Model 675
High Performance AWG
Simple TrueArb User Manual

Rev 1.7.4, July 2020

Summary

Contacting Berkeley Nucleonics Corporation

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General Safety Summary

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Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

Use Proper Power Cord
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Ground the Product
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Observe All Terminal Ratings
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Power Disconnect
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Do Not Operate Without Covers
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Do Not Operate With Suspected Failures
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Avoid Exposed Circuitry
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Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Provide Proper Ventilation
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Safety Requirements

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Safety Symbols

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CAUTION

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u   **CAUTION**   @   @ **CAUTION**

WARNING
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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 Model 675 High Performance AWG 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 Model 675 High Performance AWG Series package includes the following:
- Model 675-2C/4C/8C Arbitrary Waveform Generator equipment
- Power Cord
- Performance/Calibration Certificate
- CE certificate

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Models

Item	Description
Model 675-2C-2M	
Model 675-2C-64M	
Model 675-2C-128M	
Model 675-4C-2M	
Model 675-4C-64M	
Model 675-4C-128M	
Model 675-8C-2M	
Model 675-8C-64M	
Model 675-8C-128M	

Recommended Accessories

Item	Description
Model 675-XC-DIG8	
AT-DTTL8	
AT-LVDS-SMA8	
Model 675-2C-WAR	Model 675-2C
Model 675-4C-WAR	Model 675-4C
Model 675-8C-WAR	Model 675-8C
Model 675-2C-HV	Model 675-2C
Model 675-4C-HV	Model 675-4C
Model 675-8C-HV	Model 675-8C
RIDER-AWG-SYNC	Model 675-8C
Model 675-2C-PAT	Model 675-2C
Model 675-4C-PAT	Model 675-4C
Model 675-8C-PAT	Model 675-8C

Mechanical Characteristics

Model 675-2C

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Model 675-4C

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Model 675-8C

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Key features

The following list describes some of the key features of the Model 675 High Performance AWG series

- High resolution, high sampling rate: 14 Bits, 1.2GS/s
- Best output frequency vs amplitude trade off: 300MHz, 48V voltage window
- 3 operating modes in the same instruments: Function Generator, Arbitrary Waveform Generator or Digital Pattern Generator
- Very long memory: up to 128 MSample per channel
- Mixed signal generation: up to 8 analog outputs + 32 digital outputs (with Model 675-XC-DIG8 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
- 3U case size with the possibility of rack mounting

Installing your instrument

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

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.

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Environmental requirements

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Power supply requirements

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WARNING - Electrical Shock Hazard
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Cleaning

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Calibration

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Abnormal Conditions

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WARNING

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Power the Instrument On and Off

Power On

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Power Off

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Protect Your Instrument from Misuse

Check Input and Output Connectors

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CAUTION.)   †   u   @   u

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Obtaining the Latest Version Releases

The latest version of an optional application that you ordered with your instrument may not be installed on your instrument. The following download location is a fast and easy way to get the latest software version.

To download the latest version of software, register on the website; go to the home page of the Berkeley Nucleonics website (www.berkeleynucleonics.com), press the Register button in the upper right of your screen.
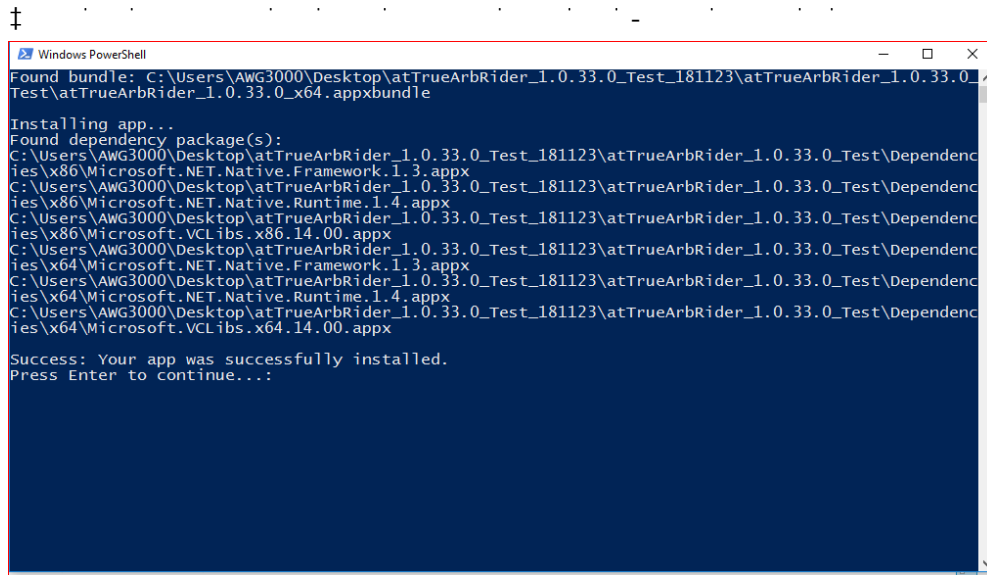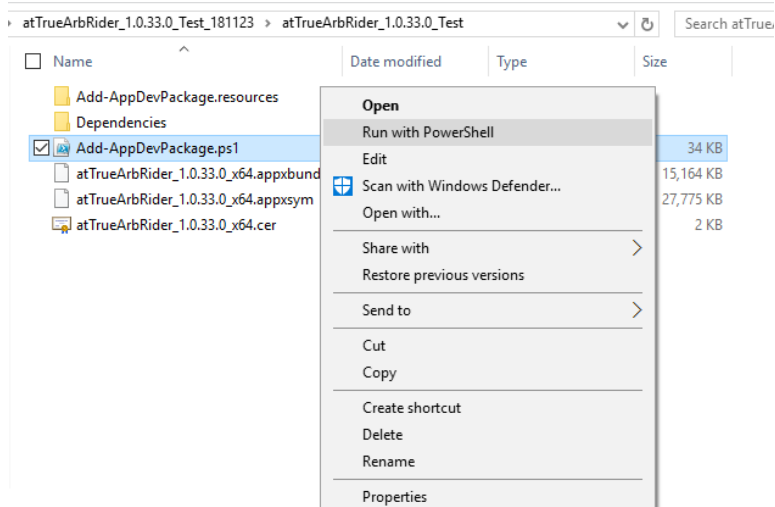
Install Simple TrueArb Application

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 Berkeley Nucleonics Corporation website and decompress it to instrument's local disk.
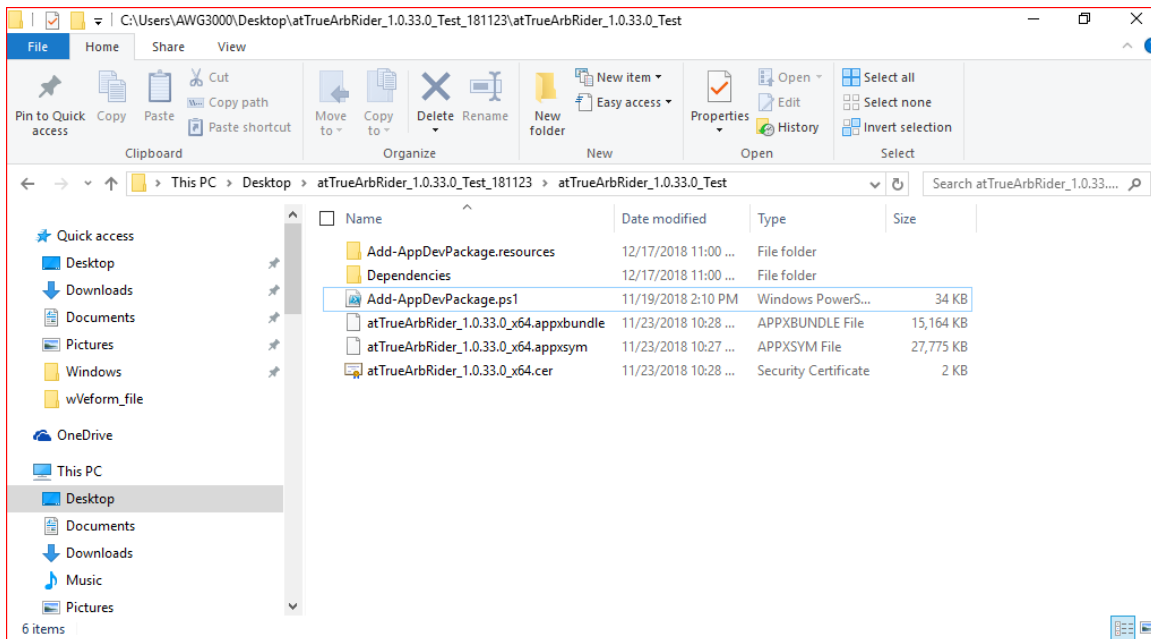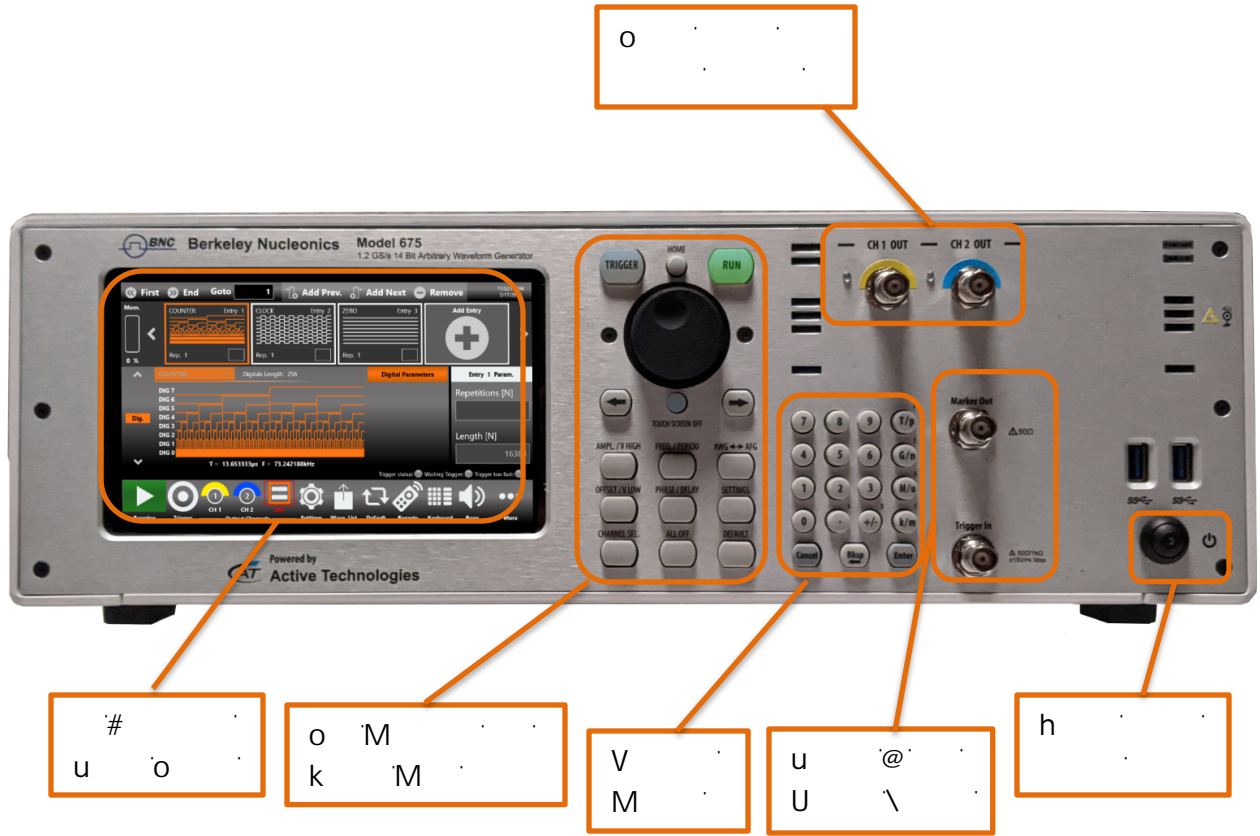

