

Tektronix®

**AWG70001B and AWG70002B
Arbitrary Waveform Generators
Installation and Safety Instructions**





**AWG70001B and AWG70002B
Arbitrary Waveform Generators
Installation and Safety Instructions**

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Contacting Tektronix

Tektronix, Inc.
14150 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

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

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

Warranty

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

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

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

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Important safety information

This manual contains information and warnings that must be followed by the user for safe operation and to keep the product in a safe condition.

General safety summary

Use the product only as specified. Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. Carefully read all instructions. Retain these instructions for future reference.

This product shall be used in accordance with local and national codes.

For correct and safe operation of the product, it is essential that you follow generally accepted safety procedures in addition to the safety precautions specified in this manual.

The product is designed to be used by trained personnel only.

Only qualified personnel who are aware of the hazards involved should remove the cover for repair, maintenance, or adjustment.

This product is not intended for detection of hazardous voltages.

Use personal protective equipment to prevent shock and arc blast injury where hazardous live conductors are exposed.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

When incorporating this equipment into a system, the safety of that system is the responsibility of the assembler of the system.

To avoid fire or personal injury

Use proper power cord. Use only the power cord specified for this product and certified for the country of use.

Ground the product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded. Do not disable the power cord grounding connection.

Power disconnect. The power cord disconnects the product from the power source. See instructions for the location. Do not position the equipment so that it is difficult to operate the power cord; it must remain accessible to the user at all times to allow for quick disconnection if needed.

Connect and disconnect properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source. Use only insulated voltage probes, test leads, and adapters supplied with the product, or indicated by Tektronix to be suitable for the product.

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

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

Do not float the common terminal above the rated voltage for that terminal.

Do not operate without covers. Do not operate this product with covers or panels removed, or with the case open. Hazardous voltage exposure is possible.

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

Do not operate with suspected failures. If you suspect that there is damage to this product, have it inspected by qualified service personnel.

Important safety information

Disable the product if it is damaged. Do not use the product if it is damaged or operates incorrectly. If in doubt about safety of the product, turn it off and disconnect the power cord. Clearly mark the product to prevent its further operation.

Before use, inspect voltage probes, test leads, and accessories for mechanical damage and replace when damaged. Do not use probes or test leads if they are damaged, if there is exposed metal, or if a wear indicator shows.

Examine the exterior of the product before you use it. Look for cracks or missing pieces.

Use only specified replacement parts.

Do not operate in wet/damp conditions. Be aware that condensation may occur if a unit is moved from a cold to a warm environment.

Do not operate in an explosive atmosphere.

Keep product surfaces clean and dry. Remove the input signals before you clean the product.

Provide proper ventilation. Refer to the installation instructions in the manual for details on installing the product so it has proper ventilation.

Slots and openings are provided for ventilation and should never be covered or otherwise obstructed. Do not push objects into any of the openings.

Provide a safe working environment. Always place the product in a location convenient for viewing the display and indicators.

Avoid improper or prolonged use of keyboards, pointers, and button pads. Improper or prolonged keyboard or pointer use may result in serious injury.

Be sure your work area meets applicable ergonomic standards. Consult with an ergonomics professional to avoid stress injuries.

Use care when lifting and carrying the product. This product is provided with a handle or handles for lifting and carrying.



WARNING. *The product is heavy. To reduce the risk of personal injury or damage to the device get help when lifting or carrying the product.*

Use only the Tektronix rackmount hardware specified for this product.

Terms in the 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



When this symbol is marked on the product, be sure to consult the manual to find out the nature of the potential hazards and any actions which have to be taken to avoid them. (This symbol may also be used to refer the user to ratings in the manual.)

The following symbols may appear on the product:



CAUTION
Refer to Manual



Protective Ground
(Earth) Terminal



Earth Terminal



Chassis Ground



Standby

Important safety information

Compliance Information

This section lists the EMC (electromagnetic compliance), safety, and environmental standards with which the instrument complies. This product is intended for use by professionals and trained personnel only; it is not designed for use in households or by children.

Questions about the following compliance information may be directed to the following address:

Tektronix, Inc.

PO Box 500, MS 19-045

Beaverton, OR 97077, USA

www.tek.com

EMC compliance

EU EMC Directive

Meets intent of Directive 2014/30/EU for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61326-1. EMC requirements for electrical equipment for measurement, control, and laboratory use. ^{1 2 3}

- CISPR 11. Radiated and conducted emissions, Group 1, Class A
- IEC 61000-4-2. Electrostatic discharge immunity
- IEC 61000-4-3. RF electromagnetic field immunity
- IEC 61000-4-4. Electrical fast transient / burst immunity
- IEC 61000-4-5. Power line surge immunity
- IEC 61000-4-6. Conducted RF immunity
- IEC 61000-4-8. Power frequency magnetic field immunity test
- IEC 61000-4-11. Voltage dips and interruptions immunity

EN 61000-3-2. AC power line harmonic emissions

EN 61000-3-3. Voltage changes, fluctuations, and flicker

EMC Compliance

Meets the intent of Directive 2014/30/EU for Electromagnetic Compatibility when it is used with the product(s) stated in the specifications table. Refer to the EMC specification published for the stated products. May not meet the intent of the directive if used with other products.

¹ This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.

² Emissions which exceed the levels required by this standard may occur when this equipment is connected to a test object.

³ For compliance with the EMC standards listed here, high quality shielded interface cables that incorporate low impedance connection between the cable shield and the connector shell should be used.

Australia / New Zealand Declaration of Conformity – EMC

Complies with the EMC provision of the Radiocommunications Act per the following standard, in accordance with ACMA:

- EN 61326-1. Radiated and conducted emissions, Group 1, Class A,

Safety compliance

This section lists the safety standards with which the product complies and other safety compliance information.

EU declaration of conformity – low voltage

Compliance was demonstrated to the following specification as listed in the Official Journal of the European Union:

Low Voltage Directive 2014/35/EU.

- EN 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.

U.S. nationally recognized testing laboratory listing

- UL 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.

Canadian certification

- CAN/CSA-C22.2 No. 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.

Additional compliances

- IEC 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.

Equipment type

Test and measuring equipment.

Safety class

Class 1 – grounded product.

Pollution degree description

A measure of the contaminants that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.

- Pollution Degree 1. No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.
- Pollution Degree 2. Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.
- Pollution Degree 3. Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.
- Pollution Degree 4. Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.

Pollution degree rating

Pollution Degree 2 (as defined in IEC 61010-1). Note: Rated for indoor, dry location use only.

IP rating

IP20 (as defined in IEC 60529).

Measurement and overvoltage category descriptions

Measurement terminals on this product may be rated for measuring mains voltages from one or more of the following categories (see specific ratings marked on the product and in the manual).

- Measurement Category II. For measurements performed on circuits directly connected to the low-voltage installation.
- Measurement Category III. For measurements performed in the building installation.
- Measurement Category IV. For measurements performed at the source of low-voltage installation.

NOTE. Only mains power supply circuits have an overvoltage category rating. Only measurement circuits have a measurement category rating. Other circuits within the product do not have either rating.

Mains overvoltage category rating

Overvoltage Category II (as defined in IEC 61010-1)

Environmental compliance

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

Restriction of hazardous substances

Complies with RoHS2 Directive 2011/65/EU.

Product end-of-life handling

Observe the following guidelines when recycling an instrument or component:

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



This symbol indicates that this product complies with the applicable European Union requirements according to Directives 2012/19/EU and 2006/66/EC on waste electrical and electronic equipment (WEEE) and batteries. For information about recycling options, check the Tektronix Web site (www.tek.com/productrecycling).

Perchlorate materials. This product contains one or more type CR lithium batteries. According to the state of California, CR lithium batteries are classified as perchlorate materials and require special handling. See www.dtsc.ca.gov/hazardouswaste/perchlorate for additional information.

