Tektronix AWG5200 Arbitrary Waveform Generator User Manual

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This document provides the AWG5200 safety and compliance information, powering the oscilloscope, and introduces the instrument controls and connections.

Contents

Documentation

Review the following user documents before installing and using your instrument. These documents provide

important operating information.

Product documentation

The following table lists the primary product specific documentation available for your product. These and other user documents are available for download from **www.tek.com.** Other information, such as demonstration guides, technical briefs, and application notes, can also be found at **www.tek.com.**

Document	Content
Installation and Safety Instructions	Safety, compliance, and basic introductory information for hardware products.
Help	In-depth operating information for the product. Availabl e from the Help button in the product UI and as a down loadable PDF on **www.tek.com/downloads**.
User Manual	Basic operating information for the product.
Specifications and Performance Verification Technical Reference	Instrument specifications and performance verification instructions for testing instrument performance.
Programmer Manual	Commands for remotely controlling the instrument.
Declassification and Security Instructions	Information about the location of memory in the instru ment. Instructions for declassifying and sanitizing the i nstrument.
Service Manual	Replaceable parts list, theory of operations, and repair and replace procedures for servicing an instrument.
Rackmount Kit Instructions	Installation information for assembling and mounting a n instrument using a specific rackmount.

How to find your product documentation and software

1. Go to **www.tek.com**.
2. Click Download in the green sidebar on the right side of the screen.
3. Select Manuals or Software as the Download Type, enter your product model, and click Search.
4. View and download your product files. You can also click the Product Support Center and Learning Center links on the page for more documentation

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.
To safely perform service on this product, see the Service safety summary that follows the General safety summary

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.

Before use, always check the product with a known source to be sure it is operating correctly.

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.

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 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.
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.

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.

WARNING: The product is heavy. Use a two-person lift or a mechanical aid.

Use only the Tektronix rackmount hardware specified for this product.

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

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(s) may appear on the product.

- **CAUTION**
  Refer to Manual
-  Protective ground (Earth) Terminal
-  Standby
-  Chassis Ground

Compliance information

This section lists the 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.

Compliance questions may be directed to the following address:

Tektronix, Inc.
PO Box 500, MS 19-045
Beaverton, OR 97077, USA
tek.com

Safety compliance

This section lists the safety compliance information.

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.

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

Operating requirements

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.

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	750 W

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)

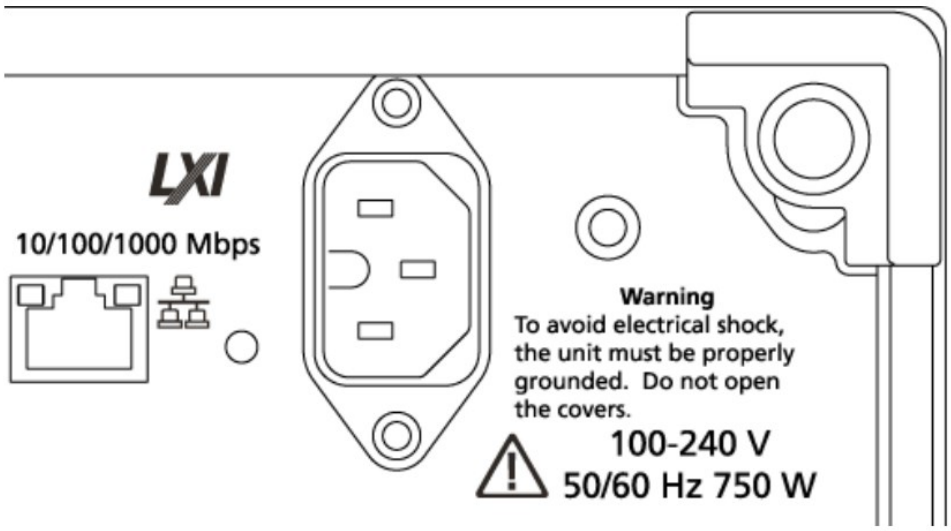
Install the instrument

Unpack the instrument and check that you received all items listed as Standard Accessories. Check the Tektronix Web site **www.tektronix.com** for the most current information.