2. Right click on the "Add-AppDevPackage.ps1" file and select **Run with PowerShell** to start the installation.
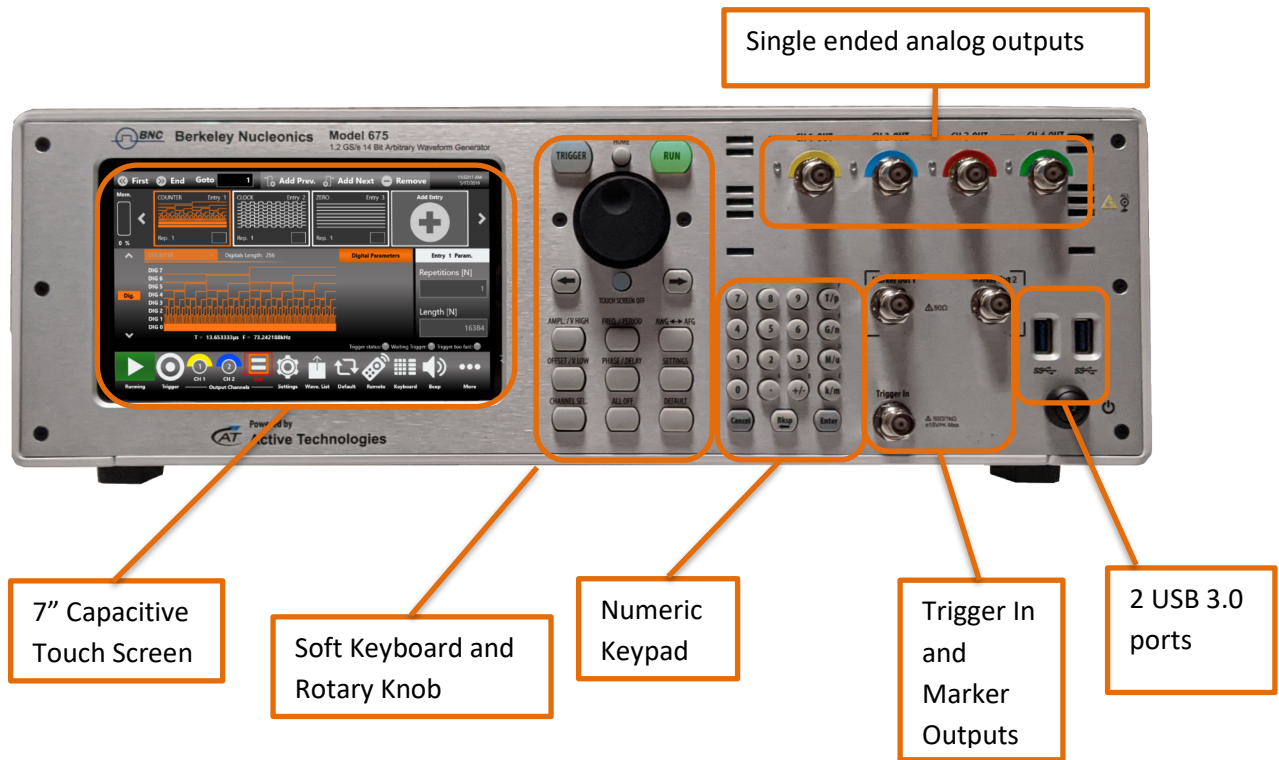
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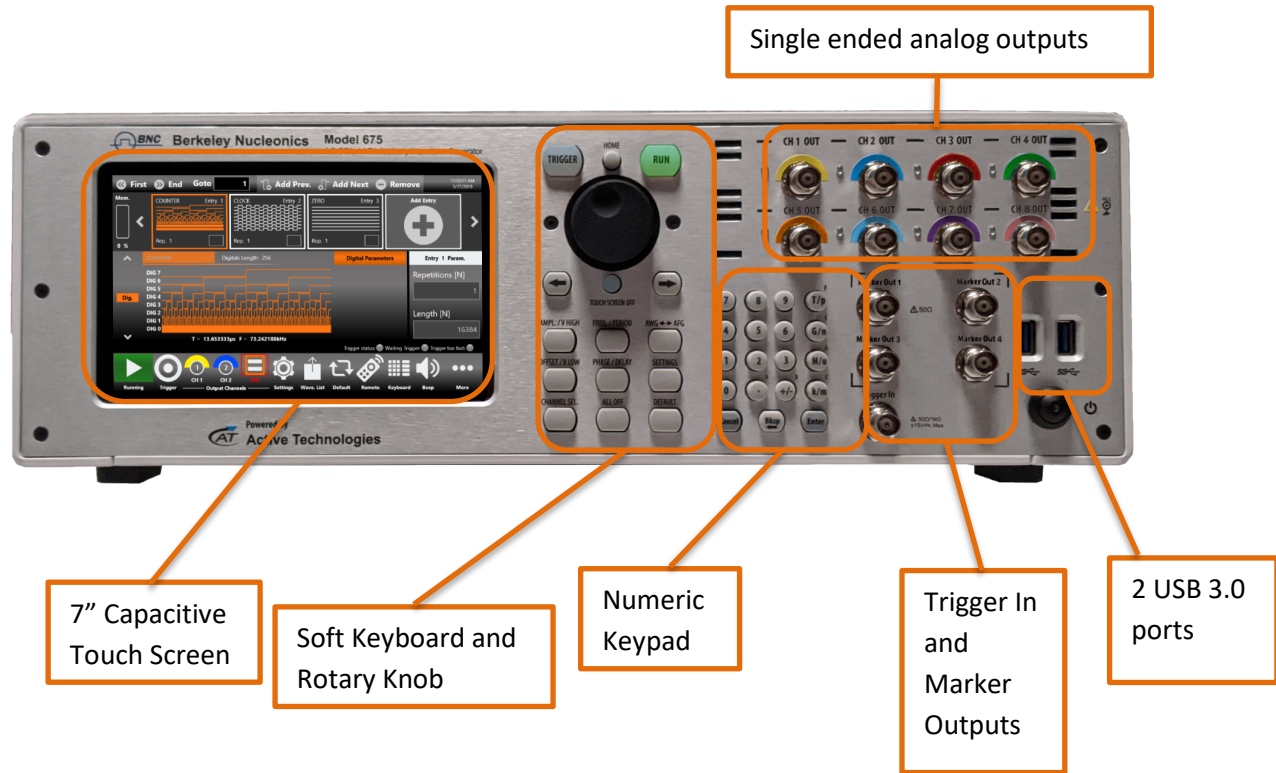info@berkeleynucleonics.com | www.berkeleynucleonics.com
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Instrument Overview

Front Panel Model 675-2C

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Front Panel Model 675-4C

Single ended analog outputs

7" Capacitive Touch Screen

Soft Keyboard and Rotary Knob

Numeric Keypad

Trigger In and Marker Outputs

2 USB 3.0 ports

Front Panel Model 675-8C

Single ended analog outputs

7" Capacitive Touch Screen

Soft Keyboard and Rotary Knob

Numeric Keypad

Trigger In and Marker Outputs

2 USB 3.0 ports

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

Analog Outputs

The Model 675 High Performance AWG instrument series has 2/4/8 analog output channels, each one is single-ended and the connector type is a standard BNC.

Marker Outputs

Each 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
Model 675-2C	1 BNC on the Front Panel
Model 675-4C	2 BNCs on the Front Panel
Model 675-8C	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 kOhm or 50 Ohm. To know how to set the trigger parameters or the Run Mode refer to the paragraph "Trigger In". In Continuous mode the Trigger In doesn't have any effect.

Trigger In Specification	Value
Connector	BNC on the Front Panel
Number of connectors	1
Input impedance	1 kΩ or 50 Ω selectable
Slope/Polarity	Positive or negative selectable
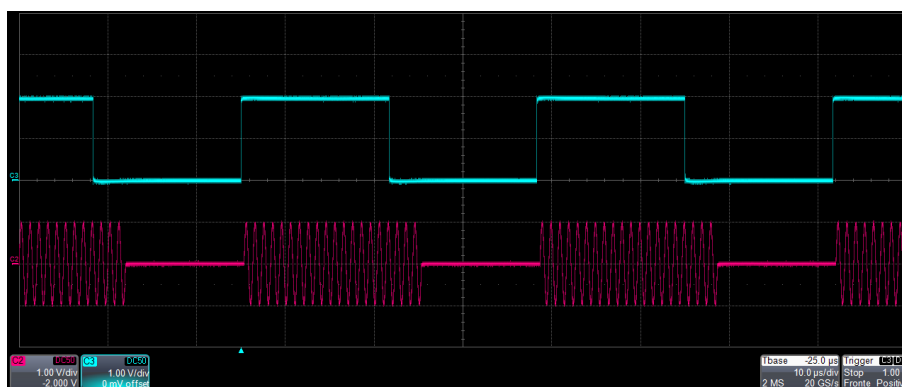
Trigger In signal (blue, top) that starts a burst of sine waveform (red, bottom)
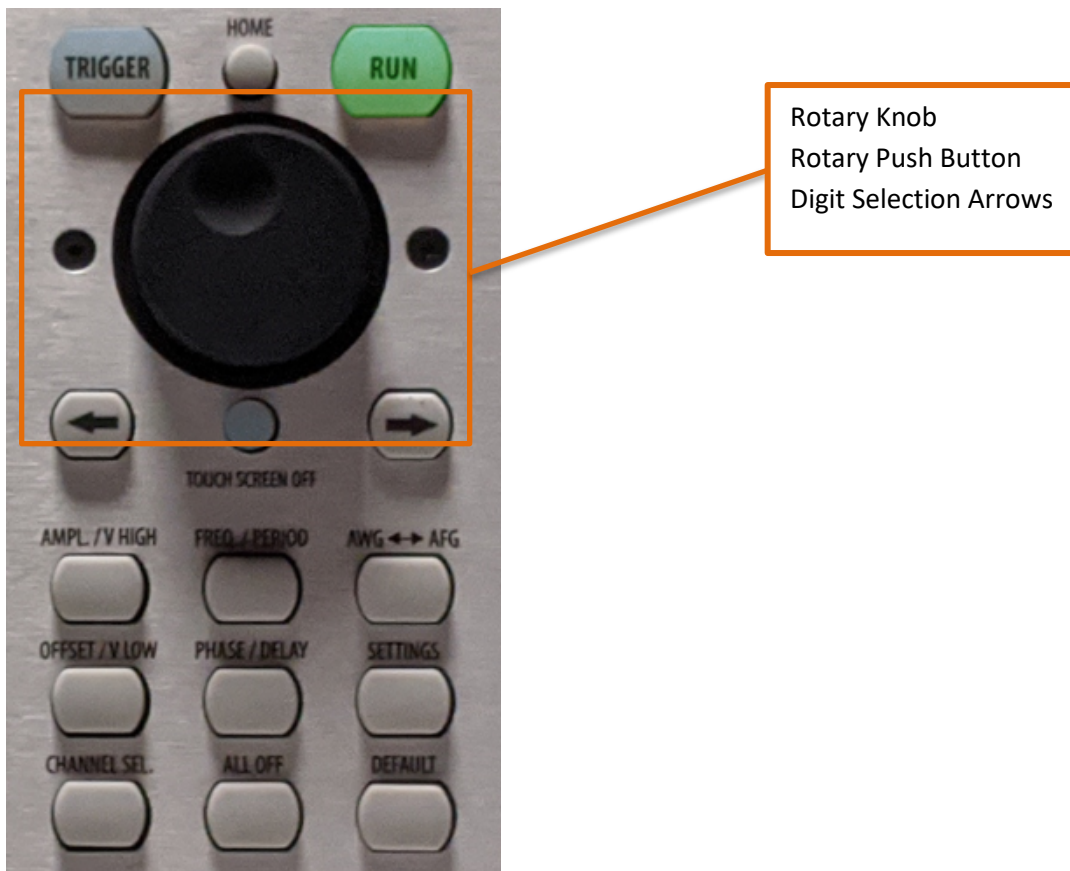
Soft keyboard and rotary knob

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.

Rotary Knob
Rotary Push Button
Digit Selection Arrows

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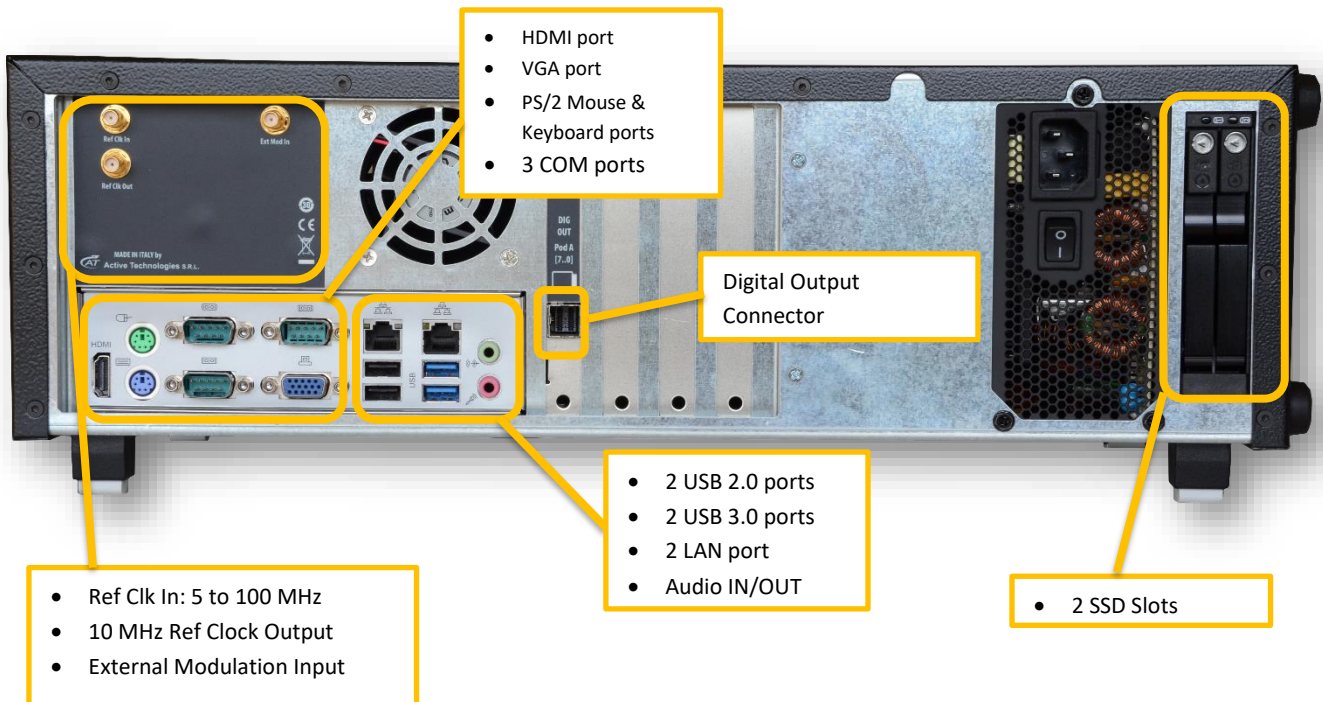
Unit Measure Range Button	Unit Measure Range
T/p	Tera / pico
G/n	Giga / nano
M/u	Mega / micro
k/m	kilo / milli

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 Model 675-2C

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

- HDMI port
- VGA port
- PS/2 Mouse & Keyboard ports
- 3 COM ports

Digital Output Connector

- 2 USB 2.0 ports
- 2 USB 3.0 ports
- 2 LAN port
- Audio IN/OUT

- 2 SSD Slots

- Ref Clk In: 5 to 100 MHz
- 10 MHz Ref Clock Output
- External Modulation Input

Rear Panel Model 675-4C and Model 675-8C

- 2 slots for Removable SSD

Digital Output Connectors:
Pod D, Pod C, Pod B, Pod A (Model 675-8C)
Pod B, Pod A (Model 675-4C

- 4 USB 3.0 ports
- 1 Ethernet port
- Audio IN/OUT ports

- Ref Clk In: 5 to 100 MHz
- 10 MHz Ref Clock Output
- External Modulation Input
- Sync OUT / Sync IN Connectors (Model 675-8C only)

