



Operator's Manual

WaveStation 3000 Function & Arbitrary Waveform Generator



WaveStation 3000 Function and Arbitrary Waveform Generator Operator's Manual

© 2015 Teledyne LeCroy, Inc. All rights reserved.

Unauthorized duplication of Teledyne LeCroy documentation materials other than for internal sales and distribution purposes is strictly prohibited. However, clients are encouraged to duplicate and distribute Teledyne LeCroy documentation for their own internal educational purposes.

WaveStation and Teledyne LeCroy are trademarks. Teledyne LeCroy is a trademark of Teledyne LeCroy, Inc. Other product or brand names are trademarks or requested trademarks of their respective holders. Information in this publication supersedes all earlier versions. Specifications are subject to change without notice.

922869 Rev C

April 2015

Contents

Welcome	iii
Introduction to WaveStation	1
High Performance and Signal Fidelity	1
Graphical Waveform Creation	1
Key Specifications	1
Package Contents	2
Front Panel	3
Back Panel	4
Adjusting the Viewing Position	4
Safety	5
Working with WaveStation	8
Function Buttons	8
Understanding the Display	9
Navigating Menus and Making Selections	9
Adjusting Parameters	12
Using WaveStation Help	14
Generating Basic Waveforms	15
Generating a DC Waveform	16
Generating an Arbitrary Waveform	17
Generating Modulated Waveforms	18
Generating an AM Modulated Waveform	18
Generating an FM Modulated Waveform	19
Generating a PM Modulated Waveform	19
Generating an FSK Modulated Waveform	20
Generating an ASK Modulated Waveform	20
Generating a DSB-AM Modulated Waveform	21
Generating a PWM Modulated Waveform	21
Generating Sweep Waveforms	22
Generating Burst Waveforms	23
N-Cycle Burst	23
Gated Burst	24
Using External Trigger	25
Triggered Sweep Mode	25
Triggered N-Cycle Burst Mode	25
Externally Gated Burst Mode	25
Externally Modulated FSK Mode	25
Using Sync Out	26
Save/Recall	27
Save/Recall Browser	27
Keyboard	27

WaveStation 3000 Function and Arbitrary Waveform Generator

Save/Recall Setups	28
Save/Recall Waveforms	29
Delete Setup or Waveform File	29
Copy Channel Settings	29
Changing System Settings	30
Output	30
USB Output	30
Number Format	31
Power On Setting	31
Sound	31
Screen Saver	32
Clock Source	32
Restoring the Default Settings	33
Remote Control of WaveStation	34
GPIB Remote Control	34
USBTMC Remote Control	35
Using LabView Software	35
Using WaveStation PC Software	36
Minimum System Requirements	36
Updates	36
Installing WaveStation PC Drivers and Software	36
Connecting WaveStation to the PC	37
Reading Files from WaveStation on a PC	37
Sending Waveform Files from a PC to WaveStation	41
Save Waveform to .CSV File	44
Maintaining WaveStation	45
Cleaning	45
Updating WaveStation Firmware	45
Self Tests	46
Self Calibration	47
Returning a Product for Service	48
Contact Teledyne LeCroy	48
Reference	49
Specifications	49
Certifications	49
Warranty	52
Index	53

Welcome

Thank you for purchasing a LeCroy WaveStation 3000 Series Function and Arbitrary Waveform Generator. We're certain you'll be pleased with the detailed features so unique to our instruments.

This manual documents how to use the following WaveStation models:

- WaveStation 3082 80 MHz
- WaveStation 3122 120 MHz
- WaveStation 3162 160 MHz

The manual contains sections addressing:

- Product overview and safety information
- Working with WaveStation
- Generating basic, arbitrary, modulated, sweep, and burst waveforms
- Remote control
- Using WaveStation PC Software
- Changing system settings and other maintenance
- Reference, including product certifications and Teledyne LeCroy contact information

WaveStation can be controlled remotely by an automation device or by a person using the WaveStation PC Software. The information in this manual is supplemented by a SCPI (Standard Commands for Programmable Instruments) Command Reference Manual available at teledynelecroy.com.

Additional supplemental information in the form of Application Notes and LabBriefs are also available from our website.

We truly hope you enjoy using Teledyne LeCroy's fine products.

Sincerely,



David C. Graef

Teledyne LeCroy
Vice President and Chief Technology Officer

Introduction to WaveStation

With five basic signal types and over 30 built-in arbitrary waveforms, the WaveStation is a versatile waveform generator. A variety of modulation schemes, large color display, simple user interface, and remote control capabilities make it easy to generate waveforms up to 160 MHz.

High Performance and Signal Fidelity

High performance hardware enables WaveStation to create accurate, stable waveforms. High sample rate and resolution combined with low jitter and harmonic distortion means the waveforms seen on the display match the waveforms output by the hardware.

Graphical Waveform Creation

Use WaveStation PC Software to easily create and edit waveforms on your computer using mathematical operations, filters and point-by-point editing—or draw a waveform with a mouse. Transfer waveforms from the PC to WaveStation over USB, then view them on the large display. Connect a WaveAce® oscilloscope to the same PC to enable seamless transfer of captured signals from the oscilloscope to the WaveStation.

Key Specifications

Bandwidth	80 MHz – 160 MHz
Channels	2
Memory	512 kpts
Sample Rate	500 MS/s
Vertical Resolution	14 bits

Detailed specifications are maintained on the product page at:
teledynelecroy.com/wavestation.

Package Contents

When your WaveStation is delivered, verify that all items on the packing list or invoice copy have shipped correctly. Contact your nearest [Teledyne LeCroy customer service center](#) or national distributor if anything is missing or damaged. We can only be responsible for replacement if you contact us immediately.

The standard WaveStation 3000 package includes the following:

- WaveStation unit
- Power Cord
- Standard USB 2.0 Type A to Type B Cable, 1 m
- USB-GPIB Converter Cable
- *WaveStation 3000 Getting Started Guide*
- Performance/Calibration Certificate
- Product Registration Card

Front Panel



- A. **USB A Connector** enables you to attach a storage drive.
- B. **Power Button** turns on/off the WaveStation.
- C. **LCD Display** shows an annotated waveform shape, the Parameter Value List, and the various option menus.
- D. **Softkey Buttons** enable you to select the corresponding option from the changing menus.
- E. **Numeric Keypad** allows you to adjust parameter values and change units.
- F. **Function Buttons** open corresponding option menus. The top, three Signal Conditioning buttons apply **Modulation**, **Sweep**, or **Burst** to the active waveform. **Parameter**, **Utility**, and **Help** open their respective menus.
- G. **Waveform Button** opens the menu of waveform shapes.
- H. **Ch1/Ch2 Button** selects the output channel and activates the corresponding tab on the display.
- I. **Adjustment Knob** and Up/Down and Left/Right **Cursor Buttons** help with making selections and modifying values.
- J. **Output Buttons** control the activation/deactivation of corresponding **BNC Channel Outputs**.

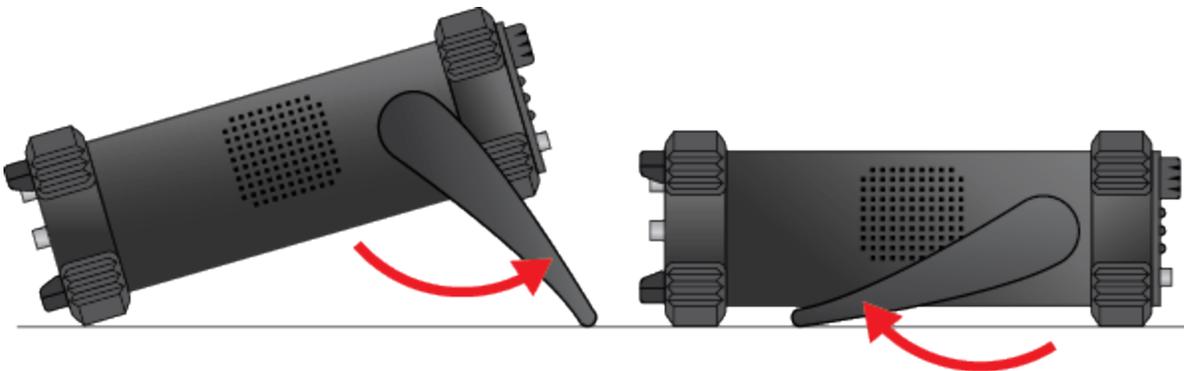
Back Panel



- A. **Input and Output BNC Connectors** - provide 10 MHz In, 10 MHz Out, Modulation In, Synch Out, Ext Trig/Gate/Fsk/Burst Out.
- B. **USB Connector** - USB 2.0 Type B, used for making USBRAW or USBTMC connections.
- C. **Ground Connector**
- D. **AC Power Connector**

Adjusting the Viewing Position

The built-in carrying handle can be used to support the weight of the product and adjust the viewing position. Gently pull both arms away from the sides of the WaveStation to unlock the mechanism, then rotate the entire handle toward you until it snaps into the upright position.



Safety

Observe these instructions to keep the oscilloscope operating in a correct and safe condition. You are required to follow generally accepted safety procedures in addition to the precautions listed here. **The overall safety of any system incorporating this instrument is the responsibility of the assembler of the system.**

Symbols

These symbols may appear on the instrument's front or rear panels and in its documentation to alert you to important safety considerations.

	CAUTION of potential damage to instrument, or WARNING of potential bodily injury. Do not proceed until the information is fully understood and conditions are met.
	High voltage. Risk of electric shock or burn.
	Frame or chassis connection.
	Power On/Off (front of instrument)

Precautions

Use proper power cord. Use only the power cord shipped with this instrument and certified for the country of use.

Maintain ground. This product is grounded through the power cord grounding conductor. To avoid electric shock, connect only to a grounded mating outlet.

Connect and disconnect properly. Do not connect/disconnect probes or test leads while they are connected to a voltage source.

Observe all terminal ratings. Do not apply a voltage to any input (C1, C2, C3, C4 or EXT) that exceeds the maximum rating of that input. Refer to the front of the oscilloscope for maximum input ratings.

Use only within operational environment listed. Do not use in wet or explosive atmospheres.

Use indoors only.

Keep product surfaces clean and dry. See Cleaning in the Maintenance section.

Do not block the cooling vents. Leave a minimum six-inch (15 cm) gap between the instrument and the nearest object. Keep the underside clear of papers and other objects.

Do not remove the covers or inside parts. Refer all maintenance to qualified service personnel.

Do not operate with suspected failures. Do not use the product if any part is damaged. Obviously incorrect measurement behaviors (such as failure to calibrate) might indicate impairment due to hazardous live electrical quantities. Cease operation immediately and sequester the instrument from inadvertent use.

Operating Environment

Temperature: 0 to 40° C.

Humidity: Maximum relative humidity 80% for temperatures up to 31° C, decreasing linearly to 50% relative humidity at 40° C.

Altitude: Up to 3,048 m (10,000 ft) at or below 30° C.

Cooling

The instrument relies on forced air cooling with internal fans and vents. Take care to avoid restricting the airflow to any part. Around the sides and rear, leave a minimum of 15 cm (6 inches) between the instrument and the nearest object. The feet provide adequate bottom clearance.



CAUTION. Do not block cooling vents. Always keep the area beneath the instrument clear of paper and other items.

The instrument also has internal fan control circuitry that regulates the fan speed based on the ambient temperature. This is performed automatically after start-up.

Calibration

The recommended factory calibration interval is one year. Calibration should be performed by qualified personnel only.

Extended warranty, calibration, and upgrade plans are available for purchase. To purchase a service plan, contact your Teledyne LeCroy sales representative or:
customersupport@teledynelecroy.com

Power

AC POWER

The instrument operates from a single-phase, 100 to 240 Vrms ($\pm 10\%$) AC power source at 50/60 Hz ($\pm 10\%$) and 100 to 120 Vrms ($\pm 10\%$) AC power source at 400 Hz ($\pm 5\%$). Manual voltage selection is not required because the instrument automatically adapts to the line voltage.

POWER CONSUMPTION

50 VA (50 W) maximum power consumption when operating with all accessories installed.

GROUND

The AC inlet ground is connected directly to the frame of the instrument. For adequate protection against electric shock, connect to a mating outlet with a safety ground contact.