Preface

This manual describes the installation and basic operation of AWG7000B series instruments. For additional operating information, refer to the instrument help on your instrument. The following instruments are supported by this document:

- AWG70001B single channel Arbitrary Waveform Generators
- AWG70002B two channel Arbitrary Waveform Generators

Key features

The following list describes some of the key features of the AWG7000B series instruments:

- Two modes of operation:
 - AWG mode (Arbitrary Waveform Generator) to play any waveshape from a file
 - Functions mode to create and play basic waveshapes
- Sample rates:
 - Up to 50 GS/s for single channel instruments
 - Up to 25 GS/s for two channel instruments
- Waveform memory
 - Up to 32 GSamples for single channel instruments
 - Up to 16 GSamples per channel for two channel instruments
- Sequencer
- Streaming Waveform ID (Streaming WID)
- –80 dBc Spurious Free Dynamic Range
- 10 bit vertical resolution
- Removable hard disk drive
- 6 USB ports (2 front - USB 2.0, 4 rear - USB 3.0)
- LAN (10/100/1000 Base-T)
- An intuitive, graphical user interface
- Capacitive touchscreen user interface
- Microsoft Windows 10, 64-bit operating system

Documentation


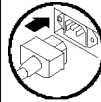
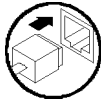
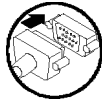
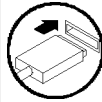
Review the following table to locate more information about this product.

Documents are provided as PDF files, downloadable from the [Tektronix manuals download website](http://www.tek.com/manuals) (www.tek.com/manuals).

To read about	Use these documents
Installation and operation (overviews)	Safety and Installation manual. (This manual.)
Operation and user interface	Instrument help from the Help menu. A PDF version of the Help system is available on the Tektronix web site. Tektronix part number: 077-1446-xx.
Programmer commands	Programmer manual. Tektronix part number: 077-1452-xx.
Specifications and performance verification procedures	Specifications and Performance Verification Technical Reference. Tektronix part number: 077-1453-xx.

Conventions used in this manual

The following icons are used throughout this manual.

Step	Front panel power	Connect power	Network	SVGA	USB
1					

Install the instrument

Unpack the instrument and check that you received all items listed as Standard Accessories. Check the [Tektronix website](http://www.tek.com) (www.tek.com) for the most current information.

Standard accessories

Accessory	Tektronix part number
AWG70000B Series Installation and Safety Manual	
English (Option L0)	071-3597-xx
Japanese (Option L5)	071-3598-xx
Simplified Chinese (Option L7)	071-3599-xx
Traditional Chinese (Option L8)	071-3600-xx
Russian (Option L10)	071-3601-xx
Windows compatible keyboard	119-7275-xx
Windows compatible mouse	119-7054-xx
Analog output SMA adapters (Pre-installed on outputs)	131-8689-xx Two with the AWG70001B (Three with Option AC) Four with the AWG70002B
50 Ω SMA Termination, Male, DC to 18 GHz	015-1022-xx One with the AWG70001B Two with the AWG70002B
Power cord – one of the following:	
North America (Option A0)	161-0348-xx
Universal Euro (Option A1)	161-0343-xx
United Kingdom (Option A2)	161-0104-07
Australia (Option A3)	161-0104-14
Switzerland (Option A5)	161-0167-xx
Japan (Option A6)	161-0342-xx
China (Option A10)	161-0341-xx
India (Option A11)	161-0324-xx
Brazil (Option A12)	161-0356-xx
No power cord or AC adapter (Option A99)	

Install the instrument

Models

AWG70001B	10 bit, 2 GSamples record length, 1-channel arbitrary waveform generator
AWG70000-150	50 Gs/s Sample Rate
AWG70000-MEM	Waveform record length expansion to 32 GSamples
AWG70001B-AC	Adds a single-ended AC coupled output connector with additional amplification and attenuation
AWG70001B-SEQ	Adds Sequencing
AWG70000-STRID	Adds Streaming Waveform ID (Streaming WID) (requires AWG70001B-SEQ)

AWG70002B	10 bit, 2 GSamples record length, 2-channel arbitrary waveform generator
AWG70000-208	8 Gs/s Sample Rate
AWG70000-216	16 Gs/s Sample Rate
AWG70000-225	25 Gs/s Sample Rate
AWG70000-MEM	Waveform record length expansion to 16 GSamples per channel
AWG70002B-SEQ	Adds Sequencing
AWG70000-STRID	Adds Streaming Waveform ID (Streaming WID) (requires AWG70002B-SEQ)

Product upgrades

AWG70001B upgrades	Description
AWG70001B STRID	Adds Streaming Waveform ID (Streaming WID) (requires AWG70001B-SEQ)
AWG70001B SEQ	Adds sequencing
AWG701BUP SSD	Provides an additional (or replacement) preprogrammed solid state drive
AWG701BUP AC	Adds a single-ended AC coupled output connector with additional amplification and attenuation (factory installation only)

AWG70002B upgrades	Description
AWG70002B STRID	Adds Streaming Waveform ID (Streaming WID) (requires AWG70002B-SEQ)
AWG70002B SEQ	Adds sequencing
AWG702BUP SSD	Provides an additional (or replacement) preprogrammed solid state drive

Plug-ins

Plug-ins increase the capabilities of the arbitrary waveform generators. Various plug-ins are available providing unique types of waveforms or additional compensation. Each plug-in has its own installation file which installs seamlessly into the generators. After installation, it simply becomes a new menu selection. No other configuration is necessary.

Plug-in	Description	Nomenclature	Licensed enhancements
Multitone & Chirp plug-in	Create generate chirps, notches and tones	MTONENL-SS01 MTONEFL-SS01	
PreCompensation plug-in	Create correction coefficients that can be applied on waveforms to get flat frequency and linear phase response	PRECOMNL-SS01 PRECOMFL-SS01	
High Speed Serial plug-in	Create pre-distorted waveforms to test a device's conformance to standards	HSSNL-SS01 HSSFL-SS01 HSSPACKNL-SS01 HSSPACKFL-SS01	S-Parameters and Intersymbol Interference unlocked with S-Parameters plug-in license Spread Spectrum Clocking unlocked with Spread Spectrum Clocking plug-in license (Licensed enhancements are included with HSSPACK)
RF Generic plug-in	Create digitally modulated signals with multiple carrier groups	RFGENNL-SS01 RFGENFL-SS01	S-Parameters unlocked with S-Parameters plug-in license
Optical plug-in	Create waveforms with complex modulation schemes for optical testing	OPTICALNL-SS01 OPTICALFL-SS01	S-Parameters unlocked with S-Parameters plug-in license Spread Spectrum Clocking unlocked with Spread Spectrum Clocking plug-in license
OFDM plug-in	Create Single or Multiple OFDM based Frames with one or more bursts	OFDMNL-SS01 OFDMFL-SS01	S-Parameters unlocked with S-Parameters plug-in license
RADAR plug-in	Create RADAR pulsed waveforms with various modulations and impairments	RADARNL-SS01 RADARFL-SS01	S-Parameters unlocked with S-Parameters plug-in license
	RADAR and Environment waveform creation plug-ins packaged together	RDRPACK1NL-SS01 RDRPACK1FL-SS01	
	RADAR, Environment, and OFDM waveform creation plug-ins packaged together	RDRPACK2NL-SS01 RDRPACK2FL-SS01	
Environment plug-in	Create real world scenarios for commercial, electronic warfare, and simulations for monitoring and receiver testing	ENVNL-SS01 ENVFL-SS01	

Install the instrument

Plug-in	Description	Nomenclature	Licensed enhancements
Spread Spectrum Clocking plug-in	Adds SSC capability to the High Speed Serial and Optical plug-ins	SSCFLNL-SS01 SSCFLFL-SS01	
S-Parameters plug-in	Adds S-Parameter capability to the RF Generic, High Speed Serial, Optical, OFDM, and RADAR plug-ins	SPARANL-SS01 SPARAFLL-SS01	

Plug-ins require the purchase of a license before they are fully functional.

There are two types of licenses available for each plug-in: node-locked (NL) and floating (FL).

- Node Locked Licenses (NL) provide your own copy of the application on your instrument and are permanently assigned to a product model/serial number.
- Floating Licenses (FL) can be moved between product models.

Replaceable parts

Item	Tektronix part number
Rear panel foot (four per instrument)	348-2037-xx
Screw	211-1459-xx
Front bottom flip-foot (two per instrument)	348-1950-xx
Screw	211-1459-xx
Foot cushion	348-1947-xx
Rear bottom foot (two per instrument)	348-1948-xx
Screw	211-1459-xx
Foot cushion	348-1947-xx
Handle (two per instrument)	367-0570-xx
Foam	348-2067-xx
Screw (two per handle)	211-1459-xx

Operating requirements

Cooling

Place the instrument on a cart or bench, observing clearance requirements:

- Top and bottom: 0 cm (0 in)
- Left and right side: 5.08 cm (2 in)
- Rear: 0 cm (0 in)



CAUTION. To ensure proper cooling, keep sides of the instrument clear of obstructions.

