About the 3110 Audio-Bandwidth Standards Waveform Generator

The 3110 features a powerful yet simple-to-use interface and a large library of Automotive and Aviation tests. Tests are easy to link, build from scratch, or customize using time-saving controls like triggers and loops with changing variables. Plus, the 3110's intuitive, drag-and-drop interface makes it easy to modify existing tests or build new tests.

The 3110 produces standard signals and waveforms with or without a DC offset. Frequency, amplitude and DC offset can be fixed or swept, and sweeps can be linear, logarithmic or exponential. It can create dropouts and surges with rise and fall times as fast as 3µs. Individual signal duration can be as short as 150µs or as long as 49 days. It can also produce ripple waveforms of up to 300 kHz.

Use the 3110 with AE Techron 7000-series amplifiers to create an intelligent, engineered, modular test system. During operation, the 3110 monitors the amplifier status and will automatically abort a test if a fault condition occurs, saving time and preventing potential equipment damage. In addition, AE Techron's 7000-series amplifiers can be easily configured into series or parallel multi-amp systems for a wide range of voltage and current capabilities. For automotive testing, continuous DC power ratings from 15A to 240A DC are possible. For aviation testing, systems can be created for 115 VAC/230 VAC with surge voltages up to 380 VAC.

Together, AE Techron's 3110 Controller and 7000-series amplifiers are a complete solution for AF EMC testing.

Disclaimer

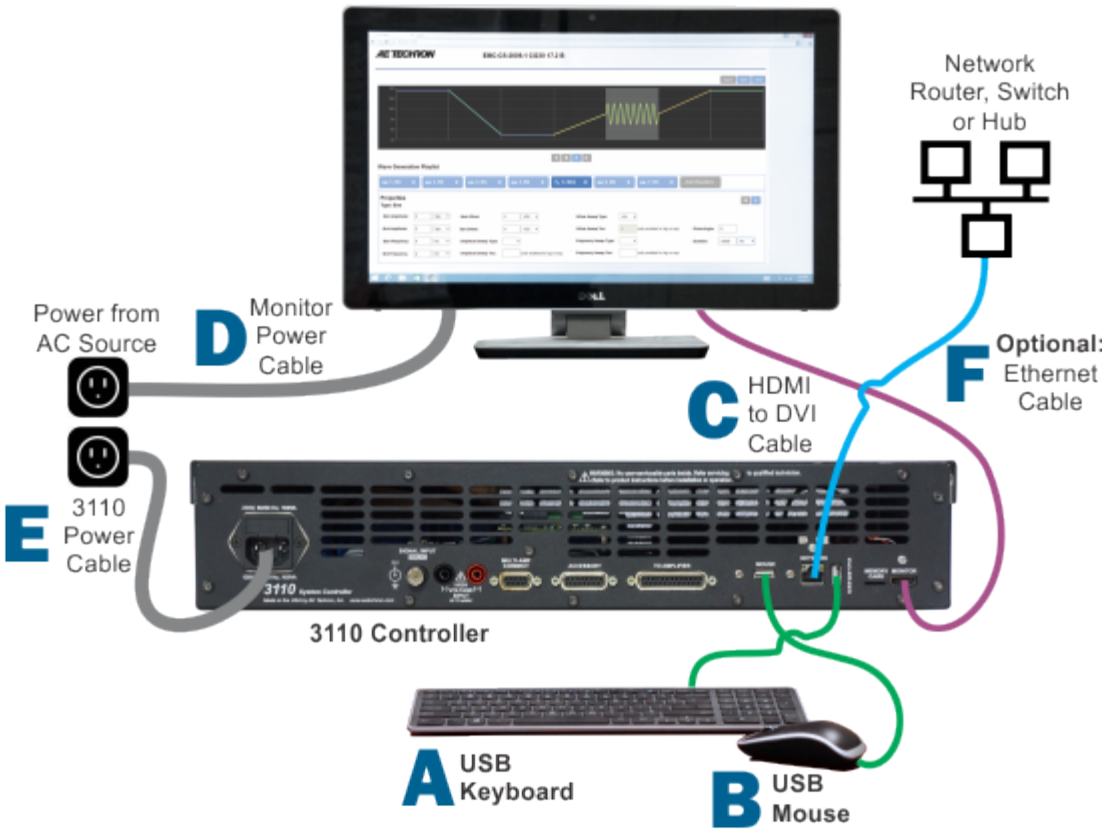
Although AE Techron has made substantial effort to ensure the accuracy of the Standards' test files (SWG files), which are included with the 3110 unit, no warranty, expressed or implied, is made regarding accuracy, adequacy, completeness, legality, reliability or usefulness of the information provided. It is the responsibility of the user to ensure the accuracy and applicability of these test files for their intended purposes.

Getting Started

3110 Controller Setup

The following steps explain how to connect the 3110 Controller using the cables and accessories provided.

A. Plug the USB keyboard into the USB port labeled KEYBOARD on the 3110 back panel.
B. Plug the USB mouse into the USB port labeled MOUSE on the 3110 back panel.
C. Plug the HDMI to DVI cable into the HDMI port labeled MONITOR on the 3110 back panel, and then connect the cable to the DVI port on the monitor.
D. Plug the monitor power cord into the monitor, and then connect the cord to a power source.
E. Plug the 3110 power cord into the power connector located on the 3110 back panel, and then connect the cord to a power source.
F. **OPTIONAL:** To connect the 3110 to be accessed and controlled through a network: Plug the Ethernet cable to the Ethernet port labeled NETWORK, and then plug the Ethernet cable into a router, switch or hub on the network. See the topic *"3110 via Network"* for more information.



AE Techron Amplifier Setup

The following steps explain how to prepare and connect a standard AE Techron amplifier for use with the 3110 controller by replacing the amplifier's standard SIM card with an SWG-enabled SIM-BNC-OPTOC card. The SWG-enabled SIM-BNC-OPTOC card and the DB-25 cable (required to make the 3110 controller to amplifier connection) are included with the 3110 Controller.

For instructions on using the 3110 controller with other audio-bandwidth, DC enabled amplifiers, see the topic *"Other Amplifiers"*.

Installing the SWG-enabled SIM-BNC-OPTOC Card into an AE Techron 7000-series Amplifier.

(NOTE: If your amplifier has been factory-configured for operation with the 3110 controller, skip to Step G.)

IMPORTANT: Make sure the amplifier is turned off and unplugged before completing these steps. After turning off the amplifier, let the unit sit for 3-5 minutes before removing the input card. This will allow the electrical charge in the power supply capacitors to discharge.

A. Locate the standard SIM card on the back of the 7000-series amplifier.

B. Using a #2 Phillips screwdriver, remove the two screws located at the edges of the card. Retain.

C. Gently pull the card from the card bay and locate the ribbon cable attached to the back of the SIM card.

D. Press down on the latches at the sides of the ribbon cable header to unlock the ribbon cable. Next pull up gently on the header to unplug the ribbon cable, and then remove the card completely from the card bay.

E. Locate the SWG-enabled SIM-BNC-OPTOC card (included with the 3110 controller). Partially insert the card into the amplifier card bay and plug the ribbon cable into the SWG-enabled card. Gently press on the ribbon cable header until the latches lock the header into place.

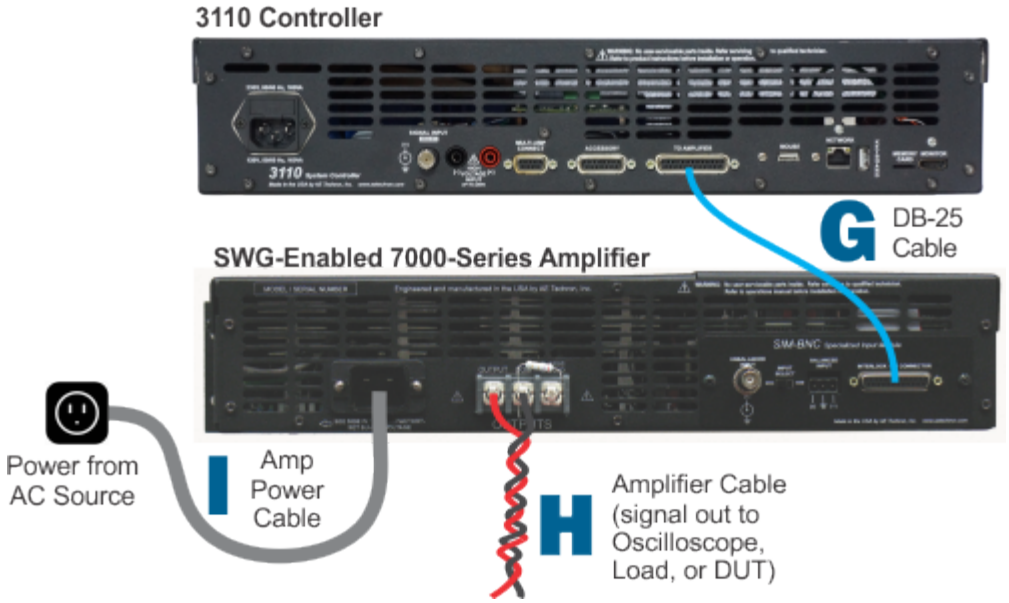
F. Completely insert the card into the card bay, and use the two retained screws to secure the new input card to the

amplifier back panel.

G. Locate the DB-25 cable included with the 3110 controller. Connect one end of the DB-25 cable to the DB-25 connector located on the 3110 back panel, and then connect the other end to the DB-25 connector located on the SWG-enabled SIM card on the amplifier back panel.

H. Connect the amplifier output cable from the amplifier output connectors to an oscilloscope, load or DUT. (See the amplifier Operator's Manual for more information on output connections.)

I. Plug the amplifier power cable into the amplifier, and then connect the cable to a power source. (See your amplifier Operator's Manual for AC wiring instructions.)



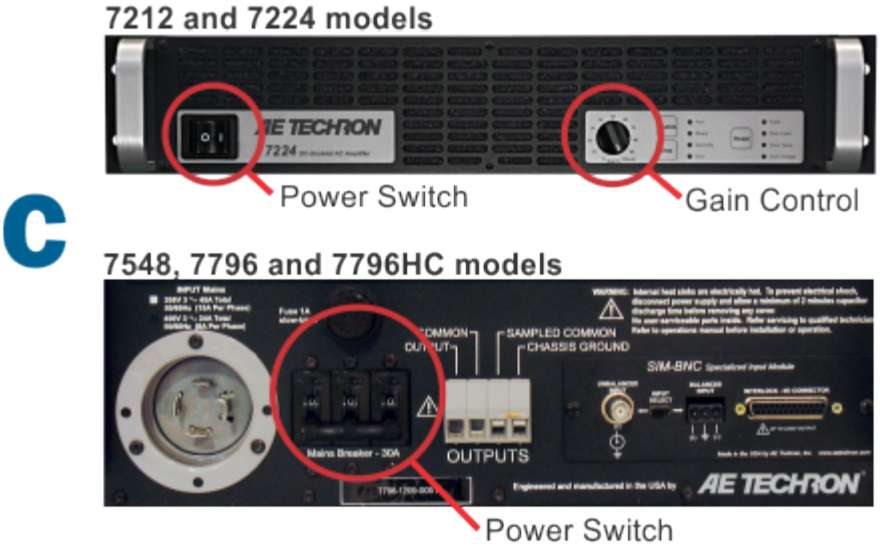
Startup Procedure

Complete the following steps to power up a 3110 Controller and 7000-Series amplifier system:

A. Use the monitor's power switch (last button on the right) to turn on the monitor.

B. Depress the 3110 POWER switch to turn the 3110 ON.

C. If the amplifier has a gain control, turn it fully ON (clockwise). Then turn the POWER switch ON to power up the amplifier.



D. Wait for the SWG interface to load (loading will take up to 30 seconds). See additional topics in this Help system for *"System Calibration"* and *"Basic Operation"*.

Other Amplifiers

Using the 3110 with other DC-enabled audio-bandwidth amplifiers

The 3110 controller can be used with other DC-enabled audio-bandwidth amplifiers. However, capabilities for system protection available with AE Techron 7000-series amplifiers will not be available when using other amplifiers.

Complete the following steps to connect and configure a non-AE Techron 7000-series amplifier for use with the 3110:

1. Complete the steps for 3110 Controller setup found under the topic *"Getting Started."*.
2. Connect from the 3110's front-panel Signal Out BNC connector to the signal input connector on your amplifier.

3. Run the System Gain and System DC Offset calibration test to determine the proper settings for your amplifier. See the topic *"System Calibration"* for more information on System Calibration.
4. Continue with normal operation of the 3110 controller.

System Calibration

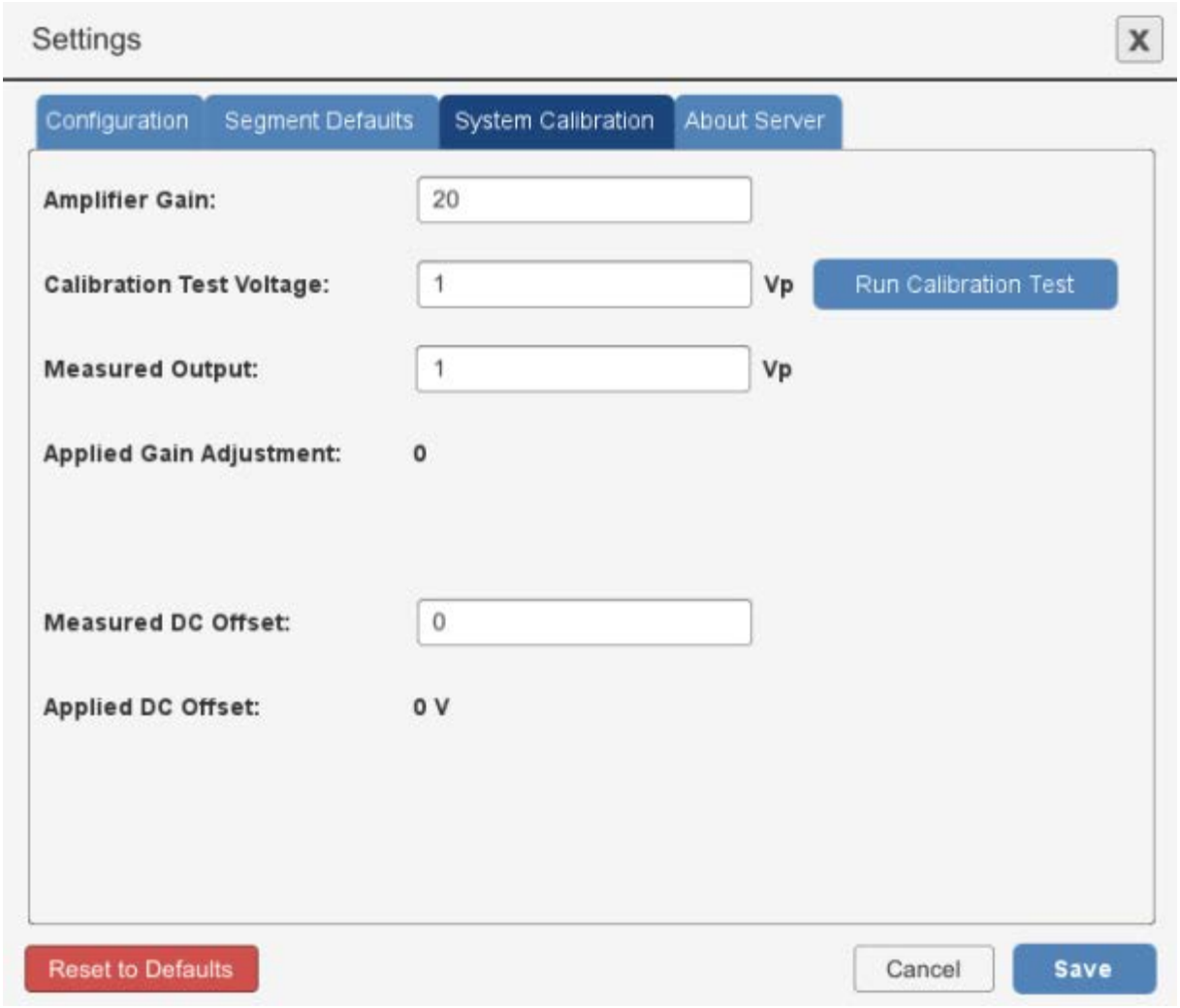
IMPORTANT: Before operating the 3110 with any amplifier, the 3110 Calibration Test should be run to determine the correct system settings for the SWG software.

Unlike most ARBs and signal generators, the Standards Waveform Generator interprets the waveform properties settings as the output desired at the amplifier's output (the combined 3110/amplifier output levels). These levels are calculated based on the Measured Output and Measured DC Offset settings entered on the System Calibration tab in the Settings window.

The SWG's default System Gain setting is 20, and the default DC Offset setting is 0, but these settings should be verified and adjusted, if needed, to reflect the measured gain of your 3110/amplifier system. If you are measuring the output of the 3110 controller without amplification (from the 3110's front-panel BNC signal output), a System Gain of 1 can be used for 3110 calibration (for an expected output of 10Vp/20Vpp).

