INSTRUCTION MANUAL

EN

ATG1005

5MHz Function Generator

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

1. PRODUCT DESCRIPTION

The ATG1005 function generators are developed to meet the requirements of design, test and education customers, providing high performance DDS waveforms and modulation at a breakthrough price.

Sine, square and pulse waveforms can be generated over the full frequency range of 1mHz to 5MHz, triangle waveforms are available from 1mHz to 500kHz, all with a resolution of 9 digits/1mHz and accuracy better than 10ppm. 1% to 99% variable symmetry/duty-cycle is available for square and pulse waveforms.

All waveforms can be swept from 0.1Hz to their maximum frequency in a single sweep at a rate variable between 100 milliseconds and 999 seconds. The sweep can be linear or logarithmic, single or dual slope. Sweeps can be triggered from the front panel or the digital interface.

Frequency Shift Keying (FSK) and Phase Shift Keying (PSK) provide coherent switching between two selected values at a user defined rate. They can be triggered from the front panel or the digital interface, either continuously or in single steps.

The A series models are designed with your workspace in mind. Their compact footprint (213 x 230 x 98 mm (WxDxH)) ensures they won't take up unnecessary space on your bench or shelf.

This instrument is supported by the Aim-TTi Test Bridge PC software (available as free download from the Aim-TTi website), which can be used to control up to 4 instruments simultaneously.

2. SAFETY

Symbols

This instruction manual contains information and warnings which must be followed by the user to ensure safe operation and to retain the instrument in a safe condition.

The following symbols are displayed on the instrument and throughout the manual, to ensure the safety of the user and the instrument, all information must be read before proceeding.

WARNING

Indicates a hazard that, if not avoided, could result in injury or death.

CAUTION

Indicates a hazard that could damage the product and may result in loss of important data or invalidation of the warranty.

NOTE

Indicates a helpful tip.

EXAMPLE

Indicates an example to show further details.

	Caution, possibility of electric shock	UK CA	UKCA 'UK Conformity Assessed' marking is a certification mark that affirms conformity with the applicable requirements for products sold within Great Britain
	Caution, possibility of damage		
	Mains supply OFF	CE	'CE' marking is a certification mark that affirms the good's conformity with European health, safety, and environmental protection standards
I	Mains supply ON		
	Standby supply. Instrument is not disconnected from AC mains power when switch is off.		WEEE (do not dispose in household waste)
~	Alternating current		Earth (ground) terminal
	Protective Earth terminal		The terminal is connected to chassis ground
	Security lock slot		

Safety Notices

This instrument is:

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

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

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

WARNING

Do not operate while condensation is present.

Do not operate outside its rated supply voltages or environmental range.

THIS INSTRUMENT MUST BE EARTHED.

Ensure that only fuses with the required rated current and of the specified type are used for replacement.

The use of makeshift fuses and the short-circuiting of fuse holders is prohibited.

Use of this instrument in a manner not specified by these instructions may impair the safety protection provided.

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

Any adjustment, maintenance, and repair of the opened instrument under voltage must be avoided. When connected, terminals may be live and opening the covers or removal of parts (except those that can be accessed by hand) may expose live parts.

To avoid electric shock or damage to the instrument, never allow water to get inside the case. If the instrument is clearly defective, or has been subject to mechanical damage, excessive moisture, or chemical corrosion, the safety protection may be impaired, and it must be withdrawn from use and returned for repair.

CAUTION

Do not wet when cleaning; use only a soft dry cloth to clean the screen.
Do not use a sharp or pointed objects to operate the touch screen.
Take care not to restrict the inlet vents at the front of the instrument.

3. INSTALLATION

Mains Operating Voltage

This instrument has a universal input range and will operate from a nominal 115V or 230V mains supply without adjustment. Check that the local supply meets the AC Input requirement given in the Specification see '*Technical Specifications*'.

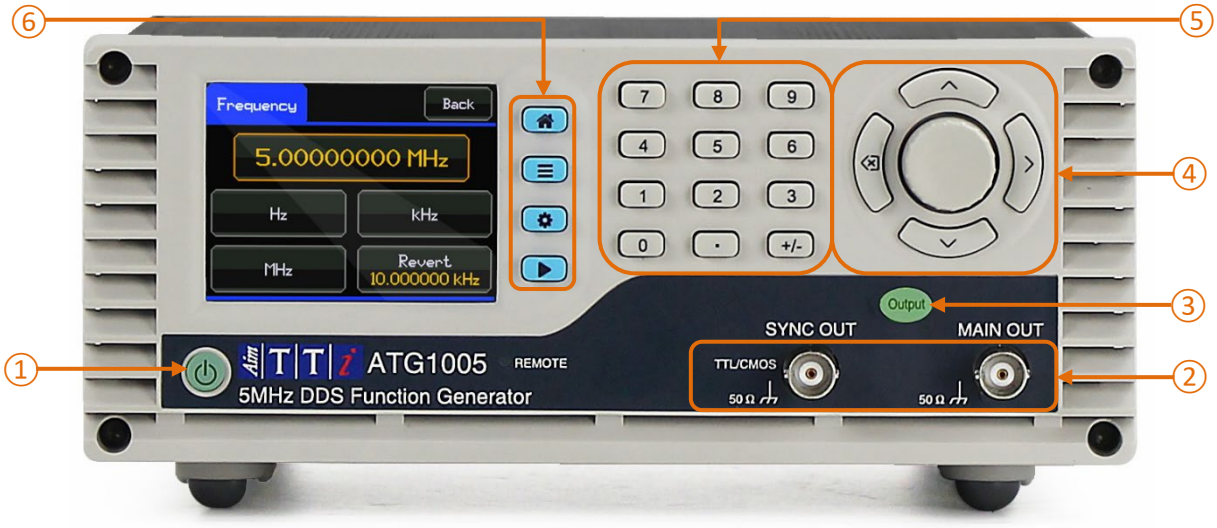
Mains Lead

Connect the instrument to the AC supply using the mains lead provided. Should a mains plug be required for a different mains outlet socket, a suitably rated and approved mains lead set should be used, which is fitted with the required wall plug and an IEC60320 C13 connector for the instrument end. To determine the minimum current rating of the lead set for the intended AC supply, refer to the power rating information on the equipment or in the Specification.

Mounting

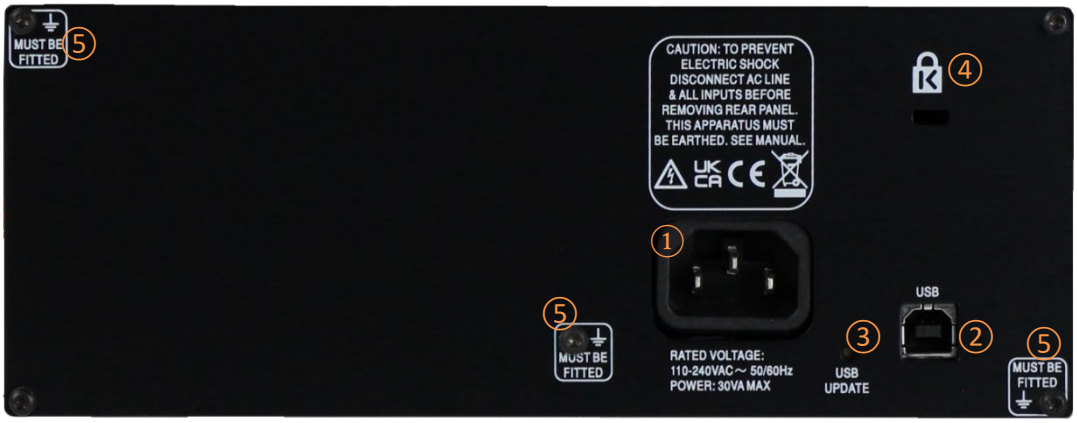
This instrument is suitable for bench use. The front feet include a tilt mechanism for optimal panel angle.

