

LOCAL OPERATION

Introduction

This chapter explains how to:

- Set up the multisource generator to produce a typical basic signal.
- Select the main operating parameters; carrier frequency, output level and type of modulation.
- Use the full range of supporting facilities.

Conventions

The following conventions are used in this chapter:

RF OUTPUT Titles marked on the instrument panel are shown in capital letters

[SETUP] Hard key titles are shown in square brackets, and

[Carrier Freq] Soft key titles are shown in italics in square brackets; for example, *[Carrier Freq]* means the soft key adjacent to the *Carrier Freq* title box at the side of the menu.

RF Level Messages appearing on the screen are shown in italic letters.

Front-panel controls and connectors

Parameters are selected by means of hard keys (which have their function printed on them), soft keys (which do not have any notation), a numerical key pad and a rotary control knob; see Fig. 1 below. The hard keys have functions which do not change, whereas the soft key functions are determined by the menu which is being displayed. The numerical keys are used to set parameters to specific values which can also be varied in steps of any size by using the [\downarrow] [\uparrow] keys or the rotary control knob.

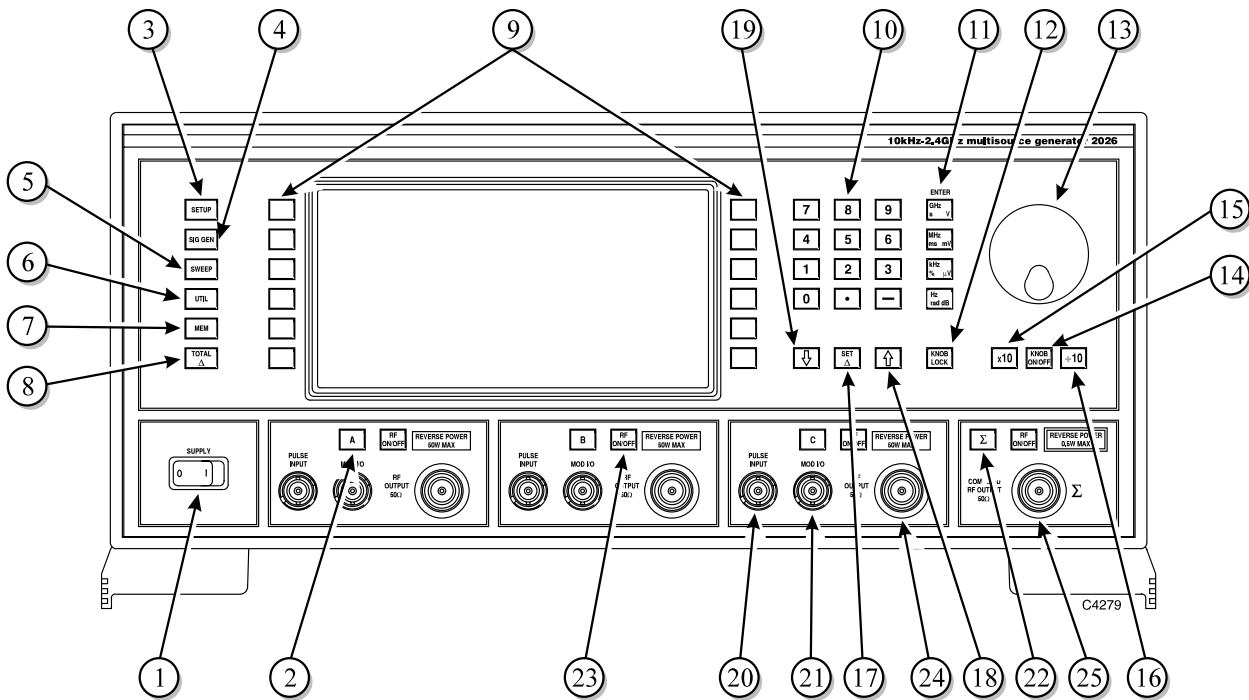


Fig. 1 2026 front panel

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- | | |
|----------------------|---|
| ① SUPPLY | Switches the AC supply voltage on and off. |
| ② [A], [B], [C] | This key is repeated for each signal source. It selects A, B or C as the current signal source for parameter display and adjustment. The C source is optional. |
| ③ [SETUP] | Displays the Setup Menu used for signal source configuration and for selecting an application mode.. |
| ④ [SIG GEN] | Displays the main, Sig Gen, menu. |
| ⑤ [SWEEP] | Displays the Sweep Control screen for the current source. |
| ⑥ [UTIL] | Displays the Utilities Selection Menu. |
| ⑦ [MEM] | Displays the Memory Store/Recall Menu. |
| ⑧ [TOTAL Δ] | Displays the Total Shift Menu for the current source. |
| ⑨ Soft keys | Twelve function keys change notation as the menus change. |
| ⑩ Numerical key pad | For entering the value of a selected parameter. Minus sign and decimal point are included. |
| ⑪ [ENTER]/Units keys | Determine the units of the set parameters and also used to terminate a numerical entry. |
| ⑫ [KNOB LOCK] | Pressing this key assigns control knob operation to the currently selected function. |
| ⑬ Control knob | When enabled by the [KNOB ON/OFF] key, adjusts the value of the selected parameter. |
| ⑭ [KNOB ON/OFF] | Enables or disables the control knob. |
| ⑮ [×10] | When control knob enabled, decreases knob resolution by a factor of 10. |
| ⑯ [÷10] | When control knob enabled, increases knob resolution by a factor of 10. |
| ⑰ [SET Δ] | Displays the Steps Menu for the current source. |
| ⑱ [↑] | Increments the value of the selected parameter. |
| ⑲ [↓] | Decrements the value of the selected parameter. |
| ⑳ PULSE INPUT | 10 kΩ BNC connector (fitted to each signal source) which accepts a pulsed input. |
| ㉑ MOD I/O | 100 kΩ BNC connector (fitted to each signal source) which allows an external modulating signal to be applied. Also provides a modulation oscillator output from a 600 Ω source impedance. With Option 4 this connector is fitted on the rear panel. |
| ㉒ [Σ] | Displays the Combiner Summary. |
| ㉓ [RF ON/OFF] | Enables or disables the associated signal source RF OUTPUT or the COMBINED RF OUTPUT connector. |
| ㉔ RF OUTPUT | 50 Ω type-N connector (fitted to each signal source). Protected against the application of reverse power of up to 50 W. With Option 4 this connector is fitted on the rear panel. |
| ㉕ COMBINED RF OUTPUT | 50 Ω type-N connector. Note that maximum reverse power at this connector is 0.5 W. With Option 4 this connector is fitted on the rear panel. |
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Rear-panel connectors

The rear-panel connectors are shown in Fig. 2 below.

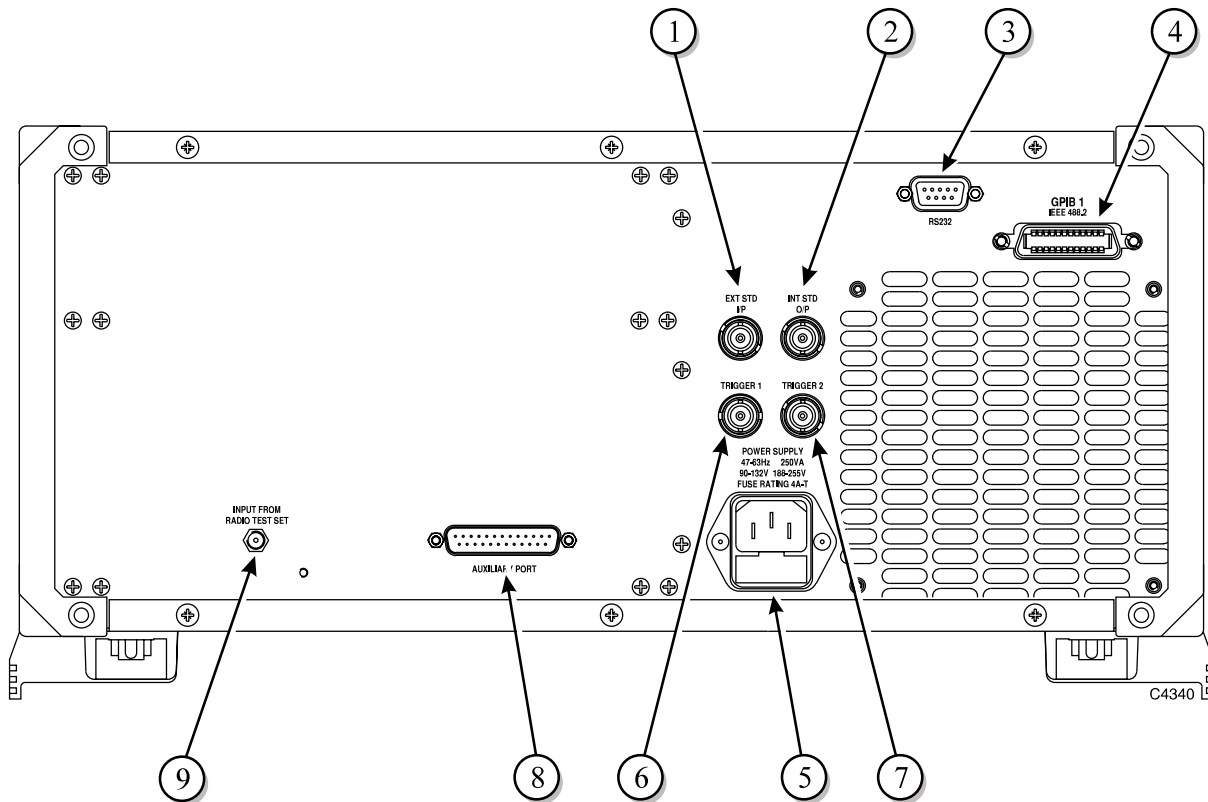


Fig. 2 2026 rear panel

- | | | |
|---|-------------------------------|---|
| ① | COMBINED RF OUTPUT (optional) | An Option 4 50 Ω type-N connector. When fitted, replaces the front-panel connector. |
| ② | PULSE INPUT (optional) | An Option 4 10 kΩ BNC connector. When fitted, replaces the front-panel connector. |
| ③ | MOD I/O (optional) | An Option 4 100 kΩ BNC connector. When fitted, replaces the front-panel connector. |
| ④ | RF OUTPUT (optional) | An Option 4 50 Ω type-N connector. When fitted, replaces the front-panel connector. |
| ⑤ | EXT STD I/P | BNC connector for the input of an external standard frequency of either 1 MHz or 10 MHz. |
| ⑥ | INT STD O/P | BNC connector for the output of the internal 10 MHz standard. |
| ⑦ | RS232 | 9-way RS-232 connector used for remote control of the instrument as well as to reprogram the internal flash memory. |
| ⑧ | GPIB 1 | 24-pin socket accepts standard IEEE connector to allow remote control of the instrument. |
| ⑨ | POWER SUPPLY | 3-pin plug integral with fuse holder. Mates with AC supply lead socket. |
| ⑩ | TRIGGER 1 | BNC connector which is used for sweep triggering. |
| ⑪ | TRIGGER 2 | Reserved. |

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- ⑫ AUXILIARY PORT 25-pin socket. Can accept external data to modulate each of the internal sources for 2-level or 4-level FSK.

- ⑬ EXT I/P 50 Ω SMA connector. Enables a signal to be fed into the combiner from an external signal generator.

- ⑭ INT O/P (optional) 50 Ω SMA connector. Used when a third source is fitted to provide a rear-panel output. When linked to the EXT I/P socket, connects the C source output to the combiner. When this socket is not in use it must be terminated by the attached 50 Ω load to prevent signal radiation from the C source.

First-time use

First-time users can quickly become familiar with the principles of control and display by carrying out the following exercise, which demonstrates how to set up a typical basic signal, having the following parameters, on one of the signal sources:

Carrier frequency: 100 MHz,
Output level: 10 dBm,
Frequency modulation: 100 kHz deviation at 500 Hz mod.

Switching on

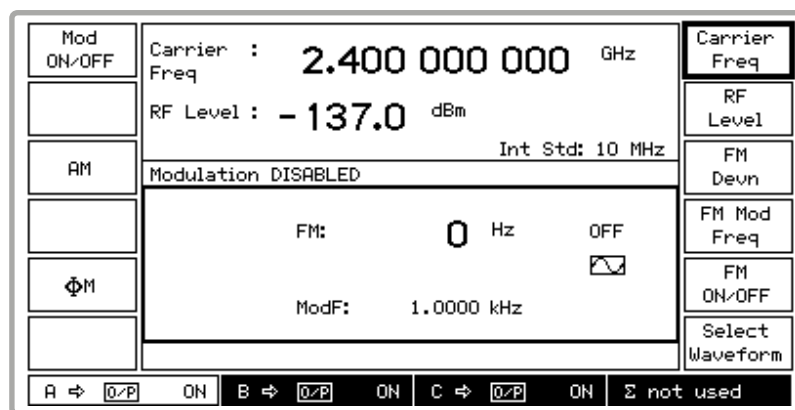
Before switching the instrument on, check that the power supply is connected and ensure that no external signal sources are connected.

Switch on by means of the SUPPLY switch and check that the display is similar to that shown in Fig. 3 below. This shows the Sig Gen menu as it appears during normal operation.

If the default display shown in Fig. 3 is not obtained, a previous user may have set the instrument to switch on with one of the user memories recalled, rather than using the default factory settings.

To reset to the factory settings press the [UTIL] hard key followed by the soft key sequence [Power Up Options] [Factory Power Up] [EXIT]. Then switch off and switch back on again.

Observe that the Sig Gen menu appears on the display showing the default parameters for FM, and that the panel for the A signal source is highlighted at the bottom left of the screen. This indicates that these parameters apply only to the A source.



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Fig. 3 2026 Sig Gen menu in normal operation showing default display

Display

Before entering any parameters it will be found useful to look at the effect that pressing various keys has on the display for the Sig Gen menu. This is the main display and it is divided into a number of fields as shown in Fig. 4 below.

Signal source field

This field, at the bottom of the display, is divided into four panels, one for each of the three signal sources and one for the combiner. When a source panel is highlighted, all the parameters shown on the screen apply to that source; for example, when the A panel is highlighted, the displayed carrier

frequency, RF level, modulation etc., apply only to the A source. The selected signal source can be changed using the [A], [B] and [C] hard keys.

The RF output from a source may be directed to its own output socket, or re-routed via the combiner (either alone or in combination with other sources) to the combiner output socket. Signal sources are combined using a menu accessed via the [SETUP] hard key.

The designation $A \Rightarrow O/P$ shows that the A source output is directed to the RF OUTPUT socket for the A source. When $A \Rightarrow \Sigma$ is displayed it shows that the A source output is directed to the combiner.

When no signal source is connected to the combiner the combiner panel shows Σ *not used*. When appropriate *not fitted* is shown against source designator C.

When one or more sources are connected via the combiner to the COMBINED RF OUTPUT socket, the combiner panel displays this information by showing all combinations from $\Sigma = A$ to $\Sigma = A+B+C$.

Note that the signal source field is displayed in all modes.

