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THURLBY THANDAR INSTRUMENTS

## PSA2702 & PSA1302

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2.7GHz & 1.3GHz Spectrum Analyzers

INSTRUCTION MANUAL



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# 1 Product Introduction

## 1.1 Items Supplied

**Portable Spectrum Analyzer** (PSA1302 or PSA2702) with detachable bench-stand/screen protector and removable stylus.

**Spare stylus.**

**USB lead** Mini B plug to standard A plug.

**Trigger input converter plug** 3.5mm jack to BNC socket.

**AC line power-supply/charger** Universal voltage with interchangeable plugs for different countries.

**Short Guide** (English, French, German, Italian and Spanish).

**Full instruction manual** (English only).

**Support CD** Containing hyper-linked PDF versions of the printed manuals, plus support files.

## 1.2 Using this Manual - Cross References

This manual covers both the PSA2702 and PSA1302 spectrum analyzers. Within the text they may be referred to jointly as PSAxx02 or PSA Series II.

The manual is also provided as a PDF file on the accompanying CD. The manual includes many cross references which are shown as follows - see section [X.X](#).

Within a PDF file, the shaded number is a hyperlink to that section number, thus enabling the user to jump rapidly to the section referred to and then jump back to continue reading the original section. (N.B. for hyperlink navigation within Acrobat Reader, enable “show all page navigation tools” or use the keyboard shortcuts Alt+Left\_Arrow and Alt+Right\_Arrow).

The Table of Contents at the front of the manual is also fully hyperlinked.

## 1.3 Product Description and Capabilities

The PSA2702 and PSA1302 are fully portable RF spectrum analyzers that incorporate a high resolution colour TFT touch screen. They are sufficiently small and lightweight to be operated as true handheld instruments and have a battery life of more than eight hours from each charge.

As bench instruments they can be powered by the supplied ac-line adaptor/charger. They can be set horizontally or vertically, or at an angle of about 40 degrees using the built-in tilt stand. For field use, the stand can be moved to the top of the instrument to form a screen protector and sun shield.

The frequency range is 1MHz to 2700MHz (PSA2702) or 1MHz to 1300MHz (PSA1302). The span can be set between 0.270 MHz and 2699.000 MHz or 1299.000 MHz respectively with a setting resolution of 1kHz. Start, stop or centre frequencies can be set to the same resolution. The resolution bandwidth (RBW) is selectable as 1MHz, 280kHz or 15kHz.

The on-screen amplitude range is 85 dB with a reference level of -20dBm or 0dBm. Amplitudes can alternatively be displayed in dB $\mu$ V. Vertical magnification down to 1dB/div can be selected. Average noise floor is better than -95dBm at -20dBm reference level and 15 kHz RBW (video filter on).

Sweeps can be repeating or single shot, and the trace can be normal (over-write), peak hold or average (2 to 48 sweeps). A zero span mode is available with AM or FM audio demodulation via a built-in speaker.

Twin vertical marker lines are available giving a readout of frequency and amplitude together with difference values. Markers can be manually positioned or automatically peak finding or tracking.

A reference trace and a view trace can be displayed in addition to the live trace. Up to 999 traces can be stored to permanent memory for recall to the screen or for data export. Similar number of instrument set-ups and complete screen bitmaps can also be stored. All files can be given user defined names.

USB interfaces are provided for direct file transfer to a PC and for connection of a USB Flash drive.

Extensive convenience features for repetitive operation include auto-set, frequency presets, and storage of the instrument state together with the trace file for simultaneous or independent recall.

Pressing the Status/Help hard key brings up a full status screen and access to help screens relevant to the current menu position.

An optional upgrade package (retro installable) provides additional features including data logging, sweep triggering, limit patterns, and compensation tables - see section 6.

More details of the product capabilities are given in the Specifications - section 12.

## 1.4 Initial Use - Charging the Battery | Switching On

As supplied, the internal battery is likely to be partly or fully discharged. At first use, the instrument should therefore be plugged into the charger until the lamp next to the charge socket stops flashing, which could take up to three hours - see section 3.1.1.

The instrument is turned on or off by pressing the small round key marked Power. When turning on, the screen backlight will flash briefly to indicate that the key press has been recognised, there is then a short delay prior to operation starting.

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## 2 Safety Information

### Spectrum Analyzer

This instrument is Safety Class III 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).

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

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

This instrument is fitted with a rechargeable Lithium ion polymer battery; do not expose the instrument to heat sources or high-temperature environments such as an unattended vehicle in the sun. Only recharge the battery, in the instrument, using the charger supplied.

Do not incinerate the instrument and/or battery; refer to the Service Guide for information on battery replacement and disposal.

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

#### WARNING!

All accessible parts will be at the same voltage as the outer body of the SMA input socket. In particular, note that the shells of both USB connectors are galvanically connected to the body of the SMA input and will therefore be at earth ground potential when either USB port is connected to a desktop PC. To maintain user safety under all other circumstances it is essential that the input is not connected to a voltage above 30Vdc or 30Vrms with respect to earth ground which is the limit of Safe Extra Low Voltage (SELV) by IEC definition.

The instrument shall be disconnected from all voltage sources before it is opened for any adjustment, replacement, maintenance or repair. Any adjustment, maintenance and repair of the opened instrument shall be carried out only by a skilled person in conjunction with the Service Guide, see Maintenance section 9.3

Do not wet the instrument when cleaning it; see Maintenance section 9.3 for further details.

The following symbols are used on the instrument and in this manual.

 Direct Current



CAUTION – refer to accompanying documentation.

Damage to the instrument may occur if these precautions are ignored.

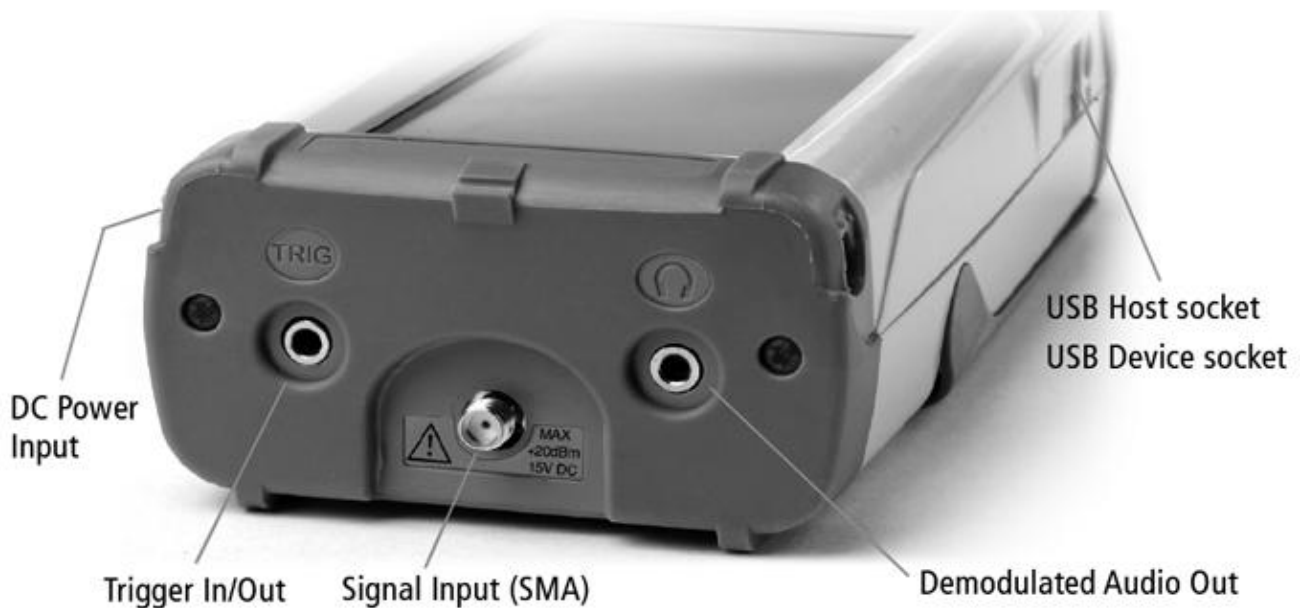
### Adaptor/Charger

The adaptor/charger supplied has a universal input voltage rating of 100-240VAC, 50/60Hz. It is a Class II (double insulated) device, fully approved to EN 60950-1 and UL 60950-1 (UL listing E245390).

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## 3 Basics of Operation

### 3.1 External Connections



#### 3.1.1 DC Power Input

DC power to operate and/or recharge the instrument is connected via a 1.3mm power socket mounted on the right hand side of the instrument.



Use ONLY the power-supply/charger provided by TTI with the unit. Use of any other power source will void the warranty.

The red lamp next to the socket flashes whilst charging is taking place and becomes continuous once charging is complete.

#### 3.1.2 RF Signal Input

The signal to be measured is connected via a standard (non reverse) SMA connector mounted at the top of the instrument. The input impedance is 50 Ohms. The maximum allowable input is +20dBm or +127dBuV of RF power (approximately 2.2 volts RMS), or 15V DC.



Applying a signal above these levels could damage the unit and such damage would not be covered by the product warranty.

It should be noted that SMA connectors have a limited mechanical life and that, where frequent connection and disconnection is expected, a sacrificial intermediate connector should be used.

#### 3.1.3 Demodulated Audio Output

Demodulated audio (when in Zero Span Mode) is available via the built-in speaker, with the volume level adjustable from within the application. The signal is also provided via a 3.5mm stereo jack socket mounted at the top of the instrument. Maximum power output is 30 milliwatts into 32 Ohms.

The signal is mono but connection can be made using either a mono or stereo plug. In the latter case the signal will be present on both channels. Connecting the jack plug automatically disconnects the internal speaker.



### 3.1.4 USB Host Connector (for USB Flash Memory)

A standard USB type A connector is provided on the left hand side of the instrument which is revealed by moving the sliding cover towards the top of the instrument. This is intended exclusively for the connection of a USB Flash memory stick. See section 5.6.3 for full information.



### 3.1.5 USB Device Connector (for connection to a PC)

A USB type mini-B connector is provided on the left hand side of the instrument which is revealed by moving the sliding cover towards the base of the instrument. This is intended exclusively for connection to a personal computer. See section 5.6.4 for full information.



### 3.1.6 Trigger Input/Output

A 3.5mm mono jack socket is mounted at the top of the instrument for trigger signals. This has no function unless option U01 is fitted - see section 6.1.2. An adaptor is provided that converts from the jack socket to a standard BNC connector.

## 3.2 Bench-top and Portable Use

The instrument is intended for both hand-held and bench-top applications. It has rubber feet for horizontal or vertical use, or can be angled using the tilt stand.

### 3.2.1 Tilt Stand

The instrument is supplied with the tilt stand folded away and magnetically latched at the bottom of the instrument. It can be hinged outwards to tilt the unit at an angle of about 40 degrees.



### 3.2.2 Screen Protector and Sun Shield

To protect the screen when in transit, the tilt stand can be detached from the bottom of the instrument and re-attached on the top to act as a screen protector.

The stand is removed by flexing it outwards at the hinged end until the lugs disengage from the sockets.

For outdoors use, the screen protector can be hinged upwards to form a sun shield which improves the screen visibility in direct sun light.

When not required, it can be detached and stowed away on the back of the instrument where it functions as a tilt stand .

## **3.3 Batteries and AC Line Power**

### **3.3.1 Battery Operation**

The instrument operates from an internal Lithium-ion rechargeable battery which can provide more than 8 hours of continuous operation (screen brightness dependent).

The battery condition is indicated on the display via a multi-segment battery symbol. When it changes colour to yellow, expected battery life has fallen below 1 hour. When it turns red, expected battery life has fallen below 20 minutes.

The approximate battery life remaining is also displayed in hours and minutes within the Status information screens.

The battery is charged from the supplied 5V/2A charger which can recharge a fully discharged battery in under 3 hours.

When the battery is being charged, the red lamp next to the charging socket flashes. When charging is complete, flashing ceases but the lamp remains illuminated while the charger is connected.

It is also possible to slow charge the instrument from the USB port of a personal computer provided that the instrument is turned off. Charge time may be up to 10 hours. Connection to the PC must be made from the mini USB "device" port of the instrument using the supplied cable. It is not possible to operate the instrument from USB power.

### **3.3.2 AC Line Operation**

For bench-top operation, the instrument can be operated continuously from the supplied ac-line operated charger. The internal power management circuitry ensures that the battery cannot be overcharged.

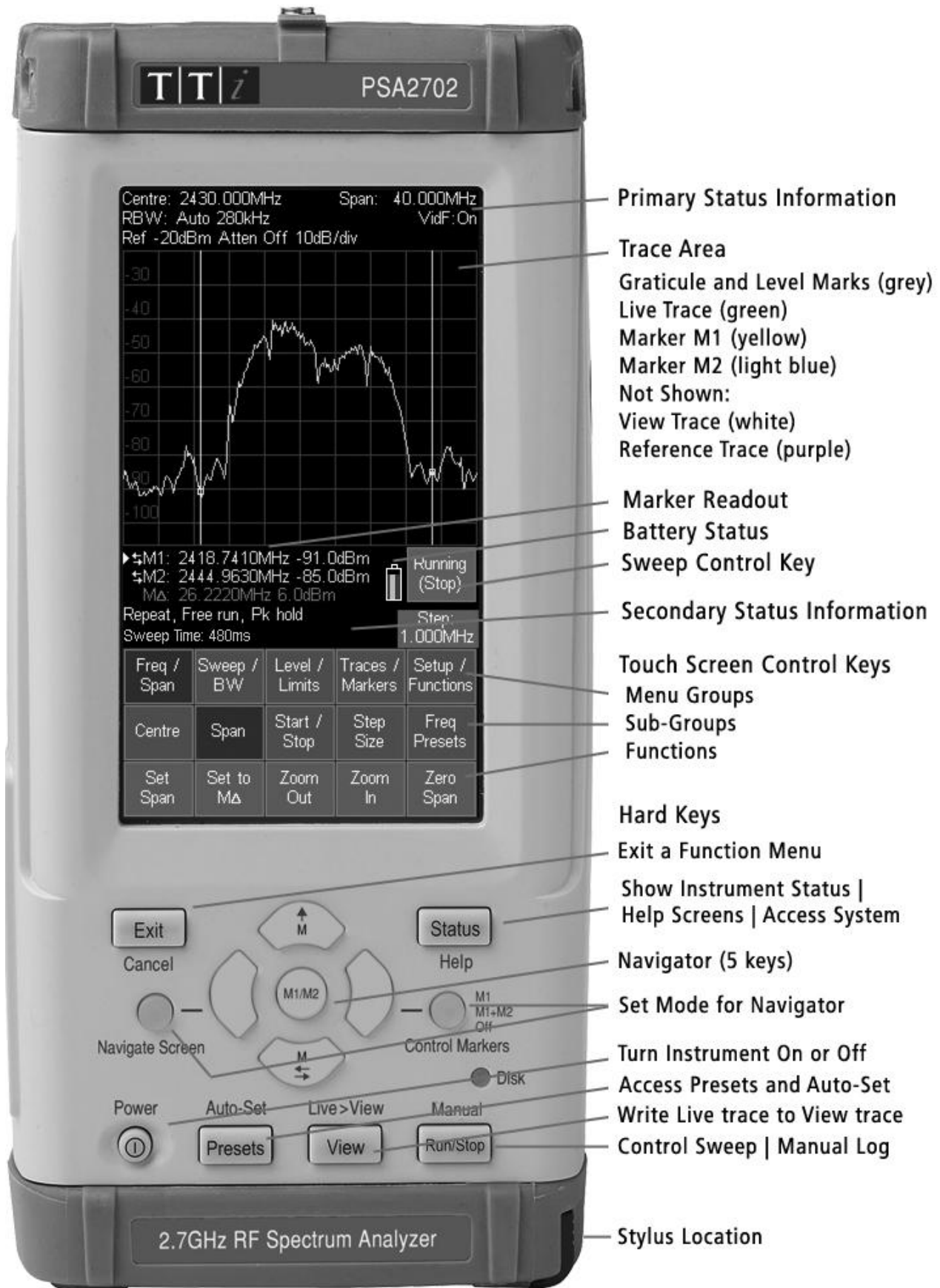
### **3.3.3 Power Saving for Battery Operation**

The battery life of the instrument is affected by the screen brightness which can be adjusted over a wide range (see section 4.9.2). Setting the brightness to maximum, for example, will reduce battery life by up to 2 hours relative to the normal setting (40%).

