MODEL
66XXB
PROGRAMMABLE SWEEP GENERATOR

OPERATOR'S MANUAL

Wiltron

490 JARVIS DRIVE ● MORGAN HILL, CA 95037-2809

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GENERAL INFORMATION

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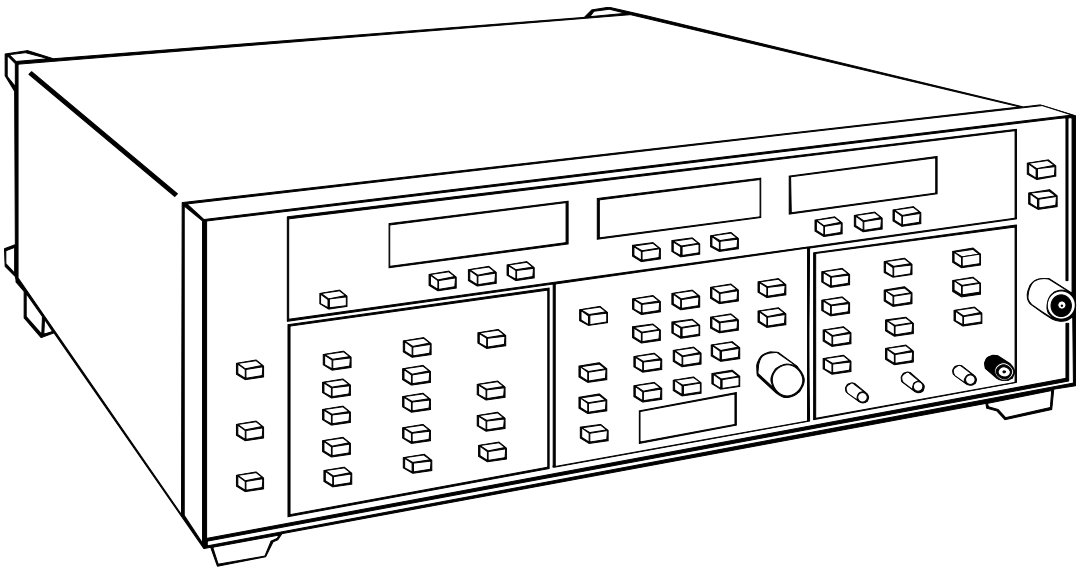

Figure 1-1. 6600B Series Sweep Generator

CHAPTER 1
GENERAL INFORMATION

1-1. SCOPE OF MANUAL

This is the operator's manual for the 66XXB Programmable Sweep Generator, hereafter called "sweep generator." This manual provides general information, installation, front panel description and operation, GPIB description and operation, and operator's maintenance and troubleshooting procedures for all 66XXB models.

1-2. INTRODUCTION

Chapter 1 provides product description; equipment characteristics, capabilities, features; option information; performance specifications. It also includes a listing of recommended test equipment for maintaining the sweep generator.

1-3. DESCRIPTION

The sweep generator is a microprocessor-based source of RF and microwave energy. It uses from one to four YIG-tuned oscillators to cover one or more frequency bands within a range of 10 MHz to 60 GHz. The sweep generator is capable of producing both broad (full range) and narrow band sweeps, along with discrete CW frequencies, across its entire range. It is fully controllable locally from the front panel or remotely (except for power on/off) via the IEEE-488 bus (GPIB).

1-4. IDENTIFICATION NUMBER

All WILTRON instruments are assigned a unique six-digit ID number. The ID number is imprinted on a decal that is affixed to the rear panel of the unit. In any correspondence with WILTRON Customer Service, please include the correct serial number, along with the specific instrument model number.

