INSTRUCTION MANUAL

EN

TGR2050 SERIES

1.5GHz & 3GHz

RF Signal Generators

1. CONTENTS

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1. 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 that 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

Terminal connected to chassis ground.

Standby supply. Instrument is not disconnected from AC mains power when switch is off.

Alternating current.

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).
- An Installation Category II instrument intended for operation from a normal single-phase supply.
- Tested in accordance with EN61010-1 and has been supplied in a safe condition.
- Designed for indoor use in a Pollution Degree 2 environment in the temperature range 5°C to 40°C, 20% - 80% RH (non-condensing).

WARNING

Do not operate while condensation is present.

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

THIS INSTRUMENT MUST BE EARTHED.

Any interruption of the mains earth connector, inside or outside, will make the instrument dangerous. Intentional interruption is prohibited.

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, 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to mechanical damage, excessive moisture or chemical corrosion the safety protection may be impaired and it must be withdrawn from use and returned for repair.

This instrument is protected by an internal fuse which is not user serviceable.

This instrument uses a Lithium button cell for non-volatile memory battery back-up; typical life is 5 years. In the event of replacement becoming necessary, replace only with a cell of the correct type, i.e. 3V Li/$Mn0_2$ 20mm button cell type 2032.
Exhausted cells must be disposed of carefully in accordance with local regulations; do not cut open, incinerate, expose to temperatures above 60°C or attempt to recharge. Refer to 'TGR2050 Service Guide' for further details.

CAUTION

Do not wet when cleaning, use only a soft dry cloth to clean the screen.

2. INSTALLATION

Mounting

This instrument is suitable for bench use and rack mounting.

For rack mounting the protective bezels and handle/stand should be removed such that the instrument can be fitted beside any other standard 2U half-rack instrument in a 19” rack. A suitable 2U 19” rack kit is available from the manufacturers or their overseas agents.

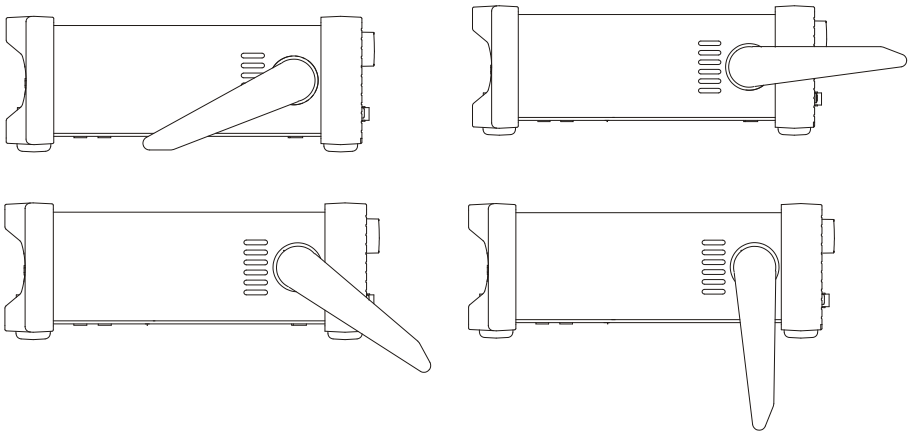
See rack mount instructions for details on how to remove the protective bezel and handle.

Ventilation

The instrument uses a fan fitted to the rear panel. Take care not to restrict the rear air exit or the inlet vents at the front (sides and underneath). In rack-mounted situations allow adequate space around the instrument and/or use a fan tray for forced cooling.

Handle/stand

The instrument is fitted with a 4-position handle/stand. Pull out both sides of the handle at the case pivot points to free the position locking pegs and rotate the handle from the stowed position to the required stand or handle position. Release the sides of the handle to lock it in the new position.



3. ELECTRICAL REQUIREMENTS

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.

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.

WARNING

THIS INSTRUMENT MUST BE EARTHED.

Any interruption of the mains earth conductor inside or outside the instrument will make the instrument dangerous. Intentional interruption is prohibited.

Before use, inspect provided mains lead for any signs of damage. Do not use if lead is damaged.

Before use, inspect the instrument for any signs of damage. Do not use if damaged.

4. FRONT PANEL

Overview

① Flash drive

This is a USB Host port for the connection of flash drive which conform to the Mass Storage Class specification. FAT16 or FAT32 filing systems are accepted. .bmp files of the display can be captured and exported using the flash drive port, see Print Screen' for more details

② Colour touch screen display

CAUTION

Do not use sharp or pointed objects to operate the touch screen

③ Standby button

Illuminated when in standby. Press and hold to turn instrument on, quick press to turn off.

④ Parameter keys

FREQ (frequency) and AMP (amplitude)- select the requested parameter for editing. These keys also return to the home screen.

- **Mode keys**

MOD (modulation) or SWEEP menus, they become illuminated only when the mode is activated ie. modulation is 'ENABLED' or sweep is 'RUN'.

- **Menu keys**

STORES key allows access to files saved in the built-in storage and to a connected flash drive.

UTILITY key gives access to menus for a variety of functions such as: Instrument and System settings, Remote Interface settings, Calibration, IQ Trim and more.

- Trigger key

TRIGGER key is used to issue a manual trigger signal.

⑤ Numeric keypad

Numeric keys permit direct entry of a value for the parameter currently selected.

⑥RF Output Port

This is a 50Ω N-type output socket. The maximum output is 1Vrms (+13dBm) into 50Ω. It can tolerate a short circuit indefinitely. Protected against accidental connection of up to 50VDC.

NOTE

The N Type connector is a precision component that should be protected z excessive wear to ensure that its RF characteristics (impedance and VSWR) are accurately maintained. If the instrument is used in a manner that demands many connections/disconnections to and from the RF OUT it is good practice to fit a male–to–female adaptor to the socket which can be replaced periodically.

CAUTION

Do not apply external voltages to the RF output port.

⑦ RF output key

The OUTPUT key switches the RF Output Port on or off. The key becomes illuminated when the output is on.

⑧ Escape Key/ Local

Entry can be abandoned at any point by pressing the escape key, this key will also exit the selection or screen currently selected. Additionally, when in remote mode this key is used to return the instrument to local operation.

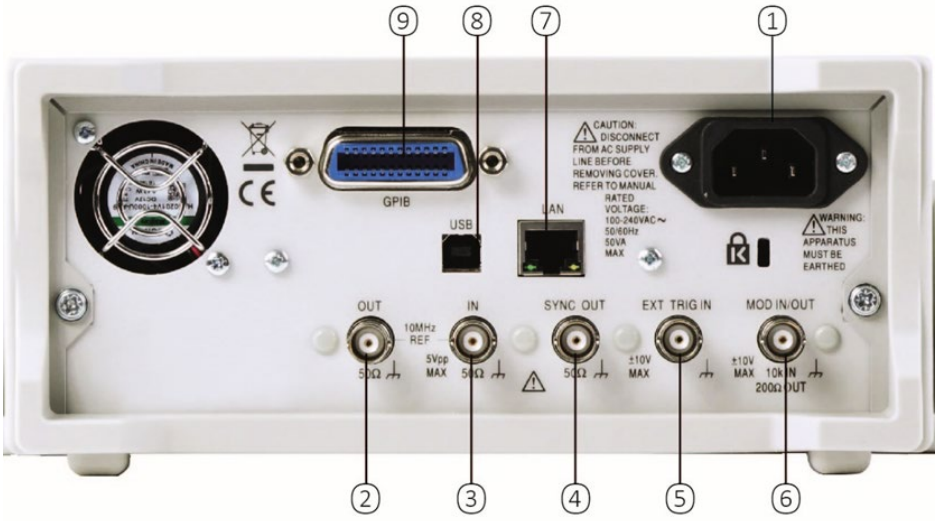
⑨ Directional keys

The direction keys are used for navigating parameter windows, scrolling numeric parameter values and selection lists, additionally these keys are used to apply step changes to the frequency and amplitude.

⑩ Rotary knob

The rotary knob is used to navigate the user interface, it features a ‘press’ function to select an option. See ‘Rotary knob principles’ for more details.

5. REAR PANEL



Connections overview

① AC power inlet

② Internal reference out

Internal reference out: 10MHz, >2Vpp into 50Ω

CAUTION

Do not apply external voltages to this output.

③ External reference in

External Reference In: 10MHz, 2-5Vpp from 50Ω

CAUTION

Do not apply external voltages exceeding 5Vpp to this socket.

④ Sync out

Automatically selected to be either Modulation Sync or Sweep Sync.

Output impedance 50Ω nominal. Logic levels of <0.8V & >3V unloaded.

SYNC will withstand a short circuit to ground.

CAUTION

Do not apply external voltages to this output.

⑤ External trigger in

DC coupled External Trigger Input signal, nominal threshold 1.65V

CAUTION

Do not apply external voltages exceeding ±10V to this socket.

⑥ Mod in/out

Analogue MOD IN, AC coupled 10kΩ input impedance, 1Vp-p full scale. Analogue MOD OUT, DC coupled 150Ω source impedance, 2Vp-p full scale unloaded. Digital MOD IN, DC coupled 10kΩ input impedance, nominal threshold of +1.65V. Digital MOD OUT, DC coupled 150Ω source impedance, logic levels of <0.8V & >3V unloaded.

CAUTION

Do not apply external voltages exceeding ±10V to this socket.

⑦ LAN

The LAN interface is designed to meet the LXI standard version 1.5 LXI Device Specification 2016..
Remote control using the LAN interface is possible using the TCP/IP Socket protocol.

⑧ USB

The USB port accepts a standard USB cable. If the USB driver has been installed from the website, the Windows plug-and-play function should automatically recognise that the instrument has been connected. See the support page on the website for information on installing the driver on a PC at www.aimtti.com .

⑨ GPIB (optional)

IEEE-488 The default GPIB address is 11.

6. MAINTENANCE

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

Refer to 'TGR2050 Series Service Manual' for details on Calibration.

Cleaning

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

WARNING

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

7. GETTING STARTED

Using this manual

This section is a general introduction to the organisation 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. FREQ, AMP, MOD; Text, entry fields and messages displayed on the LCD are shown in a different font, e.g. Frequency, Amplitude.

The descriptions in this manual relate to using the instrument via the touch screen, alternatively; the hard keys and rotary knob can be used. The TGR2050 Quick Start Guide provides concise instructions on how to use the instrument via alternative methods; it is recommended that this is read first and is available to download from www.aimtti.com/support

A separate programming manual is also available to download from www.aimtti.com/support.

Switching on

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

Press the standby button for 1-2 seconds to turn on; at power up the instrument displays a start-up message whilst initialising the application.

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

To turn off, briefly press the standby button.

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 is readily accessible. Disconnect from the AC supply when not in use.

Screen Layout

Ref.	Description	Function
1	System Status Bar	Indicates the status of the instrument, see 'Status bar details' for further details.
2	Frequency/ Amplitude window	Displays the current frequency/ amplitude settings and units.
3	Menu status/ Navigation bar	Indicates the menu location and mode status.
4	Information window	Displays instrument setting information.
5	Button	Performs an action immediately when pressed.
6	Parameter window	Activates a pop-up containing multiple options.
7	Multiple page icon	Appears when more pages are available in the current menu.
8	Home Button	Returns to the home screen.

Status bar details

①-Reference clock status

- If the internal clock is being used, INT REF is displayed in the status bar.
- If an external clock is being used, EXT REF is displayed in the status bar.

See 'Reference clock source' for more details on how to set the clock source.

②-Print screen

When the print screen function is activated and a print screen is being captured, PRT SCRN will appear in the status bar. For more details on print screen, see 'Print Screen'.

③-Remote status

When the instrument is under remote control via any interface REM will be displayed.

USB

When a USB connection is detected, the USB icon will become activated

LAN

The LAN field in the Status Line can show multiple status indications:

There is no LAN connection, for example no cable connected.

Successfully connected.

(Flashing icon) Configuring LAN connection.

Unsuccessful attempt to connect.

④- Flash drive port

When a flash drive is detected in the flash drive port, the flash drive icon will become activated.

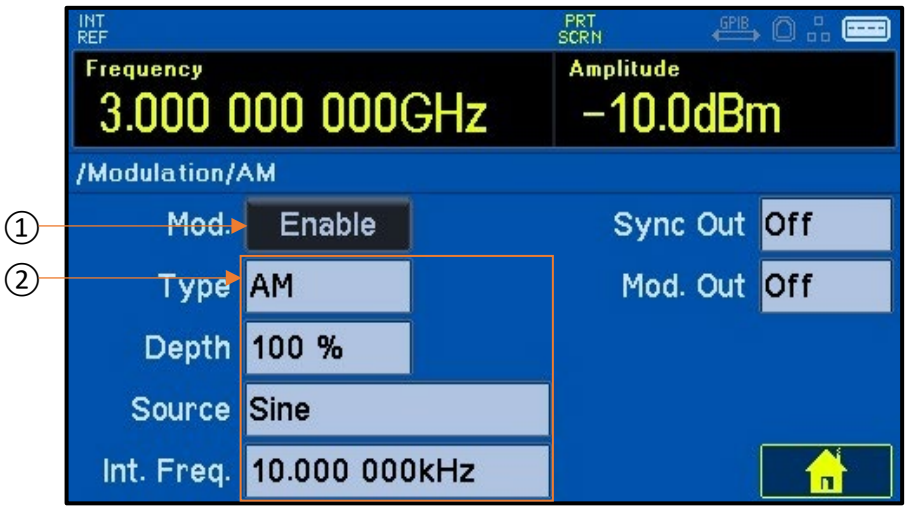
8. NAVIGATION CONTROLS

Overview

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

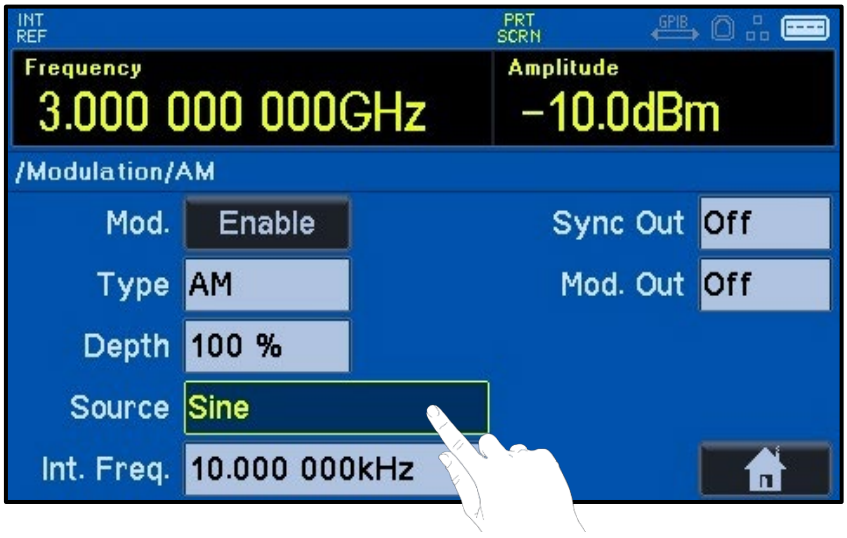
Many settings can be made more quickly and easily using the touch screen alone; the rotary knob is most useful when, for example, a parameter is being frequently varied during manual testing, see 'Rotary knob principles' section.

Both buttons and parameter windows are described in this manual. A button ① will directly select or apply the action; parameter windows ② will give a range of options.



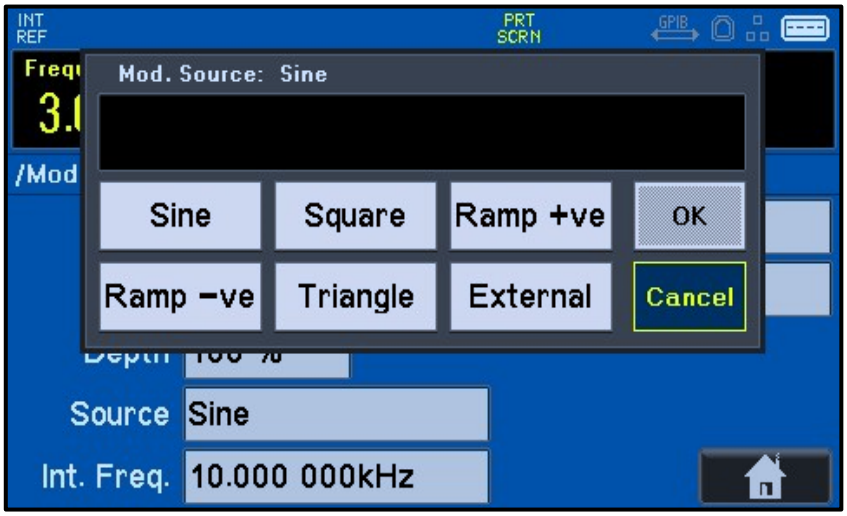
Touch Screen Principles

Touch to select a parameter window, this will cause its colour to change to blue with a yellow border and yellow text. In this state direct keyboard entry is possible for numerical parameters. Alternatively, a second touch of the parameter window will allow onscreen editing as follows.



Touch again to edit section; one of the following types of menu screen will appear:

Sub menu screen



The sub-menu screens offer a variety of options as buttons, touch the required option and then touch OK- which implements the selection.

Numeric values and units input screen

The numeric keypad offers numbers from 0-9, the option of a decimal point and +/- where available. If a negative value is unavailable the key will be greyed out.

This pop-up also gives options of units, providing automatic conversion. Touch the required unit to make the selection, ensure that the numeric value has been added and touch OK to implement the selection.

If no alternative units are available, the pop up will contain only the numeric keypad.

Text input screen

A full touch QWERTY keyboard is available to input text, where necessary.

