AWG5000B and AWG7000B Series Arbitrary Waveform Generators

Quick Start User Manual

071-2481-01

Tektronix

AWG5000B and AWG7000B Series Arbitrary Waveform Generators

Quick Start User Manual

This document supports software version 3.1.

www.tektronix.com

071-2481-01

Tektronix

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Contacting Tektronix

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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.tektronix.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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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

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

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

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

Power Disconnect. The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

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

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

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

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

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

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.*

Symbols and 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.

The following symbol(s) may appear on the product:

Compliance Information

This section lists the EMC (electromagnetic compliance), safety, and environmental standards with which the instrument complies.

EMC Compliance

EC Declaration of Conformity – EMC

Meets intent of Directive 2004/108/EC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61326-1 2006. EMC requirements for electrical equipment for measurement, control, and laboratory use. [1] [2] [3]

- CISPR 11:2003. Radiated and conducted emissions, Group 1, Class A
- IEC 61000-4-2:2001. Electrostatic discharge immunity
- IEC 61000-4-3:2002. RF electromagnetic field immunity
- IEC 61000-4-4:2004. Electrical fast transient / burst immunity
- IEC 61000-4-5:2001. Power line surge immunity
- IEC 61000-4-6:2003. Conducted RF immunity
- IEC 61000-4-11:2004. Voltage dips and interruptions immunity

EN 61000-3-2:2006. AC power line harmonic emissions

EN 61000-3-3:1995. Voltage changes, fluctuations, and flicker

European Contact.

Tektronix UK, Ltd.
Western Peninsula
Western Road
Bracknell, RG12 1RF
United Kingdom

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 **To ensure compliance with the EMC standards listed here, high quality shielded interface cables 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:

- CISPR 11:2003. Radiated and Conducted Emissions, Group 1, Class A, in accordance with EN 61326-1:2006.

Safety Compliance

EC Declaration of Conformity – Low Voltage

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

Low Voltage Directive 2006/95/EC.

- EN 61010-1: 2001. Safety requirements for electrical equipment for measurement control and laboratory use.

U.S. Nationally Recognized Testing Laboratory Listing

- UL 61010-1:2004, 2nd Edition. Standard for electrical measuring and test equipment.

Canadian Certification

- CAN/CSA-C22.2 No. 61010-1:2004. Safety requirements for electrical equipment for measurement, control, and laboratory use. Part 1.

Additional Compliances

- IEC 61010-1: 2001. Safety requirements for electrical equipment for measurement, control, and laboratory use.

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

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

Installation (Overvoltage) Category Descriptions

Terminals on this product may have different installation (overvoltage) category designations. The installation categories are:

- Measurement Category IV. For measurements performed at the source of low-voltage installation.
- Measurement Category III. For measurements performed in the building installation.
- Measurement Category II. For measurements performed on circuits directly connected to the low-voltage installation.
- Measurement Category I. For measurements performed on circuits not directly connected to MAINS.

Overvoltage Category

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

Environmental Considerations

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

Product End-of-Life Handling

Observe the following guidelines when recycling an instrument or component:

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

This symbol indicates that this product complies with the applicable European Union requirements according to Directives 2002/96/EC and 2006/66/EC on waste electrical and electronic equipment (WEEE) and batteries. For information about recycling options, check the Support/Service section of the Tektronix Web site (www.tektronix.com).

Mercury Notification. This product uses an LCD backlight lamp that contains mercury. Disposal may be regulated due to environmental considerations. Please contact your local authorities or, within the United States, refer to the E-cycling Central Web page (www.eiae.org) for disposal or recycling information.

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.

Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive.

Preface

This manual describes the installation and operation of AWG5000 and AWG7000 series instruments. Basic operations and concepts are presented in this manual. For more detailed information, see the online help on your instrument. The following instruments are supported by this manual:

AWG7121B	AWG7122B	AWG7061B	AWG7062B
AWG5012B	AWG5014B	AWG5002B	AWG5004B

Key Features

The following table and list describe the key features of the AWG5000 and AWG7000 series instruments.

Model	AWG7121B/ AWG7122B	AWG7061B/ AWG7062B	AWG5012B/ AWG5014B	AWG5002B/ AWG5004B
Maximum Sampling Rate	12 GS/s (24 GS/s by interleave)	6 GS/s	1.2 GS/s	600 MS/s
D/A Resolution	8 bits or 10 bits (selectable)		14 bits	
Waveform Length	32,400,000 or 64,800,000 (Option 01)		16,200,000 or 32,400,000 (Option 01)	
Analog Output	1 or 2		2 or 4	
Maximum Amplitude and Analog Bandwidth	2 Vp-p, 750 MHz (Direct Output: off) 1 Vp-p, 3.5 GHz (Direct Output: on) 1 Vp-p, 7.5 GHz (Option 02 or Option 06)		4.5 Vp-p, 230 MHz (Direct Output: off) 2 Vp-p, 250 MHz (Direct Output: off) 0.6 Vp-p, 370 MHz (Direct Output: on)	
Marker Output [1]	2 or 4		4 or 8	
Digital Data Output	N/A		28 bits (Option 03)	

[1] When 10 bits DAC resolution is selected in the AWG7000 series, Marker Output is disabled.

- Windows XP Professional operation system
- Extended analog output bandwidth (Option 02), AWG7000 series
- 28 bits digital data output (Option 03), AWG5012B and AWG5002B only
- Interleave and extended analog output bandwidth (Option 06), AWG7122B only
- Fast sequence switching (Option 08)
- A large 10.4 inch (264.2 mm) high resolution XGA color display
- An intuitive, graphical user interface (UI), with built-in online help
- Removable hard disk drive
- Supports USB 2.0 interface
- LAN (1000/100/10 Base-T)
- Touch screen user interface

Documentation

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

To read about	Use these documents
Installation and Operation (overviews)	Read the Quick Start User Manual for general information about how to use your instrument.
In-depth Operation and User Interface Help	Access the user online help from the Help menu for information on virtually all controls and elements on screen. Online help includes detailed instructions for using instrument functions. (See page 19, *Accessing Online Help*.)
Programmer Commands	Access the programmer online guide from the Help menu. The programmer guide includes the syntax of remote commands.
Specifications and Performance Verification Procedures	Read the Technical Reference for specifications and the performance verification procedure. The Technical Reference PDF file is on the Document CD.

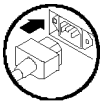
Conventions Used in this Manual

The following icons are used throughout this manual.

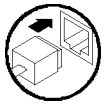
Sequence Step

Front panel power

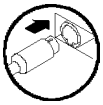
Connect power



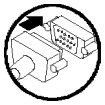
Network



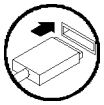
PS2



SVGA



USB



Installing Your Instrument

Unpack the instrument and check that you received all items listed as Standard Accessories. Recommended accessories and instrument options are listed in the online help. Check the Tektronix Web site (www.tektronix.com) for the most current information.

Standard Accessories

Accessory	Tektronix part number
AWG5000B and AWG7000B Series Quick Start User Manual	
English (Option L0)	071-2481-xx
Japanese (Option L5)	071-2482-xx
Simplified Chinese (Option L7)	071-2483-xx
Traditional Chinese (Option L8)	071-2484-xx
Russian (Option L10)	020-2971-xx
Product Software CD	020-2945-xx
Document CD	063-4134-xx
User Online Help (part of the product software)	---
Programmer Online Help (part of the product software)	---
1 Windows compatible keyboard	119-7083-00
1 Windows compatible mouse	119-7054-00
2 Stylus pens	119-6107-00
Lead Set for DC Output	012-1697-00
Front Protect Cover	200-4963-00
Accessory Pouch	016-1441-01
50 Ω SMA Termination, Male, DC to 18 GHz, 3 each/channel (AWG7000 series only)	015-1022-01
Power cord – one of the following:	
North America (Option A0)	161-0104-00
Universal Euro (Option A1)	161-0104-06
United Kingdom (Option A2)	161-0104-07
Australia (Option A3)	161-0104-14
Switzerland (Option A5)	161-0167-00
Japan (Option A6)	161-A005-00
China (Option A10)	161-0306-00
India (Option A11)	161-0324-00
No power cord or AC adapter (Option A99)	---

Operating Requirements

1. Place the instrument on a cart or bench, observing clearance requirements:
   - Top: 20 mm (0.8 in)
   - Left and right side: 150 mm (5.9 in)
   - Bottom: 20 mm (0.8 in)
   - Rear: 75 mm (3 in)
2. Before operating, ensure that the ambient temperature is between 10 °C and 40 °C (+50 °F to +104 °F), and warm up the instrument for 20 minutes.

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

Power Supply Requirements

Source Voltage and Frequency	Power Consumption
100 VAC to 240 VAC, 47 Hz to 63 Hz	Less than 450 W (AWG7000 series) Less than 560 W (AWG5000 series)

Cleaning

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

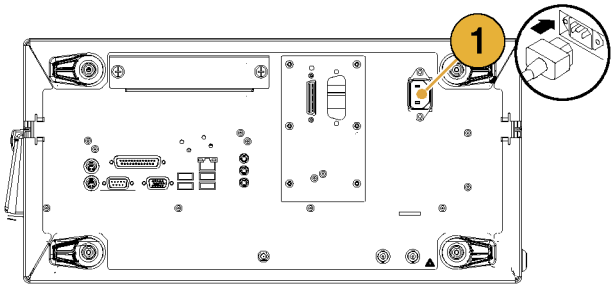
Inspect the arbitrary waveform generator as often as operating conditions require. To clean the exterior surface, perform the following steps:

1. Remove loose dust on the outside of 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. Use a 75% isopropyl alcohol solution as a cleaner.

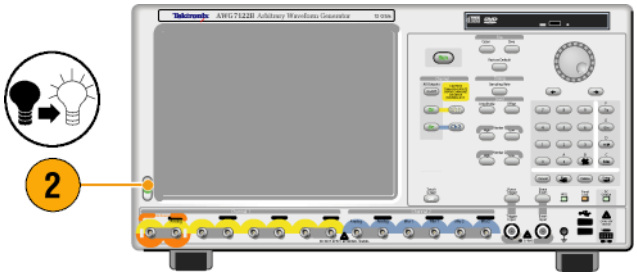
CAUTION. *To avoid damage to the surface of the arbitrary waveform generator, do not use any abrasive or chemical cleaning agents.*

Powering 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.

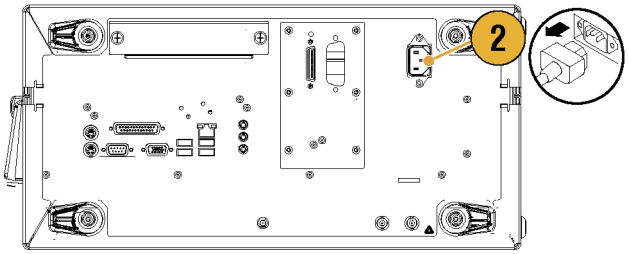


Powering Off the Instrument

1. Use the front-panel power button to start the shutdown process.

   Wait approximately 30 seconds for the instrument to power off.

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



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, WordPad, and Paint.

Follow these guidelines to avoid making operating system changes that might cause problems or annoyances while trying to use 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.
- Do not change the system Display Properties, such as the Background, Appearance, Effects, or Settings. Making such changes can affect the usability of the instrument and the touch screen.
- Do not change the contents of the Windows folder or the Program Files\Tektronix\AWG\ System folder.
- Do not change the BIOS settings; this can affect the overall operation of the instrument.

If you think that your Windows interface might cause problems with the instrument, contact your local Tektronix support center for assistance.

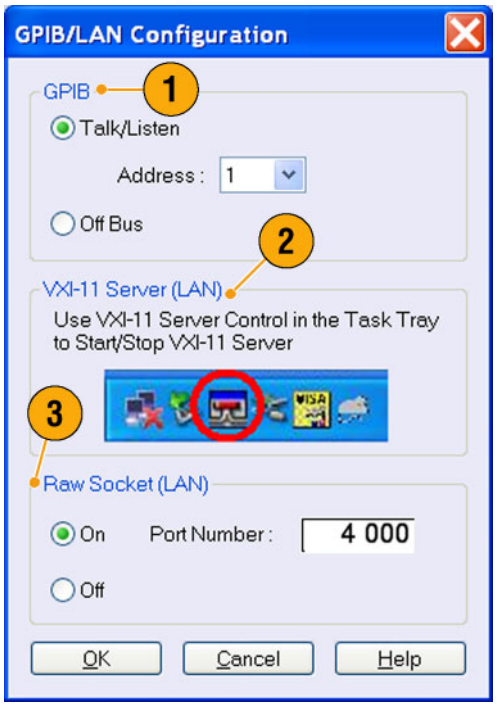
Connecting to a Network

You can connect your instrument to a network for printing, file sharing, Internet access, and other functions. Consult with your network administrator and use the standard Windows utilities to configure the instrument for your network. For setting GPIB or LAN configuration, use the GPIB/LAN Configuration dialog box from System menu.

Setting GPIB/LAN

Select **System** > **GPIB/LAN Configuration** to open the GPIB/LAN Configuration dialog box.

1. Set the instrument GPIB bus communication:
   - **Talk/Listen** – Select this mode to remotely control the instrument from an external host computer.
   - **Off Bus** – Select this mode to disconnect the instrument from the GPIB bus.
2. The instrument supports the VXI-11 Server (LAN). Use VXI-11 Server Control in the Task Tray to Start/Stop VXI-11 Server.
3. TCP/IP protocol is also supported. On and Off of socket communication are controlled here. The port number is fixed to 4000.



Quick Tip

- If you want to start the VXI-11 Server automatically at power-on, check the "Start server automatically at system power up" check box in the VXI-11 Server Control.
- The following operations cannot be performed through a GPIB or LAN connection:
  - Editing a waveform
  - Changing size or name of waveform
  - Converting the waveform format
  - Importing waveform data from the AWG5000 series and AWG7000 series setup (*.AWG) file
  - Importing a Tektronix DTG5000 series file (*.DTG)
  - Importing a Tektronix AWG400/500/600/700 series SEQ file
  - Exporting waveform data

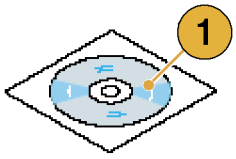
Controlling the Instrument Using a Remote PC

You can 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, you can edit waveforms easily using your keyboard and mouse. You can also use a third party software installed on your PC to create a waveform and import it through a network.

Offline Mode

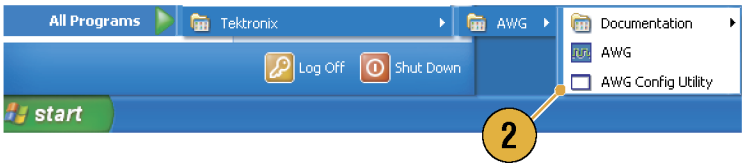
The Offline Mode is a function that you can use to run the instrument application on your PC. Install the application on your PC; the instrument hardware is not required. You can create and edit the instrument setups. The setup files that you create can be used later with your arbitrary waveform generator.

1. Use the Product Software CD provided with the instrument to install the AWG application to your PC.



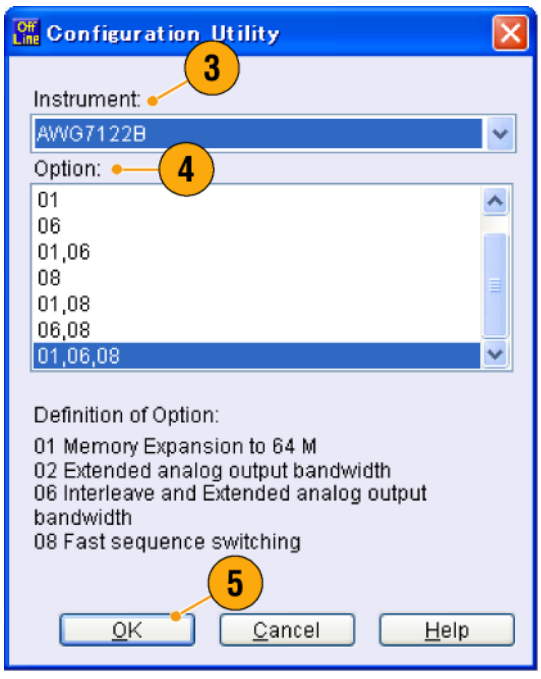
2. Before using the offline mode, you must set up the instrument configuration.

   From the Windows Start menu, select **All Programs** > **Tektronix** > **AWG** > **Config Utility**. The Configuration Utility dialog box appears.



3. Select your instrument type.
4. Select your instrument option configuration.
5. Click **OK**.

   Run the instrument application from the Start menu. The setup configuration you have made using the Configuration Utility will be reflected in the application.



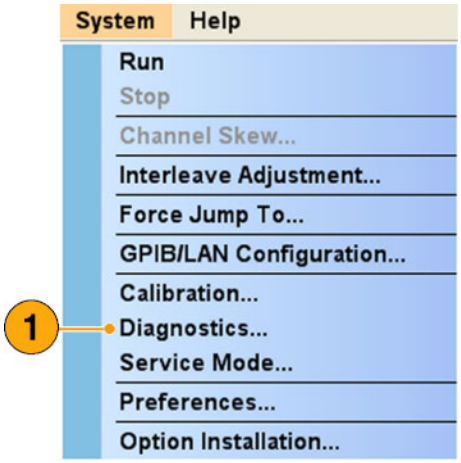
Inspecting Your Instrument

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

- Power-on self test – Every time you power on the instrument, the instrument automatically performs the internal diagnostics.
- Diagnostics from the System menu – You can also run the internal diagnostics using the System menu. Use the following procedures:

1. Select **System** > **Diagnostics...** from the menu bar.

   The Diagnostics dialog box appears.



2. Confirm that the **Loop** box is not checked.

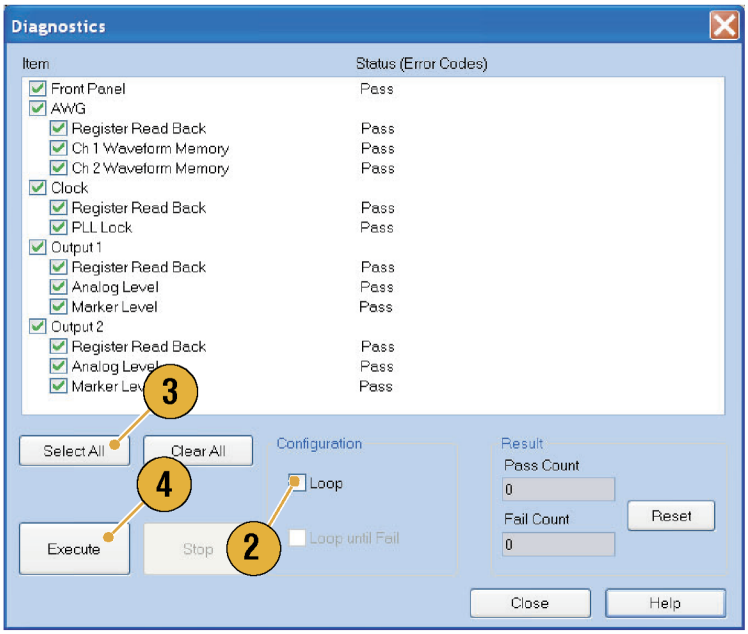
   If Loop is checked, the diagnostics runs until it is manually stopped.

3. If you click **Select All**, all diagnostic items are checked.

   You can execute all items together or you can execute only the selected item(s).

4. Click **Execute** to start the diagnostics.

   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 check electrical characteristics such as analog level and marker level, and then adjust the internal calibration constants as necessary. Marker level is checked only in the AWG7000 series instruments.

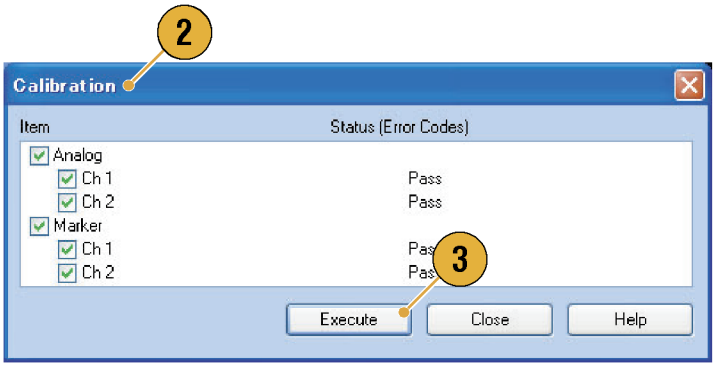
NOTE. *Power on the instrument and allow a 20 minute warm-up period before performing this procedure.*

1. Confirm that there is no output signal by verifying that the front-panel **Run** button indicator is off.

2. To perform the calibration suite, select **System** > **Calibration...** from the menu bar.

   The Calibration dialog box appears.

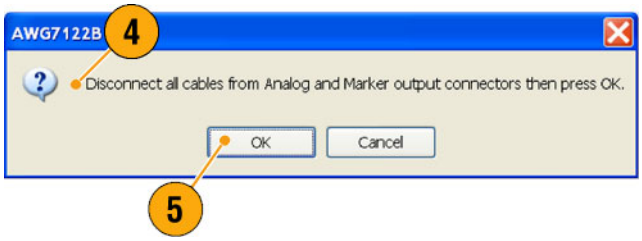
3. Select **Execute**.



4. A pop-up message asks you to remove all the cables from output connectors.

5. Remove the cables and then select **OK**. Wait until the calibration completes.

   For all calibration items, the Status control should indicate Pass. If it does not, contact your local Tektronix service personnel.



NOTE. *Self calibration is not valid until the instrument reaches a valid temperature. (See page 2, Operating Requirements.)*

NOTE. *If your instrument is an AWG7000 series, perform self calibration once a month to maintain the analog and marker output level accuracy. Failure to do so can prevent the instrument from meeting warranted performance levels for analog and marker output.*

If your instrument is an AWG5000 series, perform self calibration once a year to maintain the analog output level accuracy.

Preventing Instrument Damage

Overheat Protection

The internal instrument temperature is monitored and the instrument is protected against overheating damage by the following actions:

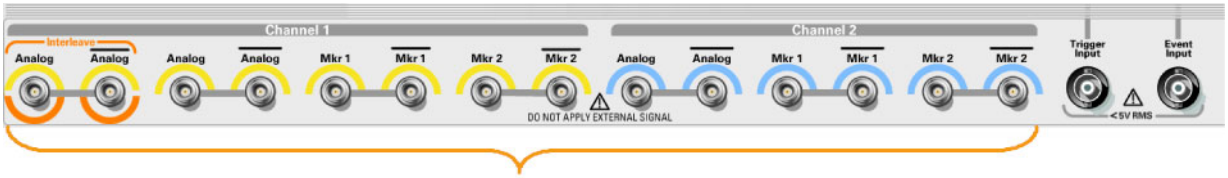
- A warning message will appear if the internal temperature reaches the first threshold level.
- The instrument will shut down if its temperature reaches the second threshold level.

If the warning message appears or the instrument shuts down, check for the following conditions. (See page 2, *Operating Requirements*.)