- DVI port
- VGA port
- COM port
- PS/2 Mouse & Keyboard ports
- DP port
- HDMI port
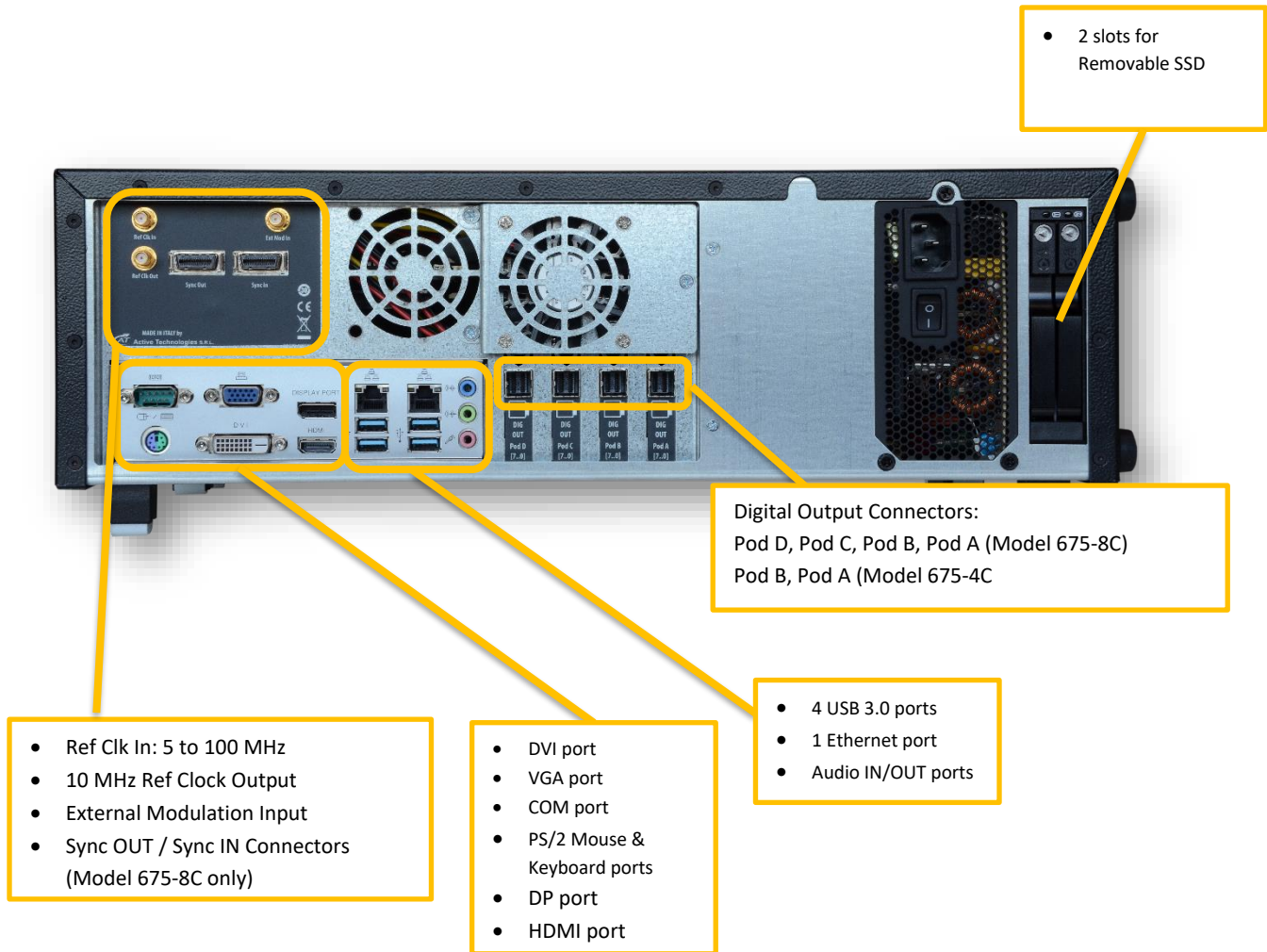
External Modulation Input Connector

Important Note: this connector is not used by TrueArb application.

Reference Clock Input Connector

The Model 675 High Performance AWG series 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.

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Digital Output connector

The Model 675 High Performance AWG series has optional 8/16/24/32-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 Model 675 High Performance AWG series.

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
Model 675-2C	Pod A
Model 675-4C	Pod A, Pod B
Model 675-8C	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 Model 675-2C 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 Model 675-8C model 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 ![switch] to turn on the instrument.

2. Press the AWG/AFG button ![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 ![Settings] 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 Channel1.
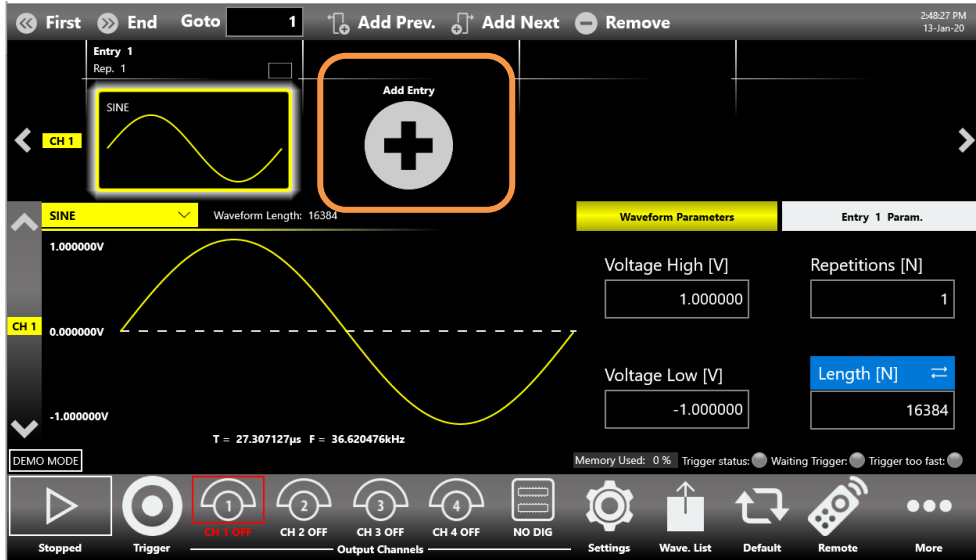
9. Touch the dropdown waveform list and change it from Sine to Ramp.
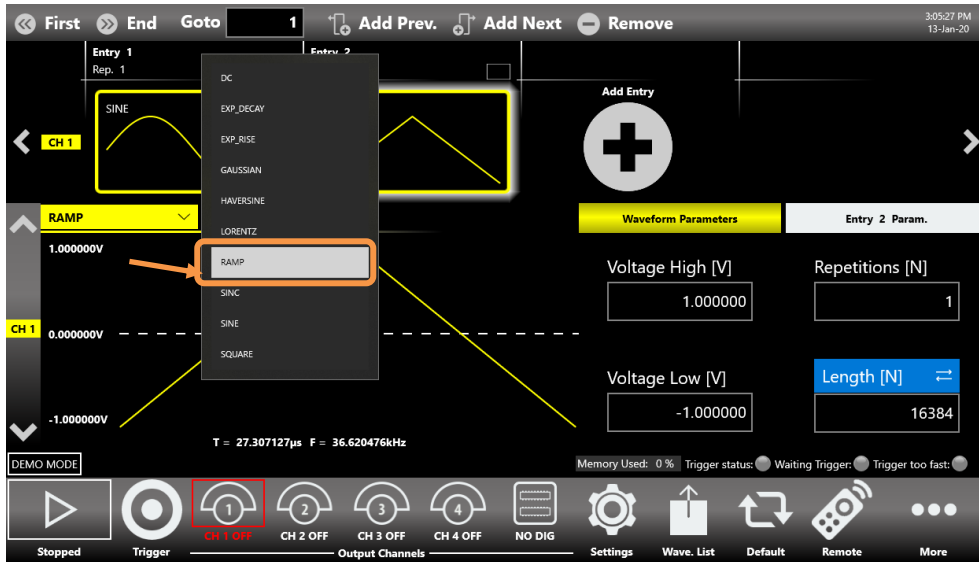
10. Enable the output channels by pressing the CH1 button located in the bottom of the application so that it is are no more grayed out.

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.

Voltage High [V]	Repetitions [N]
1.000000	3
Voltage Low [V]	Length [N]
-1.000000	16384

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 Model 675 High Performance AWG series 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
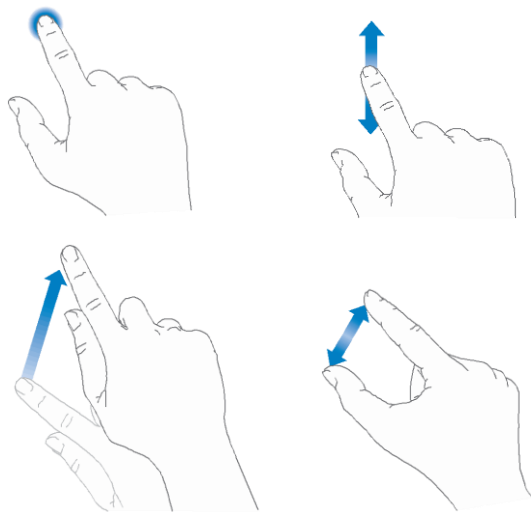
It is sometimes necessary to create long waveform files to fully implement a DUT test. In case where portions of a waveforms must be repeated, the waveform sequencer functionalities can save you a lot of memory-intensive waveform programming.

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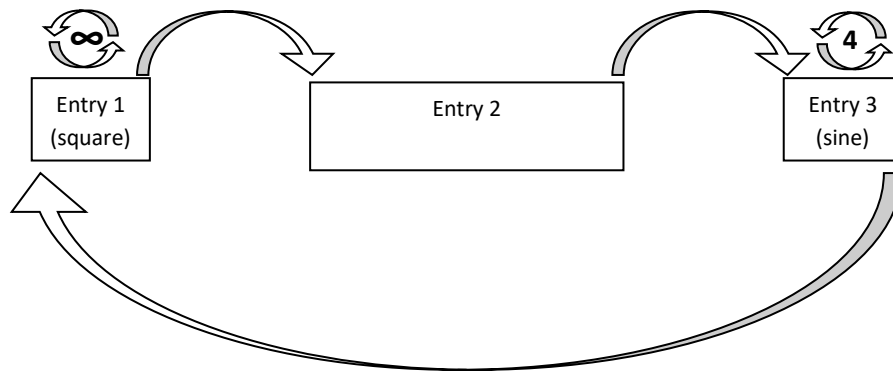
A sequence is made of multiple entries; each entry contains analog and digital waveforms properly formatted.

IMPORTANT NOTE

The Model 675 High Performance AWG series has a unique sequencer for all channels. Therefor 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 functionalities and parameters.
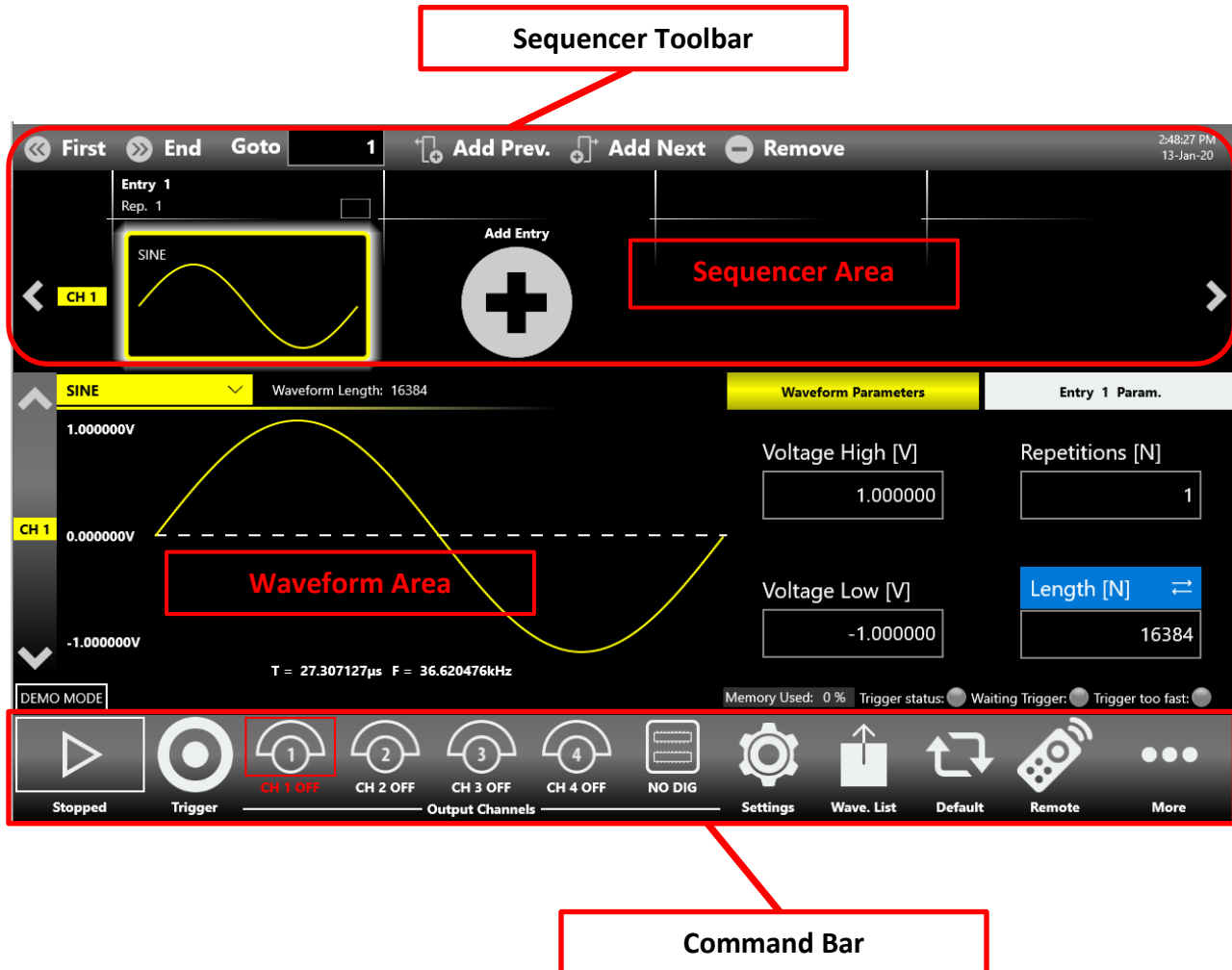
The TrueArb user interface consists of four main elements:

- **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 it 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 and Output Channel 2 page.