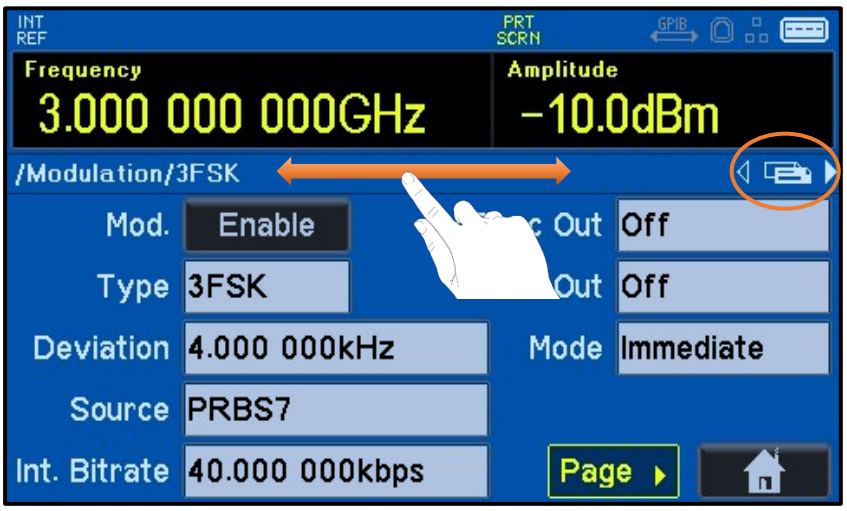
In places where spaces and full stops are not permitted e.g. file names, the keys will be greyed out and unavailable.

Once text entry is complete, touch the OK key to implement and return to the previous menu, or Cancel if no changes are to be made.

On Screen Menu and Page Selection

The menu navigation keys are found in the bottom right hand corner of the screen.

If there are more than one page of options in the menu, a Page > button will be available and  will appear in the navigation bar.



It is also possible to navigate through the menus using a swipe action, simply swipe the screen in the required direction, screens can be moved to the left or right.

The  button returns to the home screen.

Rotary knob principles

The rotary knob can be used to navigate the user interface, and the 'press' function used to select an option. The rotary knob offers two different editing modes:

Use the knob to navigate to the parameter window to be changed and click to select.

Two State Mode (factory default)

In the 2-state mode, the knob is used together with the < & > keys.

To change a currently selected numerical parameter see 'Numeric values' .

Use the knob or < & > keys to select the required parameter window. The selection will flow from top to bottom, left to right when the knob is turned clockwise and bottom to top, right to left when turned anti-clockwise; the currently selected window will be blue with a yellow surround and yellow text.

Press the knob to edit the parameter; the window will change to an active state- black background with white text.

Once actively selected, the navigation bar will change to show the currently selected option. To exit without making any changes, press the ESCAPE key on the front panel.

To change a currently selected non-numerical parameter, turn the knob or use the ^ & v keys change to the required selection and press to confirm.

Numeric values (Two-State mode)

Parameters that involve numbers can be selected in a similar way. For example, with the knob in 2-state mode (factory default), use the knob or < & > to navigate to the required parameter window; the currently selected window will be blue with a yellow surround and yellow text. Press the knob again to edit the number; the window will change to an active state- black background with white text. Use the < & > keys to navigate between digits, followed by the knob or ^ & ˅ arrow to increase or decrease the value. The digit selected will determine the incremental step to be used.

Three State Mode

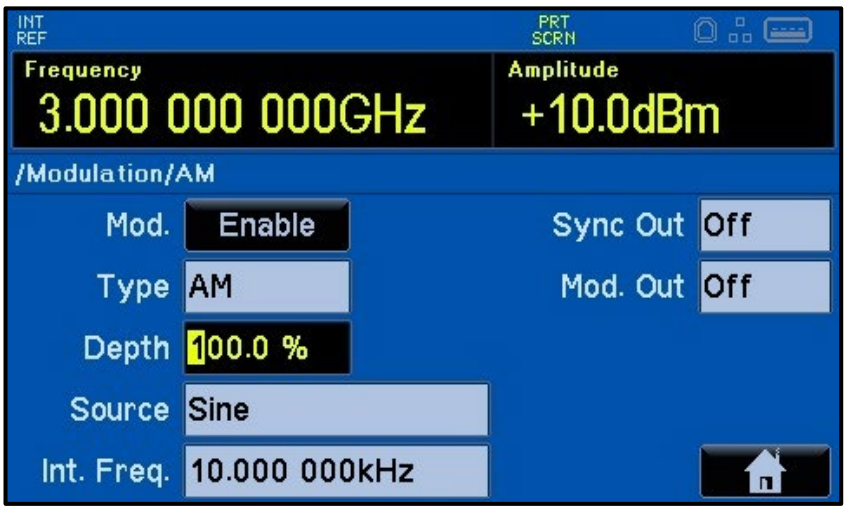
The 3-state mode can be selected via the Utility menu. In this mode most functions can be executed with the knob only.

For parameter changes involving only a selection from a menu the knob works just the same as in 2-state mode.

For numeric entries the use of the knob is different, see 'Numeric values'.

Numeric values (Three State Mode)

Parameters that involve numbers can be selected in a similar way. For example, with the knob in 2-state mode (factory default), use the knob or < & > to navigate to the required parameter window; the currently selected window will be blue with a yellow surround and yellow text. Press the knob again to edit the number; the window will change to an active state- black background with white text. Use the < & > keys to navigate between digits, followed by the knob or ^ & ˅ arrow to increase or decrease the value. The digit selected will determine the incremental step to be used.



In 3-state mode numeric fields can be edited using only the knob:

Use the knob to select the required parameter window; the currently selected window will be blue with a yellow surround and yellow text. Press the knob to edit the parameter; the window will change to a- black background with yellow text.

The knob can now be used to select the digit to be changed; press the knob again to select edit mode. The knob can now be used to increment or decrement the number with the resolution determined by the selected digit. Press the knob twice to exit numeric entry editing.

Alternatively, the numeric hard keys on the front panel can be used to input numbers. When inputting numbers with the hard keys, the units in which the value is entered can be selected using the rotary knob, press to confirm the change.

Text input screen

A full QWERTY keyboard is available to input text where necessary.

In places where Spaces and full stops are not permitted e.g. file names, the keys will be greyed out and unavailable.

To input text, simply turn the knob to highlight the required letter/number and press to select the letter/number. The < arrow key on the front panel deletes the previous character when in the keyboard screen, alternatively the backspace key can be used.

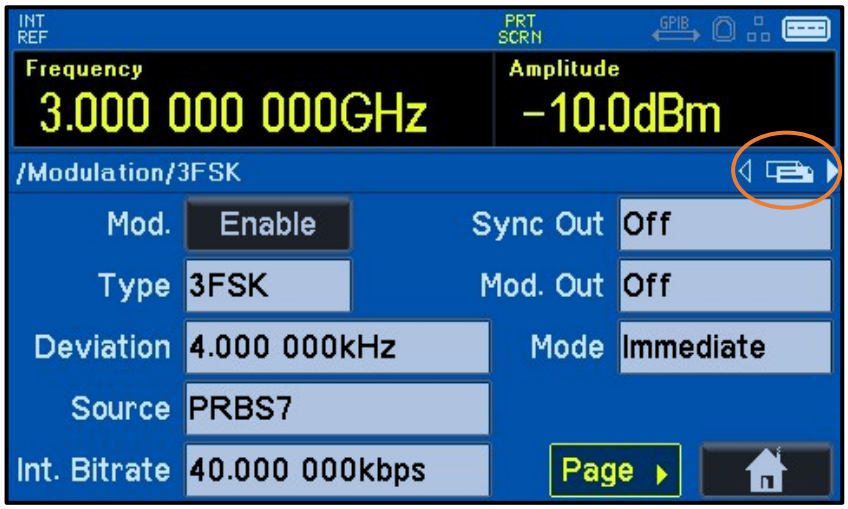
Once text entry is complete, highlight the OK key and press to return to the previous menu, or Cancel if no changes are to be made.

Menu and Page Selection

The menu navigation keys are found in the bottom right hand corner of the screen.

If there is more than one page of option in that menu, a Page > button will be available and  will appear in the navigation bar.

To move to the next page, highlight the Page > button and press the knob.



The  button returns to the home screen.

Information and error messages

Two classes of message are displayed on the screen in a Pop-up Box:

Information messages

Information messages are shown to inform the user of actions that are being taken, for example:

Please wait... the current settings are being saved

An information message will remain on-screen until the action is carried out.

Error messages

Error messages are shown on the display until an OK or ESCAPE key is pressed

The last error message can be viewed again in the UTILITY menu, see 'Last displayed message' for more details.

Each error message is accompanied by a beep. The beep may be enabled or disabled in the UTILITY menu, see 'Buzzer' for more information.

9. CONTINUOUS RF WAVEFORM OPERATION

Signal output

To activate the RF signal, press the RF ON key on the front panel. The key will become illuminated once activated.

The frequency and amplitude of the signal is shown in the ‘RF output’ display.

The displayed signal will be available from the RF OUT connection on the front panel.

Live adjustments can be made using the knob and cursor keys, see ‘Rotary knob principles’ for more details.

Frequency and amplitude step adjustment

The frequency and amplitude can be live adjusted using a user specified step. The frequency step size can be set from 10Hz to 1GHz and the amplitude step size from 0.1dB to 140dB/ 0.1uV to 998.8mV.

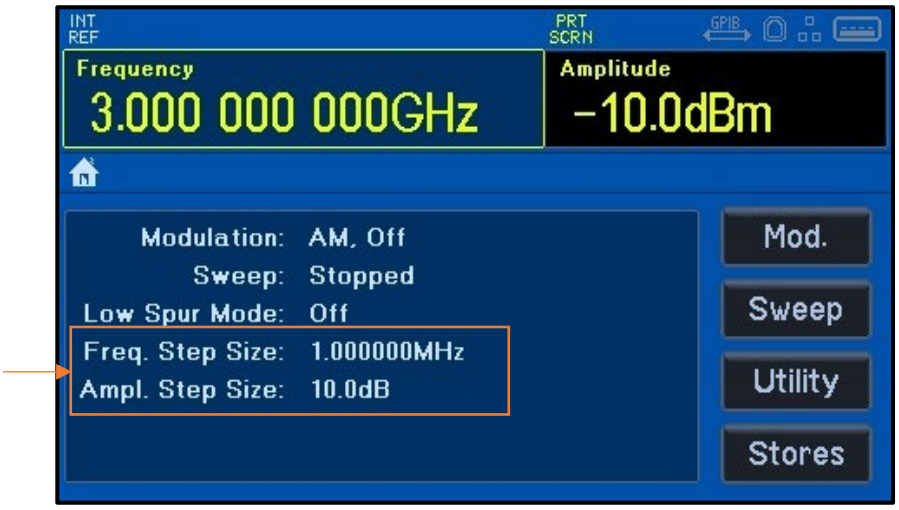
The amplitude step size can be set in dB or linear units (mV or uV) irrespective of the current output amplitude setting units. A dB step size can be used to adjust the output amplitude even when it is set in linear units. Similarly, a step size set in uV or mV can be used to adjust the output amplitude even when it is set in dBm or dBuV.

To set the step size, first open the utility menu by pressing UTILITY and select Instrument.

Select the Freq. Step Size/ Ampl. Step Size parameter window, enter the required step size and touch OK.

Return to the home screen by pressing either the FREQ or AMP key on the front panel.

The set step size is displayed in the information box on the home screen.



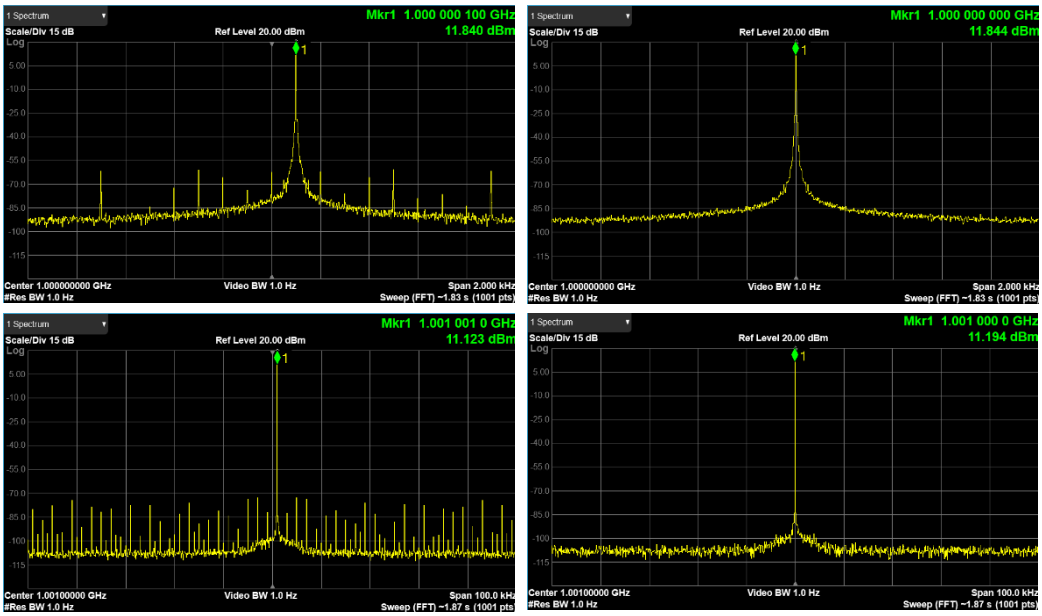
Select the frequency or amplitude parameter window on the home screen and use the ^ & ˅ arrow keys to implement the user defined step.

NOTE

For the step function to work, the step value and the set frequency or amplitude units *do not* need match to operate.

Low spur mode

Low spur mode is provided for applications requiring optimum signal purity. In low spur mode the core frequency synthesiser is operated in integer mode instead of the normal fractional mode thus avoiding the possibility of fractional spurs. Notably, integer boundary spurs are eliminated, which in fractional synthesiser mode can occur up to a few kHz away from the output carrier, depending on frequency setting. In Low Spur mode the frequency resolution is limited to 1MHz.



To activate low spur mode, firstly open the utility menu by pressing UTILITY and select Instrument.

Select the Low Spur Mode parameter window. Select On and touch OK. Low spur mode is now on, this will be shown in the information window on the home screen.

10. MODULATION

Overview

The modulation menu contains all the editable fields for setting and activating modulation.

Pressing the MOD key opens the modulation menu. The on screen Enable key will apply the currently selected modulation type indicated in the Type parameter window. The MOD key will become illuminated when modulation is activated and the Enable key will change to Disable. The Disable key will stop modulation when pressed.

IQ Carrier Feedthrough and Sideband Spurs

Additional low-level spurs will exist at 25MHz and 50MHz offsets from the carrier when modulation is active. If these are significant in a particular application, they can be minimised using the IQ TRIM facility, for more details see 'IQ Trim'.

This instrument can apply thirteen types of modulation:

Analog modulation

- AM Amplitude Modulation
- FM Frequency Modulation
- PM Phase Modulation

Digital modulation

- ASK Amplitude Shift Keying
- OOK On Off Keying
- FSK 2 Level Frequency Shift Keying or 2FSK
- 3FSK 3 Level Frequency Shift Keying
- 4FSK 4 Level Frequency Shift Keying
- GFSK Gaussian Frequency Shift Keying
- MSK Minimum Shift Keying
- GMSK Gaussian Minimum Shift Keying
- HMSK Half Sine Minimum Shift Keying
- PSK 2 Level Phase Shift Keying or BPSK

Analog Modulation

Types of modulation

Pressing the MOD key opens the modulation menu. The **Enable** key will apply the currently selected modulation type; indicated in the **Type** parameter window, the MOD key will become illuminated when the modulation is activated.

The modulation menu contains all the editable fields for setting and activating modulation:

NOTE

Modulation *cannot* be enabled if a sweep is running

Analog modulation types available:

- Amplitude modulation (AM)
- Frequency modulation (FM)
- Phase modulation (PM)

Modulation deviation/depth

When AM is selected as the modulation type, the depth parameter will be set as a %. To set the depth select the **Depth** parameter window and enter the required depth and touch **OK**.

If the amplitude is currently set to greater than +7dBm then AM selection is not allowed and a warning is issued. Change the amplitude setting before trying again.

NOTE

During AM operation ALC is turned off. Level control is calibrated when AM is enabled and each time any parameter is edited while AM is enabled. Although the rate of drift is very slow reset the level, frequency or any other parameter when best level accuracy is required.

When FM is selected as the modulation type, the deviation will be set in Hz. To set the deviation select the **Deviation** parameter window, enter the required deviation value, the value can be entered in **mHz, Hz ,kHz**, or **MHz** and touch **OK**.

When PM is selected as the modulation type, the deviation will be set in radians (rad.). To set the deviation select the **Deviation** parameter window, enter the required deviation value and touch **OK**.

Modulation source

To set the modulation source, select the **Source** parameter window. Select the required source and touch **OK**.

Internal modulation source options are **Sine, Square, Ramp +ve, Ramp -ve, Triangle** or **External**.

Selecting an external modulation source uses the signal from the MOD IN/OUT connector on the rear panel as the modulating digital data signal, if selected, no further options will be available.

Modulation frequency

To set the modulation frequency, select the **Int. Freq.** parameter window. Enter the required frequency value, the value can be entered in **mHz, Hz, kHz** or **MHz**. Select the required units and touch **OK.**

Mod out

To activate the modulation output, select the Mod. Out parameter window, select On and touch OK.

When activated, the modulation source will be available at the MOD IN/OUT connection on the rear panel.

The output modulation signal amplitude is fixed at 1Vpp.

Sync out

To activate the sync output, select the Sync Out parameter window, select ON and touch OK.

Activating the sync output will output a 3.3V logic level signal that is a square waveform with 50% duty cycle at the modulation frequency from the SYNC OUT connection on the rear panel.