1-5. OPTIONS

a. *Rack Mounting, Option 1:* Unit supplied with mounting ears and chassis track slide (90° tilt) installed.

b. *Attenuator, Option 2A:* Adds 10 dB step attenuator with 70 dB range for models having high-end frequency ≤20 GHz. Output power is selected on keypad or control knob directly in dBm over an 82 dB range.

c. *Attenuator, Option 2B:* Adds 10 dB step attenuator with 70 dB range for models having high-end frequency of 26.5 GHz. Output power is selected on keypad or control knob directly in dBm over an 82 dB range.

d. *Attenuator, Option 2C:* Adds 10 dB step attenuator with 70 dB range for models having high-end frequency of 40 GHz. Output power is selected on keypad or control knob directly in dBm over an 82 dB range.

e. *Rear Panel RF Output, Option 9:* Option 9S adds SMA female and Option 9N adds Type N female a rear panel RF output connector and deletes front panel RF connector, degrading output power (typically 1 dB at 20 GHz), source SWR (typically 2 at >8 GHz), and power variation. Not available on units with upper frequency above 26.5 GHz.

f. *Auxiliary Rear Panel RF Connector, Option 10:* Adds SMA female connector to rear panel, providing an attenuated (approximately –15 to –25 dBm) sample of the reduced RF output signal (typically 1.5 dB ≤20 GHz; 2 dB >20 GHz). Not available on models with upper frequency limit above 26.5 GHz.

g. External Square Wave Input, Option 11: Adds rear-panel BNC connector for externally applied TTL-compatible signal that modulates RF at rates from dc to 50 kHz. On/Off ratio, typically 40 dB. Maximum input, ±20 volts. Accommodates ±6V square wave. Option for 6610B, 6616B, 6619B, 6619B-40, 6620B, 6624B, 6627B, 6628B, 6628B–50, 6630B, 6630B–50, 6631B, 6632B, 6636B, 6640B, 6640B-10, and 6672B. Standard on all others.

h. Auxiliary Rear Panel RF Connector, Option 12A: Adds SMA female connector to rear panel for models having frequency range between 2 and 20 GHz. Option provides an RF sample that is approximately 10 dB below output power.

i. Auxiliary Rear Panel RF Connector, Option 12B: Adds SMA female connector to rear panel for models having frequency range between 2 and 26.5 GHz. Option provides an RF sample that is approximately 10 dB below output power.

j. Frequency Counter Interface, Option 13: Adds rear panel BNC connector to provide interface with HP 5343A counter for counting marker frequencies.

k. Model 360B VNA Compatability, Option 14: Adds side cover weldments, special bottom cover, and intelligent interface to allow WILTRON 360 or 360B Vector Network Analyzer to control the 66XXB as an RF source.

1-6. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

a. Characteristics.

- Sweep frequency or continuous wave operation over the full band
- Five front-panel or GPIB selectable sweep-frequency ranges: Full, F_1-F_2, M_1-M_2, ΔF CF, ΔF M1
- Fine-frequency adjustments (Frequency Vernier operation) in CW and ΔF 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.

1-7. EQUIPMENT DATA

a. Weights and Dimensions.

Weight	32 lb (14.5 kg)
Height	5.25 in. (133 mm)
Width	17 in. (432 mm)
Depth	18.75 in. (476 mm)

b. Power Requirements.

Voltage	115/230V ±20%
Frequency	48 to 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 10,000 ft
Storage altitude	0 to 40,000 ft

d. Performance. See Figure 1-2.

1-8. RECOMMENDED TEST EQUIPMENT

Table 1-1 provides a listing of recommended equipment for test and maintenance.

