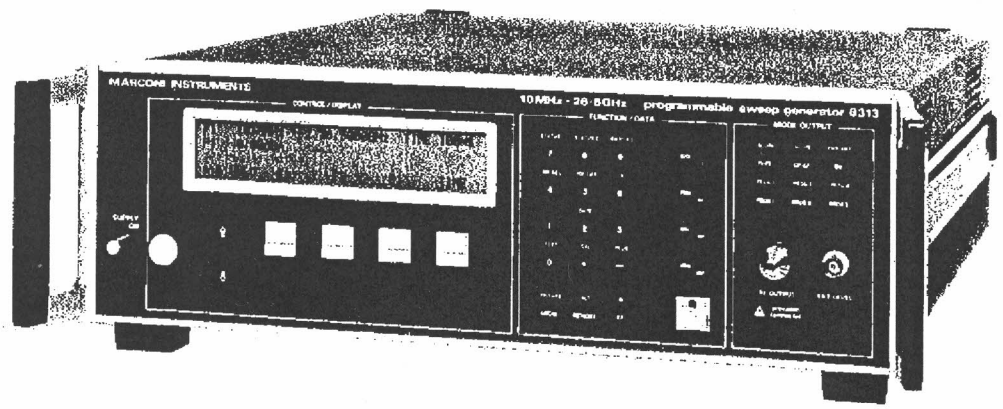
Operating Manual
H 6313
Vol. 1

10 MHz to 26.5 GHz PROGRAMMABLE SWEEP GENERATOR 6313



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GPIB Operating Manual, H 6313 Vol. 1A	46881-853Z
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PREFACE

WARNINGS, CAUTIONS AND NOTES

These terms have specific meanings in this manual:-

WARNINGS contain information to prevent personal injury.
CAUTIONS contain information to prevent damage to the equipment.
Notes contain important general information.

HAZARD SYMBOLS

The meaning of hazard symbols appearing on the equipment is as follows:-

Symbol	Nature of hazard	Reference in manual
	Dangerous voltages	Page iv
	Static sensitive components	Page iv
	Precision connector	Page 3-2

MANUAL AMENDMENT STATUS

Each page in this manual bears the date of its original issue or, if it has been amended, the date and status number of the latest amendment. Any changes subsequent to the latest amendment status are included on Manual Change sheets coded C1, C2 etc. at the front of the manual.

OPERATING PRECAUTIONS

This product has been designed and tested in accordance with IEC Publication 348 – 'Safety Requirements for Electronic Measuring Apparatus'. To keep it in a safe condition and avoid risk of injury, the precautions detailed in the WARNINGS below should be observed. To avoid damage to the equipment the precautions detailed in the CAUTIONS should also be observed.

WARNING – ELECTRICAL HAZARDS

⚠ **AC supply voltage.** This equipment conforms with IEC Safety Class 1, meaning that it is provided with a protective earthing lead. To maintain this protection the mains supply lead must always be connected to the source of supply via a socket with an earthing contact. Make sure that the earth protection is not interrupted if the supply is connected through an extension lead or an autotransformer.

Before fitting a non-soldered plug to the mains lead cut off the tinned end of the wires, otherwise cold flowing of the solder could cause intermittent contact.

Do not use the equipment if it is likely that its protection has been impaired as a result of damage.

Fuses. Note that there is a supply fuse in both the live and neutral wires of the supply lead. If only one of these fuses should rupture, certain parts of the equipment could remain at supply potential.

Make sure that only fuses of the correct rating and type are used for replacement. Do not use mended fuses or short-circuited fuse holders.

To provide protection against breakdown of the supply lead, its connectors (and filter if fitted), an external supply fuse with a continuous rating not exceeding 6 A should be used in the live conductor (e.g. fitted in the supply plug).

Removal of covers. Disconnect the supply before removing the covers so as to avoid the risk of exposing high voltage parts. If any internal adjustment or servicing has to be carried out with the supply on, it must only be performed by a skilled person who is aware of the hazard involved.

Remember that capacitors inside the equipment, including any supply filter capacitors, may still be charged after disconnection of the supply. Those connected to high voltage points should be discharged before carrying out work inside the equipment.

WARNING – OTHER HAZARDS

Parts of this equipment are made from metal pressings, therefore it should be handled with due care to avoid the risk of cuts or scratches.

Some of the components used in this equipment may include resins and other materials which give off toxic fumes if incinerated. Take appropriate precautions, therefore, in the disposal of these items.

This equipment has a lithium battery which if incorrectly handled could cause a danger to health or safety – refer to the Service Manual for safe handling precautions.

CAUTION – LCD HANDLING

When using this equipment take care not to depress the front or rear faces of the display module as this may damage the liquid crystal display elements.

CAUTION – STATIC SENSITIVE COMPONENTS

⚠ This equipment contains static sensitive components which may be damaged by handling – refer to the Service Manual for handling precautions.

Chapter 1

GENERAL INFORMATION

FEATURES

Performance

The 6313 is a programmable sweep generator with a range of 10 MHz to 26.5 GHz. It provides a combination of frequency and power sweeps with a typical accuracy of 20 MHz and ±0.4 dB. When used with Marconi Instruments' 6500 Automatic Amplitude Analyzer it forms a scalar measurement system with a private GPIB to enhance the performance of the 6500, as well as a system GPIB to allow operation as part of a complete automatic test system.

Control and display

Logically arranged keypads, with step keys and a rotary control allow rapid manual operation. A large, backlit LCD display shows operating status, current values of controlled parameters, and the current functions of four 'soft' keys. The 6313 can also be fully controlled via the GPIB.

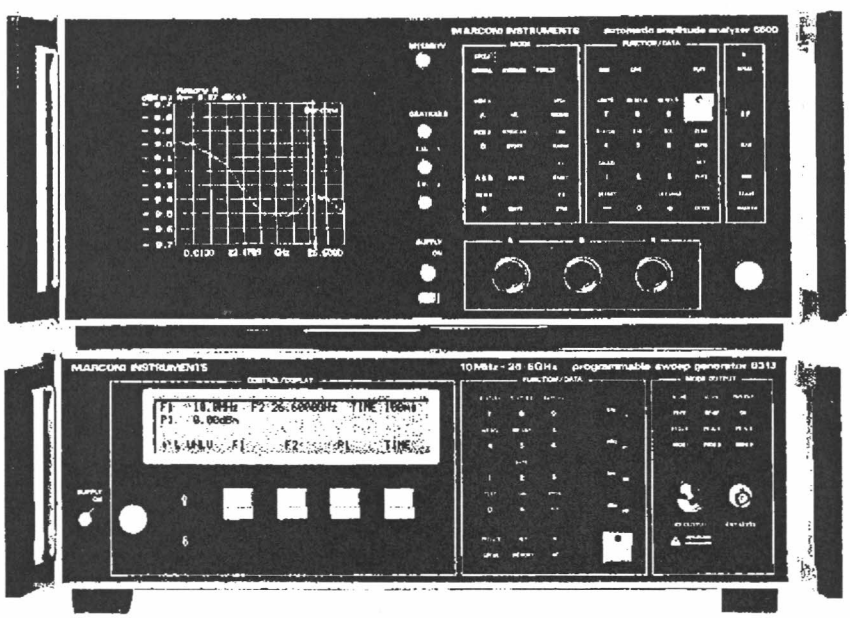

Fig. 1-1 Programmable Sweep Generator 6313 with Automatic Amplitude Analyzer 6500

Soft keys and configuration keys

In normal operation, some or all of the four soft keys have one operating parameter assigned to each of them. Selection of a soft key allows the value or state of the parameter associated with it to be changed.

Parameters are assigned to the soft keys according to which 'configuration' (group of parameters) has been selected.

There are fifteen pre-programmed configurations currently available on the 6313, for example:

Configuration	Associated parameters
[F1 – F2]	Start frequency (**F1**), stop frequency (**F2**) power level (**P1**), sweep time (**TIME**).
[SWP/TRG]	Internal/external sweep (**sweep**), sweep trigger (**swp_tr**), single sweep initiation (**s_swp**), counter trigger (**cntr_tr**).

The pre-programmed configurations are accessed by labelled 'configuration keys'. Additionally, there are six 'user-programmable' keys, which allow you to store and access your own configurations to match a particular application (see 'User programming').

Operating mode/sweep configurations

There are four basic operating modes:

1) Frequency sweep at constant power.

2) Frequency sweep with power slope.

3) Constant frequency and power.

4) Constant frequency with power sweep.

The frequency sweep can be defined either between lower and upper limits (F1 – F2) or as a frequency span about a centre frequency (CF – ΔF). These two alternatives for the definition of the frequency sweep give a total of six 'sweep configurations', each accessed by a labelled configuration key.

Markers

Up to five frequency markers may be set within a sweep. These enable you, for example, to stop the sweep at some nominal frequency and accurately measure that frequency using a counter. Another application is the setting of secondary limits within the total sweep, to allow both in-band and out-of-band testing.

Memories

Twenty non-volatile memories can each store complete sweeper settings.

The contents of the memories can be reviewed one after the other using the step keys or rotary control. While reviewing the memories, the RF output is switched off to avoid any risk of damage to sensitive test pieces.

Any memory setting can be chosen as the power-up condition, so that repetitive testing can begin immediately after switch-on.

User programming

The PROG key enables you to create and store (in non-volatile memory) up to six of your own configurations. These can then be accessed via the six 'user-programmable' configuration keys.

Applications of this facility include the ability to further simplify operation by masking non-critical parameters and adding relevant parameters which could otherwise only be accessed by selecting another configuration key. A real-time clock can also be added to the display to allow the timing of a test procedure.

If required, all frequency information may be removed from the screen for security.

User calibration

The output power and frequency of 6313 may be simply re-calibrated to match special measurement conditions. A complete user calibration might be necessary, for example, where a long cable intervenes between the 6313 and the test piece, or where there is a high ambient temperature. A limited calibration can also be performed over a specified part of the sweeper's frequency range.

Using Marconi Instruments RF Power Meter 6960 or 6960A (with Sensor 6913) and the 26.5 GHz Microwave Counter 2442 connected to 6313's Private GPIB, full re-calibration takes approximately 20 minutes.

Two sets of complete user calibration data and two sets of limited calibration data can be held in non-volatile store while the primary calibration is also retained.

User calibration is only allowed after entry of special authorization codes which are contained in a document which accompanies each sweeper. The primary calibration is doubly protected in this way. All re-calibration may be disabled by the setting of an internal switch.

The display indicates whether primary, user or limited calibration is in use.

Scalar analysis

The 6313 with Marconi Instruments' 6500 Automatic Amplitude Analyzer form a complete scalar network analysis system.

Measurements which can be made include:

Return loss
Voltage Standing Wave Ratio (VSWR)
Gain
Insertion loss
Gain compression
Absolute power

Connection between the 6313 and the 6500 via the Private GPIB allows intelligent interaction between the instruments which greatly enhances the performance of the 6500. Details of the operation of the 6313 with the 6500 are given in Chap. 3-4.

System GPIB operation

Over 170 commands allow full control via the system GPIB. In addition to those commands which are equivalent to front panel key operations, others allow fast data transfer, text display and other facilities.

RF generation

The 6313 uses fundamental YIG tuned oscillators operating in the bands 2–8 GHz, 8–12.4 GHz and 12.4–20 GHz and 20–26.5 GHz. These provide the sweeper with a very pure output having low harmonic and sub-harmonic components. Coverage to 10 MHz is achieved by employing a frequency down-converter in conjunction with the 2–8 GHz oscillator. All four YIG oscillators are kept running while the sweeper is switched on to increase stability and reduce band switching times. Switching between oscillators is by means of a PIN switch which gives a typical band switch delay of 0.5 µs. The levelling circuit uses a wide band coupler and detector diode for the 2 GHz to 26.5 GHz band and an additional coupler/diode for the 10 MHz to 2 GHz band.

Digital correction data for all significant frequency values and power levels are stored in memory, and applied to the sweep.

The FM input allows direct access to the YIG oscillators so that external frequency locking devices may be used.

The RF on/off key has an integral LED to indicate whether or not the output is enabled. The LCD gives an **UNLV** (unlevelled) display if the output power is no longer levelled; for instance if the output power is greater than the set power level at low power levels, or less than the set power level at high power levels. **UNLV** is also displayed when the output is switched off. Levelled power is guaranteed over the range –5 to +10 dBm (+7 dBm above 18 GHz).

PERFORMANCE DATA

Frequency

Range:	0.01 GHz to 26.5 GHz.
Resolution:	500 kHz in all modes. 10 kHz in CW vernier mode, manually (rotary control) and with GPIB control.
Display resolution:	100 kHz in all modes.
Accuracy at cal. temp	
F1 and CW:	±10 MHz max., ±3 MHz typical at 23°C ±5°C. ±15 MHz otherwise at cal. temp.
CF, F2, sweep modes at 100 ms sweep or slower:	±30 MHz, ±20 MHz typical.
Stability	
With temperature:	±1 MHz per °C typical. Total shift of no more than 60 MHz over 0–50°C range.
With 10% supply voltage change:	10 kHz.
With 10 dB power level change:	±300 kHz over calibrated power range.
With 3:1 load VSWR at +10 dBm output (+7 dBm for 18–26.5 GHz)	
10 MHz to 2 GHz:	±10 kHz typical, ±100 kHz max.
2 GHz to 8 GHz:	±50 kHz typical, ±500 kHz max.
8 GHz to 12 GHz:	±250 kHz typical, ±500 kHz max.
12 GHz to 20 GHz:	±50 kHz typical, ±500kHz max.
20 GHz to 26.5 GHz:	±500 kHz max.
With time at constant temp. after 1 hour warm up:	±100 kHz max.
Residual FM (in 10 Hz to 10 kHz bandwidth CW mode with filter on)	
10 MHz to 2 GHz:	8 kHz peak typical, 10 kHz peak max.
2 GHz to 8 GHz:	6 kHz peak typical, 10 kHz peak max.
8 GHz to 12 GHz:	7.5 kHz peak typical, 10 kHz peak max.
12 GHz to 20 GHz:	10 kHz peak max.
20 GHz to 26.5 GHz:	10 kHz peak typical, 15 kHz peak max.

Accuracy

10 MHz to <2 GHz:	±0.5 dB at 0 dBm and at cal. temp.
2 GHz to <26.5 GHz:	±0.4 dB at 0 dBm and at cal. temp.

Linearity: 0.1 dB typical, 0.2 dB max.

Sweep time: Selectable between 10 ms and 33.5 s.

Resolution: 1 ms.

Displayed resolution: 3 digits.

Power slope characteristics

Slope range: 0 dB/GHz to 20 dB/GHz power over calibrated range.

Accuracy

10 MHz to <2 GHz:	±0.5 dB over calibrated power range.
2 GHz to <26.5 GHz:	±0.4 dB over calibrated power range.

Linearity: 0.1 dB typical, 0.2 dB max.

Time: As for frequency sweep.

Modulation

Internal square wave AM

Frequency range: 1.0 to 100 kHz.

Frequency accuracy: ±0.05%.

Frequency resolution: 0.1 kHz up to 32.5 kHz.
1 kHz from 32.5 to 100 kHz.

Depth

10 MHz to <2 GHz:	-55 dBc.
2 GHz to <12.5 GHz:	-60 dBc.
12.5 GHz to 26.5 GHz:	-45 dBc.

Rise and fall time (10% to 90%): 0.5 µs.

External pulse AM

Frequency response: DC to 100 kHz.

Depth: As internal square wave AM.

Rise and fall time (10% to 90%): As internal square wave AM.

External AM

Frequency response:	DC to 100 kHz.
Input impedance:	10 kΩ nominally.
Dynamic range:	25 dB.

External FM

Deviation:	50 MHz peak to peak. 25 MHz peak to peak at 1 MHz rate.
Sensitivity:	-6 MHz (±1 MHz) per volt.
Input impedance:	10 kΩ nominally.

General

Display:	Contrast of liquid crystal display can be adjusted for viewing angle convenience.
RF blanking:	RF can be blanked or present during sweep retrace using STATUS 1 functions and can be blanked or present during parameter alteration using a PROG key function.
Counter trigger:	Provides a TTL drive for counter trigger and hold on F1, F2, CF and reference marker. Use connector no. 06310-176F for connection to the 2442 26.5 GHz microwave counter.
Stop sweep:	Holds up sweep with TTL drive (e.g. from counter until valid count obtained).
Non-volatile memories:	Up to 20 complete test set-ups may be stored for up to 10 years including those on 6500 when connected on the private GPIB. Memories and default settings may be reviewed with RF power off.
Start up mode:	Any memory or preset default or power down settings may be chosen for power up conditions.
Alternate sweep:	Allows operation to toggle between current setting and any memory with RF on.
Footswitch:	Use of optional accessory 06313-006T connected to the rear panel FOOTSWITCH BNC connector allows the user to operate the fourth softkey whilst leaving both hands free. This can be used in alternate sweep in a scalar analysis system when making adjustments to the device under test.

Digital sweep interface:

Provides a means by which the RF output is swept over a range of discrete values, with each individual step being controlled by a digital signal. The SYSTEM GPIB interface is the only connection required. Sweep conditions are set up in advance using anumber of GPIB commands. Thereafter Group Executive Trigger (GET) is sent over the GPIB to the sweeper to step to the next position. This has advantages in fast ATE applications where it is required to step the RF output faster than can ber achieved by sending new, explicit values of frequency or power over the GPIB.

Clocks/calendar:

Selection of DATE allows the user to set/display the current date in the format HH:MM:SS DD:MMM:YYYY. If a 6500 and digital plotter are connected to the private GPIB the date may be plotted in the bottom right-hand corner of the scalar analysis plot. User resettable elapsed time in hours and overall operating hours (factory set) can be displayed.

Programmed display & operation:

Up to 6 user defined non-volatile display & control configurations can be created using PROG key & subsequent instructions. These can be amended versions of existing settings to change soft key controls, or to add new information such as time to a display or to create new display & control configurations.

Calibration

Standard:

Calibration stores provide primary and two user calibrations held in non-volatile memory. Access is via a unique key sequence supplied with each instrument. Calibration (frequency and power) takes approximately 21 minutes with minimal operator interaction. Power sensor calibration data is held on non-volatile memory.

Limited:

In addition to the standard calibration facility which operates over the full frequency range of the sweeper, it is also possible to perform a power calibration over a limited frequency range. This allows the user to calibrate the sweeper at the output of frequency selective devices (e.g. amplifiers or filters). Two additional calibration stores are provided for this. Greater flexibility allows the user to perform a power calibration independently of a frequency calibration.

Self test:	Stored data in memory is checked at switch on or by user selection of TEST.
Output connector:	Type MPC 3.5*, 50 Ω (fem.)
Output VSWR	
10 MHz to <2 GHz:	2.0:1 max.
2 GHz to <12 GHz:	1.25:1 typical. 1.5:1 max.
12 GHz to <20 GHz:	1.4:1 typical, 1.7:1 max.
20 GHz to 26.5 GHz:	1.7:1 max.
Auxiliary outputs	
1V/GHz accuracy:	±0.3 V 10 MHz to <2 GHz. ±10% 2 GHz to 26.5 GHz.
Sweep out:	0 to 10V ±2 mV.
GPIB interface:	System and private buses. All functions except supply switch are remotely programmable.
Capabilities	
SYSTEM:	Complies with sub-sets SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0 and E2 as defined by IEEE 488-1978 and IEC 625-1.
PRIVATE:	Controller function provided for connection of 6500 Automatic Amplitude Analyzer, 2442 26.5 GHz microwave counter, 6960/6960A RF power meter and digital plotter. INIT key provides bus initialisation at any time.

Environmental

Safety:	Complies with IEC 348.
Rated range of use:	0 to 50°C.
Conditions of storage and transport	
Temperature:	-40 to +70°C.
Humidity:	Up to 90% RH.
Altitude:	Up to 2500 m (pressurized freight at 27 kPa differential, i.e. 3.9 lbf/ in2).

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* *Marconi Precision Connector 3.5 mates non-destructively with SMA and similar connectors.*

RACK MOUNTING

The instrument may be mounted in a standard 19 inch rack using the kit 46883-506M available as an optional accessory. Fitting instructions are as follows:

(1) Remove and discard the trim infills on each side of the front panel, together with their countersunk screws and screw cups.

(2) Fit the rack brackets in the front panel handles or side trim recesses using M4 x 16 pan head screws and washers.

(3) Slide into rack and secure. If the rack system is to be mobile, more support may be required at the rear of the instrument. Fixing holes are provided for the purpose. Contact Marconi Instruments if you need further advice.

Note...

It is important that the bottom feet are retained to ensure that a gap is left allowing air to enter the instrument through the holes in the bottom panel.

SAFETY TESTING

Where safety tests on the AC supply input circuit are required, the following procedures can be applied. These comply with BS 4743 and IEC Publication 348. Tests are to be carried out as follows and in the order given, under ambient conditions, to ensure that AC supply input circuit components and wiring (including earthing) are safe.

(1) **Earth lead continuity test** from any part of the metal frame to the bared end of the flexible lead for the earth pin of the user's AC supply plug. Preferably a heavy current (about 25 A) should be applied for not more than 5 seconds.

Test limit : not greater than 0.5 Ω.

(2) **500 V DC insulation test** from the AC supply circuit to earth.

Test limit : not less than 2 MΩ.

AC POWER SUPPLY

The instrument requires an AC supply of 105 to 120 V or 210 to 240 V, 50 to 400 Hz, 580 VA. The required supply fuses (time lag) are 4 A for 105 to 120 V or 2.5 A for 210 to 240 V. Before switching on, ensure that the rear panel voltage range switch is in its correct position as revealed by the cut-out in the locking place, and that the correct value fuses are fitted. To change the mains voltage setting, reverse the locking plate after setting the slide switch to its alternative position.

The AC supply cable is fitted at one end with a female plug which mates with the AC connector at the rear of the instrument. When fitting a supply plug ensure that the connections are as follows:

Earth (ground)	- Green/Yellow
Neutral	- Blue
Live (phase)	- Brown

When attaching the mains lead to a non-soldered plug it is recommended that the tinned ends of the lead are first cut off to avoid the danger of cold flow resulting in intermittent connection.

GPIB CONNECTOR CONTACT ASSIGNMENTS

The contact assignment of the GPIB lead assembly and the two device connectors is as shown in Fig. 2-1 below.

