TECHNICAL MANUAL

OPERATOR'S AND UNIT MAINTENANCE MANUAL
FOR
SWEEP GENERATOR
SG-1206/U
(NSN 6625-01-288-6361)
(EIC: N/A)

HEADQUARTERS, DEPARTMENT OF THE ARMY
1 MAY 1990

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

1 DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

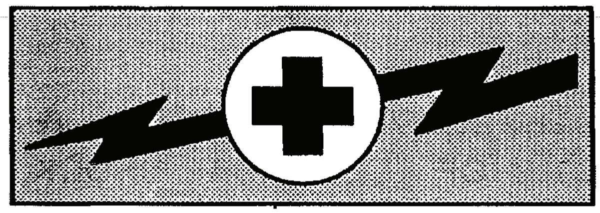
2 IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

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 warn them 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 4-25.11.

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

LIST OF EFFECTIVE PAGES

NOTE

ON CHANGED PAGES, THE PORTION OF THE TEXT AFFECTED BY THE LATEST CHANGE IS INDICATED BY A VERTICAL LINE OR OTHER CHANGE SYMBOL IN THE OUTER MARGIN OF THE PAGE.

Date of issue for original and changed pages are:

Original	0	1 May 1990
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Total number of pages in this publication is 125 consisting of the following:

Page No.	*Change No.
Cover	2
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B	2
C / (D blank)	2
i	2
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1-1, 1-2	2
1-3 thru 1-7	0
2-0 thru 2-39 / (2-40 blank)	0
3-1	0
3-2	2
3-3 thru 3-15 / (3-16 blank)	0
A-1 / (A-2 blank)	2
B-1 thru B-5 / (B-6 blank)	1
C-1, C-2	0
D-1 / (D-2 blank)	0
E-1 / (E-2 blank)	2
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* Zero in this column indicates an original page.

CHANGE No. 2

Headquarters
Department of the Army
Washington, D.C., 13 January 2006

OPERATOR'S AND UNIT MAINTENANCE MANUAL FOR SWEEP GENERATOR SG-1206/U (NSN 6625-01-288-6361) (EIC: N/A)

HAZARDOUS MATERIAL INFORMATION – This document has been reviewed for the presence of solvents containing hazardous materials as defined by the EPCRA 302 and 313 lists by the AMCOM G-4 (Logistics) Environmental Division. As of the base document, dated 1 May 1990, all references to solvents containing hazardous materials have been removed from this document by substitution with non-hazardous or less hazardous materials where possible.

OZONE DEPLETING CHEMICAL INFORMATION – This document has been reviewed for the presence of Class I ozone depleting chemicals by AMCOM G-4 (Logistics) Environmental Division. As of the base document, dated 1 May 1990, all references to Class I ozone depleting chemicals have been removed from this document by substitution with chemicals that do not cause atmospheric ozone depletion.

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i, ii	i, ii
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Cover	Cover

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PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

Sandra R. Riley
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OPERATOR'S AND UNIT MAINTENANCE MANUAL FOR SWEEP GENERATOR, SG-1206/U (NSN 6625-01-288-6361) (EIC: N/A)

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 or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, U. S. Army Aviation and Missile Command, AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via email, fax or the World Wide Web. Our fax number is: DSN 788-6546 or Commercial 256-842-6546. Our email address is: 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual immediately preceding the hardcopy 2028. For the World Wide Web use: https://amcom2028.redstone.army.mil.

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TABLE OF CONTENTS

HOW TO USE THIS MANUAL

This manual tells you about your Sweep Generator SG-1206/U and contains instructions about how to use it during maintenance on other electronic equipment.

The technical manual for the electronic equipment you are maintaining will tell you where to make certain connections and when to use various accessories which are part of the SG-1206.

When you first receive your SG-1206, start at the front of the manual and go all the way through to the back. Become familiar with every part of the manual and the SG-1206.

This manual has an edge index which will help you find specific information in a hurry. Simply spread the pages on the right edge of the manual until the printed blocks can be seen, Open the manual where the block on the edge of the page lines up with your selected topic printed on the front cover block.

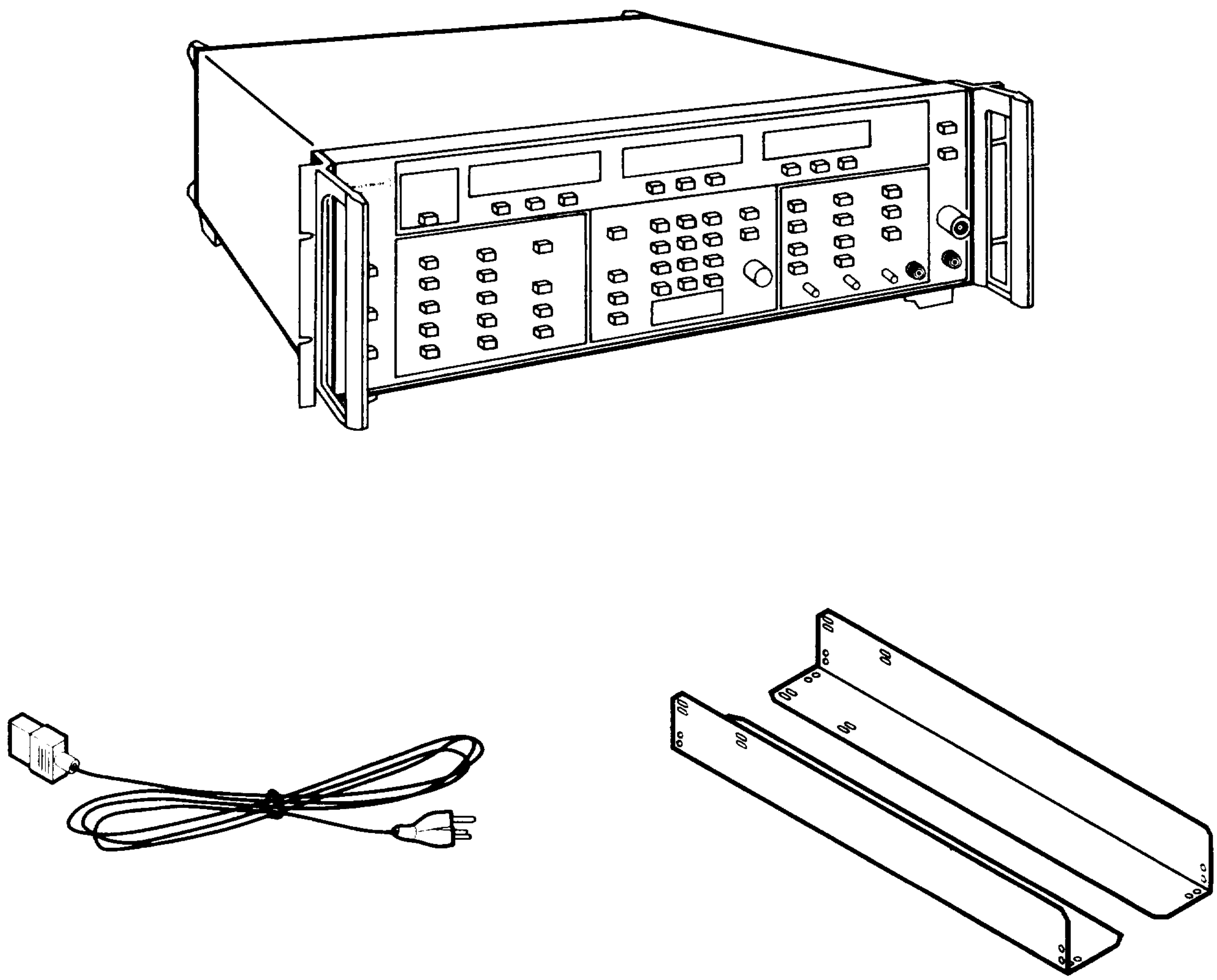

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Figure 1-1. Sweep Generator SG-1206/U.

CHAPTER 1
INTRODUCTION

Section I. GENERAL INFORMATION

1-1. SCOPE.

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

b. *Equipment Name and Model Number*: Sweep Generator SG-1206/U.

c. *Purpose of Equipment*: The Sweep Generator (fig. I-I) is designed for use in applications requiring a swept- or fixed-frequency source of RF or microwave energy.

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 750-8 as contained in the Maintenance Management Update.

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/AFR400-54/MCO 4430.3J.

c. Transportation Discrepancy Report (TDR)(SF 361). Fill out and forward Transportation Discrepancy Report (TDR)(SF 361) as prescribed in DA Pam 25-30/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 Checks and Services (PMCS) performed before storing. When removing the equipment from administrative storage, the PMCS should be performed to assure operational readiness.

1-5. DESTRUCTION OF ARMY 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).

If your Sweep Generator SG-1206/U 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, U.S. Army Aviation and Missile Command, AMSAM-MMC-MA-NM, Redstone Arsenal, AL. 35898-5000. We'll send you a reply.

1-7. WARRANTY INFORMATION

The Sweep Generator is warranted by Wiltron against defects in materials and workmanship for one year from the date of shipment, except for YIG-tuned oscillators, which are warranted for two years. Wiltron's obligation covers repairing or replacing products which prove to be defective during the warranty period. Buyers shall prepay transportation charges for equipment returned to Wiltron for warranty repairs. Obligation is limited to the original purchaser. Wiltron is not liable for consequential damages. The foregoing warranty does not apply to Wiltron connectors that have failed due to normal wear. Also, the warranty does not apply to defects resulting from improper or adequate maintenance by the Buyer, unauthorized modifications or misuse, or operation outside of the environmental specifications of the product. No other warranty is expressed or implied, and the remedies provided herein are the Buyer's sole and exclusive remedies.

1-8. NOMENCLATURE CROSS-REFERENCE LIST.

Common names will be used when the Sweep Generator SG-1206/U is mentioned in this manual.

NOTE

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

Common Name	*Official Nomenclature*
Sweep Generator	Sweep Generator SG-1206/U
SG-1206/U	Sweep Generator SG-1206/U

1-9. LIST OF ABBREVIATIONS.

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

ASCII	American Standard Code for Information Interchange
ALC	Automatic Level Control
dBc	Decibels below the carrier
dBm	Decibels referenced to 1 mW
GPIB	General Purpose Interface Bus
IC	Integrated Circuit
LED	Light Emitting Diode
M	Marker (such as MI . . . M8)
mW	Milliwatt (0.001 Watt)
CCA	Circuit Card Assembly
RAM	Random Access Memory
ROM	Read Only Memory
SB	Slow Blow
YIG	Yttrium-Iron Garnet

Section II. EQUIPMENT DESCRIPTION

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

a. *Characteristics.*

- Sweep frequency or continuous wave operation over he full band
- Five front-panel or GPIB selectable sweep-frequency ranges: Full, F1-F2, M1-M2, Δ F CF, Δ F Ml
- Fine-frequency adjustments (Frequency Vernier operation) providing up to ±12.7 MHz control in CW and Δ F sweep modes
- Three sweep triggering modes: Auto, Line, and External

b. *Capabilities and Features.*

- Eight frequency markers: M1 thru M8
- Three marker display modes: Video, RF, Intensity
- Alternately sweeps between two sets of front panel sweep parameters, such as Full and F1-F2
- Sweeps power over an up-to-15 dB range
- Retains front panel control settings in nonvolatile memory for up to 10 years. Whenever the instrument is turned on, it comes on line having the same control settings and values as when turned off last.

1-11, EQUIPMENT DATA.

a. *Weights and Dimensions.*

Weight . . . .321 b(14.5 kg)

Height . . . . .5.25 in. (133 mm)

Width . . . .17 in. (432 mm)

Depth . . . .18.75 in. (476 mm)

b. *Power Requirements.*

Voltage . . . .1151230V ±20%

Frequency . . . .48 t0 400 Hz

Input Power . . . .250 VA maximum

Fuses (2) . . . . 4 Amp SB, 115/230 Vac operation

c. *Environmental.*

Operating temperature range.. . . . .0 to +55°C

Storage temperature range . . . .-40 to+ 70°C

Relative humidity . . . .95% ±5% (10 to 30°C)
75% ± 5% (30 to 40°C)
45% ±5% (40 to 50°C)

Operating altitude . . . . .0 to 10,000ft

Storage altitude . . . .0 to 40,000ft

d. *Performance.*

Frequency range	10 MHz to 20 GHz
Frequency accuracy (25°C ±5°C)	
CW mode	±10 MHz
Frequency stability	
With temperature (MHz/°C)	±750 kHz, at ≤2 GHz output frequency ±0.02%, at >2 GHz output frequency
With 10 dB power level change	±200 kHz, at ≤2 GHz output frequency ±500 kHz, at >2 GHz output frequency
With 3:1 load SWR	±200 kHz, at ≤2 GHz output frequency ±300 kHz, at >2 GHz output frequency
Frequency resolution	
Normal	1 MHz
With Frequency Vernier mode selected	100 kHz
With Step Sweep (GPIB selectable function)	4096 programmable points
Sweep time	0.01 to 99 seconds
Output power (25°C ±5°C)	+13 dBm, at ≤2 GHz output frequency +10 dBm, at >2 to 18 GHz output frequency +7 dBm, at >18 GHz output frequency
Power level accuracy	±1.5 dB
Attenuator accuracy per step	±0.4 dB
Leveled power variation	±1.0 dB, at ≤2 GHz output frequency ±1.1 dB, at >2 GHz output frequency
Source SWR (50Ω)	1.5:1, at ≤2 GHz output frequency 2.1:1, at >2 GHz output frequency
Signal purity	
Harmonics	≤−25 dBc
Nonharmonics	≤−45 dBc
Residual FM (measured in a 30 Hz to 15 kHz bandwidth)	<5 kHz pk, at ≤4 GHz output frequency <7 kHz pk, at 4 to 6.5 GHz output frequency <15 kHz pk, at >6.5 GHz output frequency
Amplitude modulation (AM)	
Sensitivity	1 dB per volt
Frequency response (typical)	20 kHz, at ≤2 GHz output frequency 100 kHz, at >2 GHz output frequency
Frequency modulation (FM)	
Sensitivity	Selectable, −60 MHz per volt *or* −6 MHz per volt
Maximum deviation (modulation frequency), dc to 100 Hz	±75 MHz
Maximum deviation (modulation frequency), >100 Hz to 100 kHz	±7 MHz

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-12. GENERAL FUNCTIONAL DESCRIPTION.

The SG-1206 is a microprocessor-based source of RF and microwave energy. It uses a down converter and three YIG-tuned oscillators to cover the frequency range of 10 MHz to 20 GHz. The SG-1206 is capable of outputting both broad (full range) and narrow band sweeps, along with discrete CW frequencies, across the entire range. It is fully controllable locally from the front panel or remotely (except for power on/off) via the IEEE-488 bus (GPIB). A functional description of the SG-1206 (fig. 1-2) is given below.

① The *User Interface and Instrument Control Function* accepts inputs from the front panel controls or GPIB. The function is distributed over three circuit card assemblys (CCAS), one of which houses an Intel 8085 Microprocessor integrated circuit (IC). This IC, along with its associated circuitry, provides digital control over sweep generator functions. Control lines go to the Markers, ALC, Freq Inst, and FM CCAs.

② The *Sweep Ramp, Markers, ALC, Freq Inst, and FM Function is* distributed over five CCAs.

- The *Sweep Ramp CCA* provides a ramping voltage to the Markers, ALC (Automatic Level Control), and Freq Inst (Frequency Instruction) CCAs. These CCAs use this ramp to control their own operations. The Sweep Ramp CCA also controls the sweep triggering circuits. These circuits provide for the three triggering modes that are described in Chapter 2.

- The *Markers CCA* provides markers at user-selectable frequencies. It also controls the marker-mode circuits that allow the user to select between Video, RF, and Intensity markers. Thirdly, it processes the power sweep signal that provides for sweeping the output power over a range of O to 15 dB.

- The *ALC CCA* controls the flatness of the power-level variations over the sweep range. That is, it ensures that the power level does not vary more than plus or minus 1 dB at any frequency within the selected range at the output of the sweeper. The ALC is a closed-loop system that receives feedback from a directional coupler and detector. In the INTERNAL leveling mode, the coupler and detector are located on the RF deck. In the EXTERNAL leveling mode, a coupler and a detector are connected outside the instrument. (In the POWER METER leveling mode, a voltage from a power meter replaces the output from a detector.) The coupler and detector sample the Sweep Generator output power and send a controlling current to the ALC Function, which controls the output power level via an RF modulator.

- The *Freq Inst CCA* provides overall control for the Freq (frequency) Generation Function. It controls the sweep and generates control voltages that ensure proper sequencing of the frequency bands from a lower to a higher frequency. This CCA also controls the manual tuning of the sweep (front panel MANUAL SWEEP function) and CW frequency settings.

- The *FM CCA* has two functions. Its main function is to control the frequency modulation current to the YIG-tuned oscillators, thereby, causing the output frequency to vary with an externally supplied FM control voltage signal. Its secondary function is to supply control voltages and currents to the 110 dB Step Attenuator located on the RF Deck.

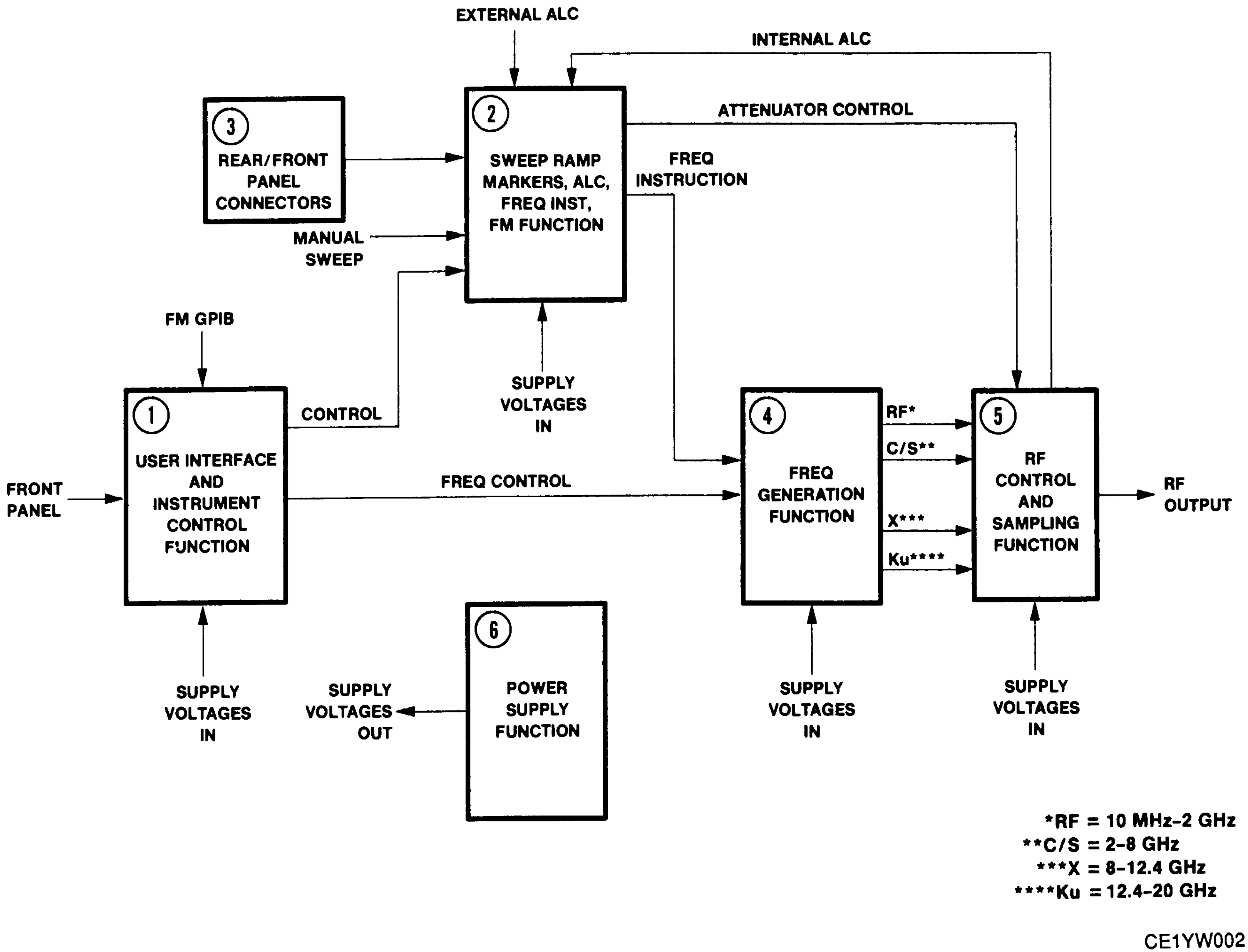

Figure 1-2. Sweep Generator SG-1206/U Overall Block Diagram.

③ The *Rear/Front Panel Connectors* provide input/output interface between the sweep generator and other instruments. Front Panel connectors include RF Output (type N), External ALC Input (BNC), and Horizontal Output (BNC). Rear Panel connectors incude Pos Z Blanking Output, Neg Z Blanking Output, Marker Output, Penlift Output, External Trigger Input, FM Input, AM Input, Horizontal Output (parallel output with front panel connector), and Ext Sq Wave Input (BNC connectors), as well as AUX I/O and GPIB Interface (multipin connectors).

④ The *Freq Generation Function* consists of the three YIG-tuned oscillators, their associated driver CCAs, and the 10 MHz to 2 GHz down converter. Each YIG driver CCA in this function receives a control signal input from the Frequency Instruction CCA. Each YIG Driver CCA outputs a frequency-control-tuning current and bias voltage to its respective oscillator.

⑤ The *RF Control and Sampling function* consists of three discrete elements:

- The first is an electronic switch for switching from a lower-frequency oscillator to a higher-frequency oscillator in a sequential sweep. This switch also contains an attenuator used by the ALC circuitry to provide leveling control of the output power.
- The second element is the directional coupler and detector previously described in the ALC CCA discussion.
- The third element is the 110 dB Attenuator used to reduce the output power level.

⑥ The Power *Supply Function* uses a switching power supply to provide dc voltages to all of the other instrument functions. It also contains diagnostic circuits that will shut the sweep generator down when the +5V power supply is out of tolerance.

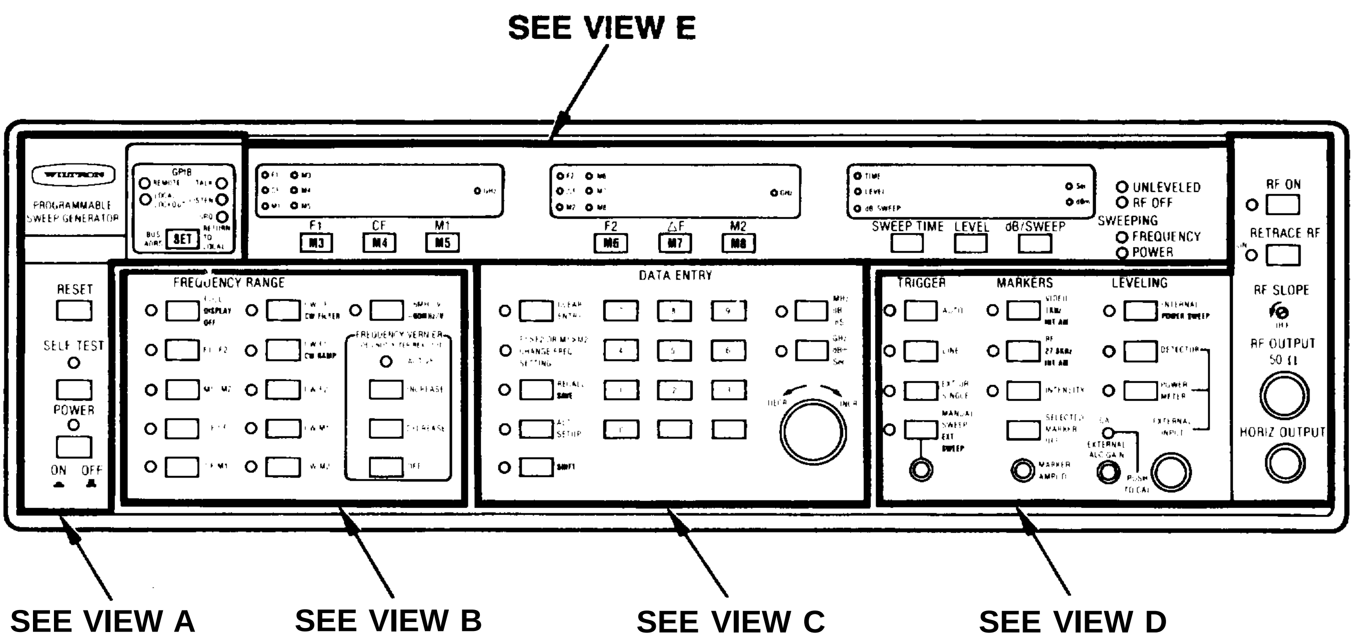

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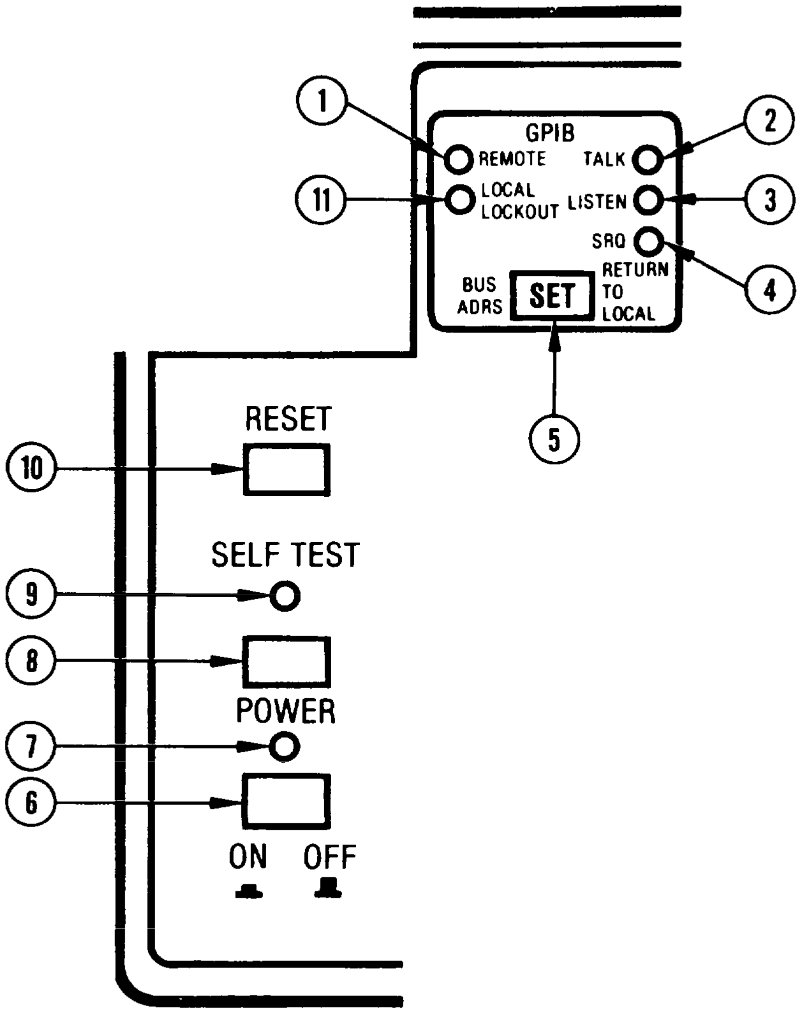
Figure 2-1. **Operator's Controls, Indicators, and Connectors, front view.**

CHAPTER 2
OPERATING INSTRUCTIONS

Section 1. DESCRIPTION AND USE OF OPERATOR'S CONTROLS, INDICATORS, AND CONNECTORS

2-1, INTRODUCTION.

This section describes all operator controls, indicators, and connectors on the SG-1206. Because of the many controls and indicators on the front panel, the front panel is divided into five portions (views A thru E). Figure 2-1 shows the front panel and identifies the different views, which are individually described on later pages. Figure 2-2 shows the rear panel and describes the connectors that it contains.



