User Manual

Models 2571A/2572A

250 MS/s Single / Dual
Arbitrary Waveform Generators

Publication No. 070307

Tabor Electronics Ltd.

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PUBLICATION DATE: July 15, 2015

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Before undertaking any troubleshooting, maintenance or exploratory procedure, read carefully the **WARNINGS** and **CAUTION** notices.

This equipment contains voltage hazardous to human life and safety, and is capable of inflicting personal injury.

If this instrument is to be powered from the AC line (mains) through an autotransformer, ensure the common connector is connected to the neutral (earth pole) of the power supply.

Before operating the unit, ensure the conductor (green wire) is connected to the ground (earth) conductor of the power outlet. Do not use a two-conductor extension cord or a three-prong/two-prong adapter. This will defeat the protective feature of the third conductor in the power cord.

Maintenance and calibration procedures sometimes call for operation of the unit with power applied and protective covers removed. Read the procedures and heed warnings to avoid “live” circuits points.

Before operation this instrument:

1. Ensure the instrument is configured to operate on the voltage at the power source. See Installation Section.

2. Ensure the proper fuse is in place for the power source to operate.

3. Ensure all other devices connected to or in proximity to this instrument are properly grounded or connected to the protective third-wire earth ground.

If the instrument:

- fails to operate satisfactorily
- shows visible damage
- has been stored under unfavorable conditions
- has sustained stress

Do not operate until performance is checked by qualified personnel.

DECLARATION OF CONFORMITY

We: Tabor Electronics Ltd.
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ISRAEL 36888

declare, that the 250MS/s Arbitrary Waveform Generators

Models 2571A and 2572A

complies with the requirements of the Electro Magnetic Compatibility 89/336/EEC as amended by 92/31/EEC, 93/68/EEC, 92/263/EEC and 93/97/EEC and the Low Voltage Directive 73/23/EEC amended by 93/68/EEC, according to testing performed at ORDOS/E.M.I TEST LABs (#5TBR964CX, Oct. 2005). Compliance was demonstrated to the following specifications as listed in the official Journal of the European Communities:

Safety:
IEC/EN 61010-1 2nd Edition: 2001+ C1, C2

EMC:
EN55022:2001 Class A Radiated and Conducted Emission
IEC61000-3-2:2001(Am1) Harmonics
IEC61000-3-3:2002(Am1) Flickers
IEC61000-4-2:2001(Am1+Am2) ESD : Contact Discharge ±4Kv
Air Discharge ±8Kv
IEC61000-4-3:2002(Am1) Radiated immunity - 3V/m (80MHz-1000MHz)
IEC61000-4-4:2001 (Am2) Electrical Fast Transient and Burst ±1.0kV, 5KHz
IEC61000-4-5:2001 (Am1) Surges DM ±1.0kV CM ±2.0Kv
IEC61000-4-6:2003 Current injection immunity - 3Vrms
IEC61000-4-8:2001 Magnetic field 1Amper
IEC61000-4-11:2001 Voltage dips and variation

Models 2571A and 2572A are built on the same platform and share specifications and features except the 2571A is a single channel version and while the 2572A has two channels. The tests were performed on a typical configuration.

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What's in This Chapter

This chapter contains a general description of the Model 2572A Waveform Generator and an overall functional description of the instrument. It also describes the front and rear panel connectors and indicators.

NOTE

This manual is common to both Model 2571A and Model 2572A. If you purchased the Model 2571A, please ignore all references to the second channel in this manual.

Introduction

Model 2572A is a dual-channel, Universal Waveform Generator. It is a high performance waveform generator that combines two separate and powerful channels in one small package. Supplied free with the instrument is ArbConnection software utility, which is used for controlling the 2572A and for generating, editing and downloading waveforms from a remote computer. The following highlights the 2572A and ArbConnection features.

2572A Feature Highlights

- Dual output configuration with Independent waveform control
- Tight phase offset control between channels (1 point resolution)
- 16-bit vertical resolution
- Generates signals up to 30 Vp-p (into high impedance load)
- 16-bit LVDS level digital pattern output
- 2M memory depth for each channel
- 250 MS/s sample clock frequency
- 100 MHz output bandwidth
- 1 ppm clock stability
- Extremely low phase noise carrier
- FM, AM, ASK, FSK, PSK frequency/amplitude hops and more
- Built-in standard waveforms; half-cycle waveforms
- Separate sequence generators for each channel
- Multiple instrument synchronization, jitter-free and phase control
- Remote calibration without removing case covers
- Auxiliary pulse generator and counter/timer functions
- GPIB, USB and Ethernet interfaces

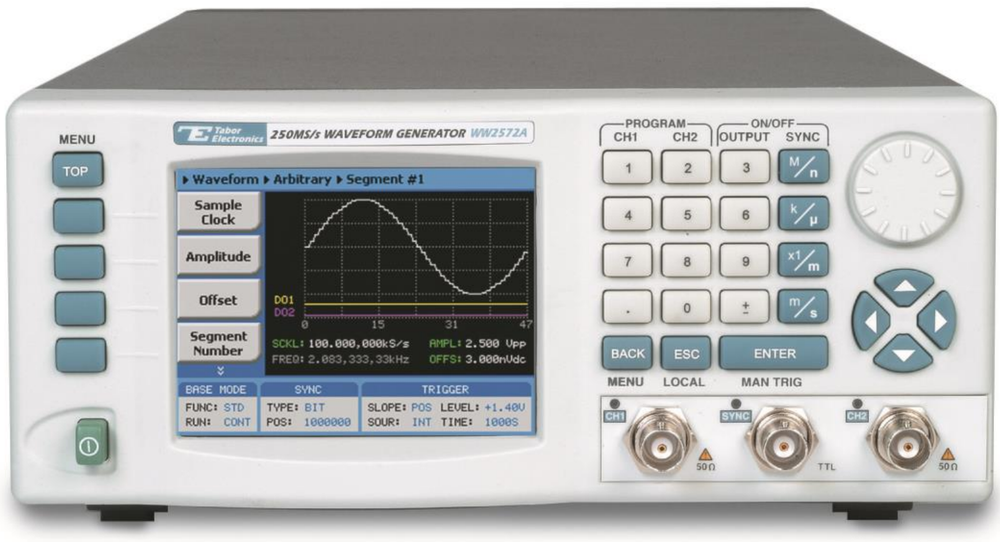

Figure 1-1, Model 2572A

ArbConnection Feature Highlights

- Four powerful tools in one software package: Complete instrument control, Waveform, pulse and FM composers
- Detailed virtual front panels control all 2572A functions and modes
- Wave composer generates, edits and downloads complex waveforms
- FM wave composer generates and downloads complex modulating signals
- Easy, on-screen generation of complex pulses using the pulse composer
- Equation editor generates waveforms from equations
- SCPI command and response editor simulates ATE operation
- Translates waveform coordinates from ASCII and other formats
- Simplifies generation of complex sequences

Various screens of the ArbConnection program are shown in Figures 1-2 through 1-5.

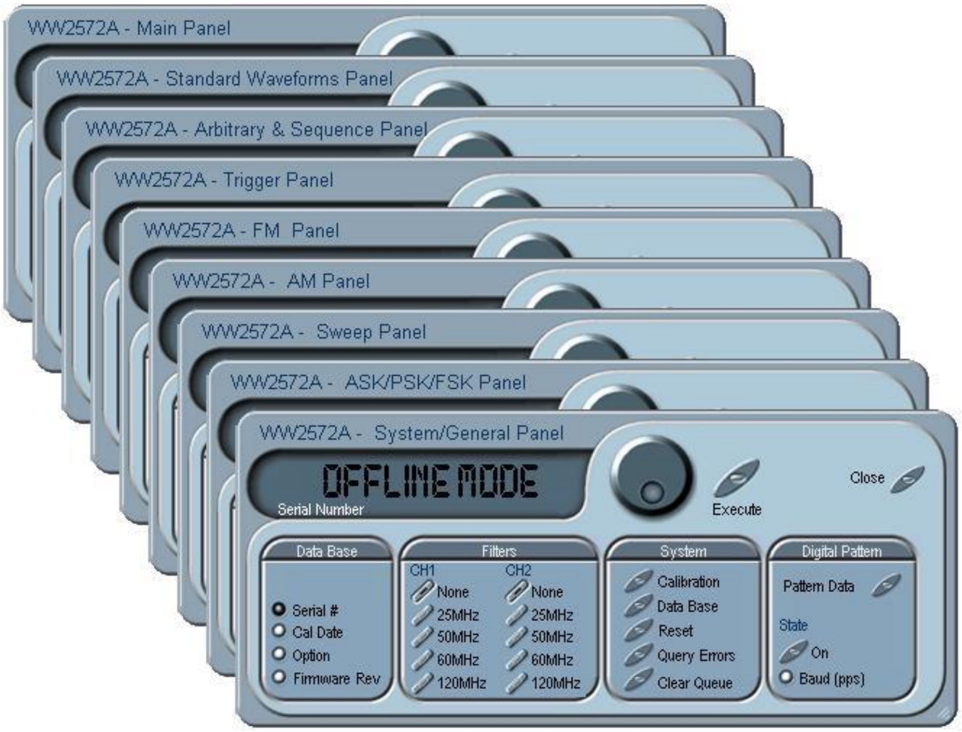

Figure 1-2, ArbConnection – The Control Panels

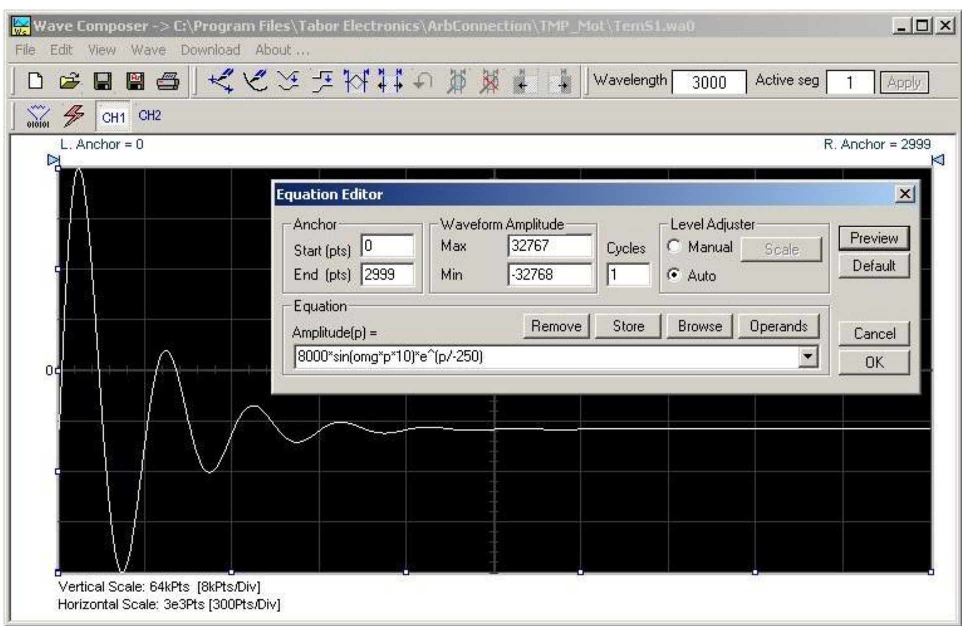

Figure 1-3, ArbConnection – The Wave Composer

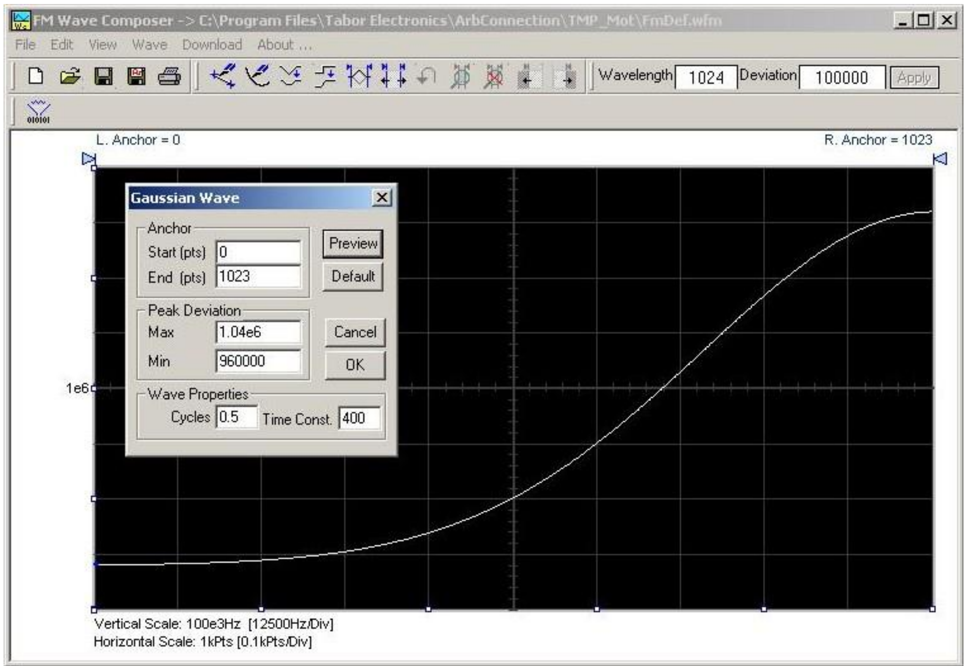

Figure 1-4, ArbConnection – The FM Wave Composer

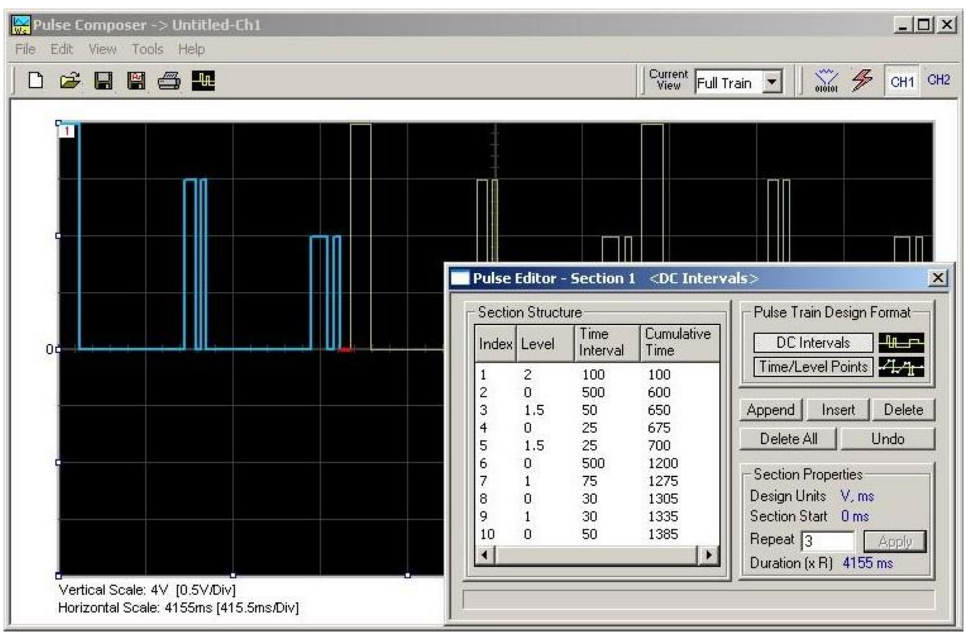

Figure 1-5, ArbConnection – The Pulse Composer

Introduction

A detailed functional description is given following the general description of the features, functions, and options available with the Model 2572A.

The Model 2572A is a bench-top, 2U high, half rack wide, dual-channel synthesized Waveform Generator, a high performance instrument that provides multiple and powerful functions in one small package. The 2572A generates an array of standard waveforms from a built-in waveform library as well as arbitrary, sequenced and modulated waveforms. It can also generate 16-bit digital patterns in parallel to its channel 1 output. The generator outputs 16-bit waveforms from two channels at up to 250MS/s with different waveform properties. The unique design provides increased dynamic range and lower "noise floor" making it ideal for the generation of multi-tone signals and I&Q modulation.

Direct Digital Synthesis (DDS) technology, utilized in the design of the 2572A, allows flexibility in usage of features like FM, ASK, FSK, PSK, sweep and amplitude and frequency hopping. The greatest feature of the DDS is the 3D modulation, which allows simultaneous change over time of frequency, amplitude and phase. The DDS circuit has an independent memory that can be used as an arbitrary modulation source. For example, the FM feature can be stimulated by an internal source, or arbitrary FM waveform allowing the production of customized chirp signals. Another example is the 3D feature that can modulate and control each channel separately in terms of amplitude, frequency and phase. The included ArbConnection software can be used to breadboard custom frequency modulation profiles graphically.

Sample rates up to 250MS/s are available with memory size up to 2Meg. Channels 1 and 2 are both synchronized to the same sampling clock however, each channel can output a different waveform shape and length.

Based entirely on digital design, the 2572A has no analog functions resident in its hardware circuits and therefore, data has to be downloaded to the instrument for it to start generating waveforms. The instrument can compute and generate a number of standard functions such as sine, square, triangle and others. Complex waveforms can be computed in external utilities, converted to an appropriate format and downloaded to the 2572A as waveform coordinates. Dedicated waveform memory stores waveforms in memory segments and allows playback of a selected waveform, when required. The waveforms are backed up by batteries or can be stored in a flash memory for use at a later time.

Frequency accuracy of the output waveform is determined by the clock reference. Using the internal TCXO the reference oscillator provides 1ppm accuracy and stability over time and temperature. If higher accuracy and/or stability are required, one may connect an external reference oscillator to the rear panel input and use this input as the reference for the 2572A. Frequency may be is programmed from the front panel with 11 digits of resolution and with up to 14 digits from an external controller, so using an external reference is recommended, if you intend to utilize the full resolution provided by the instrument.

Output amplitude for each of the channels may be programmed separately from 32 mV to 32 Vp-p into an open circuit, and 16 mV to 32 V into 50 Ω. Amplitude and offsets are completely independent to each other and can be programmed with 4 digits of resolution as long as the +8 V and the -8 V rail limitations (double into open circuit) are not exceeded. The amplitude display is calibrated to the load source, which is normally 50 Ω. In cases where the load difference is different, you can customize the instrument to display the correct amplitude reading that matches your load impedance.

Besides its normal continuous mode, the Model 2572A responds to a variety of trigger sources. The output waveform may be gated, triggered, or may generate a counted burst of waveforms. A built-in re-trigger generator with a programmable period can be used as a replacement of an external trigger source. Triggers can be delayed to a specific interval by a built-in trigger delay generator that has a range of 200ns to over 20 seconds.

The arbitrary waveform memory is comprised of a bank of 16-bit words. Each word represents a point on the horizontal waveform scale. Each word has a horizontal address that can range from 0 to 2Meg and a vertical address that can range from -32767 to +32768 (16 bits). Using a high speed clocking circuit, the digital contents of the arbitrary waveform memory is extracted and routed to the Digital to Analog Converter (DAC). The DAC converts the digital data to an analog signal, and the output amplifier completes the task by amplifying or attenuating the signal at the output connector.

There is no need to use the complete memory bank every time an arbitrary waveform is generated. Waveform memory can be divided into up to many smaller segments and different waveforms can be loaded into each segment. The various segments may then be loaded into a sequence table to generate long and complex waveforms. The sequence table can link and loop up to multiple segments in user defined order. Each channel has its own sequence generator.

The Tabor Model 2572A can be operated from either GPIB, USB, or LAN interfaces. The product is supplied with IVI.COM driver and ArbConnection software. ArbConnection simulates an array of mechanical front panels with the necessary push buttons, displays and dials to operate the Model 2572A from a remote interface as if it is a bench-top instrument. ArbConnection also allows on-screen creation and editing of complex waveforms and patterns to drive the 2572A various outputs.

It is highly recommended that the user become familiar with the 2572A front panel, its basic features, functions and programming concepts as described in this and the following chapters.

Options

Several options are available for the 2572A. These are listed below. Note that all options are factory installed and therefore, they must be ordered with the product.

1. Option 1, 2 Meg Waveform Memory – increases the memory capacity from 1 Meg to 2 Meg. The 2 Meg waveform memory option is not field installable and therefore, it must be ordered with the product. Compare the option number below with the number printed on your instrument to check if the 2 Meg waveform memory option is installed in your equipment.
2. Option 2, Modulation Package – adds the following modulation capability to the 2571A: Arbitrary FM., frequency and amplitude hops, ASK and 3D. In addition, for the 2572A it adds (n)PSK, (n)QAM and user QAM.

Identifying Installed Options

Options must be specified at the time of your purchase. If you place an order for an option, you may interrogate the instrument if the option is indeed installed on your unit. The Installed Options field in the System display shows which of the options is installed in your instrument. Information how to operate the menus and how to access the System menu is given in Chapter 3.

Manual Changes

Technical corrections to this manual (if any) are listed in the back of this manual on an enclosed MANUAL CHANGES sheet.

Safety Considerations

The Model 2572A has been manufactured according to international safety standards. The instrument meets EN61010-1 and UL1244 standards for safety of commercial electronic measuring and test equipment for instruments with an exposed metal chassis that is directly connected to earth via the chassis power supply cable.

WARNING

Do not remove instrument covers when operating the instrument or when the power cord is connected to the mains.

Any adjustment, maintenance and repair of an opened, powered-on instrument should be avoided as much as possible, but when necessary, should be carried out only by a skilled person who is aware of the hazard involved.

Supplied Accessories

The instrument is supplied with a CD that includes the User Manual, ArbConnection and IVI engine and driver.

The instrument is supplied with a power cord and a CD which contains ArbConnection, manual, IVI driver and supporting files. USB, LAN and synchronization cables and a service manual are available upon request.

Specifications

Instrument specifications are listed in Appendix A. These specifications are the performance standards or limits against which the instrument is tested. Specifications apply under the following conditions: output terminated into 50Ω after 30 minutes of warm up time, and within a temperature range of 20°C to 30°C. Specifications outside this range are degraded by 0.1% per °C.

Functional Description

A detailed functional description is given in the following paragraphs. The description is divided into logical groups: Front panel input and output connectors, rear panel input and output connectors, operating modes, output type, output state, synchronization, and front panel indicators.

Front Panel Connectors and Indicators

The Model 2572A has 3 BNC connectors on its front panel: two main outputs and one SYNC output. Each connector on the front panel has an LED associated with it, indicating when the output is active (LED on), or when inactive (LED off). The function of each of the front panel connectors is described in the following paragraphs.

Main Output - Channels 1 and 2

The main output connectors generate fixed (standard) waveforms to 100MHz, user (arbitrary), sequenced and modulated waveforms. The arbitrary and sequenced waveforms are sampled with sampling clock rate to 250 MS/s. CW from the modulated function is programmable to 100 MHz. Output source impedance is 50Ω, hence the cable connected to this output should be terminated with 50Ω load resistance. If the output is connected to a different load resistance, determine the actual amplitude from the following equation:

$$V_{out} = 2V_{prog}\left(\frac{R_L}{50+R_L} \right)$$

The output amplitude is doubled when the output impedance is above roughly 10 kΩ.

SYNC Output

The SYNC output generates a single or multiple TTL pulses for synchronizing other instruments (i.e., an oscilloscope) to the output waveform. The SYNC signal always appears at a fixed point relative to the waveform. The location of the pulse sync along the waveform is programmable. The SYNC output is used as marker output when the 2572A is programmed to one of the modulation functions. The source of the sync can be programmed to source from channel 1 or channel 2.

Front Panel Controls

Front panel controls and keys are grouped in logical order to provide efficient and quick access to instrument functions and parameters. Refer to Figure 1-6 throughout the following description to learn the purpose and effect of each front panel control.

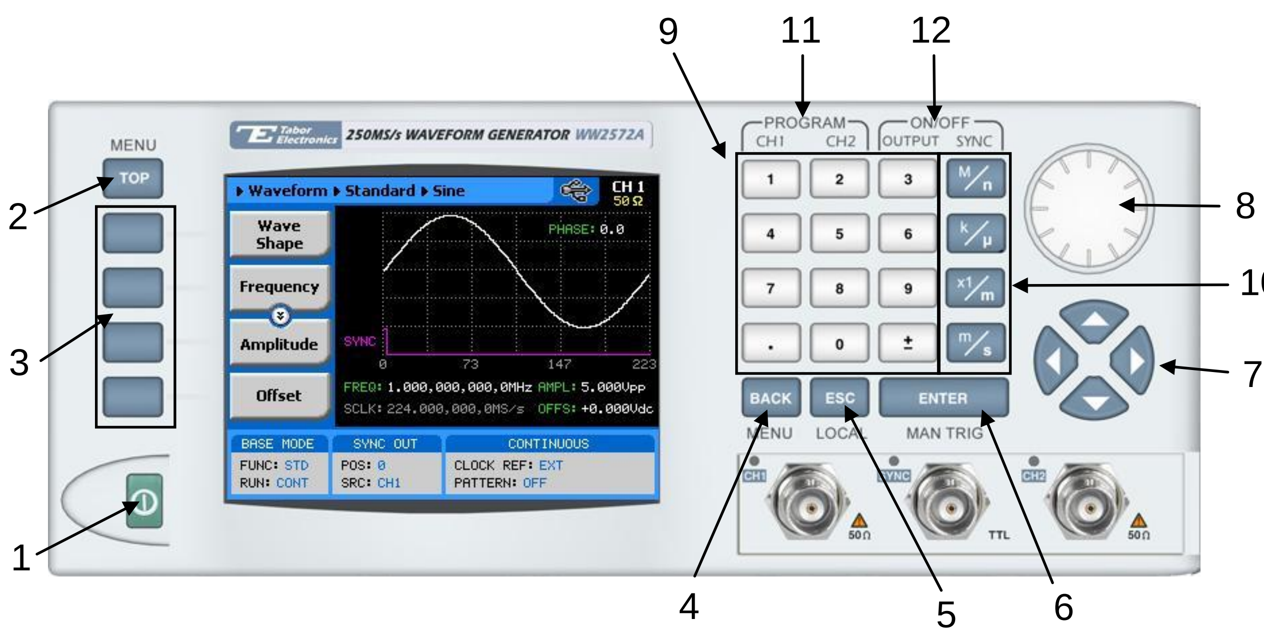

Figure 1-6, 2572A Front Panel Controls

> **Note**
>
> **The index in the following paragraphs point to the numbered arrows in Figure 1-6.**

1. *Power Switch* – Toggles 2572A power ON and OFF
2. *Menu Top* – Selects the root menu. This button is disabled during parameter editing
3. *Menu Soft Keys* – Soft keys have two functions:
    1) Selects output function shape or operating mode,

2) Selects parameter to be audited

These buttons are disabled during parameter editing

4. *Menu Back* – Backs up one menu position. This button is disabled during parameter editing
5. *Cancel (Local)* – Has two functions:
   1) When in edit mode, cancels edit operation and restore last value
   2) When operating the 2572A from a remote interface, none of the front panel buttons are active. The Local button moves control back from remote to front panel buttons
6. *Enter (Man Trig)* – Has two functions:
   1) When multiple parameters are displayed on the screen, the cursor and the dial scroll through the parameters. Pressing Enter selects the parameter for edit. After the parameter has been modified, the Enter button locks in the new variable and releases the buttons for other operations
   2) When the 2572A is placed in “Triggered” run mode, the Man Trig button can be used to manually trigger the 2572A
7. *Cursor UP, Down, Left and Right* – Has two functions:
   1) When multiple parameters are displayed on the screen, the cursor and the dial scroll through the parameters
   2) When parameter is selected for editing, cursor buttons right or left move the cursor accordingly. Cursor buttons up or down modify parameter value accordingly
8. *Dial* – Has similar functionality as the cursor UP and Down keys
9. *Numeral keypad* – These keys are used for modifying an edited parameter value
10. *Parameter Suffixes (M, k, x1 and m)* – These keys are used to place suffix at the end of the parameter. They are also used for terminating an edit operation
11. *Program* CH1, CH2 – Use Program CH1 to modify the screen to display channel 1 parameters. Use Program CH2 to modify the screen to display channel 2 parameters. These keys can be used only when the 2572A is not in edit mode
12. *ON/OFF Output, Sync* – These keys can be used only when the 2572A is not in edit mode. The Output ON/OFF toggles output waveform, at the output connector, ON and OFF. The Sync ON/OFF toggles the sync waveform, at the SYNC output connector, ON and OFF

Rear Panel Input & Output Connectors

The 2572A has a number of connectors on its rear panel. These connectors are described below. Figure 1-7 shows rear panel plugs, indicators, connectors and other parts.

TRIG IN

In general, the trigger input is used for stimulating output waveforms at the main output connector(s). The trigger input is inactive when the generator is in continuous operating mode. When placed in trigger, gated or burst mode, the trigger input is made active and waits for the right condition to trigger the instrument. The trigger input is edge sensitive, i.e., it senses transitions from high to low or from low to high.

Trigger level and edge sensitivity are programmable for the trigger input. For example, if your trigger signal rides on a dc level, you can offset the trigger level to the same level as your trigger signal, thus assuring correct threshold for the trigger signal. The trigger level is adjustable from -5V to +5V.

The trigger input is common to both channels. Therefore, if the 2572A is placed in trigger mode, both channels share the same mode and the trigger input causes both channels to start generating waveforms at the same time. Phase relationship between channels is tightly controlled in trigger mode and therefore, you should expect both channels to start generating waves with exactly the same start phase. Further control of leading edge offset between channels is also provided.

The same input is also used in FSK mode, where the output shifts between two frequencies – carrier and shifted frequencies. The output generates carrier frequency when the input signal is false (below trigger level) and shifted frequency when the input is true (above trigger level).

Figure 1-7, 2572A Rear Panel

REF IN

This SMB connector accepts 10MHz, TTL level reference signal. The external reference input is available for those applications requiring better accuracy and stability than what is provided by the 2572A. The reference input is active only after selecting the external reference source mode.

16-bit Digital Out

This 68 pin, high density SCSI-2 connector outputs 16 bits, LVDS (Low Voltage Differential Signal) logic level. The output to this connector is routed from channel 1 only and can be turned on and off from the front panel and from an interface bus. The digital patterns are derived from lines that are connected to the DAC and therefore, when the digital pattern output is enabled, the 16 bits that drive the DAC are routed to this connector in parallel. The digital patterns can be designed in two ways: 1) Downloaded to the 2572A from an external utility as an arbitrary waveform and 2) ArbConnection lets you write the patterns to a simple table (hex words) and then this table can be loaded to the instrument through a remote interface.

LAN

This RG45 connector accepts standard Ethernet cable. Correct setting of the IP address is required to avoid conflicts with other instruments or equipment on the network. Information how to change IP address and load instrument drivers to the computer is provided in the Installation chapter of this manual.

USB

This connector accepts standard USB-1 cable. The connection to the host computer is automatic and does not require any address setting from within the 2572A. The first time the 2572A is connected to the computer, it will request the driver file. This file is located on the CD which is supplied with the instrument. Information how to install the driver is provided in the Installation chapter of this manual.

GPIB

This 24-pin connector accepts standard GPIB cable. The GPIB address is configured using the front panel utility menu. The 2572A conforms to the IEEE-488.2 standard. Programming protocol is SCPI version 1993.0. GPIB cables are available separately from your Tabor dealer.

AC LINE

This 3-prong AC LINE connector accepts ac line voltage. The 2572A senses the line voltage and sets the appropriate range automatically. Therefore, the traditional line voltage selector is not available on the rear panel. To avoid potentially hazardous situations, always connect the center pin to mains ground using the line cord that is supplied with the instrument.

AC FUSE

The AC fuse protects the 2572A from excessive current. Always replace the fuse with the exact type and rating as printed on the rear panel. If the fuse blows again after replacement, we recommend that you refer your instrument immediately to the nearest Tabor service center.

X-INST SYNC

The X_INST SYNC (Multi-Instrument Synchronization) group of is comprised of four SMB connectors, designated as SCLK OUT/IN, and COUPLE OUT/IN. Theses connectors are installed in your instrument only if you ordered the multi-instrument synchronization option. Besides the rear panel connectors, you should receive a few other cables. Information how to connect and synchronize between two or more instrument is given later in this manual.

SCLK OUT

This SMB connector outputs the programmed sample clock frequency. Output level is 400mVp-p, terminated into 50Ω. Note that correct termination is necessary for this output otherwise you will not see this signal at all. This output generates sample clock waveforms continuously, regardless if the 2572A is operating in continuous, trigger, or gated modes.

The sample clock output is used for multiple-instruments synchronization. In master mode, connect this output with an SMB to SMB cable to the SCLK IN on the adjacent slave instrument. You may also use this output to synchronize other components in your system to one master clock.

SCLK IN

This SMB connector accepts 300mVp-p to 1Vp-p into 50Ω level signal. Normally, this input is disabled. When enabled, the clock at this input replaces the internal clock generator and the 2572A generates waveforms having the external sample clock rate.

When synchronizing you 2572A as a slave unit, an SMB to SMB cable is connected from the Master SCLK OUT connector to this SCLK IN connector.

COUPLE OUT

This SMB connector outputs the coupling signals to the slave unit. Output level is LVPECL, terminated into 50Ω to 1.3V. For multi-instrument synchronization, connect this output to the COUPLE IN connector on the slave unit.

COUPLE IN

This SMB connector accepts coupling signals from the master unit. Input level is LVPECL, terminated into 50Ω to 1.3V. For multi-instrument synchronization, connect this input to the COUPLE OUT connector on the master unit.

Run Modes

The 2572A can be programmed to operate in one of four run modes: Continuous, Triggered, Gated and counted burst. There are two other modes that can operate in conjunction with the basic four run modes, these are: Delayed Trigger and Re-Trigger. The run modes are common to all of the 2572A waveform output however, they may behave differently for arbitrary and for modulated waveforms. For example, the waveform baseline (where the output idles) for arbitrary waveforms in triggered mode is always a dc level but for modulated waveforms you can select from dc level or continuous carrier waveforms. The differences are explained in the relevant sections however, you do have to remember, that after you select the run mode, it affects every waveform output regardless from where you programmed the mode.

Summary of run modes and optional trigger sources are listed in Table 1-1. Information in this table also identifies legal run modes and lists possible setting conflicts.

Continuous

In normal continuous mode, the selected waveform is generated continuously at the selected frequency, amplitude and offset. Only when operated from a remote interface, the output can be toggled on and off using a trigger command.

Triggered

In triggered mode, the Model 2572A circuits are armed to generate one output waveform. The trigger circuit is sensitive to transitions at the trigger input. Select between positive or negative transitions to trigger the instrument. You may also program the trigger level to the desired threshold level. When triggered, the generator outputs one waveform cycle and remains idle at the last point of the waveform.

The Model 2572A can be triggered from a number of sources:

1) Rear panel connector, designated as TRIG IN,
2) Front panel button marked as MAN TRIG (second function to the Enter button), and
3) Bus commands that are applied to the instrument from any interface, LAN, USB or GPIB.

Description of the various trigger source options is given in the following paragraphs.

The trigger signal, whether it comes from an external source or from an interface command, is routed through some electrical circuits. These circuits cause some small delay known as system delay. System delay cannot be eliminated completely. The system delay is a factor that must be considered when applying a trigger signal. It defines the time that will lapse from a valid trigger edge or software command to the instant that the output reacts.

Note that there is different behavior of the output in triggered mode for standard, arbitrary and sequenced to that of the modulated waveform. While the modulated waveform baseline can be programmed to idle on either dc level or continuous carrier waveform frequency, the other waveforms idle on dc level only.

Burst

The burst mode is an extension of the triggered mode where the Model 2572A can be programmed to output a pre-determined number of waveforms. Note that the burst run mode cannot be applied to sequenced waveform because the two functions share the same circuit and therefore, whenever counted burst is selected for sequenced waveforms, the generator will issue a setting conflict error.

Note that there is different behavior of the output in burst mode for standard, arbitrary and sequenced to that of the modulated waveform. While the modulated waveform baseline can be programmed to idle on either dc level or continuous carrier waveform frequency, the other waveforms idle on dc level only.

Gated

In gated mode, the 2572A generates output waveforms between two gating signal. Only hardware triggers can be used to open and close the gate. The gate opens on the first trigger transition and closes on the second transition. Trigger level and trigger slope are programmable. Trigger delay and re-trigger do not apply to the gated run mode.

Note that there is different behavior of the output in gated mode for standard, arbitrary and sequenced to that of the modulated waveform. While the modulated waveform baseline can be programmed to idle on either dc level or continuous carrier waveform frequency, the other waveforms idle on dc level only.

Delayed Trigger

The delayed trigger function is exactly the same as the trigger mode except a programmable delay inhibits signal output for a pre-determined period after a valid trigger. The delay time defines the time that will lapse from a valid trigger (hardware or software) to output. The delay is programmable in steps of 20ns from 200ns to 21 seconds. The trigger delay can be applied to all run modes: continuous, trigger and burst.

Re-Trigger

The Re-trigger run mode requires only one trigger command to start a sequence of triggered or counted burst of signals. The re-trigger delay defines the time that will lapse from the end of a signal to the start of the next signal. Re-trigger delay is programmable in steps of 20ns from 200ns to 21 seconds.

Trigger Source

The Model 2572A can be triggered from a number of sources:

1) Rear panel connector, designated as TRIG IN;
2) Front panel button marked as MAN TRIG (second function to the Enter button); and
3) Bus commands that are applied to the instrument from any interface, LAN, USB or GPIB.

Description of the various trigger source options is given in the following paragraphs. Summary of trigger options and optional trigger sources are listed in Table 1-2, identifying legal operating modes and listing possible setting conflicts.

Table 1-1, Run Modes and Trigger Source Options Summary

Run Mode	Trigger Option	Status
Continuous	External Bus Mixed Delayed Trigger Re-Trigger (*) Output signal is toggled on and off using interface triggers	Disabled Active(*) Disabled Active Disabled
Triggered	External Bus Mixed Delayed Trigger Re-Trigger	Active Active Active Active Active
Counted Burst	External Bus Mixed Delayed Trigger Re-Trigger (*) Not in conjunction with Re-Trigger (**) Not in conjunction with Mixed	Active Active Active(*) Active Active(**)
Gated	External Bus Mixed Delayed Trigger Re-Trigger	Active Active Disabled Active Disabled

External

When selecting the External trigger source, the rear panel TRIG IN connector becomes active and every legal signal that is applied to this input is causing the 2572A to trigger. Alternately, if an external signal is not available, the front panel MAN TRIG button may also be used to trigger the instrument. When EXT is selected, triggers commands from a remote interface are ignored. EXT is the default trigger source.

Bus

When selecting the Bus as a trigger source, the rear panel TRIG IN connector and the front panel MAN TRIG button are disabled and only trigger commands from a remote interface are accepted by the instrument. Make sure that the appropriate trigger source is selected if you mix remote and local operation.

Mixed

Mixed trigger advance source defines special trigger behavior where the 2572A expects to first receive remote bus trigger and only then accept hardware triggers. The first time that the 2572A is placed in this mode, all EXT (rear and front panel hardware) triggers are ignored until a remote *TRG is issued. Following the first software trigger, subsequent triggers from the remote interface (software) are ignored and only rear and front panel triggers are accepted by the instrument.

Table 1-2, Trigger Source Options Summary

Trigger Option	***Source/ Description***	***Status***
External	*Interface trigger commands* *Rear panel TRIG IN connector* *Front panel MAN TRIG button*	*Disabled* *Active* *Active*
Bus	*Interface trigger commands* *Rear panel TRIG IN connector* *Front panel MAN TRIG button*	*Active* *Disabled* *Disabled*
Mixed	*Interface trigger commands* *Rear panel TRIG IN connector* *Front panel MAN TRIG button* *(*) First trigger from BUS only, subsequent triggers from EXT only*	*Active(*)* *Active(*)* *Active(*)*

Output Type

The Model 2572A can output five types of waveforms: Standard, Arbitrary, Sequenced and Modulated waveforms. The instrument can also generate Digital Patterns with or without any of the basic output types. The various output types are described in the following paragraphs.

Standard Waveforms

The 2572A can generate an array of standard waveforms. The waveforms are generated mathematically from standard equations and converted to waveform coordinates that are downloaded to the working memory. Unlike analog function generators that use electrical circuits to produce the wave shapes, the 2572A must compute the waveform coordinates every time a new function is selected or every time the parameters of the function change.

The 2572A can produce 11 standard waveforms: sine, triangle, square, ramp and pulse, sinc, gaussian and exponential pulses, dc and Pseudo-random noise. Some of the waveforms parameters can be modified such as start phase for sine and triangle, duty cycle for square, rise and fall times for pulses etc. The standard waveforms are the most commonly used wave shapes and therefore were collected to a library of standard waveforms that can be used without the need to compute and download waveform coordinates.

The repetition rate of the standard waveforms is given in units of Hz. Both channels share the same clock source and therefore, when a standard function shape is selected for re-play, the frequency of the waveforms is the same at the output connectors of both channels. Also, when standard waveforms are used, both channels share the same run mode, as well as delayed trigger and re-trigger settings. On the other hand, each channel can have a unique set of waveform, amplitude, offset and waveform parameters without interference between the channels.

When both channels are programmed for standard waveforms, the skew between the channels is minimal. Refer to Appendix A for the skew between channels specification.

Figure 1-9 shows typical front panel for the standard waveform display and Figure 1-10 shows typical standard waveform panel as displayed when ArbConnection is used for remote programming.

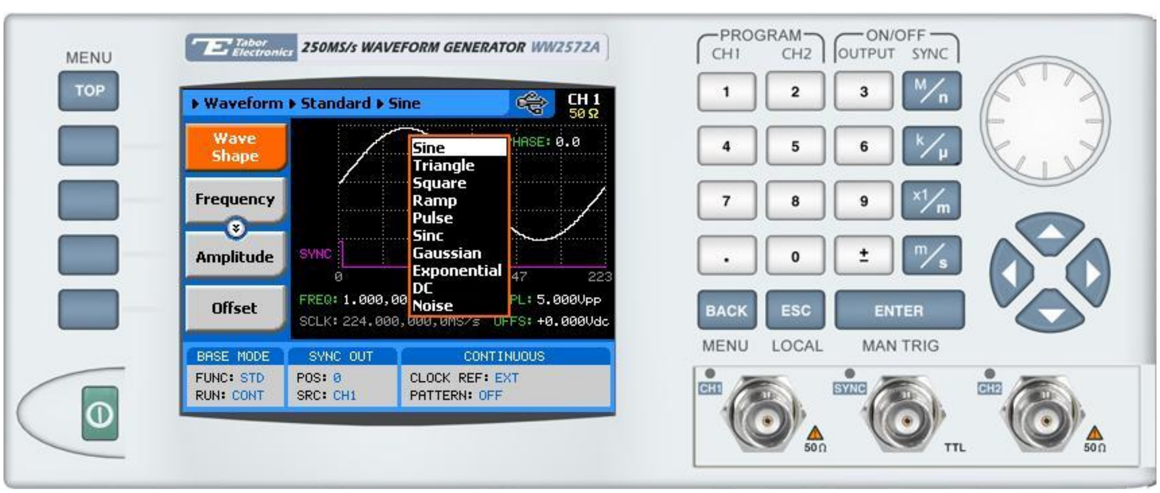

Figure 1-8, Typical 2572A Standard Waveforms Display

Figure 1-9, ArbConnection Example - Typical Standard Waveforms Panel

Half Cycle Waveforms

As a subset of the standard waveforms, the 2572A can generate some of the waveforms, split into two half cycle. When generated continuously, the second half cycle is delayed by a programmed interval. In triggered mode, each trigger stimulates half cycle of the selected function.

Three half cycle waveform shapes are available for generation: Sine, triangle and square. Note when the half cycle function is selected, both channels are placed in this mode automatically.

The repetition rate of the half cycle waveforms is given in units of Hz. Both channels share the same clock source and therefore, when a standard function shape is selected for re-play, the frequency of the half cycle waveforms is the same at the output connectors of both channels. Also, when half cycle waveforms are selected, both channels share the same run mode, as well as delayed trigger and re-trigger settings.

Figure 1-9 shows typical front panel for the standard waveform display and Figure 1-10 shows typical standard waveform panel as displayed when ArbConnection is used for remote programming. Figure 1-11 shows typical front panel for the half cycle waveforms display.

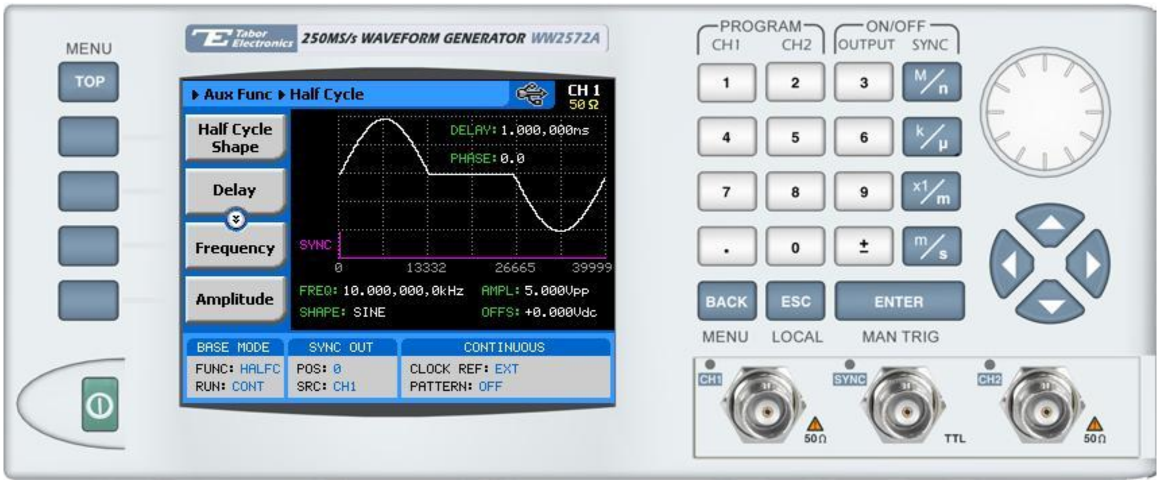

Figure 1-10, Typical Half Cycle Display

Arbitrary Waveforms

One of the main functions of the Racal model 2572A is generating real-life waveforms. These are normally not sinewaves and squares but user specific waveforms. Generating such waveforms require external utilities such as MatLAB or even spreadsheets but having the program alone is not enough for the 2572A; Once the waveform is computed and defined, it must be converted to a format which the instrument can accept and coordinates downloaded to the generator memory for re-play.

Arbitrary waveforms are stored as digital XY coordinates in a special memory, normally referred to as working memory. Each coordinate is referred to as waveform point, or waveform sample. The waveform is better defined if it has many waveform points. For example, with only 8 point, sine waveform will hardly resemble the shape of a sinewave and will look more like an up-down staircase, but with 100 points, the same sine waveform will look almost perfect.

The final shape of the waveform is produced by a DAC (Digital to Analog Converter) The waveform samples are clocked to the DAC at a rate defined by the sample clock frequency. The output of the DAC converts the digital data to analog levels and passes on the signal to the output amplifier. The shape of the function is more or less the same as it comes out of the DAC except it could be amplified or attenuated, depending on the require amplitude level.

The size of the working memory is limited to the way the hardware was designed. The 2572A has 1Meg points available as standard (2 Meg point optional) to build one or more waveforms. There is no need to use the entire memory for only one waveform; The memory can be divided into smaller segments loaded with different waveforms while the instrument can be programmed to output one segment at a time.

The Model 2572A has separate arbitrary waveform memories for each channel and each channel can be loaded with different waveforms. Channels are not limited by the number of segments and by the shape of the waveforms.

Figure 1-12 shows typical front panel for the arbitrary waveform display and Figure 1-13 shows typical ArbConnection panel as displayed when ArbConnection is used for remote programming.

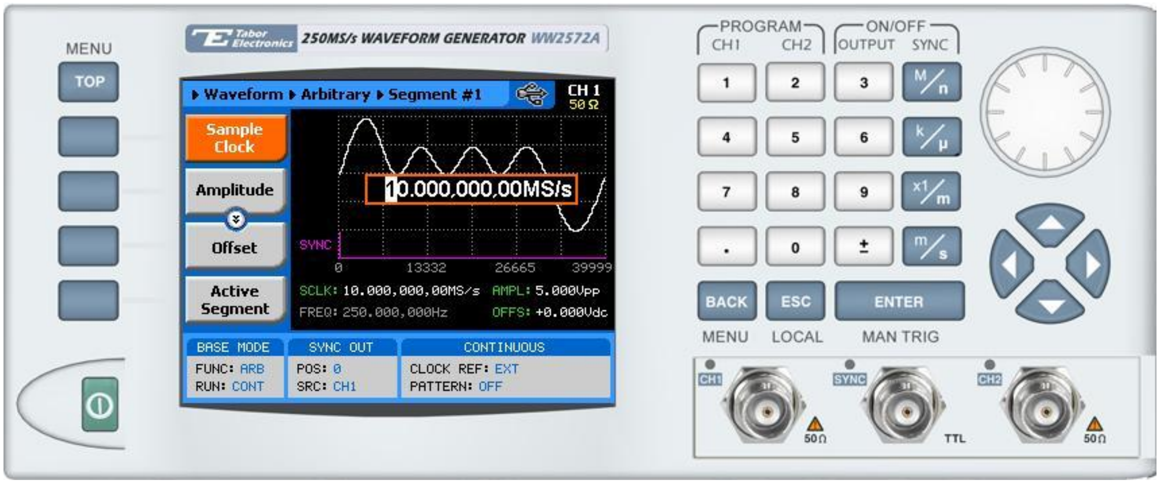

Figure 1-11, Typical 2572A Arbitrary Waveforms Display

Figure 1-12, ArbConnection Example – Typical Arbitrary & Sequenced Waveforms Panel

Sequenced Waveforms

The sequence generator is a very powerful tool that lets you link and loop segments in any way you desire. The Model 2572A has two separate sequence generators – one for each channel. Each sequence generator is dedicated to its own channel.

The sequence circuit is useful for generating long waveforms with repeated sections. The repeated waveform has to be programmed once and the repeater will loop on this segment as many times as selected. When in sequenced mode, there is no time gap between linked or looped segments. Sequence tables must be loaded to the generator before sequenced waveforms can be generated. The data for the sequence table is first prepared on an external platform, then downloaded to the generator.

As a simple example of a sequenced waveform, look at Figures 1-14 through 1-16. The waveforms shown in these figures were placed in memory segments 1, 2 and 3, respectively. The sequence generator takes these three waveforms links and loops them in a predefined order to generate the waveform shown in Figure 1-17.

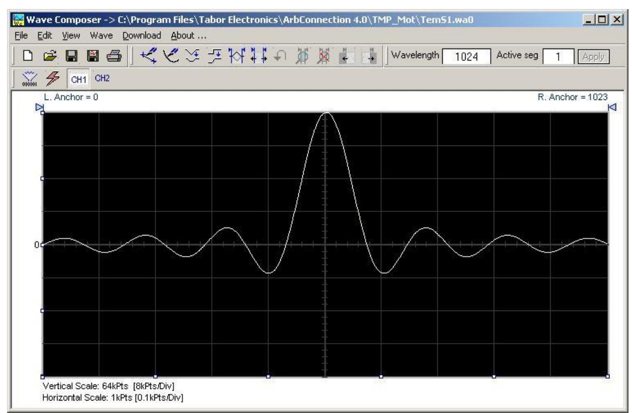

Figure 1-13, Segment 1 Waveform – Sinc

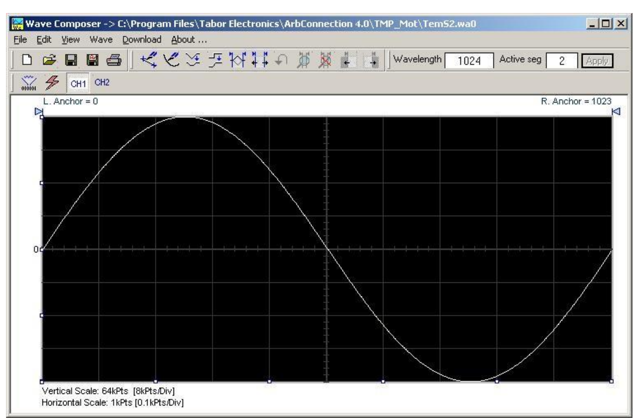

Figure 1-14, Segment 2 Waveform - Sine

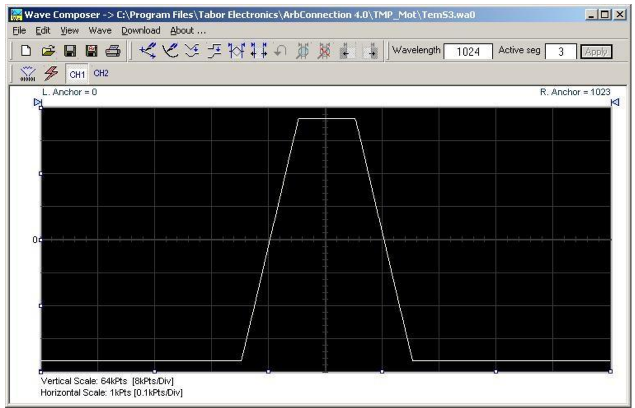

Figure 1-15, Segment 3 Waveform - Pulse

The following sequence was made of segment 2 repeated twice, segment 1 repeated four times, and segment 3 repeated two times.

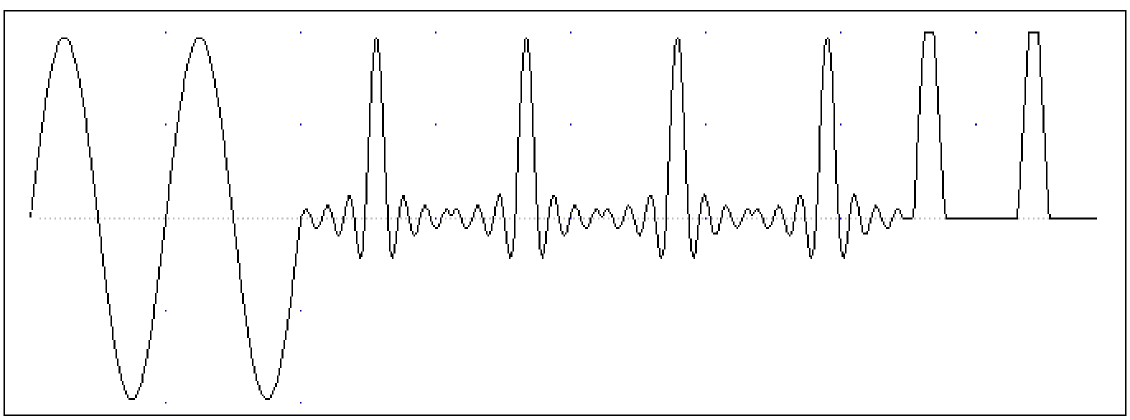

Figure 1-16, Sequenced Waveform

Figure 1-18 shows typical front panel entry for the above sequence and Figure 1-19 shows the waveform studio as is typically being used for building and generating the sequence table from remote.

Figure 1-17, Typical Front Panel Programming of a Sequence Table

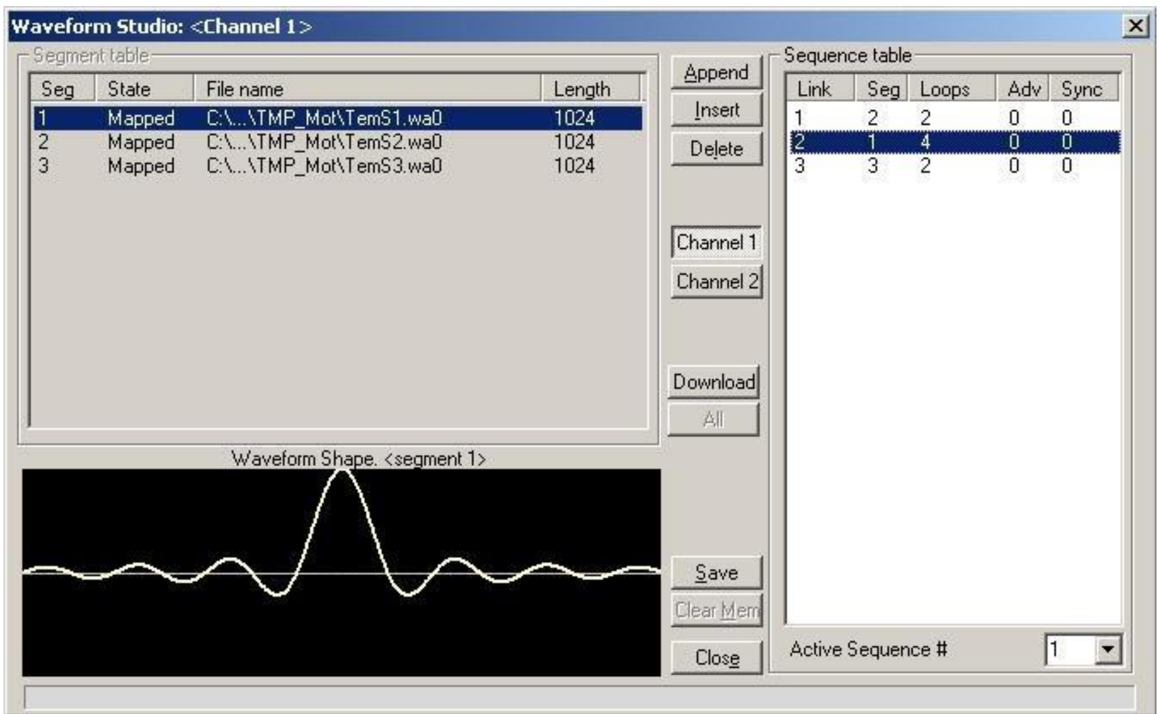

Figure 1-18, ArbConnection Sequence Table Studio

Sequence Advance Modes

As shown above, sequences are built as simple table of which define link, segment, loops and advance bits. When placed in sequenced mode, the output is changing from link to link in an ascending order. The term Sequence Advance Modes defines what is causing the instrument to step from link to link. There are four basic advance modes that can be selected for the sequence mode: Auto, Stepped, ingle and Mixed. These modes are explained in the following paragraphs. Also note that there are some limitations that should be observed while using the various sequenced advance modes. These limitations are summarized in Table 1-3.

Auto

Auto advance sequence is the mode that you want to use when the sequence is expected to run continuously from the first step in the table to the last, and then resume from the first step. There are no interrupts between steps and between the last and the first step of the sequence. When auto mode is selected, the 2572A can also be placed in triggered and gated run modes. The various run mode options that are available for the auto advance mode are summarized in Table 1-3.

Stepped

Stepped advance sequence is the mode that you want to use when the sequence is expected to advance on triggers only. The trigger source is selectable from either external or bus commands. The step will run continuously until a trigger advances the sequence to the next step. When the last step is reached, the next trigger will advance to the first step in the sequence and this sequence will repeat itself as long as triggers are applied to the generator. Note that the generator operates in continuous run mode; Trying to place it in trigger or gated run mode will issue a settings conflict error message. The various run mode options that are available for the step advance mode are summarized in Table 1-3.

Single

Single sequence advance is the mode that you want to use when the sequence is expected to advance on triggers only. The trigger source is selectable from either external or bus commands. The step will run once until a trigger advances the sequence to the next step. When the last step is reached, the next trigger will advance to the first step in the sequence and this sequence will repeat itself as long as triggers are applied to the generator. Note that the generator operates in triggered run mode; Trying to place it in continuous or gated run mode will issue a settings conflict error message. The various run mode options that are available for the single advance mode are summarized in Table 1-3.

Mixed

Mixed advance sequence is the mode that you want to use when some steps of the sequence are expected to run as if in Auto advance mode while some steps that are flagged should wait and operate as if in Stepped sequence mode. The base run mode of the instrument is continuous. The sequence will step through segments of the table that are marked as continuous and will stop and wait for a trigger on sequence steps that are marked with a special flag. Note that the generator operates in continuous run mode; Trying to place it in trigger or gated run mode will issue a settings conflict error message. The various run mode options that are available for the step advance mode are summarized in Table 1-3.

Table 1-3, Sequence Advance and Trigger Options Summary

Run Mode	Run Mode	Status	Trigger Option	Status
Auto	*Continuous* *Triggered* *Gated* *Burst*	*Active* *Active* *Active* *Disabled*	*External* *Bus* *Mixed* *Delayed Trigger* *Re-Trigger*	*Active* *Active* *Disabled* *Active* *Disabled*
Step	*Continuous* *Triggered* *Gated* *Burst*	*Active* *Disabled* *Disabled* *Disabled*	*External* *Bus* *Mixed* *Delayed Trigger* *Re-Trigger*	*Active* *Active* *Disabled* *Active* *Disabled*
Single	*Continuous* *Triggered* *Gated* *Burst*	*Disabled* *Active* *Disabled* *Disabled*	*External* *Bus* *Mixed* *Delayed Trigger* *Re-Trigger*	*Active* *Active* *Disabled* *Active* *Disabled*
Mixed	*Continuous* *Triggered* *Gated* *Burst*	*Active* *Disabled* *Disabled* *Disabled*	*External* *Bus* *Mixed* *Delayed Trigger* *Re-Trigger*	*Active* *Active* *Disabled* *Active* *Disabled*

Modulated Waveforms

Using the latest DDS technology, the 2572A is capable of producing an array of modulation, which places this generator in-line with stand-alone, high performance modulation generators. The 2572A can produce: Sweep, FSK, PSK, ASK, Frequency and amplitude Hops, AM, FM and the most advanced modulation function - Arbitrary FM. It can also generate 3D modulation where amplitude, frequency and phase are swept as a function of time. When modulation is used from one channel, the other channel is 90° phase shifted, specifically convenient for applications such as I & Q modulation and for this purpose, the 2572A can also generate many types of (n)PSK and (n)QAM schemes.

Modulated waveforms are split in two parts:

1) As standard, the 2572A is supplied with five modulation functions: FM, AM, FSK, PSK and sweep.

2) When purchased with the Modulation Package (option 2), the following modulation functions are added: Arbitrary FM, Frequency and Amplitude hops, ASK and 3D. For the 2-channel version only (Model 2572A), the modulation package adds

(n)PSK, (n)QAM and user QAM.

Figure 1-20 shows a typical front panel entry for modulated waveform and Figure 1-21 shows an ArbConnection example of a modulation panel.

If you purchased the 2572A without the modulation package and need to upgrade your product with this option, it is still not too late. An upgrade kit is available for this purpose. Contact the factory for information and instructions how to purchase and install the modulation package; General description of all modulation functions is given in the following.

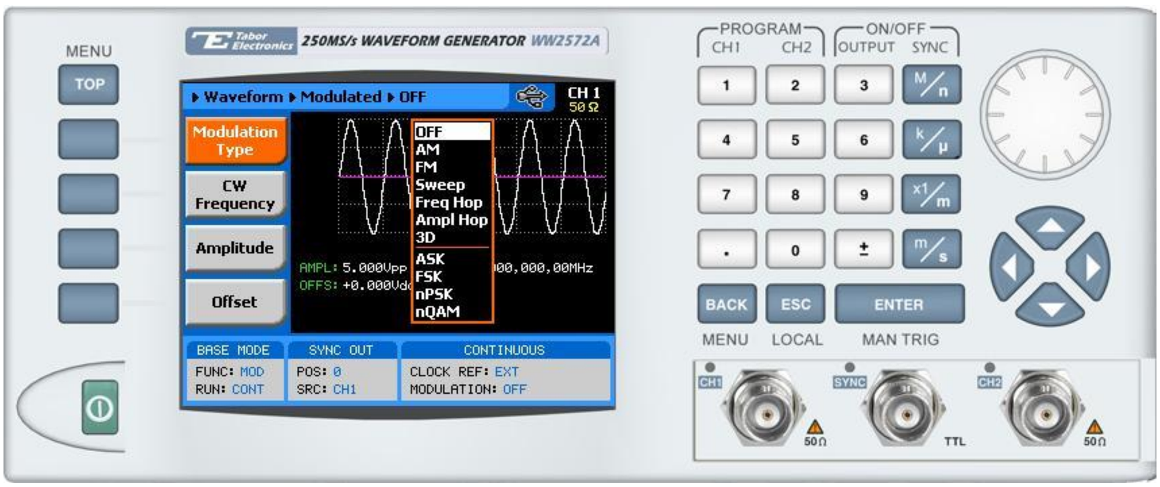

Figure 1-19, Typical Modulated waveform Display

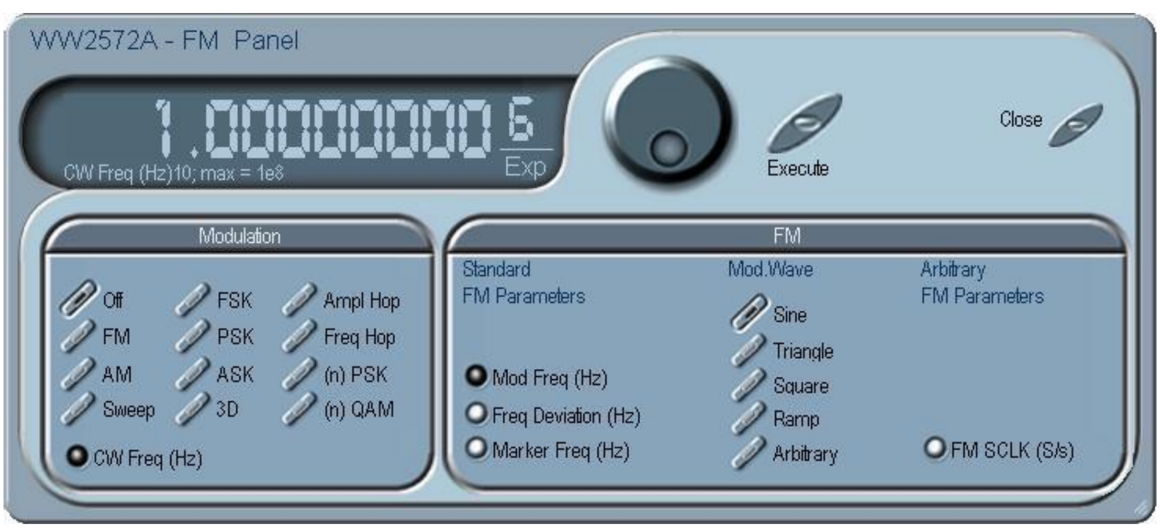

Figure 1-20, ArbConnection Example – FM Modulation Panel

Modulation Off

In modulation OFF, the output generates continuous Carrier Waveform frequency. The carrier waveform is sinewave and its frequency can be programmed using the CW Frequency menu. The value programmed for the CW Frequency parameter, is used for all other modulation functions.

AM

The AM function enables amplitude modulation of a carrier waveform (CW). The carrier waveform is sinewave and it is being modulated by an internal waveform, normally referred to as envelop waveform. The envelop waveform can be selected from sine, triangle square or ramp shapes.

FM

The FM function allows frequency modulation of a carrier waveform (CW). The carrier waveform is sinewave and it is being modulated by an internal waveform, normally referred to as modulating waveform. The modulating waveform can be selected from sine, triangle or square waveforms.

FSK

FSK (Frequency Shift keying) modulation allows frequency hops between two pre-programmed frequencies: Carrier Waveform Frequency and Shifted Frequency. Note that CW is sinewave only and that the switch between two frequencies is always coherent.

PSK

In Phase Shift Keying (PSK), the output of the 2572A hops between two phase settings: start and shifted phase while the frequency of the carrier waveform remain the same. Note that CW is sinewave only.

Sweep

Sweep modulation allows carrier waveform (CW) to sweep from one frequency, defined by the sweep start parameter to another frequency, defined by the sweep stop parameter. Note that CW is sinewave only. The start and stop frequencies can be programmed throughout the entire frequency range of the instrument.

Modulated Waveforms, Modulated Package Option

As discussed above, Modulated waveforms are split in two parts: waveforms that come as standard with the 2572A and waveforms that are purchased with the modulation package – option 2. The modulation package adds the following modulation functions: Arbitrary FM, Frequency and Amplitude hops, ASK and 3D. For the 2-channel version only (Model 2572A), the modulation package adds (n)PSK, (n)QAM and user QAM.

If you purchased the 2572A without the modulation package and need to upgrade your product with this option, it is still not too late. An upgrade kit is available for this purpose. Contact the factory for information and instructions how to purchase, install and test the modulation package. Option 2 waveforms are discussed below.

Frequency Hop

In frequency hop mode, the output waveform (sinewave) hops from frequency to frequency in a sequence defined by the hop table. There are two hop types:

1. Frequency hops with fixed dwell time and
2. Frequency hops with variable dwell time

Amplitude Hop

In amplitude hop mode, the output waveform (sinewave) hops from amplitude to amplitude in a sequence defined by the hop table. There are two hop types:

1. Amplitude hops with fixed dwell time and
2. Amplitude hops with variable dwell time

3D

The 3D modulation allows profiling over time of the carrier waveform over three domains: frequency, amplitude and phase. 3D waveforms must be generated in external utilities such as ArbConnection's 3D composer. The 3D composing software converts the curves to waveform coordinates which are stored in a dedicated 3D memory.

ASK

ASK (Amplitude Shift keying) modulation allows amplitude hops between two pre-programmed amplitude levels. Note that sinewave CW only is hopped. The signal level can hop between two amplitude levels throughout the entire amplitude range without crossing range or relay ranges. Amplitude is programmed from 0 V to 16 V.

Arbitrary FM

The Arbitrary FM function is very similar to the standard FM function except the modulating waveform is user programmable. The arbitrary waveform to modulate the carrier is generated using the FM composer panel from ArbConnection. It also can be generated by the user using other utilities.

(n)PSK

The (n)PSK function is very similar to the standard PSK function except the output can shift to multiple phase and amplitude positions to form phase shift constellations. There are 6 different types of phase shift keying that the 2572A can generate: BPSK, QPSK, OQPSK, pi/4DQPSK, 8PSK and 16PSK.

(n)QAM

The (n)QAM function is similar to the standard ASK function except the output can shift to multiple amplitudes and phase positions to form an amplitude/phase shift constellations. There are 4 different types of Quadrature Amplitude Modulation that the 2572A can generate: 16QAM, 64QAM and 256QAM. If another constellation scheme is required, one can use the User QAM to design his/her own symbol list and constellation.

Modulation Run Modes

Run modes are shared by all waveforms that are generated by the 2572A, including modulation. However, when in modulation function, where run mode options take different meaning. When in triggered, burst or gated run modes, the 2572A outputs sine carrier waveform (CW) until a valid trigger is received and then reacts to the trigger. If triggers cease to stimulate the input, the output resumes generating CW frequency only. Carrier frequency is common to all modulation functions and can be programmed from the modulation menus. If the above behavior is not desired, the 2572A can be programmed to output dc level when idle, generate the modulated signal when triggered and then, resume dc level position when the modulation cycle has ended. The baseline option is programmable from either the front panel or from remote.

Auxiliary Functions

The 2572A, besides its standard waveform generation functions, has two additional auxiliary functions that can transform the instrument to one of two, stand-alone, full-featured, instruments: Digital Pulse Generator and Counter/Timer. Operating instructions for the auxiliary functions are given in Chapter 3. The following describes these two auxiliary functions in general.

Digital Pulse Generator

The digital pulse generator auxiliary function transforms the 2572A into a pulse generator with the capability to generate pulses exactly as they would be generated by a stand-alone pulse generator instrument. When using this function one could program all pulse parameters in timing units. All pulse parameters are programmable including period, pulse width, rise and fall times, delay, polarity and more. Operating instructions for the digital pulse generator are given in Chapter 3. 2572A front panel and ArbConnection control panel examples for the digital pulse generator function are shown in figures 1-26 and 1-27, respectively.

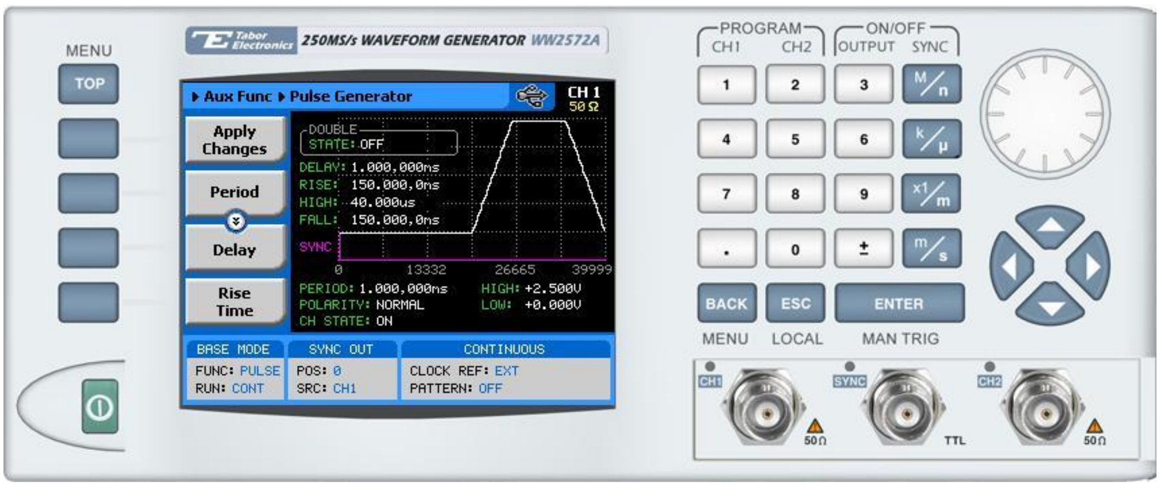

Figure 1-21, 2572A Digital Pulse Generator Menu Example

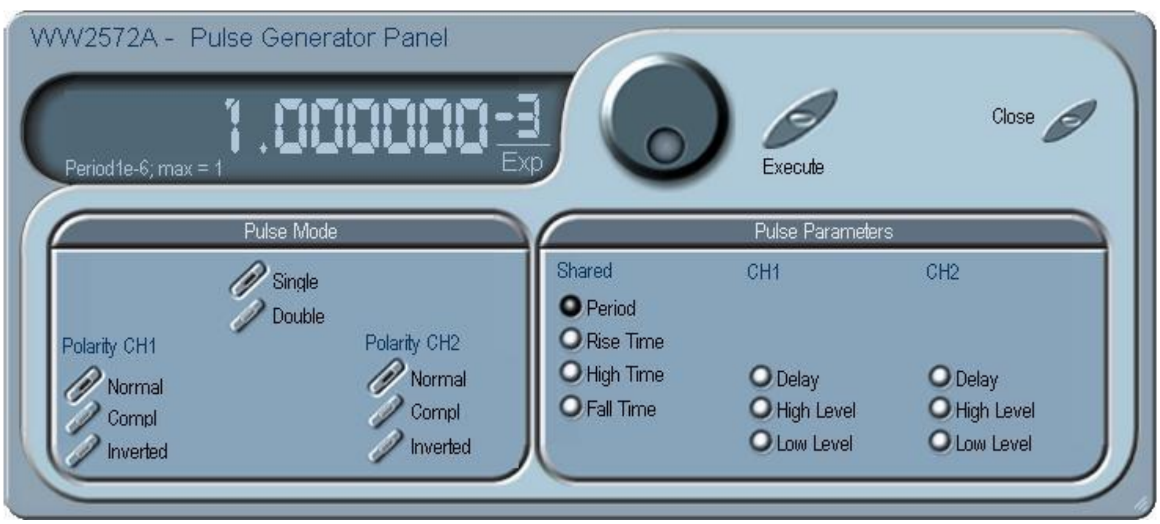

Figure 1-22, ArbConnection Digital Pulse Generator Panel Example

Counter/Timer

The counter/timer auxiliary function transforms the 2572A into a counter/timer instrument with the capability to measure parameters exactly as they would be measured by a stand-alone counter/timer instrument. When using this function one could select the measurement function, gate time trigger level and hold the measurement till condition requires a reading. The readings are taken and displayed on the LCD display, or passed on the remote interface to the host computer for further processing. Operating instructions for the counter/timer are given in Chapter 3. 2572A front panel and ArbConnection control panel examples for the counter/timer are shown in figures 1-28 and 1-29, respectively.

Figure 1-23, 2572A Counter/Timer Menu Example

Figure 1-24, ArbConnection Counter/Timer Panel Example

Digital Patterns

Digital patterns are generated through a special rear-panel connector. The output is generated from channel 1 only. Patterns are user programmable using 16-bit hex words and are stored in pattern tables, as shown in figure 1-8. The digital pattern output is activated from the front panel, or using remote programming commands.

Output State

The main outputs can be turned on or off. The internal circuit is disconnected from the output connector by a mechanical switch (relay). This feature is useful for connecting the main outputs to an analog bus. For safety reasons, when power is first applied to the chassis, the main output is always off.

Customizing the Output Units

There are some parameters that could be customized for easier fit of the output; These are: horizontal time units, load impedance, 10 MHz reference source and sample clock source. Information on the customization options is given in chapter 3.

Programming the Model 2572A

The Model 2572A has no controls on its front panel. Instrument functions, parameters, and modes can only be accessed through VXIbus commands. There are a number of ways to “talk” to the instrument. They all require that an appropriate software driver be installed in the Resource Manager (slot 0). The rest is a matter of practice and knowledge of the language in use. There are other system considerations like address selection that have to be settled before programming the instrument. These topics are discussed in later chapters.

Low level programming of the Model 2572A is done using SCPI commands. Programming aspects are covered in Chapters 4. High level drivers like IVI drivers are beyond the scope of this manual. Contact your Tabor representative for more information about high level drivers for the Model 2572A.

Chapter 2
Configuring the Instrument

Title	Page

Installation Overview

This chapter contains information and instructions necessary to prepare the Model 2572A for operation. Details are provided for initial inspection, grounding safety requirements, repackaging instructions for storage or shipment, installation information and Ethernet address configuration.

Unpacking and Initial Inspection

Unpacking and handling of the generator requires normal precautions and procedures applicable to handling of sensitive electronic equipment. The contents of all shipping containers should be checked for included accessories and certified against the packing slip to determine that the shipment is complete.

Safety Precautions

The following safety precautions should be observed before using this product. Although some instruments and accessories would normally be used with non-hazardous voltages, there are situations where hazardous conditions may be present.

CAUTION

This product is intended for use by qualified persons who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read the operating information carefully before using the product.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on power cables, connector jacks, or test fixtures. The American National Standard Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30V RMS, 42.4V peak or 60 VDC are present.

WARNING

For maximum safety, do not touch the product, test cables, or any other instrument parts while power is applied to the circuit under test. ALWAYS remove power from the entire test system before connecting cables or jumpers, installing or removing cards from the computer, or making internal changes such as changing the module address.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always keep your hands dry while handling the instrument.

When using test fixtures, keep the lid closed while power is applied to the device under test. Carefully read the Safety Precautions instructions that are supplied with your test fixtures.

Before performing any maintenance, disconnect the line cord and all test cables. Only qualified service personnel should perform maintenance.

Performance Checks

The instrument has been inspected for mechanical and electrical performance before shipment from the factory. It is free of physical defects and in perfect electrical order. Check the instrument for damage in transit and perform the electrical procedures outlined in the section entitled **Unpacking and Initial Inspection.**

Power Requirements

The function generator may be operated from a wide range of mains voltage 85 to 265 Vac. Voltage selection is automatic and does not require switch setting. The instrument operates over the power mains frequency range of 48 to 63Hz. Always verify that the operating power mains voltage is the same as that specified on the rear panel.

The 2572A should be operated from a power source with its neutral at or near ground (earth potential). The instrument is not intended for operation from two phases of a multi-phase ac system or across the legs of a single-phase, three-wire ac power system. Crest factor (ratio of peak voltage to rms.) should be typically within the range of 1.3 to 1.6 at 10% of the nominal rms. mains voltage.

Grounding Requirements

To ensure the safety of operating personnel, the U.S. O.S.H.A. (Occupational Safety and Health) requirement and good engineering practice mandate that the instrument panel and enclosure be “earth” grounded. Although BNC housings are isolated from the front panel, the metal part is connected to earth ground.

WARNING

Do not attempt to float the output from ground as it may damage the Model 2572A and your equipment.

Long Term Storage or Repackaging for Shipment

If the instrument is to be stored for a long period of time or shipped to a service center, proceed as directed below. If repacking procedures are not clear to you or, if you have questions, contact your nearest Tabor Electronics Representative, or the Tabor Electronics Customer Service Department.

1. Repack the instrument using the wrappings, packing material and accessories originally shipped with the unit. If the original container is not available, purchase replacement materials.
2. Be sure the carton is well sealed with strong tape or metal straps.
3. Mark the carton with the model and serial number. If it is to be shipped, show sending and return address on two sides of the box.

NOTE

If the instrument is to be shipped to Tabor Electronics for calibration or repair, attach a tag to the instrument identifying the owner. Note the problem, symptoms, and service or repair desired. Record the model and serial number of the instrument. Show the RMA (Returned Materials Authorization) order as well as the date and method of shipment. ALWAYS OBTAIN AN RMA NUMBER FROM THE FACTORY BEFORE SHIPPING THE 2572A TO TABOR ELECTRONICS.

Preparation for Use

Preparation for use includes removing the instrument from the container box, installing the software and connecting the cables to its input and output connectors.

Installation

If this instrument is intended to be installed in a rack, it must be installed in a way that clears air passage to its cooling fans. For inspection and normal bench operation, place the instrument on the bench in such a way that will clear any obstructions to its rear fan to ensure proper airflow.

CAUTION

Using the 2572A without proper airflow will result in damage to the instrument.

Installing Software Utilities

The 2572A is supplied with a CD that contains the following programs: IVI Driver, ArbConnection, USB driver and some other utilities to aid you with the operation of the instrument. For bench operation, all that you need from the CD is this manual however, it is recommended that you stow away the CD in a safe place in case you'll want to use the 2572A from a host computer or in a system.

The *IVI driver* is a useful utility that provides standard communication and commands structure to control the 2572A from remote. Programming examples are also available to expedite your software development. The IVI driver comes free with the 2572A however, you'll need the IVI engine and visa32.dll run time utilities to be able to use the IVI driver. The additional utilities can be downloaded for free from NI's (National instrument) web site – www.ni.com.

ArbConnection is a user friendly program that lets you control instruments functions and features from a remote computer. It also lets you generate and edit arbitrary waveforms on the screen, build sequence tables, modulating signals and much more and then download the signals to your 2572A without the hustle of writing complex programs and utilities. This is also a great tool for you to experiment simple, or complex command string to gain experience before you write your own code. ArbConnection has a command editor feature that allows direct low-level programming of the 2572A using SCPI commands, just as you will be using them in your program. Installation of ArbConnection is simple and intuitive and only requires that visa32.dll runtime file be added to your Windows system folder. Download the file from NI's (National instrument) web site – www.ni.com. Installation and operating instruction for ArbConnection are given in Chapter 4.

The *USB* driver is required if you intend to connect the 2572A to a host computer on a USB bus. Information how to connect the USB cable and how to load the software is given in this chapter.

Controlling the Instrument from Remote

In general, the 2572A can be controlled from remote using one of the following interfaces: USB, Ethernet and GPIB. Remote interface cables are not supplied with the instrument so if you plan on using one of the remote programming option, make sure you have a suitable cable to connect to your host computer. The following paragraphs describe how to connect and configure the 2572A to operate from remote. The description is given for computers fitted with Windows XP but little changes will show while installing software on different Windows versions.

Connecting to a Remote interface

You can connect your Tabor 2572A to GPIB, USB, or LAN adapters, depending on your application and requirements from your system. Installing interface adapters in your computer will not be described in this manual since the installation procedures for these adapters change frequently. You must follow the instructions supplied with your particular adapter. Before proceed with the remote interface installation, install an adapter card and follow the instructions in the following paragraphs.

GPIB Connection

Direct connection between a host computer and a single device with GPIB is not recommended since GPIB adapter is usually expensive and is not really required for direct connection. Use GPIB connection in cases where download speed is critical to the system or when you already have GPIB system in place and you are adding the 2572A as a GPIB device. The GPIB port is connected with a special 24-wire cable. Refer interconnection issues to your GPIB supplier. After you connect the 2572A to the GPIB port, proceed to the GPIB Configuration section in this chapter for instructions how to select a GPIB address.

USB Connection

Direct connection between a single host computer and a single device with USB is most recommended as this does not require any specific considerations and device configuration. Just connect your Tabor 2572A to your PC using a standard USB cable and the interface will self configure. After you connect the 2572A to the USB port, proceed to the USB Configuration section in this chapter for instructions how to install the USB driver.

LAN Connection

Direct connection between a single host computer and a single device with 10/100 BaseT is possible, but you must use a special cable that has its transmit and receive lines crossed. If your site is already wired connect the 2572A via twisted pair Ethernet cable. Take care that you use twisted pair wires designed for 10/100 BaseT network use (phone cables will not work). Refer interconnection issues to your network administrator. After you connect the 2572A to the LAN port, proceed to the LAN Configuration section in this chapter for instructions how to set up LAN parameters.

Selecting a Remote interface

The 2572A is supplied by the factory with the active remote interface set to USB. If you intend to use USB connection, then all you need to do is connect your USB cable and proceed with the USB Configuration instructions as given in this chapter to install the USB driver and to configure the USB port (first connection only). If you already used your instrument in various platforms and want to re-select your interface

To select an active Interface, you need to access the Select Interface screen as shown in Figure 2-1. To access this screen press the TOP menu button, then select the Utility soft key and scroll down with the dial to the Remote Setup option and press the Enter key. The Select Interface soft key will update the display with the interface parameters.

Use the curser keys left and right to point to the required interface option then press Enter. The new interface will Initialize and the icon at the top will be updated and will flag the active interface option.

The interface icon is always displayed at the top of the screen so if you are not sure which of the interfaces is selected, compare the following icons to what you have on the screen:

Designates GPIB interface is selected and active. GPIB configuration is required to communicate with your PC.

Designates USB interface is selected and active. First connection requires USB configuration and software driver installation to communicate with your PC.

Designates LAN interface is selected and active. LAN configuration is required to communicate with your PC.

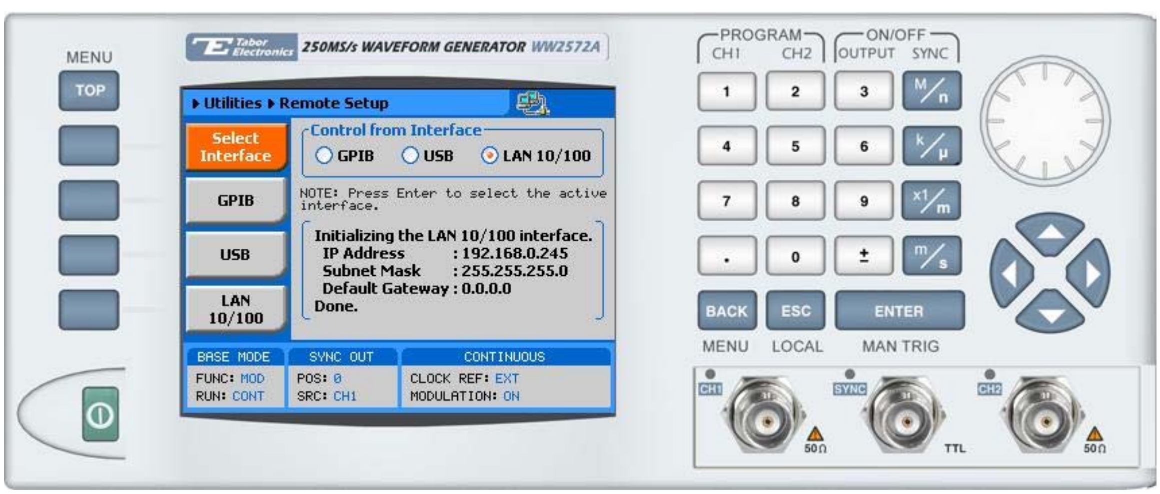

Figure 2-1, Selecting a Remote interface

GPIB Configuration

GPIB configuration requires an address setting only. If you intend to use more than one instrument on the bus, you have to make sure each device has a unique address setting. GPIB address is programmed from the front panel Utility menu as shown in Figure 2-2. To access this screen press the TOP menu button, then select the Utility soft key and scroll down with the dial to the Remote Setup option and press the Enter key. The GPIB soft key will update the display with the GPIB address parameter. The default address is 4. To modify the address, press the Enter key and use the dial or keypad to select the new address. Press Enter for the 2572A to accept the new address setting.

Note

Configuring your GPIB address setting does not automatically select the GPIB as your active remote interface. Setting a remote interface is done from the Select interface menu. Information how to select and Interface is given hereinbefore.

Figure 2-2, GPIB Configuration Screen

USB Configuration

The USB requires no front panel configuration parameters. Following simple installation steps as shown later, just connect your Tabor 2572A to your PC using a standard USB cable and the interface will self configure. The first time you connect the generator to your PC, the new hardware will be detected and the message as shown in Figure 2-3 will appear:

Figure 2-3, USB Device Detected

Figure 2-4, Found New Hardware Wizard

Immediately thereafter, the Found New Hardware Wizard will open, as shown in Figure 2-4. Select the Install from a list or specific Location option and click on next. At this time insert the installation CD into your CD driver. If you know the logical letter for your CD drive, type in the information in the path field. If you are not sure where this driver is, click on the Browse button and look for the path. Check the appropriate controls as shown in Figure 2-5 and then click on Next. With Service Pack 2 only, you'll be prompted with a Windows Logo Warning message, as shown in figure 2-6, advising you that the software has not been verified for its compatibility with Windows XP. Click on Continue Anyway. To complete the process press on Finish, as shown in Figure 2-7.

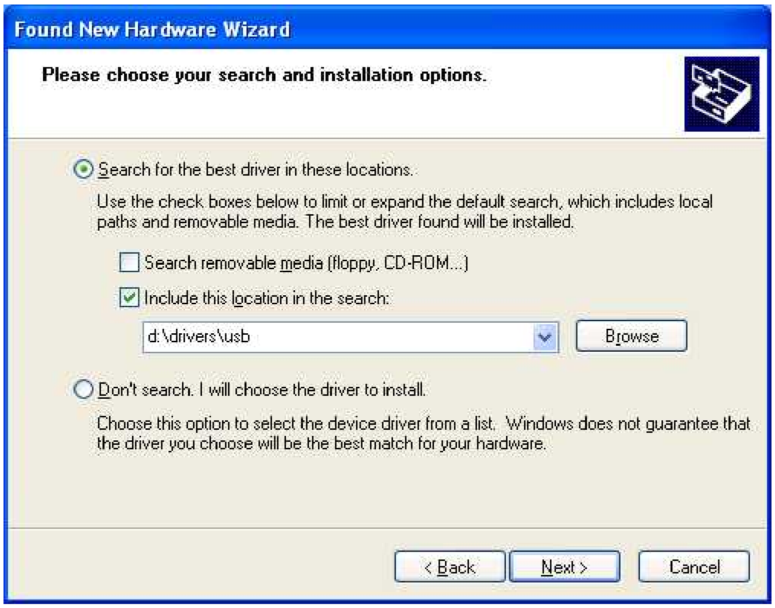

Figure 2-5, Choose Your Search and installation Options

Figure 2-6, Windows Logo Warning Message

Figure 2-7, New Hardware Found and Software installed

Figure 2-7 shows that the Tabor 2572A USB Waveform Generator has been found and software driver installed. However, the process does not end at this point but continues to assign a logical port address to the USB driver. After you click on Finish, the Found New Hardware message appears however, this time it has found a USB serial port, as shown in Figure 2-8.

Figure 2-8, Found New Hardware - USB Serial Port

Proceed with the installation till a logical drive is assigned to the USB port. The process is very similar to what you have done before, just select the path and options in the next dialog box and click on Next as shown in Figure 2-9. With Service Pack 2 only, you'll be prompted with a Windows Logo Warning message, as shown in figure 2-10, advising you that the software has not been verified for its compatibility with Windows XP. Click on Continue Anyway. To complete the process click on Finish, as shown in Figure 2-11.

Figure 2-9, Choose Your Search and installation Options

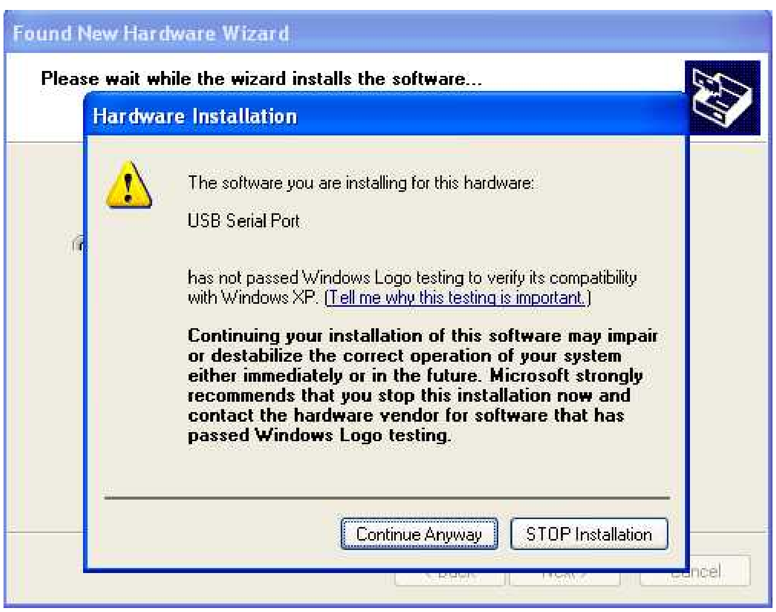

Figure 3-10, Windows Logo Warning Message

Figure 2-11, New Hardware Found and Software installed

The process above detected a USB device and installed the software for it, then it has assigned a Serial Port address to the USB post. In fact, this ends the process unless you want to verify that the drivers and the port are correctly assigned on your PC.

To make sure your USB port and the Tabor 2572A configured correctly, compare your Device Manager to the example in Figure 2-12.

Note

Configuring your USB setting does not automatically select the USB as your active remote interface. Setting a remote interface is done from the Select interface menu. Information how to select and Interface is given hereinbefore.

Figure 2-12, Model 2572A Configured for USB Operation

LAN Configuration

There are several parameters that you may have to set to establish network communications using the LAN interface. Primarily you'll need to establish an IP address. You may need to contact your network administrator for help in establishing communications with the LAN interface. To change LAN configuration, you need to access the LAN 10/100 screen as shown in Figure 2-13. To access this screen press the TOP menu button, then select the Utility soft key and scroll down with the dial to the Remote Setup option and press the Enter key. The LAN 10/100 soft key will update the display with the LAN parameters.

Note there are some parameters that are shown on the display that cannot be accessed or modified; These are: Physical Address and Host Name. These parameters are set in the factory and are unique for product. The only parameters that can be modified are the IP

Address, the Subnet mask and the Default gateway. Correct setting of these parameters is essential for correct interfacing with the LAN network. Description of the LAN settings and information how to change them is given in the following.

Note

Configuring your LAN setting does not automatically select the LAN as your active remote interface. Setting a remote interface is done from the Select interface menu. Information how to select and Interface is given herinbefore.

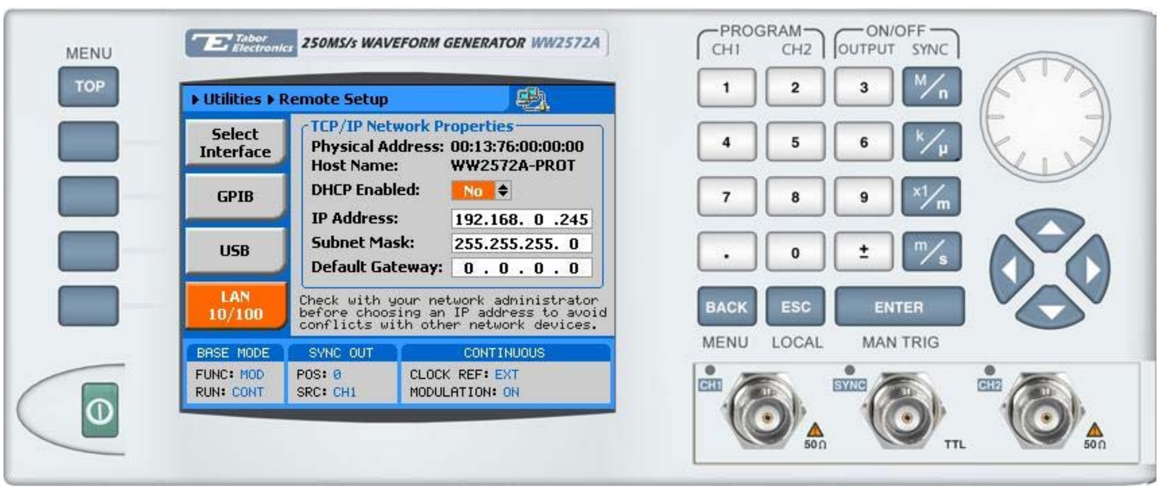

Figure 2-13, LAN Configuration Screen

There are three LAN parameters in this screen that can be modified and adjusted specifically to match your network setting; These are described below. Consult your network administrator for the setting that will best suit your application.

- **IP address** - The unique, computer-readable address of a device on your network. An IP address typically is represented as four decimal numbers separated by periods (for example, 192.160.0.233). Refer to the next section - Choosing a Static IP Address.
- **Subnet mask** - A code that helps the network device determine whether another device is on the same network or a different network.
- **Gateway IP** - The IP address of a device that acts as a gateway, which is a connection between two networks. If your network does not have a gateway, set this parameter to 0.0.0.0.

Choosing a Static IP Address

For a Network Administered by a Network Administrator

If you are adding the Ethernet device to an existing Ethernet network, you must choose IP addresses carefully. Contact your network administrator to obtain an appropriate static IP address for your Ethernet device. Also have the network administrator assign the proper subnet mask and gateway IP.

For a Network without a Network Administrator

If you are assembling your own small Ethernet network, you can choose your own IP addresses. The format of the IP addresses is determined by the subnet mask. You should use the same subnet mask as the computer you are using with your Ethernet device. If your subnet mask is 255.255.255.0, the first three numbers in every IP address on the network must be the same. If your subnet mask is 255.255.0.0, only the first two numbers in the IP addresses on the network must match.

For either subnet mask, numbers between 1 and 254 are valid choices for the last number of the IP address. Numbers between 0 and 255 are valid for the third number of the IP address, but this number must be the same as other devices on your network if your subnet mask is 255.255.255.0.

Table 2-1 shows examples of valid and invalid IP addresses for a network using subnet mask 255.255.255.0. All valid IP addresses contain the same first three numbers. The IP addresses in this table are for example purposes only. If you are setting up your own network, you probably do not have a gateway, so you should set these values to 0.0.0.0.

Table 2-1, Valid and Invalid IP Addresses for Subnet Mask 255.255.255.0

IP Address	Comment
123.234.45.211	Valid.
123.234.45.213	Valid. The first three numbers match the previous IP address. The fourth number must be a unique number in the range of 1 to 254.
123.202.45.214	Invalid. Second number does not match the previous IP addresses. The first three numbers must match on all IP addresses with subnet mask 255.255.255.0.
123.234.45.0	Invalid. The first three numbers are valid but the fourth number cannot be 0.
123.234.45.255	Invalid. The first three numbers are valid but the fourth number cannot be 255.

TIP

To find out the network settings for your computer, perform the following steps:

- **For Windows 98/Me/2000/XP**

  1. **Open a DOS prompt.**
  2. **Type IPCONFIG.**
  3. **Press <Enter>.**

If you need more information, you can run ipconfig with the /all option by typing IPCONFIG /all at the DOS prompt. This shows you all of the settings for the computer. Make sure you use the settings for the LAN adapter you are using to communicate with the LAN device.

- **For Windows 95**

  1. **Open a DOS prompt.**
  2. **Type WINIPCFG.**
  3. **Press <Enter>.**

Select the Ethernet adapters you are using to communicate with the *Ethernet device* from the drop-down list.

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Chapter 3
Using the Instrument

Title	Page

Overview

This chapter contains information about how to operate the Tabor 2572A. Operation is divided into two general categories: basic bench operation, and remote operation (GPIB, USB and ENET). Basic bench operation, which is covered in this section, describes how to operate the arbitrary waveform generator using front panel sequences. The 2572A is supplied with ArbConnection, a PC based software package with a graphical user interface to allow users to program all of the functions directly. LabView drivers and a set of SCPI commands are available for more experienced programmers.

The following paragraphs describe the various modes of operation and give examples of how to program the Model 2572A. The manual is organized by instrument function and instructions are given in each paragraph on how to use the function from both the front panel and ArbConnection.

Inter-Channel Dependency

The 2572A has two output channels. Although this is a two-channel instrument, many of the commands that set parameters and functions are common for both channels. For example, sample clock and run modes can not be set separately for each channel. On the other hand, you may program each channel to have different function shape, amplitude and offset. Table 3-1 lists the function and parameters and their related Inter-channel dependency.

Inter-Channel Phase Dependency

The 2572A has only one sample clock source, which means that waveform samples are clocked simultaneously on both channels. Therefore, if you are looking to have to completely separated channels, with no correlation between the two signals, this is not the right instrument for you. However, most applications for two channel generator require phase correlation between the channels and this is the way the 2572A is constructed. Shared sample clock source assures that both channels start generating signals exactly on the same phase and, in addition, there is an assurance that there is no jitter between the two channels. Inter-channel phase control is described later in this chapter, in the Using the Auxiliary Functions section.

Output Termination

During use, output connectors must be properly terminated to minimize signal reflection or power loss due to impedance mismatch. Proper termination is also required for accurate amplitude levels at the output connectors. Use 50Ω cables and terminate the main and SYNC cables with terminating resistors.

Always place the 50 Ω termination at the far end of the cables.

