELD,ELEC:FDD,AL	80009	3373874XX
-15	348-1276-XX			2	GASKET,SHIELD:CONDUCTIVE FORM STRIP	80009	3481276XX
-16	119-4404-XX			1	DISK DRIVE:FLOPPY,3.5 INCH W/INTERFACE (U950)	80009	1194404XX
-17	200-4191-XX			1	DOOR,FRONT:FDD,PLASTIC	TK0191	200-4191-XX
-18	366-2177-XX			1	PUSH BUTTON:BLACK,PLASTIC	TK0191	366-2177-XX
-19	200-4190-XX			1	BEZEL,FFD:FRONT,PLASTIC	TK0191	200-4190-XX
-20	211-0373-XX			8	SCREW,MACHINE:4-40 X 0.250,PNH,STL,T-10	0KB01	211-0373-XX
-21	351-0950-XX			4	GUIDE,CKT BD:SPRING TYPE,POLYCARBONATE	TK0191	351-0950-XX
-22	211-0854-XX			3	SCREW,MACHINE:M2.6 X 4MM L,STL	TK0191	211-0854-XX
-23	211-0373-XX			6	SCREW,MACHINE:4-40 X 0.250,PNH,STL,T-10	0KB01	211-0373-XX
-24	343-1084-XX			1	CLAMP,CABLE:NYLON	80009	3431084XX
-25	348-0948-XX			1	GROMMET,PLASTIC:BLACK,RING,9.5MM ID	80009	3480948XX
-26	211-0722-XX			6	SCREW,MACHINE:6-32 X 0.250,PNH,STL,T-15	0KB01	ORDER BY DESC
-27	671-3092-XX			1	CIRCUIT BD ASSY:A16 BLACKPLANE (A16)	TK0191	671-3092-XX
-28	146-0055-XX			1	BATTERY,DRY:3.0V,1200 MAH,LITHIUM (A5BT001)	61058	BR-2/3A-E2P
-29	252-0571-XX			1	PLASTIC SHEET:EXTR CHAN,5MM X 3.3MM,NYLON	80009	2520571XX
-30	211-0722-XX			3	SCREW,MACHINE:6-32 X 0.250,PNH,STL,T-15	0KB01	ORDER BY DESC
-31	337-3877-XX			1	SHIELD,ELEC:CENTER,AL	80009	3373877XX
-32	211-0373-XX			9	SCREW,MACHINE:4-40 X 0.250,PNH,STL,T-10	0KB01	211-0373-XX
-33	211-0373-XX			5	SCREW,MACHINE:4-40 X 0.250,PNH,STL,T-10	0KB01	211-0373-XX
-34	337-3969-XX			1	SHIELD,CRT:CRT SHIELD,EMI STL	80009	3373969XX
-35	211-0378-XX			4	SCR,ASSEM WSHR:4-40 X 0.375.PNH,STL,T9	0KB01	ORDER BY DESC
-36	252-0571-XX			1	PLASTIC SHEET:EXTR CHAN,5MM X 3.3MM,NYLON	80009	2520571XX
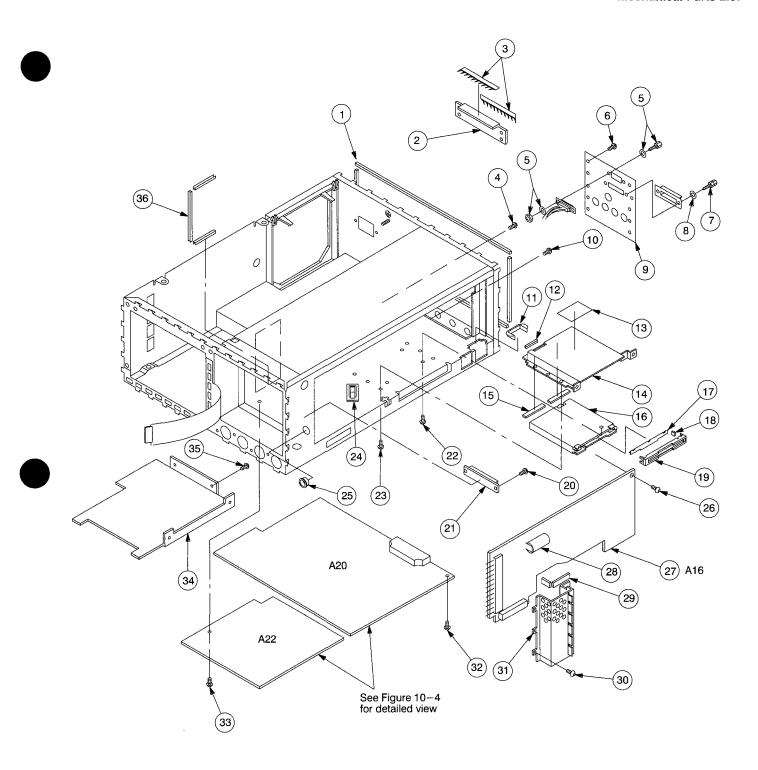