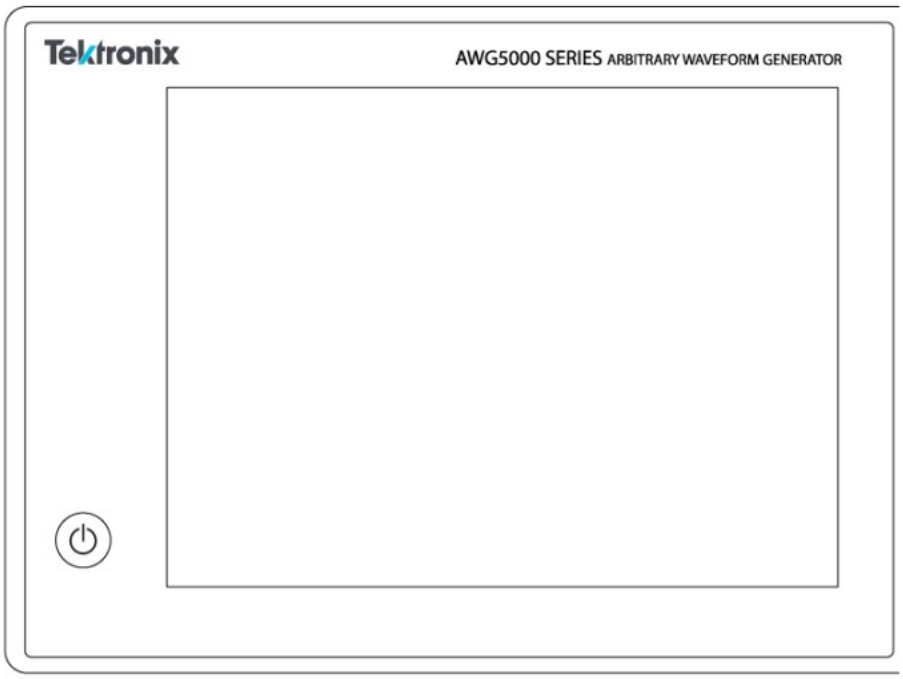
Power on the instrument

Procedure

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)