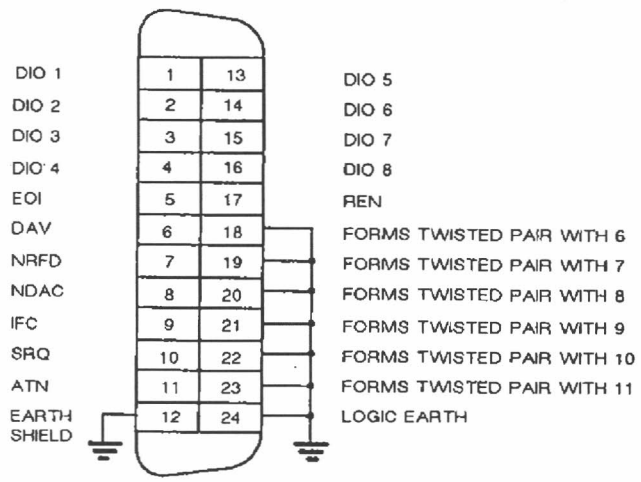


Fig. 2-1 GPIB connector contact assignments

Connection to other equipment which has a 24-way bus connector to IEEE Standard 488 can be made with the GPIB lead assembly 43129-189U, available as an optional accessory. An IEEE-to-IEC adapter 46883-408K is also available for interfacing with systems using a 25-way bus connector to IEC Recommendation 625 - see Fig. 2-2.

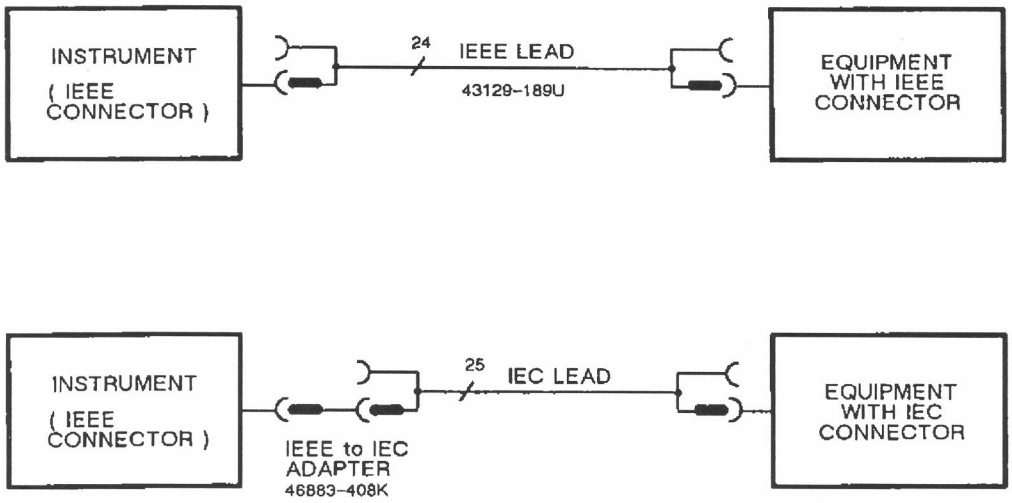


Fig. 2-2 GPIB interconnections

INTERFACE BUS LEAD CONNECTION

The leads for the interface bus use special male-female connectors at both ends. This allows several connectors to be stacked one on top of another permitting several leads to be connected to the same source and secured by a lockscrew mechanism. Too large a stack however, may form a cantilevered structure which might cause damage and should be avoided. The piggyback arrangement permits star or linear interconnection between the devices forming a system with the restriction that the total lead length for the system must be:-

(1) No greater than 20 m (65 ft).

(2) No greater than 2 m (6 ft) times the total number of devices (including the controller) connected to the bus.

Chapter 3–1
LOCAL OPERATION

FRONT PANEL CONTROLS

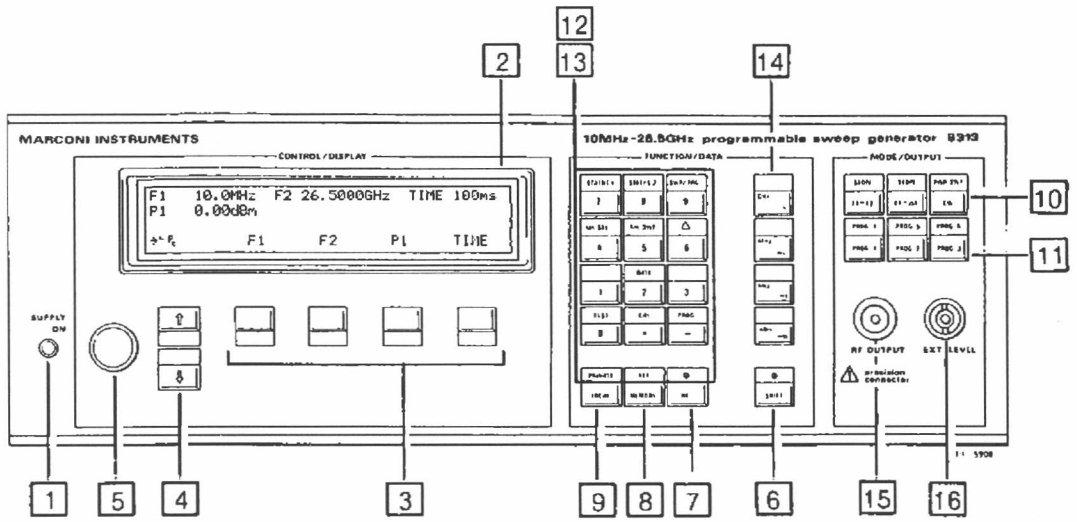


Fig. 3–1 : Front panel

[1] **SUPPLY ON.** Clockwise : ON, anti–clockwise : OFF.

[2] **LCD.** The liquid crystal display (LCD) can display four rows of forty alpha–numeric characters. The display is fitted with an electro–luminescent backlight, and the contrast between the displayed characters and the background can be varied to suit viewing angle. Rows 1 to 4 are numbered from top to bottom.

[3] **Soft keys.** The soft keys select parameters for modification. Parameters are assigned to the soft keys according to which 'configuration key' is selected. Row 4 of the LCD displays the soft key assignments. Selection of a soft key enables the value/state of the associated parameter to be changed.

[4] **Step keys.** The step–up and step–down keys are used primarily for changing the value of a parameter by a preset amount. The step sizes for frequency, power and time can be set by the operator.

Note...

In operating procedures in this manual the following conventions are used to identify control functions:

Square brackets e.g. [PROG] indicates a front key title.

Bold face e.g. **TIME** indicates a soft key designation or a functional reference to an LCD parameter.

[5] **Rotary control.** Fine adjustments may be made to a parameter value using the rotary control. The sensitivity of the control depends on the speed with which it rotates. The faster the control is turned, the greater is the change in value.

[6] **SHIFT key.** Accesses the shifted functions, which are indicated in blue in the upper halves of certain keys. The SHIFT key remains active until another key is pressed, and this is indicated by the illumination of an integral LED.

[7] **RF key.** Switches RF power on/off. The LED is illuminated when RF is on.

[8] **MEMORY key.** Provides access to 20 non-volatile store/recall memories, each capable of storing complete sweeper settings. Also used to access default settings and to define power-on state.

[9] **LOCAL key.** Returns the sweeper to front panel operation from GPIB control. This key can be disabled by the 'local lockout' message from an external controller.

[10] **Sweep configuration keys.** Select sweep modes and associated parameters for display and modification.

[11] **User programmable configuration keys.** May be programmed with up to six user-defined configurations.

[12] **Auxiliary configuration keys** (Shifted functions). Select auxiliary configurations such as step sizes, markers, GPIB addresses etc.

Notes ...

TEST and CAL are considered separately from the configuration keys. See Appendix D : SELF TEST and Chap. 3-5, CALIBRATION.

PROG is considered with the user programmable configuration keys (Chap. 3-2).

[13] **Numeric keys** (Unshifted functions). Used for entering values of numeric parameters, and other number entries.

[14] **Units keys.** Define units of numeric parameters and terminates numeric entry.

[15] **RF OUTPUT** (Precision type MPC 3.5 connector).

CAUTION...

⚠ This connector may be damaged if mated with a non-precision type MPC 3.5 or SMA male connectors.

[16] **EXT LEVEL** (BNC). Input for external levelling signal.

REAR PANEL CONNECTIONS

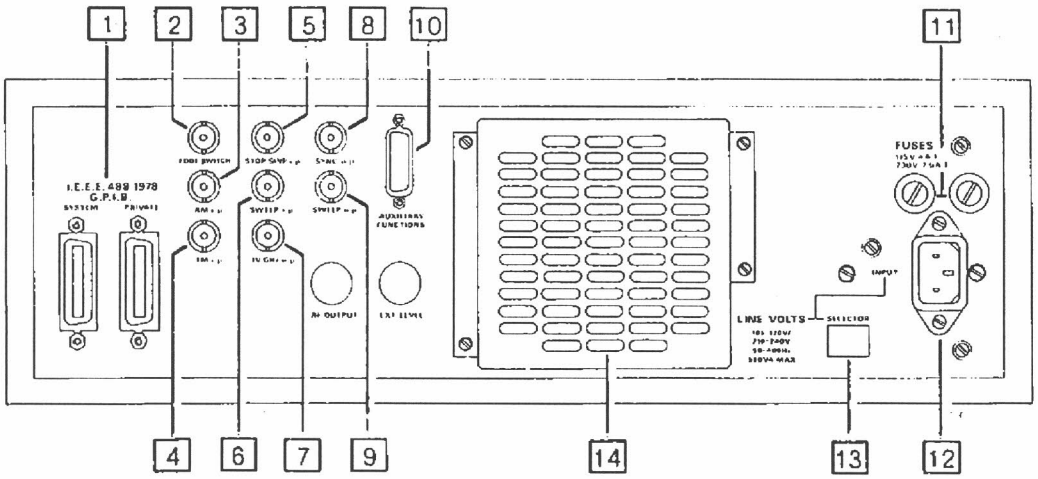


Fig. 3–2 Rear panel

[1] **GPIB connectors.** The sweeper has two GPIB interfaces: The SYSTEM GPIB allows remote programming using an external controller; the PRIVATE GPIB allows the sweeper to control a counter and power meter during auto–calibration or a 6500 Automatic Analyzer and plotter to form a scalar measurement system.

CAUTION – GPIB INTERFACES

There are two GPIB interfaces located on the rear panel of this equipment. The SYSTEM GPIB interface is intended for connection to an external controller. Under no circumstances should a GPIB controller be connected to the PRIVATE GPIB interface, otherwise damage might result to both controller and sweeper.

[2] **FOOTSWITCH** (BNC). Input for optional footswitch control 06313–006T. When connected, the footswitch can be used to change the parameter associated with soft key number 4, thus leaving the hands free for other purposes. A useful application is to use the footswitch to switch between the current sweep and a stored sweep while adjusting the device–under–test. See "Alternate sweep selection".

[3] **AM i/p** (BNC). This can be used for small signal amplitude modulation of the carrier frequency. The modulation characteristic is non–linear.

[4] **FM i/p** (BNC). This can be used to frequency modulate the sweeper carrier frequency. The sensitivity is –6 MHz/V so that the sweeper may be used in phase locking applications, e.g. using an external locking counter to enhance the stability of the sweeper.

[5] **STOP SWP i/p** (BNC). A TTL compatible logical '0' applied to this input causes the forward sweep to pause. The sweep resumes when a logical '1' (or open–circuit) is applied.

[6] **SWEEP i/p** (BNC). Accepts 0 to +10 V tuning voltage when the sweeper is set to operate with external sweep.

[7] **1 V/GHz o/p** (BNC). Voltage proportional to output frequency.

[8] **SYNC o/p** (BNC). Synchronization signal for use with 6500 Automatic Amplitude Analyzer.

[9] **SWEEP o/p** (BNC). Outputs an 0 to +10 V signal proportional to the swept or CW RF output. 0 V corresponds to the lower (F1) and 10 V to the upper (F2) frequency limit.

[10] **AUXILIARY FUNCTIONS connector.** 15-way 'D' type.

Pin	Function	Notes
1	STOP SWP i/p	Stop sweep. Also available on BNC connector
2	GND	
3	+5 V	
4	PROG 1	Set high during sweep retrace
5	PROG 3	Not currently assigned
6	PROG 5	'Blips' at reference marker frequency
7	GND	
8	GND	
9	SYNC o/p	Also available on BNC connector
10	PULSE i/p	Pulse modulation input
11	EXT TRIG i/p	
12	PROG 2	Firmware produces 'blip' once per second
13	PROG 4	Not currently assigned
14	CTR TRIG o/p	Counter trigger output
15	GND	

The PULSE i/p is TTL compatible. '0' represents RF off and '1' represents RF on. See "Performance Data" in Chap. 1 for details of pulse modulation.

The EXT TRIG i/p is TTL compatible. When external sweep trigger mode is selected, the sweep is triggered by a high-to-low transition applied to this input.

The CTR TRIG o/p provides a trigger pulse to a counter to initiate a frequency measurement. Appendix C describes interfacing suitable counters, including the Marconi Instruments type 2442.

[11] **FUSES.** For protection of live and neutral lines of the supply input. See Chap. 2, Installation, for details.

[12] **LINE VOLTS INPUT plug.** Accepts AC supply voltage input via lead No. 43129-071D.

[13] **LINE VOLTS SELECTOR.** Selects AC supply voltage range. See Chap. 2, Installation, for details.

[14] **AIR OUTLET.** Do not obstruct.

AMPLITUDE ANALYSIS : GETTING STARTED

(1) 6500 users who are impatient to begin testing may start here.

(2) The 6500 analyzer and 6313 sweeper should be connected as shown in Fig. 3-3 below. If a plot of 6500 results is required, an HP-GL (Hewlett-Packard Graphics Language) compatible digital plotter should also be connected as indicated.

(3) Ensure that the 6500 GPIB address is set to 8, the plotter address to 5.

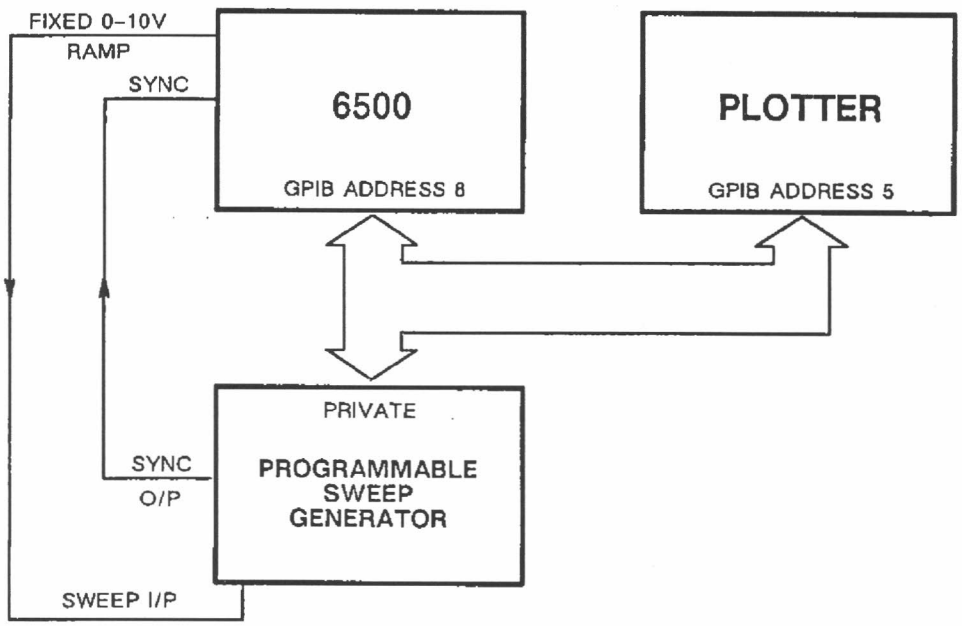
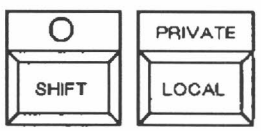


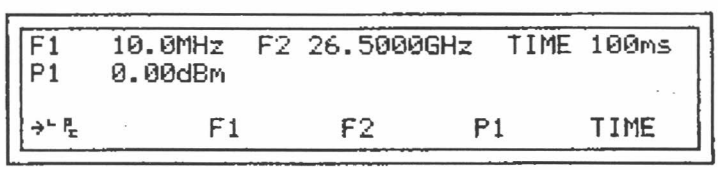
Fig. 3-3 Connections to 6500 and plotter

(4) Switch on the 6500 and the sweeper. Select 

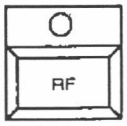
on the sweeper and press the init soft key. This initializes all devices connected to the PRIVATE bus. Initialization of the 6500 takes approximately 13 seconds including detector zero.

(5) Press the 

key on the sweeper to define the sweep range for both sweeper and 6500. The display should be as shown.



(6) To change **F1** (start frequency), **F2** (stop frequency), **P1** (RF power level) or **TIME** (sweep time) press the appropriate soft key and use the rotary control, step keys or numeric keys (with appropriate units terminator) to adjust the value.

(7) Press 

on the 6313 to switch on the RF power.

(8) The normalization procedures required to prepare the 6500 to make measurements will be familiar to existing users. New users should consult the 6500 Operating Manual. Full details of the operation of the 6313 with the 6500 are given in Chapter 3-4.

SWITCH-ON CONDITIONS

When the sweeper is first switched on a display of the following form is shown:

```
GENERIC FIRMWARE ISSUE 3          44533.365
Serial Number  100
10 MHz - 26.5 GHz Sweep Generator  6313
```

Row 1 shows the latest firmware issue number (including the part number).
Row 2 shows the serial number of the sweeper.
Row 3 identifies the sweeper as a 6313.

This is followed by a display showing the results of a check on the integrity of the data stored in all sections of the non-volatile memory. If all sections check out correctly the following message is momentarily displayed:

```
            *** MEMORY TEST ***
[-------------------------------------]
            NO FAULTS DETECTED
```

If any memory sections are found to have been corrupted a message of the form shown below is (permanently) displayed:

```
            *** MEMORY TEST ***
[A-----GHI-------QR----------def------]
  FAULT(S) DETECTED : REFER TO MANUAL
PRESS ANY CONFIGURATION KEY TO CONTINUE
```

For interpretation of a fault message see APPENDIX D : SELF TEST.

After the memory test has been completed, the sweeper will normally set itself to the PRESET operating conditions, with RF power switched off:

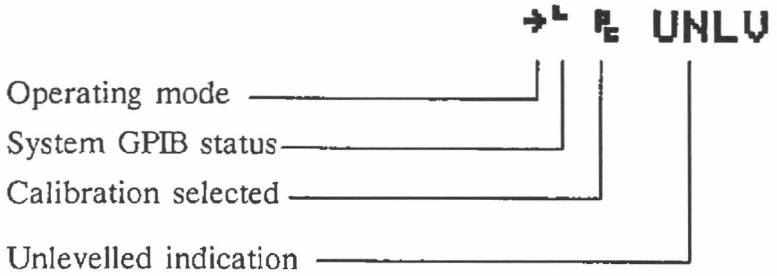
```
F1   10.0MHz  F2 26.5000GHz  TIME 100ms
P1   0.00dBm

→L R₂        F1       F2       P1       TIME
```

Any newly delivered sweeper should set itself to these conditions. It is possible, however, to cause the sweeper to power-up with the settings at power-down, or to the settings stored in one of the 20 non-volatile memories. A deviation from the PRESET conditions does not, therefore, necessarily imply that there is a fault. See "Memory Facilities" later in this chapter for details.

DISPLAY STATUS FIELD

During normal operation of the sweeper, the status field is displayed at the left hand side of row 4 of the LCD. There are four components of the status field:



Operating mode

The symbol indicates one of four possible operating modes:

- CW operation
- Swept operation (Levelled output power)
- Swept operation (Power slope)
- Power sweep

System GPIB status

The character cell is divided into two halves. The upper character indicates Local or Remote and the lower character indicates whether the sweeper is addressed to listen, addressed to talk, or unaddressed.

- Local operation (Unaddressed)
- Local operation (Addressed to listen)
- Local operation (Addressed to talk)
- Remote operation (Unaddressed)
- Remote operation (Addressed to listen)
- Remote operation (Addressed to talk)

Calibration selection

The character indicates whether the Primary calibration, a User calibration or a Limited calibration is selected. Refer to Chap. 3–5.

- Primary calibration selected
- User calibration selected (User 1)
- User calibration selected (User 2)
- Limited calibration selected (Limited 1)
- Limited calibration selected (Limited 2)

A flashing calibration symbol indicates that the selected calibration data has been over-written with default data.

Unlevelled indication

When the output power is calibrated the field of four characters is blank. If the power becomes unlevelled, **UNLV** is displayed. **UNLV** is also displayed when RF is switched off.

PARAMETERS AND CONFIGURATIONS (GENERAL)

Parameters

The operating parameters of the 6313 are the settings of the instrument which the operator can change (in value or state) to define its operation*. Examples include Start Frequency (**F1**), Sweep Time (**TIME**), System GPIB address (**S_ADDR**) and Stop Marker (**mk_stp**).

Parameters are either 'numeric' or 'non-numeric'. A full list of the 6313's parameters is given in APPENDIX A.

Numeric parameters

Numeric parameters are those which take a numerical value. Examples include Start Frequency (**F1**), Private GPIB Address (**P_ADDR**) and Start Power Level (**P1**).

Numeric parameters are shown in upper-case letters on the display.

Non-numeric parameters

Non-numeric parameters may take up one of a few defined states. Examples include CW Filter (**filter**) which can be either '**on**' or '**off**'; and Sweep Trigger (**swp_tr**) which has the states '**int**', '**ext**', '**line**' and '**single**'.

Non-numeric parameters are shown in lower case letters on the display.

Configurations

Configurations are groups of related parameters which together define some aspect(s) of the sweeper's operation.

Configurations are selected by the 'configuration keys' which are shown in Fig. 3-4 below.

The configuration keys may be sub-divided into three groups:

Those in the top row of the MODE/OUTPUT section of the front panel are the 'Sweep Configuration' keys.

Those in the second row of the MODE/OUTPUT section are the 'User Programmable Configuration' keys.

Those in the FUNCTION/DATA section are the 'Auxiliary Configuration' keys.