11. DIGITAL MODULATION (OPTION UO1)

Overview

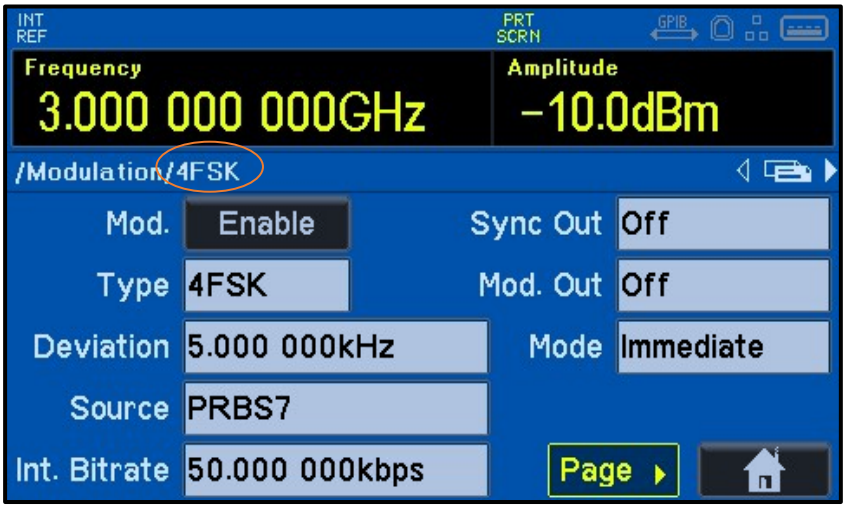
NOTE

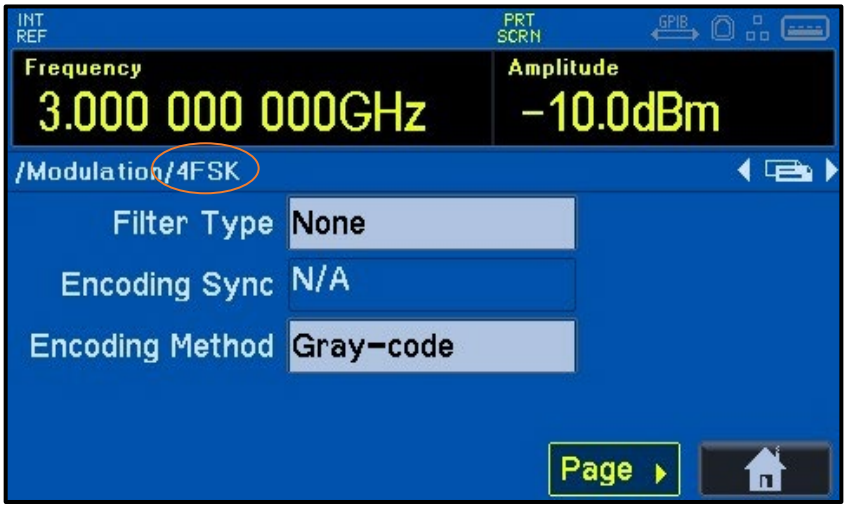
Digital modulation is available with Option U01.

Pressing the MOD key opens the modulation menu. The Enable key applies the currently selected modulation type; indicated in the Type parameter window. The MOD key will become illuminated when the modulation is activated.

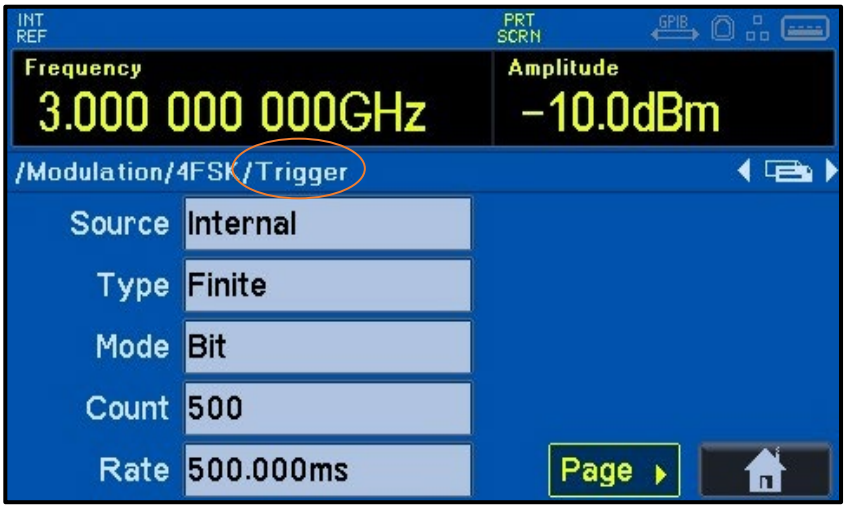
The modulation menu contains all the editable fields for setting and activating modulation. Digital modulation settings are constructed across up to four pages:

- General setup options are shown with the selected modulation type in the navigation bar, e.g. 4FSK:





- Triggering options on the 'Trigger' page :



- User Pattern Generator on the 'User Pattern' page:

Modulation type

To select a type of digital modulation, touch Type.

The digital options are:

- ASK Amplitude Shift Keying
- OOK On Off Keying
- FSK 2 Level Frequency Shift Keying or 2FSK
- 3FSK 3 Level Frequency Shift Keying
- 4FSK 4 Level Frequency Shift Keying
- GFSK Gaussian Frequency Shift Keying
- MSK Minimum Shift Keying
- GMSK Gaussian Minimum Shift Keying
- HMSK Half Sine Minimum Shift Keying
- PSK 2 Level Phase Shift Keying or BPSK

Modulation deviation/depth

When ASK is selected as the modulation type, the depth parameter will be set as a %. To set the depth select the Depth parameter window and enter the required depth and touch OK.

When OOK is selected the depth is fixed at 100%.

NOTE

During ASK or OOK operation ALC is turned off. Level control is calibrated when ASK or OOK is enabled and each time any parameter is edited while enabled. Although the rate of drift is very slow reset the level, frequency or any other parameter when best level accuracy is required.

When FSK, 3FSK, 4FSK or GFSK is selected as the modulation type, the deviation will be set in Hz. To set the deviation select the Deviation parameter window, enter the required deviation value, the value can be entered in mHz, Hz ,kHz, or MHz and touch OK.

MSK, GMSK or HMSK is selected, the deviation is automatically calculated to 0.25 x bit rate.

When PSK is selected as the modulation type, the deviation will be set in radians (rad.). To set the deviation select the Deviation parameter window, enter the required deviation value and touch OK.

Modulation source

To set the modulation source, select the Source parameter window. Select the required source and touch OK.

Internal modulation source options include Square pattern (1,0,1,0,1, 0….) PRBS pattern (PN7, PN9, PN11, PN15) or a user defined pattern. See 'Modulation pattern generator' for more details on how to use the user defined pattern generator.

Selecting an external modulation source uses the signal from the MOD IN/OUT connector on the rear panel as the modulating digital data signal, if selected, no further options will be available.

If MSK, GMSK, HMSK or GFSK are selected the modulation type, an external source cannot be applied. When the source is external the bit rate is unknown, therefore deviation cannot be automatically set to 0.25 x bit rate.

Internal bitrate

To set the internal modulation bit rate, select the Int. Bitrate parameter window. Enter the required bit rate value, the bit rate can be entered in mbps, bps, kbps or Mbps. Select the required units and touch OK.

The minimum internal bit rate is 1mpbs, the maximum is 1Mbps.

Modulation triggering mode

To set the modulation triggering mode, select the Mode parameter window. The options are Immediate or Triggered, see 'Triggering' for further details on the triggering option. Select the required mode and touch OK.

Modulation and Sync outputs

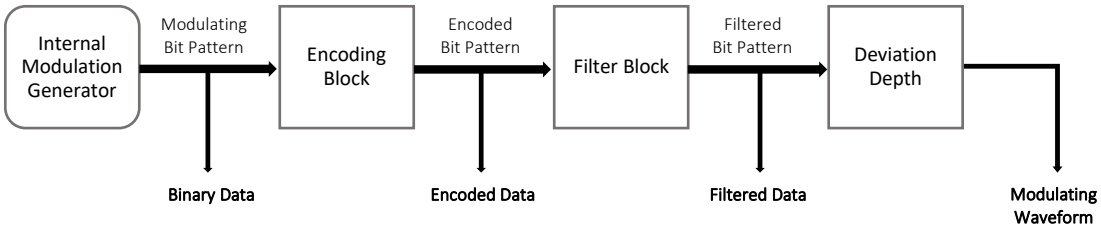
The internal modulation signal and the sync signal can both be used as an external source, through the MOD IN/ OUT and SYNC OUT connections on the rear panel of the instrument.

NOTE

Modulation must be enabled before the output signal will be available from the rear panel.

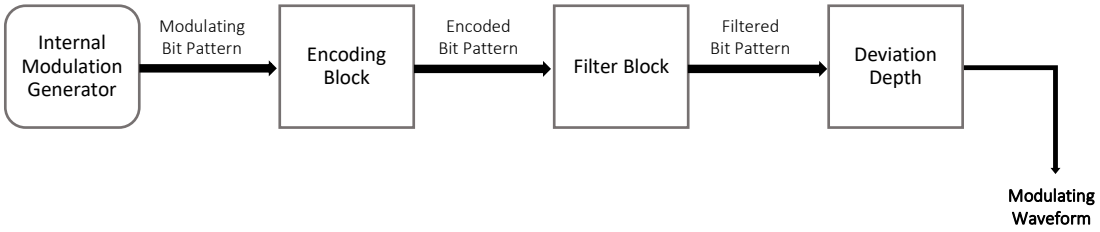
Modulation output (MOD OUT)

The digital signal is encoded and filtered before being used as the modulation source.



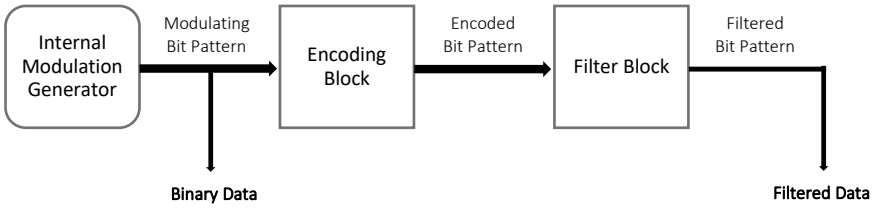
ASK, OOK, MSK, or PSK

When selected as the modulation type, the options will be On or Off. To activate the modulation output, select the Mod. Out parameter window, select On and touch OK.



FSK, GFSK, GMSK or HMSK

When selected as the modulation type, the options will be Off, Binary Data or Filt. data. , for more details on filtered data, see 'Filtering'. To activate the modulation output, select the Mod. Out parameter window, select the required output format, and touch OK.

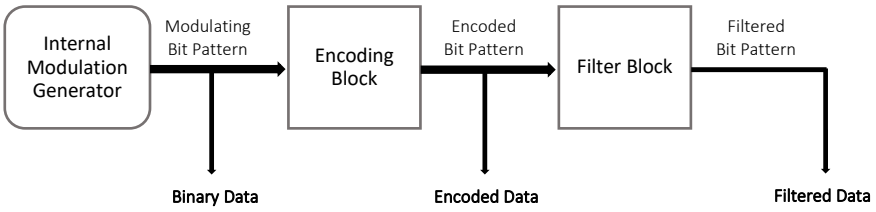


3FSK or 4FSK

When selected as the modulation type, the options will be Off, Binary Data, Filt. Data or Encoded Data.

When activated, the modulation source will be available at the MOD IN/OUT connection on the rear panel.

The output modulation signal amplitude is fixed at 1Vpp for Filtered and Encoded data and 3.3Vpp for Binary data.



Sync output

From the SYNC OUT connection on the rear panel, a 3.3V logic level signal can be received in a number of different formats. The options are Off, Start, Bitrate or Bitrate/2.

Selecting Start will output a signal that goes high for a one-bit period at the start of the pattern.

Selecting Bitrate will output a signal that is a square waveform with 50% duty cycle at the user defined bit rate.

Selecting Bitrate/2 will output a signal that is a square waveform with 50% duty cycle at half the user defined bit rate.

To activate the sync output, select the Sync Out parameter window, select the required output format and touch OK.

Filtering

Filtering options are available when FSK, 3FSK, 4FSK, GFSK, GMSK or HMSK are selected as the modulation type.

NOTE

As filtering depends on the bit rate, it can only be applied when the modulation source is internal.

The filtering options are on the second page of the modulation menu.

Options include:

Gaussian filters (Bandwidth time constant can be 0.3, 0.5 or 0.7)

Raised cosine filters (Roll-off factors can be 0.5 or 0.7)

Root raised cosine filters (Roll-off factors can be 0.5 or 0.7)

Half sine

The options are dependent on the selected modulation type:

	FSK	3FSK	4FSK	GFSK	GMSK	HMSK
Gaussian 0.3	•	•	•	•	•	
Gaussian 0.5	•	•	•	•	•	
Gaussian 0.7	•	•	•	•	•	
Raised cosine 0.5	•	•	•			
Raised cosine 0.7	•	•	•			
Root raised cosine 0.5	•	•	•			
Root raised cosine 0.7	•	•	•			
Half sine	•	•	•			•

To set the modulation filter, select the **Filter Type** parameter window, select the required filter and touch **OK**.

Encoding method

Encoding is available for 3FSK and 4FSK.

Encoding is unavailable for ASK, OOK, FSK, MSK, GMSK, GFSK, HMSK and PSK as these are 1-bit modulations. The current state of the modulated waveform output depends on the state of the current single bit, for example, with FSK as the selected modulation type:

[Fcentre is the centre frequency and Fdev is the user defined frequency deviation]

If the current modulation signal level is at **logic high**, the output frequency would be:

Fcentre + Fdev

If the current modulation signal is at **logic low**, the output frequency would be:

Fcentre - Fdev

4FSK use 2-bit modulations to determine the output frequency.

For 3FSK, the output frequency will be:

Fcentre, Fcentre + Fdev, Fcentre - Fdev

The current bit and the state of the previous bit determines the output frequency.

3FSK is also sometimes known as 'modified duo-binary FSK' as modified duo-binary algorithm is used to determine the output frequency.

For 4FSK, the output frequency will be:

Fcentre + Fdev, Fcentre + 3Fdev, Fcentre - Fdev, **Fcentre - 3Fdev**

The encoding method options for 4FSK are Binary or Gray-code.

Binary		Gray-code	
Symbols	Output frequency	Symbols	Output frequency
00	**Fcentre - 3Fdev**	00	**Fcentre - 3Fdev**
01	**Fcentre - Fdev**	01	**Fcentre - Fdev**
10	**Fcentre + Fdev**	11	**Fcentre + 3Fdev**
11	**Fcentre + 3Fdev**	10	**Fcentre + Fdev**

To set the encoding method for 4FSK, select the Encoding Method parameter window. Select the required method and touch OK.

Encoding sync

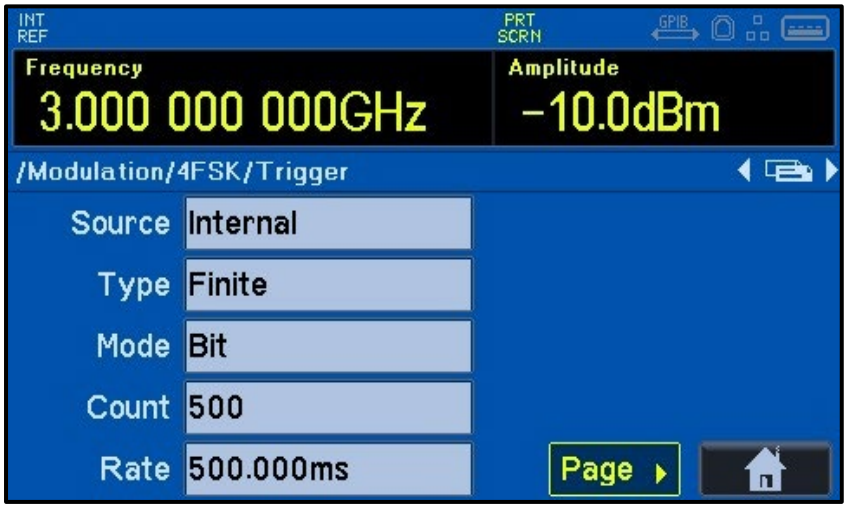
When the source is internal, encoding starts at the start of the pattern.

When the source is external, an external trigger can be used to indicate when the encoding should start. The options are Ext. +ve Trg. or Ext. -ve Trg. To set the encoding sync trigger, select the Encoding Sync parameter window. Select the required sync trigger and touch OK.

Modulation Triggering

The modulation mode can be set to immediate or triggered. To set the mode to triggered, select the Mode parameter window, select Triggered and touch OK.

The options for the modulation triggering are on the 'Trigger' page of the modulation menu; shown in the navigation bar.



Trigger source

To set the trigger source, select the Source parameter window.

The options are:

Internal - Uses trigger rate.

External +ve, External -ve - Uses rear terminal.

Manual - Uses trigger key.

Remote - Uses remote command.

Select the required source and touch OK.

Trigger type

To set the trigger type, select the Type parameter window.

The options are Finite or Infinite.

Select the required type and touch OK.

Trigger mode

To set the trigger mode, select the Mode parameter window.

The options are Bit or Block.

Select the required mode and touch OK.

Trigger count

To set the trigger count, select the Count parameter window.

The minimum count is 1, the maximum is 2147483647.

Enter the required count and touch OK.

Trigger rate

To set the trigger rate, select the Rate parameter window.

The minimum rate is 1us, the maximum is 1000s.

Enter the required rate and touch OK.

Modulation pattern generator

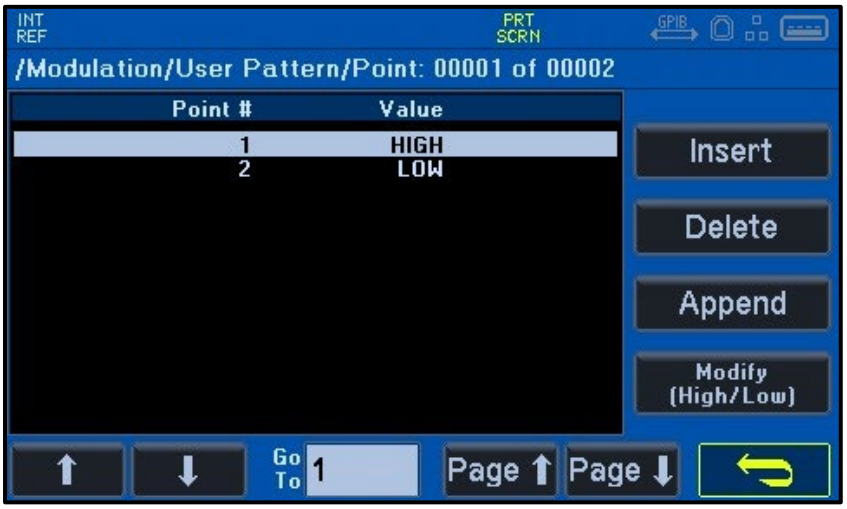
The built-in pattern generator provides a function which allows the creation of customisable patterns. The customised pattern can then be used as the modulation source for all digital modulation types.