Carrier frequency field

This shows the current carrier frequency setting for the selected signal source. This field is controlled by the [*Carrier Freq*] soft key.

When the frequency of the selected source is coupled to another source (so that it tracks it), an arrow is shown together with the other source's identity. In Fig. 4 for example, the B source is shown coupled to the A source by the A source panel being highlighted and $\Rightarrow B$ being shown in the carrier frequency field.

RF level field

This shows the current RF level setting for the selected signal source. This field is controlled by the [*RF Level*] soft key.

When the level of the selected source is coupled to another source, an arrow is shown together with the other source's identity (as for frequency coupling).

Frequency standard field

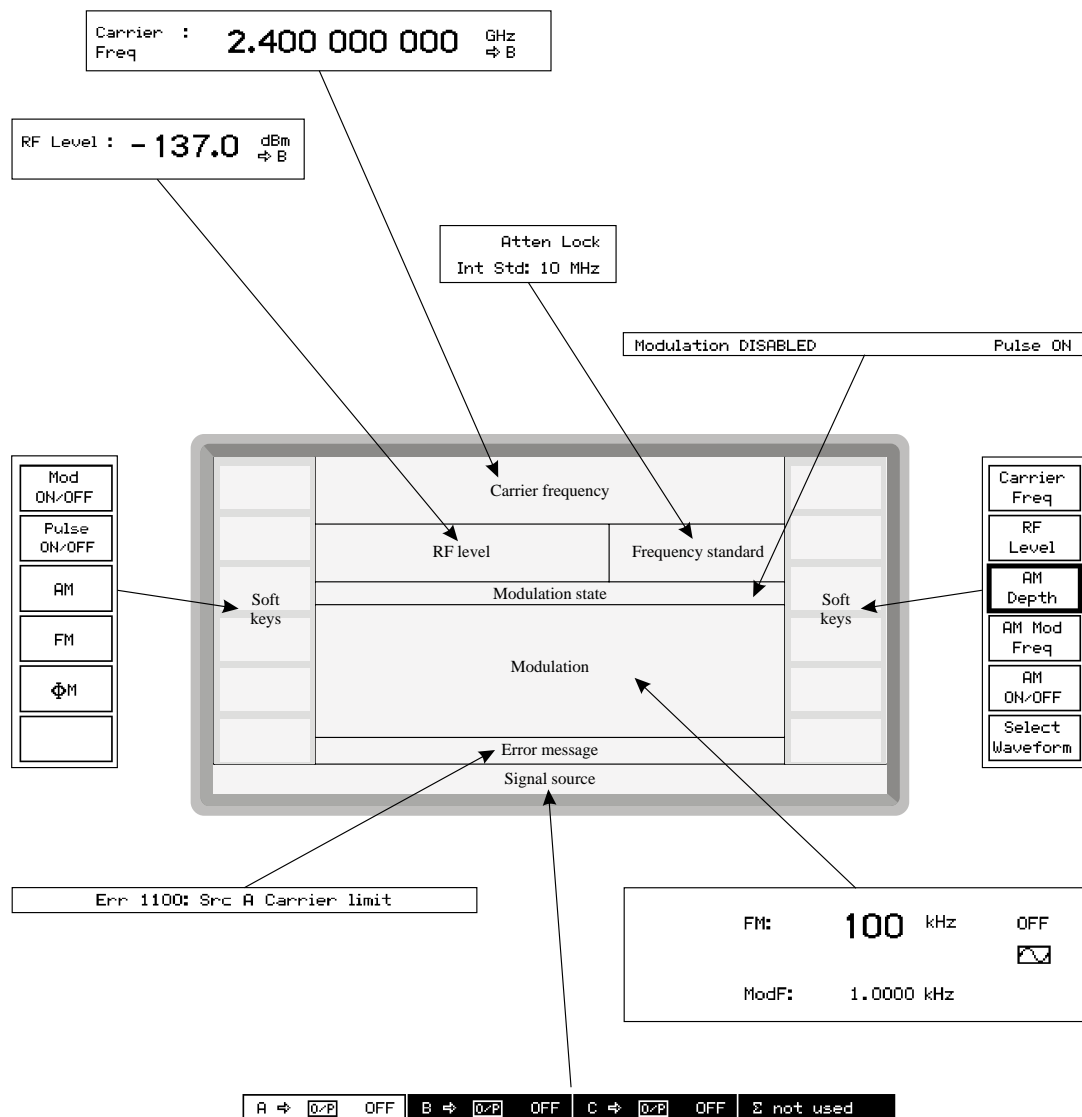
The type of standard is shown in this field together with its frequency. Frequency standard selection is made from a menu accessed via the [UTIL] hard key.

This field also displays *Atten Lock* when the attenuator lock function is enabled.

Modulation state field

Here the modulation state is shown as either *ENABLED* or *DISABLED*. This is controlled by the [*Mod ON/OFF*] key which switches all internal modulation on or off.

When pulse modulation is selected, *Pulse ON* or *OFF* is shown (an additional soft key [*Pulse ON/OFF*] also appears).



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Fig. 4 Division of the Sig Gen menu (main display) into fields

Modulation field

This field shows all the current modulation settings for the selected signal source: type of modulation; modulation deviation/depth; modulation frequency; waveform type (shown graphically); modulation ON or OFF.

The type of modulation is selected by the *[FM]*, *[AM]* and *[ϕ M]* keys. Only two of the three keys are shown at any time. This is because the display will already be showing the parameters for the omitted selection key.

Modulation deviation/depth is selected by the *[FM Devn]*, *[AM Depth]* and *[ϕ M Devn]* keys.

Modulation frequency is selected using the *[FM Mod Freq]*, *[AM Mod Freq]* and *[ϕ M Mod Freq]* keys and the value is shown on the screen against *ModF*.

The type of waveform (sine, triangle or square) is obtained from a menu after pressing the *[Select Waveform]* key. For external modulation this key is replaced by the *[Select Coupling]* key.

Internal modulation switching is controlled by the *[FM ON/OFF]*, *[AM ON/OFF]* and *[ϕ M ON/OFF]* keys.

Error message field

Error messages are displayed here when, for example, you exceed a parameter limit. A list of error messages is given at the end of this chapter.

Soft key fields

These fields can hold up to 12 soft key labels. Some soft keys are used to select a field for data entry (e.g. [*Carrier Freq*]), in which case the soft key label will remain highlighted after being pressed to show that any subsequent data entry applies to that function.

Other soft keys may perform an action (for example, turning the modulation on or off), in which case the label will flash to acknowledge the key-press.

Some soft keys cause another menu to be displayed, in which case there is no highlighting or flashing of the label, the change of menu acknowledges the key-press.

Selecting functions and keyboard entry

Whenever one of the main functions – carrier frequency, RF level, modulation – is highlighted on the main screen, making any terminated numerical entry will be accepted as being a changed parameter for that function. This enables you to enter, for example, a sequence of carrier frequencies without having to re-press the [*Carrier Freq*] key for each entry.

First of all, select the A source for adjustment by pressing the [A] key.

Carrier frequency

- (1) Press the [*Carrier Freq*] soft key to select carrier frequency as the current function. The key label is highlighted so that the line bordering the label is increased in thickness to about 1 mm. Data entered on the key pad will now be recognized as a frequency setting and replaces the current setting.
- (2) Enter 100 MHz by entering 100 on the numerical key pad and terminating with [MHz]. Observe that the *Carrier Freq:* display changes to *100.000 000 MHz*.

If you make an error when keying in, press the function key again and key in the correct value. If this causes an error message (e.g. *Err 1100: Carrier Limit*) to be displayed, it can be canceled by a correct entry (e.g. by entering a value which is within limits).

RF level

- (3) Press [*RF LEVEL*] (which causes its key label to be highlighted) to select RF level as the current function.
- (4) Enter 10 dBm by entering 10 on the numerical key pad and terminating with [dB]. Observe that the *RF Level:* display changes to *+10.0 dBm*.
- (5) Press the [RF ON/OFF] key for the A signal source. Repeated pressing toggles between the on and off states as shown by *A ⇌ O/P ON* and *OFF* in the A source panel. Select *ON*. A 100 MHz, 10 dBm carrier is now being generated from the A source RF OUTPUT socket.

Modulation

- (6) Press [*FM Devn*]. Enter 100 on the key pad and terminate with [kHz]. *100 kHz* is displayed in the modulation field.
 - (7) Press [*FM Mod Freq*]. Enter 500 on the key pad and terminate with [Hz]. *ModF: 500.00 Hz* is displayed.
 - (8) Press [*Mod ON/OFF*]. Repeated pressing toggles between the on and off states as shown by *Modulation ENABLED* and *DISABLED* at the centre of the screen. Select *Modulation ENABLED*.
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- (9) Press *[FM ON/OFF]*. Repeated pressing toggles between the on and off states as shown by *ON* and *OFF* on the screen. Select *ON*. A 100 MHz, 10 dBm carrier is now being generated at 100 kHz deviation, sine wave modulated at 500 Hz from the A source RF OUTPUT socket.

Parameter adjustment

When a function has been selected, you can increment or decrement its parameter either continuously using the control knob or in steps using the [\uparrow] and [\downarrow] keys. You can also simultaneously adjust two parameters by means of the [KNOB LOCK] key.

Using the control knob

You enable the control knob by pressing the [KNOB ON/OFF] key so that the parameter to be adjusted is displayed outlined by a bracket. With the control knob enabled, you can set its resolution. Press the [$\div 10$] key to increase the bracket length by one decimal place. Similarly, press the [$\times 10$] key to decrease the bracket length by one decimal place. In this way you respectively increase or decrease the resolution of the control knob by a factor of ten.

Disabling the control knob will help to ensure that accidental changes to the set parameters are prevented.

Two-parameter adjustment

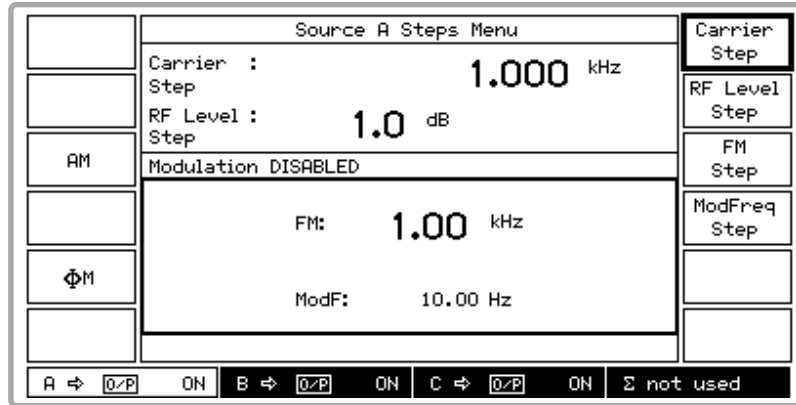
A feature of this instrument is that the [KNOB LOCK] key enables you to simultaneously and independently adjust two parameters using the control knob and the [\uparrow] [\downarrow] keys. Proceed as follows:

- (1) Select the function to be assigned to the control knob for adjustment by pressing its soft key; for example, *[Carrier Freq]*. When selected, the soft key is highlighted so that the line bordering the key label is increased in thickness to about 1 mm.
 - (2) Enable the control knob using the [KNOB ON/OFF] key (so that the bracket is visible above and below the parameter).
 - (3) Press the [KNOB LOCK] key. Now any movement of the control knob will only adjust the parameter of the assigned function leaving you free to select a second function – for example *[RF Level]* – and adjust its parameter this time using the [\uparrow] and [\downarrow] keys. At all times the function locked to the control knob is identified by its parameter being outlined by a bracket and an inverse-video bracket symbol being displayed at the lower right of the screen.
-

Using the steps keys

The selected function's parameter may be adjusted in steps using the [↑] and [↓] keys to respectively increment and decrement the parameter. The step size can be set as follows:

- (1) Press the [SET Δ] key which causes the *Steps Menu* to be displayed (see Fig. 5 below). This shows the step sizes of the currently selected signal source.



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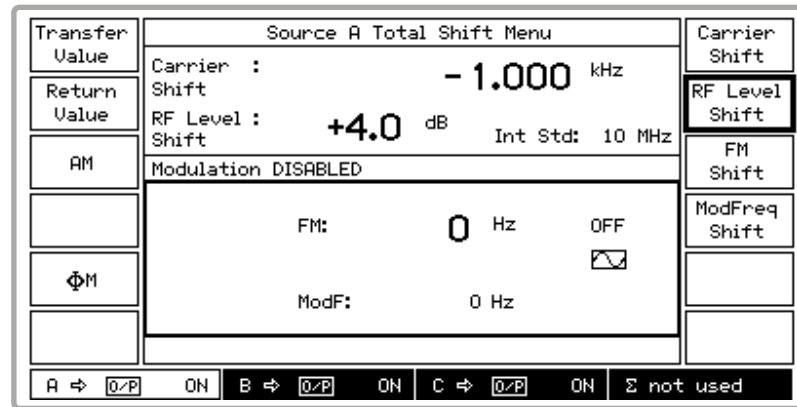
Fig. 5 Steps menu

- (2) Select [*Carrier Step*], enter the value on the key pad and press a terminator key. The step value will appear on the screen.
- (3) Return to the Sig Gen menu by pressing [SIG GEN].
- (4) Using the [↑] and [↓] keys respectively will now increment or decrement the carrier frequency by the set value.
- (5) [*RF Level Step*], [*ModFreq Step*] and [*FM Step*], [*AM Step*] and [*φM Step*] values can be entered in the same way.
- (6) Repeat as required for the other signal sources.

Displaying shifts

You can check the difference between the keyed-in value (the reference) and the current value, as well as restoring the reference either to the original value or resetting it to the new value. Proceed as follows:

- (1) Press [TOTAL Δ] to display the *Total Shift Menu* for the selected signal source. This displays the amount of shift from the reference caused by using the control knob or [↓] [↑] keys to adjust the parameters (see Fig. 6 below).



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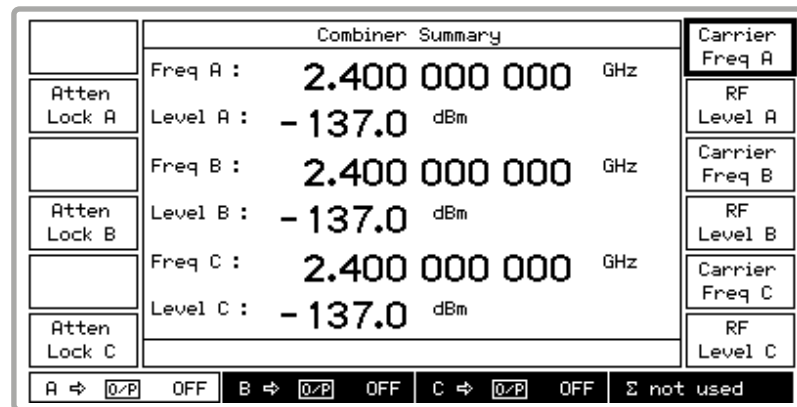
Fig. 6 Total shift menu

- (2) Carrier frequency and RF level, as well as modulation depth/deviation and frequency – in combination with the [AM], [FM] and [ΦM] keys – can be further adjusted using the appropriate [Shift] key. The amount of shift at each key-press is that of the current step value.