Note that the display reading of the amplitude level is calibrated to show the actual level on the load when the load impedance is exactly 50 Ω. There are cases however, where the load has different impedance so, in that case, the display reading will indicate a different reading than the actual amplitude level on the load. The 2572A provides a customization menu where the load impedance can be changed from 50 Ω to other values. Information how to customize the 2572A is given later in this chapter.

Input / Output Protection

The Model 2572A provides protection for internal circuitry connected to input and output connectors. Refer to the specifications in Appendix A to determine the level of protection associated with each input or output connector.

WARNING

The outputs can only be connected to resistive loads. Connecting the 2572A to inductive or capacitive load may damage the output and void the warranty on the instrument.

Power On/Reset Defaults

The 2572A utilizes non-volatile memory backup that automatically stores the last setup before the generator has been turned off. Every time you turn on the instrument, the non-volatile memory updates the front panel setting with modes, parameters and waveforms from its last setting with only one exception, for safety reasons, the outputs remain off even if they were turned on before powering down the 2572A.

After power on, the instrument displays information messages and updates the display with the last setup information. The 2572A can always be reset to its default values; Information on how to restore default parameters is given below.

If you are not yet fully familiar with front panel operation of the 2572A, you may find yourself locked into a "dead-end" situation where nothing operates the way it should. The fastest way to restore the generator to a known state is by resetting the instrument to factory defaults.

Observe Figure 3-1 and reset parameters to factory defaults as follows:

1. Press the Utilities soft key
2. Scroll down to the, or
3. Press button 3 to restore factory defaults

Table 3-1 summarizes factory defaults for the most common parameters. A complete list of all parameters, their defaults, as well as their maximum and minimum values is given in Chapter 4.

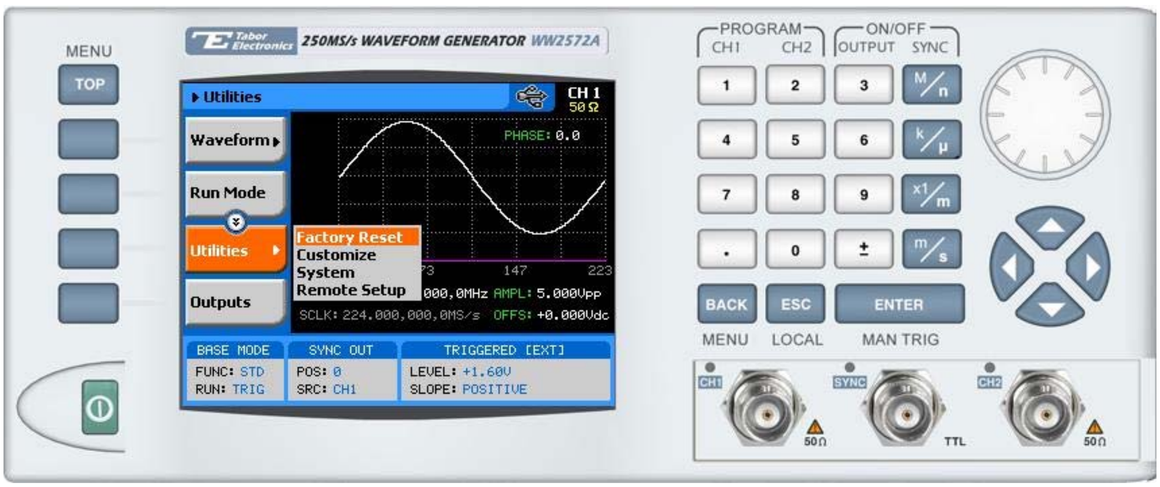


Figure 3-1, Reset 2572A to Factory Defaults

Table 3-1, Default Conditions After Reset

Function / Parameter	Default	Inter-Channel Dependency
Outputs State:	Off	Separate
SYNC State:	Off	Common
Operating Mode:	Continuous	Common
Active Channel:	1	Separate
Digital Pattern State:	Off	Separate
Output Function:	Standard	Separate
Output Function Shape:	Sine	Separate
Standard Wave Frequency:	1MHz	Common
User Wave Sample Clock:	10MS/s	Common
Sample Clock Source & Reference:	Internal	Common
Amplitude:	5V	Separate
Offset:	0V	Separate

Table 3-1, Default Conditions after Reset (continued)

Function / Parameter	**Default**	**Inter-Channel Dependency**
Filter State:	Off	Separate
Filter Type:	Auto	Separate
Trigger Slope:	Positive	Common
Trigger Level:	1.6V	Common
Trigger Source:	External	Common
Trigger Delay:	Off	Common
Re-Trigger:	Off	Common
Modulation State:	Off	Common

Controlling the 2572A

Controlling 2572A function, modes and parameters is simply a matter of pressing once or twice the appropriate button as described in the following paragraphs. Refer to Figure 3-2 throughout this description.

1. ***Power Switch*** – Toggles 2572A power ON and OFF
2. ***Menu Top*** – Selects the root menu. This button is disabled during parameter editing
3. ***Menu Soft Keys*** – Soft keys have two functions:
   1) Selects output function shape or operating mode,
   2) Selects parameter to be audited

   These buttons are disabled during parameter editing
4. ***Menu Back*** – Backs up one menu position. This button is disabled during parameter editing
5. ***Cancel (Local)*** – Has two functions:
   1) When in edit mode, cancels edit operation and restore last value
   2) When operating the 2572A from a remote interface, none of the front panel buttons are active. The Local button moves control back from remote to front panel buttons

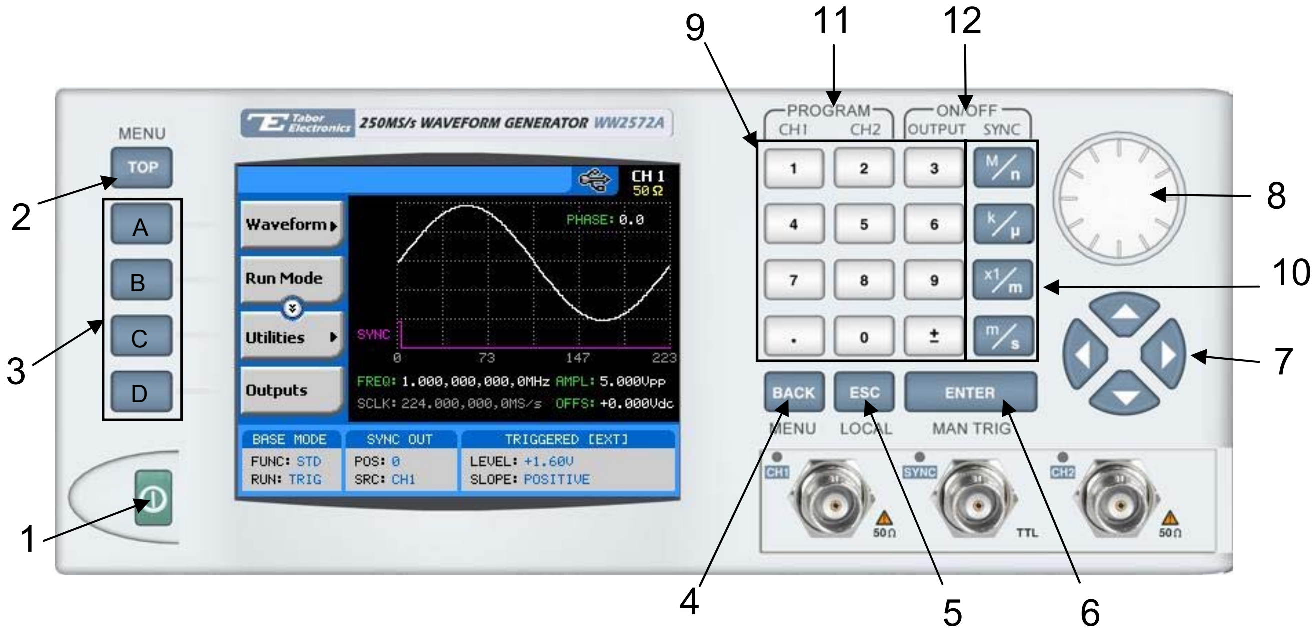


Figure 3-2, 2572A Front Panel Operation

6. ***Enter (MAN TRIG)*** – Has two functions:
   1) When multiple parameters are displayed on the screen, the cursor and the dial scroll through the parameters. Pressing Enter selects the parameter for edit. After the parameter has been modified, the Enter button locks in the new variable and releases the buttons for other operations
   2) When the 2572A is placed in “Triggered” run mode, the Man Trig button can be used to manually trigger the 2572A
7. **Cursor *UP, Down, Left and Right*** – Has two functions:
   1) When multiple parameters are displayed on the screen, the cursor and the dial scroll through the parameters
   2) When parameter is selected for editing, cursor buttons right or left move the cursor accordingly. Cursor buttons up or down modify parameter value accordingly
8. ***Dial*** – Has similar functionality as the cursor UP and Down keys
9. **Numeral *keypad*** – These keys are used for modifying an edited parameter value
10. ***Parameter Suffixes (M, k, x1 and m)*** – These keys are used to place suffix at the end of the parameter. They are also used for terminating an edit operation
11. ***Program CH1, CH2*** – Use Program CH1 to modify the screen to display channel 1 parameters. Use Program CH2 to

modify the screen to display channel 2 parameters. These keys can be used only when the 2572A is not in edit mode

12. ***ON/OFF Output, Sync*** – These keys can be used only when the 2572A is not in edit mode. The Output ON/OFF toggles output waveform, at the output connector, ON and OFF. The Sync ON/OFF toggles the sync waveform, at the SYNC output connector, ON and OFF

2572A Front Panel Menus

The 2572A has over 300 parameters that control functions, modes, waveforms and auxiliary functions. Due to the complexity of the product, the functions were divided to logical groups and sub-groups and access to these groups is provided using the soft key menus. There are five main menus, of which can be accessed after pressing the TOP soft key; These are shown in Figure 3-1 and are mark as item 3 (A, B, C and D). The main menus are Waveform, Run Mode, Utility, Outputs and Auxiliary. Each main menu provides access to sub-menus as summarized in Tables 3-2 to 3-5. Note that the description in these tables is given for general understanding of what is available in terms of operating the instrument. For detailed instructions, check the appropriate section of the manual.

Table 3-2, Front Panel Waveform Menus

Soft Key	TOP Menu	2nd Level Menu	3rd Level Menu	Notes
A	Waveform			Provides access to initial selection of the waveform type. Selects from Standard, Arbitrary, Sequenced and Modulated
A		Standard		
A			Wave Shape	Select from a wave shapes list
B			Frequency	Programs standard waveform frequency
C			Amplitude	Programs output amplitude
D			Offset	Programs output amplitude offset
↓D (*)			Phase	Parameters depend on selected shape
↓D			Reset Parameters	Resets parameters for this waveform only
B		Arbitrary		
A			Sample Clock	Programs sample clock frequency
B			Amplitude	Programs output amplitude
C			Offset	Programs output amplitude offset
D			Active Segment	Selects the active arbitrary waveform segment
↓D			Wave Composer	Provides access to the waveform composer
↓D			Delete Segments	

(*) ↓D denotes you have to scroll down to access the menu. Scroll using the arrows up or down or the dial.

Table 33-2, Front Panel Waveform Menus (continued)

Soft Key	TOP Menu	2nd Level Menu	3rd Level Menu	Notes
C		Sequenced		
A			View Table	
B			Advance Mode	
C			Advance Source	
D			Sample Clock	
↓D			Amplitude	
↓D			Offset	
↓D			Active Segment	
	Modulation Option			
D		Modulated		
A	Off		Modulation Type	Selects from Off, AM, FM, FSK, PSK, Hop and Sweep
B	Off		CW Frequency	Programs the carrier waveform frequency
C	Off		Amplitude	Programs the CW Amplitude
D	AM		Offset	Programs the CW amplitude offset
B	AM		Modulation Shape	Programs the modulating waveform shape
C	AM		Modulation Depth	Parameter modulation depth
D	AM		Modulation Freq	Parameter envelop frequency
↓D	AM		CW Frequency	Programs the carrier waveform frequency
↓D	AM		Trigger Baseline	Programs the baseline wave in triggered mode
↓D	AM		Amplitude	Programs the CW Amplitude
↓D	FM		Offset	Programs the CW amplitude offset
B	FM		Modulation Shape	Programs the modulating waveform shape
C	FM		CW Frequency	Programs the carrier waveform frequency
D	FM		Frequency Deviation	Programs FM deviation frequency
↓D	FM		Modulation Freq	Parameter modulation frequency
↓D	FM		Marker	Programs the marker frequency
↓D	FM		Trigger Baseline	Programs the baseline wave in triggered mode
↓D	FM		Amplitude	Programs the CW Amplitude
↓D	Sweep		Offset	Programs the CW amplitude offset
B	Sweep		Sweep Type	Selects from linear or logarithmic
C	Sweep		Direction	Selects from up or down
D	Sweep		Start Frequency	Programs the start frequency
↓D	Sweep		Stop Frequency	Programs the stop frequency
↓D	Sweep		Sweep Time	Programs the sweep time
↓D	Sweep		Marker	Programs the marker frequency
↓D	Sweep		Trigger Baseline	Programs the baseline wave in triggered mode
↓D	Sweep		Amplitude	Programs the CW Amplitude
↓D	Sweep		Offset	Programs the CW amplitude offset

(*) ↓D denotes you have to scroll down to access the menu. Scroll using the arrows up or down or the dial.

Table 3-2, Front Panel Waveform Menus (continued)

Soft Key	Modulation Option	2nd Level Menu	3rd Level Menu	Notes
B	Freq HOP		Hop Data	Programs the frequency hops table
C	Freq HOP		Dwell Type	Selects between fixed and variable
D	Freq HOP		Dwell Time	Programs hop dwell time (fixed mode)
↓D	Freq HOP		Marker	Programs the marker position
↓D	Freq HOP		Trigger Baseline	Programs the baseline wave in triggered mode
↓D	Freq HOP		Amplitude	Programs the CW Amplitude
↓D	Freq HOP		Offset	Programs the CW amplitude offset
B	Ampl HOP		Hop Data	Programs the frequency hops table
C	Ampl HOP		CW Frequency	Programs the carrier waveform frequency
D	Ampl HOP		Dwell Type	Selects between fixed and variable
↓D	Ampl HOP		Dwell Time	Programs hop dwell time (fixed mode)
↓D	Ampl HOP		Marker	Programs the marker position
↓D	Ampl HOP		Amplitude	Programs the CW Amplitude
↓D	Ampl HOP		Offset	Programs the CW amplitude offset
B	3D		Load Demo Table	Loads a sample 3D table for demo purpose
↓D	3D		Trigger Baseline	Programs the baseline wave in triggered mode
C	3D		Offset	Programs the CW Offset
B	ASK		ASK Data	Displays and edits ASK data table
C	ASK		CW Frequency	Programs the carrier waveform frequency
D	ASK		Start Amplitude	Programs the start amplitude level
↓D	ASK		Shifted Amplitude	Programs the shifted amplitude level
↓D	ASK		Baud	Programs the baud frequency
↓D	ASK		Marker	Programs the marker position
↓D	ASK		Offset	Programs the CW amplitude offset
B	FSK		FSK Data	Displays and edits FSK data table
C	FSK		CW Frequency	Programs the carrier waveform frequency
D	FSK		Shifted Frequency	Programs the shifted frequency
↓D	FSK		Baud	Programs the baud frequency
↓D	FSK		Marker	Programs the marker position
↓D	FSK		Trigger Baseline	Programs the baseline wave in triggered mode
↓D	FSK		Amplitude	Programs the CW Amplitude
↓D	FSK		Offset	Programs the CW amplitude offset
B	PSK		PSK Type	Programs the PSK type: PSK, BPSK, QPSK, OQPSK, pi/4DQPSK, 8PSK and 16PSK
C	PSK		PSK Data	Displays and edits PSK data table
D	PSK		CW Frequency	Programs the carrier waveform frequency
↓D	PSK		Start Phase	Programs the start phase
↓D	PSK		Shifted Phase	Programs the shifted phase
↓D	PSK		Baud	Programs the baud frequency
↓D	PSK		Marker	Programs the marker position
↓D	PSK		Trigger Baseline	Programs the baseline wave in triggered mode
↓D	PSK		Amplitude	Programs the CW Amplitude
↓D	PSK		Offset	Programs the CW amplitude offset

(*) ↓D denotes you have to scroll down to access the menu. Scroll using the arrows up or down or the dial.

Table 3-2, Front Panel Waveform Menus (continued)

Soft Key	Modulation Option	2nd Level Menu	3rd Level Menu	Notes
B	(n)PSK		PSK Type	Programs the PSK type: PSK, BPSK, QPSK, OQPSK, pi/4DQPSK, 8PSK and 16PSK
C	(n)PSK		PSK Data	Displays and edits (n)PSK data table. Also, provides access to demonstration data symbols
D	(n)PSK		CW Control	Turns CW on and off
↓D	(n)PSK		CW Frequency	Programs the carrier waveform frequency
↓D	(n)PSK		Symbol Rate	Programs the symbol transition rate
↓D	(n)PSK		Marker	Programs the marker position
↓D	(n)PSK		Amplitude	Programs the CW Amplitude
↓D	(n)PSK		Offset	Programs the CW amplitude offset
B	(n)QAM		QAM Type	Programs the QAM type: 16QAM, 64QAM, 256QAM and User QAM
C	(n)QAM		QAM Data	Displays and edits (n)QAM data table. Also, provides access to demonstration data symbols
D	(n)QAM		CW Control	Turns CW on and off
↓D	(n)QAM		CW Frequency	Programs the carrier waveform frequency
↓D	(n)QAM		Symbol Rate	Programs the symbol transition rate
↓D	(n)QAM		Marker	Programs the marker position
↓D	(n)QAM		Amplitude	Programs the CW Amplitude
↓D	(n)QAM		Offset	Programs the CW amplitude offset

Table 3-3, Front Panel Run Mode Menus

Soft Key	TOP Menu	2nd Level Menu	3rd Level Menu	Notes
B	Run Mode			Provides access to 2572A Run Mode options: Continuous, Triggered, Gated and Counted Burst
A		Continuous		Selects the continuous run mode
B		Triggered		Selects the triggered run mode. Provides access to trigger parameters, re-trigger on/off and re-trigger parameters
C		Gated		Selects the gated run mode. Provides access to gating parameters
D		Burst		Selects the triggered run mode. Provides access to counted burst parameters, re-trigger on/off and re-trigger parameters

(*) ↓D denotes you have to scroll down to access the menu. Scroll using the arrows up or down or the dial.

Table 3-4, Front Panel Utility and Output Menus

Soft Key	TOP Menu	2nd Level Menu	3rd Level Menu	Notes
C	Utility			Provides access to factory reset, display customization, remote setup and system parameters
		Factory Reset		Allows reset of all 2572A parameters to factory default values
		Customize		Provides access to display customization: horizontal units, clock sources, load impedance, dial direction and display brightness
		System		Displays all 2572A system parameters, including serial number, installed option, last calibration date. Also monitors internal temperature rise.
		Remote Setup		Provides access to selecting the remote interface. Available interfaces are LAN, USB and GPIB
A			Select interface	Selects between GPIB, USB and LAN
B			GPIB	Programs GPIB address
C			USB	Display information on the USB ID
D			LAN	Programs LAN IP address
D	Outputs			Provides access to output on/off control, filter on/off and type, SYNC output on/off control and properties, and start phase offset between channels.

Table 3-5, Front Panel Auxiliary Menus

Soft Key	TOP Menu	Auxiliary Function	2^{nd} Level Menu	Notes
↓D	Auxiliary			Provides access to the following auxiliary functions: Digital Pulse Generator, Counter/Timer, Half Cycle waveforms, Multi-instrument synchronization and Digital Patterns.
A		Pulse Generator	Apply Changes	Press this button to accept modifications of pulse parameters.
B			Period	Programs the period of the pulse
C			Delay	Programs the delay from the start of the pulse
D			Rise Time	Programs the pulse rise time parameter
↓D			High Time	Programs the pulse high time parameter
↓D			Fall Time	Programs the pulse fall time parameter
↓D			High Level	Programs the pulse high level parameter
↓D			Low Level	Programs the pulse low level parameter
↓D			Polarity	Programs the pulse polarity parameter
↓D			Double State	Toggles double pulse state on and off
↓D			Channel State	Programs the channel programmability state
↓D			Sync Position	Programs the sync pulse position parameter

(*) ↓D denotes you have to scroll down to access the menu. Scroll using the arrows up or down or the dial.

Table 3-6, Front Panel Auxiliary Menus (continued)

Soft Key	TOP Menu	Auxiliary Function	2nd Level Menu	Notes
A		Half Cycle	Half Cycle Shape	Selects the half cycle waveform shape. Select between sine, triangle or square waveforms
B			Delay	Programs the delay between the half cycles
C			Frequency	Programs the delay from the start of the pulse
D			Amplitude	Programs the half cycle Amplitude
↓D			Offset	Programs the half cycle amplitude offset
↓D				Programs the start phase of the sine and triangular waveforms
↓D			Phase	Programs the half cycle start phase angle
A		Counter/Timer	Function	Selects the counter/timer measurement function
B			Gate Time	Programs the counter gate time
C			Display Time	Selects between continuous and single measurement cycles
D			Trigger Level	Programs the trigger level for the counter input
↓D			Trigger Slope	Programs the trigger slope for the counter input
A		X-Inst Sync,	Couple State	Toggles master/slave mode on and off
B			Properties	Provide access to selection of the master and delay between adjacent instruments
C			Slaves IP Address	Allows addition of slave units. Every added IP address is automatically added as slave
A		Digital Pattern	State	Toggles digital pattern output on and off
B			Baud	Programs the baud for the digital pattern
C			Left Position	Sets the left boundary for the pattern display
D			Right Position	Sets the right boundary for the pattern display
↓D			Go to Pattern	Moves the cursor to the selected pattern number

(*) ↓D denotes you have to scroll down to access the menu. Scroll using the arrows up or down or the dial.

Enabling the Outputs

For safety reasons, main outputs default setting is OFF. The outputs can be turned on and off using either the hot keys, or the Output Menu. Observe Figure 3-3 and disable or enable the main outputs using the procedure below. The same procedure can be used for enabling and disabling the SYNC output. The numbers on Figure 3-3 correspond to the procedure steps in the following description.

1. While not editing any parameter, select the channel you want to turn on using the PROGRAM CH1 or CH2 keys
2. Press ON/OFF OUTPUT or SYNC to toggle main and sync output on and off

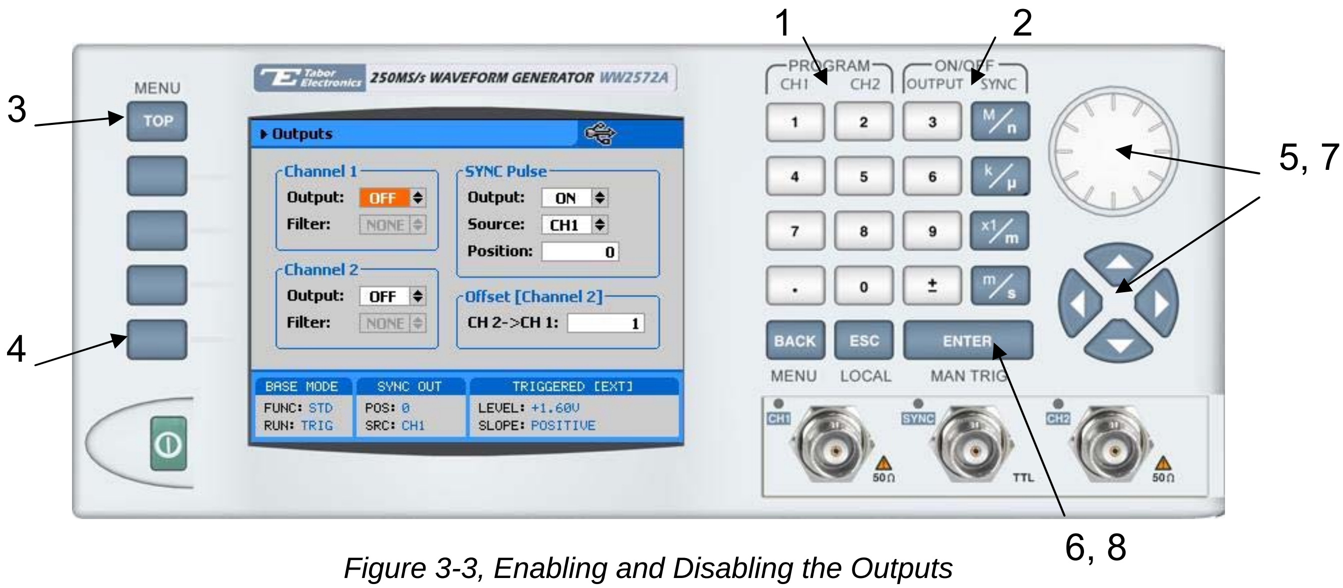


Figure 3-3, Enabling and Disabling the Outputs

Alternately, the outputs can be turned on and off from the Outputs sub menu. Use the following procedure to open the Outputs dialog box press to toggle output state:

3. Press TOP to display the root menu
4. Press Outputs to open the Outputs dialog box as shown in Figure 3-3
5. Use the dial or arrow keys to access the required field. Focus is on a filed that is painted orange.
6. To edit the field press Enter. The edited field will turn white with orange borders
7. Use the dial or arrow keys to change the field
8. Press Enter again to lock in the setting

Selecting a Waveform Type

There are four main types of waveforms that the 2572A can produce: Standard, Arbitrary, Sequenced and Modulated waveforms. Standard and modulated waveforms are computed from equations and tables that are built into the program. The instrument can output arbitrary and sequenced waveforms however, only after waveform data has been downloaded into its memory.

Digital patterns can also be generated from a rear-panel connector in conjunction with the arbitrary waveform output. The digital patterns, however, will be described and discussed separately in this chapter.

Refer to Figure 3-4 and use the following procedure to select an output type.

Note that there are sub-menus associated with each output type menu. Accessing and using these sub-menus is described later in this chapter. The numbers on Figure 3-4 correspond to the procedure steps in the following description.

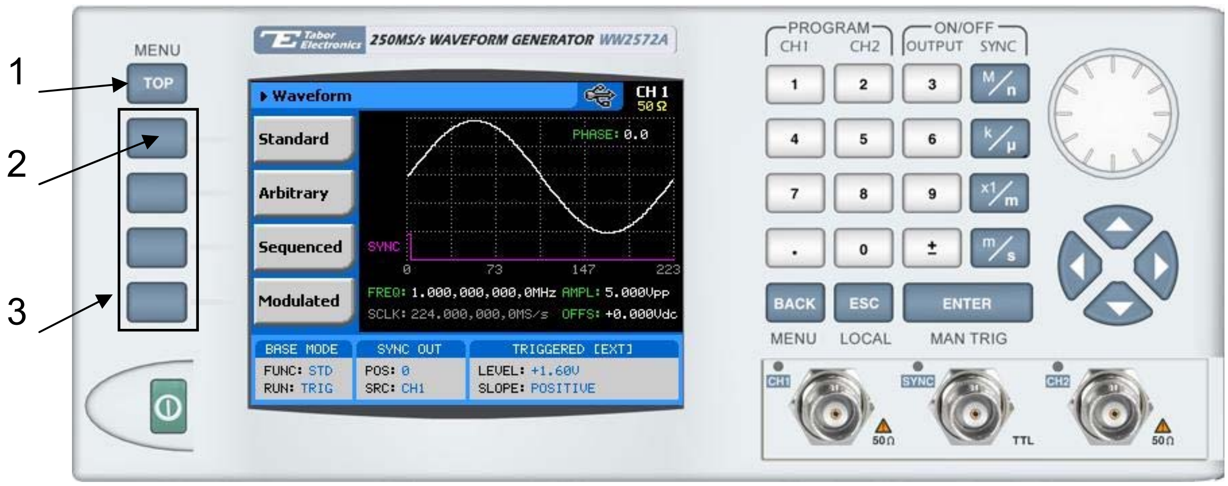


Figure 3-4, Selecting an Output Waveform Type

Alternately, the outputs can be turned on and off from the Outputs sub menu. Use the following procedure to open the Outputs dialog box press to toggle output state:

1. Press TOP to display the root menu
2. Press Waveforms, the display as shown in Figure 3-4 will open.
3. Press one of the soft keys to select the required waveform.

Note the waveform screen shows a sine waveform. The sine is the default waveform. After you select a different waveform type, the screen will be updated with a new symbol, which is associated with the new type.

Note

The picture in the 2572A LCD display is an icon only. The actual output waveform may look entirely different.

Changing the Output Frequency

You should be careful not to confuse waveform frequency with sample clock frequency. The waveform frequency parameter is valid for standard waveforms only and controls waveform frequency at the output connector; The sample clock frequency parameter is valid for arbitrary and sequenced waveforms only and defines the frequency of which the generator clocks data points.

Standard waveform frequency is measured in units of Hz. Arbitrary waveform sample clock frequency is measured in units of S/s (samples per second). The frequency of a given arbitrary waveform at the output connector is dependant on sample clock frequency, the number of data points, and other specific waveform definitions.

The frequency of the output waveform will change only if a standard waveform is generated. First select a standard waveform as described earlier and then proceed with frequency modification.

Observe Figure 3-5 and modify frequency using the following procedure. The index numbers in Figure 3-5 correspond to the procedure steps in the following description.

1. Press the Frequency soft key to select the frequency parameter
2. Use the numeric keypad to program the new frequency value
3. Press M, k, x1 or m to terminate the modification process

Alternately, you can modify the frequency value with the dial and arrow keys but then the termination of the process is by pressing Enter only.

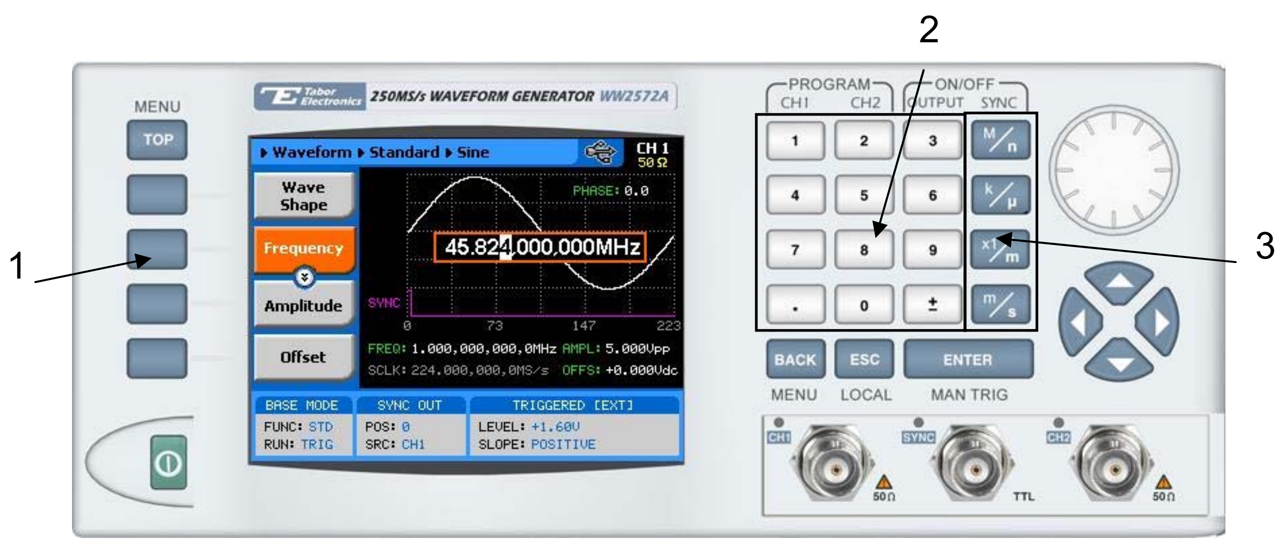


Figure 3-5, Modifying Output Frequency

Note

If you use the dial or arrow keys to modify the frequency parameter, the output is updated immediately as soon as you modify the parameter. The final value will be locked in as soon as you press Enter. If you choose to leave the old value, press Cancel to terminate the process and to discard of any change made to this parameter

Changing the Sample Clock Frequency

The frequency of the sample clock will affect the output waveform only if arbitrary or sequenced waveforms are generated. First select an arbitrary waveform as described earlier and then proceed with sample clock frequency modification.

Observe Figure 3-6 and modify the sample clock using the following procedure. The index numbers in Figure 3-6 correspond to the procedure steps in the following description.

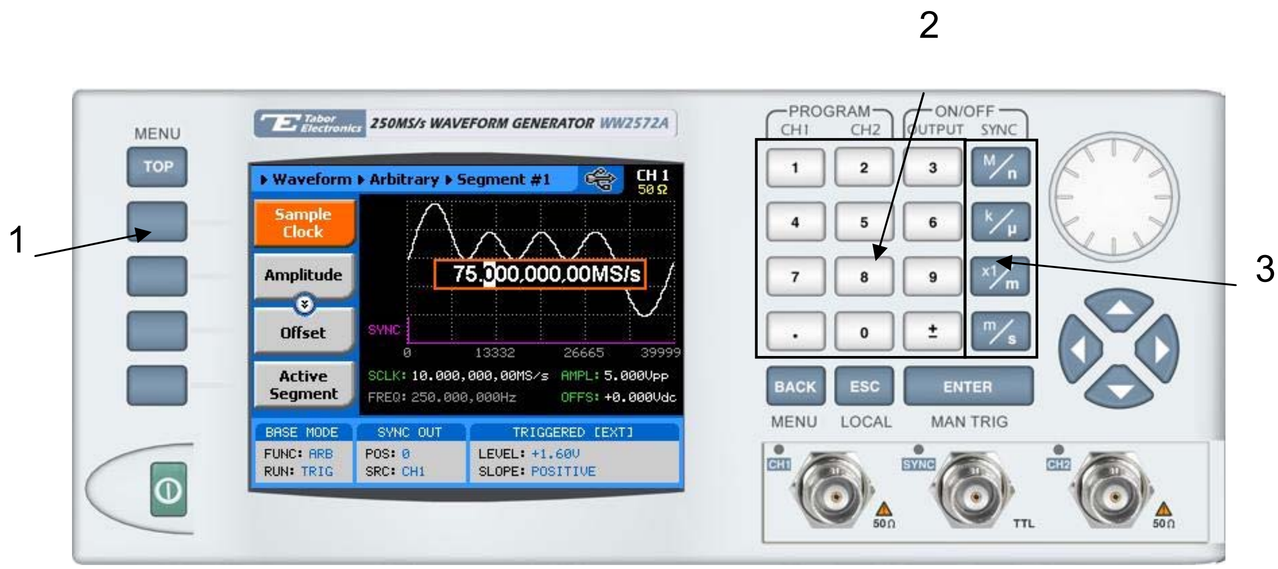


Figure 3-6, Modifying Sample Clock Frequency

1. Press the Frequency soft key to select the Sample Clock parameter
2. Use the numeric keypad to dial the new sample clock frequency value
3. Press “M” for MHz, “k” for kHz, “x1” for Hz, or “m” for mHz to terminate the modification process

Alternately, you can modify the sample clock frequency value with the dial and arrow keys but then the termination of the process is by pressing Enter only.

Note

If you use the dial or arrow keys to modify the sample clock frequency parameter, the output is updated immediately as soon as you modify the parameter. The final value will be locked in as soon as you press Enter. If you choose to leave the old value, press Cancel to terminate the process and to discard of any change made to this parameter

Programming the Amplitude and Offset

Output amplitude and offset can be programmed independently and separately for each channel. Amplitude and offset are set within windows, so before you select values for these parameters, make sure you do not exceed the limits.

Amplitude and offset can be programmed independently as long as the following relationship between the two values is not exceeded:

$$Window \geq \frac{Amplitude}{2} + |Offset|$$

The first thing you do before you program amplitude and offset setting is define which of the channels is being programmed. The active channel is displayed at the upper right corner of the LCD display.

When the display shows 

at the upper right corner, you are currently programming channel 1 parameters. Keypads “1” and “2” are used as hot keys for channel selection. While not editing any parameter, press key “2” to program channel 2 parameters.

When the display shows 

at the upper right corner, you can proceed with channel 2 programming.

The amplitude and offset parameters are duplicated in multiple screens however, when changed for a specific function shape, the new value is updated on all screens for all other function shapes. Refer to Figure 3-7 and modify amplitude and offset using the procedure as described below. The index numbers in Figure 3-7 correspond to the procedure steps in the following description.

1. Press the Amplitude soft key button
2. Press Enter to edit the Amplitude value
3. Use the numeric keypad to program the new value

4. Press “m” for mV, or “x1” for volts to select the suffix letter.
5. Press Enter to lock in the value

Alternately, you can modify the amplitude value with the dial and arrow keys but then the termination of the process is by pressing Enter.

Offset is programmed the same way as amplitude except select Offset from the soft key menus to access the offset parameter.

Note

If you use the dial or arrow keys to modify the amplitude or offset parameters, the output is updated immediately as soon as you modify the parameter. The final value will be locked in as soon as you press Enter. If you choose to leave the old value, press Cancel to terminate the process and to discard of any change made to this parameter

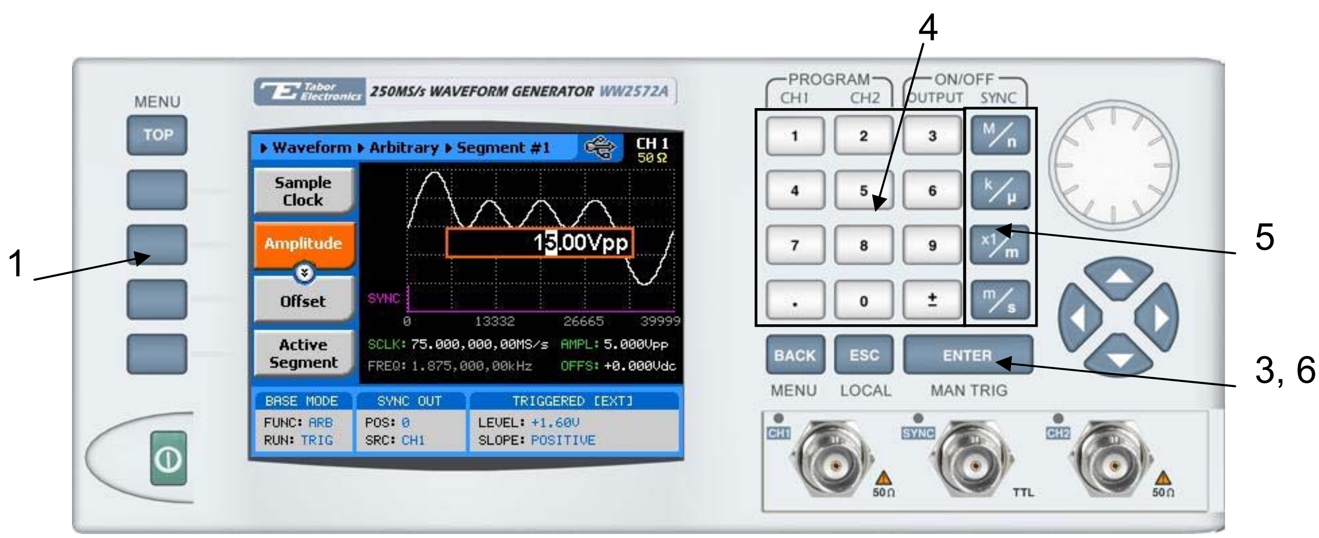


Figure 3-7, Programming Amplitude and Offset

Selecting a Run Mode

The Model 2572A offers four run modes: Continuous, Triggered, Gated and Burst.

The selected waveform is repeated continuously when the instrument is set to operate in Continuous mode. The continuous output can be turned on and off from a remote interface, and thus controlling the start and stop of the waveform from an external source. The operating mode defaults to continuous after reset.

Triggered, Gated, and Burst modes require an external signal to initiate output cycles. In some case, an internal trigger generator is available to generate the required trigger stimuli without the need to connect to external devices. Figure 3-8 show the run mode options. Press one of the soft keys in the left to select the required run mode.

Description of the various run modes and the parameters that are associated with each run mode is given in the following paragraphs.

Figure 3-8, Run Mode Options

Note

Burst run mode is shown in Figure 3-8 as an example however, the following description applies to all Run Mode menus.

In general, a specific run mode is selected from the Run Mode soft key menu. The screen as shown in Figure 3-8 is displayed. Proceed to select the run mode and to program parameters as follows:

1. Press one of the soft keys to select from: Continuous, Triggered, Gated or burst. The output will immediately be updated with the selected run mode

2. Use the arrow keys or the dial to scroll down to the parameter field you want to modify
3. Press Enter to edit the Divider value
4. Use the arrow keys or the dial to modify the edited parameter
5. Press Enter to lock in the value

Selecting the Modulation Run Modes

The 2572A run modes are shared by all waveform type: Standard, Arbitrary, Sequenced, including Modulated. However, when in modulation function, run mode options take different meaning. When in triggered, burst or gated run modes, the 2572A outputs sine carrier waveform (CW) until a valid trigger is received and then reacts to the trigger. If triggers cease to stimulate the input, the output resumes generating CW frequency only. Carrier frequency is common to all modulation functions and can be programmed from the modulation menus. If the above behavior is not desired, the 2572A can be programmed to output dc level when idle, generate the modulated signal when triggered and then, resume dc level position when the modulation cycle has ended. The baseline option is programmable from either the front panel or from remote.

Triggered Mode

In Triggered mode, the output remains at a DC level as long as a valid trigger signal has not occurred. Each time a trigger occurs, the 2572A generates one complete output waveform. At the end of the output cycle, the output resumes position at a DC level that is equal to the amplitude of the last point of the waveform.

The instrument may be triggered from one of the following sources: A rear panel input, designated as TRIG IN, front panel button, marked MAN TRIG and a remote command such as *TRG. When placed in EXT (external) trigger source, remote commands are ignored and the instrument monitors the TRIG IN connector or the MAN TRIG control. When in BUS, the hardware inputs are ignored and only remote commands can trigger the instrument. The MIX is a special trigger advance mode that senses the first remote trigger and only then enables the hardware sources.

There are four parameters you can adjust for this mode:

Source – defines the trigger source. EXT enables the rear panel trigger input, BUS enables remote commands and MIX enables remote command and after the first trigger enables the EXT source.

Slope – defines edge sensitivity for the trigger input

Level – sets the trigger level crossing point for the rear panel TRIG IN connector. Signal transition to above the trigger level will trigger the instrument. When the slope is set to negative, transitions to below the trigger level will trigger the instrument. Trigger level sensitivity and maximum level should be observed to avoid damaging the input

Trigger Delay – defines the state of the delayed trigger function.

Re-Trigger – defines the state of the re-trigger function

You may use the triggered mode to trigger standard, arbitrary sequenced and modulated waveforms. However, note that in modulation mode, the output generate CW frequency before and after the trigger event. The Trigger run mode parameters are shown in Figure 3-9.

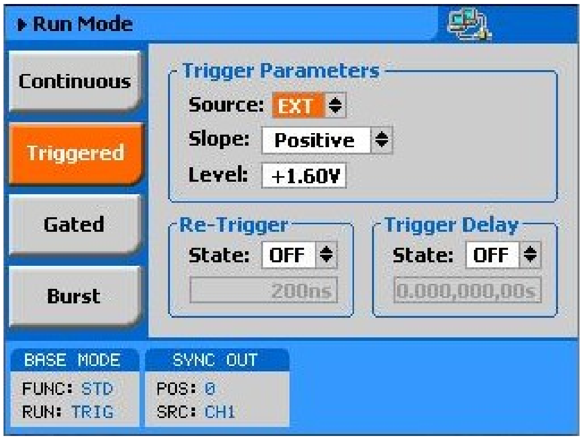


Figure 3-9, Trigger Run Mode Parameters

Delayed Trigger

The delayed trigger function operates in conjunction with the triggered and counted burst modes. When enabled, it inhibits the output signal for a pre-determined period after a valid trigger. The delay time defines the time that will lapse from a valid trigger (hardware or software) to output. To enable the delayed trigger feature, scroll down to the Trigger Delay State field and press Enter. Use the down key to change the sate to ON and press enter again to lock in the state position. The delay field then becomes active. Scroll down to the delay field and press enter. Modify the delay to match your delay requirement and press Enter again.

Note that the minimum delay is 200ns and can be increased to over 20 seconds with 20ns resolution.

Re-Trigger

The re-trigger function operates in conjunction with the triggered and counted burst modes. When enabled, it does not modify the output except when a valid trigger is received. It then starts an automatic sequence of internal triggers that generate repeated output cycles or bursts. The time in the re-trigger group defines the time that will lapse from the end of the signal to the start of the next signal.

To enable the re-trigger feature, scroll down to the Re-Trigger State field and press Enter. Use the down key to change the sate to ON and press enter again to lock in the state position. The re-trigger time field then becomes active. Scroll down to the re-trigger time field and press enter. Modify the time to match your requirement and press Enter again.

Note that the minimum re-trigger interval is 200ns and can be increased to over 20 seconds with 20ns resolution.

Gated Mode

When set to gated mode, the 2572A output remains at a DC level as long as the rear-panel TRIG IN signal remains inactive. The output gates on and off between two transitions, either positive or negative, depending on the slope setting. Only the rear panel TRIG IN connector can be used for operating the gated mode.

When placed in gated mode, the generator idles on a DC level until the first gate on transition. The signal will complete after the gate off transition and the generator will once again resume DC level equal to the last point of the waveform.

There are two parameters you can adjust for the gated mode:

Source – defines the gating signal source. Since the gated run mode relies on hardware transitions, only EXT is a valid source for the gated mode.

Slope – defines if the generator is gating on and off on positive or negative transitions.

Level – sets the trigger level crossing point for the rear panel TRIG IN connector. Signal transition to above the trigger level will gate the instrument. When the slope is set to negative, transitions to below the trigger level will gate the instrument. Trigger level sensitivity and maximum level should be observed to avoid damaging the input

You may use the gated mode to gate standard, arbitrary, sequenced and modulated waveforms. The gated run mode parameters are shown in Figure 3-10.

Figure 3-10, Gated Mode Parameters

Burst Mode

Burst mode is similar to Triggered mode with the exception that only one trigger signal is needed to generate a counted number of output waveforms. In Burst mode, the output remains at a DC level as long as a valid trigger signal has not occurred. Each time a trigger occurs, the 2572A generates a counted number of burst of waveforms. At the end of the output burst, the output resumes position at a DC level that is equal to the amplitude of the last point of the waveform.

The instrument may be triggered from one of the following sources: A rear panel input, designated as TRIG IN, front panel button, marked MAN TRIG and a remote command such as *TRG. When placed in EXT (external) trigger source, remote commands are ignored and the instrument monitors the TRIG IN connector or the MAN TRIG control. When in BUS, the hardware inputs are ignored and only remote commands can trigger the instrument. The MIX is a special trigger advance mode that senses the first remote trigger and only then enables the hardware sources.

There are four parameters you can adjust for this mode:

Source – defines the trigger source. EXT enables the rear panel trigger input, BUS enables remote commands and MIX enables remote command and after the first trigger enables the EXT source.

Slope – defines edge sensitivity for the trigger input

Level – sets the trigger level crossing point for the rear panel TRIG IN connector. Signal transition to above the trigger level will trigger the instrument. When the slope is set to negative, transitions to below the trigger level will trigger the instrument. Trigger level sensitivity and maximum level should be observed to avoid damaging the input

Burst – Defines the number of cycles the generator will output after a trigger signal. Each channel can be programmed to have a unique burst counter.

Trigger Delay – defines the state of the delayed trigger function.

Re-Trigger – defines the state of the re-trigger function

You may use the counted burst mode in conjunction with standard, arbitrary and modulated waveforms only. Sequenced waveforms can not be used in burst mode. The Burst run mode parameters are shown in Figure 3-11.

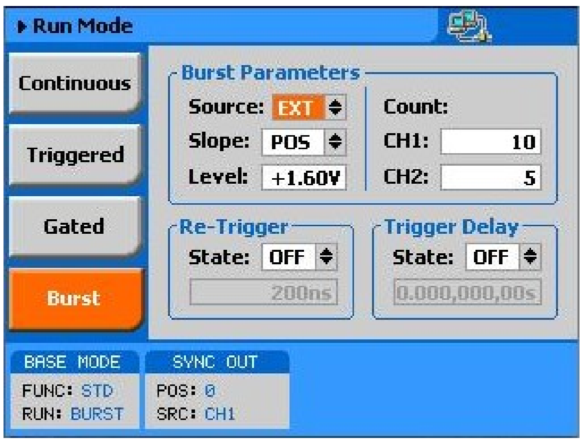


Figure 3-11, Burst Run Mode Parameters

Using the Manual Trigger

The manual trigger allows you to trigger or gate the 2572A directly from the front panel. This button is active only when the generator is placed in external trigger only. The MAN TRIG button is a second function to the Enter button and can be used only when the display is not in editing mode.

Using the SYNC Output

For safety reasons, every time you turn the 2572A OFF and ON, the SYNC output defaults to OFF. If you want to use the SYNC output you must turn it on immediately after you power up the generator. You can turn the SYNC on using the ON/OFF SYNC hot key as was explained earlier in this chapter or you can do it from the Outputs menus shown in Figure 3-12.

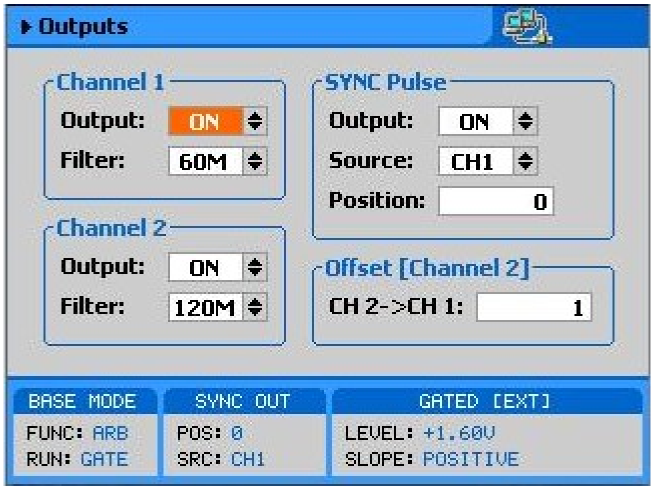


Figure 3-12, SYNC and Filter Parameters

There are four parameters you can adjust for the SYNC output:

Output – Turns the SYNC output on and off. Note that the termination of the output state shifts the dc level to 0V but leaves a low impedance path to the connector and therefore, if your UUT (unit under test) is sensitive to level transitions, make sure you remove the cable from this connector before turning the output state off.

Source – Selects if the output is synchronized to channel 1 or 2. In fact, the two channels are always synchronized between themselves however, one may select either channel because the waveforms may be different for each channel and thus the selection options.

Position – Lets you place the sync start at any point along the length of the waveform. Placement resolution is 4 points. As default, the sync signal is positioned at the beginning of the waveform.

The SYNC parameters are shown in Figure 3-12. The Menu is accessible by selecting the Outputs soft key as shown in Figure 3-3.

Applying Filters

Two filters are available for each channel. These filters have fixed cutoff frequencies of which their properties are specified in Appendix A. The built-in filters are switched in after the DAC circuit and are used for reducing the noise, harmonics and spurious signals above the cutoff frequency.

The built-in filters are available for the user in standard, arbitrary, sequenced and modulated modes. The only function where the Model 2572A does not allow external control is when standard sinusoidal waveform is selected.

Note

The default output function of the generator is the sine waveform. The instrument is using filters to reconstruct this waveform and therefore, the state of the filters can not be changed until another output function is selected. A setting conflict error will occur if one attempts to change the filter state before changing to another output function.

If you do not plan on using the filters, make sure that you leave the selection OFF. This will eliminate confusing setting conflicts.

Modification of the filter state and range is done from the Outputs menu. To access this menu select the Outputs screen as shown in Figure 3-3 and modify the parameters as shown in Figure 3-12.

Selecting the SCLK Source and Reference

In cases where synchronization to other instruments in a system is needed, you have two options: Use an external clock source for the 10MHz reference clock or replace the internal sample clock generator entirely with an external clock source. Either way, this is a major twist in the 2572A basic operation because if, for any reason, you leave one or both source options on external and do not apply the necessary signal to the input, the operation of the generator will be impeded without visual references that something is wrong.

The SCLK and the 10MHz reference source menu were placed in the Customize menu, as shown in Figure 3-13. Change these settings only if you are absolutely sure that another reference source is available at the appropriate inputs.

The SCLK input is located on the rear panel. Use this input to replace the internal sample clock generator. The external sample clock input accepts ECL level signals, terminated to –2V into 50Ω.

The 10MHz reference input is also located on the rear panel. It accepts TTL level signals only. Note that the 2572A internal reference is accurate to 1ppm.

To display and modify the SCLK or the 10MHz clock source, press TOP, then Utility and scroll down to the Customize option.

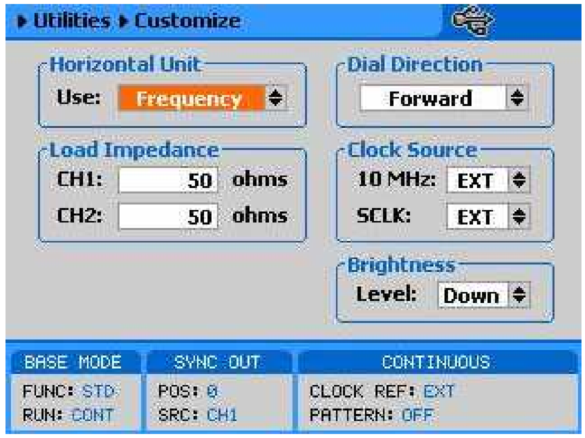


Figure 3-13, Modifying the SCLK and 10MHz Clock Source

Generating Standard Waveforms

The majority of applications require the use of common waveforms such as sinusoidal, triangular and square. In fact, these are the only waveforms that function generators can produce and therefore, one should expect that these waveforms be available even in a complex generator such as this. The 2572A, being a completely digital instrument, has a library of built-in waveforms that allow generation of these basic waveforms plus many more.

By default, the 2572A is programmed to generate one of the common waveforms in the market – sine waveform. Figure 3-14 shows a list of all other waveforms that the instrument can generate however, one must not forget that the waveforms are generated digitally from either lookup tables or formulated from standard equations and therefore, each time a new waveform is selected, one should expect to have a slight delay between the time the waveform was selected to when it is being generated at the output connector.

The waveforms that reside in the built- in library are referred to as Standard Waveforms. The meaning of this term is that these waveforms have standard characteristics that is commonly known and or associated with these waveforms. For example, sine waveform has known spectral and power distribution that could be compared to published mathematical equations. The quality of the generator determines how closeness of the waveform generation to its pure mathematical properties.

The 2572A has a library of 9 standard waveforms: Sine, Triangle, Square, Ramp, pulse, sinc, Gaussian, Exponential, DC and Noise. Some of the parameters for these waveforms can be modified to fine tune the waveforms for specific applications. For example, changing the sine start phase of the 2nd channel can create a 2-phase sine system. The standard waveforms and their parameters that can be modified are summarized in the following paragraphs.

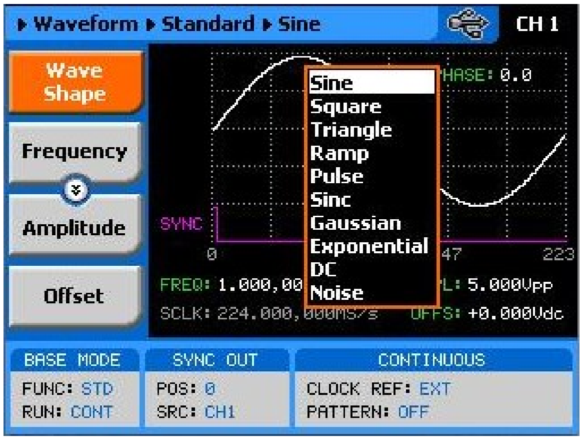


Figure 3-14, Built-in Standard Waveforms Menu

Sine Wave

The sine waveform is the most commonly used waveform. The waveform is generated from a lookup table that has 1000 points and therefore, the sine waveform is generated with 1000-points accuracy up to about frequency setting of 250kHz (output frequency = sample clock frequency / number of points). As frequency is increased above 250kHz the number of points is being reduced automatically up to a point where filters are being switched in to reconstruct the waveform. The technique of generating sine waves above certain frequency is not within the scope of this manual however, one should remember that above certain frequency the waveform is loosing purity and quality because the number of points that are available to construct the waveform are inversely proportional to the output frequency. This statement is true for all standard waveforms and this is the reason for limiting the upper frequency of certain waveforms.

There are certain menus that provide access to sine waveform parameters; These are:

Frequency – programs the frequency of the sine waveform. Note that at low frequencies (up to about 250kHz), when you modify the frequency parameter, the output responds with coherent change however, at higher frequencies, the waveform has to be re-computed every time and therefore, when you modify the frequency, the output wanders until the waveform is being re-computed and then restored to full accuracy.

Amplitude – programs the amplitude of the output waveform. Note that amplitude and offsets can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the amplitude parameter in this menu overrides amplitude setting in all other menus.

Offset – programs the offset of the output waveform. Note that offset and amplitude can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the offset parameter in this menu overrides offset setting in all other menus.

Phase – sets the start phase of the output waveform. You will not be able to see any change in the waveform if you generate a continuous sine waveform however, if you place the generator in triggered run mode, the output will start the sine wave generation from a point defined by the Phase parameter. The start phase is programmed in units of degree.

Reset Parameters – Resets the sine wave parameters to their original factory defaults.

Square Wave

The square waveform is a commonly used waveform. The waveform is generated from a lookup table that has 1000 points and therefore, the square waveform is generated with 1000-points accuracy up to about frequency setting of 250kHz (output frequency = sample clock frequency / number of points). As frequency is increased above 250kHz the number of points is being reduced automatically.

There are certain menus that provide access to square waveform parameters; These are:

Frequency – programs the frequency of the square waveform. Note that at low frequencies (up to about 250kHz), when you modify the frequency parameter, the output responds with coherent change however, at higher frequencies, the waveform has to be re-computed every time and therefore, when you modify the frequency, the output wanders until the waveform is being re-computed and then restored to full accuracy.

Amplitude – programs the amplitude of the output waveform. Note that amplitude and offsets can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the amplitude parameter in this menu overrides amplitude setting in all other menus.

Offset – programs the offset of the output waveform. Note that offset and amplitude can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the offset parameter in this menu overrides offset setting in all other menus.

Duty Cycle – programs the square wave duty cycle (pulse width to period ratio). The duty cycle is programmed as percent of the period. The default value is 50%.

Reset Parameters – Resets the square wave parameters to their original factory defaults.

Triangle Wave

The triangle waveform is a commonly used waveform. The waveform is generated from a lookup table that has 1000 points and therefore, the triangle waveform is generated with 1000-points accuracy up to about frequency setting of 250kHz (output frequency = sample clock frequency / number of points). As frequency is increased above 250kHz the number of points is being reduced automatically. The triangular waveform is reasonable up to about 25MHz where 10 points are available to generate its shape. As the number of points decrease further, the shape becomes distorted to a point where it is not usable anymore.

There are certain menus that provide access to triangle waveform parameters; These are:

Frequency – programs the frequency of the triangle waveform. Note that at low frequencies (up to about 250kHz), when you modify the frequency parameter, the output responds with coherent change however, at higher frequencies, the waveform has to be re-computed every time and therefore, when you modify the frequency, the output wanders until the waveform is being re-computed and then restored to full accuracy.

Amplitude – programs the amplitude of the output waveform. Note that amplitude and offsets can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the amplitude parameter in this menu overrides amplitude setting in all other menus.

Offset – programs the offset of the output waveform. Note that offset and amplitude can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the offset parameter in this menu overrides offset setting in all other menus.

Phase – sets the start phase of the output waveform. You will not be able to see any change in the waveform if you generate a continuous triangular waveform however, if you place the generator in triggered run mode, the output will start the triangle wave generation from a point defined by the Phase parameter. The start phase is programmed in units of degree.

Reset Parameters – Resets the triangular wave parameters to their original factory defaults.

Ramp Wave

The ramp waveform is a special case of the triangular waveform with a slight difference, the ramp can be adjusted for its rise and fall times. The ramp waveform is a very common waveform and is required for numerous applications however, not being a true ramp generator, the ramp parameters are computed and programmed as percent of the ramp period. The waveform is computed every time a parameter is modified. 1000 points are allocated for the ramp shape up to about frequency setting of 250kHz (output frequency = sample clock frequency / number of points). As frequency is increased above 250kHz the number of points is being reduced automatically. The ramp waveform is reasonable up to about 25MHz where 10 points are available to generate its shape. As the number of points decrease further, the resolution of the parameters is lost to a point where it is not usable anymore.

There are certain menus that provide access to ramp waveform parameters; These are:

Frequency – programs the frequency of the ramp waveform. Note that at low frequencies (up to about 250kHz), when you modify the frequency parameter, the output responds with coherent change however, at higher frequencies, the waveform has to be re-computed every time and therefore, when you modify the frequency, the output wanders until the waveform is being re-computed and then restored to full accuracy.

Amplitude – programs the amplitude of the output waveform. Note that amplitude and offsets can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the amplitude parameter in this menu overrides amplitude setting in all other menus.

Offset – programs the offset of the output waveform. Note that offset and amplitude can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the offset parameter in this menu overrides offset setting in all other menus.

Delay – sets the delay time for the ramp start. The delay is programmed as percent of the ramp period.

Rise – programs the ramp rise time. The rise time is programmed as percent of the ramp period.

Fall – programs the ramp fall time. The fall time is programmed as percent of the ramp period.

Note that the sum of the delay, rise and fall times cannot exceed 100%. If the sum is less than 100%, the end of the ramp will remain at a dc level to the completion of the period.

Reset Parameters – Resets the ramp wave parameters to their original factory defaults.

Pulse Wave

The pulse waveform is a very common waveform and is need for the majority of the applications however, not being a true pulse generator, the pulse parameters are computed and programmed as percent of the pulse period. The waveform is computed every time a parameter is modified. 1000 points are allocated for the pulse shape up to about frequency setting of 250kHz (output frequency = sample clock frequency / number of points). As frequency is increased above 250kHz the number of points is being reduced automatically. The pulse waveform is reasonable up to about 25MHz where 10 points are available to generate its shape. As the number of points decrease further, the resolution of the parameters is lost to a point where it is not usable anymore.

There are certain menus that provide access to pulse waveform parameters; These are:

Frequency – programs the frequency of the pulse waveform. Note that at low frequencies (up to about 250kHz), when you modify the frequency parameter, the output responds with coherent change however, at higher frequencies, the waveform has to be re-computed every time and therefore, when you modify the frequency, the output wanders until the waveform is being re-computed and then restored to full accuracy.

Amplitude – programs the amplitude of the output waveform. Note that amplitude and offsets can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the amplitude parameter in this menu overrides amplitude setting in all other menus.

Offset – programs the offset of the output waveform. Note that offset and amplitude can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the offset parameter in this menu overrides offset setting in all other menus.

Delay – sets the delay time for the ramp start. The delay is programmed as percent of the ramp period.

Rise – programs the ramp rise time. The rise time is programmed as percent of the ramp period.

Fall – programs the ramp fall time. The fall time is programmed as percent of the ramp period.

Note that the sum of the delay, rise, high and fall times cannot exceed 100%. If the sum is less than 100%, the end of the pulse will remain at a dc level to the completion of the period.

Reset Parameters – Resets the pulse wave parameters to their original factory defaults.

Sinc Wave

The sinc pulse (sine x/x) waveform is a very common waveform and is required in many applications however, not being a true pulse generator, the sinc pulse parameters are re-computed every time a parameter is changed. 1000 points are allocated for the sinc pulse shape up to about frequency setting of 250kHz (output frequency = sample clock frequency / number of points). As frequency is increased above 250kHz the number of points is being reduced automatically. The sinc pulse waveform is reasonable up to about 25MHz where 10 points are available to generate its shape. As the number of points decrease further, the shape of the pulse is deteriorated to a point where it is not usable anymore.

There are certain menus that provide access to sinc pulse waveform parameters; These are:

Frequency – programs the frequency of the sinc waveform. Note that at low frequencies (up to about 250kHz), when you modify the frequency parameter, the output responds with coherent change however, at higher frequencies, the waveform has to be re-computed every time and therefore, when you modify the frequency, the output wanders until the waveform is being re-computed and then restored to full accuracy.

Amplitude – programs the amplitude of the output waveform. Note that amplitude and offsets can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the amplitude parameter in this menu overrides amplitude setting in all other menus.

Offset – programs the offset of the output waveform. Note that offset and amplitude can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the offset parameter in this menu overrides offset setting in all other menus.

#Cycles – sets the number of “0” crossing cycles for the sinc function. Note that the default value is 4. Changing the value to a different number requires re-calculation of the waveform and may take a few seconds until the waveform is computed and generated at the output connector.

Reset Parameters – Resets the sinc pulse wave parameters to their original factory defaults.

Gaussian Wave

The gaussian pulse waveform is useful in many applications. The gaussian pulse parameters are re-computed every time a parameter is changed. 1000 points are allocated for the gaussian pulse shape up to about frequency setting of 250kHz (output frequency = sample clock frequency / number of points). As frequency is increased above 250kHz the number of points is being reduced automatically. The gaussian pulse waveform is reasonable up to about 25MHz where 10 points are available to generate its shape. As the number of points decrease further, the shape of the pulse is deteriorated to a point where it is not usable anymore.

There are certain menus that provide access to gaussian pulse waveform parameters; These are:

Frequency – programs the frequency of the sinc waveform. Note that at low frequencies (up to about 250kHz), when you modify the frequency parameter, the output responds with coherent change however, at higher frequencies, the waveform has to be re-computed every time and therefore, when you modify the frequency, the output wanders until the waveform is being re-computed and then restored to full accuracy.

Amplitude – programs the amplitude of the output waveform. Note that amplitude and offsets can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the amplitude parameter in this menu overrides amplitude setting in all other menus.

Offset – programs the offset of the output waveform. Note that offset and amplitude can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the offset parameter in this menu overrides offset setting in all other menus.

Exponent – sets the exponent factor for the gaussian function. Changing the default exponent value to a different number requires re-calculation of the waveform and may take a few seconds until the waveform is computed and generated at the output connector.

Reset Parameters – Resets the gaussian pulse wave parameters to their original factory defaults.

Exponential Wave

The exponential pulse waveform is useful in applications simulating capacitor charge or discharge. Not being a true pulse generator, the exponential pulse parameters are re-computed every time a parameter is changed. 1000 points are allocated for the exponential pulse shape up to about frequency setting of 250kHz (output frequency = sample clock frequency / number of points). As frequency is increased above 250kHz the number of points is being reduced automatically. The exponential pulse waveform is reasonable up to about 25MHz where 10 points are available to generate its shape. As the number of points decrease further, the shape of the pulse is deteriorated to a point where it is not usable anymore.

There are certain menus that provide access to sinc pulse waveform parameters; These are:

Frequency – programs the frequency of the sinc waveform. Note that at low frequencies (up to about 250kHz), when you modify the frequency parameter, the output responds with coherent change however, at higher frequencies, the waveform has to be re-computed every time and therefore, when you modify the frequency, the output wanders until the waveform is being re-computed and then restored to full accuracy.

Amplitude – programs the amplitude of the output waveform. Note that amplitude and offsets can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the amplitude parameter in this menu overrides amplitude setting in all other menus.

Offset – programs the offset of the output waveform. Note that offset and amplitude can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the offset parameter in this menu overrides offset setting in all other menus.

Exponent – sets the exponent factor for the exponential function. Setting the exponent to a negative value inverts the exponential function. Changing the default exponent value to a different number requires re-calculation of the waveform and may take a few seconds until the waveform is computed and generated at the output connector.

Reset Parameters – Resets the exponential pulse wave parameters to their original factory defaults.

DC Wave

The DC waveform is useful applications requiring simply an accurate DC level.

There are certain menus that provide access to the DC waveform parameters; These are:

DC Level – programs the level of the DC output function. The amplitude is programmed in units of volts and generated continuously at the output connector in a similar way as a power supply generates its output. Note however, that the amplitude is calibrated when the output is terminated into 50Ω load impedance.

Reset Parameters – Resets the DC amplitude parameter to its original factory default.

Noise Wave

The noise waveform is useful in applications requiring generation of simple noise. The spectral spread of the noise is pseudo-random and is limited in its bandwidth by the bandwidth parameter. The noise parameters are re-computed every time a parameter is changed. 1000 points are allocated for the noise shape up to about frequency setting of 250kHz (output frequency = sample clock frequency / number of points). As frequency is increased above 250kHz the number of points is being reduced automatically. The noise waveform is reasonable up to about 2.5MHz where 100 points are available to generate its shape. As the number of points decrease further, the shape of the noise is deteriorated to a point where it is not usable anymore.

There are certain menus that provide access to noise waveform parameters; These are:

Amplitude – programs the amplitude of the output waveform. Note that amplitude and offsets can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the amplitude parameter in this menu overrides amplitude setting in all other menus.

Offset – programs the offset of the output waveform. Note that offset and amplitude can be programmed freely within the specified amplitude window, as explained in the Programming Amplitude and Offset section in this chapter. Note that setting the offset parameter in this menu overrides offset setting in all other menus.

Bandwidth – sets the sample clock rate which generates the noise. It also serves as a simple tool to limit the bandwidth of the noise to a know value.

Note that while generating noise, bear in mind that the noise is generated in a certain memory size and it is being repeated over and over until the function is disabled. Therefore, the noise is not really random as is the pure translation of the word.

Reset Parameters – Resets the gaussian pulse wave parameters to their original factory defaults.

Generating Arbitrary Waveforms

In general, the Model 2572A cannot by itself create arbitrary waveforms. If you want to use arbitrary waveforms, you must first load them into the instrument. The 2572A is supplied with waveform creation and editing, called – ArbConnection. Besides waveform generation, ArbConnection has instrument control features, sequence table generator, FM and pulse composers and many other features that will be described separately. Figure 3-15 shows an example of a waveform that was created with the ArbConnection. Once the waveform is created on the screen, downloading it to the 2572A is just a click of a mouse away.

Detailed information on the structure of the arbitrary waveform and the commands that are needed to download arbitrary waveforms to the 2572A is given in Chapter 5. Information in this Chapter will give you some general idea what arbitrary waveforms are all about.

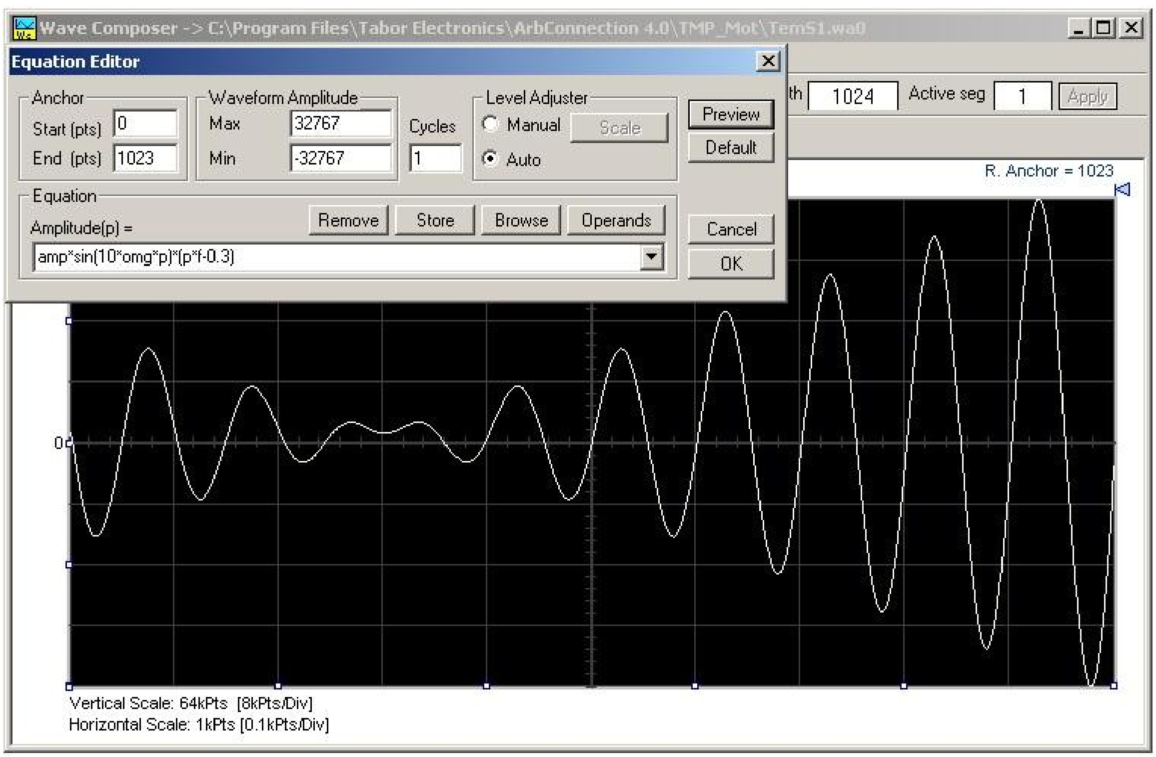


Figure 3-15, the Wave Composer Tool for Generating Arbitrary Waveforms

What Are Arbitrary Waveforms?

Arbitrary waveforms are generated from digital data points, which are stored in a working memory. The working memory is connected to a digital to analog converter (DAC) and a sample clock generator is clocking the data points, one at a time, to the output circuit. In slow motion, the output generates a waveform that resembles the look of a staircase. In reality, the DAC is generating amplitude hops that depend on bit arrangement and sample clock speed.

The working memory has two major properties: vertical resolution and memory depth.

Vertical Resolution – This term defines the precision along the vertical axis of which data points can be placed and generated by the DAC. The 2572A is using 16-bit DAC's to generate arbitrary waveforms. Converting 16 bits to precision shows that each data point can be placed along the vertical axis with a precision of 1/65,536.

Memory Depth – Defines how many data points can be stored for a single waveform cycle. The 2572A has 1M waveform memory capacity and 2M waveform memory as an option.

Having such large memory capacity is an advantage. Modern applications in the telecommunications industry require simulation of long waveforms without repeatable segments. The only way to create such waveforms is having sufficient memory depth. On the other hand, if you do not need to use very long waveforms but must have many other waveforms stored in your working memory, the 2572A lets you divide the memory bank to smaller segments and load different waveforms into each segment.

Generating Arbitrary Waveforms

Downloading waveforms to the 2572A and managing arbitrary memory are explained in the programming section of this manual. This section assumes that you have already downloaded waveforms and want the instrument to output these waveforms.

Refer to Figure 3-16 and use the following description to learn how to output arbitrary waveforms and how to program arbitrary waveform parameters. To select Arbitrary waveforms as the output waveform type press Waveforms, then Arbitrary. The screen as shown in Figure 3-16 will display and the output will already generate arbitrary waveforms. Note the channel you are currently program and make sure the icon at the upper right corner agrees with your required programming sequence. Use the following procedure to modify the parameters that are associated with the arbitrary waveform function:

1. Press the soft key next to the required parameter to display the edit field

2. Punch in the value using the numeric keypad. Be careful not to exceed parameter limits while you key the numbers
3. Select and press a suffix
4. Press Enter to lock in the new value

Alternately, after you display the edit field, you may use the dial and/or the arrow keys to modify the field then, press Enter to lock in the new value. If you did not make programming errors and did not make any mistake while downloading your waveform segment(s), then the output should generate your desired waveform.

There are four parameters that are available for programming in this window:

Sample Clock – Defines the sample clock frequency for the arbitrary waveform. Information how to modify the sample clock is given in this chapter.

Amplitude – Defines the amplitude of the arbitrary waveform. Note that regardless of the amplitude setting, the vertical resolution of which the waveform is generated is always 14 bits.

Offset – Defines the offset value of the arbitrary waveform. The offset and the amplitude can be freely programmed within a 10V window (+5V to -5V rails).

Segment Number – Defines which of the segments in the working memory is currently active at the output connector. As was discussed earlier, the working memory can be divided to 2k segments and different waveforms loaded in each segment. Any segment is available at the output connector only if it has been selected to be the active segment. The segment selection field lets you select any segment from 1 to n regardless if it contains waveform data or not so be careful when you select a segment number as it may be empty and no output will be generated.

Delete Segments – Allows distractive removal of all segments from the memory. In fact, this command does not erase the memory but only removes the table that defines start and stop for each segment location. If you have recorded your segment sizes you can always re-define the segment table, which will restore the original waveforms in each segment. There is however, no way back if you perform a download action after you delete the segment table.

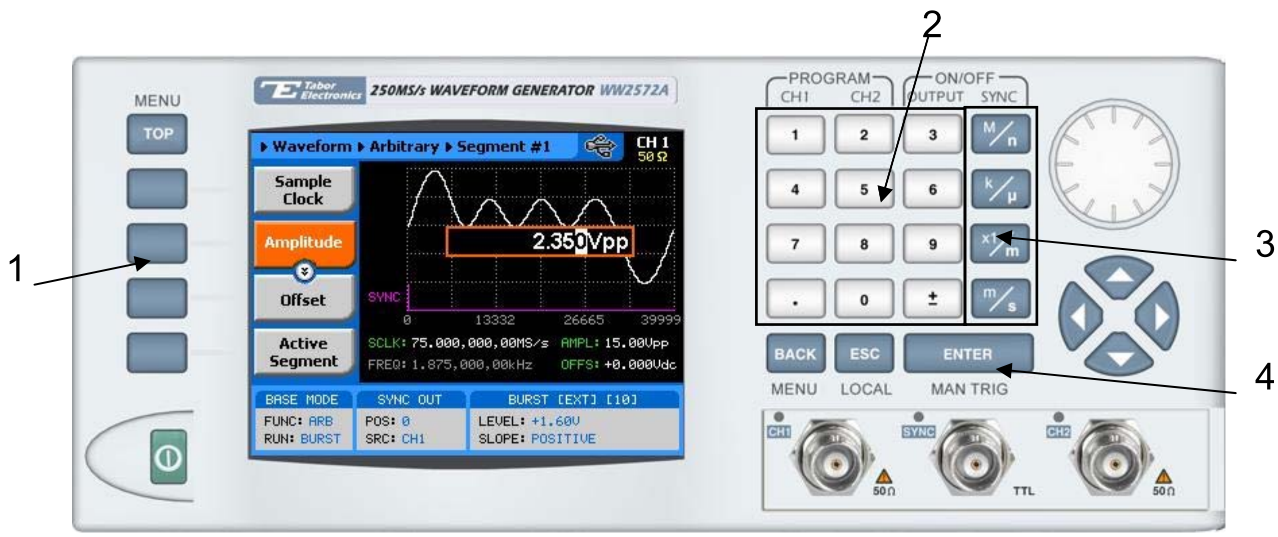


Figure 3-16, Programming Arbitrary Waveform Parameters

Generating Sequenced Waveforms

In general, the Model 2572A cannot by itself create sequenced waveforms. If you want to use sequenced waveforms, you must first load them into the instrument. The 2572A is supplied with waveform creation and editing, called – ArbConnection. Besides waveform creation, ArbConnection has instrument control features, sequence table generator, FM composer and many other features that will be described separately. To generate a sequence you must first download waveforms to the instrument, generate a sequence table and download the sequence table to the instrument. Sequences are generated easily using the waveform Studio as demonstrated in Figure 3-17. Note that different sequences can be generated for each channel.

Detailed information on the structure of the arbitrary waveform and the commands that are needed to download arbitrary waveforms to the 2572A is given in Chapter 5. There, you can also find information how to create and download sequence tables using SCPI programming commands. Information in this chapter will give you some general idea what sequenced waveforms are all about.

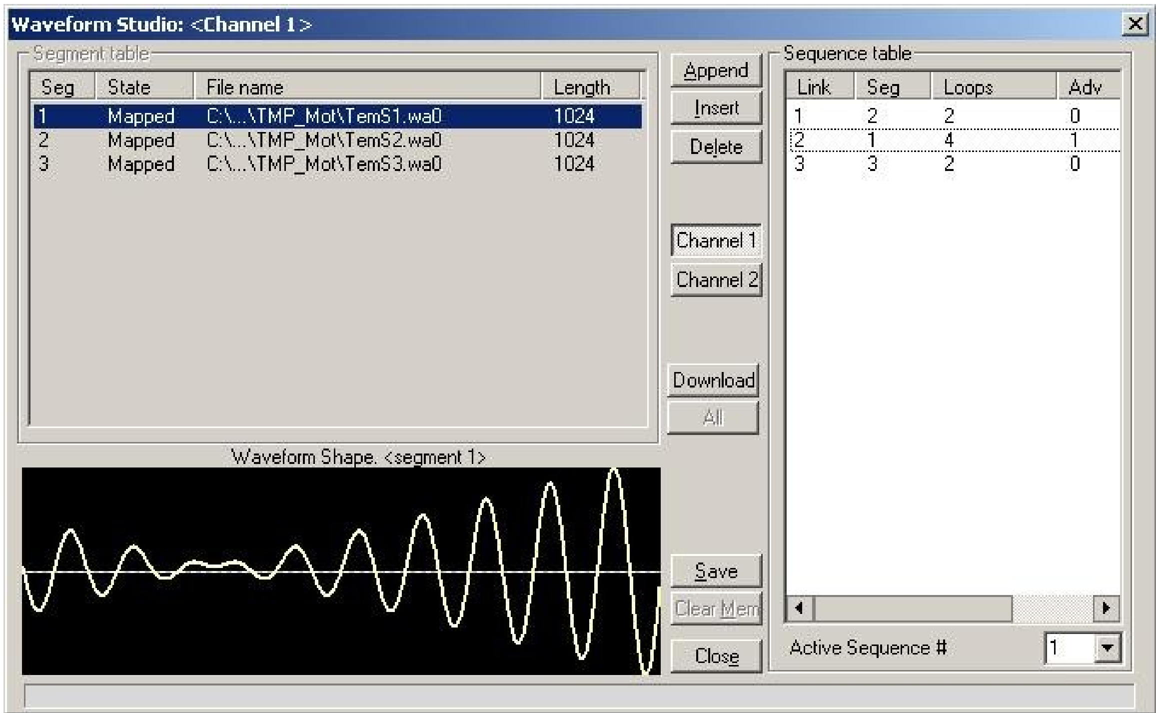


Figure 3-17, Using ArbConnection to Generate Sequences

What Are Sequenced Waveforms?

Sequenced waveforms are constructed from two or more arbitrary waveforms, which are linked and looped in any way you can imagine, as long as you observe the limitations set forth in the specification section of this manual.

The first thing to do before you can generate sequenced waveforms is download waveforms to the 2572A. You may use ArbConnection or any other application to create waveform segments. Then, you can build your sequence table. An example of how sequenced waveforms work with three different waveforms is demonstrated in Chapter 1, Figures 1-8 through 1-11.

The sequence table, as shown in Figure 3-17, specifies: Link, Seg, Loops and Adv. Description of the various elements within the sequence table is given below.

Link - This parameter defines an index array for the sequence generator. When generating sequences, the instrument steps though the link # in descending order therefore, make sure that you enter your waveform segments in exactly the order you would like them at the output.

Seg - This parameter associates waveform segments with links. You can use different segments for different links or you can use the same segment for a number of links. There are no limitations how you associate links to segments, except you can not program in the sequence table segments that were not defined earlier.

Loops – This parameter define how many times the segment will loop for the selected link. For example, if you program 2, the waveform will cycle twice through the same segment before transitioning to the next link.

Adv – This field is a special code that is used in conjunction with the mixed advance mode. This bit flags the 2572A if the selected link is continuous or stepped. Information on the Mixed sequence advance mode is given later. “0” flags continuous, “1” flags stepped.

Assuming that you already downloaded waveforms, created and downloaded sequence table, you can proceed now with the following description how to set the 2572A to output sequenced waveforms.

Refer to Figure 3-18 and use the following description to learn how to output sequenced waveforms and how to program sequence parameters. To select Sequenced waveforms as the output waveform type press Waveforms, then Sequenced. The screen as shown in Figure 3-18 will display and the output will already generate arbitrary waveforms. Note the channel you are currently program and make sure the icon at the upper right corner agrees with your required programming sequence.

Use the following procedure to modify the parameters that are associated with the Sequenced waveforms function:

1. Press the soft key next to the required parameter to display the edit field
2. Punch in the value using the numeric keypad. Be careful not to exceed parameter limits while you key the numbers
3. Select and press a suffix
4. Press Enter to lock in the new value

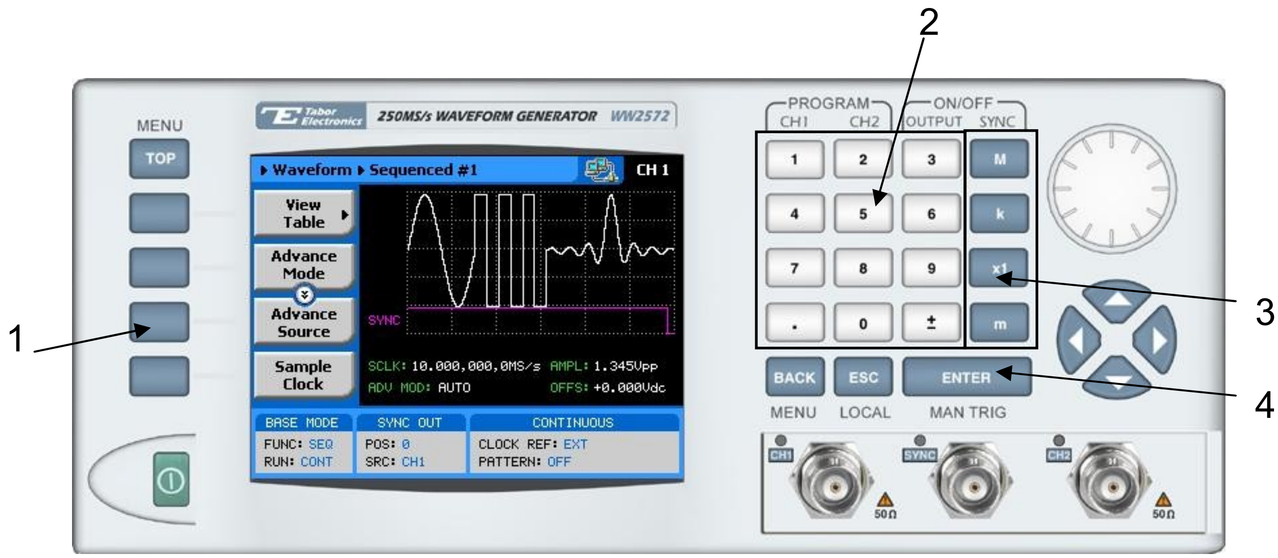


Figure 3-18, Sequence Parameters

Alternately, after you display the edit field, you may use the dial and/or the arrow keys to modify the field then, press Enter to lock in the new value. If you did not make programming errors and did not make any mistake while downloading your waveform segment(s), then the output should generate your desired waveform. There are seven parameters that are available for programming in this window:

View Table – Provides access to a sequence table. If no table was yet defined, you can define the sequence table from this menu. You can also edit an existing sequence table from this command. Information on editing the sequence table is given later.

Advance Mode – Defines the advance mode for the sequence. There are four advance mode options you can select from: Automatic, Stepped, Single and Mixed. A description of the various advance modes is given later. Note that advance mode depends on run mode and therefore, if you selected continuous run mode for the 2572A, you will not see the Single advance mode in the advance mode options list. Similarly, if you selected triggered run mode, Stepped and Mixed will be omitted from the list.

Advance Source – Defines which of the triggers inputs will advance the sequence. The advance source has no effect on Automatic advance source.

Sample Clock – Programs the sample clock frequency for the sequenced waveform. The final period of the complete sequence can be extracted from the following relationship:

Sequence Duration = 1 / (SCLK / n)

n = the number of waveform points in the sequence, including looped waveforms.

Amplitude – Defines the amplitude of the sequenced waveform.

Offset – Defines the offset of the sequenced waveform.

Active segment – Programs the active segment in a sequence. The SYNC will start at the active segment. There is no other purpose for this parameter in the sequence.

Tip

Use the arrow keys or the dial to scroll through the sequence parameters. The View Table will remain at the top while the others may be accessed selectively.

Editing the Sequence Table

If you select the View option as was described above, the sequence table will display as shown in Figure 3-19. If you already have a sequence table in place, you can edit the steps and modify the table per your new requirements. If you do not have a sequence table, you can construct the table from this screen however, you must make sure first that the segments you intend to use are loaded with waveforms.

Observe Figure 3-19 and note the commands that are available for editing and creating a sequence table.

Apply Changes – After you make modifications to the sequence table, you must use this command to update the internal registers with the new table settings and output updated immediately with the new settings. Changes, if made, in the table will be updated automatically when you exit the Edit Table screen however, the output will change to the new settings only after you re-enter the sequence function.

Edit Step – Provides entry point to the table. You may scroll between the fields using the arrow keys. If you want to edit a specific step, place the cursor on the step and press Enter. Edit the field as required and press Enter again to lock in the new value.

Insert Step – Allows adding another step to the sequence table. You have a choice of adding the step above or below the cursor line or at the end of the sequence table.

Go to Step – Provides entry point to the sequence table at a specific step number. Continue editing the step as described above.

Delete Step – Use this command to delete a specific step from the sequence. You'll be asked to confirm if you really want to delete the step before the final execution.

Delete Table – Use this command to delete the entire sequence table. You'll be asked to confirm if you really want to delete the step before the final execution.

Tip

Use the arrow keys or the dial to scroll through the edit parameters. The Apply Changes will remain at the top while the others may be accessed selectively.

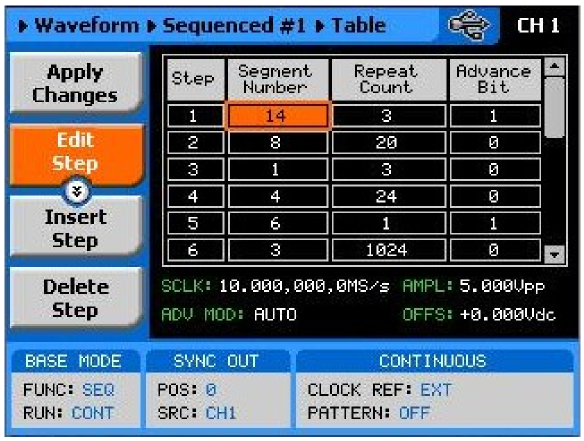


Figure 3-19, Editing the Sequence Table

Selecting Sequence Advance Modes

As was explained above, the 2572A steps through an index of links; It may loop a few times on a designated link and eventually, after the last link, the process repeats itself. Stepping from link to link through the sequence table is done automatically by the instrument. However, there are applications requiring control when and how the link is stepped. The 2572A has a number of sequence advance options: Auto, Stepped, Single and Mixed. These advance modes are described in the following.

Automatic – specifies continuous advance where the generator steps continuously and automatically through the links to the end of the sequence table and then repeats the sequence from the start. For example, if a sequence is made of three segments – 1, 2, and 3, and AUTO mode is used, the sequence will generate an infinite number of 1, 2, 3, 1, 2, 3, 1, 2, 3…waveforms. Of course, each link (segment) can be programmed with its associated loop (repeat) number. AUTO is the default sequence advance mode. Note, to use this mode, the 2572A must be in *continuous* operating mode.

Stepped – Using this advance mode, the sequence is advanced to the next link only when a valid trigger is received. The output of the 2572A generates the first segment continuously until a trigger signal advances the sequence to the next link. If repeats were selected for a segment, the loop counter is executed automatically. Note, although the trigger input controls advanced steps, to use this mode, the 2572A must be in *continuous* operating mode.

Single – Using this advance mode, the 2572A idles between steps until a valid trigger signal is sensed. The single advance mode requires that the 2572A be in trigger operating mode only. An attempt to select the Single advance mode when the instrument is in continuous operating mode can not be done. When triggered, the generator outputs one waveform cycle. Then, the output level idles at a DC level equal to the last point of the last generated waveform. If loops were programmed, the output will repeat this segment for n times automatically. Only after executing all of the programmed loops will the sequence step to the next assigned link.

Note

To use the single advance mode, the 2572A must be in programmed first to *triggered* run mode.

Mixed – This sequence advance mode allows combination of automatic and stepped links in one sequence table. To use this mode, in the sequence table, mark the Adv field “1” to flag stepped link or “0” for continuous link. Then, download the sequence table to the 2572A. Note, to use this mode, the 2572A must be in *continuous* operating mode. Step with a “0” bit assigned to a step it will advance automatically to the next step. If “1” is assigned to a step, the instrument will generate this step and its associated number of repeats then, will wait for the next trigger to advance to the next step.

1. Refer to Figure 3-20 and select the Advance Mode with the appropriate soft key. The advance mode options, as shown in Figure 3-20 will display. Use the dial or arrow keys to scroll down to the required mode and press Enter to lock in the selected mode.

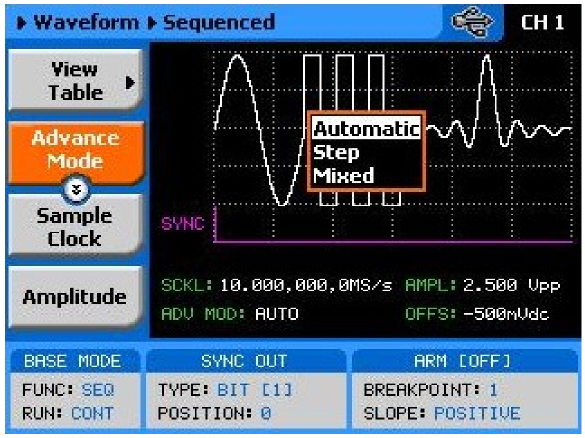


Figure 3-20, Sequence Advance Options

Note

The operating mode of the instrument, as selected from the Run Modes menu, affects the way that the 2572A lets you access the sequence advance mode parameter. If you are in continuous mode, as shown in Figure 3-20, you can select one of: AUTO, STEP, or MIXED. If you already selected the triggered run mode, you'll be able to select from AUTO, or SINGLE only as advance modes.

Generating Modulated Waveforms

Utilizing DDS (direct digital synthesis) technology, the Model 2572A is extremely frequency-agile. Changing the sample clock frequency is as easy as changing bits at the DDS control. The DDS has an extremely wide dynamic range with excellent linearity throughout the complete range. The properties of the DDS are passed on directly to the output therefore, the frequency is modulated within an extremely wide band, without loosing linearity. For example, the 2572A can sweep linearly from minimum to its maximum frequency whereas similar instruments that use the standard VCO design can sweep through 3 decades only.

The 2572A can produce: Sweep, FSK, PSK, ASK, Frequency and amplitude Hops, AM, FM and the most advanced modulation function - Arbitrary FM. It can also generate 3D modulation where amplitude, frequency and phase are swept as a function of time. When modulation is used from one channel, the other channel is 90° phase shifted, specifically convenient for applications such as I & Q modulation and for this purpose, the 2572A can also generate many types of (n)PSK and (n)QAM schemes.

Modulated waveforms are split in two parts:

1) As standard, the 2572A is supplied with five modulation functions: FM, AM, FSK, PSK and sweep.

2) When purchased with the Modulation Package (option 2), the following modulation functions are added: Arbitrary FM, Frequency and Amplitude hops, ASK and 3D. For the 2-channel version only (Model 2572A), the modulation package adds (n)PSK, (n)QAM and user QAM.

If you purchased the 2572A without the modulation package and need to upgrade your product with this option, it is still not too late. An upgrade kit is available for this purpose. Contact the factory for information and instructions how to purchase and install the modulation package; Information on all modulation functions is given in the following.

Modulated waveforms are selected from the waveforms menu. Figure 3-21 shows how to select the FM. To access this menu, press TOP, then waveforms and select the Modulated waveforms option.

Modulation type is selected from the Modulation Type menu. Refer to Figure 3-21 and use the following procedure to select the modulation type.

1. Press on the Modulation Type soft key. The following options will display: Off, AM, FM, Sweep Frequency Hop, Amplitude Hop, 3D, ASK, FSK, (n)PSK and (n)QAM
2. Using the dial or the up and down arrow keypad, scroll down to the desired option
3. Press Enter to lock in the selected modulation type. The output will be updated immediately after you press the Enter button.

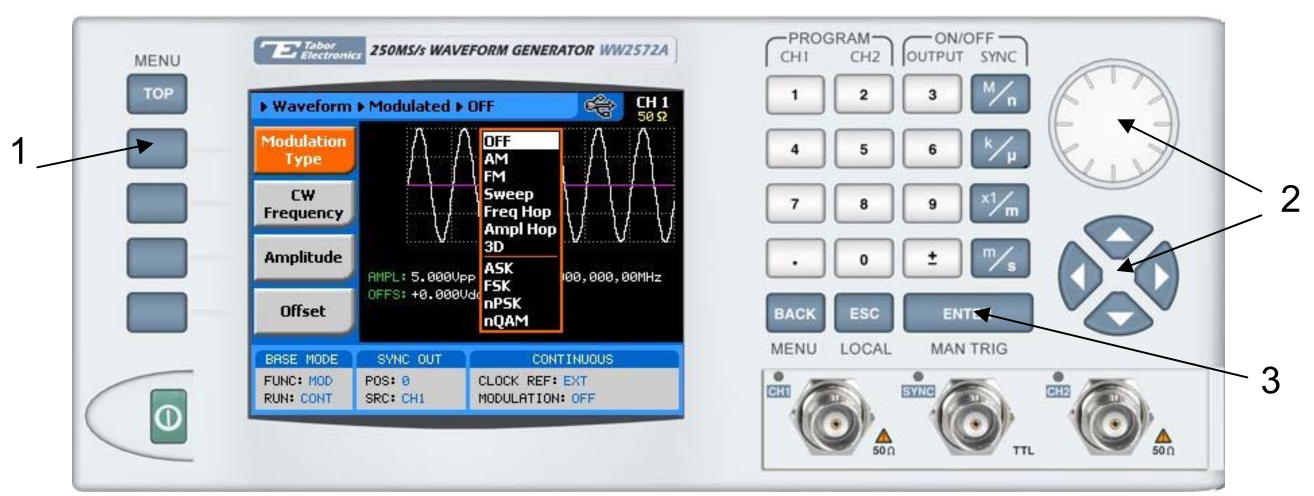


Figure 3-21, Selecting a modulated Waveform

Off

The Modulation Off is a special case of the modulation function where the output is not modulated but generates carrier waveform (CW) frequency only. CW is the sine waveform that is being modulated. When placed in Modulation Off, the sine waveform is generated from the main outputs continuously. The advantage of this mode is that sine waveforms can be generated from 100 μHz to 100 MHz. Modulation off operates in continuous mode only. The CW parameter does not change when you switch from one modulation function to another. Figure 3-22 shows the Modulation Off menus.

While in the Off option, there are some parameters that can be programmed for the carrier waveform:

CW Frequency – defines the frequency of the carrier waveform. Using this standard AM function, the shape of the carrier waveform is always sine. The CW parameter, as programmed in this menu is shared by all other modulation options.

Amplitude – defines the carrier amplitude level. The same level is used throughout the instrument when you move from waveform shape to another. The Amplitude parameter, as programmed in this menu is shared by all other waveform options.

Offset – defines the offset level for the carrier waveforms. The same level is used throughout the instrument when you move from waveform shape to another. The Offset parameter, as programmed in this menu is shared by all other waveform options.

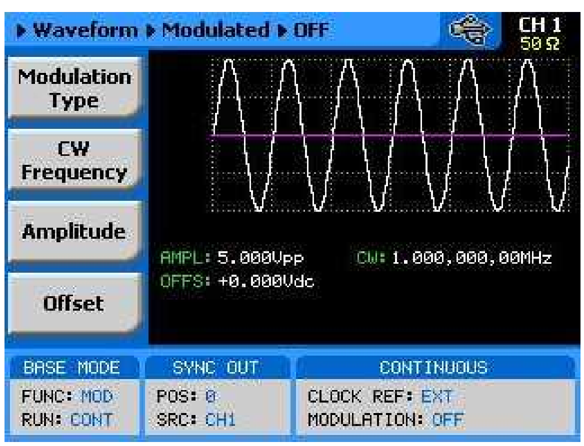


Figure 3-22, Modulation OFF Parameters

AM

The AM function enables amplitude modulation of a carrier waveform (CW). The carrier waveform is sinewave and it is being modulated by an internal waveform, normally referred to as envelop waveform. The envelop waveform can be selected from sine, triangle square or ramp shapes. When AM is selected, the menus that are associated with AM will be accessible. These are shown in Figure 3-23.

There are other parameters that control how the CW is amplitude modulated, these are:

Modulation Shape – defines the envelop function. There are four shapes that can be used: Sine, Triangle, Square and Ramp. The Modulation Shape menu that provides access to the selection of the envelop waveform is shown in Figure 3-24.

Modulation depth – programmed in units of % and defines the depth of the modulating envelop. Modulation depth is programmed from 0% to 100%.

Modulation Frequency – defines the frequency of the modulating waveform. The modulating waveform is programmed from 10mHz to 100kHz.

CW Frequency – defines the frequency of the carrier waveform. Using this standard AM function, the shape of the carrier waveform is always sine.

Trigger Baseline – defines the idle state of the AM output when placed in trigger mode. There are two options: continuous carrier or dc level. The continuous carrier option generates CW waveforms until triggered, generates the AM waveform and resumes outputting continuous CW waveform. Selecting dc, the output generates dc level until triggered. Generates the AM waveform and resumes outputting continuous dc waveform.

Amplitude – defines the carrier amplitude level. The same level is used throughout the instrument when you move from waveform shape to another.