To conserve the battery the instrument should be turned off when not in use. In addition, Auto-Off mode can be selected whereby the unit turns off automatically after a defined period from the last key press. The period can be set between 5 and 60 minutes - see section 4.10.3.2. Auto-Off is automatically disabled when external power is connected, and when data-logging is enabled. All data is retained when the instrument is off.

### 3.4 Display and Controls Layout

Fig. 1



## 3.5 Touch Screen Operation

The normal mode of operation of the spectrum analyzer is by using the touch-screen keys within the display supplemented, when required, by the hard keys below.

The touch screen keys are normally operated by pressing with the finger or thumb, but can alternatively be operated using the supplied stylus.

### 3.5.1 Finger Tip Operation

The touch screen is a resistive single-touch type (rather than the capacitive multi-touch type used on many smart phones).

It can be operated by pressing the key area firmly with the soft part of the finger or thumb. However, for greater positional accuracy it can also be operated by pressing gently with the finger nail.

When the key is depressed, its colour changes from blue to purple. The key action is performed when the key is released.

### 3.5.2 Stylus Operation

Some users may prefer to use a stylus to operate the touch screen. The supplied stylus has a soft point. Sharply pointed objects should never be used to operate the screen as they could cause damage.

The stylus should be replaced into its mounting slot at the base of the instrument to prevent it being mislaid. The stylus design is compatible with those used with the Nintendo DS handheld games console, and spares are widely available.

### 3.5.3 Operation using only the Hard Keys

It is also possible to use the spectrum analyzer without touching the screen at all, by using the five “navigator” hard keys to operate each of the touch screen functions. See section 7.1 for a full explanation of this mode of operation.

### 3.5.4 Navigator Keys - Mode Selection

The five hard keys that make up the Navigator have two alternative modes of operation which are selected by the small illuminated keys on either side.

The modes are:

Control Markers - see section 4.7.2.1, and Navigate Screen - see section 7.1.

Whenever the navigator mode is changed, an information box appears explaining the current action of the navigator keys. If preferred this can be turned off - see section 4.10.3.3.

## 3.6 Instrument Status Information

The most important elements of the instrument status are displayed at the top of the screen (see Fig. 1 in section 3.4). Further status information relevant to the current menu function is shown directly above the key area.

In addition, the full status of the instrument can be displayed at any time by pressing the hard key marked Status/Help - see section 4.10.1.

## 3.7 On-screen Help

The instrument incorporates extensive help information to assist the user. Help is accessed by pressing the hard key marked Status/Help - see section 4.10.2.

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## 4 Operation using the Menu System

The default menu system for the spectrum analyzer consists of three rows of five keys. The upper row represents the top level of the menu system and defines five “menu groups” as follows:

- |                     |  |
|---------------------|--|
| Freq/<br>Span       | enables the frequency range of sweep to be set in terms of start and stop frequencies or centre frequency plus span.   |
| Sweep/<br>BW        | enables the type of sweep to be set (repeat or single shot) and the resolution bandwidth and video filter for the sweep to be selected. When option U01 is fitted, it also enables sweep triggering.   |
| Level/<br>Limits    | enables the reference level to be changed, the amplitude units to be changed, and the vertical scaling to be altered. When option U01 is fitted, it also enables the setup and control of limit lines and patterns, and the application of external offsets and compensation tables. |
| Traces/<br>Markers  | provides control of the display traces along with the storage function for both traces and screen images. Also provides setup and control of the measurement markers.  |
| Setup/<br>Functions | provides access to the storage of instrument setups and system utilities. When option U01 is fitted, it also provides access to automatic logging functions.   |

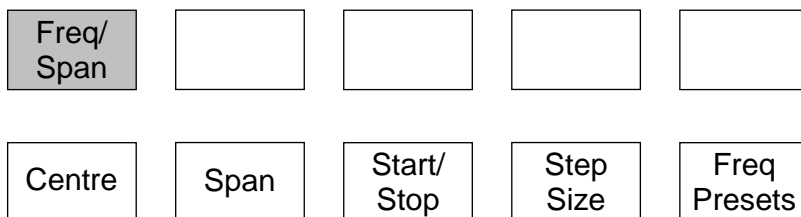
Each group has up to five “sub-groups” which appear on the middle row of keys. The currently selected group and sub-group is shown by the relevant key being dark blue.

The bottom row of keys represent the “functions” that can be performed for each of the many sub-groups. These keys may perform an immediate action, or bring up a pop-up menu, or create a special control screen for numeric entry or file operations.

See section 14 for a graphical summary of the menu tree.

### 4.1 Setting the Frequency Range of the Sweep

This menu group controls the frequency range for the current sweep of the spectrum analyzer.



The range can be set in terms of either a centre frequency plus a span width, or in terms of a start frequency and a stop frequency.

Pressing Centre or Span will cause the frequency range to be displayed at the top of the screen in terms of a centre frequency and a span. Pressing Start/Stop will cause it to be displayed in terms of a start frequency and a stop frequency.

The lowest start frequency is 1MHz. The highest stop frequency is 2700MHz or 1300MHz. The minimum span width is 0.27MHz which results in minimum and maximum centre frequencies of 1.135MHz and 2699.865MHz or 1299.865MHz respectively.

### 4.1.1 Centre

**Centre** controls the centre frequency for the sweep. Also sets the annotation to Centre/Span if it was previously Start/Stop. Creates a set of bottom-row function keys as follows:

**Set Centre** enables the centre frequency to be set to a specific value. The menu keys are replaced by a numeric keyboard from which a centre frequency can be entered in MHz to a resolution of 0.001.

Press **OK** to activate the new frequency without leaving the screen or **OK & Exit** to return to the menu. Once a new frequency has been set from this screen, the **Previous** key can be used to return to the previous frequency and then toggle between the two.

Pressing **Set by Tab/Jog** selects an alternative setting screen in which frequencies are set by “jogging” each digit up or down. Note that whichever method of setting frequency is used becomes the default whenever **Set Centre** is pressed. See section 7.2 for an illustrated description of frequency setting.

**Set C=M1** sets the centre frequency to the frequency value of the M1 marker (when active).

**Set C=Pk** sets the centre frequency to the frequency value of the highest amplitude point in the current sweep.

**Step Down**      **Step Up**      changes the centre frequency by the value of the step size  
- see section 4.1.4.

### 4.1.2 Span

**Span** controls the span for the sweep. Also sets the annotation to Centre/Span if it was previously Start/Stop. Creates a set of bottom-row function keys as follows:

**Set Span** enables the span to be set to a specific value. The method for setting the span is similar to that for setting the Centre frequency - see section 7.2 for an illustrated description of frequency setting.

**Set to Mdelta** sets the span equal to the frequency difference between the M1 and M2 markers (if active).

**Zoom Out**      **Zoom In**      sets the span to a higher or lower value in a 1-2-5 sequence starting from the existing span value. (Example: if the existing span is 1.7MHz, the first press of **Zoom Out** will take it to 2MHz and the next press to 5MHz).

**Zero Span** changes the sweep mode of the spectrum analyser and opens the Zero Span sub menu - see section 4.3.

### 4.1.3 Start/Stop

Start Stop	controls the start and stop frequencies for the sweep. Also sets the annotation to Start/Stop if it was previously Centre/Span. Creates a set of bottom-row function keys as follows:	
Set Start	Set Stop	enables the start or stop frequency to be set to a specific value. The method for setting these is similar to that for setting the Centre frequency - see section 7.2 for an illustrated description of frequency setting.
Start=M1 Stop=M2	sets the start frequency to the frequency of the M1 marker and the stop frequency to the frequency of the M2 marker. M1 and M2 must both be active and M2 must be at a higher frequency than M1.	
← Undo	reverts to the start and stop frequencies that existed directly before the Start=M1/Stop=M2 key was pressed.	
-more- 1 of 2	opens a second set of actions keys: Fix Start/Fix Stop and Step Down/Step Up.	
Fix Start	Fix Stop	changes the action of the Step Up/Down keys so that only the stop frequency or start frequency respectively is changed by the step value. The fixed start or stop frequency is preceded by the word Fix. Pressing the key again, or leaving this function-set (by pressing -more- 2 of 2 or any group or sub-group key) will cancel the fixed start or stop frequency.
Step Down	Step Up	changes the start and/or stop frequencies by the value of the step size (see next section). The action of the Fix Start/Fix Stop keys determines whether both are stepped or only one is stepped.
Note that, if the start or stop frequency is “fixed” and the step size is set to Auto, the step size will change on each press of step up/down so that it is always equal to one graticule division.		
-more- 2 of 2	returns to the alternative set of action keys for Start-Stop. Cancels the fixed start or stop frequency if set.	

### 4.1.4 Step Size

Step Size	sets the size of frequency stepping using the Step Up/Down keys. When relevant, the current step size is displayed within a green box above the keys. Creates a set of bottom-row function keys as follows:	
Set Step	enables the step size to be set to a specific value. The method for setting the step size is similar to that for setting the Centre frequency - see section 7.1 for an illustrated description of frequency setting.	
Auto Span/10	causes the step size to be automatically linked to the width of the span. Thus Step/Up down will cause the centre frequency to change in steps of one graticule division. Auto step size is indicated by the word Auto above the step size value.	
Set to Mdelta	sets the step size equal to the frequency difference between the M1 and M2 markers (if active).	
Set to Centre	Set to M1	sets the step size equal to either the centre frequency or to the frequency of the M1 marker (if active). This can be useful for observing the harmonics of a fundamental frequency.

## 4.1.5 Frequency Presets

**Freq Presets** enables up to six frequency ranges to be quickly stored and recalled. Only the centre and span (or equivalent start and stop frequencies) are stored. This differs from a Trace State or Set-up file for which more parameters are stored (see sections 5.7.1 or 5.7.3 respectively). Frequency presets are retained when the instrument is off. Creates a set of bottom-row function keys as follows:

**Full Span** sets the sweep to the full range of the instrument (1MHz to 2.7GHz or 1.3GHz).

**Store Preset** brings up a menu of six preset numbers (1 to 6) into which the current value of the sweep frequency range can be stored. Existing values are over-written.

**Recall Preset** brings up a menu of six preset numbers (1 to 6) which recall previously stored frequency ranges. Empty positions are ignored.

**Toggle Last** switches between the current sweep frequency range and the last range to be recalled from a preset (or from Full Span).

## 4.2 Sweep Time

The sweep time and update rate is automatically set from the Span and the RBW and is displayed within the lower annotation area. There is no independent adjustment of sweep time.

Narrower RBW settings create longer sweep times. For each RBW, the sweep time is broadly proportional to the frequency span. The approximate formula for calculating sweep update times is given within the specifications – see section 12.1.4.

## 4.3 Zero Span Mode

Zero span is a special case of frequency range setting. It is set from the Span sub-menu - see section 4.1.2. Pressing **Zero Span** changes the trace display to be a horizontal line at the centre frequency amplitude level, and brings up an alternative set of function keys as follows:

**Exit Z-Span** exits zero span mode and returns to a normal swept trace and the normal Span sub-menu key functions.

**Demod** brings up a menu which enables the demodulation mode to be set to AM or FM (or Off) and the Audio Filter to be set to On or Off.

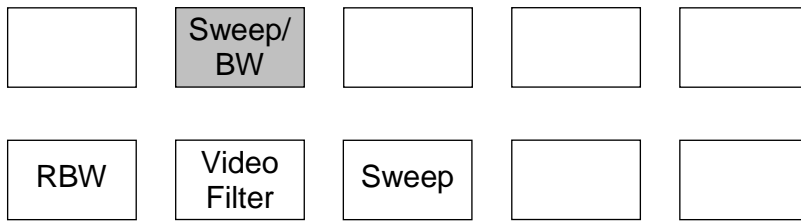
**Volume Down** **Volume Up** adjusts the demodulated audio volume (0 to 15).

The demodulated audio is routed to a built-in loudspeaker. Alternatively, the audio can be outputted via a 3.5mm jack socket - see section 3.1.3.



## 4.4 Setting the Sweep Mode and Sweep Bandwidth (RBW)

This menu group controls the sweep and the resolution bandwidth.



This enables the sweep to be controlled in terms of the type of sweep (repeat or single) and the resolution bandwidth of the sweep filter and the subsequent video filtering. If option U01 is fitted, sweep triggering can also be controlled.

### 4.4.1 RBW

**RBW** controls the resolution bandwidth of the sweep filter. A narrower RBW provides greater frequency resolution and lower noise, but increases the sweep time. Creates a set of bottom-row function keys as follows:

**Auto** causes the RBW to be automatically changed to suit the frequency span. The RBW value is displayed at the top of the screen and is preceded by the word Auto.

**15kHz** **280kHz** **1MHz** manually selects a specific RBW value which is displayed at the top of the screen

### 4.4.2 Video Filter

**Video Filter** controls the video filter. With the video filter On, displayed noise levels are lower, but signals may be slightly attenuated at narrower RBW settings. Creates a set of bottom-row function keys as follows:

**On** **Off** The status of the video filter is shown at the top of the screen preceded by the word VidF .

### 4.4.3 Sweep

**Sweep** controls how and when the sweep runs. Creates a set of bottom-row function keys as follows:

**Repeat** causes the sweep to be automatically restarted after the completion of the previous sweep unless halted by the Sweep Control key (or the Sweep Trigger settings).

**Single** enables single sweeps that are commenced by the Sweep Control key (or the Sweep Trigger settings).

Note that, whenever the sweep is stopped, whether in repeat or single mode, changing the frequency span or the reference level will re-run the sweep once.

**Sweep Trigger** Sweep Trigger is only available with the upgrade option U01 is fitted. It provides a choice of how the sweep is started or stopped. The trigger source can be manual, external, or internal from limit lines or patterns. See section 4.4.3.3 for an explanation of trigger functions.

Single  
ReArm

provides a choice of automatic or manual re-arming of the trigger when triggering is enabled and the sweep mode is set to Single.

When the menu system is set to Sweep/BW > Sweep the sweep status is displayed in the lower annotation area directly above the keys.

#### 4.4.3.1 Sweep Rate and the Sweep Progress Indicator Line

The sweep time and resultant update rate is a function of the span and the RBW and is shown within the lower annotation area. It can be calculated from the formulae within section 12.1.4.