---

* *There are in addition certain 'display-only', 'soft key only' and 'diagnostic' parameters. See 'STATUS 2'and 'PRIVATE' (this chapter) and also APPENDIX A.*

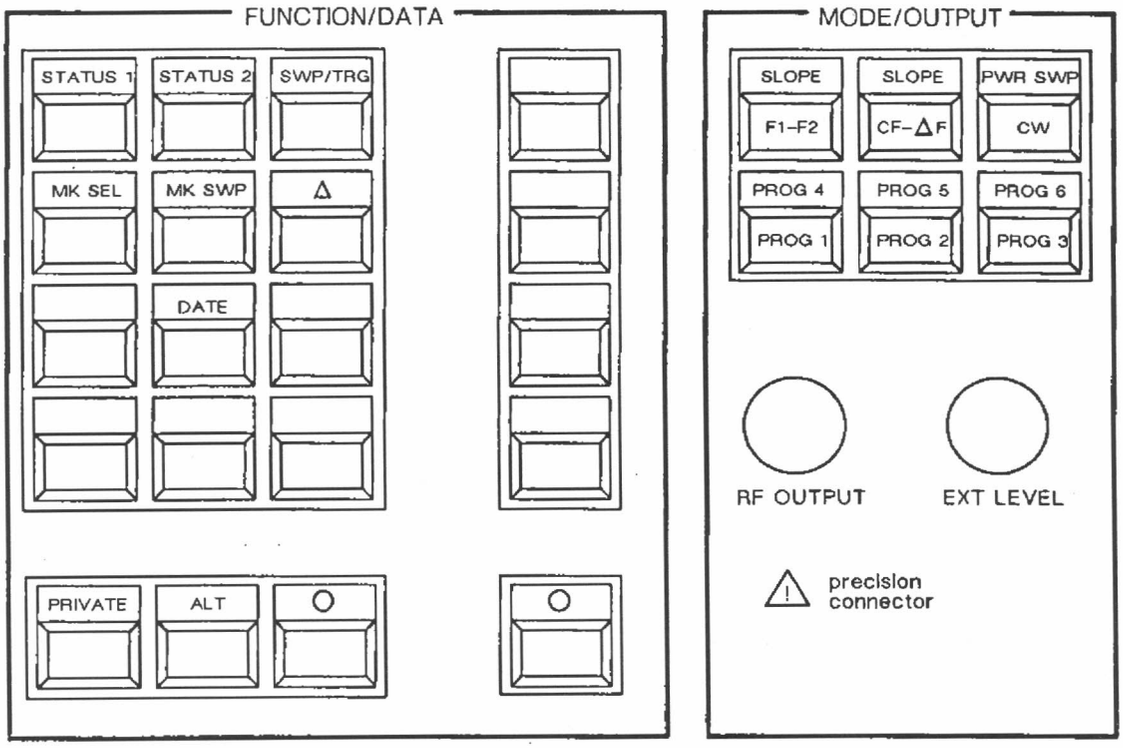
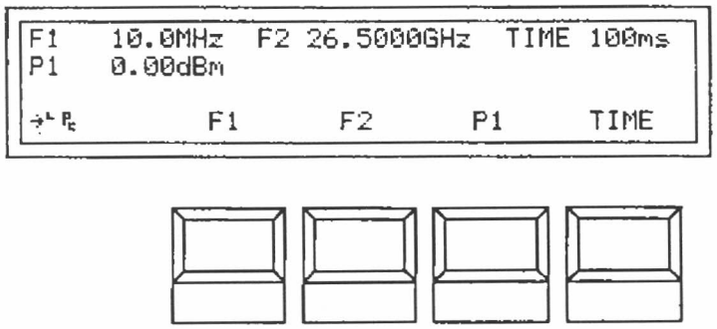


Fig. 3–4 Configuration keys

Configuration selection and display

When a configuration key is pressed, the current values/states of its associated parameters are displayed in rows 1, 2 and 3 of the display.

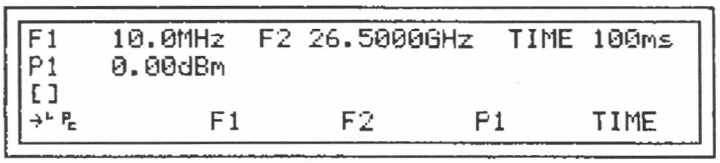
In row 4 the symbol of each (changeable) parameter is displayed above a 'soft' key. For example, selecting the [F1–F2] key should give a display like this:



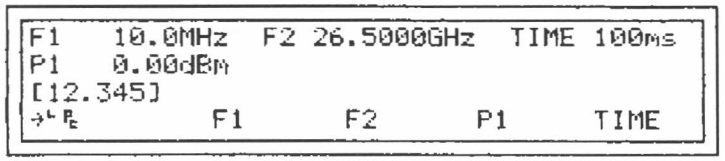
A parameter's value or state can then be changed by first selecting the soft key to which it has been assigned.

Changing numeric parameter values

When a soft key assigned to a numeric parameter is pressed, the soft key label flashes to indicate that numeric entry is enabled for that parameter. A numeric entry field prompt '[ ]' appears on the left of row 3.

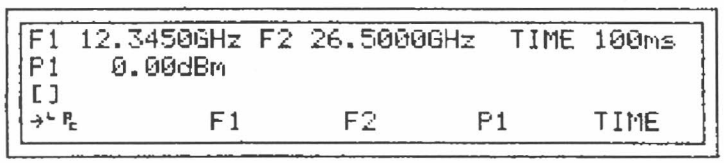


As digits are entered they are displayed in the numeric entry field:–



Numeric entry terminators

Numeric entries are terminated using a units key appropriate to the type of parameter. Frequency input is terminated using the [GHz], [MHz] or [kHz] keys; power input using the [dBm/mW] key; sweep time input using the [s] or [ms] keys. The [int] terminator is used when entering integer values such as a GPIB address. When the numeric input is terminated the new value is assigned to the parameter and the numeric entry field is cleared. The soft key label continues to flash, indicating that a further numeric entry may be started.



Step keys and rotary control

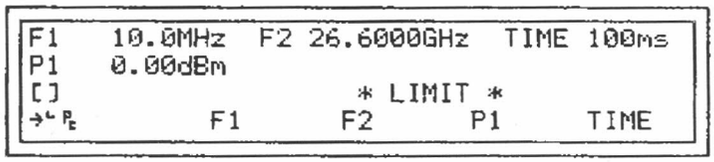
The step keys and rotary control may be used whenever numeric entry is enabled. The step size is definable for each type of numeric parameter: for frequency, power (dBm), power (mW), and time, using the Δ configuration. When a step key is pressed, the value of the parameter is incremented or decremented as appropriate. If a step key is held down it repeats automatically.

The rotary control sensitivity depends on the speed of rotation. A rapid twist to the control results in a large change to the parameter. Slow rotation allows fine adjustments to be made.

Operating the rotary control or step keys has no effect on any pending numeric entry displayed in the numeric entry field.

Limits

Every numeric parameter has a maximum and minimum permitted value. If an attempt is made to enter a value outside this range, a * LIMIT * message is displayed momentarily on row 3 of the LCD and the parameter is set to the nearest allowed value, either maximum or minimum as appropriate.

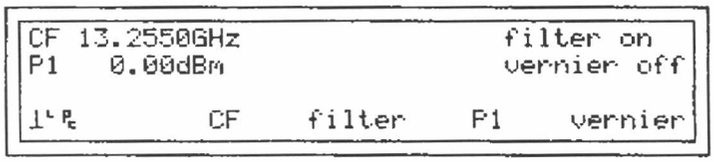


Changing non-numeric parameters

When a soft key assigned to a non-numeric parameter is pressed, the value of the parameter changes to another state, as shown below. If the key is pressed repeatedly, the parameter cycles through all its possible states.

For example the CW configuration includes two non-numeric parameters, **filter** and **vernier**. Both of these have two allowed states: **off** and **on**. Initially both of these parameters are off:

Effect of pressing the **filter** soft key:



Further presses of the **filter** soft key causes toggling between the **off** and **on** states.

Changes to non-numeric parameters have no effect on any pending entry displayed in the numeric entry field.

Programmable keys

The three programmable keys [PROG 1] to [PROG 3] (with shifted functions [PROG 4] to [PROG 6]) belong to the class of configuration keys. In these cases, however, the configurations are defined by the operator. Refer to Chap. 3-2.

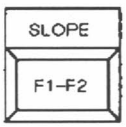
SWEEP CONFIGURATIONS

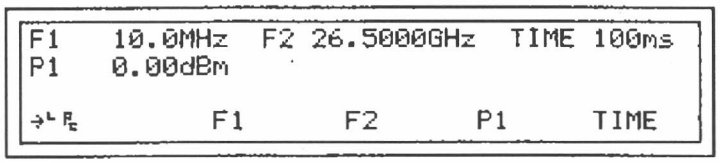
Changes between sweep configurations involve changes in operating mode, except where the configurations differ only in the definition of the frequency sweep: (F1–F2) or (CF–ΔF).

When a sweep configuration key that involves frequency or power sweeping (i.e. all except CW) is pressed you will notice a momentary pause in the sweep. This is due to the digital correction values for the sweep being recalculated.

The sweep is also halted momentarily when new parameter values are entered.

Swept operation (Levelled output power) (F1–F2)





		Range
F1	Start frequency	2 MHz to 26.6 GHz
F2	Stop frequency	2 MHz to 26.6 GHz
P1	Power level (dBm)	–15 to +20 dBm
TIME	Forward sweep time	10 ms to 33.5 s

Notes ...

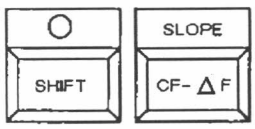
The specified frequency range and levelled power range for the sweeper are given in the Performance Data section of Chapter 1. Notice that the allowed ranges (given above) are greater than those specified. Frequencies and power levels both above and below the specified limits may be entered, to ensure that the specified limits are in fact obtained, and to allow extended usage.

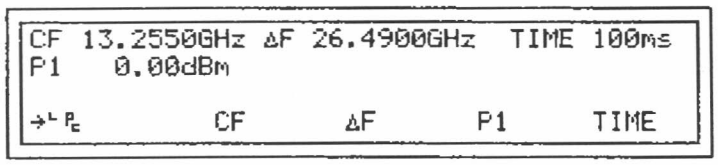
RF output sweeps from **F1** to **F2**.

Sweeps from high to low frequency are not permitted. If **F1** is set to a higher frequency than **F2**, or **F2** to a lower frequency than **F1**, both **F1** and **F2** are adjusted to the last entered frequency.

Power may also be set in mW by use of a programmable key configuration. See Chap. 3-2 "Programmable Keys" for details.

Swept operation (Levelled output power) (CF–ΔF)





		Range
CF	Centre frequency	2 MHz to 26.6 GHz
ΔF	Frequency span	0 to 26.598 GHz
P1	Power level (dBm)	–15 to +20 dBm
TIME	Forward sweep time	10 ms to 33.5 s

Notes ...

RF output sweeps from **CF – ΔF/2** to **CF + ΔF/2**.

The values of CF, ΔF, F1 and F2 are interdependent. A change in the value of any one of these parameters will cause changes in the others, in accordance with the equations:

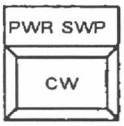
$$\mathbf{CF} = (\mathbf{F1} + \mathbf{F2})/2$$

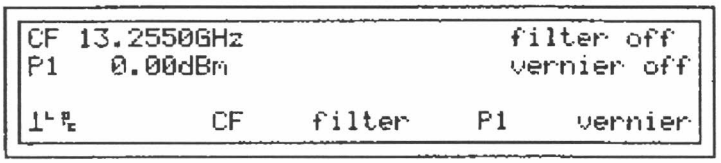
$$\Delta\mathbf{F} = \mathbf{F2} - \mathbf{F1}$$

If the centre frequency is adjusted past a point where either **F1** reaches its lower limit or **F2** reaches its upper limit, the value of **ΔF** is reduced to maintain a symmetrical sweep.

If **CF** is subsequently moved away from the band edge, **ΔF** increases towards its 'remembered' original value. Note that the 'remembered' ΔF value is lost if either a new configuration is selected or an explicit change is made to **ΔF**.

CW operation





		Range
CF	RF output frequency	2 MHz to 26.6 GHz
filter	CW filter:	
	off Filter off on Filter on	
P1	Power level (dBm)	–15 to +20 dBm
vernier	Frequency vernier control	
	off Vernier off on Vernier on	

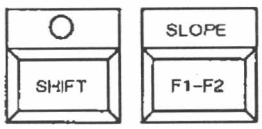
Notes ...

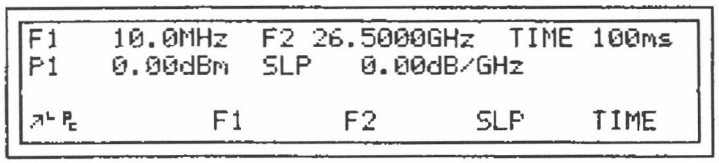
Frequency parameters may be set to a resolution of 500 kHz during normal operation. When the **vernier** is enabled, **CF**, **F1** or **F2** may be set to a resolution of 10 kHz over a range of approximately ±20 MHz.

If altering **F1** or **F2**, both values will change when the **vernier** is enabled.

The filter is used to reduce the YIG oscillator tuning bandwidth and lower the residual FM to the values specified in the Performance Data section of Chapter 1.

Swept operation (Power slope) (F1–F2)





		Range
F1	Start frequency	2 MHz to 26.6 GHz
F2	Stop frequency	2 MHz to 26.6 GHz
SLP	Power slope	0 to 20.0 dB/GHz
TIME	Forward sweep time	10 ms to 33.5 s
P1	Start power (Power level at F1)	–15 to +20 dBm

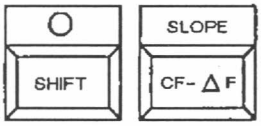
Notes ...

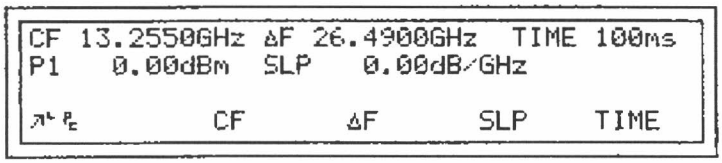
In power slope mode the RF output power increases with frequency, a typical use for which is to compensate for high frequency losses in RF cables.

The start power **P1** cannot be changed in this configuration and should be set using one of the levelled sweep configurations. Alternatively, this configuration could be used as the basis for a user-programmed configuration in which the **P1** parameter replaces one of the four controllable parameters (for example **TIME**). See Chapter 3-2, Programmable keys, for details.

The **SLP** setting is terminated with the [dBm] key.

Swept operation (Power slope) (CF–ΔF)





		Range
CF	Centre frequency	2 MHz to 26.6 GHz
ΔF	Frequency span	0 to 20.598 GHz
SLP	Power slope (dB/GHz)	0 to 20.0 dB/GHz
TIME	Forward sweep time	10 ms to 33.5 s
P1	Start power (Power level at F1)	–15 to +20 dBm

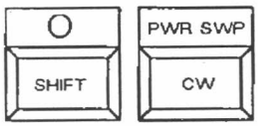
Notes ...

In power slope mode the RF output power increases with frequency, a typical use for which is to compensate for high frequency losses in RF cables.

The start power **P1** cannot be changed in this configuration and should be set using one of the levelled sweep configurations. Alternatively, this configuration could be used as the basis for a user-programmed configuration in which the **P1** parameter replaces one of the four controllable parameters (for example **TIME**). See Chapter 3–2, Programmable keys, for details.

The **SLP** setting is terminated with the [dBm] key.

Power sweep




```
CF 13.2550GHz filter on        TIME 100ms
P1    0.00dBm  P2  +5.00dBm

↑└ R̲        CF       P1       P2      TIME
```

		Range
CF	RF output frequency	2 MHz to 26.6 GHz
P1	Start power (dBm)	–15 to +20 dBm
P2	Stop power (dBm)	–15 to +20 dBm
TIME	Sweep time	10 ms to 33.5 s
filter	CW filter	
	off Filter off on Filter on	

Note ...

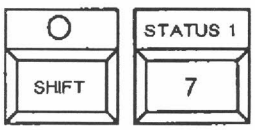
The filter setting should be selected using the CW configuration.

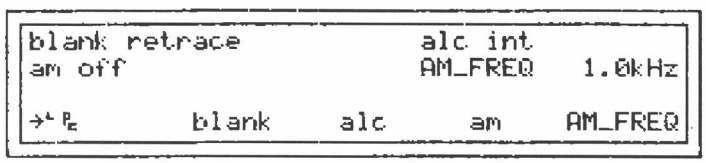
AUXILIARY CONFIGURATIONS

No change to the operating mode occurs when an auxiliary configuration is selected.

Status 1 display

States of the non-numeric parameters are selected by successive presses of the soft keys.





blank Selects RF blanking

- **off** No RF blanking
- **retrace** RF blanking during sweep retrace

alc Automatic Level Control
Selects internal or external RF power levelling

- **int** Internal levelling selected
- **ext+** External detector (+ve output)
- **ext–** External detector (–ve output)
- **mtr** Power meter levelling

am Selects internal square wave amplitude modulation

- **off** Amplitude modulation off
- **on** Amplitude modulation on

AM_FREQ Amplitude modulation frequency (range 1.0 to 100 kHz)

Notes ...

Retrace blanking is not permitted when external sweep is selected.

During normal operation, the RF output will be blanked whilst parameter values are changed. This is to prevent undefined output as the hardware is updated. For applications where it is undesirable for the RF to be blanked during alteration of sweeper parameters, it is possible to set the sweeper such that RF is always present even though its level may be undefined. The parameter **rf_on** is available using the Programmable keys and can be set either to **normal** for normal operation (RF blanked when parameters change) or to **always** for RF to be enabled continuously, unless specifically switched off by the user. Refer to Chapter 3–2 for details. It should be noted that when **blank** is set to **retrace**, **rf_on** is set to **normal**. Conversely, when **rf_on** is set to **always**, **blank** will be set to **off**.

The external detector's output or the power meter's levelling output (range 0 to 1 V in both cases) should be connected to the EXT LEVEL input on the front panel.

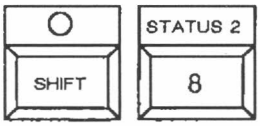
Appropriate correction data is applied to each type of automatic level control. For internal levelling, this is the power calibration data held in the selected calibration store. For external and power meter levelling default data is applied which removes the compensation for the internal detector.

The current correction data will be overwritten by new data (as outlined above) as soon as **alc** is changed. Therefore, if a calibration store contains data collected using external levelling and it is required to select this data, it is necessary first to select the correct external **alc** state and then the appropriate calibration store.

If for any reason a change is made to the **alc** state the calibration store must also be re–selected.

A flashing calibration symbol in the status field indicates that default data is being used.

Status 2 display




```
S_ADDR 20                CONTRST 10
P_ADDR 18                OP_HRS    28

                S_ADDR  P_ADDR           CONTRST
```

		Range
S_ADDR	System GPIB address	0 to 30
P_ADDR	Private GPIB address	0 to 30
CONTRST	Adjusts LCD contrast to suit viewing angle	1 to 20
OP_HRS	Total instrument operating hours	

Notes ...

Refer to the GPIB Operating Manual for details of system GPIB operation and the significance of the GPIB addresses.

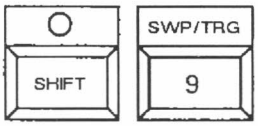
The sweeper powers-up with **CONTRST** set to a value of 10, this being the mid-way value between the minimum value 1 and maximum value 20. Under normal conditions this range is sufficient to enable a clear display when viewed from most angles. However, under certain conditions, for instance extremes of temperature, this range might not provide the required contrast. To overcome this, it is possible to alter the range by changing the contrast associated with a value of 10. The method is as follows:

(1) Adjust **CONTRST** control to bring the display to the required power-up contrast.

(2) Enter 999 into the numeric entry field, terminating with the [kHz/int] key. A *LIMIT* warning message will be displayed.

(3) Switch the sweeper off then on again. The display contrast will be as set in (1). This new contrast level corresponds to value 10, and will apply at each subsequent power-up.

Sweep/Trigger selection




```
sweep ext                    swp_tr int
s_swp inactive               cntr_tr off

→ P1        sweep   s_swp  swp_tr  cntr_tr
```

sweep Selects internal or external sweep

int	Internal sweep selected. TIME parameter determines sweep time.
ext	External sweep selected. Rear panel SWEEP i/p connector accepts 0 to +10 V tuning voltage.

swp_tr Selects method of sweep triggering

int	Internal triggering.
ext	External triggering. Sweep triggered by logical 1 to logical 0 transition applied to EXT TRIG (pin 11 of rear panel AUXILIARY FUNCTIONS connector)
line	Trigger synchronized to power line frequency
single	Sweep initiated by pressing soft key assigned to the **s_swp** parameter

s_swp Initiates sweep when single sweep triggering selected

inactive	Single sweep triggering disabled
ready	Sweep may be initiated by pressing soft key
sweeping	Sweep in progress

cntr_tr Selects counter trigger option for use with an external frequency counter

off	Counter trigger off
f1	Counter triggered at start frequency
f2	Counter triggered at stop frequency
mk	Counter triggered at reference marker frequency

Notes ...

The default settings are:

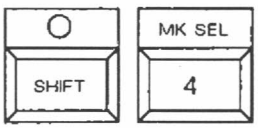
sweep – int
swp_tr – int
s_swp – inactive
cntr_tr – off

If **external** sweep is selected (e.g. for use with 6500) it is only possible to select internal triggering. Conversely, unless internal triggering is selected it is not possible to select **external** sweep.

The counter trigger facility allows frequency measurements to be made while operating in a swept frequency mode. At a point in the sweep specified by the **cntr_tr** parameter, the sweeper generates a trigger pulse. The counter responds by generating a STOP SWP signal of sufficient duration for a count to be acquired. **The counter trigger operates only when internal sweep is selected.**

Appendix C describes counter interfacing.