Offset – defines the offset level for the carrier waveforms. The same level is used throughout the instrument when you move from waveform shape to another.

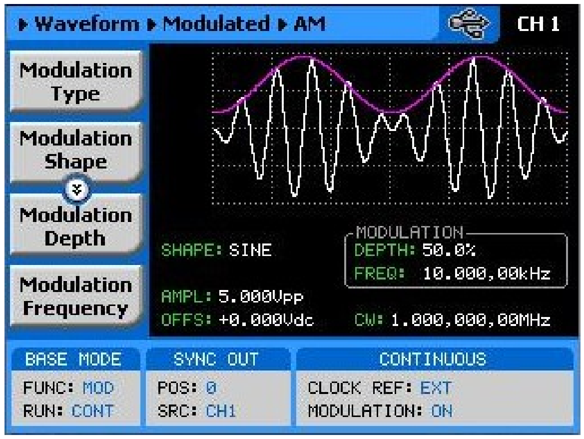


Figure 3-23, AM Menus

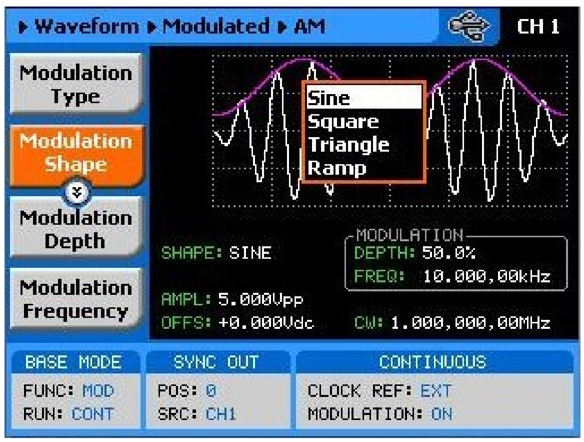


Figure 3-24, Modulating Waveform Shapes

FM

The FM function allows frequency modulation of a carrier waveform (CW). The carrier waveform is sinewave and it is being modulated by an internal waveform, normally referred to as modulating waveform. The shape of the modulating waveform can be selected from sine, triangle, square or arbitrary waveforms. Carrier waveforms are programmed with 10 digits resolution from 10 mHz to 100 MHz.

The FM function has a number of menus that control the modulation parameters. These are shown in Figure 3-25 and described in the following paragraphs:

Modulation Shape – Defines the shape and type of the modulating waveform. Although there are 5 options shown in the menu, there is a significant difference between the first four: Sine Triangle, Square and Ramp, and the last option – Arbitrary. The first four modulating waveforms are described in this section whereas, the arbitrary FM , being part of the modulation package options is described separately in the relevant section of this chapter.

The Modulation Shape menu that provides access to the selection of the envelop waveform is shown in Figure 3-26.

CW Frequency – defines the frequency of the carrier waveform. Using this standard FM function, the shape of the carrier waveform is always sine.

Frequency Deviation – defines the range of frequencies of which the modulation will go through. The peak value is symmetrical around the value of the carrier waveform frequency.

Modulation Frequency – defines the frequency of the modulating waveform. The modulating waveform is programmed from 10mHz to 100kHz.

Marker– programs a unique frequency where the SYNC output generates a pulse to mark this frequency.

Trigger Baseline – defines the idle state of the FM output when placed in trigger mode. There are two options: continuous carrier or dc level. The continuous carrier option generates CW waveforms until triggered, generates the FM waveform and resumes outputting continuous CW waveform. Selecting dc, the output generates dc level until triggered. Generates the FM waveform and resumes outputting continuous dc waveform.

Amplitude – defines the carrier amplitude level. The same level is used throughout the instrument when you move from waveform shape to another.

Offset – defines the offset level for the carrier waveforms. The same level is used throughout the instrument when you move from waveform shape to another.

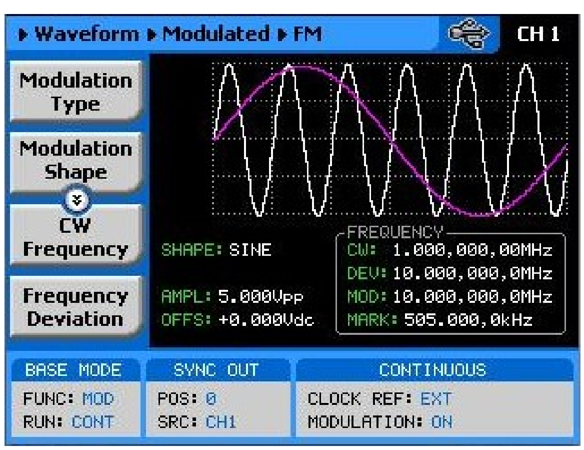


Figure 3-25, FM Modulation Parameters

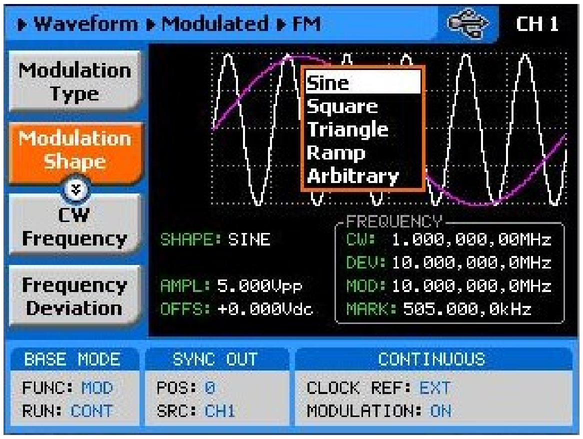


Figure 3-26, Modulation Waveform Shapes

FSK

FSK (Frequency Shift keying) modulation allows frequency hops between two pre-programmed frequencies: Carrier Waveform Frequency and Shifted Frequency. Note that CW is sinewave only and that the switch between two frequencies is always coherent.

The CW and shifted frequencies can be programmed with 10 digits throughout the entire frequency range of the instrument, from 100 μHz to 100 MHz. The FSK sequence is designed in an FSK table that can either be loaded from the front panel or downloaded from a remote interface from a utility such as ArbConnection. An example of the FSK table, as created in ArbConnection, is shown in Figure 3-27.

When you select FSK modulation, the parameters, as shown in Figure 3-28 and described in the following paragraphs, will be available for modification:

FSK Data – defines the sequence of which the frequencies will toggle. FSK data is stored in an external table. The length of the table is limited from 1 to 4096 toggle sequences. The FSK Data table contains a list of “0”s and “1”s which determine the sequence. “0” defines CW and “1” defines shifted frequency.

CW Frequency – defines the frequency of the carrier waveform. In this case, the CW frequency will also be used as the idle frequency. Using this standard FSK function, the shape of the carrier waveform is always sine.

Shifted Frequency – defines the frequency of which the generator will shift when logic level “1” is sensed at the trigger input.

Baud – defines the rate of which the frequencies are toggled. The rate can be programmed within the range of 1 bits/s to 10 Mbits/s.

Marker – defines an index point in the FSK sequence where the SYNC output will generate a marker pulse.

Trigger Baseline – defines the idle state of the FSK output when placed in trigger mode. There are two options: continuous carrier or dc level. The continuous carrier option generates CW waveforms until triggered, generates the FSK waveform and resumes outputting continuous CW waveform. Selecting dc, the output generates dc level until triggered. Generates the FSK waveform and resumes outputting continuous dc waveform.

Amplitude – defines the carrier amplitude level. The same level is used throughout the instrument when you move from waveform shape to another.

Offset – defines the offset level for the carrier waveforms. The same level is used throughout the instrument when you move from waveform shape to another.

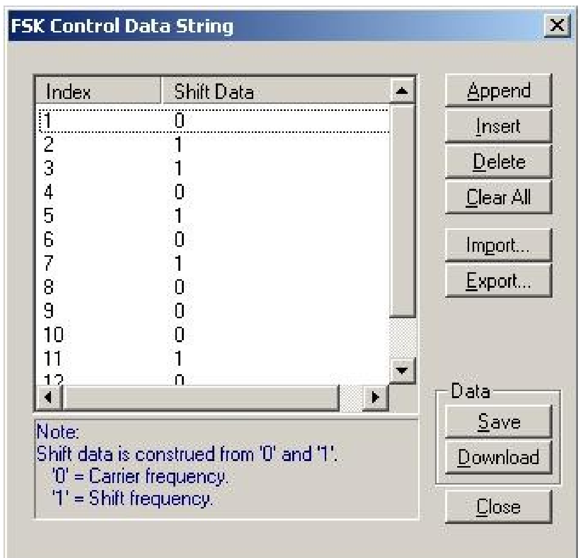


Figure 3-27, FSK Control Data String Example

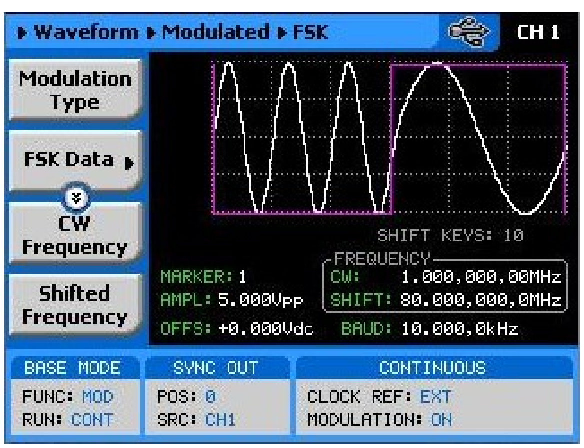


Figure 3-28, FSK Menus

PSK

PSK (Phase Shift keying) modulation allows phase hops between two pre-programmed phases: The initial phase can be programmed from 0 to 360°, the shifted phase can also be programmed through the same range. The PSK sequence is designed in a PSK table that can either be loaded from the front panel or downloaded from a remote interface from a utility such as ArbConnection. An example of the PSK table, as created in ArbConnection, is shown in Figure 3-29.

When you select PSK modulation, the parameters, as shown in Figure 3-30 and described in the following paragraphs, will be available for modification:

PSK Data – defines the sequence of which the phase will toggle. FSK data is stored in an external table. The length of the table is limited from 1 to 4096 toggle sequences. The PSK Data table contains a list of "0"s and "1"s which determine the sequence. "0" defines start phase and "1" defines the shifted phase.

CW Frequency – defines the frequency of the carrier waveform. In this case, the CW frequency will also be used as the idle frequency. Using this standard PSK function, the shape of the carrier waveform is always sine.

Start Phase – defines the initial start phase. Note that the start and stop phase only define the phase difference between these values and not fixed values of which the generator will adhere to.

Shifted Phase – defines the phase of which the generator will shift when logic level "1" is sensed at the trigger input. Note that the start and stop phase only define the phase difference between these values and not fixed values of which the generator will adhere to.

Baud – defines the rate of which the phase is toggled. The rate can be programmed within the range of 1 bits/s to 10 Mbits/s.

Marker – defines an index point in the PSK sequence where the SYNC output will generate a marker pulse.

Trigger Baseline – defines the idle state of the PSK output when placed in trigger mode. There are two options: continuous carrier or dc level. The continuous carrier option generates CW waveforms until triggered, generates the PSK waveform and resumes outputting continuous CW waveform. Selecting dc, the output generates dc level until triggered. Generates the PSK waveform and resumes outputting continuous dc waveform.

Amplitude – defines the carrier amplitude level. The same level is used throughout the instrument when you move from waveform shape to another.

Offset – defines the offset level for the carrier waveforms. The same level is used throughout the instrument when you move from waveform shape to another.

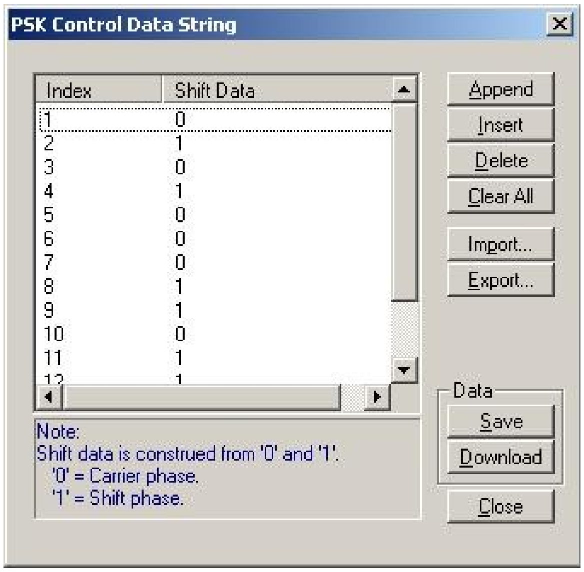


Figure 3-29, PSK Control Data String Example

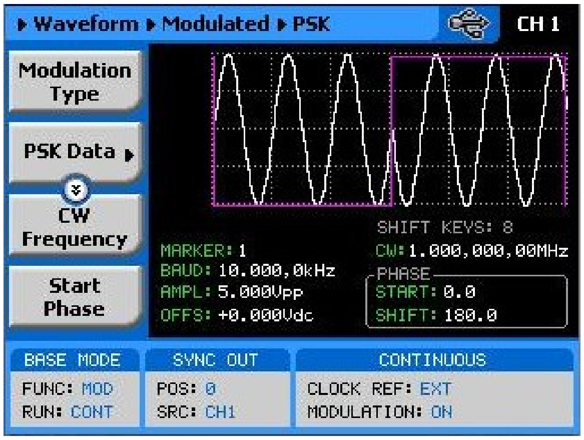


Figure 3-30, PSK Menus

Sweep

Sweep modulation allows carrier waveform (CW) to sweep from one frequency, defined by the sweep start parameter to another frequency, defined by the sweep stop parameter. Note that CW is sinewave only. The start and stop frequencies can be programmed with 11 digits throughout the entire frequency range of the instrument, from 10 mHz to 100 MHz.

When you select sweep modulation, the menus, as shown in Figure 3-31 and described in the following paragraphs, will be available for modification:

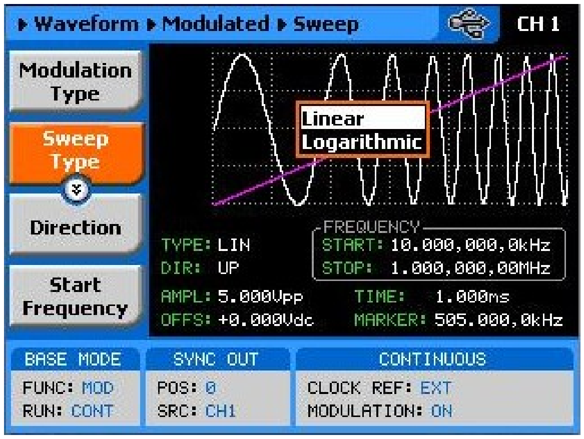


Figure 3-31, Sweep Menus

Sweep Type – defines the steps of which the frequency increments or decrements from start to stop frequencies. A choice is provided between linear and logarithmic steps. If you select linear sweep the carrier waveform frequency steps through the frequencies within a time interval which is set by the sweep time parameter. Likewise, using the logarithmic sweep type, the frequency span between the start and stop frequencies is stepped through using logarithmic steps.

Sweep Direction – defines the sweep direction. UP sets sweep direction from start frequency to stop frequency; DOWN reverses the sweep direction so the output sweeps from stop frequency to start frequency.

Start Frequency – defines the frequency value of which the generator will start its sweep. Note that the sweep start can be at a higher frequency value, depending on the sweep direction setting.

Stop Frequency – defines the frequency value of which the generator will stop its sweep. Note that the sweep stop can be at a lower frequency value, depending on the sweep direction setting.

Sweep Time – defines the time that will lapse from sweep start to sweep stop frequencies. Sweep time is programmable from 1.4 μs to 40 s.

Marker – defines a frequency of which, when transitioned through, will output a marker pulse at the SYNC output connector. The default position of the marker is the sweep start frequency.

Trigger Baseline – defines the idle state of the sweep output when placed in trigger mode. There are two options: continuous carrier or dc level. The continuous carrier option generates CW waveforms until triggered, generates the sweep waveform and resumes outputting continuous CW waveform. Selecting dc, the output generates dc level until triggered. Generates the sweep waveform and resumes outputting continuous dc waveform.

Amplitude – defines the carrier amplitude level. The same level is used throughout the instrument when you move from waveform shape to another.

Offset – defines the offset level for the carrier waveforms. The same level is used throughout the instrument when you move from waveform shape to another.

Modulated Waveforms, Modulated Package Option

As discussed above, Modulated waveforms are split in two parts: waveforms that come as standard with the 2572A and waveforms that are purchased with the modulation package – option 2. The modulation package adds the following modulation functions: Arbitrary FM, Frequency and Amplitude hops, ASK and 3D. For the 2-channel version only (Model 2572A), the modulation package adds (n)PSK, (n)QAM and user QAM. The modulation package waveforms are discussed below.

Frequency Hop

In frequency hop mode, the output waveform (sinewave) hops from frequency to frequency in a sequence defined by the hop table. Frequencies can be programmed with 11 digits resolution from 10 Hz to 100 MHz. There are two frequency hop types:

1. Frequency hops with fixed dwell time and
2. Frequency hops with variable dwell time

Dwell time defines the time that the frequency will remain stable and of which the frequency will change at the end of this interval. With the fixed dwell time, the waveform hops from frequency to frequency at constant intervals, defined by the fixed dwell time parameter. When the variable dwell time is selected, each hop can be programmed to have a unique dwell interval.

When you select frequency hop modulation, the menus, as shown in Figure 3-32 and described in the following paragraphs, will be available for modification:

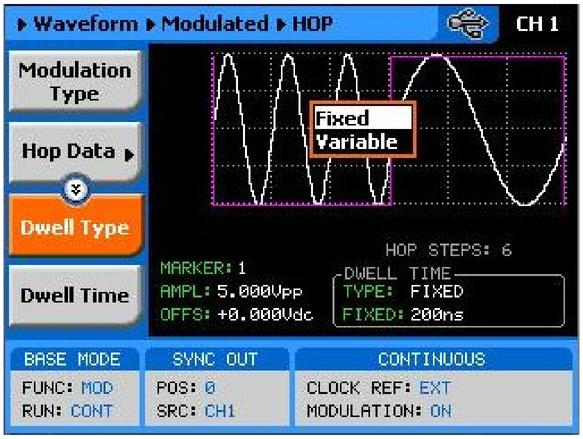


Figure 3-32, Frequency Hop Menus

Hop Data – allows programming and editing of the frequency hop table. The hop data table contains a list of frequencies and the generator will hop through these frequencies in the same order and at a rate defined by the dwell time setting. The hop table size is from 2 to 1000 and the generator can hop from 10 Hz to 100 MHz.

The frequency hop table depends on the Dwell Type selection and will display the dwell time parameter only if the variable dwell time option has been selected. The hop table as shown in Figure 3-33 is an example how such table are programmed from ArbConnection.

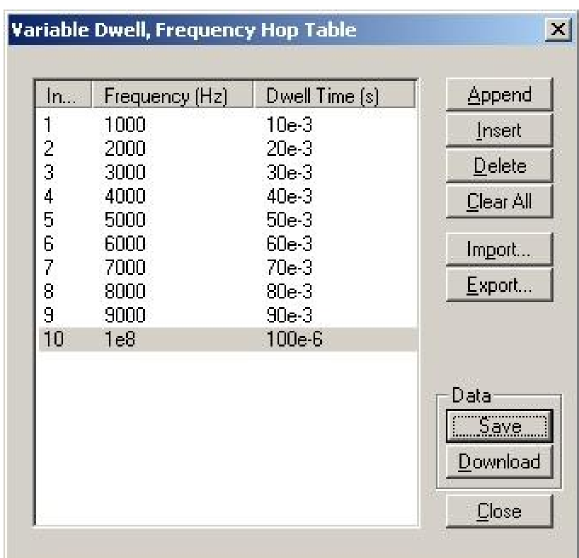


Figure 3-33, Variable Dwell Time Frequency Hop Table Example

Dwell Type **–** defines if each hop step will have constant or variable dwell times. Using the variable time option, each step can be programmed to have a unique dwell time value.

Dwell Time – defines the lapse of time for a hop step, when the variable dwell time option has been selected. Dwell time is programmable in steps of 20 ns from 200 ns to 21 seconds.

Marker– programs a unique index point where the SYNC output generates a pulse to mark a specific hop step.

Trigger Baseline – defines the idle state of the frequency hop output when placed in trigger mode. There are two options: continuous carrier or dc level. The continuous carrier option generates CW waveforms until triggered, generates the frequency hop waveform and resumes outputting continuous CW waveform. Selecting dc, the output generates dc level until triggered. Generates the frequency hop waveform and resumes outputting continuous dc waveform.

Amplitude – defines the carrier amplitude level. The same level is used throughout the instrument when you move from waveform shape to another.

Offset – defines the offset level for the carrier waveforms. The same level is used throughout the instrument when you move from waveform shape to another.

Amplitude Hop

In Amplitude hop mode, the output waveform (sinewave) hops from amplitude to amplitude in a sequence defined by the hop table. Amplitude hop modulation allows amplitude hops throughout the entire range of the instrument. The base signal is always CW (sine waveform). Amplitudes are programmed with 4 digits resolution from 0 V to 16 V.

There are two amplitude hop types:

1. Amplitude hops with fixed dwell time and
2. Amplitude hops with variable dwell time

Dwell time defines the time that the amplitude will remain stable and of which the amplitude will change at the end of this interval. With the fixed dwell time, the waveform hops from amplitude to amplitude at constant intervals, defined by the fixed dwell time parameter. When the variable dwell time is selected, each hop can be programmed to have a unique dwell interval.

When you select the amplitude hop modulation, the menus, as shown in Figure 3-34 and described in the following paragraphs, will be available for modification.

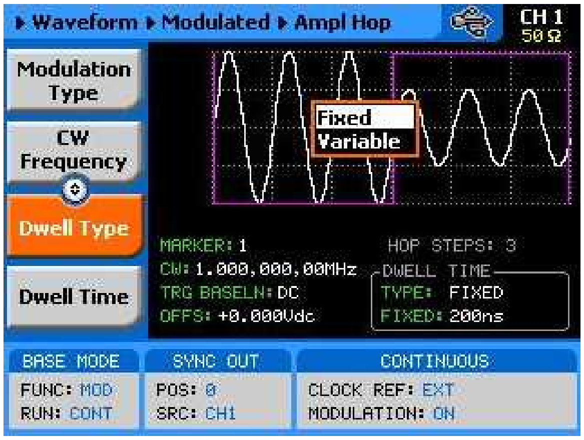


Figure 3-34, Amplitude Hop Menus

Hop Data – allows programming and editing of the amplitude hop table. The hop data table contains a list of amplitudes and the generator will hop through these amplitudes in the same order and at a rate defined by the dwell time setting. The hop table size is from 2 to 1000 and the generator can hop from 0 V to 16 V.

The amplitude hop table depends on the Dwell Type selection and will display the dwell time parameter only if the variable dwell time option has been selected. The hop table as shown in Figure 3-35 is an example how such table are programmed from ArbConnection.

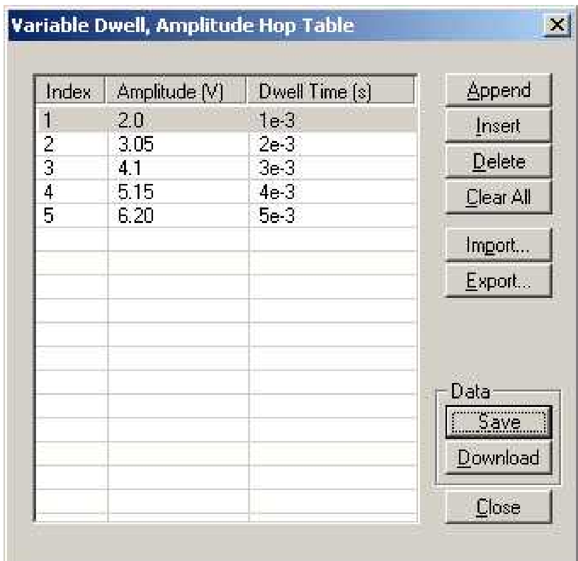


Figure 3-35, Variable Dwell Time Amplitude Hop Table Example

CW Frequency – defines the frequency of the carrier waveform. The shape of the carrier waveform is always sine.

Dwell Type – defines if each hop step will have constant or variable dwell times. Using the variable time option, each step can be programmed to have a unique dwell time value.

Dwell Time – defines the lapse of time for a hop step, when the variable dwell time option has been selected. Dwell time is programmable in steps of 20 ns from 200 ns to 21 seconds.

Marker– programs a unique index point where the SYNC output generates a pulse to mark a specific hop step.

Trigger Baseline – defines the idle state of the Amplitude hop output when placed in trigger mode. There are two options: continuous carrier or dc level. The continuous carrier option generates CW waveforms until triggered, generates the amplitude hop waveform and resumes outputting continuous CW waveform. Selecting dc, the output generates dc level until triggered. Generates the amplitude hop waveform and resumes outputting continuous dc waveform.

Amplitude – defines the carrier amplitude level. The same level is used throughout the instrument when you move from waveform shape to another.

Offset – defines the offset level for the carrier waveforms. The same level is used throughout the instrument when you move from waveform shape to another.

3D

The 3D modulation allows profiling over time of the carrier waveform over three domains: frequency, amplitude and phase. Figure 3-36 shows an example of the 3D profiling utility. Notice how the amplitude changes independently for channels 1 and 2, simultaneously while frequency and phase change as well. In this example, a complete cycle changes in 100 ms however, there is a great deal of flexibility and programmability to allow changes exactly as required by your application.

The 3D composer is part of ArbConnection and is available from version 4.1 and above. The 3D software converts the curves to waveform coordinates which are stored in a dedicated 3D memory. Notice however, that the 3D shares its memory with some other modulation functions and therefore, if you plan on using the 3D function intermittently with other modulation functions (such as arbitrary FM), make sure that the coordinates are readily available for replacement because operating one function may be destructive to the other. Instructions how to use the 3D composer are given in Chapter 4.

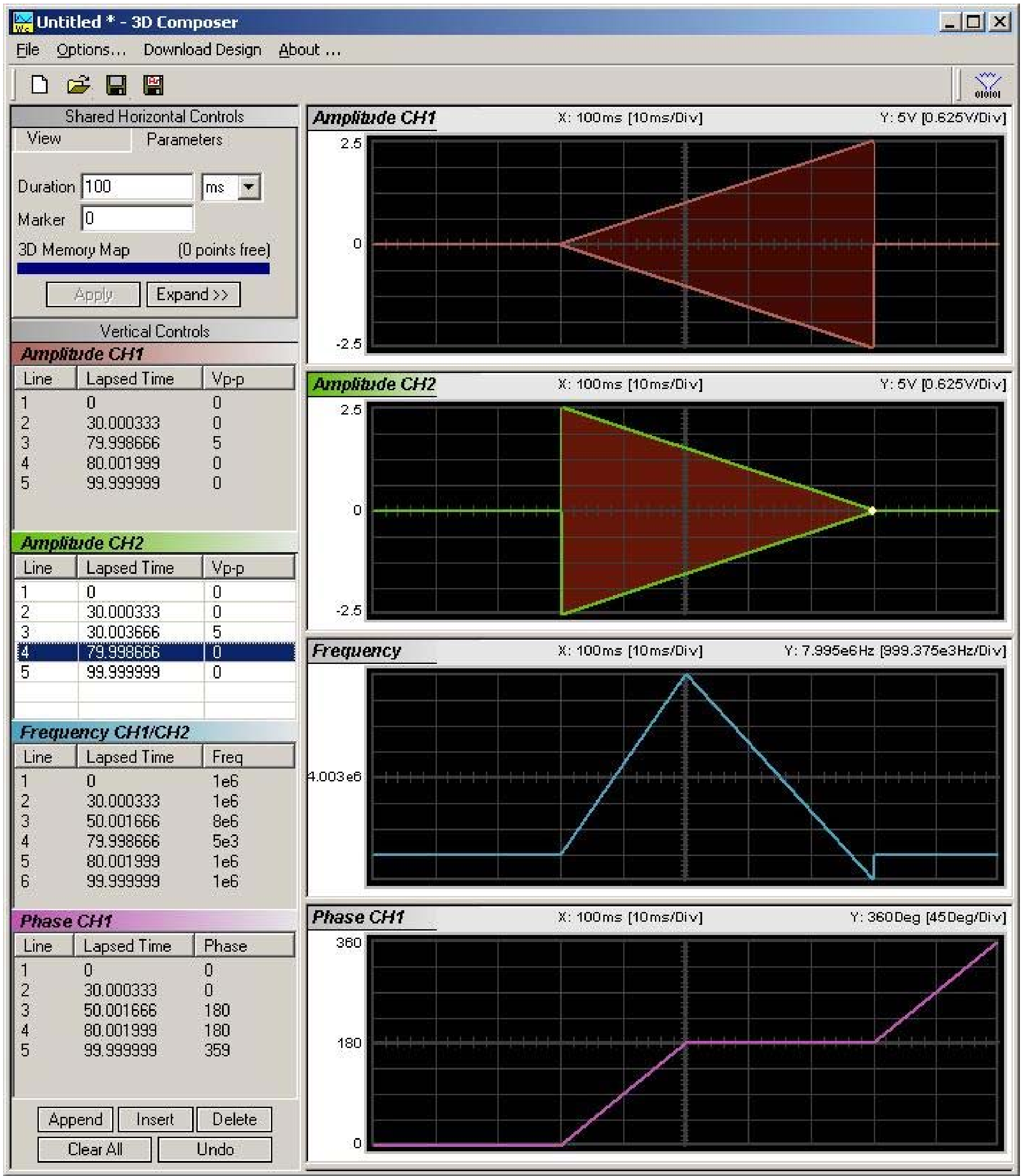


Figure 3-36, 3D Composer Example

When you select the 3D modulation option, the menus, as shown in Figure 3-37 and described in the following paragraphs, will be available for modification.

Load Demo Table – loads pre-determined set of coordinates to the 3D memory. The demo waveforms can be used for either demonstration purpose or for building your confidence that the 3D function really works. The 3D memory will be overwritten as soon as you download waveforms from the 3D composer however, the demo can always be recalled from the front panel.

Trigger Baseline – defines the idle state of the 3D output when placed in trigger mode. There are two options: continuous carrier or dc level. The continuous carrier option generates CW waveforms until triggered, generates the 3D waveform and resumes outputting continuous CW waveform. Selecting dc, the output generates dc level until triggered. Generates the 3D waveform and resumes outputting continuous dc waveform.

Offset – defines the baseline offset level for the 3D waveform. The same level is used throughout the instrument when you move from waveform shape to another.

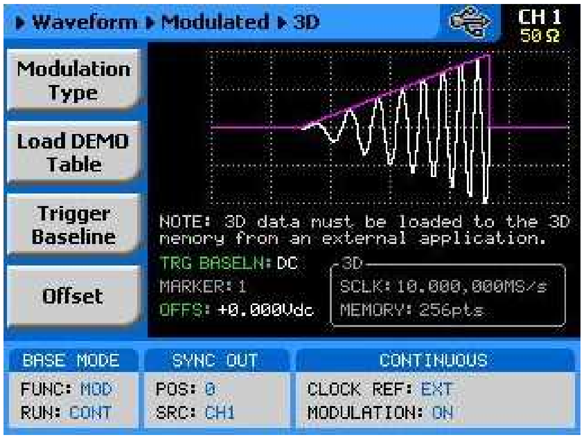


Figure 3-37, 3D Modulation Menus

ASK

ASK (Amplitude Shift keying) modulation allows amplitude hops between two pre-programmed amplitude levels. Note that sinewave CW only is hopped. The signal level can hop between two amplitude levels throughout the entire amplitude range without crossing range or relay ranges. Amplitude is programmed with 4 digits of resolution. The start and shifted amplitudes can be programmed with 4 digits from 0 V to 16 V.

The ASK sequence is designed in an ASK table that can either be loaded from the front panel or downloaded from a remote interface from a utility such as ArbConnection. An example of the ASK table, as created in ArbConnection, is shown in Figure 3-36.

When you select ASK modulation, the parameters, as shown in Figure 3-37 and described in the following paragraphs, will be available for modification:

ASK Data – defines the sequence of which the amplitudes will toggle. ASK data is stored in an external table. The length of the table is limited from 1 to 4096 toggle sequences. The ASK Data table contains a list of “0”s and “1”s which determine the sequence. “0” defines the initial amplitude and “1” the shifted amplitude.

CW Frequency – defines the frequency of the carrier waveform. In this case, the CW frequency will also be used as the idle frequency. Using this standard ASK function, the shape of the carrier waveform is always sine.

Start Amplitude – defines the initial amplitude level. Note that the start amplitude does not necessarily define lower value than the stop amplitude.

Shifted Amplitude – defines the amplitude level of which the generator will shift when logic level “1” is sensed at the trigger input. Note that the stop amplitude does not necessarily define higher value than the start amplitude.

Baud – defines the rate of which the amplitude is toggled. The rate can be programmed within the range of 1 bits/s to 10 Mbits/s.

Marker – defines an index point in the ASK sequence where the SYNC output will generate a marker pulse.

Trigger Baseline – defines the idle state of the ASK output when placed in trigger mode. There are two options: continuous carrier or dc level. The continuous carrier option generates CW waveforms until triggered, generates the ASK waveform and resumes outputting continuous CW waveform. Selecting dc, the output generates dc level until triggered. Generates the ASK waveform and resumes outputting continuous dc waveform.

Offset – defines the offset level for the carrier waveforms. The same level is used throughout the instrument when you move from waveform shape to another.

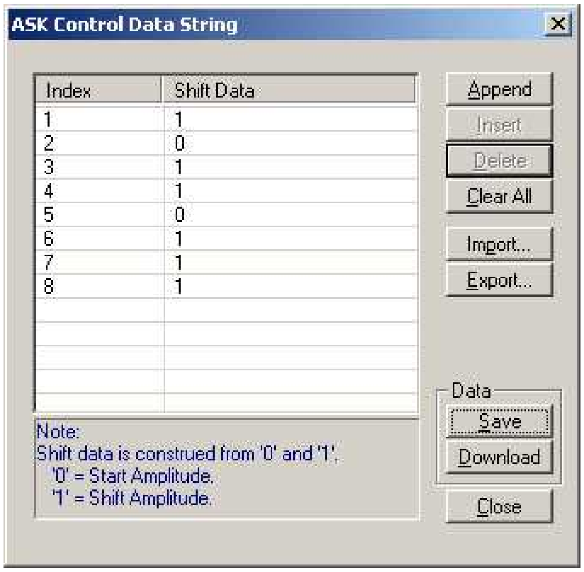


Figure 3-38, ASK Control Data String Example

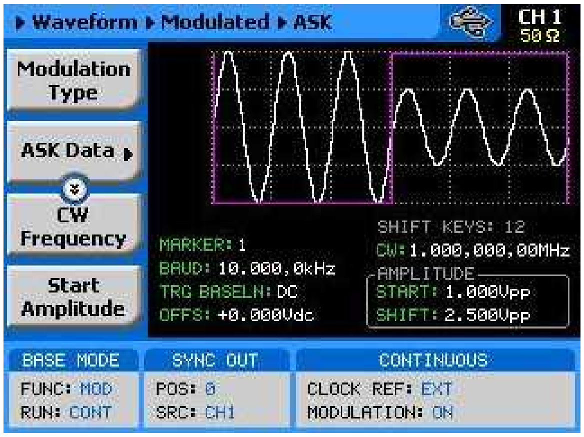


Figure 3-39, ASK Menus

FM – Arbitrary Waveforms

There are two separate FM functions within the 2572A of which differ in the way that the carrier is being modulated. Looking at Figure 3-26, the first four modulating waveforms are created internally by the instrument and their parameters can be characterized by the user from the front panel or from a remote interface. The arbitrary modulating waveform option opens an avenue for the user to create proprietary and application specific waveforms that will be used for modulating the carrier waveform. The arbitrary modulating waveform must be created and downloaded to the instrument; It is being downloaded to a special memory, separate to the main arbitrary working memory and thus, one can create arbitrary waveforms and modulate them with an arbitrary modulating waveform where the only limitations are memory size and creativity. The 2572A is supplied with an FM composer that lets you create, edit, store and download arbitrary modulating waveforms.

The arbitrary modulating waveform you will create and download to the 2572A resides in a separate and dedicated memory; It can be programmed to have variable length and has a separate and independent sample clock control.

The arbitrary FM waveform has an array size of 10000 frequency points. If you look at the following FM composer example, you'll see that the vertical scale is made of frequency points, The change in frequency will follow the curve shown in the FM composer panel.

The frequency of the arbitrary FM wave is computed in the same way as a standard arbitrary waveform.

Frequency = Sample Clock / Number of waveform points

In the example shown in Figure 3-40 below, the frequency of the waveform will change from 960kHz to 1.04MHz. The sample clock for the modulating waveform can be programmed from 1S/s to 2.5MS/s while the carrier waveform frequency can be selected from 10mHz to 100MHz.

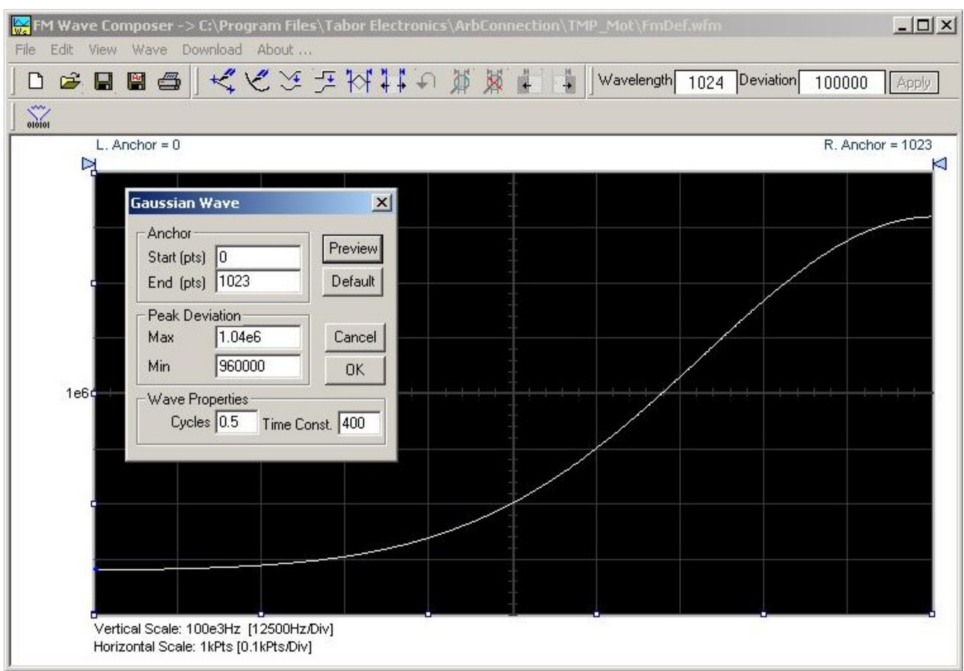


Figure 3-40, ArbConnection Example - Arbitrary FM Composer Panel

The equivalent minimum and maximum modulating frequencies you can generate with the arbitrary FM are 50µHz to 1.6MHz. Note that the CW wave is always sine waveform however, the modulating waveform can take any shape defined by the FM composer panel. While the low frequency is very useful in applications like wander and slow drifting oscillators, the higher frequencies are as much needed for testing fast modems, PLL circuits and for wide-band digital modulation technology.

The arbitrary FM function has a number of menus that control the modulation parameters. These are shown in Figure 3-41 and described in the following paragraphs:

There are other parameters that control the Arbitrary FM function, these are:

FM Sample Clock – defines the rate of which the sample of the modulating waveform is clocked. Observe the waveform as shown in Figure 3-40. Unlike an ordinary arbitrary waveform that defines amplitude over time, this curve defines frequency over time where each point on the waveform defines a specific frequency.

CW Frequency – defines the frequency of the carrier waveform. Using this arbitrary FM function, the shape of the carrier waveform is always sine.

Trigger Baseline – defines the idle state of the arbitrary FM output when placed in trigger mode. There are two options: continuous carrier or dc level. The continuous carrier option generates CW waveforms until triggered, generates the Arbitrary FM waveform and resumes outputting continuous CW waveform. Selecting dc, the output generates dc level until triggered. Generates the arbitrary FM waveform and resumes outputting continuous dc waveform.

Amplitude – defines the carrier amplitude level. The same level is used throughout the instrument when you move from waveform shape to another.

Offset – defines the offset level for the carrier waveforms. The same level is used throughout the instrument when you move from waveform shape to another.

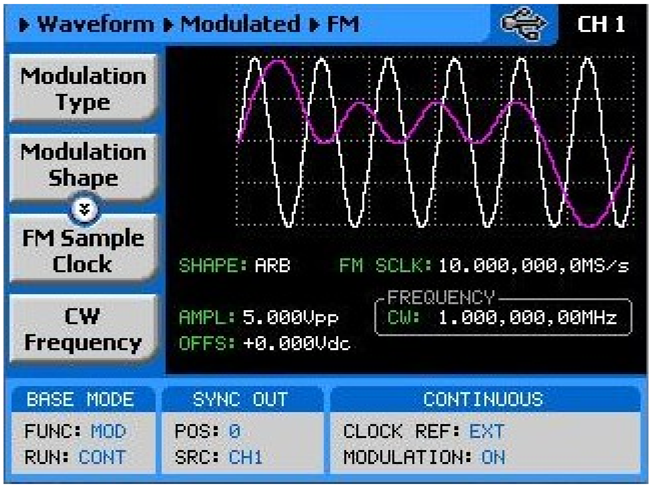


Figure 3-41, Arbitrary Frequency Modulation menus

(n)PSK

The (n)PSK function is similar to the standard PSK function except the output can shift to multiple phase and amplitude positions to form phase shift constellations. There are 6 different types of phase shift keying that the 2572A can generate: BPSK, QPSK, OQPSK, pi/4DQPSK, 8PSK and 16PSK. If another constellation scheme is required, one can use the User PSK to design his/her own symbol list and constellation. An example of a QPSK display is shown in Figure 3-42.

There are other parameters that control the (n)PSK function, these are:

PSK Type – selects from one of BPSK, QPSK, OQPSK, pi/4DQPSK, 8PSK and 16PSK. Once a type is selected the associated parameters are automatically available on the display for adjustments.

PSK Data – provides access to the PSK data symbols. By default the table is empty so the symbols must be loaded into the table before the (n)PSK function can be used. For testing and/or demonstration purpose, a default table is available to download from the front panel however, this table must be converted for different applications. An example of the QPSK data entry table is given in figure 3-43.

CW Control – can turn the carrier waveform on and off. Use the carrier off position when directly driving vector generators.

CW Frequency – defines the frequency of the carrier waveform. Using this PSK function, the shape of the carrier waveform is always sine. CW frequency is programmable from 10 Hz to 62.5 MHz.

Symbol rate – programs the rate of which symbols step through. The rates can be programmed from 1 symbol/s to 1e6 symbols/s.

Marker – defines an index point where the SYNC output generates a synchronization pulse. The marker can be programmed within the range of the symbol list.

Amplitude – defines the carrier amplitude level. The same level is used throughout the instrument when you move from waveform shape to another.

Offset – defines the offset level for the carrier waveforms. The same level is used throughout the instrument when you move from waveform shape to another.

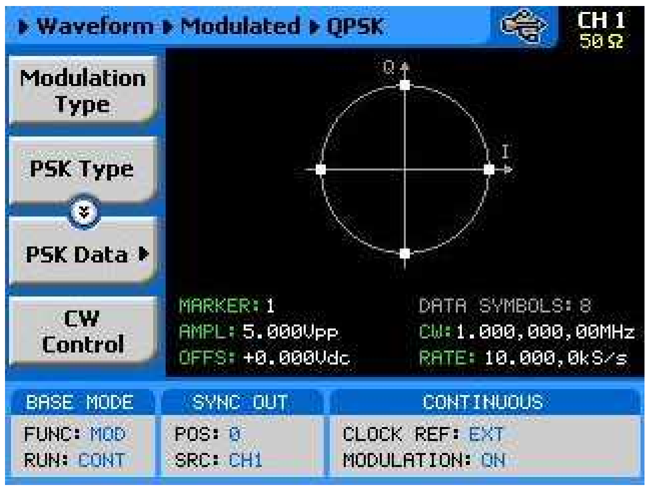


Figure 3-42, PSK Modulation Display Example

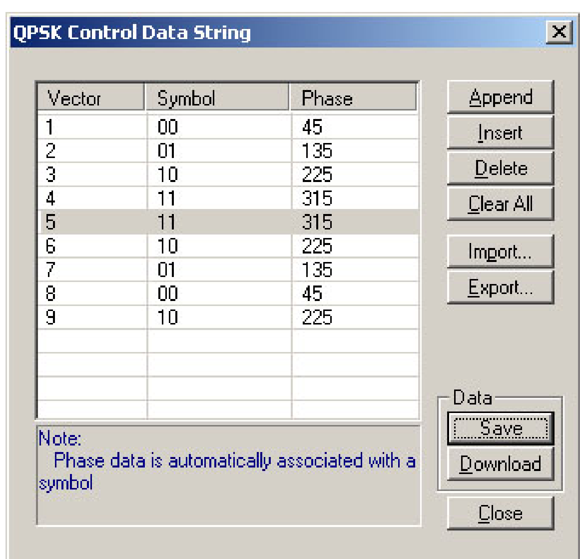


Figure 3-43, QPSK Data Entry Table Example

User PSK

The User PSK function is similar to the (n)PSK function except the symbols and their associated vector positions can be freely designed at locations that are non-standard. The user PSK display is shown in figure 3-44. The symbols can be designed on the 2572A display, or on the User PSK Control Data String dialog box as shown in figure 3-45.

After you design the symbols and generate the control data string, the definition and the modification of the other parameters are done exactly as you would do for the other PSK functions.

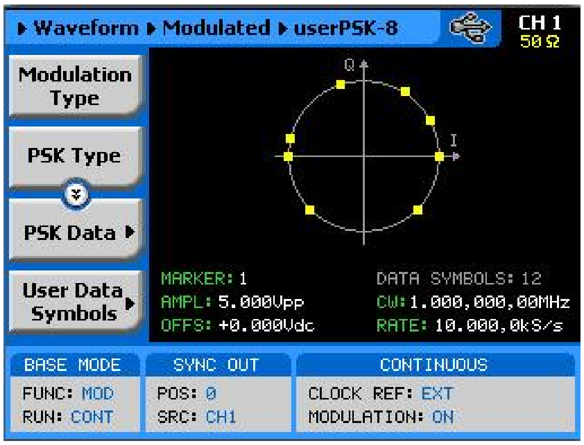


Figure 3-44, User PSK Display

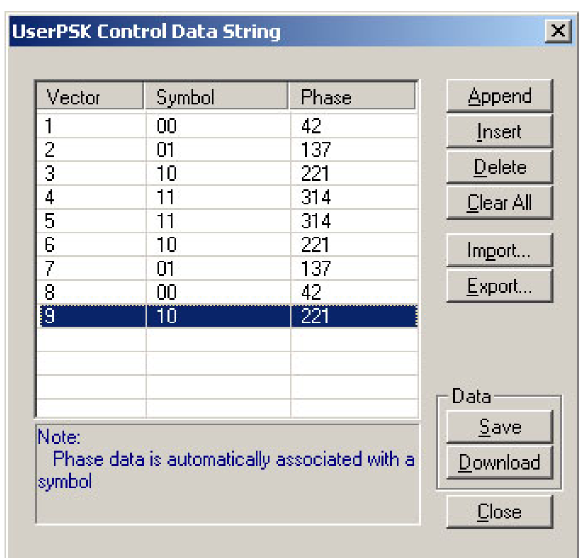


Figure 3-45, User PSK Data Entry Table Example

(n)QAM

The (n)QAM function is similar to the standard ASK function except the output can shift to multiple amplitudes and phase positions to form an amplitude/phase shift constellations. There are 4 different types of Quadrature Amplitude Modulation that the 2572A can generate: 16QAM, 64QAM and 256QAM. If another constellation scheme is required, one can use the User QAM to design his/her own symbol list and constellation. An example of a 64QAM display is shown in Figure 3-46.

There are other parameters that control the (n)QAM function, these are:

QAM Type – selects from one of 16QAM, 64QAM, 256QAM and User QAM. Once a type is selected the associated parameters are automatically available on the display for adjustments.

QAM Data – provides access to the QAM data symbols. By default the table is empty so the symbols must be loaded into the table before the (n)QAM function can be used. For testing and/or demonstration purpose, a default table is available to download from the front panel however, this table must be converted for different applications. An example of the 64QAM data entry table is shown in figure 3-47.

CW Control – can turn the carrier waveform on and off. Use the carrier off position when directly driving vector generators.

CW Frequency – defines the frequency of the carrier waveform. Using this QAM function, the shape of the carrier waveform is always sine. CW frequency is programmable from 10 Hz to 62.5 MHz.

Symbol rate – programs the rate of which symbols step through. The rates can be programmed from 1 symbol/s to 1e6 symbols/s.

Marker – defines an index point where the SYNC output generates a synchronization pulse. The marker can be programmed within the range of the symbol list.

Amplitude – defines the carrier amplitude level. The same level is used throughout the instrument when you move from waveform shape to another.

Offset – defines the offset level for the carrier waveforms. The same level is used throughout the instrument when you move from waveform shape to another.

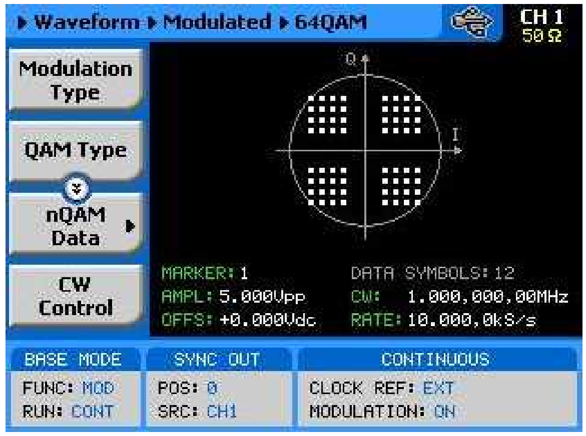
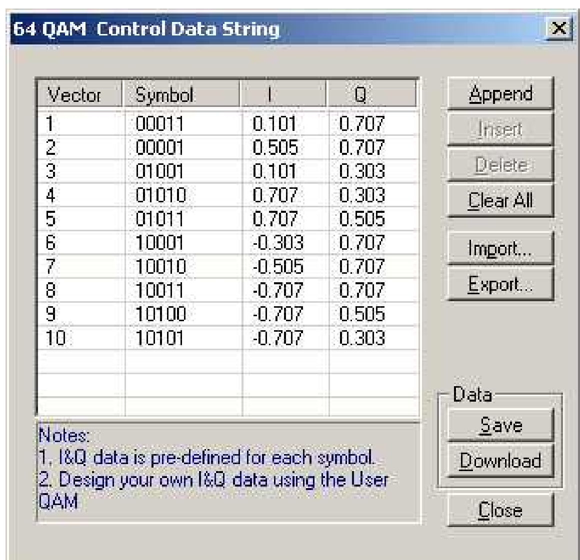


Figure 3-46, 64QAM Display Example



Vector	Symbol	I	Q
1	00011	0.101	0.707
2	00001	0.505	0.707
3	01001	0.101	0.303
4	01010	0.707	0.303
5	01011	0.707	0.505
6	10001	-0.303	0.707
7	10010	-0.505	0.707
8	10011	-0.707	0.707
9	10100	-0.707	0.505
10	10101	-0.707	0.303

Figure 3-47, 64QAM Data Entry Table Example

User QAM

The User QAM function is similar to the (n)QAM function except the symbols and their associated vector positions can be freely designed at locations that are non-standard. The user QAM display is shown in figure 3-48. The symbols can be designed on the 2572A display, or on the User QAM Control Data String dialog box as shown in figure 3-49.

After you design the symbols and generate the control data string, the definition and the modification of the other parameters are done exactly as you would do for the other QAM functions.

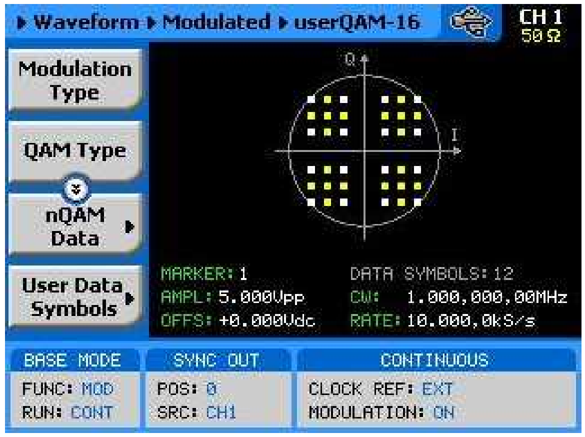


Figure 3-48, User Display

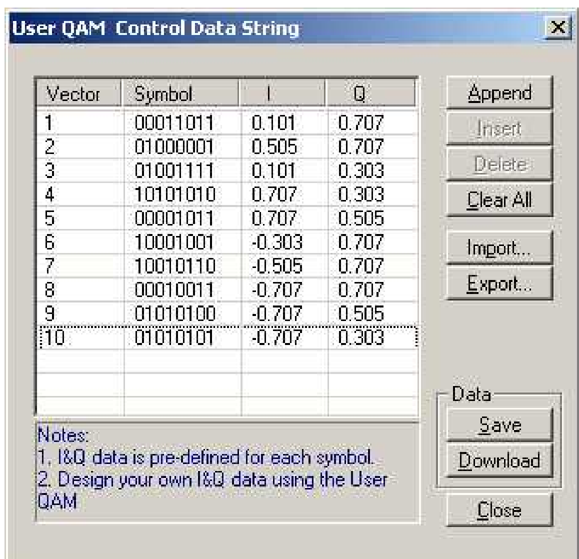


Figure 3-49, User QAM Data Entry Table Example

Using the Auxiliary Functions

The 2572A, besides its standard waveform generation functions, has two additional auxiliary functions that can transform the instrument to one of two, stand-alone, full-featured, instruments: Digital Pulse Generator and Counter/Timer. In addition, there are two other auxiliary functions: The Digital Patterns output can be used for generating 16-bit LVDS level patterns and the rear panel multi-instrument synchronization connector can transform multiple the 2572A units to multi-channel system with full synchronization, jitter and phase control between channels. Detailed operating instructions for the auxiliary functions are given in the following paragraphs.

Using the Digital Pulse Generator

The digital pulse generator function provides means of designing pulses and their associated parameters in units of time, exactly as would be done on a stand-alone, bench-type, analog pulse generator. Note however, that the pulse is built in the same memory as the arbitrary waveforms are being stored and therefore, changing from arbitrary to digital pulse modes and reverse, may overwrite waveforms that were downloaded to the memory. Use the instructions below to access and program the pulse menus.

1. Press TOP to display the root menu.
2. Press the arrow down key once and observe that the Auxiliary Functions menu appears.
3. Press Auxiliary Functions soft key and notice that the Pulse Generator option is highlighted, as shown in Figure 3-50.
4. Press the Enter button to select the digital pulse generator function Figure 3-51 shows the Pulse Generator panel and menus.

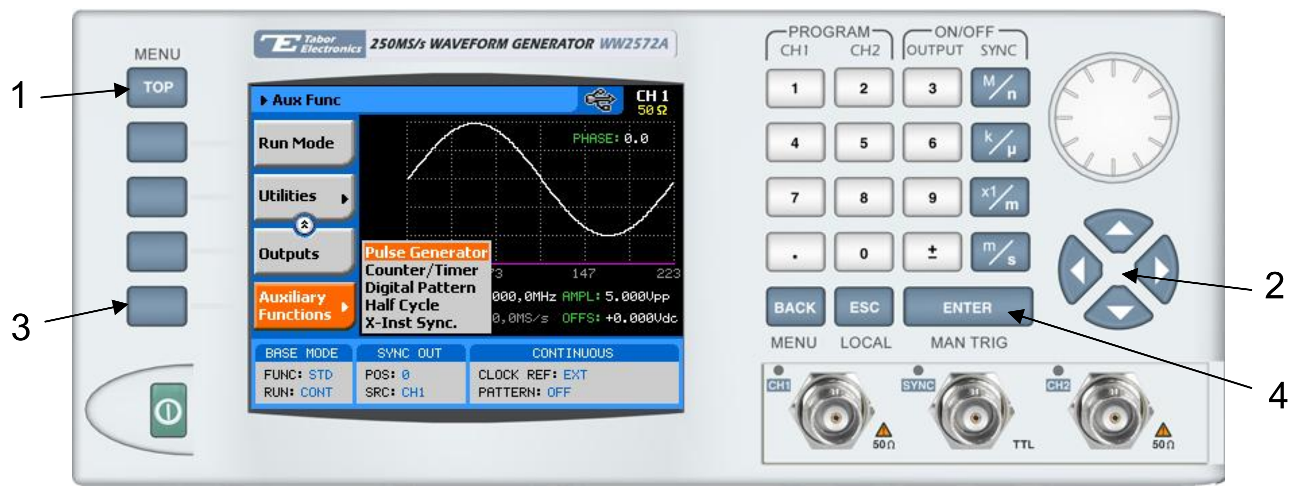


Figure 3-50, Accessing the Pulse Generator Menus

Note

The pulse shape on the 2572A LCD display is an icon only. The actual output waveform may look entirely different.

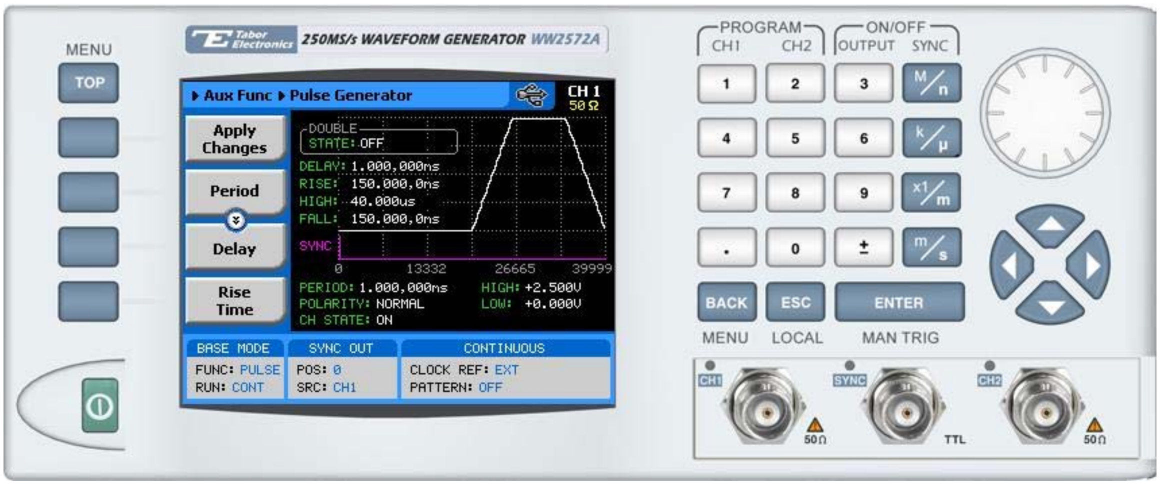


Figure 3-51, the Digital Pulse Generator Menus

The digital pulse generator menus provide access to all pulse parameters just as they would be programmed on an analog pulse generator.

To access the pulse parameters, use one of the soft keys. If you do not see a required parameter on the screen, press the key up or down to scroll through the menus.

The technique of changing parameter values is exactly the same as you are using to modify standard waveform parameters. Simply press the soft key that is associated with the parameter, then punch in the numbers using the numeric keyboard and complete the modification by assigning a suffix and pressing the Enter button. Figure 3-52 shows the screen after the Period soft key has been depressed.

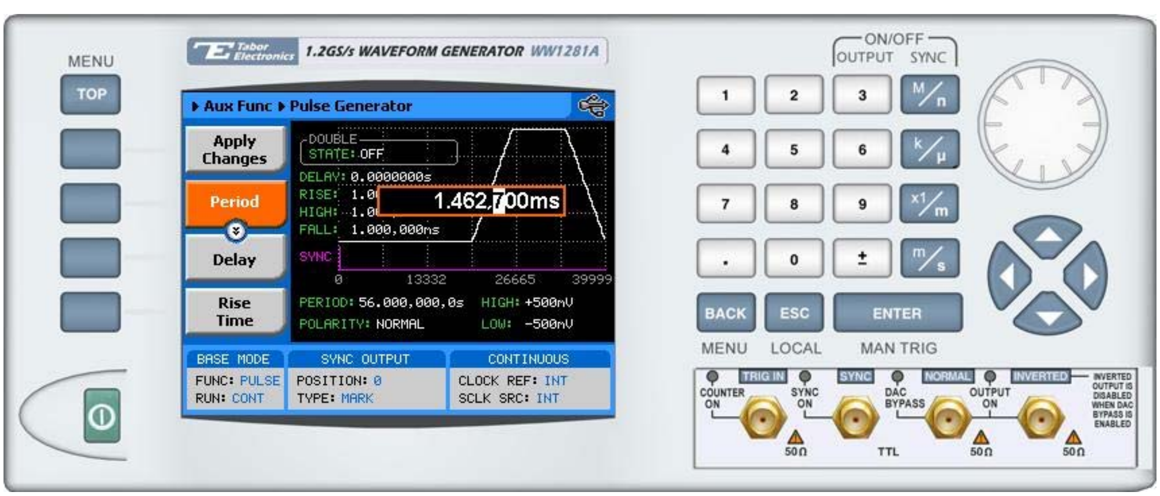


Figure 3-52, Programming the Pulse Period Parameter

The final step before the modified pulse shape will be available at the output connector is pressing the Apply Changes soft key.

NOTE

No change will be made on the pulse shape and at the output connector before the Apply Changes button has been pressed, except when the High and Low Level buttons are exercised. This was done to let the internal computing circuit do the calculation of the pulse parameters only once every time one or more parameters have been modified.

Adjusting the pulse shape with the required characteristics can only be done if all of its parameters can be adjusted both in the time and amplitude domain. The Model 2572A provides all the necessary controls to do just that. However, always bear in mind that the pulse is being generated digitally and therefore there are some limitations that would have to be observed. These limitations will be discussed later in this chapter. Below you will find a list of all pulse parameters that you'll be able to access though the soft key menus.

Pulse Generator Menus

Apply Changes

This, by far, is the most important key to understanding the pulse generation process. The 2572A is actually an arbitrary waveform generator, not a pulse generator however, with some firmware changes, the same memory that is being used by the arbitrary waveform function can be converted to design pulse shapes. In this case, every change of pulse period, parameter or transition, requires re-computation of the pulse shape and download sequence to the arbitrary waveform memory. The process is critical to assure that the pulse design was done within the legal boundaries and generation capabilities of the model 2572A. To avoid multiple design conflicts and tedious exploration of why a pulse cannot be designed with this or that parameter, the Apply Changes button makes the choice only once at the end of the pulse design. Therefore, always make sure that after you complete the design of your pulse, press the Apply Changes soft key button to end the design process and to route the new pulse design to the output terminal.

Period

The period defines the repetition rate of the pulse. The period is programmable from 80 ns.

Delay

The delay defines the time the pulse is delayed from its start to the first transition. The delay time is computed as part of the pulse period and therefore, if you do not plan to have a delayed pulse, change its value to 0 s.

Rise Time

The rise time defines the time it takes for the pulse to transition from its low level to its high level settings. Do not confuse this parameter with the industry-standard interpretations of rise time such 10% to 90% of amplitude. The rise time is computed as part of the pulse period and therefore, if you do not plan to have linear transitions, change its value to 0 s.

High Time
The high time defines the time idles on its high level setting. Do not confuse this parameter with the industry-standard interpretations of pulse width that is normally measured at 50% of amplitude level.

Fall Time
The fall time defines the time it takes for the pulse to transition from its high level to its low level settings. Do not confuse this parameter with the industry-standard interpretations of fall time such 90% to 10% of amplitude. The fall time is computed as part of the pulse period and therefore, if you do not plan to have linear transitions, change its value to 0 s.

High Level
The high level parameter defines the top amplitude level of the pulse. Any value is acceptable as long as it is larger than the low level setting and does not exceed +16 V and does not fall short of the 50 mV minimum high to low level setting.

Low Level
The low level parameter defines the lower amplitude level of the pulse. Any value is acceptable as long as it is smaller than the high level setting and does not exceed -16 V and does not fall short of the 50 mV minimum high to low level setting.

Polarity
The polarity parameter provides access to selecting the polarity of the pulse. Three options are available: Normal, Inverted and Complemented. These options are defined below.

Normal – The pulse is generated with the parameters as programmed for the pulse

Inverted – The pulse is inverted about the 0V base line setting

Complemented – The pulse is inverted about its mid-amplitude base line setting

Note that except for Normal output, inverted and complemented replace high and low levels and rise and fall times.

Double State
The Double State toggles between single and double pulse modes. When double pulse state is turned on, the screen is replaced by an icon that shows that the double pulse mode is on, as shown in Figure 3-53. In this case, the Double Delay button is made available enabling access to the double pulse delay parameter.

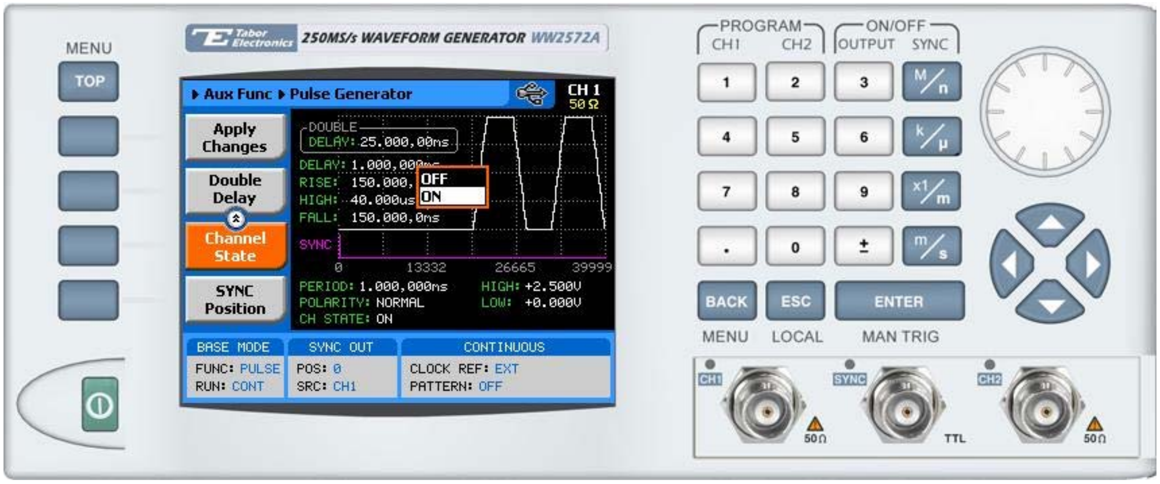


Figure 3-53, Double Pulse Mode

Double Delay
The Double Delay parameter programs the delay between the two adjacent pulses. This parameter is active only when the double pulse mode is turned on.

Sync Position
The Sync Position parameter programs the position of the sync output along the pulse cycle. The position is the only parameter that is programmed in units of waveform points. The location of the sync is visible on the screen below the pulse icon and the number of points that are used for building the pulse shape is shown below the horizontal axis.

Channel State
The channel state comes in handy when programming pulse parameters for one channel only. This option is specifically useful because you may want to program one channel while the other channel was already programmed before and its parameters may collide with the new parameters that you are programming on another channel. When you select the Channel State OFF option, you may freely program all parameters on the other channel and the OFF channel will not be computed but will generate a dc level at its output terminal.

Pulse Design Limitations

Keeping in mind that the pulse is created digitally, using memory points, one should understand there are limitations of creating such pulses that evolve from this system. These limitations are summarized below.

1. Step increment defines resolution and period
The pulse is being created digitally using a sample clock generator that clocks memory points. The rate of the sample clock defines the

incremental resolution. Consider that you want to generate 100 ms pulse rates with 1 ms high time pulse and the rest of the period low. In this case, the generator can select the 1 kS/s to 10 kS/s clock rate because this is enough for generating a high signal of 1 ms using just 100 to 1000 memory points. However, when you want to define much smaller pulse widths at larger rep rates, the number of points that are used for the generation increases as a function of the period. The limitation is set by the number of memory points; with the basic model 2572A, the incremental resolution is 1 in 1 million. This increases to 1 in 2 million if you purchased the Model 2572A with option 1 (2M memory expansion) installed.

2. *Sum of pulse parameters cannot exceed the period*
While designing a pulse shape, bear in mind that the generator will detect automatically if you are trying to mess with the mathematics. Therefore, remember, the sum of all parameters cannot exceed the period. Always start your pulse design by assigning the correct pulse period and only then work your way down the parameters list.

3. *Only single and double pulse can be designed*
Just as a stand-alone pulse generator, the capability that is built into the digital pulse generator allows generation of these two waveforms. This allows generation of single or double pulse patterns having a fixed high and low amplitude values. In case you need to design complex trains of pulse waveforms, you can always do it using the Pulse Composer in ArbConnection. The pulse composer allows creation of complex pulse trains without limiting amplitude, shape and number of pulses in one pulse train.

4. *Inter-channel parameter dependency*
As explained in 1 above, the pulse is created digitally using a sample clock generator that clocks memory points. The 2572A has only one sample clock generator and therefore, most of the pulse parameters that are associated with time interval are shared across the channels. When designing a pulse on one channel, bear in mind that some parameters will be exactly the same on the other channel. These are: Period, rise, high and fall times, double state and double state delay. The rest of the parameters are not inter-channel dependent and can be designed within the limitation of the pulse generator, as specified in Appendix A.

Using the Counter/Timer

The counter/timer auxiliary function transforms the 2572A into a counter/timer instrument with the capability to measure parameters exactly as they would be measured by a stand-alone counter/timer instrument. When using this function one could select the measurement function, gate time trigger level and hold the measurement till condition requires a reading. The readings are taken and displayed on the LCD display, or passed on the remote interface to the host computer for further processing. 2572A front panel example for the counter/timer is shown in figures 3-45.

Because the 2572A cannot measure and generate waveforms at the same time, when placed in the counter/timer mode, all waveform generation are purged and the 2572A can be used for measurements only.

Accessing the Counter/Timer Menus

The digital counter/timer function provides means of measuring timing characteristics of external signals, exactly as would be done on a stand-alone, bench-type, counter/timer. Use the instructions below to access and select the counter/timer mode and any of its measurement functions.

1. Press TOP to display the root menu.
2. Press the arrow down key once and observe that the Auxiliary Functions menu appears.
3. Press Auxiliary Functions soft key and notice that the Counter/Timer option is highlighted, as shown in Figure 3-54.
4. Press the Enter button to select the counter/timer function Figure 3-55 shows the counter/timer panel and menus.

NOTE

After you select the counter/timer function, the front-panel Counter On LED illuminates, designating the counter/timer function is enabled and all other 2572A waveform generation functions are disabled.

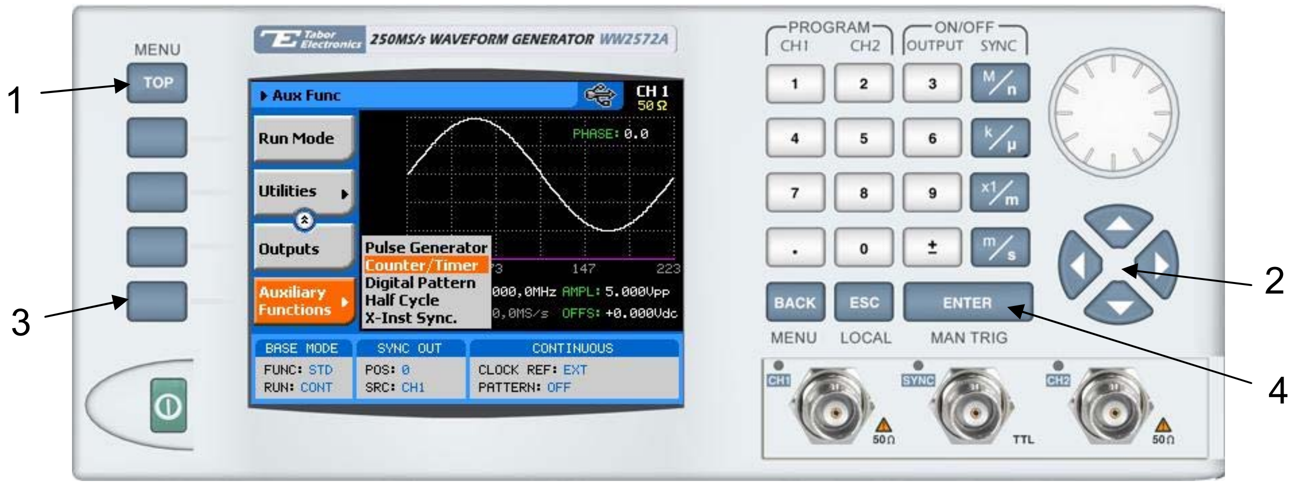


Figure 3-54, Accessing the Counter/Timer Menus

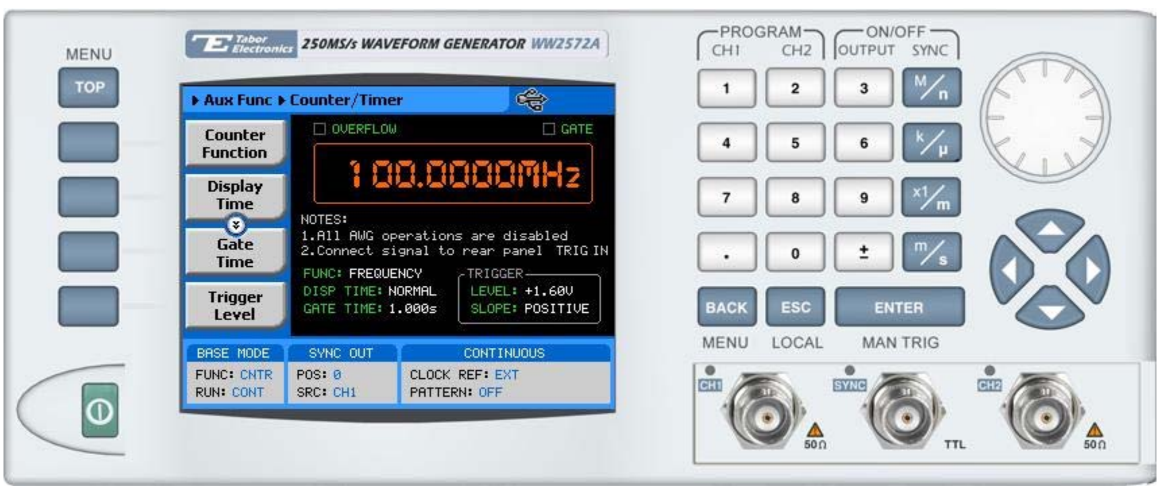


Figure 3-55, the Digital Counter/Timer Menus

Selecting a Counter/Timer Function

The digital counter/timer can measure one of the following functions: Frequency, Period, Period Averaged, Pulse Width and Totalize, either within a specified gate time or infinitely. Use the instructions below to access and select one of the counter/timer measurement functions.

1. Press the Counter Function soft key button to display the measurements list.
2. Use the dial or the up and down keys to scroll through the list. Select the required function.
3. Press Enter to execute the selected function.

Figure 3-56, Selecting a Counter/Timer Measurement Function

Counter/Timer Menus

There are various counter/timer settings that define how the instrument will perform the measurement. For example, the period of the gate time must always be larger than the period of the measured signal. The counter/timer menus are described below.

Display Time
There are two display times available with the 2572A: Normal and Hold.

Normal – defines continuous measurement taken at an interval equal to about gate time period plus 300 ms. This mode of operation assures that reading are taken and displayed long enough for the eye to see the result.

Hold – defines single reading taken and held on the display until cleared and armed for the next measurement. This mode is especially useful for systems applications where reading must be prepared only once and taken at a specific time.

Gate Time
The gate time defines how long the gate will open and allow signal to enter the measurement bin. The gate time value is important because it must be larger than the period of the signal. It also, indirectly, controls the number of digits that can be displayed. At a gate time of 1 second, the counter can display eight digits. As the gate time is reduced, the number of displayable digits is reduced proportionally. Also note that the gate opens only after a valid signal is available at the counter input (TRIG IN connector) and therefore, make sure you arm the counter for measurement only when you expect the signal to appear at the input otherwise, you may lock out the remote interface until a signal triggers the input and the measurement has been completed.

Trigger Level

The trigger level parameter defines the vertical cross point where the signal will trigger a measurement. Trigger level range is from -5 V to +5 V and the default threshold level is set to 1.6 V, which is very convenient for TTL level signals. To change the default level, select the Trigger Level menu and modify the level using direct keyboard entry. Press Enter to lock in the new value.

Trigger Slope

The Trigger Slope defines on which transition the counter input will trigger. There are two options: Positive and Negative. The default option is positive, which means that the counter will trigger on positive transitions at the counter input. The trigger slope parameter is also used for defining the measured portion of a pulse. When in pulse width measurements, the counter will measure the width when transitioning from low level to high level and when the negative slope is selected, the counter will measure the high to low level transitions.

Reset/Arm

The Rest/Arm button has two functions: Reset removes the last reading from the display and zeroes the reading. At the same time, the counter is armed for the next measurement. Use this button to clear the display reading when the display time is set to hold.

Counter/Timer Limitations

Keeping in mind that the counter/timer is a by-product of the AWG, one should understand there are limitations to what this product can do. Summary of the counter/timer limitations is given below.

1. Measurement speed

What is expected from a full-featured counter/timer is measurement speed. The rate of which the counter performs its measurements depends on the display mode setting. The Normal setting is normally used for bench reading, where the user expects to see the result after each measurement. The display time is roughly 300 ms allowing enough time to see the result after each gate time cycle. In this case, the maximum rate is 3 measurements in one second when using low period gate times. The Hold display mode allows one reading at a time. The reading starts when the input senses a valid trigger signal and ends after the gate has closed. Processing time for the reading and the display is roughly 100 ms and therefore, in this mode, the counter can take 10 readings maximum in one second. Regardless of the display mode, the readings are also available for collection from a remote interface.

2. Gate time period must be higher than the signal period

In Fact, this limitation is true for every counter. The gate must open for an interval that allows enough transitions to pass through the counter gate. If the gate time is too short to measure a signal, the gate will open but no results can be obtained and displayed.

3. Auxiliary functions disables waveform generation

When the auxiliary counter/timer function is selected, all operations of the waveform generator are purged. Do not expect from the 2572A to make counter measurements and at the same time have signals at output connectors.

Using the Digital Patterns

Patterns are generated through a 68 pin high density, SCSI-2 connector that is located on the rear panel. The output level is LVDS (Low Voltage Differential Signal) logic level. The digital patterns are derived from lines that are connected to the DAC and therefore, when the digital pattern output is enabled, the 16 bits that drive the DAC are routed to this connector.

There are two memory sources for the digital patterns: 1) A pattern-dedicated memory can store up to 128k of patterns, and 2) Individual arbitrary memory segments can be used as the data source and then the size of the table can be extended to 1M, or 2M with option 1 installed.

The digital patterns are designed in an external software utility such as ArbConnection and then downloaded to the instrument using a remote interface. The patterns are written in a simple table (hex words) as shown in Figure 3-37.

Patterns can be used with or without the main output turned on. The recommended way to use the patterns is of course generating arbitrary waveforms from channel 2 and patterns from channel 1 however, one can use the channel 1 output and in parallel generate the digital patterns from the rear panel to synchronize to other devices.

Accessing the Digital Pattern Menus

The digital pattern function provides means of generating digital data, exactly as would be done on a stand-alone, bench-type, pattern generator. Use the instructions below to access and select the digital patter mode and its associated data source.

1. Press TOP to display the root menu.
2. Press the arrow down key once and observe that the Auxiliary Functions menu appears.
3. Press the Auxiliary Functions soft key and scroll down to highlight the Digital Pattern option, as shown in Figure 3-57.
4. Press the Enter button to select the counter/timer function Figure 3-58 shows the counter/timer panel and menus.

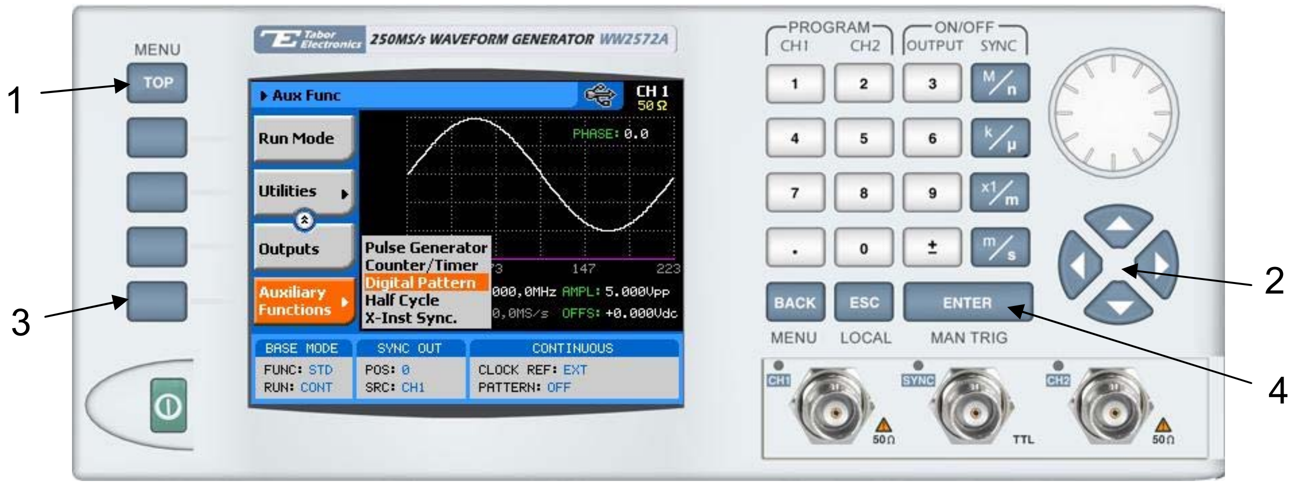


Figure 3-57, Accessing the Digital Pattern Menus

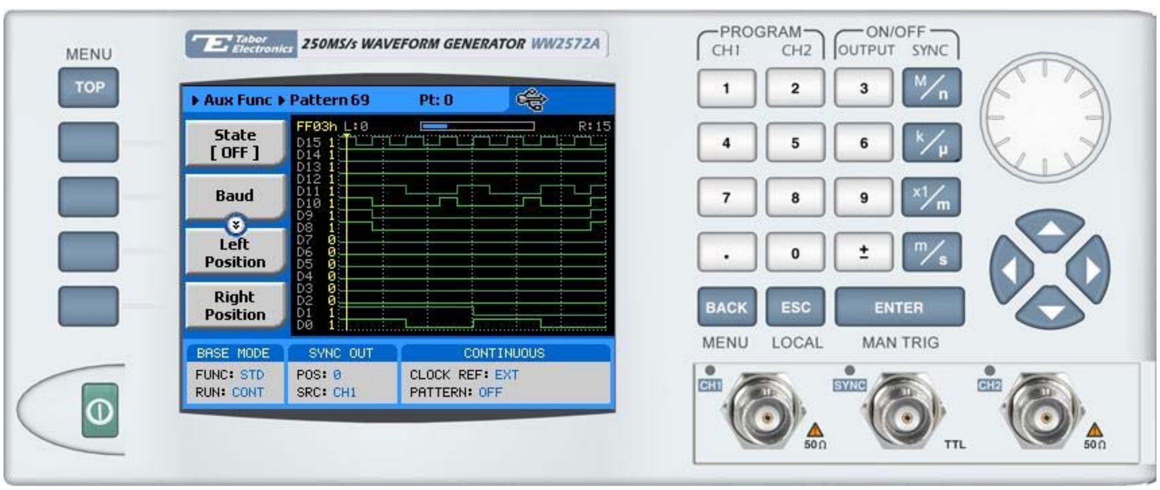


Figure 3-58, the Digital Pattern Menus

Digital Pattern Menus

There are various settings that define how the instrument will perform generate patterns. For example, the source can be defined as any of the arbitrary waveform segments or a special, dedicated pattern memory. The digital pattern menus are described below.

State On/Off – turned the digital pattern output on and off. This switch affects the rear panel connector only. In the On state, the digital pattern outputs are active and generate parallel LVDS data into a terminated load source. The channel 1 front panel output can be turned off if signal is not required through this connector. In the Off state, the rear panel connector is inactive.

Baud – defines the sample clock rate for the digital output. Note that the same parameter is used for the arbitrary and sequenced waveforms and therefore, it can be accessed from other menus as well.

Left Position – defines the left position of the data block that you want to display on the front panel.

Right position – defines the right position of the data block that you want to display on the front panel.

Data Source – selects from where you generate the patterns. There are two options:

1) Pattern Memory provides dedicated digital pattern source that is separate from the arbitrary memory data. The data from the pattern memory can be displayed and edited on the front panel. The dedicated pattern memory is limited to 128k pattern steps

2) Arbitrary Memory provides access to the entire arbitrary memory however, the data cannot be displayed on the front panel. If you select the arbitrary memory option, any waveform that is downloaded to the arbitrary memory can be generated simultaneously, from the front panel as an arbitrary memory and from the rear panel as digital pattern. When you select the arbitrary memory option, the message as shown in figure 3-59 will display.

Go to Line – provides access to a specific line in the pattern sequence. Line cannot be added from the front panel as patterns can be downloaded from a remote controller only however, when a line is accessed from the front panel, it can be modified using the field modification procedure as described in many instances in this chapter.

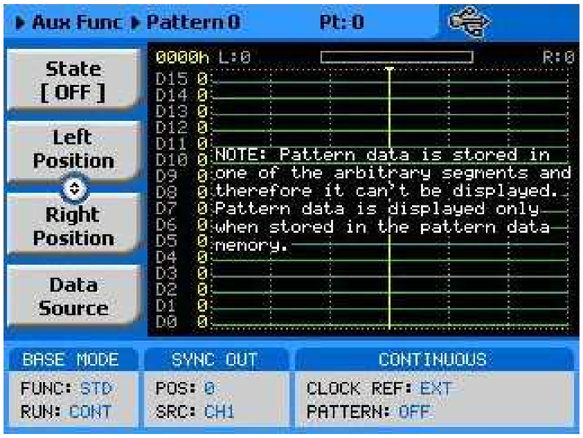


Figure 3-59, Digital Pattern Display while Using the Arbitrary Memory

Go to Pattern – provides access to a specific line in the pattern sequence. Notice that pattern sequences cannot be added from the front panel because patterns can only be downloaded from a remote controller. Figure 3-60 shows the Go to Pattern display.

Notice the display elements as shown in this figure. On the left you can see the pattern designator from D0 to D15 and the data value at the cursor position is shown on the left top position of the display. In the figure below, the cursor is placed at pattern step number 10 and the hex value of this position is F001h. You can also observe on the top of the display the left and right boundaries of the pattern (L:0, R:15) so if you are interested to see larger portions of the sequence, you can change the boundaries using the left and right position controls.

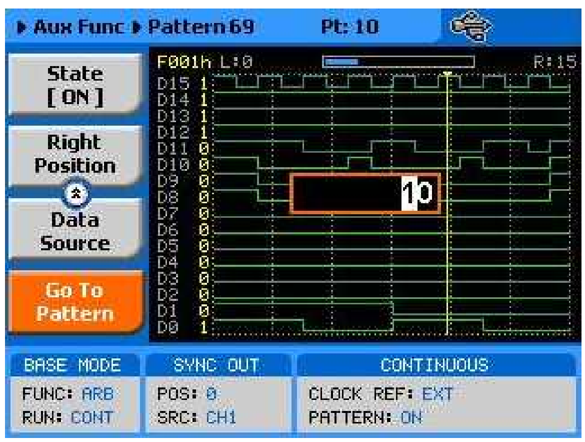


Figure 3-60, Go to Line Display

Creating Digital Patterns

As was mentioned above, digital patterns can be loaded to the 2572A from a remote interface only. Information how to generate and download patterns is provided in Chapter 4. An example of a digital pattern data table is shown in figure 3-61. The patterns are written in hex words and the 2572A will output the data in the same order as written in the table and at a rate defined by the Baud parameter.

Note that patterns are generated from channel 1 only and therefore, this option is available on the 2571A as well except, the 2572A has an advantage in a way that channel 1 can generate digital pattern data while the second channel can simultaneously generate arbitrary waveforms.

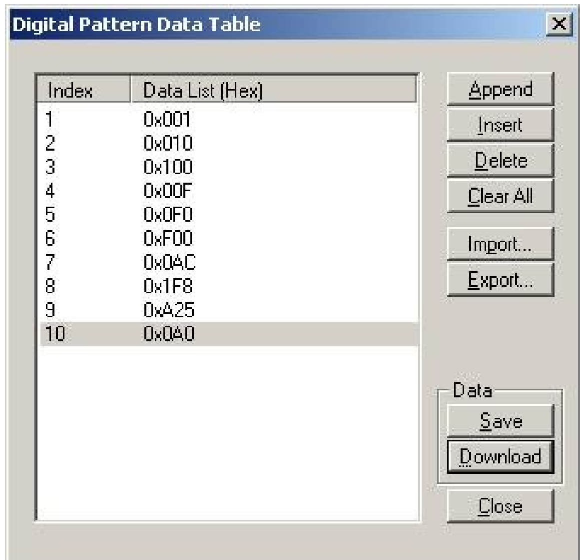


Figure 3-61, Digital Pattern Data Table Example

Using the Half Cycle Waveforms

Half Cycles is a special case of the standard waveforms except the waveforms are generated half cycle at a time, displaced by a delay time that is user programmable. In continuous mode, the half cycles are generated continuously. In triggered mode, each half cycle is generated only after a valid trigger signal is sensed at the trigger input connector. The half cycle waveforms can also be triggered from remote.

Accessing the half Cycle Menus

1. There are three half cycle waveforms that can be generated: Sine, Triangle and Square. Use the instructions below to access and select the digital patter mode and its associated data source.
2. Press TOP to display the root menu.
3. Press the arrow down key once and observe that the Auxiliary Functions menu appears.
4. Press the Auxiliary Functions soft key and scroll down to highlight the Half Cycle option, as shown in Figure 3-62.
5. Press the Enter button to select the half cycle function Figure 3-63 shows the half cycle panel and menus.

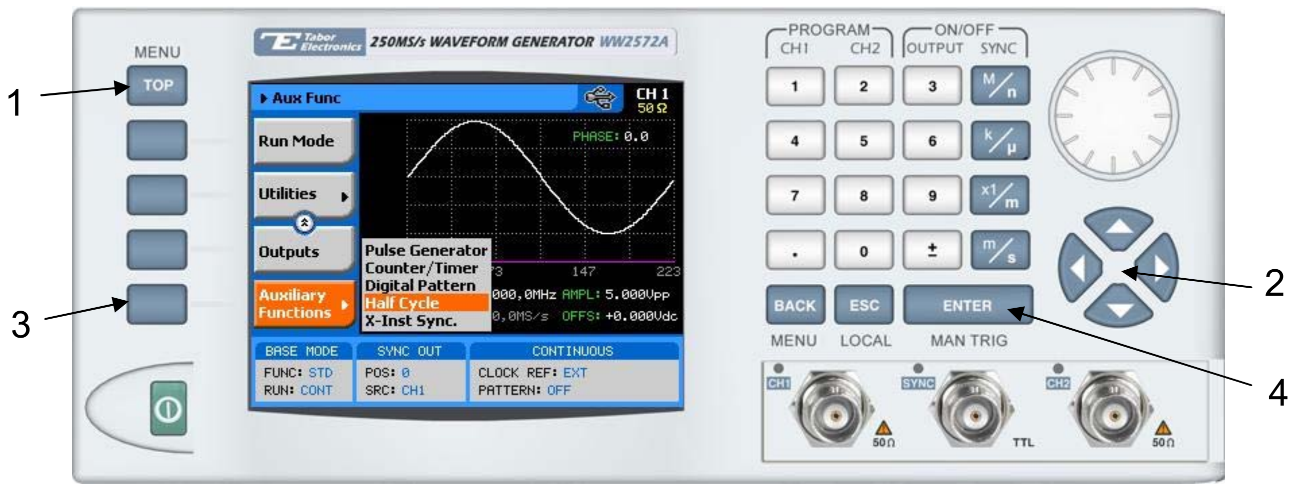


Figure 3-62, Accessing the Digital Pattern Menus

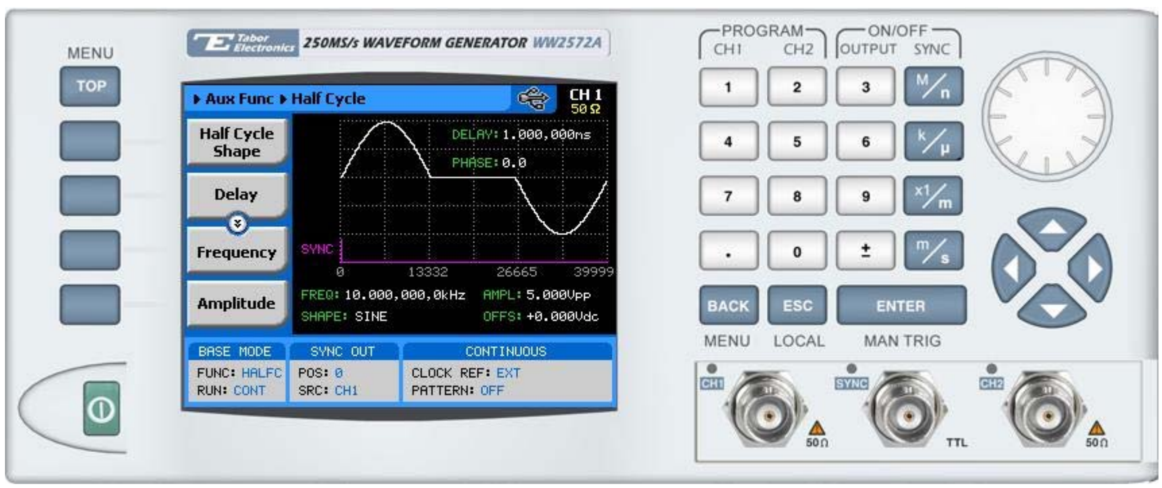


Figure 3-63, the Digital Pattern Menus

Half Cycle Menus

There are various settings that define how the instrument will generate half cycles. For example, spacing between the halves can be programmed to any length between 200 ns to 20 s. The half cycle menus are described below.

Half Cycle Shape – defines the shape of the half cycle waveform. There are three types of waveforms that can be halved: sine triangle and square.

Delay – defines the delay between the halves. The delay can be programmed from 200 ns to 20 s with increments of 20 ns.

Frequency – defines the frequency of the half cycle waveforms as if they were combined to a single cycle waveform. Actually, if you want to calculate the period of the half cycle use the following relationship:

Half Cycle Period = 2 / frequency

Amplitude – defines the amplitude level of the half cycle waveform. The same level is used throughout the instrument when you move from waveform shape to another.

Offset – defines the offset level of the half cycle waveform. The same level is used throughout the instrument when you move from waveform shape to another.

Phase – defines the start phase of the half cycle waveform. The first cycle starts with this phase offset setting and the second half starts 180° later.

Synchronizing Multiple Instruments

The 2572A waveform generator has two output channels. These outputs are just about everything you'll ever need for generating your signals however, some applications require multiple of synchronized channels, which can only be available if you purchase a much more expensive waveform generator or, by combining two separate instruments into one.

As you probably know, having two separate instruments will no do the job because each has its own clock source. Also, driving one generator from the clock of the other will not work because of the nature of memory-driven digital waveform generators that must have definite and clear signals when to start clocking the samples of the waveform.

The two instrument synchronization technique that is utilized by the 2572A provides complete control over waveform run mode, start point, phase offset between adjacent units while maintaining jitter-free and skew-free synchronized outputs. Before or after multiple instruments are synchronized, each instrument can be programmed to have different waveform shape and amplitude however, in this mode, both units share the same run mode, i.e., continuous, triggered, etc.

To achieve synchronization, you must have special inter-connection cables and, in addition, LAN cables that either connect to a LAN network or, in case you do not use a network, two adjacent instruments can be connected together by a cross-wired LAN cable, with no connection to a LAN network. In any case, before you commence with your connections, make sure you get the synchronization cables from your Tabor dealer and get yourself familiar with the information below.

The interconnection cables are proprietary and must be bought from Tabor Electronics Ltd. In case you require such cables, contact your nearest dealer or the Tabor customer service department for price and delivery information. The purpose of these cables is to link the necessary signals from instrument to instrument. These signals will assure that the clock is the same, the reference is the same and that both units share start and stop signals for careful and complete control over waveform start phase.

Hardware synchronization is only part of the deal. The two 2572A's must be set up so that one becomes master and the other(s) slave. Information how to connect the two instruments with the synchronization cable, how to select the master unit and how to proceed with synchronized operation is given in the following paragraphs.

Connecting the instruments

There is a difference if you wish to synchronize two or more instruments because, for two instruments you do not need to have a LAN network however, if you need more than 4 channels, the only way to do it is by connecting each instrument, separately, to the LAN network. For two instruments only, you can either connect to the LAN network or connect between the two instrument using a cross-wired LAN cable. In addition to the LAN cable(s) you need to connect the sample clock and the trigger signals between instruments. If you look at figure 3-64 below, you'll notice the X-INST SYNC group of connectors. These are SMB type connectors. They are connected as follows: The SCLK OUT and the COUPLE OUT connectors on the master module are connected to the SCLK IN and the COUPLE IN on adjacent slave unit. Additional units are connected in a daisy chain manner.

As a general note, if you do not intend to use the 1281A's in Master/Slave mode, it is highly recommended to remove the cable from one of the instrument because signals that are routed from one instrument to the other may interfere during normal operation.

Synchronization Connectors

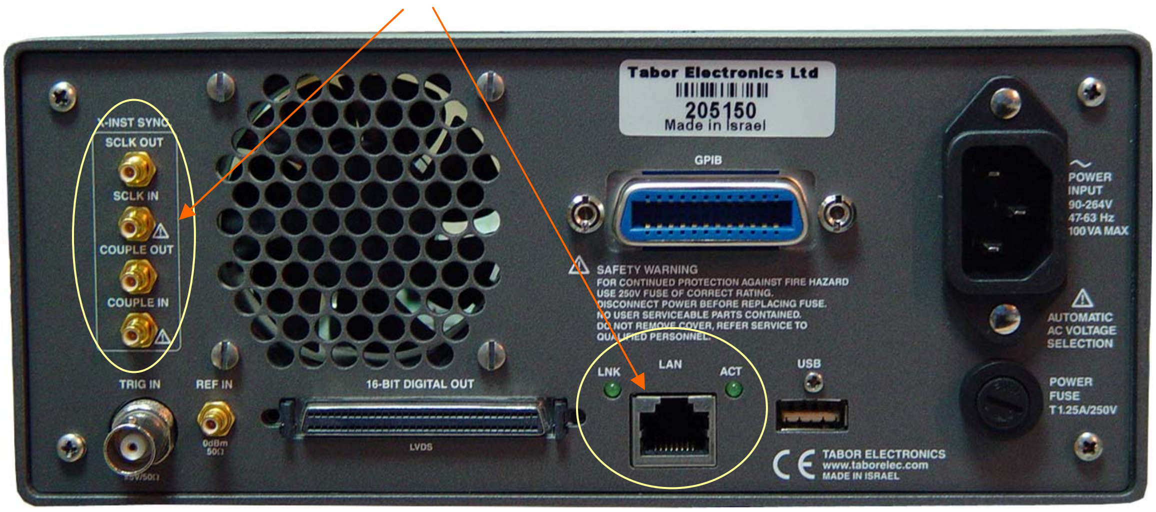


Figure 3-64, Connecting the 2572A Synchronization Cables

Selecting a Master

Connecting the cables between the instruments is just the first step. The next is to select one instrument as master and the others as slave. Use the following procedure:

1. On the master unit, press the TOP Menu button to select the root menus
2. Press the down key button
3. Press the Auxiliary Functions soft key button
4. Use the dial or the up/down keys to scroll down to the X-Inst Sync option, as shown in figure 3-65
5. Press Enter. The display will change to show the multi-instruments synchronization menus
6. Press the Properties soft key button and select the role of the instrument as mater, as shown in figure 3-66. You may select from this menu if the instrument will be master or slave. If you select as slave, you will be able to program the start phase offset for the slave instrument as well.