VIEW A

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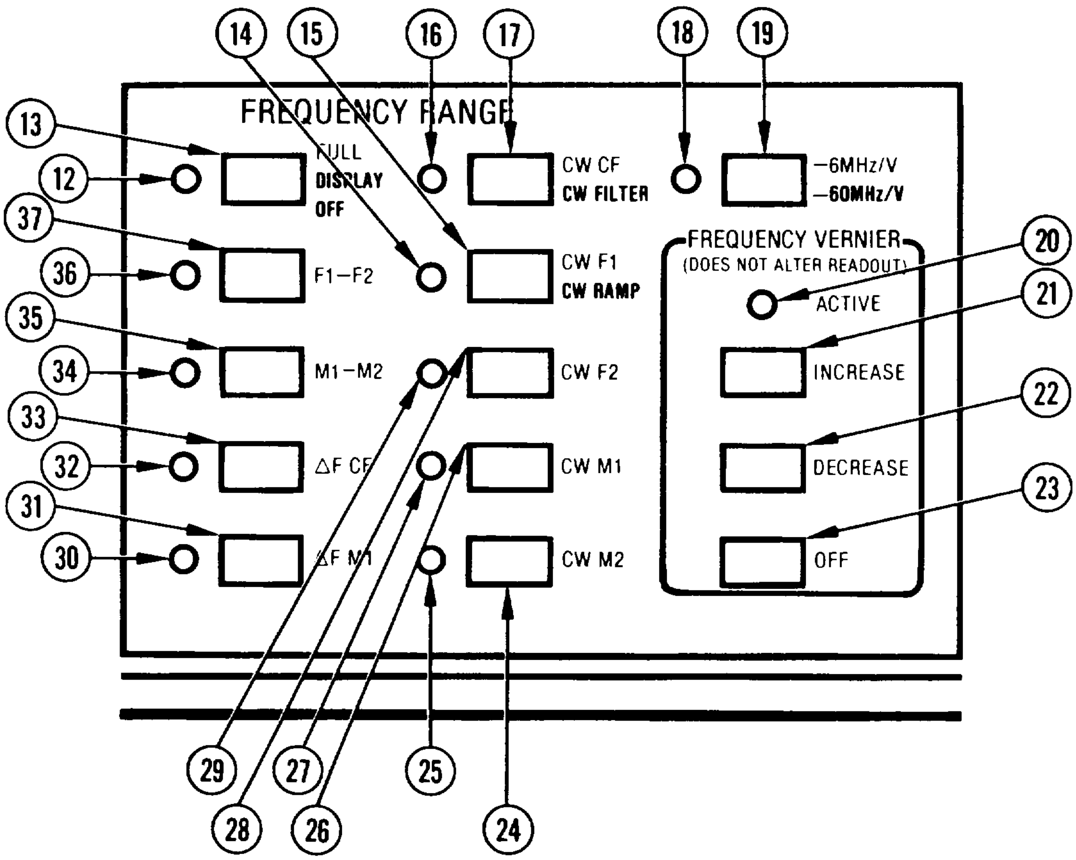
Key	Control, Indicator, or Connector	Function
1	REMOTE Indicator	Indicates whether or not SG-1206 is under GPIB control. Lights when SG-1206 goes under GPIB control and remains lit until it is returned to local (front panel) control.
2	TALK Indicator	Indicates whether or not SG-1206 is sending information to controller. Indicator remains lit while SG-1206 is sending information.
3	LISTEN Indicator	Indicates whether or not SG-1206 is receiving information from controller. Indicator remains lit while SG-1206 is receiving information.

Key	Control, Indicator, or Connector	Function
4	SRQ Indicator	Indicates whether or not SG-1206 has sent a Service Request command to the controller. Indicator remains lit until SG-1206 receives a serial poll, or until controller resets SRQ function.
5A	BUS ADRS/ RETURN TO LOCAL Key	In local (front panel) mode, key causes bus address to be displayed on middle LED readout. In remote (GPIB) mode—providing a Local Lockout bus message is not programmed—pressing key causes Sweep Generator to return to local mode. If a Local Lockout bus message is programmed, the only way to return to local control is by sending the "Go to Local" bus message via the GPIB (Appendix E).
5B	**SET**	Provides for entering a new GPIB address. To use, press **SHIFT** key then this key and enter a new address number via keypad. Address number is displayed on right-most numeric display (99).
6	POWER Key	Turns ac power on and off. Press to use. **NOTE** Pressing this key to turn power on initiates a self test and causes the version number of the firmware (such as, 1.0) to appear on left-most numeric display (89).
7	POWER Indicator	Indicates whether or not SG-1206 is turned on. Indicator lights when POWER key is pressed to ON and remains on until POWER key is pressed to OFF.
8	SELF TEST Key	Initiates self testing of Sweep Generator circuits. Press to use.
9	SELF TEST Indicator	Indicates whether or not SG-1206 is in self test mode. Indicator lights when SELF TEST key is pressed and remains lit until self test is finished.
10	RESET Key	Presets front panel controls to default values. These values are shown for RESET key operation (para 2-6). Press to use.
11	LOCAL LOCKOUT Indicator	Lights when Sweep Generator receives a local lockout message. When LOCAL LOCKOUT indicator is lit, SG-1206 cannot be returned to local control via front panel.



VIEW B

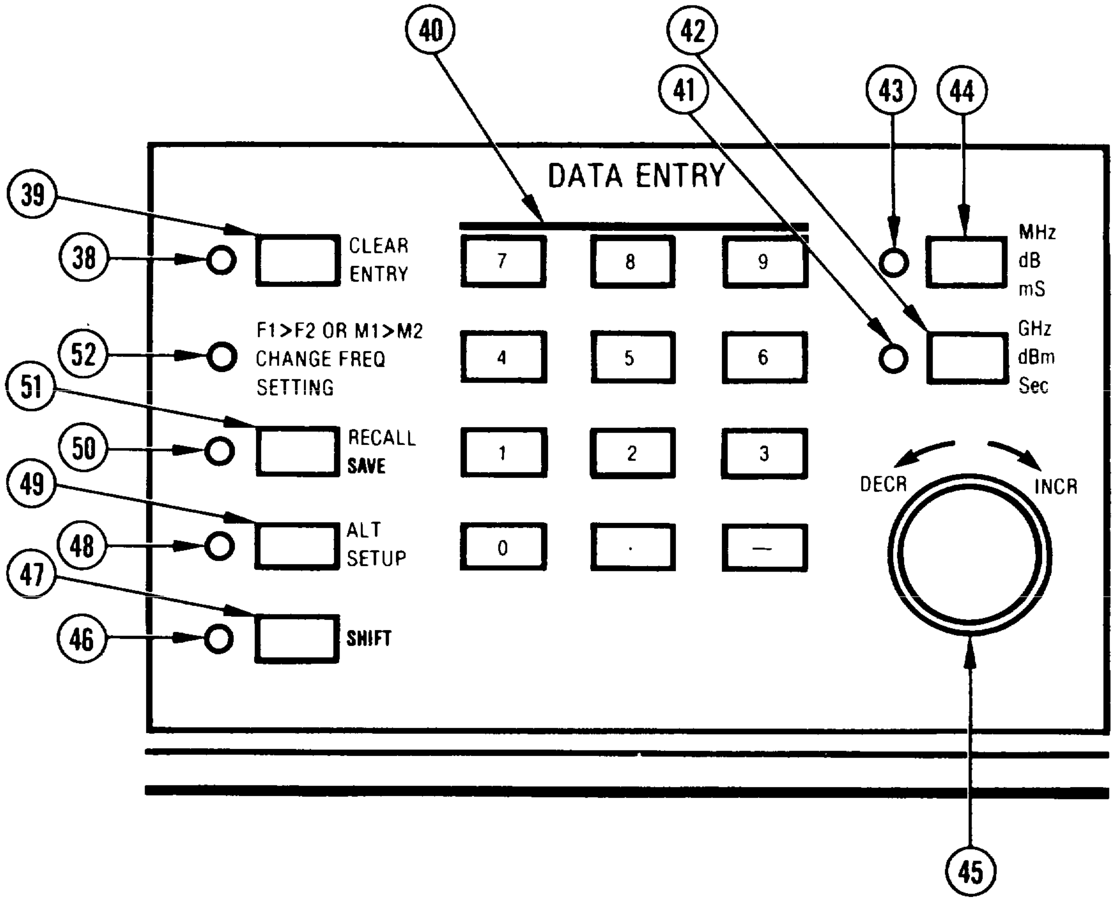
CE1YWO05

Key	Control, Indicator, or Connector	Function
12A	FULL Indicator	Indicates whether or not FULL mode is active. Indicator lights when FULL key is pressed and remains lit while mode is active.
12B	DISPLAY OFF Indicator	When **SHIFT** key is pressed, indicator shows whether or not DISPLAY OFF mode is active. Indicator lights when **SHIFT** key plus DISPLAY OFF key is pressed and remains lit while mode is active.

Key	Control, Indicator, or Connector	Function
13A	FULL Key	Selects full-band, 10 MHz to 20 GHz, sweep. Press to use.
13B	**DISPLAY OFF Key**	Turns frequency LED displays off. To use, press **SHIFT** then this key. For security, all frequency related functions except **SAVE,** RECALL, and RESET are disabled.
14A	CW F1 Indicator	Indicates whether or not CW F1 mode is active. Indicator lights when CW F1 key is pressed and remains lit while mode is active.
14B	**CW RAMP** Indicator	When SHIFT key is pressed, indicator shows whether or not **CW** RAMP mode is active, Indicator lights when **SHIFT** key plus **CW RAMP** key is pressed and remains lit while mode is active.
15A	CW F1 Key	Selects CW F1 mode. Selection of this mode provides a non-sweeping, CW signal at the frequency set for the F1 parameter. Press to use.
15B	**CW** RAMP Key	Provides a O-1OV sweep ramp for all five CW modes at front and rear panel HORIZ OUTPUT connectors. To use: Press SHIFT then this key.
16A	CW CF Indicator	Indicates whether or not CW CF mode is active. Indicator lights when CW CF key is pressed and remains lit while mode is active.
16B	CW FILTER Indicator	When SHIFT key is pressed, indicator shows whether or not CW FILTER mode is active. Indicator lights when **SHIFT** key plus **CW** FILTER key is pressed and remains lit while mode is active.
17A	CW CF Key	Selects CW CF mode. Selection of this mode provides a non-sweeping, CW, signal at the frequency set for the CF parameter. Press to use.
17B	CW FILTER Key	Provides enable/disable, condition al-in/unconditional-out, control over CW filter located in YIG oscillator tuning circuit. When enabled, CW filter is switched-in for improved accuracy in CW and ≤50 MHz sweep modes. Conversely, when CW FILTER key is not activated (LED off), CW filter is unconditionally switched-out of YIG tuning circuit. To use, press **SHIFT,** then this key.
18A	– 6 MHzN Indicator	Indicates whether or not –6 MHz-per-volt FM mode is active. Indicator lights when -6 MHz/V key is pressed and remains lit while mode is active.
18B	**–60 MHz/V** Indicator	When SHIFT key is pressed indicator shows whether or not -60 MHz/V mode is active. Indicator lights when **SHIFT** key plus -60 MHz/V key is pressed and remains lit while mode is active.

Key	Control, Indicator, or Connector	Function
19A	-6 MHz/V Key	Allows output frequency to be either phase-locked or frequency-modulated at a deviation of 6 MHz per volt of input signal amplitude. To use, apply a modulating signal via rear panel EXT FM/0 LOCK connector and press key to activate function.
19B	**-60 MHz/V** Key	Allows output frequency to be either phase locked or frequency modulated at a deviation of 60 MHz per volt of input signal amplitude. To use, press SHIFT then this key. Apply a modulating signal via rear panel EXT FM/0 LOCK connector (130).
20	ACTIVE Indicator	Lights when FREQUENCY VERNIER function is active. Indicator lights when INCREASE or DECREASE key is pressed for any of the seven affected modes: CW CF, CW F1, CW F2, CW M1, CW M2, Δ F CF, and Δ F M1. Indicator remains lit until all affected modes have frequency-vernier correction turned off.
21	INCREASE Key	Increases frequency by a maximum of 12.7 MHz in 100 kHz increments for any of the following modes: CW CF, CW F1, CW F2, CW Ml, CW M2, Δ F CF, and Δ F M1. Operation of this key does not affect displayed LED readout value. Once made, vernier corrections to frequency remain in place, even when SG-1206 is powered off. Press to use.
22	DECREASE Key	Decreases frequency by a maximum of 12.7 MHz in 100 kHz increments for any of the following modes: CW CF, CW F1, CW F2, CW M1, CW M2, Δ F CF, and Δ F M1. Operation of this key does not affect displayed LED readout value. Once made, vernier corrections to frequency remain in place, even when SG-1206 is powered off. Press to use.
23	OFF Key	Cancels vernier correction being applied to selected CW output or Δ F center frequency and turns ACTIVE indicator OFF in that mode.
24	CW M2 Key	Selects CW M2 mode. Selection of this mode provides a non-sweeping, CW, signal at the frequency set for the M2 parameter. Press to use.
25	CW M2 Indicator	Indicates whether or not CW M2 mode is active. Indicator lights when CW M2 key is pressed and remains lit while mode is active.
26	CW M1 Key	Selects CW Ml mode. Selection of this mode provides a non-sweeping, CW signal at the frequency set for the Ml parameter. Press to use.
27	CW M1 Indicator	Indicates whether or not CW Ml mode is active. Indicator lights when CW Ml key is pressed and remains lit while mode is active.
28	CW F2 Key	Selects CW F2 mode. Selection of this mode provides a non-sweeping, CW signal at the frequency set for the F2 parameter. Press to use.

Key	Control, Indicator, or Connector	Function
29	cw F2 Indicator	Indicates whether or not CW F2 mode is active. Indicator lights when CW F2 key is pre3ssed and remains lit while mode is active.
30	Δ F M1 Indicator	Indicates whether or not Δ F. M1 mode is active. Indicator lights when Δ F Ml key is pressd and remains lit while mode is active
31	Δ F Ml Key	Selects a frequency sweep that is symmetrical about the Ml frequency. Width of this sweep can go from 0% to 100% of full frequency range. One of two similar sweep modes in which a selected sweep width (Δ F) provides equal excursions about a selected center frequency. Press to use.
32	AF CF Indicator	Indicates whether or not Δ F CF mode is active. Indicator lights when Δ F CF key is pressed and remains lit while mode is active.
33	Δ F CF Key	Selects a frequency sweep that is symmetrical about the CF frequency. Width of this sweep can go from 0% to 100% of full frequency range. One of two similar sweep modes in which a selected sweep width (Δ F) provides equal excursions about a selected center frequency. Press to use.
34	M1-M2 Indicator	Indicates whether or not m1-M-2 Sweep mode is active. Indicator lights when M1-M2 key is pressed and remains lit while mode is active.
35	M1-M2 Key	Selects a frequency sweep from marker Ml to marker M2. One of two similar sweep modes in which start and stop frequency can be individually set. Press to use.
36	F1-F2 Indicator	Indicates whether or not F1-F2 sweep mode **is** active . Indicator lights when F1-F2 key is pressed and remains lit while mode is active.
37	F1-F2 Key	Selects a frequency sweep from F2 to F2. One of two sweep modes in which start and stop frequency can be individually set. Press to use.



VIEW C

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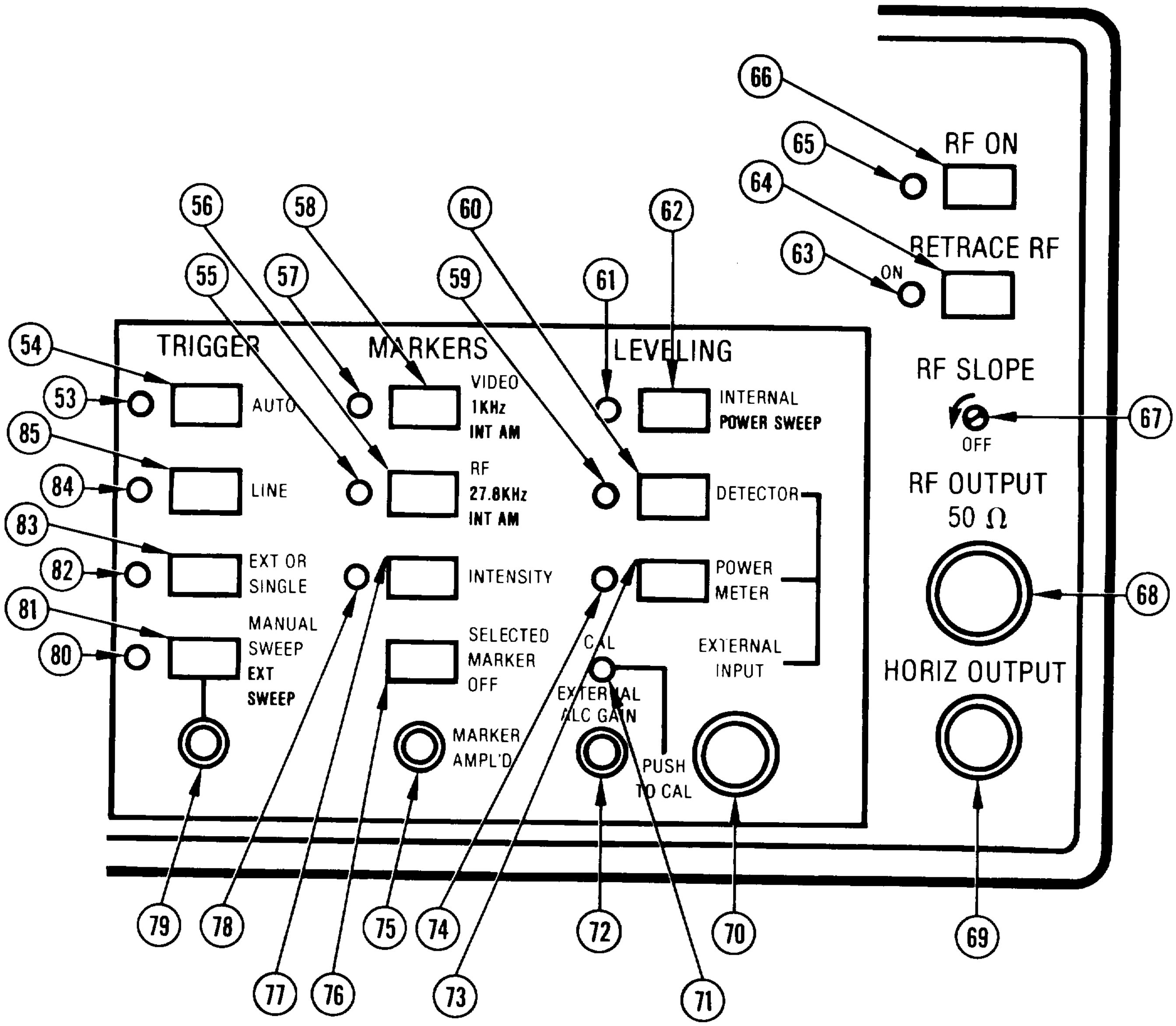
Key	Control, Indicator, or Connector	Function
38	CLEAR ENTRY Indicator	Flashes when an illegal or incomplete (see below) data entry has been attempted. • *//legal Entry:* Out-of-range frequency, sweep time, or output-power value entered via keypad. To clear, press associated CLEAR ENTRY key and re-enter data. • *incomp/efe Entry:* Value entered on keypad but not terminated with GHz/dB/mS or MHz/d Bm/Sec key. To clear, either press appropriate GHz/dB/mS or MHz/dBm/Sec key or press the CLEAR ENTRY key and re-enter data.
39	CLEAR ENTRY Key	Clears keypad of an illegal or incomplete data entry (described above) and allows parameter data to be recentered.

Key	Control, Indicator, or Connector	Function
40	DATA ENTRY Keypad	Provides for entering numeric values for selected frequency, sweep time, power sweep, and power level parameters. • For frequency parameters, values can be entered in MHz or GHz. • For SWEEP TIME, values can be entered in seconds or milliseconds. • For power LEVEL, values can be entered in dB or dBm. • For dB/SWEEP, values can be entered in dB.
41	GHz/dBm/Sec Indicator	Flashes to indicate that data input via the keypad was not terminated with GHz/dBm/Sec or MHz/dB/mS key. Indicator begins flashing, along with CLEAR ENTRY indicator, when data is entered via keypad and a key other than GHz/dBm/Sec or MHz/dB/mS key is pressed.
42	GHz/dBm/Sec Key	Terminates data entry. That is, key marks the end of a parameter-input entry and assigns appropriate units (G Hz, dBm, See) to entry. Press to use. • Frequency value is always displayed in GHz. • Sweep time value is always displayed in seconds. • Power level value is always displayed in dBm.
43	MHz/dB/mS Indicator	Flashes to indicate that data input via the keypad was not terminated with GHz/d Bm/Sec or MHz/dB/mS key. Indicator begins flashing, along with CLEAR ENTRY indicator, when data is entered via keypad and a key other than GHz/dBm/Sec or MHz/dB/mS key is pressed.
44	MHz/dB/mS Key	Terminates data entry. That is, key marks the end of a parameter-input entry and assigns appropriate units (MHz, dB, mS) to entry. Press to use. • Frequency value is always displayed in GHz. • Sweep time value is always displayed in seconds. • Power level value is always displayed in dBm.
45	DECR/I NCR Control	Increases or decreases a parameter's value. When turned slowly, parameter's value is increased or decreased by finest available resolution. Turning knob rapidly changes parameter's value in large steps. Clockwise rotation increases value; counterclockwise rotation decreases value. The finest resolution is shown below: • For frequency: 1 MHz • For power level and power sweep: 0.1 dB • For time: 1 ms, for sweeps 0.01 to 1.0 seconds 0.1 second, for sweeps 1.0 to 10 seconds 1 second, for sweeps 10 to 99 seconds

Key	Control, Indicator, or Connector	Function
46	SHIFT Indicator	Indicates that SHIFT function is active. Lights when SHIFT key is pressed.
47	SHIFT Key	Provides additional functions for certain keys. (Shift functions are designated by blue lettering on panel itself and by boldface type in this manual.) • *To use:* Press SHIFT key then desired function or parameter key. Numeric displays and LED indicators will go out, except for currently active SHIFT functions. • *To abort once begun:* Press **SHIFT** key again. This returns displays and indicators to their unshifted (normal) indications—no parameters are changed.
48	ALT SETUP Indicator	Indicates whether or not ALT SETUP mode is active. Indicator lights when ALT SETUP key is pressed and remains lit while mode is active.
49	ALT SETUP Key	Causes present front panel setup—freauency sweep, power level, markers, etc .—to alternate with a setup stored in memory. Use keypad to enter number of stored setup, from 1 to 9. Press to use.
50A	RECALL Indicator	Indicates whether or not RECALL mode is active. Indicator lights when RECALL key is pressed and remains lit while mode is active.
50B	SAVE Indicator	When **SHIFT** key is pressed, indicator shows whether or not SAVE mode is active. Indicator lights when **SHIFT** key plus **SAVE** key is pressed and remains lit while mode is active.
51A	RECALL Key	Provides for recalling any of nine stored setups. Setup number is entered via keypad. Sequentially pressing RECALL key then O key recalls setup that was in use prior to starting Recall function. Press to use.
51B	**SAVE** Key	Provides for saving present front panel setup into any of nine memory locations. Setup number is entered via keypad. To use: Press **SHIFT then** this key. **NOTE** Sequentially pressing RECALL key then O key recalls values that were previously stored in that memory location. This allows operator to correct for erronous **SAVE** key entries.
52	F1>F2 OR M1>M2 CHANGE FREQ SETTING Indicator	Flashes when backward sweep is attempted. (Backward sweep is when respective value of F2 or M2 is less than that of F1 or Ml.) Two LED readouts displaying frequency also flash. To clear: Either re-enter frequency values so that F1 or Ml is less than F2 or M2 or select a different frequency range.



VIEW D

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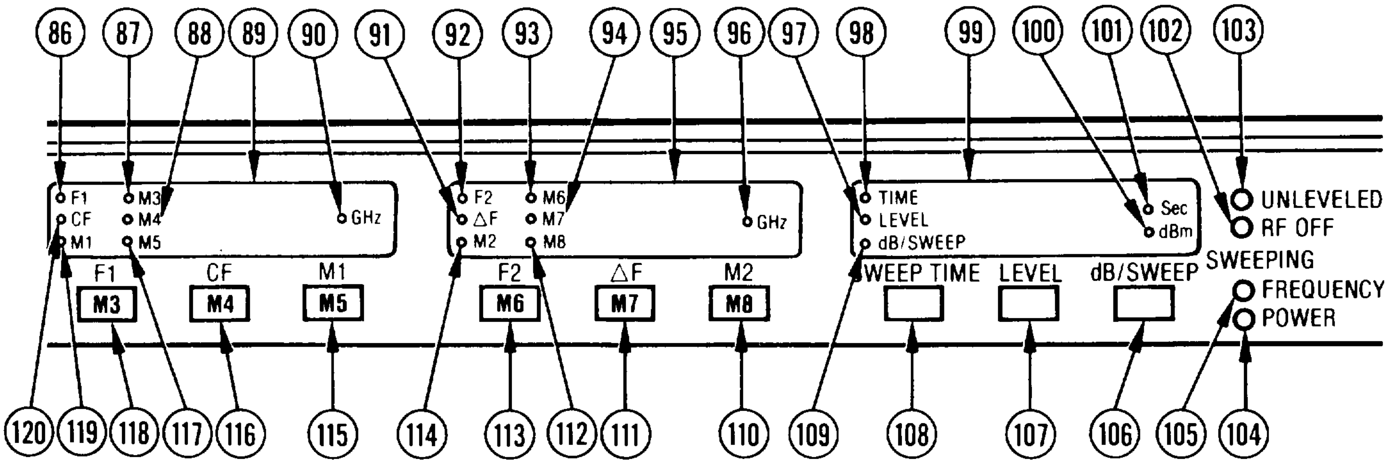
Key	Control, Indicator, or Connector	Function
53	AUTO Indicator	Indicates whether or not AUTO sweep is active. Indicator lights when AUTO key is pressed and remains lit while AUTO sweep is active.
54	AUTO Key	Selects frequency sweep to recur periodically with minimum delay (hold-off) time between one sweep and the next. Press to use.

Key	Control, Indicator, or Connector	Function
55A	RF Indicator	Indicates whether or not RF markers are on. Indicator lights when RF key is pressed and remains lit while RF markers are active.
55B	27.8 **kHz INT AM** Indicator	When SHIFT key is pressed indicator shows whether or not internal 27.8 kHz AM is being applied to the RF output. in-dicator lights when **SHIFT** key plus **27.8 kHz INT AM** key is pressed.
56A	RF Key	Dips RF output at marker frequency (or frequencies). Dip of last-selected marker can be adjusted from O to approximately 10 dB using MARKER AMPL'D control. Dip of all other markers is adjustable from O to approximately 5 dB. Press to use.
56B	**27.8 kHz INT AM Key**	Provides 27.8 kHz square-wave modulation to output signal. To use: Press **SHIFT** key then this key. Press to use.
57A	VIDEO Indicator	Indicates whether or not VIDEO markers are active. Indicator lights when VIDEO key is pressed and remains lit while VIDEO markers are active.
57B	1 kHz INT AM Indicator	When **SHIFT** key is pressed indicator shows whether or not internal 1 kHz AM is being applied to the RF output. Indicator lights when SHIFT key plus 1 **kHz INT AM** key is pressed.
58A	VIDEO Key	Provides positive-going video pulse at marker frequency (or frequencies). Amplitude of last-selected marker can be ad-justed from O to +10 volts using MARKER AMPL'D control. Amplitude of all other markers can be adjusted from O to +5 volts. Press to use.
58B	**1 kHz INT AM** Key	Provides 1 kHz square-wave modulation to output signal. To use: Press SHIFT key then this key. Press to use.
59	DETECTOR Indicator	Indicates whether or not external DETECTOR leveling is ac-tive. Indicator lights when DETECTOR key is pressed and remains lit while external detector leveling is active.
60	DETECTOR Key	Provides for using external directional coupler and positive or negative detector to level output power. Press to use.
61A	INTERNAL Indicator	Indicates whether or not INTERNAL leveling is active. in-dicator lights when INTERNAL key is pressed and remains lit while internal leveling is active.
61B	**POWER SWEEP** Indicator	When **SHIFT** key is pressed indicator shows whether or not **POWER SWEEP** mode is active. Indicator lights when **SHIFT** key plus **POWER SWEEP** key is pressed and remains lit while modulation is active.

Key	Control, Indicator, or Connector	Function
62A	INTERNAL Key	Toggles Internal Leveling function on and off. This function uses internally mounted directional detector to sample the output power for leveling purposes. Press to use.
62B	**POWER SWEEP** Key	Sweeps output power over 0-15 dB (maximum) range. To use: Press SHIFT key then this key. Press to use.
63	RETRACE RF Indicator	Indicates whether or not RETRACE RF function is active. indicator lights when RETRACE RF key is pressed and remains lit while mode is active,
64	RETRACE RF Key	Turns RF output on and off during sweep retrace. Key is interlocked with RF ON key so that it cannot be turned on unless RF ON key is also on.
65	RF ON Indicator	Indicates whether or not RF output is turned on. Indicator lights when RF key is pressed and remains lit while RF output is turned on,
66	RF ON Key	Turns RF output on and off. Press to use.
67	RF SLOPE Control	Adjusts slope of detected, leveled-RF output signal. Turn clockwise to adjust output-signal slope. This control is used to compensate for linear-with-frequency attenuation characteristics of RF transmission lines. Fully counterclockwise is off.
68	RF OUTPUT Connector	Provides RF output from 50Ω source. To prevent RF losses due to impedance mismatch, use 50Ω impedance mating connector and cable.
69	HORIZ OUTPUT Connector	Provides 0 to +10V ramp coincident with frequency sweep,
70	EXTERNAL INPUT Connector	Provides for applying external-leveling-input signal.
71	CAL Indicator	Lights when EXTERNAL ALC GAIN control is pushed in and has been adjusted for optimum ALC operation, Press to use.
72	EXTERNAL ALC GAIN Control	Control has two positions: normal and pushed in. In either position, it adjusts gain of signal applied to EXTERNAL INPUT connector. When pushed in, it works with CAL indicator (71) to show when level of input signal is optimum for ALC operation. Press to use. **NOTE** Do not rotate knob after gain has been adjusted for optimum operation. To do so invalidates setting.