Marker select



Soft keys

mk_ref	Selects one of the 5 markers, A,B,C,D or E to be the reference marker, thereby enabling its frequency to be changed
MK_FREQ	When selected (flashing) the frequency of the reference marker can be changed (range 2 MHz to 26.6 GHz)
mk on	Switches the reference marker on/off
on/off	Switches all markers on/off

Displays

A,B,C,D,E	Marker labels. The current frequency is shown adjacently.
mk_ref	Reference marker. The appropriate label is displayed.
mks_on	Displays the on/off status of all 5 markers. The presence of the marker label indicates that the marker is on; a dash indicates that the marker is off.

Notes ...

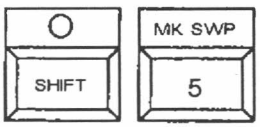
Markers are useful in amplitude analysis systems. See Chapter 3–4 for details of operation with the 6500 Automatic Amplitude Analyzer.

This configuration allows the five markers to be switched on or off and their frequencies set. To change the frequency of a particular marker, or switch it on, it must first be made the reference marker.

The reference marker frequency is the start point for the marker sweep.

An 'on' marker appears as a dip of approximately 5 dB in the RF output power at the marker frequency.

Marker sweep




```
A  2.0000GHz  B  3.5000GHz  Δ  1.5000GHz
C  5.0000GHz  D  7.1250GHz  mk_ref C
              mk_swp off    mk_stp B
→↑↑ UNLU mk_ref  mk_stp  mk_swp  transfr
```

Soft keys

mk_ref Selects one of the 5 markers, A,B,C,D or E to be the reference marker

mk_stp Selects one of the 5 markers, A,B,C,D or E to be the stop marker during marker sweeps

mk_swp Activates frequency sweep between the reference and stop markers.

on Marker sweep on
off Marker sweep off

transfr Makes the marker sweep permanent by assigning the current reference and stop marker frequencies to F1 and F2

Displays

A,B,C,D Markers labels. The current frequency is shown adjacently.

Δ Indicates the frequency difference between the reference and stop markers (Range 0 to 26.598 GHz)

mk_ref Reference marker. The appropriate label is displayed.

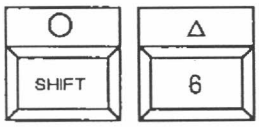
mk_stp Stop marker. The appropriate label is displayed.

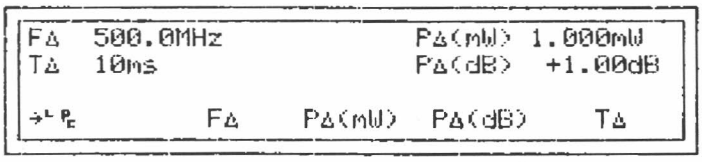
Notes ...

Although it is not displayed in this configuration, marker E may be the reference or stop marker.

A non-numeric parameter is available for setting the centre frequency CF to the reference marker frequency. If this facility is required, a programmable key configuration should be created in which the **cf=ref** parameter is assigned to one of the soft keys. Refer to Chap. 3-2.

Parameter step size selection





		Range
FΔ	Frequency step	500 kHz to 10 GHz
PΔ(mW)	Power step (mW)	0.1 mW to 20 mW
PΔ(dB)	Power step (dB)	0.0 dB to 5.0 dB
TΔ	Time step	1 ms to 10 s

Notes ...

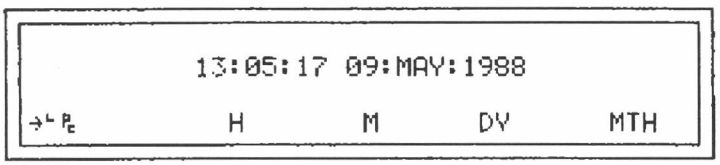
Only integer multiples of the minimum step size are allowed

This configuration is used to program the step size for each type of numeric parameter.

The step size for the 'integer' parameters (GPIB address, LCD contrast, etc.) may also be changed from its default setting of 1. To do this it is necessary to use the programmable keys. Refer to Chap. 3–2.

PΔ(mW) allows the step size of the Power (mW) parameters to be changed. The Power (mW) parameters are not found in any of the standard configurations but may be employed in a user defined configuration assigned to one of the programmable keys. Refer to Chap. 3–2.

Date (clock/calendar selection)



		Range
H	Specifies the hour of the day	0 to 23
M	Specifies the minute of the hour	0 to 59
DY	Specifies the day of the month	1 to 31
MTH	Specifies the month of the year	1 to 12

Notes...

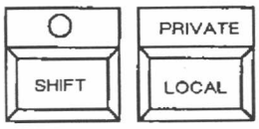
Seconds may be set with the "S" parameter and the year with the "YR" parameter via the Programmable keys. Refer to Chap. 3-2.

Although the month is displayed as a three letter abbreviation, it is set using the numerical representation 1 to 12, or by cycling through the months using the rotary control or step keys. The day, month and year parameters are held in the instrument's non-volatile memory and will thus "remember" their last value but will not be affected by a memory recall operation. Hours, minutes and seconds will be initialized to 00:00:00 at power on.

When the sweeper forms part of a scalar analysis system and the digital plot facility is being used, the time and date will appear in the bottom right hand corner of the plot in the format HH:MM DD:MMM:YR, e.g. 13:05 09:MAY:88. It is possible to disable plotting of the DATE using an option in the Plotter menu. It should be noted that the default is to have DATE plotting enabled. Refer to Chap. 3-4.

Two additional clock parameters log the total instrument operating hours (**OP_HRS**, available via STATUS 2) and user operating hours (**USR_HRS**), the latter being resettable. These integer parameters are listed in Table A-5 of Appendix A and are available via the Programmable keys. Refer to Chap. 3-2.

Private GPIB status




```
analysr[8] off                pwr_mtr[9] off
counter[6] off                plotter[5] off

→ Pε                  init
```

init Initialize private GPIB

device[X] indicates the expected address of a device connected to the Private GPIB, thus:

analysr[8] 6500 Automatic Amplitude Analyzer expected at address 8

counter[6] Counter expected at address 6

pwr_mtr[9] Power meter expected at address 9

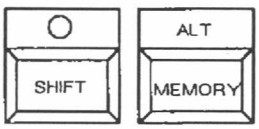
plotter[5] Plotter expected at address 5

on Device present at expected address
off Device not present at expected address

Note ...

At power on, following selection of **init** or after pressing the **CAL** softkey during calibration (see Chap. 3-5), the sweeper determines which devices are present on the private GPIB and sets **analysr[8], counter[6], pwr mtr[9]** and **plotter[5] on** or **off** accordingly.

Alternate sweep selection




```
ALT_MEM  1                altern off
                          man_alt current

→└ P₂      ALT_MEM          altern  man_alt
```

This configuration provides alternate sweep facilities.

ALT_MEM Specifies the memory to be used for alternate sweep. Range is 0 to 20; 0 is current setting, 1 to 20 are user defined settings.

altern Selects alternate sweep

- **off** Alternate sweep disabled
- **man** Alternation between current sweeper settings and those in the specified memory is actioned manually by pressing a soft key assigned to the **man_alt** parameter
- **auto** Alternation between current sweeper settings and those in the specified memory occurs automatically at the end of each sweep

man_alt allows manual switching between current sweeper settings and those in the specified memory when altern is set to man.

- **current** Sweeper operates using current settings
- **memory** Sweeper operates using the settings stored in the memory specified by **ALT_MEM**

Note ...

Automatic alternate sweep is not permitted when the sweeper is set for external sweep. Manually switched alternate sweep is primarily intended for use with the 6500 Automatic Amplitude Analyzer.

MEMORY FACILITIES

See Chapter 3-4 for details of memory operation with the 6500.

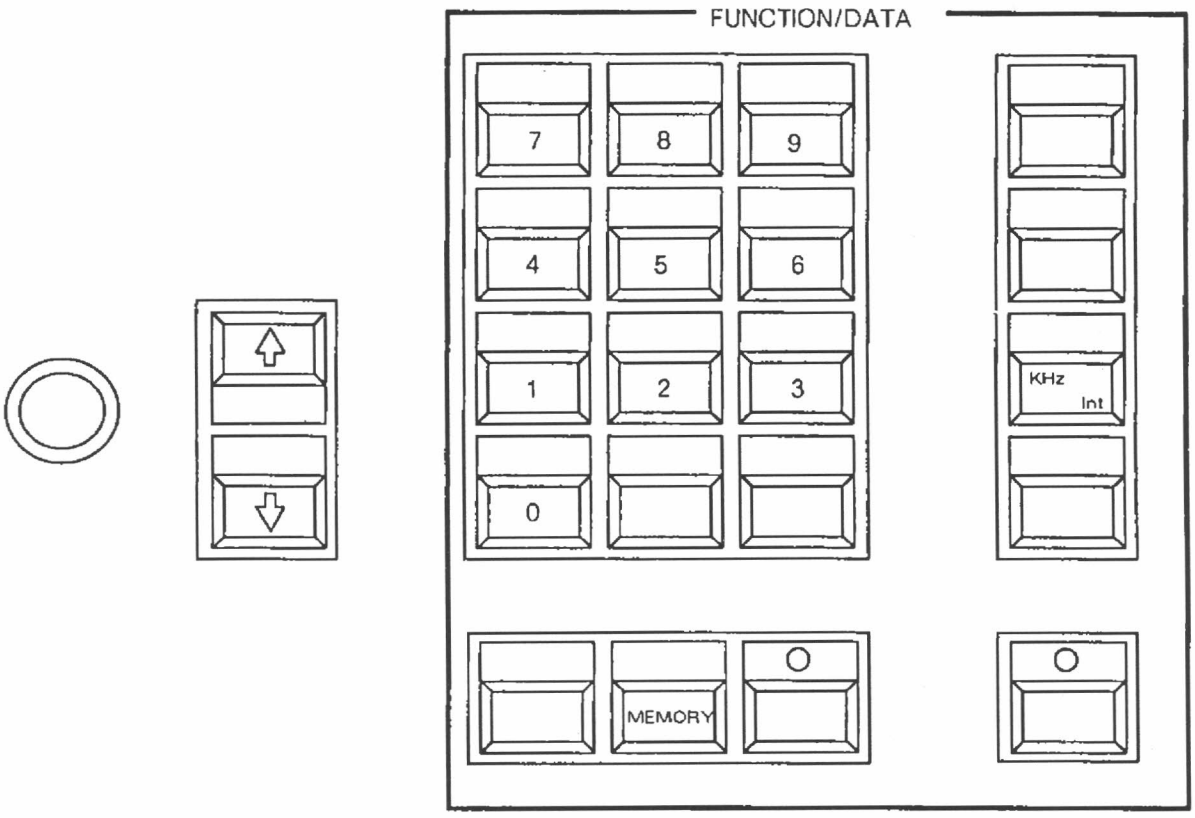


Fig. 3-5 Location of MEMORY key and associated controls

The sweeper has twenty non-volatile memories, each capable of storing the complete instrument settings. The [MEMORY] key provides access to the memories, allowing their contents to be reviewed and recalled, and allowing new contents to be stored. Additionally, the sweeper's state at power-on can be defined.

Following selection of the [MEMORY] key, the contents of the last accessed memory (MEMORY 1 at first access from power-up) are displayed as shown below.

```
F1   10.0MHz  F2 26.5000GHz  TIME 100ms
P1   0.00dBm
[]
→ MEM 1   STORE  RECALL  POWER-ON  EXIT
```

Note that the configuration displayed when reviewing the memories will be whichever configuration was displayed at the time of storage. However, all valid parameters are affected when a memory is recalled.

Parameter values are affected in three distinct ways when a memory recall operation is performed.

Firstly, the values for parameters held in non-volatile memory are retrieved. Such parameters are listed in Appendix B, Table B-1.

Secondly, the values of some parameters are not affected by recall operations. Such parameters are listed in Appendix B, Table B-2.

Thirdly, certain parameters will be set to a "default" value. Such parameters are listed in Appendix B, Table B-3.

Memory reviewing

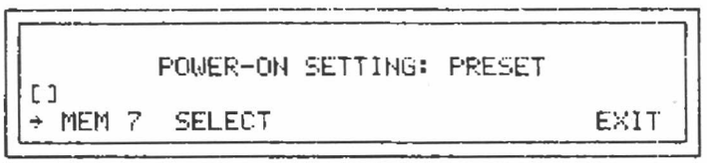
RF power is switched off as a safety precaution when the [MEMORY] key is selected. In this way, the contents of each of the sweeper's memories can be reviewed (using the step keys or rotary control) without changing the output characteristics. If RF is switched back on, the sweep selected prior to selection of [MEMORY] will be found to remain active. A specific memory may also be examined by entering the appropriate memory number terminated by the [kHz/int] key. The selected memory's number is located on row 4 directly above the step keys, next to the operating mode symbol.

In addition to the twenty store/recall memories there is also a "recall only" memory, designated PRESET. This contains the standard switch-on conditions, and is useful for overwriting the contents of the other memories at the end of an operating session should erasure be desirable for security reasons. The PRESET parameter values are listed in Appendix B, Table B-4.

Soft key assignments

STORE	Overwrites the displayed memory with the current sweeper settings. It is not possible to overwrite the contents of the PRESET memory. As selection of [MEMORY] switches RF off, it is necessary to switch it on again before pressing **STORE**, if it is required that RF is on when the memory is recalled.
RECALL	Recalls the displayed memory contents.
POWER-ON	Specifies the sweeper's state following power on. See below.
EXIT	Leaves memory menu, returns to the previous configuration.

Power-on



The sweeper status following power-on may be set to one of the following three alternatives:

The contents of one of the 20 memories.

The **PRESET** state.

The **PWR-DOWN** state (the state immediately prior to power-down).

The rotary control, step keys or numeric keys allow the desired memory number, **PRESET** or **PWR-DOWN** to be selected.

SELECT	Assigns the power-on setting.
EXIT	Returns to memory menu.

TEST AND CAL KEYS

The operation of the [TEST] key is described in APPENDIX D : SELF TEST.

The operation of the [CAL] key is described in Chap. 3-5 : CALIBRATION.

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Chapter 3–2

PROGRAMMABLE KEYS

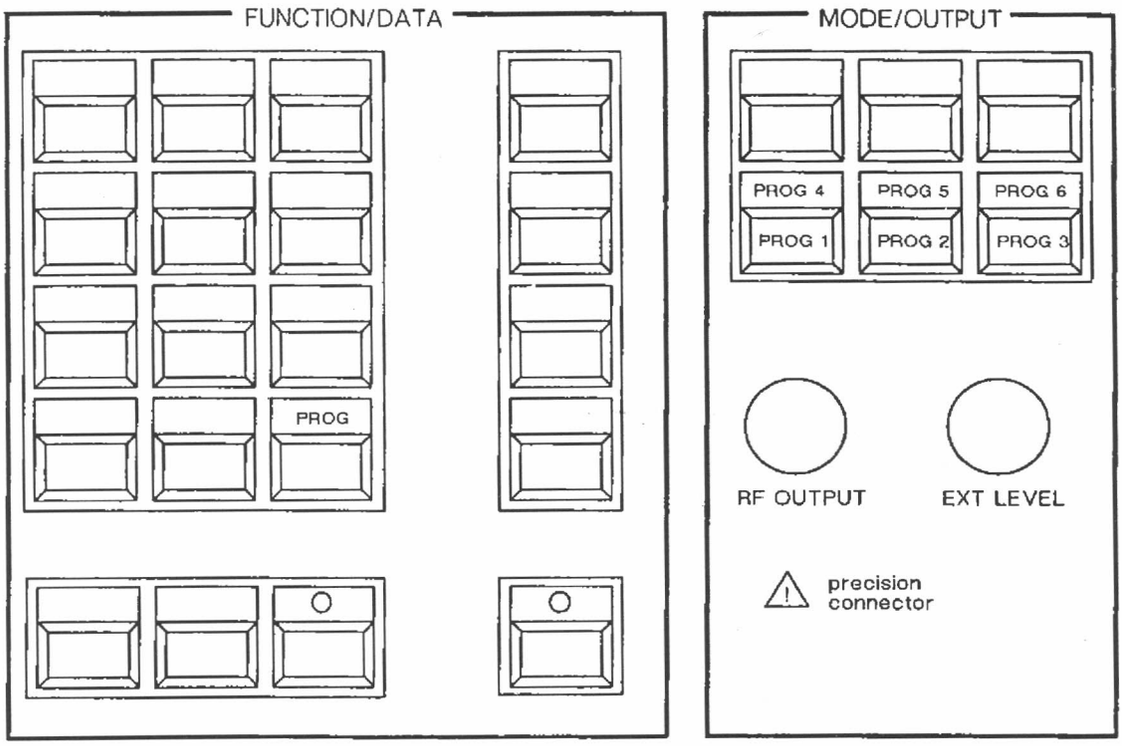


Fig. 3–6 PROG key and programmable keys

OVERVIEW

The programmable keys may be programmed with up to six operator defined configurations. The creation and modification of configurations is achieved using the [PROG] key in the FUNCTION/DATA keypad. Programmable key assignments are stored in non-volatile memory; once programmed a key retains its configuration until changed by the operator.

The keys described in Chap. 3–1 provide the configurations likely to be required for most applications. The programmable keys increase the options available to the operator by allowing new configurations to be created which can be accessed by a single key-press.

A configuration consists of: a display of the current values of a number of parameters; up to four soft key assignments; and the operating mode. The action of the [PROG] key is designed around these three components. Three Edit modes allow you to define a configuration by specifying:

The parameters to be displayed and their positions.

The soft key assignments.

The operating mode.

The [PROG] key programmer in some ways resembles a word processor. A word processor user:

(i) Either LOADS a document from a file into memory for editing or CLEARS the memory ready to start from scratch.

(ii) Performs various EDITING operations on the document.

(iii) STORES the resulting document to a file.

The [PROG] key similarly allows the sweeper user to:

(i) LOAD an existing configuration into the 'edit memory'. This can be either one of the standard configurations (described in Chap. 3-1) or a previously created programmable key configuration. Alternatively, the edit memory can be CLEARed so that an entirely new configuration may be defined.

(ii) EDIT the configuration.

(iii) STORE the new configuration to one of the programmable keys.

The [PROG] key accesses the main 'menu': LOAD, EDIT and STORE. Selection of any one of these gives rise to another menu of functions, and so on up to a maximum of three 'levels' below the main menu. The complete structure of the user programming facility is shown in Fig. 3-7.

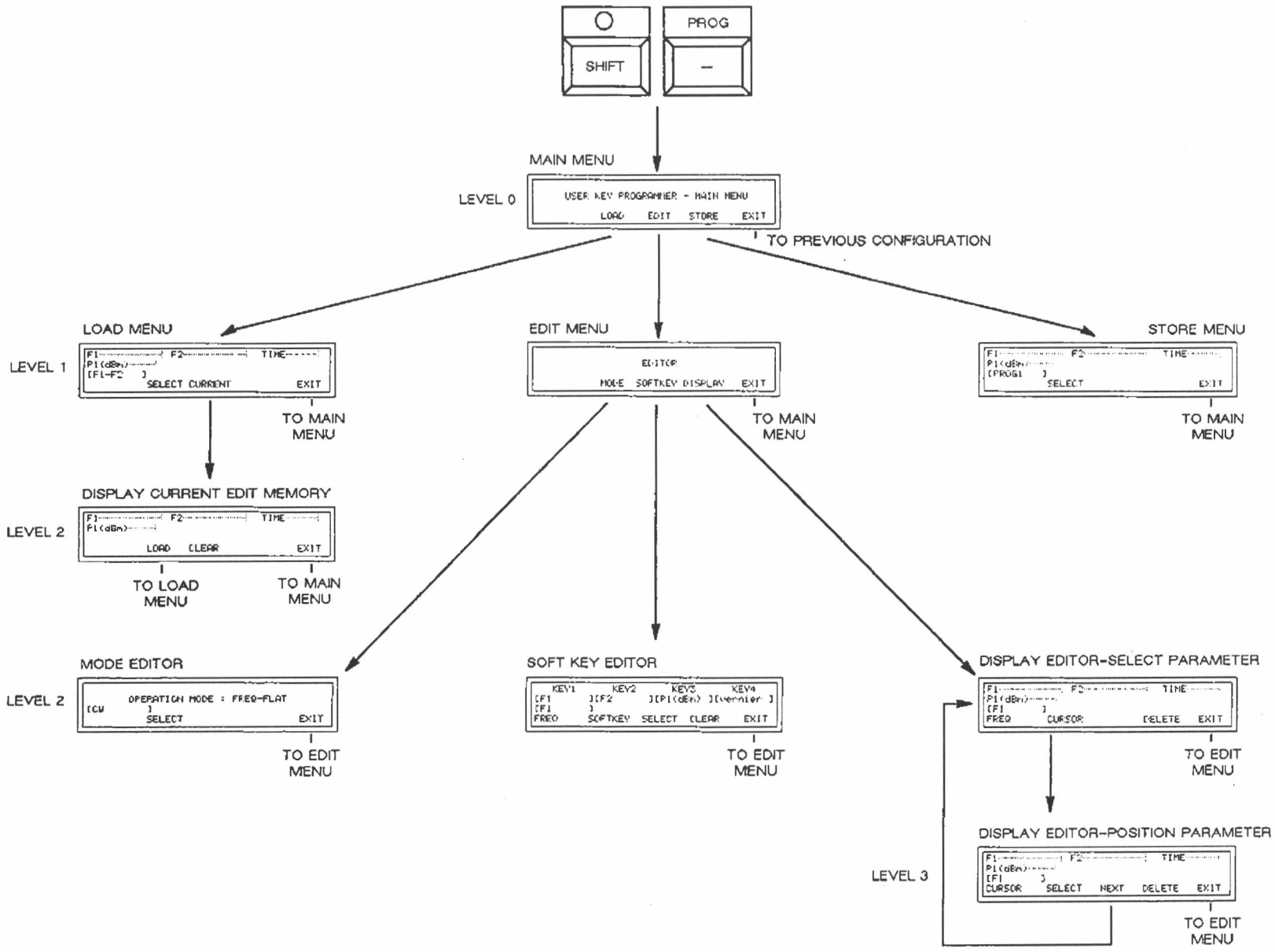
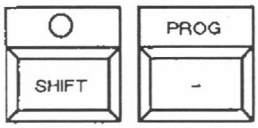


Fig. 3-7 Programmer overall structure

MENU DESCRIPTIONS

MAIN MENU




```
USER KEY PROGRAMMER - MAIN MENU
        LOAD    EDIT   STORE    EXIT
```

RF is switched off when the programmer is selected.