The options for the user pattern generator are available on the ‘User pattern’ page

of the modulation men, shown in the navigation bar.

To create a new pattern, touch the New button.

An on-screen prompt will appear, informing ‘Overwrites the current list with default list’, select Continue to proceed.



To insert a new point, touch Insert.

Points can be inserted into any position within the table, use the ↑ ↓ arrow keys to navigate up and down the table. The selected point will be copied into the position below.

Up to 65,000 points can be inserted, or imported using a USB flash drive, see ‘Copying an external file to the internal memory’ for more details.

To delete a point, navigate to the point to be deleted and touch Delete.

Append will insert a new point at the end of the sweep list, the new point will be copied from the previous final point in the list.

To modify any the points within the sweep, touch Modify (High/Low), if the point value is high, touching Modify (High/Low) will change this to low and vice-versa.

To select a specific point for modification, select the Go To parameter window, input the desired point number and touch OK.

Touch  to exit the modulation pattern, 'Apply & Exit' to apply the modulation pattern, touch 'Discard & Exit' to exit without changes or 'Cancel' to go back to editing the pattern

A pop-up will appear 'Apply changes?', touch 'Apply and Exit' to return to the modulation pattern menu.

Change the modulation Source to User Pattern and touch Enable to output the modulation.

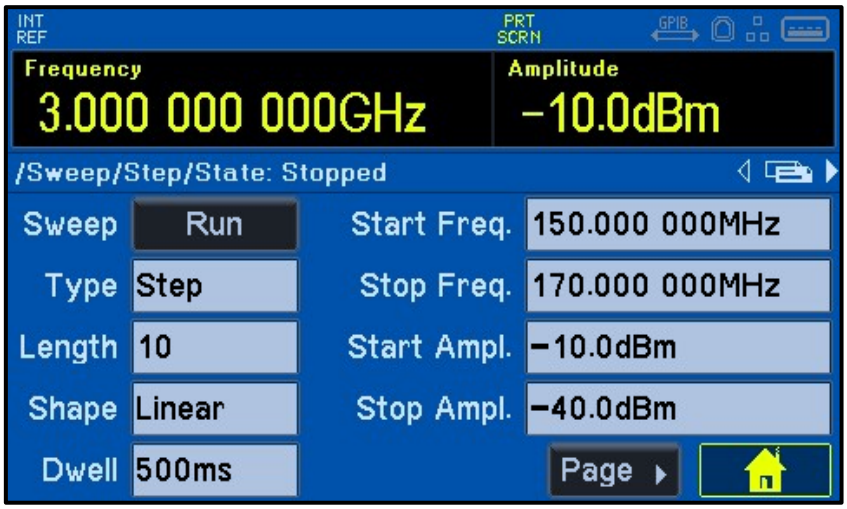
12. SWEEP

Overview

To access the sweep menu, press the SWEEP key. There are two types of sweep available:

Step Sweep

The Step sweep function allows the carrier frequency, amplitude or both frequency & amplitude, to be swept using defined start and stop values.



List Sweep

List sweep allows each point within the sweep to be defined individually in a sweep list.

Step sweep

Step sweep automatically calculates the values for a set number of points between two defined values.

To access the Step Sweep menu, press the SWEEP key, select the Type parameter window, touch Step, followed by OK.

The sweep step menu is constructed across two pages. Step specific settings feature on the first page, General sweep settings on the second. To switch between the two, simply touch the Page > button or switch using the swipe gesture. See 'Touch Screen Principles' for further details.

Sweep Length

The length of the sweep determines how many steps the sweep will be divided into.

To set the sweep length, select the Length parameter window.

Enter the required sweep length and touch OK.

The minimum number of steps is 2, the maximum is 1000.

Sweep shape

The sweep shape determines point in a spacing frequency sweep.

To set the sweep shape, select the Shape parameter window.

The options are Linear or Logarithmic. Select the required shape and touch OK.

Selecting a linear shape will change the frequency at a linear rate; spacing the points equally between the start and stop values using the number of steps stated in the Length parameter window.

Selecting a Logarithmic shape will increase the frequency exponentially between the start and stop values using the number of steps stated in the Length parameter window.

Amplitude steps are always linear.

Sweep dwell time

The sweep dwell time determines the time that the output will remain stable at each point, unless the point trigger is enabled, see 'Point trigger' for more details.

The dwell timer starts once the output is deemed stable and coincides with the rear panel SYNC signal being set to its active state, see 'Sweep synchronisation ' for more details.

The sweep will step to the next point when the dwell time expires and the SYNC signal will be returned to its inactive state.

To set the sweep dwell time, select the Dwell parameter window, enter the required length of time in ms or s, and touch OK.

The minimum dwell time for each step is 10ms, the maximum is 10 seconds.

NOTE

If point trigger is enabled, the dwell time will be ignored and the sweep will step to the next point when the point trigger occurs.

Start/stop frequency

To set the start/ stop frequencies, select the Start Freq. or Stop Freq. parameter window, enter the required start/stop frequency in kHz, MHz or GHz and touch OK.

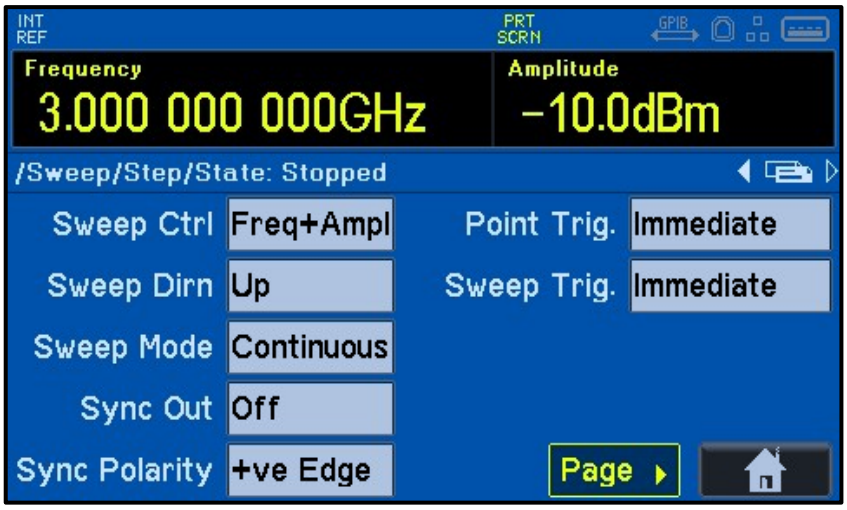
The minimum start/stop frequency is 150kHz, the maximum is 1.5GHz (TGR2051) or 3GHz (TGR2053).

Start/stop amplitude level

To set the start/ stop amplitude levels, select the Start Ampl. or Stop Ampl. parameter window, enter the required start/stop amplitude level in dBm, dBuV, uV or mV and touch OK.

The minimum start/stop amplitude level is-127dBm, the maximum is +13dBm.

General sweep settings



NOTE

The general sweep settings will remain unchanged when switching between step-sweep and list-sweep.

Sweep control

Sweep control defines the parameters to be swept.

To set the sweep control, select the **Sweep Ctrl** parameter window.

The options are **Freq.** (frequency), **Ampl.** (amplitude) or **Freq+Ampl** (frequency and amplitude).

Select the required parameter and touch **OK**.

Sweep direction

To set the sweep direction, select the **Sweep Dirn** parameter window.

The options are **Up** or **Down**.

Selecting **Up** will start the sweep at point #0001, selecting **Down** will finish with point #0001.

Select the required parameter and touch **OK**.

Sweep mode

Sweep mode determines whether the sweep will run just once or continuously.

To set the sweep mode, select the **Sweep Mode** parameter window.

The options are **Continuous** or **Single**.

Select the required parameter and touch **OK**.

Sweep synchronisation (SYNC OUT)

To activate the rear panel SYNC OUT signal select the Sync Out parameter window, select On and touch OK.

The specified edge of the SYNC OUT signal (see SYNC polarity) indicates when the RF output has become stable after each step of the sweep (see Fig. 1) The SYNC OUT signal remains asserted until the next step.

SYNC OUT is a +3V3 logic signal with 50Ω output impedance.

Sync polarity

To set the synchronisation polarity, select the Sync Polarity parameter window.

The options are +ve Edge or -ve Edge.

Select the required parameter and touch OK.

Sweep triggering

A sweep can be triggered in two ways; triggering the complete sweep (Sweep trigger), or point by point (Point trigger). The two can also be used simultaneously in any combination.

Point trigger

Point trigger allows each point within the sweep to be triggered in a nominated way, the options are Immediate, External +ve, External -ve, Manual or Remote.

Immediate trigger (default) will step the sweep from point to point without waiting for triggers but pausing at each point according to the specified dwell time, until the sweep is complete.

External -ve or external +ve trigger will step the sweep from point to point at the specified negative or positive edge of a logic signal presented to the rear panel EXT TRIG IN BNC socket.

Manual Trigger will step the sweep from point to point at each press of the front panel TRIGGER button.

Remote trigger will step the sweep from point to point upon receipt of a trigger command from the remote interfaces. More information can be found in the programming manual, available from www.aimtti.com

NOTE

Trigger functions will only become active once the sweep Run button is touched.

Sweep trigger

The sweep trigger activates the entire sweep and when specified it allows the instrument to step to the first point of the sweep after RUN. It is ignored after the first sweep for continuous sweeps.

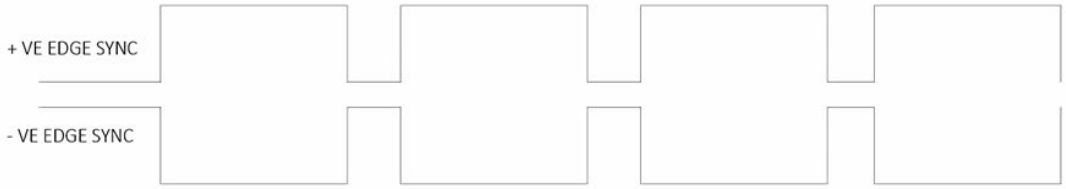
The sweep trigger provides the same options as point trigger plus a Timer option

The Timer option allows a set waiting time between the sweep being Run and going to the first point on the sweep. It is ignored after the first sweep for continuous sweeps.

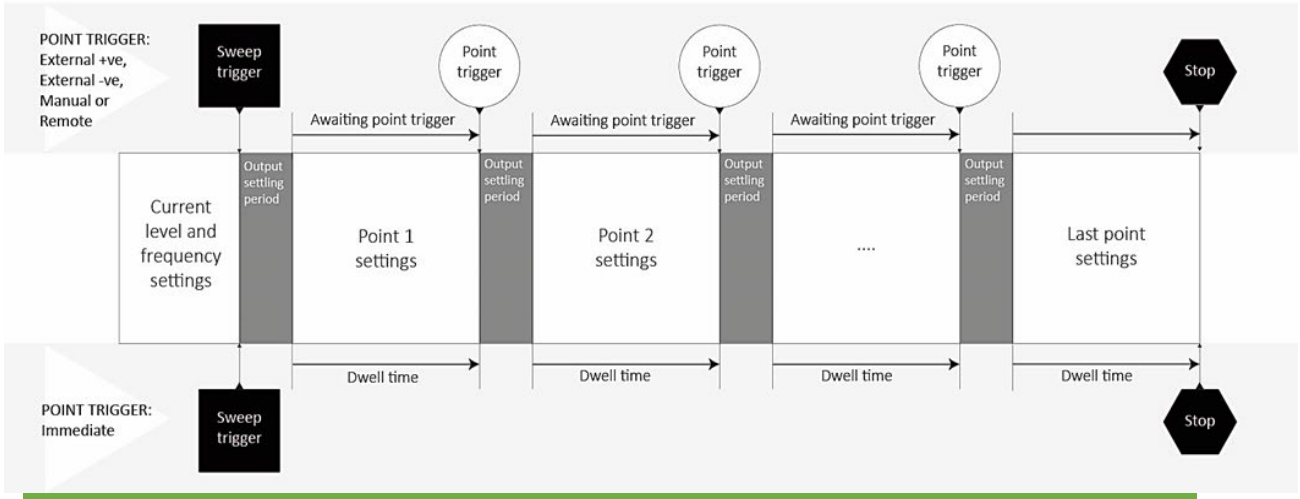
To set the timed sweep trigger, first select Timer from the Sweep Trig. menu. A new Trig. Time parameter window will appear.

Select the Trig. Time parameter window, enter the required time in ms or s and touch OK.

FIG. 1



SINGLE SWEEP



EXAMPLE

A new sweep can be triggered by an external +ve trigger, while the individual sweep points are triggered by external-ve trigger.

After RUN an external-ve trigger will be ignored before a +ve trigger is received. Thereafter External +ve triggers will be ignored while the sweep is running.

List-sweep

List-sweep allows each point within the sweep to be created individually in a sweep list. This information can then be viewed in a table format; detailing the frequency, amplitude and dwell time of each point. 'Step-sweep' setups (see Step-sweep) can also be copied into the 'list-sweep' format to allow changes and view the sweep in detail.

To access the Step Sweep menu, press the SWEEP key, select the Type parameter window, touch List, followed by OK.

The list sweep menu is constructed across two pages. List specific settings feature on the first page, General sweep settings on the second.

To switch between the two, simply touch the Page > button or switch using the swipe gesture. See 'Touch Screen Principles' for further details.

New list-sweep

To create a new list-sweep, touch New. A pop-up will appear, indicating that this action 'Overwrites the current List-sweep with "default" List-sweep'.

Touch Continue, the sweep list table will appear and a new list can be created.

The default list has 2 points already in place, the selected point is highlighted in white and the point number is displayed in the status bar.

Editing a list-sweep

To insert a new point, touch **Insert.**

Points can be inserted into any position within the table, use the ↑ ↓ arrow keys to navigate up and down the table. The selected point will be copied into the position below.

To delete a point, navigate to the point to be deleted and touch **Delete**.

Append will insert a new point at the end of the sweep list, the new point will be copied from the previous final point in the list.

To modify any the points within the sweep, touch **Modify**.

The Modify menu allows the **Frequency**, **Amplitude** and **Dwell Time** to be edited.

To modify the frequency, select the **Frequency** parameter window, enter the required frequency in **kHz**, **MHz** or **GHz** and touch **OK.**

The minimum frequency is 150kHz, the maximum is 3GHz.

To modify the amplitude level, select the **Amplitude** parameter window, enter the required amplitude level in **dBm**, **dBuV**, **uV** or **mV** and touch **OK**.

The minimum amplitude level is-127dBm, the maximum is +13dBm

To modify the sweep dwell time, select the **Dwell Time** parameter window, enter the required length of time in **ms** or **s**, and touch **OK.**

The minimum dwell time for each step is 10ms, the maximum is 10 seconds.

It is possible to navigate between points in this menu using the **← Point** and **Point →** buttons, points can also be added to the end of the sweep using the **Append** button.

To select a specific point for modification, select the **Go To** parameter window, input the desired point number and touch **OK**.

Touch the  button to return to the sweep list screen.

To run the sweep list, touch the  button, a pop-up will appear **'Apply changes?'**, touch **'Apply and Exit'** to return to the sweep menu, touching **Cancel** will return to the sweep list table.

Touch Run to run the sweep list.

The SWEEP key on the front panel will become illuminated, the current sweep point is shown in the status bar and the frequency and amplitude will proceed to change to the set dwell time.

Whilst the sweep is running amendments cannot be made, general sweep parameters can be viewed by touching the Page → button.

Touch the Stop button to stop the sweep.

To save the sweep to the internal memory, touch Save.

Select the File parameter window to insert the file name, file names can be up to 8 characters long. Touch OK to return to the save window and touch Save.

For more information on saving files to internal memory and external sources, see 'Stores menu'.

Editing the current list-sweep

To edit the current list-sweep, touch Edit. The list-sweep table will appear and the list can now be edited as described in 'Editing a list-sweep'.

Copying step-sweep to list-sweep

To copy the content from the step-sweep to list-sweep, touch **Copy**. A pop-up will appear **'Overwrites the current List-sweep with Step sweep'**, touch **Continue**.

NOTE

Ensure that the current sweep list has been saved before proceeding as this data will be erased.

The sweep list will now contain the parameters of the step-sweep, the **Length** parameter window will show the transferred length from the step-sweep.

The same actions can now be applied to the transferred step-sweep data as previously described in Editing a list-sweep; touch **Edit** to access these parameters.

13. UTILITY MENU

Instrument

To access the Instrument menu, press the UTILITY key, followed by Instrument.

Frequency and amplitude step size

The frequency and amplitude can be live adjusted using a user specified step. The step size can be set from 10Hz to 1GHz for frequency and 0.1dB to 140dB/ 0.1uV to 998.8mV for amplitude.

To set the step size select the Freq. Step Size/ Ampl. Step Size parameter window, enter the required step size and touch OK.

For more details, see 'Frequency and amplitude step adjustment'.

NOTE

Frequency and amplitude resolutions are not limited to the step size, their value can be changed at the set step with the up and down keys, see 'Frequency and amplitude step adjustment' for further details

Low spur mode

To activate low spur mode, select the Low Spur Mode parameter window. Select On and touch OK. Low spur mode is now on, this will be shown in the information window on the home screen.

For more details see 'Low spur mode'.

Reference clock source

To change the reference clock source, select the Ref. Clock parameter window. The options are Internal or External.
If the internal clock is being used, INT REF is displayed in the status bar.

If an external clock is being used, EXT REF is displayed in the status bar.

An external clock signal must have a frequency of 10MHz, 2-5Vpp.

NOTE

If the external source is selected but no external signal is present, the internal source will be used by default and INT REF will be displayed in the status bar.