Environmental requirements

The environmental requirements for your instrument are listed in the following table. For instrument accuracy, ensure that the instrument has warmed up for 20 minutes and meets the environmental requirements listed in the following table.

Requirement	Description
Temperature (operating)	0 °C to 50 °C (+32 °F to +122 °F)
Humidity (operating)	5% to 90% relative humidity at up to 30 °C (86 °F) 5% to 45% relative humidity above 30 °C (86 °F) up to +50 °C (122 °F) noncondensing
Altitude (operating)	Up to 3,000 m (9,843 feet)

Power supply requirements

The power supply requirements for your instrument are listed in the following table.



WARNING. To reduce the risk of fire and shock, ensure that the mains supply voltage fluctuations do not exceed 10% of the operating voltage range.

Source Voltage and Frequency	Power Consumption
100 VAC to 240 VAC, 50/60 Hz	500 W

Cleaning

Inspect the arbitrary waveform generator as often as operating conditions require. Follow these steps to clean the exterior surface.



WARNING. To avoid personal injury, power off the instrument and disconnect it from line voltage before performing any of the following procedures.

Install the instrument



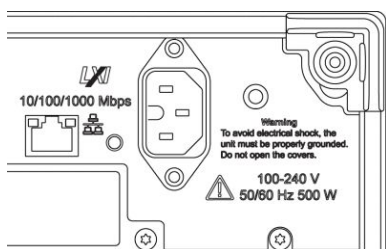
CAUTION. To avoid damage to the surface of the instrument, do not use any abrasive or chemical cleaning agents.

Use extreme care when cleaning the surface of the display. The display is easily scratched if excessive force is used.

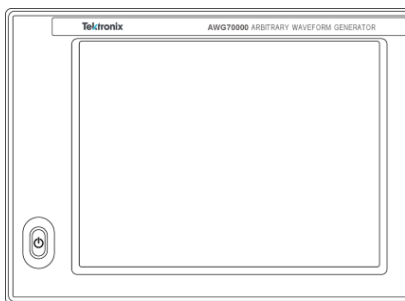
1. Remove loose dust on the outside the instrument with a lint-free cloth. Use care to avoid scratching the front-panel display.
2. Use a soft cloth dampened with water to clean the instrument. If needed, use a 75% isopropyl alcohol solution as a cleaner. Do not spray liquids directly on the instrument.

Power on the instrument

1. Connect the AC power cord to the rear of the instrument.



2. Use the front-panel power button to switch the instrument on.



The power button indicates four instrument power states:

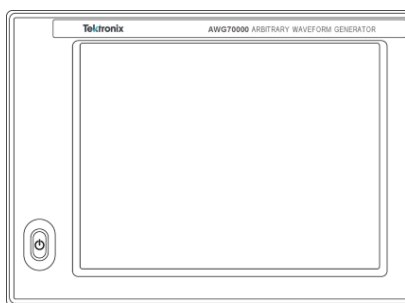
- No light – no power applied
- Yellow – standby mode
- Green – powered on
- Flashing Red – over heat condition (instrument shuts down and cannot restart until internal temperature returns to a safe level)

Power off the instrument

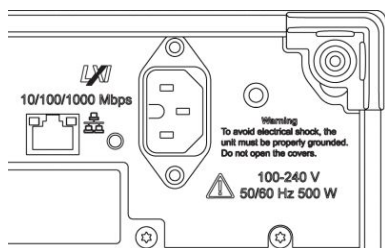
1. Press the front-panel power button to shut down the instrument.

The shutdown process takes approximately 30 seconds to complete, placing the instrument in standby mode. Alternatively, use the Windows Shutdown menu.

NOTE. You can force an immediate shutdown by pressing and holding the power button for four seconds. Unsaved data is lost.



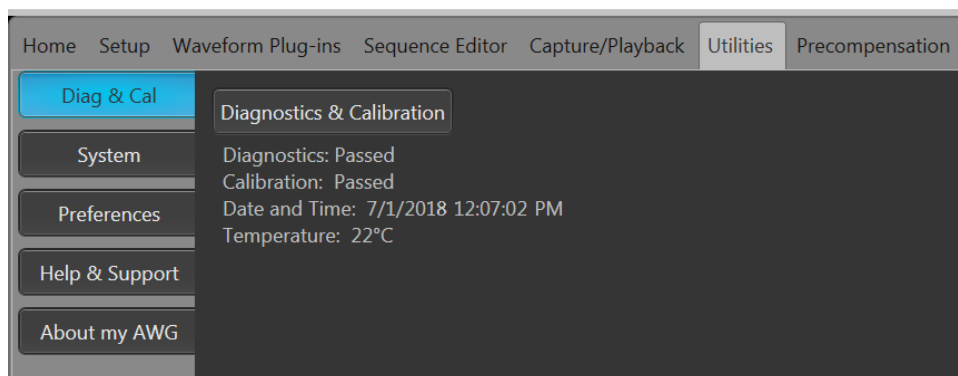
2. To completely remove power to the instrument, perform the shutdown just described, and then remove the power cord from the instrument.



Inspect the instrument

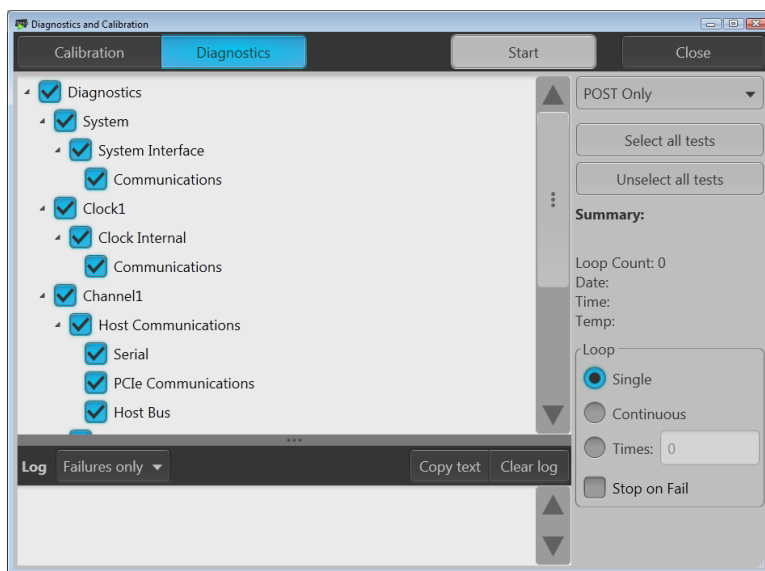
Two types of diagnostics are provided to verify the functionality of your instrument:

- Power-on self test (POST) – Every time you power on the instrument, the instrument automatically performs the POST internal diagnostics.
- Diagnostics from the System menu – You can run the internal diagnostics from the System menu. Use the following procedure:
 1. Select **Utilities** from the workspace tabs, then select **Diag & Cal**.
 2. Click **Diagnostics & Calibration**.



Install the instrument

3. In the **Diagnostics and Calibration** screen, click **Diagnostics**.
4. Choose the set of diagnostics you want to run.
 - **POST Only**: Offers a set of tests that automatically run at power on (Power On Self Test). These diagnostic selections verify such things as internal device communications, system memory, and real-time clock.
 - **Full diagnostics**: Provides access to all diagnostic self tests the instrument is able to run.



5. Select and deselect each test individually or use the **Select all tests** and **Unselect all tests** buttons.
6. Select the desired **Loop** function.
 - **Single** makes one pass through the selected tests.
 - **Continuous** continually runs through the selected tests until aborted.
 - **Times** lets you define how many times to run the selected tests.
 - **Stop on Fail** stops the diagnostics if a selected test fails, regardless of the Loop selection.
7. Click **Start** to run the diagnostics. The **Start** button changes to **Abort** while tests are actively running. Verify that the instrument passes all tests. If diagnostic failures occur, contact your local Tektronix service personnel.

Self calibration

The self calibration uses internal calibration routines that adjust the internal calibration constants as necessary.

If the instrument detects an internal temperature difference of more than 5 °C from its previous calibration, a message is displayed in the status area (at the bottom of the screen), recommending a self calibration. You can perform the self calibration at anytime.