4. INSTRUMENT OVERVIEW



①	Standby	Standby supply. Instrument is not disconnected from AC mains power when switch is off. LED is illuminated when AC power is connected.
②	Output terminals	MAIN OUT: This is the output from the main generator; output source impedance is 50Ω . It will provide up to 20V peak–to–peak e.m.f. which will yield 10V peak-to-peak into a matched load. To maintain waveform integrity only 50Ω cable should be used, and the receiving end should be terminated with a 50Ω load. It can tolerate a short circuit for 60 seconds. **Do not apply external voltages to these outputs.** If accidental connection occurs, the output is protected by a voltage protection trip.
		The SYNC output provides a TTL/CMOS level output that is automatically switched depending on the operating mode selected.
③	Output On/Off	Alternate presses of the Output key turn the output on or off. The on state is indicated by the key being illuminated in green.
④	Rotary knob and directional keypad	Turn the knob clockwise to initiate, once the desired button/ field has been selected, press to 'okay' an entry. See '*Initial operation*' for more details.
⑤	Numeric keypad	Numeric keys allow direct entry of a value from the numeric editing screen, see *'Editing a numeric field using the keypad'* for more details.
⑥	Function keys	Home , Configure , Utilities, Trigger

4 - Instrument Overview



①	AC power inlet	Connect to AC mains using the power lead provided. See '*Mains Lead*' for more details.
②	USB	The USB port accepts a standard USB cable. The Windows plug-and-play functions should automatically recognise that the instrument has been connected.
③	USB update	Used to update firmware via USB, see '*Firmware Update*' for more details.
④	Security lock slot	
⑤	Earth bond screws ⚠	Must be fitted to ensure a safe earth bond.

5. GETTING STARTED

Using this manual

This section is a general introduction to the operation of the instrument and is intended to be read before using the instrument for the first time.

In this manual front panel, keys and sockets are shown in capitals, e.g., ON, OFF. Text and messages displayed on the LCD are shown in a different font, e.g., Waveform, Duty.

The descriptions in this manual relate to using the instrument via the touch screen, alternatively, the hard keys and rotary knob can be used. See 'Navigation Controls' for details on how to use the instrument in this way.

This instrument provides to option to select an alternative colour theme for the display, all screenshots in this manual show the default theme. If an alternative theme is used, the instrument will still function in the same way, but displays may vary.

Switching on

Connect the instrument to the AC supply using the mains lead provided.

Press the STANDBY button. At power up, the instrument displays the product name and firmware version whilst initialising the application.

Loading takes a few seconds, after which the home screen is displayed.

WARNING

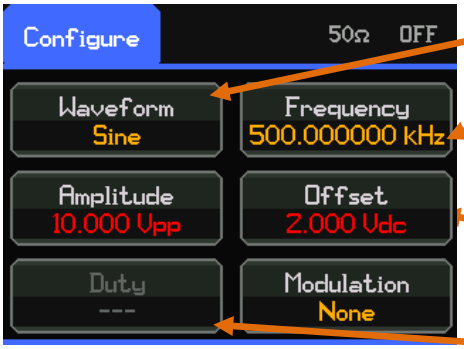
To fully disconnect from the AC supply, unplug the mains cord from the back of the instrument or switch off at the AC supply outlet; make sure that the means of disconnection are readily accessible. Disconnect from the AC supply when not in use.

Overview

Home Screen

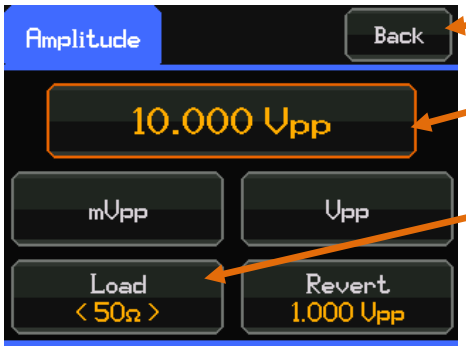
1. Displayed information.

Menu Screen



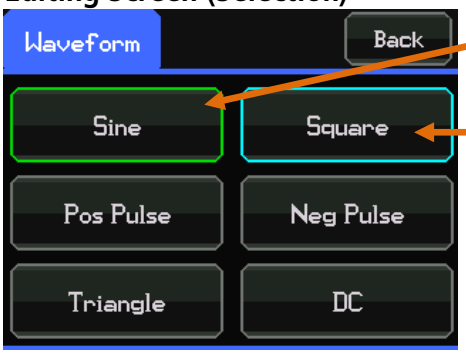
2. Menu Button - Press to navigate to a further menu.
3. Parameter - Displays the description in white and the set value of the field in yellow, press to edit via pop-up or numeric editing screen (see below).
4. Output out of specification limits, see *DC offset* for more details.
5. Disabled/ Inactive - Text is greyed out if the action is not available.

Editing Screen (Numeric)



6. Back button - Press to return to the previous screen.
7. Numeric Field - See '*Editing a numeric* field' for more details.
8. Parameter toggle - Displays the description in white and the set value of the field in yellow (with brackets), Press to toggle between the available options.

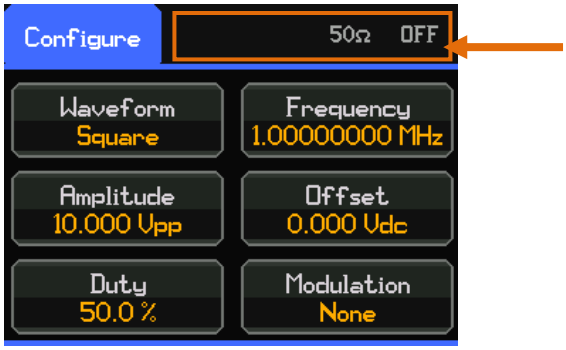
Editing Screen (Selection)



9. Selected/ Active - Shows the currently selected option. Press to select the required option.
10. Highlighted - Shows the active position of the knob navigation position in blue.

Status bar

The status bar is located at the top of the home and configuration screen, this contains information about the status of the instrument.



Displayed text	Description
SWP *or* **FSK** *or* **PSK**	Active modulation setting.
50Ω *or* **Hi-Z**	Load setting.
ON *or* **OFF** *or* **RUN**	Output status. Trigger status when output is ON, see '*Trigger*' for more details.
CLIP	Limit exceeded; waveform clipped.

Initial operation

The user interface can be navigated using the touch screen, rotary knob, front panel keys or a combination of all three options.

Many settings can be made quickly and easily using the touch screen alone; the rotary knob is most useful when, for example, a parameter is being frequently increased or decreased during manual testing.

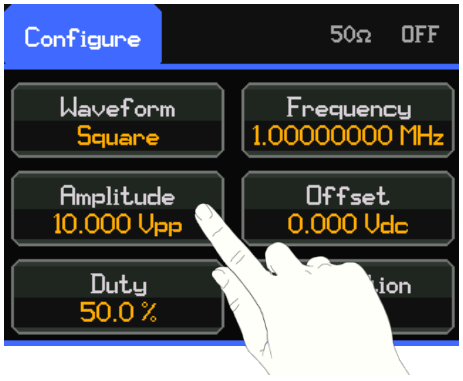
Navigation

Navigation using touch

Touch to select the required button or field.

Navigation using the rotary knob and directional keys

Use the left and right arrow keys on the front panel or the rotary knob to highlight the field or button and press the knob to 'okay' the action. When an editable field is selected, adjustments can be made by turning the knob until the required value is selected. Press the knob to action the change.



Editing a numeric field

Editing a numeric field using the keypad

When on the editing screen, the digits can be entered directly from the keyboard in any convenient units, e.g. 12.34kHz can be entered directly in kHz but can also be entered as 12340Hz or 0.01234MHz, press the Hz or kHz unit entry buttons to set units and confirm entry.

The <x] key deletes the last digit that was entered and the Back key returns to the previous screen, leaving the generator frequency unchanged.

Pressing the Revert button on the touch screen while in the editing state will return to the value as set on initial entry of the screen, this value is displayed on the button.

Editing a numeric field using the rotary knob and directional keys

Select the editable field using the knob, press to enter the active editing state. Alternatively, jump straight to the editing state by touching the editable field.

Turning the rotary control will increment or decrement the numeric value in steps determined by the position of the edit cursor (green digit); the cursor is moved by one digit to the left or right using the directional keys. A further press of the knob will exit the editing mode. Alternatively, exit the editing state by touching the editable field.