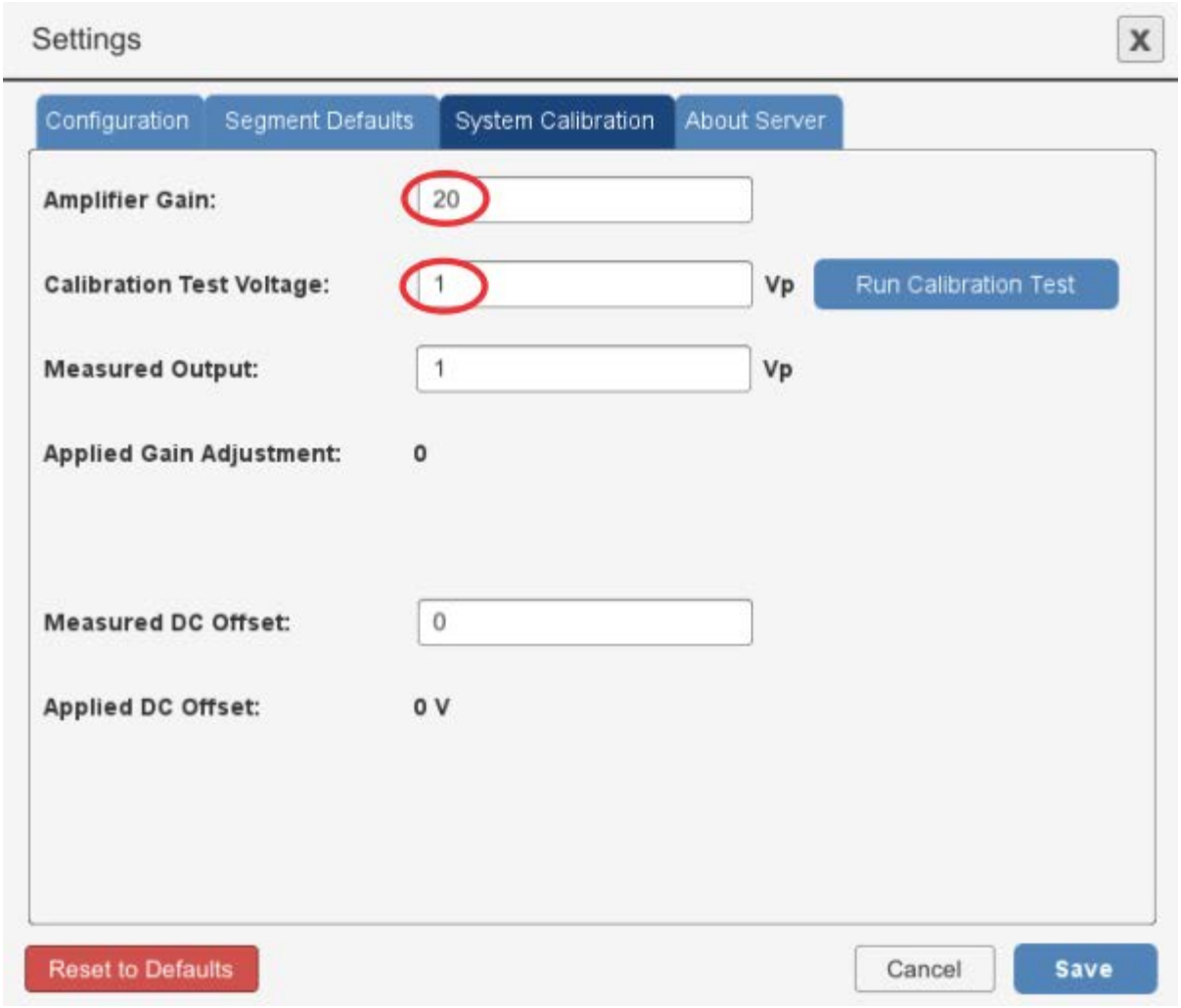
Complete the following steps to run the calibration test and adjust the SWG's System Gain and DC Offset settings:

1. Select the Settings button and then open the System Calibration tab.

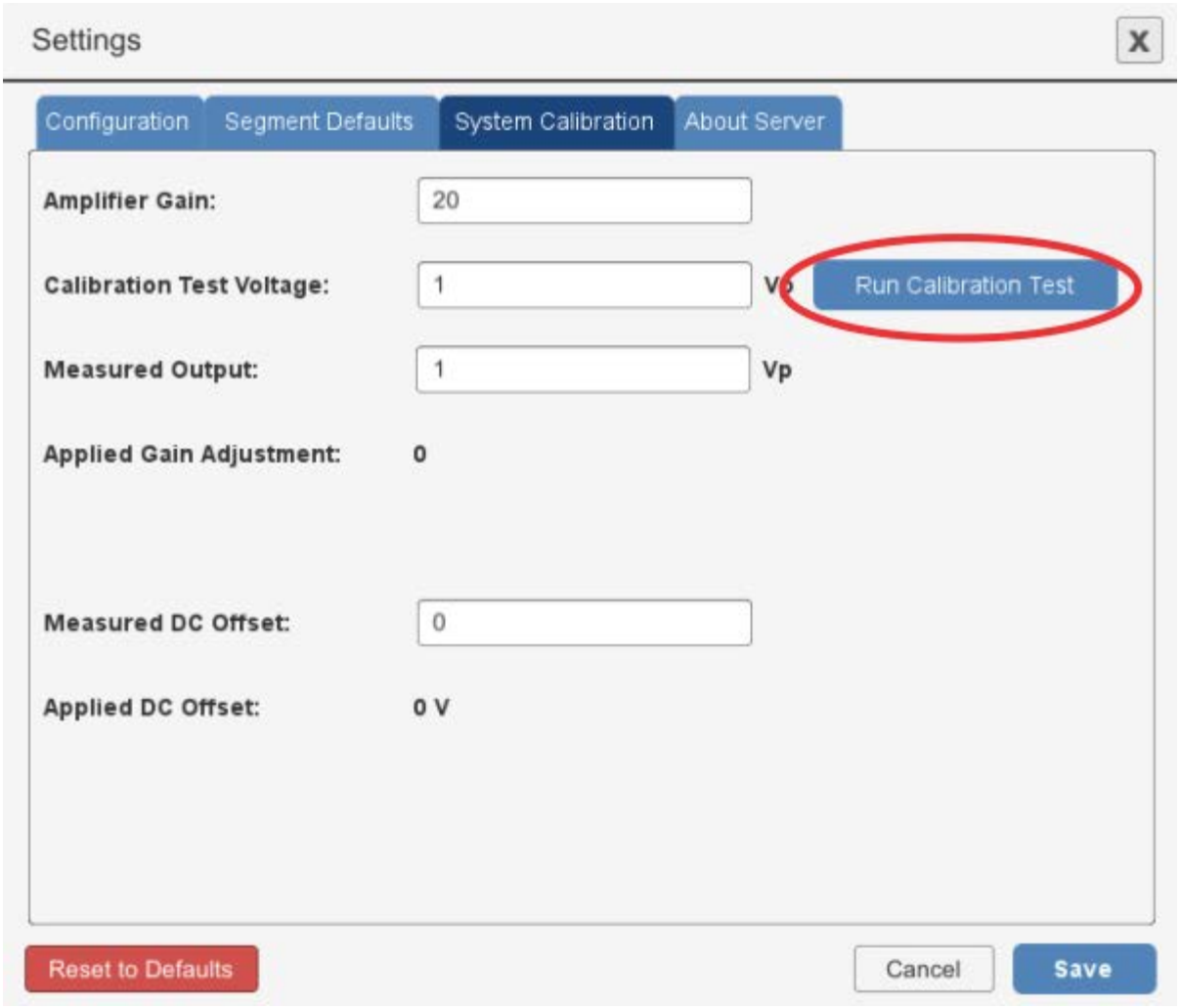


2. Make sure an estimated gain is entered in the Amplifier Gain input box. A default gain of 20 will be pre-entered in this box.

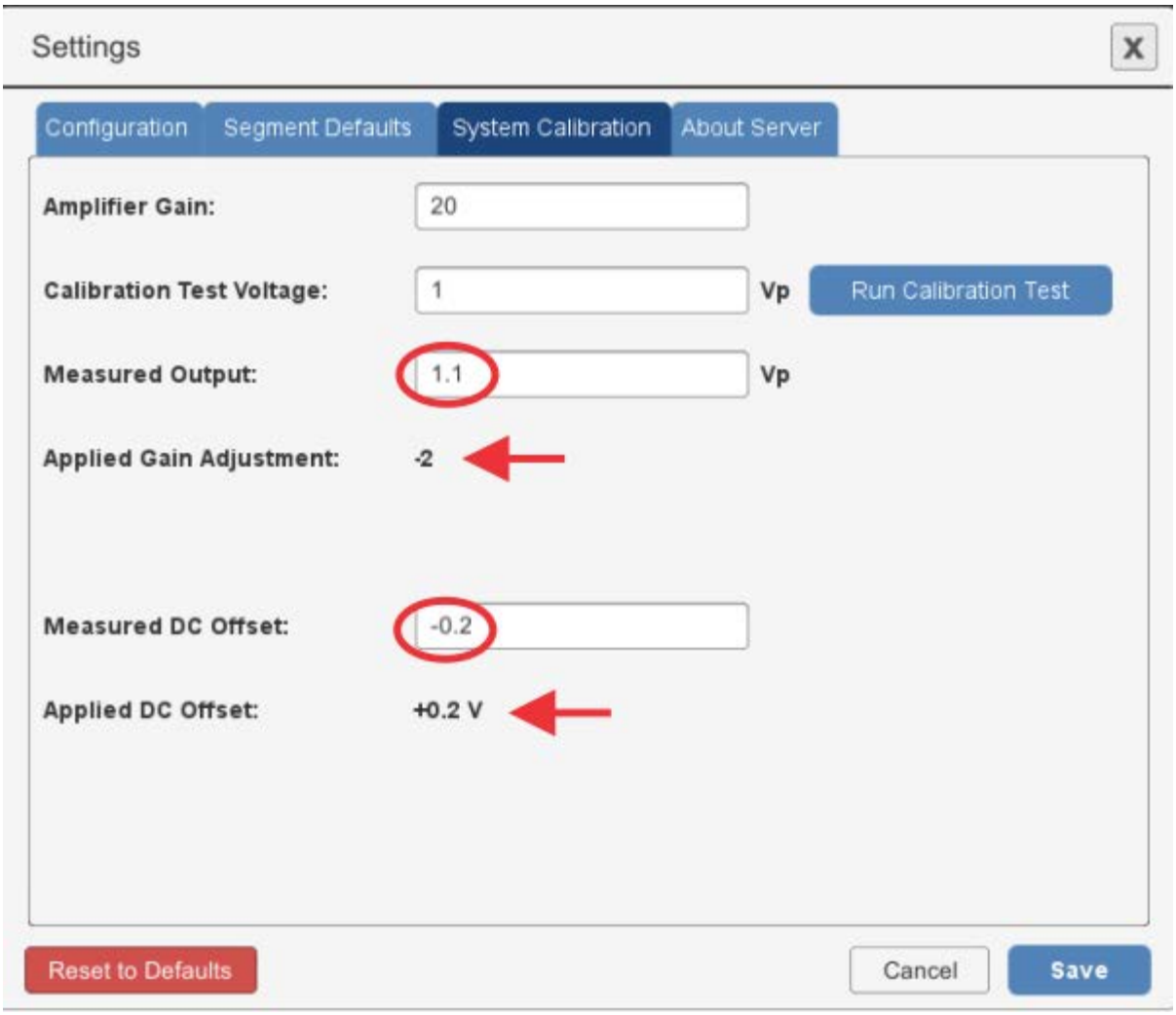
3. Adjust the Calibration Test Voltage, if desired. A default test signal of 1 Vp will be pre-entered in this box. Note: the default DC offset is 0 and cannot be changed.



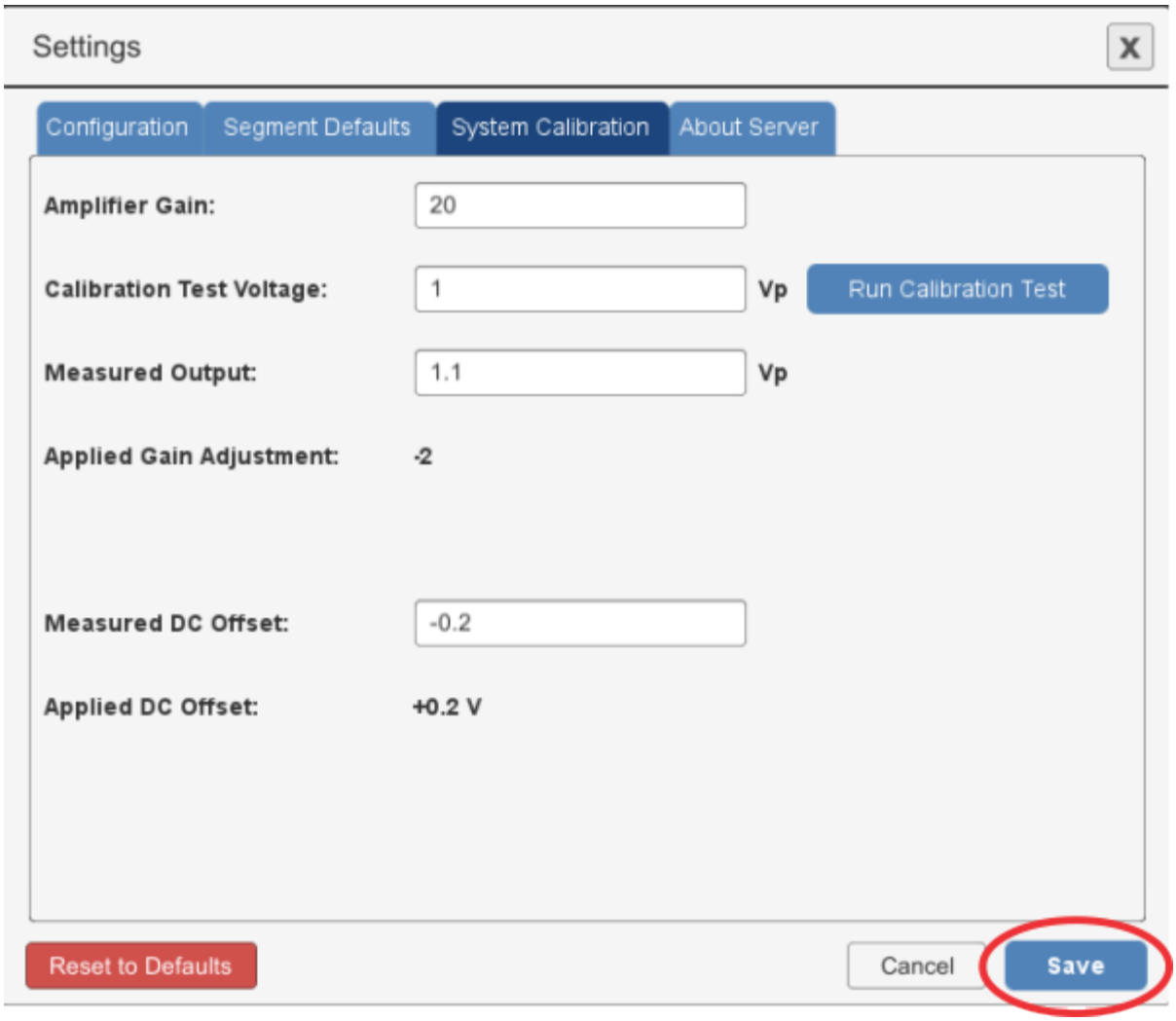
4. Connect an oscilloscope to the DUT (load at the amplifier output).
5. Press the Run Calibration Test button to begin the Calibration Test. The 3110 will generate a 1 kHz sine wave signal at the test voltage entered in the Calibration Test Voltage box.



6. Note the output voltage and any DC offset shown on the oscilloscope. Enter these results in the Measured Output and Measured DC Offset boxes on the System Calibration tab. The SWG software will automatically calculated the required Gain and DC Offset adjustments and display them on the Applied Gain Ajustment and Applied DC Offset lines on the System Calibration tab.



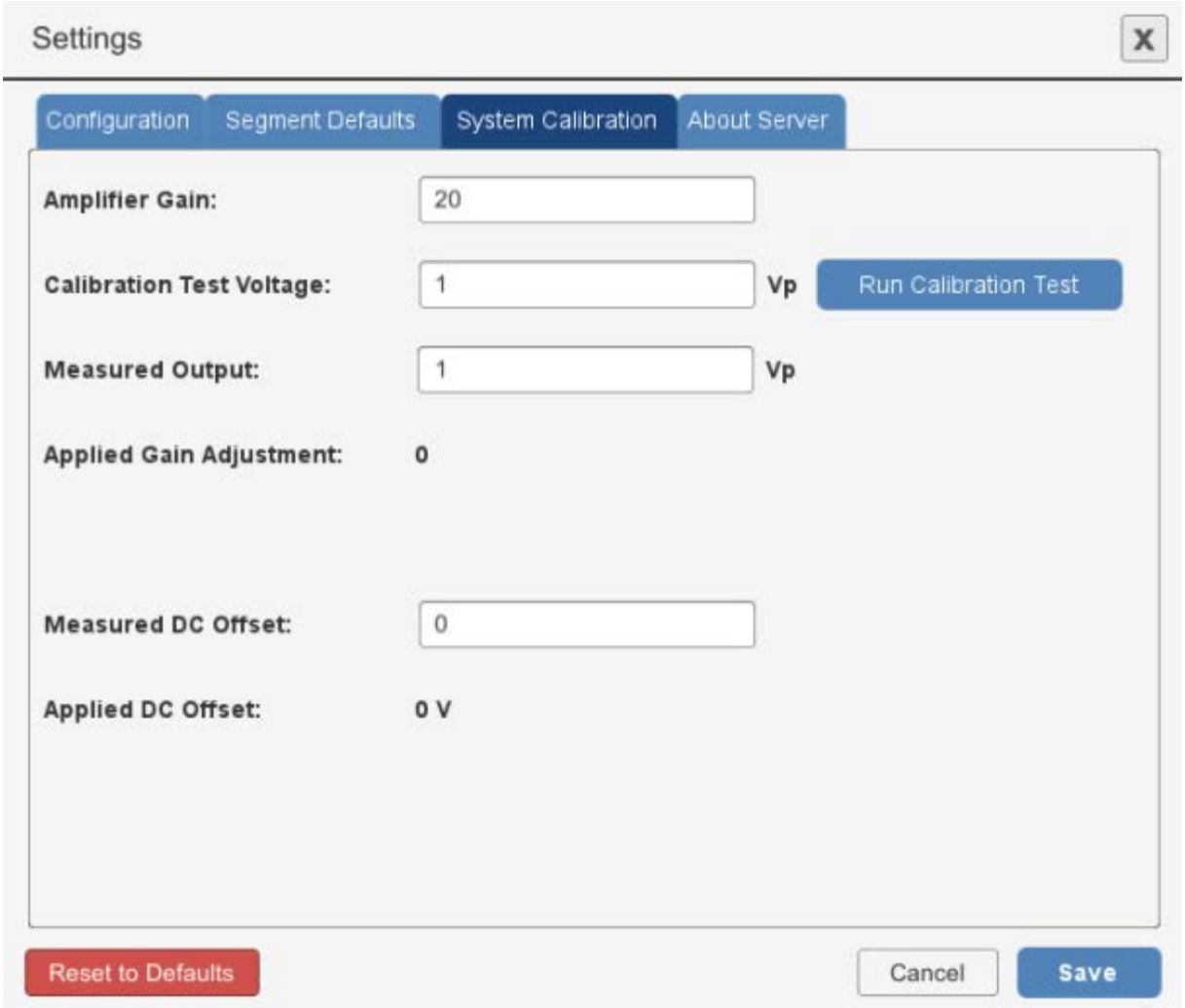
7. Press the Save button to save the resulting calibration numbers and close the Settings window.


Settings
X
Configuration
Segment Defaults
System Calibration
About Server
Amplifier Gain:
20
Calibration Test Voltage:
1
Vp
Run Calibration Test
Measured Output:
1.1
Vp
Applied Gain Adjustment:
-2
Measured DC Offset:
-0.2
Applied DC Offset:
+0.2 V
Reset to Defaults
Cancel
Save

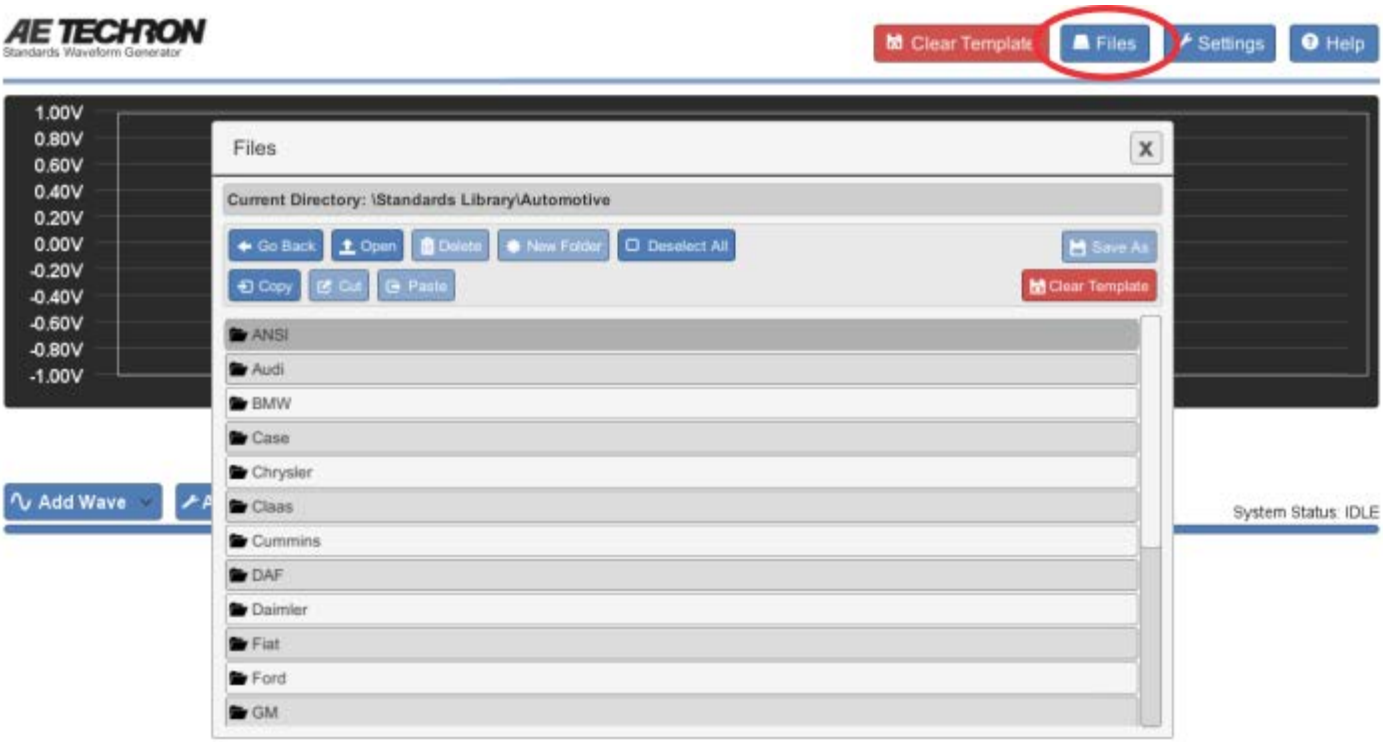
Basic Operation

IMPORTANT: Before operating the 3110 with an amplifier connected, the 3110 System Calibration Procedures should be performed to determine the correct System Gain and DC Offset settings for the 3110 controller. See the *"System Calibration"* topic for more information.