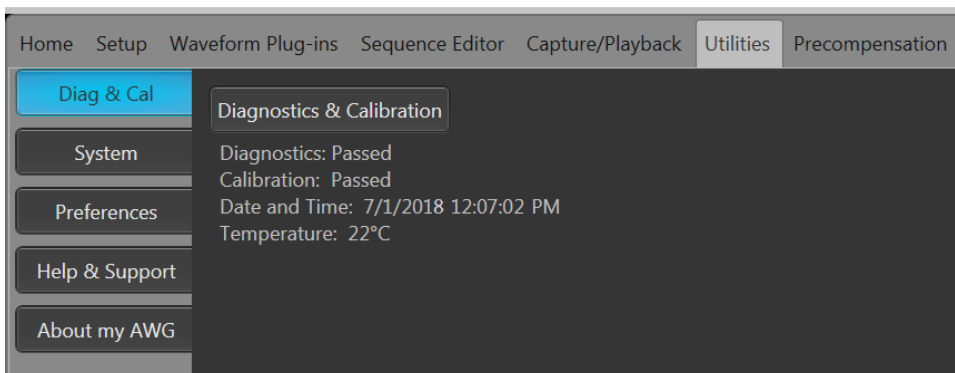
NOTE. Always power on the instrument for at least 20 minutes before performing a self calibration. See [Operating requirements](#) on page 7.

1. Confirm that there is no output signal. The front-panel **Play/Stop** button indicator is off.

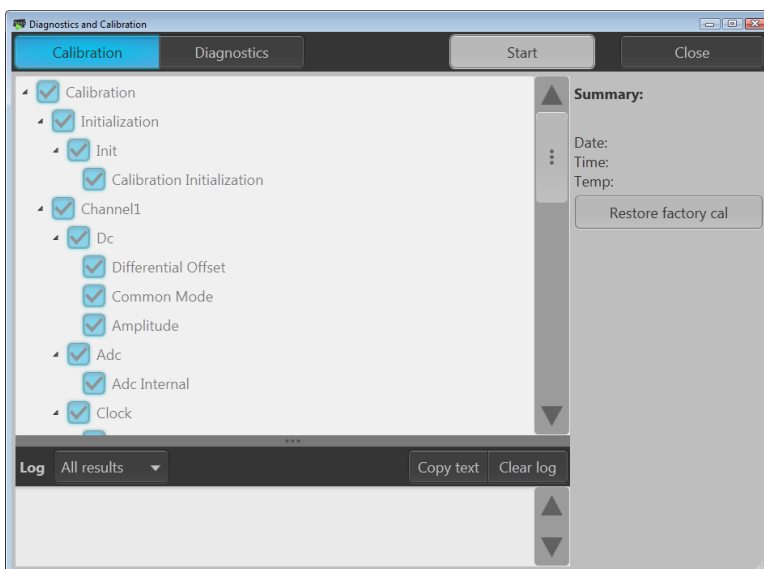


2. Click **Utilities** from the workspace tabs, then click **Diag & Cal**.

3. Click **Diagnostics & Calibration**.



4. In the **Diagnostics and Calibration** screen, click **Calibration**.
All calibration routines are selected by default and cannot be deselected.
5. Click **Start**.
The **Start** button changes to **Abort** once the calibration has started. Clicking Abort stops the calibration process and restores all values to their previous state. All calibration items should indicate Pass. If not, contact your local Tektronix service personnel.



Connecting to the instrument

Connecting to a network

You can connect your instrument to a network for file sharing, printing, Internet access, and other functions. Consult your network administrator and use the standard Windows utilities to configure the instrument for your network.

Connecting peripheral devices

You can connect peripheral devices to your instrument, such as the keyboard and mouse (provided). A mouse and keyboard are particularly helpful for opening and saving files.

Controlling the instrument using a remote PC

Use your PC to control the arbitrary waveform generator through a LAN using the Windows Remote Desktop function. If your PC has a larger screen, it will be easier to see details such as zooming waveforms or making cursor measurements. You can also use a third party software application (installed on your PC) to create a waveform and import it through a network.

Preventing instrument damage

Overheat protection

The instrument is protected against overheating damage by continuously monitoring the internal temperature. If the internal temperature exceeds the maximum rated operating range, two actions occur.

- The instrument shuts down.
- The Power button flashes red.

NOTE. *An indication that the internal temperature is escalating is continual calibration warnings due to temperature change.*

If an overheat condition was detected, the power button will continue to flash red, even after the instrument cools (unless power is disconnected). This is done to indicate that an overheat condition has occurred, regardless of how much time has passed.

Restarting the instrument (or removing and reapplying power) will stop the power button from flashing red. But if the overheat condition still remains while attempting to restart the instrument, the power button may immediately (or in a short time) start flashing red again and the instrument will shut down.

Common causes of overheating include:

- The ambient temperature requirement is not being met.
- The required cooling clearance is not being met.
- One or more instrument fans are not working properly.

Connectors

The arbitrary waveform generator has both output and input connectors. Do not apply external voltage to any output connector and ensure proper restrictions are met for any input connector.



CAUTION. Always turn off the signal outputs when you connect or disconnect cables to/from the signal output connectors. If you connect a (Device Under Test) DUT while the instrument signal outputs are in the On state, it may cause damage to the instrument or to the DUT.

Enhancements for your instrument

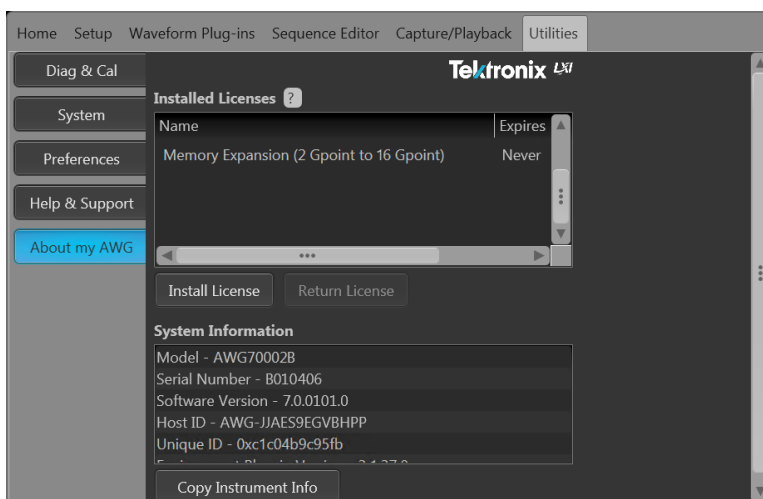
Upgrades and plug-ins purchased with your instrument are pre-installed. You can view these by going to **Utilities > About my AWG**. If you purchase an upgrade or plug-in after you've received your instrument, you may need to install a license key to activate the feature. Use the **Install Licenses** dialog box to enable the upgrades that you purchased from Tektronix for your instrument. For the most current list of upgrades, go to www.tektronix.com or contact your local Tektronix representative.

Your instrument can be enhanced by several different methods:

- Software enhancements: Enhancements ordered at the time of your purchase are pre-installed. These can also be purchased post sales and may require the installation of software in addition to installing a license to activate.
- Hardware enhancements: Features that require/enable hardware on the instrument. These can be ordered with the purchase of the instrument or as a post-purchase addition.
- Plug-ins: Applications that enhance a host application. Plug-ins designed to operate with an AWG70000B series instrument are also able to operate with the SourceXpress Waveform Creation software. Plug-ins with a floating license can be moved between instruments or SourceXpress.

View installed options

1. Select **Utilities** from the workspace tabs.
2. Select **About my AWG** to display the current license information and system information.
3. The Installed Licenses dialog box displays the currently installed licenses on the instrument.



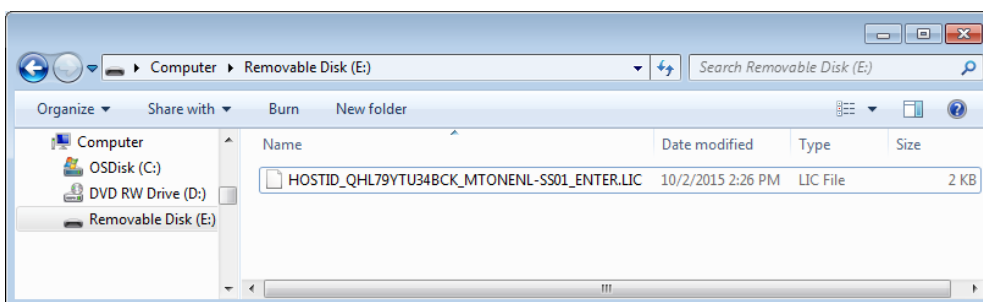
4. If you have a new license to install (to enable a new feature), click **Install License** to start the installation process.