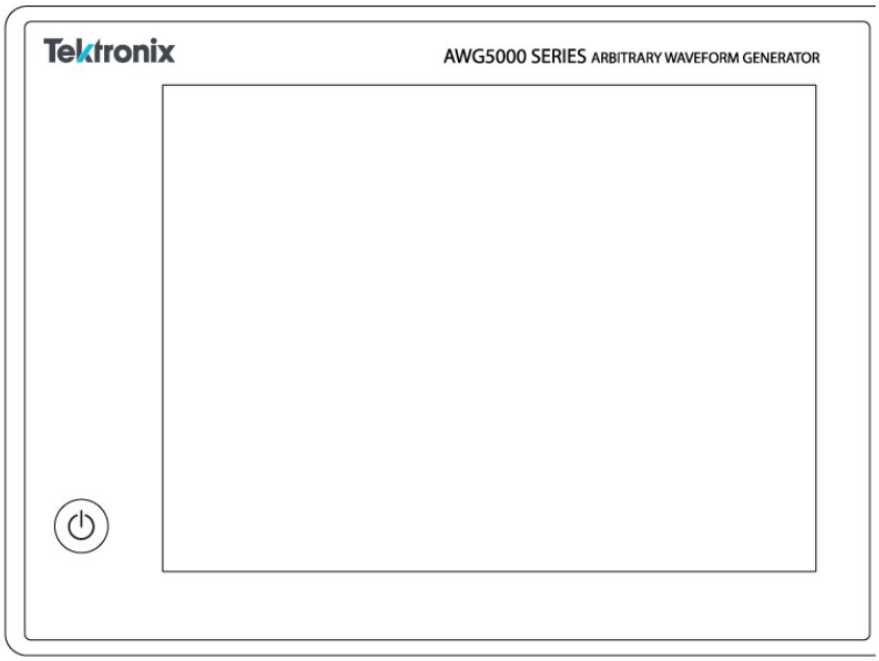
Power off the instrument

Procedure

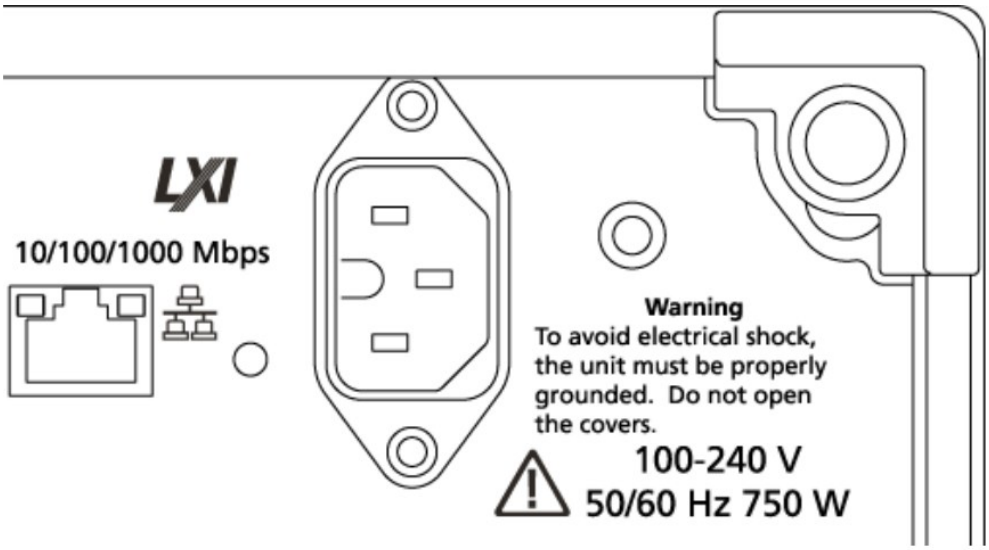
1. Press the front-panel power button to shut down the instrument.
   The shutdown process takes approximately 30 seconds to complete, placing the instrument in standby mode. Alternatively, use the Windows Shutdown menu.

   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.



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 a keyboard and mouse (provided). A mouse and keyboard can substitute for the touchscreen and 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.

External device connections

For many applications, powered external devices may need to be used on the output of the AWG. These may include Bias-Ts, Amplifiers, transformers etc. It is important to guarantee that these components are adaptable for the specific AWG and that they are configured as required by the device manufacturer.

⚠ **Note:** The term Device means external powered devices such as bias-t, whereas Device Under Test (DUT) refers to the circuit being tested.

It is critical that there is minimal inductive kickback into the AWG output when the device is connected or disconnected. Inductive kickback can occur if the external device can hold a charge and then discharge when a ground path becomes available such a connection to the output termination of the AWG channel output. To minimize this inductive kickback care should be taken before connecting the device to the AWG output.

Some simple guidelines to follow for device connection are:

1. Always use a grounded wrist strap when connecting cables.
2. Make sure the power supply to the device is turned off or unplugged.
3. Establish ground connection between the device and AWG test system.
4. Make sure the DUT's power supply is turned off or set at 0 volts.
5. Discharge cables to ground before connecting to the AWG.
6. Engage connector between device and AWG output.
7. Power up device power supply.
8. Set device voltage power supply (bias level voltage for bias-t) to desired voltage.
9. Power up DUT power supply

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 AWG5200 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.

Introduction to the instrument

Connectors and controls are identified and described in the following images and text.