Figure 10-3: Main Chassis and Circuit Boards

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Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
10-4-1	671-3093-XX			1	CIRCUIT BD ASSY:A20 AWG (A20)	80009	6713093XX
-2	343-1506-XX			8	RETAINER,CKT BD:8MM L,NYLON	TK0191	343-1506-XX
-3	671-3095-XX			4	CIRCUIT BD ASSY:A60 1M MEMORY (A60)	80009	6713095XX
-4	211-0373-XX			2	SCREW,MACHINE:4-40 X 0.250,PNH,STL,T-10	0KB01	211-0373-XX
-5	211-0371-XX			3	SCREW,MACHINE:4-40 X 0.500,PNH,STL,T-9	0KB01	ORDER BY DESC
-6	407-4302-XX			1	BRACKET,MTG:(2)SMB,TOP,EMI SHIELD	TK0191	407-4302-XX
-7	211-0856-XX			4	SCREW,MACHINE:M2 X 8MM ;,PNH,STL	TK0191	211-0856-XX
-8	131-5759-XX			2	CONN,RF JACK:SMB;FEMALE,STR,50 OHM (A20J140,A20J142)	TK0191	131-5759-XX
-9	407-4303-XX			1	BRACKET,MTG:2,SMB,BOTTOM,EMI SHIELD	TK0191	407-4303-XX
-10	671-3094-XX			1	CKT BD ASSY:OUTPUT (A22)	80009	6713094XX
-11	214-3774-XX			2	HT SK,MICROCKT:14 DIP,THERMALLOY #6012B	80009	2143774XX
-12	214-4614-XX			1	HEAT SINK,ELEC:0.384 L,AL	TK0191	214-4614-XX

Figure 10-4: Circuit Boards

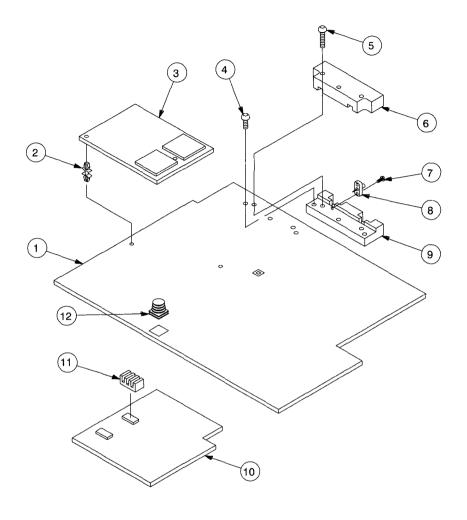| Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
10-5-1	160-9847-XX	J300101	J310100	1	IC,MEMORY:CMOS,EPROM;256K X 16,PRGM	TK0191	160-9847-XX
	163-0323-XX	J310101		1	IC,MEMORY:CMOS,EPROM;256K X 16,120NS (A6U305)	80009	1630323XX
-2	160-9677-XX	J300101	J310100	1	IC,MEMORY:CMOS,EPROM;256K X 16,PRGM	TK0191	160-9677-XX
	163-0322-XX	J310101		1	IC,MEMORY:CMOS,EPROM;256K X 16,120NS (A6U300)	80009	1630322XX
-3	131-5165-XX			1	CONN,RIBBON::PCB,;FEMALE,RTANG,24 POS (A6J40)	00779	555139-1
-4	333-4136-XX			1	PANEL,REAR:FLOATING PROCESSOR BD,BRASS	TK0191	333-4136-XX