Install the instrument

Install a new license

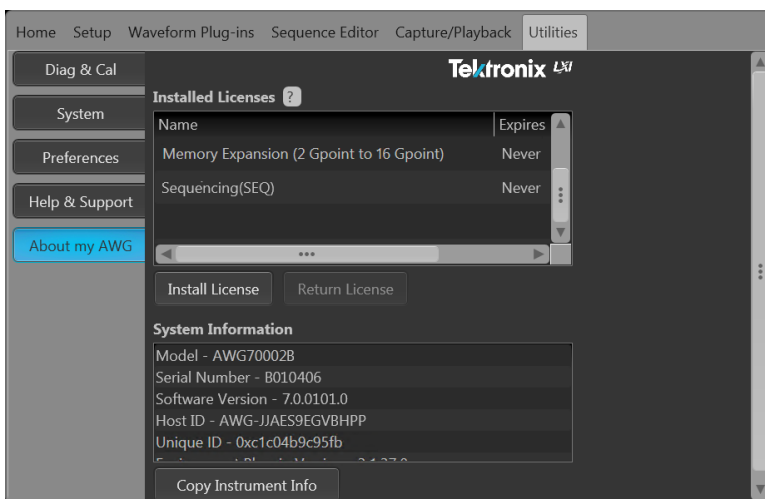
Before starting this procedure, place the new license key (received from Tektronix) in a location you can access from the instrument. This can be anywhere on the instrument's C: drive or available networks. You can also use a USB flash drive to store your license.

1. Select **About my AWG** located in the Utilities tab.
2. Select the Install License button to display the license file selection screen and browse to the location where you've stored the license file.



3. Select the license file and select Open.

After the successful installation is finished, the name of the licensed feature is listed along with the expiration date and time.



Floating licenses display the expiration date for that application. The expiration date for a floating license is defined when the license is checked out from the Tektronix Asset Management system. After the license expires, the application is automatically disabled and the license on the TekAMS is free to be assigned to a different host. Node locked license have no expiration date.

Windows interface guidelines

Because the instrument uses the Microsoft Windows interface, you have open access to the Windows operating system. You can access the Windows desktop to load and run other Windows-based applications such as Microsoft Excel.

Follow these guidelines to avoid making operating system changes that might cause problems while using the instrument:

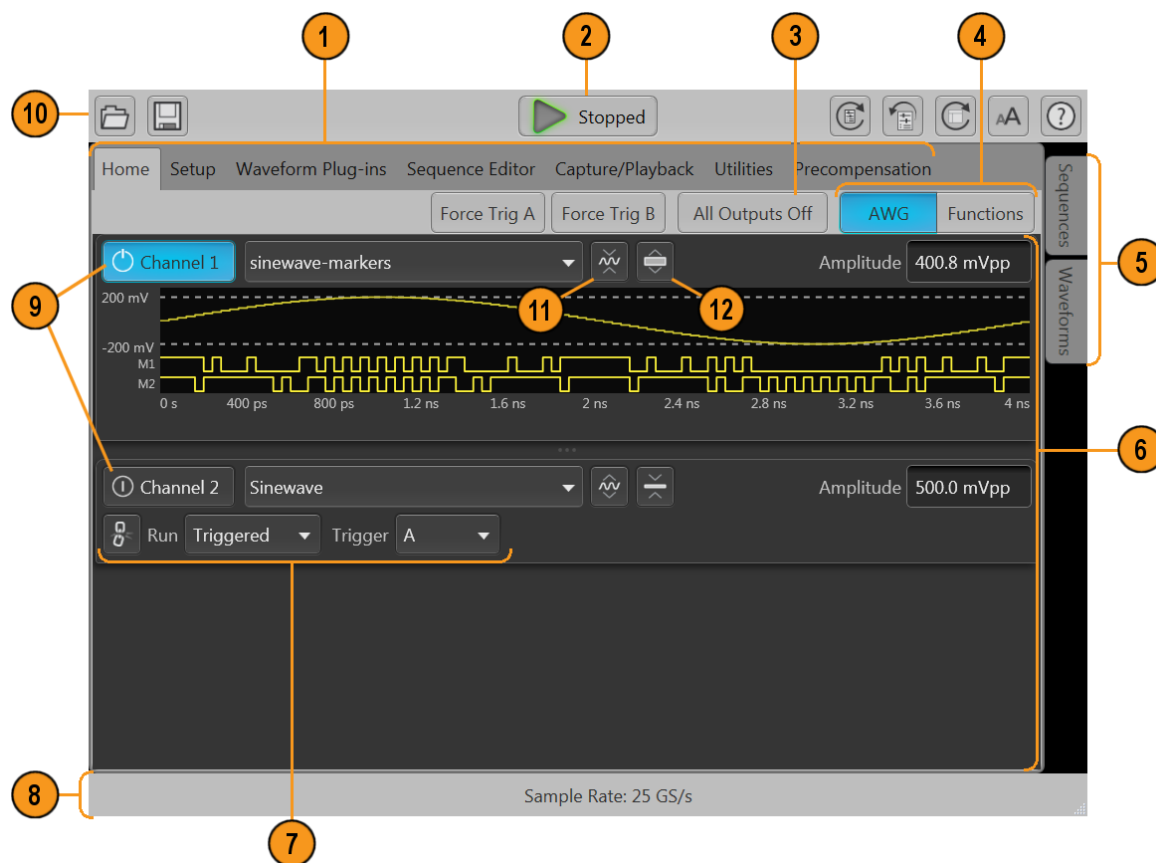
- Be careful when making changes in the Control Panel. Avoid making changes to any controls with which you are unfamiliar.
- Do not delete or change any system fonts; this can affect the quality of the display.
- Be careful when making changes to the system Display properties. Changing settings such as resolution, text size, fonts, and orientation affects the usability of the display and the touchscreen.
- Do not change the contents of the Windows folder or the Program Files\Tektronix\AWG70000\ folder.
- Do not change the BIOS settings; this can affect the overall operation of the instrument.

Install the instrument

Operation basics

AWG mode overview

The following illustration and table provide a high-level overview of the AWG mode.



Operation basics

Screen element	Description
1. Workspace tabs	<p>The workspace tabs provide access to all of the instrument functions.</p> <ul style="list-style-type: none"> ■ Home returns the workspace area to the channel plot display. ■ Setup displays the setup controls for channels, clock, triggers, and auxiliary outputs. ■ Waveform Plug-ins displays the user interface for the selected plug-in. ■ Sequence Editor displays the workspace area to create waveform sequences (license required). ■ Capture/Playback displays the workspace area to import baseband I/Q data files and compile them into a waveform for payout. ■ Utilities displays controls for system information (including diagnostics and calibration), preferences, help and support. Utilities are global instrument settings that are maintained in non-volatile memory when the application is closed or the instrument powered off. These settings are not saved and recalled with setup files nor are they impacted by restoring the default setup. ■ Precompensation displays the workspace area to create correction files to be used with a waveform file (license required).
2. Play/Stop button	<p>Starts and stops playing the waveform. The Play button icon changes to indicate the play status of the waveform. See Run state control on page 25. When a waveform is playing, it is only present at the output connectors if the following conditions are met.</p> <ul style="list-style-type: none"> ■ The channel is enabled. ■ The All Outputs Off is not active (outputs are connected).
3. All outputs off	<p>The All Outputs Off button provides a quick disconnect of the analog and marker outputs, whether those outputs are enabled or not. (All Outputs Off overrides the channel output enable controls.) The outputs are electrically disconnected. When the All Outputs Off is disabled, the outputs return to their defined state.</p>
4. Mode selection	<p>Switches the instrument mode between AWG (arbitrary waveform generator) and Functions (basic waveshape generator). Mode selection is available from the Home tab in both the AWG mode and the Functions mode.</p>
5. Waveforms and sequences	<p>Contains all waveforms and sequences available for payout. Touch and hold (or right-mouse click) a waveform or sequence name to display menu selections to manage the lists. Sequencing must be licensed.</p>
6. Workspace	<p>The workspace area shows the contents of the selected tab (such as: Home, Settings).</p>
7. Trigger controls	<p>The Trigger controls provide access to the trigger settings.</p> <ul style="list-style-type: none"> ■ Use Run mode to set the trigger type. ■ Use Trigger source for external triggering. ■ Use the couple icon to couple the trigger settings for all channels.
8. Status bar	<p>The status bar displays various user messages and status indicators.</p>
9. Channel enable	<p>Enables the channel output. Internally connects the channel and marker output connectors to the instrument. The All Outputs Off feature overrides the channel enable control.</p>

Screen element	Description
10. Toolbar	Tools are used to: <ul style="list-style-type: none"> ■ Open files (setup files, waveform files, sequence files). ■ Save the current setup. ■ Restore the default setup. ■ Restore the most recently used setup. ■ Restore the display to the default layout. ■ Toggle the font size. ■ Display the instrument help.
11. Waveform display	Toggles the channel's waveform plot display on or off.
12. Channel settings display	Shows or hides additional channel controls.

