Marconi
Instruments

2030 and 2031
AM/FM SIGNAL GENERATORS

Provisional
OPERATING MANUAL

This PROVISIONAL MANUAL is supplied to permit earliest possible delivery of your instrument. For this reason the contents are incomplete and may be subject to extensive revision. A reply paid card is included for you to claim your copy of the final manual.

M0WPS

Operating manual
H 52030-001C
Vol.1

PROVISIONAL

SIGNAL GENERATORS

2030 and 2031

10 kHz to 1.35 GHz 10 kHz to 2.7 GHz

Includes information on:
Option 001-second LF oscillator
Option 002-pulse modulation

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CONTENTS

PRELIMINARIES

CHAPTERS

These chapters are contained in a separate servicing manual.

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 following symbols appear on the equipment:

SYMBOL : TYPE OF HAZARD	REFERENCE IN MANUAL
⚠ Dangerous voltages	Page iii
⚠ Static sensitive component	Page iv
⚠ Beryllium	Page iv
Lithium batteries	Page iv

Note...

Each page bears the date of the original issue or the code number and date of the latest amendment (Am.1, Am.2 etc.) Any changes subsequent to the latest amendment state of the manual are included on inserted sheets coded C1, C2 etc.

NOTES AND CAUTIONS

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 to avoid risk of injury, observe the following **WARNING** notices.To avoid damage to the equipment, observe the **CAUTION** notices.

WARNING - ELECTRICAL HAZARDS

AC supply voltage. This equipment conforms with IEC Safety Class 1, which means that it is provide 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 - Primary and secondary. 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 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 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 disconnected before carring out work inside the equipment.

WARNING - OTHER HAZARDS

Parts of this equipment are made from metal pressing, 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.

Beryllia (beryllium oxide) is used in the construction of the following components in this equipment:

TR315 in Unit AB2, TR3 in Unit AB3/2(2031)

This material,if incorrectly handled, could cause a danger to health - refer to the service manual for safe handling precautions.

A **Lithium** battery is used in this equipment. This presents two hazards:

(1) As lithium is a toxic substance, the battery should in no circumstances be crushed, incinerated or disposed of in normal waste.

(2) If the battery is rapidly charged or discharged, there is a risk of explosion. Take care, therefore, to avoid short circuiting the battery.

CAUTION -LCD HANDLING

Take care not to depress the front or rear faces of the display module as this may damage the liquid crystal display elements. To clean the display, use a soft cloth moistened with ethyl alcohol or isopropyl alcohol. Do not use acetone, turpentine, thinners, paraffin or any abrasive material as these could damage the bonded polariser.

CAUTION -STATIC SENSITIVE COMPONENTS

This equipment contains static sensitive components which may be damaged by handling - refer to the service manual for handling precautions.

CAUTION - TILT FACILITY

When the instrument is in the tilt position, it is inadvisable for stability reasons, to stack other instruments on top of it.

CAUTION - INTEGRITY SEALS

If, during the warranty period of this product, an integrity seal is broken by removing the covers, for example, the warranty may be invalidated.

Similarly, if a module with a broken seal is returned on an exchange basis, it will not be acceptable under the terms and conditions of the exchange service.

Chapter 1

GENERAL INFORMATION

CONTENTS

INTRODUCTION

1. The 2030 and 2031 Signal Generators cover the frequency ranges 10 kHz to 1.35 GHz and 10 kHz to 2.7 GHz respectively. Dot matrix displays with soft key selected screen options allow flexibility of operation and ease of use. The output may be amplitude, phase, or frequency modulated with pulse modulation available as an option. Modulation is available using a combination of up to two external signal inputs and a built in LF source (a second internal source is optional).

2. Microprocessor control ensures that the instruments are flexible and easy to use and allows programming by the General Purpose Interface Bus (GPIB). The GPIB is designed to IEEE Standard 488.2 and is a means of sending commands to an instrument, via a data bus, from a remote controller or personal computer.The instruments can therefore be used manually or as part of a fully automated test system.

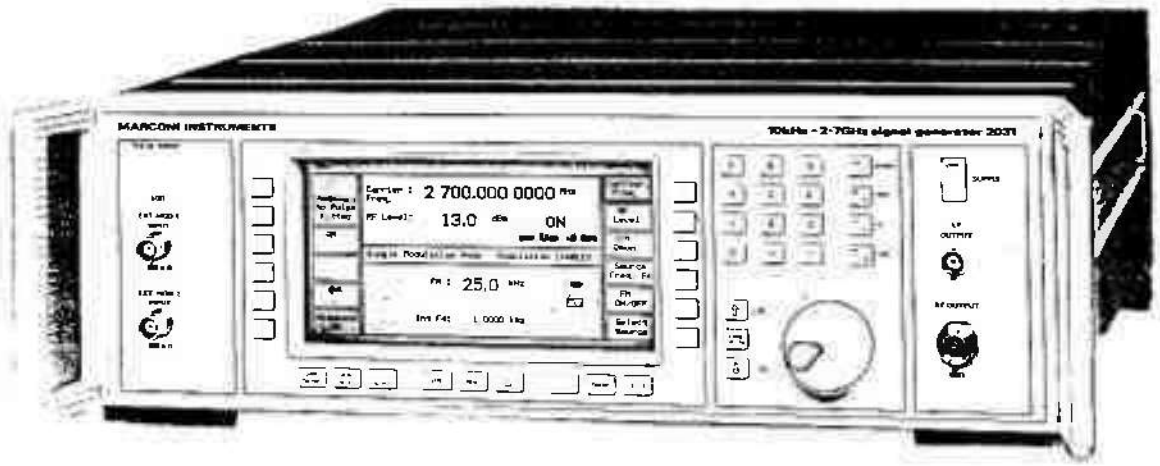


Fig. 1-1 10 kHz to 2.7 GHz Signal Generator 2031

MAIN FEATURES

Operation

3. Selection of parameters at the screen may involve one or more of the numeric, hard or soft keys or the rotary knob. Hard keys have single or dual functions which remain constant throughout, whereas soft keys have functions dependent on the present mode of operation. Parameters may be set to specific values by numeric key entry, while values may be varied in steps of any size using the ↑/↓ keys or altered by moving the knob, set at a particular sensitivity.

4. The SIG GEN, LF, SWEEP, MEM(memory), Δ(delta) and UTIL(utility) menus are selectable, at any point of operation, via the keys below the display panel. Within the display, the soft key functions are indicated by labels which appear alongside the keys situated at either side of the display panel.

Display

5. The display is a dot matrix liquid crystal panel, with backlighting. Carrier frequency, modulation and RF level are shown in horizontal regions at the principal screen. The display features 11-digit resolution for carrier frequency , 4-digit for RF level and 3-digit for modulation, with unit annunciators.

6. Contrast may be varied, using the control knob, to optimize the viewing angle. Differing lighting conditions may be accommodated using the backlight intensity function, variable from no backlight to full intensity. A full graphical display test is possible, to verify correct operation.

Frequency selection

7. Carrier frequency is selected via the soft key option at the SIG GEN display and direct entry via the keyboard. Alternatively, selection may be made via the General Purpose Interface Bus (GIPB). Frequency is resolved to 0.1 Hz across the band. Carrier frequencies can be stored in a non-volatile memory with complete recall when required. A CARRIER ON-OFF switch is provided to completely disable the output.

Output

8. RF output up to +13 dBm can be set by direct keyboard entry on the SIG GEN display or via the GPIB, with a resolution of at least 0.1 dB over the entire range and a total accuracy of ±1 dB up to 1.35 GHz and ±2 dB above 1.35 GHz.

9. A choice of calibration units is available to the operator and provision is made for the simple conversion of units (for example, dBm to μV). Calibration data for the output level is held in memory and may be altered from the front panel or over the interface bus.

10. The output level can be offset by up to ±2 dB by keyboard entry. Offsets from the calibrated value may be used to compensate for cable or switching losses external to the generator. This facility can be used as a means of deliberately offsetting the output level to ensure that all generators in an area give identical measurements. While using the offsetting facility, the principal calibration of the generator is not lost and may be returned to at any time.

11. An electronic trip protects the generator output against reverse power of up to 50 W, preventing damage to output circuits when RF or DC power is accidently applied.

Modulation

12. Comprehensive amplitude, frequency (plus wide bandwidth FM), phase and optional pulse modulation are provided for testing all types of receivers. An internal modulation oscillator is provided, having a frequency range of 0.1 Hz to 500 kHz, resolved to 0.1 Hz. A second modulation oscillator can be included as an option. Two independent BNC inputs on the front panel allow external modulation signals to be mixed with the internal signal(s). Therefore, a maximum of four modulations may be available at one time. These sources may be combined to give the single, dual tone, composite and dual composite modes, see 'MODULATION MODES', Chap. 3-1.

13. The signalling facility allows testing of radio equipment with sequential and sub-audible tone capability. The sequential calling tone system is acessible from the utility menu for all four modulation modes. Sub-audible calling tones are specified within the modulation source select display.

Incrementing

14. All major parameters can be incremented or decremented in step sizes entered via keyboard entry or the GPIB. If no step size is entered for a parameter, the steps are preset to 1 kHz for carrier frequency, 1 kHz for FM deviation, 0.1 radian for ΦM deviations, 1% for AM depth and 1 dB for output level.

Sweep

15. The sweep capability of the 2030 series allows comprehensive testing of systems. Four parameters are used to specify sweep; start, stop, number of steps and time per step. These are specified by the user, with upper and lower limits for the parameter values being dependent on the function. The sweep markers menu is available by soft key selection on the sweep display, allowing the placement of up to five user defined markers.

Non-volatile memory

16. The inclusion of a non-volatile semiconductor memory for storage of up to one hundred complete instrument settings ensures that these settings are retained when the signal generator is switched off without relying on battery back up.

Programming

17. A GPIB interface is fitted so that all functions are controllable via the interface bus which is designed to the IEEE Standard 488.2. The instrument can function both as a talker and a listener.

Protection

18. To prevent accidental interference with the contents of internal memories, internal data is protected by a secure key sequence.

19. Two levels of protection are offered, appropriate to the function being accessed. The most secure is reserved for features which alter the calibration data of the instrument. The first level of protection is less severe, enabling the user to access functions which are relevant to normal operation, such as selecting the RF level calibration units, RF level offsets and external standard frequency.

Spectral Purity

20. With an SSB phase noise performance at of typically -122 dBc/Hz at 470 MHz (20 kHz offset), the 2030 series can be used for both in-channel and adjacent channel receiver measurements. Harmonically related signals and non-harmonics are better than -30 dBc and -70 dBc respectively.

Calibration

21. The 2030 series has a two year calibration interval and is calibrated entirely by software. The calibration display is available via soft key selection at the utilities menu.

Options

22. An additional modulation oscillator is available to enable greater flexibility. This second oscillator has the same specification as the first and allows full use of complex modulation modes.

23. Pulse modulation is also optional. This extra facility allows radar RF and IF stages to be tested. Selection is from the principal display, with pulse modulation switched on and off by the MOD ON/OFF key.

PERFORMANCE DATA

CARRIER FREQUENCY

Range	10 kHz to 1.35 GHz (2030). 10 kHz to 2.7 GHz (2031).
Selection	By appropriate soft key at main display and keyboard entry.
Indication	11 digit display on main screen.
Resolution	0.1 Hz.
Accuracy	As frequency standard.
Phase Increment	Carrier phase increment facility available.

RF OUTPUT

Range	-138 dBm to +13 dBm (2030). -144 dBm to +13 dBm (2031). When AM is selected, the maximum output level reduces linearly with AM depth to +7 dBm at maximum AM depth.
Selection	By appropriate soft key at main display and keyboard entry. Units may be μV, mV, V EMF or PD; dB relative to 1 μV, 1 mV EMF or PD; dBm. Conversion between dB and voltage units may be achieved by pressing the appropriate units key (dB, V, mV, or μV).
Indication	4 digit with unit annunciators.
Resolution	0.1 dB.
Accuracy	**2030, 2031** ±1 dB, 10 kHz to 1.35 GHz down to 127 dBm. 2031 ±2 db above 1.35 GHz down to 127 dBm. Usable to an indicated value of -138 dBm (2030) or -144 dBm (2031).
Output Impedance	50 Ω nominal, N type female socket.
VSWR	For output levels less than 0 dBm: Less than 1.25:1 up to 2.2 GHz (return loss 19.1 dB). Less than 1.4:1, 2.2 GHz to 2.7 GHz (return loss 15.6 dB).
Output Protection	An electronic trip protects the generator output from reverse power of up to 50 W from a source VSWR up to 5:1.

SPECTRAL PURITY

Harmonics	Less than -30 dBc,for signal levels up to +7 dB and carrier frequencies to 1 GHz. Less than -27 dBc for carrier frequencies to 2.7 GHz.
Sub-harmonics	**All models:** less than -90 dBc to 1.35 GHz. 2031: less than -40 dBc to 2.2 GHz. less than -30 dbc to 2.7 GHz.
Non-harmonics	Less than -70 dBc for all carrier frequencies at offsets to 3 kHz or greater.
Residual FM (with FM off)	Less than 7 Hz RMS deviation in a 300 Hz to 3.4 kHz unweighted bandwidth at 470 MHz.
SSB phase noise	Less than -116 dbc/Hz (typically -122 dBc/Hz) for a carrier frequency of 470 MHz at 20 kHz offset.
RF Leakage	Less than 0.5 μV PD generated across a 50 Ω load by a two turn 25 mm loop 25 mm or more from the case of the generator with the output terminated in a 50 Ω sealed load.

MODULATION MODES

The four modulation sources, Modulation Oscillator 1, Modulation Oscillator 2, External 1 and External 2, may be configured to provide FM, AM or FM + AM in all combinations.

Phase modulation can be used instead of FM (but not simultaneously).

FREQUENCY MODULATION

Deviation	1 MHz max for carrier frequencies up to 21.09375 MHz. Up to 1% of carrier frequency for carrier frequencies above 21.09375 MHz.
Resolution	3 digits.
Selection	Soft key option from main display, keyboard entry of data.
Accuracy at 1 kHz Internal modulation source	±5% of indication ±10 Hz.
Bandwidth (±1 dB)	DC to 300 kHz (DC coupled). Typically 500 kHz. 10 Hz to 300 kHz (AC coupled). Typically 500 kHz.
Frequency Offset	Less than ±(1 Hz +1% of the set deviation) when DC coupled FM is selected.

Distortion	Less than 3% at maximum deviation for modulation frequencies up to 20 kHz. Less than 0.3% at 10% of maximum deviation for modulation frequencies up to 20 kHz.
External Modulation -accuracy at 1 kHz	±5% ±10 kHz. With ALC OFF the modulation is calibrated for an input level of 1.0 V PD RMS.

WIDEBAND FM

Deviation	Controlled in 3 dB steps only. The generator displays deviation equivalent to 1 V RMS input.
3 dB bandwidth	Typically -3 dB w.r.t. 1 kHz at 10 MHz DC or AC coupled.
Input Impedance	50 Ω nominal.

PHASE MODULATION

Deviation	Up to 10 radians in 0.1 radian steps.
Selection	Soft key option at principal screen, keyboard entry of data.
Indication	3 digit display on main screen.
Accuracy	Better than ±5% of deviation at 1 kHz.
Bandwidth	±3 dB, 100 Hz to 10 kHz.
Distortion	Less than 3% at 1 kHz modulation rate.

AMPLITUDE MODULATION

Range	0 to 99.9% in 0.1% steps.
Selection	Soft key option at main display. Entry of data via keyboard.
Indication	3 digit on main screen.
Depth Accuracy	For carrier frequencies up to 1 GHz, ±4% of setting ±1% depth. Usable to 2.7 GHz.

Phase Modulation on AM	Typically less than 0.1 radian at 30% depth on a 500 MHz carrier.
Envelope Distortion	Less than 3% of total harmonic distortion for modulation depths up to 80% at 1 kHz. Less than 1% total harmonic distortion for modulation depths up to 30% at 1 kHz.
External Modulation -Accuracy	ALC OFF: modulation calibrated for input level of 1.0 V PD RMS.
Bandwidth	Typically ±1 dB, dc to 50 kHz, relative to 1 kHz. ±1 dB, dc to 30 kHz, relative to 1 kHz. ±2 dB, dc to 50 kHz, relative to 1 kHz.

MODULATION OSCILLATOR

Frequency	0.1 Hz to 500 kHz (sine wave).
Selection	Soft key option at sub-menu.
Indication	7-digit display on *Internal Source Selection Menu*, repeated on main menu.
Resolution	0.1 Hz
Frequency Accuracy	As frequency standard.
Distortion	Less than 0.1% total harmonic distortion at frequencies up to 20 kHz in sine wave mode.
Alternative Waveform	A triangular waveform can be produced in addition to the sine wave for frequencies up to 100 kHz.
Signalling Tones	The modulation oscillator can be used to generate sequential (up to 16 tones) or sub-audible tones in accordance with EIA, ZVEI, DZVEI, CCIR, EURO 1, EEA and NATAL standards. User defined tone sysyems can be created and stored.
Second Modulation Oscillator	Specification as Modulation Oscillator.