Pressing the Revert button on the touch screen while in the editing state will return to the value as set on initial entry of the screen this value is displayed on the button.

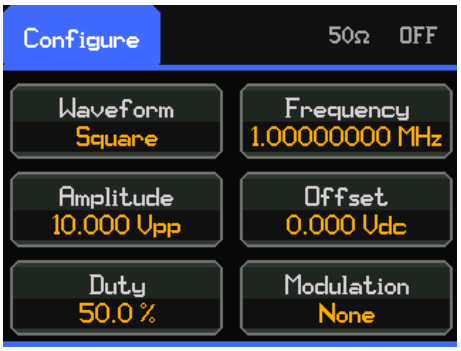
6. STANDARD WAVEFORM OPERATION

Waveform selection

Press the ☰ button and select Waveform to open up the waveform menu.

Selecting a waveform type will immediately switch to that waveform making it available at the MAIN OUT connector if the output is on, if the output is not on press the OUTPUT key to turn output on.

Waveform editing



Frequency

Press the **Frequency** button to open the Frequency editing screen.

NOTE

The upper frequency limits vary for different waveform types; see '*Technical Specifications*'.

Amplitude

Press the **Amplitude** button to open the Amplitude editing screen, The amplitude can be set in terms of peak-to-peak Volts (Vpp).

NOTE

In positive or negative pulse modes the amplitude range is 2mV to 10V pk-pk O/C.

Signal peak plus **DC Offset** is limited to ±10V, **CLIP** is shown in the status bar if this limit is exceeded, see '*DC offset*' for more details.

Load settings

V High-Z: Maximum output is 20 volts peak-to-peak open-circuit.

V (50Ω): 10 volts peak-to-peak when terminated with the output's characteristic impedance of 50Ω.

NOTE

The actual generator output impedance is always 50Ω; the displayed amplitude values for other load values take this into account.

DC offset

The DC Offset control has a range of ±10 volts from 50Ω in all output modes. DC offset plus signal peak is limited to ±10V (±5V into the characteristic output impedance). If the Output is outside of specification limits, waveform may show signal clipping and CLIP is shown in the status bar, the affected values are shown in red.

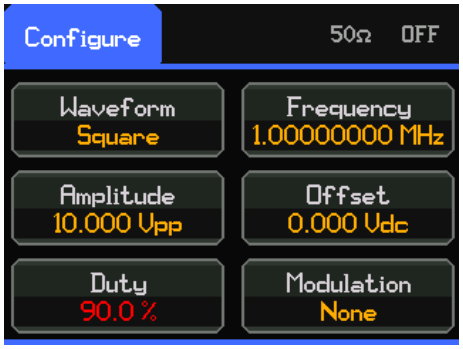
Waveform sync

A sync signal phase coincident with the MAIN OUT waveform. For sine and triangle waves the sync waveform rising edge is at the 0º phase point of MAIN OUT and the falling edge is at the 180º phase point. For square waves and pulses both phase and symmetry are coincident with MAIN OUT.

Duty

When the square or pulse waveforms are selected, the Duty button is enabled and the Duty editing screen can be used to vary the duty cycle from 1% to 99% to produce variable pulse-width waveforms.

The Duty value is shown in red if the Frequency and Duty setting combination exceed specified limits. See *'Technical Specifications'* for more details. This is to indicate that the resulting waveform no longer meets specification and may not be as expected.



When using Sweep or FSK, if either of the set frequency values in combination with the duty value are out of the specified limit, the duty will be shown in red to indicate that the resulting waveform no longer meets specification and may not be as expected. See *'Technical Specifications'* for more details.

EXAMPLE

For example, if the Duty is set to 90% and the sweep is set to run from 1Hz to 1MHz, the Duty value will be shown in red for the entire sweep to indicate the results may not be as expected when the sweep frequency exceeds the 100kHz limit.

7. MODULATION

Sweep Setup

All sweep setup parameters can be checked and updated from the sweep setup menu. Sweep modulation is turned on and off by selecting the <Off> button to show the active state as <On>. If any other Modulation is set to On, it will automatically be switched Off.

Principles of Sweep Operation

All waveforms can be swept phase-continuously from 0.1Hz up to the maximum frequency for the selected waveform. Although the frequency is stepped, not truly swept as in an analogue generator, the short step interval (500us) gives a close approximation to an analogue instrument except for the widest sweeps in the shortest time; see '*Frequency Stepping Resolution*' for more details.

The frequency steps are calculated and updated in real-time at a rate of 2kHz with full precision, following either a linear or log sweep law as selected by the user.

Sweep Range

The maximum sweep range for all waveforms is 0.1Hz to 5MHz, except triangle (up to 500kHz). The Sweep range is defined by start and stop frequencies, which set the two end points of the sweep, these points are editable in the Sweep Setup menu.

Sweep modulation has the capability of sweeping either up or down in frequency; the sweep direction is determined by the sweep start and stop frequencies as the sweep will always run from the start frequency to the stop frequency.

Sweep Time

The sweep time can be set from 0·1s to 999.99s with 10ms resolution. The shortest sweep times will have the fewest steps (a 100ms sweep will have only 200 steps whereas a 10s sweep will have 20,000 steps) and will consequently have a coarse stepping resolution with very wide sweeps, see *'Frequency Stepping Resolution'* for more details.

Upon selection of the sweep time the current sweep time value is displayed to a 10ms resolution (or 5 digits).

Sweep Slope

Sweep modulation can be set to produce either a single or dual sweep.

Single: Produces a sweep from the start to the stop frequency.

Dual: Produces a sweep from the start to the stop frequency and sweeps back to the start frequency.

Sweep Type

Sweep modulation can produce a swept output that follows either a linear or log sweep law as selected by the user.

Sweep Triggering

The Triggering mode is set in the menu, see '*Trigger*' for more details.

The trigger can be set to either a single or continuous mode.

Single: Produces a single sweep from the start to the stop frequency.

Continuous: Produces continuous sweeps between the start and stop frequencies in the defined sweep time.

Sweep is initialised by pressing the key. If the trigger is set to continuous and the Output is off, the output key will also activate the trigger when pressed.

During a running sweep (either single or continuous) the frequency of the sweep step is displayed in the Frequency button, if the frequency changes are too fast to display meaningfully, the last registered value will be shown.

If Triangle waveform is selected and the current sweep frequency is above the 500kHz limit, an error message is displayed and the start and stop frequencies are adjusted accordingly to be limited to a maximum frequency of 500kHz.

Pressing the key whilst a continuous sweep is running will pause the running sweep, press the trigger button again to resume the running sweep. Pressing the key whilst a single sweep is running will restart the sweep.

Sweep Sync

Sweeps are generally used with an oscilloscope or hard–copy device to investigate the frequency response of a circuit. The MAIN OUT is connected to the circuit input and the circuit output is connected to an oscilloscope or, for slow sweeps, a recorder. An oscilloscope can be triggered by connecting its trigger input to the generator's SYNC output; the SYNC output defaults to a Sweep Sync when a sweep is running (either continuous or single sweep).

Sweep Sync goes high at the start of sweep and low halfway through the sweep.

Frequency Stepping Resolution

The generator frequency is stepped, not truly linearly swept, between the Start and Stop frequencies. The number of discrete frequency steps in a sweep is determined by the sweep time set; the size of each step, i.e. the frequency stepping resolution, is determined by the number of steps and the sweep range (difference between the Start and Stop frequencies). At the shortest sweep times (i.e. the fewest steps) with the widest frequency spans the frequency changes will be quite large at each step; if the output is applied to a filter, for example, the response will be a succession of step-change levels with (at higher frequencies) many cycles of the same frequency at each step. This is a limitation of a DDS generator in sweep but in part, of course, this effect can only be created because of the very wide sweeps that can be achieved with DDS techniques; analogue generators usually have more restricted capabilities.

FSK Setup

All FSK setup parameters can be checked and updated from the FSK setup menu. FSK modulation is turned on and off by selecting the <Off> button to show the active state as <On>. If any other Modulation is set to On, it will automatically be switched Off.