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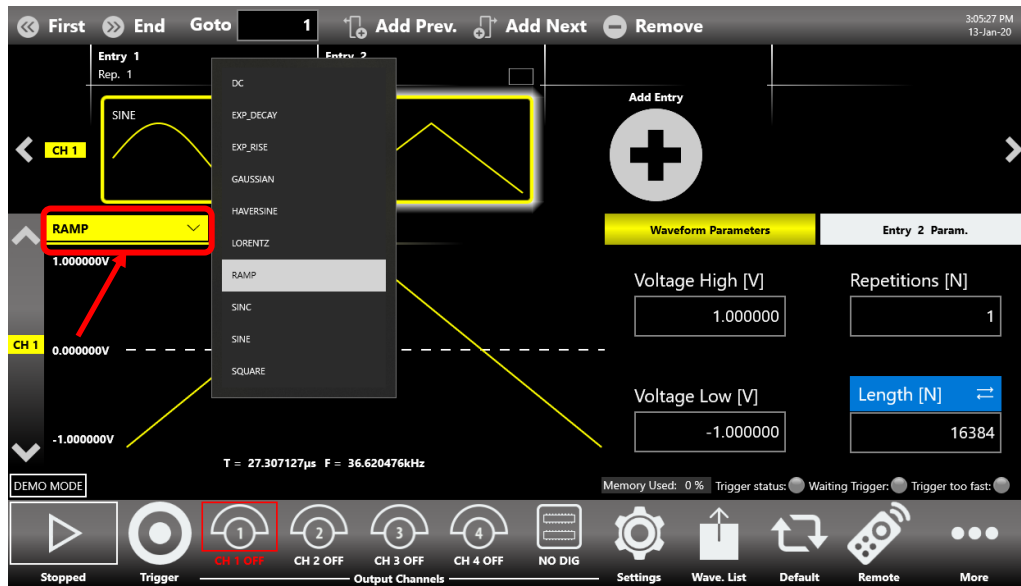
Sequencer Area

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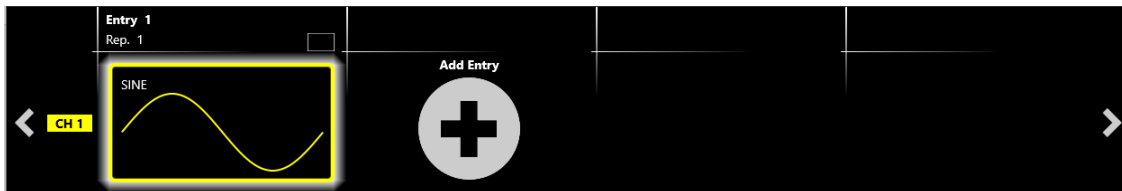
To modify the waveform of an entry of the sequencer, you can touch the waveform dropdown list that will open showing a list of all the waveforms available in the "Waveform List" (predefined or imported).

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Important Note: if you need to modify the waveform of the other channel 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.
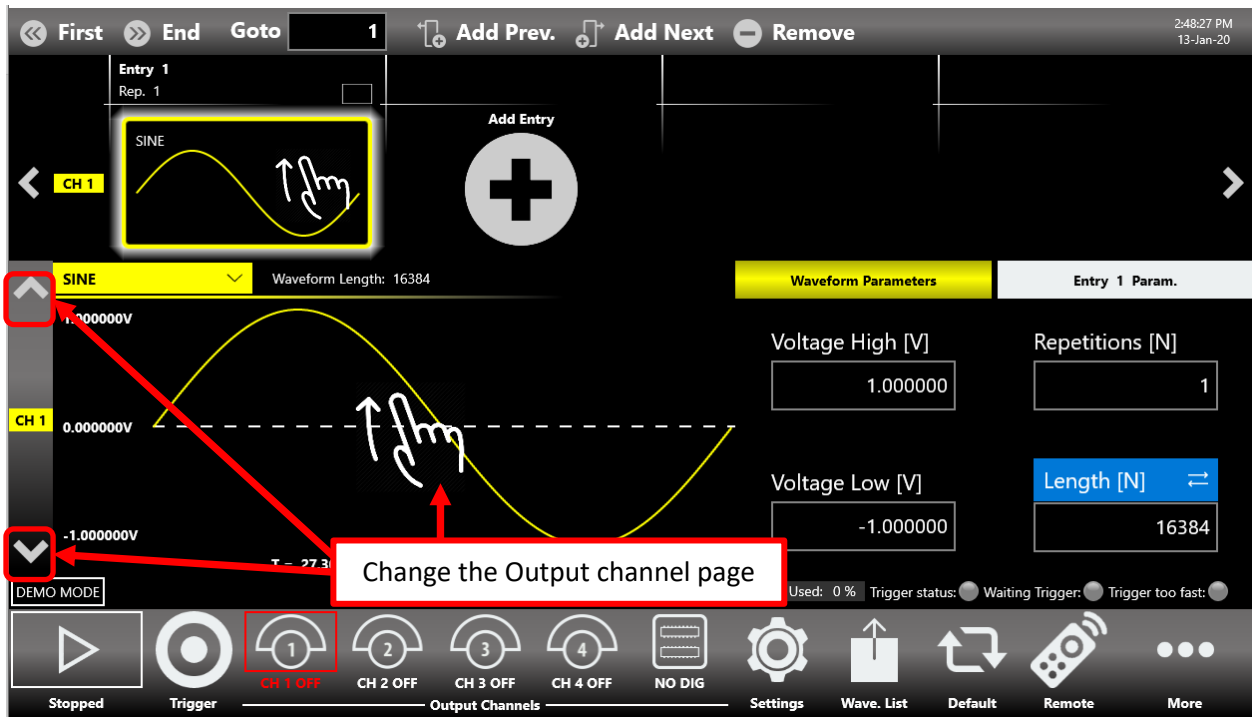

Multiple Channels View

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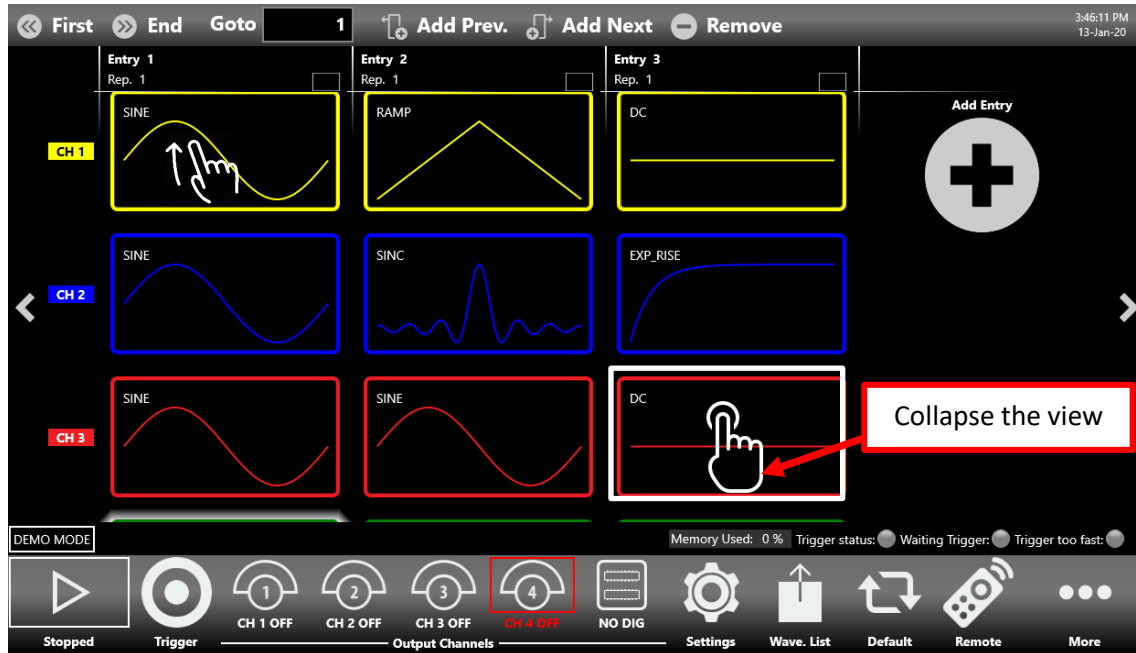
You can use the swipe up/swipe down gesture to scroll through the channels, touch again on the selected sequencer item or select another item to collapse the view.

Sequencer area items

Selection Button
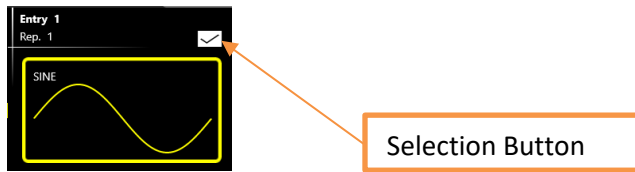
Sequencer Entry. Each sequencer item contains several information:

- 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 4294967295 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
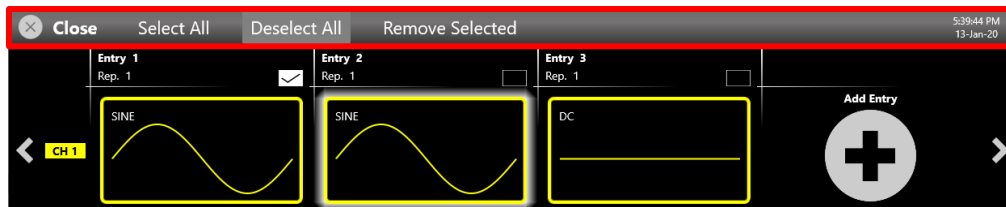
Sequencer Toolbar

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

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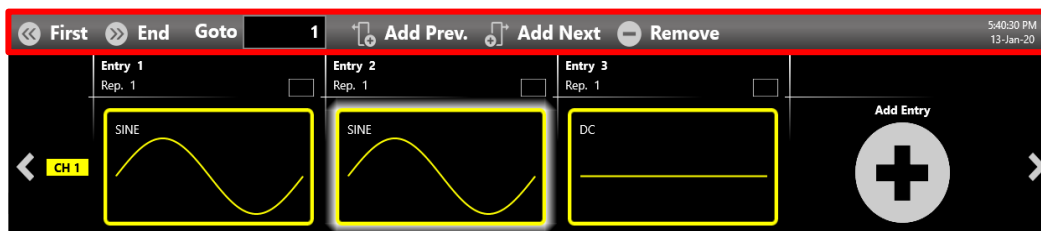
Sequencer Toolbar	Description
First	**First Entry Button** – Press this button to go to the first entry.
End	**Last Entry Button** – press this button to go to the last entry.
Goto 1	**Goto Entry Button** – Use this button to go to the Entry N.
Add Prev.	**Add Prev. Button** – Use this button to add 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)
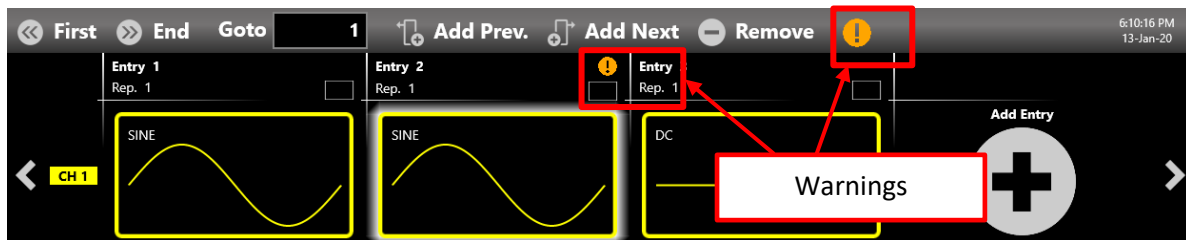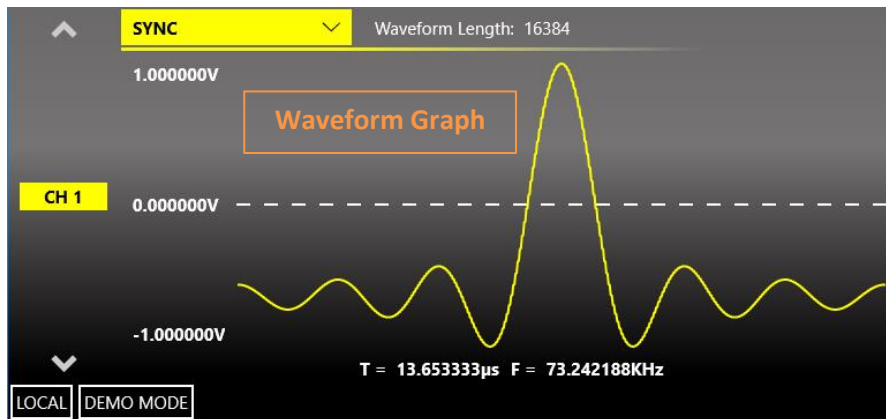

Waveform Area

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)

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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.
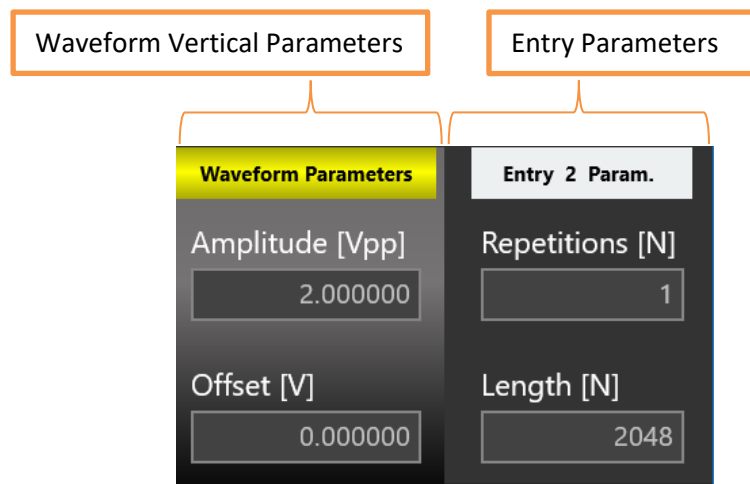
Amplitude[Vpp] parameter