Front-panel connectors

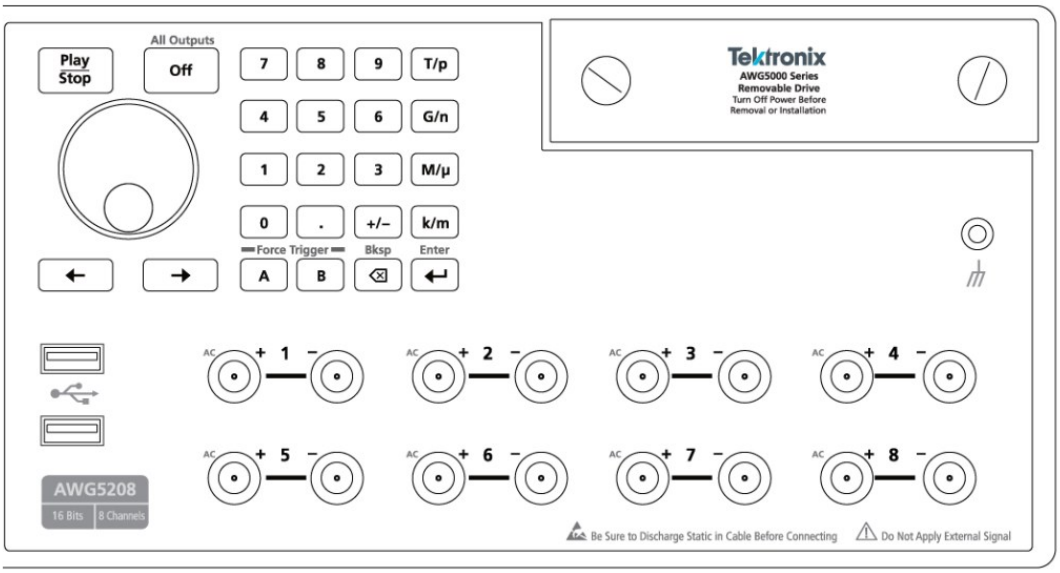


Table 1: Front-panel connectors

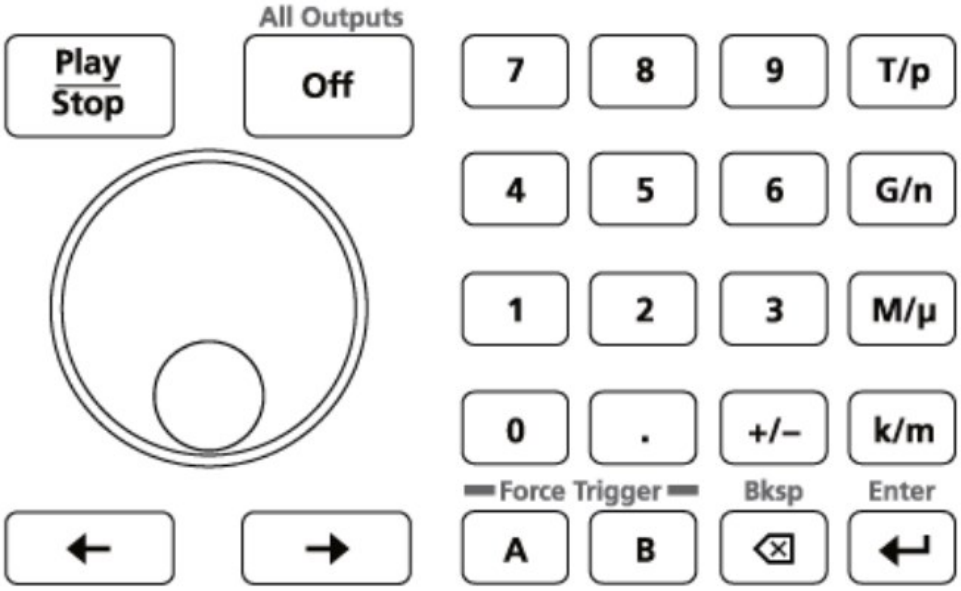
Connector	Description
Analog outputs (+ and –) AWG5202 – Two channels AWG5204 – Four channels AWG5208 – Eight channels	These SMA type connectors supply the complimentary (+) and (-) analog output signals. The channel LEDs light to indicate when the channel i s enabled and the output is electrically connected. The LED color matches the user defined waveform color. The channel (+) and (-) connectors are electrically disc onnected when the All Outputs Off control is activated.
AC outputs (+)	The (+) connector of each channel can supply a single -ended analog signal when an AC output mode is activ ated for the channel. The AC output provides for additi onal amplification and attenuation of the output signal. The (-) connector of the channel is electrically disconn ected. For best EMI reduction, install a 50 Ω terminatio n to the (-) connector when using the AC output mode.
USB	Two USB2 connectors
Removable hard disk drive (HDD)	The HDD contains the operating system, product softw are and all user data. By removing the HDD, user infor mation such as setup files and waveform data is remo ved 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 and Marker outputs. (Marker outputs are located on the rear panel.) 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 generator signal outputs are on.

Front-panel controls

The following illustration and table describe the front panel controls.



Buttons/Keys	**Description**
Play/Stop	The Play/Stop button starts or stops playing the waveform. The Play/Stop button displays the following lights: • No light – no waveform playing • Green – playing a waveform • Flashing green – preparing to play a waveform • Amber – play out temporarily inhibited due to a settings change • Red – Error preventing play out When a waveform is playing, it is only present at the output connectors if the following conditions are met: • The channel is enabled. • The All Outputs Off is not active (outputs are connected).

General purpose knob	The general purpose knob is used to increment or dec rement values when a setting is enabled (selected) for change. ⚠ **Note**: The general purpose knob operation mi mics the actions of the up and down arrow keys on a k eyboard as defined by the Windows operating system. Because of this, rotating the knob when a desired cont rol is not selected may result in seemingly odd behavior of the control or accidental changes to some other control.
Numeric keypad	The numeric keypad is used to directly enter a numeric value into a selected control setting. Units pre fix buttons (T/p, G/n, M/µ, and k/m) are used to comple te an input with the numeric keypad. You can complete your entry by pushing one of these prefix buttons (with out pressing the Enter key). If you push the units prefix buttons for frequency, the units are interpreted as T (te ra-), 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-).
Left and Right Arrow buttons	Use the arrow buttons to change (select) the focus of t he cursor in the Frequency control box when and IQ w aveform is assigned to the channel. The Digital Up Co nverter (DIGUP) must be licensed to assign IQ wavefo rms to a channel.
Force Trigger (A or B)	The A or B Force Trigger buttons generate a trigger ev ent. This is only effective when the Run mode is set to Triggered or Triggered Continuous
All Outputs Off	The All Outputs Off button provides a quick disconnect of the Analog, Marker, and Flag outputs, whether thos e outputs are enabled or not. (All Outputs Off overrides the channel output enable controls.) When activated, the button lights, the outputs are elect rically disconnected, and the channel output front-panel lights are turned off. When the All Outputs Off is deactivated, the outputs re turn to their previously defined state.