While editing is in progress, the configuration being created or modified is held in the 'edit memory'. Since the edit memory is not cleared every time the [PROG] key is pressed, it is permissible to leave the programmer at any time and resume the editing session later. The edit memory contents are not preserved, however, when power is removed. To save a configuration permanently it must be assigned to one of the programmable keys.

Soft key assignments

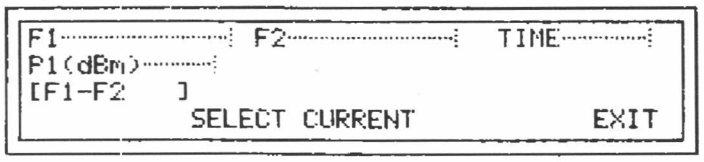
LOAD Selects the LOAD menu (level 1)which allows a "built-in" sweep or auxiliary) configuration, or a previously defined programmable key configuration, to be loaded into the edit memory for editing. DISPLAY CURRENT EDIT MEMORY (level 2) allows the edit memory to be cleared so that a new configuration may be created "from scratch".

EDIT Selects the EDIT menu for editing of the configuration currently held in the edit memory. The editor allows displayed parameters, soft key assignments and the operating mode associated with the configuration to be modified.

STORE Selects the STORE menu which allows the current edit memory contents to be stored to one of the programmable keys.

EXIT Leaves the programmer and returns to previous configuration.

LOAD MENU and DISPLAY CURRENT EDIT MEMORY MENU



LOAD (level 1) allows a standard configuration or a previously defined programmable key configuration to be copied into the edit memory. DISPLAY CURRENT EDIT MEMORY (level 2) allows the edit memory to be cleared so that a new configuration can be entered "from scratch".

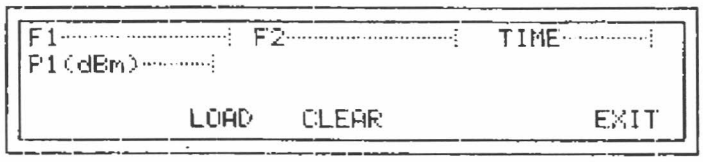
Soft key and rotary control assignments

ROTARY CONTROL — The configurations available to be loaded (listed in Table 3-1 overleaf) are displayed one after the otherusing the rotary control. The configuration label is displayed in parenthesis in row 3 and the associated parameters are shown in rows 1 and 2.

SELECT — The displayed configuration is loaded into the edit memory. This is indicated by **SELECTED** being displayed at the left-hand side of row 4.

EXIT — Returns to main menu.

CURRENT — Displays the current contents of the edit memory and the DISPLAY CURRENT EDIT MEMORY menu:



LOAD — Returns to LOAD menu.

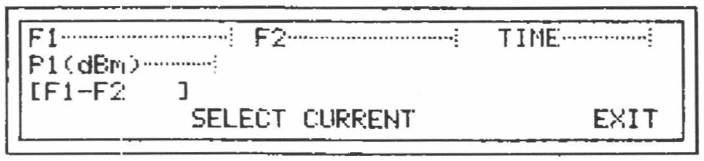
CLEAR — Clears the edit memory to allow the creation of a new configuration, rather than the modification of an existing configuration.

EXIT — Returns to main menu.

TABLE 3-1 CONFIGURATION LABELS USED IN LOAD MENU

Label	Configuration
F1–F2	Swept operation (Levelled output power) (F1–F2)
CF–ΔF	Swept operation (Levelled output power) (CF–ΔF)
CW	CW operation
F1F2 SLP	Swept operation (Power slope) (F1–F2)
CFΔF SLP	Swept operation (Power slope) (CF–ΔF)
PWR SWP	Power sweep
STATUS 1	Status 1 display
STATUS 2	Status 2 display
DELTA	Parameter step size selection
SWP–TRG	Sweep/Trigger selection
MK–SWP	Marker sweep
MK–SEL	Marker select
PRIVATE	Private GPIB status
ALT	Alternate sweep selection
DATE	Clock/calendar selection
PROG1	PROG 1 configuration
PROG2	PROG 2 configuration
PROG3	PROG 3 configuration
PROG4	PROG 4 configuration
PROG5	PROG 5 configuration
PROG6	PROG 6 configuration

LOAD MENU and DISPLAY CURRENT EDIT MEMORY MENU



LOAD (level 1) allows a standard configuration or a previously defined programmable key configuration to be copied into the edit memory. DISPLAY CURRENT EDIT MEMORY (level 2) allows the edit memory to be cleared so that a new configuration can be entered "from scratch".

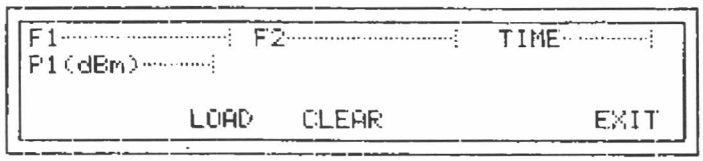
Soft key and rotary control assignments

ROTARY CONTROL — The configurations available to be loaded (listed in Table 3-1 overleaf) are displayed one after the otherusing the rotary control. The configuration label is displayed in parenthesis in row 3 and the associated parameters are shown in rows 1 and 2.

SELECT — The displayed configuration is loaded into the edit memory. This is indicated by **SELECTED** being displayed at the left-hand side of row 4.

EXIT — Returns to main menu.

CURRENT — Displays the current contents of the edit memory and the DISPLAY CURRENT EDIT MEMORY menu:



LOAD — Returns to LOAD menu.

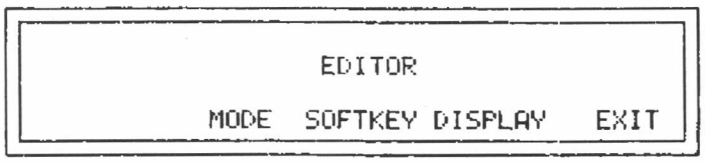
CLEAR — Clears the edit memory to allow the creation of a new configuration, rather than the modification of an existing configuration.

EXIT — Returns to main menu.

TABLE 3-1 CONFIGURATION LABELS USED IN LOAD MENU

Label	Configuration
F1–F2	Swept operation (Levelled output power) (F1–F2)
CF–ΔF	Swept operation (Levelled output power) (CF–ΔF)
CW	CW operation
F1F2 SLP	Swept operation (Power slope) (F1–F2)
CFΔF SLP	Swept operation (Power slope) (CF–ΔF)
PWR SWP	Power sweep
STATUS 1	Status 1 display
STATUS 2	Status 2 display
DELTA	Parameter step size selection
SWP–TRG	Sweep/Trigger selection
MK–SWP	Marker sweep
MK–SEL	Marker select
PRIVATE	Private GPIB status
ALT	Alternate sweep selection
DATE	Clock/calendar selection
PROG1	PROG 1 configuration
PROG2	PROG 2 configuration
PROG3	PROG 3 configuration
PROG4	PROG 4 configuration
PROG5	PROG 5 configuration
PROG6	PROG 6 configuration

EDIT MENU

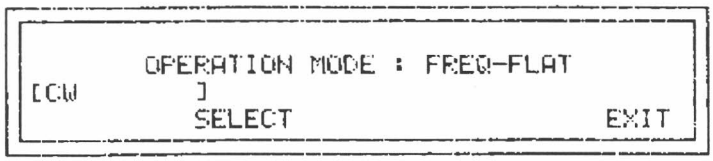


EDIT allows the operating mode, soft key assignment and dislay arrangement of the the new configuration to be defined – via the appropriate level 2 "editors".

Soft key assignments

MODE	Selects MODE editor which allows the operating mode to be defined.
SOFTKEY	Selects SOFTKEY editor which assigns parameters to the four soft keys.
DISPLAY	Selects DISPLAY editor which allows parameters to be selected for display and their positions on the LCD to be defined.
EXIT	Returns to main menu.

MODE EDITOR



Row 2 of the display shows the current operating mode stored in the EDIT memory, which may be one of the following:

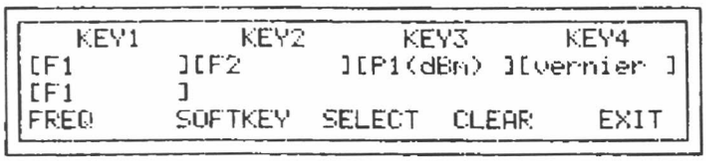
CW	(constant frequency and power)
FREQ-FLAT	(frequency sweep, levelled power)
FREQ-SLP	(frequency sweep with power slope)
PWR-SWEEP	(constant frequency with power sweep)
NO-CHANGE	

The modes are displayed one after the other in row 3 of the display, by turning the rotary control. This allows the operating mode of the new configuration to be selected. The **NO-CHANGE** option allows a configuration to be created which will not change the operating mode when selected. This is useful for status displays, and is in fact used in the built-in configurations STATUS 1 and SWP/TRG

Rotary control and soft key assignments

ROTARY CONTROL	Used to view the four available modes and the 'NO CHANGE' option. The mode is displayed in parenthesis in row 3.
SELECT	Selects the mode displayed in row 3. When selected this overwrites the current mode displayed in row 2.
EXIT	Returns to the EDIT menu.

SOFTKEY EDITOR



The soft key editor is used to assign parameters to the four soft keys.

Row 1 of the LCD shows labels representing each of the four soft keys. Parameters currently assigned to these keys are shown in row 2.

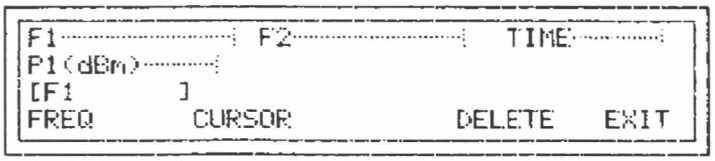
Rotary control, step key and soft key assignments

STEP KEYS	Select a group of broadly related parameters. A label identifying the group is indicated above the step keys, on the left of row 4. The labels for the various groups are listed in TABLE 3-2. A full listing of the sweeper's parameters by group is given in Appendix A.
ROTARY CONTROL	Selects a parameter from within the group. The parameter label appears in parenthesis on the left of row 3.
SOFTKEY	Selects one of the four soft keys. The corresponding label KEY1 to KEY4 flashes to indicate selection. Repeated key presses select each of KEY1 to KEY4 in turn.
SELECT	Assigns the parameter displayed in row 3 to the currently active soft key (indicated by the flashing label).
CLEAR	Removes any assigned parameter from the currently active soft key.
EXIT	Returns to the EDIT menu.

TABLE 3-2 SWEEPER PARAMETER GROUPS

Label	Parameter group
FREQ	Frequency
PWR dBm	Power (dBm)
PWR mW	Power (mW)
TIME	Time
INTEGER	Integers
DIAGNOST	Diagnostic
non num	Non-numeric

DISPLAY EDITOR – SELECT PARAMETER



The display editor facilitates positioning of parameters on the LCD.

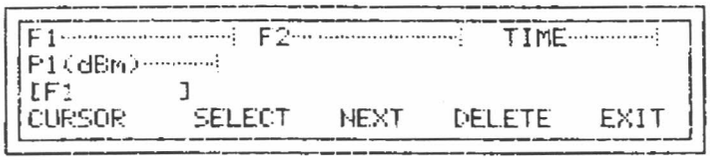
The blank area in the example display is the LCD area available for parameter display.
Row 4 is reserved for status and soft key labels, and part of row 3 is required for the numeric entry field.

The LCD shows the total length of the character field occupied by each displayed parameter.

Rotary control, step key and soft key assignments

STEP KEYS	Selects a group of broadly related parameters. A label identifying the group is indicated above the step keys.
ROTARY CONTROL	Selects a parameter from within the group. The parameter label appears in parenthesis on the left of row 3.
CURSOR	Accesses a level 3 menu which allows parameters to be positioned (see next page).
DELETE	If it is already present, the selected parameter is removed from the display.
EXIT	Returns to the EDIT menu.

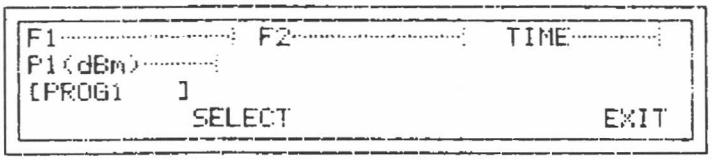
DISPLAY EDITOR – POSITION PARAMETER



In this menu the action of the step keys and rotary control is changed to allow positioning of a cursor which in turn defines the position of the parameters on the display. This is indicated by the label CURSOR above the step keys. The cursor appears as an underscore character.

ROTARY CONTROL	Clockwise – moves cursor to right. Anticlockwise – moves cursor to left.
STEP KEYS	Move cursor up/down.
SELECT	Places the chosen parameter at the position specified by the cursor. If the parameter is already present elsewhere on the display it is automatically repositioned. If the position is already occupied, or there is insufficient space, or if adding another parameter would cause the number displayed to exceed eleven (the maximum per configuration), an error message is displayed. Existing parameters cannot be 'overwritten', but must be deleted (see **DELETE**).
NEXT	Returns to Display editor to allow the next parameter to be selected.
DELETE	If already present, the selected parameter is removed from the display.
EXIT	Returns to EDIT menu.

STORE MENU



STORE enables the configuration held in the edit memory to be assigned to one of the programmable keys (PROG 1 to PROG 6).

Rotary control and soft key assignments

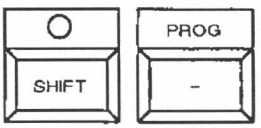
ROTARY CONTROL	Used to select a programmable key. The currently selected programmable key is displayed in parenthesis.
SELECT	Programs the selected programmable key with the configuration held in the edit memory.
EXIT	Returns to the programmer main menu.

PROGRAMMABLE KEY WORKED EXAMPLES

The following worked examples demonstrate most of the editing facilities. A good way to gain familiarity is to follow the examples on the sweeper.

Example 1

Suppose you wish to place the sweeper in CW mode but display and enter the power level in mW rather than dBm. In this example PROG 3 is programmed with a modified version of the standard CW configuration.

(1) Enter the programmer main menu by selecting 


```
USER KEY PROGRAMMER - MAIN MENU
        LOAD    EDIT   STORE    EXIT
```

Note ...

- As a safety precaution, RF power is switched off when the 

key is selected.

(2) As it is intended to modify an existing configuration, select the **LOAD** option. The LOAD menu is displayed:

```
F1·····| F2·····| TIME·····|
P1(dBm)·····|
[F1-F2   ]
          SELECT CURRENT          EXIT
```

(3) Rotate the rotary control to review each of the standard and programmable key configurations. The label in parenthesis on the left of row 3 indicates which configuration is being displayed, and the LCD shows the displayed parameters for that configuration.

(4) Rotate the rotary control until the CW configuration is displayed, then press **SELECT** to load the configuration ready for editing.

```
CF·····|                    filter·····|
P1(dBm)·····|               vernier·····|
[CW      ]
SELECTED  SELECT CURRENT          EXIT
```

(5) Press **EXIT** to return to the MAIN menu.

```
USER KEY PROGRAMMER - MAIN MENU

          LOAD    EDIT   STORE    EXIT
```

(6) Press **EDIT** to obtain the EDIT menu.

```
                EDITOR

          MODE  SOFTKEY DISPLAY   EXIT
```

The MODE editor allows you to change the mode associated with the configuration. Since the intention is to continue with CW mode, it is not necessary to use the MODE editor on this occasion.

(7) Select the **SOFTKEY** editor.

```
   KEY1      KEY2      KEY3      KEY4
[F1       ][F2       ][P1(dBm) ][vernier ]
[F1       ]
FREQ     SOFTKEY  SELECT  CLEAR    EXIT
```

The SOFTKEY editor allows you to assign parameters to the soft keys. On entering the SOFTKEY editor, the **KEY1** label flashes to indicate that this is the currently active soft key. Successive presses of **SOFTKEY** select **KEY2** to **KEY4** in turn.

(8) Press **SOFTKEY** twice to select **KEY3**.

The rotary control and step keys are used to select the parameter to be assigned to the soft key. The step keys select groups of broadly related parameters and the rotary control selects individual parameters within the group. Parameter groups are displayed on the left of row 4, and individual parameters are displayed (in parenthesis) on the left of row 3.

(9) Press one of the step keys repeatedly until the **PWR mW** parameter group is selected.

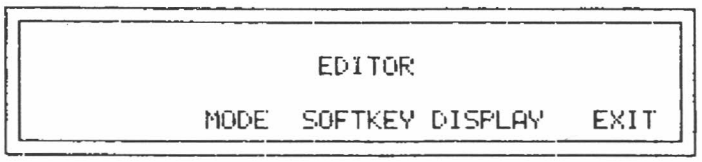
(10) Rotate the rotary control (if necessary) until the required parameter **P1(mW)** appears in the parenthesis.

(11) Press **SELECT** to assign the parameter **P1(mW)** to **KEY3**.

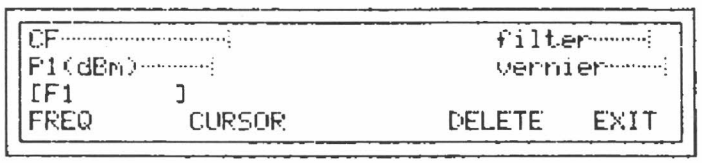
```
   KEY1      KEY2      KEY3      KEY4
[CF       ][filter   ][P1(mW)  ][vernier ]
[P1(mW)   ]
PWR mW   SOFTKEY  SELECT  CLEAR    EXIT
```

(12) Confirm that the desired parameter is assigned by checking for **P1(mW)** beneath the flashing **KEY3** symbol.

(13) Soft key editing is now complete. Press **EXIT** to return to the EDIT menu.

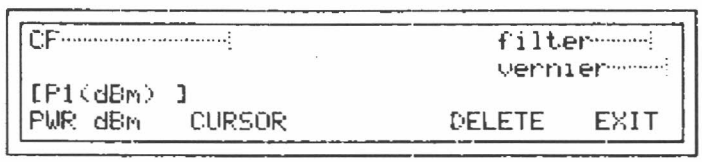


(14) Select **DISPLAY** to enter the DISPLAY editor.



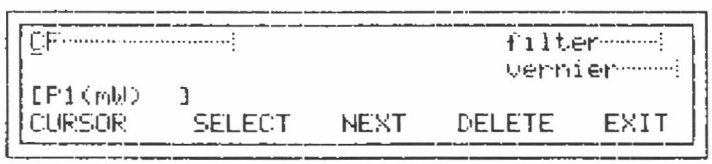
The displayed parameters are shown with bars indicating their field length. The task now is to delete the **P1(dBm)** parameter and replace it by **P1(mW)**.

(15) As with the soft key editor, the step keys are used to select a group of parameters and the rotary control is used to select a parameter within that group. Select the **PWR dBm** group and the **P1(dBm)** parameter, then press **DELETE**.



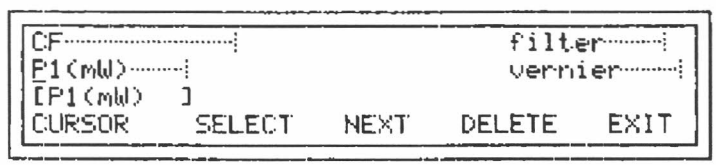
The **P1(dBm)** parameter has been deleted from the display.

(16) Use the step keys and rotary control to select the **PWR mW** group and the **P1(mW)** parameter. Press **CURSOR**.



(17) The cursor appears as an underscore character on the LCD. Using the step keys to move the cursor up and down, and the rotary control, to move it right (clockwise rotation) and left (anti-clockwise rotation), position the cursor in the parameter display area. The cursor may be positioned anywhere on the upper three rows of the LCD except the ten character field on the left of row 3, which is reserved for numeric entry.

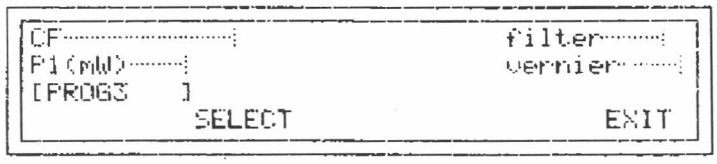
(18) Move the cursor to the position where the **P1(dBm)** parameter was formerly displayed, (the beginning of row 2) then press **SELECT**.



Modifications to the configuration are now complete.

(19) Press **EXIT** to return to the editor menu. Again press **EXIT** to return to the main menu.

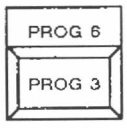
(20) Press **STORE**.



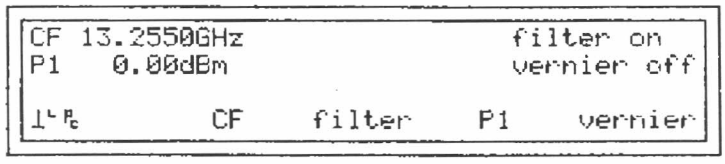
(21) The display shows the display configuration ready to be stored. The rotary control is used to select one of the programmable keys. Rotate the rotary control until **PROG 3** appears in the parenthesis.

(22) Press **SELECT** to program key PROG 3. **SELECTED** is displayed on the left of row 4.

(23) Press **EXIT** to return to the main menu, and again to exit from the programmable key programmer and return to the previous configuration.

(24) Press 

to try the new configuration.



As required, it is now possible to enter power levels in mW instead of dBm.

If it had been required that the user had the option of entering the power level either in dBm or in mW, this could easily have been achieved by deleting one of the other parameters in the CW configuration (CF, filter or vernier) and substituting P1(mW).

Example 2

The power slope configurations, Power Slope (F1–F2) and Power Slope (CF–ΔF), do not allow the start power level (P1) to be defined. Instead this parameter must be set up using one of the levelled sweep configurations. If the start power needs to be varied, it may be found inconvenient to keep having to reselect the levelled sweep configuration. If there is no requirement to vary the sweep time, therefore, it would be sensible to modify the power slope configuration(s) so that the **P1** parameter replaces **TIME**.

The example below shows how such a configuration may be programmed and stored to PROG1. The example uses the Power Slope (F1–F2) configuration as basis, but the same method would apply for modification of Power Slope (CF–ΔF).

(1) Enter the programmer MAIN menu and press **LOAD**. The LOAD menu is displayed.

(2) Rotate the rotary control until the **F1F2 SLP** configuration is displayed. Press **SELECT**. SELECTED is displayed on the left of row 4.