Reference clock output

To activate the reference clock output, select the Ref. Clock Out parameter window, select On and touch OK.

The reference clock signal will now be available from the REF OUT socket on the rear panel.

Remote command set

To change the remote command set to match that of a legacy Aim-TTi instrument, touch the **Remote Command** parameter window.

The options are **TGR1040**, **TGR2050** or **TGR2053.**

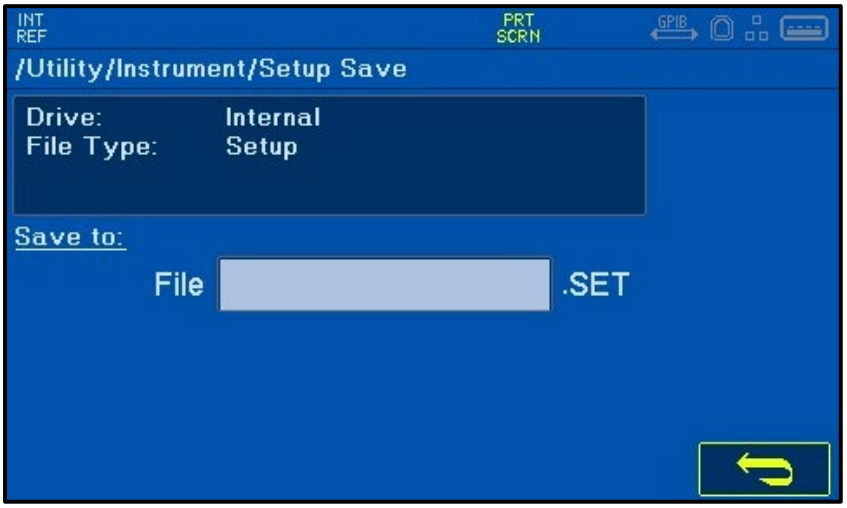
Select the required remote command set and touch **OK**.

Instrument setup

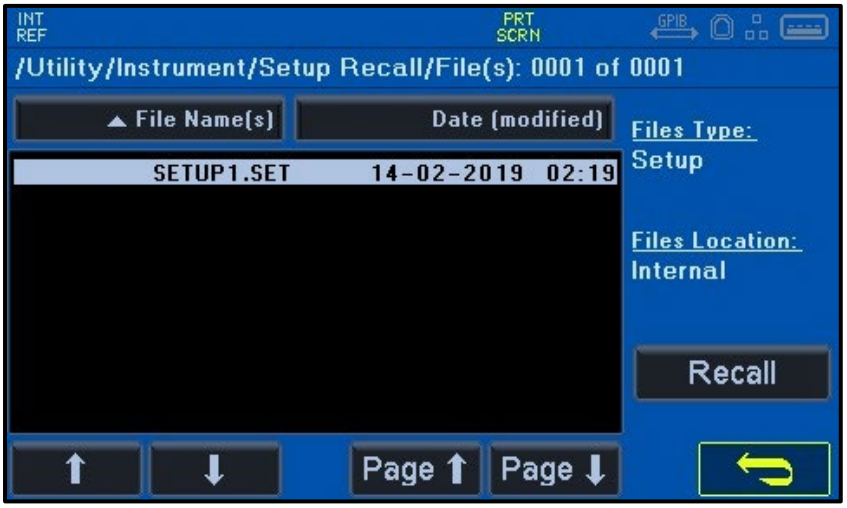
To save the instrument settings, touch **Save**.

NOTE

The instrument settings include sweep menu parameters, modulation menu parameters, frequency and amplitude values and the parameters under the '**Instrument**' menu in the **Utility** menu.



To recall a previously saved set of instrument settings, touch **Recall**.



Firmware Update

Should a firmware update be needed, a quick and convenient method of updating the firmware is available directly from the front panel via flash drive.

- Download latest firmware updates from www.aimtti.com/support
- Copy to Flash drive.
- Insert the flash drive into FLASH DRIVE port on the front panel.
- Touch Install.
- Remove flash drive once complete.

NOTE

If a connected flash drive has a firmware update loaded, it will request to update each time the instrument is powered on.

NOTE

Firmware can also be updated via the remote interface, see programming manual for further details.

To check firmware version, Select UTILITY and then Info.

User Options

This button is used to install add-on option packs, see option pack instructions for details. Alternatively, see www.aimtti.com/support

System

To access the system menu, press the UTILITY key, followed by System.

Brightness

To alter the brightness of the display, select the Brightness parameter window.

Enter the required range and touch OK.

NOTE

When the rotary knob is used to amend the value, the brightness is automatically applied.

Power-on state

To select the state in which the instrument will power on, select the Power-on State parameter window.

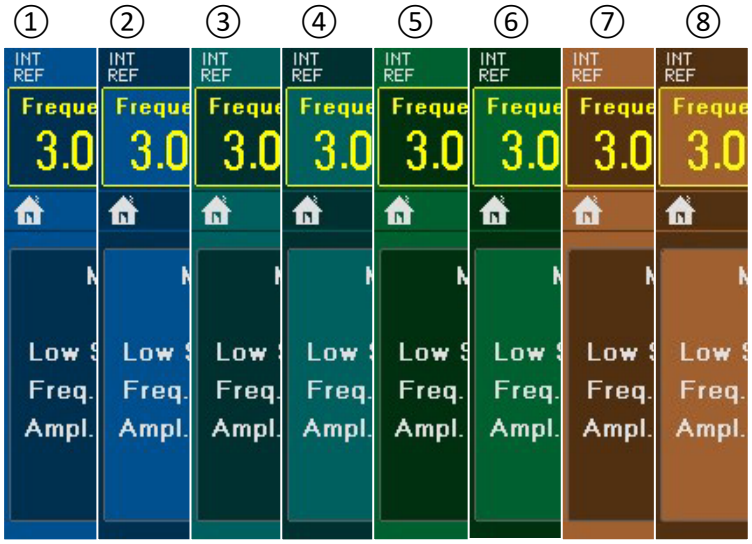
The options are Default Params or Latest Params.

With Default Params selected the instrument will power up with the factory default parameters loaded.

With Latest Params selected the instrument will power up with the parameters as they were at the last power down.

Colour theme

To change the colour theme, select the Colour Theme parameter window. A range of themes from Theme 1- Theme 8 are available, each providing a different coloured base for the user interface. The default theme is Theme 1.



Select the theme and touch OK.

Rotary knob

To change the rotary knob state, select the Encoder parameter window.

The options are 2-State or 3-State.

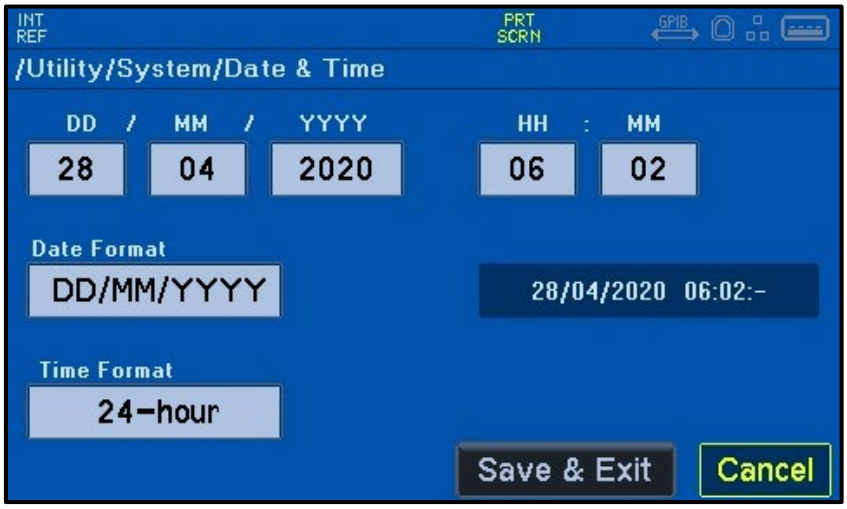
Select the required state and touch OK.

With 2- State selected; click to select whole number, turning increases and decreases value, click to select, click to exit selection.

With 3-State selected; click to select, turning allows selection of individual digits, click to edit, click to move selection to a different digit, press ESCAPE to exit selection.

Date and time

To set the Date and time touch the Set button.



Set the time and date using the parameter windows.

To change the date format, select the Date Format parameter window.

The options are DD/MM/YYYY or MM/DD/YYYY.

Select the required format and touch OK.

To change the time format, select the Time Format parameter window.

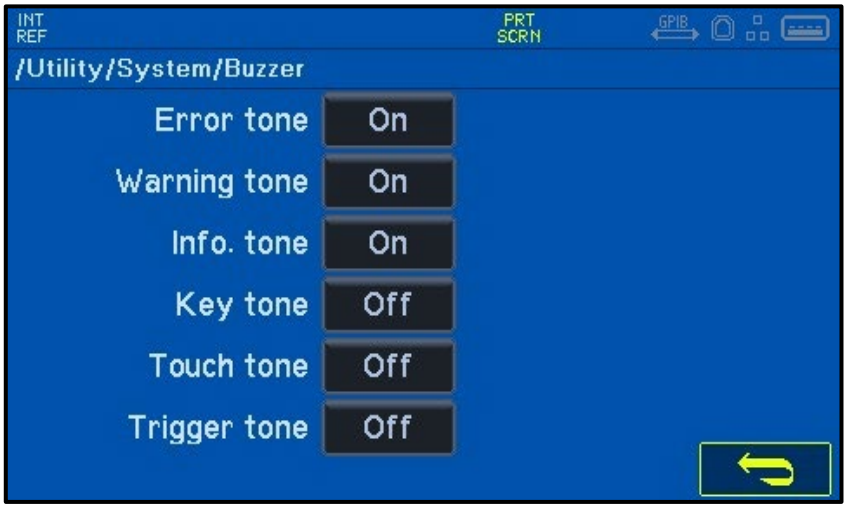
The options are 24-Hour or 12-Hour.

Select the required time format and touch OK.

Touch the Save & Exit button to save changes and return to the System menu.

Buzzer

To set the buzzer/ tone settings, touch the Settings button.



Each element that may present a buzzer sound has an individual On/Off button.

To activate/deactivate the buzzer for that element, simply touch the button to change the state.

Messages

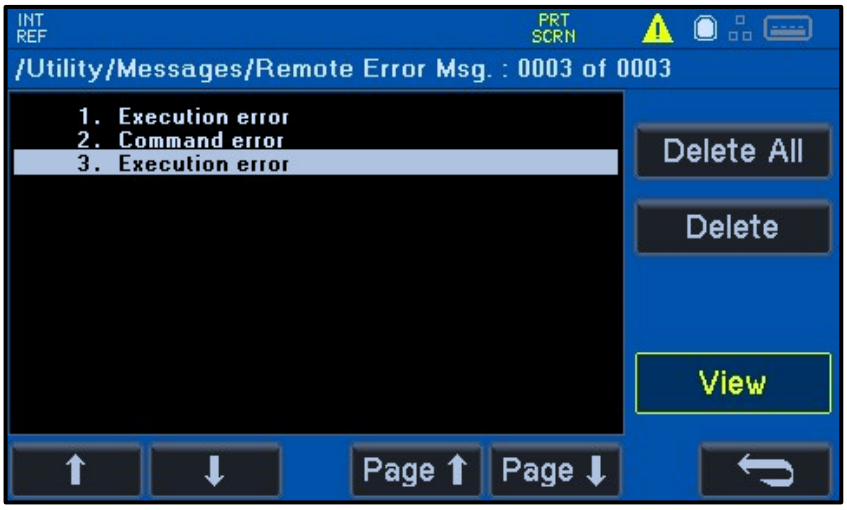
To access the messages menu, press UTILITY, followed by Messages.

Last displayed message

To show the last displayed message, touch the 'Last Displayed Message' key. This will show the previous pop-up until the OK button is touched. Alternatively, the ESCAPE key or rotary knob can be pushed to clear the message.

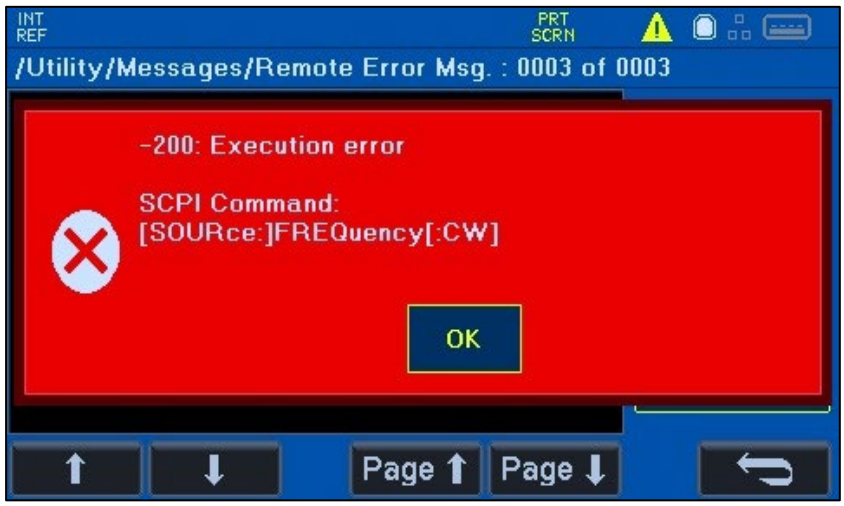
Remote Error Message queue

The Remote Error Message queue will display any error messages received when in remote control mode. The Message screen will show what type of error has occurred; for further details, select the required error using the ↑ ↓ arrow keys and touch View.



There are two types of error message that could appear in this menu:

Execution Errors-



Execution errors occur when the command has been accepted but the values provided are invalid. The pop-up message will include details of the error and the command that the error is related to.

Command Errors-

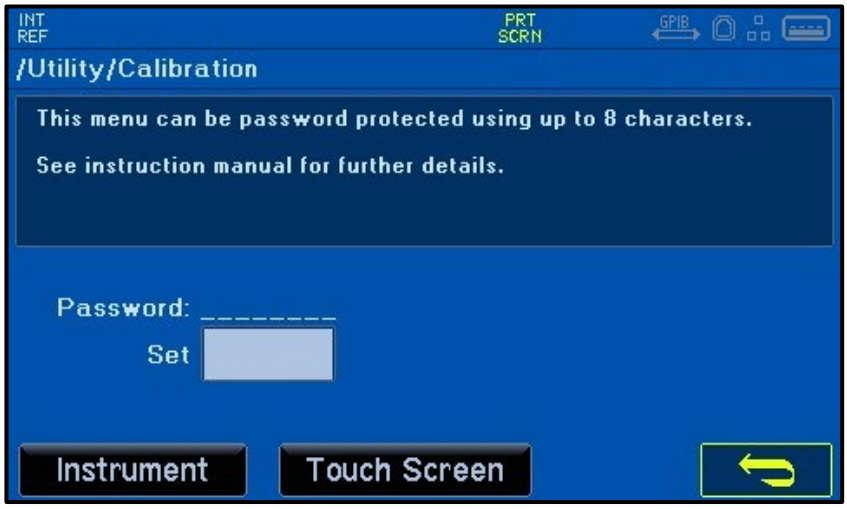
Command errors will simply display 'Command Error'; there is no more information connected to this error.

Calibration

To access the calibration menu, press the UTILITY key, followed by Calibration.

Password protection

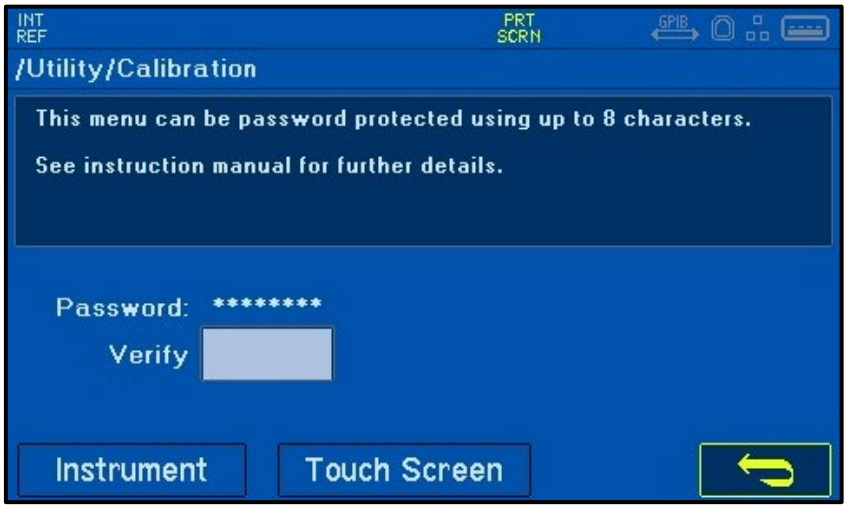
The calibration menu can be password protected using up to 8 characters.



To set the password, select the Set parameter window.

Enter the preferred password and touch OK.

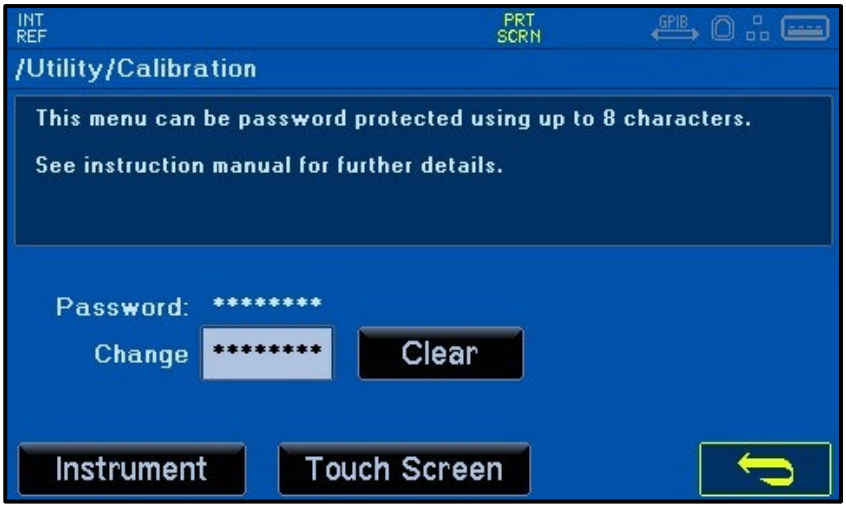
The parameter window will now show 'Verify', and the calibration menu is now locked until the password is verified.



