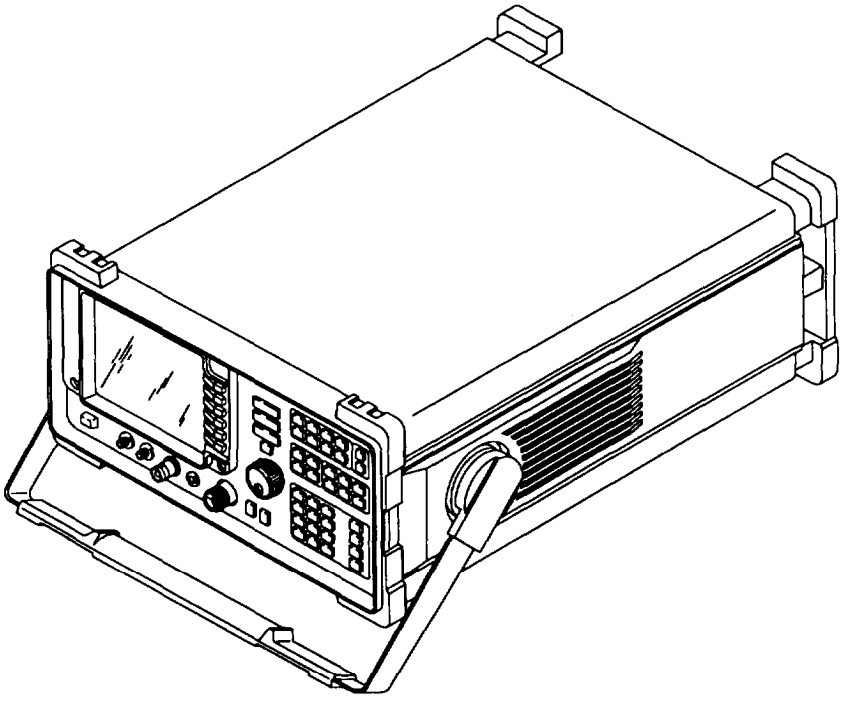
ARMY TM 11-6625-3250-12
NAVY EE393-BZ-OMI-010/ANUSM-489A

TECHNICAL MANUAL

OPERATOR'S AND UNIT MAINTENANCE MANUAL



SPECTRUM ANALYZER
AN/USM-489A
(NSN 6625-01-259-1060)

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DEPARTMENTS OF THE ARMY AND THE NAVY

1 JANUARY 1991

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1. DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

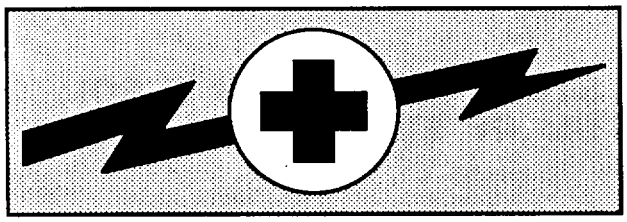
2. IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3. IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL

4. SEND FOR HELP AS SOON AS POSSIBLE

5. AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESPIRATION

WARNING



HIGH VOLTAGE

is used in the operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When technicians are aided by operators, they must be warned about dangerous areas.

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections of 115-volt ac input when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

WARNING

Do not be misled by the term "LOW VOLTAGE". Potentials as low as 50 volts may cause death under adverse conditions.

For Artificial Respiration refer to FM 21-11.

Technical Manual
No. 11-6625-3250-12
Technical Manual
No. EE393-BZ-OMl-010/ANUSM-489A

DEPARTMENTS OF THE ARMY, AND THE NAVY

Washington, DC, 1 January 1991

OPERATOR'S AND UNIT MAINTENANCE MANUAL FOR SPECTRUM ANALYZER AN/USM-489A (NSN 6625-01-259-1060)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028, (Recommended Changes to Publications and Blank Forms) or DA Form 2028-2 located in back of this manual direct to: Commander, U.S. Army Communications-Electronics Command, ATTN: AMSEL–LC–LM-LT, Fort Monmouth, New Jersey 07703-5000.

For Navy, mail comments to the Commander, Space and Naval Warfare Systems Command, ATTN: SPAWAR 8122, Washington, DC, 20363-5100.

In either case, a reply will be furnished direct to you.

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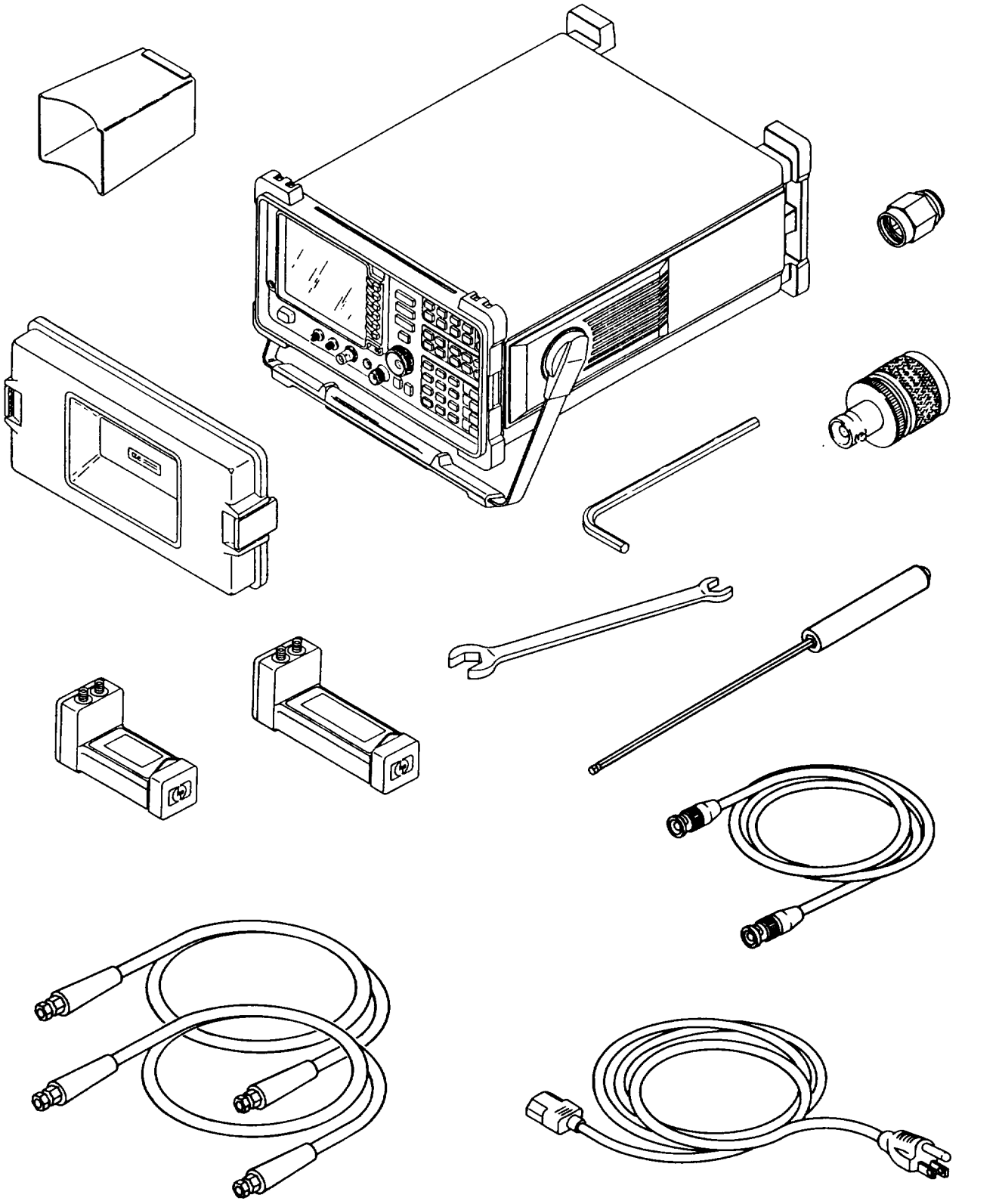

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Figure 1-1. Spectrum Analyzer AN/USM-489A.

CHAPTER 1
INTRODUCTION

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Section I. GENERAL INFORMATION

1-1. SCOPE.

a. Type of Manual: Operator's and Unit Maintenance Manual.

b. Equipment Name and Model Number: Spectrum Analyzer AN/USM-489A (Hewlett-Packard model number 8562A).

c. Purpose of Equipment: The Spectrum Analyzer is designed to measure signals from -119.9 dBm to +30 dBm over a frequency range of 10 kHz to 22 GHz. Two external mixers (supplied) increase frequency range to 40 GHz.

1-2. CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS.

Refer to the latest issue of DA Pam 25-30 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

1-3. MAINTENANCE FORMS, RECORDS, AND REPORTS.

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750 as contained in the Maintenance Management Update. Air Force personnel will use AFR 66-1 for maintenance reporting and TO-00-35D54 for unsatisfactory equipment reporting. Navy personnel will report maintenance performed utilizing the Maintenance Data Collection Subsystem (MDCS) IAW 0P NAVINST 4790.2, Vol 3 and unsatisfactory material/conditions (UR submissions) IAW OPNAVINST 4790.2, Vol 2, chapter 17.

b. Report of Item and Packaging Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/SECNAVINST 4355.18/AFR 400-54/MCO 4430.3J.

c. Transportation Discrepancy Report (TDR)(SF 361). Fill out and forward Transportation Discrepancy Report (TDR)(SF 361) as prescribed in AR 55-38 /NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.15.

1-4. ADMINISTRATIVE STORAGE.

Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from administrative storage the PMCS should be performed to assure operational readiness.

1-5. DESTRUCTION OF ARMY ELECTRONICS MATERIEL TO PREVENT ENEMY USE.

Destruction of Army materiel to prevent enemy use is described in TM 750-244-2.

1-6. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

a. Army. If your Spectrum Analyzer AN/US M-489A needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to us at: Commander, US Army Communications Electronics Command and Fort Monmouth, ATTN: AMSEL–ED–PH, Fort Monmouth, New Jersey 07703-5000. We'll send you a reply,

b. Navy. Navy personnel are encouraged to submit EIR's through their local Beneficial Suggestion Program.

1-7. WARRANTY INFORMATION.

The Spectrum Analyzer is warranted by Hewlett-Packard Company for one year. Warranty starts on the date of shipment to the original buyer. Report all defects in material or workmanship to your supervisor who will take appropriate action.

1-8. NOMENCLATURE CROSS-REFERENCE LIST.

Common names will be used when the Spectrum Analyzer AN/ US M-489A is mentioned in this manual.

NOTE

Official nomenclature must be used when filling out report forms or looking up technical manuals.

Common Name	*Official Nomenclature*
Spectrum Analyzer	Spectrum Analyzer AN/US M-489A
AN/USM-489A	Spectrum Analyzer AN/USM-489A

1-9. LIST OF ABBREVIATIONS.

This list identifies abbreviations and descriptions that are used in this manual.

button(s)	front panel pushbutton controls
dBc	dB relative to carrier
dBm	dB relative to 1 milliwatt
d_f	delta frequency
f_r	frequency readout
f_{ra}	frequency reference accuracy
f_s	frequency span
HPIB	Hewlett-Packard Interface Bus
key(s)	CRT screen softkey controls (6)
LSD	Least significant digit
m_f	marker frequency
r_b	resolution bandwidth

Section II. EQUIPMENT DESCRIPTION

1-10. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

a. CHARACTERISTICS.

- Small physical size.
- Lightweight.
- Portable.
- Designed for bench top use.

b. CAPABILITIES AND FEATURES.

- -119.9 dBm to +30 dBm signal range.
- 10 kHz to 22 GHz frequency range.
- 18 GHz to 40 GHz frequency range using external mixers (supplied).
- Pushbutton control allows for easy operation of equipment.
- CRT Screen on front panel for constant measurement and equipment status.
- Built-in fault analysis programs with extensive self-adjustment routines.
- Battery backup for saving traces, setups, and configurations.
- Programmed interface for remote operation.

1-11. EQUIPMENT DATA.

WEIGHTS AND DIMENSIONS

Net Weight	44 lb(19 kg)
Depth	18.00 in. (460.5 mm)
Width	14.00 in. (373 mm)
Height	8.00 in. (200 mm)

POWER REQUIREMENTS

115 Vac Operation:

Voltage	90 to 140 Vac
Current	3.2 amps rms maximum
Frequency	47 to 440 Hz
Power	180 watts maximum

230 Vac Operation:

Voltage	180 to 250 Vac
Current	1.8 amps rms maximum
Frequency	47 to 66 Hz
Power	180 watts maximum

Fuse Rating:

115 Vac operation	5.0 amp, 125 volt
230 Vac operation	5.0 amp, 250 volt

ENVIRONMENTAL

Operating temperature range	-10 to +55° C
Storage temperature range	-62 to +85° C

Relative humidity:

+ 40°C (for five days)	95% maximum
Rain resistance	Drip-proof at 16 liters/hour/square foot
Operating altitude	0 to 15,000 feet (4,500 m)
Storage altitude	0 to 50,000 feet (15,000 m)
Vibration (operating)	5 to 55 Hz at 0.020 in. peak-to-peak excursion
Shock (non-operating)	30 g, 11 ms (half-sine)

PERFORMANCE

Frequency:

Range:

Internal Mixing ..... 10 kHz to 22 GHz

Harmonic Mixing Mode (N*) 1- ..... 10 kHz to 2.9 GHz
Harmonic Mixing Mode (N*) 1– ..... 2.75 GHz to 6.46 GHz
Harmonic Mixing Mode (N*) 2– ..... 5.86 GHz to 13.0 GHz
Harmonic Mixing Mode (N*) 3– ..... 12.4 GHz to 19.7 GHz
Harmonic Mixing Mode (N*) 4– ..... 19.1 GHz to 22.0 GHz

External Mixing ..... 18 GHz to 40.0 GHz

Harmonic Mixing Mode (N*) 6- (using 11970K) ..... 18.0 to 26.5 GHz
Harmonic Mixing Mode (N*) 8- (using 11970A) ..... 26.5 to 40.0 GHz

Readout Accuracy (START, CENTER, STOP or MARKER) ..... $< \pm$ (f_{ra} + 5%of f_s + 15% of r_b + 250 Hz)**

Count Marker:

Resolution ..... Selectable from 10 Hz to 1 MHz
Accuracy (S/NR ≥25 dB) ..... $<\pm$(m_f x f_{ra} + 50 Hz x N* + 1 LSD)**
Delta Frequency Count Accuracy (S/NR ≥ 22 dB) ..... $<\pm$(d_f x f_{ra} + 100 Hz x N* + 2 LSD)**

Frequency Reference Accuracy (includes aging, temperature drift, and nettability) ..... ± 4 x 10^{-6} per year

Stability:

Residual FM (zero span) .....< 50 Hz x N* peak-to-peak in 20 ms
Spectral Purity/Noise Sidebands:

9 kHz offset ..... < – 70 dBc
Drift

±100 kHz SPAN ..... < 50 Hz X N* per minute of sweep time
101 kHz to ≥1 MHz SPAN ..... <2 kHz X N* per minute of sweep time

Span:

Range:

Internal Mixing 0 Hz, 2.5 kHz x N* to 19.25 GHz (over the 10-division CRT horizontal axis, variable in approximately 10/' increments, or in a 1, 2, 5 sequence
External Mixing ..... Minimum span = 2.5 kHz x N*

Accuracy (spans ≥10 kHz)..... < ± 5%

Resolution Bandwidths (-3 dB)

Range ..... 100 Hz to 1 MHz (selectable in a 1, 3, 10 sequence) and 2 MHz
Accuracy:

1 and 2 MHz RES BW ..... <± 25%
300 kHz to 300 Hz RES BW ..... <± 10%
100 Hz RES BW ..... <± 30%

Selectivity (60 dB/3 dB bandwidth ratio) ..... <15:1
Bandwidth Shape ..... Synchronously tuned, 4-pole filters

† N is harmonic mixing mode. The desired 1st LO harmonic is always higher than the tuned frequency by the 1st IF frequency (3.9107 for the 10 kHz to 2.9 GHz band, and 310.7 MHz for all other bands).

** d_f delta frequency, f_r frequency readout, f_{ra} frequency reference accuracy, f_s frequency span, m_f marker frequency, r_b resolution bandwidth

PERFORMANCE—Continued

Amplitude/Measurement Range:

Video Bandwidth ..... 1 Hz to 3 MHz in a 1, 3, 10 sequence

Maximum Safe Input Power

Average Continuous Power (input attenuation ±10 dB) ..... + 30 dBm (1 watt)

Peak Pulse Power (input attenuation ±30 dB) ..... +50 dBm (100 watts)for < 10 µs and < 1% duty cycle

DC ..... 0 volts

Gain Compression:

10 MHz to 2.9 GHz (±–5 dBm at input mixer) ..... <1.0 dB

2.9 GHz to 22 GHz (±-3 dBm at input mixer) ..... <1.0 dB

Displayed Average Noise Level (no signal a! input, 100 Hz RES BW, and 0 dB input attenuation):

10 kHz ..... <-90 dBm
100 kHz ..... <-100 dBm
1 MHz to 2.9 GHz ..... <-120 dBm
2.9 GHz to 6.46 GHz ..... <-121 dBm
6.46 GHz to 13.0 GHz ..... <-110 dBm
13.0 GHz to 19.7 GHz ..... <-105 dBm
19.7 GHz to 22.0 GHz ..... <-100 dBm

Spurious Responses (all input-related spurious responses, with ±–40 dBm mixer level***):

10 MHz to 6.46 GHz ..... < -60 dBc

Second Harmonic Distortion:

10 MHz to 2.9 GHz ..... <-72 dBc $_t$ -40 dBm mixer level***
2.75 GHz to 22.0 GHz ..... c- 100 dBc, - 10 dBm mixer level*"*

Third Order Inter modulation Distortion (two –30 dBm input signals at the input mixer***):

10 MHz to 2.9 GHz ..... <-70 dBc
2.75 GHz to 6.5 GHz ..... <-75 dBc

Image, Multiple, and Out-of-Band Responses:

10 MHz to 18 GHz ..... <-70 dBc
10 MHz to 22 GHz ..... <-60 dBc

Residual Responses (no signal at input, 0 dB input attenuation):

200 kHz to 6.46 GHz ..... <-90 dBm
6.46 GHz to 33 GHz ..... <-70 dBm

Amplitude Measurement/Display Range:

Amplitude Scale ..... 10 vertical CRT divisions, with reference level (0 dB) at top graticule line

Calibration:

Log (display expanded from reference level):

90 dB ..... 10 dB/DIV
50 dB (digital display mode, ≥ 30 ms sweep only) ..... 5 dB/DIV
20 dB ..... 2 dB/DIV
10 dB (digital display mode, ≥ 30 ms sweep only) ..... 1 dB/DIV

Linear ..... 10% of reference level per div (when calibrated in voltage)

*** Mixer level = input level - input attenuation

PERFORMANCE—Continued

Amplitude Measurement/Display Range — Continued:

Reference Level Range:

Log (adjustable in 0.1 dB steps):

10 kHz to 2.9 GHz	- 120 dBrn to + 30 dBm
2.75 GHz to 6.46 GHz	– 120 dBm to + 30 dBm
5.86 GHz to 13.0 GHz	- 115 dBm to + 30 dBm
12.4 GHz to 19.7 GHz	- 105 dBm to + 30 dBm
19.1 GHz to 22.0 GHz	–100 dBm to + 30dBm

Linear (settable in 1% steps):

10kHz to 2.9 GHz	2.2 µV to 7.07 V
2.75 GHz to 6.46 GHz	2.2 µV to 7.07 V
5.86 GHz to 13.0 GHz	4.0 µV to 7.07 V
12.4 GHz to 19.7 GHz	12.6 µV to 7.07 V
19.1 GHz to 22.0 GHz	22.0 µV to 707 V

Amplitude Accuracy/Reference Level Uncertainty:

Frequency Response (10 dB input attenuation), referenced to CAL OUTPUT (300 MHz):

1O kHz to 19.7 GHz	< ± 6.1 dB

Calibrator Uncertainty (-10 dBm, 300 MHz) < ± 0.3 dB

Input Attenuator Switching Uncertainty (O to 70 dB, referenced to 10 dB input attenuation:

10 kHz to 22.0 GHz	< ±1.8 dB/10 dB step, 3.5 dB max.

IF Gain Uncertainty (0 dBm to –80 dBm reference level, 10 dB input attenuation) . . . . < ± 1.0 dB

Resolution Bandwidth Switching Uncertainty (referenced to 300 kHz RES BW) < ± 0.5 dB

IF Alignment Uncertainty (when using 100 Hz and 300 Hz RES BW):

100 Hz RES BW	< ± 2.0 dB
300 Hz RES BW	< ± 0.5 dB

Pulse Digitization Uncertainty (pulse response mode, PRF>720/sweep time):

Log:

RES BW ≤ MHz	< 1.25 dB peak-to-peak
RES BW 2 MHz	< 3 dB peak-to-peak

Linear:

RES BW ≤ MHz	< 4% of reference level peak-to-peak
RES BW of 2 MHz	< 12% of reference level peak-to-peak

Marker (measured at 300 MHz) < ± 3.3 dB

RF Input VSWR (at tuned frequency with > 10 dB input attenuation):

10 MHz to 2.9 GHz	< 1.5:1
2.9 GHz to 19.4 GHz	<2.3:1

Amplitude Accuracy/Scale Fidelity:

Log (from reference level to a maximum of ±1.5 dB over 0 to 90 dB range) < ± 0.4 dB/4 dB

Linear < ± 3% of reference level

• N is harmonic mixing mode. The desired 1st LO harmonic is always higher than the tuned frequency by the 1st IF frequency (3.9107 for the 10 kHz to 2.9 GHz band, and 310.7 MHz for all other bands).

PERFORMANCE—Continued

Sweep:

Time:

Range:

Span = 0	50 µs to < 30 ms (analog display)
Span =0	30 ms to 60 s (digital display)
Span ≥ 2.5 kHz x N*	50 ms to 100 s (digital display)

Accuracy (Span = 0):

30 ms ≤ sweep time ≤ 60 seconds	< ± 1%
Sweep time <30 ms	< ± 15%

Sweep Trigger ..... Free Run, Single, Line, Video, External

Demodulation (typical):

Type	AM and FM
Audio Output	Internal speaker and phone jack with volume control
Marker Pulse Time	100 ms to 60 sec

Front Panel Connectors:

1st LO OUTPUT:

Connector	SMA female
Impedance	50 Ω
Frequency Range (typical)	3.0000 GHz to 6.8107 GHz
Amplitude	+ 16.5 dBm ± 2.0 dB (20°C to 30°C)

IF INPUT:

Connector type	SMA female
Impedance	50 Ω
Frequency (typical)	310.7 MHz
Noise Figure (typical)	7 dB
1 dB Gain Compression Level (typ, 0 dBm reference level, 30 dB conversion loss)	-23 dBm
Input level for full-screen deflection	– 30 dBm ± 1.5 dB
(external mixing mode, 0 dBm reference level, 30 dB conversion loss)	

CAL OUTPUT:

Connector	BNC female
Impedance	50Ω
Frequency	300 MHz ± (300 Hz x f_{ra})**
Amplitude	–10 dBm + 0.3 dB

PROBE POWER:

Voltage (typical)	+ 15 Vdc, –12.6 Vdc
Current (typical)	150 mA max., each

INPUT 50Ω:

Connector type	Precision Type N female
Input level	+ 30 dBm, 1 watt, 0 Vdc
Impedance	50 Ω

** df=delta frequency, f_r=frequency readout, f_{ra}=frequency reference accuracy, f_s=frequency span, m_f=marker frequency, r_b=resolution bandwidth

PERFORMANCE—Continued

Rear Panel Connectors:

EARPHONE:

Connector	1/8 inch miniature monophonic jack
Power Output	0.25 watts into 4 Ω

HP-IB:

Connector	IEEE 488 bus connector
Interface Functions	SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP1, DC1, DT0, C1, C28, E1

VIDEO OUTPUT:

Connector	BNC female, rear panel
Impedance (DC coupled)	50 Ω
Amplitude (typical into 50 Ωload)	0 to + 1 volt full-scale
Scale (typic al)	Linear or Log 100 dB/V

EXT TRIG INPUT:

Connector	BNC female, rear panel
Impedance	10 k Ω
Trigger Level	Rising edge of TTL Level

BLANKING OUTPUT:

Connector	BNC female, rear panel
Amplitude (typical):	
during SWEEP	Low TTL Level (sink 150 mA max.)
during"' RETRACE	High TTL Level (source 0.5 mA max.)
Maximum input (typical, high TTL state)	+40 v

LO SWP I0.5 V/GHz OUTPUT:

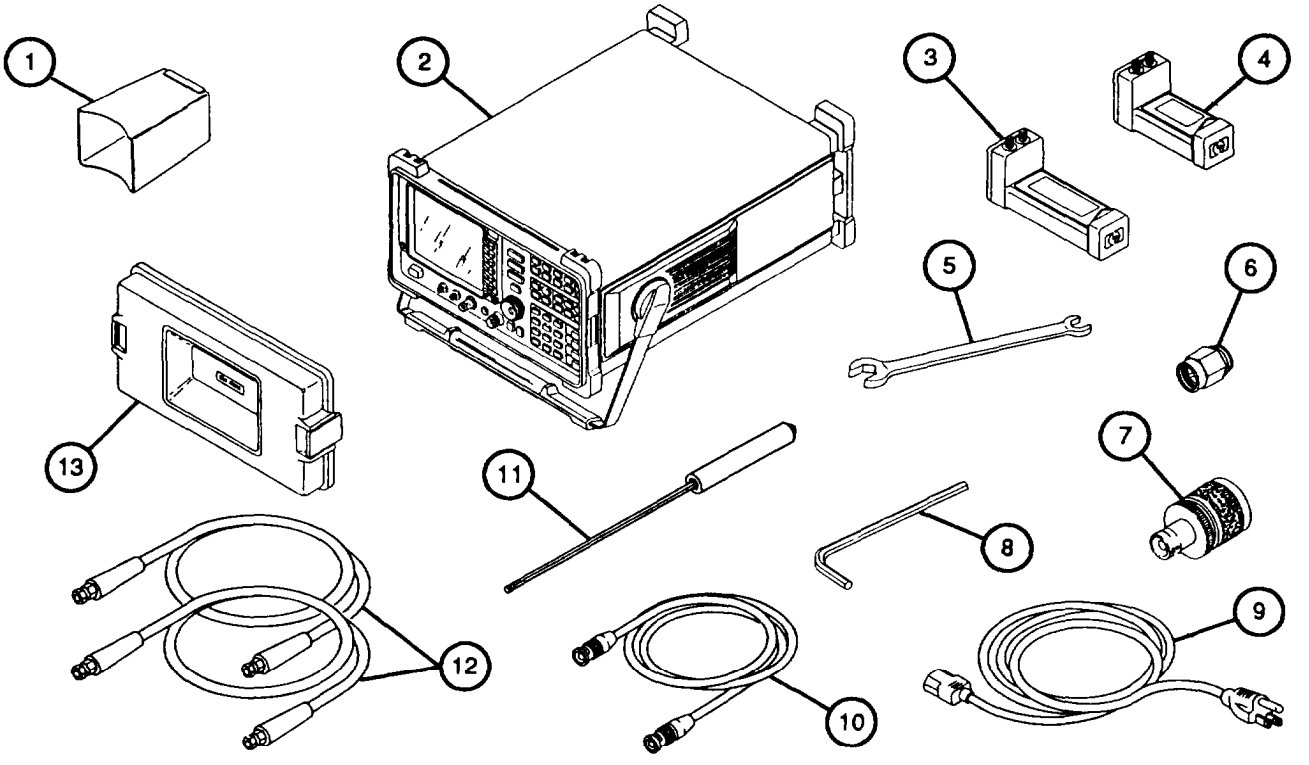
Connector	BNC female, rear panel
Impedance (DC coupled)	2 κΩ
LO SWP OUTPUT (typical, no load)	0 to + 10 V
0.5 V/GHz OUTPUT (typical, no load)	0.5 V/GHz of tuned frequency

10 MHz REF IN/OUT:

Connector	BNC female, rear panel
Impedance	50 Ω
Output Amplitude (typical)	0 dBm
Input Amplitude (typical)	–2 to + 10 dBm
Frequency	10 MHz ± (10 MHz x f_{ra})**

** d_f=delta frequency, f_r=frequency readout, f_{ra}=frequency reference accuracy, f_s=frequency span, m_f=marker frequency, r_b=resolution bandwidth

1-12. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS



1 VIEWING HOOD. Used to view Spectrum Analyzer CRT screen in bright light.

2 SPECTRUM ANALYZER. Performs measurement of signals from -119.9 to + 30 dBm at from 10 kHz to 22 GHz.

3 K BAND MIXER. Used with Spectrum Analyzer to measure signals from 18 to 26.5 GHz.

4 A BAND MIXER. Used with Spectrum Analyzer to measure signals from 26.5 to 40 GHz.

5 1/4 X 5/16 OPEN END WRENCH. Used to tighten/loosen SMA Cables and 50 Ω Termination.

6 50 Ω TERMINATION. Used to terminate (into 50 Ω) 1st LO Output signal.

7 BNC TO TYPE N ADAPTER. Used to connect a BNC Cable to the INPUT 50 Ω connector.

8 4mm HEX WRENCH. Used to tighten/loosen case screws.

9 POWER CABLE. Used to power the Spectrum Analyzer.

10 BNC CABLE. Used to connect the CAL OUTPUT connector to the INPUT 50 Ω connector during REF LVL CAL alignment.

11 3/32 BALL DRIVER WRENCH. Used to tighten/loosen external mixer attachment screws.

12 SMA CABLES. Used to connect the external mixers to the Spectrum Analyzer.

13 FRONT COVER. Used to protect Spectrum Analyzer front panel and store accessories.

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-13. GENERAL FUNCTIONAL DESCRIPTION.

The Spectrum Analyzer (fig. 1-2) is a complete self-contained device capable of measuring signals from –119.9 to +30 dBm at from 10 kHz to 22 GHz. Frequency range is increased to 40 GHz by use of external mixers (supplied).

Operation is simplified by numerous automatic functions and selections. Clearly labeled front panel controls and connectors, along with easily understandable information displayed on the CRT Screen display, allow operation of the Spectrum Analyzer with minimum instruction.

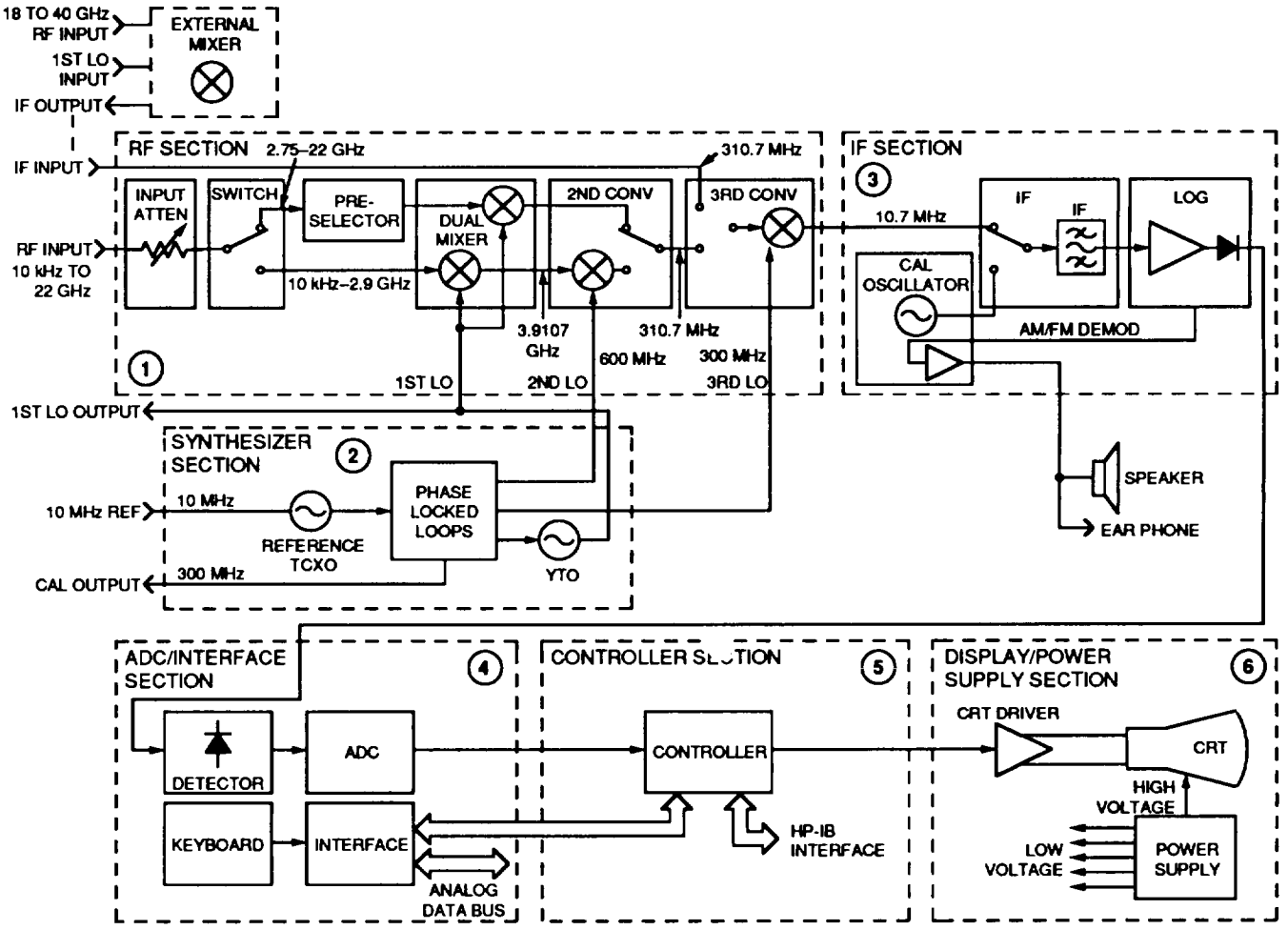


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Figure 1-2. Spectrum Analyzer AN/USM-489A Simplified Block Diagram.

(1) The RF Section converts all input signals (10 kHz to 22 GHz) to a fixed Intermediate Frequency (IF) of 10.7 MHz. This IF signal is routed to the IF Section for processing. Reference and control signals are provided by the Synthesizer and Controller Sections, respectively. Internal or External mixing depends on the input frequency (two external mixers are supplied). Routing of the input signal depends on the input frequency, mixer (internal or external), and connector (INPUT or IF INPUT) used.

- 10 kHz to 2.9 GHz signals use triple conversion to produce the 10.7 MHz IF signal. The internal dual mixer up-converts the RF input signal to a 3.9107 GHz 1st IF signal. The second converter down-converts the 1st IF signal to a 310.7 MHz 2nd IF signal. The 3rd converter up-converts the 2nd lF signal to the final 10.7 MHz lF signal.
- 2.75 to 22 GHz signals use double conversion to produce the 10.7 MHz IF signal. The internal dual mixer down-converts the RF input signal to a 310.7 MHz 1st IF signal. The second converter is bypassed. The 3rd converter up-converts the 2nd IF signal to the final 10.7 MHz lF signal.
- 18 to 40 GHz signals use double conversion to produce the 10.7 MHz IF signal. The external mixer down-converts the RF input signal to a 310,7 MHz 1st IF signal. This signal is input to the 3rd converter using the IF INPUT connector. The 3rd converter up-converts the 1st lF signal to the final 10.7 MHz IF signal.

The Input Attenuator provides RF input signal level control from O to 70 dB.

The preselector performs bandpass filtering (= 25 to 40 MHz) on 2.75 to 22 GHz RF input signals. Data presently in the Current Data Table is used to tune the preselect or. This data is loaded from either the User or Factory Data Table, and can be modified before use.

- Factory Data Table is set at the factory and is sufficient for virtually all applications. When used, measurements meet published specifications (para 1-11).
- User Data Table is created and saved by the user for special applications.

The Synthesizer Section generates the necessary reference signals used by the Spectrum Analyzer. Control signals are provided by the Controller Section. All reference signals are phased locked to the internal 10 MHz TCOX, or external reference (if connected),

- 3 to 6.8107 GHz 1st Local Oscillator (LO) signal is used by the internal and external mixers to obtain the 310.7 MHz IF signal. This signal is routed to the RF Section (internal mixers) or the front panel 1st LO OUTPUT connector (external mixers).
- 600 MHz for the second LO used by the RF Section 2nd Converter.
- 300 MHz for the third LO used by the RF Section 3rd Converter.
- 300 MHz for the CAL OUTPUT connector on the front panel.

The IF Section processes the 10.7 MHz lF signal from the RF Section. Control signals are provided by the Controller Section. The incomming IF signal is filtered and amplified, and the detected video output is routed to the ADC/interface Section for measurement. If selected, demodulated audio (AM or FM) is amplified and routed to the speaker. The CAL oscillator provides a 10.7 MHz signal for automatic IF adjustments.

The ADC/interface Section links the Controller Section with the operator and all the other sections in the Spectrum Analyzer. This includes:

- Operator inputs via the keyboard to control overall operation.
- Control signals (over the bus) to control operation of the other sections.
- Analog signals from the other sections to monitor operation.
- Detected video from the IF Section for measurement of the input signal.

The Controller Section provides overall control of the internal circuitry in the Spectrum Analyzer. Data and control signals are sent to/received from all the other sections as required to perform all Spectrum Analyzer functions. Also contains the circuits that allow the Spectrum Analyzer to be operated remotely using an external controller connected to the rear panel HPIB connector.

The Display/Power Supply Section provides the Spectrum Analyzer with a visual display, and the necessary internal power required for normal operation.

- The displayed information (CRT Screen) includes the processed RF signal (both waveform and displayed measurement data), current measurement status, current active softkey selections, current equipment and operational status, active special functions, and all the various menu selections.
- The power supply provides the internal operating voltages for all sections. Fuse protection is provided on the rear panel. During normal operation, both low (+28, +15, +13, -12.6, and -15) and high (-2.5 kV) voltages are provided.

CHAPTER 2
OPERATING INSTRUCTIONS

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Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS, INDICATORS, AND CONNECTORS

2-1. INTRODUCTION.

This section describes all of the operator controls, indicators, and connectors for the Spectrum Analyzer. Due to the large number of controls and indicators on the front panel, it is necessary to separate the panel into 24 different portions. In addition, an index is provided (in alpha-numeric order) to cross-reference the controls, indicators, and connectors to the corresponding item number. Table 2-1 contains the index. Figure 2-1 (views A thru X) shows each portion of the front panel. The rear panel is shown in figure 2-2. The external mixers are shown in figure 2-3.

NOTE

Pushbutton controls are referred to as "BUTTONS", and the six display soft keys are referred to as "KEYS" in this manual.

Table 2-1. Controls, Indicators, and Connectors Cross-Reference

CONTROL/INDICATOR/CONNECTOR	ITEM	CONTROL/INDICATOR/CONNECTOR	ITEM
A EXCH B key	212	BIAS key	146
A+B–>A key	211	BIAS OFF key	147
A-B+DL->A ON OFF key	209	BK SP button	242
A-B–>A ON OFF key	208	BLANK A key	200
AC POWER connector	293	BLANK B key	205
ACTIVE FUNCTION area	20	BLANKING OUTPUT (J6) connector	285
ADJ CURR IF STATE key	35	BW button	189
AGC ON OFF key	100	CAL OUTPUT connector	276
ALL key	224	CENTER annotation	17
AM DE MOD ON OFF key	90	CENTER FREQ key	54, 92
AMPLITUDE button	23	CF STEP AUTO MAN key	58
AMPTD CORRECT key	135	CF STEP key	57
ANNOT ON OFF key	185	CHAR SET 1 2 key	182
ATTEN annotation	3	CL annotation	3
ATTEN AUTO MAN key	26	CLR-WRT A key	197
ATTEN key	25	CLR-WRT B key	202
AUTO COUPLE button	223	CNT annotation	6
AVERAGE CNV LOSS key	136	CNV LOSS VS FREQ key	137
B–DL–>B	213	COLOR PRINT key	163
BACK SPACE key	180	CONT key	154, 229

Table 2-1. Controls, Indicators, and Connectors Cross-Reference — Continued

CONTROL/INDICATOR/CONNECTOR	ITEM
COUNTER button	63
COUNTER ON OFF key	64
COUNTER RES key	65
CRT ADJ PATTERN key	121
CRT HV indicator	288
CRT Screen	1
dB button	238
dBm key	40
dBmV key	42
dBµV key	41
DE MOD button	89
DE MOD TIME key	96
DETECTOR MODES key	215
DETECTOR NEG PEAK key	219
DETECTOR NORMAL key	216
DETECTOR POS PEAK key	218
DETECTOR SAMPLE key	217
DISPLAY button	160
DISPLAY LINE key	172
DSPL LIN ON OFF key	173
EARPHONE (J1) connector	282
ELAPSED TIME key	122
ERASE TITLE key	183
ERROR annotation	12
EXT button	131
EXT TRIG INPUT (J5) connector	283
EXTERNAL key	159
FACTORY PRESEL PK key	123
FFT key	221
FM DE MOD ON OFF key	91
FOCUS key	187
FREE RUN key	156
FREQ DIAGNOSE key	114
FREQ DSP OFF key	186
FREO OFFSET key	60
FREQUENCY button	53
FULL BAND key	132
FULL IF ADJ key	36
FULL SPAN key	48
GHz button	238
GRAT ON OFF key	184
HOLD button	271
HP-IB (J2) connector	284
HP-IB ADDRESS key	74
Hz button	241
IF ADJ ON OFF key	34
IF ADJUST key	33
IF INPUT connector	277
INPUT connector	274
INT button	125
INTEN key	188
KEY MENU area	10
kHz button	240
KNOB	272
LAST SPAN key	50
LAST STATE key	72
LINE button	279
LINE FUSE	294
LINE indicator	280
LINE key	158
LINEAR annotation	5
LINEAR key	28
LO FREQ key	115
LO SWP I0.5V/GHz (J8) connector	295
LOCK HARMONIC key	133
LOCK ON OFF key	134
LOG annotation	5
LOG dB/DIV key	27
MAIN ROLLER key	118
MARKER 1/DELTA key	267
MARKER 1/ Δ ->CF key	261
MARKER 1/ Δ ->CF STEP	262
MARKER DELTA key	67, 92, 143, 246, 258, 266
MARKER NORMAL key	66, 92, 143, 245257, 265
MARKER Δ -> SPAN key	260
MARKER Δ –>CF key	261
MARKER Δ ->CF STEP key	262
MARKER -> CF key	245, 261
MARKER -> CF STEP key	262
MARKER -> REF LVL key	260
MAX HOLD A key	198
MAX HOLD B key	203
MAX MXR LEVEL key	32, 227
MAX NO. VID AVGS key	194
MEAS UNCAL annotation	21
MENU TITLE area	9
MHz button	239
Mixer CL label	298, 301
Mixer IF OUTPUT connector	296, 302
Mixer LO INPUT connector	297, 303
Mixer RF INPUT connector	299, 300
MKR annotation	6
MKR OFF button	263
MKR ON button	264
MKR -> button	256
MKR NOISE ON OFF key	248, 268
MODULE button	102
MORE key	29, 59, 85, 95, 111,176, 207, 250
MORE TRC MATH key	210
ms button	240
mV button	240
NEGATIVE BIAS key	149
NEXT PEAK key	69, 94, 145, 247
NEXT PK LEFT key	252
NEXT PK RIGHT key	251
NEXT STATES key	79, 106
NUMERIC (O —9) keypad	237
OFFSET ROLLER key	119
OPTION MODULE (J3) connector	286
PEAK EXCURSN key	253
PEAK SEARCH button	244
PEAK SEARCH key	68, 93, 144, 259
PEAK THRESHLD key	254
PLOT ANNOT key	169
PLOT GRATICUL key	168
PLOT key	164
PLOT OPTIONS key	165
PLOT ORG DSP GRAT key	170
PLOT TRACE A key	166
PLOT TRACE B key	167
POSITIVE BIAS key	148
PRESEL AUTO PK key	127
PRESEL MAN ADJ key	126

Table 2-1. Controls, Indicators, and Connectors Cross-Reference — Continued

CONTROL/INDICATOR/CONNECTOR	ITEM
PRESET button	70
PREV key	86, 112, 255
PREV MENU key	37, 45, 62, 101, 138, 150, 171, 214, 220, 222, 236
PREV STATES key	80, 107
PRINT key	162"
PRINT/PLOT key	161
PROBE POWER connector	275
PWR ON STATE key	81
RBW annotation	16
RBW:SPAN key	226
REALIGN LO & IF key	73
REAR PNL OUTPUT key	233
RECALL # key	105
RECALL button	103
RECALL ERRORS key	113
RECALL PRSEL PK key	124
RECALL PWR ON key	71
RECALL STATE key	104
RECALL TO TRA key	108
RECALL TO TR B key	109
REF LVL CAL key	30
REF LVL key	24
REF LVL OFFSET key	31
RES BW AUTO MAN key	191
RES BW key	190
RL annotation	2
SAMPLER FREQ key	116
SAMPLER HARMONIC key	117
SAVE button	76
SAVE PRESL PK key	88
SAVE STATE key	77
SAVE TRACE A key	82
SAVE TRACE B key	83
SAVELOCK ON OFF key	87
SCREEN TITLE key	177
sec. button	239
SELECT CHAR key	178
SIG ID AT MKR key	128, 140
SIG ID ON OFF key	130, 142
SIG ID-> CF key	129, 141
SIG TRK ON OFF key	249, 269
SIGNAL IDENT key	139
SINGLE key	155, 230
SOFT KEYS	11
SPACE key	179
SPAN button	46
SPAN WIDTH key	47
SPAN/STOP annotation	13
SPECIAL FUNCTION annotation	19
SQUELCH key	98
SQUELCH ON OFF key	99
START annotation	17
START FREQ key	55
STATE # key	78
STEP buttons	273
STOP ADJUST key	36
STOP ANNOT key	169
STOP FREQ key	56
STOP GRATICUL key	168
STOP PLOT key	164
STOP PRINT key	162, 163
STOP REALIGN key	75
STOP SIG ID key	128, 140
STOP TRACE A key	166
STOP TRACE B key	167
STORE FOCUS key	187
STORE HPIB ADR key	74
STORE INTEN key	188
STORE REF LVL key	30
SWEEP button	228
SWEEP TIME key	51, 231
SWP annotation	14
SWP TIME AUTO MAN key	52, 232
THRESHLD key	174
THRESHLD ON OFF key	175
TITLE area	7
TITLE DONE key	181
TRACE # key	84,110
TRACE A key	206
TRACE ALIGN control	289
TRACE B key	201
TRACE button	196
TRANSFER ROLLER key	120
TRIGGER button	153
UNITS AUTO MAN key	39
UNITS key	38
VAVG annotation	4
VBW annotation	15
VBW:RBW key	225
VID AVG ON OFF key	195
VIDEO BW AUTO MAN key	193
VIDEO BW key	192
VIDEO key	157
VIDEO OUTPUT (J4) connector	281
VIEW A key	199
VIEW B key	204
VOLTAGE SELECTION switch	291
VOLTS key	43
VOLUME key	97
WATTS key	44
WAVEFORM	18
X POSN control	287
Y POSN control	290
ZERO SPAN key	49
.5V/GHz (FAV) key	235
0->10V LO SWP key	234
1st LO OUTPUT connector	278
10 MHz EXT INT key	61
10 MHz REF IN/OUT (J9) connector	292
99% PWR BW key	270
● (active marker) annotation	22
● (asterisk s) annotation	8
. (decimal) button	243
+ dBm button	238
- button	242
- dBm button	239
µs button	241
µV button	241
ΔCNT annotation	6
ΔMKR annotation	6
(volume) button	151
(volume) button	152

Each view contains a minimum of one function pushbutton, and its associated CRT screen menu. Each CRT screen menu choice is then discussed in order.

