TELEDYNE LECROY
Everywhereyoulook™

Operator's Manual

WaveStation
Function/Arbitrary
Waveform Generator

WaveStation Function/
Arbitrary Waveform Generator

Operator's Manual

March 2013

Warranty

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The WaveStation 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 instrument. Spare and replacement parts, and repairs, all have a 90-day warranty.

The instrument's firmware has been thoroughly tested and is presumed to be functional. Nevertheless, it is supplied without warranty of any kind covering detailed performance. Products not made by Teledyne LeCroy are covered solely by the warranty of the original equipment manufacturer.

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Welcome

Thank you for purchasing a Teledyne LeCroy WaveStation.

The WaveStation is a function/arbitrary waveform generator that allows you to simultaneously create and view custom waveforms. You can control WaveStation through USB-GPIB and/or USBTMC interfaces, and even transfer waveforms to and from your WaveStation using the WaveStation PC Software.

This WaveStation Operator's Manual covers how to use WaveStation models 2012 10 MHz, 2022 25 MHz, and 2052 50 MHz. The material is organized in the following manner:

- Package Contents and Safety Requirements, along with the Hardware and I/O description.
- Getting Started with WaveStation, a general overview of the standard controls on the front panel and how they correspond with the display.
- How to create Waveform Types, Modulated Waveforms, Sweep Waveforms, and Burst Waveforms. Additional sections explain how to use Save/Recall, Utility, and Help sections.
- How to control WaveStation with USB-GPIB (using the USB-GPIB Adapter) and/or USBTMC.
- How to use the WaveStation Software to send and receive waveforms over a PC connection with your WaveStation.
- Reference, including where to find regularly updated Specifications and other details.

We truly hope these materials provide increased comprehension when using Teledyne LeCroy's fine products.

Sincerely,

David C. Graef
Teledyne LeCroy
Vice President and Chief Technology Officer

Package Contents

The standard WaveStation package includes the following:

- WaveStation Function/Arbitrary Waveform Generator
- Power Cord
- Standard USB 2.0 Type A to Type B Cable, 1 m
- USB to GPIB Converter Cable
- WaveStation Operator's Manual
- Performance/Calibration Certificate
- Product Registration Card

Safety Instructions

This section contains instructions that must be observed to keep the instrument operating in a correct and safe condition. You are required to follow generally accepted safety procedures in addition to the precautions specified in this section. **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 damage to instrument, or **WARNING** of hazard to health. Attend to the accompanying information to protect against personal injury or damage. Do not proceed until conditions are fully understood and met.

WARNING. Risk of electro-shock.

Measurement ground connection.

Frame or chassis connection.

Safety (protective) ground connection.

Power on/off.

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 that exceeds the maximum rating of that input. Refer to the markings next to the BNC terminals for maximum allowed values.

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

Use indoors only.

Keep product surfaces clean and dry.

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° C to 40° C

Humidity: Maximum relative humidity 80% (non-condensing) for temperatures up to 30° C decreasing linearly to 50 % relative humidity at 40° C.

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

Cooling

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

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

Cleaning

Clean only the exterior of the instrument using a damp, soft cloth. 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.

Calibration

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

CAUTION. It is required that all inputs be removed from the WaveStation prior to performing a manual calibration.

Schedule an annual factory calibration as part of your regular maintenance. Extended warranty, calibration, and upgrade plans are available for purchase. Contact your Teledyne LeCroy sales representative or customersupport@teledynelecroy.com to purchase a service plan.

Power

Power Consumption

50 VA (50 W) Max

Power and Ground Connections

100-240 VAC (±10%) at 50/60 Hz (±5%) or 100-120 VAC (±10%) at 400 Hz (±5%)

Automatic AC voltage selection. No manual voltage selection is required because the instrument automatically adapts to line voltage.

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

WARNING. Interrupting the protective conductor inside or outside the instrument, or disconnecting the safety ground terminal, creates a hazardous situation. Intentional interruption is prohibited.

Powering On/Off

The  Power button 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.

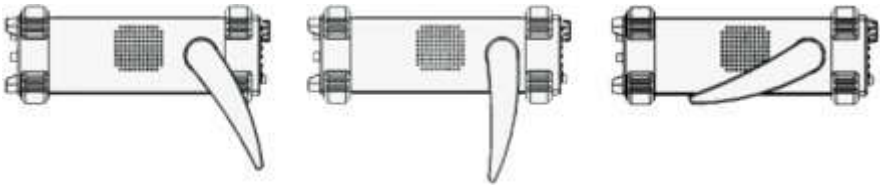
Hardware and I/O

Adjusting the Handle

The construction of the handle on your WaveStation can be adjusted to bridge the front panel and fully-support the weight of the generator during transport.

NOTE: Adjust the handle while gently pulling outward on the two arms where they attach to the sides of your WaveStation.

You can also move the handle into a tucked position under the generator for different viewing positions.



Front Panel

1. **Power Button**
2. **USB Connector** - USB 2.0 connector which is used for making **USB-GPIB** or **Memory Stick** connections as explained in Controlling WaveStation with USB-GPIB and/or USBTMC (on page 62) and Main Save/Recall Operations (on page 46), respectively.
3. **LCD Display**
4. **Display Menu Operation Buttons**
5. **Waveform Buttons** - These buttons control the selection of **Waveform Types and Default Parameters**.
6. **Number Buttons**
7. **Function Buttons** - When pressed, these buttons setup corresponding **Initial Function Settings**. Specifically, the top three buttons are **Waveform Signal Conditioning** buttons and apply **Mod**, **Sweep**, or **Burst** functions to the waveform you've selected. Meanwhile, the lower three, **Save/Recall**, **Utility**, and **Help**, are for various WaveStation tools and configurations along with some Help information.
8. **BNC Channel Outputs and Corresponding Control Buttons** - The buttons above the BNC connectors control the activation/deactivation of corresponding channel outputs.
9. **Direction Buttons**
10. **Adjustment Control Knob**

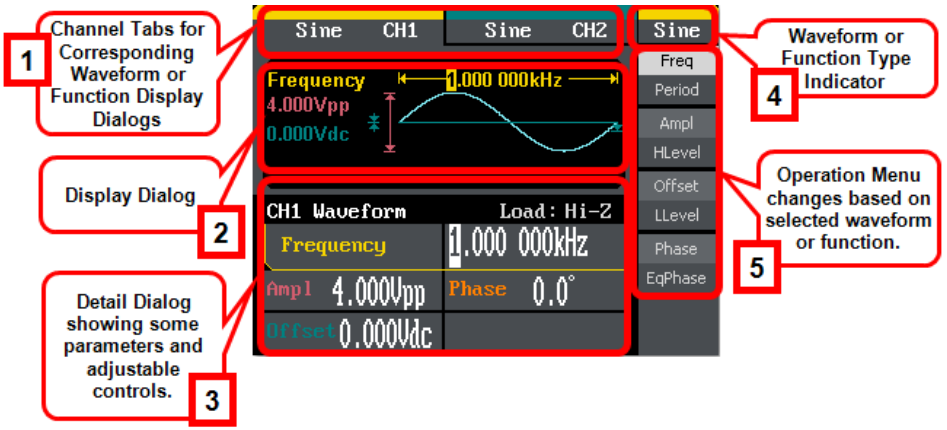
NOTE: It's important to understand the relationship between the Main Waveform Type buttons, the Waveform Signal Conditioning function buttons, and the Save/Recall, Utility, and Help function buttons. See Combined Use of Waveform, Function, and Configuration Buttons (on page 17).

Back Panel

1. **Input and Output BNC Connectors** - Four BNC Connectors provide **10 MHz In**, **Modulation In**, **Synch Out**, **Ext Trig/Gate/Fsk/Burst Out**.
2. **USB Connector** - USB 2.0 connector which is used for making **USBRAW** or **USBTMC** connections as explained in WaveStation PC Software Overview (on page 64) and Controlling WaveStation with USB-GPIB and/or USBTMC (on page 62), respectively.
3. **Ground Connector**
4. **AC Power Connector**

Getting Started with WaveStation

The WaveStation Interface



NOTE: The default signal is a Sine wave as each channel tab and in the upper-right corner of the display show.

1. **Channel Tabs** - The channel tabs display the currently chosen **Waveform** or **Function** type and, when selected, show their corresponding **Display** and **Detail** dialog.
2. **Display Dialog** - Shows a rendered waveform or modulated waveform display of your generated signal and some additional waveform details.
3. **Detail Dialog** - Shows even more data regarding specific parameters for your selected Waveform or Function.
4. **Waveform/Function Type Indicator** - When using the **Waveform** buttons, shows the waveform type for the corresponding waveform channel selected. Waveform types include **Sine**, **Square**, **Ramp**, **Pulse**, **Noise**, and **Arb**. When using the **Function** buttons, shows the selected function from **Modulate**, **Sweep**, **Burst**, **Save/Recall**, **Utility**, and **Help**.
5. **Operation Menu** - This menu changes based on the selected **Waveform** or **Function** chosen. Refer to more detailed corresponding coverage later in this manual for more information.

Navigating Interfaces, Adjusting Parameters, and Making Selections

Specific waveform types may be used as carrier waveforms for specific functions as explained in Initial Function Settings (on page 16).

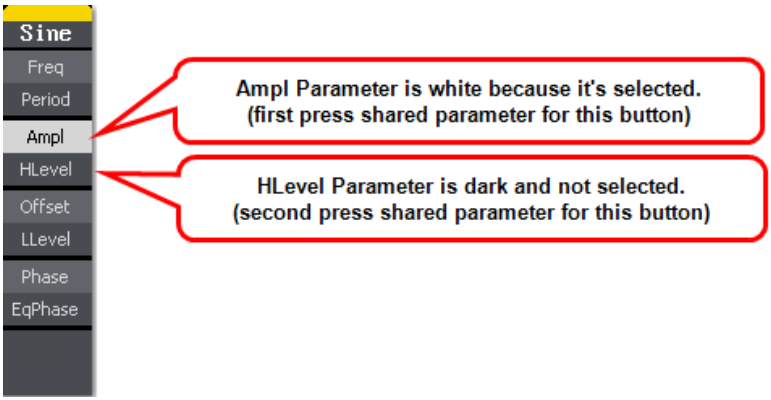
NOTE: Default values for most modulated waveform parameters may be set using certain options available from the Utility menu. Learn more in Main Utility Operations (on page 52).

Subsequent sections go into more detail when using specific **Waveform** and **Function** buttons and adjusting specific parameters - all of which vary based on the specific waveform, function, and/or carrier waveform selections made. This particular topic covers some common navigation, parameter adjustments, and making selections when using the WaveStation interfaces.

1. Typically, the first step when using interfaces is to make specific **Waveform** or **Function** button selections on the **Front Panel** in order to make specific parameter adjustments or other selections.

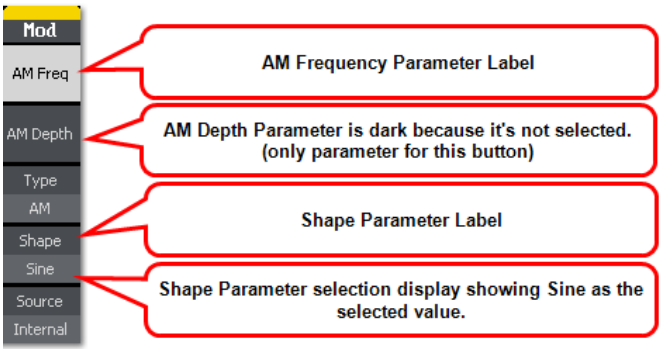
   NOTE: If you've selected a Function button, you now choose a desired carrier waveform type using the Display Menu Operation buttons. The waveform is shown on the Waveform Display.

2. At this point, the **Display Menu Operation** buttons are used to select applicable parameters and make adjustments as desired. The operation menu's currently selected parameter is shown in white.

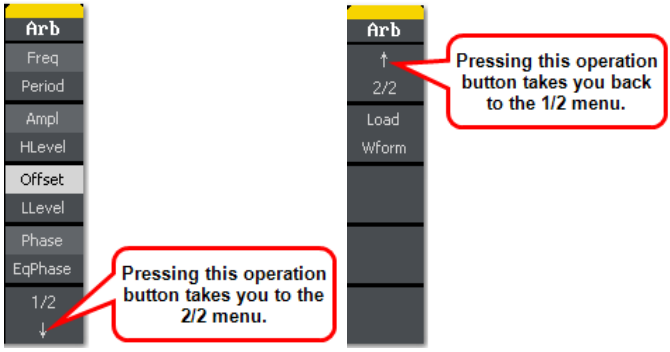


While navigating, you'll come across the following interfaces and button type combinations.

- **First/Second Press Shared Buttons** - A good portion of the operation buttons control two separate parameters. Operation buttons controlling two parameters have additional, lighter shaded control labels on them; press the button **once to adjust the top control parameter**; **twice to adjust the bottom one**. Second operation button press parameters are shown in reverse color on some interface dialogs to provide a visual indication as to which parameter is being adjusted.
- **Parameter Label and Selection Display Button** - Some parameters look like they're first/second press shared buttons, but really are not. Instead, the parameter title is shown in the top portion and the lower portion displays the particular parameter selection as the following **Shape** parameter shows.

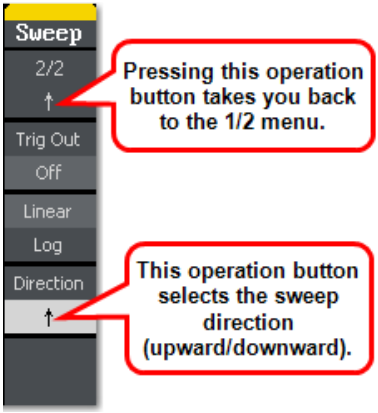


- **Additional Menus** - Operation menus containing more parameters than the ones showing on the first menu have a **1/X ↓** final selection. The additional menu(s) therefore have a **2/X ↑** first selection. Press the adjacent operation button to navigate additional menu(s) and parameter(s) as desired.

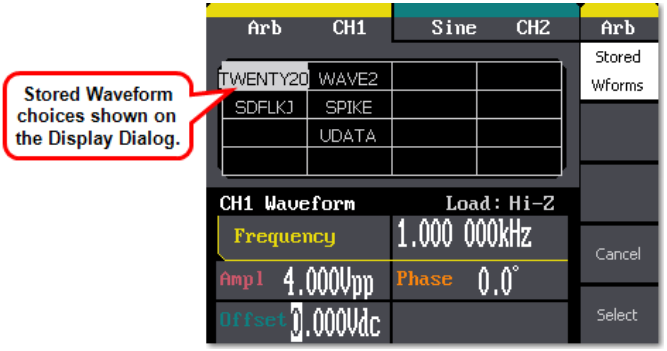


3. Making the actual parameter adjustments or other selection is made a few different ways. Most are done by selecting a **specific parameter** using a **corresponding operation menu button**, changing the value or selection using the Digital Input Front Panel Controls, and then pressing the same corresponding **operation menu button again to preserve the adjustment/selection**. The only variation includes where the interface shows the adjustment/selection choices.