-5	211-0722-XX			5	SCREW,MACHINE:6-32 X 0.250,PNH,STL,T-15	0KB01	ORDER BY DESC
-6	131-0450-XX			1	CONN,RF JACK:SMB,;50 OHM,MALE (A10J321)	98291	051-027-0000-XX
-7	386-6158-XX			1	SUPPORT,CKT BD:MAT MATERIAL	80009	3866158XX
-8	131-5760-XX			4	CONN,RF JACK:SMB;FEMALE,STR,50 OHM,PNL MT (A14J110,A14J112,A14J410,A14J420)	TK0191	131-5760-XX
-9	333-3976-XX			1	PANEL,REAR:AL	TK0191	333-3976-XX
-10	671-3091-XX			1	CKT BD ASSY:TRIGGER (A14)	80009	6713091XX
-11	671-3090-XX			1	CIRCUIT BD ASSY:A10 CLOCK (A10)	TK0191	671-3090-XX
-12	671-3148-XX	J300101	J310100	1	CIRCUIT BD ASSY:A06 CPU	TK0191	671-3148-XX
	671-3506-XX	J310101		1	CKT BD ASSY:A06,CPU (A6)	80009	6713506XX
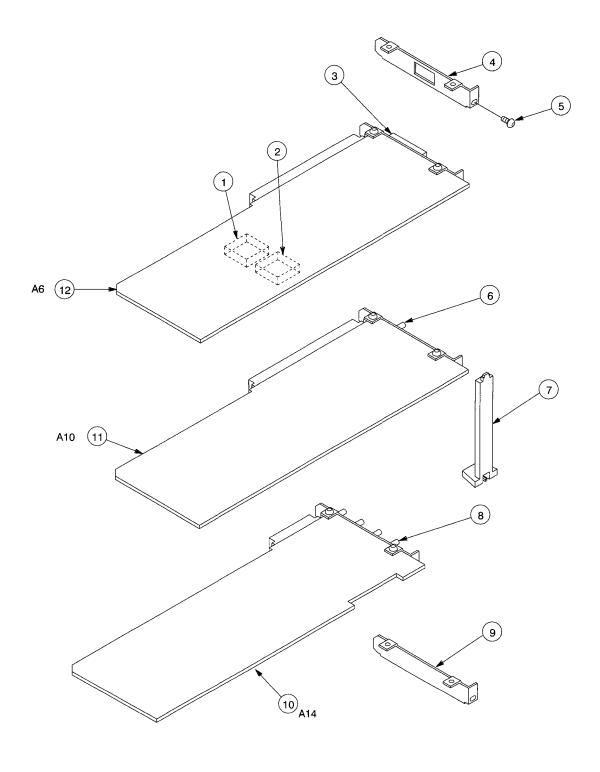
Figure 10-5: Circuit Boards

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
10-6-1	671-2520-XX			1	CIRCUIT BD ASSY:KEYBOARD (A12)	TK0191	671-2520-XX
-2	213-0153-XX			1	SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESC
-3	260-2497-XX			1	SWITCH,ROTARY:ENCODER,5VDC,70MA,INCREMENTAL (A12S103)	80009	2602497XX
-4	384-1686-XX			1	EXTENSION SHAFT:0.790 L X 0.500 DIA,PLASTIC	80009	3841686XX
-5	160-7853-XX			1	IC,PROCESSOR:CMOS,MICROCOMPUTER;8-BIT (A12U101)	80009	1607853XX
-6	210-0413-XX			2	NUT,PLAIN,HEX:0.375-32 X 0.5,BRS	73743	3145-402
-7	210-0840-XX			1	WASHER,FLAT:0.39 ID X 0.562 OD X 0.02,STL	86928	ORDER BY DESC
-8	348-1276-XX			1	GASKET,SHIELD:CONDUCTIVE FORM STRIP	80009	3481276XX
-9	131-1315-XX			1	CONN,RF JACK:BNC/PNL,;50 OHM,FEMALE (J970)	24931	28JR306-1
-10	366-2159-XX			1	KNOB:IVORY GRAY,SCROLL,1.243 IDX 1.4 OD X 0.4 H	TK1163	ORDER BY DESC
-11	213-0048-XX			1	SETSCREW:4-40 X 0.125,STL	TK0392	ORDER BY DESC
-12	333-4126-XX			1	PANEL,FRONT:MAIN KEY,POLYCARBONATE	TK0191	333-4126-XX
