AIM & THURLBY THANDAR INSTRUMENTS

TGP3100 Series

Pulse and Universal Generators

QUICK START GUIDE

Aim-TTi

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The full Specification for the instrument can be found in the separate Instruction Manual.

Note: The latest revisions of this manual, device drivers and software tools can be downloaded from: http://www.aimtti.com/support or http://www.aimtti.us/support (USA).

This manual is 48591-1340 Issue 1

2 Introduction

2.1 The TGP3100 Series of Pulse and Universal Generators

2.1.1 General Description

The TGP3100 Series are true pulse generators using all digital techniques. They can replicate the capabilities of traditional pulse generators whilst adding many additional facilities such as pulse modulations.

As well as operating as pulse generators, the instruments can act as high performance noise generators and as function/arbitrary generators - making them truly universal waveform generators.

Single and dual channel models are available with a maximum frequency of either 50MHz or 25MHz

2.1.2 Important Features

Pulse waveforms from 1mHz to 50MHz [25MHz], minimum rise time 5ns [8ns]

Pulse, double pulse, pulse pattern and PRBS waveforms

Pulse period, width, and delay resolutions of 100ps or 11 digits

Independently variable rise and fall times from 5ns [8ns] to 800 seconds

Low jitter asynchronous operation, externally triggered pulses or pulse reconstruction

High drive capability output can provide 20V pk-pk into 50Ω (unmatched)

Wide range of pulse modulations including AM.FM, PM, FSK, BPSK, SUM, PWM, PDM using internal or external modulation sources.

Triggered (burst count) or gated operation using internal or external trigger sources

Full Noise generator to 25MHz [12.5MHz] with selectable crest factor and user defined distribution

Full Arbitrary/Function generator with 16 waveform types

Sine waves up to 50MHz [25MHz]

Arbitrary waveforms at 800MS/s sampling rate and 16-bit vertical resolution

Extensive internal/external modulation of all waveform types

Linear and logarithmic sweeps of all waveform types

Front panel mounted USB Flash drive interface

GPIB, USB and LXI compliant LAN interfaces

2.2 About this Guide

This Quick Start guide is for bench-top use of the TGP3100 Series comprising the TGP3151 and TGP3121 single channel generators and the TGP3152 and TGP3122 dual channel generators.

A full Instruction Manual (English only) is also provided that includes comprehensive explanations of all functions and additional information on remote control, calibration, and the detailed technical specifications.

3 **Safety**

This generator is a Safety Class I instrument according to IEC classification and has been designed to meet the requirements of EN61010–1 (Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use). It is an Installation Category II instrument intended for operation from a normal single phase supply.

This instrument has been tested in accordance with EN61010–1 and has been supplied in a safe condition. This instruction manual contains some information and warnings which have to be followed by the user to ensure safe operation and to retain the instrument in a safe condition.

This instrument has been designed for indoor use in a Pollution Degree 2 environment in the temperature range 5°C to 40°C, 20% – 80% RH (non–condensing). It may occasionally be subjected to temperatures between +5° and –10°C without degradation of its safety. Do not operate while condensation is present.

Use of this instrument in a manner not specified by these instructions may impair the safety protection provided. Do not operate the instrument outside its rated supply voltages or environmental range.

WARNING! THIS INSTRUMENT MUST BE EARTHED

Any interruption of the mains earth conductor inside or outside the instrument will make the instrument dangerous. Intentional interruption is prohibited. The protective action must not be negated by the use of an extension cord without a protective conductor.

When the instrument is connected to its supply, terminals may be live and opening the covers or removal of parts (except those to which access can be gained by hand) is likely to expose live parts. The apparatus shall be disconnected from all voltage sources before it is opened for any adjustment, replacement, maintenance or repair.

Any adjustment, maintenance and repair of the opened instrument under voltage shall be avoided as far as possible and, if inevitable, shall be carried out only by a skilled person who is aware of the hazard involved.

If the instrument is clearly defective, has been subject to mechanical damage, excessive moisture or chemical corrosion the safety protection may be impaired and the apparatus should be withdrawn from use and returned for checking and repair.

Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of makeshift fuses and the short–circuiting of fuse holders is prohibited.

This instrument uses a Lithium button cell for non–volatile memory battery back–up; typical life is 5 years. In the event of replacement becoming necessary, replace only with a cell of the correct type, i.e. 3V Li/$Mn0_2$ 20mm button cell type 2032. Exhausted cells must be disposed of carefully in accordance with local regulations; do not cut open, incinerate, expose to temperatures above 60°C or attempt to recharge.

Do not wet the instrument when cleaning it and in particular use only a soft dry cloth to clean the LCD window. The following symbols are used on the instrument and in this manual:–



Caution –refer to the accompanying documentation, incorrect operation may damage the instrument.



terminal connected to chassis ground.



mains supply OFF.

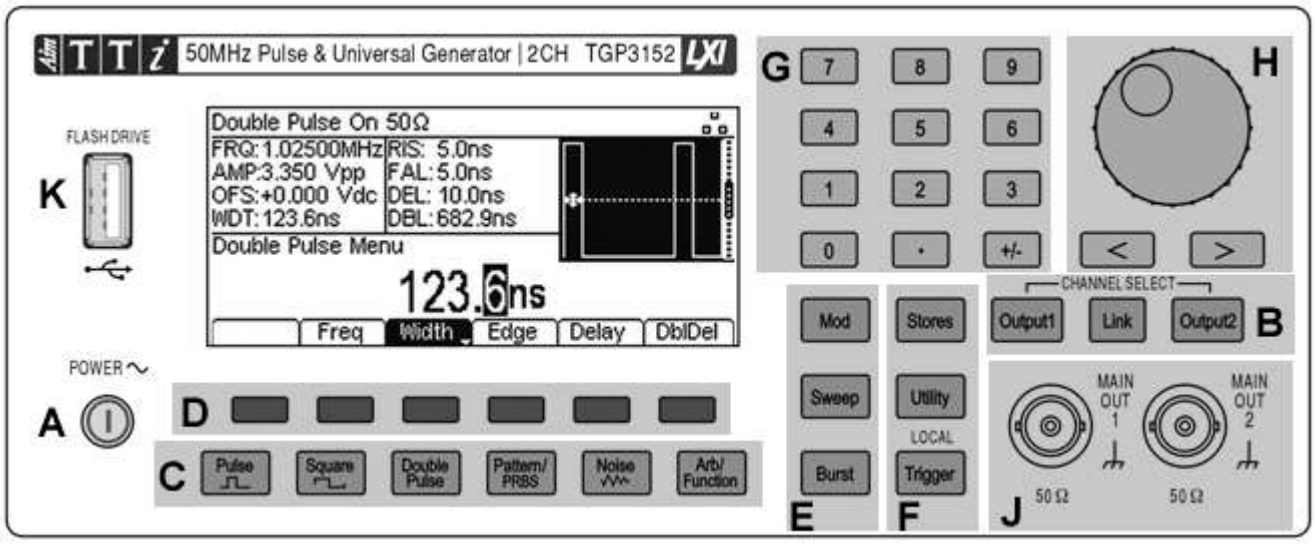
mains supply ON.



alternating current.

4 Operational Principles

4.1 Front Panel Layout



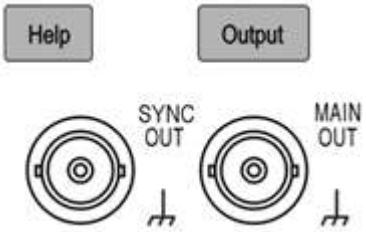
Ref.	Short Description	Function
A	Power Switch	Switches instrument on or off. *Safety Note:* To fully disconnect from the AC supply, unplug the mains cord from the back of the instrument or switch off at the AC supply outlet; make sure that the means of disconnection is readily accessible.
B	Output Menu(s) Select Channel Select Help Menu Select	Opens Output menu(s) to set output parameters Selects the desired channel for parameter editing (dual channel instruments only). Selects Channel Linking menu (dual channel instruments only). Opens Help menu (single channel instruments only).
C	Waveform Menus Waveform Select	Opens Waveform menus to set waveform parameters. Selects the main waveform type (carrier waveform) as active. (Pulse, Square, Double Pulse, Pattern/PRBS, Noise, ARB/Function.)
D	Soft-keys	Performs the function shown on the LCD soft-key label above.
E	Waveform Modification Menus	Opens menus for setting parameters for Modulation, Sweep and Burst
F	Other Menus	Selects menus for internal and external file storage, instrument utilities, and trigger conditions.
G	Numeric Keypad	Used to enter numeric parameter values directly.
H	Cursor Keys and Spin Wheel	Used to change numeric parameter values digit by digit. Used to select items within some menus.
J	Main and/or Sync Sockets	Main output and Sync output sockets (single channel instruments only). Main output sockets (dual channel instruments only)
K	USB Flash Drive	USB Host connector for USB Flash drive storage.

4.1.1 Front Panel Layout - Single Channel Models

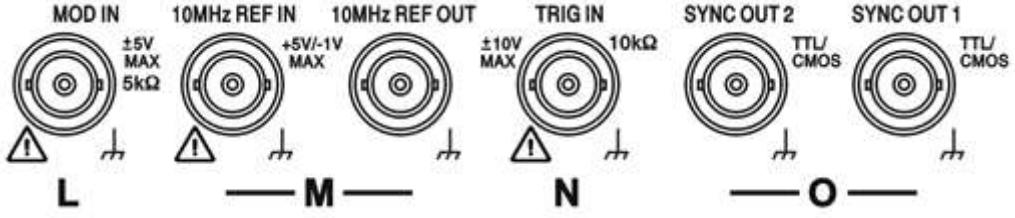
On single channel models (TGP31x1) the output terminal area differs in having only one Output key and Output socket.

The Sync output socket is mounted on the front panel instead of the rear panel.

A Help key is provided that directly accesses the help screens. On dual channel models Help is accessed from the Utility menu.

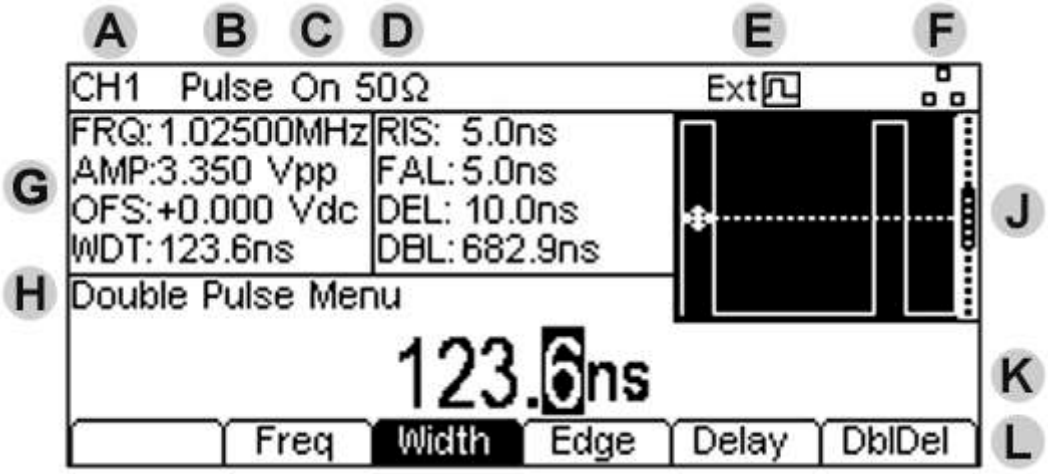


4.2 Rear Panel Layout



L	Modulation Input	External input for modulation of main waveforms.
M	Reference In/Out	Input for external10MHz reference clock. Output for internal 10MHz reference clock.
N	Trigger Input	External input for triggering of main waveforms. Also used with Reference In/Out to synchronise two generators.
O	Sync Outputs	Sync signal outputs for both channels (dual channel instruments only).

