



Operator's Manual

T3AWG3K Series

Simple TrueArb

Rev. 2.0.5

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General Safety Summary

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

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

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

Use Proper Power Cord

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

Ground the Product

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

Observe All Terminal Ratings

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

Power Disconnect

The power cord provides Mains disconnect.

Do Not Operate Without Covers

Do not operate this product with covers or panels removed.

Do Not Operate With Suspected Failures

If you suspect that there is damage to this product, have it inspected by qualified service personnel.

Avoid Exposed Circuitry

Do not touch exposed connections and components when power is present. Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Provide Proper Ventilation

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

Safety Requirements

This section contains information and warnings 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 safety precautions specified in this section.

Safety Symbols

Where the following symbols appear on the instrument's front or rear panels, or in this manual, they alert you to important safety considerations.



This symbol is used where caution is required. Refer to the accompanying information or documents in order to protect against personal injury or damage to the instrument.



This symbol warns of a potential risk of shock hazard.



This symbol is used to denote the measurement ground connection.



This symbol is used to denote a frame or chassis connection.



This symbol is used to denote a safety ground connection.



On (Supply). This is the DC power connect/disconnect switch at the back of the instrument.



Off (Supply). This is the DC power connect/disconnect switch at the back of the instrument.



This symbol is used to denote Power. It is located on the front panel and denotes Power On/Off status of the instrument.



This symbol is used to denote Direct Current.



This symbol is used to denote that the device connectors are sensitive to electrostatic discharge

CAUTION

The **CAUTION** sign indicates a potential hazard. It calls attention to a procedure, practice or condition which, if not followed, could possibly cause damage to equipment. If a **CAUTION** is indicated, do not proceed until its conditions are fully understood and met.

WARNING

The **WARNING** sign indicates a potential hazard. It calls attention to a procedure, practice or condition which, if not followed, could possibly cause bodily injury or death. If a **WARNING** is indicated, do not proceed until its conditions are fully understood and met.

CAT I

Installation (Overvoltage) Category rating per EN 61010-1 safety standard and is applicable for the instrument front panel measuring terminals. CAT I rated terminals must only be connected to source circuits in which measures are taken to limit transient voltages to an appropriately low level.

Environmental considerations

Product End-of-life Handling

Observe the following guidelines when recycling an instrument or component.

Equipment Recycling

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



The symbol shown to the left indicates that this product complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE).

Preface

This manual describes the installation and operation of Arb T3AWG-3K Series using the Simple TrueArb software. Basic operations and concepts are presented in this manual.

The easiest touch screen display interface allows to create waveforms scenarios, only in few screen touches.

In summary the True Arb technology provides AWG capabilities to the instrument where every data point is used to generate the output signal which has been stored in memory; the software architecture makes arbitrary waves easier to manipulate and more flexible once they've been created and it adds sequencing features to the instrument.

Package Contents

The standard T3AWG3K Series package includes the following:

- T3AWG325X or T3AWG335X Arbitrary Waveform Generator equipment
- Power Cord
- Performance/Calibration Certificate
- Quick Start Guide
- CE certificate

Recommended Accessories T3AWG3352/3252

Item	Description
T3AWG3-8DIG/T3AWG3-8DIG-UPGRADE	8 Bit digital outputs (requires LVDS cable)
T3AWG3-8DIG-TTL	LVDS to LVTTTL digital adapter probe
T3AWG3-8DIG-SMA	LVDS to SMA digital adapter cable
T3AWG3-8DIG-MSCAB	Digital output LVDS cable
T3AWG3-RACKMOUNT	Rack Mount Kit

Recommended Accessories T3AWG3354/3254

Item	Description
T3AWG3-16DIG-4CH/T3AWG3-16DIG-UPGRADE-4CH	16 Bit digital outputs (requires 2 x LVDS cables)
T3AWG3-8DIG-TTL	LVDS to LVTTTL digital adapter probe
T3AWG3-8DIG-SMA	LVDS to SMA digital adapter cable
T3AWG3-8DIG-MSCAB	Digital output LVDS cable

Recommended Accessories T3AWG3358/3258

Item	Description
T3AWG3-16DIG-8CH/T3AWG3-16DIG-UPGRADE-8CH	16 Bit digital outputs (requires 2 x LVDS cables)
T3AWG3-32DIG-8CH/T3AWG3-32DIG-UPGRADE-8CH	32 Bit digital outputs (requires 4 x LVDS cables)
T3AWG3-8DIG-TTL	LVDS to LVTTTL digital adapter probe
T3AWG3-8DIG-SMA	LVDS to SMA digital adapter cable
T3AWG3-8DIG-MSCAB	Digital output LVDS cable
T3AWG3-SYNC	SYNC accessories for T3AWG3K-8CH

Mechanical Characteristics

Model T3AWG3352-T3AWG3252

Net Weight	6.5 kg
Net Weight with Package	7 kg
Overall Dimensions	Height: 143 mm Width: 362 mm Depth: 258 mm

Model T3AWG3354-T3AWG3254

Net Weight	10 kg
Net Weight with Package	10.5 kg
Overall Dimensions	Height: 160 mm Width: 450 mm Depth: 340 mm

Model T3AWG3358-T3AWG3258

Net Weight	10.8 kg
Net Weight with Package	11.3 kg
Overall Dimensions	Height: 160 mm Width: 450 mm Depth: 340 mm

Key features

The following list describes some of the key features of the T3AWG335X and T3AWG325X

- High resolution, high sampling rate: 16 Bits, 1.2GS/s
- Best output frequency vs amplitude trades off: 350MHz, 48V voltage window
- 2 operating modes in the same instruments: Function Generator and Arbitrary Waveform Generator.
- Very long memory: up to 1 GSample per channel
- T3AWG3352/3252 Mixed signal generation: 2 analog output + 8 digital outputs (with T3AWG3-8DIG option)
- T3AWG3354/3254 Mixed signal generation: 4 analog output + 16 digital outputs (with T3AWG3-16DIG-4CH option)
- T3AWG3358/3258 Mixed signal generation: 8 analog output + 32 digital outputs (with T3AWG3-32DIG-8CH option)
- Simple touch screen user interface to create complex waveforms scenarios just in few screen touches
- Large 7 inch, 1024x600 capacitive touch LCD
- Touchscreen or Keypad data entering
- Windows 10 operating system
- USB and LAN interfaces
- Compact case size with the possibility of rack mounting in 3U

Operating Requirements

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

Place the instrument on a cart or bench, observing clearance requirements:

- Top: 20 mm (0.8 in)
- Left and right side: 150 mm (5.9 in)
- Bottom: 20 mm (0.8 in)
- Rear: 75 mm (3 in)

CAUTION. Ensure that the equipment is positioned in a way that the disconnecting device can be readily accessible.

The instrument is intended for indoor use and should be operated in a clean, dry, nonconductive environment. Occasionally a temporary conductivity that is caused by condensation must be expected.

This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.

Environmental requirements

Before using this product, ensure that its operating environment is maintained within these parameters:

Temperature	Operating +5 °C to +40 °C (+41 °F to 104 °F) Non-operating -20 °C to +60 °C (-4 °F to 140 °F)
Humidity	Operating 5% to 80% relative humidity with a maximum wet bulb temperature of 29 °C at or below +40 °C, non-condensing. Non-operating 5% to 95% relative humidity with a maximum wet bulb temperature of 40 °C at or below +60 °C, non- condensing.
Altitude	Operating 3,000 m (9,843 feet) Non-operating 12,000 m (39,370 feet)

Power supply requirements

WARNING. To reduce the risk of fire and shock, ensure that the mains supply voltage fluctuations do not exceed 10% of the operating voltage range.

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

Source Voltage and Frequency	100 to 240 VAC ±10% @ 45-66 Hz
Power Consumption	T3AWG3352/3252 Maximum: 100W T3AWG3354/3254 Maximum: 130W T3AWG3358/3258 Maximum: 150W



WARNING - Electrical Shock Hazard

Only use the power cord provided with your instrument

Cleaning

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

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

- Remove loose dust on the outside the instrument with a lint-free cloth. Use care to avoid scratching the front panel display.
- Use a soft cloth dampened with water to clean the instrument. Use a 75% isopropyl alcohol solution as a cleaner.

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

Calibration

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

Abnormal Conditions

Operate the instrument only as intended by the manufacturer.

If you suspect the instrument's protection has been impaired, disconnect the power cord and secure the instrument against any unintended operation.

The instrument's protection is likely to be impaired if, for example, the instrument shows visible damage or has been subjected to severe transport stresses.

Proper use of the instrument depends on careful reading of all instructions and labels.

WARNING

Any use of the instrument in a manner not specified by the manufacturer may impair the instrument's safety protection.

Protect Your Instrument from Misuse

Check Input and Output Connectors

When connecting a cable, be sure to distinguish the input connector from the output connectors to avoid making the wrong connection.



CAUTION. Do not short output pins or apply external voltages to Output connectors. The instrument may be damaged.

CAUTION. Do not apply excessive inputs over ± 15 Vpk to Trigger Input connector. The instrument may be damaged.

Installing your instrument

Unpack the instrument and check that you received all items listed in the Package Contents paragraph.

NOTE. The instrument does not ship with a product software CD. To reinstall the product software, follow the instructions in the paragraph "Obtaining the Latest Software Releases" to get the latest software release and the instructions in the paragraph "Install Simple TrueArb Application" to install the application.


Power the Instrument On and Off

Power On

- Insert the AC power cord into the power receptacle on the rear panel.



- Use the front-panel power button to power on the instrument.
- Wait until the system shows windows desktop.
- The Simple TrueArb software will start automatically if at the previous power off the instrument was working in TrueArb mode.

Alternatively push the TrueArb icon  to launch the application from the desktop or push the

Switch App button  to switch in TrueArb mode from another application.

Power Off

- Close the application in use.



- Press the front-panel power button  to power off the instrument.

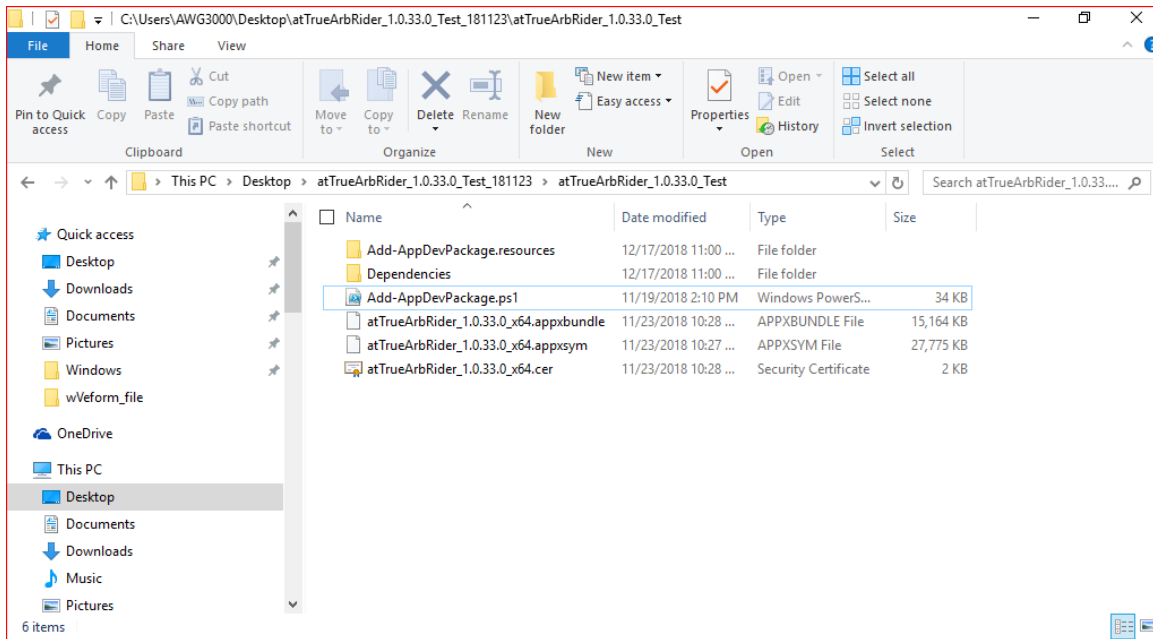
Obtaining the Latest Version Releases

The latest release of the software may not be installed on your instrument. The latest version could be found on Teledyne LeCroy website (www.teledynelecroy.com) in the support area.

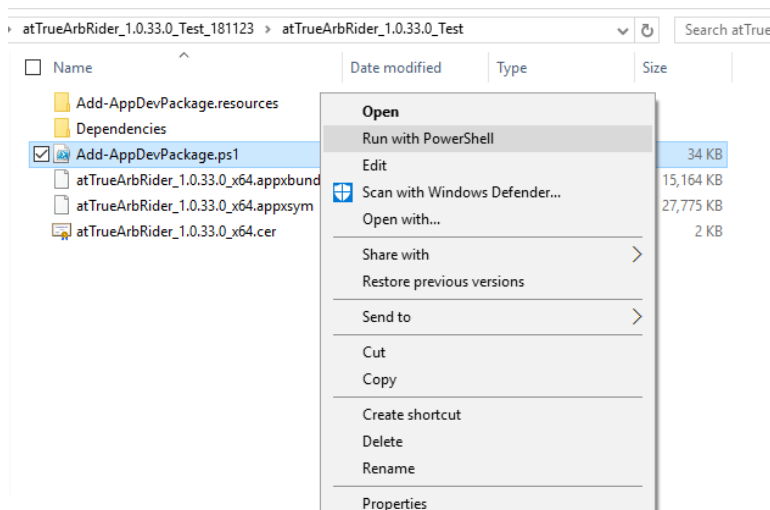
Install Simple TrueArb Application

If your instrument has already installed another version of the Simple TrueArb application, DO NOT uninstall it otherwise you will lose all the configurations and projects.

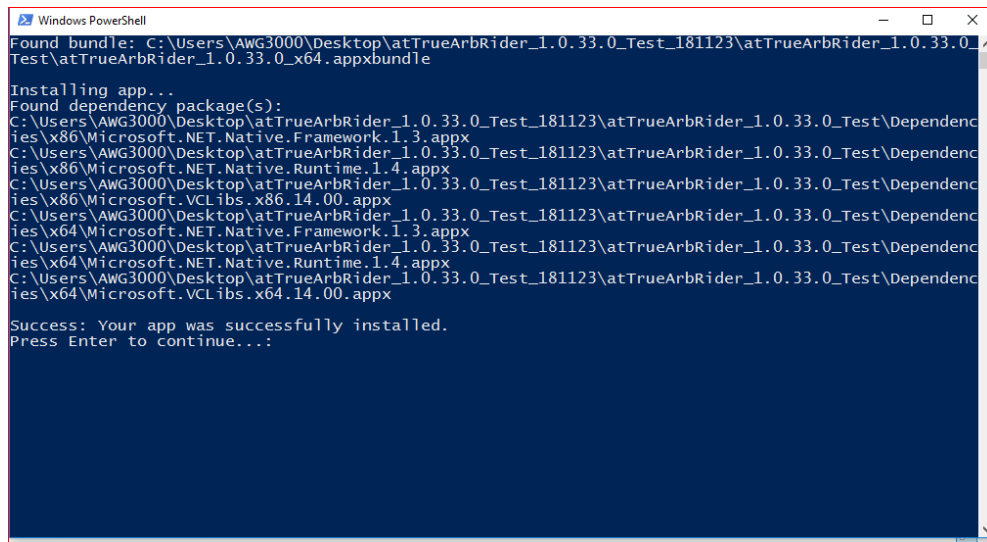
1. Download the Simple TrueArb setup package from Teledyne LeCroy website and decompress it to instrument's local disk.



2. Right click on the "Add-AppDevPackage.ps1" file and select **Run with PowerShell** to start the installation.



3. When the application has been installed, press the “Enter” button to continue.



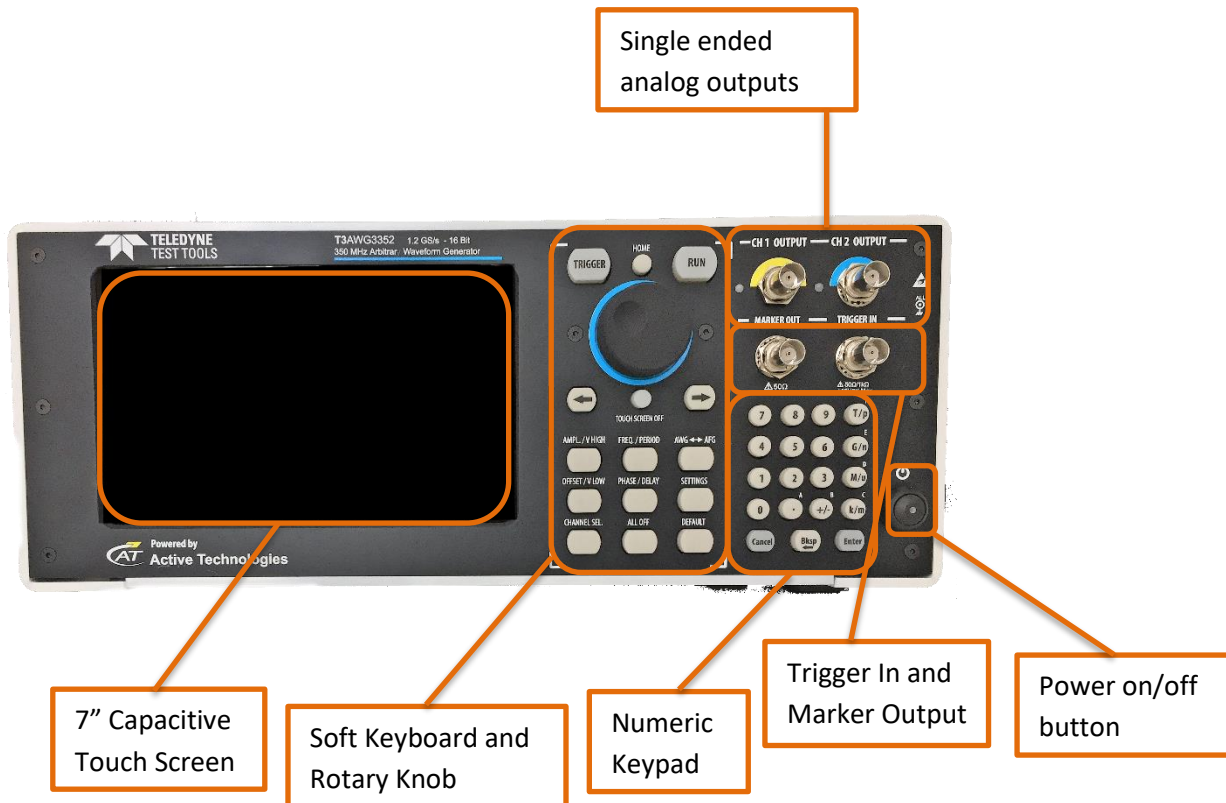
```
Windows PowerShell
Found bundle: C:\Users\AWG3000\Desktop\atTrueArbRider_1.0.33.0_Test_181123\atTrueArbRider_1.0.33.0_Test\atTrueArbRider_1.0.33.0_x64.appxbundle

Installing app...
Found dependency package(s):
C:\Users\AWG3000\Desktop\atTrueArbRider_1.0.33.0_Test_181123\atTrueArbRider_1.0.33.0_Test\Dependencies\x86\Microsoft.NET.Native.Framework.1.3.appx
C:\Users\AWG3000\Desktop\atTrueArbRider_1.0.33.0_Test_181123\atTrueArbRider_1.0.33.0_Test\Dependencies\x86\Microsoft.NET.Native.Runtime.1.4.appx
C:\Users\AWG3000\Desktop\atTrueArbRider_1.0.33.0_Test_181123\atTrueArbRider_1.0.33.0_Test\Dependencies\x86\Microsoft.VCLibs.x86.14.00.appx
C:\Users\AWG3000\Desktop\atTrueArbRider_1.0.33.0_Test_181123\atTrueArbRider_1.0.33.0_Test\Dependencies\x64\Microsoft.NET.Native.Framework.1.3.appx
C:\Users\AWG3000\Desktop\atTrueArbRider_1.0.33.0_Test_181123\atTrueArbRider_1.0.33.0_Test\Dependencies\x64\Microsoft.NET.Native.Runtime.1.4.appx
C:\Users\AWG3000\Desktop\atTrueArbRider_1.0.33.0_Test_181123\atTrueArbRider_1.0.33.0_Test\Dependencies\x64\Microsoft.VCLibs.x64.14.00.appx

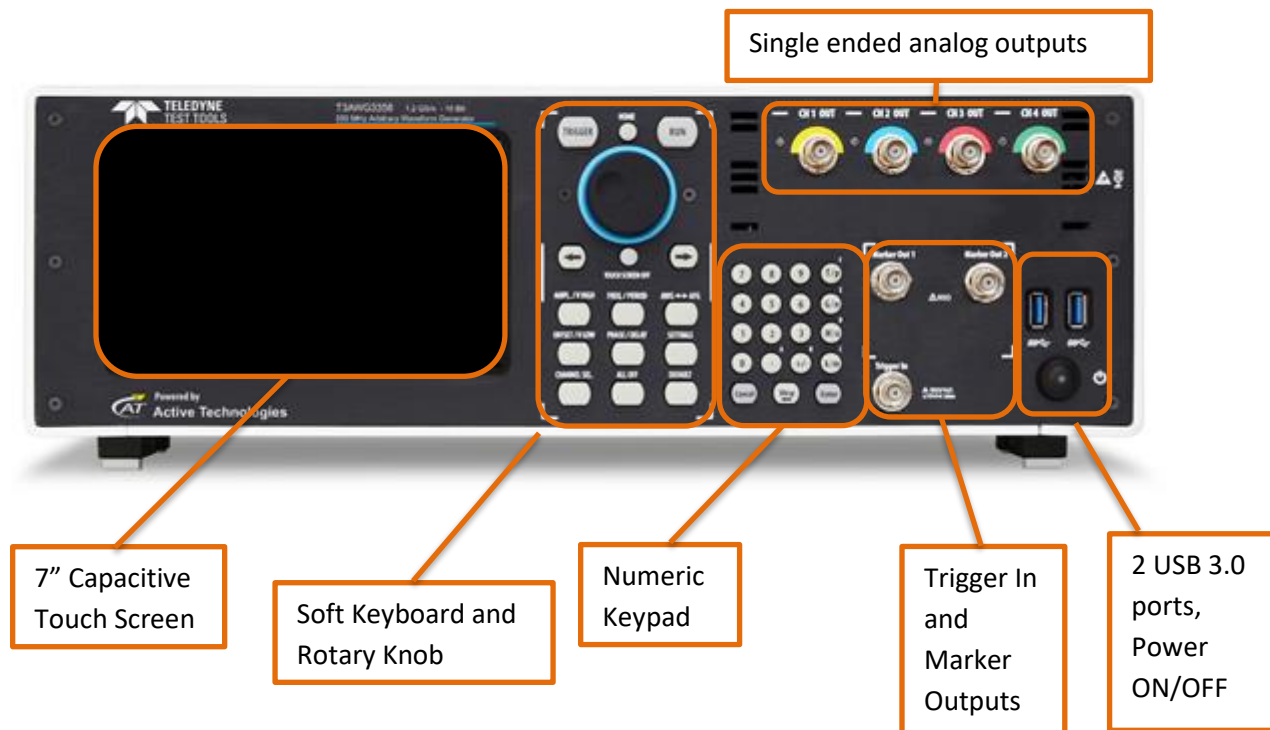
Success: Your app was successfully installed.
Press Enter to continue...:
```

Instrument Overview

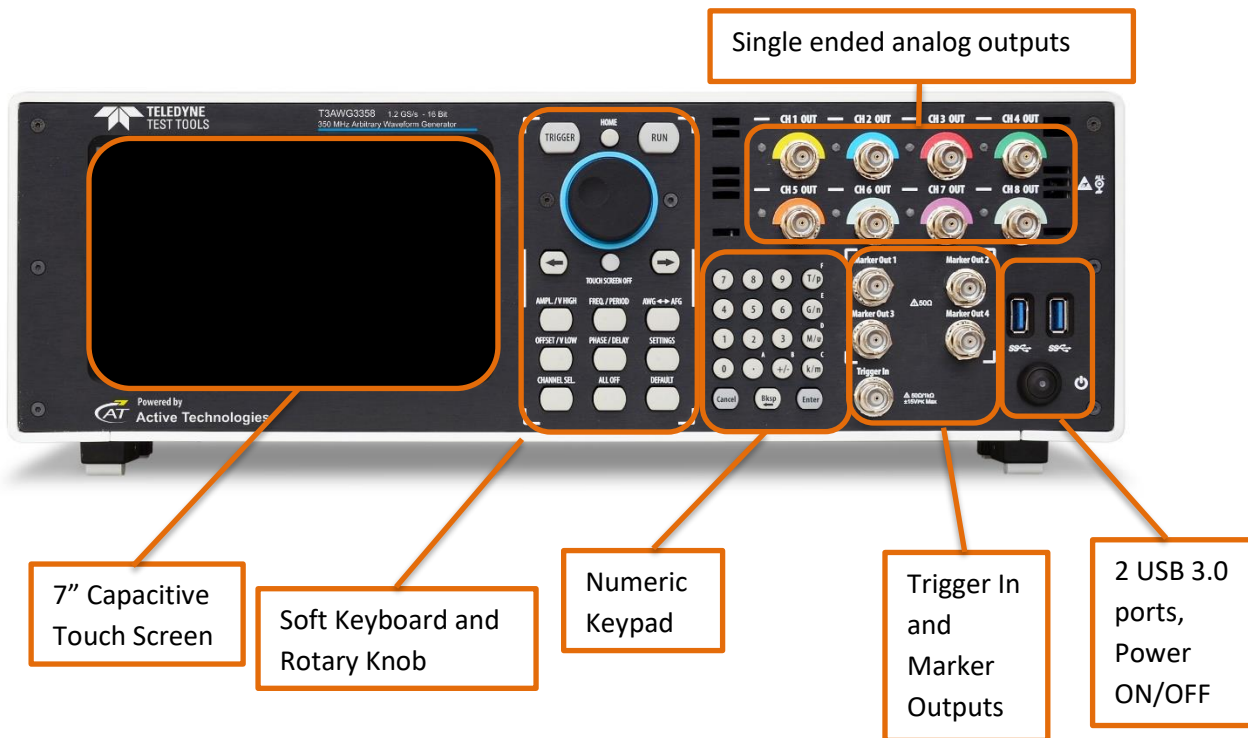
Front Panel T3AWG3352/3252



Front Panel T3AWG3354/3254



Front Panel T3AWG3358/3258



The Touch screen functionalities and features are described in the Simple TrueArb Application paragraph.