The Instrument and Touch Screen buttons are no longer selectable.

To unlock the calibration menu, select the Verify parameter window.

Enter the password and touch OK.



Once the correct password has been entered, the calibration menu will be unlocked. This will also give the option to clear the password and return to non-restricted calibration, to clear the password, touch **Clear**.

Touch **Continue** to proceed, the password has now been removed.

NOTE

If password is forgotten, contact www.aimtti.com/support to reset.

Instrument and Touch Screen calibration

Full details on how to calibrate the Instrument and Touch Screen can be found in the 'TGR2050 Series Service Guide'.

I/O

To access the I/O menu, press the UTILITY key, followed by I/O.

NOTE

GPIB will only be present if GPIB option is fitted.

LAN

The LAN interface is designed to meet LXI 1.5 LXI Device Specification 2016.
Remote control using the LAN interface is possible using the TCP/IP Socket protocol. The instrument also contains a Web server which provides information on the unit and allows it to be configured. Since it is possible to misconfigure the LAN interface, making it impossible to communicate with the instrument over LAN, a LAN Configuration Initialise (LCI) mechanism is provided via the user interface to reset the unit to the factory default.

See 'TGR2050 Series Programming Manual' for further details. This can be found on the Aim-TTi website: www.aimtti.com

For more information on LXI standards refer to www.lxistandard.org

Reset

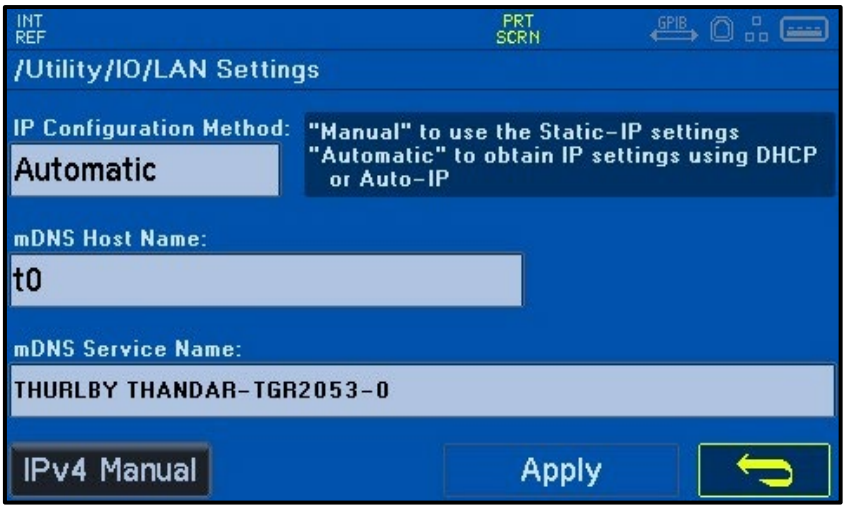
To reset the LAN, touch **Reset**.

A pop-up will appear **'Reset instrument's LAN configuration to "default" and reinitialise LAN port?'**

Touch **Continue** to reset.

Settings

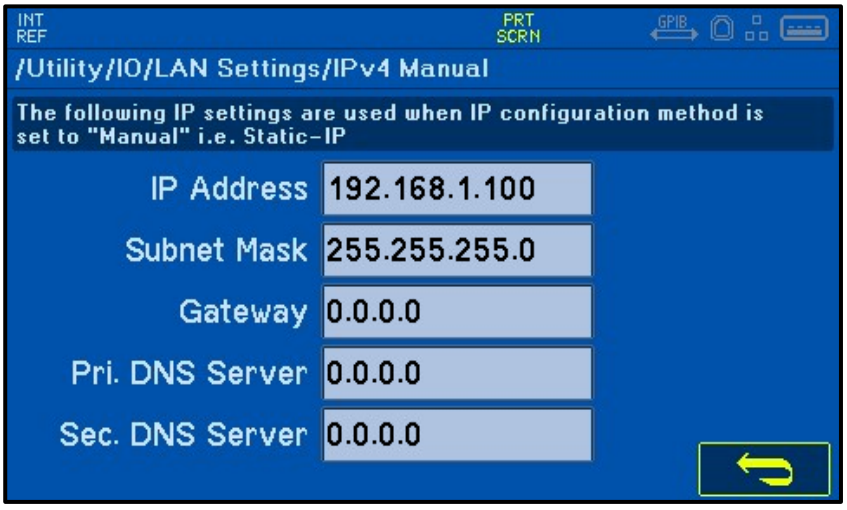
To change the LAN settings, touch **Settings.**



To change the IP configuration method, select the **IP Configuration Method** parameter window. Select **Automatic** to obtain the IP settings using DHCP or Auto-IP.

Select **Manual** to use the Static-IP settings

To edit the Static-IP settings, touch the **IPv4 Manual** button.



See 'TGR2050 Series Programming Manual' for further details.

Status

To view the LAN status, touch **Status**. This will display all of the settings for LAN configuration. For details on how to edit these, see **Settings**.

See TGR2050 series programming manual for further details. This can be found on the Aim-TTi website: www.aimtti.com

USB

Reset

To reset the USB, touch **Reset**.

A pop-up will appear:

'Reset instrument's USB Device and reinitialise USB Virtual COM port?'

Touch **Continue** to reset.

See 'TGR2050 series programming manual' for further details. This can be found on the Aim-TTi website: www.aimtti.com

GPIB (optional)

Reset

To reset the GPIB, touch **Reset**.

A pop-up will appear:

'Reset instrument's GPIB configuration to "default" and reinitialise GPIB port?'

Touch **Continue** to reset.

GPIB address

To change the GPIB address, select the **GPIB Address** parameter window.

Enter the required address and touch **OK**.

See 'TGR2050 series programming manual' for further details. This can be found on the Aim-TTi website: www.aimtti.com

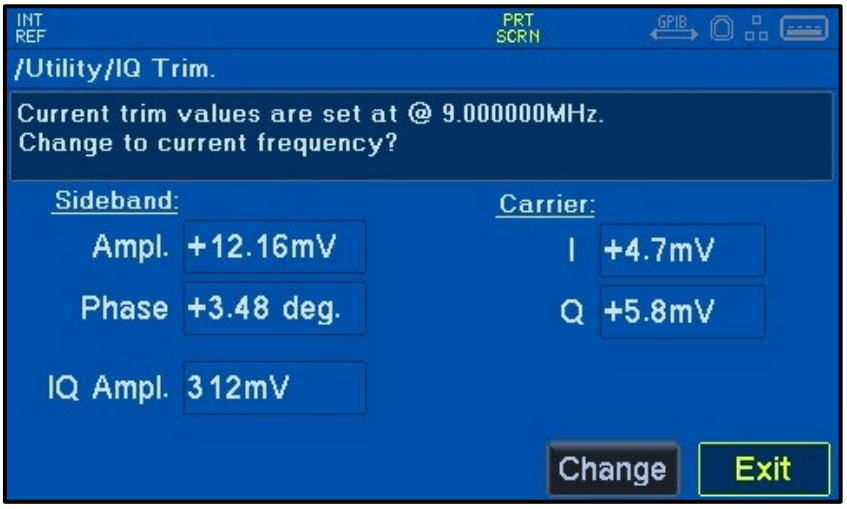
Info

Touch Info to view instrument information, including: Manufacturer details, CTRL firmware & RF firmware versions, Serial number, MAC address and TCP/IP socket port details.

IQ Trim

The suppression of unwanted sideband and carrier feedthrough can be optimised at any currently set frequency using the IQ trim facility.

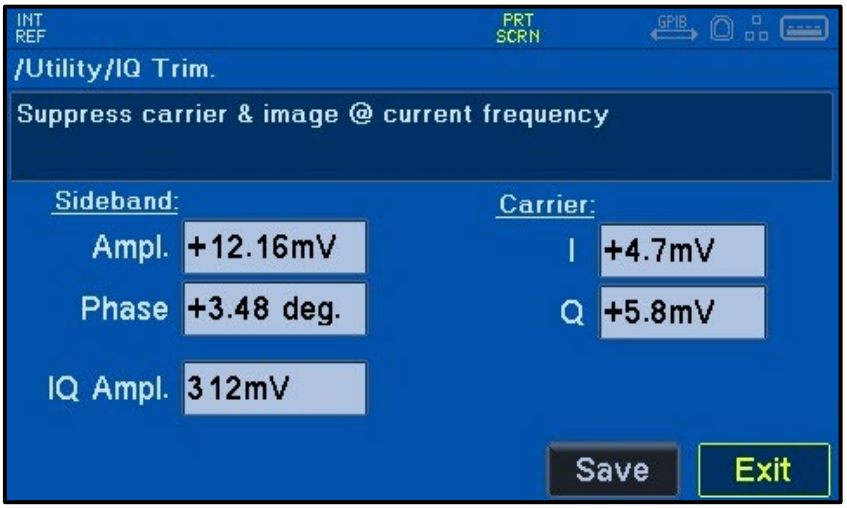
Carrier modulation is performed via an IQ modulator, which provides inherent suppression of the unwanted sideband and of carrier feedthrough. The degree of sideband suppression is subject to IQ phase orthogonality and amplitude balance and carrier suppression is subject to the effect of IQ offsets. The suppression of both is adjusted at a set number of predefined frequencies during the regular calibration procedure with an interpolation formula applied between them but the user can optimise the suppression at any currently set frequency using the IQ Trim.



To use the IQ trim function, select the IQ Trim button in the UTILITY menu.

To change the trim values to the current frequency, touch Change.

Sideband suppression is performed by interactively adjusting the amplitude and phase values presented on screen whilst monitoring the sideband at 50MHz below the currently set output frequency above 250MHz and at 50MHz above the set output frequency at 250MHz or below.



NOTE

The best method of adjustment is by numerical scrolling, using either the rotary knob or the ^ & ˅ arrow keys on the front panel.

It is recommended that phase is adjusted first for minimum signal followed by amplitude, repeating the process until the required suppression is achieved.

The same process is applied to carrier suppression at 25MHz below the currently set output frequency above 250MHz and at 25MHz above the set output frequency at 250MHz or below.

The I and Q offset adjustments are interactive and must be adjusted iteratively until the required suppression is achieved.

Once all the IQ trim parameters have been adjusted, touch Save, followed by Exit to save and exit back to the Utility menu.

To discard the changes touch Exit, a pop-up will appear asking to 'Save changes?' The options are Save & Exit, Discard & Exit or Cancel. Touch Discard & Exit to return to the utility menu without saving.

Print Screen

To access the print screen function, press the UTILITY button, followed by Print Screen.

Enabling the print screen function

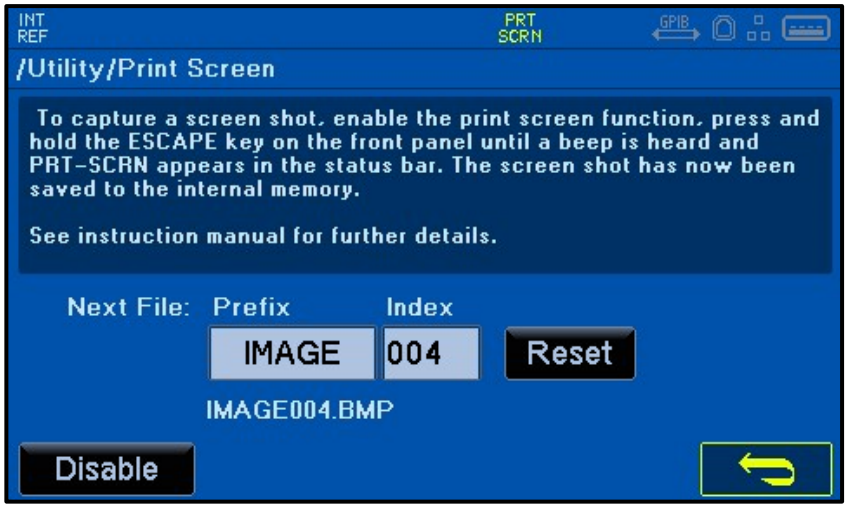
The print screen function allows screen shots to be saved to the internal memory as bitmap files. These can be exported to an external drive using the stores menu, for more details see 'Copying an internal file to an external flash drive'.

Taking a screen shot

To take a screen shot, firstly the function must be enabled, once enabled this will stay active until disabled. To enable the print screen function, touch Enable.

Screen shots can now be captured for any screen within the user interface.

To capture a screen shot, press and hold the ESCAPE key on the front panel until a beep is heard and PRT SCRN appears in the status bar. The screen shot has now been saved to the internal memory.



Naming the file

The file will be saved with the default prefix name IMAGE alongside an index number e.g. 001. Resulting in the complete file name being IMAGE001.BMP.

To change the prefix, select the Prefix parameter window. A name of up to 5 characters can be entered using the on- screen keypad, enter the required prefix and touch OK.

To change the index number, select the Index parameter window. Up to three digits can be entered, enter the required number and touch OK. The index number works as a counter and each screen shot will take the next consecutive number.

Touching Reset will bring up a decision box with the following options:

'Reset file Name- Prefix, index or both?'

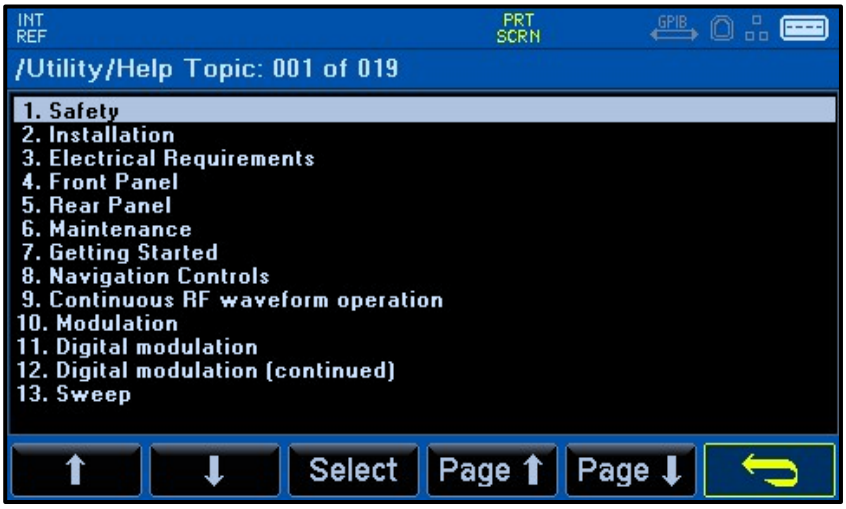
NOTE

If a file name has already been used, the file will not save.

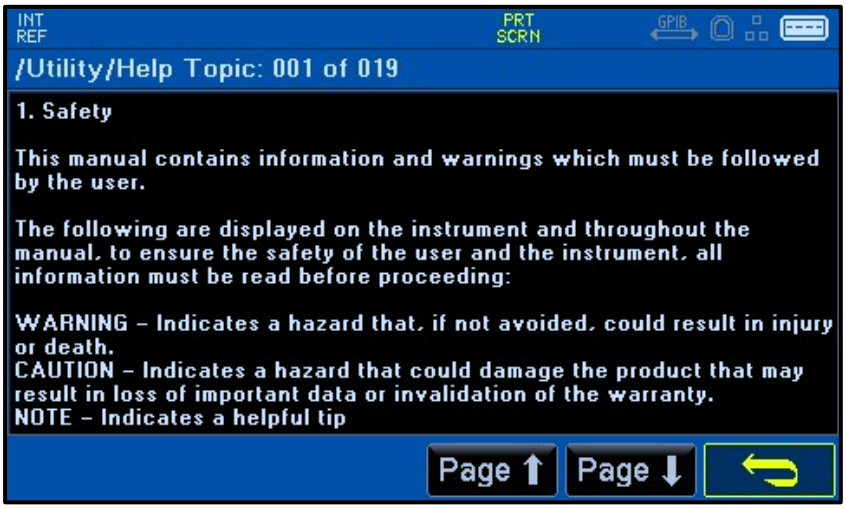
Help

To access the help menu, press the UTILITY key, followed by Help.

The help menu provides a list of help topics which give general information about instrument operations.



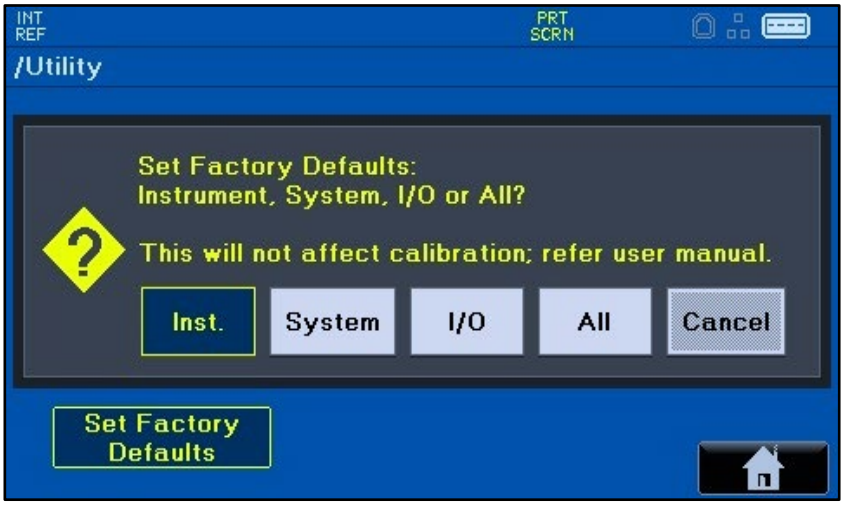
Use the ↑ ↓ arrow keys to navigate up and down the table and select the required help topic using Select.



Use the Page ↑ and Page ↓ arrow keys to navigate up and down the page, touch the  'Back' key to return to the help menu.

Factory Default

To set the instrument/ system or I/O back to default instrument settings press UTILITY, followed by Factory Defaults.



