Tutorials

About the Tutorials

This chapter consists of seven tutorials. You have selected the one that is highlighted in red:

- Tutorial 1 Fundamentals
- Tutorial 2 Working with Channels
- Tutorial 3 Triggering
- Tutorial 4 Working with Special Modes
- Tutorial 5 Working with Subchannels
- Tutorial 6 Arbitrary Waveform Generator
- Tutorial 7 Using the Graphical Waveform Editor

Each section is a self-contained tutorial. If you are new to GageScope[®], it is recommended that you do the tutorials in the order they are presented, as each section assumes you have gone through the previous material.

Tutorial 6: Arbitrary Waveform Generator

GageScope[®] has the unique ability to connect to Arbitrary Waveform Generators (CompuGen cards) sold by Gage Applied Technologies Inc. The primary step in achieving this connectivity is to create a rich set of waveforms within the GageScope[®] software. The waveforms created in GageScope[®] can then be uploaded to an appropriate CompuGen card.

There are three different ways to create arbitrary waveforms from within GageScope[®]:

- Equation
- Predefined
- Standard Waveforms

In this tutorial, we will go through the unique features of each of the methods outlined above. It is assumed that you have launched GageScope[®] prior to starting this tutorial.

Waveform Generation using Equation as an input

1 Click **File** menu from the menu bar.



It can be clearly observed that the Channel Control at the bottom right hand of the GageScope[®] screen is blank. This is due to the fact that no channel is currently active.

2 Select New from the drop down menu. You will see the following window:

W			I
ң Channel	🖹 Paran	neter 💯 Analysis 🗐 Generator 💧	
f(×) Math char AutoSave [] Sub Chan () Average c	playback nel	Operand 1 Ch 01 + - * Operand 2 Ch 01 Result Ch 02 Ch 02	
		OK Cance	

3 Click on the **Generator** tab. You will notice that the Equation text is highlighted as a default.

(×) <mark>Equation</mark> ऒ Predefined ऑ Standard	Duration Equation
	Load Save
	Ampl (%): 100 - Offset (%): 0 -

Using controls in window shown above, users can type in an equation to generate a specific signal.

4 Click inside the text box under the label **Equation**, brings up the Equation editor dialog box as shown below:

quation												
[•] ×: 1		Test	+									
_ Trigonom	ietry		Exponen	itial		Angle			Consta	ants	_ Кеура	d
sin	cos	tan	10^	exp	~	Deg	Rad	1	X	micro		1 ×
Arcsin	Arccos	atn	log	Log10				1	Pi	milli	7 8	9
- Hyperboli	ic Trig.	4	Roundin	g		— Utility —			е	kilo	4 5	6
HSin	HCos	HTan	abs	Ceil	Floor	Fact	rnd	Signum		mega	1 2	3 +
HArcsin	HArccos	HArctan	int	mod		sqr	^2				0	
				[OK		Cancel					

There is an entire range of functions provided here. See the **Reference** Section of this manual for a complete listing of these functions.

We will attempt to create a simple equation at this stage. Later on we will show that more complex signals can be created using controls provided in the Equation editor dialog box above.

5 Let us now create the equation for generating a constant frequency sine wave.

Type **Exp[-0.1*X] * Sin[X]** in the text box either using keyboard or the buttons provided in Equation Editor dialog box. After entering the complete equation,

Equation				×
exp(-0.1*X) * sin(X)				
X: 1 - Tes	+			A Part
Trigonometry	Exponential	Angle	Constants	_ Keypad
sin cos tan	10 [^] exp	^ Deg Rad	X micro	()/*
Arcsin Arccos atn	log Log10		Pi milli	789
Hyperbolic Trig.	Rounding	Utility	e kilo	4 5 6
HSin HCos HTan	abs Ceil	Floor Fact rnd	Signum mega	1 2 3 +
HArcsin HArccos HArcta	n int mod	sqr ^2		0 . ^
		OK Cancel		

Click OK.

6 New dialog box appears again. Notice that the equation typed in the previous step, is shown in the text box beneath the **Equation** label.

(≍) Equation A Predefined ऑ Standard	Duration Equation Duration Equation 1 exp(-0.1*X)*sin(X)
	Load Save

7 Click inside the text box on the left of the typed equation. This is the text box right under the **Duration** label.

Duration				×
Test				
For_	T		7	×
At_	7	8	9	-
To_	4	5	6	
	1	2	3	
)		
OK		Can	cel	

Type in 100 in the text box. These are the total number of samples for the waveform. Click **OK**.

8 The New dialog box appears, showing the duration to be 100 samples.

(×) <mark>Equation</mark> APredefined	Duration Equation 1 100 exp(-0.1*X)*sin(X)	
∑ Standard		
	Load Save	 □÷

Click OK.