EXTERNAL MODULATION	Two independent inputs on the front panel, BNC connectors EXT1 and EXT2. With ALC OFF, the modulation is calibrated for an input level of 1.0 V PD RMS. With ALC ON, the modulation is calibrated for input levels between 0.7 and 1.4 V PD RMS.
Modulation ALC Distortion	Less than 0.1% over the range 10 Hz to 20 kHz at 1 V RMS.
Modulation ALC Bandwidth	Typical 1 dB bandwidth, 10 Hz to 500 kHz.
LF OUTPUT (in sine wave mode)	Front panel BNC connector. The output may be configured in the LF generator mode to give an output from the internal modulation oscillator and in the LF monitor mode to give an output from the internal modulation signal paths.
Common Mode Voltage	Maximum Common Mode Voltage, ±0.5 V.
Level	100 µV to 5 V RMS with a load impedance >600 Ω. 100 µV to 1.4 V RMS with a load impedance >50 Ω.
Source Impedance	5.6 Ω nominal.
Level Accuracy	With a load impedance > 10 kΩ : ±5% for levels above 50 mV. ±10% for levels from 500 µV to 50 mV.
Frequency Response	Typically better than 1 dB, 0.1 Hz to 300 kHz.
SWEEP	
Control Modes	Start/stop values of selected parameter. Number of steps. Time per step.
Step Time	1 ms to 10 s per step.
Sweep Ramp	Synchronised analogue ramp with an amplitude of 0 to 10 V nominal on a rear panel BNC connector.
Markers	User selectable markers for frequency or level provide an indication when specified parameters have been reached. Output 0 V to +5 V nominal from 600 Ω on rear panel BNC socket.
Trigger	Rear panel BNC connector. Applying 0 V or a switch closure starts the sweep. Socket is internally connected via 10 kΩ pull-up resistor to internal +5 V rail.

FREQUENCY STANDARD

Frequency	10 MHz
Temperature Stability	Better than ±5 in 10^8 over the operating range of 0 to 50 °C.
Aging Rate	Better than 2 in 10^7 per year; better than 5 in 10^{10} per day after one month continuous use.

AUXILIARY INPUTS/OUTPUTS

Internal Standard Output	Rear panel BNC socket provides an output at frequencies of 1, 5 or 10 MHz with a nominal level of 2 V peak to peak into 50 Ω.
External Standard Input	Rear panel BNC socket accepts an input at 1, 5 or 10 MHz with a minimum level of 2 V peak to peak. Maximum level is 5 V peak to peak.
Sweep Trigger	See SWEEP.
Wideband FM	See FREQUENCY MODULATION.
Ramp Output	See SWEEP.
Marker Output	See SWEEP.

GPIB INTERFACE

A GPIB interface is fitted. All functions except the supply switch are remotely programmable.

Capabilities	Complies with the following subsets as defined in IEEE Standard 488.1 SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C0, E2. Designed in accordance with IEEE 488.2.

RADIO FREQUENCY INTERFERENCE

Conforms to the requirements of EEC Directive 76/889 and VDE 0871 as to limits of RF interference.

SAFETY

Complies with IEC 348.

RATED RANGE OF USE (over which full specification is met)

Temperature	0 to 55 °C
Humidity	Up to 95% Relative Humidity at 40 °C

CONDITIONS OF STORAGE AND TRANSPORT

Temperature	-40 °C to +71 °C.
Humidity	Up to 95% relative humidity at 40 °C.
Altitude	Up to 4600 m (15,000 ft).

POWER REQUIREMENTS

AC supply	100 V set 90 - 115 V 120 V set 105 - 132 V 220 V set 188 - 242 V 240 V set 216 - 265 V 45 Hz to 400 Hz. 120 VA maximum.
Battery	3.6 V size AA Lithium battery for real time clock.

CALIBRATION INTERVAL

2 years.

DIMENSIONS AND WEIGHT

(Over projections but excluding front panel handles).

Height	Width	Depth	Weight
152 mm	425 mm	525 mm	16.5 kg
6 in	16.6 in	20.5 in	36 lb

VERSIONS AND OPTIONS

Alternative Versions

2030: 10 kHz to 1.35 GHz Signal Generator.
2031: 10 kHz to 2.7 GHz Signal Generator.

Options

001: Second Internal Modulation Oscillator.
002: Pulse modulation.

ACCESSORIES

Supplied accessories

	Part no.
AC supply lead.	
Operating manual H 52030-001C Vol. 1.	46881-976P

Optional accessories

Service manual H 52030-001C Vol. 2 (for 2030 and 2031).	46881-978M
Rack mounting kit (480 - 680 mm depth).	46884-291W
Rack mounting kit (680 - 840 mm depth).	46884-292D
RF connecting cable, TM 4969/3, 50Ω, 1.5 m, BNC.	43126-012S
Coaxial adapter N male to BNC female.	54311-092P
Impedance adapter 50/75 Ω.	54411-051X
RF connecting cable, 1 m , type N connectors.	54311-095C
GPIB Lead assembly.	43129-189U
IEEE/IEC Adapter block for GPIB socket.	46883-408K

Chapter 2

INSTALLATION

CONTENTS

UNPACKING AND REPACKING

1. Retain the container and packing material in case it is necessary to reship the instrument.

2. If the instrument is to be returned for servicing, attach a label indicating the service required, type or model number (ref. rear panel label), serial number, full details of the fault symptoms and your return address. Pack the instrument in accordance with the general instructions below.

(1) Place the lower padded fitting in the bottom of the container.

(2) Put the polythene cover over the instrument and place it in position on the padding.

(3) Place the upper padded fitting over the instrument.

(4) Wrap the container in waterproof paper and secure with adhesive tape.

(5) Mark the package FRAGILE to encourage careful handling.

Note

If the original container or materials are not available, use a strong double walled carton packed with a 7 to 10 cm layer of shock absorbing material around all sides of the instrument to hold it firmly. Protect the front panel controls with a plywood or cardboard load spreader. If the rear panel has guard plates or other projections, a rear load spreader is also advisable.

MOUNTING ARRANGEMENTS

3. Excessive temperatures may affect the performance of the instrument. Completely remove the plastic cover, if one is supplied over the case, and avoid standing the instrument on or close to other equipment which is hot.

CONNECTING TO SUPPLY

4. Before connecting the instrument to the AC supply, check the setting of the voltage selector switch which is an integral part of the supply connector at the rear of the instrument.

Voltage selector

5. The selected voltage is displayed in a window at the top of the connector. The instrument is normally despatched with the selector set to 240 V. To select another voltage, insert a screwdriver into the slot at the top of the moulding and twist slightly so that the cover is free to hinge downwards. Rotate the barrel so that the correct setting is displayed, ref. Fig. 1.

Setting	Voltage range
100 V	90 - 115 V
120 V	105 - 132 V
220 V	188 - 242 V
240 V	216 - 265 V

Fuses

6. The correct fuse rating for each voltage setting is as follows:

100 V to 120 V, 1.6 A-TT (1.6 amp time lag)

220 V to 240 V, 1 A-TT (1 amp time lag)

Fuses are cartridge type measuring 20 mm x 5 mm.

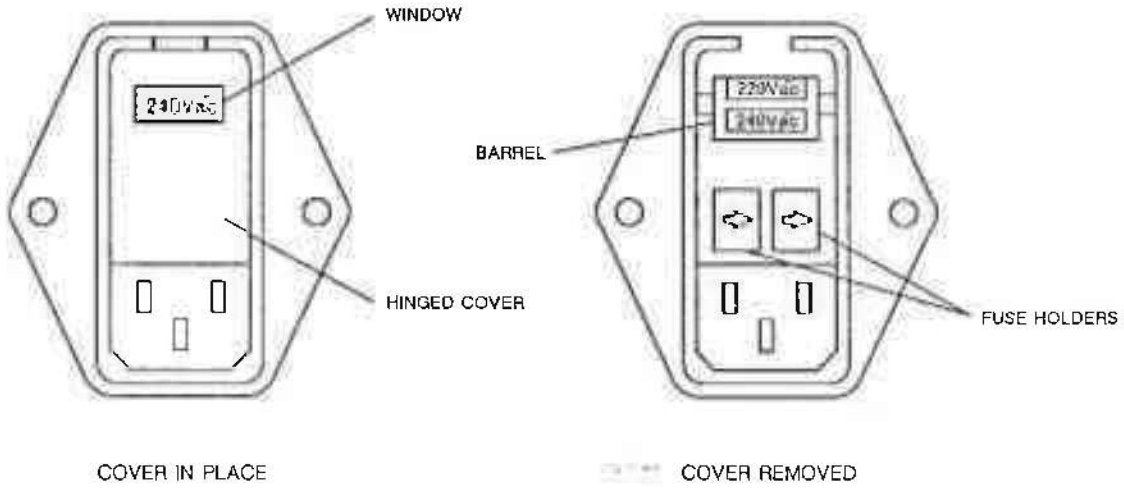


Fig. 1 AC connector showing voltage selector and fuse holders

Supply cable

7. The AC supply cable is fitted at one end with a socket which mates with the AC connector on the rear panel. When fitting a supply plug, ensure that connections are made as follows:

Earth - Green/Yellow
Neutral - Blue
Live - Brown

When attaching the supply lead to a non-soldered plug, it is recommended that the tinned ends of the lead are cut off to avoid intermittent connections resulting from cold flow.

SAFETY TESTING

8. Where safety tests on the AC supply input circuit are required, the following procedures can be applied. These procedures 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 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.

GENERAL PURPOSE INTERFACE BUS (GPIB)

9. The GPIB interface built into the 2030 and 2031 enables the signal generators to be remotely controlled to form part of an automatic measuring system.

GPIB cable connection

10. Connection to other equipment which has a 24-way connector to IEEE Standard 488 is made using the rear panel GPIB socket. For this purpose, the GPIB cable assembly available as an optional accessory (ref. Chap 1 'Accessories') may be used.

GPIB connector contact assignments

11. The contact assignments of the GPIB cable connector and the device connector are as shown in Fig. 2.

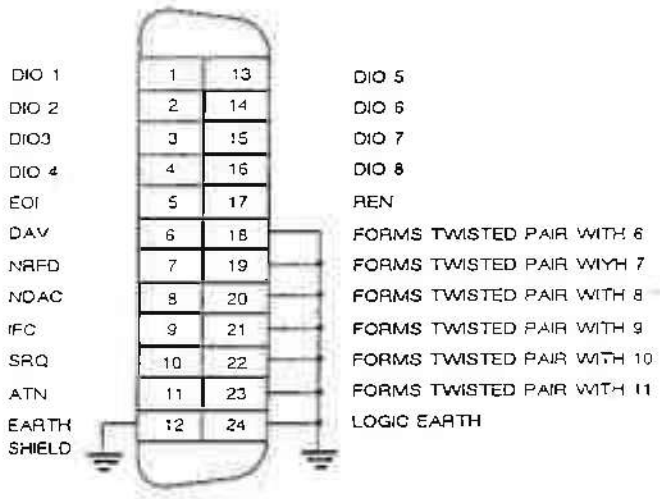


Fig.2 GPIB connector contact assignments

IEEE to IEC conversion

12. An optional IEEE to IEC adapter is also available (ref. Chap 1 'Accessories') for interfacing with systems using a 25-way bus connector to IEC Recommendation 625. The method of use is shown in Fig. 3.

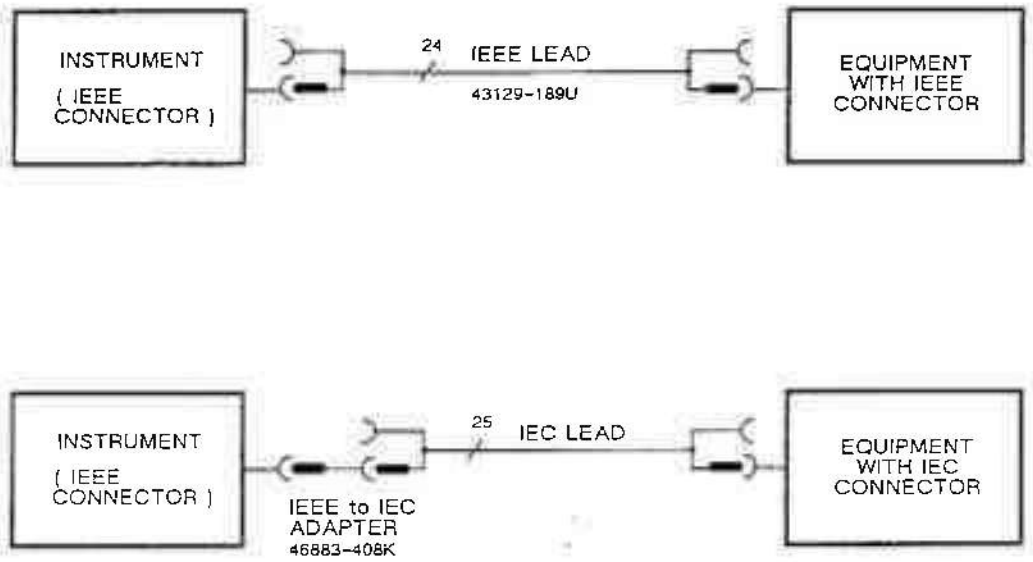


Fig. 3 IEEE to IEC conversion

Interface bus connection

13. The cables 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 cables 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 with the restriction that the total cable 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.

RACK MOUNTING

14. The instrument, which is normally supplied for bench mounting, may be fitted with slides and mounted in a standard 19 inch rack using a rack mounting kit, Part No. 46884-291A (short slide) or 46884-292Z (long slide). These kits are available as optional accessories with full fitting instuctions.

Chapter 3-1

OPERATION

CONTENTS

Fig. Page

Table

INTRODUCTION

1. This chapter explains how to :

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

CONVENTIONS

2. The following conventions are used in this chapter:

RF OUTPUT	Capitals refer to titles marked on the panel.
[MEM]	Capitals in square brackets indicate hard key titles.
Int. F4	Italics refer to data or messages on the display.
[Pulse]	Italics in square brackets indicate soft key titles, e.g. *[Pulse]* means the soft key adjacent to the *Pulse* title box at the side of the menu.
(1)	Sequence of steps in a procedure.
•	List of topics or items.
(1)	Topics or items keyed to the same number on a diagram.

FRONT PANEL

3. Parameters are selected by means of hard keys, which have their function printed on them, soft keys, which do not have any notation, a numerical key pad and a rotary control knob, ref. Fig. 3-2. The hard keys have functions which do not change, whereas the soft key functions are determined by the menu which is being displayed. The numerical keys are used to set parameters to specific values which can also be varied in steps of any size by using the ↑/↓ keys or the rotary control knob.

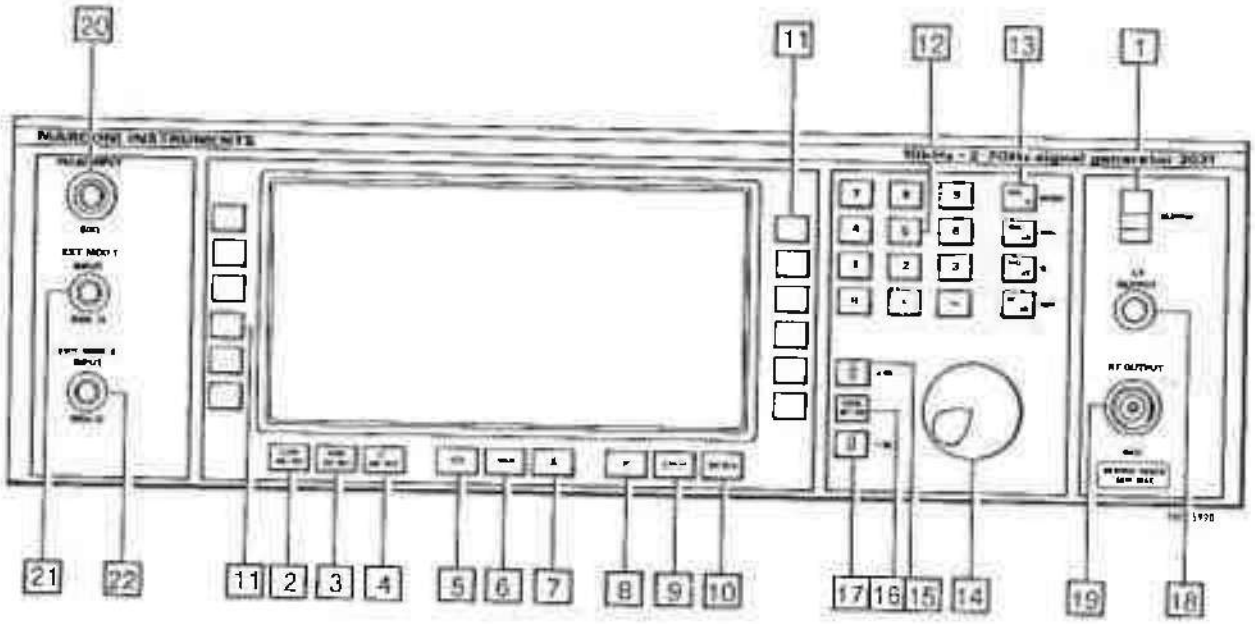


Fig. 1 2031 front panel.

(1)	SUPPLY	Switches the AC supply voltage on and off.
(2)	CARR ON-OFF	Enables or disables the carrier frequency.
(3)	MOD ON-OFF	Enables or disables the modulation.
(4)	LF ON-OFF	Switches the low frequency output on and off.
(5)	UTIL	Displays the utilities menu.
(6)	MEM	Displays the store/recall menu.
(7)	Δ	Displays the total shift menu.
(8)	LF	Displays the audio monitor menu.
(9)	SWEEP	Displays the sweep status menu.
(10)	SIG GEN	Displays the main menu.