Functions mode overview

The Functions interface provides you with a quick and easy way to generate simple types of waveforms. Refer to the following illustration and table for information on the key screen elements.



Screen element	Description
2. Play/Stop button	Starts and stops waveform play out. The Play button icon changes to indicate the waveform play out status. See Run state control on page 25.
1. Workspace tabs	The workspace tabs provides access to all instrument functions. <ul style="list-style-type: none"> ■ Home returns the workspace area to the Function mode setup display. ■ Utilities displays controls for preferences, system information, help and support. Utilities are global instrument settings.
7. Channel controls	Select, enables, set the channel output path. Internally connects the channel and marker output connectors to the instrument. The All Outputs Off feature overrides the channel enable control.
4. Mode selection	Switches the instrument mode between AWG (arbitrary waveform generator) and Functions (basic waveshape generator). Mode selection is available from the Home tab in both the AWG mode and the Functions mode.
5. Workspace	The workspace area shows the parameters of the selected waveform type.
3. All outputs off	The All Outputs Off button provides a quick disconnect of the analog and marker outputs, whether those outputs are enabled or not. (All Outputs Off overrides the output enable controls.) The outputs are electrically disconnected. When the All Outputs Off is disabled, the outputs return to their defined state.
6. Status bar	The status bar displays various user messages and status indicators.
8. Toolbar	Tools are used to: <ul style="list-style-type: none"> ■ Open files. While in the Functions mode, only Setup files impact the Functions mode. You can open waveform and sequence file types, and the Waveform and Sequence lists will be populated, but these are only available for use when in the AWG mode. ■ Save the current setup. ■ Display the instrument help. ■ Restore the default setup. ■ Restore the most recently used setup. ■ Restore the display to the default layout. ■ Toggle the font size. ■ Display the instrument help.

Front panel connectors

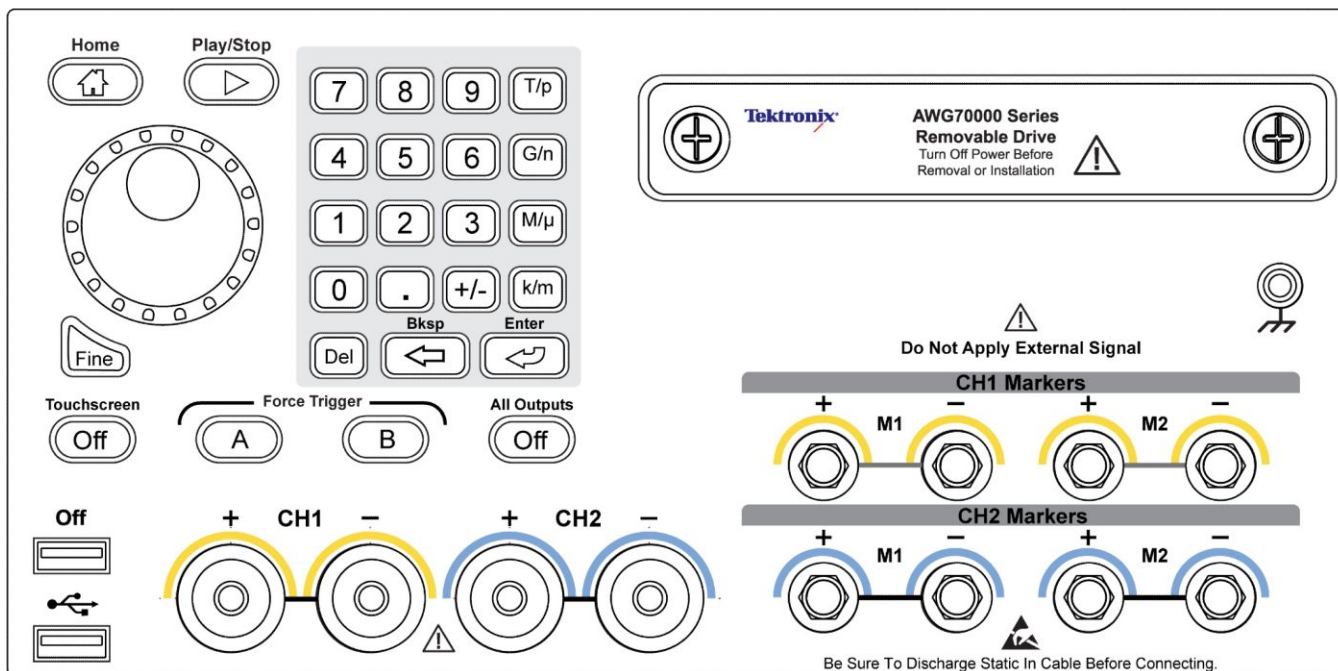


Table 1: Front-panel connectors

Connector	Description
Analog outputs (+ and –) AWG70001B – CH1 AWG70002B – CH1 and CH2	<p>These connectors supply analog signals.</p> <p>The channel LEDs light to indicate when the channel is enabled and the output is electrically connected. The LED color matches the user defined waveform color.</p> <p>The output connector utilizes the Planar Crown® Universal Connector System providing you the ability to easily replace a damaged connector.</p> <p>You also have the ability to use a variety of different types of connectors.</p> <p>The instruments ship with SMA type adapters installed.</p>
AC output (option AC, AWG70001B only)	<p>This connector supplies a single-ended analog signal. The AC output provides for additional amplification and attenuation of the output signal.</p> <p>The AC output LED lights to indicate when the AC output is enabled and the output is electrically connected. The LED color matches the user defined waveform color.</p> <div style="text-align: center;"> </div> <p>The output connector utilizes the Planar Crown® Universal Connector System providing you the ability to easily replace a damaged connector.</p> <p>You also have the ability to use a variety of different types of connectors.</p>

Operation basics

Connector	Description
Marker outputs AWG70001B – CH1 Markers AWG70002B – CH1 and CH2 Markers	These SMA type connectors supply marker signals, two markers for each channel. The marker LEDs light when the corresponding channel is enabled and the outputs are electrically connected. Marker LEDs are always white.
USB	Two USB connectors. When OFF is lighted, the front USB connectors have been disabled from the Utilities > Preferences menu.
Removable hard disk drive (HDD)	The HDD contains the operating system, product software and all user data. By removing the HDD, user information such as setup files and waveform data is removed from the instrument.
Chassis ground	Banana type ground connection.



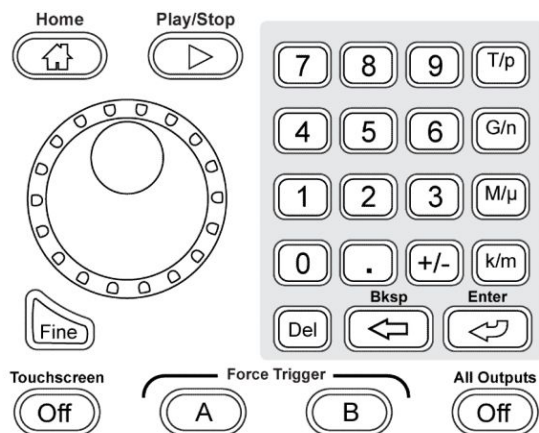
CAUTION. Always turn off the signal outputs when you connect or disconnect cables to/from the signal output connectors. Use the All outputs off button (either the front-panel button or the screen button) to quickly disable the Analog, Marker, and Flag outputs. When the All outputs off is enabled, the output connectors are electrically disconnected from the instrument.

Do not connect a DUT to the front-panel signal output connectors when the instrument signal outputs are on.

Do not power on or off the DUT when the arbitrary waveform generator signal outputs are on.

Front-panel controls

The following illustration and table describe the front panel controls.



Buttons/Keys	Description
Home	The Home button returns the graphical interface to the home screen of the current mode (AWG or Functions).
Play/Stop	The Play button starts or stops playing the waveform. The Play button changes to indicate the waveform play out status. When a waveform is playing, it is only present at the output connectors if the following conditions are met. <ul style="list-style-type: none"> ■ The channel is enabled. ■ The All Outputs Off is not active (outputs are connected).