Combiner summary

The [Σ] hard key may be used to display a summary of all the sources' frequencies and levels and provides an easy means to change these parameters. This menu is also used to implement the attenuator lock function for each individual source. The function inhibits operation of the step attenuator from the level at which the key is enabled, and is usable for a level reduction of at least 10 dB.

- (1) Press the [Σ] hard key to show the *Combiner Summary* similar to that shown in Fig. 7 below.



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Fig. 7 Combiner summary (for instrument with three sources fitted)

- (2) You can reset the carrier frequencies and RF levels for each of the sources fitted in your instrument. Press the [Carrier Freq] or [RF Level] key for the applicable source, enter the new value on the key pad and press a terminator key.
- (3) To display the individual signal source settings press the required [A], [B] or [C] key.
- (4) To implement the attenuator lock function, press the [Atten Lock] key for the required A, B or C source. *Atten Lock* is shown on the menu (and also shown on the Sig Gen menu) against the appropriate source parameters.

Individual source operation

The following section describes the method of controlling the settings of the individual signal sources. The method of control can be used irrespective of the routing of the signal source output, whether to its own RF OUTPUT or to the COMBINED RF OUTPUT, and irrespective of any coupling that may have been set up.

Signal source selection

Select the required signal source by pressing the [A], [B] or [C] key. The selection is acknowledged by the A, B or C panel at the bottom of the display being highlighted. Having entered the parameters for that signal source you can then repeat the procedure for each additional source. In Fig. 8 below the parameters for the A source are shown.

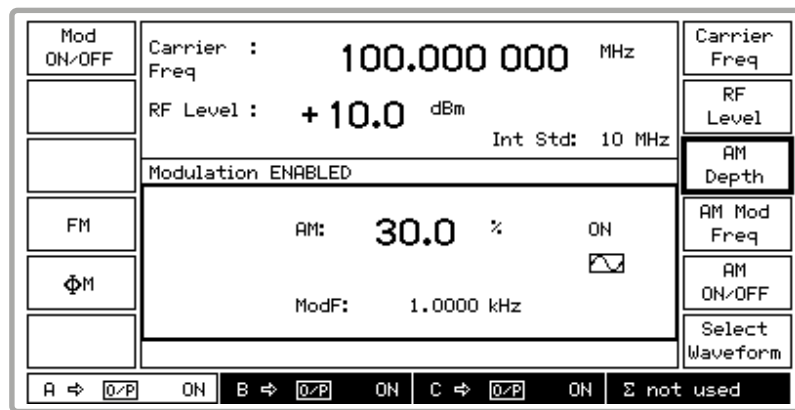


Fig. 8 Sig Gen menu with amplitude modulation selected for the A source

Carrier frequency selection

You can enter the carrier frequency in the range 10 kHz to 2.4 GHz to a resolution of 1 Hz.

- (1) Press [SIG GEN] to show the Sig Gen menu with the current carrier frequency displayed.
- (2) Press the [Carrier Freq] soft key to select carrier frequency as the current function.
- (3) Enter the required value using the numerical key pad. Terminate using the [Hz], [kHz], [MHz] or [GHz] key. If a value outside the specified range is requested, an error message is displayed and the instrument is automatically set to the end of the range.
- (4) You can then adjust the frequency either in steps using the [↓],[↑] keys or by using the control knob for continuous adjustment. The default increment/decrement is 1 kHz.
- (5) You can check the current amount of offset from the reference carrier frequency by pressing [TOTAL Δ]. This causes the *Total Shift Menu* to be displayed.
- (6) On the *Total Shift Menu* pressing the [Return Value] key returns you to the reference carrier frequency; pressing [Transfer Value] selects the currently displayed frequency as the reference frequency.
- (7) Pressing [SIG GEN] returns you to the Sig Gen menu.

Carrier on/off

The carrier can be switched on or off at any time by means of the [RF ON/OFF] key. This effectively switches the output on and off, retaining the 50 Ω output impedance.

RF level selection

You can enter the RF level in the range -137 to $+24$ dBm (to $+20$ dBm above 1.2 GHz).

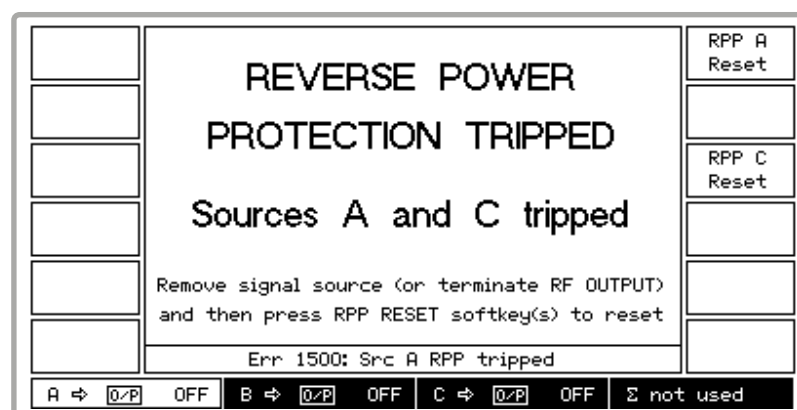
- (1) Press [SIG GEN] to show the Sig Gen menu with the current RF level displayed.
- (2) Press the [RF Level] soft key to select RF level as the current function.
- (3) Enter the required value using the numerical key pad. For voltage terminate using the [μ V], [mV] or [V] key. For logarithmic units terminate using the [dB] key. RF levels in linear and logarithmic units are selected from the utilities (see 'Choice of units' below). If a value outside the specified range is requested, an error message is displayed and the instrument is automatically set to the end of the range.
- (4) You can then adjust the level either in steps using the [\downarrow],[\uparrow] keys or by using the control knob for continuous adjustment. The default increment/decrement is 1 dB.
- (5) You can check the current amount of offset from the reference level by pressing [TOTAL Δ]. This causes the *Total Shift Menu* to be displayed.
- (6) Pressing [Return Value] returns you to the reference level; pressing [Transfer Value] selects the currently displayed level as the reference level.
- (7) Pressing [SIG GEN] returns you to the Sig Gen menu.

Choice of units

Units may be μ V, mV, V or dB. Conversion between dB and the voltage units is carried out by pressing the appropriate units key; for example, to change dBm to a voltage unit, press any voltage key for the correct conversion. The choice of Volts EMF, Volts PD and the dB reference is made by using the *RF Level Units Selection Menu*.

Reverse power protection

Accidental application of power to an individual signal source's RF OUTPUT socket trips the reverse power protection circuit (RPP) and a menu similar to that shown in Fig. 9 below appears with a flashing message.



B3473

Fig. 9 RPP tripped

Note that the protection circuit may be activated when a source is set to a high level and its RF OUTPUT socket has no terminating load.

The protection circuit can be reset by pressing the *[RPP Reset]* key for the appropriate source after having either removed the signal to the source or terminated the RF OUTPUT socket. The display then returns to the menu in use at the time that the RPP was tripped. If *[RPP Reset]* is pressed with the signal still applied, the RPP will trip again.

CAUTION

The maximum reverse power at the COMBINED RF OUTPUT socket is 0.5 W.

Modulation selection

The carrier from each signal source can be amplitude, frequency or phase modulated from an internal or external source. Additionally pulse modulation is available from an external source. The internal modulation oscillator is capable of generating two tones simultaneously in one modulation channel and has a frequency range of 0.01 Hz to 20 kHz.

Modulation modes

Each signal source has its own independent modulation facilities. The MOD I/O socket on each of the signal sources allows an external modulation signal to be summed with the signals from the internal oscillator. This allows up to three modulations to be available from each source; for example, external FM with a combined internal AM1 and AM2.

Modulation source can be internal or external. If internal, the modulation can be the sum of two signals – AM1 + AM2, FM1 + FM2 or ϕ M1 + ϕ M2 – each of which can have its own depth/deviation and modulation frequency.

The common carrier wave can be modulated by two different types of modulation, where one uses an internal source and the other an external source. The internal source may be composed of two signals. Allowed combinations are:

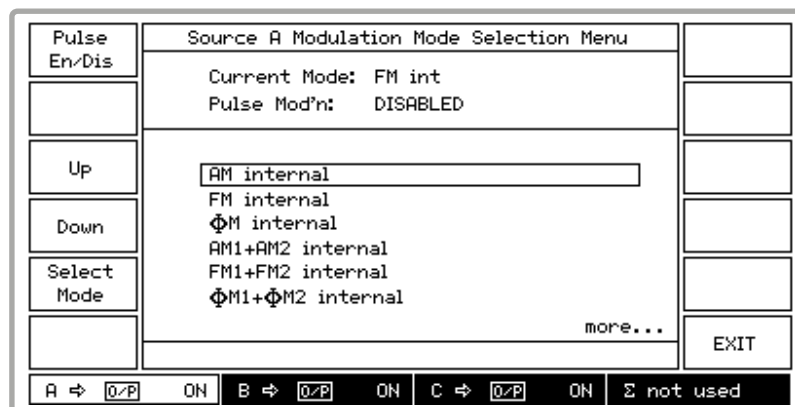
- internal AM + external FM ; internal FM + external AM
- internal AM + external ϕ M ; internal ϕ M + external AM

Note that pulse modulation may be selected for each signal source in addition to any normal modulation combination.

Mode selection

Modulation mode is selected as follows:

- (1) Press the *[UTIL]* hard key to display the *Utilities Selection Menu 1* (additionally pressing *[Utils Menu 1]* if necessary). Then select *[Mod'n Mode]* to display the *Modulation Mode Selection Menu*. This shows the currently selected modulation mode (see Fig. 9 below) for the selected signal source.



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Fig. 10 Modulation mode selection menu

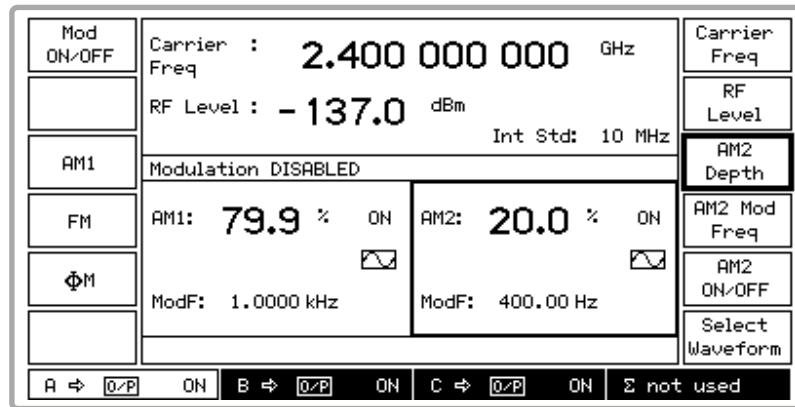
- (2) Use the [Up] and [Down] keys to move the selection box over the required modulation mode. Repeated pressing of the [Down] key will cause the screen to scroll, revealing further selections.
- (3) Press [Select Mode]. The display changes to show your new current modulation mode.
- (4) Press [Sig Gen] to display the Sig Gen menu which has been modified to show the new configuration.

Sig gen screens

Changing the modulation mode by means of the *Modulation Mode Selection Menu* affects the way in which the Sig Gen screen is presented as follows:

If a single internal modulation mode – for example, *AM internal* – has been selected, the [Select Waveform] key is displayed. This is replaced by the [Select Coupling] key if instead, a single external modulation mode – for example, *FM external* – has been selected.

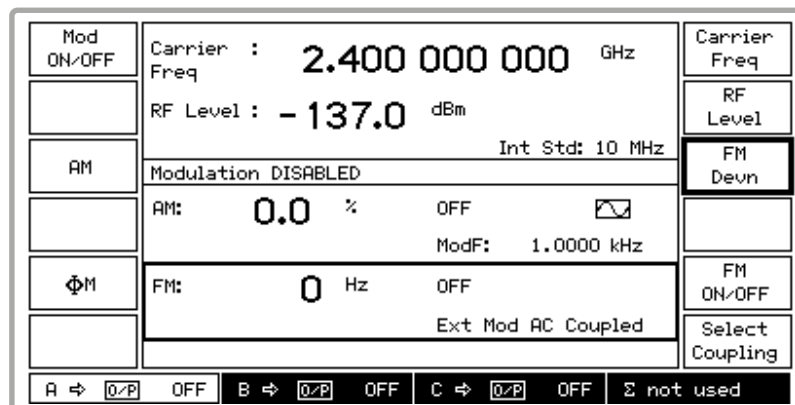
If a dual internal modulation mode – for example, *AM1 + AM2 internal* – has been selected, the modulation field is divided vertically into two panels, one for each modulation channel as shown in Fig. 11 below.



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Fig. 11 Sig Gen menu with two internal modulation channels

If a dual mixed modulation mode – for example, *AM1 internal & FM external* – has been selected, the modulation field is divided horizontally into two panels, one for each modulation source as shown in Fig. 12 below.



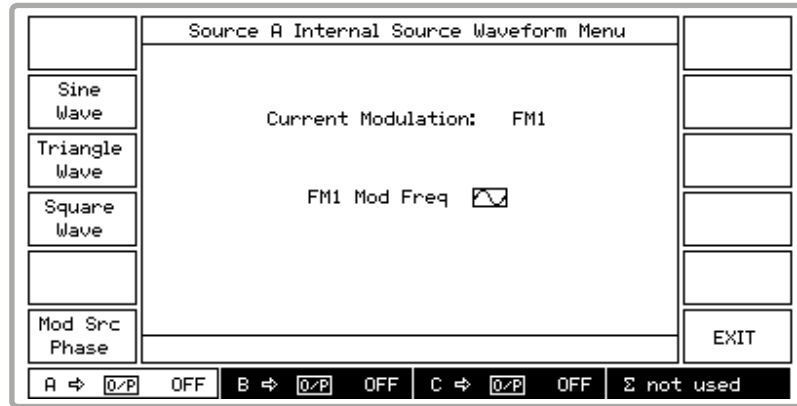
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Fig. 12 Sig Gen menu with internal and external modulation sources

Internal waveform selection

Having selected an internal modulation mode, you can select the type of waveform as follows:

- (1) Press [SIG GEN] to show the Sig Gen menu.
- (2) Press [Select Waveform] to display the *Internal Source Waveform Menu*. This shows the currently selected modulation and waveform (see Fig. 13 below).



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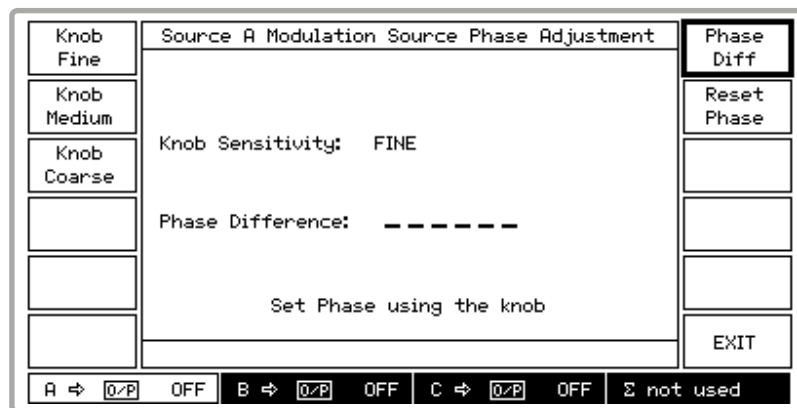
Fig. 13 Internal source waveform menu

- (3) Select between [Sine Wave], [Triangle Wave] and [Square Wave]. The waveform on the screen changes to show your new waveform selection.
- (4) Press [EXIT] to return to the Sig Gen menu.