(11)	SOFT KEYS(12)	Function keys change notation as the menu changes.
(12)	NUMERICAL KEY PAD	For changing the value of a selected parameter. Minus sign and decimal point are included.
(13)	UNITS KEYS	Determine the units of set parameters and terminate the numerical entry.
(14)	CONTROL KNOB	When enabled, adjusts value of selected parameter.
(15)	↑ X10	When knob disabled, increments a selected parameter. When knob enabled, increases knob sensitivity by value of ten.
(16)	KNOB UP-DN	Enables or disables the control knob.
(17)	↓ X10	When knob disabled, decrements a selected parameter. When knob enabled, decreases knob sensitivity by value of ten.
(18)	LF OUTPUT	BNC socket provides a low impedance output at the frequency selected at the *LF* ***GENERATOR*** *MENU* or monitors the modulating signal.
(19)	RF OUTPUT	50 Ω N type socket with reverse power protection.
(20)	PULSE INPUT	50 Ω BNC socket accepts a pulsed signal when this optional facility is fitted.
(21)	EXT MOD 1 INPUT	100 kΩ BNC socket. An independent input which allows external and internal modulation signals to be mixed.
(22)	EXT MOD 2 INPUT	100 kΩ BNC socket, similar to (21)

REAR PANEL

4. The following facilities are available at the rear panel, see Fig. 2.

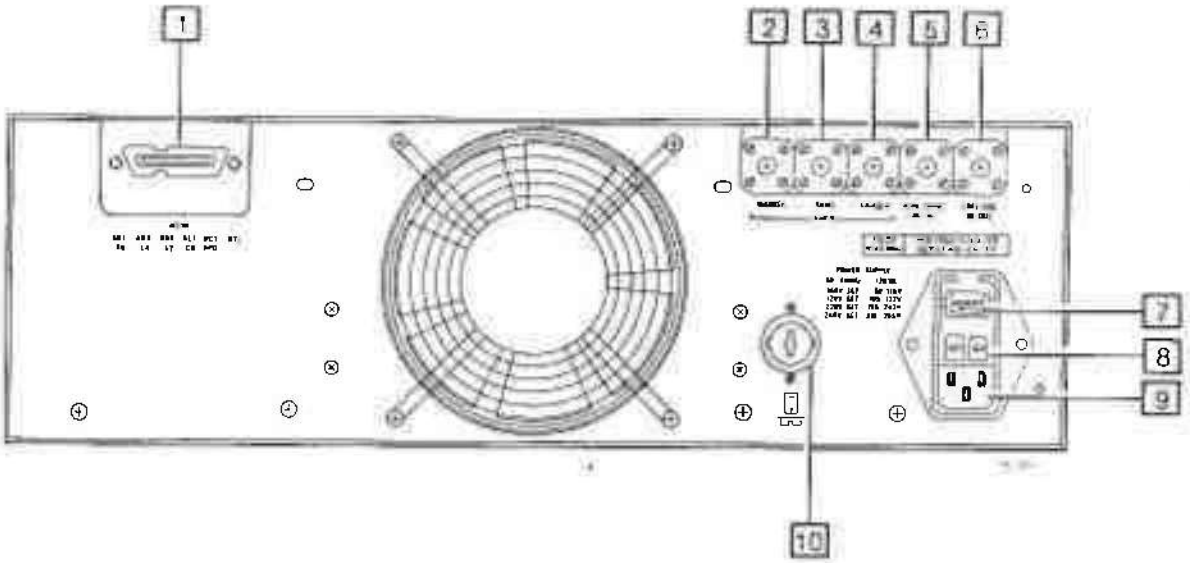


Fig. 2 2031 rear panel

(1)	GPIB	24 pin socket accepts standard IEEE connector to allow remote control of the instrument.
(2)	SWEEP MARKER	BNC socket supplies sweep marker.
(3)	SWEEP RAMP	BNC socket provides a ramp output at 0 to 10 V peak to peak.
(4)	SWEEP TRIGGER	BNC socket provides access for a trigger input.
(5)	WIDE BAND FM IN	BNC socket accepts a wide bandwidth FM signal into 50 Ω with a typical bandwidth of 10 MHz.
(6)	FREQ STD IN/OUT	BNC socket for standard frequencies at 1, 5, or 10 MHz at TTL levels.
(7)	VOLTAGE SELECTOR	Removable cover reveals barrel which can be rotated to select the required voltage range.
(8)	FUSES	AC fuses rated at 1.6 A (time lag) for the 100 to 120 V range and 1 A (time lag) for the 220 to 240 V range.
(9)	AC SUPPLY INPUT	3 pin plug integral with voltage selector and fuse holders. Mates with supply lead socket.
(10)	BATTERY HOLDER	Houses lithium battery for real time clock.

THE MENUS

5. The 2030 series instruments are operated by calling up various displays or menus on the screen. Menus are accessed via both hard and soft keys. Pressing a hard key causes the appropriate primary menu to appear on the screen regardless of the current working position within the menu hierarchy. As the display changes from one menu to another, so the 12 soft keys assume those functions necessary to drive the instrument from that menu. Secondary menus are displayed by pressing a soft key while in a primary menu. Some sub-menus are nested e.g. UTILITIES. Clearance from these is obtained by pressing the *[EXIT]* key.

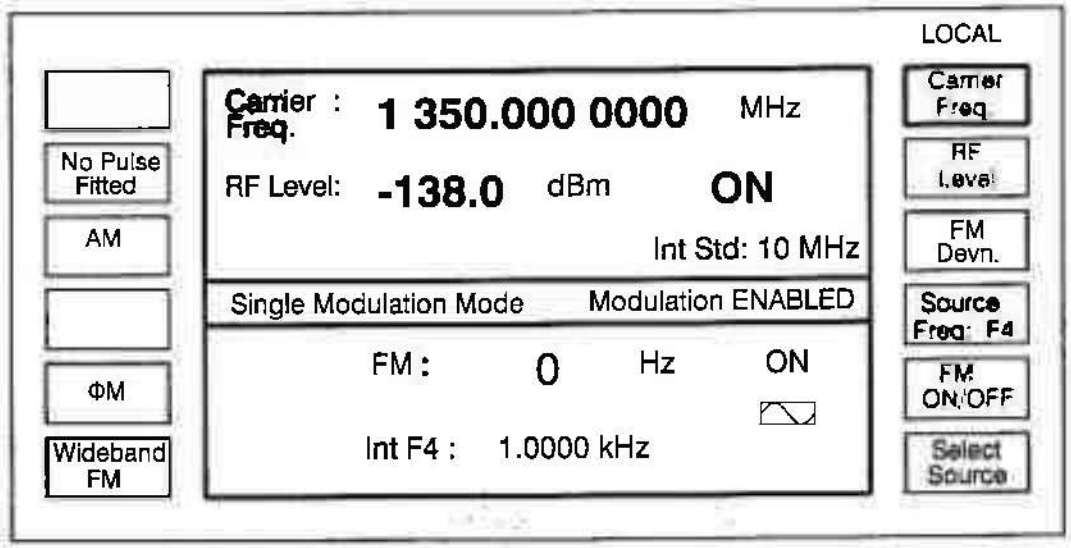


Fig. 3 Main, SIG GEN, menu - default display for 2030

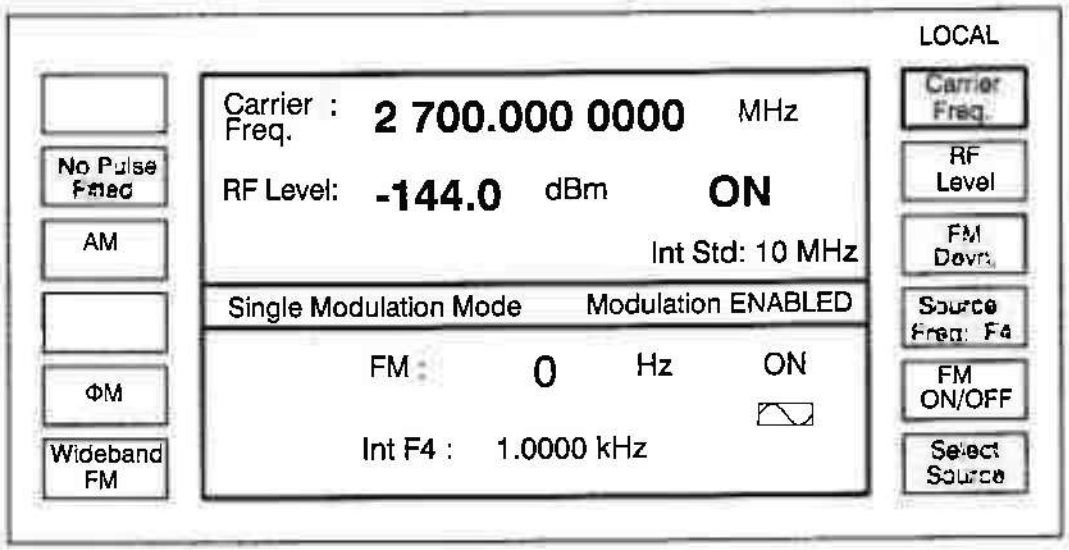


Fig. 4 Main, SIG GEN, menu - default display for 2031

FIRST TIME USE

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

Carrier frequency: 100 MHz.
Output level: 10 dBm.
Amplitude modulation: 30% depth at 1 kHz.

Switching on

7. (1) Before switching the instrument on, check that the voltage selector has been set to the value of the power supply as described in Chap.2.

(2) If the default display shown in Fig. 3 and Fig. 4 is not obtained, a previous user may have set the instrument to switch on with one of the user memories recalled rather than using the default factory settings. Before proceeding any further you should reset this selection, see Para. 65.

(3) Observe that the main menu appears on the display showing default parameters for FM. The soft key label marked *[Carrier Freq]* is highlighted (i.e. the line bordering the label is increased in thickness to about 1 mm), which means that anything entered at this stage will change the carrier frequency.

(3) If necessary, adjust the display for brightness and contrast, see 'UTILITIES' see Para. 49.

Changing the value of the selected parameter

8. (1) Using the numerical key pad, enter 100 MHz by pressing keys [1], [0], [0] and the key marked [MHz/mV/sec]. Observe that the Carrier Freq. display changes to *100.000 0000 MHz*.

(2) Press *[RF level]*. The *RF level* soft key label is now highlighted.

(3) Using the numerical key pad, enter 10 dBm by pressing keys [1],[0] and the key marked [Hz/dB/rad]. Observe that the RF Level display changes to *10.0 dBm*.

(4) Press *[AM]* on the left hand side of the display. The menu will now change to display AM modulation parameters in the lower panel. The *[FM Devn.]* soft key on the right hand side of the menu changes to *[AM depth]* and this label is now highlighted. *AM* disappears from the left hand side.

(5) Using the numerical key pad, enter 30% AM depth by pressing [3], [0] and [kHz/µV/%]. Observe that the *AM* depth display changes to *30%*. The display will now be as in Fig. 5 and the selected signal will now be present at the RF OUTPUT socket.

Note...
Small changes in a selected parameter can be made using the [↑ X10] key, the [↓ ÷10] key or the rotary control knob. This procedure is described in Para. 12.

Enabling or disabling the modulation

9. The modulation is ON by default, but the AM can be turned ON and OFF pressing *[AM ON/OFF]* at the right hand side of the display and the modulation can be enabled or disabled by pressing [MOD ON-OFF]. These are both toggle actions, i.e. press ON, press OFF.

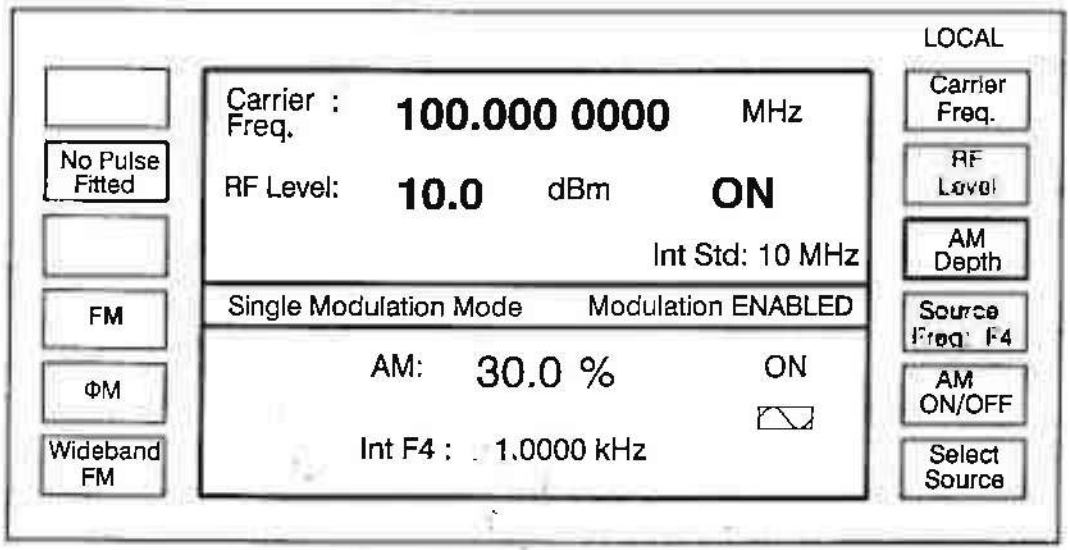


Fig. 5 Amplitude modulation - menu configuration

Using the [↑ X10] and [↓ ÷10] keys

10. When a parameter has been selected via the numerical key pad, its value can be incremented or decremented either in steps using the [↑] key and the [↓] key, or continously with the control knob. Select *[Carrier Freq.]* and observe that the effect of pressing the [↑] and [↓] keys is to change the carrier frequency in steps of 1 kHz. Default step sizes are assigned to all parameters but these can be changed, see Para. 33.

Using the control knob

11. (1) Press [KNOB UP/DN] to enable the control knob.

(2) On the display, brackets will appear above and below the selected parameter. These brackets embrace the part of the value which the control knob can change. Pressing the [X10] key shortens the bracket length by one decimal place. Pressing the [÷10] key increases the bracket length by one decimal place. In this way the gearing of the control knob can be increased ordecreased by a factor of ten.

Note...
For *RF Level* the knob resolution is fixed at 0.1 dB.

(3) Rotate the control knob and observe the change in the selected parameter. Press [KNOB UP/DN] to disable the knob.

CARRIER FREQUENCY

12. The carrier frequency is selected from the main menu by pressing *[Carrier Freq]*, unless it is already highlighted as in the default display.

Enter the required value via the numerical key pad. The value can then be incremented or decremented using the control knob and its associated keys, [KNOB UP/DN], [X10] and [÷10].

If a value outside the specified range is requested, the message:

ERROR 36: Carrier Outside Limits

is displayed on the screen when the terminator key is pressed, and the instrument is automatically set to the end of the range.

Carrier ON/OFF

13. The carrier may be switched *ON* or *OFF* at any time via the [CARR ON-OFF] key. This effectively switches the output ON and OFF .

OUTPUT LEVEL

14. The output level is selected at the main menu by pressing *[RF Level]* and entering the required value on the numerical key pad. If a value outside the specified range is requested the message:

ERROR 37: RF Level Outside Limits

is displayed and the instrument is automatically set to the end of the range.

Choice of units

17. Units may be μV, mV, V or dB. Conversion between dB and the voltage units is carried out by pressing the appropriate units key, i.e. to change dBm to a voltage unit, press any voltage key for the correct conversion. The choice of Volts EMF, Volts PD, and the dB reference is made by using the *[RF Level Units]* utility, see Para. 63.

Reverse power protection

16. Accidental application of power to the RF OUTPUT socket trips the reverse power protection circuit (RPP) and a flashing message:

RPP
TRIPPED

appears on the screen in large characters with the following message beneath it in small characters:

*** DISCONNECT SIGNAL SOURCE ***

Pressing *[Reset]* resets the RPP and returns the display to the menu in use when the reverse power protection was tripped. If *[Reset]* is pressed with the signal still applied, the RPP will trip again.

MODULATION

17. The carrier can be modulated by frequency, amplitude, or phase, with pulse modulation as an option. The internal modulation oscillator has a frequency range of 0.1 Hz to 500 kHz, with a resolution of 0.1 Hz.

Selecting the modulation

18. When switched ON, the instrument is in the internal modulation mode. The type of modulation required, AM, FM, ΦM, wideband and optional pulse modulation can be selected by soft keys at the main menu.

Source selection

19. The modulation source may be selected by pressing *[Select Source]*. Sources may be internal or external. If the currently selected source is internal, the *Internal Source Selection Menu* is displayed, giving a choice of six sources, F1-F6, see Fig. 6. The frequency assigned may be changed by the numerical key pad and terminated with [Hz], [kHz], or [MHz]. Soft keys allow the selection of either a sine or triangular waveform. The selection of sub-audible continuous tones can be achieved by pressing *[CTCSS]*. Pressing *[LF Phase]* displays the *LF Source Phase Control* menu. An external source may be selected by pressing *[Select External]*. The *External Source Selection Menu* is then displayed on the screen. (This menu is displayed immediately when pressing *[Select Source]* if the currently selected source is external.)

20. The pictograms at the end of each line show a symbolic sine wave when a source is selected. This changes to a triangular wave if *[Triangle Wave]* is selected. These symbols also appear on the main menu. A horizontal bar is shown when a source is not selected.