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

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Offset[V]

It defines the voltage of (Vmax+Vmin)/2 expressed in Volts where Vmax is the maximum level of the waveform and Vmin is the minimum level of the waveform
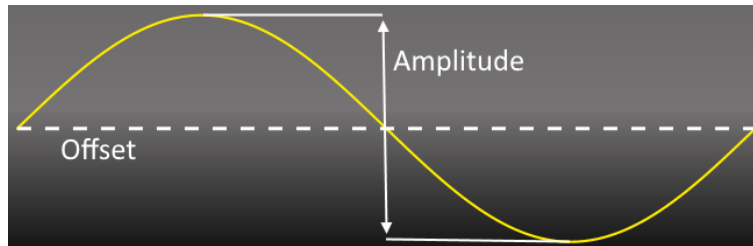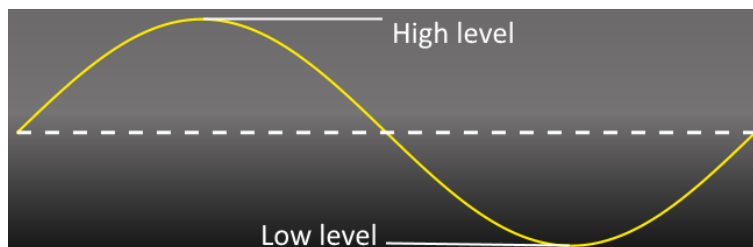

Voltage High[V]

It defines the maximum level of the waveform expressed in Volts

Voltage Low[V]

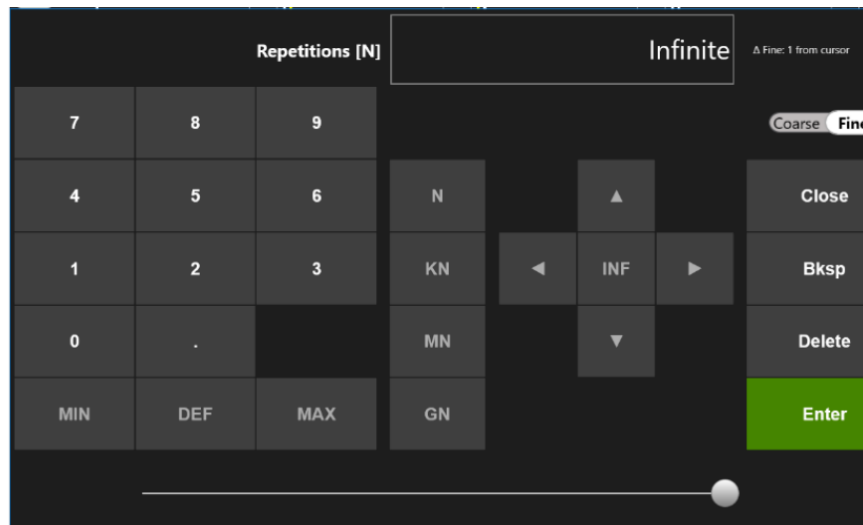It defines the minimum level of the waveform expressed in Volts

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;

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- 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].

Samples

Time

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

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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 digits of the textbox.

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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.
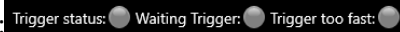
Waveform warnings

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)
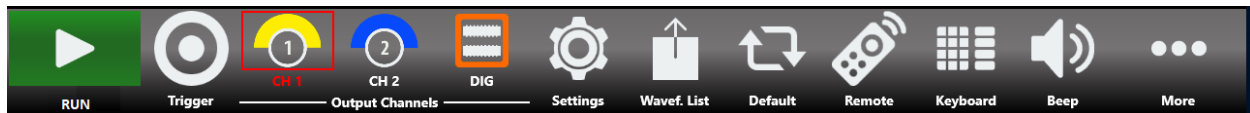
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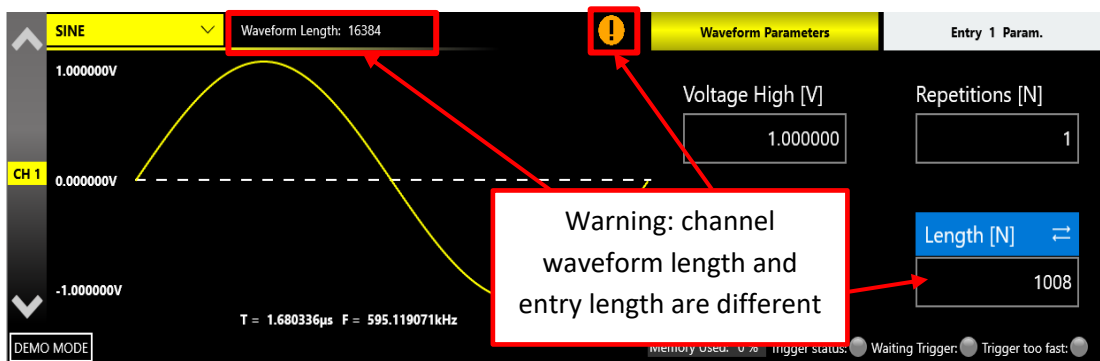
Status Toolbar

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

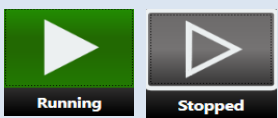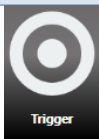**Trigger Information** indicator: `Trigger status: ⬤  Waiting Trigger: ⬤  Trigger too fast: ⬤` provides information on the trigger signal condition.

- 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.
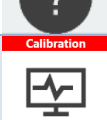
Command Bar

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. Bushing 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.

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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.		
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.		
Beep – Use this button to enable or disable the beep audio signal when the user touches a button.		
More Button – Use this button to have access to other instrument features. These buttons are explained in the following table.		

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More Button Menu Items		Description
Exit		**Exit Button** – Press this button to close the application.
Full Screen		**Full/Float Button** – press this button to maximize or reduce the application screen; in this way you can access to Windows OS.
Load From		**Load From Button** – Use this button to load a configuration file. (For more information, please refer to the relative section).
Save As		**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		**Export** – Use this button to export the current configuration. (For more information, please refer to the relative section).
Remote Control		**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		**Change Format** – Use this button to change the waveform vertical parameters from Voltage High(V) and Voltage Low(V) to Amplitude(Vpp)/Offset(V)
AFG		**Change Application** – Use this button to switch from AWG to AFG application.
About		**About Button** – Use this button to check the credits, the software and firmware release number and the instrument serial number.
Help		**Help Button** – Use this button to open the User Manual.
Calibration		**Calibration button** – Use this button to enter the Calibration and Diagnostic page. (For more information, please refer to the relative section).
Wav. Editor		**Waveform Editor** – Use this button to open the Waveform Editor software. (For more information please refer to the Waveform Editor User Manual).
License		**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
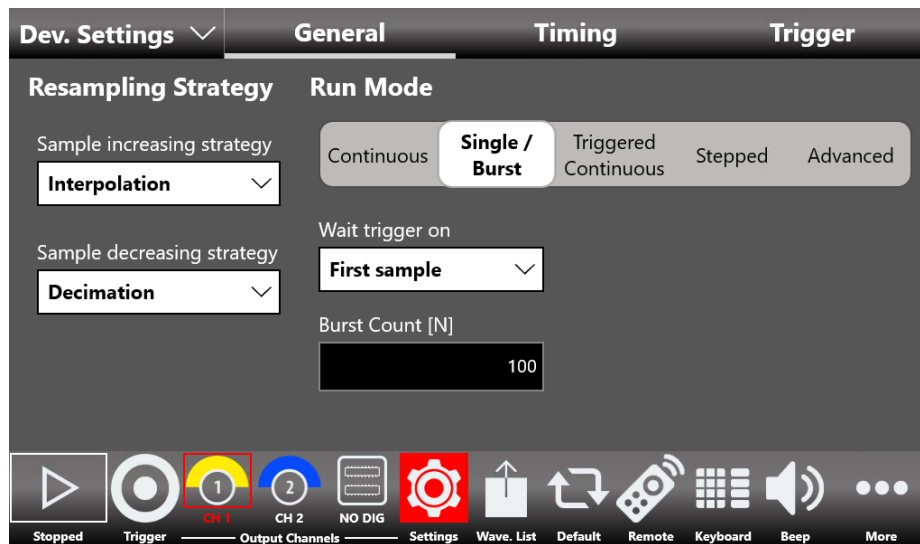
Run Mode

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:

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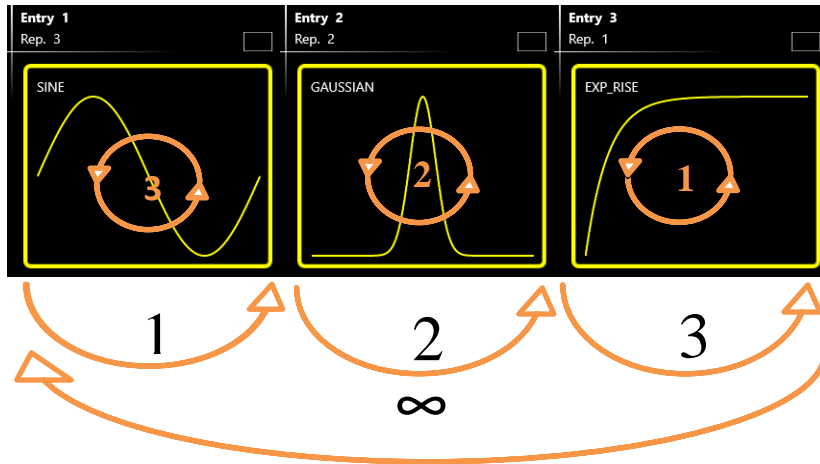
- **Single/Burst**: when the RUN/STOP button is pressed the instrument waits for a trigger event. When the trigger event occurs, each waveform will loop as written in the entry repetition parameter and the entire sequence will be repeated circularly many times as written in the Burst Count[N] parameter.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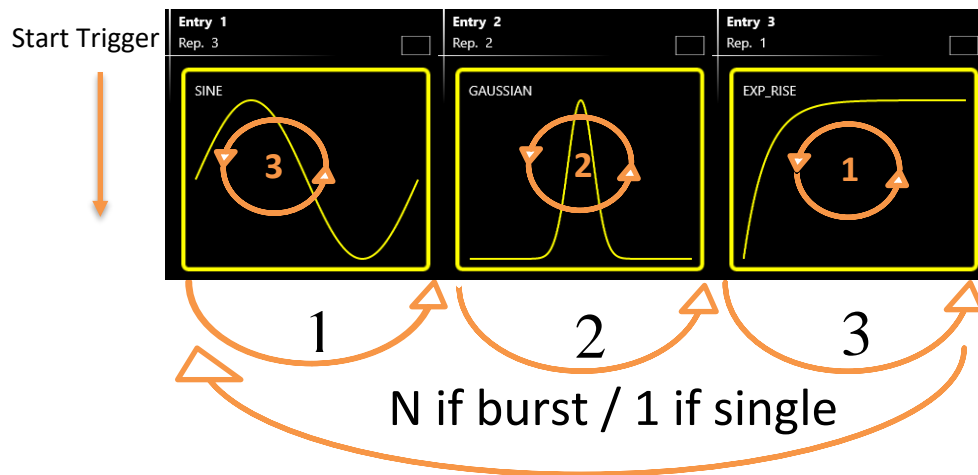
- **Triggered Continuous**: when pressing the RUN/STOP button the instrument waits for a trigger event. When the trigger event occurs, each waveform will loop as written in the entry repetition parameter and the entire sequence will be repeated circularly until the user will press the RUN/STOP button.

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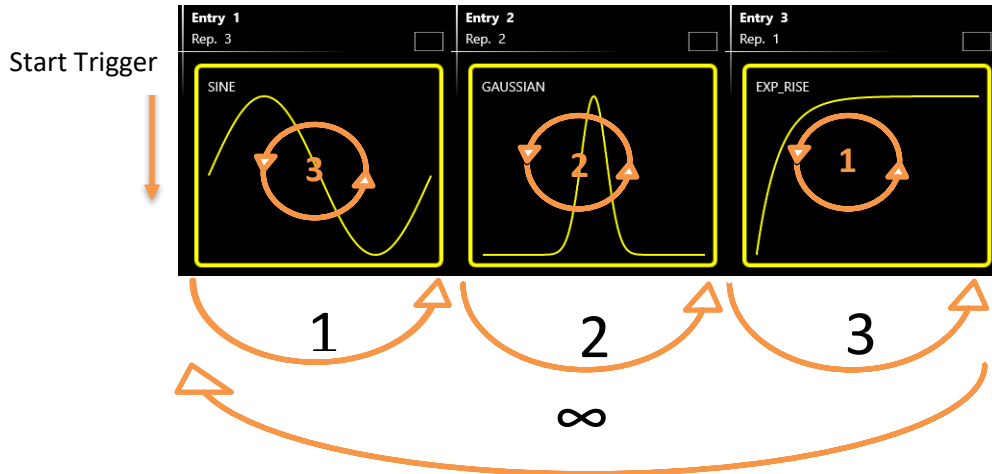
- **Stepped**: after pressing the RUN/STOP button each entry waits for a trigger event before its execution. The waveform of the entry will loop as written in the entry repetition parameter. After the generation of an entry has completed, the last sample of the current entry or the first sample of the 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.
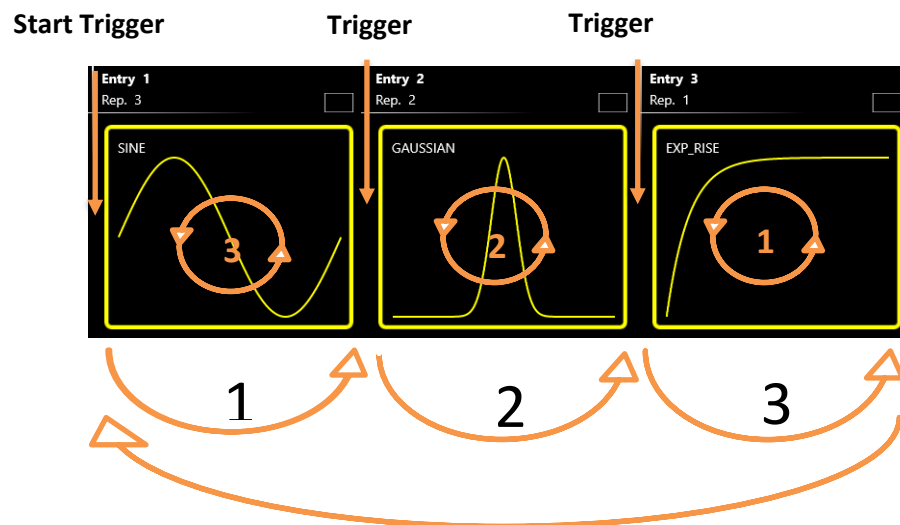
- **Advanced:** In this mode the execution of the sequence can be changed by using conditional and unconditional jumps (JUMP TO and GO TO features) and dynamic jumps (PATTERN JUMP feature). Please refer to the Advanced Run Mode section for more information.