Modulation source adjustment

You can adjust the phase difference of modulation oscillator channel 2 relative to channel 1 in degrees as follows:

- (5) Press the [Mod Src Phase] key to display the *Modulation Source Phase Adjustment* menu shown in Fig. 14 below. This shows the currently selected phase difference setting for the selected signal source.



B3418

Fig. 14 Modulation source phase adjustment menu

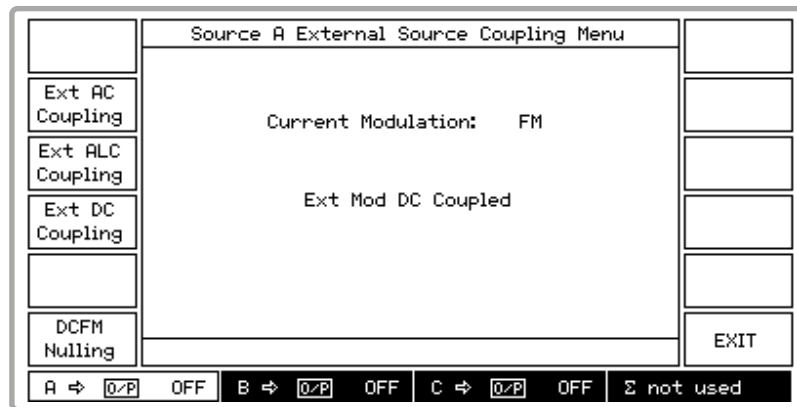
- (6) Select the required adjustment control by pressing [Knob Fine], [Knob Medium] or [Knob Coarse]. These provide adjustments in steps of 0.1°, 1.0° and 3.0° respectively.

- (7) Press [*Phase Diff*] and adjust the phase using the control knob. Turn clockwise to advance the phase and anticlockwise to retard the phase. Note that if you have set the source phase and subsequently adjusted the source frequency or changed the waveform, the menu *Phase Difference*: value will be blanked. This is because the value will then be indeterminate due to the adjustment or changed waveform.
- (8) To establish a reference, the displayed phase shift can be reset to 0.0° by pressing [*Reset Phase*].
- (9) Press [*EXIT*] to return to the Sig Gen menu.

External source coupling

Having selected an external modulation mode, you can select the type of external coupling as follows:

- (1) Press [SIG GEN] and show the Sig Gen menu for a single modulation mode.
- (2) Press [*Select Coupling*] to display the *External Source Coupling Menu*. This shows the currently selected modulation and external coupling (see Fig. 15 below). The [DCFM Nulling] key appears only during FM external modulation mode with DC coupling.



B3417

Fig. 15 External source coupling menu

- (3) Select between [*Ext AC Coupling*], [*Ext ALC Coupling*] and [*Ext DC Coupling*]. The screen changes to show your new coupling selection.
- (4) Apply a signal to the MOD I/O socket.
- (5) When Automatic Levelling Control is selected by pressing [*Ext ALC Coupling*], and the error message *Err 511: ALC too high* or *Err:512: ALC too low* is displayed, the level must be adjusted. Adjust the signal level until it is within the 0.75 to 1.25 V RMS ALC range of the source.
- (6) Press [*EXIT*] to return to the Sig Gen menu.

DCFM nulling

For a DC-coupled external signal, small frequency offsets can be reduced by using the DCFM nulling facility. Operation is as follows:

- (1) With *FM External* mode previously selected from the *Modulation Mode Selection Menu* press the [*Ext DC Coupling*] key shown in Fig. 15 above.
- (2) Connect your ground reference to the MOD I/O socket.
- (3) Press the [*DCFM Nulling*] key which is now displayed. * *DCFM Nulling* * appears during the nulling process and when it disappears the process is completed.

Modulation ON/OFF

[Mod ON/OFF] switches all modulation ON or OFF and the condition is indicated in the centre of the Sig Gen menu:

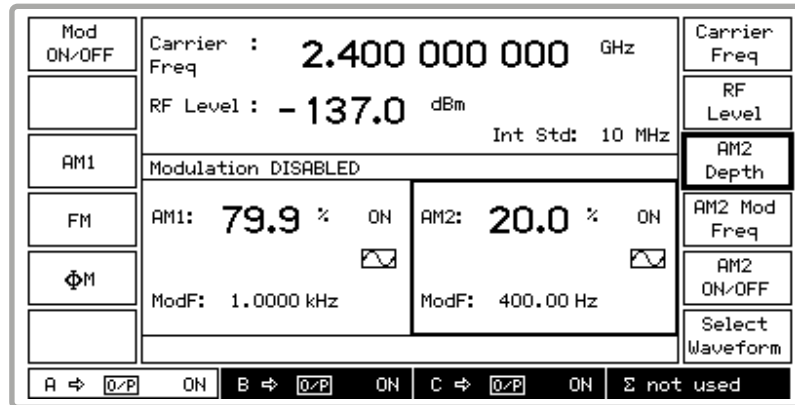
Modulation DISABLED

Modulation is also controlled by the individual modulation ON/OFF keys. For modulation to appear on the carrier, modulation must be both enabled with the [Mod ON/OFF] key and the individual [AM ON/OFF], [FM ON/OFF], [ϕ M ON/OFF] and [Pulse ON/OFF] keys. The individual modulation ON/OFF keys only reduce the modulation to zero, whereas the [Mod ON/OFF] key completely disables the modulation system so that the instrument reverts to a carrier frequency generator.

Amplitude modulation selection

Select amplitude modulation as follows:

- (1) Press [SIG GEN] to show the Sig Gen menu with the current modulation displayed in the bottom half of the screen.
- (2) Press the [AM] soft key if displayed (otherwise the instrument is already in the AM mode).
- (3) Press [AM Depth]. Enter the modulation depth using the numerical key pad and terminate with any [ENTER] key. If you exceed the 99.9% modulation limit it is automatically reset to the maximum allowed value.
- (4) If the internal modulation is to be the sum of two internal signals, select *AM1 + AM2 internal* from the utilities (see 'Mode selection' on page 3-15). A typical display is shown in Fig. 16 below. Press the [AM2] key to select the second signal. Press the [AM2 Depth] key and enter the required modulation depth for the second signal. If you exceed the (99.9% – AM1) modulation depth limit, it is automatically reset to the maximum allowed value.



B3425

Fig. 16 Sig Gen menu with two modulation channels

- (5) Select [AM Mod Freq], enter the modulation frequency and terminate with the [Hz] or [kHz] key. If you exceed the 20 kHz modulation limit it is automatically reset to the maximum allowed value.
- (6) If required, change the waveform from that shown on the display (see 'Internal waveform selection' on page 3-17).
- (7) Press [AM ON/OFF] to toggle between the on and off states as shown by the display.

Frequency modulation selection

Select frequency modulation as follows:

- (1) Press [SIG GEN] to show the Sig Gen menu with the current modulation displayed in the bottom half of the screen.
- (2) Press the [FM] soft key if displayed (otherwise the instrument is already in the FM mode).
- (3) Press [FM Devn]. Enter the deviation using the numerical key pad and terminate with the [Hz] or [kHz] key. If you exceed the 100 kHz deviation limit it is automatically reset to the maximum allowed value.
- (4) If the internal modulation is to be the sum of two signals, select *FM1 + FM2 internal* from the utilities (see 'Mode selection' on page 3-15). A typical display is shown in Fig. 16 above. Press the [FM2] key to select the second signal. Press the [FM2 Depth] key and enter the required deviation for the second signal. If you exceed the (100 kHz – FM1) deviation limit, it is automatically reset to the maximum allowed value.
- (5) Select [FM Mod Freq], enter the modulation frequency and terminate with the [Hz] or [kHz] key. If you exceed the 20 kHz modulation limit it is automatically reset to the maximum allowed value.
- (6) If required, change the waveform from that shown on the display (see 'Internal waveform selection' below).
- (7) Press [FM ON/OFF] to toggle between the on and off states as shown by the display.

Phase modulation selection

Select phase modulation as follows:

- (1) Press [SIG GEN] to show the Sig Gen menu with the current modulation displayed in the bottom half of the screen.
- (2) Press the [ϕ M] soft key if displayed (otherwise the instrument is already in the ϕ M mode).
- (3) Press [ϕ M Devn]. Enter the deviation using the numerical key pad and terminate with the [rad] key. If you exceed the 10 rad deviation limit it is automatically reset to the maximum allowed value.
- (4) If the internal modulation is to be the sum of two signals, select ϕ M1 + ϕ M2 *internal* from the utilities (see 'Mode selection' on page 3-15). A typical display is shown in Fig. 16 above. Press the [ϕ M2] key to select the second signal. Press the [ϕ M2 Depth] key and enter the required deviation for the second signal. If you exceed the (10 rad – ϕ M1) deviation limit, it is automatically reset to the maximum allowed value.
- (5) Select [ϕ M Mod Freq], enter the modulation frequency and terminate with the [Hz] or [kHz] key. If you exceed the 20 kHz modulation limit it is automatically reset to the maximum allowed value.
- (6) If required, change the waveform from that shown on the display (see 'Internal waveform selection' on page 3-17).
- (7) Press [ϕ M ON/OFF] to toggle between the on and off states as shown by the display.

Pulse modulation selection

Pulse modulation may be selected in addition to any other normal modulation modes. The source is external from any of the PULSE INPUT sockets. Select pulse modulation as follows:

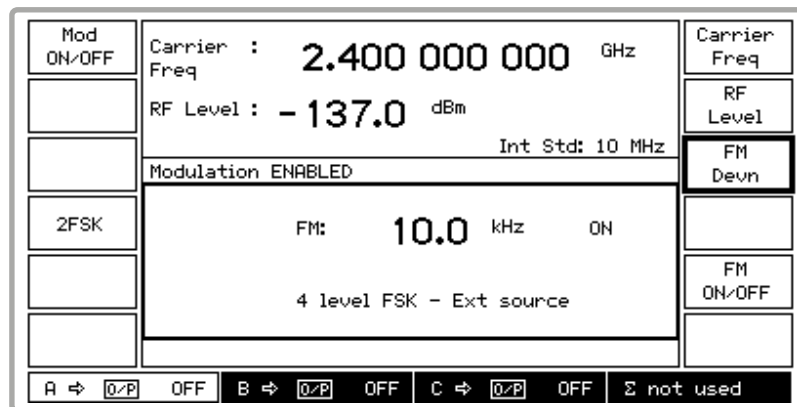
- (1) Press [UTIL] to display the *Utilities Selection Menu 1*. If the *Utilities Selection Menu 2* is displayed, it will be necessary to press the [Utils Menu 1] key.
 - (2) Select [Mod'n Mode] to display the *Modulation Mode Selection Menu*.
 - (3) Press the [Pulse Enab/Dis] key to toggle between the ON and OFF states until the display shows *Pulse Mod'n: ENABLED*.
 - (4) Press [SIG GEN] to return to the Sig Gen menu.
-

- (5) Press [*Pulse ON/OFF*] to toggle between the ON and OFF states until the display shows *Pulse ON*.
When ON the carrier is controlled by the logic level applied to the PULSE INPUT socket. A logical '1' (a voltage between 3.5 and 5 V) allows carrier output, a logical '0' (a voltage between 0 and 1.0 V) suppresses it. Turning pulse mod OFF effectively applies a logical '1' allowing carrier output.

FSK selection

The instrument accepts logic level inputs to the AUXILIARY PORT connector to produce an FSK modulated output signal from each source. The input data is sampled at 100 kHz and produces a 2- or 4-level shift waveform which is filtered by a 20 kHz Bessel filter and applied to the carrier. Frequency shift keying is selected as follows:

- (1) Press [UTIL] to display the *Utilities Selection Menu 1*. If the *Utilities Selection Menu 2* is displayed, it will be necessary to press the [*Utils Menu 1*] key.
- (2) Select [*Mod'n Mode*] to display the *Modulation Mode Selection Menu*.
- (3) Use the [*Up*] and [*Down*] keys to move the selection box over the required 2FSK or 4FSK modulation mode.
- (4) Press [*Select Mode*]. The display changes to show your new current modulation mode.
- (5) Press [Sig Gen] to display the Sig Gen menu. This has been modified to show either *2 level FSK – Ext source* or *4 level FSK – Ext source* in the modulation field (see Fig. 17 below).



B3474

Fig. 17 Sig Gen menu with 4FSK selected

- (6) Press [FM Devn], enter the required deviation and terminate with the [Hz] or [kHz] key. If you exceed the 100 kHz deviation limit the entered value is automatically reset to the maximum allowed value.
- (7) If FSK is turned off (either locally with [*FM ON/OFF*] or globally with [*Mod ON/OFF*]) no frequency shift is applied to the carrier.

Sweep

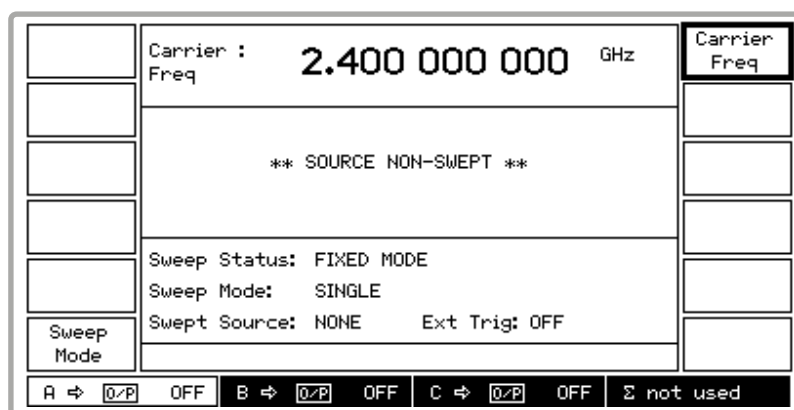
The sweep capability allows the comprehensive testing of systems, since measurements at single points will not necessarily give an overall indication of the performance. The sweep function is specified by the following parameters:

- Start frequency
- Stop frequency
- Size of step
- Time per step

The sweep can be operated in single shot or continuous modes with the start command triggered by a key press, an external pulse or GPIB control. Once started, the sweep can be stopped at any time when the display will indicate the current parameter value.