Key	Control, Indicator, or Connector	Function
73	POWER METER Key	Provides for leveling output power using external power meter. SG-1206 is compatible with power meters that have ±1V FS (full-scale) analog output. Press to use.
74	POWER METER Indicator	Indicates whether or not POWER METER leveling is active. Indicator lights when POWER METER key is pressed and remains lit while power meter leveling is active.
75	MARKER AMPL'D Control	Adjusts amplitude of VIDEO and RF markers. Rotate clockwise to increase marker aplitude and counterclockwise to decrease marker amplitude.
76	SELECTED MARKER OFF Key	Causes selected marker to disappear from externally connected oscilloscope display. Press to use.
77	INTENSITY Key	Causes intensity dot to occur at marker frequency (or frequencies) for sweep times of less than 1.0 seconds. Press to use. NOTE Intensity marker is created by causing sweep to dwell at marker frequency (ies). Therefore, to view using oscilloscope requires no connection to CRT Z-axis input. Marker intensity is not affected by MARKER AMPL'D control. Marker is not viewable on a display that is digitally refreshed.
78	INTENSITY Indicator	Indicates whether or not INTENSITY markers are active. indicator lights when INTENSITY key is pressed and remains lit while INTENSITY markers are active.
79	MANUAL SWEEP Control	Tunes sweep manually over selected range, when MANUAL SWEEP key is pressed on. Rotate control clockwise to increase frequency.
80A	MANUAL SWEEP Indicator	Indicates whether or not MANUAL SWEEP mode is active. Indicator lights when MANUAL SWEEP key is pressed and remains lit while mode is active.
80B	**EXT SWEEP** Indicator	When SHIFT key is pressed, indicator shows whether or not **EXT** SWEEP mode is active. Indicator lights when **SHIFT** key plus EXT SWEEP key is pressed and remains lit while mode is active.
81A	MANUAL SWEEP Key	Provides for manually sweeping output signal using associated control (79). Press to use.
81B	**EXT SWEEP** Key	Provides for sweeping output frequency using an external sweep ramp supplied via rear panel EXT SWEEP connector. To use: Press SHIFT key then this key. Pressing any other TRIGGER key will deactivate **EXT SWEEP** function.
82	EXT OR SINGLE Indicator	Indicates whether or not EXT OR SINGLE mode is active. Indicator lights when EXT OR SINGLE key is pressed and remains lit while mode is active.

Key	Control, Indicator, or Connector	Function
83	EXT OR SINGLE Key	Provides for triggering a frequency sweep in either of two ways: • By using an external pulse supplied via rear panel SWEEP TRIGGER INPUT connector (126). • By pressing this key a second time. . To trigger a single sweep using this key: Press key once to select mode and a second time to trigger sweep. Pressing key a third time while sweep is in progress aborts sweep and resets it to start point.
84	LINE Indicator	Indicates whether or not LINE mode is active. Indicator lights when LINE key is pressed and remains lit while mode is active.
85	LINE Key	Provides for triggering sweep at a multiple or submultiple of line frequency. Press to use.



VIEW E

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Key	Control, Indicator, or Connector	Function
86	F1 Indicator	Indicates whether or not F1 parameter is active. Lights when F1 key is pressed and remains lit while F1 parameter is active.
87	M3 Indicator	Indicates whether or not M3 parameter is active. Lights when M3 key is pressed and remains lit while M3 parameter is active.
88	M4 Indicator	Indicates whether or not M4 parameter is active. Lights when M4 key is pressed and remains lit while M4 parameter is active.
89	LED Frequency Display	Displays frequency of selected F1, CF, M1, M3, M4, or M5 parameter.
90	GHz Indicator	Indicates that displayed frequency numerals are in GHz.
91	ΔF Indicator	Indicates whether or not ΔF parameter is active. Lights when ΔF key is pressed and remains lit while ΔF parameter is active.
92	F2 Indicator	Indicates whether or not F2 parameter is active. Lights when F2 key is pressed and remains lit while F2 parameter is active.
93	M6 Indicator	Indicates whether or not M6 parameter is active. Lights when M6 key is pressed and remains lit while M6 parameter is active.
94	M7 Indicator	Indicates whether or not M7 parameter is active. Lights when M7 key is pressed and remains lit while M7 parameter is active,

Key	Control, Indicator, or Connector	Function
95	LED Frequency Display	Displays frequency of selected F2, Δ F, M2, M6, M7, or M8 parameter.
96	GHz Indicator	Indicates that displayed frequency numerals are in GHz.
97	LEVEL Indicator	Indicates whether or not LEVEL parameter is active. Lights when LEVEL key is pressed and remains lit while LEVEL parameter is active.
98	TIME Indicator	Indicates whether or not SWEEP TIME parameter is active. Lights when SWEEP TIME key is pressed and remains lit while SWEEP TIME parameter is active.
99	LED Level/Time Display	Displays value of selected LEVEL, SWEEP TIME, or dB SWEEP parameter.
100	dBm Indicator	Indicates that displayed frequency numerals are in dBm.
101	Sec Indicator	Indicates that displayed frequency numerals are in seconds.
102	RF OFF Indicator	Indicates whether or not RF output power is off. Indicator lights when RF ON key is pressed and remains on until key is pressed to turn the RF power on.
103	UNLEVELED Indicator	Indicates whether or not RF output power is leveled. Indicator lights when output power goes unleveled. Indicator also lights when INTERNAL key is toggled to turn leveling off.
104	SWEEPING, POWER Indicator	Indicates whether or not output power is sweeping. Indicator lights during forward portion of a power sweep. It is out during the retrace sweep.
105	SWEEPING, FREQUENCY Indicator	Indicates whether or not output frequency is sweeping. Lights during forward portion of a frequency sweep, It is out during retrace sweep.
106	dB/SWEEP Key	Selects power sweep parameter and opens it for data entry. Press to use.
107	LEVEL Key	Selects level parameter and opens it for data entry. Press to use.
108	SWEEP TIME Key	Selects sweep time parameter and opens it for data entry. Press to use.
109	dB/SWEEP Indicator	Indicates whether or not dB/SWEEP parameter is open. Indicator lights when dB/SWEEP key is pressed and remains lit until a different parameter is selected.
110A	M2 Key	Selects M2 parameter, opens it for data entry, and activates marker if any MARKERS key mode is selected. Press to use.
110B	M8 Key	Selects **M8** parameter, opens it for data entry, and activates marker if any MARKERS key mode is selected. To use: Press **SHIFT** key then this key.

Key	Control, Indicator, or Connector	Function
111A	Δ F Key	Selects Δ F parameter and opens it for data entry. Press to use.
111 B	M7 Key	Selects **M7** parameter, opens it for data entry, and activates marker if any MARKERS key mode is selected. To use: Press SHIFT key then this key.
112	M8 Indicator	Indicates whether or not **M8** parameter is open. Indicator lights when SHIFT plus **M8** key is pressed and remains lit until a different parameter is selected.
113A	F2 Key	Selects F2 parameter and opens it for data entry. Press to use.
113B	M6 Key	Selects **M6** parameter, opens it for data entry, and activates marker if any MARKERS key mode is selected. To use: Press SHIFT key then this key.
114	M2 Indicator	indicates whether or not M2 parameter is open. Indicator lights when M2 key is pressed and remains lit until a different parameter is selected.
115A	MI Key	Selects MI parameter, opens it for data entry, and activates marker if any MARKERS key mode is selected. Press to use.
115B	M5 Key	Selects **M5** parameter, opens it for data entry, and activates marker if any MARKERS key mode is selected. To use: Press SHIFT key then this key.
116A	CF Key	Selects CF parameter and opens it for data entry. Press to use.
116B	M4 Key	Selects **M4** parameter, opens it for data entry, and activates marker if any MARKERS key mode is selected. To use: Press SHIFT key then this key.
117	M5 Indicator	Indicates whether or not M5 parameter is open. Indicator lights when SHIFT plus M5 key is pressed and remains lit until a different parameter is selected.
118A	F1 Key	Selects F1 parameter and opens it for data entry. Press to use.
118B	M3 Key	Selects **M3** parameter, opens it for data entry, and activates marker if any MARKERS key mode is selected. To use: Press SHIFT key then this key.
119	MI Indicator	Indicates whether or not MI parameter is open. Indicator lights when MI key is pressed and remains lit until a different parameter is selected.
120	CF Indicator	Indicates whether or not CF parameter is open. Indicator lights when CF key is pressed and remains lit until a different parameter is selected.

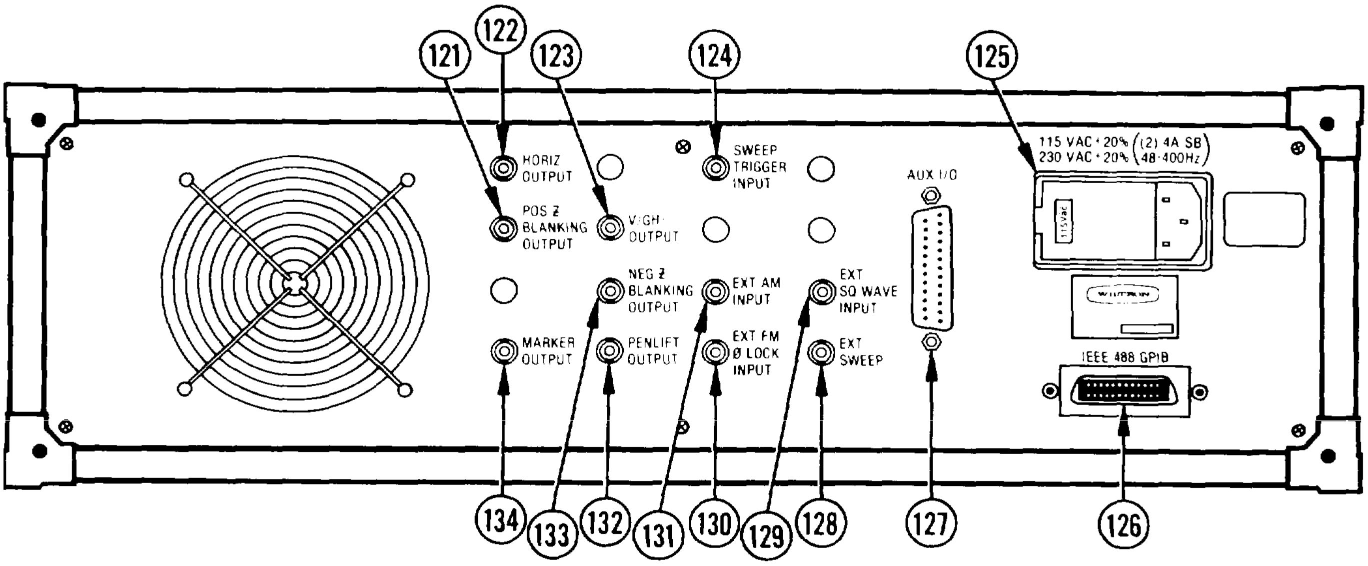

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Figure 2-2. Operator's Controls, Indicators, and Connectors.

Key	Control, Indicator, or Connector	Function
121	POS Z BLANKING OUTPUT Connector	Provides direct-coupled, +5.0 V rectangular pulse during sweep retrace and bandswitch points.
122	HORIZ OUTPUT Connector	Provides 0 to +10V ramp coincident with low- to high-frequency sweep.
123	V/GHz OUTPUT Connector	Provides voltage equal to IV per GHz of output frequency.
124	SWEEP TRIGGER INPUT Connector	Provides for externally triggering sweep when TRIGGER-EXT OR SINGLE key is engaged. Trigger occurs on closure-to-ground. Input pulse should be a clock pulse with following characteristics: Amplitude: 4 to 25 Vpk Fall Time: <5µs Pulse Width: >1 µs Polarity: Low true
125	Line Voltage Module	Provides for supplying 115 Vac or 230 Vac line voltage to SG-1206.
126	IEEE-488 (GPIB) Interface Bus Connector	Provides input/output connections to IEEE-488 Bus. (The IEEE-488 bus is also known as General Purpose Interface Bus (GPIB).
127	AUX 1/0 Connector	Only used to provide interface between SG-1206 and Wiltron Models 560A, 561, or 562 Scalar Network Analyzer.
128	EXT SWEEP Connector	Allows external O to +10 V ramp to be used to sweep output frequency. EXTERNAL SWEEP key must be activated.
129	EXT SQ WAVE INPUT Connector	Provides for external square-wave input. Square wave can have a frequency of up to 50 kHz and an amplitude of +10 V.

Key	Control, Indicator, or Connector	Function
130	EXT FM 0 LOCK INPUT Connector	Provides for external FM and/or phase-lock input signal. For phase locking, front panel -6 MHz/V key must be selected. Input impedance is 2 k Ω .
131	EXT AM INPUT Connector	Provides for AM input. The frequency of the modulating signal can go from dc to 50 kHz. Input impedance is 10 κΩ.
132	PENLIFT OUTPUT Connector	Provides isolated, normally-open (NO) relay contacts for lifting recorder pen during sweep retrace. Internal jumper provides for normally-closed (NC) relay-contact operation.
133	NEG Z BLANKING OUTPUT Connector	Provides direct-coupled, –5.0 V rectangular pulse coincident in time with RF blanking.
134	MARKER OUTPUT Connector	Provides video-marker output when MARKERS VIDEO key is engaged. All markers that have been selected and assigned a frequency, except the one selected last, are adjustable from O to +5 volts using MARKER AMPL'D control (75). The last-selected marker is adjustable from O to +10 volts.

Section II. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-2. GENERAL.

To be sure that the equipment is always ready for a mission, do the 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 D, items 1 thru 3.

b. PMCS for the SG-1206 is limited to routine checks such as those 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. GENERAL.

This section describes Preparation for Use, Turn-On, Self Test, Reset and Operating Procedures Under Usual Conditions.

2-5. PREPARATION FOR USE.

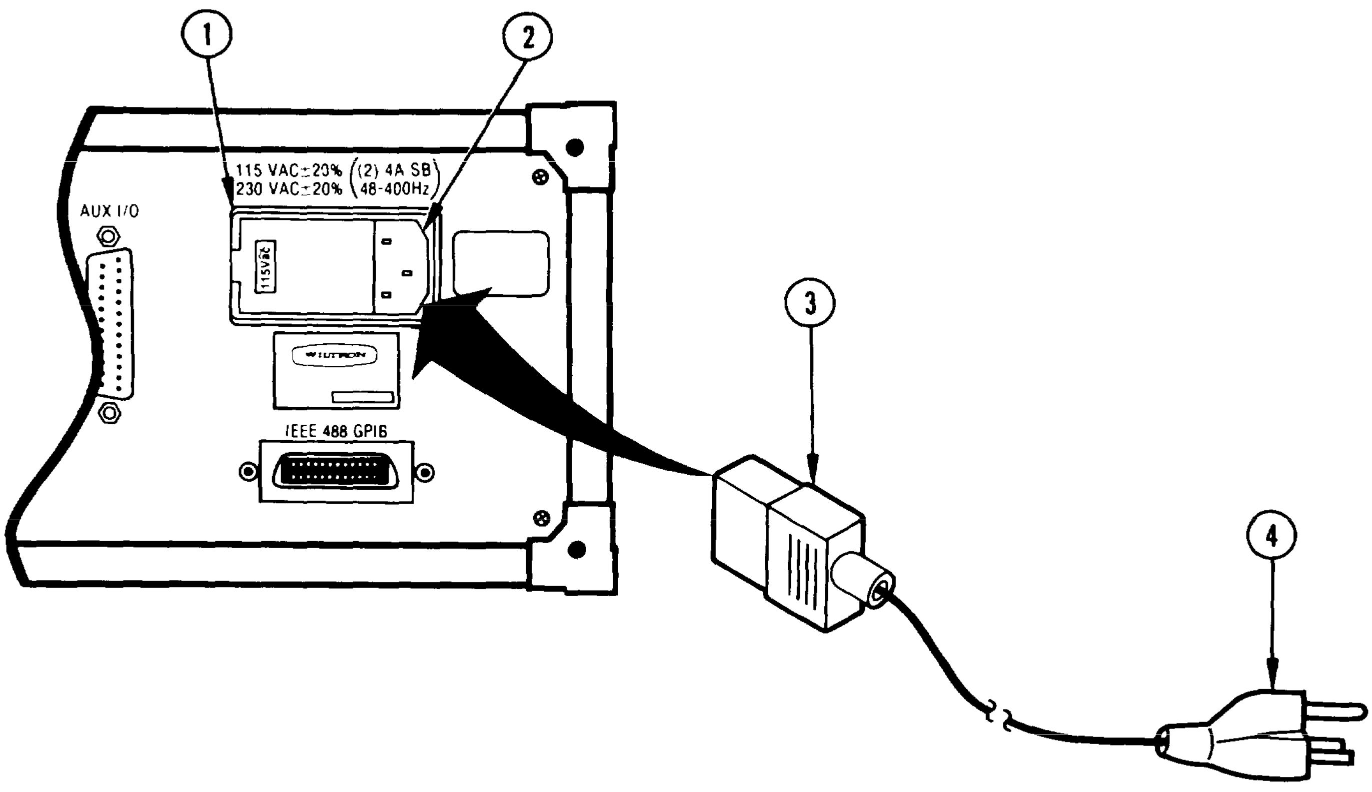
a. Ensure that voltage value shown on rear panel line module (1) is correct for the area in which SG-1206 will be operated-115 Vac or 230 Vat. If voltage is incorrect, refer the SG-1206 to the next higher level of maintenance for corrective action.

b. Connect SG-1206 line power source, as follows:

WARNING

Ensure that correct power cable is used. The SG-1206 comes with a 3-wire cable that grounds the instrument to the cabinet. Use with 3-receptacle outlet that provides a protective ground contact.

1. Plug female end of line cord (3) into receptacle on line voltage module (2).
2. Plug male end of line cord (4) into a power outlet having correct line voltage value.



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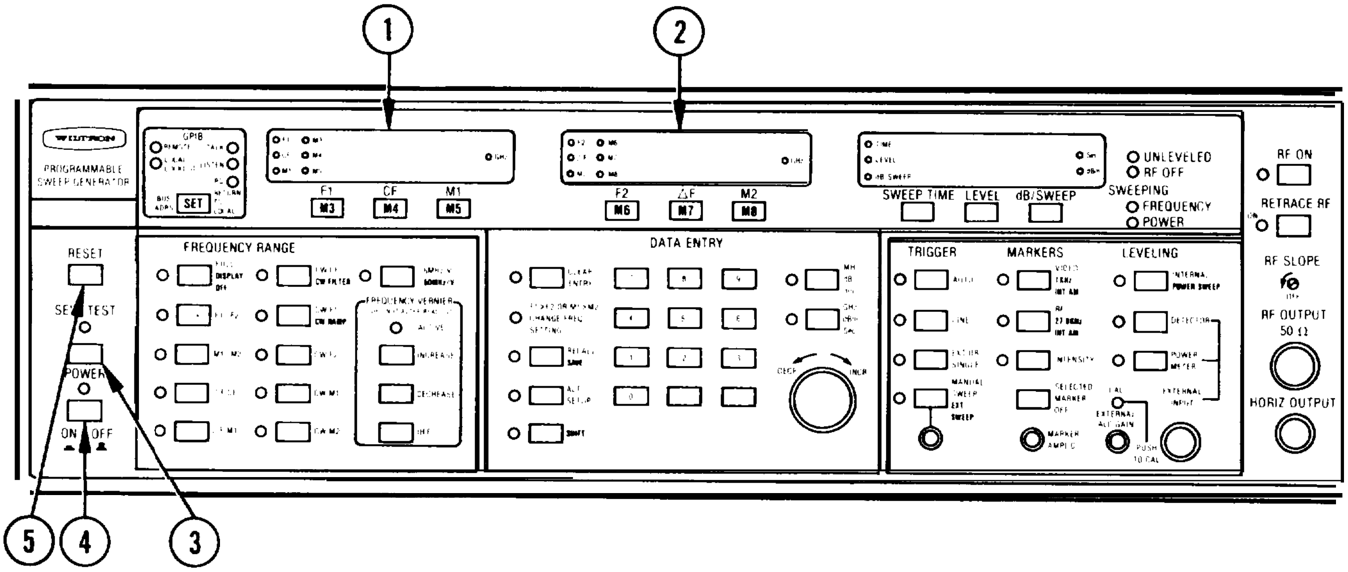
2-6. TURN-ON PROCEDURE.



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CAUTION

Full instrument power may be applied to unit-under test when SG-1206 is turned on.

a. Press POWER (4) key to ON.

b. After a short delay, while the SG-1206 undergoes self test, verify that "PASS" appears on display (2). If one or more error codes display, instead, note the number(s) and notify the next higher level of maintenance.

NOTE

- The number that appears on display (1) is firmware revision number. Firmware is the SG-1206 operating system stored in internal ROM.
- Self test runs automatically at turn-on. It can also be called up during operation by pressing SELF TEST (3) key.

c. The SG-1206 comes on line with same front panel settings as when last turned off. On initial turn-on, it comes on line with front panel default settings shown below. To return SG-1206 to default values at any time during operation, press RESET (5) key.

FREQUENCY RANGE:FULL	Δ F: 1.000 GHz
TRIGGER: AUTO	F1: 0.010 GHz
VIDEO MARKER: On	F2: 20.000 GHz
LEVELING: INTERNAL	CF 10.000 GHz
SWEEP TIME: .050 sec	M1 :3.000 GHz
RF ON: On	M2:19.000 GHz
LEVEL: 7 dBm	M3-M8: Off

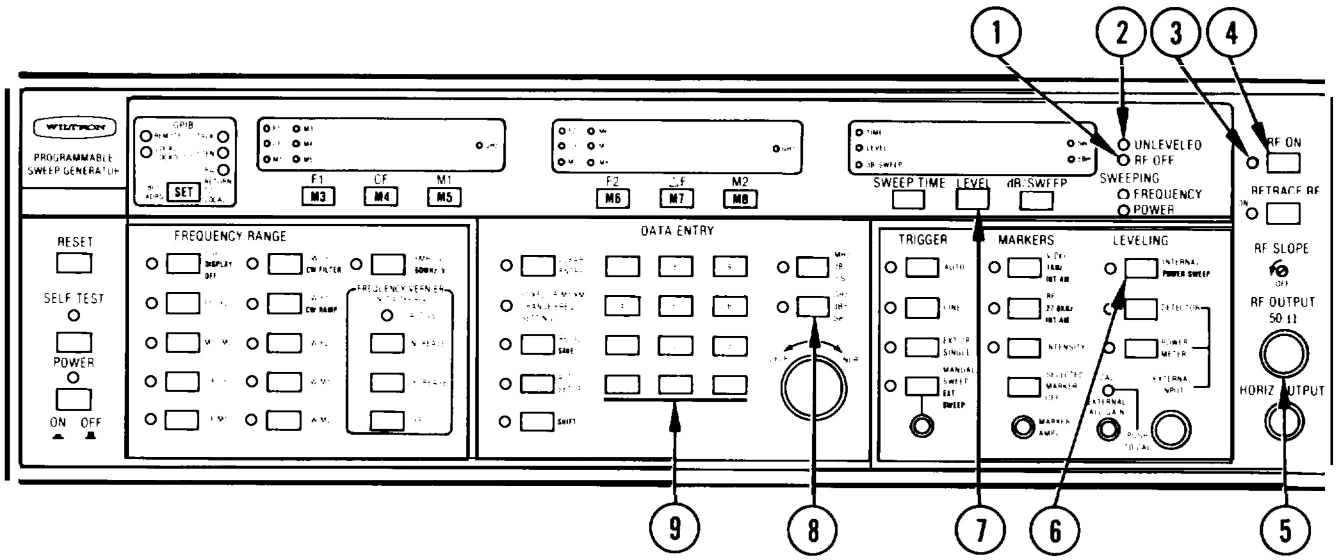
d. If no error codes appear, the SG-1206 is ready for use in any of its operating modes.

2-7. INITIAL SETUP.

This procedure provides an acceptable method for applying microwave power to the unit-under-test (UUT).

CAUTION

The SG-1206 is capable of outputting 10 dBm (10 mW) of leveled power, and in excess of 13 dBm (20 mW) of unleveled power. Use this procedure to apply microwave power to UUT, to prevent damage or destruction of UUT.

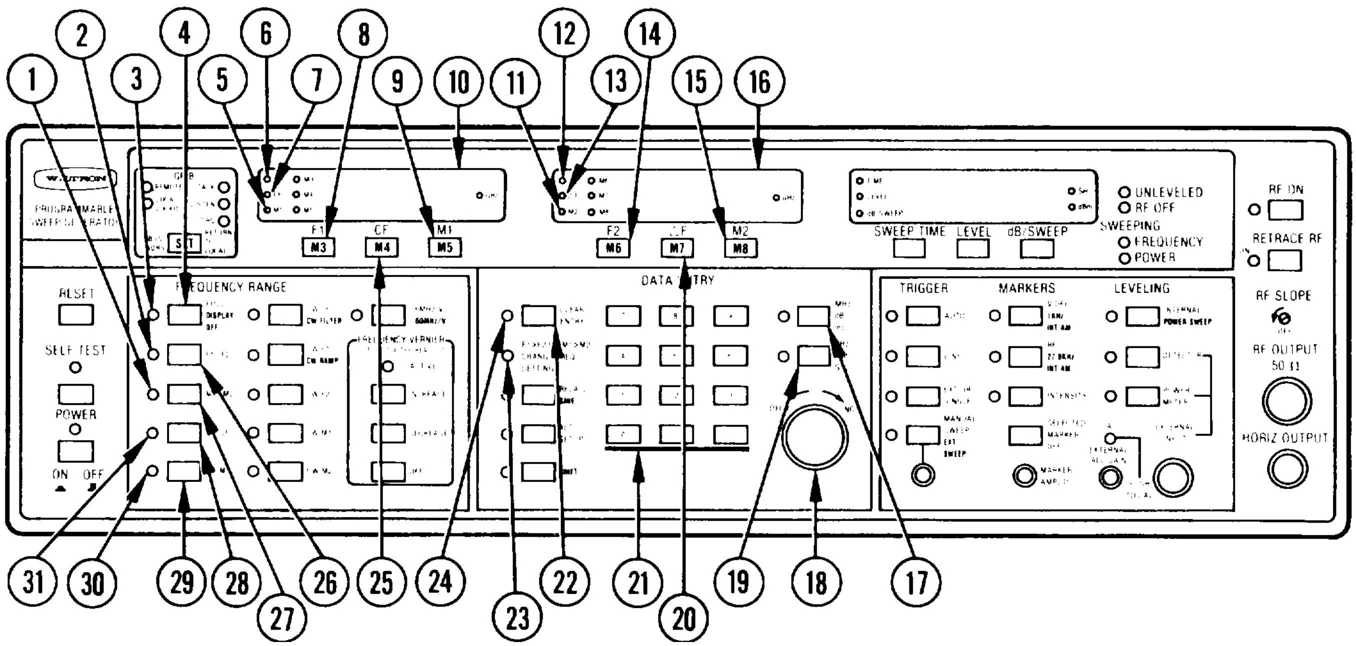


CE1YW012

1. Ensure that UNLEVELED (2) indicator is not lit. If lit, press INTERNAL (6) key to place SG-1206 in internally leveled-power mode.
2. Press RF ON (4) key; observe that RF OFF (1) indicator lights.
3. Set output power level to -115 dBm, as follows:
   - Press LEVEL (7) key.
   - Enter -1 1 5 on keypad (9).
   - Press GHz/dBm/Sec (8) key.
4. Connect 50-ohm cable between RF OUTPUT (5) connector and unit-under-test (UUT).
5. Press RF ON (4) key; observe that RF OFF (1) indicator goes out and RF ON indicator (3) lights.
6. Set output power for desired level (para 2-13).

2-8. FREQUENCY SWEEP OPERATION.

There are five frequency sweep modes. The Full mode provides a 10 MHz to 20 GHz sweep for which the end points cannot be changed. The F1-F2 and M1-M2 modes provide for sweeping between respective user-selected frequencies F1-F2 or M1-M2. The Δ F CF and Δ F M1 modes provide for semetrically sweeping on both sides of a center frequency, CF or Ml.