4.3 Screen Layout



Ref.	Short Description	Function
A	Channel Indicator	Shows currently select channel (dual channel instruments only).
B	Main Waveform type	Shows current carrier waveform (Pulse, Square, Double Pulse, Pattern/PRBS, Noise, ARB/Function.).
C	Output State	Shows main output On or Off
D	Load Impedance	Shows load impedance for which output level is displayed.
E	External Clock Indicator	Shows status of external clock (if applied)
F	LAN Status Indicator	Shows status of LAN (Ethernet) connection.
G	Parameters Box	Shows main parameters for waveform.
H	Menu Description	Shows the currently selected editing menu.
J	Graph Box	Shows a graphical representation of the selected waveform.
K	Edit Box	Shows the current parameter that can be edited
L	Soft-key Labels	Shows the current functions for the six keys below.

5 Getting Started

In order to familiarise the user with some of the basic functionalities of the instrument, a number of set-up examples are shown in this guide.

It is recommended that all users should carry out the first three examples:

- Setting up a square wave clock signal
- Setting up a pulse signal
- Setting up a sine wave signal

This will have introduced some of the basic operating principles. These can be expanded in the next three examples:

- Setting-up more Output Options
- Setting-up a simple Bit Pattern
- Setting-up an AM modulated Pulse Waveform

A number of further set-up examples are provided that assume some familiarity with the instrument:

- Double Pulse Operation
- PRBS Pattern
- Frequency Modulation of a Pulse Waveform
- Pulse Width Modulated Waveform (PWM)
- Pulse Delay Modulated Waveform (PDM)
- Frequency Sweep of a Sine Wave
- Generating a Triggered Burst
- Reconstructing an External Pulse Waveform
- Coupling the Frequency of Both Channels (TGP31x2 models only)
- Summing Both Channels Together (TGP31x2 models only)

For more detailed information on all functionality - see the full Instruction Manual.

5.1 Initial Conditions

Before setting up the instrument for any of the examples, it should be returned to default conditions.

To do this follow these steps:

Press the hard key marked **Utility**

Press the soft-key labelled **System**

Press the soft-key labelled **Default** (display will show Restore Factory Default?)

Press the soft-key labelled **Yes**

This sets the main waveform to Pulse (10kHz, 50% duty cycle, 1V pk-pk) and cancels any modulations, sweep, or burst triggering or gating.

NOTE:

The instrument can be set to remember its latest settings on power-off and restore them at power-on. This is set from the **Utility** menu and the **PwrOn** soft-key. This setting will be lost when the instrument is restored to default conditions as described above.

6 Basic Set-up Examples

6.1 Setting-up a Square Wave Clock Signal

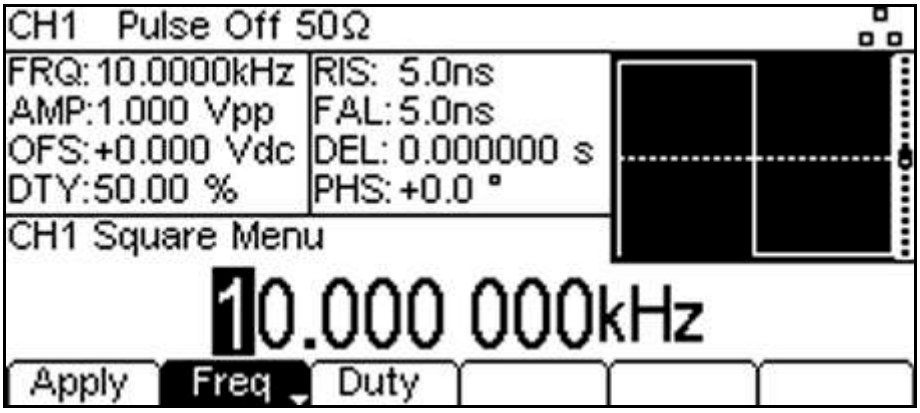
Requirement

Output a continuous square wave clock signal with 20MHz frequency, 50% duty cycle and a high level of 3.3V and a low level of 0.0 volts.

Starting Conditions

Before starting, reset the instrument to defaults as described in section 5.1 Initial Conditions .

Open Waveform Menu - Square



- Press the hard key marked **Square**, followed by the soft-key labelled **Apply**.

Note that the new waveform type does not become active until the Apply key is pressed.

Set the Frequency

- Press the soft-key labelled **Freq** - the current frequency appears in the edit box.

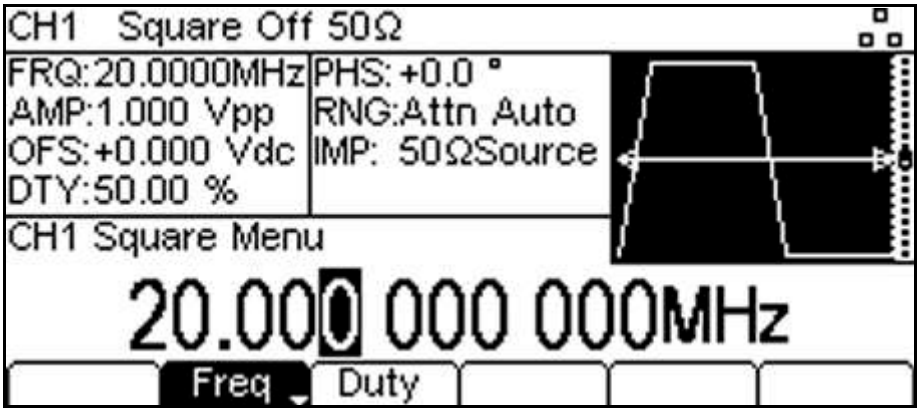
Note that pressing this soft-key repeatedly changes its function between Frequency and Period.

- Use the numeric keypad to enter a new frequency. Press the numbers **2 0**.

Note that, as soon as a number is entered, the soft-keys change to show units of frequency.

- Press the soft-key labelled **MHz** to confirm a frequency of 20MHz.

Note that the graph box changes to show the rise time on the edges which is now significant.

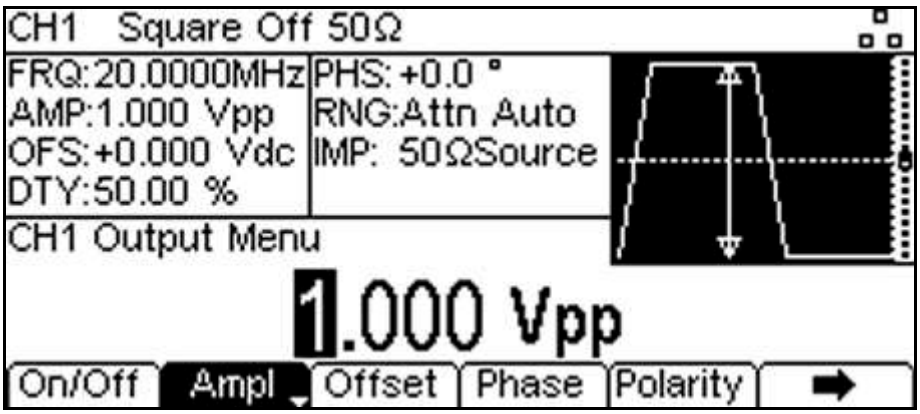


Confirm the Duty Cycle

- Press the soft-key labelled **Duty** - the current duty cycle appears in the edit box.

Note that the duty cycle is already set at 50%, but could be changed here if required.

Open the Output Menu

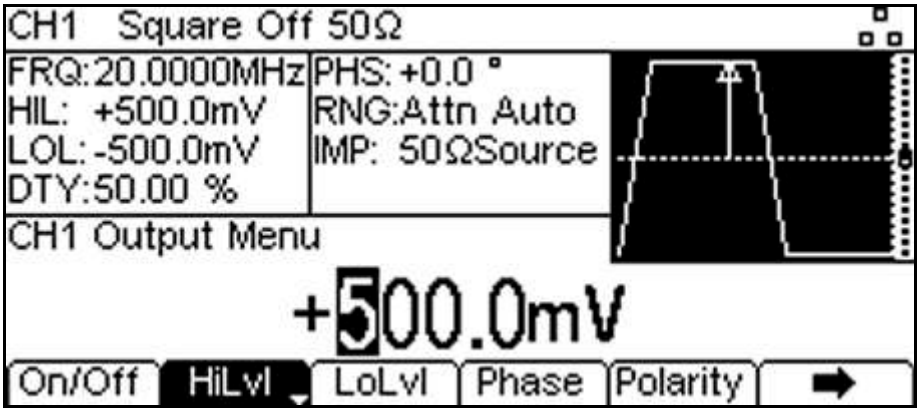


- Press the hard key marked **Output** (or Output1 on dual channel instruments) - the current pk-pk amplitude appears in the edit box.

Set the High and Low Levels

- Press the soft-key labelled **Ampl** - the key label changes to **HiLvl** and the current high level voltage appears in the edit box

Note that successive presses of the Ampl soft-key changes the Ampl and Offset key labels to HiLvl (high level) and LoLvl (low level) and vice versa.



- Press the soft-key labelled **HiLvl** - the current high level voltage appears in the edit box.
- Use the numeric keypad to enter a new level. Press the numbers **3 . 3** .

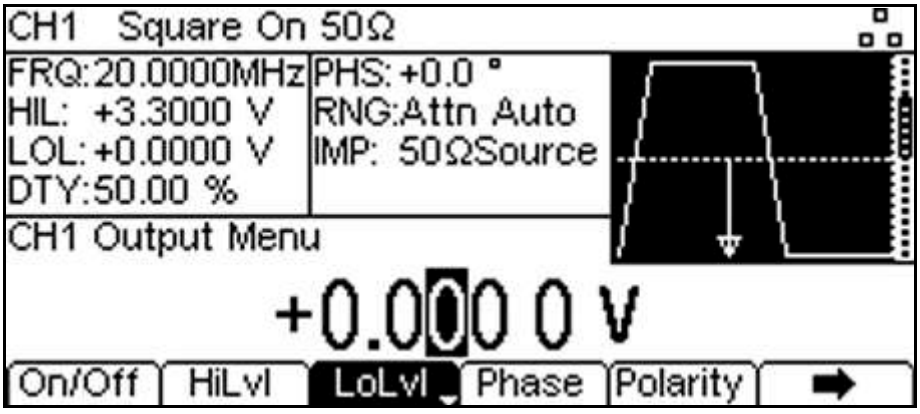
Note that, as soon as a number is entered, the soft-keys change to show units of voltage.

- Press the soft-key labelled **V** to confirm a high level of 3.3 volts.
- Press the soft-key labelled **LoLvl** - the current low level voltage appears in the edit box.
- Use the numeric keypad to enter a new level. Press **0** .
- Press the soft-key labelled **V** to confirm a low level of 0.0 volts.

Turn the Output On

- Press the soft-key labelled **On/Off** to set the main output to On.

Note that the Output key illuminates in green to indicate the on state.



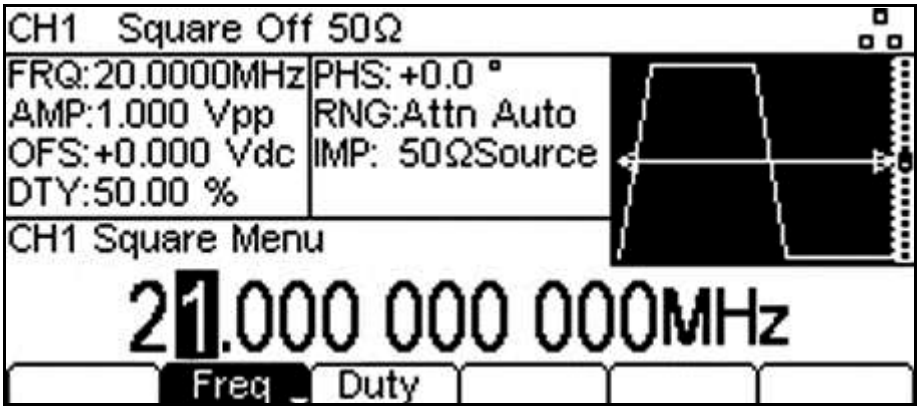
To make further changes to Frequency or Duty Cycle

- Press the hard key marked **Square**.

This closes the output menu and opens the waveform menu.