General

FSK (Frequency Shift Keying) permits fast phase-continuous switching between two frequencies within the range of 0.1Hz to 5MHz at a rate of up to 10kHz. All other parameters of the waveform (amplitude, offset, duty) remain the same as the frequency is switched.

Frequency Setting

The two frequencies Freq 0 and Freq 1, between which the waveform is switched, are checked and updated in the FSK Setup Menu.

Rate Setting

The waveform can be continuously switched between the two frequencies F0 and F1 at a rate defined by the rate entry. This rate can be set within the range of 0.1ms to 999.99s at a resolution of 0.1ms.

FSK Triggering

The trigger options are Single or Continuous. The Trigger mode is set in the menu, see '*Trigger*' for more details.

FSK is initialised by pressing the key. If the trigger is set to continuous and the Output is off, the output key will also active the trigger when pressed.

Single: The waveform frequency switches between Frequency 0 and Frequency 1 on each press of the key.

Continuous: The waveform frequency is continually switched between Frequency 0 and Frequency 1 at the FSK rate defined when the key is pressed.

FSK Sync

The SYNC output defaults to an FSK Sync when FSK is running (either continuous or single). FSK Sync goes low whilst Freq 0 is output at MAIN OUT and goes high whilst Freq 1 is output at MAIN OUT.

PSK Setup

All PSK setup parameters can be checked and updated from the PSK setup menu. PSK modulation is turned on and off by selecting the <Off> button to show the active state as <On>. If any other Modulation is set to On, it will automatically be switched Off.

General

PSK (Phase Shift Keying) modulation permits fast phase-continuous switching between two phases within the range of 0°-360°. All other parameters of the waveform (frequency, amplitude, offset, duty) remain the same as the phase is switched.

Phase Setting

The two phases Phase 0 and Phase 1, between which the waveform is switched, are checked and updated in the PSK Setup Menu.

Rate Setting

The waveform can be continuously switched between the two phases at a rate defined by the rate entry. This rate can be set within the range of 0.1ms to 100s at a resolution of 0.1ms.

PSK Triggering

The trigger options are Single or Continuous. The Trigger mode is set in the menu, see '*Trigger*' for more details.

PSK is initialised by pressing the key. If the trigger is set to continuous and the Output is off, the output key will also active the trigger when pressed.

Single: The waveform phase switches between Phase 0 and Phase 1 on each press of the key.

Continuous: The waveform phase is continually switched between Phase 0 and Phase 1 at the PSK rate defined when the key is pressed.

PSK Sync

The SYNC output defaults to a PSK Sync when PSK is running (either continuous or single). PSK Sync goes low whilst Phase 0 is output at MAIN OUT and goes high whilst Phase 1 is output at MAIN OUT.

8. UTILITIES MENU

Power On

The state in which the instrument will power on can be toggled between Last Settings and Defaults. To change the Power-on state, press the Power-on State button.

Last Settings: Instrument will automatically load the settings that the unit was powered down with.

Defaults: Unit will power up with the default values - see '*Default Values*' for more information.

Buzzer

A buzzer is incorporated that produces a 'beep' when a touch button is pressed, or an error occurs. By default, the buzzer is disabled <Off>. This can be enabled by pressing the Buzzer button to show <On> as the status.

Store/ Recall

6 memory slots are provided, allowing the user to store and recall the settings for the instrument.

To save a setup, select the Store menu by pressing the Store tab ①, then press any Slot button ②, a pop-up will appear asking to confirm the store. Press OK to save the file.

To load a setup, select the recall menu by pressing the Recall tab ③, then press the required Slot button ②, a pop-up will appear asking to confirm the Recall. Press OK to recall the file.

Slots that have data saved to them will have Saved as the status, otherwise Empty is shown. Slots can be overwritten with new data at any time.

Reset Defaults

This function can be used to return most of the instrument settings back to the factory default values as listed in '*Default Values*' The Store memories are unaffected. Press the Reset Defaults button to reset, a pop-up will appear asking to Confirm Reset Defaults.

Display Settings

Theme

A range of colour themes are available, each providing a different coloured base for the user interface. Press the Theme button repeatedly to scroll through the options, the user interface colour will change to preview the colour theme. The default theme is Blue.

<Blue> // <Orange> // <Green> // <Pink> // <Light> // <Classic>

Backlight

To adjust the brightness of the display, press the Backlight button and select from the options.

Trigger

The behaviour of the trigger will vary depending on what modulation is active, see *'Modulation'* for more details.

The trigger options are Single or Continuous. The modulation is initialised by pressing the ▶ key. When the modulation is actively running RUN will be shown on the status bar. If the trigger is set to continuous and the Output is off, the output key will also active the trigger when pressed.

NOTE

Modulation is activated using the On/Off buttons in the specific modulation menus. It must be set to ON before the modulation will run using the ▶ key. See *'Modulation'* for further details.

9. REMOTE OPERATION

General

Remote and Local Operation

At power-on, the instrument will be in the local state. In this state, all front panel operations are possible. When the instrument receives a command from an interface the remote state will be entered, and the Remote LED will illuminate. In this state the front panel and touch control is disabled. The instrument may be returned to the local state by pressing the key; however, the effect of this action will only remain until the instrument receives another character from the interface, when the remote state will once again be entered. Returning to Local by this action will keep the settings at their last remotely set values.

Remote Interface Configuration

The ATG1005 can be remotely controlled via its USB connection.

The USB interface enumerates as a Communications Class device and interacts with application software through a standard virtual COM port device driver on the PC. The instrument firmware can be updated in the field via the USB port; see *'Firmware Update'* for more details.

USB Interface

Using the USB interface for remote control requires a Communications Device Class driver on the PC to provide a virtual COM port instance.

Windows 10 and later will automatically install a suitable driver. In earlier versions of Windows, a suitable driver is provided by Microsoft, but it is not installed by default. The data (.INF) file to control the installation is provided on the website: www.aimtti.com

If required, unzip the contents of the downloaded USB driver.

NOTE

The same driver is also used by many other TTi instruments and may already be known to the PC.

Installing USB driver for the first time

To install the driver for the first time:

- First switch the unit On.
- Then connect the USB port to PC.

NOTE

In Windows 10 or later, the driver is automatically installed by the operating system.

The Windows plug and play functions should automatically recognise the attachment of new hardware to the USB interface and (possibly after searching the internet for some time) prompt for the location of a suitable driver.

Follow the Windows prompts and point to the downloaded driver file named USB_ARM_VCP_xxx.INF, where xxx is a version number.

In some cases, Windows will not complete this procedure (especially recent versions which search the internet first, looking for the unique Vendor ID and Product ID), in which case the instrument will show in Device Manager as “not working properly”. If this happens, select this device, right click, and choose “update driver software...”, followed by: “browse this computer for driver software...”; then locate the downloaded .INF file.

Once Windows has installed the device driver it will assign a COM port number to this particular unit. This number will depend on previous COM port assignments on this PC, and it may be necessary to use Device Manager to discover it. Each instrument has a unique USB identifier which is remembered by the system, so it will receive the same COM port number whenever it is attached to the same PC (regardless of the physical interface socket used), even though the COM port will disappear while the instrument is disconnected or switched off. Other instruments will receive different COM port numbers.

NOTE

A different PC will not necessarily assign the same COM port number to a particular instrument (it depends on the history of installations). Device Manager can be used to change the assignments given.

Command Timing

There are no dependent parameters, coupled parameters, overlapping commands, expression program data elements or compound command program headers.

All commands are separate and sequential and are executed when parsed and immediately considered complete. To provide useful functionality, the Operation Complete bit (bit 0) in the Standard Event Status Register is only ever set by the *OPC command. Either the *OPC command or the *OPC? query can be used for device synchronisation due to the sequential nature of remote operations.

Status Reporting

Error status is maintained using a set of registers; these are described in the following paragraphs and shown on the Status Model at the end of this section. Not all bits or registers are used in this product, see *ATG1005 Status Model* for more details.

Standard Event Status and Standard Event Status Enable Registers (ESR/ESE)

Any bits set in the Standard Event Status Register which correspond to bits set in the Standard Event Status Enable Register will cause the ESB bit to be set in the Status Byte Register.