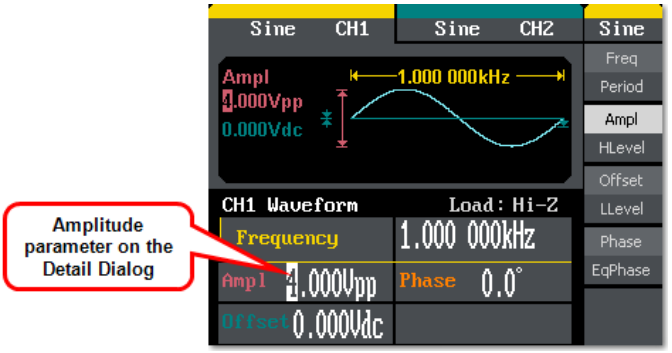
    - **Inside the Operation Menu** - Some adjustment/selection choices are shown right on the **Operation** menu.



- **On the Display Dialog** - Some adjustment/selection choices are shown right on the **Display** dialog.



- **On the Detail Dialog** - Some adjustment/selection choices are shown right on the **Detail** dialog.



- **On the Browser Display Dialog** - Some interfaces are provided using file explorer-like screens for saving and recalling a variety of folders and file types.

Waveform Types and Default Parameters

Provided your WaveStation is powered on, a single waveform type is always selected and only one waveform type is selected at a time. Each waveform type (**Sine**, **Square**, **Ramp**, **Pulse**, **Noise**, and **Arb**) contains default parameters when initially selected.

NOTE: It's important to understand the relationship between the Main Waveform Type buttons, the Waveform Signal Conditioning function buttons, and the Save/Recall, Utility, and Help function buttons. See Combined Use of Waveform, Function, and Configuration Buttons (on page 17).

Select waveform types by pressing the corresponding waveform button on the **Front Panel**.

- **Sine** - The default Sine waveform is set to 1 kHz frequency, 4.0 Vpp amplitude and a 0V dc offset. The WaveStation can produce 1 µHz up to 50 MHz (WaveStation 2052) Sine waves.
- **Square** - The default Square waveform is set to 1 kHz frequency, 4.0 Vpp amplitude, 0V dc offset with a 50% duty cycle. The WaveStation can produce 1 µHz to 25 MHz with variable duty cycle Square waves.
- **Ramp** - The default Ramp waveform is set to 1 kHz frequency, 4.0 Vpp amplitude, 0V dc offset with a 50% symmetry. The WaveStation can produce 1 µHz to 300 kHz with variable symmetry Ramp waves.
- **Pulse** - The default Pulse waveform is set to 1 kHz frequency, 4.0 Vpp amplitude, 0V dc offset, 200 µs pulse width. The WaveStation can produce 500 µHz to 5 MHz with variable pulse width and delay Pulse waves.
- **Noise** - The default Noise waveform is set to 2.0V Variance and 10 mV Mean. The WaveStation can produce signal bandwidth up to 50 MHz for Noise waves.
- **Arb** - The default Arb waveform is set to 1 kHz frequency, 4.0 Vpp amplitude and 0mV dc offset. The WaveStation can produce repeatable arbitrary waveform signals with a 16K point maximum and a 5 MHz frequency.

Initial Function Settings

Each function (**Modulate**, **Sweep**, **Burst**, **Save/Recall**, **Utility**, and **Help**) contains default settings when initially selected.

Specifically, the top three buttons are **Waveform Signal Conditioning** buttons and apply **Mod**, **Sweep**, or **Burst** functions to the waveform you've selected. Meanwhile, the lower three, **Save/Recall**, **Utility**, and **Help**, are for various WaveStation tools and configurations along with some Help information.

NOTE: See Combined Use of Waveform, Function, and Configuration Buttons (on page 17).

Select a function by pressing the corresponding function button on the **Front Panel**.

Waveform Signal Conditioning Buttons

- **Modulate** - Press the **Mod** button and the modulated waveforms you've created using the WaveStation are generated. Waveforms are modulated using **AM**, **FM**, **ASK**, **FSK**, and **PM**.

  NOTE: Sine, Square, Ramp, or Arb waveforms may be modulated, while Pulse, Noise, and DC cannot.

- **Sweep** - Press the **Sweep** button and the WaveStation produces a signal with variable frequencies.

  NOTE: Sine, Square, Ramp, or Arb waveforms may be swept, while Pulse, Noise, and DC cannot.

- **Burst** - Press the **Burst** button and the waveforms you've created using the WaveStation are generated for either N-Cycle Burst (a specified number of waveform cycles) or Gated Burst (controlled by an external gated signal).

  NOTE: Sine, Square, Ramp, or Arb waveforms may be set to an N-Cycle Burst, while Noise is the only waveform type available for a Gated Burst.

Save/Recall, Utility, and Help Buttons

- **Save/Recall** - Press the **Save/Recall** button to store or arrange waveform data either on the WaveStation itself or on an external memory device. This function is also used for retrieving data previously stored on internal or external memory as well.
- **Utility** - Press the **Utility** button to set **Auxiliary System Functions**, **Output Parameters**, **Interface Settings**, and to **View System Setting Information**.
- **Help** - Press the **Help** button and the WaveStation help system is pertaining to the current function or operation is shown.

Combined Use of Waveform, Function, and Configuration Buttons

Main Waveform Buttons

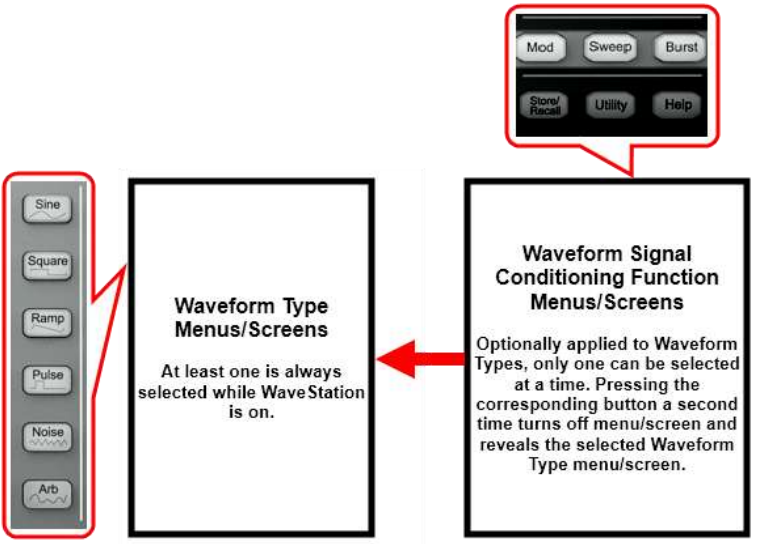
As mentioned in Waveform Types and Default Parameters (on page 15), provided your WaveStation is powered on, a single waveform type is always selected and only one waveform type is selected at a time.

Waveform Signal Conditioning Function Buttons

As mentioned in Initial Function Settings (on page 16), you apply one of the three signal conditioning function buttons to your selected waveform type for specific **Mod**, **Sweep**, or **Burst** functionality.

Menus are therefore displayed in a prioritized order of **Waveform Type** (one of which is always selected) and a second level of **Mod**, **Sweep**, or **Burst** (one of the three at a time). However, it is not mandatory to apply **Mod**, **Sweep**, or **Burst** functionality to your selected waveform. Therefore, a second press of the **Mod**, **Sweep**, or **Burst** button turns the LED and function off to reveal the originally selected waveform type menu.

The menu behavior/relationship looks like the following:

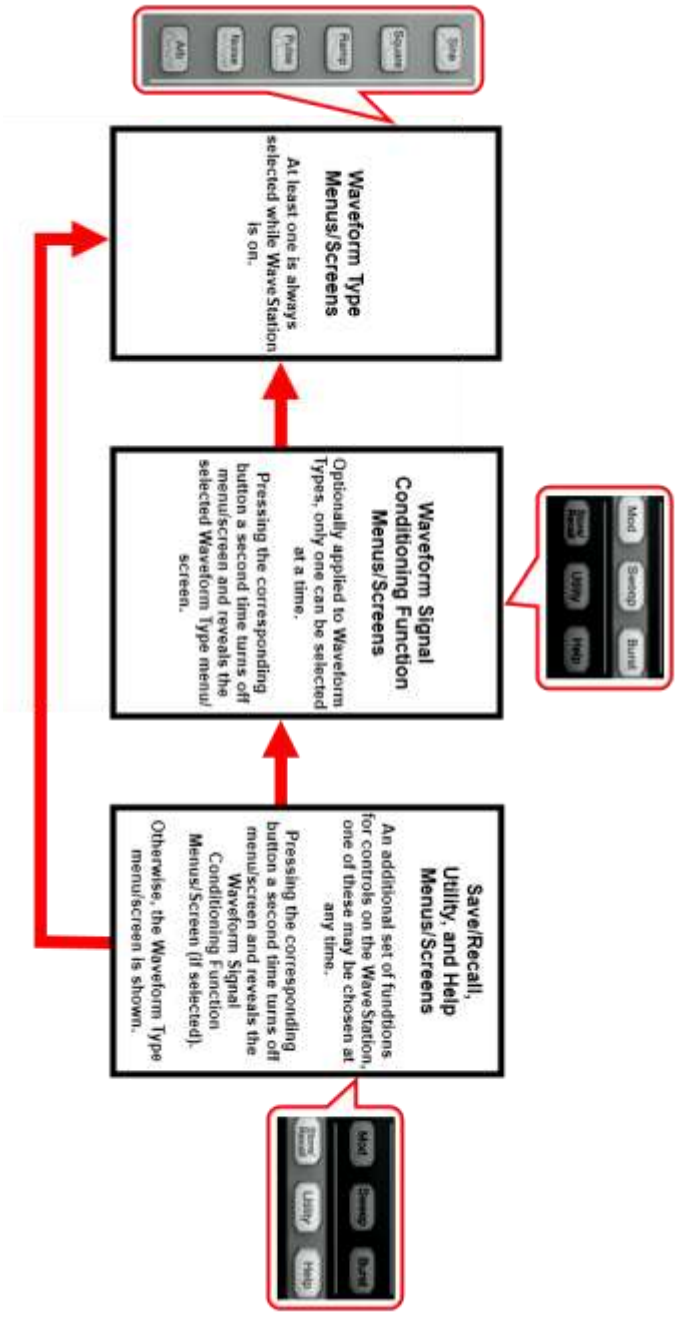


Save/Recall, Utility, and Help Function Buttons

Also mentioned in Initial Function Settings (on page 16), while the waveform type and an optional signal conditioning function is (or is not) applied to your signal, you can also use one of the **Save/Recall**, **Utility**, or **Help** function buttons.

So, at any given time, you can press the **Save/Recall**, **Utility**, or **Help** function button, and the corresponding menu is shown. Similar to **Mod**, **Sweep**, or **Burst** these buttons are optional and a second press turns off their corresponding LED and function to reveal either the **Mod**, **Sweep**, or **Burst** menu if applied to the selected waveform, otherwise, the selected waveform type menu is shown.

The menu behavior/relationship looks like the following:



Digital Input Front Panel Controls

Three sets of buttons - **The Number Buttons**, **The Direction Buttons**, and the **Adjustment Control Knob** - all provide unique means to provide digital input from the Front Panel in the following ways:

- **The Number Buttons** are used to set parameter and input values.
- **Up and Down Direction Buttons** select through different parameters while the **Left and Right** ones are used to decrease/increase, respectively, preset value increments for a selected parameter. Also used to navigate the Path, Folder, File sections of the Browser display dialog in Main Save/Recall Operations (on page 46).

  TIP: Combine Number and Direction buttons to edit a parameter by using the left direction button to move the cursor backward and delete or change values entered using the number buttons.

- **The Adjustment Control Knob** allows you to decrease/increase more precise value increments for a selected parameter or select items from listings when by turning the knob counterclockwise/clockwise, respectively.

Creating Waveforms

Overview

The first step in creating your waveform is to press the corresponding **Waveform** button on the **Front Panel**.

PLEASE NOTE THE FOLLOWING:

- When using WaveStatio it's important to understand the relationship between the **Main Waveform Type** buttons, the **Waveform Signal Conditioning** function buttons, and the **Save/Recall**, **Utility**, and **Help** function buttons. See Combined Use of Waveform, Function, and Configuration Buttons (on page 17).
- Default values for many controls can be set using certain options available on the **Utility** menu. Learn more in Main Utility Operations (on page 52).

This section covers details around creating waveforms and making specific adjustment/selection parameter choices - all of which vary based on the specific waveform selection made.

For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

Creating a Sine Wave

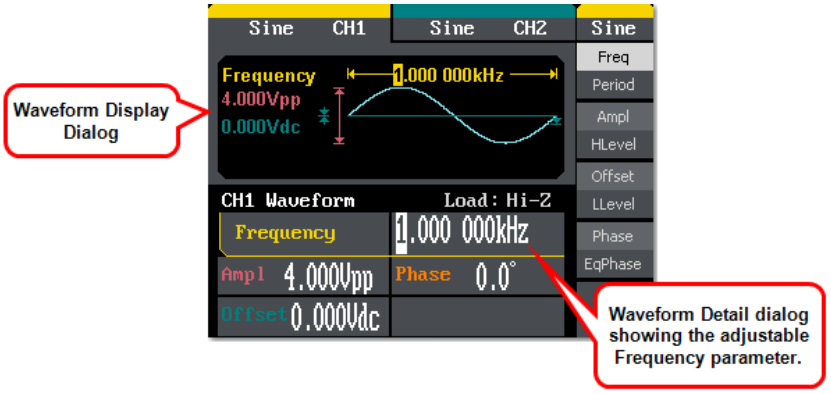
When first pressing this waveform button on the **Front Panel**, the WaveStation shows the **Sine Operation** menu and corresponding **Display** and **Detail** dialogs.

Press adjacent Operation buttons and use the Digital Input Front Panel Controls to make specific adjustment/selection parameter choices. For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

Sine Operation menu selections and parameters include **Frequency/Period**, **Amplitude/HLevel**, **Offset/LLevel**, **Phase**, and **Duty Cycle** as explained in the remainder of this topic.