Analog Outputs

The T3AWG-3K Series instrument has 2/4/8 analog output channels, each one is single-ended and the connector type is a standard BNC.

Marker Output

The Marker Out is a digital output channel that generates a pulse related to the analog waveform. Its impedance is 50 Ohm and the output voltage amplitude ranges from 1 V to 2.5 V into 50 Ohm load. The Marker Out generates a digital pulse synchronous with the waveform depending on the Run Mode. To set the Marker Out parameters refer to the Marker Settings. The connector type is a standard BNC.

Marker Out Specification	Value
Connector	1 BNC for each pair of channels on the Front Panel
Output impedance	50 Ω
Output level (into 50 Ω)	1 V to 2.5 V

Important Note:

the Marker Out 1 is linked to the Channel 1 and Channel 2, the Marker Out 2 is linked to the Channel Out 3 and Channel Out 4, the Marker Out 3 is linked to the Channel Out 5 and Channel Out 6, the Marker Out 4 is linked to the Channel Out 7 and Channel Out 8.

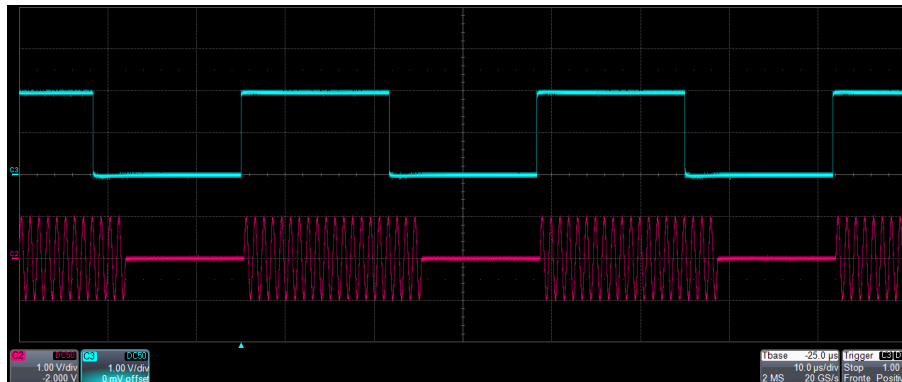
Model	Marker Out Connectors
T3AWG3352/3252	1 BNC on the Front Panel
T3AWG3354/3254	2 BNCs on the Front Panel
T3AWG3358/3258	4 BNCs on the Front Panel

Trigger In

The Trigger In (Trigger In connector on the front panel) allows to control the generation by an external signal source. It has a selectable impedance of 1 k Ω m or 50 Ω m. To know how to set the trigger parameters or the Run Mode refer to the paragraph “

Trigger ”. In Continuous mode the Trigger In doesn't have any effect.

Trigger In Specification	Value
Connector	1 BNC on the Front Panel
Input impedance	1 k Ω or 50 Ω selectable
Slope/Polarity	Positive or negative selectable



Trigger In signal (blue, top) that starts a burst of sine waveform (red, bottom)

Soft keyboard and rotary knob

Most of the buttons you use with Simple TrueArb application are virtual ones on the touchscreen, but a few physical buttons control basic functions, such as the setting of amplitude, offset, frequency, etc.

A physical numeric keypad is available on the front-panel and it can be used instead of the virtual numeric pad.

A useful central knob is available for fine-tuning and adjustments during the on the fly set up operation. The rotary knob will change the value in continuous, analog fashion. The push button rotary knob lets you to change the value increment between Coarse and Fine adjustment.

The → key will move the selected digit to the right and the ← key will move the selected digit to right. You can keep pressed the rotating knob and rotate it on the right or on the left to change the Delta increment.



Button	Description
HOME	If you are in a sub-menu page, use this button to return to the main page.
TRIGGER	Use this button to send an internal trigger to the instrument.
RUN	Use this button to start and stop the signal generation. If the button is on and green the instrument is running while if it is off the instrument is stopped. Bushing the button will change the instrument state.
LEFT ARROW	Once the virtual numeric keypad will be opened, use this button to move to the left the digit selection cursor.
RIGHT ARROW	Once the virtual numeric keypad will be opened, use this button to move to the right the digit selection cursor.
TOUCH SCREEN OFF	Use this button to disable the touch screen.
AMPL./V HIGH	Use this button to set the high voltage level or the amplitude of the waveform.
FREQ/PERIOD	Use this button to set the period or the frequency of the waveform.
AWG <-> AFG	Use this button to switch between AFG mode and AWG operating mode.
OFFSET/V LOW	Use this button to set the low voltage level or the offset of the waveform.
PHASE/DELAY	N.A.
SETTINGS	Use this button to open the Settings page
CHANNEL SEL.	Use this button to change the output selection in the user interface
ALL OFF	Use this button to turn off all the outputs.
DEFAULT	Use this button to restore the default settings.

Numeric Keypad

The physical numeric keypad lets you to set the parameter value and their measure unit.

Once a parameter to be edited is selected by using the touch panel or the soft keyboard each number pressed in the keypad will be displayed in the display. The Bksp key is provided for deleting erroneous key presses. The [+/-] key will toggle the sign of the number being entered and may be pressed after terminating the entry. After the sign and the numeric portion of the desired value have been entered, the pressing of the multiplier button applies the parameter. The Enter button closes the virtual keyboard and will apply the entered value.



When you select a parameter on the user interface, if you press a Unit Measure Range button it will automatically update the available range allowed for that parameter.

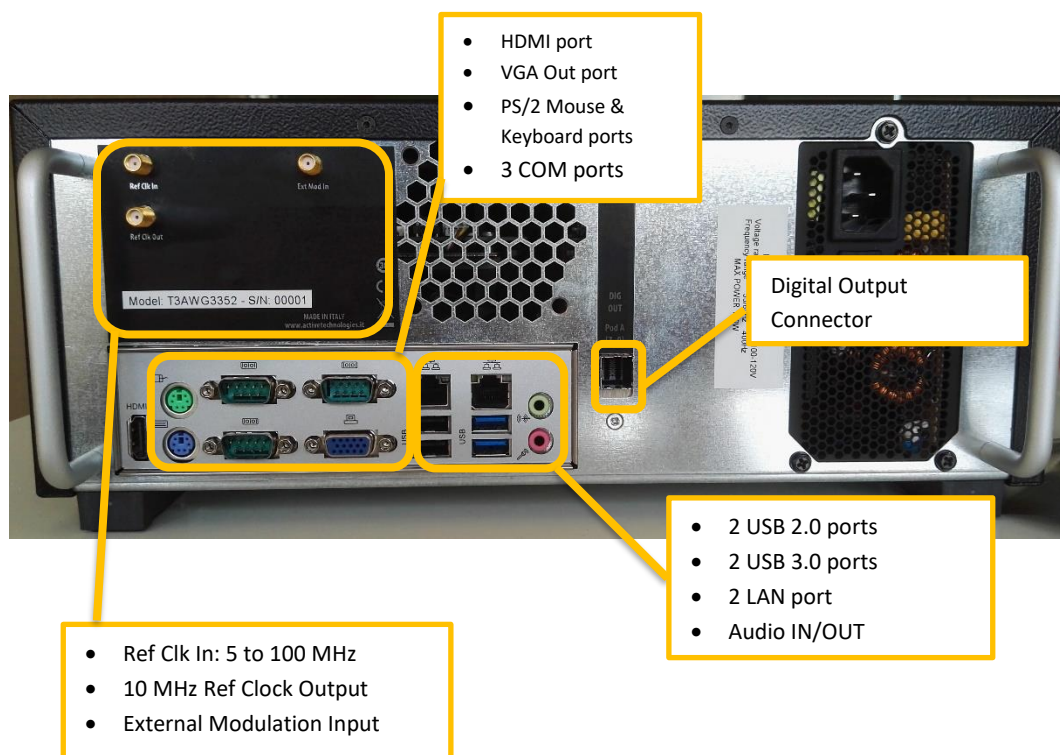
Unit Measure Range Button	Unit Measure Range
T/p	Tera / pico
G/n	Giga / nano
M/u	Mega / micro
k/m	kilo / milli

For example, if you select the Frequency parameter and you press k/m the unit measure range will be kHz, if you press M/u it will be MHz, if you press G/n it will be GHz, if you press T/p nothing will happen because that range is not available for the selected parameter.

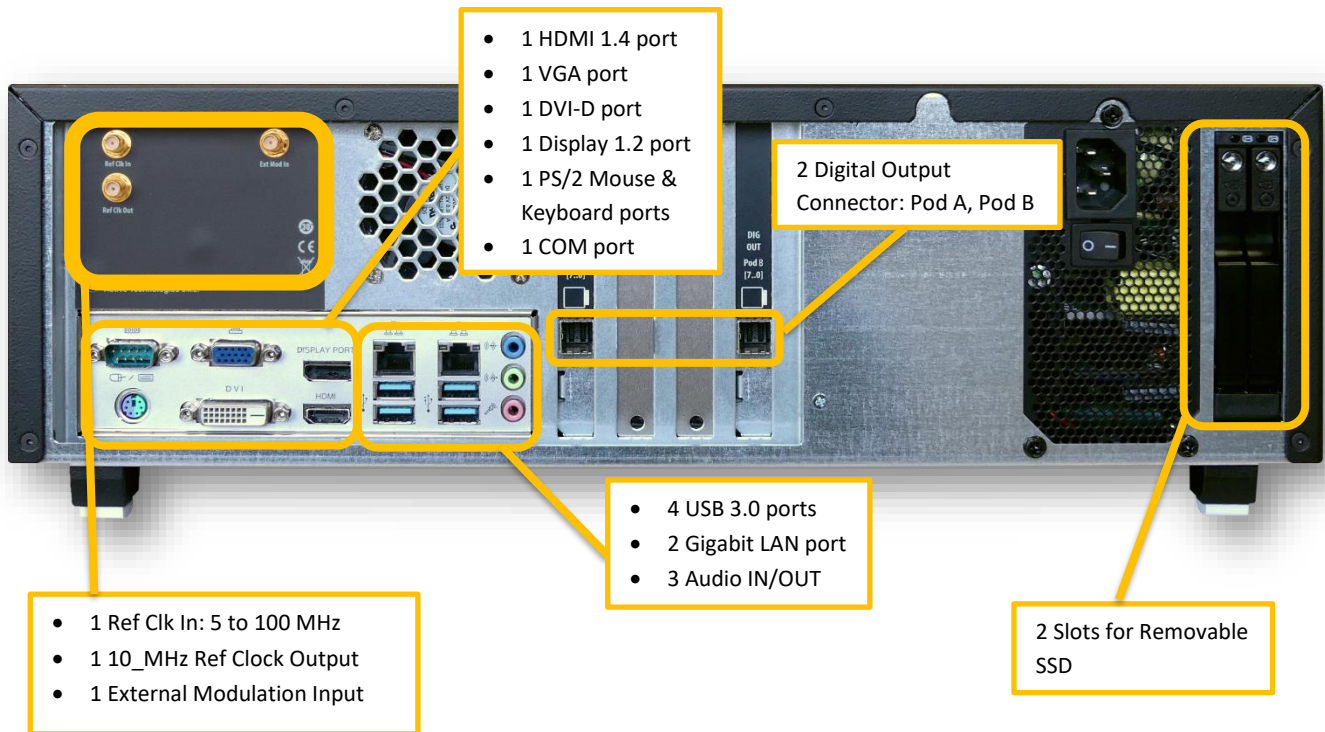
If both the two unit of measure of a Unit Measure Range button are available for the selected parameter (i.e. Mega and Micro), if you press the range button **M/u**, the range will switch accordingly between Mega and Micro.

Rear Panel T3AWG3352/3252

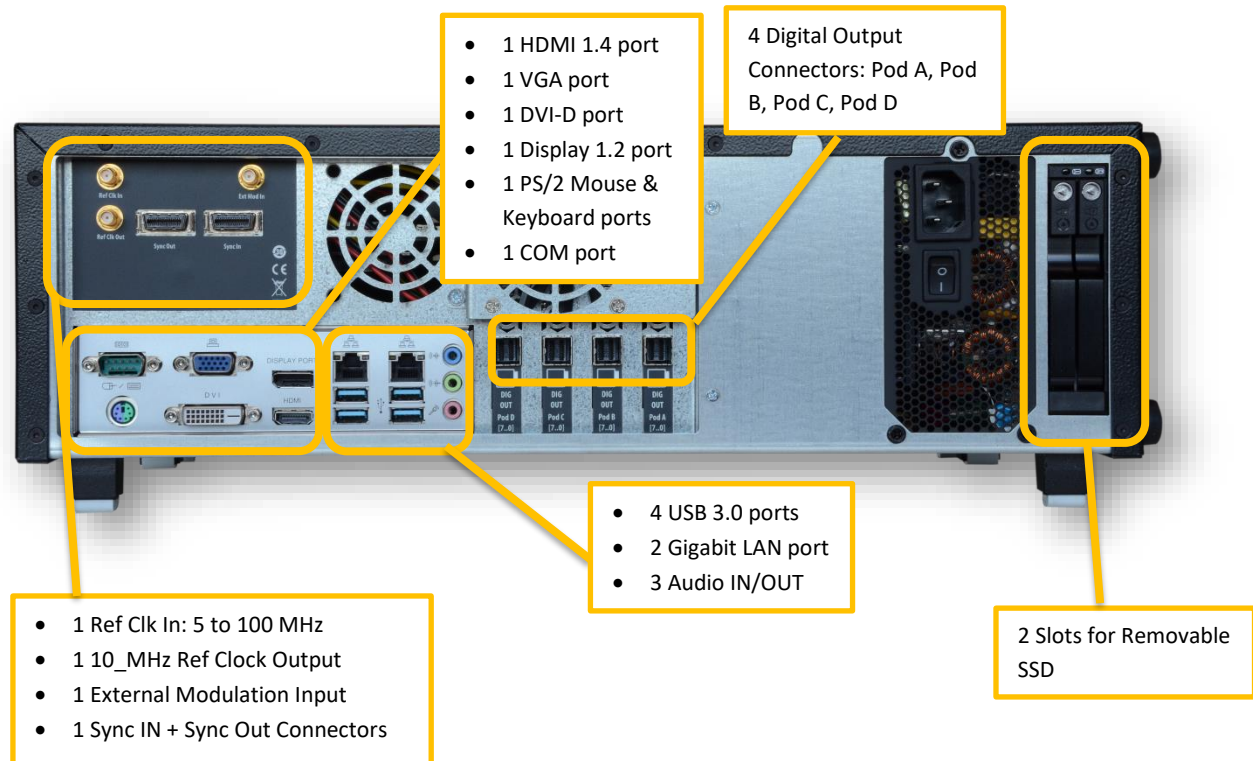
The callouts on this image gives the description of the corresponding connectors.



Rear Panel T3AWG3354/T3AWG3254



Rear Panel T3AWG3358/T3AWG3258



External Modulation Input Connector

In TrueArb application it could be used as a second source of an external signal of trigger (available only in Advanced Run Mode).

The connector type is a SMA.

Reference Clock Input Connector

The T3AWG-3K can use an external clock source to generate the sampling clock frequency.

This feature allows to synchronize the generator with an external clock.

The connector type is a SMA.

Reference Clock Output Connector

This connector outputs the internal 10MHz reference clock used to synthesize the DAC sampling clock. If the clock source is internal it produces a signal at 10 MHz, if the source is external it is disabled.

The connector type is a SMA.

Digital Output connector

The T3AWG-3K series has optional 8/16/32-bit digital outputs, synchronized with the corresponding analog channels.

The digital output pins are native LVDS standard and the maximum update rate is 1.2 Gbps for the T3AWG335X (1.0 Gbps for the T3AWG325X).

The output connector is a customized version of the Mini-SAS HD standard connector. An optional adapter cable to convert from Mini-SAS HD to SMA is available.

The mixed signal generation is a great solution for digital designs and validation, system synchronization and DAC/ADC tests.

Model	Connector Name
T3AWG3352/3252	Pod A
T3AWG3354/3254	Pod A, Pod B
T3AWG3358/3258	Pod A, Pod B, Pod C, Pod D

The digital output connector and the digital cable should be connected as shown in the picture below.



Digital Connector on T3AWG3252/3352 model

Sync In / Sync Out Connectors


The purpose of those connectors is to connect and synchronize together multiple instruments: up to 4 instruments can be linked together.


Those connectors are available on T3AWG3358/T3AWG3258 models only.

Quick Start Guide

If you are a beginner user, you can follow the steps here below to generate your first waveform.


Important Note: the pictures reported in this manual may be relative to 2, 4 or 8 channels models. Therefore, they could be slightly different from the UI that you are using.

1. Connect the power cord and the push the front-panel on/off switch  to turn on the instrument.

2. Press the AWG/AFG button  to switch from the Simple AFG to the Simple TrueArb application. Wait until the Simple TrueArb application is executed and ready to accept new commands.

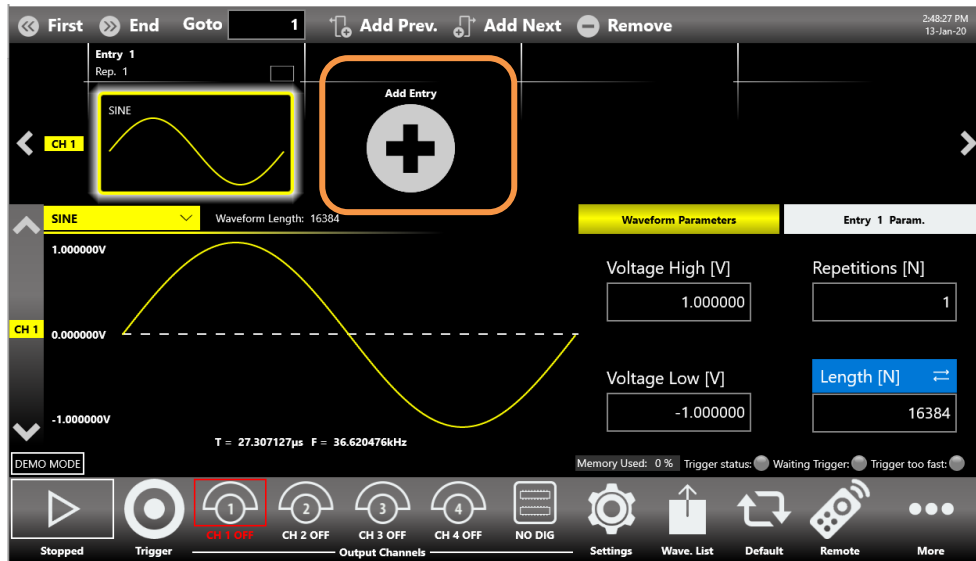
3. Connect the Output 1 of the instrument to the oscilloscope input with a cable, select 50 Ohm load on the oscilloscope input.



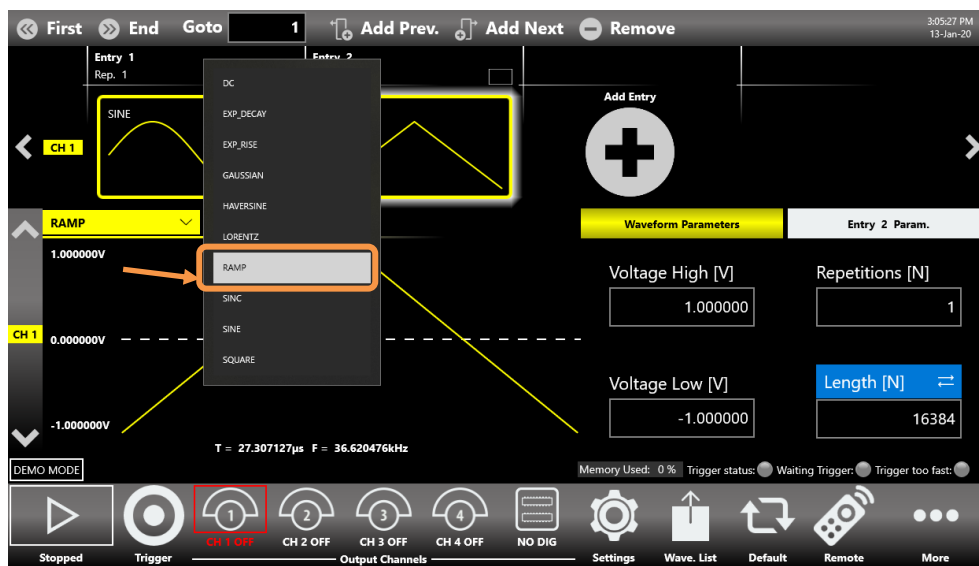
4. Touch the settings button  on the Simple TrueArb UI to open the instrument settings window
5. Select Dev. Settings → General page, select Continuous as Run Mode



6. Touch again the setting button to close the instrument settings window
7. By default, all the channels are disabled: it means that the outputs are mechanically disconnected from the load and the digital outputs are in OFF state.
8. The waveform sequencer located at the top of the application starts by default with a single entry with a sine waveform. Touch the Add Entry button to insert a new entry into the sequencer.



9. Touch the dropdown waveform list and change it from Sine to Ramp.




10. Enable the output channels by pressing the CH1 button located in the bottom of the application so that it is no more grayed out.



11. Touch the Entry 1 and set the Repetition[N]=2 than touch the Entry 2 and set Repetition[N]=3.
12. You can change the Amplitude/Voltage High and Offset/Voltage Low for each entry.



13. Press the RUN/STOP button  and check the generated waveforms on the oscilloscope: the Entry 1 should be repeated two times and the Entry 2 should be repeated three times.



Simple TrueArb Application

The T3AWG-3K includes a 7" capacitive touch screen and Simple touch user interface based on a Microsoft Windows 10 platform.

You can control instrument operations using one or all of the following entering methods:

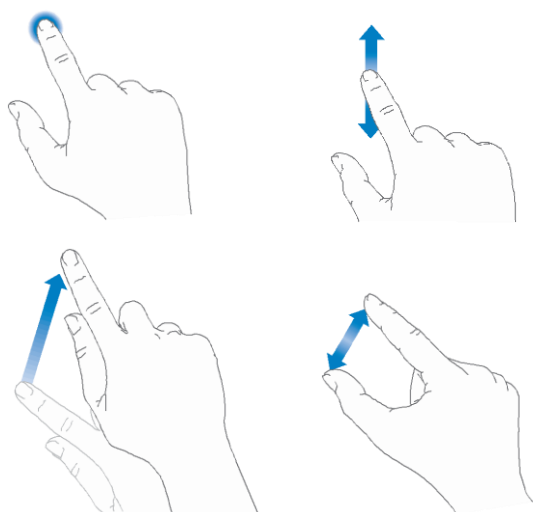
- Touch Screen and Front-panel soft key controls
- Keyboard and mouse

Simple TrueArb Touch UI

Simple TrueArb UI is designed for touch to drive simplicity in operating with an Arbitrary Waveform Generator, by using the today's modern technique, used on Tablet or smart phones, available in capacitive touch-screen displays.

All the important instrument controls and settings are always one touch away:

- swipe down gesture to change the output channel
- swipe left or right to navigate through the sequencer entries
- pinch in-out to zoom the waveform graph
- use the touch-friendly virtual numeric keyboard to modify the parameters and to entry new values on the fly

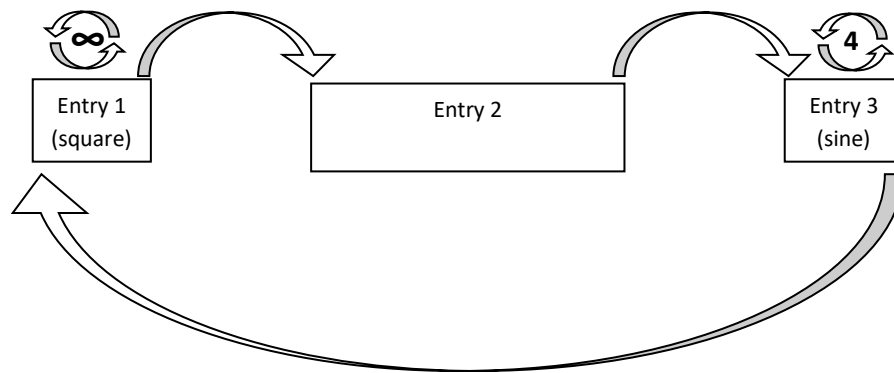


It is sometimes necessary to create long waveform files to fully implement a DUT test. In case where portions of a waveforms must be repeated, the waveform sequencer functionalities can save you a lot of memory-intensive waveform programming.

The Sequencer allows you to define the set of waveforms that will be generated, their sequence, the number of repetitions for each waveform and the generation conditions.