The options are Inst., System, I/O, All or Cancel.

Inst. (Instrument settings) include all user set values of frequency and amplitude, all user set operating modes including modulation type and sweep type and all the numerical and operating settings within them.

System (System settings) are as listed on the Utility/System menu such as screen brightness and buzzer settings but excluding Power–on state and Date & Time.

I/O (Input/Output settings) are those of the rear panel remote control interfaces.

All (All Factory Settings) includes all of the above.

For factory default setting details, see Appendix 1.

CAUTION

Ensure all necessary settings are saved before setting to factory default, all selected parameters will be reset.

NOTE

The instrument will restart when set to factory default settings.

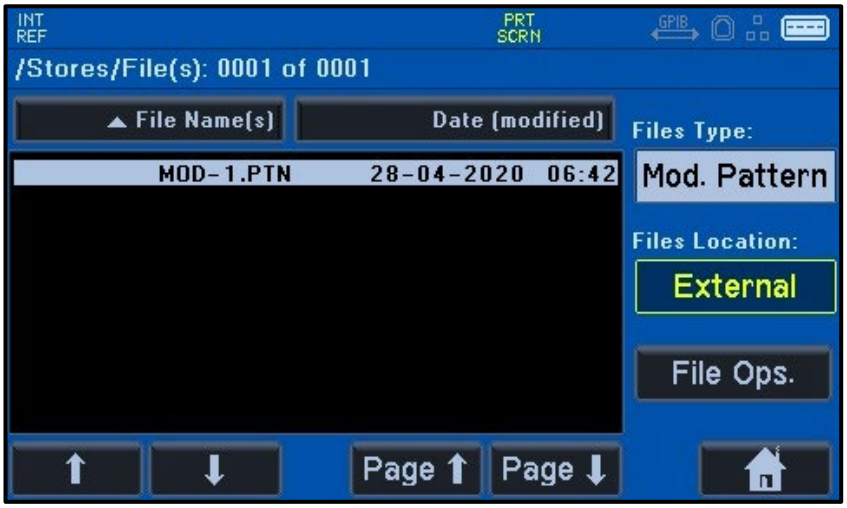
NOTE

Factory default does not affect calibration. To reset calibration to default settings, see 'Calibration'.

14. STORES MENU

Overview

The stores function is for recalling information from the internal memory or an external flash drive.



Various file types can be added or copied within this menu including: Print screens, instrument setups, modulation patterns and sweep lists.

To set the file type, select the 'Files Type' parameter window. The options are Print Screen, Setup, Mod. Pattern or Sweep list. Select the required file type and touch OK.

The 'Files location' field shows the source of the stored files.

When 'Internal' is displayed and the button is blanked, no external drive has been detected.

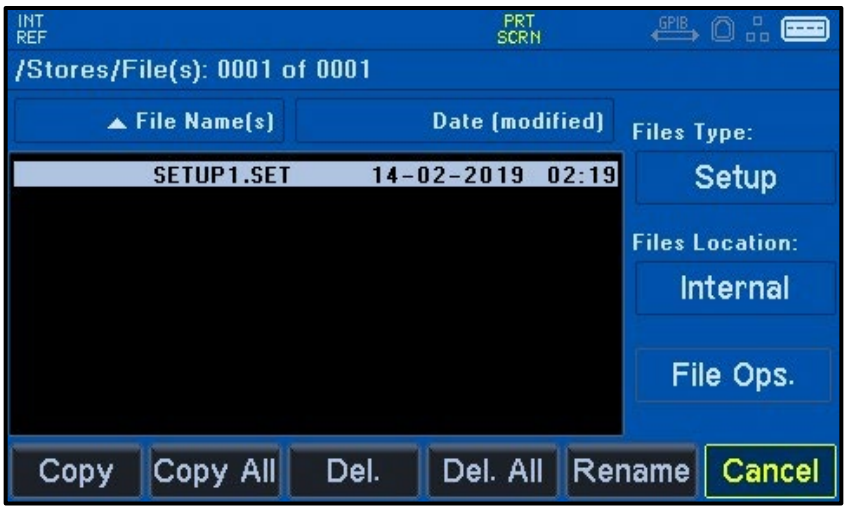
Copying files

Copying an internal file to an external flash drive

To copy a file from the internal memory to an external flash drive, firstly, make sure the flash drive is inserted and recognised; indicated by the symbol in the status bar:

Select the File Location parameter window, select Internal and touch OK.

Select the file to be copied using the ↑ ↓ arrow keys.



To copy the file, touch File Ops. This will bring up the file options menu.

Here files can be copied, deleted or renamed. To copy the file, touch Copy.

The copy menu allows files to be copied to both internal memory and an external flash drive. Select the Drive parameter window, select External and touch OK.

The file can now be re-named and copied.

Select the File parameter window, type in the file name using the on-screen keypad and touch OK. Touch Copy to copy the file, the file is now stored on the external flash drive.

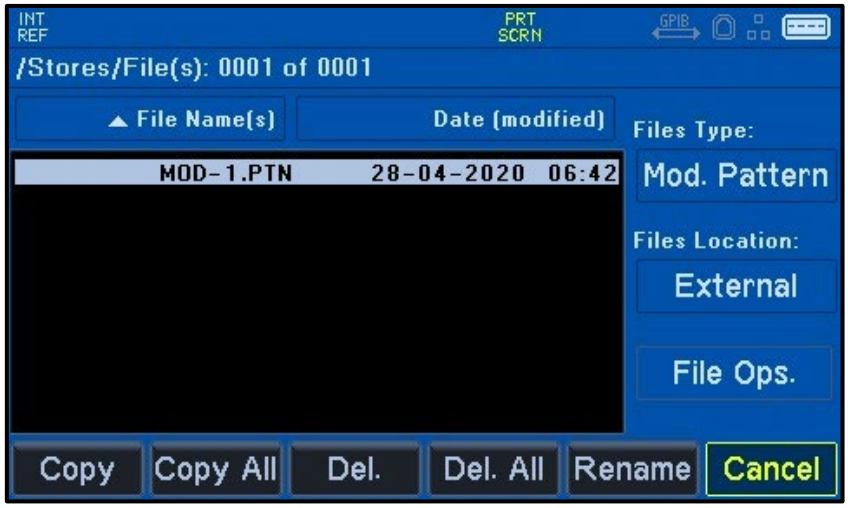
To copy all of the selected file type, touch Copy All. The file name will remain the same when all files are copied.

Copying an external file to the internal memory

To copy a file from an external flash drive to the internal memory, firstly, make sure the flash drive is inserted and recognised; indicated by the symbol in the status bar:

Select the File Location parameter window, select External and touch OK.

Select the file to be copied using the ↑ ↓ arrow keys.



To copy the file, touch File Ops. This will bring up the file options menu.

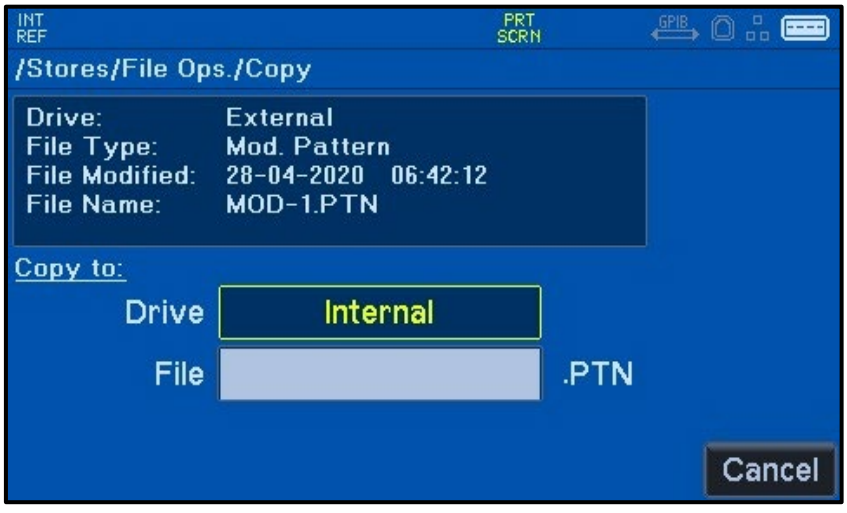
Here files can be copied, deleted or renamed. To copy the file, touch Copy.

The copy menu allows files to be copied to both internal memory and an external flash drive. Select the Drive parameter window, select Internal and touch OK.

The file can now be re-named and copied.

Select the File parameter window, type in the file name using the on-screen keypad and touch OK. Touch Copy to copy the file, the file is now stored in the internal memory of the instrument.

To copy all of the selected file type, touch Copy All. The file name will remain the same when all files are copied.



Deleting files

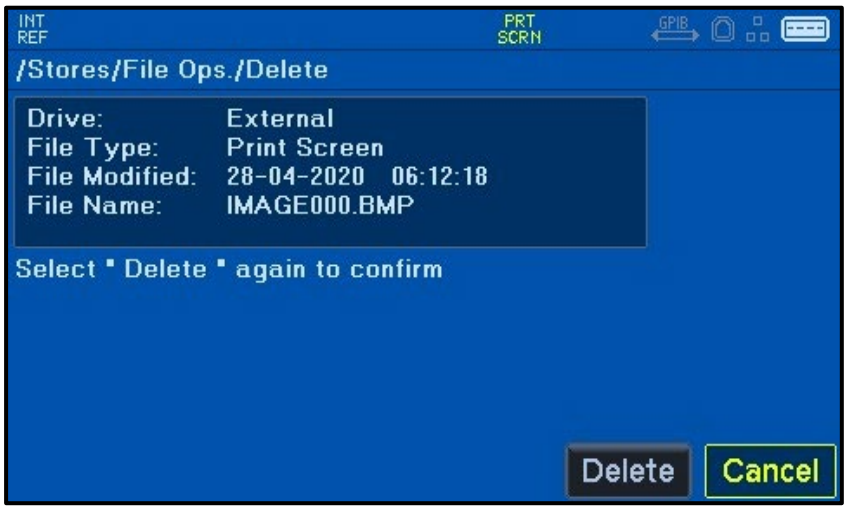
Files can be deleted from both the internal memory and the external flash drive using the STORES menu.

To delete a file, firstly select the type of file to be deleted using the Files Type parameter window.

Next, select the location from which the file will be deleted using the Files Location parameter window and then select the file to be deleted using the ↑ ↓ arrow keys.

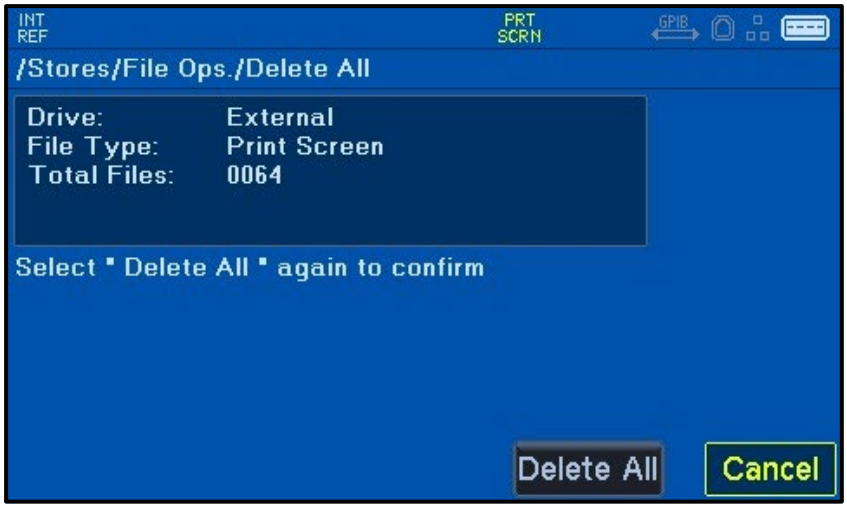
Touch the File Ops button and touch Delete, another screen will appear asking to confirm the action.

The details of the selected file are shown in the information box.



Touch Delete to delete the selected file.

To delete all files, touch Delete All. This will delete all of the files of that type stored in the selected location.



Renaming files

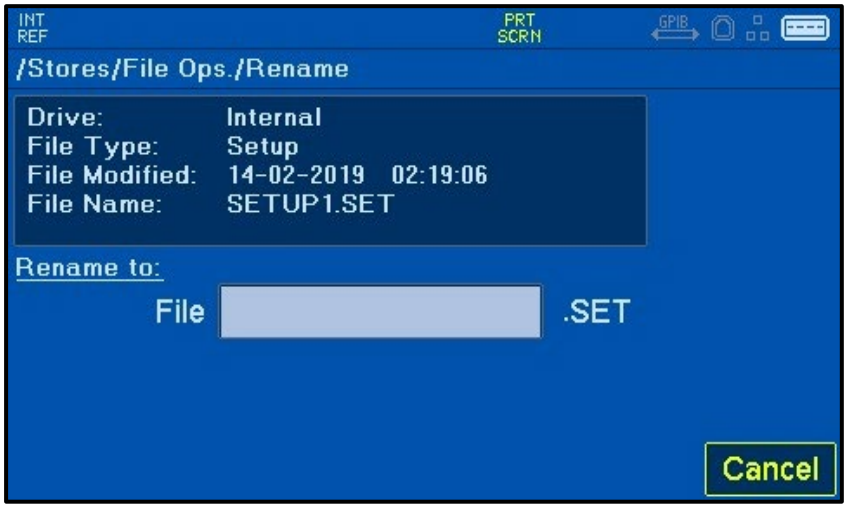
Files can be renamed from both the internal memory and the external flash drive using the STORES menu.

To rename a file, firstly select the type of file to be renamed using the Files Type parameter window.

Next, select the location from which the file will be renamed using the Files Location parameter window and then select the file to be renamed using the ↑ ↓ arrow keys.

Touch the File Ops button and touch Rename.

The details of the selected file are shown in the information box.

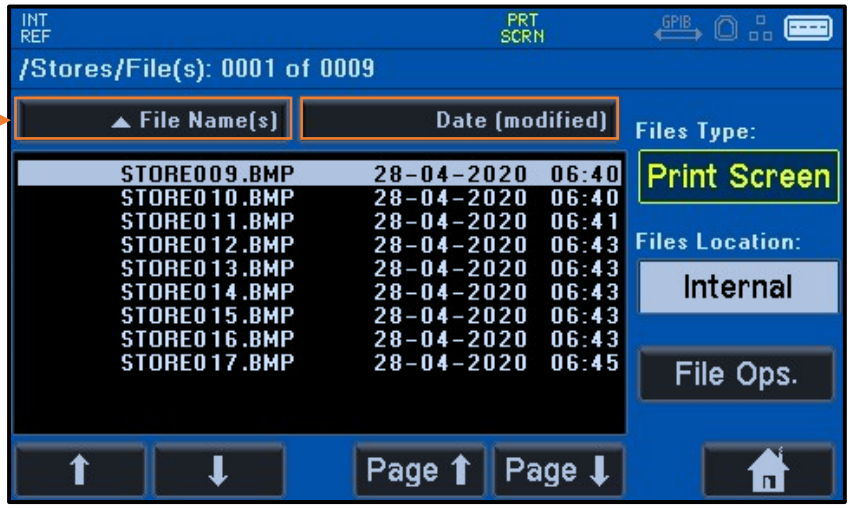


Select the File parameter window and enter the required file name using the on-screen keypad and touch OK.

Touch the Rename button to rename the file.

File handling

Files can be arranged by name or date using the File Name(s) and Date (modified) buttons above the file display box.



To arrange files by the most recently modified, touch the Date (modified) button.

To arrange files alphabetically, touch the File Name(s) button.

15. REMOTE OPERATION

Overview

The TGR can be remotely controlled via USB, LAN or (optional) GPIB interfaces.

USB remote control operates in a similar way to an RS232 interface but via the USB connector on the rear panel.

This instrument sets up the controlling computer to treat the USB connection as a virtual COM port.

Application software on the computer can then access the instrument via that COM port.

The LAN interface is designed to meet 1.5 LXI Device Specification 2016.