(3) Press **EXIT** to return to the MAIN menu.

(4) Press **EDIT**. The EDIT menu is displayed.

(5) As there is no need to change the mode of the configuration, the MODE EDITOR does not need to be used. Press **SOFTKEY**. The SOFTKEY EDITOR menu is displayed.

(6) Press **SOFTKEY** three times to select **KEY4**.

(7) Use the step keys to display the **PWR dBm** parameter group on the left of row 3. **P1(dBm)** should be displayed on the left of row 3.

(8) Press **SELECT** to assign the parameter **P1(dBm)** to **KEY4**. **P1(dBm)** will be displayed below **KEY4** on the display.

(9) Soft key editing is now complete. Press **EXIT** to return to the EDIT menu.

(10) Since **P1(dBm)** is already displayed in the Power Slope (F1–F2) configuration, there is no need to use the DISPLAY editor. Press **EXIT** again to return to the MAIN menu.

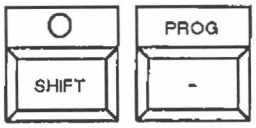
(11) Press **STORE** to display the STORE menu. If necessary, rotate the rotary control to display **PROG1** on the left of row 3. Press **SELECT** to program PROG1 with the new configuration. Press **EXIT** to return to the MAIN menu, and then again to exit from the programmable key editor and return to the previous configuration.

(12) Press 

to try the new configuration.

Example 3

In this example a new configuration is created 'from scratch' in which F1 and F2 and markers A and B are displayed and can be controlled. The configuration is stored to PROG5.

(1) Press 

to display the programmer MAIN menu.

(2) Press **LOAD** to display the LOAD menu.

(3) Press **CURRENT** to display the current contents of the EDIT memory.

(4) Press **CLEAR** to clear the the contents of the EDIT memory.

(5) Press **EXIT** to return to the MAIN menu.

(6) Press **EDIT** to display the EDIT menu.

(7) Press **MODE** to display the MODE EDITOR menu.

(8) Rotate the rotary contol until the **FREQ-FLAT** mode is displayed in row 2. Press **SELECT** to select this mode, then **EXIT** to return to the EDIT menu.

(9) Press **SOFTKEY** to display the SOFTKEY EDITOR menu.

(10) Use the step keys to select the **FREQ** parameters. **F1** should now be displayed on the left of row 3. Press **SELECT** to assign **F1** to **KEY1** (which will be flashing).

(11) Rotate the rotary control to display **F2**. Press **SOFTKEY** once to select **KEY2**. Press **SELECT** to assign **F2** to **KEY2**. Repeat procedure to assign **A** to **KEY3** and **B** to **KEY4**. Press EXIT to return to the EDIT menu.

(12) Press **DISPLAY** to give the DISPLAY EDITOR - SELECT PARAMETER menu. The **FREQ** parameters should be displayed on the left of row 4, and **F1** on the left of row 3.

(13) Press **CURSOR** to display the DISPLAY EDITOR - POSITION PARAMETER menu. Use the step keys and rotary control to position the cursor in a suitable position and press **SELECT**. The **F1** parameter is displayed in the position defined by the cursor, with bars indicating the field length.

(14) Press **NEXT** to return to the SELECT PARAMETER menu. Use the rotary control to select **F2**.

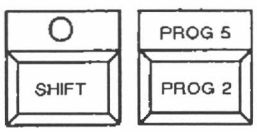
(15) Press **CURSOR** to return to the POSITION PARAMETER menu. Use the step keys and rotary control to position the cursor suitably and press **SELECT**. **F2** is displayed in the position defined by the cursor.

(16) Repeat (14) and (15) to position **A** and **B** as required.

(17) Press **EXIT** to return to the EDIT menu, and again to return to the MAIN menu.

(18) Press **STORE** to give the STORE menu. Rotate the rotary control to **PROG5** and press **SELECT**.

(19) Press **EXIT** to return to the MAIN menu, and then again to return to the previous configuration.

(20) Select 

to check the new configuration.

In addition to the above examples, useful applications of the user programming facility include the ability to remove all frequency information from the display (by deleting the appropriate parameters using the display editor), and the overlaying of the INTEGER clock parameters H (hours), M (minutes) and S (seconds) to allow the timing of a test procedure.

A complete list of the sweeper's parameters is given in Appendix A. It may be useful to consult this in designing a configuration for storing to the programmable keys.

Chapter 3-3

PRIVATE GPIB OPERATION

INTRODUCTION

The private GPIB enables the sweeper to control a Marconi Instruments RF Power Meter type 6960 or 6960A and a Marconi Instruments 26.5 GHz Microwave Counter type 2442 during autocalibration.

It also provides an interface to an Automatic Amplitude Analyzer type 6500 and, optionally, an HP-GL (Hewlett Packard Graphics Language) compatible plotter, to form a scalar measurement system.

CAUTION

There are two GPIB interface connectors located on the rear panel of the sweeper. The SYSTEM GPIB interface is intended for remote programming of the sweeper. Under no circumstances should a GPIB controller be connected to the interface connector marked PRIVATE, or damage to the sweeper and GPIB controller might result.

ADDRESS ALLOCATIONS

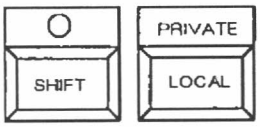
Private GPIB addresses are allocated as follows:

6500 Automatic Amplitude Analyzer	8
Plotter	5
Power meter	9
Frequency counter	6

PRIVATE GPIB INITIALIZATION

At power-on, in response to an **init** command from the keyboard or system GPIB, or after pressing **CAL** softkey during calibration, the sweeper checks the private GPIB addresses listed above to determine which instruments are installed. It is necessary to reinitialize the private GPIB should a device be added or removed. For this reason, it is recommended that all instruments intended to be used on the private GPIB should be connected and switched on before the sweeper.

A status display showing the private GPIB configuration is obtained using:




```
analysr[8] off              pwr_mtr[9] off
counter[6] off              plotter[5] off

                    init
```

init Initialize private GPIB

device[X] indicates the expected address of a device connected to the Private GPIB, thus:

analysr[8] 6500 Automatic Amplitude Analyzer expected at address 8

counter[6] Counter expected at address 6

pwr_mtr[9] Power meter expected at address 9

plotter[5] Plotter expected at address 5

on Device present at expected address
off Device not present at expected address

At power on or following a private GPIB reset command, the sweeper determines which devices are present on the private GPIB and sets **analysr[8]**, **counter[6]**, **pwr_mtr[9]** and **plotter[5]** **on** or **off** accordingly.

Power meter and counter operation

The power meter and counter are used for automatic calibration. Refer to Chap. 3–5.

Pass through facilities

A GPIB controller connected to the system GPIB may communicate with a device installed on the private GPIB. Refer to the GPIB Operating Manual.

Chapter 3–4

OPERATION WITH 6500 AUTOMATIC AMPLITUDE ANALYZER

ection in

AR NETWORK ANALYZER SYSTEM

graticule
mpatible

hen used in conjunction with a 6300 series sweeper to form a scalar network r system, many enhancements are made to the operation of the 6500 Automatic ude Analyzer. The main additional facilities are as follows:

eration as
at the

gh resolution x–axis display. Units may be either GHz or dBm depending on the weeper mode (dBm for power sweeps). Annotation is automatically updated when- ver the sweeper's frequency range or operating mode is changed.

IS 1

a calibration trace is stored and, subsequently, a measurement over a narrower equency band is made, the sweeper expands and interpolates the data stored in 00 to maintain a calibrated display.

1 as

a digital plotter is installed, the sweeper controls plotting of 6500 measure- nts. A title may be entered via the 6500 keyboard and added to the plot. This t title is held in non–volatile memory. Plotting is implemented as a 'background sk', allowing 6500 to make new measurements while plotting is in progress.

d to the
e x–axis
power in

00 front panel settings are stored automatically to the selected sweeper memory henever a sweeper memory store operation is carried out. This allows non–volatile orage of up to 20 sets of 6500 settings. These may be recalled by sweeper mory recall operations or by means of the special alternate sweep facilities veloped for use with the 6500.

Numeric
possible

power is switched off automatically during 6500 detector zero operation.

ne marker and delta marker facilities are provided on the display and on the otted output, if 6500 firmware is Issue 6 or higher.

t is dis–

atibility

gram the

r correct operation, 6500 must have installed firmware Issue 5 or higher. 6500 e issue status may be determined at power–on. Refer to 6500 Operating Manual.

The following marker facilities apply to analyzers equipped with Issue 6 or higher software:

Provision has been made for the electronically generated line markers available on 6500 to be assigned to and track the sweeper's markers.

Line markers are vertical lines similar in appearance to the brightline cursor. Issue 6 firmware provides a small highlight "pip" on the lower end of the brightline to distinguish it from the line markers.

Control of the line markers is achieved by means of a menu displayed on the 6500 screen. They may be displayed instead of or as well as the RF dip markers generated by the sweeper.

Marker control from the 6500 marker menu

Full control of the 6500 line marker facilities is obtained by selecting [SHIFT] [MARKER].

The following information is displayed:

6300 Markers:	**A**	**B**	**C**	**D**	**E**
6500 Markers:	**Off**	**Off**	**Off**	**Off**	**Off**
Toggle using:	**1**	**2**	**3**	**4**	**5**

6 - All Off
7 - All On

8 - Marker Δ On/Off

9 - Marker Δ with ΔF On/Off

NORMAL - Exit

The upper two lines show which of the sweeper markers, A to E, have been assigned 6500 line markers.

Numeric keys 1 to 5 may be used to assign a line marker to a sweeper marker. These keys have a toggling action; the current assignments are shown as Off or On.

Numeric keys 6 and 7 may be used to switch all five line markers on or off together.

Option 8 toggles the Marker Δ display on or off. This shows the difference in amplitude between the measurement at the reference marker frequency and at the 6500 brightline frequency. Marker Δ information is updated at the same time as the other brightline related information - at the end of each measurement sweep and when the brightline is moved.

Option 9 performs the same function as option 8, but additionally displays the absolute value of the frequency difference between the reference marker and the brightline, in place of the usual brightline frequency. This is indicated by a Δ character displayed as part of the 6500's frequency axis annotation.

The Marker Δ display is switched on only when the sweeper is in a swept frequency mode (not CW or power sweep), and when the Reference Marker is displayed as a line marker.

The Marker Δ field is blanked if it is not possible to compute a valid amplitude difference value. The most likely reason for this is that the reference marker frequency lies outside the current F1–F2 frequency range.

Assigning the reference marker frequency using the 6500 brightline

The 6500's [MARKER] key sets the sweeper reference marker frequency from the 6500's current brightline frequency. This may be used to position a marker at a feature of interest on the new trace. At the same time as the reference marker is assigned the new frequency, the corresponding 6500 line marker is switched on. (This action is performed automatically, so that it is not necessary to select the marker menu – see above).

Brightline skip

The [ΔF] key on the 6500 has been re-assigned to provide a brightline skip facility.

When [ΔF] is pressed, the brightline skips to the first line marker it encounters at a frequency higher than its present position. If the brightline reaches the end of the sweep (F2) without finding a line marker, the search is resumed starting at the beginning of the sweep, (F1). A message is displayed at the lower right of the 6500 graticule area to identify the destination marker. For example,

BL -> B

means that the brightline has skipped to marker B.

Instrument settings stores

The [STO] and [RCL] keys on 6500 are disabled when the instrument is used with the sweeper. Instead, 6500 settings are stored in the sweeper at the same time that sweeper STORE and RECALL operations take place.

This provides two advantages. The number of stores available for holding 6500 instrument settings increases from 9 to 20, and the storage is non–volatile.

STORE and RECALL operations are transparent as far as the 6500 operator is concerned. When a STORE operation is initiated in the sweeper, a "snapshot" of the current settings of the 6500 is transferredvia the private GPIB and stored together with the sweeper settings. The 6500 settings are transmitted back to the 6500 and are activated when the sweeper memory is recalled.

If the sweeper power–on condition is specified to be one of the memories (see under MEMORY FACILITIES, Chapter 3–1) the 6500 settings in that memory will also be recalled following power–on.

Note ...

When the 6500 is displaying a menu or other sweeper generated prompt, it is not possible for technical reasons to carry out a store or recall operation. The store or recall operation is held "pending" until you exit from the menu displayed on the 6500 screen. In most cses this is done by pressing the 6500's [NORMAL] key. As a reminder that there is a store or recall operation pending, a message is displayed on the top line of the 6500 display:

STO/RCL Pending – Select Exit

Alternate sweep with the 6500

The alternate sweep facility provides a means of switching between two complete analyzer and sweeper instrument settings with one key press. Refer to "Alternate sweep selection" in Chapter 3-1.

When the **altern** parameter is toggled from **off** to **man** a "snapshot" of the 6500 settings is taken - these are the current settings.

The **ALT_MEM** parameter specifies which of the twenty 6313/6500 settings memories will be used for alternate sweep.

The **man_alt** parameter toggles between the 6313/6500 current settings and those in the specified memory.

Notes ...

The analyzer **current** settings are updated only when the **altern** parameter undergoes a transition from **off** to **man**. You must remember to switch **altern** to **off** and then to **man** again if you change any parameter (such as DATUM, RANGE etc.) on the 6500. If you do not do this, the new 6500 settings will be overwritten by the "old" **current** settings the next time **man_alt** toggles from **memory** to **current.**

It is not possible to engage **auto** alternate sweep with a 6500. The **altern** parameter will not toggle to **auto** when an analyzer is present on the private bus.

Alternate sweep worked example

Here is a simple example to demonstrate the alternate sweep operation.

(1) Select the **ALT** configuration on the sweeper and ensure that the **altern** parameter is set to **off** and the **man_alt** parameter is set to **current.**

(2) Select channel A on the 6500 and set a DATUM level of 3.0 dBm. Store settings to Memory 3 using the sweeper's memory facility.

(3) Set a new datum of 10 dBm on the 6500. In this way we have made a change to distinguish the analyzer operation from that stored in Memory 3.

(4) Select the ALT configuration on the sweeper and set the **ALT_MEM** parameter to 3. This means that the system will alternate between the current settings and those in Memory 3.

Toggle the **altern** parameter from **off** to **man.** This causes the the 6500 current settings to be acquired.

Now use the **man_alt** key to alternate between the **current** settings and those in Memory 3.

Although, in this simple example, the only difference between the current and memory settings is the 6500 DATUM value, the principle of operation is demonstrated.

ZERO

During 6500 detector zero RF power is switched off automatically.

STORE and SUB MEM keys

Whenever a trace is stored to one of the analyzer memories, a copy is transferred to the sweeper. If a SUB MEM operation is initiated on 6500, the sweeper transfers the appropriate memory data back to 6500 after performing any necessary interpolation if the swept frequency range has changed. Warning messages are displayed on the sweeper LCD if it is not possible to interpolate the stored calibration data because either the sweeper operating mode has changed or the current sweep range encompasses frequencies for which no data was stored.

Changing 6500 sweep speed

A change to the 6500 sweep time causes the sweeper TIME parameter to be updated. Despite the fact that the sweeper operates in external sweep mode with 6500, the TIME parameter value is set to the 6500 nominal sweep speed to ensure that speed dependent error correction performed by the sweeper is properly applied.

PLOT key

If a digital plotter is not connected, the 6500 displays the conventional analog X-Y recorder menu (see 6500 Operating Manual). If, however, a digital plotter (address 5) is connected to the private GPIB, any previous plot title is displayed, followed by the Plotter Menu. For example:

Filter AB123 27/5/89

Plotter Menu

0 - Plot All
1 - Plot Graticule
2 - Label Graticule
3 - Plot Trace Only

4 - Edit Title

5 - Abort Plot

6 - Enable/disable DATE

NORMAL - Exit

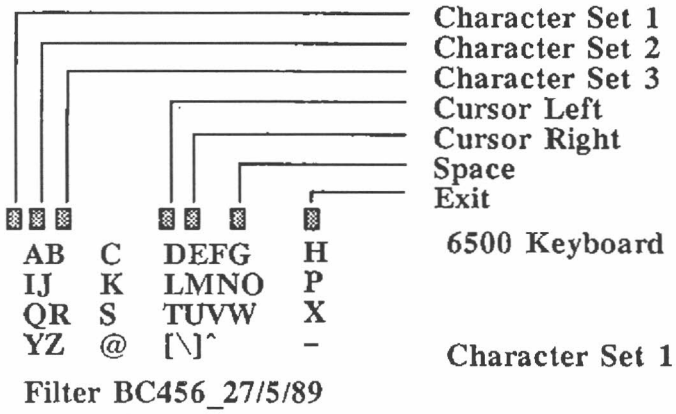
If menu items 0 to 3 are selected, the sweeper acquires the plotter command strings from 6500 and commences transmitting short HP-GL 'packets' to the plotter. Providing the plotter does not hold up the GPIB handshaking excessively, other bus commands may be interleaved between the HP-GL packets, allowing you to exit from the plot menu using the NORMAL key and make further measurements.

Menu option 5 causes any plot operation in progress to be aborted.

Plot title editor

A title of up to 33 characters may be added to a plot. Following selection of menu option 4, the 6500 keyboard is redefined. A pictorial representation of the new 6500 key assignments is displayed on the 6500 screen, together with the current plot title and the edit cursor (–).

The top row of 6500 keys provide the basic edit functions: defining the character set which applies to the other 32 keys and providing cursor control. In the example below, character set 1 is in use and the previously displayed title has been partially overwritten with the new title.



Filter BC456_27/5/89

Editor function keys

Character Set 1	Selects upper case alphabetic characters.
Character Set 2	Selects lower case alphabetic characters.
Character Set 3	Selects numeric and symbol characters.
Cursor Left	Moves cursor non-destructively one space left.
Cursor Right	Moves cursor non-destructively one space right.
Space	Inserts space character at cursor position and moves cursor one space right.
Exit	Returns to the plotter menu.

It should be noted that the characters plotted are a function of the plotter, not the sweeper or amplitude analyzer, and may therefore differ slightly from those displayed on the 6500 screen.

The plot title is held in non-volatile memory.

Enabling/disabling DATE plotting

Menu option 6 gives rise to another menu as shown below :

DATE Plotting Enabled

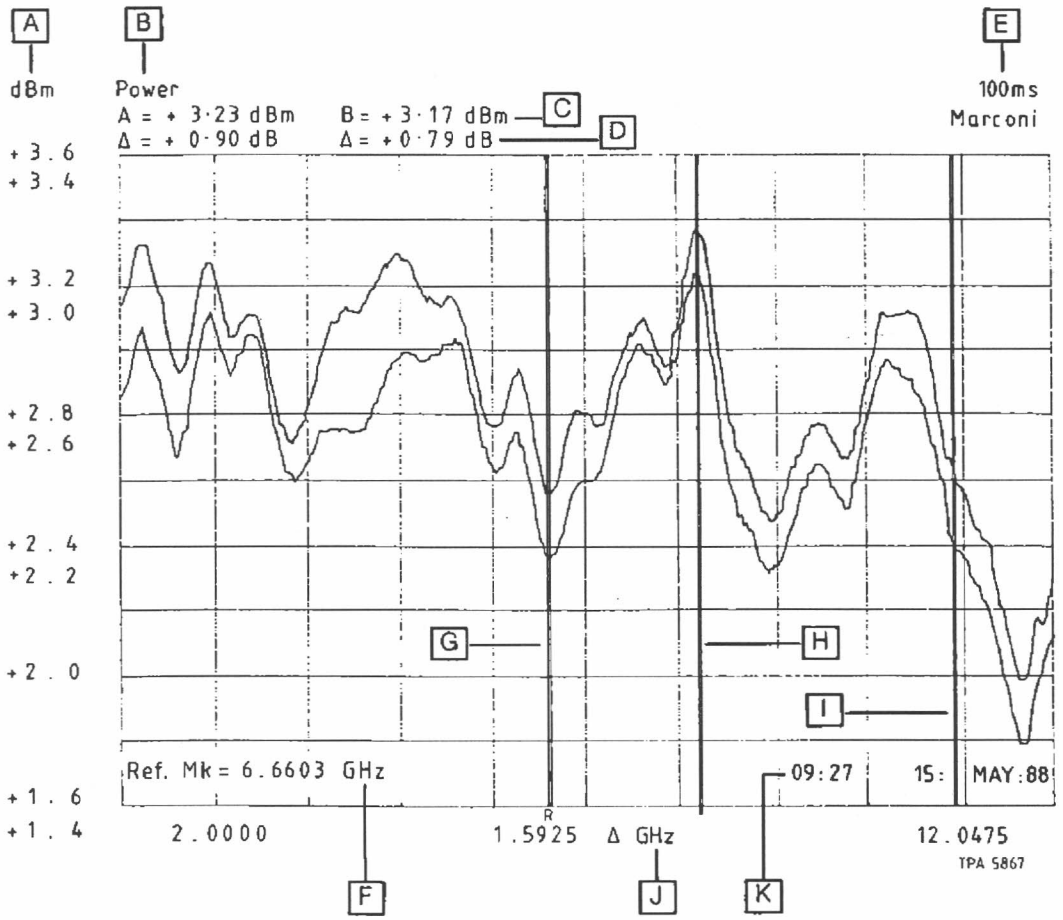
0 – Disable DATE plotting
1 – Enable DATE plotting

NORMAL – Exit

The first line of text is a message showing the current status of DATE plotting. It will either be 'Enabled' or 'Disabled'. It will default to 'Enabled' when the instrument is switched on. The state can be toggled using the '0' or '1' options, and will remain as set until the instrument is switched off.

Presentation of brightline and marker information on 6500 plots

Fig. 3-9 below illustrates the presentation of brightline and marker information on a digital plot of channels A and B. The plot shown is half the actual size. Option 9 (Marker Δ with ΔF) has been selected from the marker control menu, and the reference marker and one other marker are switched on.



- A =Power scaling
- B =Current measurement
- C =Brightline power
- D =Difference in power between brightline and reference marker
- E =Sweep time
- F =Reference marker frequency
- G =Reference marker (identified by "R" at the bottom of the graticule)
- H =Brightline (extends below graticule)
- I =Marker
- J =Difference in frequency between brightline and reference marker
- K =Time and date – use [DATE] key. See "Clock/calendar selection" in Chapter 3-1. May be disabled from Plotter menu.