Making live changes to any numeric parameter (e.g. Frequency)

Numeric parameters can be changed by using the cursor keys and spin wheel as an alternative to the numeric keypad.



- Press the hard key marked **Square**.
- Press the soft-key labelled **Freq** – the current frequency value of 20.0MHz is displayed
- Press the Cursor hard keys to move the edit highlight to the second digit.
- Use the spin wheel to change the value – the frequency is changed immediately.

NOTE:

Soft-key labels that include a downward arrow perform more than one a function when pressed. This may be a change in parameter type or parameter option.

6.2 Setting-up a Pulse Waveform

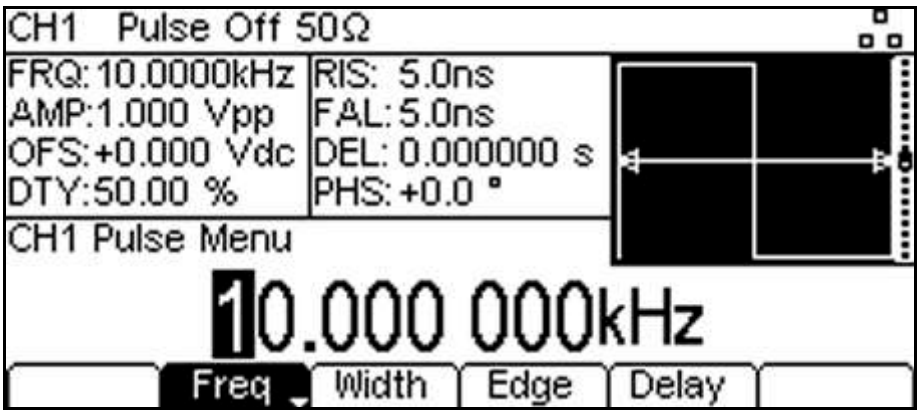
Requirement

Output a continuous pulse signal with 100ns period, 30ns pulse width, zero delay, 10ns edge times and a high level of 2.7V and a low level of -0.6 volts.

Starting Conditions

Before starting, reset the instrument to defaults as described in section 5.1 Initial Conditions .

Open Waveform Menu - Pulse

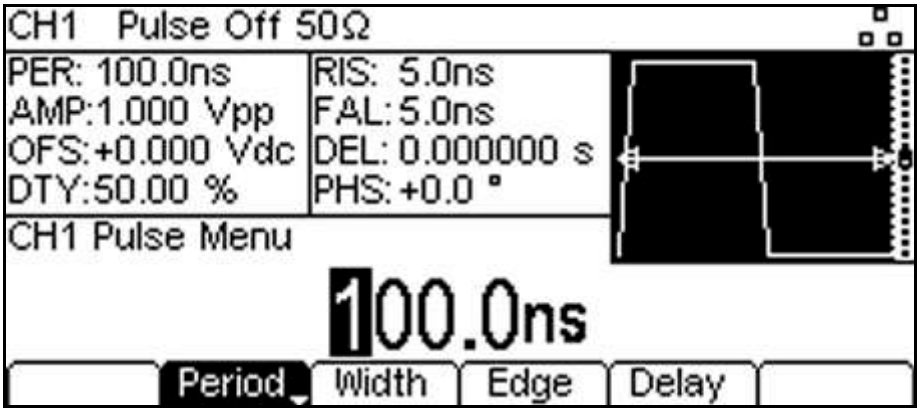


Note that the Pulse waveform menu will be already selected as the default.

Set the Period

- Press the soft-key labelled **Freq** so that it changes to **Period** - the current period appears in the edit box.

Note that pressing this soft-key repeatedly changes its function between Frequency and Period.



- Use the numeric keypad to enter a new period. Press the numbers **1 0 0**.

Note that, as soon as a number is entered, the soft-keys change to show units of time.

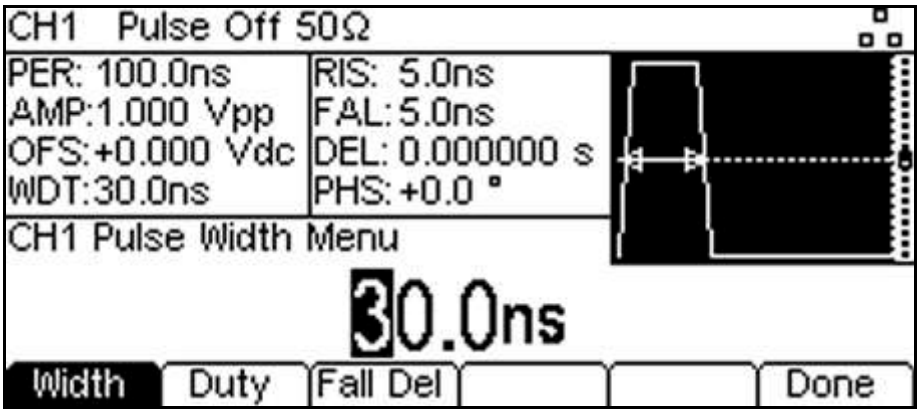
- Press the soft-key labelled **ns** to confirm a period of 100ns.

Note that the graph box changes to show a representation of the pulse and edge times.

Set the Pulse Width

- Press the soft-key labelled **Width** to open the pulse width sub-menu.

Note that by default the pulse width is described in terms of duty cycle.



- Press the soft-key labelled **Width** to display the width as a time.
- Use the numeric keypad to enter a new width. Press the numbers **3 0**.

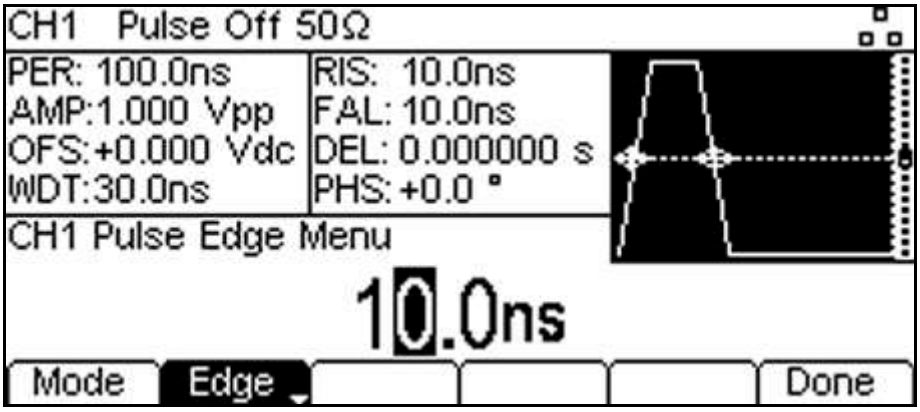
Note that, as soon as a number is entered, the soft-keys change to show units of time.

- Press the soft-key labelled **ns** to confirm a width of 30ns.
- Press the soft-key labelled **Done** to return to the main pulse menu.

Set the Pulse Edge Times

- Press the soft-key labelled **Edge** to open the pulse edge sub-menu.

Note that by default the edge times are set together (coupled) but that Mode key can be used to choose independent rise and fall times when required.



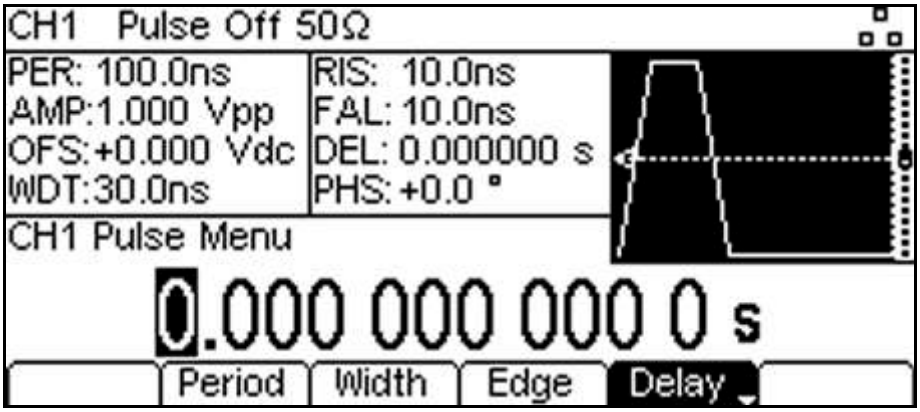
Note that edge times can be set as an absolute time or as a percentage of the pulse width. Pressing the Edge soft-key repeatedly changes its function between time and percentage.

- Use the cursor keys to select the digit representing units of 1ns
- Use the spin wheel to change the value to 10.0ns
- Press the soft-key labelled **Done** to return to the main pulse menu.

Note that the value could have been entered using the numeric keypad if preferred.

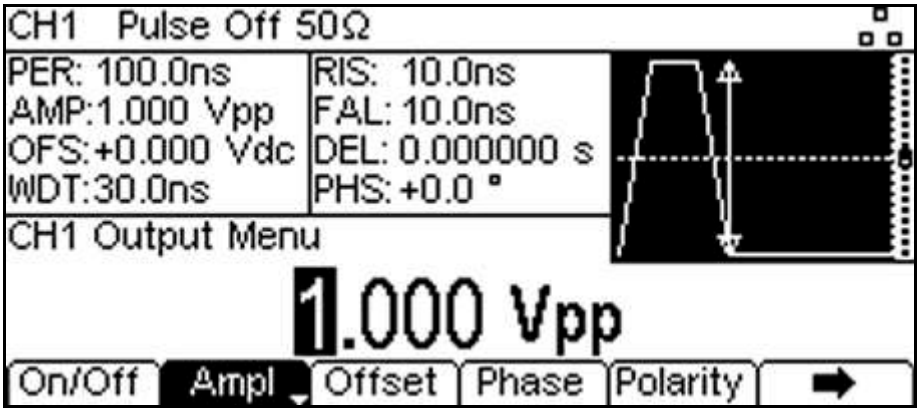
Confirm the Pulse Delay

- Press the soft-key labelled **Delay** - the current pulse delay appears in the edit box.



Note that the delay is already set to zero, but could be changed here if required.

Open the Output Menu

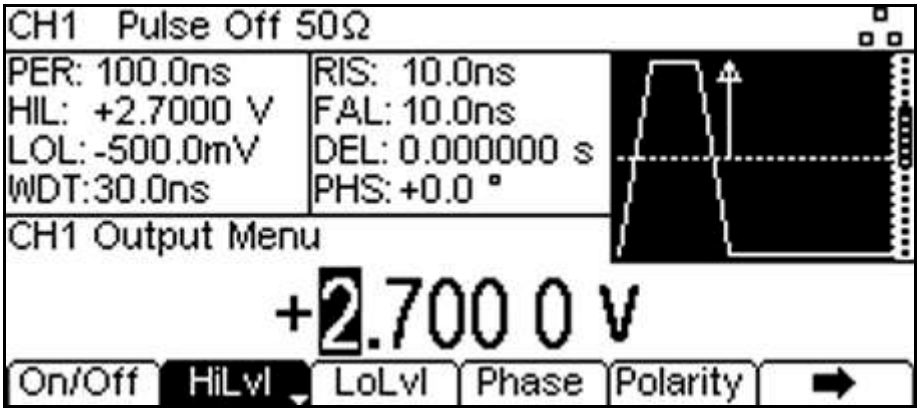


- Press the hard key marked **Output** (or **Output1** on dual channel instruments) - the current pk-pk amplitude appears in the edit box.

Set the High and Low Levels

- Press the soft-key labelled **Ampl** - the key label changes to **HiLvl** and the current high level voltage appears in the edit box

Note that successive presses of the Ampl soft-key changes the Ampl and Offset key labels to HiLvl (high level) and LoLvl (low level) and vice versa.



- Press the soft-key labelled **HiLvl** - the current high level voltage appears in the edit box.
- Use the numeric keypad to enter a new level. Press the numbers **2 . 7** .