- The ambient temperature requirement is not being met.
- The required cooling clearance is not being met.
- The instrument fan is not working properly.

Output Connectors

The arbitrary waveform generator has both output and input connectors on the front panel. Do not apply external voltage to the output connectors.



To prevent damage to the instrument, do not apply external voltages to the output connectors.

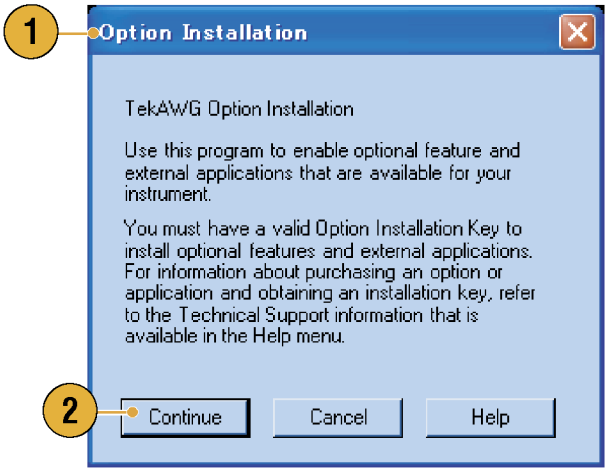
CAUTION. *Always turn off the signal outputs when you connect or disconnect cables to/from the signal outputs connectors. If you connect a DUT while the instrument signal outputs are in the On state, it may cause damage to the instrument or DUT.*

Option Installation

Use the Option Installation 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.

1. Select **System** > **Option Installation...** to open the Option Installation dialog box.
2. Click **Continue** to open the second dialog box.

   Enter the Option Installation Key provided by Tektronix, and follow the on-screen instructions to install the option.



NOTE. *After entering the option key, you must restart the instrument application to activate the option.*

Creating Operating System Restore CD-ROMs

The instrument does not ship with operating system restore DVD. Use the following procedure to create a set of CD-ROMs that enable you to restore the operating system if the need arises.

NOTE. *This procedure creates a set of restore CD-ROMs for the Microsoft Windows operating system. After restoring the operating system, use the Product Software CD to reinstall the instrument application software. Follow the instructions supplied with the Product Software CD to reinstall the instrument application software.*

Creating Restore CD-ROMs

Prerequisites. You will need:

- A separate PC with a CD-R/W or DVD±R/Wdrive and CD burning software.
- USB flash drive (1 GB or larger) or a local area network to transfer ISO image files from the instrument to the PC with CD burner.
- Blank CD-R discs (about 5; the exact number depends on the number of backup files).

To create a set of restore CD-ROMs:

1. On the instrument, navigate to **C:\Tektronix\BackupImages**.
2. Using the USB flash drive (or through your LAN), transfer each of the files labeled **AwgBackupN** to the PC with the CD burner.
3. Using the CD burning software, burn each of the backup ISO image files (AwgBackup1.iso to AwgBackupN.iso) to a CD. Label each of the CDs with the backup file name, instrument name, instrument serial number, and date.
4. After you have burned the OS restore CDs, also place copies of the disk image files (*.iso) in a network location, on a separate hard disk, or on optical media for backup purposes. (If you ever restore the instrument OS, the ISO images on the instrument hard disk will be erased.)
5. Store the backup CDs as defined by your company policy.

NOTE. *You can use restore discs only on the instrument with which they were created.*

Restoring the Instrument Operating System

You can restore the instrument operating system from either a file on the instrument hard disk drive, or from the set of instrument restore CD-ROMs (see *Creating Restore CD-ROMs*). The preferred restore method is to use the hard disk restore file.

CAUTION. *Using the restore process reformats the hard drive and reinstalls the operating system. All saved data will be lost. If possible, save important files to external media before performing a system restore.*

Restoring the Operating System from the Instrument Hard Disk

The instrument contains an operating system restore file on a separate partition of the hard drive.