NOTE

Pushbutton controls are referred to as “BUTTONS”, and the six display softkeys are referred to as “KEYS” in this manual.

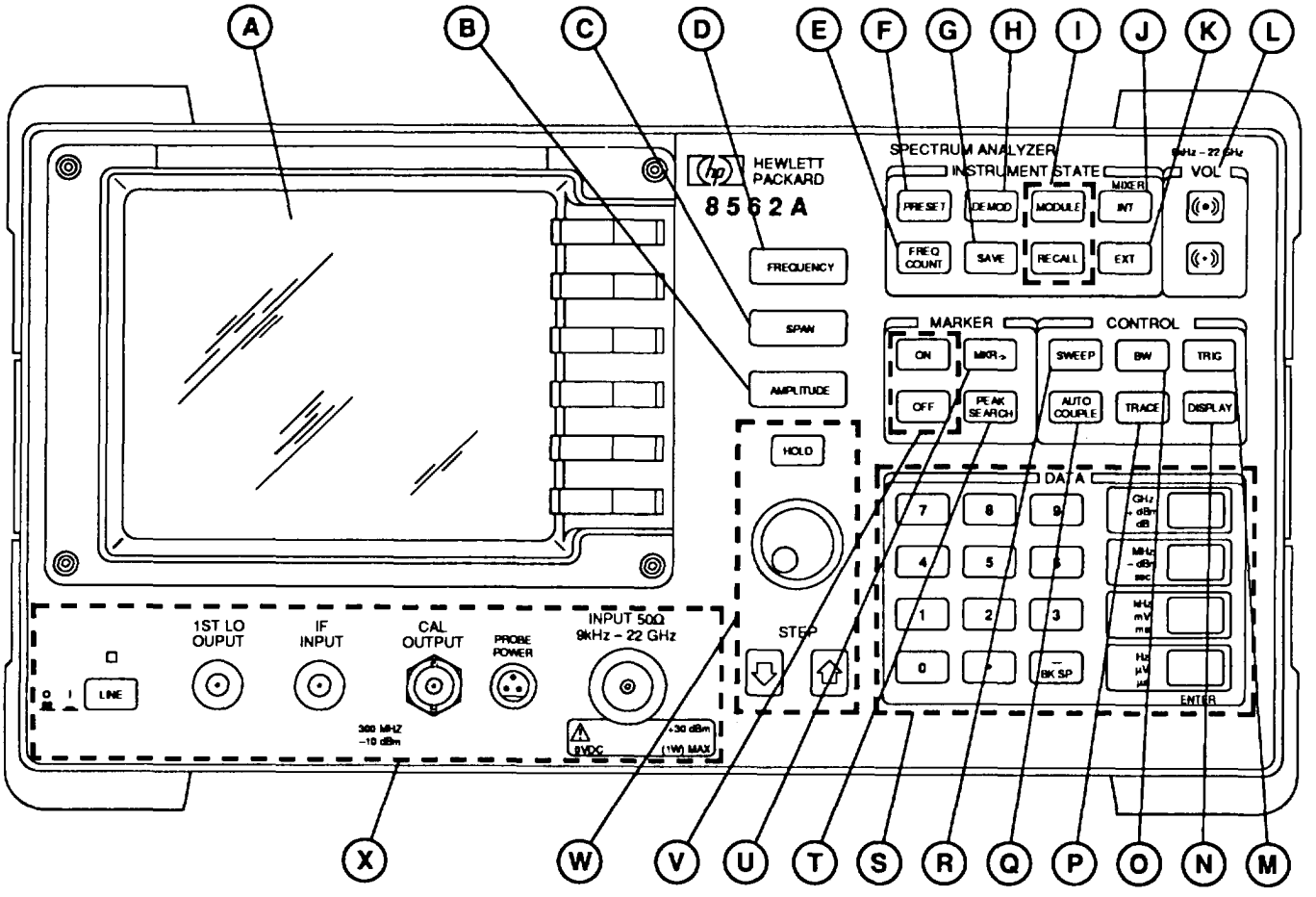

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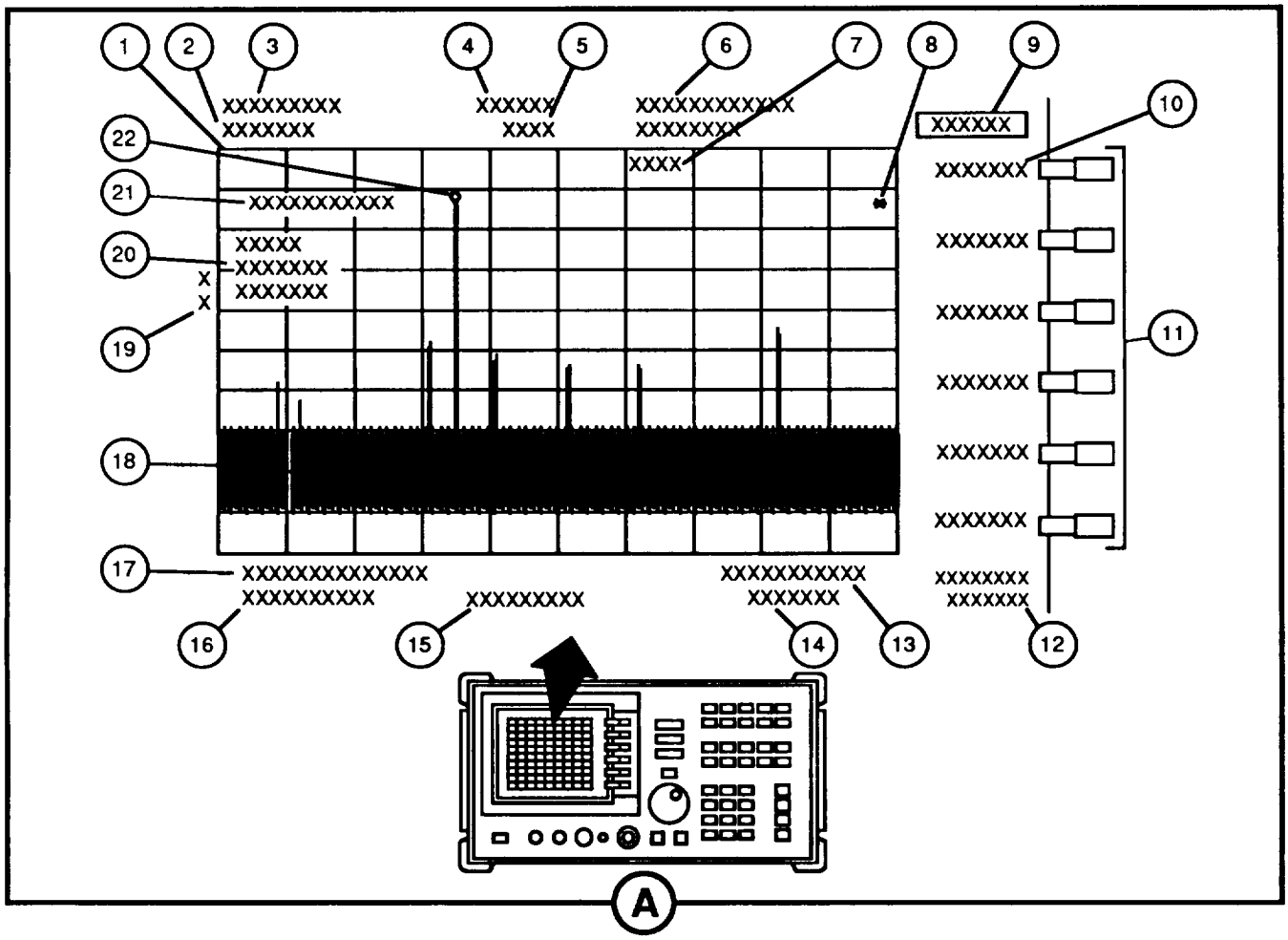
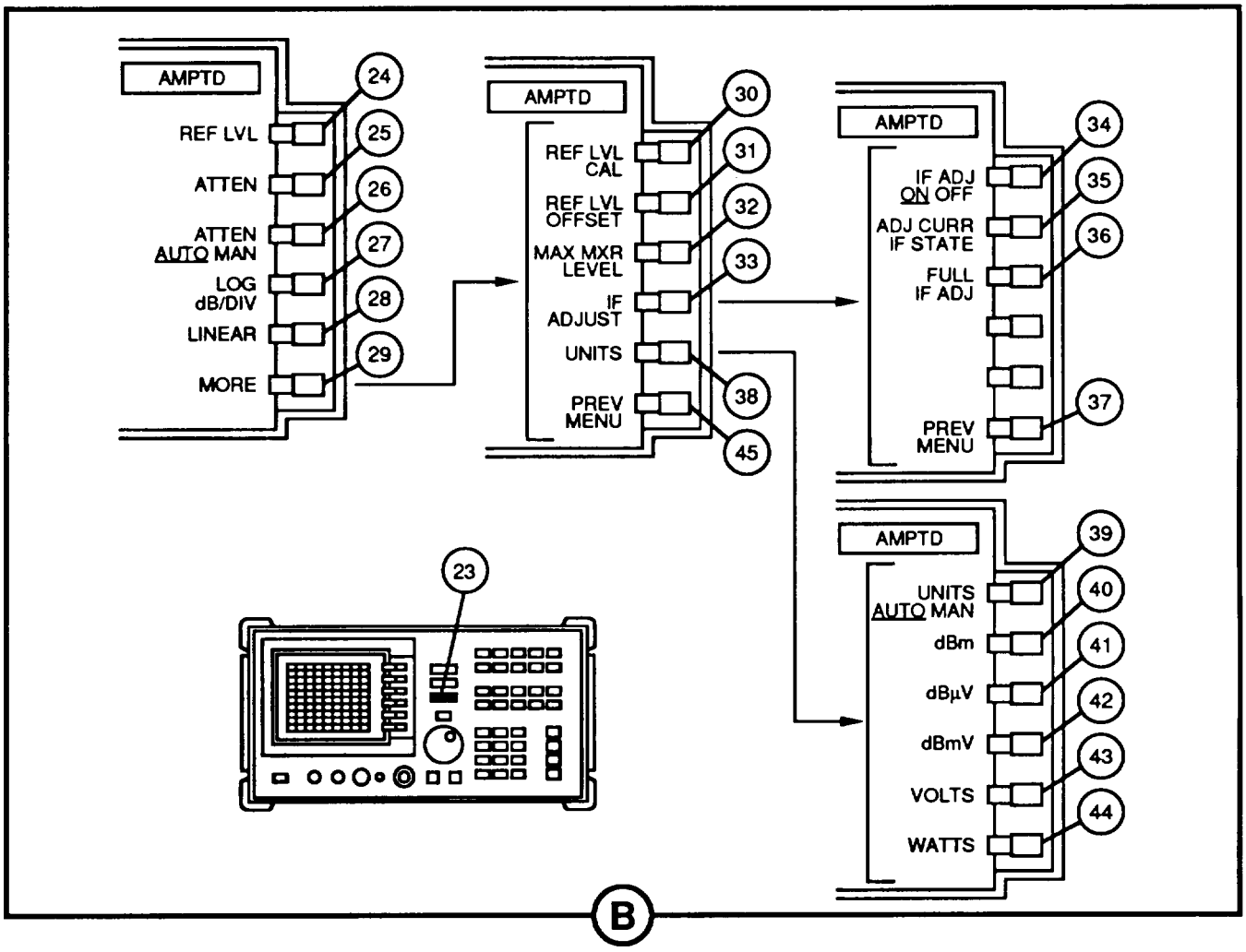
Figure 2-1. Operator’s Controls, Indicators, and Connectors, front view.



ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
1	CRT Screen	Used to display measured waveform. Screen annotations show measurement data and status; equipment and operational status; active special functions; and the currently active control with associated softkey selections.
2	RL annotation	"RL xxx dBm/dBµV/dBmV/xV/xW" indicates the current reference level setting. See item 24 for selection information.
3	ATTEN/CL annotation	"ATTEN xx dB" indicates the current attenuator setting. An '*" before the annotation indicates the function is no longer in automatic mode. See item 25 for selection information. "CL xx. x dB" indicates the current conversion loss setting. See item 136 for selection information.
4	VAVG annotation	"VAVG xx" indicates the current number of video averages selected. See item 194 for selection information.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
5	LOG/LINEAR annotation	“XX dB/” indicates logarithmic amplitude scale and current dB per division setting. See item 27 for selection information. “LIN” indicates linear amplitude scale is currently selected. See item 28 for selection information.
6	MKR/CNT annotation	"MKR xxxx dBm/dBµV/dBmV/xV/xW” indicates current marker amplitude. “xxxx XHZ” displayed to indicate current marker frequency. “A” before the annotation indicates values are measured differences between the anchor and active markers. See items 258 and 259 for more information. “CNT xxxx dBm/dBµV/dBmV/xV/xW” indicates the current marker amplitude. "xxxx xHZ” indicates the current marker frequency count. ‘A” before the annotation indicates the values are measured differences between the anchor and active markers. See items 66 and 67 for more information.
7	TITLE area	Used to name a screen when saving or printing. See item 177 for selection information.
8	* annotation	‘*” indicates that the displayed data is invalid. Usually displayed when settings are changed before completion of a sweep.
9	MENU TITLE area	xxxxx indicates what control button is currently active. The active control button determines what functions are displayed in the KEY MENU (10) area.
10	KEY MENU area	Up to six functions are displayed. Choices are dependent on the control button that is currently displayed in the MENU TITLE (9) area. Function is selected by pressing the corresponding SOFT KEY (11). Active or selected function will be highlighted or underlined. See the desired control button for a description of the functions.
11	SOFT KEYS	Pressing one of the six keys selects the corresponding function in the KEY MENU (10) area.
12	ERROR annotation	‘ERR xxx XXX XXX” indicates that an error has occurred. See paragraph 2-7 for more information.
13	SPAN/STOP annotation	"SPAN xxx xHz" indicates the current span frequency selected. See item 47 for selection information. "STOP xxx xHz" indicates the current stop frequency selected. See item 56 for selection information.
14	SWP annotation	"SWP xxx ms/sec" indicates the current sweep time selected. An “*” before the annotation indicates the function is no longer in automatic mode. See item 51 for selection information.
15	VBW annotation	"VBW xxx xHz" indicates the current video bandwidth selected. An "*" before the annotation indicates the function is no longer in automatic mode. See item 192 for selection information.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
16	RBW annotation	"RBW xxx xHz" indicates the current resolution bandwidth selected. An "*" before the annotation indicates the function is no longer in automatic mode. See item 190 for selection information.
17	CENTER/START annotation	"CENTER xxx xHz" indicates the current center frequency selected. See item 54 for selection information. "START xxx xHz" indicates the current start frequency selected. See item 55 for selection information.
18	WAVEFORM	Measured waveform with anchor and active marker, (if selected).
19	SPECIAL FUNCTION annotation	'A" indicates the automatic IF adjust is OFF. See item 34 for selection information. "D" indicates the detector mode is set to sample, negative peak, or positive peak. See item 215 for selection information. "F" indicates frequency offset is not 0 Hz. See item 60 for selection information. "K" indicates signal track is ON. See item 250 for selection information. "M" indicates trace math is ON. See items 208 and 209 for selection information. "R" indicates reference level offset is not 0 dB. See item 31 for selection information. "S" indicates single sweep mode. See items 155 and 231 for selection information. "T" indicates the trigger mode is set to line, video, or external. See items 157, 158, and 159 for selection information. 'X" indicates the external frequency reference is selected. Does not indicate that a signal is connected. See item 61 for selection information. "+" indicates positive external mixer bias is >0 mA. See item 148 for selection information. "-" indicates negative external mixer bias is <0 mA. See item 149 for selection information.
20	ACTIVE FUNCTION area	Displays the selected function, along with the current value(s), and any special messages. Use STEP buttons (273) or KNOB (272) to change value(s).
21	MEAS UNCAL annotation	"MEAS UNCAL" indicates that the displayed data is suspect. Usually displayed when the current settings are in conflict.
22	● annotation	" ● " indicates the active marker location. I V " indicates the anchor marker. Displayed data in the ACTIVE FUNCTION (20) area and MKR annotation (6) corresponds to the marker position(s). An arrow pointing off screen indicates a marker is selected, but presently off screen. See items 257 and 258 for more information.

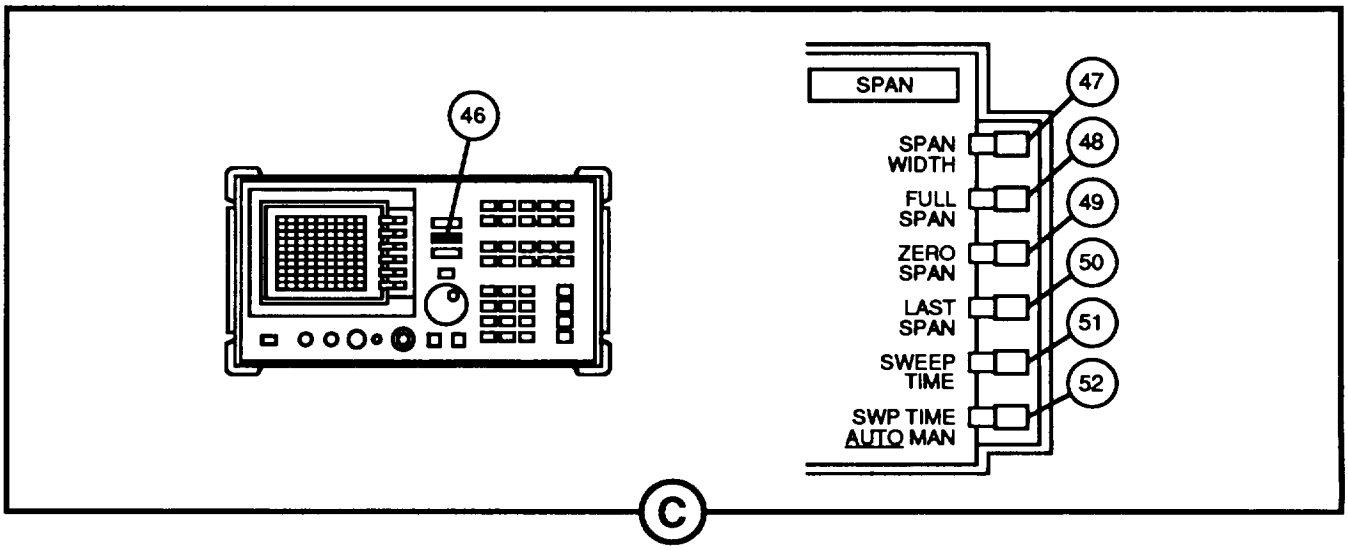


ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
23	AMPLITUDE button	Used to activate amplitude related functions. When selected, AMPTD is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION (20) area.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
24	REF LVL key	Used to display and adjust the reference level. Current value displayed in the RL annotation (2) and ACTIVE FUNCTION (20) area. Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Maximum available reference level is +30 dBm, or equivalent UNITS (38). Defaults to 0 dBm. RESTRICTIONS: Minimum available reference level is -90dBm to -120 dBm dependent on frequency band selected (refer to para 1-13). Input ATTEN (25) must be set to 0 dB before minimum reference level can be selected. SPECIAL NOTE: In LOG mode, reference level is top most horizontal line of the graticule. For best measurement accuracy, place the peak of a signal of interest on the reference level line. To avoid compression of the input signal, the input attenuator is automatically adjusted (in AUTO mode) to changes in reference level. When switching frequency bands, the reference level will automatically increase, if the current reference level is not available in the new band.
25	ATTEN key	Used to display and adjust the input attenuator. Current value displayed in the ATTEN annotation (3), and ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available input attenuation is 0 to 70 dB in 10 dB steps. if level is changed, ATTEN MAN (26) is automatically selected. Defaults to 10 dB. RESTRICTIONS: 0 dB must be entered using the DATA buttons. Input attenuator must be set to 0 dB before minimum REF LVL (24) can be selected.
26	ATTEN AUTO MAN key	Used to select the input attenuator mode. Currently active mode is underlined. Press key to toggle selection. Defaults to AUTO. If level is changed using ATTEN (25), manual mode is automatically selected. CAUTION: Maximum input signal amplitude is +30 dBm with at least 10 dB of input attenuation. Higher amplitude signals can result in damage to the Spectrum Analyzer. SPECIAL NOTE: In AUTO mode, attenuation is automatically adjusted to changes in REF LVL (24). The attenuator adjusts so that the maximum signal amplitude at the input prevents signal compression.
27	LOG dB/DIV key	Used to display and adjust logarithmic amplitude scale. Current value displayed in LOG annotation (5) and ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available settings are 1 , 2, 5, or 10 dB per division. Defaults to 10 dB/DIV, and sets UNITS (38) to dBm.
28	LINEAR key	Used to select linear amplitude scale. LIN displayed in LINEAR annotation (5). Press key to activate. Sets UNITS (38) to volts.

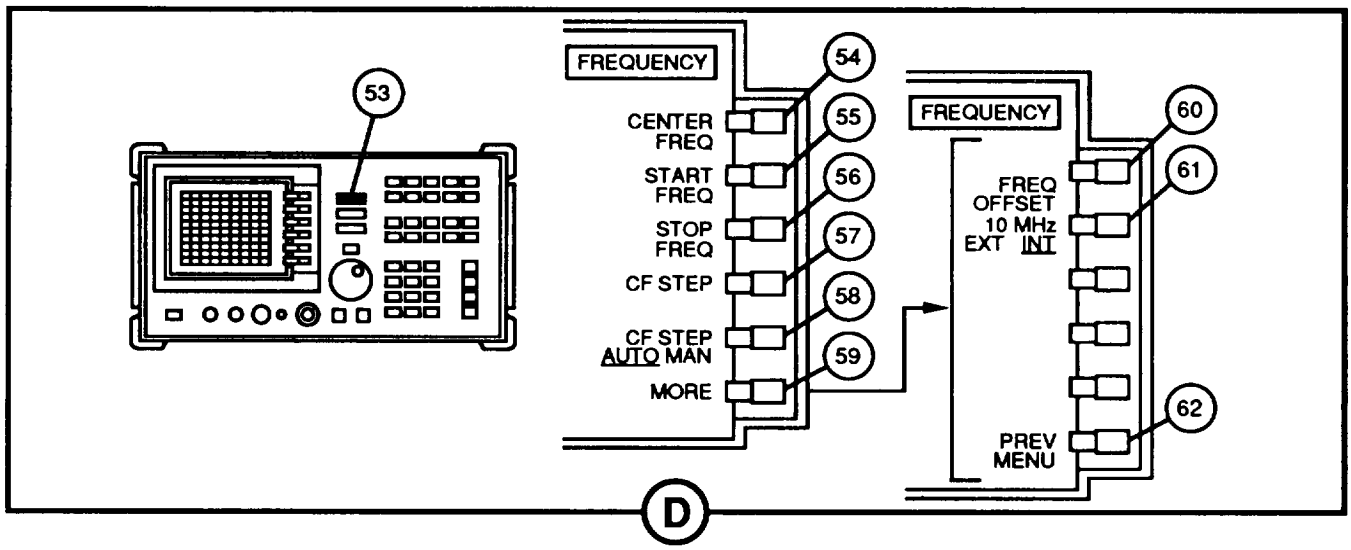
ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
29	MORE key	Used to access additional amplitude related functions. Choices are displayed in the KEY MENU (10) area.
30	REF LVL CAL key	Used to calibrate the reference level. Previously stored value displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Key changes to STORE REF LVL when pressed. Available settings are -33 to +33. Press STORE REF LVL key to save new setting. See paragraph 2-6 for procedure.
31	REF LVL OFFSET key	Used to display and adjust an offset that affects ALL amplitude readouts. Current value displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available offsets are -100 to +100 dB in 0.1 dB steps. If level is changed (from 0dB), “R” is displayed in SPECIAL FUNCTION annotation (19). Defaults to 0 dB. SPECIAL NOTE: Offset is useful to compensate for gains or losses in accessories connected to the Spectrum Analyzer.
32	MAX MXR LEVEL key	Used to display and adjust the maximum allowable signal amplitude to the input mixer (para 1-13). Current value displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available levels are -10 to -80 dBm in 10 dB steps. Defaults to -10 dBm. SPECIAL NOTE: Used when distortion-free dynamic range is required.
33	IF ADJUST key	Used to access amplitude related — IF adjust functions. Choices are displayed in the KEY MENU (10) area.
34	IF ADJ ON OFF key	Use to turn the automatic IF adjustment function ON or OFF. Internally adjusts various parameters in the IF section during the retrace time of the sweep. Currently active mode is underlined. Press key to toggle selection. Defaults to ON. If changed to OFF, “A” is displayed in SPECIAL FUNCTION annotation (19). SPECIAL NOTE: Completion of all IF adjustments may take several sweeps.
35	ADJ CURR IF STATE key	Use to execute an internal adjustment of the currently selected parameters in the IF section. Press key to activate adjustment. Adjustment status is displayed in the ACTIVE FUNCTION area (20).
36	FULL IF ADJ key	Use to execute an internal adjustment of all parameters in the IF section. Press key to activate adjustment. Key changes to STOP ADJUST when pressed. Press key again to stop the adjustment. Adjustment status is displayed in the ACTIVE FUNCTION area (20).

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
37	PREV MENU key	Used to access the previously displayed amplitude related functions. Choices are displayed in the KEY MENU (10) area.
38	UNITS key	Used to access amplitude related — units functions. Choices are displayed in the KEY MENU (10) area. Highlighted choice is the currently selected unit.
39	UNITS AUTO MAN key	Use to turn the automatic units selection function ON or OFF. In AUTO mode, the default units are dBm (LOG) or volts (LINEAR). Currently active mode is underlined. Press ,key to toggle selection. Defaults to AUTO. If units are changed, manual mode is automatically selected.
40	dBm key	Used to select amplitude units in absolute decibel referenced to 1 milliwatt. Default unit when LOG (27) is selected. When pressed, UNITS MAN (39) is automatically selected.
41	dBµV key	Used to select amplitude units in absolute decibel referenced to 1 microvolt. When pressed, UNITS MAN (39) is automatically selected.
42	dBmV key	Used to select amplitude units in absolute decibel referenced to 1 millivolt. When pressed, UNITS MAN (39) is automatically selected.
43	VOLTS key	Used to select amplitude units in volts. Default unit when LINEAR (28) is selected. When pressed, UNITS MAN (39) is automatically selected.
44	WATTS key	Used to select amplitude units in watts. When pressed, UNITS MAN (39) is automatically selected.
45	PREV MENU key	Used to access the previously displayed amplitude related functions. Choices are displayed in the KEY MENU (10) area.



ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
46	SPAN button	Used to activate span related functions. When selected, SPAN is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION (20) area. SPECIAL NOTE: When SPAN is selected, CENTER FREQ (54) will be automatically selected and displayed.
47	SPAN WIDTH key	Used to display and adjust the sweep span width. Current value displayed in the SPAN annotation (13), and ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available span is 0 Hz to 22 GHz (INT mixer) or 344.6 GHz (EXT mixer) dependent on selected CENTER FREQ (54). Defaults to 19.25 GHz. RESTRICTIONS: Span cannot be set to overlap both the low band (10 kHz to 2.9 GHz) and the high band (2.75 GHz to 22 GHz) at the same time in CONT (229) sweep. Entered span will be adjusted and displayed in the ACTIVE FUNCTION area.
48	FULL SPAN key	Used to set span width to maximum range. The maximum span available depends on what band CENTER FREQ (54) is currently in. Press key to activate. Full span for low band (10 kHz to 2.9 GHz) is 2.9 GHz. Full span for high band (2.75 GHz to 22 GHz) is 19.25 GHz. Full span for EXT mixer is 344.6 GHz. Current value displayed in SPAN annotation (13).
49	ZERO SPAN key	Used to set the sweep span frequency to 0 Hz. Press key to activate. Current value displayed in SPAN annotation (13). SPECIAL NOTE: Used for viewing modulation.

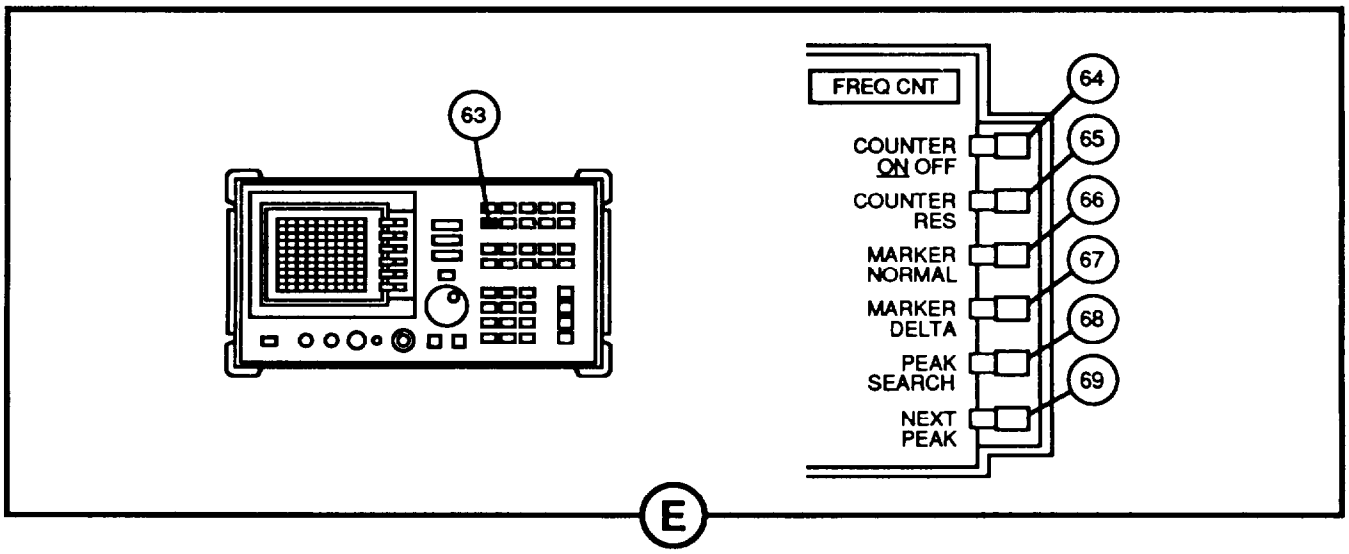
ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
50	LAST SPAN key	Used to select the previously entered span setting. Press key once to select previous span. Press key again to return to current span. Active span displayed in SPAN annotation (13). SPECIAL NOTE: Used for viewing modulation in both the frequency and time domains.
51	SWEEP TIME key	Used to display and adjust the time for one sweep. Current value displayed in the SWP annotation (14), and ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available sweep time is from 50ms to 100 sec. If time is changed, SWEEP MAN (52) is automatically selected. Defaults to 400 msec.
52	SWP TIME AUTO MAN key	Used to select the sweep time mode. Currently active mode is underlined. Press key to toggle selection. Defaults to AUTO. If time is changed using SWEEP TIME (51), manual mode is automatically selected. SPECIAL NOTE: In AUTO mode, sweeptime is automatically adjusted to changes in SPAN (46) and BW (189). If the entered sweep time is too fast for the measurement conditions, MEAS UNCAL (21) will appear in the display.



ITEM	CONTROL. INDICATOR. OR CONNECTOR	FUNCTION
53	FREQUENCY button	Used to activate frequency related functions. When selected, FREQ is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION (20) area.

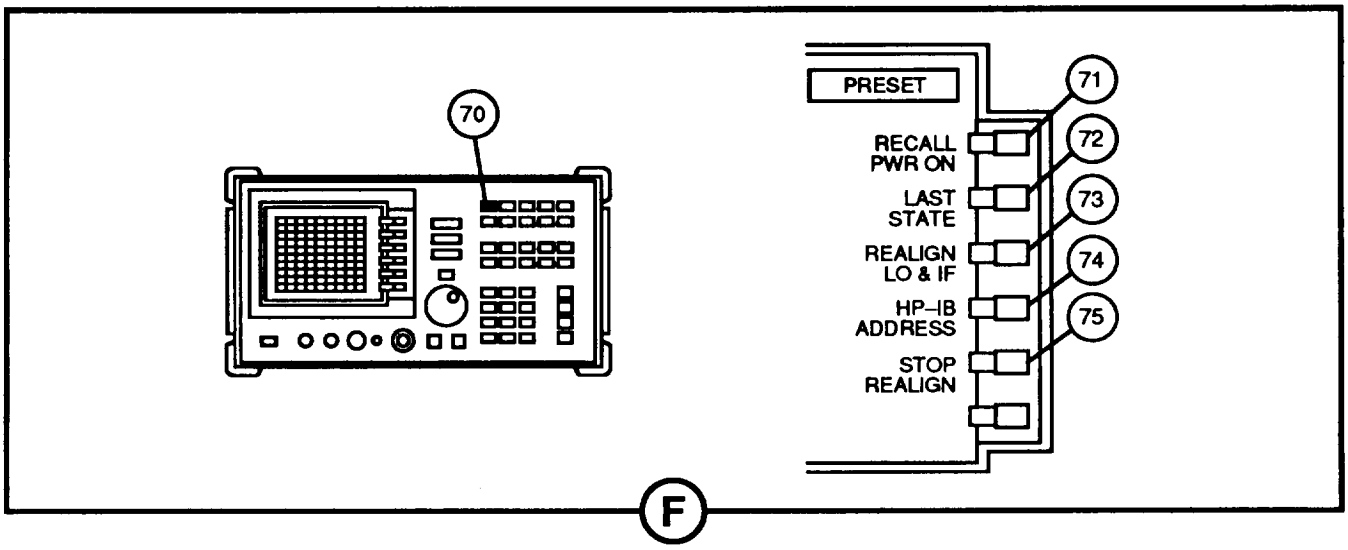
ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
54	CENTER FREQ key	Used to display and adjust sweep center frequency. Current value displayed in the CENTER annotation (17), and ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available frequency is from 0 Hz to 26.93 GHz (l NT mixer) or 0 Hz to 362.6 GHz (EXT mixer). Defaults to 12.38 GHz. RESTRICTIONS: When STEP buttons are used to adjust the center frequency, the increment of change is dependent on CF STEP (57) and CF STEP AUTO MAN (58). SPECIAL NOTE: If the new center frequency is not compatible with the current span setting, SPAN WIDTH (47) is adjusted to the nearest value that will accommodate the new center frequency.
55	START FREQ key	Used to display and adjust sweep start frequency. Current value displayed in the START annotation (17), and ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available start frequency is from -1.3 kHz to 26.93 GHz ([NT mixer) or 18 GHz to 362.6 GHz (EXT mixer). Defaults to 2.75 GHz. SPECIAL NOTE: If the selected start frequency exceeds the stop frequency, STOP FREQ (56) is automatically adjusted to equal the start frequency plus the minimum span. Minimum span = harmonic number x 2.5 kHz (see para 1-11 for harmonic numbers).
56	STOP FREQ key	Used to display and adjust sweep stop frequency. Current value displayed in the STOP annotation (13), and ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available stop frequency is from 1.3 kHz to 26.93 GHz (l NT mixer) or 18 GHz to 362.6 GHz (EXT mixer). Defaults to 22 GHz. SPECIAL NOTE: If the selected stop frequency is less than the start frequency, START FREQ (55) is automatically adjusted to less than the stop frequency plus the minimum span. Minimum span = harmonic number x 2.5 kHz (see para 1-11 for harmonic numbers).
57	CF STEP key	Used to display and adjust amount center frequency will change when STEP buttons are pressed. Current value displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use DATA buttons to enter a new value. Available step size is from 25 Hz to 26.93 GHz (INT mixer) and 150 Hz to 362.6 GHz (EXT mixer). If step size is changed, CF STEP MAN (58) is automatically selected. Defaults to 1.93 GHz. SPECIAL NOTE: Use for tuning to harmonics of an input signal.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
58	CF STEP AUTO MAN key	Used to select the center frequency step mode. Currently active mode is underlined. Press key to toggle selection. Defaults to AUTO. In AUTO, step size dependent on current SPAN (46) setting. If step size is changed using CF STEP (57), manual mode is automatically selected. SPECIAL NOTE: When MAN is selected, pressing a STEP button will change CENTER FREQ (54) by the setting currently stored in CF STEP. When AUTO is selected, and SPAN is > 0 Hz, pressing a STEP button will change the CENTER FREQ by 10% of the current SPAN setting (1 division). When AUTO is selected, and the SPAN is 0 Hz, pressing a STEP button will change CENTER FREQ by 50% of the current RBW (190) setting.
59	MORE key	Used to access additional frequency related functions. Choices are displayed in the KEY MENU (10) area.
60	FREQ OFFSET key	Used to display and adjust an offset that affects all frequency readouts, except SPAN (46) and range of a sweep. Current value displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available offsets are -100 to +100 GHz. If frequency is changed (from 0HZ), “F” is displayed in SPECIAL FUNCTION annotation (19). Defaults to 0 Hz.
61	10 MHz EXT INT key	Used to select the internal frequency reference (l NT) or user supplied external reference (EXT). Currently active mode is underlined. Press key to toggle selection. If EXT is selected, “X” is displayed in SPECIAL FUNCTION annotation (19). Defaults to INT. SPECIAL NOTE: External reference connected to the rear panel 10 MHZ REF lN/OUT J9 connector (292) must be 10 MHz ±100 Hz at a nominal amplitude of 0 dBm (–2 dBm to +10 dBm).
62	PREV MENU key	Used to access the previously displayed frequency related functions. Choices are displayed in the KEY MENU (10) area.



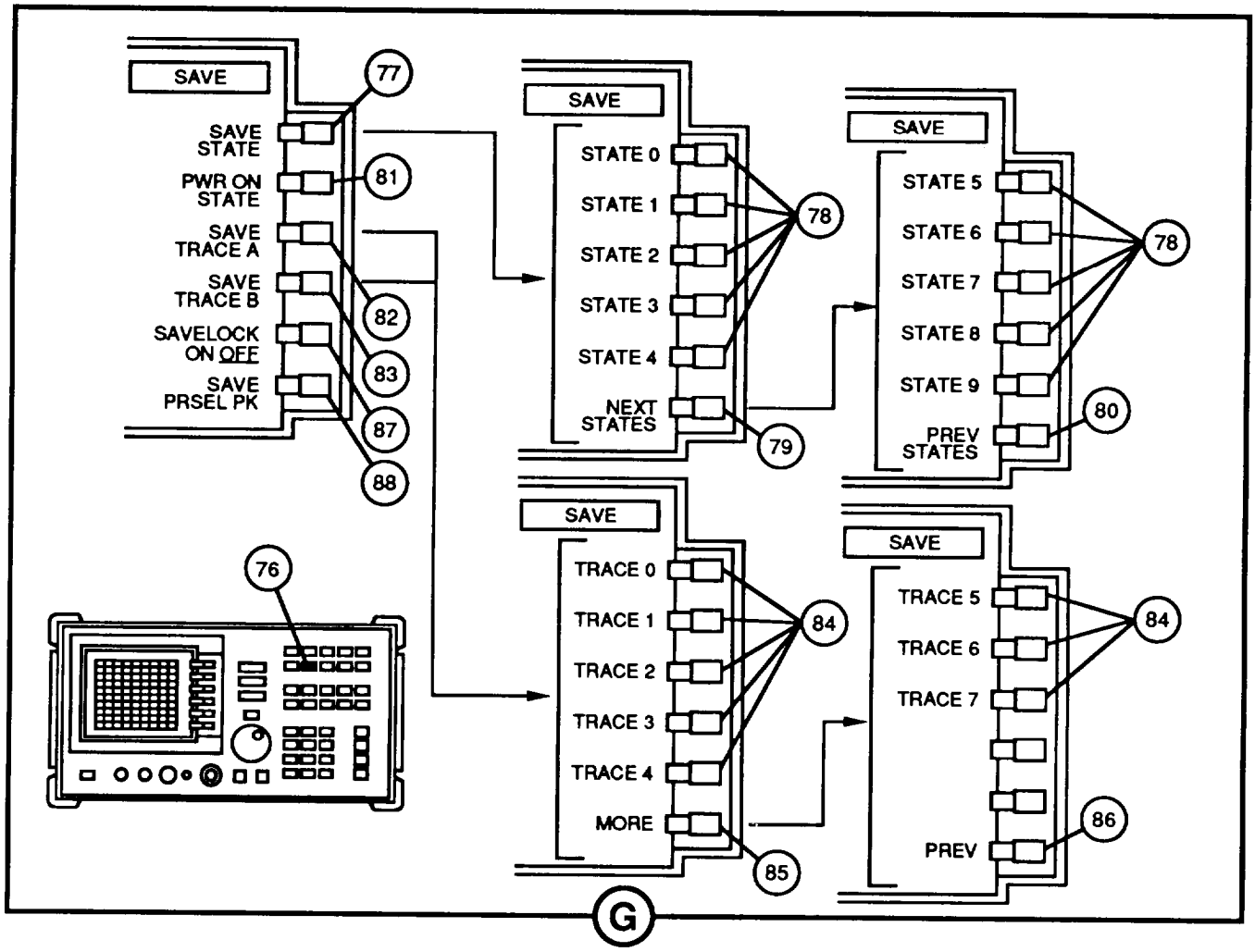
ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
63	COUNTER button	Used to activate frequency counter related functions. When selected, FREQ CNT is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION (20) area.
64	COUNTER ON OFF key	Used to turn the frequency counter function ON or OFF. When ON, the counted frequency (at the active marker position) is displayed in the CNT annotation (6). Currently active mode is underlined. Press key to toggle selection. Defaults to ON.
65	COUNTER RES key	Used to display and adjust the resolution for the frequency count function. Current value displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available resolution is from 10 Hz to 1 MHz in decade increments. Defaults to 10 kHz. SPECIAL NOTE: For RES BW (190) $\geq$ 300 Hz, the actual counter measurement occurs over a time interval twice the reciprocal of the counter resolution.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
66	MARKER NORMAL key	Used to activate a single marker. The marker reads the amplitude, and the frequency (SPAN (46) >0Hz) or relative time (SPAN = 0Hz) at the current location as displayed on the waveform. Press key to activate, then use STEP buttons, KNOB, or DATA buttons to move the marker. The measured values are displayed in the ACTIVE FUNCTION area (20) and CNT/MKR annotation (6). SPECIAL NOTE: If MARKER DELTA (67) is on, selecting MARKER NORMAL key deletes the anchor marker, and makes the active marker a single marker. Data is read from the marker in the currently active trace. (An active trace is one in either the CLR-WRT (197) or MAX HOLD (198); and may be either trace A or trace B.) If both traces are active, or if both traces are in view mode, the data from trace A marker is read.
67	MARKER DELTA key	Used to activate the Δ marker. The marker reads the difference in amplitude, and frequency (SPAN (46) >0Hz) or relative time (SPAN = 0Hz) between the anchor marker and the active marker as displayed on the waveform. Press key to activate, then use STEP buttons, KNOB, or DATA buttons to move the active marker. The measured differences are displayed in the ACTIVE FUNCTION area (20) and Δ CNT/ Δ MKR annotation (6). Amplitude is displayed in dB, or as a ratio depending on the UNITS (38) selected. SPECIAL NOTE: If MARKER NORMAL (66) is on, selecting MARKER DELTA key places both the anchor marker and active marker at the position of the original, single marker. If MARKER DELTA is already on, pressing MARKER DELTA key moves the anchor marker to the current active marker position.
68	PEAK SEARCH key	Used to place the single or active marker on the highest point of the displayed waveform. The measured values (Δ =difference) are displayed in the ACTIVE FUNCTION area (20) and CNT/MKR annotation (6). SPECIAL NOTE: The peak must meet the current PEAK EXCURSN (253) and PEAK THRESHLD (254) criteria in order to be considered a peak. If a peak cannot be found, “PEAK NOT FOUND” is displayed in the ACTIVE FUNCTION area.
69	NEXT PEAK key	Used to place the single or active marker on the next highest point of the displayed waveform relative to the current marker position. Press key again to find successively lower peaks.



ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
70	PRESET button	Used to set the Spectrum Analyzer to a known (default) configuration (para 2-6). Does not affect current HP-IB ADDRESS (74), stored settings using SAVE (76), EXT (131), and DISPLAY (160). When selected, PRESET is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION (20) area.
71	RECALL PWR ON key	Used to set the Spectrum Analyzer controls and indicators to the last configuration stored using PWR ON STATE (81). Same configuration as if LINE (279) is cycled. Press to activate.
72	LAST STATE key	Used to set the Spectrum Analyzer controls and indicators to the last configuration that existed before PRESET (70) was pressed or LINE (279) was turned off.
73	REALIGN LO & lF key	Used to perform an internal alignment of the RF, LO, and IF circuits. Press key to activate adjustment. Adjustment status is displayed in the ACTIVE FUNCTION area (20). After the RF and LO adjustments are completed, STOP REALIGN (75) is displayed to allow termination of the IF adjustment. SPECIAL NOTE: Same alignment when LINE (279) is switched on.
74	HP-IB ADDRESS key	Use to display and adjust the HP-IB address for remote operation. Current address is displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons or KNOB to enter a new value. Key changes to STORE HPIB ADR when pressed. Press key again to store the setting. Available address selections are 0 to 30.

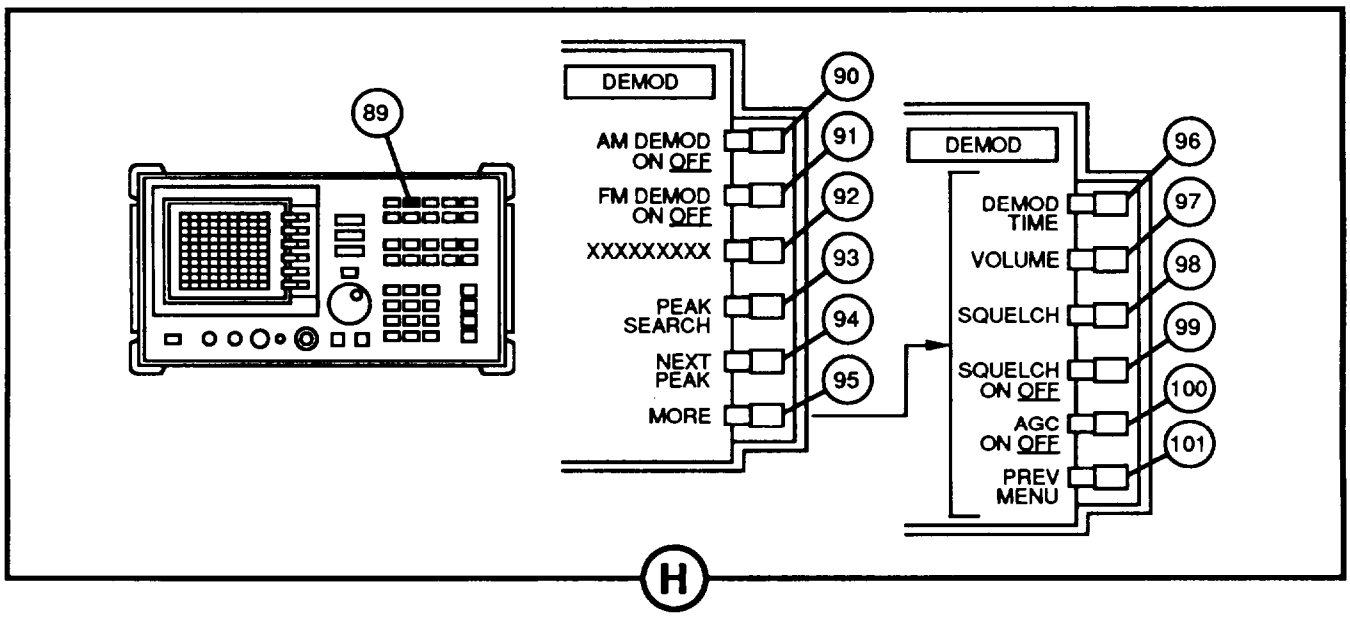
ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
75	STOP REALIGN key	Use to stop an internal alignment in progress, if the alignment was started using REALIGN LO & IF (73) or LINE (279). Selection is not displayed during RF and LO adjustments, and only allows termination of the IF adjustment (not RF or LO adjustments). Press key to stop alignment. SPECIAL NOTE: If the IF alignment is stopped, the accuracy of measurements may not meet specifications (para 1-11).



ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
76	SAVE button	Used to activate storage related functions. When selected, SAVE is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages are displayed in the ACTIVE FUNCTION (20) area.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
77	SAVE STATE key	Used to store a current Spectrum Analyzer configuration in memory. Configuration will remain in memory even with power removed. All current settings and selections are saved. Up to 10 configurations can be stored. Press key to display state numbers in the KEY MENU (10) area. Storage status is displayed in the ACTIVE FUNCTION area (20). Press SAVE (76) to return to the previous KEY MENU. See RECALL STATE (104) to recall saved data. RESTRICTIONS: State cannot be saved when SAVELOCK (87) is ON.
78	STATE # key	Used to select a register (location) to store the current Spectrum Analyzer configuration in memory. Press desired key to store configuration. Use NEXT STATES (79) and PREV STATES (80) to display all 10 locations. CAUTION: Data previously stored in the selected location will be overwritten. SPECIAL NOTE: If a SCREEN TITLE (7) is displayed, the first sixteen characters (top line) of the title are used as the location annotation in the KEY MENU (10) for that key. The sixteen characters will appear as two rows of eight characters in the KEY MENU.
79	NEXT STATES key	Used to access additional (STATE 5 to 9) storage locations. Choices are displayed in the KEY MENU (10) area.
80	PREV STATES key	Used to access the previously displayed (STATE O to 4) storage locations. Choices are displayed in the KEY MENU (10) area.
81	PWR ON STATE key	Used to store the current Spectrum Analyzer configuration in memory as the power on configuration. Spectrum Analyzer is set to this configuration when the LINE (279) is set to ON, or when RECALL PWR ON (71) is selected. Press to store current configuration. Storage status is displayed in the ACTIVE FUNCTION area (20). RESTRICTIONS: State cannot be saved when SAVELOCK (87) is ON.
82	SAVE TRACE A key	Used to store a current trace (waveform) in memory. Waveform will remain in memory even with power removed. Up to eight waveforms can be stored. Press key to display trace numbers in the KEY MENU (10) area. Storage status is displayed in the ACTIVE FUNCTION area (20). Press SAVE (76) to return to the previous KEY MENU. See RECALL TO TR A (108) to recall saved data. RESTRICTIONS: Trace cannot be saved when SAVELOCK (87) is ON.

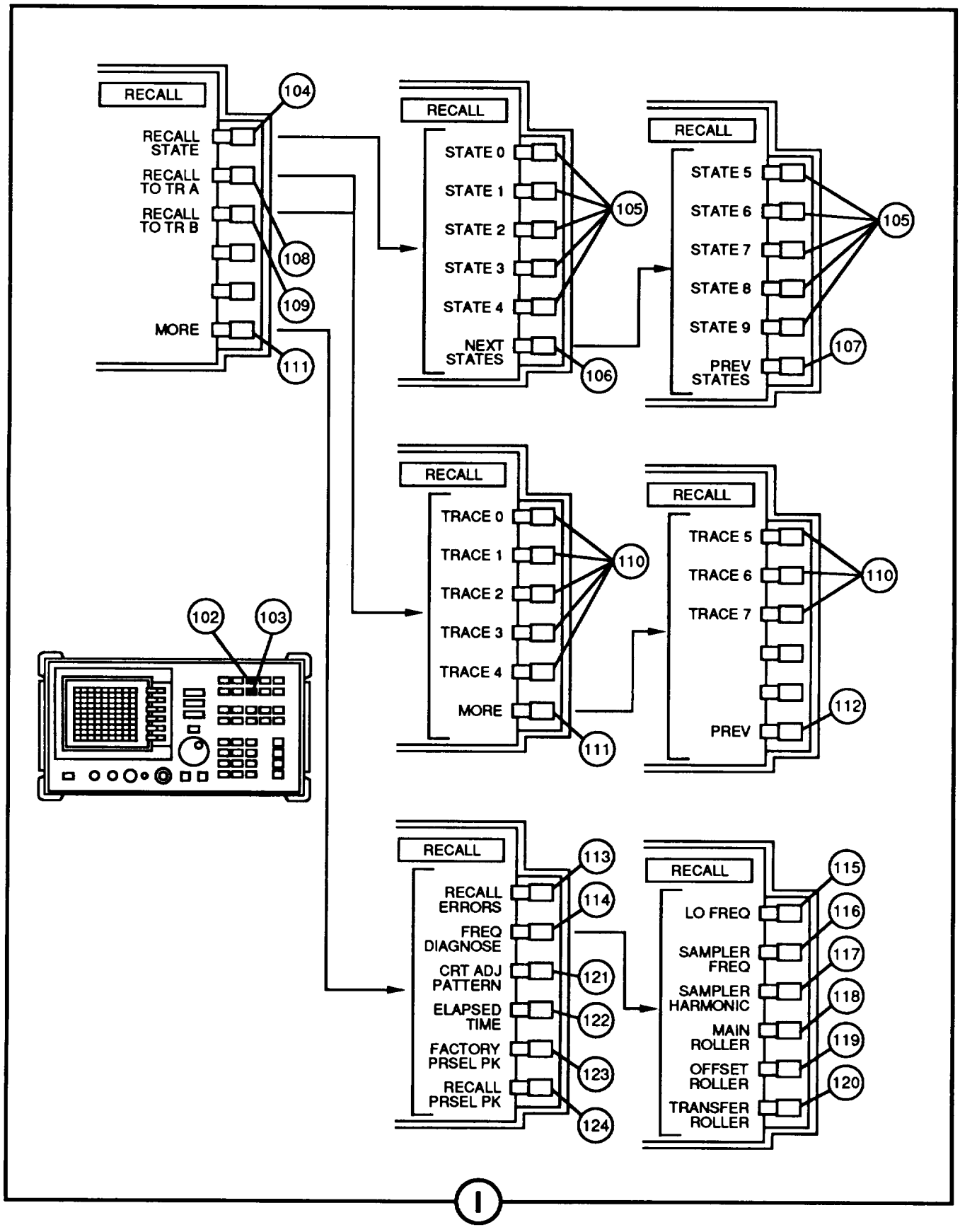
ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
83	SAVE TRACE B key	Used to store a current trace (waveform) in memory. Waveform will remain in memory even with power removed. Up to eight waveforms can be stored. Press key to display trace numbers in the KEY MENU (10) area. Storage status is displayed in the ACTIVE FUNCTION area (20). Press SAVE button to return to the previous KEY MENU. See RECALL TO TR B (109) to recall saved data. RESTRICTIONS: Trace cannot be saved when SAVELOCK (87) is ON.
84	TRACE # key	Used to select a register (location) to store the current trace (waveform) in memory. Press desired key to store waveform. Use MORE (85) and PREV (86) to display all eight locations. CAUTION: Data previously stored in the selected location will be overwritten. In addition, SAVE TRACE A (82) and SAVE TRACE B (83) use exactly the same eight locations to store trace data. Take care not to overwrite previously stored trace data. SPECIAL NOTE: If a SCREEN TITLE (7) is displayed, the first sixteen characters (top line) of the title are used as the location annotation in the KEY MENU (10) for that key. The sixteen characters will appear as two rows of eight characters in the KEY MENU.
85	MORE key	Used to access additional (TRACE 5 to 7) storage locations. Choices are displayed in the KEY MENU (10) area.
86	PREV key	Used to access the previously displayed (TRACE 0 to 4) storage locations. Choices are displayed in the KEY MENU (10) area.
87	SAVELOCK ON OFF key	Used to prevent storing data in the PWR ON STATE (81), STATE (78) or TRACE (84) registers. When ON, the stored data can be recalled, but cannot be erased or overwritten. Attempts to store data causes “SAVELOCK ON” to be displayed in the ACTIVE FUNCTION area (20). Set to OFF to store new data. Currently active mode is underlined. Press key to toggle selection. Defaults to OFF.
88	SAVE PRESL PK key	Used to store current preselector-peak data. Does not change the factory preselector data. See” RECALL PRSEL PK (124) to recall saved data. SPECIAL NOTE: See paragraph 1-13 for more information on preselector data.



ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
89	DE MOD button	Used to activate demodulation related functions. When selected, DE MOD is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION (20) area.
90	AM DE MOD ON OFF key	Used to turn AM demodulation ON or OFF. When ON, demodulates the signal at the active marker position (or center frequency), and produces an audio output. Currently active mode is underlined. Press key to toggle selection. Defaults to OFF. Selecting AM DEMOD ON causes FM DE MOD OFF (91). RESTRICTIONS: When SPAN (46) is >0 Hz, a fixed 10 kHz RES BW (190) is used during demodulation (not displayed bandwidth). When the SPAN is 0 Hz, the displayed RES BW is used. VIDEO BW (192) is not used during demodulation. SPECIAL NOTE: If SPAN is 0 Hz, the signal at the currently selected CENTER FREQ (92) is demodulated. If SPAN is > 0 Hz, the signal at the active marker position is demodulated. If a marker is not selected, one is automatically placed at the center of the trace.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
91	FM DEMOD ON OFF key	Used to turn FM demodulation ON or OFF. When ON, demodulates the signal at the active marker position (or center frequency), and produces an audio output. Currently active mode is underlined. Press key to toggle selection. Defaults to OFF. Selecting FM DE MOD ON causes AM DE MOD OFF (90). RESTRICTIONS: When SPAN (46) is >0 Hz, a fixed 100 kHz RES BW (190) is used during demodulation (not displayed bandwidth). When the SPAN is 0 Hz, the displayed RES BW is used. VIDEO BW (192) is not used during demodulation. SPECIAL NOTE: If SPAN is 0 Hz, the signal at the currently selected CENTER FREQ (92) is demodulated. If SPAN is > 0 Hz, the signal at the active marker position is demodulated. If a marker is not selected, one is automatically placed at the center of the trace.
92	MARKER NORMAL/ MARKER DELTA/ CENTER FREQ key	One of these three choices will be displayed at this location depending on the Spectrum Analyzer conditions. MARKER NORMAL displayed when one marker is on (or markers are off), and SPAN (46) is > 0 Hz. Used to activate a single marker, and automatically place at the center of the trace. If a marker is already active, no operation takes place. Amplitude and the frequency at the active marker location are displayed. Press key to activate, then use STEP buttons, KNOB, or DATA buttons to move the marker. The measured values are displayed in the ACTIVE FUNCTION area (20) and CNT/MKR annotation (6). MARKER DELTA displayed when two markers are on, and SPAN is > 0 Hz. The difference in amplitude and frequency between the anchor marker and the active marker is displayed. Pressing MARKER DELTA key moves the anchor marker to the current active marker position. Use STEP buttons, KNOB, or DATA buttons to move the active marker. The measured differences are displayed in the ACTIVE FUNCTION area (20) and Δ CNT/AMKR annotation (6). Amplitude is displayed in dB, or as a ratio depending on the UNITS (38) selected. CENTER FREQ displayed when SPAN is 0 Hz. Used to select and adjust center frequency. Current value displayed in the CENTER annotation (17), and ACTIVE FUNCTION area (20). Use STEP buttons, KNOB, or DATA buttons to change value. SPECIAL NOTE: Data is read from the marker in the currently active trace. (An active trace is one in either the CLR-WRT (197) or MAX HOLD (198); and may be either trace A or trace B.) If both traces are active, or if both traces are in view mode, the data from trace A marker is read.
93	PEAK SEARCH key	Used to place the single or active marker on the highest point of the displayed waveform. The measured values (Δ =difference) are displayed in the ACTIVE FUNCTION area (20) and CNT/MKR annotation (6). SPECIAL NOTE: The peak must meet the current PEAK EXCURSN (253) and PEAK THRESHLD (254) criteria in order to be considered a peak. If a peak cannot be found, “PEAK NOT FOUND” is displayed in the ACTIVE FUNCTION area.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
94	NEXT PEAK key	Used to place the single or active marker on the next highest point of the displayed waveform relative to the current marker position. Press key again to find successively lower peaks.
95	MORE key	Used to access additional demodulation related functions. Choices are displayed in the KEY MENU (10) area.
96	DE MOD TIME key	Used to display and adjust the duration of demodulation between sweeps. Used only when SPAN (46) is > 0 Hz. When SPAN = OHZ, demodulation is continuous. Current value displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Maximum available times are 0.1 to 60 sec. Defaults to 1 sec.
97	VOLUME key	Used to display and adjust the volume of the demodulated audio signal. Current value displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Maximum available settings are 0 (minimum) to 15 (maximum). Defaults to 0. Same as VOL (151).
98	SQUELCH key	Used to display and adjust the squelch level of the input signal during demodulation. Current value displayed in the ACTIVE FUNCTION area (20) and as a dashed line on the display. Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Maximum available settings are -220.0 dBm to +30 dBm, or equivalent UNITS (38). If level is changed, SQUELCH OFF (99) is automatically selected. RESTRICTIONS: When SPAN (46) = 0HZ, squelch for AM DE MOD (90) is inactive.
99	SQUELCH ON OFF key	Used to turn the squelch mode ON or OFF. When ON, an active marker must be located above the squelch (dashed) line for demodulation to occur. Currently active mode is underlined. Press key to toggle selection. Defaults to OFF. If squelch level is changed using SQUELCH (98), ON mode is automatically selected.
100	AGC ON OFF key	Used to turn the automatic gain control (AGC) ON or OFF. AGC keeps the volume constant during AM demodulation. Currently active mode is underlined. Press key to toggle selection. Defaults to OFF. RESTRICTIONS: AGC functions only during AM DEMOD (90) when SPAN (46) > 0 Hz.
101	PREV MENU key	Used to access the previously displayed demodulation related functions. Choices are displayed in the KEY MENU (10) area.


RECALL
RECALL STATE
RECALL TO TR A
RECALL TO TR B
MORE
104
108
109
111
RECALL
STATE 0
STATE 1
STATE 2
STATE 3
STATE 4
NEXT STATES
105
106
RECALL
STATE 5
STATE 6
STATE 7
STATE 8
STATE 9
PREV STATES
105
107
RECALL
TRACE 0
TRACE 1
TRACE 2
TRACE 3
TRACE 4
MORE
110
111
RECALL
TRACE 5
TRACE 6
TRACE 7
PREV
110
112
102
103
RECALL
RECALL ERRORS
FREQ DIAGNOSE
CRT ADJ PATTERN
ELAPSED TIME
FACTORY PRSEL PK
RECALL PRSEL PK
113
114
121
122
123
124
RECALL
LO FREQ
SAMPLER FREQ
SAMPLER HARMONIC
MAIN ROLLER
OFFSET ROLLER
TRANSFER ROLLER
115
116
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118
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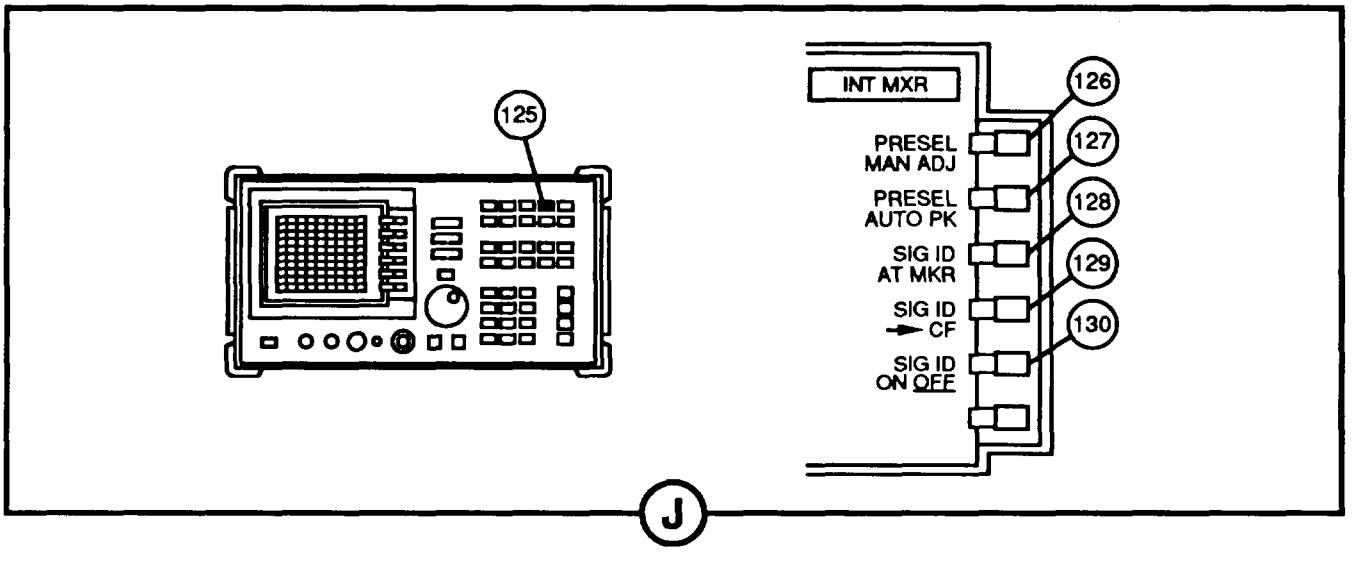
I

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
102	MODULE button	Used to activate and select the functions of an OPTION MODULE, connected to the rear panel. When selected, MODULE is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. SPECIAL NOTE: If an OPTION MODULE is not connected to the rear panel when selected, 'MODULE NOT FOUND" is displayed in the ACTIVE FUNCTION area (20), and the KEY MENU area is blanked.
103	RECALL button	Used to activate recall related functions. When selected, RECALL is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION (20) area.
104	RECALL STATE key	Used to recall a previously stored Spectrum Analyzer configuration from memory. Up to 10 previously stored configurations can be recalled. Press key to display state numbers in the KEY MENU (10) area. Recall status is displayed in the ACTIVE FUNCTION area (20). Press RECALL button to return to the previous KEY MENU. See SAVE STATE (77) to store data.
105	RECALL # key	Used to select a register (location) in memory where a previously stored Spectrum Analyzer configuration resides. Press desired key to recall stored configuration. Use NEXT STATES (106) and PREV STATES (107) to display all 10 locations. SPECIAL NOTE: If a SCREEN TITLE (7) was used during SAVE (76), then the first sixteen characters (top line) of the title are used as the location annotation in the KEY MENU (10) for that key. The sixteen characters appear as two rows of eight characters in the KEY MENU. If the selected register does not contain a previously-saved configuration, "NOT SAVEDI" is displayed in the ACTIVE FUNCTION area (20).
106	NEXT STATES key	Used to access additional (STATE 5 to 9) recall locations. Choices are displayed in the KEY MENU (10) area.
107	PREV STATES key	Used to access the previously displayed (STATE 0 to 4) recall locations. Choices are displayed in the KEY MENU (10) area.
108	RECALL TO TR A key	Used to recall a previously stored trace (waveform) from memory. Up to eight previously stored waveforms can be recalled. Press key to display trace numbers in the KEY MENU (10) area. Recall status is displayed in the ACTIVE FUNCTION area (20). Press RECALL (103) to return to the previous KEY MENU. See SAVE TRACE A (82) to store trace.

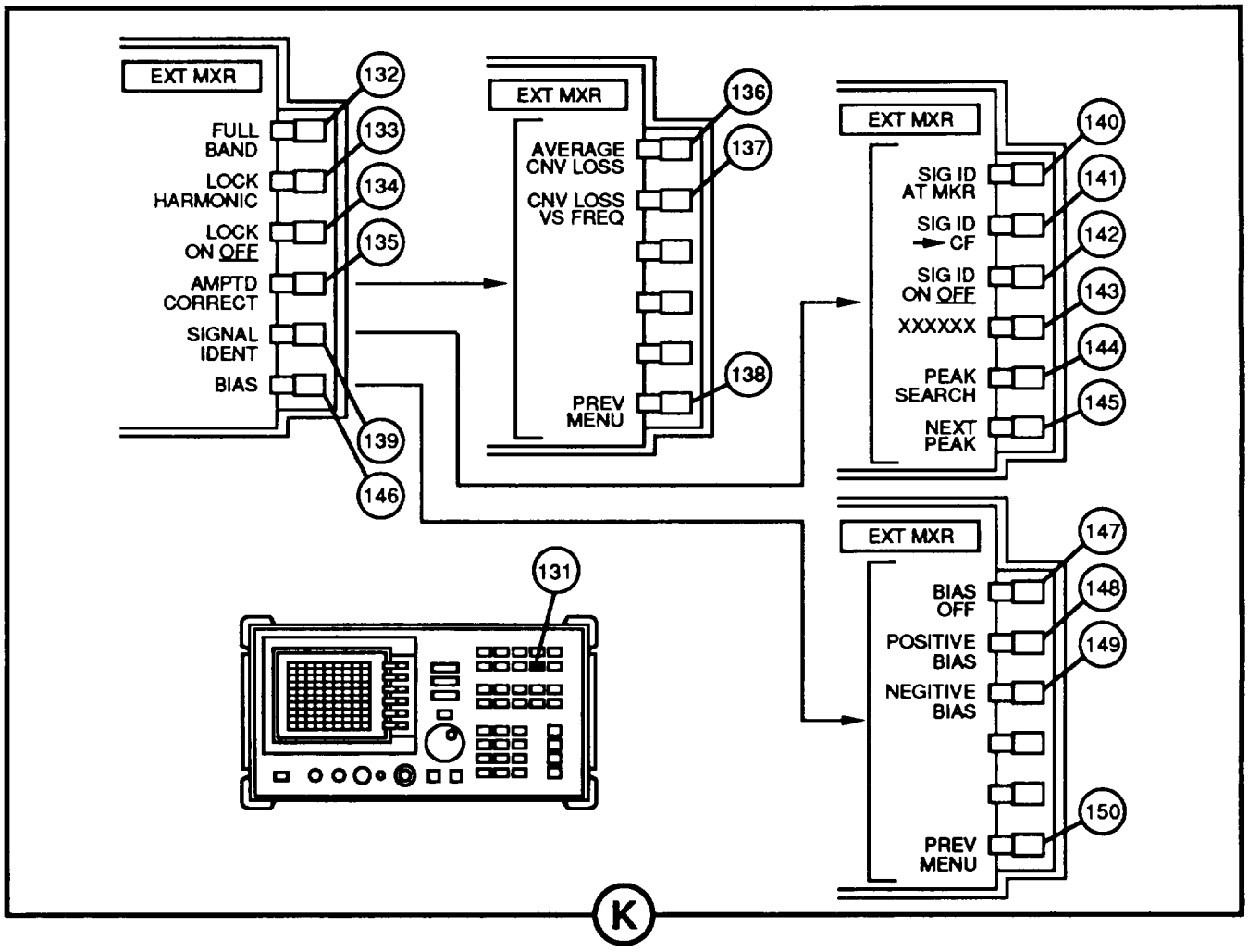
ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
109	RECALL TO TR B key	Used to recall a previously stored trace (waveform) from memory. Up to eight previously stored waveforms can be recalled. Press key to display trace numbers in the KEY MENU (10) area. Recall status is displayed in the ACTIVE FUNCTION area (20). Press RECALL (103) to return to the previous KEY MENU. See SAVE TRACE B (83) to store trace.
110	TRACE # key	Used to select a register (location) in memory where the previously stored trace (waveform) resides. Press desired key to recall stored waveform . Use MORE (111) and PREV (112) to display' all eight locations. SPECIAL NOTE: If a SCREEN TITLE (7) was used during SAVE (76), then the first sixteen characters (top line) of the title are used as the location annotation in the KEY MENU (10) for that key. The sixteen characters appear as two rows of eight characters in the KEY MENU. If the selected register does not contain a previously-saved waveform, "NOT SAVEDI" is displayed in the ACTIVE FUNCTION area (20).
111	MORE key	Used to access additional (TRACE 5 to 7) recall locations. Choices are displayed in the KEY MENU (10) area.
112	PREV key	Used to access the previously displayed (TRACE 0 to 4) recall locations. Choices are displayed in the KEY MENU (10) area.
113	RECALL ERRORS key	Used to display error messages. Last error message generated displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons or KNOB to scroll all accumulated error messages. See paragraph 2-7 for more Information.
114	FREQ DIAGNOSE key	Used to access maintenance related — diagnostic functions. Choices are displayed in the KEY MENU (10) area. Press RECALL (103) to return to the previous KEY MENU. SPECIAL NOTE: Because these functions are used during troubleshooting, only a brief description is provided.
115	LO FREQ key	Used to display the current first local oscillator frequency.
116	SAMPLER FREQ key	Used to display the current sampling oscillator frequency.
117	SAMPLER HARMONIC key	Used to display the current sampler harmonic number.
118	MAIN ROLLER key	Used to display the current main-roller oscillator frequency.
119	OFFSET ROLLER key	Used to display the current offset-roller oscillator frequency.
120	TRANSFER ROLLER key	Used to display the current transfer-roller oscillator frequency.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
121	CRT ADJ PATTERN key	Used to adjust the CRT screen. Displays a fixed pattern of lines and characters. Press key to activate. Press EXIT key to return to the previous KEY MENU (10).
122	ELAPSED TIME key	Used to display the cumulative operating time of the Spectrum Analyzer. Press key to display time (in hours) in the ACTIVE FUNCTION area (20).
123	FACTORY PRESEL PK key	Used to restore the preselector-peaking data as set at the factory. Selects factory data table to be used as current preselector data. SPECIAL NOTE: See paragraph 1-13 for more information on the preselector data.
124	RECALL PRSEL PK key	Used to recall previously stored preselect or-peak data. See SAVE PRSEL PK (88) to store data. SPECIAL NOTE: See paragraph 1-13 for more information on the preselector data.



ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
125	INT button	Used to activate internal mixer related functions. When selected, INT MXR is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION (20) area.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
126	PRESEL MAN ADJ key	Used to display and manually adjust the preselector tracking data. Current value is displayed in the ACTIVE FUNCTION area (20). Place an active MARKER (264) on the desired signal, then press key to activate. Use STEP buttons, KNOB, or DATA buttons to enter a new value. Available selections are O to 255. Press INT (125) to return to the previous menu. RESTRICTIONS: An active marker must be selected, or "ACTIVATE MARKER" will be displayed in the ACTIVE FUNCTION area. Frequency must be tuned to >2.9 GHz, or "SET FREQ >2.9 GHz" will be displayed in the ACTIVE FUNCTION area. SPECIAL NOTE: This function affects data in the current preselect data table. See SAVE PRESEL PK (88) to save this data in the user data table. Data tables explained in para 1-13.
127	PRESEL AUTO PK key	Used to automatically peak the preselector tracking data. Verify trace mode is CLR-WRT (197 or 202), place an active MARKER (264) on the desired signal, then press key to activate. Peaking status is displayed in the ACTIVE FUNCTION area (20). After the preselector tracking is adjusted, the display returns to normal. RESTRICTIONS: Frequency must be tuned to >2.9 GHz, or "SET FREQ >2.9 GHz" will be displayed in the ACTIVE FUNCTION area. SPECIAL NOTE: Use PRESEL MAN ADJ (126) to view new data. This function affects data in the current preselect data table. See SAVE PRESEL PK (88) to save this data in the user preselect data table. Data tables explained in paragraph 1-13.
128	SIG lD AT MKR key	Used to activate the signal identification function. Locates and displays the signal frequency and current harmonic number. Verify trace mode is CLR-WRT (197 or 202), place an active MARKER (264) on the desired signal, then press key to activate. Key changes to STOP SIG ID when pressed. Press key again to stop the function. Signal Frequency and LO Harmonic Mixing Number (N) are displayed in the ACTIVE FUNCTION area (20). RESTRICTIONS: An active marker must be selected, or "ACTIVATE MARKER" will be displayed in the ACTIVE FUNCTION area. CLR-WRT must be selected, or "ACTIVATE TRACE" will be displayed in the ACTIVE FUNCTION area. SPECIAL NOTE: If a signal cannot be identified, "NOT FOUND" or "LOST SIGNAL" is displayed in the ACTIVE FUNCTION area.
129	SIG ID —> CF key	Used to change the CENTER FREQ (54) to the Signal Frequency found using SIG ID AT MKR (128). Press key to activate. New CENTER FREQ displayed in the ACTIVE FUNCTION area (20). RESTRICTIONS: Must execute SIG ID AT MKR before selecting.
130	SIG lD ON OFF key	Used to turn the manual signal identification function ON or OFF. When ON, frequency shift method of identifying signals is used. Currently active mode is underlined. Press key to toggle selection. Defaults to OFF. RESTRICTIONS: To ensure accuracy, limit SPAN (46) to <20MHz. SPECIAL NOTE: Displayed signals are shifted horizontally and vertically on alternate sweeps. Signals that are correct for the selected harmonic band are shifted less than 80 kHz. In addition, all signals are shifted downward in amplitude by approximately one division.



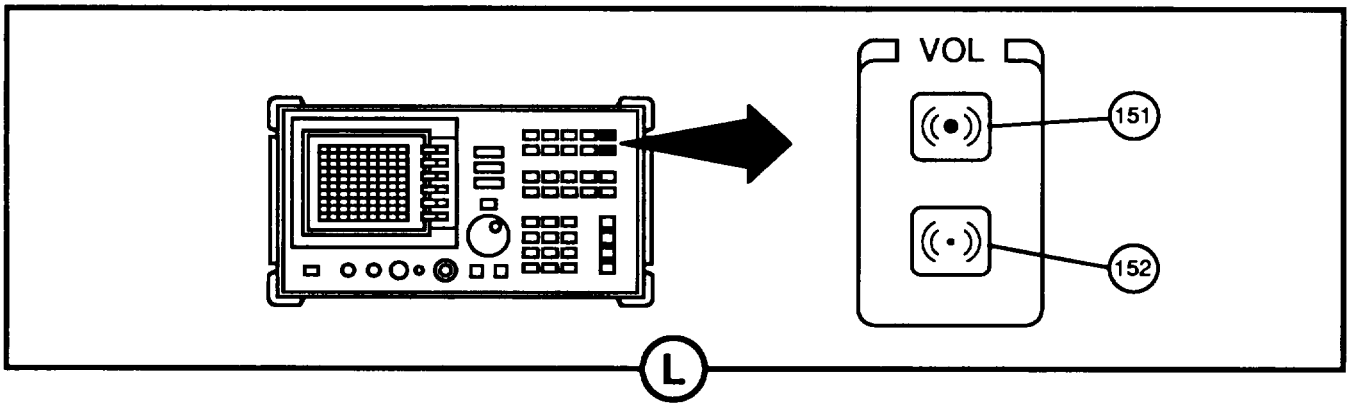
ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
131	EXT button	Used to activate external mixer related functions. When selected, EXT MXR is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION area (20). RESTRICTIONS: Input signal must be connected to external mixer (A and K band supplied), and the external mixer must be properly connected to the Spectrum Analyzer 1st LO OUTPUT (278) and IF INPUT (277) connectors. SPECIAL NOTE: Select INT (125) when finished using the external mixer.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
132	FULL BAND key	Used to display and select the entire external mixer frequency band (para 1-11). Press key to activate, then use STEP buttons or KNOB to enter a frequency band. Available bands are A or K (other bands are selectable but mixers are not supplied). When selected, LOCK ON (134) automatically selected. Band letter displayed in the ACTIVE FUNCTION area (20), and frequency displayed in the START (17) and STOP (13) annotations. Defaults to K.
133	LOCK HARMONIC key	Used to display and adjust the current harmonic number. Harmonic Number refers to the local oscillator harmonic used to sweep a specific frequency band (para 1-11). Current number is displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available numbers are from 5-9 (other numbers are selectable but mixers are not supplied). When pressed, LOCK ON (134) automatically selected and current FULL BAND (132) value automatically changed. Defaults to 6.
134	LOCK ON OFF key	Used to turn the range lock ON or OFF. When ON, only CENTER FREQ (54) and SPAN (46) settings that fall within the frequency band of the current harmonic number can be entered. When FULL SPAN (48) is selected, the span is limited to the frequency band of the selected harmonic (i. e., 18 to 26.5 GHz). When OFF, more than one band can be used to sweep across a desired span (i. e., 18 to 40 GHz). Currently active mode is underlined. Press key to toggle selection. Defaults to OFF. if band is changed using FULL BAND (132), or harmonic number is changed using LOCK HARMONIC (133), then ON is automatically selected. SPECIAL NOTE: When FULL SPAN is selected and LOCK HARMONIC is OFF, the entire range of external mixing appears on the display.
135	AMP TD CORRECT key	Used to access external mixer related — conversion loss and flatness functions. Choices are displayed in the KEY MENU (10) area.
136	AVERAGE CNV LOSS key	Used to display and adjust the average conversion loss for the current SPAN (46). Current value displayed in the CL annotation (3) and ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available conversion loss is from +15.0 to +60.0 dB. RESTRICTIONS: SPAN is limited to a portion of a band (LOCK HARMONIC (133), or an entire band FULL BAND (132). If the SPAN currently selected covers more than one band, ‘SINGLE BAND ONLY” will be displayed in the ACTIVE FUNCTION area. See LOCK ON OFF (134) for more information. SPECIAL NOTE: In FULL BAND, the average conversion loss is defined as the minimum loss plus the maximum loss for that band divided by two. Any change in average conversion loss affects the flatness data CNV LOSS VS FREQ (136).

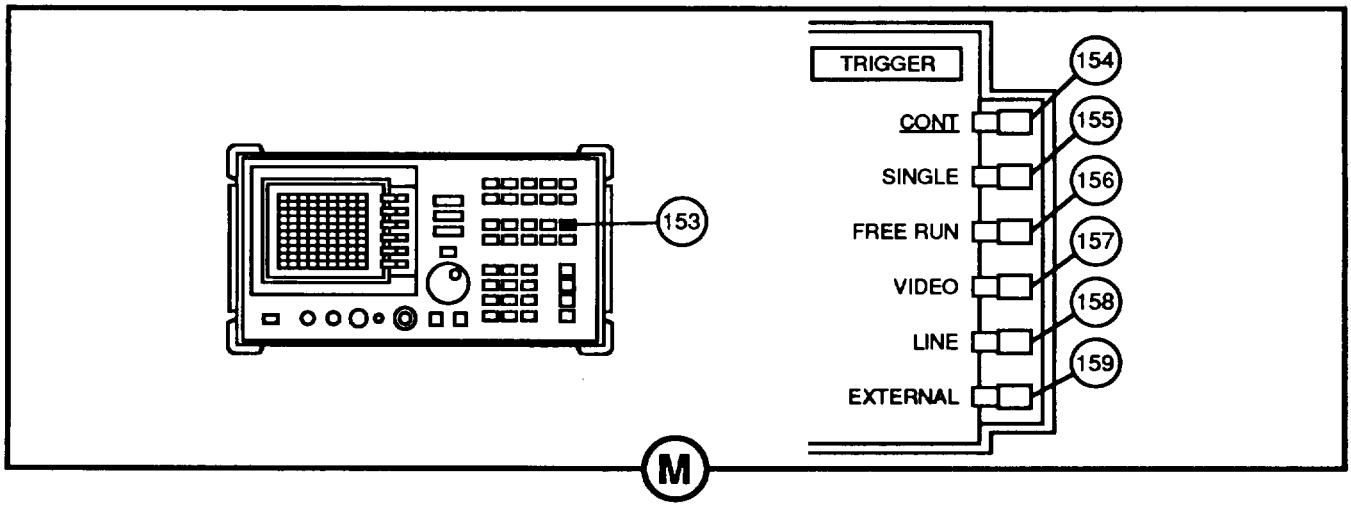
ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
137	CNV LOSS VS FREQ key	Used to display and adjust conversion loss for specific frequencies in the selected band. Allows amplitude correction to be entered to compensate for changes in conversion loss with frequency. Current conversion loss setting and frequency displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use KNOB, or DATA buttons to enter a new conversion loss for the displayed frequency. Use STEP buttons to change frequency (from 6 to 9 settings, dependent on band selected). Band K has 6 frequency settings, and band A has 8. Available conversion loss is +9.5 to +65.5 dB at each frequency setting. RESTRICTIONS: If not in FULL BAND (132), "PREDEFINE BANDS ONLY" will be displayed in the ACTIVE FUNCTION area. See FULL BAND (132) for more information. SPECIAL NOTE: To view the conversion loss correction, connect a 310.7 MHz signal of a known amplitude (=–30 dBm) to the IF INPUT (277) connector and set the controls to sweep the associated band.
138	PREV MENU key	Used to access the previously displayed external mixer related functions. Choices are displayed in the KEY MENU (10) area.
139	SIGNAL lDENT key	Used to access external mixer related — signal identification functions. Choices are displayed in the KEY MENU (10) area. Press EXT (131) to return to the previous menu.
140	SIG ID AT MKR key	Used to activate the signal identification function. Locates and displays the signal frequency and current harmonic number. Verify trace mode is CLR-WRT (197 or 202), place an active MARKER (264) on the desired signal, then press key to activate. Key changes to STOP SIG ID when pressed. Press key again to stop the function. Signal Frequency and LO Harmonic Mixing Number (N) are displayed in the ACTIVE FUNCTION area (20). RESTRICTIONS: An active marker must be selected, or "ACTIVATE MARKER" will be displayed in the ACTIVE FUNCTION area. CLR-WRT must be selected, or "ACTIVATE TRACE" will be displayed in the ACTIVE FUNCTION area. SPECIAL NOTE: If a signal cannot be identified, "NOT FOUND" or "LOST SIGNAL" is displayed in the ACTIVE FUNCTION area.
141	SIG ID—> CF key	Used to change the CENTER FREQ (54) to the Signal Frequency found using SIG ID AT MKR (140). Press key to activate. New CENTER FREQ displayed in the ACTIVE FUNCTION area (20). RESTRICTIONS: Must execute SIG ID AT MKR before selecting.
142	SIG lD ON OFF key	Used to turn the manual signal identification function ON or OFF. When ON, frequency shift method of identifying signals is used. Currently active mode is underlined. Press key to toggle selection. Defaults to OFF. RESTRICTIONS: To ensure accuracy, limit SPAN (46) to <20MHz. SPECIAL NOTE: Displayed signals are shifted horizontally and vertically on alternate sweeps. Signals that are correct for the selected harmonic band are shifted less than 80 kHz. In addition, all signals are shifted downward in amplitude by approximately one division.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
143	MARKER NORMAL/ MARKER DELTA key	One of these two choices will be displayed at this location depending on the Spectrum Analyzer conditions. MARKER NORMAL displayed when one marker is on (or markers are off). Used to activate a single marker, and automatically place at the center of the trace. If a marker is already active, no operation takes place. Amplitude and frequency at the current marker location are displayed. Press key to activate, then use STEP buttons, KNOB, or DATA buttons to move the marker. The measured values are displayed in the ACTIVE FUNCTION area (20) and CNT/MKR annotation (6). MARKER DELTA displayed when two markers are on. The difference in amplitude and frequency between the anchor marker and the active marker is displayed. Pressing MARKER DELTA key moves the anchor marker to the current active marker position. Use STEP buttons, KNOB, or DATA buttons to move the active marker. The measured differences are displayed in the ACTIVE FUNCTION area and Δ CNT/ Δ MKR annotation. Δ amplitude is displayed in dB, or as a ratio depending on the UNITS (38) selected. SPECIAL NOTE: Selecting either marker causes NEXT PEAK (145) to be displayed. Data is read from the marker in the currently active trace. (An active trace is one in either the CL R-WRT (197) or MAX HOLD (198); and may be either trace A or trace B.) If both traces are active, or if both traces are in view mode, the data from trace A marker is read.
144	PEAK SEARCH key	Used to place the single or active marker on the highest point of the displayed waveform. The measured values (Δ =difference) are displayed in the ACTIVE FUNCTION area (20) and CNT/MKR annotation (6). SPECIAL NOTE: The peak must meet the current PEAK EXCURSN (253) and PEAK THRESHLD (254) criteria in order to be considered a peak. If a peak cannot be found, “PEAK NOT FOUND” is displayed in the ACTIVE FUNCTION area.
145	NEXT PEAK key	Used to place the single or active marker on the next highest point of the displayed waveform relative to the current marker position. Press key again to find successively lower peaks. SPECIAL NOTE: Only displayed when MARKER NORMAL or MARKER DELTA (143) selected.
146	BIAS key	Used to access external mixer related — bias functions. Choices are displayed in the KEY MENU (10) area.
147	BIAS OFF key	Used to turn off the external-mixer bias. Press to set POSITIVE BIAS (148) and NEGATIVE BIAS (149) to 0 ma. Press key to turn off previously selected positive or negative bias.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
148	POSITIVE BIAS key	Used to display and adjust positive mixer bias for an external mixer. Selected bias present at the IF INPUT connector (277) center conductor. Press key, then use STEP buttons, KNOB, or DATA buttons to select the desired level. Selected bias is displayed in the ACTIVE FUNCTION area (20). When selected, "+" is displayed in SPECIAL FUNCTION annotation (19). Available bias is from 0 to +10.0 ma. Defaults to 0 ma. CAUTION: Open-circuit bias voltage (≤ +3.5V into 300 Ω) may be present when using RECALL (103) if bias level previously stored. SPECIAL NOTE: The bias value is given in terms of short-circuit current. Actual amount of current flowing into the mixer is less.
149	NEGATIVE BIAS key	Used to display and adjust negative mixer bias for an external mixer. Selected bias present at the IF INPUT connector (277) center conductor. Press key, then use STEP buttons, KNOB, or DATA buttons to select the desired level. Selected bias is displayed in the ACTIVE FUNCTION area (20). When selected, "-" is displayed in SPECIAL FUNCTION annotation (19). Available bias is from 0 to -10.0 ma. Defaults to 0 ma. CAUTION: Open-circuit bias voltage (≤ -3.5V into 300 Ω) may be present when using RECALL (103) if bias level previously stored. SPECIAL NOTE: The bias value is given in terms of short-circuit current. Actual amount of current flowing into the mixer is less.
150	PREV MENU key	Used to access the previously displayed external mixer related functions. Choices are displayed in the KEY MENU (10) area.