Sweep operation

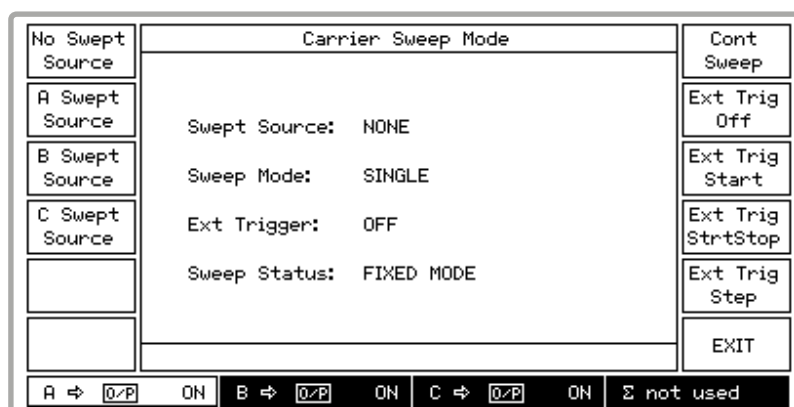
- (1) Press the [SWEEP] key which causes the Sweep Control screen to be displayed. In fixed, non-sweep, mode the screen is similar to that shown in Fig. 18 below. In sweep mode the screen changes similar to that shown in Fig. 20.



B3426

Fig. 18 Sweep control screen in fixed mode

- (2) Press [Sweep Mode] to display the Carrier Sweep Mode menu shown in Fig. 19 below.



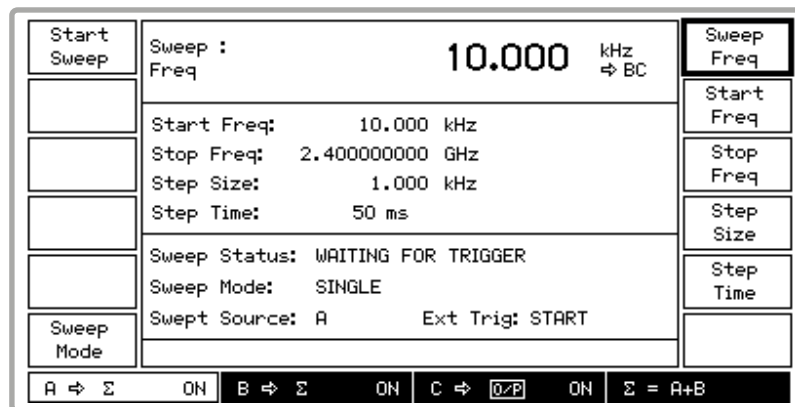
B3427

Fig. 19 Carrier sweep mode menu

- (3) Select the A, B or C source for sweeping by pressing the appropriate [*A Swept Source*], [*B Swept Source*] or [*C Swept Source*] key.
- (4) Select the sweep mode between single shot and continuous sweeping by pressing the [*Sweep*] key which toggles between [*Single Sweep*] and [*Cont Sweep*].
- (5) For external triggering press [*Ext Trig Off*] to inhibit the external trigger or press one of the following keys to select the appropriate trigger mode:
 - [*Ext Trig Start*] – The first trigger input causes the carrier sweep to commence sweeping. Any other trigger inputs whilst sweeping are ignored. Only at the end of each sweep is the trigger latch reset ready for the next input.
 - [*Ext Trig StrtStop*] – The first trigger input starts the carrier sweep and the following trigger input pauses it, so that the user can investigate a particular point of interest. The next trigger input continues the sweep from where it was paused. At the start of each sweep the trigger latch is reset ready for the next input.
 - [*Ext Trig Step*] – Each trigger input steps the sweep on by one frequency step. The trigger latch is reset after each step ready for the next step.
- (6) Pressing [*No Swept Source*] disables sweep mode.
- (7) If no source has been selected for sweeping, pressing [*EXIT*] will return you to the *Carrier Sweep Mode Menu*. Otherwise, the Sweep Control screen will be displayed.

Sweep control

- (8) The Sweep Control screen displayed is similar to that shown in Fig. 20 below. This is used to perform the sweeping operation.



B3428

Fig. 20 Sweep control screen in sweep mode (B and C sources coupled to A source)

- (9) Enter the sweep start and stop frequencies using the [*Start Freq*] and [*Stop Freq*] keys.
- (10) Press [*Step Size*] and enter the step size in the range 1 Hz to the instrument maximum frequency, to a resolution of 1 Hz.
- (11) Press [*Step Time*] and enter the step time in the range 50 ms to 10 s to a resolution of 1 ms.
- (12) To start the sweep press [*Start Sweep*]. The key changes its function to [*Stop Sweep*] and *Sweep Status* changes from *WAITING FOR TRIGGER* to *SWEEPING*. The displayed *Sweep Freq* changes to show the progress of the sweep.
- (13) The sweep can be stopped at any time by pressing [*Stop Sweep*]. This causes the key function to change to [*Continue Sweep*] and *Sweep Status* changes to *PAUSED*.

- (14) Whilst the sweep is paused you can adjust the frequency by selecting [*Sweep Freq*] then using the control knob to look at a particular frequency of interest. Pressing [*Transfer*] followed by [*Continue Sweep*] causes the sweep to continue from your adjusted frequency. Otherwise simply pressing [*Continue Sweep*] restarts the sweep from where it was paused. Pressing [*Reset Sweep*] discontinues the sweep and resets it to the start frequency.
 - (15) At the end of a single sweep, the stop frequency is shown and the key function changes to [*Start Sweep*] with *SWEEP COMPLETE* displayed. For continuous sweep, the sweep automatically recommences from the start frequency.
 - (16) To change the sweep mode, press the [*Sweep Mode*] key which returns you to the *Carrier Sweep Mode* menu.
-

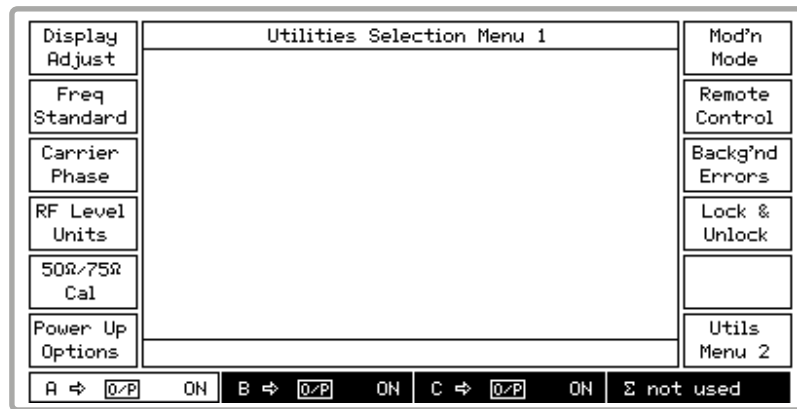
Utilities

Utility menu selection

Pressing the [UTIL] key gains access to the utilities options from two primary menus, *Utilities Selection Menu 1* and *Utilities Selection Menu 2*. When a selection is made from either of these menus and [UTIL] is subsequently pressed, the primary menu is re-displayed. However, if instead a selection is made and then one of the other hard keys – for example, [MEM] – is pressed, pressing [UTIL] subsequently once return to the sub-menu, pressing it again returns to the primary menu. This provides an operating short-cut in that it allows you to re-access a sub-menu without first having to go again through the primary menu.

Selection menu 1

The display for *Utilities Selection Menu 1* is shown in Fig. 21 below.



B3453

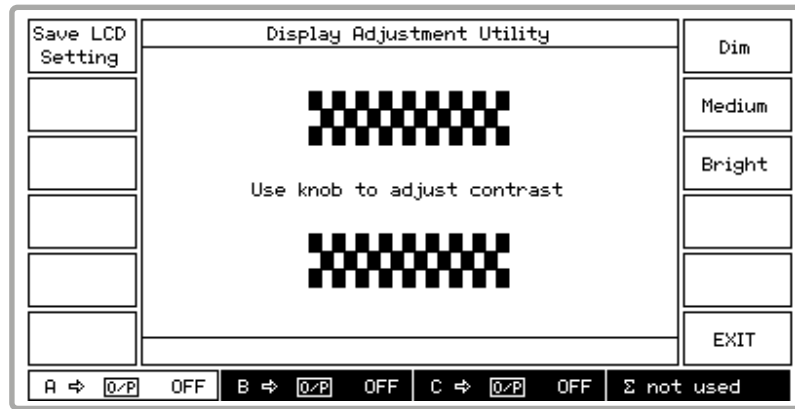
Fig. 21 Utilities selection menu 1

To obtain *Utilities Selection Menu 2* from the menu, select [*Utils Menu 2*].

Display adjustment (menu 1)

You can set the display contrast and brightness to suit your individual preferences using this utility. The setting can then be saved for automatic recall whenever the instrument is switched on. Proceed as follows:

- (1) Select [*Display Adjust*] to call up the *Display Adjustment Utility* shown in Fig. 22 below.



B3454

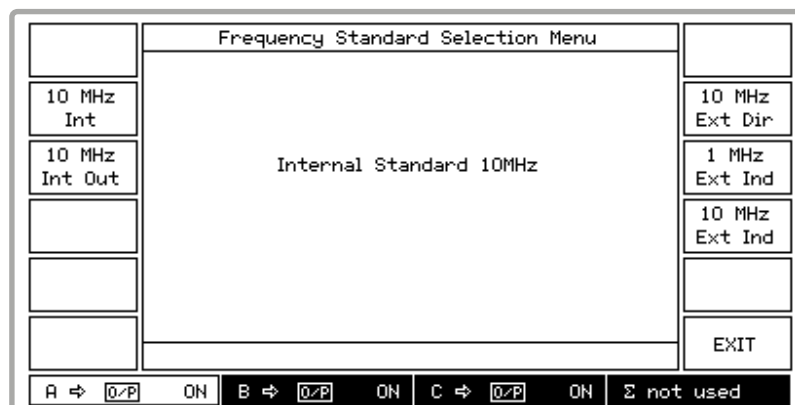
Fig. 22 Display adjustment utility

- (2) Set the required brightness by pressing [*Dim*], [*Medium*] or [*Bright*]. You can then adjust the contrast by means of the control knob.
- (3) Once adjusted, the display setting can be stored in the non-volatile memory by pressing [*Save LCD Setting*]. The setting will be subsequently recalled on power-up.
- (4) Press [*EXIT*] to return to the *Utilities Selection Menu 1*.

Frequency standard selection (menu 1)

This utility enables you to select a 10 MHz output as a standard for use with associated equipment. It also enables you to select a standard (either external or internal) for use by the instrument. When an external standard is selected, the internal TCXO is locked to the external standard using a phase locked loop. For a 10 MHz standard, the menu allows you to select between *direct* and *indirect*. When *direct* is selected the internal standard for the RF trays is provided directly from the external standard. When *indirect* is selected this standard is provided from the TCXO locked to the external standard. Frequency standard selection is as follows:

- (1) Select [*Freq Standard*] to display the *Frequency Standard Selection Menu* shown in Fig. 23 below. This shows the currently selected standard.



B3455

Fig. 23 Frequency standard selection menu

- (2) Select the internal standard for the instrument by pressing [*10 MHz Int*].
- (3) To provide an externally generated 1 or 10 MHz standard for the instrument, connect the signal to the rear-panel EXT STD I/P socket. Then choose one of the three external standards [*10 MHz Ext Dir*], [*1 MHz Ext Ind*] or [*10 MHz Ext Ind*]. You should choose [*10 MHz Ext Dir*] if your provided 10 MHz standard is better than that fitted in the instrument.

- (4) To obtain an internally generated 10 MHz standard from the instrument's INT STD O/P socket, select *[10 MHz Int Out]*.
- (5) Press *[EXIT]* to return to the *Utilities Selection Menu 1*.

Carrier phase adjustment (menu 1)

You can adjust the phase offset of the carrier with respect to its current phase in degrees as follows:

- (1) Press *[Carrier Phase]* to display the *Carrier Phase Adjustment Utility* shown in Fig. 24 below. This shows the currently selected phase offset for the selected signal source.

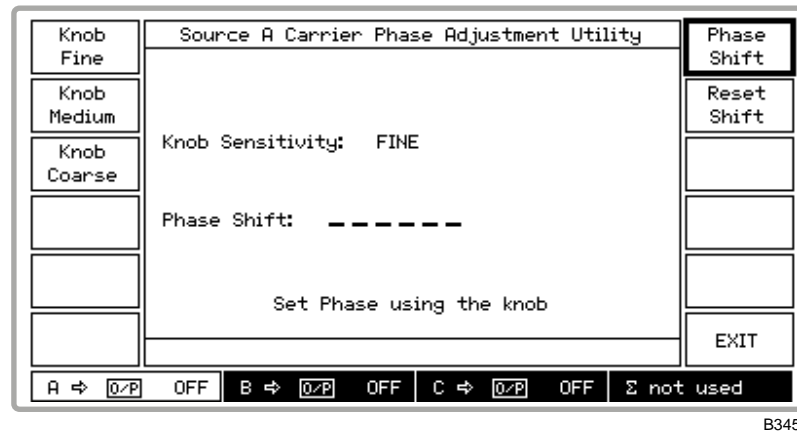


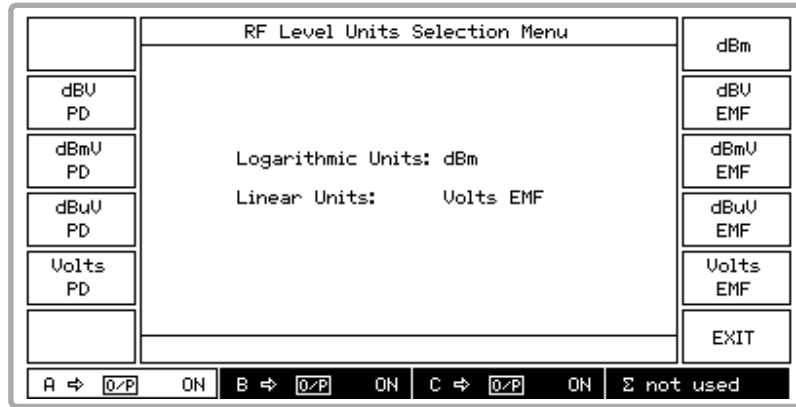
Fig. 24 Carrier phase adjustment utility

- (2) Select the required adjustment control by pressing *[Knob Fine]*, *[Knob Medium]* or *[Knob Coarse]*. These provide adjustments in steps of 0.09° , 0.9° and 2.7° respectively.
- (3) Press *[Phase Shift]* and adjust the carrier phase using the control knob. Turn clockwise to advance the phase and anticlockwise to retard the phase. Note that if you have set the carrier phase and subsequently adjusted the carrier frequency, the menu *Phase Shift:* value will be blanked. This is because the value will then be indeterminate due to the adjustment.
- (4) To establish a reference the displayed phase shift can be reset to 0.00° by pressing *[Reset Shift]*. But note that this does not reset the actual phase shift, only the displayed value is reset to provide a new reference.
- (5) Press *[EXIT]* to return to the *Utilities Selection Menu 1*.

RF level units selection (menu 1)

RF output level units may be changed as follows:

- (1) Press *[RF Level Units]* to display the *RF Level Units Selection Menu* which shows the current selection (see Fig. 25 below).