Rear-panel connectors

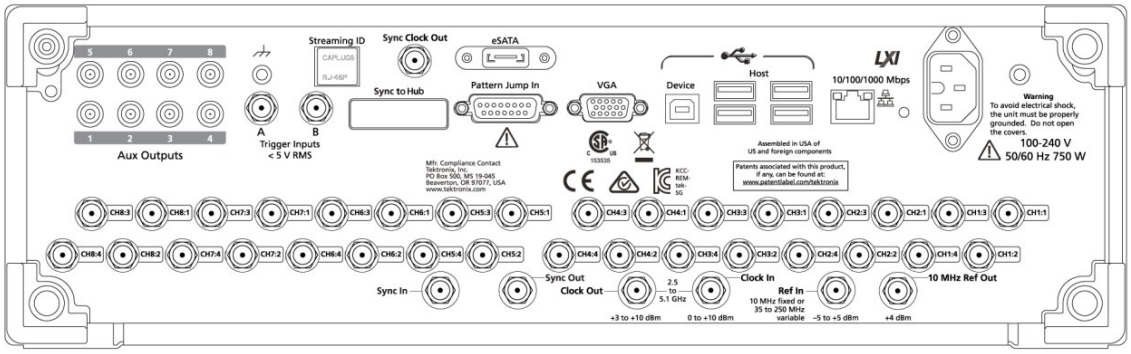


Table 2: Rear-panel connectors

Connector	Description
Aux Outputs AWG5202 – Four AWG5204 – Four AWG5208 – Eight	SMB connectors to supply output flags to mark the stat e of sequences. These outputs are not affected by the All Outputs Off s tate.
Chassis ground	Banana type ground connection.
Trigger Inputs A and B	SMA type input connectors for external trigger signals.
Streaming ID	RJ-45 connector for future enhancement.
Sync Clock Out	SMA type output connector used to synchronize the o utputs of multiple AWG5200 series generators. This output is not affected by the All Outputs Off state.
Sync to Hub	Connector for future enhancement.
eSATA	eSATA port to connect external SATA devices to the in strument
Pattern Jump In	15-pin DSUB connector to provide a pattern jump event for Sequencing. (Requires SEQ license.)
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 t o the VGA connector, use a DVI-to-VGA adapter.
USB Device	USB Device connector (type B) interfaces with the TE K-USB-488 GPIB to USB adapter and provides connectivity with GPIB based control systems.
USB Host	Four USB3 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 optional mouse and keyboard.
LAN	RJ-45 connector to connect the instrument to a networ k
Power	Power cord input

Marker outputs	SMA type output connectors for marker signals. Four per channel. These outputs are affected by the All Outputs Off state.
Sync In	SMA type connector to use a synchronization signal from another AWG5200 series instrument
Sync Out	Connector for future enhancement.
Clock Out	SMA type connector to provide a high speed clock that is related to the sample rate. This output is not affected by the All Outputs Off state.
Clock In	SMA type connector to provide an external clock signal.
Ref In	SMA type input connector to provide a reference timing signal (variable or fixed).
10 MHz Ref Out	SMA type output connector to provide a 10 MHz reference timing signal. This output is not affected by the All Outputs Off state.

Cleaning the instrument

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

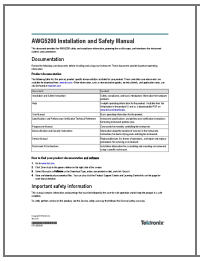
⚠ **WARNING:** To avoid personal injury, power off the instrument and disconnect it from line voltage before performing any of the following procedures.

⚠ **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.

Procedure

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 spay liquids directly on the instrument.

Documents / Resources



	Tektronix AWG5200 Arbitrary Waveform Generator [pdf] User Manual AWG5200, Arbitrary Waveform Generator, AWG5200 Arbitrary Waveform Generator, Waveform Generator, Generator

References

- Product Take-Back and Recycle Program | Tektronix
- Test and Measurement Equipment | Tektronix
- dtsc.ca.gov/
- dtsc.ca.gov/hazardouswaste/perchlorate
- dtsc.ca.gov/hazardouswaste/perchlorate
- Test and Measurement Equipment | Tektronix
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