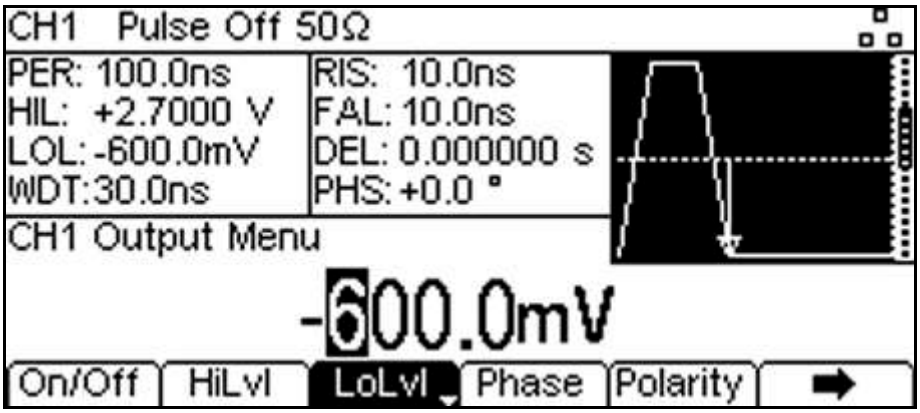
Note that, as soon as a number is entered, the soft-keys change to show units of voltage.

- Press the soft-key labelled **V** to confirm a high level of 2.7 volts.
- Press the soft-key labelled **LoLvl** - the current low level voltage appears in the edit box.
- Use the numeric keypad to enter a new level. Press **- . 6** .
- Press the soft-key labelled **V** to confirm a low level of -600 mV.

Turn the Output On

- Press the soft-key labelled **On/Off** to set the main output to On.

Note that the Output key illuminates in green to indicate the on state.



To make further changes to the pulse waveform

- Press the hard key marked **Pulse**.

This closes the output menu and opens the waveform menu.

NOTE:

Soft-key labels that include a downward arrow perform more than one a function when pressed. This may be a change in parameter type or parameter option.

6.3 Setting-up a Sine Wave Signal

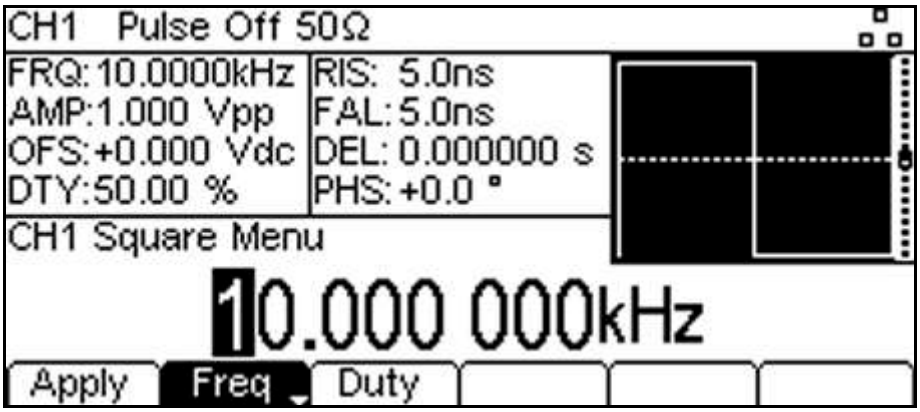
Requirement

Output a continuous sine wave signal with 15MHz frequency and an amplitude of 6 volts pk-pk.

Starting Conditions

Before starting, reset the instrument to defaults as described in section 5.1 Initial Conditions .

Open Waveform Menu - Arb/Function



- Press the hard key marked **Arb/Function**, followed by the soft-key labelled **Apply**.

Note that the new waveform type does not become active until the Apply key is pressed.

Set the Frequency

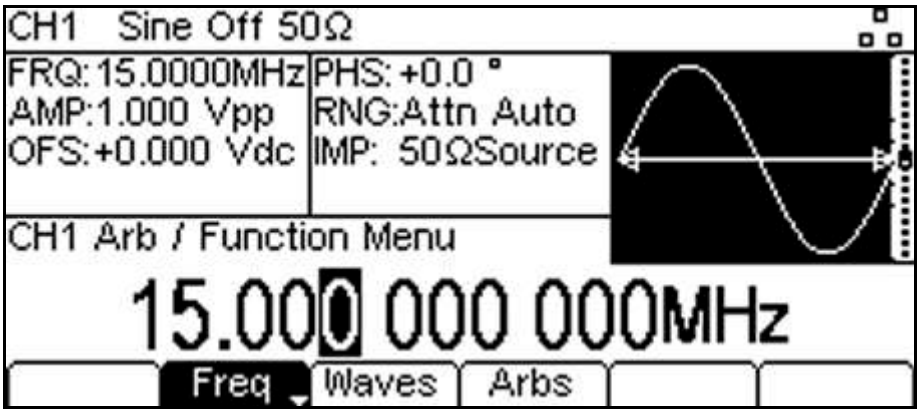
- Press the soft-key labelled **Freq** - the current frequency appears in the edit box.

Note that pressing this soft-key repeatedly changes its function between Frequency and Period.

- Use the numeric keypad to enter a new frequency. Press the numbers **1 5**.

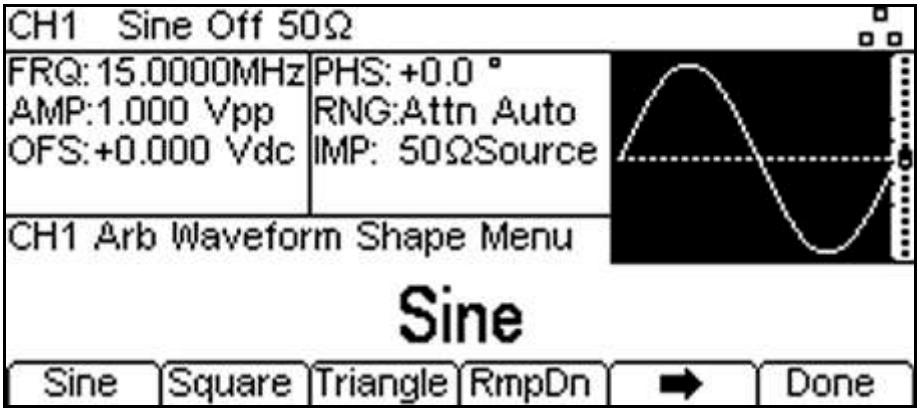
Note that, as soon as a number is entered, the soft-keys change to show units of frequency.

- Press the soft-key labelled **MHz** to confirm a frequency of 15MHz.



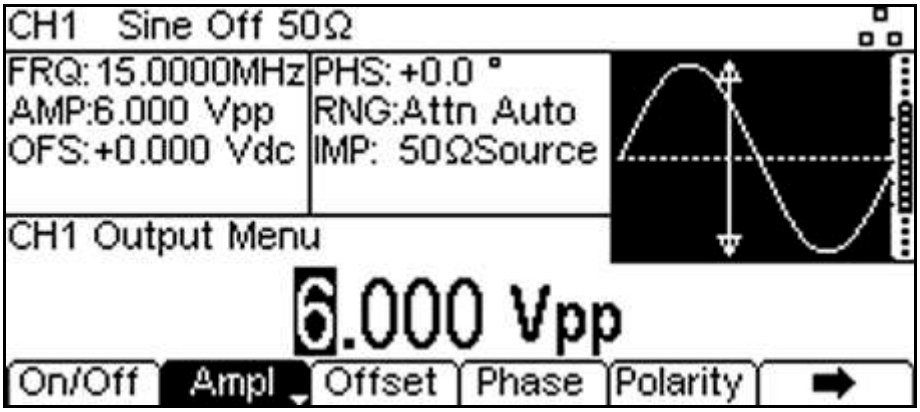
Confirm the Waveform Type

- Press the soft-key labelled **Waves** - the soft-keys change to show alternative waveforms.



Note that the waveform type is already set to sine, but could be changed here if required.

Open the Output Menu



- Press the hard key marked **Output** (or Output1 on dual channel instruments) - the current pk-pk amplitude appears in the edit box.

Set the Amplitude

Note that successive presses of the Ampl soft-key changes the Ampl and Offset key labels to HiLvl (high level) and LoLvl (low level) and vice versa.

- Use the numeric keypad to enter a new amplitude. Press the number **6** .

Note that, as soon as a number is entered, the soft-keys change to show units of voltage.

- Press the soft-key labelled **V** to confirm a pk-pk amplitude of 6.0 volts.

Turn the Output On

- Press the soft-key labelled **On/Off** to set the main output to On.

Note that the Output key illuminates in green to indicate the on state.

To make further changes to Waveform or Frequency

- Press the hard key marked **Arb/Function**.

This closes the output menu and opens the waveform menu.

NOTE:

Soft-key labels that include a downward arrow perform more than one a function when pressed. This may be a change in parameter type or parameter option.

7 Further Set-up Examples

In the following examples it is assumed that the user has understood the basic operation of the instrument from the previous set-up examples.

7.1 Setting-up more Output Options

Requirement

In the earlier set-up examples it was shown how the output menu is used to set the output level (amplitude plus offset or high level plus low level) and turn the output on or off. This example demonstrates the setting of output phase, output polarity, source impedance and load impedance.

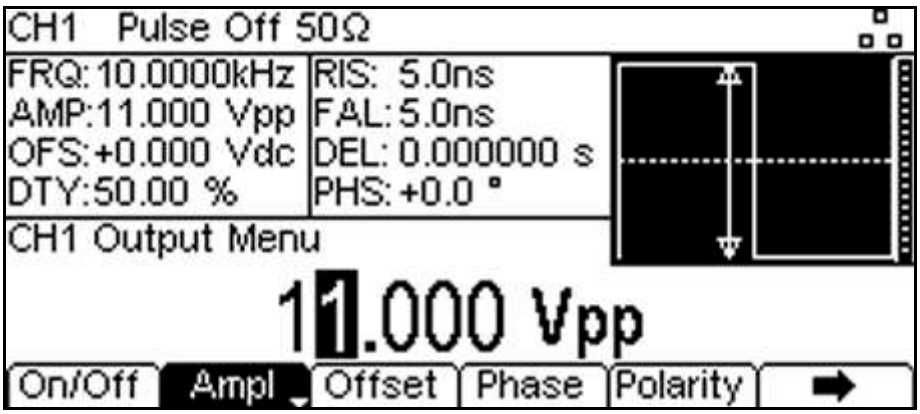
Starting Conditions

Before starting, reset the instrument to defaults as described in section 5.1 Initial Conditions .

Open the Output Menu

- Press the hard key marked **Output** (or Output1 on dual channel instruments)
  - the current pk-pk amplitude appears in the edit box.

Set the Amplitude

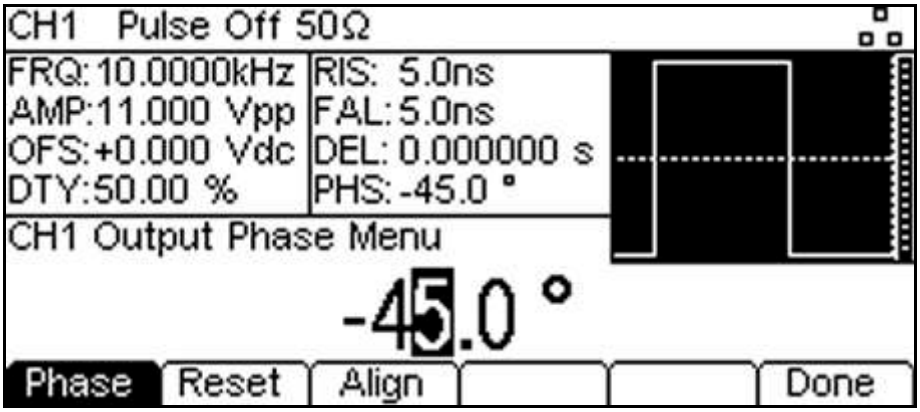


- Enter a pk-pk amplitude of 11.0 volts with an offset of zero.

Note that this is the largest amplitude that can be set with a source impedance and load impedance both at 50 Ohms.