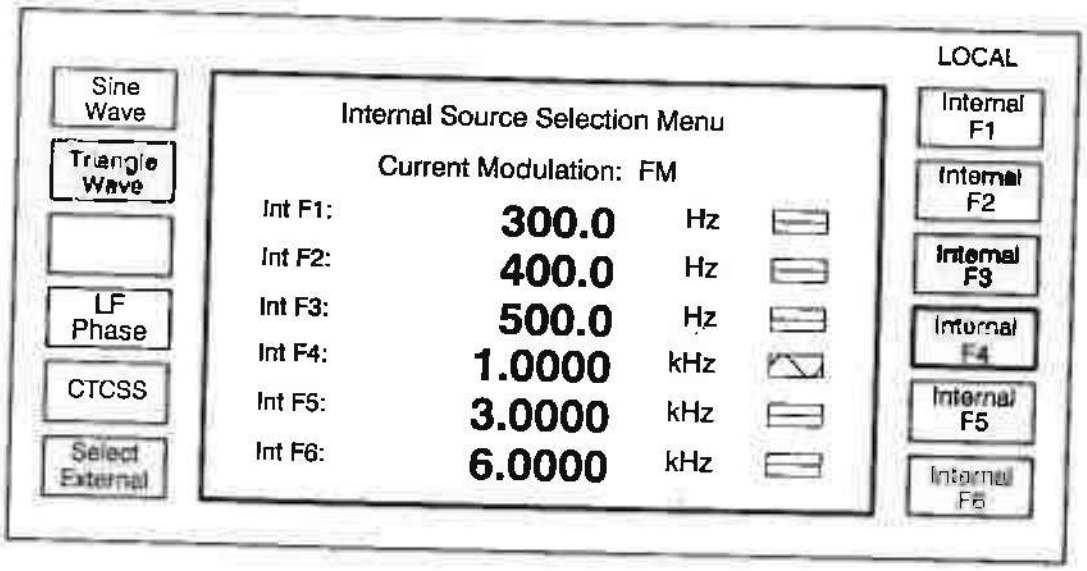


Fig. 6 Internal source selection menu

Modulation ON/OFF

21. [MOD ON-OFF] switches all modulation *ON* or *OFF* and the condition is indicated in the centre of the main display, e.g:

Modulation DISABLED

For example, *[AM ON/OFF]* turns the source on or off. For modulation to appear on the carrier, modulation must be both enabled (with the [MOD ON-OFF] hard key) and turned on via the *[AM ON/OFF]* soft key. In single modulation modes the [MOD ON-OFF] key and the *[FM ON-OFF]*, *[AM ON-OFF]*, *[ΦM ON-OFF]* keys appaer to carry out the same function, but the action is different, particularly in the FM mode. The *[FM ON-OFF]* etc. soft keys only reduce the modulation to zero whereas the [MOD ON-OFF] key completely disables the modulation system such that the instrument reverts to a carrier frequency generator.

Selecting amplitude modulation

22. (1) At the main menu, press *[AM]*, the *AM Depth* box is now highlighted.

(2) Enter the required modulation depth via the numerical key pad and terminate by the [%] key. If the modulation depth requested exceeds the maximum, the level is reset to the maximum value available and the message:

ERROR 41: AM Outside Limits

is displayed at the top of the screen.

(3) Switch the AM ON or OFF by pressing *[AM ON/OFF]*. The AM information is displayed in the lower half of the screen.

Selecting frequency modulation

23. (1) At the main menu, press *[FM]*, the *FM* box will be highlighted.

(2) Enter the FM deviation value via the numerical key pad and terminate it with [Hz], [kHz] or [MHz].

(3) Switch the FM ON or OFF via *[FM ON/OFF]*. The FM information is displayed in the lower half of the screen.

Selecting phase modulation

24. (1) At the main menu, press *[ΦM]*. The *ΦM DEVN* box will be highlighted.

(2) Enter the phase modulation deviation value via the numeric key pad and terminate it with the [RAD] key.

(3) Switch the ΦM ON or OFF via the *[ΦM ON/OFF]* key. The ΦM information is displayed in the lower half of the screen.

Selecting wide bandwidth frequency modulation

25. (1) At the main menu, press *[Wideband FM]*. The *[Wideband FM]* key is highlighted on the left hand side of the menu.

(2) The value can be changed via the key pad and frequency terminator key. To preserve the widest bandwidth, the control of the wideband FM is carried out in a series of fixed steps and the signal generator automatically displays the calculated fixed step which is closest to the keyed in value. Applying a 1 V RMS signal to the rear panel WIDE BAND FM IN socket will produce the indicated deviation.

(3) Pressing *[AC/DC Coupling]* changes the coupling from AC to DC and vice versa. When the input is DC coupled, nulling can be effected by pressing *[DCFM Nulling]*. The legend:

*** DCFM NULLING ***

appears momentarily on the display.

MODULATION ALC

26. The automatic levelling control (ALC) is used in conjunction with an external source and can be disabled when not required. To enable the ALC, proceed as follows:

(1) At the main menu, press *[Select Source]*. The display will show the *Internal Source Selection Menu* (Fig. ?).

(2) Press *[Select External]*. The display will now show the *External Source Selection Menu* (Fig. ?). The pictogram at the end of each line will change from a horizontal line to an arbitrary waveform symbol when the source is selected.

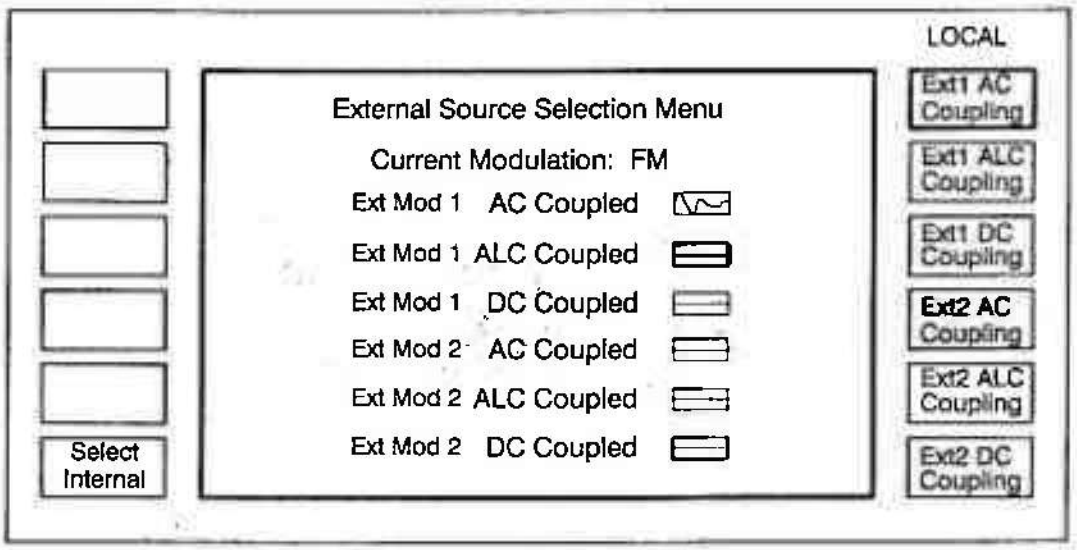


Fig. 7 External source selection menu

(3) Select the required external source from the options shown, e.g. *[Ext 1 ALC Coupling]* or *[Ext 2 ALC Coupling]*.

(4) Return to the main menu by pressing [SIG GEN]. The legend *Ext Mod 1(or 2) ALC coupled* appears at the bottom of the display.

(5) Inject a signal into the [EXT MOD 1] or [EXT MOD 2] input socket and vary the level. If the input applied to the external modulation socket is outside the ALC range (0.7 to 1.4 V RMS) *HI* or *LO* will be indicated and an error message will be displayed at the top of the screen. If the level is within the required range, the arbitrary waveform symbol will appear alongside the modulation value

MODULATION MODES

27. Two independent inputs on the front panel allow external modulation signals to be mixed with signals from the internal oscillator and a second optional internal oscillator (if fitted). Thus four modulations may be available at one time. These can be combined to give single, dual, composite and dual composite modes.

Single

28. In the single mode, only one modulation can be active at any one time, and selecting another modulation cancels out the first.

Dual

29. In the dual mode, a common carrier wave is modulated by two different types of modulation, e.g. AM and FM. Each type of modulation carries separate information.

Composite

30. This mode consists of two modulating channels with similar types of modulation, the effective modulation being the sum of the two waveforms e.g. FM1 + FM2.

Dual composite

31. This mode is similar to single composite with each of the two modulating channels being the sum of two sources, e.g. FM1 + FM2 and AM1 + AM2.

MODULATION MODE SELECTION

32. In order to select a different modulation mode;

(1) Press [UTIL]. *Utilities Selection Menu 1* will appear on the display.

(2) Press *[Mod'n Mode]*. The display changes to show the four options. Press the required soft key.

(3) Press [SIG GEN] to return to the main menu where the modulation mode and individual source parameters will be shown.

Note...

Full information on the range of utilities can be found under 'UTILITIES'.

INCREMENTING (using the delta function)

33. (1) Check that the control knob is disabled i.e. there are no brackets on the display above and below the selected parameter. If brackets are present, press [KNOB UP-DN] and they will disappear.

(2) Press the [Δ] hard key. The total shift menu is displayed as shown in Fig. 5. This menu displays the difference between the modified value and the keyed-in value. Parameters can be incremented or decremented by using the [↑] or [↓] key or the control knob, see 'Using the control knob'. To cancel any changes made here, press *[Return Value]*. This will restore the setting of the selected parameter to the keyed-in value, i.e. the indicated shift will return to zero.

(3) Select the parameter for which increments are to be set, e.g.*[Carrier Shift]*.

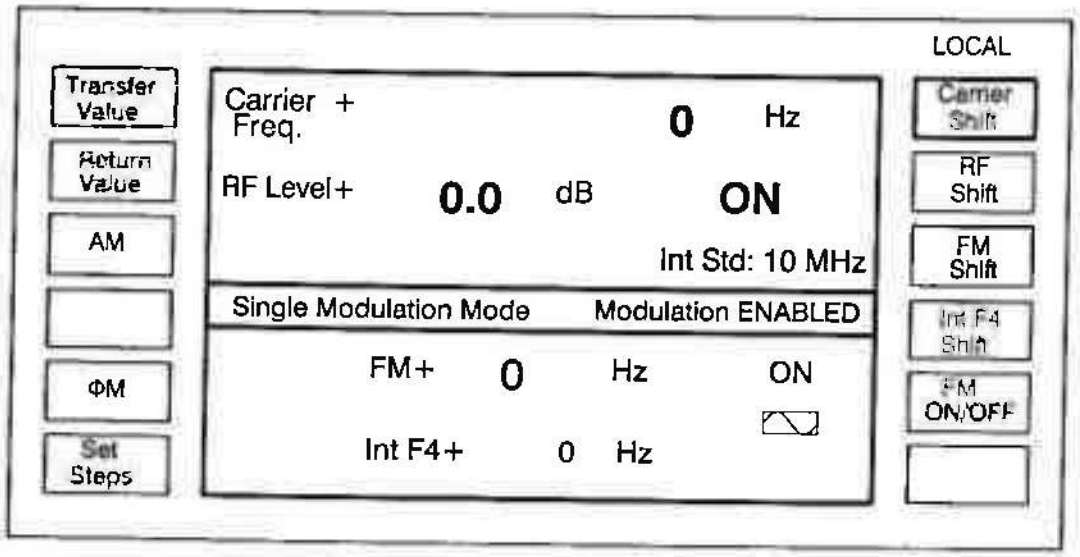


Fig. 8 Total shift menu

(4) From the menu select *[Set Steps]*.

(5) Select *[Carrier Step]* , enter the value on the key pad and press the [kHz] terminator key. The step value will appear on the screen.

(6) Return to the main menu by pressing [SIG GEN].

(7) Using the ↑\↓ keys respectively will now increment or decrement the carrier frequency by the set value.

(8) *[RF Level Step]*, *[AM step]* and *[Source Step]* values can be entered in the same way.

SWEEP

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

- Start
- Stop
- Number of steps
- Time per step

Up to five individually adjustable markers may be set. Each marker can be turned on and off separately. Sweep functions available are:

- Carrier frequency with AM, FM, ΦM, WBFM or no modulation
- RF Level
- Modulation rate
- LF frequency)
- LF level) If in LF generator mode.

The sweep can be operated in single shot or continuous modes with the start command triggered by a key press, an external pulse or GPIB control. Once started, the sweep can be stopped at any time when the display will indicate the current display value. The sweep can be used with oscilloscopes, X-Y display units and X-Y plotters by connecting the display unit X input to the SWEEP RAMP output at the rear panel.
A sweep routine is set up as follows:

Sweep type

35. (1) Press the [SWEEP] hard key. The sweep parameters display, with soft key options, appears on the screen, see Fig. 9.

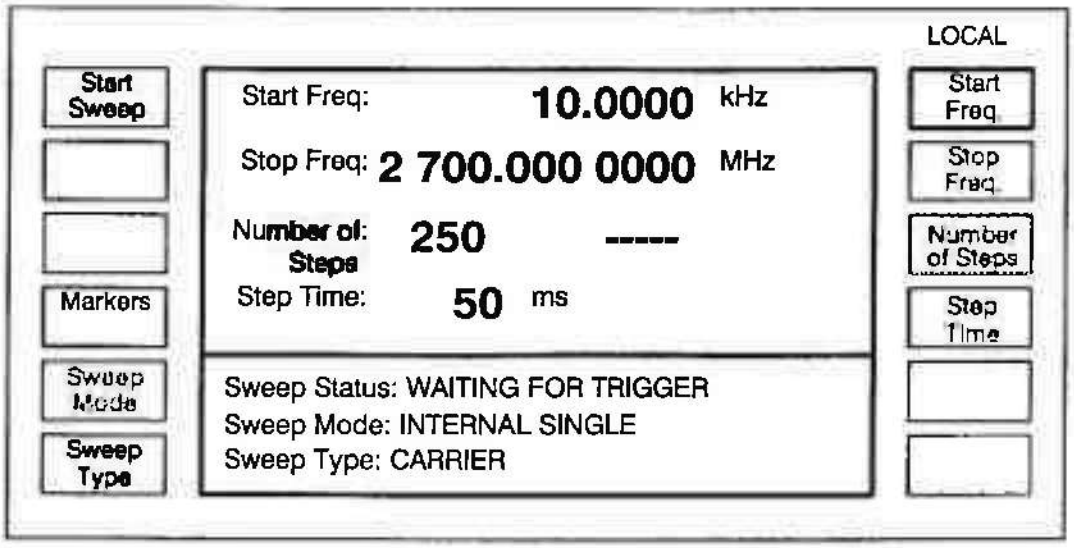


Fig. 9 Sweep parameters display

(2) Press *[Sweep Type]*. The *Sweep Type Menu* is displayed, see Table 1.

TABLE 1 SWEEP TYPE MENU

Carrier Sweep	*LF Freq. Sweep*
RF Level Sweep	*LF Level Sweep*
Int. Fn Sweep	
Sweep OFF	
EXIT	

Note...

The instrument must be in the LF mode before an LF sweep can be initiated.

(3) Select the required sweep type by pressing the appropriate soft key, e.g. *[Carrier Sweep]*. The Sweep Type screen changes to display:

Current Sweep Type : CARRIER

(4) Press [SWEEP] to return to the sweep parameters display.

Note...
When carrier frequency parameters are entered, the instrument calculates all the individual step values together with any level and modulation correction factors. While this process is taking place, the sweep status line changes to indicate *'CALCULATING SWEEP'*.

Sweep mode

36. (1) At the sweep parameters menu, press *[Sweep Mode]*. The *Sweep Trigger Mode Menu* is displayed, see Table 2.

TABLE 2 SWEEP TRIGGER MODE MENU

Internal Single	-
Internal Cont.	-
External Sweep	-
.	-
	-
EXIT	-

(2) Select the sweep mode, *[Internal single]*, *[Internal Continuous]*, or *[External Sweep]*.

(3) Press *[EXIT]* to return to the sweep parameters display menu.

Start frequency

37. (1) Select *[Start Freq]*.

(2) Enter the required start frequency via the numerical key pad and the appropriate terminator key.

Stop frequency

38. (1) Select *[Stop Freq]*.

(2) Enter the required stop frequency via the numerical key pad and the appropriate terminator key.

Number of steps

39. (1) Select *[Number of Steps]*.

(2) Enter the number of steps via the numerical key pad and the [GHz/V/ENTER] terminator key.

Note...
If an inappropriate number of steps is selected, the instrument will automatically choose a more reasonable value.

Step time

40. (1) Select *[Step Time]*.

(2) Enter the step time via the numerical key pad and the [MHz/mV/ms] terminator key.

Markers

41. A facility exists for producing markers, controlled by the Markers Menu, see Fig. 10.

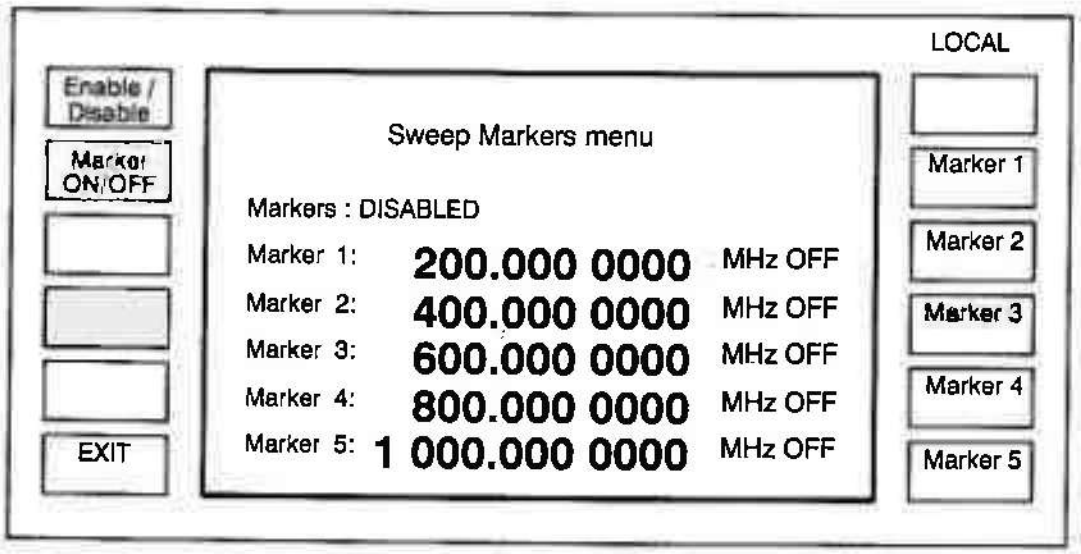


Fig. 10 Markers Menu

To set a marker, press one of the marker soft keys e.g. *[Marker 3]*, enter the required value on the key pad and terminate with the appropriate units hard key. Turn the marker ON using the *[Marker ON/OFF]* key. WHen all markers have been entered use the *[Enable/Disable]* key to activate the marker output on the rear panel.