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 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.

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.

Jump Mode
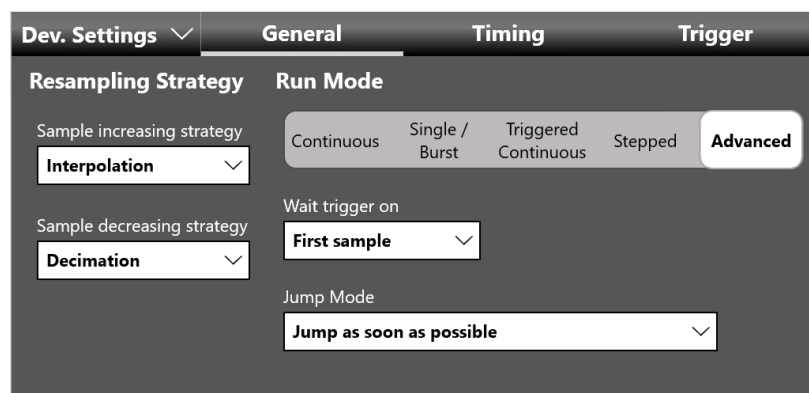
This parameter is available in Advanced run mode only. It defines the behaviour of the output when a "Jump To" or a "Pattern Jump" event happens. If "Jump as soon as possible" is selected, the sequencer jumps to the selected entry as soon as possible, without waiting for the completion of the repetitions of the current waveform execution. It will jump always at the end of a period of the current 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.

Advanced Run Mode

The Advanced run mode allows you to change the execution of the sequence by using loops, conditional, unconditional jumps (Jump To, Pattern Jump and Go To features) and 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
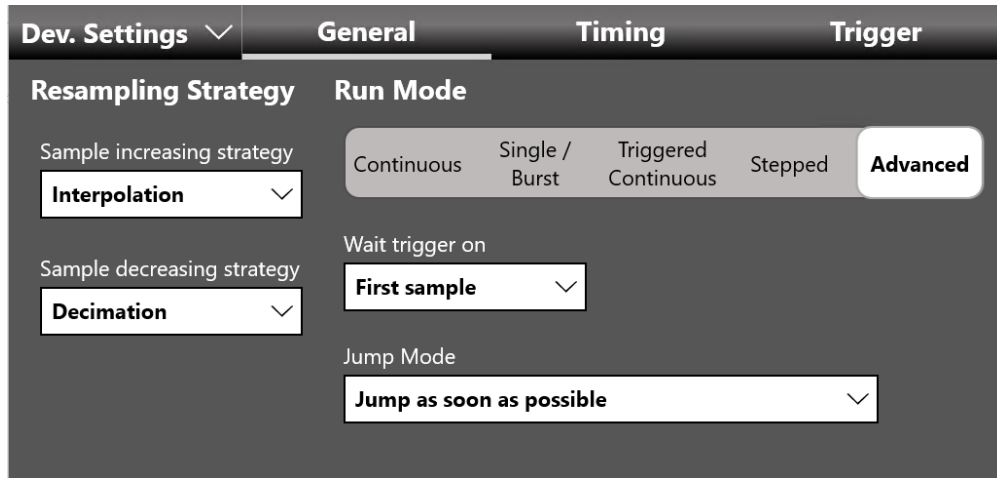
- The sequencer page will change its standard layout and the Edit Entry button will appear in the Entry Parameters area.
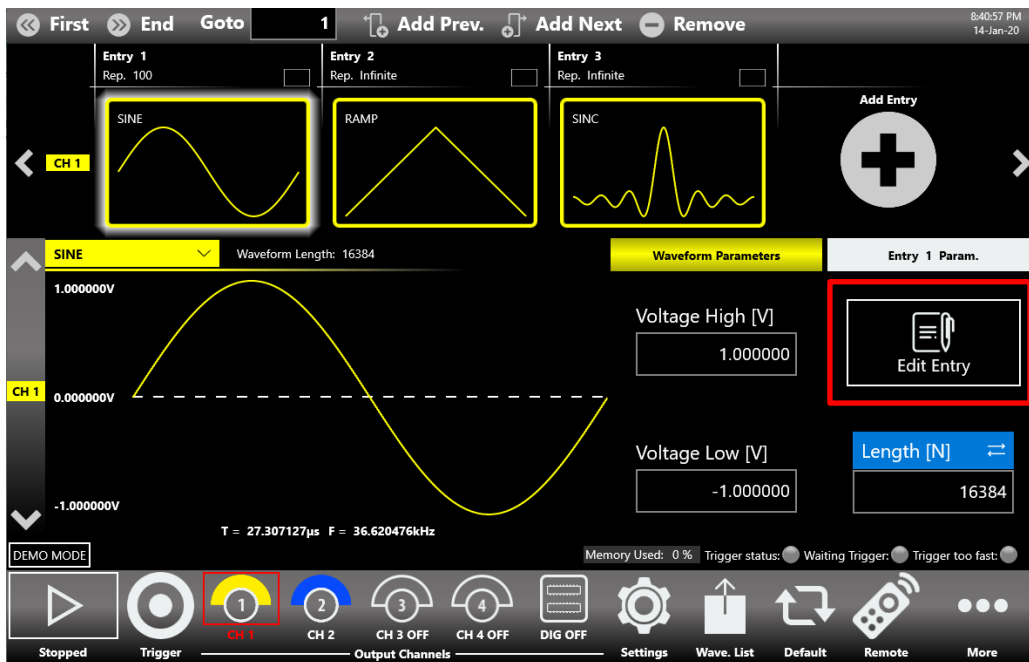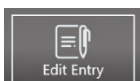
- Press the "Edit Entry" button on Sequencer Area to open the Entry Editor Table.

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	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. • **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. • **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. *Note:* The Trigger buttons and the Trigger from remote command are always active, independently from the selecting Trigger Source.
Repeat	Defines how many times the waveform in the entry is repeated: 1 to 4,294,967,295 or infinite cycles.
Jump If Event	Defines the event that must occur for the Jump To feature. 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. • **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. *Note:* The Trigger buttons and the Trigger from remote command are always active, independently from the selecting Trigger Source.
Jump To Entry	Defines the Jump To entry target. The sequencer jumps to the entry selected in that target when the event condition is met. **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). • **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	When all 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. • **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.
Pattern Jump	Defines the pattern code for the "Pattern Jump" feature. It can be a number from 0 to 255. The "Pattern Jump" is a conditional jump that occurs when a Pattern code is received by the sequencer. **IMPORTANT NOTE:** the pattern is sent by using the SCPI command AWGControl:DJStrobe only. **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).

Pattern To Entry	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.
	• **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.

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

Go To Entry = 3
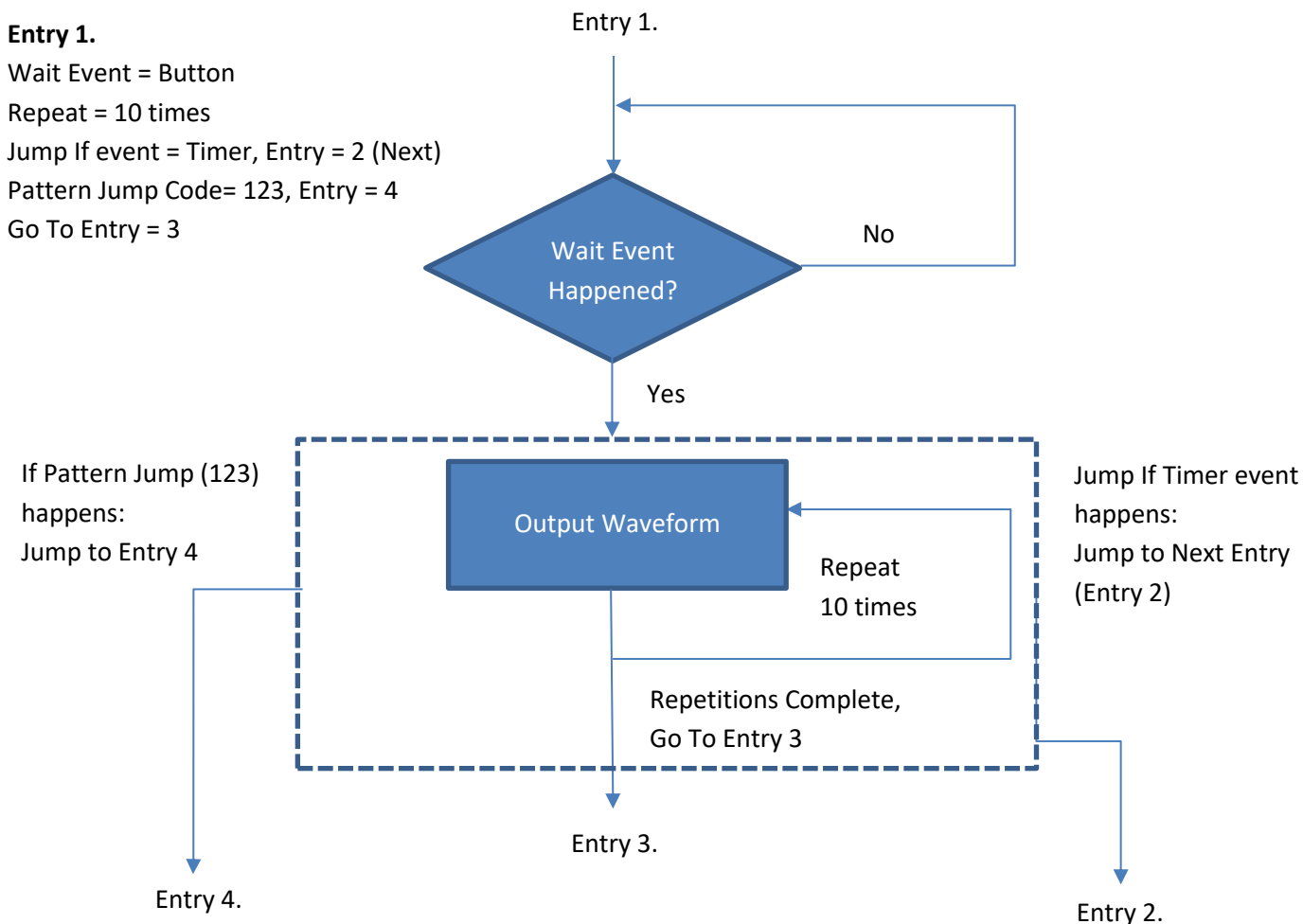
Timing

- *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:
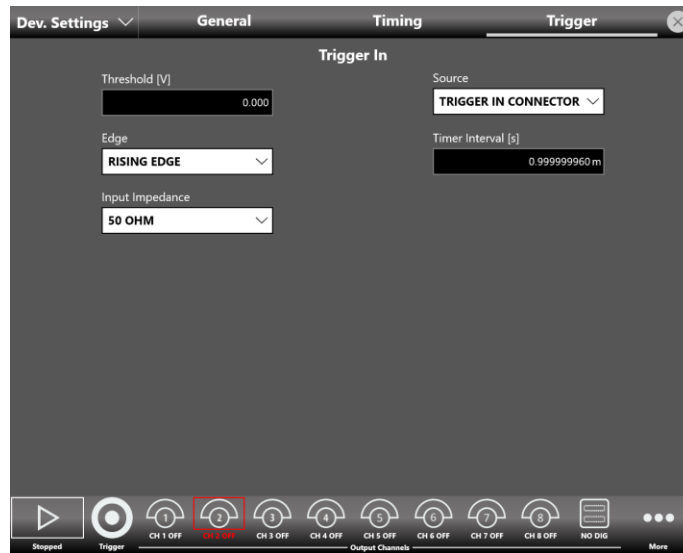
Trigger In Setting	Description
Source	**Trigger Button:** The Trigger event is provided to the instrument by the Trigger button on the keyboard or Trigger button on the menu bar or from a Remote Command. **Timer:** The Trigger event is internally generated by a Timer. The Timer count interval is set by Interval [s] textbox. **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. *Note:* The Trigger buttons and the Trigger from remote command are always active, independently from the selecting Trigger Source.
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.
Edge	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. It has effect only when the selected Source is External.
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 External.
Input Impedance	It selects the "TRIGGER IN" connector impedance: 1 kOhm or terminated into 50 Ohm.