9 Damped sinusoid will be displayed in GageScope[®] as follows:

GageScope (Professional edition)		
Elle Yiew Capture Iools Window Help		_161_X
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Info Viewx		
Ch 01	M.	
	V.	
Arm	Timebase: 20 S M.Pos: 1.0us press F1	
CG1100 Dur 01	General Settings	Trace
Sample rate: 80 MS/s Trigger Int_Ext. Burst Tiggered Continuous Burst T	Channel Na.	500 mV
CG1100 CS8500	C61100:YT1	

This signal can be saved as a sig file to be uploaded to an AWG.

10 Click on **Ch 01** tab located in the bottom of Channel Control display. You will notice that **AWG Input** tab appears in the Channel Control as shown below:

GageScope (Professional edition)		
Ele Yiew Capture Iool: Window Help		_161×
🎯 🖬 🗃 🏥 🔿 🤯 🎒 🖄	t= 1t= t @ @ ≈ ^ /	
	1 6 6 1 1 5 8 hits + C	
Into View _jxj		
Ch 01	M	
casi	Wv	
	Т	
Arm For Help.	I imebase: 20 S M.Pos: 1.Ous press F1	
CG1100 Out 01 Sample rate: 80 MS/s Tigger Mode Trit_Ext. Tiggered Continuous Burst	General Settings Timebase Charmel Na. 20 5/4 Charmel Na. Charmel Na.	AWG Input Trace Drawing Duration Equation 1 100 exp(0.1%)*inf(-) Ampl (tb); Tool
CG1100 CS8500	C61100.YT1	

The parameters can be modified using controls in the channel control above.

Predefined Waveforms

- GageScope (Professional edition) ver. 3.0 [CG1100:YT1] _ 8 × _ 8 × Elle View Capture Lools Window Help Save Setup... Ctrl+E x | [;]; ;) @ @ | = ^ / 😤 Load Setup... Ctrl+L II IHI HI 🖌 KA 🖙 🖉 🖬 🖬 f-New. Ctrl+N Ctrl+O 😂 Load Channel Na 🔛 Save Channel. Ctrl+S A Print Setup.. Print... Ctrl+P Egit -1 Arming Timebase: 500 S M.Pos: 0.0 s New Charnel, Display Watch1 NUM CG1100 Out 01 General Settings Timebase Channel Na... Sample rate: 80 MS/s Trigger Mode Trigger Triggered Continuous 500 S/d $\sim m$ Burst 1 💉 CG1100 💉 CS8500 CG1100:YT1 • •
- 1 Click File menu from the menu bar.

2 Select New from the drop down menu. You will see the following window:

W			I
ң Channel	🖹 Paran	neter 💯 Analysis 🗐 Generator 💧	
f(×) Math char AutoSave [] Sub Chan () Average c	playback nel	Operand 1 Ch 01 + - * Operand 2 Ch 01 Result Ch 02 Ch 02	
		OK Cance	

3 Click on the **Generator** tab. You will notice that the Equation text is highlighted as a default.

(×) <mark>Equation</mark> 孙 Predefined ☆ Standard	Duration Equation

Using controls in window shown above, users can enter an equation to generate a specific signal.

4 Click **Predefined** from the list in the dialog box. Click **OK**.

<) Equation • Predefined • Standard	File: Select Ampl (%): 100 - Offset (%): 0

5 Click Select. You will see the Load Channel window as follows:

Load channel		? ×
Look in: Signal Files Am_sig.sig Half_am.sig AmSweep.sig Her_bone.sig Chopsine.sig Sawtooth.sig Dim_sine.sig Sine.sig Frqsweep.sig Sinnoisy.sig Glitch.sig Sqr_wave.sig	 ★ Image Signature 	✓ Show Preview
File name: Sig	Cancel	

6 The dialog box shows that there are several types of signals stored for use. Click on **Sawtooth.sig**. The signal appears in the Preview window.

Load channel					?	×
Look in: 🔂 Signa	l Files	- 🗈 🜌		Show Previe	W	
篇 Am_sig.sig AmSweep.sig 第 Chopsine.sig 聞 Dim_sine.sig 第 Frqsweep.sig 篇 Glitch.sig	歸 Half_am.sig 第 Her_bone.sig Sawtooth sig 第 Sine.sig 第 Sinnoisy.sig 第 Sqr_wave.sig	聞 ToneBrst.sig 聞 Triangle.sig				V
File <u>n</u> ame: Sawt	ooth.sig		<u>O</u> pen	Data: Depth:	12 bit 10241 smpl	
Files of type: Gage	eScope signal file(*.sig)	•	Cancel	Records:	1	
						/

7 Click **Open**. The predefined signal appears in the New window as a Preview.



8 To load the Sawtooth signal file in GageScope, click **OK**. If you do not wish to load the signal at this point, click **Cancel**.