Table 1-1. Recommended Test Equipment List

Instrument	Critical Specifications	Recommended Manufacturer
Digital Multimeter	DC Volts: 0.05% to 30V 0.002% to 10V 5½ digit resolution	Keithley Model 191
Oscilloscope	Bandwidth: DC to 150 MHz Vertical Sensitivity: 1 mV/division Horizontal Sensitivity: 50 ns/division	Tektronix Inc. Model 2445
Frequency Counter	Frequency Range: 0.01 to 60 GHz Input Impedance: 50Ω Resolution: 1 Hz External Time Base Input	EIP Microwave Inc., Model 548A, with External Mixers: Option 91 (26.5 to 40 GHz) Option 92 (40 to 60 GHz
Power Meter	Frequency Range: 0.01 to 40 GHz Measurement capability: +13 dBm	Hewlett-Packard Model 436A
Power Sensor	Frequency Range: 0.05 to 40 GHz Power Range: –30 to +20 dBm (1µW to 100 mW)	Hewlett-Packard Model 8487A
Spectrum Analyzer with Diplexer and External Mixer	Frequency Range: 0.01 to 60 GHz Resolution Bandwidth: 10 Hz	Tektronix Model 494 with External Mixers WM490K (18 to 26.5 GHz) WM490A (26.5 to 40 GHz) WM490U (40 to 60 GHz) Diplexer PN: 015-3085-00
Modulation Meter	Bandwidth: 15 kHz Sensitivity: –60 dB	Marconi TF2304
True RM Voltmeter	Bandwidth: 10 kHz Sensitivity: –60 dB	Fluke 8921A
Adjustable AC Line Transformer (Variac)	Line Voltage: 100/120V Line Voltage: 220/240V	General Radio W5MTB General Radio W10HM73
RF Detector	Frequency Range: DC to 40 GHz	WILTRON 70KC50
RF Detector	Frequency Range: 18 to 40 GHz	HP R422A
Waveguide Attenuator	Frequency Range: 18 to 40 GHz Attenuation: 20 dB	HP R382A and K382A
Directional Coupler	Frequency Range: 18 to 40 GHz	HP R752C
Power Supply	0-5 Vdc	HP 6281
Waveguide Section	40 to 60 GHz	Baytron Co., Inc. PN: 3-R-69.Q
Waveguide Transitions (2ea)	40 to 60 GHz	Baytron Co., Inc. PN: 3-28-669/19
Adapter	K-female to WR-28 Waveguide	WILTRON WR28KF
Controller	GPIB (IEEE-488) Configured	HP85A or 85B