Change the Output Phase

- Press the soft-key labelled **Phase** to open the output phase sub-menu



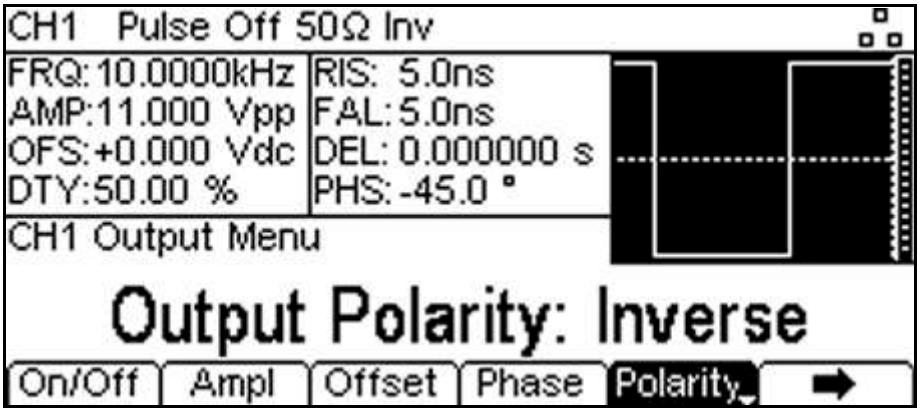
- Enter a phase of -45 degree.
- Press the soft-key labelled **Done** to return to the main output menu.

The set phase angle is the point in the waveform period which is coincident with the Sync or trigger edge, i.e. it is the point in the period at which the waveform starts. Hence a negative phase setting advances, and a positive phase setting delays the waveform relative to the Sync or trigger; the waveform in the graph box changes to show this.

Note that Phase is not the same as Delay. Phase is a defined proportion of the period whereas pulse Delay is a defined time.

The phase can be returned to zero by pressing the Reset soft-key. The Align soft-key appears only on two channel generators and is used to re-align phase when making frequency changes.

Change the Output Polarity

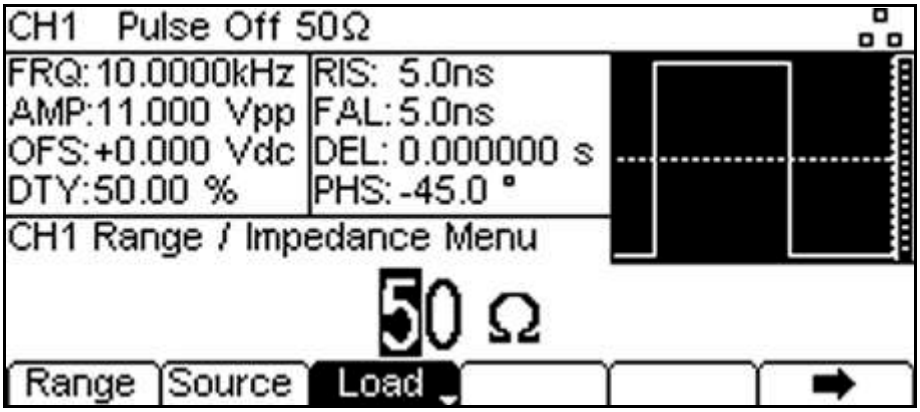


- Press the soft-key labelled **Polarity** to invert the output polarity.

Note that successive presses of the Polarity key alternates between normal and inverted.

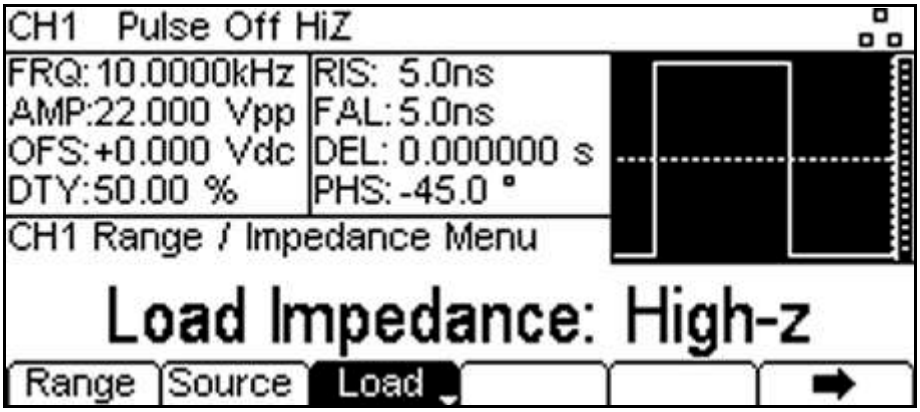
Change the Load Impedance

- Press the soft-key labelled ➡ to move to the next set of menu options.



Note that the default load impedance is 50 Ohms, but that this could be changed to any impedance between 50 and 10,000 Ohms. Levels are calculated based upon this impedance.

- Press the soft-key labelled **Load** to change the load impedance to High-z (high impedance).

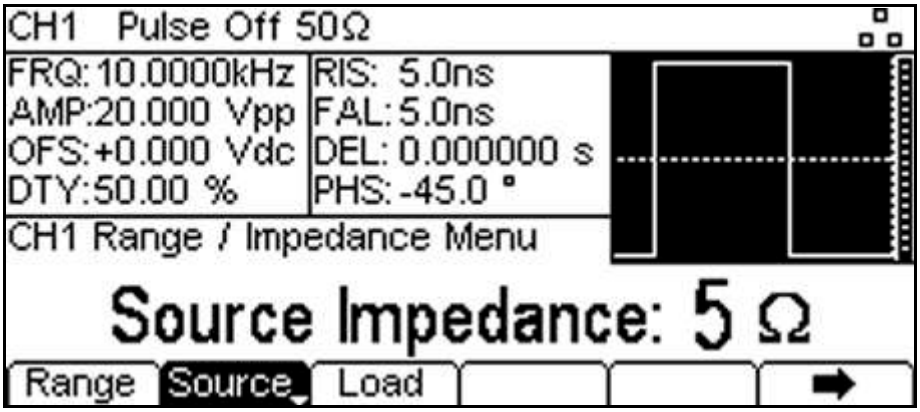


Successive presses of the Load key alternates between a numeric value and High-z.
Note that the amplitude readout increases to 22 volts pk-pk.

- Press the soft-key labelled **Load** to return the load impedance to 50 Ohms.

Change the Source Impedance

- Press the soft-key labelled **Source** to set the generator output impedance to 5 Ohms.



Successive presses of the Source key alternates between a 50 Ohms and 5 Ohms.
Note that the amplitude readout increases to 20 volts pk-pk.

7.2 Setting-up a simple Bit Pattern

Requirement

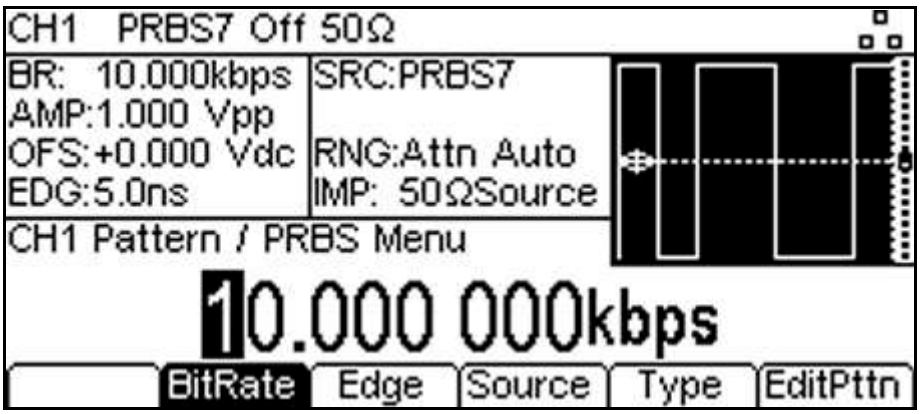
Create a user-defined continuously repeating bit pattern of 8 bits at 25MBps.

Starting Conditions

Before starting, reset the instrument to defaults as described in section 5.1 Initial Conditions .

Open the Pattern/PRBS Menu

- Press the hard key marked **Pattern/PRBS** to open the pattern waveform menu.



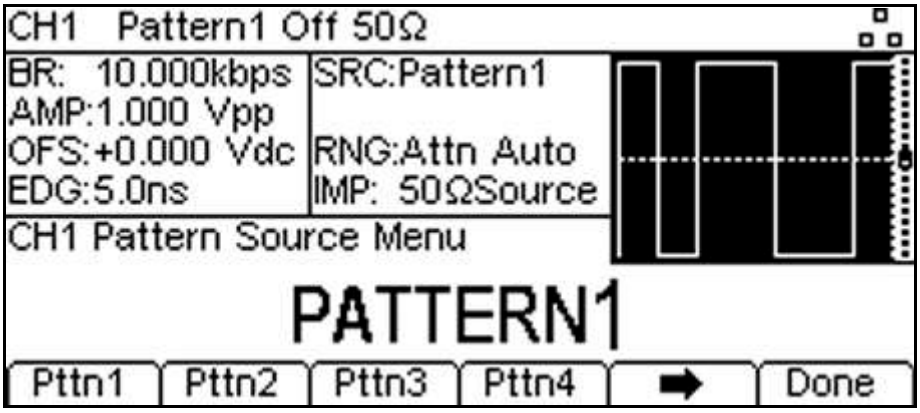
Note that the default pattern source is an internal PRBS (pseudo random bit stream).

Select a Pattern to Use

- Press the soft-key labelled **Source** to select one of four patterns available.



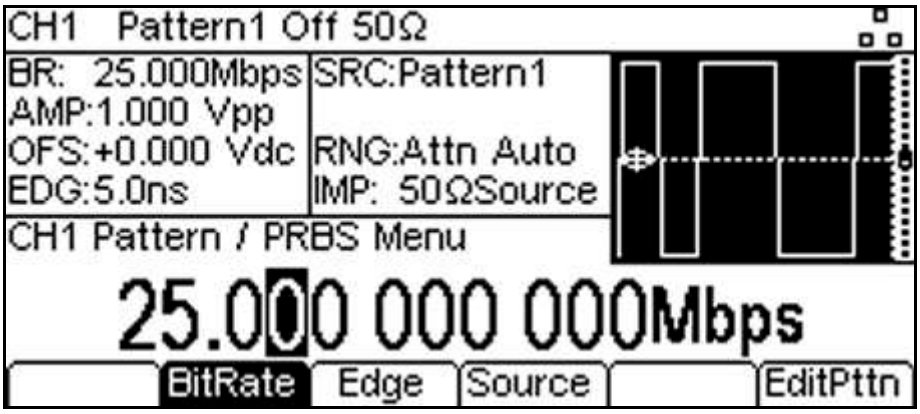
- Press the soft-key labelled **Pttn1** (or any unused pattern) to select the pattern.



- Press the soft-key labelled **Done** to return to the main menu.

Set the Bit Rate

- Press the soft-key labelled **BitRate** and enter 25Mbps as the bit rate.

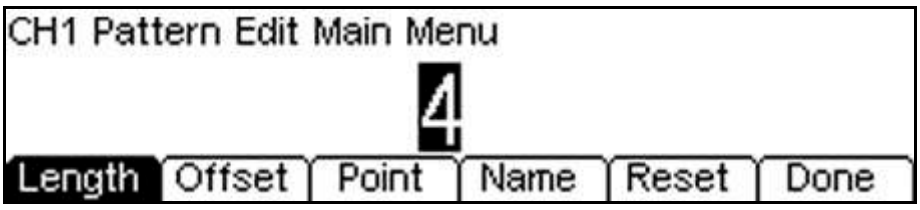


Edit the Pattern

- Press the soft-key labelled **EditPttn**.



- Press the soft-key labelled **Edit** to enter the pattern editing menu.



- Press the soft-key labelled **Length** and change the pattern length to 8.

As supplied from the factory, all patterns are 4 bits long. This can be increased to any number up to 65536 bits.

- Press the soft-key labelled **Point** to enter the point edit sub-menu.



- Edit the points using the **Point#** soft-key to select the point position number, and the **High** and **Low** soft-keys to set the bits as high or low.
- Press the ↵ key to return to the previous menu.
- Press the soft-key labelled **Done** to return to the main Pattern/PRBS waveform menu.