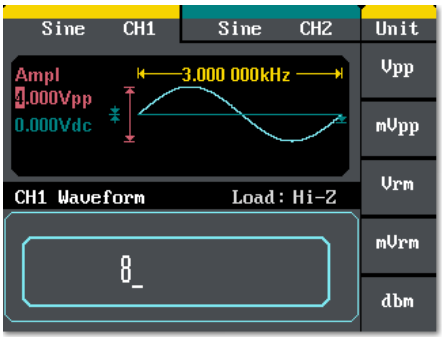
Frequency/Period

With the **Sine** waveform and the **Frequency/Period** operation button **pressed once to select Frequency**, a Sine waveform is shown on the **Waveform Display** and the **Frequency** is shown on the **Waveform Detail** dialog.



PLEASE NOTE THE FOLLOWING:

- Press the **Frequency/Period** operation button **a second time** to select and adjust the **Period** parameter in the same manner.
- When using the **Number Buttons** to edit certain parameters, applicable unit(s) are shown on the adjacent **Units** menu. Press a Unit menu button to select the desired unit for your entry. These units do not appear if you use the Adjustment Control knob to edit parameter settings.

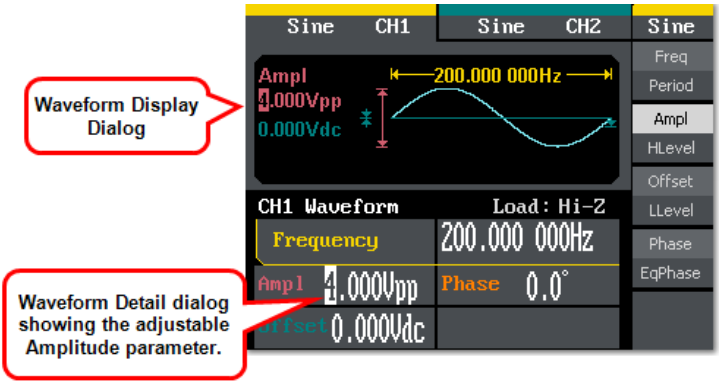


While editing certain parameters using the Number Buttons, applicable unit(s) are shown on the Operation menu. Press an adjacent Operation button to select a desired Unit for your entry.

- Provide your desired **Frequency** or **Period** using the Digital Input Front Panel Controls.

Amplitude/HLevel

With the **Sine** waveform and the **Amplitude/HLevel** operation button **pressed once**, a Sine waveform is shown on the **Waveform Display** and **Amplitude** is shown on the **Waveform Detail** dialog.



Waveform Display Dialog

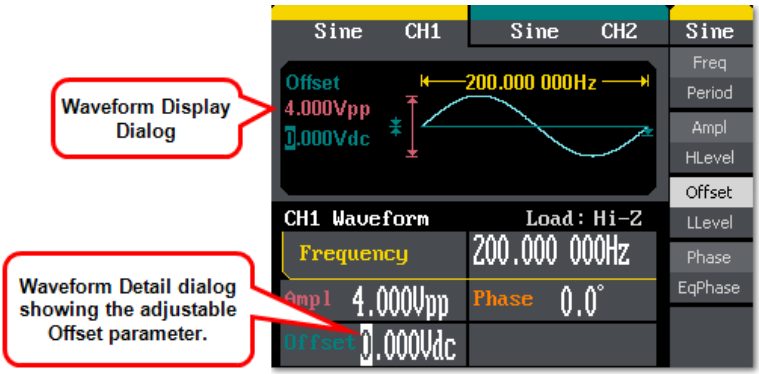
Waveform Detail dialog showing the adjustable Amplitude parameter.

PLEASE NOTE THE FOLLOWING:

- Press the **Amplitude/HLevel** operation button **a second time** to select and adjust the **HLevel** (High Level) parameter in the same manner. Second operation button press parameters are shown in reverse color on the waveform detail dialog to provide a visual indication as to which parameter is being adjusted.
- When using the **Number Buttons** to edit certain parameters, applicable unit(s) are shown on the adjacent **Units** menu. Press a Unit menu button to select the desired unit for your entry. These units do not appear if you use the Adjustment Control knob to edit parameter settings.
- Provide your desired **Amplitude** or **HLevel** using the Digital Input Front Panel Controls.

Offset/LLevel

With the **Sine** waveform and the **Offset/LLevel** operation button **pressed once to select Offset**, a Sine waveform is shown on the **Waveform Display** and the **Offset** is shown on the **Waveform Detail** dialog.

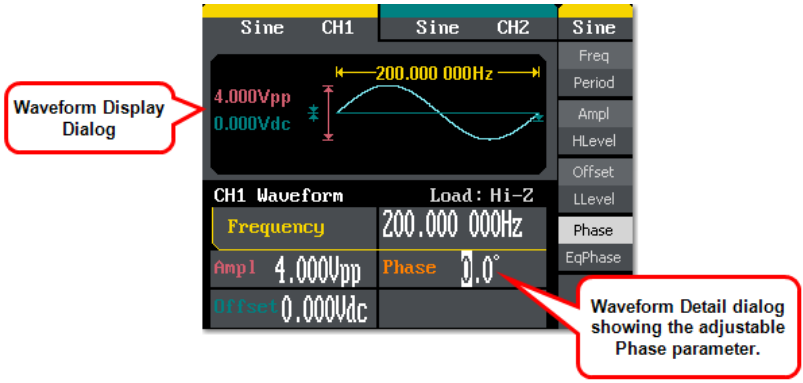


PLEASE NOTE THE FOLLOWING:

- Press the **Offset/LLevel** operation button **a second time** to select and adjust the **LLevel** (Low Level) parameter in the same manner. Second operation button press parameters are shown in reverse color on the waveform detail dialog to provide a visual indication as to which parameter is being adjusted.
- When using the **Number Buttons** to edit certain parameters, applicable unit(s) are shown on the adjacent **Units** menu. Press a Unit menu button to select the desired unit for your entry. These units do not appear if you use the Adjustment Control knob to edit parameter settings.
- Provide your desired **Offset** or **LLevel** using the Digital Input Front Panel Controls.

Phase/EqPhase

With the **Sine** waveform and the **Phase/EqPhase** operation button **pressed once to select Frequency**, a Sine waveform is shown on the **Waveform Display** and the **Phase** is shown on the **Waveform Detail** dialog.



PLEASE NOTE THE FOLLOWING:

- Press the **Phase/EqPhase** operation button **a second time** to select and adjust the **EqPhase** parameter in the same manner. Second operation button press parameters are shown in reverse color on the waveform detail dialog to provide a visual indication as to which parameter is being adjusted.
- When using the **Number Buttons** to edit certain parameters, applicable unit(s) are shown on the adjacent **Units** menu. Press a Unit menu button to select the desired unit for your entry. These units do not appear if you use the Adjustment Control knob to edit parameter settings.
- Provide your desired **Phase** or **EqPhase** using the Digital Input Front Panel Controls**.**

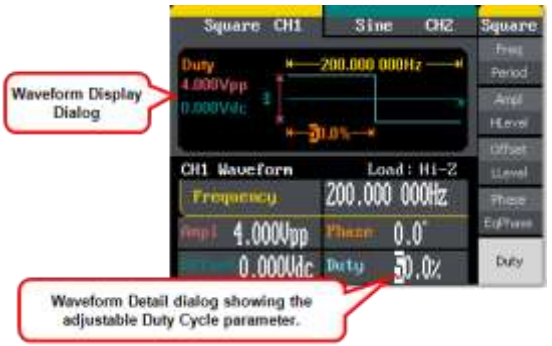
Creating a Square Wave

When first pressing this waveform button on the **Front Panel**, the WaveStation shows the **Square Operation** menu and corresponding **Display** and **Detail** dialogs.

Press adjacent Operation buttons and use the **Digital Input Front Panel Controls** to make specific adjustment/selection parameter choices. For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

NOTE: Square Operation menu selections and parameters include Frequency/Period, Amplitude/HLevel, Offset/LLevel, Phase, and Duty Cycle. The parameters for Frequency/Period, Amplitude/HLevel, Offset/LLevel, Phase are carried out the same way as done when Creating a Sine Wave.

With the **Square** waveform and the **Duty** (Duty Cycle) operation button pressed, a Square waveform is shown on the **Waveform Display** and **Duty Cycle** is shown on the **Waveform Detail** dialog.



Duty Cycle is entered as the percentage of the High Level taking up the whole period.

% of High Level	Frequency
20 to 80%	< 10 MHz
40 to 60%	From 10 MHz to 20 MHz
50%	> 20 MHz

PLEASE NOTE THE FOLLOWING:

- Press an adjacent Operation button to select a desired **Unit** (unit interval) for your entry.
- Provide your desired **Duty Cycle** amount using the Digital Input Front Panel Controls**.**

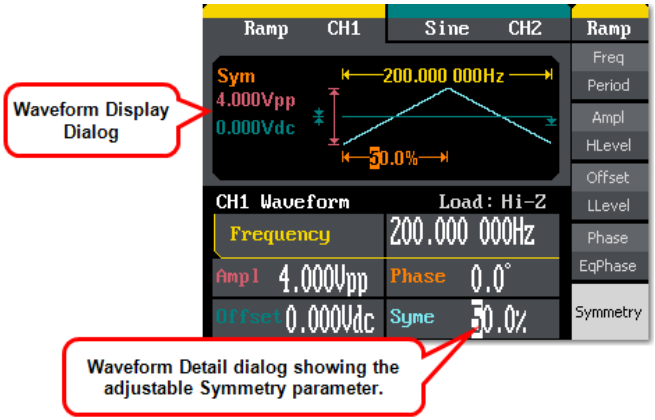
Creating a Ramp Wave

When first pressing this waveform button on the Front Panel, the WaveStation shows the **Ramp Operation** menu and corresponding **Display** and **Detail** dialogs.

Press adjacent Operation buttons and use the Digital Input Front Panel Controls to make specific adjustment/selection parameter choices. For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

NOTE: Ramp Operation menu selections and parameters include Frequency/Period, Amplitude/HLevel, Offset/LLevel, Phase/EqPhase, and Symmetry. The parameters for Frequency/Period, Amplitude/HLevel, Offset/LLevel, Phase/EqPhase are carried out the same way as done when creating a Sine Wave.

With the **Ramp** waveform and the **Symmetry** operation button pressed, a Ramp waveform is shown on the **Waveform Display** and **Symmetry** is shown on the **Waveform Detail** dialog.



PLEASE NOTE THE FOLLOWING:

- Press an adjacent Operation button to select a desired **Unit** (unit interval) for your entry.
- Provide your desired **Symmetry** amount using the Digital Input Front Panel Controls.

Creating a Pulse Wave

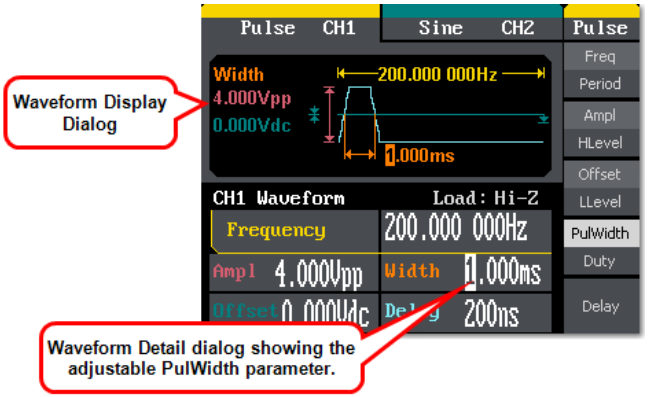
When first pressing this waveform button on the Front Panel, the WaveStation shows the **Pulse Operation** menu and corresponding **Display** and **Detail** dialogs.

Press adjacent Operation buttons and use the Digital Input Front Panel Controls to make specific adjustment/selection parameter choices. For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

NOTE: Pulse Operation menu selections and parameters include Frequency/Period, Amplitude/HLevel, Offset/LLevel, PulWidth/Duty, and Delay. The parameters for Frequency/Period, Amplitude/HLevel, and Offset/LLevel are carried out the same way as done when creating a Sine Wave.

PulWidth/Duty

With the **Pulse** waveform and the **PulWidth/Duty** operation button **pressed once to select PulWidth**, a Pulse waveform is shown on the **Waveform Display** and the **Pulse Width** is shown on the **Waveform Detail** dialog.



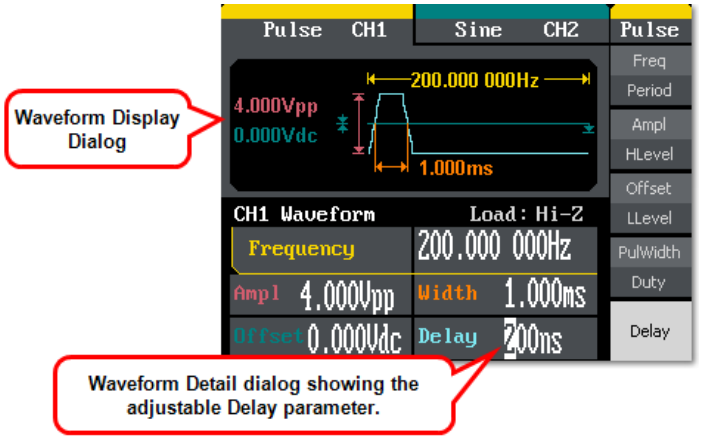
Positive Pulse Width is the time from the first rising edge to the first falling edge, Similar to **Negative Pulse Width**.

PLEASE NOTE THE FOLLOWING:

- Press an adjacent Operation button to select a desired **Unit** (unit interval) for your entry.
- Provide your desired **PulWidth** amount using the Digital Input Front Panel Controls.

Delay

With the **Pulse** waveform and the **Delay** operation button **pressed once**, a Pulse waveform is shown on the **Waveform Display** and the **Delay** is shown on the **Waveform Detail** dialog.



PLEASE NOTE THE FOLLOWING:

- Press an adjacent Operation button to select a desired **Unit** (unit interval) for your entry.
- Provide your desired **Delay** amount using the Digital Input Front Panel Controls.