Model	Frequency Range (GHz)	Output Power (25°C ±5°C)		Power Level Accuracy			Leveled Power Variation		Source SWR (Leveled Power)	Source SWR With Opt., 2 70 dB Attenuator	Signal Purity @ Rated Power			Frequency Accuracy⑤		Frequency Stability		
		Internally Leveled Maximum (mW)	With Opt. 2, 70 dB Attenuator (mW)	Leveled (dB)	With Opt. 2, 70 dB Attenuator (dB)	Attenuator Accuracy Per Step Add (dB)	With Frequency (dB)	With Frequency Opt. 2, 70 dB Attenuator (dB)			Harmonics (dBc)	Non-Harmonics (dBc)	Residual FM③ (kHz peak)	Cw Mode (MHz)	Sweep Mode ≤50 MHz (MHz)	With Temperature (MHz/°C)	With 10 dB Power Level Change (kHz)	With 3:1 Load SWR (kHz)
6609B	**0.01 to 2**	>20	>17.8	±0.6	±0.8	±0.3	±0.3	±0.8	1.3	1.5	<–30	<–40	<7	±5	±10	±1	±100	±100
6609B-50		>50	>44.5								<–20							
6610B	**1 to 2**	>20	>17.8	±1	±1.5	±0.4	±0.3	±0.5	1.3	1.5	<–30②	<–60	<7	±10	±15	±0.5	±500	±300
6616B	**1.7 to 4.3**	>10	>7.8	±1	±1.5	±0.4	±0.4	±0.7	1.2	1.5	<–20 (<2.26 GHz) <–30 (≥2.26 GHz)	<–60	<7	±10	±15	±0.5	±500	±300
6617B	**0.01 to 8**	>10	>7.9	±0.9	±1	±0.4	±0.5	±1	1.5	1.5	<–30 (≤2 GHz) <–40 (>2 GHz) <–20 (≤2 GHz) <–25 (>2 GHz)	<–40 (≤2 GHz) <–60 (>2 GHz)	<7	±5	±10	±1 (≤2 GHz) ±0.5 (>2 GHz)	±100	±100
6617B-40		>40	>31.6															
6619B	**2 to 8**	>10	>7.9	±1	±1.5	±0.4	±0.4	±0.9	1.5	1.5	<–40 <–25	<–60	<7	±10	±15	±0.5	±100	±100
6619B-40		>40	>31.6															
6620B	**3.6 to 6.5**	>20	>15.6	±1	±1.5	±0.4	±0.3 (±0.03 dB/30 MHz)	±0.8	1.5	1.5	<–40	<–60	<7	±10	±15	±0.5	±500	±300
6621B	**2 to 12.4**	>10	>7.4	±1	±1.5	±0.4	±0.5	±1.4	1.5	1.5 (<8 GHz) 1.6 (8-12.4 GHz)	<–40 <–25	<–60	<10	±10	±15	±0.5	±500	±300
6621B-40		>40	>29.5															
6622B	**0.01 to 12.4**	>10	>7.4	±1	±1.5	±0.4	±0.5	±1.4	1.5	1.5	<–30 (≤2 GHz) <–40 (>2 GHz) <–20 (≤2 GHz) <–25 (>2 GHz)	<–40 (≤2 GHz) <–60 (>2 GHz)	<7 (≤8 GHz) <10 (>8 GHz)	±10	±15	±1 (≤2 GHz) ±0.5 (>2 GHz)	±500	±300
6622B-40		>40	>29.5															
6624B	**4 to 8**	>10	>7.8	±1	±1.5	±0.4	±0.4	±0.9	1.5	1.5	<–30②	<–60	<7	±10	±15	±0.5	±500	±300
6627B	**5.9 to 9.0**	>10	>7.8	±1	±1.5	±0.4	±0.3	±0.8	1.5	1.8	<–40	<–60	<10	±10	±15	±0.5	±500	±300
6628B	**8 to 12.4**	>10	>7.4	±1	±1.5	±0.4	±0.4	±0.9	1.5	1.8	<–40	<–60	<10	±10	±15	±0.5	±500	±300
6628B-50		>50	>37.2								<–25							
6629B	**8 to 20**	>10	>6.6	±1	±1.5	±0.4	±0.5	±1.5	1.5	1.6 (≤12.4 GHz) 1.8 (>12.4 GHz)	<–40 <–25	<–60	<10	±10	±15	±0.5	±500	±300
6629B-40		>40	>26.3															
6630B	**12.4 to 20**	>10	>6.6	±1	±1.5	±0.4	±0.5	±1	1.5	1.8	<–32 <–25	<–60	<10	±10	±15	±0.5	±500	±300
6630B-50		>50	>33.9															
6631B	**10 to 15.5**	>10	>7	±1	±1.5	±0.4	±0.4	±0.9	1.5	1.8	<–40	<–60	<10	±10	±15	±0.5	±500	±300
6632B	**17 to 22**	>5	>3.2	±1	±3	±0.7	±0.8	±2.3	1.7	2	<–40	<–60	<10	±15	±25	±1	±500	±300
6635B	**2 to 18**	>10	>6.6	±1	±1.5	±0.4	±0.5	±1.5	1.5	1.5 (<8 GHz) 1.6 (8–12.4 GHz) 1.8 (>12.4 GHz)	<–40 <–25	<–60	<7 (<8 GHz) <10 (>8 GHz)	±10	±15	±0.5	±500	±300