Buttons/Keys	Description
General purpose knob	<p>The general purpose knob is used to increment or decrement values when a setting is enabled (selected) for change.</p> <p>Push the knob to toggle the Fine mode on and off, increasing or decreasing the change resolution of the general purpose knob.</p> <p>NOTE. <i>The general purpose knob operation mimics the actions of the up and down arrow keys on a keyboard as defined by the Windows operating system. Because of this, rotating the knob when a desired control is not selected may result in seemingly odd behavior of the control or accidental changes to some other control.</i></p>
Fine	The Fine button increases the resolution of the general purpose knob.
Numeric keypad	<p>The numeric keypad is used to directly enter a numeric value into a selected control setting.</p> <p>Units prefix buttons (T/p, G/n, M/μ, and k/m) are used to complete an input with the numeric keypad. You can complete your entry by pushing one of these prefix buttons (without pressing the Enter key).</p> <p>If you push the units prefix buttons for frequency, the units are interpreted as T (tera-), G (giga-), M (mega-), or k (kilo-). If you push the buttons for time or amplitude, the units are interpreted as p (pico-), n (nano-), μ (micro-), or m (milli-).</p>
Touchscreen Off	<p>The Touchscreen Off button enables or disables touchscreen control. When disabled, the button lights.</p> <p>When the touchscreen is enabled, you can use your finger or the stylus to control all operations of the instrument from the display. The touchscreen can be used alone or in combination with the mouse and front-panel controls.</p> <p>When the touchscreen is disabled, you can still access the on-screen menus with a mouse or keyboard.</p> <p>NOTE. <i>The stylus must be of the conductive type designed for projected-capacitance screens, such as commonly used with smart phones and tablets.</i></p> <p><i>If the instrument is powered on in Windows Safe Mode, the touchscreen is inoperative. You may need to use a mouse or keyboard to restore normal operation.</i></p>
Force Trigger (A or B)	The A or B Force Trigger buttons generate a trigger event. This is only effective when the Run mode is set to Triggered or Triggered Continuous.
All Outputs Off	<p>The All Outputs Off button provides a quick disconnect of the Analog, Marker, and Flag outputs, whether those outputs are enabled or not. (All Outputs Off overrides the output enable controls.)</p> <p>When activated, the button lights, the outputs are electrically disconnected, and the channel and marker output front-panel lights are turned off.</p> <p>When the All Outputs Off is deactivated, the outputs return to their defined state.</p>

Rear panel connectors

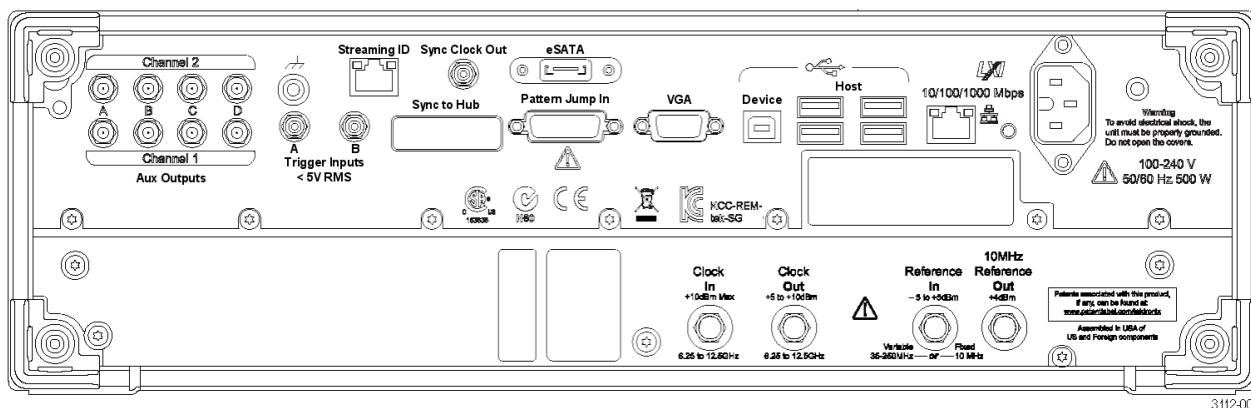


Table 2: Rear-panel connectors

Connector	Description
Aux Outputs	SMB connectors configurable to supply either output flags to mark the state of sequences or output a timer. These outputs are not affected by the All Outputs Off state.
Streaming ID	RJ-45 connector to stream instructions to the sequencer.
Sync Clock Out	SMA type connector to provide a synchronization signal to external devices.
eSATA	eSATA port to connect external SATA devices to the instrument.
LAN	RJ-45 connector to connect the instrument to a network.
VGA	VGA video port to connect an external monitor to view a larger copy of the instrument display (duplicate) or to extend the desktop display. To connect a DVI monitor to the VGA connector, use a DVI-to-VGA adapter.
USB Host	Four USB Host connectors (type A) to connect devices such as a mouse, keyboard, or other USB devices. Tektronix does not provide support or device drivers for USB devices other than the supplied mouse and keyboard.
USB Device	USB Device connector (type B) interfaces with the TEK-USB-488 GPIB to USB adapter and provides connectivity with GPIB based control systems.
Pattern Jump In	15-pin DSUB connector to provide a pattern jump event for Sequencing (Option 03).
Sync to Hub	Connector for use with the AWGSYNC01 Synchronization Hub, providing the ability to synchronize the outputs of up to four AWG70000B Series instruments.
Clock In	SMA type connector to provide an external clock signal.
Clock Out	SMA type connector to provide a high speed clock that is related to the sample rate.
Reference In	SMA type input connector to provide a reference timing signal (variable or fixed).
10MHz Reference Out	SMA type output connector to provide a 10 MHz reference timing signal.
Trigger Inputs A and B	SMA type input connectors for external trigger signals.
Power	Power cord input.

Touchscreen interface

The arbitrary waveform generator offers a touchscreen interface that you can use to access all features and controls.

Enable or disable the touchscreen interface by pushing the front-panel Touchscreen button.



When the touchscreen is in the Off state, the LED is lighted. On-screen menus are then operated via the front panel, keyboard, or mouse.

Run state control

Start and stop the waveform play out (run state) using the Play button. Start the waveform play out using the Play button, but no signal is output through the Analog Output connectors unless the Channel output is enabled.

Run state status indicators (screen Play/Stop button)

The play button in the graphical interface changes appearance to indicate the waveform play out status. Below are the various indicators.

Indicator	Description
	Not lighted – stopped (or idle) with no waveforms being played.
	Green with sine wave – currently playing a waveform.
	Green with T symbol – waiting for a trigger event to begin waveform play out.
	Yellow with clock symbol – the instrument is busy and play out is temporarily inhibited.
	Red – An error is preventing waveform play out.

Run state status indicators (front-panel Play/Stop button)



The front-panel play button changes appearance to indicate the waveform play out status. Below are the various indicators.

Indicator	Description
Not lighted	Stopped (or idle) with no waveforms being played.
Green	Currently playing a waveform.
Flashing green	Waiting for a trigger event to begin waveform play out.
Amber	The instrument is busy and play out is temporarily inhibited.
Red	An error is preventing the waveform play out.

Run mode

The AWG supports the following Run modes:

Continuous. Waveform play out starts when the Play button is pressed, without the need for a trigger event.

Triggered. Waveform play out starts when a proper external trigger event occurs or a Force Trig (A or B) button is pressed. Waveform play out stops after one complete waveform cycle.

Waveform play out can not be retrIGGERed until the current waveform play out completes an entire cycle. For two channel instruments, both waveforms must complete a cycle.

Pressing a **Force Trig (A or B)** button has no effect if play out is in process.

Triggered Continuous. Waveform play out starts when a proper external trigger event occurs or a Force Trig (A or B) button is pressed. Once a trigger event occurs, waveform play out continues until stopped by the user.

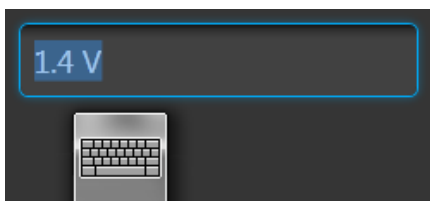
Changing control settings

As you configure the instrument, you might need to set a numerical parameter such as an amplitude level or offset. To set these parameters in a screen window, touch or click the parameter to select it. Once the parameter is selected, the general purpose knob is assigned to the parameter.