For sweep times slower than about 1 second, a yellow indicator line below the graticule indicates the progress of the sweep – see section 4.6.2.

#### 4.4.3.2 Manually Controlling the Sweep

The sweep can be started or stopped using the touch screen Sweep Control key directly under the graticule on the right hand side. This key changes colour to indicate the current state of the sweep. The action of the key is duplicated by the hard key marked Run/Stop.

Running  
(Stop)

When the sweep is running, the key is green and is marked Running (Stop). The word in brackets indicates the action that will be performed by pressing the key.

When the sweep is stopped, and the sweep mode is Repeat, the key is blue and is marked Stopped (Run). Stopping the sweep freezes the current sweep trace on the display so that it can be observed.

Stopped  
(Run)

When the sweep is stopped, and the sweep mode is Single, the key is blue and is marked Stopped (Single).

Stopped  
(Single)

At other times, when the sweep is temporarily halted by the system, the key becomes red and is marked Paused. When sweep triggering is enabled (see next section) the key can provide triggering and arming functions which are indicated by other colours and markings.

#### 4.4.3.3 Triggered Sweep (when fitted)

When upgrade option U01 is fitted, it is possible to trigger the sweep using an external or internal trigger signal. Triggered sweep has a different action dependent upon the sweep mode (Single or Repeat).

If the sweep mode is set to **Single**, the effect of the trigger is to start the sweep. When a trigger event occurs a single sweep will be initiated. The trigger options are None, Ext +ve (trigger from a positive going edge on the external trigger input) or Ext -ve.

If Single ReArm is set to Auto, a sweep will be initiated every time a trigger event occurs. If Single ReArm is set to Manual, further trigger inputs are ignored after the first sweep. The Sweep Control key turns yellow and is labelled Stopped (Arm). Pressing the key changes the labelling to Run on Trigger, and a further sweep will be initiated as soon as a trigger event occurs.

If the sweep mode is set to **Repeat**, the effect of the trigger is to stop the sweep. The options are Free Run (no triggering), Ext +ve (trigger from a positive going edge on the external trigger input), Ext -ve, and Limits (trigger from the Limits comparator - see section 7.6.2). The key marking becomes Stop on Trigger.

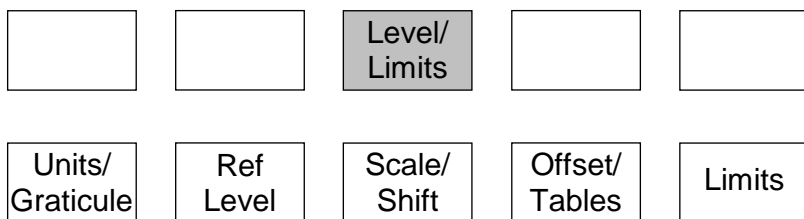
When a trigger occurs the current sweep will be completed after which the sweep control key will become blue and the sweep will remain stopped until it is restarted with the sweep control key. There is no separate Arming function for repeat mode sweeps.

Sweep triggering is turned off whenever the sweep mode is changed between Single and Repeat or vice versa.

Note that, when a Logging file is initiated, triggered sweep is automatically cancelled and set to Repeat mode and Free Run.

## 4.5 Setting the Level Attenuator, Amplitude Scale, and Limits

This menu group controls the input attenuator, thus changing the reference level, and controls the measurement units and scaling of the amplitude display. When option U01 is fitted, it also enables the sweep amplitude to be compared with limit lines or patterns and the use of level offset and compensation tables.



### 4.5.1 Measurement Units and Graticule

**Units/Graticule** sets the measurement units and controls the graticule display. Creates a set of bottom-row function keys as follows:

**dBm** provides measurement in dBm (dB milliwatts into 50 Ohms, where 0dBm = 1mW) and sets the graticule and graticule markings accordingly.

**dBuV** provides measurement in dBuV (dB micro volts across 50 Ohms, where 0dBuV = 1uV) and sets the graticule and graticule markings accordingly.

**Graticule** creates a pop-up menu enabling the Graticule to be dimmed or turned off completely.

### 4.5.2 Reference Level

**Ref Level** the reference level for amplitude measurement is changed by switching the attenuator On or Off. Creates a set of bottom-row function keys as follows:

**0dBm** sets the reference level to 0dBm (or 107dBuV) by setting the attenuator to On. The setting is shown within the upper area of the screen.

**-20dBm** sets the reference level to -20dBm (or 87dBuV) by setting the attenuator to Off. The setting is shown within the upper area of the screen.

### 4.5.3 Vertical Scaling

**Scale/Shift** enables the vertical amplitude scaling to be changed. Creates a set of bottom-row function keys as follows:

**Scale** creates a pop-up menu enabling the vertical scaling to be set to 10dB/div (the default) through to 1dB/div.

**Shift Down** **Shift Down** For scales below 10dB/div only a portion of the sweep amplitude will be visible and the Shift Up/Shift down keys can be used to pan the trace through the amplitude range of the graticule. These keys auto-repeat.

### 4.5.4 Amplitude Offset and Compensation Tables (when fitted)

- Offset/Tables** enables the amplitude scaling to be offset to match external attenuation or gain, or to add frequency dependent amplitude compensation tables to match transducers or antennae. These functions are only available when the upgrade option U01 is fitted - see section 6. Creates a set of bottom-row function keys as follows:
- Clear All** cancels any offset or compensations that have been set and returns the amplitude scaling to normal.
- Set** opens a control menu that enables compensation for a 75 Ohm source impedance, a fixed attenuation or gain, or a frequency dependent compensation table to be used. The functions can be used individually or together.

The three keys on the upper line select which function is to be controlled.

For 75 Ohm source, the options are only on or off.

For Fixed Offset, the Set Offset key creates a dialogue box by which an offset can be set between -50.0dB and +50.0dB. The set figure is added to the displayed reference level and to the graticule values and marker readout.



For Compensation Table, the Select Table key opens a file list of stored compensation tables that can be loaded. See section 7.5.2 for a full explanation.

Whenever offsets or compensations are active, a warning message is displayed at the top right of the graticule. See section 7.5.1 for safety warnings on the use of these function.

### 4.5.5 Amplitude Limits (when fitted)

- Limits** sets one or two horizontal lines or a complex patterns that can be compared with the sweep. This function is only available when the upgrade option U01 is fitted - see section 6. Creates a set of bottom-row function keys as follows:
  - Set Limits** creates a control screen that enables the selection of lines and patterns, or allows existing ones to be turned on or off. When Set Line is pressed, the value can be entered numerically in dBm or dBuV. When Select Pattern is pressed, a Recall File screen is opened enabling a pattern to be loaded from a file. See section 7.6.1.
  - Limit Condition** creates a pop-up menu that selects the criteria upon which a limit condition is created. The options are None, Above, Below, Outside or Inside.
  - Limit Action** creates a pop-up menu that selects an action that will be performed when the limit condition occurs. The options are None, Beep, Pulse Out, or Beep + Pulse Out.
- Note that other actions (sweep triggering or log file entry) can also be created from the limits condition. Further information on the Limits function is given in section 7.6.
- Limit Offset** creates a control screen from which a limit can be offset from its initial values. This is particularly useful for limit patterns which would otherwise have to be recreated.

## 4.6 Controlling and Storing Traces and Images

This menu group controls the traces that appear on the screen (as well as the markers that are used for measurement).



There are three traces: Live (green), View (white) and Reference (purple). Only the Live trace is updated from the sweep. The View trace is a temporary copy of the live trace created whenever the View key is pressed. The reference trace is recalled from a trace file stored within the instrument. Trace files can be saved from either the live trace or the view trace. Complete images of the screen can also be saved.

### 4.6.1 Displaying Traces; Controlling the View Trace

Traces Control	enables each of the three trace types to be turned on or off, controls the View trace, and enables traces and screen images to be stored and recalled. Creates a set of bottom-row function keys as follows:
Show Traces	enables each of the three trace types to be turned on or off via a pop-up menu.
View	copies the current Live trace to the View trace, and turns the View trace on if it was off. The View trace sits behind the live trace and can therefore be partly obscured by it.
View Off/On	toggles the View trace off, or back on without creating a new View (this is a shortcut to the function provided by the pop-up menu on the Show Traces key).
Swap	halts the live trace and swaps the order of the traces on the screen. Thus the View trace (white) sits in front of the halted live trace enabling it to be observed and analyzed using the markers. When the sweep is restarted with the Sweep Control key, the traces are swapped back so that the Live trace sits in front again.

#### 4.6.1.1 Understanding the Live, View and Reference Traces

The instrument can display three traces - Live, View and Reference which can be turned on or off individually using the **Show** key. Only the Live trace is updated from the sweep.

The Live trace is green and is normally on-top of the other traces. The Live trace can be “frozen” at any time by pressing the **Sweep Control** key directly under the graticule (see section 3.4) or the hard key marked Run/Stop. This also stops the sweep.

The Live trace can be duplicated to the View trace by pressing **View**. This enables an “instance” of the sweep to be captured without stopping the sweep. The View trace is white and is normally located behind the Live trace. The View trace is retained when the instrument is turned off.

The measurement markers normally operate on the Live trace. However, the Live and View traces can be “swapped” by pressing the **Swap** key. This stops the sweep and causes the View trace to be placed in front of the Live trace. When the traces are swapped, the measurement markers operate on the View trace.

When the sweep is re-started (or the Swap key pressed again), the View and Live traces are swapped back.

Either the Live trace or the View trace can be saved to a trace file (see section 5.1).

The Reference trace is purple and is always underneath the other traces if they are on. The reference trace is created by recalling a trace file from the memory. Measurement markers cannot be used on a Reference trace.

Note that the View and Reference traces relate to the frequency span, RBW and level settings that existed when they were stored. Changing these parameters will result in the graticule values and annotations no longer being correct for these traces.

However, it is possible to recall a Reference trace along with its State. This restores the frequency span, RBW and level settings that existed when it was stored (see section 5.1).

#### 4.6.2 Sweep Progress Indicator Line

There are two modes by which the live trace is updated from the sweep. For sweep times below approximately 1 second, the trace is updated at the end of the sweep. For longer sweep times, the trace is updated continuously while the sweep is taking place.

In this latter mode a yellow line appears at the bottom of the graticule indicating the progress of the sweep through its span.

#### 4.6.3 Setting the Trace Writing Mode

Trace Mode	provides control of the way in which the sweep is written to the Live trace. Creates a set of bottom-row function keys as follows:
Normal	each frequency point of the trace is written with the amplitude obtained from the current sweep.
Peak Hold	the trace is written with the highest amplitude value found for each frequency point since sweeping was commenced.
Average	the trace is written with the average amplitude value over a number of sweeps..
Average Number	creates a pop-up menu that enables the number of sweeps averaged to be set between 2 and 48 .
Reset	operates in both Average and Peak hold modes and re-starts the averaging or peak hold process from zero.

#### 4.6.4 Storing and Recalling Traces and Screen Images

Trace Stores	Traces or complete Screen Images can be stored as files under automatically incrementing names or user assigned names. Creates a set of bottom-row function keys as follows:
Store	enables the Live trace, the View trace, or a complete screen image, to be saved as a file. See section 5.1 for a full description of the Store function.
Recall	enables a stored trace to be recalled to the Reference trace on the screen. The Ref trace is purple and is always behind both the Live trace and the View trace. Recall also enables stored screen images to be viewed. See section 5.2 for a full description of the Recall function.

## 4.7 Using Measurement Markers

This menu group controls the markers that are used for measurement (as well as the traces that appear on the screen).

There are two markers M1 and M2 which provide a readout of amplitude at any frequency point on the trace. M2 can only be on if M1 is on, and the frequency difference between the two is also shown. Markers can be set to automatically find peaks, or track the largest peak.



### 4.7.1 Setting-up Markers

- Marker Setup

controls the visibility of the markers, their function, and their measurement units. Creates a set of bottom-row function keys as follows:
- Select

creates a pop-up menu that enables the markers, M1 and M2, to be turned on or off. Note that M2 can only be on if M1 is also on.
- Units

creates a pop-up menu that enables the marker measurement units to be set. Graticule Units provides logarithmic measurements in dBm or dBuV (as set within the Level/Limits > Units/Graticule menu).  $\mu$ W (micro watts) or mV (millivolts) changes the marker measurement to the appropriate linear scaling.
- Function

creates a pop-up menu with a choice of Scroll, Peak Find, or Peak Track modes. In Scroll mode a single press of the Move Left/Right keys cause the selected marker to move in one pixel steps (i.e. a frequency step of  $\text{span}/270$ ), whilst holding a key down auto-repeats in larger steps.

In Peak Find mode the Move Left/Right keys cause the selected marker to jump to the next peak of the trace in that direction. In Peak Track mode, the marker will attempt to maintain its position on the highest peak of the trace even when the peak frequency is changing (see section 4.7.2.2 for a fuller explanation of Peak Find/Track modes).

The current mode of a marker is shown on the left hand side of the marker read out. Two horizontal arrows indicate scroll mode whereas an upwards vertical arrow indicates peak-find mode. An upward arrow followed by a small T indicates peak-track mode.
- Fix / Unfix M1

fixes the amplitude reading of the M1 marker so that it no longer follows level changes from the sweep. The marker readout is preceded with the word "Fix". Pressing the key again, or pressing either of the marker "move" keys, returns M1 to normal operation.
- Move M2 to M1

moves the M2 marker to the frequency position of the M1 marker (also turns M2 on if it was off). This is intended for use with the Fix M1 function to enable amplitude changes at a specific frequency to be monitored.

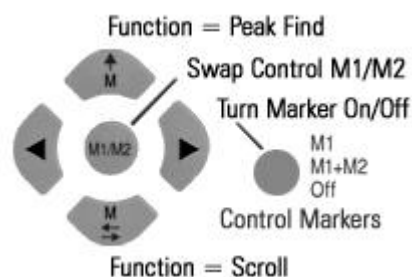
## 4.7.2 Controlling Markers

Marker Control	controls the frequency position of the markers. Creates a set of bottom-row function keys as follows:
M1/M2 Active	selects which marker is controlled by the marker movement keys. The active marker is indicated by an arrow (>) in front of its readout.
Manual Set	enables the frequency position of the active marker to be set numerically using similar frequency entry screens as for Set Centre (see section 4.1.1). Note that the marker position can be set outside of the current span and therefore off the screen.
Marker >Centre	moves the active marker to the sweep centre frequency (i.e. the centre of the trace). This is particularly useful if the active marker is off the screen.
Move Left	moves the active marker left or right either in frequency steps or from peak to peak of the trace depending on the Marker Mode (Scroll or Peak Find). In Scroll mode, a single press moves one pixel on the display and holding the key down causes it to move continuously in steps of about ten pixels.
Move Right	

### 4.7.2.1 Controlling Markers with the Hard Keys

The normal function of the five “navigator” hard keys in the centre of the instrument is to control the markers. This allows control at all times without the need to select the Marker Setup or Marker Control sub-group menus.

When the navigator keys are in this mode, the round key marked Control Markers is illuminated. If not, pressing the key will restore this mode. Pressing the key repeatedly cycles through selection of the visible markers (Both Off > M1 Only > M1 and M2 > Both Off).



Pressing the centre button on the navigator toggles the active marker between M1 and M2, or turns M2 on if it is off. Pressing the Up key selects Peak Find function, while pressing the Down key select Scroll function. Whenever the Up key is pressed, the selected marker will jump to the highest peak.