WARNING. Only use the power cord provided with your instrument. Interrupting the protective conductor inside or outside the oscilloscope, or disconnecting the safety ground terminal, creates a hazardous situation. Intentional interruption is prohibited.

APPLYING POWER

The Power button on the front of the WaveStation controls the operational state of the instrument. Press the button to switch the instrument AC power On or Off. Always use the Power button to execute a proper shut down process and preserve settings before powering down. Do not power off by pulling the power cord from the socket or shutting down a connected power strip.

Working with WaveStation

Function Buttons



These Front Panel buttons control major functional areas of the software. They appear white when inactive, unlike the navigation and selection controls, which are black.

Function buttons are lit blue when they are active. You can perform a [Self Test](#) to check that the LED is working properly.

Channel and Waveform Buttons

The **Ch1/Ch2** button is the starting point in waveform configuration. Press it to select the output channel and activate the corresponding tab on the display.

The **Waveform** button opens the menu of basic and arbitrary waveform shapes. Whatever you select is immediately assigned to the active channel.

Signal Conditioning Buttons

The top three function buttons are waveform signal conditioning buttons and apply **Modulation**, **Sweep**, or **Burst** functions to the active waveform.

The first press of a Signal Conditioning button applies that functionality to the active waveform and opens a menu of corresponding parameters. You'll see the name (e.g., "Mod" for Modulation) appear next to the carrier waveform on the Channel tab. The second press removes the functionality from the waveform and closes the menu.

Other Function Buttons

The next three function buttons, **Save/Recall**, **Parameter**, **Utility**, and **Help**, open menus of functionality other than waveform configuration.

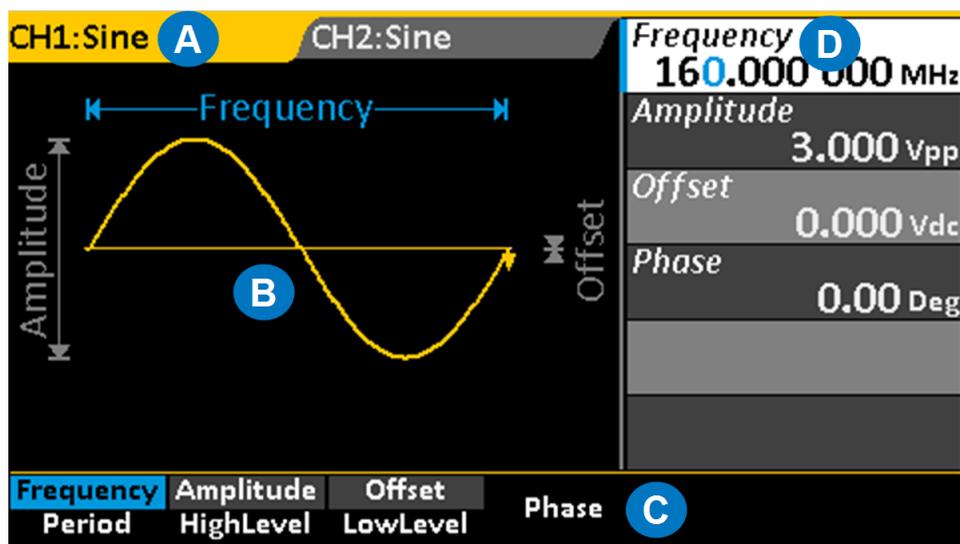
- Parameter restores the menu of waveform parameters to the display for quick re-adjusting. This can be useful if you've moved onto one of the other functional menus.
- Many output and system settings can be made through Utilities; see the topics in that section of this manual.
- Help opens a menu of Help topics.

Output Buttons

These buttons, both labeled **Output**, each correspond to one of the output channels. They enable and disable output on that channel. Connect a BNC cable to the output before activating the button.

Understanding the Display

Each area of the display serves a unique function.



- A. **Channel Tabs** display the currently selected waveform, plus any additional signal conditioning, such as Modulation. The tab changes to match the channel color when it is active.
- B. **Waveform Display** shows an annotated diagram of the waveform. The diagram shows how the selected parameters relate to the wave shape.
- C. **Option Menu** changes based on the chosen **Waveform** and **Function**.
- D. **Parameter Value List** shows parameter settings. Use this area to [adjust parameters](#).

Navigating Menus and Making Selections

Pressing any Function button opens a corresponding menu of options on the display. These menus are navigated using the softkey buttons below them.

Option Menus and Softkey Buttons

The softkey buttons correlate with the menu options directly above them, which change based on functionality. The softkeys behave a bit differently depending on the option. They may:

- Select a numeric parameter for editing on the Parameter Value List
- Toggle a set of non-numeric selections
- Open a second menu, etc.

Continue pressing the softkey button until your desired selection is highlighted in blue. Then, either adjust the value on the Parameter List, or press the softkey for the next menu option you wish to select.

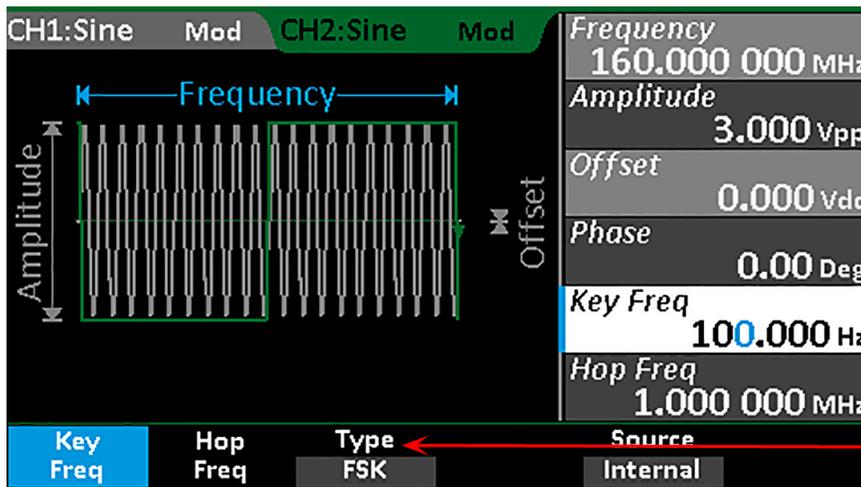
DUAL PARAMETER OPTIONS

A good portion of the menu options show two separate parameters. This indicates an either/or selection: you can choose to configure one parameter or the other, but not both. For example, you can configure *either* Frequency *or* Period, but not both. The first press of the softkey button selects the top parameter, which is then highlighted in blue; the second press selects the bottom.

These dual parameter options have two different colored backgrounds, one lighter and one darker, to keep them distinct. Selected parameters will show the lighter shading (when they are not active and blue), and you'll notice that these are the parameters you see in the Parameter Value List. You may sometimes notice that when you select one dual parameter, the shading changes over other dual parameters. This indicates parameters that must be configured together. For example, Amplitude *and* Offset, or HighLevel *and* LowLevel.

LABELED MENU OPTIONS

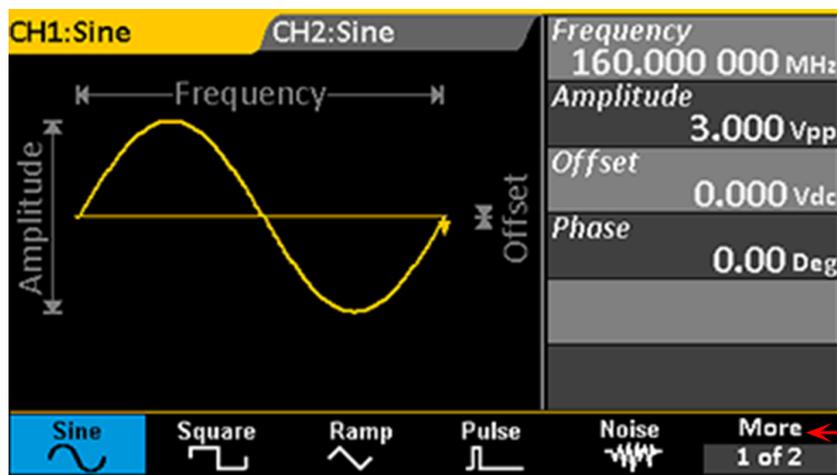
Some menu options appear to be dual parameters, but actually the top part of the option is a label, while the bottom shows the selected value. When configuring waveforms, this usually indicates the selection was made on a previous menu, but is made available again in case you decide to change it. For example, when you display Modulation parameters, the Type option shows the selection made on the previous Modulation type menu. You need only press the softkey for these menu options if you now wish to change the selection.



Type is a label. FSK is a selection made on the previous menu.

ADDITIONAL MENUS

Menus that have a **More** at the end have additional pages of options. Press the softkey button to go to the next or previous page.



There are more options on page 2. Press the "More" softkey to see them.

DONE AND CANCEL

Some option menus, such as Utilities, go several levels deep. In this case, you may see a **Done** or **Cancel** option at the end of the menu. The procedures in this manual explain their use in specific situations, which may vary slightly menu to menu.

Parameter Value List

The right side of the display is a detailed list of numeric parameter values. This area is used to adjust the parameter.

Adjusting Parameters

Once a numeric parameter has been selected from an option menu, it is activated for editing on the Parameter Value list. You can adjust the value using either the front panel Adjustment knob or the numeric keypad.

Using the Adjustment Knob

This is perhaps the easiest way to both select and adjust parameters when configuring waveforms.

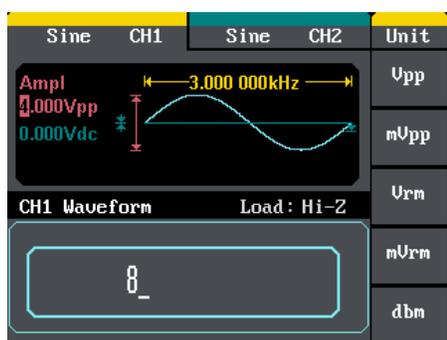
1. Select the first parameter from the menu using the softkey button. The parameter will appear blue on the option menu and white on the Parameter Value list.
2. Use the Left/Right Cursor buttons to select the digit to change. The selected digit is highlighted blue.
3. Turn the Adjustment knob to raise or lower the value of the digit.
4. Repeat Steps 2 and 3 until all digits are adjusted.
5. Press the Adjustment knob to save the setting and activate the next parameter on the list.

The Adjustment knob is also used to navigate and select from the [Built-in Arbitrary waveform menus](#). In general, if a selection is highlighted white on the display, it can be controlled using the Adjustment knob.

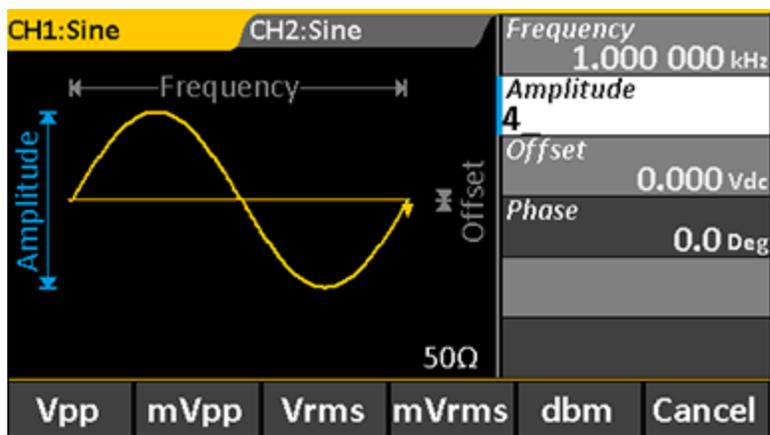
Using the Keypad

This method is required to change the unit of measure associated with the parameter value.

1. Select the parameter from the option menu using the softkey button. The parameter will appear blue on the Parameter menu and white on the Parameter Value list.
2. Press the keypad buttons to enter the new value. The display will change to show a menu of units of measure.



Units appear when using the Keypad to adjust parameters. Press the corresponding softkey button to make a selection.