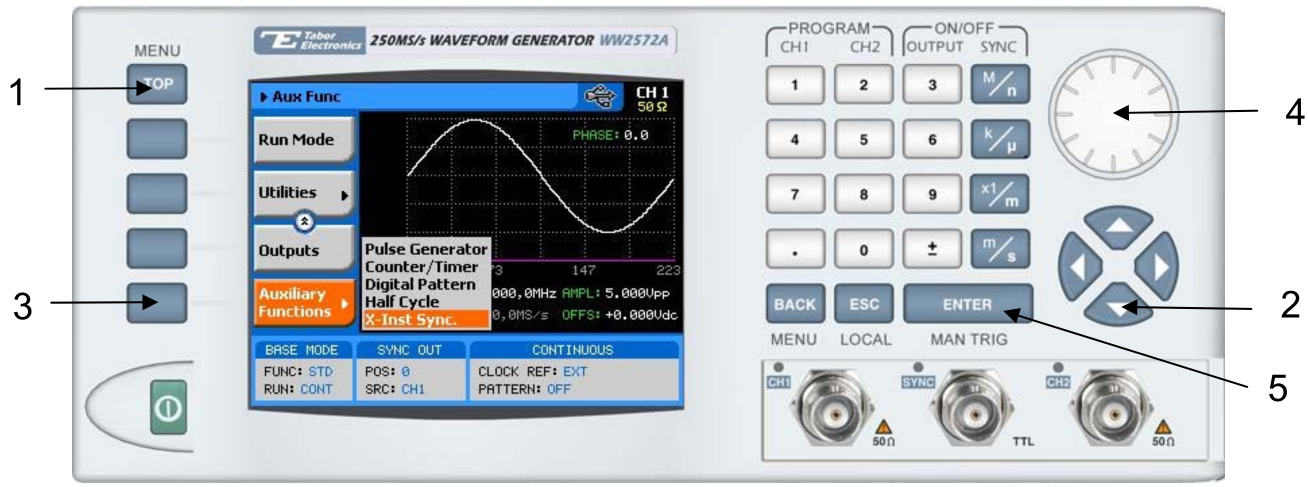


Figure 3-65, Selecting the Multi-Instruments Synchronization Menus

Figure 3-66, Selecting the Couple State

The next step is to tell the master instrument that will become slave instrument. Remember that the 2572A can synchronize more than two instruments and that each one must be connected to a LAN network for communications and synchronization signals and therefore, all instruments must be set up to operate from a LAN interface and each instrument must have a unique LAN address for identification.

Slave units are identified by their LAN address. Press the Slaves IP Address soft key button to access the identification menu as shown in Figure 3-67.

There are two additional soft key commands added as you enter the Slaves IP Address menu: Insert Slave and Delete Slave. Use these buttons to add or remove salve identifications from your synchronization list. Every IP address that will be added to this table will automatically become part of the synchronization scheme.

Figure 3-67, Programming Slaves IP Address

The final step to synchronize all instruments is the Couple State button as shown in figure 3-68. Select the Active state and press Enter to synchronize the instruments.

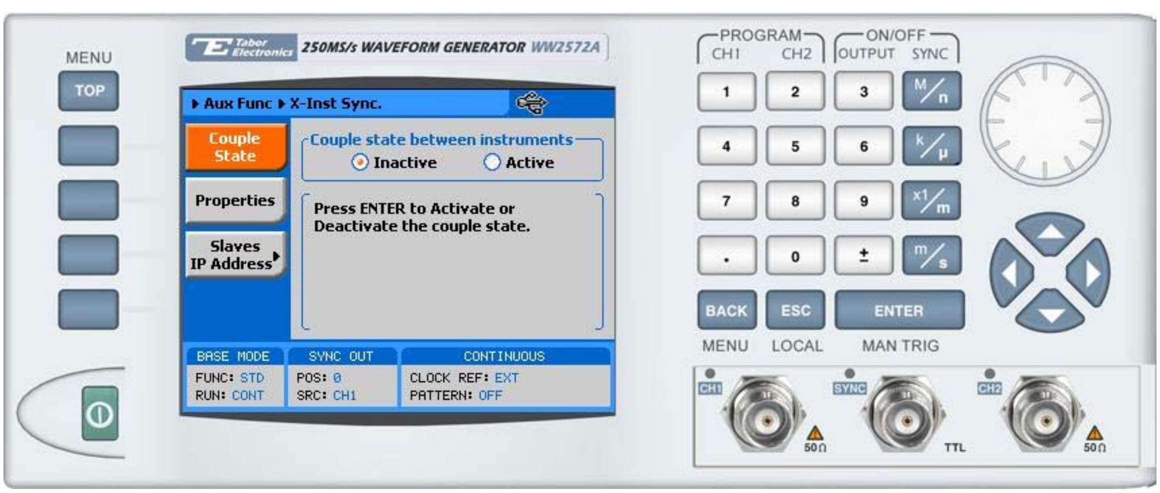


Figure 3-68, Activating the Synchronization Process

Operating Synchronized Instruments

Operating synchronized instruments is best achieved if some ground-rules are learned and adhered to.

1. Connecting the synchronization cables is pre-requisite however, additional steps must be performed to set one unit in master mode the others as slave.
2. Make sure you activate the synchronization sequence from the Master unit only
3. Sample clock and output frequency can only be controlled from the master unit
4. Both master and slave units must be placed in the same run mode to operate synchronously. For example, units in burst mode will synchronize however, one set to continuous and the another to burst will not synchronize
5. Both master and slave units must be placed in the same waveform mode to operate synchronously. For example, both units in sequence mode will synchronize however, one set to Arbitrary and the other to sequence will not synchronize
6. Two instrument synchronization does not operate in modulated waveform mode
7. Trigger signal is applied to the master input and is common to both master and slave units
8. Each instrument can have a unique set of waveforms, active segment, sequence, amplitude and offset parameters
9. Slave channels can be delayed in reference to the master channels by a pre-defined number of sample clocks. Observe Figure 3-66 and access the Start Phase field in the Synchronization Properties group. The start phase defines the delay time that the instrument will hold off before it will start generating the output waveform. Setting resolution is 20 ns and the delay can be programmed from 200 ns to 20 s.
10. There is always some skew between adjacent instruments, which is due to circuit delays and cable length. Always consider the initial skew in your inter-instrument delay calculations. The initial waveform skew on the slave unit is roughly 15 ns.

Understanding the Basics of Phase Offset between Channels

The 2572A has two output channels that can generate various and numerous waveforms. Although the control over waveform parameters is separate for each channel, the sample clock is derived from a single source. Having a single source for both channels is of great advantage because of two main reasons: 1) There is no jitter between the two channels and 2) If we ignore the initial skew, both waveforms start at exactly the same phase.

Understanding the initial skew term is very important. If you set both channels to output square waveforms and then connect these signals to an oscilloscope; If you then set the oscilloscope to its fastest time base setting, you'll see the two rising edges of the 2572A signals. They do not overlap exactly because the instrument has a skew spec of ±1 ns.

Skew is caused as a result of many factors. Although the two channels were designed exactly the same, small variations in printed circuit board layout or component values are enough to cause skew. These factors were known during the design phase and were minimized as practical. On the other hand, skew can also be generated from external factors that are controlled by the user alone. Examples for these factors are variation in cable length and quality, as well as, non-symmetrical end termination. Therefore, if you want to eliminate skew between channels, you have to use exactly the same cable type, the same cable length and the same termination on both channels.

There are times, however, that you do need to offset phase between channels. In that case, the 2572A lets you adjust phase-offset variations with resolution of one point. When you do, just keep in mind that the initial skew will escort your programmed phase offset throughout the entire phase offset range.

Adjusting Phase Offset for Standard Waveforms

The 2572A can generate an array of standard waveforms however, one should bear in mind that the 2572A is a digital instrument and that standard waveforms are created from lookup tables or computed from equations; The lookup tables or equations are converted to waveform coordinates, placed in the arbitrary waveform memory and then clocked to the DAC with the sample clock generator. The frequency of the output waveform is computed from the relationship of two parameters: sample clock frequency and number of points.

Output Frequency = SCLK / number of waveform points

As you probably already realize, the sample clock has a finite frequency, 250 MS/s in the case of the 2572A. And therefore, to reach high frequencies, the number of points is reduced proportionally. For example, consider output frequency of 25 MHz, there are only 10 points available to create the shape of the waveform.

With the above information on hand, we can deduct that if we want to phase offset one channel in reference to another, the number of waveform points determine the resolution of the phase steps. For example, for a 250 kHz sine wave, the number of points that are required to generate the waveform is 1000. So, phase offset can be programmed with resolution of 360°/1000=0.36°. On the other hand, at 25 MHz, the number of points that are required to generate the waveform is 10. So, phase offset can be programmed with resolution of 360°/10=36°.

So how do you figure out how many waveform points are used and what is the best resolution you may get? Simply look at the display of the standard waveform. You may not control the sample clock frequency when you use standard waveforms however, the display provides information on the internal SCLK setting and you may find out how many waveform points are used by looking at the SYNC line below the waveform icon. With this information, you can now compute your phase offset resolution.

Now, navigate to the Outputs menu, as shown in figure 3-69, you can see the Offset [Channel 2] field. CH2->CH1 delay is programmed in units of waveform points. Use the examples above to compute how many degrees are represented by each waveform point and enter the phase offset you wish to program. If you program any value besides 0, the start of channel 2 output will be delayed for an interval set by the following relationship:

Offset [Channel 2] = n x 1/sclk

Or, if you prefer to use phase offset in degrees, compute your phase offset resolution from the following relationship:

Phase Offset Resolution = 360° / n (where n = wave points)

And then multiply n by the value you program in the CH2->CH1 field.

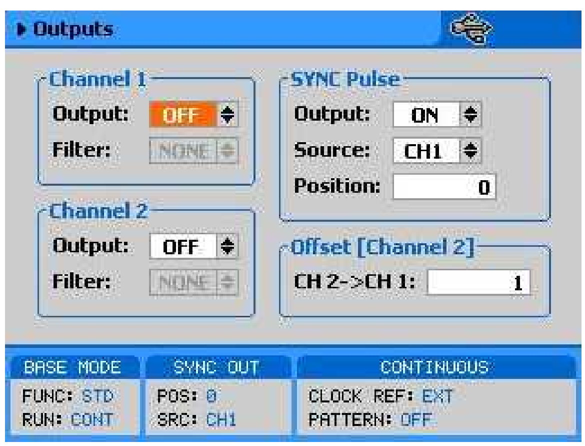


Figure 3-69, Programming Phase Offset Between Channels

Contrary to what was discussed in the above, there are two waveforms that behave differently; these are sine and triangular waveforms. You can still use the phase offset method as was described in the above however, the two functions are different in a way that you can change the start phase on each waveform in increments of 0.2° regardless of how many waveform points are being used for generating the shape. This is true even if the number of waveform points do not allow such resolution however, it is also limited to 50MHz maximum. The phase offset for sine and triangle are changed from the Standard Sine and Standard Triangle menus and not from the Outputs menu. When you change start phase on one channel, you automatically generate a phase offset between the two channels, provided that both channels generate the same waveform shape. The phase adjustment for the sine and triangle waveforms is accessed from the Waveform->Standard->Phase menu, as shown in figure 3-70.

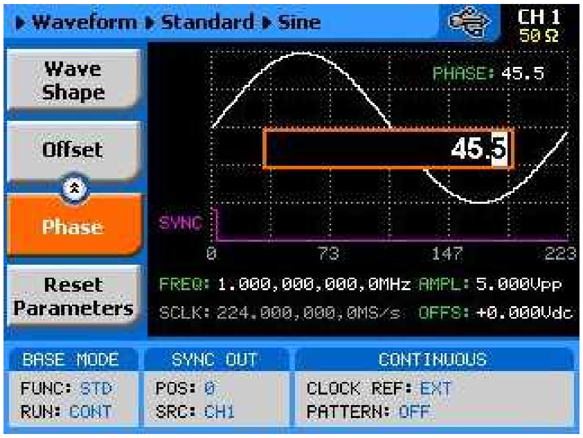


Figure 3-70, Changing the Start Phase on the Sine Waveform

Adjusting Phase Offset for Arbitrary Waveforms

The method of setting phase offset between channels when the 2572A is programmed to generate arbitrary or sequenced waveforms is simpler because you already know how many waveform points you used for generating your waveform and what is the programmed sample clock and therefore, as discussed before, the delay is computed from the following relationship:

Offset [Channel 2] = n x 1/sclk

Or, if you prefer to use phase offset in degrees, compute your phase offset resolution from the following relationship:

Phase Offset Resolution = 360° / n (where n = wave points)

And then multiply n by the value you program in the CH2->CH1 field. Navigate to the Outputs menu, as shown in figure 3-69, and modify the Offset [Channel 2] field as required.

Adjusting Phase Offset for Modulated Waveforms

Modulated waveforms are generated by the DDS circuit and therefore the phase offset between channels cannot be modified because the DDS generates sine waveform only and does not depend on waveform memory for the shape of the waveform. Using the modulated waveforms, there is a constant phase offset between the channels; this phase offset is always 90°. The constant phase offset for the modulated waveform is especially valuable for generating I & Q vectors.

Customizing the Output Units

There are two parameters that could be customized for easier fit of the output parameters; These are: the Horizontal Units, the Load Impedance, Dial Direction, Clock Source and Display Brightness. Figure 1-30 shows the customization panel. Navigate to the customization display from the Utility menu. Adjust the brightness and the dial direction for your preferences and select the clock source as required by your system management. Information on the how to adjust the horizontal units and how to adjust the display for your load impedance is given in the following paragraphs.

Selecting the Horizontal Units

Normally, frequency units – Hertz are used when specifying waveform frequency however, at times and as part of global system considerations, it makes it more convenient to work with time units – seconds. The horizontal scale of the 2572A can be modified to operate either in the frequency domain or time domain. The default setting for the generator is frequency units.

Adjusting Load Impedance

As specified in Appendix A, the display of the output amplitude is valid when the load impedance is exactly 50Ω. Such impedance is absolutely necessary when operating at high frequencies where unmatched output impedance can cause reflections and standing waves. It is therefore recommended to terminate the output with 50Ω loads only. In certain applications where the load impedance is of no consequence, it may range from 50Ω to open circuit however, since the source impedance is 50Ω, the displayed amplitude will be different than the actual level on the load. If you know your load impedance, you can adjust the display to show the exact level on your load. The adjustment, as you can see in Figure 1-30 can be made separately for each channel. The default load impedance setting is 50Ω.

Figure 3-71, Customizing the Output Parameters

Monitoring the Internal Temperature

The 2572A has an internal temperature sensor that allows monitoring of the internal temperature. In cases where you suspect that the instrument is getting too warm, or malfunction occurs, you can monitor the internal temperature to see if the cause is excessive heat inside the unit. The temperature information is also available to read from a remote interface, so constant control over system temperature can be maintained.

Temperature reading is automatically read and displayed every time you select the System display from the Utility menus. Figure 3-72 is an example of the System menu, showing the temperature inside the unit as 35°C. To update the reading press the numeric "0" button.

Figure 3-72, Reading the 2572A Internal Temperature

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Chapter 4
ArbConnection

What's in This Chapter?

This Chapter contains information how to install, invoke and use ArbConnection. Introduction to ArbConnection and examples how to program instrument controls and parameters and how to generate waveforms and download them to the 2572A are also given in the following sections.

Introduction to ArbConnection

In general, ArbConnection is a utility program that serves as an aid for programming the Model 2572A. ArbConnection has many functions and features of which all of them share a common purpose – controlling 2572A functions from remote. As minimum, to use ArbConnection, you'll need the following tools:

1. Computer, Pentium III or better
2. Windows 2000/XP, or higher
3. High resolution screen, at least, 1024 x 768 pixels
4. Pointing device, mouse or ball
5. Visa 2.6, or higher installation
6. Last, but not least, some basic knowledge how to operate computers and Windows-based programs.

ArbConnection operation is divided into three main functions: 1) Front panel control, 2) Waveform generation and editing and 3) FM waveform generation and editing. These operating options are described in this chapter however, you must install ArbConnection before you can use it. The next paragraphs describe installation and first steps before going into in-depth operation.

Installing ArbConnection

The installation program installs ArbConnection on a logical drive of your choice. The default is drive C. It automatically creates a new directory and copies the files that are required to run the program. Before you install ArbConnection, make sure that there is at least 10 megabytes of available memory on your hard disk drive.

To install ArbConnection, insert the distribution disk in the A: drive.

Invoke Run and type:

```
A:\Setup
```

The install program does the complete job far you and creates a workgroup and icons to start ArbConnection.

Quitting ArbConnection

Before you start roaming through menus and editing commands, we strongly recommend that you make yourself familiar with ArbConnection basics and concept. For now quit the program and spend some more time with this section of the manual. Point the mouse cursor to the File menu and press the left mouse button. Move the mouse cursor to the Exit command and press the left mouse button.

For the New and Advanced Users

For the New User
Learning to use ArbConnection is easy, intuitive and quick, even if you have never used such programs before. After you have installed ArbConnection on your computer read the following paragraphs to learn how to find your way around ArbConnection's menus.

Once you are familiar with the basics, you'll continue to learn about features, programming, and editing commands. If you can't find the answer to a question in this guide, call your distributor or the LeCroy customer support service near you and we'll gladly assist you with your problems.

For the Advanced User
If you are already familiar with computer conventions and have basic knowledge of Windows programming, you may want to skip some of the following paragraphs.

Conventions Used in This Manual

This manual uses certain typographical conventions to make it easier for you to follow instructions. These conventions are described in the following:

[Enter, or ↵] Press the Enter or Return key.

[Esc] Press the Escape key.

[Alt-F] Press the Alt key and the key that follows, simultaneously. In this example the key that follows is F.

[Ctrl-S] Press the Control key and the letter that follows, simultaneously. In this example, the letter is S. The control key also appears in the menus as a target sign.

[↑] [↓] [→] [←] Press the Arrow key with the symbol pointing in the direction specified (i.e., up, down, left, or right).

<+> Press the key for the character or word enclosed in angle brackets. In this case, the Plus sign key.

The Opening Screen

Invoke ArbConnection by double clicking on the icon. If you cannot find the icon on your desktop, click on Start, Programs and ArbConnection. The opening screen will show. If you installed the program correctly, your screen should look as shown in Figure 4-1.

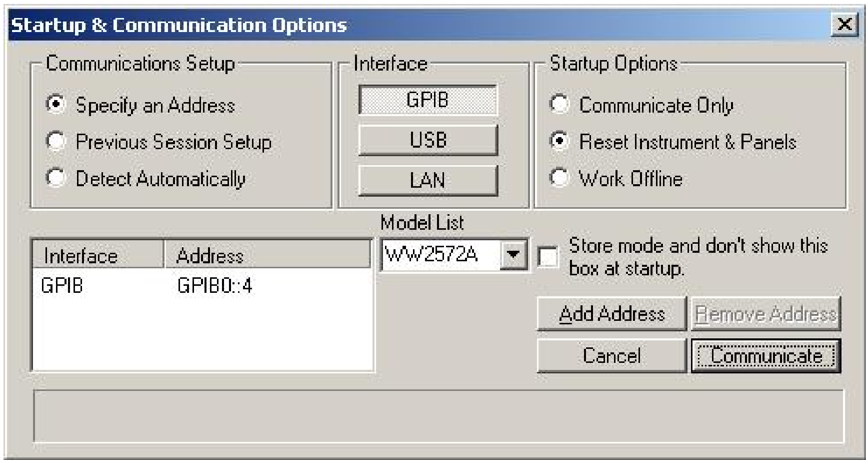

Figure 4-1, Startup & Communication Options

The Startup & Communication Options dialog box is displayed. You can check the “Store and don’t show…” so next time you invoke ArbConnection, this dialog box will not be displayed. The purpose of this dialog box is to update the program in the way you intend to use it. For example, if you are using a GPIB device that has address 4, you can click on the Specify an Address option and type in the required address so the next time you use ArbConnection, the program will automatically resume communication with the same address as was originally detected.

If you chose to hide this dialog box, you can still access and change the options from the System command, at the top of the screen.

Make your selection and click OK. The Startup & Communication Updater dialog box will be removed from the screen. And the Main panel will now be accessible. But before we go into panel operation, let’s look at the toolbars at the left top of the screen as shown in Figures 4-2 and 4.2A.

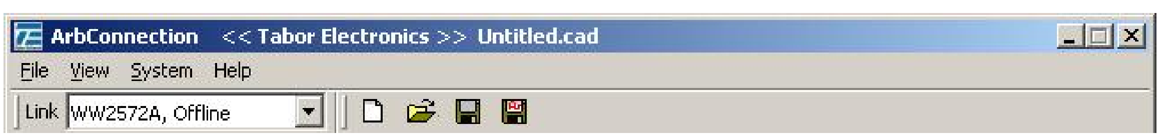

Figure 4-2, ArbConnection's Toolbars

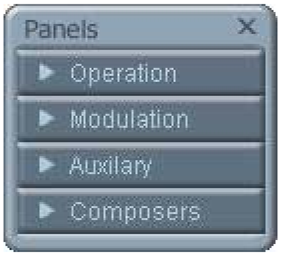

Figure 4-2A, the Panels Toolbar

The standard Windows **Menu Bar** is the top bar. It provides access to main system controls like saving files, and viewing or removal of screen images.

The second bar is called **Link** bar. It provides direct access to different instruments that are active on the active interface bus. ArbConnection can control a number of 2572A units simultaneously. If the instruments were connected to the interface while invoking ArbConnection, they will automatically be detected by the program and will be placed in the Link pull-down window. The active instrument is displayed with its associated address. If you run ArbConnection in offline mode, the Link bar will show 2572A, Offline.

The **Panels** toolbar, as shown in Figure 4-2A, provides direct access to instrument control panels. The individual control panels are explained later in this chapter. The Main, Standard, Arbitrary, Trigger and the other buttons will bring up to the screen panels that are associated with these names. The Composers button provides access to the Waveform, Pulse, FM and 3D composers. The first time you launch ArbConnection, the opening screen will have the Main panel open. Click on other buttons and interactively get the feel how ArbConnection opens and closes control panels.

ArbConnection Features

ArbConnection's main purpose is controlling 2572A functions and parameters. The 2572A can generate standard waveforms from a built-in library, arbitrary waveforms from user-downloaded coordinates, modulated waveforms, digital patterns and much more. The only way to access all of these features is through software utilities such as Plug & Play drivers, and soft front panels. ArbConnection is built to provide complete control over the 2572A.

ArbConnection has four main screens: control panels, waveform composers and various utility control panels. The various screen images along with instructions how to access and use them are described below in detail.

The Control Panels

The control panels look and feel just as if you would operate an instrument from its front panel. They even look like instrument front panels, so operating function and changing parameters is easy and intuitive. Let's look at the first panel that shows at the opening screen. This panel, as shown in Figure 4-3, is called the Main Panel.

To begin with, let's explore the panel controls to see how they feel, react and what they do. All other panels share almost the same feel, so the description of how to operate the Main Panel can serve as general guide for controlling the rest of the panels.

Looking at the panel you can identify the following controls: Push buttons, LED's, radio buttons, Dial and Digital display. The function of each control is described below.

Push Buttons – These are used for toggling a function on and off. For example, the Output Enable button in the Output group toggles the output on and off. The first mouse click will push the button inwards and will turn on a red bar at the center of the button, indicating that the function is on. The second mouse click will turn the function off.

Radio Buttons – Are used for changing operating modes, or selecting between mode options. One of the radio buttons is always on with a red dot in its center, indicating its state condition.

LED's – The LED's indicate which of the parameters are displayed on the Digital Display. Red LED indicates that the parameter name next to this LED is selected. Only one LED can be ON at a time.

HINT

LED's are turned on by clicking on the LED or the text next to it. The selected parameter is flagged by a darker LED shade.

Dial – Use the dial to modify displayed reading. To use the dial, press and hold the mouse cursor on the dial and move the mouse in a clockwise circle to increase the number, or counterclockwise circle to decrease the displayed number. The dial modifies digits at the cursor position and will allow modification within the legal range of the displayed parameter. If you reach the end of the range, the dial will have no further effect on the display. If you do not want to use the dial, you can still change the display reading by using the [↑], or [↓] keys, or simply type the required number using the standard keyboard features.

NOTE

After you change the displayed readout, the 2572A will be updated with the new parameter only after you press the Execute button.

Digital Display – The display is used for displaying and reading various 2572A parameters, just as you would use it on your instrument.

Note

Normal color of the digital reading is dark blue. If you modify the reading, the color changes to a lighter shade of blue, indicating that the 2572A has not been updated

yet with the new parameter. Pressing Execute will update the instrument and will restore the color of the digital readout to dark blue, indicating that the displayed value is the same as the generator setting.

Also note that the digital readout has an autodetect mechanism for the high and low limits. You cannot exceed the limits if you are using the dial but only if you use the keypad. In case you do, the program will not let you download an illegal parameter and you'll be requested to correct your setting.

The Operation Panels

Figure 4-3a -, the Operation Panels

The Operation tab provides access to a group of panels that control the basic operation of the generator. From this group you can set the output function, run mode, turn the outputs on and off and adjust the parameters for the various functions. There are four panels in this group: Main, Standard, Arbitrary/Sequence and Trigger. The Main panel is always visible because this is the panel that controls operating functions, run modes and sets the outputs on and off. The other panels can be made visible by clicking on the appropriate tab in the Operation group. The operation set of panels are described below.

Main

The Main Panel, as shown in Figure 4-3, is the first panel you see after invoking ArbConnection. Notice how buttons and LED's are grouped; this is done specifically so that common parameters are placed in functional groups. The Main Panel groups allow (from left to right) adjustment of amplitude and offset, selection of waveform mode, selection of run mode and control over SYNC and Main output parameters. Controls, where applicable, are provided for each channel separately.

Figure 4-3, the Main Panel

If you are connected properly to a PC and ArbConnection has detected your instrument, then every time you press a button, you are getting an immediate action on the 2572A. It is different if you are changing parameters on the display; Doing this, you'll have to press the Execute button for the command to update the instrument. The functional groups in the Main Panel are explained below.

CH1 and CH2 Parameters

The Parameters group has two parameters for each channel: Amplitude and Offset and a phase offset parameter that defines the phase shift of CH2 in respect to CH1. To access the required parameter, click on the LED or the text next to it to display the required parameter. The value that is associated with the lit LED is displayed on the digital display. You can use the dial, keyboard, or the [↑] [↓} keys to adjust the readout to the required setting. After you modify the reading, press Execute to update the 2572A with the new reading.

Function

The Function group is used for selecting between function types. The 2572A provides four types of waveforms: Standard, Arbitrary, Sequenced and Modulated. By pressing one of these buttons output waveform will change to the selected option. The default function type is Standard. If you want to change standard waveform parameters, you can select Standard from the Panels bar.

Run Mode

The Run Mode group is used for selecting the active run mode for the instrument. You can select between continuous, triggered, gated and burst modes. There is no additional panel associated with the continuous mode, but if you press one of the other run mode options, you'll be able to adjust the trigger parameters from the Trigger Panel.

Output Control

The Output Control group controls the state of the main outputs and the sate of the SYNC output. Click on the State buttons to toggle the outputs on and off.

From this group you also control the position of the SYNC pulse and the source of the sync. If you select the SYNC source to come from channel 1, the waveform that is generated at the CH1 output connector will be synchronized with the rising edge of the SYNC output pulse. Selecting the SYNC source as CH2, transfers the synchronization to the second channel. Note that you'll notice the difference only if you have different waveforms and waveform length in channels 1 and 2.

The load impedance buttons allow you to adjust the display amplitude reading to your actual load impedance value. The default value is 50 ohms and the output range is calculated in reference to this value. If your actual load impedance is higher than 50 ohms and you increase the load impedance value in this group, the output of the 2572A will display the correct value as is measured on your load impedance.

Standard

The Standard Panel, as shown in Figure 4-4, is accessible after you click on the Standard button in the Panels bar. The Standard Waveform Panel groups allow (from left to right) adjustment of CH1 and CH2 waveforms and their associated parameters. The functional groups in the Standard panel are described below.

Figure 4-4, the Standard Waveforms Panel

CH 1 and CH 2 Waveforms
The Waveforms group provides access to a library of built-in standard waveforms. The library includes: Sine, Triangle, Square, Pulse Ramp, Sinc, Exponential, Gaussian and DC waveforms. Each waveform has one or more parameters that can be adjusted for the required characteristics of the output. For example, phase start can be adjusted for the sine and triangle waveforms and duty-cycle can be adjusted for the square waveform. The pulse waveform can be adjusted for rise and fall time as well as width and delay. Parameters that are associated with each waveform are automatically displayed when the waveform is selected.

Note that by clicking a button in this group, you are immediately updating the 2572A output with this waveform shape.

Parameters
The parameters group contains buttons that control the source of the 10MHz reference and the setting of the output frequency for the standard waveforms function.

The 10MHz Ref controls toggle between an internal and external references. The default setting is internal, which provides frequency accuracy of 1ppm. If such accuracy is not sufficient for your application, click on the external option but make sure that a reference source is applied to the rear panel connector; otherwise, the accuracy of the output will deteriorate completely.

The Frequency control lets you program the output frequency of the selected waveform shape. The frequency parameter may be modified when the LED illuminates. You can use the dial, keyboard, or the [↑] [↓} keys to adjust the readout to the required setting. After you modify the reading, press Execute to update the 2572A with the new reading.

Arbitrary/Sequence

The Arbitrary & Sequence panel, as shown in Figure 4-5, is invoked by pressing the Arb/Seq button on the Panels bar. Note that if you invoke the Arbitrary & Sequence Panel from the Panels menu, the 2572A will not change its output type. On the other hand, if you select the arbitrary, or the sequenced options from the Main Panel, the 2572A will immediately change its output to the selected waveform type. The functional groups in the Arbitrary Waveforms Panel are described below.

Parameters
The Parameters group contains three parameters for each channel: Amplitude and Offset. Actually, the values exhibited in this group are exactly the same as in the Main Panel, so every time you change amplitude and offset in the Parameters group, the other panels are updated automatically. The segment parameter provides access to the active segment for each channel.

To access the required parameter, click on the parameter name.

The LED next to the required parameter turns on. The value that is associated with the lit LED is displayed on the digital display. You can use the dial, keyboard, or the [↑] [↓} keys to adjust the readout to the required setting. After you modify the reading, press Execute to update the 2572A with the new reading.

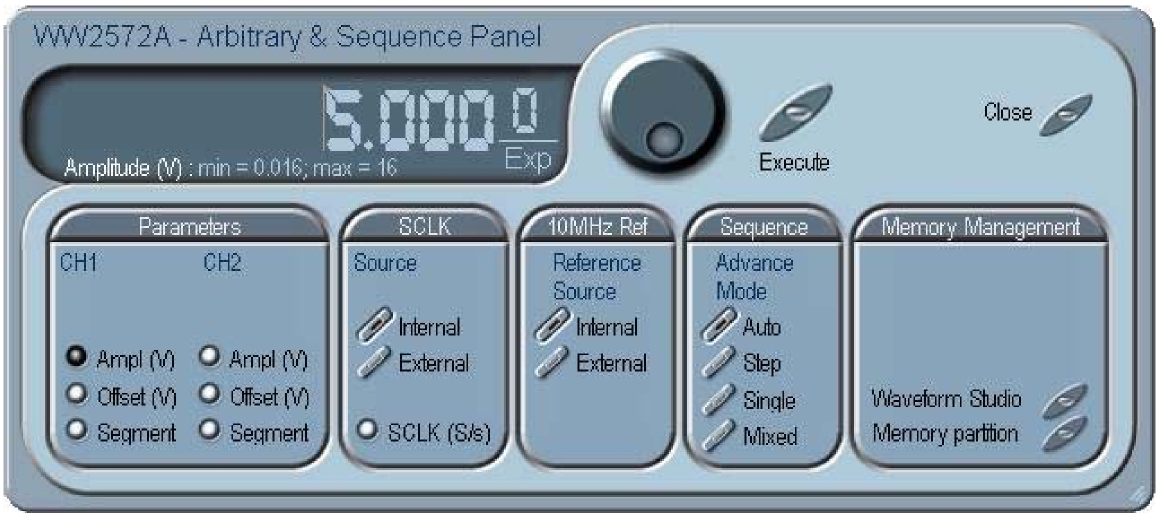

Figure 4-5, the Arbitrary & Sequence Panel

SCLK

The SCLK (Sample Clock) group is comprised of parameters that control the sample clock frequency. The sample clock setting affects the 2572A in arbitrary mode only.

The sample clock rate is programmed in units of S/s (samples per second) and will affect the instrument only when it is programmed to output arbitrary or sequenced waveforms. The SCLK parameter has no effect on the frequency of the standard waveforms.

The two switches in the SCLK group select between internal and external sample clock inputs. The internal is the default setting. When you select the external sample clock option, make sure an appropriate signal is connected to the external sample clock connector on the rear panel.

To access the required parameter, click on the button until the LED next to the required parameter turns on. The value that is associated with the lit LED is displayed on the digital display. You can use the dial, keyboard, or the [↑] [↓} keys to adjust the readout to the required setting. After you modify the reading, press Execute to update the 2572A with the new reading.

***10MHz* Ref**

The 10MHz Ref controls toggle between an internal and external references. The default setting is internal, which provides frequency accuracy of 1ppm. If such accuracy is not sufficient for your application, click on the external option but make sure that a reference source is applied to the rear panel connector; otherwise, the accuracy of the output will deteriorate completely.

Sequence
The Sequence Advance Mode group provides control over advance modes for the sequence generator. Advance options are: Auto, Stepped, Single and Mixed. Refer to the 2572A manual to find out more when and how to use these advance modes. You should be careful while selecting modes because it is possible to cause settings conflict, for example, if you select the Single option before you modified the run mode to Triggered.

Memory Management
The memory management group provides access to the memory partition and waveform studio screens. The Waveform Partition button opens a screen as shown in Figure 4-6 and the Waveform Studio button opens a screen as shown in Figure 4-7. Information how to use these screens is given in the following paragraphs.

Using the Memory Partition Table

If you want to learn more about waveform memory and segment control, you should refer to section 3 of this manual. In general, the 2572A can generate arbitrary waveforms but, before it can generate waveforms, they must be downloaded to the instrument from a host computer. Waveforms are downloaded to the instrument as coordinates and are stored in the 2572A in a place designated as “waveform memory”. The waveform memory has a finite size of 2M.

Having such long memory does not necessarily mean that you have to use the entire memory every time you download a waveform. On the contrary, the 2572A allows segmentation of the memory so that up to 4096 smaller waveforms could be stored in this memory. There are two ways to divide the waveform memory to segments: 1) Define a segment and load it with waveform data, define the next and load with data, then the third etc. or 2) Use what ArbConnection has to offer and that is to make up one long waveform that contains many smaller segments, download it to the instrument in one shot and then download a memory partition table that splits the entire waveform memory into the required segment sizes. Want to use it? Here is how it is done. Point and click on the Memory Partition. A dialog box as shown in Figure 4-6 will pop up.

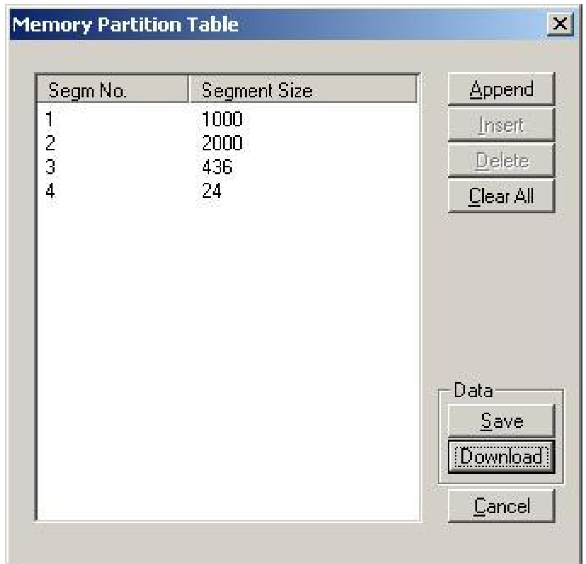

Figure 4-6, the Memory Partition Table

The two main fields in the segment table are Segment number and segment size. The **Seg No** (segment number) is an index field that can has values only, from 1 to 2048. The **Segment Size** is always associated with the segment number. You can program any segment size from 16 to 2M.

Use the **Append** key to add a segment at the end of the segment list. If you highlighted a segment, the Append key turns automatically to insert Use the **Insert** key to insert a segment at the cursor location. The **Delete** key is used for deleting a segment at the cursor position.

The **Clear All** key will remove all segments from the table and will let you start designing your segment table from fresh.

Click on the **Close** to discard of the contents of the dialog box without saving your last actions and to remove the Segment Table from the screen.

The **Save** key saves the current session so you can start the Memory Partition table from the same point after you close this session. The **Download** key updates the 2572A with the present segment table settings.

TIP

The Memory Partition table does not download waveforms. Use the memory partition table only if you merged a few waveforms to one. The partition table then divides the memory to the individual and original size of each waveform. If you download waveforms using the

waveform studio, they already contain segment size and there is no need for further use of the memory partition table.

Using the Waveform Studio

The Waveform Studio, as shown in Figure 4-7 has two parts: 1) Segment Table and 2) Sequence Table. The purpose of the waveform studio is to provide access to waveform files that are already resident in the system. These files can be delegated to various segments and later be used as individual waveforms or combined into complex sequences.

The Segment Table

Using the Segment Table you may list and download waveform files that were previously stored on the computer. The table shows the segment number and its associated file name, length and its download status. There are other means to download waveforms to memory segments such as the Wave Composer and individual function calls; The waveform studio makes it easier by combining multiple and complex commands into one simple dialog box.

To access the Segment table, click anywhere on the Segment Table area. If it was not yet, it will turn white as opposed to the Sequence Table area that turns gray. The Segment Table area is divided into three parts: the table area, the waveform shape area and control buttons. When you point and click on one of the waveforms, its shape is shown in the Waveform Shape window.

The Segment Table has four fields:

The **Seg** field contains numbers from 1 through 2048, designating the programmed memory segment. Note that memory segments are numbered from 1 to 2048.

The **State** field shows the current status of the memory segment. It can be *Free*, if no file has yet been assigned to this segment number, or *Mapped*, if file name has been assigned to the segment but the Download button has not been used yet to move the file to the 2572A memory, or *Loaded*, if the process has been completed by pressing either the Download button or the All (download all) button.

The **File** field is an edit field that lets you browse and select file names to be applied to a specific memory segment. To change or add file name, point and click on the File name field and either type your path or browse to the file location and let Windows find the right path.

The **Length** field displays the length of the selected memory segment. Memory segments size may be programmed from 16 to 2M. Note that the length field is not accessible and shown for reference purpose only.

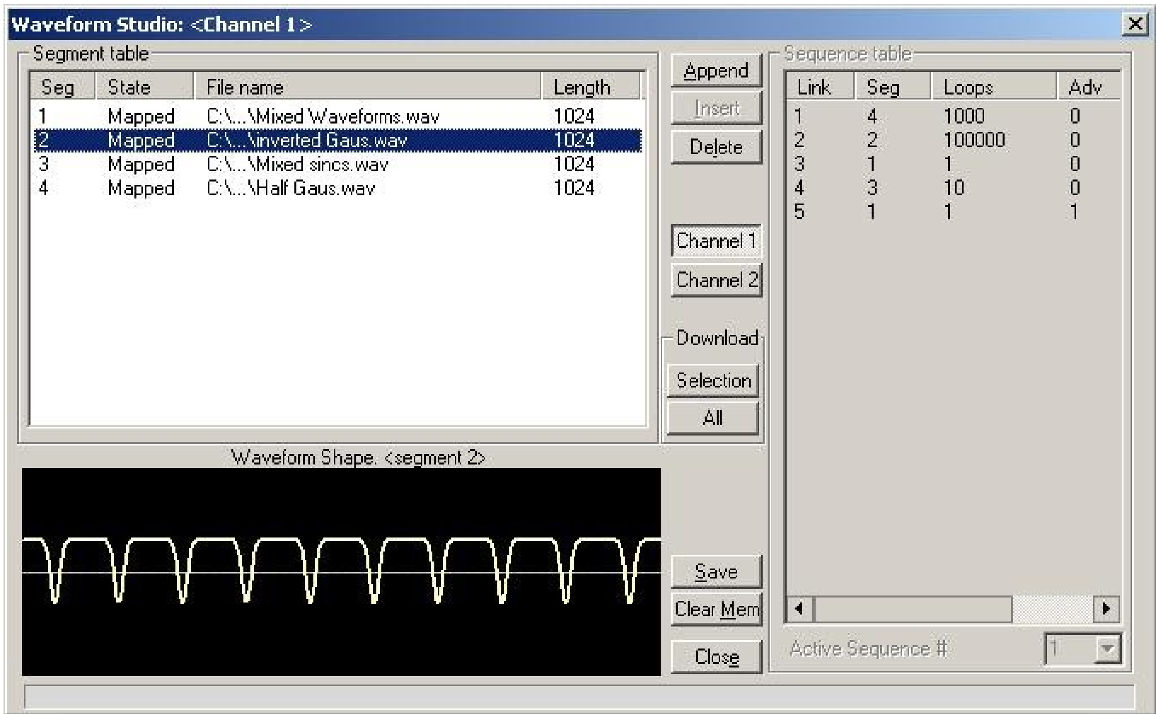

Figure 4-7, the Waveform Studio

TIP

Point and click on one of the segments to show its shape in the Waveform Shape window.

Description of the various buttons in the Segment Table is given below.

Append – adds segment number at the end of the table

Insert – adds a segment above a highlighted segment line

Delete – removes a highlighted segment

Channel 1 – shows segment table for channel 1 only

Channel 2 – shows segment table for channel 2 only

Save – saves current table settings

(Download) Selection – downloads a highlighted segment only to the 2572A memory

(Download) All – downloads the complete table to the 2572A memory

Clear Mem – wipes out the entire memory and clears the table for fresh settings

Close – removes the Waveform Studio from the screen. If you have not saved your work, the table setting will be lost.

The Sequence Table

As was explained in the above, the waveform memory can be divided into smaller segments and up to 2048 segments can be defined and used as individual arbitrary waveforms. Having a limited size of waveform memory can, for some applications, pose a limitation however, if sections of the waveform are repetitive, one may use the sequence generator to take these segments and replay them as part of the complete waveform without loosing valuable memory space and without scarifying waveform coherences, or integrity. The tool for using repetitive and multiple segments in one long waveform is called Sequence Generator. The 2572A has two separate sequence generators, one for each channel and ArbConnection has a special dialog box where sequences are designed. This tool is called – Sequence Table.

Using the Sequence table you can use waveforms that you already downloaded to the 2572A from the Segment table, link and loop in random order to create one long and complex waveform that combines the individual memory segments.

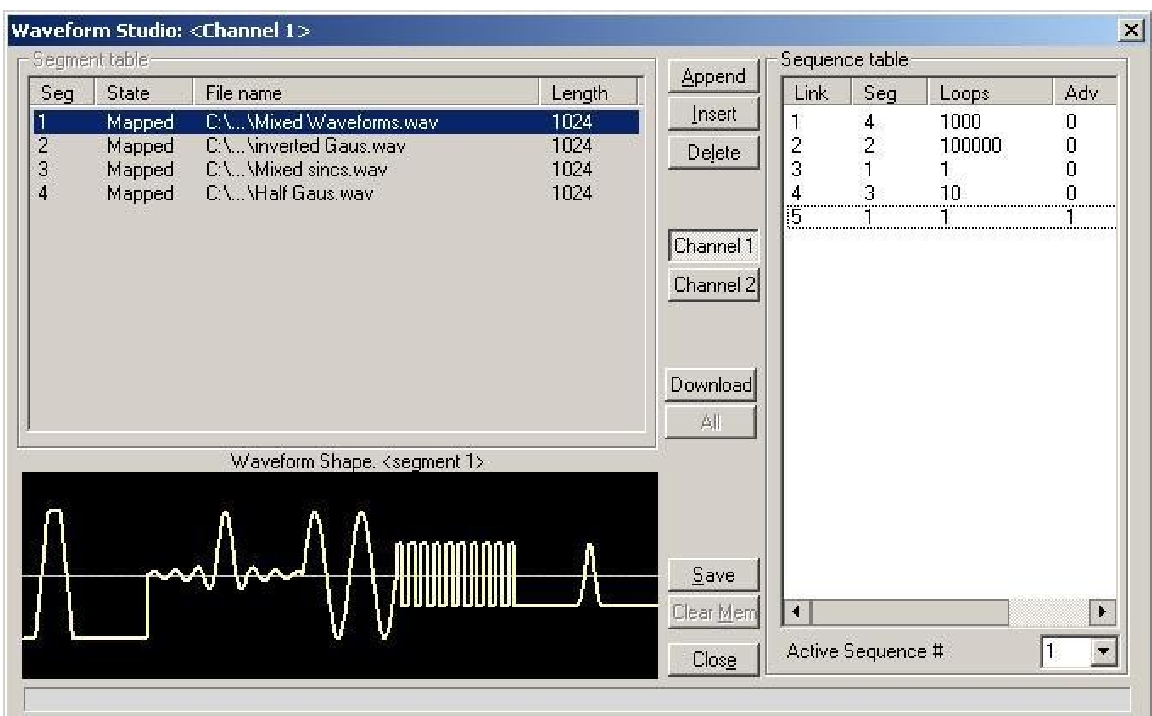

Figure 4-8, the Sequence Table

The Sequence Table is demonstrated in Figure 4-8. To access the Sequence table, click anywhere on the Sequence Table area. If it was not yet, it will turn white as opposed to the Segment Table area that turns gray.

There are four major elements that you should consider while programming a sequence table. They are: Link, Seg, Loops and Adv. These terms are explained below.

Link - This parameter defines an index array for the sequence generator. When generating sequences, the instrument steps though the links in descending order therefore, make sure that you enter your waveform segments in exactly the order you would like them at the output.

Seg - This parameter associates waveform segments with links. You can use different segments for different links or you can use the same segment for a number of links. There are no limitations how you associate links to segments, except you cannot program in the sequence table segments that were not defined earlier.

Loops – This parameter define how many times the segment will loop for the selected link. For example, if you program 2, the waveform will cycle twice through the same segment before transitioning to the next link.

Adv – This parameter flags the advance mode for the specific segment. This flag is active when the advance mode is Stepped. When set to 0, the sequence will advance through the list automatically until a segment that is flagged 1 is encountered. When 1 is encountered, the generator will idle on this segment until an external trigger is applied. Learn more about the sequence advance modes in Chapter 3.

Figure 4-8 shows an example of a 5-step sequence of which the first waveform is made of segment 2, which will loop 15 times; segment 4, looping 2 times; segment 1, looping 7 times; segment 2, once and segment 3, looping 4 times. The Adv bits on links 2 and 5 are set to 1 and therefore, external triggers are required for the sequencer to step through these links.

HINT

The 2572A has two separate sequence generators, one for each channel. If the 2572A is programmed to continuous run mode, make sure both channels have the same sequence length for inter-channel synchronization. For triggered run mode, each channel can be programmed for a unique sequence length.

The control buttons on the left of the Sequence Table have the same functionality as for the Segment Table.

Use the **Append** key to add a step at the end of the sequence list. Use the **Insert** key to insert a step at the cursor location. The **Delete** key is used for deleting a step at the cursor position.

Click on the **Close** to discard of the contents of the dialog box without saving your last actions and to remove the sequence Table from the screen but click on the **Save** key if you want just to save your work before you close the dialog box.

The **Download** key has double action, it will download the sequence table to the instrument and will save the contents of your table so the next time you open this table, it will have the same contents as you saved in your previous session.

Active Sequence

The active sequence field let you select between 10 different sequence settings. You may program each sequence separately and replay them individually as required. The output is updated with the selected sequence number as soon as the active sequence is selected.

Trigger

The Trigger panel, as shown in Figure 4-9, is invoked by pressing the Trigger button on the Panels bar. Note that if you invoke the Trigger Panel from the Panels menu, the 2572A will not change its trigger mode. To modify the instrument run mode, use the Main Panel. The trigger parameters and setting in the Trigger Panel will have an effect on the 2572A only if an appropriate run mode setting has been selected. The Trigger Panel groups allow (from left to right) adjustment of Trigger Modifier and their associated Trigger Parameters. The functional groups in the Standard panel are described below.

Trigger Modifier

The Trigger modifier group provides access to delayed trigger state and its delay parameter, to the Re-trigger state and its parameter and to the burst count for channel 1 and channel 2.

To change trigger burst count for channels 1 or 2, point and click on one of these parameters. The value that is associated with the lit LED is displayed on the digital display. You can use the dial, keyboard, or the [↑] [↓} keys to adjust the readout to the required setting. After you modify the reading, press Execute to update the 2572A with the new reading.

Figure 4-9, the Trigger Panel

Trigger Parameters

Slope - The Slope group lets you select edge sensitivity for the trigger input of the 2572A. If you click on Pos, the instrument will trigger on the rising edge of the trigger signal. Likewise, if you click on Neg, the instrument will trigger on the falling edge of the trigger signal.

Source - The 2572A can accept triggers from a number of sources: BUS, External or Mixed. When the Bus option is selected, only bus commands trigger the instrument. The External position is the default trigger option which enables the rear panel trigger input and the front panel manual trigger button. The Mixed position disables the rear-panel trigger input until a software command is executed, the trigger source then reverts to the rear-panel trigger input.

Manual – Use this button when an external generator is not available. Pressing the Manual button is stimulating the instrument as if an external trigger has been applied.

Trigger Level – Programs the trigger level parameter. Depending on the slope setting, the 2572A will be stimulated to output waveforms when the trigger level threshold has been crossed.

The Modulation Panels

The Modulation functions were designed over seven separate panels, as shown in Figures 4-10 through 4-17. The panels are invoked by pressing the Modulation header and then one of the modulation panels that appear below it (Figure 4-10a). These panels provide access to all modulation functions and their respective run modes and parameters. The modulation functions that are available on these panels are: FM (frequency modulation), AM (amplitude modulation), Sweep, FSK (frequency shift keying), PSK (phase shift keying) and ASK (amplitude shift keying) and Amplitude and Frequency hops. There are also two other panels for controlling the I&Q modulation modes – (n)PSK and (n)QAM. All modulation functions are programmed simultaneously for both channels except AM where each channel can be programmed separately with a different set of parameters.

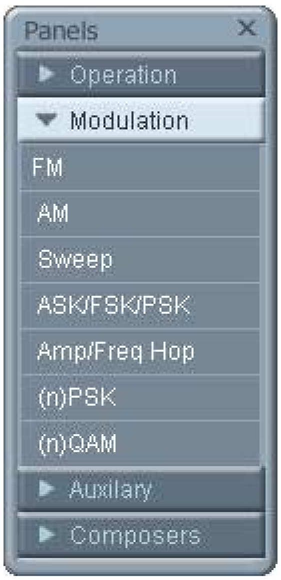

Figure 4-10a, the Modulation Panels

When modulation run other than continuous is selected, there are two options that control the idle state between triggers: 1) Carrier baseline and 2) DC baseline. When the first option is selected, the instrument generates non-modulated carrier frequency (CW) until a valid stimuli signal is applied and when the second option is selected, the instrument generates a dc level signal until a stimulated to generate a modulation cycle. The modulation options, their associated parameters and the various run mode options are described separately for each of the panels.

The Modulation Group is common to all modulation panels. It contains an array of buttons that select the appropriate modulation scheme. It also provides access to the CW (Carrier Waveform) frequency setting. The CW frequency parameter is common to all of the modulation functions.

FM

The FM group contains parameters for controlling the frequency modulation function. To turn the FM function on and off, click on the FM button in the Modulation group. The various controls in the FM group are described below.

Standard FM Parameters
Allow adjustment of the parameters that are associated with the standard modulating waveform. The controllable parameters are Modulation, Deviation and the Marker Frequencies.

Mod. Wave
Defines the shape of the modulating waveform. There are two basic options: Standard waveforms and Arbitrary waveforms. If you do not need exotic waveforms, you can use one of the built-in standard wave shapes: Sine, Triangle, Square, or Ramp. These waveforms can be adjusted for their frequency and deviation range. On the other hand, you can select the arbitrary modulating wave option where you can use any shape however, you must load the

modulating waveform from an external application, such as the FM composer in ArbConnection. Information on the standard and arbitrary FM functions is given in Chapter 3. Click on the button next to the required modulating waveform shape to select it.

Arbitrary FM Parameters
Allow adjustment of the sample clock of the modulating waveform. The shape of the modulating waveform must be downloaded from an external utility such as ArbConnection and the sample clock is programmed from this location.

To change the FM parameters, point and click on the required parameter. The value that is associated with the lit LED is displayed on the digital display. You can use the dial, keyboard, or the [↑] [↓} keys to adjust the readout to the required setting. After you modify the reading, press Execute to update the 2572A with the new reading.

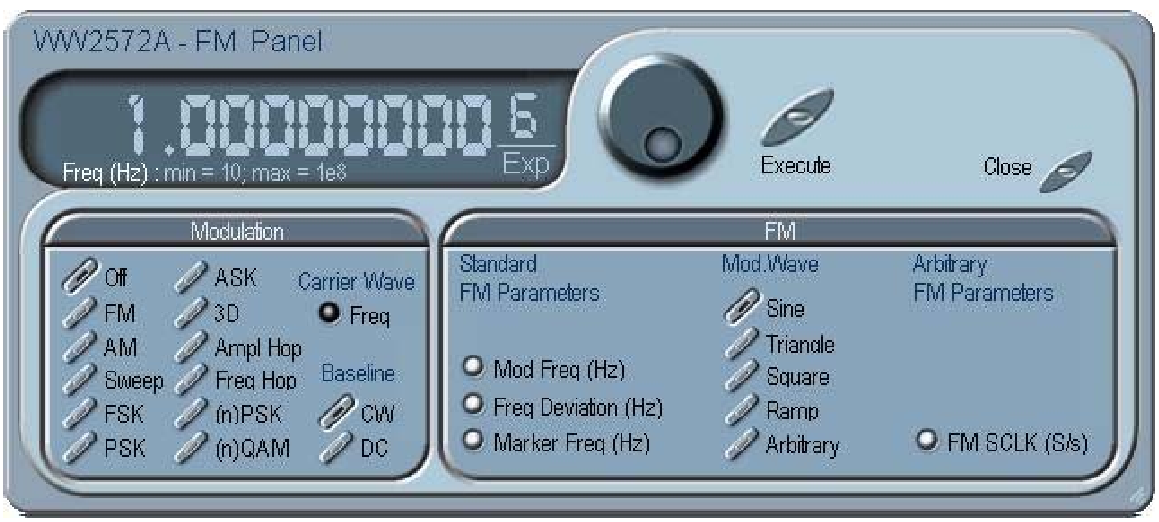

Figure 4-10, the FM Panel

AM

Although both channels are set to output amplitude modulations simultaneously, each channel can be programmed to be modulated using a unique envelop waveform. There are two sets of identical parameters for each channel, as discussed in the following paragraphs.

CH1/CH2 Mod Wave
There is a list of 4 waveforms that can be selected to modulate the carrier waveform (CW). These are sine, triangle, square and ramp. The frequency and amplitude of the modulating waveforms are programmable

Freq
Programs the frequency of the modulating waveform. Note that the frequency setting must be smaller than the CW frequency for the AM function to operate correctly. Although, two frequency parameters are shown on this panel, the frequency of the modulating waveform is identical for both channels.

Depth
The Depth parameter programs the modulation depth, or index in percent of the un-modulated CW amplitude. The depth is symmetrical about the center of the CW amplitude.

Figure 4-11, the AM Panel

Sweep

The Sweep group contains parameters for controlling sweep options. To turn the Sweep function on and off, click on the ***SWP*** button in Modulation group. The various parameters that control sweep features are described below.

Step
Use these keys to select sweep step from two increment options: linear, or logarithmic.

Direction
Use these keys to program sweep direction. Up select sweep from Start to Stop sample clock setting and Down selects sweep from the Stop to Start sample clock setting. Refer to Chapter 3 of this manual to learn more about sweep operation.

Parameters
Allow adjustment of Sweep Start, Stop and Sweep Time. You can also place a marker at a position programmed by the Mark parameter. To access the required parameter, click on the button

below parameters sub-group until the LED next to the required parameter turns on. The value that is associated with the lit LED is displayed on the digital display. You can use the dial, keyboard, or the [↑] [↓} keys to adjust the readout to the required setting. After you modify the reading, press Execute to update the 2572A with the new setting.

Figure 4-12, the Sweep Modulation Panel

ASK/FSK/PSK

The ASK/FSK/PSK panel contains parameters for controlling the ASK, FSK and the PSK functions. To select the required function, click on the appropriate button and adjust the parameters in the associated group. The various controls in the ASK/FSK/PSK groups are described below.

ASK

Control Data

The Control Data button in the ASK group provides access to the data string that controls the sequence of base amplitude and shifted amplitude. It contains a list of “0” and “1” and the output will repeatedly follow the amplitude shift keying sequence in the same order as programmed.

“0/1” Amplitude

In ASK, the carrier waveform (CW) has two amplitudes: an initial amplitude level which is set by the “0” Amplitude parameter and shifted amplitude which is set by the “1” Amplitude. The control data table has a list of “0” and “1” values that flag when the amplitude shifts from base to shifted amplitudes.

Baud

The baud parameter sets the rate of which the generator steps through the sequence of the ASK Control Data bits.

Marker Index
The marker setting programs a specific step (index) in the control data string to output a pulse at the SYNC output connector. The SYNC State button must be turned on to generate the ASK marker output.

Figure 4-13, the ASK/FSK/PSK Modulation Panel

FSK

Control Data
The Control Data button in the FSK group provides access to the data string that controls the sequence of base frequency and shifted frequency. It contains a list of "0" and "1" and the output will repeatedly follow the frequency shift keying sequence in the same order as programmed.

"0/1" Frequency
In FSK, the carrier waveform (CW) has two frequencies: an initial frequency level which is set by the "0" Frequency parameter and shifted frequency which is set by the "1" Frequency. The control data table has a list of "0" and "1" values that flag when the frequency shifts from base to shifted frequency.

Baud
The baud parameter sets the rate of which the generator steps through the sequence of the FSK Control Data bits.

Marker Index
The marker setting programs a specific step (index) in the control data string to output a pulse at the SYNC output connector. The SYNC State button must be turned on to generate the FSK marker output.

PSK

Control Data
The Control Data button in the PSK group provides access to the data string that controls the sequence of base phase and shifted phase. It contains a list of “0” and “1” and the output will repeatedly follow the phase shift keying sequence in the same order as programmed.

“0/1” Phase
In PSK, the carrier waveform (CW) has two phase settings: an initial phase which is set by the “0” Phase parameter and shifted phase which is set by the “1” Phase. The control data table has a list of “0” and “1” values that flag when the phase shifts from base to shifted phase.

Baud
The baud parameter sets the rate of which the generator steps through the sequence of the PSK Control Data bits.

Marker Index
The marker setting programs a specific step (index) in the control data string to output a pulse at the SYNC output connector. The SYNC State button must be turned on to generate the PSK marker output.

To access the required parameter, click on the button below parameters sub-group until the LED next to the required parameter turns on. The value that is associated with the lit LED is displayed on the digital display. You can use the dial, keyboard, or the [↑] [↓} keys to adjust the readout to the required setting. After you modify the reading, press Execute to update the 2572A with the new reading.

Ampl/Freq Hop

The Ampl/Freq Hop panel contains parameters for controlling amplitude and frequency hop options. To turn the amplitude or frequency hop functions on and off, click on the ***Ampl HOP*** or ***Freq Hop*** buttons in Modulation group. The various parameters that control amplitude and frequency hopping features are described below. The output has two hop options: Fixed and Variable. In the Fixed mode, the output steps through the pre-assigned hop values at a constant rate, as programmed using the dwell time parameter. In the variable mode, the output dwells on each step for a period of time that is programmed in the Dwell Time field in the hop data table that is programmed for the Variable Hold option.

Ampl Hop

Hop Data
The Hop Data button in the Ampl Hop group provides access to the data string that controls the sequence of amplitude hops. The hop

data table contains a list of amplitude levels and the output will step from one amplitude level to another in the same order as programmed in the hop data table.

Fixed Hold
The hold parameter determines how long will certain step of amplitude dwells on this specific setting before it will step to the next amplitude setting. By selecting the Fixed Hold, the hold time remains constant throughout the entire hop table.

Variable Hold
The hold parameter determines how long will certain step of amplitude dwells on this specific setting before it will step to the next amplitude setting. By selecting the Variable Hold, the hold time changes automatically from one step to the next, depending on the hold time value that is affixed to the hop step. The values can be programmed in the HOP Data table.

Dwell Time
The Dwell Time parameter programs the period of time that will lapse before the amplitudes hops to the next amplitude setting. The Dwell time is associated with the Fixed Dwell option only.

Marker Index
The marker setting programs a specific step (index) in the hop data string to output a pulse at the SYNC output connector. The SYNC State button must be turned on to generate the hop marker output.

Figure 4-14, the Ampl/Freq Hop Panel

Freq Hop

Hop Data
The Hop Data button in the Freq Hop group provides access to the

data string that controls the sequence of frequency hops. The hop data table contains a list of frequencies and the output will step from one frequency to another in the same order as programmed in the hop data table.

Fixed Hold
The hold parameter determines how long will certain step of frequency dwells on this specific setting before it will step to the next frequency setting. By selecting the Fixed Hold, the hold time remains constant throughout the entire hop table.

Variable Hold
The hold parameter determines how long will certain step of frequency dwells on this specific setting before it will step to the next frequency setting. By selecting the Variable Hold, the hold time changes automatically from one step to the next, depending on the hold time value that is affixed to the hop step. The values can be programmed in the HOP Data table.

Dwell Time
The Dwell Time parameter programs the period of time that will lapse before the frequency hops to the next frequency setting. The Dwell time is associated with the Fixed Dwell option only.

Marker Index
The marker setting programs a specific step (index) in the hop data string to output a pulse at the SYNC output connector. The SYNC State button must be turned on to generate the hop marker output.

To access the required parameter, click on the button below parameters sub-group until the LED next to the required parameter turns on. The value that is associated with the lit LED is displayed on the digital display. You can use the dial, keyboard, or the [↑] [↓} keys to adjust the readout to the required setting. After you modify the reading, press Execute to update the 2572A with the new setting.

(n)PSK

The (n)PSK panel contains parameters for controlling multiple phase modulation options. To select one of the (n)PSK functions, click on BPSK, QPSK, DPSK, OPSK, 8PSK, 16PSK, or User PSK. The various parameters that control PSK features are described below.

Marker Index
The marker setting programs a specific step (index) in the control data string to output a pulse at the SYNC output connector. The SYNC State button must be turned on to generate the PSK marker output.

Baud
The baud parameter sets the rate of which the generator steps through the phase symbols.

Data Table

The Data Table provides means of programming the phase steps sequence. An example of a 16PSK data table sequence is shown in Figure 4-16. Note that the value of each symbol is pre-defined and hence, every time you enter a vector, the associated symbol is automatically fetched from the list and displayed in the Phase field. The sequence of which the symbols are generated at the output has the same order as was entered in the Vector list. For applications requiring non-standard phase values, use the Symbol Design option to design your custom symbols.

Figure 4-15, the (n)PSK Modulation Panel

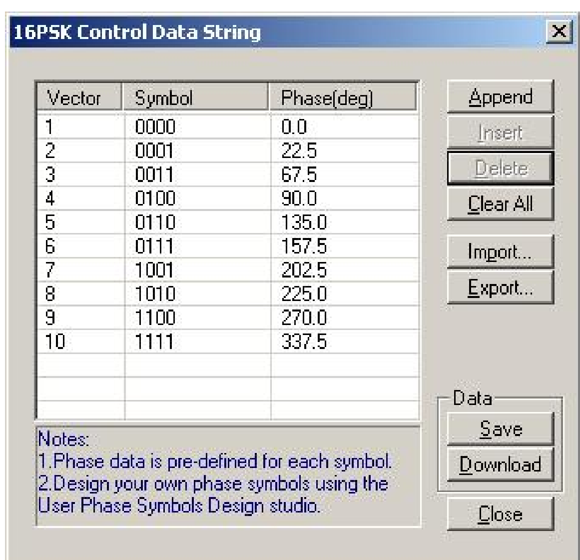

Figure 4-16, 16PSK Data Table Sample

Symbol Design

The Symbol Design table, as shown in Figure 4-17, is used for generating custom symbols. While the standard (n)PSK modulation functions use pre-defined phase values, using the Symbol Design table, you can design and associate any symbol with any vector as you desire.

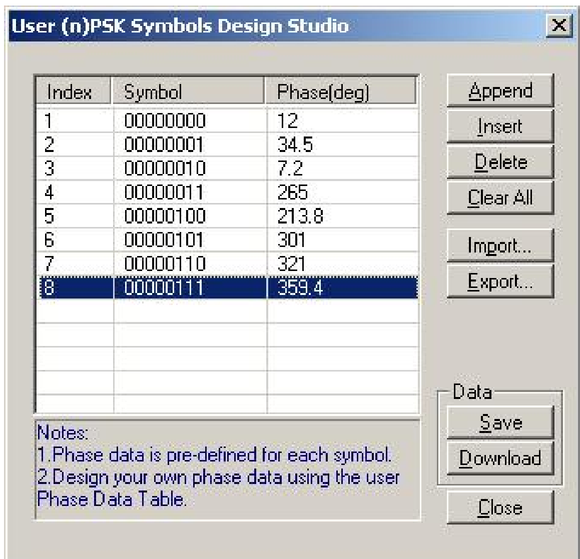

Figure 4-17, Symbol Design Table Sample

(n)QAM

The (n)QAM panel contains parameters for controlling multiple amplitude-phase modulation options. To select one of the (n)QAM functions, click on 16QAM, 64QAM, 256QAM, or User QAM. The various parameters that control QAM features are described below.

Marker Index

The marker setting programs a specific step (index) in the control data string to output a pulse at the SYNC output connector. The SYNC State button must be turned on to generate the QAM marker output.

Baud

The baud parameter sets the rate of which the generator steps through the amplitude-phase symbols.

Data Table

The Data Table provides means of programming the amplitude-phase steps sequence. An example of a 64QAM data table sequence is shown in Figure 4-19. Note that the value of each symbol is pre-defined and hence, every time you enter a vector, the associated symbol is automatically fetched from the list and displayed in the “I” and “Q” fields. The sequence of which the symbols are generated at the output has the same order as was entered in the Vector list. For applications requiring non-standard amplitude-phase values, use the Symbol Design option to design your custom symbols.

Figure 4-18, the (n)QAM Modulation Panel

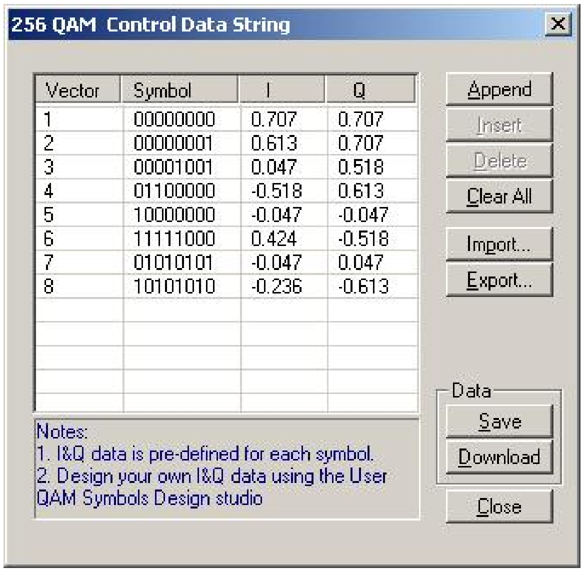

Figure 4-19, 64QAM Data Table Sample

Symbol Design

The Symbol Design table, as shown in Figure 4-20, is used for generating custom symbols. While the standard (n)QAM modulation functions use pre-defined amplitude-phase values, using the Symbol Design table, you can design and associate any symbol with any vector as you desire.

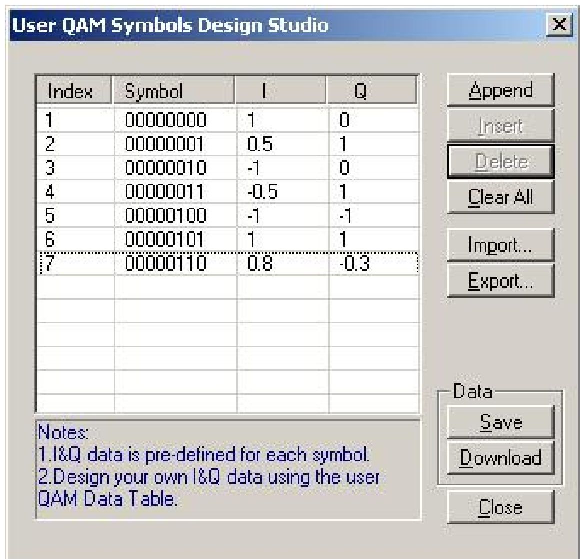

Figure 4-20, Symbol Design Table Sample

3D

The 3D modulation has no dedicated panel however, to select the 3D modulation click on 3D button. 3D programming and the 3D Composer will be discussed later in this chapter.

The Auxiliary Panels

Figure 4-20a, the Auxiliary Panels

The Auxiliary tab provides access to a group of panels that control some auxiliary and Utility functions.

There are six panels in this group: Counter/Timer, which provides access to the auxiliary Counter/Timer function; Pulse Generator, which provides access to the auxiliary digital pulse generator function; Half Cycle, which provides access to the half cycle functions; Digital Patterns, which provides access to the auxiliary digital pattern generator function; and X-Instrument Sync for multi instrument synchronization control.

The Auxiliary set of panels are shown in Figure 4-20a. Each of the panels is described below.

Counter/Timer

The Counter/Timer panel contains controls that select the measurement function and adjusts the counter/timer parameters for measuring external signals. The counter/timer measures signals that are connected to the TRIG IN input. The various parameters that control the counter/timer features are described below.

State
The State Group has controls to turn the counter on and off. And to reset the counter and arm it for the next measurement cycle. Note that when the counter function is turned on, all other waveform generation features of the 2572A are purged.

Measurement Function
The measurement function group has control to select the measurement function for the counter/timer operation. The 2572A can measure the following function: Frequency, Period, Period Averaged, Pulse Width, and Totalize. The totalize function has two options. If Totalize Infinite function is selected the input will count every legal pulse at the counter input, for an indefinite period of time, and will display the total number of pulses until the counter has been reset. If Totalize Gated function is selected, the input will count every legal pulse at the trigger input for a period of time that is defined with the Gate Time parameter.

Figure 4-21, the Counter/Timer Panel

Display

The Display Group has controls to select the display mode and to select if the display shows measurement or gate time readings.

In normal mode, the counter is armed to receive signal at the trigger input. When signal is sensed, the gate to the counter opens for duration as programmed with the Gate Time parameter, processes the result, displays the reading and continues with the same process as long as the signal is available at the input.

In hold mode, the counter is armed to receive signal at the trigger input. When signal is sensed, the gate to the counter opens for duration as programmed with the Gate Time parameter processes the result, displays and holds the reading until the next Reset/Arm command.

To display and modify the gate time parameter, click on the Gate Time LED and modify the gate time per your requirements. Gate time rage is from 100 μs to 1 s. Normal counter/timer readings are displayed when the Reading LED is selected.

Pulse Generator

The Pulse Generator panel contains controls that select the pulse function and adjusts the pulse parameters. The pulses are generated digitally suing the arbitrary waveform memory and digital computation and therefore, there are some limitations to the minimum to maximum range that must be observed. The pulse design limitations are given in Appendix A. The various parameters that control the digital pulse generator features are described below.

Figure 4-22, the Digital Pulse Generator Panel

Pulse Mode

The Pulse Mode group has controls to turn on pulse generator functions, select of the output generates single or double pulse shape and selects the pulse polarity from one of the Normal, Complemented and Inverted options.

Pulse Parameters

There are two types of pulse parameters: the Shared parameters are common to both channels so modification of one of these parameters affects both channels simultaneously. The shared parameters are Period, Rise Time, High Time and Fall time.

There are also other parameters that can be programmed individually for each channel. These are: Delay, High Level and Low level. Programming channel 1 parameters do not affect channel 2 parameters and visa versa.

To display and modify parameters, click on the and next to the required parameter change and modify time per your requirements. The range of each parameter is specified in Appendix A.

Half Cycle

The Half Cycle panel contains controls that select the half cycle functions and adjust the half cycle parameters.

The half cycle functions are generated with variable and controllable delay between the halves. If triggered mode, one half at a time is generated as a result of a trigger signal regardless of the programmed delay value. The half cycle functions have different limitations compared to the standard functions; These are listed in Appendix A. The half cycle panel and the various parameters that control these functions are described below.

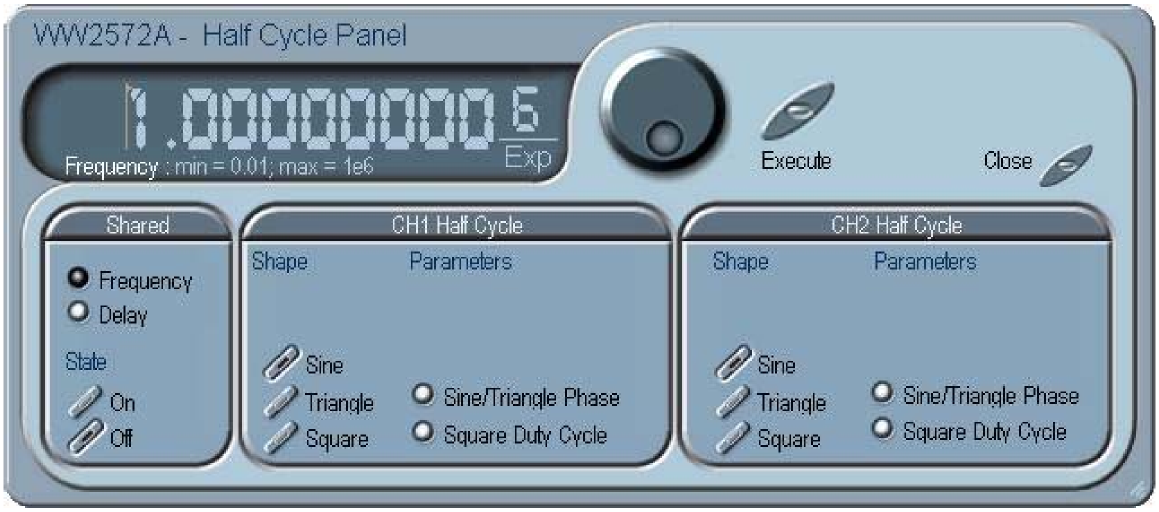

Figure 4-23, the Half Cycle Panel

Shared

The shared group has parameters that are shared by the two channels. The shared parameters are: Frequency, Delay and the half cycle state. Note that the frequency value is a bit different than the standard frequency parameter because it describes the frequency as if the two halves were combined (which is never the case). Since two halves are always separated by certain delay, the frequency value has a meaning as if the two halves were combined.

CH1 Half Cycle

The CH1 Half Cycle group has controls that select the shape of the function and for programming the amplitude, offset, start phase and duty cycle. Since each channel can have an independent set of such parameters, they were separated into two groups.

CH2 Half Cycle

The CH2 Half Cycle group has controls that select the shape of the function and for programming the amplitude, offset, start phase and duty cycle. Since each channel can have an independent set of such parameters, they were separated into two groups.

Digital Pattern

The Digital Pattern panel contains controls that control the functionality of the pattern output and provides access to the pattern source. The Digital Pattern panel and the various parameters that control this function are described below.

Figure 4-24, the Digital Pattern Panel

State

The state button toggles the pattern output on and off. When the state is on, patterns are routed to the rear panel connector. Note that the channel 1 output connector can also be made active and then both the rear and front outputs generate waveforms and patterns.

Data Source

This Data Source has two buttons which select between the Data Table and an Arbitrary Segment as the source for the digital pattern output. If you select the Data Table option, you must generate pattern data as shown in Figure 4-25. Pattern data for the Data Table option can be generated from the Pattern Data group.

If you select the Arbitrary Segment as your data source, data is stored as a normal waveform and can be generated simultaneously from the front-panel output connector, as an arbitrary waveform and from the rear-panel Digital Pattern output, as a pattern sequence.

The question if to use one data source option or the other is relevant only if your pattern data is longer than 128k sequences. Below 128k, you can use the Data table entry and further, you can look at the data from the display. Larger blocks of data can be stored in the same memory as arbitrary waveforms are bring stored however, such data cannot be displayed on the front panel but on the other hand, multiple blocks of data can be stored in the arbitrary waveform data, as long as the total length of patterns do not exceed the arbitrary waveform memory capacity of the 2572A.

Baud

The baud parameter programs the rate of which the output step through the pattern sequence, which was programmed in the Pattern Design table.

Pattern Data

This opens a table that allows programming of the digital patterns. Patterns are 16 bits and are programmed in hex format. An example of the Data table entry format is shown in Figure 4-25.

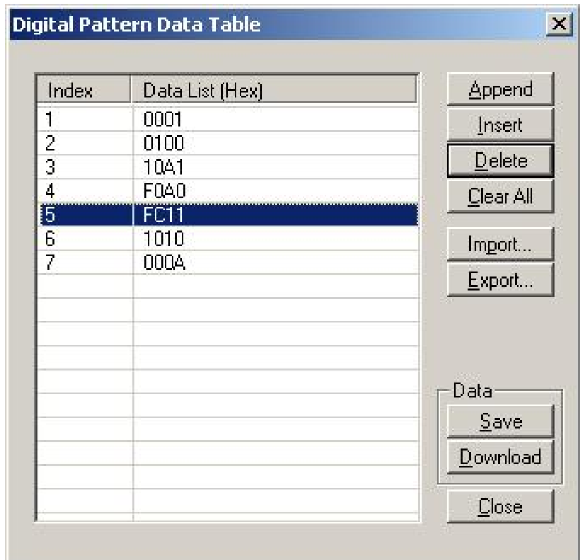

Figure 4-25, Digital Pattern Data Table Example

X-Instrument Sync

The X-Instrument Sync serves the multi-instrument synchronization purpose. It is a bit different than the other panels as it has only one function of providing an environment for setting up the various instruments for the setting and therefore, a dialog box is invoked when you hit the X-Instrument Sync button.

There are some preliminary actions you must take before you can synchronize instruments of which the first is to connect the cables and set up LAN addresses. Follow the procedure as described hereinafter:

Tip

Multiple Instrument synchronization requires that all instruments are connected to a Local Area Network (LAN) system. If just two instruments are to be synchronized, connection between the two instruments can be made with a crossed wire LAN cable however, activation and operation is possible from the front panel only.

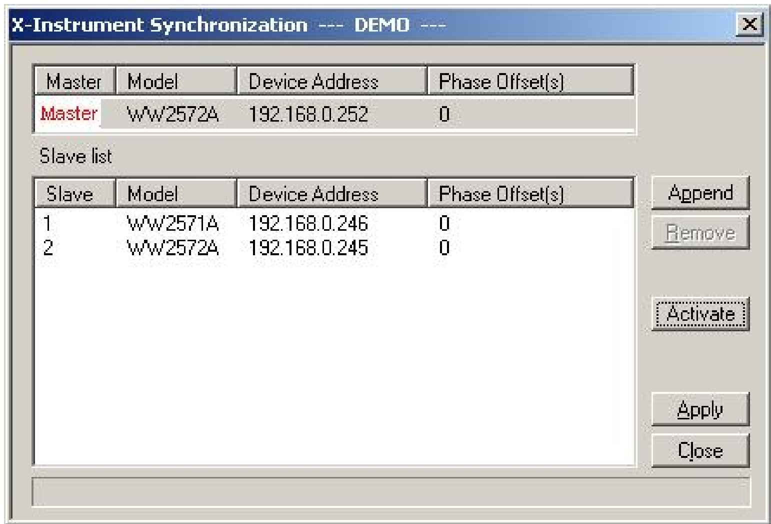

Figure 4-26, Multi-Instruments Synchronization Dialog Box Example

1. First, and most important step, designate which of the instruments will be set up as master and which will serve as slaves.
2. Locate the multi-instrument cluster of connectors on the back of the 2572A. They are grouped under the X-Inst Sync title. There are four SMB connectors. These should be connected as follows: The SCLK OUT from the master should be connected to the SCLK IN on the first slave unit and the TRIG OUT from the master connected to the TRIG IN on the first slave.
3. Connect LAN cables from your LAN system to both the master and slave units. If more than two units are connected to the system, proceed with connecting wires as described in step 2 above, in a daisy-chain manner, OUT to the next IN connector. Connect all instruments in the chain.
4. Turn on the instruments and set all of them up to operate from a LAN interface. Information how to set up the 2572A to operate from a LAN interface is given in Chapter 2. An example of mater and slave IP address setting is shown in Figure 4-27. The master was assigned the highest IP address …252 and the two slaves were assigned …246 and …245, respectively.

Tip

The IP address determines if instruments are to be set up as master or slave. The highest IP address setting designates the master instrument. Lower IP addresses designate slave instruments.

Figure 4-27, IP Address Setup Example (from left to right) Master and two Slaves

5. Invoke the System->Setup and Communication Options. Select the Communicate Only in the Startup Options group and select the Specify an Address Option in the Communications Setup group.
6. Select the LAN Interface and add the master and slave addresses as shown in Figure 4-28.
7. ArbConnection can communicate with one instrument at a time and therefore, highlight the master IP address and then click on Communicate. Regardless, each of the assigned addresses will be tested for LAN accessibility and made available in the Link field for future programming.

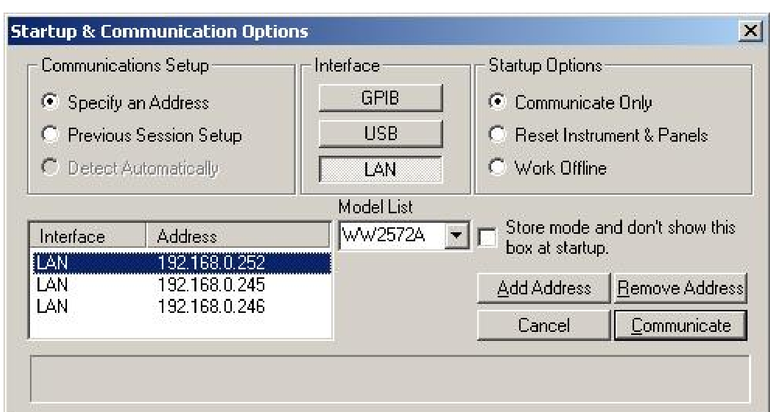

Figure 4-28, Assigning Master and Slave Addresses

8. The last step is to activate the synchronization. This is done from the X-Instruments Synchronization dialog box, as shown in Figure 4-26. Click on Activate to start the synchronization, click on the same button to toggle synchronization off.

9. Adjust the parameters and the functions on the master and slave units however, bear in mind that some functions are shared by all modules and therefore can only be modified on the master instrument. Chapter 3 describes the synchronization aspects and Appendix A lists the multi-instruments specifications and limitations.

The System Panels

The System tab provides access to a group of panels that control some general system parameters and provides access to the calibration. There are two panels in this group: General/System, which provides access to some system commands, utilities and filters; and Calibration, which provides access to the calibration remote calibration utility. Note however, that access to the calibration panel is permitted to qualified service persons and requires special user name and password. Information how to access the calibration panel is given in Chapter 7.

The System set of panels are shown in Figure 4-29a. Each of the panels is described below.

Figure 4-29a, the System Panels

General/Filters

The General/Filters panel provides access to some general system common commands, allows read back of information that is stored in the flash and provides means of adding filters to the output path. The General/Filters panel and the various parameters that control these functions are described below.

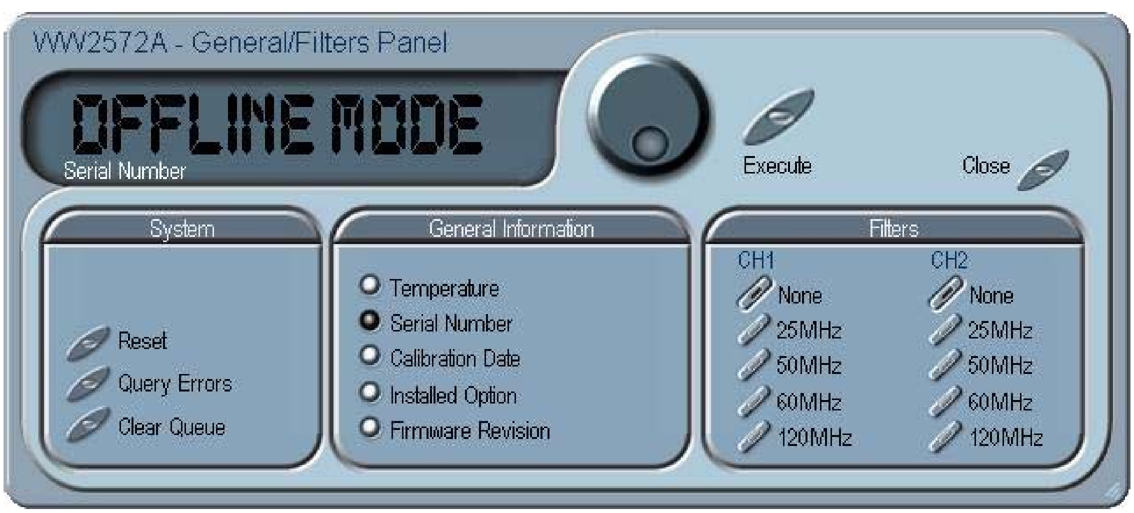

Figure 4-29, the General/Filters Panel

System

The System group has three buttons that are normally associated with system control. These are:

Reset – generates soft reset to the instrument controls and dialog boxes and modifies all parameters to factory default. A list of factory defaults is given in Chapter 5.

Query Error – queries the 2572A for programming errors. This command is normally no necessary because ArbConnection makes sure that programming errors cannot be made from the panels however, while executing commands from the Command Editor, errors can be generated and the only way to monitor the errors is by using this command.

Clear Queue – clears the error queue. The error queue can buffer up to 35 errors and then generates an error queue overflow message while ignoring new errors. This command clears the error queue and allows fresh errors to be captured.

Data Base

This Data Base is used for displaying or monitoring of certain parameters that are stored in the flash memory. These are: Instrument serial number, Last calibration data, 2572 installed options and the installed firmware version.

Filters

The Filters group has two sets of switches, one for each channel. Filters can be turned on and off freely as long as you are not generating the standard sine waveform. The following filter options are available:

Off – no filter is applied to the output path

25MHz – a Bessel type filter that has 25 MHz cutoff frequency.

50MHz – a Bessel type filter that has 50 MHz cutoff frequency.

60MHz – an Elliptic type filter that has 60 MHz cutoff frequency.

120MHz – an Elliptic type filter that has 120 MHz cutoff frequency.

Calibration

The Calibration panel provides access to remote calibration procedures. To access the remote calibration panel, you will need to have a valid User Name and Password and to quality to perform such calibration, you'll need to be trained and certified by Tabor Electronics. Information how to access the calibration panel and how to perform the calibration is given in Chapter 7. The picture below is just for reference how the calibration panel will look after you gain access to this panel.

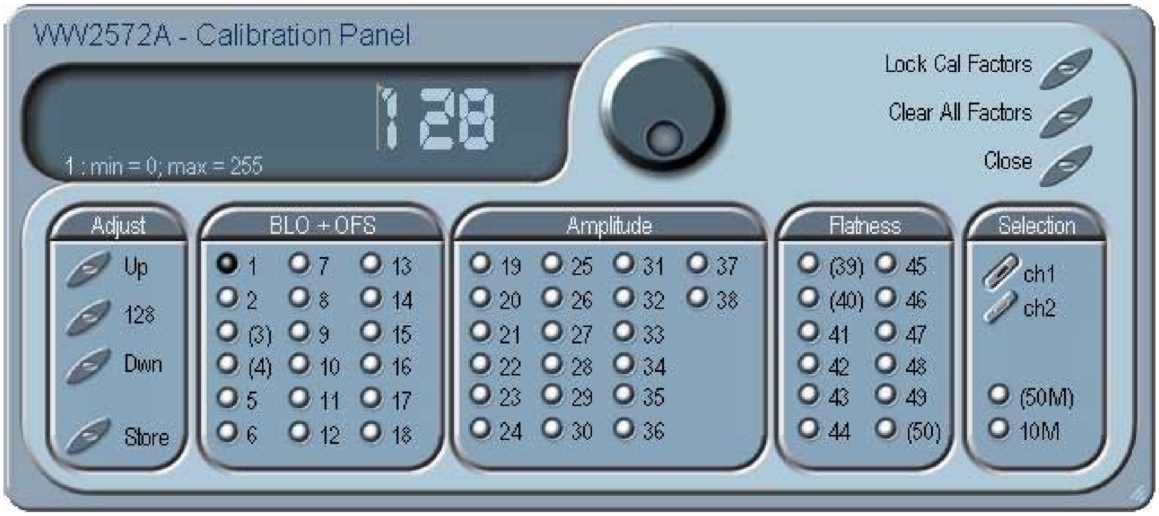

Figure 4-30, the Utility Panel

The Composers Panels

Figure 4-30a, the Composers Panels

The Composers tab provides access to a group of composers that allow generation and editing of arbitrary waveforms, pulse shapes, arbitrary frequency modulation and 3D profiling. Without utilities such as the above, the operation of an arbitrary waveform generator is extremely limiting.

There are four waveform composers built into ArbConnection:

Wave – for generating arbitrary waveforms. Arbitrary waveforms can be generated from standard libraries, from an equation editor, or imported to the composer from external utilities such as MatLAB. The waveforms can be edited and stored on hard or soft disks.

Pulse – for generating complex pulse trains. Unlike a standard pulse generator, you can design and edit multiple pulse trains with linear transitions and variable amplitudes.

FM – for generating arbitrary frequency modulation profiles without being limited by the standard sine, triangle and square modulating shapes, and

3D – for generating chirps and simultaneous variations of amplitude, frequency and phase on each channel, separately.

The Composers set of panels are shown in Figure 4-30a. Each of the composers is described below.

The Wave Composer

Being an arbitrary waveform generator, the 2572A has to be loaded with waveform data before it can start generating waveforms. The waveform generation and editing utility is part of ArbConnection and is called – The Waveform Composer. This program gives you tools to create definitions for arbitrary waveforms. It can also convert coordinates from other products, such as, oscilloscopes and use them directly as waveform data. The program is loaded with many features and options so use the following paragraphs to learn how to create, edit and download waveforms to the 2572A using the Waveform Composer.

To launch the wave composer point and click on the Wave tab in the Panels bar. Figure 4-31 shows an example of the wave composer. The Wave Composer has main sections: Commands bar, Toolbar and Waveform screen. Refer to Figure 4-31 throughout the description of these sections.

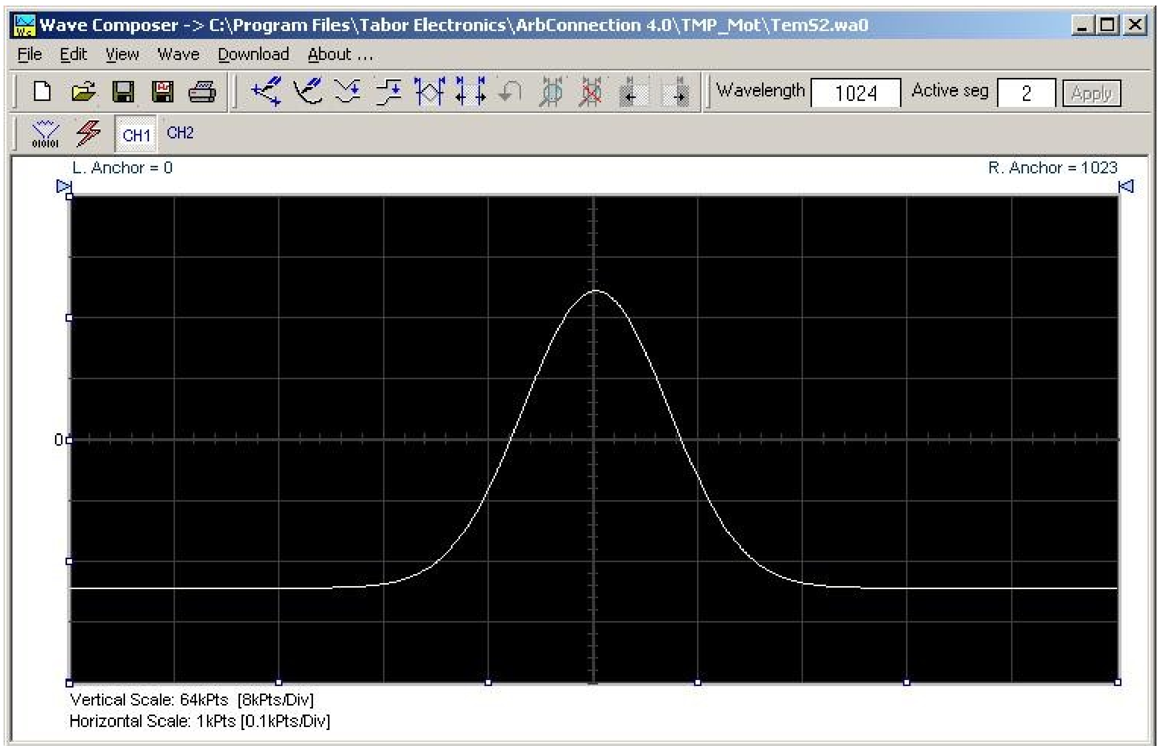

Figure 4-31, the Wave Composer Opening Screen

The Commands bar

The commands bar provides access to standard Windows commands such as File and View. In addition, there are ArbConnection-specific commands such as Edit, Wave and System.

In general, clicking on one of the commands opens a dialog box with an additional list of commands. Then, clicking on an additional command, may open a dialog box, or generate an immediate action. For example, Clicking on File and then Exit will cause an immediate termination of the Wave Composer. On the other hand, clicking on Wave and then on Sine, will open a Sine Wave dialog box that lets you program and edit sine wave parameters. The various commands in the Commands bar are listed and described below.

File Commands

The File command has 4 command lines that control waveform files. Also use this command to print the active waveform, or exit the wave composer program. Description of the various commands under File is given below.

New Waveform
The New Waveform (Ctrl+N) command will remove the waveform from the screen. If you made changes to the waveform area and use the New Waveform command, you should save your work before clearing the screen. The New Waveform command is destructive to the displayed waveform.

Open Waveform…
The Open Waveform… (Ctrl+O) command will let you browse your disk for previously saved waveform files and load these waveforms to the waveform area. This command is also very useful for converting waveform files to format that is acceptable by the Wave Composer. The Open Waveform command can convert ASCII. *CSV (comma delimited text), *PRN (space delimited text) and *.0* (LeCroy binary format). The Open dialog box in Figure 4-32 shows the various file extensions that can be opened into the Wave Composer environment. The file that is opened is automatically converted to *.wav format and can later be saved as a standard ArbConnection file.

Save Waveform
The Save Waveform (Ctrl+S) command will store your active waveform in your 2572A directory, as a binary file with an *.wav extension. If this is the first time you save your waveform, the Save Waveform As… command will be invoked automatically, letting you select name, location and format for your waveform file.

Save Waveform As…
Use the Save Waveform As… command the first time you save your waveform. It will let you select name, location and format for your waveform file.

Print
With this command you may print the active Waveform Window. The standard printer dialog box will appear and will let you select printer setup, or print the waveform page.

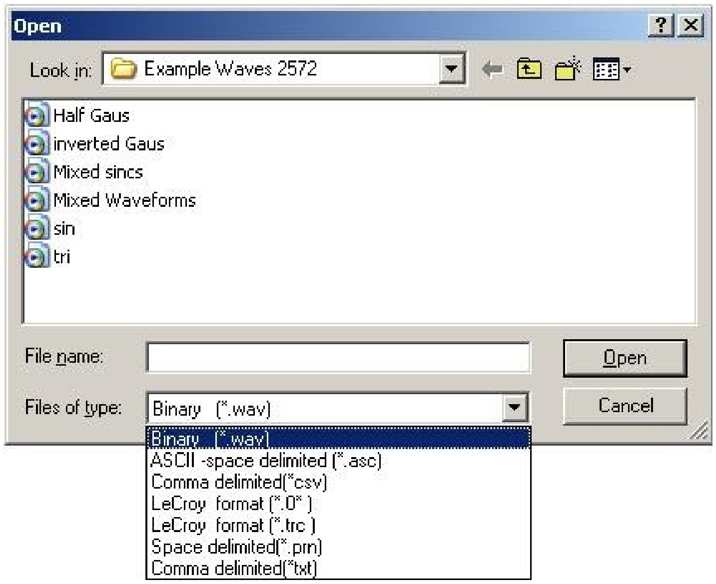

Figure 4-32, the Open Waveform Dialog Box

Exit

The Exit command ends the current Wave Composer session and takes you back to the Panels screen. If you made changes to your waveform since it was last saved, the Wave Composer will prompt you to Save or Abandon changes these changes.

Edit Commands

The Edit commands are used for manipulating the waveform that is drawn on the screen. The editing commands are explained in the following paragraphs.

Autoline

The Autoline command lets you draw straight-line segments. To draw a line the left mouse button at the start point. Click again at the next point and then click on the right mouse button to terminate this operation.

Sketch

The Sketch command lets you draw free-hand segments. To draw a line using this command click and hold the left mouse button at the start point. Release the mouse button when you want to stop and then click on the right mouse button to terminate this operation.

Smooth

The Smooth command lets you smooth out rough transitions on your waveform. This is done mathematically by multiplying waveform coordinates by the non-linear portion of a cubic parabola.

The Smooth operation is done on segments of the waveform that are bound by anchors. Anchor operation is described later in this chapter. Place the anchors on the left and right of your waveform segment and select the Smooth command. The waveform will change its shape immediately to follow the mathematical pattern of a parabolic curve.

Note that small segments with fast transitions, when combined with parabolic expressions have tendencies to generate even larger transitions. Therefore, make sure you omit such sections of the waveform when you use this operation.

Filter
The Filter used with this command is moving average. This is done by recalculating each point as an average of symmetrical number of adjacent points. When you select the Filter command, a dialog box pops up, letting you program the filter spacing in number of adjacent points. You can filter the entire waveform, or you may chose to filter a segment of the waveform by placing the anchors as boundaries on the left and right of the segment.

Invert
The Invert command lets you invert the entire waveforms, or marked segments of waveforms. The waveform is inverted about the 0-point axis.

Trim Left
The trim left command lets you trim waveforms to the left of the anchor point. This command is grayed out if the left anchor was not moved from its original left position. The waveform is trimmed and the point at the left anchor point becomes the first point of the waveform.

Trim Right
The trim right command lets you trim waveforms to the right of the anchor point. This command is grayed out if the right anchor was not moved from its original right position. The waveform is trimmed and the point at the right anchor point becomes the last point of the waveform.

Unmark
The unmark command removes the anchors from the waveform screen and resets anchor positions to point 0 and the last waveform point.

Undo
The Undo command undoes the last editing operation.

View Commands

The View commands have commands that let you view various sections of the waveform area. The View commands include: Zoom In, Zoom Out, Hide/Show Toolbars and Channel ½ waveforms. Description of the view commands is given in the following.

Zoom In

The zoom in command operates between anchors. Anchors are marked as left and right hand triangles. The default position of the anchors is the start and the end of the waveform. To move an anchor to a new location, click and hold on the triangle and drag the anchor to left or right as required. If you move the left anchor to the right and the right anchor to the left, the area between the anchors will zoom in as you select this command.

Looking at the Waveform Map, as shown in Figure 4-33, you'll see that the white portion is the zoomed area. Click and hold on the white area and move your cursor around and the waveform screen will be updated accordingly.

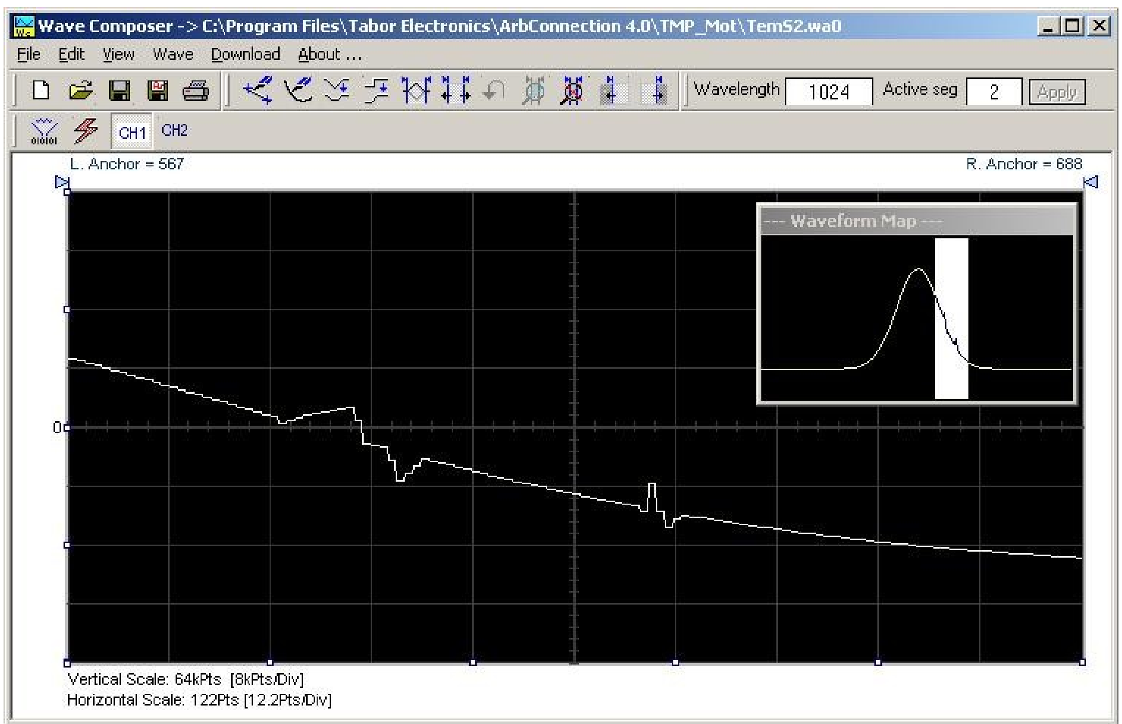

Figure 4-33, Zooming In on Waveform Segments

While zoomed in you can perform Autoline and sketch editing, or zoom-in further by clicking and holding the mouse at one corner and releasing the mouse button at the other corner.