The Standard Event Status Register is read and cleared by the *ESR? command. The Standard Event Status Enable register is set by the *ESE<NR1> command and read by the *ESE? command.

On power up this register is set to 0 for all interface instances.

Bit 7 Set when power is first applied to the instrument.
Bit 6 User Request (Not used).
Bit 5 Set when a syntax type error is detected in a command from the bus. The parser is reset and parsing continues at the next byte in the input stream
Bit 4 Set when an error is encountered while attempting to execute a completely parsed

command. The appropriate error number will be reported in the Execution Error Register.

Bit 3 Not used.

Bit 2 Set when an error occurs. The appropriate error number will be reported in the Query Error Register, see 'Error messages' section.

Bit 1 Not used.

Bit 0 Set in response to the '*OPC' command

Status Byte Register (STB/SRE)

The Status Byte Register is read either by the *STB? command, which will return MSS in bit 6, or by a Serial Poll which will return RQS in bit 6.

On power up this register is set to 0 for all interface instances.

Bit 7	OPEN	This bit is set if any bits in the STATus:OPERation:CONDition register correspond to bits set in the STATus:OPERation:ENABle register.
Bit 6	RQS/ MSS	This bit, as defined by IEEE Std. 488.2, contains both the Requesting Service message and the Master Status Summary message. RQS is returned in response to a Serial Poll and MSS is returned in response to the *STB? command.
Bit 5	ESB	This bit is set if any bits set in the Standard Event Status Register correspond to bits set in the Standard Event Status Enable Register.
Bit 4	MAV	This will be set when the instrument has a response message formatted and ready to send to the controller. The bit will be cleared after the Response Message Terminator has been sent.
Bit 3		Not used.
Bit 2	EAV	Error Queue is not empty. This will be set when there is one or more entries in the error queue.
Bit 1		Not used.
Bit 0	INST	Set when a limit/trip has been detected on any of the channels from operation instrument summary register (OISR).

Operation Instrument Summary Register (OISR/OISE)

Any bits set in the Operation Instrument Summary Enable registers which correspond to bits set in the Operation Instrument Summary Register will cause the INST bit to be set in the Status Byte Register.

The Operation Instrument Summary Register is read and cleared by the OISR? command. The Operation Instrument Summary Enable register is set by the OISE <NR1> command and read by the OISE? command.

It is a bit field where each bit has the following significance.

On power up this register is set to 0 for all interface instances.

Bit 15 Reserved for future use

Bit 14 Reserved for future use

Bit 13 Reserved for future use

Bit 12 Reserved for future use

Bit 11 Summary of ETR4 and ETE4 registers

Bit 10 Summary of ISR4 and ISE4 registers

Bit 9 Summary of CSR4 and CSE4 registers

Bit 8 Summary of ETR3 and ETE3 registers

Bit 7 Summary of ISR3 and ISE3 registers

Bit 6 Summary of CSR3 and CSE3 registers

Bit 5 Summary of ETR2 and ETE2 registers
Bit 4 Summary of ISR2 and ISE2 registers
Bit 3 Summary of CSR2 and CSE2 registers
Bit 2 Summary of ETR1 and ETE1 registers
Bit 1 Summary of ISR1 and ISE1 registers
Bit 0 Summary of CSR1 and CSE1 registers

Channel Status and Channel Status Enable Registers (CSR/CSE)

Their purpose is to inform the controller of entry to and/or exit from any conditions since the last read.

Any bits set in the Channel Status Register (CSR<N>) which correspond to bits set in the Channel Status Enable register (CSE<N>) will cause the CSR<N> bit to be set in the Operation Instrument Summary Register, where <N> is 1 for output 1.

The Channel Status Register is read and cleared by the CSR<N>? command. The Channel Status Enable register is set by the CSE<N> <NR1> command and read by the CSE<N>? command.

On power up this register is set to 0 for all interface instances.
Bit 15 Reserved for future use
Bit 14 Reserved for future use
Bit 13 Reserved for future use
Bit 12 Reserved for future use
Bit 11 Reserved for future use
Bit 10 Reserved for future use
Bit 9 Reserved for future use
Bit 8 Reserved for future use
Bit 7 Reserved for future use
Bit 6 Reserved for future use
Bit 5 Reserved for future use
Bit 4 Set when output modulation is enabled
Bit 3 Set when output is clipped.
Bit 2 Set when output enters power limit (unregulated mode)
Bit 1 Set when output enters current limit (constant current mode)
Bit 0 Set when output enters voltage limit (constant voltage mode)

Input State Register (ISR/ISE)

Their purpose is to inform the controller of entry to and/or exit from any conditions since the last read.

Any bits set in the Input State Register (ISR<N>) which correspond to bits set in the Input State Enable register (ISE<N>) will cause the ISR<N> bit to be set in the Operation Instrument Summary, where <N> is 1 for output 1.

The Input State Register is read and cleared by the ISR<N>? command. The Input State Enable register is set by the ISE<N> <NR1> command and read by the ISE<N>? command.

On power up this register is set to 0 for all interface instances.
Bit 15 Reserved for future use
Bit 14 Reserved for future use
Bit 13 Reserved for future use
Bit 12 Reserved for future use
Bit 11 Reserved for future use

Bit 10 Reserved for future use
Bit 9 Reserved for future use
Bit 8 Reserved for future use
Bit 7 Reserved for future use
Bit 6 Reserved for future use
Bit 5 Low Voltage Limiting Event
Bit 4 Duty cycle protect: Set in 600W mode if the permitted power and time limit is exceeded. If no action is taken, an Over Power Protect Trip will follow 10 seconds later.
Bit 3 The load is not conducting current because the source voltage is below the dropout voltage setting.
Bit 2 The load is not conducting the current expected because the power limit circuit is restricting it.
Bit 1 The load cannot conduct the current required because there is insufficient voltage from the source.
Bit 0 Reports the present state of the input enable setting.

Event Trip Register (ETR/ETE)

Their purpose is to inform the controller of entry to and/or exit from any conditions since the last read.

Any bits set in the Event Trip Register (ETR<N>) which correspond to bits set in the Event Trip Enable register (ETE<N>) will cause the ETR<N> bit to be set in the Operation Instrument Summary, where <N> is 1 for output 1.

The Input State Register is read and cleared by the ETR<N>? command. The Input State Enable register is set by the ETE<N> <NR1> command and read by the ETE<N>? command.

On power up this register is set to 0 for all interface instances.
Bit 15 Reserved for future use
Bit 14 Reserved for future use
Bit 13 Reserved for future use
Bit 12 Reserved for future use
Bit 11 Reserved for future use
Bit 10 Reserved for future use
Bit 9 Set when a Powerflex event trip occurs.
Bit 8 Set when a low voltage event trip occurs.
Bit 7 Set when a high power event trip occurs.
Bit 6 Set when Triplink event occurs.
Bit 5 Set when hardware fault event occurs.
Bit 4 Set when sense trip event occurs.
Bit 3 Set when OTP event trip occurs.
Bit 2 Set when OPP event trip occurs.
Bit 1 Set when OCP event trip occurs.
Bit 0 Set when OVP event trip occurs.

Execution Error Register

This register contains a number representing the last error encountered over the current interface. The Execution Error Register is read and cleared using the ‘EER?’ command. On power up this register is set to 0 for all interface instances.

Error messages have the following meaning:
0 No error encountered

101 Command error
103 Data out of range
104 Command execution error. The command is valid but a parameter is invalid or the not valid in the current circumstances.

Operation Status Register

Any bits set in the Operation Status Enable register which correspond to bits set in the Operation Status Register will cause the OPEN bit to be set in the Status Byte Request Register.

The Operation Status Register is read and cleared by the STATus:OPERation:CONDition? command. The Operation Status Enable register is set by the STATus:OPERation:ENABle <NR1> command and read by the STATus:OPERation:ENABle? command.