CE1YW013

Perform initial setup procedure (para 2-7).

a. Full-Range Sweep Mode.

1. Press FULL (4) key; observe that associated indicator (3) lights.
2. Observe that 0.010 GHz is displayed on display (10).
3. Observe that 20.000 GHz is displayed on display (16).

b. F1-F2 or M1-M2 Sweep Modes.

1. Press F1-F2 (26) or M1-M2 (27) key; observe that associated indicator (2) or (1) lights.
2. Press F1 key (8), if F1-F2 key was pressed in step 1, or Ml key (9), if M1-M2 key was pressed in step 1 ; observe that F1 (6) or Ml (5) indicator lights.
3. Enter start-frequency using keypad (21) or DECR-INCR (18) control.
4. If keypad was used, press MHz/dB/mS (17) key or GHz/dBm/Sec (19) key to complete data entry.
5. If CLEAR ENTRY (24) indicator starts flashing, the entered value is not within the 10 MHz to 20 GHz range. To clear, press CLEAR ENTRY (22) key and enter a new, in-range frequency value.

6. If FI>F2 OR M1>M2 CHANGE FREQ SETTING (23) indicator starts flashing, frequency F1 is greater than F2 (or MI is greater than M2). To clear, enter new value for F1 (MI) or F2 (M2) so that F1 (MI) is lower in frequency than F2 (M2).
7. Observe that frequency is displayed (in GHz) on display (10).
8. Press F2 key (14), if F1-F2 key was pressed in step 1, or M2 key (15), if M1-M2 key was pressed in step 1; observe that F2 (12) or M2 (11) indicator lights.
9. Enter stop-frequency using keypad (21) or DECR-INCR control (18).
10. If keypad was used, press MHz/dB/mS (17) key or GHz/dBm/Sec (19) key to complete data entry.
11. If CLEAR ENTRY (24) indicator starts flashing, refer to step b5 for corrective action.
12. If F1>F2 OR M1>M2 CHANGE FREQ SETTING (23) indicator starts flashing, refer to step b6 for corrective action.
13. Observe that frequency is displayed (in GHz) on display (16).

c. *Δ F CF or Δ F M1 Sweep Modes.*

1. Press Δ F CF (28) or Δ F M1 (29) key; observe that associated indicator (31) or (30) lights. Also, observe that Δ F (13) indicator lights.
2. Press CF (25) or MI (9) key; observe that CF (7) or MI (5) indicator lights.
3. Enter center-frequency for sweep using keypad (21) or DECR-INCR (18) control.
4. If keypad was used, press MHz/dB/mS (17) key or GHz/dBm/Sec (19) key to complete data entry.
5. If CLEAR ENTRY (24) indicator starts flashing, refer to step b5 for corrective action.
6. Observe that frequency is displayed (in GHz) on display (10).
7. To enter new Δ F frequency, press Δ F (20) key.
8. Enter sweep width using keypad (21) or DECR-INCR (18) control.

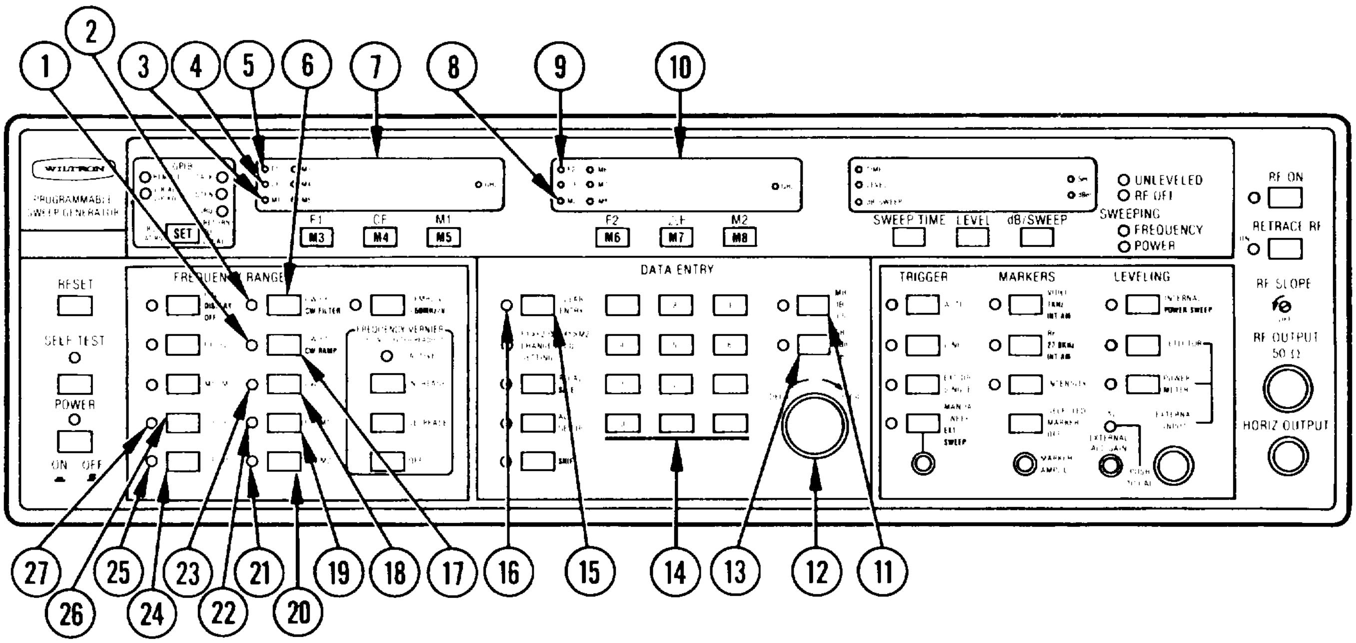
NOTE

The sweep range equals the Δ F value. For example, if the CF or MI value is 1 GHz and the Δ F value is 1 GHz, the sweep starts at 500 MHz and ends at 1500 MHz.

9. If keypad was used, press MHz/dB/mS (17) key or GHz/dBm/Sec (19) key to complete data entry.
10. If CLEAR ENTRY (24) indicator starts flashing, refer to step b5 for corrective action.
11. Observe that frequency is displayed (in GHz) on display (16).

2-9. CONTINUOUS WAVE (CW) OPERATION.

There are five CW modes: CW CF. CW F1, CW F2, CW Ml, and CW M2. All provide user-selected, fixed-frequency, CW signals.



CE1YW014

Perform initial setup procedure (para 2-7).

a. CW CF Mode.

1. Press CW CF (6) key; observe that both associated indicator (2) and CF indicator (4) light.
2. Enter desired CW frequency using keypad (14) or DECR-INCR (12) control.
3. If keypad was used, press MHz/dB/mS (11) key or GHz/dBm/Sec (13) key to complete data entry.
4. If CLEAR ENTRY (16) indicator starts flashing, the entered value is not within the 10 MHz to 20 GHz range. To clear, press the CLEAR ENTRY (15) key and enter a new, in-range frequency value.
5. Observe that frequency is displayed (in GHz) on display (7).

b. CW F1 Mode.

1. Press CW F1 (17) key; observe that both associated indicator (1) and F1 indicator (5) light.
2. Enter desired CW frequency using keypad (14) or DECR-INCR (12) control.
3. If keypad was used, press MHz/dB/mS (11) key or GHz/dBm/Sec (13) key to complete data entry.
4. If CLEAR ENTRY (16) indicator starts flashing, refer to step a4 for corrective action.
5. Observe that frequency is displayed (in GHz) on display (7).

c. *CW F2 Mode.*

1. Press CW F2 (18) key; observe that both associated indicator (23) and F2 indicator (9) light.
2. Enter desired CW frequency using keypad (14) or DECR-INCR (12) control.
3. If keypad was used, press MHz/dB/mS (11) key or GHz/dBm/Sec (13) key to complete data entry.
4. If CLEAR ENTRY (16) indicator starts flashing, refer to step a4 for corrective action.
5. Observe that frequency is displayed (in GHz) on display (1 O).

d. *CW Ml Mode.*

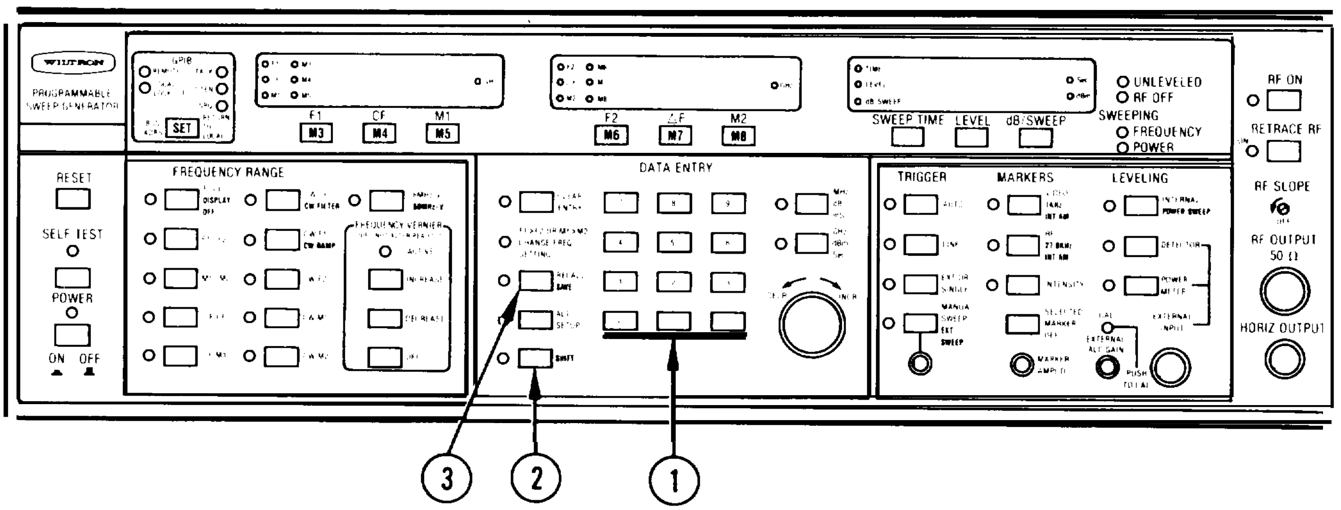
1. Press CW Ml (19) key; observe that both associated indicator (22) and Ml indicator (3) light,
2. Enter desired CW frequency using keypad (14) or DECR-INCR (12) control.
3. If keypad was used, press MHz/dB/mS (11) key or GHz/dBm/Sec (13) key to complete data entry.
4. If CLEAR ENTRY (16) indicator starts flashing, refer to step a4 for corrective action.
5. Observe that frequency is displayed (in GHz) on display (7).

e. *CW* M2 *Mode.*

1. Press CW M2 (20) key; observe that both associated indicator (21) and M2 indicator (8) light.
2. Enter desired CW frequency using keypad (14) or DECR-INCR (12) control.
3. If keypad was used, press MHz/dB/mS (11) key or GHz/dBm/Sec (13) key to complete data entry.
4. If CLEAR ENTRY (16) indicator starts flashing, refer to step a4 for corrective action.
5. Observe that frequency is displayed (in GHz) on display (10).

2-10. STORE/ RECALL OPERATION.

Up to nine front panel control settings and entry parameters can be stored for later recall, as follows:



CE1YW015

a. To store a setup:

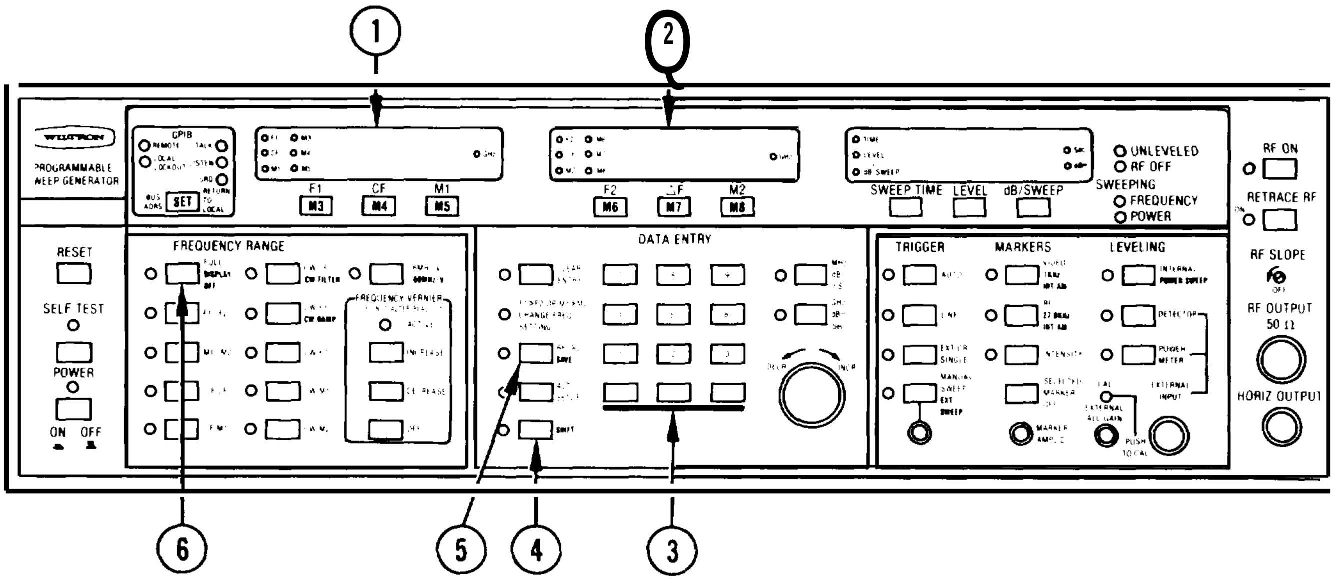
1. Sequentially press **SHIFT** (2) then **SAVE** (3) then desired number from 1 to 9 using numeric keypad (l). If setup was previously stored at selected location (1 to 9), it will be overwritten by new setup.
2. To provide for forgiving (undoing) a setup saved in error, setup that was overwritten is transferred to memory location O. It can be recalled by sequentially pressing RECALL (3) then O (1).

b. To *recall a setup:*

1. Sequentially press RECALL (3) then desired number from 1 to 9 using numeric keypad (I).
2. To provide for forgiving (undoing) a setup replaced in error by a recalled setup, setup that was in use before replacement by recalled setup is written into memory location O. It can then be recalled by sequentially pressing RECALL (3) then O (l).

2-11. SECURE MODE OPERATION.

The Secure Mode Function provides for blanking the front panel frequency displays to prevent unauthorized persons from being able to observe operating frequencies.



CE1YW016

a. To blank the front panel frequency information, proceed as follows:

1. Sequentially press SHIFT (4) then DISPLAY OFF (6) keys.
2. Observe that the frequency information disappears from frequency displays (1) and (2).

b. To save a secure-mode front panel setup to a memory location, proceed as follows:

1. Sequentially press SHIFT (4) then SAVE (5) then desired number from 1 to 9 using numeric keypad (3); observe that the word “Code” appears on display (l). If a setup was previously stored at selected location (1 to 9), it will be overwritten by new setup.
2. Enter a numeric code (password) using the keypad.

NOTE

The password can contain up to eight numerals. If less than eight numerals are used, the last numeral must be the decimal point. In other words, for a password of less than eight numerals, the decimal point acts as a terminator.

c. *To recall a secure-mode (pass-worded) setup, proceed as follows:*

1. Sequentially press RECALL (5) then desired number from 1 to 9 using keypad (3).

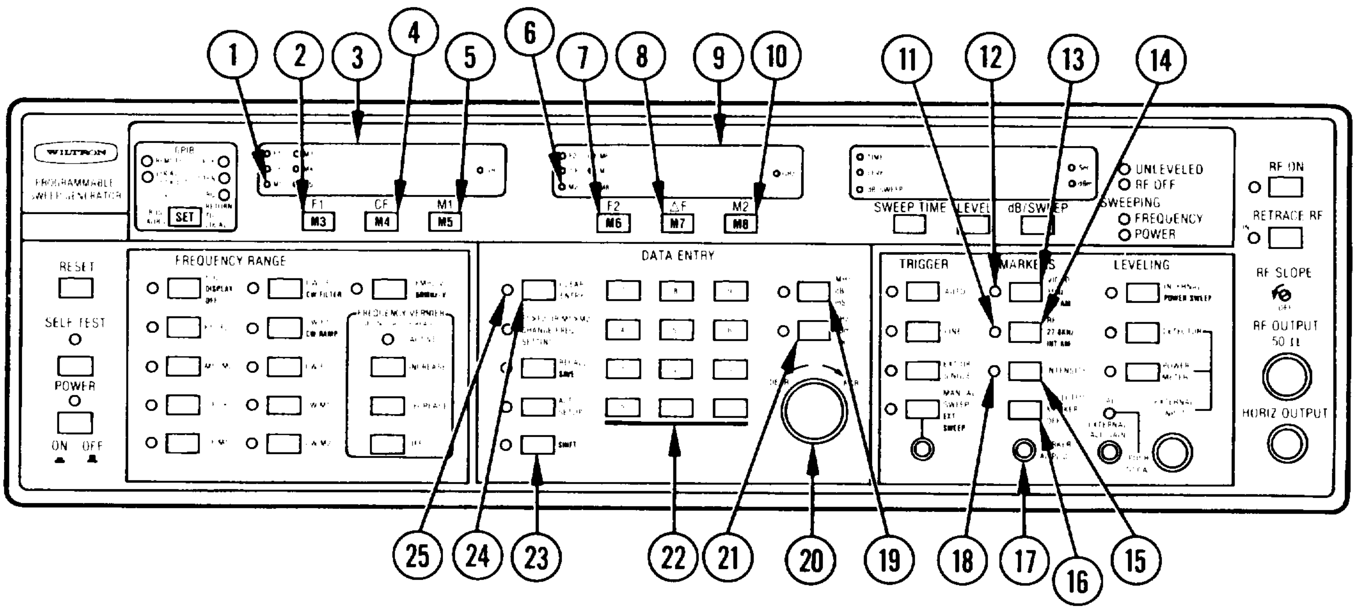
CAUTION

A stored passworded setup for which recall is attempted *will be* erased if password is not correctly entered by the third try.

2. Enter the password using the keypad (3).
3. If password has fewer than eight numerals, press decimal point key on keypad (3).

2-12. FREQUENCY MARKER OPERATION.

The SG-1206 provides up to eight discrete-frequency markers that can be Video, RF, or Intensity types.



CE1YW017

Perform initial setup procedure (para 2-7).

a. To apply markers to RF output signal, proceed as follows:

1. Press VIDEO (13) key; observe that associated indicator (12) lights.
2. Press Ml (5) key; observe that Ml indicator (1) lights.
3. Enter desired marker-frequency value using keypad (22) or DECR-INCR (20) control.
4. If keypad was used, press MHz/dB/mS key (19) or GHz/dBm/Sec key (21) to terminate data entry.

NOTE

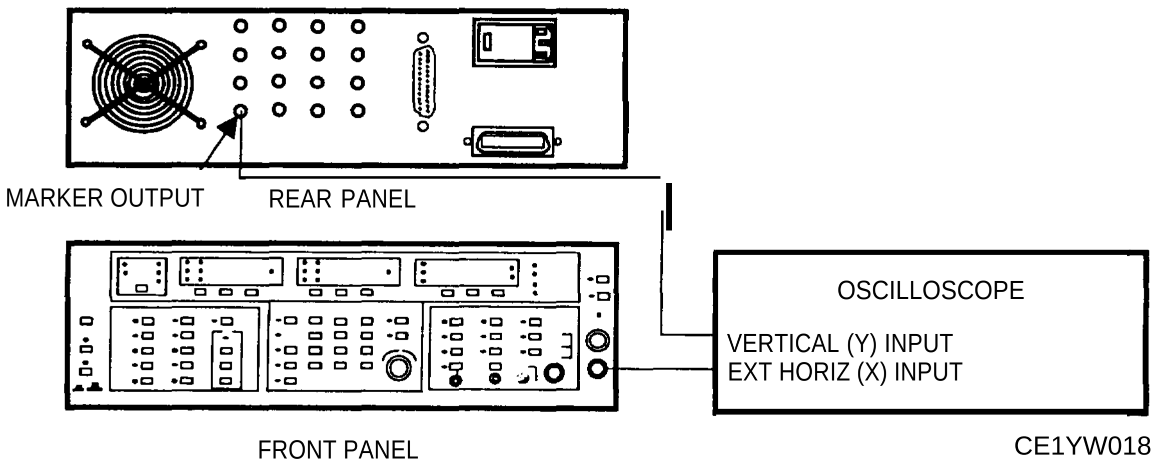
If marker value is out of the 10 MHz to 20 GHz range, the CLEAR ENTRY (25) indicator will start flashing. To clear, press CLEAR ENTRY (24) key and enter a new, in-range, marker value (steps 2 to 4).

5. Observe that frequency value is displayed (in GHz) on display (3).
6. Press M2 (10) key; observe that M2 indicator (6) lights.
7. Enter desired marker-frequency value using keypad (22) or DE CR-I NCR (20) control.
8. If keypad was used, press MHz/dB/mS key (19) or GHz/dBm/Sec key (21) to terminate data entry.
9. Observe that frequency value is displayed (in GHz) on display (9).
10. Sequentially press SHIFT (23) then **M3** (2) keys.

11. For remaining **M4** (4), **M5** (5), **M6** (7), **M7** (8), and **M8** (10) markers, repeat steps for **M3** marker, except substitute appropriate marker number and use different frequency value for each.

b. view *markers on an oscilloscope and turn a selected marker off, proceed as follows:*

Connect oscilloscope to SG-1206 as shown below.

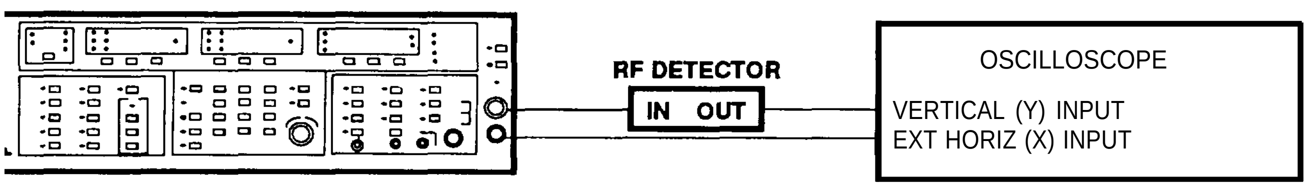


CE1YW018

2. Adjust MARKER AMPL'D (17) control, if necessary, to obtain a marker.
3. Press marker-parameter key (M1-M8) to select marker to be turned off.
4. Press SELECTED MARKER OFF (16) key.
5. Observe that marker disappears from oscilloscope display.

c. *To change marker-type setting and View Markers on Oscilloscope, proceed as follows:*

1. Connect oscilloscope to SG-1206 as shown below.



CE1YW019

NOTE

The RF marker is a dip in the RF output power,

2. Press RF (14) key; observe that associated indicator (11) lights.
3. Adjust MARKER AMPL'D (17) control, if necessary, to obtain a marker.
4. Press INTENSITY (15) key; observe that associated indicator (18) lights.

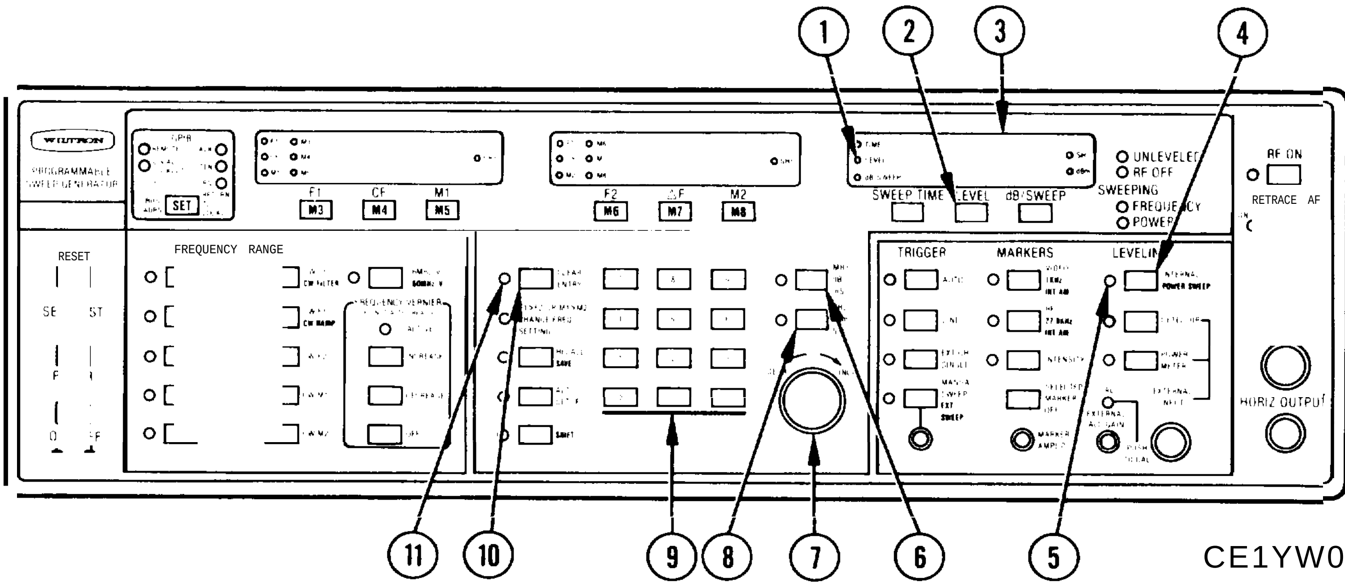
NOTE

The INTENSITY marker is an intensified dot on the Z-axis of a CRT display. *Ensure that sweep time is less than 1 second.*

5. Observe that this marker is unaffected by the MARKER AMPL'D (17) control.

2-13. INTERNAL POWER LEVELING OPERATION.

The SG-1206 provides internally leveled output power over a 10 dB range.



CE1YW020

Perform initial setup procedure (para 2-7).

a. To set a power-level value, proceed as follows:

1. Press INTERNAL (4) key; observe that associated indicator (5) lights.

NOTE

The INTERNAL key is a toggle. If the indicator is on (which means the mode is selected), then pressing the key will turn off the mode and cause the indicator to go out.

2. Press LEVEL (2) key; observe that LEVEL indicator (1) lights.
3. Enter desired power-level value using keypad (9) or DECR-INCR (7) control,
4. If the keypad was used, press GHz/dBm/Sec (8) key to terminate data entry.

NOTE

If power-level value is out of the -115 to +15 dBm range, the CLEAR ENTRY (11) indicator will start flashing. To clear, press CLEAR ENTRY (10) key and enter a new in-range, level value (steps 2 to 4).

5. Observe that power-level value appears on display (3).

b. To subtract power in dB from indicated power-level value, proceed as follows:

1. Press LEVEL (2) key.
2. Using keypad (9) or DECR-INCR (7) control, enter desired power-level-difference value (as an example, use -5).
3. If the keypad was used, press MHz/dB/mS (6) key to terminate data entry.

NOTE

If decrease goes below –1 15 dBm, display (3) and CLEAR ENTRY (11) indicator will flash. To clear condition, press CLEAR ENTRY (10) key and re-enter a value that causes power to stay above –1 15 dBm.