Please see TGR2050 series programming manual for further details. This can be found on the Aim-TTi website: www.aimtti.com

16. APPENDIX 1.

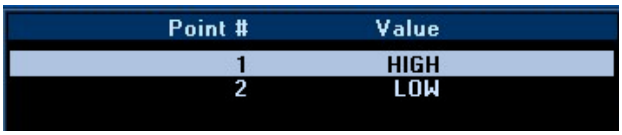
Default Parameters

Frequency	3 GHz / 1.5 GHz (for TGR2051)
Frequency Step	1 MHz
Amplitude	-10 dBm
Amplitude Step	10 dB
Low Spur Mode	Off
Reference Clock	Internal
Reference Clock Out	Off
MODULATION	
Modulation	OFF
Modulation Type	AM
AM Depth	30%
AM Modulating Source	Sine
AM Modulating Internal Frequency	1 kHz
AM Sync Out	OFF
AM Mod. Out	OFF
FM Deviation	20 kHz
FM Modulating Source	Sine
FM Modulating Internal Frequency	2 kHz
FM Sync Out	OFF
FM Mod. Out	OFF
PM Deviation	25.00 rad.
PM Modulating Source	Sine
PM Modulating Internal Frequency	3 kHz
PM Sync Out	OFF
PM Mod. Out	OFF
DIGITAL MODULATION (optional)	
ASK Depth	100%
ASK Modulating Source	PRBS7
ASK Modulating Internal Frequency	1 kbps
ASK Sync Out	OFF
ASK Mod. Out	OFF
ASK Mode	Immediate

ASK Trigger Source	Internal
ASK Trigger Type	Finite
ASK Trigger Mode	Bit
ASK Trigger Count	100
ASK Trigger Rate	100ms
OOK Depth	N/A
OOK Modulating Source	PRBS7
OOK Modulating Internal Frequency	1.5 kbps
OOK Sync Out	OFF
OOK Mod. Out	OFF
OOK Mode	Immediate
OOK Trigger Source	Internal
OOK Trigger Type	Finite
OOK Trigger Mode	Bit
OOK Trigger Count	150
OOK Trigger Rate	150ms
FSK Deviation	20 kHz
FSK Modulating Source	PRBS7
FSK Modulating Internal Frequency	2 kbps
FSK Sync Out	OFF
FSK Mod. Out	OFF
FSK Mode	Immediate
FSK Filter Type	None
FSK Encoding Sync	N/A
FSK Encoding Method	N/A
FSK Trigger Source	Internal
FSK Trigger Type	Finite
FSK Trigger Mode	Bit
FSK Trigger Count	200
FSK Trigger Rate	200ms
3FSK Deviation	30 kHz
3FSK Modulating Source	PRBS7
3FSK Modulating Internal Frequency	3 kbps
3FSK Sync Out	OFF
3FSK Mod. Out	OFF

3FSK Mode	Immediate
3FSK Filter Type	None
3FSK Encoding Sync	N/A
3FSK Encoding Method	N/A
3FSK Trigger Source	Internal
3FSK Trigger Type	Finite
3FSK Trigger Mode	Bit
3FSK Trigger Count	300
3FSK Trigger Rate	300ms
4FSK Deviation	40 kHz
4FSK Modulating Source	PRBS7
4FSK Modulating Internal Frequency	4 kbps
4FSK Sync Out	OFF
4FSK Mod. Out	OFF
4FSK Mode	Immediate
4FSK Filter Type	None
4FSK Encoding Sync	N/A
4FSK Encoding Method	Gray-code
4FSK Trigger Source	Internal
4FSK Trigger Type	Finite
4FSK Trigger Mode	Bit
4FSK Trigger Count	400
4FSK Trigger Rate	400ms
GFSK Deviation	50 kHz
GFSK Modulating Source	PRBS7
GFSK Modulating Internal Frequency	5 kbps
GFSK Sync Out	OFF
GFSK Mod. Out	OFF
GFSK Mode	Immediate
GFSK Filter Type	Gauss BT 0.3
GFSK Encoding Sync	N/A
GFSK Encoding Method	N/A
GFSK Trigger Source	Internal
GFSK Trigger Type	Finite
GFSK Trigger Mode	Bit

GFSK Trigger Count	500
GFSK Trigger Rate	500ms
MSK Deviation	N/A
MSK Modulating Source	PRBS7
MSK Modulating Internal Frequency	6 kbps
MSK Sync Out	OFF
MSK Mod. Out	OFF
MSK Mode	Immediate
MSK Filter Type	N/A
MSK Encoding Sync	N/A
MSK Encoding Method	N/A
MSK Trigger Source	Internal
MSK Trigger Type	Finite
MSK Trigger Mode	Bit
MSK Trigger Count	600
MSK Trigger Rate	600ms
GMSK Deviation	N/A
GMSK Modulating Source	PRBS7
GMSK Modulating Internal Frequency	7 kbps
GMSK Sync Out	OFF
GMSK Mod. Out	OFF
GMSK Mode	Immediate
GMSK Filter Type	Gauss BT 0.3
GMSK Encoding Sync	N/A
GMSK Encoding Method	N/A
GMSK Trigger Source	Internal
GMSK Trigger Type	Finite
GMSK Trigger Mode	Bit
GMSK Trigger Count	700
GMSK Trigger Rate	700ms
HMSK Deviation	N/A
HMSK Modulating Source	PRBS7
HMSK Modulating Internal Frequency	8 kbps
HMSK Sync Out	OFF
HMSK Mod. Out	OFF

HMSK Mode	Immediate
HMSK Filter Type	Half Sine
HMSK Encoding Sync	N/A
HMSK Encoding Method	N/A
HMSK Trigger Source	Internal
HMSK Trigger Type	Finite
HMSK Trigger Mode	Bit
HMSK Trigger Count	800
HMSK Trigger Rate	800ms
PSK Deviation	25.00 rad.
PSK Modulating Source	PRBS7
PSK Modulating Internal Frequency	9 kbps
PSK Sync Out	OFF
PSK Mod. Out	OFF
PSK Mode	Immediate
PSK Trigger Source	Internal
PSK Trigger Type	Finite
PSK Trigger Mode	Bit
PSK Trigger Count	900
PSK Trigger Rate	900ms
Modulation-User Pattern	Used for: ASK, OOK, FSK, 3FSK, 4FSK, GFSK, MSK, GMSK, HMSK, PSK
Modulation-User Pattern Length	2
Modulation- User Pattern settings	

SWEEP

Sweep Type	OFF
Sweep Type	Step
Sweep Control	Freq. + Ampl.
Sweep Direction	Up
Sweep Mode	Continuous
Sweep Sync Out	OFF
Sweep Sync Polarity	+ve Edge

Point Trigger	Immediate
Sweep Trigger	Immediate
Sweep Trigger Timer	500 ms
Step-Sweep Length	10
Step-Sweep Shape	Linear
Step-Sweep Dwell time	500 ms
Step-Sweep Start Frequency	150 MHz
Step-Sweep Stop Frequency	170 MHz
Step-Sweep Start Amplitude	-10 dBm
Step-Sweep Stop Amplitude	-40 dBm
List Sweep Length	2
List Sweep settings	

UTILITY		
Brightness	40%	
Power-on State	Latest	
Colour Theme	Theme1	
Encoder State	2 State	
Buzzer	Error Tone-ON	
	Warning Tone-ON	
	Info. Tone-ON	
	Key Tone-ON	
	Touch Tone-ON	
	Remote Tone-ON	
	Trigger Tone-ON	
LAN\IP Config. Method	Automatic	
LAN\IPv4 Manual	IP Address	192.168.1.100
	Subnet Mast	255.255.255.0
	Gateway	0.0.0.0
	Pri. DNS Server	0.0.0.0
	Sec. DNS Server	0.0.0.0
GPIB Address	11	

17. SPECIFICATION

Frequency

Frequency Range: TGR2053	150kHz – 3000MHz
TGR2051	150kHz – 1500MHz
Setting Resolution:	10Hz
Setting Resolution Low Spur mode:	1MHz
Accuracy/stability:	see Reference Frequency
Phase Noise:	1GHz Carrier: <-117dBc/Hz (typ) @ 10kHz offset
	500MHz Carrier: <-124dBc/Hz (typ) @ 10kHz offset
	See Fig. 2
Residual FM:	<2 Hz @ 1GHz –Equivalent peak deviation in a 300Hz to 3.4kHz bandwidth.

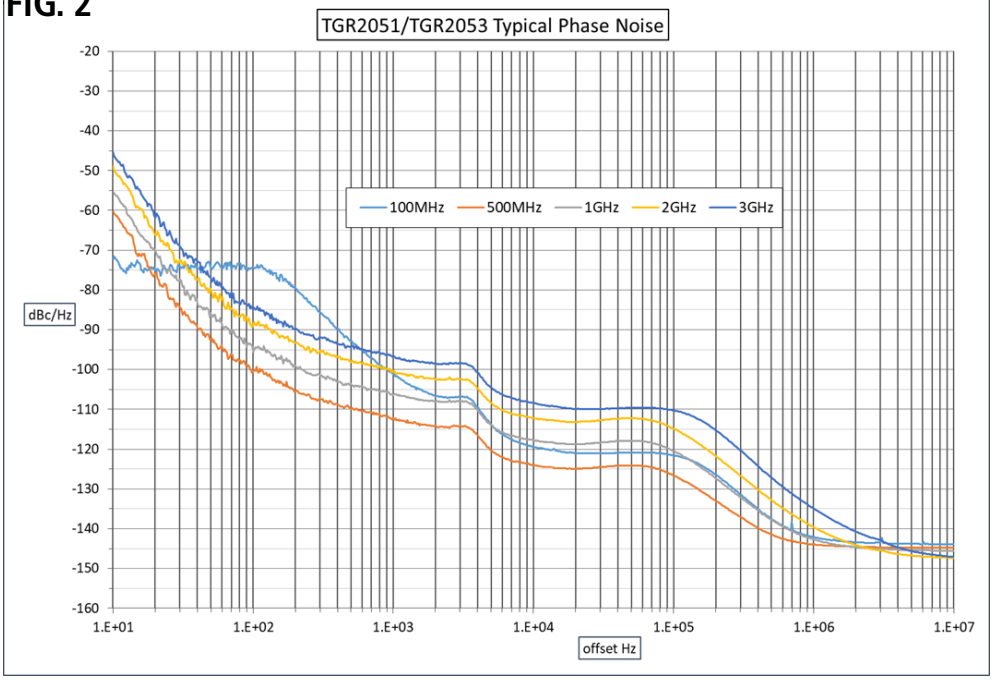
Reference frequency

Internal Reference Accuracy:	<± 1ppm, 15ºC – 30ºC <± 2ppm, 5ºC – 40ºC
Internal Reference Stability:	<1ppm/year
Reference IN & OUT:	Both can be disabled when not required.
Reference IN	10MHz +/- 25ppm, 50Ω input impedance, 2- 5Vpp
Rear Panel BNC:	Automatic detection and selection when an external reference signal is present and Ref. Clock is selected to be EXTERNAL. LCD status indicator shows when external reference is active
Reference OUT	10MHz, 50Ω output impedance, >2Vpp into 50Ω
Rear panel BNC:	The active reference signal (from internal or external source) is present when Ref. Clock Out is selected to be ON.

Output level

Output Level Range:	–127dBm to +13dBm
Setting Resolution:	0.1dB, 0.01uV –1mV
Accuracy:	±1dB output levels >-53dBm ±2dB output levels <=-53dBm
Additional Uncertainty AM, ASK & OOK ON:	+/-0.5dB
Harmonically Related Signals:	<-25dBc @ +13dBm, <-30dBc@levels <=0dBm
Non-harmonic Spurii:	<–50dBc >10kHz offset 1.5GHz – 3GHz <-56dBc > 10kHz offset 150KHz- 1.5GHz
Output Impedance:	50Ω
VSWR:	<2.0 typ <=1.6
RF Output Connector:	Type N Female
Reverse Voltage Protection:	50V DC
Output Switch:	RF OUT On/Off switch with LED showing ON status

FIG. 2



Analog Modulation

Source

Internal:	DDS generator providing Sine, Square, + Ramp,-Ramp, Triangle
	1mHz – 1MHz, Resolution 1mHz
	Signal available at MOD IN/OUT, 150Ω source impedance
External:	100Hz – 1MHz, 1dB relative to 1kHz, 1Vp-p for full scale
	10kΩ input impedance AC coupled

Frequency Modulation

Deviation:	1mHz – 1MHz subject to carrier frequency
Deviation Setting Resolution:	1mHz
Deviation Accuracy:	Ref freq accuracy +/- 1mHz for internal modulation
	±2% for external modulation @ 1kHz, 1V p-p
Distortion:	<1% @ 1kHz modulation, 300 – 3.4kHz bandwidth.

Phase Modulation

Deviation:	0- 25.00 rad
Deviation Setting Resolution:	0.01 rad
Deviation Accuracy:	Ref freq accuracy ±0.1rad for internal modulation
	±2% for external modulation @ 1kHz, 1V p-p
Distortion:	<1% @ 1kHz modulation, 300 – 3.4kHz bandwidth

Amplitude Modulation (Levels ≤+7dBm)

Modulation Depth:	0 – 100%
Setting Resolution:	0.1%
Accuracy:	±1% for internal modulation
	±2% for external modulation @ 1kHz, 1V p-p
Distortion:	≤1% @ ≤90% depth

Digital Modulation **

Source

Internal:	NRZ Patterns:	Square Wave, User Defined Pattern, 7-bit PRBS,9-bit PRBS, 11-bit PRBS, 15-bit PRBS.
	User Defined Pattern	16384 states Can be created in the instrument or downloaded via the remote interfaces.
	Bit rate:	1mbits/sec – 1Mbits/sec
	Modulation signal available at MOD IN/OUT, 150 Ω source impedance	
External:	Input via	DC – 1Mbits/sec, >=2Vp-p, logic threshold +1.5V nominal.
	MOD IN/OUT:	10kΩ input impedance

Internal Modulation Pattern Trigger

Source:	External +ve edge, External –ve edge, Manual, via remote interface or Internal. Internal trigger repeats at a programmable rate of 1 per 1us – 999.999999s	
Modes:	Immediate:	Modulation starts immediately.
	Triggered:	Modulation waits for a trigger event.
Trigger Types	Infinite:	First trigger event starts the modulation pattern, which repeats indefinitely.
	Finite:	Each trigger event starts one modulation pattern (one 'block') or a count of bits in the modulation pattern. The bit count is programmable and can be greater than a pattern length.
	Bit count range:	1 – 2^31
Trigger Delay:	<500ns from specified edge of external trigger signal to modulation start.	

Internal Modulation Pattern SYNC

Signal available from the rear panel SYNC BNC to synchronise internally produced modulation patterns.

SYNC modes:	OFF, Start, Bit Rate, Bit Rate/2
SYNC polarity:	High going SYNC pulse
Start SYNC:	SYNC pulse 1 bit period wide at the start of the modulation pattern.
Bit Rate SYNC:	½-bit period wide pulses at the modulation bit rate repeated indefinitely or for a programmed repeat count from the start of the modulation pattern in triggered mode.
Bit Rate/2 SYNC:	As for Bit Rate SYNC but at half the modulation bit rate.

Frequency Shift Keying

Modes:	FSK, GFSK, MSK, GMSK, HMSK, 3FSK, 4FSK Continuous phase frequency modulation.	
Filter Settings:	None Gaussian (BT=0.3, 0.5 or 0.7) Raised Cosine (α =0.5 or 0.7) Root Raised Cosine (α =0.5 or 0.7) Half sine	
Deviation:	1mHz – 1MHz subject to carrier frequency	
Deviation Setting Resolution:	1mHz	
Deviation Accuracy:	Ref freq accuracy ±1mHz for internal and external modulation	
4FSK Encoding:	Gray Code or Binary.	
Encoding Synchronisation	3FSK	Start SYNC output indicates the start of encoding
Internal Modulation Source:	4FSK	Bit Rate/2 SYNC output indicates the start of encoding

Encoding Synchronisation External Modulation Source:	3FSK 4FSK	The external Trigger input can be used to define the start of encoding for both.

Phase Shift Keying

Modes:	PSK
Deviation:	0- 25.00 rad
Deviation Setting Resolution:	0.01 rad
Deviation Accuracy:	Ref freq accuracy ±0.1rad for internal and external modulation

Amplitude Shift Keying (ASK)

ASK Depth:	0- 100%
Setting Resolution:	0.1%
Accuracy:	±1% for internal and external modulation
Internal Rate:	1mb/s- 1Mb/s
External Rate:	DC – 1Mb/s

ON-OFF Keying (OOK) (Basic Pulse Modulation)

On-Off Ratio:	>80dB
External Input:	Logic high = Carrier On
Internal Rate:	1mB/s- 1Mb/s
External Rate:	DC – 1Mb/s
Rise/Fall Time:	50ns

** Digital modulations available with TGR-U01 option (see Option TGR-U01).

Frequency and Amplitude Sweep

Frequency settling time to within 100Hz or 0.1ppm of final frequency if greater:	<5ms*, typ <2ms
Amplitude settling time to within 0.2dB:	<5ms*, typ <4ms
Rear panel SYNC pulse width (defines guaranteed settling period):	5ms *

*Settling time and SYNC pulse width is extended to 15ms for all points in the sweep if the frequency crosses 250.00000MHz between any points in the sweep.

Step Sweep

Step frequency and/or amplitude according to a formula over a specified number of points.	
Number of Points:	2- 1000
Formula specifies:	Sweep Start and Stop Frequencies Sweep Start and Stop Amplitudes Dwell time following SYNC at each point
Dwell Time:	0.01 – 10.000sec
Sweep Mode:	Continuous or Single
Sweep Direction:	Up or Down
Sweep Point Spacing:	Linear or Logarithmic
Sweep Trigger: (Sweep start held until trigger event)	Manual, ext signal +ve or –ve edge, Timed (0.01 – 999.9sec) or via remote interface
Point Trigger: (Sweep point stepping held until trigger event)	Manual, ext signal +ve or –ve edge, or via remote interface
Point Trigger timing:	>=10ms after SYNC signal
SYNC signal ('output stable'):	Available after output has settled at each point until next point. Programmable high or low logic.

List Sweep

As for Step Sweep except that a user defined table of frequency, amplitude and dwell time values defines the points. The table can be created within the instrument or downloaded via the remote interfaces.

Max 1000 points.

Trigger Input

Rear panel BNC accepts logic trigger signal for sweeps and modulation.

Trigger logic threshold:	+1.6V

Remote Control Interfaces

Full digital remote control facilities are available through the USB, LAN and GPIB (optional) interfaces using a SCPI style command set.

USB:	Standard USB 2.0 hardware connection. Operates as a virtual COM port.
LAN:	Ethernet 100/10base-T hardware connection.
GPIB (optional):	Conforming with IEEE488.1 and IEEE488.2

Settling time from remote command:

Frequency settling time to within 100Hz or 0.1ppm of final frequency if greater:	<=15 ms typ <7ms
Amplitude settling time to within 0.2dB:	<=15ms typ <4ms

USB Host Interface

Front panel USB host interface for connection of USB Flash drives. Allows unlimited storage and transfer of instrument setups, sweep lists and user defined modulation patterns.

Connector type:	Standard USB type A

Option TGR-U01

Makes available all digital modulation schemes with full trigger and SYNC capabilities listed under 'DIGITAL MODULATION' above.

General

Power:	85…264Vac, 47…63Hz, 35VA max. Installation Category II. Standby <0.5W
Display:	4.3 inch (10.9 cm) backlit TFT LCD, 480 x 272 pixels total, 16 colours, resistive touch screen.
Data Entry:	Multiple entry methods; keyboard or touch screen selection of all major functions; edit field selection by screen touch or rotary control; value entry by keyboard, rotary control or touch screen; frequency and amplitude adjustable by value entry, character scrolling, user defined step values or a combination.
Storage:	4G bytes internal storage available for 1000's of instrument setups, sweep lists and user defined modulation patterns.
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.
EMC:	Complies with EN61326
Safety:	Complies with EN61010-1
Size:	2U high, half rack width.
Weight:	3 kg
Options:	19-inch rack mounting kit.

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