The sequencer is mainly used for the following two purposes:

- Output waveform longer than hardware memory
- Change the output waveform quickly on a specific trigger condition



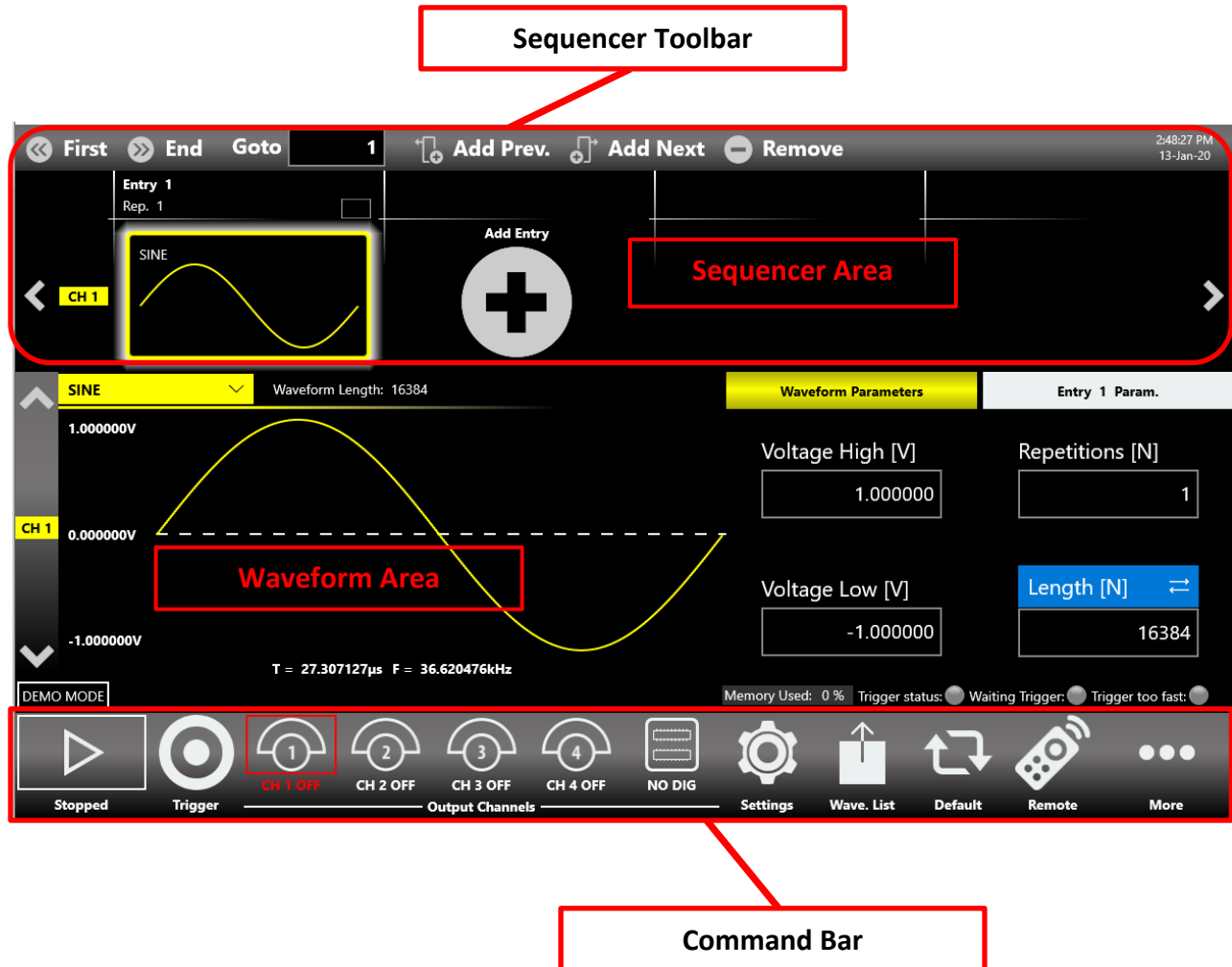
A sequence is made of multiple entries; each entry contains analog and digital waveforms properly formatted.

IMPORTANT NOTE

The T3AWG-3K Series has a unique sequencer for all channels. Therefore, the length and repetitions of each sequencer entry are common to all output channels. In the same way all analog and digital outputs share the same sampling clock. In this way they are synchronized each other.

User Interface Description

The Simple TrueArb software environment provides an easy access to all instrument features and parameters.



The TrueArb user interface consists of four main elements:

- **Sequencer Area:** the sequencer contains a list of entries that the user can add/remove to create its own waveform scenario. Each entry can be repeated or changed in length. The sequencer is common to all channels.
- **Sequencer Toolbar:** this bar contains elements that are used to navigate, add and remove the sequencer items that will be described below.
- **Waveform Area:** It contains the **Waveform Graph** and the **Waveform Parameters** related to the selected entry.
- **Command Bar:** in this bar there are elements to control the instrument operations, to modify the instrument settings and to manipulate waveforms.

As mentioned, the display is 7" capacitive touch screen display and you can use the gestures like in a mobile phone:



If you use the Swipe up or down gesture on the **Waveform Area** you can switch between the Output Channel 1, Output Channel 2, ..., Output Channel N page.

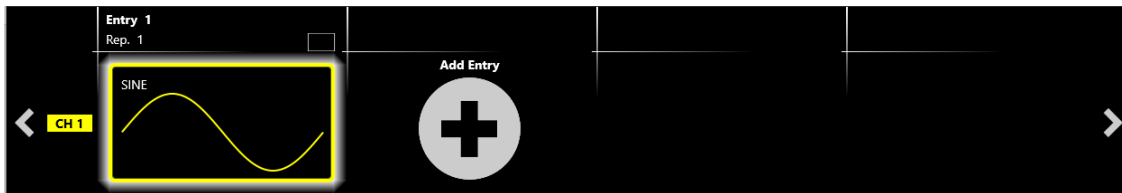


If you use the Swipe left or right gesture on the **Sequencer Area** you can navigate through the sequencer entries.

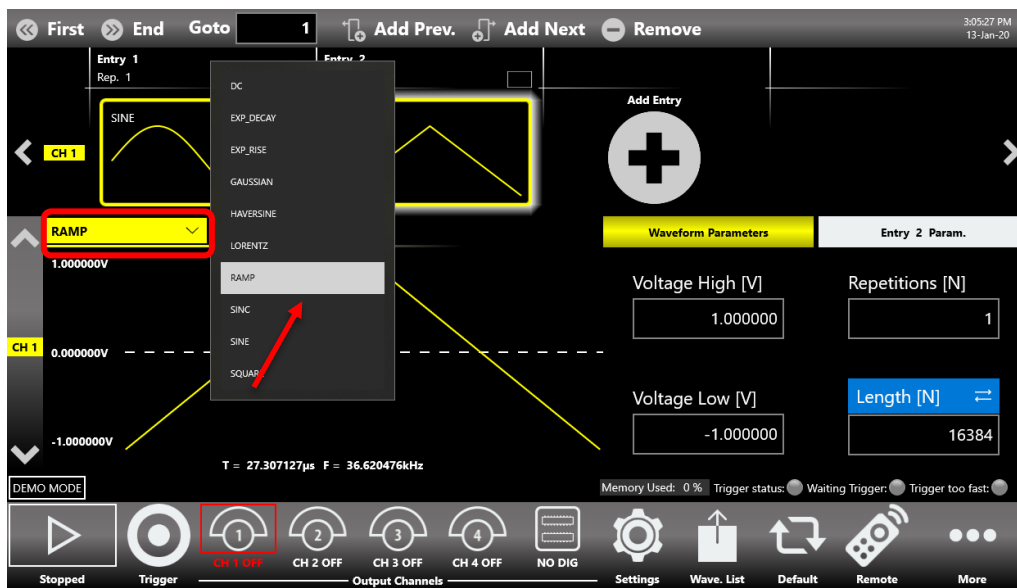
Sequencer Area

The sequencer starts by default with a single entry with a Sine Waveform. You can touch on the “Add Entry Button” to insert a new entry into the sequencer.

The TrueArb inserts by default a DC level waveform into the new Entry.

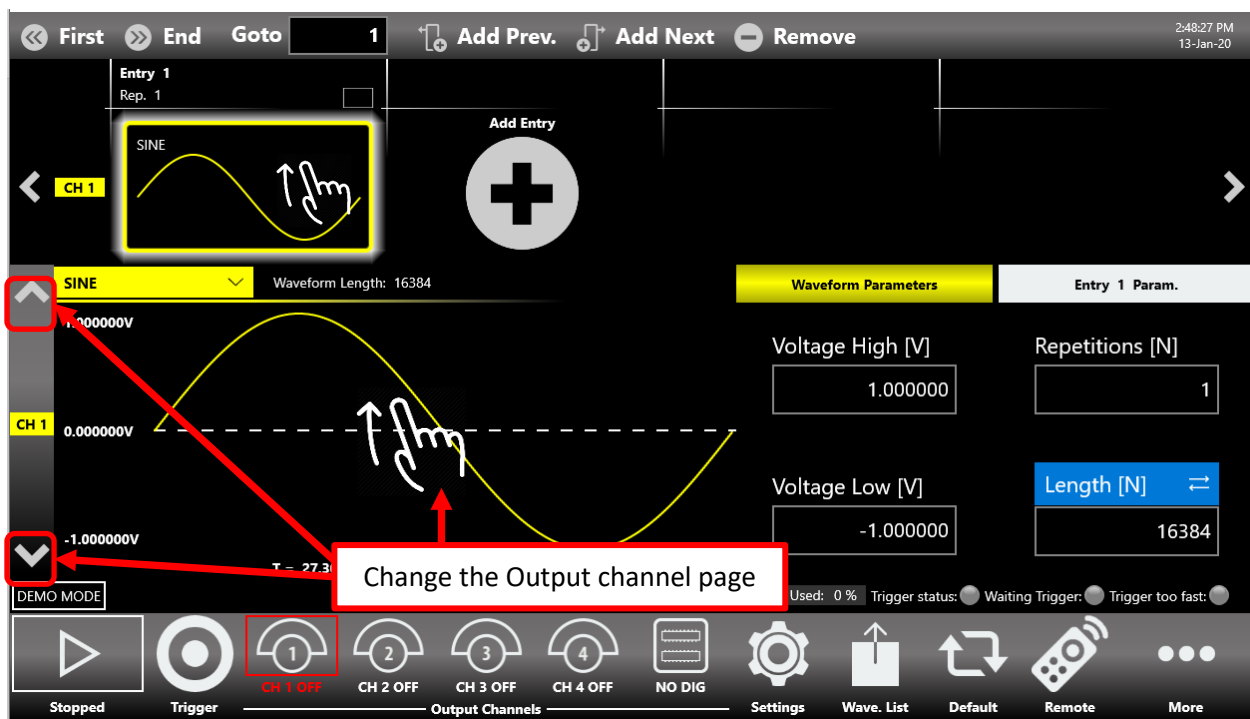


To modify the waveform of an entry of the sequencer, you can touch the waveform dropdown list that will open showing a list of all the waveforms available in the “Waveform List” (predefined or imported).



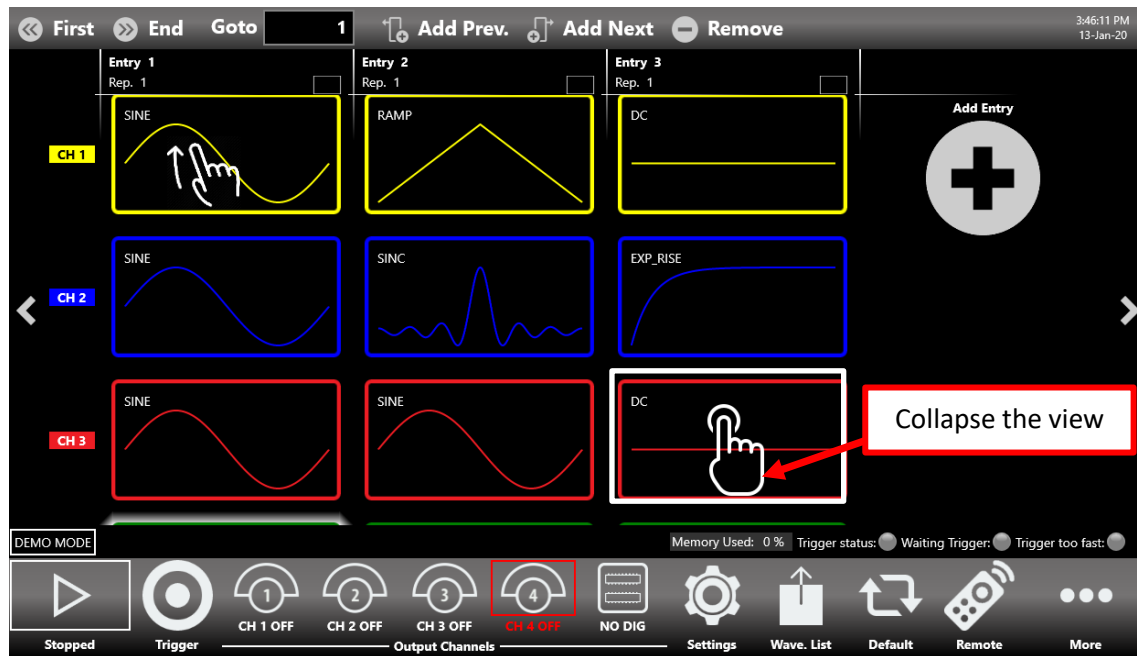
Important Note: For analog output channels the dropdown list will show only the waveforms of type “Analog” that are available in the Waveform List (see “Waveform List” paragraph). Therefore only the waveforms of type “Analog” in the Waveform List can be assigned to analog output channels. For Digital output channels the dropdown list will show only the waveforms of type “Digitals” that are available in the Waveform List (see “Waveform List” paragraph). Therefore only the waveforms of type “Digitals” in the waveform List can be assigned to Digital output channels.

Important Note: if you need to modify the waveform of the other channels that by default are automatically set to DC level waveform when you add a new entry in the sequencer, you should use the swipe up/down gesture on the Graph Area, use the swipe up/down gesture on the selected entry item or press the up/down arrow on the left side of the graph to change the Output Channel page. Then you can change the waveform by pressing the dropdown waveform list.



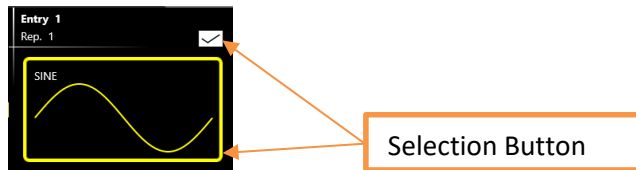
Multiple Channels View

You can tap on the selected sequencer item to display more than one channel at the same time: it allows you to have an overall view of the channels and of the sequencer entries.



You can use the swipe up/swipe down gesture to scroll through the channels, touch again on the selected sequencer item or select another item to collapse the view.

Sequencer area items

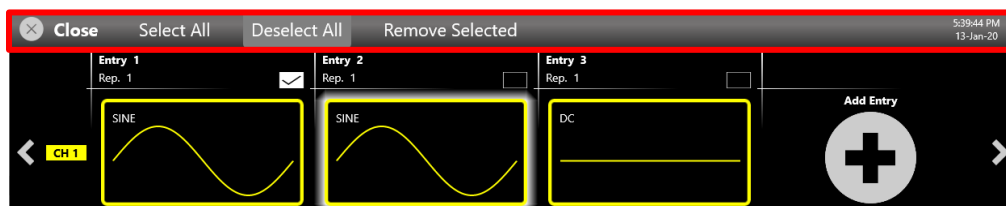


Sequencer Entry. Each sequencer item contains several information:

- The index of the Entry (Entry N). Each entry is enumerated starting from 1 up to 16384;
- The name of the Waveform assigned to the selected output channel in that entry. Each output channel can have a different waveform assigned to the same sequencer entry;
- The number of Repetitions. Each entry can be repeated from 1 up to 4,294,967,295 times or infinite times (INF button).

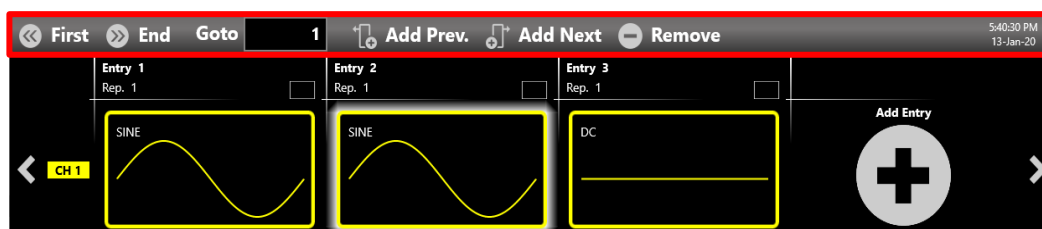
If you touch the selection button in the entry, a second bar will open that will let you to:






- Select All the entries
- Deselect All the entries
- Remove the Selected entry
- Close the bar



Sequencer Toolbar

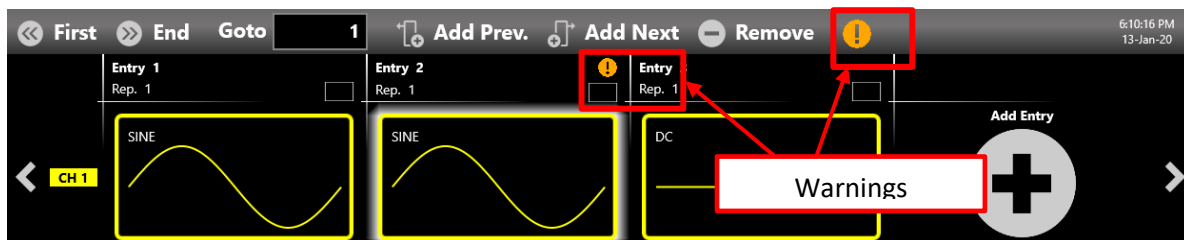
This sequencer toolbar contains several buttons to navigate and control the sequencer that are described here below in detail:



Sequencer Toolbar	Description
 First	First Entry Button – Press this button to go to the first entry
 End	Last Entry Button – press this button to go to the last entry
Goto <input type="text" value="1"/>	Goto Entry Button – Use this button to go to the Entry N
 Add Prev.	Add Prev. Button – Use this button to add a sequencer entry before the selected entry
 Add Next	Add Next. Button – Use this button to add a sequencer entry after the selected entry
 Remove	Remove Button – Use this button to remove the selected entry

Sequencer Warnings

Warnings are shown in the sequencer toolbar in case one or more channel waveforms have been assigned to an entry with a different length. The upper warning gives is general warning that notifies this condition. Additional warnings are displayed inside the entries where the warning condition is detected. In presence of warnings the application will modify the mismatching waveforms during the execution to match the entry length using the strategy specified in the *Sample increasing/decreasing strategy* parameter (Device Settings -> General page)



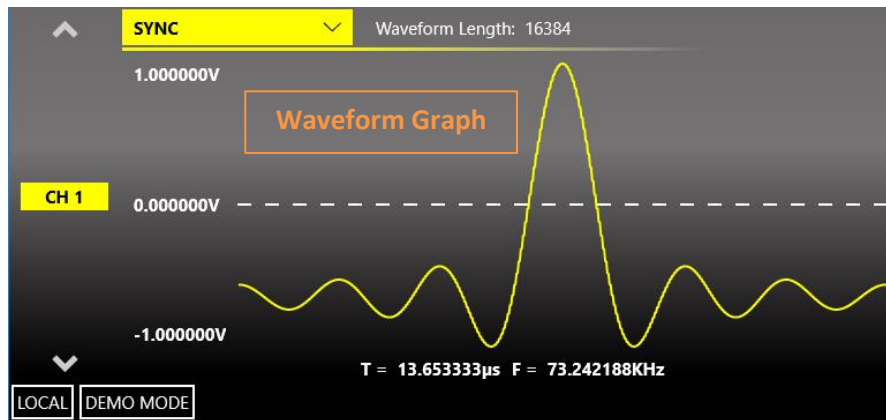
Waveform Area

This area is divided in two main sections, the **Waveform Graph** area that contains a graphical representation of the channel waveform and the **Waveform Parameters** area.

The Waveform Graph gives a description of the waveform assigned to the current channel and sequencer entry. The waveform is described as:

- The waveform shape
- The waveform duration and frequency
- The waveform amplitude

- The waveform length in term of number of samples as it was originally defined in the Waveform List (described below)



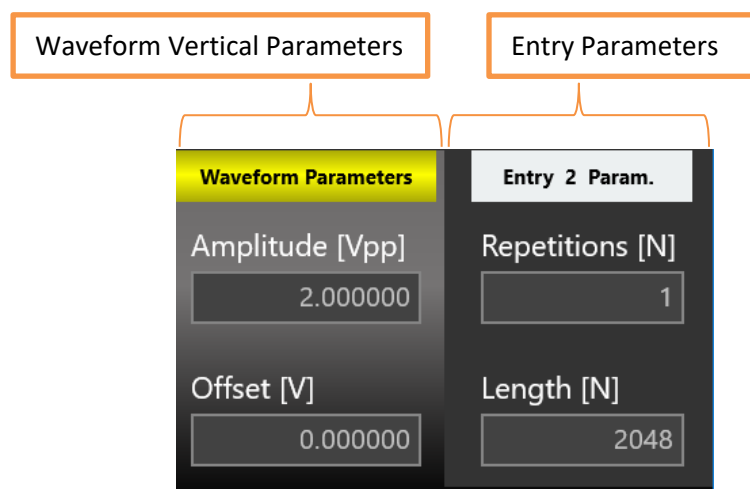
The Waveform Parameters area is divided in two parts. The left part contains the vertical parameters of the selected waveform in terms of Voltage High[V] / Voltage Low [V] (or Amplitude[Vpp] and Offset[V] via Change Format button).

These two parameters can be specified independently for each sequencer entry and for each output channel.

In the right part there are the Repetitions[N] and the Entry Length[N] for the selected sequencer entry. These two parameters are specific for the selected **sequencer entry**. In particular Repetitions[N] is the number of repetitions of the selected sequencer entry.

These parameters are common to all the channels in the same sequencer entry.

Note: Repetitions[N]=1 means that the waveform is executed only once.

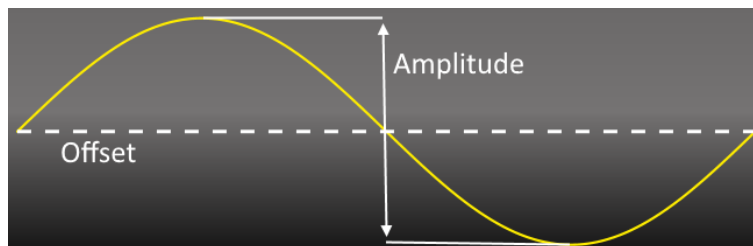


Amplitude[Vpp] parameter

It defines the difference between the maximum value and the minimum value of the waveform expressed in Volts.

Offset[V]

It defines the voltage of $(V_{max}+V_{min})/2$ expressed in Volts where V_{max} is the maximum level of the waveform and V_{min} is the minimum level of the waveform

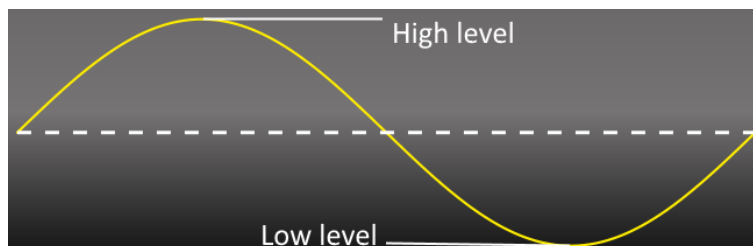


Voltage High[V]

It defines the maximum level of the waveform expressed in Volts

Voltage Low[V]

It defines the minimum level of the waveform expressed in Volts



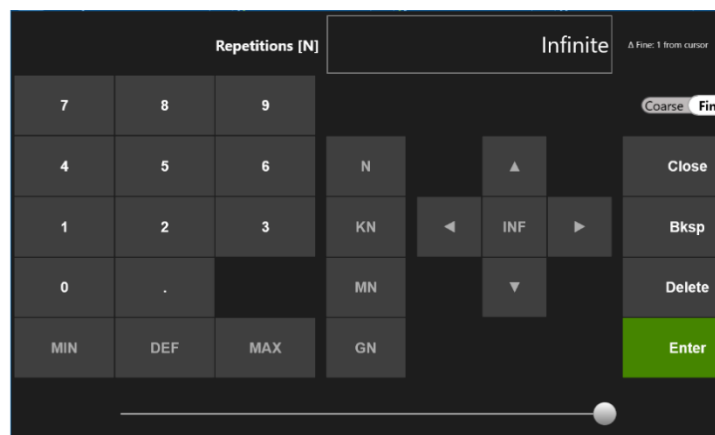
IMPORTANT NOTES

- The maximum value of repetitions is infinite: Repetitions[N]=Infinite. To set the repetitions to infinite open the On-Screen Keyboard and press the “INF” button;
- Entry Length[N] (set to 16348 by default) is the length of the selected sequencer entry;
- The minimum entry length is 16 samples. The entry length granularity is:
 - 1 if the entry length is > 384;
 - 16 if entry length is ≥ 16 and ≤ 384 samples;
- The Waveform length is the original length of the waveform in term of number of samples;

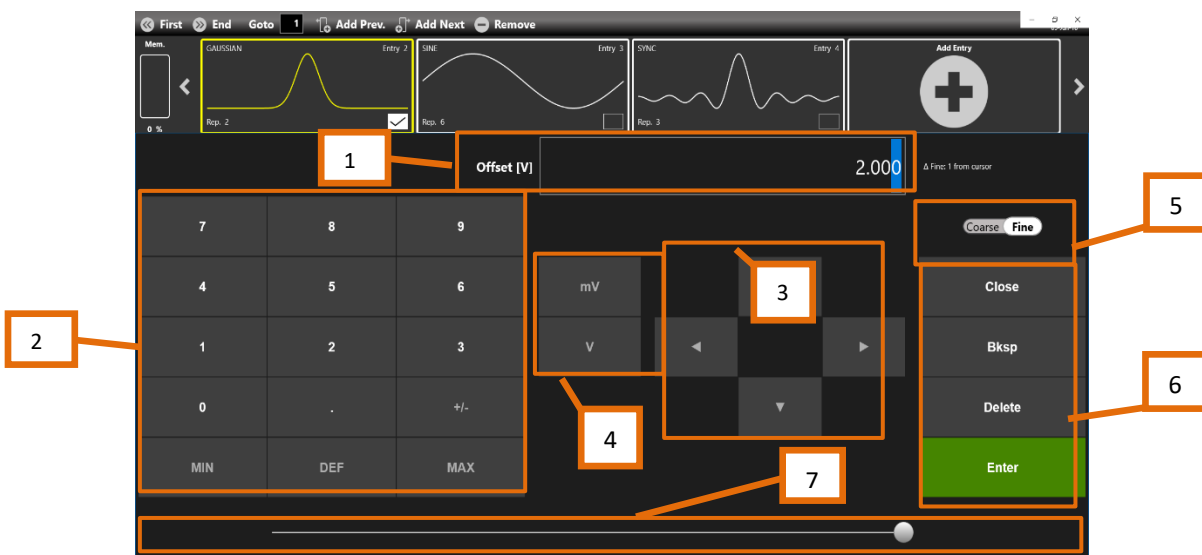
- The entry length can be different from the waveform length because the entry length is the same for all the instrument channels while the waveform length can be different. In case the entry length and the waveform length are different the original waveform will be manipulated (resampled/cut/extended) to match the entry length;
- You can insert the length of an entry in samples or time: press the Length[N] label to switch from samples to time representation expressed by a Duration [s].