1. 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
   ```

2. Repeatedly press the F5 key until the Acronis True Image Tool opens. There is a three-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.
3. Click **Restore**.
4. In the Confirmation dialog box, click **Yes** to restore the instrument operating system, or No to exit the restore process. The restore process takes approximately 30 minutes; the actual time depends on the instrument configuration.

Restoring the Operating System from the Restore CD-ROMs

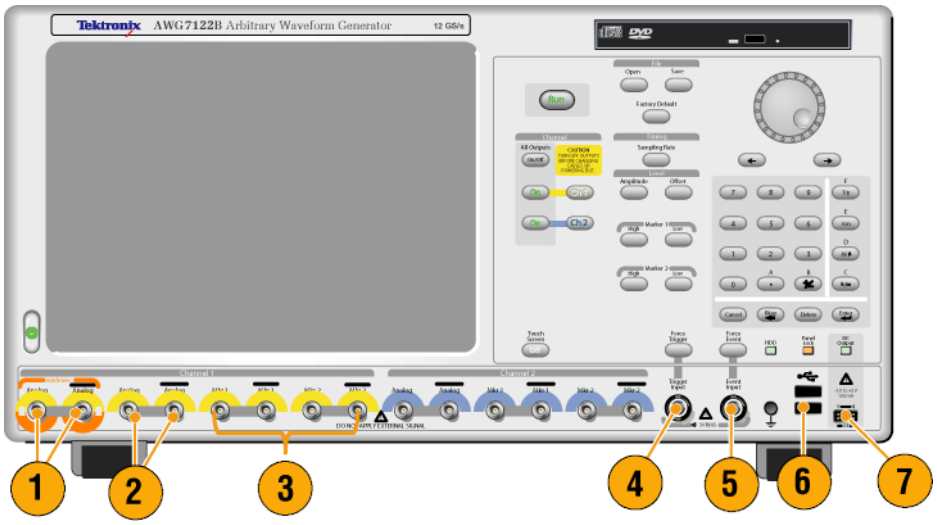
NOTE. *This procedure requires that the CD/DVD drive is set as the first boot device (this is the default setting).*

NOTE. *You can use restore discs only on the instrument with which they were created.*

1. Insert restore CD disc 1 in the instrument CD/DVD drive.
2. Restart the instrument. The restore software opens automatically if the CD/DVD drive is the first bootable device. If the CD/DVD drive is not the first bootable device you must enable it as the first bootable device before performing a restore from the CD-ROMs.
3. Click **Restore**.
4. In the Confirmation dialog box, click **Yes** to restore the operating system, or **No** to exit the restore process.
5. When prompted, remove the current restore CD and insert the next restore CD. Continue until the restore process is complete.
6. When the restore process is completed, remove the last restore CD and restart the instrument. The instrument will open into the operating system, settings, and appearance as shipped from the factory.

Front Panel

The following figure shows the front panel of the AWG7122B Option 06:

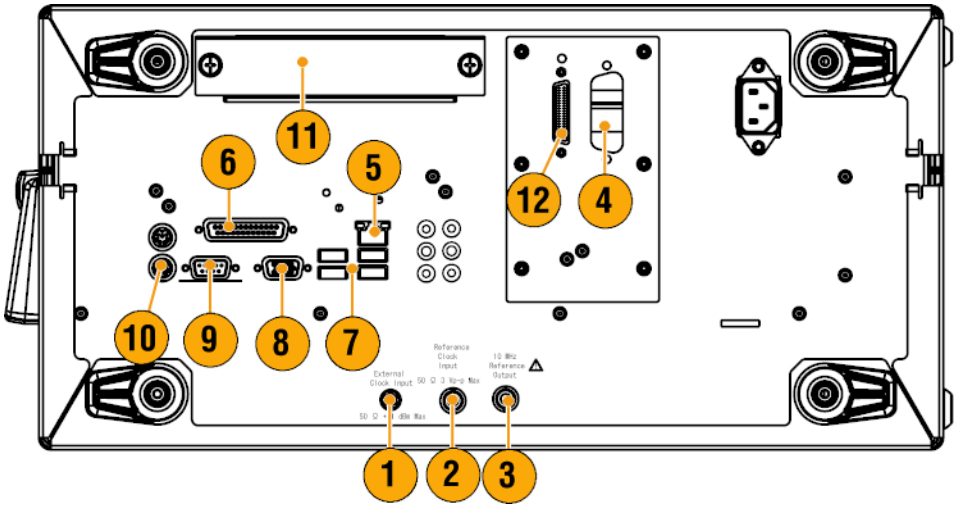


Front Panel Connectors

Connector	Description
1. Interleave Output	(AWG7122B Option 06 only) The interleave connectors supply analog signals with 12 GS/s through 24 GS/s range. Connector type: SMA
2. Analog Output	These connectors supply analog signals. Connector type: SMA (AWG7000 series) Connector type: BNC (AWG5000 series)
3. Marker Output	These connectors supply marker signals. Connector type: SMA (AWG7000 series) Connector type: BNC (AWG5000 series)
4. Trigger Input	External trigger signal is applied to this connector. Connector type: BNC
5. Event Input	Event signal is applied to this connector. Connector type: BNC
6. USB	Two USB connectors are present on the front panel. Connect a USB device.
7. DC Output	This connector supplies four channel DC voltage. Connector type: 2.54 mm 2 x 4 pin header (female)

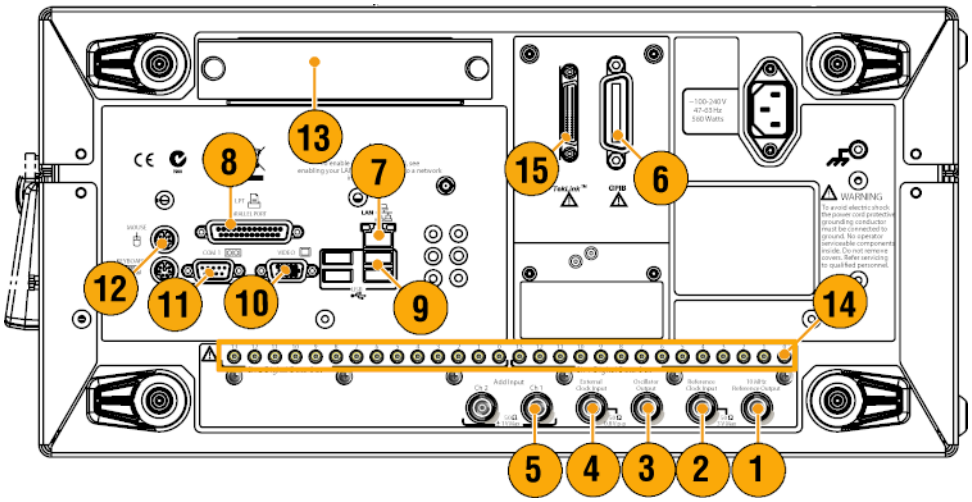
CAUTION. *Always turn off the signal outputs when you connect or disconnect cables to/from the signal outputs connectors. If you connect a DUT while the instrument signal outputs are in the On state, it might cause damage to the instrument or DUT.*

Rear Panel (AWG7000 Series)



Connector	Description
1. 10 MHz Reference Output	Output connector for 10 MHz reference clock signal Connector Type: BNC
2. Reference Clock Input	Input connector for external reference clock Connector Type: BNC
3. External Clock Input	Input connector for oscillator input Connector Type: SMA
4. GPIB	Use the GPIB connector to connect the instrument to a GPIB controller for GPIB operation.
5. LAN	Use the RJ-45 connector to connect the instrument to a network.
6. Parallel Port	Use the parallel port (Centronics) to connect a printer or other device.
7. USB	Use the USB connectors to connect a USB mouse, keyboard, or other USB device to the instrument.
8. Video	Use the Video port to connect a monitor for extended desktop operation.
9. COM1	Use the COM1 serial port to connect to other devices through the serial port.
10. PS-2 connector	Use the PS-2 connectors to connect a PS-2 keyboard or mouse to the instrument.
11. Removable HDD	Removable hard disk drive to secure data. If you remove the HDD, user information such as setup files or waveform data does not remain within the instrument.
12. TekLink	Use the TekLink connector for data import.

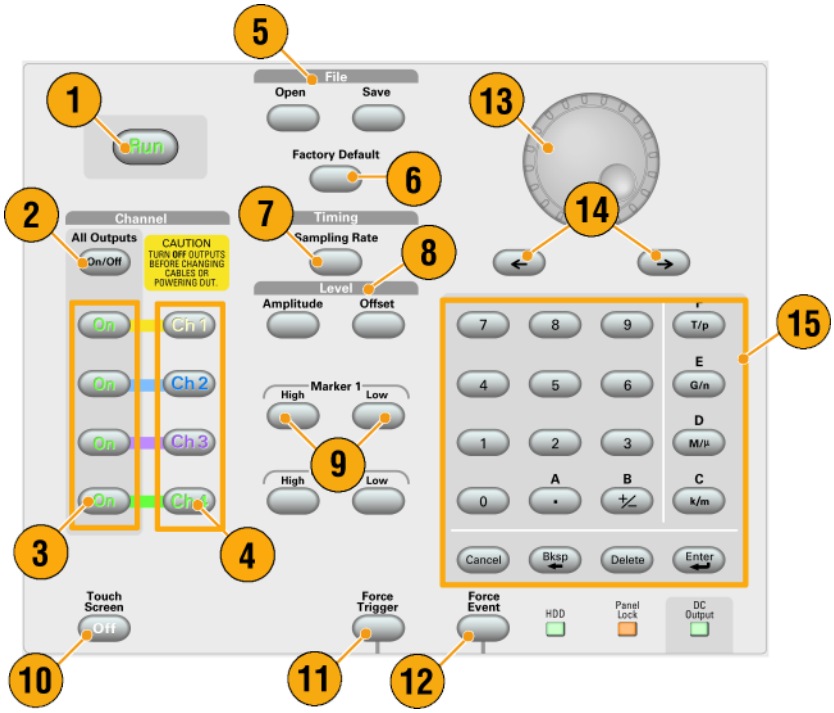
Rear Panel (AWG5000 Series)



Connector	Description
1. 10 MHz Reference Output	Output connector for 10 MHz reference clock signal Connector Type: BNC
2. Reference Clock Input	Input connector for external reference clock Connector Type: BNC
3. Oscillator Output	Output connector for internal oscillator Connector Type: BNC
4. External Clock Input	Input connector for oscillator input Connector Type: BNC
5. Add Input	Add external signal to the output signal of arbitrary waveform generator Connector Type: BNC
6. GPIB	Use the GPIB connector to connect the instrument to a GPIB controller for GPIB operation.
7. LAN	Use the RJ-45 connector to connect the instrument to a network.
8. Parallel Port	Use the parallel port (Centronics) to connect a printer or other device.
9. USB	Use the USB connectors to connect a USB mouse, keyboard, or other USB device to the instrument.
10. Video	Use the Video port to connect a monitor for extended desktop operation.
11. COM1	Use the COM1 serial port to connect to other devices through the serial port.
12. PS-2 connector	Use the PS-2 connectors to connect a PS-2 keyboard or mouse to the instrument.
13. Removable HDD	Removable hard disk drive to secure data. If you remove the HDD, user information such as setup files or waveform data does not remain within the instrument.
14. Digital Data Out	Use these connectors to output digital data. To enable digital data output, option 03 must be installed in the AWG5002B or AWG5012B. Connector Type: SMB
15. TekLink	Use the TekLink connector for data import.

Getting Acquainted with Your Instrument

Control Panel



Buttons/Keys	Description
1. Run	The Run button is used to start and stop the signal generation. If the signal is being generated, the LED indicator lights up. To output the signal through the output connectors, you must push the front-panel All Outputs On/Off button or the Channel Output On button.
2. All Outputs On/Off	If one or more Outputs are on, they will all be turned off when you push the All Outputs On/Off button. If all Outputs are off, they will all be turned on when you push the All Outputs On/Off button.
3. Channel Output On	These buttons are used to enable/disable the channel output. If the output is in the On state, the LED is turned on.
4. Channel Select	These buttons are used to select a channel that you want to interact with. If a channel select button on the front panel is pushed, the selected channel page in the Settings Window will be activated.
5. File – Open/Save	When the Open or Save button is pushed, the corresponding dialog box is displayed. You can load or save a setup (*.AWG) file using this dialog box.
6. Factory Default	When this button is pushed, the specified default setups are recalled. (See page 42, *Default Setup*.)
7. Sampling Rate	When you push this button, the sampling rate parameter in the Settings window is selected. Sampling Rate is common to each channel.

Buttons/Keys	Description
8. Level – Amplitude/Offset	When you push these buttons, the amplitude or offset parameter of the corresponding channel in the Settings window is selected. Amplitude and offset can be set independently for each channel.
9. Marker 1 and Marker 2 – High/Low	When you push one of these buttons, the Marker High or Marker Low parameter of the corresponding channel in the Settings window is selected. Marker High and Marker Low can be set independently for each channel.
10. Touch Screen Off	When the Touch Screen is On state, you can use your finger or stylus to control the screen interface. The LED is lit while the Touch Screen interface is disabled.
11. Force Trigger	When you push this button, the instrument generates an internal trigger signal.
12. Force Event	When you push this button, the instrument generates an internal event signal.
13. General Purpose Knob	The knob is used to increase or decrease a set value or select an item from a pop-up menu, pull-down menu, or dialog box. Turn the knob clockwise to increase the value, and turn the knob counterclockwise to decrease the value.
14. Digit Select Arrow Keys	The digit select arrow keys are used to move the under bar (cursor) to a field that contains an editable number. After you specify the digit, you can change the number with the knob.
15. Numeric Keypad	Units prefix buttons (T/p, G/n, M/µ, and k/m) are used to complete an input with the numeric keypad. You can determine the units by pushing one of these prefix buttons without pressing the Enter key. If you push the units prefix buttons for frequency, the units are interpreted as T (tera-), G (giga-), M (mega-), or k (kiro-). If you push the buttons for time, the units are interpreted as p (pico-), n (nano-), µ (micro-), or m (milli-).

CAUTION. *Do not connect a DUT (Device Under Test) 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.

Locking and Unlocking the Front Panel Controls

The front panel may be locked by a remote user while the arbitrary waveform generator is being remotely controlled via GPIB or Ethernet. When the front panel is locked, all keys and buttons are disabled except the power switch. You cannot use your mouse or keyboard. However, the Windows operations are available even if the instrument front panel is locked.

To unlock the front-panel controls, use a remote command or push the front-panel Cancel button twice. If you exit the application, the lock state is cleared. When you restart the application, the front-panel controls are unlocked.

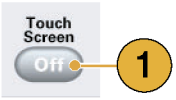
Touch Screen Interface

The arbitrary waveform generator offers two methods of making menu selections:

- Front-panel controls, keyboard, and mouse (keyboard and mouse are standard accessories)
- Front-panel controls and touch screen interface

1. You can enable or disable the touch screen interface by pushing the front-panel Touch Screen button.

   When the touch screen is in the Off state, the LED is lighted. You can still access the on-screen menus with a mouse or keyboard.



Quick Tip

You need to adjust the touch screen when one of the following occurs:

- The operating system is restored
- The hard disk drive is exchanged
- The touch screen is not responding correctly

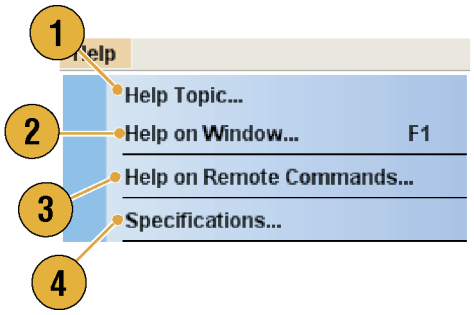
Run the touch screen program from the shortcut on the Windows desktop to adjust the touch screen.

Accessing Online Help

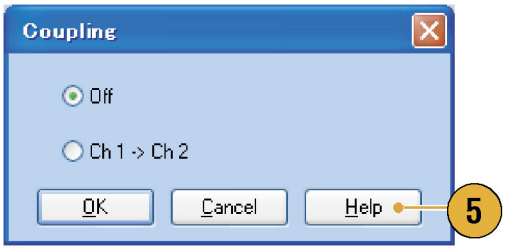
The arbitrary waveform generator provides two types of online help:

- User online help – In-depth information is available in the online help on all the features of your instrument.
- Programmer online help – The instrument offers programmer online help about remote commands.

To access the Help system, select **Help** from the menu bar.



1. To access the user online help, select **Help** > **Help Topic...**.
2. To use context-sensitive help on the current setup, select **Help** > **Help on Window...** or press **F1**.
3. To access Programmer Online Help, select **Help** > **Help on Remote Commands...**.
4. To access specifications and performance verification, select **Specifications** to open the PDF Technical Reference Manual.
5. Most dialog boxes have a **Help** button. For contextual overviews of the dialog box, click the button to open the help system with an overview of the dialog box that is displayed.



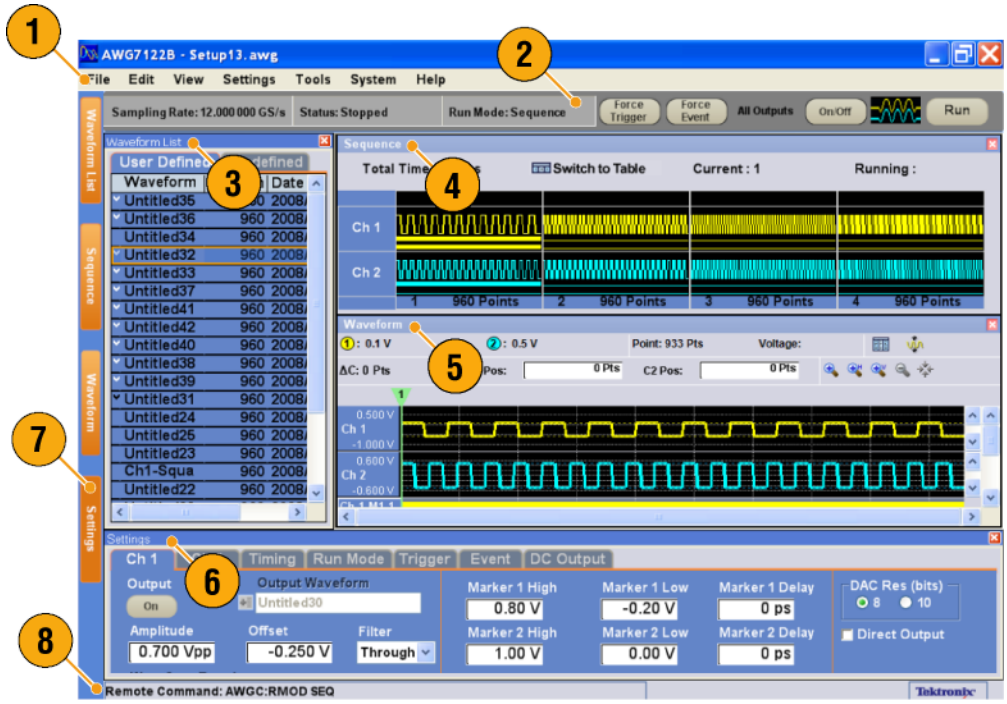
Quick Tips

- You can select English or Japanese for the user online help. By default, English is selected. To change the language, use the **System** menu > **Preferences** dialog box. (See page 27, *Setting the User Preferences*.)

NOTE. *When you first open the Japanese user online help, a pop-up message is displayed to prompt you to install the Japanese language pack. Click Install to install the language pack.*

- The programmer online help is available only in English.