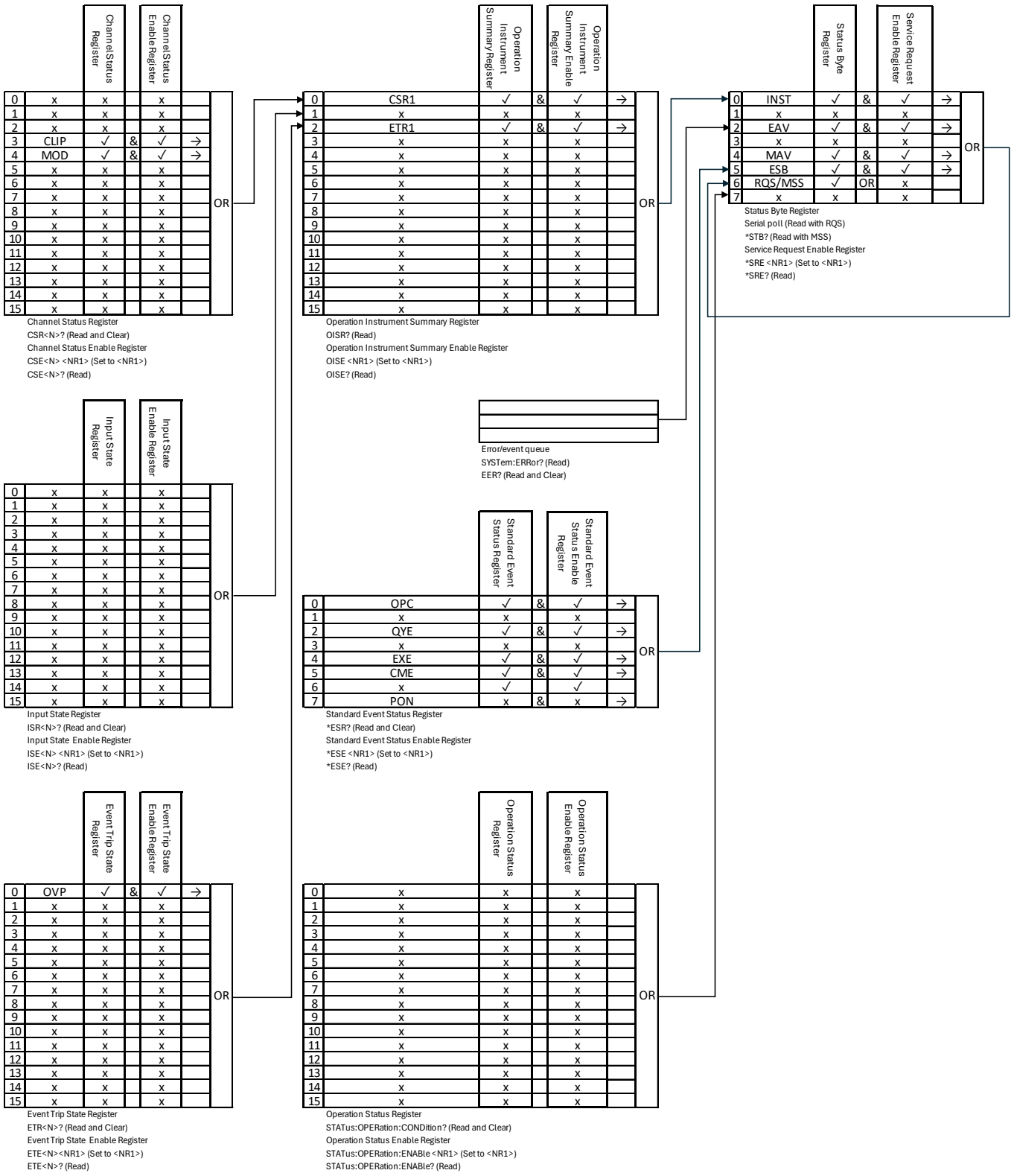
On power up this register is set to 0 for all interface instances.

STATus:OPERation:CONDition / STATus:OPERation:ENABle

Bit 15 Reserved for future use
Bit 14 Reserved for future use
Bit 13 Reserved for future use
Bit 12 There are measurements available in the buffer.
Bit 11 Sequence mode running.
Bit 10 Sequence mode currently active.
Bit 9 Trigger in global pin detected.
Bit 8 Set when the current calibration or test failed.
Bit 7 Set when the instrument is currently performing a correction.
Bit 6 Set when the instrument is in a “wait for arm” state of the trigger model.
Bit 5 Set when the instrument is in a “wait for trigger” state of the trigger model.
Bit 4 Set when the instrument is actively measuring.
Bit 3 Set when a sweep is in progress.
Bit 2 Set when the instrument is currently changing its range.
Bit 1 Set when the instrument is waiting for signals it controls to stabilize enough to begin measurements.
Bit 0 Set when the instrument is currently performing a calibration.

9 - Remote Operation

ATG1005 Status Model



10. SCPI COMMANDS

SCPI Overview

This instrument uses SCPI (Standard Commands for Programmable Instruments) commands for remote control. The commands are based on SCPI Version 1999 and follow the syntax and rules including commands that are not taken from the SCPI standard. These commands are separated into two groups: common and subsystem.

Common commands are defined by the IEEE 488.2 standard to perform common instrument functions such as querying the status or resetting to default parameters.

Subsystem commands perform instrument specific functions and allow all operating parameters to be configured and queried. They are arranged in groups which correspond to particular functionality of the instrument. A tree structure is used extending to one or more levels below the root.

Square brackets ([ ]) are used to represent a keyword that is optional for the command. Uppercase letters are used to differentiate between the short and long form version of keywords.

EXAMPLE

The following command is used to set the start frequency of a sweep to 12Hz :

[SOURce:]SWEep:FREQuency:STARt 12.000000

The above command can also be executed in below listed formats and they all will set the start frequecy to 12 in this case.

SOUR:SWE:FREQ:STAR 12.000000

SWE:FREQ:STAR 12

Multiple SCPI commands can be combined into a single message using a semicolon as separator.

EXAMPLE

The combined message below will set the start frequency of a sweep to 12Hz and the stop frequency to 20Hz. Using these commands:

[SOURce:]SWEep:FREQuency:STARt <NRF>

[SOURce:]SWEep:FREQuency:STOP <NRF>

you can send any of the following to get the same result:

SOURce:SWEep:FREQuency:STARt 12;:SOURce:SWEep:FREQuency:STOP 20

SOUR:SWE:FREQ:STARt 12;:SOUR:SWE:FREQ:STOP 20

SOUR:SWE:FREQ:STARt 12;STOP 20

The colon : character after ; in the above example is used to reset the SCPI parser to the root level. If the multiple commands in a single message are from the same SCPI subsystem then the colon may be omitted. A message terminator (typically a ‘new line’ character) completes the message and resets the current path to the root.

Modulation with delayed start SCPI example

EXAMPLE

This example shows how to set and start a sweep with a delayed start using SCPI commands.

· Reset to defaults.	*RST
· Select sine wave output.	SOURce:FUNCtion SINusoid
· Set frequency to 1kHz.	SOURce:FREQuency 1KHZ
· Turn the output on.	OUTPut:STATe 1
· Set the sweep start frequency to 500Hz.	SOURce:SWEep:FREQuency:STARt 500HZ
· Set the sweep stop frequency to 1500Hz.	SOURce:SWEep:FREQuency:STOP 1500HZ
· Set the sweep time to 2.5 seconds.	SOURce:SWEep:TIMe 2.5
· Set the sweep to single direction.	SOURce:SWEep:SLOPe SINGle
· Set the sweep to be linear.	SOURce:SWEep:SPACing LINear
· Enable the sweep modulation. The sweep will not start yet.	SOURce:MODulation SWEep
· Set the trigger to continuously run the sweep.	SYSTem:TRIGger:TYPe CONTinuous
· Trigger the sweep to start	*TRG

Parameter Data Format

<NR1>	Digits with no fractional part, i.e., an integer Example: 451
<NR2>	Digits with an explicit decimal point. Example: 0.451
<NR3>	Digits with an explicit decimal point and an exponent. Example: 45.1e+01
<NRF>	A number in any format. Example: 12, 12·00, 1·2 e1 and 120 e-1 are all accepted as the number 12
<CPD>	<CHARACTER PROGRAM DATA>, i.e., a short mnemonic or string such as ON or OFF. Multiple CPDs in a command are shown as <CPD1>, <CPD2>, <CPD3>, etc.
<CRD>	<CHARACTER RESPONSE DATA> Returns a short mnemonic or string. Only the short form of the parameter is returned.
<Bool>	Boolean data. Example: 0 | 1 or ON | OFF
<Quad>	A number in dotted quad notation.
<Unquoted String>	String data without any quotation.