You can touch the parameter area to open the Virtual numeric keypad, edit the parameter value and its measure unit.



Below there is a description of the keypad items:



1. **Parameter Name and Value:** This area of the virtual keyboard displays the parameter name, value and unit of measure.
2. **Numeric Keypad:** this area contains the keys to edit the number that will be displayed in the area 1. The [+/-] key will toggle the sign of the number being entered and can be pressed at the end of the number editing.
Touch the "MIN" and "MAX" buttons to set the minimum and maximum allowed value for the selected parameter. Use the "DEF" button to set the default value.
3. **Arrows:** The left/right arrows allow to move the cursor or select the different digit position as the arrows on the front panel. The up/down arrows allow to modify the value.
4. **Measurement Unit:** After typing the numeric value these buttons can apply a different multiplier of the measurement unit. When a measurement unit is pressed, the value is applied on the fly.
5. **Coarse / Fine:** the coarse/fine button let you to modify the granularity of the increment. You can increment or decrement the selected parameter using the UP/DOWN arrows button or rotating knob on the front panel.
When Fine is selected, the increment is of 1 unit at the current cursor position.
When Coarse is pressed, the Delta increment is displayed in the parameter area and the parameter value changes in steps of the selected increment.
You can keep pressed the knob and rotate it on the right or on the left to change the Delta Coarse increment.
6. **Control Buttons:** The "Close" button closes the virtual keypad without applying any changes on the instrument while the "Enter" button confirms the changes and it applies them on the instrument.

“Bksp” (backspace) button is provided for deleting erroneous key presses, “Delete” button deletes all digit of the textbox.

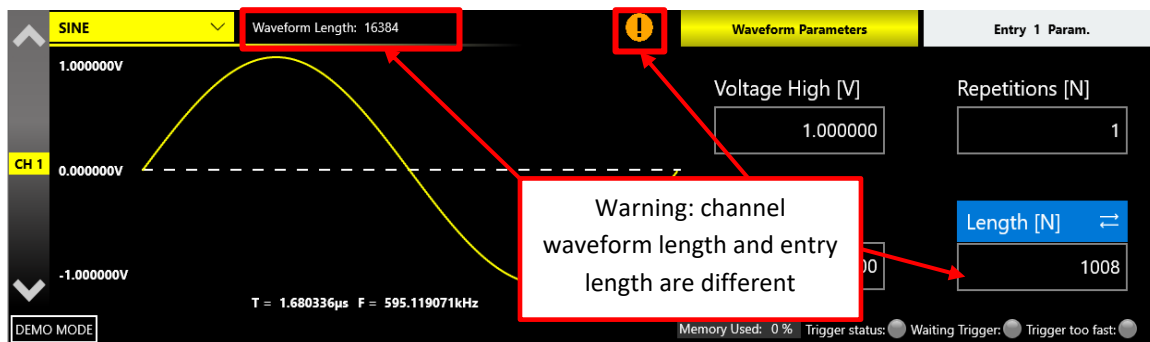
7. The **horizontal scrollbar** allows to change quickly the selected value. The position specifies the value between the allowed minimum and the maximum.

The increment/decrement value entered by the rotary knob or by the scrollbar are applied to the instrument on the fly.

Waveform warnings

A warning is shown in the waveform graph in case the channel waveforms length is different from the entry length. The upper warning gives is general warning that notifies this condition. Additional warnings are displayed inside the entries where the warning condition is detected.

In presence of warnings the application will modify the mismatching waveforms during the execution to match the entry length using the strategy specified in the *Sample increasing/decreasing strategy* parameter (Device Settings -> General page)



Status Toolbar

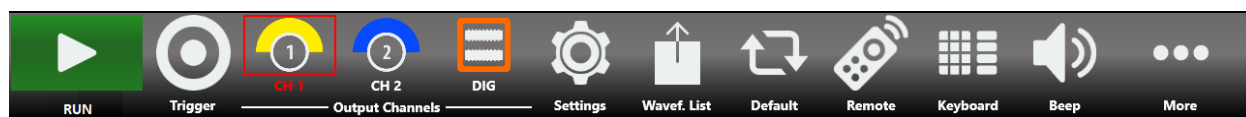
Memory Used indicator: Memory Used: 35 % shows the percentage of memory used to store the waveforms placed in the sequencer.



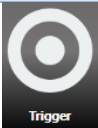

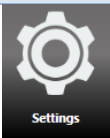


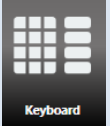
Trigger Information indicator: Trigger status: ● Waiting Trigger: ● Trigger too fast: ● provides information on the trigger signal condition.

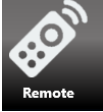
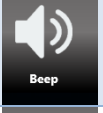

- The **Trigger status** led notifies you that the instrument has received a trigger signal
- The **Waiting Trigger** led notifies you when the instrument is waiting for a trigger signal.
- The **Trigger too fast** led notifies you that the trigger event has been latched, but the trigger frequency is too high and the instrument cannot be rearmed before the completion of the previous trigger event. In this situation some trigger events may be lost.

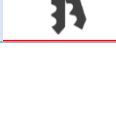
Command Bar

The command bar contains several touch buttons to control the instrument and its layout changes depending on the model (in the 4/8 channel models some buttons can be located in the More menu instead of in the Command Bar). Below a detailed description of this bar is provided.



Command Bar Buttons	Description
 	RUN/STOP Button – Use this button to set the instrument in Running state (or Ready to receive a Trigger) or in the Stopped state. If the button is green the instrument is running while if it is grey the instrument is stopped. Pushing the button will change the instrument state.
	Trigger Button – Use this button to send an internal software trigger to the instrument. Independently from the setting this trigger is always received.
	Output Channels Buttons - Press CH1, CH2, ..., CH N, DIG to change the Output Channel page. If you press again the Channel button, you will turn it OFF/ON. When a channel is OFF, it is mechanically disconnected from the output. The DIG button means “Digital” and it will connect/disconnect the Digital Signals. When digital signals are disabled, they will keep logic “zero” value at the output.
	Settings Button – Use this button to open the output channel Settings, device Settings, Marker Settings and Sequencer Settings. (For more information, please refer to the relative section).
	Wavef. List – Use this button to open a page where you can Import/Export a waveform from file. (For more information, please refer to the relative section).
	Default – Use this button to restore the default value of all parameters of the instrument.
	Numeric Keyboard Button – Use this button to enable or disable the virtual numeric keyboard.

	<p>Remote – Use this button to open the SCPI server page. In that page you can enable or disable the SCPI server and see the sequence of commands sent to the instrument and its response.</p>
	<p>Beep – Use this button to enable or disable the beep audio signal when the user touches a button.</p>
	<p>More Button – Use this button to have access to other instrument features. These buttons are explained in the following table.</p>

More Button Menu Items	Description
	Exit Button – Press this button to close the application.
	Full/Float Button – press this button to maximize or reduce the application screen; in this way you can access to Windows OS.
	Load From Button – Use this button to load a configuration file. (For more information, please refer to the relative section).
	Save As – Use this button to Save the Current configuration into an existing one or create a new one. (For more information, please refer to the relative section).
	Export – Use this button to export the current configuration. (For more information, please refer to the relative section).
	Remote Control Button – Use this button to open the SCPI server page. In that page you can enable or disable the SCPI server and see the sequence of commands sent to the instrument and its response.
	Change Format – Use this button to change the waveform vertical parameters from Voltage High(V) and Voltage Low(V) to Amplitude(Vpp)/Offset(V)
	Change Application – Use this button to switch from AWG to AFG application.
	About Button – Use this button to check the credits, the software and firmware release number and the instrument serial number.
	Help Button – Use this button to open the User Manual.
	Calibration button – Use this button to enter the Calibration and Diagnostic page. (For more information, please refer to the relative section).
	Waveform Editor – Use this button to open the Waveform Editor software. (For more information please refer to the Waveform Editor User Manual).
	License button – Use this button to enter the License setup page. (For more information, please refer to the relative section).

Settings

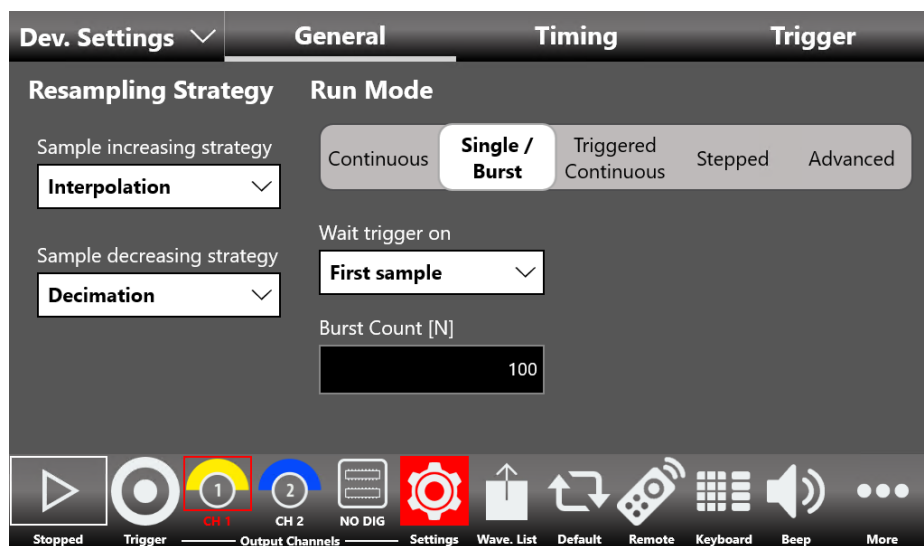


Touch the “Settings” button to open the page relative to the Device Settings, Channel Settings, Marker Setting and Sequencer Setting.

Device Settings

The device settings are common for all the instrument and they are grouped in General settings, Timing settings and Trigger settings.

General



Resampling Strategy

It defines the strategy to adapt the original waveform length to the sequencer entry length.

The “Sample increasing strategy” parameter defines the strategy used to adapt the waveform length to the sequencer entry length in the case where the original waveform length is shorter than the sequencer entry length. The techniques adopted can be:

- *Interpolation*: it performs a linear interpolation between the waveform samples
- *Return Zero*: it fills with '0's the tail of the waveform
- *Hold Last*: it holds the last value of the waveform
- *Samples Duplication*: it repeats the waveform samples

The “Sample decreasing strategy” parameter defines the strategy used to adapt the waveform length to the sequencer entry length in the case where the original waveform length is longer than the sequencer entry length. The techniques adopted can be:

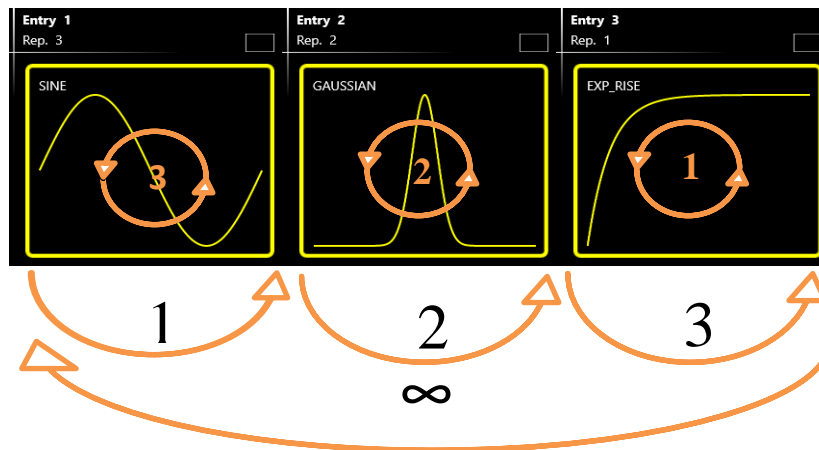
- *Decimation*: it reduces the number of samples maintaining the waveform shape

- *Cut tail*: it cuts the tail of the waveform reducing its size
- *Cut head*: it cuts the head of the waveform reducing its size.

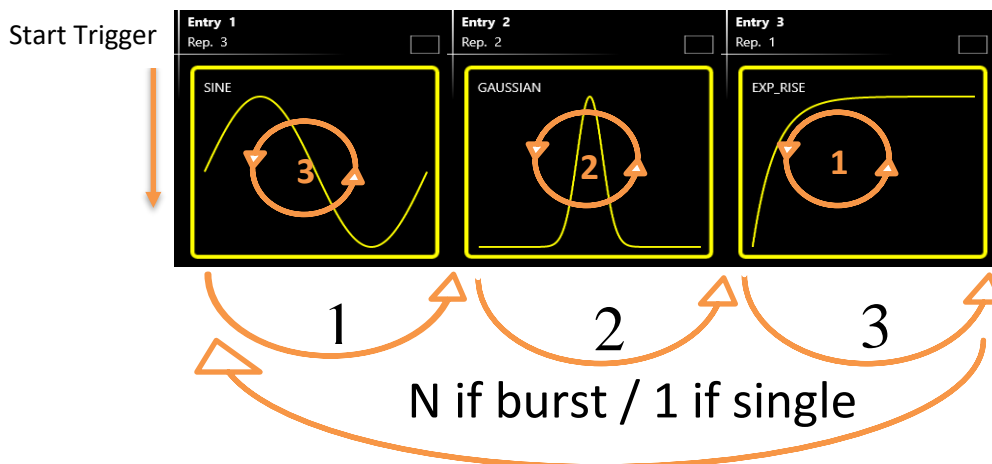
Run Mode

The Run Mode defines the sequencer execution flow:

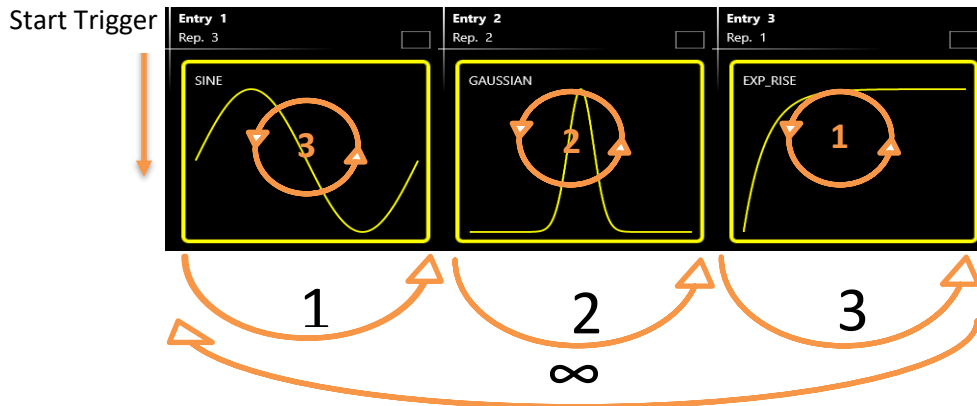
- **Continuous**: when the RUN/STOP button is pressed each waveform will loop as written in the entry repetition parameter and the entire sequence is repeated circularly until the user presses the RUN/STOP button as shown in the picture below:



- **Single/Burst**: when the RUN/STOP button is pressed the instrument waits for a trigger event. When the trigger event occurs, each waveform will loop as written in the entry repetition parameter and the entire sequence will be repeated circularly many times as written in the Burst Count[N] parameter. If you set Burst Count[N]=1 the instrument is in Single mode and the sequence will be repeated only once.

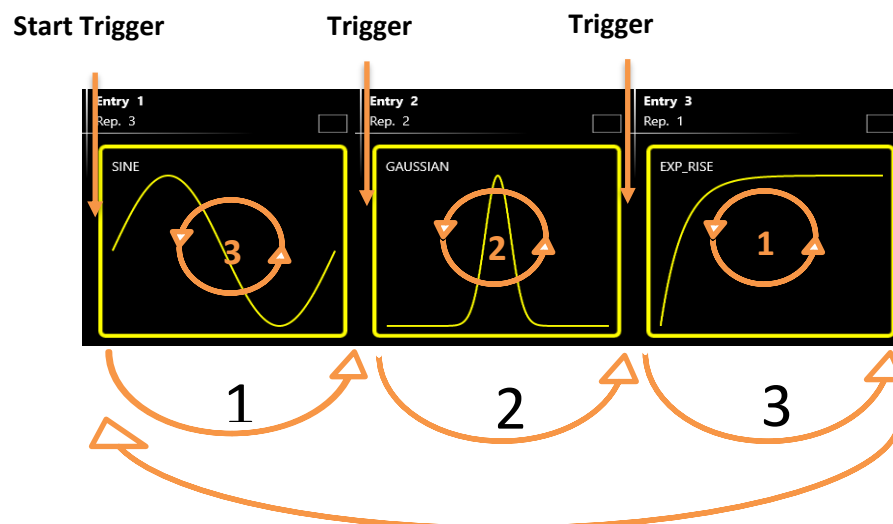


- **Triggered Continuous:** when pressing the RUN/STOP button the instrument waits for a trigger event. When the trigger event occurs, each waveform will loop as written in the entry repetition parameter and the entire sequence will be repeated circularly until the user will press the RUN/STOP button.



- **Stepped:** after pressing the RUN/STOP button each entry waits for a trigger event before its execution. The waveform of the entry will loop as written in the entry repetition parameter. After the generation of an entry has completed, the last sample of the current entry or the first sample of the next entry is held until the next trigger is received. At the end of the entire sequence the execution will restart from the first entry.

Note: if you set Infinite repetitions on one entry, the Trigger event lets you jump to the next one.



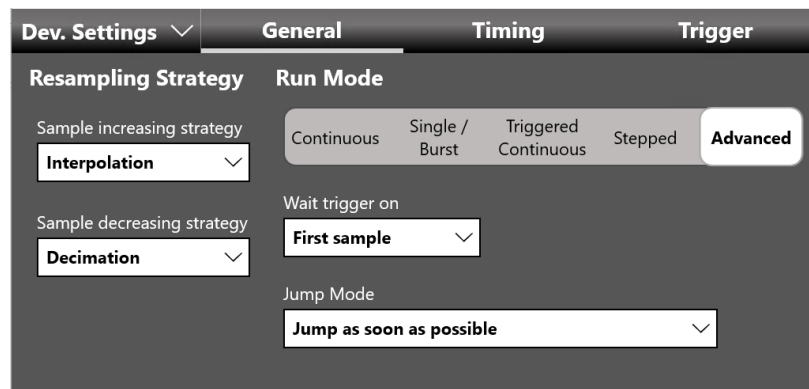
- **Advanced:** In this mode the execution of the sequence can be changed by using conditional jumps (JUMP TO feature), unconditional jumps (GO TO feature) and dynamic jumps (PATTERN JUMP and FORCED JUMP features). Please refer to the Advanced Run Mode section for more information.

Run Mode options

Wait Trigger On

Defines the behaviour of the output during the wait trigger condition in the Triggered Run Modes. If “First sample” is selected the first waveform sample of the next entry to be generated is held until the next trigger is received. If “Last sample” is selected the last waveform sample of the current entry is held until the next trigger is received.

Jump Mode



This parameter is available in Advanced run mode only. It defines the behaviour of the output when a “Jump To” or a “Pattern Jump” event happens. If “Jump as soon as possible” is selected, the sequencer jumps to the selected entry as soon as possible, without waiting for the completion of the repetitions of the current waveform execution. It will jump always at the end of a period of the generating waveform. If “Jump when all repetitions have been executed” is selected, the sequencer jumps to the selected entry after the completion of the current waveform repetitions. If the repetitions are infinite, this option will not be considered and the instrument will perform the jump as soon as possible.

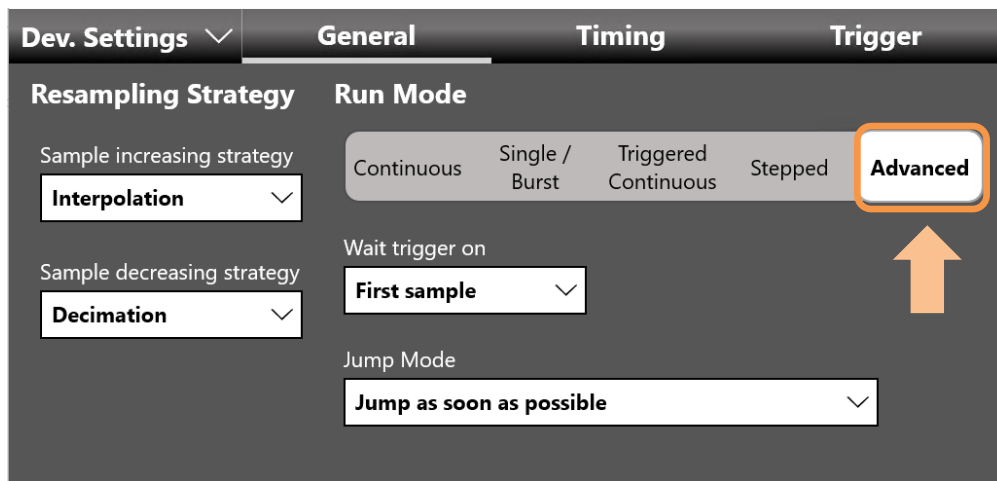
Advanced Run Mode

The Advanced run mode allows to change the execution of the sequence by using loops, conditional and unconditional jumps (JUMP TO and GO TO features) and dynamic jumps (PATTERN JUMP and FORCED JUMP features) events.

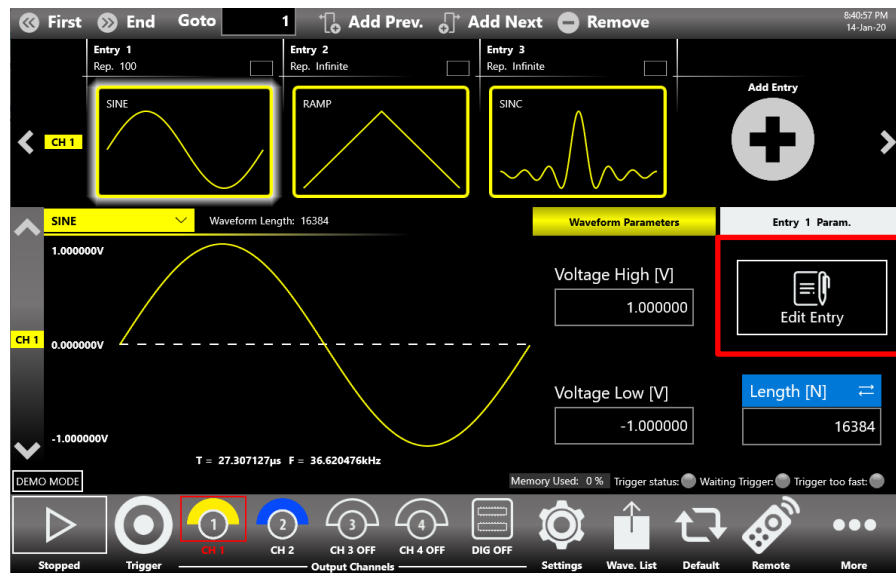
It can be used to create long and complex waveform scenarios.

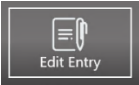
Follow these steps to start working with the Advanced Mode:

- In the Device Setting → General page select Advanced as Run Mode



- The sequencer page will change its standard layout and the Edit Entry button will appear in the Entry Parameters area.



- Press the “Edit Entry” button  on Sequencer Area to open the Entry Editor Table.

Entry Editor Table

This table allows you to change all the parameters associated to a selected Entry for the exception of the Length that should be set on the Sequencer area page.

You can use the swipe up or down gesture to scroll through the table elements, you can touch the table icons to have access to the available options.

The first column in the Entry Editor Table are the Entry numbers that define the play sequence and they are used as the targets for the Jump To, Pattern Jump and Go To features.

The selected Entry is highlighted in yellow.