Screen Interface

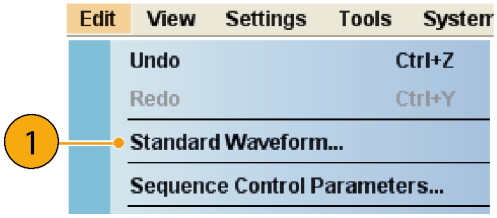


Screen element	Description
1. Menu bar	The menu bar provides access to all of the instrument functions.
2. Status bar	The status bar shows information about the instrument, such as sampling rate, run mode status, or output status.
3. Waveform List window	User-defined waveforms and predefined waveforms are listed in this window.
4. Sequence window	This window mainly provides information on output sequence.
5. Waveform window	This window displays the waveform that you selected in the Settings window or in the Sequence window.
6. Settings window	This window is provided for quick access to the parameter settings.
7. Window tag	Click these tags to toggle display of corresponding windows on or off.
8. Remote command bar	Displays a remote command corresponding to current instrument operation.

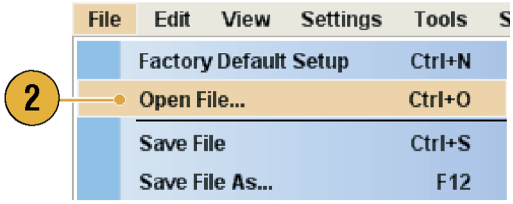
Basic Steps for Using the Arbitrary Waveform Generator

After you have powered on the instrument, use the application's menu bar or control windows to create and edit a waveform. (See page 23, *Accessing Menus and Control Windows*.) Do the following steps to output a waveform or a sequence:

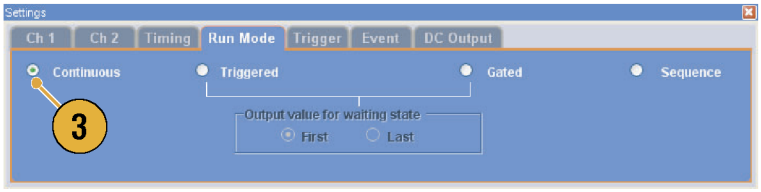
1. To create a new waveform, select **Edit** > **Standard Waveform...**. The created waveform is displayed in the Waveform List window.



2. To use an existing waveform, select **File** > **Open File...** to open a setup file, and then select a waveform in the Waveform List window.

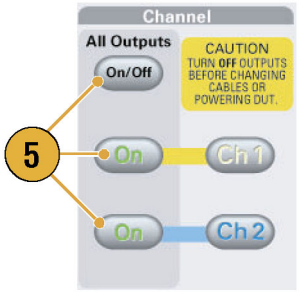


3. Confirm the Run mode. Check that the desired run mode is selected on the **Run Mode** tab of the Settings window.



4. To generate a signal, push the front-panel **Run** button or the **Run** button on the Status Bar.

5. Use one of the following methods to set the channel output On:
   - Front-panel Channel Output On button or All Outputs On/Off button
   - Output On button of the Ch page of Settings window



Run Mode

The arbitrary waveform generator supports the following four types of Run mode:

Continuous. A continuous waveform is output.

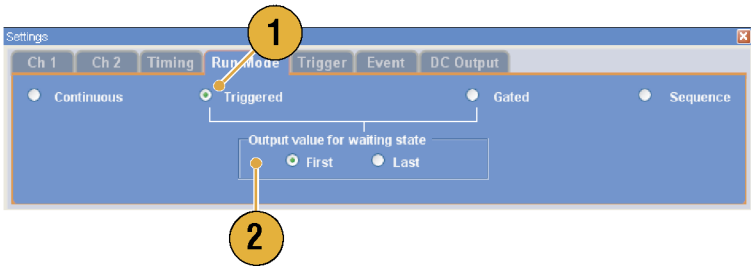
Triggered. A waveform is output once when the instrument receives a trigger signal. The instrument will wait for the next trigger signal after outputting the waveform.

Gated. A waveform is output only when a gate signal is asserted. A continuous waveform is output while the gate signal stays asserted.

Sequence. Multiple waveforms can be output in the order specified in the sequence.

You can select a run mode using the Run Mode page of Settings window.

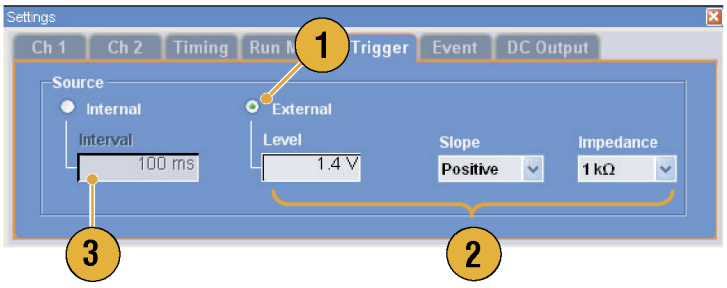
1. Select a Run mode.
2. In the Triggered or Gated mode, you can select the output value while the instrument is in the waiting-for-trigger state.
   - First – Sets the output level to the first value of the waveform
   - Last – Sets the output level to the last value of the waveform



Trigger Control

Trigger controls waveform output when the Run mode is Triggered, Gated or Sequence. Use the Trigger page of Settings window to set Trigger parameters.

1. You can select Trigger Source (**Internal** or **External**). The default is External.
2. If **External** is selected, Trigger Level, Trigger Slope, and Trigger Impedance can be set.
   - Level – Sets external trigger level.
   - Slope – Determines whether the instrument finds trigger point on the rising edge or the falling edge of the signal.
   - Impedance – Specifies external trigger impedance (1 kΩ or 50 Ω).
3. If **Internal** is selected, internal trigger Interval can be set.



Quick Tips

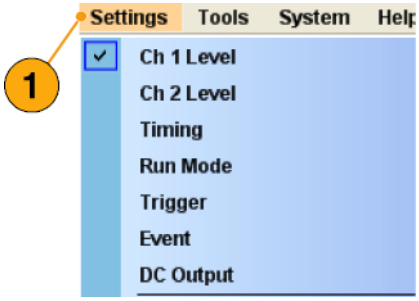
- Trigger parameters control the signal outputs of the instrument. Trigger parameters cannot be set if Continuous is selected in the Run Mode.
- You can also control the trigger by pushing the front-panel Force Trigger button in addition to specifying a signal as the trigger source.

Accessing Menus and Control Windows

You can access menu commands and control windows using the following techniques:

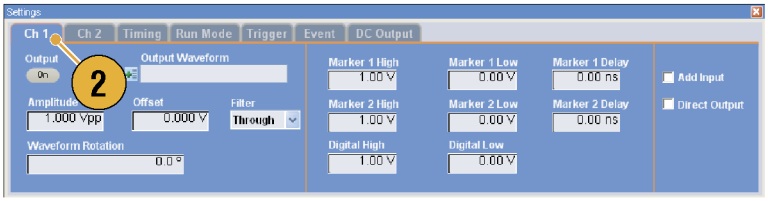
1. Click **Settings** from the menu bar, and then select a command.

   The selected item in the Settings window will become active.



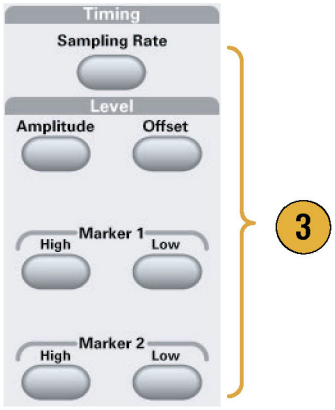
2. For a shortcut to settings menus, you can use the Settings window.

   Clicking a tab, such as **Ch 1** or **Timing**, on the Settings window opens the corresponding page that you can use to select the instrument settings.



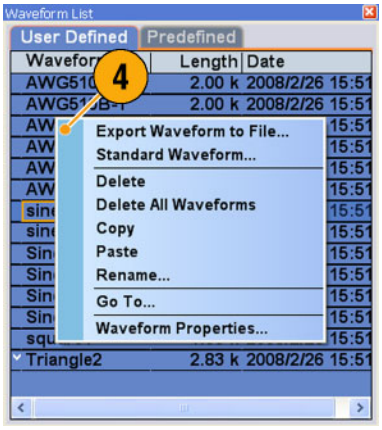
3. From the front panel, you can quickly access the parameters for sampling rate, amplitude level, offset level, and marker level.

   If you push one of these buttons, the corresponding parameter in the Settings window will be selected.



4. You can right-click to gain quick access to associated menu commands.

   For example, right-click on the **Waveform List** window to display the related menu commands.



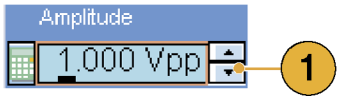
Changing Control Settings

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.

You can use the general purpose knob to change parameters, although the following methods are generally available.

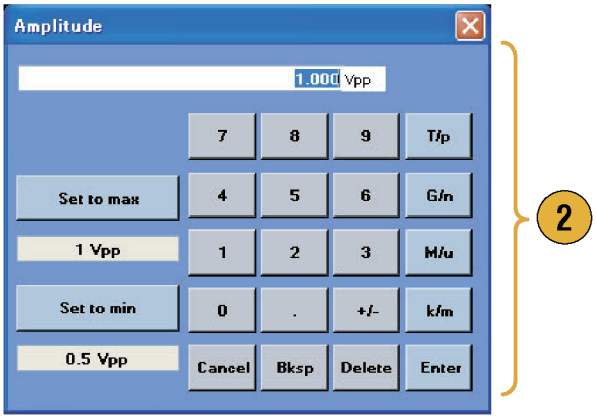
1. Some parameters have increase/decrease buttons. These buttons are also called spin buttons. Touch or click the spin buttons to change to the next available value.

   To move the underbar to a field that contains an editable number, use the digit select arrow keys. (See page 16, *Getting Acquainted with Your Instrument*.)



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

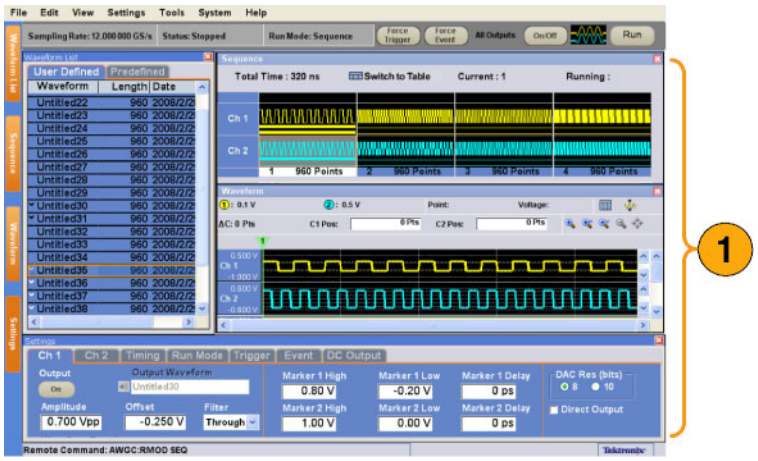
   Touch or click the keypad (or keyboard) icon to display the keypad (or keyboard).



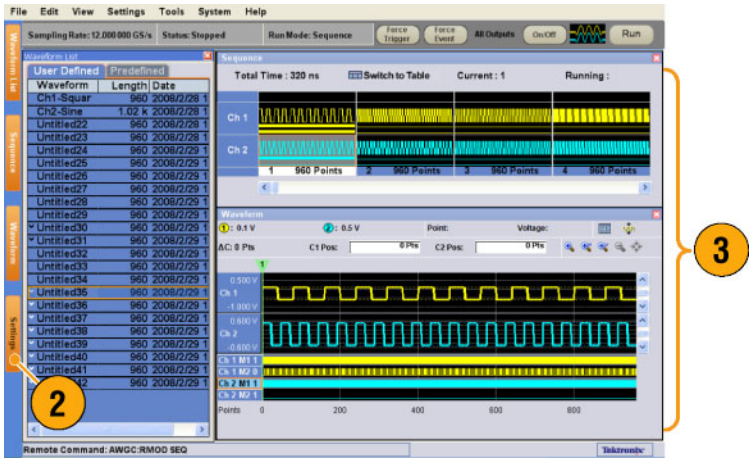
Display/Hide Control Windows

The arbitrary waveform generator displays four control windows by default. You can quickly hide or display each window using the window tag.

1. By default, four windows are displayed if the Run mode is Sequence.

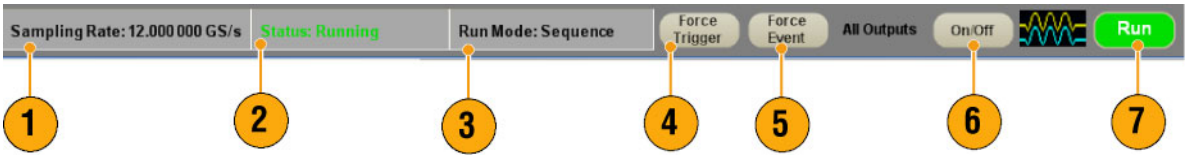


2. Click the **Settings** tag.
3. The Settings window is hidden.



Status Bar

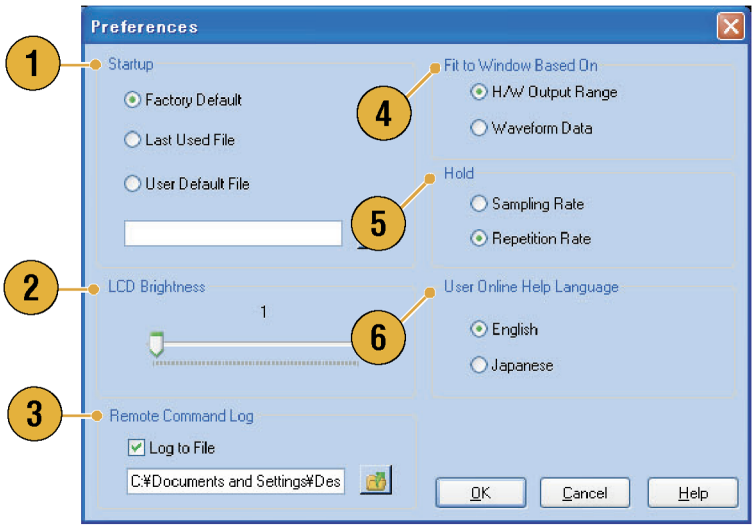
The Status Bar has two functions. It displays the status of the instrument, such as Sampling Rate, Run State, and Run Mode. It also has action buttons, such as Force Trigger, Force Event, All Outputs On/Off, and Run.



1.	Sampling Rate	Sampling rate setting is displayed.
2.	Run Status	Instrument status (Running or Stopped) is displayed.
3.	Run Mode	Run Mode is displayed.
4.	Force Trigger button	Same function as the front-panel Force Trigger button.
5.	Force Event button	Same function as the front-panel Force Event button.
6.	All Outputs On/Off button	Same function as the front-panel All Outputs On/Off button.
7.	Run button	Same function as the front-panel Run button.

Setting the User Preferences

Select **System** > **Preferences...** to open the Preferences dialog box.



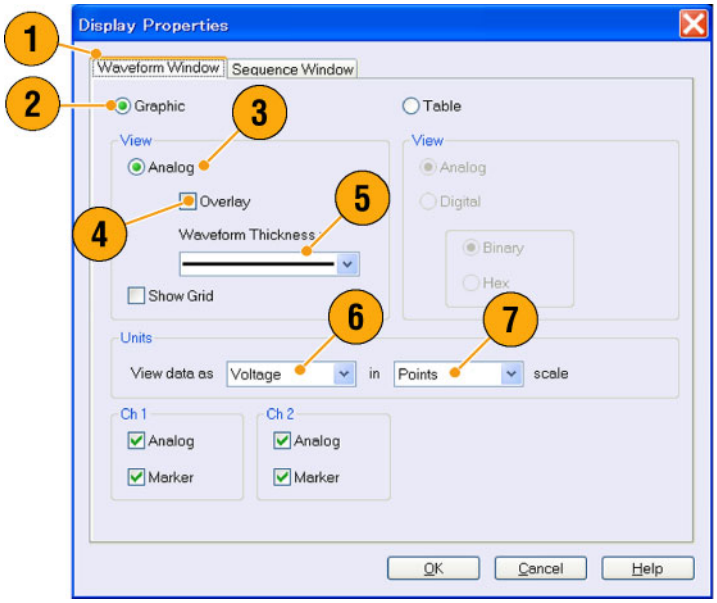
1. Startup – Select a power-on setting. (See page 42, *Changing Settings at Power-on*.)
2. LCD Brightness – Set the LCD brightness.
3. Remote Command Log – You can record the sequence of GPIB commands you used with your instrument.
4. Fit to Window Based On – Select the vertical scale setting when you use the Zoom Fit function.
   - **H/W Output Range** – Vertical scale is set based on the instrument hardware limitation.
   - **Waveform Data** – Vertical scale is set based on the waveform data.
5. Hold – Select which parameter is held when the effective waveform length is modified.
   - Sampling Rate
   - Repetition Rate
6. User Online Help Language – Select a language in which to display on the User Online Help.

Changing the Windows Display Style

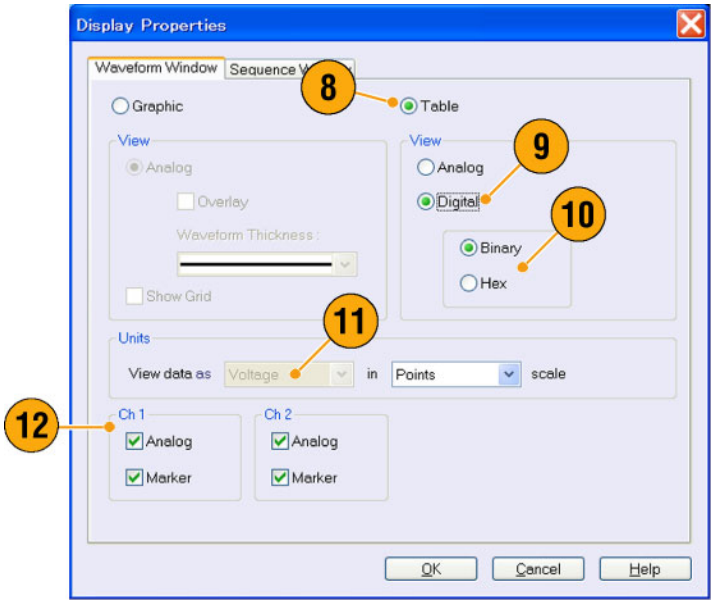
You can configure the appearance of Waveform and Sequence windows for your arbitrary waveform generator.

Waveform Window

1. Select **View** > **Display Properties...** to display the Display Properties dialog box. Click the Waveform Window tab.
2. You can select the Waveform window display format (**Graphic** or **Table**).
3. This example shows Graphic display. The view is fixed to Analog. You can select on and off for Overlay and Grid.
4. When **Overlay** is specified, analog data from multiple channels can be displayed overlaid.
5. Select waveform thickness.
6. You can select vertical units. Select Voltage or Normalized in the View data as box.
7. You can select horizontal units. Select Points or Time in the Scale box.

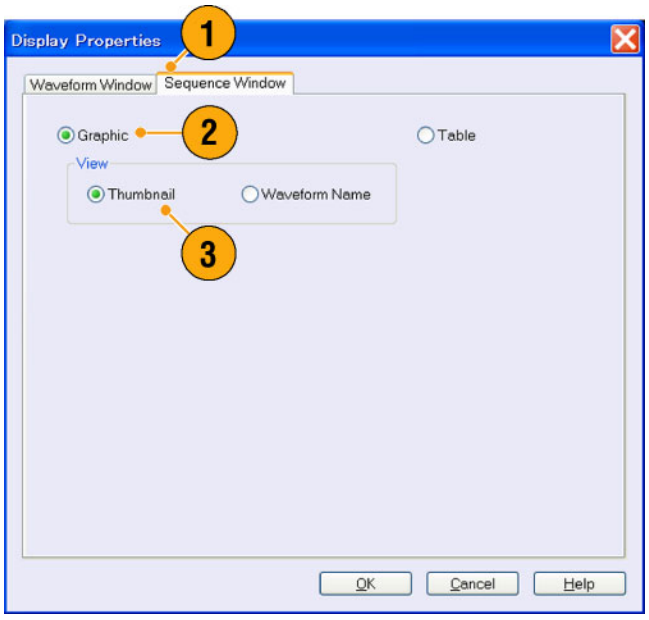


8. Click Table to set the Waveform window to Table display.
9. You need to select Analog or Digital when Table is specified.
10. When Digital is selected, you can select Binary or Hex.
11. You can select the vertical and horizontal units. If Digital is selected in the Table display, vertical units selection (Voltage or Normalized) is disabled.
12. You can select displayed items for each channel in the Waveform window.



Sequence Window

1. Select **View** > **Display Properties...** to display the Display Properties dialog box. Click the Sequence Window tab.
2. You can select the display format (**Graphic** or **Table**).
3. When Graphic is selected, you can select either **Thumbnail** or **Waveform Name**.



Quick Tips

- (AWG7000 series only) When the DAC resolution of a channel is set to 10 bits, the marker data of the channel cannot be displayed.
- You can also access the Display Properties dialog box by right-clicking on the Waveform or Sequence window.

Run State Control and Output On/Off

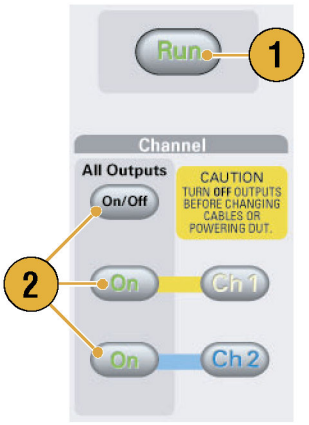
Do the following steps to control the start and stop of signal generation for the arbitrary waveform generator.

1. Use the front-panel **Run** button to start and stop signal generation.

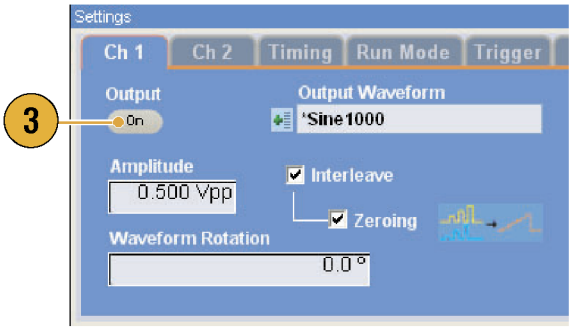
   Switching signal generation on or off is called Run State control.

   If a signal is being generated, the LED indicator lights up.

2. To output the signal through the output connectors, push the front-panel **All Outputs On/Off** button or the **Channel Output On** button.



3. Alternatively, you can use the Ch n (Channel) tab on the Settings window to enable the signal output.

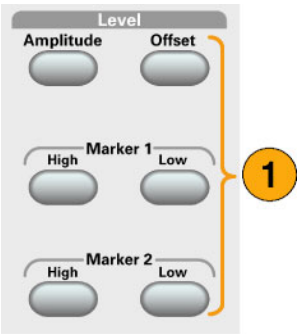


Setting Output Signals

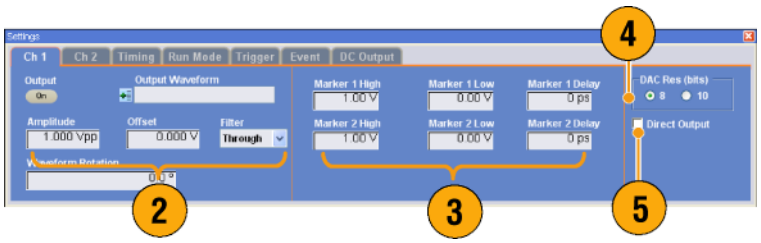
Analog and Marker Output

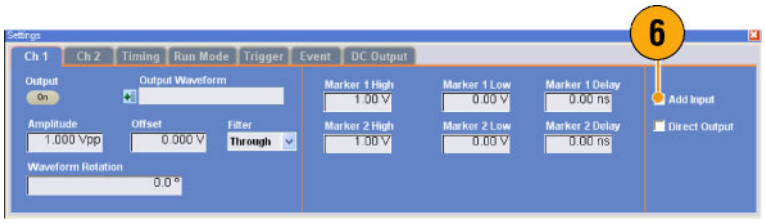
You can set the parameters for analog and marker output signals using the front panel buttons or the Channel page of Settings window.

1. Use the front-panel Level buttons to set the Amplitude, Offset, and Marker High/Low for each channel.



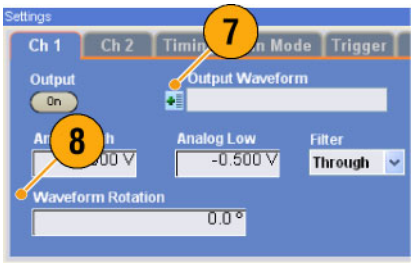
2. In the same way, you can set parameters for Amplitude, Offset, and Filter using the Ch n page of Settings window.
3. You can set parameters for marker high, low and delay.
4. (AWG7000 series) When 10 bits DAC Resolution is selected, Marker Outputs will be disabled.
5. Select Direct Output On and Off.
6. (AWG5000 series) You can add an external signal to each channel analog output.





7. When the instrument is in the non-sequence mode, you can select the output waveform data using the Output Waveform field. Click the waveform list icon to display the Waveform List dialog box.

8. You can set phase shift or delay for each analog output signal when the instrument is in the non-sequence mode.



Quick Tips

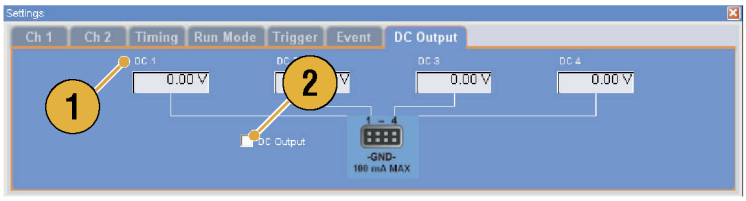
- Each channel has independent output on and off control. When the output status of Ch n is set to On, both analog output and marker output are enabled.
- When Direct Output is set to On, filter and offset settings become inactive. The analog bandwidth setting range will change.