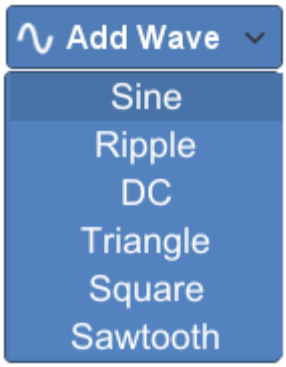
1. Select the Settings button and then open the System Calibration tab to set the 3110 system gain. The default setting for a 3110 controller plus amplifier system is 20, but this should be calibrated to match your actual system gain. When measuring 3110 controller output directly (without amplification), the system gain can be set to 1 for a 10Vp/20Vpp output.



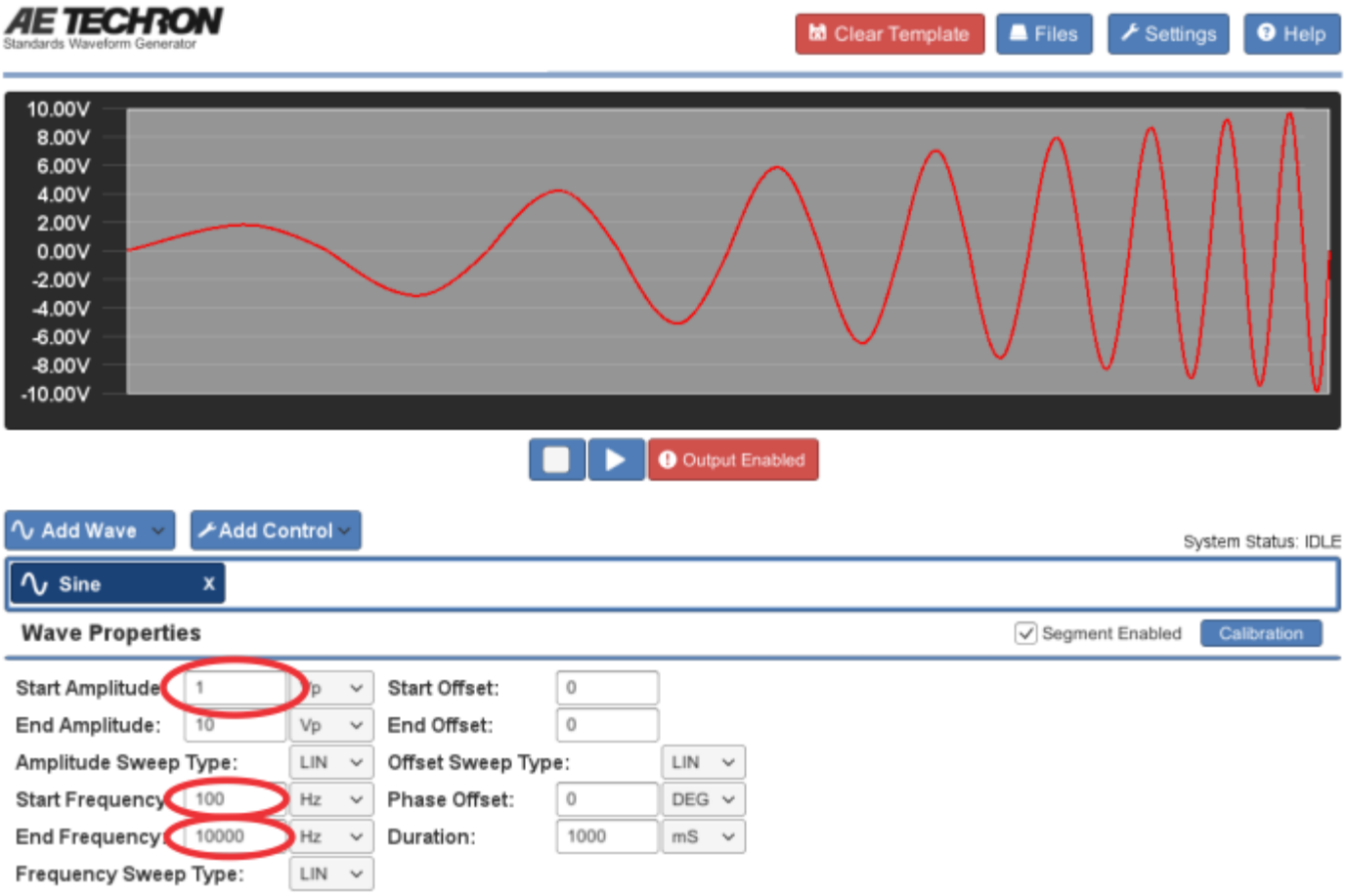
2. Use the Files button to load a test from the Standards library.



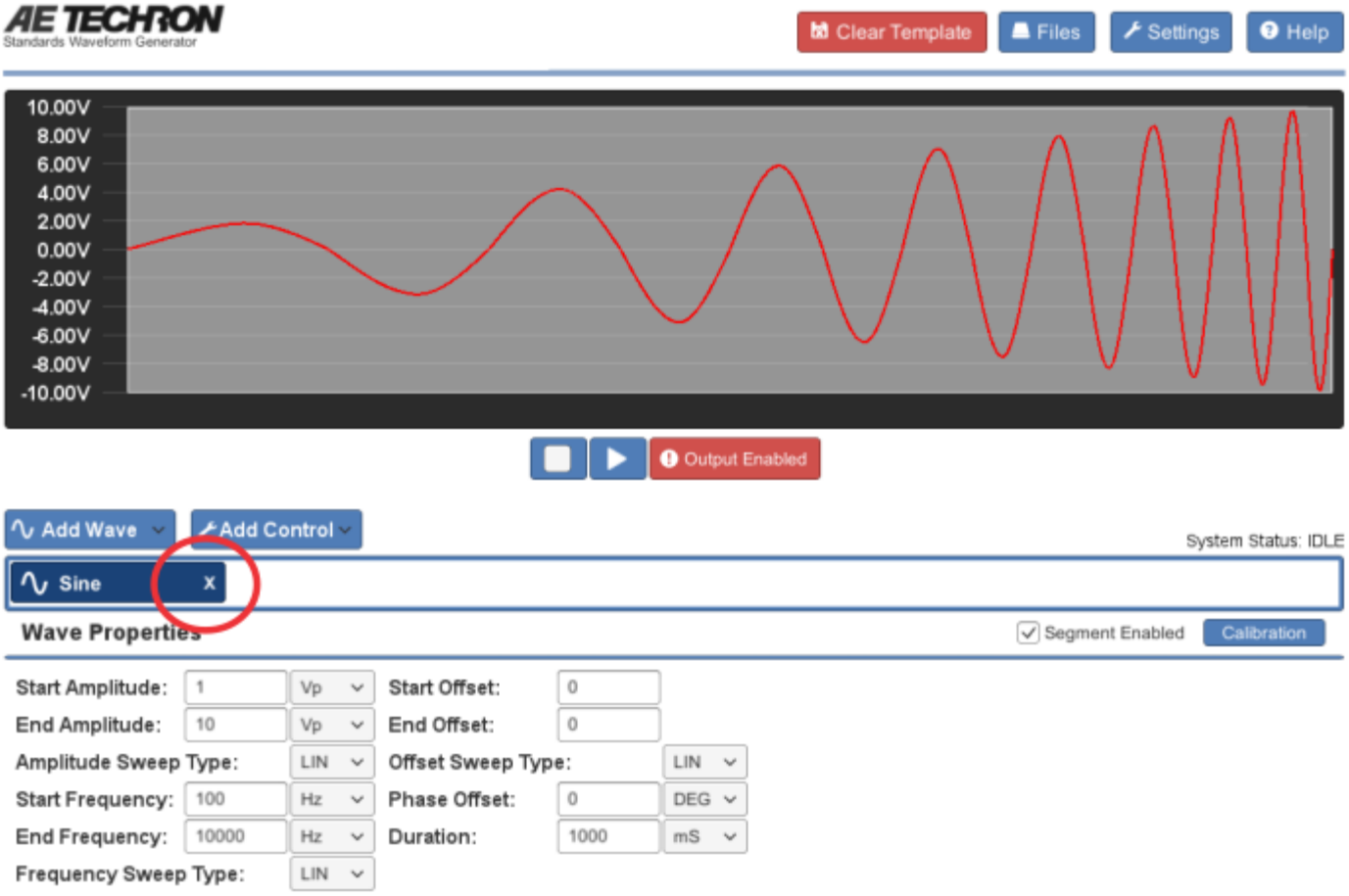
3. Use the Add Wave and Add Control buttons to select a waveform or control to add to the active test window.



4. Select the tab for a waveform or control to open the Properties dialog. Edit the properties to create complex waveforms and waveform sequences.



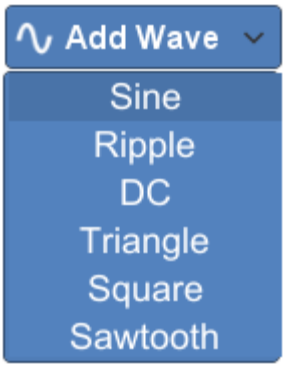
5. Segments can be dragged to change their order. To remove a segment from the test, press the X on the segment's tab.



6. When your test sequence is complete, press the Arrow button to begin generating signal output from the amplifier.

Adding Waveforms

The Add Wave button opens a drop down menu listing the types of waveforms that can be added to the active window. You can choose Sine, Ripple, DC, Triangle, Square or Sawtooth waveforms.



When you choose a waveform from the Add Wave drop-down menu, the default waveform of that type is added to the active window. Click on the tab or the waveform in the display to open the Properties form containing the available property settings for that waveform. See the individual entries in this Help system for more information about the settings available for each waveform type.

As you add or adjust settings for the waveform in the Properties tab, the visual depiction in the active test window will adjust to reflect the approximate signal being described by the waveform properties. Note that time sequences are NOT to scale.

To add additional waveforms to the active test, select additional waveforms from the drop-down menu. New waveforms will be added sequentially and will appear to the right of the selected control or waveform in the active window.

Position Waveforms: To reposition a waveform within the test sequence, click on the waveform to highlight and then click and drag the waveform to the desired position in the sequence.

Enable/Disable Segment: Each waveform segment can be set to Enabled (Segment Enabled checkbox checked) or Disabled (unchecked). When enabled, the waveform will be played as part of the test sequence. When unchecked, the waveform will be skipped during the running of the test segment. This can be useful when building or troubleshooting test sequences to skip over long or previously verified segments.

Segment Calibration: Each waveform segment can be individually calibrated using the segment calibration procedure. This can allow minor adjustments in system gain to be performed for a single segment.

To perform segment level calibration, complete the following:

1. Locate the segment to be calibrated and press the blue Calibration button located to the right of the waveform properties. The Segment Calibration window will open.

2. Connect an oscilloscope to the DUT (load at the amplifier output).
3. Press the Run Calibration Test button to begin the Calibration Test. The 3110 will continuously generate a waveform with the amplitude and frequency defined in the wave properties.
4. Note the output voltage shown on the oscilloscope. If the output does not match the test voltage, enter the amount required to adjust the output to match the test voltage in the Wave Gain input box. For example, if the oscilloscope reading is 1.1 Vp, enter -0.1 in the Wave Gain input box. Rerun the Calibration Test to verify the calibration, and then press the Close button to save your adjustment and close the Segment Calibration dialog.

NOTE: The calibration test can only produce voltage levels within the voltage limits of the system. If levels above system limits are entered in the Wave Gain input box, the calibration test levels will remain at the highest level capable.

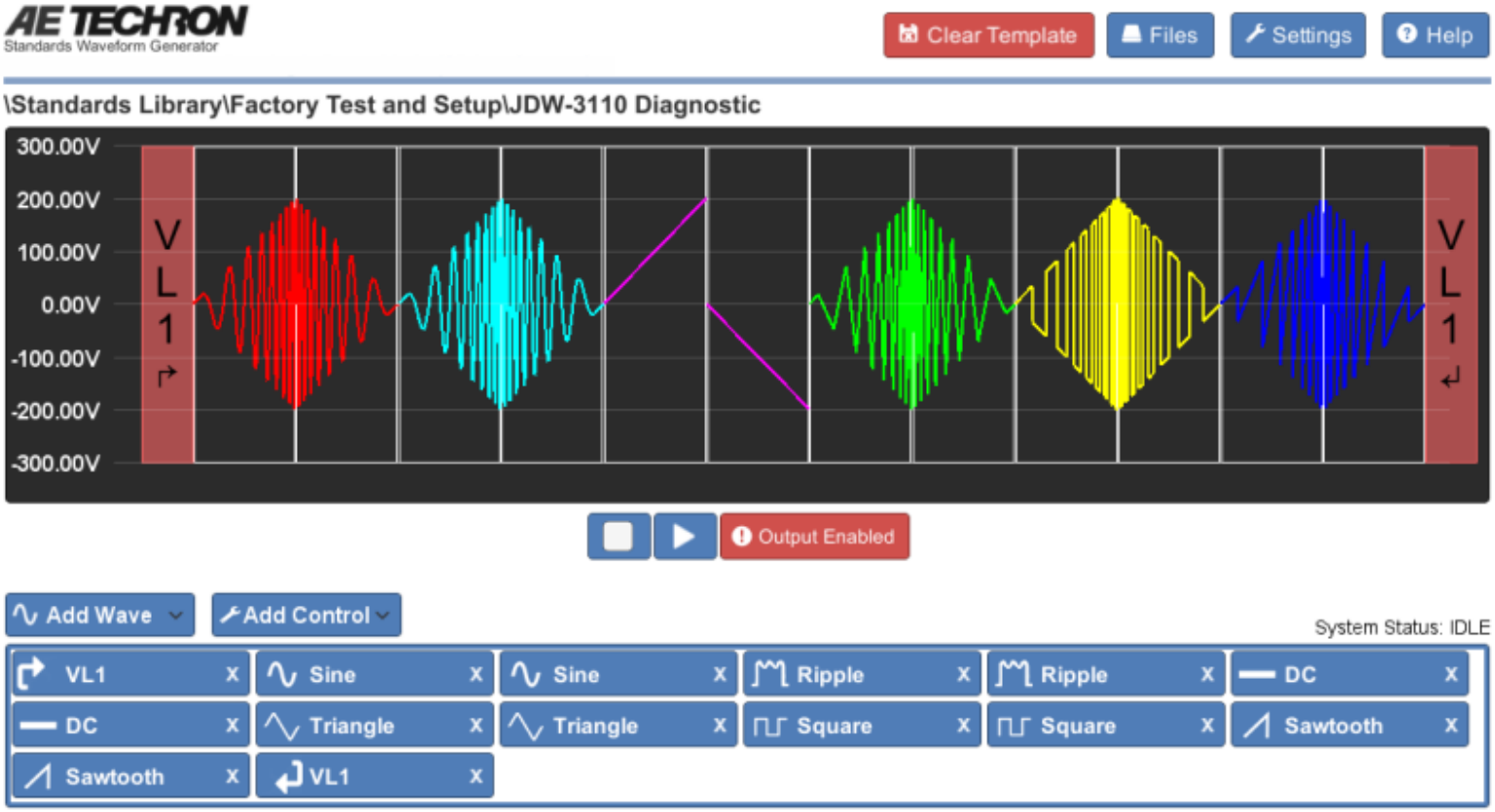
Adding Controls

The Add Control button opens a drop down menu listing the types of controls that can be added to the active window. You can choose Trigger, Fixed Loop, Variable Loop, Template, or GPIO Output.

When you choose a control from the Add Control drop-down menu, an icon representing that control type is added to the active window, and a form containing the available settings for that control opens below the active test display. See the individual entries in this Help system for more information about the settings available for each control type.

To add additional controls to the active test, select additional controls from the drop-down menu. New controls will be added sequentially and will appear to the right of the selected waveform or control in the active window. To reposition a control within the test sequence, click on the control to highlight and then click and drag the control to the desired position in the sequence.

Running a Test



One or more waveforms and/or controls that have been added to the active test window can be run using the controls located below the SWG's active window.

RUN: When the Run button is pressed, the active test sequence will be sent to the 3110 controller, and the system will begin generating signal starting at the beginning of the test sequence (the waveform or control farthest to the left). The System Status reporting message will change from 'Idle' to '1 of X,' with X being the total combined number of waveforms and controls in the test.

An individual segment may be highlighted in the active test window during playback. This occurs when the 3110 system is currently generating the highlighted segment and the segment is equal to or greater than one second in duration. Segments shorter than one second are too short to register as being highlighted.

STOP: When the Stop button is pressed, the 3110 controller will stop signal generation, and the test will reset to the start of the first waveform. The system will report its status as 'Idle.' The system will also report its status as Idle at all times that the 3110 controller is operating normally but a test is not active .

OUTPUT ENABLED/DISABLED: When the Output Enabled button 

is displayed, the signal defined by the active test sequence will be generated by the 3110 Controller. When pressed, the Output Enabled button will toggle to the Output Disabled display 

, and the test sequence can be run without generating output signal. This can be

useful for testing a sequence before generating output.

Using the 6-to-1 Attenuator

A BNC male-to-female fixed attenuator is included in the 3110 accessory pack. This attenuator has a drop of 6:1, or 6 volts in, 1 volt out.

Most test sequences do not require the use of this attenuator. However, tests having a maximum voltage of less than 30V may require the use of the attenuator.

The purpose of the attenuator is to force the user to DECREASE the overall system gain setting of the 3110 + amplifier from 20X (typical) to 20/6, or 3.33. Lowering the gain of the 3110 System (3110 + amplifier) allows the user to achieve maximum system signal to noise performance.

In general, if you are experiencing noise during testing, use of the attenuator is recommended.