Channel Settings

The channels settings page allows to manage the parameters of the analog and digital channels
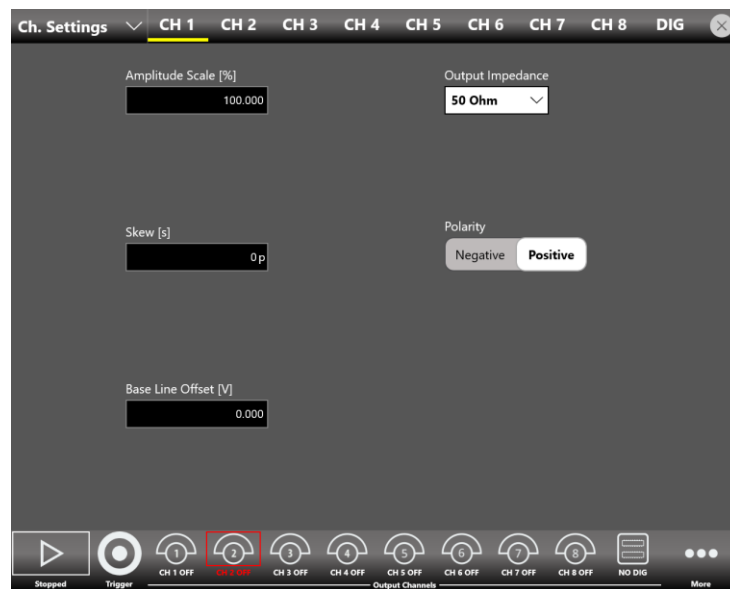
CH 1, CH2, …, CH N analog channel page

- *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

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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
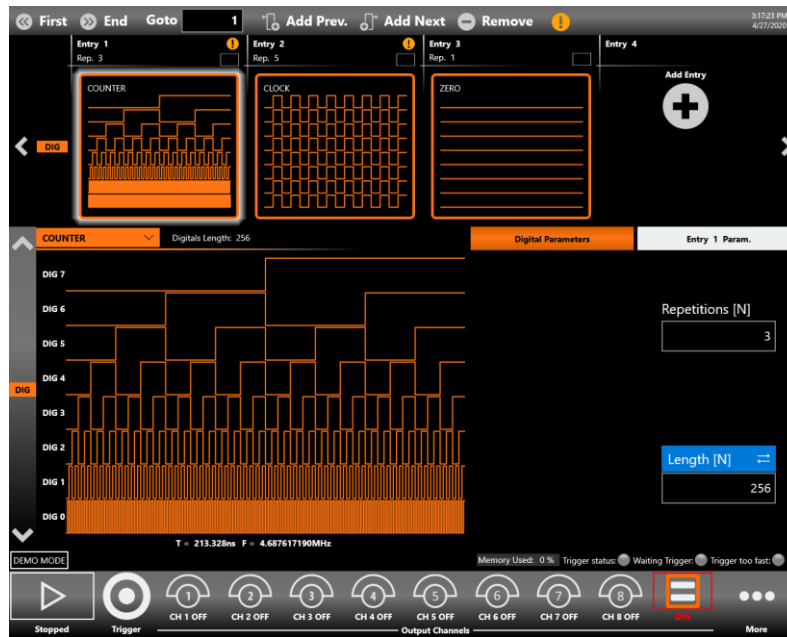
- *Voltage Level[V]:* this parameter defines the output voltage level (in Volt) of the LVDS to LVTTL Digital Probe. Please note that it will take effect only when the Digital Option is installed in the instrument and with the LVDS to LVTTL probe connected.

- *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 signal that is provided at the front panel MARKER OUT BNC connectors.
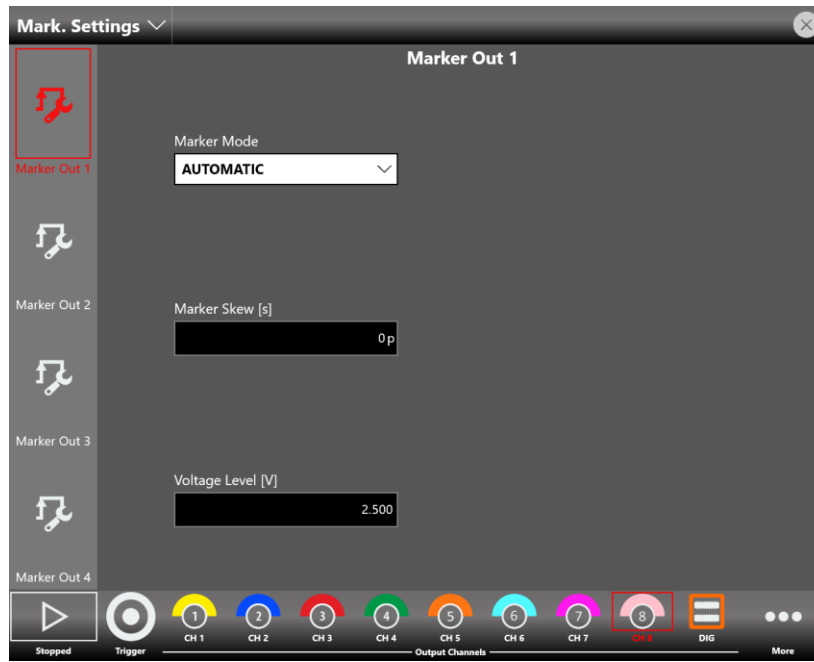
The available Marker signals depend on the instrument Model, refer to the Marker Output section for a complete description.

On Model 675-4C and Model 675-8C 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

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Marker pulse will be generated 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.

- o **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.
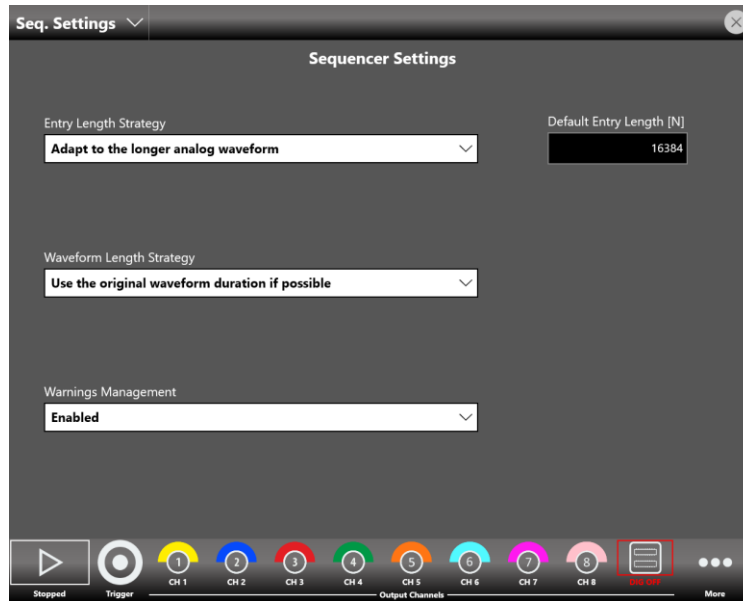
Entry Length Strategy:
- *Adapt to the longer analog waveform*: if this option is selected the length of an entry of the sequencer by default will be equal to the length of the longer channel waveform, among all analog channels, assigned to the entry.
- *Adapt to the shorter analog waveform*: if this 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 the 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

Press the ![Wavef. List] button to open the Waveform List page that collects all the waveforms available in the current configuration.

The Model 675 High Performance AWG series contains by default a set of Factory Predefined Waveforms that are common to all configurations.
The Predefined Waveforms are the ones in red color on the list, the imported waveforms are the ones in gray.

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 ![Load Factory Predefined] button. Please note that the imported waveforms previously promoted as Predefined will not be deleted.

How to import an Analog/Digital waveform from a file

Import button allow 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

1. Press the import button and the Windows File Browser will open, select the txt or zip file you would like to import. 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.

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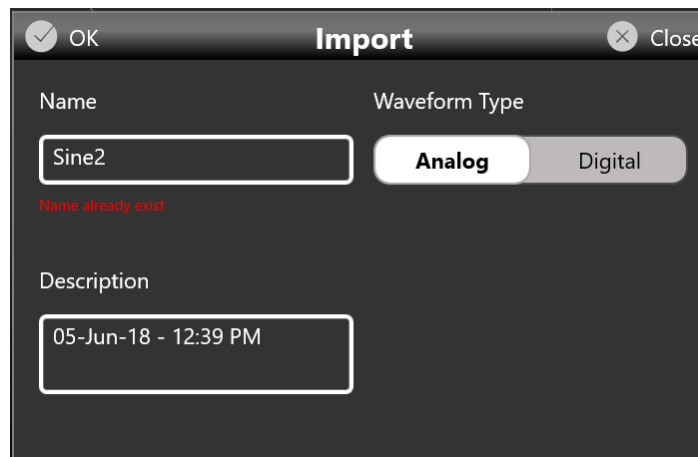
How to export an Analog/Digital waveform to a file

- Select an analog or digital waveform on the waveform list
- Press 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

- Select an imported analog or digital waveform on the waveform list
- Press 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 waveform on the waveform list
- Press the **Edit** 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 **Wav. Editor** 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.

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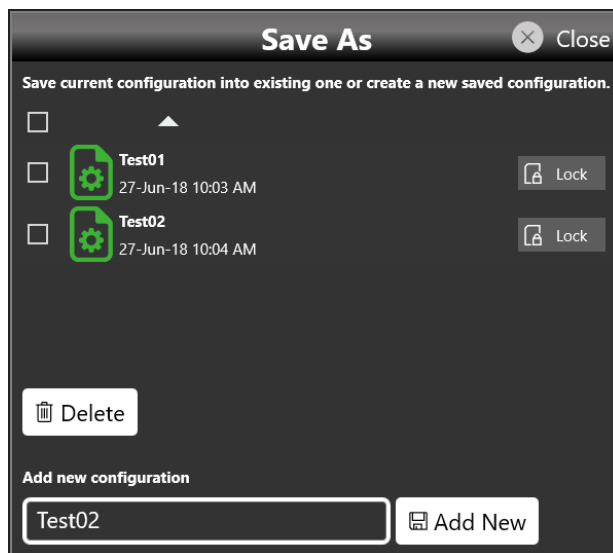
In this page you can add a new configuration entry or overwrite an existing one. To create a new configuration entry, it is necessary to write a name in the text box in the bottom of the page and click on "Add New".

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.

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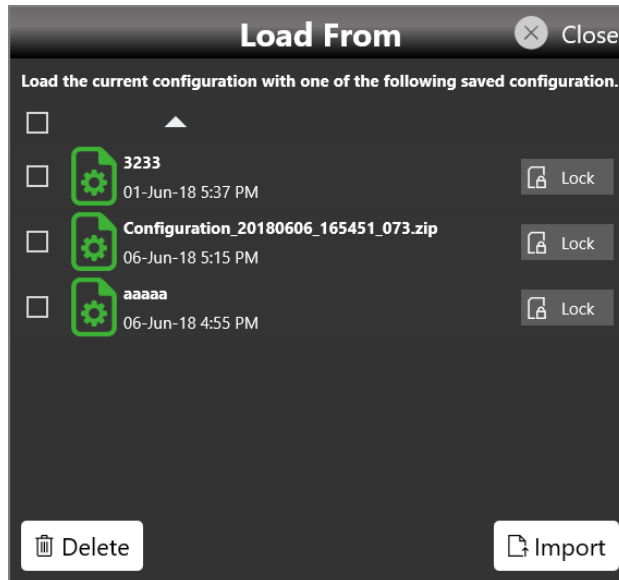
If you touch the Import Configuration button you can import the configuration file that comes from a different machine or from a different user. The imported configuration will be inserted in the "Load From" list.

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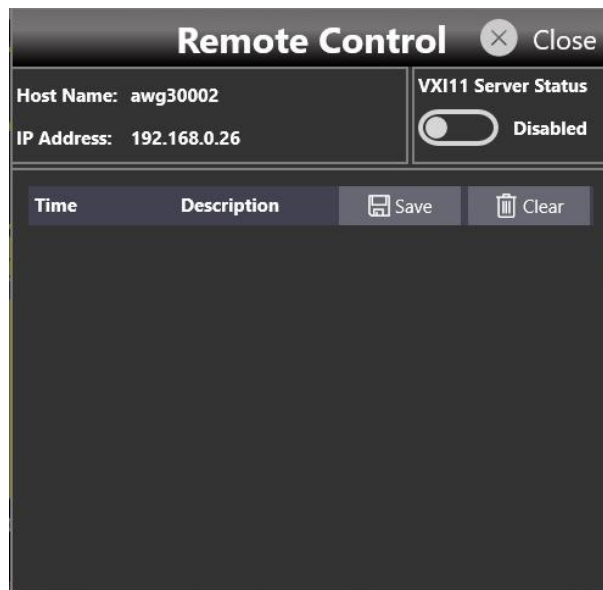
In the top of the page the Host Name and the IP Address of the instrument are shown. The slider on the right side of the page allows to enable or disable the SCPI server. It is enabled by default.

Remote Desktop Connection

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

Computer Name: AWG4010
User Name: awg4010
Password: 1234

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Calibration and Diagnostic

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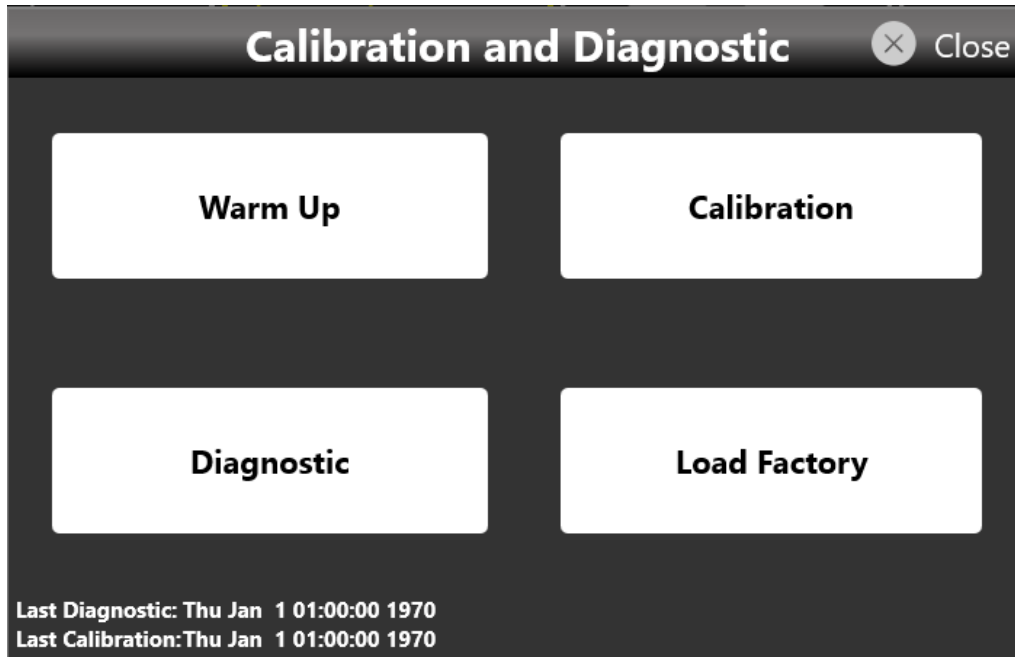

Below a description of the actions executed by pressing the buttons located in the page:

- *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.