- (AWG7000 series) The Option 02 (Extended analog output bandwidth) and Option 06 (Interleave and wide bandwidth direct output) models do not have the control settings for Filter, Offset, and Direct Output.
- (AWG5000 series) You can use Add Input when Direct Output is set to off. If Direct Output is selected, Add Input is disabled.
- The Waveform Rotation can be set independently for each channel.
  - Analog Phase – Can be set by degree (°).
  - Analog Delay – Can be set by time or points.
- The Waveform Rotation setting does not affect the Waveform window display.

DC Output Page

1. The arbitrary waveform generator has four lines of DC output.

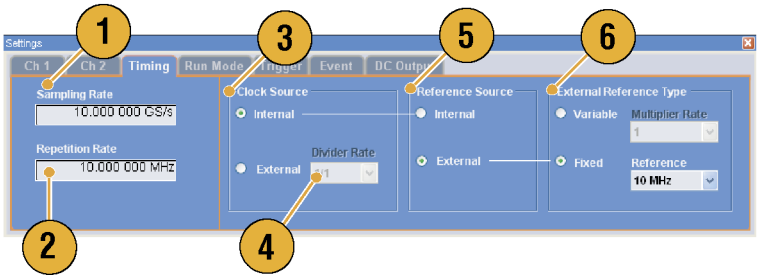
   The level of each output can be set independently.

2. The output state (On or Off) of the DC output is common to all DC output channels.



Timing Control

You can set parameters for sampling rate or clock using the Timing page of Settings window.



1. Sets Sampling Rate.
2. You can set Repetition Rate when the Run mode is not set to Sequence.
3. You can select Clock Source (**Internal** or **External**).
   - If External is selected, the clock signal from External Oscillator Input is used.
   - If Internal is selected, the clock signal is generated internally.
4. Divider Rate can be set when the Clock Source is set to **External**.
5. You can select the Reference Source (**Internal** or **External**).

   Reference Source is selectable only when the Clock Source is set to **Internal**.
6. You can select the External Reference Type (**Variable** or **Fixed**).

   This parameter is selectable only when the Clock Source is set to **Internal** and the Reference Source is set to **External**.

Quick Tips

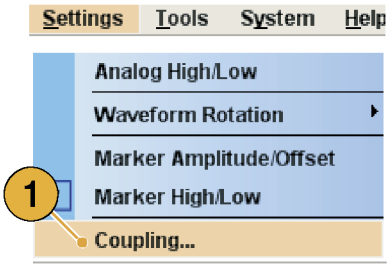
- The Sampling Rate can be set when the internal clock source is selected and one of the following conditions is met:
  - **Internal** is selected as the reference source.
  - **External** is selected as the reference source and **Fixed** is selected as the external reference type.
- The arbitrary waveform generator accepts a 10 MHz, 20 MHz, or 100 MHz frequency signal as a Fixed external reference source.
- You can set the Multiplier Rate when the Clock Source is set to **Internal**, the Reference Source is set to **External**, and the External Reference Type is set to **Variable**.

Channel Coupling

You can change the parameter values for multiple channels at a time. This function is called Channel Coupling.

1. Select **Settings** > **Coupling...** to open the Coupling dialog box.

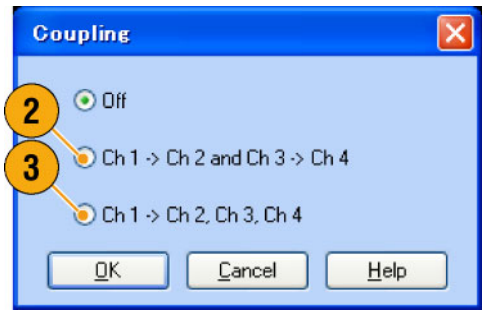
   You can also open this dialog box from the pop-up menu displayed by right-clicking on the Channel page of the Settings window.



2. Select a coupling method.

   Ch 1 –> Ch 2 and Ch 3 –> Ch 4 means that Ch 1 and Ch 2, and Ch 3 and Ch 4 are coupled, respectively.

3. Select **Ch 1 -> Ch 2, Ch 3, Ch 4** to couple the Ch 1 parameters with Ch 2, Ch 3, and Ch 4 parameters.



Quick Tips

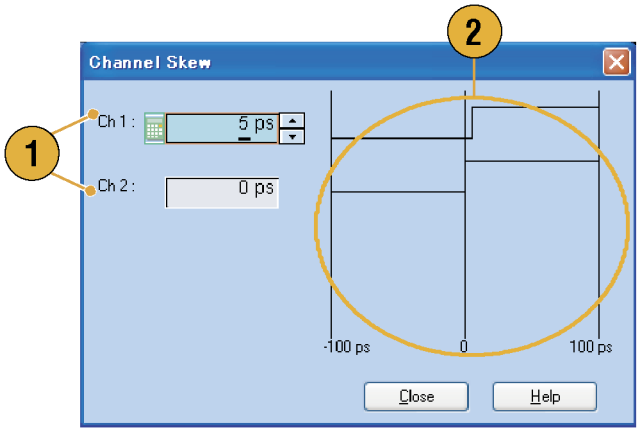
- **Ch 1-> Ch 2, Ch 3, Ch 4** means that Ch 1 parameters are coupled with Ch 2, Ch 3 and Ch 4 parameters. With the Channel Coupling in the On state, the Ch 1 parameters are applied to the instrument hardware settings of the other three channels. You cannot select parameters for channel coupling in the Channel page of the Settings window. The disabled parameters are grayed out.
- The following parameters are excluded from channel coupling:
  - Channel skew
  - Output waveform
  - Sequence waveform
  - External signal add function
  - Waveform rotation
  - Marker delay
  - Parameters that are not related to the output signal, such as marker display on/off

Channel Skew Adjustment

The channel skew adjusts the skew (delay) of each channel output.

Select **System** > **Channel Skew...** to open the Channel Skew dialog box.

1. You can adjust the skew for each channel independently. This adjustment applies to analog output and marker output.
2. Adjusting the skew value will update the dialog box display.

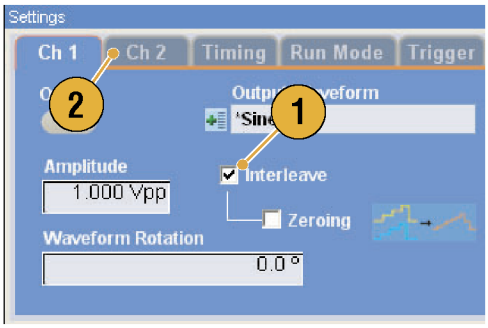


NOTE. *If your instrument is a single channel model, the channel skew function is not supported.*

Interleave (AWG7122B Option 06)

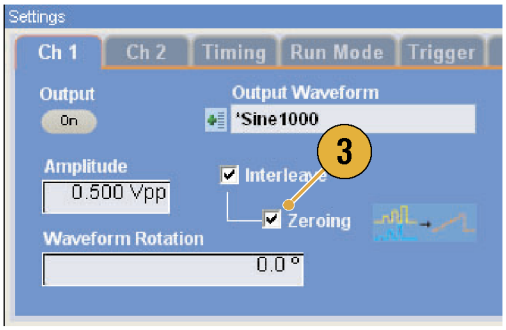
The AWG7122B Option 06 offers interleave capability. The instrument can interleave two channels to attain higher sampling rates and longer waveform length.

1. To activate Interleave, select the **Ch 1** page of Settings window, and then check the Interleave check box.
2. When Interleave is set to On, the Ch 2 tab is grayed out. You cannot access the Ch 2 parameters.



3. When Interleave is in the On state, you can select Zeroing On/Off.

   The bandwidth becomes wider but the amplitude range is changed with Zeroing On. The default is Zeroing Off.



Quick Tips

- Interleaving is applied to analog output. When interleaving is on, marker data with even numbers will be output, such as 0,0,2,2,4,4,6,6.
- When output is on, changing the Interleave mode on and off will turn the output off.

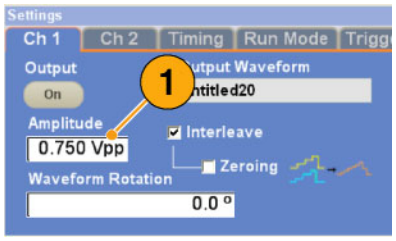
The following table lists how interleaving extends the maximum sampling rate and waveform length:

Instrument type and option	Interleave	Sampling rate	Waveform length
AWG7122B Option 01, Option 06	On	12 GS/s to 24 GS/s	1 to 129,600,000 points
	Off	10 MS/s to 12 GS/s	1 to 64,800,000 points
AWG7122B Option 06	On	12 GS/s to 24 GS/s	1 to 64,800,000 points
	Off	10 MS/s to 12 GS/s	1 to 32,400,000 points
AWG7122B Option 01	Not available	10 MS/s to 12 GS/s	1 to 64,800,000 points
AWG7122B Standard model	Not available	10 MS/s to 12 GS/s	1 to 32,400,000 points

Interleave Adjustment

Interleaving is a function to attain twice the sampling rate of single channel by combining the Ch 1 and Ch 2 outputs. When the interleaving is set to On, you can adjust the relative values for Phase and Amplitude between the channels.

1. In this example, Ch 1 amplitude is set to 0.75 Vp-p. Use the Settings window to enter Ch 1 amplitude value.



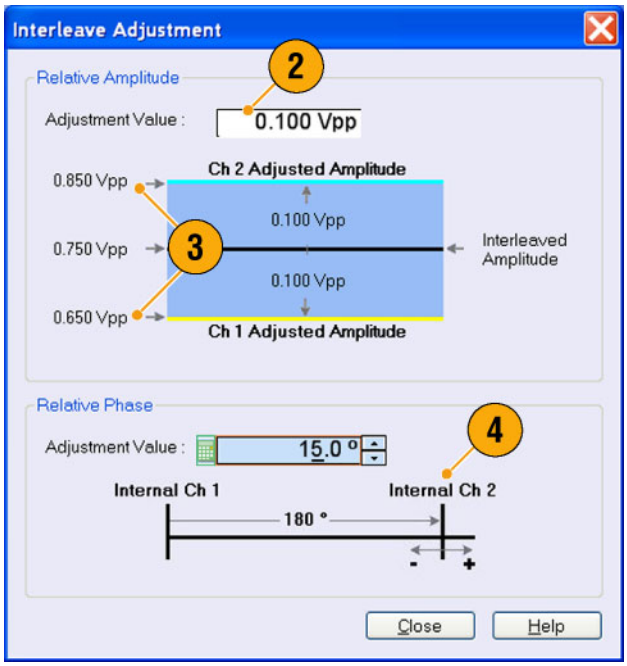
2. Select **System** > **Interleave Adjustment...** to open the Interleave Adjustment dialog box.

   Enter 0.100 Vp-p in this example as an adjustment value of relative amplitude.

3. Both Ch 1 and Ch 2 amplitude values are adjusted internally. See the Quick Tip below for calculation formula.

4. The phase adjustment will be done by fixing Ch 1 and changing Ch 2. The adjustment units are degrees. The setting range is as follows:

   - -180.0 to +180.0 degrees



Quick Tip

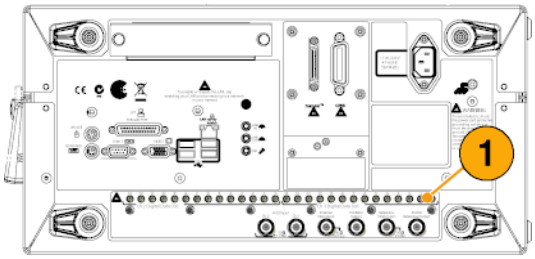
- Both Ch 1 and Ch 2 will be adjusted internally in the amplitude adjustment. The internal amplitude values for each channel will be calculated as follows:
  - Internal Ch 1 Amplitude = Ch 1 Amplitude Value – Adjustment Value
  - Internal Ch 2 Amplitude = Ch 1 Amplitude Value + Adjustment Value

NOTE. *You can set the amplitude adjustment value within the range of Ch 1 amplitude setting. The adjustment value may be clipped to maximum or minimum value depending on the Ch 1 amplitude setting. The clipped value will be applied to the instrument hardware.*

Digital Output (AWG5002B/AWG5012B Option 03)

The AWG5002B/AWG5012B Option 03 supports digital data output.

1. The SMB connectors for 14 bit digital data output are present for Ch 1 and Ch 2 on the rear panel.

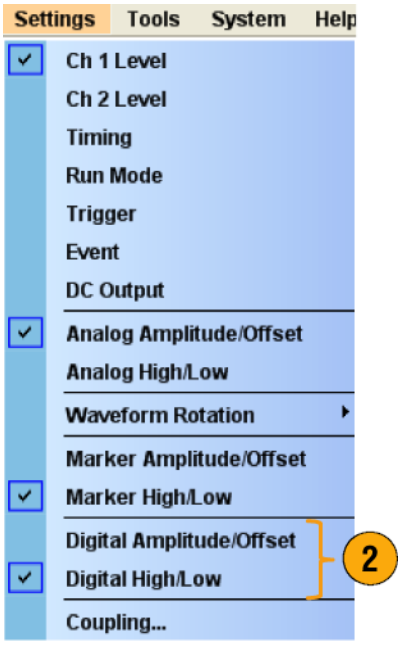


2. You can set the output parameters as follows:

   - Digital Amplitude/Offset
   - Digital High/Low

   The digital output levels are fixed as follows:

   - –1.0 V to +2.7 V, into 50 Ω
   - 0.01 V resolution



Quick Tip

- Each channel has independent output on and off control. When the output status of Ch n is set to On, both analog output and digital output are enabled.

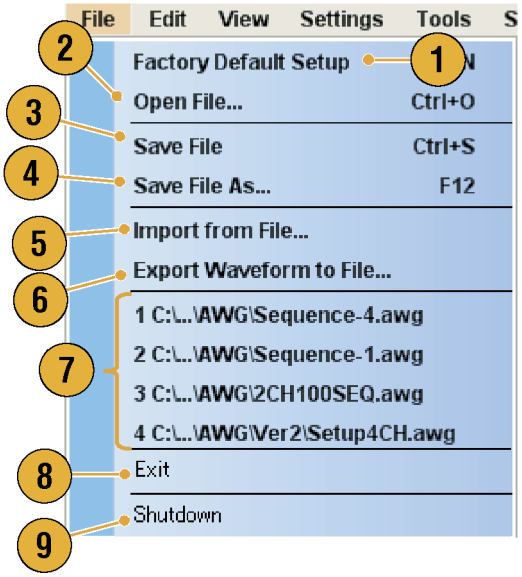
Saving and Recalling Setups

Use the File menu for basic file operations such as saving or recalling instrument setups or importing or exporting waveform data. You can also use the File menu for standard Windows operations such as loading the most recent setup files.

File Menu

The following menu items are provided in the File menu. For a complete description of each menu command, refer to the instrument online help system.

1. Recalls factory default setups. (See page 42, *Default Setup*.)
2. Opens a dialog box to load an instrument setup.
3. Saves (Overwrites) an instrument setup.
4. Saves an instrument setup assigning a new setup file name.
5. Use these commands to import waveform data.
6. Exports waveform data to a file for use with other applications.
7. A list of setup files you accessed recently is displayed here.
8. The application closes.
9. The application closes and then the instrument shuts down.



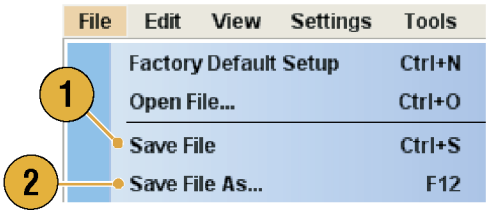
Quick Tip

- You can also shut down the instrument by pushing the front-panel power button (On/Standby switch) while the application is running. When the power button is pushed, a dialog box asks you whether to save current setups. If you select Yes, the current setups are preserved and then the instrument will start the shutdown process.

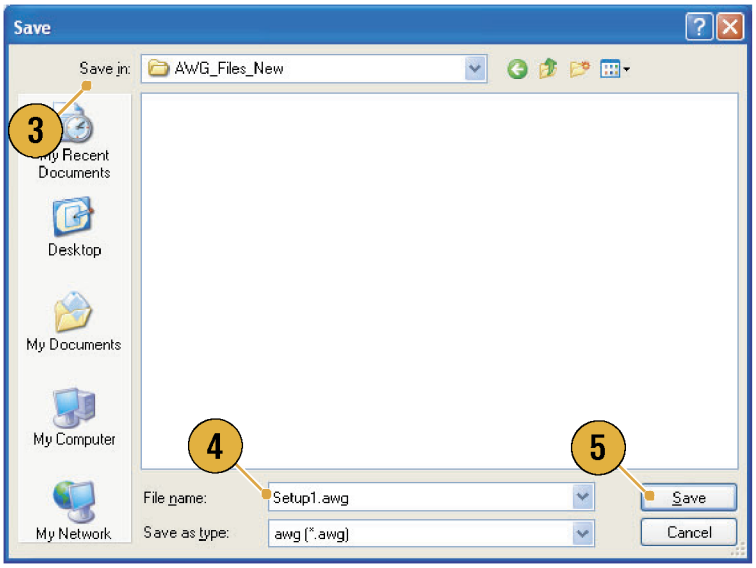
Saving an Instrument Setup

Use the following steps to save an instrument setup:

1. Select **File** > **Save File** to overwrite the existing instrument setup with an updated setup file.
2. To save the current setup to a new setup file, select **File** > **Save File As...** or push the front-panel **Save** button.



3. Select a location where you want to save the setup.
4. Type a file name or use the default name.
5. Click **Save**.



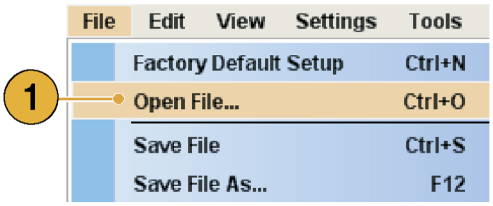
Quick Tips

- If a setup file contains Integer format waveform(s), the file size is reduced. For more information about waveform data format (Real or Integer), refer to the online help.
- To change the waveform format in the Waveform, Waveform List, or Settings window, you can use the Waveform Properties dialog box. (See page 55, *Confirming Waveform Properties*.)

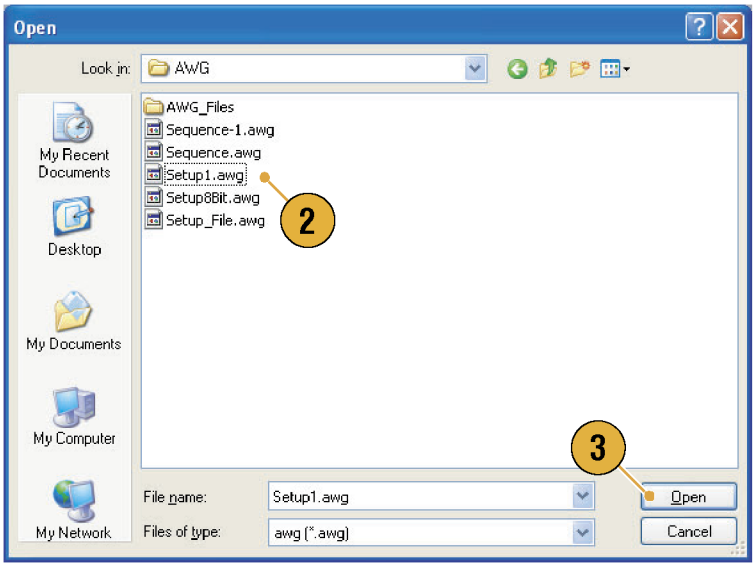
Recalling an Instrument Setup

You can recall an instrument setup from the File menu or from Windows Explorer.

1. Select **File** > **Open File...** to open the Open File dialog box.



2. Select a setup file.
3. Click **Open**.



Quick Tips

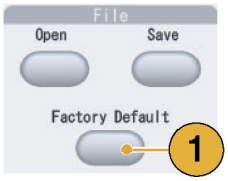
- The arbitrary waveform generator uses a setup file that has an extension AWG. Only *.AWG files are displayed on the Open File dialog box by default.
- Once you recall a setup, the instrument retains the setup until you execute **Save File** or **Save File As....** If you select **Save File** after changing the instrument parameters, the instrument setup file will be automatically overwritten.
- Output status including DC Output becomes Off when a setup file is recalled.

NOTE. *The AWG5000 series and AWG7000 series setup files are compatible each other. However, if the parameter value(s) of an instrument setup file are out of range, a warning message is displayed. In this case, out of range parameter values are set to the default values.*

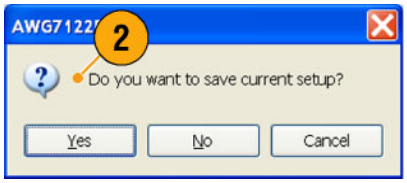
Default Setup

Push the front-panel **Factory Default** button to recall the factory default settings.

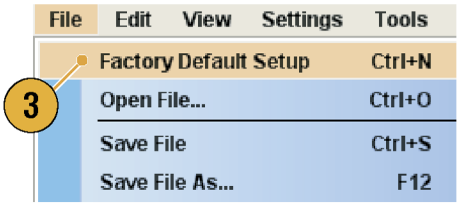
1. To quickly return to the factory default settings, push the front-panel Factory Default button.



2. When the instrument setups are modified, a confirmation dialog box appears.



3. You can also recall the factory default settings from the **File** menu.



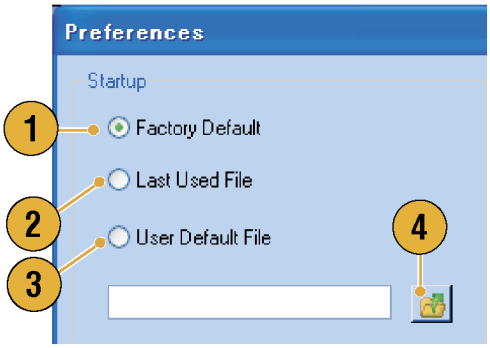
Changing Settings at Power-on

You can select the instrument settings that are restored when you power on the instrument.

Select **System** > **Preferences...** to display the Preferences dialog box. You can select the power-on setups from the following:

1. Factory Default – The factory default settings are always restored when the instrument is powered on.