Installing the Attenuator

1. Connect the attenuator's BNC male end to the Signal Out BNC female connector on the front of the 3110.
2. Connect a BNC cable to the female end of the attenuator, and then connect the cable to the unbalanced BNC input on the amplifier.
3. The DB-25 cable, if used, MUST be disconnected from the 3110 when using the attenuator.

System Gain Adjustment and Calibration

When the attenuator is used, the 3110's System Gain setting must be adjusted. This allows the 3110 Controller to adjust its output levels to deliver the required levels at the system output.

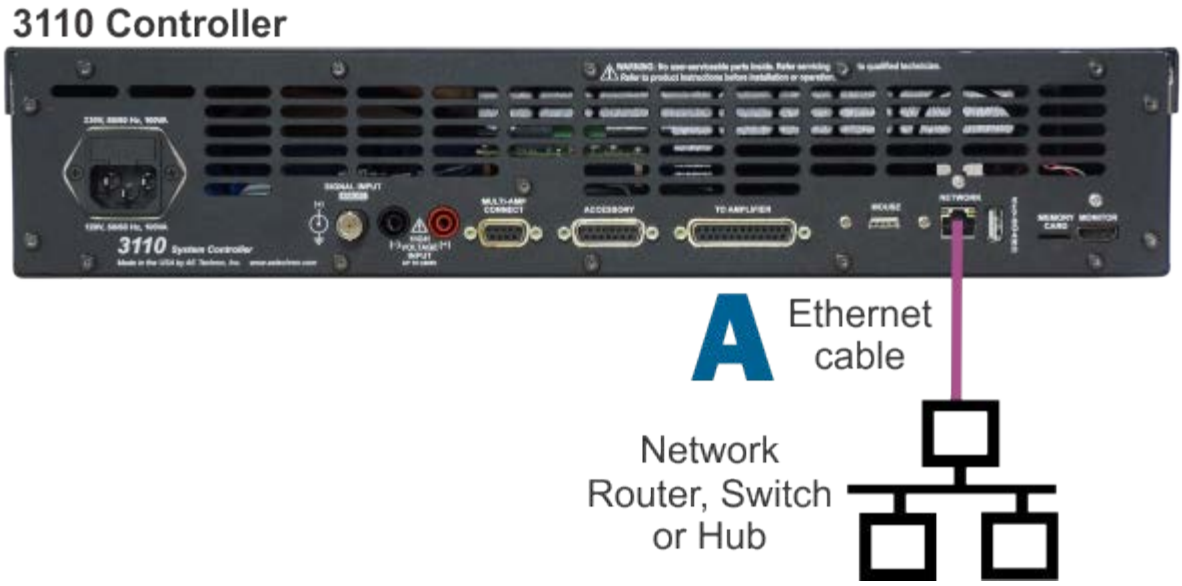
To adjust the 3110's System Gain setting complete the following steps:

1. Press the Settings button from the 3110's main window, and then select the System Calibration tab.
2. In the Amplifier Gain input box, replace the gain level with a level that is 1/6 of the verified level. For example, if your verified System Gain is 20, replace this with a gain of 3.33.
3. Run the Calibration Test using the *"System Calibration"* procedure.
4. When the System Calibration testing is completed, press the Save button to save the new System Gain setting and return to the 3110's main menu.

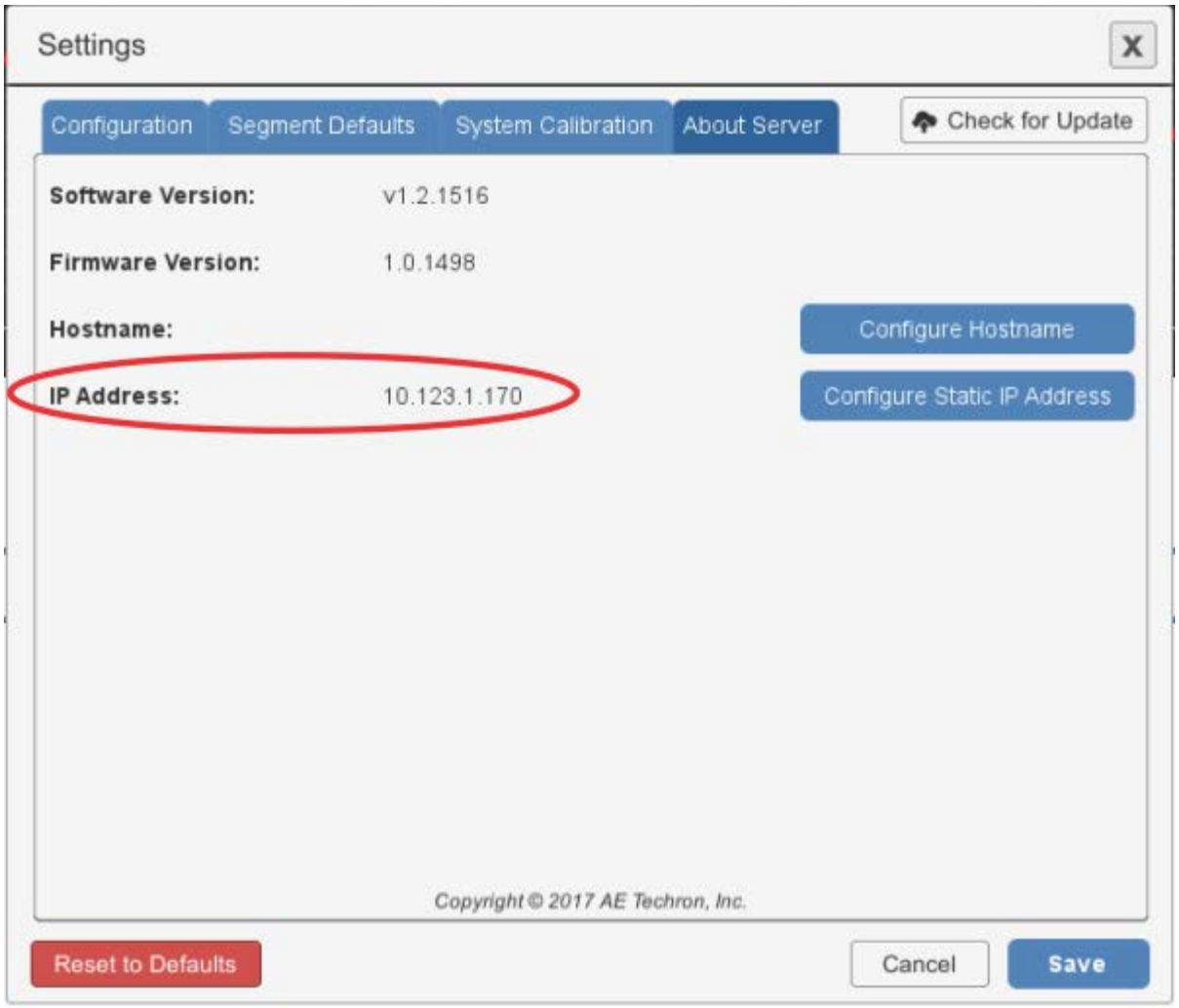
Controlling the 3110 Through a Network

To access and control the 3110 controller through your local network, complete the steps below:

A. Connect the 3110 controller to the keyboard, monitor, mouse and amplifier as directed for a free-standing workstation setup (see the topic *"Getting Started"*), but also connect the Ethernet cable between the 3110 controller and your network hub, router or switch, as shown below:

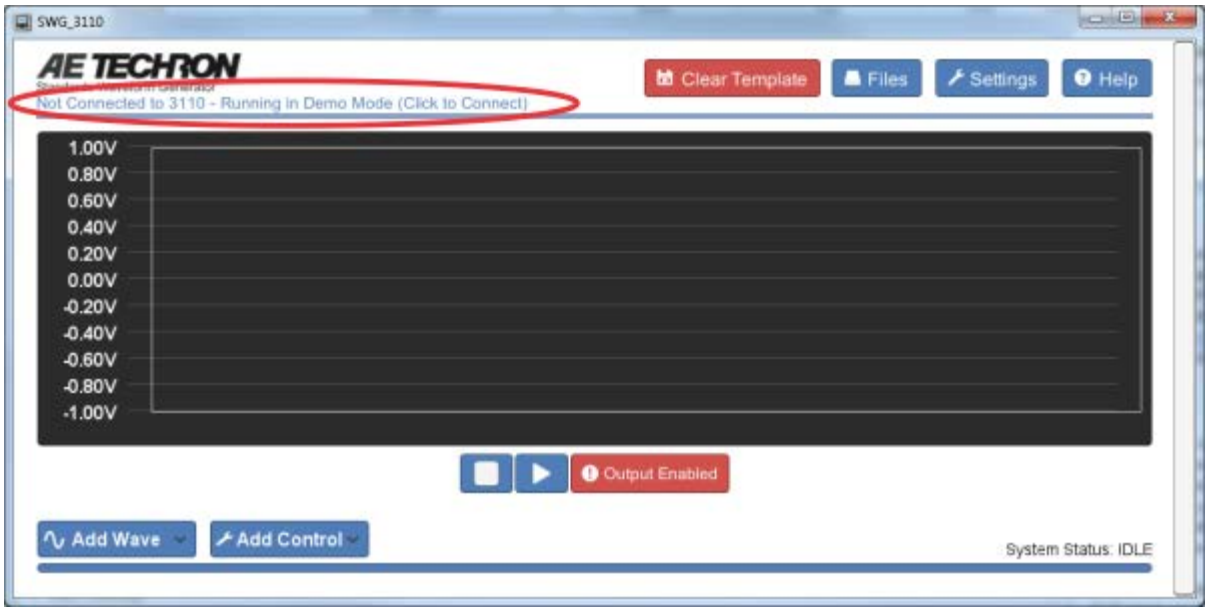


B. Power up the 3110 controller and amplifier, and wait for the 3110's SWG interface to load (this can take up to 30 seconds). Press the Settings button to open the Settings window, and then select the About Server tab. Write down the IP address shown in the IP Address section for later reference, and then press the Cancel button to close the Settings window. NOTE: If the Service Endpoint box is blank or contains the IP address 0.0.0.0, then the 3110 controller is not connected to your network. Check your Ethernet connection or contact your network administrator for assistance.



C. Insert the microSD card with USB adapter (included with the 3110 unit) into an open USB port on the computer to be used for accessing the 3110 across the network. Open the USB drive and then locate and install and the SWG Setup.exe file.

D. When the program has loaded, the notice "Not Connected to 3110 - Running in Demo Mode (Click to Connect)" will be displayed in the upper left of the window. Click the message to open the connection dialog, and then type the 3110 IP address you wrote down into the IP Address text box. Press OK to connect to the remote 3110 controller. The 3110's SWG interface will be displayed on your computer monitor, and the 3110 can now be controlled remotely.



REMOVING I/O DEVICES: If the 3110 controller will only be operated remotely through your network, the I/O devices (monitor, mouse and keyboard) can be removed from the 3110 system. Leave the 3110 controller and amplifier powered on for continued use through the network.

RECONNECTING TO THE 3110 REMOTELY: If the 3110 is disconnected from the network, it may be assigned a new IP address when the 3110 is reconnected to the network. To find the new IP, go to the 3110 controller (reconnect monitor and mouse, if necessary), and then press the Settings button to open the Settings window. Select the About Server tab and review the IP address listing. Enter the new IP address in the IP Address text box on the remote computer.

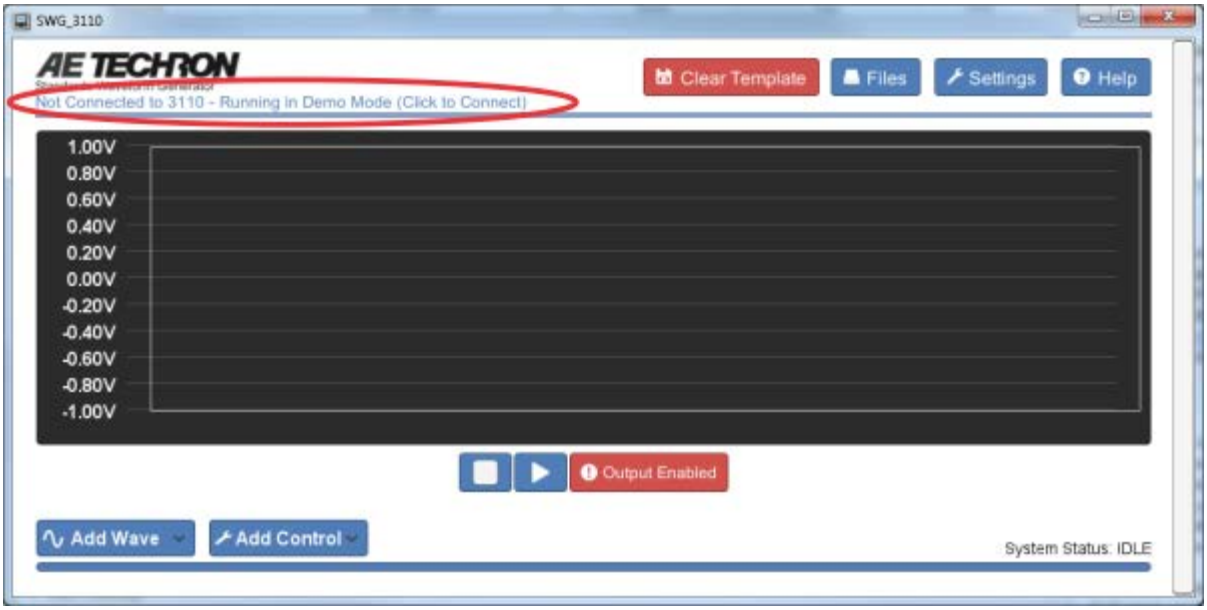
Working in Demo Mode

A Windows computer (WIN 7, 8 or 10) can be used to create .swg test files for later use by working in Demo Mode using the SWG Windows Remote Client software.

When working in Demo Mode, the Windows computer does not need to be in contact with the 3110 via network connection, so the 3110 controller can be used to run existing test routines while new routines are created elsewhere.

To prepare a computer to run in Demo Mode, install the SWG Windows Remote Client software (Setup.exe), which is provided on the microUSB card with USB adapter that was included with the 3110 unit.

Once the program has installed and loaded, the notice "Not Connected to 3110 - Running in Demo Mode (Click to Connect)" will be displayed in the upper left of the window.



You can use the Add Wave and Add Control buttons to create a waveform sequence. In addition, you can load existing tests from the Standard's Library to use as a template or to edit and save as a new test file.

When the test sequence is complete, press the Files button to save the .swg file in the User Standards directory.

When working in Demo Mode, files saved to the User Standards directory will be saved on your local hard drive in your Documents directory in a sub-directory named "Demo SWG."

To transfer the files saved on your local drive to the 3110 Controller, use the provided micro SD card with USB adapter to copy the .swg files from your hard drive to the micro SD card. Then insert the micro SD card into the SD card slot on the back of the 3110 Controller. Be careful when installing the card to insert the card in a straight line directly into the card slot. If the card is inserted at an angle, it may miss the internal card slot and be inaccessible from your 3110 unit.

Start the 3110 Controller (if needed) and use the Files button to open the files manager, and then open the SD card. Copy the files located on the SD card, and then paste the files into the User Standards directory on the 3110.

NOTE: The files can be retreived from the SD card using the 3110 locally and can also be transferred using a remote computer connected to the 3110 via network. For more information, see the help topic *"3110 via Network."*

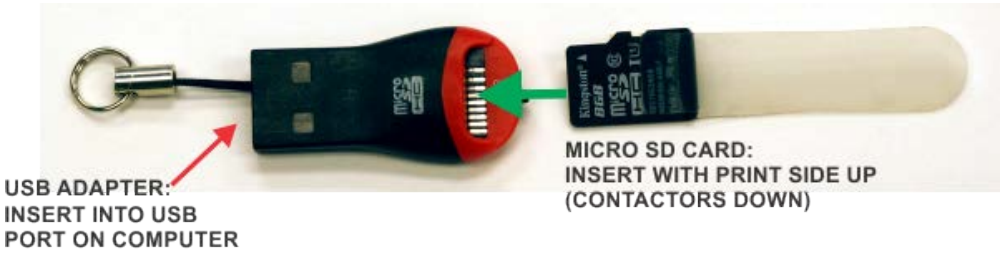
Updating the 3110

Updates for the 3110 Controller software (including additions to the Standards Library) and the SWG Windows Remote Client software are available on the AE Techron website (aetechron.com). NOTE: When updating the 3110 Controller software, all Windows computers used to access the 3110 remotely must also be updated with the corresponding version of the SWG Windows Remote Client software.

Updating the 3110 Controller

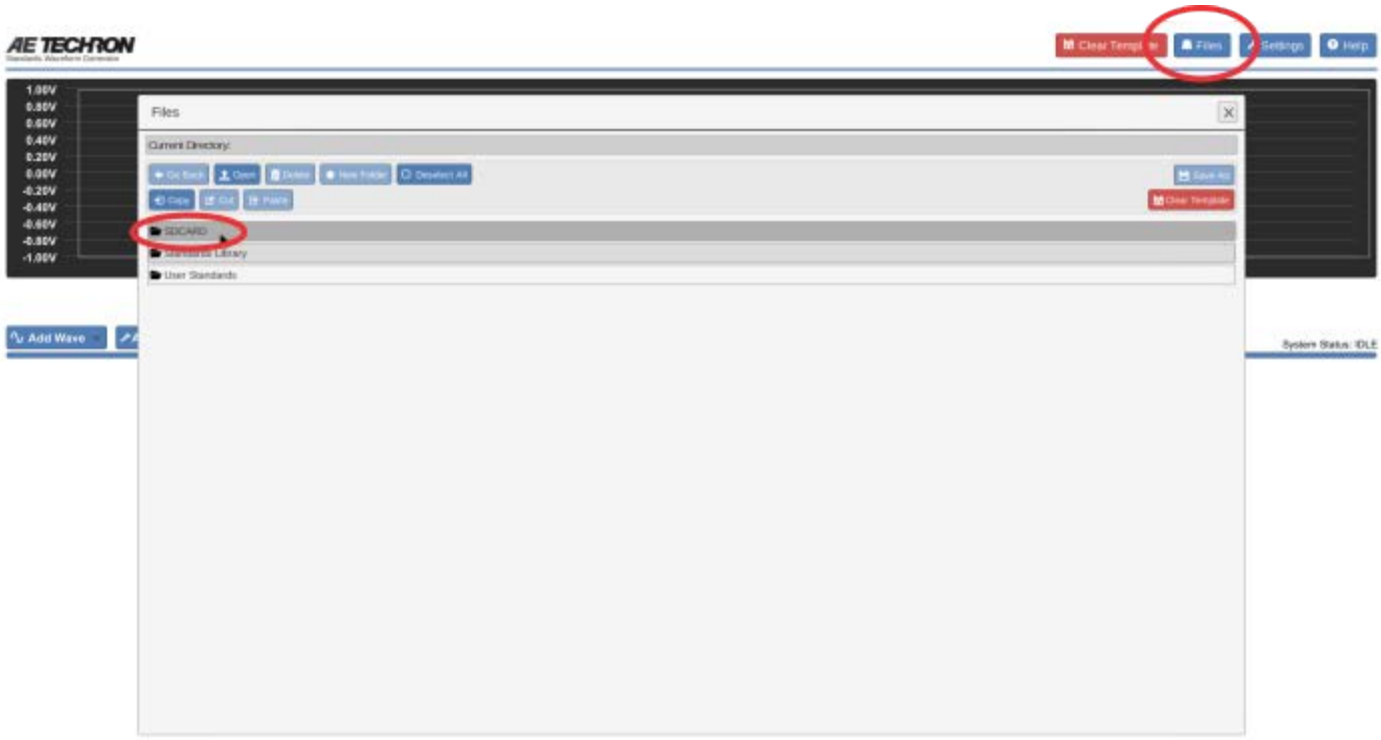
Complete the following steps to update the SWG software and load additional tests into the Standard's Library on the 3110 Controller:

1. From a computer with access to your network, go to the AE Techron website (aetechron.com) and check for 3110 updates. Locate the update package (Apk file) for updating the 3110 Controller (not the Windows remote client .exe file). Follow the instructions provided there for downloading the update file. Save the file on the microSD card with USB adapter that came with your 3110 unit.