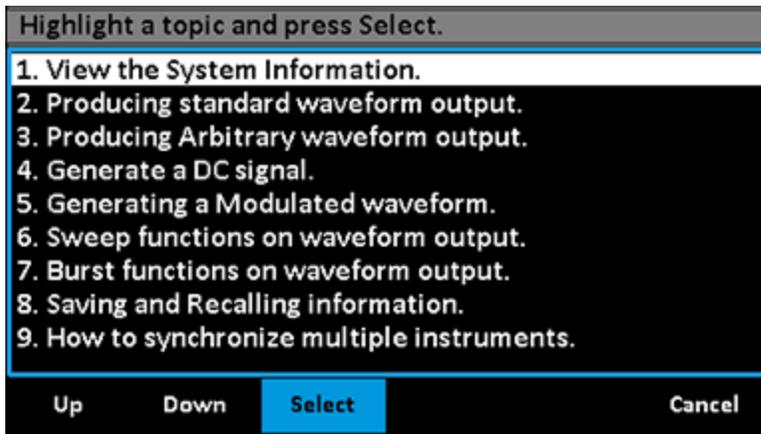
3. If desired, press the softkey to select a new unit of measure. You will return to the parameter menu.
4. Use the softkeys to select the next parameter to edit.

The Keypad is also used during [Self Calibration](#) and [Self Test](#) functions.

Using WaveStation Help

Onboard Help provides brief topics to guide you while using the system. To use the Help:

1. Press the **Help** function button on the Front Panel to open the Help menu. A list of topics appears on the display.
2. Press the **Up** or **Down** softkey buttons to navigate the list.
3. When the desired topic is highlighted on the display, press the **Select** softkey to view it.
4. Press **Done** to return to the menu of Help topics, or **Cancel** to exit the Help menu.



Generating Basic Waveforms

Follow this procedure to generate one of the five basic waveform types.

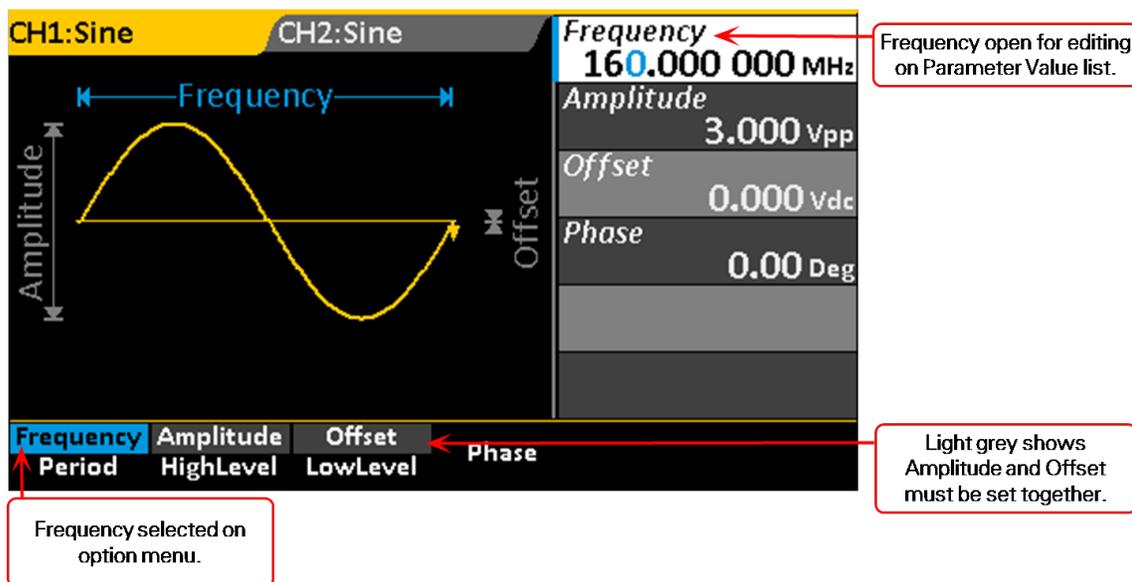
1. Choose your output channel by pressing the **Ch1/Ch2** function button until the correct tab is active on the display.

NOTE: WaveStation defaults to the Channel 1 tab and Waveform menu whenever you power on, although you can [change this setting](#) on the Utility menu. If Channel 1 is correct, skip to Step 2.

2. Press the **Waveform** function button to open the Waveform menu, then select the desired shape using the softkey. The options are: Sine, Square, Ramp, Pulse, and Noise.

NOTE: The default and min/max settings for each waveform depend on your WaveStation model. See the specifications maintained on the product datasheet at teledynelecroy.com.

You should see your waveform selection appear on the active Channel tab, along with the parameter option menu and Parameter Value list.



3. [Adjust parameters](#) as necessary using either the Adjustment knob or the numeric keypad.

For all waveforms except Noise, adjust the values for:

- **Frequency or Period.**
- **Amplitude and Offset**, or absolute **HighLevel** and **LowLevel** of voltage.

For Sine waves, also adjust **Phase**.

For Square waves, also adjust:

- **Phase**
- **DutyCycle**, entered as the percentage of the High Level taking up the whole period.

For Ramp waves, also adjust **Symmetry**.

For Pulse waves, also adjust:

- **Width** or **Duty Cycle**
- **Rise**(ing Edge) or **Fall**(ing Edge)
- **Delay**

For Noise waves, adjust:

- **Stdev**
- **Mean**

4. When all parameters are configured, press the appropriate **Output** button to output the waveform, or go on to apply [Modulation](#), [Sweep](#), or [Burst](#) signal conditioning before outputting.

NOTE: Noise waves cannot be modulated or swept. Pulse waves cannot be swept.

Generating a DC Waveform

DC waveforms cannot be conditioned using Mod(ulate), Sweep, or Burst.

1. Choose your output channel by pressing the **Ch1/Ch2** function button until the correct tab is active on the display.

NOTE: WaveStation defaults to the Channel 1 tab and Waveform menu whenever you power on, although you can [change this setting](#) on the Utility menu. If Channel 1 is correct, skip to Step 2.

2. Press the **Waveform** function button to open the Waveform menu, then press the **More 1 of 2** softkey.
3. Press the **DC** softkey.
4. Enter the **DC Offset** value.
5. Press the appropriate **Output** button to output the waveform.

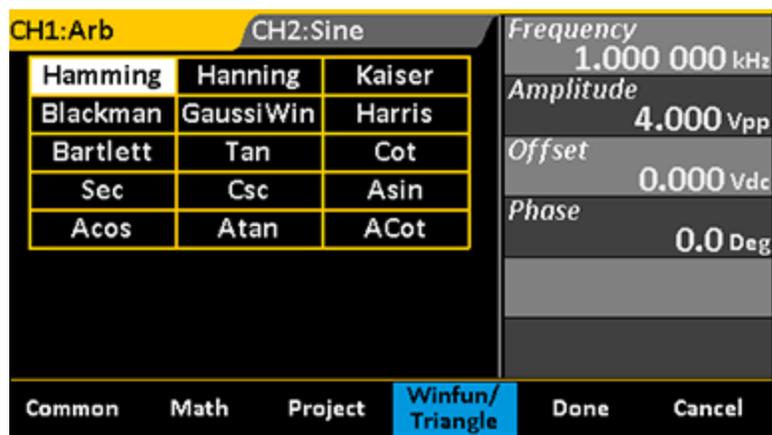
Generating an Arbitrary Waveform

WaveStation offers several built-in Arbitrary waveforms for selection, all of which can be further adjusted to your needs.

1. Choose your output channel by pressing the **Ch1/Ch2** function button until the correct tab is active on the display.

NOTE: WaveStation defaults to the Channel 1 tab and Waveform menu whenever you power on, although you can [change this setting](#) on the Utility menu. If Channel 1 is correct, skip to Step 2.

2. Press the **Waveform** function button to open the Waveform menu, then press the **More 1 of 2** softkey.
3. Press the **Arb** softkey, then press the **Built-in** softkey. The display changes to show the first group of built-in arbitrary waveforms.
4. Press the softkeys to select different groups until you find the desired waveform, then turn the **Adjust knob** until the waveform is highlighted white on the LCD.



5. Press **Done** to complete the selection. The LCD returns to the regular waveform display, where you should see a diagram of the selected wave shape.
6. [Adjust parameters](#) as necessary using either the knob or the keypad.
7. When all parameters are set, press the appropriate **Output** button to begin outputting the waveform.

Generating Modulated Waveforms

Sine, Square, Ramp, Pulse and Arb(itrary) waveforms all may be modulated using WaveStation. You can apply [Amplitude Modulation](#) (AM), [Frequency Modulation](#) (FM), [Amplitude Shift Keying Modulation](#) (ASK), [Frequency Shift Keying Modulation](#) (FSK), or [Phase Modulation](#) (PM), [Pulse-Width Modulation](#) (PWM), or [Double-Side Band Amplitude Modulation](#) (DSB-AM) depending on the type of carrier wave used.

Noise and DC waveforms cannot be modulated.

Generating an AM Modulated Waveform

1. [Generate a carrier wave](#) of type Sine, Square, Ramp, or Arb(itrary).
2. Before outputting, press the Front Panel **Mod** function button. You should see "Mod" appear next to the carrier wave type on the Channel tab, and the modulation parameter menu and value list on the display.
3. Press the **Type** softkey, then press the **AM** softkey.
4. Set the following AM parameters:
 - **Modulation Source** - **Internal** or **External**. If External is selected, attach the modulation source to the **Modulation In** connector on the Back Panel. You do not need to set any other parameters.
 - **AM Freq** - modulating waveform frequency. The internal source frequency range is 2 MHz to 20 kHz.
 - **AM Depth** - also referred to as Amplitude Range or percentage modulation. It's a percentage value that varies from 1 to 120% . When set to 0%, the output amplitude is approximately half of the user set amplitude value. When set to 100%, the output amplitude matches the amplitude set. When using an external source, the AM depth is controlled by the voltage level of the connector attached to **Modulation In** on the Back Panel. ± 10 V corresponds to 100% of your current depth setting.
5. Press the appropriate channel **Output** button to begin outputting the waveform.

Generating an FM Modulated Waveform

1. [Generate a carrier wave](#) of type Sine, Square, Ramp, or Arb(itrary).
2. Before outputting, press the Front Panel **Mod** function button. You should see "Mod" appear next to the carrier wave type on the Channel tab, and the modulation parameter menu and value list on the display.
3. Press the **Type** softkey, then press the **FM** softkey.
4. Set the following FM parameters:
 - Modulation **Source** - **Internal** or **External**. If External is selected, attach the modulation source to the **Modulation In** connector on the Back Panel.
 - **FM Freq** - modulating waveform frequency. The internal source frequency range is 2 MHz to 20 kHz. You do not need to set FM Freq if using an external modulation source.
 - **FM Dev** - maximum frequency deviation. The frequency deviation value should be \leq the carrier waveform frequency. The sum of the deviation and the carrier waveform frequency should be \leq the maximum frequency of the selected waveform. When using an external source, the deviation is controlled by the voltage level of the connector attached to **Modulation In** on the Back Panel: +10 V corresponds to the selected deviation, and -10 V to the negative selected deviation. So, a ± 10 V input results in an output FM deviation equal to the preset FM deviation.
5. Press the appropriate channel **Output** button to begin outputting the waveform.

Generating a PM Modulated Waveform

Modulated waveforms are one part carrier waveform; the other modulated. In Phase Modulation, the phase of the carrier waveform varies with the instantaneous voltage level of the modulated waveform.

1. [Generate a carrier wave](#) of type Sine, Square, Ramp, or Arb(itrary).
2. Before outputting, press the Front Panel **Mod** function button. You should see "Mod" appear next to the carrier wave type on the Channel tab, and the modulation parameter menu and value list on the display.
3. Press the **Type** softkey, then press the **PM** softkey.
4. Set the following PM parameters:
 - Modulation **Source** - **Internal** or **External**. If External is selected, attach the modulation source to the Modulation In connector on the Back Panel.
 - **PM Freq** - sets the frequency at which the output amplitude shifts between the carrier amplitude and 0. The internal source frequency range is 1 MHz to 50 kHz. You do not need to set PM Freq if using an external modulation source.
 - **Phase Dev** - sets the maximum phase deviation. Values range from 0° to 360°.
5. Press the appropriate channel **Output** button to begin outputting the waveform.