2. Last Used File – Restores the setups that were saved or recalled last time.
3. User Default File – A specified setup file is always restored when the instrument is powered on.
4. Click the icon to display a dialog box to select the setup file.

   This icon is enabled when User Default File is selected.



Importing Waveform Data

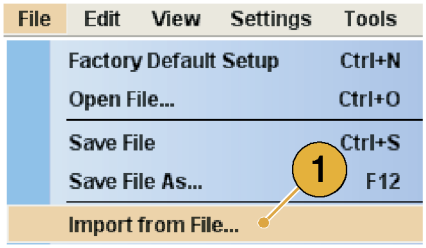
Data import functions allow you to use waveform data created outside the arbitrary waveform generator. You can import data to create a new waveform or to replace existing waveform data.

The arbitrary waveform generator supports the following file formats:

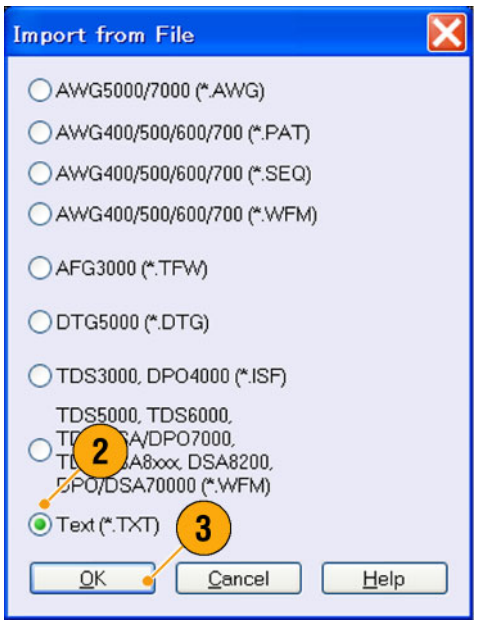
- *.AWG file created by Tektronix AWG5000 series or AWG7000 series
- The following file formats created by Tektronix arbitrary waveform generators such as AWG400/500/600/700 series:
  - *.PAT
  - *.SEQ
  - *.WFM
- *.TFW file created by Tektronix AFG3000 series arbitrary/function generator
- *.DTG file created by Tektronix DTG5000 series data timing generator
- *.WFM or *.ISF file created by Tektronix TDS/DPO series oscilloscope
- Text file (*.TXT)

Refer to the online help system for more information about file import.

1. Select **File** > **Import from File...** to display the Import from File dialog box.



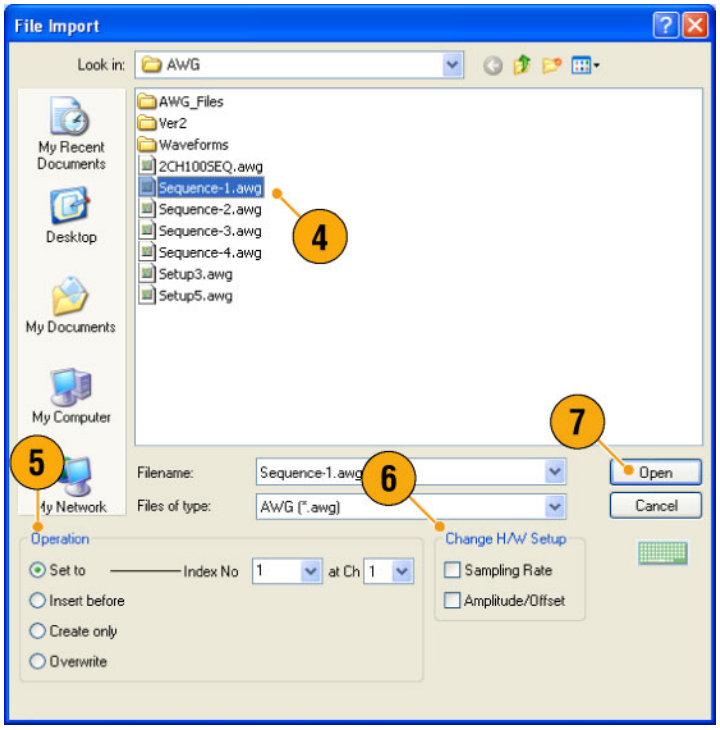
2. Select the file format that you want to import.
3. Click **OK**. The File Import dialog box, such as shown in step 4, is displayed.



4. Select a file to import.

5. Select an import action in the Operation frame.

   - **Set to** – Select the channel and index number. The imported waveform data will be assigned to the specified position.
   - **Insert before** – The imported waveform data will be inserted before the specified cell of the sequence. When the run mode is non-sequence, this parameter is disabled.
   - **Create only** – The imported waveform will be added to the Waveform List window.
   - **Overwrite** – Specified existing waveform data is overwritten.



6. If the imported waveform data contains information on sampling rate, amplitude, or offset, you can select whether you load that information using the Change H/W Setup.

   For example, if you check the Sampling Rate check box, the sampling rate will be modified to reproduce the same signal as the imported data.

7. Click **Open**.

   When the import file format is *.AWG, *.DTG, or *.TXT, a corresponding dialog box is displayed.

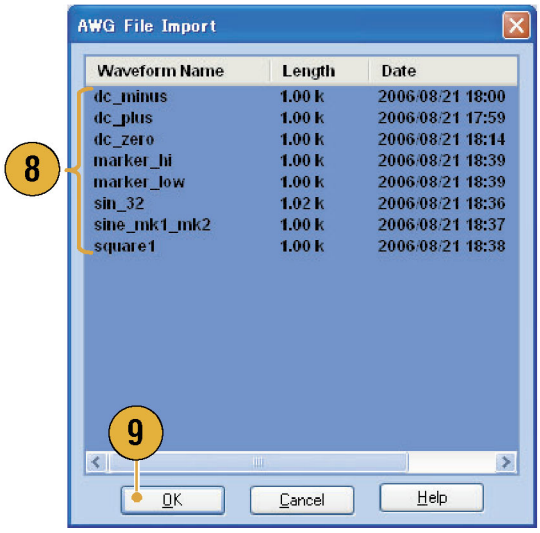
   When the import file format is other than *.AWG, *.DTG, or *.TXT, the selected file is imported and the waveform name(s) are listed in the Waveform List window.

8. If the file format is Tektronix AWG5000 series or AWG7000 series, the AWG File Import dialog box is displayed.

   Select a waveform to import.

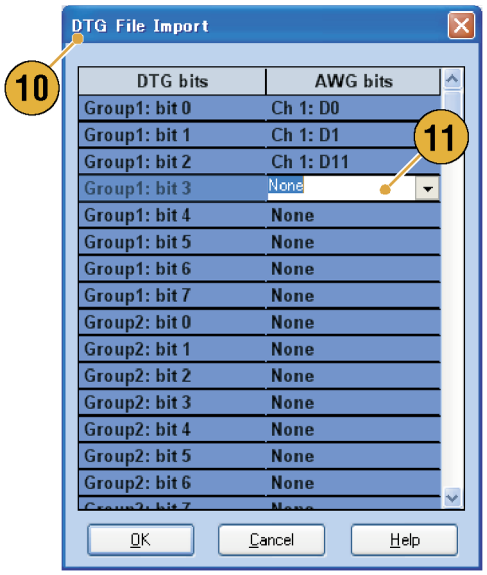
9. Click **OK**. The selected waveform is imported.

   You can select multiple waveforms.



10. If the file format is Tektronix DTG5000 series, the DTG File Import dialog box is displayed.

11. Assign each bit of imported DTG5000 series block data (DTG bits) to AWG bits.

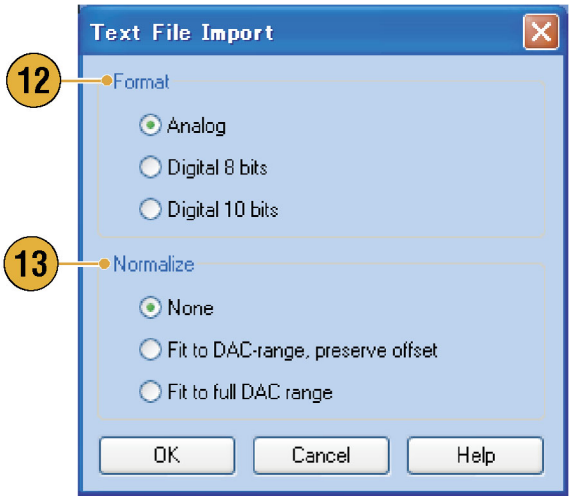


12. If text file format is selected, the Text File Import dialog box is displayed. Select the file format using the Format frame.

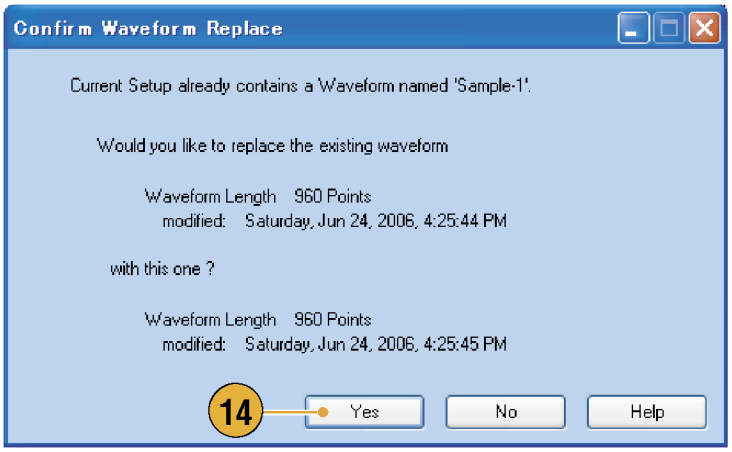
    Select **Digital** if you want to specify each bit for DAC. If your instrument is an AWG5000 series, Digital format is fixed to 14 bits.

13. Select the normalize option using the Normalize frame.

    - **None** – The waveform data is not normalized.
    - **Fit to DAC range, preserve offset** – The waveform data is scaled relative to 0 (zero).
    - **Fit to full DAC range** – Minimum value goes to –1.0 in normalized value and the maximum value goes to +1.0 in normalized value.



14. This dialog box is displayed when you execute import and the same name waveforms already exist. Select **Yes** or **Yes to All** if you want to replace the waveform(s).



Quick Tips

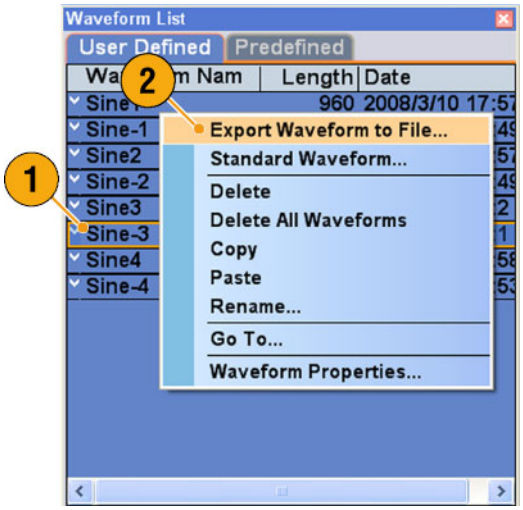
- When creating a new waveform, the name of the imported file will be the name of created waveform.
- By executing the file import function, the existing waveform is changed to be the same length as the imported file.

Exporting Waveform Data

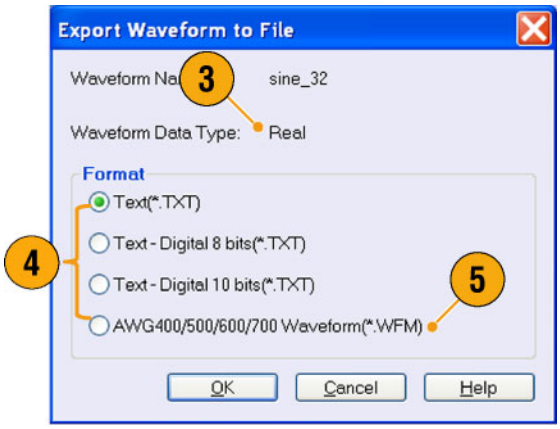
The arbitrary waveform generator can export waveform data to a text file for use with other applications. You can also select a pattern file or waveform file for use in AWG400/500/600/700 series instruments.

1. Select the waveform data for export. You can select a waveform from the Waveform List window.
2. Right click to display the popup menu. Select **Export Waveform to File...** to open the dialog box.

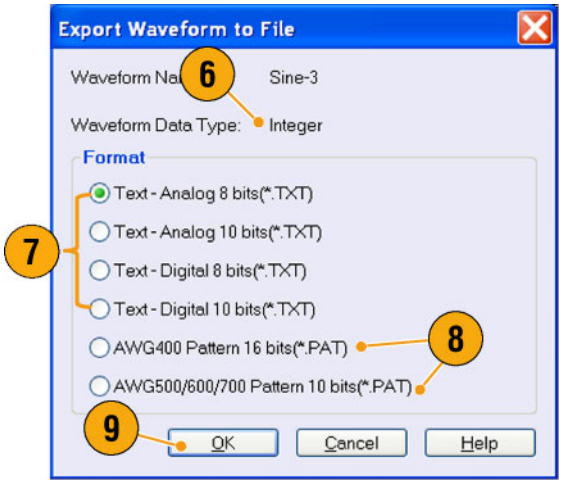
   You can also select the Export Waveform to File dialog box by right-clicking in the Sequence or Waveform window.



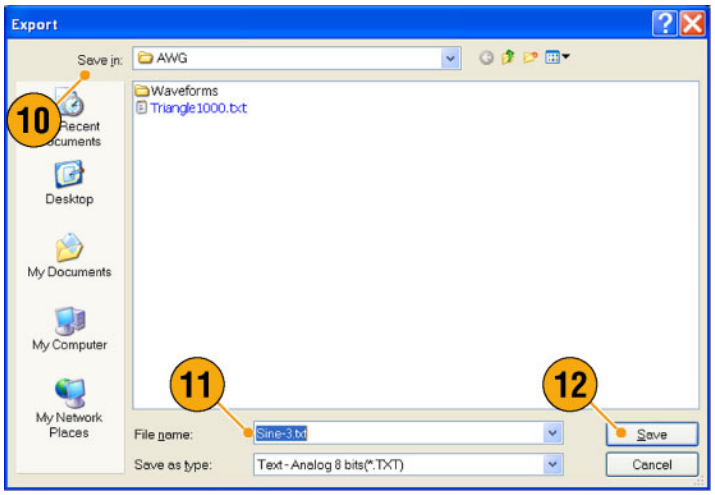
3. This is an example of a dialog box when you export a Real format waveform in an AWG7000 series instrument.
4. Select a file format.
5. You can export a Real format waveform into a *.WFM file for the AWG400/500/600/700 series instruments.



6. This is an example of a dialog box when you export an Integer format waveform in an AWG7000 series instrument.
7. You can select Analog or Digital when you select a *.TXT format. Select **Digital** if you want to specify each bit for DAC.
8. You can export an Integer format waveform into a *.PAT file for the AWG400/500/600/700 series instruments.
9. Click **OK**. The Export dialog box shown in step 10 is displayed.



10. Select a location to save the waveform data in Save in box.
11. The waveform name you selected in the Waveform List window is displayed.
12. Click **Save**. You can export the selected waveform data as a specified file format.



Quick Tips

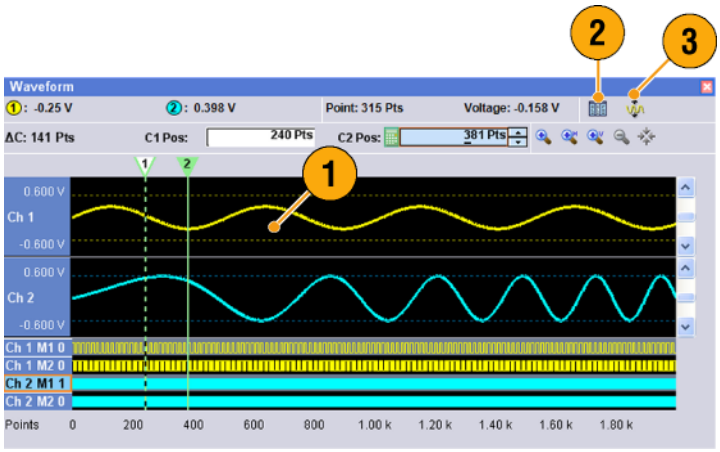
- Analog data is exported as normalized value.
- You can select DAC resolution when an Integer waveform is exported. The selected DAC resolution is used to convert integer data to normalized value.
- To change waveform format (Real or Integer), use the Waveform Properties dialog box. (See page 55, *Confirming Waveform Properties*.)

Waveform Display and Edit

Waveform Window

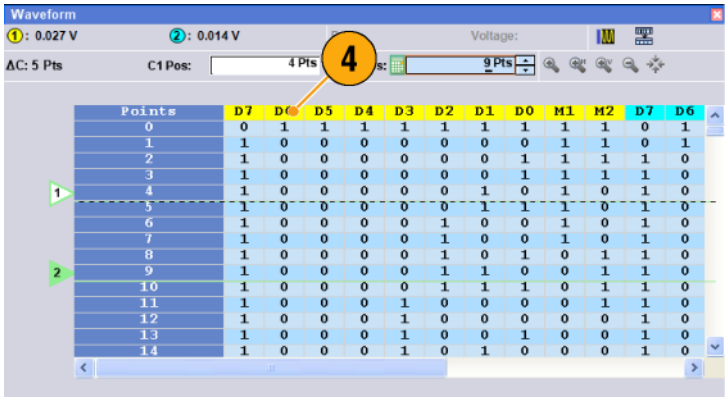
You can use the Waveform window to edit a newly created waveform or user-defined waveform listed in the Waveform List window. A selected element in the Sequence window or a selected waveform on the Ch n page of the Settings window is displayed in the Waveform window.

1. This is an example of Graphic display. Analog data and markers for Ch 1 and Ch 2 are displayed.
2. Click this icon to toggle graphic display and table display.
3. Click this icon (Vertical Best Fit) to adjust analog channel height so that all the elements are contained in the Waveform window.



4. This is an example of Table display.

   You can select either Analog or Digital in the Table display. This example shows Digital display with binary format.

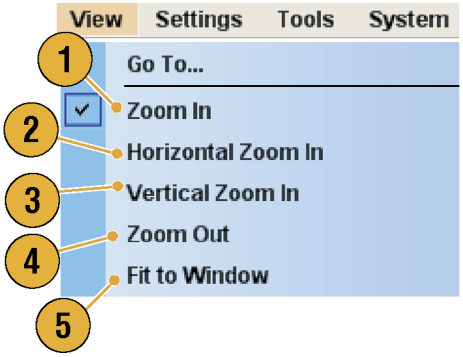


Quick Tips

- You can select displayed items in the Waveform window from analog data only, marker data only, or analog and marker data.
- To remove waveform data from the Waveform window, select **Edit** > **Clear** from the menu bar.
- You can select the vertical and horizontal units using the **Display Properties** dialog box. (See page 28, *Changing the Windows Display Style*.)
- To set a waveform from the Waveform List window, select a waveform and drag and drop it to the Waveform window.

Using Zoom

Use Zoom when you want to temporarily look at details of a waveform. To magnify a waveform, select Zoom commands from the View menu, or use the Zoom icons. The choices are as follows:



1. **Zoom In** – Use **Zoom In** to magnify a waveform horizontally and vertically at the same time.
2. **Horizontal Zoom In** – Use **Horizontal Zoom In** to magnify a waveform horizontally.
3. **Vertical Zoom In** – Use **Vertical Zoom In** to magnify a waveform vertically.

   You can select the vertical scale definition when zooming vertically. Use the Preferences dialog box. (See page 27, *Setting the User Preferences*.)
4. **Zoom Out** – Use **Zoom Out** to return the previous zoom factor. You can use Zoom Out only after the waveform is magnified.
5. **Fit to Window** – Use **Fit to Window** to fit the waveform in the window and restore the waveform to its state before the first zoom in. You can use Fit to Window only after the waveform is magnified.
6. The fastest way to set up a zoom display is to use Zoom icons on the Waveform window.

   Select one of the Zoom icons, and then click and drag across the segment of the waveform to create a box for zooming, or just click on a point in the waveform.

Creating or Modifying a Waveform

Use the Edit menu to create a new waveform or modify an existing waveform.

1. Select **Undo** to cancel the last process.

   Undo does not apply to cursor position, zoom, and scroll functions.

2. Select **Redo** to repeat the last process.

3. Opens the Standard Waveform dialog box.

4. Opens the Sequence Control Parameters dialog box.

5. Opens the Cut or Delete dialog box.

   In the sequence, Cut or Delete causes an immediate action.

6. Select **Delete All Waveforms** to delete all the user-defined waveforms in the setup file.

7. **Clear** removes contents of selected element(s) in the Sequence window. Remaining elements do not shift.

   In the Waveform window, **Clear** removes the selected waveform data.

8. Opens the Copy dialog box.

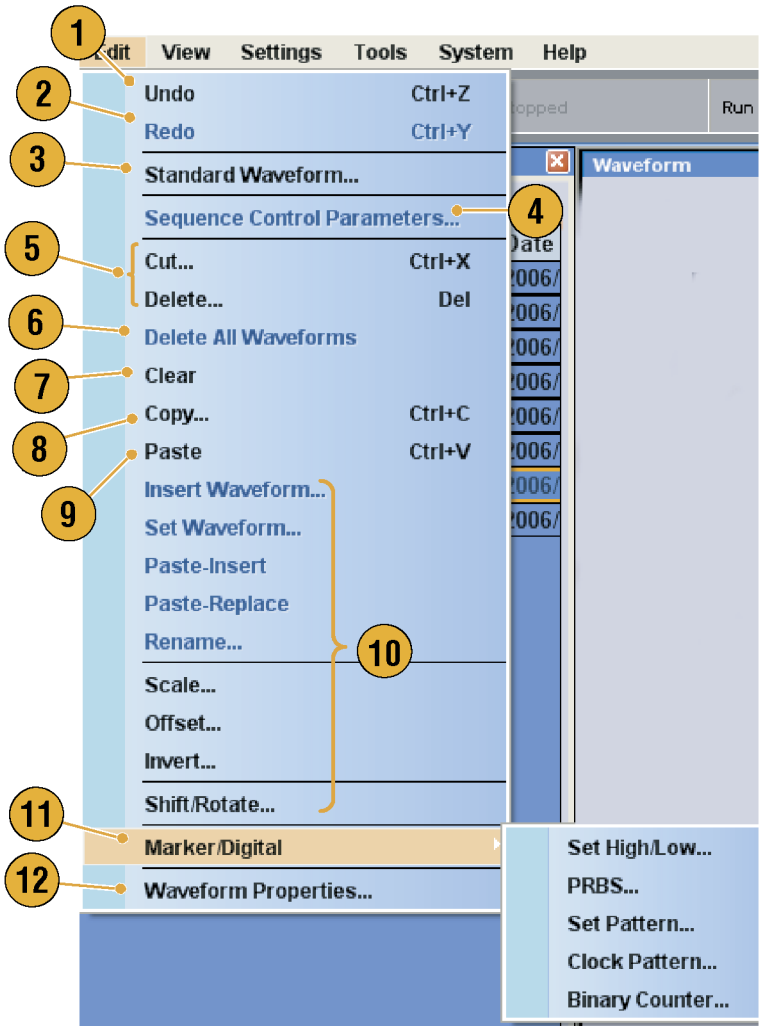
   In the sequence, Copy causes an immediate action.

9. Select **Paste** to copy the content of clipboard.

10. Opens edit-related dialog boxes.

11. Opens the Marker related submenu.

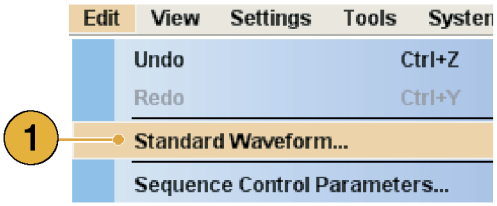
12. Opens Waveform Properties dialog box.



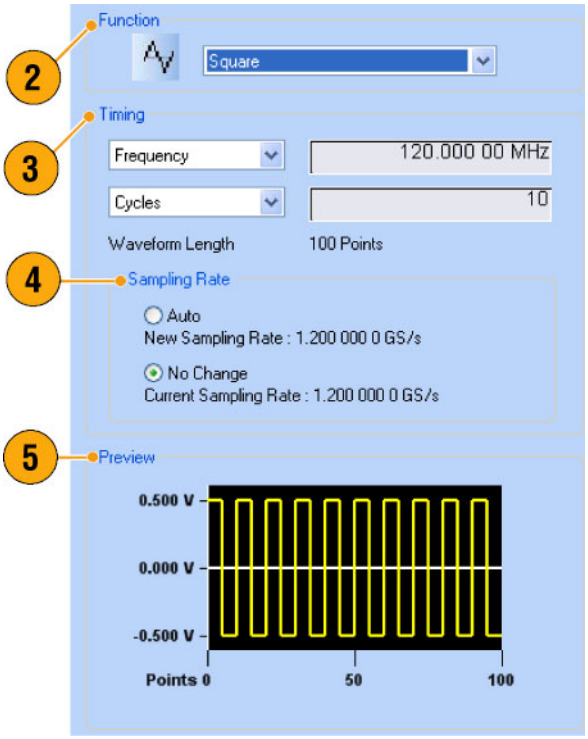
Creating a Standard Waveform

You can create a new waveform using the standard waveform dialog box.

1. Select **Edit** > **Standard Waveform...** to open the Standard Waveform dialog box.



2. Use **Function** to select a waveform type. You can select a waveform from Sine, Triangle, Square, Ramp, Gaussian Noise, and DC.
3. Use **Timing** to set parameters for Frequency, Waveform Length, and Cycle.
4. Select **Auto** or **No Change** in Sampling Rate.
   - **Auto** Sampling rate and waveform length are automatically set to appropriate values.
   - **No Change** Sampling rate is not changed. You can select any two parameters from frequency, waveform length, and cycle. The remaining parameter will be calculated automatically.
5. A waveform is displayed on the Preview screen.



6. Use **Level** to set parameters for Amplitude/Offset or High/Low.

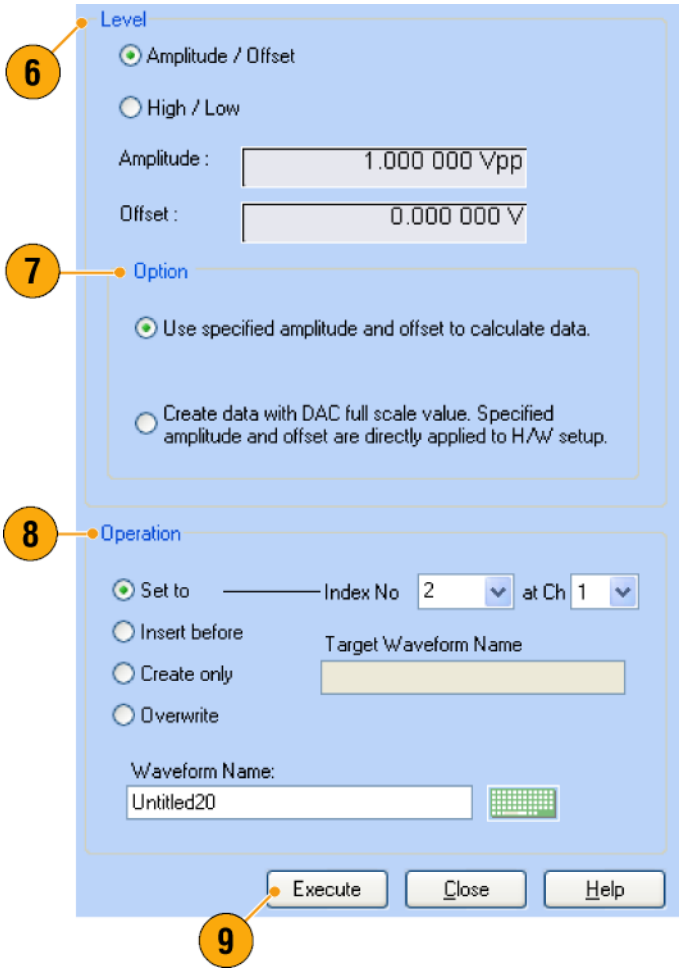
7. Use **Option** to select the amplitude/offset settings. This frame is displayed when you set the vertical units to Voltage.

   If you set the vertical units to Normalized Value, this frame is disabled. (See page 28, *Changing the Windows Display Style*.)

8. Select an edit action in the Operation frame.

   - **Set to** – Specifies the channel and index number. The created waveform is assigned to the specified position.
   - **Insert before** – The created waveform is inserted before the specified cell of the sequence. When this command is executed, the remaining data is shifted. When the Run mode is non-sequence, this parameter is disabled.
   - **Create Only** – Creates a new waveform, but the waveform is not loaded. Enter the waveform name in the Waveform Name box. The created waveform is listed in the Waveform List window.
   - **Overwrite** – Specified existing waveform data is overwritten. When you select Overwrite, a waveform currently being loaded is displayed in the Target Waveform Name box. The Waveform Name box is disabled.