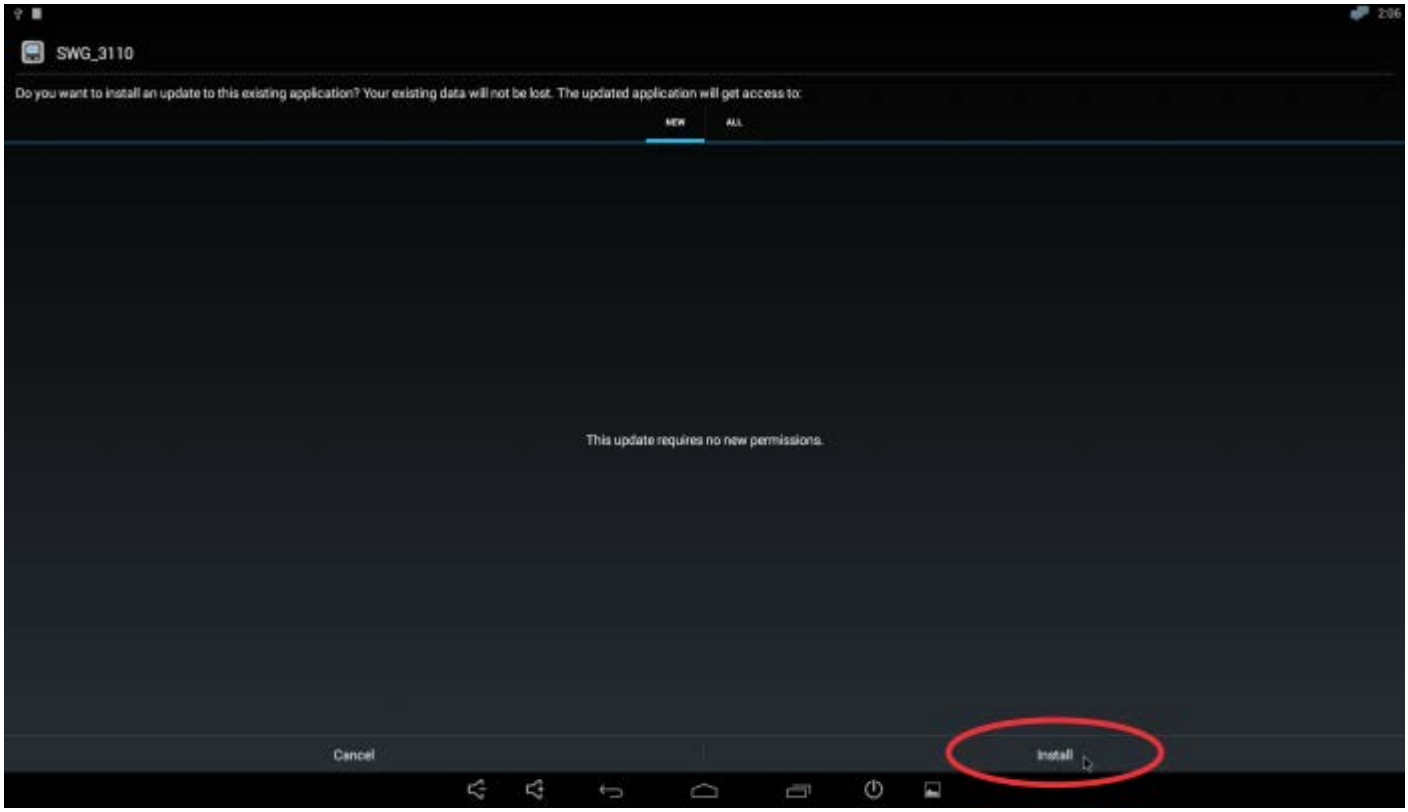


2. Remove the micro SD card from the USB adapter and insert the card into the card slot located on 3110 Controller back panel. Be careful when installing the card to insert the card with the printed side UP. The card must also be inserted in a straight line directly into the card slot. If the card is inserted at an angle, it may miss the internal card slot and be inaccessible from your 3110 unit.

3. Turn on the 3110 Controller and allow the software interface to load. Then locate and press the Files button to open the Files explorer. Open the SDCARD directory and then locate the update Apk file you saved. **NOTE: If the SDCARD directory won't open, the microSD card is not being recognized by the 3110 controller. Check the insertion of the microSD card. It may not have been inserted properly or completely.**



4. Select and open the .apk file. You will be prompted to approve new permissions (if any). If no new permissions are required, select the INSTALL button at the bottom right of the screen to start the update process.



5. The message "App installed" will appear in the window when the update has been successfully performed. Select the "Done" button to close the dialog box and return to the normal 3110 Controller interface.
6. Check the version information displayed on the About Server tab in the Settings window to confirm the update has

been successfully installed.

Updating the SWG Windows Remote Client Software

Complete the following steps to update the SWG Windows remote client software on a Windows computer (Windows 7, 8 and 10):

1. From a computer with access to your network, go to the AE Techron website (aetechron.com) and check for 3110 updates. Locate the update program (.exe file) for updating the Windows remote client (not the 3110 Controller Apk file). Follow the instructions provided there for downloading the update file. Save the file on your local computer or on a network drive that is accessible to the computer(s) being updated.
2. Locate and open the downloaded .exe file via Windows File Explorer. You will be prompted to approve the update process. Once approved, the update process will begin.
3. A dialog box will confirm the update has been successfully performed. Close the dialog and the 3110 Remote Client will automatically load.
4. Check the version information displayed on the About Server tab in the Settings window to confirm the update has been successfully installed.

Shutdown Procedure

Use the front-panel ON/OFF switch located on the 3110 to turn the unit OFF.

Sine Wave Properties

A Sine Wave created in the SWG makes use of the 3110's arbitrary waveform generator to generate the desired waveform. Select the Sine button from the Add Waveform drop-down when you need to create an audio-frequency sinusoidal waveform (DC to 20 kHz).

Set the following properties to specify the characteristics of the sine wave to be produced at the amplifier output:

Amplitude: The Start Amplitude and End Amplitude properties determine the height of the sine wave from the zero-crossing point to the crest, measured in volts. Amplitude can be defined using the unit Volts peak (Vp), Volts peak-to-peak (Vpp) or Volts root-mean-square (Vrms). When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure. The units of measure used for Start Amplitude and End Amplitude do not need to be the same.

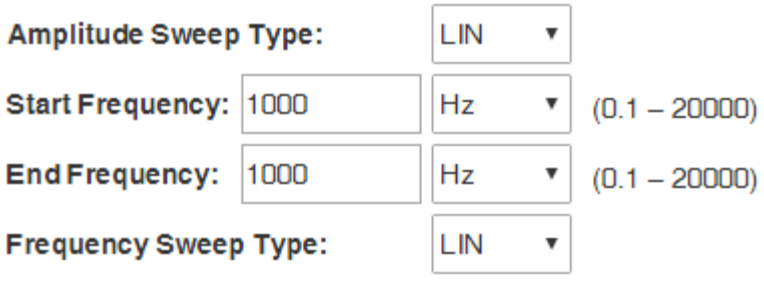
The values for both Start and End Amplitude can be positive or negative, and the allowable range for these values will be determined by the SWG based on the System Calibration settings (for more information, see the topic *"System Calibration"*) The default allowable range is +/-200Vp (with system gain set to 20). When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Amplitude Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.

Frequency: The Start Frequency and End Frequency properties determine the frequency of the sine wave in cycles per second (Hertz). Frequency can be defined using Hertz (Hz) or Kilohertz (kHz) as the unit of measure. When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure. The units of measure used for Start Frequency and End Frequency do not need to be the same.

The allowable range for Start and End Frequency is 0.1 Hz to 20 kHz. When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Frequency Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.

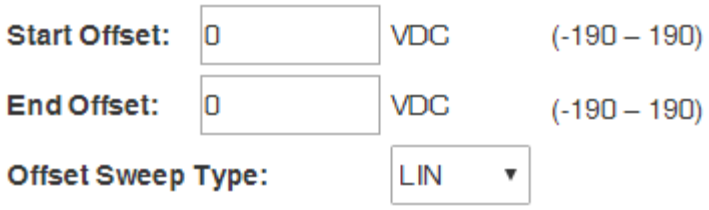


DC Offset: The Start Offset and End Offset properties supply a constant positive or negative DC voltage on the sine

wave. DC Offset is defined in Volts DC (VDC) as the unit of measure.

The allowable range for Start and End Offset is +/-200 VDC (with system gain set to 20). When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Offset Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.



Phase Offset: The Phase Offset property determines the beginning offset of the waveform within the cycle. Phase Offset can be defined using degrees (deg) or radians (rad) as the unit of measure.

The allowable range for Phase Offset is 0 to 359 degrees. When a value outside of the allowable range is entered, only the value greater than complete (360 degree) cycles will be set as the offset amount.

Duration: The Duration property determines how long the waveform will be generated. Duration can be defined using the microsecond (us), millisecond (ms), second, (sec), minute (min) or hour (hour) as the unit of measure. When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure.

The maximum duration of a single segment is 1193 hours, and the minimum duration is 150 us. When the duration specified for the waveform has been completed, the 3110 will begin outputting the next waveform defined in the test. However, if a Trigger Control follows the just-completed waveform, and the Trigger Control's "Continue Prev. Wave" property is set to TRUE, the waveform before the Trigger Control will continue indefinitely, regardless of the duration time set in that waveform's properties.

If no additional waveform has been defined to follow the completed waveform, the system output will stop.

Ripple Wave Properties

A Ripple Wave created in the SWG makes use of the 3110's arbitrary waveform generator to generate the desired waveform. Select the Ripple button from the Add Waveform drop-down when you need to create a sinusoidal waveform with a frequency up to 300 kHz.

Set the following properties to specify the characteristics of the ripple wave to be produced at the amplifier output:

Amplitude: The Start Amplitude and End Amplitude properties determine the height of the ripple wave from the zero-crossing point to the crest, measured in volts. Amplitude can be defined using the unit Volts peak (Vp), Volts peak-to-peak (Vpp) or Volts root-mean-square (Vrms). When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure. The units of measure used for Start Amplitude and End Amplitude do not need to be the same.

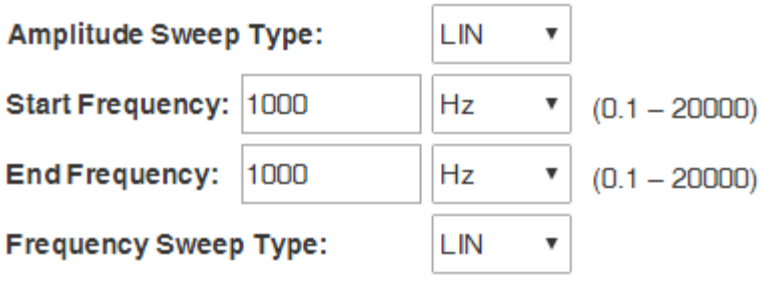
The values for both Start and End Amplitude can be positive or negative, and the allowable range for these values will be determined by the SWG based on the System Calibration settings (for more information, see the topic *"System Calibration"*). The default allowable range is +/-200Vp (with system gain set to 20). When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Amplitude Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.

Frequency: The Start Frequency and End Frequency properties determine the frequency of the ripple wave in cycles per second (Hertz). Frequency can be defined using Hertz (Hz) or Kilohertz (kHz) as the unit of measure. When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure. The units of measure used for Start Frequency and End Frequency do not need to be the same.

The allowable range for Start and End Frequency is 0.1 Hz to 300 kHz. When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Frequency Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.

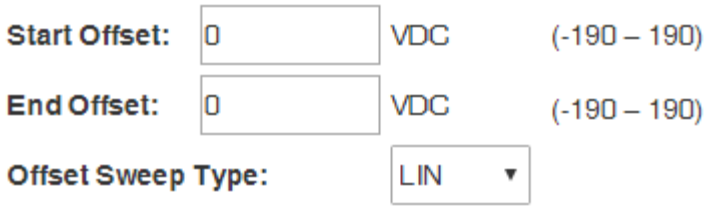


DC Offset: The Start Offset and End Offset properties supply a constant positive or negative DC voltage on the ripple

wave. DC Offset is defined in Volts DC (VDC) as the unit of measure.

The allowable range for Start and End Offset is +/-200 VDC (with system gain set to 20). When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Offset Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.



Phase Offset: The Phase Offset property determines the beginning offset of the waveform within the cycle. Phase Offset can be defined using degrees (deg) or radians (rad) as the unit of measure.

The allowable range for Phase Offset is 0 to 359 degrees. When a value outside of the allowable range is entered, only the value greater than complete (360 degree) cycles will be set as the offset amount.

Duration: The Duration property determines how long the waveform will be generated. Duration can be defined using the microsecond (us), millisecond (ms), second, (sec), minute (min) or hour (hour) as the unit of measure. When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure.

The maximum duration of a single segment is 1193 hours, and the minimum duration is 150 us. When the duration specified for the waveform has been completed, the 3110 will begin outputting the next waveform defined in the test. However, if a Trigger Control follows the just-completed waveform, and the Trigger Control's "Continue Prev. Wave" property is set to TRUE, the waveform before the Trigger Control will continue indefinitely, regardless of the duration time set in that waveform's properties.

If no additional waveform has been defined to follow the completed waveform, the system output will stop.

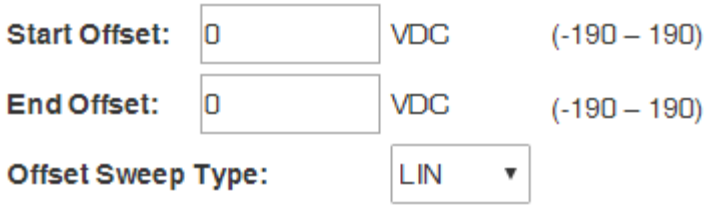
DC Signal Properties

Select the DC button from the Add Wave drop-down when you need to create a positive or negative DC output. Set the following properties to specify the characteristics of the DC output to be produced at the amplifier output:

DC Offset: The Start Offset and End Offset properties supply a constant positive or negative DC voltage. DC Offset is defined in Volts DC (VDC) as the unit of measure.

The allowable range for Start and End Offset is +/-200 VDC (with system gain set to 20). When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Offset Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.



Duration: The Duration property determines how long the waveform will be generated. Duration can be defined using the microsecond (us), millisecond (ms), second, (sec), minute (min) or hour (hour) as the unit of measure. When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure.

The maximum duration of a single segment is 1193 hours, and the minimum duration is 150 us. When the duration specified for the waveform has been completed, the 3110 will begin outputting the next waveform defined in the test. However, if a Trigger Control follows the just-completed waveform, and the Trigger Control's "Continue Prev. Wave" property is set to TRUE, the waveform before the Trigger Control will continue indefinitely, regardless of the duration time set in that waveform's properties.

If no additional waveform has been defined to follow the completed waveform, the system output will stop.

Triangle Wave Properties

A Triangle Wave created in the SWG makes use of the 3110's arbitrary waveform generator to generate the desired waveform. Select the Triangle button from the Add Waveform drop-down when you need to create an audio-frequency sinusoidal waveform (DC to 20 kHz).

Set the following properties to specify the characteristics of the triangle wave to be produced at the amplifier output:

Amplitude: The Start Amplitude and End Amplitude properties determine the height of the triangle wave from the zero-crossing point to the peak value, measured in volts. Amplitude can be defined using the unit Volts peak (Vp), Volts peak-to-peak (Vpp) or Volts root-mean-square (Vrms). When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure. The units of measure used for Start Amplitude and End Amplitude do not need to be the same.

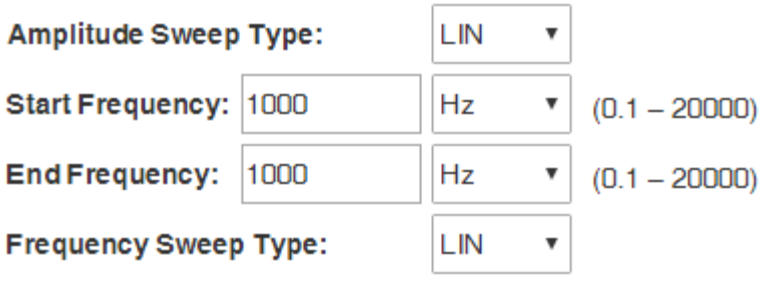
The values for both Start and End Amplitude can be positive or negative, and the allowable range for these values will be determined by the SWG based on the System Calibration settings (for more information, see the topic *"System Calibration"*). The default allowable range is +/-200Vp (with system gain set to 20). When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Amplitude Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.

Frequency: The Start Frequency and End Frequency properties determine the frequency of the triangle wave in cycles per second (Hertz). Frequency can be defined using Hertz (Hz) or Kilohertz (kHz) as the unit of measure. When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure. The units of measure used for Start Frequency and End Frequency do not need to be the same.

The allowable range for Start and End Frequency is 0.1 Hz to 20 kHz. When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Frequency Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.

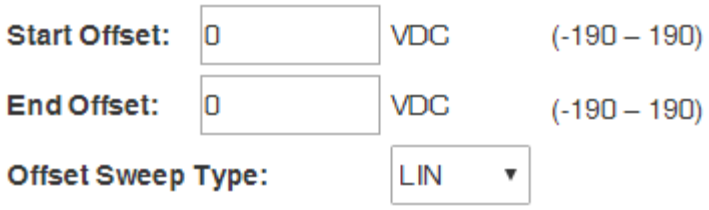


DC Offset: The Start Offset and End Offset properties supply a constant positive or negative DC voltage on the triangle

wave. DC Offset is defined in Volts DC (VDC) as the unit of measure.

The allowable range for Start and End Offset is +/-200 VDC (with system gain set to 20). When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Offset Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.



Phase Offset: The Phase Offset property determines the beginning offset of the waveform within the cycle. Phase Offset can be defined using degrees (deg) or radians (rad) as the unit of measure.

The allowable range for Phase Offset is 0 to 359 degrees. When a value outside of the allowable range is entered, only the value greater than complete (360 degree) cycles will be set as the offset amount.

Duration: The Duration property determines how long the waveform will be generated. Duration can be defined using the microsecond (us), millisecond (ms), second, (sec), minute (min) or hour (hour) as the unit of measure. When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure.

The maximum duration of a single segment is 1193 hours, and the minimum duration is 150 us. When the duration specified for the waveform has been completed, the 3110 will begin outputting the next waveform defined in the test. However, if a Trigger Control follows the just-completed waveform, and the Trigger Control's "Continue Prev. Wave" property is set to TRUE, the waveform before the Trigger Control will continue indefinitely, regardless of the duration time set in that waveform's properties.

If no additional waveform has been defined to follow the completed waveform, the system output will stop.