The Entry Editor Table has the following options:

Item	Description
Wait Event	<p>Defines the event that must occur before the waveform is generated. The waveform output is held until the Wait Event happens, then the waveform output starts.</p> <ul style="list-style-type: none"> None: No waiting, the waveform plays immediately; Button: the event is provided to the instrument by the Trigger button on the keyboard or Trigger button on the menu bar or from a Remote Command;

	<ul style="list-style-type: none"> • Timer: the event is internally generated by a Timer you can set on the Settings → Trigger page; • External: the event is generated by the signal applied externally on the BNC connector (Trigger In) when it crosses the selected Threshold. • Ext.Mod.: the event is generated when the settings of Threshold end Edge of the external signal applied on the Ext Mod In connector (rear SMA connector) are verified. The detection of the External Modulation Input must be enabled. <p>The parameters Ext. Mod. Threshold and Ext. Mod. Edge are found in Device Settings → Trigger → Ext. Modulation Input page.</p> <p>Note: keep in mind that unlike the Trigger In signal, the time interval between the detection of the Ext. Mod. event and the generated signal output is not deterministic because there is no alignment mechanism that guarantees it.</p> <p>Note: The Trigger buttons and the Trigger from remote command are always active, independently from the selecting Trigger Source.</p>
Repeat	Defines how many times the waveform in the entry is repeated: 1 to 4,294,967,295 or infinite cycles.
Jump If Event	<p>Defines the event that must occur for the Jump To feature.</p> <p>When a Jump event happens the sequencer jumps to the selected entry in the Jump To Entry field. It will complete the period of the current waveform before jump to another entry.</p> <p>This is considered a conditional jump.</p> <ul style="list-style-type: none"> • None: The Jump To feature is disabled. • Button: the event is provided to the instrument by the Trigger button on the keyboard or Trigger button on the menu bar or from a Remote Command. • Timer: the event is internally generated by a Timer you can set on the Settings → Trigger page. • External: the event is generated by the signal applied externally on the BNC connector (Trigger In) when it crosses the selected Threshold. • Ext.Mod.: the event is generated when the settings of Threshold end Edge of the external signal applied on the Ext Mod In connector (rear SMA connector) are verified. The detection of the External Modulation Input must be enabled. <p>The parameters Ext. Mod. Threshold and Ext. Mod. Edge are found in Device Settings → Trigger → Ext. Modulation Input page.</p> <p>Note: keep in mind that unlike the Trigger In signal, the time interval between the detection of the Ext. Mod. event and the generated signal output is not deterministic because there is no alignment mechanism that guarantees it.</p>

	<p>Note: The Trigger buttons and the Trigger from remote command are always active, independently from the selecting Trigger Source.</p>
Jump To Entry	<p>Defines the Jump To entry target. The sequencer jumps to the entry selected in that target when the event condition is met.</p> <p>Note: The sequencer can jump immediately or when all the repetitions have been executed as selected in the Jump Mode field (Device Settings → General section).</p> <ul style="list-style-type: none"> • Next: the sequencer jumps to the next element in the sequence • Previous: the sequencer jumps to the previous element in the sequence. • First: the sequencer jumps to the first element in the sequence • Last: the sequencer jumps to the last element in the sequence • Item: the sequencer jumps to the selected entry index.
Pattern Jump	<p>The “Pattern Jump” is a dynamic jump that occurs when the sequencer receives a Pattern Code equal to the Pattern Jump parameter or when an external signal on Ext Mod In connector crosses the selected threshold, during the generation of the specific entry.</p> <p>The dynamic jumps (and the related settings) override all other types of jumps.</p> <ul style="list-style-type: none"> • Pattern: defines the pattern code for the “Pattern Jump” feature. It can be a number from 0 to 254. A Pattern Code can be sent to the sequencer by using the SCPI command AWGControl:DJStrobe. • Ext.Mod.: the event is generated when the settings of Threshold end Edge of the external signal applied on the Ext Mod In connector (rear SMA connector) are verified. The detection of the External Modulation Input must be enabled. <p>The parameters Ext. Mod. Threshold and Ext. Mod. Edge are found in Device Settings → Trigger → Ext. Modulation Input page.</p> <p>Note: keep in mind that unlike the Trigger In signal, the time interval between the detection of the Ext. Mod. event and the generated signal output is not deterministic because there is no alignment mechanism that guarantees it.</p> <p>Note: The sequencer can jump immediately or when all the repetitions have been executed as selected in the Jump Mode field (Device Settings → General section).</p>
Pattern To Entry	<p>Defines the target entry index for the “Pattern Jump” feature. As soon as the sequencer receives the pattern event, it will jump to the entry selected in this field.</p> <ul style="list-style-type: none"> • Next: the sequencer jumps to the next element in the sequence • Previous: the sequencer jumps to the previous element in the sequence. • First: the sequencer jumps to the first element in the sequence • Last: the sequencer jumps to the last element in the sequence • Item: the sequencer jumps to the selected entry index.

Go To Entry	<p>When all the waveform repetitions are completed (without being interrupted by a Jump To or Pattern jump To feature), the sequencer goes to the selected Go To Entry. By default, the Go To entry is Next. This is considered an unconditional jump.</p> <ul style="list-style-type: none"> • Next: the sequencer goes to the next element in the sequence. If the current element is the last, it will go to the first. • Previous: the sequencer goes to the previous element in the sequence. If the current element is the first, it will go to the last. • First: the sequencer goes to the first element in the sequence • Last: the sequencer goes to the last element in the sequence • Item: the sequencer goes to the selected entry index.
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As example this table entry can be represented by a flow chart in the following way:



Entry 1.

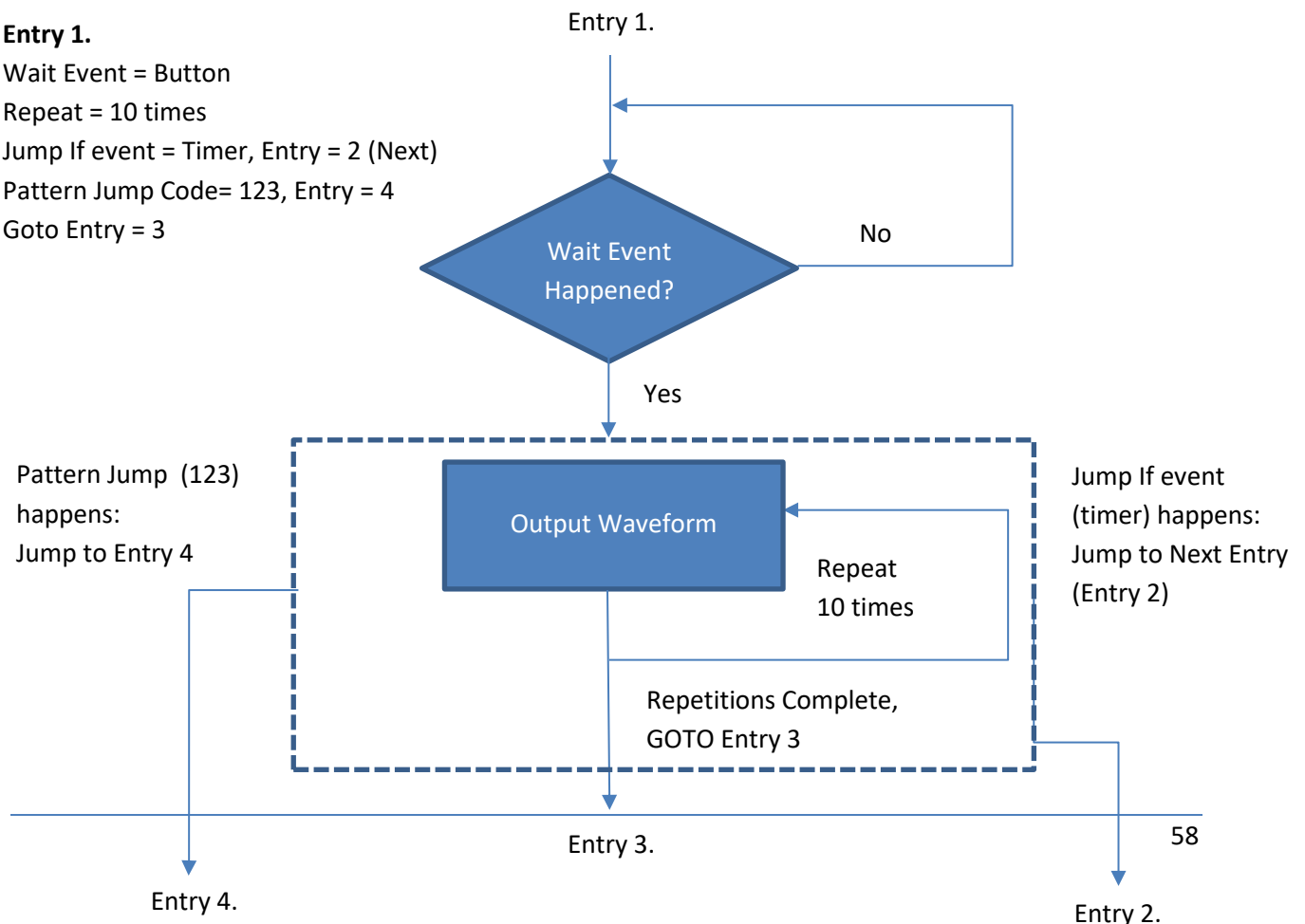
Wait Event = Button

Repeat = 10 times


Jump If event = Timer, Entry = 2 (Next)

Pattern Jump Code= 123, Entry = 4

Goto Entry = 3



Jump to Selected button

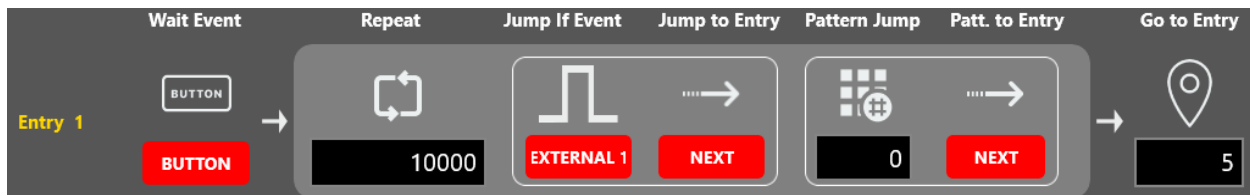
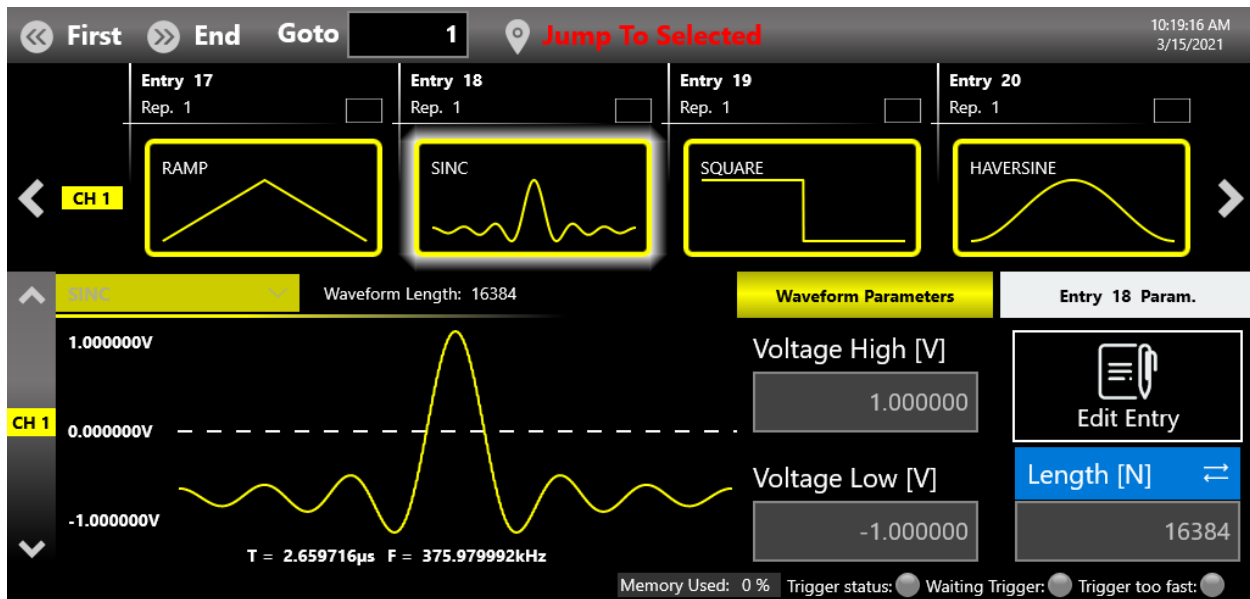
In Advanced Run Mode the “Jump To Selected” button  will appear on the Sequencer Toolbar after the start of the generation.

While instrument is generating and the execution flow is not in a Wait Event state, pressing this button the generation is forced to jump to the entry highlighted in the sequencer.

The execution flow can jump immediately or when all the repetitions have been executed as selected in the Jump Mode field (Device Settings → General section).

This forced jump is considered as dynamic jump.

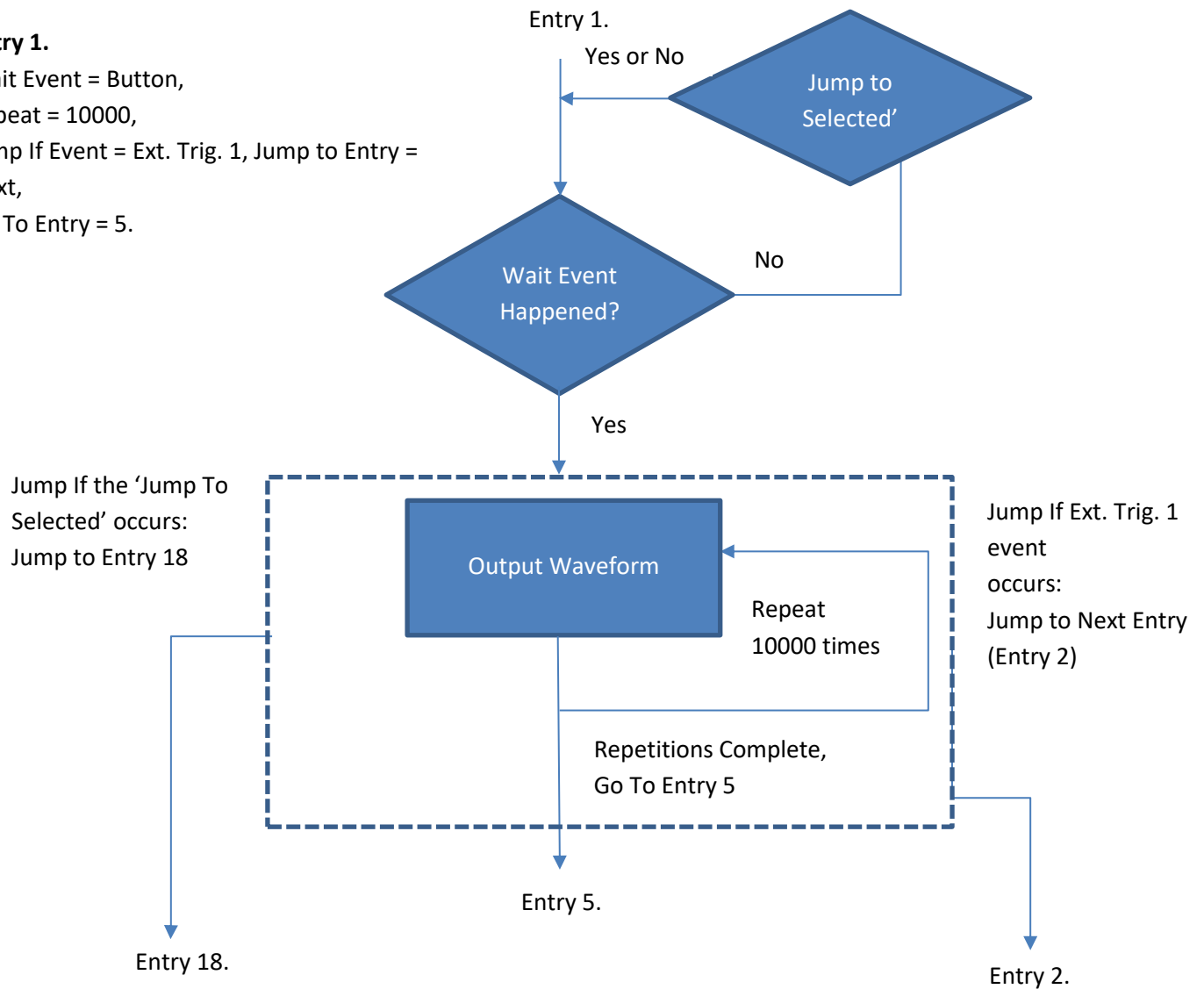
As example look the sequencer below where entry 18 is highlighted, and the following table entry for entry 1.



This table entry is represented by a flow chart below:

Entry 1.

Wait Event = Button,
Repeat = 10000,
Jump If Event = Ext. Trig. 1, Jump to Entry =
Next,
Go To Entry = 5.



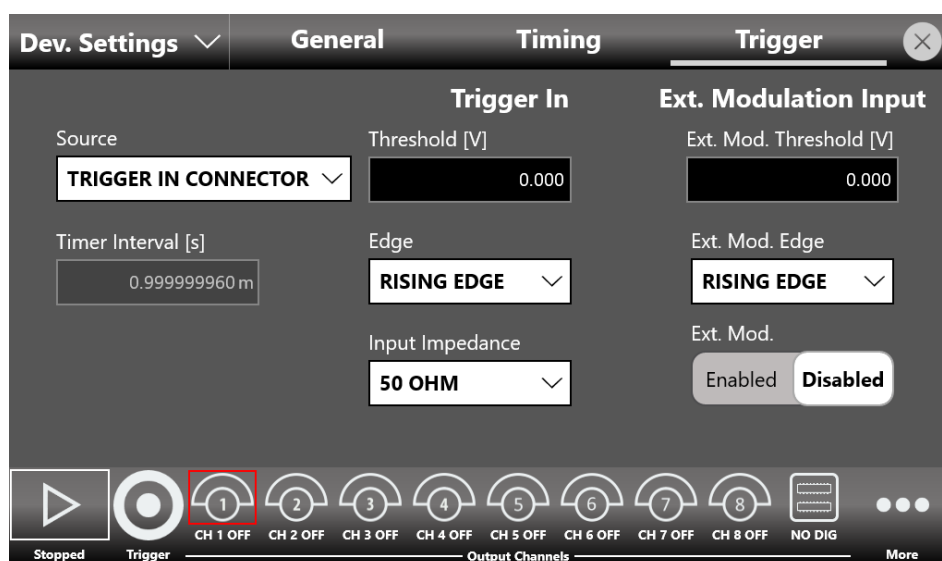
Timing



- *Sampling Clock[Hz]*: specifies the Arbitrary Waveform Generator Sample Rate.
- *Sampling Clock Source*: specifies the clock source as Internal or External.
If **Internal Clock** is selected, the sampling clock is synthesized using a reference clock generated internally.
If **External** is selected, the sampling clock is synthesized using the clock provided externally to the Ref.Clock In SMA connector.
When the External is selected, the Reference Clock[Hz] control will appear and the user needs to specify the Reference Clock frequency[Hz].

Trigger

The Trigger settings are common for all the channels:

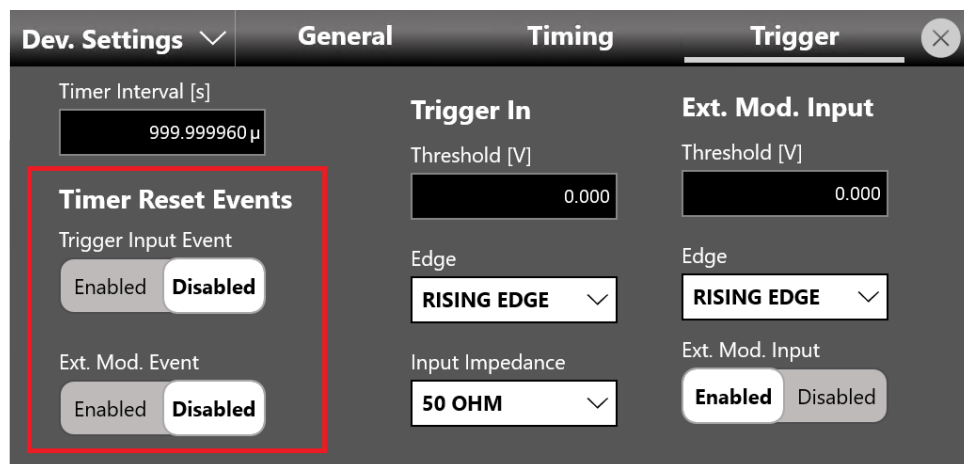


Trigger In Setting	Description
Source	<p>Trigger Button: The Trigger event is provided to the instrument by the Trigger button on the keyboard or Trigger button on the menu bar or from a Remote Command.</p> <p>Timer: The Trigger event is internally generated by a Timer. The Timer count interval is set by Timer Interval [s] textbox.</p> <p>Trigger In Connector: the Trigger event is generated by the signal applied externally on the BNC connector (TRIGGER IN) when it crosses the selected Threshold with the selected Slope. You can select Threshold value and Slope using the relative textbox and slider.</p> <p>Note: The Trigger buttons and the Trigger from remote command are always active, independently from the selecting Trigger Source.</p>
Timer Interval [s]	Sets the timer count interval. It has effect only when the trigger Source is Timer. The edited value is automatically rounded to the closest value that the hardware can implement.
Trigger In: Threshold [V]	It is the threshold that the external signal applied to the "TRIGGER IN" connector must cross to issue a Trigger event to the instrument. It has effect only when the selected Source is Trigger In Connector.
Trigger In: Edge	It has effect only when the trigger Source is Trigger In Connector. The Slope can be positive or negative. When Rising Edge is selected the trigger is detected when the signal on the "TRIGGER IN" BNC connector crosses the threshold from low to high. The Falling Edge option is the opposite. "Both Edges" means that Trigger is sensitive to both edges of the signals.
Trigger In: Input Impedance	It selects the "TRIGGER IN" connector impedance: 1 kOhm or terminated into 50 Ohm. It has effect only when the selected Source is Trigger In Connector.

Ext. Modulation Input: Ext. Mod. Threshold [V]	It is the threshold that the external signal applied to the Ext Mod In connector must cross to make a conditional jump for a specific entry of the sequencer. It has effect only when the selected Run Mode is Advanced and Ext. Mod. feature is enabled.
Ext. Modulation Input: Ext. Mod. Edge	The Slope of the external modulation signal can be positive or negative. When Rising Edge is selected the Ext. Mod. signal is detected when the signal on the "Ext. Mod In" SMA connector crosses the threshold from low to high. The Falling Edge option is the opposite. It has effect only when the selected Run Mode is Advanced and Ext. Mod. feature is enabled.
Ext.Mod.	It enables or disables the External Modulation Input feature.

Only in Advanced Run Mode a set of conditions allows to reset the timer and to restart the time interval after which the Timer event is generated.

The "Timer Reset Events" buttons appears in Trigger Settings section when the Run Mode is Advanced.



Timer Reset Events	Description
Conditions	<p>Trigger Input Event: the timer is reset when an event on the external Trigger In signal occurs.</p> <p>Ext.Mod.Event: the timer is reset when an event on the external Ext Mod In signal occurs.</p> <p>Note: these conditions are not mutually exclusive; by pressing the corresponding button you can enable or disable the desired ones, so a combination of them can be used while generating the sequencer waveforms.</p>

Channel Settings

The channels settings page allows to manage the parameters of the analog and digital channels




CH 1, CH2, ..., CH N analog channel page


- *Amplitude Scale[%]*: this parameter that can be modified at run-time to adjust the waveform amplitude while the instrument is running and it is applied to all the waveforms contained in the sequencer. It is expressed in % and it has a range of 0% to 100%. 100% means that the waveform keeps its original amplitude.
- *Skew[s]*: this parameter defines a fine time delay among the analog output channels in order to de-skew the outputs. The resolution is about 3 ps and depends on the sampling frequency as well as the maximum time skew allowed. The edited value is automatically rounded to the closest value that the hardware can implement.
- *Output Impedance*: defines the output impedance of the analog outputs. It can be set 50 Ohm or Low Impedance (5 Ohm).
- *Polarity*: when "Negative" is selected the analog output signal will be inverted.
- *Base Line Offset[V]*: defines the DC offset value added to the output signal respect to the ground level.

Digital Channels



- *Digital Channels*: it is possible to enable up to 8 digital line on two channels model, up to 16 on four channels model and up to 32 on eight channels model.

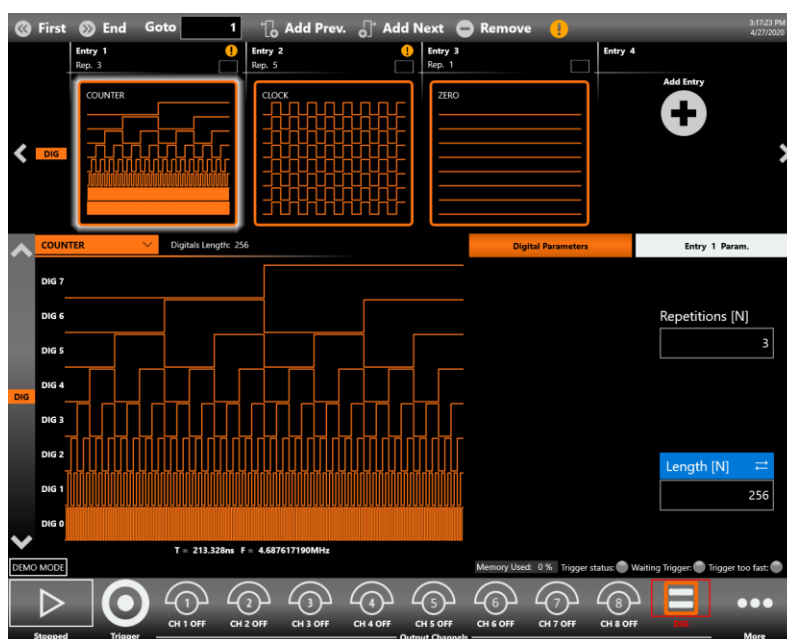
If the Digital Channels number is 0, the DIG button  will be disabled. If two or more

digital lines are selected the DIG button  can be touched to enable/disable the digital lines. Once the digital channels are enabled (≥ 2 digital channels selected) it is possible to access to the Digital Channels Page (see the picture below) to define the digital waveform sequence as for the analog channel page.