Creating a Noise Wave

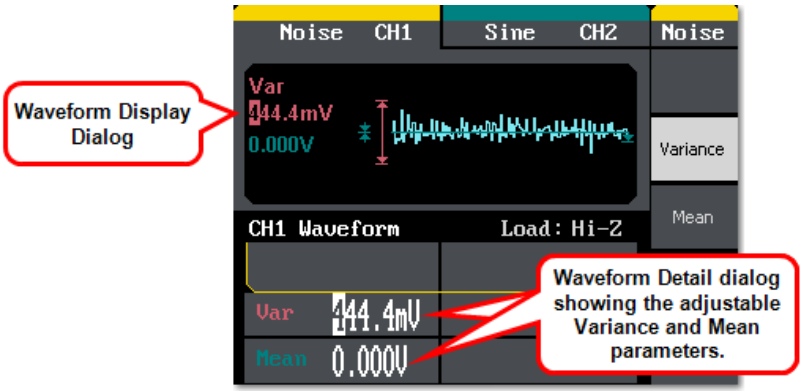
When first pressing this waveform button on the Front Panel, the WaveStation shows the **Noise Operation** menu and corresponding **Display** and **Detail** dialogs.

Press adjacent Operation buttons and use the Digital Input Front Panel Controls to make specific adjustment/selection parameter choices. For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

Set **Variance/Mean** values on Noise Waveforms as follows:

Press the **Variance/Mean operation button once to select Variance**, a Noise waveform is shown on the Waveform Display and Variance is shown on the Waveform Detail dialog.

Press the **Variance/Mean** operation button **a second time** to select and adjust the **Mean** parameter in the same manner.



PLEASE NOTE THE FOLLOWING:

- When using the **Number Buttons** to edit certain parameters, applicable unit(s) are shown on the adjacent **Units** menu. Press a Unit menu button to select the desired unit for your entry. These units do not appear if you use the Adjustment Control knob to edit parameter settings.
- Provide your desired **Variance** or **Mean** values using the Digital Input Front Panel Controls.

Creating an Arbitrary Waveform

When first pressing this waveform button on the Front Panel, the WaveStation shows the **Arb Operation** menu and corresponding **Display**

and **Detail** dialogs. There is a **System Default Arb Waveform** and a **User-Defined Arb Waveform**.

Press adjacent Operation buttons and use the Digital Input Front Panel Controls to make specific adjustment/selection parameter choices. For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

PLEASE NOTE THE FOLLOWING:

- Arb Operation menu selections and parameters include **Frequency/Period**, **Amplitude/HLevel**, **Offset/LLevel**, **Phase/EqPhase**, and **Load Wform**. The parameters for **Frequency/Period**, **Amplitude/HLevel**, **Offset/LLevel**, and **Phase/EqPhase** are carried out the same way as done when creating a Sine Wave.
- Operation menus containing more parameters than the ones showing on the first menu have a **1/X ↓** final selection. The additional menu(s) therefore have a **2/X ↑** first selection. Press the adjacent button to navigate additional menu(s) and parameter(s) as desired.

Loading a Stored Waveform is done as follows:

Load Wform

- Press the **1/2 ↓** button to access the additional Arb Operation menu.
- Now, press the **Load Wform** button.
- An Arb menu showing **Built-In** and **Stored Waveform** options is shown.

NOTE: There are 40+ Built-In Arbitrary Waveforms available in the WaveStation.

Built-In Arbitrary Waveforms

After selecting **Arb → Load Wform → Built-In**, a menu is shown categorizing the Built-In Arbitrary Waveforms as follows:

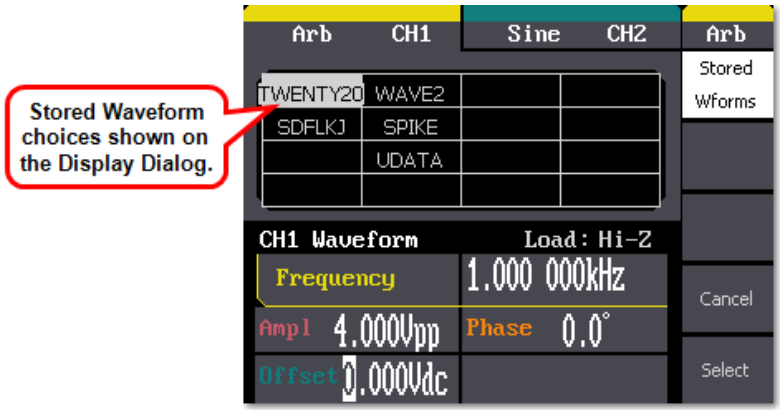
NOTE: When you select one of the following categories using the Operation button, the built-in waveforms are shown on the Waveform Display dialog and may be selected using the Digital Input Front Panel Controls, specifically the Direction Buttons or the Control Knob. Make your selection by pressing the Select option button.

- **Common** - Common Built-In Arbitrary Waveforms include **StairUp**, **StairDn**, **StairUD** (Stair Up and Down), **PPulse** (Positive Pulse), **NPulse** (Negative Pulse), **Trapezia** (Trapezoid), **UpRamp**, and **DnRamp**.
- **Math** - Math Built-In Arbitrary Waveforms include **ExpFall** (Exponential Fall), **ExpRise**, **LogFall** (Logarithmic Fall), **LogRise**, **Sqrt** (Square Root), **Root**^{3}, **X^2**, **X^3**, **Sinc**, **Gaussian**, **Dlorentz** (D-Lorentz), **Haversin** (Haversine), **Lorentz**, **Gauspuls** (Gaussian-modulated sinusoidal pulse), **Gmonpuls** (Gaussian monopulse), and **Tripuls** (triangle pulse).
- **Project** - Project Built-In Arbitrary Waveforms include **Cardiac** (electrocardiogram or ECG), **Quake** (loma prieta earthquake), **Chirp** (swept-frequency cosine), **TwoTone** (two tone signal), and **SNR** (sine wave with white noise).
- **Winfun/Triangle** - Winfun/Triangle Built-In Arbitrary Waveforms include **Hamming**, **Hanning**, **Kaiser**, **Blackman**, **Gaussian**, **Triangle**, **Hairs**, **Bartlett**, **Tan**, **Cot**, **Sec**, **Csc**, **Asin**, **Acos**, **Atan**, and **Acot**.
- **Choice** - Choice Built-In Arbitrary Waveforms include **StairUp**, **StairDn**, **StairUD** (Stair Up and Down), **PPulse** (Positive Pulse), **NPulse** (Negative Pulse), **Trapezia** (Trapezoid), **UpRamp**, and **DnRamp**.

Stored Waveforms

After selecting **Arb → Load Wform → Stored Wforms**, the Stored Waveforms are shown on the Waveform Display dialog as follows:

NOTE: Select the stored waveforms showing on the Waveform Display dialog using the Digital Input Front Panel Controls - specifically, the Direction Buttons or the Control Knob. Make your selection by pressing the Select option button.



Generating Modulated Waveforms

Overview

Specific waveform types may be modulated (as carrier waveforms) using the WaveStation. **Sine**, **Square**, **Ramp**, or **Arb** waveforms may be modulated, while **Pulse**, **Noise**, and **DC** cannot.

The first step in creating your modulated waveform is to press the **Mod** Function button on the Front Panel. Then, select a modulated waveform type from the **AM** (Amplitude Modulation)**, FM** (Frequency Modulation)**, ASK** (Amplitude Shift Keying Modulation), **FSK** (Frequency Shift Keying Modulation), **PM** (Phase Modulation), and **PWM** (Pulse Width Modulation) choices on the Mod operation menu.

PLEASE NOTE THE FOLLOWING:

- See Combined Use of Waveform, Function, and Configuration Buttons (on page 17).
- Default values for many controls can be set using certain options available on the **Utility** menu. Learn more in Main Utility Operations (on page 52).

This section covers details around creating modulated waveforms and making specific adjustment/selection parameter choices - all of which vary based on the specific **function** and **carrier waveform selection** made.

For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

Generating an AM Modulated Waveform

After selecting the **Mod → AM** (Amplitude Modulation) operator button, the WaveStation shows the **AM Operation** menu and corresponding **Display** and **Detail** dialogs.

Press adjacent Operation buttons and use the Digital Input Front Panel Controls to make specific adjustment/selection parameter choices. For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

Mod → AM Operation menu selections and parameters include **AM Freq**, **AM Depth**, **Type**, **Shape**, and **Source** as follows:

- **AM Freq** - This parameter sets the modulating waveform frequency. The internal source frequency range is 2 MHz to 20 kHz.
- **AM Depth** - This parameter sets the amplitude range.

  NOTE: Amplitude range is also referred to as amplitude depth 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 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. ±6V corresponds to 100% of your current depth setting.
- **Type** - Amplitude modulation.
- **Shape** - Choose the waveform shape type (used as a carrier waveform) for modulation. **Sine**, **Square**, **Ramp**, or **Arb** waveforms may be modulated, while **Pulse**, **Noise**, and **DC** cannot.
- **Source** - Select **Internal** or **External**. If External is selected, use the **Modulation In** connector on the **Back Panel**.

Generating an FM Modulated Waveform

After selecting the **Mod → FM** (Frequency Modulation) operator button, the WaveStation shows the **FM Operation** menu and corresponding **Display** and **Detail** dialogs.

Press adjacent Operation buttons and use the Digital Input Front Panel Controls to make specific adjustment/selection parameter choices. For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

Mod → FM Operation menu selections and parameters include **FM Freq**, **FM Dev**, **Type**, **Shape**, and **Source** as follows:

- **FM Freq** - This parameter sets the modulating waveform frequency. The internal source frequency range is 2 MHz to 20 kHz.
- **FM Dev** - This parameter sets the maximum frequency deviation.

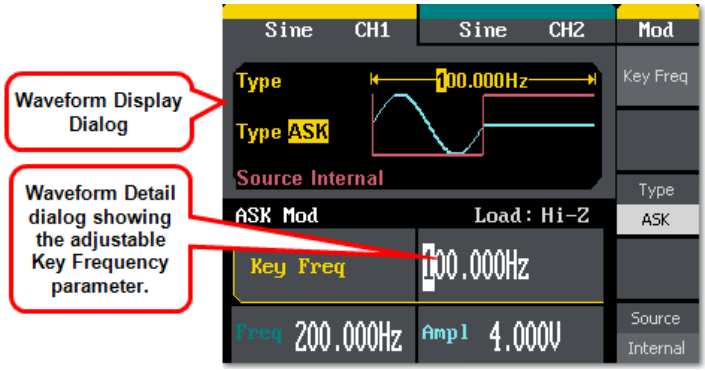
  NOTE: The frequency deviation value should be ≤ the carrier waveform frequency. The sum of the deviation and the carrier waveform frequency should be ≤ the maximum frequency of the selected waveform. When using an external source, the deviation is controlled by the voltage level of the connector attached to Modulation In on the Back Panel. +6V corresponds to the selected deviation and -6V to the negative selected deviation. So, a +/- 6 V input results in an output FM deviation equal to the preset FM deviation.
- **Type** - Frequency modulation.
- **Shape** - Choose the waveform shape type (used as a carrier waveform) for modulation. **Sine**, **Square**, **Triangle**, **UpRamp**, **DnRamp**, **Noise**, or **Arb** waveforms may be modulated, while **Pulse**, and **DC** cannot.
- **Source** - Select **Internal** or **External**. If External is selected, use the **Modulation In** connector on the Back Panel.

Generating an ASK Modulated Waveform

After selecting the **Mod → ASK** (Amplitude Shift Keying) operator button, WaveStation shows the **ASK Operation** menu and corresponding **Display** and **Detail** dialogs.

Press adjacent Operation buttons and use the Digital Input Front Panel Controls to make specific adjustment/selection parameter choices. For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

ASK 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.



Mod → ASK Operation menu selections and parameters include **Key Freq**, **Type**, and **Source** as follows:

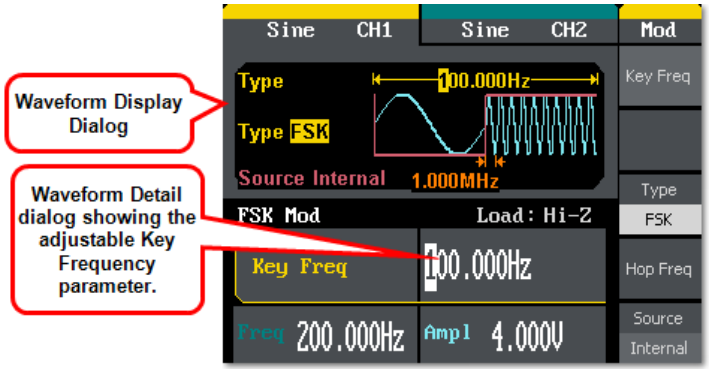
- **Key Freq** - This parameter sets the frequency at which the output amplitude shifts between the carrier amplitude and 0. The internal source frequency range is 2 MHz to 50 kHz.
- **Type** - Amplitude Shift Keying Modulation.
- **Source** - Select **Internal** or **External**. If External is selected, use the **Trig/Gate/Fsk/Burst** connector on the **Back Panel**.

Generating an FSK Modulated Waveform

After selecting the **Mod → FSK** (Frequency Shift Keying) operator button, WaveStation shows the **FSK Operation** menu and corresponding **Display** and **Detail** dialogs.

Press adjacent Operation buttons and use the Digital Input Front Panel Controls to make specific adjustment/selection parameter choices. For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

FSK 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**.



Mod/ASK Operation menu selections and parameters include **Key Freq**, **Type**, and **Source** as follows:

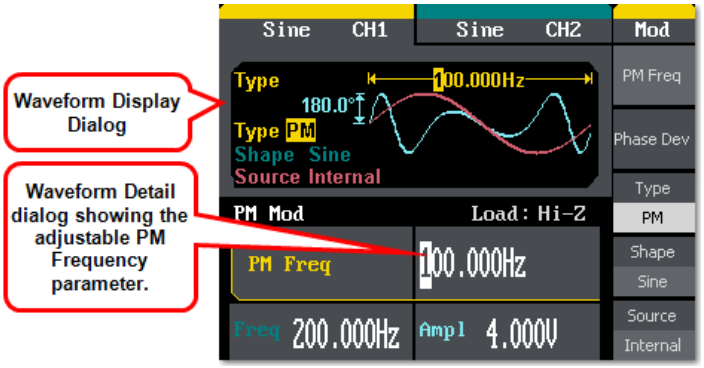
- **Key Freq** - This parameter sets the frequency at which the output frequency shifts between the carrier amplitude and the hop frequency. The internal source frequency range is 2 MHz to 50 kHz.
- **Type** - Frequency Shift Keying Modulation.
- **Hop Freq** - Specify the desired hop frequency level (for variation from the set carrier waveform frequency).
- **Source** - Select **Internal** or **External**. If External is selected, use the **Trig/Gate/Fsk/Burst** connector on the Back Panel.

Generating a PM Modulated Waveform

After selecting the **Mod → PM** (Phase Modulation) operator button, WaveStation shows the **PM Operation** menu and corresponding **Display** and **Detail** dialogs.