9. Click **Execute** to create a waveform.

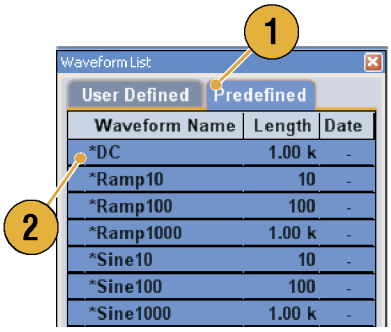


Accessing Waveform in a Setup File

A created waveform is registered as a user-defined waveform in the Waveform List window. The Waveform List window lists the waveforms that are saved in the setup files (*.AWG). The instrument provides two types of waveform list (predefined and user-defined).

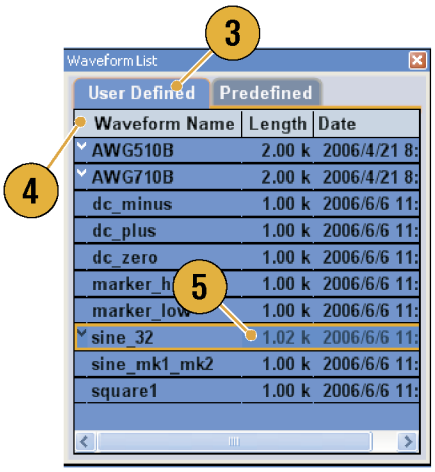
1. To select a predefined waveform, click the **Predefined** tab.
2. Predefined waveforms have an asterisk sign (*) to the left of the waveform name.

NOTE. You cannot edit, delete, or rename the predefined waveforms.

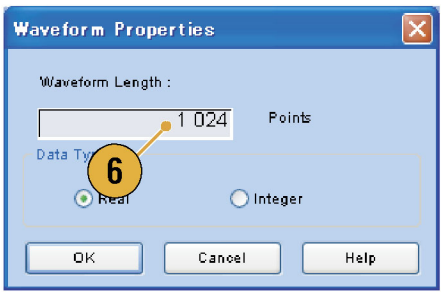


3. To select a user-defined waveform, click the **User Defined** tab.

   To edit a user-defined waveform, select the waveform and drag it to the Waveform window.
4. You can sort the waveform list by the order of Waveform Name, Length, or Date.
5. Each waveform length is displayed as a three-digit number in the Waveform List window.



6. If you want to know the exact waveform length, select the waveform and then right-click to display the pop-up menu. Select **Waveform Properties...** to display the Waveform Properties dialog box. You can confirm the waveform length with this dialog box.



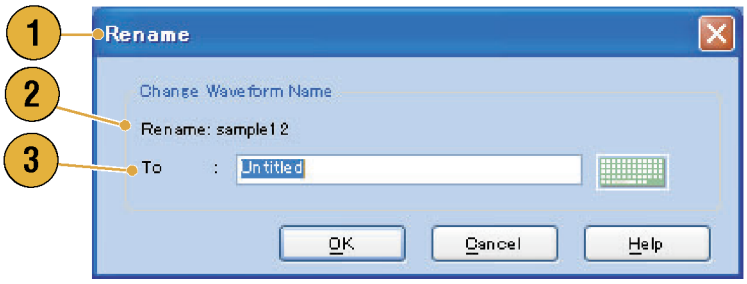
Quick Tips

- If you right-click on this window, a pop-up menu is displayed. You can access the commands, such as Delete, Copy, and Paste.
- When you create a waveform, you cannot use the same name as a predefined waveform.

Changing a User-Defined Waveform Name

You can change a user-defined waveform name in the Waveform List window.

1. Select a waveform in the Waveform List window, and then select **Edit** > **Rename...** from the menu bar to open the Rename dialog box.
2. The waveform name is displayed.
3. Enter the new waveform name in the To field.

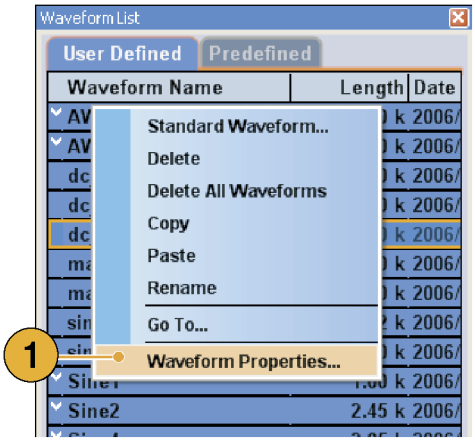


Confirming Waveform Properties

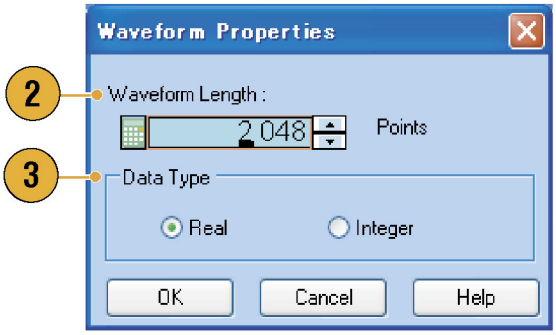
You can confirm or change properties of waveform data using the Waveform Properties dialog box.

1. Select a waveform in the Waveform List window, and then select **Waveform Properties...** from the popup menu to display the dialog box.

   You can access the Waveform Properties dialog box by right-clicking in the Waveform window or the Ch n page of Settings window.



2. You can confirm or change the waveform length.
3. You can confirm or change the waveform data type (Real or Integer).



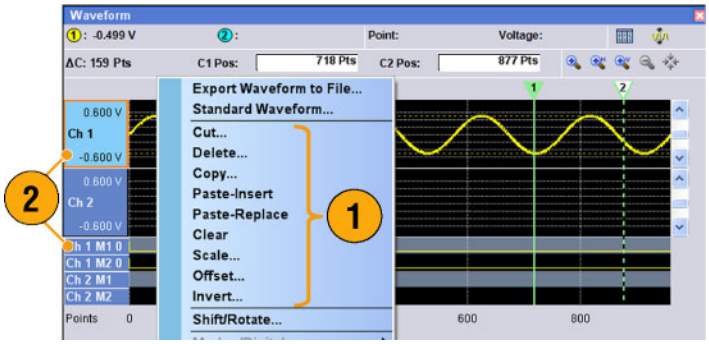
Editing a Waveform

You can edit a waveform which is created using the Standard Waveform dialog box, imported waveform, or a user-defined waveform listed in the Waveform List window.

Item and Range

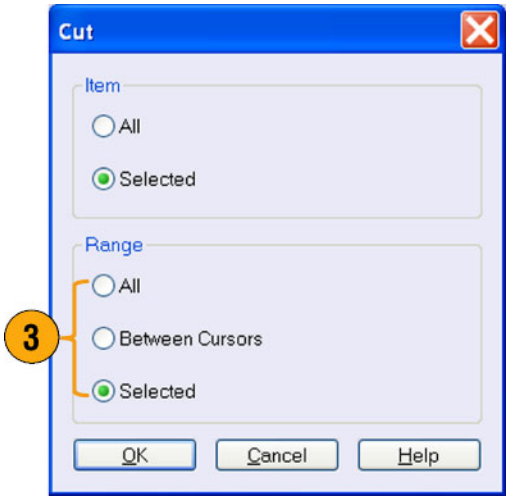
When you edit a waveform, items and range are usually specified as an edit target.

1. To edit a waveform, you can use these menu items.
2. You can select edit item(s) from the following:
   - Ch n Analog data
   - Ch n Marker 1 data/Marker 2 data
   - All - Edit is applied to all items. All can be target of an edit operation such as Cut or Copy.
   - All Analog - Edit is applied to all analog data. All Analog can be selected when Scale or Offset is selected.
   - All Markers - Edit is applied to all marker data.



3. You can select edit range from the following:

   - All - Edit is applied to all the range of selected item(s).
   - Between Cursors - Edit is applied to the range between cursors.
   - Selected - Edit is applied to selected range. This selection is available only in the Table display

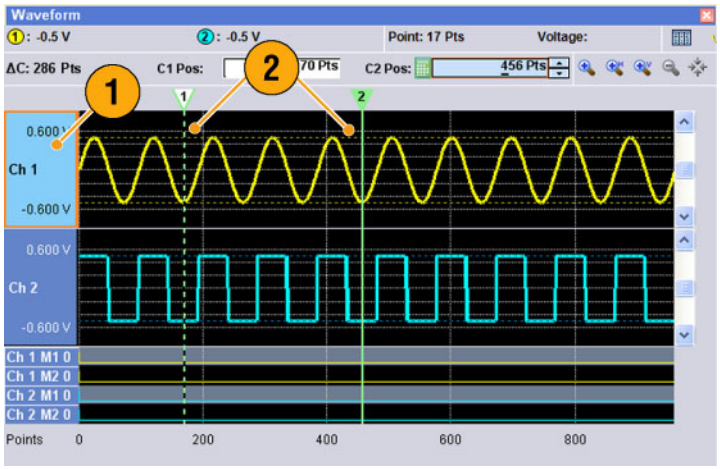


NOTE. The internal clipboard resides in the instrument application software. It is different from Windows clipboard. You cannot transfer data from other applications like Microsoft Excel into the instrument clipboard. Data transfer from other applications is possible using the import/export functions.

Cut and Paste Example

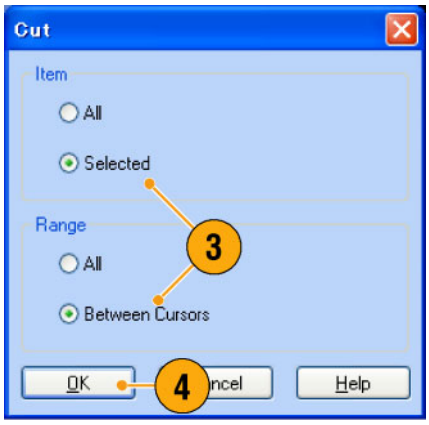
The following procedure shows Cut and Paste example in the Waveform window (Graphic display). You can also execute Cut or Paste in the Table display.

1. Select the item(s) you want to edit. This example shows cut and paste operation using two channels.
2. Specify the range using cursors.



3. Select **Edit** > **Cut...** to open the Cut dialog box. Select the following:
   - Items – Selected
   - Range – Between Cursors

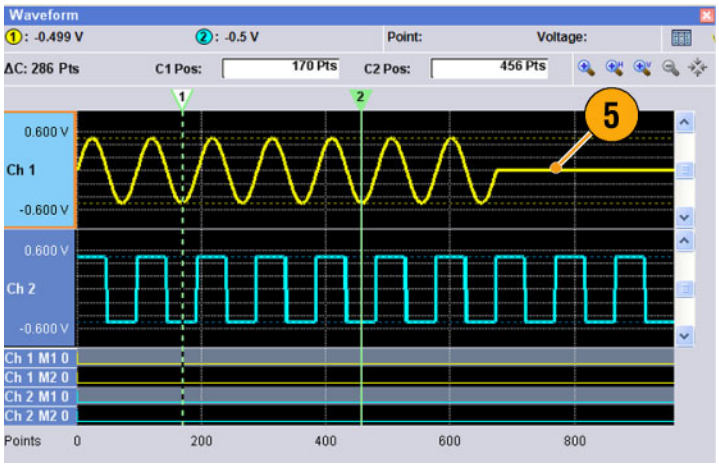
   If you need to change the Items or Range settings, use this dialog box.
4. Click **OK**.



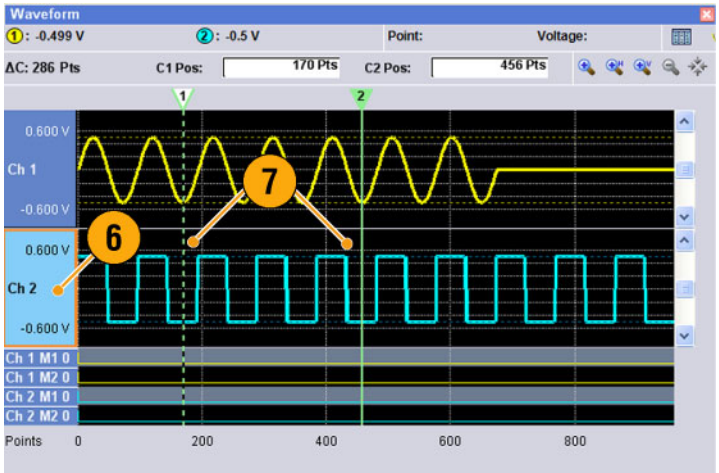
5. The selected portion of the waveform is cut.

NOTE. *If a part of items are cut or deleted, the waveform length will not be shortened. The data is shifted. The portion after the shifted area will be filled with default value.*

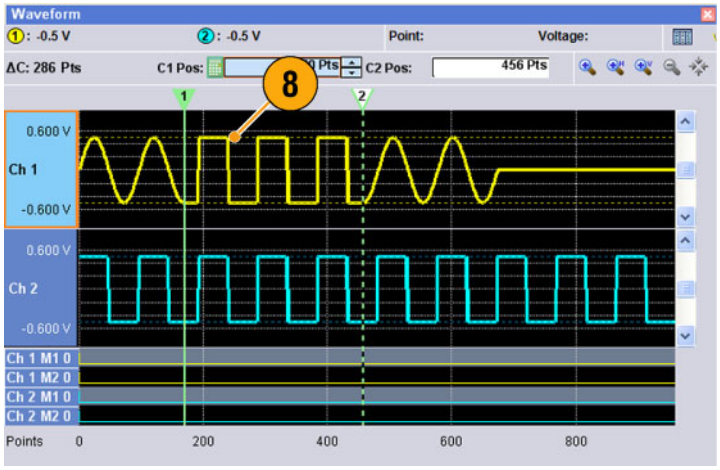
NOTE. *If all items are cut or deleted, the waveform length is shortened accordingly.*



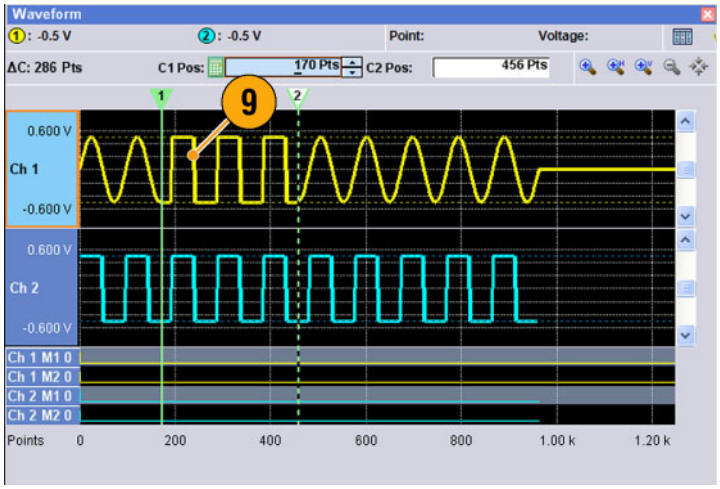
6. Select Ch 2.
7. Specify the edit target using the cursors. From the Edit menu, select **Copy**.



8. This is an example of **Paste-Replace**. The specified range of Ch 2 waveform is pasted and replaces the Ch 1 waveform. The Ch 1 waveform length is not changed.



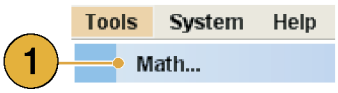
9. This is an example of **Paste-Insert**. The specified range of Ch 2 waveform is inserted on the Ch 1 waveform. The Ch 1 waveform length is changed.



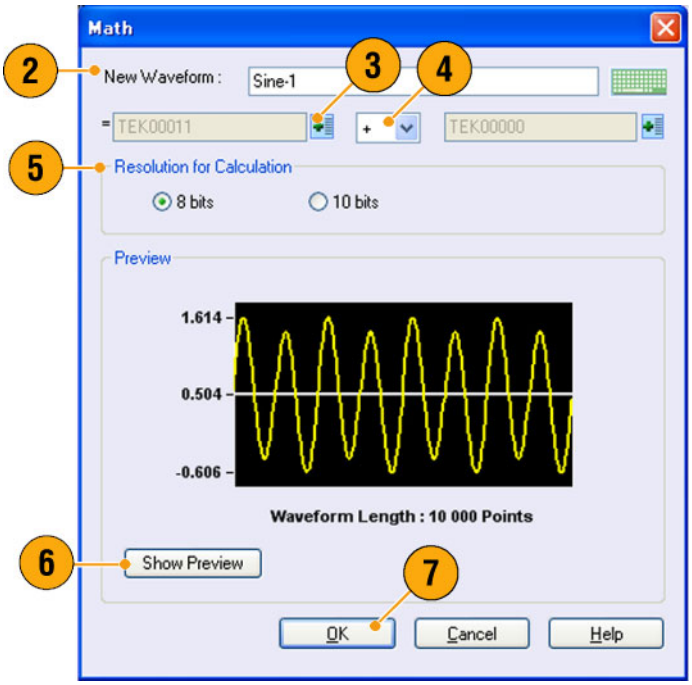
Math Waveforms

You can use the Math dialog box to perform mathematical operations on the waveform you are editing. The analog data of two waveforms can be added, subtracted, or multiplied. The created waveform data can be added to the Waveform List.

1. Select **Tools** > **Math...** to display the Math dialog box.



2. You can enter a waveform name in the New Waveform field.
3. Select a waveform from the waveform list. Click the icon to display the Waveform List dialog box.
4. Select a math operator.
5. (AWG7000 series) Select the resolution.
6. If you click **Show Preview**, the calculation results will appear on the Preview screen.
7. Click **OK** to add the new waveform to the Waveform List window.



Quick Tips

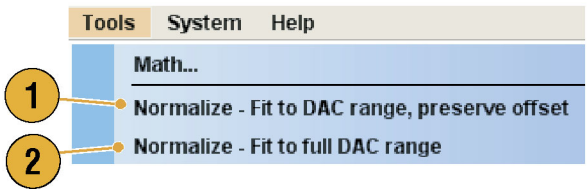
- A new waveform will be created as the result of waveform math operation. For the marker data, the data of the first operand waveform will be copied to the new waveform.
- The math operation is executed for all analog waveform data.
- If the length of two waveforms is not the same, the length of the result is the same as the length of the shorter waveform. The beginning part of the longer waveform is used for the calculation.

Normalize Option

You can select normalize options when analog data is normalized. Normalize is executed for the entire analog waveform data.

Select one of the following options from the Tools menu:

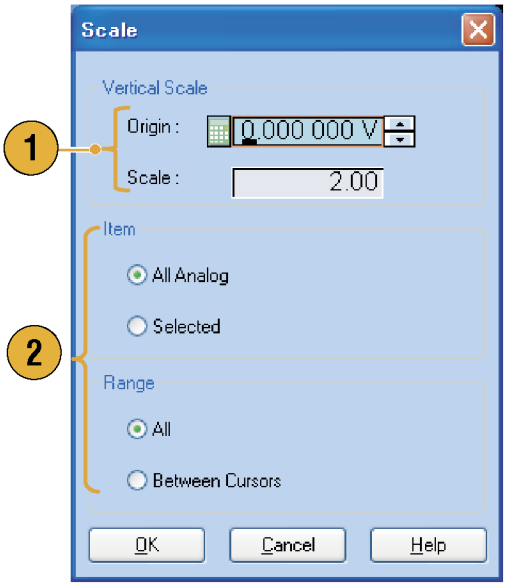
1. **Fit to DAC range, preserve offset**
   The waveform data is scaled relative to 0 (zero).
2. **Fit to full DAC range**
   Minimum value goes to –1.0 in normalized value and the maximum value goes to +1.0 in normalized value.



Using Other Edit Menu Commands

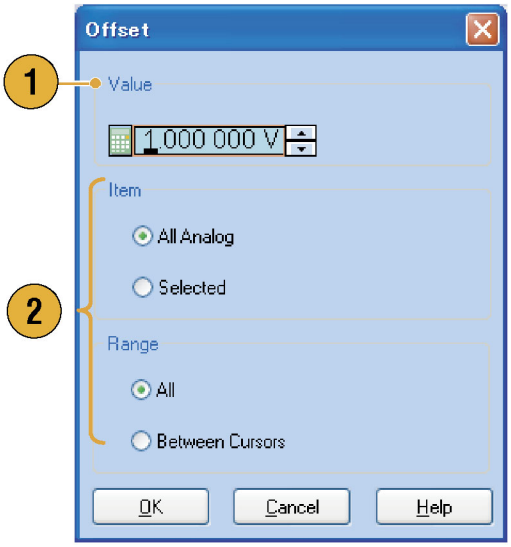
Scale. You can scale the specified range of analog data using **Scale...** from the Edit menu.

1. Vertical scale origin and scale factor can be set. The scale factor does not have the units.
2. Use this dialog box to change the Item or Range. (See page 56, *Item and Range*.)



Offset. You can add constants to the specified range of analog data using **Offset...** from the Edit menu.

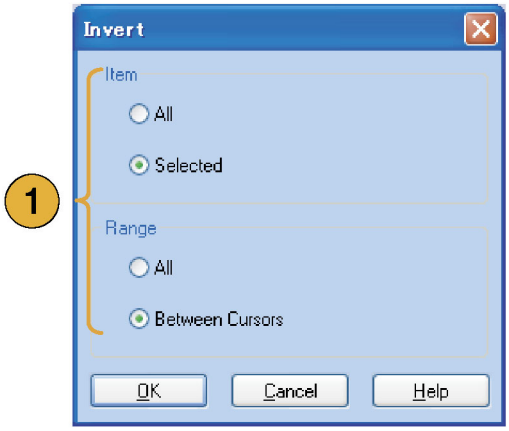
1. Offset can be set by voltage or normalized value.
2. Use this dialog box to change the Item or Range. (See page 56, *Item and Range*.)



Invert. Data values in the specified range can be inverted using **Invert...** from the Edit menu.

1. For analog data, a positive value will become negative. For marker data, low (0) becomes high (1).

   Use this dialog box to change the Item or Range. (See page 56, *Item and Range*.)



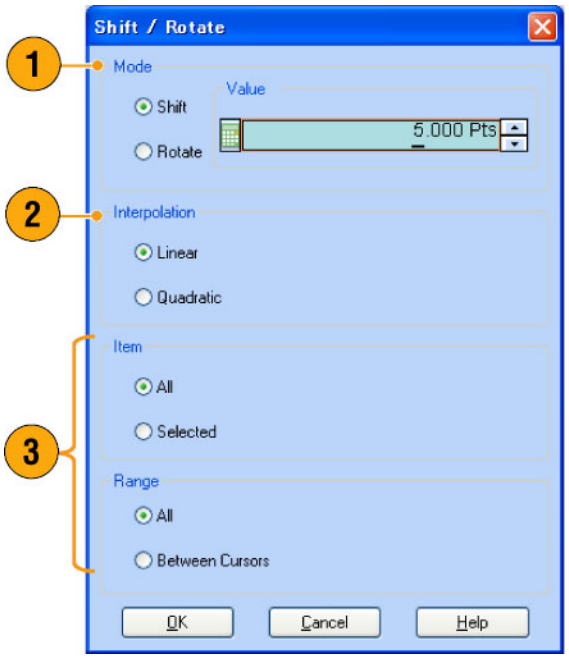
Horizontal Shift/Rotate. You can shift or rotate the specified range of waveform data horizontally using **Shift/Rotate...** from the Edit menu.

1. Select Mode (Shift or Rotate).

   You can set the shift or rotate values (time or points).

2. Linear or Quadratic interpolation can be selected for fractional shift or rotation.

3. Use this dialog box to change the Item or Range. (See page 56, *Item and Range*.)

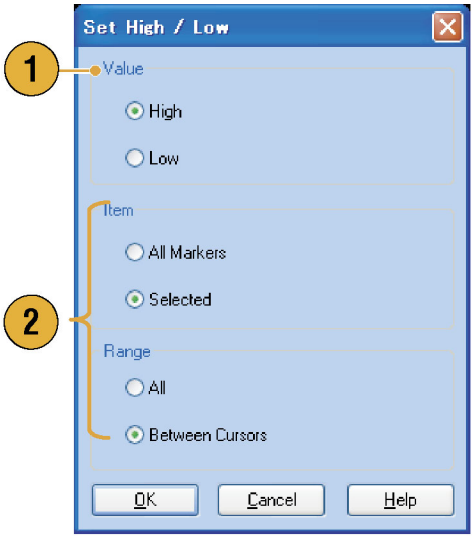


Quick Tips

- Horizontal Rotate is used to check if the waveform data is connected smoothly from the end of the first waveform to the beginning of the second waveform. This is especially useful when the waveform is looped by the sequencer.
- Horizontal Shift/Rotate is applied for analog data and marker.

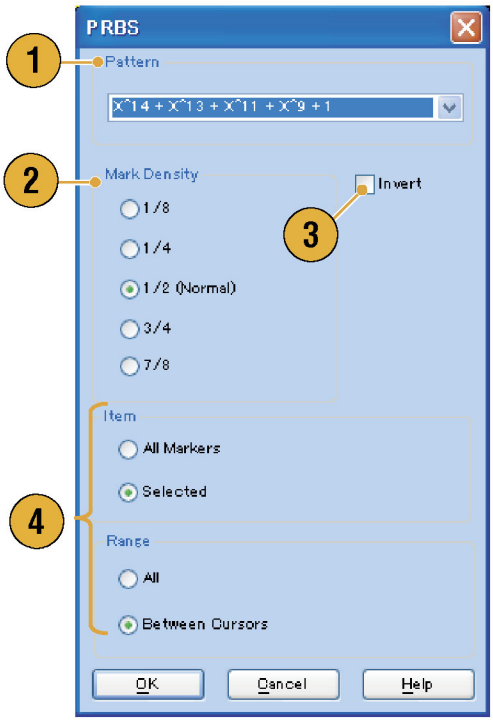
Set High/Low. You can set the specified range of marker data to high or low using **Set High/Low...** from the Edit > Marker/Digital menu.

1. Select High or Low.
2. Use this dialog box to change the Item or Range. (See page 56, *Item and Range*.)



PRBS. You can replace a specified range of waveform data with a PRBS pattern using **PRBS...** from the Edit > Marker/Digital menu.

1. Select a PRBS pattern.
2. Select a Mark Density.
3. Invert can be set to On or Off.
4. Use this dialog box to change the Item or Range. (See page 56, *Item and Range*.)

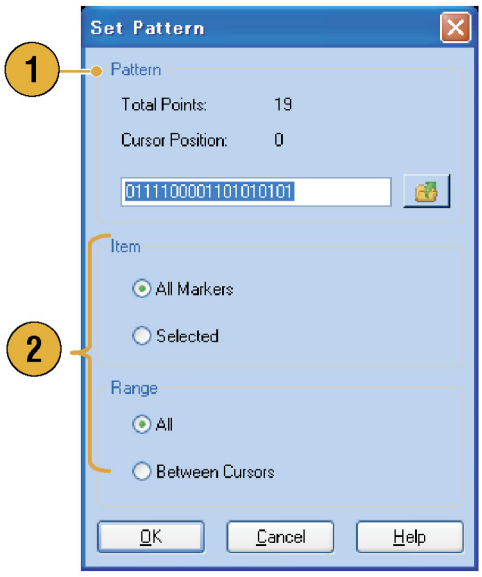


Set Pattern. You can fill the specified area of marker data with a selected digital pattern using **Set Pattern...** from the Edit > Marker/Digital menu.

1. You can enter a pattern directly, or load a text file from the internal hard drive or an external memory device.

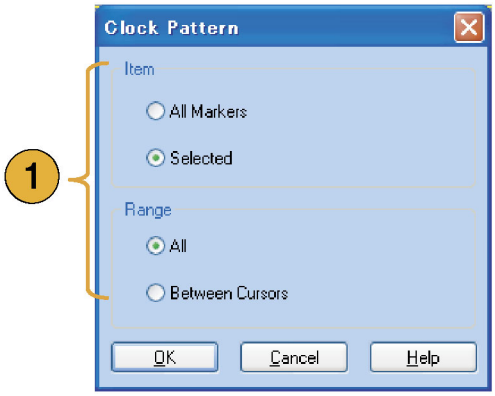
   The maximum length of a bit pattern is 1000.

2. If multiple items are specified as a target for Set Pattern, the same data will be filled in for all items. (See page 56, *Item and Range*.)



Clock Pattern. You can fill a specified area of marker data with the 1010 clock pattern using **Clock Pattern...** from the Edit > Marker/Digital menu.

1. Use this dialog box to change the Item or Range. (See page 56, *Item and Range*.)

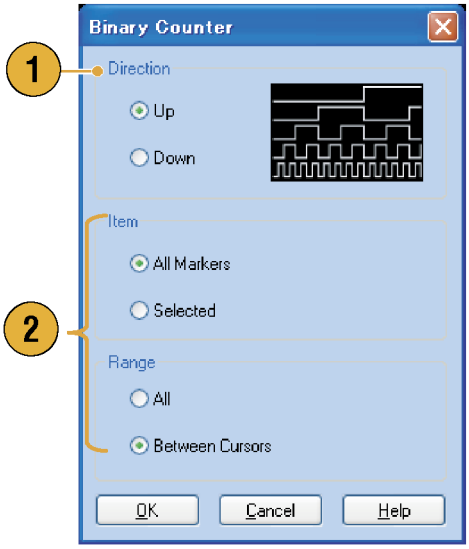


Binary Counter. You can fill the specified area of marker data with a binary counter pattern using **Binary Counter...** from the Edit > Marker/Digital menu.

1. You can select the direction (Up counter or Down counter).

   The up counter begins from all 0, and the down counter begins from all 1.

2. Use this dialog box to change the Item or Range. (See page 56, *Item and Range*.)



Sequence

It is sometimes necessary to create long waveform files to fully implement a DUT test. Where portions of the waveforms are repeated, a waveform sequencing function can save you a lot of memory-intensive waveform programming.

Sequence is used for mainly the following two purposes:

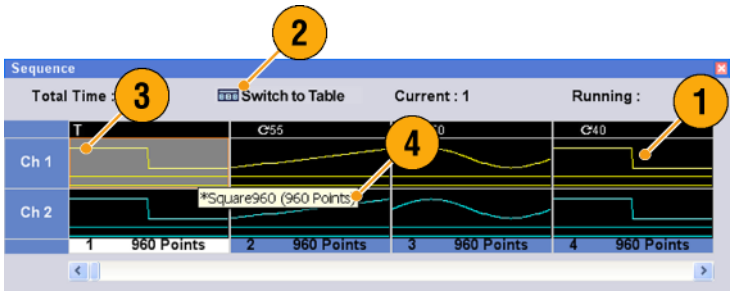
- Output longer waveform than hardware memory
- Change the output waveform quickly (such as ATE applications)

NOTE. *Wait Trigger is set to On in an instrument without option 08. To set Wait Trigger Off, option 08 must be installed in the instrument.*

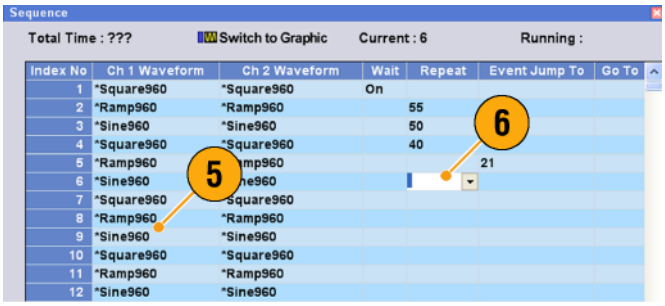
Sequence Window

When Sequence is selected in the Run Mode, this window shows information on the status of the sequence settings. (See page 22, *Run Mode*.)

1. This is an example of the Sequence window Thumbnail display.
2. Click Switch to Table to change the display to Table display.
3. If you click on a cell, the selected waveform is displayed in the Waveform window. The background color of the selected cell changes.