-13	337-3962-XX	J300101	J310323	1	SHIELD,ELEC:FRONT PANEL,EMI,ALUMINUM FOIL	TK0191	337-3962-XX
-14	380-1060-XX			1	HOUSING,SWITCH:POLYCARONATE,W/METALLIZED	80009	3801060XX
-15	260-2552-XX			1	SWITCH,PUSH:50 BUTTON,SP/ST	80009	2602552XX
-16	366-2163-XX			32	PUSH BUTTON:IVORY GRAY,OVAL	80009	3662163XX

A12
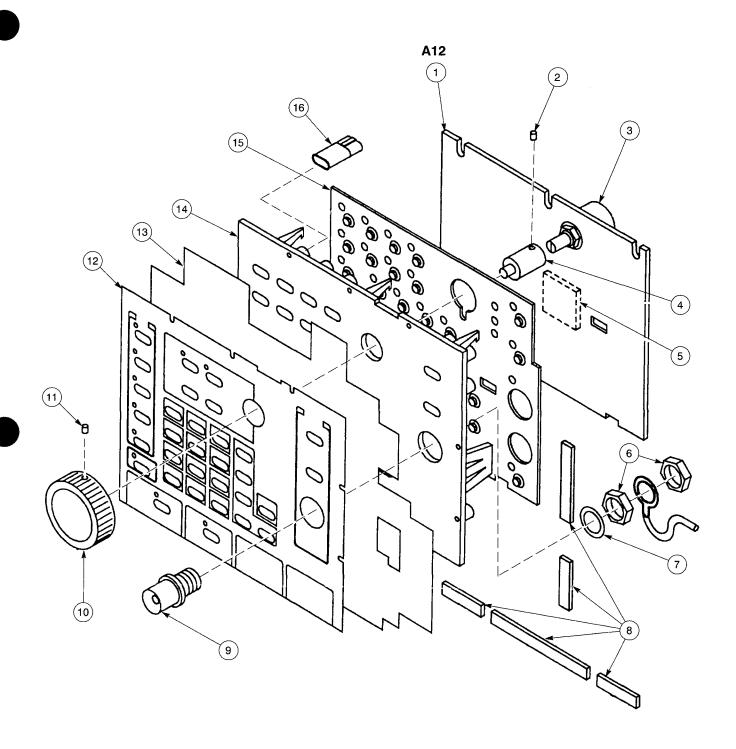
Figure 10-6: Front Panel Assembly

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Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					OPTION 01		
10-7-1	671-3185-XX	J300101		1	CKT BD ASSY:TRIGGER CKT BD ASSY:TRIGGER	80009	6713185XX
-2	671-3096-XX			1	CIRCUIT BD ASSY:A61 4M MEMORY (A61 – OPTION 01 ONLY)	TK0191	671-3096-XX

Figure 10-7: Option 01

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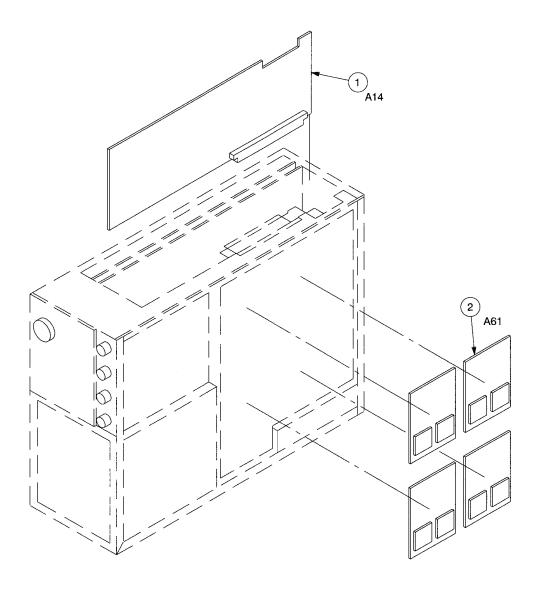| Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					OPTION 03		
10-8-1	200-4172-XX			1	COVER,REAR:POLYCARBONATE	TK0191	200-4172-XX
-2	334-8700-XX			1	MARKER,IDENT:MKD I/O SIGNAL,POLYCARBONATE	TK0191	334-8700-XX
-3	334-8705-XX			1	MARKER,IDENT:MKD WARRNING/FUSE DATA	80009	3348705XX
-4	211-0392-XX			4	SCREW,MACHINE:4-40 X 0.250,FLH82,STL,T-8	0KB01	211-0392-XX
-5	211-0856-XX			18	SCREW,MACHINE:M2 X 8MM ;,PNH,STL	TK0191	211-0856-XX
-6	131-5759-XX			9	CONN,RF JACK:SMB;FEMALE,STR,50 OHM (A20J120,A20J122,A20J124,A20J126,A20J128, A20J130,A20J132,A20J134,A20J136)	TK0191	131-5759-XX
-7	407-4305-XX			1	BRACKET,MTG:9,SMB,BOTTOM,EMI SHIELD	TK0191	407-4305-XX
-8	407-4304-XX			1	BRACKET,MTG:9,SMB,TOP,EMI SHIELD	TK0191	407-4304-XX
-9	348-1404-XX			2	GASKET,SHIELD:FINGER TYPE,BE-CU,609,6MM L	TK0191	348-1404-XX
-10	211-0371-XX			4	SCREW,MACHINE:4-40 X 0.500,PNH,STL,T-9	0KB01	ORDER BY DESC