Generating an FSK Modulated Waveform

Frequency Shift Keying modulation is an output frequency that switches from the carrier waveform and hop preset frequencies at a specific point. The specific frequency point where the output switches is the Key Frequency. The Key Frequency is determined by the internal frequency generator or the signal voltage level from the Trig/Gate/Fsk/Burst connector on the Back Panel.

1. [Generate a carrier wave](#) of type Sine, Square, Ramp, or Arb(itrary).
2. Before outputting, press the Front Panel **Mod** function button. You should see "Mod" appear next to the carrier wave type on the Channel tab, and the modulation parameter menu and value list on the display.
3. Press the **Type** softkey, then press the **FSK** softkey.
4. Set the following FSK parameters:
 - Modulation **Source** - **Internal** or **External**. If External is selected, attach the modulation source to the Modulation In connector on the Back Panel.
 - **Key Freq** - the frequency at which the output frequency shifts between the carrier amplitude and the hop frequency. The internal source frequency range is 1 mHz to 1 MHz. You do not need to set Key Freq if using an external modulation source.
 - **Hop Freq** - the desired hop frequency level (for variation from the set carrier waveform frequency).
5. Press the appropriate channel **Output** button to begin outputting the waveform.

Generating an ASK Modulated Waveform

Amplitude Shift Keying modulation represents digital data as variations in the amplitude of a carrier wave. The amplitude of an analog carrier signal varies in accordance with the bit stream (modulating signal), keeping frequency and phase constant.

1. [Generate a carrier wave](#) of type Sine, Square, Ramp, or Arb(itrary).
2. Before outputting, press the Front Panel **Mod** function button. You should see "Mod" appear next to the carrier wave type on the Channel tab, and the modulation parameter menu and value list on the display.
3. Press the **Type** softkey, then press the **ASK** softkey.
4. Set the following ASK parameters:
 - Modulation **Source** - **Internal** or **External**. If External is selected, attach the modulation source to the **Trig/Gate/FSK/Burst** connector on the Back Panel. You do not need to set any other parameters.
 - **Key Freq** - the frequency at which the output amplitude shifts between the carrier amplitude and 0. The internal source frequency range is 2 MHz to 50 kHz.
5. Press the appropriate channel **Output** button to begin outputting the waveform.

Generating a DSB-AM Modulated Waveform

1. [Generate a carrier wave](#) of type Sine, Square, Ramp, or Arb(itrary).
2. Before outputting, press the Front Panel **Mod** function button. You should see "Mod" appear next to the carrier wave type on the Channel tab, and the modulation parameter menu and value list on the display.
3. Press the **Type** softkey, then press the **DSB-AM** softkey.
4. Set the following DSB-AM parameters:
 - Modulation **Source** - **Internal** or **External**. If External is selected, attach the modulation source to the **Modulation In** connector on the Back Panel. You do not need to set any other parameters.
 - **DSB Frequency** - If using Internal source, set a DSB frequency of up to 50 KHz.
5. Press the appropriate channel **Output** button to begin outputting the waveform.

Generating a PWM Modulated Waveform

Pulse-Width Modulation is used exclusively with Pulse type waves.

1. [Generate a carrier wave](#) of type Pulse.
2. Before outputting, press the Front Panel **Mod** function button. You should see "Mod" appear next to the carrier wave type on the Channel tab, and the modulation parameter menu and value list on the display. The modulation Type will be set to PWM.
3. Set the following PWM parameters:
 - Modulation **Source** - **Internal** or **External**. If External is selected, attach the modulation source to the **Modulation In** connector on the Back Panel. You do not need to set any other parameters.
 - **PWM Freq(ueency)** - the rate at which the pulse is modulated.
 - **Width Dev(iation)** -modulating pulse width.
4. Press the appropriate channel **Output** button to begin outputting the waveform.

Generating Sweep Waveforms

Sine, Square, Ramp, and Arb(itrary) waveforms may be swept using a Frequency function, which sweeps either from an absolute start frequency to stop frequency or across a frequency span at a specified sweep rate.

Pulse, Noise, and DC waveforms cannot be swept.

1. [Set up a basic wave](#) of type Sine, Square, Ramp, or Arb.
2. Before outputting, press the Front Panel **Sweep** function button.
3. Set the following sweep parameters:
 - **Sweep Time** - sets the overall sweep rate.
 - **StartFreq** and **StopFreq** - the specific frequencies where the sweep begins and ends. If you choose to set StartFreq and StopFreq, you do not set MidFreq and FreqSpan.
 - **MidFreq** and **FreqSpan** - the frequency that must remain at the center of the sweep, and the overall span or range that it may deviate from the MidFreq in either a positive or negative direction.
 - **Source** - choose **Internal**, **External**, or **Manual** to manually start and stop the sweep. If External is selected, connect the sweep trigger source to the **Trig/Gate/Fsk/Burst** connector on the Back Panel.
 - **TrigOut** - choose **Off** or **Open**. Open sends a trigger pulse on the rising edge of the waveform; connect from the **Trig/Gate/Fsk/Burst** connector on the Back Panel.
 - **Linear** or **Log** - choose either Linear or Logarithmic spacing.
 - **Direction** - choose to sweep in either an **Up** or **Down** direction.
4. When all sweep parameters are set, press the appropriate **Output** button to begin outputting the waveform.

Generating Burst Waveforms

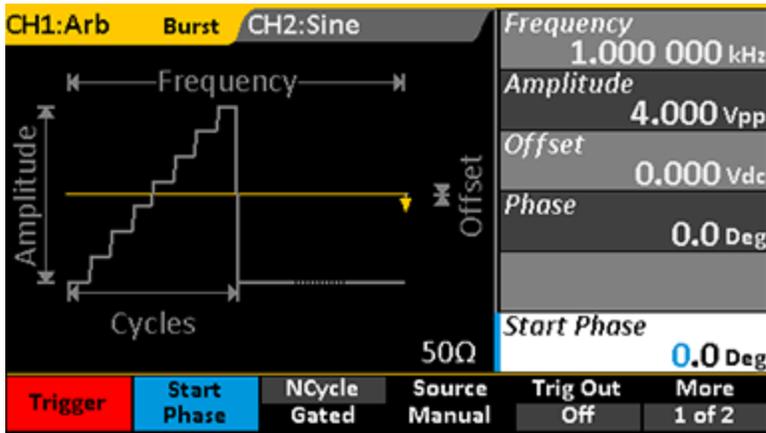
Sine, Square, Ramp, Pulse, and Arb waveforms may utilize an N-Cycle Burst or a Gated Burst. Noise waveforms utilize only a Gated Burst.

N-Cycle Burst

In this method, you either specify a number of cycles after which to begin the burst and its duration (period), or set an infinite cycle and trigger the burst manually or upon an external event.

1. [Generate a basic waveform](#) of type Sine, Square, Ramp, Pulse, or Arb. Before outputting, press the **Burst** function button.
2. Press the **NCycle** softkey until it is selected.
3. Set the following Burst parameters:
 - **Source** - Choose **Internal**, **External**, or **Manual**. If you select External, connect the trigger source to the **Trig/Gate/Fsk/Burst** connector on the Back Panel.
 - **Start Phase** - Enter a specific phase value (in °) to define the starting point of the burst. The phase varies from 0° to 360°; the default setting is 0°. For an Arbitrary waveform, 0° is the first waveform point.
 - **Burst Period** - If using Internal Source, enter the length of the burst period.
NOTE: The period time increases if necessary to allow the specified number of cycles in a burst. The following formula is applied: $Burst\ Period > Carrier\ Period \times Burst\ Number$.
 - **TrigOut** (Internal and Manual Sources) or **Edge** (External Source) - Choose **Up** (rising edge), **Down** (falling edge), or **Off**.
 - **Delay** - Press the **More** softkey to display this option. Specify a span of time between the trigger input and the start of the burst. The minimum delay amount is 240 ns.
 - **Cycles** or **Infinite** - Press the **More** softkey to display these options. If Cycles is selected, enter the desired number of repetitions (from 1 to 1,000,000). Infinite generates a continuous waveform that only stops upon a trigger event. Choose External or Manual Source to use Infinite.
4. When all parameters are set, press the appropriate **Output** button.
5. If you selected Manual source, a red Trigger option appears on the Burst menu. Press the **Trigger** softkey

to manually start and stop the burst as the waveform is output.



Gated Burst

This method sets a gate on the waveform to mark the burst period.

1. [Generate a basic waveform.](#)
2. Before outputting, press the **Burst** function button.
3. Press the **Gated** softkey until it is selected.
4. Enter the **Start Phase** value (in °) to define the starting point of the burst. The phase varies from 0° to 360°; the default setting is 0°. For an Arbitrary waveform, 0° is the first waveform point.
5. Choose either **Positive** or **Negative Polarity**.
6. Press the appropriate **Output** button to begin outputting the waveform.

Using External Trigger

The back-panel **Ext Trig/Gate/FSK/Burst connector** is a multi-purpose input used to accept the External Source for several modes.

Triggered Sweep Mode

If using External Source to trigger a [Sweep wave](#), the instrument outputs a single sweep when an edge of the correct polarity is received on the Ext Trig connector.

Triggered N-Cycle Burst Mode

If using External Source to trigger a [Burst](#) wave, the instrument outputs a waveform with specified number of cycles (burst count) each time a trigger is received on the Ext Trig connector.

Externally Gated Burst Mode

If using External Source for a [Gated Burst](#) wave, the instrument outputs a continuous waveform when the Gate signal is true. When the external Gate signal goes false, the current waveform cycle completes, then the instrument stops while remaining at a voltage level corresponding to the starting burst phase. For Noise waveforms, output stops as soon as the Gate signal goes false.

Externally Modulated FSK Mode

If using External Source for an [FSK modulated wave](#), the carrier frequency is output when a logic low level is present on the FSK connector. When a logic high level is present, hop frequency is output. Maximum external FSK rate is 100 kHz.

Using Sync Out

All standard output functions (except DC and Noise) have a corresponding Sync signal that can be sent through the Sync Out connector on the back panel. This is useful for synchronizing different devices to the occurrence of a particular waveform event.

Waveform Type	Sync Signal Reference
Non-modulated	carrier signal
AM, FM, and PM Modulated (internal modulation source)	modulated signal
ASK and FSK Modulated	keying frequency
Sweep	TTL level high (at start), then at a frequency equal to the sweep time
Burst	level high (at start)
External Gated Burst	external gated signal
Pulse	pulse signal with a fixed positive pulse width more than 50 ns

NOTE: If an output waveform is inverted, the corresponding Sync signal does not also invert.

To enable/disable the Sync signal output:

1. Press the **Utility** function button.
2. Press the **Sync** softkey.
3. Press the **State** softkey until **On** or **Off** appears.
4. Select the **Channel** to use as the Sync reference.
5. Press **Done**.

When the Sync signal is disabled, the output voltage of the [Sync] connector is set to low level.

Save/Recall

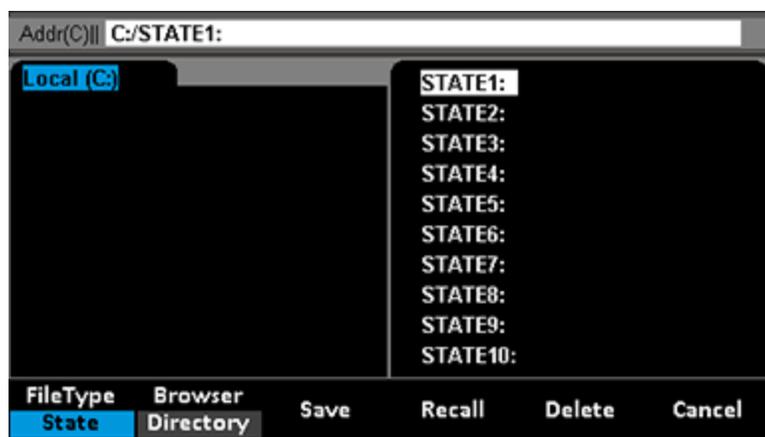
The WaveStation offers onboard storage of setup (state) files. Ten internal memory banks are provided for you to quickly save work and recall it to the instrument when needed. Setup files can also be saved to and from external drives for quick transfer of state data between devices.