Zoom Out

The zoom out restores the screen to display the complete waveform.

Channel 1

The Channel 1 Waveform command updates the waveform screen with the Channel 1 waveform. If you have not yet generated a waveform for channel 1, the waveform screen will show a dc level at vertical point 0.

Channel 2

The Channel 2 command updates the waveform screen with the Channel 2 waveform. If you have not yet generated a waveform for Channel 2, the waveform screen will show a dc level at vertical point 0.

Wave Commands

The Wave commands let you create waveforms on the screen. The Wave command has a library of 8 waveforms: Sine, Sawtooth, Square, Sinc, Gaussian, Exponent, Pulse, and Noise. It also lets you create waveforms using the Equation Editor. Information how to create waveforms using the Wave commands is given below.

Creating Waveforms From the Built-in Library

You can create any waveform from the built-in library using the Wave command. Clicking on one of the Wave options will open a dialog box. An example of the Sine waveform dialog box is shown in Figure 4-34. This dialog box is representative of the rest of the waveforms, so other waveforms will not be described.

Creating Sine Waveforms

Use the following procedure to create sine waveforms from the built-in library. Click on Wave, then sine… the dialog box as shown in Figure 4-34 will appear. You can now start programming parameters that are available in this box.

Start Point – Defines the first point where the created wave will start. Note that if you change the start point the left anchor will automatically adjust itself to the selected start point. The example shows start point set at point 0.

End Point – Defines where the created waveform will end. Note that as you change the end point the right anchor will automatically adjust itself to the selected end point. The example shows end point set at point 499.

Cycles – The Cycles parameter defines how many sine cycles will be created within the specified start and end points. The example below shows five sine cycles.

Amplitude – 14-bit of vertical define 16,384 incremental steps. The Amplitude parameter defines how many of these steps are used for generating the sine. The example is showing sine waveform with maximum peak-to-peak amplitude. Any number below the maximum will generate an attenuated sine.

Start Phase – The start phase parameter defines the angle of which the sine will start. The example shows start phase of 90°.

Power – The example shows sine cubed. Sine to the power of 1 will generate a perfect sine. Power range is from 1 through 9.

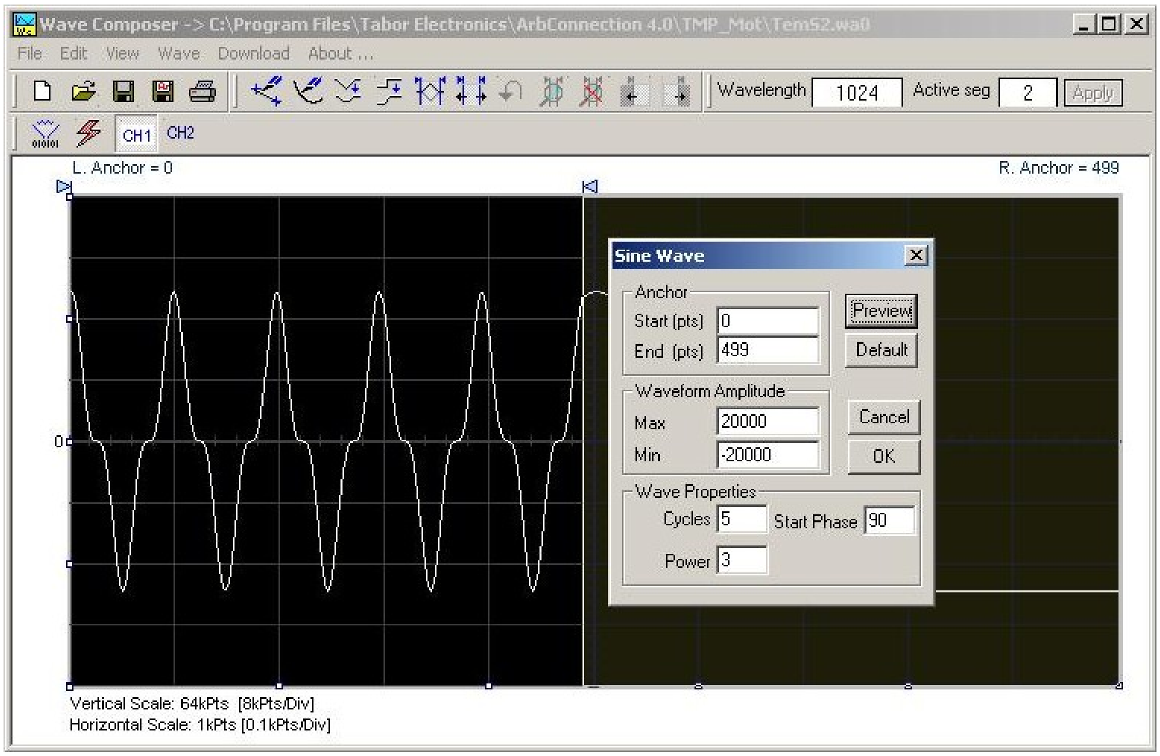

Figure 4-34, Generating Distorted Sine waves from the built-in Library

The Toolbar

The toolbar contains icons for editing the waveform screen, icons for saving and loading waveforms, fields for selecting an active channel and for adjusting segment length and more. The Toolbar is shown in Figure 4-35. For the individual icons, refer to the descriptions above of the Wave Composer Menus.

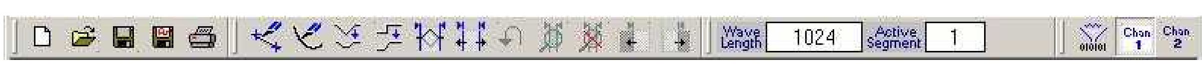

Figure 4-35, the Toolbar Icons

The Waveform Screen

Waveforms are created and edited on the waveform screen. Figure 4-36 shows an example of a waveform created using the equation editor and the anchors to limit generation of the waveform between points 100 and 900. The various elements of the waveform screen are described below.

The waveform screen has two axes – vertical and horizontal. Both axes are divided into points.

The vertical axis is labeled from –8191 through 8192 for a total of 16,384 point. This number represents 14 bits of vertical resolution and cannot be changed because it is critical to the range of which the 2572A operates.

The horizontal axis, by default has 1000 points (from point 0 to 999). This number can be changed using the Wave Length field in the Toolbar. The maximum length depends on the option installed in your instrument. The wave composer will let you define the horizontal axis to a maximum of 2M words).

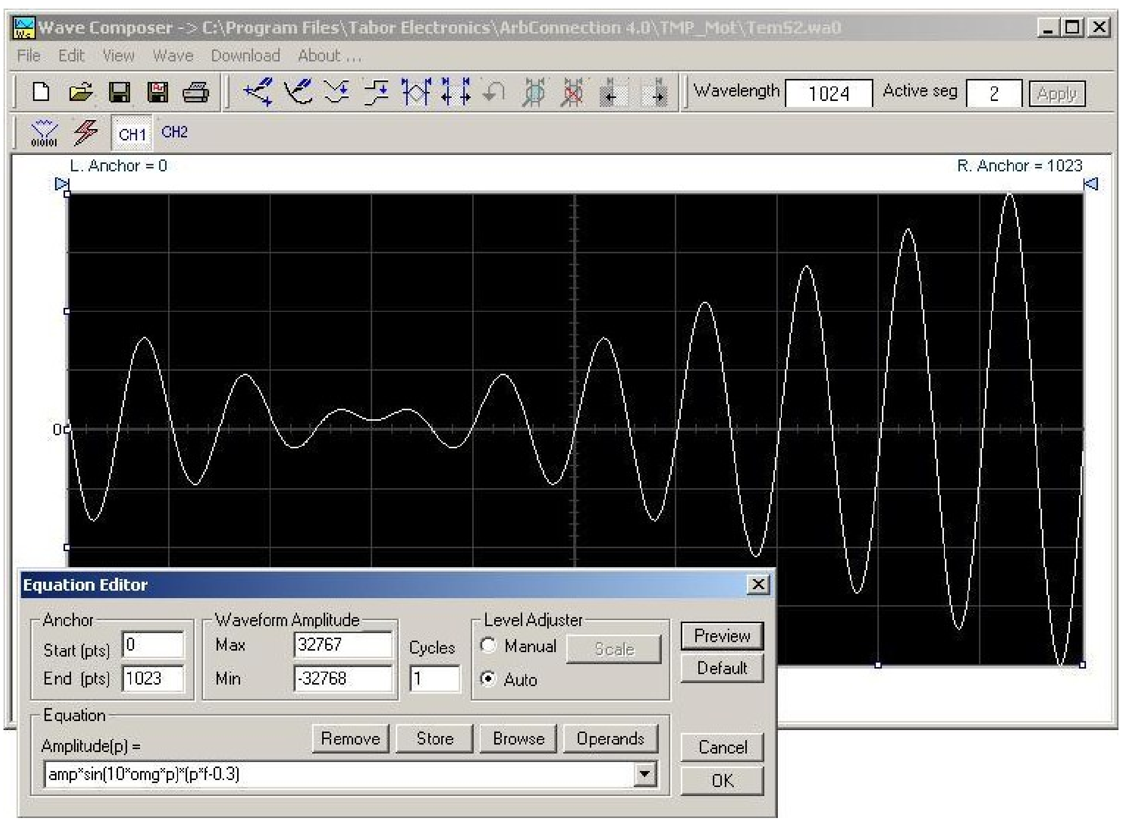

Figure 4-36, the Waveform Screen

Notice on the left top and on the right top there are two triangles pointing to the center of the screen. These are the anchors. The anchors are used as the start and end pointers where your waveform will be created. For example, if you want to create a sine waveform between point 100 and point 500, you place the left anchor at point 100 and the right at point 500 and then generate the sine from the built-in library.

There are two ways to control anchor placements.

1) Click and hold your mouse cursor on the left anchor triangle and then drag the curtain to the left position. Do the same for the right anchor. Notice the X and Y coordinates at the top of the waveform screen and how they change to correspond to your anchor placement.
2) You can also place your anchors in a more precise manner from the waveform library by programming the start and end points for the waveform. An example of anchor placement using the sine dialog box is shown in Figure 4-34.

Finally, when you are done creating and editing your waveform, you can save your work to a directory of your choice. The name at the title will show you the name you selected for storing your waveform and its path.

Generating Waveforms Using the Equation Editor

One of the most powerful feature within ArbConnection and probably the feature that will be used most is the Equation Editor. The Equation Editor let you write equations the same way as you would do on a blank piece of paper. The equations are then translated to sequential points that form waveforms and are displayed on the waveform screen. The Equation Editor will detect and inform you on syntax errors and, with its self adjusting feature, will automatically adjust your parameters so that none of the points on your waveform will exceed the maximum scale limits.

When you invoke the Equation Editor, the dialog box, as shown in Figure 4-37 will display. Use the following paragraphs to learn how to use this dialog box and how to write your equations.

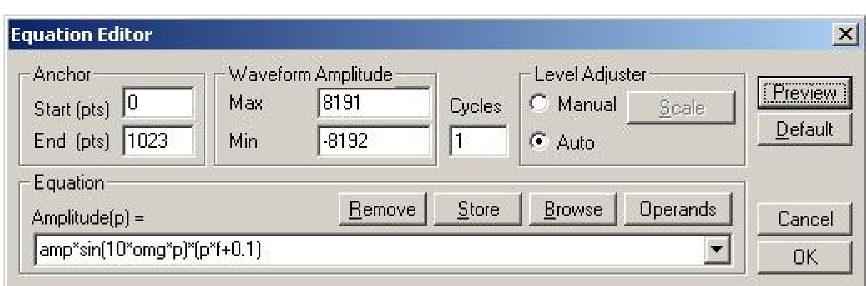

Figure 4-37, the Equation Editor Dialog Box

There are four sub-group parameters in the equation editor plus control buttons and equation field. These parts are described below.

Anchor
The anchors define start and end point of which the equation will be generated. By default the anchors are placed at the start and the end of the horizontal (time) scale however, the equation can be limited to a specific time scale by moving the anchor points from their default locations.

Start – defines the first point where the created wave will start. Note that if you change the start point the left anchor will automatically adjust itself to the selected start point.

End – defines where the created waveform will end. Note that as you change the end point the right anchor will automatically adjust itself to the selected end point.

Waveform Amplitude
The vertical axis of the Wave Composer represents 14-bits of vertical resolution. That means that the equation is computed, resolved and generated with 1/32,768 increments and accuracy. The Waveform Amplitude fields in the Equation Editor are used in two cases: 1) when the “amp” parameter is used in the equation or 2 if the Level Adjuster is set to Auto. Information on these two operations is given later.

Max – defines the positive peak of the vertical axis

Min – defines the negative peak of the vertical axis

Cycles
The Cycles parameter defines how many waveform cycles will be created within the specified start and end anchor points.

Level Adjuster
The Level Adjuster is a convenient tool that helps you adjust the amplitude and offset without modifying your equation. The Level Adjuster mode does not interfere with your calculations and displays the waveform as computed from your equation. The only difference is that your final calculations are stretched or shrunk or offset on the vertical scale to fit the new amplitude and offset boundaries.

If you change the Max and Min setting in the Waveform Amplitude fields and press the Adjust key, your waveform will offset immediately without changing the equation. The same way, you can also change amplitude only or both amplitude and offset. If you check the Manual option, you’ll have to click on the Adjust button for the Waveform Amplitude parameters to take effect. The Adjust button name will change to Restore and back to Adjust if you click on it again. If you check the Auto option, your waveform will be created automatically with the new Amplitude setting.

Equation

The Equation group has four buttons and the equation field. You will be using the Equation field for writing your equations. Equation syntax and conventions are discussed in the following paragraphs. The *Remove* button clears the equation field so you can start typing a new equation. Click on the *Store* button to store your equation if you intend to use it again. The Browse button provides access to waveform pre-stored files in your computer for combining them in new equations. The *Operands* button expands the bottom of the dialog box to show the operands you can use with your equation.

While you type and store equations, they are collected in a history file and can be used again by expanding the history log from the equation field.

Control Buttons

There are four control buttons at the right corner of the dialog box. Use the *Preview* button to preview an image of your equation, or use the *OK* button to place your waveform on the waveform screen and to leave the dialog box on the screen. The *Default* button restores the parameters in the equation editor to their original factory default values. The *Cancel* button will remove the dialog box from the screen and will discard of any waveforms that you previewed with your Equation Editor.

Writing Equations

The Equation Editor lets you process mathematical expressions and convert them into waveform coordinates. As you probably already know, waveforms are made of vertical samples. The number of samples on your waveform is determined by the wavelength parameter. For example, if you have 1024 horizontal points, your equation will be computed along 1024 points as a function of the vertical scale. Each vertical sample is computed separately and placed along the horizontal axis. The points are graphically connected to form a uniform and continuous waveform shape however, if you zoom in on a waveform line, you'll see that the points are connected like a staircase. In reality, the 2572A generates its waveforms exactly as shown on the screen but, if the waveform has many horizontal points, the steps get smaller and harder to see without magnification.

Equations are always computed as a function of the vertical (Amplitude) axis therefore the left side of your equation will always look as Amplitude(p)=, where “p” is the equation variables in units of waveform points. You can write equations with up to 256 characters. If the equation is too long to fit in the visible field, parts to the left or right will scroll off the ends.

Equation Convention

The following paragraphs describe the conventions that are used for writing an equation. To avoid errors, it is extremely important that you make yourself familiar with these conventions before you plan your waveforms.

Equations are written in conventional mathematical notation. You may only enter the right part of the equation. The only limitation is that the equation must be of a single variable that is directly related to the current horizontal axis setting. Case is not important and spaces are ignored. Numbers are entered in scientific notation. All calculations are done with double-digit precision. For the trigonometric functions, all angles are expressed in radians.

A number of constants are provided: e, which is the base of the natural logarithm; pi, which is the circumference of a unit-diameter circle; per, which equals the programmed horizontal range; f, which equals 1 /per; omg, which equals 2 * pi / per, and numerals in the range of -1E^20 to 1E^20.

There are three classes of precedence: ^ (raise to power) has the highest precedence; (multiply) and / (divide) come second; + and - have the lowest precedence. Parentheses may be used to change the order of precedence. The following table summarize the mathematical expressions and their respective abbreviated commands that can be used with the Equation Editor.

Equation Editor Operands

^	Raise to the power
*	Multiply
/	Divide
+	Add
Ä	Subtract
( )	Parentheses
e	Base of natural Logarithm
pi (π)	Circumference of unit-diameter circle
per	Horizontal wavelength in points
f	I/per
omg (Ω)	$2*\pi$ / per
amp	Amplitude in units of points or seconds
sin(x)	The sine of x(*)
cos(x)	The cosine of x
tan(x)	The tangent of x
ctn(x)	The cotangent of x
log(x)	The base IO logarithm of x
In(x)	The natural (base e) logarithm of x
abs(x)	The absolute value of x
-1E^20<>1E^20	Numerals, equation constants

(*)x = argument mathematical expression

After you get familiar with the operands and conventions, you can commence with a few simple equations and see what they do to your waveform screen. Once you'll get the feel, you'll be able to explore your own creativity to generate much more complicated and complex waveforms.

Typing Equations

If you remember from your old high school studies, the simplest curve of Y as a function of X is defined by the equation Y=aX+b. You can use the same “technique” to generate straight lines with the Equation Editor. Assuming first that p=0, try this:

Amplitude(p)=1000

Press [Preview] and see what you get. Of course, you get an uninteresting line that runs parallel to the X-axis. Now, lets give the line some angle by typing:

Amplitude(p)=-2*p+2000

Press [Preview] and see that the line slopes down. It may still be not very interesting however, pay close attention to the convention that is used in this equation. You cannot type: Amplitude(p)=-2p+1000, like you would normally do in your notebook; You must use the * (multiply) sign, otherwise you'll get a syntax error. Now we'll try to generate a simple sine waveform. Try this:

Amplitude(p)=sin(10)

Press [Preview] and… sorry, you still get nothing on the screen. The Wave Composer did not make a mistake! The sine of 10 in radians is exactly what it shows. You are unable to see the result because the line on your screen running across the 0 vertical point.

REMEMBER

The equation must be a function of a single variable and that variable must be directly related to the Horizontal axis Scale setting.

Now try this:

Amplitude(p)=sin(omg*p)

Still no good, but now press the [Adjust] button and here is your sinewave. So what's wrong? Well, if you'll give it a little amplitude it might help so, do it now exactly as follows:

Amplitude(p)=8000*sin(omg*p)

There you go. You should now see a perfect sine waveform with a period of 1000 points. This is because you have asked the Equation Editor to compute the sine along p points (“p” is the equation variable, remember?). If you want to create 10 sine waveforms, you should multiply p by 10. Try this:

Amplitude(p)=8000*sin(omg*p*10)

Equation Samples

So far, you have learned how to create two simple waveforms: straight lines and trigonometric functions. Let's see if we can combine these waveforms to something more interesting. Take the straight line equation and add it to the sinewave equation:

Amplitude(p)=12000*sin(omg*p*l0)-8*p+4000

Press [Preview]. Your screen should look like Figure 4-38.

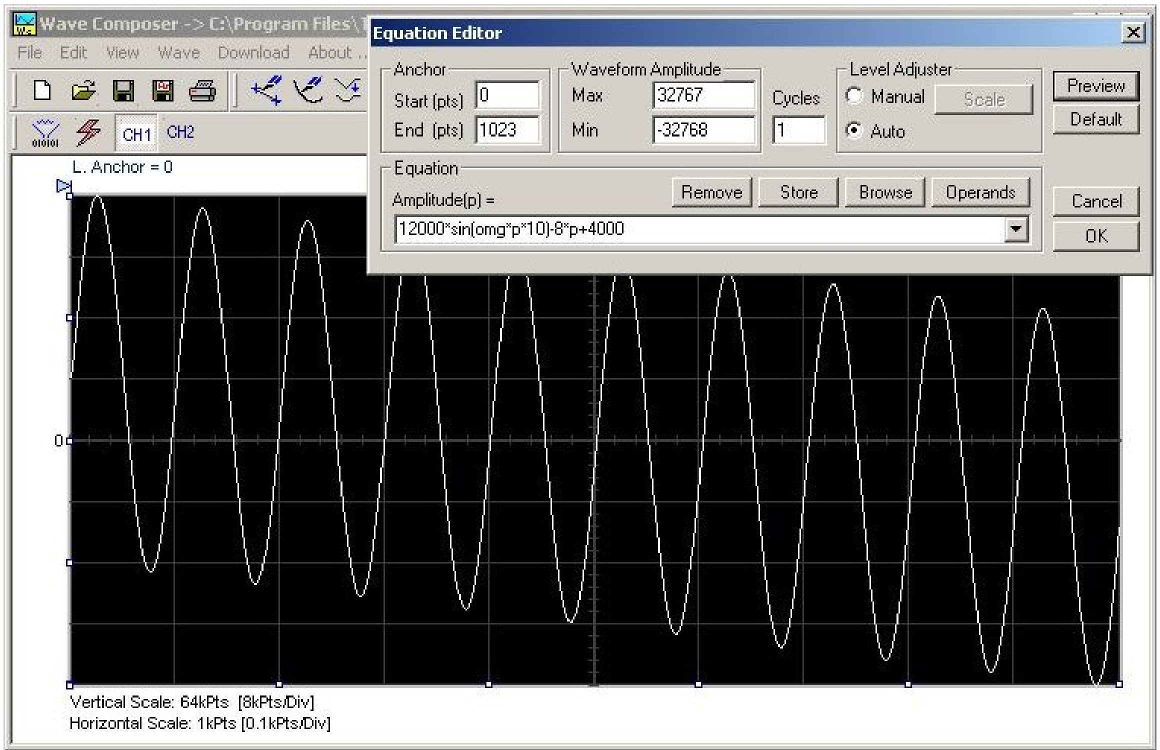

Figure 4-38, an Equation Editor Example

Now let's try to modulate two sine waves with different periods and different start phase. Type this:

Amplitude(p)= 12000*sin(omg*p)*cos(omg*p*30)

Press [Preview]. Your screen should look like Figure 4-39.

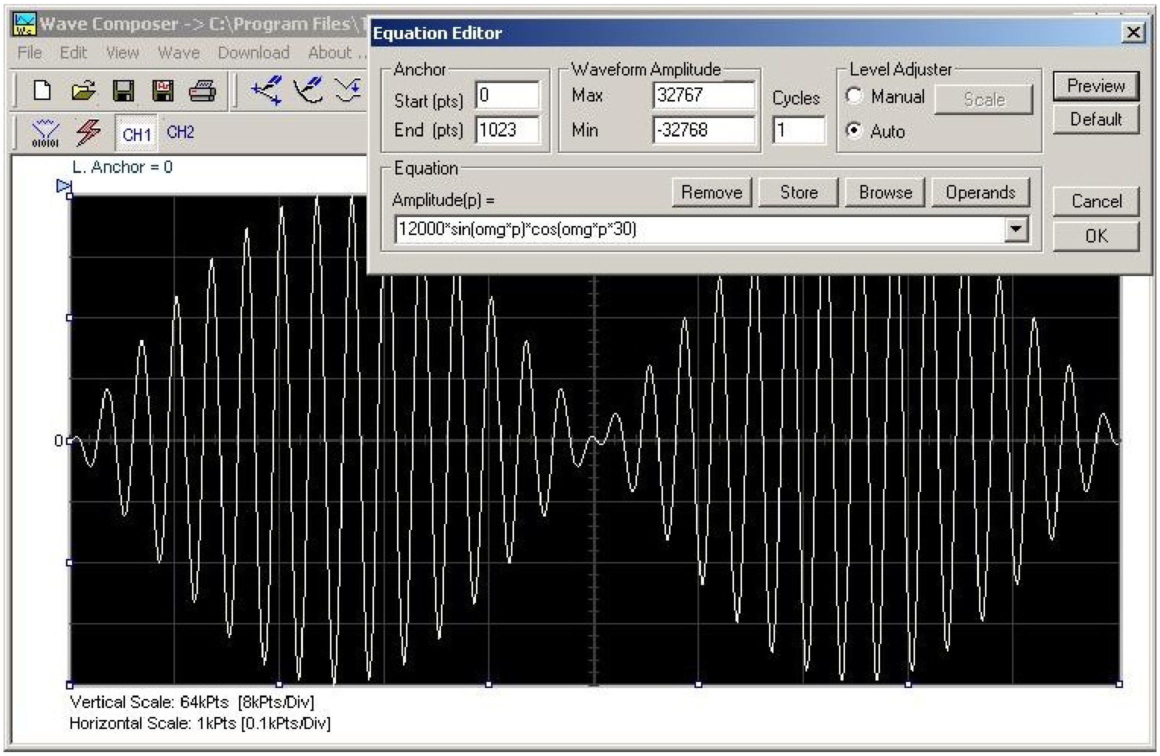

Figure 4-39, Using the Equation Editor to Modulate Sine Waveforms

In the following example, as shown in Figure 4-40, 20% second harmonic distortion has been added to a standard sinewave. The original waveform had a peak-to-peak value of 24000 points so 19% second harmonic is equivalent to 4500 points. The frequency of the second harmonic is obviously double that of the fundamental, so term +4500*sin(2*omg*p) is added to the original sine wave equation. Use the following equation:

Amplitude(p)=24000*sin(omg*p)+4500*sine(2*omg*p)

Press [Preview]. Your screen should look like Figure 4-40.

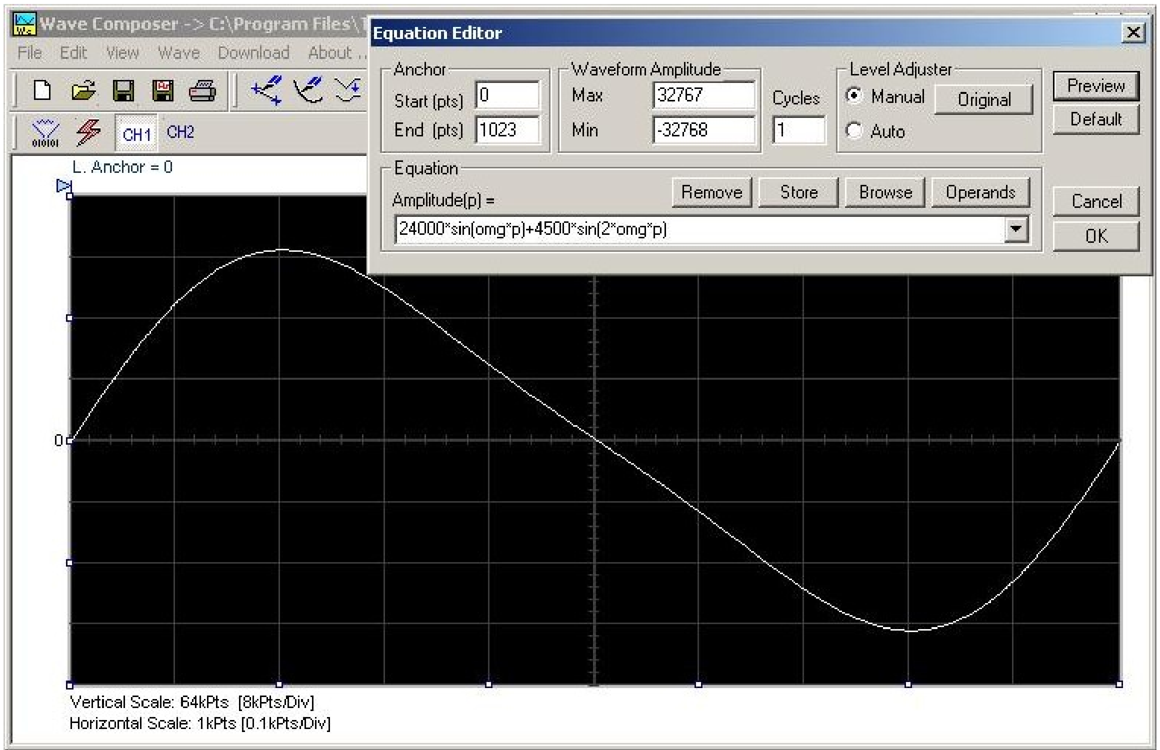

Figure 4-40, Using the Equation Editor to Add Second Harmonic Distortion

In Figure 4-41 we created 10 cycles of sinewave made to decay exponentially. The original expression for a standard sinewave is multiplied by the term e^(p/-250). Increasing the value of the divisor (200 in this case) will slow down the rate of decay.

Use the following equation:

Amplitude(p)=12000*sin(omg*p*10)*e^(p/-250)

Press [Preview]. Your screen should look like Figure 4-41.

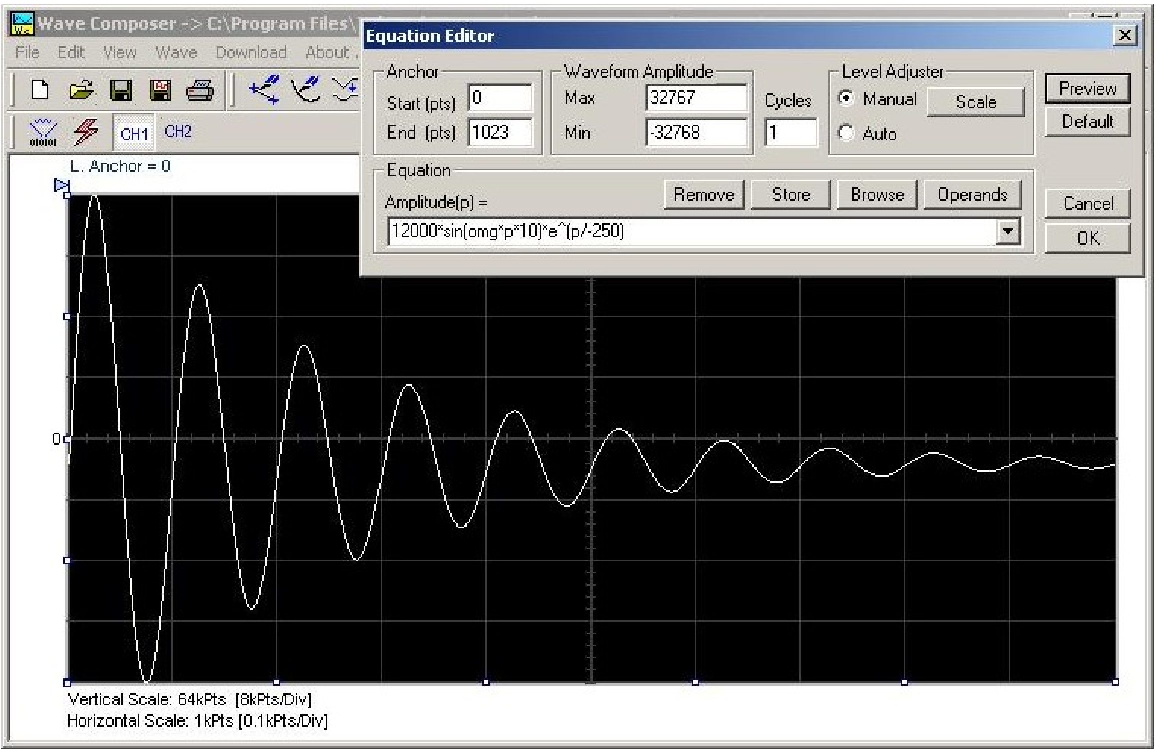

Figure 4-41, Using the Equation Editor to Generate Exponentially Decaying Sinewave

The last example as shown in Figure 4-42 is the most complex to be discussed here. Here, 100 cycles of sinewave are amplitude modulated with 10 cycles of sine wave with a modulation depth of 20%. To achieve this, the upper and lower sidebands are defined separately and added to the fundamental or carrier. The upper sideband is produced by the expression 100*cos(110*omg*p) and the lower sideband by the term 100*cos(90*omg*p).

Use the following equation:

Ampl(p)=6000*sin(100*omg*p)+1200*cos(110*omg*p)-1200*cos(90*omg*p)

Press [Preview]. Your screen should look like Figure 4-42.

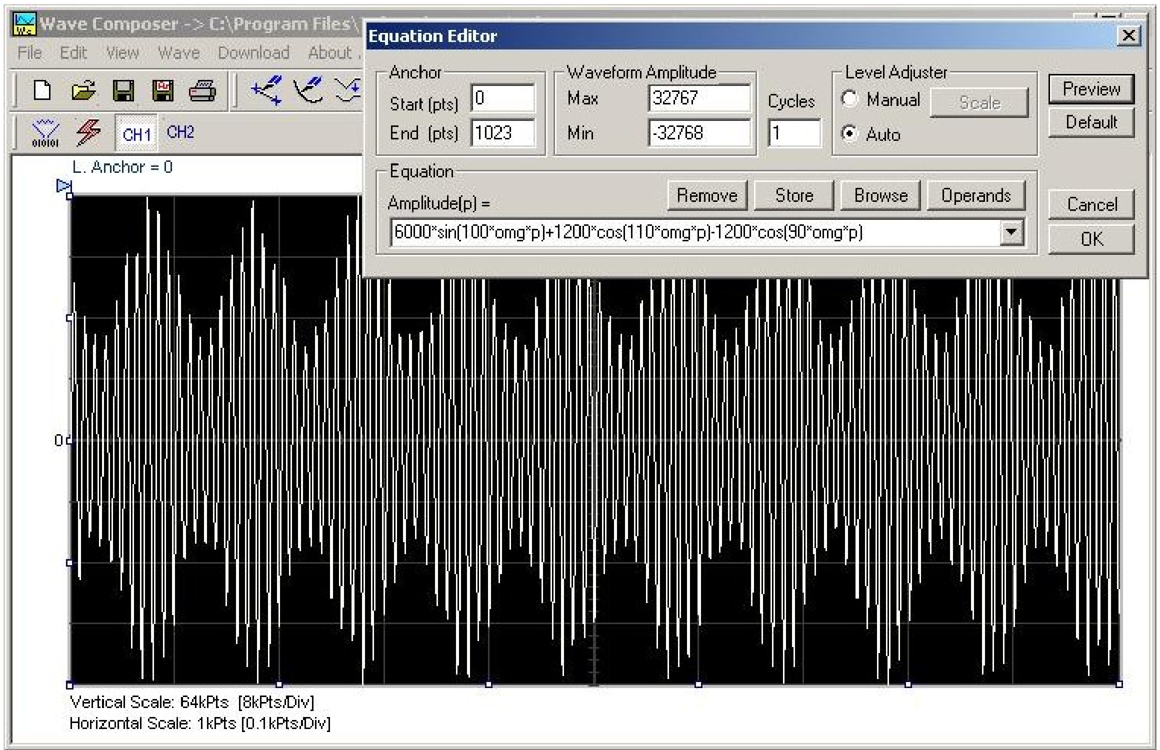

Figure 4-42, Using the Editor to Build Amplitude Modulated Signal with Upper and Lower Sidebands

Combining Waveforms

The last but not least powerful feature allows you to combine waveforms which you previously stored on your hard disc. You can write mathematical expressions that contain waveforms, simple operands and trigonometric functions similar to the example given below. If you want to use waveforms in your equations, you must first generate these waves and store them on your hard disk. You identify waveforms by adding the *.wav extension as shown in the example below.

Amplitude(p)= Sine.wav*sin(omg*p*10)*Noise.wav/1000

The above equation will generate amplitude-modulated waveform with added noise. The following steps demonstrate how to create, store and combine waveforms using this equation.

Step 1 – Create and store sine.wav. Invoke the Wave command and generate a sine waveform. Press OK and then select the Save Waveform As… from the File command. Save this file using the name Sine.wav. Note where you store this waveform as you would have to know the path for the next step.

Step 2 – Create and store Noise.wav. From the Wave command select Noise. Click OK and watch your waveform screen draw noisy signal. From the File menu select Save Waveform As… and save this waveform using the name Noise.wav.

Step 3 – Write and compute the original equation:

Amplitude(p)= c:/Sine.wav*sin(omg*p*5)*c:/Noise.wav/10

If you did not make any mistakes, your waveform screen should look as shown in Figure 4-43

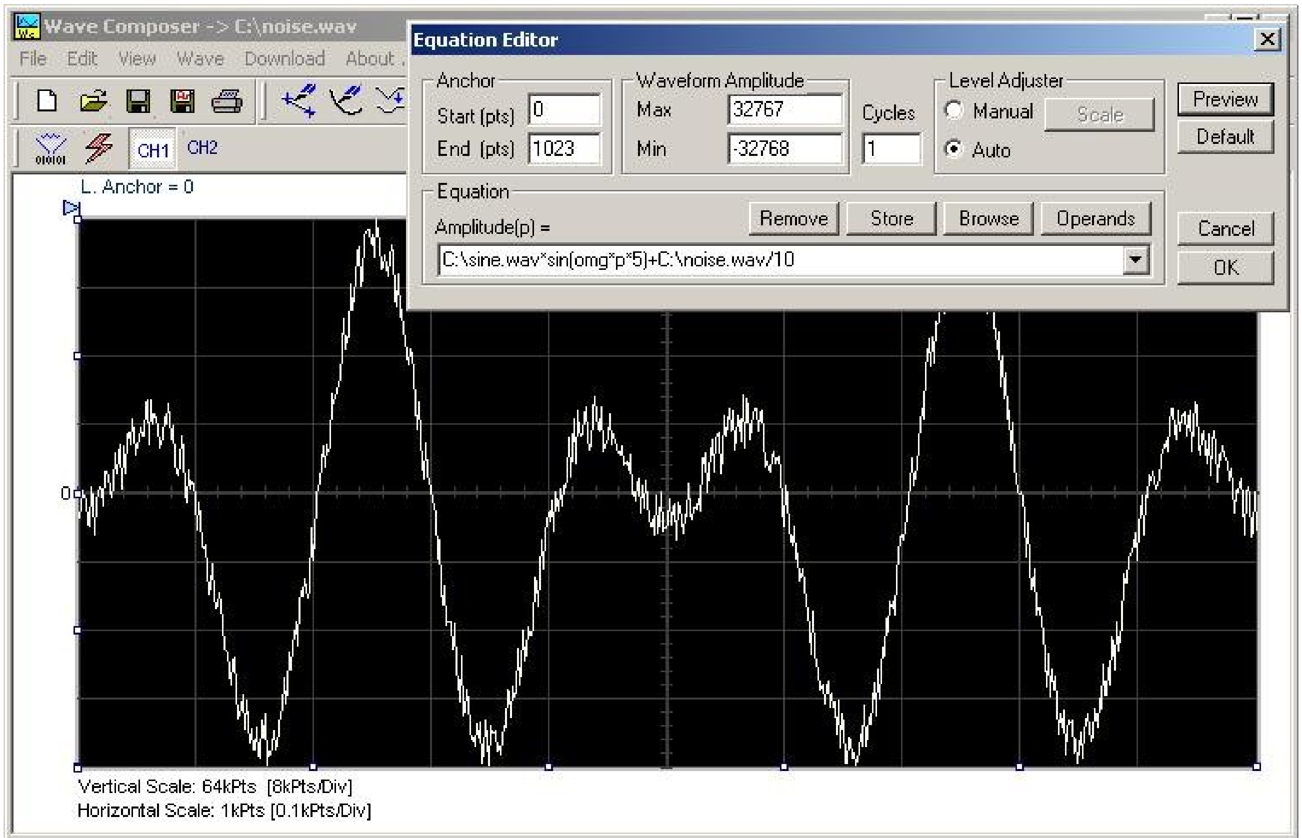

Figure 4-43, Combining Waveforms into Equations

The Pulse Composer

The Pulse Composer is a great tool for creating and editing pulses without the need to think about sample clock, number of points and complex equations. Pulses are created on the screen, simply and efficiently in a special dialog box by typing in the width and level, or by using the “rubber band” method to place straight line segments with the exact amplitude and time duration. The pulse composer can also multiply pulse sections to create pulse duplication along lengthy time intervals.

When you finally have your pulse design on the screen the program determines if the pulse design will fit in one memory segment or use multiple segments and employ the sequence generator for repeatable segments. In either case, bear in mind that if you already have some waveforms stored in memory segments, these will be erased to make room for the new pulse design. If you insist on keeping arbitrary waveforms and still download complex pulses, you can check the “Force pulse to one segment” option and the 2572A will do some extra “muscle flexing” to fit the pulse as required.

To launch the pulse composer point and click on the Pulse tab in the Panels bar. Figure 4-44 shows an example of the pulse composer. The Pulse Composer has three main sections: Commands bar, Toolbar and Waveform screen. Refer to Figure 4-44 throughout the description of these sections.

The Pulse Composer Commands bar

The commands bar provides access to standard Windows commands such as File and View. In addition, there are ArbExplorer-specific commands such as Edit, Wave and System.

In general, clicking on one of the commands opens a dialog box with an additional list of commands. Then, clicking on an additional command, may open a dialog box, or generate an immediate action. For example, Clicking on File and then Exit will cause an immediate termination of the Pulse Composer. The various commands in the Commands bar are listed and described below.

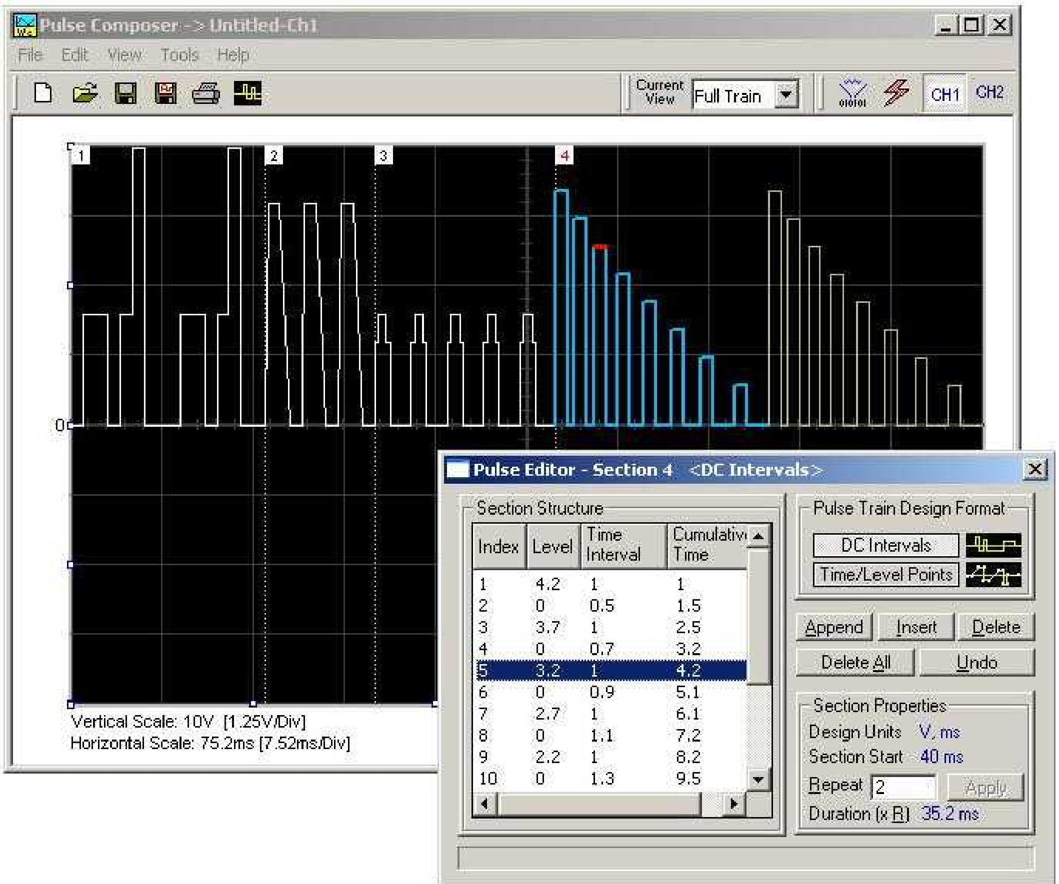

Figure 4-44, the Pulse Composer Screen

File Commands

The File command has 4 command lines that control pulse waveform files. Also use this command to print the active waveform, or exit the pulse composer program. Description of the various commands under File is given below.

New

The New (Ctrl+N) command will remove the waveform from the screen. If you made changes to the waveform area and use the New command, you should save your work before clearing the screen. The New command is destructive to the displayed waveform.

Open…

The Open… (Ctrl+O) command will let you browse through your disk space for previously saved pulse waveform files and load them to the pulse screen area. File extension that can be read to the pulse composer is *.pls.

Save

The Save (Ctrl+S) command will store the active waveform in your 2572A directory with a *.pls extension. If this is the first time you save your waveform, the Save As… command will be invoked automatically, letting you select name, location and format for your waveform file.

Save As…
Use the Save As… command the first time you save your waveform. It will let you select name, location and format for your waveform file.

Print
With this command you may print the active Pulse Window. The standard printer dialog box will appear and will let you select printer setup, or print the waveform page.

Exit
The Exit command ends the current Pulse Composer session and takes you back to the Panels screen. If you made changes to your waveform since it was last saved, the Wave Composer will prompt you to Save or Abandon changes these changes.

Edit Commands

The Edit commands are used for adding or removing pulse train sections. Use these commands to Append, Delete, Insert, or Undo last operation. The editing commands are explained in the following paragraphs.

Append Section
The Append Section command lets you append a new section at the end of the pulse train. Only one new section can be appended at the end of the train. If an empty section already exists, the append command will alert for an error. New sections are always appended at the end of the pulse train.

Insert Section
The insert Section command lets you insert a new section in between sections that were already designed. Only one new section can be inserted at the middle of the train. If an empty section already exists, the insert command will alert for an error.

Delete Section
The Delete Section command lets you remove sections from the pulse train without affecting the rest of the train. If you use this command from the Edit menu, make sure that the section you want to remove is currently the active section.

Remove all Sections
The Remove all Sections command lets you remove the entire pulse design from the pulse screen and start from a fresh page.

Undo
The Undo command undoes the last editing operation. This command is extremely useful in cases where you unintentionally delete a section from the pulse train and want to restore it to the screen.

View Commands

The View commands have commands that let you view various sections of the pulse area. The View commands include: Pulse Editor, Full Train or individual Sections, Channel 1 and 2 screens and Options. Description of the view commands is given in the following.

Pulse Editor

The view Pulse Editor command invokes a dialog box as shown in Figure 4-45. In general, the pulse editor is used for placing straight line segments on the screen in intervals that define pulse width, rise/fall times and amplitude. Information how to use the pulse editor to create pulse trains is given later in this chapter.

Full Train

The view Full Train shows on the pulse screen all sections of the pulse train. Eventually, when all pulse sections have been designed, the entire pulse train as shown when the Full Train option has been selected will be downloaded to the instrument as a single waveform.

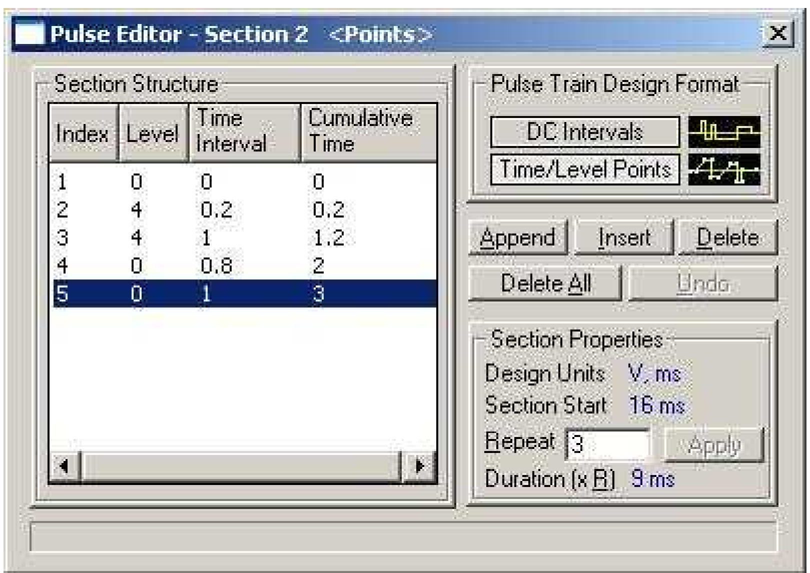

Figure 4-45, the Pulse Editor

Single Section

The view Single Section shows on the pulse screen one section at a time. Eventually, when all pulse sections have been designed, the entire pulse train as shown when the Full Train option has been selected will be downloaded to the instrument as a single waveform.

Channel 1

The view Channel 1 command updates the waveform screen with the Channel 1 pulse train. If you have not yet generated a waveform for channel 1, the waveform screen will show a clear display.

Channel 2
The view Channel 2 command updates the waveform screen with the Channel 2 pulse train. If you have not yet generated a waveform for channel 2, the waveform screen will show a clear display.

Options
The view options command opens the dialog box as shown in Figure 3-46. Use this dialog box to fine-tune the pulse composer to the way it should deal with operational modes and the waveform memory. Information on options is given later in this chapter.

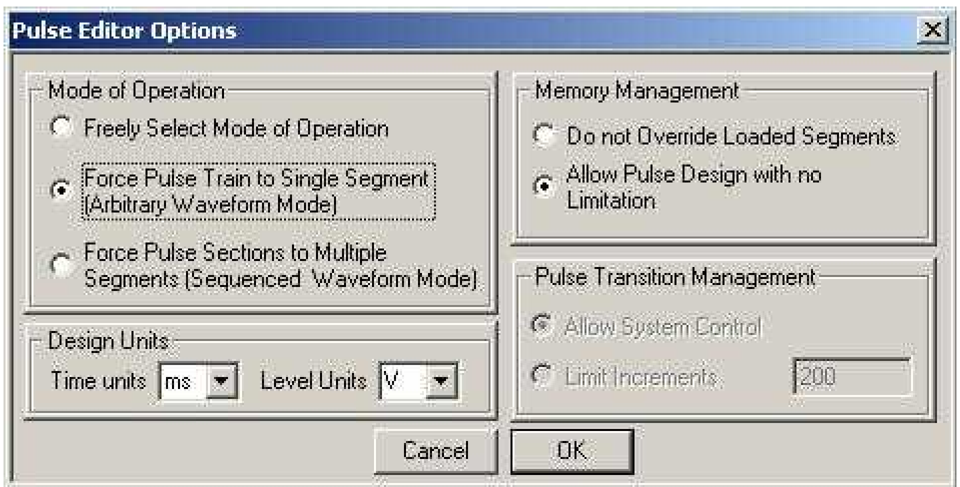

Figure 4-46, the Pulse Editor Options

Tools Commands

The Tools commands let you download pulse trains to either channel 1 or channel 2. You can also clear the entire waveform memory using the Clear memory command.

Note

The Clear Memory command affects the entire waveform memory of the 2572A and therefore, be careful not to erase memory segments that you'll need to use with the arbitrary function.

The Pulse Composer Toolbar

The toolbar contains icons for editing the waveform screen, icons for saving and loading waveforms, fields for selecting an active channel and more. The Toolbar is shown in Figure 4-47. The icons, from left to right operate the following functions: New waveform, Open an existing waveform file, Save pulse train, Save pulse train As, Print the screen and open the pulse editor dialog box. Other icons select the current view on the screen, shows channel 1 and channel 2 waveforms, clear the memory and download the displayed pulse train to the active channel.

Figure 4-47, the Pulse Composer Toolbar Icons

Creating Pulses

As was mentioned above, creating pulses with the pulse editor is simple and intuitive, just as you would draw the pulse on a piece of paper. The pulse editor then processes the information, determines the appropriate mode and converts to waveform coordinates for downloading to the instrument for it to generate the required pulse shape.

There are a number of terms that will be used throughout the following description; Make yourself familiar with these terms before you proceed with actual design of your pulse.

Pulse Editor
The Pulse Editor is the prime tool for creating pulses. To invoke the pulse editor, point and click on the pulse editor icon on the pulse composer toolbar. You can also invoke the editor by clicking on the Section Number icon as will be shown later in this description. The pulse editor dialog box is shown in Figure 4-45.

Pulse Train
The Pulse Train identifies the entire pulse design. When downloading the waveform to the instrument, the entire pulse train will be downloaded, regardless if part of the pulse train is displayed on the pulse composer screen.

Pulse Section
Pulse train is constructed from 1 or more sections. If the pulse is simple, it can be created using one section only. For more complex pulse train, the train can be divided to smaller sections and each section designed separately for simplicity. Figure 4-48 shows a complex pulse train which was made from five simpler sections and Figure 4-49 shows the design of the fifth section only of the pulse train.

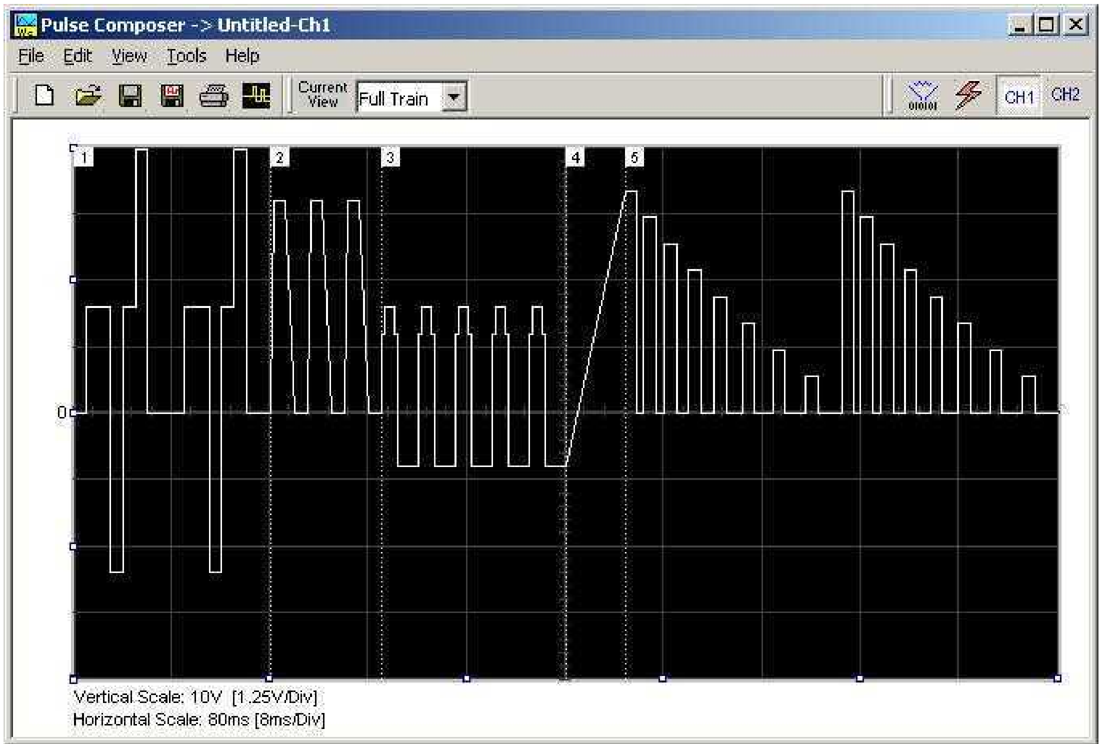

Figure 4-48, Complete Pulse Train Design

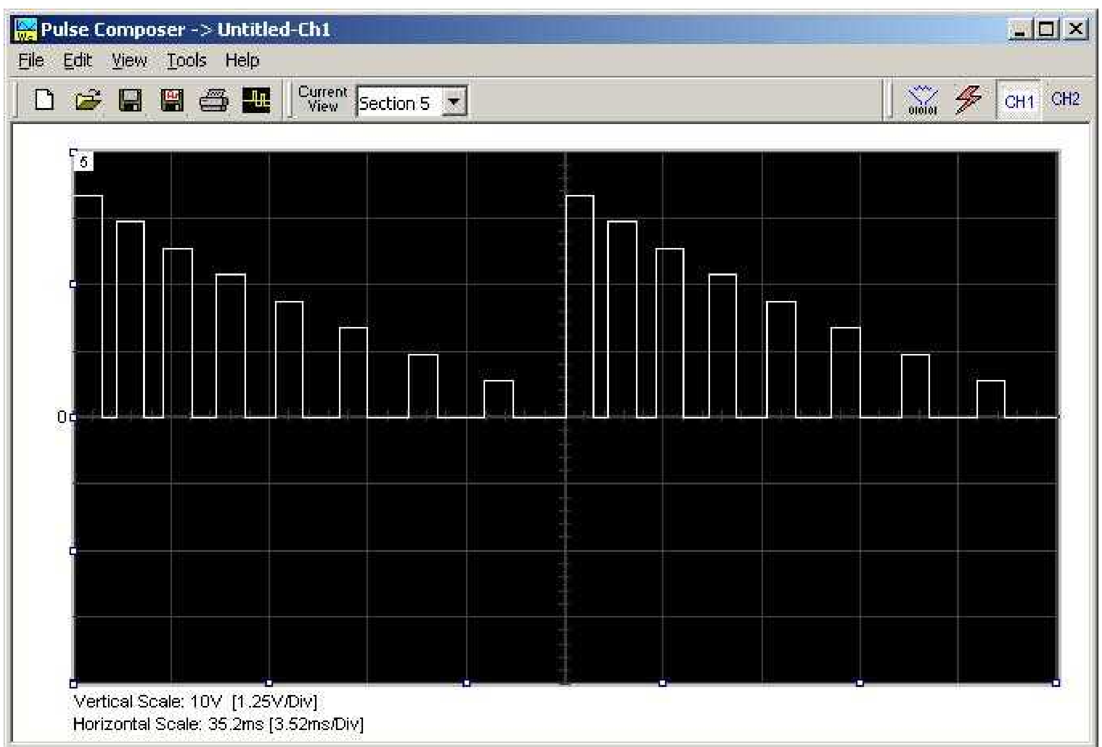

Figure 4-49, Section 5 of the Pulse Train Design

Now that we somewhat understand the terms we use for the pulse design, we start with an example how to design the pulse train as shown in Figure 4-48. If you already have some pulses shown on your pulse composer screen, click on New to start from a fresh page. Another step before you design your pulse train is to set the design parameters in the options menu that will determine the way that the pulse will be distributed in your waveform memory. Click on View→Options and refer to Figure 4-50 throughout the following description.

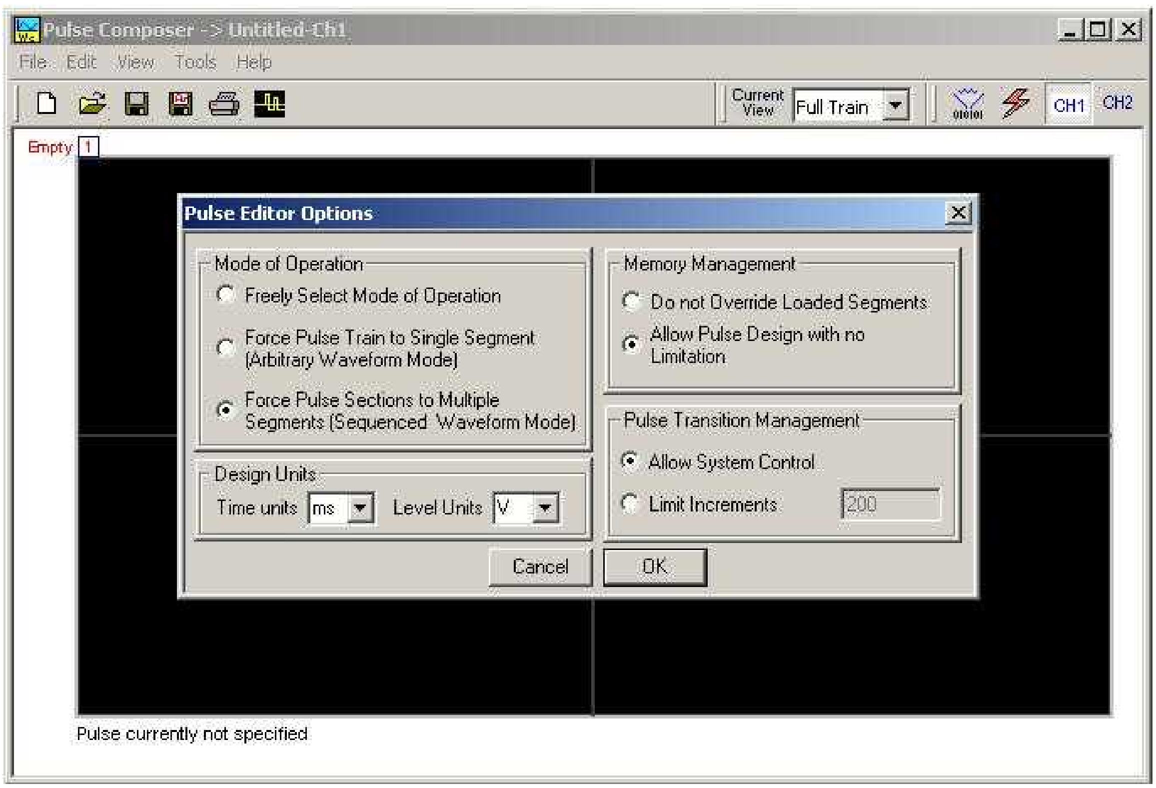

Figure 4-50, Selecting Pulse Editor Options

Setting the Pulse Editor Options

As shown in Figure 4-50, the pulse editor option dialog box is divided to functional groups: Mode of operation, Design Units, Memory Management and Pulse Transition Management. These groups are described below.

Mode of Operation

There are three options in the mode of operation group.

The force pulse train to single segment option is recommended if you are using one pulse section only. In this case, the pulse waveform will occupy one segment only and the generator will automatically be set to operate in arbitrary mode.

The force pulse sections to multiple segments option will place each section of the pulse train into a different memory segment and the generator will automatically be set to operate in sequenced mode. Select this option for the example we are going to build later.

If you are not sure what to do, select the freely select mode of operation and the generator will do the work for you.

Design Units
As you design your pulse pattern, it will be easier if you design it using the exact units as you would want to output to your load. Select between μs, ms and s for the pulse intervals and mV or V for the amplitude level. Select ms and V for the example we are going to build later.

Memory management
There are two options in the memory management group.

The do not override loaded segments option will make sure that whatever waveforms you already stored for the arbitrary function will stay intact after you save your pulse waveform.

The allow pulse design with no limitations option may overwrite memory segments that you already used previously for the arbitrary function however, this is the recommended option for the program and for the example we are going to build later.

Pulse Transition management
The pulse transition management parameter defines for the program how many waveform points will be used to step from one amplitude level to another amplitude level. The longer the transition time, the program will need more steps to smooth the transition. If you select the limit increments and set a pre-defined number of increments, you manually control how many waveform points will be dedicated for transitions however, if you are not sure what is the optimum number of increments, select the allow system control option for the program to make the transitions efficient in terms of memory usage and slope smoothness.

After you complete setting the pulse editor options, point and click on OK.

Using the Pulse Editor

The prime tool for building pulse patterns on the pulse composer screen is the pulse editor. To invoke the pulse editor, point and click on the pulse editor icon on the tools bar. The editor as shown in Figure 4-51 will show. Refer to this figure for the following descriptions.

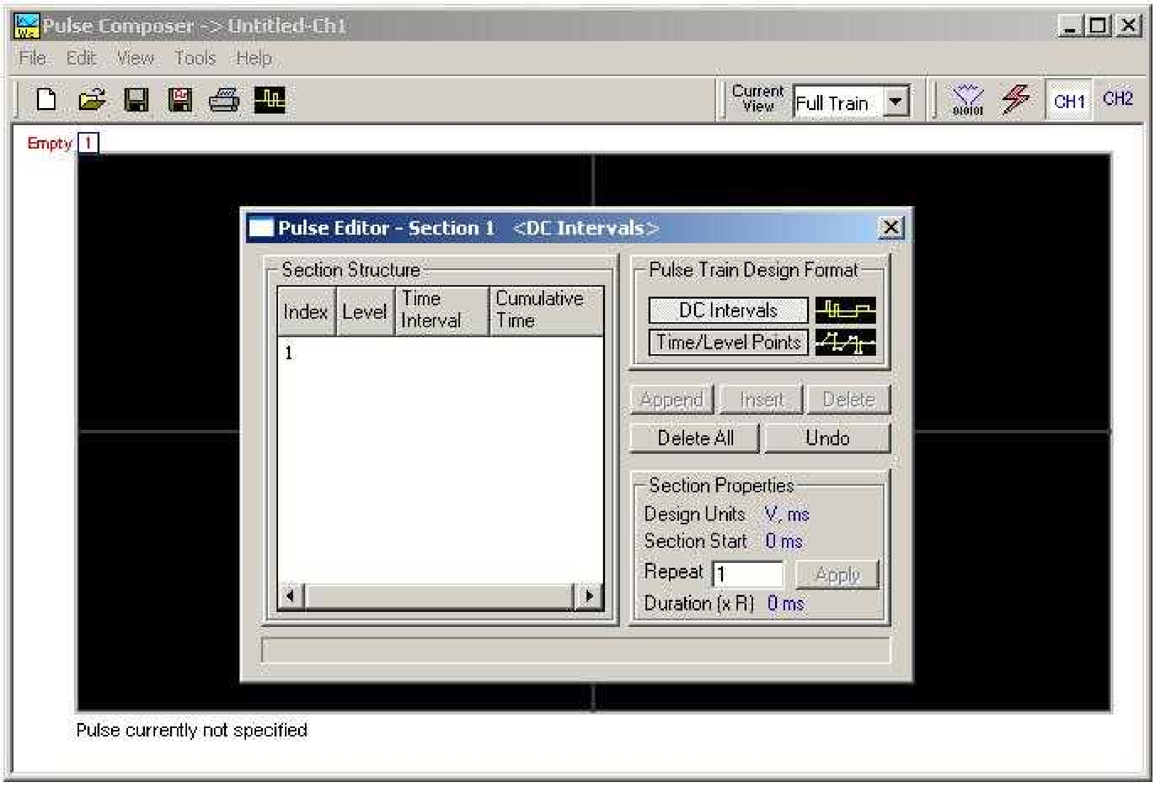

Figure 4-51, Using the Pulse Editor

The Pulse Editor as shown in Figure 4-51 has four groups: Section Structure, Pulse Train Design Format, Section Properties and control buttons. These groups are described below.

Pulse Train Design Format

There are two methods (or formats) that can be use for designing the pulse shape: DC Intervals and Time/Level Points. The design format is unique for the current section and cannot be switched during the section design.

DC Intervals – programs pulse duration using DC levels only. Transition times for this format are at the maximum rate that the generator can produce. For example, if you want to draw a simple square waveform that has 0V to 3.3V amplitude, 50% duty cycle and 1ms period, you enter the following parameters:

Index = 1, Level = 3.3, Time interval = 0.5 (Cumulative Time = 0.5)
Index = 2, Level = 0, Time Interval = 0.5 (Cumulative Time = 1.0)

Note as you build the segments that the pulse is being drawn on the screen as you type in the parameters. Also note that the Cumulative Time column is updated automatically with the cumulative time lapse from the start of the pulse.

Time/Level Points – programs pulse turning points using level and time markers. This format is a bit more complex to use however, it allows pulse design that require linear transition times. For example, if you want to draw a simple square waveform that has 0V to 3.3V amplitude, 50% duty cycle, 1ms period and 100ns transition times, you enter the following parameters:

Index = 1, Level = 0, Time interval = 0, (Cumulative Time = 0)
Index = 2, Level = 3.3, Time Interval = 0.1, (Cumulative Time = 0.1)
Index = 3, Level = 3.3, Time interval = 0.4, (Cumulative Time = 0.5)
Index = 4, Level = 0, Time interval = 0.1, (Cumulative Time = 0.6)
Index = 5, Level = 0, Time interval = 0.4, (Cumulative Time = 1.0)

Note as you build the segments that the pulse is being drawn on the screen as you type in the parameters and the specified point is marked with a red dot. Also note that the Cumulative Time column is updated automatically with the cumulative time lapse from the start of the pulse.

Section Structure
The term Section Structure is used to define part of the pulse train that share common properties. There are four parameters that can be programmed in this group: Index, Level, Time Interval and Cumulative Time.

Index – Is added automatically as you program pulse segments. The index line is highlighted as you point and click on pulse segments on the pulse editor screen.

Level – Specifies that peak level of the programmed segment. As you build the pulse, the level window is expended automatically to fit the required amplitude range. Note however, there is a limit to the level, which is being determined by the generator's peak to peak specification.

Time Interval – Specifies the time that will lapse for the current index level. You can program the time interval and the cumulative time will be adjusted accordingly.

Cumulative Time – Specifies the time that will lapse from the start of the current pulse section. You can program the cumulative time and the time interval will be adjusted accordingly.

Section Properties
The Section Properties contains a summary of properties that are unique for the current section.

Design Units – Provide information on the units that are used when you draw the pulse segments. These units can be changed in the pulse editor options.

Section Start – Provides timing information for the start of the current section. If this is the first pulse section the value will always be 0. Subsequent sections will show the start mark equal to the end mark of the previous section.

Repeat – Allows multiplication of pulse segments without the need to re-design repetitive parts. After you enter a repeat value, press the Apply button to lock in the repeat multiplier.

Duration – Displays the time that will lapse from the start of the pulse section to the end. The duration shows the total time lapse, including the repeated sections.

Control Buttons
The control buttons allow appending, inserting, and deleting one or all index lines. The Undo button is useful in cases where an error was made and restoration of the last operation is critical.

Pulse Example, Section 1

Now that we are better familiar with the pulse editor and its options, we are ready to start building the first section of the pulse as shown in Figure 4-48. Point and click on the New icon and open the pulse editor. Type in the level and time intervals as shown in Figure 4-52. Note that the pulse segments are being created on the screen as you type the values.

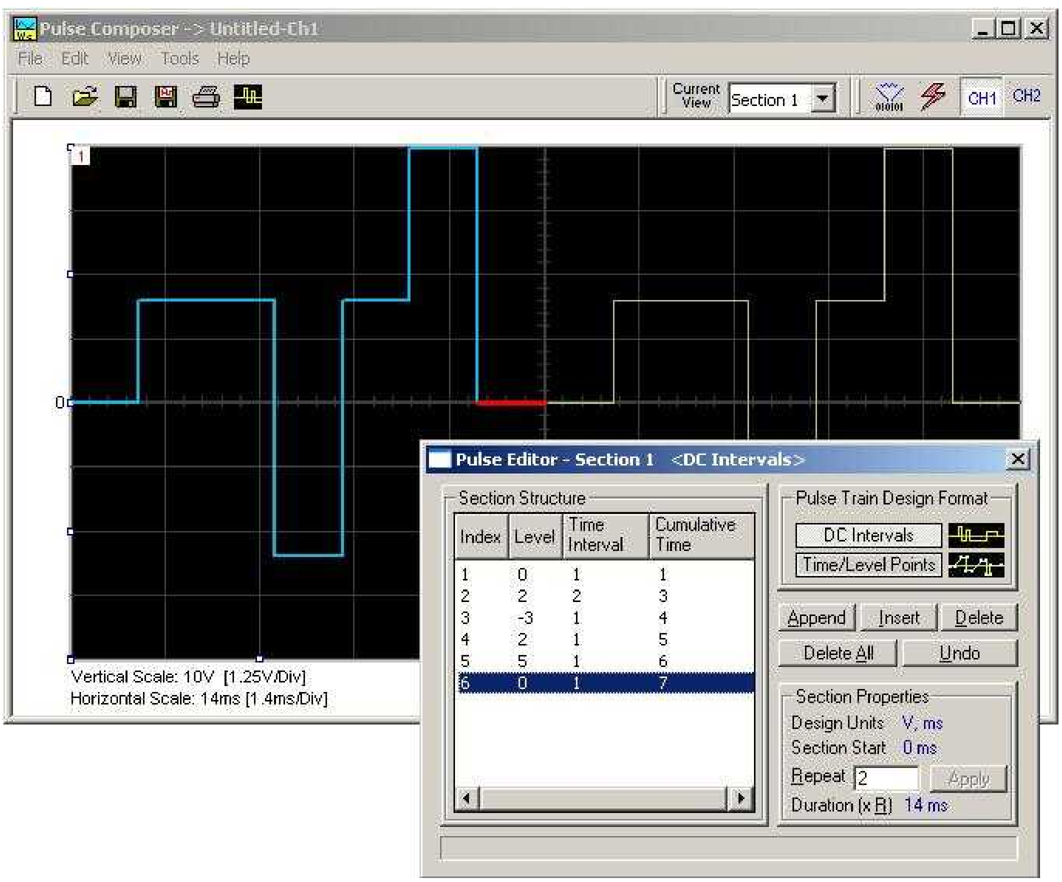

Figure 4-52, Building Section 1 of the Pulse Example

Tips

1. Use the tab button to edit the Section Structure fields.
2. Use Append to add an index line at the end of the list.
3. Use insert to add a segment above a focused line.

Before we proceed with the design of the next section, pay attention to some values that are now available on the composer screen. On the left bottom corner of the composer, Vertical Scale is showing 10V (1.25V/Div) and Horizontal Scale is showing 14ms (1.4ms/Div). These two values are critical for the integrity of the design because they are later being interpreted by the program and converted to waveform coordinates that the generator can process and output as a pulse shape. These values, may change as you add more sections to the pulse train.

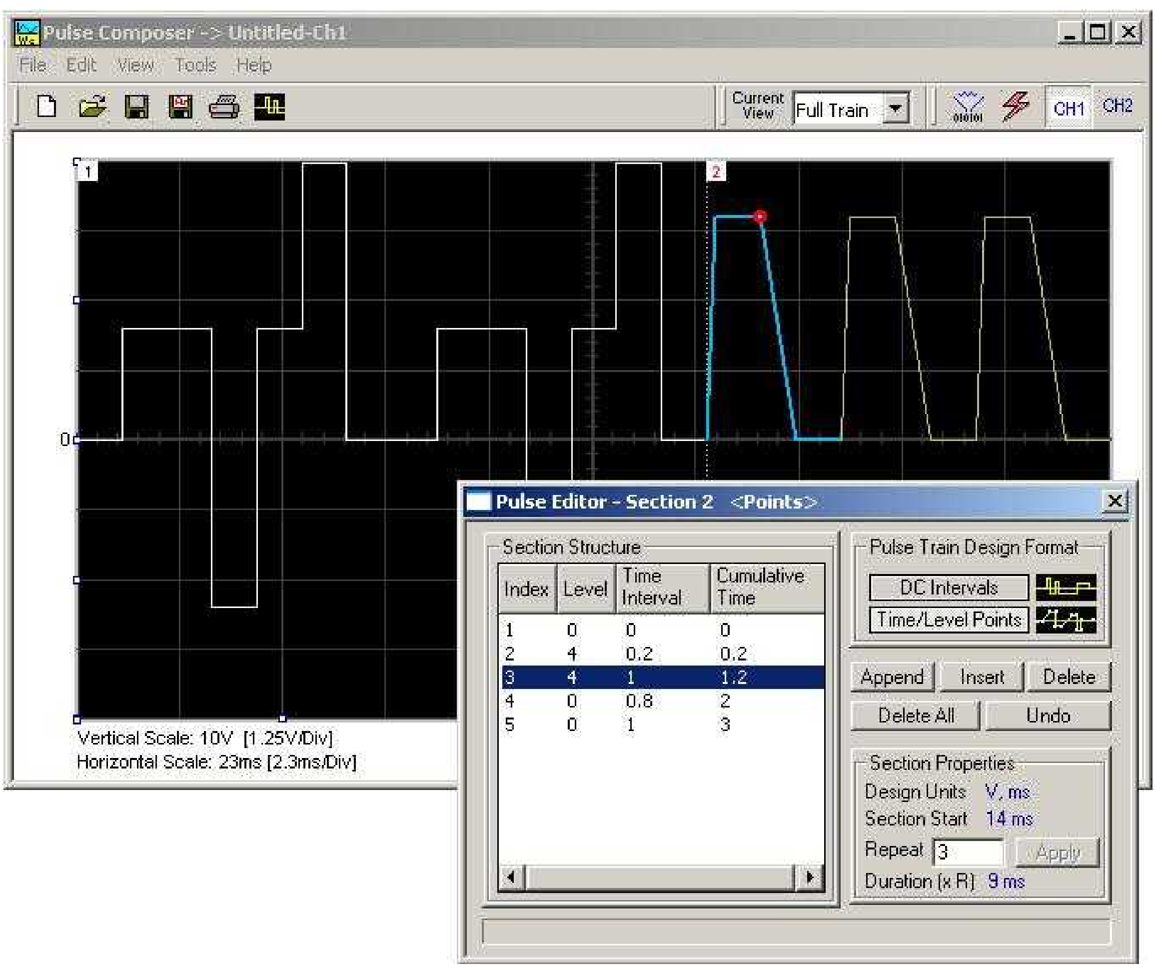

Figure 4-53, Building Section 2 of the Pulse Example

Pulse Example, Section 2

The first pulse section is complete. We are ready now to start building the second section of the pulse as shown in Figure 4-48. Point and click on the Edit command and select the Append Section option. A new section number will appear but it will show empty next to the section identifier.

Before you start entering values to this section, note that there are linear transitions required for this section. Therefore, select the Time/Level Points option in the Pulse Train Design Format. You are now ready to start programming values. In case you made a mistake and want to switch design formats after you have already typed in some values, the Pulse Editor will show an error alerting you that design format can only be changed for empty section. In this case, the only way to recover is to delete all entries and start from an empty index list. Type the section entries as shown in Figure 4-53.

Pulse Example, Section 3

The second pulse section is complete. We are ready now to start building the third section of the pulse as shown in Figure 4-48. Point and click on the Edit command and select the Append Section option. A new section number will appear but it will show empty next to the section identifier.

Before you start entering values to this section, note that there are fast transitions required for this section. Therefore, select the DC Intervals option in the Pulse Train Design Format. You are now ready to start programming values. In case you made a mistake and want to switch design formats after you have already typed in some values, the Pulse Editor will show an error alerting you that design format can only be changed for empty section. In this case, the only way to recover is to delete all entries and start from an empty index list. Type the section entries as shown in Figure 4-54.

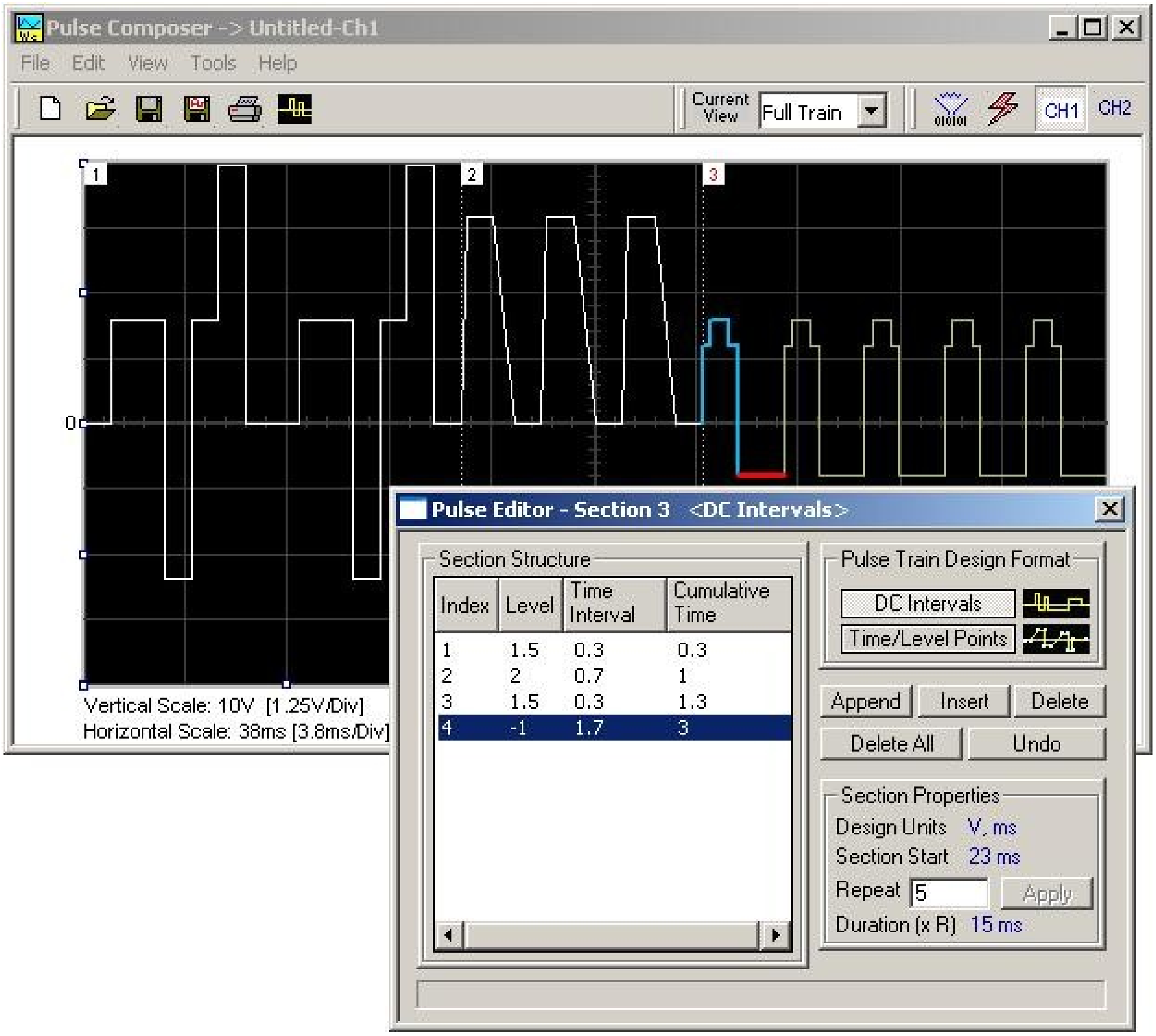

Figure 4-54, Building Section 3 of the Pulse Example

Pulse Example, Section 4

The third pulse section is complete. We are ready now to start building the forth section of the pulse as shown in Figure 4-48. Point and click on the Edit command and select the Append Section option. A new section number will appear and will show empty next to the section identifier.

Before you start entering values to this section, note that there is only one linear transition required for this section that will start from the last point of the previous section and will connect to the start point of the next section. Therefore, select the Time/Level Points option in the Pulse Train Design Format. You are now ready to start programming values. Type the section entries as shown in Figure 4-55.

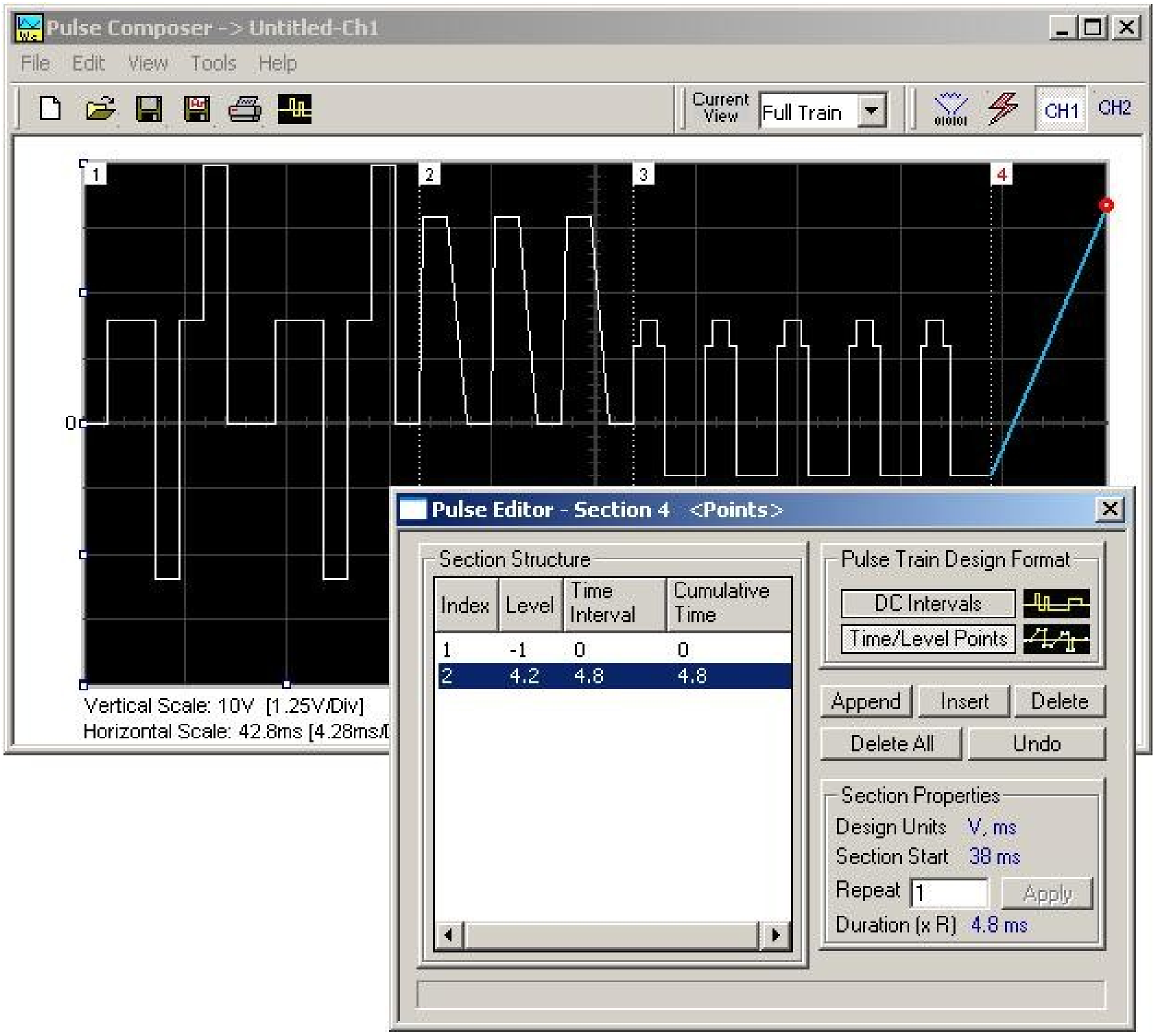

Figure 4-55, Building Section 4 of the Pulse Example

Pulse Example, Section 5

The fourth pulse section is complete. We are ready now to start building the fifth and final section of the pulse as shown in Figure 4-48. Point and click on the Edit command and select the Append Section option. A new section number will appear and will show empty next to the section identifier.

Note that there are fast transitions required for this section that will start from the last point of the previous section and will connect to the start point of the next section. Therefore, select the Time/Level Points option in the Pulse Train Design Format. You are now ready to start programming values. Type the section entries as shown in Figure 4-56.

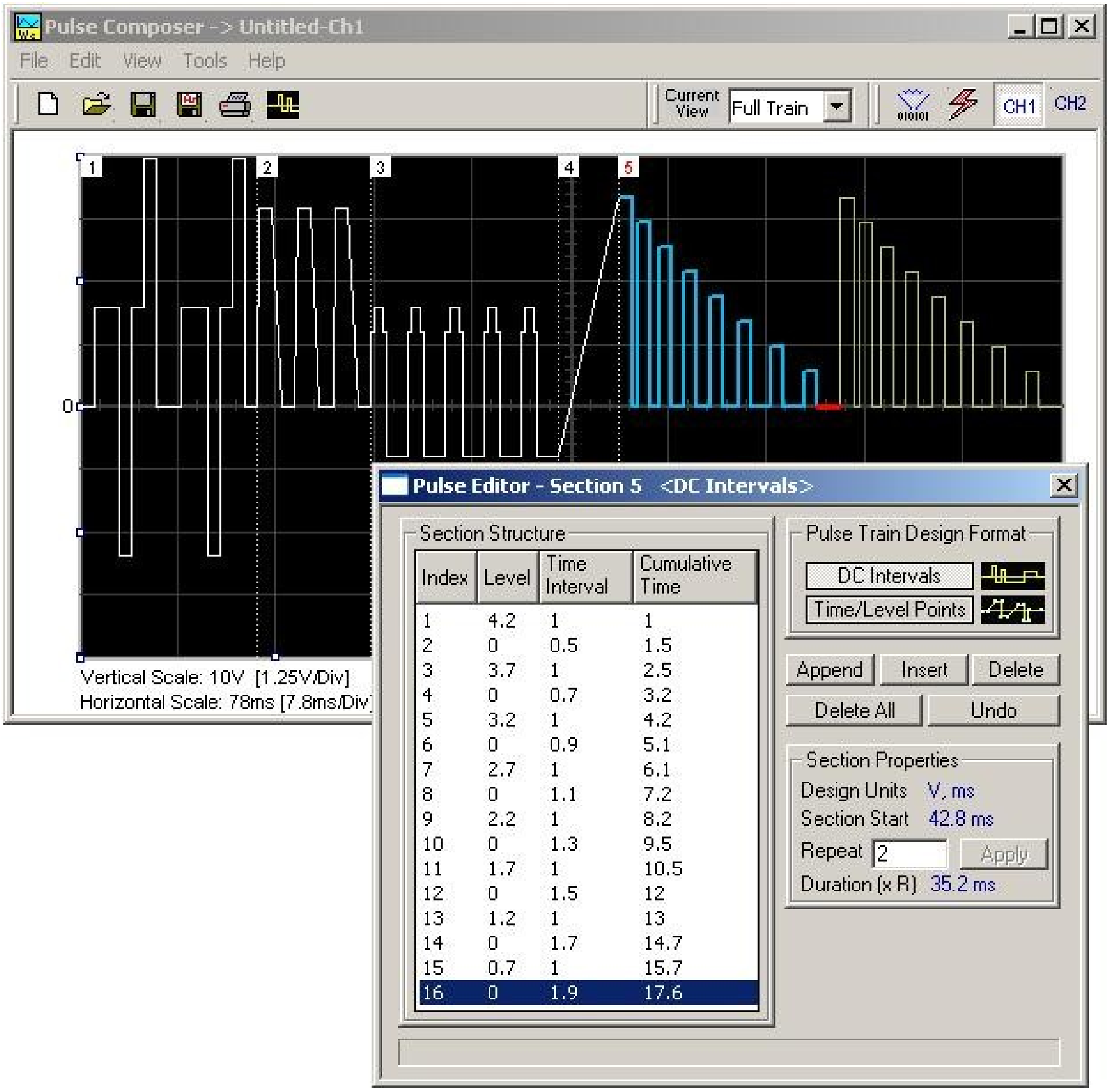

Figure 4-56, Building Section 5 of the Pulse Example

Downloading the Pulse Train

Congratulations for coming that far. If you followed the above description how to build this pulse example, the screen should look exactly as shown in Figures 4-48 and 4-56. If you are happy with the results, the next step is to download what you see on the pulse composer screen to the generator.

One more step before you download the waveform to the instrument is to check the Pulse Train Download Summary as appears after you press the Download icon. You can also view the same information if you select it from the View menu. Refer to Figure 4-57 for information how to interpret your download summary.

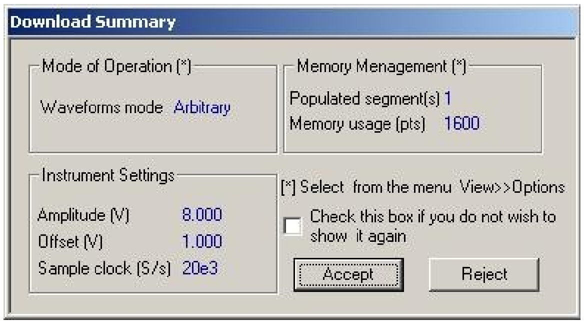

Figure 4-57, the Pulse Editor Download Summary

Interpreting the Download Summary

It is very important for you to understand that when you download a pulse waveform from the pulse composer, parameters and mode of operation may change settings on your generator. The download summary shows what will change and will let you reject the new settings if you do not agree to the changes. Once you press the Accept button, the waveform will be downloaded to the generator and the modes and parameters updated as shown in the dialog box. If you are already familiar with the changes and do not care to see the download summary every time you download a pulse waveform, you can check the box and it will not be shown on your next download. You can restore this summary from the View>>Download Summary command.

Mode of Operation – This describes the new setting of the operating mode. This field could display one of two options: Arbitrary or sequenced. Pay attention to the note (*) that says “Select from the menu View>>Options” Since we checked the Force Pulse Train to Single Segment (see Figure 4-50), the generator determines that the waveform mode be arbitrary and only one segment can be loaded with the pulse train.

Memory management – By selecting the arbitrary mode of operation, the pulse train is forced to a single segment. This summary shows which segment has been populated and how much memory was used to build the required pulse train.

Instrument Settings – Show the amplitude, offset and sample clock settings that will be changed on the generator. The settings in this summary cannot be affected from the pulse editor options settings. These are being computed and modified specifically for the current pulse train pattern and will change from pattern to pattern.

Accept/Reject – These buttons are the final step before you download the pulse train to the instrument. If you are unhappy with the instrument setting and want to change some of the options, there is still time Point and click on the Reject button and go do your changes. Point and click on the Accept button to complete the download process.

The FM Composer

The FM Composer looks and feels almost like the waveform composer except there is a major difference in what it does. If you look at the opening screen as shown in Figure 4-58, you'll see that the vertical axis is marked with frequencies. You'll see later that as you draw waveforms on the FM composer screen, these waveforms represent frequency changes and not amplitude changes as are generated by the waveform composer.

The FM composer is a great tool for controlling frequency agility by generating the agility curve as an arbitrary waveform. For example, if you create a sine waveform, the 2572A will generate frequency-modulated signal that will follow the sine pattern. The resolution and accuracy of the modulated waveform is unsurpassed and can only be duplicated by mathematical simulation. The FM composer is loaded with many features and options so use the following paragraphs to learn how to create and download modulating waveforms to the 2572A using the FM Composer.

Invoke the FM Composer from Panels bar. The Wave Composer has three sections: Commands bar, Toolbar and Waveform screen. Refer to Figure 4-58 throughout the description of these parts.

The Commands bar

The commands bar is exact duplication of the commands bar in the Wave composer. It provides access to standard Windows commands such as File and View.

In general, clicking on one of the commands opens a dialog box with an additional list of commands. Then, clicking on an additional command, may open a dialog box, or generate an immediate action. For example, Clicking on File and then Exit will cause an immediate termination of the FM Composer. On the other hand, clicking on Wave and then on Square, will open a Square Wave dialog box that lets you program and edit square wave parameters. The various commands in the Commands bar are listed and described below.

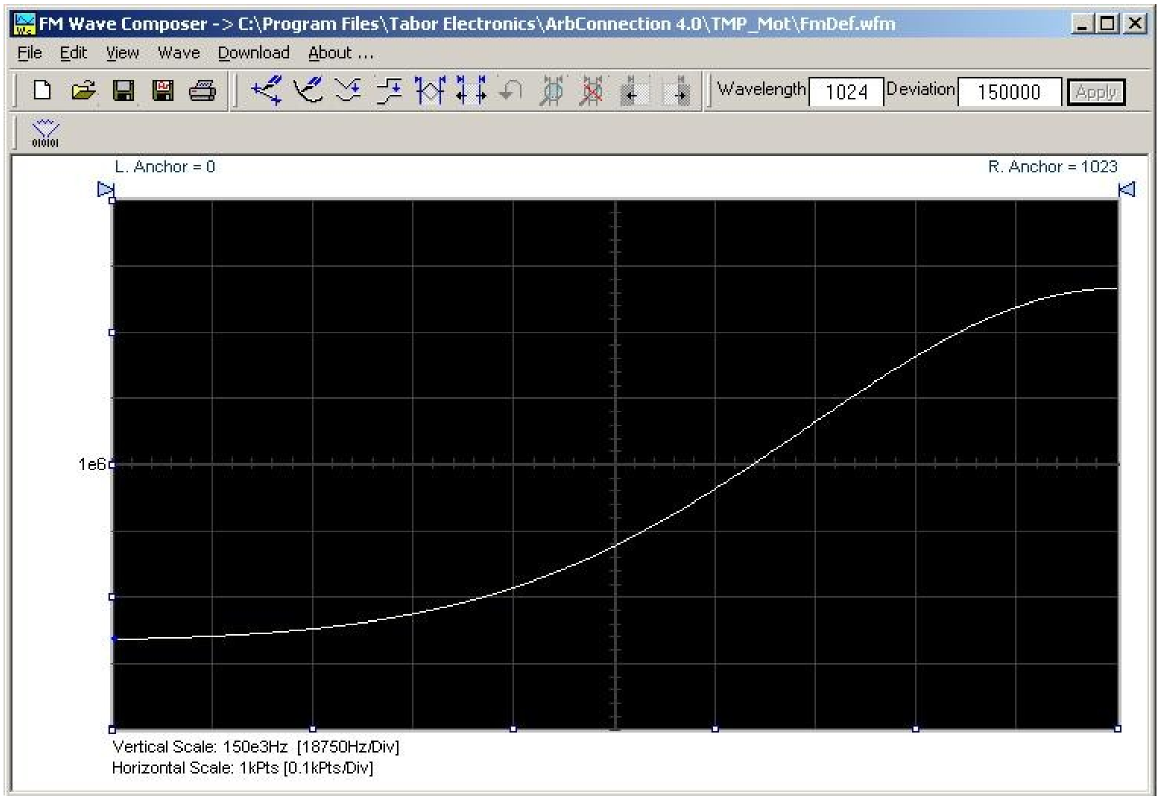

Figure 4-58, The FM Composer opening Screen

File Commands

The File command has 4 command lines that control waveform files. Also use this command to exit the FM composer program. Description of the various commands under File is given below.

New Waveform

The New Waveform command will remove the waveform from the screen. If you made changes to the waveform area and use this command, you should save your work before clearing the screen. The New Waveform command is destructive to the displayed waveform.

Open Waveform…

The Open Waveform… command will let you browse your disk for previously saved waveform files and load these waveforms to the waveform area. This command is also very useful for converting waveform files to format that is acceptable by the Wave Composer.

Save Waveform

The Save Waveform command will store your active waveform in your 2572A directory, as a binary file with a *.wvf extension. If this is the first time you save your waveform, the Save Waveform As… command will be invoked automatically, letting you select name, location and format for your waveform file.

Save Waveform As…
Use the Save Waveform As… command the first time you save your waveform. It will let you select name, location and format for your waveform file.

Print
With this command you may print the active Waveform Window. The standard printer dialog box will appear and will let you select printer setup, or print the waveform page.

Exit
The Exit command ends the current FM Composer session and takes you back to the Panels screen. If you made changes to your waveform since it was last saved, make sure to Save your work before you use this command.

Wave Commands

The Wave commands let you create waveforms on the screen. The Wave command has a library of 6 waveforms: Sine, Triangle, Square, Exponent, Pulse, and Noise. It also lets you create waveforms using an Equation editor. Information how to create waveforms using the Wave commands is given below.

Creating Waveforms From the Built-in Library
You can create any waveform from the built-in library using the Wave command. Clicking on one of the Wave options will open a dialog box. An example of the Sine waveform dialog box is shown in Figure 4-59. This dialog box is representative of the rest of the waveforms, so other waveforms will not be described.

Creating Sine Waveforms
Use the following procedure to create sine waveforms from the built-in library. Click on Wave, then sine… the dialog box as shown in Figure 4-59 will appear. You can now start programming parameters that are available in this box.

Start Point Anchor – Defines the first point where the created wave will start. Note that if you change the start point the left anchor will automatically adjust itself to the selected start point. The example shows start point set at point 200.

End Point Anchor – Defines where the created waveform will end. Note that as you change the end point the right anchor will automatically adjust itself to the selected end point. The example shows end point set at point 499.

Max. Peak Deviation – This parameter defines the forward peak deviation. Note that the forward peak deviation cannot exceed the pre-defined Deviation parameter as shown on the Toolbar. In case you need to exceed the pre-defined peak value you must quit this box and modify the Deviation parameter to provide sufficient range for the forward peak deviation range.

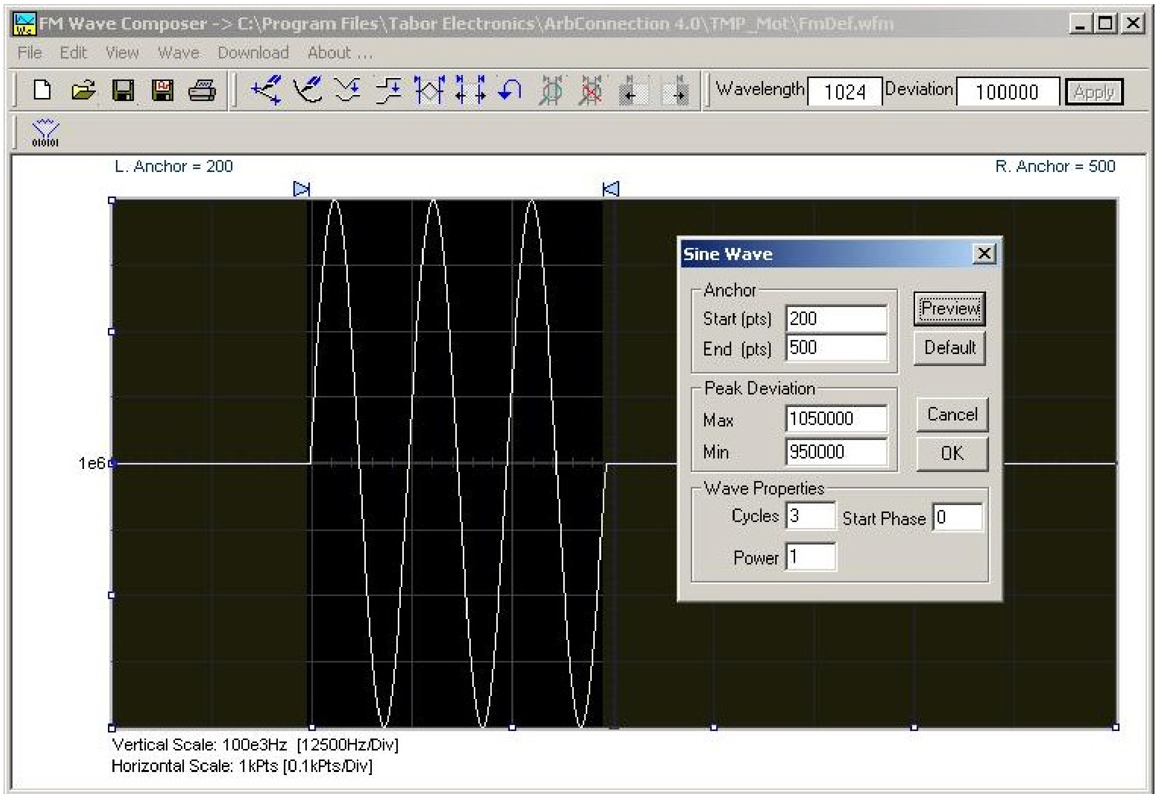

Figure 4-59, Generating Sine Modulation Using the FM Composer

Min. Peak Deviation – This parameter defines the backwards peak deviation. Note that the backwards peak deviation cannot exceed the pre-defined Deviation parameter as shown on the Toolbar. In case you need to exceed the pre-defined peak value you must quit this box and modify the Deviation parameter to provide sufficient range for the backwards peak deviation range.