-11	211-0373-XX			2	SCREW,MACHINE:4-40 X 0.250,PNH,STL,T-10	0KB01	211-0373-XX
-12	671-3186-XX	J300101		1	CIRCUIT BD ASSY:A20 AWG (A20)	80009	6713186XX
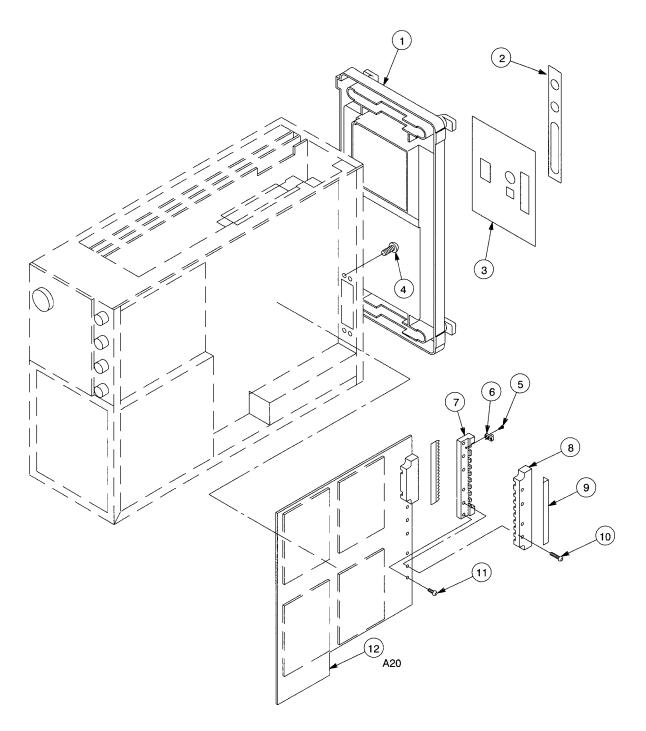
Figure 10-8: Option 03

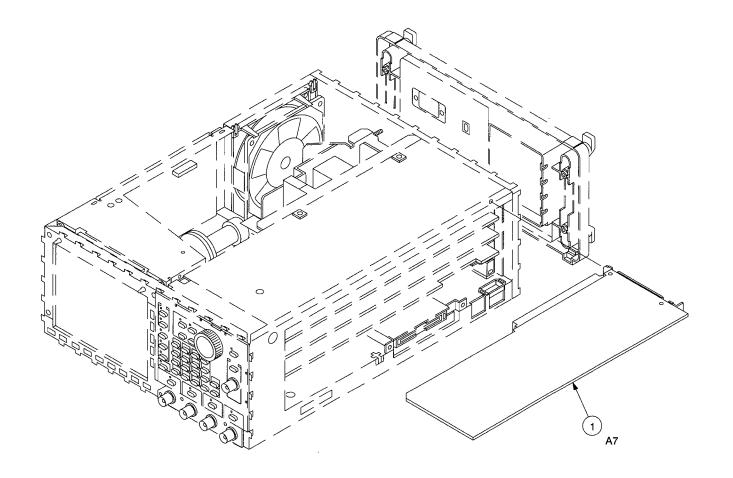| Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					OPTION 09		
10-9-1	671-3179-XX			1	CIRCUIT BD ASSY:FLOATING PROCESSOR (A7)	TK0191	671-3179-XX

Figure 10-9: Option 09

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
				CABLE ASSEMBLIES		
W1	174-2934-XX			CA ASSY,SP,ELEC:3,18 AWG,18CM L	80009	1742934XX
W3	196-3112-XX			LEAD,ELECTRICAL:18 AWG,6.0 L,5-4	80009	1963112XX
W4	174-2935-XX	J300100	J310329	CA ASSY,SP,ELEC:2.18 AWG,12CM L,W/CONN	80009	1742935XX
	174-2803-XX	J310330		CA ASSY,SP,ELEC:2.18 AWG,12CM L,W/FSTN	80009	1742803XX
W6	174-2971-XX			CA ASSY,SP,ELEC:22,18 AWG,10CM L	80009	1742971XX
W7	196-3389-XX			LEAS,ELECTRICAL:18 AWG,15CM L,5-4,W/TERM LUG	80009	1963389XX
W10	174-2936-XX			CA ASSY,SP,ELEC:5,26 AWG,26CM L,RIBBON	80009	1742936XX
W100	174-3211-XX			CA ASSY,RF:50 OHM COAX,10CM L,9-1,W/PELTOLA	TK0191	174-3211-XX
W102	174-3211-XX			CA ASSY,RF:50 OHM COAX,10CM L,9-1,W/PELTOLA	TK0191	174-3211-XX
W104	174-3212-XX			CA ASSY,RF:50 OHM COAX,15CM L,9-2,W/PELTOLA	TK0191	174-3212-XX
W106	174-3212-XX			CA ASSY,RF:50 OHM COAX,15CM L,9-2,W/PELTOLA	TK0191	174-3212-XX
W108	174-3201-XX			CA ASSY,RF:50 OHM COAX,20CM L,9-1,W/PELTOLA	TK0191	174-3201-XX
W200	174-3212-XX			CA ASSY,RF:50 OHM COAX,15CM L,9-2,W/PELTOLA	TK0191	174-3212-XX
W202	174-3212-XX			CA ASSY,RF:50 OHM COAX,15CM L,9-2,W/PELTOLA	TK0191	174-3212-XX
W204	174-3201-XX			CA ASSY,RF:50 OHM COAX,20CM L,9-1,W/PELTOLA	TK0191	174-3201-XX