Press adjacent Operation buttons and use the Digital Input Front Panel Controls to make specific adjustment/selection parameter choices. For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

Modulated waveforms consist of a carrier waveform and a modulated waveform. For PM, the phase of the carrier waveform varies with the instantaneous voltage level of the modulated waveform.



Mod/PM Operation menu selections and parameters include **PM Freq**, **Phase Dev**, **Type**, **Shape**, and **Source** as follows:

- **PM Freq** - This parameter sets 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.
- **Phase Dev** - This parameter sets the maximum phase deviation. Values range from 0° to 360°.
- **Type** - Phase Modulation.
- **Shape** - Choose the waveform shape type (used as a carrier waveform) for modulation. **Sine**, **Square**, **Triangle**, **UpRamp**, **DnRamp**, **Noise**, or **Arb** waveforms may be modulated, while **Pulse**, and **DC** cannot.
- **Source** - Select **Internal** or **External**. If External is selected, use the **Trig/Gate/Fsk/Burst** connector on the Back Panel.

Generating Sweep Waveforms

Specific waveform types may be swept (as carrier waveforms) using the WaveStation. **Sine**, **Square**, **Ramp**, or **Arb** waveforms may be swept, while **Pulse**, **Noise**, and **DC** cannot. Frequency sweep mode uses the WaveStation to sweep from the start frequency to the stop frequency at a specified sweep rate.

PLEASE NOTE THE FOLLOWING:

- It's important to understand the relationship between the **Main Waveform Type** buttons, the **Waveform Signal Conditioning** function buttons, and the **Save/Recall**, **Utility**, and **Help** function buttons. See Combined Use of Waveform, Function, and Configuration Buttons (on page 17).
- Default values for many controls can be set using certain options available on the **Utility** menu. See Main Utility Operations (on page 52).

This section covers sweep waveform creation and making specific adjustment/selection parameter choices - all of which vary based on the specific **function** and **carrier waveform selection** made.

While details around creating waveforms and adjusting specific parameters (which vary based on the specific sweep waveform) are covered here, the following section covers some menu control considerations. For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

The first step in creating a sweep waveform is to press the **Sweep** button on the Front Panel.

After pressing the **Sweep** button, select the desired modulated waveform type using the **Display Menu Operation** buttons. The waveform is shown on the **Waveform Display**.

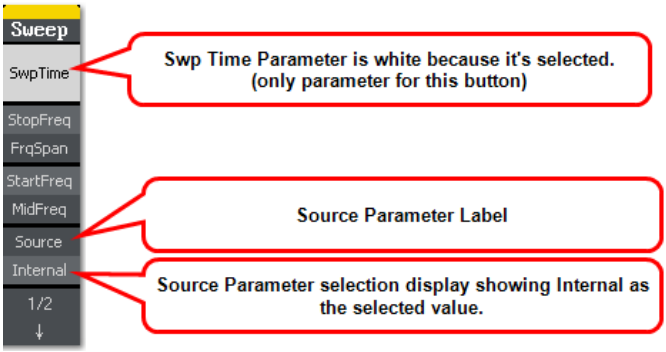
At this point, the **Display Menu Operation** buttons are used to select applicable parameters and make adjustments as desired.

A good portion of the waveform operation buttons control two separate parameters. Operation buttons controlling two parameters have additional, lighter shaded function labels on them; press the button once to adjust the top control parameter**;** twice to adjust the bottom one**.** Make adjustments using the Digital Input Front Panel Controls.

Second operation button press parameters are shown in reverse color on the waveform detail dialog to provide a visual indication as to which parameter is being adjusted in the detail dialog.

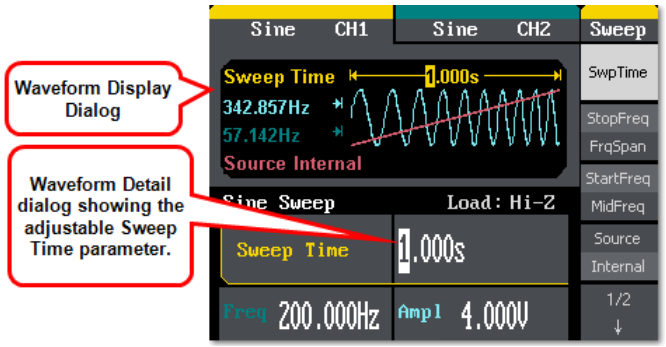
PLEASE NOTE THE FOLLOWING:

- Some parameters look like they're first/second press shared and really are not. Instead the parameter title is shown in the top portion and the lower portion displays the particular parameter selection.
- Operation menus containing more parameters than the ones showing on the first menu have a **1/X ↓** final selection. The additional menu(s) therefore have a **2/X ↑** first selection. Press the adjacent button to navigate additional menu(s) and parameter(s) as desired.



Frequency sweep mode uses the WaveStation to sweep from the start frequency to the stop frequency at a specified sweep rate.

Press adjacent Operation buttons and use the Digital Input Front Panel Controls to make specific adjustment/selection parameter choices.



Sweep Operation menu selections and parameters include **SwpTime**, **StopFreq**, **FreqSpan**, **StartFreq**, **MidFreq**, **Source**, **TrigOut**, **Linear/Log**, and **Direction** as follows:

- **SwpTime** - This parameter sets the overall sweep time span in which the frequency changes from specified start frequency to stop frequency values.
- **StopFreq** - Provide a specific frequency value where the sweep must end.
- **FreqSpan** - Provide an overall span or range in which the sweep must remain.
- **StartFreq** - Provide a specific frequency value where the sweep is to begin.
- **MidFreq** - Specify a frequency where the center of the sweep must remain.
- **Source** - Select **Internal**, **External**, or **Manual**. If External is selected, use the **Trig/Gate/Fsk/Burst** connector on the **Back Panel**. You can also select **Manual** and specify exact start and stop times.
- **TrigOut** - Select **Off** or **Open**. Open sets trigger on the rising edge of the waveform.
- **Linear/Log** - Press this operation button to highlight and select either **Linear** or **Log** spacing for your sweep waveform.
- **Direction** - Press this operation button to toggle between an **upward (↑)** or **downward (↓)** sweep direction for your waveform.

Generating Burst Waveforms

Specific waveform types may be burst using WaveStation. **Sine**, **Square**, **Ramp**, or **Arb** waveforms may be set to an **N-Cycle Burst**, while **Noise** is the only waveform type available for a **Gated Burst**.

PLEASE NOTE THE FOLLOWING:

- It's important to understand the relationship between the **Main Waveform Type** buttons, the **Waveform Signal Conditioning** function buttons, and the **Save/Recall**, **Utility**, and **Help** function buttons. See Combined Use of Waveform, Function, and Configuration Buttons (on page 17).
- Default values for many controls can be set using certain options available on the **Utility** menu. Learn more in Main Utility Operations (on page 52).

The first step in creating a burst waveform is to press the **Burst** button on the Front Panel.

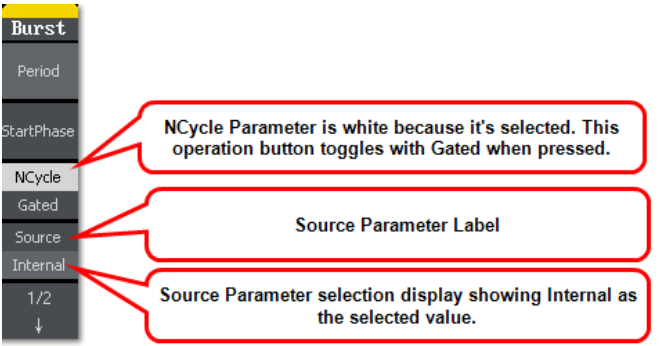
After pressing the **Burst** button on the **Front Panel**, select the desired modulated waveform type using the **Display Menu Operation** buttons. The waveform is shown on the **Waveform Display**.

At this point, use the **Display Menu Operation** buttons to select applicable parameters and make adjustments as desired.

A good portion of the waveform operation buttons control two separate parameters. Operation buttons controlling two parameters have additional, lighter shaded function labels on them; press the button once to adjust the top control parameter**;** twice to adjust the bottom one**.** Make adjustments using the Digital Input Front Panel Controls.

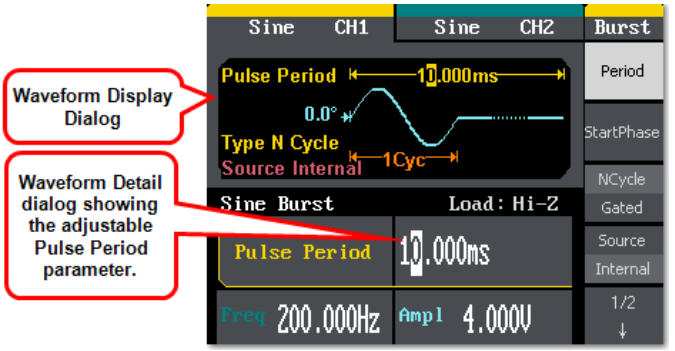
Second operation button press parameters are shown in reverse color on the waveform detail dialog to provide a visual indication as to which parameter is being adjusted in the detail dialog.

Some parameters look like they're first/second press shared and really are not. Instead the parameter title is shown in the top portion and the lower portion displays the particular parameter selection.



Operation menus containing more parameters than the ones showing on the first menu have a **1/X ↓** final selection. The additional menu(s) therefore have a **2/X ↑** first selection. Press the adjacent button to navigate additional menu(s) and parameter(s) as desired.

Press adjacent Operation buttons and use the Digital Input Front Panel Controls to make specific adjustment/selection parameter choices.



Burst Operation menu selections and parameters include **Period**, **StartPhase**, **NCycle/Gated**, **Source**, **TrigOut**, **Cycles/Infinite**, and **Delay** as follows:

- **Period** - This control is only available when NCycle is selected from the third operation button. Press the Period operation button and provide a specific value for the **Pulse Period** control using the detail dialog.
- **StartPhase** - Press this operation button and provide a specific phase value (in °) using the detail dialog to define the starting point of the waveform. The phase varies from 0° to 360°, and the default setting is 0°. For an Arbitrary Waveform, 0° is the first waveform point.

- **NCycle/Gated** - Press this operation button to select either NCycle or Gated for your burst waveform(s). Many controls on the Burst operation menu change based on the selection made on this control. When NCycle is selected, you can press the Period operation button and provide a specific value for the **Pulse Period** control using the detail dialog.

  NOTE: The period time increases if necessary to allow the specified number of cycles in a burst. The formula applied to this control is:

  Burst Period x Carrier Period x Burst Number

  N-Cycle has a specific number of waveform cycles and every burst is activated by a trigger event, whereas a Gated burst is activated by an external source.

- **Source** - This control is only available when NCycle is selected from the third operation button. Select **Internal**, **External**, or **Manual**. If External is selected, use the **Trig/Gate/Fsk/Burst** connector on the **Back Panel**. You can also select **Manual** and specify exact start and stop times.
- **TrigOut** - This control is only available when NCycle is selected from the third operation button. Select **Off**, **rising edge (↑)**, or **falling edge (↓)** as desired.
- **Cycles/Infinite** - This control is only available when NCycle is selected from the third operation button. Press this operation button to highlight and select either **Cycles** or **Infinite** amounts for your burst waveform(s). With Cycle selected, provide a desired amount of repetitions (from 1 to 50,000) using the detail dialog. Infinite generates a continuous waveform that only stops on a trigger event.

  NOTE: The period time increases if necessary to allow the specified number of cycles in a burst as previously mentioned in the NCycle/Gated bullet. An external or manual trigger is required in order to activate an infinite burst.

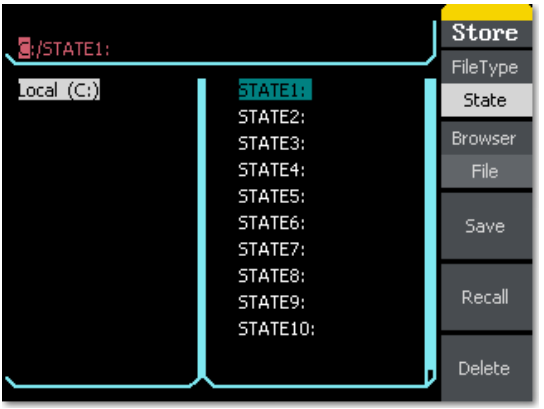
- **Delay** - This control is only available when NCycle is selected from the third operation button. With Delay selected, you can specify a span of time between the trigger input and the start of the N-Cycle burst using the detail dialog. The minimum delay amount is 240 ns.
- **Polarity** - This control is only available when Gated is selected from the third operation button. Press this operation button to select either **Positive** or **Negative** polarity for your gated signal.

Save/Recall

Overview

The first step when using the **Save/Recall** is to press the corresponding Save/Recall function button on the **Front Panel**.

The following interface is shown with the Store Operation menu on the right side of the screen.



PLEASE NOTE THE FOLLOWING:

- See Combined Use of Waveform, Function, and Configuration Buttons (on page 17).
- Default values for many controls can be set using certain options available on the **Utility** menu. Learn more in Main Utility Operations (on page 52).

Main Save/Recall Operations

After pressing the **Save/Recall** button on the **Front Panel**, select the desired function using the corresponding **Display Menu Operation** buttons.

The main screen area or Browser shows a Path, Directory, File display dialog which is used with Digital Input Front Panel Controls to specify locations for saved and recalled items.

While details around saving and recalling different folders and file types are covered here, the following section covers some menu control considerations.

For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

Save/Recall Menu Controls and Considerations

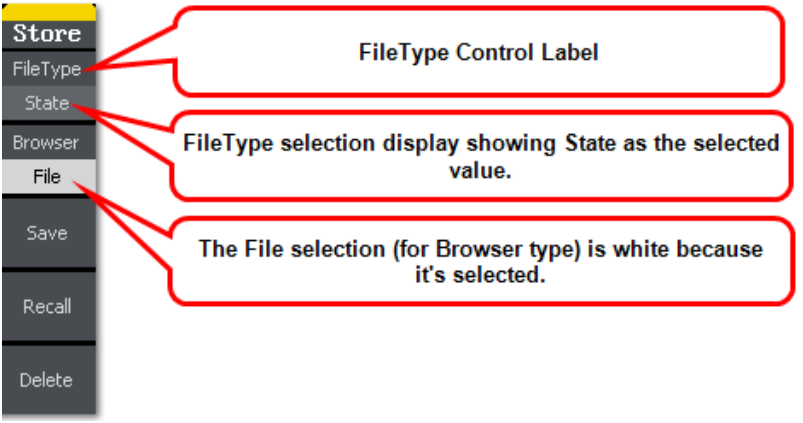
After pressing the **Save/Recall** button on the Front Panel, the **Display Menu Operation** buttons are used to select applicable parameters and make adjustments as desired.