Square Wave Properties

A Square Wave created in the SWG makes use of the 3110's arbitrary waveform generator to generate the desired waveform. Select the Square button from the Add Waveform drop-down when you need to create an audio-frequency sinusoidal waveform (DC to 20 kHz).

Set the following properties to specify the characteristics of the square wave to be produced at the amplifier output:

Amplitude: The Start Amplitude and End Amplitude properties determine the height of the square wave from the zero-crossing point to the maximum value, measured in volts. Amplitude can be defined using the unit Volts peak (Vp), Volts peak-to-peak (Vpp) or Volts root-mean-square (Vrms). When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure. The units of measure used for Start Amplitude and End Amplitude do not need to be the same.

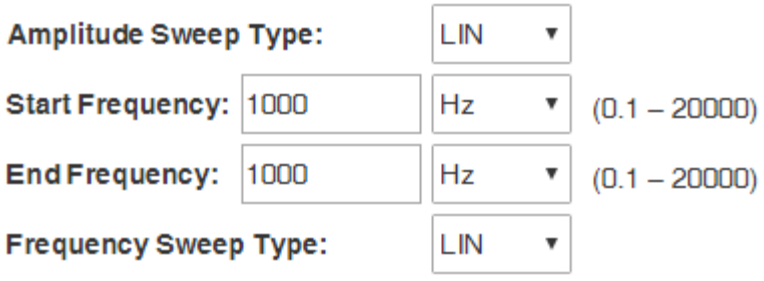
The values for both Start and End Amplitude can be positive or negative, and the allowable range for these values will be determined by the SWG based on the System Calibration settings (for more information, see the topic *"System Calibration"*). The default allowable range is +/-200Vp (with system gain set to 20). When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Amplitude Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.

Frequency: The Start Frequency and End Frequency properties determine the frequency of the square wave in cycles per second (Hertz). Frequency can be defined using Hertz (Hz) or Kilohertz (kHz) as the unit of measure. When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure. The units of measure used for Start Frequency and End Frequency do not need to be the same.

The allowable range for Start and End Frequency is 0.1 Hz to 20 kHz. When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Frequency Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.

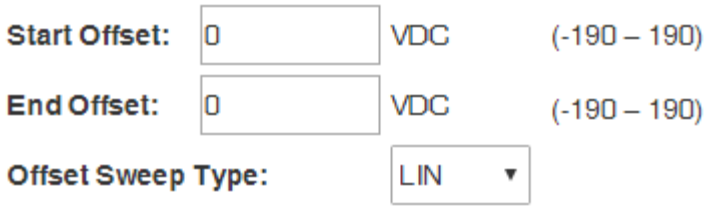


DC Offset: The Start Offset and End Offset properties supply a constant positive or negative DC voltage on the square

wave. DC Offset is defined in Volts DC (VDC) as the unit of measure.

The allowable range for Start and End Offset is +/-200 VDC (with system gain set to 20). When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Offset Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.



Phase Offset: The Phase Offset property determines the beginning offset of the waveform within the cycle. Phase Offset can be defined using degrees (deg) or radians (rad) as the unit of measure.

The allowable range for Phase Offset is 0 to 359 degrees. When a value outside of the allowable range is entered, only the value greater than complete (360 degree) cycles will be set as the offset amount.

Duration: The Duration property determines how long the waveform will be generated. Duration can be defined using the microsecond (us), millisecond (ms), second, (sec), minute (min) or hour (hour) as the unit of measure. When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure.

The maximum duration of a single segment is 1193 hours, and the minimum duration is 150 us. When the duration specified for the waveform has been completed, the 3110 will begin outputting the next waveform defined in the test. However, if a Trigger Control follows the just-completed waveform, and the Trigger Control's "Continue Prev. Wave" property is set to TRUE, the waveform before the Trigger Control will continue indefinitely, regardless of the duration time set in that waveform's properties.

If no additional waveform has been defined to follow the completed waveform, the system output will stop.

Sawtooth Wave Properties

A Sawtooth Wave created in the SWG makes use of the 3110's arbitrary waveform generator to generate the desired waveform. Select the Sawtooth button from the Add Waveform drop-down when you need to create an audio-frequency sinusoidal waveform (DC to 20 kHz).

Set the following properties to specify the characteristics of the sawtooth wave to be produced at the amplifier output:

Amplitude: The Start Amplitude and End Amplitude properties determine the height of the sawtooth wave from the zero-crossing point to the peak value, measured in volts. Amplitude can be defined using the unit Volts peak (Vp), Volts peak-to-peak (Vpp) or Volts root-mean-square (Vrms). When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure. The units of measure used for Start Amplitude and End Amplitude do not need to be the same.

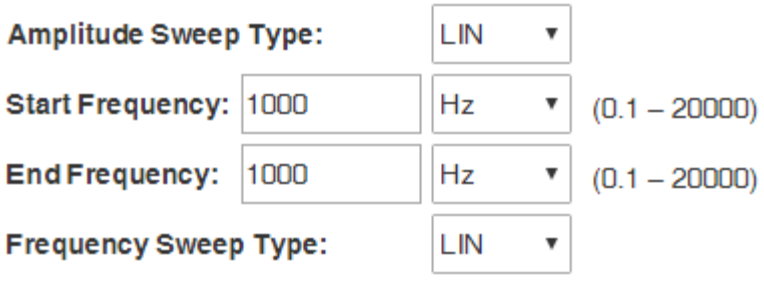
The values for both Start and End Amplitude can be positive or negative, and the allowable range for these values will be determined by the SWG based on the System Calibration settings (for more information, see the topic *"System Calibration"*). The default allowable range is +/-200Vp (with system gain set to 20). When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Amplitude Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.

Frequency: The Start Frequency and End Frequency properties determine the frequency of the sawtooth wave in cycles per second (Hertz). Frequency can be defined using Hertz (Hz) or Kilohertz (kHz) as the unit of measure. When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure. The units of measure used for Start Frequency and End Frequency do not need to be the same.

The allowable range for Start and End Frequency is 0.1 Hz to 20 kHz. When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Frequency Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.

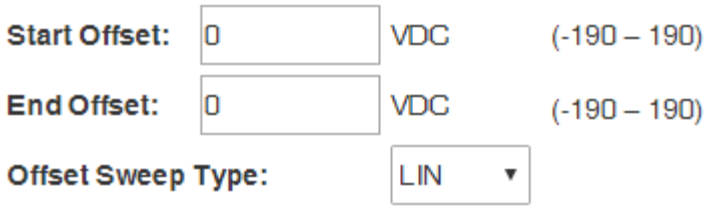


DC Offset: The Start Offset and End Offset properties supply a constant positive or negative DC voltage on the sawtooth

wave. DC Offset is defined in Volts DC (VDC) as the unit of measure.

The allowable range for Start and End Offset is +/-200 VDC (with system gain set to 20). When a value outside of the allowable range is entered, the input box will turn red and an error message will be displayed.

Offset Sweep Type: A Sweep can be Linear, Logarithmic or Exponential. Choose the desired sweep type from the drop-down.



Phase Offset: The Phase Offset property determines the beginning offset of the waveform within the cycle. Phase Offset can be defined using degrees (deg) or radians (rad) as the unit of measure.

The allowable range for Phase Offset is 0 to 359 degrees. When a value outside of the allowable range is entered, only the value greater than complete (360 degree) cycles will be set as the offset amount.

Duration: The Duration property determines how long the waveform will be generated. Duration can be defined using the microsecond (us), millisecond (ms), second, (sec), minute (min) or hour (hour) as the unit of measure. When the unit of measure is changed, the SWG automatically converts the property's value to the new unit of measure.

The maximum duration of a single segment is 1193 hours, and the minimum duration is 150 us. When the duration specified for the waveform has been completed, the 3110 will begin outputting the next waveform defined in the test. However, if a Trigger Control follows the just-completed waveform, and the Trigger Control's "Continue Prev. Wave" property is set to TRUE, the waveform before the Trigger Control will continue indefinitely, regardless of the duration time set in that waveform's properties.

If no additional waveform has been defined to follow the completed waveform, the system output will stop.

Trigger Control Properties

The Trigger Control will cause a a running test to pause and wait for an input that will cause the trigger to "release."

To create a trigger within a test, select the Trigger option from the Add Control drop-down menu in the SWG's active window. A Trigger icon will be added to the active test sequence. Drag the trigger icon until it is positioned where you want the trigger to occur within the test sequence. Select the Trigger tab and change the Trigger properties as required.

Trigger Type

Two types of input can be used: user or gpio.

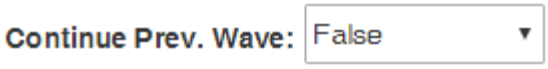
User Trigger: Select user trigger to enable a local action (eitiher pressing the Arrow (RUN) button in the 3110 active window or pressing the spacebar on the keyboard) to release the trigger.

GPIO Trigger: Select the GPIO Trigger option if you want an input signal received on one of the three GPIO ports to cause the trigger to be released. When GPIO Trigger is selected, three GPIO port controls are provided for selection. Choose a GPIO port that you have previously designated as a GPIO input during GPIO setup. See the help topic *"Settings* for more information.

After you have selected a GPIO monitor as "true," you will be prompted to choose the logic state (0 or 1) that will cause the trigger to be released.

Continue Prev. Waveform:

When the trigger is released, the 3110 controller will being generating the next waveform in the test sequence. While waiting for the trigger, the 3110 will continue to generate the waveform previous to the trigger control indefinitely until the trigger is released (default). To set the 3110 to not generate any signal between the end of the last waveform and the release of the trigger, set the Trigger's Continue Prev. Wave property to False.



Fixed Loop Control Properties

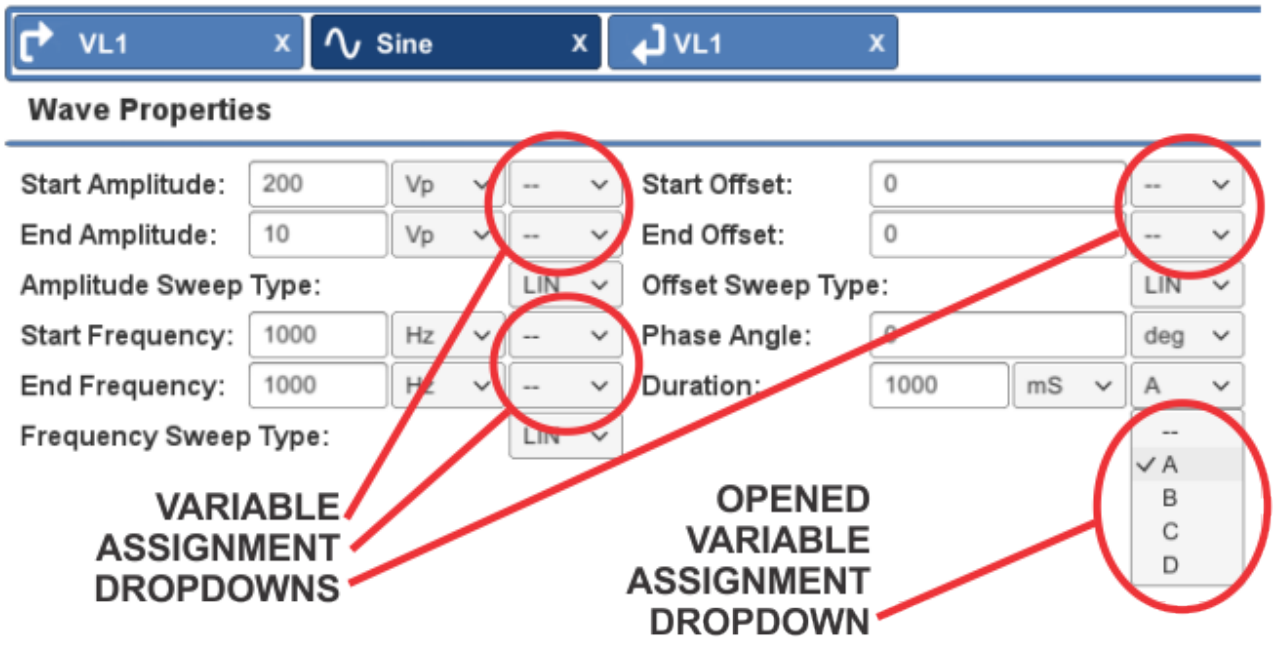
When one or more waveforms are positioned between the Fixed Loop Start control and Fixed Loop End control, those waveforms will be generated repeatedly. The number of times the waveforms will be repeated is determined by the Loop Count property found under the Fixed Loop Start tab.

To create a fixed loop within a test, select the Fixed Loop option from the Add Control drop-down menu in the SWG's active window. Two control icons, Fixed Loop Start and Fixed Loop End, will be added to the active test sequence. Drag the waveform(s) to be repeated so they are positioned between the Fixed Loop icons. Select the Fixed Loop Start tab and enter the desired number of loops in the Loop Count property.

Variable Loop Control Properties

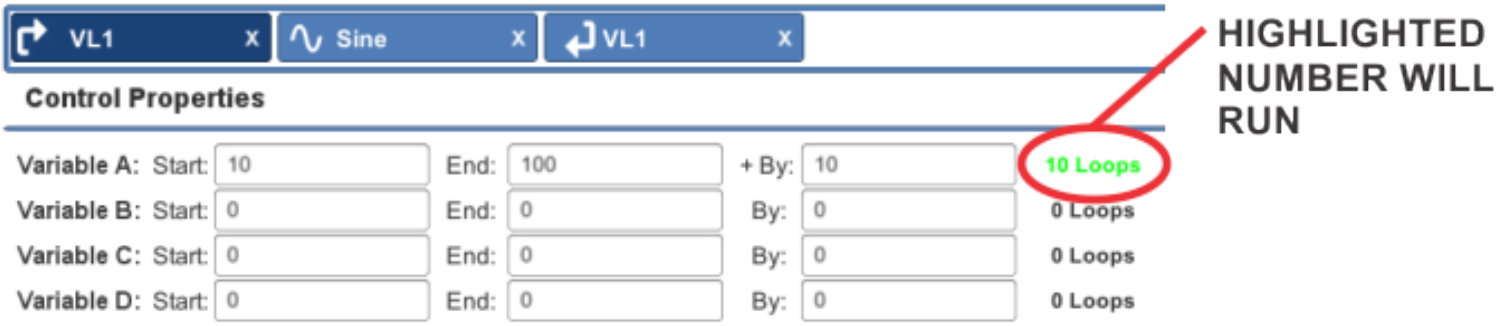
When one or more waveforms are positioned between the Variable Loop Start control and Variable Loop End control, those waveforms will be generated repeatedly with one or more changing variables. Up to four of the following properties can be set as variables within a single Variable Loop: Start Amplitude, End Amplitude, Start Frequency, End Frequency, Start Offset, End Offset, and Duration.

To create a variable loop within a test, select the Variable Loop option from the Add Control drop-down menu in the SWG's active window. Two control icons, Variable Loop Start and Variable Loop End, will be added to the active test sequence. Drag the waveform(s) to be looped so they are positioned between the Variable Loop icons. When a waveform is positioned between the two Variable Loop icons, the Properties tab for the waveform will be changed to provide additional drop-down lists to be used to assign variables within the Variable Loop.

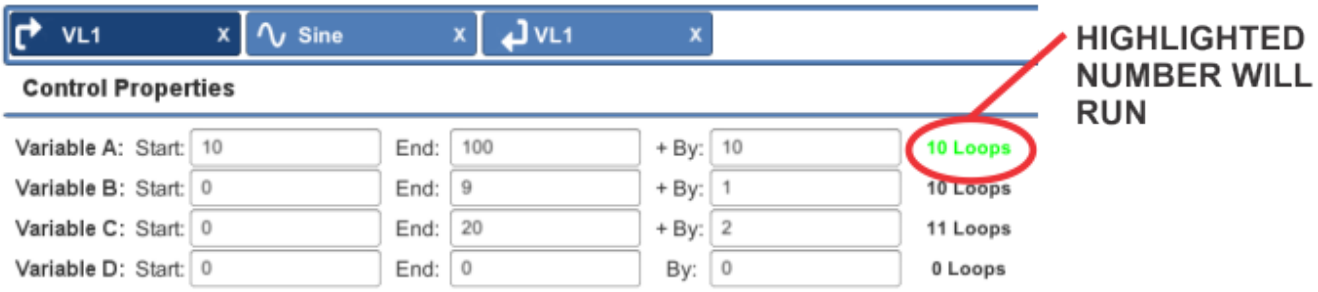


Find the waveform property to be varied within the loop, and then use the variable assignment drop-down to select a letter. After variable assignment, the input box for that property will be grayed to indicate its status as a variable. Check to make sure that the units being used for the property to be varied are the system default units (Vp for amplitude, Hz for frequency, VDC for offset, and ms for duration).

Next, open the Variable Loop Start tab and find the property controls for the variable letter you just assigned. In the Variable Start input box, enter the setting you want for that property at the beginning of the loop sequence (first loop). In the End input box, enter the setting you want for that property at the end of the loop sequence (last loop). Last, input the amount the variable should increase or decrease from one loop to the next. The SWG will calculate and display the total number of loops that will result.



Adding Additional Variables: Up to four different waveform properties can be assigned as variables within a Variable Loop control. When the properties set for variables will result in a different number of loops to be generated, the SWG will only generate the lesser number of loops. The actual number of loops to be generated will be highlighted on the Variable Loop Start tab.



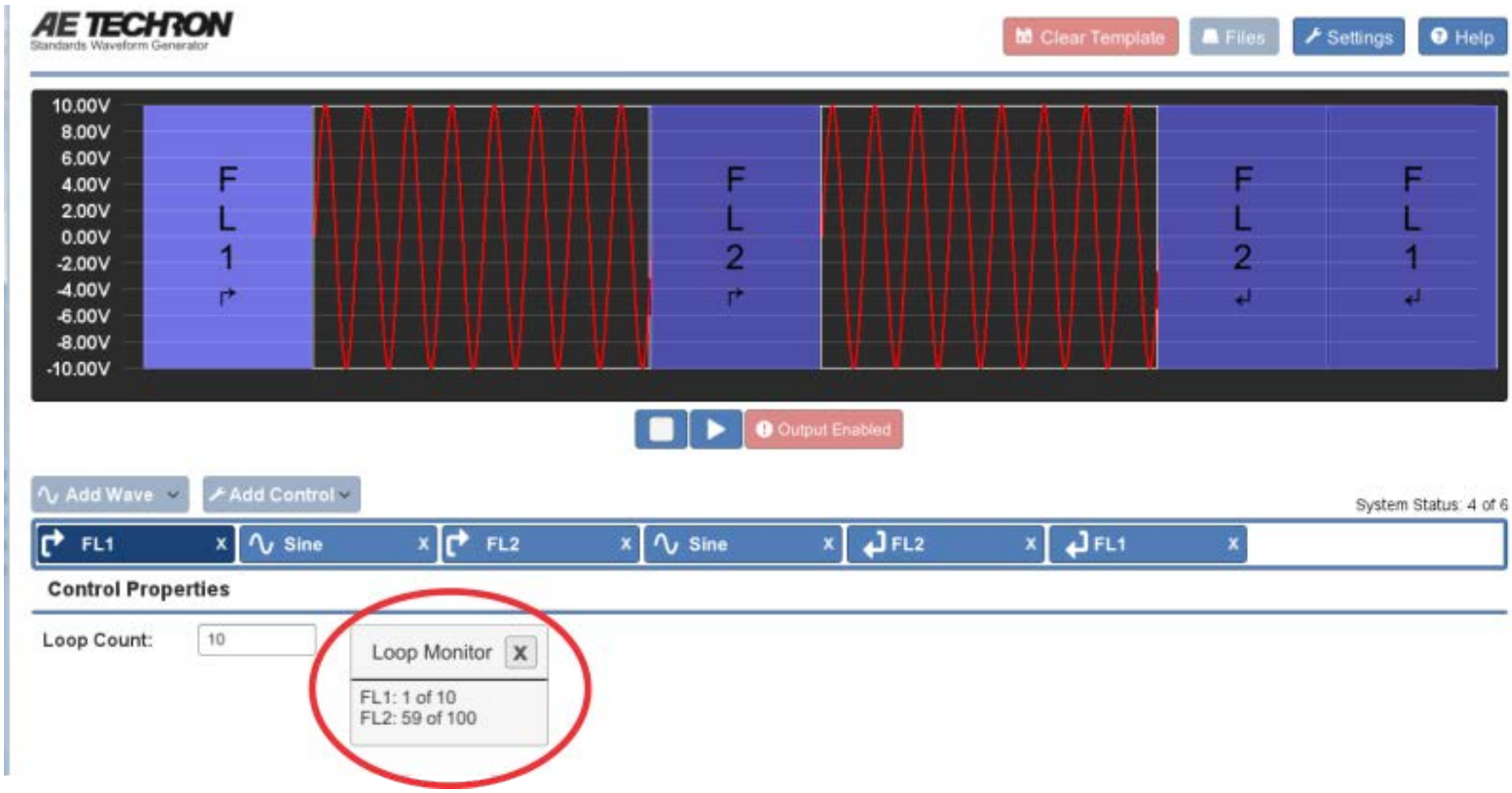
Once a variable has been created, it can be used on other waveforms contained within the Variable Loop, or on other properties within the same waveform, since the variables are independent of unit. For example, if variable A is defined as starting at 1000 and ending at 10,000 with an increment of 1000, this variable could be used to create a 10-loop repeat with starting frequencies from 1000 Hz to 10,000 Hz increasing in 1000 Hz increments, and variable A could also be used to create a 10-loop repeat with a duration increasing from 1000 ms on the first loop to 10,000 ms on the final loop.