W205	174-3201-XX			CA ASSY,RF:50 OHM COAX,20CM L,9-1,W/PELTOLA	TK0191	174-3201-XX
W206	174-3201-XX			CA ASSY,RF:50 OHM COAX,20CM L,9-1,W/PELTOLA	TK0191	174-3201-XX
W207	174-3201-XX			CA ASSY,RF:50 OHM COAX,20CM L,9-1,W/PELTOLA	TK0191	174-3201-XX
W210	174-3218-XX			CA ASSY,SP:30,28 AWG,3CM L,FLAT,AWG2040	TK0191	174-3218-XX
W310	174-3213-XX			CA ASSY,RF:50 OHM COAX,25CM L,9-1,W/PELTOLA	TK0191	174-3213-XX
W311	174-3215-XX			CA ASSY,RF:50 OHM COAX,25CM L,9-2,W/PELTOLA	TK0191	174-3215-XX
W320	174-3219-XX			CA ASSY,SP,ELEC:40,30AWG,5CM L,FLAT W/PULLTAB	80009	1743219XX
W321	174-3217-XX			CA ASSY,RF:50 OHM COAX,20CM L,9-2,W/PELTOLA	TK0191	174-3217-XX
W430	174-3215-XX			CA ASSY,RF:50 OHM COAX,25CM L,9-2,W/PELTOLA	TK0191	174-3215-XX
W431	174-3216-XX			CA ASSY,RF:50 OHM COAX,45CM L,9-1,W/PELTOLA	TK0191	174-3216-XX
W630	174-2933-XX			CA ASSY,SP,ELEC:5,26 AWG,15CM L,RIBBON W/O-SUB	80009	1742933XX
W664	174-2945-XX			CA ASSY,SP,ELEC:10,26 AWG,23CM L,RIBBON	80009	1742945XX
W675	174-2775-XX			CA ASSY,SP,ELEC:26,350MM L,FLAT FLEX	80009	1742775XX
W900	174-2770-XX			CA ASSY,SP,ELEC:10,26 AWG,390MM L,RIBBON	80009	1742770XX

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Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					STANDARD ACCESSORIES		
	063-1705-XX			1	SOFTWARE PKG:3.5 DISK,AWG2040 WAVEFORM LIB	TK0191	063-1705-XX
	063-1708-XX			1	SOFTWARE PKG:3.5 DISK,AWG2000 SERIES SAMPLE PRGM	TK0191	063-1708-XX
	063-1707-XX			1	SOFTWARE PKG:3.5 DISK,AWG2040 PERF CHECK/ADJ	TK0191	063-1707-XX
	070-8657-XX			1	MANUAL,TECH:PROGRAMMER,ENGLISH VERSION,AWG	TK2548	0708657XX
	070-8957-XX			1	MANUAL,TECH:USER,AWG2040,DP	TK2548	070-8957-XX
	-----------			1	CABLE ASSY,PWR:3,18 AWG,92 L,SVT,TAN (SEE FIGURE 10-1-2)		