The Left and Right keys move the active marker left or right either in screen resolution steps or from peak to peak of the trace depending on the function.

Whenever the navigator mode is changed, an information box appears. This alert can be turned off if preferred - see section 4.10.3.3.

### 4.7.2.2 Further Notes on the Use of Markers

#### Function = Peak Find

Peak Find mode is selected from Marker Setup > Function or from the Navigate Up hard key, and is indicated by an upwards arrow on the left hand side of the marker readout. The mode is selected for the marker that is currently active.

Pressing the Navigate Up hard key places the currently selected marker on the largest peak of the trace.

Pressing the Move Left/Right keys will cause the instrument to attempt to position the marker on the next peak of the trace in that direction. The peak-find algorithm may sometimes place the marker on the rising or falling edge of a peak and its performance will depend upon signal and noise levels.



## Function = Scroll

Scroll mode is selected from Marker Setup > Function or from the Navigate Down hard key, and is indicated by two horizontal arrows on the left hand side of the marker readout. The mode is selected for the marker that is currently active.

## Function = Peak Track

Peak Track mode can only be selected for M1. It is selected from Marker Setup > Function, and is indicated by an upwards arrow followed by a capital T on the left hand side of the marker readout.

When selected the marker will attempt to track the highest peak of the live trace.

## Marker Frequency Precision

The frequency position of a marker is always shown to a resolution of 0.001MHz (1kHz). However, the actual position of the marker is a function of the span. If, for example, the span is set to 50MHz, each frequency point on the trace represents a “bucket” of frequencies 185kHz wide (span/270).

If the marker is set using the Move Left/Right keys, it will give a frequency readout equal to the upper frequency of the bucket. If the marker is set numerically to a specific frequency using Manual Set, the marker position on screen will jump to the upper frequency of the bucket that contains that numerical value.

If the span is reduced, the accuracy of the marker frequency readout improves. However, it is only when the span is reduced to 270kHz that the marker frequency position becomes accurate to 1kHz.

## “Off Screen” Markers

Markers are positioned by absolute frequency. Consequently, when the frequency span of the sweep is changed, the marker may no longer appear within the trace area. This is indicated by an arrow within the marker readout replacing the amplitude value.

The frequency position of the marker is retained, but no amplitude information is available. If the frequency span is subsequently changed to include the marker frequency, it will reappear in the correct position.

Pressing the Navigate Up hard key (Peak Find mode) will bring the marker on screen at the highest level in the trace.

Re-positioning a marker using the Move Left/Right keys will cause it to reappear immediately from the appropriate side of the graticule. Alternatively pressing Marker>Centre in the Marker Control sub-group menu will cause it to appear in the centre of the screen.

## Marker Mode Symbols

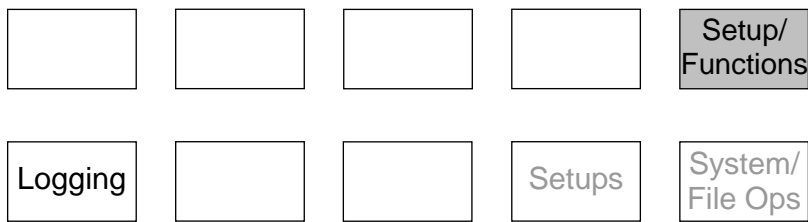
- ▶↔M1: 80.0000MHz -64.7dBm Marker in Scroll mode
- ▶↑M1: 80.0000MHz -64.7dBm Marker in Peak Find mode
- ▶↑M1: 80.0000MHz -64.7dBm M1 in Peak Track mode
- ▶F<sub>x</sub>M1: 80.0000MHz -64.7dBm M1 in Fixed mode
- ▶↑M1: 80.0000MHz → Marker above Stop frequency
- ▶↑M1: 80.0000MHz ← Marker below Start frequency

## Marker Difference Readout

If both markers are turned on, the difference in frequency and level is shown in grey underneath as Mdelta. The readout represents the M2 values minus the M1 values (M2 - M1).

## 4.8 Data Logging Functions (when fitted)

This menu group controls logging functions when fitted (see section 6.1). It also controls store/recall of instrument set-ups and access to system functions, which are covered in the next section - section 4.9.



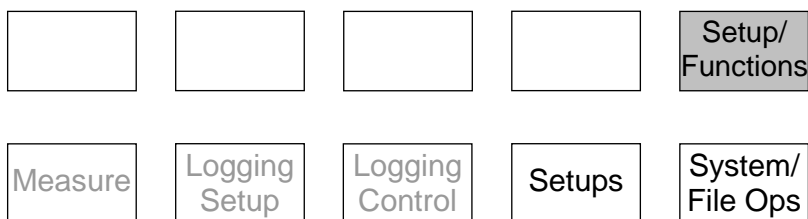
### 4.8.1 Setting-up the Logging Function

- Logging** Logging is only available when the upgrade option U01 is fitted. Logging enables files containing multiple traces, screen images or peak values to be created in response to trigger events or a timer. Creates a set of bottom-row function keys as follows:
- Log Type** creates a pop-up menu that enables the type of log file to be selected. **Centre Amplitude** logs only the amplitude at the centre frequency. **Peak Value** logs the frequency and amplitude of the highest peak in every sweep. **Trace** logs the whole trace. **Screen Image** logs the whole screen as a bit-map image.
  - Log Trigger** creates a pop-up menu that enables selection of the trigger event that will cause each logging entry. The options are Manual, Timer, Ext +ve, Ext -ve, Limits and Continuous.
  - Timer Setup** enables the time interval between logging events to be set. The timer value is only used when the log trigger is set to Timer.
  - Logging Control** opens a new control menu from which the logging function to be controlled (see section 7.7.1).

For a more detailed description of the Logging function see section 7.7 .

## 4.9 Storing and Recalling Set-ups | System Settings

This menu group controls storing and recalling complete instrument set-ups, and access to system functions such as screen brightness and file operations (as well logging when fitted - see section 4.8).



### 4.9.1 Storing and Recalling Instrument Setups

- Setups** enables the complete setup of the instrument to be stored and recalled via user nameable files. See section 5.7.3 for an explanation of setup files. Creates a set of bottom-row function keys as follows:
- Presets** opens the Presets menu, duplicating the action of the PRESET hard key (see section 4.11).
- Store Setup** **Recall Setup** opens the store and recall control screens for setup files. See sections 5.3 for a description of the store screens, and section 5.4 for a description of the recall screen.
- Load Defaults** loads the factory default setup, thus restoring the instrument status to its original ex-factory settings. Note that no user-created files are modified or deleted.

### 4.9.2 System Settings, Screen Brightness, Filing System and USB Operations

- System/File Ops** provides access to some system and file management options, including screen brightness and file transfer via USB. Creates a set of bottom-row function keys as follows:
- System Utilities** opens the System Utilities special menu, which is also available via the Status/Help hard key (see section 4.10)
- File Ops** enables file management in terms of renaming, deleting and copying of files to or from a Flash Memory Drive or a PC using the USB link (see section 5.6.2).

				Brightness 50%
Freq/ Span	Sweep/ BW	Level/ Limits	Traces/ Markers	Setup/ Functions
Measure	Logging Setup	Logging Control	Setups	System/ File Ops
System Utilities	File Ops		Display Darker	Display Brighter

- Display Darker** **Display Brighter** changes the screen brightness and provides a bar graph showing the current brightness level.

## 4.10 Status Information | On-screen Help | System Utilities

This menu group is accessed using the hard key marked STATUS/Help or by the soft key Setup/Functions > System/File-Ops > System Utilities. When the key is pressed, the normal key menu is replaced by a special menu as shown opposite.



### 4.10.1 Status Display

When the Status/System key is selected, the top part of the screen is replaced by a detailed listing of the current instrument setup conditions.

The status information is split over three pages. Press Status again to access the next page or press Exit to return to normal operation and restore the menu group and sub-group that were in place when the Status hard key was pressed.



### 4.10.2 Help Screens

Help information is available from the same menu system as is status, by pressing the Context Help or Topic List keys.

**Context Help** brings up a help screen relevant to the menu sub-group that was in use prior to the Status/Help key being pressed.

Context Help may cover several pages, these are selected with the Next/Prev Page keys.

**Topics List** brings up a topics list from which all of the individual help screens can be selected. Select the required menu sub-group using Move Up/Down and confirm with Select Topic.

Pressing Exit when displaying a Help screen returns the analyzer to normal operation.

### 4.10.3 System Utilities

**System Utilities** Pressing Setup/Functions > System/File-Ops > System Utilities, or the Status hard key followed by Status/System brings up a sub-group menu as follows:

#### 4.10.3.1 Screen Utilities

**Screen** enables aspects of the TFT color screen to be adjusted. Creates a set of bottom-row function keys as follows:

**Calibrate Screen** opens a calibration screen for the touch screen. (The touch screen is a resistive layer which overlays the TFT screen. From time to time it may be necessary to re-calibrate the positional accuracy of the system).

Calibration must be done using a stylus, and the centre of the “bulls eye” must be touched accurately in each of three positions. To abort the calibration, press the Exit hard key.

**View On PC** View on PC is only available with the upgrade option U01 is fitted. It places the instrument into a special mode in which the graphics of the display are sent to a PC via USB. See section 7.8.

Bright  
Level\*\*

opens an information box explaining where the screen brightness controls are located (Setup/Functions > System/File Ops). This is because screen brightness should be adjusted with the trace and graticule displayed rather than the status screen.

#### 4.10.3.2 Power Options, Power On State, Clock Setting

Power/  
Clock

enables aspects of the power on-off system to be set, along with the real-time clock. Creates a set of bottom-row function keys as follows:

Set Date  
& Time

opens a dialogue box from which the date and time can be set for the real-time clock. Times are in 24 hour format and dates are day-month-year.

Auto  
Off

creates a pop-up menu that enables the instrument to be automatically turned off after a period of inactivity. Options are Never and 5 mins to 60 mins. Auto Off ceases to operate when the instrument is externally powered.

Pwr-On  
State

creates a pop-up menu that enables the condition of the instrument at switch-on to be set. Options are Last Used (restore the settings that existed at switch off), or User Preset (over-ride previous settings with those defined in the User Preset - see section 4.11.1).

#### 4.10.3.3 Alerts

Alerts

enables certain elements of the user interface to be turned on or off. Creates a set of bottom-row function keys as follows:

Beep

creates a pop-up menu that enables the warning beep to be turned on or off. Beeps are created in response to illegal operations such as setting an out-of-range value.

Navig.  
Prompt

creates a pop-up menu that enables the information boxes that confirm and explain the current mode of the navigator keys (control markers or navigate touch screen) to be turned on or off.

#### 4.10.3.4 System Updating and Calibration

System  
Update

enables updating of the instrument firmware or recalibration of the instrument. Creates a set of bottom-row function keys as follows:

Calibrate  
Hardware

opens a dialogue box which enables the instrument to be recalibrated. Recalibration should only be performed by skilled personnel with access to precision equipment and in conjunction with the Service Guide.

Install  
Options

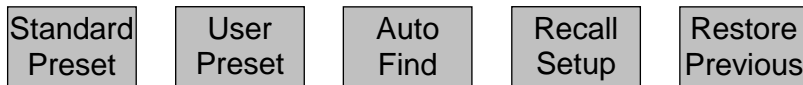
enables firmware-based options to be installed. See section 9.1.

Update  
Firmware

enables firmware updates to be installed. See section 9.1 .

## 4.11 Using Instrument Presets | Automatic Setting

This special menu is accessed using the hard key marked PRESET (Presets/Auto). Its function is to enable the overall setup of the instrument to be changed quickly to suit specific requirements.



Standard Preset	sets the frequency, level and sweep parameters back to known state (see section 8.1). It differs from the Factory Default setup in that it does not override user preferences such as screen brightness, auto-off timer etc.
User Preset	sets the frequency, level and sweep parameters back to defined state as set by the user. It is initially identical to the Standard Preset, but can be modified by the user to match their specific preferences - see section 4.11.1.
Auto Find	performs a maximum-span sweep at the widest RBW and then sets the centre frequency, span, RBW and Level to create a useful display of the highest amplitude point found within the initial sweep. The Auto Find function takes several seconds to complete.
Recall Setup	goes directly to the Recall Setup control screen from which any setup file can be recalled.
Restore Previous	restores the setup to its condition at the point that the Presets hard key was pressed.
Execute	executes the operation selected by any of the above keys.
Presets Help	creates a Help screen specific to the Presets function.
Exit	restores the menu and sub-group menu that were in place when the Presets hard key was pressed.

### 4.11.1 The User Preset

The User Preset is a user-modified version of the Standard Preset. To change the action of the user preset, set up the spectrum analyzer as required and select **Save Current** from the User Preset function keys. The parameters as described in section 8.1 will be overwritten by their current values.

If preferred, the User Preset can be loaded whenever the instrument is switched back on from off - see section 4.10.3.2.

## 5 File Storage - Traces, Screens, Setups, Logs, Tables

The instrument incorporates a large Flash based disk drive for the storage of a variety of different file types including Traces, Screen Images and Instrument Set-ups. When the upgrade pack (U01) is fitted it may also include Logging Files, Limit Pattern Tables and Amplitude Compensation Tables.

The instrument filing system provides a consistent method for storing, recalling, renaming, deleting and copying files. Files can be transferred to and from a personal computer for backup, analysis, printing and documentation purposes.

Whenever files are being accessed, the front panel LED marked **Disk** flashes. Depending upon the file operation in progress, there may be a significant delay before further key operations are possible.

### 5.1 Storing Traces or Screens

Storing of Traces or Screen Images is controlled from the menu function:

Traces/Markers > Traces/Stores > Store.  
(as described in section 4.6.4)

This function enables a trace or screen image to be stored as a file within the internal memory. (N.B. external memory cannot be used to store files directly, although files can be copied to external memory later).

The menu keys are replaced by a control screen as shown.

The top row of keys sets what will be stored: the Live Trace, the View Trace, or a Screen Image. The currently selected file type is shown in the green box above the keys.

See section 5.7 for an explanation of Trace files and Screen Image files.

There are two methods for saving to a file: **Quick Save** and **Save As**.

**Quick Save** stores the trace or screen under an automatically incrementing name (e.g. TRACE001 etc.) as set by the Default name as described below in section 5.1.1.1.

The key can be pressed repeatedly to store traces/images as they appear. The next name that will be used is shown in yellow within the area above the keys.

**Save As** halts the trace update (causing the sweep status key to go to Pause) and enters the next screen as shown.

The auto-allocated file name is shown (based upon the current default file name), and pressing **Save** will store the file under that name. However, the option also exist to change the name before saving.

Pressing **Change Name** brings up an alpha-numeric keypad which can be used to enter any name of up to eight characters that the user may choose.

See section 5.6.1.

Freq / Span	Sweep / BW	Level / Limits	Traces / Markers	Setup / Functions
Traces Control	Trace Mode	Traces Stores	Marker Setup	Marker Control
Store	Recall			

Store Live Trace		Next Name = TRACE001		
	Live Trace	View Trace	Screen Image	
Quick Save		Save As		EXIT

		PAUSE		
Continuous Sweep		Default Name = TRACE		
Store Live Trace		File TRACE001.CSV		
		Change Default	File Utilities	
Save		Change Name	EXIT	

Pressing **Save** completes the storing of the file under the chosen name.