GageScope (Professional edition)		GoGe LaX
Ele Yew Capture Ioolt Window Help		X
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	11 66 6 A A 5 8 bits - 1 1 1	
Info View IX		
	1 1	1 1
Ch 01		
	π	
	Timebase: 1 kS M.Pos: 50.0us	
For Help.		NUM
CG1100 00x 01		ace
Sample rate: 80 MS/s Trigger Mode Int. Ext. Triggered Continuous Burst	11/5//	t. Scale Connect Dots Method Min Max
CG1100 CS8500	C61100:YT1 • •	All 🕁 Ch 01

9 Clicking **Ch 01** tab in the channel control, brings up the **AWG Input** tab at the top of the control. Click **AWG Input** tab to view the associated property page as follows:



Standard Waveform Generation

- GageScope (Professional edition) ver. 3.0 [CG1100:YT1] _ 8 × _ 8 × Ele View Capture Lools Window Help Save Setup... Ctrl+E x | [; 1; 1) @ @ | 12 ^ # 😤 Load Setup... Ctrl+L 1 HH HH K K A S 8 bits V 🗂 🖬 🖬 ţ. D New Ctrl+N Ctrl+O Load Channel Na Save Channel. Ctrl+S A Print Setup. Print... Ctrl+P Egit Arming Timebase: 500 S M.Pos: 0.0 s New Channel, Display Watch1 NUM CG1100 Out 01 General Settings Timebase Channel Na... Sample rate: 80 MS/s 💌 Trigger Mode Continuous 500 S/d $\sim \infty$ Burst 1 💉 CG1100 💉 CS8500 👿 CG1100:YT1 🛛 • •
- 1 Click File menu from the menu bar.

2 Select New from the drop down menu. You will see the following window:

<mark>y</mark> Channel	🖹 Param	neter 💯 Analysis 🗊 Generator
) Math chann AutoSave p Sub Channe Average ch	layback el	Operand 1 Ch 01 + - * Operand 2 Ch 01 Ch 01
		Ch 02

3 Click on the **Generator** tab. You will notice that the Equation text is highlighted as a default.

(x) <mark>Equation</mark> ऒ Predefined ☆ Standard	Duration Equation
	Load Save
	Ampl (%): 100 - Offset (%): 0 -

Using controls in window shown above, users can specify an equation to generate a specific signal.

4 Click Standard from the list in the dialog box. Click OK.

New		×
Channe Paramete	er Manalysis Conerator Waveform: Sine Duty (%): 50 * Samples: 1600 * Ampl (%): 100 * Offset (%): 0 *	
	OK Cancel	1

5 One can observe that the Sine waveform is the default selection. Click on the scroll down arrow in the Waveform text box. You will find out that there are three different types of standard waveforms available for selection. These are **Sine**, **Square**, and **Triangle** as shown below:

🚽 Channel 🖹 Parameter	Analysis	Generator
<)Equation A Predefined A Standard	Waveform: Duty (%): 50 Ampl (%): 100	Sine Sine Source Triangle Offset (%): 0

6 Select Square from the drop down list. Click OK.

w		
ᡐ Channel 🖹 Parai	meter 🛺 Analysis 🗐 Generator	
f(×) Equation ≌ Predefined ☆ Standard	Waveform: Square Duty (%): 50 ★ Samples: 1600 ★ Ampl (%): 100 ★ Offset (%): 0 ★	
	OK Cand	cel

The resulting window shows the default settings for input parameters: Duty, Samples,

Amplitude and **Offset**. Users can choose to change these parameters depending on their particular application.

In the current setting, a single cycle of a Square wave will be generated with 50% duty cycle. The total number of samples within one cycle of this wave will be 1600. The amplitude of the wave is 100% referenced to the input range selected. There will be no DC Offset.

7	Click OK .	A single cycle S	quare wave will I	be displayed in	GageScope [®] :
	Cher Olt.	r single cycle b	quale mare milli	oe alspiayea m	Gugebeepe .

GageScope (Professional edition)		
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	# # # Q Q ≋ ∧ ? # # K K ⊨ 5 8 bits 7 🖸	
Info View IX		
Ch 01		
	T	
	ming Timebase: 1 kS M.Pos: 50.Ous	
CG1100 004 01	General Settings	AWG Input Trace Drawing
Sample rate: 80 MS/s Trigger Int. Ext. Triggered Continuous	Timebase Charnel Na	Waveform: Square Duby (3): 50 Samples: 1600 Ampl (3): 100 Offset (3): 0
Burst 1 -	C61100:YT1	

Note that Channel 1 displays the generated Square wave. The AWG Input tab has been selected and consequently the AWG property page appears in the bottom right hand corner of GageScope[®] display.

Refer to the Reference section of this manual on further details for arbitrary waveform generation.