You may also save waveform (data) files created on Teledyne LeCroy oscilloscopes or in the WaveStation PC software to the WaveStation for recall and output at a future time. WaveStation 3000 has two banks to accommodate waveform files up to 16K and 512K, allowing you to make and store longer acquisitions.

Save/Recall Browser

You'll see a different LCD screen when performing Save/Recall than when generating waveforms. The screen is divided into three principal sections:

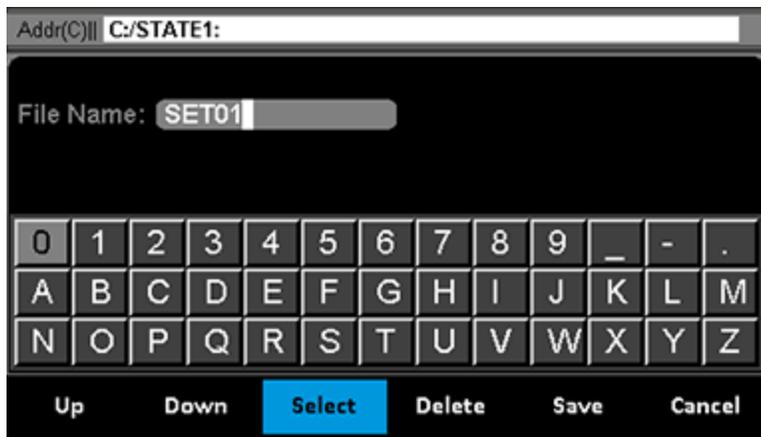
- File name at the top of the display
- Drive/folder list at the left of the display
- File list at the right of the display



Switch between the folder and file sections of the display by pressing the **Browser softkey** on the Save/Recall option menu. Scroll each list using the **Adjust knob**.

Keyboard

The default name for internal setup files is SET<number>. This is appended to the STATE to create the full setup name that appears at the top of the Browser display (e.g., STATE1:SET01). The number increments each time a new setup is saved. Similarly, setup files created on an external drive are by default named WST3000, WST3001, etc. These autogenerated file names can be changed to something more descriptive using the keyboard display.



When you first press the Save softkey during the Save procedure, the keyboard is displayed with the default File Name shown at the top. To change the name:

1. Press the **Delete** softkey to clear characters from the File Name field.
2. Use the **Adjust** knob and the **Up** and **Down** softkeys to navigate to characters on the keyboard.
3. When the desired character is selected, press the **Select** softkey to insert it in the File Name field.
4. Repeat until you have entered the desired File Name, then press the **Save** softkey.

Save/Recall Setups

1. If saving to (or recalling from) a USB drive, insert the drive into the USB host port on the front of the WaveStation.
2. Press the **Utility** function button, then press the **Store/Recall** softkey.
3. Press the **FileType** softkey until **State** is selected.
4. WaveStation defaults to the Local (C:) folder. If using an external drive, press the **Browser** softkey until **Directory** is selected, then turn the Adjust knob until **USB Device** is selected. Otherwise, skip this step.
5. Press the **Browser** softkey to select **File**. The cursor switches to the file list at the right side of the display.
6. If using internal storage, turn the Adjust knob to select the desired **STATE** memory bank (1-10).

NOTE: Any prior data stored in an internal memory will be overwritten when you save. If possible, select a State that does not already have a setup file associated with it.

7. To save the current setup:
 - Press the **Save** softkey.
 - If desired, use the [keyboard](#) to change the default File Name.

To *restore* the WaveStation to the selected setup, press **Recall**.

Save/Recall Waveforms

Waveforms files created outside the WaveStation can be saved to and recalled from a memory bank on the WaveStation.

1. Insert the drive into the USB host port on the front of the WaveStation.
2. Press the **Utility** function button, then press the **Store/Recall** softkey.
3. Press the **FileType** softkey until **Data** is selected.
4. Press the **Browser** softkey until **Directory** is selected, then turn the Adjust knob until **USB Device** is selected.
5. Press the **Browser** softkey to select **File**. The cursor switches to the file list at the right side of the display.
6. Turn the Adjust knob to select the desired memory bank, **ARB(16k)** or **ARB(512k)**, then press **Select**. The display changes to show a table of waveform files.
7. Turn the Adjust knob until the desired cell/file is selected.

NOTE: If possible, choose an empty cell when saving a file. Any prior data saved in that location will be overwritten.

8. Press **Save** to store the file, or **Recall** to output it using WaveStation.

NOTE: 512K files must be output via Channel 2.

9. When saving data files, use the [keyboard](#) to change the File Name.

Delete Setup or Waveform File

Follow the Save/Recall procedures to navigate to the setup or data file. With the file selected from the File List at the right side of the Browser, press the **Delete** softkey.

Copy Channel Settings

The setups from either WaveStation channel can be quickly copied to the other. Complete your waveform configuration on the source channel, then:

1. Press the **Utility** function button.
2. Press the **Channel Copy** softkey.
3. Press either **CH1=>CH2** or **CH2=>CH1**, depending on the direction you wish to copy.
4. Press **Done**.

Changing System Settings

Many default WaveStation settings can be modified through the Utility menu. Follow the procedures below to change Output and System settings.

See the [Using Sync Out](#), [Remote Control](#), and [Maintenance](#) sections for instructions on using other Utility menu options.

Also see [Restoring Default Settings](#).

Output

This setting changes the output Voltage and Polarity on the generated waveform. For output over 10 V pk-pk, use the HighZ setting.

1. Press the **Utility** function button.
2. Press the **Output Setup** softkey.
3. Press the **Load** softkey until either **50Ω** or **HighZ** is selected.
4. Press **Polarity** to select either **Normal** or **Invert**.
5. Press **Done**.

USB Output

The USB Type B port on the back of the WaveStation can be configured to output either:

- USBRAW
- USBTMC, used for remote control and WaveStation PC software

1. Press the **Utility** function button.
2. Press the **Interface** softkey.
3. Press the **USB Setup** softkey.
4. Press either **USBRAW** or **USBTMC**.
5. Press **Done**.

Number Format

1. Press the **Utility** function button.
2. Press the **More** softkey, then press **System** and **Number Format**.
3. Choose a **Point** style of either period (.) or comma (,). This character is placed after the first thousand.
4. Choose a **Separator** of:
 - **On** - places the other Point character (period or comma) between whole units and decimals.
 - **Space** - uses a space rather than a character to separate whole units and decimals.
 - **Off** - no separator.
5. Press **Done**.

Power On Setting

The WaveStation default is to revert to the factory settings after power down. To retain the last saved settings and restore them at power on:

1. Press the **Utility** function button.
2. Press the **More** softkey, then press **System**.
3. Press **PowerOn** until **Last** is selected.
4. Press **More**, then press **Done**.

Sound

The WaveStation default is to emit a low beep whenever a control is pressed. To turn off the sound:

1. Press the **Utility** function button.
2. Press the **More** softkey, then press **System**.
3. Press the **Beep** softkey until **Off** is selected.
4. Press **More**, then press **Done**.

Screen Saver

The WaveStation is set to turn off the LCD if there is no activity for 15 minutes. To change this setting:

1. Press the **Utility** function button.
2. Press the **More** softkey, then press **System**.
3. Press **More**, then press **ScrnSvr**.
4. Choose another time out value from the menu, or **Off** to disable this feature.
5. Press **Cancel** to return to the previous menu, then press **Done**.

NOTE: Only the LCD is disabled after the time out to preserve the display. The WaveStation continues to run and generate waveforms.

Clock Source

By default, WaveStation utilizes an internal 10 MHz reference clock. You can choose to instead input an external reference clock. To change the reference clock:

1. Connect the clock to the 10 MHz Input connector on the Back Panel.
2. Press the **Utility** function button.
3. Press the **More** softkey, then press **System**.
4. Press **More**, then press **CLKSource** until **External** is selected.
5. Press **Done**.

Restoring the Default Settings

To restore the WaveStation to the factory default settings (shown in the table below), press **Utility > More > System > Set to Default**. After a moment, the screen will blink and reset to the CH1:Sine wave parameter menu.

SubSystem & Parameter	Default Values
Output	
Function	Sine Wave
Frequency	1 kHz
Amplitude/Offset	100 mVpp/0 V DC
Phase	0°
Terminals	High Z
Modulation	
Carrier	1 kHz Sine Wave
Modulating	100 Hz Sine Wave
AM Depth	100%
FM Deviation	500 Hz
Key Freq	100 Hz
FSK Hop Frequency	1 MHz
Phase Deviation	180°
Sweep	
Start/Stop Frequency	100 Hz/1.9 kHz
Sweep Time	1 S
Trig Out	Off
Mode	Linear
Direction	Up
Burst	
Period	10 ms
Phase	0°
Count	1 Cycle
Trig	Off
Trigger	
Source	Internal

Remote Control of WaveStation

WaveStation can be remote controlled using either a USB-GPIB or USBTMC connection. For a complete list of remote control commands and their syntax, refer to the *WaveStation SCPI (Standard Commands for Programmable Instruments) Reference Manual* available at:

teledynelecroy.com/wavestation.

NOTE: WaveStation remote commands must not contain termination characters of any kind. This includes Null characters.

GPIB Remote Control

WaveStation conforms to the IEEE 488.2 GPIB standard. GPIB controls can be used to interface WaveStation with other GPIB compatible devices.

NOTE: The GPIB interface on the WaveStation supports Device mode only, not Controller.

GPIB remote control of WaveStation requires the use of the USB-GPIB converter cable included with the product. The USB connection from the WaveStation provides all necessary power to the converter.

To utilize GPIB remote control:

- Prepare your control files according to the conventions documented in the *WaveStation SCPI Command Reference*.
- Connect the USB-GPIB converter cable.
- Configure the WaveStation for GPIB communication.

Connecting the USB-GPIB Converter

Connect the USB-GPIB converter from the USB A port on the front of the WaveStation to the GPIBbus on the controller.

The converter has two LED indicators on it showing when the device is powered on and Ready (red), and Active (green) and transmitting data.



NOTE: Do not disconnect either end of the converter until all equipment is powered down.

Configuring WaveStation for GPIB

1. Check the GPIB address assigned to WaveStation on the controller. WaveStation uses 18 by default; if the controller is using a different number, you will need to change it on either side to match.
2. Press the **Utility** function button.
3. Press the **Interface** softkey.
4. Press the **GPIB** softkey.
5. If necessary, use the number keypad to enter the correct GPIB address.
6. Press **Done**.

USBTC Remote Control

To utilize a USBTC connection:

- Install NI-VISA on the controller. See the *WaveStation SCPI Command Reference* for configuration details.
- Prepare your control files according to the conventions documented in the *WaveStation SCPI Command Reference*.
- Connect a USB 2.0 Type A-B cable from the USB B port on the back of the WaveStation to a USB A port on the controller.
- [Configure WaveStation for USBTC output.](#)

Using LabView Software

Either the USB or GPIB interface can be utilized with the free LabView Driver to remote control the WaveStation using LabView projects.

The download includes three sample LabView projects that you can use to set up your own LabView workflow.

Waveform files saved in the WaveStation PC Software must be saved in SendWave CSV format to be exchanged with LabView.

See the *WaveStation SCPI* for instructions on installing the LabView driver.

Using WaveStation PC Software

The WaveStation PC Software allows you to exchange waveform files between the WaveStation and your PC. The software includes tools to help you modify or generate new files on the PC, then save them to one of WaveStation's internal memory banks for future output.

NOTE: Waveform files are a scalar representation of the waveform data. Adjust the amplitude, frequency, and offset as desired on the WaveStation.

Minimum System Requirements

- Operating system Windows® Vista 32-Bit Version, Windows® 7 32-Bit Version, Windows 8
- Pentium® IV processor
- 1 Gb RAM
- 150 Mb hard disk available space for software set -up
- Video resolution 800 X 600
- USB 2.0 connections

Updates

Teledyne LeCroy periodically releases updates of the WaveStation PC Software providing new features, enhancements, and software corrections. These updates are available free from:

teledynelecroy.com/support/softwaredownload/

Installing WaveStation PC Drivers and Software

Follow these steps in this exact order to install the WaveStation PC drivers and software:

1. Download the latest version of WaveStation PC Software compatible with your WaveStation model from teledynelecroy.com. Unzip the installer archive on the PC where you will install the software.
2. With both the WaveStation and the PC turned on, connect the 1 m USB 2.0 Type A- B Cable from the USB B port on the back of the WaveStation to a USB A port on your PC. If shown, you can close pop-ups on the PC resulting from the connection of the USB cable.
3. Install the drivers:
 - On the PC, navigate to the location for **Universal Serial Bus controllers** (usually under Device Manager).
 - Right-click on **LeCroy Series Function/Arbitrary Waveform Generator** and select **Update Driver Software** (depending on your OS, you may have to navigate through the Properties dialog to this selection).