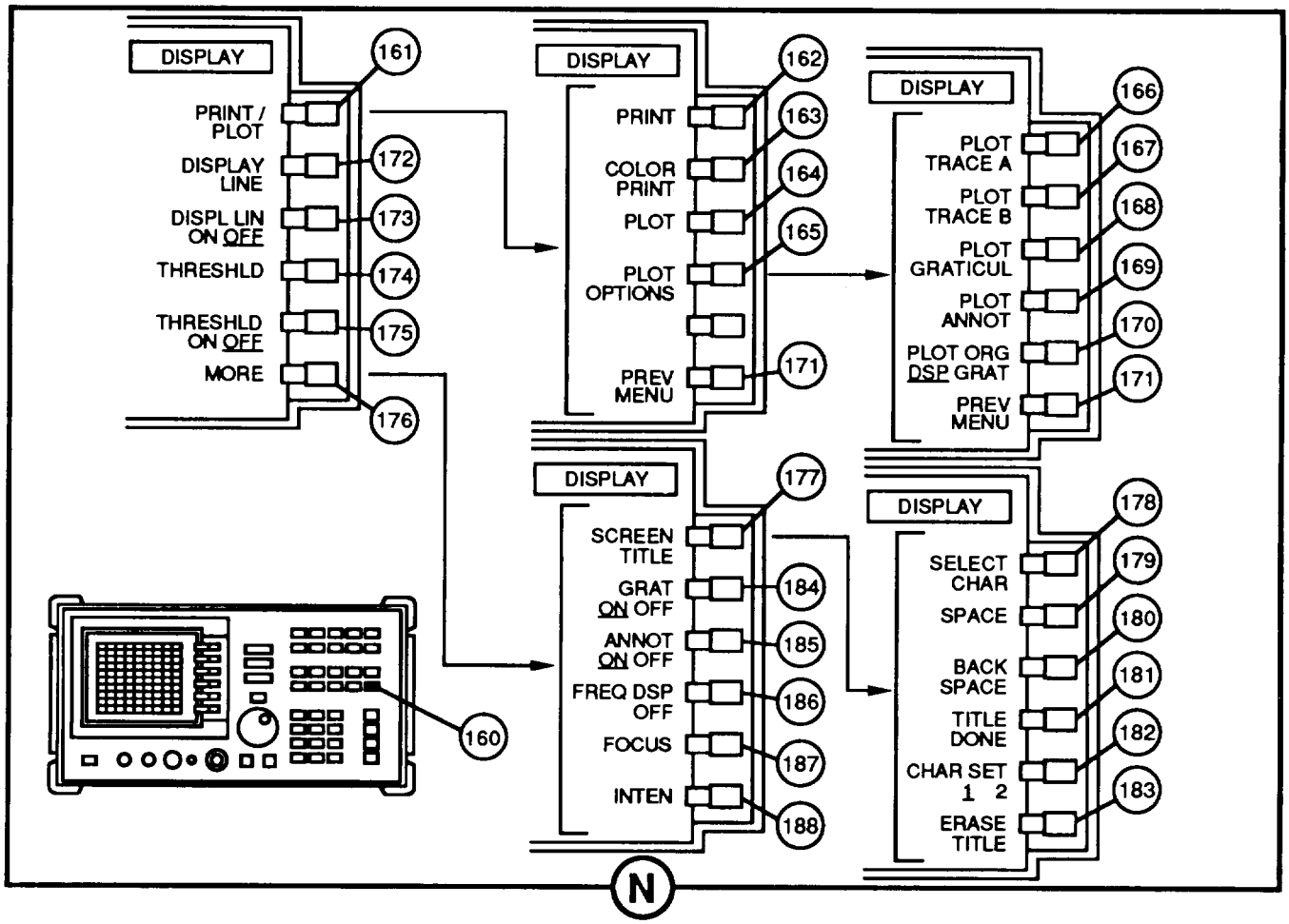


ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
151	button	Used to increase volume of audio during AM or FM DE MOD (89), Press key once to increase one level. Press and hold to increase up to 15 levels. See VOLUME (97) to display current volume level. Range is 0 to 15. Defaults to 0.
152	button	Used to decrease volume of audio during AM or FM DE MOD (89). Press key once to decrease one level. Press and hold to decrease up to 15 levels. See VOLUME (97) to display current volume level. Range is 0 to 15. Defaults to 0.



ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
153	TRIGGER button	Used to activate the trigger related functions described below. When selected, TRIGGER is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages. displayed in the ACTIVE FUNCTION (20) area. Defaults to CONT (154) and FREE RUN (156). RESTRICTIONS: Only CONT (154) or SINGLE (155) can be selected at one time. Selecting one will deactivate the other.
154	CONT key	Used to set the sweep to continuous mode. Press key to activate. When selected, choice is underlined, and when selected trigger is received, continuous sweeps are made. CONT is the default sweep mode. Press key to restart a sweep.
155	SINGLE key	Used to set the sweep to single mode. Press key to activate. When selected, choice is underlined, and when selected trigger is received, one sweep is made. Press again to for another sweep at the next trigger. When selected, “S" is displayed in SPECIAL FUNCTION annotation (19).
156	FREE RUN key	Used to set the trigger to free run mode. Sweep triggers occur as fast as possible, regardless of input signal. Press key to activate. When selected, choice is highlighted.
157	VIDEO key	Used to set the trigger to video mode. Sweep triggers occur when the positive slope of the input signal exceeds the selected video trigger level. Video trigger level is a dashed line on the screen. Press key to activate, then use STEP buttons, KNOB, or DATA buttons to select the desired level. When selected, choice is highlighted, dashed line appears, and a “T” is displayed in SPECIAL FUNCTION annotation (19). Selected level is displayed in the ACTIVE FUNCTION area (20). Available trigger levels are from +30 to -220 dBm, or equivalent UNITS (38). Defaults to 0 dBm.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
158	LINE key	Used to set the trigger to line mode. Sweep triggers occur at intervals synchronized to the input power line frequency (47-440 Hz). Press key to activate. When selected, choice is highlighted, and a "T" is displayed in SPECIAL FUNCTION annotation (19).
159	EXTERNAL key	Used to set the trigger to external mode. Sweep triggers from an external trigger source must be connected to EXT TRIG INPUT J5 (283) connector. Sweep trigger occurs on the rising, positive edge of the external trigger signal (about 1.5 V). When selected, choice is highlighted, and a "T" is displayed in SPECIAL FUNCTION annotation (19).



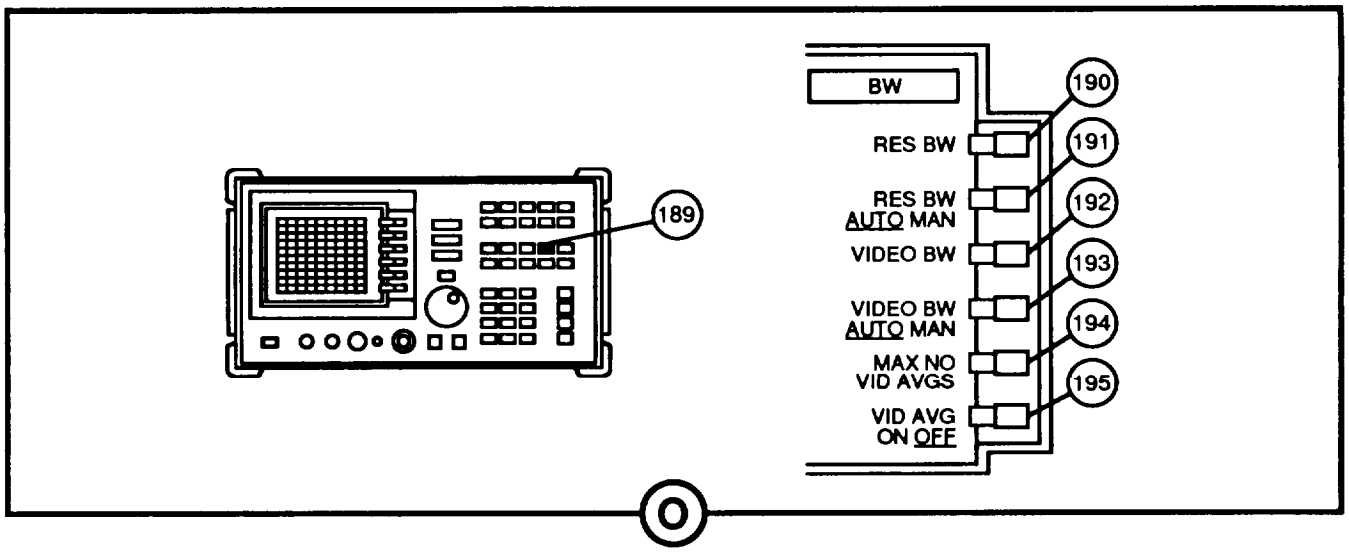
ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
160	DISPLAY button	Used to activate display related functions described below. When selected, DISPLAY is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION (20) area.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
161	PRINT/PLOT key	Used to access display related — printer and plotter functions. Choices are displayed in the KEY MENU (10) area.
162	PRINT key	Used to print a hard copy of the CRT Screen (1). Prints everything except menus and error codes. Press key to start printing. Key changes to STOP PRINT when pressed. Press key again to stop printing. Printing status is displayed in the ACTIVE FUNCTION area (20). SPECIAL NOTE: An HP-IB compatible printer must be connected to the HP-IB connector (284). If a printer is not properly connected, "CONNECT PRINTER" is displayed in the ACTIVE FUNCTION area.
163	COLOR PRINT key	Used to print a color hard copy of the CRT Screen (1). Colors are fixed by the Spectrum Analyzer. Prints everything except menus and error codes. Press key to start printing. Top key changes to STOP PRINT when pressed. Press this key to stop printing. Printing status is displayed in the ACTIVE FUNCTION area (20). SPECIAL NOTE: An HP-IB Paint Jet printer must be connected to the HP-IB connector (284). If a Paint Jet printer is not properly connected, "CONNECT PRINTER" is displayed in the ACTIVE FUNCTION area. If a printer other than a Paint Jet printer is connected, incorrect information will be printed.
164	PLOT key	Used to plot a hard copy of the CRT Screen (1). Prints everything except menus and error codes. Press key to start plotting. Key changes to STOP PLOT when pressed. Press key again to stop plotting. Plotting status is displayed in the ACTIVE FUNCTION area (20). SPECIAL NOTE: An HP-IB compatible plotter must be connected to the HP-IB connector (284). If a plotter is not properly connected, "CONNECT PLOTTER" is displayed in the ACTIVE FUNCTION area. See PLOT OPTIONS (165) for more information).
165	PLOT OPTIONS key	Used to access display related — plotter option functions. Choices are displayed in the KEY MENU (10) area. SPECIAL NOTE: An HP-IB compatible plotter must be connected to the HP-IB connector (284) for all plot functions except PLOT ORG DSP GRAT (170). If a plotter is not properly connected, "CONNECT PLOTTER" displayed in ACTIVE FUNCTION area (20).
166	PLOT TRACE A key	Used to plot a hard copy of TRACE A (196). Press key to start plotting. Key changes to STOP TRACE A when pressed. Press key again to stop plotting. Plotting status is displayed in the ACTIVE FUNCTION area (20). SPECIAL NOTE: If TRACE A is blank, 'TRACE IS BLANKED" is displayed in the ACTIVE FUNCTION area.
167	PLOT TRACE B key	Used to plot a hard copy of TRACE B (201). Press key to start plotting. Key changes to STOP TRACE B when pressed. Press key again to stop plotting. Plotting status is displayed in the ACTIVE FUNCTION area (20). SPECIAL NOTE: If TRACE B is blank, "TRACE IS BLANKED" is displayed in the ACTIVE FUNCTION area.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
168	PLOT GRATICUL key	Used to plot a hard copy of the graticule. Press key to start plotting. Key changes to STOP GRATICUL when pressed. Press key again to stop plotting. Plotting status is displayed in the ACTIVE FUNCTION area (20).
169	PLOT ANNOT key	Used to plot a hard copy of the CRT Screen (1) annotations. Prints everything except menus, trace markers, and error codes. Press key to start plotting. Key changes to STOP ANNOT when pressed. Press key again to stop plotting. Plotting status is displayed in the ACTIVE FUNCTION area (20). SPECIAL NOTE: If ANNOT OFF (185) is selected, a plot is not provided.
170	PLOT ORG DSP GRAT key	Used to select the display or graticule mode. Select DSP for plotter references (P1 and P2) at the corners of the CRT Screen (1). Select GRAT for plotter references (P1 and P2) at the lower-left and upper-right corners of the graticule. Currently active mode is underlined. Press key to toggle selection. Defaults to GRAT. RESTRICTIONS: Function is locked out when any plot is pending, or in process. SPECIAL NOTE: GRAT is used to position desired plot information on a preprinted graticule obtained using PLOT GRAT (168).
171	PREV MENU key	Used to access the previously shown display related functions. Choices are displayed in the KEY MENU (10) area.
172	DISPLAY LINE key	Used to display and adjust the display line. Solid line shown on CRT screen (1), and current level displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new level. When pressed, DISP LIN ON (173) automatically selected. Available levels are -220.0 to +30 dBm, or equivalent UNITS (38). Defaults to 0 dBm.
173	DSPL LIN ON OFF key	Used to turn the display line function ON or OFF. When ON, DISPLAY LINE (172) is highlighted, solid line shown on CRT screen (1), and current level displayed in the ACTIVE FUNCTION area (20). Currently active mode is underlined. Press key to toggle selection. Defaults to OFF.
174	THRESHLD key	Used to display and adjust the lower limit of an active trace(s). Dashed line shown on CRT screen (1), and current level is displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. When pressed, THRESHLD ON (175) automatically selected. Available levels are -220.0 to +30 dBm, or equivalent UNITS (38). Defaults to -90.0 dBm. CAUTION: When VIEW (199) or MAX-HOLD (198) are selected, and threshold level is raised, any data below the new threshold level is permanently lost.

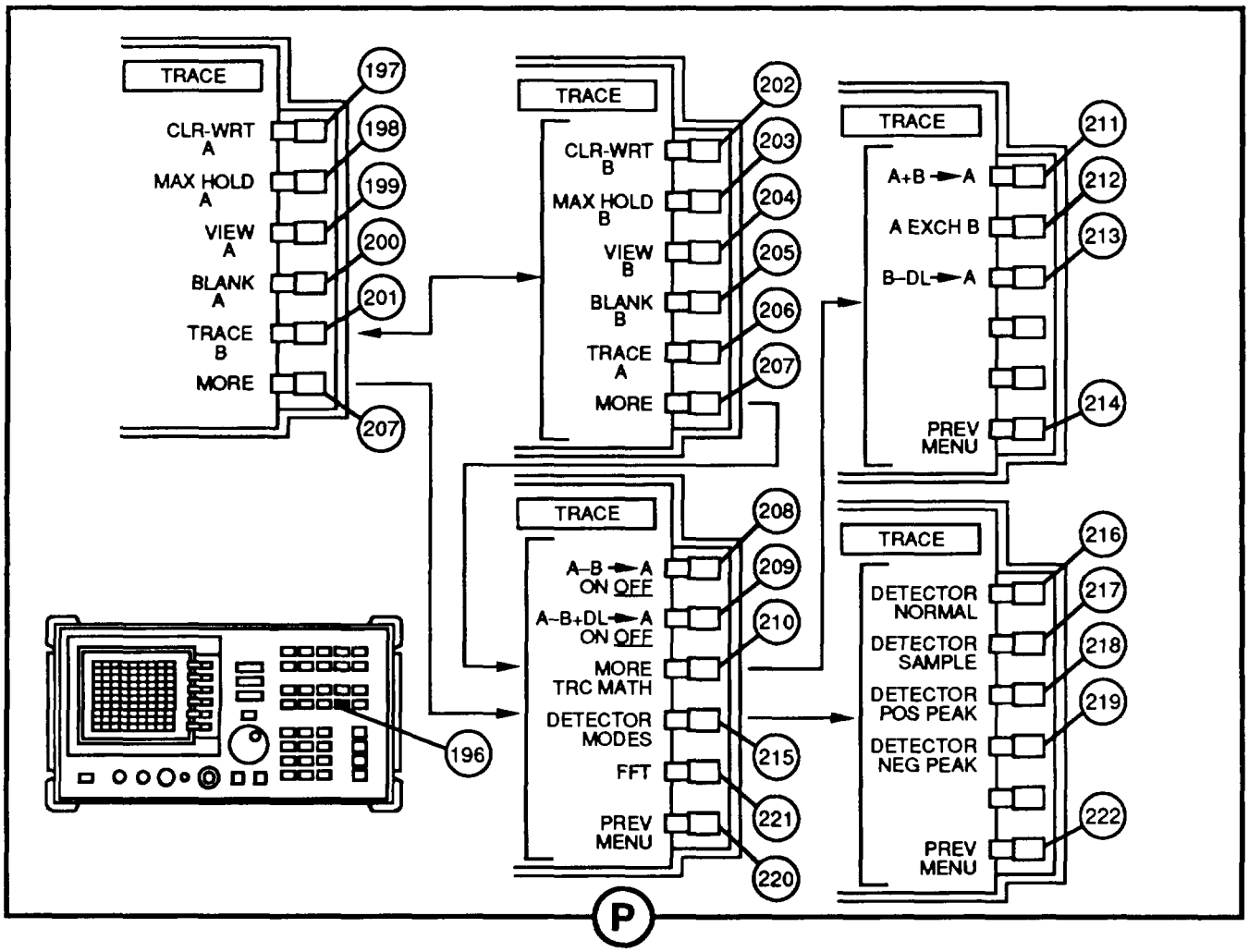
ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
175	THRESHLD ON OFF key	Used to turn the threshold function ON or OFF. When ON, THRESHLD (174) is highlighted, a dashed line shown on CRT screen (1), and current level is displayed in ACTIVE FUNCTION area (20). Currently active mode is underlined. Press key to toggle selection. Defaults to OFF.
176	MORE key	Used to access additional display related functions. Choices are displayed in the KEY MENU (10) area.
177	SCREEN TITLE key	Used to access display related — screen title functions. Choices are displayed in the KEY MENU (10), area. Press DISPLAY (160) to return to previous menu.
178	SELECT CHAR key	Used to display and enter title characters on the screen. Two lines of 16 characters each can be entered from the character set displayed in the ACTIVE FUNCTION area (20). Use STEP buttons or KNOB to highlight (select) a character. Press key once, or press and hold, to enter character(s) in the TITLE area (7). DATA buttons can be used to enter numeric characters.
179	SPACE key	Used to enter a blank space in the TITLE (7) area. Press once, or press and hold, for desired blank space(s).
180	BACK SPACE key	Used to delete the last selected character in the TITLE (7) area. Press once, or press and hold, for desired back space(s).
181	TITLE DONE key	Used to enter the SCREEN TITLE (177). Press to enter the displayed TITLE (7) and return to the previous menu.
182	CHAR SET 1 2 key	Used to display and select a character set. Selected character set displayed in the ACTIVE FUNCTION area (20). 1 contains uppercase letters, numbers, and miscellaneous characters. 2 contains lowercase letters and miscellaneous characters. Currently active mode is underlined. Press key to toggle selection. Defaults to 1.
183	ERASE TITLE key	Used to erase a title currently displayed in the TITLE area (7). Press to erase.
184	GRAT ON OFF key	Used to turn the display graticule ON or OFF. Currently active mode is underlined. Press key to toggle selection. Defaults to ON.
185	ANNOT ON OFF key	Used to turn the display annotations ON or OFF. Includes all annotations except menus. Currently active mode is underlined. Press key to toggle selection. Defaults to ON.
186	FREQ DSP OFF key	Used to turn off ALL frequency annotations. Press key activate. OFF underlined when active. To re-display frequency annotations, press PRESET (70).

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
187	FOCUS key	Used to display and, adjust CRT Screen (1) focus. Current setting displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value (adjust focus). Key changes to STORE FOCUS when pressed. Press key again to store new setting. Available entries from 0 to 255.
188	INTEN key	Used to display and adjust CRT Screen (1) brightness. Current setting displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value (adjust brightness). Key changes to STORE INTEN when pressed. Press key again to store new setting. Available entries from 0 to 255. SPECIAL NOTE: Use = 80 for indoor use. Excessive brightness shortens CRT life.



ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
189	BW button	Used to activate bandwidth related functions. When selected, BW is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages are displayed ACTIVE FUNCTION area (20).
190	RES BW key	Used to display and adjust the resolution bandwidth (3 dB). Current value displayed in the RBW annotation (16), and ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available bandwidth is from 100 Hz to 1 MHz in a 1, 3, 10 sequence, and 2 MHz. If resolution bandwidth is changed, RES BW MAN (191) is automatically selected. Defaults to 1.0 MHz. SPECIAL NOTE: If measuring signals close in frequency, select a RES BW less than or equal to the frequency separation.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
191	RES BW AUTO MAN key	Used to select the resolution bandwidth mode. Currently active mode is underlined. Press key to toggle selection. Defaults to AUTO. If resolution bandwidth is changed using RES BW (190), manual mode is automatically selected. SPECIAL NOTE: In AUTO mode, RES BW is automatically adjusted to changes in SPAN (46) and FREQUENCY (53). If the entered RES BW is not compatible measurement conditions, MEAS UNCAL (21) will appear in the display.
192	VIDEO BW key	Used to display and adjust the video bandwidth. Current value displayed in the VBW annotation (15), and ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available bandwidth is from 1 Hz to 3 MHz. If video bandwidth is changed, VIDEO BW MAN (192) is automatically selected. Defaults to 1.0 MHz. SPECIAL NOTE: When VIDEO BW is <300 Hz, the IF DETECTOR (215) automatically changes to sample mode. Narrow VIDEO BW helps smooth a trace, allowing you to view, signals that are otherwise masked by the noise, but requires a longer sweep time.
193	VIDEO BW AUTO MAN key	Used to select the video bandwidth mode. Currently active mode is underlined. Press key to toggle selection. Defaults to AUTO. If video bandwidth is changed using VIDEO BW (192), manual mode is automatically selected. SPECIAL NOTE: In AUTO mode, VIDEO BW automatically adjusted to changes in SPAN (46), and FREQUENCY (53), and RES BW (190). If the entered VIDEO BW is not compatible measurement conditions, MEAS UN CAL (21) will appear in the display.
194	MAX NO. VID AVGS	Used to display and select the number of video averages. Selected value is displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. When selected, choice is highlighted, and a “D” is displayed in SPECIAL FUNCTION annotation (19) indicating DETECTOR SAMPLE (217). Video averaging automatically begins when selected, or when new value is entered. The number of sweeps that have been averaged is displayed in the VAVG annotation (4). Available selections are from 1 to 999. When selected, VID AVG ON (195) is automatically selected. Defaults to 100.
195	VID AVG ON OFF key	Used to select the video average mode. Currently active mode is underlined. Press key to toggle selection. Defaults to OFF. If MAX NO. VID AVGS (194) is pressed, ON is automatically selected. RESTRICTIONS: Video averaging is available only when CLR-WRT A (197) is selected. SPECIAL NOTE: Video averaging sets the IF DETECTOR (215) to sample mode and smooths the trace by averaging successive traces with each other. This smooths the displayed trace, and allows viewing changes to the entire trace much faster than using narrow VIDEO BW (192) settings.

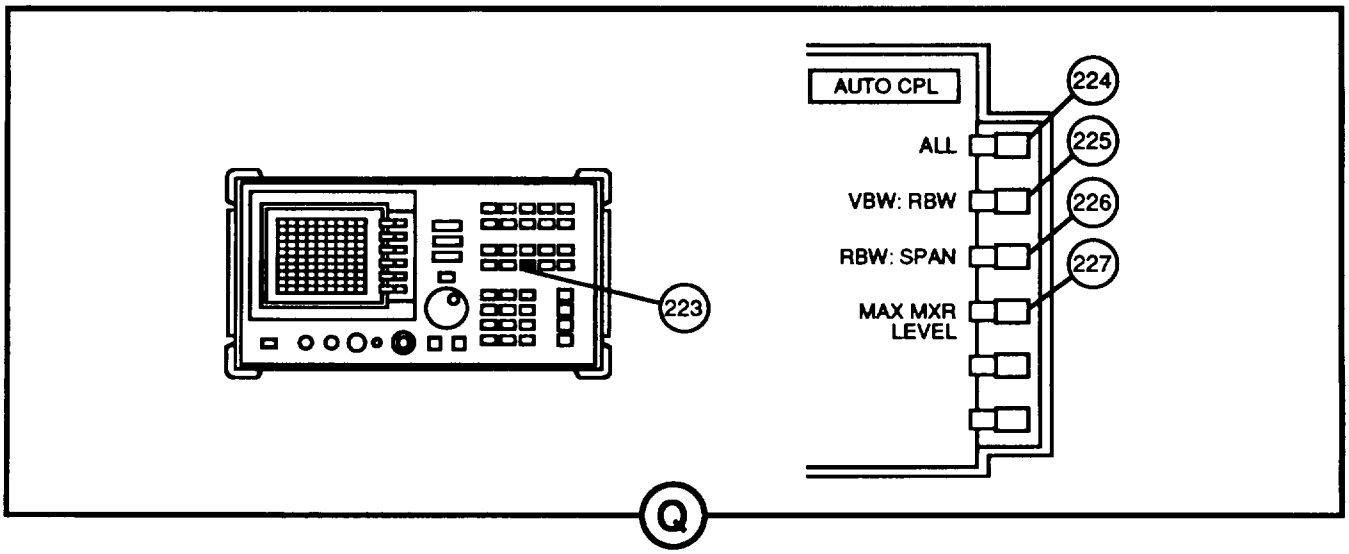


ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
196	TRACE button	Used to activate trace related functions. When selected, TRACE is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION (20) area. SPECIAL NOTE: Trace A waveform is displayed brighter than trace B.
197	CLR-WRT A key	Used to clear, and then continuously display new input-signal data in trace A. Press key to activate.
198	MAX HOLD A key	Used to display and hold the maximum response of the input signal in trace A. Retained trace data is updated from subsequent sweeps, then displayed. Press key to activate. When selected, choice is highlighted, and “D” is displayed in SPECIAL FUNCTION annotation (19) indicating DETECTOR POS PEAK (21 8).

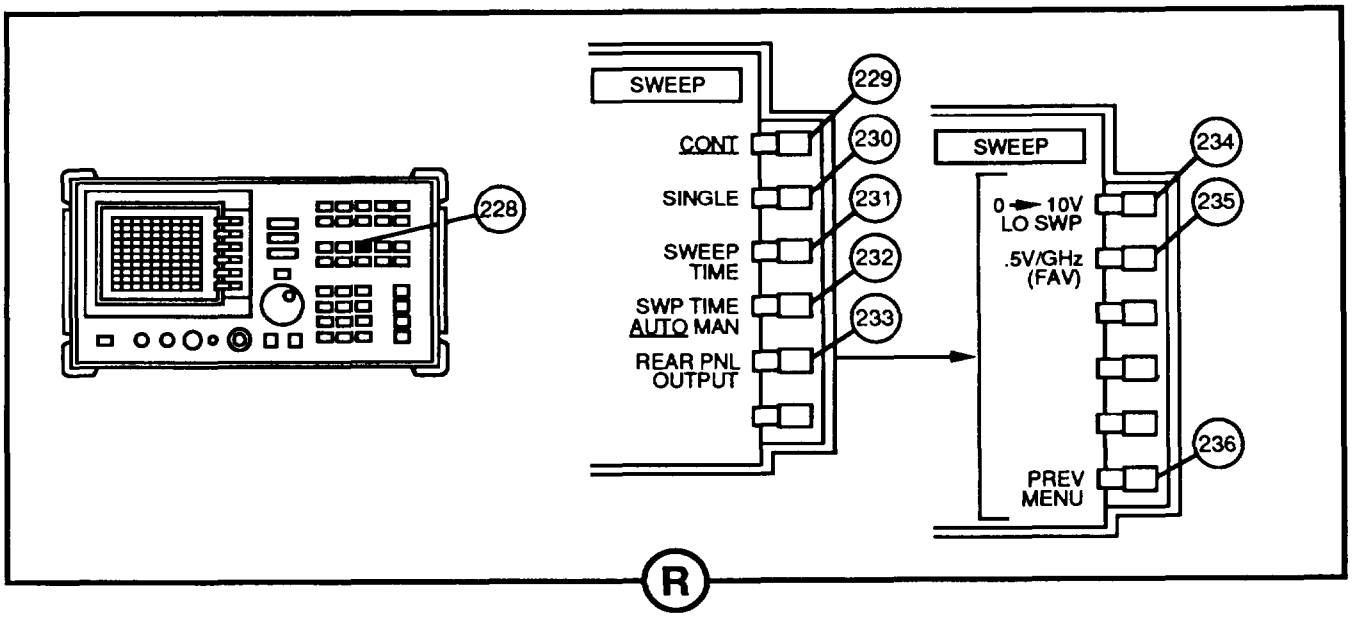
ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
199	VIEW A key	Used to display current contents of trace A. Press key to activate. When selected, choice is highlighted, and trace A contents are displayed. Trace A contents are not updated with new input-signal data when selected.
200	BLANK A key	Used to blank trace A from the display. The current trace A contents are retained, but not updated with new input-signal data. Press key to activate. When selected, choice is highlighted, and trace A is blanked from the display.
201	TRACE B key	Used to access trace related — trace B functions. Choices are displayed in the KEY MENU (10) area.
202	CLR-WRT B key	Used to clear, and then continuously display new input-signal data in trace B. Press key to activate.
203	MAX HOLD B key	Used to display and hold the maximum response of the input signal in trace B. Retained trace data is updated from subsequent sweeps, then displayed. Press key to activate. When selected, choice is highlighted, and “D” is displayed in SPECIAL FUNCTION annotation (19) indicating DETECTOR POS PEAK (218).
204	VIEW B key	Used to display current contents of trace B. Press key to activate. When selected, choice is highlighted, and trace B contents are displayed. Trace B contents are not updated with new input-signal data when selected.
205	BLANK B key	Used to blank trace B from the display. The current trace B contents are retained, but not updated with new input-signal data. Press key to activate. When selected, choice is highlighted, and trace B is blanked from the display.
206	TRACE A key	Used to access previously displayed — trace B functions. Choices are displayed in the KEY MENU (10) area.
207	MORE key	Used to access additional trace related functions. Choices are displayed in the KEY MENU (10) area.
208	A-B->A ON OFF key	Used to turn A-B—>A trace math ON or OFF. When ON, the current contents of trace B are subtracted from the current contents of trace A, and the result is stored in trace A. Result is in UNITS (38) selected. Currently active mode is underlined. Press key to toggle selection. Defaults to OFF. When ON, an “M” is displayed in SPECIAL FUNCTION annotation (19), and trace math is executed on every sweep until OFF is selected. When selected, turns A-B+DL->A OFF (209).

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
209	A-B+DL->A ON OFF key	Used to turn A–B+DL->A trace math ON or OFF. When ON, the current contents of trace B are subtracted from the current contents of trace A. This value is added to the DISPLAY LINE (172) level, and the result is stored in trace A. Result is in UNITS (38) currently selected. Currently active mode is underlined. Press key to toggle selection. Defaults to OFF. When ON, an “M” is displayed in SPECIAL FUNCTION annotation (19), and trace math is executed on every sweep until OFF is selected. When selected, turns A-B->A OFF (208). SPECIAL NOTE: DISPLAY LINE is activated when ON is selected. See DSPL LIN ON OFF (173) to turn off display line.
210	MORE TRC MATH key	Used to access additional trace related — trace math functions. Choices are displayed in the KEY MENU (10) area.
211	A+B–>A key	Used to add current contents of trace A to trace B, and then store the result in trace A. Result is in UNITS (38) currently selected. Press key to perform function. Function is executed each time key is pressed.
212	A EXCH B key	Used to exchange the contents of trace A with the contents of trace B. Press key to perform function. Function is executed each time key is pressed.
213	B–DL->B	Used to subtract current contents of trace B from the DISPLAY LINE (172) level, and store the result in trace B. Result is in UNITS (38) currently selected. Press key to perform function. Function is executed each time key is pressed. SPECIAL NOTE: DISPLAY LINE is activated when key is selected. See DSPL LIN ON OFF (173) to turn off display line.
214	PREV MENU key	Used to access the previously shown trace related functions. Choices are displayed in the KEY MENU (10) area.
215	DETECTOR MODES key	Used to access additional trace related — detector functions. Choices are displayed in the KEY MENU (10) area.
216	DETECTOR NORMAL key	Used to set the detector to normal mode. Analog display is simulated by alternately displaying positive and negative peaks when noise is detected. Signals are displayed as positive peaks. Press key to activate.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
217	DETECTOR SAMPLE key	Used to set the detector to video sample mode Automatically selected when using VID AVG (195), MKR NOISE (248), and combinations of RES BW (190) ≥ 300 Hz and VIDEO BW (192) ≤ 100 Hz. Press key to activate. When selected, choice is highlighted, and a "D" is displayed in SPECIAL FUNCTION annotation (19). SPECIAL NOTE: If RES BW is close to display resolution, peak responses can be easily missed when video signal is sampled.
218	DETECTOR POS PEAK key	Used to set the detector to positive-peak mode. Detects positive-peak noise level of a trace. Automatically selected when using MAX HOLD (198). Press key to activate. When selected, choice is highlighted, and a "D" is displayed in SPECIAL FUNCTION annotation (19).
219	DETECTOR NEG PEAK key	Used to set the detector to negative-peak mode. Detects negative-peak noise level of a trace. Press key to activate. When selected. choice is highlighted, and a "D" is displayed in SPECIAL FUNCTION annotation (19).
220	PREV MENU key	Used to access the previously shown trace related functions. Choices are displayed in the KEY MENU (10) area.
221	FFT key	Used to perform a Discrete Fourier Transform on the input signal. Converts ZERO SPAN (49) information into frequency-domain, results. Allows a demodulated signal to be viewed as spectral data relative to the modulation frequency. Press key to activate. When selected, a "D" and "S" are displayed in SPECIAL FUNCTION annotation (19), and the PEAK SEARCH (244) marker is activated. The DETECTOR SAMPLE (217) mode is selected, and a single sweep is made to obtain a sample of the input signal. A series of computations is performed on the time-domain data and frequency-domain results are displayed in a 10 dB/division logarithmic scale. For the horizontal dimension, the frequency at the left side of the graph is 0 Hz, and at the right side is 300/SWEEP TIME (51). See Glossary for more information. RESTRICTIONS: Performing an FFT function on a frequency sweep will not provide time-domain results. SPECIAL NOTE: Pressing FFT selects SINGLE (230) sweep mode. To remain in FFT measure mode, select CONT (229) sweep. Press PRESET (70) to exit mode. FFT can be used to measure AM in the presence of incidental FM.
222	PREV MENU key	Used to access the previously shown trace related functions. Choices are displayed in the KEY MENU (10) area.

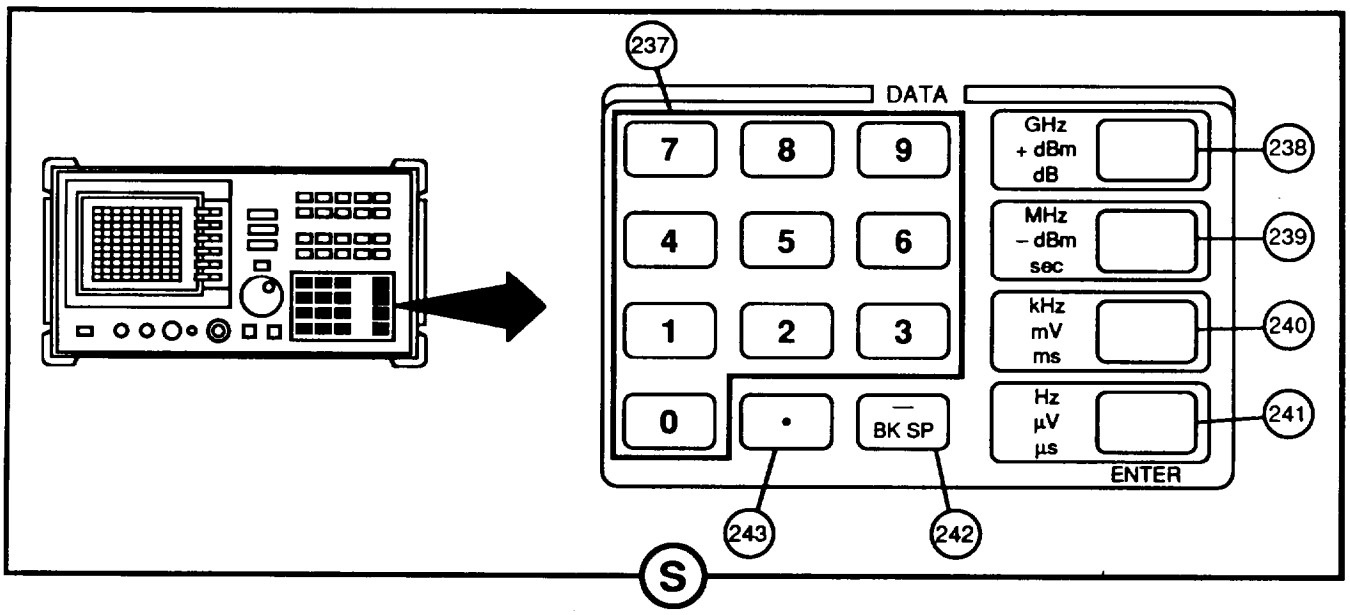


ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
223	AUTO COUPLE button	Used to activate automatic coupling related functions. When selected, AUTO CPL is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION (20) area.
224	ALL key	Used to automatically select all coupled functions. Press key to activate. Values for VIDEO BW (192), RES BW (190), ATTEN (25), SWEEP TIME (51), and CF STEP (57) are automatically selected. Values are set according to the coupled ratios stored in VBW:RBW (225) or RBW:SPAN (226), and are dependent on the currently selected sweep parameters.
225	VBW:RBW key	Used to display and select the coupling ratio between VIDEO BW (192) and RES BW (190) used for ALL (224). Current value displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available ratio range from 0.003 to 3, in a 1, 3, 10 sequence Defaults to 1.
226	RBW:SPAN key	Used to display and select the coupling ratio between RES BW (190) and SPAN (46) used for ALL (224). Current value displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available ratio range from 0.002 to 0.100, in a 1, 2, 5 sequence Defaults to 0.011.
227	MAX MXR LEVEL key	Used to display and adjust maximum allowable signal amplitude to input mixer (para 1-13). Current value displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available levels are-10 to-80 dBm in 10 dB steps. Defaults to - 10 dBm. SPECIAL NOTE: Use when distortion-free dynamic range is required.

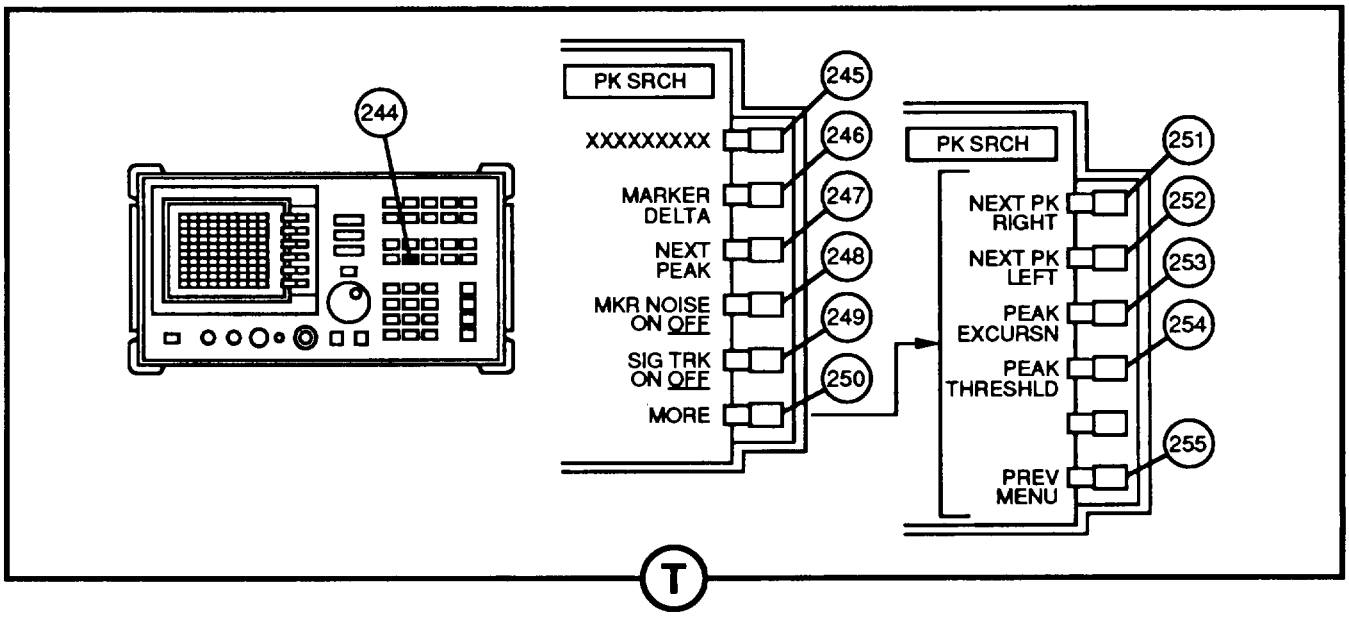


ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
228	SWEEP button	Used to activate sweep related functions. When selected, SWEEP is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION (20) area.
229	CONT key	Used to set the sweep to continuous mode. Press key to activate. When selected, choice is underlined, and when selected trigger is received, continuous sweeps are made. CONT is the default sweep mode. Press key to restart a sweep. RESTRICTIONS: Only CONT or SINGLE (230) can be selected at one time. Selecting one will deactivate the other.
230	SINGLE key	Used to set the sweep to single mode. Press key to activate. When selected, choice is underlined, and when selected trigger is received, one sweep is made. Press again to for another sweep at the next trigger. When selected, “S” is displayed in SPECIAL FUNCTION annotation (19). RESTRICTIONS: Only CONT (229) or SINGLE can be selected at one time. Selecting one will deactivate the other.
231	SWEEP TIME key	Used to display and adjust the time for one sweep. Current value displayed in the SWP annotation (14), and ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available sweep time is from 50ms to 100 sec. If time is changed, SWEEP MAN (232) is automatically selected. Defaults to 400 msec.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
232	SWP TIME AUTO MAN key	Used to select the sweep time mode. Currently active mode is underlined. Press key to toggle selection. Defaults to AUTO. If time is changed using SWEEP TIME (231), manual mode is automatically selected. SPECIAL NOTE: In AUTO mode, sweeptime is automatically adjusted to changes in SPAN (46) and BW (189). If the entered sweep time is too fast for the measurement conditions, MEAS UNCAL (21) will appear in the display.
233	REAR PNL OUTPUT key	Used to access additional sweep related — output signal functions. Choices are displayed in the KEY MENU (10) area.
234	0->10 V LO SWP key	Used to select a 0—10 V ramp. Press key to activate. When selected, choice is highlighted, and ramp is routed to LO SWPI0.5 V/GHz OUTPUT J8 (295) on the rear panel. During singleband sweeps, one ramp is provided corresponding to the displayed sweep. During multi band sweeps, one ramp is provided for each frequency band (para 1-13) swept.
235	.5V/GHz (FAV) key	Used to select a DC ramp voltage. Press key to activate. When selected, choice is highlighted, and ramp is routed to LO SWPI0.5 V/GHz OUTPUT J8 (295) on the rear panel. Ramp corresponds to tuned frequency, at 0.5 V per GHz, from 0 Hz to 22 GHz. If ZERO SPAN (49) is selected, output is constant DC voltage.
236	PREV MENU key	Used to access the previously shown sweep related functions. Choices are displayed in the KEY MENU (10) area.



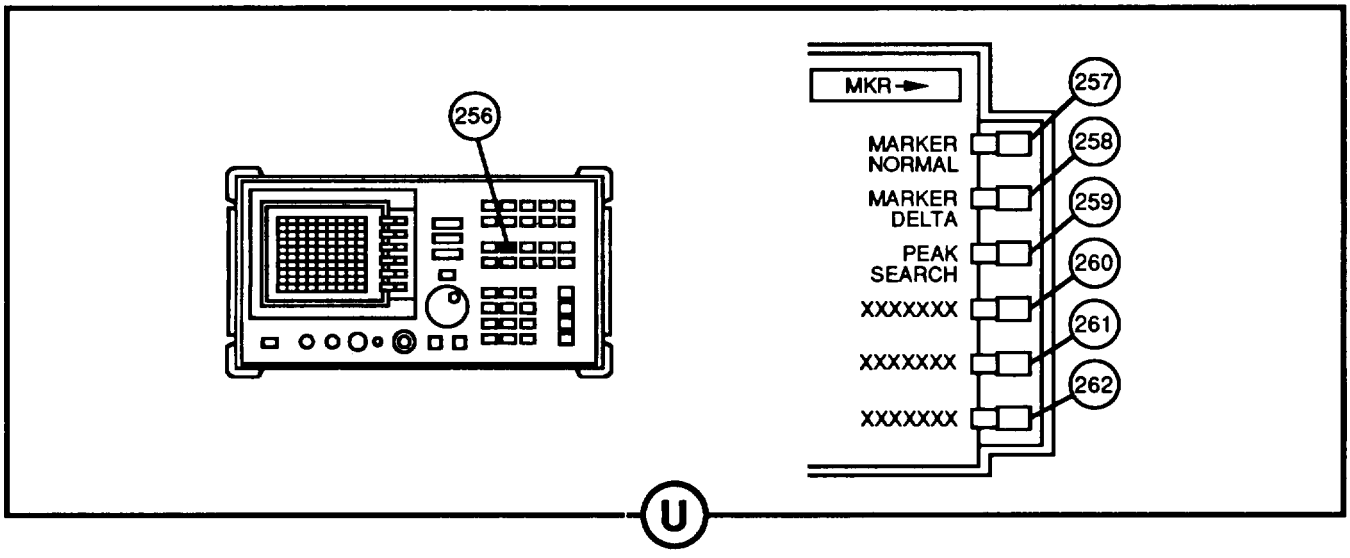
ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
237	NUMERIC (0 — 9) keypad	DATA buttons used to enter a 0, 1, 2, 3, 4, 5, 6, 7, 8, or 9 for numeric data entry. Press desired digit.
238	GHz I +d Bm I dB button	DATA button used to terminate entries from NUMERIC keypad (237). Press after numeric data entry to transfer displayed contents as gigahertz, positive decibels relative to 1 milliwatt, or decibels. Values entered not within specifications are disregarded, rounded, or entered to nearest available value.
239	MHz I –dBm I sec button	DATA button used to terminate entries from NUMERIC keypad (237). Press after numeric data entry to transfer displayed contents as megahertz, negative decibels relative to 1 milliwatt, or seconds. Values entered not within specifications are disregarded, rounded, or entered to nearest available value.
240	kHz I mV I ms button	DATA button used to terminate entries from NUMERIC keypad (237). Press after numeric data entry to transfer displayed contents as kilohertz, millivolts, or milliseconds. Values entered not within specifications are disregarded, rounded, or entered to nearest available value.
241	Hz I µV I µs button	DATA button used to terminate entries from NUMERIC keypad (237). Press after numeric data entry to transfer displayed contents as hertz, microvolt, or microseconds. Values entered not within specifications are disregarded, rounded, or entered to nearest available value.
242	- I BK SP button	DATA button used to enter a positive or negative sign for numeric data entry. Also used to back space entries from the NUMERIC keypad (237). Blank indicates positive, - indicates negative. Press to change sign or back space.
243	. (DECIMAL) button	DATA button used to enter a decimal for numeric data entry.



ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
244	PEAK SEARCH button	Used to place the single or active marker on the highest point of the displayed waveform. The measured values (Δ = difference) are displayed in the ACTIVE FUNCTION area (20) and CNT/MKR annotation (6). Also activates the peak search related functions described below. When selected, PK SRCH is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION area.
245	MARKER —> CF/ MARKER NORMAL key	One of these two choices will be displayed at this location depending on the Spectrum Analyzer conditions. MARKER NORMAL is displayed when MARKER DELTA (246) is selected, or if the SPAN (46) is 0HZ. Used to activate a single marker. The marker reads the amplitude, and the frequency (SPAN >0HZ) or relative time (SPAN = 0HZ) at the current location as displayed on the waveform. Press key to activate, then use STEP buttons, KNOB, or DATA buttons to move the marker. Key changes to MARKER —> CF when pressed (SPAN >0HZ). The measured values are displayed in the ACTIVE FUNCTION area (20) and CNT/MKR annotation (6). MARKER —> CF is displayed when one marker is on and the SPAN is >0HZ, or after MARKER NORMAL has been selected (SPAN >0HZ). Used to change the CENTER FREQ (54) to the frequency currently displayed in the ACTIVE FUNCTION area and MKR annotation. Press key to activate. New center frequency displayed in the CENTER (17) annotation. SPECIAL NOTE: If MARKER DELTA (246) is on, selecting MARKER NORMAL key deletes the anchor marker, and makes the active marker a single marker. Data is read from the marker in the currently active trace. (An active trace is one in either the CLR-WRT (197) or MAX HOLD (198); and may be either trace A or trace B.) If both traces are active, or if both traces are in view mode, the data from trace A marker is read.

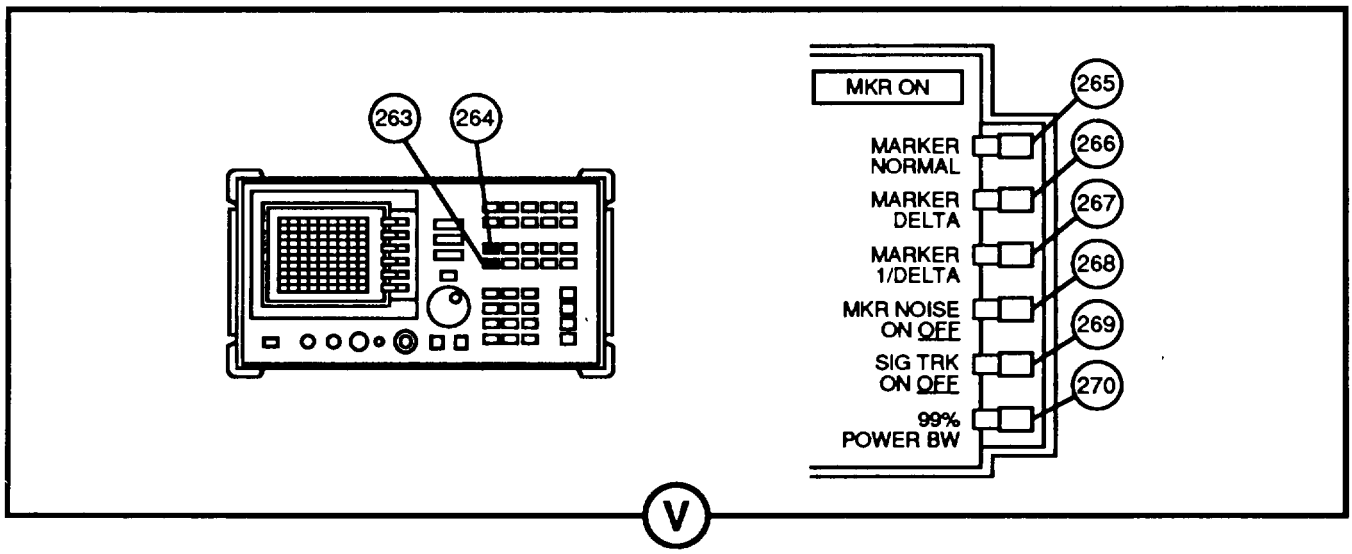
ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
246	MARKER DELTA key	Used to activate the D marker. The marker reads the difference in amplitude, and frequency (SPAN (46)>0HZ) or relative time (SPAN = 0HZ) between the anchor marker and the active marker as displayed on the waveform. Press key to activate, then use STEP buttons, KNOB, or DATA buttons to move the active marker. The measured differences are displayed in the ACTIVE FUNCTION area (20) and ΔCNT/ D MKR annotation (6). Δamplitude is displayed in dB, or as a ratio depending on the UNITS (38) selected. SPECIAL NOTE: If MARKER NORMAL (245) is on, selecting MARKER DELTA key places both the anchor marker and active marker at the position of the original, single marker. If MARKER DELTA is already on, pressing MARKER DELTA key moves the anchor marker to the current active marker position.
247	NEXT PEAK key	Used to place the single or active marker on the next highest point of the displayed waveform relative to the current marker position. Press key again to find successively lower peaks. SPECIAL NOTE: The peak must meet the current PEAK EXCURSN (253) and PEAK THRESHLD (254) criteria in order to be considered a peak. If a peak cannot be found, “PEAK NOT FOUND” is displayed in the ACTIVE FUNCTION area (20).
248	MKRNOISE ON OFF key	Used to turn the marker noise function ON or OFF. Currently active mode is underlined. Press key to toggle selection. Defaults to OFF. When ON, averages the measured noise to a 1 Hz bandwidth. Selects DETECTOR SAMPLE (217) and displays the corrected average of 32 data points (16 data points on one side of the marker, the marker itself, and 15 data points on the other side). If MARKER DELTA (246) on, function works on the active marker (not anchor marker). When selected, "D" is displayed in SPECIAL FUNCTION annotation (19). SPECIAL NOTE: Marker OFF (263) also turns function OFF.
249	SIG TRK ON OFF key	Used to turn the signal tracking function ON or OFF. Currently active mode is underlined. Press key to toggle selection. Defaults to OFF. When ON, automatically changes CENTER FREQ (54) to keep the active marker centered on the screen. Updated every sweep. When selected, “K is displayed in SPECIAL FUNCTION annotation (19).
250	MORE key	Used to access additional peak search related functions. Choices are displayed in the KEY MENU (10) area.
251	NEXT PK RIGHT key	Used to move the current active marker on displayed waveform to next peak on the right. The measured values (Δ = difference) are displayed in the ACTIVE FUNCTION area (20) and CNT/MKR annotation (6). SPECIAL NOTE: The peak must meet the current PEAK EXCURSN (253) and PEAK THRESHLD (254) criteria in order to be considered a peak. If a peak cannot be found, "PEAK NOT FOUND" is displayed in the ACTIVE FUNCTION area (20).

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
252	NEXT PK LEFT key	Used to move the current active marker on displayed waveform to next peak on the left. The measured values (A-difference) are displayed in the ACTIVE FUNCTION area (20) and CNT/MKR annotation (6). SPECIAL NOTE: The peak must meet the current PEAK EXCURSN (253) and PEAK THRESHLD (254) criteria in order to be considered a peak. If a peak cannot be found, 'PEAK NOT FOUND" is displayed in the ACTIVE FUNCTION area (20).
253	PEAK EXCURSN key	Used to display and adjust what defines a peak on a trace. Specifies the amount that a trace must increase and then decrease in amplitude in order to be a peak. Current value displayed in the ACTIVE FUNCTION area (20). Press key to activate, then use STEP buttons, KNOB, or DATA buttons to enter a new value. Available values from 0 to 30 dB LOG (27) or 0.1 Δ DIVS to 10.0 Δ DIVS LINEAR (28). SPECIAL NOTE: Any portion of a peak that falls below PEAK THRESHLD (254) is also used to satisfy peak excursion criteria. EXAMPLE: If the peak excursion is 5 dB, the amplitude of the sides of a candidate peak must descend at least 5 dB in order to be considered a peak. In addition, a peak that is equal to 2.5 dB above PEAK THRESHLD will be found if the peak extends an additional 2.5 dB or more below the PEAK THRESHLD level.
254	PEAK THRESHLD key	Used to display and adjust the minimum amplitude level from which a peak on the trace can be detected. Level is a dashed line on the screen. Press key to activate, then use STEP buttons, KNOB, or DATA buttons to select the desired level. When selected, choice is highlighted, a dashed line appears, selected level is displayed in the ACTIVE FUNCTION area (20). Available levels from +30 to –200 dBm. Defaults to -120 dBm.
255	PREV key	Used to access the previously displayed peak search related functions. Choices are displayed in the KEY MENU (10) area.



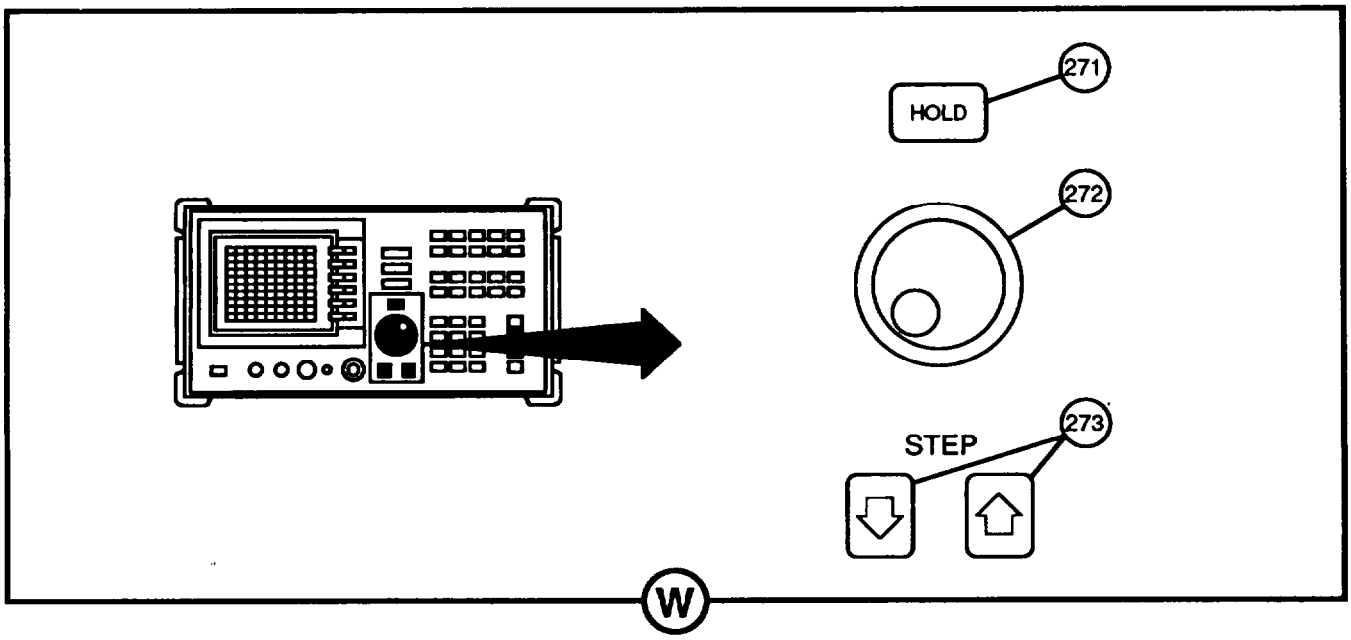
ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
256	MKR-> button	Used to activate marker related functions. When selected, MKR–> is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION (20) area. SPECIAL NOTE: If no markers are active when selected, activates MARKER NORMAL (257) and places the active marker at the center of the trace.
257	MARKER NORMAL key	Used to activate a single marker. The marker reads the amplitude, and the frequency (SPAN (46) >0HZ) or relative time (SPAN = 0HZ) at the current location as displayed on the waveform. Press key to activate, then use STEP buttons, KNOB, or DATA buttons to move the marker. The measured values are displayed in the ACTIVE FUNCTION area (20) and CNT/MKR annotation (6). SPECIAL NOTE: If MARKER DELTA (258) is on, selecting MARKER NORMAL key deletes the anchor marker, and makes the active marker a single marker. Data is read from the marker in the currently active trace. (An active trace is one in either the CLR-WRT (197) or MAX HOLD (198); and may be either trace A or trace B.) If both traces are active, or if both traces are in view mode, the data from trace A marker is read.
258	MARKER DELTA key	Used to activate the Δ marker. The marker reads the difference in amplitude, and frequency (SPAN (46) >0HZ) or relative time (SPAN = 0HZ) between the anchor marker and the active marker as displayed on the waveform. Press key to activate, then use STEP buttons, KNOB, or DATA buttons to move the active marker. The measured differences are displayed in the ACTIVE FUNCTION area (20) and Δ CNT/AMKR annotation (6). Amplitude is displayed in dB, or as a ratio depending on the UNITS (38) selected. SPECIAL NOTE: If MARKER NORMAL (257) is on, selecting MARKER DELTA key places both the anchor marker and active marker at the position of the original, single marker. If MARKER DELTA is already on, pressing MARKER DELTA key moves the anchor marker to the current active marker position.
259	PEAK SEARCH key	Used to place the single or active marker on the highest point of the displayed waveform. The measured values (Δ =difference) are displayed in the ACTIVE FUNCTION area (20) and CNT/MKR annotation (6). SPECIAL NOTE: The peak must meet the current PEAK EXCURSN (253) and PEAK THRESHLD (254) criteria in order to be considered a peak. If a peak cannot be found, “PEAK NOT FOUND” is displayed in the ACTIVE FUNCTION area.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
260	MARKER -> REF LVL/ MARKER A -> SPAN key	One of these two choices will be displayed at this location depending on the Spectrum Analyzer conditions. MARKER -> REF LVL displayed when NORMAL MARKER (257) is on. Used to change the REF LVL (24) to the amplitude currently displayed in the ACTIVE FUNCTION (20) area and MKR annotation (6). Press key to activate. New reference level displayed in the RL (2) annotation. MARKER A -> SPAN displayed when MARKER DELTA (258) is on, and SPAN (46) is >0 Hz. Used to change the START FREQ (55) to the left marker frequency, and the STOP FREQ (56) to the right marker frequency. Press key to activate. New frequencies displayed in START (17) and STOP (13), or SPAN (13) annotation(s).
261	MARKER -> CF/ MARKER A ->CF/ MARKER l/A ->CF key	One of these three choices will be displayed at this location depending on the Spectrum Analyzer conditions. MARKER -> CF displayed when NORMAL MARKER (257) is on, and SPAN (46) is >0 Hz. Used to change the CENTER FREQ (54) to the frequency currently displayed in the ACTIVE FUNCTION area (20) and MKR (6) annotation. Press key to activate. New center frequency displayed in the CENTER (17) annotation. MARKER Δ -> CF displayed when MARKER DELTA (258) is on, and SPAN is > 0 Hz. Used to change the CENTER FREQ to the frequency currently displayed in the ACTIVE FUNCTION area and Δ MKR annotation. Press key to activate. New center frequency displayed in the CENTER annotation. MARKER 1/ Δ ->CF displayed when MARKER DELTA is on, and SPAN is 0 Hz. Used to change the CENTER FREQ to the relative time currently displayed in the ACTIVE FUNCTION area and Δ MKR annotation. Press key to activate. New center frequency (1/time) displayed in the CENTER annotation.
262	MARKER -> CF STEP/ MARKER A ->CF STEP/ MARKER l/A ->CF STEP	One of these three choices will be displayed at this location depending on the Spectrum Analyzer conditions. MARKER -> CF STEP displayed when NORMAL MARKER (257) is on, and SPAN (46) is >0 Hz. Used to change the CF STEP (57) to the frequency currently displayed in the ACTIVE FUNCTION area (20) and MKR (6) annotation. Press key to activate. MARKER Δ ->CF STEP displayed when MARKER DELTA (258) is on, and SPAN is > 0 Hz. Used to change the CF STEP to the frequency currently displayed in the ACTIVE FUNCTION area and Δ MKR annotation. Press key to activate. MARKER 1/ Δ ->CF STEP displayed when MARKER DELTA is on, and SPAN is 0 Hz. Used to change the CF STEP frequency (1/time) to the relative time currently displayed in the ACTIVE FUNCTION area and Δ MKR annotation. Press key to activate.

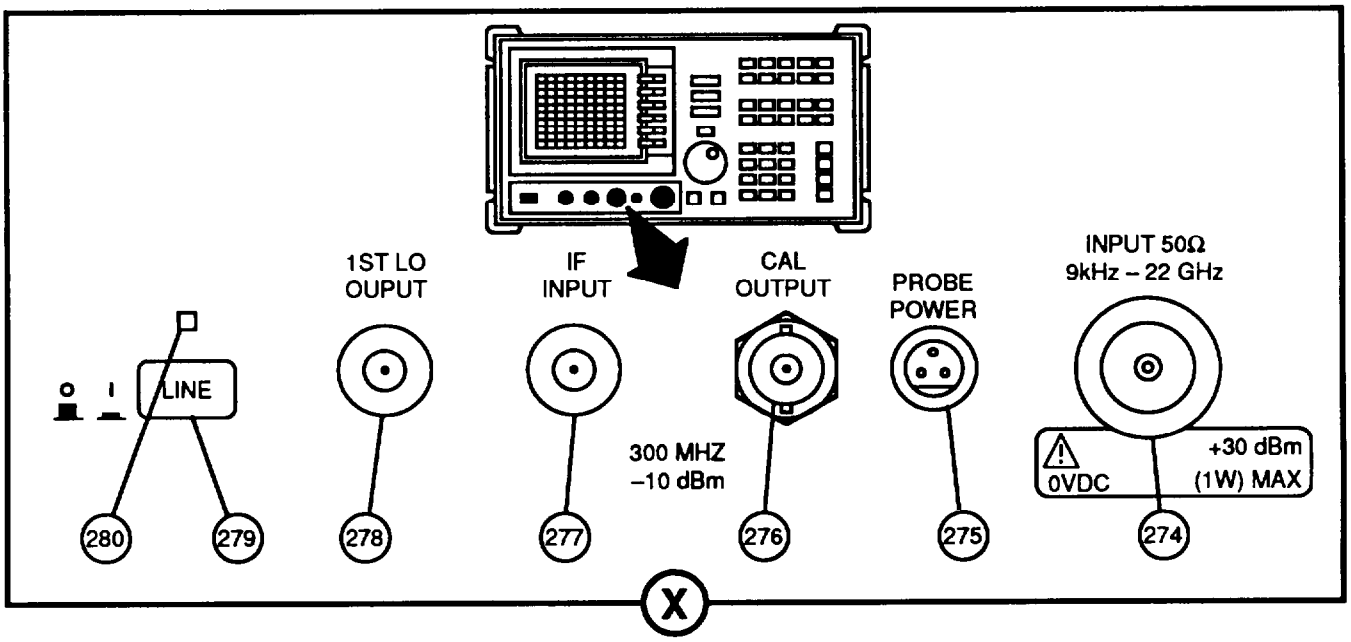


ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
263	MKR OFF button	Used to deactivate markers and marker displays. When selected, the MENU TITLE (9) area, KEY MENU (10) area, and CNT/MKR annotation (6) are blanked. Press button to activate.
264	MKR ON button	Used to activate marker related functions. When selected, MKR ON is displayed in the MENU TITLE (9) area. Choices are displayed in the KEY MENU (10) area, and are selected by pressing the corresponding key. Currently selected choices are highlighted or underlined, with present values and special messages displayed in the ACTIVE FUNCTION (20) area. SPECIAL NOTE: If no markers are active when selected, activates MARKER NORMAL (265) and places the active marker at the center of the trace.
265	MARKER NORMAL key	Used to activate a single marker. The marker reads the amplitude, and the frequency (SPAN (46) >0HZ) or relative time (SPAN = 0HZ) at the current location as displayed on the waveform. Press key to activate, then use STEP buttons, KNOB, or DATA buttons to move the marker. The measured values are displayed in the ACTIVE FUNCTION area (20) and CNT/MKR annotation (6). SPECIAL NOTE: If MARKER DELTA (266) is on, selecting MARKER NORMAL key deletes the anchor marker, and makes the active marker a single marker. Data is read from the marker in the currently active trace. (An active trace is one in either the CLR-WRT (197) or MAX HOLD (198); and may be either trace A or trace B.) If both traces are active, or if both traces are in view mode, the data from trace A marker is read.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
266	MARKER DELTA key	Used to activate the Δ marker. The marker reads the difference in amplitude, and frequency (SPAN (46) >0HZ) or relative time (SPAN = 0HZ) between the anchor marker and the active marker as displayed on the waveform. Press key to activate, then use STEP buttons, KNOB, or DATA buttons to move active marker. Measured differences are displayed in ACTIVE FUNCTION area (20) and Δ CNT/ Δ MKR annotation (6). Δ amplitude is displayed in dB, or as a ratio depending on the UNITS (38) selected. SPECIAL NOTE: If MARKER NORMAL (265) is on, selecting MARKER DELTA key places both the anchor marker and active marker at the position of the original, single marker. If MARKER DELTA is already on, pressing MARKER DELTA key moves the anchor marker to the current active marker position.
267	MARKER 1/DELTA key	Used to activate the reciprocal Δ marker function. The marker reads the difference in amplitude, and relative time (SPAN (46) >0HZ) or frequency (SPAN = 0HZ) between the anchor marker and the active marker as displayed on the waveform. Press key to activate, then use STEP buttons, KNOB, or DATA buttons to move the active marker. The measured differences are displayed in the ACTIVE FUNCTION area (20) and Δ CNT/ Δ MKR annotation (6). Δ amplitude is displayed in dB, or as a ratio depending on the UNITS (38) selected. SPECIAL NOTE: If MARKER NORMAL (265) is on, selecting MARKER 1/DELTA key places both the anchor marker and active marker at the position of the original, single marker. If MARKER DELTA (266) is on, selecting MARKER l/DELTA key changes relative time to frequency, or frequency to relative time without changing the marker positions. If MARKER DELTA/1 is already on, pressing MARKER DELTA/1 key moves the anchor marker to the current active marker position.
268	MKRNOISE ON OFF key	Used to turn the marker noise function ON or OFF. Currently active mode is underlined. Press key to toggle selection. Defaults to OFF. When ON, averages the measured noise to a 1 Hz bandwidth. Selects DETECTOR SAMPLE (217) and displays the corrected average of 32 data points (16 data points on one side of the marker, the marker itself, and 15 data points on the other side). If MARKER DELTA (266) on, function works on the active marker (not anchor marker). When selected, “D” displayed in SPECIAL FUNCTION annotation (19). SPECIAL NOTE: Marker OFF (263) also turns function OFF.
269	SIG TRK ON OFF key	Used to turn the signal tracking function ON or OFF. Currently active mode is underlined. Press key to toggle selection. Defaults to OFF. When ON, automatically changes CENTER FREQ (54) to keep the active marker centered on the screen. Updated every sweep. When selected, “K” is displayed in SPECIAL FUNCTION annotation (19).
270	99% PWR BW key	Used to perform a power bandwidth function. Press key to activate. Computes the combined power of all signal responses contained in the waveform, then computes the bandwidth equal to 99% Of the total power. An anchor marker and active marker are then displayed on the waveform between the points containing 99% Of the power. The measured differences are displayed in the ACTIVE FUNCTION area (20) and Δ CNT/ Δ MKR annotation (6). Amplitude is displayed in dB, or as a ratio depending on the UNITS (38) selected.



ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
271	HOLD button	Used to deactivate all the functions. When selected, the MENU TITLE (9), KEY MENU (10), and ACTIVE FUNCTION (20) areas are blanked. The NUMERIC keypad (237), ENTER (238 to 241), KNOB (272), and STEP (273) are also disabled. All other controls will activate when selected. The waveform and displayed annotations remain active. Press any button to reactivate.
272	KNOB	Used to change numeric values displayed in the ACTIVE FUNCTION (20) area, and marker positions displayed on the waveform. CW rotation increases value (or moves marker to right), CCW rotation decreases value (or moves marker to left).
273	STEP buttons	Used to change numeric values displayed in the ACTIVE FUNCTION (20) area, and marker positions displayed on the waveform. ⇧ increases value (or moves marker to right one division), ⇩decreases value (or moves, marker to left one division). Press or press and hold to activate.



ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
274	INPUT connector	Precision Type N female connector used to connect a 10 kHz to 22 GHz signal for measurement. Input impedance is 50 Ω , with maximum input of +30 dBm, 1 watt, or 0 Vdc.
275	PROBE POWER corm	Keyed three pin male connector provides +15 Vdc at 150 mA, and -12.6 Vdc at 150 mA for external active probe power.
276	CAL OUTPUT connector	BNC female connector provides a 300 MHz at -10 dBm signal. Output impedance is 50 Ω nominal. This signal is used during reference level calibration.
277	IF INPUT connector	SMA female connector used to connect a 310.7 MHz IF signal from an external mixer IF connector (296) for measurement. Input impedance is 50 Ω , with maximum input of 0 Vdc.
278	1st LO OUTPUT corm	SMA female connector provides from 3.0000 GHz to 6.8107 GHz at +16.5 dBm signal. Output impedance is 50 Ω nominal. This signal is used as local oscillator input to an external mixer LO connector (297).
279	LINE button	Used to turn the Spectrum Analyzer ON (1) or OFF (0). ON when button is in, OFF when button is out. Press for ON, press again for OFF. LINE INDICATOR (280) lights when on.
280	LINE indicator	When on, indicates Spectrum Analyzer is ON with power applied.

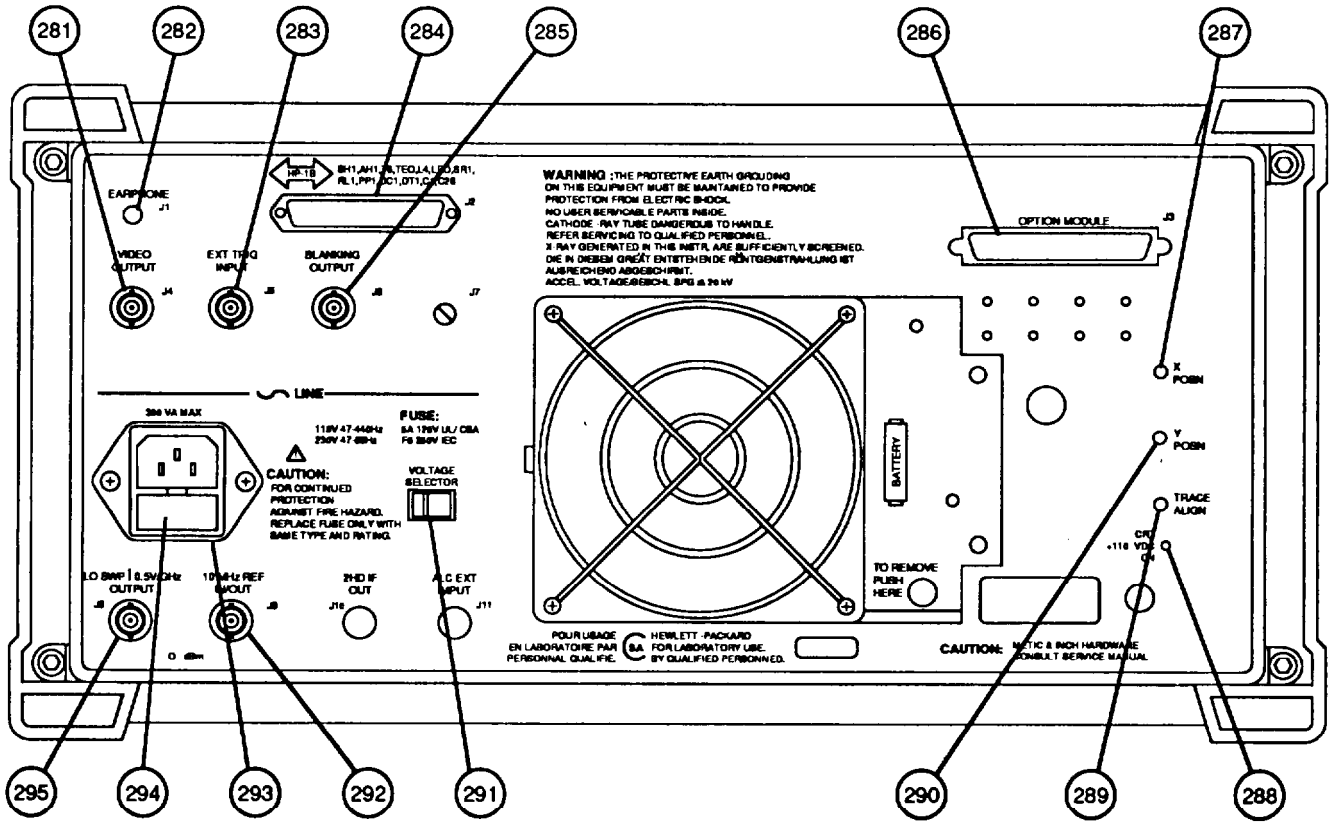


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Figure 2-2. Operator's Controls, Indicators, and Connectors, rear view.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
281	VIDEO OUTPUT (J4) conn	BNC female connector provides 0 volt (no signal) to +1 volt (full-scale). Output impedance is 50 Ω nominal. The output voltage is scaled to the vertical deflection of the display.
282	EARPHONE (J1) conn	1/8 inch miniature monophonic jack provides 0.25 watts into 4 Ω. Demodulated audio present when AM DE MOD ON (90) or FM DEMOD ON (91).
283	EXTTRIG INPUT (J5) connector	BNC female connector used to connect a 0-5 volt (TTL) signal for external trigger sweeps. Input impedance is 10 k Ω. Triggers sweep on rising edge of signal when EXTERNAL (159) is selected.
284	HP-IB (J2) connector	Used to connect an external Controller to the Spectrum Analyzer during remote operation. Also used to connect a printer or plotter when using PRINT/PLOT (161). Connector has 24 pins and threaded posts conforming to IEEE-488-1978. See Appendix F for remote programming information.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
285	BLANKING OUTPUT (J6) connector	BNC female connector provides 0 to 5 volt (TTL) signal for synchronization and pen lift. Output is TTL low (0 volt) during a sweep. Output is TTL high (5 volt) during retrace and when sweeping between bands (para 1-11).
286	OPTION MODULE (J3) connector	Used to connect an external option module to the Spectrum Analyzer. Option modules include the Test and Adjustment Module (TAM) and Mass Memory Module. Modules controlled using MODULE (102) button. Connector has 50 female pins.
287	X POSN control	Used to adjust the CRT screen (1). Controls the left-right position of the display.
288	CRT HV indicator	When on, indicates the CRT+110 VDC power supply is on.
289	TRACE ALIGN control	Used to adjust the CRT screen (1). Controls the tilt of the display.
290	Y POSN control	Used to adjust the CRT screen (1). Controls the up-down position of the display.
291	VOLTAGE SELECTION switch	Used to select operating line voltage. Provides for operation at 115 or 230 Vat. Number visible on switch is operating line voltage Spectrum Analyzer currently set to. To change, slide switch so desired voltage is shown.
292	10 MHz REF lN/OUT (J9) connector	BNC female connector provides a selectable input or output for the 10 MHz reference. When 10 MHz INT (61) selected, a 10 MHz >0 dBm signal is present at the connector for use by other instruments. When 10 MHz EXT selected, an externally connected 10 MHz ±100 Hz, -2 to +10 dBm signal is used as the 10 MHz reference.
293	AC POWER connector	Used as AC power input connector for the Spectrum Analyzer. Operation available from 115/230 Vat, 47-440 Hz, at 180 watts. Selection dependent on VOLTAGE SELECTION switch (291) and FUSE (294) installed. Accepts female end of power cable (supplied). Protective grounding conductor connects through this connector.
294	LINE FUSE	Provides AC power input protection. Fuseholder and carrier accept 5 mm by 20 mm cartridge fuse. AC line power fuse is 5 amp, 125 volts for 115 Vac operation and 5 amp, 250 volts for 230 Vac operation. Remove fuseholder to remove fuse.
295	LO SWP I 0.5V/GHz (J8) connector	BNC female connector provides a selectable 0 to 10 volt ramp signal. When 0->10V LO SWP (234) is selected, a 0 to 10 volt ramp is output during a singleband sweep. During multiband sweeps, one 0 to 10 volt ramp is output for each frequency band (para 1-11). When .5V/GHz (FAV) (235) is selected, the ramp voltage corresponds to tuned frequency, at 0.5 V per GHz, from 0 Hz to 22 GHz.

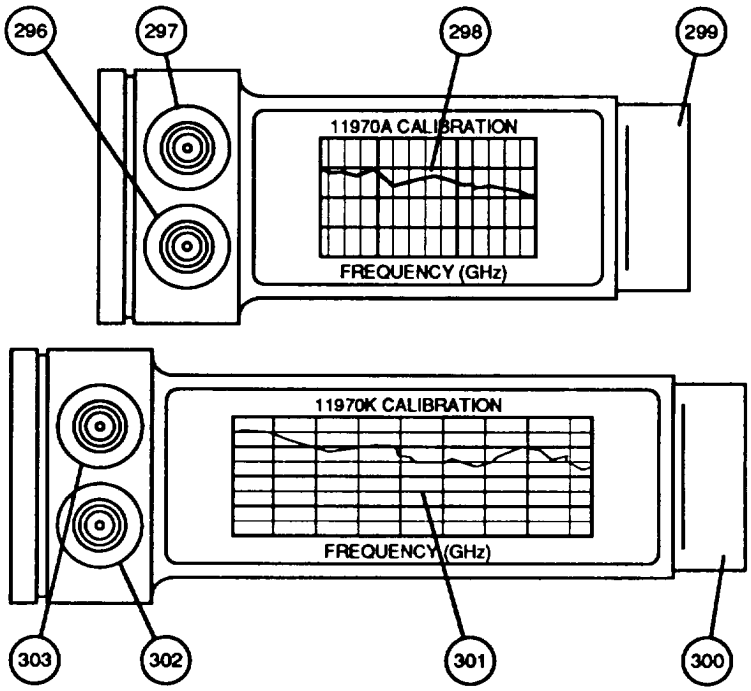

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Figure 2-3. Operator's Controls, Indicators, and Connectors, external mixers.

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
296	K band IF OUTPUT corm	SMA female connector provides a 310.7 MHz IF signal. This signal is routed to the Spectrum Analyzer IF INPUT (277) connector for measurement.
297	K band LO lNPUT conn	SMA female connector used to connect a 2.95 to 4.36 GHz at +14 to +18 dBm LO signal for mixing. This signal is provided by the Spectrum Analyzer 1st LO OUTPUT (278) connector.
298	K band CL label	Conversion loss label is unique for each mixer. Contains conversion loss and reference level offset (in dB) for the operating frequency range (18 to 26.5 GHz). This information entered into the Spectrum Analyzer CNV LOSS VS FREQ (137) or REF LVL OFFSET (31) key.
299	K band RF lNPUT conn	Waveguide UG-595/U (WR-42) connector used to connect an 18 GHz to 26.5 GHz signal for measurement. Maximum input is +20 dBm (100 milliwatt).
300	A band RF lNPUT conn	Waveguide UG-599/U (WR-28) connector used to connect a 26.5 GHz to 40 GHz signal for measurement. Maximum input is +20 dBm (100 milliwatt).

ITEM	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
301	A band CL label	Conversion loss label is unique for each mixer. Contains conversion loss and reference level offset (in dB) for the operating frequency range (26.5 to 40.0 GHz). This information entered into the Spectrum Analyzer CNV LOSS VS FREQ (137) or REF LVL OFFSET (31) key.
302	A band IF OUTPUT corm	SMA female connector provides a 310.7 MHz IF signal. This signal is routed to the Spectrum Analyzer IF INPUT (277) connector for measurement.
303	A band LO lNPUT conn	SMA female connector used to connect a 3.27 to 4.96 GHz at +14 to +18 dBm LO signal for mixing. This signal is provided by the Spectrum Analyzer 1st LO OUTPUT (278) connector.

Section II. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

2-2. GENERAL.

To be sure that the equipment is always ready for the mission, perform scheduled preventive maintenance checks and services (PMCS). When doing any PMCS or routine checks, keep in mind the WARNINGS and CAUTIONS about electrical shock and bodily harm.

2-3. PMCS PROCEDURES.

a. Tools, Materials, and Equipment Required for Preventive Maintenance. No tools or equipment are required for operator preventive maintenance. Cleaning materials required are listed in Appendix E, items 2 and 3.

b. PMCS for Spectrum Analyzer is limited to routine checks such as shown below.

- cleaning
- dusting
- wiping
- checking for frayed cables
- storing items not in use
- covering unused receptacles
- checking for loose nuts, bolts, and screws

c. Perform these routine checks anytime they must be done.

Section III. OPERATION UNDER USUAL CONDITIONS

2-4. INTRODUCTION.

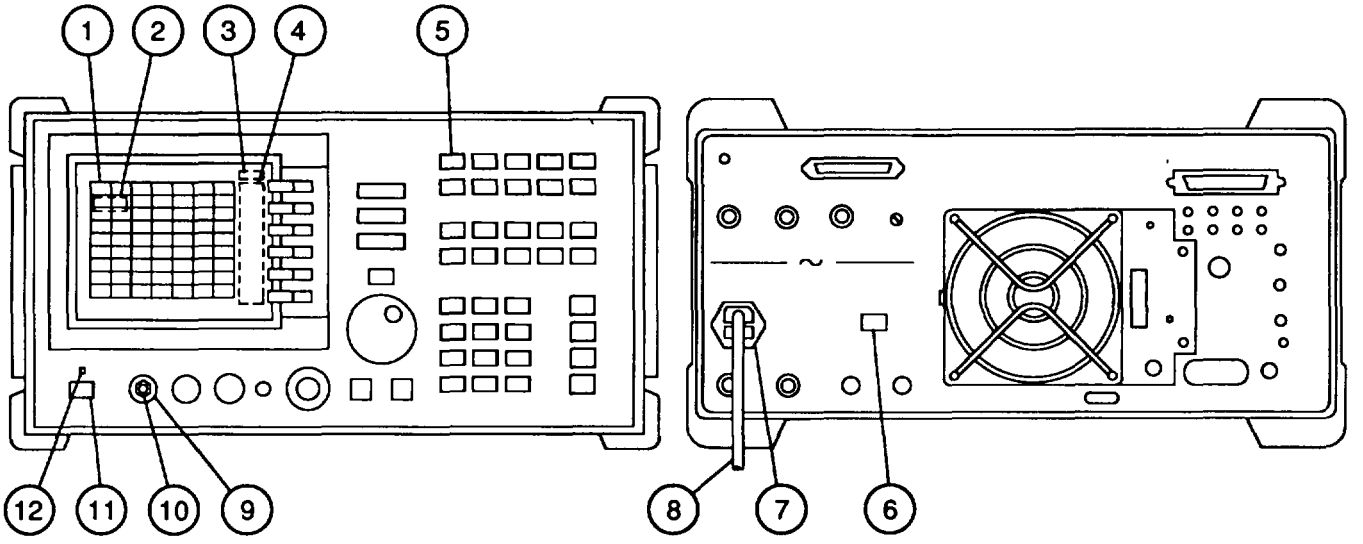
This section provides the information required to set up and operate the Spectrum Analyzer. Information required for operation in the remote mode is provided in Appendix F. Operation is divided into eight separate procedures. Individual operating procedures for performing basic measurements, using external mixers, measuring harmonic related and third order intermodulation distortion, measuring amplitude and frequency modulated signals, measuring pulsed RF signals, and demodulating AM/FM signals are provided.

Table 2-2 lists error messages along with the probable cause and corrective action.

2-5. PREPARATION FOR USE.

W A R N I N G

The Spectrum Analyzer is equipped with a three-wire power cable. When connected to a grounded AC power receptacle, this cable grounds the instrument front panel and cabinet. Do not use extension cords or AC adapters without a ground.



a. Verify that LINE switch (11) is set to OFF, and the 50 Ω Termination (10) is connected to the 1st LO OUTPUT (9) connector.

b. Verify VOLTAGE SELECTION switch (6) on rear panel indicates line voltage available in your area. Connect power cable (8) to AC POWER connector (7) on rear panel.

2-6. TURN-ON PROCEDURE.

a. Verify that only the power cable (8) is connected to Spectrum Analyzer. All other cables should be disconnected.

b. Set LINE switch (11) from OFF to ON. Verify that the LINE Indicator (12) lights. After approximately five seconds, verify the CRT Screen (1) increases in intensity.

c. The Spectrum Analyzer will perform an internal alignment routine for approximately 30 seconds. During alignment, the ACTIVE FUNCTION (2) area displays “LO ADJUST STATUS:” then “IF ADJUST STATUS:" with the current adjustment status, and the KEY MENU (4) area displays “STOP REALIGN”. After the alignment is complete, the ACTIVE FUNCTION (2) area displays “HP 8562A COPYRIGHT 19xx,19xx Hewlett-Packard Co. Rev: xx xx xxx”, the MENU TITLE (3) annotation displays PRESET, and the KEY MENU (4) area displays the PRESET choices.

NOTE

- If STOP REALIGN is pressed before the IF alignment routine is completed, the accuracy of measurements may not meet specifications.
- The values displayed in the various CRT Screen annotations are dependent on the last configuration stored using the PWR ON STATE key. See item 81 in Section I for more information.
- If an error message is shown in display, see table 2-2 for probable cause and corrective action.

d. Press PRESET button (5). The front panel default conditions are as follows:

NOTE

See Section I for location of controls and indicators.

CRT SCREEN DISPLAY:

ATTEN annotation	10 d B
RL annotation	O dBm
10 dB/ annotation	10 dB/division
MENU TITLE annotation	PRESET
KEY MENU area	RECALL PWR ON/LAST STATE/REALIGN LO & IF/HP-I B ADDRESS
ACTIVE FUNCTION area	HP 8562A COPYRIGHT 19xx,19xx Hewlett-Packard Co. Rev: xxxxxxx
CENTER annotation	12.38 GHz
SPAN annotation	19.25 GHz
RBW annotation	1.0 MHz
VBW annotation	1.0 MHz
SWP annotation	400 ms
10 dB/ annotation	10 dB/division

NOTE

Press the button, followed by the desired key to display the following default value(s). Pressing a key or button may change the default state (e. g., from AUTO to MANUAL, from OFF to ON, etc).

FREQUENCY button:

CENTER FREQ	12.38 GHz
START FREQ	2.75 GHz
STOP FREQ	22.00 GHz
Center Freq STEP I (mode)	1.93 GHz I AUTO
FREQ OFFSET	o Hz, OFF
10 MHz	INTERNAL

SPAN button:

SPAN WIDTH	19.25 GHz
SWEEP TIME I (mode)	400 ms I AUTO

AMPLITUDE button:

REFerence LEVEL	O dBm
Input Attenuation I (mode)	10 dB I AUTO
Vertical Scale	LOG 10 dB/DIV
REF LVL OFFSET	O dB (OFF)
MAX MXR LEVEL	-10 dBm
Automatic IF ADJUST	ON
UNITS I (mode)	dBm I AUTO

FREQ COUNT button:

FREQ COUNTer	OFF
COUNTER Resolution	10 kHz

Demodulation button:

AM Demodulation	OFF
FM Demodulation	OFF
Demodulation TIME	1 second
VOLUME	0
SQUELCH (mode)	OFF
AGC	OFF

INTernal mixer button:

Internal Mixer	selected
SIGnal identification	OFF

EXTernal mixer button:

FULL BAND	K
LOCK HARMONIC	6
Band LOCK	OFF
SIGNAL identification	OFF

Marker buttons:

Marker mode	OFF
MKR NOISE	OFF
SIGnal TRK	OFF
PEAK EXCURSION	6 dB
PEAK THRESHOLD	-120 dBm

SWEEP button:

Continuous mode	ON
SWEEP TIME I (mode)	400 ms I AUTO

AUTO COUPle button:

MAX MXR LEVEL	-10 dBm
VBW:RBW ratio	1
RBW:SPAN ratio	0.011

BW (bandwidth) button:

Resolution BW I (mode)	1 MHz I AUTO
VIDEO BW I (mode)	1 MHz I AUTO
VIDeo AVG I (mode)	100 I OFF

TRACE button:

TRACE A	CLEAR-WRITE
TRACE B	BLANK
A - B - > A	OFF
A - B + Display Line -> A	OFF
DETECTOR MODES	NORMAL
FFT	OFF

TRIGger button:

Continuous mode	ON
Source	FREE RUN
VIDEO TRIG LEVEL	0 dBm

DISPLAY button:

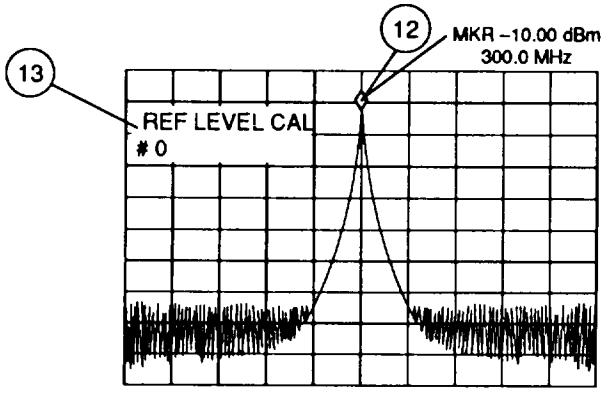
DISPLAY LINE I (mode)	0 dBm I OFF
THRESHLD I (mode)	-90 dBm I OFF
GRATicule	ON
ANNOTation	ON
FREQUENCY DISPLAY OFF	not selected

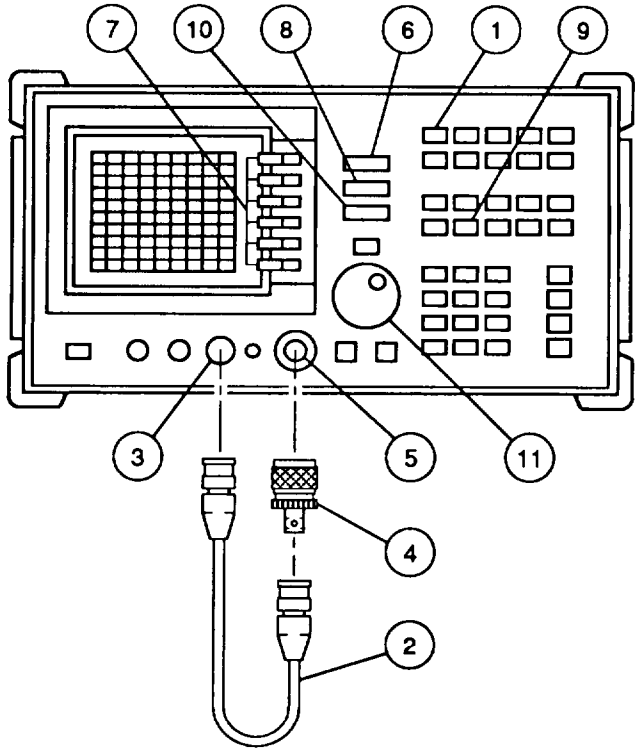
e. Perform Reference Level Calibration as follows:

NOTE

- Perform the Reference Level Calibration Procedure when first turning on the Spectrum Analyzer, or when the ambient temperature changes more than 10 °C.
- This Calibration procedure does not replace calibration performed in accordance with the technical bulletin listed in TB 43-180 for this equipment.