4. If you hover the mouse over a sequence cell, a tooltip appears to show you the waveform name and waveform length.



5. This is an example of Table display.
6. You can directly enter a sequence parameter value, such as Repeat count or Go To target, in the Table display.



Quick Tips

- The following methods are available for applying an existing waveform to a sequence:
  - Drag and drop a waveform from the Waveform List window to a cell of the Sequence window
  - After selecting a cell in the Sequence window, use Set Waveform... or Insert Waveform... from the Edit menu
- When Continuous, Triggered, or Gated is selected in the Run mode, the Sequence window is hidden.

The following icons are used in the Sequence window:

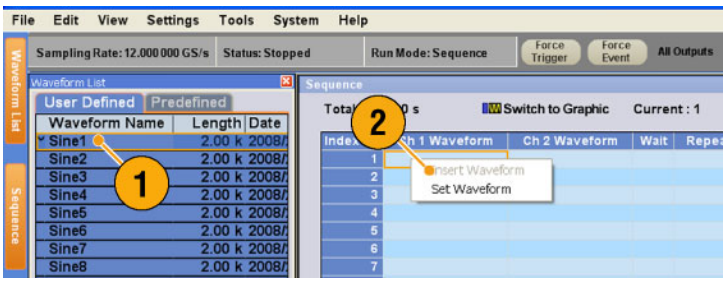
Display Icons	Description
	Wait Trigger
	Repeat. (Repeat count is set to 26 in this example.)
	Repeat (Infinite)
	Event Jump. (Jump target is set to index number 26 in this example.)
	Go To. (Go To target is set to index number 26 in this example.)

Creating a Sequence

To create a sequence, waveforms must be assigned to Sequence window. The following example shows basic steps to create a sequence.

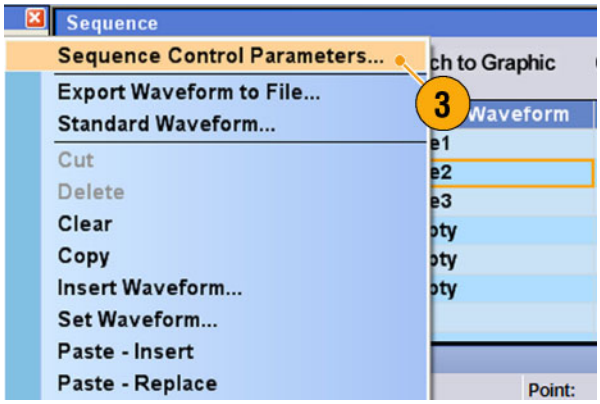
1. Select a waveform in the Waveform List window.
2. Drag and drop the waveform to a sequence window cell.

   As a quick access to the waveform list, you can double-click or right-click on a cell.



3. After assigning waveforms to sequence cells, you can define the sequence parameters.

   Right-click on a cell, or use the **Edit** menu to open the Sequence Control Parameters dialog box.



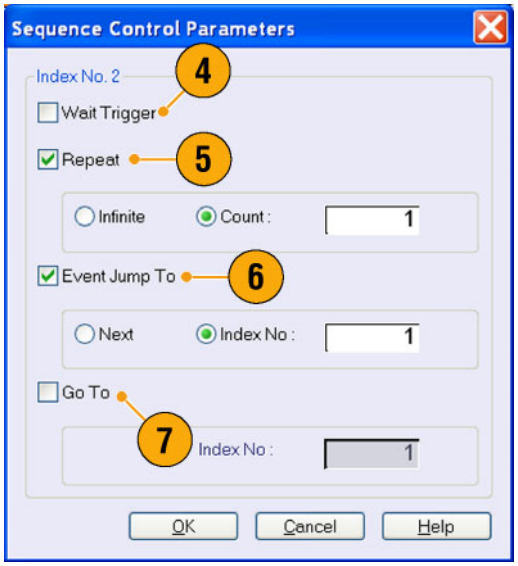
4. The sequencer will wait for the trigger before generating a waveform if **Wait Trigger** is checked.

5. A waveform can be repeated if the **Repeat** Count is specified for each element of the sequence.

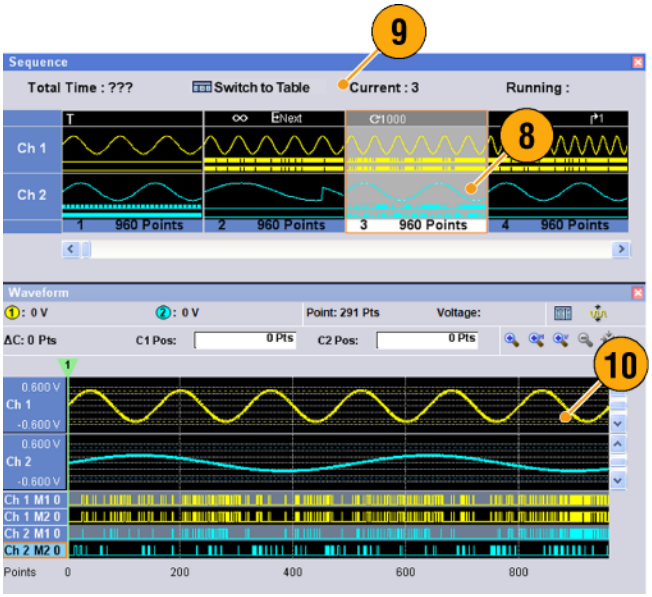
6. **Event Jump To** changes the sequencing of the waveform by the external event.

   See the Quick Tips below for supported event signals.

7. If you specify **Go To** target for each sequence element, the sequencer jumps to the element specified by Go To target immediately after generating the waveform specified in a sequence element.



8. A sequence element consists of all analog waveform data and marker data with an index number.
9. A selected element is called current element.
10. A selected element in the Sequence window will be displayed in the Waveform window.



Quick Tips

- You can use the Standard Waveform dialog box to create a waveform and set the waveform to Sequence window.
- When importing waveform data, you can directly set the waveform to Sequence window.
- If Sequence is selected in the Run mode, the sequencer executes the sequence definition. Sequence definition consists of a series of sequence elements. Each sequence element has the following information:
  - References to the waveform for each channel
  - Sequence control parameters (Wait, Repeat, Event Jump To and Go To)
- Sequence is executed in turn from the first element (Element Index = 1) to the last element. If an element has Jump To or Go To, the sequencer follows that definition.
- The following signals are supported as an event:
  - A signal is applied to the front-panel Event Input connector
  - The front-panel Force Event button is pushed
  - Remote command is received – EVENt[:IMMediate]
- Maximum sequence length is different depending on the instrument type.

Instrument type	Maximum sequence length
AWG7061B, AWG7062B, AWG7121B, AWG7122B	1 to 16,000 steps
AWG5002B, AWG5004B, AWG5012B, AWG5014B	1 to 8,000 steps

NOTE. There are two sequencer modes in the arbitrary waveform generator to execute the created sequence: the hardware sequencer mode and the software sequencer mode. Refer to the online help for details about the difference between the hardware and software sequencer modes.

Editing a Sequence

The following commands are provided for sequence edit:

Set Waveform and Insert Waveform. Use these menus to set or insert a waveform to a Sequence window cell.

Clear. Clear removes the contents of selected element(s). You can clear multiple non-contiguous elements. Unselected elements do not shift.

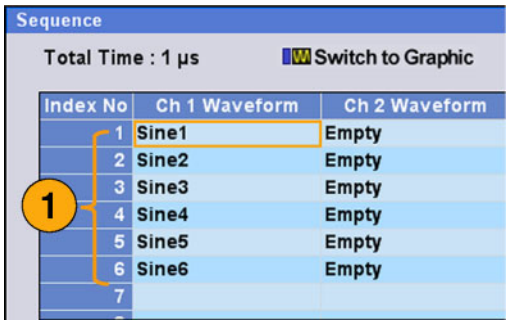
Cut and Delete. Cut and Delete can be done by the units of element. You can cut or delete multiple and continuous elements at a time.

Copy, Paste-Insert and Paste-Replace. You can copy or paste data on one or more contiguous elements. The data in the clipboard will be inserted or replaced at the specified position of the sequence. If Paste-Insert is executed, the existing data is shifted.

Edit Example

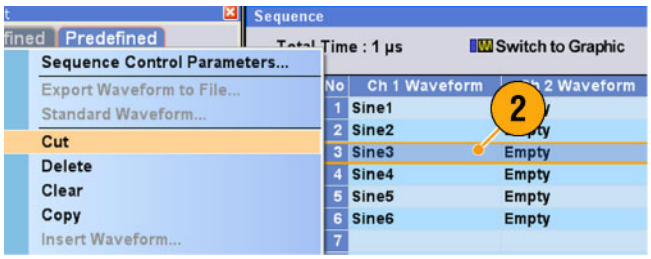
The following procedure shows Cut and Paste example in the Sequence window (Table display).

1. Create a sequence.



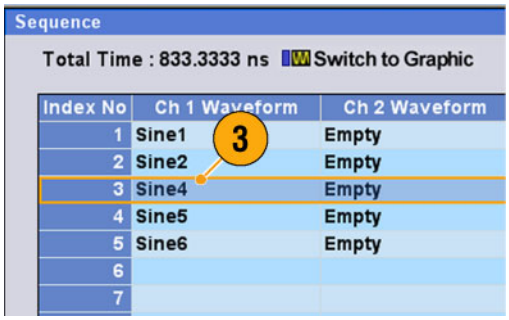
2. Select the element(s) to cut. In this example, Index number 3 is the target of Cut.

NOTE. You can Cut and Delete at the units of element level.

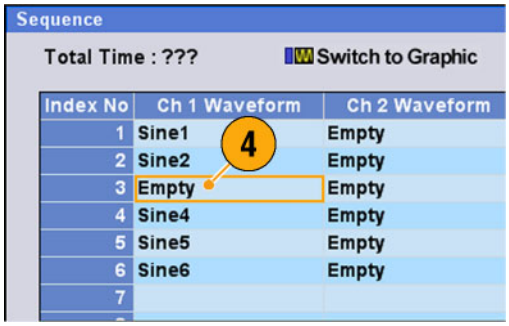


3. Cut is executed and the remaining data in the sequence are shifted.

NOTE. Cut data is placed in the clipboard. Deleted data is removed from the sequence and cannot be recovered.

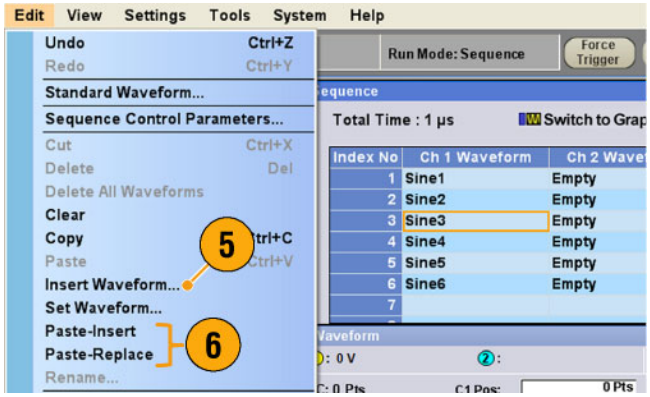


4. **Clear** initializes the data of selected waveform(s) or element(s). A cleared cell becomes Empty.



5. Use **Insert Waveform...** to insert a waveform from the Waveform List.

6. You can use **Paste-Insert** or **Paste-Replace** when you want to set a waveform after copying any waveform in the Sequence window.



Event Jump

Use the Event page of Settings window to set parameters for event signal. You can use the Event page when the Run mode is Sequence.

1. Sets external event input threshold level.
2. Selects the polarity of external event input signal (**Positive** or **Negative**).
   - Positive – Jump will occur when the instrument receives a positive pulse.
   - Negative – Jump will occur when the instrument receives a negative pulse.
3. Sets jump timing (**Async** or **Sync**).
   - Async – Jump will occur immediately.
   - Sync – Jump will occur after the waveform is generated.
4. Sets event input impedance (1 kΩ or 50 Ω).

Quick Tips

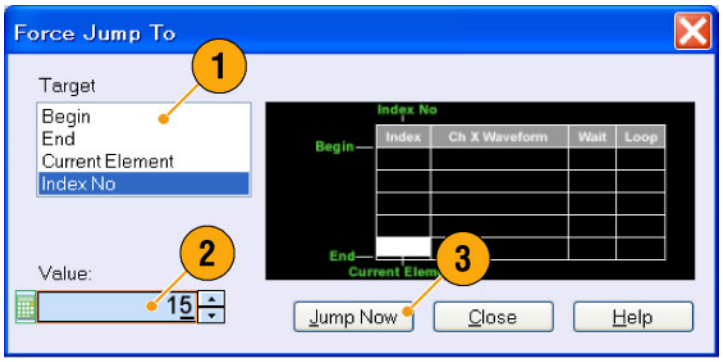
- Event Jump can change the sequence order using an event signal.
- Jump timing is applied to both Event Jump and Force Jump.

Force Jump To

Force Jump allows you to jump to a position that you choose while the instrument is outputting a sequence.

Select **System** > **Force Jump To...** to open the Force Jump To dialog box.

1. Specify a jump target or select Index No.
2. When Index No is selected as jump target, enter the index number using the Value: field.
3. Click **Jump Now** to change the waveform output to the position specified by jump target.



Quick Tips

- The arbitrary waveform generator has an Event Jump function which changes the sequence using an event signal. Use the Event page of the Settings window to set parameters for Event Jump.
- Force Jump is similar to Event Jump. In the case of Force Jump, you must specify the jump target explicitly by using the Force Jump To dialog box.
- Force Jump is independent from Event Jump. Force Jump can be executed regardless of the Event Jump setting.

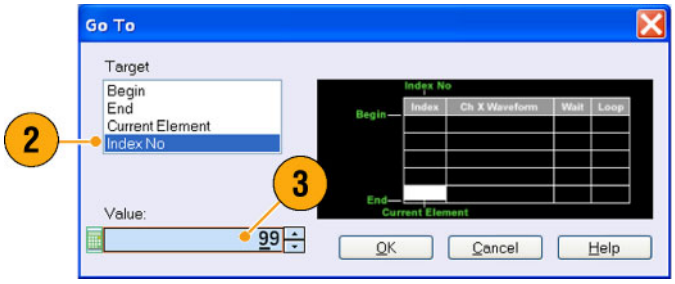
Accessing Sequence Elements Outside the Display Area

When you create a long sequence, the Sequence window cannot display the whole sequence elements. You can use the Go To dialog box to move to a specified element that is not displayed in the window.

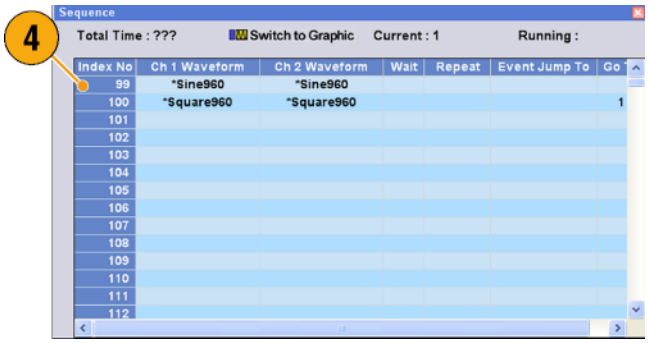
1. After creating a sequence, select **View** > **Go To...** or select **Go To...** from the popup menu.

   The dialog box shown in step 2 is displayed.

2. Select **Index No** as a Go To target.
3. Enter a value.



4. Select **OK** in the Go To dialog box. The display will jump to the specified position.



Quick Tip

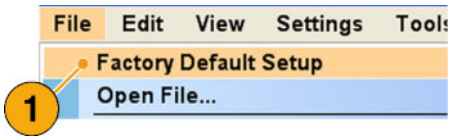
- You can also use the Go To dialog box in the Waveform or Waveform List window.

Tutorials

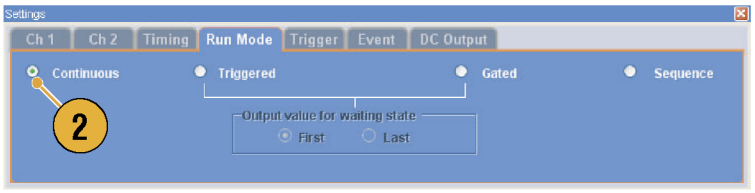
The examples in this section show how to use your instrument to do common arbitrary waveform generator tasks. These examples use the dual-channel model.

Creating and Editing a Waveform

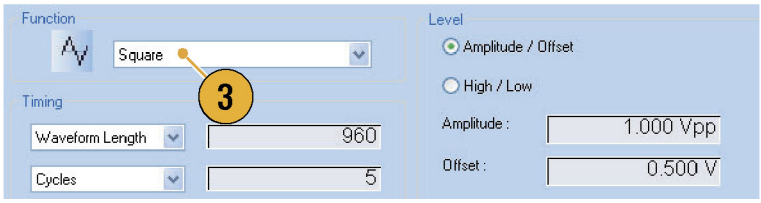
1. Recall the default setup.



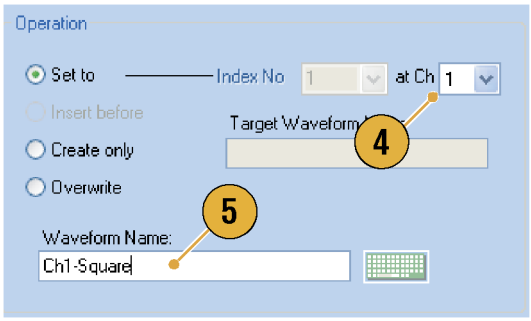
2. Select **Continuous** from the Run Mode page of the Settings window.



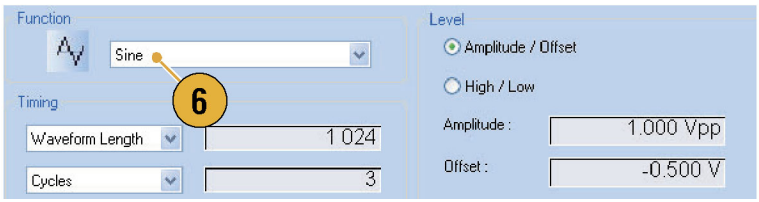
3. Use the Standard Waveform dialog box to create the following square waveform:
   - Waveform Length: **960 points**
   - Cycles: **5**
   - Amplitude: **1.0 Vp-p**
   - Offset: **0.5 V**



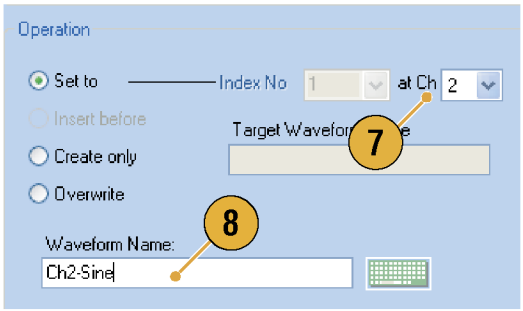
4. Set the waveform created in step 3 to **Ch 1**.
5. Assign the waveform name “Ch1-Square” to the waveform.



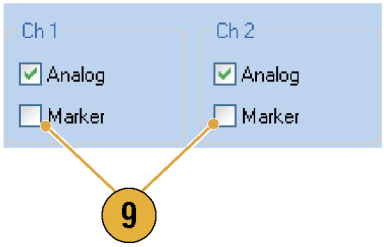
6. Use the Standard Waveform dialog box to create the sine waveform shown below:
   - Waveform Length: **1024 points**
   - Cycles: **3**
   - Amplitude: **1.0 Vp-p**
   - Offset: **–0.5 V**



7. Set the waveform created in step 6 to **Ch 2**.
8. Assign the waveform name “Ch2-Sine” to the waveform.

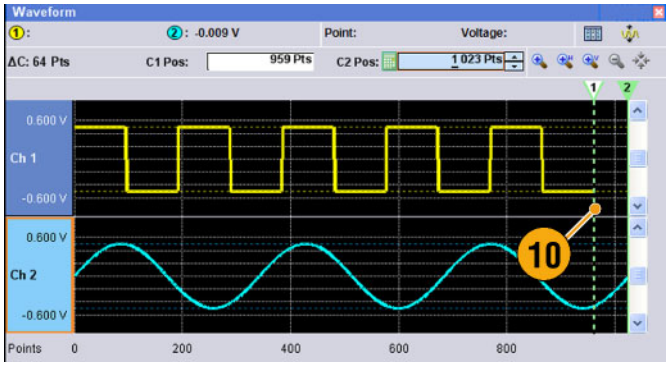


9. To edit analog waveform data, hide the Ch 1 and Ch 2 **Marker** data using the Display Properties dialog box.

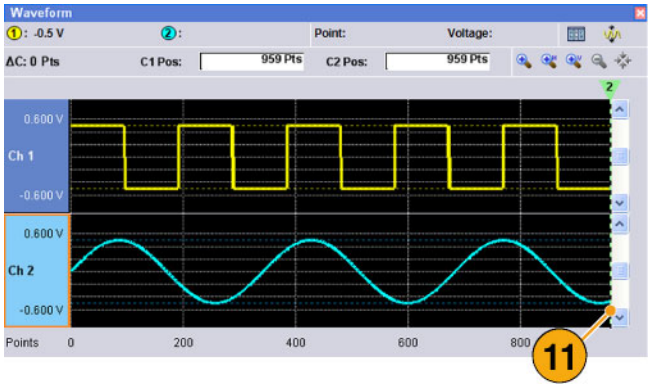


10. Delete points from the end of the Ch 2 waveform to make it the same length as the Ch 1 waveform.

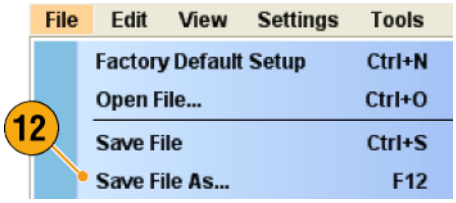
    Use cursors to set the range.



11. Ch 1 and Ch 2 waveforms have the same waveform length. You can now output the signal.

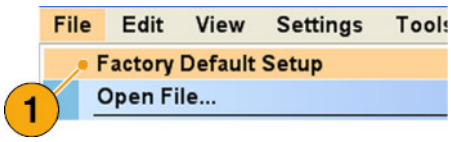


12. Save the setup.



Creating and Editing a Sequence

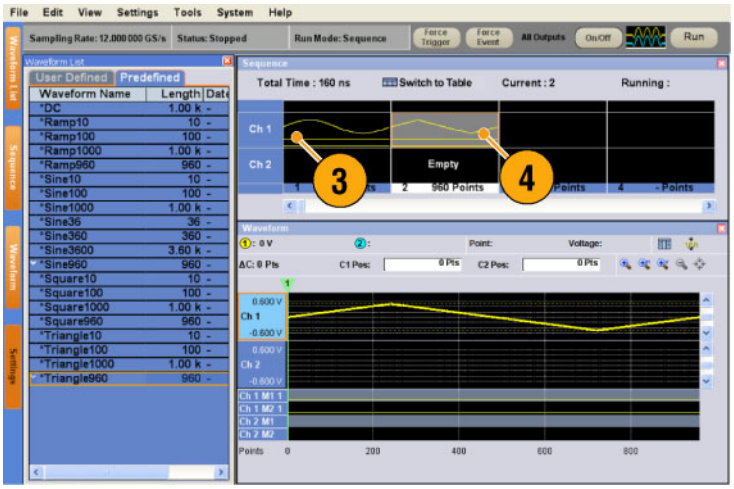
1. Recall the default setup.



2. Select **Sequence** from the Run Mode page of the Settings window.

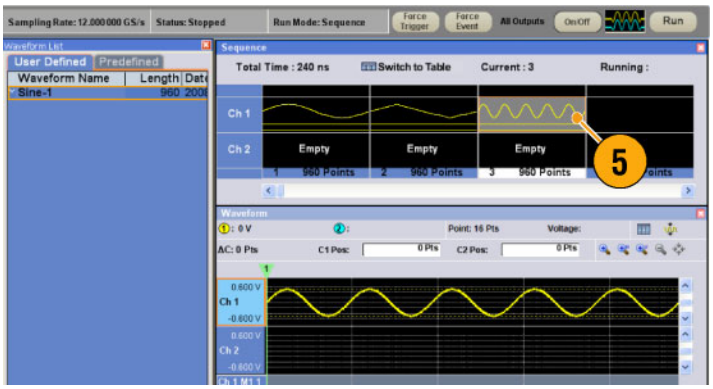
3. Select ***Sine960** from the Predefined page of the Waveform List window, and drag and drop it to the first cell of Ch 1 sequence.

4. In the same way, select ***Triangle960** from the Waveform List window, and set the waveform to the second cell of Ch 1 sequence.

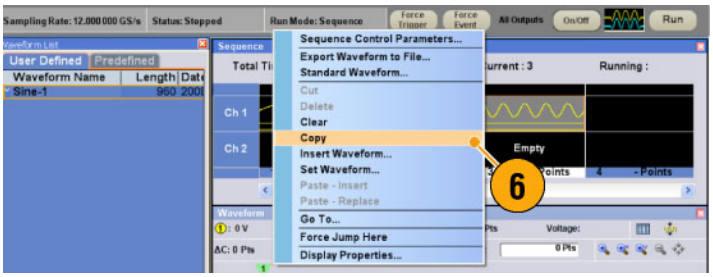


5. Create a sine waveform with the following attributes and set the waveform to the third cell of Ch 1 sequence.

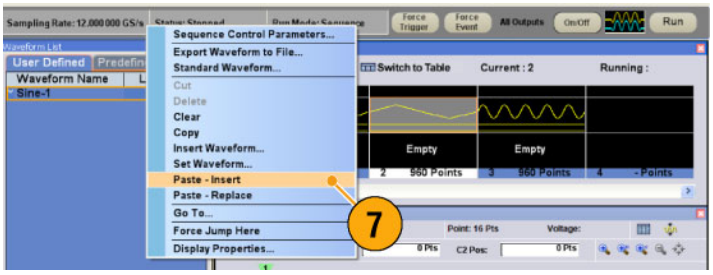
   - Waveform Length: **960 points**
   - Cycles: **5**
   - Amplitude: **1.0 Vp-p**
   - Offset: **0.0 V**
   - Waveform Name: **Sine-1**



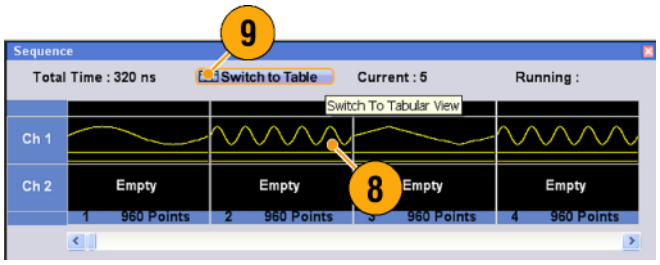
6. Select third cell of sequence, and select **Copy** from the popup menu.



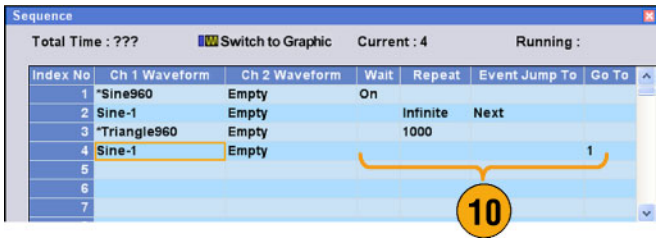
7. Select second cell of sequence, and select **Paste-Insert** from the popup menu.



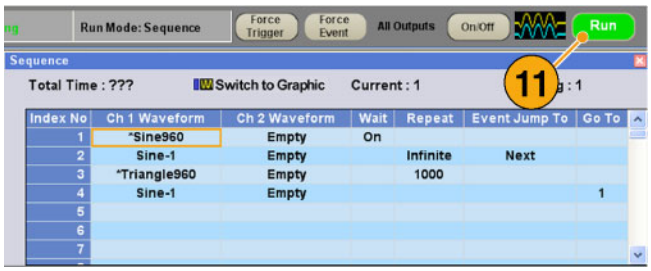
8. The copied waveform is pasted to index 2.
9. Click the **Switch to Table** icon to change the display to Tabular view.



10. Set the following sequence parameters:
    - Index 1: Wait Trigger **On**
      The sequence waits for a trigger before generating the first element.
    - Index 2: Repeat count **Infinite**
      The sequence infinitely generates the Sine-1 waveform until an event occurs.
    - Index 2: Event Jump To **Next**
      When the instrument receives an event signal, the sequence jumps to next element.
    - Index 3: Repeat count **1000**
      The sequence repeats the *Triangle960 waveform 1000 times.
    - Index 4: Go To **1**
      The sequence jumps to index number 1 after generating index number 4 waveform.



11. Click the **Run** button to confirm that the sequence works properly. The animation window next to the Run button will be activated when the instrument is in the running state.



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