6635B-40		>40	>26.3															
6636B	**18 to 26.5**	>3.1	>1.2	±1	±3	±0.7	±1	±2.5	1.7	2	<–40	<–60	<30	±15	±25	±2	±500	±300
6637B	**2 to 20**	>10	>6.6	±1	±1.5	±0.4	±0.5	±1.5	1.5	1.7 (≤12.4 GHz) 2 (>12.4 GHz)	<–40 <–25	<–60	<7 (<8 GHz) <10 (>8 GHz)	±10	±15	±0.5	±500	±300
6637B-40		>40	>26.3															
6640B	**26.5 to 40**	>1①	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<–30②	<–60	<40	±20	±30	±2	±500	±300
6640B-10		>10	>5	±1	æ2	±1	±1	±2	2.0									
6645B	**0.01 to 18**	>10	>6.6	±1	±1.5	±0.4	±0.6	±1.5	1.5	1.5 (<8 GHz) 1.6 (8–12.4 GHz) 1.8 (>12.4 GHz)	<–30 (≤2 GHz) <–40 (>2 GHz) <–20 (≤2 GHz) <–25 (>2 GHz)	<–40 (≤2 GHz) <–60 (>2 GHz)	<7 (≤8 GHz) <10 (>8 GHz)	±10	±15	±1 (≤2 GHz) ±0.5 (>2 GHz)	±500	±300
6645B-40		>40	>26.3															
6647B	**0.01 to 20**	>10	>6.6	±1	±1.5	±0.4	±0.6	±1.5	1.5	1.7 (≤12.4 GHz) 2 (>12.4 GHz)	<–30 (≤2 GHz) <–40 (>2 GHz) <–20 (≤2 GHz) <–25 (>2 GHz)	<–40 (≤2 GHz) <–60 (>2 GHz)	<7 (≤8 GHz) <10 (>8 GHz)	±10	±15	±1 (≤2 GHz) ±0.5 (>2 GHz)	±500	±300
6647B-40		>40	>26.3															
6653B	**2 to 26.5**	>10 (≤18 GHz) >5 (>18 GHz)	>5 (≤18 GHz) >2 (>18 GHz)	±1.5	±2.0	±0.7	±1.0	±1.5	1.5 (≤18 GHz) 1.7 (>18 GHz)	1.7 (≤12.4 GHz) 2 (>12.4 GHz)	<–40	<–60	<7 (<8 GHz) <10 (8–18 GHz) <15 (>18 GHz)	±20	±30	±1	±500	±300
6659B	**0.01 to 26.5**	>10 (≤18 GHz) >5 (>18 GHz)	>5 (≤18 GHz) >2 (>18 GHz)	±1.5	±2.0	±0.7	±1.0	±1.5	1.5 (≤18 GHz) 1.7 (>18 GHz)	1.7 (≤12.4 GHz) 2 (>12.4 GHz)	<–30 (<2 GHz) <–40 (>2 GHz)	<–40 (≤2 GHz) <–60 (>2 GHz)	<7 (<8 GHz) <10 (8–18 GHz) <15 (>18 GHz)	±20	±30	±1 (≤2 GHz) ±0.5 (>2 GHz)	±500	±300
6660B	**12.4 to 40**	>4	>2	±2	±2.5	±1	±1.5	±2	1.5 (≤18 GHz) 1.7 (18-26.5 GHz) 2 (>26.5 GHz)	N/A	<–40 (≤26.5 GHz) <–20 (>26.5 GHz)	<–60	<10 (<18 GHz) <15 (18–26.5 GHz) <20 (>26.5 GHz)	±20	±30	±1 (≤26.5 GHz) ±2 (>26.5 GHz)	±300	±300
6662B⑦	**2 to 40**	>10 (≤18 GHz) >4 (>18 GHz)	N/A	±1.5 N/A (>26.5 GHz)	N/A	N/A	±1 N/A (>26.5 GHz)	N/A	1.5 (≤18 GHz) 1.7 (>18 GHz) N/A (>26.5 GHz)	1.25 (<8 GHz) 1.45 (8–12.4 GHz) 1.6 (12.4–20 GHz) 1.8 (20–26.5 GHz) 2.1 (26.5–40 GHz)	<–40 (2–26.5 GHz) <–30 (>26.5 GHz)②	<–60	<7 (<8 GHz) <10 (8–18 GHz) <15 (18–26.5 GHz <20 (>26.5 GHz)	±20	±30	±1 (≤26.5 GHz) ±2 (>26.5 GHz)	±500	±300
6663B		>3.1	>1.5	±2	±2.5	±1	±1.5	±2	1.5 (≤18 GHz) 1.7 (>18 GHz) 2 (>26.5 GHz)									
6668B⑥	**0.01 to 40**	>10 (≤18 GHz) >4 (>18 GHz)	N/A	±1.5 N/A (>26.5 GHz)	N/A	N/A	±1 N/A (>26.5 GHz)①	N/A	1.5 (≤18 GHz) 1.7 (>18 GHz) N/A (>26.5 GHz)①	1.25 (<8 GHz) 1.45 (8–12.4 GHz) 1.6 (12.4–20 GHz) 1.8 (20–26.5 GHz) 2.1 (26.5–40 GHz)	<–30 (<2 GHz) <–40 (2–26.5 GHz) <–30 (>26.5 GHz)②	<–40 (≤2 GHz) <–60 (>2 GHz)	<7 (<8 GHz) <10 (8–18 GHz) <15 (18–26.5 GHz <20 (>26.5 GHz)	±20	±30	±1 (≤26.5 GHz) ±2 (>26.5 GHz)	±500	±300
6669B		>3.1	>1.5	±2	±2.5	±1	±1.5	±2	1.5 (≤18 GHz) 1.7 (>18 GHz) 2 (>26.5 GHz)									
6672B	**40 to 60**	>1①	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<–20④	<–60	<50	±30	±45	±3	N/A	±300