	161-0104-05			1	CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 METER (OPTION A3 – AUSTRALIAN)	S3109	198-010
	161-0104-06			1	CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 METER (OPTION A1 – EUROPEAN)	S3109	198-010
	161-0104-07			1	CA ASSY,PWR:3,1.0MM SQ,240V/10A,2.5 METER (OPTION A2 – UNITED KINGDOM)	S3109	209010
	161-0104-08			1	CA ASSY,PWR:3,18 AWG,250/10A,98 INCH L (OPTION A4 – NORTH AMERICAN)	2W733	ORDER BY DESC
	161-0167-00			1	CA ASSY,PWR:3,0.75MM SQ,250V/10A,2.5 METER (OPTION A5 – SWITZERLAND)	S3109	ORDER BY DESC
					OPTIONAL ACCESSORIES		
	011-0049-XX			1	TERMN,COAXIAL:50 OHM,2W,BNC	64537	T132DS
	012-0991-XX			1	CABLE,INTCON:SHLD CMPST,GPIB;CRC,12 TW PR	6D224	81190-020
	012-1256-XX			1	CABLE,INTCON:50 OHM COAX,98.0 L	TK0BD	7220369010
	012-1342-XX			1	CA ASSY,RF:COAXIAL,;RFD,50 OHM,24 L,BNC,MALE	80009	0121342XX
	012-1458-XX			1	CA ASSY,RF:50 OHM COAX,100CM L,SMB-SMB	TK0191	012-1458-XX
	012-1459-XX			1	CA ASSY,RF:50 OHM COAX,100CM L,SMB-BNC	TK0191	012-1459-XX
	015-0657-XX			1	FILTER,LOW PASS:100MHZ,50 OHM,BNC,TUBULAR	TK0191	015-0657-XX
	015-0658-XX			1	FILTER,LOW PASS:200MHZ,50 OHM,BNC,TUBULAR	TK0191	015-0658-XX
	015-0659-XX			1	FILTER,LOW PASS:400MHZ,50 OHM,BNC,TUBULAR	TK0191	015-0659-XX
	015-0660-XX			1	FILTER,LOW PASS:DC-800MHZ,50 OHM,0.5W,BNC	TK0191	015-0660-XX
	016-1159-XX			1	POUCH:POUCH & PLATE,GPS SIZE	80009	0161159XX
	067-1396-XX			1	FIXTURE,CAL:AWG2005	TK0191	067-1396-XX
	070-8963-XX			1	MANUAL,TECH:SERVICE,AWG2040,DP	80009	0708963XX
	200-3232-XX			1	COVER,FRONT:ABS	TK1908	ORDER BY DESC
	-----------			1	FUSE,CARTRIDGE:(P/O TABLE 2-2)		
	-----------			1	CAP,FUSEHOLDER:(P/O TABLE 2-2)		