- Choose to **Browse my computer for driver software** and navigate to the **WaveStation PC Software** → **USB Driver** folder. Select the drivers for either 32 or 64-Bit installation.
 - If alerted by Windows Security, choose to **Install this driver software anyway**.
4. After the driver installation is complete, navigate to the **WaveStation PC Software** → **Setup** folder and run **WaveStation_setup.exe**. Follow the prompts on the installer dialogs.

Connecting WaveStation to the PC

To re-establish the link between the WaveStation and your PC after the initial software installation:

1. Power on WaveStation.
2. With the PC turned on, connect the USB Type B-A cable from the rear USB B port on the WaveStation to a USB A port on the PC.
3. Launch the WaveStation PC software.

Reading Files from WaveStation on a PC

You can retrieve any stored or arbitrary waveform file from the WaveStation and send it to the WaveStation PC software for modification.

Complete the preliminary steps to:

- [Install WaveStation PC drivers and software](#).
- [Make the connection](#) from WaveStation to the PC.

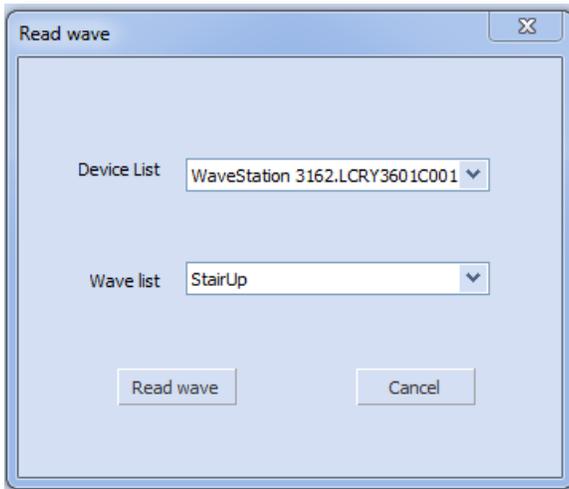
Starting from WaveStation

1. Follow the steps to [generate an arbitrary waveform](#), choosing either one of the **Built-In** or **Stored Wforms**.
2. In the WaveStation PC Software, choose **Communication** → **Read wave** from the menu bar.

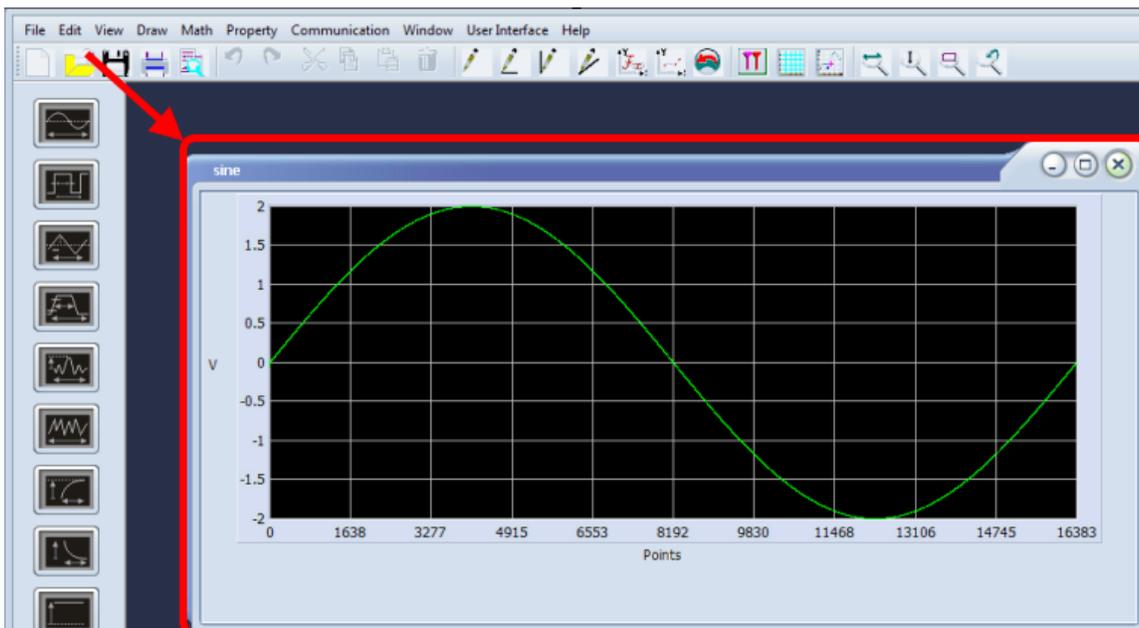


WaveStation 3000 Function and Arbitrary Waveform Generator

3. Select the device you want to read the wave from the **Device List**. The software detects multiple devices.



4. Select the stored or built-in waveform from the **Wave List**. You will see all the wave files stored on the device.
5. Click **Read Wave**.
6. Use the PC software tools to modify the file as desired.

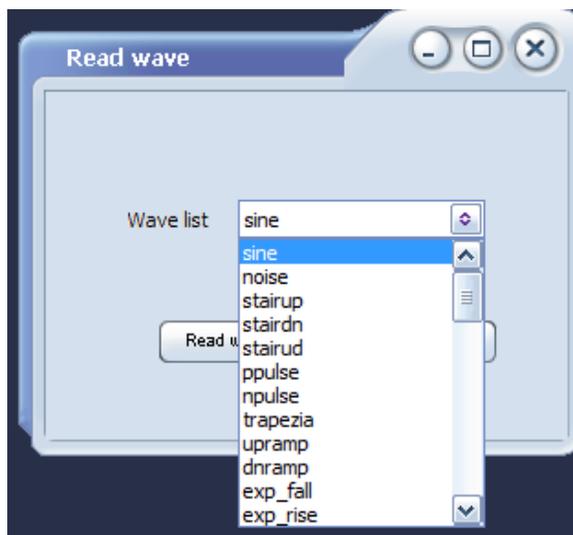


Starting from the PC

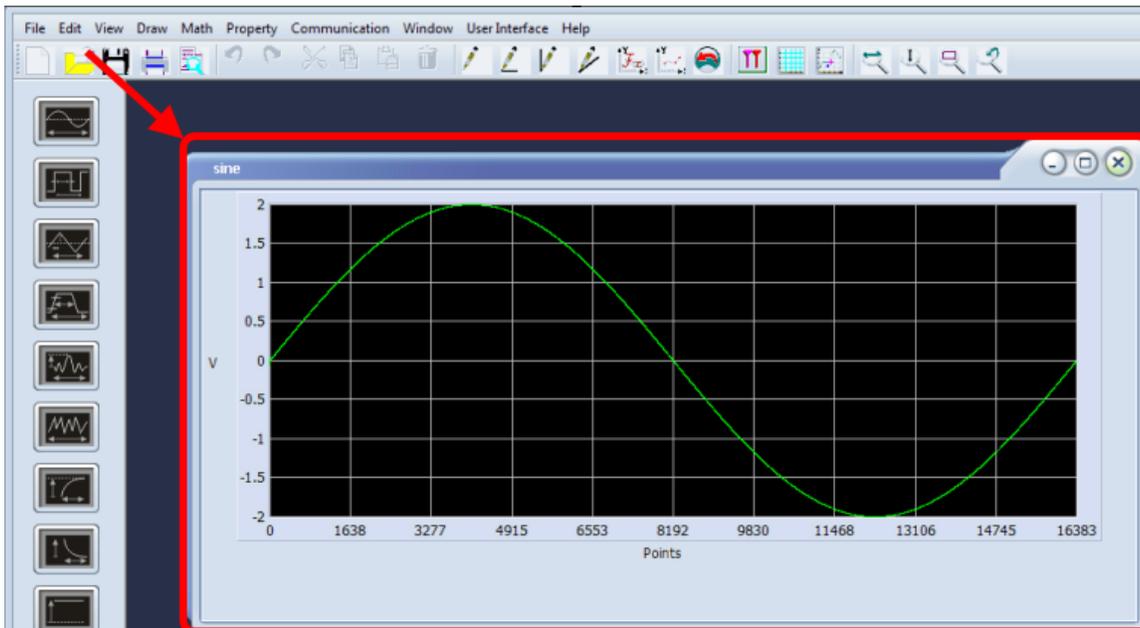
1. Click the **Read wave** button on the lower part of the screen



2. On the **Read wave** pop-up, select the desired waveform from the **Wave List**. This list will include the names of all the built-in arbitrary and saved waveforms.



3. Use the PC software tools to modify the file as desired.



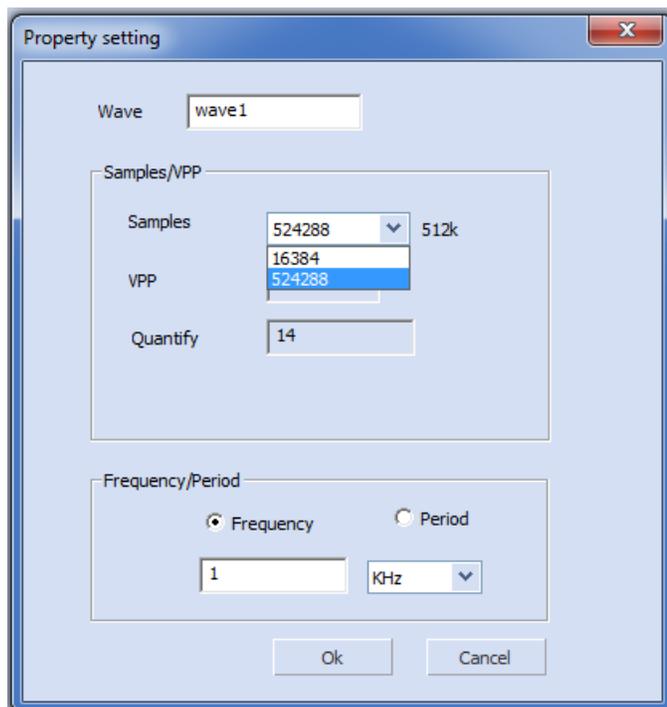
Sending Waveform Files from a PC to WaveStation

New waveform files generated in the WaveStation PC Software can be sent and stored on the WaveStation for future use.

Complete the preliminary steps to:

- [Install WaveStation PC drivers and software.](#)
- [Make the connection](#) from WaveStation to the PC.

1. Launch the WaveStation PC Software and select **File** → **New** from the menu bar. The **Property setting** pop-up is shown.