SCPI Subsystems

:SOURce	The SOURce subsystem contains the commands for configuring the output signal.
:OUTPut	The OUTPut subsystem configures the output signal state.
:MEASure	The MEASure subsystem returns the output voltage, current or power.
:STATus	The STATus subsystem is used to query the Operation Condition Register
:SYSTem	The SYSTem subsystem is used for a number of functions not associated with the output signal, such as configuring the USB.

Query commands

All commands (with the exception of any set in Orange) can be presented as a query command by adding '?' at the end, this will return the current set value or parameter as <...> Commands set in Blue are query only.

Global

***IDN?**

Query the instrument identification. The exact response is determined by the instrument configuration and is of the form of <Manufacturer, Model,Serial No., XX.xx>

FW?

Query the instrument firmware versions.

Status

***STB?**

Query the value of the Status Byte register in <NR1> numeric format. The response is <NR1>. See Status reporting section for details.

***SRE <NR1>**

Set or return the Status Byte Enable register in <NR1> numeric format. The query response is <NR1>. See Status reporting section for details.

OISR?

Query the Operation Instrument Summary Register in <NR1> numeric format. The response is <NR1>. See Status reporting section for details.

OISE <NR1>

Set or return the Operation Instrument Summary Enable register in <NR1> numeric format. The query response is <NR1>. See Status reporting section for details.

CSR1?

Query the value of the Channel Status Register in <NR1> numeric format. The response is <NR1>. See Status reporting section for details.

CSE1 <NR1>

Set or return the value of the Channel Status Enable register in <NR1> numeric format. The query response is <NR1>. See Status reporting section for details.

ETR1?

Query the value of the Event Trip Register in <NR1> numeric format. The response is <NR1>. See Status reporting section for details.

ETE1 <NR1>

Set or return the value of the Event Trip Enable register in <NR1> numeric format. The query response is <NR1>. See Status reporting section for details.

EER?

Query the most recent error number. The response is <NR1>.

***ESR?**

Query the value in the Standard Event Status Register in <NR1> numeric format. The register is then cleared. The response is <NR1>. See Status reporting section for details.

***ESE <NR1>**

Query the value in the Standard Event Status Enable register in <NR1> numeric format. The response is <NR1>. See Status reporting section for details.

***OPC**

Set the Operation Complete bit (bit 0) in the Standard Event Status Register. This will happen immediately when the command is executed because of the sequential nature of all operations. Querying returns a 1 when all pending device operations have completed. Can be used to verify when a long-running command has completed.

STATus:OPERation:CONDition?

Query the Status Operation Condition register. The response is <NR1>. See Status reporting section for details.

STATus:OPERation:ENABle <NR1>

Set or return the Status Operation Enable register. The query response is <NR1>. See Status reporting section for details.

QER?

Query and clear Query Error Register. The response is <NR1>.

***RST**

Reset the instrument parameters to their default values.

***CLS**

Clear Status. Clears the Status structure. This indirectly clears the Status Byte Register.

System

SYSTem:ERRor[:NEXT]?

Query the next error from the error log. If the log is empty "0, No Error" is returned.

***TRG**

Trigger the active modulation.

[SYSTem:]LOCal

Go to local. Stops the instrument from being in remote mode. Same as pressing Home when the 'Remote' LED is lit. When another command is received, the instrument will return to remote mode.

[SYSTem:]TRIGger

Same function as *TRG

[SYSTem:]TRIGger:TYPe <String>

Set or return the trigger type to <String> CONTinuous|SINGle. The query response is <String>.

Output

OUTPut[:STATe] <Bool>

Set or return the outout state to <Bool> OFF|ON|0|1. The response is <Bool>.

[OUTPut:]LOAD[:IMPedance] <String>

Set or return the output load <String> HIGHz|50. The query response is <String>.

Source

[SOURce:]FUNCtion[:SHAPe] <String>

Set the source waveform to <String> SINusoid|SQUare|POSPulse|NEGPulse|TRIangle|DC. The query response is <String>.

[SOURce:]FUNCtion[:SHAPe]:DCYCle <NRF>

Set or return the source waveform duty cycle (%). Only applies to Square, Positive Pulse and Negative Pulse waveforms. The query response is <NRF> in percent.

[SOURce:]FREQuency <NRF>

Set or return the source frequency (Hz) to <NRF> MAHZ|KHZ|HZ. The query response is <NRF> in Hertz.

[SOURce:]MODulation <String>

Set or return the source modulation to <String> CW|FIXed|SWEep|FSK|PSK. The query response is <String>.

Voltage

[SOURce:]VOLTage:AMPLitude <NRF>

Set or return the waveform amplitude (V) to <NRF> V|MV. The query response is <NRF> in Volts.

[SOURce:]VOLTage:OFFSet <NRF>

Set or return the waveform offset (V) to <NRF> V|MV. The query response is <NRF> in Volts.

Sweep

[SOURce:]SWEep:TIMe <NRF>

Set or return the Sweep time (s) to <NRF> MS|S. The query response is <NRF> in seconds.

[SOURce:]SWEep:SLOPe <String>

Set or query the Sweep slope to <String> SINGle|DUAL. The query response is <String>.

[SOURce:]SWEep:SPACing <String>

Set or return the Sweep type to <String> LINear|LOGarithmic. The query response is <String>.

Frequency

[SOURce:]SWEep:FREQuency:STARt <NRF>

Set or return the Sweep start frequency (Hz) to <NRF> MAHZ|KHZ|HZ. The query response is <NRF> in Hertz.

[SOURce:]SWEep:FREQuency:STOP <NRF>

Set or return the Sweep stop frequency (Hz) to <NRF> MAHZ|KHZ|HZ. The query response is <NRF> in Hertz.

FSK

[SOURce:]FSKey:FREQuency:0 <NRF>

Set or return the FSK frequency 0 (Hz) to <NRF> MAHZ|KHZ|HZ. The query response is <NRF> in Hertz.

[SOURce:]FSKey:FREQuency:1 <NRF>

Set ore return the FSK frequency 1 (Hz) to <NRF> MAHZ|KHZ|HZ. The query response is <NRF> in Hertz.

[SOURce:]FSKey:[INTernal:]RATe <NRF>

Set or return the FSK rate (s) to <NRF> MS|S. The query response is <NRF> in seconds.

PSK

[SOURce:]PSKey:PHASe:0 <NRF>

Set or return the PSK phase 0 (º) to <NRF> DEG. The query response is <NRF> in degrees.

[SOURce:]PSKey:PHASe:1 <NRF>

Set or return the PSK phase 1 (º) to <NRF> DEG. The query response is <NRF> in degrees.

[SOURce:]PSKey:[INTernal:]RATe <NRF>

Set or return the PSK rate (s) to <NRF> MS|S. The query response is <NRF> in seconds.

11. MAINTENANCE

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

Cleaning

If the instrument requires cleaning use a cloth that is only lightly dampened with water or a mild detergent, to avoid damage to the case never clean with solvents.

WARNING

To avoid electric shock, or damage to the instrument, never allow water to get inside the case.

Internal AC Power Fuse

The correct fuse type is:

500mA 250V HRC time-lag (T), 5 x 20mm

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

To replace the fuse, first disconnect the instrument from the AC supply. Remove the 5 rear panel securing screws and the top two screws on the front panel. Slide back and lift off the cover. Replace the fuse with one of the correct type and refit the cover and screws.

NOTE

The main function of the fuse is to make the instrument safe and limit damage in the event of failure of one of the switching devices. If a fuse fails it is therefore very likely that the replacement will also blow, because the supply has developed a fault; in such circumstances the instrument will need to be returned to the manufacturer for service.

Calibration

To ensure that the accuracy of the instrument remains within specification the calibration must be checked (and if necessary adjusted) annually. The procedure is detailed in the Service Guide, which also lists the calibrated test equipment required.