The newly defined 8 bit pattern is now active.

7.3 Setting-up an AM modulated Pulse Waveform

Requirement

Create a 10MHz pulse waveform amplitude modulated by a 100kHz sine wave signal.

Starting Conditions

Before starting, reset the instrument to defaults as described in section 5.1 Initial Conditions .

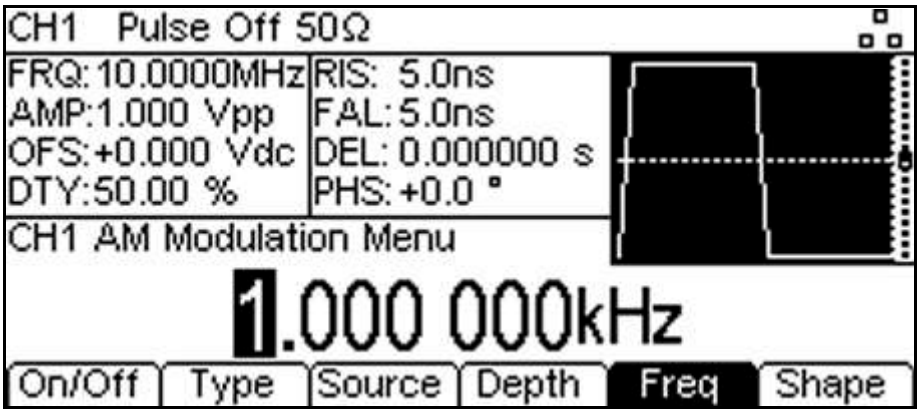
Set the Main Waveform Frequency

- Set a pulse repetition frequency of 10MHz.

Note that the carrier waveform is set to pulse by default.

Open the Modulation Menu

- Press the hard key marked **Mod** to open the modulation menu.



Note that the default modulation type is AM.

Set the Modulation Frequency

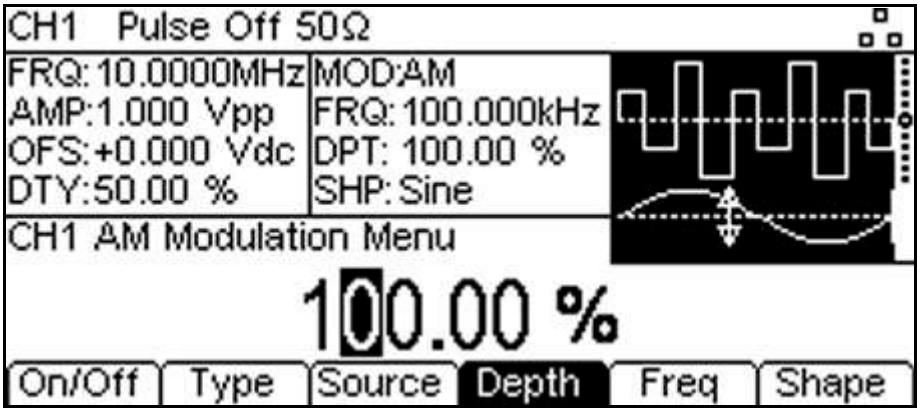
- Press the soft-key labelled **Freq** and set the modulation frequency to 100kHz.

Set the Modulation Depth

- Press the soft-key labelled **Depth** and set the modulation depth to 100%.

Turn Modulation On

- Press the soft-key labelled **On/Off** to turn the main output to on.



*Note that the hard key marked **Mod** illuminates and the display changes to show modulation parameters and a graphical representation of the modulation.*

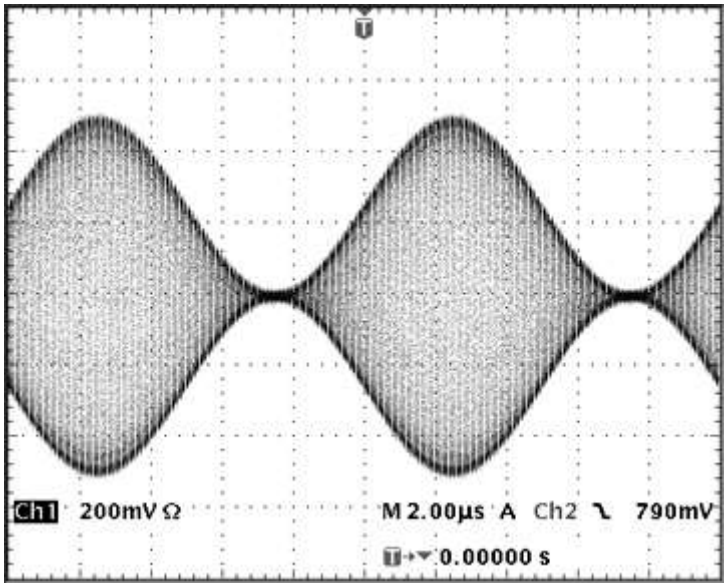
- Press the Source and Shape soft-keys in turn to confirm the settings as internal modulation source and sine wave shape.





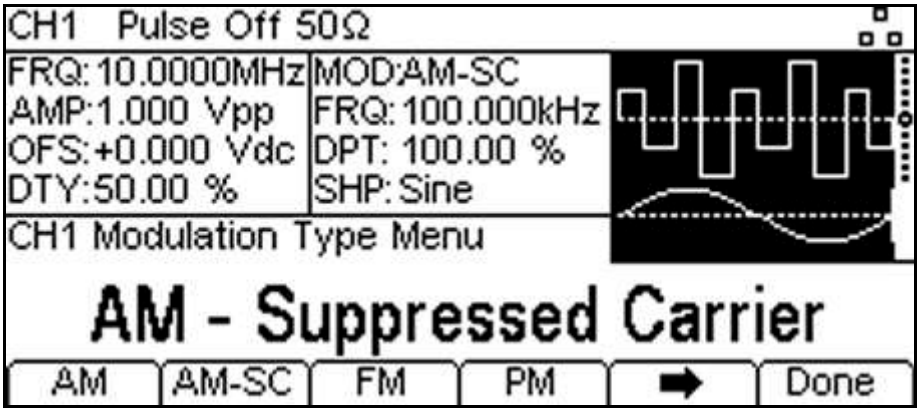
Note that these are the default settings.

The resultant output can be observed on an oscilloscope:

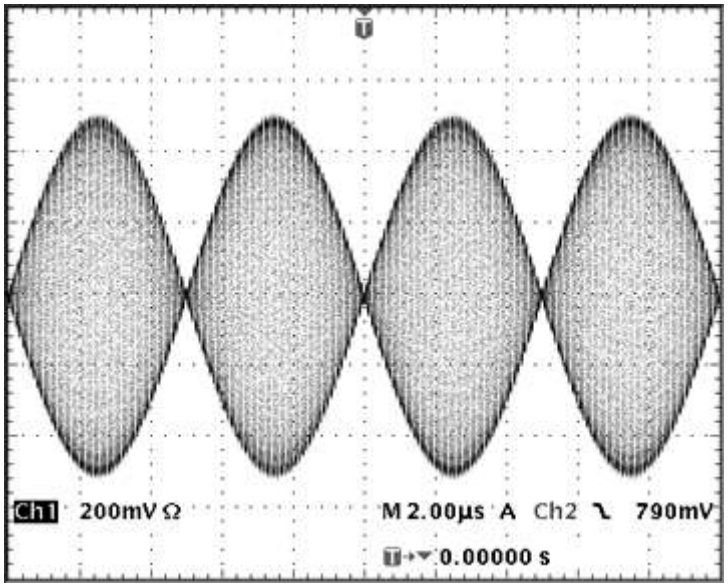


Change the Modulation to AM-SC

- Press the soft-key labelled **Type** and change the modulation type to AM-SC (suppressed carrier amplitude modulation.



The change can be seen on the oscilloscope:



Alternative modulation types and modulation wave shapes could be selected.
See the full Instruction Manual for detailed explanations.

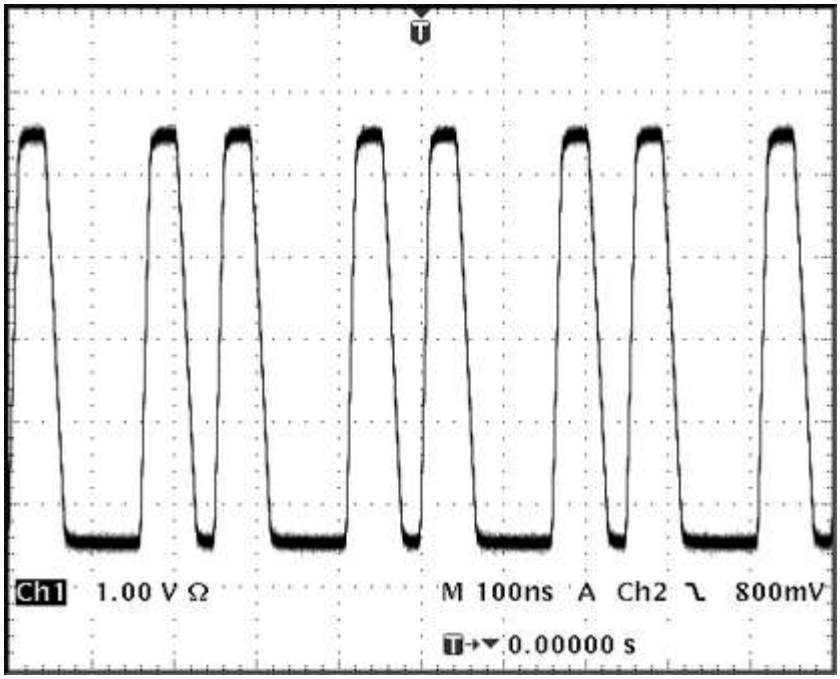
8 Exploring the Generator Capabilities

In the following examples only the parameter settings are described, together with the related key names. The resultant output waveforms are shown, along with the sync or trigger waveform where relevant. Output amplitude and offset settings are examples only and need not be followed.

8.1 Double Pulse Operation

Start with the instrument returned to Default Settings.

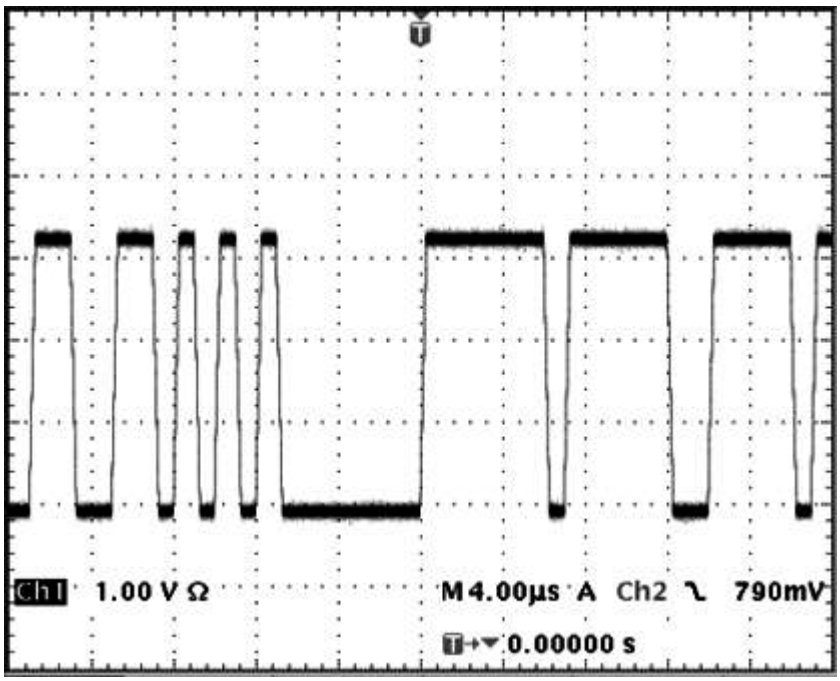
MENU	**HARD KEY NAME**	
Double Pulse	**Double Pulse**	
Parameter	**Soft-key Name**	**Setting**
Period	**(Freq) Period**	250ns
Width	**(Duty) Width**	50ns
Edge Mode	**Edge > Mode**	Independent
Rise Time	**Rise**	10ns
Fall Time	**Fall**	20ns
Delay	**Delay**	0ns
Double Delay	**DblDel**	160ns
MENU	**HARD KEY NAME**	
Output	**Output**	
Parameter	**Soft-key Name**	**Setting**
Amplitude	**Ampl**	5.0V
Offset	**Offset**	0.0V
Output State	**On/Off**	On



8.2 PRBS Pattern

Start with the instrument returned to Default Settings.