B3457

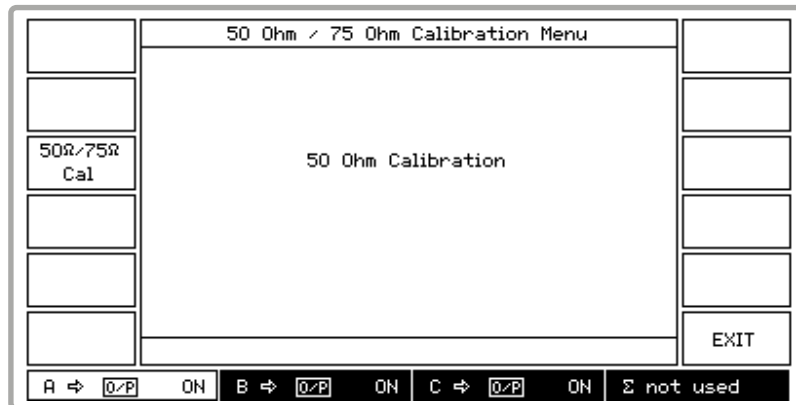
Fig. 25 RF level units selection menu

- (2) Select between linear and logarithmic units in EMF or PD. Logarithmic units may be referred to volts (dBV), millivolts (dBmV), microvolts (dBμV) or to 1 millivolt into 50 Ω (dBm).
- (3) Press [EXIT] to return to the *Utilities Selection Menu 1*.

50 Ω /75 Ω impedance selection (menu 1)

The performance specification of each signal source assumes operation into 50 Ω loads. By means of this menu in association with a 75 Ω adapter you can select operation into 75 Ω loads whilst maintaining correct voltage calibration. It also enables the reverse power protection circuit to function correctly. But note that in the event of an overload the RPP will function but the adapter will NOT be protected. Proceed as follows:

- (1) Press [50Ω/75Ω Cal] to display the *50 Ohm/75 Ohm Calibration Menu* shown in Fig. 26 below.



B3458

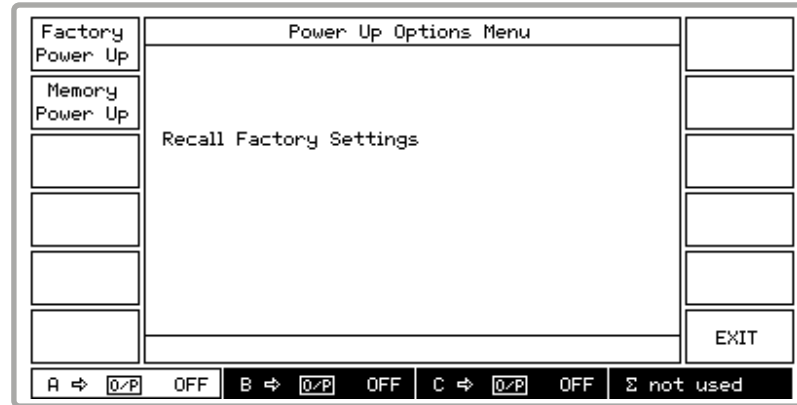
Fig. 26 50 ohm/75 ohm calibration menu

- (2) Press [50Ω/75Ω Cal] which toggles between *50 Ohm Calibration* and *75 Ohm Calibration* as shown by the screen. Note that all RF OUTPUT sockets, including the combiner's, will change calibration.
- (3) For 75 Ω operation connect a 50 Ω/75 Ω adapter to the front-panel RF OUTPUT socket for each appropriate signal source. Whenever the impedance is changed, the value of the displayed level is adjusted (by 5.7 dB) to the level at the output from the adapter.
- (4) Press [EXIT] to return to the *Utilities Selection Menu 1*.

Power-up options (menu 1)

The instrument can power-up in one of two states; with the factory settings or with the settings of your choice stored in one of the full memory locations. Selection is made as follows:

- (1) Press [*Power Up Options*] to display the *Power Up Options Menu* shown in Fig. 27 below. This shows the currently selected power-up choice.



B3459

Fig. 27 Power up options menu

- (2) Press [*Factory Power Up*] to select the factory power-up settings (these are listed in Table 1 below). Otherwise press [*Memory Power Up*] to store the current settings as your selected power-up state.
- (3) Press [*EXIT*] to return to the *Utilities Selection Menu 1*.

Default settings

The instrument is reset to the factory default settings in the following cases:

- (1) At power-up to factory default settings.
- (2) Following execution of the *RST command.
- (3) When [*Factory Recall*] is pressed on the *Memory Recall Menu*.

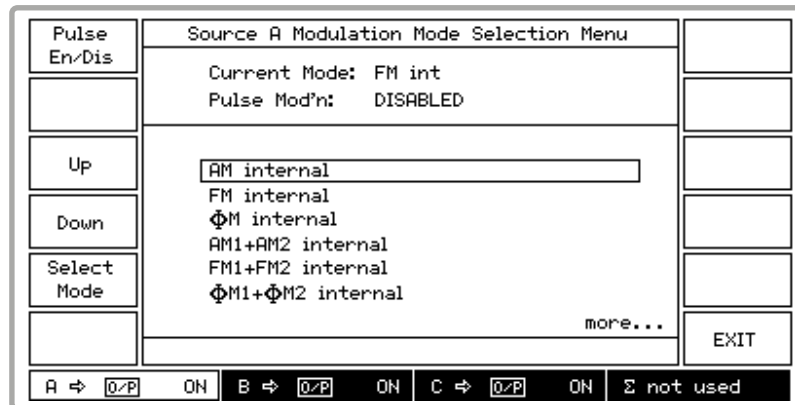
The default settings are shown in Table 1.

Table 1 Instrument default settings

Source selected	Source A
Carrier frequency :	(Maximum available) 2.4 GHz
Step :	1 kHz
RF level	-137 dBm
Step :	1 dB Status: ON
Modulation mode	Internal FM, modulation disabled
Modulations :	FM1 : Deviation: 0 Hz, OFF : Internal source, frequency: 1 kHz, sine
	FM2 : Deviation: 0 Hz, OFF : Internal source, frequency: 400 Hz, sine
	Φ M1 : Deviation: 0 rad, OFF : Internal source, frequency: 1 kHz, sine
	Φ M2 : Deviation: 0 rad, OFF : Internal source, frequency: 400 Hz, sine
	AM1 : Deviation: 0%, OFF : Internal source, frequency: 1 kHz, sine
	AM2 : Deviation: 0%, OFF : Internal source, frequency: 400 Hz, sine
	Pulse : OFF :
Modulation steps :	Δ FM 1 kHz, $\Delta\Phi$ M 0.1 rad, Δ AM 1%
Mod frequency steps :	10 Hz
Carrier sweep	
Freq mode :	Fixed
Mode :	Single sweep
Ext trigger :	Off
Start :	10 kHz
Stop :	(Maximum available)
Step size :	1 kHz
Time :	50 ms

Modulation mode selection (menu 1)

Modulation mode is selected by pressing [Mod'n Mode] to display the *Modulation Mode Selection Menu* shown in Fig. 28 below. Using the menu is explained under 'Modulation mode selection' above.



B3460

Fig. 28 Modulation mode selection menu

Remote control selection (menu 1)

The remote mode of operation is selected as follows:

- (1) Select [*Remote Control*] to display the *Remote Control Utility*. This shows the currently selected remote mode (see Fig. 29 below).

Remote Control Utility		Baud Rate
GPIB/RS232	Remote Operation : GPIB	GPIB Address
Data Bits	RS232 Settings	
Stop Bits	Baud Rate (300 - 9600) : 9600 ----	
Parity	Data Bits (7 or 8) : 7	
Hardware Hndshk	Stop Bits (1 or 2) : 1	
XON/XOFF Hndshk	Parity (None/Odd/Even) : None	
	Hardware Handshaking : OFF	
	XON/XOFF Handshaking : OFF	
	GPIB Settings	
	GPIB Address (0 - 30) : 00 --	EXIT
A ⇨ [0/P] ON B ⇨ [0/P] ON C ⇨ [0/P] ON Σ not used		

B3475

Fig. 29 Remote control utility

- (2) Press [*GPIB/RS232*] to toggle between *GPIB* and *RS232*.

GPIB mode

- (3) Press [*GPIB Address*] and enter the address, which must be unique on the system to the instrument and within the range 0 to 30.

RS-232 mode

- (3) Press [*Data Bits*] to toggle between 7 and 8 data bits.
- (4) Press [*Stop Bits*] to toggle between 1 and 2 stop bits.
- (5) Press [*Parity*] to cycle through the selections *None*, *Odd*, *Even*.
- (6) Press [*Hardware Hndshk*] and [*XON/XOFF Hndshk*] to select any combination between both *OFF* to both *ON*.
- (7) Press [*Baud Rate*] and set the baud rate in the range 300 to 9600 bit/s. But note that if the entered value is not one of the following standard settings, the next higher value will be selected by default.

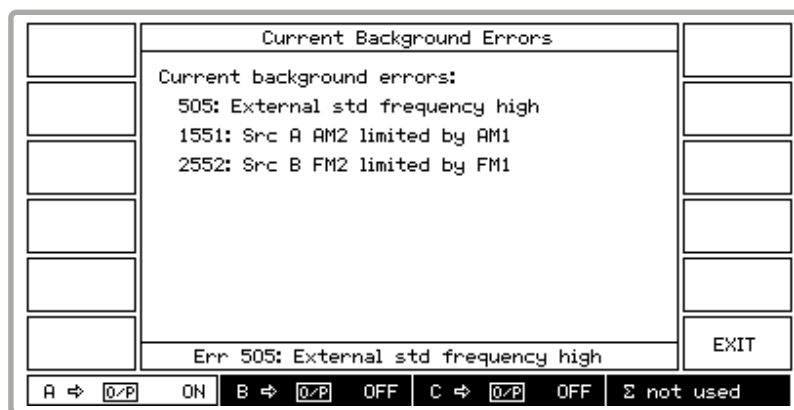
300
600
1200
2400
4800
9600

- (8) Press [*EXIT*] to return to the *Utilities Selection Menu 1*.

Background error reporting (menu 1)

Background errors are generated due to an incorrect operating condition within the instrument. These error messages are generated automatically to warn the operator. Although there is room only to display one message in the error message field of the displays, this utility enables a complete list of the current background errors to be shown. Proceed as follows:

- (1) Press [*Backg'nd Errors*] which causes the *Current Background Errors* display similar to that in Fig. 30 below to be shown. The errors are shown in priority order.



B3476

Fig. 30 Current background errors display (showing example errors)

- (2) Where there are more background errors than can be displayed on one screen page, the [Next Page] and [Previous Page] soft keys will be displayed to enable more than one page of errors to be viewed.
- (3) Press [EXIT] to return to the Utilities Selection Menu 1.

Protection locking and unlocking (menu 1)

To prevent accidental interference with the contents of internal memories, internal data is protected by secure key sequences. There are two levels of protection. The most secure, Level 2, is used for memory erasure, elapsed time reporting and for servicing purposes such as altering the calibration data of the instrument. Level 1 protection is used for display blanking and memory protection.

The lock and unlock utility is selected as follows:

- (1) Select [Lock & Unlock] to display the Lock & Unlock Utility. When Level 1 and Level 2 are both locked the display will be similar to Fig. 31 below.



B3477

Fig. 31 Lock and unlock utility (during password entry)

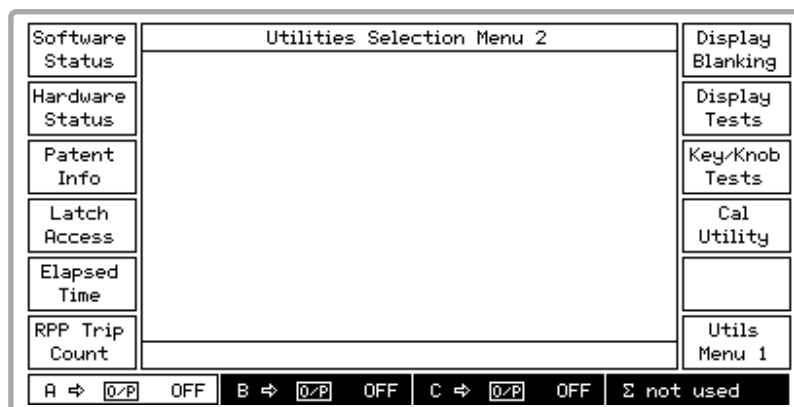
- (2) To unlock to Level 1 press [Unlock Level 1] and enter a 4-digit password (the default is 1234). As each digit is entered an asterisk is displayed. Terminate with [ENTER].
- (3) To unlock to Level 2 press [Unlock Level 2] and enter a 6-digit password (the default is 123456). As each digit is entered an asterisk is displayed. Terminate with [ENTER].
- (4) When successful, UNLOCKED is displayed on the screen against the appropriate level and the [Unlock Level 1] or [Unlock Level 2] key is blanked. If the entered password is not recognized by the instrument the password will have been changed by operating personnel.
- (5) To lock the instrument, press the appropriate [Lock Level 1] or [Lock Level 2] key.
- (6) Press [EXIT] to return to the Utilities Selection Menu 1.

Note

If you have lost or forgotten the password contact our Customer Services or your nearest agent (for addresses see inside rear cover). You will be required to give the instrument's serial number.

Selection menu 2

Press the [Utils Menu 2] on the *Utilities Selection Menu 1* to obtain the display for *Utilities Selection Menu 2* as shown in Fig. 32 below. Some of the items on this menu are intended for use in servicing and are described in the maintenance manual. As a result, some of these keys appear only when unlocked to the appropriate Level.



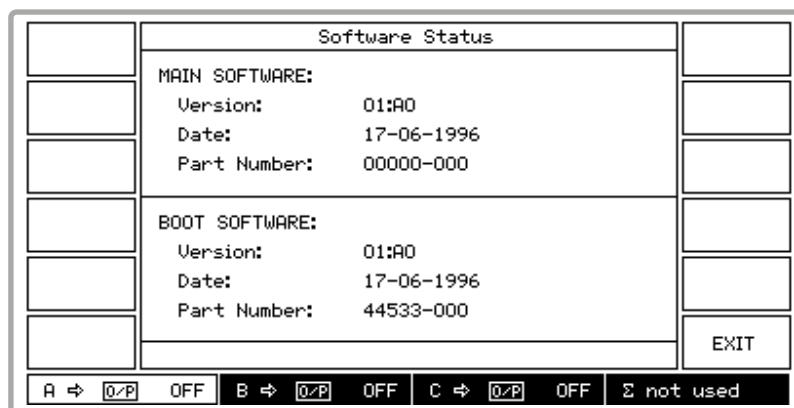
B3478

Fig. 32 Utilities selection menu 2

To obtain *Utilities Selection Menu 1* from the menu, select [Utils Menu 1].

Software information (menu 2)

You can obtain a description of the instrument's software by pressing [Software Status] which causes Fig. 33 below to be displayed. This shows the software version and date as well the EPROM part number.



B3429

Fig. 33 Software status display

- (1) Press [EXIT] to return to the *Utilities Selection Menu 2*.

Hardware information (menu 2)

You can obtain a description of the instrument's hardware by pressing [*Hardware Status*] which causes Fig. 34 below to be displayed. This shows the instrument type and serial number as well as options fitted.