Firmware Update

The firmware of the instrument can be updated through the USB port using a PC software utility available from the manufacturer. This uses a HID (human interface device) USB class driver which will already be installed on any PC with a USB port.

Before the firmware can be updated the instrument must be placed in a special mode that enables it to accept the update. Unless the instrument is placed in this mode it cannot be updated.

- Ensure that the USB interface is connected and the instrument is powered on. The instrument should be connected to the PC with a USB cable.
- Press the 'USB UPDATE' button on the rear panel. If this has been done correctly then 'Firmware Update' will be displayed on the ATG display.
- The instrument will now wait for an update from the PC via the USB connection and the Windows based update utility can now be run.
- The latest Firmware update, together with file transfer utility can be downloaded from https://www.aimtti.com/
- Once downloaded, unzip the file, and run the **File Transfer Utility** application.
- Within the File Transfer Utility application, select **File** and **Open**.
- Open the **ATG1005.ttiupd** file.
- Select **Start Update**.
- The instrument will power cycle and be ready to use one the update is complete.

NOTE

After a Firmware update, the settings will automatically be reset to default.

12. TECHNICAL SPECIFICATIONS

Waveforms

Sine	
Range	1mHz to 5MHz
Resolution	1mHz or 9 digits
Accuracy	10ppm for 1 year; ±1mHz below 0.2Hz
Temperature Stability	Typically <1ppm /°C outside 18° to 28°C
Output Level	2mV to 20V pk-pk open circuit, (1mV to 10V pk-pk into 50Ω)
Amplitude flatness (1Vp-p relative to 1 kHz)	≤ 500kHz : ±0.2dB ≤ 5MHz : ±1dB (Typically < ±0.5dB)
Harmonic distortion (1Vp-p)	≤ 500kHz : <-65dBc ≤ 5MHz : <-50dBc (typically <-60dBc)
Total Harmonic Distortion DC to 20kHz (typical):	0.05%
Non-harmonic Spurii	<-65dBc to 1MHz, <-65dBc + 6dB/octave 1MHz to 5MHz
Square	
Range	1mHz to 5MHz
Resolution	1mHz or 9 digits
Symmetry	1.0% to 99.0% for full frequency range 0.1% Resolution for full frequency range Specifications only apply: ≤ 100kHz : 1.0% to 99.0% ≤ 5MHz : 20.0% to 80.0%
Asymmetry	1% of period + 10ns
Accuracy	10ppm for 1 year; ±1mHz below 0.2Hz
Output level	2mV to 20V pk-pk open circuit, (1mV to 10V pk-pk into 50Ω)
Rise and Fall Times	<30ns
Aberrations	<5% + 2mV
Triangle	
Range	1mHz to 500kHz
Resolution	1mHz or 9 digits
Accuracy	10ppm for 1 year; ±1mHz below 0.2Hz
Output level	2mV to 20V pk-pk open circuit, (1mV to 10V pk-pk into 50Ω)
Linearity Error	<5% to 100kHz
Positive and Negative Pulse	
Range	1mHz to 5MHz
Resolution	1mHz or 9 digits
Symmetry	1.0% to 99.0% for full frequency range 0.1% Resolution for full frequency range Specifications only apply: ≤ 100kHz : 1.0% to 99.0% ≤ 5MHz : 20.0% to 80.0%
Asymmetry	1% of period + 10ns
Aberrations	<5% + 2mV
Rise and Fall Times	<30ns
Output level	2mV to 10V pk-pk open circuit, (1mV to 5V pk-pk into 50Ω) positive or negative only pulses with respect to the DC offset baseline

Operating Modes

Continuous	
Continuous cycles of the selected waveform are output at the programmed frequency	
Sweep	
Carrier Waveforms	All
Sweep Mode	Linear or logarithmic Trigger: single or continuous Slope: single or dual
Sweep Width	From 0.1Hz to 5MHz in one range. Phase continuous. Independent setting of the start and stop frequency. 0.1Hz Resolution. Square / Pulse Symmetry specifications only apply: When both start and stop frequencies ≤ 100kHz : 1.0% to 99.0% If either start or stop frequencies > 100kHz : 20.0% to 80.0%
Sweep Time	100ms to 999s (10ms resolution).
Trigger Source	The sweep may be free run or triggered from the front panel TRIGGER key
Frequency Shift Keying (FSK)	
Phase coherent switching between two selected frequencies at a rate defined by the switching signal source	
Carrier frequency	From 0.1Hz to 5MHz. 0.1Hz Resolution. Square / Pulse Symmetry specifications only apply: When both frequencies ≤ 100kHz : 1.0% to 99.0% If either frequency > 100kHz : 20.0% to 80.0%
Carrier waveforms	All
Switch repetition rate	DC to 10kHz (internal trigger)
Switching signal source	Manual (front panel TRIGGER key) or internal trigger generator
Phase Shift Keying (Binary PSK)	
Phase	0.0° to 360.0°
Carrier frequency	From 1mHz to 5MHz.
Carrier waveforms	All
Switch repetition rate	DC to 10kHz (internal trigger)
Switching signal source	Manual (front panel TRIGGER key) or internal trigger generator

Outputs

Main Outputs	
Output Impedance	50Ω
Amplitude	2mV to 20V pk-pk open circuit, (1mV to 10V pk-pk into 50Ω) Note that in positive or negative Pulse modes the amplitude range is 2mV to 10V pk-pk open circuit.
Accuracy	±3% ±1mV at 1kHz into 50Ω
DC offset range	±10V from 50Ω. Clipping warning when DC offset plus signal peak exceeds ±10V. Accuracy ±3% ±15mV
Resolution	1mV for both amplitude and offset
Sync Output	
Waveform Sync	A square wave at the main waveform frequency. Symmetry ≈ 50% for sine and triangle waves at MAIN OUT; for square waves symmetry is the same as that of the waveform at MAIN OUT
FSK Sync	Outputs the FSK switching frequency
PSK Sync	Outputs the PSK switching frequency

12 - Technical Specifications

Signal Levels	Output impedance 50Ω nominal. Logic levels of <0.8V & >3V
Interfaces	
USB	Full digital remote control facilities are available through the USB interface. Standard USB 2.0 hardware connection. Implemented as virtual-COM port. SCPI compatible.
General	
Display	2.8” IPS TFT (320x240) Backlit
Data Entry	Resistive touch screen user interface navigation, value entry direct by numeric keys or by rotary control.
Stored Settings	Up to 6 complete instrument set-ups may be stored in non-volatile memory.
Size and Weight	213.3 x 230 x 98.2 mm (WxDxH) 1.2kg
Power	110-240VAC ±10% 50/60Hz; 30VA max. Installation Category II.
Operating Range	+5°C to 40°C, 20-80% RH.
Storage Range	-20°C to + 60°C.
Environmental	Indoor use at altitudes up to 2000m, Pollution Degree 2.
Safety & EMC	Complies with EN61010-1 & EN61326-1.
Security	Kensington Lock

General specifications apply for the temperature range 5°C to 40°C. Accuracy specifications apply for the temperature range 18°C to 28°C after 30 minutes warm-up, at maximum output into 50Ω. Typical specifications are determined by design and are not guaranteed.

13. DEFAULT VALUES

When supplied from the factory the function generator is set as follows:

Waveform	Sine
Frequency	500kHz
Amplitude	2Vpp
Duty	50%
Offset	0.0Vdc
Sweep Start Frequency	1.0Hz
Sweep Stop Frequency	500Hz
Sweep Cycle Time	1.0s
Sweep Type	Logarithmic
Sweep Slope	Single
FSK Frequency 0	1.0Hz
FSK Frequency 1	1.0kHz
FSK Rate	1.0s
PSK Phase 0	90°
PSK Phase 1	270°
PSK Rate	1.0s
Modulation	None (carrier)
Load	50Ω
Output	Off

System Level Settings

Power-On state	Defaults
Buzzer	Off
Brightness	80%
Trigger	Continuous
Theme	Blue

The default values can be restored from the “Reset to factory Defaults” function – see ‘*Reset Defaults’*.

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