Starting the sweep

42. From the sweep parameters menu, press *[Start Sweep]*. The sweep status single line display changes to:

Sweep Status : SWEEPING

and a solid bar increments to show the sweep progression, see Fig. 11.

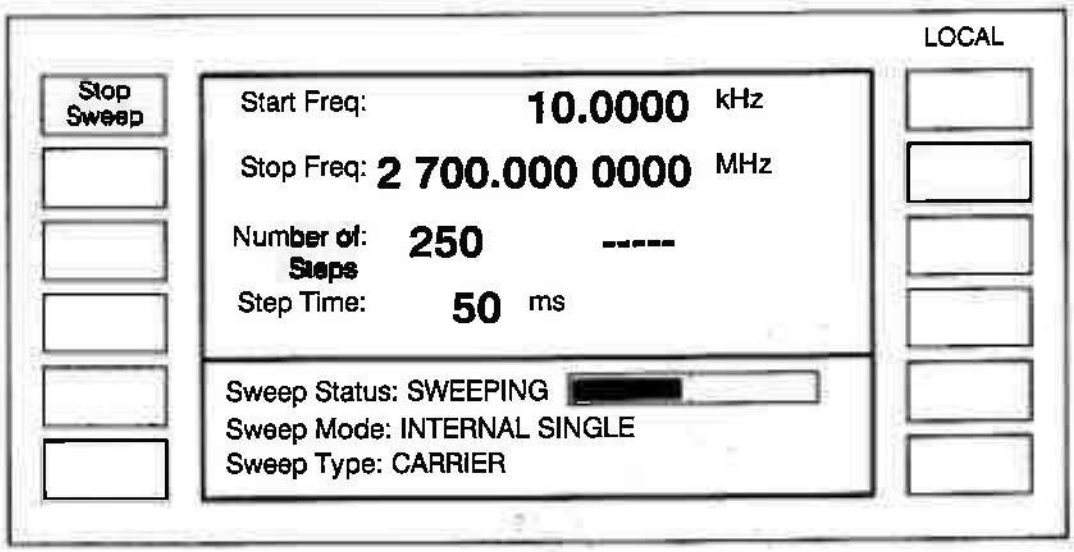


Fig. 11 Sweep in progress

Note 1...
When the sweep is in progress, only *[Stop Sweep]* is active.

Note 2...
Hard keys are disabled when a sweep is in progress.

Stopping the sweep

43. Press *[Stop Sweep]*. The sweep stops and the menu presents the opportunity to change the sweep parameters by pressing *[Reset Sweep]*, to continue the sweep or to transfer the current value of the swept parameter as the last keyed in value in the [SIG GEN] or [LF](*[LF Gen]*) mode, see Figs. 11 and 12. When the sweep is in the paused state, the ↑ and ↓ keys can be used to step the frequency up or down. The sweep can then be continued by pressing *[Continue Sweep]*. For use of external trigger modes see Para.?.

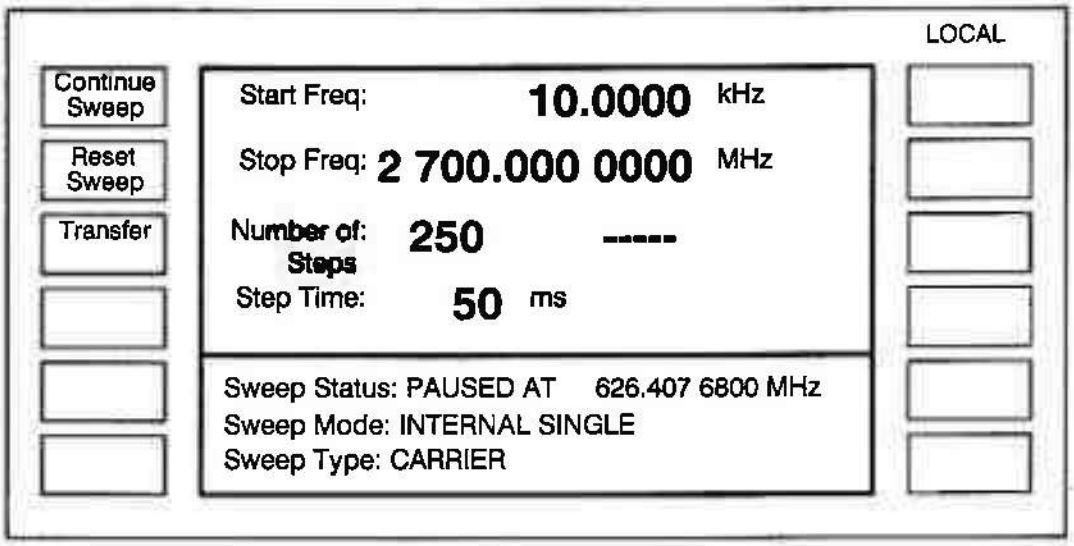


Fig. 12 Sweep stopped

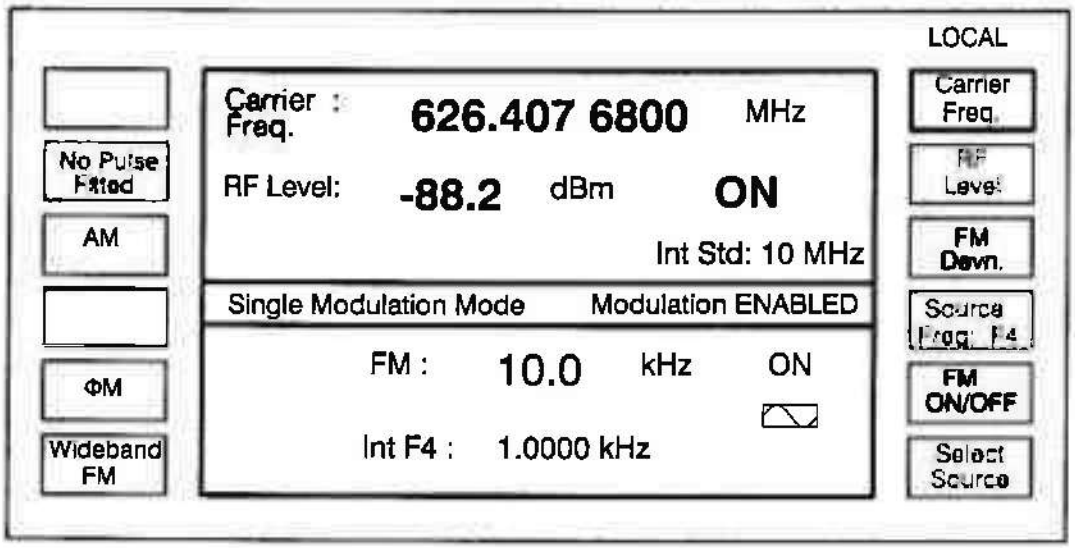


Fig. 13 Carrier frequency transferred

UTILITIES

44. The utilities options are accessed from two primary menus. Pressing the [UTIL] hard key from any menu causes the *Utilities Selection Menu 1* to appear on the display, see Table 4, unless the user is in a sub-menu of *Utilities Selection Menu 2*, in which case pressing [UTIL] will cause *Utilities Selection Menu 2 to be displayed*, see Table 10. To obtain *Utilities Selection Menu 2* from *Utilities Selection Menu 1*, press *[Utils Menu 2]* .

Table 3 UTILITIES SELECTION MENU 1

Display Adjust	*Mod Mode*
Hardware Status	*GPIB Address*
Software Status	*Calling Tones*
External Trigger	*Carrier Phase*
Time and Date	*Int/Ext Standard*
Utils Menu 2	-

Adjusting the display

45. To adjust the display, press *[Display Adjust]*. The *Display Adjust* menu is displayed on the screen, see Fig.14.

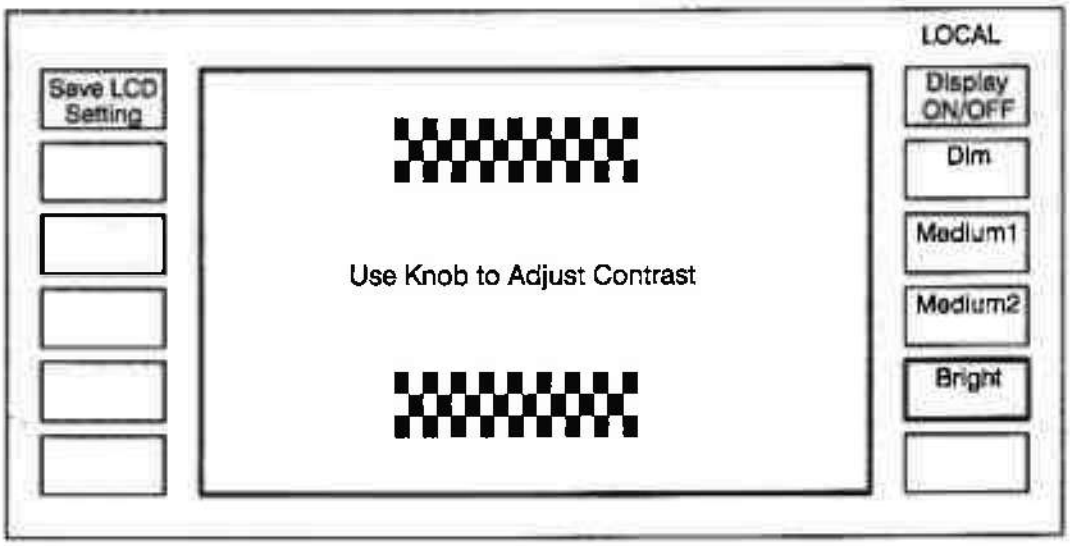


Fig. 14 Display Adjust Menu

The backlight, which is on when the instrument is switched ON, can be toggled ON or OFF using the *[Display On/Off]* key, and when ON can be varied in brightness by *[Dim]*, *[Medium 1]*, *[Medium 2]* and *[Bright]*. Contrast is adjusted with the control knob. The contrast and brightness levels can be stored in the the non-volatile memory. Press [UTIL] to return to either one of the utilities menus.

Note...

(1) To return to the main menu from any level in the utilities hierarchy, press [SIG GEN].

(2) The instrument always activates the backlighting whenever it is switched on.

Hardware information

46. To obtain a description of the instrument hardware, press *[Hardware Status]* and the following information is displayed:

Instrument type (e.g. *2031*)
Serial no. (e.g. *1543256/045*)
Options fitted (e.g. *SECOND LF OSC.*)
Attenuator type and serial no.

Pressing *[Atten. Info.]* displays attenuator calibration information.

Software information

47. To obtain a description of the instrument software, press *[Software Status]* and the following information is displayed:

Software Version Number e.g. 1.004
Part number e.g. *44533-366*
GPIB address e.g. *07* (cannot be changed from this display)

External trigger

48. To use the external trigger facility, press *[External Trigger]*. The display will change to show the External Trigger Selection Menu which has the following options for selecting the function of the SWEEP TRIGGER socket on the rear panel:

[Sweep Start]	Starts the external sweep.
[Sweep Step]	Goes to next step of external sweep.
[Send Seq Tones]	Equivalent to *[Send Tones]* on main menu.
[Recall Up]	Recall next store.
[Recall Down]	Recall previous store.
[No Ext. Trigger]	Trigger ignored (default)

Time and date

49. Press *[Time and Date]* and the screen shows the current time, date and day of the week.

Note...
The time shown does not change during display. The clock is powered by a rear panel battery.

Setting the modulation mode

50. Press *[Mod'n Mode]* to display the *Modulation Mode Selection Menu*, choose the type of modulation required by pressing *[Single]*, *[Dual]*, *[Comp]* or *[Dual Comp]* see Para.32.

Setting the GPIB address

51. Press *[GPIB Address]* to display the *GPIB Address Change Menu*. To change the address, enter the address, in the range 0-30, via the numerical key pad and press [enter]. The data is then saved automatically in the non-volatile memory. For information on operating the instrument via the GPIB , refer to Chapter 3-2.

Setting up sequential calling tones

52. Sequential calling tones are set up from a utility menu, Table 4, but are activated by pressing *[Send Tones]* which appears on the main menu after the tones have been set up. *[Send Tones]* also appears on the calling tones menu.
Pressing the *[Calling Tones]* soft key at *Utilities Selection Menu 1* calls up the *Sequential Calling Tones Utility* menu, see Table 4.

TABLE 4 SEQUENTIAL CALLING TONES UTILITY MENU

Send Tones	*Tone Sequence*
Mode Control	*Duration Sequence*
Select Standard	*Freq. Offset*
Edit Standard	*Extended Duration*
Store Tones	*Define Repeat*
Recall Tones	*Start Delay*

Pressing *[Mode Control]* enables you to attach the calling tones to a selected type of modulation, see Table 5. All other modulation is turned off when the tones are triggered and restored after the tones have been sent.

TABLE 5 CALLING TONES MODE CONTROL MENU (with *[FM]* selected)

	No. of Repeats
No Mod.	
AM	
	FM 1
ΦM	*FM 2*
EXIT	*Total FM*

The *[NO mod]* option effectively inhibits sequential tones. The tone sequence can be sent between 1 and 9 times, set by *[No. of Repeats]*, every time the *[Send Tones]* key is pressed. Setting the number of repeats to 10 allows the tones to be sent continually under control of the *[Start/Stop]* key at the main menu.

The *[Select Standard]* key causes the *Tone Standard Selection Menu* to be displayed, see Table 6.

TABLE 6 TONE STANDARD SELECTION MENU

CCIR	*EEA*
EURO	*EIA*
DZVEI	*NATEL*
ZVEI 1	*USER 1*
ZVEI 2	*USER 2*
EXIT	*TEMP*

The tone system to be used is selected by pressing the appropriate soft key. This menu also shows the frequency and timing characteristics for each tone in the group. User 1 and User 2 enable you to define the tone parameters and save them in the non-volatile memory. *[TEMP]* provides access to a volatile store which is used in the *[Edit Standard]* facility.

Pressing the [Edit Standard] key will produce the *Edit Sequential Tones Standard* menu, see Table 7.

TABLE 7 EDIT SEQUENTIAL TONES STANDARD MENU

(CCIR) to TEMP	*Tone Number*
	Tone Freq.
Store to User 1	*Default Duration*
Store to User 2	*Tone Gap*
	Next Tone
EXIT	*Previous Tone*

To change tone parameters, select the appropriate soft key, enter the value on the key pad and press the required terminator key.

[Tone Sequence] Pressing this key causes hexadecimal data entry keys to appear at the right hand side of the menu. To change the sequence, enter the tone numbers via the digits 0- 9 on the numerical keypad and the soft keys *[A]* to *[F]* and press [enter].

[Duration Sequence] Pressing this key causes *[Default Duration]* and *[Extended Duration]* to appear at the left hand side of the menu. Press either key to set the duration of tones in the sequence. A dash (-) indicates the default duration and E indicates an extended duration. These two keys disappear when [enter] is pressed.

[Define Repeat] allows a repeat tone to be set by using the [A] to [F] keys and pressing enter. To add extended duration to the repeat tone, press *[Extended Duration]* and [enter].

[Freq. Offset] To change the frequency offset value, select *[Freq. Offset]* and enter the new value on the key pad. Terminate with the [%] key.

Carrier phase adjustment

53. Pressing *[Carrier Phase]* displays the *Carrier Phase Control Menu*. To change the carrier phase with respect to a reference, rotate the control knob clockwise to advance the phase and counterclockwise to retard the phase.

Selection of frequency standard

54. Pressing *[Int/Ext Standard]* changes the menu to display the *Frequency Standard Selection Menu* which has the following options:

- *1 MHz Int.Std.*
- *5 MHz Int. Std.*
- *10 MHz Int. Std.*
- *1 MHz Ext. Std.*
- *5 MHz Ext. Std.*
- *10 MHz Ext. Std.*

If an internal standard is selected, it is available as an output at the rear panel. Selecting an external option enables the instrument to accept a standard from an exterior source at that frequency. These settings are saved in the non-volatile memory.

Selection Menu 2

55. Press *[Utils Menu 2]* from *Utilities Selection Menu 1*. The display now changes to show *Utilities Selection Menu 2*, see Table 8. This menu allows access to the protected data. Utilities on this menu have either 1st or 2nd level protection. If the instrument is locked, the appropriate level must be unlocked otherwise the utility will only be usable in a read only mode. To change parameters, the function must be unlocked.

TABLE 8 UTILITIES SELECTION MENU 2

Cal. Value	*Display Blanking*
Latch Data	*Power Up Options*
Elapsed Time	*RF Level Units*
Set Time and Date	*RF Offset*
Lock and Unlock	
Utils Menu 1	

Calibration

56. Pressing *[Cal. Value]* brings the *Calibration Utilities Menu* to the display. This menu tells you when the last complete check was made and when the next calibration check is due. It also tells you the date on which the following items were adjusted:

Path/Source Gain
Modulation
FM Tracking
RF Level
Frequency Standard

It is possible to inspect the calibration value of these items but calibration cannot be carried out unless the protection facility is unlocked at Level 2. Full details regarding calibration can be found in the Service Manual.

Latch data

57. The latch data menu for the decimal mode is shown in Table 9, and for the binary mode in Table 10.

TABLE 9 LATCH DATA MENU (decimal mode)

Restore On/Off	*Latch Number*
1,2,3,5, Latches	*Latch Data*
Decimal/Binary	-
Next Latch	-
Previous Latch	-
-	-

TABLE 10 LATCH DATA MENU (binary mode)

Restore On/Off	*Latch Number*
1,2,3,5 Latches	-
Decimal/Binary	-
Next Latch	-
Previous Latch	*Toggle Bit*
Cursor Left	*Cursor Right*

This facility is intended for use as a diagnostic aid. Data which is being sent to latches within the instrument can be inspected on the screen. Revised data can be sent. A latch is specified by pressing *[Latch Number]* and entering the number via the key pad and the [enter] key. Two, three or five latches can be grouped together and treated as single number by using the *[1,2,3,5 Latches]* key. Press the key once to display 2 latches, twice for 3 latches and three times to display 5 latches. In the 1 or 2 latch mode, the latch contents can be displayed in either decimal or binary form by pressing the *[Decimal/Binary]* key. In the binary mode data is displayed as 8 or 16 bits with a cursor for selecting individual bits. A selected bit can be toggled between the two states by pressing *[Toggle Bit]*. In the 3 and 5 latches mode the [Decimal/Binary] key is erased from the menu. For further information consult the Service Manual.