Cycles – The Cycles parameter defines how many sine cycles will be created within the specified start and end anchor points. The example below shows three sine cycles.

Start Phase – The start phase parameter defines the angle of which the sine will start. The example shows 0° start phase.

Power – Sine to the power of 1 will generate a perfect sine. Power range is from 1 through 9.

Tip

The functionality of the FM composer is similar to the Wave composer. If you need more information on the FM composer functions, features and it equation editor, refer to the Wave composer section in this manual information.

The 3D Composer

The 3D Composer was specifically designed for simultaneous profiling of amplitude, frequency and phase. Amplitude profiles can be designed separately for channels 1 and 2, but frequency and phase profiles are shared by both channels. The following paragraphs will describe the various sections of the 3D composer and will guide you through some 3D programming examples.

The opening screen of the 3D composer is shown in Figure 4-60. As you can see it does not at all look like any of the other composers that were described previously discussed however, generating waveforms and programming profiles is very similar to other composer so you will be up and running in no time.

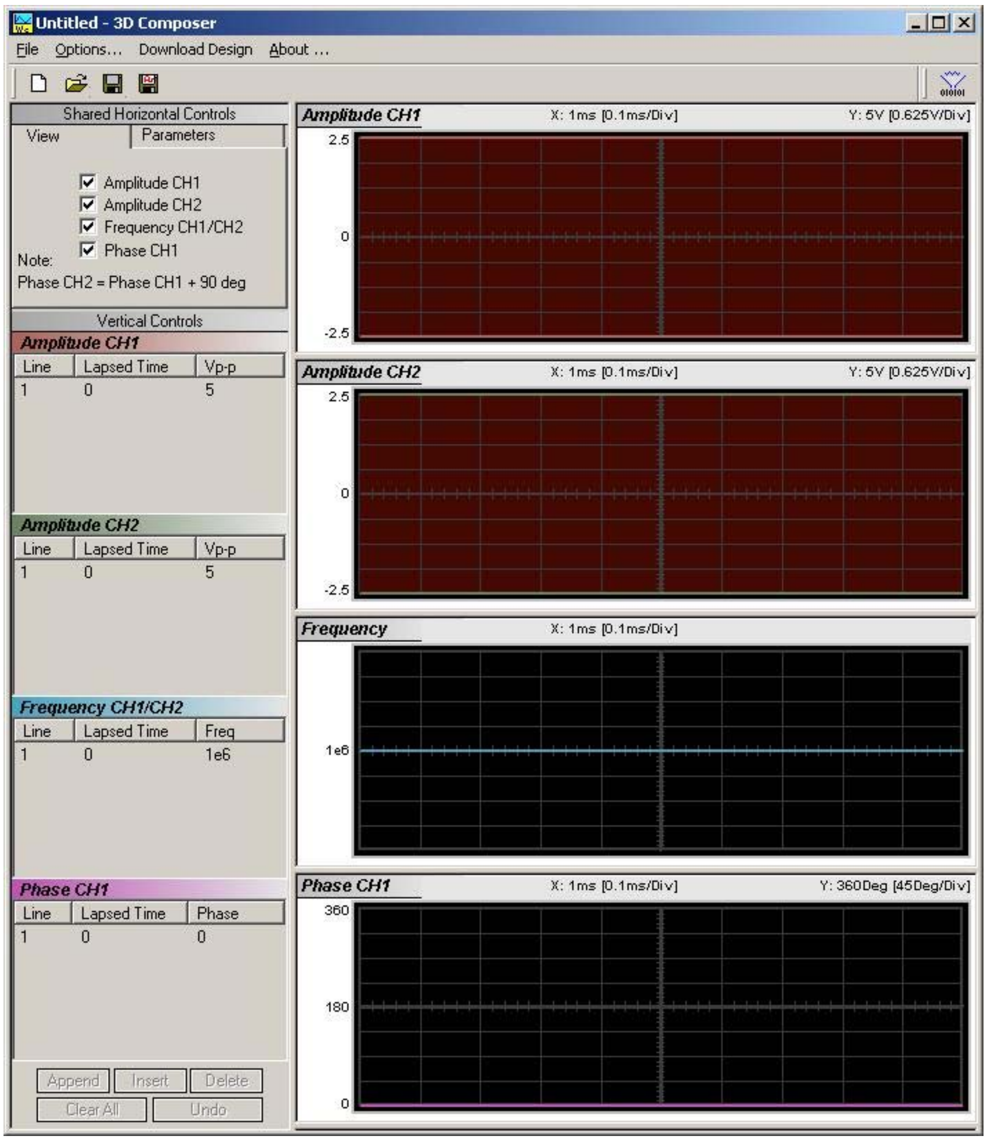

Figure 4-60, the 3D Composer Screen

The 3D composer has three main sections: Shared horizontal Controls, Vertical Controls and Graphical Screens. The panels on the left are used for designing the waveform parameters and the screens on the right side depict the shape of the profile. Below find a detailed description of all of these sections. Refer to Figure 4-60 throughout the description.

Shared Vertical Parameters

The *Shared Horizontal Control* has two tabs: *View* and *Parameters*.

View
The *View* tab is useful if you are interested in programming 1 or two profiles only and do not care to see other screens. Check the boxes for the profiles you wish to program only and these will be shown on the screen. For example, if you check the Amplitude CH1 and the Frequency CH1/CH2 options, the Amplitude CH2 and Phase CH1 screens will not be visible.

Parameters
The *Parameters* tab is used for setting up the duration of the signal, the position of the marker (if required) and the amount of memory that is allocated for this purpose. Setting up correctly the parameters in this group is the basic and the most important task before you start designing 3D waveforms. The duration can be set in units of ns, us, ms and seconds and can be programmed within the range of 800 ns to 30,000 s.

The 3D profiler behaves just like an arbitrary waveform. The shape of the profiler is generated using waveform points and a dedicated 3D sample clock. So, just as the basics for an arbitrary waveform design, the duration is derived from the following relationship:

Duration = SCLK / # of waveform points

where SCLK is the 3D sample clock and the # of waveform points can be programmed from 2 to 30,000.

Figure 4-61, the Parameters Tab

The best idea is to let the 3D composer set up the sample clock and the number of points automatically for you however, in some cases you may fine tune your requirement by pressing the Expand button. Figure 4-62 shows the Expanded Parameters options dialog box.

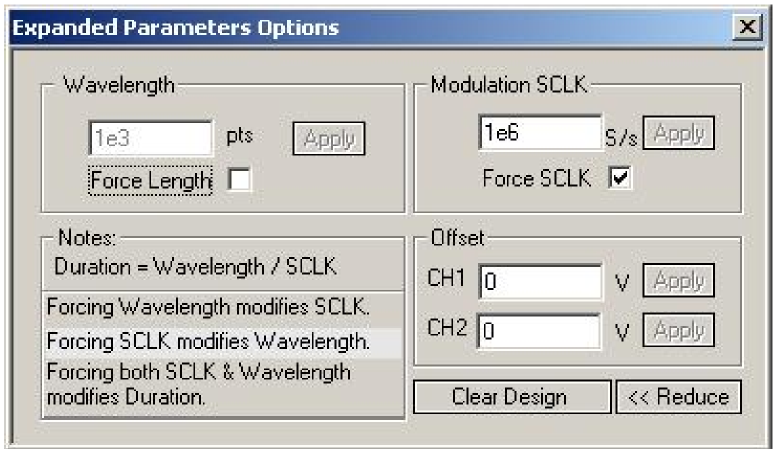

Figure 4-62, the Expanded Parameters Options Dialog Box

The Expanded Parameters options dialog box has three sections: Wavelength, Modulation SCLK and Offset. The wavelength and the modulation SCLK control the duration of the entire wave through the following relationship:

Duration = Modulation SCLK / Wavelength

Each of the parameters has a finite length and therefore, the duration has maximum and minimum intervals. The modulation SCLK has a range of 1 Hz to 2.5 MHz and the Wavelength is limited from 2 points to 30,000 points. As a result, the duration can be programmed from 800 ns to 30,000 s.

If you do not care to control the wavelength and the SCLK, then you can leave the task for the 3D composer. In that case you must leave the Force Length and Force SCLK check boxes – unmarked. If you check the Force SCLK box, the wavelength will be modified automatically to match the selected duration, as shown in Figure 4-62. If you check the Force Length box, the modulation SCLK will be modified automatically to match the selected duration. Finally, if you check both the Force Length and the Force Modulation SCLK boxes, the duration of the 3D profile will be affected.

To modify wavelength or modulation SCLK, check the appropriate box, modify the value and click on the Apply button to force the selected value. Any successive changes that you make to the edit fields require that you click on the Apply button to accept the new value.

The Offset group controls DC offsets of the modulated waveform. Changing offset does not affect other parameters except the location of the waveform along the vertical axis.

The Clear Design button resets the 3D composer and the Reduce button closes the dialog box.

Vertical Controls

The *Vertical Controls* are used for profiling amplitude, frequency and phase. When you modify the fields in any of the controls, the associated graphical screen are automatically updated with the assigned values and display the profile as designed in the vertical control fields. The Vertical Controls are shown in Figure 4-63. You can start designing profiles only when one of the control fields is active. Control fields become active when you click on a control field. Note in the figure below that the Amplitude CH2 control was removed from the group. This was done by un-checking the Amplitude CH2 check box in the View group.

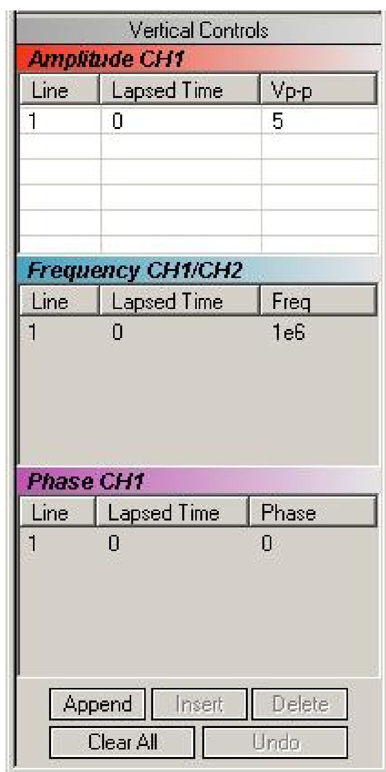

Figure 4-63, the 3D Vertical Controls

Graphical Screens

The *Graphical Screens* are shown in Figure 4-64. You can not change anything on the screens however, anything that you design in the Vertical Controls fields will automatically be updated and displayed on the graphical screens.

Note in the figure below that the Amplitude CH2 graphical screen was removed from the group. This was done by un-checking the Amplitude CH2 check box in the View group.

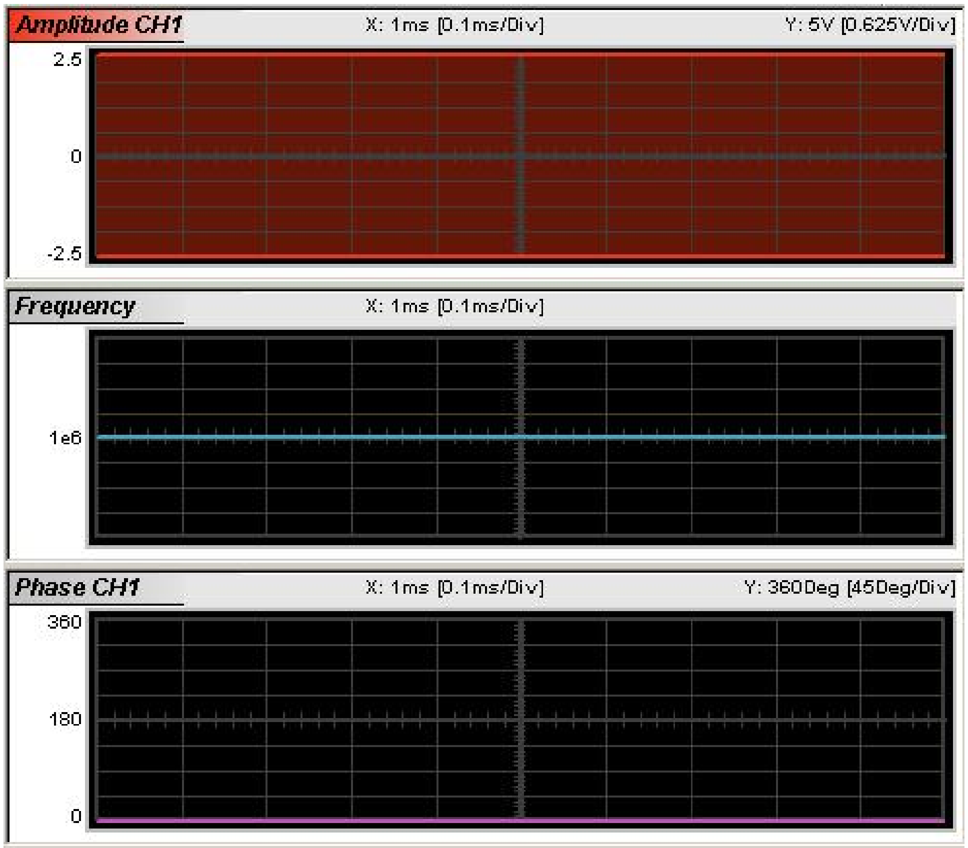

Figure 4-64, the 3D Graphical Screens

Designing 3D profiles

3D profiles are designed in the Vertical Controls fields. Notice that there are four separate control fields: Amplitude CH1, Amplitude CH2, Frequency CH2/CH2 and Phase CH1. Amplitude control is separate for channels 1 and 2 however, frequency is common to both channels. The phase parameter is designed for channel 1 only but is automatically converted to phase + 90° for channel 2.

Always start the design from the Shared Horizontal Controls group. In the View group, remove profiles that you do not care to change. Click on the Parameters tab and set up the duration of the waveform. An example of a 3D profile (chirp, in this example) is shown in Figure 4-65. Profiles were designed for channel 1, frequency and phase. As you can see the duration of the waveform was selected to be 100 ms.

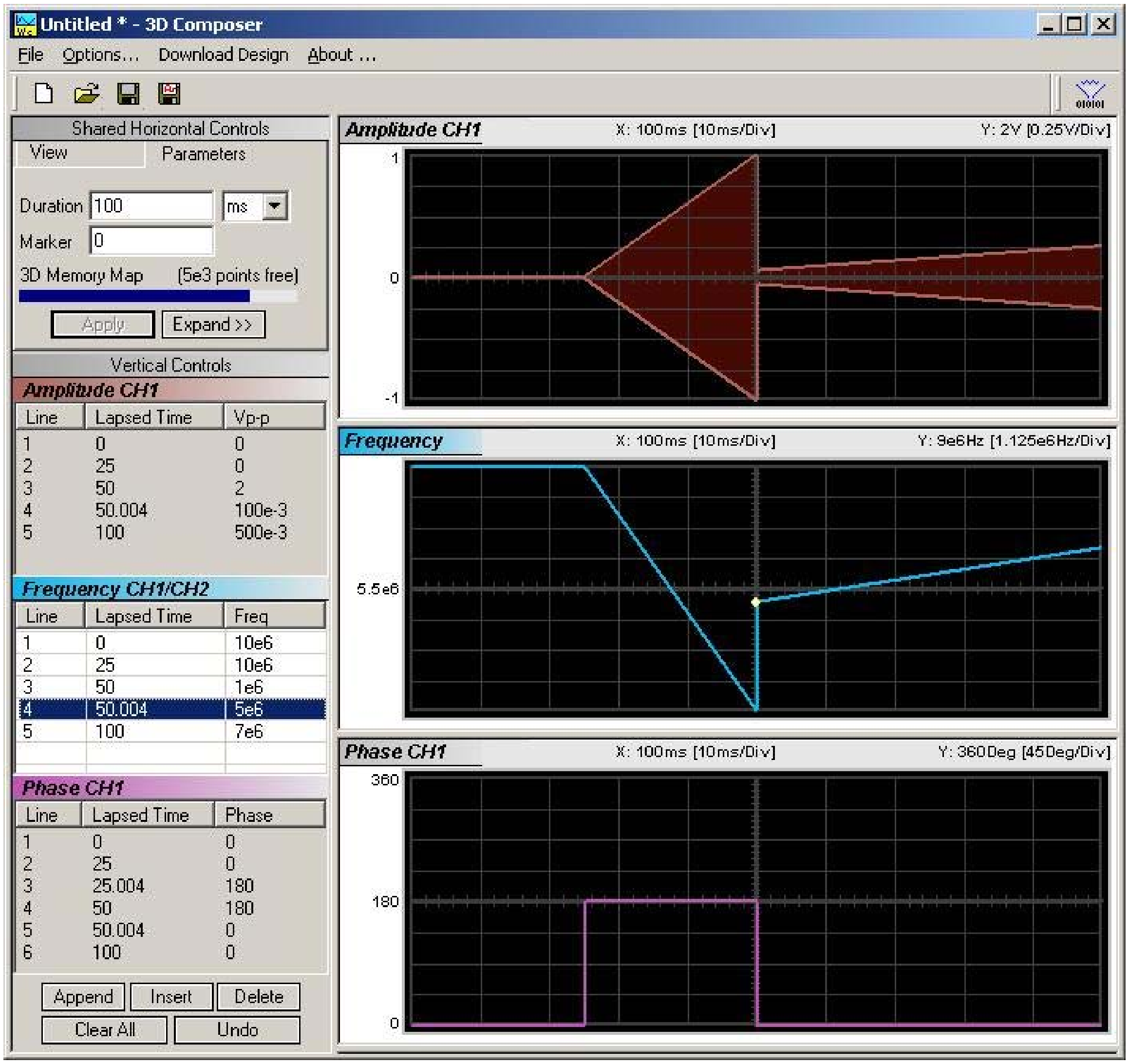

Figure 4-65, 3D Chirp Design Example

The Command Editor

The Command Editor is an excellent tool for learning low level programming of the 2572A. Invoke the Command Editor from the System menu at the top of the screen. Dialog box, as shown in Figure 4-66 will pop up. If you press the Download button, the function call in the Command field will be sent to the instrument.

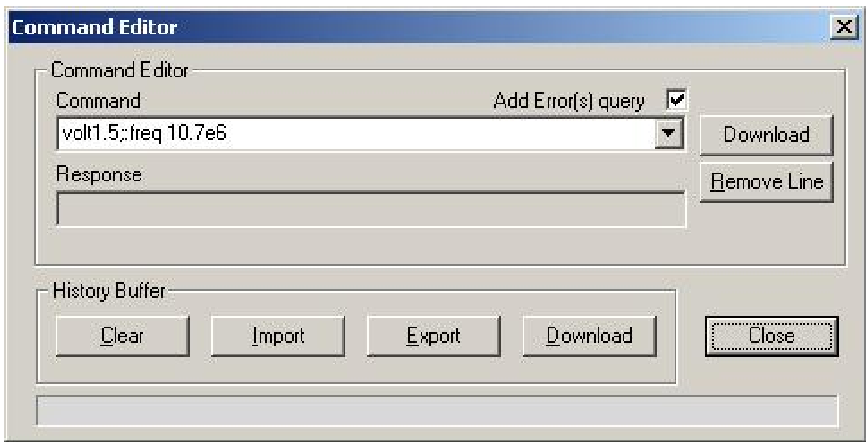

Figure 4-66, the Command Editor

Low-level SCPI commands and queries can be directly sent to the 2572A from the **Command** field and the instrument will respond to queries in the **Response** field. The command editor is very useful while developing your own application. Build your confidence or test various commands using the command editor. This way you can assure that commands or syntax that you use in your application will behave exactly the same way as it responds to the editor commands. A complete list of SCPI commands is available in Chapter 5.

Logging SCPI Commands

The Log File is very useful for programmers that do not wish to spend a lot of time on manuals. When you use ArbConnection, every time you click on a button or change parameter, the command is logged in the same format as should be used in external applications. Figure 4-67 shows an example of a log file and a set of SCPI commands as resulted from some changes made on ArbConnection panels. You can set up the 2572A from ArbConnection to the desired configuration, log the commands in the log file and then copy and paste to your application without any modifications. Of course, this is true for simple commands that do not involve file download but, on the other hand, this is a great tool to get you started with SCPI programming.

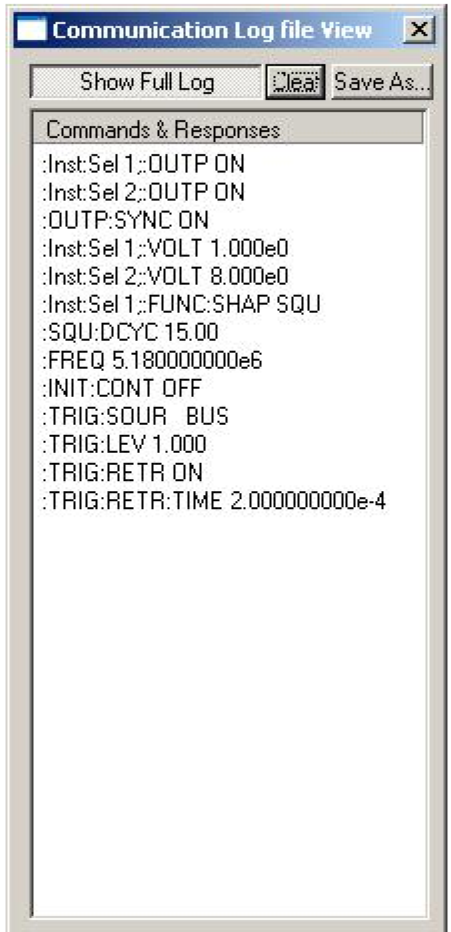

Figure 4-67, Log File Example

Chapter 5
Remote Programming Reference

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What's in This Chapter

This Chapter lists and describes the set of SCPI-compatible (Standard Commands for Programmable Instruments) remote commands used to operate the 2572A. To provide familiar formatting for users who have previously used the SCPI reference documentation, the command descriptions are dealt with in a similar manner. In particular, each sub-system's documentation starts with a short description, followed by a table showing the complete set of commands in the sub-system; finally the effects of individual keywords and parameters are described. Complete listing of all commands used for programming the 2572A is given in Table 5-1.

Introduction to SCPI

Commands to program the instrument over the GPIB are defined by the SCPI 1993.0 standard. The SCPI standard defines a common language protocol. It goes one step further than IEEE-STD-488.2 and defines a standard set of commands to control every programmable aspect of the instrument. It also defines the format of command parameters and the format of values returned by the instrument.

SCPI is an ASCII-based instrument command language designed for test and measurement instruments. SCPI commands are based on a hierarchical structure known as a tree system. In this system, associated commands are grouped together under a common node or root, thus forming subsystems.

Part of the OUTPut subsystem is shown below to illustrate the tree system:

```
:OUTPut
  :FILTer
     [:LPASs] {NONE|25M|50M|ALL}
        [:STATe] OFF | ON
```

OUTPut is the root keyword of the command; FILTer and STATe are second level keywords. LPASs is third level keyword. A colon (:) separates a command keyword from a lower level keyword.

Command Format

The format used to show commands in this manual is shown below:

```
FREQuency {<frequency>|MINimum|MAXimum}
```

The command syntax shows most commands (and some parameters) as a mixture of upper and lowercase letters. The uppercase letters indicate the abbreviated spelling for the command. For shorter program lines, send the abbreviated form. For better program readability, use the long form.

For example, in the above syntax statement, FREQ and FREQUENCY are both acceptable forms. Use upper or lowercase letters. Therefore, FREQ, FREQUENCY, freq, and Freq are all acceptable. Other forms such as FRE and FREQUEN will generate an error.

The above syntax statement shows the frequency parameter enclosed in triangular brackets. The brackets are not sent with the command string. A value for the frequency parameter (such as "FREQ 50e+6") must be specified.

Some parameters are enclosed in square brackets ([]). The brackets indicate that the parameter is optional and can be omitted. The brackets are not sent with the command string.

Command Separator

A colon (:) is used to separate a command keyword from a lower level keyword as shown below:

```
SOUR:FUNC:SHAP SIN
```

A semicolon (;) is used to separate commands within the same subsystem, and can also minimize typing. For example, sending the following command string:

```
TRIG:SLOP NEG;COUN 10;TIM 5e-3
```

is the same as sending the following three commands:

```
:TRIG:SLOP NEG
:TRIG:COUN 10
:TRIG:TIM 5e-3
```

Use the colon and semicolon to link commands from different subsystems. For example, in the following command string, an error is generated if both the colon and the semicolon are not used.

```
OUTP:STATE ON;:TRIG:BURS ON
```

The MIN and MAX Parameters

Substitute MINimum or MAXimum in place of a parameter for some commands. For example, consider the following command:

```
FREQuency {<frequency>|MINimum|MAXimum}
```

Instead of selecting a specific frequency, substitute MIN to set the frequency to its minimum value or MAX to set the frequency to its maximum value.

Querying Parameter Setting

Query the current value of most parameters by adding a question mark (?) to the command. For example, the following command sets the output function to square:

```
SOUR:FUNC:SHAP SQR
```

Query the output function by executing:

```
SOUR:FUNC:SHAP?
```

Query Response Format

The response to a query depends on the format of the command. In general, a response to a query contains current values or settings of the generator. Commands that set values can be queried for their current value. Commands that set modes of operation can be queried for their current mode. IEEE-STD-488.2 common queries generate responses, which are common to all IEEE-STD-488.2 compatible instruments.

SCPI Command Terminator

A command string sent to the function generator must terminate with a <new line> character. The IEEE-STD-488 EOI message is a <new line> character. Command string termination always resets the current SCPI command path to the root level.

IEEE-STD-488.2 Common Commands

The IEEE-STD-488.2 standard defines a set of common commands that perform functions like reset, trigger and status operations. Common commands begin with an asterisk (*), are four to five characters in length, and may include one or more parameters. The command keyword is separated from the first parameter by a blank space. Use a semicolon (;) to separate multiple commands as shown below:

```
*RST; *STB?; *IDN?
```

SCPI Parameter Type

The SCPI language defines four different data formats to be used in program messages and response messages: numeric, discrete, boolean, and arbitrary block.

Numeric Parameters

Commands that require numeric parameters will accept all commonly used decimal representations of numbers including optional signs, decimal points, and scientific notation. Special values for numeric parameters like MINimum and MAXimum are also accepted.

Engineering unit suffices with numeric parameters (e.g., MHz or kHz) can also be sent. If only specific numeric values are accepted, the function generator will ignore values, which are not allowed and will generate an error message. The following command is an example of a command that uses a numeric parameter:

```
VOLT:AMPL <amplitude>
```

Discrete Parameters

Discrete parameters are used to program settings that have a limited number of values (i.e., FIXed, USER and SEQuence). They have short and long form command keywords. Upper and lowercase letters can be mixed. Query responses always return the short form in all uppercase letters. The following command uses discrete parameters:

```
SOUR:FUNC:MODE {FIXed | USER | SEQuence}
```

Boolean Parameters

Boolean parameters represent a single binary condition that is either true or false. The generator accepts "OFF" or "0" for a false condition. The generator accepts "ON" or "1" for a true condition. The instrument always returns "0" or "1" when a boolean setting is queried. The following command uses a boolean parameter:

```
OUTP:FILT { OFF | ON }
```

The same command can also be written as follows:

```
OUTP:FILT {0 | 1 }
```

Arbitrary Block Parameters

Arbitrary block parameters are used for loading waveforms into the generator's memory. Depending on which option is installed, the Model 2572A can accept binary blocks up to 1M bytes. The following command uses an arbitrary block parameter that is loaded as binary data:

```
TRAC:DATA#564000<binary_block>
```

Binary Block Parameters

Binary block parameters are used for loading segment and sequence tables into the generator's memory. Information on the binary block parameters is given later in this manual.

SCPI Syntax and Styles

Where possible the syntax and styles used in this section follow those defined by the SCPI consortium. The commands on the following pages are broken into three columns; the KEYWORD, the PARAMETER FORM, and any NOTES.

The KEYWORD column provides the name of the command. The actual command consists of one or more keywords since SCPI commands are based on a hierarchical structure, also known as the tree system. Square brackets ([ ]) are used to enclose a **keyword** that is optional when programming the command; that is, the 2572A will process the command to have the same effect whether the optional node is omitted by the programmer or not. Letter case in tables is used to differentiate between the accepted short form (upper case) and the long form (upper and lower case).

The PARAMETER FORM column indicates the number and order of parameter in a command and their legal value. Parameter types are distinguished by enclosing the type in angle brackets (< >). If **parameter** form is enclosed by square brackets ([ ]) these are then optional (care must be taken to ensure that optional parameters are consistent with the intention of the associated keywords). The vertical bar (|) can be read as "or" and is used to separate alternative parameter options.

Table 5-1, Model 2572A SCPI Commands List Summary

Keyword	Parameter Form	Default
Instrument Control Commands		
:INSTrument		
[:SELect]	1 | 2 |.3.|.4.|...n	1
:COUPle		
:MODE	MASTer | SLAVe	MAST
:DELay	0 to 20	0
:SLAVe		
:DELete	<LAN_IP_address>	
:INSert	<2572A>,<LAN_IP_address>	
:STATe	OFF | ON | 0 | 1	0
:OUTPut		
:LOAD	50 to 1e6	50
[:STATe]	OFF | ON | 0 | 1	0
:SYNC		
[:STATe]	OFF | ON | 0 | 1	0
:POSition	0 to 1e6-1 (0 to 2e6-1 with option 2)	0
:SOURce	1 | 2	1
:FILTer		
[:LPASs]	NONE | 25M | 50M | 60M | 120M	NONE
[:SOURce]		
:ROSCillator		
:SOURce	INTernal | EXTernal	INT
:FREQuency		
[:CW]	10e-3 to 100e6 | MINimum | MAXimum	1e6
:RASTer	1.5 to 250e6 | MINimum | MAXimum	1e7
:SOURce	INTernal | EXTernal	INT
:VOLTage		
[:LEVel]		
[:AMPLitude]	16e-3 to 16 | MINimum | MAXimum	5
:OFFSet	-7.992 to 7.992	0
:PHASe		
[:OFFSet]	0 to 1e6-1 (0 to 2e6-1 with option 2)	0
:FUNCtion		
:MODE	FIXed | USER | SEQuence | MODulation | COUNter | PULSe | HALFcycle	FIX

Table 5-1, Model 2572A SCPI Commands List Summary (continued)

Keyword	Parameter Form	Default
Standard Waveforms Commands		
:SHAPe	SINusoid | TRIangle | SQUare | PULSe | RAMP | SINC | GAUSsian | EXPonential | NOISe | DC	SIN
:SINusoid		
:PHASe	0 to 360	0
:TRIangle		
:PHASe	0 to 360	0
:SQUare		
:DCYCle	0 to 99.99	50
:PULSe		
:DELay	0 to 99.999	10
:WIDth	0 to 99.999	10
:TRANsition		
[:LEADing]	0 to 99.999	10
:TRAiling	0 to 99.999	10
:RAMP		
:DELay	0 to 99.99	0
:TRANsition		
[:LEADing]	0 to 99.99	60
:TRAiling	0 to 99.99	30
:SINC		
:NCYCle	4 to 100	10
:GAUSsian		
:EXPonent	10 to 200	20
:EXPonential		
:EXPonent	-100 to 100	1
:DC		
[:AMPLitude]	-8 to 8	5
Arbitrary Waveforms Commands		
:TRACe		
[:DATA]	<data_array>	
:DEFine	<1 to 10k>,<16 to 1(2)e6> (<segment_#>,<size>)	1
:DELete		
[:NAME]	1 to 10k	
:ALL		
:SELect	1 to 10k	1
:SEGMent		
[:DATA]	<data_array>	

Table 5-1, Model 2572A SCPI Commands List Summary (continued)

Keyword	Parameter Form	Default
Digital Pattern Commands		
[:SOURce]		
:DIGital		
:DATA	<data_array>	
:SOURce	FIXed | USER	FIX
:RATE	1.5 to 50e6	10e3
[:STATe]	OFF | ON | 0 | 1	0
Sequence Commands		
[:SOURce]		
:SEQuence		
[:DATA]	<data_array>	
:ADVance	AUTOmatic | STEP | SINGle | MIX	AUTO
:SELect	1 to 10	1
:DEFine	<step>,<seg_number>,<repeat>,<adv_mode>,<sync_bit>	
:DELete		
:NAME	1 to 4096	
:ALL		
:SYNC		
[:TYPe]	BIT | LCOMplete	LCOM
Modulated Waveforms Commands		
[:SOURce]		
:MODulation		
:TYPE	OFF | FM | AM | SWE | FSK | ASK | FHOPping | AHOPping | 3D | PSK | QAM	OFF
:CARRier		
[:FREQuency]	10 to 100e6	1e6
:BASeline	CARRier | DC	CARR
:LOAD		
:DEMO		
:FM		
:DEViation	10.0e-3 to 100e6	100e3
:FUNCtion		
:SHAPe	SINusoid | TRIangle | SQUare | RAMP | ARB	SIN
:FREQuency	10e-3 to 350e3	10e3
:RASTer	1 to 2.5e6	1e6
:MARKer		
[:FREQuency]	10e-3 to 100e6	1e6
:DATA	<data_array>	

Table 5-1, Model 2572A SCPI Commands List Summary (continued)

Keyword	Parameter Form	Default
Modulated Waveforms Commands (continued)		
:AM		
:FUNCtion		
:SHAPe	SINusoid | TRIangle | SQUare | RAMP	SIN
:MODulation		
:FREQuency	10e-3 to 1e6	10e3
:DEPTh	0 to 100	50
:SWEep		
[:FREQuency]		
:STARt	10 to 100.0e6	10e3
:STOP	10 to 100e6	1e6
:TIME	1.4e-6 to 40.0	1e-3
:DIRection	UP | DOWN	UP
:SPACing	LINear | LOGarithmic	LIN
:MARKer		
[:FREQuency]	10 to 100e6	505e3
:FSK		
:FREQuency		
:SHIFted	10e-3 to 100e6	100e3
:BAUD	1 to 10e6	10e3
:MARKer	1 to 4000	1
:DATA	<data_array>	
:ASK		
[:AMPLitude]		
[:STARt]	0 to 16	5
:SHIFted	0 to 16	1
:BAUD	1 to 10e6	10e3
:MARKer	1 to 1000	1
:DATA	<data_array>	
:FHOPping		
:DWELl		
:MODe	FIXed | VARiable	FIX
[:TIMe]	200e-9 to 20	200e-9
:FIXed		
:DATA	<data_array>	
:VARiable		
:DATA	<data_array>	
:MARKer	1 to 5000	1

Table 5-1, Model 2572A SCPI Commands List Summary (continued)

Keyword	Parameter Form	Default
Modulated Waveforms Commands (continued)		
:AHOPping		
:DWELl		
:MODe	FIXed | VARiable	FIX
[:TIMe]	200e-9 to 20	200e-9
:FIXed		
:DATA	<data_array>	
:VARiable		
:DATA	<data_array>	
:MARKer	1 to 5000	1
:3D		
:DATA	<data_array>	
:MARKer	1 to 30000	
:RASTer	1 to 2.5e6	1e6
:PSK		
:TYPE	PSK | BPSK | QPSK | OQPSK | DQPSK | 8PSK | 16PSK | USER	PSK
:PHASe		
[:STARt]	0 to 360	0
:SHIFted	0 to 360	180
:RATE	1 to 10e6	10e3
:DATA	<data_array>	
:MARKer	1 to 4000	1
:BAUD	1 to 10e6	10e3
:CARRier		
:STATe	OFF | ON | 0 | 1	1
:USER		
:DATA	<data_array>	
:QAM		
:TYPE	16QAM | 64QAM | 256QAM | USER	QAM
:CARRier		
:STATe	OFF | ON | 0 | 1	1
:BAUD	1 to 10e6	10e3
:DATA	<data_array>	
:MARKer	1 to 4000	1
:USER		
:DATA	<data_array>	

Table 5-1, Model 2572A SCPI Commands List Summary (continued)

Keyword	Parameter Form	Default
Run Mode Commands		
:INITiate		
[:IMMediately]		
:CONTinuous	OFF | ON | 0 | 1	1
:TRIGger		
[:IMMediate]		
:BURSt		
[:STATe]	OFF | ON | 0 | 1	0
:COUNt	1 to 1000000	1
:DELay		
[:STATe]	OFF | ON | 0 | 1	0
:TIMe	200e-9 to 20	200e-9
:GATE		
[:STATe]	OFF | ON | 0 | 1	0
:LEVel	-5 to 5	1.6
:SOURce		
[:ADVance]	BUS | EXTernal | MIXed	EXT
:SLOPe	POSitive | NEGative	POS
:RETRigger		
[:STATe]	OFF | ON | 0 | 1	0
:TIMe	200e-9 to 20	200e-9
Auxiliary Functions Commands		
:AUXiliary		
:COUNter		
:FUNCtion	FREQuency | PERiod | APERiod | PULSe | GTOTalize | ITOTalize	FREQ
:DISPlay		
:MODE	NORMal | HOLD	NORM
:GATE		
:TIME	100e-6 to 1	1
:RESet		
:READ		
:HALFcycle		
:DELay	200e-9 to 20	1e-6
:DCYCle	0 to 99.99	50
:FREQuency	10e-3 to 1e6	1e6
:PHASe	0 to 360	0
:SHAPe	SINusoid | TRIangle | SQUare	SIN

Table 5-1, Model 2572A SCPI Commands List Summary (continued)

Keyword	Parameter Form	Default
Auxiliary Functions Commands (continued)		
:AUXiliary		
:PULSe		
:DELay	0 to 10	0
:DOUBle		
[:STATe]	OFF | ON | 0 | 1	0
:DELay	0 to 1e3	1e-3
:LEVel		
:HIGH	-7.992 to 8	5
:LOW	-8 to 7.992	0
:HIGH	0 to 1e3	1e-3
:POLarity	NORMal | COMPlement | INVerted	NORM
:PERiod	80e-9 to 1e6 (80e-9 to 2e6 with option 2)	10e-3
:STATe	OFF | ON | 0 | 1	1
:TRANsition		
[:LEADing]	0 to 1e3	1e-3
:TRAiling	0 to 1e3	1e-3
System Commands		
:RESet		
:SYSTem		
:ERRor?		
:LOCal		
:VERSion?		
:INFOrmation		
:CALibration?		
:MODel?		
:SERial?		
:IP		
[:ADDRess]	<IP_address>	
:MASK	<mask>	
:GATeway	<gate_way>	
:BOOTp	OFF | ON | 0 | 1	0
HOSTname:	<host_name>	
:KEEPalive		
:STATe	OFF | ON | 0 | 1	1
:TIMEout	2 to 300	45
:PROBes	2 to 10	2
:TEMPerature?		

Table 5-1, Model 2572A SCPI Commands List Summary (continued)

Keyword	Parameter Form	Default
System Commands (continued)		
*CLS		
*ESE	1 to 255	1
*OPC		
*RST		
*SRE	1 to 255	1
*TRG		
*ESR?		
*IDN?		
*OPT?		
*STB?		

Instrument Control Commands

This group is used to control output channels and their respective state, amplitude and offset settings, as well as the waveform mode. You can also set the phase offset between channels and select filters to re-structure the shape of your waveform. Multiple instruments can be synchronized with these commands, as well. The output frequency and the reference source are also selected using commands from this group. Factory defaults after *RST are shown in the Default column. Parameter range and low and high limits are listed, where applicable.

Table 5-2, Instrument Control Commands Summary

Keyword	Parameter Range	Default
:INSTrument		
[:SELect]	1 | 2 |.3.|.4.|...n	1
:COUPle		
:MODE	MASTer | SLAVe	MAST
:DELay	0 to 20	0
:SLAVe		
:DELete	<LAN_IP_address>	
:INSert	<257xA>,<LAN_IP_address>	
:STATe	OFF | ON | 0 | 1	0
:OUTPut		
:LOAD	50 to 1e6	50
[:STATe]	OFF | ON | 0 | 1	0
:SYNC		
[:STATe]	OFF | ON | 0 | 1	0
:POSition	0 to 1e6-1 (0 to 2e6-1 with option 2)	0
:SOURce	1 | 2	1
:FILTer		
[:LPASs]	NONE | 25M | 50M | 60M | 120M	NONE
[:SOURce]		
:ROSCillator		
:SOURce	INTernal | EXTernal	INT
:FREQuency		
[:CW]	10e-3 to 100e6 | MINimum | MAXimum	1e6
:RASTer	1.5 to 250e6 | MINimum | MAXimum	1e7
:SOURce	INTernal | EXTernal	INT
:VOLTage		
[:LEVel]		
[:AMPLitude]	16e-3 to 16 | MINimum | MAXimum	5
:OFFSet	-7.992 to 7.992	0
:PHASe		
[:OFFSet]	0 to 1e6-1 (0 to 2e6-1 with option 2)	0
:FUNCtion		
:MODE	FIXed | USER | SEQuence | MODulation | COUNter | PULSe | HALFcycle	FIX

INSTrument{1|2|.3.|.4.|..n}(?)

Description
This command will set the active channel for future programming sequences. Subsequent commands affect the selected channel only.

Parameters

Range	Type	Default	Description
1-2 (3 - n)	Discrete	1	Sets the active channel for programming from remote. Channels 1 and 2 are associated with the 2572A. Channels 3 and subsequent channels are available only when the 2572A operate in master/slave mode and was coupled to other instruments. The channel designator is automatically adjusted to the number of channels that are joined to form the multi-channel system, regardless if 2572A or 2571A units are used in this system

Response
The 2572A will return 1, 2 or n depending on the present active channel setting

INSTrument:COUPle:MODE{MASTer|SLAVe}(?)

Description
This command will assign master or slave properties to the instrument. If the assignment is slave, most of the instrument operational functions will be controlled from the master instrument however, waveforms, amplitudes and offsets can be controlled individually for each slave unit.

Parameters

Name	Type	Default	Description
MASTer	Discrete	MAST	Programs a specific 2572A, in a multi-instruments system, as master instrument. Note that only one instrument can be designated as master while all other instruments must be programmed as slaves.
SLAVe	Discrete		Programs 2572A’s, in a multi-instruments system, as slave instrument. Note that multiple instruments can be designated as slaves but only one instrument can be designated as master.

Response
The 2572A will return MAST or SLAV depending on current instrument couple mode assignment.

INSTrument:COUPle:DELay<delay>(?)

Description
This command will assign master or slave properties to the instrument. If the assignment is slave, most of the instrument operational functions will be controlled from the master instrument however, waveforms, amplitudes and offsets can be controlled individually for each slave unit.

Parameters

Name	Range	Type	Default	Description
<delay>	0 to 20	Numeric	0	Will set the waveform start delay between channels in units of seconds. Channel 1 is always the reference channel. Channels 2 to "n" are delayed in reference to channel 1. Note that this parameter is operating in conjunction with the continuous run mode and only when multiple instruments are synchronized.

Response

The 2572A will return the present delay value in units of seconds.

INSTrument:COUPle:SLAVe:DELete<LAN_address>

Description

This command will delete a designated slave unit from a synchronized multi-instruments system list.

Parameters

Name	Type	Default	Description
<LAN_address>	String		Will remove a designated instrument, which is specified through its IP address, from a synchronized multi-instruments system list. Contact your computer administrator, if you are not sure how to specify LAN address.

INSTrument:COUPle:SLAVe:INSert<257xA>,<LAN_address>

Description

This command will add a designated slave unit to a synchronized multi-instruments system list.

Parameters

Name	Type	Default	Description
<257xA>, <LAN_address>	String		257xA specifies if the instrument has one channel (2571A), or 2 channels (2572A). Specifying the correct model number is crucial for correct assignment of the channel designators, for selecting the correct channel number for the INST:SEL command.

INSTrument:COUPle:STATe{OFF|ON|0|1}(?)

Description

This command will turn the 2572A couple state on and off.

Parameters

Range	Type	Default	Description
0-1	Discrete	0	Sets the couple mode on and off. Note that this command must be applied to the master instrument only otherwise, the couple state will not be affected. To select the master instrument use the INST:SEL 1 command.

Response

The 2572A will return 1 if the couple state is on, or 0 if the couple state is off.

OUTPut:LOAD<load>

Description

This command will specify the load impedance that will be applied to the 2572A output.

Parameters

Name	Type	Default	Description
<load>	Numeric (integer only)	50	Will specify the load impedance that will be applied to the 2572A outputs in units of Ω. The default setting is 50 Ω. The range of load impedance is 50 Ω to 1 MΩ..Accurate setting of the load impedance is crucial for correct display readout of the amplitude level on the load.

OUTPut{OFF|ON|0|1}(?)

Description

This command will turn the 2572A output on and off. Note that for safety, the outputs always default to off, even if the last instrument setting before power down was on

Parameters

Range	Type	Default	Description
0-1	Discrete	0	Sets the output on and off

Response

The 2572A will return 1 if the output is on, or 0 if the output is off.

OUTPut:SYNC{OFF|ON|0|1}(?)

Description

This command will turn the 2572A SYNC output on and off. Note that for safety, the SYNC output always defaults to off, even if the last instrument setting before power down was on

Parameters

Range	Type	Default	Description
0-1	Discrete	0	Will set the SYNC output on and off

Response

The 2572A will return 1 if the SYNC output is on, or 0 if the SYNC output is off.

OUTPut:SYNC:POSition<position>(?)

Description

This command will program the 2572A SYNC position. This command is active in arbitrary (USER) mode only.

Parameters

Name	Range	Type	Default	Description
<position>	0 to 1e6-1	Numeric (Integer only)	0	Will set the SYNC position in waveform points. The sync position can be programmed in increments of 4 points minimum. The range is extended to 2e6-1 when option 2 is installed. 1M memory size is standard.

Response

The 2572A will return the present SYNC position value

OUTPut:SYNC:SOURce{1|2}(?)

Description

This command will program the 2572A source of the SYNC output.

Parameters

Range	Type	Default	Description
1-2	Discrete	1	Will set the source for the SYNC output. 1 selects channel 1 as the source; 2 selects channel 2 as the source.

Response

The 2572A will return the present SYNC source value

OUTPut:FILTer{NONE|25M|50MH|60M|120M}(?)

Description

This command will select which filter is connected to the 2572A output. Observe the following restrictions when you try to use this command:

1) Filter selection is not available when the instrument is set to output the standard sine waveform. In fact, the default waveform shape is sine. Therefore, filter selection will be available for use only after you

select a different waveform, or change the output mode to use.

2) Filters are placed before the output amplifier. Therefore, do not expect the filters to remove in-band amplifier harmonics and spurious.

Parameters

Name	Type	Default	Description
None	Discrete	None	Disables all filters at the output path. This option cannot be selected when standard waveform is generated
25M	Discrete		Connects a 25MHz, Bessel type filter, to the output path
50M	Discrete		Connects a 50MHz, Bessel type filter, to the output path
65M	Discrete		Connects a 25MHz, Elliptic type filter, to the output path
120M	Discrete		Connects a 120MHz, Elliptic type filter, to the output path

Response

The 2572A will return NONE, 25M, 50M, 60M, or 120M depending on the type of filter presently connected to the output.

ROSCillator:SOURce{INTernal|EXTernal}(?)

Description

This command will select the reference source for the sample clock generator.

Parameters

Name	Type	Default	Description
INTernal	Discrete	INT	Selects an internal source. The internal source could be either the standard 100ppm oscillator, or the optional 1ppm TCXO
EXTernal	Discrete		Activates the external reference input. An external reference must be connected to the 2572A for it to continue normal operation

Response

The 2572A will return INT, or EXT depending on the present 2572A setting.

FREQuency{<freq>|MINimum|MAXimum}(?)

Description

This command modifies the frequency of the standard waveforms in units of hertz (Hz). It has no affect on arbitrary waveforms.

Parameters

Name	Range	Type	Default	Description
<freq>	10e-3 to 100e6	Numeric	1e6	Will set the frequency of the standard waveform in units of Hz. Although the display resolution for the frequency setting is 9 digits only, the frequency command can be used with resolutions up to 14 digits. The accuracy of the instrument however, can only be tested to this accuracy using an external reference that provides the necessary accuracy and stability
<MINimum>		Discrete		Will set the frequency of the standard waveform to the lowest possible frequency (10e-3).
<MAXimum >		Discrete		Will set the frequency of the standard waveform to the highest possible frequency (100e6).

Response

The 2572A will return the present frequency value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

FREQuency:RASTer{<sclk>|MINimum|MAXimum}(?)

Description

This command modifies the sample clock frequency of the arbitrary waveform in units of samples per second (S/s). It has no affect on standard waveforms.

Parameters

Name	Range	Type	Default	Description
<sclk>	1.5 to 250e6	Numeric	1e7	Will set the sample clock frequency of the arbitrary and sequenced waveform in units of S/s. Although the display resolution for the frequency setting is 9 digits only, the frequency command can be used with resolutions up to 14 digits. The accuracy of the instrument however, can only be tested to this accuracy using an external reference that provides the necessary accuracy and stability
<MINimum>		Discrete		Will set the sample clock frequency to the lowest possible frequency (1.5).
<MAXimum >		Discrete		Will set the frequency of the standard waveform to the highest possible frequency (300e6).

Response

The 2572A will return the present sample clock frequency value. The returned value will be in standard scientific format (for example: 100MHz would be returned as 100e6 – positive numbers are unsigned).

FREQuency:RASTer:SOURce{EXTernal|INTernal}(?)

Description
This command selects the source of the sample clock generator. This command affects both the standard and the arbitrary waveforms.

Parameters

Name	Type	Default	Description
INTernal	Discrete	INT	Selects an internal source.
EXTernal	Discrete		Activates the external sample clock reference input. An external reference must be connected to the 2572A, in the range of the internal source, for it to continue normal operation. Observe the input level and limitations before connecting an external signal.

Response
The 2572A will return EXT if an external source is selected, or INT if the internal source is selected.

VOLTage{<ampl>|MINimum|MAXimum}(?)

Description
This command programs the peak to peak amplitude of the output waveform. The amplitude is calibrated when the source impedance is 50Ω.

Parameters

Name	Range	Type	Default	Description
<ampl>	16e-3 to 16e0	Numeric	5	Will set the amplitude of the output waveform in units of volts. Amplitude setting is always peak to peak. Offset and amplitude settings are independent providing that the offset + amplitude does not exceed the specified window.
<MINimum>		Discrete		Will set the amplitude to the lowest possible level (16mV).
MAXimum>		Discrete		Will set the amplitude to the highest possible level (16V).

Response
The 2572A will return the present amplitude value. The returned value will be in standard scientific format (for example: 100mV would be returned as 100e-3 – positive numbers are unsigned).

VOLTage:OFFSet<offs>(?)

Description
This command programs the amplitude offset of the output waveform. The offset is calibrated when the source impedance is 50Ω.

Parameters

Name	Range	Type	Default	Description
<offs>	-7.992 to 7.992	Numeric	0	Will set the offset of the output waveform in units of volts. Offset and amplitude settings are independent providing that the offset + amplitude does not exceed the specified window.

Response
The 2572A will return the present offset value. The returned value will be in standard scientific format (for example: 100mV would be returned as 100e-3 – positive numbers are unsigned).

PHASe:OFFSet<phase_offs>(?)

Description
This command programs the start phase offset between channels 1 and 2 in units of waveform points. Phase offset resolution when using this command is 1 point.

Parameters

Name	Range	Type	Default	Description
<phase_offs>	0 to 1e6-1	Numeric (Integer only)	0	Will set the phase offset between the two channels. Channel 1 trails channel 2 edge. The range is extended to 2e6-1 when option 2 is installed. 1M is standard.

Response
The 2572A will return the present phase offset value.

FUNCtion:MODE{FIXed|USER|SEQuence|MODulatedCOUNter|PULSe|HALFcycle}(?)

Description
This command defines the type of waveform that will be available at the output connector. It also selects one fo the auxiliary functions from: counter/timer, digital pulse generator and half cycle waveforms

Parameters

Name	Type	Default	Description
FIXed	Discrete	FIX	Selects the standard waveform shapes. There is an array of waveforms that is built into the program. You can find these waveform shapes in the standard waveforms section.
USER	Discrete		Selects the arbitrary waveform shapes. Arbitrary waveforms must be loaded to the 2572A memory before they can be replayed. You can find information on arbitrary waveforms in the appropriate sections in this manual.

SEQuenced	Discrete	Selects the sequenced waveform output. To generate a sequence, you must first download waveform coordinates to different segments and then build a sequence table to generate a complex waveform that is using these segments.
MODulated	Discrete	Selects the modulated waveforms. There is an array of built-in modulation schemes. However, you can also build custom modulation using the arbitrary function.
COUNter	Discrete	Selects the counter/timer auxiliary function. Note that when you select this function, all waveform generation of the 2572A are purged and the 2572A is transformed to behave as if it was a stand-alone counter/timer. The counter/timer functions and parameters can be programmed using the auxiliary commands.
PULSe	Discrete	Selects the digital pulse generator auxiliary function. Note that when you select this function, all waveform generation of the 2572A are purged and the 2572A is transformed to behave as if it was a stand-alone pulse generator. The digital pulse generator functions and parameters can be programmed using the auxiliary commands.
HALFcycle	Discrete	Selects the half cycle auxiliary function. Note that when you select this function, all waveform generation of the 2572A are purged and the 2572A is transformed to behave as if it was a stand-alone half cycle generator. The half cycle generator functions and parameters can be programmed using the auxiliary commands.

Response

The 2572A will return FIX, USER, SEQ, MOD, COUN, PULS or HALF depending on the present 2572A setting.

Standard Waveforms Control Commands

This group is used to control the standard waveforms and their respective parameters. There is an array of standard waveforms that could be used without the need to download waveform coordinates to the instrument. You can also modify the parameters for each waveform to a shape suitable for your application.

Factory defaults after *RST are shown in the Default column. Parameter range and low and high limits are listed, where applicable.

Table 5-3, Instrument Control Commands Summary

Keyword	Parameter Range	Default
:FUNCtion		
:SHAPe	**SINusoid** | TRIangle | SQUare | PULSe | RAMP | SINC | GAUSsian | EXPonential | NOISe | DC	SIN
:SINusoid		
:PHASe	0 to 360	0
:TRIangle		
:PHASe	0 to 360	0
:SQUare		
:DCYCle	0 to 99.99	50
:PULSe		
:DELay	0 to 99.999	10
:WIDth	0 to 99.999	10
:TRANsition		
[:LEADing]	0 to 99.999	10
:TRAiling	0 to 99.999	10
:RAMP		
:DELay	0 to 99.99	0
:TRANsition		
[:LEADing]	0 to 99.99	60
:TRAiling	0 to 99.99	30
:SINC		
:NCYCle	4 to 100	10
:GAUSsian		
:EXPonent	10 to 200	20
:EXPonential		
:EXPonent	-100 to 100	1
:DC		
[:AMPLitude]	-8 to 8	5

FUNCtion:SHAPe{SINusoid|TRIangle|SQUare|PULSe|RAMP|SINC|EXPonential| GAUSsian|NOISe|DC}(?)

Description
This command defines the type of waveform that will be available at the output connector.

Parameters

Name	Type	Default	Description
SINusoid	Discrete	SIN	Selects the sine waveform from the built in library.
TRIangle	Discrete		Selects the triangular waveform from the built in library.
SQUare	Discrete		Selects the square waveform from the built in library.
PULSe	Discrete		Selects the pulse waveform from the built in library.
RAMP	Discrete		Selects the ramp waveform from the built in library.
SINC	Discrete		Selects the sinc waveform from the built in library.
EXPonential	Discrete		Selects the exponential waveform from the built in library.
GAUSsian	Discrete		Selects the gaussian waveform from the built in library.
DC	Discrete		Selects the DC waveform from the built in library.
NOISe	Discrete		Selects the noise waveform from the built in library.

Response
The 2572A will return SIN, TRI, SQU, PULS, RAMP, SINC, EXP, GAUS, NOIS, or DC depending on the present 2572A setting

SINusoid:PHASe<phase>(?)

Description
This command programs start phase of the standard sine waveform. This command has no affect on arbitrary waveforms.

Parameters

Name	Range	Type	Default	Description
<phase>	0 to 360	Numeric	0	Programs the start phase parameter in units of degrees. Sine phase can be programmable with resolution of 0.05° throughout the entire frequency range of the sine waveform.

Response
The 2572A will return the present start phase value.

TRIangle:PHASe<phase>(?)

Description
This command programs start phase of the standard triangular waveform. This command has no affect on arbitrary waveforms.

Parameters

Name	Range	Type	Default	Description
<phase>	0 to 360	Numeric	0	Programs the start phase parameter in units of degrees. Triangle phase can be programmable with resolution of 0.05° throughout the entire frequency range of the triangular waveform.

Response
The 2572A will return the present start phase value.

SQUare:DCYCle<duty_cycle>(?)

Description
This command programs duty cycle of the standard square waveform. This command has no affect on arbitrary waveforms.

Parameters

Name	Range	Type	Default	Description
<duty_cycle>	0 to 99.99	Numeric	50	Programs the square wave duty cycle parameter in units of percent

Response
The 2572A will return the present duty cycle value.

PULSe:DELay<delay>(?)

Description
This command programs delay of the standard pulse waveform. This command has no affect on arbitrary waveforms.

Parameters

Name	Range	Type	Default	Description
<delay>	0 to 99.999	Numeric	10	Programs the pulse delay parameter in units of percent

Response
The 2572A will return the present pulse delay value.

PULSe:WIDth<pulse_width>(?)

Description
This command programs pulse high portion of the standard pulse waveform. This command has no affect on arbitrary waveforms.

Parameters

Name	Range	Type	Default	Description
<pulse_width>	0 to 99.999	Numeric	10	Programs the pulse width parameter in units of percent

Response
The 2572A will return the present width value.

PULSe:TRANsition<rise>(?)

Description
This command programs pulse transition from low to high of the standard pulse waveform. This command has no affect on arbitrary waveforms.

Parameters

Name	Range	Type	Default	Description
<rise>	0 to 99.999	Numeric	10	Programs the pulse rise time parameter in units of percent

Response
The 2572A will return the present rise time value

PULSe:TRANsition:TRAiling<fall>(?)

Description
This command programs pulse transition from high to low of the standard pulse waveform. This command has no affect on arbitrary waveforms.

Parameters

Name	Range	Type	Default	Description
<fall>	0 to 99.999	Numeric	10	Programs the pulse fall time parameter in units of percent

Response
The 2572A will return the present fall time value.

RAMP:DELay<delay>(?)

Description
This command programs delay of the standard ramp waveform. This command has no affect on arbitrary waveforms.

Parameters

Name	Range	Type	Default	Description
<delay>	0 to 99.99	Numeric	10	Programs the ramp delay parameter in units of percent

Response
The 2572A will return the present ramp delay value.

Ramp:TRANsition<rise>(?)

Description
This command programs ramp transition from low to high of the standard ramp waveform. This command has no affect on arbitrary waveforms.

Parameters

Name	Range	Type	Default	Description
<rise>	0 to 99.99	Numeric	60	Programs the pulse rise time parameter in units of percent

Response
The 2572A will return the present rise time value

RAMP:TRANsition:TRAiling<fall>(?)

Description
This command programs ramp transition from high to low of the standard ramp waveform. This command has no affect on arbitrary waveforms.

Parameters

Name	Range	Type	Default	Description
<fall>	0 to 99.99	Numeric	30	Programs the ramp fall time parameter in units of percent

Response
The 2572A will return the present fall time value.

SINC:NCYCleN_cycles>(?)

Description
This command programs the number of “0-crossings” of the standard SINC pulse waveform. This command has no affect on arbitrary waveforms.

Parameters

Name	Range	Type	Default	Description
<N_cycle>	4 to 100	Numeric (Integer only)	10	Programs the number of zero-crossings parameter

Response
The 2572A will return the present number of zero-crossing value.

GAUSsian:EXPonent<exp>(?)

Description
This command programs the exponent for the standard gaussian pulse waveform. This command has no affect on arbitrary waveforms.

Parameters

Name	Range	Type	Default	Description
<exp>	4 to 100	Numeric	20	Programs the exponent parameter

Response
The 2572A will return the present exponent value.

EXPonential:EXPonent<exp>(?)

Description
This command programs the exponent for the standard exponential waveform. This command has no affect on arbitrary waveforms.

Parameters

Name	Range	Type	Default	Description
<exp>	-100 to 100	Numeric	1	Programs the exponent parameter

Response
The 2572A will return the present exponent value.

DC<amplitude>(?)

Description
This command programs the exponent for the standard exponential waveform. This command has no affect on arbitrary waveforms.

Parameters

Name	Range	Type	Default	Description
<amplitude>	-8 to 8	Numeric	5	Programs the DC amplitude parameter

Response
The 2572A will return the present DC amplitude value.

Arbitrary Waveforms Control Commands

This group is used to control the arbitrary waveforms and their respective parameters. This will allow you to create segments and download waveforms. Using these commands you can also define segment size and delete some or all unwanted waveforms from your memory. Use the commands in this group to turn the digital output on and off and to download data to the digital pattern buffer.

Factory defaults after *RST are shown in the Default column. Parameter range and low and high limits are listed, where applicable.

Generating Arbitrary Waveforms
Arbitrary waveforms are generated from digital data points, which are stored in a dedicated waveform memory. Each data point has a vertical resolution of 16 bits (65536 points), i.e., each sample is placed on the vertical axis with a precision of 1/65536. The Model 2572A has the following waveform memory capacity:

1M – standard memory configuration
2M – optional memory expansion

Each horizontal point has a unique address - the first being 00000 and the last depends on the memory option. In cases where smaller waveform lengths are required, the waveform memory can be divided into smaller segments.

When the instrument is programmed to output arbitrary waveforms, the clock samples the data points (one at a time) from address 0 to the last address. The rate at which each sample is replayed is defined by the sample clock rate parameter.

Unlike the built-in standard waveforms, arbitrary waveforms must first be loaded into the instrument's memory. Correct memory management is required for best utilization of the arbitrary memory. An explanation of how to manage the arbitrary waveform memory is given in the following paragraphs.

Arbitrary memory Management
The arbitrary memory in comprised of a finite length of words. The maximum size arbitrary waveform that can be loaded into memory depends on the option that is installed in your instrument. The various options are listed in Chapter 1 of this manual. If you purchased the 2572A with in its basic configuration, you should expect to have 1 Meg words to load waveforms.

Waveforms are created using small sections of the arbitrary memory. The memory can be partitioned into smaller segments (up to 16k) and different waveforms can be loaded into each segment, each having a unique length. Minimum segment size is 16 points. Information on how to partition the memory, define segment length and download waveform data to the 2572A is given in the following paragraphs.

Table 5-4, Arbitrary Waveforms Commands Summary

Keyword	Parameter Range	Default
:TRACe		
[:DATA]	<data_array>	
:DEFine	<1 to 10k>,<16 to 1(2)e6> (<segment_#>,<size>)	1
:DELete		
[:NAME]	1 to 10k	
:ALL		
:SELect	1 to 10k	1
:SEGMent		
[:DATA]	<data_array>	

TRACe#<header><binary_block>

Description

This command will download waveform data to the 2572A memory. Waveform data is loaded to the 2572A using high-speed binary transfer. A special command is defined by IEEE-STD-488.2 for this purpose. High-speed binary transfer allows any 8-bit bytes (including extended ASCII code) to be transmitted in a message. This command is particularly useful for sending large quantities of data. As an example, the next command will download to the generator an arbitrary block of data of 1024 points

```
TRACe#42048<binary_block>
```

This command causes the transfer of 2048 bytes of data (1024 waveform points) into the active memory segment. The <header> is interpreted this way:

- The ASCII "#" ($23) designates the start of the binary data block.
- "4" designates the number of digits that follow.
- "2048" is the even number of bytes to follow.

The generator accepts binary data as 16-bit integers, which are sent in two-byte words. Therefore, the total number of bytes is always twice the number of data points in the waveform. For example, 20000 bytes are required to download a waveform with 10000 points. The IEEE-STD-488.2 definition of Definite Length Arbitrary Block Data format is demonstrated in Figure 5-1.

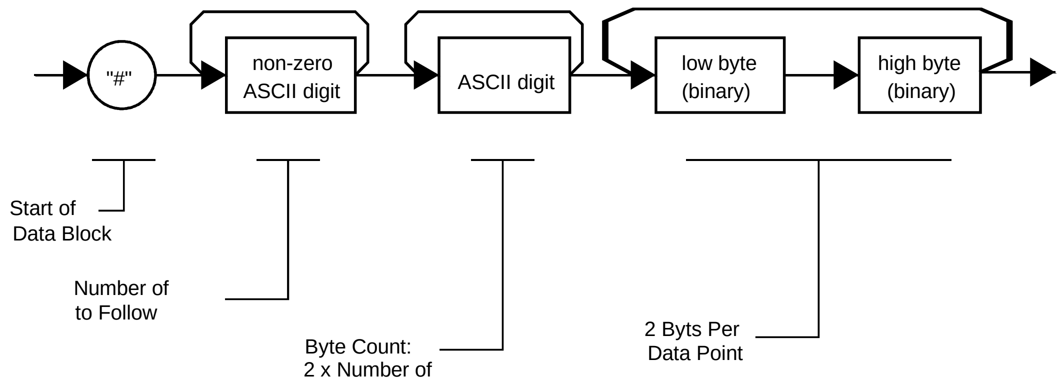

Figure 5-1, Definite Length Arbitrary Block Data Format

Transfer of definite length arbitrary block data must terminate with the EOI bit set. This way, carriage-return (CR – 0dH) and line feed (LF – 0aH) characters can be used as waveform data points and will not cause unexpected termination of the arbitrary block data.

- <binary_block> Represents waveform data.

The waveform data is made of 16-bit words however, the GPIB link has 8 data bas lines and accepts 8-bit words only. Therefore, the data has to be prepared as 16-bit words and rearranged as two 8-bit words before it can be used by the 2572A as waveform data points. The following description shows you how to prepare the data for downloading to the 2572A. There are a number of points you should be aware of before you start preparing the data:

1. Each channel has its own waveform memory. Therefore, make sure you selected the correct active channel before you download data to the generator
2. Waveform data points have 16-bit values
3. Data point range is 0 to 65,535 decimal
4. Data point 0 to data point 65,535 corresponds to full-scale amplitude setting.

Figure 5-2 shows how to initially prepare the 16-bit word for a waveform data point. Data has to be further manipulated to a final format that the instrument can accept and process as waveform point.

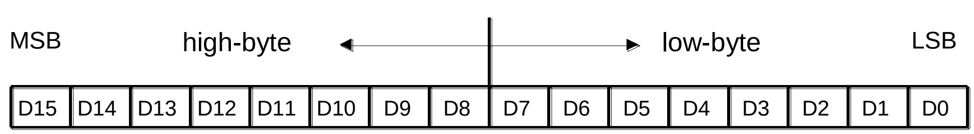

Figure 5-2, 16-bit Initial Waveform Data Point Representation

Figure 5-3 shows the same 16-bit word as in Figure 5-2, except the high and low bytes are swapped. This is the correct format that the 2572A expects as waveform point data. The first byte to be sent to the generator is the low-byte and then high-byte.

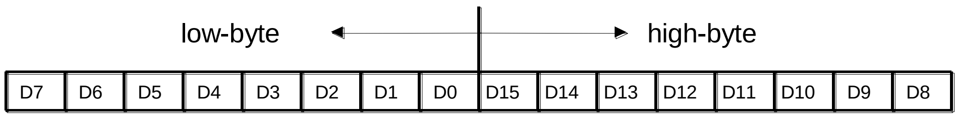

Figure 5-3, 16-bit Waveform Data Point Representation

Parameters

Name	Type	Description
<header>	Discrete	Contains information on the size of the binary block that contains waveform coordinates.
<binary_block>	Binary	Block of binary data that contains information on the waveform coordinates.

TRACe:DEFine<segment_number>,<length>

Description

Use this command to attach size to a specific memory segment. The final size of the arbitrary memory is 1M points (2M optional). The memory can be partitioned to smaller segments, up to 10k segments. This function allows definition of segment size. Total length of memory segments cannot exceed the size of the waveform memory.

NOTE

The 2572A operates in interlaced mode where four memory cells generate one byte of data. Therefore, segment size can be programmed in numbers evenly divisible by four only. For example, 2096 bytes is an acceptable length for a binary block. 2002 is not a multiple of 4, therefore the generator will generate an error message if this segment length is used.

Parameters

Name	Range	Type	Default	Description
<segment_ number>	1 to 10k	Numeric (integer only)	1	Selects the segment number of which will be programmed using this command
<length>	16 to 1(2)M	Numeric (integer only)		Programs the size of the selected segment. Minimum segment length is 16 points, the maximum is limited by the memory option that is installed in your instrument either 1M or 2M

TRACe:DELete<segment_number>

Description

This command will delete a segment. The memory space that is being freed will be available for new waveforms as long as the new waveform will be equal or smaller in size to the deleted segment. If the deleted segment is the last segment, then the size of another waveform written to the same segment is not limited. For example, let consider two segments, the first being a 1000-point waveform and the second with 100 points. If you delete segment 1, you can reprogram another waveform to segment 1 with size to 1000 points. If you reprogram segment 1 with 1004 points, the instrument will generate an error and will not accept this waveform. On the other hand, if you delete segment 2, which was the last segment you programmed, then you can reprogram this segment with waveforms having length limited only by the size of the entire memory space.

Parameters

Name	Range	Type	Default	Description
<segment_ number>	1 to 10k	Numeric (integer only)	1	Selects the segment number of which will be deleted

TRACe:DELete:ALL

Description

This command will delete all segments and will clear the entire waveform memory. This command is particularly important in case you want to de-fragment the entire waveform memory and start building your waveform segments from scratch.

TIP

The TRAC:DEL:ALL command does not re-write the memory so, whatever waveforms were downloaded to the memory are still there for recovery. The TRAC:DEL:ALL command removes all stop bits and clears the segment table. You can recover memory segments by using the TRAC:DEF command. You can also use this technique to resize, or combine waveform segments.

TRACe:SELect<segment_number>

Description

This command will select the active waveform segment for the output. By selecting the active segment you are performing two function:

1. Successive :TRAC commands will affect the selected segment
2. The SYNC output will be assigned to the selected segment. This behavior is especially important for sequence operation, where multiple segments form a large sequence. In this case, you can synchronize external devices exactly to the segment of interest

Parameters

Name	Range	Type	Default	Description
<segment_ number>	1 to 10k	Numeric (integer only)	1	Selects the active segment number

Response

The 2572A will return the active segment number.

SEGment#<header><binary_block>

Description

This command will partition the waveform memory to smaller segments and will speed up memory segmentation. The idea is that waveform segments can be built as one long waveform and then just use this command to split the waveform to the appropriate memory segments. In this way, there is no need to define and download waveforms to individual segments.

Using this command, segment table data is loaded to the 2572A using high-speed binary transfer in a similar way to downloading waveform data with the trace command. High-speed binary transfer allows any 8-bit bytes (including extended ASCII code) to be transmitted in a message. This command is particularly useful for large number of segment. As an example, the next command will generate three segments with 12 bytes of data that contains segment size information.

```
SEGment#212<binary_block>
```

This command causes the transfer of 12 bytes of data (3 segments) into the segment table buffer. The <header> is interpreted this way:

- The ASCII "#" ($23) designates the start of the binary data block.
- "2" designates the number of digits that follow.
- "12" is the number of bytes to follow. This number must divide by 4.

The generator accepts binary data as 32-bit integers, which are sent in two-byte words. Therefore, the total number of bytes is always 4 times the number of segments. For example, 36 bytes are required to download 9 segments to the segment table. The IEEE-STD-488.2 definition of Definite Length Arbitrary Block Data format is demonstrated in Figure 5-1. The transfer of definite length arbitrary block data must terminate with the EOI bit set. This way, carriage-return (CR – 0dH) and line feed (LF – 0aH) characters can be used as segment table data points and will not cause unexpected termination of the arbitrary block data.

The segment table data is made of 32-bit words however, the GPIB link has 8 data bas lines and accepts 8-bit words only. Therefore, the data has to be prepared as 32-bit words and rearranged as six 8-bit words before it can be used by the 2572A as segment table data. Figure 5-4 shows how to prepare the 32-bit work for the segment start address and size. There are a number of points you should be aware of before you start preparing the data:

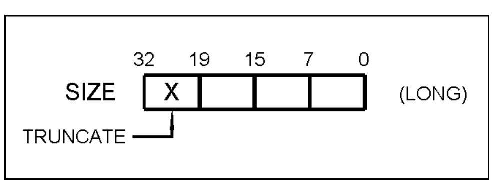

Figure 5-4, Segment Address and Size Example

1. Each channel has its own segment table buffer. Therefore, make sure you selected the correct active channel (with the INST:SEL command) before you download segment table data to the generator
2. Minimum number of segments is 1; maximum number of segments is 16k
3. Maximum segment size depends on your installed option. With the basic 2572A you can program maximum 1M in one segment. With the 2M option, you can use the full size of 2 Meg
4. Segment table data has 32-bit values of which are used for segment size. Therefore, Data for each segment must have 4 bytes
5. The number of bytes in a complete segment table must divide by 6. The Model 2572A has no control over data sent to its segment table during data transfer. Therefore, wrong data and/or incorrect number of bytes will cause erroneous memory partition

Parameters

Name	Type	Description
<binary_block>	Binary	Block of binary data that contains information on the segment table.

Digital Patterns Control Commands

This group is used to control the data at the digital pattern output connector. Use this group of commands to define the source of the data and the rate of which the data is clocked at the output connector.

Factory defaults after *RST are shown in the Default column. Parameter range and low and high limits are listed, where applicable.

Table 5-5, Digital Pattern Commands Summary

Keyword	Parameter Range	Default
:DIGital		
:DATA		
:SOURce	FIXed | USER	FIX
:RATe	1.5 to 50e6	10e3
[:STATe]	OFF | ON | 0 | 1	0

DIGital:DATA<pattern_block>

Description

This command will download digital patterns. Similar to waveform data, the pattern data is downloaded to a predefined memory cell. There are two options to store pattern data: 1) Dedicated memory that can store up to 128k patterns, or 2) any arbitrary memory segment that can store from 16 to 1 M (2 M optional) patterns. The difference between the two options is that the dedicated pattern memory can be displayed on the front panel while the arbitrary segments can not be displayed. The location where you intend to store digital patterns is selectable using the DIG:DATA:SOUR command.

Digital patterns are generated from channel 1 only. Since this function can be turned on and off regardless of the output mode, one could mix digital and analog data output by generating digital patterns from channel 1 while generating arbitrary waveforms from channel 2. While in arbitrary mode of operation, the digital patterns can be turned on for simultaneous generation of analog signal and its equivalent digital pattern.

The rate of which the patterns change is defined by the baud parameter. Digital patters are input to the 2572A in 16-bit hex words.

Parameters

Name	Type	Description
<pattern_block>	Integer	Contains an array of 16-bit hex pattern data.

DIGital:RATe<rate>(?)

Description
This command will programs the rate of which digital patterns change state at the output connector.

Parameters

Name	Range	Type	Default	Description
<rate>	1.5 to 250e6	Numeric	10e3	Programs the rate for the digital patterns. Note that although the rate range is specified to 250 Mpps, the highest baud depends on the quality of the cable and may deteriorate the high limit dramatically. Full rate is possible with the interconnecting circuit connected directly at the rear-panel Digital Pattern output connector.

Response
The 2572A will return the current rate value.

DIGital:DATA:SOURce{FIXed|USER}(?)

Description
This command will select the source of the digital pattern data.

Parameters

Range	Type	Default	Description
FIXed	Discrete	FIX	Allocates a dedicated memory for the digital patterns with a finite size of 128k. The data that is stored using this option can be viewed from the front panel. Using the FIX option, generation of arbitrary waveforms is purged.
USER	Discrete		Allocates storage of digital patterns in any arbitrary segment up to 1 M pattern length (2 M optional) however, in this case, the data cannot be viewed from the front panel.

Response
The 2572A will return FIX, or USER depending on the current setting.

DIGital{OFF|ON|0|1}(?)

Description
This command will toggle the digital pattern output on and off. The command is available for all output functions including standard, arbitrary, sequenced and modulated waveforms however, meaningful output can be controlled in the arbitrary and sequenced function modes only.

Parameters

Range	Type	Default	Description
0-1	Discrete	0	Sets the digital pattern output on and off

Response
The 2572A will return 1 if the output is on, or 0 if the output is off.

Sequenced Waveforms Control Commands

This group is used to control the sequenced waveforms and their respective parameters. This will allow you to create multiple sequence table and modify segment loops and links. Also use these commands to add or delete sequences from your instrument.

Factory defaults after *RST are shown in the Default column. Parameter range and low and high limits are listed, where applicable.

Generating Sequenced Waveforms
Sequenced waveforms are made of a number of arbitrary waveforms, which can be linked and looped in user-programmable order. Sequenced waveforms are generated from waveforms stored in the 2572A as memory segments. Therefore, before a sequence can be used, download waveform segments to the arbitrary memory using TRAC# or DMA methods. Information on how to partition the memory and how to download waveforms is given in the section entitled **Generating Arbitrary Waveforms**.

An example of how sequenced waveforms work is demonstrated in figure 1-13 through 1-15. The sequence generator lets you link and loop segments in user-defined order. Figure 1-16 shows a sequence of waveforms that were stored in three different memory segments.

There are a number of tools that you can use to build a sequence table. The easiest way is of course to use the ArbConnection program. Information how to use the ArbConnection program is given in a later chapter. In other cases, SCPI programming allows low-level programming of sequence tables.

In general, sequences can be build one step at a time using the SEQ:DEF command. The one step method is slow and tedious however, it allows better control for one who just begins his first sequence programming. Advanced users can download a complete sequence table using the binary sequence download option. The later being much faster for applications requiring large sequence tables. Use the information below to understand sequence commands and how to implement them in your application.

Table 5-6, Sequence Control Commands

Keyword	Parameter Form (Default in Bold)	Notes
[:SOURce]		
:SEQuence		
[:DATA]	<data_array>	
:ADVance	AUTOmatic | STEP | SINGle | MIX	AUTO
:SELect	1 to 10	1
:DEFine	<step>,<seg_number>,<repeat>,<adv_mode>,<sync_bit>	
:DELete		
:NAME	1 to 4096	
:ALL		
:SYNC		
[:TYPe]	BIT | LCOMplete	LCOM

SEQuence#<header><binary_block>

Description

This command will build a complete sequence table in one binary download. In this way, there is no need to define and download individual sequencer steps. Using this command, sequence table data is loaded to the 2572A using high-speed binary transfer in a similar way to downloading waveform data with the trace command. High-speed binary transfer allows any 8-bit bytes (including extended ASCII code) to be transmitted in a message. This command is particularly useful for long sequences that use a large number of segment and sequence steps. As an example, the next command will generate three-step sequence with 16 bytes of data that contains segment number, repeats (loops) and mixed mode flag option.

```
SEQuence#216<binary_block>
```

This command causes the transfer of 16 bytes of data (2-step sequence) to the sequence table buffer. The <header> is interpreted this way:

- The ASCII "#" ($23) designates the start of the binary data block.
- "2" designates the number of digits that follow.
- "16" is the number of bytes to follow. This number must divide by 8.

The generator accepts binary data as 64-bit integers, which are sent in two-byte words. Therefore, the total number of bytes is always eight times the number of sequence steps. For example, 16 bytes are required to download 2 sequence steps to the sequence table. The IEEE-STD-488.2 definition of Definite Length Arbitrary Block Data format is demonstrated in Figure 5-1. The transfer of definite length arbitrary block data must terminate with the EOI bit set. This way, carriage-return (CR – 0dH) and line feed (LF – 0aH) characters can be used as sequence data and will not cause unexpected termination of the arbitrary block data. Figure 5-5 shows how to prepare the 64-bit word for the sequence step, repeat, mixed mode and sync bit.

The sequence table data is made of 64-bit words however, the GPIB link has 8 data bas lines and accepts 8-bit words only. Therefore, the data has to be prepared as 64-bit words and rearranged as six 8-bit words before it can be used by the 2572A as sequence table data. Figure 5-6 shows how to prepare the 64-bit word for the sequence step, repeat and mixed mode flag.

There are a number of points you should be aware of before you start preparing the data:

1. Each channel has its own sequence table buffer. Therefore, make sure you selected the correct active channel (with the INST:SEL command) before you download sequence table data to the generator
2. Minimum number of sequencer steps is 1; maximum number is 4096
3. The number of bytes in a complete sequence table must divide by 8. The Model 2572A has no control over data sent to its sequence table during data transfer. Therefore, wrong data and/or incorrect number of bytes will cause erroneous sequence partition
4. The LSB bit is the only bit used in the mode byte. This bit has an affect on the operation of the sequence only when Mixed Step Advance mode is active. With the LSB bit set to “0”, the sequence generator will advance to the next step automatically. With the LSB bit set to “1”, the sequence generator will advance to the next step only when a valid trigger signal will be sensed at the trigger input.
5. SYNC state bit is valid only when the sequence sync type is BIT

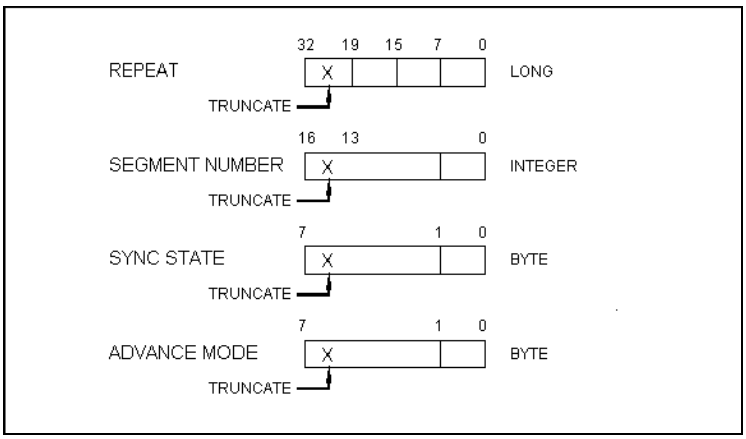

Figure 5-5, 64-bit Sequence Table Download Format

Parameters

Name	Type	Description
<binary_block>	Binary	Block of binary data that contains information on the sequence table.

SEQuence:ADVance{AUTOmatic|STEP|SINGle|MIXed}(?)

Description

This command will select the sequence advance mode. The way the instrument advances through the sequence links can be specified by the user.

Parameters

Name	Type	Default	Description
AUTOmatic	Discrete	AUTO	Specifies continuous advance where the generator steps continuously to the end of the sequence table and repeats the sequence from the start. For example, if a sequence is made of three segments 1,

		2 and 3, the sequence will generate an infinite number of 1,2,3,1,2,3,1,2,3…waveforms. Of course, each link (segment) can be programmed with its associated loop (repeat) number.
STEP	Discrete	In step advance mode, the sequence is advanced to the next waveform only when a valid trigger is received. The output of the 2572A generates the first segment continuously until a trigger signal advances the sequence to the next segment. If repeats were selected for a segment, the loop counter is executed automatically.
SINGle	Discrete	In single advance mode, the generator idles between steps until a valid trigger signal is sensed. This mode operates with trigger mode only. An attempt to select the SING advance mode when the 2572A is in continuous operating mode will generate an error. After trigger, the generator outputs one waveform cycle. Then, the output level idles at a DC level equal to the last point of the last generated waveform. If loops (repeats) were programmed, the output will repeat this segment every time a trigger is received. Only after executing all of the programmed loops will the sequence step to the next assigned segment.
MIXed	Discrete	Mixed mode is a special mode that combines continuous step advance with single step advance in a sequence. There are three conditions for the sequence generator to operate in this mode: 1) The 2572A must be set to operate in continuous mode 2) Select the MIX sequence advance mode 3) Assign the mixed mode bits for each sequence step in your SEQ:DEF command. “0” programs normal advance, “1” programs trigger advance. Step with a “0” bit assigned to it will advance automatically to the next step. If “1” is assigned to a step, the instrument will generate this step and its associated number of repeats continuously and only a valid trigger signal will advance this step to the next step.

Response
The 2572A will return the AUTO, STEP, SING, or MIX depending on the present sequence advance mode setting.

SEQuence:SELect<sequence_number>(?)

Description
This command will select an active sequence to be generated at the output connector. By selecting the active sequence, successive :SEQ commands will affect the selected sequence only

Parameters

Name	Range	Type	Default	Description
<sequence_ number>	1 to 10	Numeric (integer only)	1	Selects the active sequence number

Response

The 2572A will return the active sequence number.

SEQuence:DEFine<step>,<seg_number>,<repeat>,<adv_mode>,<sync_ bit>(?)

Description

This command builds a step in a sequence table. It defines all of the parameters that are associated with the sequence step such as segment number, link, loop, advance mode and sync mode.

Parameters

Name	Range	Type	Description
<step>	1 to 4096	Numeric (integer only)	Programs the step in the sequence table. Steps are indexed from 1 to 4096 and must be programmed in an ascending order; Empty step locations in a sequence table are not permitted.
<seg_number>	1 to 10k	Numeric (integer only)	Assigns a segment to a specific step number. When encountered in the sequence table, the segment number that is associated with the step will be generated.
<repeat>	1 to 1M	Numeric integer only)	Programs the repeat number of loops that a specific step will play before advancing to the next step in the sequence.
<adv_mode>	0-1	Boolean	"0" programs normal advance, "1" programs trigger advance. Step with a "0" bit assigned to it will advance automatically to the next step. If "1" is assigned to a step, the instrument will generate this step continuously and only a valid trigger signal will cause the sequence to advance to the next step. Note that the <adv_mode> parameter has no affect when the sequence advance mode is set to SING
<sync_bit>	0-1	Boolean	"1" programs bit present at a specific sequence step. This feature is required in applications where multiple sync bits are required in a single sequence. Note that normal sync output during sequence mode is LCOM.

NOTE

Although trigger signals are used to advance mixed mode, the mixed mode operates in continuous mode only. The <mode> parameter will be ignored if you will use SING as advance mode for the sequence table.

TIP

Every time you use the SEQ:DEF command while your 2572A is in sequenced operating mode, the instrument attempts to rebuild the sequence table and restart the sequence. Therefore, sending this command in sequenced mode will slow the programming process and the operation of the generator. Using the SEQ:DEF command in FIX or USER mode will greatly speed up programming time.

SEQuence:DELete<sequence_number>

Description

This command will delete a step in a specific sequence table. Before you use this step make sure your sequence number is setup correctly for this operation.

Parameters

Name	Range	Type	Default	Description
<sequence_ number>	1 to 4096	Numeric (integer only)	1	Selects the step number of which will be deleted

SEQuence:DELete:ALL

Description

This command will delete the enire sequence table. Before you use this step make sure your sequence number is setup correctly for this operation.

OUTPut:SYNC:TYPE{BIT|LCOMplete}(?)

Description

This command will program the 2572A SYNC mode.

Parameters

Name	Type	Default	Description
BIT	Discrete		The sync output will generate a pulse at the beginning of a specific segment regardless how many times the segment appears in a sequence. The width of the sync pulse is 16 waveform points.
LCOMplete	Discrete	LCOM	The sync output will transition high at the beginning of the sequence and will transition low at the end of the sequence, less 16 waveform points.

Response

The 2572A will return BIT or LCOM depending on the present SYNC mode

Modulated Waveforms Control Commands

This group is used to control the modulated waveforms and their respective parameters. Note that the modulation can be turned off to create continuous carrier waveform (CW). The following modulation schemes can be selected and controlled: FM, AM, FSK, ASK, Sweep, Amplitude and Frequency hops, 3D, (n)PSK and (n)QAM. The modulation commands are summarized in Table 5-7. Factory defaults after *RST are shown in the Default column. Parameter range and low and high limits are listed, where applicable.

Table 5-7, Modulated Waveforms Commands

Keyword	Parameter Form	Default
[:SOURce]		
:MODulation		
:TYPE	OFF |FM | AM | SWEep | FSK | ASK | FHOPping | AHOPping | 3D | PSK | QAM	OFF
:CARRier		
[:FREQuency]	10 to 100e6	1e6
:BASeline	CARRier | DC	CARR
:LOAD		
:DEMO		
	Frequency Modulation Commands	
:FM		
:DEViation	10.0e-3 to 100e6	100e3
:FUNCtion		
:SHAPe	SINusoid | TRIangle | SQUare | RAMP | ARB	SIN
:FREQuency	10e-3 to 350e3)	10e3
:RASTer	1 to 2.5e6)	1e6
:MARKer		
[:FREQuency]	10e-3 to 100e6)	1e6
:DATA	<data_array>	
	Amplitude Modulation Commands	
:AM		
:FUNCtion		
:SHAPe	SINusoid | TRIangle | SQUare | RAMP	SIN
:MODulation		
:FREQuency	10e-3 to 1e6	10e3
:DEPTh	0 to 100	50
	Sweep Modulation Commands	
:SWEep		
[:FREQuency]		
:STARt	10 to 100.0e6	10e3
:STOP	10 to 100e6	1e6
:TIME	1.4e-6 to 40.0	1e-3
:DIRection	UP | DOWN	UP
:SPACing	LINear | LOGarithmic	LIN
:MARKer		
[:FREQuency]	10 to 100e6	505e3

Table 55-7, Model 2572A SCPI Commands List Summary (continued)

Keyword	Parameter Form	Default
[:SOURce]		
	Frequency Shift Keying Modulation Commands	
:FSK		
:FREQuency		
:SHIFted	10e-3 to 100e6	100e3
:BAUD	1 to 10e6	10e3
:MARKer	1 to 4000	1
:DATA	<data_array>	
	Amplitude Shift Keying Modulation Commands	
:ASK		
[:AMPLitude]		
[:STARt]	0 to 16	5
:SHIFted	0 to 16	1
:BAUD	1 to 10e6	10e3
:MARKer	1 to 1000	1
:DATA	<data_array>	
	Frequency Hopping Modulation Commands	
:FHOPping		
:DWELl		
:MODe	FIXed | VARiable	FIX
[:TIMe]	200e-9 to 20	200e-9
:FIXed		
:DATA	<data_array>	
:VARiable		
:DATA	<data_array>	
:MARKer	1 to 5000	1
	Amplitude Hopping Modulation Commands	
:AHOPping		
:DWELl		
:MODe	FIXed | VARiable	FIX
[:TIMe]	200e-9 to 20	200e-9
:FIXed		
:DATA	<data_array>	
:VARiable		
:DATA	<data_array>	
:MARKer	1 to 5000	1
	3D Modulation Commands	
:3D		
:DATA	<data_array>	
:MARKer	1 to 30000	
:RASTer	1 to 2.5e6	1e6

Table 55-7, Model 2572A SCPI Commands List Summary (continued)

Keyword	Parameter Form	Default
[:SOURce]		
:PSK		
:TYPE	PSK | BPSK | QPSK | OQPSK | DQPSK | 8PSK | 16PSK | USER	PSK
:PHASe		
[:STARt]	0 to 360	0
:SHIFted	0 to 360	180
:RATE	1 to 10e6	10e3
:DATA	<data_array>	
:MARKer	1 to 4000	1
:BAUD	1 to 10e6	10e3
:CARRier		
:STATe	OFF | ON | 0 | 1	1
:USER		
:DATA	<data_array>	
:QAM		
:TYPE	16QAM | 64QAM | 256QAM | USER	QAM
:CARRier		
:STATe	OFF | ON | 0 | 1	1
:BAUD	1 to 10e6	10e3
:DATA	<data_array>	
:MARKer	1 to 4000	1
:USER		
:DATA	<data_array>	

MODulation:TYPE{OFF|FM|AM|SWEeep|FSK|ASK|FHOPping|AHOPping|3D|PSK|QAM}(?)

Description
This command will select the modulation type. All modulation types are internal, thus external signals are not required for producing modulation.

Parameters

Name	Type	Default	Description
OFF	Discrete	OFF	Modulation off is a special mode where the output generates continuous, non-modulated sinusoidal carrier waveform (CW).
FM	Discrete		This turns on the FM function. Program the FM parameters to fine tune the function for your application.
AM	Discrete		This turns on the AM function. Program the AM parameters to fine tune the function for your application.
SWEep	Discrete		This turns on the sweep function. Program the sweep parameters to fine tune the function for your application.
FSK	Discrete		This turns on the FSK function. Program the FSK parameters to fine tune the function for your application.
ASK	Discrete		This turns on the ASK function. Program the ASK parameters to fine tune the function for your application.
FHOPping	Discrete		This turns on the frequency hopping function. Program the hop parameters to fine tune the function for your application.
AHOPping	Discrete		This turns on the amplitude hopping function. Program the amplitude hopping parameters to fine tune the function for your application.
3D	Discrete		This turns on the 3D function. Program the 3D parameters to fine tune the function for your application.
PSK	Discrete		This turns on the PSK function. Program the PSK parameters to fine tune the function for your application.
QAM	Discrete		This turns on the QAM function. Program the QAM parameters to fine tune the function for your application.

Response
The 2572A will return OFF, FM, AM, SWE, FSK, ASK, HOP, AHOP, 3D, PSK, or QAM depending on the present modulation type setting.

MODulation:CARRier<frequency>(?)

Description

This command programs the CW frequency. Note that the CW waveform is sine only and its frequency setting is separate to the standard sine waveform. The CW frequency setting is valid for all modulation types.

Parameters

Name	Range	Type	Default	Description
<frequency>	10e-3 to 100e6	Numeric	1e6	Programs the frequency of the carrier waveform in units of Hz. Note that the CW waveform is sine only and its frequency setting is separate to the standard sine waveform.

Response

The 2572A will return the current carrier frequency value.

MODulation:CARRier:BASeline{CARRier|DC}(?)

Description

This command will program the carrier baseline when the modulation is used in triggered mode.

Parameters

Name	Type	Default	Description
CARRier	Discrete	CARR	This selects the carrier as the baseline for the modulation function, when operating in one of the interrupted run modes. The output will generate continuous, none modulated sinusoidal waveform (CW) until triggered, upon trigger will generate the modulated waveform and then resume generating continuous CW.
DC	Discrete		This selects DC level as the baseline for the modulation function, when operating in one of the interrupted run modes. The output will generate continuous DC until triggered, upon trigger will generate the modulated waveform and then resume generating continuous DC level.

Response

The 2572A will return CARR, or DC depending on the present carrier baseline setting.

MODulation:LOAD:DEMO

Description

This command will load demo table to the memory. The table type depends on the selected modulation function. Table will be loaded for the following functions: (n)PSK, User PSK, (n)QAM and User QAM.

FM Modulation Programming

Use the following command for programming the FM parameters. FM control is internal. There are two types of waveforms that can be used as the modulating waveforms: Standard and Arbitrary. The standard waveforms are built in a library of waveforms and could be used anytime without external control. The arbitrary waveforms must be loaded into a special FM arbitrary waveform memory and only then can be used as a modulating waveform.

FM:DEViation<deviation>(?)

Description
This programs the deviation range around the carrier frequency. The deviation range is always symmetrical about the carrier frequency. If you need non-symmetrical deviation range, you can use the arbitrary FM composer screen or an external utility to design such waveforms.

Parameters

Name	Range	Type	Default	Description
<deviation>	10e-3 to 100e6	Numeric	100e3	Programs the deviation range around the carrier frequency in units of Hz.

Response
The 2572A will return the present deviation frequency value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

FM:FUNCtion:SHAPe(SINusoid|TRIangle|SQUare|RAMP|ARB}(?)

Description
This command will select one of the waveform shapes as the active modulating waveform.

Parameters

Name	Type	Default	Description
SINusoid	Discrete	SIN	Selects the sine shape as the modulating waveform
TRIangle	Discrete		Select the triangular shape as the modulating waveform
SQUare	Discrete		Select the square shape as the modulating waveform
RAMP	Discrete		Selects the ramp shape as the modulating waveform
ARB	Discrete		Selects an arbitrary waveform as the modulating shape. The waveform must be designed and downloaded to the FM arbitrary modulating waveform memory before one can use this option. Information on how to create and download FM arbitrary waveforms is given later in this chapter.

Response
The 2572A will return SIN, TRI, SQU, RAMP, or ARB depending on the selected function shape setting.

FM:FREQuency<fm_freq>(?)

Description

This command will set the modulating wave frequency for the built-in standard modulating waveform library.

Parameters

Name	Range	Type	Default	Description
<fm_freq>	10e-3 to 350e3	Numeric	10e3	Programs the frequency of the modulating waveform in units of Hz. The frequency of the built-in standard modulating waveforms only is affected.

Response

The 2572A will return the present modulating waveform frequency value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

FM:FREQuency:RASTer<arb_fm_freq>(?)

Description

This command will set the sample clock frequency for the arbitrary modulating waveform. Arbitrary modulating waveforms must be created in an external utility and downloaded to the FM arbitrary waveform memory before this function can be used.

Parameters

Name	Range	Type	Default	Description
<arb_fm_freq>	1 to 2.5e6	Numeric	1e6	Programs the sample clock frequency of the arbitrary modulating waveform in units of S/s.

Response

The 2572A will return the present sample clock of the arbitrary modulating waveform value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

FM:MARKer<frequency>(?)

Description

This function programs marker frequency position. FM marker can be placed inside the following range: (carrier frequency ± deviation frequency / 2). The marker pulse is output from the SYNC output connector.

Parameters

Name	Range	Type	Default	Description
<frequency>	10e-3 to 100e6	Numeric	1e6	Programs the marker frequency position in units of Hz.

Response

The 2572A will return the present marker frequency value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

FM:DATA#<header><binary_block>

Description

This command will download FM modulating waveform data to the arbitrary FM memory. Arbitrary modulating waveform table data is loaded to the 2572A using high-speed binary transfer in a similar way to downloading waveform data with the trace command. High-speed binary transfer allows any 8-bit bytes (including extended ASCII code) to be transmitted in a message. Remember, downloading data to the arbitrary FM waveform memory is very different than loading arbitrary waveform data. Waveform data programs amplitude domain therefore, every point programs an amplitude level. On the other hand, FM modulating waveform data programs frequency domain therefore, every point sets different sample clock frequency.

```
FM:DATA#3100<binary_block>
```

This command causes the transfer of 10 bytes of data to the arbitrary FM waveform memory. The <header> is interpreted this way:

- The ASCII "#" ($23) designates the start of the binary data block.
- "3" designates the number of digits that follow.
- "100" is the number of bytes to follow. This number must divide by 4.

The generator accepts binary data as 32-bit integers, which are sent in five-byte words. Therefore, the total number of bytes is always three times the number of arbitrary FM waveform points. For example, 100 bytes are required to download 20 arbitrary FM waveform points. The IEEE-STD-488.2 definition of Definite Length Arbitrary Block Data format is demonstrated in Figure 5-1 (refer to the TRACe subsystem). The transfer of definite length arbitrary block data must terminate with the EOI bit set. This way, carriage-return (CR – 0dH) and line feed (LF – 0aH) characters can be used as sequence data and will not cause unexpected termination of the arbitrary block data.

Downloading data to the arbitrary FM waveform memory is very different than loading arbitrary waveform data. Waveform data programs amplitude domain therefore, every point programs an amplitude level. On the other hand, FM modulating waveform data programs frequency domain therefore, every point sets different frequency. The FM modulating waveform data is made of 32-bit words. However, the GPIB link has 8 data bas lines and accepts 8-bit words only. Therefore, the data has to be prepared as 32-bit words and rearranged as five 8-bit words before it can be used by the 2572A as FM modulating waveform data. Figure 4-8 shows how to prepare the 32-bit word for the FM modulating waveform.

There are a number of points you should be aware of before you start preparing the data:

1. The FM function is shared by both channels
2. The number of bytes in a complete FM modulating waveform data must divide by 4. The Model 2572A has no control over data sent to its FM waveform during data transfer. Therefore, wrong data and/or incorrect number of bytes will cause errors
3. The LSBit on the last byte sets marker position. “0” = sets no marker and “1” sets marker. You can set as many markers as you want.
4. The SYNC output serves as marker output when you have the 2572A set to operate in FM mode. Normal SYNC level is TTL low. The SYNC output is set to TTL high at the position of the marker. This way you can use the SYNC output to mark frequency occurrences during FM operation.
5. Data download is terminated with the MSBit of the last byte set to 1.

The following sequence should be used for downloading arbitrary FM Waveforms:

1. Prepare your FM waveform data points using the following relationship:

N = Frequency[Hz] x 14.31655765

2. Use an I/O routine such as ViMoveAsync (from the VISA I/O library) to transfer binary blocks of data to the generator.

Parameters

Name	Type	Description
<binary_block>	Binary	Block of binary data that contains information on the arbitrary modulating waveform.