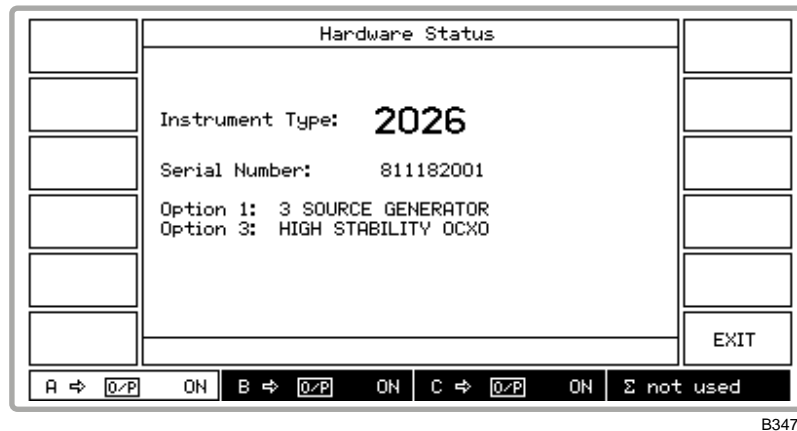


Fig. 34 Hardware status display

- (1) Press [*EXIT*] to return to the *Utilities Selection Menu 2*.

Patent information (menu 2)

To obtain the more important patent information, press [*Patent Info*] which causes Fig. 35 below to be displayed.

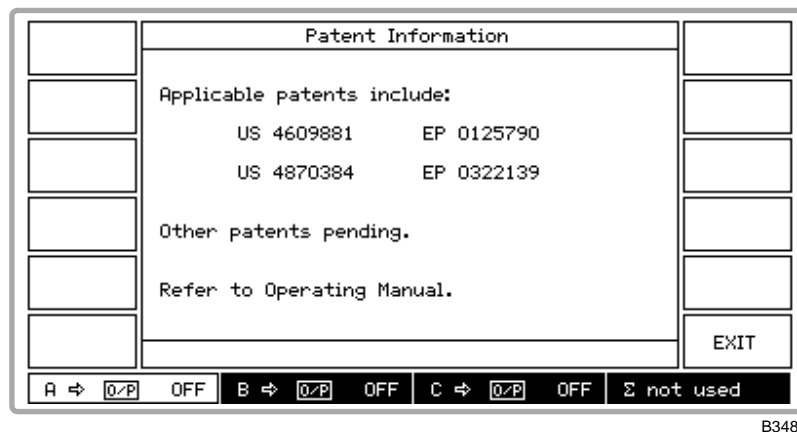
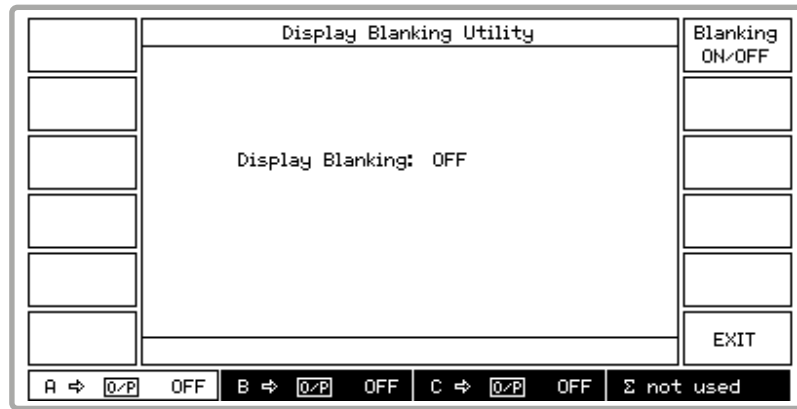


Fig. 35 Patent information display

- (1) For a full list of patents refer to 'Patent protection' in the Preface.
- (2) Press [*EXIT*] to return to the *Utilities Selection Menu 2*.

Display blanking (menu 2)

This facility is used to prevent sensitive data from being displayed. It allows various parts of the display to be replaced by a series of dashes so that values entered by the user or recalled from the memory will not be visible.



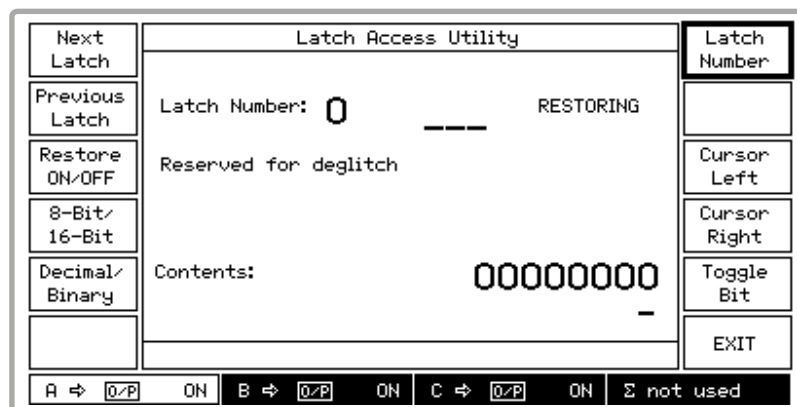
B3481

Fig. 36 Display blanking utility

- (1) Unlock the protection to Level 1 by means of the *Lock & Unlock Utility* (menu 1).
- (2) Press [*Display Blanking*] which causes the screen shown in Fig. 36 above to be displayed.
- (3) To blank the screen press the [*Blanking ON/OFF*] key which toggles between the on and off states.
- (4) Press the [SIG GEN] key to display the main screen. Here it can be seen that the main parameters are blanked and replaced by dashes. This also applies to the parameters displayed on the Sweep Control screen.
- (5) Press [*EXIT*] to return to the *Utilities Selection Menu 2*.

Latch access utility (menu 2)

This utility is intended for use as a diagnostic aid by allowing data to be sent to latches within the instrument. For further information consult the maintenance manual. The menu is shown in Fig. 37 below.

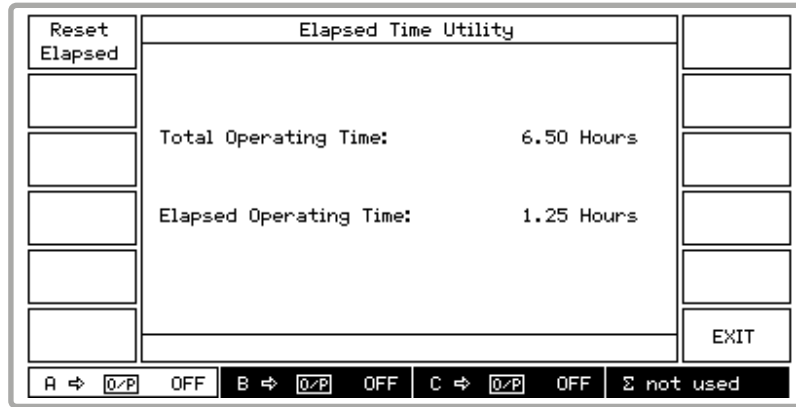


B3530

Fig. 37 Latch access utility

Elapsed time (menu 2)

The elapsed time facility displays the total number of operating hours as well as the number of elapsed operating hours since the last reset by the [*Reset Elapsed*] key. This facility can be used to assess the instrument's operational reliability and utilization. To use this facility the instrument must be unlocked to Level 2. The screen is shown in Fig. 38 below.

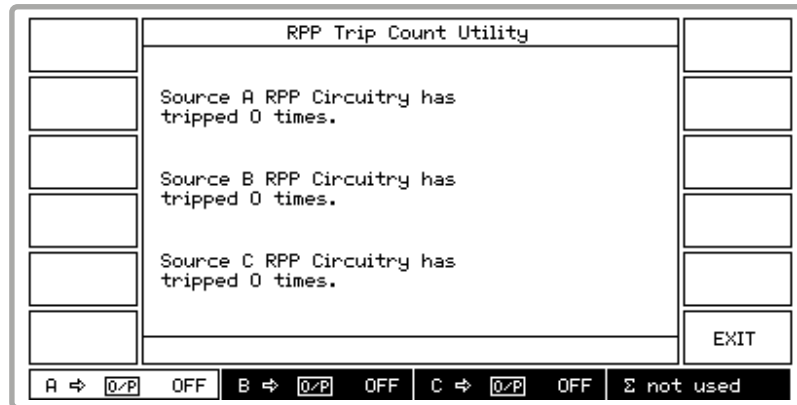


B3516

Fig. 38 Elapsed time utility

RPP trip count utility (menu 2)

This utility lists the number of times each of the fitted sources has tripped. The screen is shown in Fig. 39 below.

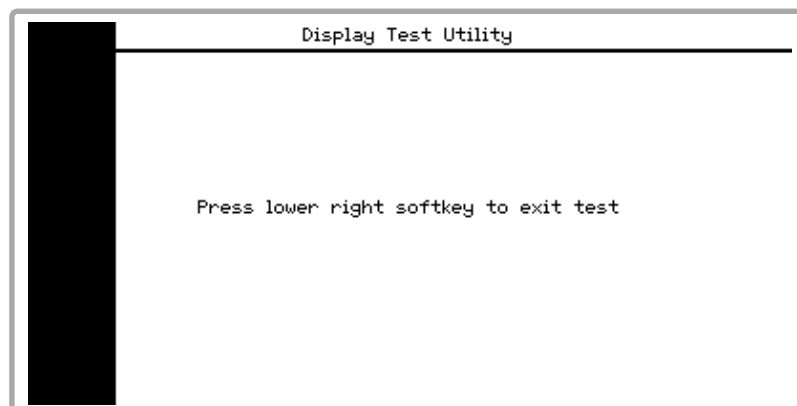


B3526

Fig. 39 RPP trip count utility

Display test utility (menu 2)

This utility provides a simple test of the display. The screen is shown in Fig. 40 below.

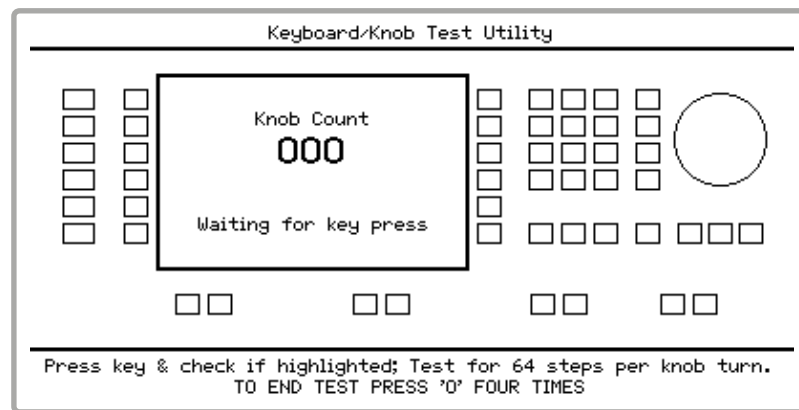


B3527

Fig. 40 Display test utility

Key/knob tests (menu 2)

In this utility the user is invited to operate the keys and control knob whilst checking the reaction of the instrument. The screen is shown in Fig. 41 below.

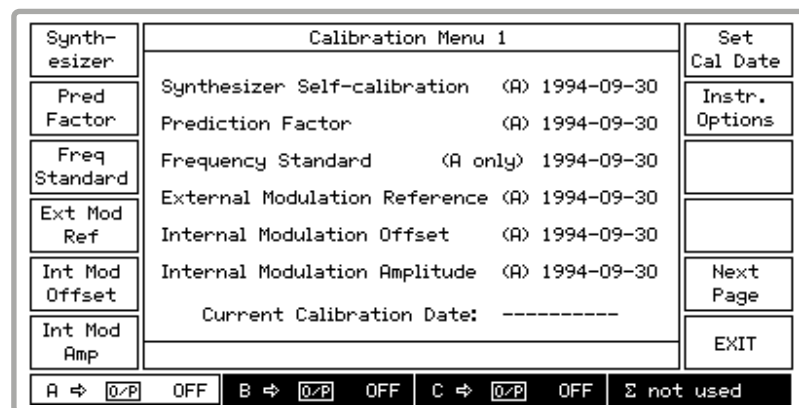


B3528

Fig. 41 Keyboard/knob test utility

Calibration utility (menu 2)

This menu shows when each individual item was last adjusted and enables you to enter the date of the current adjustment. The instrument must be unlocked to Level 2 to use this utility. Full details regarding calibration can be found in the maintenance manual. The first page of the menu is shown in Fig. 42 below.



B3529

Fig. 42 Calibration menu

Memory

Memory stores

There are three types of store: carrier, full and RAM. Both carrier and full stores are non-volatile. The contents of the RAM store are lost when the instrument is switched off.

Each type of store holds the data for all fitted sources.

Carrier store

The non-volatile carrier frequency store has 100 locations numbered 0 to 99 for the storage of carrier frequency only. This store can be used to apply a set of test conditions to a range of frequencies. For example, if you wish to use the same modulation at a variety of frequencies you can use the carrier store to set the instrument to each of the frequencies in turn. When a carrier store is used it will only replace the current carrier frequency – all the other settings will remain unchanged.

Full store

The non-volatile full store has 100 locations numbered 0 to 99 for the storage of instrument settings. This store is used to store those parameters which currently affect the RF output; carrier frequency, RF level, modulations in use, on/off and source information and the two modulation oscillator frequencies in use.

A full store contains the following information:

- Carrier frequency setting
- Carrier frequency step size
- RF level setting
- RF level step size
- All modulation settings
- All modulation step sizes
- Modulation mode and status
- The active modulation frequencies
- The modulation frequency step size
- All sweep settings

RAM store

The volatile RAM store has locations numbered from 0 to 99 for the full storage of instrument settings. The parameters stored are the same as those for the full store. However, the RAM store has no long-term wear-out mechanism and is therefore recommended for use in ATE programs where all the settings to be used in a test sequence are initially declared and then recalled. This results in a reduction of the GPIB/RS-232 overhead.

Storing data

Select the memory store function as follows:

- (1) Press the [MEM] hard key and then, if necessary, press the [Store/Recall] soft key to display the *Memory Store Menu* shown in Fig. 43 below.

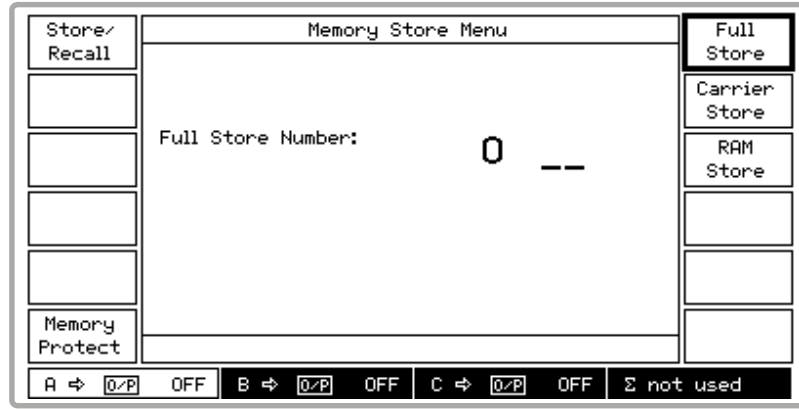


Fig. 43 Memory store menu

- (2) To store data, press the [Full Store], [Carrier Store] or [RAM Store] key for the type of store required, then enter the store location via the numerical key pad and terminate with [ENTER].