A good portion of the operation buttons control two separate parameters. Operation buttons controlling two parameters have additional, lighter shaded function labels on them; press the button once to adjust the top control parameter**;** twice to adjust the bottom one**.** Make adjustments using the Digital Input Front Panel Controls.

Second operation button press parameters are shown in reverse color on the waveform detail dialog to provide a visual indication as to which parameter is being adjusted in the detail dialog.

Some parameters look like they're first/second press shared and really are not. Instead the parameter title is shown in the top portion and the lower portion displays the particular parameter selection.

Some operation menus contain more parameters than the ones showing on the first menu. When this is the case, a **1/X ↓** final selection is provided. The additional menu(s) therefore have a **2/X ↑** first selection. Press the adjacent button to navigate additional menu(s) and parameter(s) as desired.



Operation menu selections and parameters for Save/Recall include the following.

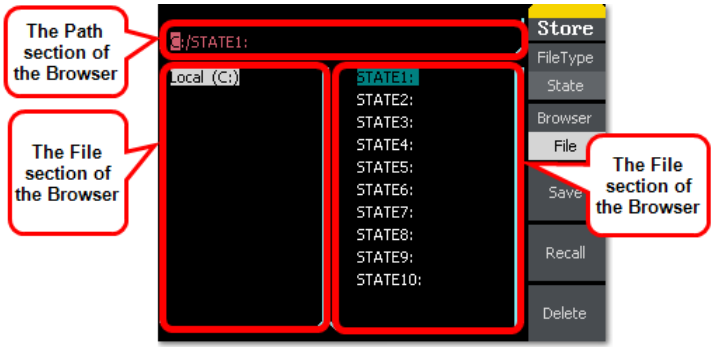
FileType

This control contains State, Data, and All File options based on which kinds of files are being used. **State (or Setup)** handles various WaveStation setup files, **Data** handles arbitrary waveform files, and **All File** is used when storing or recalling any other file type.

NOTE: When saving State (Setup) or Data (Arbitrary Waveforms) onto your WaveStation, 10 specific Memory Banks are provided for each type on the File section of the Browser. When a Save is completed, the name you provide is shown to the right of the specific bank.

Browser

This control contains **Path**, **Folder**, and **File** options.



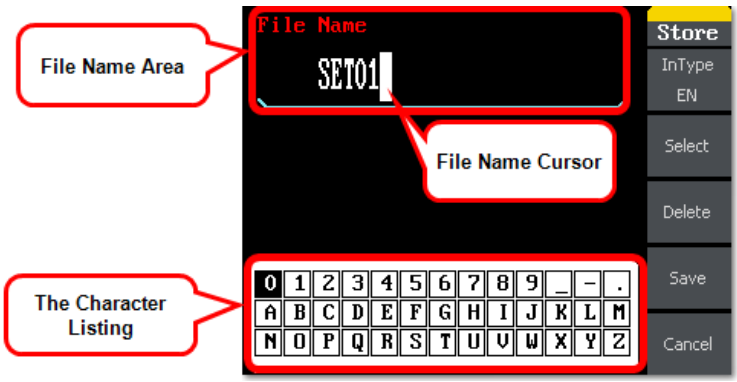
Successively pressing the Browser option button places the cursor in corresponding sections of the **Browser** display dialog, where you can then use Digital Input Front Panel Controls to make appropriate input selections.

NOTE: The Direction Buttons on the Digital Input Front Panel Controls are used to make Folder and File selections which are then shown in the Path display area of the Browser.

Save

Once you've made all selections on the aforementioned control options for Setup or Data and navigated to the desired storage location, press this control button to and **Save** your file.

If you're saving **State (Setup)** or **Data (Arbitrary Waveforms)** onto your WaveStation, onto one of their 10 specific **Memory Banks**, and select a Bank/File location already containing previously stored information, **your new information always overwrites the old**.



When saving information, use Digital Input Front Panel Controls to provide a file name in the following manner:

- Press **The Number Buttons** to quickly input a number or character.
- Use the **Up and Down Direction Buttons** to switch rows from your immediate position on the character listing, and the **Adjustment Control Knob** to sequentially move through the character listing.
- Use the **Left and Right Direction Buttons** to move the cursor in a linear fashion through your **Filename**.
- With the desired character highlighted on the listing and your cursor in the desired location within your **Filename**, press the **Select** button to add it to your **Filename**.
- When finished providing your Filename, press the **Save** option button to store your file.
- The **Delete** option button erases characters as it moves the cursor backward through your **Filename**.
- Use the **Cancel** option button if you wish to return to the main Save/Recall menu without saving your file.

NOTE: Refer to the WaveStation PC Software Overview (on page 64) to learn how to transfer waveform files between the WaveStation and your PC.

Recall

You can retrieve stored Setups or Data by navigating to the desired file stored on either WaveStation itself or from a USB device.

- Use the Browser controls to navigate to the desired file for retrieval.
- With the **specific file** highlighted on the **File** display area on the Browser, press the **Recall** control button.
- A status message should then be shown on the **bottom of the Folder display** area indicating the read completed successfully.

NOTE: Refer to the WaveStation PC Software Overview (on page 64) to learn how to transfer waveform files between the WaveStation and your PC.

Delete

You can delete stored Setups or Data by navigating to the desired file stored on either WaveStation itself or from a USB device.

- Use the Browser controls to navigate to the desired file for deletion.
- With the **specific file** highlighted on the **File** display area on the Browser, press the **Delete** control button.
- A confirmation menu is shown with Done and Cancel buttons. Press the **Done** button to complete the deletion.

PLEASE NOTE THE FOLLOWING:

- **USB memory devices** are automatically shown as mapped as **USB Device (A:)** on the **Folder** section of the **Browser** when plugged into your WaveStation **Front Panel**.
- **External Hard Drives** are not supported for use as **USB flash memory**. The front USB is meant for use by what is commonly known as **memory sticks** or **thumb drive** devices.

Utility

NOTE: See Combined Use of Waveform, Function, and Configuration Buttons (on page 17).

Main Utility Operations

The first step when using **Utility** is to press the corresponding Utility function button on the **Front Panel**.

After pressing the **Utility** button on the Front Panel, select the desired function using the corresponding **Display Menu Operation** buttons.

While details around the Utility operations are covered here, the following section covers some menu control considerations.

For more information on getting to this point, see Navigating Interfaces, Adjusting Parameters, and Making Selections (on page 11).

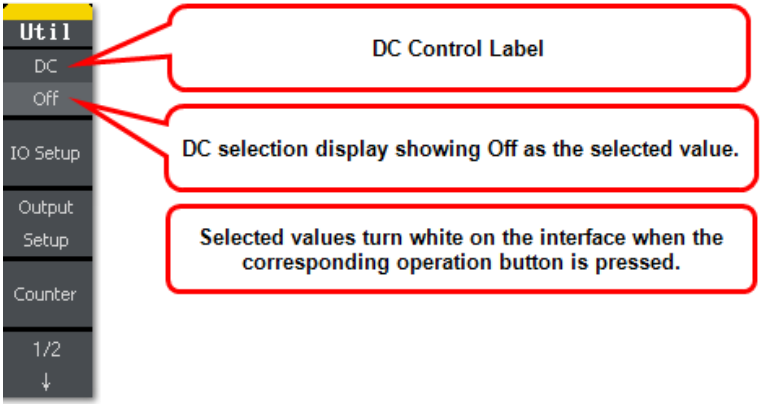
Common Util Menu Controls and Considerations

A good portion of the operation buttons control two separate parameters. Operation buttons controlling two parameters have additional, lighter shaded function labels on them; press the button once to adjust the top control parameter**;** twice to adjust the bottom one. Make adjustments using the Digital Input Front Panel Controls.

Second operation button press parameters are shown in reverse color on the waveform detail dialog to provide a visual indication as to which parameter is being adjusted in the detail dialog.

Some parameters look like they're first/second press shared and really are not. Instead the parameter title is shown in the top portion and the lower portion displays the particular parameter selection.

Some operation menus contain more parameters than the ones showing on the first menu. When this is the case, a **1/X ↓** final selection is provided. The additional menu(s) therefore have a **2/X ↑** first selection. Press the adjacent button to navigate additional menu(s) and parameter(s) as desired.



Utility Operation Menu Selections and Parameters

The following operations are available from the Util menu option buttons. Some are explained in the remainder of this section. Where necessary, even more detail is provided in subsequent topics to clearly explain their proper use.

DC

The DC switch offers the options of direct current output (On) or Arbitrary Waveform Output (Off). Pressing the option button turns the **DC On** and shows an additional menu where you can quickly select a **1/-1V** or **2/-2V DC Offset** using corresponding option buttons.

NOTE: After pressing either 1/-1V or 2/-2V DC Offset option buttons, the Adjustment Control Knob may also be used to dial in the desired level within a -3 to 3V range.

IO Setup

After pressing the IO Setup option button, an additional menu is shown where you can set **USB** or **GPIB** input/output options.

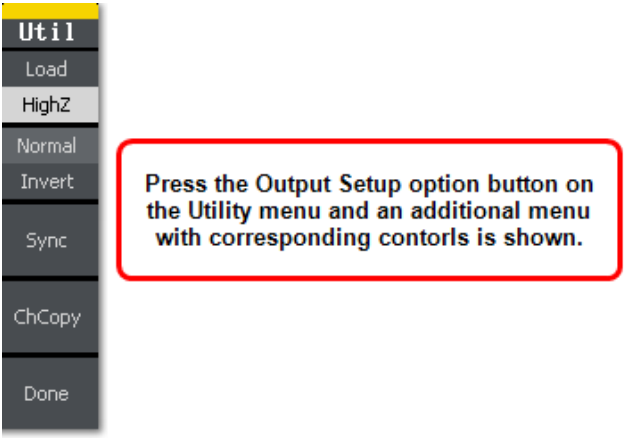
- Press the **USB Setup** option button and an additional menu is shown where you can choose either **USBRAW** or **USBTMC** options by pressing corresponding option buttons for the USB connector on the **Back Panel** of your WaveStation.
- **NOTE:** Be sure to make the USBRAW setting before connecting to WaveStation from a PC using the WaveStation PC Software. For more detailed installation instructions, see Installing the

WaveStation PC Drivers and Software (on page 66). Be sure to make the USBTMC setting before connecting to WaveStation from a PC using VISA. Download the latest copy of NI-VISA at www.ni.com/visa/.

- Press the GPIB option button and use the **Adjustment Control Knob** from the Digital Input Front Panel Controls to provide a specific GPIB Address value. This GPIB enables the USB connector on the **Front Panel** of your instrument.
- **NOTE:** Be sure to make the correct GPIB Address setting before connecting to WaveStation from a PC using the USB-GPIB Adapter. The USB connector on the Front Panel is also used for USB memory sticks. USB memory sticks are plug-and-play supported and no special setting is needed for their use.
- Make selections as desired and press the **Done** (to commit) or **Cancel** option button and the main **Util** menu is shown.

Output Setup

Press this option button and an additional menu is shown.



Use these additional output controls for the following:

- **Load/HighZ** - Use this option button to select either **Load** or **HighZ** for your waveform output.
- **Normal/Invert** - Use this option button to select either **Normal** or **Invert** for your waveform output.

- **Sync** - Press this option button and an additional menu is provided where you can turn the State of your synchronization **On/Off** and use the **Channel** option button to send the synchronized signal to CH1 or CH2.

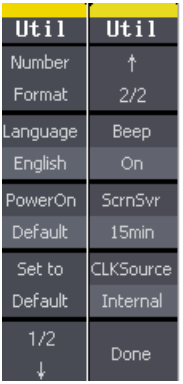
  All standard output functions (except DC and Noise) have a corresponding Sync signal sent through the **Sync Out** connector on the Back Panel. This can be disabled on certain settings as follows:

  - **Default** - The Sync signal should be connected to the activated Sync Out connector on the Back Panel. When the Sync Signal is disabled, the output voltage of the [Sync] connector is set to low level.
  - **Inverse** - In this mode, the Waveform corresponding to the Sync Signal does not inverse.
  - **Non-Modulated Waveforms** - The Sync Signal reference is the carrier signal on non-modulated waveforms.
  - **AM, FM, and PM** - Internal modulating waveforms (AM, FM, and PM) the Sync signal reference is the modulated signal
  - **ASK and FSK** - The Sync Signal Reference is the keying Frequency.
  - **Sweep** - Once the sweep starts, the Sync Signal becomes TTL Level High. The Sync frequency equals the specific Sweep time.
  - **Burst** - For the Burst, when the burst starts, the Sync Signal is Level High.
  - **External Gated Burst** - The Sync Signal follows the External Gated Signal.
  - **Pulse** - The Sync Signal is a Pulse Signal with a fixed positive pulse width more than 50 ns.
- **ChCopy** - Press this option button and an additional menu is provided where you can port a particular channel's configuration to another. Option buttons are labeled as **CH1->CH2** and **CH2->CH1** accordingly.

Make selections as desired and press the **Done** (to commit) or **Cancel** option button and the main **Util** menu is shown.

System

Press this option button on the **2/2** main **Util** menu and additional menus are provided where you can make various default settings on your WaveStation.

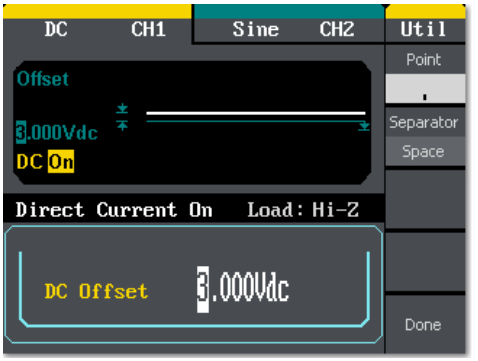


Press the System option button on the Utility menu and additional menus with corresponding contorls are shown. They're provided here side-by-side for convenience.

NOTE: The menus don't appear on the WaveStation in this manner; they are shown here side-by-side for convenience.

When corresponding option buttons are pressed and the item is selected for **Number Format**, **Language**, **PowerOn**, **Set to Default**, **Beep**, **ScrnSvr**, and **CLKSource**, only Number Format provides an additional menu where the **Point** (period or comma) and **Separator** (Space, Off, or On) format may be chosen. The **Cancel** option button may also be pressed and returns you to the main **Util** menu.

Otherwise, subsequent presses of corresponding buttons select the available values.