AM modulation Programming

Use the following command for programming the AM parameters. AM control is internal. The commands for programming the amplitude modulation function are described below. Note that the carrier waveform frequency (CW) setting is common to all modulation schemes.

AM:FUNCtion:SHAPe(SINusoid|TRIangle|SQUare|RAMP}(?)

Description

This command will select one of the waveform shapes as the active modulating waveform.

Parameters

Name	Type	Default	Description
SINusoid	Discrete	SIN	Selects the sine shape as the modulating waveform
TRIangle	Discrete		Select the triangular shape as the modulating waveform
SQUare	Discrete		Select the square shape as the modulating waveform
RAMP	Discrete		Selects the ramp shape as the modulating waveform

Response

The 2572A will return SIN, TRI, SQU, or RAMP depending on the selected function shape setting.

AM:FREQuency<am_freq>(?)

Description

This command will set the modulating wave frequency for the built-in standard modulating waveform library.

Parameters

Name	Range	Type	Default	Description
<am_freq>	10e-3 to 1e6	Numeric	10e3	Programs the frequency of the modulating waveform in units of Hz. The frequency of the built-in standard modulating waveforms only is affected.

Response
The 2572A will return the present modulating waveform frequency value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

AM:DEPth<depth>(?)

Description
This command will set the modulating wave frequency for the built-in standard modulating waveform library.

Parameters

Name	Range	Type	Default	Description
<depth>	0 to 100	Numeric	50	Programs the depth of the modulating waveform in units of percent.

Response
The 2572A will return the present modulating depth value.

Sweep Modulation Programming

Use the following command for programming the sweep parameters. Sweep control is internal. The frequency will sweep from start to stop frequencies at an interval determined by the sweep time value and controlled by a step type determined by the sweep step parameter.

There are two sweep modes: Linear, where the step of which the generator increments from start to stop frequency is linear and Logarithmic, where the step of which the generator increments from start to stop frequency is logarithmic

The commands for programming the frequency sweep function are described below.

SWEep:STARt<start_freq>(?)

Description
This specifies the sweep start frequency. The 2572A will normally sweep from start to stop frequencies however, if the sweep direction is revered, the output will sweep from stop to start frequencies. The start and stop frequencies may be programmed freely throughout the frequency of the standard waveform frequency range.

Parameters

Name	Range	Type	Default	Description
<start_freq>	10e-3 to 100e6	Numeric	10e3	Programs the sweep start frequency. Sweep start is programmed in units of Hz.

Response

The 2572A will return the present sweep start frequency value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

SWEep:STOP<stop_freq>(?)

Description

This specifies the sweep stop frequency. The 2572A will normally sweep from start to stop frequencies however, if the sweep direction is revered, the output will sweep from stop to start frequencies. The start and stop frequencies may be programmed freely throughout the frequency of the standard waveform frequency range.

Parameters

Name	Range	Type	Default	Description
<stop_freq>	10e-3 to 100e6	Numeric	1e6	Programs the sweep stop frequency. Sweep stop is programmed in units of Hz.

Response

The 2572A will return the present sweep stop frequency value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

SWEep:TIMe<time>(?)

Description

This specifies the time that will take the 2572A to sweep from start to stop frequencies. The time does not depend on the sweep boundaries as it is automatically adjusted by the software to the required interval. At the end of the sweep cycle the output waveform maintains the sweep stop frequency setting except if the 2572A is in continuous run mode where the sweep repeats itself continuously.

Parameters

Name	Range	Type	Default	Description
<time>	1.4e-6 to 40	Numeric	1e-3	Programs the sweep time. Sweep time is programmed in units of s.

Response

The 2572A will return the present sweep time. The returned value will be in standard scientific format (for example: 100ms would be returned as 100e-3 – positive numbers are unsigned).

SWEep:DIRection(UP|DOWN}(?)

Description

This specifies if the 2572A output will sweep from start-to-stop (UP) or from stop-to-start (DOWN) frequencies. Sweep time does not affect the sweep direction and frequency limits. At the end of the sweep cycle the output waveform normally maintains the sweep stop frequency setting but will maintain the start frequency, if the DOWN option is selected except if the 2572A is in continuous run mode where the sweep repeats itself continuously.

Parameters

Name	Type	Default	Description
UP	Discrete	UP	Selects the sweep up direction
DOWN	Discrete		Select the sweep down direction

Response

The 2572A will return UP, or DOWN depending on the selected direction setting.

SWEep:SPACing(LINear|LOGarithmic}(?)

Description

This specifies the sweep step type. Two options are available: logarithmic or linear. In linear, the incremental steps between the frequencies are uniform throughout the sweep range. Logarithmic type defines logarithmic spacing throughout the sweep start and stop settings.

Parameters

Name	Type	Default	Description
LINear	Discrete	LIN	Selects the linear sweep spacing
LOGarithmic	Discrete		Select the logarithmic sweep spacing

Response

The 2572A will return LIN, or LOG depending on the selected spacing setting.

SWEep:MARKer<frequency>(?)

Description

This function programs marker frequency position. Sweep marker can be placed in between the start and the stop frequencies. The marker pulse is output from the SYNC output connector.

Parameters

Name	Range	Type	Default	Description
<frequency>	10e-3 to 100e6	Numeric	505e3	Programs the marker frequency position in units of Hz.

Response

The 2572A will return the present marker frequency value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

FSK Modulation Programming

Use the following command for programming the FSK parameters. FSK control is internal. The frequency will shift from carrier to shifted frequency setting at a rate determined by the baud value and controlled by a sequence of bits in the FSK data table. The commands for programming the frequency shift keying function are described below. Note that the carrier waveform frequency (CW) setting is common to all modulation schemes.

FSK:FREQuency:SHIFted<shift_freq>(?)

Description

This programs the shifted frequency. The frequency shifts when the pointer in the data array points to "1".

Parameters

Name	Range	Type	Default	Description
<shift_freq>	10e-3 to 100e6	Numeric	100e3	Programs the shifted frequency value in units of Hz.

Response

The 2572A will return the present shifted frequency value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

FSK:FREQuency:BAUD<baud>(?)

Description

This allows the user to select FSK word rate. The word rate is the interval of which the bit streams in the FSK data array are clocked causing the output frequency to hop from carrier to shifted frequency values and visa versa.

Parameters

Name	Range	Type	Default	Description
<baud>	1 to 10e6	Numeric	10e3	Programs the rate of which the frequency shifts from carrier to shifted frequency in units of Hz.

Response

The 2572A will return the present baud value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

FSK:FREQuency:MARKer<index>(?)

Description
Programs where on the data stream the 2572A will generate a pulse, designated as FSK marker, or index point. The marker pulse is generated at the SYNC output connector. Note that if you intend to program marker position, you must do it before you load the FSK data list.

Parameters

Name	Range	Type	Default	Description
<index>	1 to 4000	Numeric (integer only)	1	Programs a marker pulse at an index bit position.

Response
The 2572A will return the present marker position.

FSK:DATA<fsk_data>

Description
Loads the data stream that will cause the 2572A to hop from carrier to shifted frequency and visa versa. Data format is a string of "0" and "1" which define when the output generates carrier frequency and when it shifts frequency to the FSK value. "0" defines carrier frequency,"1" defines shifted frequency. Note that if you intend to program marker position, you must do it before you load the FSK data list.

Below you can see how an FSK data table is constructed. The sample below shows a list of 10 shifts. The 2572A will step through this list, outputting either carrier or shifted frequencies, depending on the data list: Zero will generate carrier frequency and One will generate shifted frequency. Note that the waveform is always sinewave and that the last cycle is always completed.

Sample FSK Data Array

0 1 1 1 0 1 0 0 0 1

Parameters

Name	Type	Description
<fsk_data>	ASCII	Block of ASCII data that contains information for the generator when to shift from carrier to shifted frequency and visa versa.

ASK Modulation Programming

Use the following command for programming the ASK parameters. ASK control is internal. The amplitude will toggle between two amplitude settings at a rate determined by the baud value and controlled by a sequence of bits in the ASK data table. The commands for programming the amplitude shift keying function are described below. Note that the carrier waveform frequency (CW) setting is common to all modulation schemes.

ASK<amplitude>(?)

Description

This programs the normal amplitude setting. The amplitude shifts when the pointer in the data array points to “1”.

Parameters

Name	Range	Type	Default	Description
<amplitude>	0 to 16	Numeric	5	Programs the amplitude setting in units of volt.

Response

The 2572A will return the present amplitude value. The returned value will be in standard scientific format (for example: 100mV would be returned as 100e-3 – positive numbers are unsigned).

ASK:SHIFted<shift_ampl>(?)

Description

This programs the shifted amplitude. The amplitude shifts when the pointer in the data array points to “1”.

Parameters

Name	Range	Type	Default	Description
<shift_ampl>	0 to 16	Numeric	1	Programs the shifted amplitude setting in units of volt.

Response

The 2572A will return the present shifted amplitude value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

ASK:BAUD<rate>(?)

Description

This allows the user to select ASK word rate. The word rate is the interval of which the bit streams in the ASK data array are clocked causing the output amplitude to hop from one level to shifted amplitude level values and visa versa.

Parameters

Name	Range	Type	Default	Description
<rate>	1 to 10e6	Numeric	10e3	Programs the rate of which the frequency shifts from carrier to shifted frequency in units of Hz.

Response

The 2572A will return the present baud value. The returned value will be in standard scientific format (for example: 100kHz would be returned as 100e3 – positive numbers are unsigned).

ASK:FREQuency:MARKer<index>(?)

Description

Programs where on the data stream the 2572A will generate a pulse, designated as ASK marker, or index point. The marker pulse is generated at the SYNC output connector. Note that if you intend to program marker position, you must do it before you load the ASK data list.

Parameters

Name	Range	Type	Default	Description
<index>	1 to 1000	Numeric (integer only)	1	Programs a marker pulse at an index bit position.

Response

The 2572A will return the present marker position.

ASK:DATA<ask_data>

Description

Loads the data stream that will cause the 2572A to hop from one amplitude level to shifted amplitude level and visa versa. Data format is a string of "0" and "1" which define when the output generates base level and when it shifts amplitude to the ASK value. "0" defines base level amplitude,"1" defines shifted amplitude level. Note that if you intend to program marker position, you must do it before you load the ASK data list.

Below you can see how an ASK data table is constructed. The sample below shows a list of 10 shifts. The 2572A will step through this list, outputting either base or shifted amplitudes, depending on the data list: Zero will generate base level and One will generate shifted amplitude. Note that the waveform is always sinewave and that the last cycle is always completed.

Sample ASK Data Array

0 1 1 1 0 1 0 0 0 1

Parameters

Name	Type	Description
<ask_data>	ASCII	Block of ASCII data that contains information for the generator when to shift from base to shifted amplitude and visa versa.

Frequency Hopping Modulation Programming

Use the following command for programming the frequency hop parameters. Hop control is internal. The frequency will hop from frequency to frequency at a rate determined by the dwell time value and controlled by a sequence of frequencies in the HOP data table.

There are two hop modes: Fixed Dwell, where the rate of which the generator hops from frequency to frequency is constant and Variable Dwell, where the rate of which the generator hops from frequency to frequency is programmable for each hop.

The commands for programming the frequency hopping function are described below. Note that the carrier waveform frequency (CW) setting is common to all modulation schemes.

FHOP:DWELl:MODe(FIXed|VARiable}(?)

Description

This selects between fixed or variable dwell-time for the frequency hops. Select the fixed option if you want each frequency to dwell equally on each step. The variable option lets you program different dwell times for each frequency hop. The 2572A output hops from one frequency to the next according to a sequence given in a hop table. The variable dwell time table contains dwell time data for each step however, the fixed dwell time table does not contain any dwell time information and therefore, if you select the fixed option, make sure your dwell time is programmed as required.

Parameters

Name	Type	Default	Description
FIXed	Discrete	FIX	Selects the fixed dwell time frequency hops mode
VARiable	Discrete		Select the variable dwell time frequency hops mode

Response

The 2572A will return FIX, or VAR depending on the selected dwell setting.

FHOP:DWELl<dwell_time>(?)

Description

This selects the dwell time for frequency hops when the selected mode is Fixed dwell time hops. The dwell time table in this case does not contain the dwell time per step parameters and therefore, the value which is programmed with this command remains constant for the entire hop sequence.

Parameters

Name	Range	Type	Default	Description
<dwell_time>	200e-9 to 20	Numeric	200e-9	Programs dwell time for the fixed dwell-time frequency hop function. The same dwell time will be valid for each frequency hop. Dwell time is programmed in units of s.

Response
The 2572A will return the present dwell time value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

FHOP:FIX:DATA<fix_hop_data>

Description
This command will download the data array that will cause the instrument to hop through the frequency list. The dwell time for each frequency list item is fixed and can be programmed using the HOP:DWEL command. Note that if you intend to program marker position, you must do it first and then load the frequency hops list.

Below you can see how a hop table is constructed. The file sample below shows a list of 10 frequencies. The 2572A will hop through this list, outputting the next frequency each time it hops. Note that the carrier waveform is always sinewave and that the last cycle is always completed even if the dwell time is shorter than the period of the waveform. For example, if you program dwell time of 1ms and the frequency step has frequency of 1Hz (1s period), the frequency step will last 1 second although the dwell time is 1ms.

Sample Frequency Hops Data Array

1e+6 2e+6 3e+3 4e+6 5e+5 6e+2 7e+1 8e+6 9e+3 10e+5

Parameters

Name	**Type**	**Description**
<fix_hop_data>	Double	Block of binary data that contains information of frequency values.

FHOP:FIX:DATA<var_hop_data>

Description
This command will download the data array that will cause the instrument to hop through the frequency list. The dwell time for each frequency list item is variable and is supplied in the variable hop table data array. Note that the HOP:DWEL command has no effect on this sequence. Also note that if you intend to program marker position, you must do it first and then load the frequency hops list.

Below you can see how a hop table is constructed. The file sample below shows a list of 10 frequencies and their associated dwell times. The 2572A will hop through this list, outputting the next frequency each time it hops. Note that the carrier waveform is always sinewave and that the last cycle is always completed even if the dwell time is shorter than the period of the waveform. For example, if you program dwell time of 1ms and the frequency step has frequency of 1Hz (1s period), the frequency step will last 1 second although the dwell time is 1ms.

Sample Frequency Hops Data Array

1e+6 100 2e+6 2000 3e+3 3e4 4e+6 40 5e+5 5e3 6e+2 6000 7e+1 0.7 8e+8e2 6 9e+3 90 10e+51000

In the above example, the first number is the frequency value and the second number is its dwell time. Therefore, only even number of sets can be located in this table.

Parameters

Name	Type	Description
<var_hop_data>	Double	Block of binary data that contains information of frequency hop values and their respective dwell time.

FHOP:MARKer<index>(?)

Description

Programs where on the frequency list the 2572A will generate a pulse, designated as Hop marker, or index point. The marker pulse is generated at the SYNC output connector.

Parameters

Name	Range	Type	Default	Description
<index>	1 to 5000	Numeric (integer only)	1	Programs a marker pulse at an index frequency hop position.

Response

The 2572A will return the present marker position.

Amplitude Hopping Modulation Programming

Use the following command for programming the amplitude hop parameters. Hop control is internal. The amplitude will hop from amplitude level to amplitude level at a rate determined by the dwell time value and controlled by a sequence of amplitudes in the HOP data table.

There are two hop modes: Fixed Dwell, where the rate of which the generator hops from amplitude level to amplitude level is constant and Variable Dwell, where the rate of which the generator hops from amplitude level to amplitude level is programmable for each hop.

The commands for programming the amplitude hopping function are described below. Note that the carrier waveform frequency (CW) setting is common to all modulation schemes.

AHOP:DWELl:MODe(FIXed|VARiable}(?)

Description

This selects between fixed or variable dwell-time for the amplitude hops. Select the fixed option if you want each amplitude level to dwell equally on each step. The variable option lets you program different dwell times for each amplitude hop. The 2572A output hops from one amplitude level to the next according to a sequence given in a hop table. The variable dwell time table contains dwell time data for each step however, the fixed dwell time table does not contain any dwell time information and therefore, if you select the fixed option, make sure your dwell time is programmed as required.

Parameters

Name	Type	Default	Description
FIXed	Discrete	FIX	Selects the fixed dwell time amplitude hops mode
VARiable	Discrete		Select the variable dwell time amplitude hops mode

Response

The 2572A will return FIX, or VAR depending on the selected dwell setting.

AHOP:DWELl<dwell_time>(?)

Description

This selects the dwell time for amplitude hops when the selected mode is Fixed dwell time hops. The dwell time table in this case does not contain the dwell time per step parameters and therefore, the value which is programmed with this command remains constant for the entire hop sequence.

Parameters

Name	Range	Type	Default	Description
<dwell_time>	200e-9 to 20	Numeric	200e-9	Programs dwell time for the fixed dwell-time amplitude hop function. The same dwell time will be

valid for each amplitude hop. Dwell time is programmed in units of s.

Response

The 2572A will return the present dwell time value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

AHOP:FIX:DATA<fix_hop_data>

Description

This command will download the data array that will cause the instrument to hop through the amplitude list. The dwell time for each amplitude list item is fixed and can be programmed using the HOP:DWEL command. Note that if you intend to program marker position, you must do it first and then load the amplitude hops list.

Below you can see how a hop table is constructed. The file sample below shows a list of 10 amplitudes. The 2572A will hop through this list, outputting the next amplitude each time it hops. Note that the carrier waveform is always sinewave and that the last cycle is always completed even if the dwell time is shorter than the period of the waveform. For example, if you program dwell time of 1ms and the amplitude step has frequency of 1Hz (1s period), the frequency step will last 1 second although the dwell time is 1ms.

Sample Amplitude Hops Data Array

0 1e0 2e0 3e0 4e+0 5e+0 100e-3 200e-3 300e-3 400e-3 500e-3

Parameters

Name	Type	Description
<fix_hop_data>	Double	Block of binary data that contains information of amplitude values.

AHOP:FIX:DATA<var_hop_data>

Description

This command will download the data array that will cause the instrument to hop through the amplitude list. The dwell time for each amplitude list item is variable and is supplied in the variable hop table data array. Note that the HOP:DWEL command has no effect on this sequence. Also note that if you intend to program marker position, you must do it first and then load the amplitude hops list.

Below you can see how a hop table is constructed. The file sample below shows a list of 10 amplitudes and their associated dwell times. The 2572A will hop through this list, outputting the next amplitude each time it hops. Note that the carrier waveform is always sinewave and that the last cycle is always completed even if the dwell time is shorter than the period of the waveform. For example, if you program dwell time of 1ms and the amplitude step has frequency of 1Hz (1s period), the amplitude step will last 1 second although the dwell time is 1ms.

Sample Amplitude Hops Data Array

1e0 100 2e0 2000 3e0 3000 4e0 4000 5e0 5000 6e0 6000 7e0 7000 8e0 8000 9e0 9000 10e0 10000

In the above example, the first number is the amplitude value and the second number is its dwell time. Therefore, only even number of sets can be located in this table.

Parameters

Name	Type	Description
<var_hop_data>	Double	Block of binary data that contains information of amplitude hop values and their respective dwell time.

AHOP:MARKer<index>(?)

Description

Programs where on the amplitude list the 2572A will generate a pulse, designated as Hop marker, or index point. The marker pulse is generated at the SYNC output connector.

Parameters

Name	Range	Type	Default	Description
<index>	1 to 5000	Numeric (integer only)	1	Programs a marker pulse at an index amplitude hop position.

Response

The 2572A will return the present marker position.

3D Modulation Programming

Use the following command for programming the 3D modulation parameters. 3D modulation requires an external utility to download the modulation coordinates into the 3D memory location. In case you intend to build your own 3D profiles, use the examples as given in the IVI drivers that are supplied with the 2572A.

The commands for programming the 3D function are described below. Note that the carrier waveform frequency (CW) setting is common to all modulation schemes.

3D:DATA<data_array>

Description

The 3D modulation allows simultaneous profiling of amplitude, frequency and phase. Amplitude profiles can be different for each channel however, frequency and phase are common to both channels. There are 30,000 waveform points that are allocated for the 3D modulation of which can be clocked using a 3D sample clock generator from 1 Hz to 2.5 MHz and thus generating up to 30,000 increments of simultaneous amplitude, frequency and phase profiles within the programmed period.

3D data must be downloaded to the 2572A before it can generate 3D profiles. The best way to generate such data would be by using the supplied ArbConnection program. Information how to use ArbConnection is given in a separate chapter of this manual. To generate the data, open the 3D Composer and create your profiles, then store the profiles with a known name. You can then use the stored files as data entry for the 3D data array input. Another way to create 3D data is by using the supplied IVI driver. The IVI driver has sample programs and software routines that show how to generate 3D data.

Regardless if you select to use ArbConnection or the IVI driver, you are always welcomed to contact the Tabor Electronics support center for information and help with this function.

Parameters

Name	Type	Description
<data_array>	Double	Block of binary data that contains information of the 3D profiles. Data contains amplitude sweeps for both channels as well as, frequency and phase sweep parameters for the 3D waveform.

3D:MARKer<index>(?)

Description

Programs where on the 3D profile the 2572A will generate a pulse, designated as 3Dop marker, or index point. The marker pulse is generated at the SYNC output connector.

Parameters

Name	Range	Type	Default	Description
<index>	1 to 30000	Numeric (integer only)	1	Programs a marker pulse at an index 3D position.

Response
The 2572A will return the present marker position.

3D:RASTer<3D_freq>(?)

Description
This command will set the sample clock frequency for the 3D modulation profiler. The 3D waveforms must be created using an external utility and downloaded to the 3D memory before this function can be used.

Parameters

Name	Range	Type	Default	Description
<3D_freq>	1 to 2.5e6	Numeric	1e6	Programs the sample clock frequency of the 3D modulating waveform in units of S/s.

Response
The 2572A will return the present sample clock of the 3D modulating waveform value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

PSK Modulation Programming

Use the following command for programming the PSK parameters. The following commands will be divided into two groups: PSK commands and (n)PSK commands. The PSK function can shift from start to shifted phase setting, within the range of 0 to 360°, at a frequency determined by the rate value and controlled by a sequence of bits in the PSK data table. The (n)PSK functions use pre-defined table settings. In case the standard table do not suit the application you can design your own (n)PSK data using the User PSK data table entry option. Note that the carrier waveform frequency (CW) setting is common to all modulation schemes.

PSK:TYPE{PSK|BPSK|QPSK|OQPSK|8PSK|16PSK|USER}(?)

Description

This selects between the various (n)PSK modulation schemes. Note that PSK and BPSK are almost identical functions except PSK can be programmed to shift from any phase to any phase and the BPSK toggles between two pre-determined values only – 0° and 180°.

Parameters

Name	Type	Default	Description
PSK	Discrete	PSK	Selects the PSK modulation function. In this mode, the instrument shifts from any phase to any phase as programmed by the PSK:PHAS and PSK:PHAS:SHIF commands. The rate of which the PSK toggles phase values is programmed using the PSK:RATE command.
BPSK	Discrete		Selects the Binary Phase Shift Keying (BPSK) modulation type. In this mode, the instrument shifts from 0° to 180° at a rate determined by the PSK:BAUD command and in a sequence as programmed by the PSK:DATA table.
QPSK	Discrete		Selects the Quadrature Phase Shift Keying (QPSK) modulation type. In this mode, the instrument responds to 2 input bits that correspond to four phases of the carrier wave. The symbols are shifts at a rate determined by the PSK:BAUD command and in a sequence as programmed by the PSK:DATA table.
OQPSK	Discrete		Selects the Offset Phase Shift Keying (OPSK) modulation type. The mapping is the same as for the QPSK except the element of I is moved first and then the element of Q is moved if the status changes from one to another. These two steps are carried out within the time of one step of QPSK. By shifting the movement of the Q element, the status can be changed without going through the origin even if a

		change of 180° occurs. Because one symbol period is calculated in two steps, an even value must be used for oversampling. The symbols are shifts at a rate determined by the PSK:BAUD command and in a sequence as programmed by the PSK:DATA table.
DQPSK	Discrete	Selects the Π/4-shifted Differentially encoded QPSK modulation type. In this mode, the symbol is located at the position where the phase is shifted from the current symbol position by 45° from the value of the next data symbol. The first symbol position is defined by QPSK. pre-defined values. Π/4DQPSK uses both the QPSK and another four-point table rotated by 45°.The symbols are shifts at a rate determined by the PSK:BAUD command and in a sequence as programmed by the PSK:DATA table.
8PSK	Discrete	Selects the 8-phase Shift Keying (8PSK) modulation type. In this mode, the instrument shifts through eight symbols with 3 bits. The symbols are shifts at a rate determined by the PSK:BAUD command and in a sequence as programmed by the PSK:DATA table.
16PSK	Discrete	Selects the 16-phase Shift Keying (16PSK) modulation type. In this mode, the instrument shifts through sixteen symbols with 4 bits. The symbols are shifts at a rate determined by the PSK:BAUD command and in a sequence as programmed by the PSK:DATA table.
USER	Discrete	Selects the User PSK modulation type. There are no pre-assigned symbols for this mode and therefore, the symbols must first be designed using the PSK:USER:DATA table. The number of bits are user definable. The symbols are shifts at a rate determined by the PSK:BAUD command and in a sequence as programmed by the PSK:DATA table.

Response

The 2572A will return PSK, BPSK, QPSK, OPSK, DPSK, 8PSK, 16PSK, or USER on the selected PSK type setting.

PSK:PHASe:<start_phase>(?)

Description

This programs the start phase of the carrier waveform. The start phase shifts when the pointer in the data array points to “0”.

Parameters

Name	Range	Type	Default	Description
<start_phase>	0 to 360	Numeric	0	Programs the start phase for the carrier waveform in units of degrees.

Response
The 2572A will return the present start phase value.

PSK:PHASe:SHIFted<shift_phase>(?)

Description
This programs the shifted phase. The phase shifts when the pointer in the data array points to “1”.

Parameters

Name	Range	Type	Default	Description
<shift_phase>	0 to 360	Numeric	180	Programs the shift phase for the carrier waveform in units of degrees.

Response
The 2572A will return the present shift phase value.

FSK:RATE<rate>(?)

Description
This allows the user to select PSK word rate. The word rate is the interval of which the bit streams in the PSK data array are clocked, causing the output phase to hop from start to shifted phase values and visa versa. Note that this command is dedicated for programming the PSK modulation function only.

Parameters

Name	Range	Type	Default	Description
<baud>	1 to 10e6	Numeric	10e3	Programs the rate of which the phase shifts from start to shifted frequency in units of Hz.

Response
The 2572A will return the present baud value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

PSK:DATA<psk_data>

Description
Loads the data stream that will cause the 2572A to hop from phase to phase. Data format is a string of "0" and "1" which define when the output generates the various phases. The size of the data word depends on the PSK function. For PSK and BPSK there are only two bits - "0" defines start phase,"1" defines shifted phase. 16PSK has 4 bits of which 0000 defines the first phase vector 0001 defines the second, 0000 the third and 1111 defines the 16th phase vector. Note that if you intend to program marker position, you must do it before you load the PSK data list.

Below you can see how an PSK data table and a 16PSK data table are constructed. The PSK data table sample below shows a list of 10 shifts. The 2572A will step through this list, outputting either start or shifted phases, depending on the data list: Zero will generate start phase and One will generate shifted phase. Note that the output waveform is always sinewave and that the last cycle is always completed. The 16PSK data array has 10 shifts as well except this time the shifts are a bit more complex.

Sample PSK Data Array
0 1 1 1 0 1 0 0 0 1

Sample 16PSK Data Array
0000 0100 1010 0111 1111 0001 0010 0111 0101 1111

Parameters

Name	Type	Description
<psk_data>	ASCII	Block of ASCII data that contains information for the generator when to step from one phase setting to another.

PSK:MARKer<index>(?)

Description
Programs where on the data stream the 2572A will generate a pulse, designated as PSK marker, or index point. The marker pulse is generated at the SYNC output connector. Note that if you intend to program marker position, you must do it before you load the PSK data list. The PSK:MARK command is common to all PSK modulation functions.

Parameters

Name	Range	Type	Default	Description
<index>	1 to 4000	Numeric (integer only)	1	Programs a marker pulse at an index bit position.

Response
The 2572A will return the present marker position.

PSK:BAUD<baud>(?)

Description
This allows the user to select (n)PSK baud. The baud is the interval of which the symbols stream in the (n)PSK data array as they are clocked with the baud generator. Note that this command is dedicated for programming the (n)PSK modulation function only and will have no effect on the PSK function.

Parameters

Name	Range	Type	Default	Description
<baud>	1 to 10e6	Numeric	10e3	Programs the baud of which the symbols stream in the (n)PSK data table. Baud is programmed in units of Hz.

Response
The 2572A will return the present baud value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

PSK:CARRier:STATe{OFF|ON|0|1}(?)

Description

This command will toggle the carrier waveform (CW) on and off. This command affects all (n)PSK function and has no effect on the PSK function. The carrier off function is especially useful as direct input for I & Q vector generators that need the digital information only and supply the carrier information separately.

Parameters

Range	Type	Default	Description
0-1	Discrete	1	Sets the carrier output on and off

Response

The 2572A will return 1 if the output is on, or 0 if the output is off.

PSK:USER:DATA<user_data>

Description

Loads the user phase data for the (n)PSK modulation function. The data contains a list of phase values within the range of 0° to 360°. The user data table is associated with the User PSK function only where symbols can be freely designed as non-standard vectors. After you enter the symbol data in this table, you must generate the symbol sequence using the PSK:DATA command, as shown earlier in this section.

Below you can see an example of the User PSK data table. The symbol index is automatically incremented from 0 to n so there is no need to provide index numbers in this table.

Sample User PSK Symbols Data Array

5.5 50 95 120 150 190.4 210 225.8 265 280 307 90.7 180.2

Parameters

Name	Type	Description
<user_data>	Binary	Block of binary data that contains phase information for the (n)PSK modulation function.

QAM Modulation Programming

Use the following command for programming the QAM parameters. The QAM commands allow selection of the (n)QAM type, programming the QAM baud, placing the marker position, turning the carrier waveform (CW) on and off function and designing data symbols.

QAM:TYPE{16QAM|64QAM|256QAM|USER}(?)

Description

This selects between the various (n)QAM modulation schemes. The 16QAM, 64QAM and 256QAM types have standard symbol configuration. In case you need a non-standard symbol constellations, use the User QAM to design your own symbol data.

Parameters

Name	Type	Default	Description
16QAM	Discrete	16QAM	Selects the 16 Quadrature Amplitude Modulation (16QAM) modulation type. 16QAM is a 4-level modulation method that uses 16 phases/amplitude symbols. The first two bits define at which event of the IQ plane the phase exists (00: upper right, 01: upper left, 10: lower left, 11: lower right) and the rest of the 2 bits defines the position of the symbol in each event. The instrument steps through these events in a sequence as listed in the QAM:DATA table and at a frequency which is programmed using the QAM:BAUD parameter.
64QAM	Discrete		Selects the 64 Quadrature Amplitude Modulation (64QAM) modulation type. 64QAM is a 6-level modulation method that uses 64 phases/amplitude symbols. The first two bits define at which event of the IQ plane the phase exists (00: upper right, 01: upper left, 10: lower left, 11: lower right) and the rest of the 4 bits defines the position of the symbol in each event. The instrument steps through these events in a sequence as listed in the QAM:DATA table and at a frequency which is programmed using the QAM:BAUD parameter.
256QAM	Discrete		Selects the 256 Quadrature Amplitude Modulation (256QAM) modulation type. 64QAM is a 8-level modulation method that uses 256 phases/amplitude symbols. The first two bits define at which event of the IQ plane the phase exists (00: upper right, 01: upper left, 10: lower left, 11: lower right) and the rest of the 6 bits defines the position of the symbol in each

		event. The instrument steps through these events in a sequence as listed in the QAM:DATA table and at a frequency which is programmed using the QAM:BAUD parameter.
USER	Discrete	Selects the User QAM modulation type. There are no pre-assigned symbols for this mode and therefore, the symbols must first be designed using the QAM:USER:DATA table. The instrument will then step through the programmed symbols in a sequence as listed in the QAM:DATA table and at a frequency which is programmed using the QAM:BAUD parameter.

Response
The 2572A will return 16QAM, 64QAM, 256QAM, or USER depending on the selected QAM type setting.

QAM:BAUD<baud>(?)

Description
This allows the user to select (n)QAM baud. The baud is the interval of which the symbols stream in the (n)QAM data array as they are clocked with the baud generator.

Parameters

Name	Range	Type	Default	Description
<baud>	1 to 10e6	Numeric	10e3	Programs the baud of which the symbols stream in the (n)QAM data table. Baud is programmed in units of Hz.

Response
The 2572A will return the present baud value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

QAM:CARRier:STATe{OFF|ON|0|1}(?)

Description
This command will toggle the carrier waveform (CW) on and off. The carrier off function is especially useful as direct input for I & Q vector generators that need the digital information only and supply the carrier information separately.

Parameters

Range	Type	Default	Description
0-1	Discrete	1	Sets the carrier output on and off

Response
The 2572A will return 1 if the output is on, or 0 if the output is off.

QAM:DATA<qam_data>

Description

Loads the data stream that will cause the 2572A to hop from vector to vector. Data format is a string of "0's" and "1's" which define when the output generates the various vectors. The size of the data word depends on the QAM type. For 16QAM there are only four bits and for 256QAM there are 8 bits. Note that if you intend to program marker position, you must do it before you load the PSK data list.

Below you can see how a 16QAM data table is constructed. The 16QAM data table sample below shows a list of 10 shifts. The 2572A will step through this list, outputting the various vectors in a sequence as defined by the data list.

Sample 16QAM Data Array

0000 0100 1010 0111 1111 0001 0010 0111 0101 1111

Parameters

Name	Type	Description
<qam_data>	ASCII	Block of ASCII data that contains information for the generator when to step from one vector setting to another.

QAM:MARKer<index>(?)

Description

Programs where on the data stream the 2572A will generate a pulse, designated as QAM marker, or index point. The marker pulse is generated at the SYNC output connector. Note that if you intend to program marker position, you must do it before you load the QAM data list. The QAM:MARK command is common to all QAM modulation types.

Parameters

Name	Range	Type	Default	Description
<index>	1 to 4000	Numeric (integer only)	1	Programs a marker pulse at an index bit position.

Response

The 2572A will return the present marker position.

Run Mode Commands

The Run Mode Commands group is used to synchronize device actions with external events. These commands control the trigger modes of the Model 2572A. The generator can be placed in Triggered, Gated or Burst mode. Trigger source is selectable from an external source, an internal re-trigger generator or a software trigger. Optional nodes were omitted from these commands. The Run Mode settings affect all waveform shapes equally except when using the modulated waveforms. In the case of modulated waveform, the output idles on the carrier waveform until stimulated to output a modulation cycle or burst of cycles. Additional information on the run mode options and how the 2572A behaves in the various run mode options is given in Chapter 3. Factory defaults after *RST are shown in bold typeface. Parameter low and high limits are given where applicable.

Table 5-8, Run Mode Commands

Keyword	Parameter Form	Default
:INITiate		
[:IMMediately]		
:CONTinuous	OFF | ON | 0 | 1	1
:TRIGger		
[:IMMediate]		
:BURSt		
[:STATe]	OFF | ON | 0 | 1	0
:COUNt	1 to 1000000	1
:DELay		
[:STATe]	OFF | ON | 0 | 1	0
:TIMe	200e-9 to 20	200e-9
:GATE		
[:STATe]	OFF | ON | 0 | 1	0
:LEVel	-5 to 5	1.6
:SOURce		
[:ADVance]	BUS | EXTernal | MIXed	EXT
:SLOPe	POSitive | NEGative	POS
:RETRigger		
[:STATe]	OFF | ON | 0 | 1	0
:TIMe	200e-9 to 20	200e-9

INITiate:CONTinuous{OFF|ON|0|1}(?)

Description

This command will set the output in continuous operation and interrupted operation. The run mode commands will affect the 2572A only after it will be set to interrupted operation.

Parameters

Name	Type	Default	Description
ON	Discrete	ON	Disables all interrupted modes and forces the continuous run mode
OFF	Discrete		Select the interrupted run mode. While in this switch option, you can program the 2572A to operate in triggered, gated, or counted burst run modes.

Response

The 2572A will return OFF, or ON depending on the selected option.

TRIGger:BURSt{OFF|ON|0|1}(?)

Description

This command will toggle the counted burst run mode on and off. This command will affect the 2572A only after it will be set to INIT:CONT OFF.

Parameters

Name	Type	Default	Description
OFF	Discrete	OFF	Turns the burst run mode off.
ON	Discrete		Enables the counted burst run mode. Burst count is programmable using the TRIG:BURS:COUN command.

Response

The 2572A will return OFF, or ON depending on the selected option.

TRIGger:BURSt:COUNt<burst>(?)

Description

This function sets the number of cycles when the Burst Mode is on. Use the init:cont off;:trig:burs on commands to select the Burst Mode.

Parameters

Name	Range	Type	Default	Description
<burst>	1 to 1M	Numeric (integer only)	1	Programs the burst count.

Response

The 2572A will return the present burst count value.

TRIGger:DELay{OFF|ON|0|1}(?)

Description
This command will toggle the delayed trigger mode on and off. This command will affect the 2572A only after it will be set to INIT:CONT OFF.

Note: System delay must always be considered when using an external trigger. System delay is measured from a valid trigger input to the transition of the first waveform point. It has a fixed period that adds to the programmed trigger delay value. Consult Appendix A for the system delay specification.

Parameters

Name	Type	Default	Description
OFF	Discrete	OFF	Turns the delayed trigger mode off.
ON	Discrete		Enables the delayed trigger mode.

Response
The 2572A will return OFF, or ON depending on the selected option.

TRIGger:DELayTime<time>(?)

Description
The trigger delay time parameter defines the time that will elapse from a valid trigger signal to the initiation of the first output waveform. Trigger delay can be turned ON and OFF using the trig:del command. The trigger delay time command will affect the generator only after it has been programmed to operate in interrupted run mode. Modify the 2572A to interrupted run mode using the init:cont off command.

Parameters

Name	Range	Type	Default	Description
<time>	200e-9 to 20	Numeric	200e-9	Programs the trigger delay time.

Response
The 2572A will return the present trigger delay time value.

TRIGger:GATE{OFF|ON|0|1}(?)

Description
This command will toggle the gate run mode on and off. This command will affect the 2572A only after it will be set to INIT:CONT OFF.

Parameters

Name	Type	Default	Description
OFF	Discrete	OFF	Turns the gate run mode off.
ON	Discrete		Enables the gated run mode.

Response
The 2572A will return OFF, or ON depending on the selected option.

TRIGger:LEVel<level>(?)

Description
The trigger level command sets the threshold level at the trigger input connector. The trigger level command will affect the generator only after it has been programmed to operate in interrupted run mode. Modify the 2572A to interrupted run mode using the init:cont off command.

Parameters

Name	Range	Type	Default	Description
<level>	-5 to +5	Numeric	1.6	Programs the trigger level. The value affects the rear panel input only.

Response
The 2572A will return the present burst count value.

TRIGger:SOURce:ADVance{EXTernal|BUS|MIXed}(?)

Description
This selects the source from where the 2572A will be stimulated to generate waveforms. The source advance command will affect the generator only after it has been programmed to operate in interrupted run mode. Modify the 2572A to interrupted run mode using the init:cont off command.

Parameters

Name	Type	Default	Description
EXTernal	Discrete	EXT	Activates the rear panel TRIG IN input and the front panel MAN TRIG button. Either a front panel button push or a legal signal which will be applied to the rear panel input will stimulate the 2572A to generate waveforms. BUS commands are ignored.
BUS	Discrete		Selects the remote controller as the trigger source. Only software commands are accepted while rear and front panel signals are ignored
MIXed	Discrete		Hardware triggers are ignored until. First output cycle is initiated using a software command. Subsequent output cycles are initiated using one of the following: rear panel TRIG IN, or front panel MAN TRIG button.

Response
The 2572A will return EXT, BUS, or MIX depending on the selected trigger source advance setting.

TRIGger:SLOPe{POSitive|NEGative}(?)

Description
The trigger slope command selects the sensitive edge of the trigger signal that is applied to the TRIG IN

connector. The Model 2572A can be made sensitive to either the positive or negative transitions. Positive going transitions will trigger the generator when the POS option is selected. Negative transitions will trigger the generator when the NEG option is selected. In Gated mode, two transitions in the same direction are required to gate on and off the output. The trigger slope command will affect the generator only after it has been programmed to operate in interrupted run mode. Modify the 2572A to interrupted run mode using the init:cont off command.

Parameters

Name	Type	Default	Description
POSitive	Discrete	POS	Selects the positive going edge.
NEGative	Discrete		Selects the negative going edge.

Response

The 2572A will return POS, or NEG depending on the selected trigger slope setting.

RETRigger{OFF|ON|0|1}(?)

Description

This command will toggle the re-trigger mode on and off. This command will affect the 2572A only after it will be set to INIT:CONT OFF.

Parameters

Name	Type	Default	Description
OFF	Discrete	OFF	Turns the re-trigger mode off.
ON	Discrete		Enables the re-trigger mode.

Response

The 2572A will return OFF, or ON depending on the selected option.

RETRigger:Time<time>(?)

Description

This parameter specifies the amount of time that will elapse between the end of the delivery of the waveform cycle and the beginning of the next waveform cycle. Re-trigger can be initiated from any of the selected advance options. The re-trigger command will affect the generator only after it has been programmed to operate in interrupted run mode. Modify the 2572A to interrupted run mode using the init:cont off command.

Parameters

Name	Range	Type	Default	Description
<time>	200e-9 to 20	Numeric	200e-9	Programs the re-trigger period.

Response

The 2572A will return the present re-trigger period value.

Auxiliary Commands

The auxiliary commands control auxiliary functions that are not directly related to the main function of the arbitrary waveform generator however, constitute an important part of operating the 2572A. These commands can transform the 2572A into a stand-alone pulse generator, or counter/timer. Also use these commands to generate half cycle waveforms. The auxiliary commands are listed in Table 5-8. Factory defaults after *RST are shown in bold typeface. Parameter low and high limits are given where applicable.

Table 5-9, Auxiliary Commands

Keyword	Parameter Form	Default
	Digital Pulse Commands	
:AUXiliary		
:PULSe		
:DELay	0 to 10	0
:DOUBle		
[:STATe]	OFF | ON | 0 | 1	0
:DELay	0 to 1e3	1e-3
:HIGH	0 to 1e3	1e-3
:LEVel		
:HIGH	-7.992 to 8	5
:LOW	-8 to 7.992	0
:PERiod	80e-9 to 1e6 (80e-9 to 2e6 with the 2 M option)	10e-3
:POLARity	NORMal | COMPlemented | INVerted	NORM
:STATe	OFF | ON | 0 | 1	1
:TRANsition		
[:LEADing	0 to 1e3	1e-3
:TRAiling]	0 to 1e3	1e-3
	Counter/Timer Commands	
:COUNter		
:DISPlay		0
:MODe	NORMal | HOLD	NORM
:GATe		0
[:TIMe]	100e-6 to 1	1
:FUNCtion	FREQuency | PERiod | APERiod | PULSe | GTOTalize | ITOTalize	FREQ
:READ		
:RESet		
	Half Cycle Commands	
:HALFcycle		
:DELay	200e-9 to 20	1e-6
:DCYCle	0 to 99.99	50
:FREQuency	10e-3 to 1e6	1e6
:PHASe	0 to 360	0
:SHAPe	SINusoid | TRIangle | SQUare	SIN

Digital Pulse Programming

Use the following command for programming the pulse parameters. The pulse is created digitally however, it closely simulates an analog pulse generator so pulse parameters are programmed just as they would be programmed on a dedicated pulse generator instrument. Just bear in mind that since this is a digital instrument, there are some limitations to the pulse design that evolve from the fact that the best resolution is one sample clock interval and also, keep in mind that the pulse is created digitally in the arbitrary memory and therefore, its smallest incremental step has a maximum value limitation as specified in Appendix A.

AUXiliary:PULse:DELay<delay>(?)

Description

This command will program the delayed interval of which the output idles on the low level amplitude until the first transition to high level amplitude.

Parameters

Name	Range	Type	Default	Description
<delay>	0 to 10	Numeric	0	Will set the delay time interval in units of seconds. Note that the sum of all parameters, including the pulse delay time must not exceed the programmed pulse period and therefore, it is recommended that the pulse period be programmed first and then all other pulse parameters.

Response

The 2572A will return the pulse delay value in units of seconds.

AUXiliary:PULse:DOUBle{OFF|ON|0|1}(?)

Description

This command will turn the double pulse mode on and off. The double pulse mode duplicates the first pulse parameters at a delayed interval set by the double pulse delay value.

Parameters

Range	Type	Default	Description
0-1	Discrete	0	Sets the double pulse mode on and off

Response

The 2572A will return 0, or 1 depending on the present double mode setting.

AUXiliary:PULse:DOUBle:DELay<d_delay>(?)

Description
This command will program the delay between two adjacent pulses when the double mode is selected. Otherwise, the double pulse delay has no effect on the pulse structure.

Parameters

Name	Range	Type	Default	Description
<d_delay>	0 to 1e3	Numeric	2e-3	Will set the delay between two adjacent pulses for the double pulse mode in units of seconds. Note that the sum of all parameters, including the pulse delay time must not exceed the programmed pulse period and therefore, it is recommended that the pulse period be programmed before all other pulse parameters.

Response
The 2572A will return the present double pulse delay value in units of seconds.

AUXiliary:PULse:HIGH<high>(?)

Description
This command will program the interval the pulse will dwell on the high level value. Although they have similar interpretation, the high time and pulse width are significantly different. The standard terminology of pulse width defines the width of the pulse at the mid-point of its peak-to-peak amplitude level. Therefore, if you change the rise and fall time, the pulse width is changing accordingly. The digital pulse high time parameter defines how long the pulse will dwell on the high level so even if you change the rise and fall times, the high time remains constant. The pulse high time is programmed in units of seconds.

Parameters

Name	Range	Type	Default	Description
<high>	0 to 1e3	Numeric	1e-3	Will set the width of the high time for the pulse shape in units of seconds. Note that the sum of all parameters, including the high time must not exceed the programmed pulse period and therefore, it is recommended that the pulse period be programmed before all other pulse parameters.

Response
The 2572A will return the present high time value in units of seconds

AUXiliary:PULse:LEVel:HIGH<high>(?)

Description
This command will program the high level for the pulse shape. Note that the same level is retained for the second pulse in the double pulse mode.

Parameters

Name	Range	Type	Default	Description
<high>	-7.992 to 8	Numeric	5	Will set the pulse high level in units of volts. Note that the high level setting must be higher than the low level setting. Also note that high to low level value must be equal or larger than 8 mV.

Response

The 2572A will return the present low level value in unit of volts.

AUXiliary:PULse:LEVel:LOW<low>(?)

Description

This command will program the phase offset between two adjacent instruments. Normally this command should be used on the slave unit. The phase offset control provides means of generating multiple signals with phase offset between them.

Parameters

Name	Range	Type	Default	Description
<low>	-8 to 7.992	Numeric	0	Will set the pulse low level in units of volts. Note that the low level setting must be smaller than the high level setting. Also note that low to high level value must be equal or larger than 8 mV.

Response

The 2572A will return the present high level value in unit of volts.

AUXiliary:PULse:PERiod<period>(?)

Description

This command will program the pulse repetition rate (period). Note that the sum of all parameters, including the pulse delay, rise, high and fall times must not exceed the programmed pulse period and therefore, it is recommended that the pulse period be programmed first before all other pulse parameters. Note that by selecting the double pulse mode, the pulse period remains unchanged.

Parameters

Name	Range	Type	Default	Description
<period>	80e-9 to 1e6	Numeric	10e-3	Will program the period of the pulse waveform in units of seconds. The maximum period is extended to 2e6 when the 2 Meg memory option is installed.

Response

The 2572A will return the present pulse period value in units of seconds.

AUXiliary:PULse:POLarity{NORMal||COMPlemented|INVerted (?)

Description
This command will program the polarity of the pulse in reference to the base line level. The polarity options are: Normal, where the pulse is generated exactly as programmed; Inverted, where the pulse is inverted about the 0 level base line; and Complemented, where the pulse is inverted about its mid amplitude level.

Parameters

Name	Type	Default	Description
NORMal	Discrete	NORM	Programs normal pulse output
COMPlemeted	Discrete		Programs complemented pulse output
INVerted	Discrete		Programs an inverted pulse output

Response
The 2572A will return NORM, COMP or INV depending on the present polarity setting

AUXiliary:PULse:STATe{OFF|ON|0|1}(?)

Description
Use this command to disable a specific channel from calculating pulse parameters. This is specifically useful for accelerating pulse computation for channels that are needed for pulse generation.

Parameters

Range	Type	Default	Description
0-1	Discrete	0	Toggles pulse computation for a specific channel on and off

Response
The 2572A will return 0, or 1 depending on the present state setting.

AUXiliary:PULse:TRANsition<rise>(?)

Description
This command will program the interval it will take the pulse to transition from its low to high level settings. The parameter is programmed in units of seconds.

Parameters

Name	Range	Type	Default	Description
<rise>	0 to 1e3	Numeric	1e-3	Will set the rise time parameter. Note that the sum of all parameters, including the rise time must not exceed the programmed pulse period and therefore, it is recommended that the pulse period be programmed before all other pulse parameters.

Response
The 2572A will return the present rise time value in units of seconds.

AUXiliary:PULse:TRANsition:TRAiling<fall>(?)

Description
This command will program the interval it will take the pulse to transition from its high to low level settings. The parameter is programmed in units of seconds.

Parameters

Name	Range	Type	Default	Description
<fall>	0 to 1e3	Numeric	1e-3	Will set the fall time parameter. Note that the sum of all parameters, including the fall time must not exceed the programmed pulse period and therefore, it is recommended that the pulse period be programmed before all other pulse parameters.

Response
The 2572A will return the present fall time value in units of seconds.

Counter/Timer Programming

Use the following command for programming the counter/timer measuring function and other parameters. The counter/timer function is created digitally however, it closely simulates a stand-alone counter/timer so its functions are programmed just as they would be programmed on a dedicated instrument. The specifications and limitations of the counter/timer are specified in Appendix A.

COUNter:DISPlay:MODe{NORMal|HOLD(?)

Description
This command will program the display time mode for the counter/timer. The two modes are normal for continuous display readings and hold for single reading after arming the counter input.

Parameters

Name	Type	Default	Description
NORMal	Discrete	NORM	Will select the continuous reading mode. In this case, the counter input is self-armed, which means that every valid signal that is sensed at the trigger input connector will be counted and measured processed and results placed on the interface port.
HOLD	Discrete		Will select the single reading mode. In this case, the counter input is armed first and the first valid signal that is sensed at the trigger input connector will be counted and measured and its result processed and placed on the interface port.

Response
The 2572A will return NORM, INV or COMP depending on the present polarity setting

COUNter:GATe<interval>(?)

Description
This command will program the gate time interval for frequency, period averaged and totalize in gated mode. Measurements will be taken only after the input has been armed and valid signal available at the input connector. Notice however, that the gate time internal must be larger than the period of the measure signal.

Parameters

Name	Range	Type	Default	Description
<interval>	100e-6 to 1	Numeric	1	Will program the gate time interval in units of seconds. In continuous mode, the counter is self-armed and therefore every valid signal at the counter input will open the gate and initiate a measurement

cycle. In hold mode, the counter must be armed before the gate can open. Always make sure the programmed gate time interval is larger than the period of the measured signal.

Response

The 2572A will return the present gate time value in units of seconds.

COUNter:FUNCtion{FREQuency|PERiod|APERiod|PULSe|ITOTalize|GTOTalize(?)

Description

This command will program the measurement function for the counter/timer. Each measurement can be set up with its gate time (where applicable) and display mode.

Parameters

Name	Type	Default	Description
FREQuency	Discrete	FREQ	Will select the frequency measurement function. Frequency is measured on continuous signal only. The result of the frequency measurement has gate-dependent resolution. The 2572A displays 7 digits of frequency reading in one second of gate time. If the gate time is decreased, the number of displayed digits decreases proportionally to the gate time interval. Reduce the gate time when you want to accelerate the reading process however, always make sure that the period of the signal is smaller than the gate time setting.
PERiod	Discrete		Will select the period measurement function. Period can be measured on either continuous or non-repetitive signals. Since the period of the signal is directly proportional to the gating time, the number of displayed digits decreases proportionally to the period of the signal. If you need to have more resolution and you signal is repetitive, use the period averaged measurement function. The best resolution in period measurements is 100 ns.
APERiod	Discrete		Will select the period averaged measurement function. Period averaged can be measured continuous signals only. In fact, this is the inverse function of frequency and therefore, gate time determines the resolution of the reading. Reduce the gate time when you want to accelerate the reading process however, always make sure that the period of the signal is smaller than the gate time setting.
PULSe	Discrete		Will select the pulse width measurement function. Pulse width can be measured on either continuous or non-repetitive signals. Since the width of the signal is directly proportional to the gating time, the number of displayed digits decreases proportionally to the pulse width of the

		signal. The best resolution in period measurements is 10 ns.
GTOTalize	Discrete	Will select the gated totalize measurement function. In this mode, the gate opens when the first valid signal is sensed at the counter input and closed at the end of the gate time interval. The number of pulses that enter during the gate time interval is displayed until cleared and the counter is armed for the next measurement cycle. The counter can accumulate 8 digits before it will overflow. An overflow indication is available.
ITOTalize	Discrete	Will select the totalize measurement function. In this mode, the gate opens when the first valid signal is sensed at the counter input and remains open until programmed otherwise. Pulse are counted and displayed continuously until intervened externally. The counter can accumulate 8 digits before it will overflow. An overflow indication is available.

Response
The 2572A will return FREQ, PER, APER, PULS, GTOT or ITOT depending on the present measurement function setting.

COUNter:READ

Description
This command will interrogate the counter/timer for a reading. Note that the read command must follow a valid gate time interval otherwise reading will not be available and the interface bus will be held until the measurement cycle has been completed and result available to be read.

Response
The 2572A will return the result of the present measurement function reading. The returned value will be in standard scientific format (for example: 10 MHz would be returned as 10e6 – positive numbers are unsigned).

COUNter:RESet

Description
This command will reset the counter/timer and arm the instrument for its next reading.

Half Cycle Programming

Use the following command for programming the half cycle functions and their associated parameters. There are three half cycle functions: Sine, Triangle and Square. The specifications and limitations of the half cycle functions are specified in Appendix A.

AUXiliary:HALFcycle:DELay<delay>(?)

Description

This command will program the interval of which the output idles between half cycles. The idle level is normally 0 V except if programmed otherwise with the volt:offs command.

Parameters

Name	Range	Type	Default	Description
<delay>	200e-9 to 20	Numeric	1e-6	Will set the delay time interval between half cycles in units of seconds.

Response

The 2572A will return the half cycle delay value in units of seconds.

AUXiliary:HALFcycle:DCYCle<duty_cycle>(?)

Description

This command will program the duty cycle of the square waveform when the half cycle square shape is selected. Note that this command has no effect on the standard square wave duty cycle.

Parameters

Name	Range	Type	Default	Description
<duty_cycle>	0 to 99.99	Numeric	50	Will set the delay time interval between half cycles in units of seconds.

Response

The 2572A will return the square wave duty cycle value in units of percent.

AUXiliary:HALFcycle:FREQuency<freq>(?)

Description

This command programs the frequency of the half cycle waveforms in units of hertz (Hz). It has no affect on the frequency of other waveform functions.

Parameters

Name	Range	Type	Default	Description
<freq>	10e-3 to 1e6	Numeric	1e6	Will set the frequency of the half cycle waveform in units of Hz. This parameter does not affect the frequency of other waveform functions.

Response

The 2572A will return the present half cycle frequency value. The returned value will be in standard scientific format (for example: 100mHz would be returned as 100e-3 – positive numbers are unsigned).

AUXiliary:HALFcycle:PHASe<phase>(?)

Description

This command programs the start phase of the half cycle sine and triangle waveform. This command has no affect on other waveform functions.

Parameters

Name	Range	Type	Default	Description
<phase>	0 to 360	Numeric	0	Programs the start phase parameter for the half cycle sine and triangle waveforms in units of degrees. The phase can be programmable with resolution of 0.05° throughout the entire frequency range of the half cycle function.

Response

The 2572A will return the present start phase value.

AUXiliary:HALFcycle:SHAPe{SINusoid|TRIangle|SQUare}(?)

Description

This command defines the type of half cycle waveform that will be available at the output connector.

Parameters

Name	Type	Default	Description
SINusoid	Discrete	SIN	Selects the half cycle sine waveform.
TRIangle	Discrete		Selects the half cycle triangular waveform.
SQUare	Discrete		Selects the half cycle square waveform.

Response

The 2572A will return SIN, TRI, or SQU depending on the present 2572A setting

System Commands

The system-related commands are not related directly to waveform generation but are an important part of operating the 2572A. These commands can reset or test the instrument, or query the instrument for system information.

Table 5-10, System Commands Summary

Keyword	Parameter Form	Default
:RESet (*RST)		
:SYSTem		
:ERRor?		
:LOCal		
:VERSion?		
:INFOrmation		
:CALibration?		
:MODel?		
:SERial?		
:IP		
[:ADDRess]	<IP_address>	
:MASK	<mask>	
:GATeway	<gate_way>	
:BOOTp	OFF | ON | 0 | 1	0
HOSTname:	<host_name>	
:KEEPalive		
:STATe	OFF | ON | 0 | 1	1
:TIMEout	2 to 300	45
PROBes	2 to 10	2
:TEMPerature?		

RESet, or *RST

Description
This command will reset the 2572A to its factory defaults.

SYSTem:ERRor?

Description
Query only. This query will interrogate the 2572A for programming errors.

Response
The 2572A will return error code. Error messages are listed later in this manual.

SYSTem:LOCal

Description
This command will deactivate the active interface and will restore the 2572A to local (front panel) operation.

SYSTem:VERSion?

Description
Query only. This query will interrogate the 2572A for its current firmware version. The firmware version is automatically programmed to a secure location in the flash memory and cannot be modified by the user except when performing firmware update.

Response
The 2572A will return the current firmware version code in a format similar to the following: 1.35

SYSTem:INFormation:CALibration?

Description
Query only. This query will interrogate the instrument for its last calibration date.

Response
The generator will return the last calibration date in a format similar to the following: 24 Oct 2006 (10 characters maximum).

SYSTem:INFormation:MODel?

Description
Query only. This query will interrogate the instrument for its model number in a format similar to the following: 2572A. The model number is programmed to a secure location in the flash memory and cannot be modified by the user.

Response
The generator will return its model number either 2571A or 2572A.

SYSTem:INFormation:SERial?

Description
Query only. This query will interrogate the instrument for its serial number. The serial number is programmed to a secure location in the flash memory and cannot be modified by the user.

Response
The generator will return its serial number in a format similar to the following: 000000451 (10 characters maximum).

SYSTem:IP<ip_adrs>(?)

Description

This command programs the IP address for LAN operation. The programming must be performed from either USB or GPIB controllers.

Parameters

Name	Range	Type	Description
<ip_adrs>	0 to 255	String	Programs the IP address for LAN operation. Programming must be performed from USB or GPIB interfaces. Current IP address can be observed on LAN Properties front panel display.

Response

The 2572A will return the present IP address value similar to the following: 192.168.0.6

SYSTem:IP:MASK<mask_adrs>(?)

Description

This command programs the subnet mask address for LAN operation. The programming must be performed from either USB or GPIB controllers.

Parameters

Name	Range	Type	Description
<mask_adrs>	0 to 255	String	Programs the subnet mask address for LAN operation. Programming must be performed from USB or GPIB interfaces. Current subnet mask address can be observed on LAN Properties front panel display.

Response

The 2572A will return the present IP address value similar to the following: 255.255.255.0

SYSTem:IP:BOOTp{OFF|ON|0|1}(?)

Description

Use this command to toggle BOOTP mode on and off.

Parameters

Range	Type	Default	Description
0-1	Discrete	0	Toggles BOOTP mode on and off. When on, the IP address is administrated automatically by the system

Response

The 2572A will return 0, or 1 depending on the present BOOTP setting.

SYSTem:IP:GATeway<gate_adrs>(?)

Description

This command programs the gateway address for LAN operation. The programming must be performed from either USB or GPIB controllers.

Parameters

Name	Range	Type	Description
<gate_adrs>	0 to 255	String	Programs the gateway address for LAN operation. Programming must be performed from USB or GPIB interfaces. Current gateway address can be observed on LAN Properties front panel display.

Response

The 2572A will return the present IP address value similar to the following: 0.0.0.0

SYSTem:IP:HOSTname<name>(?)

Description

This command programs the host name address for LAN operation. The programming is performed in the factory and it is highly suggested that users do not change the host name without first consulting a Tabor customer service person.

Parameters

Name	Type	Description
<name>	String	Programs the host name for LAN operation.

Response

The 2572A will return a string containing the host name. String length is 16 characters.

SYSTem:KEEPalive:STATe{OFF|ON|0|1}(?)

Description

Use this command to toggle the keep alive mode on and off. The keep alive mode assures that LAN connection remains uninterrupted throughout the duration of the LAN interfacing.

Parameters

Range	Type	Default	Description
0-1	Discrete	1	Toggles the keep alive mode on and off. When on, the 2572 constantly checks for smooth LAN connection at intervals programmed by the syst:keep:time command. The LAN will be probed as many times as programmed by syst:keep:prob parameter to check if there is an interruption in the LAN communication. When communication fails, the 2572A reverts automatically to local (front panel) operation.

Response

The 2572A will return 0, or 1 depending on the present keep alive setting.

SYSTem:KEEPalive:TIMEout<time_out>(?)

Description
This command programs the keep alive time out. The keep alive mode assures that LAN connection remains uninterrupted throughout the duration of the LAN interfacing.

Parameters

Name	Range	Type	Default	Description
<time_out>	2 to 300	Numeric	45	Programs the keep alive time out in units of seconds. The time out period is initiated when the LAN is idle for more than the time out period. The LAN will be probed as many times as programmed by syst:keep:prob parameter to check if there is an interruption in the LAN communication. When communication fails, the 2572A reverts automatically to local (front panel) operation.

Response
The 2572A will return the present keep alive time out value.

SYSTem:KEEPalive:PROBes<probs>(?)

Description
This command programs the number of probes that are used by the keep alive sequence. The keep alive mode assures that LAN connection remains uninterrupted throughout the duration of the LAN interfacing.

Parameters

Name	Range	Type	Default	Description
<time_out>	2 to 10	Numeric	2	Programs the number of probes that are used by the keep alive sequence. The time out period is initiated when the LAN is idle for more than the time out period and the LAN will be probed as many times as programmed by this parameter to check if there is an interruption in the LAN communication. When communication fails, the 2572A reverts automatically to local (front panel) operation.

Response
The 2572A will return the present keep alive number of probes.

SYSTem:TEMPerature?

Description
Query only. This query will interrogate the 2572A for its internal temperature reading.

Response
The 2572A will return the current internal temperature value in units of degrees C, similar to the following: 40.00

IEEE-STD-488.2 Common Commands and Queries

Since most instruments and devices in an ATE system use similar commands that perform similar functions, the IEEE-STD-488.2 document has specified a common set of commands and queries that all compatible devices must use. This avoids situations where devices from various manufacturers use different sets of commands to enable functions and report status. The IEEE-STD-488.2 treats common commands and queries as device dependent commands. For example, *TRG is sent over the bus to trigger the instrument. Some common commands and queries are optional, but most of them are mandatory.

The following is a complete listing of all common-commands and queries, which are used by the 2572A

***CLS** - Clear the Status Byte summary register and all event registers.

***ESE** <enable_value> - Enable bits in the Standard Event enable register. The selected bits are then reported to the status byte.

***ESE?** - Query the Standard Event enable register. The generator returns a decimal value, which corresponds to the binary-weighted sum of all bits, set in the register.

***ESR?** - Query the Standard Event register. The generator returns a decimal value, which corresponds to the binary-weighted sum of all bits, set in the register.

***IDN?** - Query the generator's identity. The returned data is organized into four fields, separated by commas. The generator responds with its manufacturer and model number in the first two fields, and may also report its serial number and options in fields three and four. If the latter information is not available, the device must return an ASCII 0 for each. For example, Model 2572A response to *IDN? is:

Tabor,2572A,0,1.0

***OPC** - Set the "operation complete" bit (bit 0) in the Standard Event register after the previous commands have been executed.

***OPC?** - Returns "1" to the output buffer after all the previous commands have been executed. *OPC? is used for synchronization between a controller and the instrument using the MAV bit in the Status Byte or a read of the Output Queue. The *OPC? query does not affect the OPC Event bit in the Standard Event Status Register (ESR). Reading the response to the ***OPC?** query has the advantage of removing the complication of dealing with service requests and multiple polls to the instrument. However, both the system bus and the controller handshake are in a temporary hold-off state while the controller is waiting to read the *OPC? query response.

***OPT?** - Returns the value "0" for a 2572A with no options.

***RST** - Resets the generator to its default state. Default values are listed in Table 5-1.

***SRE** <enable_value> - Enables bits in the Status Byte enable register.

***SRE?** - Query the Status Byte enable register. The generator returns a decimal value in the range of 0 to 63 or 128 to 191 since bit 6 (RSQ) cannot be set. The binary-weighted sum of the number represents the value of the bits of the Service Request enable register.

***STB?** - Query the Status Byte summary register. The *STB? command is similar to a serial poll but is processed like any other instrument command. The *STB? command returns the same result as a serial poll, but the "request service" bit (bit 6) is not cleared if a serial poll has occurred.

***TRG** - Triggers the generator from the remote interface. This command effects the generator if it is first placed in the Trigger or Burst mode of operation and the trigger source is set to "BUS".

***WAI** – Wait for all pending operations to complete before executing any additional commands over the interface.

The SCPI Status Registers

The Model 2572A uses the Status Byte register group and the Standard Event register group to record various instrument conditions. Figure 5-1 shows the SCPI status system.

An Event Register is a read-only register that reports defined conditions within the generator. Bits in an event register are latched. When an event bit is set, subsequent state changes are ignored. Bits in an event register are automatically cleared by a query of that register or by sending the *CLS command. The *RST command or device clear does not clear bits in an event register. Querying an event register returns a decimal value, which corresponds to the binary-weighted sum of all bits, set in the register.

An Event Register defines which bits in the corresponding event register are logically ORed together to form a single summary bit. The user can read from and write to an Enable Register. Querying an Enable Register will not clear it. The *CLS command does not clear Enable Registers but it does clear bits in the event registers. To enable bits in an enable register, write a decimal value that corresponds to the binary-weighted sum of the bits required to enable in the register.

The Status Byte Register (STB)

The Status Byte summary register contains conditions from the other registers. Query data waiting in the generator's output buffer is immediately reported through the Message Available bit (bit 4). Bits in the summary register are not latched. Clearing an event register will clear the corresponding bits in the Status Byte summary register. Description of the various bits within the Status Byte summary register is given in the following:

Bit 0 - Decimal value 1. Not used, always set to 0.

Bit 1 - Decimal value 2. Not used, always set to 0.

Bit 2 - Decimal value 4. Not used, always set to 0.

Bit 3 - Decimal value 8. Not used, always set to 0.

Bit 4 - Decimal value 16. Message Available Queue Summary Message (MAV). The state of this bit indicates whether or not the output queue is empty. The MAV summary message is true when the output queue is not empty. This message is used to synchronize information exchange with the controller. The controller can, for example, send a query command to the device and then wait for MAV to become true. If an application program begins a read operation of the output queue without first checking for MAV, all system bus activity is held up until the device responds.

Bit 5 - Decimal value 32. Standard Event Status Bit (ESB) Summary Message. This bit indicates whether or not one or more of the enabled ESB events have occurred since the last reading or clearing of the Standard Event Status Register.

Bit 6 - Decimal value 64. Master Summary Status (MSS)/Request Service (RQS) Bit. This bit indicates if the device has at least one condition to request service. The MSS bit is not part of the IEEE-STD-488.1 status byte and will not be sent in response to a serial poll. However, the RQS bit, if set, will be sent in response to a serial poll.
Bit 7 - Decimal value 128. Not used, always set to 0.

Reading the Status Byte Register

The Status Byte summary register can be read with the *STB? common query. The *STB? common query causes the generator to send the contents of the Status Byte register and the MSS (Master Summary Status) summary message as a single <NR1 Numeric Response Message> element. The response represents the sum of the binary-weighted values of the Status Byte Register. The *STB? common query does not alter the status byte.

Clearing the Status Byte Register

Removing the reasons for service from Auxiliary Status registers can clear the entire Status Byte register. Sending the *CLS command to the device after a SCPI command terminator and before a Query clears the Standard Event Status Register and clears the output queue of any unread messages. With the output queue empty, the MAV summary message is set to FALSE. Methods of clearing other auxiliary status registers are discussed in the following paragraphs.

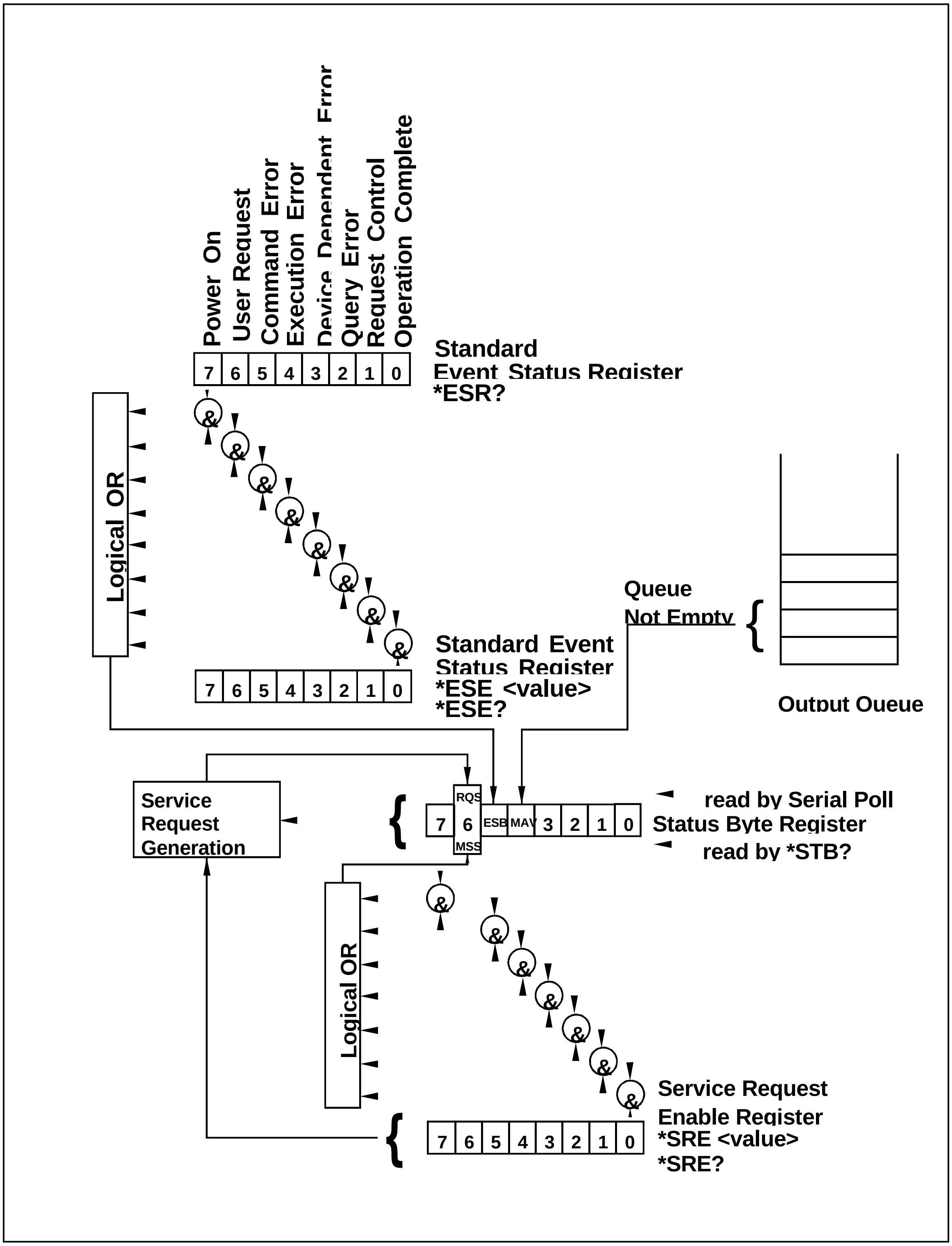

Figure 5-6. SCPI Status Registers

Service Request Enable Register (SRE)

The Service Request enable register is an 8-bit register that enables corresponding summary messages in the Status Byte Register. Thus, the application programmer can select reasons for the generator to issue a service request by altering the contents of the Service Request Enable Register.

The Service Request Enable Register is read with the *SRE? common query. The response to this query is a number that represents the sum of the binary-weighted value of the Service Request Enable Register. The value of the unused bit 6 is always zero.

The Service Request Enable Register is written using the *SRE command followed by a decimal value representing the bit values of the Register. A bit value of 1 indicates an enabled condition. Consequently, a bit value of zero indicates a disabled condition. The Service Request Enable Register is cleared by sending *SRE0. The generator always ignores the value of bit 6. Summary of *SRE commands is given in the following.

***SRE0** - Clears all bits in the register.

***SRE1** - Not used.

***SRE2** - Not used.

***SRE4** - Not used.

***SRE8** - Not used.

***SRE16** - Service request on MAV.

***SRE32** - Service request on ESB summary bit.

***SRE128** - Not used.

Standard Event Status Register (ESR)

The Standard Event Status Register reports status for special applications. The 8 bits of the ESR have been defined by the IEEE-STD-488.2 as specific conditions, which can be monitored and reported back to the user upon request. The Standard Event Status Register is destructively read with the *ESR? common query. The Standard Event Status Register is cleared with a *CLS common command, with a power-on and when read by *ESR?.

The arrangement of the various bits within the register is firm and is required by all GPIB instruments that implement the IEEE-STD-488.2. Description of the various bits is given in the following:

Bit 0 - Operation Complete. Generated in response to the *OPC command. It indicates that the device has completed all selected and pending operations and is ready for a new command.

Bit 1 - Request Control. This bit operation is disabled on the Model 2572A.

Bit 2 - Query Error. This bit indicates that an attempt is being made to read data from the output queue when no output is either present or pending.

Bit 3 - Device Dependent Error. This bit is set when an error in a device function occurs. For example, the following command will cause a DDE error:

```
VOLTage 5;:VOLTage:OFFSet 2
```

Both of the above parameters are legal and within the specified limits, however, the generator is unable to generate such an amplitude and offset combination.

Bit 4 - Execution Error. This bit is generated if the parameter following the command is outside of the legal input range of the generator.

Bit 5 – Command Error. This bit indicates the generator received a command that was a syntax error or a command that the device does not implement.

Bit 6 - User Request. This event bit indicates that one of a set of local controls had been activated. This event bit occurs regardless of the remote or local state of the device.

Bit 7 - Power On. This bit indicates that the device's power source was cycled since the last time the register was read.

Standard Event Status Enable Register (ESE)

The Standard Event Status Enable Register allows one or more events in the Standard Event Status Register to be reflected in the ESB summary message bit. The Standard Event Status Enable Register is an 8-bit register that enables corresponding summary messages in the Standard Event Status Register. Thus, the application programmer can select reasons for the generator to issue an ESB summary message bit by altering the contents of the ESE Register.

The Standard Event Status Enable Register is read with the *ESE? Common query. The response to this query is a number that represents the sum of the binary-weighted value of the Standard Event Status Enable Register.

The Standard Event Status Enable Register is written using the *ESE command followed by a decimal value representing the bit values of the Register. A bit value one indicates an enabled condition. Consequently, a bit value of zero indicates a disabled condition. The Standard Event Status Enable Register is cleared by setting *ESE0. Summary of *ESE messages is given in the following.

***ESE0** – No mask. Clears all bits in the register.
***ESE1** – ESB on Operation Complete.
***ESE2** – ESB on Request Control.
***ESE4** – ESB on Query Error.
***ESE8** – ESB on Device Dependent Error.
***ESE16** – ESB on Execution Error.

***ESE32** – ESB on Command Error.
***ESE64** – ESB on User Request.
***ESE128** – ESB Power on.

Error Messages

In general, whenever the 2572A receives an invalid SCPI command, it automatically generates an error. Errors are stored in a special error queue and may be retrieved from this buffer one at a time. Errors are retrieved in first-in-first-out (FIFO) order. The first error returned is the first error that was stored. When you have read all errors from the queue, the generator responds with a 0,"No error" message.

If more than 30 errors have occurred, the last error stored in the queue is replaced with -350, "Queue Overflow". No additional errors are stored until you remove errors from the queue. If no errors have occurred when you read the error queue, the generator responds with 0,"No error".

The error queue is cleared when power has been shut off or after a *CLS command has been executed. The *RST command does not clear the error queue. Use the following command to read the error queue:

```
SYSTem:ERRor?
```

Errors have the following format (the error string may contain up to 80 characters):

-102,"Syntax error"

A complete listing of the errors that can be detected by the generator is given below.

-100,"Command error". When the generator cannot detect more specific errors, this is the generic syntax error used.

-101,"Invalid Character". A syntactic element contains a character, which is invalid for that type.

-102,"Syntax error". Invalid syntax found in the command string.

-103,"Invalid separator". An invalid separator was found in the command string. A comma may have been used instead of a colon or a semicolon. In some cases where the generator cannot detect a specific separator, it may return error -100 instead of this error.

-104,"Data type error". The parser recognized a data element different than allowed.

-108,"Parameter not allowed". More parameters were received than expected for the header.

-109,"Missing parameter". Too few parameters were received for the command. One or more parameters that were required for the command were omitted.

-128."Numeric data not allowed". A legal numeric data element was received, but the instrument does not accept one in this position.

-131,"Invalid suffix". A suffix was incorrectly specified for a numeric parameter. The suffix may have been misspelled.

-148,"Character data not allowed". A character data element was encountered where prohibited by the instrument.

-200,"Execution error". This is the generic syntax error for the instrument when it cannot detect more specific errors. Execution error as defined in IEEE-488.2 has occurred.

-221,"Setting conflict". Two conflicting parameters were received which cannot be executed without generating an error. Listed below are events causing setting conflicts.

1. Sum of pulse or ramp parameters is more than 100. Corrective action: Change parameters to correct the problem.
2. ampl/2 + |offset| is more than 16. Corrective action: Reduce offset to 0, then change amplitude-offset values to correct the problem.
3. Activating filters when the 2572A is set to output the built-in sine waveform, or activating the built-in sine waveform when one of the 2572A filters is turned on. Corrective action: If in sine, select another function and activate the filter(s).
4. Activating burst mode when the 2572A is set to sequence mode, or activating sequence mode when the 2572A is set to burst mode. Corrective action: Remove the 2572A from burst or sequence and then selected the desired mode.
5. Changing operating mode from triggered to continuous when the 2572A is set to single sequence advance, or changing the operating mode from continuous to triggered when the 2572A is set to automatic sequence advance mode. Corrective action: Observe the 2572A advance mode while setting sequence advance.

-222,”Data out of range”. Parameter data, which followed a specific header, could not be used because its value is outside the valid range defined by the generator.

-224,”Illegal parameter value”. A discrete parameter was received which was not a valid choice for the command. An invalid parameter choice may have been used.

-300,”Device-specific-error”. This is the generic device-dependent error for the instrument when it cannot detect more specific errors. A device- specific error as defined in IEEE-488.2 has occurred.

-311,”Memory error”. Indicates that an error was detected in the instrument’s memory.

-350,”Queue Overflow”. The error queue is full because more than

30 errors have occurred. No additional errors are stored until the errors from the queue are removed. The error queue is cleared when power has been shut off, or after a *CLS command has been executed.

-410,"Query INTERRUPTED". A command was received which sends data to the output buffer, but the output buffer contained data from a previous command (the previous data is not overwritten). The output buffer is cleared when power is shut off or after a device clear has been executed.

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Chapter 6
Performance Checks

Title	Page

What's in This Chapter

This chapter provides performance tests necessary to troubleshoot the Model 2572A Universal Waveform Generator.

WARNING

The procedures described in this section are for use only by qualified service personnel. Many of the steps covered in this section may expose the individual to potentially lethal voltages that could result in personal injury or death if normal safety precautions are not observed.

CAUTION

ALWAYS PERFORM PERFORMANCE TESTS IN A STATIC SAFE WORKSTATION.

Performance Checks

The following performance checks verify proper operation of the instrument and should normally be used:

1. As a part of the incoming inspection of the instrument specifications;
2. As part of the troubleshooting procedure;
3. After any repair or adjustment before returning the instrument to regular service.

Environmental Conditions

Tests should be performed under laboratory conditions having an ambient temperature of 25°C, ±5°C and at relative humidity of less than 80%. If the instrument has been subjected to conditions outside these ranges, allow at least one additional hour for the instrument to stabilize before beginning the adjustment procedure.

Warm-up Period

Most equipment is subject to a small amount of drift when it is first turned on. To ensure accuracy, turn on the power to the Model 2572A and allow it to warm-up for at least 30 minutes before beginning the performance test procedure.

Initial Instrument Setting

To avoid confusion as to which initial setting is to be used for each test, it is required that the instrument be reset to factory default values prior to each test. To reset the Model 2572A to factory defaults, use the Factory Rest option in the Utility menu.

Recommended Test Equipment

Recommended test equipment for troubleshooting, calibration and performance checking is listed in Table 6-1 below. Test instruments other than those listed may be used only if their specifications equal or exceed the required characteristics.

Table -1, Recommended Test Equipment

Equipment	**Model No.**	**Manufacturer**
Oscilloscope (with jitter package)	LT342	LeCroy
Distortion Analyzer	6900B	Krohn Hite
Digital Multimeter	2000	Keithley
Freq. Counter	6020R	Tabor Electronics
Spectrum Analyzer	E4411	HP
Pulse Generator (with manual trigger)	8500	Tabor Electronics

Test Procedures

Use the following procedures to check the Model 2572A against the specifications. A complete set of specifications is listed in Appendix A. The following paragraphs show how to set up the instrument for the test, what the specifications for the tested function are, and what acceptable limits for the test are. If the instrument fails to perform within the specified limits, the instrument must be calibrated or tested to find the source of the problem.

Frequency Accuracy

Frequency accuracy checks tests the accuracy of the internal oscillators. Both channels same the same output frequency and the same reference oscillators and therefore, the accuracy is tested on channel 1 only.

Frequency Accuracy, Internal Reference

Equipment: Counter

Preparation:

1. Configure the counter as follows:
   Termination: 50 Ω, DC coupled
2. Connect the 2572A Channel 1 output to the counter input – channel A
3. Configure the 2572A, channel 1 as follows:
   Waveform: Squarewave
   Amplitude: 2 V
   Output: On
   Frequency: As specified in Table 6-2

Test Procedure:

1. Perform frequency Accuracy tests using Table 6-2

Table -2, Frequency Accuracy

2572A Setting	Error Limits	Counter Reading	Pass	Fail
10.000000000 Hz	±10 µHz			
1.0000000000 kHz	±1 mHz			
100.00000000 kHz	±100 mHz			
1.0000000000 MHz	±1 Hz			
100.000000000 MHz	±100 Hz			

Frequency Accuracy, External 10MHz Reference

Equipment: 10MHz reference (at least 0.1ppm), Counter

Preparation:

1. Leave counter setting and 2572A connections as in last test
2. Connect the 10MHz reference oscillator to the 2572A rear panel input
3. Configure the 2572A channel 1 as follows:
   10 MHz: External
   Waveform: Squarewave
   Amplitude: 2 V
   Output: On
   Frequency: As specified in Table 6-3

Test Procedure

1. Perform frequency Accuracy tests using Table 6-3

Table -3, Frequency Accuracy Using External 10 MHz Reference

2572A Setting	Error Limits	Counter Reading	Pass	Fail
10.000000000 MHz	±1 Hz			
50.000000000 MHz	±5 Hz			

Amplitude Accuracy

Amplitude accuracy checks tests the accuracy of the output amplifier and attenuators. Each channel has its own set of amplifiers and attenuators and therefore, the accuracy is tested on each channel separately. Amplitude path is checked for both the DAC route (arbitrary and standard waveforms) and the DDS route (CW and modulated waveforms).

Amplitude Accuracy, DAC Output

Equipment**:** DMM

Preparation:

1. Configure the DMM as follows:
   Termination: 50 Ω feedthrough at the DMM input
   Function: ACV
2. Connect 2572A Channel outputs to the DMM input
3. Configure the 2572A as follows:
   Frequency: 1 kHz
   Output: On
   Amplitude: As specified in Table 6-4

Test Procedure

1. Perform amplitude Accuracy tests on both channels using Table 6-4

Table -4, Amplitude Accuracy, DAC output

2572A Amplitude Setting	Error Limits	DMM Reading		Pass	Fail
		CH 1	CH 2		
16.00 V	5.657 V, ±113 mV				
10.00 V	3.535 V, ±59 mV				
1.000 V	353.5 mV, ±7 mV				
100.0 mV	35.35 mV, ±2.1 mV				

Amplitude Accuracy, DDS Output

Equipment: DMM

Preparation:

1. Configure the DMM as follows:
   Termination: 50 Ω feedthrough at the DMM input
   Function: ACV
2. Connect 2572A Channel outputs to the DMM input
3. Configure the 2572A as follows:
   Waveform: Modulated
   Modulation: OFF
   CW Frequency: 1 kHz
   Output: On
   Amplitude: As specified in Table 6-5

Test Procedure

1. Perform amplitude Accuracy tests on both channels using Table 6-5

Table -5, Amplitude Accuracy, DDS output

2572A Amplitude Setting	Error Limits	DMM Reading		Pass	Fail
		CH 1	CH 2		
16.00 V	5.657 V, ±113 mV				
10.00 V	3.535 V, ±59 mV				
1.000 V	353.5 mV, ±7 mV				
100.0 mV	35.35 mV, ±2.1 mV				

Offset Accuracy

Offset accuracy checks tests the accuracy of the offset generators. Each channel has its own set of offset generators and therefore, the accuracy is tested on each channel separately. Offset path is checked for both the DAC route (arbitrary and standard waveforms) and the DDS route (CW and modulated waveforms).

Offset Accuracy, DAC Output

Equipment**:** DMM

Preparation:

1. Configure the DMM as follows:
   Termination: 50 Ω feedthrough at the DMM input
   Function: DCV
2. Connect 2572A Channel outputs to the DMM input
3. Configure the 2572A as follows:
   Frequency: 1 MHz
   Amplitude: 20 mV
   Output: On
   Offset: As specified in Table 6-6

Test Procedure

1. Perform Offset Accuracy tests on both channels using Table 6-6

Table -6, Offset Accuracy, DAC Output

2572A Offset Setting	Error Limits	DMM Reading		Pass	Fail
		CH 1	CH 2		
+7.800 V	7.800 V ±83 mV				
+4.000 V	4.000 V ±45 mV				
0.000 V	0 V ±20 mV				
-4.000 V	-4.000 V ±45 mV				
-7.800 V	-7.800 V ±83 mV				

Offset Accuracy, DDS Output

Equipment**:** DMM

Preparation:

1. Configure the DMM as follows:
   Termination: 50 Ω feedthrough at the DMM input
   Function: DCV
2. Connect 2572A Channel outputs to the DMM input
3. Configure the 2572A as follows:
   Waveform: Modulated
   Modulation: OFF
   CW Frequency: 1 MHz
   Amplitude: 6 V
   Output: On

Test Procedure

1. Perform Offset Accuracy tests on both channels using Table 6-7

Table -7, Offset Accuracy, DDS Output

2572A Offset Setting	Error Limits	DMM Reading		Pass	Fail
		CH 1	CH 2		
0.000 V	0 ±20 mV				

Squarewave Characteristics

This tests the characteristics of the square waveform. It includes transition times, aberrations and skew between channels. Each channel has its own set of amplifiers and attenuators and therefore, the characteristics are tested on each channel separately.

Squarewave Checks

Equipment: Oscilloscope, 50 Ω, 20 dB attenuator feed through

Preparation:

1. Configure the Oscilloscope follows:
   Termination: 50 Ω, 20 dB attenuator feed through at the oscilloscope input

Setup: As required for the test

2. Connect 2572A Channel outputs to the oscilloscope input
Configure the 2572A as follows:
   Frequency: 1 MHz
   Waveform: Squarewave
   Amplitude: 10 V
   Output: On

Test Procedure

1. Perform Squarewave Characteristics tests on both channels using Table 6-8

Table -8, Square wave Characteristics

Parameter Tested	Error Limits	Oscilloscope Reading		Pass	Fail
		CH 1	CH 2		
Rise/Fall Time	<5 ns				
Ringing	<6% + 10 mV				
Over/undershoot	<6% + 10 mV				

Skew Between Channels

Equipment: Oscilloscope, 50 Ω, 20 dB attenuator feed through

Preparation:

1. Configure the Oscilloscope follows:
   Termination: 50Ω, 20 dB feedthrough attenuator at the oscilloscope 50 ohms input. Use two identical cables to connect with Ch1/2.
   Setup: As required for the test
2. Connect 2572A Channel outputs to the oscilloscope input
3. Configure the 2572A as follows:
   Waveform: Arbitrary
   SCLK: 250 MS/s
   Amplitude: 6 V
   Output: On

Test Procedure

1. Using ArbConnection prepare and download the following waveform (both channels):
   Wavelength: 1024
   Waveform: Square
2. Measure the skew between the channels to be less than 1ns.
3. Program the skew from 1 to 10 and check the phase offset between channels is increased by 4 ns with every offset step.

Test Results	Pass		Fail	

Sinewave Characteristics

This tests the characteristics of the sine waveform. It includes distortions, spectral purity and flatness. Each channel has its own set of amplifiers and attenuators and therefore, the characteristics are tested on each channel separately. Tests are done for both the DAC route (arbitrary and standard waveforms) and the DDS route (CW and modulated waveforms).

Sinewave Distortions, DAC Output

Equipment: Distortion Analyzer, Spectrum Analyzer, and ArbConnection

Preparation:

1. Connect 2572A Channel outputs to the distortion analyzer input. Configure the 2572A as follows:
   SCLK: As required by the test
   Waveform: Arbitrary
   Amplitude: 5 V
   Output: On
2. Using ArbConnection prepare and download the following waveform:
   Wavelength: As required by the test
   Waveform: Sinewave

Test Procedure

1. Perform Sinewave distortion tests on both channels using Table 6-9

Table -9, Sinewave Distortion, DAC Output Tests

2572A SCLK Settings	Sinewave Points	2572A Frequency	Reading Limits	Distortion CH 1	Distortion CH 2	Pass	Fail
4 MS/s	4000	1.000 kHz	< 0.1 %				
40 Ms/s	4000	10.00 kHz	< 0.1 %				
200 Ms/s	2000	100.00 kHz	< 0.1 %				

Sinewave Spectral Purity, DAC Output

Equipment: Spectrum Analyzer

Preparation:

1. Connect 2572A Channel outputs to the spectrum analyzer input. Use 50Ω and 20dB feedthrough termination at the spectrum analyzer input
2. Configure the 2572A as follows:
   Amplitude: 5 V
   Output: On
   Frequency: As required by the test

Test Procedure

1. Perform sinewave spectral purity, DAC waveforms tests using Table 6-10

Table -10, Sinewave Spectral Purity, DAC Output Test

2572A Freq Settings	Reading Limits	Spectrum Analyzer, Settings & Results				Pass	Fail
		Start	Stop	CH 1	CH 2		
10 MHz	>43 dBc	1 M	100 M				
50 MHz	>30 dBc	10 M	200 M				
100 MHz	>25 dBc	10 M	250 M				

Sinewave Spectral Purity, DDS Output

Equipment: Spectrum Analyzer

Preparation:

1. Connect 2572A Channel outputs to the spectrum analyzer input. Use 50 Ω and 20 dB feedthrough termination at the spectrum analyzer input
2. Configure the 2572A as follows:
   - Waveform: Modulated
   - Modulation: OFF
   - Amplitude: 5 V
   - Output: On
   - CW Frequency: As required by the test

Test Procedure

1. Perform sinewave spectral purity, DDS Waveforms tests on both channels using Table 6-11

Table -11, DDS CW Spectral Purity Test.

2572A CW Freq	Reading Limits	Spectrum Analyzer, Settings & Results				Pass	Fail
		Start	Stop	CH 1	CH 2		
10 MHz	>40 dBc	1 M	100 M				
50 MHz	>30 dBc	10 M	200 M				
100 MHz	>25 dBc	10 M	250 M				

Sinewave Flatness, DAC Output

Equipment: Oscilloscope

Preparation:

1. Configure the Oscilloscope follows:
   - Termination: 50 Ω, 20 dB feedthrough attenuator at the

oscilloscope input
Setup: As required for the test

2. Connect 2572A Channel outputs to the oscilloscope input
3. Configure the 2572A as follows:
   - Amplitude: 6 V
   - Output: On
   - Frequency: Initially, 1 kHz then, as required by the test

Test Procedure

1. Adjust the vertical controls of the Oscilloscope to get 6 division of display
2. Perform Sine flatness, DAC waveforms tests on both channels using Table 6-12

Table -12, Sinewave Flatness, DAC Output Test

2572A Sine Frequency	Error Limits	Oscilloscope Reading		Pass	Fail
		CH 1	CH 2		
1 MHz	6 Divisions	Reference	Reference	X	X
10 MHz	6 ±0.15 Divisions				
50 MHz	6 ±1.2 Divisions				
100 MHz	6 ±1.2 Divisions				

Sinewave Flatness, DDS Output

Equipment: Oscilloscope

Preparation:

1. Configure the Oscilloscope follows:
   - Termination: 50 Ω, 20 dB feedthrough attenuator at the oscilloscope input
   - Setup: As required for the test
2. Connect 2572A Channel outputs to the oscilloscope input
3. Configure the 2572A as follows:
   - Waveform: Modulated
   - Modulation: OFF
   - Amplitude: 6 V
   - Output: On
   - CW Frequency: Initially, 1 kHz then, as required by the test

Test Procedure

1. Adjust the vertical controls of the Oscilloscope to get 6 division of display
2. Perform Sine flatness, DDS waveforms tests on both channels using Table 6-13

Table -13, Sinewave Flatness, DDS Output Test

2572A Sine Frequency	Error Limits	Oscilloscope Reading		Pass	Fail
		CH 1	CH 2		
1 MHz	6 Divisions	Reference	Reference	X	X
10 MHz	6 ±0.15 Divisions				
50 MHz	6 ±1.2 Divisions				
100 MHz	6 ±1.2 Divisions				

Trigger operation Characteristics

This tests the operation of the trigger circuit. It includes tests for the triggered, gated and counted bursts run modes. It also tests the operation of the trigger advance options, the delayed trigger and re-trigger functions, as well as the trigger input level and slope sensitivity. The run modes are common to both channels and therefore the tests are performed on channel 1 only.

Trigger, Gate, and Burst Characteristics

Equipment: Oscilloscope, function generator, counter

Preparation:

1. Configure the Oscilloscope follows:
   - Termination: 50 Ω, 20d B feedthrough attenuator at the oscilloscope input
   - Setup: As required for the test
2. Connect 2572A Channel outputs to the oscilloscope input
3. Configure the function generator as follows:
   - Frequency 1 MHz
   - Run Mode: As required by the test
   - Wave: TTL Square
4. Connect the function generator output to the 2572A TRIG IN connector
5. Configure the 2572A as follows:
   - Frequency: 28 MHz
   - Waveform: Sinewave
   - Burst Count: 1e6 counts, each channel
   - Amplitude: 1 V
   - Trigger Source: External
   - Output: On

Test Procedure

1. Perform trigger and gate tests using Tables 6-14
2. Configure the counter to TOTB Measurements and perform burst tests using Tables 6-14. Set counter trigger level to 100mV.

Table -14, Trigger, gate, and burst Characteristics.

2572A Run Mode	External Trigger Pulse	Oscilloscope Reading		Pass	Fail
		CH 1	CH 2		
Triggered	1 MHz, Continuous	Triggered waveform	Triggered waveform		
Gated	1 MHz, Continuous	Gated Waveform	Gated Waveform		
Burst	Single shot	Burst, 1e6 waveforms	Burst, 1e6 waveforms		

Mixed Trigger Advance Test

Equipment: Oscilloscope, function generator, ArbConnection

Preparation:

1. Configure the Oscilloscope follows:
   - Termination: 50 Ω, 20 dB feedthrough attenuator at the oscilloscope input
   - Setup: As required for the test
   - Run Mode: Single
2. Connect 2572A Channel 1 output to the oscilloscope input
3. Configure the function generator as follows:
   - Frequency 100 kHz
   - Run Mode: Continuous
   - Wave: TTL Square from the main output.
4. Connect the function generator output to the 2572A TRIG IN connector
5. Configure the 2572A, channel 1 only, as follows:
   - Frequency: 28 MHz
   - Waveform: Sinewave
   - Run Mode: Burst
   - Burst Count: 5 counts, each channel
   - Trigger Delay: On
   - Delay: 5 s
   - Amplitude: 5 V
   - Trigger Source: Mixed
   - Output: On

Test Procedure

1. Note that no signal is shown on the oscilloscope
2. From ArbConnection, press the MAN TRIG button.
3. Note and record the time that lapsed from when you pressed MANUAL Trigger button until you first see the burst of 5 sine waveforms. Lapsed time should be 5 seconds

Test Results	Pass		Fail	

4. Modify oscilloscope setting to Auto, or Normal and observe that bursts of 5 sine cycles appear at 10μs intervals

Test Results	Pass		Fail	

Delayed Trigger Characteristics

Equipment: Function generator, 50 Ω "T" connector, Counter, ArbConnection CAD

Preparation:

1. Configure the Function generator as follows:
   - Amplitude: 1 V
   - Frequency: 1 MHz
   - Trigger Mode: Triggered.
   - Wave: Squarewave
2. Place the "T" connector on the output terminal of the function generator. Connect one side of the "T" to the 2572A TRIG IN connector and the other side of the "T" to the channel A input of the counter
3. Connect the 2572A output to channel B input of the counter
4. Configure the counter to TI A to B measurements
5. Using ArbConnection prepare and download the following waveform:
   - Wavelength: 100 points
   - Waveform: Pulse, Delay = 0.1, Rise/Fall = 0, High Time = 99.99
6. Configure the 2572A, channel 1 only, as follows:
   - SCLK: 200 MS/s
   - Waveform: Arbitrary
   - Run Mode: Triggered
   - Trigger Level 0 V
   - Trigger Delay: On
   - Delay: As required for the test
   - Amplitude: 5 V
   - Trigger Source: External
   - Output: On

Test Procedure

1. Perform trigger delay tests using Tables 6-15

Table -15, Trigger Delay Tests

2572A Delay Setting	Error Limits	Counter Reading	Pass	Fail
1 µs	1 µs ±230 ns			
1 ms	1 ms ±50 µs			
1 s	1 s ±50 ms			

Re-trigger Characteristics

Equipment: Counter, ArbConnection

Preparation:

1. Configure the counter as follows:
   Function: Pulse Width Measurement
   Ch A Slope: Negative
2. Connect the counter channel A to the 2572A output
3. Using ArbConnection prepare and download the following waveform:
   Wavelength: 100 points
   Waveform: Pulse, Delay = 0.1, Rise/Fall = 0, High Time = 99.99
4. Configure the 2572A, channel 1 only, as follows:
   SCLK 200 MS/s
   Waveform: Arbitrary
   Amplitude: 5 V
   Run Mode: Triggered
   Trigger Level 0 V
   Re-trigger: On
   Re-trigger Delay: As required by the test
   Trigger Source: Bus
   Output: On

Test Procedure

1. Manually trigger the instrument
2. Perform trigger delay tests using Tables 6-16

Table -16, Re-Trigger Delay Tests

2572A Delay Setting	Error Limits	Counter Reading	Pass	Fail
1 µs	1 µs ±85 ns			
1 ms	1 ms ±50 µs			
1 s	1 s ±50 ms			

Trigger Slope

Equipment: Oscilloscope, function generator

Preparation:

1. Configure the Oscilloscope follows:
   - Termination: 50 Ω, 20 dB feedthrough attenuator at the oscilloscope input
   - Setup: As required for the test

   Trigger Source: External
2. Connect 2572A Channel outputs to the oscilloscope input
3. Configure the function generator as follows:
   - Frequency 10 kHz
   - Run Mode: Continue
   - Waveform: TTL Output
4. Connect the function generator TTL output to the 2572A TRIG IN connector
5. Connect the function generator main output to the 2nd channel of the oscilloscope
6. Configure the 2572A as follows:
   - Frequency: 1 MHz
   - Waveform: Sine wave
   - Run Mode: Triggered
   - Output: On

Test Procedure

1. Toggle 2572A trigger slope from positive to negative visa versa
2. Verify on the oscilloscope that the 2572A transitions are synchronized with the slope of the trigger

Test Results	Pass		Fail	

Trigger Level

Equipment: Oscilloscope, function generator

Preparation:

1. Configure the Oscilloscope as follows:
   - Termination: 50 Ω, 20 dB feedthrough attenuator at the oscilloscope input
   - Setup: As required for the test
2. Connect 2572A Channel 1 output to the oscilloscope input
3. Configure the function generator as follows:
   - Frequency 10 kHz
   - Run Mode: Continuous
   - Waveform: Squarewave.
   - Amplitude: 1 V
4. Connect the function generator output to the 2572A TRIG IN connector
5. Configure the 2572A as follows:

Frequency:	1 MHz
Waveform:	Sine wave
Run Mode:	Triggered
Trigger level:	0 V
Ch1 Output:	On

Test Procedure

1. Verify that the 2572A outputs triggered waveforms spaced at0.1 ms
2. Modify the function generator offset to +2 V and change the 2572A trigger level to +4 V. Verify that the 2572A outputs triggered waveforms spaced at 0.1ms
3. Modify the function generator offset to -2 V and change the 2572A trigger level to -4 V. Verify that the 2572A outputs triggered waveforms spaced at 0.1ms

Test Results	Pass		Fail	

Sequence operation

This tests the operation of the sequence generators. Each channel has its own sequence generator and therefore operations is tested on each channel separately. This also checks the sequence advance options.