Elapsed time

58. Pressing *[Elapsed time]* displays the number of operating hours which have elapsed since the time was reset and the date of the reset. To reset the counter, the instrument must first be unlocked at Level 2. Press *[Reset Elapsed]* and the display will return to zero. When unlocked to Level 2, the display also shows the total number of operating hours that have elapsed since the instrument was first switched on during manufacture. This value cannot be reset and is intended as an aid to assess equipment utilisation.

Set time and date

59. To set the time and the date, the instrument must be unlocked to Level 2. Press *[Set Time and Date]* to display the *Clock Set Utility*. Two soft keys, *[Set Time]* and *[Set Date]*, appear on the display. When resetting, the day of the week is automatically calculated as a check.

Locking and unlocking

60. When Level 1 and Level 2 are both locked, the menu looks like this:

Unlock Level 1
Unlock Level 2

Set Serial

Press *[Unlock Level 1]* and the message *Enter 4 digit password* will appear on the display. Level 1 is unlocked by entering the 4 digits on the key pad and pressing [enter]. The menu will change and a soft key, *[Lock level 1]*, will appear on the left hand side. The default password is 1234. If this password is not recognised by the instrument, then the password has been changed by your calibration/repair department which should be consulted for further information.

Press *[Unlock Level 2]* and the message *Enter 6 digit password* will appear on the display. Level 2 is unlocked by entering the 6 digits on the key pad and pressing [enter]. The menu will change to look like this:

Lock Level 1
Lock Level 2

Set Levl Password
Set Lev2 Password *Set Serial*

From this menu the passwords can be changed.

Display blanking

61. To prevent sensitive data from being displayed, the instrument must be unlocked to Level 2. This facility is not accessible to the user. Consult the Service Manual for further information.

Power up options

62. Unlock to Level 1. Two options are available from the *Utilities Selection Menu 2*, *[Factory]* and *[Memory]*. When *[Factory]* is pressed, the factory set power up state is recalled. Pressing *[Memory]* causes *[Memory Number]* to appear at the right hand side of the menu. To change the power up state of the instrument to a particular setting, enter the memory number (for a full store only) on the key pad and press [enter].

RF level units

63. With the instrument unlocked to Level 1, pressing [RF Level Units] changes the menu as shown in Table 11.

TABLE 11 RF LEVEL UNITS

Save Units	*dBm*
dBV PD	*dBV EMF*
dBmV PD	*dBmV EMF*
dBµV PD	*dBµV EMF*
Volts PD	*Volts EMF*

The RF level units as shown on the main [SIG GEN] menu can be altered at the *RF Level Units Selection Menu*. A linear unit, EMF or PD, is in use when the [V], [mV] or [µV] hard keys are pressed. When the [dB] key is pressed, the unit shown at the display will be a logarithmic one, dBm or dB relative to a volt, millivolt or microvolt, EMF or PD. The selected units can be saved to the non-volatile memory using the *[Save Units] key*.

RF offset

64. With the instrument unlocked to Level 1, pressing *[RF Offset]* produces this layout for the soft keys:

Save Offset	*Carrier Freq.*
Enable/Disable	*Offset Value*
Offset ON/OFF	

To compensate for cable or switching losses or to standardise a group of instruments so that they give identical measurements, the RF output level can be offset by up to ±2 dB. This is done by selecting *[Offset Value]* and either keying in the value or making the adjustment with the control knob. A separate offset can be set for the carrier frequency range 10 kHz to 337.5 MHz and each octave above this. Offsets can be turned on or off individually using the *[Offset ON/OFF]* key or all offsets can be turned on or off via the *[Enable/Disable]* key.

LOW FREQUENCY OPERATION

65. The instrument has two modes of LF operation, it can be used either as a modulation signal monitor or as an independent low frequency generator. Pressing [LF] displays either the *LF Monitor Menu* or the *LF Generator Menu*, depending on which mode was last selected.

Modulation monitor

66. The left hand side of the LF Monitor Menu, see Table 12, varies according to the modulation mode; single, composite, dual or dual composite. In each case the right hand side is occupied by a single soft key, *[LF Gen.]*.

TABLE 12 LF MONITOR MENU (LHS)

Single	Comp.	Dual	Dual Comp.
Mod. Drive	*Mod. Drive*	*AM Drive*	*AM Drive*
Mod. Source	*Mod. 1 Source*	*AM Source*	*AM 1 Source*
	Mod. 2 Source		*AM 2 Source*
		FM/ΦM Drive	*FM/ΦM Drive*
		FM/ΦM Source	*FM/ΦM 1 Source*
			FM/ΦM 2 Source

Modulation source monitoring

67. To monitor a modulating signal source, press the appropriate key. The source monitor level and the source information appear on the display. The modulating signal output is fed to the LF OUTPUT socket.

Modulation drive monitoring

68. Modulation drive monitoring is intended for the experienced user to monitor complex modulating signals from internal and external sources. To monitor a modulation drive, press the appropriate key. The LF Monitor Level and the selected drive are displayed.

69. The summed AM drive signal is fed to the LF OUTPUT socket. The signal is the sum of both AM channels, if in a dual mode, irrespective of the modulation sources selected. The LF level function controls the output level at 100% depth, therefore the actual output voltage depends on the modulation depth. If AM is turned off, the associated LF output is removed.

70. The summed FM/ΦM drive signal is also fed to the LF OUTPUT socket. The signal is the sum of both channels, if in a dual mode, irrespective of the modulation sources selected. The FM drive signal at the monitored point varies over a range of approximately 3 dB (except at deviation frequencies below 1 kHz) depending on the set modulation and the FM tracking value. If FM/ΦM is turned off, the LF signal is removed. If one component of a dual modulation setting is turned off, the component which is left on remains at the same level.

Note...
Wideband FM and Pulse modulating signals are not accessible via the monitor mode.

Use as an independent LF generator

71. To use the instrument as an independent LF generator, select *[LF Gen.]* at the *LF Monitor Menu*. The *LF Generator Menu* appears on the display as shown in Table 13.

TABLE 13 LF GENERATOR MENU

Sine Wave	*LF Freq.*
Triangle Wave	*LF Level*
•	•
•	•
LF Step	•
LF Δ	*LF Monitor*

In this mode, one internal oscillator is 'stolen' from the signal generator modulation resources. LF frequency and LF level are adjusted by pressing the appropriate key and entering the value via the numerical keypad and pressing [enter]. To set step values, press *[LF Step]* for the *LF Step Menu*. *[Freq.Step]* or *[Level Step]* can be selected and the values entered as before. To regain the oscillator as a modulation source, the monitor mode should be selected.

MEMORY

72. Pressing the [MEM] hard key causes the store/recall menu to be displayed. There are four types of store, full, partial, carrier frequency and sweep.

Full store

73. Selecting *[Full Store]* enables the storage of a complete instrument setting, i.e. carrier frequency, RF level, modulations and their increments, ON/OFF and source information. Also stored are all 6 modulation oscillator frequencies, plus one increment, and the LF Generator/Monitor setting. *[Inhibit Carrier]* provides the option not to recall the carrier frequency setting. There are 50 locations for full storage.

Partial store

74. This is a less comprehensive store of only those parameters which currently affect the RF output; carrier frequency, RF level, modulations in use (without increments), ON/OFF and source information and the two modulation oscillator frequencies in use. As with the full store, the option not to recall the carrier frequency is provided. There are 50 locations for partial storage.

Carrier frequency store

75. The carrier frequency store has 100 locations for the storage of carrier frequency only. This store can be used in conjunction with the full and partial stores to to apply a set of test conditions to a range frequencies.

Sweep store

76. The sweep store has 20 locations for the storage of complete sets of sweep parameters.

Note...
Sweep parameters can be stored or recalled whether the instrument is in sweep mode or not. They are only used when sweep is selected.

Store and recall

77. To store information, press the soft key for the type of store required, e.g. *[Partial Store]*, see Table 16, define a store location via the numerical key pad, and press [enter]. To recall data, press the soft key for the type of recall required, e.g. *[Carrier Recall]* and select the location by means of the keypad. The [↑] and [↓] keys can be used to to recall the next locations. Pressing *[Return]* recalls the location last specified on the numerical key pad.

Note...

The settings for the sequential calling tones are stored and recalled via the calling tones menu in UTILITIES, see Table 4. These stores can be erased from the Store Erase Menu, Table 15. This facility is for use by servicing departments and therefore is not normally available to the user.

TABLE 14 STORE/RECALL MENU

Full Store	*Full Recall*
Partial Store	*Partial Recall*
Carrier Store	*Carrier Recall*
Sweep Store	*Sweep Recall*
Store Erase	•
Return	*Inhibit On/Off*

Store Erase

78. Pressing *[Store Erase]* causes the *Store Erase Menu*, see Table 17, to appear on the screen.

TABLE 15 STORE ERASE MENU

Full Store	*Erase*
Partial Store	-
Carrier Store	•
Sweep Store	-
Tones Store	-
Entire Stores	•

Chapter 3-2

GPIB OPERATION

CONTENTS

INTRODUCTION

1. The 2030 series signal generators can be operated remotely from a personal computer or dedicated controller. All functions can be controlled by coded messages sent over the interface bus via the 24 way socket on the rear panel of the instrument. IEEE Standard 488.2 is implemented, which defines the protocols and syntax of commands.

The 2031 can function either as a talker or a listener. In the listen mode, both the GPIB address and parameters can be set. In the talk mode, inspection of these functions, current settings and the identity string is possible along with a display of a user string only, as a non-printable character block. This allows the controller to check that information has been transferred without error or to learn settings for later use.

GPIB FUNCTIONS

2. The interface functions which provide the communication capabilities are as follows:

Source handshake (SH1)	complete capability.
Acceptor handshake (AH1)	complete capability.
Talker (T6)	basic talker, serial poll, unaddress if MLA.
Listener (L4)	basic listener, unaddress if MTA.
Service Request (SR1)	complete capability.

Remote/Local (RL1)	complete capability, when in remote or local lock out, selected functions can be enabled and disabled using commands sent over the bus.
Device clear (DC1)	complete capability, the instrument adopts its preset state.
Device trigger (DT1)	complete capability
Parallel Poll (PP0)	no capability.
Controller (C0)	no capability.
Tri-state drivers (E2)	as opposed to open collector drivers.

These interface functions are defined as follows:

SH1 Source handshake

The source handshake sequences the transmission of each data byte over the bus data lines. The sequence is initiated when the controller or talker becomes active. The purpose of the function is to synchronize the rate at which bytes become available to the rate at which accepting devices on the bus can receive the data.

AH1 Acceptor handshake

The acceptor handshake sequences the reading of each data byte from the bus data lines.

T6 Talker

The talker provides the instrument with the ability to send device dependent messages over the bus to other devices. The instrument has the ability to talk only when addressed as a talker.

L4 Listener

The listener function enables the intrument to receive device dependent messages over the bus. The capability exists only when the instrument is addressed to listen via the bus by the controller.

SR1 Service request

The service request enables the instrument to inform the controller when it requires attention.

RL1 Remote/local

The remote/local function allows the instrument to switch between local front panel or control via device dependent messages over the bus.

DC1 Device clear

The device clear function enables the instrument to be cleared either individually or as part of a group of devices.

DT1 Device trigger

The device trigger function enables the instrument to be started in its basic operation either individually or as part of a group of devices.

The GPIB interface for this instrument consists of tri-state bus drivers, E2, as distinct from open collector drivers.

PROGRAMMING

3. The instrument is operated remotely by a series of commands sent by a controller over the interface bus. In order to be effective, these commands must conform to a specified message format.

Syntax

Before studying the message format, it is useful to be familiar with the various symbols which may be used.

Notation

<aaaaa> Enclosed item in lower case letters indicates information that is to be entered as a string, e.g. <header>

<AAAAA> Enclosed item in upper case letters indicates a keyboard function that is to be entered as a single key stroke, e.g. <SPACE>

{|} Enclosed items are alternatives, e.g.

{V|dB} = V or dB

[ ] Enclosed item is optional

... Indicates a repetition of the previous item

Message format

The form of a command statement is:

<header> <data>[<suffix>]

Note that <data> must always be preceded by a space (if the suffix field is omitted,the default suffix listed in the table will be assumed).

Note...

The semi-colon (;) is interpreted by this instrument as the program message unit separator.

The colon

The colon is used to separate components of the compound headers used in programming the 2030 and 2031 as specified in IEEE Standard 488.2. e.g.

```
AM:OFF
```

In this example AM is a root and OFF is a branch. More complex headers may comprise a hierarchy of branches, such as RFLV:OFFS:ON. If several commands with a common header are required, a short form can be used. e.g. the three command statements:

```
AM:OFF
AM:DEPTH 30PCT
AM:ON
```

can be written as one statement with three segments:

```
AM:OFF;DEPTH 30PCT;ON
```

Note the use of semi-colons to back the command segments down the hierarchy to the common root, and the space before the data '30PCT'. The common root remains in force until a program message terminator is sent. This is defined as <NL>, <NL>AEND or <last char>AEND, meaning that the EOI line is asserted while the New Line or Line Feed character (10 decimal) is sent. To combine different commands within a single program message, the colon is used as the leading character of the new common header. e.g.

```
AM:OFF
AM:DEPTH 30PCT
AM:ON
CFRQ:VALUE 100MHZ
RFLV:VALUE 10DBM
```

can be written as:

```
AM:OFF;DEPTH 30PCT;ON;:CRFQ:VALUE 100MHZ;:RFLV:VALUE 10DBM
```

Common commands

Common command instructions are preceded by an asterisk (*) to distinguish them from device dependent data such as instrument programming strings, e.g. the *OPC? (output complete query) is used to provide a response message when the output signal is valid.

Mnemonic	Description
*IDN?	Identification query
*RST	Reset
*TST?	Self test
*OPC(?)	Output complete (query)
*WAI	Wait to complete
*CLS	Clear status
*ESE(?)	Event status enable (query)
*ESR(?)	Event status register (query)
*SRE(?)	Service request enable (query)
*STB?	Read status byte query
*TRG	Device trigger
*OPT?	Option identification query
*PUD(?)	Protected user data (query)

TABLE 1 DEVICE DEPENDENT COMMANDS

<char> = characters
<nrf> = number, using flexible
numeric representation*
<src> = source

The value may be expressed as a signed or unsigned number in any of the following formats:

NR1: Decimal integer, e.g. 1234 or -567
NR2: Floating point number, e.g. 1.234 or -56.789
NR3: Fixed point number with exponent, e.g. 1.2345E5 or +6.7E-8

Header	Data type	Default Suffix	Allowed Suffices	Action
IMODE	<char>		= { NORMAL | SWEEPER | CAL }	Select Instrument Mode
	Normal	Mode	Commands	
CFRQ	<nrf>	HZ	GHZ,MHZ,KHZ,HZ	Set Carrier Frequency (short form)
:VALUE	<nrf>	HZ	GHZ,MHZ,KHZ,HZ	Set Carrier Frequency
:INC	<nrf>		GHZ,MHZ,KHZ,HZ	Set Carrier Freq. step
:UP	-	-		Go UP 1 step
:DN	-	-		Go DOWN 1 step
:RET	-	-		Do "return"
:XFER	-	-		Do "transfer"
:PHASE	<nrf>	pi/128		Adjust Phase of Carrier (+/- 999)
CFRQ?				
RFLV	<nrf>	***	DBM	Set RF output level (short form)
:VALUE			DBV	Set RF output level
			DBMV *** default unit set by UNITS - dBm at switch-on	
			DBUV (pd/emf	
			V preset by TYPE)	
			MV	
			UV	
:INC	<nrf>	DB	(dB only)	Set RF level step (dB)
:UP	-	-		Go UP 1 step
:DN	-	-		Go DOWN 1 step
:RETN	-	-		Do "return"
:XFER	-	-		Do "transfer"
:ON	-	-		Turn RF output ON
:OFF	-	-		Turn RF output OFF
:TYPE	<char>		= { emf | pd }	Sets Bus-units with below..
:UNITS	<char>		= { dBm | dBV | dBmV | dBuV | V | mV | uV }	
:OFFS:VALUE	<nrf>	dB	dB	Set Offset of current band
:ON				Turn ON offset of current band
:OFF				Turn OFF offset of current band
:ENABLE				Enable Offset
:DISABLE				Disable Offsets