Nested Controls: All Wave Controls (Trigger, Fixed Loop, Variable Loop and Template Playback) can be included within loop controls to become a part of the sequence. When a Variable Loop is included (nested) within another Variable Loop, a maximum of four different variables can be assigned between the two variable loops. Variables assigned in the outer loop are also available to the inner loop and can be reused. However, if the same variable letter is defined in both an outer and an inner Variable Loop, the variable assignment from the outer Variable Loop takes precedence and will be applied to all variables with the same letter assignment.

Loop Monitor

The Loop Monitor allows the user to track the status of the fixed and variable loops in any test sequence. To enable the Loop Monitor feature, complete the following steps:

1. Press the Settings button to open the Settings window and locate the Loop Monitor selection box on the Configuration tab. Check to box labeled "Show Loop Monitor Window During Playback." Press the SAVE button to save your selection.
2. Create or open the test to be monitored into the 3110's active window. Press the arrow button to start the test.
3. The Loop Monitor Window will appear in the 3110 active window and display the loops contained in the test sequence, displaying the number of completed loops out of the total loops required to complete the sequence.



Note that the Loop Monitor window can be dragged to another location on the screen, if desired.

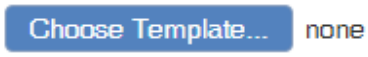
If the test sequence is stopped, the loop monitor count will also be stopped. If the test is restarted, the loop monitor count will be reset to the beginning of the count.

Use the X in the upper right of the Loop Monitor window to close the window. Note that this will also prevent the Loop Monitor window from opening for this or other tests until the Loop Monitor check box is selected again on the Configuration tab in the Settings window.

Template Control Properties

Use the Template Control when you want to link two or more pre-programmed tests from the Standards Library, or when you want to incorporate a pre-programmed test into a custom test routine you have created. Template controls can be inserted (nested) within Fixed and Variable Loop controls. Template controls inserted into a Variable Loop should first be reviewed by opening the test from the Standards Library. Make note of any variables that have already been assigned in the pre-programmed test to avoid assigning the same variable letter within the Variable Loop.

To load a Template using the Template control into a test, select the Template option from the Add Control drop-down menu in the SWG's active window. A Template icon will be added to the active test sequence. Select the Template tab and press the Choose Template... button to open the file selection dialog box. Locate the .swg file for the test desired, and then double-click on the file name to add it to the Template control. Or you can click on the file name to select the .swg file, and then press the Open button in the file selection dialog to add the test to the Template control.



When a test has been added to a Template control, the file name will appear in the Template properties tab. An Open button is available to allow the associated test to be loaded into the active window. Loading the test into the active window will clear any waveforms or controls currently in the active window. A confirmation dialog also provides the opportunity to save the current active window before opening the Template.

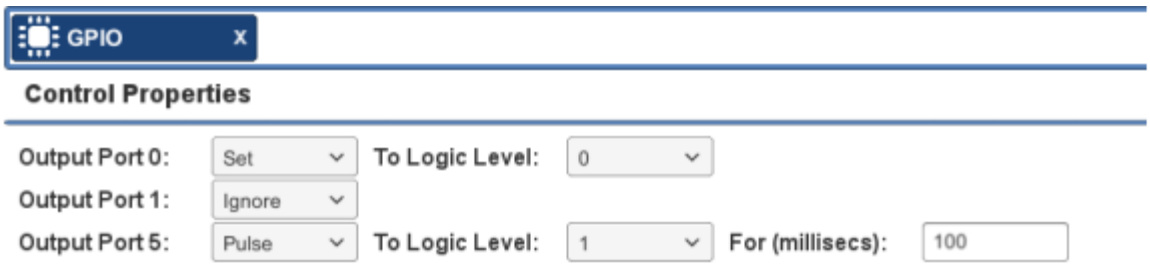
GPIO Output Control Properties

Use the GPIO Output Control to send a signal through the GPIO-enabled pins on the 3110's DB-15 and DB-9 connectors when the GPIO Output is played as part of a test sequence.

Before configuring the GPIO Output Control, first configure each GPIO port to function as an input or an output using the GPIO Setup controls on the Configuration tab located under Settings. See the help topic *"Settings"* for more information.

If a GPIO port has been configured as an input in the GPIO Setup controls, that port can be used as a GPIO Trigger only, so you must set that Output Port to **Ignore** (no signal) on the GPIO Output control properties. If one or more GPIO ports has been configured as an output in the GPIO Setup controls, you can configure the GPIO Output segment to send a signal on that port, or you can set the port to "ignore," if desired.

Each GPIO port configured as an output can be set to send a signal when the GPIO Output segment is played as part of a test sequence. The signal type can be configured as **Set** (a continuous signal of 0 or 1), or **Pulse** (a pulseed signal of 0 or 1 for a specified number of milliseconds).



Files

The Files button opens the Files window, which provides access to the 3110 controller's file system, including the Standards library and the User Standards directory.

The **Standards library** contains the .swg (Standards Waveform Generator) files for a variety of EMC Standards' tests. The Standards' test files are separated into the main categories, Automotive and Aviation, and organized in sub-directories by Standard. The Standards library also contains a Factory Test and Setup directory, which contains test routines that may be required during factory or on-site troubleshooting. All files contained in the Standards library are Read-Only.

The **User Standards** directory is a write-able storage space to be used to store user-created custom tests and test variations. Files saved in the User Standards directory can be copied, altered and deleted. Subdirectories can be added to the User Standards directory.

To open a pre-programmed .swg file, open the Files window and double-click on the Standard's Library directory (or use the Open button), and then locate the test to be used. Double-click on the test name to load the file into the SWG's active window.

Once loaded, simply press the Arrow button to begin generating the required waveform sequence. You can also add or remove individual waveforms and controls from the test sequence, or make changes to the properties of a waveform or control, and then save the modified test in the User Standards directory for later use.

The following functions are available in the Files window:

Go Back: Press the Go Back button to display the files and/or folders one level higher in the 3110's file system hierarchy.

Open: Press the Open button to open the selected folder or file. When a folder is opened, the files and/or folders one level lower in the file system hierarchy will be shown in the Files window. When a file is selected, pressing the Open button will cause the file to be loaded into the 3110's active window. Double-clicking on a folder or file in the Files window will also function the same as pressing the Open button.

Delete: Press the Delete button to delete the selected folder(s) or file(s). Confirmation is required before the delete action is completed. Click on additional folder or file names to select multiple items for deletion. Click on a selected item again to clear that item from selection. To clear all selected items, use the Clear Selection button.

New Folder: Press the New Folder button to create a new folder in the User Standards directory. The new folder will be created at the level currently displayed in the Files window.

Deselect All: Press the Deselect All button to deselect all selected items. To deselect individual selected items, click again on the selected item.

Save As: Press the Save As button to save the test sequence displayed in the active window as a Standards Waveform Generator (.swg) file. Navigate first to the location in the User Standards directory where you want to save the file. The file will be saved at the level currently displayed in the Files window.

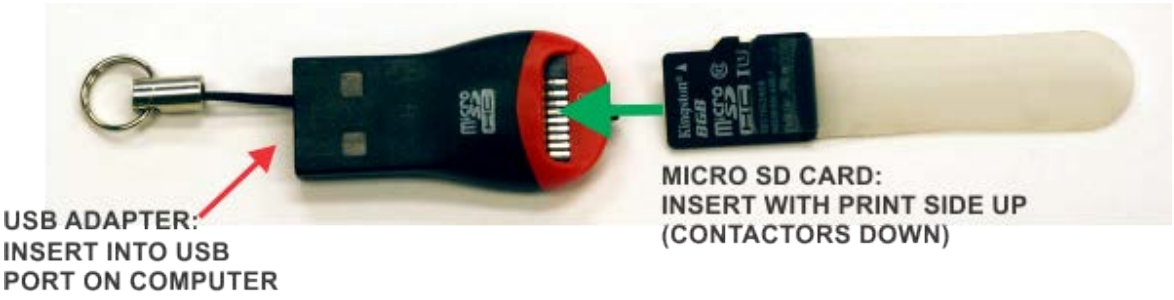
Copy: Use the copy button to make a copy of an .swg file located in the 3110's internal storage. Click on an .swg file to select, and then press the Copy button to copy the file into the 3110's temporary memory.

Cut: Use the cut button to cut an .swg file located in the 3110's User Standards directory. Click on an .swg file to select, and

then press the Cut button remove the file from its storage location in the User Standards directory and copy the file into the 3110's temporary memory. Note that .swg files located in the Standards library cannot be cut.

Paste: Press the paste button to paste .swg file from the 3110's temporary memory into the current location in the User Standards directory. Note that .swg files cannot be pasted into the Standards library.

SDCARD: The 3110 ships with a microSD card with extension tab (attached) and a USB adapter.



The microSD card contains the SWG Setup.exe file that is used to install the remote access SWG program on a Window's computer. For more information, see the topic *"3110 via Network."*

The microSD card also can be used to create a backup of the .swg files stored in the 3110 and to move .swg files created on a Windows computer running in Demo Mode to the 3110 for use. See the topic *"Working in Demo Mode."*

In addition, the microSD card is used to update the 3110 Controller. See the topic *"Updating the 3110"* for more information.

The SDCARD directory will be visible at the top level of the Files window when working directly on the 3110 or when accessing the 3110 remotely. However, the SDCARD directory will not appear when working in Demo Mode.

The SDCARD directory can only be opened when the microSD card has been inserted into the card slot labeled "Memory Card" located on the 3110 back panel. Be careful when installing the card. The card must be inserted with the printed side UP. The card also must be inserted in a straight line directly into the card slot. If the card is inserted at an angle, it may miss the internal card slot and be inaccessible from your 3110 unit. If the card is inserted, but the SDCARD directory still cannont be opened, check the card's installation. It may have missed the internal docking slot or it may not be completely inserted into the card slot.

Clear Template: Press the New Template button to clear all waveform and control segments currently loaded in the active window. Confirmation is required before the active window will be cleared.

Settings

The Settings window contains four tabs that provide information and control settings for the 3110 controller.

Configuration

The Configuration tab allows the control for the loop monitor window to be toggled on and off, and also provides the controls for GPIO setup.

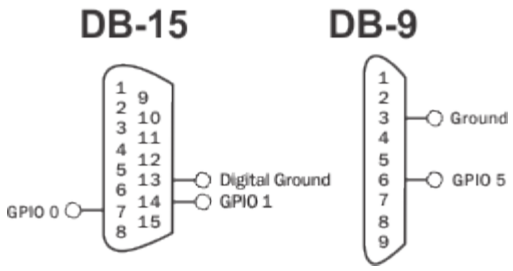
Loop Monitoring:

The Loop Monitoring checkbox turns the loop monitor window on or off. When the box is checked, the loop monitor window will be displayed during test playback. For more information about loop monitoring, see the topic *"Loop Monitoring."*

GPIO Setup:

The GPIO Setup checkboxes are used to configure the usage of the 3110's three dedicated GPIO ports. These ports can be accessed using the 3110's DB-15 connector using pins 7 and 14 (referenced to ground on pin 13), and the DB-9 connector using pin 6 (referenced to ground on pin 3).

IMPORTANT: The GPIO pins are tied directly to the microprocessor and are not isolated. Take care not to exceed maximum ratings as permanent damage can occur. We highly recommend optical isolation (opto-coupler, solid state relay, etc.) be used on all GPIO pins before connecting to external equipment.



Each GPIO port can be configured as an Input or an Output.

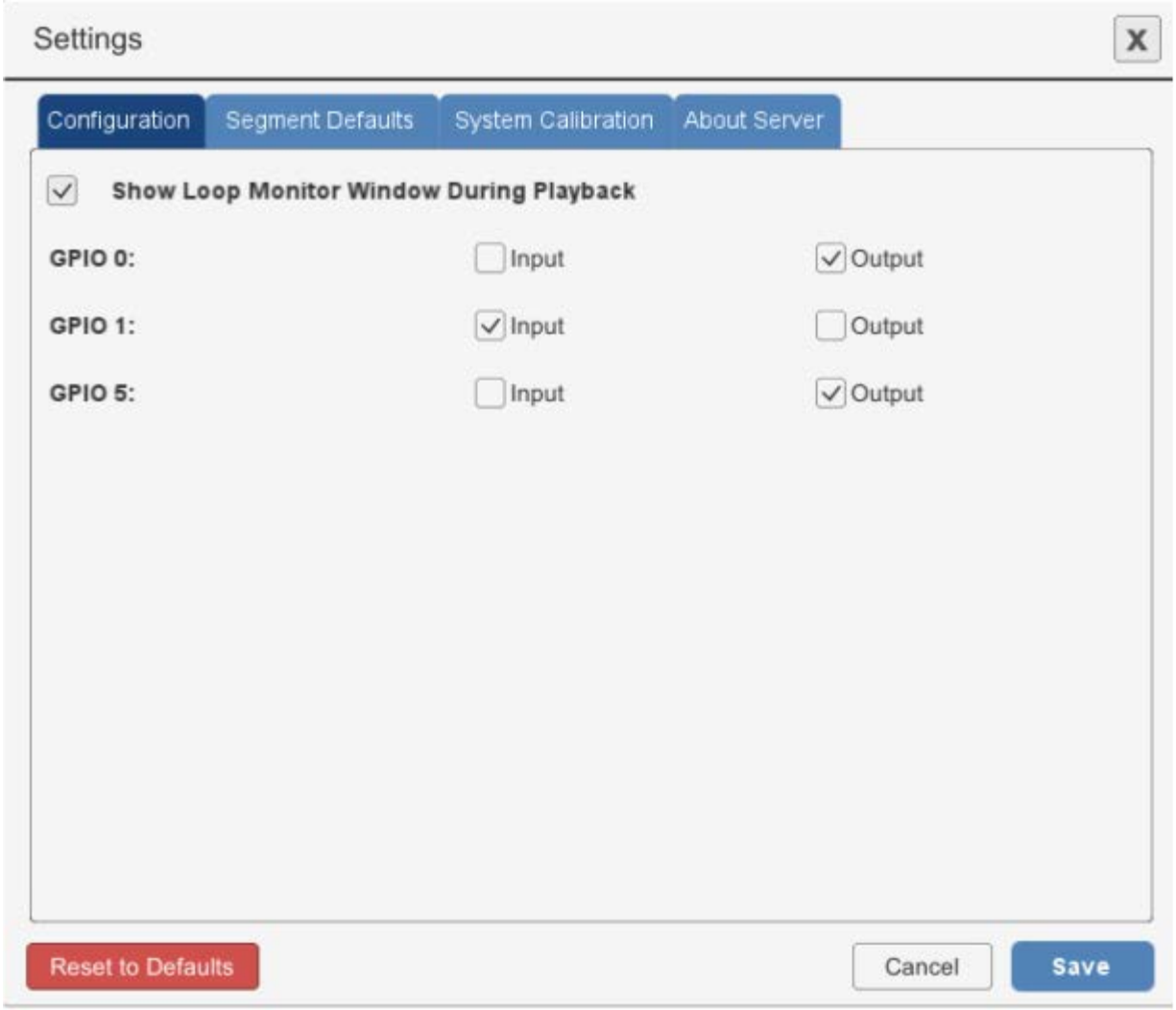
GPIO Input: When a GPIO port is configured as an input, it can be used in a GPIO Trigger segment. When a GPIO Trigger segment is reached in a test sequence, the 3110 will will pause and wait for the specified signal to be received on the designated GPIO port. When the signal is received, the test sequence will continue with the next segment following the trigger. NOTE: Only one GPIO port should be configured as an Input for use as a Trigger.

The electrical characteristics of a GPIO port when programmed as an input:
Voltage: Logic 0 = 0VDC; Logic 1 = 3.3VDC
Impedance: =>10 Mohm

GPIO Output: When a GPIO port is configured as an output, it can be used in a GPIO Output segment. When a GPIO Output segment is reached in a test sequence, the specified signal(s) will be sent through the GPIO port(s) designated in the GPIO Output segment. NOTE: Up to three GPIO ports can be configured as Outputs for use in one or more GPIO Output segments.