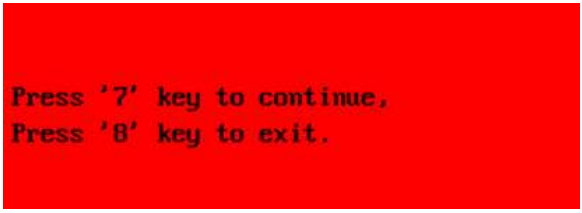


Press the Number Format option button on the System menu and an additional menu with the following options is shown.

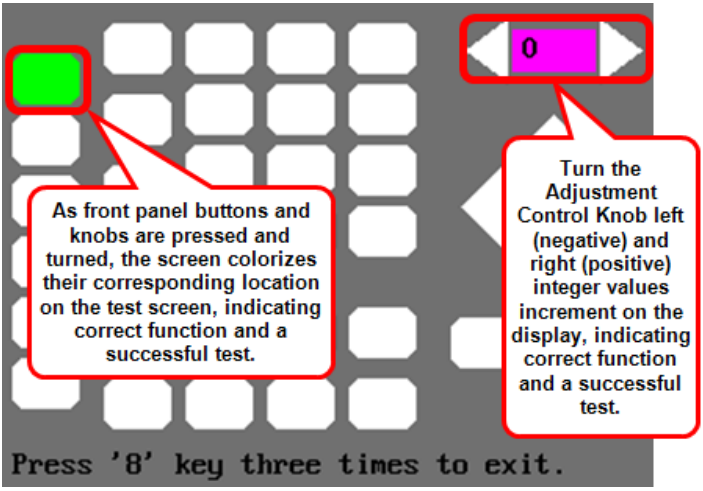
NOTE: When selecting the Set to Default option button, your WaveStation is restored to various factory settings as described in Restoring the Default Settings (on page 59).

Make selections as desired and press the **Done** (to commit) option button and the **System** menu is shown.

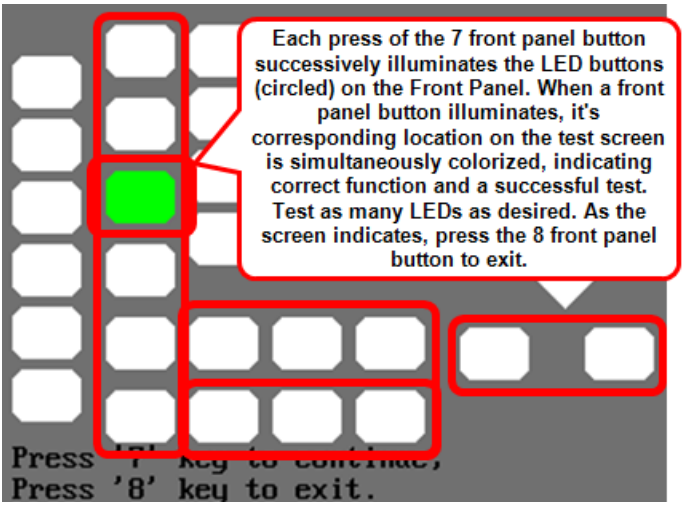
- **Test/Cal** - Press this option button on the **2/2** main **Util** menu and an additional menu with option buttons for **SelfTest** and **SelfCal** is provided.
    - Press the **SelfTest** option button and an additional menu is provided where you can select a **Scr(Screen)Test**, **KeyTest**, or **LEDTest**. After making your selection a corresponding screen is shown where the number **7** or **8** front panel buttons are used to either proceed with the test and/or exit the test screen, respectively.



Screen Test



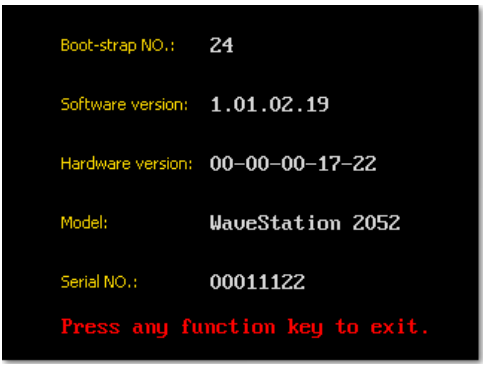
Keyboard Test



LED Test

- Press the **SelfCal** option button and the WaveStation starts a series of calibration tests as a progress bar is shown on the Display Dialog indicating the percentage of completion. When the progress reaches 100%, press any key to continue.
- The **Cancel** option button may also be pressed and returns you to the 2/2 main Util menu.

- **EditInfo** - Press this option button and a WaveStation firmware version details screen is shown and contains details for **Boot-Strap Number**, **Software Version**, **Hardware Version**, **Model Number**, and **Serial Number**.



Exit the screen by pressing any Option, Waveform, or Function button on the **Front Panel**.

- **Update** - Firmware updates are made available for the WaveStation function/arbitrary waveform generator and may be downloaded from teledynelecroy.com. Follow the procedure on page 64 to download and install the update.

Restoring the Default Settings

The WaveStation function/arbitrary waveform generator is set up for normal operation when it is shipped from the factory. After making changes to various settings, the defaults can be restored in the following manner:

- Press the **System** option button on the **2/2** main **Util** menu.
- Then, press the **Set to Default** option button on the **Util/System** menu.

WaveStation default settings are listed on the following tables:

Output	Default Value
Function	Sine Wave
Frequency	1 kHz
Amplitude/Offset	4 Vpp/0 V DC
Phase	0°
Terminals	High Z

Modulation	Default Value
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	Default Value
Start/Stop Frequency	100 Hz/1.9 kHz
Sweep Time	1 S
Trig Out	Off
Mode	Linear
Direction	↑

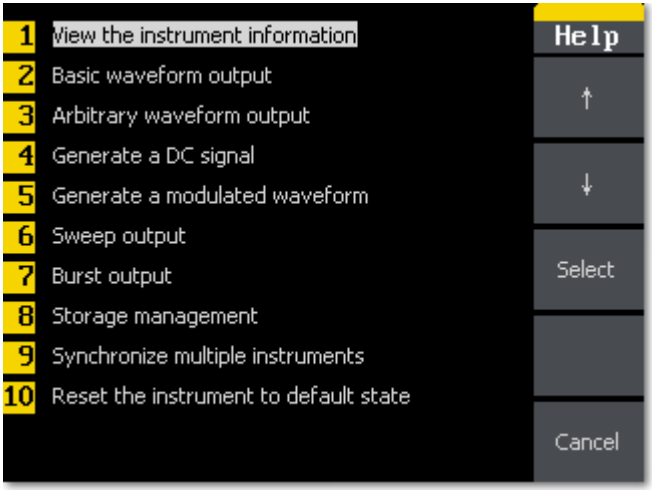
Burst	Default Value
Period	10 ms
Phase	0°
Count	1 Cycle
Trig	Off

Trigger	Default Value
Source	Internal

Using WaveStation Help

To access online Help**,** press the **Help** function button on the **Front Panel**.

After pressing the Help button, a listing of very shortened versions of various help topics based on the information in this manual is provided right on your WaveStation.



- Use the **Arrow** option buttons to move up and down the list.
- Highlight the desired topic on the list, and then press the **Select** option button to display the content on the main screen.
- When inside a selected topic, press the **Cancel** option button to return to the main list of topics. Otherwise, pressing **Cancel** from the main listing of topics takes you out of the Help system.

The information in this manual is supplemented by a WaveStation SCPI (Standard Commands for Programmable Instruments) Command Reference Manual available on teledynelecroy.com.

Additional supplemental information in the form of Application Notes and LabBriefs are also always available on teledynelecroy.com.

Controlling WaveStation with USB-GPIB and/or USBTMC

WaveStation can be controlled using either USB-GPIB (for GPIB) or USBTMC (for VISA) protocols. To set the WaveStation to receive the desired protocol, choose either:

- **Utility → IO Setup → GPIB**.
- **Utility → IO Setup → USB Setup → USBTMC**.

PLEASE NOTE THE FOLLOWING:

- For more information, please refer to the *WaveStation SCPI (Standard Commands for Programmable Instruments) Command Reference Manual* available on teledynelecroy.com.
- WaveStation requires that remote commands **do not** contain termination characters of any kind. This includes Null characters.

About the USB-GPIB Adapter

To use GPIB control, the USB-GPIB Adapter is needed to make the connection from your PC to your WaveStation.

The USB-GPIB adapter connects the USB host interface on your product to the GPIB bus controller and command set. The GPIB and USB on the adapter conforms to IEEE 488.2 and USB 2.0, respectively.

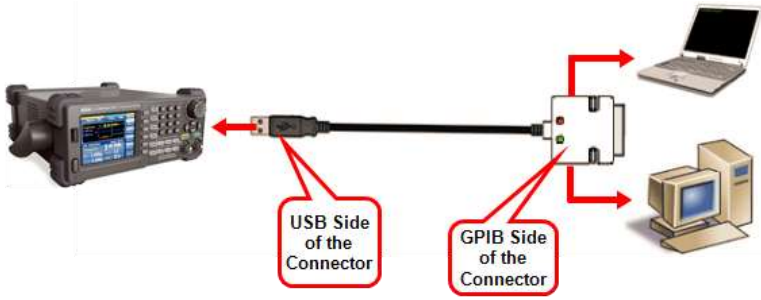
- The USB connection provides all necessary power.
- LED indicators in the Signal Generator provide an adapter connection status.
- GPIB controls can interface with compatible Teledyne LeCroy oscilloscopes and, if desired, a GPIB address may be used.

NOTE: The GPIB interface specifically supports Device (and not Controller) mode.

Connecting the USB-GPIB Adapter

First, make sure you've set your WaveStation to receive the USB-GPIB connection. This is described in Controlling WaveStation with USB-GPIB and/or USBTMC (on page 62) and in Main Utility Operations (on page 52). The default address for the adapter is **18**.

1. **Attach the USB side** of the connector to the interface on the Teledyne LeCroy compatible oscilloscope. **Connect the GPIB side** of the connector to your Laptop or Desktop computer.



2. **Verify the GPIB address** on the oscilloscope. When making the USB-GPIB setting on your computer. This address number is set when configuring your WaveStation for the USB-GPIB connection. Ensure the address is correct. The default address for the adapter is **18**.

   NOTE: The GPIB address is then saved in the GPIB card on your oscilloscope.

3. **Two LED indicators on the GPIB side** of the connector indicate red when the adapter has **power** and yellow when **communicating** data.

NOTE: Once connected, do not unplug USB or GPIB ends from oscilloscope and/or computer respectively before powering down all equipment first.

Updating WaveStation Firmware

WaveSation firmware updates are released periodically and available for free download from the Teledyne LeCroy website. An illustrated version of this procedure is also available for download from the WaveStation 2000 product page on the website.

Follow these to install firmware updates.

1. Download the latest firmware for the WaveStation 2000 series Function/Arbitrary waveform generators from teledynelecroy.com/support/softwaredownload/.
2. Extract the firmware file, **<filename>.ads** and save it to a USB drive.
3. Power up the WaveStation 2000 and plug the USB drive into the front-panel USB port.
4. Press **Utility** and go to page **2/2 of the Util menu**.
5. Select **Update**.
6. On the **Store** menu, change Browser to **Directory**.
7. Select the USB device from the list of directories.
8. Navigate to the folder on the USB drive containing **<filename>.ads.** If the file is inside a sub-folder, press the right ► button to open the folder.
9. With the folder selected, change Browser to **File**.
10. Select the ***.ads file** and press **Recall**.
11. Follow the instructions 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.

12. When the update is complete, restart the WaveStation.

WaveStation PC Software

Overview

You can use the WaveStation Software to send and receive waveforms files over a PC connection with your WaveStation. You can make modifications to Waveform files using the software, save the files, and then see your changes on your WaveStation.

Topics in this section explain:

- **Making the WaveStation - PC Software Connection** - Connecting to your WaveStation using your PC and the WaveStation Software
- **Modifying Waveform Files From WaveStation to PC/Software** - Modify a Waveform on WaveStation, Send it to Your PC, See the Changes Using the Software
- **Modifying Waveform Files From PC/Software to WaveStation** - Modify a Waveform on your PC Using the Software, Send it to Your WaveStation and See the Changes

NOTE: It's important to realize that a scalar representation of the waveform data is sent. Adjust the amplitude, frequency, and offset as desired.

Minimum PC Software System Requirements

- Operating system Microsoft™ Windows® XP, Windows® Vista 32 Bit Version, Windows® 7 32 Bit Version.
- 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 software updates for the WaveStation PC software providing new features, enhancements, and software corrections. These updates are available free from teledynelecroy.com/support/softwaredownload/.

Installing Drivers and Software

In order to use WaveStation with your PC, you must install the drivers and software in the following order:

1. Download latest version of WaveStation PC Software from www.teledynelecroy.com/wavestation.
2. Turn on your WaveStation and configure the rear USB connector for **USBRAW** as explained in Main Utility Operations (on page 52). The setting can quickly be made at **Utility** → **IO Setup** → **USB Setup** → **USBRAW**.
3. With your PC turned on, connect the 1 m USB 2.0 Type A to Type B Cable from the rear of WaveStation to a USB connector on your PC.
4. Your PC eventually should indicate that it's installing/looking for the driver. If shown, you can close pop-ups or screens from the connection of the USB cable.
    - On your PC, go to **Control Panel** → **Hardware and Sound** → **Devices and Printers**. Right-click the unspecified listing for your WaveStation and select **Properties**. On the pop-up, click the **Properties** button on the lower-right.
    - On the new pop-up shown, click the **Update Driver** button on the lower-right of its General tab.
    - Another pop-up is shown. Select to **Browse my computer for driver software**. On the next screen shown on the pop-up, use the Browse button to navigate to the Driver folder and the applicable subfolder for either 32 or 64-Bit installation.
    - If you're prompted by Windows Security, select to **Install this driver software anyway**.
4. The pop-up indicates when the driver installation successfully updates. Close all the windows left open as part of the driver installation process and launch Windows File Explorer. Locate **setup.exe**, and launch the WaveStation PC Software installer.

Making the WaveStation-PC Software Connection

To share waveform data between your WaveStation and a PC:

1. Install the WaveStation PC Software on your the PC you plan to use with your WaveStation.
2. Enable the USB connector on the **Back Panel** for a USBRAW connection by choosing: **Utility** → **IO Setup** → **USB Setup** → **USBRAW**.
3. Make the USB cable connection from the Back Panel of the WaveStation to your PC.
4. On the PC, launch the WaveStation PC Software.

Now your WaveStation and your PC are ready to share waveform data.