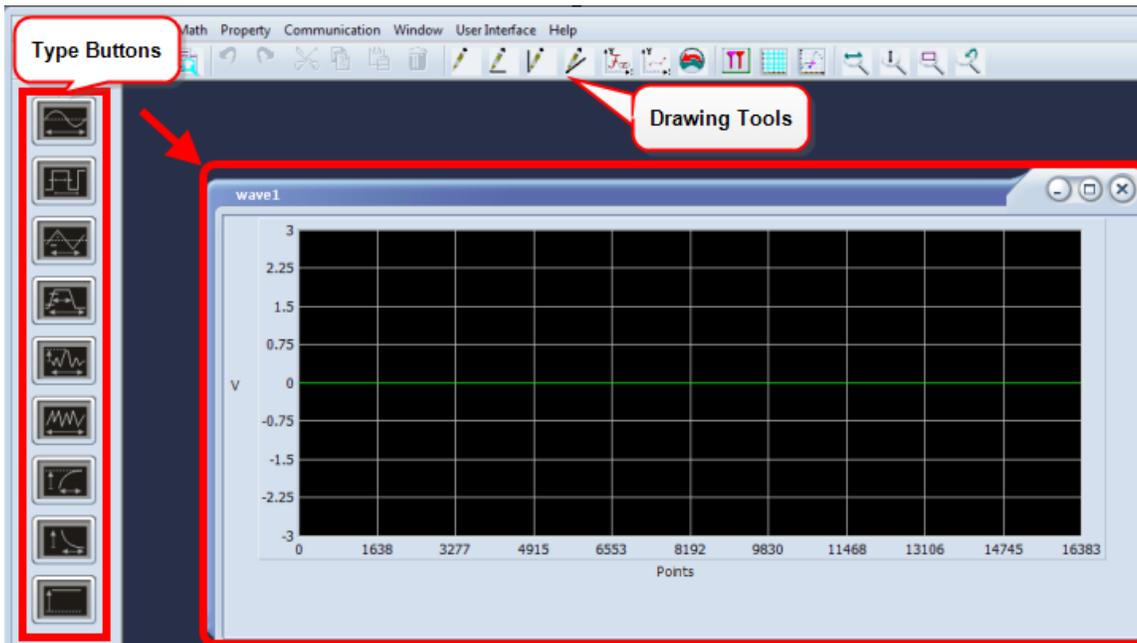
2. Provide a name for you **Wave** and details for:
 - **Samples** - choose either 16k or 512k; the file will be stored in the respective bank.
 - **VPP** - defaults to 20 Vpp.
 - **Quantify** - defaults to 14.
 - **Frequency** or **Period** of the waveform.

Click the **Ok** button when finished.

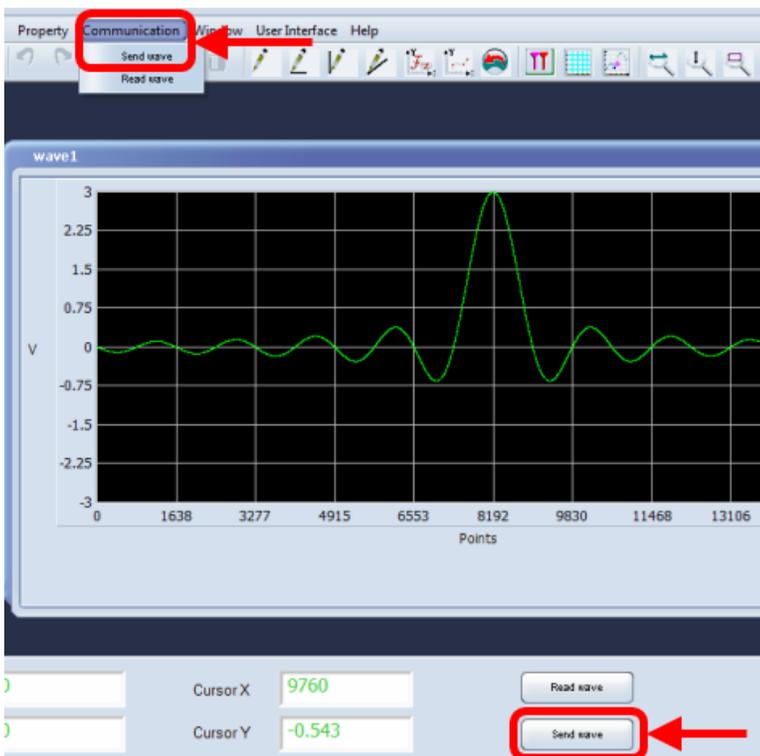
NOTE: Vpp can be changed in the next step using the Type buttons after the default waveform appears on the WaveStation PC software screen.

WaveStation 3000 Function and Arbitrary Waveform Generator

- The resulting waveform appears on screen. Use the **Waveform Type** buttons or using various **Waveform Drawing Tools** to modify it as desired.

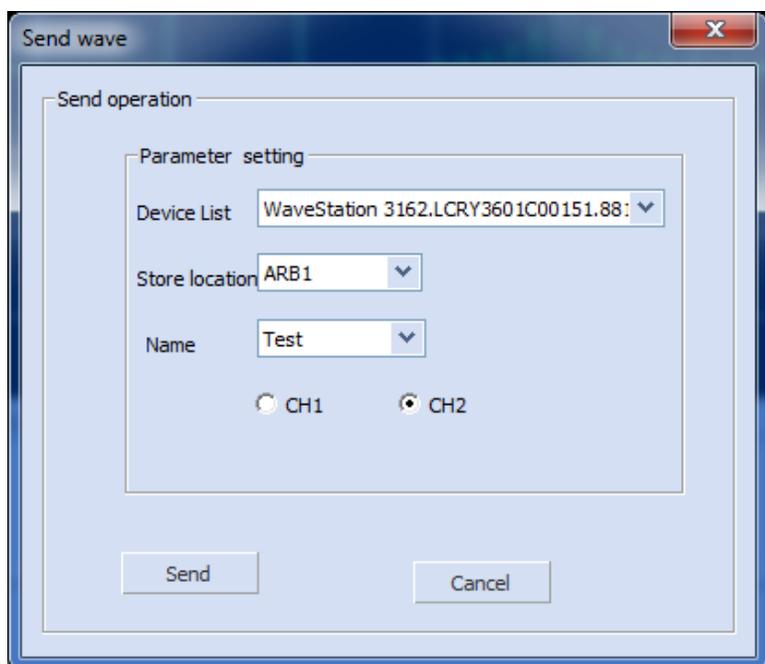


- With your waveform setup as desired, click **Save**.
- Choose **Communication** → **Send wave** from the menu bar, or click the **Send wave** button at the bottom of the window.



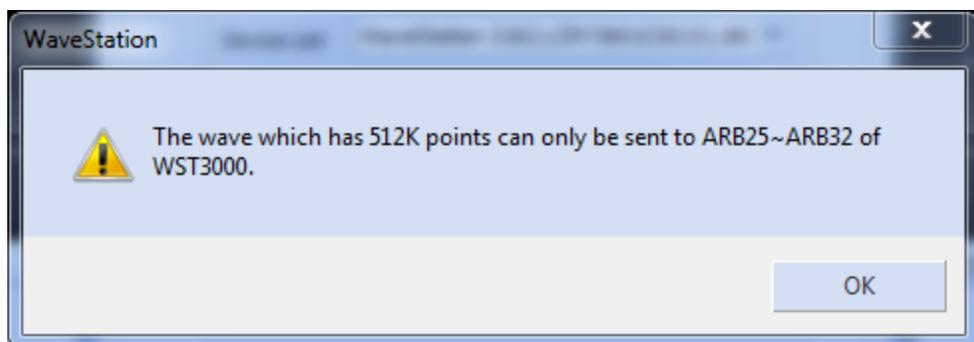
6. On the Send Wave pop-up, choose the:
- Target WaveStation from the **Device List**. All connected devices will appear for selection.
 - **Store location** Arb 1 or Arb2 (depending on the size of the file you're saving).
 - **Name** of the file.
 - Transfer **channel**. 512k files can only be sent over CH2.

Click **Send**.



A status message should appear indicating the read completed successfully.

NOTE: When you save a data file to a location already containing previously stored information, **your new information always overwrites the old**. If you choose the wrong bank or transfer channel for the size of the file, you'll see the following error message.



Save Waveform to .CSV File

Waveform data can be saved in two different formats using the WaveStation PC software:

- Comma-Separated Values (*.CSV), - includes all usual waveform parameters such as frequency, amplitude, etc. in a comma-delimited file. The file header shows the saved data.
- SendWave .CSV - includes just the amplitude data in a format that can be exchanged with LabView software.

To save a waveform:

1. Choose **File > Save**.
2. Browse to the folder where you wish to save the file.
3. Enter a **File Name**.
4. Chose to **Save as Type** *.CSV or SendWave CSV.
5. Click **Save**.

Maintaining WaveStation

Cleaning

Clean only the exterior of the instrument using a soft cloth moistened with water or an alcohol solution. Do not use harsh chemicals or abrasive elements. Under no circumstances submerge the instrument or allow moisture to penetrate it. Avoid electric shock by unplugging the power cord from the AC outlet before cleaning.



CAUTION. Do not attempt to clean internal parts. Refer to qualified service personnel.

Updating WaveStation Firmware

WaveStation firmware updates are released periodically and are available for free. It is recommended to update your WaveStation whenever there is a new firmware release to keep it performing optimally.

To check your current firmware version, press **Utility**→ **More**→ **Edit Info** to display the WaveStation details screen.



Download the latest firmware for the WaveStation 3000 series Function/Arbitrary waveform generators from teledynelecroy.com/support/softwaredownload/.

To install firmware updates:

1. Extract the firmware file, *<filename>.ads*, and save it to a USB drive.
2. Power on the WaveStation, and plug the USB drive into the Front Panel USB port.
3. Press the **Utility** function button, then press the **More** and **Update** softkeys.
4. You'll see the Browser display used to [Save/Recall files](#). Press the **Browser** softkey to select **Directory**, then turn the Adjust knob to select **USB Drive**. If the file is inside a sub-folder, press the Right Cursor button below the Adjust knob to open the folder.
5. Change **Browser** to **File**, and navigate to *<filename>.ads*.
6. Select the *.ads file and press **Recall**.
7. Follow the instructions on screen to begin the update.

NOTE: When the update starts, you will see the message “System updating... Please don’t shutdown your WaveStation during the updating procedure.” Do not power off the WaveStation for any reason during this process. Doing so can render the WaveStation inoperable.

8. When the update is complete, power off and restart the WaveStation.

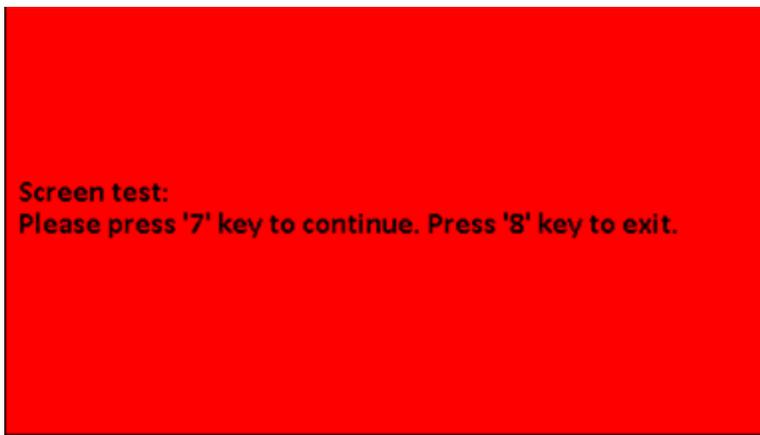
Self Tests

These tests enable you to determine if the WaveStation controls are functioning properly. It is recommended to perform them periodically. If you discover a malfunction during a test, contact your nearest [Teledyne LeCroy service center](#) for instructions. You may or may not need to [return the product for repair](#).

Screen Test

This test enables you to check the color registration of the LCD.

1. Press the **Utility** function button.
2. Press the **More** softkey, then press **Test/Cal**.
3. Press **SelfTest**, then **ScrTest**. You will see the display change to red.

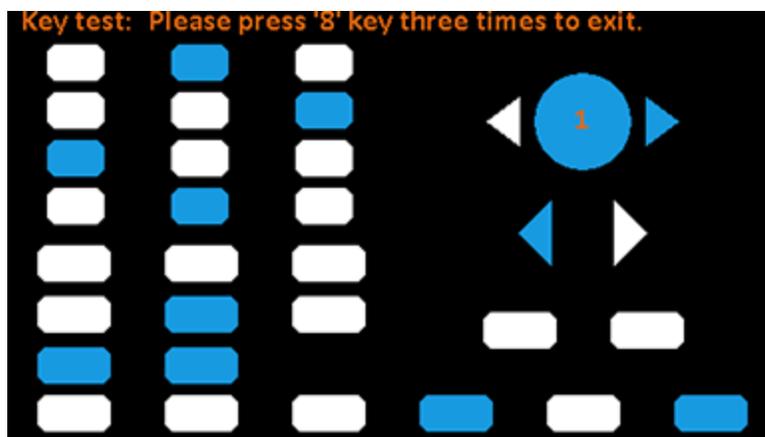


4. Following the directions on the display, continue to press the **number 7** on the keypad to cycle through red, green, and blue. Press the number 8 on the keypad to exit the test.