Use the general purpose knob to change parameters, although the following methods are generally available.

- Some parameters supply a pop-up keyboard that you can use to enter a new value.

Touch or click the keyboard icon to display the keyboard.

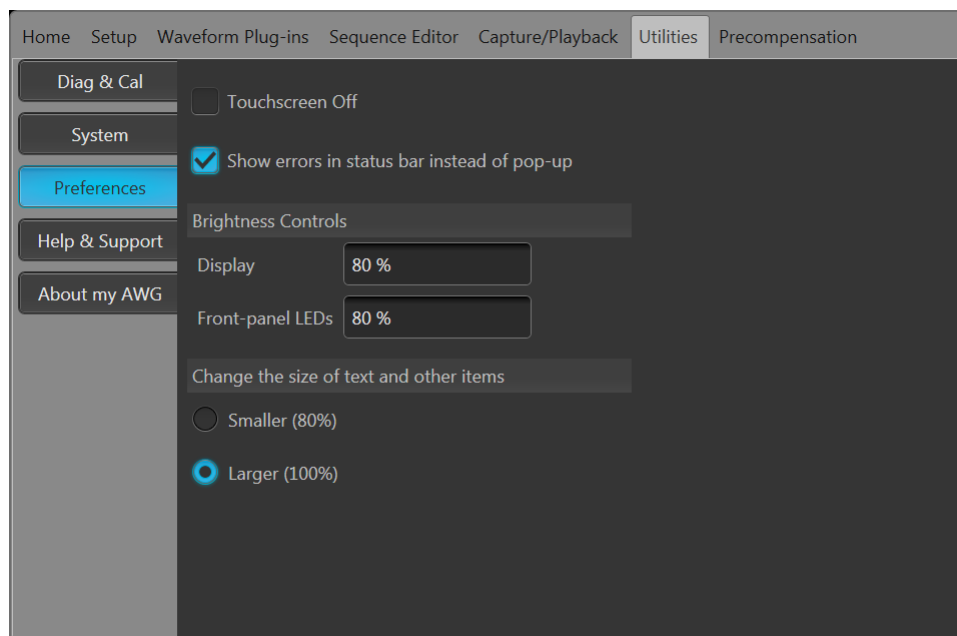


- Enter the desired value using the numeric keypad on the front panel or with an attached USB keyboard.

Preferences

Use the Preferences to set certain instrument characteristics that are retained for each subsequent power on. The Preferences screen also contains the instrument's security settings.

In the toolbar, go to Utilities > Preferences to access user preferences.



Touchscreen control. You can choose to disable the instrument's touchscreen.

Error display control. You can choose to disable all error pop-up screens. When enabled, errors messages are displayed in the status bar at the bottom of the display.

Brightness controls. Adjust the brightness levels of the display and front panel LEDs.

NOTE. Marker front panel LEDs are not adjustable.

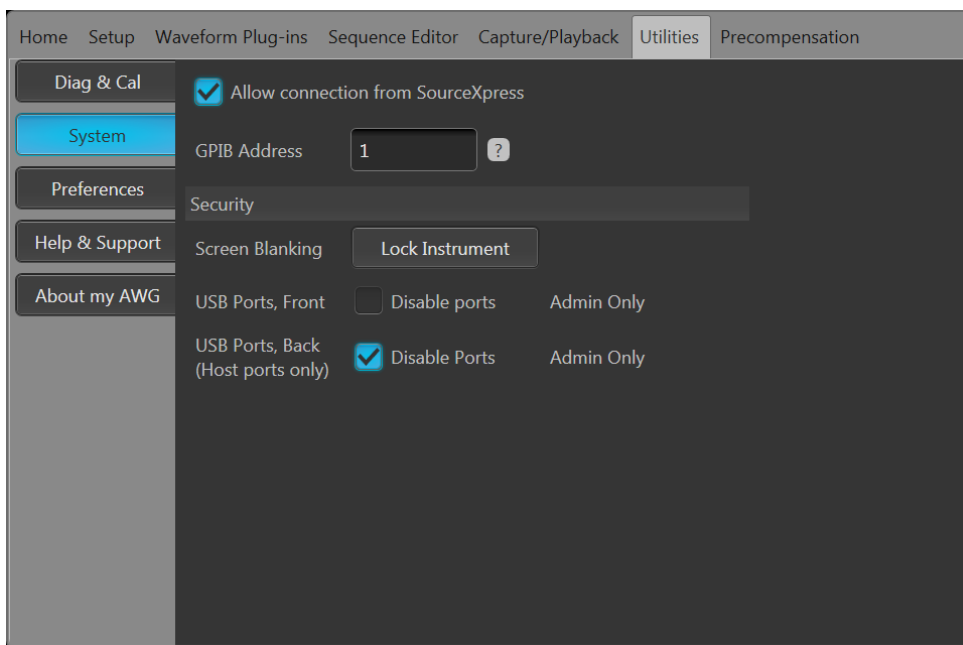
Display size control. You can choose to reduce the display size of all text and dialog screens.

NOTE. The display size control performs the same function as the Font size control located on the tool bar.

System

Use System to set certain instrument characteristics that are retained for each subsequent power on. The System screen also contains the instrument's security settings.

In the toolbar, go to Utilities > System.



SourceXpress connection. You can choose to disable the ability of the external SourceXpress application to connect to the instrument. SourceXpress has the ability to connect to, and control, the instrument directly from its interface. This setting is retained for subsequent power on cycles.

GPIB. You can enter a unique GPIB address here. If changing the address, you must disconnect and reconnect the external USB-to-GPIB converter.

Security. Adjust the security settings for the instrument.

- **Lock Instrument.** Displays the Windows lock screen. The programmable interface is not affected.
- **USB Ports, Front.** Allows you to disable the front panel USB ports.
- **USB Ports, Back** Allows you to disable the rear panel Host USB ports.

Restoring instrument operating system and product software

You can restore the instrument's Windows Operating System directly from the instrument. The instrument does not ship with an operating system restore disc.

To restore or update the AWG product software, you need to download the current version from the Tektronix web site.

NOTE. Restoring or updating the AWG product software does not require that you restore the Windows operating system.

Operating system restore



CAUTION. Restoring the operating system reformats the hard disk drive. The product software and all user data will be lost. (The Acronis Recovery partition and the related data are not destroyed.)

The Windows operating system installed is designed for this instrument's hardware and product software. Installing a version other than the one provided will not function properly.

After the operating system is installed, you need to download the AWG70000 Series Product Software installation package from the [Tektronix web site](#) and reinstall the software.

Internal recovery utility

This is the preferred method to restore a damaged Windows Operating System. This method restores the Windows Operating System using the Acronis Startup Recovery Manager. The Acronis software reinstalls the operating system using restore images preinstalled on the hard drive.

This method retains the restore images, providing the ability to repeat the restore process.

1. Attach the keyboard to the instrument.
2. Restart the instrument. During the boot-up process you will see the following message at the top of the screen:

Starting Acronis Loader... press F5 for Acronis Startup Recovery Manager

3. Repeatedly press the F5 key until the Acronis True Image Tool opens. There is a 15-second time period from when the message appears until the instrument proceeds with the normal instrument startup. If the instrument does not open the Acronis application, power off the instrument, then power on the instrument and try again.
4. Within the Acronis TrueImage window, click Restore.
5. In the Confirmation dialog box, click Yes to restore the instrument operating system, or No to exit the restore process.

AWG product software installation

1. Download the AWG70000 Series product software installation package. The installation package contains:
 - Instructions
 - AWG70000 Series product software installer
 - TekVISA Connectivity software installer

NOTE. Tektronix recommends using the version of TekVISA supplied with the product software installation package. This is the version verified for use.

2. Install the AWG70000 Series product software following all on-screen prompts.
3. Install the TekVISA Connectivity software, following all on-screen prompts.

Basic guidelines to play a waveform

The Arbitrary Waveform Generator provides many controls and options that you can use when preparing to play a waveform.

Here are some basic guidelines and tips to help obtain your goal of playing a waveform. Refer to the instrument's help system for more detail about instrument controls and functions.

- Load a waveform (or waveforms) into the waveform list.
- Assign a waveform (from the waveform list) to a channel.
- Set the Run mode, see [Run mode](#) on page 26. If using a triggered run mode, supply the necessary trigger event.
- Enable the channel output.
- Make sure All Outputs Off control is not active.
- Press the Play button (front-panel or screen).
- To deal with problems or errors, refer to the instrument help system.

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