①External leveling only ②Excluding 5% band edges where specification is >20 dBc ③Measured in 30 Hz-15 kHz bandwidth ④Subharmonics ⑤At 25°C ⑥ Dual outputs: 0.01–26.5 GHz and 26.5–40 GHz ⑦ Dual outputs: 2–26.5 GHz and 26.5–40 GHz

Figure 1-2. Performance Specifications

CHAPTER 2
INSTALLATION

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CHAPTER 2
INSTALLATION

2-1. INTRODUCTION

This chapter provides initial inspection, preparation for use, and turn-on instructions.

2-2. INITIAL INSPECTION.

Inspect the shipping container for damage. If the container or cushioning material is damaged, retain until the contents of the shipment have been checked against the packing list and the instrument has been checked for mechanical and electrical operation.

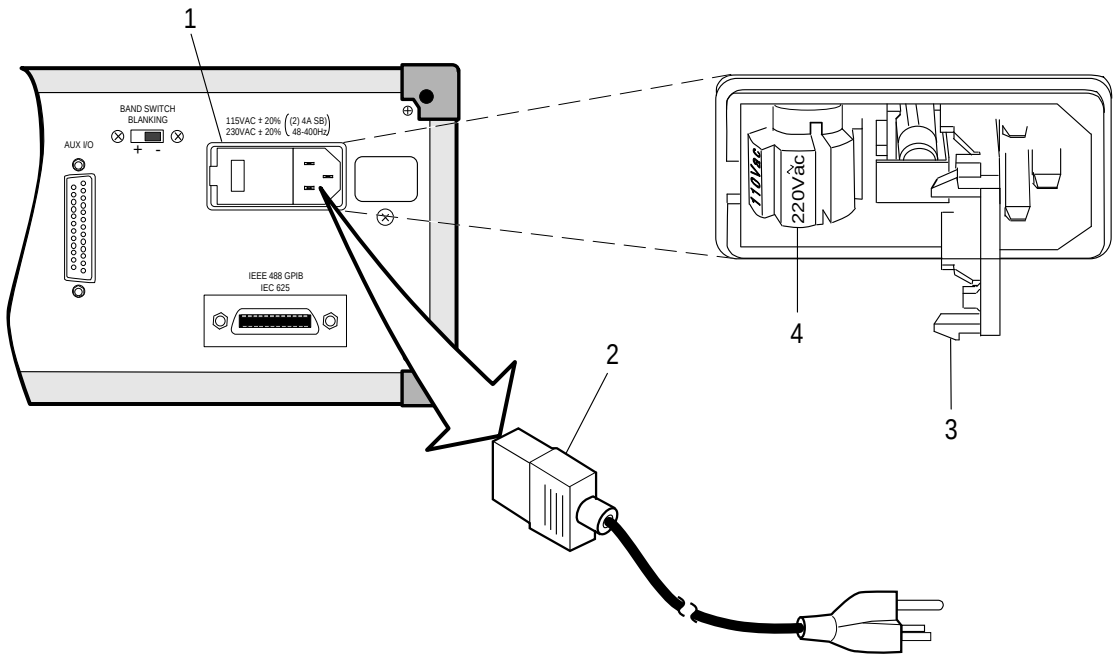
If the sweep generator is damaged mechanically, notify your local sales representative or WILTRON Customer Service. If either the shipping container is damaged or the cusioning material shows signs of stress, notify the carrier as well as WILTRON. Keep the shipping materials for carrier inspection.