1. Press PRESET (1) button. Allow five minutes warm-up.





2. Connect the supplied 50 Ω BNC-BNC Cable (2) to the CAL OUTPUT connector (3).
3. Using the supplied Type N to BNC adapter (4), connect the BNC Cable (2) to the input connector (5).
4. Press FREQUENCY button (6), then set Center Frequency (7) to 300 MHz.
5. Press SPAN button (8), then set Span Width (7) to 20 MHz.
6. Press PEAK SEARCH button (9).
7. Press AMPLITUDE button (10), then set Reference Level (7) to -10 dBm.
8. Press MORE (7) then REF LVL CAL (7) keys.
9. Slowly rotate the knob (11) until the marker (12) reads -10.00 dBm ±0.17 dB.
   - Verify the REF LVL CAL value (13) is 0 ± 10.

NOTE

There is a slight delay between the knob and a change in marker value.

10. Press STORE REF LVL (7) key
11. Disconnect the cable and adapter.
12. Press the PRESET (1) button.

f. If all above conditions are correct, the Spectrum Analyzer is ready for operation. If indication is incorrect, notify next higher level maintenance.

2-7. ERROR MESSAGES.

Some incorrect operating procedures and internal circuit failures cause error messages to appear in the display. See table 2-2 for a list of possible error messages and probable cause.

NOTE

If an indication appears that is not listed in table 2-2, notify next higher level maintenance.

Table 2-2. Error Messages.

DISPLAY	PROBABLE CAUSE	CORRECTIVE ACTION
ERR XXX XXXXXXXX	Improper operation/unit failure.	Press RECALL button, MORE key, then RECALL ERRORS key. Use the STEP buttons to scroll the stored error messages, and record all the error messages displayed. Press PRESET BUTTON button, then REALIGN LO & IF key. Wait approximately 30 seconds for the internal alignment to complete. • If error(s) are no longer displayed, unit is operational. • If different error(s) are displayed, repeat procedure. • If identical error(s) are displayed, notify, next higher level maintenance.

2-8. OPERATING PROCEDURES.

Operation of Spectrum Analyzer is provided in paragraphs 2-9 thru 2-16. Refer to paragraph 2-1 for a further description of the controls, indicators, and connectors.

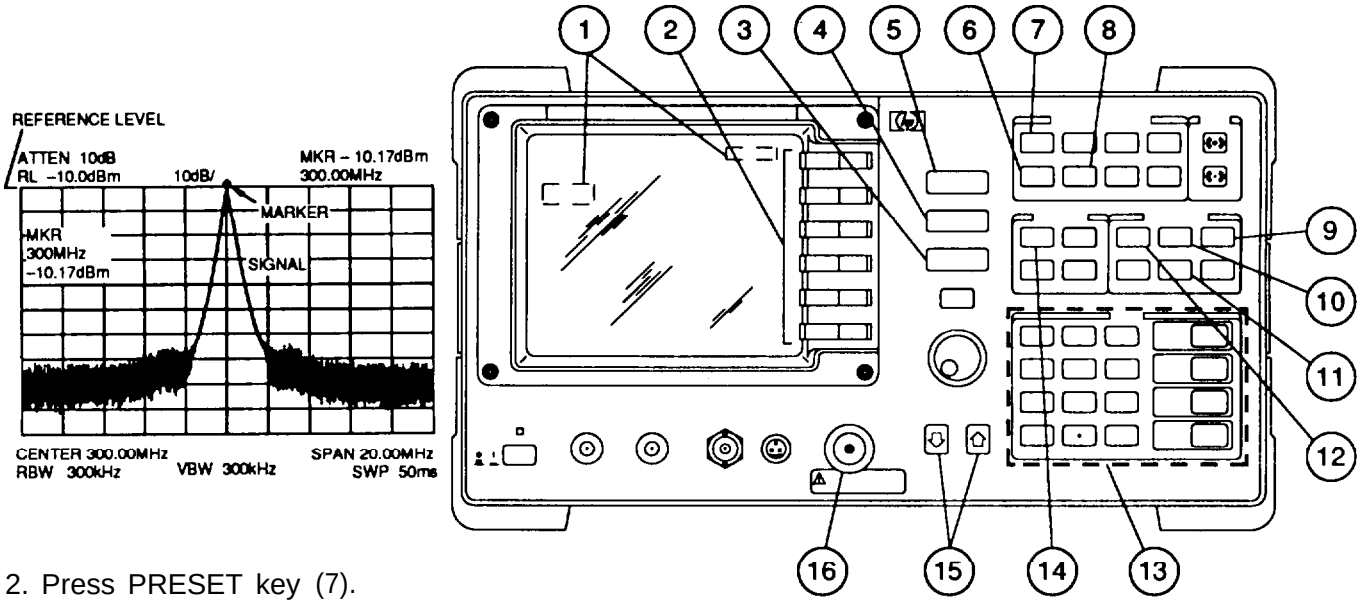
2-9. BASIC MEASUREMENTS.

Perform the following steps for basic frequency and amplitude measurements from 10 kHz to 22 GHz.

1. Connect input signal to the INPUT connector (16) using a cable or antenna.

CAUTION

Do not exceed maximum input to the Spectrum Analyzer. Use an appropriate attenuator if signal to be measured is > + 30 dBm (1 watt).



2. Press PRESET key (7).
3. Press FREQUENCY button (5). then select CENTER FREQ. or START FREQ and STOP FREQ and enter desired frequency using DATA (13) buttons. Choices-are displayed in KEY MENU (2) area.
   - If CENTER FREQ was entered, press SPAN button (4) and enter the desired SPAN WIDTH (2).

NOTE

Frequency span cannot be set to overlap both bands at the same time in continuous SWEEP (12) mode. Low band is 10 kHz to 2.9 GHz, and high band is 2.75 GHz to 22 GHz. Frequency span can be set to overlap both bands in single SWEEP mode.

4. Press AMPLITUDE button (3), then adjust REF LVL (2) to place the signal peak at the desired level.

NOTE

In most cases, placing the signal peak at the reference level (top line of the screen) provides the best measurement accuracy.

5. Press marker ON button (14) and select desired marker functions in the KEY MENU (2) area.
   - Select MARKER NORMAL and place the active marker at the desired location on the trace. Display (1) indicates frequency and amplitude at the marker location.
   - Select MARKER DELTA and place the active marker at the desired location on the trace. Display (1) indicates difference in frequency and amplitude between the anchor and active marker locations.

6. Press BW (10) and select functions depending on measurement conditions.

NOTE

The bandwidth functions default to automatic mode, and should only be selected and adjusted if necessary.

- Select and adjust VIDEO BW (2) as required to view signals masked by noise.
- Select and adjust RES BW (2) as required to view signals that are so close in frequency, they appear as a single response. As a minimum, RES BW should be set to less than or equal to the frequency separation of the signals to be measured.

NOTE

Reducing RES BW and/or VIDEO BW increases sweep time. For fastest measurement times, use the widest possible RES BW and VIDEO BW that still permits resolution of all desired signals.

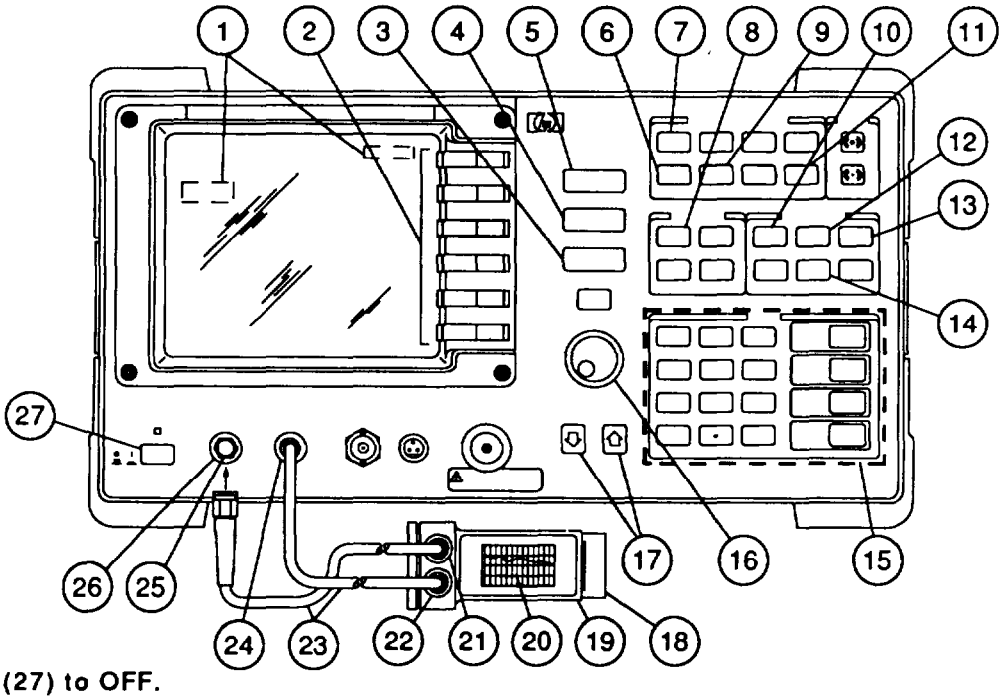
7. If signal compression is suspected, press AMPLITUDE (3), then select ATTEN (2). While observing the peak of the displayed signal, increase ATTEN by pressing STEP (15) [UP] key once. If the peak shifts by more than 1dB, the signal is in compression.
   - If signal is in compression, continue to increase ATTEN until the peak shifts by less than 1dB, then decrease ATTEN by one step.
   - If signal is not in compression, reselect ATTEN AUTO (2).
8. Select other functions as required.
   - Select AMPLITUDE (3) then UNITS (2) to change the displayed amplitude units.
   - Select FREQ COUNT (6) to activate the counter function.
   - Select SAVE (8) to store trace or instrument configuration.
   - Select TRIG (9) to change triggering.
   - Select TRACE (11) for trace math functions, or selection of A and B traces.
   - Select SWEEP (12) to activate single sweep or change sweep time.

NOTE

All functions are explained in Section I. Refer to table 2-1 for a complete listing of all controls, indicators, and connectors.

2-10. MEASUREMENTS USING EXTERNAL MIXERS.

Perform the following steps for basic frequency and amplitude measurements from 18 GHz to 40 GHz.



1. **Set LINE (27) to OFF.**
2. Remove the 50 Ω Termination (25) and connect the external mixer (19) using cables (23) supplied. Connect the mixer LO connector (21) to the 1st LO Output connector (26). Connect the mixer IF connector (22) to the IF Input connector (24). Connect the mixer RF INPUT connector (18) to the signal to be measured using screws provided. Mixers, cables, wrenches, and screws are normally located in the front cover.

NOTE

If necessary, remove the packing on the inside of the waveguide flange.

- Use 11970K for measuring frequencies from 18. 0 to 26.5 GHz.
- Use 11970A for measuring frequencies from 26.5 to 40.0 GHz.

CAUTION

- Do not exceed maximum input to the mixer. Use an appropriate waveguide attenuator if signal to be measured is > +20 dBm (100mW).
- Do not over-tighten cables.

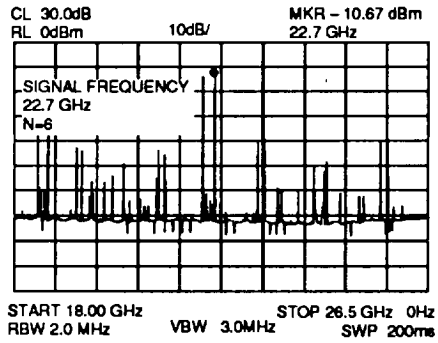
3. Set LINE (27) to ON and press PRESET (7). Allow five minutes warm-up.
4. Press EXT button (11), then set FULL BAND (2) to A if using 11970A or K if using 11970K.
5. Select AMPTD CORRECT (2), then AVERAGE CNV LOSS (2) and enter 30 dB using KNOB (16). Select CONV LOSS VS FREQ (2) and enter the conversion loss (in dB) plotted on the mixer calibration label (20) for the following frequencies. Use KNOB (16) to enter the conversion loss. Use STEP (17) buttons to change displayed frequency.
   - 11970K at 18 GHz, 20 GHz, 22 GHz, 24 GHz, 26 GHz, and 26.5 GHz (displays 27 GHz).
   - 11970A at 27 GHz, 29 GHz, 31 GHz, 33 GHz, 35 GHz, 37 GHz, 39 GHz, and 40 GHz.
6. Select PREV MENU (2), BIAS (2), then BIAS OFF (2) (11970 series mixers do not require bias).

7. Press FREQUENCY button (5), then select CENTER FREQ, or START FREQ and STOP FREQ and enter desired frequency using DATA (15) buttons. Choices are displayed in KEY MENU (2) area.
   - If CENTER FREQ was entered, press SPAN button (4) and enter the desired SPAN WIDTH (2).
8. Press AMPLITUDE button (3), then adjust REF LVL (2) to place the signal peak at the desired level.

NOTE

In most cases, placing the signal peak at the reference level (top line of the screen) provides the best measurement accuracy.

9. Press EXT button (11), then SIGNAL IDENT (2). Select MARKER NORMAL (2) and place the active marker on the signal to be measured. Select SIGNAL ID AT MKR (2). For the measurement to be valid:
   - "SIGNAL FREQUENCY" and "N." must be displayed in the ACTIVE FUNCTION area (l).
   - Signal Frequency from 18.0 to 26.5 GHz when using 11970K and from 26.5 to 40.0 GHz when using 11970A.
   - N=6 when using 11970K and N=8 when using 11970A



NOTE

If incorrect, displayed signal is an invalid signal from the mixer. Repeat step 9 on a different displayed signal.

10. Press marker ON button (8) and select desired marker functions in the KEY MENU (2) area.
    - Select MARKER NORMAL and place the active marker at the desired location on the trace. Display (1) indicates frequency and amplitude at the marker location.
    - Select MARKER DELTA and place the active marker at the desired location on the trace. Display (1) indicates difference in frequency and amplitude between the anchor and active marker locations.
11. Select other functions as required.
    - Select AMPLITUDE (3), MORE (2), then UNITS (2) to change the displayed amplitude units.
    - Select FREQ COUNT (6) to activate the counter function.
    - Select BW (12) to change resolution and/or video bandwidths.
    - Select SAVE (9) to store trace or instrument configuration.
    - Select TRIG (13) to change triggering.
    - Select TRACE (14) for trace math functions, or selection of A and B traces.
    - Select SWEEP (10) to activate single sweep or change sweep time.

NOTE

All functions are explained in Section I. Refer to table 2-1 for a complete listing of all controls, indicators, and connectors.

12. Remove power (27), disconnect Mixer/cables, and reinstall 50 Ω Termination (25).

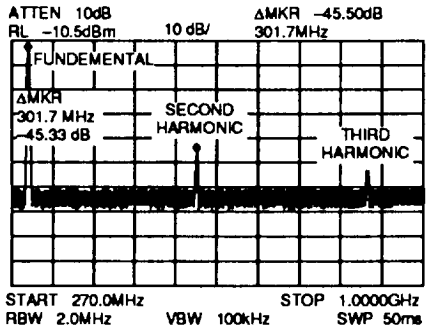
2-11. HARMONIC DISTORTION MEASUREMENTS.

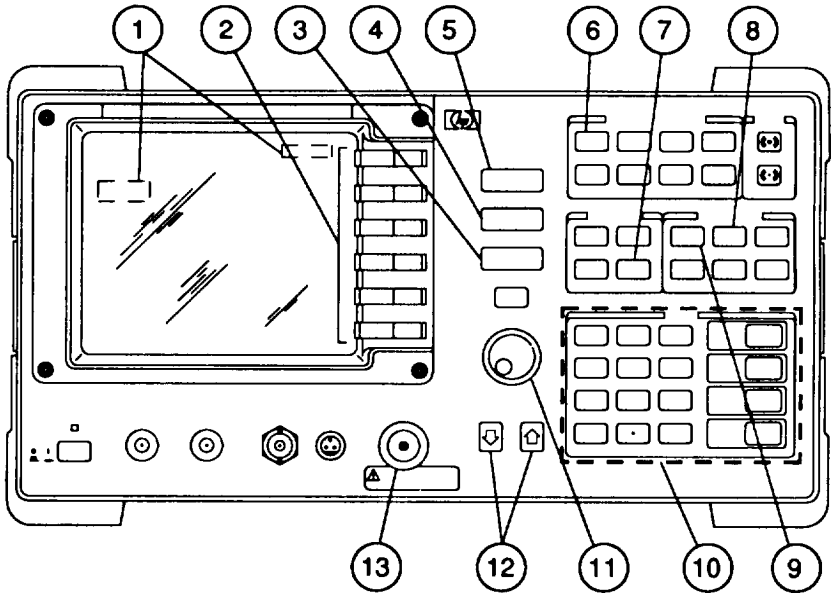
Perform the following steps to measure harmonic distortion.

1. Connect input signal to the INPUT connector (13) using a cable or antenna.

CAUTION

Do not exceed maximum input to the Spectrum Analyzer. Use an appropriate attenuator if signal to be measured is > + 30 dBm (1 watt).





2. Press PRESET button (6).
3. Press FREQUENCY button (5), then select CENTER FREQ, or START FREQ and STOP FREQ and enter the fundamental using DATA (10) buttons. Choices displayed in KEY MENU (2) area.

- If CENTER FREQ was entered, press SPAN button (4) and enter the desired SPAN WIDTH (2).

NOTE

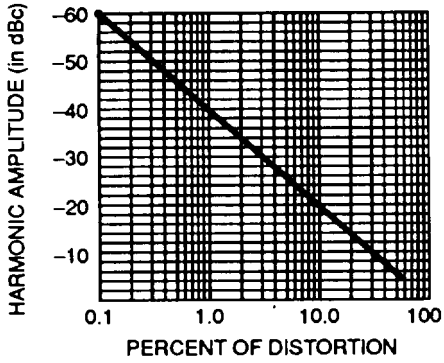
- When selecting START/STOP or SPAN, verify that the fundamental and harmonics to be measured are displayed.
- Frequency span cannot be set to overlap both bands at the same time in continuous SWEEP (9) mode. Low band is 10 kHz to 2.9 GHz, and high band is 2.75 GHz to 22 GHz. Frequency span can be set to overlap both bands in single SWEEP mode.

4. Press BW button (8), then select VIDEO BW (2). Press the STEP (12) buttons until harmonics are visible.
5. Press AMPLITUDE button (3), then adjust REF LVL (2) to place the fundamental signal peak at the desired level.

NOTE

In most cases, placing the fundamental peak at the reference level (top line of the screen) provides the best measurement accuracy.

6. Press PEAK SEARCH button (7), then select MARKER DELTA (2). Harmonics (in dBc) can be measured one of three ways:
   - Select NEXT PEAK (2) to place the active marker at the largest harmonic peak. Display (1) indicates difference in frequency and amplitude (in dBc) from the fundamental signal peak. Repeat to measure all displayed harmonics.
   - Use the KNOB (11) to place the active marker on the desired harmonic. Display (1) indicates difference in frequency and amplitude (in dBc) from the fundamental signal peak. Repeat to measure all displayed harmonics.
   - Press FREQUENCY (5) then CENTER FREQ (2) and enter fundamental frequency. Select CF STEP (2) and enter the fundamental frequency. Decrease SPAN (4) as required to view fundamental. Press PEAK SEARCH (7) then MARKER DELTA (2). Press FREQUENCY (5), then CENTER FREQ (2). Press the STEP (12) [UP] to place the active marker on the second harmonic. Display (1) indicates difference in frequency and amplitude (in dBc) from the fundamental signal peak. Press STEP (12) [UP] until all harmonics are measured. Decrease SPAN (4) if required to view harmonics'.



7. Percentage of harmonic distortion is obtained by comparing the measured amplitude from step 6 (in dBc) to the graph. To measure total percentage of harmonic distortion, proceed as follows:
   - Perform steps 2 to 5.
   - Press AMPLITUDE (3) button, then select MORE, UNITS, and VOLTS. Choices displayed in KEY MENU (2) area.
   - Press PEAK SEARCH button (7), then use NEXT PEAK (2) to measure and record the amplitude of the fundamental and harmonics in volts.
   - Calculate total percentage of harmonic distortion using the following formula:

$$\text{Percent of distortion} = \frac{\sqrt{(A_2)^2 + (A_3)^2 + (A_4)^2 + (A_n)^2} \times 100}{A_1}$$

where:

A_1 = the amplitude of the fundamental frequency, in volts
A_2 = the amplitude of the second harmonic, in volts
A_3 = the amplitude of the third harmonic, in volts
A_4 = the amplitude of the fourth harmonic, in volts
A_n = the amplitude of the nth harmonic, in volts

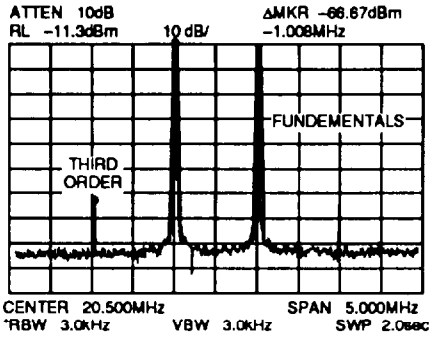
2-12. THIRD-ORDER INTERMODULATION DISTORTION MEASUREMENTS.

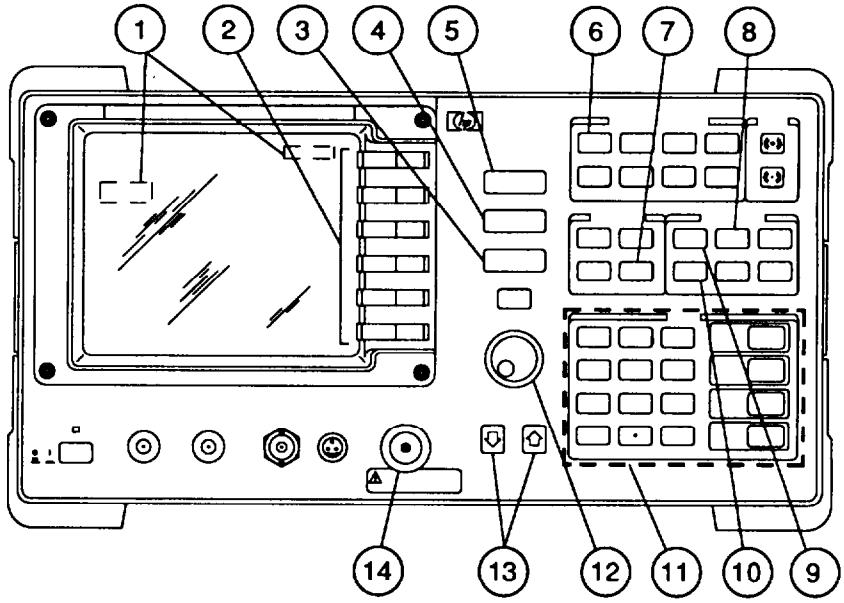
Perform the following steps to measure third-order intermodulation distortion (see glossary for a definition of third-order intermodulation distortion).

1. Connect input signal to the INPUT connector (14) using a cable or antenna.

CAUTION

Do not exceed maximum input to the Spectrum Analyzer. Use an appropriate attenuator if signal to be measured is > + 30 dBm (1 watt).





2. Press PRESET button (6).

3. Press FREQUENCY button (5), select CENTER FREQ (2), and enter the center of the fundamental frequencies using the DATA (11) buttons. Press SPAN button (4), select SPAN WIDTH (2), and enter a span wide enough to include all distortion products on the display (typically greater than three times the amount of separation between both fundamental frequencies).

   · For example, if one signal is 21 MHz, and the other is 20 MHz, set the CENTER FREQ to 20.5 MHz. Set the SPAN to 5 MHz (>1 MHz x 3).

NOTE

Frequency span cannot be set to overlap both bands at the same time in continuous SWEEP (9) mode. Low band is 10 kHz to 2.9 GHz, and high band is 2.75 GHz to 22 GHz. Frequency span can be set to overlap both bands in single SWEEP mode.

4. Press AMPLITUDE button (3), then adjust REF LVL (2) to place the fundamental signal peaks at the desired level.

NOTE

In most cases, placing the fundamental peaks at the reference level (top line of the screen) provides the best measurement accuracy.

5. To increase visibility of distortion products, select the following functions as required.
   - Press BW button (8), then select RES BW (2). Use STEP (13) buttons to reduce bandwidth until all distortion products are clearly visible.

NOTE

When measuring signals of equal amplitude, RES BW should be set to less than or equal to the frequency separation of the signals to be measured. However, when measuring third order distortion products where amplitude differences between the signals are large (typically 40 dB), RES BW may have to be reduced further to view all desired signals.

   - Press BW button (8), then select VIDEO BW (2). Use STEP (13) buttons to reduce bandwidth until all distortion products are clearly visible.

NOTE

Reducing RES BW and/or VIDEO BW increases sweep time. For fastest measurement times, use the widest possible RES BW and VIDEO BW that still permits resolution of all desired signals.

   - Press AUTO COUPLE button (10), select MAX MXR LEVEL (2). Use STEP (13) buttons to change input mixer level until all distortion products are clearly visible.

NOTE

Reducing MAX MXR LEVEL automatically sets the attenuator so that the maximum signal level at input mixer is the MAX MXR LEVEL entered.

6. Press PEAK SEARCH button (7) to place the marker on one of the fundamental signal peaks, then select MARKER DELTA (2). Distortion products can be measured one of three ways:
   - Select NEXT PEAK (2) to place the active marker at the next largest peak. Display (1) indicates difference in frequency and amplitude (in dBc) from the fundamental signal peak with the anchor marker. Repeat to measure all distortion products.
   - Select MORE (2), NEXT PK RIGHT or NEXT PK LEFT (2) to place the active marker at the next peak to the right or left of the anchor marker. Display (1) indicates difference in frequency and amplitude (in dBc) from the fundamental signal peak with the anchor marker. Repeat to measure all distortion products.

NOTE

It may be necessary to change the PEAK THRESHLD (2) to a level higher than any noise present on the input signal.

   - Use the KNOB (12) to place the active marker on the distortion products. Display (1) indicates difference in frequency and amplitude (in dBc) from the fundamental signal peak with the anchor marker. Repeat to measure all distortion products.

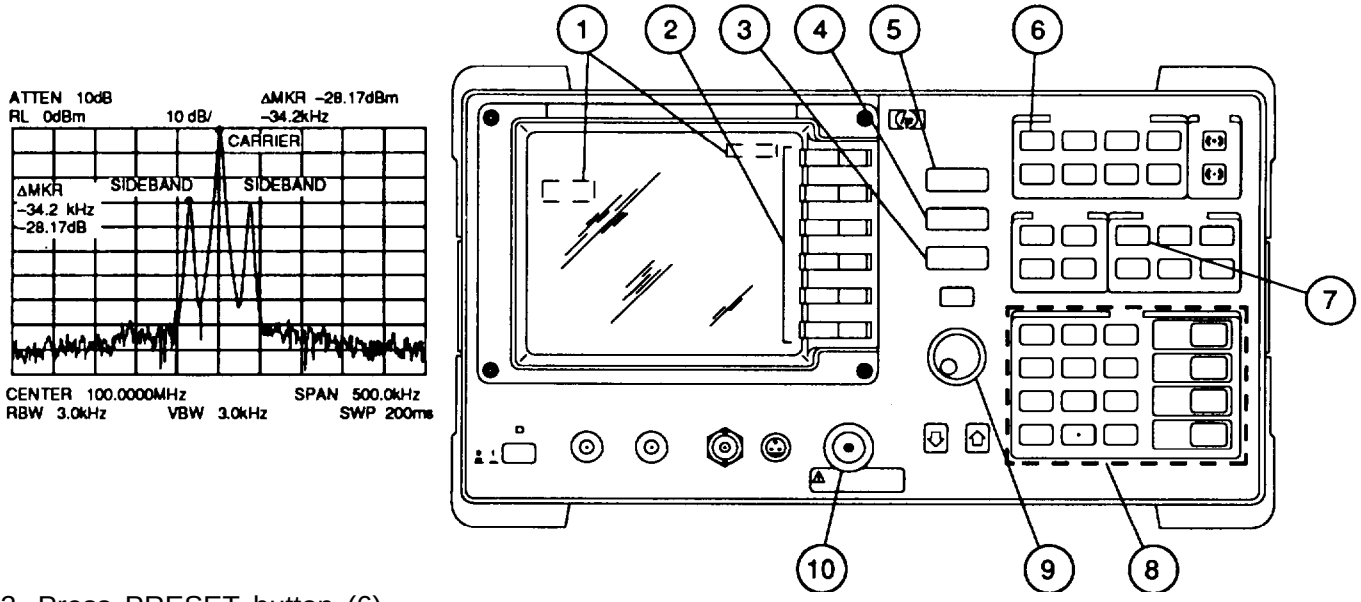
2-13. AMPLITUDE MODULATION MEASUREMENTS.

Perform the following steps to measure modulating frequency and depth of an amplitude modulation (AM) input signal.

1. Connect input signal to the INPUT connector (10) using a cable or antenna.

CAUTION

Do not exceed maximum input to the Spectrum Analyzer. Use an appropriate attenuator if signal to be measured is > + 30 dBm (1 watt).



2. Press PRESET button (6).
3. Press FREQUENCY button (5), then select CENTER FREQ, or START FREQ and STOP FREQ and enter the carrier frequency using the DATA (8) buttons. Choices displayed in KEY MENU (2) area.
   - If CENTER FREQ was entered, press SPAN button (4) and enter the desired SPAN WIDTH (2).

NOTE

- When selecting START/STOP or SPAN, verify that the carrier and sidebands are visable on the display.
- Frequency span cannot be set to overlap both bands at the same time in continuous SWEEP (7) mode Low band is 10 kHz to 2.9 GHz, and high band is 2.75 GHz to 22 GHz. Frequency span can be set to overlap both bands in single SWEEP mode.

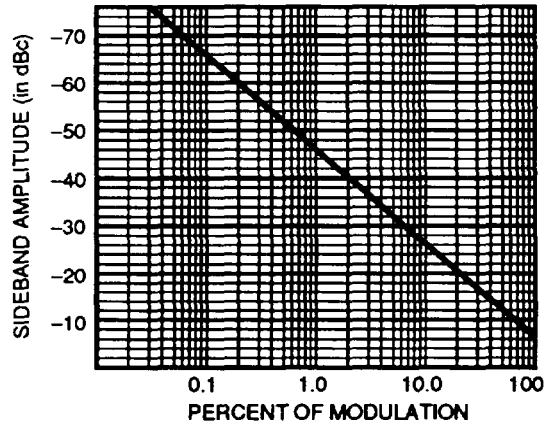
4. Press AMPLITUDE button (3), then adjust REF LVL (2) to place the fundamental signal peak at the desired level.

NOTE

In most cases, placing the carrier peak at the reference level (top line of the screen) provides the best measurement accuracy.

5. Press PEAK SEARCH button (7). Carrier frequency and amplitude is displayed in the MKR (1) annotation.

6. Select MARKER DELTA (2). Select NEXT PEAK (2) or use the KNOB (9) to place the active marker on the sideband peak. Difference in frequency and amplitude is displayed in the MKR (1) annotation.
   - Displayed frequency difference is the modulating frequency.
   - Displayed amplitude difference is the modulation depth (see graph for conversion to percent).



NOTE

Unequal amplitudes of the lower and upper sidebands indicate incidental FM on the input signal. Incidental FM can reduce the accuracy of modulation depth measurements. See FFT (item 221) in Section 1, for more information on measuring AM in the presence of incidental FM.

7. To calculate "total percentage of modulation, proceed as follows:
   - Perform steps 2 to 4.
   - Press AMPLITUDE (3) button, then select MORE, UNITS, and VOLTS (choice displayed in KEY MENU (2) area).
   - Press PEAK SEARCH button (7), then use the NEXT PEAK (2) to measure and record the amplitude of the carrier and sideband in volts.
   - Calculate total modulation depth (in percent) using the following formula:

$$\text{Depth (percent)} = \frac{2A_S \times 100}{A_C}$$

where:

A_S = sideband amplitude, in volts
A_c = carrier amplitude, in volts

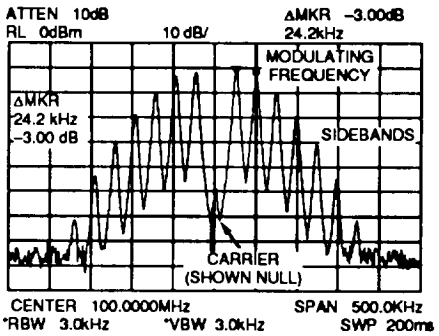
2-14. FREQUENCY MODULATION MEASUREMENTS.

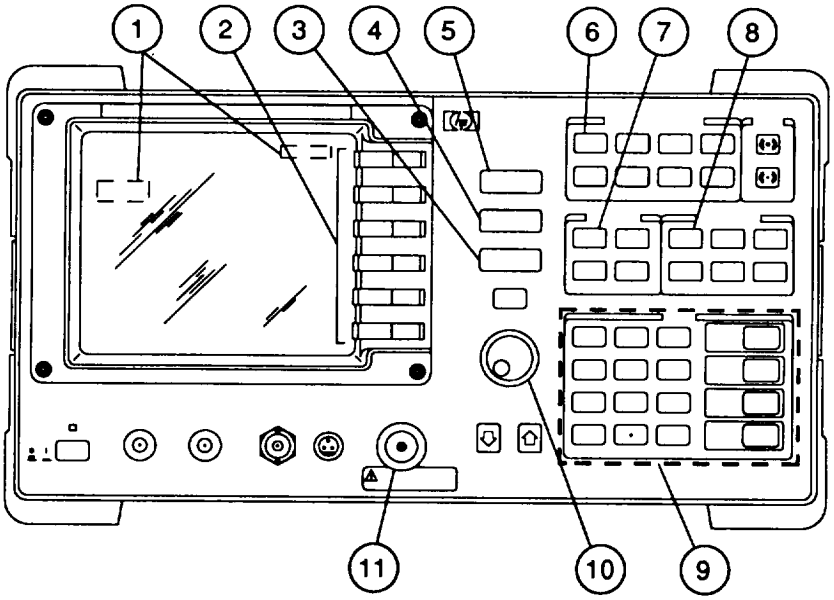
Perform the following steps to measure modulating rate and calculate deviation of a frequency modulation (FM) input signal.

1. Connect input signal to the lNPUT connector (11) using

CAUTION

Do not exceed maximum input to the Spectrum Analyzer. Use an appropriate attenuator if signal to be measured is > + 30 dBm (1 watt).





2. Press PRESET button (6).
3. Press FREQUENCY button (5), then select CENTER FREQ, or START FREQ and STOP FREQ, and enter the carrier frequency using the DATA (9) buttons. Choices displayed in KEY MENU (2) area.
   - If CENTER FREQ was entered, press SPAN button (4) and enter the desired SPAN WIDTH (2).

NOTE

- When selecting START/STOP or SPAN, verify that the carrier and sidebands are visual on the display.
- Frequency span cannot be set to overlap both bands at the same time in continuous SWEEP (8) mode Low band is 10 kHz to 2.9 GHz, and high band is 2.75 GHz to 22 GHz. Frequency span can be set to overlap both bands in single SWEEP mode.

4. Press AMPLITUDE button (3), then adjust REF LVL (2) to place the signal peak at the desired level.

NOTE

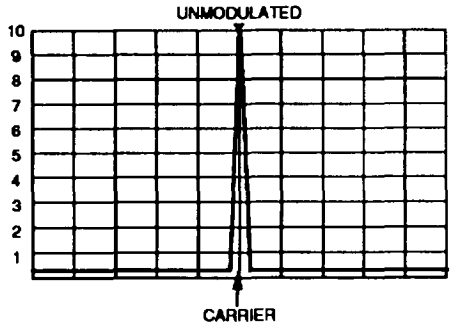
In most cases, placing the signal peak at the reference level (top line of the screen) provides the best measurement accuracy.

5. Press marker ON button (7) and use the KNOB (10) to place the active marker on the carrier peak (may not always be the largest signal). Carrier frequency and amplitude is displayed in the MKR (1) annotation.
6. Select MARKER DELTA (2). Use the KNOB (10) to place the active marker on the first sideband peak. Difference in frequency and amplitude is displayed in the MKR (1) annotation.
   - Displayed frequency difference is the modulating rate.

NOTE

- Measuring frequency between any two adjacent sideband peaks will display the modulating rate. Take care not to skip the carrier or a sideband that is nulled when making the measurement.
- Incidental AM on the input signal can cause the frequency null to shift that can reduce the accuracy of measurements.

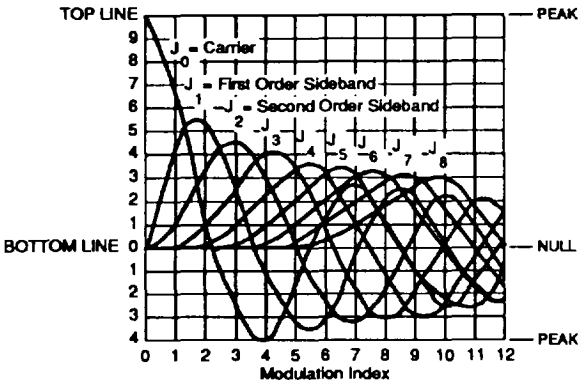
7. To measure the approximate deviation of an input signal, use the following procedure:
   - UNMODULATED the input so just the carrier is displayed. Press AMPLITUDE (3) and select LINEAR (2). Select REF LVL (2) and adjust the peak of the UNMODULATED carrier to the top line of the display.



   - DEMODULATE the carrier and observe the displayed signal to determine the relative position (from bottom of scale) of the carrier and sidebands.
   - Locate the closest duplicate pattern on the graph to determine the modulation index.

NOTE

Location of the relative position (from bottom of scale) of the carrier and sidebands on the graph can be either positive or negative going.



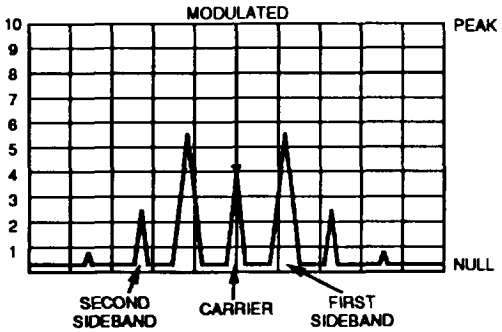
   - Calculate the deviation using the following formula:

DEVIATION = MOD RATE X MOD INDEX

where:

MOD RATE = from step 6
MOD INDEX = from graph

For Example, a 300 MHz carrier is frequency modulated at 3 kHz rate. Analyzing the frequency modulated waveform shown, the carrier is 4 (divisions from bottom of scale), the first sideband is 5.5, and the second sideband is 2.5. On the graph, this occurs at a modulation index of 1.8. As the modulation rate is 3 kHz, the deviation calculates to 5.4 kHz (1.8 X 3000).



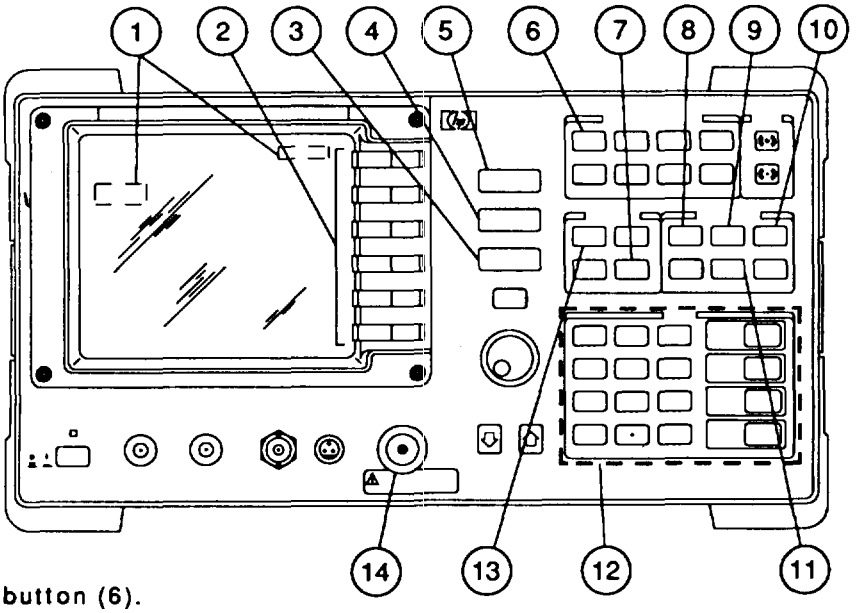
2-15. PULSED RF MEASUREMENTS.

Perform the following steps to measure center frequency, pulse width, and pulse repetition frequency in a pulsed RF input signal.

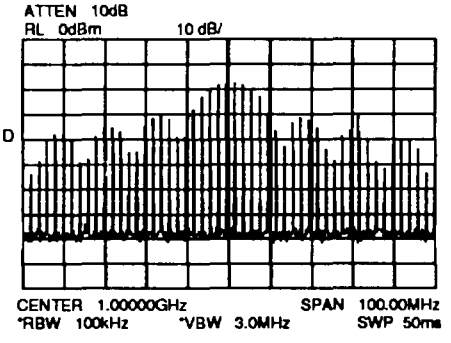
1. Connect input signal to the INPUT connector (14) using a cable or antenna.

CAUTION

Do not exceed maximum input to the Spectrum Analyzer. Use an appropriate attenuator if signal to be measured is > + 30 dBm (1 watt).



2. **Press PRESET button (6).**
3. Press BW button (9), then adjust VIDEO BW (2) to 3 MHz.
4. Press TRACE button (11), then select MORE, DETECTOR MODES, then DETECTOR POS PEAK. Choices displayed in KEY MENU (2) area.
5. Press FREQUENCY button (5), select CENTER FREQ (2), then enter the center lobe frequency using the DATA (12) buttons.
6. Press SPAN button (4) and enter the desired SPAN WIDTH (2).



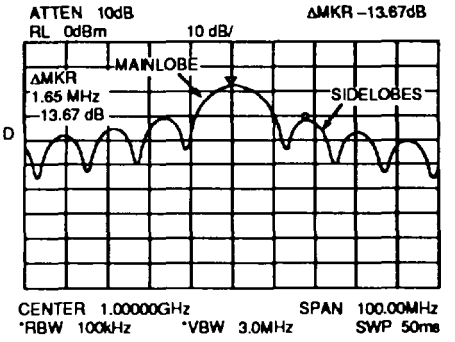
NOTE

- When selecting SPAN, verify that the main lobe and one pair of side lobes are visible on the display. If necessary, adjust RES BW (9) to display the input signal.
- Frequency span cannot be set to overlap both bands at the same time in continuous SWEEP (8) mode Low band is 10 kHz to 2.9 GHz, and high band is 2.75 GHz to 22 GHz. Frequency span can be set to overlap both bands in single SWEEP mode.

7. Press SWEEP button (8), then increase (slower) SWEEP TIME (2) until the display fills in and becomes a solid line as shown on next page.

NOTE

If line does not fill in as shown, signal is not pulsed RF. Side lobe ratio and pulse width (step 9), and peak pulse power (step 10) cannot be performed.



8. Press AMPLITUDE button (3), then adjust REF LVL (2) to place the signal peak at the desired level.

NOTE

In most cases, placing the signal peak at the reference level (top line of the screen) provides the best measurement accuracy.

9. This must be performed in the order given. Press PEAK SEARCH button (7) to place the active marker on the main lobe peak. Main lobe frequency and amplitude is displayed in the MKR (1) annotation. Record displayed amplitude.
   - To measure side lobe ratio, select MARKER DELTA (2) then NEXT PEAK (2). Difference in amplitude displayed in the MKR (1) annotation is the side lobe ratio.
   - To measure pulse width, select MARKER DELTA (2). MORE, then NEXT PK RIGHT (2). Press ON (13) then MARKER I/DELTA. Difference in time displayed in the MKR (1) annotation is the pulse width. Record displayed Δ MKR time and current RES BW (9).