The default name can also be changed by pressing **Change Default**. Any name of up to five characters can be used - see section 5.1.1.1 below.

It is also possible to delete or rename files from this screen by pressing **File Utilities** - see section 5.5.

### 5.1.1.1 Default File Name Rules

Default names are always five characters long, but the user can choose to enter less than five characters and the system will add the appropriate number of underscores at the end. The five characters are followed by a three digit number that starts at 001 and auto-increments up to 999.

Deleting files will have no effect on the increment system so that, if the user had created fifteen files and then deleted them all, the next file saved would still have the number 016. Should the number reach 999, the auto increment will start again at 001. If this file already exists, the user will be prompted to delete or rename files or to change the default name.

If the user needs to check the list of existing stored files, or to rename or delete files, this can be done by pressing **File Utilities** - see section 5.5.

## 5.2 Recalling Traces and Images

The Recall function from the Traces/Stores sub-group menu (see section 4.6.4) creates a control screen as shown.

The top line of keys enable the selection of the type of file to be recalled.

Trace files can be recalled in three different ways, Trace & State, Trace Only, or State Only. See section 5.7.1 for an explanation.



Screen images can also be recalled from this screen. A recalled screen image overwrites the existing graticule and annotation area. Recalling an image takes around three seconds, with the image building from the bottom upwards.

Pressing **Recall File** opens a file list which can show any of the currently stored files of the selected type. See section 5.4 for an explanation of the File Recall screen.

Pressing **Recall Next** or **Recall Prev.** recalls the next or previous file in the list without the need to re-enter the File Recall screen. This is particularly useful when searching through stored screen images.

### 5.2.1 Traces and States

A trace file represents the swept trace as appears upon the screen along with information that defines the frequency span, RBW, VBW and reference level at the time that it was stored. The latter information is referred to as the State.

When a trace file is recalled, the user can choose to recall the whole file (Recall Trace & State), the trace amplitude values only (Recall Trace) or the State values only (Recall State). Whenever the State is recalled, the spectrum analyser set-up is changed to match the parameters within the recalled file.



## 5.3 Storing Instrument Set-up Files

Storing of Instrument Set-ups is controlled from the menu function:

Setup/Functions > Setups > Store Setup.  
(as described in section 4.9.1)

This function enables a complete instrument set-up to be stored as a file within the internal memory. (N.B. external memory cannot be used to store files directly, although files can be copied to external memory later).

The menu keys are replaced by a control screen as shown.

The auto-allocated file name is shown (based upon the current default file name), and pressing **Save** will store the file under that name. However, the option also exist to change the name before saving.

Pressing **Change Name** brings up an alpha-numeric keypad (see illustration in section 5.6.1) which can be used to enter any name of up to eight characters that the user may choose.

In the event that a file with that name already exists, a warning message will be displayed.

The default name can also be changed by pressing **Change Default**. Any name of up to five characters can be used - see section 5.1.1.1

It is also possible to delete or rename files from this screen by pressing **File Utilities** - see section 5.5.

Freq / Span	Sweep / BW	Level / Limits	Traces / Markers	Setup / Functions
Logging			Setups	System / File Ops
Presets	Store Setup	Recall Setup	Load Defaults	

Store Setup		Default Name = SETUP		
File SETUP001.SET		Change Default	File Utilities	
Save		Change Name	EXIT	

## 5.4 File Recall Screen

The recall screen for any file type uses the whole of the display area in order to include a file list. The list consists of the file name (without its extension) the date of storage (in format dd/mm/yy) and the time of storage (in 24 hour format hh:mm). A moveable pointer operated by the **Up** and **Down** keys shows which file is to be executed.

The keys that control the file selection are in a vertical list on the right hand side.

One screen can show 20 files simultaneously.

Pressing **Page Up** or **Page Down** scrolls through the files in blocks of twenty.

By default, files appear within the list in date/time order with the oldest files at the top.

Pressing **All Files** returns to this listing type at any time.

Pressing **Latest Files** will show a screen of up to 20 files that represent the most recently stored or recalled files.

Files can also be found from their starting character using **File A-Z**.

All-files List: ▶ 0004 of 0154 files				
Name	Date	Time		Up
PTB44-01	28-04-12	11:23		
PTB44-02	28-04-12	11:24		
PTB44-03	28-04-12	11:28		Down
▶ PTB44-04	28-04-12	11:37		
TRACE001	01-05-12	14:15		Page Up
TRACE002	01-05-12	14:15		
TRACE003	01-05-12	14:16		
FIX-01	03-05-12	16:22		Page Down
PTB45-01	03-05-12	09:37		
PTB45-02	03-05-12	09:44		
ROGER-A	17-05-12	10:07		All Files
PTB48-01	17-05-12	10:18		
FAULT-A1	17-05-12	10:33		
FAULT-A2	04-06-12	16:56		Latest Files
FAULT-B1	04-06-12	17:05		
FAULT-B2	04-06-12	17:11		
FAULT-B3	04-06-12	17:11		Find A-Z
ROGER-B	04-06-12	17:23		
FIX-01A	16-07-12	12:24		
FIX-01B	17-07-12	12:33		
Recall Trace				File Utilities
Recall				EXIT

Pressing **Find A-Z** brings up an alpha numeric keyboard. When a character is pressed the keypad disappears and the listing then shows only files that start with that character.

Pressing **Recall** executes the file operation.

It is also possible to delete or rename files from this screen by pressing **File Utilities** - see section 5.5.

## 5.5 File Utilities Screen

Store and Recall screens include a **File Utilities** key which enables files to be renamed or deleted.

The layout is similar to a File Recall screen - see section 5.4 .

Pressing **Rename** brings up the alpha-numeric keypad from which the file name can be changed.

See section 5.6.1 for an explanation of file renaming.

Pressing **Delete** asks for confirmation before permanently deleting the selected file.

## 5.6 File Operations Screen

The File Operations screen is an extended version of the File Utilities screen provided for Store and Recall. It can be used for all types of file, supports external Flash memory drives, and also provides access for the "Link to PC" USB connection.

File Operations is selected from the Setup/Functions menu:

Setup/Functions > System/FileOps > File Ops.

The upper row of keys enables the file type to be selected (Traces, Images, Setups etc.).

The upper section of the screen shows a file list for the selected file type, and is similar to the File Utilities screen except that the options of Latest Files and Find A-Z are not available.

The lower row of keys provides further options and actions.

Pressing **Switch Drive** enables the files present on an external USB Flash drive to be listed in place of the internal drive. If no external drive is connected, the key will have no effect.

Pressing the key repeatedly alternates between the two drives. The currently selected drive is displayed within the green box.

On the first occasion that the external drive is accessed there will be a delay and a warning message will be displayed - see section 5.6.3.

				Back
Rename	Delete			EXIT

Freq/ Span	Sweep/ B/W	Level/ Limits	Traces/ Markers	Setup/ Functions
Measure	Logging Setup	Logging Control	Setups	System/ File Ops
System Utilities	File Ops		Display Darker	Display Brighter

All-files List: ▶ 0004 of 0154 files				Up
Name	Date	Time		Down
PTB44-01	28-04-12	11:23		Page Up
PTB44-02	28-04-12	11:24		Page Down
PTB44-03	28-04-12	11:28		All Files
▶ PTB44-04	28-04-12	11:37		Latest Files
TRACE001	01-05-12	14:15		Find A-Z
TRACE002	01-05-12	14:15		
TRACE003	01-05-12	14:16		
FIX-01	03-05-12	16:22		
PTB45-01	03-05-12	09:37		
PTB45-02	03-05-12	09:44		
ROGER-A	17-05-12	10:07		
PTB48-01	17-05-12	10:18		
FAULT-A1	17-05-12	10:33		
FAULT-A2	04-06-12	16:56		
FAULT-B1	04-06-12	17:05		
FAULT-B2	04-06-12	17:11		
FAULT-B3	04-06-12	17:11		
ROGER-B	04-06-12	17:23		
FIX-01A	16-07-12	12:24		
FIX-01B	17-07-12	12:33		
File Operations: Internal drive				Select File Type
Traces	Images	Logs	Setups	Limits
Link to PC		File Actions	Switch Drive	EXIT

Pressing **Link to PC** causes all spectrum analyzer operation to be suspended and enables a connection to be made to a personal computer.

See section 5.6.4 for a detailed explanation.

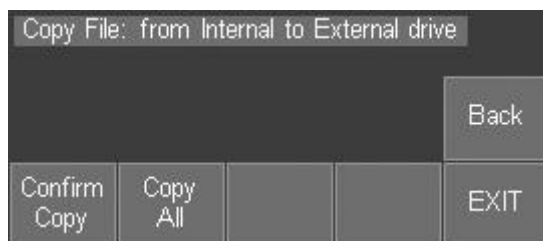
Pressing **File Actions** changes the screen to provide options of Rename, Delete or Copy.

Rename and Delete operate in a similar way as for the File Utilities screen - see section 5.5.



The Copy function copies a file from the currently selected drive. Files can therefore be copied from the internal drive to the external drive or vice versa by using Switch Drive on the previous screen.

It is also possible to copy all files of the selected file type by using Copy All.



### 5.6.1 Editing File Names

Editing a file name (Store File screen) or renaming a file (File Utilities or File Ops screens) uses an alpha numeric key matrix. The matrix replaces the upper screen area.

The whole of the required name must be entered. It is not possible to edit an existing name character by character.

The new name appears at the bottom of the screen replacing the eight triangles shown in the illustration.

Names can be from one to eight characters long and can include upper case letters, numbers, dash (-), and underscore ( \_ ).

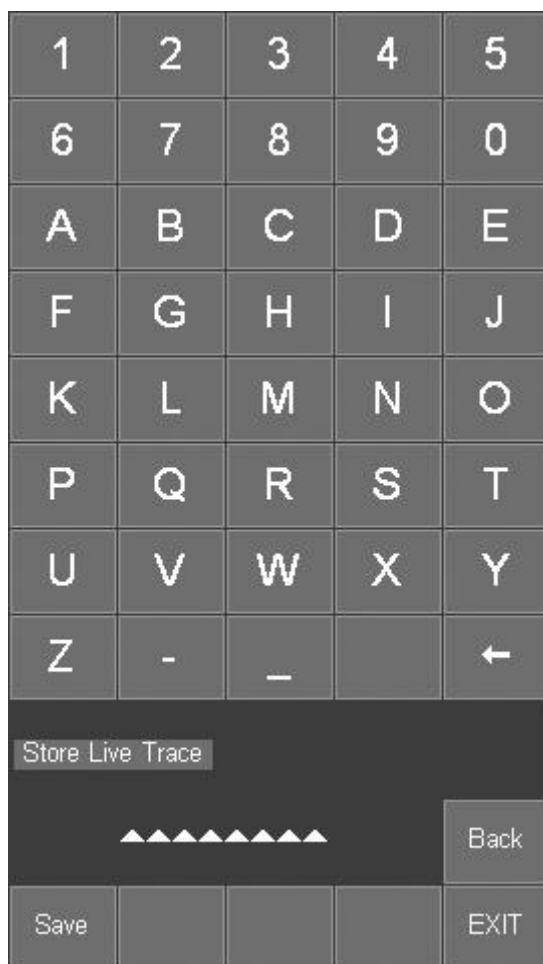
Corrections can be made during entry using the back-space key.

In the event that a file with that name already exists, a warning message will be displayed.

Pressing **Save** applies the new name and returns to the previous screen.

Pressing **Back** returns to the previous screen without applying the new name.

Pressing **Exit** leaves the selected filing system function immediately.



### **5.6.1.1 File Names Created or Renamed Externally**

Files may be created externally or created within the instrument and renamed externally (e.g. using Link to PC mode). Such files may have long file names and/or include lower case characters and additional characters such as ?.

The instrument will correctly list all such files that conform with an 8.3 naming system and which have the correct extension for the relevant folder. Where the file name exceeds eight characters, it will truncate the file name using a ~1 convention.

Files with the wrong extension, or which have been placed in the wrong folder will not be visible to the instrument filing system. See section 5.7 for a description of file types and their file extensions.

### **5.6.2 Internal Filing System Organisation**

The organisation of the instrument filing system is not visible to the user from within the instrument. Although a folder system exists, files are automatically placed into, or retrieved from, the correct folder whenever a particular type of file is being used.

Similarly, when an external flash drive is connected, the instrument will automatically select the correct external folder for the current file type.

The folder structure of the internal drive is only visible when linked to a PC - see section 5.6.4.

### **5.6.3 Using an External Flash Drive**

The USB Type A connector on the left hand side of the instrument is arranged as USB Host and is intended exclusively for the connection of a USB Flash Drive.

This enables files to be copied to and from the internal memory of the instrument. Note that files cannot be loaded from or saved to external memory directly.

Copy operations are performed using the File Ops (File Operations) function - see section 5.6.

The instrument pre-defines a folder system for the USB Flash Drive whereby different file types are placed in specific folders. These folders are automatically created when the File Ops function is selected with a Flash Drive plugged in.

A master folder is created called PSA within which are sub-folders named TRACES, IMAGES, SETUPS, LOGS, and TABLES. Files copied from the instrument onto the external drive are automatically placed into the correct folder. However, where files are being placed onto the external drive from a personal computer, they must be put into the correct folder or it will not be possible to copy them onto the instrument.

Note that, whenever the File Ops function is first used after a USB Flash Drive has been plugged in or the instrument has been switched off, the files on the Flash Drive will be interrogated and an information message will appear asking the user to wait for this to take place.

If the Flash Drive is of large capacity and/or contains a large number of files, the interrogation could take a long time. If the user wishes to abort this procedure, they may do so by simply unplugging the Flash Drive. To avoid long delays, it is recommended that Flash Drives containing large numbers of un-related files are not used.

Note that it is not possible to connect a USB Flash Drive if the USB Link to PC connection is in place.

## 5.6.4 Linking to a PC via USB

The USB Type Mini B connector on the left hand side of the instrument is arranged as USB “device” and is intended exclusively for connection to the USB port of a personal computer for the transfer of files to or from the internal memory of the instrument.

The connection should be made using the cable supplied, which is a standard USB Mini B plug to USB Standard A plug. Note that it is not possible to use the USB Link to PC when a USB Flash Drive is connected.

“Link to PC” mode is selected via Setup/Functions > System/FileOps > File Ops > Link to PC see section 5.6. When the key is pressed all spectrum analyzer activity is suspended and the instrument waits for the PC to recognise its Flash based disc drive and “log it on”.

When the link is enabled, the internal drive of the instrument appears on the PC as a removable disc drive. When in this condition, the PC is in control of the link and file operations are performed on the PC using Windows Explorer or a similar file system manager.



When in this mode, all of the user area of the internal drive becomes accessible. It is therefore possible to rename files and directories, delete directories or to add invalid files. Care must be taken NOT to do this.

The internal drive contains a master folder named PSA within which are five folders: TRACES, IMAGES, SETUPs, LOGS, and TABLES. Only the correct file types must be placed into these folders, no files should be placed in the Root folder and no additional folders created.

Note that it is possible to place files with long filenames into the folders provided that the extension is correct and the files themselves are valid - see section 5.6.1.1.

The link can be closed by pressing the EXIT hard key. When this happens, the instrument re-checks its filing system in order to ensure that changes have not been made that would cause system problems. This may take several seconds.

When this has been completed, normal spectrum analyzer operation resumes.