IMPORTANT NOTE: enabling the digital lines will cause a decrease of resolution in the analog output channels as shown in the following table:

Number of digital lines	CH1 Res.	CH2 Res.	CH3 Res.	CH4 Res.	CH5 Res.	CH6 Res.	CH7 Res.	CH8 Res.
0	16 bits	16 bits	16 bits	16 bits	16 bits	16 bits	16 bits	16 bits
2	14 bits	16 bits	16 bits	16 bits	16 bits	16 bits	16 bits	16 bits
4	12 bits	16 bits	16 bits	16 bits	16 bits	16 bits	16 bits	16 bits
6	12 bits	14 bits	16 bits	16 bits	16 bits	16 bits	16 bits	16 bits
8	12 bits	12 bits	16 bits	16 bits	16 bits	16 bits	16 bits	16 bits
10	12 bits	12 bits	14 bits	16 bits	16 bits	16 bits	16 bits	16 bits
12	12 bits	12 bits	12 bits	16 bits	16 bits	16 bits	16 bits	16 bits

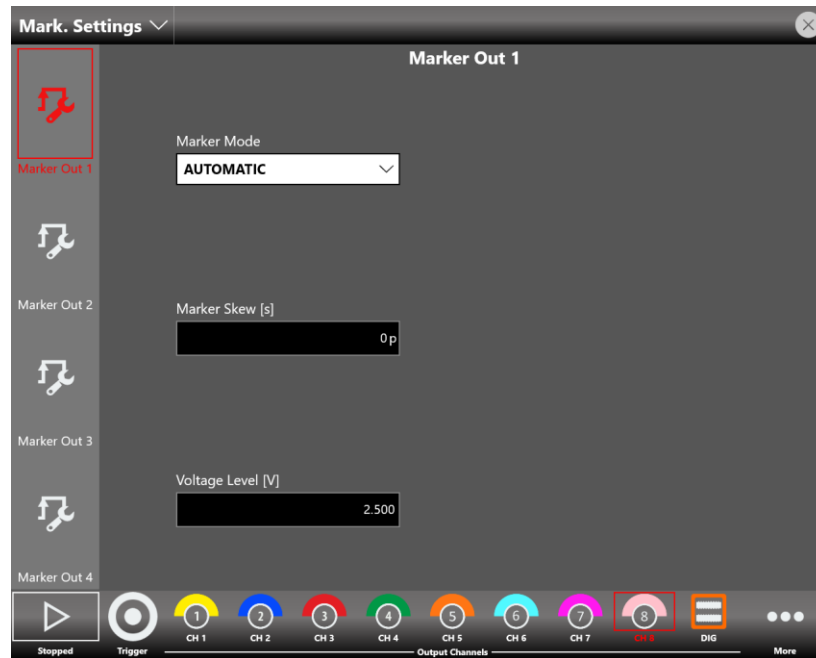
14	12 bits	12 bits	12 bits	14 bits	16 bits	16 bits	16 bits	16 bits
16	12 bits	12 bits	12 bits	12 bits	16 bits	16 bits	16 bits	16 bits
18	12 bits	12 bits	12 bits	12 bits	14 bits	16 bits	16 bits	16 bits
20	12 bits	12 bits	12 bits	12 bits	12 bits	16 bits	16 bits	16 bits
22	12 bits	12 bits	12 bits	12 bits	12 bits	14 bits	16 bits	16 bits
24	12 bits	12 bits	12 bits	12 bits	12 bits	12 bits	16 bits	16 bits
26	12 bits	12 bits	12 bits	12 bits	12 bits	12 bits	14 bits	16 bits
28	12 bits	12 bits	12 bits	12 bits	12 bits	12 bits	12 bits	16 bits
30	12 bits	12 bits	12 bits	12 bits	12 bits	12 bits	12 bits	14 bits
32	12 bits	12 bits	12 bits	12 bits	12 bits	12 bits	12 bits	12 bits



- *Voltage Level[V]*: this parameter defines the output voltage level (in Volt) of the LVDS to LVTTTL Digital Probe. Please note that it will take effect only when the Digital Option is installed in the instrument and with the LVDS to LVTTTL probe connected.
- *Skew[s]*: it sets the delay between the analog channels and the digital channels in order to de-skew the analog and digital outputs. The skew between analog/digital channels depends on the sampling frequency: the minimum skew is 1 clock cycle @ the sampling frequency. The edited value is automatically rounded to the closest value that the hardware can implement.

Marker Settings

On the marker output page, you can set the behaviour and parameters of the Marker signals that is provided at the front panel MARKER OUT BNC connectors.



The available Marker signals depend on the instrument Model, refer to the Marker Output section for a complete description.

On four and eight channels model, press the marker button to change the selection of the Marker signal.

Marker Mode:

- **Automatic:** the marker has a behavior that depends on the Run Mode. In detail:
 - **Continuous:** the instrument generates a Marker pulse of the duration of 8 sampling clock periods, synchronous with the analog outputs, for each sequencer entry and for each repetition.
 - **Single/Burst:** each time a trigger event has been received, while the instrument is waiting for a trigger event, a Marker pulse is generated of the duration of 8 sampling clock periods.
 - **Triggered Continuous:** at the start event the instrument generates a Marker pulse of the duration of 8 sampling clock periods.
 - **Stepped:** each time a trigger event is received, while the instrument is waiting for a trigger event, a Marker pulse is generated of the duration of 8 sampling clock periods. In case an entry with infinite repetitions is being executed, if a trigger event occurs, a

Marker pulse will be generate and the execution will skip to the next entry. In this case the Marker pulse could be not synchronous with the waveform of next entry.

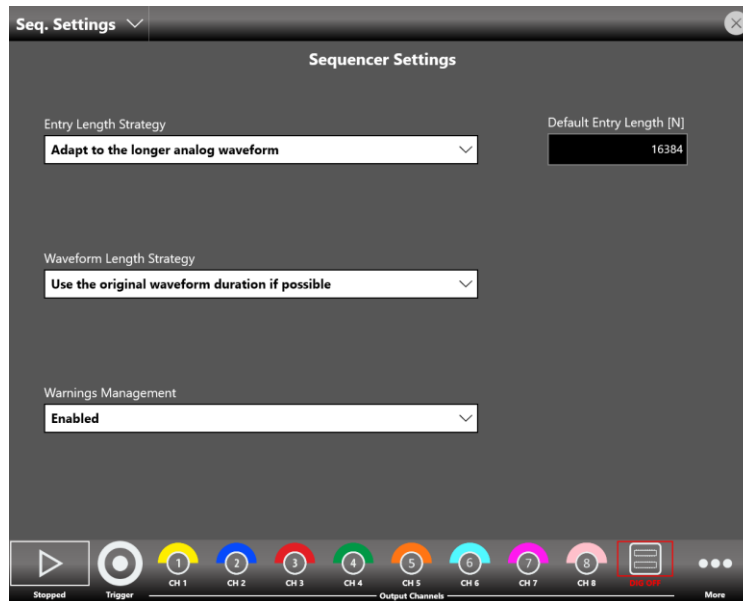
- **Advanced:** each time a trigger event has been received, while the instrument is waiting for a trigger event, a Marker pulse is generated of the duration of 8 sampling clock periods. The marker pulse is generated also each time a Jump event occurs; in this case it could be not synchronous with the output waveform.
- *Fixed To Low Voltage/ Fixed To High Voltage:* the marker level is fixed to low level or high level.
- *Replicate Digital 0:* it means that The Marker Out will behave like the Digital line 0 output. This choice is available only when the digital option is installed and the *Digital Channels* parameter (Channel Settings -> DIG page) is > 0.

Marker Skew[s]: defines the skew between the marker and the analog channels. The resolution is 78 ps. The edited value is automatically rounded to the closest value that the hardware can implement.

Voltage Level[V]: it sets the Marker high level Voltage. The Low level is fixed to 0V.

Sequencer Settings

The sequencer setting page contains some parameter to define the strategy to manage the length of the sequencer entries in relationship with the length of the channel waveforms defined for each entry.



Entry Length Strategy can be:

- *Adapt to the longer analog waveform*: if this option is selected, the length of an entry of the sequencer by default will be equal to the length of the longer channel waveform, among all analog channels, assigned to the entry;
- *Adapt to the shorter analog waveform*: if this option is selected the length of an entry of the sequencer by default will be equal to the length of the shorter channel waveform, among all analog channels, assigned to the entry;
- *Apply the default value*: if this option is selected the length of an entry of the sequencer by default will be equal to the value specified in the *Sequencer Item Default Length [N]* parameter.

Waveform Length Strategy:

This strategy is applied only to the imported waveforms that have a Sampling Rate information like the .trc files and the files imported/created from the Waveform Editor.

- *Use the original waveform duration if possible*: if this option is selected, the length of the entry will be automatically calculated to match the original duration of the imported waveform. For example, you can playback the waveforms that come from an oscilloscope acquisition (.trc files only) respecting their original duration. Please note that it is possible to use the original waveform duration only if the imported waveform data contains the sampling rate information like the .trc files and the waveforms

created using the Waveform Editor.

Warning: if you change the instrument Sampling Rate, the entry length will not be automatically recalculated; you must remove the imported waveform from the Sequencer and insert it again.

- *Use the waveform length:* if this option is selected, the length of the entry will be the same as the imported waveform length in samples. In this case, the original duration of the imported waveform will not be maintained.

The length of each entry can be manually and individually overwritten by changing the Entry Length [N] parameter in the Waveform Parameters section of the Waveform Area. Anyway, if a change in any channel waveform of the entry occur, the length of the entry will be recalculated using the strategy specified in the *Sequencer item Length Strategy* parameter.

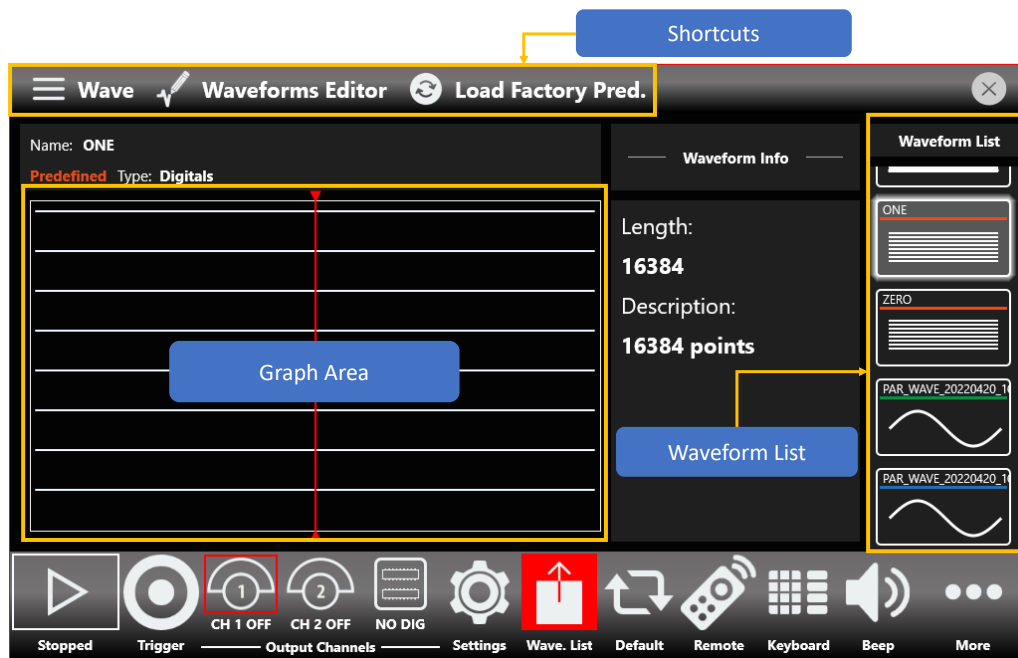
Default Entry Length [N]: this parameter specifies the length of the sequencer entries in the case when the *Sequencer item Length Strategy* parameter is set to *Apply the default value*.

Warnings Management: this parameter enables or disables the warnings shown in the Sequencer Toolbar and in the Waveform Area that notify that one or more channel waveforms have been assigned to an entry with a different length. This situation will cause the application to modify the mismatching waveforms during the execution to match the entry length using the strategy specified in the *Sample increasing/decreasing strategy* parameter (Device Settings -> General page).

When “Consider a warning as an error” option is selected, the application checks if one or more sequencer entries have a length that differs from the selected waveform length. If this condition is met, the instrument will not start.

For example if you insert a SINE waveform with a length of 16384 points into an entry of the sequencer with Length[N]=1024, when you press the Run button you will get a ‘Start Failed!’ error message; in this case you have to change the entry Length[N] parameter to 16384 to run the instrument.

Waveform List



The Waveform List consists of three main elements:

- **Shortcuts:** in this area you can access a plethora of options dedicated to managing the waveform list.
- **Graph Area:** this area displays a graphical rendition of the current selected waveform.
- **Waveform List:** in this area you can scroll between all stored waveforms.

The T3AWG-3K series contains by default a set of Factory Predefined Waveforms that are common to all configurations.

The Predefined Waveforms sport an orange line under their names, Imported Waveforms instead sport a blue underline while Parametric Waveforms sport a green underline.

Please note that:

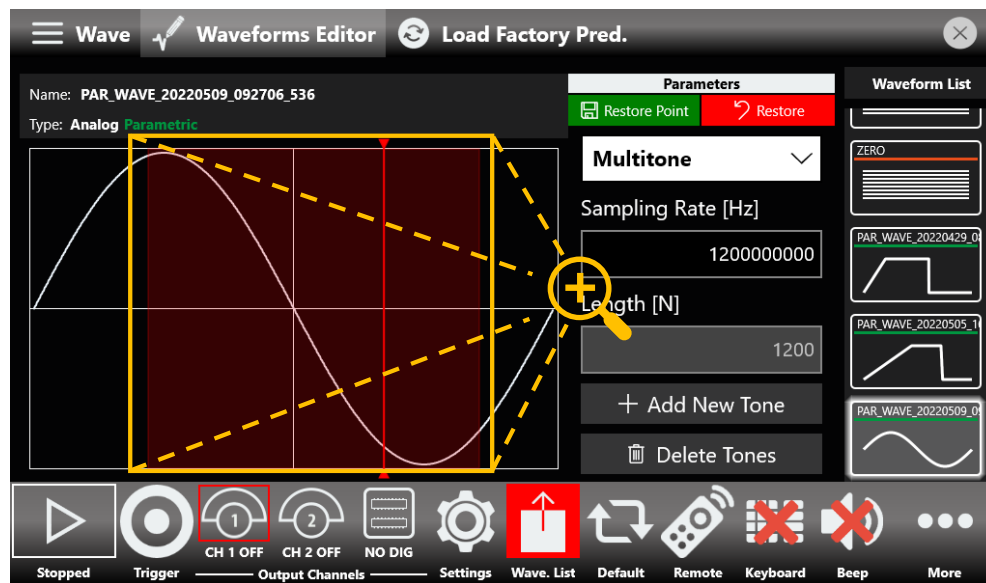
- You can build your own set of Predefined Waveform promoting waveforms in the list to Predefined ones.
- You can delete a Predefined waveform for the exception of ZERO for digital waveforms and SINE and DC level for analog waveforms.
- If you want to restore the Factory Predefined waveforms, you should press the



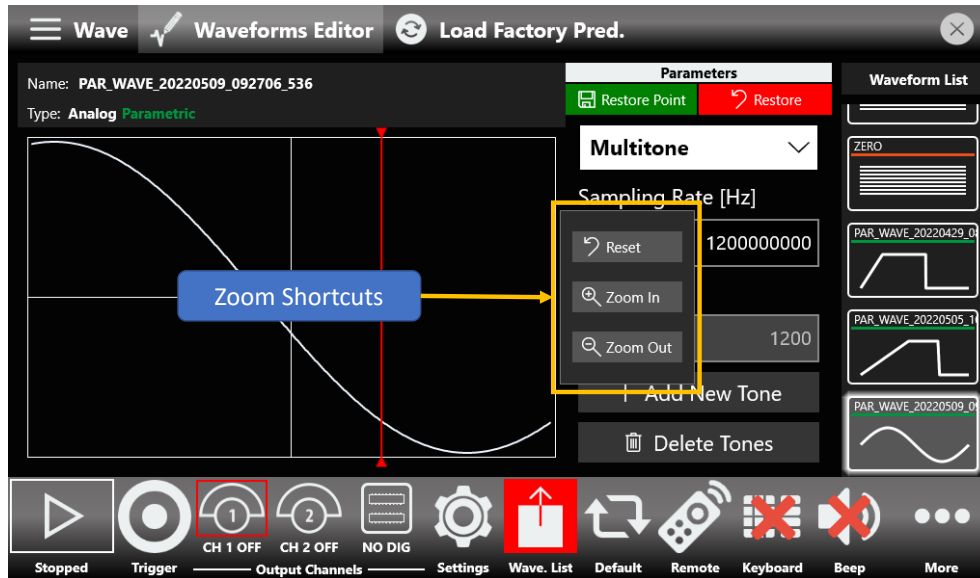
button. Please note that the imported waveforms previously promoted as Predefined will not be deleted

The Waveform Graph

The Graph Area presents you with a rendition of the currently selected waveform. You can zoom in both directions, by simply doing a pinch-in/pinch-out gesture, or by holding the left mouse button while dragging the pointer over the section you want to zoom. Doing so will highlight the selected section with a red hue overlay, like its shown in the following image.




Instead, to zoom out while using a mouse, simply drag the red slider, amongst the various information, it also contains a Reset Zoom button. If you keep the right mouse button pressed you will bring up a small shortcut menu, with option for both zooming in and out and one for resetting the zoom level to default. You can also access this menu by simply holding down when operating via touch, as shown below.




Please note that the drawn waveform is an ideal waveform depicting the value of each sample.

How to import an Analog/Digital waveform from a file

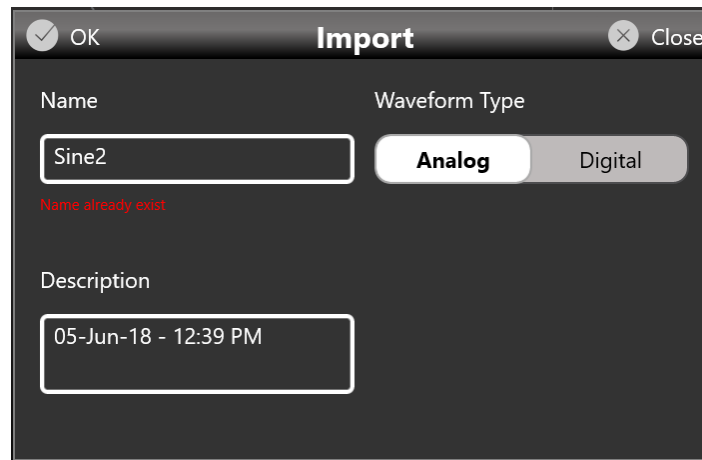
Import button  **Import** allows you to import data from a file to create a new waveform

The supported file formats are:



- .txt – New line (\n) separated text file (one column only with no header)
- .zip – Compressed file in binary proprietary format
- .trc – LeCroy oscilloscope binary file format
- .bin – Binary file. If the file will be loaded as an analog waveform, the software will use two bytes for each sample (little endian format) otherwise if the file will be loaded as a digital waveform, the software will use four bytes for each sample (little endian format).

1. Press the wave button  **Wave** located at the left end of the shortcuts area, then press the import button and a Windows File Browser will open. Select the txt or zip file you would like to import, then the Import page will open.
2. In the Import dialog, the Name and Description fields will be automatically filled with default values.
3. Select the Waveform Type you would like to import ("Analog" or "Digital").
If "Analog" is selected the waveform data will be interpreted as a single column of values (the header is not allowed). The imported waveform is normalized so that the user can easily adjust its amplitude/offset using the Waveform parameters in the Graph area of the sequencer.
If "Digital" is selected each data point is represented by a 32-bit unsigned integer where the value of each bit is transferred to the corresponding digital line (Bit 0 -> Digital Line 0, Bit 1 -> Digital Line 1, ...).

4. Press OK to confirm or Close to cancel the operation.





How to export an Analog/Digital waveform to a file

- Select an analog or digital waveform on the waveform list
- Press the  **Wave** button and then the  **Export** button
- The exported waveform will be stored in a proprietary binary .zip file format that can be shared with other instruments running the same application.
- You can export also the Predefined waveforms.
Please note this special case: if you export a Predefined waveform and then you try to import it again on the list, it will be imported as a standard analog or digital waveform.


How to promote an Analog/Digital waveform to a Predefined

Please note that when a configuration is loaded only all Predefined waveforms and those directly used at the time of saving will appear in the Waveform list.


Before saving a configuration it's necessary to promote an imported waveform as Predefined if the user want to keep it in the Waveform List.

- Select an imported analog or digital waveform on the waveform list
- Press the  **Wave** button and then the  **Set Predefined** button
- The waveform will appear on the list in red color to show that it has been promoted to Predefined.

How to edit an Analog/Digital Waveform

- Prerequisites: “Waveform Editor” software installed
- Select an analog or digital non parametric waveform on the waveform list
- Press the  button to launch the “Waveform Editor”
- Please refer to the “Waveform Editor” user manual for a complete explanation about editing and creating waveforms.




How to create a new Analog/Digital Waveform

- Prerequisites: “Waveform Editor” software installed
- Press the  button in the **More...** menu to launch the “Waveform Editor”
- Please refer to the “Waveform Editor” user manual for a complete explanation about editing and creating waveforms.

Parametric Waveforms

Parametric waveforms want to simplify and speed up the process of creating custom waveforms. While the AT Waveform Editor is still available, parametric waveforms introduce a set of highly customizable and ready to use waveforms, while still being part of the True-Arb software.

How to create a new Parametric Waveform

1. Press the  button located at the left end of the shortcuts area, then press the  button to start the creation process.
2. In the Add Parametric Waveform dialog, the Name and Description fields are automatically filled in with default values.
3. Select Predefined if you want to make the new waveform predefined.
4. Press the  button to complete the creation process, adding the newly created waveform to the waveform list. The newly created parametric waveform will be by default a sine waveform, which can be later changed to other kinds of waveform.

Add Parametric Waveform

Name

PAR_WAVE_20220420_145623_033

Description

Parametric Waveform

Analog

Yes

PredefinedNo

+ Add Waveform

Parametric Waveform Types

Wave

Waveforms Editor

Load Factory Pred.

Name: PAR_WAVE_20220420_100304_250

Type: Analog Parametric Frequency [Hz]: 73243.187500

Waveform Type

Parameters

Waveform List

type

Sine

Auto Calc Option

Frequency

Length [N]

16384

Sampling Rate [Hz]

ONE

ZERO

PAR_WAVE_20220420_1

PAR_WAVE_20220420_1

Stopped

Trigger

CH 1 OFF

CH 2 OFF

NO DIG

Settings

Wave. List

Default

Remote

Keyboard

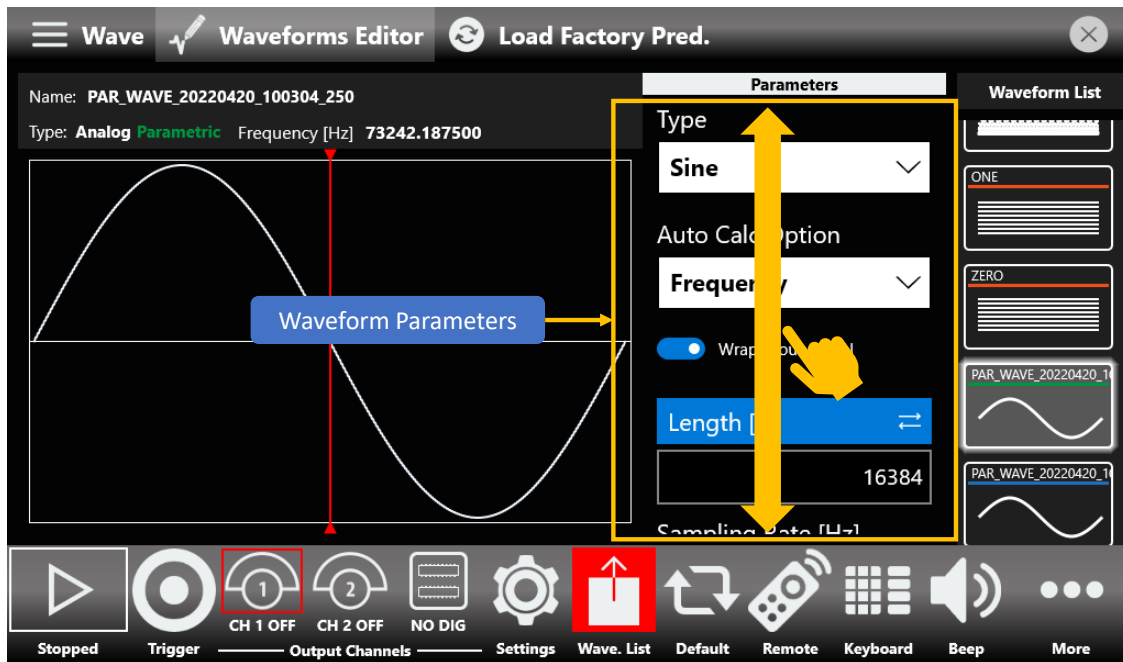
Beep

More

Once a new parametric waveform has been created, the page above will be opened. From here, you can select different type of waveforms by interacting with the **Type** drop down menu. Types available are:

Waveform Type	Parameters	Auto Calc Available
Sine Sine	Length, Sampling Rate, Cycles, Frequency, Phase	<input checked="" type="checkbox"/>
Square Pulse	Length, Sampling Rate, Cycles, Frequency, Phase, Rise & Fall Time, Duty Cycle / Pulse Width	<input checked="" type="checkbox"/>
Sweep Sweep	Length, Sampling Rate, Start Frequency, Stop Frequency, Sweep Mode	
Sinc Sinc	Length, Sampling Rate, Peak Position, Lobe Width	
Exp Exp	Length, Sampling Rate, Cycles, Time Constant, Exp Mode	
PRBS PRBS	Length, Sampling Rate, PRBS Type	
Square Square	Length, Sampling Rate, Cycles, Frequency, Phase, Rise & Fall Time	<input checked="" type="checkbox"/>
Multitone Multitone	Sampling Rate, Tone Frequency, Tone Phase, Tone Amplitude	

Once you have decided which waveform type you want, you can start customizing it as it better suits your needs. To do that, you need to set the characteristic parameters of a waveform type, which can be easily accessed by scrolling up and down the waveform parameters area as shown in the following image.