Automatic Advance

Equipment: Counter

Preparation:

1. Configure the Counter as follows:
   Function: TOTB Measurement
2. Connect the counter channel B to the 2572A output
3. Configure the 2572A as follows (both channels):

SCLK	225 MS/s
Waveform:	Sequence
Run Mode:	Trigger
Trigger Source:	Bus
Amplitude:	2 V
Output:	On

4. Using ArbConnection prepare and download the following waveform to both channels:

Segments:	1 to 5
Wavelength:	128 points
Waveform:	1 cycle square

5. Using ArbConnection, build and download the following sequence table:

Step 1:	Segment 1, loop 100,000
Step 2:	Segment 2, loop 100,000
Step 3:	Segment 3, loop 100,000
Step 4:	Segment 4, loop 100,000
Step 5:	Segment 5, loop 100,000

Test Procedure

1. From ArbConnection, click on the Manual Trigger button and observe that counter reading is 500,000 counts. Reset counter and repeat the test a few times. Every time the counter reading should be 500,000 counts exactly

Test Results	Pass		Fail	

2. Remove the cable from 2572A channel 1 and connect to channel 2
3. Repeat the test procedure as above for channel 2

Test Results	Pass		Fail	

Step Advance

Equipment: Oscilloscope, function generator

Preparation:

1. Configure the Oscilloscope as follows:

Termination:	50 Ω, 20 dB feedthrough attenuator at the oscilloscope input
Setup:	As required for the test

2. Connect 2572A Channel 1 output to the oscilloscope input
3. Configure the function generator as follows:

Frequency	10 kHz
Run Mode:	Triggered
Waveform:	Squarewave.
Amplitude:	Adjust for TTL level on 50 Ω

4. Connect the function generator output to the 2572A TRIG IN connector
5. Connect 2572A Ch1 to the Oscilloscope input
6. Configure the 2572A as follows:

SCLK	200 MS/s
Waveform:	Sequence
Seq Advance:	Step
Amplitude:	2 V
Trigger Source:	External
Output:	On

7. Using ArbConnection prepare and download the following waveform to both channels:

Segment 1:	Sine, 1000 points
Segment 2:	Triangle, 1000 points
Segment 3:	Square, 1000 points
Segment 4:	Sinc, 1000 points
Segment 5:	Gaussian Pulse, 1000 points

8. Using ArbConnection, build and download the following sequence table:
   - Step 1: Segment 1, loop 1
   - Step 2: Segment 2, loop 1
   - Step 3: Segment 3, loop 1
   - Step 4: Segment 4, loop 1
   - Step 5: Segment 5, loop 1

Test Procedure

1. Press the manual trigger button on the function generator and observe that the waveforms advance through the sequence table repeatedly

Test Results	Pass		Fail	

2. Remove the cable from 2572A channel 1 and connect to channel 2
3. Repeat the test procedure as above for channel 2

Test Results	Pass		Fail	

Note

Leave the same setup for the next test

Single Advance

Equipment: Oscilloscope, function generator

Preparation: (Same preparation as for previous step, except change mode to single sequence advance)

1. Change Oscilloscope configuration to single

Test Procedure

1. Press the manual trigger button on the function generator and observe that one cycle waveform advances through the sequence table repeatedly with each external trigger signal. Note that you need to press the Single mode on the oscilloscope for each trigger advance

Test Results	Pass		Fail	

2. Remove the cable from 2572A channel 1 and connect to channel 2
3. Repeat the test procedure as above for channel 2

Test Results	Pass		Fail	

Modulated Waveforms Characteristics

This tests the operation of the modulation circuits. It includes tests for the various modulation functions: FM, AM, FSK, PSK, Frequency hops and Sweep. Since the run modes are common to all modulation functions, they are being tested on the FM function only. The tests are performed on each channel.

FM - Standard Waveforms

Equipment: Oscilloscope

Preparation:

1. Configure the oscilloscope as follows:

   Time Base: 50 µs
   Sampling Rate: 50 MS/s at least.
   Trace A View: Jitter, Type: FREQ, CLK.
   Trigger source: Channel 2, positive slope
   Amplitude: 1 V/div
2. Connect 2572A Channel 1 output to the oscilloscope input, channel 1
3. Connect the 2572A SYNC output to the oscilloscope input, channel 2
4. Configure model 2572A controls on both channels as follows:

   Waveform: Modulated
   Modulation: FM
   Carrier Freq: 1 MHz
   Mod Frequency: 10 kHz
   Deviation: 500 kHz
   Sync: On
   Output: On

Test Procedure:

1. Verify FM operation on the oscilloscope as follows:

   Waveform: Sine
   Frequency: 10 kHz
   Max A: 1.25 MHz
   Min A: 750 kHz

Test Results	Pass		Fail	

2. Modify 2572A modulating waveform to triangle, then square and ramp and verify FM waveforms as selected

Test Results	Pass		Fail	

3. Move 2572A marker position to 1.25MHz and verify marker position

Test Results	Pass		Fail	

4. Remove the cable from 2572A channel 1 and connect to channel 2
5. Repeat the test procedure as above for channel 2

Test Results	Pass		Fail	

Triggered FM - Standard Waveforms

Equipment: Oscilloscope, function generator

Preparation:

1. Configure the oscilloscope as follows:
   Time Base: 0.2 ms
   Sampling Rate: 50 MS/s at least.
   Trace A View: Jitter, Type: FREQ, CLK.
   Trigger source: Channel 2, positive slope
   Amplitude: 1 V/div
2. Connect 2572A Channel 1 output to the oscilloscope input, channel 1
3. Connect the 2572A SYNC output to the oscilloscope input, channel 2
4. Configure the function generator as follows:
   Frequency 1 kHz
   Run Mode: Continuous
   Waveform: Squarewave.
   Amplitude: 2 V
   Offset: 1 V
5. Connect the function generator output connector to the 2572A TRIG IN connector
6. Configure model 2572A controls on both channels as follows:
   Waveform: Modulated
   Modulation: FM
   Mod Run Mode: Triggered

Carrier Freq:	1 MHz
Mod Frequency:	10 kHz
Deviation:	500 kHz
Sync:	On
Output:	On

Test Procedure:

1. Verify triggered FM – standard waveforms operation on the oscilloscope as follows:

Waveform:	Triggered sine waves
Sine Frequency:	10 kHz
Trigger Period:	1 ms
Max A:	1.25 MHz
Min A:	750 kHz

Test Results	Pass		Fail	

FM Burst - Standard Waveforms

Equipment: Oscilloscope, function generator

Preparation:

1. Configure the oscilloscope as follows:

Time Base:	0.2 ms
Sampling Rate:	50 MS/s at least.
Trace A View:	Jitter, Type: FREQ, CLK.
Trigger source:	Channel 2, positive slope
Amplitude:	1 V/div

2. Connect 2572A Channel 1 output to the oscilloscope input, channel 1
3. Connect the 2572A SYNC output to the oscilloscope input, channel 2
4. Configure the function generator as follows:

Frequency	1 kHz
Run Mode:	Continuous
Waveform:	Squarewave.
Amplitude:	Adjust to TTL level on 5 Ω

5. Connect the function generator output connector to the 2572A TRIG IN connector
6. Configure model 2572A controls on both channels as follows:

Waveform:	Modulated
Modulation:	FM
Modulation Run Mode: Burst	
Burst:	5
Carrier Freq:	1 MHz
Mod Frequency:	10 kHz
Deviation:	500 kHz
Sync:	On

Output: On

Test Procedure:

1. Verify Burst FM – standard waveforms operation on the oscilloscope as follows:
   Waveform: Burst of 5 Sine waveforms
   Sine Frequency: 10 kHz
   Burst Period: 1 ms
   Max A: 1.25 MHz
   Min A: 750 kHz

Test Results	Pass		Fail	

Gated FM - Standard Waveforms

Equipment: Oscilloscope, function generator

Preparation:

1. Configure the oscilloscope as follows:
   Time Base: 0.2 ms
   Sampling Rate: 50 MS/s at least.
   Trace A View: Jitter, Type: FREQ, CLK.
   Trigger source: Channel 2, positive slope
   Amplitude: 1 V/div
2. Connect 2572A Channel 1 output to the oscilloscope input, channel 1
3. Connect the 2572A SYNC output to the oscilloscope input, channel 2
4. Configure the function generator as follows:
   Frequency 1 kHz
   Run Mode: Continuous
   Waveform: Squarewave.
   Amplitude: 2 V
   Offset: 1 V
5. Connect the function generator output connector to the 2572A TRIG IN connector
6. Configure model 2572A controls on both channels as follows:
   Waveform: Modulated
   Modulation: FM
   Mod Run Mode: Gated
   Carrier Freq: 1 MHz
   Mod Frequency: 10 kHz
   Deviation: 500 kHz
   Sync: On
   Output: On

Test Procedure:

1. Verify Gated FM – standard waveforms operation on the oscilloscope as follows:
   Waveform: Gated sine waveforms
   Sine Frequency: 10 kHz
   Gated Period: 1 ms

Max A: 1.25 MHz
Min A: 750 kHz

Test Results	Pass		Fail	

Re-triggered FM Bursts - Standard Waveforms

Equipment: Oscilloscope

Preparation:

1. Configure the oscilloscope as follows:
   Time Base: 0.2 ms
   Sampling Rate: 50 MS/s at least.
   Trace A View: Jitter, Type: FREQ, CLK.
   Trigger source: Channel 2, positive slope
   Amplitude: 1 V/div
2. Connect 2572A Channel 1 output to the oscilloscope input, channel 1
3. Connect the 2572A SYNC output to the oscilloscope input, channel 2
4. Configure model 2572A controls on both channels as follows:
   Waveform: Modulated
   Modulation: FM
   Modulation Run Mode: Burst
   Burst Count: 5
   Carrier Freq: 1 MHz
   Mod Frequency: 10 kHz
   Deviation: 500 kHz
   Sync: On
   Re-trigger: On
   Re-trigger Delay: 200 μs
   Output: On

Test Procedure:

1. Verify re-triggered FM burst – standard waveforms operation on the oscilloscope as follows:
   Waveform: Repetitive burst of 5-cycle sine waveforms
   Sine Frequency: 10 kHz
   Re-trigger delay: 200 μs
   Max A: 1.25 MHz
   Min A: 750 kHz

Test Results	Pass		Fail	

FM - Arbitrary Waveforms

Equipment: Oscilloscope

Preparation:

1. Configure the oscilloscope as follows:
   Time Base: 0.2 ms
   Sampling Rate: 50 MS/s at least.
   Trace A View: Jitter, Type: FREQ, CLK.
   Trigger source: Channel 2, positive slope
   Amplitude: 1 V/div
2. Connect 2572A Channel 1 output to the oscilloscope input, channel 1
3. Connect the 2572A SYNC output to the oscilloscope input, channel 2
4. Configure model 2572A controls on both channels as follows:
   Waveform: Modulated
   Modulation: FM
   Mod Waveform: Arbitrary
   Carrier Freq: 1 MHz
   FM SCLK: 2.5 MS/s
   Sync: On
   Output: On
5. Using ArbConnection prepare, open the FM Composer and download the following waveform:
   Wavelength: 4000 points
   Waveform: 4 cycles sinewave
   Deviation: 0.5 MHz

Test Procedure:

1. Verify FM operation on the oscilloscope as follows:
   Waveform: Sine
   Frequency: 2.5 kHz
   Max A: 1.25 MHz
   Min A: 750 kHz

Test Results	Pass		Fail	

2. Remove the cable from 2572A channel 1 and connect to channel 2
3. Repeat the test procedure as above for channel 2

Test Results	Pass		Fail	

AM

Equipment: Oscilloscope

Preparation:

1. Configure the oscilloscope as follows:
   Time Base: 0.5 ms
   Trigger source: Channel 2, positive slope
   Amplitude: 1 V/div
2. Connect 2572A Channel 1 output to the oscilloscope input, channel 1
3. Connect the 2572A SYNC output to the oscilloscope input, channel 2
4. Configure model 2572A controls on both channels as follows:
   Waveform: Modulated
   Modulation: AM
   Carrier Freq: 1 MHz
   Mod Frequency: 1 kHz
   Mod Depth: 50 %
   Mod Wave Ch1 Sine
   Mod Wave Ch2 Triangle
   Sync: On
   Output: On

Test Procedure:

1. Verify AM operation on the oscilloscope as follows:
   Waveform: Amplitude modulated sine
   Mod depth: 50 % ±5 %

Test Results	Pass		Fail	

2. Remove the cable from 2572A channel 1 and connect to channel 2
3. Repeat the test procedure as above for channel 2 but observe a triangle modulating wave form.

Test Results	Pass		Fail	

FSK

Equipment: Oscilloscope

Preparation:

1. Configure the oscilloscope as follows:
   Time Base: 0.1 ms
   Sampling Rate: 50 MS/s at least.
   Trace A View: Jitter, Type: FREQ, CLK.
   Trigger source: Channel 2, positive slope
   Amplitude: 1 V/div.
2. Connect 2572A Channel 1 output to the oscilloscope input, channel 1
3. Connect the 2572A SYNC output to the oscilloscope input, channel 2
4. Configure model 2572A controls on both channels as follows:
   Waveform: Modulated
   Modulation: FSK
   Carrier Freq: 2 MHz
   Shift Frequency: 4 MHz
   Baud Rate: 10 kHz
   Marker Index: 1
   Sync: On
   Output: On
5. Using ArbConnection, prepare and download 10-step FSK list with alternating “0” and “1”

Test Procedure:

1. Verify FSK operation on the oscilloscope as follows:
   Waveform: Squarewave
   Period: 0.2 ms
   Max Freq.: 4 MHz
   Min Freq.: 2 MHz

Test Results	Pass		Fail	

2. Remove the cable from 2572A channel 1 and connect to channel 2
3. Repeat the test procedure as above for channel 2

Test Results	Pass		Fail	

PSK

Equipment: Oscilloscope

Preparation:

1. Configure the oscilloscope as follows:
   Time Base: 50 μs
   Amplitude: 1 V/div.
2. Connect 2572A Channel 1 output to the oscilloscope input, channel 1
3. Connect the 2572A SYNC output to the oscilloscope input, channel 2
4. Configure model 2572A controls on both channels as follows:
   Reset
   Waveform: Modulated
   Modulation: PSK
   Carrier Freq: 10 kHz
   Shift Phase: 180 degrees
   Baud Rate: 10 kHz
   Sync: On
   Output: On
5. Using ArbConnection, prepare and download 10-step PSK list with alternating “0” and “1”

Test Procedure:

1. Verify PSK operation on the oscilloscope as follows:
   Waveform: Sinewave
   Period: 0.1 ms
   Phase: Every 0.1 ms change 180 degrees

Test Results	Pass		Fail	

2. Remove the cable from 2572A channel 1 and connect to channel 2
3. Repeat the test procedure as above for channel 2

Test Results	Pass		Fail	

Variable Dwell Time Frequency Hops

Equipment: Oscilloscope

Preparation:

1. Configure the oscilloscope as follows:

Time Base:	0.5 ms
Sampling Rate:	50 MS/s at least.
Trace A View:	Jitter, Type: FREQ, CLK.
Trigger source:	Channel 2, positive slope
Amplitude:	1 V/div

2. Connect 2572A Channel 1 output to the oscilloscope input, channel 1
3. Connect the 2572A SYNC output to the oscilloscope input, channel 2
4. Configure model 2572A controls on both channels as follows:

Waveform:	Modulated
Modulation:	Hop
Hop Mode:	Variable
Sync:	On
Output:	On

5. Using ArbConnection prepare, open the Hop Table composer and download the following table (both channels):

Frequency	**Dwell Time**
1.0e6	50e-6
1.2e6	100e-6
1.4e6	150e-6
1.6e6	200e-6
1.8e6	250e-6
2.0e6	300e-6
2.2e6	350e-6
2.4e6	400e-6
2.6e6	450e-6
2.8e6	500e-6

Test Procedure:

1. Verify Hop operation on the oscilloscope as follows:

Waveform:	Frequency steps, increasing dwell time from 50 μs to 500 μs
Max A:	2.8 MHz
Min A:	1.0 MHz
Period:	2750 μs

Test Results	Pass		Fail	

2. Remove the cable from 2572A channel 1 and connect to channel 2
3. Repeat the test procedure as above for channel 2

Test Results	Pass		Fail	

Fix Dwell Time Frequency Hops

Equipment: Oscilloscope

Preparation:

1. Configure the oscilloscope as follows:

Time Base:	1.0 ms
Sampling Rate:	50 MS/s at least.
Trace A View:	Jitter, Type: FREQ, CLK.
Trigger source:	Channel 2, positive slope
Amplitude:	1 V/div

2. Connect 2572A Channel 1 output to the oscilloscope input, channel 1
3. Connect the 2572A SYNC output to the oscilloscope input, channel 2
4. Configure model 2572A controls on both channels as follows:

Waveform:	Modulated
Modulation:	Hop
Hop Mode:	Fix
Dwell Time:	50μs
Sync:	On
Output:	On

5. Using ArbConnection prepare, open the Hop Table composer and download the following table (both channels):

Frequency
1.0e6
1.2e6
1.4e6
1.6e6
1.8e6
2.0e6
2.2e6
2.4e6
2.6e6
2.8e6

Test Procedure:

1. Verify Hop operation on the oscilloscope as follows:

Waveform:	Frequency steps, fixed dwell time of 50 μs
Max A:	2.8 MHz
Min A:	1.0 MHz
Period:	500 μs

Test Results	Pass		Fail	

2. Remove the cable from 2572A channel 1 and connect to channel 2
3. Repeat the test procedure as above for channel 2

Test Results	Pass		Fail	

Sweep

Equipment: Oscilloscope

Preparation:

1. Configure the oscilloscope as follows:
   Time Base: 0.2 ms
   Sampling Rate: 50 MS/s at least.
   Trace A View: Jitter, Type: FREQ, CLK.
   Trigger source: Channel 2, positive slope
   Amplitude: 1 V/div
2. Connect 2572A Channel 1 output to the oscilloscope input, channel 1
3. Connect the 2572A SYNC output to the oscilloscope input, channel 2
4. Configure model 2572A controls on both channels as follows:
   Waveform: Modulated
   Modulation: Sweep
   Start Frequency: 1 MHz
   Stop Frequency: 2 MHz
   Sweep Time: 1 ms
   Sweep Type: Linear
   Sync: On
   Output: On

Test Procedure:

1. Verify Sweep operation on the oscilloscope as follows:
   Waveform: Ramp up
   Frequency: 1 kHz
   Max A: 2 MHz
   Min A: 1 MHz

Test Results	Pass		Fail	

2. Move 2572A sweep marker position to 1.5 MHz and verify marker position at the middle of the ramp

Test Results	Pass		Fail	

3. Reverse between Start and Stop frequencies and verify oscilloscope reading as before except the ramp is down

Test Results	Pass		Fail	

4. Change sweep step to logarithmic and verify oscilloscope exponential down waveform with properties as in 3 above

Test Results	Pass		Fail	

5. Remove the cable from 2572A channel 1 and connect to channel 2
6. Repeat the test procedure as above for channel 2

Test Results	Pass		Fail	

Digital Pattern Generator Characteristics

This tests the operation of the digital pattern generator and the output connector on the rear panel. The output is associated with channel 1. This test requires connection of a special test board to the rear panel connector. This board is available at specific service centers around the world and is not available for individuals. Therefore, if you suspect that there are problems with the digital pattern output, contact your nearest service center for details how to obtain access to the test board.

Digital Patterns

Equipment: Oscilloscope, Digital pattern test board, Dual DC power supply

Preparation:
1. Turn power OFF
2. Connect +3.3 V to the test board
3. Chook up the test board on the digital output connector
4. Turn power ON
5. Turn power supply power ON

WARNING

Do not attempt to connect the test board to the 2572A connector while power is ON as this may result in permanent damage to the 2572A. Always turn power OFF before connecting or disconnecting the test board to the 2572A.

6. Connect 2572A Channel 1 output to the oscilloscope input, channel 1
7. Configure model 2572A channel 1 controls as follows:
   Waveform: Arbitrary
   Auxiliary Function: Digital Pattern
   Pattern Rate: 2 pps
8. Using ArbConnection prepare, open the Digital Pattern Stimulation List Table and download the following table:

Index	Stimulation List (Hex)
1	1
2	2
3	4
4	8
5	10
6	20
7	40
8	80
9	100
10	200
11	400
12	800
13	1600
14	3200
15	6400
16	12800

Test Procedure:

1. Watch the LED’s on the test board. The 16 MSD LED’s light in sequence. Each LED lights for about 0.25 second
2. Set up the oscilloscope and check the output levels. Verify output levels are LVDS

Test Results	Pass		Fail	

3. Turn power off and remove the cable from the 2572A

SYNC Output operation

This tests the operation of the SYNC output. There are two parameters being tested, the qualifier and the sync source. The sync output has a fixed TTL level amplitude into an open circuit.

SYNC Qualifier - Bit

Equipment: Oscilloscope

Preparation:

1. Configure the oscilloscope as follows:
   Time Base: As required by the test
   Amplitude: 2 V/div
2. Connect 2572A SYNC output to the oscilloscope input
3. Configure model 2572A as follows:
   Ch1 Waveform: Sine
   Ch1 Output: On
   SYNC: On

Test Procedure:

1. Verify trace on the oscilloscope shows synchronization pulses at 1 μs intervals

Test Results	Pass		Fail	

SYNC Qualifier - LCOM

Equipment: Oscilloscope

Preparation:

1. Configure the oscilloscope as follows:
   Time Base: As required by the test
   Amplitude: 2 V/div
2. Connect the 2572A CH1 output to the oscilloscope input (1)
3. Connect the 2572A SYNC output to the oscilloscope input (2)
4. Configure model 2572A channel as follows:
   Waveform: Sine
   Run Mode: Burst
   Burst Count: 10
   Re-trigger On
   Re-trig period: 10 μs
   Output: On

Test Procedure:

1. Manually trigger the 2572A
2. Verify trace on the oscilloscope shows synchronization pulse having 10 μs pulse width. Verify the SYNC is high for the duration of the burst.

Test Results	Pass		Fail	

SYNC Source

Equipment: Oscilloscope

Preparation:

1. Configure the oscilloscope as follows:

Time Base:	As required by the test
Amplitude:	2 V/div
Trigger Source:	Channel 1

2. Connect 2572A SYNC output to the oscilloscope input, channel 1
3. Connect 2572A CH1 output to the oscilloscope input, channel 2
4. Connect 2572A CH2 output to the oscilloscope input, channel 3
5. Configure model 2572A channel 1 and 2 controls as follows:

Function:	Arbitrary
Output:	On
SYNC:	On

6. Using ArbConnection prepare and download the following waveform:

Ch1:	64 points sine waveform
Ch2:	100 points sine waveform

Test Procedure:

1. Verify that the trace on the oscilloscope is synchronized with the 2572A channel 1 waveform

Test Results	Pass		Fail	

2. Modify the 2572A SYNC Source from channel 1 to channel 2
3. Verify that the trace on the oscilloscope is synchronized with the 2572A channel 2 waveform

Test Results	Pass		Fail	

Waveform Memory Operation

This tests the integrity of the waveform memory. The waveform memory stores the waveforms that are being generated at the output connector and therefore, flaws in the memory can cause distortions and impurity of the output waveforms. Each channel has its own working memory and therefore each channel is tested separately.

Waveform memory

Equipment: Distortion Analyzer, ArbConnection

Preparation:

1. Connect 2572A Channel outputs to the distortion analyzer input. Configure the 2572A as follows:
   SCLK: As required by the test
   Waveform: Arbitrary
   Amplitude: 5 V
   Output: On
2. Using ArbConnection prepare and download the following waveform:
   Wavelength: 1 M points (2 M with an option installed)
   Waveform: Sine wave
   SCLK 250 MS/s

Test Procedure

1. Perform Sine wave distortion. It should be less than 0.1 %

Test Results	Pass		Fail	

Remote Interfaces

This tests the communication with the 2572A using the various interface options. Connecting and setting up the 2572A for operation with the various interface options is described in Chapter 2. Before you proceed with and of the following tests, make sure first that the 2572A is configured to operate with the selected test. GPIB operation requires setting of the GPIB address, LAN operation requires correct setting of the LAN parameters and USB operation requires that the USB port is configured correctly and USB driver installed on the host computer.

GPIB Control

Equipment: Distortion Analyzer, ArbConnection

Preparation:

1. Set up the 2572A for GPIB operation and connect the instrument to a host controller
2. Connect 2572A output to the distortion analyzer input.
3. Configure the 2572A as follows:
   SCLK: 250 MS/s
   Waveform: Arbitrary
   Output: On
4. Using ArbConnection prepare and download the following waveform:
   Wavelength: 1 M points (2 M with an option installed)
   Waveform: Sine wave

Test Procedure

1. Check the resulting trace on the oscilloscope
2. Perform Sine wave distortion. It should be less than 0.1 %

Test Results	Pass		Fail	

USB Control

Equipment: Distortion Analyzer, ArbConnection

Preparation:

1. Set up the 2572A for USB operation and connect the instrument to a host controller
2. Connect 2572A output to the distortion analyzer input.
3. Configure the 2572A as follows:
   SCLK: 250 MS/s
   Waveform: Arbitrary
   Output: On
4. Using ArbConnection prepare and download the following waveform:
   Wavelength: 1 M points (2 M with an option installed)
   Waveform: Sine wave

Test Procedure

1. Check the resulting trace on the oscilloscope
2. Perform Sine wave distortion. It should be less than 0. 1 %

Test Results	Pass		Fail	

LAN Control

Equipment: Distortion Analyzer, ArbConnection

Preparation:
1. Set up the 2572A for USB operation and connect the instrument to a host controller
2. Connect 2572A output to the distortion analyzer input.
3. Configure the 2572A as follows:
   SCLK: 250 MS/s
   Waveform: Arbitrary
   Output: On
4. Using ArbConnection prepare and download the following waveform:
   Wavelength: 1 M points (2 M with an option installed)
   Waveform: Sine wave

Test Procedure
1. Check the resulting trace on the oscilloscope
2. Perform Sine wave distortion. It should be less than 0.1 %

Test Results	Pass		Fail	

Auxiliary Counter/Timer Operation

This tests the operation of the auxiliary counter/timer function. Note that when you select the counter/timer function all other 2572A waveform generation are automatically purged and the instrument is transformed to a stand-alone counter/timer. Waveform generation is resumed as soon as the counter/timer function is turned off.

Frequency

Equipment: Function Generator with at least 1 ppm accuracy

Preparation:
1. Configure the function generator as follows:
   Frequency: As required by the test
   Wave: Square
   Amplitude 500 mV
2. Connect the function generator to the 2572A TRIG IN connector
3. Configure the 2572A, as follows:
   Auxiliary Function: Counter/Timer
   Function: Frequency
   Trigger Level: 0 V

Test Procedure:
1. Perform Frequency Measurement Accuracy tests using Table 6-17

Table -17, Frequency Measurement Accuracy

Function Generator Setting	Error Limits	2572A Counter Reading	Pass	Fail
1.000000 MHz	±2 Hz			
100.0000 MHz	±100 Hz			
120.0000 MHz	±200 Hz			

2. Change the display time to Hold
3. Press the Reset/Arm button and verify that the frequency reading is 120.000000 MHz, ±200 Hz

Test Results	Pass		Fail	

Period, Period Averaged

Equipment: Function Generator with at least 1 ppm accuracy

Preparation:

1. Configure the function generator as follows:
   Frequency: As required by the test
   Wave: Square
   Amplitude 500 mV
2. Connect the function generator to the 2572A TRIG IN connector
3. Configure the 2572A, as follows:
   Auxiliary Function: Counter/Timer
   Function: Period
   Trigger Level: 0 V

Test Procedure:

1. Perform Period Accuracy tests using Table 6-18

Table -18, Period Measurement Accuracy

Function Generator Setting	Error Limits	2572A Counter Reading	Pass	Fail
10 kHz	100.0 µs ±100 ns			
100 kHz	10.00 µs ±100 ns			
1 MHz	1.000 µs ±100 ns			

2. Change the counter/timer function to Period Averaged
3. With the last function generator setting in Table 6-18, verify that the period reading is 1.000000 µs ±50 ps

Test Results	Pass		Fail	

Pulse Width

Equipment: Function Generator with at least 1 ppm accuracy

Preparation:

1. Configure the function generator as follows:
   Frequency: As required by the test
   Wave: Square
   Duty Cycle: As required by the test
   Amplitude 500 mV
2. Connect the function generator to the 2572A TRIG IN connector
3. Configure the 2572A, as follows:
   Auxiliary Function: Counter/Timer
   Function: Pulse Width
   Trigger Level: 0 V

Test Procedure:

1. Perform Pulse Width Accuracy tests using Table 6-19

Table -19, Pulse Width Measurement Accuracy

Function Generator Setting		Error Limits	2572A Counter Reading	Pass	Fail
Frequency	Duty Cycle				
10 kHz	50 %	50.00 µs ±100 ns			
100 kHz	50 %	5.000 µs ±100 ns			
1 MHz	70 %	700 ns ±100 ns			

2. Change the counter/timer slope to Negative
3. With the last function generator setting in Table 6-19, change the function generator duty cycle to 70 %
4. Verify that the pulse width reading is 300 ns ±100 ns

Test Results	Pass		Fail	

Totalize, Gated

Equipment: Function Generator with at least 1 ppm accuracy

Preparation:

1. Configure the function generator as follows:
   Frequency: 1 MHz
   Wave: Square
   Amplitude 500 mV
   Run Mode: Burst

Burst Count: 100

2. Connect the function generator to the 2572A TRIG IN connector
3. Configure the 2572A, as follows:
   Auxiliary Function: Counter/Timer
   Function: Totalize, Gated
   Trigger Level: 0 V

Test Procedure:

1. Press the Reset/Arm button on the 2572A to reset and arm the totalize function
2. Manually trigger the function generator and verify that the 2572A counter reading is 100 ±1

Test Results	Pass		Fail	

Totalize, Infinite

Equipment: Function Generator with at least 1 ppm accuracy

Preparation:

1. Configure the function generator as follows:
   Frequency: 100 MHz
   Wave: Square
   Amplitude 500 mV
2. Connect the function generator to the 2572A TRIG IN connector
3. Configure the 2572A, as follows:
   Auxiliary Function: Counter/Timer
   Function: Totalize, Infinite
   Trigger Level: 0 V

Test Procedure:

1. Verify that the display is updated continuously with the totalized counts
2. Verify that the reading is held at 4000000000 counts and that the overflow indication turns on

Test Results	Pass		Fail	

3. Change the function generator run mode to Burst and set Burst Count to 1’000’000
4. Press the Reset/Arm button on the 2572A to reset and arm the totalize function
5. Manually trigger the function generator and verify that the 2572A counter reading is 1000000 ±2

Test Results	Pass		Fail	

2. Connect the function generator to the 2572A TRIG IN connector
3. Configure the 2572A, as follows:
   Auxiliary Function: Counter/Timer
   Function: Totalize, Infinite
   Trigger Level: 0 V

Test Procedure:

1. Verify that the display is updated continuously with the totalized counts
2. Verify that the reading is held at 4000000000 counts and that the overflow indication turns on

Test Results	Pass		Fail	

3. Change the function generator run mode to Burst and set Burst Count to 1’000’000
4. Press the Reset/Arm button on the 2572A to reset and arm the totalize function
5. Manually trigger the function generator and verify that the 2572A counter reading is 1000000 ±2

Test Results	Pass		Fail	

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Chapter 7
Adjustments and Firmware Update

Title	Page

What's in This Chapter

This chapter provides adjustment information for the 2572A dual channel waveform generator. The same procedures are used for the Model 2571A except all references to the second channel should be ignored.

WARNING

The procedures described in this section are for use only by qualified service personnel. Many of the steps covered in this section may expose the individual to potentially lethal voltages that could result in personal injury or death if normal safety precautions are not observed.

CAUTION

ALWAYS PERFORM DISASSEMBLY, REPAIR AND CLEANING AT A STATIC SAFE WORKSTATION.

Performance Checks

Do not attempt to calibrate the instrument before you verify that there is no problem with the functionality of the product. A complete set of specification is listed in Appendix A. If the instrument fails to perform within the specified limits, the instrument must be tested to find the source of the problem.

In case there is a reasonable suspicion that an electrical problem exist within the 2572A, perform a complete performance checks as given in Chapter 6 to verify proper operation of the instrument.

Environmental Conditions

The 2572A can operate from 0°C to 50°C. Adjustments should be performed under laboratory conditions having an ambient temperature of 25°C, ±5°C and at relative humidity of less than 80%. Turn on the power to the 2572A and allow it to warm up for at least 30 minutes before beginning the adjustment procedure. If the instrument has been subjected to conditions outside these ranges, allow at least one additional hour for the instrument to stabilize before beginning the adjustment procedure.

Warm-up Period

Most equipment is subject to a small amount of drift when it is first turned on. To ensure accuracy, turn on the power to the Model 2572A and allow it to warm-up for at least 30 minutes before beginning the performance test procedure.

Recommended Test Equipment

Recommended equipment for adjustments is listed in Table 6-1. Instruments other than those listed may be used only if their specifications equal or exceed the required minimal characteristics. Also listed below are accessories required for calibration.

Table 7-1, Recommended calibration for Adjustments

Equipment	**Model No.**	**Manufacturer**
Oscilloscope (with jitter package)	LC684	LeCroy
Digital Multimeter	2000	Keithley
Frequency Counter (Rubidium reference)	6020R	Tabor Electronics
Function Generator (with manual trigger)	8020	Tabor Electronics
Accessories	BNC to BNC cables	
	50Ω Feedthrough termination	
	Dual banana to BNC adapter	

Adjustment Procedures

Use the following procedures to calibrate the Model 2572A. The following paragraphs show how to set up the instrument for calibration and what the acceptable calibration limits are.

Calibration is done with the covers closed and the 2572A connected through an interface to a host computer. Any interface can be used from the following: USB, LAN, or GPIB. Calibration requires that ArbConnection utility be installed and interfaced to the instrument.

Calibration is performed from the Calibration Panel in ArbConnection. To invoke this panel, one requires a password that is available to service centers only. Contact your nearest Tabor service center for information and permit to obtain your calibration password. Use the following procedure to calibrate the generator:

1. Invoke ArbConnection
2. Click on the UTIL icon on the Panels bar
3. On the Utility Panel click on Calibration and expect to be prompted with the following dialog box

Figure 7-1, Calibration Password

4. Type your User Name Password and click on OK. The Calibration Panel as shown in Figure 2 will appear.

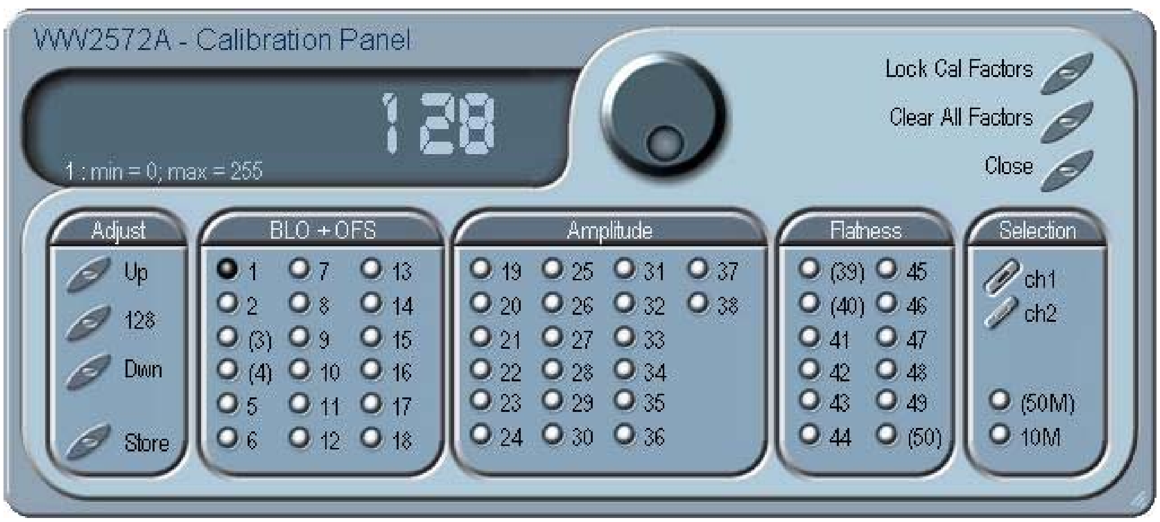

Figure 7-2, Calibration Panel

NOTE

Initial factory adjustments require that the covers be removed from the instrument. Field calibration does not require re-adjustments of these factory settings unless the unit was repaired in an authorized service center. Factory adjustments are enclosed in parentheses to differentiate from normal field calibration setups; bypass these adjustments when performing field calibration.

Calibrations are marked with numbers from 1 to 50 and, except the (50M) and 10M adjustments in the Selection group, should be carried out exactly in the order as numbered on the panel. There are separate adjustments for Channel 1 and Channel 2 so make sure that the output cables are connected to the appropriate channel during the adjustments.

The numbers that are associated with each adjustment are identified as Setup Number at the title of each of the adjustments in the following procedure.

Remote adjustments have the range of 1 through 256 with the center alignment set to 128. Therefore, if you are not sure of the direction, set the adjustment to 128 and add or subtract from this value. If you have reached 1 or 256 and were not able to calibrate the range, there is either a problem with the way you measure the parameter or possibly there is a problem with the instrument. In either case, do not leave any adjustment in its extreme setting but center the adjustment and contact your nearest service center for clarifications and support.

Note in the following procedures that although configuration of the 2572A is done automatically, some of the configuration is shown for reference. There is no requirement to change configuration of the 2572A during the remote adjustment procedure except in places where specifically noted.

Reference Oscillators Adjustments

Use this procedure to adjust the reference oscillators. The reference oscillators determine the accuracy of the output frequency so if you suspect that there is an accuracy issue, proceed with the calibration of the reference oscillators

(Setup 50M)

50MHz Gated Oscillator Adjustment

Equipment: Counter, Function Generator, BNC to BNC cables,

Preparation:

1. Configure the counter as follows:
   - Termination: 50Ω DC
   - Function: TI A -> B
   - Slope B: Negative
2. Connect the 2572A Channel 1 output to the oscilloscope input
3. Connect an external function generator to the rear panel TRIG IN connector
4. Using ArbConnection prepare and download the following waveform:
   - Wavelength: 100 points
   - Waveform: Pulse: Delay = 0.01%, Rise/Fall Time = 0%, High Time = 99.99%
5. Configure the 2572A as follows:
   - Function Mode: Arbitrary
   - Run Mode: Triggered
   - Retrigger Mode: On
   - Retrigger Delay: 20μs
6. Using an external function generator, manually trigger the 2572A

Adjustment:

1. Adjust C18 for a period of 20μs, ±5%

Setup 10M

10MHz TCXO Frequency

Equipment: Counter, BNC to BNC cables

Preparation:

1. Configure the counter as follows:
   - Function: Freq A
   - Termination: 50Ω
2. Connect the 2572A Channel 1 output to the counter input.
3. Configure the 2572A as follows:
   - Frequency: 10MHz
   - Ch1 Output: On
   - Ch1 Amplitude 2V
   - Wave: Square

Adjustment:

4. Adjust CAL:SETUP57 for counter reading of 10MHz, ±2Hz

Channel 1 Adjustments

The following procedures pertain to the channel 1 output only. Therefore, make sure that your connections are made to the channel 1 connectors.

Base Line Offset Adjustments

The base line offset adjustments assure that the AC signal is symmetrical around the 0V line. Use this procedure if you suspect that there is a base line accuracy issue.

Setup 1

Amplifier Offset

Equipment: DMM, BNC to BNC cable, 50Ω Feedthrough termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 100mV
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feedthrough termination
3. Configure the 2572A as follows:
   CAL:SERV 1

Adjustment:

4. Adjust CAL:SETUP1 for DMM reading of 0V, ±20mV

Setup 2

Pre-Amplifier Offset

Equipment: DMM, BNC to BNC cable, 50Ω Feedthrough termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 100mV
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   CAL:SERV 2

Adjustment

4. Adjust CAL:SETUP2 for DMM reading of 0V, ±5mV

(Setup 3)

Base Line Offset, Low Range, Amplifier Out – Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feedthrough termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 100mV
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Mode: Modulation
   Ch1 Amplitude: 510mV

Adjustment

4. Note DMM reading

(Setup 4)

Base Line Offset, High Range, Amplifier Out – Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feedthrough termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 100mV
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Mode: Modulation
   Ch1 Amplitude: 1.590V

Adjustment

4. Adjust CAL: SETUP 6 for DMM reading the same as Setup 3
5. Repeat Setup 3 and Setup 4 until the DMM readings are the same +/-10mV.
6. Adjust RV1 for DMM readings of 0V+/-10mV.

Setup 5

Base Line Offset, Amplifier In – Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feedthrough termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 100mV
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Mode: Modulation

Ch1 Output: On
Ch1 Amplitude: 6V

Adjustment

4. Adjust CAL:SETUP 5 for DMM reading of 0V, ±20mV

Setup 6

Base Line Offset, Amplifier Out – Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation**:**

1. Configure the DMM as follows:
   Function: DCV
   Range: 100mV
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Mode: Modulation
   Ch1 Output: On
   Ch1 Amplitude: 1V

Adjustment:

4. Adjust CAL:SETUP 6 for DMM reading of 0V, ±5mV

Setup 7

Base Line Offset, Amplifier In – Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 100mV
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch1 Output: On
   Ch1 Amplitude: 6V

Adjustment:

4. Adjust CAL:SETUP 7 for DMM reading of 0V, ±20mV

Setup 8

Base Line Offset, Amplifier Out - Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 100mV
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch1 Output: On
   Ch1 Amplitude: 1V

Adjustment:

4. Adjust CAL: SETUP 8 for DMM reading of 0V, ±5mV

Offset Adjustments

The offset adjustments assure that the DC offsets are within the specified range. Use this procedure if you suspect that the offset accuracy is an issue.

Setup 9

Offset (+1V) Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feedthrough termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 1 V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch1 Amplitude: 2V
   Ch1 Offset +1V
   Ch1 Output: On

Adjustment:

4. CAL: SETUP 61 for DMM reading of +1V, ± 5mV

Setup 10

Offset (+3V) Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 10 V
2. Connect the 2572A Channel 1 output to the DMM input.

Terminate the 2572A output at the DMM input with the 50Ω Feed through termination

3. Configure the 2572A as follows:
    - Ch1 Amplitude: 2V
    - Ch1 Offset +3V
    - Ch1 Output: On

Adjustment:

4. CAL: SETUP 60 for DMM reading of +3V, ± 15mV

Setup 11

+5V Offset Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
    - Function: DCV
    - Range: 10 V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:
    - Ch1 Amplitude: 20mV
    - Ch1 Offset +5V
    - Ch1 Output: On

Adjustment:

4. CAL: SETUP 59 for DMM reading of +5V, ± 25mV

Setup 12

+7V Offset Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
    - Function: DCV
    - Range: 10 V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:
    - Ch1 Amplitude: 20mV
    - Ch1 Offset +7V
    - Ch1 Output: On

Adjustment:

4. CAL: SETUP 58 for DMM reading of +7V, ± 35mV;

Setup 13

-1V Offset Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feedthrough termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 1 V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch1 Amplitude: 2V
   Ch1 Offset -1V
   Ch1 Output: On

Adjustment:

4. CAL: SETUP 62 for DMM reading of -1V, ± 5mV

Setup 14

-3V Offset Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 10 V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch1 Amplitude: 2V
   Ch1 Offset -3V
   Ch1 Output: On

Adjustment:

4. CAL: SETUP 63 for DMM reading of -3V, ± 15mV

Setup 15

-5V Offset Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 10 V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination

3. Configure the 2572A as follows:
   Ch1 Amplitude: 20mV
   Ch1 Offset -5V
   Ch1 Output: On

Adjustment:

4. CAL: SETUP 64 for DMM reading of -5V, ± 25mV

Setup 16

-7V Offset Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 10 V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch1 Amplitude: 20mV
   Ch1 Offset -7V
   Ch1 Output: On

Adjustment:

4. CAL: SETUP 65 for DMM reading of -7V, ± 35mV

Setup 17

(+) Offset, Output Amplifier Out

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 1V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch1 Amplitude: 20mV
   Ch1 Offset +1V
   Ch1 Output: On

Adjustment:

4. CAL:SETUP14 for DMM reading of +1V, ±5mV; Note reading

Setup 18

(-) Offset, Output Amplifier Out

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 1V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch1 Amplitude: 20mV
   Ch1 Offset -1V
   Ch1 Output: On

Adjustment:

4. CAL:SETUP14 for DMM reading of -1V, ±5mV; note reading
5. Repeat steps Setup 17 and Setup 18 until errors are balanced between the steps

Amplitude Adjustments

The amplitude adjustments assure that the AC levels are within the specified range. Use this procedure if you suspect that the amplitude accuracy is an issue.

Setup 19

10V Amplitude - Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 10V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch1 Output: On
   Ch1 Amplitude: 10V

Adjustment:

4. Adjust CAL:SETUP17 for DMM reading of 3.535V ±30mV

Setup 20

3V Amplitude - Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV

Range: 1V

2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch1 Output: On
   Ch1 Amplitude: 3V

Adjustment:

4. Adjust CAL:SETUP18 for DMM reading of 1.0606V ±7mV

Setup 21

1V Amplitude, Output Amplifier In – Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch1 Output: On
   CAL:SERV 5

Adjustment:

4. Adjust CAL:SETUP19 for DMM reading of 353.5mV ±3mV

Setup 22

500mV Amplitude, Amplifier In – Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch1 Output: On
   CAL:SERV 6

Adjustment:

4. Adjust CAL:SETUP20 for DMM reading of 176.7mV ±1.5mV

Setup 23

100mV Amplitude, Amplifier In – Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 100mV
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch1 Output: On
   CAL:SERV 7

Adjustment:

4. Adjust CAL:SETUP21for DMM reading of 35,35mV ±0.3mV

Setup 24

50mV Amplitude, Amplifier In – Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 100mV
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch1 Output: On
   CAL:SERV 8

Adjustment:

4. Adjust CAL:SETUP22 for DMM reading of 17,67mV ±0.15mV

Setup 25

1V Amplitude, Output Amplifier Out – Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω

Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch1 Output: On
   Ch1 Amplitude 1V

Adjustment:
4. Adjust CAL:SETUP23 for DMM reading of 353.5mV ±3mV

Setup 26

500mV Amplitude, Output Amplifier Out – Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:
1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch1 Output: On
   Ch1 Amplitude 500mV

Adjustment:
4. Adjust CAL:SETUP24 for DMM reading of 176.7mV ±1.5mV

Setup 27

100mV Amplitude, Output Amplifier Out – Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:
1. Configure the DMM as follows:
   Function: ACV
   Range: 100mV
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch1 Output: On
   Ch1 Amplitude 100mV

Adjustment:
4. Adjust CAL:SETUP25 for DMM reading of 35,35mV ±0.3mV

Setup 28

50mV Amplitude, Output Amplifier Out – Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 100mV
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch1 Output: On
   Ch1 Amplitude 50mV

Adjustment:

4. Adjust CAL:SETUP26 for DMM reading of 17,67mV ±0.15mV

Setup 29

10V Amplitude - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 10V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   CW Frequency: 1kHz
   Mode: Modulation
   Ch1 Output: On
   Ch1 Amplitude: 10V

Adjustment:

4. Adjust CAL:SETUP27 for DMM reading of 3.535V ±30mV

Setup 30

3V Amplitude - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω

Feed through termination

3. Configure the 2572A as follows:

CW Frequency:	1kHz
Mode:	Modulation
Ch1 Output:	On
Ch1 Amplitude:	3V

Adjustment:

4. Adjust CAL:SETUP28 for DMM reading of 1.0606 ±7mV

Setup 31

1V Amplitude, Amplifier In - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:

Function:	ACV
Range:	1V

2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:

CW Frequency:	1kHz
Mode:	Modulation
Ch1 Output:	On
CAL: SERV	5

Adjustment:

4. Adjust CAL:SETUP29 for DMM reading of 353.5mV ±3mV

Setup 32

500mV Amplitude, Amplifier In - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:

Function:	ACV
Range:	1V

2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:

CW Frequency:	1kHz
Mode:	Modulation
Ch1 Output:	On
CAL:SERV	6

Adjustment:

4. Adjust CAL:SETUP30 for DMM reading of 176.7mV ±1.5mV

Setup 33

100mV Amplitude, Amplifier In - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 100mV
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   CW Frequency: 1kHz
   Mode: Modulation
   Ch1 Output: On
   CAL:SERV 7

Adjustment:

4. Adjust CAL:SETUP31for DMM reading of 35,35mV ±0.3mV

Setup 34

50mV Amplitude, Amplifier In - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 100mV
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   CW Frequency: 1kHz
   Mode: Modulation
   Ch1 Output: On
   CAL: SERV 8

Adjustment:

4. Adjust CAL:SETUP32 for DMM reading of 17,67mV ±0.15mV

Setup 35

1V Amplitude, Amplifier Out - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 1 output to the DMM input.

Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination

3. Configure the 2572A as follows:
   CW Frequency: 1kHz
   Mode: Modulation
   Ch1 Output: On
   Ch1 Amplitude 1V

Adjustment:

4. Adjust CAL:SETUP33 for DMM reading of 353.5mV ±3mV

Setup 36

500mV Amplitude, Amplifier Out - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   CW Frequency: 1kHz
   Mode: Modulation
   Ch1 Output: On
   Ch1 Amplitude 500mV

Adjustment:

4. Adjust CAL:SETUP34 for DMM reading of 176.7mV ±1.5mV

Setup 37

100mV Amplitude, Amplifier Out - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 100mV
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   CW Frequency: 1kHz
   Mode: Modulation
   Ch1 Output: On
   Ch1 Amplitude 100mV

Adjustment:

4. Adjust CAL:SETUP35 for DMM reading of 35,35mV ±0.3mV

Setup 38

50mV Amplitude, Amplifier Out - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:

Function:	ACV
Range:	100mV

2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:

CW Frequency:	1kHz
Mode:	Modulation
Ch1 Output:	On
Ch1 Amplitude	50mV

Adjustment:

4. Adjust CAL:SETUP36 for DMM reading of 17,67mV ±0.15mV

Pulse Response Adjustments

The pulse response adjustments assure that the rise and fall times, as well as, the aberrations are within the specified range. Use this procedure if you suspect that the pulse response is an issue.

(Setup 39)

Pulse Response, Amplifier Out

Equipment: Oscilloscope, BNC to BNC cable, 20dB Feedthrough attenuator

Preparation:

1. Configure the 2572A as follows:
   Function: Square
   Amplitude: 1.5V
2. Connect the 2572A Channel 1 output to the oscilloscope input. Set oscilloscope input impedance to 50Ω
3. Set oscilloscope vertical sensitivity to 20mV

Adjustment:

4. Adjust vertical trace to 6 divisions
5. Adjust RV3 for best pulse response (4ns type, 5% aberrations)

(Setup 40)

Pulse Response, Amplifier In

Equipment: Oscilloscope, BNC to BNC cable, 20dB Feedthrough attenuator

Preparation:

1. Configure the 2572A as follows:
   Function: Square
   Amplitude: 6V
2. Connect the 2572A Channel 1 output to the oscilloscope input. Use 20dB Feedthrough attenuator at the oscilloscope input
3. Set oscilloscope input impedance to 50Ω
4. Set oscilloscope vertical sensitivity to 0.1V

Adjustment:

5. Adjust vertical trace to 6 divisions
6. Adjust C1036 for best pulse response (4ns type, 5% aberrations)

Flatness Adjustments

The flatness adjustments assure that the flatness of the amplifier is within the specified range. Use this procedure if you suspect that the flatness is an issue.

Setup 41

1MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:
   Input Impedance: 50 ohms
   Range: 100mV
2. Connect the 2572A Channel 1 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1MHz
   Ch1 Output: On

Adjustment:

4. Adjust the Fine Amplitude of the Oscilloscope to get the signal of 6 divisions on the screen.

Setup 42

10MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:
   Input Impedance: 50 ohms
   Range: 100mV
2. Connect the 2572A Channel 1 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:
   Frequency: 10MHz
   Ch1 Output: On

Adjustment:

4. Adjust CAL:SETUP74 to get the signal of 6 divisions on the screen.

Setup 43

20MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:
   Input Impedance: 50 ohms
   Range: 100mV
2. Connect the 2572A Channel 1 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:
   Frequency: 20MHz
   Ch1 Output: On

Adjustment:

4. Adjust CAL:SETUP75 to get the signal of 6 divisions on the screen.

Setup 44

30MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:
   Input Impedance: 50 ohms
   Range: 100mV
2. Connect the 2572A Channel 1 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:
   Frequency: 30MHz
   Ch1 Output: On

Adjustment:

4. Adjust CAL:SETUP76 to get the signal of 6 divisions on the screen.

Setup 45

37.3333333MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:
   Input Impedance: 50 ohms
   Range: 100mV
2. Connect the 2572A Channel 1 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:
   Frequency: 37.3333333MHz
   Ch1 Output: On

Adjustment:

4. Adjust CAL:SETUP77 to get the signal of 6 divisions on the screen.

Setup 46

56MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:
   Input Impedance: 50 ohms
   Range: 100mV

2. Connect the 2572A Channel 1 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:
   Frequency: 56MHz
   Ch1 Output: On

Adjustment:

4. Adjust CAL:SETUP78 to get the signal of 6 divisions on the screen.

Setup 47

56.0000001MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:
   Input Impedance: 50 ohms
   Range: 100mV
2. Connect the 2572A Channel 1 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:
   Frequency: 56.0000001MHz
   Ch1 Output: On

Adjustment:

4. Adjust CAL:SETUP79 to get the signal of 6 divisions on the screen.

Setup 48

80MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:
   Input Impedance: 50 ohms
   Range: 100mV
2. Connect the 2572A Channel 1 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:
   Frequency: 80MHz
   Ch1 Output: On

Adjustment:

4. Adjust CAL:SETUP80 to get the signal of 6 divisions on the screen.

Setup 49

100MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:

   Input Impedance: 50 ohms
   Range: 100mV
2. Connect the 2572A Channel 1 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:

   Frequency: 100MHz
   Ch1 Output: On

Adjustment:

4. Adjust CAL:SETUP81 to get the signal of 6 divisions on the screen.

(Setup 50)

Frequency Flatness – Modulation

Equipment: Oscilloscope, BNC to BNC cable, 20dB Feedthrough attenuator

Preparation:

1. Configure the 2572A as follows:

   Function: Modulation ON
   Modulation: Sweep
   Start Freq: 1MHz
   Stop Freq: 100MHz
   Sweep Time: 1ms
   Marker: 1MHz
   Amplitude: 6V
2. Connect the 2572A Channel 1 output to the oscilloscope input. Use 20dB Feedthrough attenuator at the oscilloscope input
3. Set oscilloscope input impedance to 50Ω
4. Set oscilloscope vertical sensitivity to 0.1V

Adjustment:

5. Adjust C1016 for the best flatness.

Channel 2 Adjustments

The following procedures pertain to the channel 2 output only. Therefore, make sure that your connections are made to the channel 1 connectors.

Base Line Offset Adjustments

The base line offset adjustments assure that the AC signal is symmetrical around the 0V line. Use this procedure if you suspect that there is a base line accuracy issue.

Setup 1

Amplifier Offset

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 100mV
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   CAL:SERV 3

Adjustment:

4. Adjust CAL:SETUP 3 for DMM reading of 0V, ±20mV

Setup 2

Pre-Amplifier Offset

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 100mV
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   CAL:SERV 4

Adjustment:

4. Adjust CAL:SETUP4 for DMM reading of 0V, ±5mV

(Setup 3)

Base Line Offset, Low Range, Amplifier In - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 100mV
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Mode: Modulation
   Ch2 Amplitude: 510mV

Adjustment:

Note DMM reading

(Setup 4)

Base Line Offset, High Range, Amplifier Out - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 100mV
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Mode: Modulation
   Ch2 Amplitude: 1.590V

Adjustment:

4. Adjust CAL: SETUP 12 for DMM reading the same as in Setup 3
5. Repeat Setup 3 and Setup 4 until the DMM readings are the same +/-10mV.
6. Adjust RV2 for DMM readings of 0V+/-10mV.

Setup 5

Base Line Offset, Amplifier In - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 100mV

2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:

   Mode: Modulation
   Ch2 Output: On
   Ch2 Amplitude: 6V

Adjustment:

4. Adjust CAL:SETUP 11 for DMM reading of 0V, ±20mV

Setup 6

Base Line Offset, Amplifier Out - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:

   Function: DCV
   Range: 100mV
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:

   Ch2 Output: On
   Mode: Modulation
   Ch2 Amplitude: 1V

Adjustment:

4. Adjust CAL:SETUP 12 for DMM reading of 0V, ±5mV

Setup 7

Base Line Offset, Amplifier In - Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:

   Function: DCV
   Range: 100mV
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:

   Ch2 Output: On
   Ch2 Amplitude: 6V

Adjustment:

4. Adjust CAL:SETUP 9 for DMM reading of 0V, ±20mV

Setup 8

Base Line Offset, Amplifier Out - Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 100mV
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch2 Output: On
   Ch2 Amplitude: 1V

Adjustment:

4. Adjust CAL:SETUP 10 for DMM reading of 0V, ±5mV

Offset Adjustments

The offset adjustments assure that the DC offsets are within the specified range. Use this procedure if you suspect that the offset accuracy is an issue.

Setup 9

+1V Offset Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feedthrough termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 1 V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch2 Amplitude: 2V
   Ch2 Offset +1V
   Ch2 Output: On

Adjustment:

4. CAL: SETUP 69 for DMM reading of +1V, ± 5mV

Setup 10

+3V Offset Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV

Range: 10 V

2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch2 Amplitude: 2V
   Ch2 Offset +3V
   Ch2 Output: On

Adjustment:

4. CAL: SETUP 68 for DMM reading of +3V, ± 15mV

Setup 11

+5V Offset Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 10 V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch2 Amplitude: 20mV
   Ch2 Offset +5V
   Ch2 Output: On

Adjustment:

4. CAL: SETUP 67for DMM reading of +5V, ± 25mV

Setup 12

+7V Offset Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 10 V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch2 Amplitude: 20mV
   Ch2 Offset +7V
   Ch2 Output: On

Adjustment:

4. CAL: SETUP 66 for DMM reading of +7V, ± 35mV

Setup 13

-1V Offset Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feedthrough termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 1 V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch2 Amplitude: 2V
   Ch2 Offset -1V
   Ch2 Output: On

Adjustment:

4. CAL: SETUP 70 for DMM reading of -1V, ± 5mV

Setup 14

-3VOffset Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 10 V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch2 Amplitude: 2V
   Ch2 Offset -3V
   Ch2 Output: On

Adjustment:

4. CAL: SETUP 71for DMM reading of -3V, ± 15mV

Setup 15

-5V Offset Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 10 V
2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed

through termination

3. Configure the 2572A as follows:

Ch2 Amplitude:	20mV
Ch2 Offset	-5V
Ch2 Output:	On

Adjustment:

4. CAL: SETUP 72 for DMM reading of -5V, ± 25mV

Setup 16

-7V Offset Output Amplifier In

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:

Function:	DCV
Range:	10 V

2. Connect the 2572A Channel 1 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:

Ch2 Amplitude:	20mV
Ch2 Offset	-7V
Ch2 Output:	On

Adjustment:

4. CAL: SETUP 73for DMM reading of -7V, ± 35mV

Setup 17

(+)Offset, Output Amplifier Out

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:

Function:	DCV
Range:	10V

2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:

Ch2 Amplitude:	20mV
Ch2Offset	+1V
Ch2 Output:	On

Adjustment:

4. CAL:SETUP16 for DMM reading of +1V, ±5mV; Note reading

Setup 18

(-)Offset, Output Amplifier Out

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: DCV
   Range: 10V
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the 50Ω Feed through termination
3. Configure the 2572A as follows:
   Ch2 Amplitude: 20mV
   Ch2Offset -1V
   Ch2 Output: On

Adjustment:

4. CAL:SETUP16 for DMM reading of -1V, ±5mV; note reading
5. Repeat Setup 17 and Setup 18 until errors are balanced between the steps

Amplitude Adjustments

The amplitude adjustments assure that the AC levels are within the specified range. Use this procedure if you suspect that the amplitude accuracy is an issue.

Setup 19

10V Amplitude – Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 10V
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch2 Output: On
   Ch2 Amplitude: 10V

Adjustment:

4. Adjust CAL:SETUP37 for DMM reading of 3.535V ±30mV

Setup 20

3V Amplitude – Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 3 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch2 Output: On
   Ch2 Amplitude: 3V

Adjustment:

4. Adjust CAL:SETUP38 for DMM reading of 1.0606V ±7mV

Setup 21

1V Amplitude, Amplifier In - Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch2 Output: On
   CAL:SERV 9

Adjustment:

4. Adjust CAL:SETUP39 for DMM reading of 353.5mV ±3mV

Setup 22

500mV Amplitude, Amplifier In - Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination

3. Configure the 2572A as follows:

Frequency:	1kHz
Ch2 Output:	On
CAL:SERV	10

Adjustment:

4. Adjust CAL:SETUP40 for DMM reading of 176.7mV ±1.5mV

Setup 23

100mV Amplitude, Amplifier In - Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:

Function:	ACV
Range:	100mV

2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:

Frequency:	1kHz
Ch2 Output:	On
CAL:SERV	11

Adjustment:

4. Adjust CAL:SETUP41for DMM reading of 35,35mV ±0.3mV

Setup 24

50mV Amplitude, Amplifier In - Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:

Function:	ACV
Range:	100mV

2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:

Frequency:	1kHz
Ch2 Output:	On
CAL:SERV	12

Adjustment:

4. Adjust CAL:SETUP42 for DMM reading of 17,67mV ±0.15mV

Setup 25

1V Amplitude, Amplifier Out - Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch2 Output: On
   Ch2 Amplitude 1V

Adjustment:

4. Adjust CAL:SETUP43 for DMM reading of 353.5mV ±3mV

Setup 26

500mV Amplitude, Amplifier Out - Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch2 Output: On
   Ch2 Amplitude 500mV

Adjustment:

4. Adjust CAL:SETUP44 for DMM reading of 176.7mV ±1.5mV

Setup 27

100mV Amplitude, Amplifier Out - Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 100mV
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination

3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch2 Output: On
   Ch2 Amplitude 100mV

Adjustment:

4. Adjust CAL:SETUP45 for DMM reading of 35,35mV ±0.3mV

Setup 28

50mV Amplitude, Amplifier Out - Arbitrary

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 100mV
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1kHz
   Ch2 Output: On
   Ch2 Amplitude 50mV

Adjustment:

4. Adjust CAL:SETUP46 for DMM reading of 17,67mV ±0.15mV

Setup 29

10V Amplitude - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 10V
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   CW Frequency: 1kHz
   Mode: Modulation
   Ch2 Output: On
   Ch2 Amplitude: 10V

Adjustment:

4. Adjust CAL:SETUP47 for DMM reading of 3.535V ±30mV

Setup 30

3V Amplitude - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   CW Frequency: 1kHz
   Mode: Modulation
   Ch2 Output: On
   Ch2 Amplitude: 3V

Adjustment:

4. Adjust CAL:SETUP48 for DMM reading of 1.0606V±7mV

Setup 31

1V Amplitude, Amplifier In - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   CW Frequency: 1kHz
   Mode: Modulation
   Ch2 Output: On
   CAL:SERV 9

Adjustment:

4. Adjust CAL: SETUP49 for DMM reading of 353.5mV ±3mV

Setup 32

500mV Amplitude, Amplifier In - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 2 output to the DMM input.

Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination

3. Configure the 2572A as follows:

CW Frequency:	1kHz
Mode:	Modulation
Ch2 Output:	On
CAL:SERV	10

Adjustment:

4. Adjust CAL: SETUP50 for DMM reading of 176.7mV ±1.5mV

Setup 33

100mV Amplitude, Amplifier In - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:

Function:	ACV
Range:	100mV

2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:

CW Frequency:	1kHz
Mode:	Modulation
Ch2 Output:	On
CAL:SERV	11

Adjustment:

4. Adjust CAL:SETUP51 for DMM reading of 35,35mV ±0.3mV

Setup 34

50mV Amplitude, Amplifier In - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:

Function:	ACV
Range:	100mV

2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:

CW Frequency:	1kHz
Mode:	Modulation
Ch2 Output:	On
CAL:SERV	12

Adjustment:

4. Adjust CAL:SETUP52 for DMM reading of 17,67mV ±0.15mV

Setup 35

1V Amplitude, Amplifier Out - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   CW Frequency: 1kHz
   Mode: Modulation
   Ch2 Output: On
   Ch2 Amplitude 1V

Adjustment:

4. Adjust CAL:SETUP53 for DMM reading of 353.5mV ±3mV

Setup 36

500mV Amplitude, Amplifier Out - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V
2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:
   CW Frequency: 1kHz
   Mode: Modulation
   Ch2 Output: On
   Ch2 Amplitude 500mV

Adjustment:

4. Adjust CAL:SETUP54 for DMM reading of 176.7mV ±1.5mV

Setup 37

100mV Amplitude, Amplifier Out - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 1V

2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:

CW Frequency:	1kHz
Mode:	Modulation
Ch2 Output:	On
Ch2 Amplitude	100mV

Adjustment:

4. Adjust CAL:SETUP55 for DMM reading of 35,35mV ±0.3mV

Setup 38

50mV Amplitude, Amplifier Out - Modulation

Equipment: DMM, BNC to BNC cable, 50Ω Feed through termination, Dual banana to BNC adapter

Preparation:

1. Configure the DMM as follows:

Function:	ACV
Range:	100mV

2. Connect the 2572A Channel 2 output to the DMM input. Terminate the 2572A output at the DMM input with the, 50Ω Feed through termination
3. Configure the 2572A as follows:

CW Frequency:	1kHz
Mode:	Modulation
Ch2 Output:	On
Ch2 Amplitude	50mV

Adjustment:

4. Adjust CAL:SETUP56 for DMM reading of 17,67mV ±0.15mV

Pulse Response Adjustments

The pulse response adjustments assure that the rise and fall times, as well as, the aberrations are within the specified range. Use this procedure if you suspect that the pulse response is an issue.

(Setup 39)

Pulse Response, Amplifier Out

Equipment: Oscilloscope, BNC to BNC cable, 20dB Feedthrough attenuator

Preparation:

1. Configure the 2572A as follows:

Function:	Square
Amplitude:	1.5V

2. Connect the 2572A Channel 2 output to the oscilloscope input. Use 20dB Feedthrough attenuator at the oscilloscope input
3. Set oscilloscope input impedance to 50Ω

4. Set oscilloscope vertical sensitivity to 20mV

Adjustment:

5. Adjust vertical trace to 6 divisions
6. Adjust RV4 for best pulse response (4ns type, 5% aberrations)

(Setup 40)

Pulse Response, Amplifier In

Equipment: Oscilloscope, BNC to BNC cable, 20dB Feedthrough attenuator

Preparation:

1. Configure the 2572A as follows:
   Function: Square
   Amplitude: 6V
2. Connect the 2572A Channel 2 output to the oscilloscope input. Use 20dB Feedthrough attenuator at the oscilloscope input
3. Set oscilloscope input impedance to 50Ω
4. Set oscilloscope vertical sensitivity to 0.1V

Adjustment:

5. Adjust vertical trace to 6 divisions
6. Adjust C1073 for best pulse response (4ns type, 5% aberrations)

Flatness Adjustments

The flatness adjustments assure that the flatness of the amplifier is within the specified range. Use this procedure if you suspect that the flatness is an issue.

Setup 41

1MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:
   Input Impedance: 50 ohms
   Range: 100mV
2. Connect the 2572A Channel 2 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:
   Frequency: 1MHz
   Ch2 Output: On

Adjustment:

4. Adjust the Fine Amplitude of the Oscilloscope to get the signal of 6 divisions on the screen.

Setup 42

10MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:

   Input Impedance: 50 ohms
   Range: 100mV

2. Connect the 2572A Channel 2 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:

   Frequency: 10MHz
   Ch2 Output: On

Adjustment:

4. Adjust CAL:SETUP82 to get the signal of 6 divisions on the screen.

Setup 43

20MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:

   Input Impedance: 50 ohms
   Range: 100mV

2. Connect the 2572A Channel 2output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:

   Frequency: 20MHz
   Ch2 Output: On

Adjustment:

4. Adjust CAL:SETUP 83 to get the signal of 6 divisions on the screen.

Setup 44

30MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:

   Input Impedance: 50 ohms
   Range: 100mV

2. Connect the 2572A Channel 2 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:

   Frequency: 30MHz

Ch2 Output: On

Adjustment:

4. Adjust CAL:SETUP 84 to get the signal of 6 divisions on the screen.

Setup 45

37.3333333MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:
   Input Impedance: 50 ohms
   Range: 100mV
2. Connect the 2572A Channel 2 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:
   Frequency: 37.3333333MHz
   Ch2 Output: On

Adjustment:

4. Adjust CAL:SETUP 85 to get the signal of 6 divisions on the screen.

Setup 46

56MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:
   Input Impedance: 50 ohms
   Range: 100mV
2. Connect the 2572A Channel 2output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:
   Frequency: 56MHz
   Ch2 Output: On

Adjustment:

4. Adjust CAL:SETUP 86 to get the signal of 6 divisions on the screen.

Setup 47

56.0000001MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:
   Input Impedance: 50 ohms
   Range: 100mV

2. Connect the 2572A Channel 2 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:
   Frequency: 56.0000001MHz
   Ch2 Output: On

Adjustment:

4. Adjust CAL:SETUP 87 to get the signal of 6 divisions on the screen.

Setup 48

80MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:
   Input Impedance: 50 ohms
   Range: 100mV
2. Connect the 2572A Channel 2 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:
   Frequency: 80MHz
   Ch2 Output: On

Adjustment:

4. Adjust CAL:SETUP88 to get the signal of 6 divisions on the screen.

Setup 49

100MHz Amplitude

Equipment: 50Ω, 20dB Feed through termination, Oscilloscope

Preparation:

1. Configure the Oscilloscope as follows:
   Input Impedance: 50 ohms
   Range: 100mV
2. Connect the 2572A Channel 2 output to the Oscilloscope input. Terminate the 2572A output at the Oscilloscope input with the, 50Ω, 20dB Feed through termination
3. Configure the 2572A as follows:
   Frequency: 100MHz
   Ch2 Output: On

Adjustment:

4. Adjust CAL:SETUP89 to get the signal of 6 divisions on the screen.

(Setup 50)

Carrier Flatness – Modulation

Equipment: Oscilloscope, BNC to BNC cable, 20dB Feedthrough attenuator

Preparation:

1. Configure the 2572A as follows:

Function:	Modulation ON
Modulation:	Sweep
Start Freq:	1MHz
Stop Freq:	100MHz
Sweep Time:	1ms
Marker:	1MHz
Amplitude:	6V

2. Connect the 2572A Channel 2 output to the oscilloscope input. Use 20dB Feedthrough attenuator at the oscilloscope input
3. Set oscilloscope input impedance to 50Ω
4. Set oscilloscope vertical sensitivity to 0.1V

Adjustment:

5. Adjust C1061for the best flatness.

Updating 2572A Firmware

WARNING

Only qualified persons may perform Firmware updates. DO NOT even attempt to perform this operation unless you were trained and certified by Tabor as you may inflict damage on the instrument. Always verify with the factory that you have the latest firmware file before you start with your update.

Before you update the firmware of your 2572A, check the revision level which is installed in your instrument. Each firmware update was done for a reason and therefore, if you want to update the firmware for a problem in your system, check the readme file that is associated with the update to see if an update will solve your problem. The revision level of your firmware can be displayed as shown in Figure 7-3. To access this screen, select the TOP menu, then select the Utility soft key and scroll down to the System option. Press Enter and the screen will show with the system information. Check both the Software Version and the Version Date as both should match with the latest release.

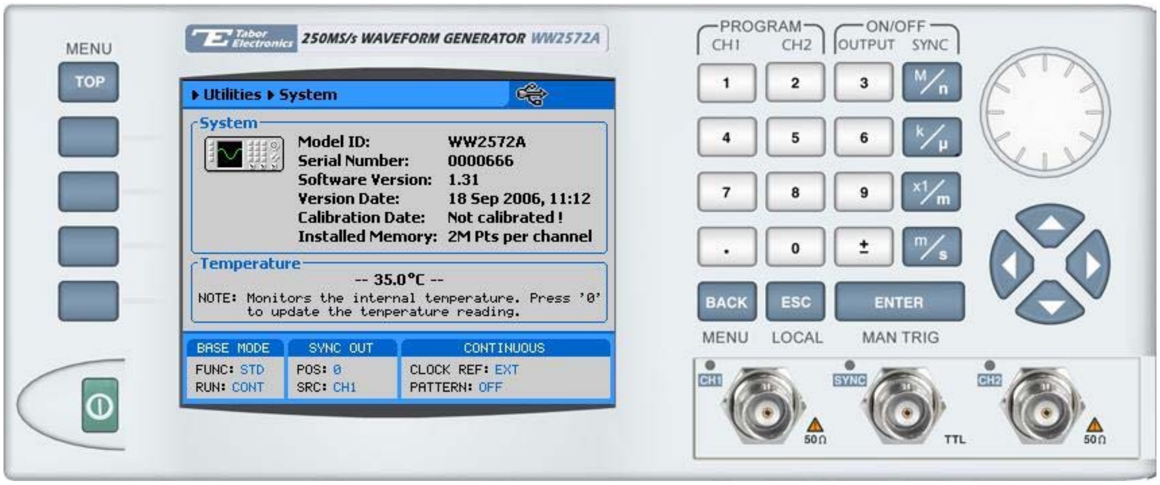

Figure 7-3, Software Version Screen

NOTE

Firmware updates are performed with the LAN set as the active interface and with the 2572A communicating with the PC through the network.

To update the 2572A firmware, you will have to run the **NETConfig** utility. If you do not have this utility installed on your computer, run the installation procedure from the enclosed CD. You will not be able to update firmware without the NETConfig utility. To invoke this utility, complete the following steps:

1. Turn power **OFF** on your 2572A

2. Click on NETConfig shortcut on the desktop or select Start »Programs» Tabor Electronics» NETConfig» NETConfig 1.0

The NETConfig window lists Tabor devices found on your subnet. Figure 7-4 shows an example of this display.

3. Click on the “Use wait message” to select this option as shown in Figure 7-4.

Figure 7-4, The NETConfig Utility

4. Turn power **ON** on your 2572A and observe that the progress bar, as shown in Figure 7-5, is advancing from left to right. Do not do anything on the 2572A until the progress bar completes its travel to the right end.

Tips

If the progress bar is not moving check the following for possible problems:

1. If you are connecting to a LAN network, make sure your device is connected with standard LAN wire to your wall plug

2. If you use direct connection from your PC to the 2572A, your cable should be cross wired. You can get such cable from any computer store near your area

3. If your network is using a managed switch, it is possible that it is configure to break the package with broadcast address and therefore, the only way to use NetConfig is to connect the instrument directly to the PC with a cross wired cable

---

Figure 7-5, Check for Progress Bar Movement

5. As soon as the progress bar reached the far right hand of the bar, click on the Refresh button. If your device was connected and booted correctly, the device address will appear in the device list, as shown in Figure 7-6.

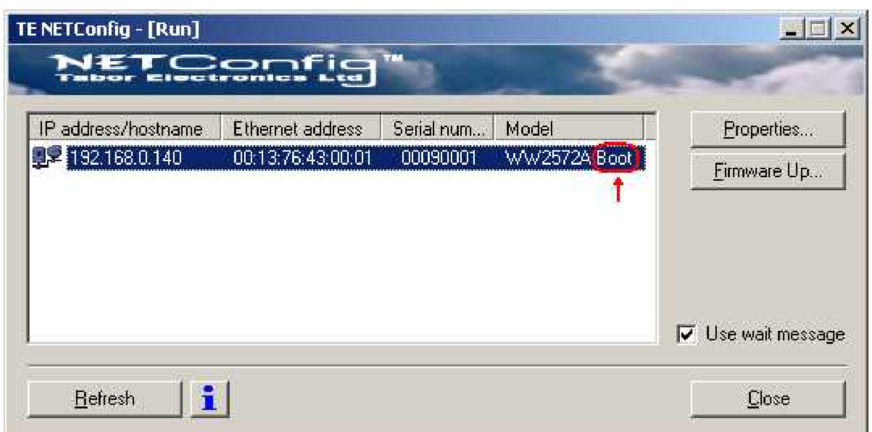

Figure 7-6, WW2572A has been Detected on the LAN Network

NOTES

Click Refresh again if you do not see your device in the list of Ethernet devices. If you cannot detect your device after a few attempts check that you have not lost the connection as described in previous paragraphs.

You can only update instrument(s) that appear in the NETConfig window.

Point and click on the device you want to update. The selected device will now have blue background. Click on the Firmware Up... button. The firmware Update dialog box as shown in Figure 6-7 appears.

Figure 7-7, The Firmware Update Dialog Box

In the TE NETConfig [Firmware Update] dialog box click on the  button to browse and locate the upgrade file. After you select the file its complete path will be displayed in the Flash binary image filename field as shown in Figure 7-8. Make sure the file in the path agrees with that specified by your supervisor. To complete the update process, click on Update and observe the File Transfer Progress bar. The update will complete with a Firmware Update d Successfully message, as shown in Figure 7-9.

Click on Back to close NETConfig Firmware Update dialog box and turn off the power to the 2572A. The next time you power up the instrument, the device automatically reboots with the new firmware in effect.

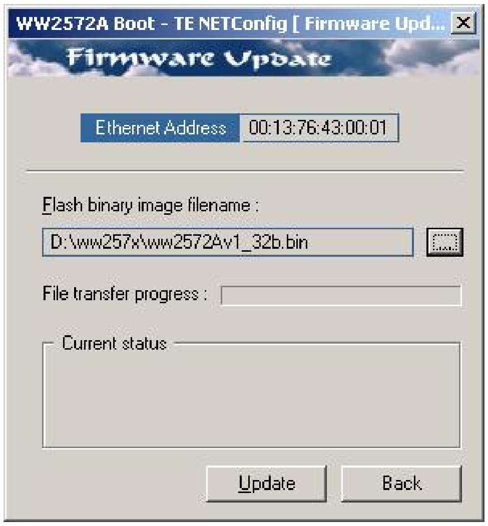

Figure 7-8, Firmware Update Path

Figure 7-9, Firmware Update Completed

Appendices

Appendix A
Specifications

Configuration

Output Channels	2, semi-independent

Inter-Channel Dependency

Separate controls	Output on/off, amplitude, offset, standard waveforms, user waveforms, user waveform size, sequence table
Common Controls	Sample clock, frequency, reference source, trigger modes, trigger advance source, SYNC output, Modulation

Leading Edge Offset

Description	Channel 2 waveform start trails channel 1 waveform start by a programmable number of points.
Offset Units	Waveform points
Range	0 to 2M points
Resolution and Accuracy	1 point
Skew Between Channels	1 ns (50Ω cables, equal length)

Multiple Instruments Synchronization

Description	Multiple instruments can be daisy-chained together and synchronized to provide multi-channel synchronization. Phase (leading edge) offset between master and slave units is programmable
Initial Skew	<±25 ns + 1 sample clock cycle, depending on cable length and quality, typically with 1 meter coax cables
Synchronized Waveforms	Standard, Arbitrary and Sequenced using the automatic sequence advance mode only
Synchronized Run Modes	Continuous, Triggered, Gated and Counted Burst
Trigger Delay	200 ns to 20 s, separately programmable for each synchronized instrument
Trigger Delay Resolution	20 ns
Synchronization Frequency Range	
Standard Waveforms	1.5 kHz to 100 MHz
Arbitrary and Sequenced Waveforms	2.5 MS/s to 250 MS/s

Leading Edge Offset

Description	Leading edge offset is programmable for master

	and slave units. Operates in conjunction with the continuous run mode only
Offset Range	200 ns to 20 s
Resolution and Accuracy	20 ns

Sample Clock

Range	
Continuous Run Mode	1.5 S/s to 250 MS/s (300 MS/s, typically at 25°C)
All Other Run Modes	1.5 S/s to 225 MS/s
Resolution	10 digits
Accuracy and Stability	Same as reference
10MHz Reference Clock	
Standard	≥0.0001% (1 ppm TCXO) initial tolerance over a 19°C to 29°C temperature range; 1ppm/°C below 19°C and above 29°C; 1ppm/year aging rate
External	
Frequency	10 MHz
Connector	Rear Panel BNC
Impedance and Level	10 kΩ ±5%, TTL, 50% ±2% duty cycle, or 50Ω ±5%, 0 dBm, selectable using an internal jumper

Amplitude Characteristics

Amplitude	32 mV to 32 Vp-p, output open circuit 16 mV to 16 Vp-p, into 50Ω
Resolution	4 digits
Accuracy (measured at 1kHz into 50Ω)	12 V to 16 Vp-p: ±2% 1.6 V to 11.99 Vp-p: ±(1% + 70 mV) 160 mV to 1.599 Vp-p: ±(1% + 10 mV) 16 mV to 159.9 mVp-p: ±(1% + 5 mV)
DC Offset Range	0 to ±8 V
Resolution	1 mV
Accuracy	±(1% ± 1% from Amplitude ±5 mV)

Run Modes

Description	Define how waveforms start and stop. Run modes description applies to all waveform types and functions, except where noted. Continuous operation is specified across the entire sample clock frequency range. Other run modes are limited to 225MS/s.
Continuous	Continuously free-run output of a waveform. Output can be enabled and disabled from a remote interface only
Triggered	Upon trigger, outputs one waveform cycle. Last cycle always completed
Burst	Upon trigger, outputs a single or multiple pre-programmed number of waveform cycles. (Does not apply to Sequence Mode). Burst is programmable from 1 through 1M cycles
Gated	Transition enables or disables generator output. Last cycle always completed
Mixed	Same as triggered except first output cycle is initiated by a software trigger. Consequent output requires external triggers through the rear panel

	TRIG IN connector

Trigger Characteristics

Trigger Sources	
External	Rear panel BNC, or front panel manual trigger button
BUS	Trigger commands from a remote controller only
External Trigger Input	
Impedance	10 kΩ
Trigger Level Range	±5 V
Resolution	1 mV
Sensitivity	200 mV
Damage Level	±12 V
Frequency Range	DC to 2.5 MHz
Slope	Positive/Negative transitions, selectable
Minimum Pulse Width	≥10 ns
System Delay (Trigger input to waveform output)	6 sample clock cycles+150 ns
Trigger Delay (Trigger input to waveform output)	[(0; 200 ns to 20 s) + system delay]
Resolution	20 ns
Error	6 sample clock cycles + 150 ns + 5% of setting
Re-trigger Delay (Waveform end to waveform restart)	200 ns to 20 s
Resolution	20 ns
Error	3 sample clock cycles + 20 ns + 5% of setting
Trigger Jitter	±1 sample clock period

Standard Waveforms

Frequency Range	
Sine, Square	10 mHz to 100 MHz
All other waveforms	10 mHz to 32 MHz
Frequency Resolution	11 digits
Accuracy & Stability	Same as frequency standard
Sine	
Start Phase Range	0-360.0°
Start Phase Resolution	0.1°
Triangle	
Start Phase Range	0-360.0°
Start Phase Resolution	0.1°
Square	
Duty Cycle Range	0% to 99.9%
Pulse	
Delay, Rise/Fall Time, High Time Ranges	0%-99.99% of period (each independently)
Ramp	
Delay, Rise/Fall Time, High Time Ranges	0%-99.9% of period (each independently)
Gaussian Pulse	
Time Constant Range	10-200
Sinc Pulse	
“Zero Crossings” Range	4-100
Exponential Pulse	
Time Constant Range	-100 to 100
DC Output Function	
Range	-8 V to +8 V

Sine Wave Performance

Description	Sine wave is created in two different circuits: 1) Computed using the standard sine waveform function, and 2) Generated from the DDS (direct digital synthesis) circuit as CW (carrier wave) for the modulation functions. CW is available when the 2572 is set to Modulation OFF. Performance in the following will refer to either STD sinewave or CW (above case 1 and 2, respectively)
THD	0.1% to 100 kHz, STD and CW
Harmonics and Spurious at less than 3 Vp-p	28dBc, <100 MHz 35dBc, <50 MHz 50dBc, <10 MHz 55dBc, <1 MHz
Harmonics and Spurious at less than 5 Vp-p	25dBc, <100 MHz 30dBc, <50 MHz 43dBc, <10 MHz 48dBc, <1 MHz
Harmonics & Spurious at less than 10 Vp-p	23dBc, <100 MHz 28dBc, <50 MHz 35dBc, <10 MHz 37dBc, <1 MHz
Flatness at less than 5 Vp-p	5% to 10 MHz 20% to 100 MHz
Flatness at less than 10Vp-p	5% to 10 MHz 20% to 100 MHz

Square Wave, Pulse Performance

Rise/Fall Time (10%-90%)	<5 ns, 16 mV to 16 Vp-p
Aberration	<6% +10 mV, to 10 Vp-p; <8%, to 16 Vp-p

Pulse Generator Waveforms

Operation	The 2572A has a special mode where the instrument type is transformed to operate as a digital pulse generator. When this mode is selected, the operation of the arbitrary waveform and its outputs are disabled and possibly, arbitrary waveforms are overwritten
Programmability	1. All pulse parameters, except rise and fall times, may be freely programmed within the selected pulse period provided that the ratio between the period and the smallest incremental unit does not exceed the ratio of 1,000,000 to 1. With the 2M option, the ratio is extended to 2,000,000 to 1, hence the specifications below do not show maximum limit as each must be computed from the above relationship. 2. Rise and fall times, may be freely programmed provided that the ratio between the rise/fall time and the smallest incremental unit does not exceed the ratio of 100,000 to 1. 3. The sum of all pulse parameters must not

	exceed the pulse period setting
Channel Dependency	Both channels share pulse parameters except level, polarity, delay and state
Pulse State	On or Off. On generates pulse output; Off generates 0 Vdc
Pulse Mode	Single or double, programmable
Polarity	Normal, inverted or complemented
Period	80 ns minimum, programmed with 16 ns increments
Delay	0 ns min; 1e3 s max (2e6 s max with option 2)
Double Pulse Delay	0 ns minimum; 1e3 s max
Rise/Fall Times	0 ns minimum; 1e3 s max (actual min = <5 ns)
High Time	0 ns minimum
Amplitude Window	16 mVp-p to 16 Vp-p
Low Level	-8 V to +7.983 V
High Level	-7.983 V to +8 V

Arbitrary Waveforms

Vertical Resolution	16 bits
Waveform Segmentation	Permits division of waveform memory into smaller segments.
Number of Memory Segments	1 to 10k
Waveform Segments, size and resolution	4 points size increments from 16 to 1M points (2M optional)
Custom Waveform Creation Software	ArbExplorer software allows instrument control and creation of custom waveforms either freehand, with equations or built-in functions or with imported waveforms

Sequenced Waveforms

Operation	Segments may be linked and repeated in a user-selectable fashion to generate extremely long waveforms. Segments are advanced using either a command or a trigger
Advance Modes	
Automatic Sequence Advance	No trigger required to step from one segment to the next. Sequence is repeated continuously per a pre-programmed sequence table.
Stepped Sequence Advance	Current segment is sampled continuously until a trigger advances the sequence to the next programmed segment and sample clock rate.
Single Sequence Advance	Current segment is sampled the specified number of repetitions and then idles at the end of the segment. Next trigger samples the next segment the specified repeat count, and so on.
Mixed Sequence Advance	Each step of a sequence can be programmed to advance either a) automatically (Automatic Sequence Advance), or b) with a trigger (Stepped Sequence Advance)
Sequencer Steps	1 to 4096
Segment Loops	1 to 1Meg
Minimum Segment Duration	500 ns
Minimum Segment Size in a Sequence	16 points

Modulated Waveforms

General Description

Carrier Waveform	Sinewave
Modulation Source	Internal
Inter-Channel Phase Relationship	Channel 2 output is phase offset by 90° relative to channel 1 output
Run Modes	Off (outputs CW), Continuous, Triggered, Delayed Trigger, Re-trigger, Burst and Gated
Interrupted Modulation Carrier Idle Mode	On or Off, programmable
Run Mode Advance Source	Front panel manual trigger, Rear panel TRIG IN, Software commands
Trigger Delay (Trigger input to modulation output)	[(0; 200 ns to 20 s) + system delay]
Resolution	20 ns
Error	6 sample clock cycles + 150 ns +5% of setting
Re-trigger Delay (Modulation end to modulation restart)	200 ns to 20 s
Resolution	20 ns
Error	3 sample clock cycles + 20 ns +5% of setting
Trigger Parameters	All trigger parameters such as level, slope, jitter, etc. apply

Sweep

Channel Dependency	Both channels share sweep parameters
Swept Waveform	Sine wave
Sweep Step	Linear or log
Sweep Direction	Up or Down
Sweep Range	10 mHz to 100 MHz
Sweep Time	1 µs to 40 s
Marker Output	Programmable marker at a selected frequency.

FM

Channel Dependency	Both channels share FM parameters
Modulated Waveform	Sine wave
Modulating Waveforms	Sine, square, triangle, Ramp
Carrier Frequency Range	10 Hz to 100 MHz
Modulating Frequency Range	10 mHz to 350 kHz
Peak Deviation	Up to 50 MHz
Marker Position	Programmable at selectable a frequency

AM

Channel Dependency	Both channels share AM parameters except envelop waveform and modulation depth
Modulated Waveform	Sine wave
Carrier Frequency Range	10 Hz to 100 MHz
Envelop Waveform	Sine, square, triangle, Ramp
Envelop Frequency	10 mHz to 1 MHz
Modulation Depth	0% to 100%

FSK

Channel Dependency	Both channels share FSK parameters
Shifted Waveform	Sine wave
Carrier/Shifted Frequency Range	10 Hz to 100 MHz
Baud Range	1 bit/sec to 10 Mbits/sec
FSK Data Bits Length	2 to 4000
Marker Output	Programmable marker at a selected step

PSK

Channel Dependency	Both channels share PSK parameters
Shifted Waveform	Sine wave
Carrier Frequency Range	10 Hz to 100 MHz
Phase Shift Range	0° to 359.99°
Baud Range	1bits/sec to 10Mbits/sec
PSK Data Bits Length	2 to 4000
Marker Output	Programmable marker at a selected step

Wireless Signal Generation Characteristics

Description — Wireless signals are generated using Modular software. These signals are downloaded to the 2572A through GPIB, LAN or USB interface. The output was characterized using the following test conditions: Sample Clock = External; Sample Clock Frequency = as specified; Modulation = QPSK; Baseband Filter = Raised Cosine; Alfa = 0.35. ACLR was characterized using the following test conditions: BW = Symbol Rate; Offset = 1.35 x Symbol Rate

EVM

	0.1 MSymbols/s	1 MSymbols/s	5 MSymbols/s
10 MHz	0.15% (1)	0.30% (1)	1.40% (1)
80 MHz	0.25% (2)	0.50% (2)	1.20% (2)
100 MHz	0.25% (3)	0.50% (3)	1.20% (3)

ACPR

	0.1 MSymbols/s	1 MSymbols/s	5 MSymbols/s
10 MHz	73 dB (1)	73 dB (1)	65 dB (1)
80 MHz	64 dB (2)	64 dB (2)	60 dB (2)
100 MHz	64 dB (3)	64 dB (3)	60 dB (3)

(1) Sample Clock Frequency = 100 MS/s
(2) Sample Clock Frequency = 200 MS/s
(3) Sample Clock Frequency = 250 MS/s

Counter/Timer

Operation	The 2572A has a special mode where the instrument type is transformed to operate as a counter/timer. When this mode is selected, the operation of the arbitrary waveform and its outputs are disabled. The Counter/Timer option is part of the Modulation Package Option
Measurement Functions	Frequency, Period, Period Averaged, Pulse Width and Totalize

Frequency, Period Averaged

Frequency Range	20 Hz to 100 MHz (typically >120 MHz)
Period Averaged Range	10 ns to 50 ms
Resolution	7 digits in one second of gate time, reduced proportionally with lower gate times

Period, Pulse Width

Range	500 ns to 50 ms

Resolution	100 ns

Totalize

Frequency Range	20 Hz to 100 MHz
Accumulation Range	10^{12}-1
Overflow Indication	LED, turns on when capacity is exceeded

General

Input	Rear Panel TRIG IN, BNC connector
Trigger Level Range	±5 V
Sensitivity	500 mVp-p
Damage Level	±12 V
Minimum Pulse Width	≥10 ns
Slope	Positive/Negative transitions, selectable
Gate Time	100 μs to 1 s
Display Modes	
Repetitive	Continuous measurements are executed when signal is present at the input
Hold	Single measurement is executed upon command
Gated	Active in Gated Totalize mode only
Time Base	
Type	TCXO
Temperature Stability	1 ppm, 0°C - 40°C
Long Term Stability	1 ppm, 1 year

Digital Pattern Output

Connector	Rear panel SCSI-2 type, 68-pin VHDC, CH 1 only
Pattern Width	16-bits, differential
Pattern Length	1 to 128k, dedicated pattern memory; 16 to 1 M (2 M optional) using the arbitrary memory space, user selectable
Level	LVDS
Update Frequency	1.5 pps to 25 Mpps (Usable above this frequency however, depends on the cable quality)

Front Panel Outputs

Main Outputs

Connector:	Front panel BNC, each channel Impedance: 50Ω ±1%
Protection	Short Circuit to Case Ground, 10s max
Standby	Output On or Off (Output Disconnected)

Sync Outputs

Connector	Front panel BNC
Level	TTL
Sync Type:	Pulse with Arbitrary and Standard Waves; LCOM in Sequence and Burst Modes (including Burst Modulation); Marker with Modulation Mode only, programmable position
Position	Point 0 to maximum segment size, programmable with 4-point resolution

GENERAL

GPIB Information

Connector	Rear panel 25-pin D connector
GPIB Revision	IEEE-488.2
SCPI Revision	1993.0
Logical Address Settings	1 - 31, configured via front panel programming
DMA	Downloads arbitrary waveform data, arbitrary FM waveform data and sequence table data. DMA support is required by the controller

Ethernet

Connector	Rear panel RJ-45, female
Physical Layer	Twisted pair 10/100Base-T
IP address	Programmed from the front panel or through the USB port
Baud Rate	10/100 Mbit/sec with auto negotiation
Protocol	SCPI commands over TCP/IP.

USB

Connector	Type A receptacle
Specifications	Version 1.1
Protocol	SCPI commands over USB

Front Panel Display

Color LCD, 3.8” reflective, 320 x 240 pixels, back-lit

Front Panel Indicator LED's

Output On	Green – Output on / off (Separate for each channel)
SYNC On	Green – SYNC on / off

Power Requirements

Mains Input Range	85 to 265Vac, 47-63 Hz
Maximum Total Module Power	60W

Mechanical

Dimensions	212 x 88 x 415 mm (W x H x D)
Weight	Approximately 3.5 Kg

Environmental

Operating temperature	0 °C - 50 °C
Humidity (non-condensing)	11 °C - 30 °C, 85% 31 °C - 40 °C, 75%

EMC Certification

CE marked

Safety

EN61010-1, 2nd revision

Options

Description	All 2572A options are factory installed. Therefore, if you want to purchase any of the options, make sure your order specifies the required option at the time of your purchase
Format	Options are designated by numeral digits. For

	example, if you require option -1 and option -2, specify 2572A-1-2
Option -1	2M arbitrary memory. Extends the arbitrary memory from the standard 1M to 2M
Option -2	Adds the modulation package option to the 2571A

2M Arbitrary Memory, Option -1

Description	2M arbitrary memory. Extends the arbitrary memory from the standard 1M to 2M

Modulation Package, Option -2

Description	The modulation package option adds the following modulation capability to the 2571A: Arbitrary FM, Frequency Hops, Amplitude Hops, ASK and 3D. For the 2572A, the modulation package adds (nPSK), (n)QAM and User QAM in addition.

ARBITRARY FM

Operation	Operated from and external utility only such as ArbConnection. The modulating waveform can be designed as an arbitrary waveform
Channel Dependency	Both channels share Arbitrary FM parameters
Modulated Waveform	Sine wave
Carrier Frequency Range	10 Hz to 100 MHz
Modulating Waveform	Arbitrary waveform
Modulating Waveform Sampling Clock	1 S/s to 2.5 MS/s
Number of frequencies	2 to 10,000
Marker Output	Programmable at the selected frequencies

FREQUENCY HOPS

Channel Dependency	Both channels share Frequency Hop parameters
Hopped Waveform	Sine wave
Hop Frequency Range	10 Hz to 100 MHz
Resolution	11 digits
Hop Table Size	2 to 1000
Dwell Time Mode	Fixed or Programmable for each step
Dwell Time	200 ns to 20 s
Dwell Time Resolution	20 ns
Marker Position	Programmable on a selected step

AMPLITUDE HOPS

Channel Dependency	Amplitude Hop parameters are separate for each channel except hop table size
Hopped Waveform	Sine wave
Frequency Range	10 Hz to 100 MHz
Resolution	11 digits
Hop Amplitude Range	0 to 16 Vp-p
Resolution	Maximum amplitude/4096
Hop Table Size	2 to 5000
Dwell Time Mode	Fixed or Programmable for each step
Dwell Time	200 ns to 20 s
Dwell Time Resolution	20 ns
Marker Position	Programmable on a selected step

ASK

Channel Dependency	Both channels share ASK parameters
Shifted Waveform	Sine wave
Carrier Frequency Range	10 Hz to 100 MHz
Amplitude Shift Range	0 V to 16 Vp-p
Resolution	Maximum amplitude/4096
Baud Range	1bits/sec to 10Mbits/sec
ASK Data Bits Length	2 to 1000
Marker Output	Programmable marker at a selected step

3D

Operation	Operated from an external utility only such as ArbConnection, the carrier waveform can be programmed to freely sweep in three dimensions: amplitude, frequency and phase. Each channel has its own amplitude profile but both channels share frequency and phase. Channel 2 is always 90° phase shifted from channel 1.
Modulated Waveform	Sine
Carrier Frequency Range	10 Hz to 100 MHz
Modulating Sampling Clock	1 S/s to 2.5 MS/s
Number of profile indexes	2 to 30000
Marker Output	Programmable at the selected index point

I & Q Modulation

Operation	The Model 2572A can generate I & Q signals using channels 1 and 2 outputs. Carrier waveform can be turned off to directly drive vector generator inputs. I & Q Modulation functions are not available on 2571A
Modulation Schemes	(n)PSK, (n)QAM and User QAM

PSK and QAM

Carrier Waveform	Sine wave
Carrier Waveform Control	On or Off, programmable
Carrier Frequency	10 Hz to 62.5 MHz (75 MHz typical)
Modulation Type	
PSK	BPSK, QPSK, OQPSK, π/4 DQPSK, 8PSK, 16PSK
QAM	16QAM, 64QAM, 256QAM
User Defined QAM Symbols	2^1 to 2^8 proprietary symbols
Symbol Rate Range	1 symbol/s to 1e6 symbols/s
Symbol Period Accuracy	±(500 ns + Carrier Period)
Table Size:	2 to 4000

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Appendix B
Option 3 – Specifications Amendment

Outputs

Main Outputs

Amplitude	42 mV to 32 Vp-p, into open circuit
	21 mV to 20 Vp-p, into 50 Ω
Accuracy (measured at 1 kHz into 50Ω)	16 Vp-p to 20 Vp-p: ±5%

Square Wave, Pulse Performance

Rise/Fall Time (10%-90%)	<6 ns, 16 V to 20 V
Aberration	<8%, 16 V to 20 Vp-p

Function Generator Characteristics

DC Output Function

Range	-10 V to +10 V

Digital Pulse Generator Characteristics

Output

Level Setting Modes	High/Low, Amplitude/Offset, Positive, Negative
High Level Range	-9.979 V to +10.000 V, into 50 Ω;
	-15.966 to +16.000 V, into open circuit
Low Level Range	-10.000 V to +9.979 V, into 50 Ω;
	-16.000 to +15.966 V, into open circuit
Amplitude Range	21 mV to 20 Vp-p, into 50 Ω;
	42 mV to 32 Vp-p, into open circuit
Offset Range	0 to ±9.989 V, into 50 Ω;
	0 to ±16 V, into open circuit
Positive Level Range	10 mV to +10.000 V, into 50 Ω;
(Low level fixed at 0 V)	21 mV to +16.000 V, into open circuit
Negative Level Range	-10 mV to -10.000 V, into 50 Ω;
(High level fixed at 0 V)	-21 mV to -16.000 V, into open circuit

Modulated Waveforms Generator Characteristics

ASK

Amplitude Shift Range	0 V to 20 Vp-p

Amplitude Hops

Hop Amplitude Range	0 to 20 Vp-p

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