Fig. 3-9 6500 plot of channels A and B showing presentation of brightline and marker information

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Chapter 3-5

CALIBRATION

INTRODUCTION

The sweeper may be calibrated by the user to match non-standard test conditions (e.g. high ambient temperature) using Marconi Instruments' 2442 26.5 GHz Microwave Counter and 6960A or 6960 RF Power Meter with a 6913 (10 MHz to 26.5 GHz) Power Sensor. The calibration process is fully automatic and is controlled via the private GPIB.

CALIBRATION TYPES

There are two distinct types of calibration - standard and limited. For a standard calibration the sweeper is calibrated for frequency and power over its full operating range. Standard calibration data is held in any of three independent stores: Primary, User 1 and User 2. The limited calibration facility allows you to perform a **power** calibration over a limited frequency range. This makes it possible to calibrate the sweeper at the output of frequency selective devices such as filters and amplifiers. Limited calibration data is held in either of two independent stores: Limited 1 and Limited 2.

The Primary calibration data, created during factory calibration, is stored in EEPROM (Electrically Erasable Programmable Read Only Memory), and the User and Limited calibrations, which may be created by the operator, are stored in NOVRAM (NOn-Volatile Random Access Memory). The calibration currently in use is indicated by a symbol displayed in the status field.

- Primary calibration selected
- User 1 calibration selected
- User 2 calibration selected
- Limited 1 calibration selected
- Limited 2 calibration selected

Appropriate calibration data is applied for each type of automatic level control. For internal levelling, this is the power calibration data held in the selected calibration store. For external and power meter levelling, default data is applied which removes the compensation for the internal detector.

A flashing symbol indicates that the selected calibration store contains default data.

Provision is made to transfer calibration data from either User 1 or User 2 to the Primary calibration store. Limited calibration data cannot be transferred into the Primary store.

USER AND LIMITED CALIBRATION

In User calibration, frequency and power data is gathered across the complete system frequency range, as is done during Primary calibration.

For Limited calibration, the frequency calibration data from the currently selected store is retained, and the power calibration data is gathered over any defined frequency range greater than 500 MHz span.

(1) The power calibration process is quicker if performed over a narrower frequency span.

(2) The power output over the restricted range is flatter than it would be after Primary or User calibration, since the data points are closer together for Limited calibration.

(3) There is no need to perform a frequency calibration immediately before the Limited power calibration. Thus, assuming the frequency calibration is satisfactory, the user can calibrate the power level over a limited frequency range for a number of frequency selective devices without having to perform frequency calibration on each occasion.

The calibration process is controlled through a sequence of menus. This is illustrated in the Calibration flowchart, Fig. 3–10.

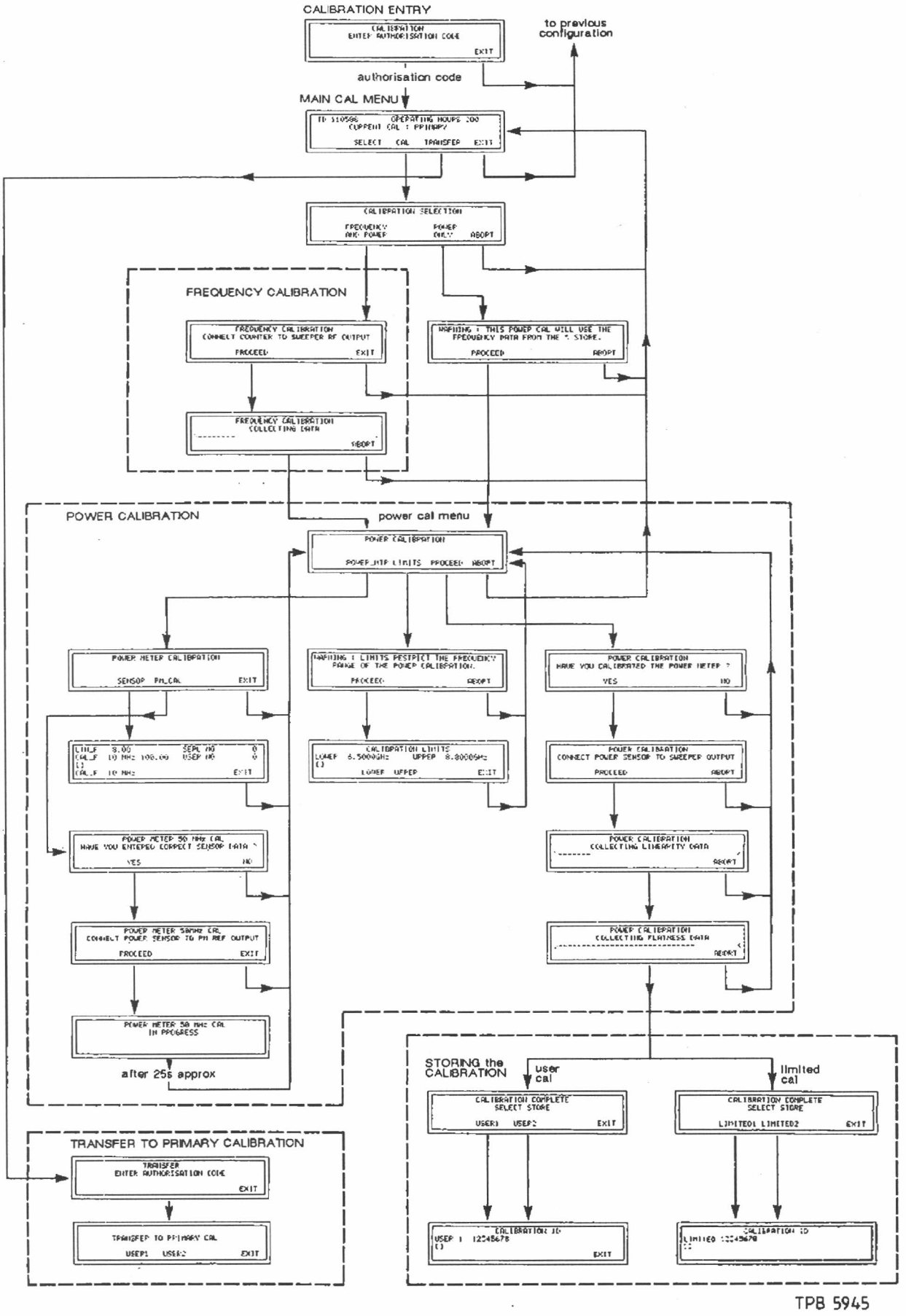


Fig. 3-10 Calibration flow chart

CALIBRATION INTEGRITY

There are three protection measures incorporated into the design to guard against unauthorized interference with the sweeper's calibration.

(i) An internal switch may be set to disable the front panel calibration function. To access the internal switch the sweeper's covers must be removed, and these may be sealed. During manufacture, the switch is preset to permit front panel calibration. Refer to the Service Manual for setting instructions.

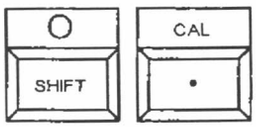
(ii) The operator must enter a six digit authorization code before a new calibration can be acquired or selected.

(iii) Transfer of data from either User 1 or User 2 calibration stores to the Primary calibration store is protected by a second six digit authorization code.

On the following pages the method of gathering frequency and power calibration data for the User and Limited calibrations is detailed together with the method for transferring of User calibration data into the Primary calibration store. Each group of menus is considered in turn. Refer to Fig. 3–10 to see how the various menus are related.

MENU DESCRIPTIONS

CALIBRATION ENTRY

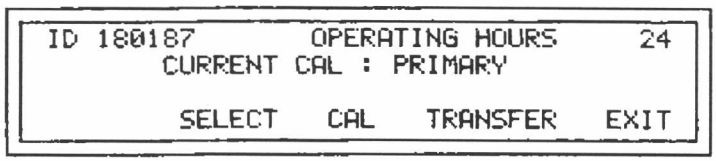


The correct sequence of six digits must be entered before access to the calibration main menu is permitted. The digits are not displayed as they are entered.

EXIT Exits from the calibration facility.

MAIN CAL MENU

When the authorization code has been entered correctly, the display is as shown below.



ID — Optional identification number. This may be used to show the date of calibration.

OPERATING HOURS — Operating hours since calibration data was stored.

CURRENT CAL — Identifies the calibration currently in use. If corruption of the calibration data is detected, the appropriate store will be overwritten with default data and this will be indicated by the label DEFAULT adjacent to the current calibration label.

Soft key assignments

SELECT — Selects and applies calibration data from Primary, User 1, User 2, Limited 1 or Limited 2 calibration stores. During subsequent operation, the selected calibration is displayed in the status field.

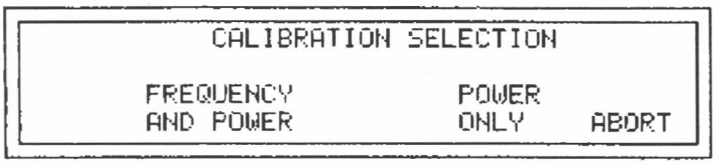
CAL — Initiates acquisition of calibration data.

TRANSFER — Transfers calibration data from User 1 or User 2 to the Primary calibration store. The Primary calibration is protected by a second authorization code.

EXIT — Exits from the calibration facility.

To initiate the acquisition of new calibration data, press **CAL**. The private GPIB is then initialized as though the **init** softkey had been pressed. There will therefore be a short delay before the CALIBRATION SELECTION menu is presented. The duration of the delay depends upon the devices connected to the private GPIB. This is to ensure that any devices connected to the private GPIB since the sweeper was powered up are initialized.

CALIBRATION SELECTION

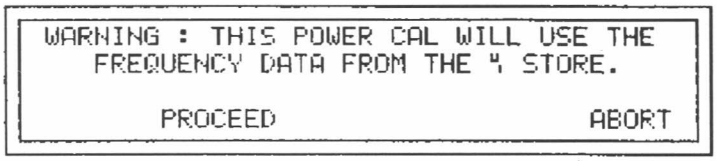


FREQUENCY AND POWER Selects calibration of both frequency and power.

POWER Selects calibration of power only.

When **FREQUENCY AND POWER** is selected, the FREQUENCY CALIBRATION menu is presented first (see next section).

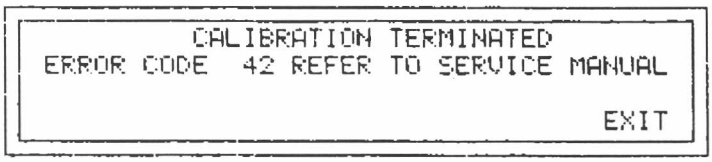
If **POWER ONLY** is selected the warning display appears as shown below, indicating which calibration store will provide the frequency calibration data for the power calibration:



PROCEED Calls up the POWER CALIBRATION menu.

ABORT Returns to the CALIBRATION SELECTION menu.

If the incorrect devices or no devices at all are present on the GPIB then the following error screen will be displayed:

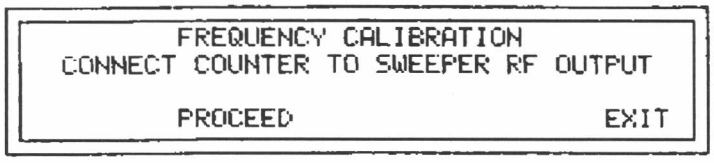


EXIT Returns to the calibration main menu.

If this error occurs the private GPIB connections should be checked. If these are satisfactory the addresses of the devices should be inspected to ensure they are those expected by the sweeper. (See section on private GPIB status, Chap. 3-3.)

FREQUENCY CALIBRATION

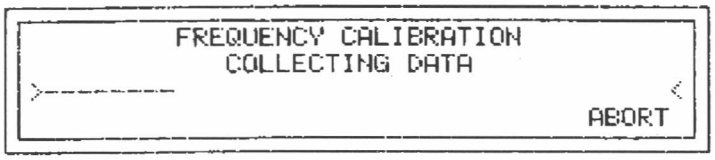
The sweeper presents the following frequency calibration menu.



PROCEED Starts frequency calibration data acquisition.

EXIT Returns to the calibration main menu without acquiring any calibration data.

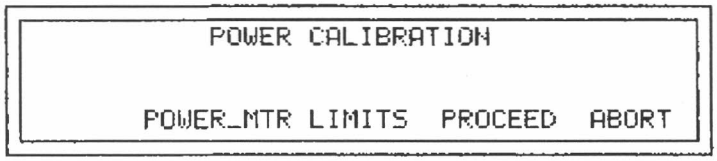
During calibration the display is as below. The progress of the calibration is indicated by the series of dashes which progressively fills row 3 of the display.



ABORT Aborts calibration and returns to the calibration main menu.

POWER CALIBRATION – Power calibration menu

Following successful acquisition of the frequency calibration data, or if POWER ONLY and then PROCEED has been selected, the sweeper presents the POWER CALIBRATION menu.



POWER_MTR Initiates calibration of power meter.

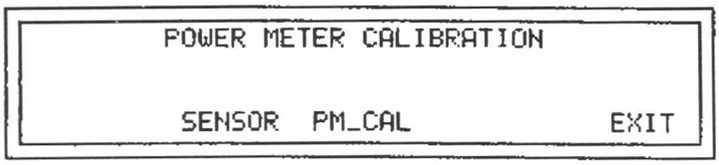
LIMITS Allows entry of frequency limits for power calibration.

PROCEED Commences acquisition of power calibration data. Only to be pressed after the SENSOR and PM_CAL routines are completed.

ABORT Aborts calibration and returns to the calibration main menu.

Detailed descriptions of the POWER_MTR, LIMITS and PROCEED options follow.

POWER_MTR – Power meter calibration

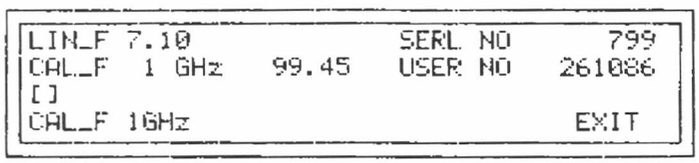


SENSOR	Allows entry of power sensor data into non–volatile store.
PM_CAL	Initiates power meter calibration.
EXIT	Returns to POWER CALIBRATION menu.

Detailed descriptions of the SENSOR and PM_CAL options follows.

SENSOR – Enter or modify sensor data

Before starting power calibration, it is important to ensure that the sweeper has been programmed with calibration information for the particular power sensor in use. The linearity factor and calibration factor data table should be entered from the calibration certificate supplied with the sensor. This information is stored within the sweeper's non–volatile memory.



The sensor data editor allows the following data to be entered.

LIN_F	Linearity factor. (Range 0.10 – 14.99)
CAL_F	Calibration factor. This is stored at 10, 30, 50, 100, 300 and 500 MHz and then at 1 GHz intervals between 1 and 20 GHz and 0.5 GHz intervals between 20 and 26.5 GHz. (Range 70.00 – 100.00).
SERL NO	Sensor serial number. This may be entered to remind you to which sensor the linearity and cal. factor data applies. (Range 0 – 999999).
USER NO	An optional reference number which can be employed, for example, to show the power sensor calibration date. (Range 0 – 999999).

Editing power sensor data

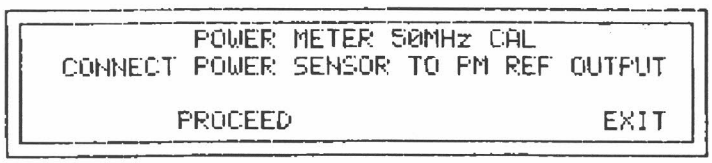
The rotary control or step keys are used to select a parameter for numeric entry. The current selection is displayed on row 4 of the LCD directly above the step keys. Numeric entry should be terminated using the [kHz/int] units key.

PM_CAL – Power meter 50 MHz calibration

Following selection, the sweeper displays a message reminding you to check that the power sensor data is correct.

NO Returns to the power calibration menu.

YES Allows power meter 50 MHz calibration to proceed.



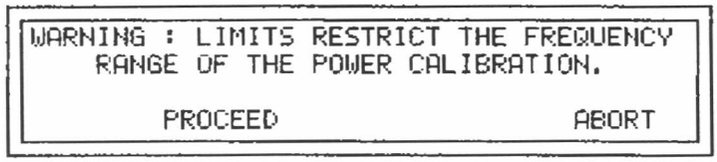
EXIT Aborts power meter calibration and returns to the sweeper power calibration menu.

PROCEED Initiates power meter 50 MHz calibration.

On completion of the power meter calibration the main POWER CALIBRATION menu is again presented.

LIMITS – Entry of frequency limits for power calibration

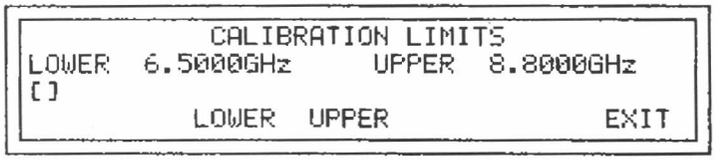
On selection of LIMITS in the POWER CALIBRATION menu, the following display appears to indicate that the use of limits restricts the valid frequency range of the power calibration:



PROCEED Calls up the LIMITS menu

ABORT Returns to the main POWER CALIBRATION menu

The LIMITS menu is of the form:



LOWER Allows entry of lower frequency limit.

UPPER Allows entry of upper frequency limit.

EXIT Returns to main power calibration menu.

Upper and lower frequency limits may be of any value within the range 10 MHz to 26.6 GHz provided the span is greater than or equal to 500 MHz.

Note ...

For a standard user calibration over the full frequency range of the sweeper, the lower limit must be 10 MHz and the upper limit 26.6 GHz, otherwise a limited calibration will be performed.

PROCEED – Start power calibration

Approximately 25 s after initiating the power meter 50 MHz calibration, the power calibration menu is again displayed.

```
POWER CALIBRATION

POWER_MTR LIMITS  PROCEED  ABORT
```

PROCEED Displays warning message.

```
POWER CALIBRATION
HAVE YOU CALIBRATED THE POWER METER ?

YES                              NO
```

YES Starts calibration process. **NO** Returns to the power calibration menu.

```
POWER CALIBRATION
CONNECT POWER SENSOR TO SWEEPER OUTPUT

PROCEED                          ABORT
```

PROCEED The sweeper begins acquiring linearity data (see first display below) and then flatness data (see second display below). For a User calibration, the progress of the power calibration process is indicated by the series of dashes progressively filling row 3 of the display. This does not occur for a Limited calibration, when power calibration data is acquired over a restricted frequency range only.

```
POWER CALIBRATION
COLLECTING LINEARITY DATA
>-------                          <
                                 ABORT
```

```
POWER CALIBRATION
COLLECTING FLATNESS DATA
>-----------------------------   <
                                 ABORT
```

ABORT Returns to power calibration menu.

Note ...

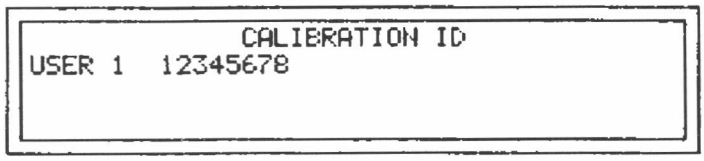
For a Limited calibration (power calibration over a limited frequency range), the calibration progress indication (the series of dashes) will not be present.

STORING THE CALIBRATION

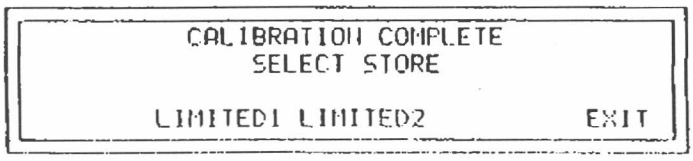
When calibration has been completed the data can be stored. Which screen is displayed will depend upon whether it is a user calibration in progress or a limited calibration. For a user calibration the screen will be:

USER1 (USER2) Assigns the newly acquired calibration data to the USER1 (USER2) store.

When the new calibration has been assigned to either User1 or User2 the sweeper prompts for an identification number of up to 8 digits.

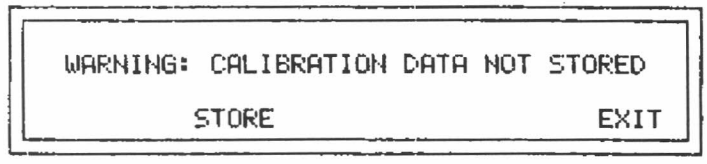


For a limited calibration the screen will be:



LIMITED1 (LIMITED2) Assignes the newly acquired calibration data to LIMITED1 (LIMITED2) store.

EXIT Returns to the calibration main menu. Note that if the calibration data has not been stored, a warning is displayed. If EXIT is selected a second time, the new calibration is lost.

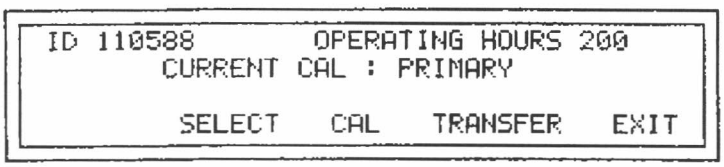


TRANSFER TO PRIMARY CALIBRATION

The calibration data in the user stores can be transferred to the primary calibration store.

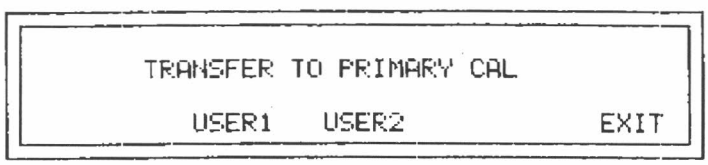
CAUTION

The transfer function overwrites the primary calibration. Access to this facility should be restricted to authorized personnel.



TRANSFER Selects transfer facility.

Transfer to the primary calibration store is protected by a second six digit authorization code.



If the authorization code is entered correctly, the display is as shown above.

USER1 Transfers from USER1 to the primary calibration.

USER2 Transfers from USER2 to the primary calibration.

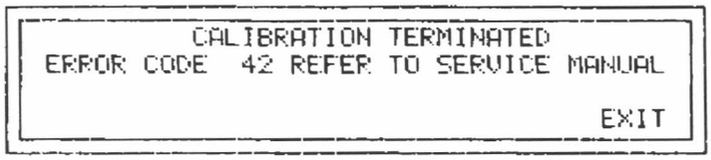
EXIT Returns to the calibration main menu.

Note ...