## 5.7 File Types

The basic instrument uses three file types: Traces, Images and Setups. If option U01 is installed, several further file types become available.

### 5.7.1 Trace Files

A trace file represents the swept trace as appears upon the screen. A trace file can be recalled to the screen as a reference trace (purple).

The file consists of a set of 271 values representing the trace amplitude from left to right across the screen in CSV (comma separated variable) format, plus additional information that defines the frequency span, RBW, VBW and reference level.

The latter information is referred to as the State. When a trace file is recalled, the user can choose to recall the whole file (Recall Trace & State), the trace amplitude values only (Recall Trace) or the State values only (Recall State). Whenever the State is recalled, the spectrum analyser set-up is changed to match the parameters within the recalled file.

Trace files are small being a few kilobytes each. Within the instrument they use an 8.3 naming format with the extension .CSV. A maximum of 999 files can be stored within the internal memory of the instrument. Trace files can be copied to a PC and imported into graphing programs such as Excel, MathCad etc.

Trace files can also be displayed using PSA-Manager software which is supplied with Option U01.

## 5.7.2 Screen Image Files

A screen image file represents a "snapshot" of the whole of the screen excluding the key area. A screen file can be recalled in a similar way to an image on a digital camera, whilst sweeping of the spectrum analyser is suspended (Paused). It can also be exported to a PC and printed for documentation purposes.

Screen files are indexed colour bitmaps of about 50 kilobytes in size. Within the instrument they use an 8.3 naming format with the extension .BMP. A maximum of 999 files can be stored within the internal memory of the instrument. Screen files can be copied to a PC and imported into photo viewing and editing programs such as Windows Picture and Fax Viewer, Paint, Photoshop etc.

Image files can also be displayed using PSA-Manager software which is supplied with Option U01.

## 5.7.3 Setup Files

A setup file records the complete state of the instrument at the point that it was saved, including marker positions, the view trace and the reference trace.

Setup files are small being a few kilobytes each. Within the instrument they use an 8.3 naming format with the extension .SET. A maximum of 999 files can be stored within the internal memory of the instrument. Setup files can be copied to a memory stick or onto a PC for backup purposes, but have no function outside of the instrument.

## 5.7.4 Other File Types

When Option U01 is fitted (see section 6) three other file types can exist. These are Compensation Table files, Limit Pattern files, and Logging files. Details of the functions are provided within section 6 of the manual.

### 5.7.4.1 Compensation Tables

Compensation tables are normalised files of amplitude versus frequency which must be created outside of the instrument using PSA-Manager software. They are a few kilobytes in size.

They files have the extension .CMP and are located in the folder named TABLES. Files can be transferred using either a USB Flash drive, or by direct connection to the USB port of a PC.

### 5.7.4.2 Limit Pattern Tables

Limit pattern tables are normalised files of amplitude versus frequency which must be created outside of the instrument using PSA-Manager software. They are a few kilobytes in size.

They have the extension .CSV and are located in the folder named TABLES. Files can be transferred using either a USB Flash drive, or by direct connection to the USB port of a PC.

### 5.7.4.3 Logging Files

Logging Files record multiple entries of sweep data in response to a variety of trigger signals. They can contain several types of data and are variable in size up to tens of megabytes. They have the extension .LOG and are located in the folder named LOGS.

The files are created within the instrument and must be transferred to a PC for analysis using PSA-Manager software. Files can be transferred using either a USB Flash drive, or by direct connection to the USB port of a PC.

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## 6 Upgrade Option U01

The capabilities of the instrument can be enhanced by installing the upgrade option U01 which adds additional firmware to the instrument.

Option U01 can be downloaded from the Aim-TTi website and can be installed by the user without any requirement to return the instrument to its supplier. Activation of the upgrade is achieved via an activation code which can be purchased from the Aim-TTi website, or from our distributors and agents across the world.

### 6.1 Additional Functions from Option U01

The following facilities will be incorporated. Additional facilities may also have been added - see the Aim-TTi website for up to date information.

#### 6.1.1 Logging of Values, Traces or Screens

The Logging function enables results to be saved into log files in response to a timer or to a trigger event. Individual amplitude values, complete traces, or full screen images can be saved.

See section [4.8.1](#) for more information.

#### 6.1.2 Triggering

The triggering function enables sweeps or logging to be triggered in response to an internal or external trigger event. The internal trigger event can be generated by the Limits function.

See section [7.4](#) for more information.

#### 6.1.3 Limit Lines and Patterns

Limit lines and patterns can be shown on the display, and compared with the trace. They can be used to trigger a logging event, generate an audible warnings or output a trigger pulse.

Limit lines are simple straight lines whereas limit patterns are frequency dependent amplitude limits that are stored as files. Two limits can be used simultaneously.

See section [7.6](#) for more information.

#### 6.1.4 Level Offsets

The level offset function enables the level values for the graticule and markers to be corrected for external attenuation or gain. Compensation can also be made for signals coming from a  $75\Omega$  source.

#### 6.1.5 Compensation Tables

Compensation tables are lists of amplitude versus frequency which enable frequency related amplitude variations from antennae or transducers to be compensated for within the spectrum analyzer.

Compensation tables are stored as files. See section [7.5.2](#) for more information.

#### 6.1.6 View on PC

View on PC places the instrument into a special mode in which the graphics of the display are sent to a PC via USB. The screen can then be viewed at any size using PSA-Manager.

#### 6.1.7 PSA-Manager Software

PSA-Manager is a Windows based software application which is used in conjunction with the instrument. It provides the capability for displaying and printing Traces and Screen Images, display and analysis of Log files, and creation of Limit Patterns and Compensation Tables.

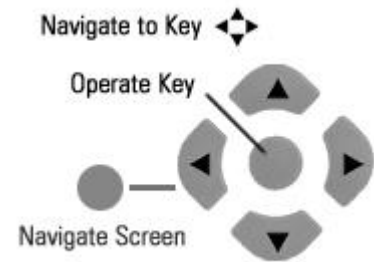
See section [13](#) for more information.

## 7 Further Notes on Operation

### 7.1 Operation using the Hard Keys Only

Although the instrument is designed to be operated via the touch screen, it is also possible to operate it using only the hard keys. This may be appropriate in particular circumstances such as when the user is wearing gloves.

Hard-key-only operation is activated by pressing the circular button marked **Navigate Screen** which then illuminates. This changes the function of the five Navigator keys from controlling the Markers to controlling the position of the on-screen key highlight.



The highlight position is shown by a change in the key color to purple. Pressing the centre button operates the key.

Almost all menu functions can be operated in this way. Pop-up menus and other special function screens can be exited by pressing the EXIT hard key. An exception is the Set by Tab/Jog function, described in section 7.2.2, where the horizontal and vertical navigator keys operate the tab and jog functions respectively.

Note that, if a touch-screen key is pressed directly, the "hard-key only" mode is cancelled and the **Navigate Screen** button ceases to be illuminated. To re-enable the mode, the button must be pressed again.

Whenever the navigator mode is changed, an information box appears similar to that shown above. If preferred, this reminder can be turned off - see section 4.10.3.3.

### 7.2 Setting Frequencies

The control screens used for setting frequencies are common to Set Centre, Set Span, Set Start, Set Stop, Set Step and Marker Manual Set. The following illustrated example is for Set Centre but is similar for all other frequency setting functions.

Set Centre
------------

 pressing this key will bring up either the Set by Keybd (set by keyboard) screen or the Set by Tab/Jog screen depending upon which one was last used for setting that frequency parameter.

#### 7.2.1 Set by Keyboard

This control screen replaces the menu with a 0 to 9 keyboard. The frequency is entered in MHz using the decimal point if required (maximum resolution 0.001MHz). Frequencies can be entered in whole MHz when kHz resolution is not needed.

Entry errors can be corrected with the back-space key (←).

Pressing OK sets the entered frequency without leaving the control screen. The frequency value is cleared ready for entering a new value.

Pressing OK & Exit sets the entered frequency and returns to the menu.

Pressing Exit/Cancel returns to the menu without setting the entered frequency.

Pressing Previous returns the frequency to the value directly prior to the last frequency entry.

Pressing Tab/Jog changes to the alternate control screen as detailed below.





## 7.2.2 Set by Tab/Jog

This control screen replaces the menu with a display of the existing frequency and enables it to be changed.

Pressing either of the Tab keys moves the arrows left or right along the digits.

Pressing either of the Jog keys increments or decrements the value of that digit.



The Jog keys auto-repeat, and the new frequency is accepted and executed after a delay of around two seconds.

Pressing Exit returns to the menu. Pressing Set by Keybd changes to the alternate control screen as detailed above.

Note that when Navigate Screen mode is selected, the navigator keys perform the tab/jog function directly - see section 7.1.

## 7.2.3 Shortcuts to setting a Specific Frequency Span

### Narrower Span

Having set a frequency span in which the signals of interest are visible, the user may wish to examine a specific part of the span at greater resolution.

If the point of interest is the highest level within the current sweep, it can be moved to the centre of the screen from the Centre sub-group menu (Freq/Span > Centre > Set C=Pk).

Alternatively, marker M1 can be placed at the point of interest and moved to the centre of the screen from the Centre sub-group menu (Freq/Span > Centre > Set C=M1).

Once the point of interest is in the centre of the screen, the resolution can be increased using the Zoom In function from the Span sub-group menu (Freq/Span > Span > Zoom In/Out).

An alternative method which enables a more precise span to be set is to place marker M1 at the start of the area of interest and marker M2 at its end. The new span is then set from the Start/Stop sub-group menu (Freq/Span > Start/Stop > Start=M1, Stop=M2).

### Wider Span

Having set a frequency span in which the signals of interest are visible, the user may wish to examine a wider span in order to see further signals not currently visible.

One method of doing this is to zoom out from the Span sub-group menu (Freq/Span > Span > Zoom) which shows frequencies both above and below the current span.

Alternatively, the user may wish to look only at frequencies above (or below) the current span. This can be done from the Start/Stop sub-group menu (Freq/Span > Start/Stop > Fix Start or Stop). Once the start or stop frequency is fixed, the word Fix is displayed next to its frequency at the top of the screen. The Step Up and Step down keys can then be used to increase or decrease the opposite frequency only. Pressing the key again will cancel the condition. See section 4.1.3.

## 7.2.4 Repetitive Operations

A common requirement for a spectrum analyzer user is to change repetitively between two or more frequency ranges. The PSAxx02 provides several methods for doing this.

1. When setting the centre frequency using the keyboard, the Previous key can be used to toggle between two centre frequencies - see section 7.2.1. The same facility is provided for Set Span, Set Start and Set Stop.
2. Frequency Presets, selected via the Frequency/Span menu group, enable up to six frequency spans to be stored and rapidly recalled - see section 4.1.5. Only Centre/Span or the equivalent Start/Stop frequencies are stored. Other parameters such as RBW are not affected (unless set to Auto).
3. Trace States are files which contain not only the frequency span, but the RBW, the Level setting and the graticule scale and units. Up to 999 trace files can be stored and are recalled from the Traces/Stores control screen - see section 4.6.1.
4. The hard key marked PRESET brings up a menu of set-up states - see section 4.11. Note, however, that these change many parameters of the instrument simultaneously.

## 7.3 Measuring Relative Amplitude

When both measurement markers are turned on, a readout is provided of the difference between them in terms of both frequency and level.

A common requirement is to measure the signal amplitude at a specific frequency under different conditions. The PSAxx02 provides a convenient method of doing this.

Having measured the amplitude in the initial condition using marker M1, the value can be fixed from the Marker Setup sub-group menu (Traces/Markers > Marker Setup > Fix/Unfix M1). The M1 readout shows Fx at the left hand side. With the new condition applied, the measurement can be made again by moving M2 to the same frequency using the key Move M2 to M1. The difference in amplitude level can then be read directly.

To return M1 to normal operation, press Fix/Unfix M1 again. See section 4.7.1.

## 7.4 Triggered Operation

Triggered operation is only available when the upgrade option U01 is fitted (see section 6). Triggering is used either to start or stop the sweep, or to initiate logging of sweeps or screen images. The trigger can be generated manually (by a key press), externally (from the trigger input) or internally from the sweep in combination with a limit line or limit pattern.

For a description of Triggered Sweep see section 4.4.3.3. For a description of Triggered Logging see section 7.7.

### 7.4.1 External Trigger Input

The external trigger input is provided via the 3.5mm jack socket at the top of the instrument. This can be converted to a standard BNC socket using the adaptor provided. The selection between positive or negative transition triggering is made from the Sweep Trigger or Logging



Trigger functions. It has a TTL threshold and a high input impedance. Maximum input voltage is limited to +/-20V. Voltages above this level could damage the instrument.

### 7.4.2 Trigger Output

A trigger output pulse can be generated using the same socket as trigger input (see above). The signal is generated by the Limits comparator function (see section 7.6.3) and is a positive going TTL level pulse of approximately 10ms duration from a 1kΩ source impedance.

The trigger output is not available if either sweep trigger or log trigger is set to external triggering.

## 7.5 Level Offset and Compensation Tables

These functions are only available when the upgrade option U01 is fitted - see section 6. They enable the amplitude scaling to be offset to match external attenuation or gain, or to add frequency dependent amplitude compensation tables to match transducers or antennae. A description of the menu keys used to control the function is given in section 4.5.4.

### 7.5.1 Dynamic Range and Maximum Signal



Adding offset or compensation can create confusion as to the maximum and minimum signal levels that can be viewed.

This could result in the instrument being in amplitude overload even when the displayed amplitude value is apparently within the instrument range. Where an offset is set to a large negative value (to compensate for an external gain element) there is a danger that the absolute maximum signal level could be exceeded resulting in damage to the instrument - see section 3.1.2.

Offset levels and compensation tables should therefore be used with care !

### 7.5.2 Creating and using Compensation Tables

Compensation tables are normalised files of amplitude versus frequency that are used to compensate for frequency related non-linearity in antennae or transducers.

The files contain lists of up to 100 frequency/amplitude points. When a file is used by the instrument, linear interpolation is employed between the points.

Every point on the trace is then changed by the amount calculated from the interpolated compensation table. Note that this could result in parts of the trace being outside of the graticule area.

Compensation Tables must be created outside of the instrument using PSA-Manager software - see section 6.1.7.

Compensation Table files have the extension .CMP and are located in the folder named TABLES. Files can be transferred using either a USB Flash drive, or by direct connection to the USB port of a PC. See section 5 for an explanation of copying and transferring files.

A compensation table file is loaded in a similar way to other types of file using a File Recall screen - see section 5.4 .

Note that compensation tables and limit patterns are both placed in a folder called Tables and can therefore appear within the same File Utilities screen. It is possible to toggle between the two file types by pressing the key marked Tables (toggle).

## 7.6 Limit Lines & the Limits Comparator | Creating Limit Patterns

These functions are only available when the upgrade option U01 is fitted - see section 6. A description of the menu keys used to control the function is given in section 4.5.5 .

Two types of limits are available, Lines and Patterns. Up to two limits can be displayed, Limit 1 in red and Limit 2 in blue.

A Line is a simple horizontal line (single amplitude level) that can be set to any value.

A Pattern can have multiple levels and can include vertical steps and angled lines. Patterns are contained within files that are lists of up to 100 frequency/amplitude points. When a file is used by the instrument, linear interpolation is employed between the points.