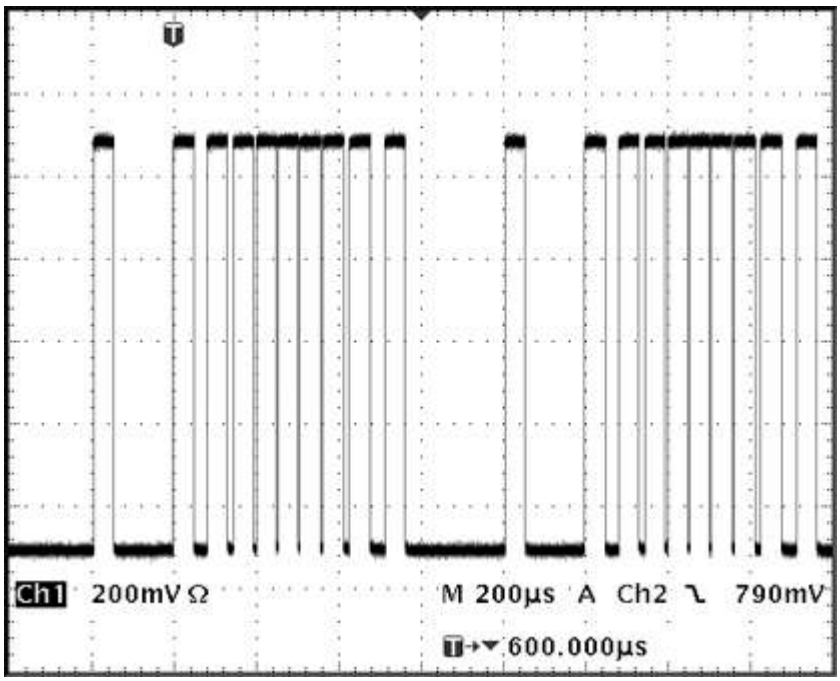
MENU	HARD KEY NAME	
Pattern/PRBS	**Pattern/PRBS**	
Parameter	**Soft-key Name**	**Setting**
Bit Rate	**BitRate**	1Mbps
Edge Time	**Edge**	250ns
Source	**Source**	PRBS
PRBS Type	**Type**	PN7
MENU	**HARD KEY NAME**	
Output	**Output**	
Parameter	**Soft-key Name**	**Setting**
Amplitude	**Ampl**	3.3V
Offset	**Offset**	1.65V
Output State	**On/Off**	On



8.3 Frequency Modulation of a Pulse Waveform

Start with the instrument returned to Default Settings.

MENU	**HARD KEY NAME**	
Modulation	**Mod**	
Parameter	**Soft-key Name**	**Setting**
Modulation State	**On/Off**	On
Modulation Type	**Type**	FM
Modulation Frequency	**Freq**	1kHz
Deviation	**Deviatn**	9kHz
MENU	**HARD KEY NAME**	
Output	**Output**	
Parameter	**Soft-key Name**	**Setting**
Amplitude	**Ampl**	1.0V
Offset	**Offset**	0.0V
Output State	**On/Off**	On

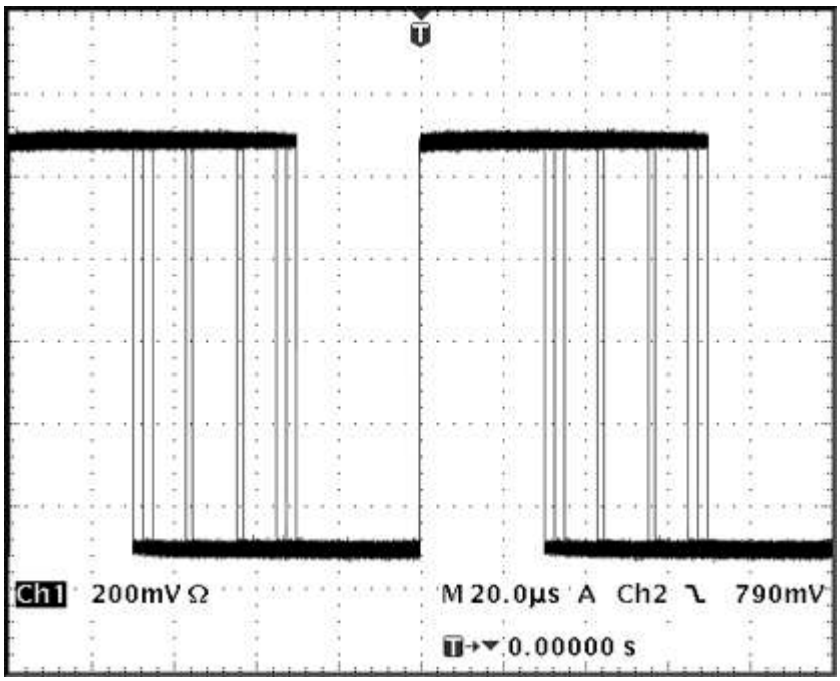


Note that the frequency/period is modulated but the pulse width remains constant.

8.4 Pulse Width Modulated Waveform (PWM)

Start with the instrument returned to Default Settings.

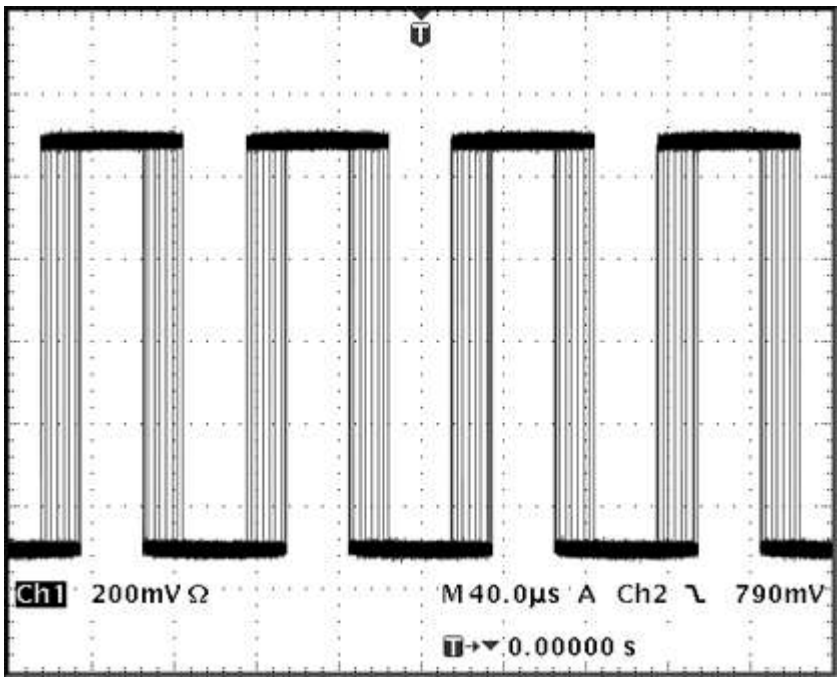
MENU	**HARD KEY NAME**	
Modulation	**Mod**	
Parameter	**Soft-key Name**	**Setting**
Modulation State	**On/Off**	On
Modulation Type	**Type**	PWM
Modulation Frequency	**Freq**	1kHz
Deviation	**Deviatn**	20us
MENU	**HARD KEY NAME**	
Output	**Output**	
Parameter	**Soft-key Name**	**Setting**
Amplitude	**Ampl**	1.0V
Offset	**Offset**	0.0V
Output State	**On/Off**	On



8.5 Pulse Delay Modulated Waveform (PDM)

Start with the instrument returned to Default Settings.

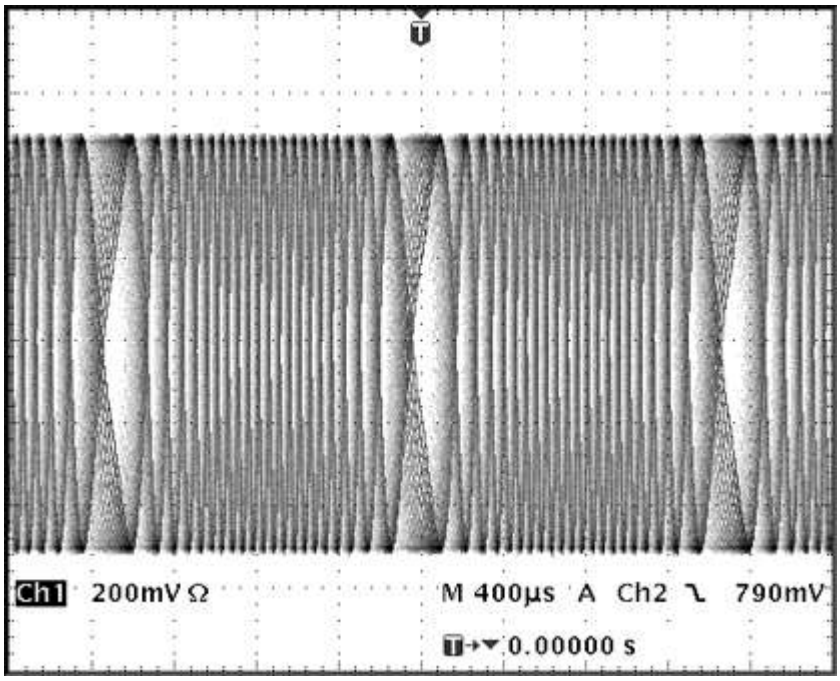
MENU	HARD KEY NAME	
Pulse	**Pulse**	
Parameter	**Soft-key Name**	**Setting**
Delay	**Delay**	25us
MENU	**HARD KEY NAME**	
Modulation	**Mod**	
Parameter	**Soft-key Name**	**Setting**
Modulation State	**On/Off**	On
Modulation Type	**Type**	PDM
Modulation Frequency	**Freq**	1kHz
Deviation	**Deviatn**	10us
MENU	**HARD KEY NAME**	
Output	**Output**	
Parameter	**Soft-key Name**	**Setting**
Amplitude	**Ampl**	1.0V
Offset	**Offset**	0.0V
Output State	**On/Off**	On



8.6 Frequency Sweep of a Sine Wave

Start with the instrument returned to Default Settings.

MENU	**HARD KEY NAME**	
Arb/Function	**Arb/Function**	
Parameter	**Soft-key Name**	**Setting**
Waveform	**Waves**	Sine
MENU	**HARD KEY NAME**	
Sweep	**Sweep**	
Parameter	**Soft-key Name**	**Setting**
Sweep State	**On/Off**	On
MENU	**HARD KEY NAME**	
Output	**Output**	
Parameter	**Soft-key Name**	**Setting**
Amplitude	**Ampl**	1.0V
Offset	**Offset**	0.0V
Output State	**On/Off**	On



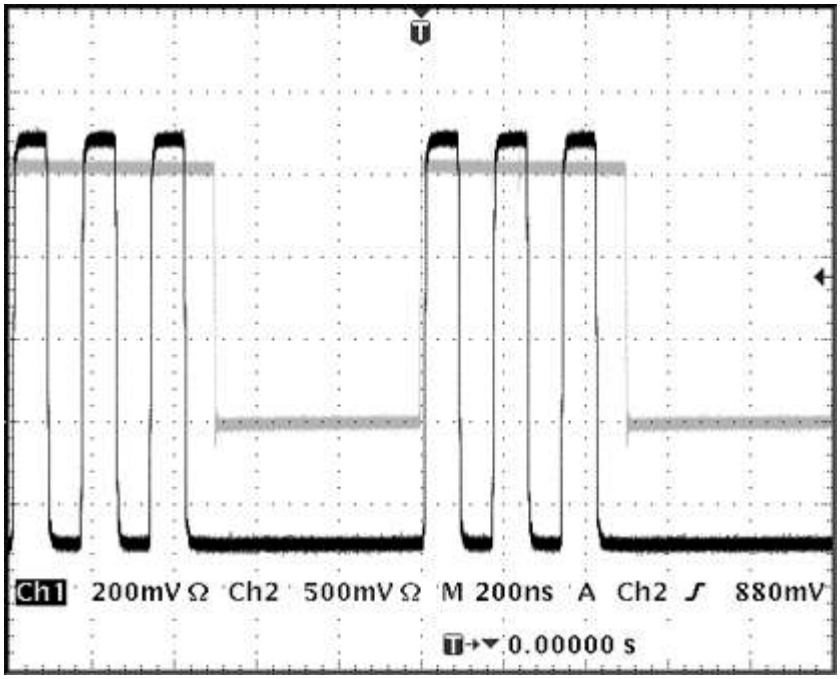
8.7 Generating a Triggered Burst

Start with the instrument returned to Default Settings.