4. Observe that, for the example, power-level value appearing on right display (3) decreased by 5 dB.

*c. To **add power** (in dB) to indicated power-level value, proceed as follows:*

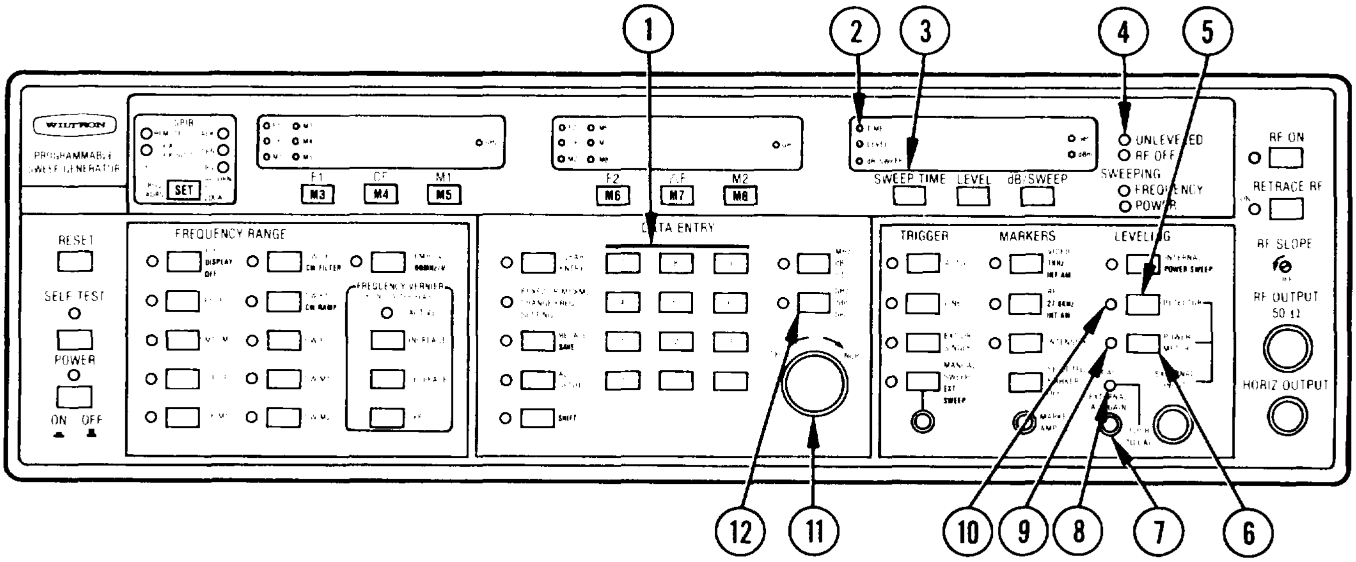
1. Press LEVEL (2) key; observe that LEVEL indicator (1) lights.
2. Enter desired power-level value using keypad (9) or DECR-INCR (7) control (as an example, use +5).
3. If the keypad was used, press MHz/dB/mS (6) key to terminate data entry.
4. Observe that, for the example, power-level value appearing on right display (3) increased by 5 dB.

NOTE

If increase exceeds +15 dBm, display (3) and CLEAR ENTRY (11) indicator will flash. To clear condition, press CLEAR ENTRY (10) key and re-enter a value that causes increase in power to stay below +15 dBm.

2-14. EXTERNAL POWER LEVELING OPERATION.

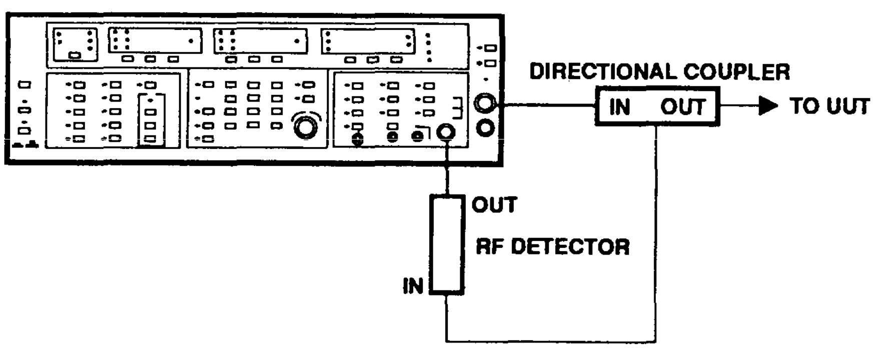
The SG-1206 provides for leveling the output power externally using a directional-coupler and either a detector or a power meter.



CE1YW021

a. To level output power using an external coupler and detector, proceed as follows:

1. Connect external directional coupler and detector as shown below. Ensure that directional coupler is sensitive to a band of frequencies (1 to 2 GHz, 2 to 18 GHz, 8 to 12.4 GHz, etc.) within the 10 MHz to 20 GHz range of the SG-1206.



CE1YW022

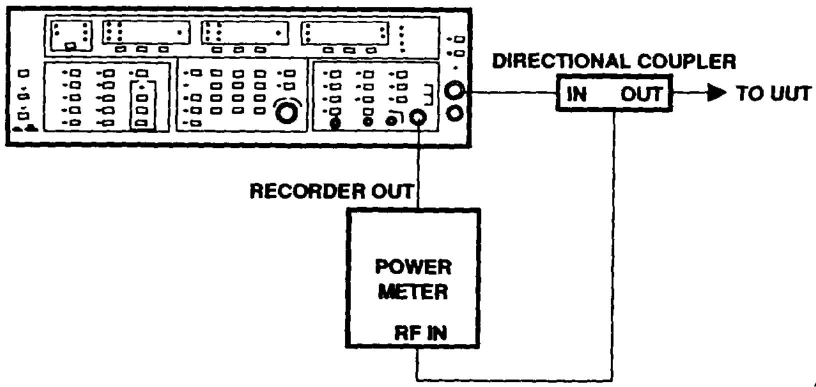
2. Set SG-1 206 to sweep a range of frequencies within the coupler's range (para 2-8).
3. Press DETECTOR (5) key; observe that associated indicator (10) lights.
4. Push in EXTERNAL ALC GAIN (7) control and turn in one direction or the other until the CAL (8) indicator just comes on and remains on continuously.
5. Release EXTERNAL ALC GAIN (7) control.

NOTE

Do not allow EXTERNAL ALC GAIN (7) control to be moved from its calibrated position.

b. To level sweep at a remote location using an external coupler and power meter, proceed as follows:

1. Connect external directional coupler, power meter, and power sensor as shown below. Ensure that directional coupler is sensitive to a band of frequencies (1 to 2 GHz, 2 to 8 GHz, 8 to 12.4 GHz, etc.) within the 10 MHz to 20 GHz range of the SG-1206.



CE1YW023

2. Set SG-1206 to sweep a range of frequencies within the coupler range (para 2-8).

NOTE

The response to a changing power level is slow using a power meter; consequently, external leveling should be accomplished using either CW or a slow (99 see) sweep speed.

3. To level using CW, set SG-1206 for CW CF mode and CF parameter to frequency equal to midband frequency of directional coupler (para 2-9). Go to step 4.
4. To level using a slowly sweeping signal, proceed as follows:

   Select F1-F2 sweep and set F1 and F2 parameters for a sweep range that is within the range of the directional coupler (para 2-8).

   Press SWEEP TIME (3) key; observe that TIME (2) indicator lights.

   Using keypad (1) or INCR-DECR (11) control, set sweep time for 99-second sweep.

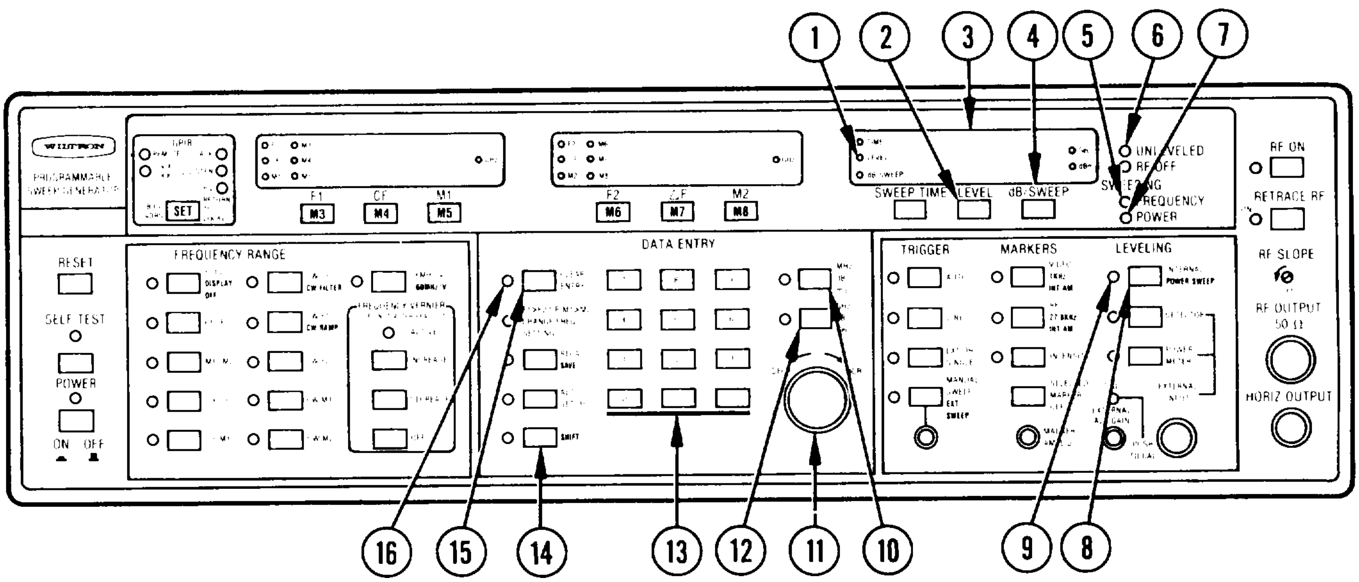
   If keypad was used, terminate data entry with GHz/dBm/Sec (12) key.
5. Press POWER METER (6) key; observe that associated indicator (9) lights.
6. Push in EXTERNAL ALC GAIN (7) control and turn in one direction or the other until the CAL (8) indicator just comes on and remains on continuously.
7. Release EXTERNAL ALC GAIN (7) control.

NOTE

Do not allow EXTERNAL ALC GAIN (7) control to be moved from its calibrated position.

2-15. POWER SWEEP OPERATION.

The SG-1206 provides for sweeping the output power either as an independent operation or in conjunction with a frequency sweep.



CE1YW024

Perform initial setup procedure (para 2-7).

a. Enter Power Sweep.

1. Press LEVEL (2) key; observe that LEVEL indicator (1) lights.
2. Enter desired power-level value using keypad (13) or INCR-DECR (11) control.
3. If keypad was used, press GHz/dBm/Sec (12) key.

NOTE

If power-level value is out of the -115 to +15 dBm range, the CLEAR ENTRY (16) indicator will start flashing. To clear, press CLEAR ENTRY (15) key and enter a new, in-range level value (steps 1 to 3).

4. Observe that power-level value appears on display (3).

CAUTION

A unit-under-test (UUT) can be damaged or destroyed by subjecting it to a higher level of input microwave power than it can tolerate. The SG-1206 is capable of outputting power in excess of 20 mW (+13 dB). Ensure that the LEVEL power setting is low enough to prevent the top-of-the-sweep power level from exceeding the maximum-power capability of the unit-under-test.

5. Press dB/SWEEP (4) key.

6. Enter desired power-sweep value using keypad (13) or INCR-DECR (11) control.
7. If keypad was used, press MHz/dB/mS (10) key.
8. Observe that sweep value is displayed on display (3).

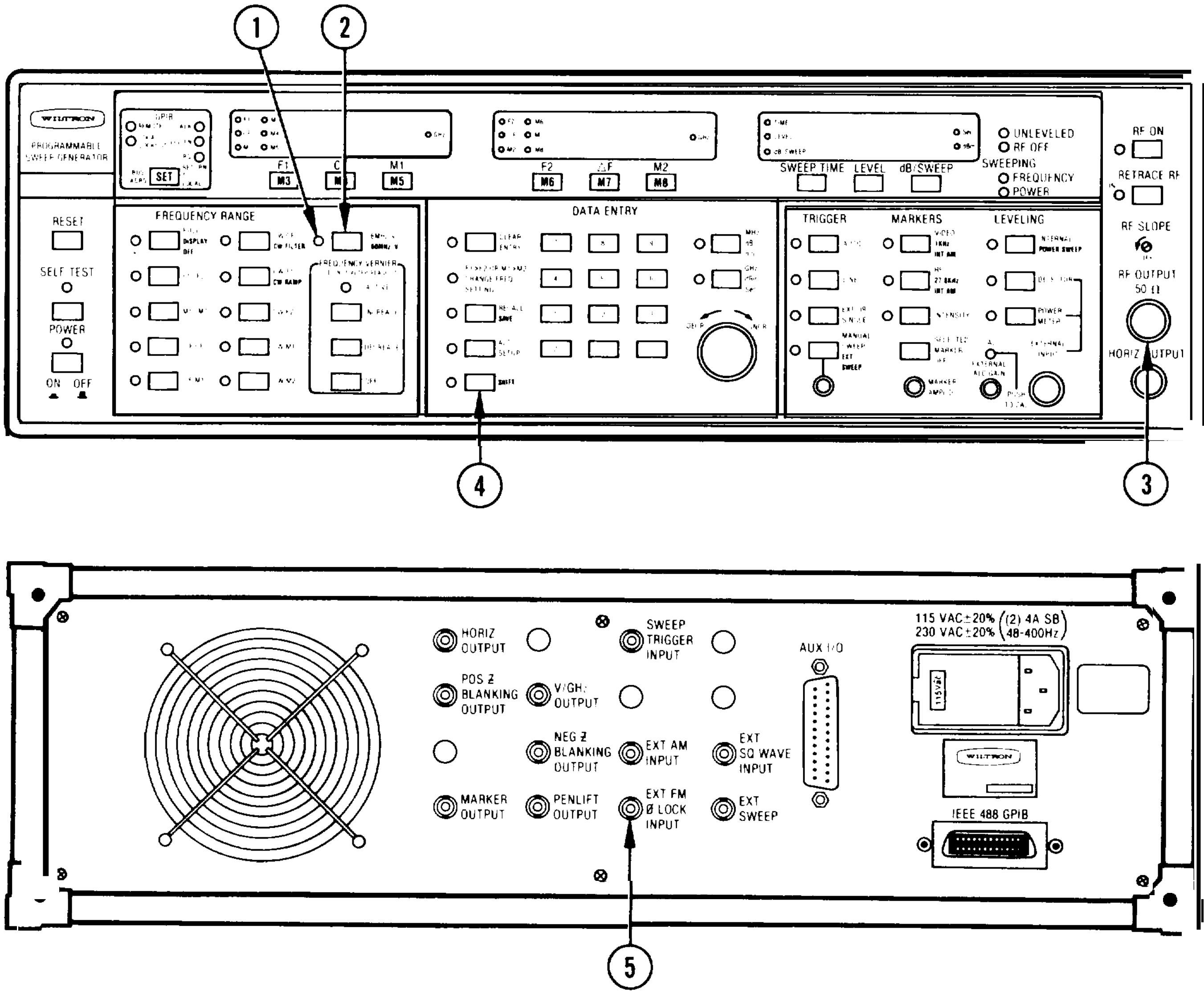
CAUTION

If the output power is allowed to exceed the maximum-input-power capability of the unit-under-test, it could be damaged or destroyed.

9. Sequentially press **SHIFT** (14) then **POWER SWEEP** (8) keys.
10. Observe that SWEEPING POWER (7) indicator blinks to indicate that sweeping is occurring. If a frequency sweep is also selected (para 2-8), both FREQUENCY (5) and POWER (7) SWEEPING indicators blink.
11. If UNLEVELED (6) indicator blinks, sequentially press **SHIFT** (14) then **POWER SWEEP** (8) keys to exit the power-sweep mode.
12. If power goes unleveled, recheck power sweep settings to ensure that high-end excursion of power sweep does not exceed +10 dBm. (Example: a power LEVEL entry of 6 dBm and a dB/SWEEP entry of 5 dB will produce a sweep that reaches +11 dBm on its high-end excursion [6 + 5 = 11]).

2-16. FREQUENCY MODULATION (FM) OPERATION.

The SG-1206 provides for frequency modulating the output frequency.



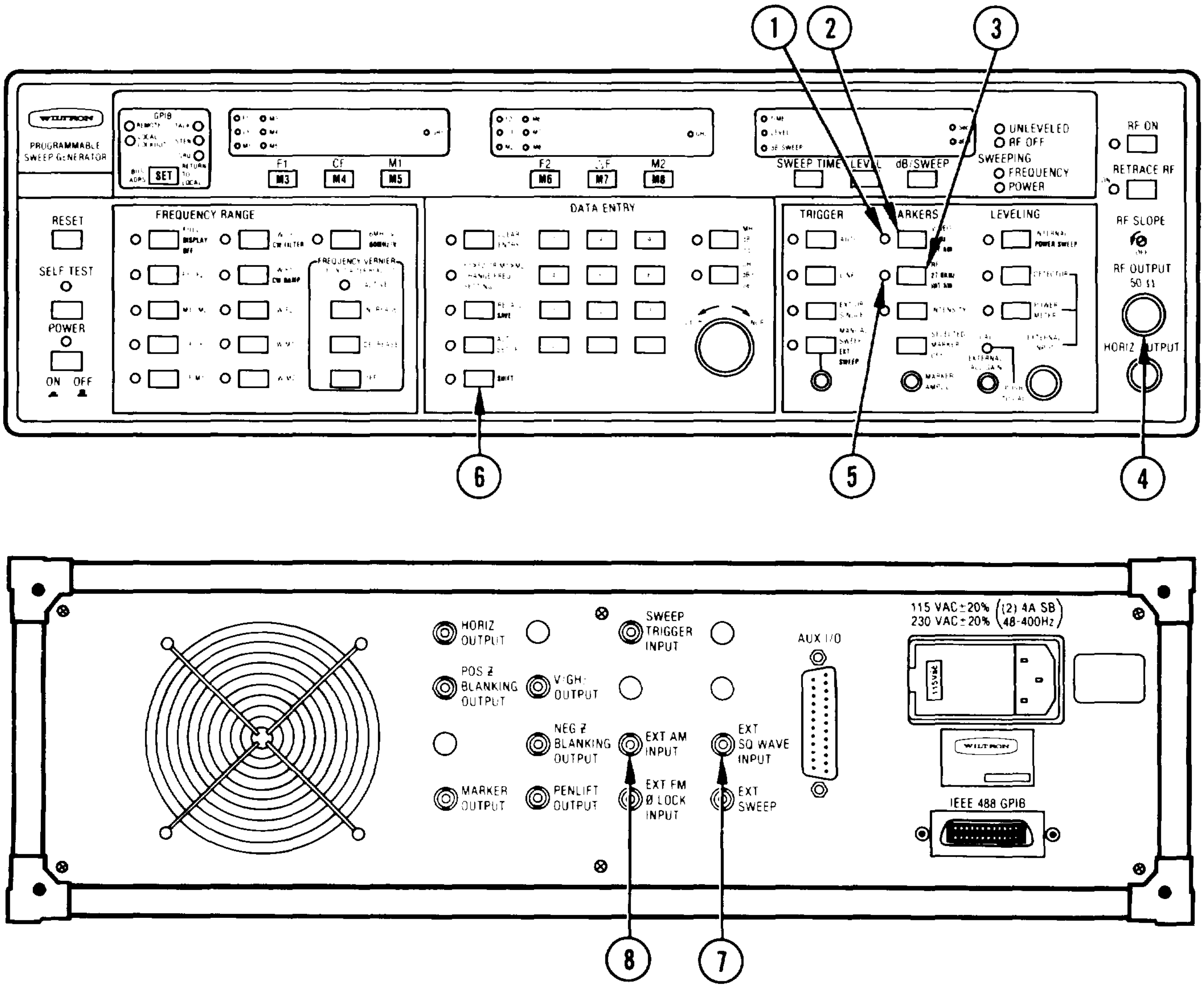
CE1YW025

Perform initial setup procedure (para 2-7).

1. Connect FM signal source to rear panel EXT FM/0LOCK INPUT (5) connector.
2. Set SG-1206 for CW output using any of the five CW modes (para 2-9).
3. For 6 MHz-per-volt FM sensitivity, press -6 MHz/V key (2); observe that associated indicator (1) lights.
4. For 60 MHz-per-volt FM sensitivity, sequentially press **SHIFT (4)** then -60 MHz/V keys (2); observe that associated indicator (1) lights.

2-17. AMPLITUDE MODULATION (AM) OPERATION.

The SG-1206 provides for amplituding modulating the output frequency in any of three ways: external, internal 1 kHz, or internal 27.5 kHz.



CE1YW026

Perform initial setup procedure (para 2-7).

a. To provide external AM, proceed as follows:

1. For linear AM, connect AM signal source to rear panel EXT AM INPUT (8) connector. For on/off AM, connect square-wave input to EXT SQ WAVE INPUT connector (7).
2. Set SG-1206 for CW output using any of the five CW modes (para 2-9).

b. To provide internal 1 kHz squarewave modulation, sequentially press SHIFT (6) then 1 kHz INT AM (2) *keys; observe that associated indicator (1) lights.*

c. To provide internal 27.8 kHz squarewave modulation, sequentially press SHIFT (6) *then 27.8* kHz INT AM (3) *keys; observe that associated indicator (5) lights.*

CHAPTER 3
UNIT MAINTENANCE

Section 1. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

3-1. COMMON TOOLS AND EQUIPMENT.

Common tools and equipment required for unit maintenance of the Sweep Generator SG-1206/U are listed in the Maintenance Allocation Chart (MAC) (Appendix B).

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

There are no special tools, TM DE, or support equipment required.

3-3. REPAIR PARTS.

Repair parts are listed and illustrated in Repair Parts and Special Tools List, TM 11-6625-3231-24P.

Section II. SERVICE UPON RECEIPT

3-4. SERVICE UPON RECEIPT OF MATERIEL.

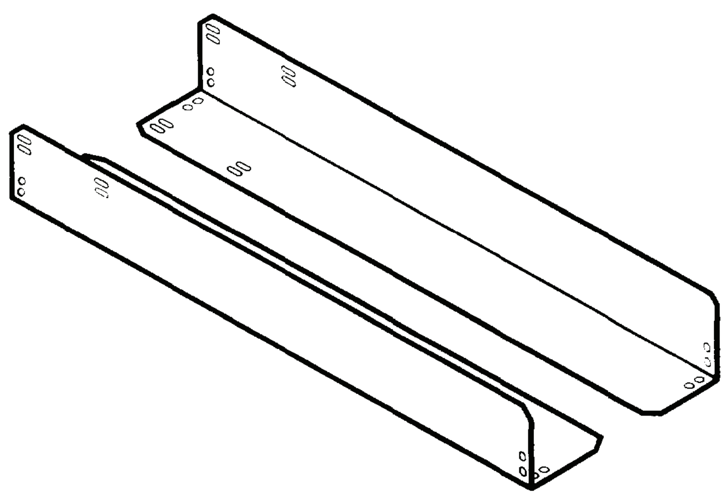
a. Unpacking. Special design reusable packing material inside of the shipping carton provides maximum protection for the Sweep Generator. Avoid damaging carton and packing material during equipment unpacking. Use the following steps for unpacking the Sweep Generator.

- Cut and remove paper sealing tape on carton top and open carton.
- Remove packing foam.
- Remove inner packing container by either turning shipping carton upside down or lifing inner container up and out.

- Cut and remove protective aluminum foil from inner packing container.
- Cut and remove paper sealing tape on carton top and open carton.
- Grasp Sweep Generator firmly, and while restraining packing carton, lift up and out of packing carton.
- Remove the packing foam and two cabinet-mounting angle-brackets (fig. 3-1).
- Place Sweep Generator on a suitable flat clean and dry surface.
- Remove protective plastic bag.
- Place desiccant bags back inside protective plastic bag, and place plastic bag inside of shipping carton.
- Return shipping carton to supply system.

b. Checking Unpacked Equipment.

- Inspect the equipment for damage incurred during shipment. If the shipment 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 750-8.



CE1YW036

Figure 3-1. Cabinet-Mounting Angle-Brackets

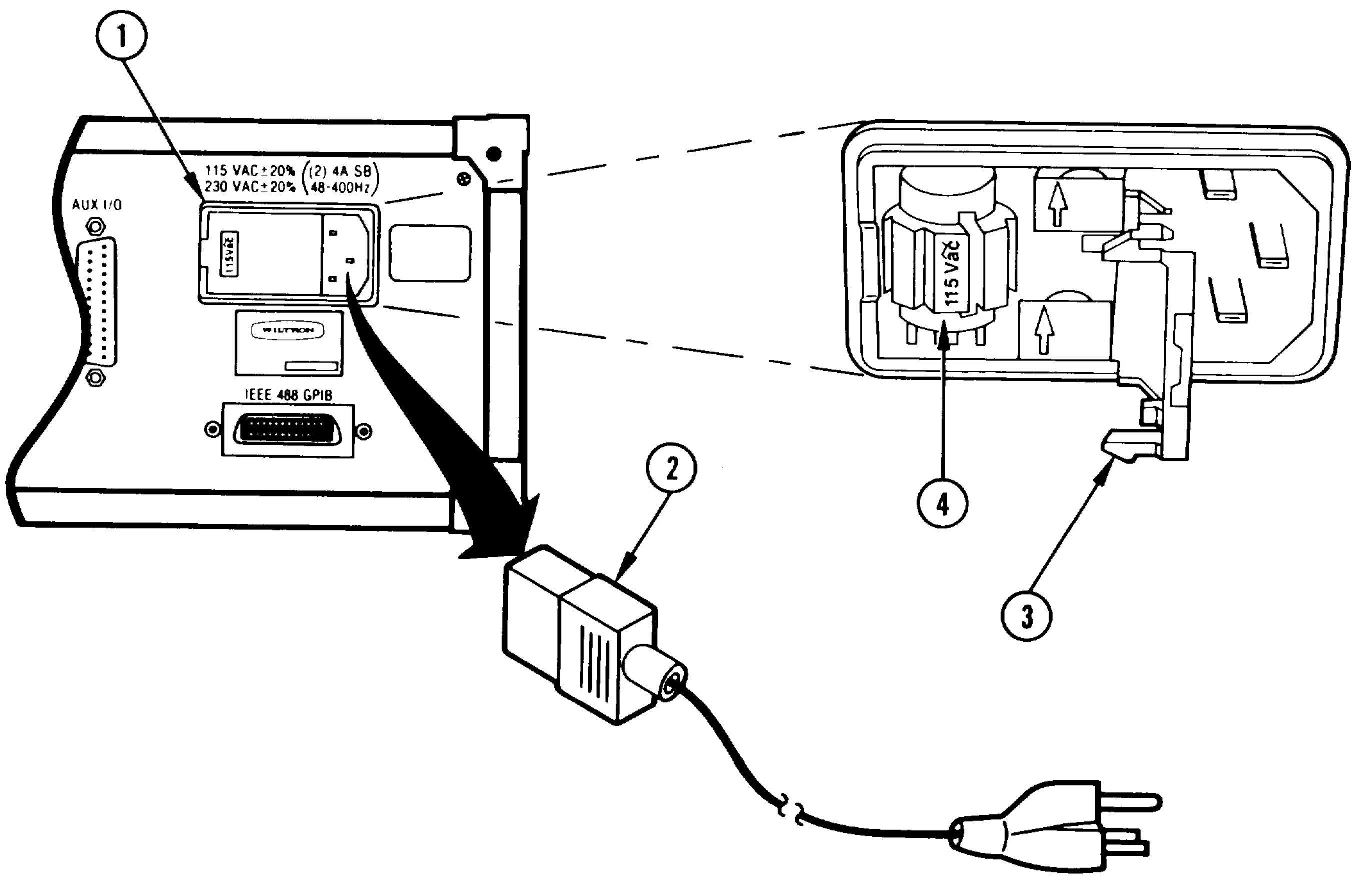
3-5. PRELIMINARY SERVICING AND ADJUSTMENT OF EQUIPMENT.

a. Inspect rear panel line module to ensure that SG-1206 is set correctly (115 Vac or 220 Vat). If incorrectly set, change to correct line-voltage value using following procedure.

- On line module (l), remove line cord (2) and pry cover (3) open.
- Remove voltage-selector drum (4) by pulling staight out.
- Rotate drum so that desired line-voltage marking faces out; then reinstall drum.
- Close cover (3), and reinstall line cord (2).

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

c. If the SG-1206 is to be rack mounted, use the two cabinet-mounting angle-brackets (fig. 3-1) to provide a mounting surface. These angle brackets are intended for use with many different types of equipment racks. Specific installation procedures depend on the type of equipment rack in which the SG-1206 is to be installed. A generalized procedure is given in paragraph 3-14.



CE1YW027

Section iii. TROUBLESHOOTiNG

SYMPTOM INDEX

3-6. TROUBLESHOOTING TABLE.

Table 3-1 lists common malfunctions which you may find during operation or maintenance of the SG-1206. You should perform corrective actions in the order listed.

This manual cannot list all malfunctions that may occur, nor all corrective actions. If a malfunction is not listed, or is not corrected by listed corrective actions, notify your supervisor.

Table 3-1. Troubleshooting

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

1. SG-1206 WILL NOT TURN ON.

Step 1. Check fuse and fuseholder (para 3-7).

- Replace faulty component.

Step 2. Check to see if power is available at power receptacle.

- Move to a working receptacle.

Step 3. Check power cable.

- Replace faulty component.
- Notify next higher level of maintenance.

2. SG-1206 QUITS DURING OPERATION.

Step 1. Perform malfunction No. 1.

Table 3-1. Troubleshooting (Continued)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

Step 2. Allow the SG-1206 to cool and then try operating.

- If SG-1206 operates normally, check air filter. Clean or replace (para 3-9) as required.
- If SG-1206 does not operate, notify next higher level of maintenance.

3. ERROR CODE (OR CODES) IS (ARE) DISPIAYED ON FRONT PANEL.

Press SELF TEST key.

- if error code(s) does not repeat, resume normal operation.
- If error code(s) remains, notify next higher level of maintenance.