NOTE

To increase for frequencies >2.7 GHz, use PRESEL AUTO PK. See item 127 in Section 1, for more information.

10. To calculate Peak Pulse Power, proceed as follows:

    Peak Pulse Power =(Mainlobe Amplitude) – (20 log Teff)(1.5 BW)

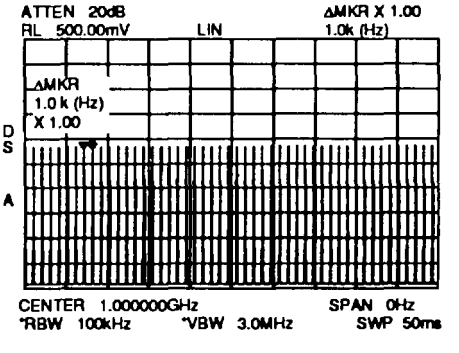
    where: Mainlobe Amplitude = measured and recorded in step 9.
    Teff = time difference measured and recorded in step 9.
    BW = resolution bandwidth recorded in step 9.

11. To calculate Pulse Desensitization, proceed as follows:

    Pulse Desensitization =(Peak Pulse Power) - (Mainlobe Amplitude)

    where: Mainlobe Amplitude = measured and recorded in step 9.
    Peak Pulse Power = Calculated in step 10.

12. To measure pulse repetition frequency, proceed as follows:
    - Press SPAN button (4) then select ZERO SPAN (2).
    - Press SWEEP button (8), then decrease (faster) SWEEP TIME (2) until the display is as shown.
    - Press AMPLITUDE button (3), then select LINEAR (2), and if necessary readjust RF LVL until signal is displayed.
    - Press TRIGGER button (10), then SINGLE (2)
    - Press PEAK SEARCH button (7), then MARKER DELTA, MORE, then NEXT PK RIGHT. All choices displayed in the KEY MENU (2) area. Press ON (13), then MARKER I/DELTA (2). Difference in frequency displayed in the MKR (1) annotation is the pulse repetition frequency.



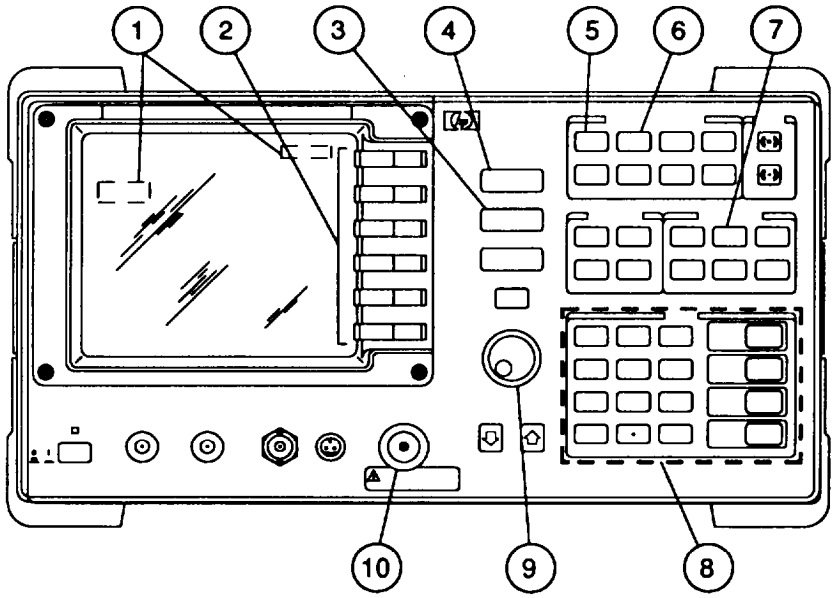
2-16. DEMODULATE INPUT SIGNALS.

Perform the following steps to demodulate the input signal. Demodulated audio is available on the speaker and rear panel EARPHONE JACK (J1).

1. Connect input signal to the INPUT connector (10) using a cable or antenna.

CAUTION

Do not exceed maximum input to the Spectrum Analyzer. Use an appropriate attenuator if signal to be measured is > + 30 dBm (1 watt).



2. Press PRESET button (5).
3. Press FREQUENCY button (4),then select and enter desired START FREQ and STOP FREQ in KEY MENU (2) area using the DATA (8) buttons.

NOTE

Reduce attenuation (3) and/or bandwidth (7) as required to view the input signal.

4. Press DE MOD button (6) and select desired functions in KEY MENU (2) area as required.
   - Select marker (NORMAL or PEAK SEARCH).
   - Select AM DE MOD or FM DE MOD to ON.
   - Select DEMOD TIME and adjust using DATA (8) buttons or KNOB (9) to desired audio level.
   - Select VOLUME and adjust using DATA (8) buttons or KNOB (9) to desired audio level.
   - Select AGC to ON (for AM).
   - Select SQUELCH level using DATA (8) buttons or KNOB (9).
6. Audio is available at the speaker or rear panel ear phone jack, and the carrier frequency is displayed in the MKR (1) annotation.

CHAPTER 3
UNIT MAINTENANCE

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Common Tools and Equipment	3-1	3-1
CRT Trace Alignment	3-9	3-8
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Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

3-1. COMMON TOOLS AND EQUIPMENT.

Common tools and equipment required for unit maintenance of Spectrum Analyzer AN/USM-489A are listed in the Maintenance Allocation Chart (MAC) (Appendix B).

3-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

There are no special tools, TMDE, and support equipment required for unit maintenance of Spectrum Analyzer AN/USM-489A.

3-3. REPAIR PARTS.

Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 11-6625-3250-24P.

Section II. SERVICE UPON RECEIPT

3-4. SERVICE UPON RECEIPT OF MATERIAL.

a. Unpacking. Special design reusable packing material inside this shipping carton provides maximum protection for Spectrum Analyzer. Avoid damaging carton and packing material during equipment unpacking. Use the following steps for unpacking Spectrum Analyzer:

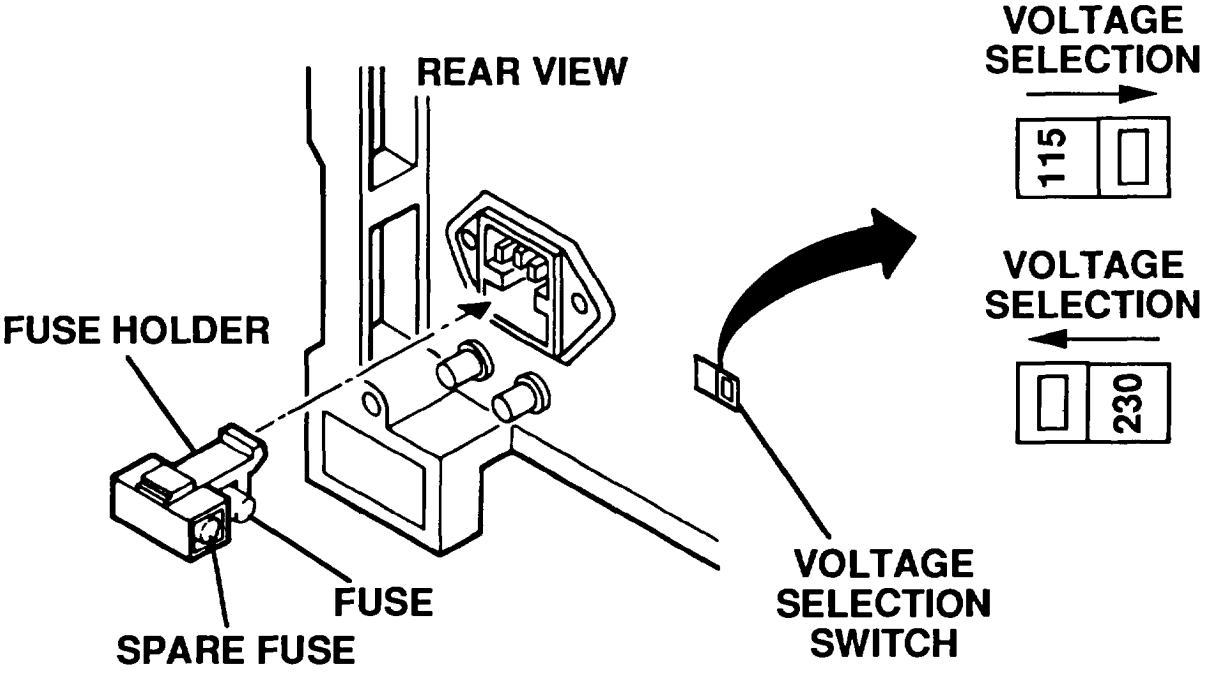
- Cut and remove paper sealing tape on carton front and open carton.
- Grasp Spectrum Analyzer firmly while restraining shipping carton and remove equipment and packing material.
- Place Spectrum Analyzer and bottom tray packing material on a suitable flat clean and dry surface.
- Remove end cap packing material.
- Remove protective plastic bag from Spectrum Analyzer. Place desiccant bags back inside protective plastic bag.
- Place protective plastic bag, end caps, and bottom tray packing materials inside shipping carton,
- Return shipping carton to supply system.

b. Checking Unpacked Equipment.

- Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on SF 364, Report of Discrepancy (ROD).
- Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.
- Check to see whether the equipment has been modified.

3-5. PRELIMINARY SERVICING AND ADJUSTMENT OF EQUIPMENT.

a. Remove fuse (para 3-7). Check that fuse and voltage selection switch are correct for the line voltage available in your area.



Input Voltage	Voltage Selector Switch Position	Fuse
90 to 140 180 to 280	115 230	5 amp 125 volt 5 amp 250 volt

b. Perform turn on procedures (para 2-6).

c. Perform CRT trace alignment procedure (para 3-10).

Section III. TROUBLESHOOTING

SYMPTOM INDEX

Spectrum Analyzer Symptom

		Page
1.	SPECTRUM ANALYZER NOT OPERATING	3-3
2.	SPECTRUM ANALYZER DISPLAYS ERROR MESSAGES	3-4
3.	DISPLAY BLANK	3-4
4.	DISPLAY NOT CENTERED	3-4
5.	LEVEL READINGS INCORRECT	3-4
6.	READINGS INCORRECT USING EXTERNAL MIXERS	3-5

3-6. TROUBLESHOOTING TABLE.

Table 3-1 lists common malfunctions which you may find during operation or maintenance of the Spectrum Analyzer. You should perform the tests/inspections and corrective actions in the order listed.

NOTE

- This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify next higher level maintenance.
- The calibration referenced below does not replace the calibration performed in accordance with the technical bulletin listed in TB 43-180 for this equipment.

Table 3-1. Troubleshooting.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. SPECTRUM ANALYZER NOT OPERATING.

Step 1. Check to see if fuse is blown or broken.

- Replace fuse (para 3-7).

Step 2. Verify power cable contacts not missing, burned, or broken. Verify cable conductors are not open.

- Replace power cable.
- Notify next higher level maintenance.

Table 3-1. Troubleshooting—Continued.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

2. SPECTRUM ANALYZER DISPLAYS ERROR MESSAGES.

ERR XXX XXXXXXXX displayed.

Step 1. Record the displayed error message.

Step 2. Press RECALL button, MORE key, then the RECALL ERRORS key. Verify that NO ERRORS is displayed.

- If correct, proceed with step 4.
- If incorrect, record the error message and proceed with step 3.

Step 3. Use the STEP buttons to scroll the stored error messages. Record all the error messages displayed.

Step 4. Press PRESET button, then the REALIGN LO & lF key. The display will show “XX ADJUST STATUS” for approximately 30 seconds while an internal alignment takes place. Observe the display.

- If no errors are displayed, unit is operational.
- If different error(s) appear, repeat steps 1 to 3.
- If identical error(s) appear, notify next higher level maintenance.

3. DISPLAY BLANK.

Step 1. Verify that rear panel “CRT +110VDC ON” indicator is on.

- If on, proceed with step 2.
- If off, notify next higher level maintenance.

Step 2. Press PRESET button.

- If display normal, unit is operational.
- If DISPLAY blank, proceed with step 3.

Step 3. Press DISPLAY button, then bottom key on the CRT bezel two times. Rotate knob CW.

- If display brightens, set to desired intensity level.
- If display remains blank, notify next higher level maintenance.

4. DISPLAY NOT CENTERED.

Perform CRT Trace Alignment procedure (para 3-9).

- If corrected, unit is operational.
- If still incorrect, notify next higher level maintenance.

5. LEVEL READINGS INCORRECT.

Perform Reference Level Calibration procedure (para 2-6).

- If corrected, unit is operational.
- If still incorrect, notify next higher level maintenance.

Table 3-1. Troubleshooting—Continued.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
6. READINGS INCORRECT USING EXTERNAL MIXERS.
Step 1. Analyze malfunction by frequency. • If only incorrect from 18 to 26.5 GHz, notify next higher level maintenance. • If only incorrect from 26.5 to 40 GHz, notify next higher level maintenance. • If incorrect from 18 to 40 GHz, proceed with step 2.
Step 2. Verify proper operation using external mixers.
Step 3. Verify SMA cables are not damaged or open. • Replace cables if faulty. • If cables are not faulty, notify next higher level maintenance.

Section IV. MAINTENANCE PROCEDURES

3-7. REPLACE FUSE.

DESCRIPTION

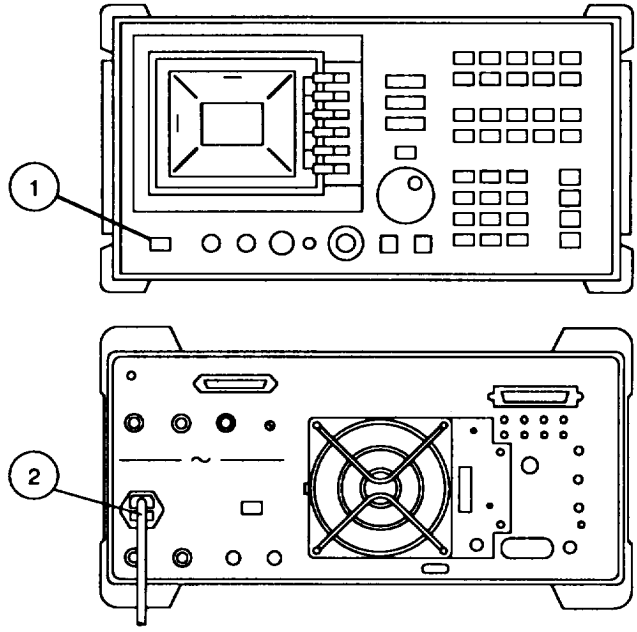
This procedure covers: Remove. Install.

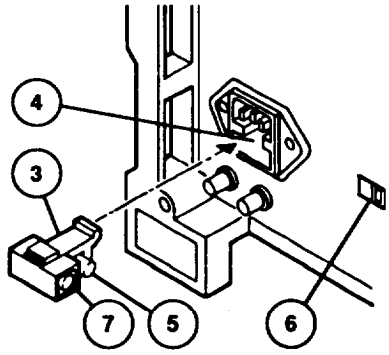
REMOVE

1. Set POWER switch (1) to OFF.
2. Unplug power cable (2),
3. Remove fuseholder (3) from receptacle (4).
4. Pull fuse (5) out of fuseholder (3).

INSTALL

1. Insert fuse (4) into fuseholder (3) and press into place.
2. Verify that voltage selector switch (6) and fuse (5) are correct for line voltage being used.
3. Verify spare fuse (7) is present.
4. Install fuseholder (3) into receptacle (4).
5. Install power cable (2).
6. Set POWER switch (1) to ON.





END OF TASK

3-8. REPLACE KNOB.

DESCRIPTION

This procedure covers: Remove. Install.

REMOVE

1. Set POWER switch (1) to OFF.
2. Loosen two 7/64” hex drive setscrews (2).
3. Remove knob (3) from shaft (4).

INSTALL

1. Install knob (3) onto shaft (4).

NOTE

Knob alignment is not required.

2. Tighten two, 7/64” hex drive setscrews (2). Verify free movement of knob.
3. Set POWER switch (1) to ON.

END OF TASK

3-9. CRT TRACE ALIGNMENT.

DESCRIPTION

This procedure covers: Adjust.

INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES:

- Perform turn-on procedures (para 2-6).
- Allow five minutes for warm-up.

ADJUST

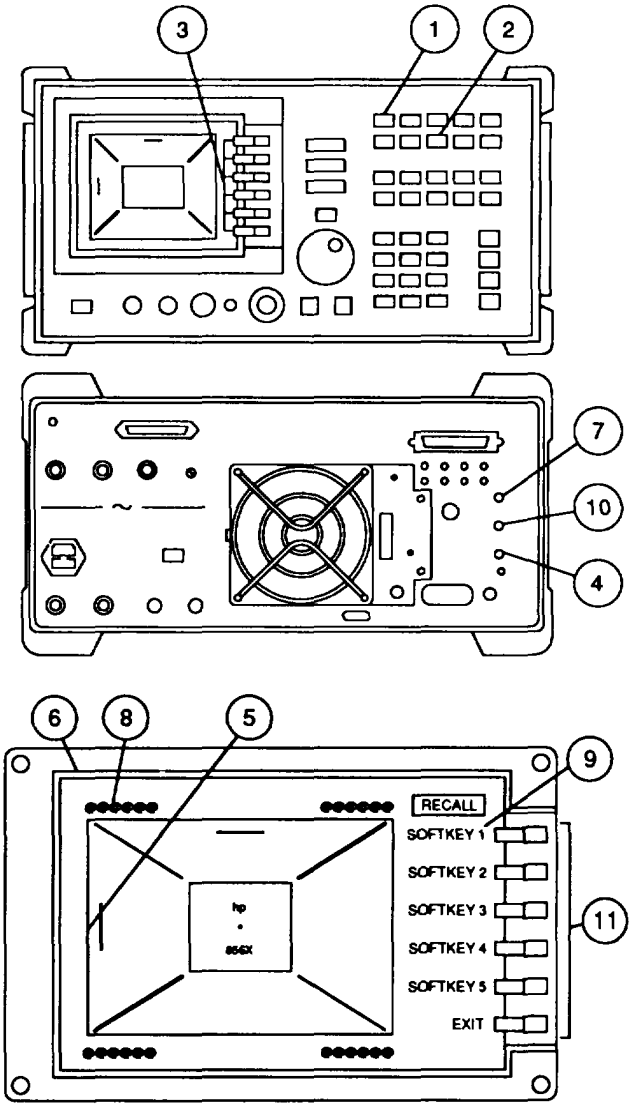
1. Press PRESET (1) then RECALL (2) buttons. Press the MORE (3) then CRT ADJ PATTERN (3) keys.

2. Adjust the rear panel TRACE ALIGN (4) control until the leftmost line (5) is parallel to the bezel (6).

3. Adjust the rear panel X POSN (7) control until the leftmost @ characters (8) and the key labels (9) appear just inside the bezel (6).

4. Adjust the rear panel Y POSN (10) control until the key labels (9) align with the keys (11).

5. Press PRESET (1) button.



END OF TASK

Section V. PREPARATION FOR STORAGE OR SHIPMENT

3-10. PACKAGING.

Package Spectrum Analyzer in original shipping container. When using packing materials other than the original, use the following guidelines:

- Wrap Spectrum Analyzer in plastic packing material.
- Use double-wall cardboard shipping container,
- Protect all sides with shock-absorbing material to prevent Spectrum Analyzer movement within the container.
- Seal the shipping container with approved sealing tape.
- Mark 'FRAGILE' on all sides, top, and bottom of shipping container.

3-11. TYPES OF STORAGE.

- Short-Term (administrative) = 1 to 45 days.
- Intermediate = 46 to 180 days.
- Long term-over 180 days. After long term storage, perform turn-on procedure (para 2-6). If this procedure fails, notify next higher level maintenance.

3-12. ENVIRONMENT.

The Spectrum Analyzer should be stored in a clean, dry environment. In high humidity environments, protect the Spectrum Analyzer from temperature variations that could cause internal condensation. The following environmental conditions apply to both shipping and storage:

Temperature	-62° C to +85° C
Relative Humidity (sea level)	0 to 95% at +40°C (up to five days)
Altitude	0 to 50.000 feet (15,000 meters)
Shock	0 to 30 g

APPENDIX A

REFERENCES

A-1. SCOPE.

This appendix lists all forms, field manuals, technical manuals, and miscellaneous publications referenced in this manual.

A-2. FORMS.

Equipment Inspection and Maintenance Worksheet ..... DA Form 2404

Product Quality Deficiency Report ..... Form SF 368

Recommended Changes to Equipment Technical Manuals ..... DA Form 2028-2

Recommended Changes to Publications and Blank Forms ..... DA Form 2028

Report of Discrepancy (ROD) ..... Form SF 364

Transportation Discrepancy Report (TDR) ..... Form SF 361

A-3. TECHNICAL MANUALS.

Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command) ..... TM 750-244-2

The Army Maintenance Management System (TAMMS) ..... DA Pam 738-750

Unit and Intermediate Direct Support and General Support Repair Parts and Special Tools List, for Spectrum Analyzer AN/USM-489A ..... TM 11-6625-3250-24P

A-4. MISCELLANEOUS.

Abbreviations for Use on Drawings, Specifications, Standards and in Technical Documents ..... MI L- STD-12

Common Table of Allowances ..... CTA 50-970

Consolidated Index of Army Publications and Blank Forms ..... DA Pam 25-30

First Aid for Soldiers ..... FM 21-11

Safety Precautions for Maintenance of Electrical/Electronic Equipment ..... TB 385-4

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. GENERAL.

a. This appendix provides a general explanation of all maintenance and repair functions authorized at various maintenance levels for the Spectrum Analyzer AN/USM-489A.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels.

c. Section Ill lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from section Il.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS.

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. *Service.* Operations required periodically to keep an item in proper operating condition, i. e., to clean (includes decontaminate, when required), preserve, drain, paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. Maintain or regulate within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine the cause and corrections to be made or adjusted on instruments or test measuring and diagnostic equipment used in precision measurement. This consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/install. To remove and install the same item when required to perform service on other maintenance functions. Install may be the act of emplacing, seating, of fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. Replace is authorized by the MAC and is shown as the 3d position code of the SMR code.

i. *Repair.* The application of maintenance services (inspect, test, service, adjust, align, calibrate, and/or replace) including fault location/troubleshooting, removal/installation, and disassembly/assembly procedures, and maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to identify troubles, and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), and item or system.

j. *Overhaul.* That periodic maintenance effort (service/ action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (i. e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/ actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipment/ components.

B-3. EXPLANATIONS OF COLUMNS IN THE MAC, SECTION II.

a. Column 1, *Group Number.* Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies and modules with the next higher assembly. End item group number shall be “00”.

b. Column 2, Component/ Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in column *2.*

d. Co/urnn 4, Maintenance Level. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the level of maintenance authorized to perform the function listed in column *3.* This figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different levels, appropriate work time figures will be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time and quality assurance/ quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance levels are as follows:

c — Operator/Crew

o — Unit Maintenance

F — Direct Support Maintenance

H — General Support Maintenance

L — Specialized Repair Activity

D — Depot Maintenance

e. Column 5, Tools and Equipment. Column *5* specifies by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

f. Column 6, Remarks. This column shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks contained in Section IV.

B-4. EXPLANATIONS OF COLUMNS IN THE TEST EQUIPMENT REQUIREMENTS, SECTION III.

a. Column 1, Reference Code. The tool and test equipment code correlates with a code used in the MAC, Section II, Column 5.

b. Column 2, Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

c. *Column* 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, *National Stock Number.* The National Stock Number of the tool or test equipment.

e. Column 5, *Too/ Number.* The manufacturer's part number.

B-5. EXPLANATIONS OF COLUMNS IN REMARKS, SECTION IV.

a. Co/umn 1, Reference Code, The code recorded in column 6, Section Il.

b. Co/umn 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section Il.

Section II. MAINTENANCE ALLOCATiON CHART FOR SPECTRUM ANALYZER AN/USM-489A

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
00	Spectrum Analyzer AN/USM-489A	Inspect		0.1					A
		Inspect				0.5		2	B
		Test		0.1					C
		Test				16.0		2,4,5,9, 10,12-36, 38-40, 42-49, 53-58, 60-63, 65-68	D
		Calibrate				2.0		2-4,6-9, 11,14,15, 17-19,26, 28,30-32, 37,41,44, 53-56,58, 59,63, 65-67, 70-72	E
		Repair		0.5				1	F
		Repair				1.0		2-73	G
01	Spectrum Analyzer	Inspect				0.5		2	B
		Test				1.0		2,41, 50-52,71	
		Repair				2.5		2-73	H
0101	Front Frame Assy A1	Inspect				0.1		2	
		Repair				1.0		2,41, 50-52	I
0102	Controller CCA A2	Inspect				0.1		2	
		Repair				5.0		2,41, 50-52,67, 71	
0103	Interface CCA A3	Inspect				0.1		2	
		Repair				4.0		2,41,45, 50-52,64, 67,71	
0104	Log Amplifier CCA A4	Inspect				0.1		2	
		Repair				2.0		2,3,41, 50-52,65, 67,71	J

Section II. MAINTENANCE ALLOCATION CHART FOR SPECTRUM ANALYZER AN/USM-489A — CONTINUED

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
0105	IF Filter CCA A5	Inspect Repair				0.1 3.0		2 2,3,41, 50-52,65, 67,71,73	
0106	Power Supply CCA A6	Inspect Repair				0.1 3.0		2 2,41, 50-52,70	K
0107	Mixer Assembly A8	Inspect Replace Repair				0.1 1.0	 0.5	2 2	 L
0108	Attenuator Assy A9	Inspect Replace Repair				0.1 1.0	 0.5	2 2	 L
0109	Port Lvl EYO Assy A11	Inspect Replace Repair				0.1 1.0	 0.5	2 2	 L
0110	Freq Control CCA A14	Inspect Repair				0.1 4.0		2 2-4,15,19 32,41,44, 50-53,56, 63,65-67, 71	M
0111	RF CCA A15	Inspect Repair				0.1 4.0		2 2-4,15,19 32,41,44, 50-53,56, 58,59, 65-67,71	
0112	CRT Assembly A18	Inspect Repair				0.1 1.5		2 2,41	N
02	Mixer Assembly MX1	Inspect Repair				0.1 0.5		2 2,69	O
03	Mixer Assembly MX2	Inspect Repair				0.1 0.5		2 2,69	O

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR SPECTRUM ANALYZER AN/USM-489A

(1) TOOL / TEST EQUIPMENT REF CODE	(2) MAINT LEVEL	(3) NOMENCLATURE	(4) NATIONAL / NATO STOCK NUMBER	(5) TOOL NUMBER
1	0	Tool Kit, Electronic Equipment	5160-00-064-5176	TK-101/G
2	H	Tool Kit, Electronic Equipment	4931-01-073-3845	JTK-17AL
3	H	Active Probe	6625-00-516-8387	TEK P6201
4	H	Adapter, APC 3.5 (f) to APC 3.5 (f) (2 required)	5935-01-I 90-I 296	HP5061-5311
5	H	Adapter, APC 3.5 mm (f) to WR-42 (2 required)	5965-01-140-6122	HP K281C
6	H	Adapter, BNC (f) to BNC (f)	5935-00-280-2251	H P 1250-005
7	H	Adapter, BNC (f) to Dual Banana Plu	5935-00-124-5438	HP1251-2816
6	H	Adapter, BNC (f) to SMA (m)	5935-00-024-0612	HP1250-1200
9	H	Adapter, BNC Tee (f) (m) (f)	5935-00-103-7571	HP1250-0781
10	H	Adapter, SMA (f) to SMA (f)	5935-00-931-3004	HP1250-1158
11	H	Adapter, Type N (f) to APC 3. 5 (m)	5935-01-183-3408	HP1250-1750
12	H	Adapter, Type N (f) to APC 3.5 (f) (2 required)	5935-01-271-5838	HP1250-1745
13	H	Adapter, Type N (f) to BNC (f)	5935-01-200-4948	HP1250-1474
14	H	Adapter, Type N (f) to BNC (m)		HP1250-1477
15	H	Adapter, Type N (f) to SMA (f)	5935-01-I 91-9692	HP1250-1772
16	H	Adapter, Type N (f) to Type N (f)	5935-01-I 83-3405	HP1250-1472
17	H	Adapter, Type N (m) to APC 3.5 (f)	5935-01-I 83-3407	HP1250-1744
16	H	Adapter, Type N (m) to APC 3.5 (m) (2 required)	5935-01-183-3406	HP1250-1743
19	H	Adapter, Type N (m) to BNC (f) (3 required)	5935-01-090-3993	HP1250-1476
20	H	Adapter, Type N (m) to SMA (f) (2 required)	5935-00-847-9683	HP1250-1250
21	H	Adapter, Type N (m) to Type N (m)	5935-01-189-8055	HP1250-1475
22	H	Amplifier, Microwave	6625-01-199-0442	HP 6349A
23	H	Amplifier, Microwave Power	6625-01-223-I 273	HP 11975A

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR SPECTRUM ANALYZER AN/USM-489A — CONTINUED

(1) TOOL / TEST EQUIPMENT REF CODE	(2) MAINT LEVEL	(3) NATIONAL / NATO NOMENCLATURE	(4) TOOL STOCK NUMBER	(5) NUMBER
24	H	Attenuator, 1 dB Step	5985-00-763-7326	HP 355C
25	H	Attenuator, 10 dB Fixed	6695-01-109-9117	W 9918-10dB
26	H	Attenuator, 10 dB Step (w/cal sheet)	5985-00-957-1860	HP 355D
27	H	Attenuator, 20 dB Fixed	6695-01-109-9116	W 9918-20dB
28	H	Attenuator, Reference (supplied with HP 8484A)	5985-01-120-6207	HP 11708A
29	H	Bridge, Directional	5985-01-266-0884	HP 85027C
30	H	Cable, Coaxial, 48-inch 50-ohm, BNC (m) (5 required)	4931-00-842-9273	RG58AU
31	H	Cable, Flexible RF, APC 3.5 (m) connectors (2 required)		HP8120-4921
32	H	Cable, Flexible RF, SMA (m) connectors (3 required)	4931-01-070-3388	W 1585-1000
33	H	Cable, HP-IB Interconnect	5995-01-107-7366	HP 10833B
34	H	Cable, RF, SMA (m) connectors		HP8120-4396
35	H	Cable, RG-214/U with Type N (m) connectors	4931-00-844 -3260	10519061
36	H	Cable, Semirigid 50-ohm cable, SMA (m) connectors		11975-20002
37	H	Cable, Test, BNC (m) to SMB (f) connectors		85680-60093
38	H	Coupler, Directional (with calibration data)	5985-00- 084-8991	HP R752D
39	H	Coupler, Directional (with calibration data)	5985-00-913-984 2	HP K752C
40	H	Coupler, Directional	5985-01-080-5532	HP 11691D
41	H	Digital Multimeter	6625-00-557-8305	HP 3490A
42	H	Filter , 4.4 GHz Low-Pass (2 required		HP 11689A
43	H	Filter , 50 MHz Low-Pass		HP0955-0306
44	H	Frequency Counter, Microwave TD-1225A(V)2/U	6625-01-121-6934	HP5342A/H16

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR SPECTRUM ANALYZER AN/USM-489A — CONTINUED

(1) TOOL / TEST EQUIPMENT REF CODE	(2) MAINT LEVEL	(3) NATIONAL / NATO NOMENCLATURE	(4) TOOL STOCK NUMBER	(5) NUMBER
45	H	Frequency Counter, Universal	4931-01-039-4040	HP 5345A
48	H	Frequency Tripler		HW TKA-1
47	H	Isolator		HP0960-0081
48	H	Isolator		HP0960-0082
49	H	Open	6625-01-290-8536	HP 85032-60001
50	H	Oscilloscope	6625-01-086-5980	TEK R5440
5 1	H	Plug-in Unit	6625-01-008-I 479	TEK 5842
52	H	Plug-in Unit	6625-01-008-1480	TEK 5A48
53	H	Power Meter (HP-IB)	6625-01-075-0261	HP 436A
54	H	Power Sensor	6625-01-015-4412	HP 8482A
55	H	Power Sensor	6625-01-028-2882	HP 8464A
58	H	Power Sensor	6625-01-178-7627	HP 8485A
57	H	Power Sensor	6625-01-257-I 021	HP R8486A
58	H	Power Splitter	6625-01-237-0342	HP 116678
59	H	Power Supply	6695-01-076-8966	PS 503A
80	H	Pulse/Function Generator	6625-01-226-2793	HP 8116A
61	H	Scalar Network Analyzer (compatible with Sweeper)	6625-01-254-393s	HP 8757A
62	H	Short	5935-00-799-9381	HP 11512A
83	H	Signal Generator SO-1 207/U	6625-01-233-8615	HP 8642M
64	H	Signature Analyzer, TS-3791/U	6625-01-068-8641	HP 5004A
65	H	Spectrum Analyzer AN/USM-469	6625-01-079-9495	TEK 492
66	H	Sweeper, Synthesized (HPIB) (2 EA)	6625-01-258-3140	HP 83408
67	H	Synthesizer Generator	6695-01-I 83-6314	HP3335A/001 /K06
68	H	Termination, 50Ω	5985-01-235-5413	HP 909D

Section III. TOOL AND TEST EQUIPMENT FOR SPECTRUM ANALYZER AN/USM-489A — CONTINUED

(1) TOOL / TEST EQUIPMENT REF CODE	(2) MAINT LEVEL	(3) NATIONAL / NATO NOMENCLATURE	(4) TOOL STOCK NUMBER	(5) NUMBER
		SPECIAL TOOLS		
69	H	Connector Tool (M/A COM)		2098-0248-54
70	H	Service Accessory Kit		HP 08562-60021
71	H	TAM Module		HP 85629B
72	H	Tuning Tool	5120-01-194-8658	HP8710-1010
73	H	SMB Tee (f) (m) (m)		HP1250-1391
74	H	High Voltage Probe	6625-01-023-6253	HPK25-3490A

Section IV. REMARKS
FOR
SPECTRUM ANALYZER AN/USM-489A

(1) REFERENCE CODE	(2) REMARKS
A	External visual inspection and check for completeness.
B	Visual external and internal inspection for signs of damage, loose parts, broken connectors or cables, missing items, ETC.
c	Turn-on self diagnostics and observation of error messages.
D	Performance Tests.
E	Calibration procedures as listed in TB 43-180.
F	Repair by replacement of fuse, knob, cover, SMA cables, open end wrench, ball driver, and power cable which are all nonrepairable items.
G	Fault isolate to Spectrum Analyzer, External Mixers, or cables.
H	Fault isolate to major assembly or cables. Repair includes replacement of A7 Amplifier Assembly, A10 YIG Filter Assembly, A12 Coaxial Switch, A13 Second Converter Assembly, A16 CAL Oscillator CCA, A17 CRT Driver CCA, A19 HP-IB CCA, inter-assembly cable assemblies, and panel mounted parts which are nonrepairable items.
I	Repair includes replacement of A1A1 Keyboard CCA, A1A2 RPG Assembly, and cable assembly which are nonrepairable items.
J	Repair limited to replacement of piece parts in the following circuits: Input Converter, Control, Linear Amplifier, Buffer Amplifier, Video Offset, Video Buffer Amplifier, AM/FM Demodulator, and Frequency Counter Prescaler/Conditioner.
K	Repair includes replacement of A6A1 High Voltage Assembly which are nonrepairable.
L	Contractor repair. Time indicated for Depot to send defective module to contractor for repair.
M	Repair includes replacement of A14A101 Offset Roller CCA, A14A102/A14A103 Roller Oscillator CCAs which are nonrepairable items.
N	Repair includes replacement of A18MP1 CRT Assembly and A18V1 CRT Tube Assembly which are nonrepairable items.
o	Repair limited to replacement of SMA Connectors and waveguide caps.

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

C-1. SCOPE.

This appendix lists components of the end item and basic issue items for the Spectrum Analyzer AN/USM-489A to help you inventory items required for safe and efficient operation.

C-2. GENERAL.

The components of End Item and Basic Issue Items List (Bll) are divided into the following sections:

a. *Section I/—Components of End Item.* This listing is for information purposes only and is not authority to requisition replacements. These are part of the end item, but are removed and/or separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

b. Section Ill—Basic Issue Items. These are the minimum essential items required to place the Spectrum Analyzer AN/USM-489A in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, Bll must be with the Spectrum Analyzer AN/USM-489A during operation and whenever it is transferred between property accounts. This manual is your authority to request/requisition replacement Bll, based on TO E/MTOE authorization of the end item.

C-3. EXPLANATION OF COLUMNS.

a. Column (1)—Illustration Number (Illus Number). This column indicates the number of the illustration in which the item is shown.

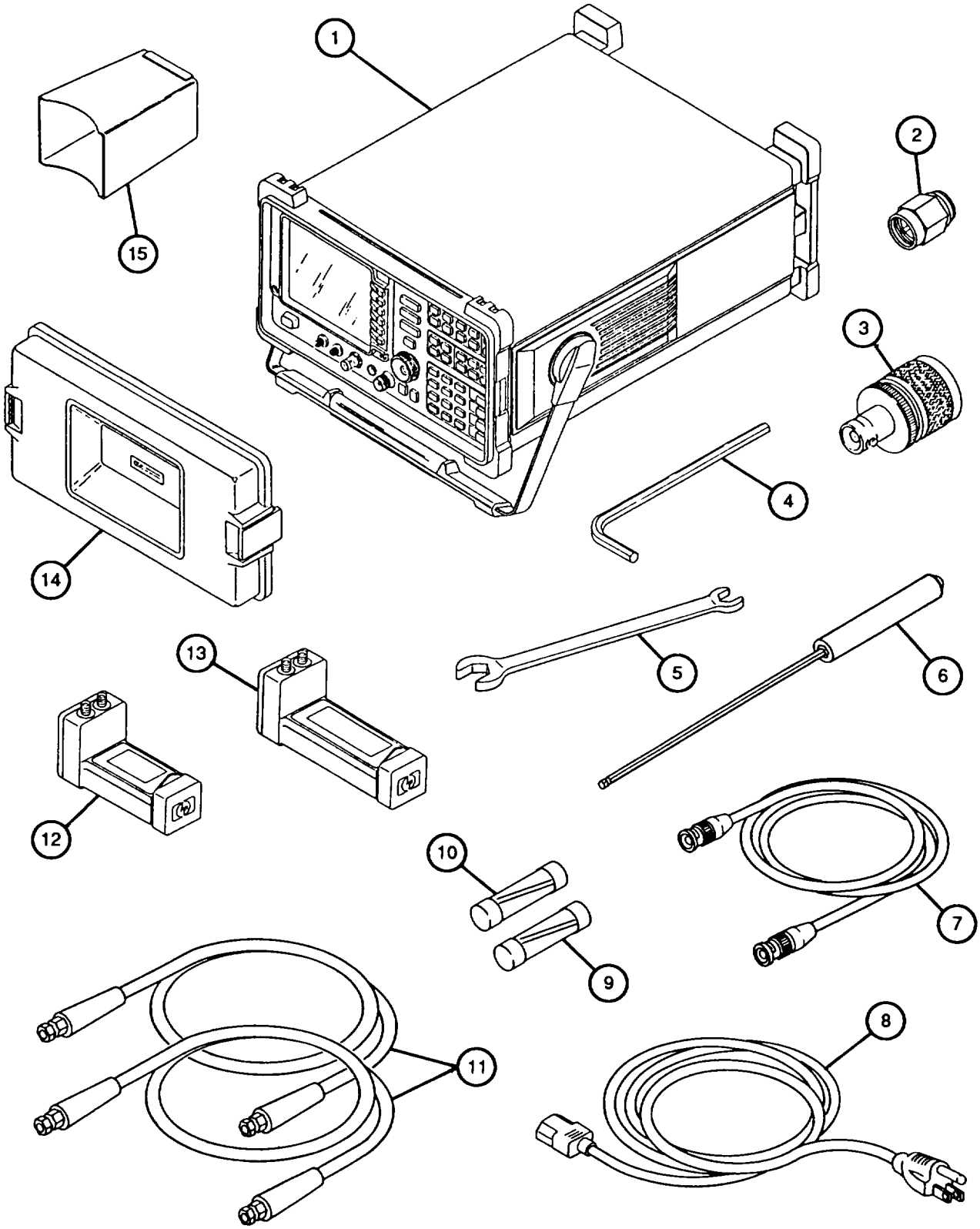
b. Column (2)—National Stock Number. This column indicates the national stock number assigned to the item and will be used for requisitioning purposes.

c. *Column (3)—Description.* This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the CAGEC (commercial and government entity code) (in parentheses) followed by the part number.

d. Column (4)—Unit of Measure (U/M). This column indicates the measure used in performing the actual operation/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e. g., ea, in, pr).

e. *Column (5)—Quantity Required (Qty Rqr).* This column indicates the quantity of the item authorized to be used with/on the equipment.

Section II. COMPONENTS OF END ITEM



(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC and PART NUMBER	(4) U/M	(5) QTY RQR
1		SPECTRUM ANALYZER (26460) 8562A/H51	EA	1
2	5985-01-029-6567	TERMINATION, 50Ω (26480) 1810-0118	EA	1
3	5935-00-761-5765	ADAPTER,TYPE N-BNC (26480) 1250-0780	EA	1
4		WRENCH, HEX, 4mm (26480) 871 O-I 755	EA	1
5		WRENCH, OPEN END, 1/4" x 5/1 6" (26480) 871 O-051 0	EA	1
6		WRENCH, BALL DRIVER, 3/32" (28480) 8710-0510	EA	1
7		CABLE ASSEMBLY, RF, BNC-BNC (28460) 10502A	EA	1
6	6150-00-008-5075	CABLE ASSEMBLY, POWER (2 8 4 8 0) 8120-1378	EA	1
9		FUSE, CARTRIDGE, 5A AMP 125V SLO-BLO (28480) 211 O-0756	EA	1
10		FUSE, CARTRIDGE, 5A AMP 250V SLO-BLO (28460) 211 O-0709	EA	1
11	5995-01-220-3644	CABLE ASSEMBLY, RF, SMA-SMA (28480) 5061-5458	EA	2
12		MICROWAVE MIXER (28480) 11970A	EA	1
13		MICROWAVE MIXER (26460) 11970K	EA	1
14		COVER,FRONT STORAGE (26460) 5062-I 937	EA	1
15		HOOD, VIEWING (26480) 5180-9055	EA	1

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC and PART NUMBER	(4) U/M	(5) QTY RQR
1		SPECTRUM ANALYZER (26460) 8562A/H51	EA	1
2	5985-01-029-6567	TERMINATION, 50Ω (26480) 1810-0118	EA	1
3	5935-00-761-5765	ADAPTER,TYPE N-BNC (26480) 1250-0780	EA	1
4		WRENCH, HEX, 4mm (26480) 871 O-I 755	EA	1
5		WRENCH, OPEN END, 1/4" x 5/1 6" (26480) 871 O-051 0	EA	1
6		WRENCH, BALL DRIVER, 3/32" (28480) 8710-0510	EA	1
7		CABLE ASSEMBLY, RF, BNC-BNC (28460) 10502A	EA	1
6	6150-00-008-5075	CABLE ASSEMBLY, POWER (2 8 4 8 0) 8120-1378	EA	1
9		FUSE, CARTRIDGE, 5A AMP 125V SLO-BLO (28480) 211 O-0756	EA	1
10		FUSE, CARTRIDGE, 5A AMP 250V SLO-BLO (28460) 211 O-0709	EA	1
11	5995-01-220-3644	CABLE ASSEMBLY, RF, SMA-SMA (28480) 5061-5458	EA	2
12		MICROWAVE MIXER (28480) 11970A	EA	1
13		MICROWAVE MIXER (26460) 11970K	EA	1
14		COVER,FRONT STORAGE (26460) 5062-I 937	EA	1
15		HOOD, VIEWING (26480) 5180-9055	EA	1

APPENDIX D

ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

D-1. SCOPE.

This appendix lists additional items you are authorized for the support of the Spectrum Analyzer AN/USM-489A.

D-2. GENERAL.

This list identifies items that do not have to accompany the Spectrum Analyzer AN/USM-489A and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

D-3. EXPLANATION OF COLUMNS.

a. *Column (1)—National Stock Number.* This column indicates the national stock number assigned to the item and will be used for requisitioning purposes.

b. Column (2)—Description. This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the CAGEC (commercial and government entity code) (in parentheses) followed by the part number.

c. Colurnn (3)—Unit of Measure (U/M). This column indicates the measure used in performing the actual operation/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e. g., ea, in, pr).

d. Column (4) —Quantity *Recommended (Qty RECM).* This column indicates the quantity of the item recommended to be used with/on the equipment.

D-4. EXPLANATION OF LISTING.

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i. e., CTA, MTOE, TD, or JTA) which authorized the item(s) to you.

Section II. ADDITIONAL AUTHORIZATION LIST

(1) NATIONAL STOCK NUMBER	(2) DESCRIPTION CAGEC and PART NUMBER USABLE ON CODE	(3) U/M	(4) QTY RECM
	FUSE, CARTRIDGE, 5A AMP 125V SLO-BLO (28480) 2110-0756	EA	1
	FUSE, CARTRIDGE, 5A AMP 250V SLO-BLO (28480) 2110-0709	EA	1

APPENDIX E

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

E-1. SCOPE.

This appendix lists expendable supplies you will need for maintenance on Spectrum Analyzer AN/USM-489A. These items are authorized to you by CTA 50-970, Expendable items (Except Medical, Class V, Repair Parts, and Heraldic Items).

E-2. EXPLANATION OF COLUMNS.

a. Column (1)—Itern Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e. g., "Use cleaning compound, item 5, App. D-).

b. Column (2)—Level. This column identifies the lowest level of maintenance that requires the listed item.

C - Operator/Crew.