:SAVE				Store Offsets in EAROM
RFLV?				
RFLV:OFFS?				
MODE	<modelist>			<modelist> = 1 to 4 of these modulations: (AM | AM1 | AM2 | FM | FM1 | FM2 | PM | PM1 | PM2 | WBFM | PULSE) these are character data separated by commas: <ch>[,<ch>...] Only valid combinations are accepted.
MODE?				
MOD:ON	-	-		Turn mod. Globally ON
:OFF	-	-		Turn mod. Globally OFF
MOD?				
FM \	<nrf>	HZ	(GHZ),MHZ,KHZ,HZ	Set FM deviation (short form)
FM1 | :DEVN	<nrf>	HZ	(GHZ),MHZ,KHZ,HZ	Set FM deviation
FM2 / :<src>				Select mod. source
:ON	-	-		Turn FM ON (locally)
:OFF	-	-		Turn FM OFF (locally)
:INC	<nrf>	HZ	(GHZ),MHZ,KHZ,HZ	Set FM step size
:UP	-	-		Go Up 1 step
:DN	-	-		Go Down 1 step
:RETN	-	-		Do "return"
:XFER	-	-		Do "transfer"
FM?				
FM1?				
FM2?				
PM \	<nrf>	RAD	RAD	Set Phase deviation (short form)
PM1 | :DEVN	<nrf>	RAD	RAD	Set Phase deviation
PM2 / :<src>				Select mod. source
:ON	-	-		Turn PhM ON (local)
:OFF	-	-		Turn PhM OFF (local)
:INC	<nrf>	RAD	RAD	Set PhM step size
:UP	-	-		Go UP 1 step
:DN	-	-		Go DOWN 1 step
:RETN	-	-		Do "return"
:XFER	-	-		Do "transfer"
PM?				
PM1?				
PM2?				
AM \	<nrf>	PCT	PCT	Set AM Depth (short form)
AM1 | :DEPTH	<nrf>	PCT	PCT	Set AM Depth
AM2 / :<src>				Select mod. source
:ON	-	-		Turn AM ON (local)
:OFF	-	-		Turn AM OFF (local)
:INC	<nrf>			Set AM step size
:UP	-	-		Go Up 1 step
:DN	-	-		Go DOWN 1 step
:RETN	-	-		Do "return"
:XFER	-	-		Do "transfer"

AM?				
AM1?				
AM2?				
			<src> = (EXT1DC | EXT1AC | EXT1ALC | EXT2DC | EXT2AC | EXT2ALC | INTF1 | INTF2 | INTF3 | INTF4 | INTF5 | INTF6)	
DCFMNL	-			Perform DC FM/WBFM null operation
WBFM	<nrf>	HZ	(GHZ),MHZ,KHZ,HZ	Set WBFM deviation (short form)
:DEVN	<nrf>	HZ	(GHZ),MHZ,KHZ,HZ	Set WBFM deviation
:ON	-			Turn WBFM ON (local)
:OFF	-			Turn WBFM OFF (local)
:AC	-			Select "AC" coupling
:DC	-			Select DC coupling
WBFM?				
PULSE:ON	-	-		Turn Pulse mod. ON
:OFF	-	-		Turn Pulse mod. OFF
PULSE?				
INTF1 \	<nrf>	HZ	(GHZ), MHZ, KHZ, HZ	Set mod.osc. frequency (short form)
INTF2 | /:FREQ	<nrf>	HZ	(GHZ), MHZ, KHZ, HZ	Set mod.osc. frequency
INTF3 | |:SIN	-	-		Select sine waveform
INTF4 | |:TRI	-	-		Select Triangle wave
INTF5 | |:UP				Go UP 1 step
INTF6 / |:DN				Go DOWN 1 step
|:RETN				Do "return"
|:XFER				Do "transfer"
|:INC				Set Increment
|:PHASE	<nrf>	deg	deg	Adjust Phase of Mod. Osc.
|:CTC1	<nrf>	-		Select Cont.Tone Grp1 - tonenumber
|:CTC2	<nrf>	-		Select Cont.Tone Grp2 - tonenumber
|:USER	<nrf>	-		Select Cont.Tone User - tonenumber
\:TEMP	<nrf>	-		Select Cont.Tone Temp.- tonenumber
INTF1?				
INTF2?				
INTF3?				
INTF4?				
INTF5?				
INTF6?				
CTONES:EDIT:TNUM	<nrf>	-		Select Tone-number 0-15
:TFRQ	<nrf>	HZ	(GHZ,MHZ,) KHZ,HZ	Set Tone frequency
:LOAD	<char>		= { CTC1 | CTC2 | USER }	Copy Standard to Temp
:SAVE				Save Temp to User
SEQT:SEQ	<str>		{0..9 | A..F } eg. "123C5"	Set Tone sequence
:DUR	<str>		(- | E | e) eg. "---E-"	Set Duration Mask
:SEND	<nrf>	-		Send Sequence 'n' times
:STOP				Abort Sequence.
:MODE:STD	<char>		= <standards>	Select Tones standard

:MOD	<char>		= <mods>	Select Modulation Channel
:PARAM:EXTD	<nrf>	ms	ms	Set Extended Duration
:SHFT	<nrf>	PCT	PCT	Set Frequency Shift (+/-/10.0%)
:RPTT				Select Repeat Tone
:SDLY	<nrf>	ms	ms	Set Starting Delay
:EDIT:TNUM	<nrf>	-		Select Tone to Edit
:TFRQ	<nrf>	HZ	(GHZ,MHZ,) KHZ,HZ	Set Tone Freq.
:TDUR	<nrf>	ms	ms	Set Normal Tone Duration
:TGAP	<nrf>	ms	ms	Set Inter-element Gap
:LOAD	<char>		= <standards> (except TEMP)	Load a Standard to Temp
:SAVE	<char>		= { USER1 | USER 2 }	Copy Temp to User1/2

<standards> = { CCIR | EURO | DZVEI | ZVEI1 | ZVEI2 | EEA | EIA | NATEL | TEMP | USER1 | USER2 }

<mods> = { AM1 | AM2 | FM1 | FM2 | PM1 | PM2 | TOTAL_AM | TOTAL_FM | TOTAL_PM | NO_TONES }

SEQT?				
SEQT:MODE?				
SEQT:PARAM?				
SEQT:EDIT?				
LF:ON	-	-		Turn LF o/p ON
:OFF	-	-		Turn LF o/p OFF
:GEN				Select AF Generator
:MON	<char>	●	<monitor_modes>	Select Mod.Monitor

<monitor_modes> = { AM1S | AM2S | AMD | ANG1S | ANG2S | ANGD | OFF }

LF?				
LFGL	<nrf>	V	V, mV, uV	Set LF Gen. level (short form)
:VALUE	<nrf>	V	V, mV, uV	Set LF Gen. level
:INC	<nrf>			Set LF Gen. Level step
:UP				Go Up 1 step
:DN				Go DOWN 1 step
:RETN				Do "return"
:XFER				Do "transfer"
LFGL?				
LFGF	<nrf>	HZ	(GHZ),MHZ,KHZ,HZ	Set LF Gen. freq. (short form)
:VALUE	<nrf>	HZ	(GHZ),MHZ,KHZ,HZ	Set LF Gen. freq.
:INC	<nrf>	HZ	(GHZ),MHZ,KHZ,HZ	Set LF Gen. freq. step
:UP				Go Up 1 step
:DN				Go DOWN 1 step
:RETN				Do "return"
:XFER				Do "transfer"
:SIN				Select Sine Gen. waveform
:TRI				Select Triangle Gen. waveform
LFGF?				
STO:FULL	<nrf>			Full Store 0-49

:PART	<nrf>			Partial Store 0-49
:CFRQ	<nrf>			Carrier Freq Store 0-99
:SEQT	<nrf>			Seq.Tones Store 0-19
:SWEEP	<nrf>			Sweep Store 0-19
RCL:FULL	<nrf>			Recall Full 0-49
:FXCF	<nrf>			Recall Full 0-49 (no CF)
:PART	<nrf>			Recall Partial 0-49
:RXCF	<nrf>			Recall Partial 0-49 (no CF)
:CFRQ	<nrf>			Recall Carrier Freq 0-99
:SEQT	<nrf>			Recall Seq.Tones 0-19
:SWEEP	<nrf>			Recall Sweep 0-19
ERASE:FULL	-			Erase Full Stores 0-49
:PART	-			Erase Partial Stores 0-49
:CFRQ	-			Erase Carrier Freq Stores 0-99
:SEQT	-			Erase Seq.Tones Stores 0-19
:SWEEP	-			Erase Sweep Stores 0-19
:ALL	-			Erase All Stores
RPPR	-			RPP Reset
FSTD	<char>		= { INT1 | INT5 | INT10	Select Internal Std(With o/p freq.)
			| EXT1 | EXT5 | EXT10 }	Select External Std. input freq.
FSTD?				
BLANK	<nrf>	-		Display Blanking
				0 = toggle CF, 1 = toggle RFLV,
				2 = toggle INTF,
				3 = toggle MODN, 4 = all Blanked
BACKL:ON	-			Backlighting On/Off
:OFF	-			
TIME:MIN	<nrf>	-		Set RTC
:HRS	<nrf>	-		""
TIME?				Time Query
DATE:YEAR	<nrf>	-		Set RTC
:MONTH	<nrf>	-		""
:DAY	<nrf>	-		""
DATE?				Date Query
OPER?				Total Operating Hours Query
ELAPSED:RESET				Reset Elapsed Time
ELAPSED?				Elapsed Time Query
PORT:ADDR	<nrf>	-		Select Latch Adress
:ONE	<nrf>	-		Set Byte data
:TWO	<nrf>	-		Set 2-byte data

:THREE	<nrf>	-		Set 3-byte date
:FIVE	<nrf>	-		Set 5-byte data (up to 11 digits)
:RON	-			Enable Restoring
:ROFF	-			Disable Restoring
PORT:ONE?				Query one byte of latch data at current address
:TWO?				Query two bytes
:THREE?				Query three bytes
:FIVE?				Query five bytes
UNLOCK	-			Enables ' *PUD '
LOCK	-			Disables ' *PUD '
ERROR?				Query Next Error on Queue
DEFTRG	<char>		= (SEQT | FLSWP | SSSWP | VOID)	Set Device Trigger Function

Sweep Mode Commands

SWEEP:CFRQ\/:START	<nrf>	***	*** Units as for	Set Initial Value
:RFLV| :STOP	<nrf>	***	*** Main Parameter	Set Final Value
:LFGF| :STEP	<nrf>	-		Set Number of Steps
:LFGL| :TIME	<nrf>	ms	ms	Set Time per Step
:INTF| :MKRNUM	<nrf>	-		Set Current Marker Number
:MOD / :MKRON	-	-		Turn Current Marker ON
:MKROFF	-	-		Turn Current Marker OFF
:VALUE	<nrf>	***	***	Set Value of Current Marker
:MKRON	-			Enable Sweep Markers
:MKROFF	-			Disable sweep Markers
SWEEP:CFRQ?				Sweep Queries
:RFLV?				"
:LFGF?				"
:LFGL?				"
:INTF?				"
SWEEP?				"
SWEEP:MODE	<char>		= (SNGL | CONT | EXT)	
:TYPE	<char>		= (OFF | CFRQ | RFLV | LFGF | LFGL | INTF1 | INTF2 | INTF3 | INTF4 | INTF5 | INTF5 | INTF6 ...)	
SWEEP:GO				Commence Sweep
:HALT				Pause Sweep
:CONT				Continue Sweep
:RESET				Reset sweep to Start Value
:XFER				Transfer Paused Value to Main Parameter

Calibrate Mode Commands & Queries

CAL:FSTD:CRSE	<nrf>	-		Set Freq.Std. Coarse

:FINE	<nrf>	-		Set Freq.Std. Fine
:SAVE				
:ABORT				
CAL:FSTD:CRSE?				
:FINE?				
CAL:SRCPTH:NODE	<char>		= <nodes>	Select Node
:VALUE	<nrf>			Set Cal-factor
:VALUE?				
:SAVE				
:ABORT				
			<nodes> = { EXT1 | EXT1ALC | EXT2 | EXT2ALC | INT1 | INT2 | AM1 | AM2 | FM1 | FM2 | LF }	
CAL:RFLV:BAND	<char>		= { BFO | B0 | B1 | B2 | B3 }	Select Band
:ZERO	<nrf>			Select Low Cal-point
:TEN	<nrf>			Select High Cal-point
:VALUE	<nrf>			Set Cal-factor
:VALUE?				
:SAVE				
:ABORT				
CAL:MOD:TYPE	<char>		= <types>	Select Function
:VALUE				Set Cal-factor
:VALUE?				
:SAVE				
:ABORT				
			<types> = { AM | FM0 | FM1 | PM | WBFM |PULSE0 | PULSE1 }	
CAL:FMSC:VCO	<nrf>	-	n = 0...3	Initiate Self-cal of VCO 'n'
:SAVE				
:ABORT				
CAL:DATE:YEAR				Set Calibration Due Date
:MONTH				"
:DAY				"
CAL:DATE?				Cal Due Query
CAL:CHECK				Sets Cal. Checked = Today
:CHECK?				Cal. Checked Query

Queries & associated Responses:

The following respond in the form of 'learn strings' that are re-loadable into the instrument as commands. The responses contain most of the information associated with the function queried.

IEEE 488.2 does not allow units nor leading padding spaces.

Data is sent in Default units.

For each query an example of a response is given, where responses are similar for a group of queries not all are listed. Some queries can produce more than one type of response - an example of each is usually given.

CFRQ?	:CFRQ:VALUE 1000000000.0;INC 25000.0
MODE?	:MODE FM1,FM2
AM? | AM1?	:AM1:DEPTH 56.6;INTF3;ON;INC 5.0
AM2?	:AM2:DEPTH 6.0;EXT2ALC;OFF;INC 5.0
FM? | FM1?	:FM1:DEVN 25000.0;INTF2;ON;INC 1723.4
FM2?	
PM? | PM1?	
PM2?	:PM2:DEVN 1.00;EXT1DC;OFF;INC 0.05
INTF1?	:INTF1:FREQ 440.0;INC 100.0;SIN
INTF2?	:INTF2:FREQ 256000.5;INC 100.0;TRI
INTF3?	:INTF3:CTC1 5
INTF4?	:INTF4:USER 12
INTF5?	
INTF6?	
WBFM?	:WBFM:DEVN 500000.0;AC;ON
PULSE?	:PULSE:OFF
RFLV?	:RFLV:UNIT DBM;VALUE -103.5;INC 2.0;OFF
	:RFLV:UNIT MV;TYPE EMF;VALUE 33.3;INC 2.0;ON
RFLV:OFFS?	:CFRQ:VALUE 500000000.0;:RFLV:OFFS:VALUE -0.4;ON;ENABLE
MOD?	:MOD:ON
LF?	:LF:GEN;ON
	:LF:MON AM1S;OFF
LFGL?	:LFGL:VALUE 125.8;INC 1.0
LFGF?	:LFGF:VALUE 25067.8;INC 500.0
FSTD?	:FSTD INT10
SEQT?	:SEQT:SEQ "12345B7";DUR "----E--"
SEQT:PARAM?	:SEQT:PARAM:EXTD 200;SHFT -1.6;RPPT "E";SDLY 300
SEQT:MODE?	:SEQT:MODE:STD CCIR;MOD TOTAL_FM
SEQT:EDIT?	:SEQT:EDIT:TNUM 3;TFREQ 1342.7;TDUR 40;TGAP 0
CTONES:EDIT?	:CTONES:EDIT:TNUM 8;TFREQ 202.8
SWEEP?	:SWEEP:MODE CONT;TYPE CFRQ;MKROFF
SWEEP:CFRQ?	:SWEEP:CFRQ:START 1000000.0;STOP 1000000000.0;STEP 100;TIME 33
SWEEP:CFRQ:VALUE?	:SWEEP:CFRQ:MKRNUM 2;VALUE 250000000.0;MKRON
+ similar for each sweep type	
PORT:ONE?	:PORT:ADDR 27;ONE 127
PORT:TWO?	:PORT:ADDR 1;TWO 32768
PORT:THREE?	:PORT:ADDR 49;THREE 1234567
PORT:FIVE?	:PORT:ADDR 31;FIVE 2

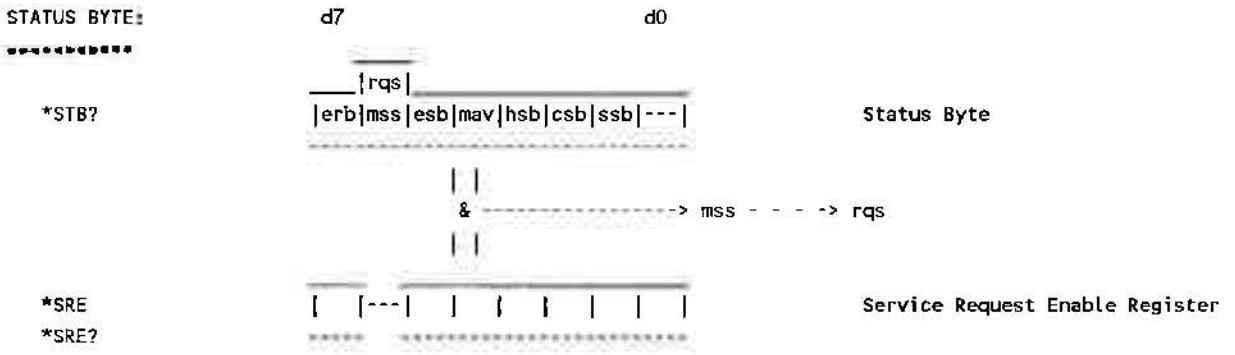
The following responses are not in the form of re-loadable messages, they are either numeric or string type.

TIME?	"17:55"	
DATE?	"1990-04-01"	
CAL:FSTD:CRSE?	18	
CAL:FSTD:FINE?	123	
CAL:SRCPTH:VALUE?	32789	
CAL:RFLV:VALUE?	567	
CAL:MOD:VALUE?	29427	
CAL:DATE?	"1989-10-25"	
CAL:CHECK?	"2001-01-24"	
*IDN?	MARCONI INSTRUMENTS LIMITED,2031,811121007,001 <lf>+EOI	(Arbitrary ASCII response)
*OPT?	SECOND OSCILLATOR,PULSE MODULATION <lf>+EOI	(Arbitrary ASCII response)
*PUD?	#222Testgear number 123456	(Definite Block response)
ERROR?	28 (0 = no error, 255 = error queue was full)	

Status Reporting

See IEEE488.2 for full details.