4. F1>F2 OR M1>M2 CHANGE FREQ SETTING INDICATOR FLASHES.

Check to see that the F1 or MI frequency is lower than the F2 or M2 frequency.

- Reset respective F1 or MI frequency to be lower than F2 or M2 frequency (para 2-8).
- If error remains, notify next higher level of maintenance.

5. CLEAR ENTRY INDICATOR LIGHTS OR FLASHES.

Check that value being entered for selected parameter is within parameter's range.

- Press CLEAR ENTRY key and re-enter value.
- If error remains, notify next higher level of maintenance.

6. UNLEVELED INDICATOR LIGHTS OR FLASHES.

Step 1. For the type of leveling used, check that appropriate INTERNAL, DETECTOR, or POWER METER indicator is lit,

- If indicator not lit, press appropriate INTERNAL, DETECTOR, or POWER METER key.
- If error remains, notify next higher level of maintenance.

Step 2. Check that output power does not exceed specified rating (+13 dBm, 10 MHz to 2 GHz; +10 dBm, 2.01 to 18 GHz; +7 dBm, 18.01 to 20 GHz).

- Reset power level to not exceed specified rating.
- If error remains, notify next higher level of maintenance.

Table 3-1. Troubleshooting (Continued)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

Step 3. Check that upper value of power sweep does not exceed specified power ing. To determine whether this condition exists:

(1) Press dB/SWEEP key and record displayed power-level value.
(2) Press LEVEL key and record displayed power-level value.
(3) Add the step (1) value to step (2) value.

- Change power level value so that it does not exceed specified leveled-power rating (para 2-13 or 2-14).
- If malfunction remains, notify next higher level of maintenance.

Step 4. Step 4. Check that a Δ F CF or Δ F MI sweep does not exceed 20 GHz. To determine whether this condition exists:

(1) Press appropriate CF or MI key and record displayed frequency value.
(2) Press Δ F key and record displayed frequency value.
(3) Divide the step (2) value by 2 and add to the step (1) value.

- Change either the Δ F value or the CF or MI value so that the Δ F CF or Δ F MI sweep does not exceed 20 GHz.
- IIf malfunction remains, notify next higher level of maintenance.

7. RF OFF INDICATOR IS LIT.

Check whether RF ON indicator is lit.

- If not lit, press RF ON key.
- If malfunction remains, notify next higher level of maintenance.

8. PRESSING FRONT PANEL KEY DOES NOT PRODUCE PROPER RESPONSE.

Step 1. Check that LOCAL LOCKOUT indicator is not lit.

- Refer to Appendix E.

Step 2. Press RESET key.

- If malfunction remains, notify next higher level of maintenance.

9. FREQUENCY DISPLAYS ARE BLANK.

Press RESET key.

- If frequency displays return, SG-1206 was in Secure Mode (para 2-11) operation.
- If malfunction remains, notify next higher level of maintenance.

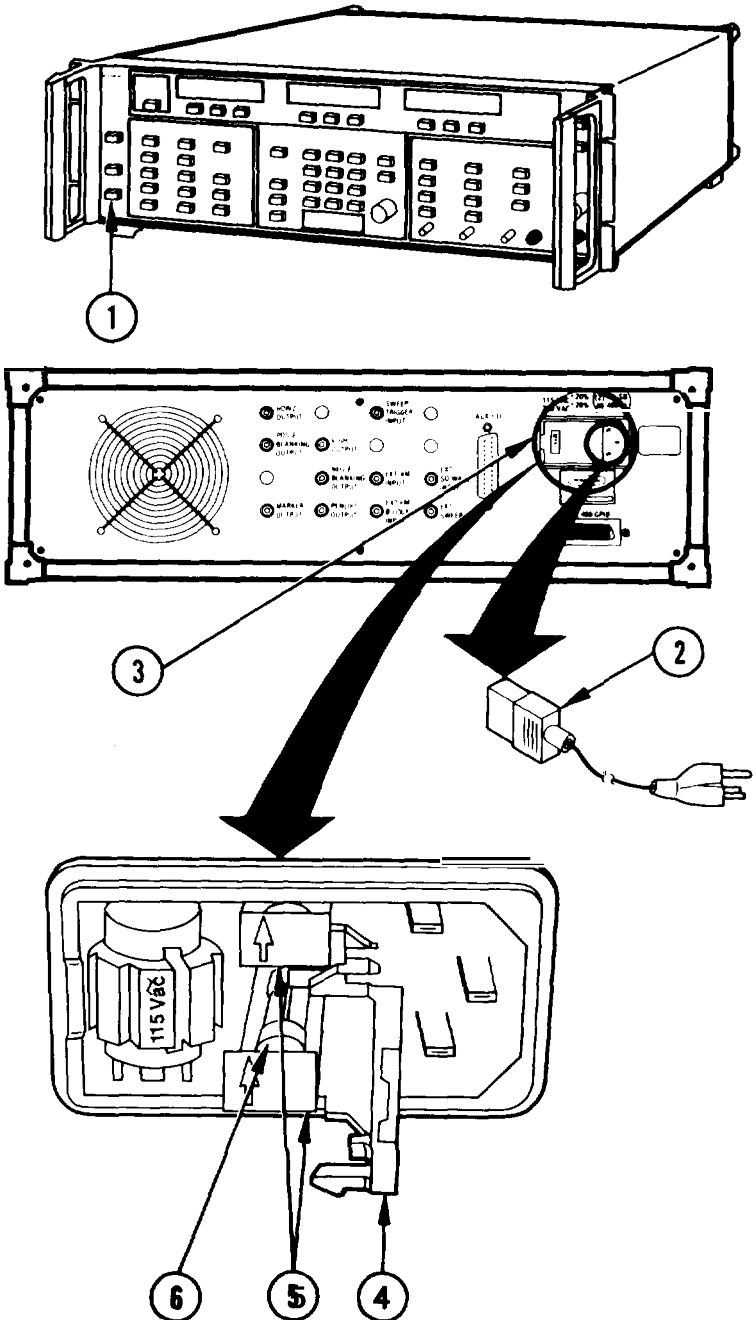
Section IV. MAINTENANCE PROCEDURES.

3-7. REPLACE FUSE.

DESCRIPTION

This procedure covers: Remove. Install.

REMOVE



CE1YW028

1. On front panel, press POWER key (1) to OFF.
2. From rear panel, unplug power cable (2) from power outlet and pull out of instrument.
3. On line module (3), gently pry open fuse holder cover (4).
4. Grasp top and bottom fuse holders (5) and pull them straight out.
5. Remove fuse (6) from fuse holder.

INSTALL

1. Insert fuse (6) into fuse holder (5). Fuse rating is 4A slow blow for both fuses.
2. On rear panel, push fuse holder (arrow pointing up) into slots in line module (3).
3. Push fuse holder cover all the way down until it snaps shut.
4. Connect power cable (2) to instrument, and plug into power source.

END OF TASK

3-8. REPLACE INCREASE/DECREASE KNOB.

DESCRIPTION

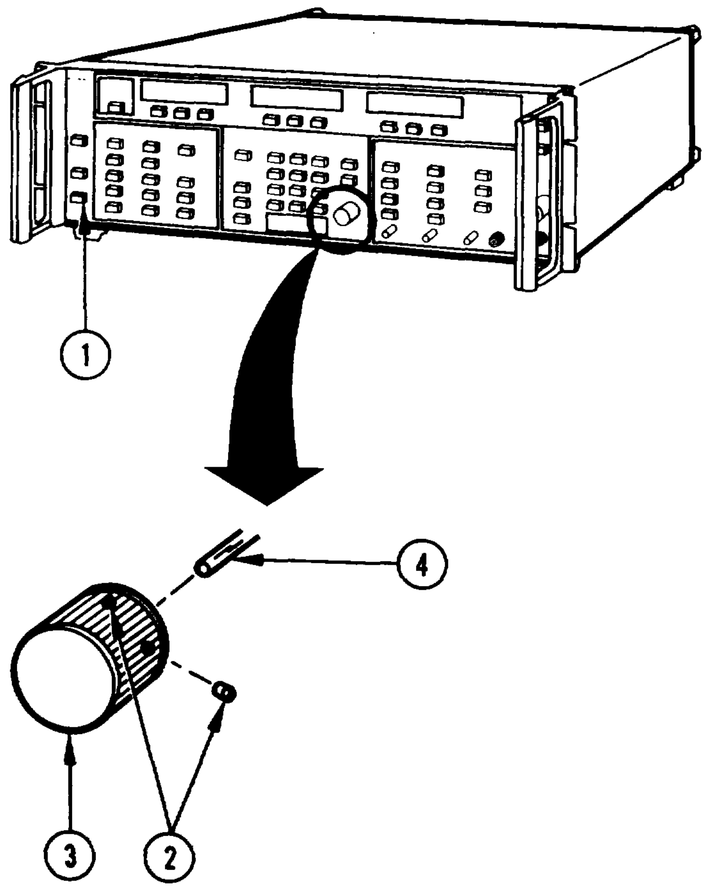
This procedure covers: Remove. Install.

REMOVE

1. On front panel, set POWER key (1) to OFF.
2. On front panel, loosen both hex screws (2) in knob (3) by turning the hex screws counterclockwise.
3. Pull knob off shaft (4).

INSTALL

1. Place knob (3) onto shaft (4).
2. Tighten both hex screws (2) by turning them clockwise.



CE1YW029

END OF TASK

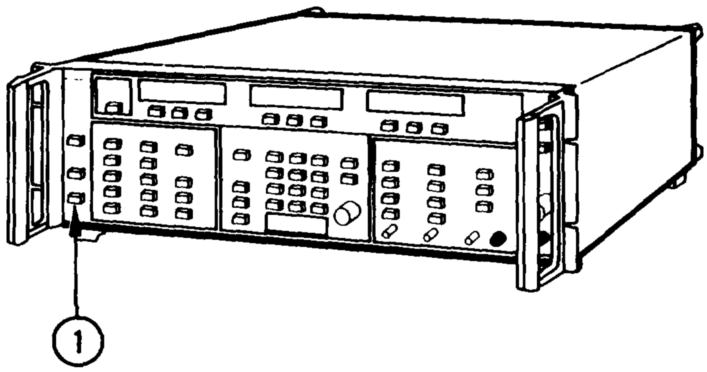
3-9. REPLACE AIR FILTER AND/OR FAN GUARD.

DESCRIPTION

This procedure covers: Remove. Install.

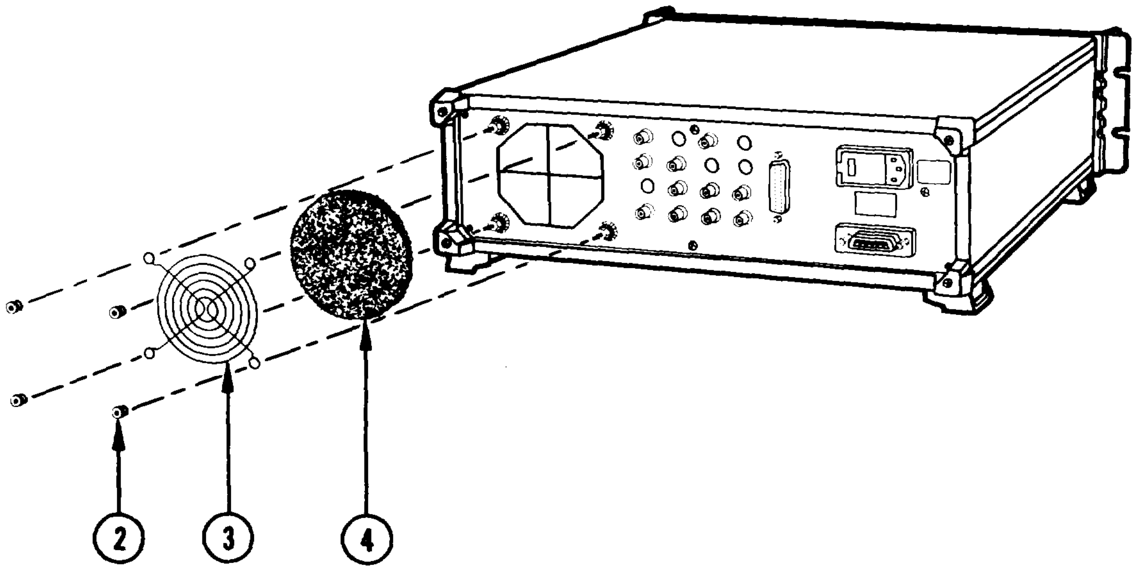
REMOVE

1. On front panel, press POWER key (1) to OFF, and unplug power cable from power outlet.
2. ‘Turn thumbnuts (2) counterclockwise and remove fan guard (3).
3. Remove air filter (4).



INSTALL

1. Position air filter (4) behind fan guard (3).
2. Install thumbnuts (2) and tighten by turning clockwise.



CE1YW030

END OF TASK

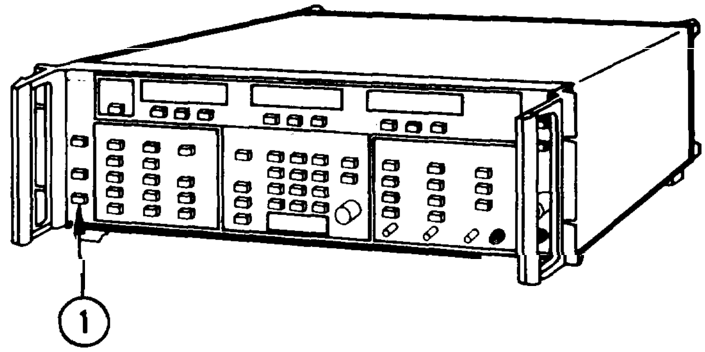
3-10. REPLACE REAR FEET.

DESCRIPTION

This procedure covers: Remove. Install.

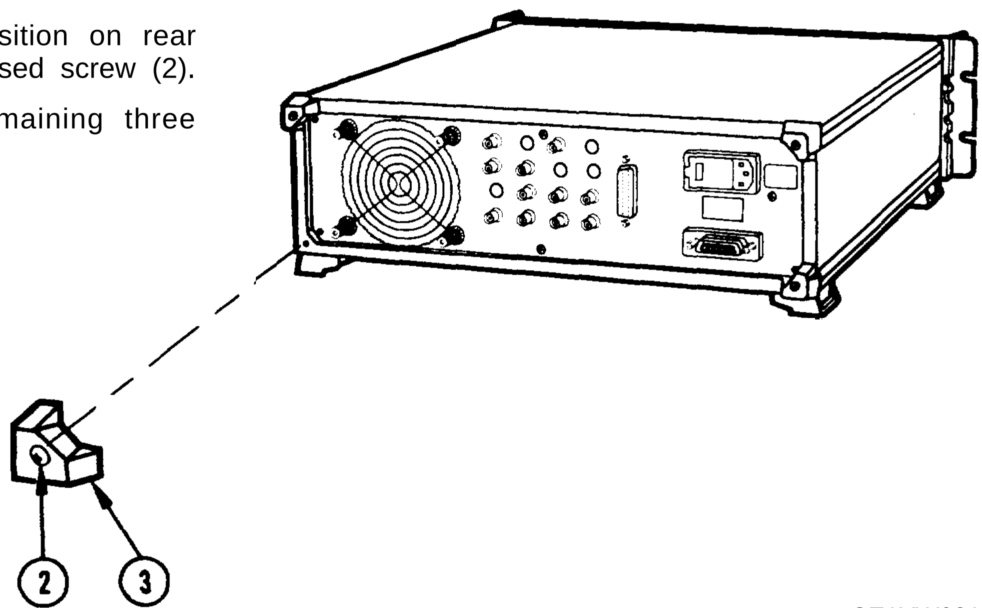
REMOVE

1. On front panel, set POWER key (1) to OFF.
2. On rear panel, loosen recessed screw (2).
3. Remove foot (3) from instrument by pulling it straight away.
4. Repeat steps 2 and 3 for remaining three feet.



INSTALL

1. Place foot (3) into position on rear panel and tighten recessed screw (2).
2. Repeat step 1 for remaining three feet.



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END OF TASK

3-11. REPLACE MANUAL SWEEP, MARKER, AND ALC GAIN KNOBS.

DESCRIPTION

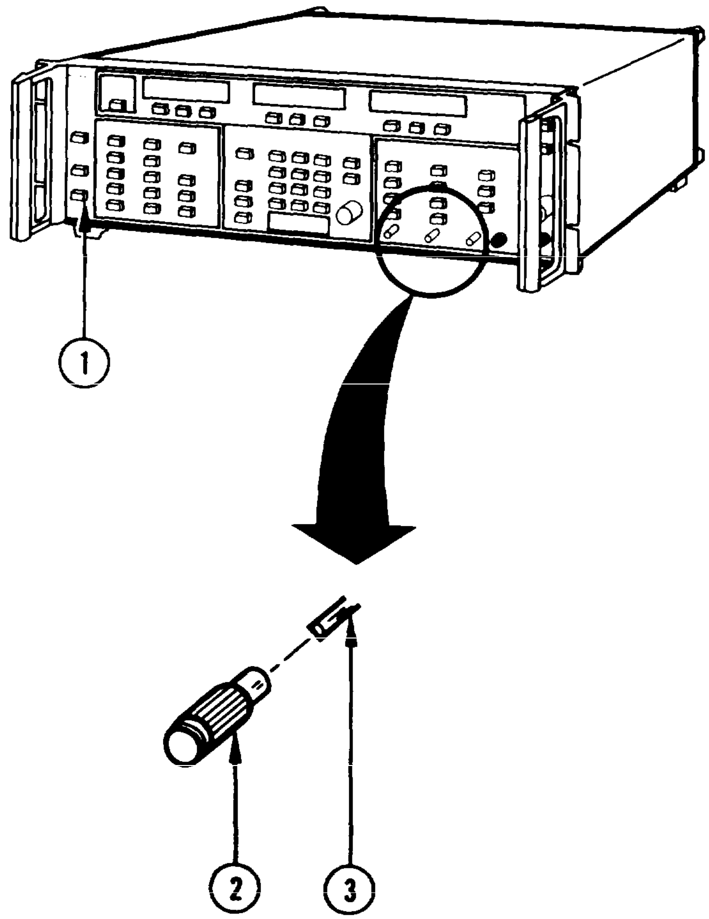
This procedure covers: Remove. Install.

REMOVE

1. On front panel, set POWER switch (1) to OFF.
2. On front panel, grasp knob (2) and pull it off shaft (3).

INSTALL

1. Align knob (2) with shaft (3).
2. Push knob (2) all the way onto shaft (3).



CE1YW032

END OF TASK

3-12. REPLACE FRONT HANDLES.

DESCRIPTION

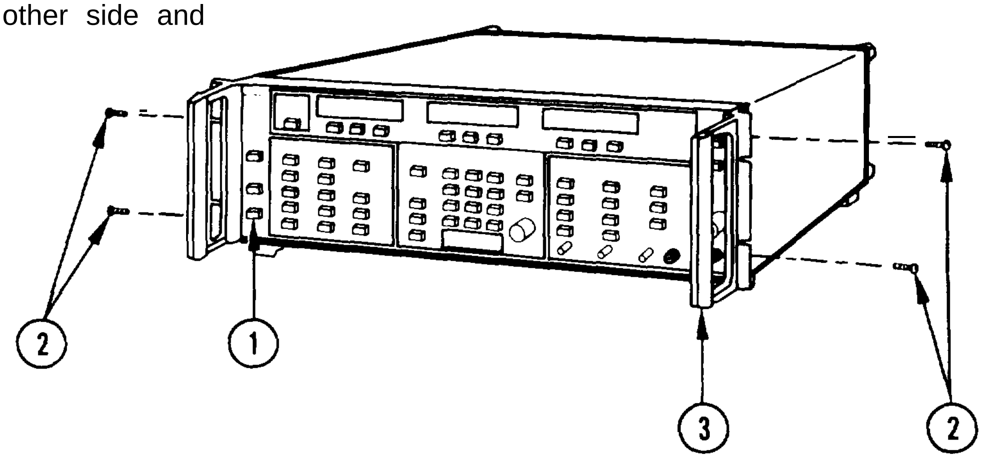
This procedure covers: Remove. Install.

REMOVE

1. On front panel, press POWER switch (1) to OFF.
2. Turn instrument on its side.
3. Remove screws (2) from handle(3).
4. Turn instrument onto its other side and repeat step 3.

INSTALL

1. Place instrument on its side.
2. Fasten handle (3) to frame. Install and tighten screws (2).
3. Turn instrument on its other side and repeat step 2.



CE1YW033

END OF TASK

3-13. REPLACE FRONT PANEL KEY CAPS.

DESCRIPTION

This procedure covers: Remove. Install,

NOTE

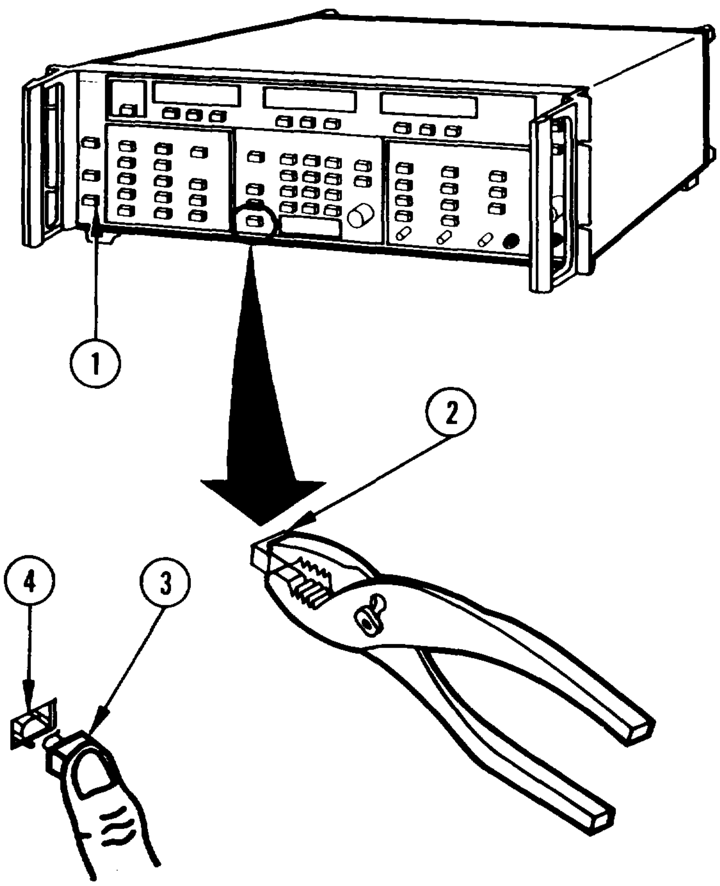
Procedure shown is representative for all key caps.

REMOVE

1. On front panel, press POWER switch (1) to OFF.
2. Carefully pull key cap (2) straight away from actuator.

INSTALL

1. Align key cap (3) onto the switch actuator.
2. Press the new key cap (3) until it seats full on the switch actuator (4).
3. Check the key for free movement and proper operation.



CE1YW034

END OF TASK

3-14. INSTALL CABINET-MOUNTING ANGLE-BRACKETS.

DESCRIPTION

This procedure covers: Install.

PRELIMINARY

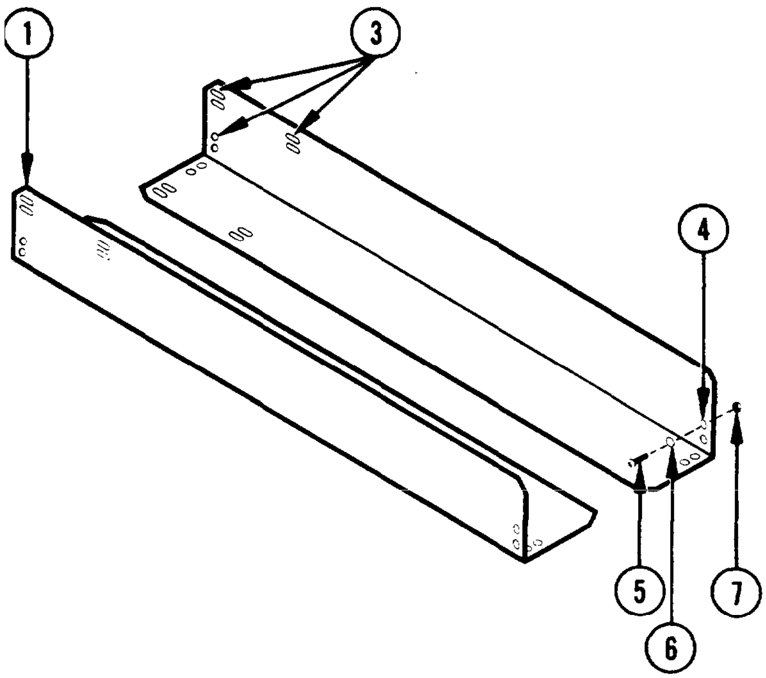
1. Procure eight #10 machine screws, split lockwashers, nuts and washers.
2. Prepare the equipment rack by making holes that will align with the front pair and one of the three pairs of rear holes in the angle-bracket.

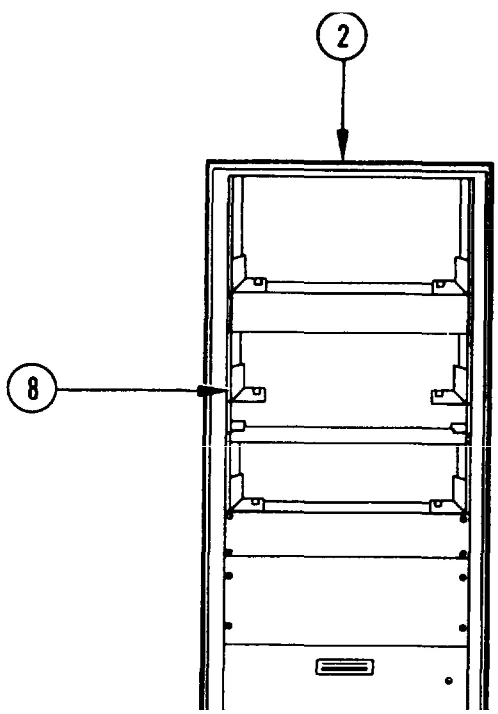
INSTALL

1. Orient brackets (1) to form a left and right pair, as shown. The ends having the slotted holes are the rear.
2. Insert rear of left or right bracket into equipment cabinet (2).
3. Position bracket so that a set of rear holes (3) and the set of front holes (4) align with holes in the equipment rack.
4. Secure bracket using screw (5), lock-washer (6), and nut (7) in two front and two rear holes.
5. Install remaining angle-bracket as described in steps 2 thru 4, above,
6. Position SG-1206 into opening formed by the two angle-brackets (8). No mounting hardware is required.

NOTE

The SG-1206 is intended to rest, on its bottom feet, on the horizontal surface of the angle-brackets.





END OF TASK

CE1YW035

Section V. PREPARATION FOR STORAGE OR SHIPMENT

3-15. PACKAGING.

Package the SG-1206 in original shipping container. When using packing material other than original, use following guidelines.

- Wrap SG-1206 in plastic packing material.
- Use double-walled cardboard shipping container.
- Protect all sides with shock-absorbing material to prevent SG-1206 from moving within container.
- Seal shipping container with approved sealing tape.
- Mark "FRAGILE" on all sides—plus top and bottom—of shipping container.

3-16. 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 any portion of the associated self test fails, notify next higher level of maintenance.

3-17. ENVIRONMENT.

SG-1206 should be stored in clean, dry environment. In high humidity environments, protect SG-1206 from temperature variations that could cause internal condensation. The following environmental conditions apply to both shipping and storage.

Temperature	-40° C to +70°C (-40°F to +167°F)
Relative Humidity	.95% ±5%, 10°C to 30°C (50°F to 86°F)
	75% ±5%, 30°C to 40°C (86°F to 104°F)
	45%±5%, 40°C to 50°C (104°F to 122°F)
Altitude	0 to40,000ft

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 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

Unit and Intermediate Direct Support and General Support Repair Parts and Special Tools List, for Sweep Generator SG-1206/U....... TM 11-6625-3231-24P

A-4. MISCELLANEOUS.

Abbreviations for Use on Drawings, Specifications, Standards and in Technical Documents MIL-STD-12

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

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

First Aid....... FM 4-25.11

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

The Army Maintenance Management System (TAMMS) .... DA Pam 750-8

APPENDIX B
MAINTENANCE ALLOCATION CHART (MAC)

INTRODUCTION

The Army Maintenance System MAC

This introduction provides a general explanation of all maintenance and repair function authorized at the two maintenance levels under the Two-Level Maintenance System concept.

This MAC (immediately following the introduction) 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 levels, which are shown on the MAC in column (4) as:

> Field – includes two columns, Unit maintenance and Direct Support maintenance. The Unit maintenance column is divided again into two more subcolumns, C for Operator or Crew and O for Unit maintenance.
> Sustainment – includes two subcolumns, general support (H) and depot (D).