O - Unit Maintenance.

c. Column (3)—National Stock Number. This column indicates the national stock number assigned to the item and will be used for requisitioning purposes.

d. Column (4)—Description. This column indicates the federal item name and if required, a minimum description to identify the item. The last line for each item indicates the CAGEC (commercial and government entity code) (in parentheses) followed by the part number.

e. *Column (5)—Unit of Measure (U/M).* This column indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e. g., EA, IN, PR). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION CAGEC AND PART NUMBER	(5) U/M
1	o	6810-00-753-4993	Alcohol, Isopropyl, 802 Can, MIL-A-10428, Grade A (81349)	CN
2	c	8305-00-267-3015	Cloth, Cheesecloth, Cotton, Lintless, CCC-C-440, Type II, Class 2 (81349)	YD
3	c		Detergent, Mild, Liquid	02

APPENDIX F

REMOTE OPERATION

F-1. SCOPE.

This appendix describes Spectrum Analyzer AN/USM-489A remote operation (HPIB) procedures using an external controller. HPIB Digital Interface conforms to IEEE 488-1978 subsets SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP1, DC1, DT0, C1, C28, E1.

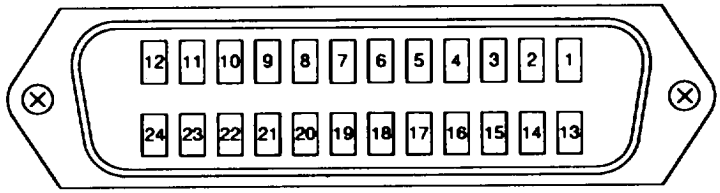
F-2. GENERAL.

Remote operation of the Spectrum Analyzer is very similar to local operation, except the commands are entered and received using an external controller, and not by pressing keys and observing the CRT screen on the front panel. The HPIB connector permits remote control of nearly all functions. Refer as necessary to Chapter 2 for descriptions of controls, indicators, and connectors (para 2-1), and individual operating procedures (para 2-8 through 2-16). Rear panel HPIB connector input and output information is supplied below.

Logic Levels

True=1=Low=≤+0.4V

False=0=High=≥+2.5V



Pin	Assignment	Nomenclature	Description
1	DIO 1	Data In/Out Bit 1	Data Line*
2	DIO 2	Data In/Out Bit 2	Data Line*
3	DIO 3	Data In/Out Bit 3	Data Line*
4	DIO 4	Data In/Out Bit 4	Data Line*
5	EOI	End or Identify	Interface Line***
6	DAV	Data Valid	Handshake Line**
7	NRFD	Not Ready for Data	Handshake Line**
8	NDAC	Not Data Accepted	Handshake Line**
9	IFC	Interface Clear	Interface Line***
10	SRQ	Service Request	Interface Line***
11	ATN	Attention	Interface Line***
12	SHIELD		Connect GND
13	DIO 5	Data In/Out Bit 5	Data Line*
14	DIO 6	Data In/Out Bit 6	Data Line*
15	DIO 7	Data In/Out Bit 7	Data Line*
16	DIO 8	Data In/Out Bit 8	Data Line*
17	REN	Remote Enable	Interface Line***
18	TW PR with 6		GND at TERM
19	TW PR with 7		GND at TERM
20	TW PR with 8		GND at TERM
21	TW PR with 9		GND at TERM
22	TW PR with 10		GND at TERM
23	TW PR with 11		GND at TERM
24	Signal Ground		

* Data lines are used to transfer data from one instrument to another.
** Handshake lines operate in a proper time sequence for complete communication between instruments.
***Interface lines are used to provide an orderly flow of information between units.

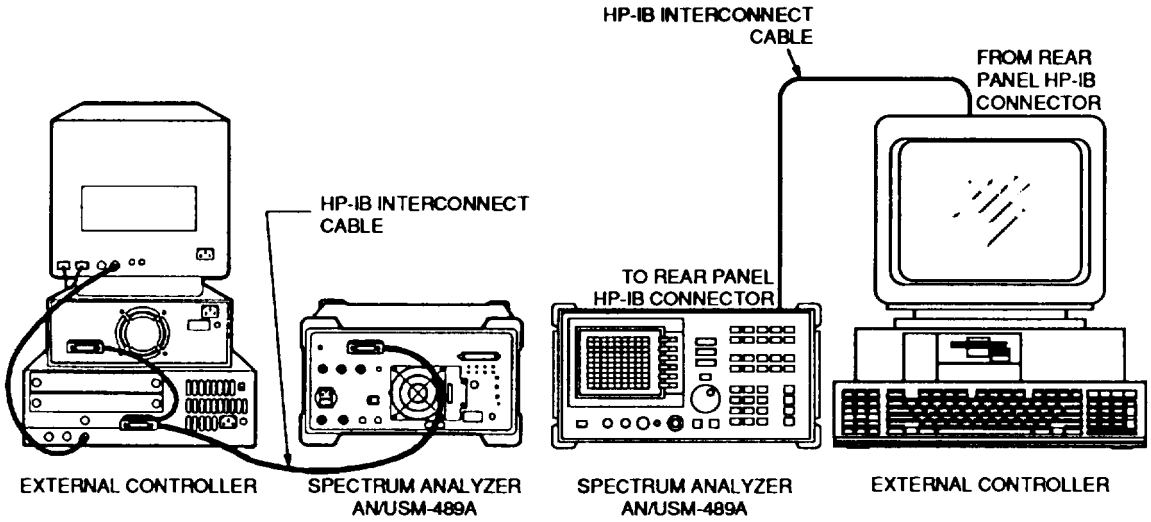
F-3. OPERATING PROCEDURES.

Perform the following steps for remote operation of Spectrum Analyzer.

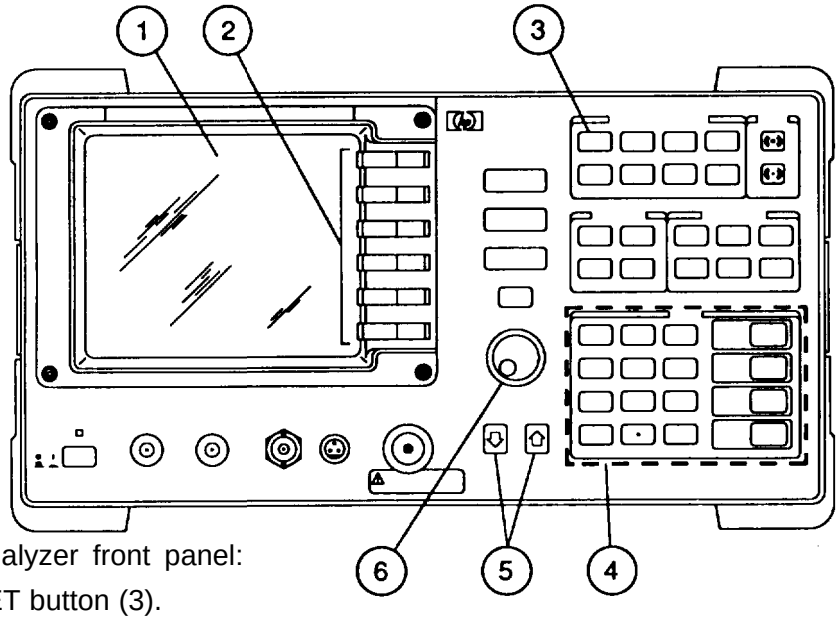
1. Connect the equipment as shown below.

NOTE

Keep HPIB interconnect cable length below 6 feet (1.8 m)



2. Perform turn-on procedure (para 2-6).



3. On Spectrum Analyzer front panel:
   - Press PRESET button (3).
   - Press HP-IB ADDR key (2). Key changes to STORE HP-IB when pressed. Use STEP (5) buttons, DATA (4) buttons, or KNOB (6) to enter desired address from 00 to 30. Press STORE HP-IB key (2).
4. During remote operation, RMT LCL (2) appears in the KEY MENU (1) area. Underline indicates present mode. Press key to toggle selection, and return to local mode.

F-4. AN/USM-489A COMMANDS.

The Spectrum Analyzer is sent two basic types of information:

- Commands (such as instrument preset - IP) make the Spectrum Analyzer perform an immediate action. Sometimes, this action is further defined by specifying a parameter.
- Parameters set operational states, provide a list of distinct choices, enhance or modify a command, specify a particular numerical value, or query the Spectrum Analyzer to send information to the controller. Parameters must be sent with their associated command.

F-5. COMMAND SYNTAX.

A general syntax for a command string is: <COMMAND>SPACE<PARAMETER> TERMINATION.

The command name and parameter are both listed in the Command List (para F-10). The command is the function from the COMMAND column, and the parameter is a numeric setting, keyword, or special character from the PARAMETER column of the table.

Parameter values may use exponential (E) notation. Query parameters often return values for states. Unless otherwise specified, a returned “1” is “ON”, and a returned “O” is “OFF”.

F-6. TERMINATORS.

When the controller sends the Spectrum Analyzer more than one command in a string, then individual commands should have semicolons (;) inserted between them as terminators. The Spectrum Analyzer will accept either spaces or semicolons, but the semicolons are easier to read, and work better in program debugging.

F-7. INPUT/OUTPUT BUFFERS.

The Spectrum Analyzer contains a 64-character input buffer, and a 64-character output buffer. These buffers provide an efficient method of programming by allowing more than one function per statement.

- The input-data buffer allows the controller to send several data queries to the Spectrum Analyzer using only one write statement.
- The output-data buffer holds queried values so that the controller can read them into variables using only one read statement. When used correctly, the output buffer should be clear after the last read statement is executed. To ensure that the buffer is empty, execute the device clear statement, or interface clear statement.

F-8. INSTRUMENT PRESET.

The "IP" command presets the Spectrum Analyzer to initialized conditions described in paragraph 2-6.

F-9. REMOTE OPERATION.

Operator commands (para 2-1) are programmed using an external controller and HPIB commands and parameters listed in the Command List (para F-10). Programming errors (para F-11) are also provided. When performing remote operation, the order in which Spectrum Analyzer commands are received is important. The following guidelines are provided to assist in remote operation.

NOTE

Measurement procedures are explained in paragraphs 2-8 to 2-16.

1. Send instrument preset (IP), then activate single sweep mode (SNGLS). Sets Spectrum Analyzer to a known condition, and provides control of Spectrum Analyzer sweeps, and the input and output of data.

2. Select and send measurement settings. Use the following guidelines, in the order presented, when selecting appropriate commands:
   - Set the center frequency and span, or set the start and stop frequencies.
   - Set the input attenuation.
   - Set the resolution bandwidth, video bandwidth, and the sweep time.

NOTE

In most applications input attenuation, resolution bandwidth, video bandwidth, and sweep time can be left in AUTO mode.

   - Set the reference level to a specific level (if required).

NOTE

In most cases, reading the signal amplitude (peak) at the reference level provides the best measurement accuracy. However, to do this under remote operation, a sweep will need to be executed prior to setting the reference level. If the reference level is not being set to a SPECIFIC level, do not set in this step (it will be set in step 4).

3. After the settings have been programmed, execute a take sweep command (TS). Ensures that, for the entire sweep, the functions are set to the values selected, and that any measurements on the trace will be made with these settings.

NOTE

If single sweep and take sweep commands were not included, the Spectrum Analyzer could transfer data before completing a full sweep. As a result, part of the trace data may not be valid, as it could have been taken from previous settings.

4. Activate the desired marker(s). If not set to a specific level (step 2), set reference level to signal peak.

NOTE

To set reference level at the signal peak (provides the best measurement accuracy), activate the peak search function (MKPK HI). This finds the highest point on the trace and places a marker on it. Then send the marker to reference level function (MKRL) to set the reference level to the value of the marker. Execute another take sweep command (TS) to set reference level.

5. Read the marker amplitude and frequency. It may be necessary to execute another take sweep command (TS) to re-peak" the marker (if not done in step 4). Marker values are returned to the controller in the "K-format, unless another is specified.
6. If desired, screen titles can be created to label the data. Three methods (no format, A-block format, or l-block format) are available. Each method is described below.

NOTE

The first 16 characters of a title become the label for a stored state or stored trace. The label replaces the register number that usually appears on the key menu. When save/recall states or traces are executed remotely, be sure to use the register number and not the label.

- No-Format Method - simplest for creating a title. Enclose the title within string delimiters (@). Title can be up to 32 characters in length, and can be made up of any valid printing ASCII characters (line feed and carriage return are not recommended).
- A-block Format Method - use a data string as a title. Data can be ASCII characters, binary or decimal equivalents. The string length must be specified, and must be sent as a 16-bit word that is made up of two 8-bit bytes. "#A indicates that title is A-block format.
- I-block Format Method - same as A-block, except string can be of indefinite length. The Spectrum Analyzer will continue to accept data (up to 32 characters) until an end- or-identify (EOI) signal is sent.

7. If desired, trace data can be sent and received in five formats. Both trace A (TRA) and trace B (TRB) are available for transferring trace data, and it is possible to read data from one trace and then send it to the other. Before selecting the desired format and sending/receiving trace data, three transfer requirements or conditions must be addressed. All three requirements listed below apply to the trace data transfer formats.

   l Trace Length- when transferring trace data to or from the controller, set the dimension of trace-data arrays to 601 elements.

   l Trace Conditions- five conditions that MUST be stored in addition to the trace data are ;start and stop frequencies; reference level; amplitude scaling; and absolute amplitude units. Additional conditions such as resolution bandwidth, attenuation, or sweep time may be stored if desired.

   · Specify the Data Format Before Transferring Data - use TDF (para F-10) command to specify the format before sending/receiving data.

   Transferring data to and from the controller with each format (P-format, B-format, A-block format, I-block format, and M-format) is described below.

   · P-Format - real number, or 'P, " format allows trace data to be received or sent in a real-number format. This is the default format when the Spectrum Analyzer is powered up. Numbers are in dBm, dBmV, dBµV, volts, or watts. Real-number format is selected when using data later in a program. Transfers using P-format tend to be slow and take up a lot of memory.

   l B-Format - binary, or 'B, " format provides the fastest data transfer and requires the least amount of memory to store data. Each data point is transferred in binary as two 8-bit bytes in the internal representation of measurement data. If speed and memory are important, select B-format over P-format.

NOTE

B-Format allows trace data to be sent to the controller only, and not returned to the Spectrum Analyzer. See A-block format or I-block format below to receive trace data.

   l A-block Format - each data point is sent/received as two 8-bit bytes in the internal representation of measurement data. Transfers a four-byte header before the 601 points of trace data. The header contains ASCII characters "#, " "A," (indicates data is in A-block format) and a two-byte length field equal to 1202 (indicates the length of the trace data, in bytes). As trace data is composed of 601 trace elements, each element is transferred as one word that is composed of two 8-bit bytes. Thus, 601 words contains 1202 bytes, and 1202 is the trace length sent. When sending the trace data to the controller, it might be necessary to keep this format and trace length information separate from the actual trace data.

   · I-Block Format - each data point is sent/received as two 8-bit bytes in the internal representation of measurement data. Also transfers the characters "#" and "1" (indicating data is in I-block format). I-block format allows the Spectrum Analyzer to send/receive data of "indefinite" length. When sending the trace data to the controller, it might be necessary to keep this format information separate from the actual trace data. When receiving data, the Spectrum Analyzer will continue to accept data until an end-of instruction (EOI) signal is received, even though only 601 points of trace data are used.

- M-Format - measurement units, or 'M, " format transfers trace data in the internal format used by the Spectrum Analyzer. The displayed amplitude of each element falls on one of 600 vertical points (with 600 equal to the reference level). For example, if the peak of a signal is equal to -10 dBm, or one division below the reference level, it is equal to 540 (600 - 60 = 540) in measurement units. There are also 10 additional points of overrange. Measurements units, then, range from O to 610. Use M-format to transfer data as ASCII characters, allowing data to be viewed directly. Data points are separated by commas.

NOTE

M-Format allows trace data to be sent to the controller only, and not returned to the Spectrum Analyzer.

F-10. COMMAND LIST.

Operator commands are programmed using an external controller and HPIB commands listed in the table below. Commands are listed alphabetically. The CONTROL and ITEM columns refer to Chapter 2, Section I item number where the command and parameter is fully explained. A '/' in the parameter column indicates a choice of selections and should not be sent. A blank indicates no parameter.

Command	Parameter	Description	Control	Item No.
ADJALL		Execute Turn-on Adjustments	REALIGN LO & IF	73
ADJCRT		Display CRT Adjustment Pattern	CRT ADJ PATTERN	121
ADJIF	FULL	Execute Full IF Adjustments	FULL IF ADJ	36
	CURR	Execute Current IF Adjustments	ADJ CURR IF STATE	35
	DN/OFF/?	Turn IF Adjustments on, off, or query present state	IF ADJ ON OFF	34
AMB	DN/OFF/?	Turn Trace A Minus Trace B Math on, off, or query present state	A-B–>A ON OFF	208
AMBPL	ON/OFF/?	Turn Trace A Minus Trace B Plus Display Line Math on, off, or query present state	A-B+DL–>A ON OFF	209
AN NOT	ON/OFF/?	Turn Annotation on, off, or query present state	ANNOT ON OFF	185
APB		Perform Trace A Plus Trace B math	A+B->A	211
AT	0 to 70	Enter Input Attenuation in dB	ATTEN	25
	UP/DN	increase/decrease Input Attenuation by 10dB	ATTEN	25
	?	Query present Input Attenuation value	ATTEN	25
	AUTO/MAN	Set Input Attenuator mode to auto or manual	ATTEN AUTO MAN	26
	EP	Set Input Attenuation from front panel	None	
AUNITS	DBM	Absolute Amplitude Units to decibel milliwatt	dBm	40
	DBMV	Absolute Amplitude Units to decibel millivolt	dBmv	42
	DBUV	Absolute Amplitude Units to decibel microvolt	dBµv	41
	v	Absolute Amplitude Units to volts	volts	43
	w	Absolute Amplitude Units to watts	watts	44
	?	Query Absolute Amplitude Units selected	UNITS	38
	AUTO/MAN	Select Absolute Amplitude Units mode to auto or manual	UNITS AUTO MAN	39
AUTOCPL		Autocouple All "AUTO Functions	ALL	224
AXB		Exchange Trace A contents with Trace B contents	A EXCH B	212
BLANK	TRA	Blank Trace A	BLANK A	200
	TRB	Blank Trace B	BLANK B	205

Command	Parameter	Description	Control	tern No.
BML		Perform Trace A Minus Display Line math	B-DL->B	213
CF	O to 362E9	Enter Center Frequency in Hz”	CENTER FREQ	54
	UP/DN	Increase or decrease Center Frequency by CF STEP	CENTER FREQ	54
	?	Query present Center Frequency value	CENTER FREQ	54
	EP	Set Center Frequency from front panel	None	
CLRW	TRA	Clear/Write Trace A	CLR-WRT A	197
	TRB	Clear/Write Trace B	CLR-WRT B	202
CNVLOSS	15 t0 60	Enter External Mixer Average Conversion Loss in dB	AVERAGE CNV LOSS	136
	UP/DN	Increase or decrease External Mixer Average Conversion Loss by 0.1dB	AVERAGE CNV LOSS	136
	?	Query present External Mixer Average Conversion Loss value	AVERAGE CNV LOSS	136
	EP	Enter External Mixer Average Conversion Loss from front panel	None	
CONTS		Continuous Sweep	CONT	154
DE MOD	AM	Set AM Demodulation to on	AM DE MO DON OFF	90
	F M	Set FM Demodulation to on	FM DE MOD ON OFF	91
	OOF	Set AM/FM Demodulation to off	None	
	?	Query present Demodulation state	None	
DEMODAGC	ON/OFF/?	Turn Demodulation Automatic Gain Control on, off, or query present state	AGC ON OFF	100
DEMODT	100 E-3 to 60	Enter Demodulation Time in seconds	DE MOD TIME	96
	UP/DN	Increase or decrease Demodulation Time in a 1,2,5,10 seq	DEMOD TIME	96
	?	Query present Demodulation Time value	DEMOD TIME	96
	EP	Enter Demodulation Time from front panel	None	
DET	NEG	Set Detection Mode to negative peak	DETECTOR NEG PEAK	219
	NRM	Set Detection Mode to normal	DETECTOR NORMAL	216
	POS	Set Detection Mode to positive peak	DETECTOR POS PEAK	218
	SMP	Set Detection Mode to sample	DETECTOR SAMPLE	217
	?	Query present Detection Mode state	DETECTOR MODES	215
DL	Any NO.	Enter Display Line in any unit, but must terminate entry in DB, DBM, DBMV, MV, UV, MV, V, or W	DISPLAY LINE	172
	UP/DN	Increase or decrease Display Line one division	DISPLAY LINE	172
	?	Query present Display Line value	DISPLAY LINE	172
	EP	Enter Display Line from front panel	None	
	DN/OFF	Turn Display Line on or off	DISP LIN ON OFF	173
DONE?		Sends a 1 to controller when all commands prior to DONE have executed	None	
ERR?		Read error messages (see para F-1)	RECALL ERRORS	113
ET?		Read Elapsed Time in hours	ELAPSED TIME	122
FA	O to 362E9	Enter Start Frequency in Hz	START FREQ	55
	UP/DN	Increase or decrease Start Frequency by 10% of span	START FREQ	55
	?	Query present Start Frequency value	START FREQ	55
	EP	Enter Start Frequency from front panel	None	

Command	Parametel	Description	Control	Item No.
FB	O to 362E9	Enter Stop Frequency in Hz	STOP FREQ	56
	UP/DN	Increase or decrease Stop Frequency by 10% of span	STOP FREQ	56
	?	Query present Stop Frequency value	STOP FREQ	56
	EP	Enter Stop Frequency from front panel	None	
FDIAG	HARM, ?	Display current sampler harmonic frequency	SAMPLER HARMONIC	117
	LO, ?	Display current first local oscillator FREQ	LO FREQ	115
	MROLL, ?	Display current main roller oscillator FREQ	MAIN ROLLER	118
	DROLL, ?	Display current offset roller oscillator FREQ	OFFSET ROLLER	119
	SMP, ?	Display current sampling oscillator FREQ	SAMPLER FREQ	116
	XROLL, ?	Display current transfer roller oscillator FREQ	TRANSFER ROLLER	120
FDSP	OFF/?	Turn Frequency Display off or query present state	FREQ DSP OFF	186
FFT	x,x, x	Used to perform a Fast Fourier Transform, where X equals TRA or TRB. The first X is the location for storage of the result, the second X is the source to be transformed, and the third X is the window (see TWNDOW)	FFT	221
FOFFSET	±100E9	Enter Frequency Offset in Hz	FREQ OFFSET	60
	UP/DN	Increase or decrease Frequency Offset by 20%. of span	FREQ OFFSET	60
	?	Query present Frequency Offset value	FREQ OFFSET	60
	EP	Enter Frequency Offset from front panel	none	
FREF	INT/EXT/?	Set Frequency Reference INT, EXT, or query present state	10 MHz INT EXT	61
FS		Select Full Span	FULL SPAN	48
FULBAND	A/K	Set Full Band to A or K	FULL BAND	132
GRAT	ON/OFF/?	Set Graticule on, off, or query present state	GRAT ON OFF	184
HD		Select Hold	HOLD	271
HNLOCK	1 to 54	Enter Harmonic Number	LOCK HARMONIC	133
	UP/DN	Increase or decrease Harmonic Number by 1	LOCK HARMONIC	133
	EP	Enter Harmonic Number from front panel	None	
	ON/OFF/?	Turn Harmonic Range Lock on, off, or query present state	LOCK ON OFF	134
HNUNLK		Turn Harmonic Range Lock off	LOCK ON OFF	134
ID?		Returns model number (HP 8562A)	None	
IDCF		Set Signal identification Frequency to Center Frequency	SIG ID->CF	129
IDFREQ?		Returns Signal Identification Frequency	None	
IP		Instrument Preset	PRESET	70
LG	1/2/5/10	Selects Logarithmic Display Scale and db/DIV	LOG dB/DIV	27
	UP/DN	Increase or decrease db/DIV by one setting	LOG dB/DIV	27
	?	Query present db/DIV	LOG dB/DIV	27
	EP	Enter db/DIV from front panel	None	
LN		Select Linear Display Scale	LINEAR	28

Command	Parameter	Description	Control	Hem No.
MBIAS	Any No.	Enter positive or negative External Mixer Bias in amps	POS/NEG BIAS	1481149
	UP/DN	Increase or decrease External Mixer Bias by 0.01 ma	POS/NEG BIAS	148/149
	ON/OFF/?	Turn External Mixer Bias on, off, or query present state	OFF/POS/NEG BIAS	147 to 149
	EP	Select and enter External Mixer Bias from front panel	None	
MINH	TRA/TRB	Updates trace with minimum signal level detected	None	
MKA?		Returns Marker Amplitude	MARKER NORMAL	245
MKCF		Marker to Center Frequency	MARKER->CF	245
MKD	±362E9	Enter frequency in Hz between anchor and active markers	MARKER DELTA	246
	UP/DN	Increase or decrease set frequency by 10% of span	MARKER DELTA	246
	?	Query present frequency between anchor/ active markers	MARKER DELTA	246
	EP	Enter frequency in Hz between anchor and active markers from front panel	None	
MKDR	?	Return Marker Delta Reciprocal value	MARKER l/DELTA	267
	EP	Select Marker Delta Reciprocal from front panel	None	
MKF	O to 362E9	Enter active marker frequency in Hz	MARKER NORMAL	245
	?	Query present active marker frequency value	MARKER NORMAL	245
MKFC	ON/OFF/	Turn Marker Frequency Counter on, off, or query present state	COUNTER ON OFF	64
MKFCR	10 to 1E6	Enter Frequency Counter Resolution in Hz in powers of 10	COUNTER RES	65
	?	Query present Frequency Counter Resolution value	COUNTER RES	65
	EP	Enter Frequency Counter Resolution from front panel	None	
MKMIN		Place active marker on minimum detected signal	None	
MKN		Place active marker at center of trace	MARKER NORMAL	245
	O to 362E9	Enter active marker frequency in Hz	MARKER NORMAL	245
	UP/DN	Increase or decrease active marker by 10% of span	MARKER NORMAL	245
	?	Query present active marker frequency value	MARKER NORMAL	245
	EP	Enter active marker frequency from front panel	None	
MKNOISE	ON/OFF/?	Turn Marker Noise on, off, or query present state	MKRNOISE ON OFF	248/268
MKOFF		Turns active marker off	OFF	263
	ALL	Turns all markers off	OFF	263
MKPK	HI	Place active marker at highest point on trace	PEAK SEARCH	244
	NH	Place active marker at next highest point on trace	NEXT PEAK	247
	NR	Move active marker to next peak on right of current marker	NEXT PK RIGHT	251
	NL	Move active marker to next peak on left of current marker	NEXT PK LEFT	252

Command	Parameter	Description	Control	Item No.
MKPT	-200 to 30	Enter Marker Peak Threshold in dBm	PEAK THRESHLD	254
	UP/DN	Increase or decrease Marker Peak Threshold by 10 dB	PEAK THRESHLD	254
	?	Query present Marker Peak Threshold value	PEAK THRESHLD	254
	EP	Enter Marker Peak Threshold from front panel	None	
MKPX	0 to 30	Enter Marker Peak Excursion in dB	PEAK EXCURSN	253
	UP/DN	Increase or decrease Marker Peak Threshold by 1 division	PEAK EXCURSN	253
	?	Query present Marker Peak Excursion value	PEAK EXCURSN	253
	EP	Enter Marker Peak Excursion from front panel	None	
MKRL		Set Reference Level to active marker value	MARKER–>REF LVL	260
MKSP		Set Span to difference in anchor and active marker values	MKR Δ –>SPAN	260
MKSS		Set Center Frequency Step Size to active marker value	MARKER -> CF STEP	262
MKT	0 to 100	Enter active marker time (when span > 0 Hz) in seconds	MARKER l/DELTA	267
	?	Query current active marker time (when span > 0 Hz) value	MARKER l/DELTA	267
MKTRACK	ON/OFF/?	Turns Marker Signal Track on, off, or query state	SIG TRK ON OFF	249
ML	-60 to -10	Enter Mixer Level in dBm	MAX MXR LEVEL	32
	UP/DN	Increase or decrease Mixer Level by 10 dB	MAX MXR LEVEL	32
	?	Query present Mixer Level value	MAX MXR LEVEL	32
	EP	Enter Mixer Level from front panel	None	
MXMH	TRA	Select Maximum Hold Trace A	MAX HOLD A	198
	TRB	Select Maximum Hold Trace B	MAX HOLD B	203
MXRMODE	lNT/EXT/?	Select Internal Mixer, External Mixer, or query state	INT or EXT	125/131
OP		Enter Output Display Parameters (coordinates)	None	
	?	Query present Output Display Parameters	None	
PLOT		Use default plotter positions	None	
	X, Y, X, Y	Enter plotter positions (first X, Y specifies lower-left, and second X, Y specifies upper-right positions)	None	
PLOTORG	DSP/GRT/?	Set plotter references to display, graticule, or query state	PLOT ORG DSP GRAT	170
PLOTSRC	ANNT	Plot annotation only	PLOT ANNOT	169
	GRT	Plot graticule only	PLOT GRATICUL	168
	TRB	Plot trace B	PLOT TRACE B	167
	TRA	Plot trace A	PLOT TRACE A	166
	ALL	Plot CRT Screen	PLOT	164
	?	Query plot source	PLOT	164
PP		Perform Preselector Peak	PRESEL AUTOPK	127
PRINT	0	Print CRT Screen in monochrome	PRINT	162
	1	Print CRT Screen in color	COLOR PRINT	163

Command	Parameter	Description	Control	Item No.
PSDAC	0 to 255	Enter Preselector Tracking data	PRESEL MAN ADJ	126
	UP/DN	Increase/decrease Preselector Tracking by 1	PRESEL MAN ADJ	126
	?	Query present Preselector Tracking value	PRESEL MAN ADJ	126
	EP	Enter Preselector Tracking data from front panel	None	
PSTATE	ON/OFF/?	Turn Protect State on, off, or query state	SAVELOCK ON OFF	87
PWRBW	TRA, X	Perform Power Bandwidth on trace A, X is %. of total power	99% POWER BW	270
	TRB, X	Perform Power Bandwidth on trace B, X is % of total power	99% POWER BW	270
RB	100 to 1E6	Enter Resolution Bandwidth in Hz	RES BW	190
	UP/DN	Increase or decrease Resolution Bandwidth in 1,3,10 seq	RES BW	190
	?	Query present Resolution Bandwidth value	RES BW	190
	EP	Enter Resolution Bandwidth from front panel	None	
	AUTO/MAN	Select Resolution Bandwidth mode to manual or auto	RES BW AUTO MAN	191
RBR	0.002 to 0.1	Enter Resolution Bandwidth to Span Ratio	RBW:SPAN	226
	UP/DN	Increase or decrease ratio in 1,2,5 seq	RBW:SPAN	226
	?	Query present ratio value	RBW:SPAN	226
	EP	Enter Resolution Bandwidth to Span Ratio from front panel	None	
RCLS	LAST	Recall Last Configuration	LAST STATE	72
	PWRON	Recall Power On Configuration	RECALL PWR ON	71
	0 to 9	Recall Stored Configuration	RECALL STATE	103
RCLT	TRA, X	Recall Trace A Register, X is number from 0 to 7	RECALL TO TRA	108
	TRB, X	Recall Trace B Register, X is number from 0 to 7	RECALL TO TRB	109
REV?		Return Output Revision Number	PRESET	70
RL	Any No.	Enter Reference Level in any unit, but must terminate entry in DB, DBM, DBMV, MV, UV, MV, V, or W	REF LVL	24
	?	Query present Reference Level value	REF LVL	24
RLCAL	-33 to +33	Enter Reference Level Calibration in dB	REF LVL CAL	30
	?	Query present Reference Level Calibration value	REF LVL CAL	30
ROFFSET	± 100	Enter Reference Level Offset in dB	REF LVL OFFSET	31
	UP/DN	Increase or decrease Reference Level Offset by one DIV	REF LVL OFFSET	31
	?	Query present Reference Level Offset value	REF LVL OFFSET	31
	EP	Enter Reference Level Offset from front panel	None	
RQS	1 to 255	Request Service Conditions	See paragraph F-13	
	?	Query present Request Service Conditions	See paragraph F-13	
SAVES	PWRON	Save Current Configuration as power on state	PWR ON STATE	81
	0 to 9	Save Current Configuration	SAVE STATE	77
SAVET	TRA, X	Save waveform in Trace A Register, X is number from O to 7	SAVE TRACE A	82
	TRB, X	Save waveform in Trace B Register, X is number from O to 7	SAVE TRACE B	83
SER?		Return Serial Number	None	

Command	Parameter	Description	Control	Item No.
SIGID	AUTO	Activate Signal Identification	SIG ID AT MKR	128
	MAN	Turn manual Signal Identification on	SIG ID ON OFF	130
	OFF	Turn manual Signal Identification off	SIG ID ON OFF	130
	?	Query present manual Signal Identification state	SIG ID ON OFF	130
SNGLS		Single Sweep	SINGLE	155
SP	O to 345E9	Enter Frequency Span in Hz	SPAN WIDTH	47
	UP/DN	Increase or decrease Frequency Span in 1,2,5 seq	SPAN WIDTH	47
	?	Query present Frequency Span value	SPAN WIDTH	47
	EP	Enter Frequency Span from front panel	None	
	FULL	Select Full Frequency Span	FULL SPAN	48
	ZERO	Select 0HZ Frequency Span	ZERO SPAN	49
	LAST	Select Last Frequency Span	LAST SPAN	50
SQUELCH	Any No.	Enter Squelch level in any unit, but must terminate entry in DB, DBM, DBMV, MV, UV, MV, V, or W	SQUELCH	98
	UP/DN	Increase or decrease Squelch level by one division	SQUELCH	98
	?	Query present Squelch value	SQUELCH	98
	EP	Enter Squelch level from front panel	None	
	ON/OFF	Turn Squelch on or off	SQUELCH ON OFF	99
SRQ	0 to 255	Service Request	See paragraph F-13	
SS	25 to 362E9	Enter Center Frequency Step Size in Hz	CF STEP	57
	UP/DN	Increase/decrease Step Size in 1,2,5,10 seq	CF STEP	57
	?	Query present Center Frequency Step Size value	CF STEP	57
	EP	Enter Center Frequency Step Size from front panel	None	
	AUTO/MAN	Center Frequency Step Size mode to manual or auto	CF STEP AUTO MAN	58
ST	50 E–3 to 100	Enter Sweep Time in seconds	SWEEP TIME	51
	UP/DN	Increase or decrease Sweep Time in 1,2,5, 10 sequence	SWEEP TIME	51
	?	Query present Sweep Time value	SWEEP TIME	51
	EP	Enter Sweep Time from front panel	None	
	AUTO/MAN	Sweep Time mode to manual or auto	SWP TIME AUTO MAN	52
STB?		Return Status Byte Query	See paragraph F-14	
SWPOUT	FAV/RAMP	Sweep Output connector output	REAR PNL OUTPUT	233
	?	Query present Sweep Output	REAR PNL OUTPUT	233
TDF	A/ B/I/M/P	Trace Data Format (A= Ablock, I=lblock, P= Parameter Units, M-ASCII, or B= Binary)	See paragraph F-9	
	?	Query current Trace Data Format state	See paragraph F-9	
TH	Any No.	Enter Threshold Level in any unit, but must terminate entry in DB, DBM, DBMV, MV, UV, MV, V, or W	THRESHLD	174
	UP/DN	Increase or decrease Threshold Level by one division	THRESHLD	174
	?	Query present Threshold Level value	THRESHLD	174
	EP	Enter Threshold Level from front panel	None	
	ON/OFF	rum Threshold Level on or off	THRESHLD ON OFF	175
TITLE	@xx@	Enter Title, XX is name up to 16 characters	SCREEN TITLE	177

Commard	Parameter	Description	Control	tern No.
TM	EXT	Select external Trigger Mode	EXTERNAL	159
	FREE	Select free run Trigger Mode	FREE RUN	156
	LINE	Select line Trigger Mode	LINE	158
	VID	Select video Trigger Mode	VIDEO	157
	?	Query present Trigger Mode selected	TRIGGER	153
TRA		Trace A Data Input/Output	See paragraph F-9	
	?	Returns Trace A Data	See paragraph F-9	
TRB		Trace B Data Input/Output	See paragraph F-9	
	?	Returns Trace B Data	See paragraph F-9	
TS		Take one full Sweep	See paragraph F-9	
TWNDOW	TRA, X	Trace A Window array, X is UNIFORM, HANNING, or FLATTUP	None	
	TRB, X	Trace B Window array, X is UNIFORM, HANNING, or FLATTUP	None	
VAVG	1 to 999	Enter number of Video Averages	MAX NO VID AVG	194
	UP/DN	Increase or decrease number of Video Averages by 1	MAX NO VID AVG	194
	?	Query present Video Averages value	MAX NO VID AVG	194
	EP	Enter number of Video Averages from front panel	None	
	ON/OFF	Turn Video Average mode on or off	VID AVG ON OFF	195
VB	1 to 3E6	Enter Video Bandwidth in Hz	VIDEO BW	192
	UP/DN	Increase or decrease Video Bandwidth in 1,3,10 sequence	VIDEO BW	192
	?	Query present Video Bandwidth value	VIDEO BW	192
	EP	Enter Video Bandwidth from front panel	None	
	AUTOMAN	Select Video Bandwidth mode to manual or auto	VIDEO BW AUTO MAN	193
VBR	0.003 to 3	Enter Video Bandwidth Resolution Bandwidth Ratio	VBW:RBW	225
	UP/DN	Increase or decrease Ratio in a 1, 3, 10 seq	VBW:RBW	225
	?	Query present Ratio value	VBW:RBW	225
	EP	Enter Video Bandwidth Resolution Bandwidth Ratio from front panel	None	
VIEW	TRA	View Trace A	VIEW A	199
	TRB	View Trace B	VIEW B	204
VOL	0 to 15	Enter Volume level	VOLUME	97
	UP/DN	Increase or decrease Volume level by 1	VOLUME	97
	?	Query present Volume level	VOLUME	97
VTL	Any No.	Enter Video Trigger Level in any unit, but must terminate entry in DB, DBM, DBMV, MV, UV, MV, V, or W	VIDEO	157
	UP/DN	Increase or decrease Video Trigger Level by one division	VIDEO	157
	?	Query present Video Trigger Level value	VIDEO	157
	EP	Enter Video Trigger Level from front panel	None	

F-11. PROGRAMMING ERRORS.

The following table contains the error messages that can appear in the lower-right corner of the Spectrum Analyzer CRT screen or be queried using ERR? during remote operation. Another aid for determining programming errors is the ERRORS softkey. If an HP-IB error is generated in the analyzer during remote operation, ERRORS appears on the Spectrum Analyzer CRT screen. Press this key to read the errors. The cause of the error appears in the active function block. After reviewing the errors, press CLR ALL & EXIT to return the previous Spectrum Analyzer CRT screen.

Code	Error	Probable Cause
100	NO PWRON	Power-on state not valid; a default state was loaded instead
101	NO STATE	Recalled state not valid or not saved
106	ABORTED I	Aborted operation
107	HELLO ??	NO HP-IB listener on bus
108	TIME OUT	Controller time out
109	CTRLFAIL	Take control of HP-IB failed
110	NOT CTRL	Not a controller
111	# ARGMTS	Command does not have enough arguments
112	??CMD??	Command not recognized
113	FREQ NO!	Command cannot have frequency units
114	TIME NO!	Command cannot have time units
115	AMPL NO!	Command cannot have amplitude units
116	?UNITS??	Units not recognized
117	NOP NUM	Command cannot have numeric units
118	NOP EP	Enable parameter cannot be used
119	NOP UP DN	Up/down are not valid arguments for the command
120	NOP ONOF	On/off are not valid arguments for the command
121	NOP ARG	Auto/man are not valid arguments for the command
122	NOP TRC	Trace register not valid for the command
123	NOP ABLK	A-block not valid for the command
124	NOP IBLK	l-block not valid for the command
125	NO STRNG	Strings are not valid for the command
126	NO ?	Query is not allowed for the command
127	BAD DTMD	Detector mode is not valid
128	PK WHAT?	Peak-search parameter is not valid
129	PRE TERM	Premature termination
130	BAD TDF	Arguments are valid only for the TDF command
131	?? AM/FM	AM/FM are not valid arguments for the command
132	!FAV/RMP	FAV/RAMP are not valid arguments for the command
133	!INT/EXT	ENT/EXT are not valid arguments for the command
134	??? ZERO	ZERO is not a valid arguments for the command
135	??? CURR	CURR is not a valid argument for the command
136	??? FULL	FULL si not a valid argument for the command
137	??? LAST	LAST is not a valid argument for the command
138	!GRT/DSP	GRT/DDSP is not a valid argument for the command
139	PLOTONLY	Use argument only with the PLOT command
140	?? PWRON	PWRON is not a valid argument for the command
141	BAD ARG	Argument is valid only for the FDIAG command
142	BAD ARG	Query is expected for the FDIAG command
143	NO PRESL	Preselector hardware is required
144	NEXT 44	Next error space

F-12. UNIVERSAL AND ADDRESSED COMMANDS.

Universal and addressed (U/A) commands make most HPIB instruments perform generally accepted standard functions. Usually, universal commands control all of the instruments on the bus, while addressed commands control individual instruments at specific addresses on the bus.

F-13. SERVICE REQUEST (SRQ).

The Spectrum Analyzer can set the SRQ line to the controller whenever:

- Requesting service
- An error is present
- Any command is completed
- Any sweep is completed
- A display message is present
- A trigger is activated

SRQ enablement is inhibited (masked) on all conditions, except Request Service (bit 6, para F-14), unless enabled using the RQS command. The RQS command selects which of the above six types of conditions will produce service requests. These six conditions are shown by their bit positions in the Status Byte in paragraph F-14. Given condition(s) are selected by sending the RQS command followed by the decimal value for its bit position (or sum of values for more than one condition). The Request Service (bit 6) is always selected, but can also be sent. RQS? command sends this number back.

As an example, to cause a service requests (SRQ line enabled) when an error is present (bit 5) or a message is displayed (bit 1), “RQS 34” is sent.

When the controller sends the Spectrum Analyzer the SRQ command, the Spectrum Analyzer automatically triggers the service request (condition specified by the decimal value). The bit mask (using RQS command) must be sent before executing the SRQ command.

As an example, to set error present (bit 5), “SRQ 32” is sent.

F-14. STATUS BYTE.

When the controller sends the Spectrum Analyzer the STB? command, or when the controller initiates a serial poll, the Spectrum Analyzer sends its current Status Byte. The Status Byte informs the controller of the unit’s status. The Status Byte format is STB=### where ### is the decimal equivalent of the byte.

As an example, if "6" is returned, it indicates that a message is displayed (bit 1), and that the sweep has completed (bit 2).

Bit No.	Decimal Equivalent	Spectrum Analyzer State	Description
7	128		Not used
6	64	RQS	Requests Service (cannot be masked)
5	32	ERROR PRESENT	Set when error present
4	16	COMMAND COMPLETE	Any command is completed
3	8		Not used
2	4	END OF SWEEP	Set when any sweep is completed
1	2	MESSAGE	Set when display message appears
0	1	TRIGGER	Trigger is activated

GLOSSARY

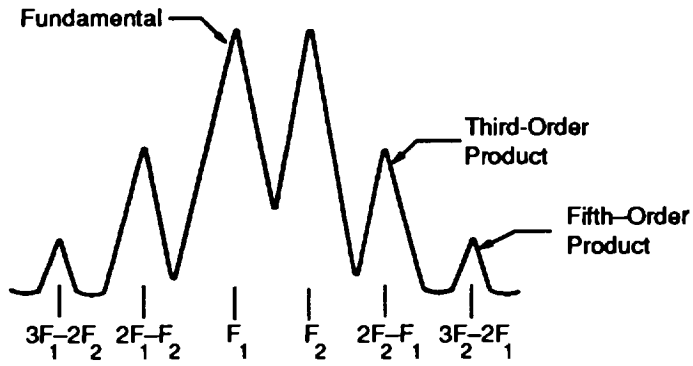
DEFINITION OF UNUSUAL TERMS

Discrete Fourier Transform

Converts zero-span information into the frequency domain, allowing the demodulated signal to be viewed as spectral data relative to the frequency of the modulation. Commonly used to measure AM in the presence of incidental FM. In this case, performing an FFT on the demodulated, zero-span AM signal, will result in a component (shown at O Hz) that depicts the power in the carrier of an AM signal. Other components are shown at the power level of the AM sidebands, with FM sidebands rejected. The amplitude accuracy of these sidebands is affected by the effective filtering of the resolution bandwidth filter (equivalent to a low-pass filter with half the resolution bandwidth) and the video filter. Aliasing can occur when modulation rates on the carrier are higher than one-half the sample rate for the zero-span signal, or 300 divided by the sweep time. The aliasing can be reduced by using a narrow resolution and/or video bandwidth.

Intermodulation Distortion

When two signals (F1 and F2) are present in a system, they can mix with the second harmonics generated (2F1 and 2F2) and create third-order intermodulation distortion products. These distortion products are located close to the original signals at 2F2 – F1 and 2F1 - F2.



Pulse Desensitization

The difference between the calculated peak pulse power and the measured main lobe amplitude. Desensitization occurs because the power of a pulsed continuous wave (CW) carrier is distributed over a number of spectral components (carrier and sidebands). As a result, each spectral component contains only a fraction of the total power.

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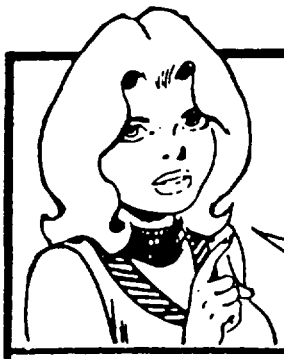

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PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 11-5840-340-12	23 Jan 74	Radar Set AN/PRC-76

BE EXACT PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2^{o} IFF antenna lag rather than 1^{o}. REASON: Experience has shown that with only a 1^{o} lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2^{o} without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
		F03		Zone C 3. On J1-2, change "+24 VDC to "+5 VDC." REASON: This is the output line of the 5 VDC power supply. +24 VDC is the input voltage.

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