A bit in the status register is set when the corresponding bit in the condition register changes in the direction specified by the transition filter. A status register is cleared by the appropriate status register being read (*ESR?, HSR? etc.) or by *CLS.



d6 is ignored in data for *SRE, it is always 0 in the response to *SRE?

rqs, esb, mav are as defined in IEEE488.2

"rqs" is the SRQ line as read by serial poll. It is cleared by the poll. It is set by a new reason for service

"mss" is read by *STB?. "mss" = (status_byte AND enable_register) > 0

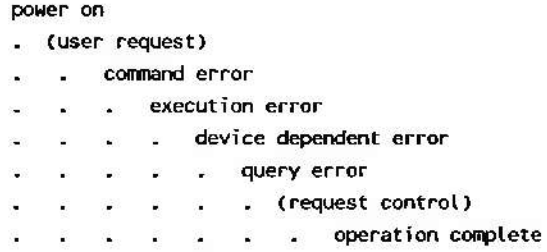
"esb" is the standard event register summary bit

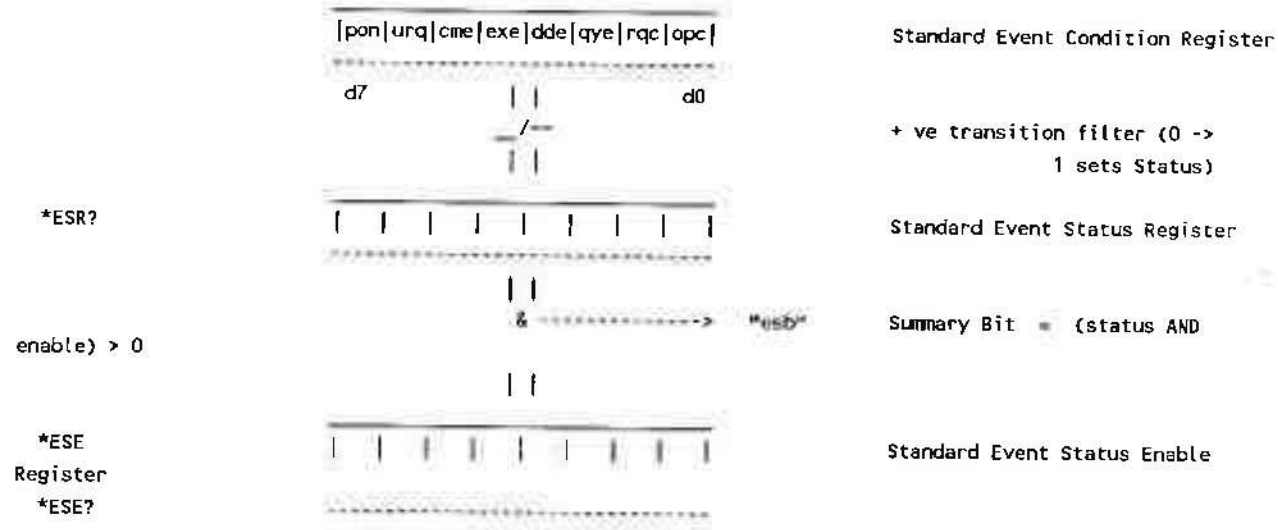
"mav" is 'message available' indicating that the output queue is non-empty

"erb" is a device defined Queue Summary Bit indicating that the Error Queue is non-empty

"hsb", "csb", "ssb" are device defined summary message bits for the associated status registers

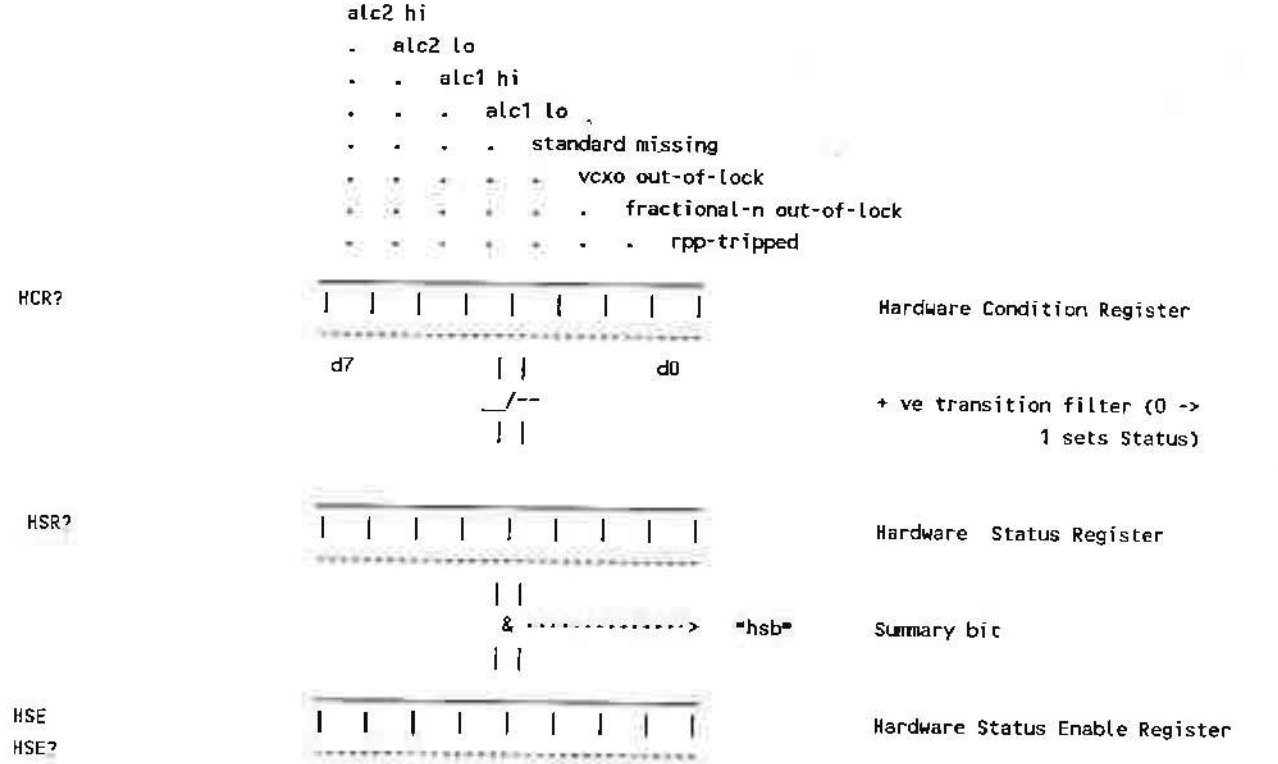
STANDARD EVENT REGISTER



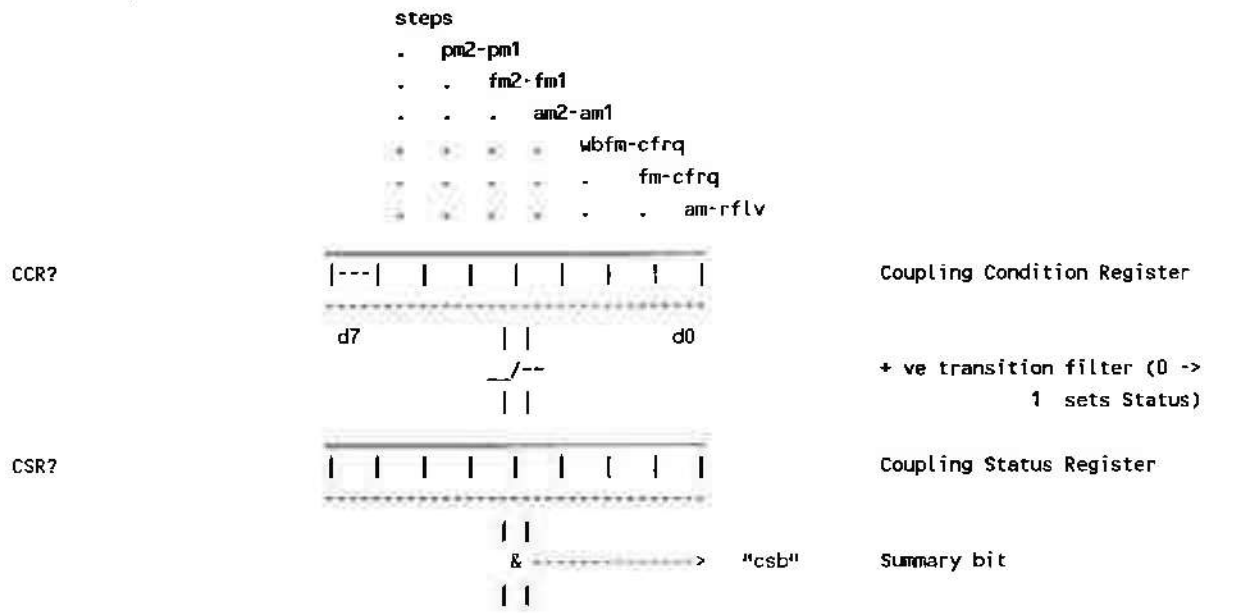


DEVICE DEFINED STATUS REGISTERS

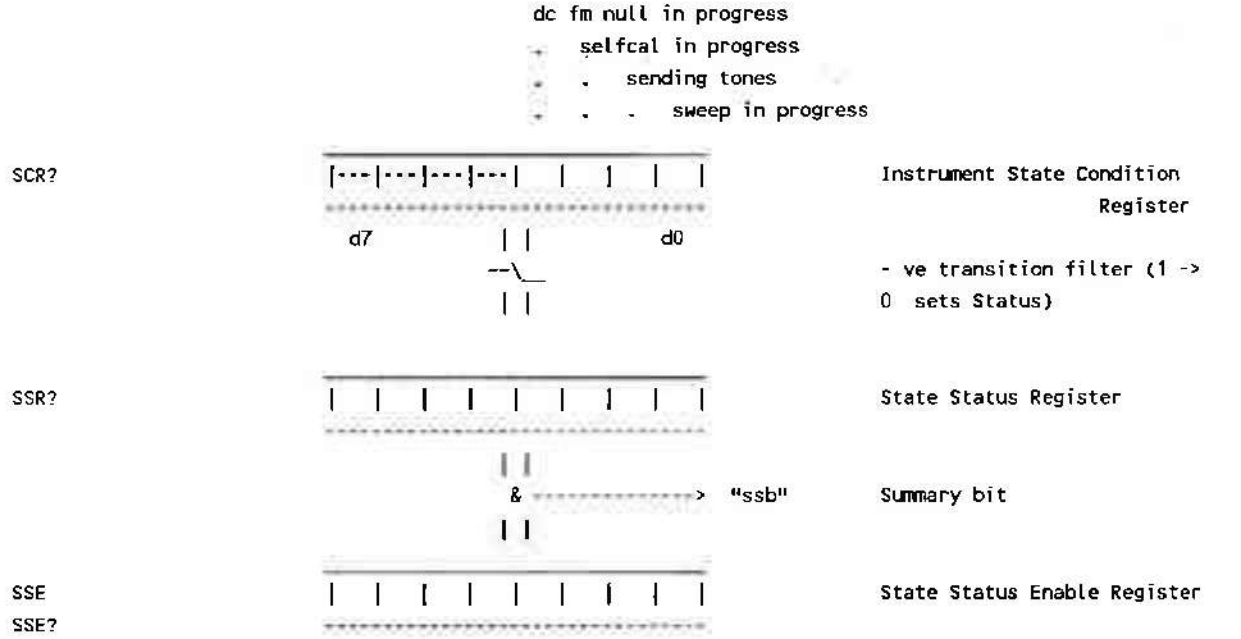
i) Hardware



ii) Coupling



iii) Instrument State



Status Reporting Commands & Queries

*CLS — Clears Status Registers and also the Error queue

*STB? — Status Byte Query

*SRE	<nrf>	-	Service Requset Enable Register
*SRE?			Service Request Enable Query
*ESR?			Standard Event Status Register
*ESE	<nrf>	-	Standard Event Enable Register
*ESE?			Standard Event Enable Query
HCR?			Hardware Condition Register Query
HSR?			Hardware Status Register Query
HSE	<nrf>	-	Hardware Status Enable Reg.
HSE?			Hardware Status Enable Query
CCR?			Coupling Condition Reg. Query
CSR?			Coupling Status Reg. Query
CSE	<nrf>	-	Coupling Status Enable Reg.
CSE?			Coupling Status Enable Query
SCR?			State Condition Reg. Query
SSR?			State Status Register Query
SSE	<nrf>	-	State Status Enable Reg.
SSE?			State Status Enable Query

All the above queries respond with NR1 numeric response.

Chapter 4

BRIEF TECHNICAL DESCRIPTION

CONTENTS

INTRODUCTION

1. The 2030 series signal generators cover the frequency ranges 10 kHz to 1.35 GHz (2030) and 10 kHz to 2.7 GHz (2031). Calibrated output levels from -144 or -138 dBm to +13 dBm are available. The simplified block schematic diagram for the instrument is shown in Fig. 1.

MODULATION

2. The carrier frequency can be frequency, phase or amplitude modulated from internal or external modulation sources. A maximum of four modulations can be made available by the use of a second optional internal oscillator and two external modulation signals applied to the EXT MOD 1 INPUT and EXT MOD 2 INPUT connectors on the front panel.

FREQUENCY GENERATION

3. Frequency generation is by means of an oven controlled 10 MHz crystal oscillator standard, a fractional n synthesizer system and four voltage controlled oscillators (VCOs) covering the range 675 to 1350 MHz. The complete frequency range is achieved by means of a beat frequency oscillator (BFO) and a frequency doubler.

DISPLAY

4. The display is a high definition dot matrix liquid crystal panel with backlighting to cater for variations in ambient light conditions. The display can be adjusted for both contrast and brightness.

CONTROL

5. The 2030 series are menu driven instruments. Main menus are displayed by the use of hard keys, and parameters are changed by means of soft keys which change as the menu changes. Internal control of the instruments is achieved by a microprocessor which receives data from the various controls and sends instructions via an internal 8 bit data bus to the signal processing circuits.

The instruments can also be controlled by the built in general purpose interface bus (GPIB). This facility enables the instruments to be used both as manually operated bench mounted instruments or as part of a fully automated test system.

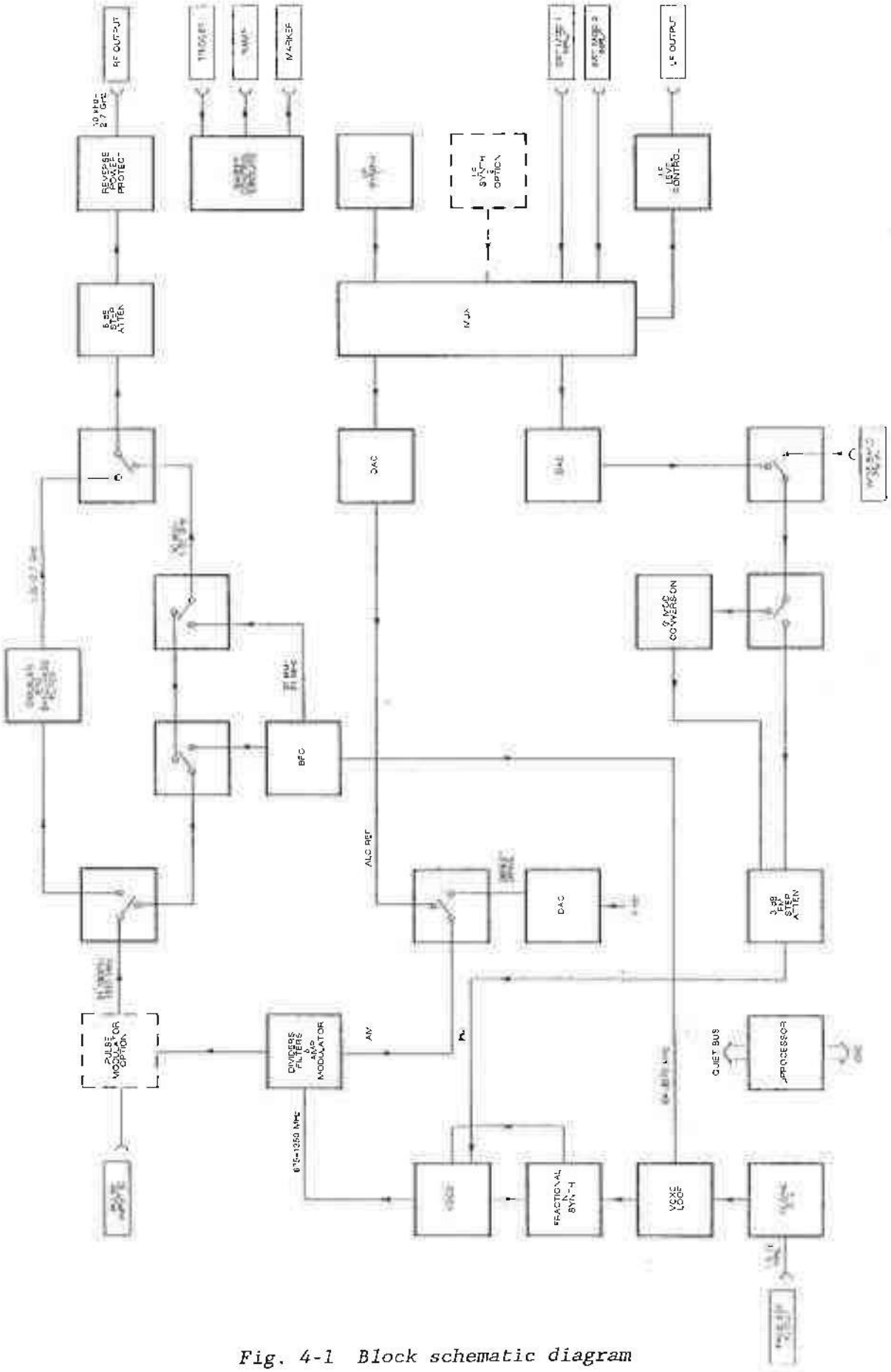


Fig. 4-1 Block schematic diagram

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