Key Test

This test determines if the WaveStation CPU is receiving proper input from the Front Panel controls.

1. Press the **Utility** function button.
2. Press the **More** softkey, then press **Test/Cal**.
3. Press **SelfTest**, then **KeyTest**. The display changes to show a simulation of the Front Panel.



4. Press each button and knob on the Front Panel in turn. As you press them, you should see the corresponding block on the simulation turn blue, indicating proper functioning. If any block fails to change, the control is malfunctioning.
5. Press the number 8 on the keypad three times to exit the test.

LED Test

This test determines whether the LEDs that light the Function buttons on the Front Panel buttons are working properly.

1. Press the **Utility** function button.
2. Press the **More** softkey, then press **Test/Cal**.
3. Press **SelfTest**, then **LEDTest**. The display changes to show a simulation of the Front Panel exactly like the one in the Key Test.
4. Continue to press the **number 7** on the keypad. Each block on the simulation that corresponds to a Function button turns blue, while the button itself lights up, indicating proper functioning. If any block or button fails to light, the control is malfunctioning.
5. Press the number 8 on the keypad three times to exit the test.

Self Calibration

WaveStation includes a self-calibration routine that makes gain and phase adjustments. Run the self calibration on an as needed basis.

Contact your nearest [Teledyne LeCroy service center](#) to schedule a factory calibration once per year.

1. Press the **Utility** function button.
2. Press the **More** softkey, then press **Test/Cal**.
3. Press **SelfAdjust**. You will see a progress bar appear over the display. Wait until the calibration completes, then press any Function button to exit.

Returning a Product for Service

Contact your local Teledyne LeCroy service center for calibration or other service. If the product cannot be serviced on location, the service center will give you a **Return Material Authorization (RMA) code** and instruct you where to ship the product. All products returned to the factory must have an RMA.

Return shipments must be prepaid. Teledyne LeCroy cannot accept COD or Collect shipments. We recommend air-freighting. Insure the item you're returning for at least the replacement cost.

1. Remove all accessories from the device. Do not include the manual.
2. Pack the product in its case, surrounded by the original packing material (or equivalent).
3. Label the case with a tag containing:
 - The RMA
 - Name and address of the owner
 - Product model and serial number
 - Description of failure or requisite service
4. Pack the product case in a cardboard shipping box with adequate padding to avoid damage in transit.
5. Mark the outside of the box with the shipping address given to you by Teledyne LeCroy; be sure to add the following:
 - ATTN: <RMA code assigned by Teledyne LeCroy>
 - FRAGILE
6. **If returning a product to a different country:**
 - Mark the shipment as a "Return of US manufactured goods for warranty repair/recalibration."
 - If there is a cost for the service, list the cost in the Value column and the original purchase price "For insurance purposes only."
 - Be very specific about the reason for shipment. Duties may have to be paid on the value of the service.

Extended warranty, calibration, and upgrade plans are available for purchase. Contact your Teledyne LeCroy sales representative to purchase a service plan.

Contact Teledyne LeCroy

For the most complete and up-to-date list of sales and service centers by country, visit teledynelecroy.com/support/contact.

Reference

Specifications

The most current specification information regarding your product are maintained on the Teledyne LeCroy website atteledynelecroy.com. Specifications are subject to change without notice.

Certifications

EMC Compliance

EC DECLARATION OF CONFORMITY- EMC

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

EN 61326-1:2013, EN 61326-2-1:2013 EMC requirements for electrical equipment for measurement, control, and laboratory use. ¹

Electromagnetic Emissions:

EN 55011:2010, Radiated and Conducted Emissions Group 1, Class A ^{2 3}

EN 61000-3-2/A2:2009 Harmonic Current Emissions, Class A

EN 61000-3-3:2008 Voltage Fluctuations and Flickers, Pst = 1

Electromagnetic Immunity:

EN 61000-4-2:2009 Electrostatic Discharge, 4 kV contact, 8 kV air, 4 kV vertical/horizontal coupling planes ⁴

EN 61000-4-3/A2:2010 RF Radiated Electromagnetic Field, 3 V/m, 80-1000 MHz; 3 V/m, 1400 MHz - 2 GHz; 1 V/m, 2 GHz - 2.7 GHz

EN 61000-4-4/A1:2010 Electrical Fast Transient/Burst, 1 kV on power supply lines, 0.5 kV on I/O signal data and control lines ⁴

EN 61000-4-5:2006 Power Line Surge, 1 kV AC Mains, L-N, L-PE, N-PE ⁴

EN 61000-4-6:2009 RF Conducted Electromagnetic Field, 3 Vrms, 0.15 MHz - 80 MHz

EN 61000-4-11:2004 Mains Dips and Interruptions, 0%/1 cycle, 70%/25 cycles, 0%/250 cycles ^{4 5}

1. To ensure compliance with all applicable EMC standards, use high quality shielded interface cables.
2. Emissions which exceed the levels required by this standard may occur when the instrument is connected to a test object.
3. This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.
4. Meets Performance Criteria "B" limits of the respective standard: during the disturbance, product undergoes a temporary degradation or loss of function or performance which is self-recoverable.
5. Performance Criteria "C" applied for 70%/25 cycle voltage dips and 0%/250 cycle voltage interruption test levels per EN61000-4-11.

European Contact:*

Teledyne LeCroy Europe GmbH
Im Breitspiel 11c
D-69126 Heidelberg
Germany
Tel: + 49 6221 82700

AUSTRALIA & NEW ZEALAND DECLARATION OF CONFORMITY– EMC

The instrument complies with the EMC provision of the Radio Communications Act per the following standards, in accordance with requirements imposed by Australian Communication and Media Authority (ACMA):

AS/NZS CISPR 11:2011 Radiated and Conducted Emissions, Group 1, Class A.

AUSTRALIA / NEW ZEALAND CONTACTS:*

RS Components Pty Ltd.
Suite 326 The Parade West
Kent Town, South Australia 5067

RS Components Ltd.
Unit 30 & 31 Warehouse World
761 Great South Road
Penrose, Auckland, New Zealand

*Visit teledynelecroy.com/support/contact for the latest contact information.

Safety Compliance

EC DECLARATION OF CONFORMITY– LOW VOLTAGE

The instrument meets intent of EC Directive 2006/95/EC for Product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements

EN 61010-2:030:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-030: Particular requirements for testing and measuring circuits

The design has been verified to conform to the following limits put forth by these standards:

- Mains Supply Connector: CAT II, local distribution level, equipment connected to the mains supply (AC power source).
- Measuring Terminals: CAT 0, signal level, equipment measuring terminals connected to source circuits where measures are taken to limit transient voltages to an appropriately low level.
- Unit: Pollution Degree 2, operating environment where normally only dry, non-conductive pollution occurs. Conductivity caused by temporary condensation should be expected.
- Unit: Protection Class I, grounded equipment, in which protection against electric shock is achieved by Basic Insulation and a connection to the protective ground conductor in the building wiring.

U.S. NATIONALLY RECOGNIZED AGENCY CERTIFICATION

The instrument has been certified by Underwriters Laboratories (UL) to conform to the following safety standard and bears UL Listing Mark:

UL 61010-1 Third Edition – Safety standard for electrical measuring and test equipment.

CANADIAN CERTIFICATION

The instrument has been certified by Underwriters Laboratories (UL) to conform to the following safety standard and bears cUL Listing Mark:

CAN/CSA-C22.2 No. 61010-1-12. Safety requirements for electrical equipment for measurement, control and laboratory use.

Environmental Compliance

END-OF-LIFE HANDLING



The instrument is marked with this symbol to indicate that it complies with the applicable European Union requirements to Directives 2002/96/EC and 2006/66/EC on Waste Electrical and Electronic Equipment (WEEE) and Batteries.

The product is subject to disposal and recycling regulations that vary by country and region. Many countries prohibit the disposal of waste electronic equipment in standard waste receptacles. For more information about proper disposal and recycling of your Teledyne LeCroy product, please visit teledynelecroy.com/recycle.

RESTRICTION OF HAZARDOUS SUBSTANCES (RoHS)

This instrument and its accessories conform to the 2011/65/EU RoHS2 Directive, as it is classified as Industrial Monitoring and Control Equipment (per Article 3, Paragraph 24) and is exempt from RoHS compliance until 22 July 2017 (per Article 4, Paragraph 3).

ISO Certification

Manufactured under an ISO 9000 Registered Quality Management System.

Warranty

THE WARRANTY BELOW REPLACES ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS, OR ADEQUACY FOR ANY PARTICULAR PURPOSE OR USE. TELEDYNE LECROY SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT OR OTHERWISE. THE CUSTOMER IS RESPONSIBLE FOR THE TRANSPORTATION AND INSURANCE CHARGES FOR THE RETURN OF PRODUCTS TO THE SERVICE FACILITY. TELEDYNE LECROY WILL RETURN ALL PRODUCTS UNDER WARRANTY WITH TRANSPORT PREPAID.

The product is warranted for normal use and operation, within specifications, for a period of three years from shipment. Teledyne LeCroy will either repair or, at our option, replace any product returned to one of our authorized service centers within this period. However, in order to do this we must first examine the product and find that it is defective due to workmanship or materials and not due to misuse, neglect, accident, or abnormal conditions or operation.

Teledyne LeCroy shall not be responsible for any defect, damage, or failure caused by any of the following: a) attempted repairs or installations by personnel other than Teledyne LeCroy representatives or b) improper connection to incompatible equipment, or c) for any damage or malfunction caused by the use of non-Teledyne LeCroy supplies. Furthermore, Teledyne LeCroy shall not be obligated to service a product that has been modified or integrated where the modification or integration increases the task duration or difficulty of servicing the product. Spare and replacement parts, and repairs, all have a 90-day warranty.

Products not made by Teledyne LeCroy are covered solely by the warranty of the original equipment manufacturer.

Index

- A**
 - arbitrary wave 17, 37
- B**
 - back panel 4
 - burst wave 23, 25
- C**
 - calibration 6, 47
 - clock source 32
 - compliance 49
 - controls 3-4
 - adjust knob 12
 - function buttons 8
 - key test 46
 - keypad 13
 - LED test 47
 - softkeys 9
 - sync signal 26
- D**
 - DC wave 16
 - display 9
 - keyboard 27
 - number format 31
 - screen test 46
 - store list 27
- E**
 - EC compliance 49
 - EMC 49
 - external trigger 25
- F**
 - firmware 45
 - front panel 3
 - function buttons 8
- G**
 - gated burst 24-25
 - GPIB 34
- H**
 - handle
 - adjusting 4
 - help 14
- I**
 - inputs/outputs 3-4, 25-26
- M**
 - modulation
 - AM 18
 - ASK 20
 - DSB-AM 21
 - FM 19
 - FSK 20, 25
 - PM 19
 - PWM 21
- N**
 - N-cycle burst 23, 25
 - navigation 9
 - noise wave 15

- O**
 - operating environment 6
 - output
 - GPIB 34
 - USB 30, 35
 - voltage 30
- P**
 - parameters
 - adjusting 9, 12
 - parts list 2
 - power 6
 - applying 7
 - consumption 6
 - ground 7
 - pulse wave 15
- R**
 - ramp wave 15
 - remote control 34
 - GPIB 34
 - USB 35
 - RoHS 51
- S**
 - safety 5, 50
 - precautions 5
 - symbols 5
 - save/recall 27
 - setups 28-29
 - waveform file 29, 36-37, 41
 - screen saver 32
 - self tests 46
 - key test 46
 - LED test 47
 - screen test 46
 - setups 28
 - copy 29
 - default 33
 - power on setting 31
 - utilities 30
 - sine wave 15
 - sound 31
 - specifications 1, 49
 - square wave 15
 - support
 - help 14
 - sweep wave 22, 25
 - sync signal 26
- U**
 - UL compliance 51
 - USB 30, 35
- V**
 - viewing position 4
 - voltage 30
- W**
 - waveform
 - arbitrary 17
 - burst 23
 - DC 16
 - noise 15

pulse 15

ramp 15

save/recall 29, 37, 41

sine 15

square 15

sweep 22

WaveStation PC Software 36-37, 41

WEEE 51



700 Chestnut Ridge Road
Chestnut Ridge, NY 10977
USA

teledynelecroy.com