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Multi-Instrument System

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Please note that
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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:
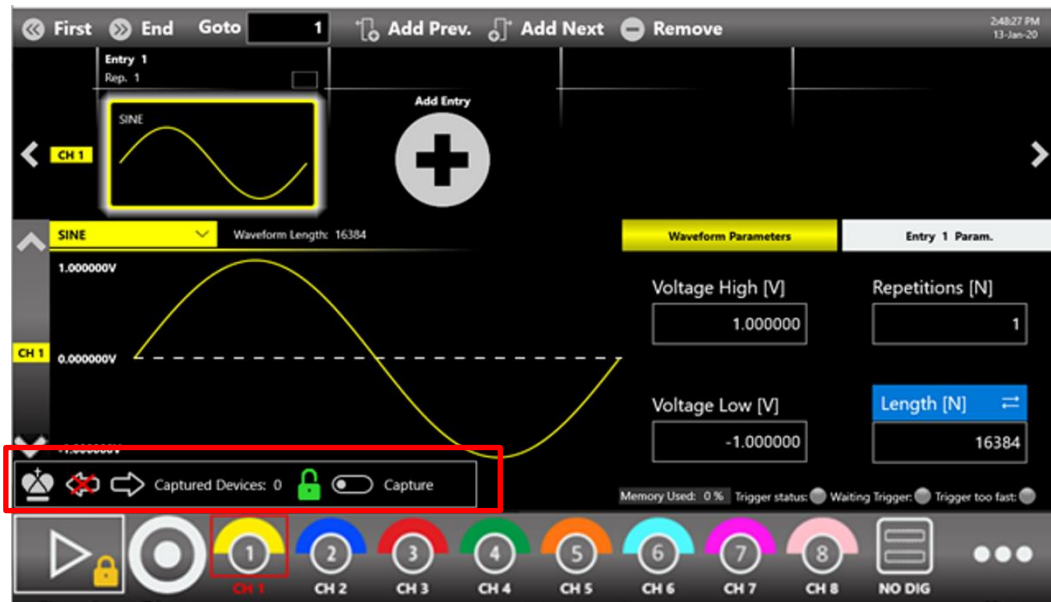
3. On the Slave unit (the one with the Sync IN port connected) will appear a new Slave Multi-instrument bar:
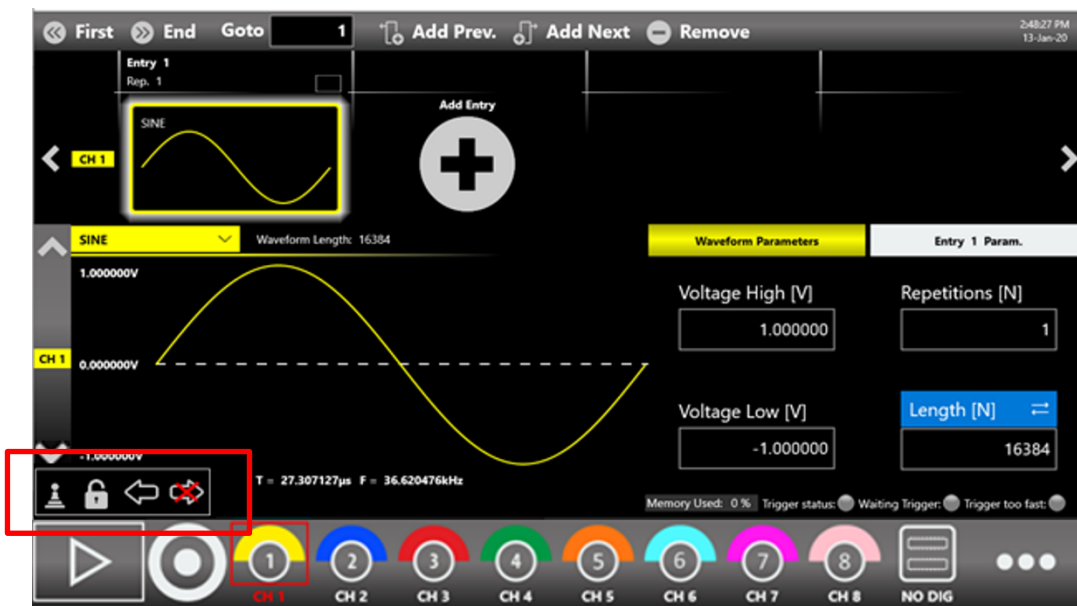
4. Slide the Capture switch on the Master Multi-Instrument bar:

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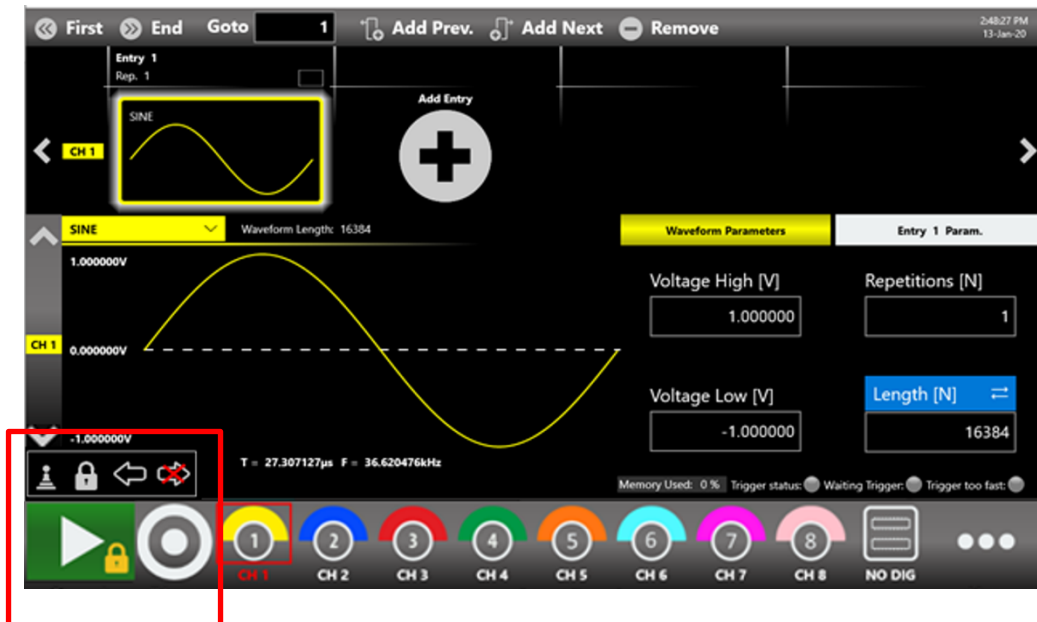
8. To stop the generation, press the Stop button on the master device;
9. To unlink the instruments, slide the Release switch on the master device. In this way the two devices can be independently controlled by their respective interfaces.

Master Multi-Instrument Bar

On the Master device, a new Multi-Instrument bar will appear when it detects the connection with other Model 675-8C units via the RIDER-AWG-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.

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Slave Multi-Instrument Bar

On the Slave device, a new Multi-Instrument bar will appear when it detects the connection with other Model 675-8C units via the RIDER-AWG-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 other slave devices have been found forward, so this instrument is the last of the chain.

License
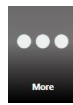
The license button in the More.. menu opens the License page that serves to manage the license options.
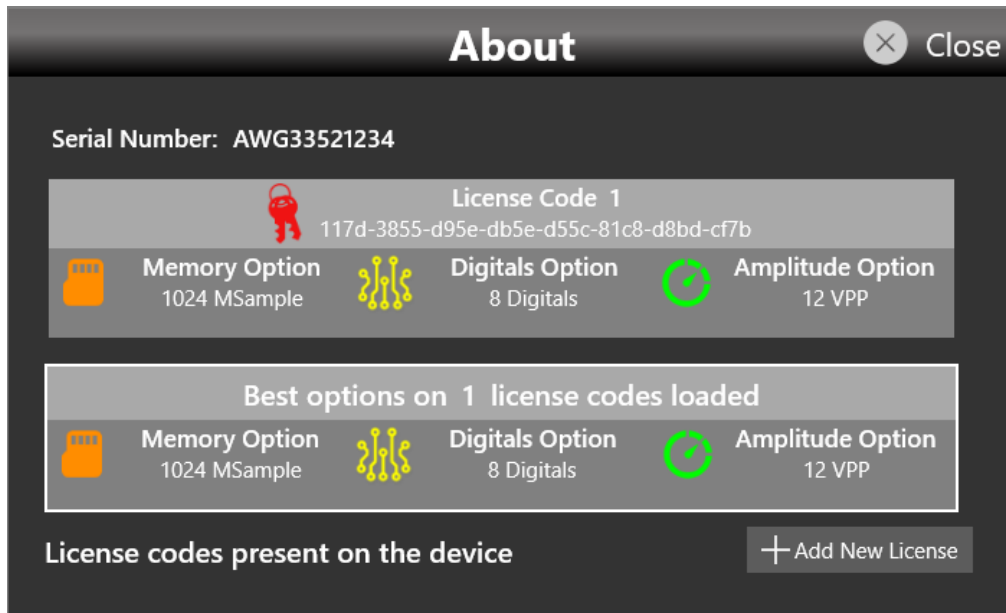
Touching the Add New License button it is possible enter a new licence key to enable any of the following features:

Model 675-2C options:

     a.   Model 675-2C-64M: memory extension to 64MSamples per channel;
     b.   Model 675-2C-128M: memory extension to 128MSamples per channel;
     c.   Model 675-2C-HV: high voltage output (12 Vpp on 50 Ohm);
     d.   Model 675-XC-DIG8: 8 channel digital license.

Model 675-4C options:

     a.   Model 675-4C-64M: memory extension to 64MSamples per channel;
     b.   Model 675-4C-128M: memory extension to 128MSamples per channel;
     c.   Model 675-4C-HV: high voltage output (12 Vpp on 50 Ohm);
     d.   Model 675-XC-DIG8: 8 channel digital license (8/16 digital channels available)

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Model 675-8C options:

    a.   Model 675-8C-64M: memory extension to 64MSamples per channel;

    b.   Model 675-8C-128M: memory extension to 128MSamples per channel;

    c.   Model 675-8C-HV: high voltage output (12 Vpp on 50 Ohm);

    d.   Model 675-XC-DIG8: 8 channel digital license (8/16/24/32 digital channels available)

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

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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 <u>not</u> possible to use standard mini-SAS HD cables** otherwise the unit will be **<u>damaged</u>**.

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 AT-LVDS-SMA8 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 AT-DTLL8. 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 LVTTL 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, TE Connectivity 2227580-1) but you should take case of using the electrical connection shown below.
The connection of the AT-LVDS-SMA8 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	AT-LVDS-SMA8 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

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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

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1.1 AT-LVDS-SMA8

The AT-LVDS-SMA8 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 Model 675 High Performance AWG series.

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

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1.2 AT-DTTL8

The AT-DTTL8 is a 8 bit LVDS to LVTTL converter that converts LVDS differential signals provided by the mini-SAS HD digital connector to standard LVTTL 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 AT-DTTL8 probe max bit rate is 125 Mbps @ 0.8V and 400 Mbps@3.6V.

Important Note: the Model 675-XC-DIG8 does not include the AT-DTTL8, that must be bought separately.
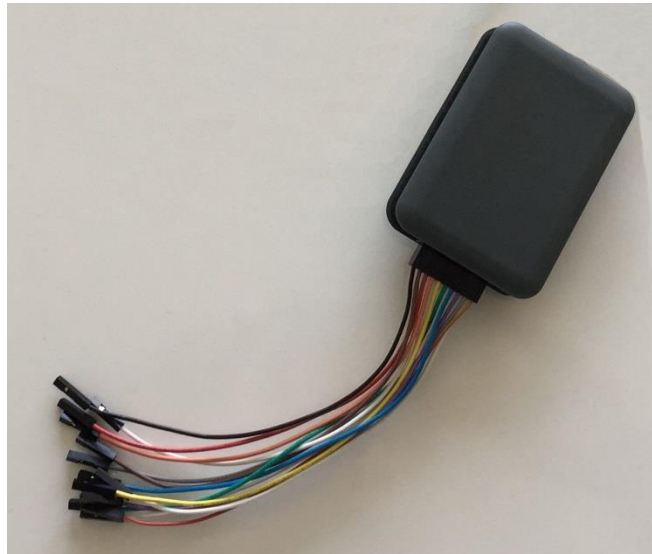
Below the description of the TTL signal connector is provided.

0 1 2 3 4 5 6 7

AT-DTLL8 Pod A/Pod B/Pod C/Pod D Pinout

Ch.0	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	n.c.	n.c.
GND	GND	GND	GND	GND	GND	GND	GND	GND	GND

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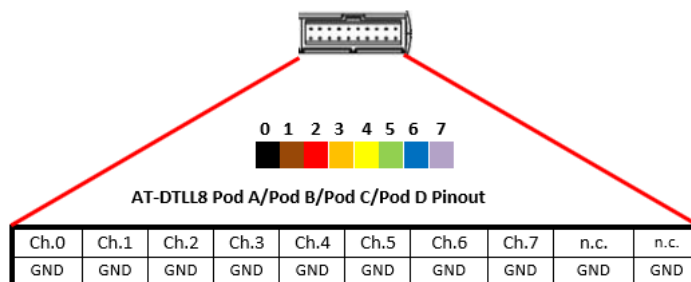
Output connector	20 position 2.54 mm 2 Row IDC Header
Output electrical standard	LVTTL
Output impedance	50 Ω nominal
Output voltage	0.8V to 3.8V programmable (same for all channels)
Maximum Update Rate	125 Mbps @ 0.8V and 400 Mbps @ 3.6V
Dimensions	W 52 mm – H 22 mm – D 76 mm
Input Connector	Proprietary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

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Certifications

Berkeley Nucleonics Corporation 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.

RESTRICTION OF HAZARDOUS SUBSTANCES (RoHS)

This instrument and its accessories conform to the 2011/65/EU RoHS2 Directive.