The Auto Calc Menu

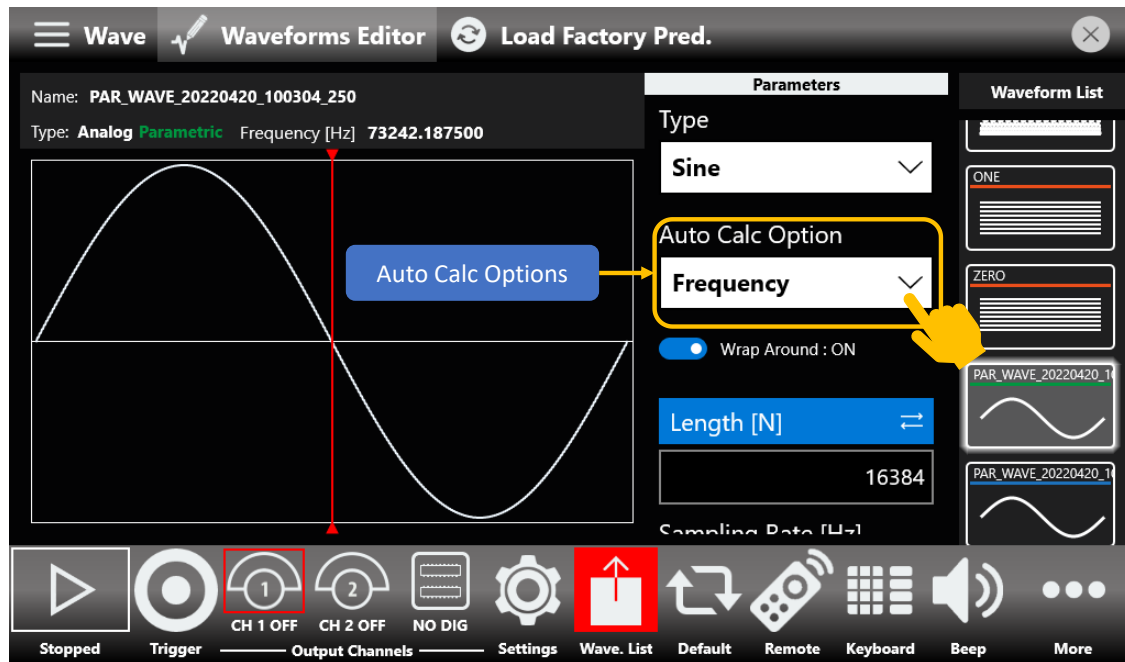
As shown in the table detailing the different waveform types you can choose (see Parametric Waveform Types paragraph), some of these (i.e., Pulse, Square, Sine) have Auto Calc.

What Auto Calc does is simple, it lifts you from the bothersome and sometime time-consuming task of finding a setup which correctly synthesize the desired frequency. There are four different strategies, with varying degree of freedom detailed in the following table.

Auto Calc Strategy	Length	Sampling Rate	Cycles	Frequency
Length	🔒	☑	☑	☑
Sampling Rate	☑	🔒	☑	☑
Cycles	☑	☑	🔒	☑
Length & Cycles	🔒	☑	🔒	☑

Each ☑ in the table means that you are able to freely change that parameter within reasonable boundaries such as those specified by Shannon's theorem; whilst the lock means that a parameter or pair of thereof are being automatically determined and aren't directly customizable.

To change the employed strategy, tap the Auto Calc Options drop down button and then select the strategy that best suits your needs from the submenu.



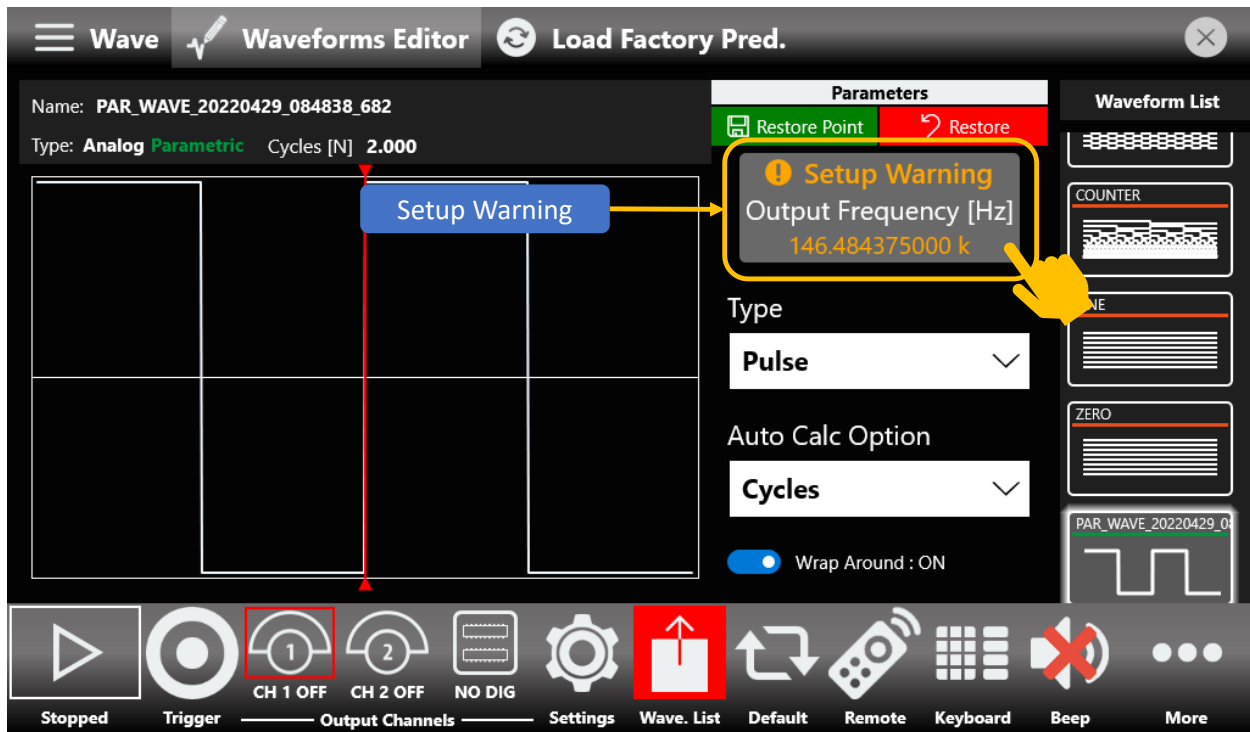
Lastly it is important to note the impact of the Wrap Around toggle switch. When on, it enforces that the number of cycles must be whole. Instead, when turned off, the number of cycles can be not-whole. This is very important and impactful whilst the Auto Calc Cycles or Auto Calc Cycles and Length strategy are in use, as it can lead to wildly different results. This comes with its drawbacks though, as a not-whole number of cycles can lead to undesired signal behaviors, like a spurious signal once analyzed in the frequency domain.

The Setup Warning Menu

The setup warning is a feature that comes with those waveform types that sport Auto Calc (i.e., Pulse, Sine, Square).

Sometimes the set of values assigned to parameters part of the Auto Calc domain, which are Frequency, Sampling Rate, Length, Cycles leads to an unfeasible setup.

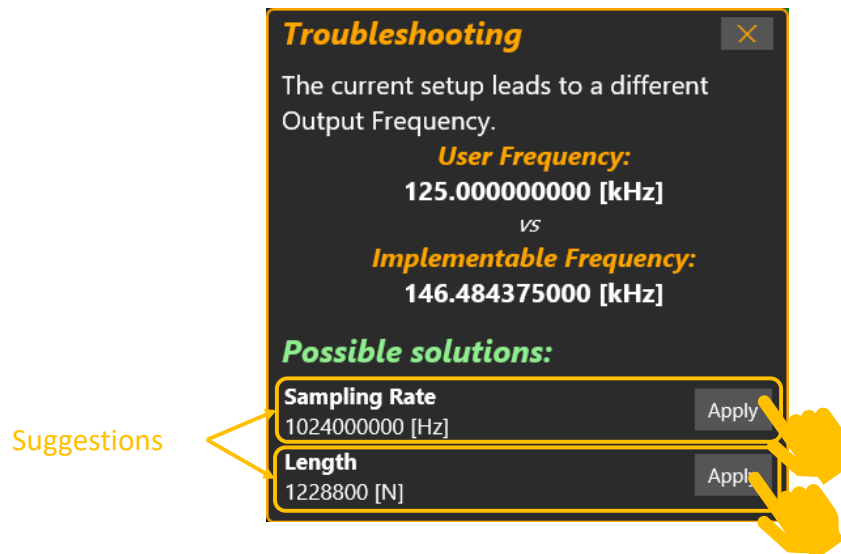
This behavior is highlighted by the Setup Warning message, which appears as soon as this condition arises.



Tapping on the setup warning message, will open a small pop up with a brief description of what is happening.

Furthermore, it also may offer suggestions regarding those same parameters, so that the user-set output frequency is correctly synthesized, as shown in the image below. You can directly apply those values from within the pop-up message, or note them down and manually input them.

Note though that these suggestions aren't always guaranteed to be available.

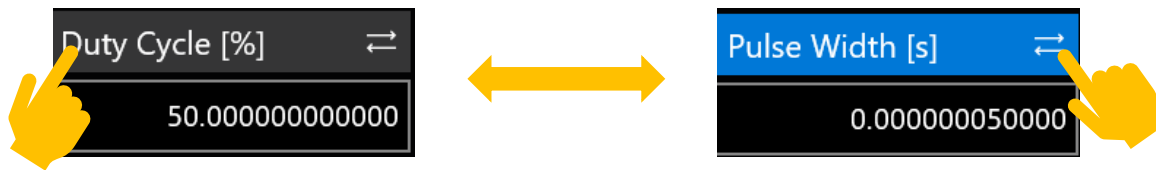


Pulse Type Parametric Waveform

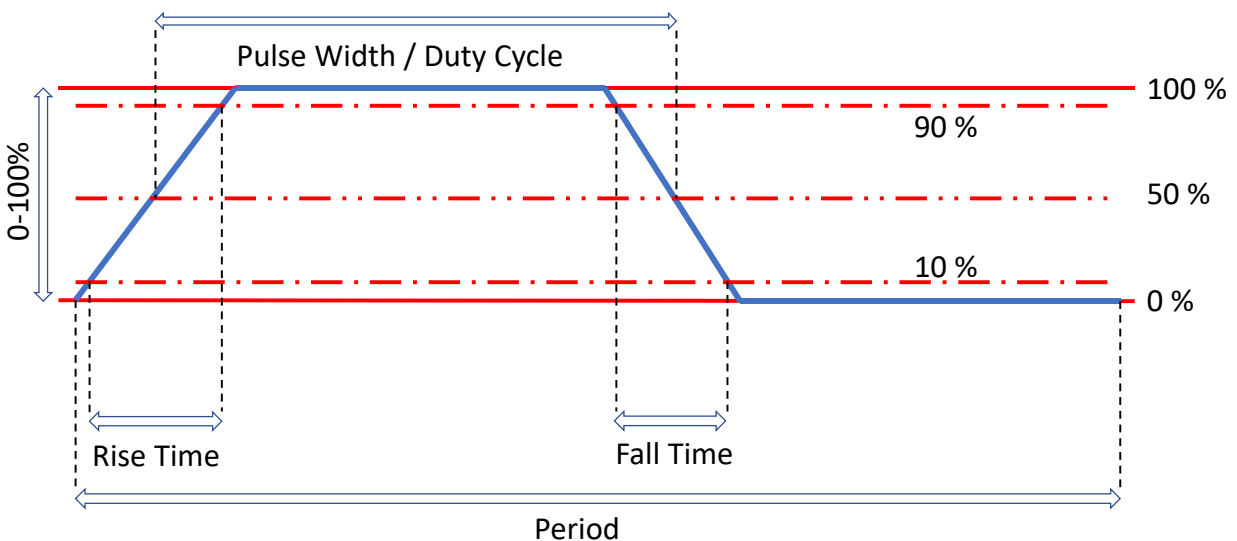
Once you select **Pulse** from the list of available waveform types and set it up so that it has the desired frequency, it's now time to start customizing it.

A **Pulse** parametric waveform, offers the following parameters related to the shape of a pulse: **Fall Time**, **Rise Time**, **Pulse Delay** and one between **Duty Cycle** and **Pulse Width**.

You can change between Duty Cycle and Pulse Width anytime by simply tapping on them.



A **Pulse** type parametric waveform abides by the following model:



Both Rise and Fall times follow the 10-90 format and are taken into account so that the above model holds true.

With **Pulse Delay** you can control the initial delay you want your pulse to have.

Square Type Parametric Waveform

Square type parametric waveforms are closely related to **Pulse** type parametric waveforms, having in common all parameters except Pulse Width/Duty Cycle, as they aren't available. These differences arise from the fact that a **Square** waveform **always** has a **50%** Duty Cycle.

Sweep Type Parametric Waveform

The **Sweep** type parametric waveform is one of the types that doesn't have Auto Calc, as such you're free to customize both **Length** and **Sampling Rate**.

It has three characteristic parameters: **Start Frequency**, **Stop Frequency** and **Sweep Mode**.

While Start and Stop Frequency are straightforward, as their names imply, Sweep Mode instead lets you change between a **Linear** and a **Logarithmic** sweep.

To change the Sweep Mode, you only need to tap on the Sweep Mode toggle switch, as shown in the image below.



Exponential Type Parametric Waveform

The **Exponential** type parametric waveform is one of the types that doesn't have Auto Calc, as such you're free to customize both **Length**, **Sampling Rate** and **Cycles**.

It has two characteristic parameters: **Time Constant** and **Exponential Mode**.

By interacting with the Exponential Mode toggle switch, you can toggle between an Exponential **Rise** and an Exponential **Decay**, as shown in the image below.



Sine Type Parametric Waveform

Sine type parametric waveforms have Auto Calc, so once you're set with the frequency you want you signal at, you can change its **Phase** by customizing the Phase constant among the available parameters.

Sinc Type Parametric Waveform

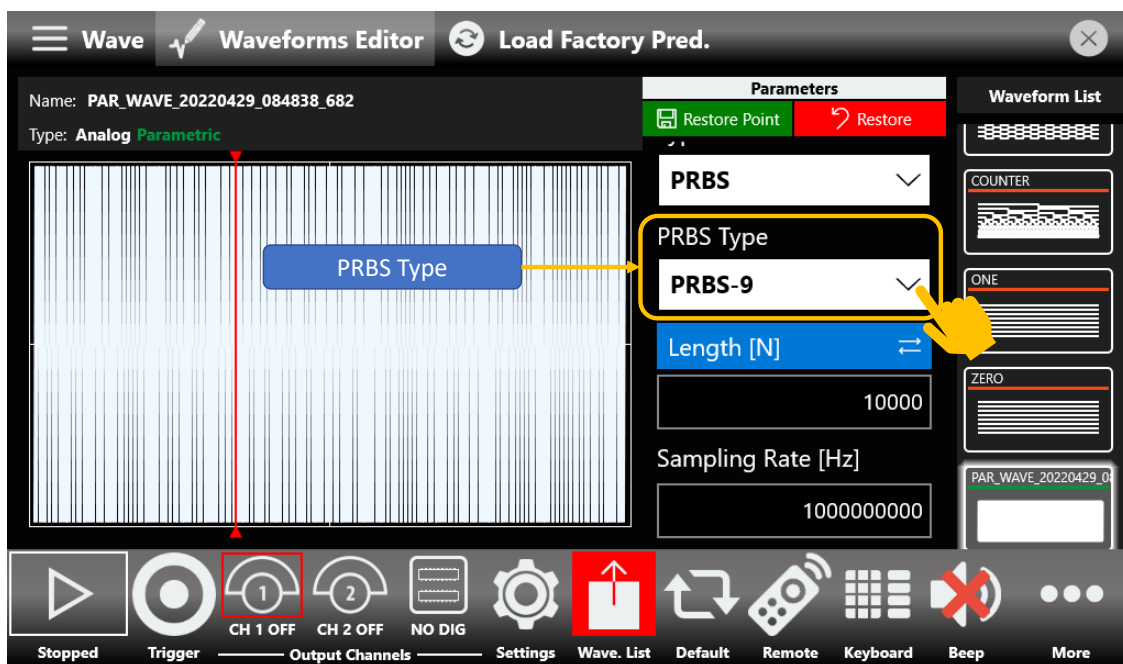
Sinc type parametric waveforms do not have Auto Calc, as such you're free to customize both **Length** and **Sampling Rate** as you see fit.

You can further customize its shape by changing one or both among the **Peak Position** and **Lobe Width**.

PRBS Type Parametric Waveform

PRBS type parametric waveform don't have Auto Calc, leaving you free to customize **Length** and **Sampling Rate** as you see fit.

You can change the PRBS type by tapping on the PRBS type drop down menu and selecting one amongst the available ones, as shown in the image below.



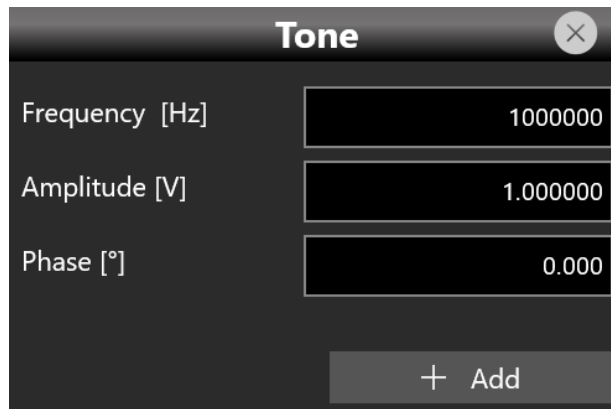
Available PRBS types are:

1. PRBS 7
2. PRBS 9
3. PRBS 11
4. PRBS 15
5. PRBS 23
6. PRBS 31

Multitone Type Parametric Waveform

Multitone type parametric waveforms let you create your own custom sum of different sinusoidal tones, with a maximum of 10 Tones, or less if the number of samples exceed the memory limit.

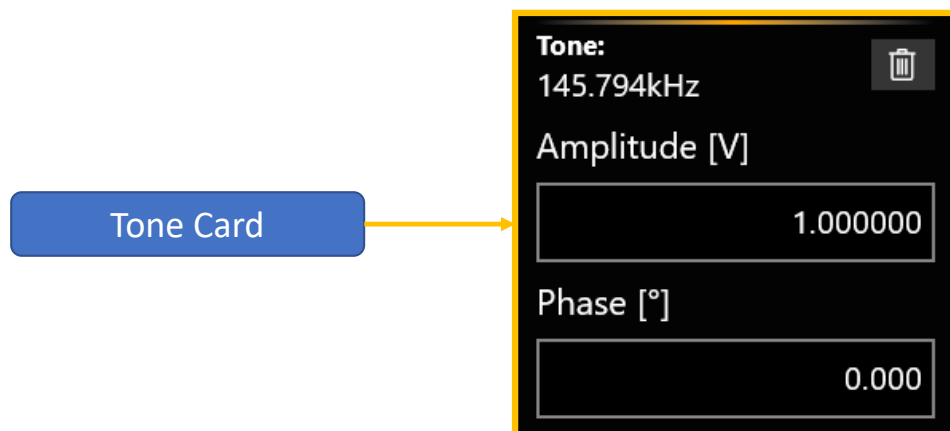
Once you've set the **Sampling Rate** as you see fit, you can start adding in your desired Tones. To add a Tone, you only need to tap onto the **+ Add New Tone** button, then a dialog box will open and within it, you can set the characteristic parameters of a Tone: Frequency, Amplitude, Phase.



The image shows a 'Tone' dialog box with a close button (X) in the top right corner. It contains three input fields: 'Frequency [Hz]' with the value '1000000', 'Amplitude [V]' with the value '1.000000', and 'Phase [°]' with the value '0.000'. At the bottom right, there is a button labeled '+ Add'.

This kind of waveform doesn't have Auto Calc, yet it works in similar fashion to the Length & Cycles option that auto calc powered waveforms have. As such, while still being displayed, the **Length** parameter isn't directly customizable, but it's determined each time you add or remove a Tone.



Once you have finished adding in your set of tones, you can further customize their Amplitude and Phase on a tone-by-tone basis, as shown in the image below, simply interacting with each tone "card" in the tone "queue".

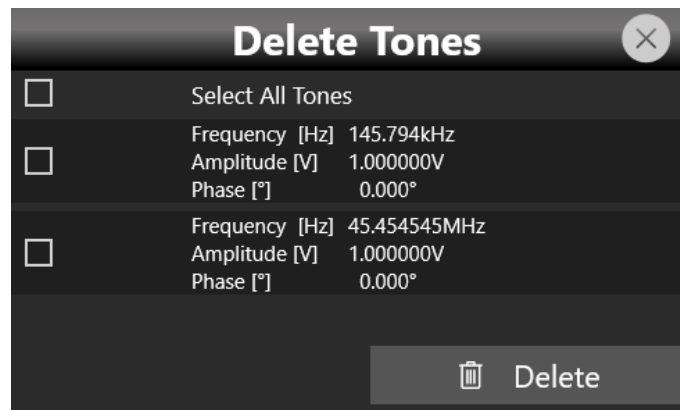


The diagram illustrates a 'Tone Card' (a blue rounded rectangle) with an arrow pointing to a detailed view of a tone's parameters. The detailed view is a black box with a yellow border containing the following information: 'Tone:' followed by '145.794kHz', a trash icon, 'Amplitude [V]' followed by '1.000000', and 'Phase [°]' followed by '0.000'.


You can't change the Tone Frequency though, more so as soon as a single Tone is present in the tone queue, trying to alter the Sampling Rate will result in a warning message, prompting you to either dismiss the change or deleting all queued tones before changing the Sampling Rate.


Whilst you're adding a tone, it may happen that you misenter its frequency. If you want to delete a tone you can follow two distinct routes:

- The first one, simply entails you to tap onto the  button, part of each Tone card in the Tone queue.
- The second one instead, while fundamentally working as the first, is more tailored towards deletion of multiple tones at once. To do that, tap onto the  **Delete Tones** button; a submenu will open, showing a brief summary of the currently queued tones. Each entry has a small checkbox that you can mark if you want that tone to be delete once you tap onto the delete button, as shown in the image below.





How to create and load a Restore Point

Once you finish setting up a parametric waveform as you see fit you can create a **Restore Point**. What a restore point does is fairly simple: it takes a snapshot of the current parametric waveform configuration, so that if you modify it, perhaps unknowingly, or you aren't satisfied with result of your changes you only need to tap onto the  button to go back.

To create a **Restore Point** simply tap onto the  button.

How to obtain the array points from a parametric waveform

Once you have finished customizing a parametric waveform as you see fit you can obtain its array points. To do so, after selecting the chosen parametric waveform, tap onto the  **Wave** button in the shortcuts area and then onto the  button.

A new non parametric waveform containing the array points will be created and added to the waveform list, which you can later export and modify as you see fit.

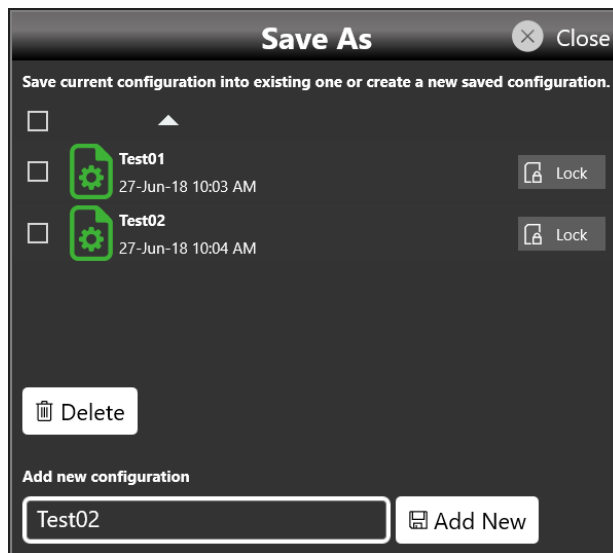
Configurations

A configuration contains the data in proprietary format relative to the channel waveforms inserted into the sequencer and all the instrument and sequencer parameters.

Save As...



A configuration can be saved by means of the “Save As” button that will open the following dialog box. The configuration will be saved in the configuration list that can be accessed by the “Load From” dialog box



In this page you can add a new configuration entry or overwrite an existing one. To create a new configuration entry, it is necessary to write a name in the text box in the bottom of the page and click on “Add New”.

Export Configuration



If you touch the Export Configuration button a proprietary binary .zip file relative to the current configuration will be exported. The exported file can be used to share configurations between different users or instruments.

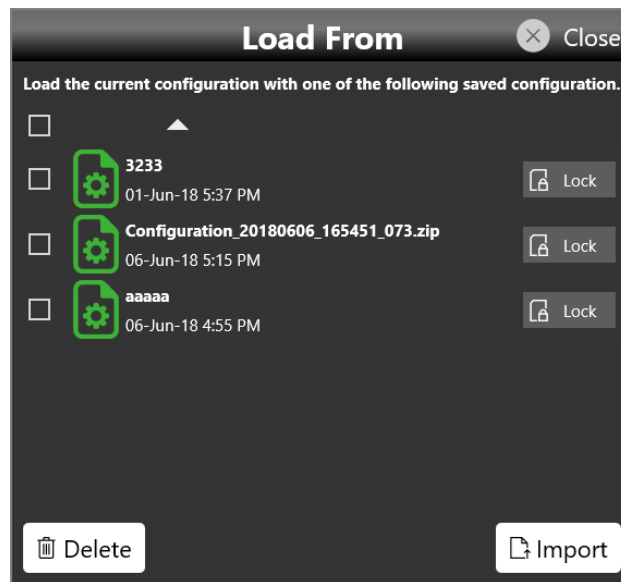
Load From...



Touching the “Load From” button in the “More” menu, a page will be opened that shows the list of all the saved and imported configurations.

If you select an existing Configuration, you will load all the settings into the instrument.

In the “Load From” page it is also possible to manage the configuration list: you can delete, import or lock a configuration. When a configuration is locked it can't be deleted or overwritten.