MENU	**HARD KEY NAME**	
Pulse	**Pulse**	
Parameter	**Soft-key Name**	**Setting**
Frequency	**Freq**	6MHz
MENU	**HARD KEY NAME**	
Burst	**Burst**	
Parameter	**Soft-key Name**	**Setting**
Burst State	**On/Off**	On
Burst Count	**Count**	3
Trigger Source	**SetTrg > Source > Ext**	External Trigger
MENU	**HARD KEY NAME**	
Output	**Output**	
Parameter	**Soft-key Name**	**Setting**
Amplitude	**Ampl**	1.0V
Offset	**Offset**	0.0V
Output State	**On/Off**	On

Connect an external 1MHz square wave trigger signal of +3V /-0V level to the **TRIG IN** input.

Note that, on a two channel generator, the second channel could be selected in place of the external trigger signal.



Note that the second trace is the output from the Sync Out socket which follows the trigger input signal. Both the main and sync outputs are delayed by 448ns relative to the trigger input.

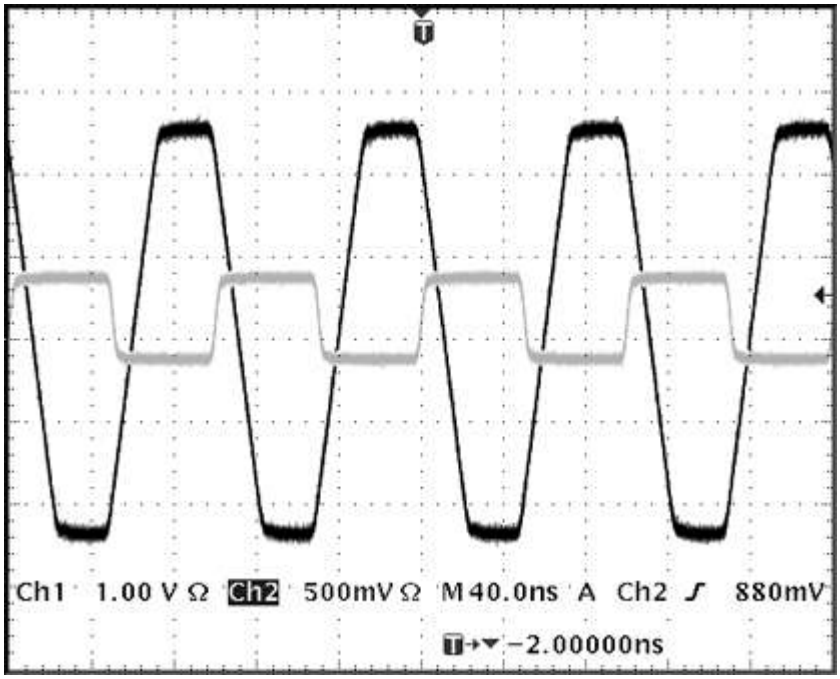
8.8 Reconstructing an External Pulse Waveform

Note that this mode of operation is referred to as External Width. It is a variant of the Pattern waveform but can be accessed from the Trigger menu.

Start with the instrument returned to Default Settings.

MENU	**HARD KEY NAME**	
Trigger	**Trigger**	
Parameter	**Soft-key Name**	**Setting**
External Width	**ExtWdt > Yes**	Yes
MENU	**HARD KEY NAME**	
Pattern/PRBS	**(Pattern/PRBS)**	
Parameter	**Soft-key Name**	**Setting**
Edge Speed	**Edge**	20ns
MENU	**HARD KEY NAME**	
Output	**Output**	
Parameter	**Soft-key Name**	**Setting**
Amplitude	**Ampl**	5.0V
Offset	**Offset**	0.0V
Output State	**On/Off**	On

Connect an external 10MHz square wave trigger signal of +2V /-0V level to the **TRIG IN** input.



The waveform is recreated with a different amplitude and offset and a defined edge speed.

Note that a fixed delay of 448ns between output and trigger is introduced.

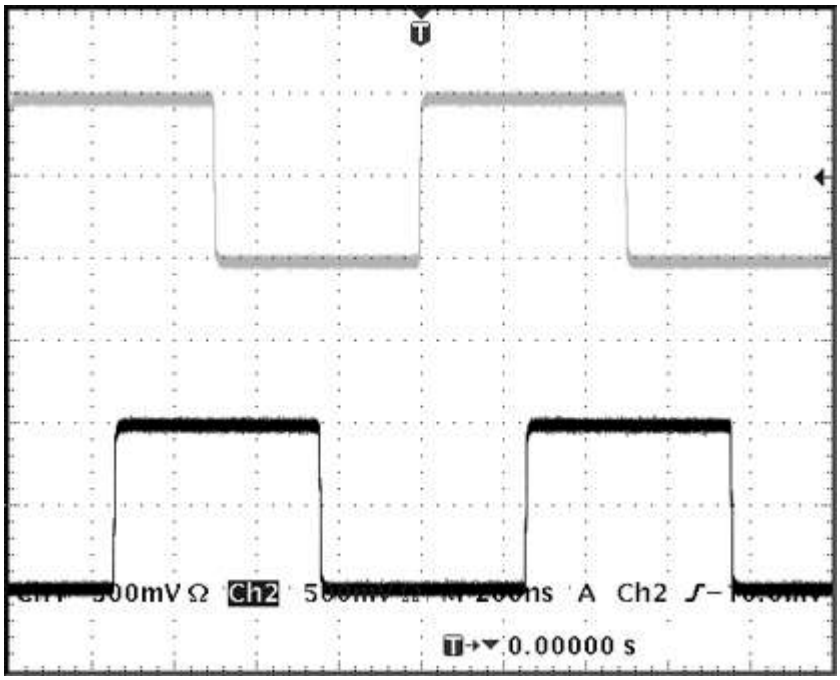
Note that AM or SUM modulations could be performed on the reconstructed waveform, if required.

8.9 Coupling the Frequency of Both Channels (TGP31x2 only)

Note that the following applies only to two channel generators.

Start with the instrument returned to Default Settings.

MENU	**HARD KEY NAME**	
Channel Linking	**Link**	
Parameter	**Soft-key Name**	**Setting**
Frequencies	**Freq > On/Off**	Coupled
Coupling Ratio	**Ratio**	(1.000)
MENU	**HARD KEY NAME**	
Output 1	**Output1**	
Parameter	**Soft-key Name**	**Setting**
Output State	**On/Off**	On
MENU	**HARD KEY NAME**	
Output 2	**Output2**	
Parameter	**Soft-key Name**	**Setting**
Phase Shift	**Phase**	90 degrees
Output State	**On/Off**	On
MENU	**HARD KEY NAME**	
Pulse	**Pulse**	
Parameter	**Soft-key Name**	**Setting**
Frequency	**Freq**	1MHz



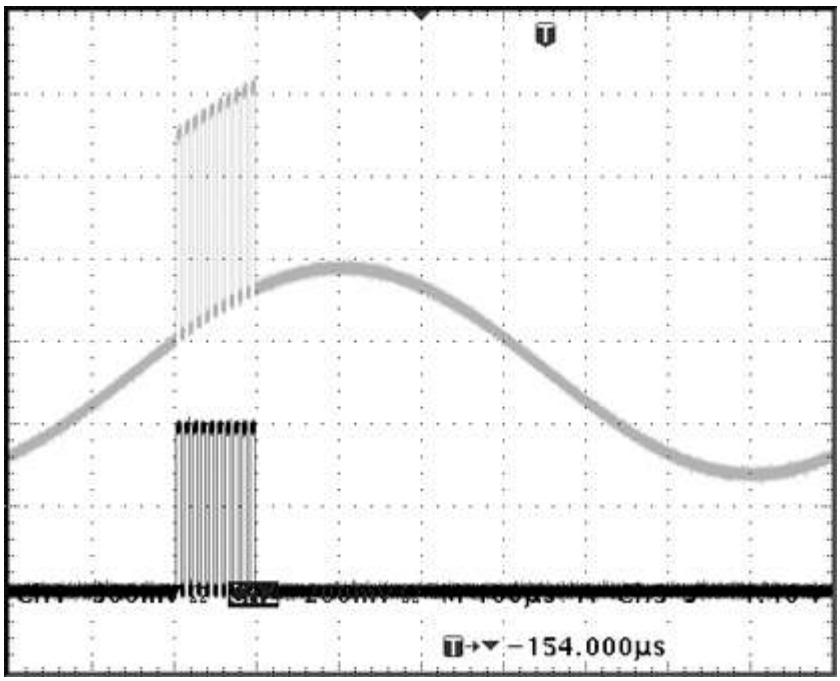
Note that, when channel 2 is set to 1MHz, channel 2 is also set to 1MHz.
The 90 degree phase shift between the channels can be seen.

8.10 Summing Both Channels Together (TGP31x2 only)

Note that the following applies only to two channel generators.

Start with the instrument returned to Default Settings.

MENU	**HARD KEY NAME**	
Output 1	**Output1**	
Parameter	**Soft-key Name**	**Setting**
Output State	**On/Off**	On
MENU	**HARD KEY NAME**	
Pulse	**Pulse**	
Parameter	**Soft-key Name**	**Setting**
Frequency	**Freq**	100kHz
MENU	**HARD KEY NAME**	
Burst	**Burst**	
Parameter	**Soft-key Name**	**Setting**
Burst State	**On/Off**	On
Burst Count	**Count**	10
Trigger Source	**SetTrg > Source > Int**	Internal Trigger
Trigger Period	**Period**	1ms
MENU	**HARD KEY NAME**	
Output 2	**Output2**	
Parameter	**Soft-key Name**	**Setting**
Output State	**On/Off**	On
MENU	**HARD KEY NAME**	
Arb/Function	**Arb/Function**	
Parameter	**Soft-key Name**	**Setting**
Waveform Type	**Waves**	Sine
Frequency	**Freq**	1kHz
MENU	**HARD KEY NAME**	
Modulation	**Mod**	
Parameter	**Soft-key Name**	**Setting**
Modulation Type	**Type > SUM**	SUM
Summing Level	**Level**	100%
Modulation Source	**Source > Chn2**	Channel 2
Modulation State	**On/Off**	On



Note that the channel 2 signal is summed onto the channel 1 signal (upper trace) while the channel 1 signal (lower trace) remain unchanged.

9 Maintenance

The Manufacturers or their agents overseas will provide a repair service for any unit developing a fault. Where owners wish to undertake their own maintenance work, this should only be done by skilled personnel in conjunction with the service guide which may be obtained directly from the Manufacturers or their agents overseas.

9.1.1 Cleaning

If the instrument requires cleaning use a cloth that is only lightly dampened with water or a mild detergent.

WARNING! TO AVOID ELECTRIC SHOCK, OR DAMAGE TO THE INSTRUMENT, NEVER ALLOW WATER TO GET INSIDE THE CASE. TO AVOID DAMAGE TO THE CASE NEVER CLEAN WITH SOLVENTS.



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