Lines or patterns may be used as simple visual aids to determine whether a signal is within a specific level range, or they may be used in conjunction with the Limits Comparator to create an automatic action.

## 7.6.1 Setting Limits

Pressing the Set Limits key (Level/Limits > Limits > Set Limits) brings up a control screen as shown.

The keys on the top line select which limit is to be controlled by the bottom row keys. Where a limit line or pattern has already been set, it can be turned on or off using Limit On/Limit Off.

The status of the two limits is displayed within the area directly above the keys.

Pressing Set Line defines the currently selected limit as a line (if it was previously a pattern) and brings up a numeric entry keypad or tab/jog system by which the level of the line can be set numerically in graticule units.

Pressing Select Pattern brings up a list of files from which a limit pattern can be loaded. Limit pattern files have the default prefix PTN and are placed in the Tables folder. Pressing Recall from the Recall Limits files screen will load the pattern as the selected limit.

Limit1 Type: Line, -034.0 dBm				
Limit2 Type: Line, -060.0 dBm				
Limit1 Status: On			Limit2 Status: On	
Limit Action: None			Limit1	Limit2
Limit Condition: None				
Set Line	Select Pattern	Limit On	Limit Off	Exit

## 7.6.2 The Limit Comparator

The limits comparator enables automated actions to be selected in response to specified limit conditions. The actions include audible warning, pulse output from the trigger socket, stopping of the sweep, or entry into a logging file.

The limit condition is created from the trace being either above or below the limit line/pattern. If the measurement markers are turned off, or if only M1 is turned on, any part of the swept trace being above or below the line will create the condition. If both M1 and M2 are turned on, the limits comparison takes place only on the part of the trace between the markers.

The **Limit Condition** options are None, Above, Below, Outside or Inside. Where two limits are being displayed, the limit conditions of Inside or Outside can be used. Note that there is no concept of an upper or lower limit line. Above means above the higher point of the two limit lines, Below means below the lower point of the two limit lines, Outside means either above the higher point or below the lower point of the two limit lines, while Inside means between the higher and lower points.

The **Limit Action** can be set to None, Beep, Pulse Out, or Beep and Pulse Out together. The action only takes places when the sweep has completed. The Pulse Out is provided at the Trigger socket - see section 7.4.2.

Regardless of the setting of the Trigger Action, it is also possible to use the limit condition to stop the sweep (see section 4.4.3.3) or to create an entry into a logging file (see section 7.7.5).

## 7.6.3 Creating and Loading Limit Patterns

Limit Patterns must be created outside of the instrument using PSA-Manager software - see section 6.1.7.

Limit Patterns files have the extension .CSV and are located in the folder named TABLES. Files can be transferred using either a USB Flash drive, or by direct connection to the USB port of a PC. See section 5 for an explanation of copying and transferring files.

A limit pattern table file is loaded in a similar way to other types of file using a File Recall screen - see section 5.4. Up to 999 pattern files can be held within the memory of the instrument.

Note that limit patterns and compensation tables are both placed in a folder called Tables and can therefore appear within the same File Utilities screen. It is possible to toggle between the two file types by pressing the key marked Tables (toggle).

## 7.6.4 Limit Offset

The Limit Offset function enables a limit to be offset from its initial value. It is intended primarily for limit patterns (which would otherwise have to be regenerated) but can also be used with limit lines.

The Limit Offset control screen enables a limit to be “nudged” up or down in steps of 1dB or 0.1dB.

Where a limit has had an offset applied to it, a \*\* symbol is displayed within the Set Limits control screen.

Limit1: Off, Line, -041.0 dBm				
Limit2: Off, Line, -060.0 dBm				
Offset**: +09.0 dBm				
Step: 1.0 dBm			Step	Exit
Range: +/-40.0 dBm			0.1/1.0	
Select	Select	Offset	Offset	Offset
Limit1	Limit2	Reset	-	+

## 7.7 The Logging Function

The Logging function is only available when the upgrade option U01 is fitted (see section 6). A description of the menu keys used to control the function is given in section 4.8.1.

The logging function saves results into log files within the memory of the instrument. The type of result saved can be selected as **Centre Level** (logs only the amplitude at the centre frequency), **Peak Level** (logs the frequency and amplitude of the highest peak in every sweep), **Full Trace** (logs the whole trace) or **Screen Image** (logs the whole screen as a bit-map image).

The saving of an entry into the file can be after every sweep (continuous) or in response to a Timer, a key press (manual trigger), the external trigger input, or the Limits function.

Each entry within the file includes the time of the entry as read from the instrument’s real time clock. Up to 9,999 entries can be saved within a single file with the exception of Screen Image logging where the entries are limited to 999. The saving of an entry takes a finite length of time varying from 0.1 seconds (centre amplitude or peak value) up to 1.5 seconds (screen image). Entries are only saved after the sweep has been completed, and the sweep cannot re-start until the entry has been saved.

Note that, when a logging file is “enabled”, the sweep mode is automatically set to Repeat and the sweep trigger is set to Free Run. No changes can be made to the set-up of the analyser while logging is in progress.

### 7.7.1 The Logging Control Menu

Selecting Logging Control from the Logging sub-group menu (see section 4.8.1) opens a new control screen as shown opposite.

The type of data to be logged, the trigger type, and the timer interval (if used) must be set prior to entering Logging Control. This information is shown within the area above the keys.

Similarly the spectrum analyzer state (frequency span, level etc). must also have been set-up in advance.

Logging Interval: 1 min - 0 sec				
Log File: LOG_001.LOG				
Log Type: Centre Level		Log Trigger: Timer		
Log Status: Paused				
Log Count: 0286			Change	File
Default Name: LOG_			Default	Utilities
Change	Enable	Pause /	Close	Cancel /
Name	Logging	Resume	File	Exit

Once logging has commenced it is not possible to make any changes to the instrument’s set-up without closing the logging file. It is also not possible to turn the instrument power to Off without closing the file first.

**Change Name:** the name of the logging file that will be created is displayed at the top of the menu area. The file name is an auto-incrementing numeric of the default file name (shown in green). Pressing Change Name opens an alpha-numeric keypad from which a user-chosen name of up to 8 characters can be entered.

**Change Default:** enables the default file name that will be automatically allocated to the next logging file to be changed. Standard default file name rules apply - see section 5.1.1.1

**Enable Logging:** commences the opening of a logging file under the currently displayed name. An information message is displayed and logging is actually enabled after confirming with the Status hard key.

**Pause/Enable:** causes new entries into the current logging file to be suspended and re-started. However it is not possible to exit from the logging control menu without closing the current file.

**Close File:** closes and saves the current logging file. Once closed the file cannot be re-opened (although it can be renamed or deleted). The Log File name changes to the next default name ready for the next logging file to be enabled.

**Cancel/Exit:** exits the logging control menu provided that a logging file is not currently enabled or paused, in which case a warning message is displayed telling the user that exiting will disable logging and close and save the current file.

**File Utilities:** displays a list of logging files currently within the instrument. Operates similarly to other file utilities screens – see section 5.5.

## 7.7.2 Manual Logging

The logging function can be set via the Log Trigger key to save entries in response to a manual key press. Both the Run/Stop hard key and the sweep control touch-screen key act as the manual trigger.

The data that is logged will relate to the sweep that was in progress when the key was pressed.

### 7.7.2.1 The Run/Stop key and Sweep Control key

When logging, the Run/Stop hard key and sweep control touch-screen key have no function unless the Log Trigger has been set to Manual, in which case both act as a manual trigger key.

In all other trigger modes (timer, external, limits or continuous) the keys are inactive. However, the touch-screen key does provide visual feedback of the stages of the logging process. When no trigger event has yet occurred the key is green and marked Awaiting Trigger. When a trigger has occurred but the sweep has yet to complete it becomes yellow and is marked Triggered. When the sweep is completed and the log file entry is being made it becomes red and is marked Writing File.

## 7.7.3 Logging from the Timer

The logging function can be set via the Log Trigger key to save entries triggered at a fixed time interval.

The Timer Setup key enables a time between trigger events to be set between 5 seconds and 100 minutes. However, if the timer interval is set to a short period, the actual time between logging entries may be considerably longer than the trigger interval. This is because, for each entry, a sweep must be completed and the data must be saved. If the sweep is set to a wide span and/or narrow RBW, the sweep time could be several tens of seconds.

The timer is asynchronous with respect to the sweep. Consequently the time between logging entries will be longer than the timer interval by a variable amount which is a function of the sweep time. The log entry time stamp represents the time at the end of the logged sweep.

To achieve the fastest possible logging use Continuous trigger - see section 7.7.6.

## 7.7.4 Logging from External Trigger

The logging function can be set via the Log Trigger key to save entries on either a positive or negative going edge applied to the Trigger socket - see section 7.4.1.

The data that is logged will relate to the sweep that was in progress when the trigger signal occurred.

### **7.7.5 Logging from Amplitude Limits**

The logging function can be set via the Log Trigger key to save entries when a signal is generated by the Amplitude Limits Comparator. The data that is logged will relate to the sweep that was in progress when the limit condition occurred.

The Limits function must be set to have a potentially valid condition. See section 7.6 for an explanation of the Limits function.

### **7.7.6 Logging Every Sweep (Continuous)**

The logging function can be set via the Log Trigger key to save entries continuously, i.e. after every sweep. The actual speed will depend upon the sweep rate and the type of data being logged. The fastest possible logging rate is about two per second.

### **7.7.7 Viewing and Analyzing Logging Files**

The instrument has no capability for viewing the contents of a logging file. Instead, the file must be copied to a Windows based PC where the file can be viewed and analyzed using the PSA Manager software - see section 6.1.7.

Log files have the extension .LOG and are located in the folder named LOGS. Up to 999 logging files can be stored within the memory of the instrument. Files can be transferred using either a USB Flash drive, or by direct connection to the USB port of a PC.

See section 5 for an explanation of copying and transferring files.

## **7.8 View on PC**

The View on PC function is only available when the upgrade option U01 is fitted (see section 6). A description of the menu keys used to control the function is given in section 4.10.3.1.

View on PC places the instrument into a special mode in which the graphics of the display are sent to a PC via USB. The screen can then be viewed at any size using PSA-View software. The message View on PC is displayed in blue at the top right of the graticule area.

When in this mode, screen update rate may be reduced.

---

## 8 Default Settings | Power On State | Hard Reset

### 8.1 Standard Preset

The standard preset is accessed by pressing the hard key marked **Preset**. The standard preset returns the instrument to a set of known conditions as follows (values apply to PSA2702):

Parameters in {brackets} are relevant only if option pack U01 is installed.

Centre Frequency:	1350.5MHz	Span:	2699.0MHz
Start Frequency:	1.0MHz	Stop Frequency:	2700.0MHz
Step Value:	1.0MHz		
RBW:	Auto	Video Filter:	On
Sweep:	Repeat,	{Sweep Trigger:	Free Run}
Reference Level:	0dBm (Atten. On)	Units:	dBm
Scale:	10dB/div		
{Offset:	None}	{Compensation Table:	None}
{Limit 1 & 2	Off}		
Live Trace:	On	Trace Mode	Normal
View Trace:	Off	Reference Trace:	Off
Markers:	M1 on, position = centre, mode = peak find, M2 off		
{Logging:	Disabled}		

Parameters for the PSA1302 are identical apart from Centre Frequency (650.5Mz), Span (1299MHz) and Stop Frequency (1300MHz).

The User Preset is a customisable version of the Standard Preset – see section [4.11.1](#).

### 8.2 Factory Default Set-up

When shipped from the factory, the set-up of the instrument is as per the Standard Preset (see above) with the following additions:

Brightness:	40%	Auto-sleep:	Never
Navigator function:	Marker Control	Frequency Setting:	By Keyboard
Audio Demod.	Off (volume = 10)	Power-On State:	Last Used
Graticule:	Normal	Trace Avg. No.	16

#### 8.2.1 Restoring to Factory Defaults

The instrument can be returned to its factory defaults condition, as described above, from Setup/Functions > Setups > Load Defaults (see section [4.9.1](#)).

### 8.3 Power-On State

The set-up of the instrument each time that it is turned on (from off) is normally set to “Last Used”. This results in no change occurring when the instrument is powered off and then back on.

Alternatively, the user can choose to load the User Preset which overwrites the major settings with ones chosen by the user (see section [4.11.1](#)). This choice is made from: STATUS > System Utils > Power/Clock > Pwr-On State - see section [4.10.3.2](#).



## 8.4 Unrecoverable Fault Condition - Hard Reset

If the spectrum analyzer gets into a condition in which normal operation is not possible, it can be returned to normal operation by reloading the Factory Default settings - see section 4.9.1.

However, if it “locks up” (i.e. will not respond to key presses) or cannot be recovered by using Load Defaults, it can be put through a Hard Reset.

The reset button is accessed through a small hole at the top right hand side of the case. It can be operated using the stylus (or other thin rigid object). Press and hold for longer than 1 second.

Hard Reset will re-load the operating system, return all parameters to their factory defaults, and clear all of the non-volatile buffers. User data and settings that have been saved as files will not be affected.



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## 9 Firmware Updates | Upgrades | Maintenance

### 9.1 Updating the Firmware

From time to time TTI may make updated versions of the instrument firmware available in order to add new features or to correct “bugs”. These will be downloadable from the Aim-TTI website without charge. The current version is displayed within the Status display screens.

The method of updating requires the use of a USB Flash drive. Full information on how to perform the update will be provided with the firmware file.

### 9.2 Upgrading the Firmware (Option U01)

Installing option U01 is done in a similar way to a firmware update, but an additional step of entering an activation code will be needed (see section 6). Full details are provided with the option.

### 9.3 Maintenance, Re-calibration & Cleaning

To ensure that the accuracy of the instrument remains within specification, the calibration should be checked (and if necessary adjusted) annually. TTI or their agents overseas will provide a calibration service for any PSA1302/2702 and will repair any PSA developing a fault.

Where owners wish to undertake their own recalibration, this should only be done by skilled personnel in conjunction with the Service Guide which may be obtained directly from TTI or their agents overseas. Recalibration requires the use of a precision signal generator as specified in the Service Guide

**Cleaning:** If the unit requires cleaning, use a cloth that is only lightly dampened with water or a mild detergent. Take particular care in cleaning the touch screen area.

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## 10 EMC

### Spectrum Analyzer – powered by internal battery or Adaptor/Charger

This instrument has been designed to meet the requirements of the EMC Directive 89/336/EEC.

Compliance was demonstrated by meeting the test limits of the following standards:

#### Emissions

EN61326-1 (2006) EMC product standard for Electrical Equipment for Measurement, Control and Laboratory Use. Test limits used were:

- a) Radiated: Class B

*Note:* Limits were met without a test object connected; emissions which exceed the levels required by this standard may occur when the instrument is connected to a test object.

#### Immunity

EN61326-1 (2006) EMC product standard for Electrical Equipment for Measurement, Control and Laboratory Use.

Test methods, limits and performance achieved were:

- a) EN61000-4-2 (2009) Electrostatic Discharge : 4kV air, 4kV contact, Performance A (A).
- b) EN61000-4-3 (2006) Electromagnetic Field, 3V/m, 80% AM at 1kHz, Performance B (A).

*Note:* The PSA1302 & PSA2702 are sensitive measuring instruments and, if subjected to a sufficiently large RF field, the interfering signal may show a few dB above the noise floor even with the SMA input capped (Performance B). In all other respects the instrument will operate correctly (Performance A) in fields up to 3V/m.