The tools and test equipment requirements (immediately following the MAC) list the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from the MAC.

The remarks (immediately following the tools and test equipment requirements) contain supplemental instructions and explanatory notes for a particular maintenance function.

Maintenance Functions

Maintenance functions are limited to and defined as follows:

1. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g. by sight, sound, or feel). This includes scheduled inspection and gagings and evaluation of cannon tubes.

2. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards on a scheduled basis, i.e., load testing of lift devices and hydrostatic testing of pressure hoses.

3. Service. Operations required periodically to keep an item in proper operating condition; e.g., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases. This includes scheduled exercising and purging of recoil mechanisms. The following are examples of service functions:

   a. Unpack. To remove from packing box for service or when required for the performance of maintenance operations.
   b. Repack. To return item to packing box after service and other maintenance operations.
   c. Clean. To rid the item of contamination.
   d. Touch up. To spot paint scratched or blistered surfaces.
   e. Mark. To restore obliterated identification.

4. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.

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

6. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments of test, measuring, and diagnostic equipment used in precision measurement. 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.

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

8. Paint. To prepare and spray color coats of paint so that the ammunition can be identified and protected. The color indicating primary use is applied, preferably, to the entire exterior surface as the background color of the item. Other markings are to be repainted as original so as to retain proper ammunition identification.

9. Replace. To remove an unserviceable item and install a serviceable counterpart in its place "Repair" is authorized by the MAC and assigned maintenance level is shown as the third position code of the Source, Maintenance and Recoverability (SMR) code.

10. Repair. The application of maintenance services, including fault location/troubleshooting, removal/installation, disassembly/assembly procedures and maintenance actions 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), end item or system.

NOTE

The following definitions are applicable to the "repair" maintenance function:

Services. Inspect, test, service, adjust, align, calibrate, and/or replace.
Fault location/troubleshooting. The process of investigating and detecting the case of equipment malfunctioning; the act of isolating a fault within a system or Unit Under Test (UUT).
Disassembly/assembly. The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant).
Actions. Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

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

12. 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 (e.g., hours/miles) considered in classifying Army equipment/components.

APPENDIX B
MAINTENANCE ALLOCATION CHART (MAC)

Explanation of Columns in the MAC

Column (1) Group Number, Column (1) lists FGC numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the Next Higher Assembly (NHA).

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

Column (3) Maintenance Function. Column (3) lists the functions to be performed on the item listed in column (2). (For a detailed explanation of these functions, refer to “Maintenance Functions” outlined above).

Column (4) Maintenance Level. Column (4) specifies each level of maintenance authorized to perform each function listed in column (3), by indicating work time required (expressed as manhours in whole hours or decimals) in the appropriate subcolumn. The work time 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 varies at different maintenance levels, appropriate work time figures are to 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 time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

Field:
- C Operator or Crew maintenance
- O Unit maintenance
- F Direct Support maintenance

Sustainment:
- L Specialized Repair Activity
- H General Support maintenance
- D Depot maintenance

NOTE

The “L” maintenance level is not included in column (4) of the MAC. Functions to this level of maintenance are identified by work time figure in the “H” column of column (4), and an associated reference code is used in the REMARKS column (6). This code is keyed to the remarks and the SRA complete repair application is explained there.

Column (5) Tools and Equipment Reference Code. Column (5) specifies, by code, those common tool sets (not individual tools), common Test, Measurement and Diagnostic Equipment (TMDE), and special tools, special TMDE and special support equipment required to perform the designated function. Codes are keyed to the entries in the tools and test equipment table.

Column (6) Remarks Code. When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks table entries.

APPENDIX B
MAINTENANCE ALLOCATION CHART (MAC)

Table 1. MAC for Sweep Generator SG-1206/U

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL FIELD UNIT C	(4) MAINTENANCE LEVEL FIELD UNIT O	(4) MAINTENANCE LEVEL FIELD DS F	(4) MAINTENANCE LEVEL SUSTAINMENT GS H	(4) MAINTENANCE LEVEL SUSTAINMENT DEPOT D	(5) TOOLS AND EQUIPMENT REFERENCE CODE	(6) REMARKS
00	Sweep Generator SG-1206/U	INSPECT		0.5					A
		TEST		0.1					B
		TEST			2.5			1-11,15,16,22	C
		REPAIR		0.5				16	D
		REPAIR			2.5			1-22,27,28	
		CALIBRATE			6.0			1-22	E
01	Basic Frame Assembly A1	REPAIR			7.0			1-22,27,28	
0101	Ramp Generator CCA A1A2	ADJUST			0.5			2,3,22	
		REPLACE			1.0			2,22	
0102	Markers Generator CCA A1A3	ADJUST			0.5			2,3,22	
		REPLACE			1.0			2,22	
0103	ALC CCA A1A4	ADJUST			3.0			2-7,15,22	
		REPLACE			1.5			2-8,15,22	F
		REPAIR					0.5		G
0104	Frequency Instruction CCA A1A5	ADJUST			2.0			2,3,22	
		REPAIR			2.5			1,2,5,6,15,17-19,22,27	
0105	S/C-Band YIG Driver CCA A1A6	ADJUST			0.5			3	
		REPLACE			1.0			2-6,22	J
		REPAIR					0.5		G
0106	X-Band YIG Driver CCA A1A7	ADJUST			0.5			3	
		REPLACE			1.0			2-6,22	I
		REPAIR					0.5		G
0107	KU-Band YIG Driver CCA A1A8	ADJUST			0.5			3	
		REPLACE			1.0			2-6,22	H
		REPAIR					0.5		G
0108	FM/Attenuator CCA A1A10	ADJUST			0.5			1	
		REPLACE			1.0			2	
0109	Switching Power Supply CCA A1A13	REPAIR			2.0			2,3,13,14,17-19,22,28	
0110	Motherboard CCA A1A14	REPAIR			7.0			2,3,15,17-19,22	
02	Front Panel Assembly A2	REPAIR			5.0			2,3,15	
0201	Front Panel Subassembly A2A1	REPAIR			2.0			2,3,15	
0202	Front Panel CCA A2A11	REPAIR		0.5				24	K
		REPLACE			2.0				
0203	Microprocessor CCA A2A12	REPLACE			2.5			22	
		REPAIR					0.5		G
03	Rear Panel Assembly A3	REPAIR			4.0			3,17,18,22	
04	RF Deck Assembly A4	REPAIR			5.0			1-6,8,15,17-19,22,23	
0401	Step Attenuator A4AT1	REPLACE			2.0			22	
		REPAIR					0.5		G
0402	Directional Coupler A4DC1	REPLACE			2.0			22	L
		REPAIR					0.5		G
0403	PIN Switch A4S1	REPLACE			4.0			22	
		REPAIR					0.5		G
0404	Down Converter A4A1	REPLACE			2.5			22	
		REPAIR					0.5		G
0405	Ku-Band YIG Assembly A4A2	REPLACE			4.0			1-6,15,17-19,22	M
		REPAIR					0.5		G
0406	X-Band YIG Assembly A4A3	REPLACE			4.0			1-6,15,17-19,22	N
		REPAIR					0.5		G
0407	S/C Band YIG Assembly A4A4	REPLACE			4.0			1-6,15,17-19,22	P
		REPAIR					0.5		G

APPENDIX B
MAINTENANCE ALLOCATION CHART (MAC)

Table 2. Tools and Test Equipment for Sweep Generator SG-1206/U

(1) TOOLS OR TEST EQUIPMENT REF CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER	(5) TOOL NUMBER
1	F	Microwave Counter	6625-01-336-1124	5352B
2	F	Oscilloscope	6625-01-470-7541	OS-303/G
3	F	Digital Multimeter	6625-01-221-9367	AN/USM-64D
4	F	RF Power Meter	5895-01-338-7543	4220-S/10, W/51033-S10 AND 51051-S10
5	F	Crystal Detector	6625-00-139-3328	7923182
6	F	Crystal Detector	5961-00-779-1916	7923241
7	F	Function Generator	6625-01-094-7716	145
8	F	Spectrum Analyzer	6625-01-079-9495	AN/USM-489(V)1
9	F	Modulation Meter	6625-01-336-4093	8200-S10
10	F	Power Supply	4931-00-115-0567	MIS-10230
11	F	Coupler, Directional	5985-01-080-5532	11691D OPTION 001
12	F	Variable Autotransformer	6695-01-132-7597	9020F
13	F	Triple Voltage Power Supply		PS503
14	F	30 V DC Power Supply	6695-01-142-4682	7916707
15	F	BNC – BNC Coaxial Cable, 42 in. (2 ea)	5995-00-498-4834	012-0057-01
16	F	N – N Coaxial Cable	5995-00-477-1440	012-0114-00
17	F	Test Lead, Red, test Clip to Stacking Banana Plug (2 ea)	6625-00-537-4338	37821 RED
18	F	Test Lead, Black, Test Clip to Stacking Banana Plug (2 ea)	6625-00-581-6338	3782-12-0
19	F	Adapter, BNC Female to Double Banana Plug (2ea)	6625-00-053-9454	1269
20	F	Adapter, BNC-Tee	5935-01-174-6967	3285
21	F	Termination, BNC Feed-thru	5985-01-080-7338	4119-50
22	F	Tool Kit, Electronic Equipment	5180-01-073-3845	JTK-17AL
23	F	Torque Wrench		C90-8-5/16
24	O	Tool Kit, Electronic Equipment	5180-00-064-5178	TK-101/G
25	F	Signature Analyzer	6625-01-068-8641	5004A-120
26	F	Logic Probe	6625-01-047-7309	545A
27	F	CCA Extender	5998-01-372-9396	660-D-8062-3
28	F	Test Connector Assembly		

APPENDIX B
MAINTENANCE ALLOCATION CHART (MAC)

Table 3. Remarks for Sweep Generator SG-1206/U

REMARKS CODE	REMARKS
A	Visual inspection.
B	Self test.
C	Performance test.
D	Repair limited to replacement of front panel knobs, front handles, power cord, rear panel fuse, rear feet, and air filter/fan guard.
E	Calibration in accordance with the technical bulletin listed in TB 43-180.
F	Also replace A4DC1 Directional Coupler.
G	Time indicated is the allotment for the Depot to ship the defective assembly/parts to the contractor service center for repair/exchange.
H	Also replace A4A2 Ku-Band YIG Assembly.
I	Also replace A4A3 X-Band YIG Assembly.
J	Also replace A4A4 S/C-Band YIG Assembly.
K	Repair limited to replacement of push buttons (key caps).
L	Also replace A1A4 ALC CCA.
M	Consists of A4A2G1 Ku-Band YIG Oscillator, and A4A2Q1, A4A2Q2, and A4A3Q3 Power Transistors. Also replace A1A8 Ku-Band YIG Driver CCA.
N	Consists of A4A3G1 X-Band YIG Oscillator, and A4A3AT1 Isolator, and A4A3Q1, A4A3Q2, and A4A3Q3 Power Transistors. Also replace A1A7 X-Band YIG Driver CCA.
O	Consist of A4A4G1 S/C-Band YIG Oscillator and A4A4U1 Match Modulator, and A4A4Q1, A4A4Q2, and A4A4Q3 Power Transistors. Also replace A1A6 S/C-Band YIG Driver CCA.

APPENDIX C
COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST

Section 1. INTRODUCTION

C-1. SCOPE.

This appendix lists components of end item and basic issue items for the SG-1206 to help you inventory items required for safe and efficient operation.

C-2. GENERAL.

The Components of End Item and Basic Issue Items Lists are divided into the following sections:

a. *Section II. Components of End Item.* This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed and 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 III. Basic Issue /terns.* These are the minimum essential items required to place the SG-1206 in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the SG-1206 during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

C-3. EXPLANATION OF COLUMNS.

The following provides an explanation of columns found in the tabular listings:

a. *Column (1) - Illustration Number (lllus Number).* Indicates the number of the illustration n which the end item is shown.

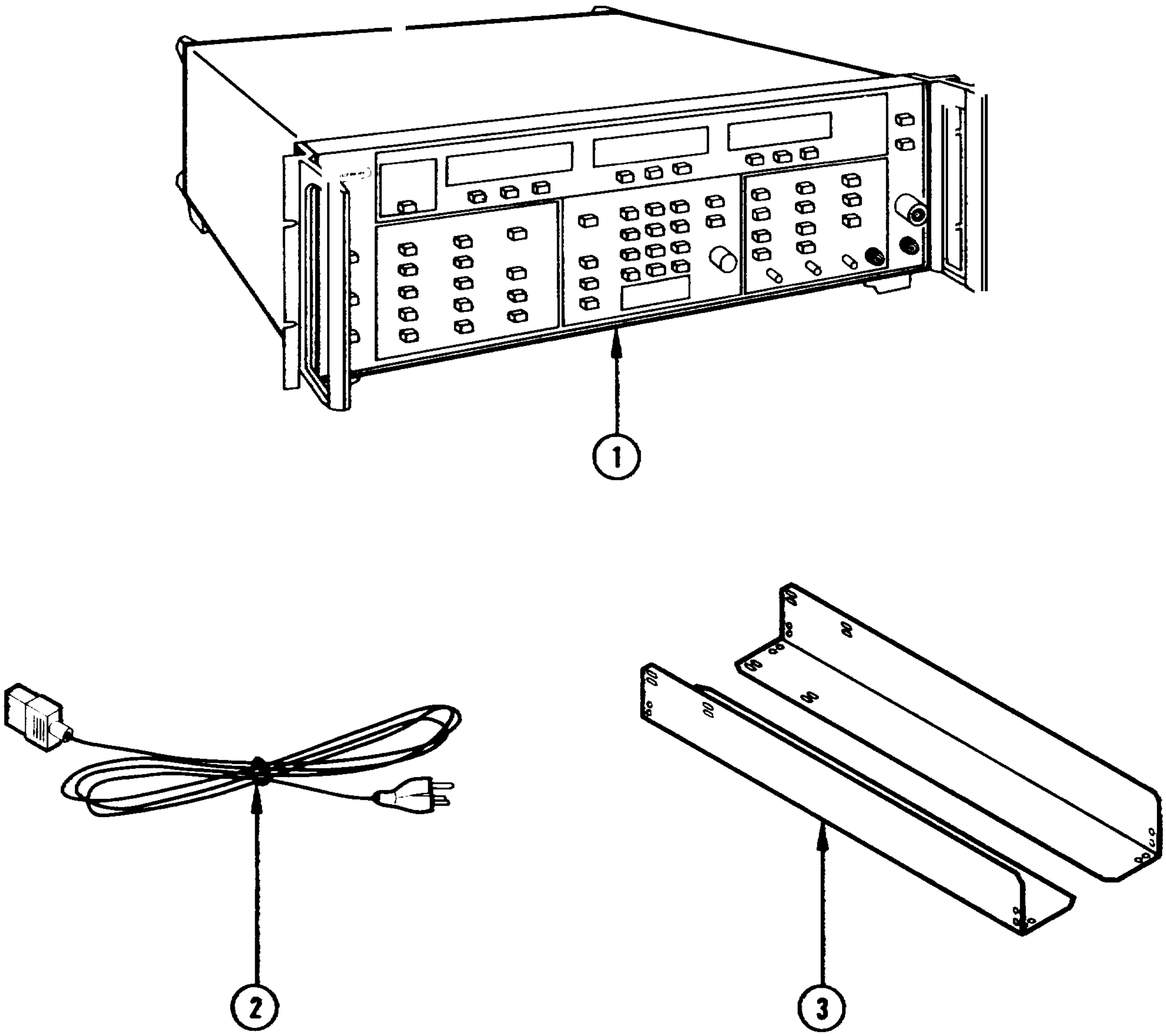
b. *Column (2) - National Stock Number.* Indicates the national stock number assigned to the item and will be used for requisition purposes.

c. *Column (3) - Description.* 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 FSCM (in parentheses) followed by the part number.

d. *Column (4) - Unit of Measure (UAW).* Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e. g., ea, in, pr).

e. Column (5) - *(Quantity Required (Qty Rqr).* Indicates the quantity of the item authorized to be used with/on the equipment.

Section II. COMPONENTS OF END ITEM



CE1YW037

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, FSCM, AND PART NUMBER	(4) U/M	(5) QTY AUTH
1		Sweep Generator (20944), 6647M	EA	1
2		Wire, Power Cord, 3 Conductor, 18 AWG; (16428), 17251	EA	1
3		Cabinet-Mounting Angle-Brackets (20944), D35582	EA	2

APPENDIX D

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D- 1. SCOPE.

This appendix lists expendable supplies you will need for general support maintenance on SG-1206. These items are authorized to you by CTA 50-970, Expendable items (Except Medical, Class V, Repair Parts, and Heraldic Items).

D- 2. EXPLANATION OF COLUMNS.

a. Column (l)—Item 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 Commercial And Government Entity (CAGE) 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	(5) UN
1	C	8305-00-267-3015	Cloth, Cheesecloth, Cotton, Lintless, CCC-C-440, Type II, Class 2 (81349)	YD
2	C	6810-00-753-4993	Alcohol, Isopropyl, 8OZ. Can, TT-I-735, Grade A (81349)	OZ
3	C	7930-00-066-1669	Detergent, Mild, Liquid	OZ

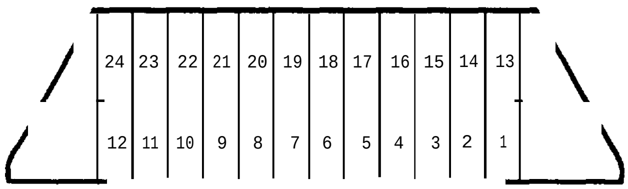
APPENDIX E
GPIB OPERATION

Section i. INTRODUCTION

E-1. GPIB SETUP AND INTERCONNECTION.

The SG-1206 is capable of providing automated microwave measurements via the IEEE-488 Bus (GPIB). Specific GPIB information, including interface connections, cable requirements, and addressing instructions, is contained in subparagraphs a thru d, below.

a. Interface Connector. Interface between the SG-1206 and other devices on the GPIB is via a 24-wire interface cable. The interface cable has a connector shell on each end that contains two connector faces. These double-faced connectors allow for parallel connection of two or more cables to a single device. The connector pinout is shown below.



CE1YW038

GPIB Connector Pin Assignments

Pin	Signal Line	Pin	Signal Line	Pin	Signal Line
1	DIO 1	7	NRFD	13	DIO 5
2	DIO 2	8	NDAC	14	DIO 6
3	DIO 3	9	IFC	15	DIO 7
4	DIO 4	10	SRQ	16	DIO 8
5	EOI	11	ATN	17	REN
6	DAV	12	Chassis Ground	18 thru 24	Logic Ground

b. Cable Length Restrictions. The GPIB can accommodate up to 15 instruments at any one time. To achieve design performance on the bus, the proper timing and voltage-level relationships must be maintained. If either the cable length between separate instruments or the accumulated cable length between all instruments is too long, the data and control lines cannot be driven properly and the system may fail to perform. Cable length restrictions are as follows:

- No more than 15 instruments may be installed on the bus.
- Total accumulative cable length in meters may not exceed twice the number of bus instruments, or 20 meters—whichever is less.

c. GPIB /interconnection. The only interconnection required for GPIB operation is between the SG-1206 and the bus controller.

d. GPIE? Address. The SG-1206 leaves the factory preset to address 5. If a different address is desired, it can be set using the front panel SET key and keypad (fig. 2-1, key 5A).

Section ii. OPERATION AND COMMAND CODES

E-2. GPIB OPERATION.

All front panel control functions can operate via the GPIB. When used on the GPIB, the Sweep Generator functions as both a listener and a talker.

To provide bus control, a system of device-dependent commands (hereafter known as bus commands) and IEEE-488 Bus Messages (hereafter known as bus messages) is used. The bus commands (approximately 100 in number) are divided into the following six classes:

1. Front Panel Control Related Commands.
2. Digital Sweep Commands.
3. Group Execute Trigger Mode Commands.
4. Service Request Mode Commands,
5. Output Commands.
6. Miscellaneous Commands.

A command string is discussed in paragraph E-3, the six classes of commands are described in paragraphs E-4 thru E-9 respectively. The bus messages recognized by the Sweep Generator are discussed in paragraph E-10. In addition to bus commands and bus messages, the three types of errors that can occur with bus programming are discussed in paragraph E-n. The Sweep Generator's default from-reset-or-turn-on states are described in paragraph E-12. An alphabetical index to bus command mnemonics is provided in paragraph E-13.

E-3. COMMAND STRING.

This paragraph provides a definition of a command string, as it applies to the SG-1206, and a discussion on facts to be aware of when sending a command string over the bus.

a. Definition. A command string is a string of commands sent over the bus and terminated by an end message. The SG-1206 firmware recognizes the following messages.

- A carriage return (ASCII 13).
- A carriage return with the EOI (end or identify) bus message asserted.
- A carriage return followed by a line feed (ASCII 10).
- A carriage return followed by a line feed, with EOI asserted on the line feed.
- EOI asserted on the last data byte.

b. Facts about command strings to be aware of:

- A new command string will destroy any output generated in a previous command string. The following is an example using BASIC language programming that assumes SG-1206 is at address 05.

Program Sequence

```
10 OUTPUT 05; "01"
20 OUTPUT 05; "OF2"
30 ENTER 05; A$
40 DISP A$
```

Sweep Generator returns the value of F2

Remarks. The first command string, "01" (Output Identify) is overridden by the second string, "OF2" (Output Frequency F2).

- A new command will reset the status byte, provided an SRQ is not sent. For example:

Program Sequence

```
10 OUTPUT 05; "XYZ"
20 OUTPUT 05; "F2 0SB"
30 ENTER 05; A$
40 DISP ASC (A$)
```

Sweep Generator returns O

Remarks. The first command string "XYZ" (an invalid sequence that sets the syntax error bit) is overridden by the second string, "F2 OSB, " which resets the status byte to zero. All commands reset the status byte, except '0SB. " For example: OUTPUT 05; "XYZ OSB F2" is valid. The 0SB command sends the correct status reflecting the syntax error, but "XYZ F2 0SB" does not. Reason: F2 resets the status byte.

E-4. GPIB COMMANDS: FRONT PANEL CONTROLS.

The GPIB commands used to activate front-panel-control functions are listed in table E-1. Programming examples that demonstrate the use of these commands are shown in fig. E-1.

Table E-1. Front Panel Control Related Commands

Front Panel Keys	Bus Command	Notes
A. DATA ENTRY 1. Parameter Entry CF F1 F-2 M1-M8 ΔF SWEEP TIME RF LEVEL dB/SWEEP	 CFFXXXXGH (or MH) F1xxxxGH (or MH) F2xxxxGH (or MH) MnxxxxGH (or MH) DLFxxxxGH (or MH) SWTXXXSEC (or MS: LVLXXXXDM (or DB) PSWXXDB (or DM)	Selects the Sweep Generator parameter and enters its value. The decimal digits (represented by x's) in these commands are the parameter's value in either GHz or MHz, seconds or milliseconds, dBm or dB (see below). This value is written in the same manner that it is entered from the keyboard. That is, it is written as either an integer or decimal number (such as 2 or 2.21) followed by a suitable terminator. The number is not limited to two or four digits; it can be any number of digits, so long as it does not exceed the limits of the instrument.
2. Data Terminators		
GHz	GH	Selects the GHz terminator.
MHz	MH	Selects the MHz terminator.
Sec	SEC	Selects the seconds terminator.
Ms	MS	Selects the milliseconds terminator.
dB	DB	Selects the dB terminator.
dBm	DM	Selects the dBm terminator.
3. SHIFT	SH	Enables shifted functions to be selected using their unshifted command codes. For example, programming "SH FUL" (shift, full) evokes the front panel security mode (DSO).
4. CLEAR ENTRY	CLR	Clears invalid or illegal parameter entries. Also clears the status byte and any SRQs that have been sent. Also removes the front panel from the shifted state.
B. FREQUENCY RANGE		
1. Sweep Range		
FULL	FUL	Selects the full-sweep range,
F1-F2	FF	Selects the F1-F2 sweep range.
M1-M2	MM	Selects the M1-M2 sweep range.
DF CF	DCF	Selects the Δ F CF sweep range.
DF MI	DLM	Selects the Δ F MI sweep range.
2. CW Frequency		
CW CF	CCF	Selects the CW CF function.
CW F1	CF1	Selects the CW F1 function.
CW F2	CF2	Selects the CW F2 function.
CW MI	CM1	Selects the CW MI function.
CW M2	CM2	Selects the CW M2 function.

Table E-1. Front Panel Control Related Commands (Continued)

Front Panel Keys	Bus Command	Notes
3. FREQUENCY VERNIER		
INCREASE	FVSxxxE	Selects the increase function.
DECREASE	FVS-xxxE	Selects the decrease function.
OFF	FV0	Cancels the vernier correction.
	Where xxx = hundreds of kHz (i.e. 750 = 7.5 MHz)	
C. TRIGGER		
AUTO	AUT	Selects AUTO sweep.
LINE	LIN	Selects LINE sweep.
EXT OR	EXT	Selects external sweep.
SINGLE	TRS	Triggers single sweep.
MANUAL SWEEP	MAN	Selects manual frequency tuning. When MAN command is used, sweep tuning is accomplished using front panel controls.
D. MARKERS		
VIDEO	VM1	Turns on the video marker.
RF	RM1	Turns on the RF marker.
INTENSITY	IM1	Turns on the intensity marker.
All Markers Off	MKO	Turns all markers off.
E. LEVELING		
INTERNAL	IL1	Selects internal leveling.
DETECTOR	DL1	Selects detector leveling.
POWER METER	PL1	Selects power meter leveling.
No Leveling	LVO	Turns leveling off.
F. RF OUTPUT		
RF OFF	RFO	Turns RF off.
RF ON	RF I	Turns RF on.
RETRACE RF: Off	RTO	Turns RF off during retrace.
RETRACE RF: On	RT1	Turns RF on during retrace.
G. POWER	None	AC power cannot be turned off and on over the interface bus.
H. SELF TEST	TST	Initiates a self-test. The operator will see no evidence of self testing on front panel displays. The test results are passed back to the GPIB controller. The syntax for issuing a self test is as follows: OUTPUT 05; “TST” ENTER 05; I$ IF I$ = “P” THEN DISP “PASSED” IF I$ = “F” THEN DISP “FAILED” *(Note: Assumes SG- 1206 set to address* 05)

Table E-1. Front Panel Control Related Commands (Continued)

Front Panel Keys	Bus Command	Notes
I. RESET	RST	Resets all parameters and controls to a predetermined (initialized) state. The RST command causes the Sweep Generator's GPIB interface to become unaddressed. Therefore, RST should be used alone. Any commands in a string following RST are ignored: i.e., in the command OUTPUT 05; "RST F1 5GH", the "F1 5 GH" is ignored. Programming "RST'', "F1 5GH", however, allows "F1 5GH" to be read.
J. FM off On	 FMO FM1	Allows external frequency modulation or phase-lock control to be applied to the Sweep Generator.
K. RECALL	RCS x	The argument "x" is a number that corresponds with the number (1 to 9) of the setup to be recalled.
	RCS 0	The argument "O" recalls the setup that was last overwritten, This feature provides for recovering from an error in programming. That is, when a setup is overwritten in any one of the nine memory locations, the setup previously stored in that location moves to location 0. The following provides a typical command sequence for recovering the data from location O. ***Code*** ***Comments*** SVS5 Assume this code was sent in error, and it inadvertently overwrote a still-needed setup. RCSO SVS5 Accesses the setup previously stored in location 5, and restores it to location 5. RCSO SVS4 Accesses the setup that was accidently stored in location **5.** (This data was moved to location O when the command SVS5 was implemented the second time.) The routine moves this setup to location 4
L. ALT SETUP	ALT x	The argument "x" is the setup number (O to 9) with which the present setup is to alternate.

Table E-1. Front Panel Control Related Commands (Continued)

Front Panel Control	Bus Command	Notes
M. Front Panel Display off	DSO (This code is similar but not identical to the front panel Shift-FULL command. The Shift-FULL command extinguishes only the frequency LEDs.)	Turns off the front panel numeric displays to prevent unauthorized persons from reading the frequency range currently in use. This command provides a fully secure mode in which (1) *all front* panel displays and LEDs are turned off, and (2) the SG-1206 returns non-meaningful responses to the Output Frequency commands (OF1, OF2, OFL, OFH, table E-5) **NOTE** Front panel displays cannot be restored except through use of the RST command. A secured front pane I is not maintained when power is removed from the Sweep Generator.