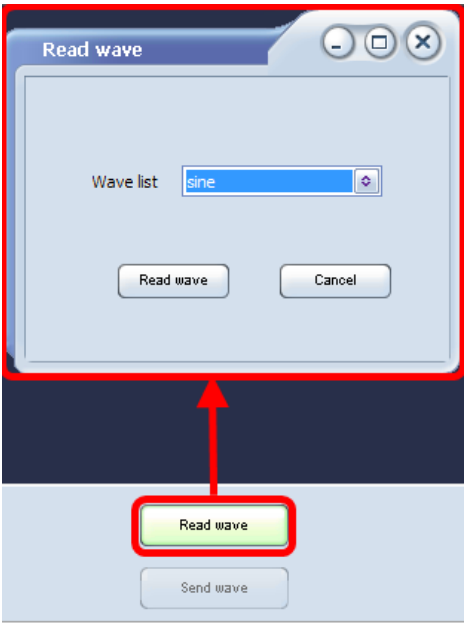
Modifying Waveform Files from WaveStation to PC Software

With your WaveStation - PC Software connection completed as explained in Making the WaveStation - PC Software Connection (above), you now need to save Data (Arbitrary Waveform) in one of their 10 specific **Memory Banks** on your WaveStation as explained in Main Save/Recall Operations (on page 46). Otherwise, you can pull one of the many preset Arb files stored on WaveStation as explained in the **Stored Waveforms** section of Creating an Arbitrary Waveform (on page 30).

NOTE: When you save a Data (Arbitrary Waveform) to a Bank/File location already containing previously stored information, your new information always overwrites the old.

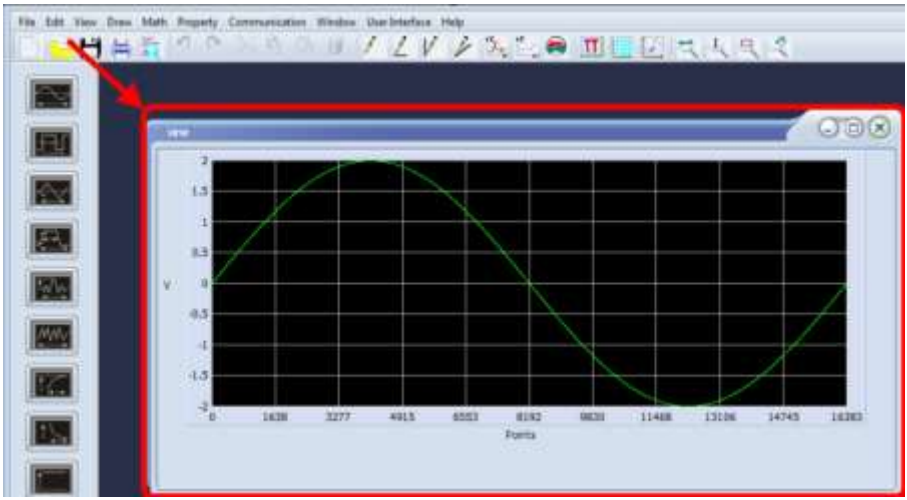
Now, launch the WaveStation PC Software and select **Communication** → **Read** wave from the menu bar.

You can also just click the **Read wave** button on the lower part of the WaveStudio PC Software.



The **Read wave** pop-up is then shown and provides a **Wave list** control showing all the waveforms (**Data - Arbitrary Waveform** and **Stored Waveforms**) stored on your connected WaveStation.

Select the desired waveform from the **Wave list** drop-down on the **Read wave** pop-up and click the **Read wave** button to pull the waveform from your WaveStation onto your PC.

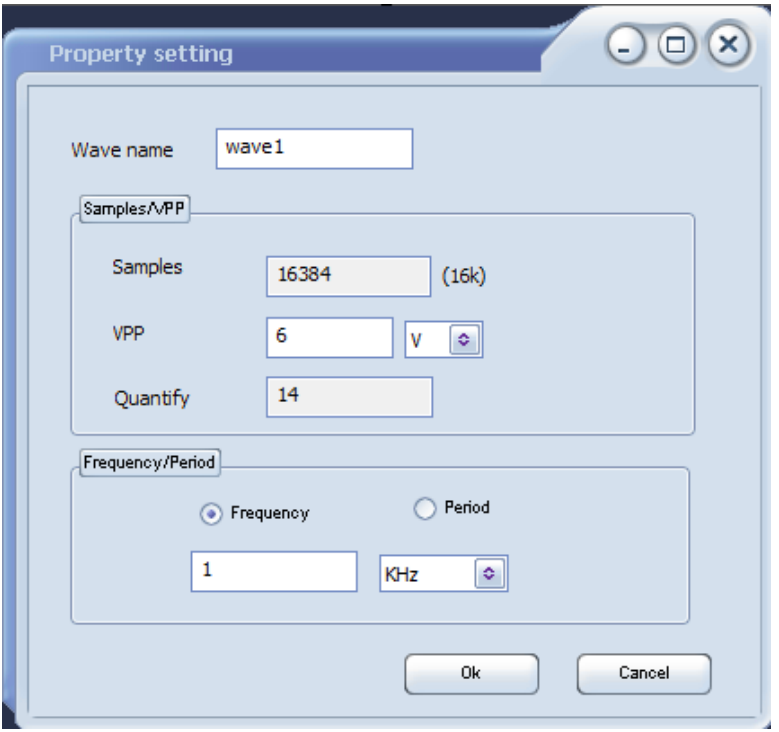


NOTE: A scalar representation of the waveform data is sent. Adjust the amplitude, frequency, and offset as desired.

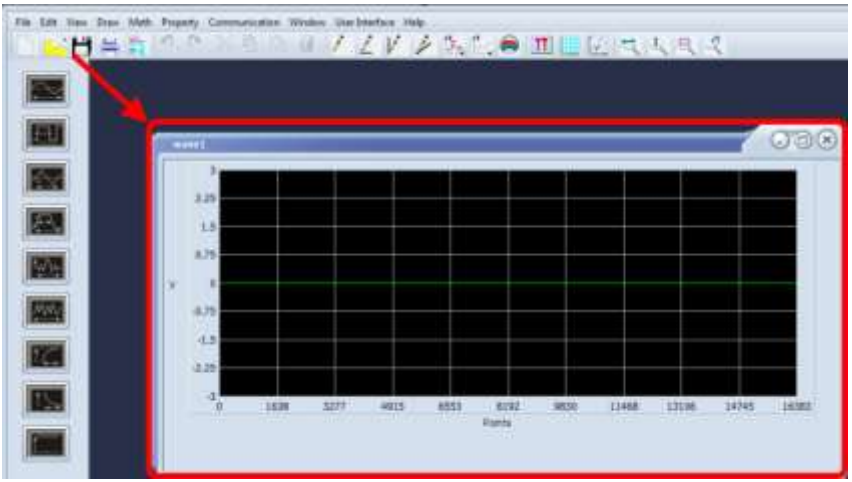
Modifying Waveform Files from PC Software to WaveStation

With your WaveStation - PC Software connection completed as explained in Making the WaveStation - PC Software Connection (on page 67), you now need to create and save **Data (Arbitrary Waveform)** using the WaveStation PC Software.

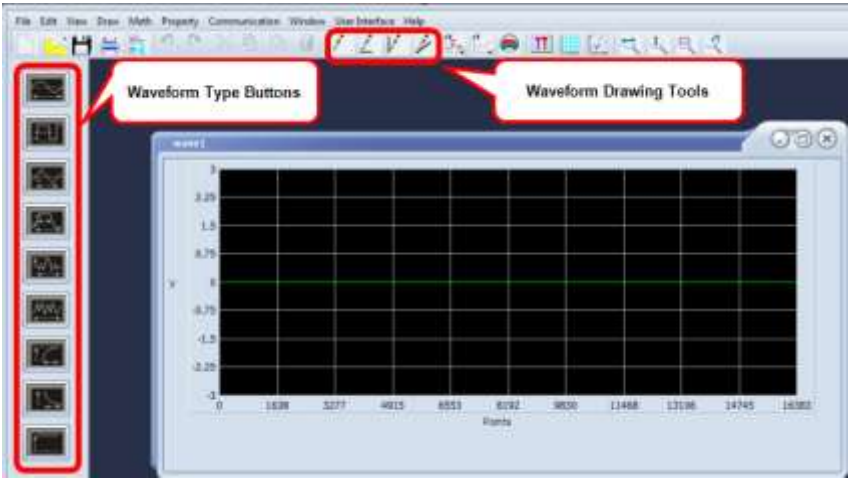
Select **File → New** from the menu bar to open the **Property setting** pop-up.



Provide a **Name** for your waveform and, if desired, provide details for **Samples**, **VPP**, **Quantify**, **Frequency**, and **Period**. Click the **Ok** button when finished and your new Waveform is shown.

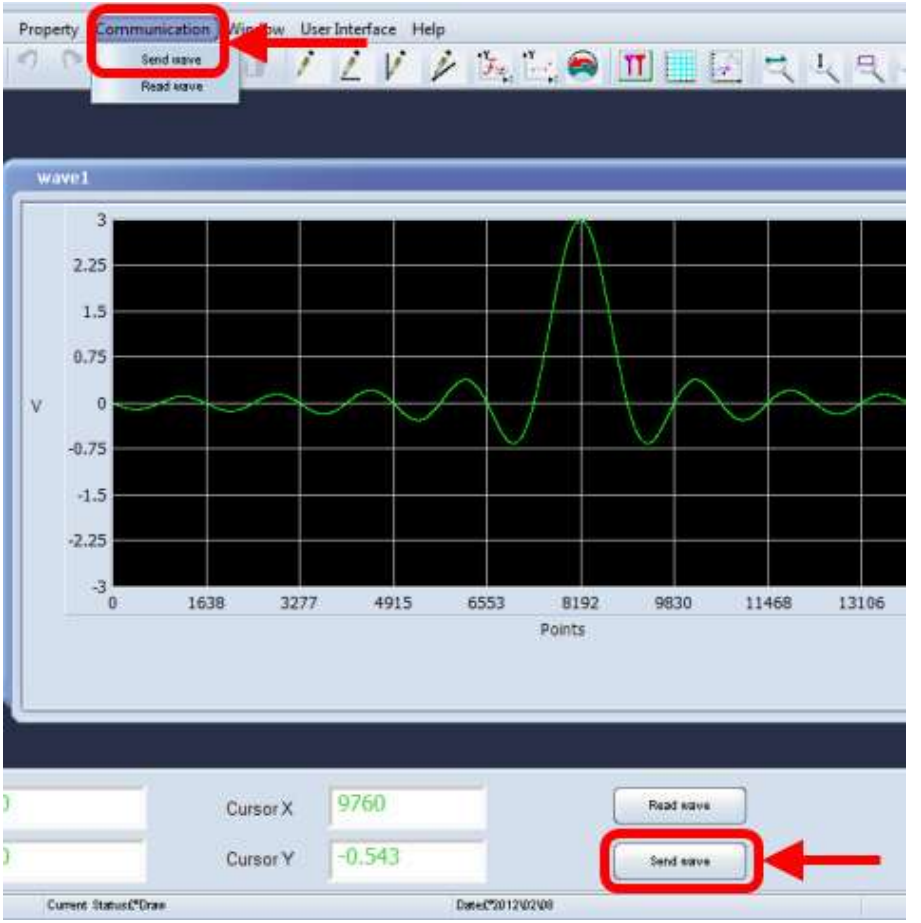


Modify your waveform as desired by either selecting one of the **Waveform Type** buttons or using various **Waveform Drawing Tools**.



With your waveform setup as desired, click the **Save** button.

Transfer waveform files to WaveStation by selecting **Communication → Send wave** from the menu bar or, click the **Send wave** button on the lower interface.



The Send wave pop-up is then shown. Select one of the 10 ARB waveform bank locations for saving your waveform (from the **Store location** control) and exactly which waveform for saving to WaveStation (from the **Name** control) and click the **Send** button.

NOTE: When you save a Data (Arbitrary Waveform) to a Bank/File location already containing previously stored information, your new information always overwrites the old.

Retrieve the sent ARB sent to your WaveStation as explained in Main Save/Recall Operations (on page 46), by pressing the Save/Recall **Front Panel** button, selecting Data using the FileType operation button, selecting your waveform on the **File** display area on the Browser, pressing the **Recall** control button.

The waveform you created using the PC Software is now shown in your WaveStation.

PLEASE NOTE THE FOLLOWING:

- A status message should then be shown on the **bottom of the Folder display** area indicating the read completed successfully.
- A scalar representation of the waveform data is sent. Adjust the amplitude, frequency, and offset as desired.

Reference

Certifications

This section certifies the instrument's Electromagnetic Compatibility (EMC), Safety and Environmental compliances.

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 as listed in the Official Journal of the European Communities:

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

Electromagnetic Emissions:

CISPR 11:2003, Radiated and Conducted Emissions Group 1, Class A [2 3]

EN 61000-3-2:2006 Harmonic Current Emissions, Class A

EN 61000-3-3/A2:2005 Voltage Fluctuations and Flickers, Pst = 1

Electromagnetic Immunity:

EN 61000-4-2:2001 Electrostatic Discharge, 4 kV contact, 8 kV air, 4 kV vertical/horizontal coupling planes [4]

EN 61000-4-3:2006 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 [4]

EN 61000-4-4:2004 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 61000-4-6:2007 RF Conducted Electromagnetic Field, 3 Vrms, 0.15 MHz - 80 MHz [4]

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, high quality shielded interface cables should be used.

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 for 0%/250 cycle voltage interruption test levels per EN61000-4-11.

European Contact:

Teledyne LeCroy Europe GmbH
Waldhofer Str 104
D-69123 Heidelberg
Germany
Tel: (49) 6221 82700

AUSTRALIA & NEW ZEALAND DECLARATION OF CONFORMITY – EMC

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):

CISPR 11:2003 Radiated and Conducted Emissions, Group 1, Class A, in accordance with EN61326-1:2006 and EN61326-2-1:2006.

Australia / New Zealand Contacts:

Vicom Australia Ltd.
1064 Centre Road
Oakleigh, South Victoria 3167
Australia

Vicom New Zealand Ltd.
60 Grafton Road
Auckland
New Zealand

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 of the instrument has been verified to conform to the following limits put forth by these standards:

- Overvoltage Category II: this refers to equipment intended to be supplied from the building wiring with a nominal supply voltage up to 300V.
- Measurement Category 0: this refers to measurement terminals on the instrument that are not intended to be directly connected to the MAINS supply.
- Pollution Degree 2: this refers to an operating environment where normally only dry, non-conductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment.
- Protection Class I: this refers to 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 instrument 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 has been classified as Industrial Monitoring and Control Equipment, and is outside the scope of the 2011/65/EU RoHS Directive until 22 July 2017 (per Article IV, Paragraph 3).

Contact Teledyne LeCroy

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