### Adaptor/Charger

This AC adaptor/charger has been designed to meet the requirements of the EMC Directive 89/336/EEC. Compliance was demonstrated by meeting the test limits of the following standards:

#### Emissions

EN55022, radiated and conducted Class B.

#### Immunity

EN55024:1998 + A2:2003. Test methods, limits and performance achieved were:

- a) EN61000-4-2 (2001) Electrostatic Discharge : 4kV air, 4kV contact, Performance A (B).
- b) EN61000-4-3 (2002) Electromagnetic Field: 3V/m, 80% AM at 1kHz, Performance A (A).
- c) EN61000-4-11 (2004) Voltage Interrupt: ½ cycle 0%: Performance A (B); 1 cycle 0% Performance B (B); 25 cycles, 70% and 250 cycles, 0%: Performance B (C).
- d) EN61000-4-4 (2004) Fast Transient: 1kV peak (AC line), Performance A (B)
- e) EN61000-4-5 (2001) Surge: 1kV (line to line), 2kV (line to ground), Performance A (B).
- f) EN61000-4-6 (2003) Conducted RF: 3V, 80% AM at 1kHz (AC line & DC Output) Performance A (A).

### Performance Definitions

The definitions of performance criteria are:

**Performance criterion A:** 'During test normal performance within the specification limits.'

**Performance criterion B:** 'During test, temporary degradation, or loss of function or performance which is self-recovering.'

**Performance criterion C:** 'During test, temporary degradation, or loss of function or performance which requires operator intervention or system reset occurs.'

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# 11 Declaration of Conformity

## EC Declaration of Conformity

We Thurlby Thandar Instruments Ltd  
Glebe Road  
Huntingdon  
Cambridgeshire PE29 7DR  
England

declare that the

### PSA1302 and PSA2702 Portable RF Spectrum Analyzers

meet the intent of the EMC Directive 2004/108/EC and the Low Voltage Directive 2006/95/EC. Compliance was demonstrated by conformance to the following specifications which have been listed in the Official Journal of the European Communities.

#### EMC

- Emissions: a) EN61326-1 (2006) Radiated, Class B
- Immunity: EN61326-1 (2006) Immunity Table 1, Performance B, referring to:
- a) EN61000-4-2 (2009) Electrostatic Discharge
  - b) EN61000-4-3 (2006) Electromagnetic Field

#### Safety – PSA1302/PSA2702

EN61010-1 Pollution Degree 2.

#### Safety – AC Adaptor/Charger

EN60950-1



CHRIS WILDING  
TECHNICAL DIRECTOR  
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## 12 Specification

### 12.1.1 Frequency Measurement

#### Frequency Span

Frequency Range:	1 MHz to 2700 MHz in one range - PSA2702 1 MHz to 1300 MHz in one range - PSA1302
Setting Modes:	Centre frequency plus Span, or Start frequency plus Stop frequency
Maximum Span:	2699 MHz (1 MHz to 2700 MHz) - PSA2702 1299 MHz (1 MHz to 1300 MHz) - PSA1302
Minimum Span:	270 kHz, or Zero Span with demodulation
Setting Resolution:	1 kHz at any frequency
Setting Accuracy:	Reference Frequency Accuracy for Start, Stop & Centre (Zero-Span) frequencies

#### Reference Frequency Accuracy

Initial Accuracy:	Better than $\pm 10$ ppm at 20°C
Stability:	Better than $\pm 10$ ppm over 10°C to 30°C
Ageing:	Better than $\pm 3$ ppm per year

#### Phase Noise

Phase Noise:	Typically -90dBc/Hz at 100kHz offset at 500MHz
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#### Resolution Bandwidth

RBW:	Selectable as 1 MHz, 280 kHz or 15 kHz
Video Filtering:	Selectable On or Off

#### Frequency Markers

Number of Markers:	One, Two, or None
Marker Resolution:	0.1 kHz at all frequencies
Marker Accuracy:	$1/270^{\text{th}}$ of Frequency Span $\pm 0.1\text{kHz}$ + Reference Frequency Accuracy
Frequency Readout:	Display of absolute and difference frequencies for both markers

### 12.1.2 Amplitude Measurement (Level)

#### Amplitude Range

Display Range:	85 dB
Measurement Units	dBm or dB $\mu$ V (dB milliwatts or dB micro volts)
Reference Level:	Selectable as -20 dBm or 0dBm (87 dB $\mu$ V or 107 dB $\mu$ V)

#### Amplitude Accuracy

Ref. Level Accuracy:	Better than $\pm 1$ dB at 50MHz at 10dB below ref. level (20°C $\pm 5^\circ\text{C}$ )
Level Flatness:	Better than $\pm 1.5$ dB relative to 50MHz over 1MHz to 2700MHz
Amplitude Linearity:	Better than $\pm 1$ dB over 50dB range down from reference level

#### Noise Floor

Noise Floor:	Better than -95 dBm average displayed noise floor for $F > 3\text{MHz}$ (reference level = -20 dBm, RBW = 15 kHz, video filter On)
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#### Distortion and Spuri

3rd Order Intermod.:	$< -60\text{dBc}$ for two signals(500MHz and 502MHz) at 10dB below reference level
Harmonic:	$< -60\text{dBc}$ at 10dB below reference level (100MHz)
1st & 2nd Image:	$< -55\text{dBc}$ , typically $< -60\text{dBc}$
Residual Spuri:	$< 3\text{dB}$ above noise floor

## Amplitude Markers

Number of Markers:	One, Two, or None
Marker Resolution:	0.1 dB
Amplitude Readout:	Display of absolute and difference amplitudes for both markers in graticule units (dBm or dBuV) or linear units (mV or uW).

## Amplitude Limits (only with Option U01)

Limit Types:	Limit Lines from numeric values, or Limit Patterns from Files. Pattern files are created using PSA-Manager software.
Number of Limits:	One or two limits on screen. Up to 999 patterns can be stored
Limits Comparator:	Conditions of Above, Below, Inside or Outside creating actions of beep, stop sweep, log sweep and pulse out

## Amplitude Compensation (only with Option U01)

Offset:	Amplitude can be offset by up to +/-50dB to compensate for external attenuation or gain.
75Ω Compensation Compensation Tables:	Compensation can be made for inputs from a 75Ω source impedance. Linearly interpolated tables of up to 100 frequency/amplitude points can be used. Up to 999 tables can be stored. Table files are created using PSA-Manager software.

## 12.1.3 Traces

Graticule:	8.5 x 10 divisions light grey graticule. Selectable as normal, dim, or off.
Displayed Points:	271 points per sweep (peak detected).
Live Trace:	Dot-joined trace from current or held sweep. Selectable on or off.
View Trace	Additional trace created from the live trace. Selectable on or off.
Reference Trace:	Trace recalled from a file. Selectable on or off.
Trace Modes:	Normal, Peak Hold, or Average (2 to 48 sweeps)

## 12.1.4 Sweep

Sweep Method:	Peak detection for 270 points per sweep. The amplitude of the peak level found within each sub-span is stored (sub-span = span/270).
Sweep Time:	Set automatically by Span and RBW. Typically 150ms + 2.3ms/MHz of span for RBW = 1MHz Typically 150ms + 7ms/MHz of span for RBW = 280kHz Typically 180ms + 77ms/MHz of span for RBW = 15kHz
Sweep Modes:	Normal (repeat) or Single
Sweep Trigger	(Only with Option U01), External or Limits Comparator

## 12.1.5 Data Logging (only with Option U01)

Log Files	Files of up to 9,999 data entries can be created. Up to 999 files can be stored. Files are read using PSA-Manager Software.
Logged Data:	Log files can be created from Peak Value, Centre Frequency Level, Complete Sweep, or Screen Image
Log Trigger:	Log entry can be triggered by Key Press, Continuous (every sweep), External Input, Internal Timer, or Limits Comparator
Timer Interval	Adjustable between 2 seconds and 100 minutes per entry
Time Stamp	Each entry is time stamped from the real-time clock

### 12.1.6 Demodulation (Zero Span mode)

Demod. Modes:	AM or FM
Display:	Carrier amplitude only (horizontal line).
Audio Out:	30 mW into 32 Ohms mono or stereo headphones, adjustable volume, 3.5mm jack socket
Audio Filter	Selectable low-pass filter to attenuate high frequency interference. 2 pole filter with turnover point at approximately 3 kHz.

### 12.1.7 Display

Display Type:	4.3 inch (10.9 cm) transfective backlit TFT LCD, 480 x 272 pixels total, 16 colours, touch screen.
Graticule:	8.5 x 10 divisions light grey graticule. Selectable as normal, dim, or off.

### 12.1.8 Memory Storage

Memory Type:	Internal non volatile Flash memory (1.8GB nominal).
Store Trace:	Up to 999 traces can be stored under either default file names or user entered file names. Traces are stored as tables of amplitude versus frequency and can be imported into other programs, as well as being recalled to the screen. Traces can be stored from either the live trace or the view trace and include State information.
Recall Trace:	Recalls any stored trace to the reference trace of the display. The State can be recalled independently from the Trace
Store Screen:	This function copies the whole screen area (excluding key area) to memory as a bit-map image. Up to 999 screens can be stored under either default file names or user entered file names..
Recall Screen:	Recalls any stored screen image to the display.
Store Set-up:	Up to 999 instrument set-ups can be stored under either default file names or user entered file names. All settings of the instrument are saved.
Recall Set-up:	Recalls any stored set-up, overwriting the existing settings of the instrument.
Recall Limits Pattern:	Only with Option U01. Up to 999 limit pattern files produced within PSA-Manager software can be stored within the instrument.
Recall Compensation Table:	Only with Option U01. Up to 999 compensation tables produced within PSA-Manager software can be stored within the instrument.
Store Logging File:	Only with Option U01. Up to 999 logging files can be stored for download and analysis by PSA-Manager software.


### 12.1.9 Connectors

RF Input Connector:	Standard SMA connector (female).
Power Connector:	1.3mm dc power socket for AC power adaptor/charger as supplied by TTI.
USB link to PC interface:	Mini USB connector (5 pin mini B) which acts as a USB "device" for connection to a personal computer.
USB Flash Drive interface:	USB standard A connector (USB Host) for connection of USB Flash memory drive
Audio Connector:	3.5 mm jack socket for demodulated audio out (accepts mono or stereo plugs).
Trigger connector:	3.5mm mono jack socket for connection of BNC adaptor (supplied).

## Signal Input

Input Connector: SMA connector, 50 Ohms

VSWR: 1.5:1 typical

 Absolute Maximum Input Level: + 20 dBm or +127 dBμV (2.2V rms) or 15V dc

### 12.1.10 AC Line Operation

The PSAXx02 can be operated continuously from mains power using the AC power adaptor provided by TTI. This also recharges the internal battery.

Input Voltage Range: 100V to 240V nominal 50Hz/60Hz. Interchangeable plus for UK, Euro, USA and Australia are supplied.

### 12.1.11 Battery Operation

The PSAXx02 operates from internal rechargeable batteries. The batteries are recharged using the AC power adaptor supplied.

Battery Type: Li-ion 3.7V, 3Ahr nominal

Battery Life: > 8 hours continuous operation

Recharge Time: < 3 hours from fully discharged

Auto-Sleep Mode: To conserve battery life, the system can be set to automatically switch into sleep mode after a defined time from the last key press. This can be set between 5 mins and 60 mins (or never).

### 12.1.12 Mechanical

Size: 192 x 92 x 49mm (7.5 x 3.6 x 1.9”) plus 3mm projection of SMA connector

Weight: 560 grms (1lb 4oz).

Tilt Stand: Built-in tilt stand for bench use which angles the unit at approximately 40 degrees to the horizontal.

Screen Protector: For portable use, the tilt stand can be moved from the rear of the instrument to the front where it acts as a screen protector and sun shield.

### 12.1.13 Environmental and Safety

Operating Range: +5°C to + 40°C, 20% to 80% RH.

Storage Range: -10°C to +50°C

Environmental: Indoor use at altitudes to 2000m, Pollution Degree 2.

Electrical Safety: Complies with EN61010-1.

EMC: Complies with EN61326.

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## **13 Appendix A: PSA-Manager Software**

PSA-Manager is a Windows\* PC application for the creation, editing, analysis and management of PSAxx02 files. It is compatible with versions of Windows from XP onwards (including 32 and 64 bit versions).

PSA-Manager may be supplied on the CD accompanying the instrument, or may be downloaded from the web site. Installing PSA-Manager will also install a secondary application called PSA-View.

### **PSA-Manager Functions**

#### **File Backup and Organisation**

PSAxx02 files can be backed-up to the PC and organised into “projects”. This enables the instrument to be used by several different operators or used for different projects and to contain files relevant only to that user.

#### **Trace File Display**

Trace files downloaded from the instrument can be viewed on the PC.

#### **Limit Patterns Creation**

Limit pattern files can be used within the Limits function of the instrument when option U01 is installed. Limit patterns are tables of amplitude against frequency that are created within PSA-Manager and uploaded to the instrument.

Limit pattern table files can be created from scratch or imported and edited from CSV files. Editing tools include both numeric entry and graphical editing.

#### **Compensation Tables Creation**

Compensation tables files can be used within the Offset/Tables function of the instrument when option U01 is installed. Compensation tables are normalised tables of amplitude against frequency that are created within PSA-Manager and uploaded to the instrument.

Compensation table files can be created from scratch or imported and edited from CSV files. Editing tools include both numeric entry and graphical editing.

#### **Log File Analysis**

Logging files downloaded from the instrument can be viewed and analysed. (Requires Option U01)

#### **PSA-View**

PSA-View is an additional application which can be used with the View-on-PC function of the instrument when option U01 is installed.

It enables the screen of the instrument to be duplicated on the PC at any desired size.

\* Windows is a trademark of Microsoft, inc.





<b>Traces/ Markers</b>	<b>Traces Control</b>	<b>Trace Mode</b>	<b>Trace Stores</b>	<b>Marker Setup</b>	<b>Marker Control</b>
	Show Traces View View On/Off Swap	Normal Peak Hold Average Avg Number Reset	Store Recall	Select Units Function Fix/Unfix M1 M2>M1	M1/M2 Active Manual Set Marker>Centre Move Left Move Right

<b>Setup/ Functions</b>	<b>Logging</b>			<b>Setups</b>	<b>System/ File Ops</b>
	Log Type Log Trigger Timer Setup Logging Control			Presets * Store Setup Recall Setup Load Defaults	System Utils* File Ops  Darker Brighter

Hard Key

<b>Help Status</b>	<b>Status/ System</b>		<b>Context Help</b>	<b>Topic List</b>	<b>Exit</b>
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\* also accessed from System/File-Ops sub-group

<b>System Utilities</b>	<b>Screen</b>	<b>Power/ Clock</b>	<b>Alerts</b>		<b>System Update</b>
	Calibrate Screen Bright. Level View on PC Navig. Help System Help	Set Clock Auto Off Pwr-On State Navig. Help System Help	Beep On/Off Navig. Prompt  Navig. Help System Help		Calibrate Hardware Install Options Update Firmware Navig. Help System Help

Hard Key \* also accessed from Setups sub-group

<b>Presets</b>	<b>Standard Preset</b>	<b>Auto Find</b>	<b>Recall Setup</b>	<b>Custom Presets</b>	<b>Restore Previous</b>
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