Limited calibrations cannot be transferred into the Primary calibration store.

ERROR CONDITIONS

If an error condition arises during calibration, an error screen is displayed similar to the one shown below. An error condition encountered during calibration in general indicates a problem with the sweeper hardware. The one exception is error 42 which indicates GPIB instrumentation failure. If this error occurs the private GPIB connections should be checked. If these appear satisfactory the addresses of the devices on the private GPIB should be checked to ensure they are those expected by the sweeper. Refer to the section on private GPIB status in Chap. 3-3. All other fault conditions are described in the Service Manual.



EXIT Returns to the calibration main menu.

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Appendix A
SWEEPER PARAMETERS

FORMAT

The sweeper is controlled by the parameters listed in the following tables. The format for presenting the parameter tables is as follows:

The parameter tables are divided into groups containing a number of related parameters. The groups correspond to those used in the programmable key programmer (see Chap. 3–2, Table 3–2).

For each numeric parameter its minimum and maximum permitted values are given. Note that the allowed range of a parameter may be greater than its specified range as given in the Performance Data section of Chap. 1. For non–numeric parameters each state is given.

Some parameters may not be assigned to soft keys. These 'display only' parameters are indicated by a [D]. Similarly, a few parameters designated 'soft key only' are indicated by an [S].

TABLE A–1 FREQUENCY PARAMETERS

Name	Description	Minimum	Maximum	
F1	Start frequency	2 MHz	26.6 GHz	
F2	Stop frequency	2 MHz	26.6 GHz	
CF	Centre frequency	2 MHz	26.6 GHz	
ΔF	Frequency span	0	26.598 GHz	
A	Marker A	2 MHz	26.6 GHz	
B	Marker B	2 MHz	26.6 GHz	
C	Marker C	2 MHz	26.6 GHz	
D	Marker D	2 MHz	26.6 GHz	
E	Marker E	2 MHz	26.6 GHz	
MK_FREQ	Ref. marker frequency	2 MHz	26.6 GHz	
Δ	Marker sweep width	0	26.598 GHz	[D]
FΔ	Frequency increment	500 kHz	10.0 GHz	
AM_FREQ	AM frequency	1 kHz	100 kHz	

The reference marker frequency, MK_FREQ, is equal to the value of that marker (A to E) which is designated 'reference'. In the standard marker configurations A to E are manipulated indirectly. It is permissible to change the frequencies of markers directly if required.

TABLE A-2 POWER (dBm) PARAMETERS

Name	Description	Minimum	Maximum
P1	Power level	-15.0 dBm	+20.0 dBm
P2	Stop power	-15.0 dBm	+20.0 dBm
PΔ (dB)	Power step	0.0 dB	5.0 dB
SLP	Power slope	0.0 dB/GHz	+20.0 dB/GHz

TABLE A-3 POWER (mW) PARAMETERS

Name	Description	Minimum	Maximum
P1	Power level	.0316 mW	100 mW
P2	Stop power	.0316 mW	100 mW
PΔ (mW)	Power step	0.1 mW	20 mW

Although the units are different, P1 (dBm) and P2 (dBm) always have the same power values as P1 (mW) and P2 (mW).

TABLE A-4 TIME PARAMETERS

Name	Description	Minimum	Maximum
TIME	Forward sweep time	10 ms	33.5 s
TΔ	Time step	1 ms	10 s

TABLE A-5 INTEGER PARAMETERS

Name	Description	Minimum	Maximum	
H	Clock hours	0	23	
M	Clock minutes	0	59	
S	Clock seconds	0	59	
DY	Calendar day	1	31	
MN	Calendar month	1	12	
YR	Calendar year	1988	2030	
OP_HRS	Total Instrument operating hours	0	99999	[D]
USR_HRS	User settable operating hours	0	99999	
CONTRST	LCD contrast	1	20	
INTΔ	Integer step	1	10	
S_ADDR	System GPIB address	0	30	
P_ADDR	Private GPIB address	0	30	
DS_NPOS	Number of (digital) sweep positions	1	4096	[D]
ALT_MEM	Alternate sweep memory	0	20	
RATE	Rotary control rate	0	1000	[D]
LAST_KEY	No. of last key pressed	0	65	[D]
mks_on	Marker on/off status	-----	ABCDE	[D]
6500_mks	6500 line marker status	-----	ABCDE	[D]

TABLE A-6 DIAGNOSTIC PARAMETERS

Name	Description	Minimum	Maximum
RAMP	0 - 10 V ramp position	0	4095
OFFSET	OFFSET DAC	0	65535
LEVEL	Level DAC	0	65535
SCALE	Scale DAC	0	65535
VERN	Vernier DAC	0	4095
BAND	Frequency band	0	4
CONTROL		0	65535
CNTRL_A		0	255
CNTRL_B		0	255
PROG		0	15

Diagnostic parameters are used during calibration and service. Refer to Service Manual.

TABLE A-7 NON-NUMERIC PARAMETERS

Name	Description	States	
cntr_tr	Counter trigger	off, f1, f2, mk	
filter	CW filter	off, on	
swp_tr	Sweep trigger	int, ext, line, single	
alc	Automatic level control	int, ext+, ext-, mtr	
sweep	Sweep select	int, ext	
am	Amplitude modulation	off, on	
blank	Retrace blanking	off, retrace	
mk_on	Marker on/off	on/off	[S]
analysr[8]	6500 on/off indicator	off, on	[D]
pwr_mtr[9]	6960 on/off indicator	off, on	[D]
counter[6]	2440 on/off indicator	roff, on	[D]
plotter[5]	Plotter on/off indicator	off, on	[D]
mk_swp	Marker sweep	off, on	
altern	Alternate sweep select	off, man, auto	
man_alt	Alt. sweep indicator	current, memory	
vernier	Vernier select	off, on	
mk_ref	Reference marker	A,B,C,D,E	
mk_stp	Stop marker	A,B,C,D,E	
on/off	All markers on/off		[S]
mkr_Δ	line marker Δ select	off, on, on[ΔF]	
d_swp	Digital sweep	off, on	
ds_dir	Digital sweep step direction	up,down	[D]
rf_on	RF during parameter change	normal, always	
s_swp	Initiate single sweep	ready, sweeping, inactive	

TABLE A-8 NON-NUMERIC 'ACTION' PARAMETERS

Name	Description	
init	Initiate private GPIB	[S]
cf=ref	Assign CF from reference marker	[S]
transfr	Make the current marker sweep permanent	[S]
skip	6500 brightline skip to next line marker	[S]

Action parameters have no states. When a soft key assigned to one is pressed the appropriate action is initiated immediately.

Appendix B

SWEEPER MEMORY FACILITIES

Table B-1 PARAMETERS HELD IN NON-VOLATILE MEMORY AFTER STORE OPERATION

Parameter	Description	Parameter	Description
F1	Start frequency	P1 (dBm)	Power level
F2	Stop frequency	P2 (dBm)	Stop power
CF	Centre frequency	PΔ (dB)	Power step
ΔF	Frequency span	SLP	Power slope
A	Marker A		
B	Marker B	P1 (mW)	Power level
C	Marker C	P2 (mW)	Stop power
D	Marker D	PΔ (mW)	Power step
E	Marker E		
MK_FREQ	Ref. marker frequency	TIME	Forward sweep time
Δ	Marker sweep width	TΔ	Time step
FΔ	Frequency increment		
AM_FREQ	AM frequency		
INTΔ	Integer step		
mks_on	Marker on/off status		

Parameter	Description
6500_mks	6500 line marker on/off status
* DS_NPOS	Number of (digital) sweep positions
cntr_tr	Counter trigger
filter	CW filter
swp_tr	Sweep trigger
alc	Automatic level control
sweep	Sweep select
am	Amplitude modulation
blank	Retrace blanking
vernier	Vernier select
mk_ref	Reference marker
mk_stp	Stop marker
mk_Δ	Line marker Δ select
* d_sweep	Digital sweep
*ds_dir	Digital sweep step direction
s_swp	Initiate single sweep

* At power-on, these parameters are set to their default values, but thereafter may be stored in one of the sweeper's memories.

TABLE B-2 PARAMETERS NOT AFFECTED BY MEMORY RECALL OPERATIONS

Parameter	Description
H	Clock hours
M	Clock minutes
S	Clock seconds
DY	Calendar day
MTH	Calendar month
YR	Calendar year
OP_HRS	Total instrument operating hours
USR_HRS	User settable operating hours
CONTRST	LCD contrast
S_ADDR	System GPIB address
P_ADDR	Private GPIB address
RATE	Rotary control rate
LAST_KEY	No. of last key pressed
analysr[8]	6500 on/off indicator
pwr mtr[9]	6960 on/off indicator
counter[6]	2440 on/off indicator
plotter[5]	Plotter on/off indicator
init	Initiate private GPIB
mk_on	Reference marker on/off
on/off	All markers on/off
cf=ref	Assign CF from reference marker
transfr	Make current marker sweep permanent
skip	6500 brightline skip to next line marker

TABLE B-3 PARAMETERS WHICH ARE SET TO A DEFAULT VALUE WHENEVER A MEMORY RECALL OPERATION OCCURS

Parameter	Default value
ALT_MEM	0 (current)
RAMP	0
OFFSET	0
LEVEL	0
SCALE	0
VERN	0
BAND	0
CONTROL	0
CONTRL_A	0
CONTRL_B	0
PROG	0
mk_swp	off
altern	off
man_alt	current

TABLE B-4 DEFAULT SETTINGS OF THE 6313 CONTAINED IN THE PRESET MEMORY

Parameter	Value	Unit
F1	10.0	MHz
F2	26.5	GHz
CF	13.255	GHz
ΔF	26.49	GHz
A	13.255	GHz
B	13.255	GHz
C	13.255	GHz
D	13.255	GHz
E	13.255	GHz
MK_FREQ	13.255	GHz
Δ	0	GHz
FΔ	500	MHz
AM_FREQ	1.0	kHz
P1 (dBm)	0	dBm
P2 (dBm)	0	dBm
PΔ	1.0	dB
SLP	0	dB/GHz
P1 (mW)	1.0	mW
P2 (mW)	1.0	mW
PΔ	1.0	mW
TIME	100	ms
TΔ	10	ms
INTΔ	1	
ALT_MEM	0	(current)
mks_on	-----	(all markers off)
6500_mks	-----	(all line markers off)
DS_NPOS	401	

TABLE B-4 DEFAULT SETTINGS OF THE 6313 CONTAINED IN THE PRESET MEMORY (contd.)

Diagnostic parameter	Value	Non-numeric parameter	State
RAMP	0	cntr_tr	off
OFFSET	0	filter	on
LEVEL	0	swp_tr	int
SCALE	0	alc	int
VERN	0	sweep	int
BAND	0	am	off
CONTROL	0	blank	retrace
CNTRL A	0	mk_swp	off
CNTRL B	0	altern	off
		vernier	off
		mk_ref	A
		mk_stp	B
		mkr_Δ	off
		s_swp	inactive

Notes.

(1) The PRESET configuration is [F1-F2].
(2) When the PRESET MEMORY is recalled, RF power is switched OFF.

Appendix C
COUNTER INTERFACE

USE OF COUNTER

A frequency counter such as the Marconi Instruments 2442 26.5 GHz Microwave Counter may be used with the sweeper operating in a swept frequency mode.

The **cntr_tr** non-numeric parameter (see Chap. 3-1, Sweep/Trigger selection) specifies the point at which the sweep will be halted temporarily for a frequency measurement to be made. This may be at F1, F2 or the reference marker frequency.

At the appropriate point in the sweep, the sweeper asserts the signal CTR TRIG L on pin 14 of the rear panel AUXILIARY FUNCTIONS connector. The forward sweep is halted for up to 40 µs, during which time the counter must respond by asserting STOP FWD SWP L (pin 1 of the AUXILIARY FUNCTIONS connector) to halt the forward sweep for as long as is necessary for the counter to perform a frequency measurement.

It should be noted that if a frequency reading is taken at the reference marker and the reference marker is on, then the RF output at the marker frequency dips appreciably and the counter may have difficulty in acquiring a reading. It is therefore advisable to ensure that the reference marker is switched off during frequency measurements.

Internal amplitude modulation is disabled automatically while the counter is making a frequency measurement.

Marconi 20 GHz Microwave Counter 2442

Connect instruments as shown in Fig. C-1.

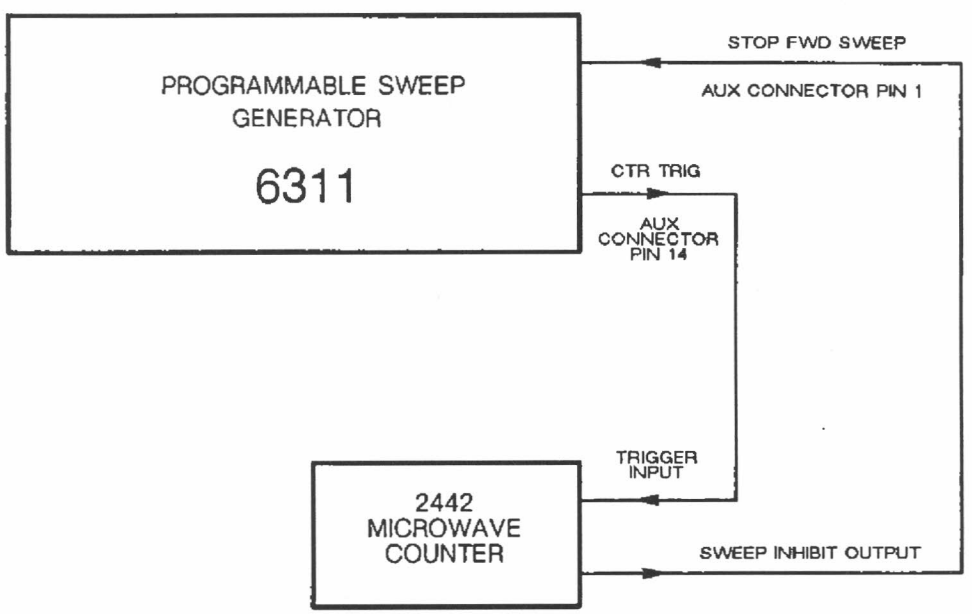

Fig. C-1 Connections to Marconi 2442 Counter

Set the 2442 to Test Mode B – External trigger mode by pressing its RESET key followed by the channel C selector button. The 2442 displays **trig on** momentarily. Measurements are triggered by the negative-going CTR TRIG pulse from the sweeper. The external trigger mode may be switched off by repeating the above procedure.

Hewlett Packard 5343A Microwave Frequency Counter

Connect instruments as shown in Fig. C–2.

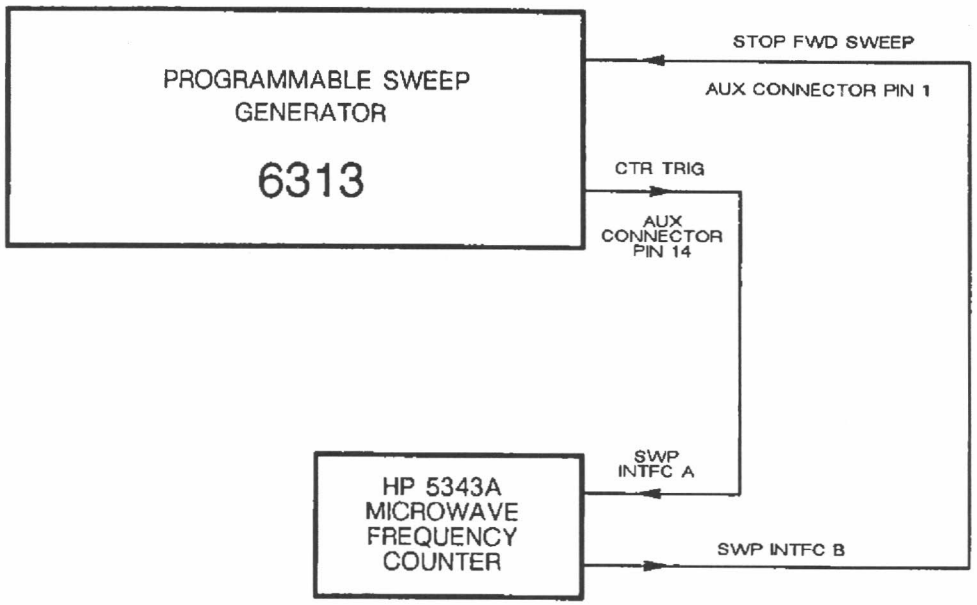

Fig. C–2 Connections to HP 5343A Counter

Set HP 5343A to AUTO, SWP M and set the desired frequency resolution. Set the ACQ TIME switch on the rear panel of the counter to MED.

Appendix D
SELF TEST

MEMORY TEST

At power-on or in response to selection of the TEST 0 key, the sweeper performs a memory test to ensure the integrity of the data stored in the non volatile memories. If all is well, the LCD displays the following message momentarily.

```
*** MEMORY TEST ***
[-----------------------------------]
NO FAULTS DETECTED
```

If the sweeper discovers that parts of the memory have been corrupted, a permanent message is displayed as shown below.

```
*** MEMORY TEST ***
[A-----GHI-------QR-----------def------]
  FAULT(S) DETECTED : REFER TO MANUAL
PRESS ANY CONFIGURATION KEY TO CONTINUE
```

The sweeper's non-volatile memory is divided into a number of independent sections which, for convenience, are labelled with the alphabetic characters A to Z and a to k. The display shows which sections have been corrupted. In the above example faults have been discovered in sections A,G,H,I,Q,R,d,e and f.

If a section of non-volatile memory is found to contain bad data, the sweeper attempts recovery action by overwriting the affected memory with suitable default data. This process is initiated when you press a configuration key such as [F1–F2].

Table D–1 lists the memory sections and the default data employed for recovery. It should be noted that the design of the sweeper's non-volatile memories incorporates a number of measures to ensure integrity of the stored data. Persistent memory test failures should therefore be regarded as indicating a hardware fault which should be referred to your nearest Marconi Instruments service centre.

TABLE D-1 MEMORY SECTIONS AND DEFAULT DATA

Section	Description	Default
A	Programmable key configurations	[F1-F2] configuration
B	User defined LCD characters	Block characters
C	OP_HRS, USER_HRS, cal. times and day, month, year	0 hours, 1 JAN 1988
D	GPIB addresses	System 19, Private 18
E	Sweeper power up state	PRESET
F	Memory 1	PRESET
G	Memory 2	PRESET
H	Memory 3	PRESET
I	Memory 4	PRESET
J	Memory 5	PRESET
K	Memory 6	PRESET
L	Memory 7	PRESET
M	Memory 8	PRESET
N	Memory 9	PRESET
O	Memory 10	PRESET
P	Memory 11	PRESET
Q	Memory 12	PRESET
R	Memory 13	PRESET
S	Memory 14	PRESET
T	Memory 15	PRESET
U	Memory 16	PRESET
V	Memory 17	PRESET
W	Memory 18	PRESET
X	Memory 19	PRESET
Y	Memory 20	PRESET
Z	Power down state	PRESET
a	6500 analyzer instrument settings	6500 Power on state
b	Primary Cal (CMOS RAM)	Primary cal EEPROM
c	User Cal 1	Primary cal EEPROM
d	User Cal 2	Primary cal EEPROM
e	6913 Sensor data	Default sensor data
f	Primary Cal (EEPROM)	Approximate cal data
g	Calibration ID numbers	0
h	Sweeper serial number	0
i	Yig lag correction constants	0
j	Limited Cal 1	Primary cal EEPROM
k	Limited Cal 2	Primary cal EEPROM

Appendix E

ERROR MESSAGES

ERROR 1 NUMERIC ENTRY OVERFLOW

Entered number exceeds 214783647 during front panel numeric entry. The parameter value remains unchanged.

ERROR 2 NO ROOM TO INSERT PARAMETER

When using the User Key Programmer display editor, this error occurs if an attempt is made to insert a parameter which would overwrite an existing parameter or overflow the edge of the LCD.

ERROR 3 MAXIMUM NUMBER OF PARAMETERS EXCEEDED

When using the User Key Programmer display editor, this error occurs if an attempt is made to insert more than eleven parameters on the LCD.

WARNING 4 POWER SUPPLY OVERHEATING

Ensure ventilation slots are clear of obstructions and that rear panel filter is clean. If warning persists, switch off and refer to service engineer.

ERROR 5 * LIMIT *

Indicates attempt to set value of parameter outside its specified limits. Parameter is set automatically to the nearest permitted value (i.e. its maximum or minimum value, as appropriate).

ERROR 6 EXTERNAL SWEEP CURRENTLY SELECTED

When external sweep is selected (e.g. for use with a 6500 Automatic Amplitude Analyzer) it is not possible to change the values of certain non-numeric parameters.

These are:

cntr_tr	(must be 'off')
swp_tr	(must be 'int')
altern	(must be 'off' or 'man')

ERROR 7 COUNTER TRIGGER CURRENTLY SELECTED

It is not permitted to select external sweep when counter trigger is enabled.

ERROR 8 INTERNAL TRIGGER NOT SELECTED

It is not permitted to select external sweep unless internal sweep triggering is enabled.

ERROR 9 ALTERNATE SWEEP CURRENTLY SELECTED

It is not permitted to select external sweep when the alternate sweep parameter, altern is set to 'auto'.

ERRORS 11 to 19 are related to GPIB operation. Refer to the GPIB Operating Manual.

ERROR 20 CANNOT OVERWRITE PRESET SETTINGS

It is not possible to write sweeper settings to the PRESET memory.

ERROR 21 CORRUPT DATA : PRESET SETTINGS RECALLED

Data stored in the sweeper's non-volatile memory has been corrupted. The sweeper attempts recovery action by over-writing the damaged memory with PRESET settings. If this error persists, refer to service engineer.

ERROR 22 CANNOT INTERPOLATE 6500 MEMORY

Interpolation of 6500 channel memory contents has failed for one or more of the following reasons.

i) The sweeper mode has changed

ii) Current F1 < Stored F1

iii) Current F2 > Stored F2

ERROR 23 MARKER SWEEP CURRENTLY SELECTED

It is not permitted to change a frequency parameter (F1, F2, CF, ΔF) while marker sweep is selected.

ERROR 24 LIMITED CAL CURRENTLY SELECTED

It is not permitted to recall a frequency parameter outside the current operating frequency range whilst limited calibration is selected.

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