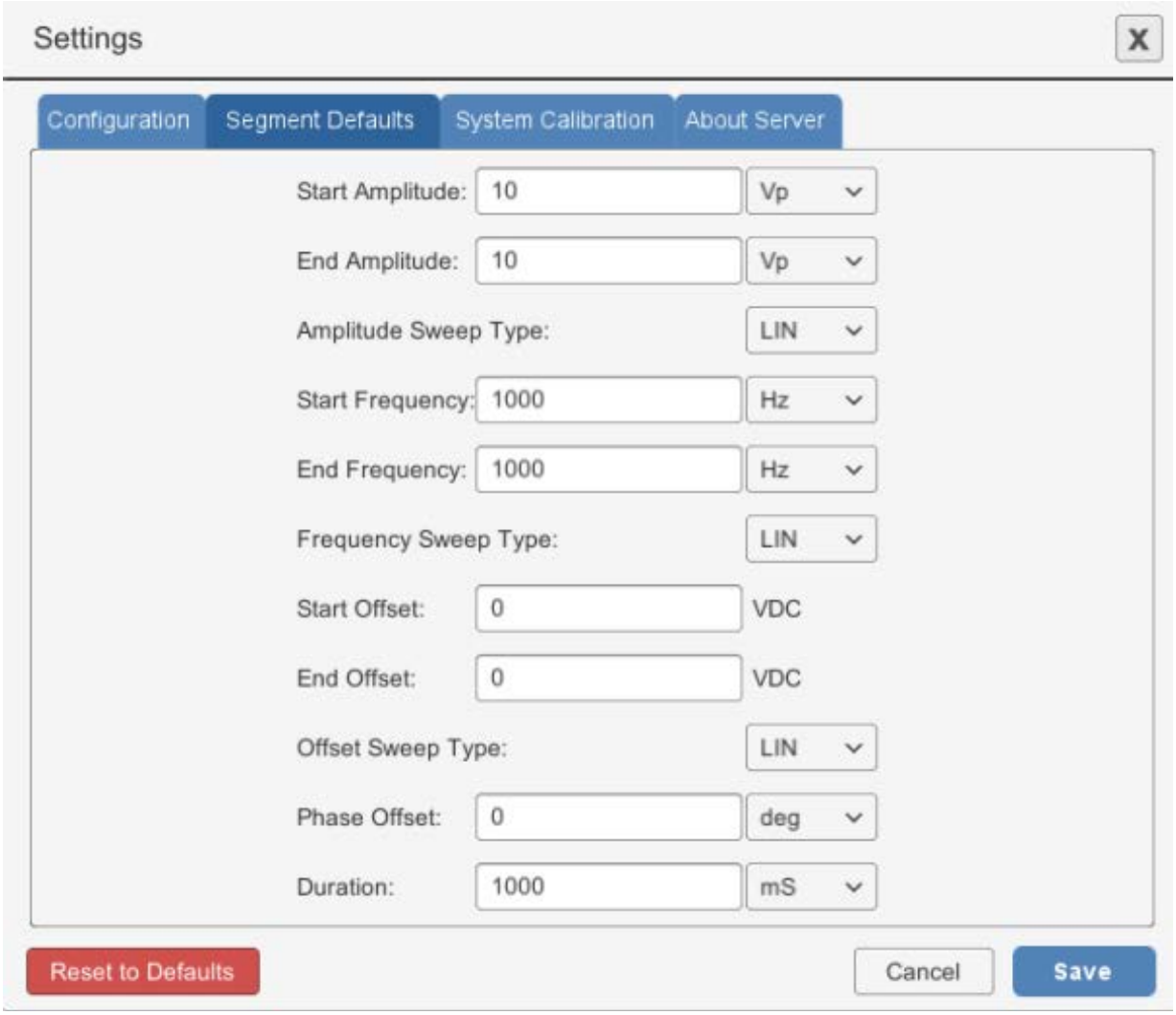
The electrical characteristics of a GPIO port when programmed as an output:
Voltage: Logic 0 = 0VDC; Logic 1 = 3.3VDC
Max Current Drive: >20 mA

After assigning the pins as required for your use or application, press the Save button to save the settings. and then use the corresponding pins to program a GPIO Trigger or GPIO Output segment. For more information about GPIO triggers and output segments, see the topics *"Trigger Control"* or *"GPIO Output Control."*



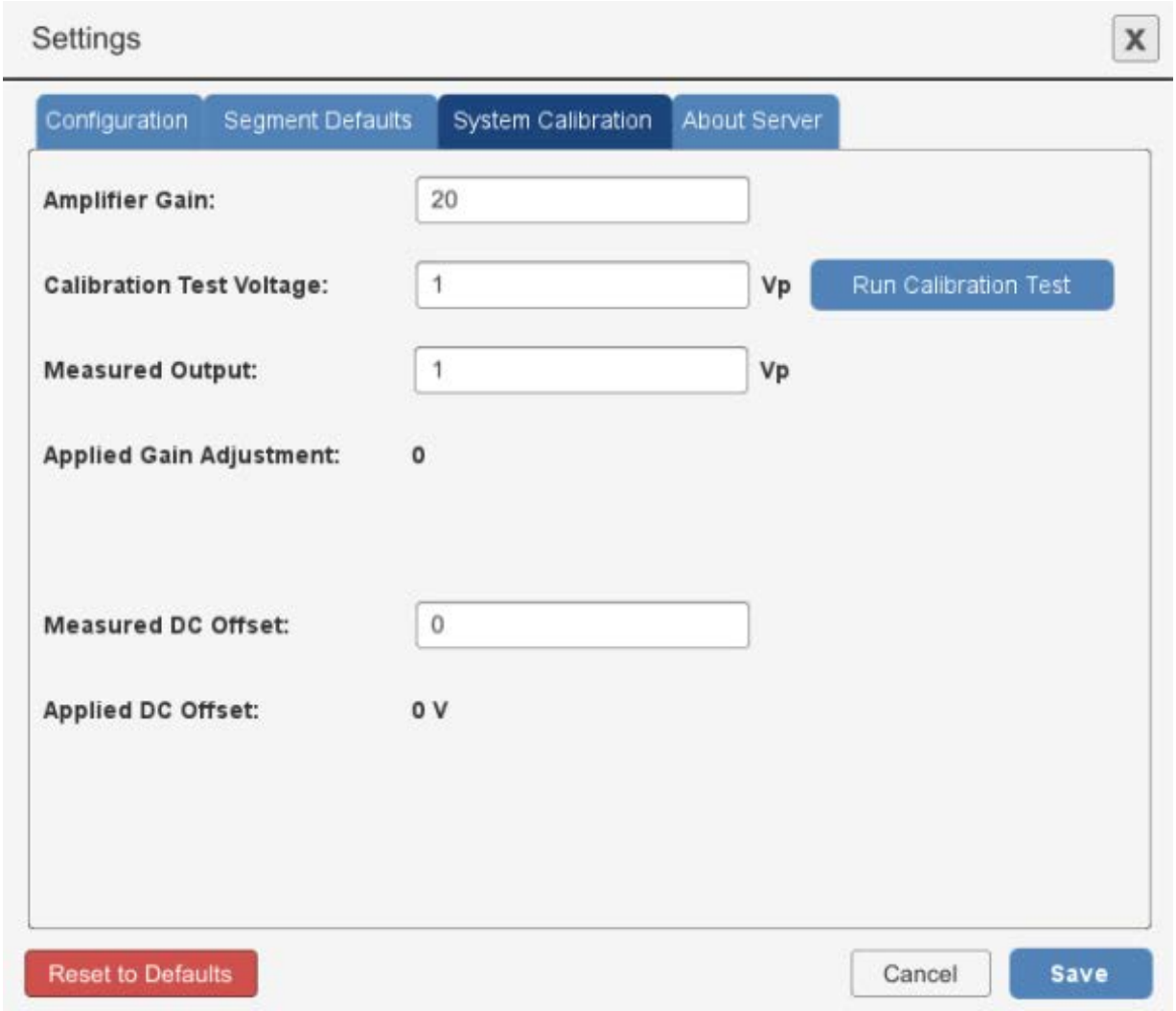
Segment Defaults

The Segment Defaults tab contains the default settings for SWG waveforms. When a new waveform is added into the active window, the initial waveform properties will be determined by these default settings. To change a default setting, select the input box for that setting, and then type the new setting into the text box or select the new value from the dropdown window. Select Save to save the new settings and close the Settings window. To return all Segment Default settings to the factory defaults, select the Reset to Defaults button.



System Calibration

The System Calibration tab holds information about the output generated by the combined 3110 controller/amplifier system. Both system gain and system DC offset information are used by the SWG to adjust its signal output to produce the expected signal at the amplifier output. By default, the SWG sets the system gain at 20 and DC offset at 0, which are the typical settings for a single AE Techron amplifier as configured from the factory. For accurate operation, the actual gain and offset of your system should be tested by running the Calibration Test. See the *"System Calibration"* topic in these Help files for more information.



About Server

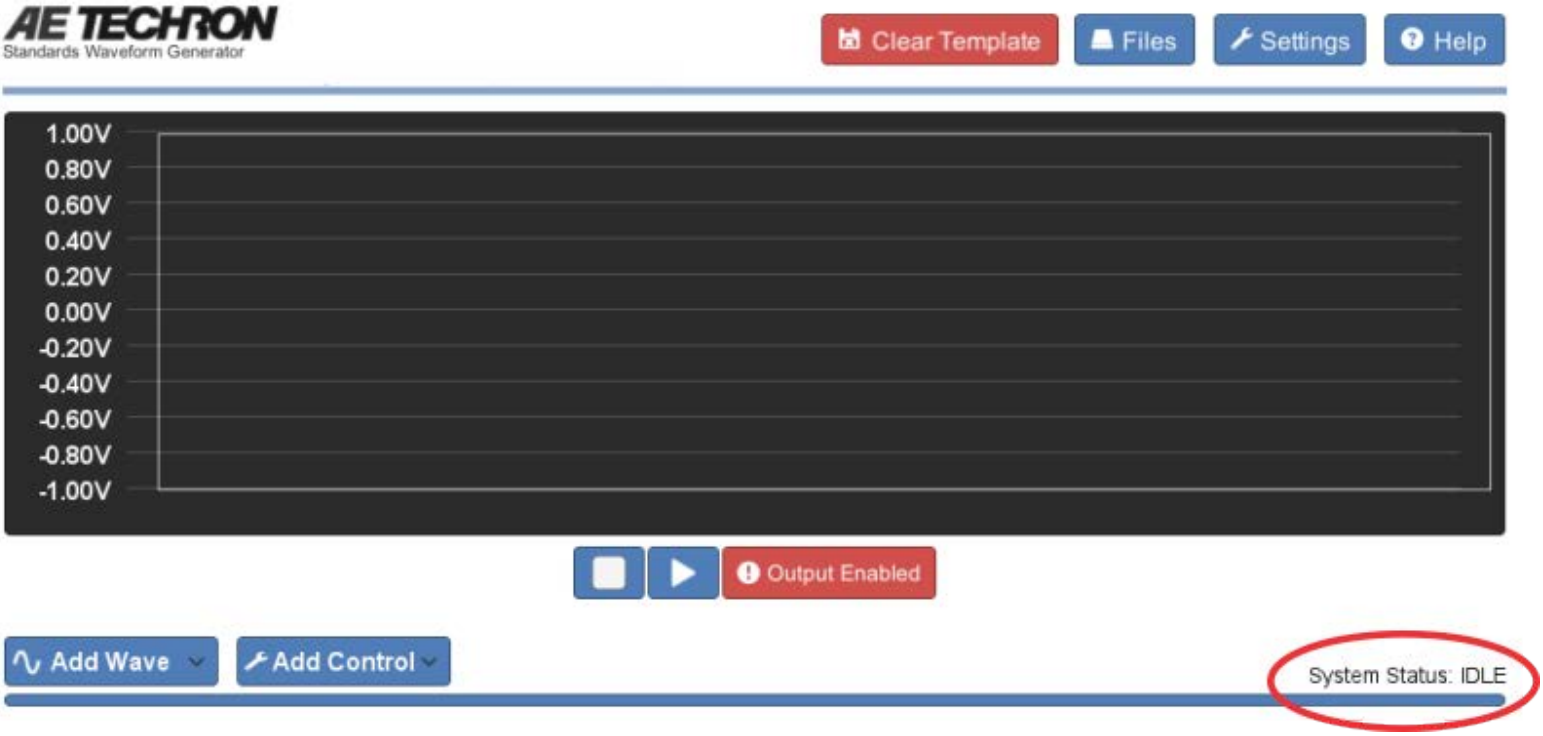
The About Server tab contains the 3110 controller version information for the Software and Firmware. It also displays the current IP address for the 3110. This information is automatically displayed and is used for diagnostic purposes.

Help

The Help button opens this electronic Help system within the SWG software. You can find additional helpful product information at the AE Techron website at www.aetechron.com.

System Status

System Status is reported as a system message located on the right side of the SWG's main window directly below the active test display. Under normal operation, the system will report its status as one of two states: Running or Idle.



Running: When the Arrow (RUN) button  is pressed, the test or wave sequence loaded in the active window will be sent to the 3110 controller, and it will begin generating signal starting with the waveform or control farthest to the left in the active window. The SWG's System Status should display '1 OF X' where X is the total number of waveform segments and controls included in the test sequence.

Idle: When the Stop button  is pressed, the 3110 controller will stop sending signal and the test will reset to the beginning of the first waveform or control. The SWG will report its status as 'Idle.' The SWG will also show its status as Idle at all times that a test is not actively running.

Troubleshooting

If the 3110 controller is not operating correctly, review the topics below for help with troubleshooting the problem. If the condition or error you are experiencing is not listed below, please contact AE Techron Technical Support at 574-295-9495 for additional help.

Enter the correct IP address in the Service Endpoint text box and then press Save to save the settings and close the Settings window.

PROBLEM: 3110 unit does not power on.
A: Check the connection to AC power, both at the AC source and at the back panel of the unit. Check the front-panel power switch to make sure the unit is in the ON position. A fuse located in a compartment above the back panel AC power connector protects the unit. Remove the compartment cover to access the fuse and replace the fuse if needed.

PROBLEM: Experiencing noise during testing.
A: Install the 6:1 attenuator provided with the 3110 Controller. Adjust the system gain as instructed to improve the system's signal-to-noise performance. See the Help topic *"Using the 6-to-1 Attenuator."*

PROBLEM: The SWG Windows Remote software will not load or will not connect remotely to the 3110 Controller; instead, an error message indicates a "version mismatch."
A: The 3110 Controller software and the Windows Remote software versions must match for successful interaction between the two modules. See the topic *"Updating the 3110"* for information about how to install new versions of these modules.

PROBLEM: SDCARD directory won't open or can't be found.
A: The SDCARD directory will be visible at the top level of the Files window when working directly on the 3110 or when accessing the 3110 remotely. However, the SDCARD directory will not appear when working in Demo Mode.

The SDCARD directory can only be opened when the microSD card has been inserted into the card slot labeled "Memory Card" located on the 3110 back panel. Be careful when installing the card. The card must be inserted with the printed side UP. The card also must be inserted in a straight line directly into the card slot. If the card is inserted at an angle, it may miss the internal card slot and be inaccessible from your 3110 unit. If the card is inserted, but the SDCARD directory still cannont be opened, check the card's installation. It may have missed the internal docking slot or it may not be completely inserted into the card slot.

3110 Calibration Guide

This section provides the guidelines for establishing the performance of key parameters for the 3110 output. It provides instructions for the measurement of the various output signals the 3110 can provide. Although the output of the 3110 can be adjusted via the gain settings, this feature is intended for use in calibrating the system (both the 3110 and the associated amplifier) and not for calibrating the output of the isolated 3110. For instructions on the calibration of a 3110/amplifier system, please see the Help topic *"System Calibration."*

For the calibration of an isolated 3110, tolerances and ranges will be provided for a variety of measurements. The results of the measurements will be essentially a "Pass" or "Fail." Tests conducted according to these instructions should be considered "functional tests" that are intended to confirm the function of the settings of the 3110. Since fine adjustment of the test system can be accomplished via the 3110/amplifier System Calibration, the calibration of the isolated 3110 will require only general instrumentation. The procedure should be carried out with the gain set at the anticipated gain to be used in testing. The default gain used in the assessment tables is 20.

Documentation

Standard SI units commonly found in electrical standard are used for checking the calibration of the 3110. The minimum requirements for calibration documentation are that the instruments used should be able to accurately measure the quantities in Table 1 within the tolerances provided. Instruments should bear evidence (via a label on the instrument or similar documentation) that the measuring instrument is calibrated. The table shown below is provided to record the performance of the 3110 in key areas, and to facilitate interaction with the AE Techron when needed.

ANSI Z540 or ISO 17205 calibration with documentation is available as an option.

Required Instruments

Instruments required are an oscilloscope and a digital multimeter. All measurements should be made into high-impedance instruments. The measurements outlined here do not require a probe. Using BNC connectors to both instruments is advised. It is assumed that the oscilloscope probe attenuation is set at 1X.

Best performance will be attained if the measuring instruments are either isolated (battery powered) or grounded at the same point with the 3110.

Instruments requirements are suggested requirements. Virtually any calibrated high impedance DMM and oscilloscope will serve. Observe any temperature corrections or other temperature based requirements for the measuring instruments.

Oscilloscope:
Bandwidth: 50 MHz, minimum
Sample Rate: 1 GS/sec minimum
Automatic Measurements: Frequency, RMS, Peak-to-Peak
Input Impedance (DC): 10M ohm

DMM:
Frequency Range: ±(% of reading + # of counts)
50 Hz to 10 kHz: 0.3 + 20
10 to 20 kHz: 1 + 40

20 to 100 kHz: 2 + 150
Impedance: Up to 20 M ohm over available ranges

Connections

Test connections are made from the front panel Signal Out BNC connector to the test instrument.
Cables and connectors having minimal insertion loss over the bandwidth (DC to 300 kHz) are required.
An amplifier may be connected to the 3110, but must be turned off during this series of tests.
No other peripheral connections will affect these tests.
Use common ground or isolated instruments, if possible. Select an environment with minimal radiated noise.

Temperature and run time: Allow the 3110 to run for 20 minutes in a quiescent state.

Settings and features not tested: Sweep functions, Control functions, Duration setting

Output Assessment

The assessment of a waveform consists of setting up the 3110 SWG user interface with the values as indicated for each waveform type listed on the far left of Table 1. The duration may be set for several seconds, or more depending on the triggering selected. The test varies voltage and, for alternating waveforms, a range of frequencies is given for each voltage level.

Set up the test waveforms in the "User Defined Standards" Directory

Procedure for Phase Testing

A. Create a 0 VDC segment of short duration (no more than a few seconds)

B. Insert a trigger (True) after the 0 VDC segment

C. Insert a ripple waveform with the following settings:

D. Recommended Vp = 20 Vp (Start and End)

E. f = 1 kHz

F. Offset = 0 V

G. Sweep = LIN (ALL settings)

For testing each phase shift, enter the value of the phase for each test and start the waveform running. With the oscilloscope trigger function set to capture the initiation of the ripple function, touch the space bar and measure the time from the start of the (truncated ripple to the end of the first cycle. Repeat for each of the phase values shown in Table 1.

Assessment Table

Notes:

G = 20.0 for all waveforms
Use 0 VDC for offset setting for varying waveforms
Sweep Type = LIN for all tests

Where applicable, frequency values should be within 2% of values selected

For the Square waveform, slew rate should be within 3 V/ms for each test

Waveform	Start/End Offset (V)	Frequency (kHz)	Measured Frequency (kHz)	Low Limit (V)	Measured (V)	High Limit (V)
DC	0	NA	NA	0.0		0.0
100	NA	NA	4.9		5.1	
200	NA	NA	9.9		10.1	
Ripple	Start/End Amplitude, Vp	Frequency (kHz)	Measured Frequency (kHz)	Low Limit (Vp)	Measured (V)	High Limit (Vp)
100	1		4.8		5.3	
10		4.8		5.3		
100		4.8		5.3		
300		3.5		3.6		
200	1		9.5		10.5	
10		9.5		10.5		
20		9.5		10.5		
Sawtooth	Start/End Amplitude, Vp	Frequency (kHz)	Measured Frequency (kHz)	Low Limit (V)	Measured (V)	High Limit (V)
100	1		4.8		5.3	
10		4.8		5.3		
20		4.8		5.3		
200	1		9.5		10.5	
10		9.5		10.5		
20		9.5		10.5		
Phase*	Start/End Vp = 20 V, f = 1 kHz	Phase Offset (°)	Measured Frequency (kHz)	Low Time (msec)	Measured Time (msec)	High Time (msec)
90	NA	735		765		
180	NA	490		510		
270	NA	245		255		

Table 1

*See procedure above.

If you have any questions, please contact AE Techron Technical Support at 574-295-9495.