Note that memory erasure requires unlocking to Level 2 (see 'Protection locking and unlocking' on page 3-34).

Memory protection

Memory stores may be protected against accidental overwriting of the contents.

Memory protection summary

- (1) To see which store locations are protected (or unprotected), press the [Memory Protect] key. If the instrument is in the protection locked state, the *Memory Write Protection Summary* shown in Fig. 44 below is displayed. Otherwise Fig. 45 below is shown.

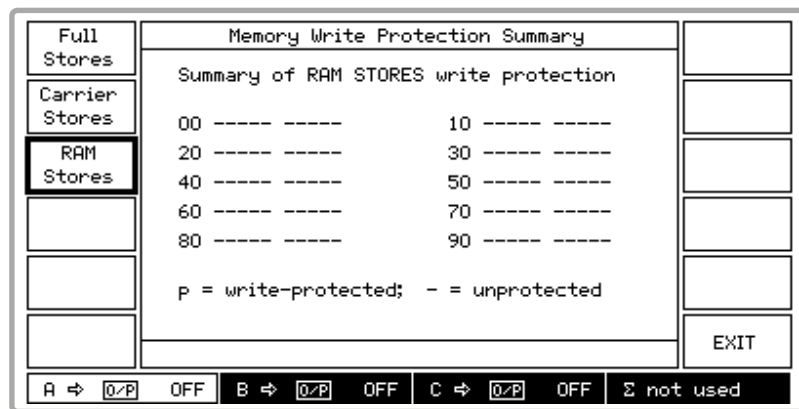
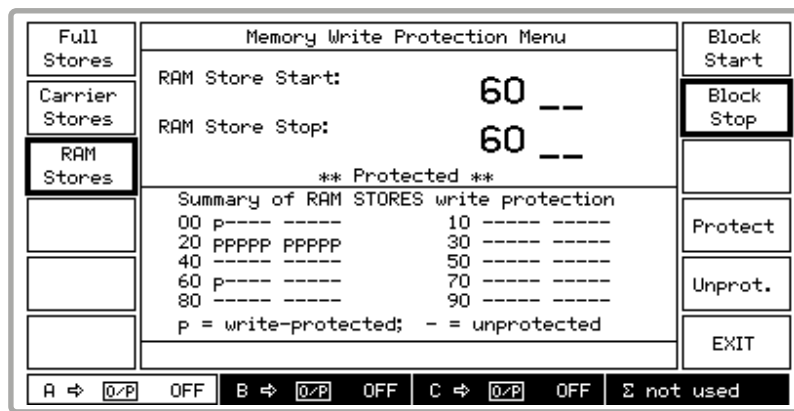


Fig. 44 Memory write protection summary

- (2) From the summary, select the type of memory stores to be displayed by selecting between [Full Stores], [Carrier Stores] and [RAM Stores]. An unprotected store is indicated by a dash (-), a protected store is indicated by the letter **p**.
- (3) Press [EXIT] to return to the *Memory Store Menu*.

Memory protection menu

- (4) To change the write protection, the instrument must be unlocked to Level 1 (see ‘Protection locking and unlocking’ on page 3-34). Subsequently pressing [Memory Protect] causes the Memory Write Protection Menu similar to that shown in Fig. 45 below to be displayed.



B3483

Fig. 45 Memory write protection menu

- (5) Select the type of memory stores to be changed by selecting between [Full Stores], [Carrier Stores] and [RAM Stores]. An unprotected store is indicated by a dash (–), a protected store is indicated by the letter **p**.
- (6) To change the protection for a memory block enter the [Block Start] and [Block Stop] numbers. For a single store make both numbers the same.
- (7) Select [Protect] or [Unprot.] as required. This action is acknowledged by the message **** Protected **** or **** Unprotected **** appearing respectively.
- (8) Press [EXIT] to return to the Memory Store Menu.

Note that at power-on the volatile RAM stores are unprotected to allow immediate use.

Memory recall

There are three types of recall: carrier, full and RAM. Both carrier and full stores are non-volatile. The contents of the RAM store are lost when the instrument is switched off.

Carrier recall

The non-volatile carrier frequency store has 100 locations numbered 0 to 99 for carrier frequency only. These can be recalled and used in conjunction with full recall to apply a set of test conditions to a range of frequencies.

Full recall

The non-volatile store has 100 locations numbered 0 to 99 for the storage of instrument settings. These stores may be recalled and used to reset the instrument’s parameters to those which affect the RF output: carrier frequency, RF level, modulations in use, on/off and source information and the two modulation oscillator frequencies in use.

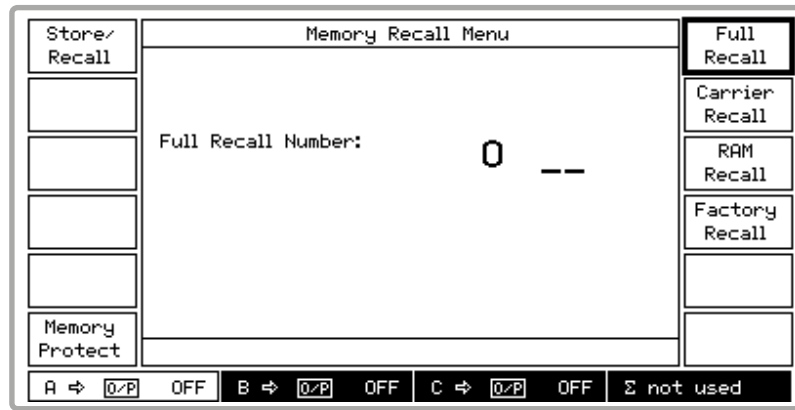
RAM recall

The volatile RAM store has 100 locations numbered 0 to 99 for the full storage of instrument settings. The parameters that are recalled are the same as those for full recall.

Recalling data

Select the memory recall function as follows:

- (1) Press the [MEM] hard key and then, if necessary, press the [Store/Recall] soft key to display the *Memory Recall Menu* shown in Fig. 46 below.



B3485

Fig. 46 Memory recall menu

- (2) To recall data, press the [Full Store], [Carrier Store] or [RAM Store] key for the type of recall required, then enter the store location via the numerical key pad and terminate with [ENTER].
 - (3) Pressing [Memory Protect] causes a *Memory Write Protection* screen to be displayed. For details of displaying the stores and changing their protection states see 'Memory protection' on page 3-42.
 - (4) Press [Factory Recall] to set the instrument to the factory settings (these are listed in Table 1 above).
-

Error messages

Error handling

Error messages are divided into four groups:

- (1) Background errors – represent a condition of the instrument.
- (2) Foreground errors – generally caused by the user.
- (3) GPIB errors – generated by incorrect programming.
- (4) Fatal errors – caused by failure associated with the main RAM or the PROM. These errors may or may not be displayed according to the severity of the failure or corruption.

Background errors:

These are generated due to an incorrect operating condition within the instrument. These errors are generated automatically to warn the operator. For example if the reverse power protection circuit should trip the message: *Err 500: RPP tripped* will be displayed on the main screen. Background errors are listed in Table 2. Only one error will be displayed, that with the highest priority. To obtain a full list of errors occurring on your instrument in priority order, select [*Backg'nd Errors*] from the *Utilities Selection Menu 1*. This causes the *Current Background Errors* screen to be displayed (see Fig. 30). Select [*Next Page*] if the list is continued on a subsequent page.

Foreground errors:

These are typically generated when an entered parameter value is outside the valid range or for some other invalid operation. For example trying to set the carrier frequency above or below the specified range will display the following message *Err 100: Carrier limit* on the screen. The foreground errors are cleared upon function selection or by re-entering the parameter correctly. Foreground errors are listed in Table 3.

Error message priority:

A background error has a priority bit set which is used to determine which message needs to be displayed. A foreground error will temporarily overwrite the background error if currently displayed, but will return to displaying that error once the foreground error has been cleared.

GPIB errors

When an error occurs the error number is put into the error queue and the error message is displayed. Clearing the error message from the screen does not clear the error queue, which is only cleared by the GPIB command ERROR? query, which returns the error at the head of the queue, or by the *CLS command which clears the whole error queue. GPIB errors are listed in Table 4.

The queue holds a maximum of 64 error message error numbers. If an error occurs while the queue is full the last error number is replaced with 399 to indicate that the queue is full. The ERROR? query returns a value of 399 for queue full and 0 for queue empty.

When an error number is written into the queue, a bit (<erb>) in the status byte register is set, and an appropriate bit in the standard event register is also set (one of <cme>, <exe>, <dde> or <qye>). These errors will also generate SRQ if the relevant bit in the status register is set. Many background errors are also reported in the Hardware and Coupling Status Registers.

Source-specific errors

Where it is necessary to identify the signal source causing an error, the error message number has 1000, 2000 or 3000 added to it for the A, B and C sources respectively. Thus error number 2500 indicates that the B source has tripped the reverse power protection circuit.

Table 2 Background errors(500599) in priority order

–	–	–	591	ftl	Main PROM faulty
590	ftl	Main RAM faulty	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
500	dde	RPP tripped ‡	501	dde	Fractional-N loop low ‡
502	dde	Fractional-N loop high ‡	503	dde	Ext standard missing
504	dde	External std frequency low	505	dde	External std frequency high
506	dde	VCXO loop low ‡	507	dde	VCXO loop high ‡
508	dde	Amplitude mod unlevelled ‡	509	dde	Output unlevelled ‡
510	dde	High power amplifier failed ‡	511	dde	ALC too high ‡
512	dde	ALC too low ‡	513	dde	DSP not responding ‡
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	549	exe	RF level uncalibrated ‡
550	exe	RF level limited by AM ‡	551	exe	AM2 limited by AM1 ‡
552	exe	FM2 limited by FM1 ‡	553	exe	ΦM2 limited by ΦM1 ‡
554	–	–	555	–	–
556	–	–	557	exe	Carrier limited by coupling ‡
558	exe	Offset limited by harmonic	559	exe	Offset limited by sub-harm
560	exe	Harmonic limited by offset	561	exe	Sub-harm limited by offset

(‡ = Source-specific)

Table 3 Foreground errors (0–399)

0	dde	No error	1	dde	EEPROM checksum
2	dde	Pad cal checksum †	3	dde	RF cal checksum †
4	dde	Freq std checksum †	5	dde	Synthesizer cal checksum †
6	dde	Mod ref checksum †	7	dde	Mod offset checksum †
8	dde	Mod amp checksum †	9	dde	ALC cal checksum †
10	dde	FM cal factor checksum †	11	dde	FM tracking checksum †
12	dde	ΦM cal factor checksum †	13	dde	System cal checksum †
14	dde	AM cal checksum †	15	dde	Store checksum
16	dde	Image checksum	17	dde	EEPROM unreliable
20	dde	Frac-N out of lock at <freq> †	21	dde	VCO cal fail at <freq> †
22	dde	VTF tune cal fail at <freq> †	23	dde	FM tracking cal fail at <freq> †
24	dde	Local EEPROM write	51	dde	Keyboard buffer overflow
52	dde	Display buffer overflow	53	dde	Display missing
62	dde	Source not fitted †	–	–	–
100	exe	Carrier limit †	101	exe	Carrier step limit †
102	exe	RF level limit †	103	exe	RF level step limit †
104	exe	Invalid modulation mode †	105	exe	AM limit †
106	exe	AM2 limit †	107	exe	AM step limit †
108	exe	AM2 step limit †	109	exe	FM limit †
110	exe	FM2 limit †	111	exe	FM step limit †
112	exe	FM2 step limit †	113	exe	ΦM limit †
114	exe	ΦM2 limit †	115	exe	ΦM step limit †
116	exe	ΦM2 step limit †	117	exe	Memory limit
118	exe	AM mod freq limit †	119	exe	AM mod step limit †
120	exe	AM2 mod freq limit †	121	exe	AM2 mod step limit †
122	exe	FM mod freq limit †	123	exe	FM mod step limit †
124	exe	FM2 mod freq limit †	125	exe	FM2 mod step limit †
126	exe	ΦM mod freq limit †	127	exe	ΦM mod step limit †
128	exe	ΦM2 mod freq limit †	129	exe	ΦM2 mod step limit †
130	exe	Return/Transfer not allowed	131	exe	Util limit
132	exe	Start freq limit †	133	exe	Stop freq limit †
134	exe	Sweep time limit	135	exe	Sweep mode disabled †
136	exe	Carrier phase limit †	137	exe	AM phase limit †
138	exe	FM phase limit †	139	exe	ΦM phase limit †
140	exe	Memory store limit	141	exe	Memory recall limit
142	exe	Display blanking limit	143	exe	GPIB address limit
144	exe	Latch address limit	145	exe	Latch data limit
146	exe	Freq std carrier limit †	147	exe	Freq std course adj limit †
148	exe	Freq std fine adj limit †	149	exe	Mod ref adj limit †
170	exe	Util not available	171	exe	Entry outside limits
172	exe	Data out of range	173	exe	Units not valid
174	exe	Unlev fact limited by FM fact †	175	exe	Invalid baud rate
176	exe	Data overrun	177	exe	Data parity
178	exe	Data framing	179	exe	Break in data

continued

Foreground errors (0–399) - continued

180	exe	Transmit buffer full	181	exe	Receiver not enabled
182	exe	Protected utility – Level 1	183	exe	Protected utility – Level 2
184	–	–	185	exe	This store is Read Only
186	–	–	187	–	–
188	exe	Receive buffer full	189	exe	Pulse has been disabled ‡
190	exe	No attenuator fitted	191	exe	No high power amp fitted
192	–	–	193	exe	Ext DCFM mod mode required ‡
–	–	–	195	exe	Invalid coupling mode ‡
196	exe	Invalid in application mode	–	–	–
198	exe	Atten lock disabled	199	exe	Atten lock not allowed ‡
200	exe	Atten lock not allowed	201	exe	Atten lock not allowed ‡
202	exe	No pulse with application	–	–	–
398	–	–	399	exe	Error queue full

(‡ = Source-specific)

Table 4 GPIB errors (400–499)

400	cme	Syntax error	401	cme	Unrecognized mnemonic
402	cme	Numeric syntax	403	cme	Data expected
404	cme	Illegal data	405	cme	Too much data
406	cme	Incorrect data type	407	cme	Unrecognized character data
408	cme	Character data not unique	409	cme	Block definition
410	cme	Block size	411	cme	Missing quote
412	cme	Terminator expected	413	cme	Invalid unit
414	cme	Unit not expected	415	cme	No header match found
416	cme	Header not unique	417	cme	Illegal star command
418	cme	Sub-command not allowed	419	cme	Action not allowed with header
420	cme	Query not allowed with header	421	cme	Parser decode
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
450	qye	Query INTERRUPTED	451	qye	Query UNTERMINATED
452	qye	Query DEADLOCK	453	qye	Query lost after arbitrary char
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–