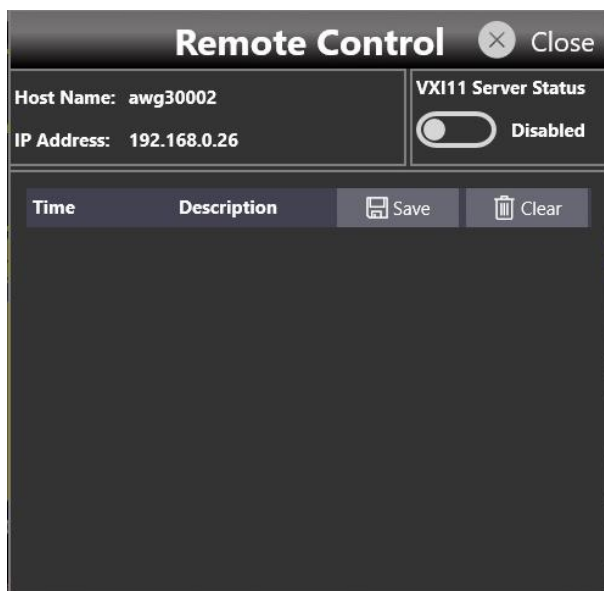


If you touch the Import Configuration button you can import the configuration file that comes from a different machine or from a different user. The imported configuration will be inserted in the “Load From” list.

Remote Control



The “Remote” button located in the Command Bar opens the page of the SCPI server. In that page there is the list of all the commands received by the SCPI server and its replies. If the text of the command is displayed in **green** it means that the command is correct and it has been accepted by the server. If the text of the command is displayed in **red** it means that the command is wrong and it hasn't been accepted by the server.



In the top of the page the Host Name and the IP Address of the instrument are shown. The slider on the right side of the page allows to enable or disable the SCPI server. It is enabled by default.

Remote Desktop Connection



If you need to connect to the instrument using the remote desktop connection, you should insert the following credentials:

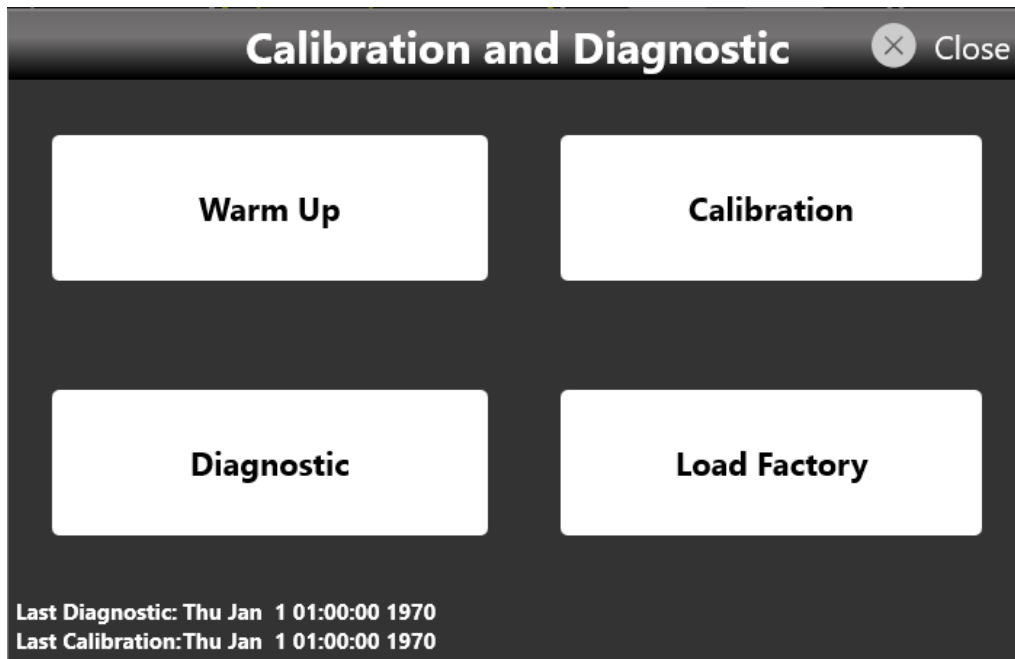
Computer Name: awg3000

User Name: awg3000

Password: 1234

Calibration and Diagnostic

The calibration button  in the More... menu  opens the Calibration and Diagnostic page.



Below a description of the actions executed by pressing the buttons located in the page:

- *Warm up* button: touching this button will start the warm up instrument procedure that will take 30 minutes. The elapsed time is shown. The procedure can be stopped by touching the Stop button located at the bottom right of the Warm Up page
- *Calibration button*: touching this button will start the self-calibration of the instrument. The logs of the procedure are displayed in a text box that can be saved at the end of the procedure for further analysis.
- *Diagnostic* button: touching this button will start the self-diagnostic of the instrument. The logs of the procedure are displayed in a text box that can be saved at the end of the procedure for further analysis.
- *Load Factory* button: touching this button will load the factory calibration parameters.

Multi-Instrument System

In a Multi-Instrument configuration a Master device can control every triggering and timing setting in order to synchronize its operation with that of other Slave devices.

You can connect up to four T3AWG3358/3258 units to have a system with 32 synchronized analog channels and up to 128 digital channels.

In order to set up a Multi-Instrument system you must first:

- Turn off the instruments;
- Select the instrument that you want to use as Master, the other units will be considered as Slave.
- Using the Sync Cable, connect the Master **Sync Out** connector to the Slave **Sync In** connector you can find on the rear of the instruments.



Sync OUT and Sync IN
connectors



Master instrument

Slave instrument

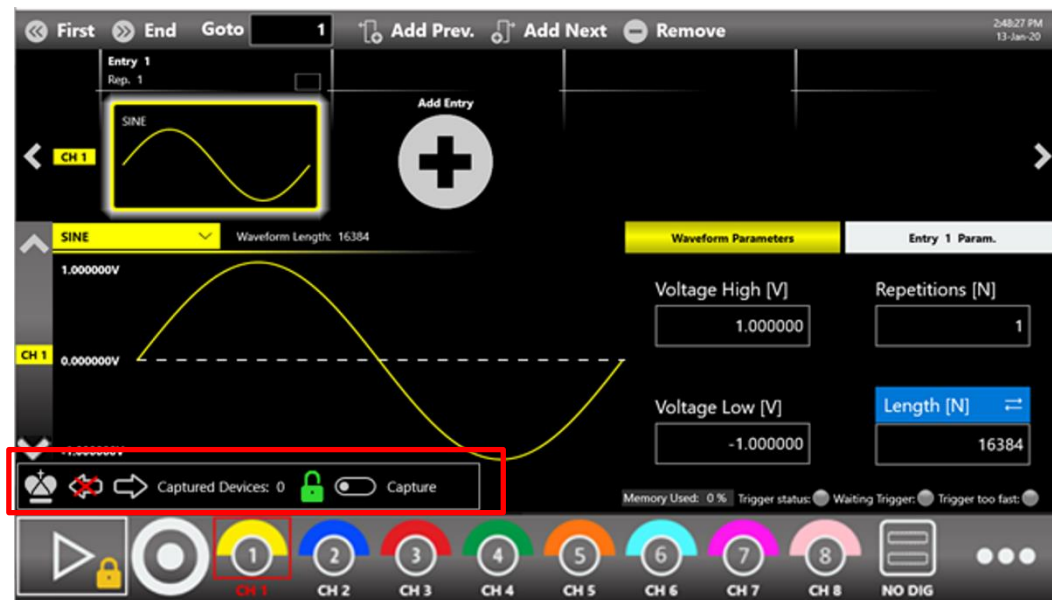
Once all the instruments have been connected, turn them on and launch the Simple TrueArb application.

Please note that:

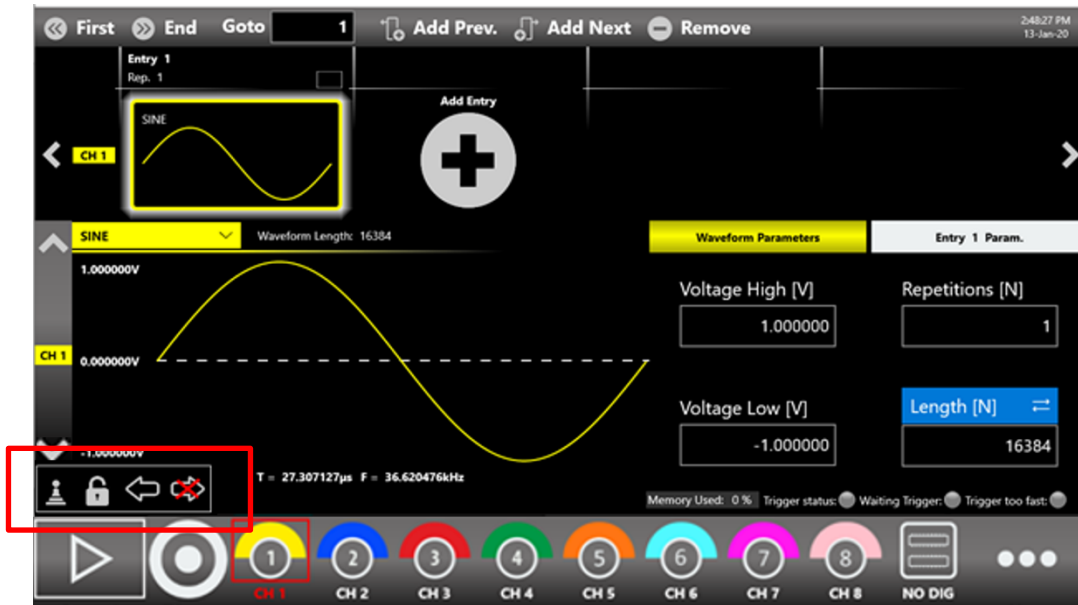
- The Multi-Instrument System is available on T3AWG3358/3258 units only;
- Before connecting or disconnecting Sync Cables, you must turn off the instruments;
- The external sampling clock and external trigger input are available in Master device only;

The following steps describe the operations that you should perform to set up a Multi-Instrument system and start the generation of two devices.

1. On Master and Slave units, launch the Simple TrueArb Application.
2. On the Master unit (the one with the Sync OUT port connected) will appear a new Master Multi-instrument bar:



3. On the Slave unit (the one with the Sync IN port connected) will appear a new Slave Multi-instrument bar:



4. Slide the Capture switch on the Master Multi-Instrument bar:



5. The lock icon will change to show that a device has been captured:

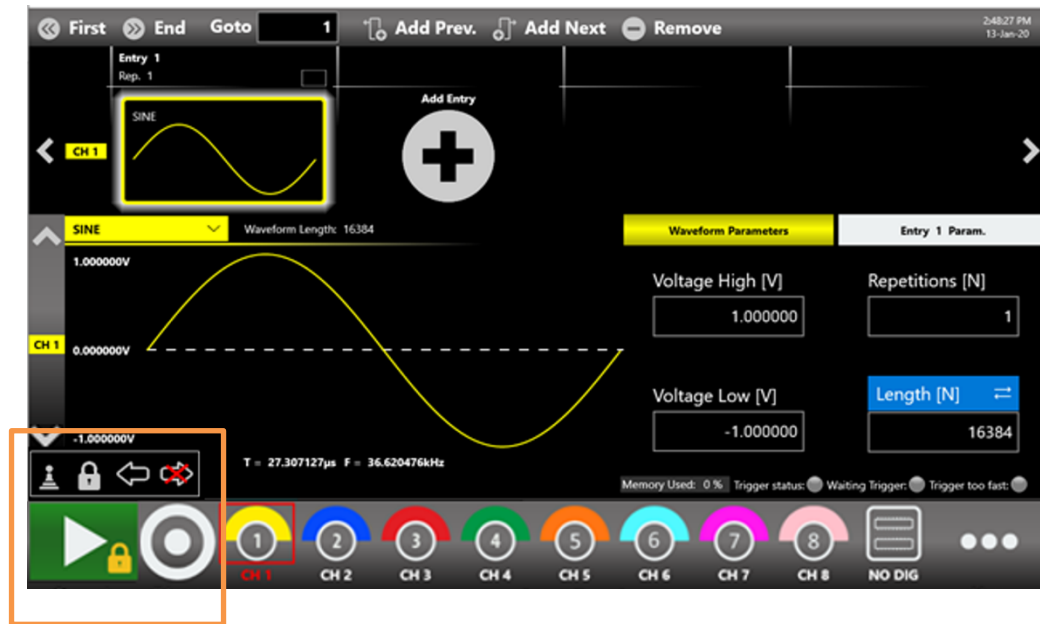


The number of captured devices is now 1.

6. On the slave device also the lock icon will change to show that the instrument has been captured:



7. Press Start on the Master device. Both the master and the slave instruments will start synchronously. A lock symbol on the start button of the captured instrument indicates that it is controlled by the master device:









8. To stop the generation, press the Stop button on the master device;
9. To unlink the instruments, slide the Release switch on the master device. In this way the two devices can be independently controlled by their respective interfaces.

Master Multi-Instrument Bar

On the Master device, a new Multi-Instrument bar will appear when it detects the connection with other T3AWG3358/3258 units via the Sync cable:



The description of these symbols is summarized in the following table:







	It indicates that the instrument is the Master. It is the first device of the chain and it can control the generation of all the connected devices.
	It indicates that no other device has been found backward on the device chain. It will appear only on the master instrument.
	It indicates that a slave device has been found forward on the device chain.
	It indicates that the master instrument has not captured the slave instruments connected. By sliding the Capture button, the master instrument will capture and control the connected devices.
	It shows the number of devices that are controlled by the master instrument after a Capture event.
	It indicates that the master instrument has captured the slave devices, so it can control the generation of the whole instruments chain. By sliding the Release button, the master instrument will release the control of the connected devices.

Slave Multi-Instrument Bar


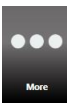
On the Slave device, a new Multi-Instrument bar will appear when it detects the connection with other T3AWG3358/3258 units via the Sync cable:

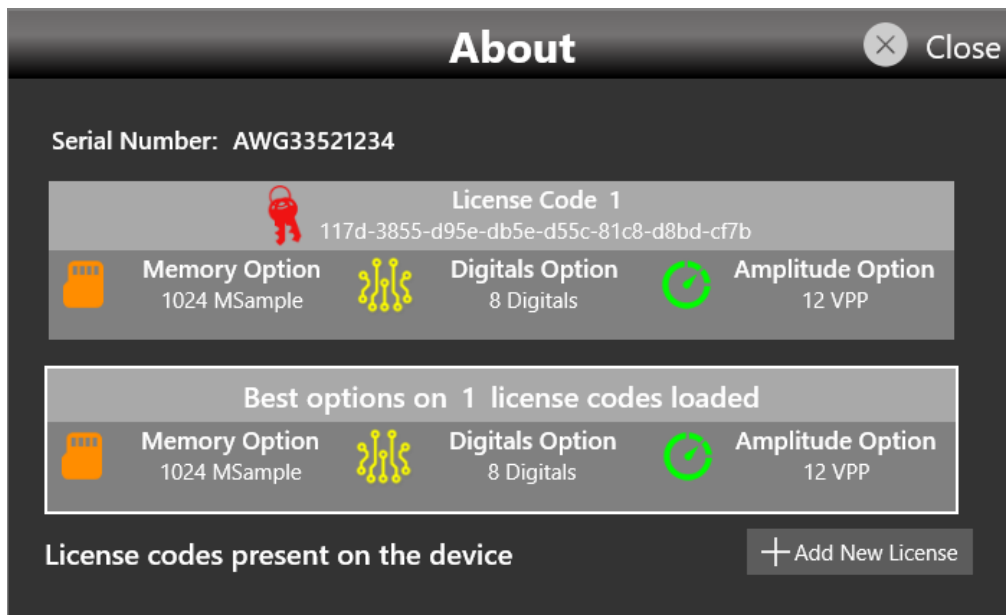


The description of these symbols is summarized in the following table:

	It indicates that the instrument is a slave device and, if captured, it can be controlled by the master unit.
	It indicates that the instrument has not been captured by the master device.
	It indicates that the instrument has been captured and will be controlled by the master device.
	It indicates that another device has been found backward on the device chain. It could be the master unit or another slave unit.
	It indicates that another slave device has been found forward on the chain.
	It indicates that no others slave devices has been found forward, so this instrument is the last of the chain.

License

The license button  in the More.. menu  opens the License page that serves to manage the license options.



Touching the Add New License button it is possible to enter a new license key to enable any of the following licenses:

T3AWG-3352/3252 models

- a. T3AWG3-M: memory extension to 256 MSamples per channel
- b. T3AWG3-X: memory extension to 512 MSamples per channel
- c. T3AWG3-XL: memory extension to 1024 MSamples per channel
- d. T3AWG3-HV: hi voltage output (12 Vpp on 50 Ohm)
- e. T3AWG3-8 DIG: 8 channel digital license
- f. T3AWG3-M-UPGRADE: memory extension to 256 MSamples per channel
- g. T3AWG3-X-UPGRADE: memory extension to 512 MSamples per channel
- h. T3AWG3-XL-UPGRADE: memory extension to 1024 MSamples per channel
- i. T3AWG3-HV-UPGRADE: hi voltage output (12 Vpp on 50 Ohm)
- j. T3AWG3-8DIG-UPGRADE: 8 channel digital license

T3AWG-3354/3254 models

- a. T3AWG3-XL-4CH: 1024 Mpt/Ch Memory Option for T3AWG3K-4CH
- b. T3AWG-XL-UPGRADE-4CH: 1024 Mpt/Ch Memory Upgrade-4CH
- c. T3AWG3-HV-4CH: High Voltage (12 Vpp on 50 Ohm) for T3AWG3K-4CH
- d. T3AWG3-HV-UPGRADE-4CH: High Voltage (12 Vpp on 50 Ohm) UPGRADE for T3AWG-4CH
- e. T3AWG3-16DIG-4CH: 16 Digital Output Channels (incl. Mini-SAS cable) for T3AWG3K-4CH
- f. T3AWG3-16DIG-UPGRADE-4CH: 16 Digital Output Channels (incl. Mini-SAS cable) UPGRADE for T3AWG3K-4CH

T3AWG-3358/3258 models

- a. T3AWG3-XL-8CH: 1024 Mpt/Ch Memory Option for T3AWG3K-8CH
- b. T3AWG-XL-UPGRADE-8CH: 1024 Mpt/Ch Memory Upgrade-8CH
- c. T3AWG3-HV-8CH: High Voltage (12 Vpp on 50 Ohm) for T3AWG3K-8CH
- d. T3AWG3-HV-UPGRADE-8CH: High Voltage (12 Vpp on 50 Ohm) UPGRADE for T3AWG-8CH
- e. T3AWG3-16DIG-8CH: 16 Digital Output Channels (incl. Mini-SAS cable) for T3AWG-8CH
- f. T3AWG3-16DIG-UPGRADE-8CH: 16 Digital Output Channels (incl. Mini-SAS cable) UPGRADE for T3AWG-8CH
- g. T3AWG3-32DIG-8CH: 32 Digital Output Channels (incl. Mini-SAS cable) for T3AWG-8CH
- h. T3AWG3-32DIG-UPGRADE-8CH: 32 Digital Output Channels (incl. Mini-SAS cable) UPGRADE for T3AWG-8CH

To get the licence key please contact your distributor sales representative.

Appendix A – Digital Option and accessories

When you buy the digital option, you will receive a software licence key and 1 mini-SAS HD cable 1m long.

Be careful that even if this cable has the same mechanical dimension of SFF-8644 standard the electrical connection are customized, so **it's not possible to use standard mini-SAS HD cables** otherwise the unit will be **damaged**.

There are also two additional accessories available to be used with the digital outputs. These accessories must be bought separately because they are not included in the digital option. The two accessories are:

- The T3AWG3-8DIG-SMA cable. This is a mini-SAS to SMA cable adapter. It allows to convert the 8 digital LVDS output of the mini-SAS connector into 16 SMA connectors (2 SMA per LVDS pair)
- The T3AWG3-8DIG-TTL. This is a probe that can be connected to the mini-SAS HD cable provided with the dig license and it allows to convert LVDS output of the mini-SAS HD connector into LVTTTL standard signals.

The end of the mini-SAS HD cable provided with the digital options mechanically mates with standard mini-SAS HD connectors while the **electrical connection is different from the standard**.

So if you need to connect the mini-SAS HD cable provided with the digital option you custom pcb to you can use standard mini-SAS HD connectors (e.g. Amphenol 10112626-101LF, Amphenol 10112632-101LF, Amphenol 10120666-101LF, TE Connectivity 2198484-1) but you should take case of using the electrical connection shown below.

The connection of the T3AWG3-8DIG-SMA cable adapter (mini-SAS HD to 16 SMA adapter cable) are also described in the table below.

Mini-SAS HD connector pinout



Mini-SAS HD connector	Assigned signal	T3AWG3-8DIG-SMA Mini SAS HD to 16 SMA cable (8 LVDS output)
A1	+12Vcc	NA
A2	+12Vcc	NA
A3	GND	SMA Ground
A4	DO7_P	DO 7_P
A5	DO7_N	DO 7_P
A6	GND	NA
A7	DO0_P	DO 0_P
A8	DO0_N	DO 0_N
A9	GND	SMA Ground
B1	CS1 (RESERVED). Do not connect.	NA
B2	+12Vcc	NA
B3	GND	SMA Ground
B4	DO6_P	DO 6_P
B5	DO6_N	DO 6_N

B6	GND	SMA Ground
B7	DO1_P	DO 1_P
B8	DO1_N	DO 1_N
B9	GND	SMA Ground
C1	+5Vcc	NA
C2	+5Vcc	NA
C3	GND	SMA Ground
C4	D5_P	DO 5_P
C5	D5_N	DO 5_N
C6	GND	SMA Ground
C7	D2_P	DO 2_P
C8	D2_N	DO 2_N
C9	GND	SMA Ground
D1	SCL (RESERVED). Do not connect.	NA
D2	SDA (RESERVED). Do not connect.	NA
D3	GND	SMA Ground
D4	D4_P	DO 4_P
D5	D4_N	DO 4_N
D6	GND	SMA Ground
D7	D3_P	DO 3_P
D8	D3_N	DO 3_N
D9	GND	SMA Ground

1.1 T3AWG3-8DIG-SMA



The T3AWG3-8DIG-SMA cable adapter converts from the Mini SAS HD connector located on the rear of the instrument to 16 SMA connectors. This cable ensures the best signal integrity and flexibility required for transmitting the high speed digital signals provided by the T3AWG-3K generator series.

Output connector	SMA
Output type	LVDS
Number of SMA	16 (8 bits)
Cable type	Proprietary standard
Cable Length	1 meter

1.2 B. T3AWG3-8DIG-TTL

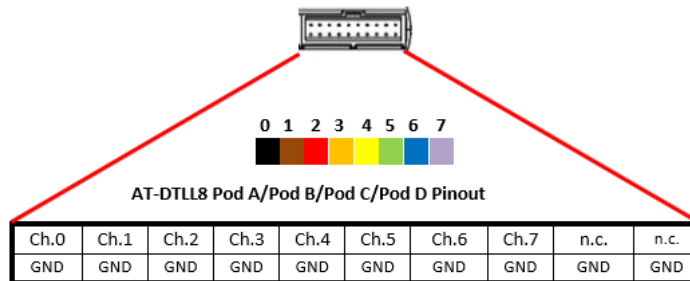
The T3AWG3-8DIG-TTL is a 8 bit LVDS to LVTTTL converter that converts LVDS differential signals provided by the mini-SAS HD digital connector to standard LVTTTL single ended signals. The probe provides the possibility to programme by software the voltage high level of the TTL signals from 0.8V to 3.8V.

The T3AWG3-8DIG-TTL probe max bit rate is 125 Mbps @ 0.8V and 400 [Mbps@3.6V](#).



Important Note: the T3AWG3-8 DIG/T3AWG3-8DIG-UPGRADE does not include the T3AWG3-8DIG-TTL that must be bought separately.

Below the description of the TTL signal connector is provided.



Output connector	20 position 2.54 mm 2 Row IDC Header
Output electrical standard	LVTTTL
Output impedance	50 Ω nominal
Output voltage	0.8V to 3.8V programmable (same for all channels)
Maximum Update Rate	125 Mbps @ 0.8V and 400 Mbps @ 3.6V
Dimensions	W 52 mm – H 22 mm – D 76 mm
Input Connector	Proprietary standard
Cable Length	1 meter
Cable Type	Proprietary

Certifications

Teledyne LeCroy certifies compliance to the following standards as of the time of publication. Please see the EC Declaration of Conformity document shipped with your product for current certifications.

EMC Compliance

EC DECLARATION OF CONFORMITY - EMC

The instrument meets intent of EC Directive 2014/30/EU for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications listed in the Official Journal of the European Communities:

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

Electromagnetic Emissions:

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

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

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

Electromagnetic Immunity:

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

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

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

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

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

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

¹ To ensure compliance with all applicable EMC standards, use high-quality shielded interface cables.

² Emissions which exceed the levels required by this standard may occur when the instrument is connected to a test object.

³ This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.

⁴ Meets Performance Criteria "B" limits of the respective standard: during the disturbance, product undergoes a temporary degradation or loss of function or performance which is self-recoverable.

⁵ Performance Criteria "C" applied for 70%/25

Safety Compliance

EC DECLARATION OF CONFORMITY – LOW VOLTAGE

The instrument meets intent of EC Directive 2014/35/EU 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:

- Mains Supply Connector: Overvoltage Category II, instrument intended to be supplied from the building wiring at utilization points (socket outlets and similar).
- Measuring Circuit Terminals: No rated measurement category. Terminals not intended to be connected directly to the mains supply.
- Unit: Pollution Degree 2, operating environment where normally only dry, non-conductive pollution occurs. Temporary conductivity caused by condensation should be expected.



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 2012/19/EU and 2013/56/EU 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)

Unless otherwise specified, all the materials and processes are compliant with RoHS Directive 2011/65/EU in its entirety, inclusive of any further amendments or modifications of said Directive.