EXAMPLE 1

10 OUTPUT 05; "F1 5.3GH F2 12.6GH FF LIN RF1 IL1"

(Assumes Sweep Generator set to address 5)

F1 Frequency: 5.3 GHz
F2 Frequency: 12.6 GHz
Sweep Range: F1-F2
TRIGGER: LINE
RF: ON
LEVELING: INTERNAL

EXAMPLE 2

10 OUTPUT 05; “DCF CFF2GH DLF10MH AUT FM1 FVS-75E IL1 RF1"

(Assumes Sweep Generator set to address 5)

Sweep Range: Δ FCF
CF Frequency: 2 GHz
Δ **F** Frequency: 10 MHz
TRIGGER: AUTO
FM: On
Set Vernier: -7.5 MHz
LEVELING: INTERNAL
RF: On

Figure E-1. GPIB Front Panel Programming Examples

E-5. GPIB COMMANDS: STEP SWEEP.

To provide a high-resolution sweep over a narrow band of frequencies, the Sweep Generator is equipped with a digitally stepped sweep (step sweep). This sweep, which contains **4096** discrete points, can be incrementally stepped so that any or all of the discrete points can be used. The width of the step sweep and the frequency start and stop points (or center frequency for a Δ **F** sweep) are selected using the front-panel-control command statements described in table E-1. Because the step sweep is a frequency sweep, the following apply:

a. The front panel LED displays remain unchanged as the sweep progresses from start to stop.

b. The frequencies corresponding to the step sweep's intermediate steps must be calculated. The formula for calculating step sweep frequencies is given in fig. E-2,

The step sweep commands are given in table E-2.

Table E-2. Digital Sweep Commands

Name	Command	Function
Step Sweep	STP	Selects the Step Sweep mode of operation.
Step Select	STSxxxxE	Selects the increment point at which the Step Sweep starts. This sweep start can be any point from O to 4095. Zero (the low-end frequency) is STSOE (or STSE), while 4095 (the high-end frequency) is STS4095E,
Increment Size	SIZxxxxE	Selects number of steps by which Step Sweep is to be incremented when an "N" command (see below) is received. Also, selects number of steps in which an "UP" or "DN" command (table E-6) will increment the selected parameter. Digits (x's) may be between O and 4095; where O is no step increment, 1 is the smallest increment, and 4095 is the highest increment. The number that is formed by the digits *must be an integer.* If a fractional number is used, any digits that appear to right of decimal point are ignored. (Example: SIZ146E and SIZ146.5E are equivalent commands.)
Go to Next Step	N	Increments Step Sweep by number of steps programmed with Increment Size Command **(SIZ).** The following is an example of syntax required to implement step sweep that starts at the minimum frequency, has an increment size of 819 steps, and takes data at 5 discrete frequency points:* 10 OUTPUT 05; "STP STSE SIZ819E" 20 FOR I= 0 T0 4 30 • 40 • Input Statements, etc. 50 • 60 OUTPUT 05; "N" 70 NEXT I **Assumes SG-1206 is addressed is 05.*

Formula

$$F = F_{start} + \left[\frac{N}{4095} x \left(F_{stop} - F_{start} \right) \right]$$

where F is the Sweep Generator output frequency

F start is the low end of the frequency sweep, as determined by sweep range selected (that is, FULL, ‘F1-F2, M1-M2, etc.).

F stop is the high end of the frequency sweep, as determined by sweep range selected.

N is the step number currently selected. The step number currently selected is found using the following formula.

Nsts + (Nsize x number of times the N command has been executed.)

For example, assume the following:

a. Sweep *Range Programming:*

Sweep Range Δ F, with CF = 2 GHz and Δ F = 10 MHz

Command: DCF CF2GH DLF 10 MH

b. *Step Sweep Programming:*

Sweep Start = Fstart

Step Size = 819 steps

Number of Frequency Points = 6

Command: STP STSE SIZ819E N N N N N

Calculation to Find 1st Frequency Point:

N= 0+(819X0)

F= 1.995 GHz

Calculation to Find 2nd Frequency Point:

N= O +(819X1)=819

$$F = 1.995 + \left[\frac{819}{4095} x \left(F_{2.005} - F_{1.995} \right) \right]$$

Calculation to Find 3rd Frequency Point:

N= O +(819X2)=1638

$$F = 1.995 + \left[\frac{1638}{4095} x \left(F_{2.005} - F_{1.995} \right) \right]$$

Calculation to Find 4th through 6th Frequency Points:

Calculations are the same as above: answers are as shown below.

4th point = 2.001 GHz
5th point = 2.003 GHz
6th point = 2.005 GHz

Figure E-2. Step Sweep Step-to-Frequency Conversion Formula

E-6. GPIB COMMANDS: GROUP EXECUTE TRIGGER MODES.

To speed up bus operations, the Group Execute Trigger (GET) bus message can be used to increment or decrement frequency, sweep time, or output-power level, The GET bus message can also be used to increment or decrement the step sweep. The bus commands that configure the Sweep Generator for this increase/decrease response to a GET bus message are listed in table E-3.

Table E-3. Trigger (GET) Mode Commands

Name	Command	Function
Trigger Single Sweep	GTS	Configures the Sweep Generator to execute a single sweep each time a GET bus message is received. This is the default mode. That is, this is the mode that the Sweep Generator assumes when no GET mode command is programmed.
Increment Selected Parameter	GTU	Configures the Sweep Generator to execute an “UP” command (table E-6) each time a GET bus message is received.
Decrement Selected Parameter	GTD	Configures the Sweep Generator to execute a “DN” command (table E-6) each time a GET bus message is received.
Go to Next Step	GTN	Configures the Sweep Generator to execute an “N” command (table E-2) each time a GET bus message is received.

E-7. GPIB COMMANDS: SERVICE REQUEST MODES.

To notify the controller that certain conditions exist (such as end-of-sweep, marker encountered, unleveled, and error entry), the Sweep Generator uses the GPIB Service Request function. To use this function, the Sweep Generator employs a system of Service Request mode commands; these commands are described in table E-4.

Table E-4. Service Request (SRQ) Commands

Name	Command	Function
Enable SRQ Capability	SQ1	Enables the SRQ mode commands described in this table to request service from the controller.
Disable SRQ Capability	**SQ0**	Disables the SRQ function. This is the default mode, that is, the mode assumed when neither SQ1 nor SQ0 is programmed.
Dwell-at-Marker Mode: On	DW1	Activates the dwell-at-marker mode, In this mode, when an intensity marker is encountered, the frequency sweep dwells at the marker until a Continue Sweep (CNT) command is received. When DW1 and

Table E-4. Service Request (SRQ) Commands (Continued)

Name	Command	Function
		SQ1 are both programmed, the SRQ line is pulled LOW (true), and Status Byte (fig. E-3) bits O and 6 are set HIGH (decimal 65). When DW1 and SQ0 are both programmed, only the Status Byte is generated; the SRQ line is not activated.
off	DW0	Deactivates the dwell-at-marker mode. This is the default mode, that is, the mode assumed when neither DW1 nor DW0 is programmed.
End-of-Sweep Mode:		
On	ES1	Activates the end-of-sweep mode. When ES1 and SQ1 are both programmed, the ending of the frequency sweep causes the SRQ line to be pulled LOW (true) and Status Byte bits 1 and **6 to** be set HIGH (decimal 66). When ES1 and SQ0 are both programmed, only the Status Byte is generated; the SRQ line is not activated.
off	ES0	Deactivates end-of-sweep mode. This is the default mode, that is, the mode assumed when neither ES1 nor ES0 is programmed.
Unleveled Condition Mode:		
On	UL1	Activates the unleveled-condition mode. When UL1 and SQ1 are both programmed, an unleveled output power condition causes the SRQ line to be pulled LOW (true) and Status Byte bits 2 and 6 to be set HIGH (decimal 68). When UL1 and SQ0 are both programmed, only the Status Byte is generated; the SRQ line is not activated.
off	UL0	Deactivates the unleveled condition mode. This is the default mode; that is, the mode assumed when neither UL0 nor UL1 is programmed.
Parameter-Entry Error Mode:		
On	PE1	Activates the parameter-entry-error mode. Whenever PE1 and SQ1 are both programmed, a parameter-entry error generates an SRQ. If either PE0 or SQ0 is programmed, The SRQ will not be generated. A parameter-entry error always sets bit 4 of the Status Byte regardless of the status of the PE or SQ mode.
off	PE0	Deactivates the parameter-entry error mode. This is the default mode; that is, the mode assumed when neither PE0 nor PE1 is programmed.

Table E-4. Service Request (SRQ) Commands (Continued)

Name	command	Function
Syntax Error Mode:		
On	SE1	Activates the syntax error mode. When SE I and SQ1 are both programmed, a syntax error (para E-11) causes the SRQ line to be pulled LOW (true) and Status Byte bits 5 and 6 to be set HIGH (decimal 96). When SE I and SQ0 are both programmed, only the Status Byte is generated; the SRQ line is not activated.
off	SE0	Deactivates the syntax error mode. This is the default mode; that is, the mode assumed when neither SE0 nor SE1 is programmed.
Overflow Error Mode:		
On	SV1	Activates the buffer-overflow-error mode. Whenever SV1 and SQ1 are both programmed, a buffer-overflow condition generates an SRQ. If either SV0 or SQ0 is programmed, the SRQ will not be generated. A buffer-overflow condition will always set bit 3 of the Status Byte regardless of the status of the SV or SQ mode.
off	SV0	Deactivates the overflow-error mode. This is the default mode, that is, the mode assumed when neither SV0 nor SV1 is programmed.

Status Byte

RESERVED BIT 7 DECIMAL = 128	SRO BIT 6 DECIMAL = 64	SYNTAX BIT 5 DECIMAL = 32	PARAMETER BIT 4 DECIMAL = 16	BUFFER OVERFLOW BIT 3 DECIMAL = 8	UNLEVELED RF BIT 2 DECIMAL . 4	END OF SWEEP BIT 1 ECIMAL . 2	INT MKR OCCURRED BIT 0 DECIMAL . 1

Bit 7 is reserved for future use.

Bit 6 is the request service bit. This bit is set HIGH when certain conditions, as shown below, exists.

Bits O through 5 combine with the service request bit to provide a code number that tells the controller which condition exists. The condition codes are given below.

Bit 6 and O set high: An intensity marker was encountered.

Bit 6 and 1 set high: The frequency sweep has ended.

Bit 6 and 2 set high: An unleveled RF output condition has been detected.

Bit 6 and 3 set high: A buffer-overflow-condition exists.

Bit 6 and 4 set high: An invalid parameter was entered.

Bit 6 and 5 set high: A syntax error has been detected.

NOTE

As long as bit 6 is set, any high states in the other bits will be maintained. A serial poll or the command string “OSB” resets bit 6. The other bits will be reset upon the decoding of the first command in the next command string, other than “OSB”. This permits the user to query the status byte after a command string, in order to determine if any problems were encountered.

The entire status byte is cleared by sending CLR, RST, or the bus message Device Clear.

Figure E-3. Status Byte Coding

E-8. GPIB COMMANDS: OUTPUT.

To provide equipment identification and parameter information upon request, the Sweep Generator is equipped with output commands. The use of these commands causes the Sweep Generator to output the requested information when next addressed to talk.

Multiple output commands may be given in the command string. All resultant data will be available in the output buffer, up until the first byte of a new command string is received.

If an output is requested from the Sweep Generator when the output buffer is empty, it sends a question mark (?) to indicate that it has no data available. This "?" prevents a potential bus hangup.

The output commands are described in table E-5.

Table E-5. Output Commands

Name	Command	Function
Output Identity	O1	Causes the Sweep Generator to identify itself by returning certain parameter information to the controller. This parameter information consists of model number, low-end frequency, high-end frequency, minimum leveled output power, maximum leveled output power, and software revision number. This command can be used to send parameter information to the controller automatically, thus relieving the operator from having to input the information manually. A description of the 01 string is shown below: 6647 0.010 20.00 -002.0 0010 1.00 M Model Suffix Firmware Version Maximum Leveled Output Power (dBm) Minimum Leveled Output Power (dBm) High-End Frequency Low-End Frequency Model Number
output Δ F Parameter	ODF	Returns the value of the Δ **F** frequency parameter to the controller. Value is given in MHz.
Output F0 Parameter	OCF	Returns the value of the F0 frequency parameter to the controller. Value is given in MHz.
Output F1 Parameter	OF1	Returns the F1 frequency value in MHz.
Output F2 Parameter	OF2	Returns the F2 frequency value in MHz.
Output **Flow**	OFL	Returns the low-end frequency value in MHz.

Table E-5. Output Commands (Continued)

Name	Command	Function
Output Fhigh	OFH	Returns the high-end frequency value in MHz.
Output M1 -M8 Parameter	OM1-0M8	Returns the Ml thru M8 frequency value in MHz.
Output Power Sweep	OLP	Returns the value of the power sweep in 0.1 dBm increments (that is, 14 = 1.4 dBm).
Output Power Level	OLV	Returns the output-power level value to the controller in 0.1 dBm increments (that is, 14 = 1.4 dBm).
Output Status Byte	OSB	Returns the SRQ Status Byte (fig. E-3) to the controller.
Output Sweep Time	OST	Returns the sweep time value to the controller. Value is given in milliseconds.

E-9. GPIB COMMANDS: MISCELLANEOUS.

There are nine GPIB commands unrelated to either front-panel, digital-sweep, GET-mode, SRQ-mode or output operation. These miscellaneous commands are described in table E-6.

Table E-6. Miscellaneous Commands

Name	Command	Function
Continue Sweep	**CNT**	Causes the sweep to continue after having dwelled at an intensity marker. CNT is used in conjunction with the SRQ Dwell-at-Marker Mode.
Return to Local	RL	Causes the Sweep Generator to return to local (front panel) control, provided that a local lockout message (table E-7) is not in effect.
Decrement the Selected Parameter	DN	Decrements the selected frequency, sweep time or RF level parameter by the number of steps programmed with the Increment Size command (SIZ). For DN to be effective, the selected parameter must still be active. That is, the selected parameter's command statement (F 1xxxx GH, SWTxxMS, LVLxxDM, etc.) must be the last command to appear before DN is commanded. A non-parameter command, such as AUT, IL1, or VM1, cannot be inserted between the parameter mnemonic and the DN command. If necessary, ensure that the selected parameter is still active by prefacing DN (or a string of DNs) with the selected parameter's mnemonic. For example, send F1 DN (or DN DN DN etc.) rather than just DN (or DN DN DN etc.).
Increment the Selected Parameter	UP	Increments the selected frequency, sweep time or RF level parameter by the number of steps programmed with the Increment Size command (SIZ). As described for the DN command, above, the selected parameter must still be active for UP to be effective.
C W Filter:		
Automatic	FL1	Enables automatic CW filter control. (That is, CW filter inserted for CW and sweep widths ≤50 MHz and not inserted for sweep widths >50 MHz). (Default mode.)
out	FLO	Causes the CW filter to be out of the RF output signal line unconditionally. Any other command re-enables the filter.
Recall the Front Panel Settings	RCL	Causes the Sweep Generator to be reconfigured with the front panel settings that were previously saved using the SAV command (below).
Horizontal Output During CW:		
On	CS1	Enables horizontal ramp during CW.
off	CS0	Disables horizontal ramp during CW. (Default mode.)

Table E-6. Miscellaneous Commands (Continued)

Name	Command	Function
Reset Sweep	RSS	Resets the frequency sweep to the sweep-start frequency, as programmed by a Parameter Entry command (such as, FFF1xxxxGH). RSS can be used to abort the sweep currently in progress prior to sending a trigger command.
Save the Front Panel Settings	SAV	Causes the Sweep Generator to return an ASCII encoded representation of the entire instrument setup. This instrument setup information is contained in a data string 483 bytes long. The SAV command can be used to store the front-panel-control settings for a measurement test setup. This test setup information can be stored by the controller for future use.
Turn Off Selected Marker	SMO	Appends a marker command to turn the last programmed marker off. For example, programming "M1 SM0" or "M2 3GH M1 SM0" turns the MI marker off.
Save Setup	SVS x	Saves the current front panel setup into an internal memory location 1 thru 9, where "x" is the location number. Before any existing setup is overwritten, its contents are temporarily placed into setup #O. Operator can recover the previous contents of a setup by sending an "RCS 0" command.
Power Sweep	PSW	Toggles power sweep on or off.
	PSWxxxDB	Turns power sweep on and sets the power-sweep level in dB. The x's in the command (xxx) may be from zero to the maximum power output of the Sweep Generator. (This output is usually 5 dBm above the maximum leveled output, but never more than 25.5 dB above.) **NOTE** Since PSW toggles the power sweep on and off, the programmer must be careful of the data entry sequence. For example: "PSW 5 DB" turns the power sweep on and sets the power sweep parameter to 5 dB. However, the sequence "PSW, "PSW 10DB" will not work because the second "PSW" turns off the power sweep mode. A sequence that will work is "PSW","IODB".
External Sweep	ESW	Activates the external sweep mode. The Sweep Generator frequency is now being controlled by an external voltage applied to rear panel EXT SWEEP connector.

E-10. BUS MESSAGES.

The SG-1206 recognizes most of the IEEE-488 bus messages. A listing of the recognized bus messages, including specific information describing how the messages are used, is given in table E-7.

Table E-7. Bus Messages Recognized by the SG-1206

Bus Messages	How Message is Used By Sweep Generator
Device Clear	Clears the input buffer, the status byte, and the SRQ function. Also sends a CLR message to the main microprocessor on the front panel PCB.
Go to Local	Returns the Sweep Generator to local (front panel) control.
Group Execute Trigger	1, Triggers a new sweep if the EXT and the GTS commands are both programmed. 2. If the GTU command is programmed, the selected parameter is incremented by the number of programmed steps using the SIZ command . 3. If the GTD command is programmed, the selected parameter is decremented by the number of programmed steps using the SIZ command. 4. If the GTN command is programmed, the digital sweep is incremented by the number of programmed steps using the SIZ command.
Interface Clear	Stops the Sweep Generator GPIB interface from listening or talking. The front panel controls *are not* cleared.
Local Lockout	Prevents the RETURN TO LOCAL key or the RL command from returning the Sweep Generator to local control.
Remote Enable	Places the Sweep Generator under remote control if the REM line is TRUE and the Sweep Generator is addressed to listen. If placed in remote and not supplied with program data, Sweep Generator operation is determined by the position in which the front panel controls were set immediately prior to going remote.
Service Request (SRQ) Messages:	The Sweep Generator is equipped with SRQ capability. It will respond to both serial-poll and parallel-poll messages. Serial-poll and parallel-poll operations are described below.
Serial-Poll Enable (SPE) Serial-Poll Disabi~ (SPD)	*Serial Poll Operation* The SPE message causes the Sweep Generator to respond with a decimally-coded status byte (fig. E-3). This status byte is coded to tell the controller if it was the device requesting service and what kind of service it needs. The SPD message, which is sent by the controller in response to receiving a status byte, terminates serial-poll operation.

Table E-7. Bus Messages Recognized by the SG-1206 (Continued)

Bus Messages	How Message is Used By Sweep Generator
	Paralle-Poll Operation When queried by a parallel-poll message command the SG-1206 (if configured for parallel-poll operation; see below) responds by setting its assigned data bus line to the logical state (1, O) that indicates its correct SRQ status.
Parallel-Poll Configure (PPC) Parallel-Poll Enable (PPE)	To configure a bus device that is built for parallel-poll operation and designed to be remotely configured on the bus, the controller sends a two-byte parallel-poll configure and enable (PPC and PPE) message. The PPC byte configures the device to respond to a parallel-poll message such as PPOLL or POL. The PPE byte assigns the logical sense (1, O) that the parallel-poll response will take. When the Sweep Generator receives the PPC/PPE message, it configures itself to properly respond to the parallel-poll message.
Parallel-Poll Unconfigure (PPU) Parallel-Poll Disable (PPD)	The PPU (or PPD) message is sent by the controller when a parallel-poll response is no longer desired. This message causes the Sweep Generator to become unconfigured for parallel-poll response.

E-11. PROGRAM ERRORS.

There are three types of errors that occur in bus programming: invalid-parameter errors, syntax errors and buffer overflow conditions. These three error types are described below.

a. *Invalid-Parameter Error.* Invalid-parameter errors are those that will cause either the front panel CLEAR ENTRY, F1 > F2 OR Ml > M2 CHANGE FREQ SETTING, or GHz/dBm/Sec and MHz/dB/mS indicators to flash. Invalid-parameter errors also cause the front-panel indicators to flash. These errors include:

- Programming a frequency sweep where F1 is greater than F2 or Ml is greater than M2 (backward sweep).
- Attempting to enter a frequency, sweep-time, or RF level parameter that exceeds the limits of the Sweep Generator.
- Failing to properly end a parameter entry with a suitable terminator, such as MH, DB, MS, etc.

b. *Syntax Errors.* Syntax errors are those that occur in the formulation of a program statement, such as writing “EXTTFS” instead of “EXTTRS. ” To prevent misinterpretation of command statements, the sweep generator ignores all portions of the command statement following the syntax error. All commands in a command string following a syntax error are ignored until a delimiter is detected. When this happens, normal decoding and execution will resume. The three delimiters are:

Name	ASCII No.
Carriage Return	13
Comma (,)	44
Slash (/)	47

c. *Buffer Overflow Condition.* The Sweep Generator has large input and output buffers to provide for smoother data flow and minimum delays on the bus. However, if the controller issues a sequence of commands that completely fills both the input and output buffers and is still trying to talk to the sweeper, the bus will hang up. The controller continually checks for this condition. When detected, the pointers on the output buffer are reset to empty, which allows data flow to restart. To signal the subsequent loss of output data, bit 3 of the status byte is set. If both SV1 and SQ1 have been programmed, a service request (SRQ) is then sent. An example that illustrates program errors is shown in fig. E-4.

E-12. RESET PROGRAMMING AND DEFAULT CONDITIONS

Reset programming provides the means for quickly returning the Sweep Generator to its default (preprogrammed) operational state. In this discussion, the term warm reset means resetting all instrument parameters except for the GPIB IC. In *a* warm reset, codes STS, SIZ, SQ, DW, UL, ES, and GTS and all numeric parameters assume their default states.

Resetting the SG-1206

- RETURN TO LOCAL Key.

  If local lockout has been programmed, this key is ignored.

  If local lockout is not in effect, and if the SG-1206 is in remote mode, pushing this key returns it to the local state.

  If neither local lockout or remote mode is in effect, pushing this button causes the GPIB address to be displayed on the front panel.

The following are examples of command strings that produce errors. In each case, the appropriate bit in the status byte is set to show the type of error. The last two lines in each example query the status byte to determine which bit has been set.

1. Example of a command string that results in a parameter error. In line 10, the start frequency is higher than the stop frequency.

```
10 OUTPUT 05; "F1 12GH F2 10GH FF"
20 OUTPUT 05; "OSB"
30 ENTER 05; A$
40 DISP ASC (A$)
```

Sweep Generator Returns: 16

2. Example of a command string that results in a syntax error. In line 10, the frequency parameter "F3" is a mistake. Note that the OSB command is preceeded with a comma. This has the same effect as if the OSB command were in the next line down, as in example 1 above.

```
10 OUTPUT 05; "F1 12 GH F3 10 GH FF, OSB"
20 ENTER 05; A$
30 DISP ASC (A$)
```

Sweep Generator Returns: 32

3. Example of a command string that results in a buffer-overflow condition. In line 30, too many commands have been programmed.

```
10 OUTPUT 05; "SAV"
20 ENTER 05; A$
30 OUTPUT 05; "SAV SAV RCL"; A$; "RCL"; A$
40 OUTPUT 05; "OSB"
6030 ENTER 05; A$
70 DISP ASC (A$)
```

Sweep Generator Returns: 8

Figure E-4. Examples of Program Errors.

- RESET Key.

  Pressing this key while in the local mode performs an instrument reset, as described above.

  The RESET key is ignored when in remote or local lockout.

- RST Command.

  Sending the RST command does a warm reset of the GPIB interface, an instrument reset, and it resets the status byte and pending SRQs. It does not reset a local lockout or remote condition.

- Bus Messages: Device Clear or Selected Device Clear.

  The status byte and any pending service requests are cleared.

  The input buffers are emptied.

E-13. INDEX OF SWEEP GENERATOR GPIB COMMAND CODES.

An alphabetical index of the Sweep Generator GPIB command codes is given in table E-8. This table lists the command mnemonic, the name of the command, and the table number where the command is described.

Table E-8. SG-1206 Command Codes

Code	Name	Table No.
ALT	Alternate Setup	E-1
AUT	Auto Trigger	E-1
CCF	Enter Parameter CF	E-1
CF1	CW Select F1	E-1
CF2	CW Select F2	E-1
CLR	Clear Keypad	E-1
CM1	CW Select Ml	E-1
CM2	CW Select M2	E-1
CNT	Continue Sweep	E-6
CS0	Horizontal Output Off During CW Operation	E-6
CS1	Horizontal Output On During CW Operation	E-6
DB	dB Data Terminator	E-1
DCF	Sweep Range **Δ F CF**	E-1
DLM	Sweep Range **Δ F** Ml	E-1
DL1	Detector Leveling	E-1
DLF	Enter **Δ F** Frequency	E-1
DM	dBm Data Terminator	E-1
DN	Decrement Selected Parameter	E-6
DS0	Front Panel Display Off	E-1
DW0	Dwell at Marker Mode Off	E-4
DW1	Dwell at Marker Mode On	E-4
ES0	End of Sweep SRQ Off	E-4
ES1	End of Sweep SRQ On	E-4
ESW	External Sweep Mode	E-6
EXT	External Trigger	E-1
F1	Enter Parameter F1	E-1
F2	Enter Parameter F2	E-1
FF	Sweep Range F1-F2	E-1
FL0	CW Filter Off	E-6
FL1	CW Filter Enabled	E-6
FM0	FM Off	E-1
FM1	FM On	E-1
FUL	Sweep Range Full	E-1
FV0	Frequency Vernier Off	E-1
FVS	Set Frequency Vernier	E-1
GH	GHz Data Terminator	E-1
GTD	GET Mode Execute “DN” Command	E-3
GTN	GET Mode Execute ‘N” Command	E-3
GTS	Get Mode Trigger Sweep	E-3
GTU	GET Mode Execute “UP” Command	E-3
IL1	Internal Leveling	E-1
IM1	Intensity Marker	E-1
LIN	Line Trigger	E-1
LVO	Leveling Off	E-1
LVL	Enter Level Parameter	E-1
M1 -M8	Enter Markers Ml thru M8	E-1
MAN	Manual Sweep	E-1
MH	MHz Data Terminator	E-1
MKO	Markers Off	E-1
MM	Sweep Range M1-M2	E-1
MS	Millisecond Data Terminator	E-1

Table E-8. SG-1206 Command Codes (Continued)

Code	Name	Table No.	Code	Name	Table No.
N	Go to Next Increment (Digital Sweep)	E-2	RL	Return to Local	E-6
			RM1	RF Marker On	E-1
OCF	Output CF Frequency	E-5	RSS	Reset Sweep	E-6
ODF	Output Δ **F** Frequency	E-5	RST	Reset Front Panel	E-1
01	Identify Instrument	E-5	RT0	RF During Retrace Off	E-1
OF1	Output F1 Frequency	E-5	RT1	RF During Retrace On	E-1
OF2	Output F2 Frequency	E-5	SAV	Save Front Panel Setup	E-6
OFL	Output Low-End Frequency	E -5	SE0	Syntax Error Mode Off	E-4
OFH	Output High-End Frequency	E-5	SE1	Syntax Error Mode On	E-4
OLV	Output RF Level	E-5	SEC	Seconds Data Terminator	E-1
OLP	Output Power Level	E-5	SH	Shift	E-1
OM1 -OM8	Output Ml Frequency thru Output M8 Frequency	E-5	SlZ	Increment Size	E-2
			SM0	Turn Selected Marker Off	E-6
OSB	Output Status Byte	E-5	SQ0	SRQ Mode Off	E -4
OST	Output Sweep Time	E-5	SQ1	SRQ Mode On	E-4
PE0	Parameter Entry Error SRQ off	E-4	STP	Step Sweep	E-2
			STS	Step Select	E-2
PE1	Parameter Entry Error SRQ On	E-4	SV0	Buffer Overflow SRQ Off	E-4
			SV1	Buffer Overflow SRQ On	E-4
PL1	Power Meter Leveling	E-1	SVS n	Store Setup n (to internal storage)	E-6
PSW	Power Sweep Mode	E-6			
RCL	Recall Front Panel Setup (from controller)	E-6	S WT	Enter Sweep Time Parameter	E-1
			TRS	Trigger Sweep	E-1
RCS 0	Recall Setup O (from external storage)	E-1	TST	Self Test	E-1
			UL0	Unleveled Condition Mode Off	E-4
RCS n	Recall Setup n (from external storage)	E-1	UL1	Unleveled Condition Mode On	E-4
			UP	Increment Selected Parameter	E-6
RF0	RF Off	E-1	VM1	Video Marker On	E-1
RF1	RF On	E-1			

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19. *Paragraph:* 3
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1	WP0005 PG 3		2			Test or Corrective Action column should identify a different WP number.

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PUBLICATION NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS (*Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	***To***	***Multiply by***	***To change***	***To***	***Multiply by***
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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