2-3. PRELIMINARY SERVICING AND ADJUSTMENT OF EQUIPMENT

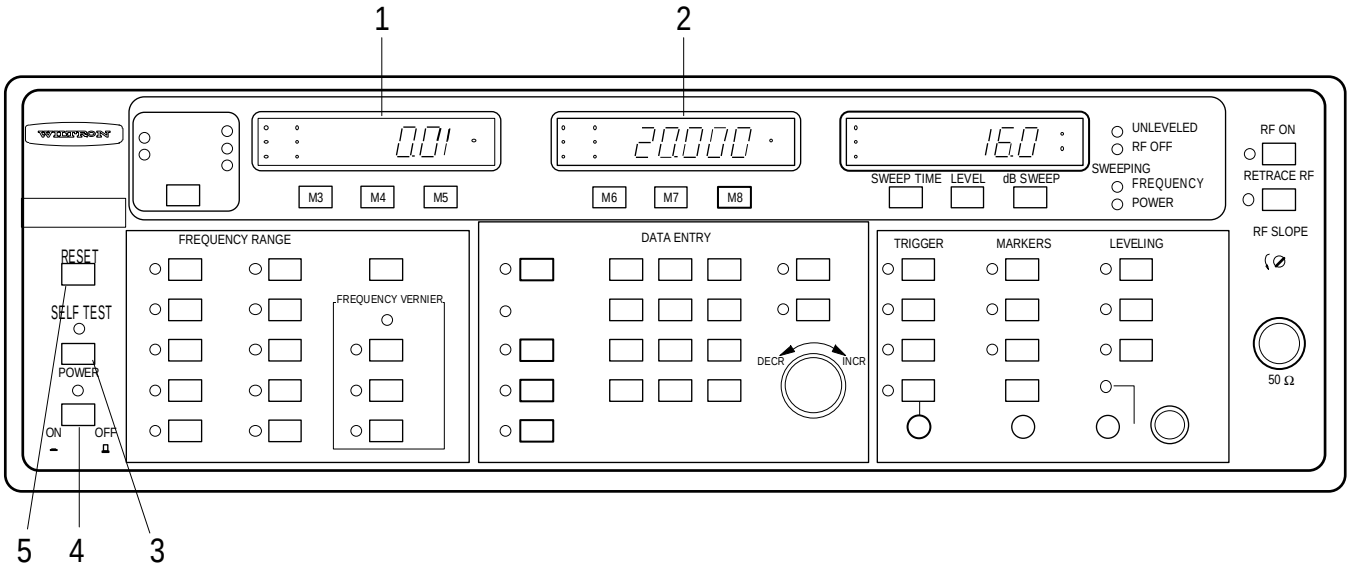
a. Inspect rear panel line module to ensure that it is set correctly (115 Vac or 230 Vac). If incorrectly set, change to correct line-voltage value using following procedure.

- On line module (1), remove line cord (2) and pry cover (3) open.
- Remove voltage-selector drum (4) by pulling straight 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.



2-4. TURN-ON PROCEDURE



CAUTION

Full instrument RF output power may be applied to unit-under test when sweep generator is turned on.

a. Press POWER (4) key to ON.

b. After a short delay, while the sweep generator undergoes self test, verify that "PASS" appears on display (2). If one or more error codes display, instead, note the number(s) and refer to 66XXB Maintenance Manual, part number 10350-00028, for further troubleshooting.

NOTE

- The number that appears on display (1) is firmware revision number. Firmware is the sweep generator 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 sweep generator 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 sweep generator to default values at any time during operation, press RESET (5) key.

FREQUENCY RANGE: FULL	ΔF: Model Dependent
TRIGGER: AUTO	F1: Model Dependent
VIDEO MARKER: On	F2: Model Dependent
LEVELING: INTERNAL	CF: Model Dependent
SWEEP TIME: .050 sec	M1: Model Dependent
RF ON: On	M2: Model Dependent
LEVEL: Model Dependent	M3-M8: Off

d. If no error codes appear, the sweep generator is ready for use in any of its operating modes.

CHAPTER 3
FRONT AND REAR PANEL DESCRIPTION

CONTENTS

CHAPTER 3
FRONT AND REAR PANEL DESCRIPTION

3-1. INTRODUCTION

This chapter provides descriptions for controls, indicators, and connectors on front panel and connectors on rear panel.

3-2. DESCRIPTION AND USE OF FRONT AND REAR PANEL CONTROLS, INDICATORS, AND CONNECTORS

Figure 3-1 shows the front panel and indicates the "Views" in which the included controls, indicators, and connectors are described in the accompanying text. Figure 3-2 (page 3-22) shows the location of the rear panel connectors, fan, and line voltage module. They are described in the accompanying text.

NOTE

The **SHIFT** key provides alternate functions for certain front panel keys. Shift functions for most keys are designated by blue lettering on front panel and by boldface type in this manual. Some shift functions provide extraordinary functions and features. These are called Hidden-Shift functions; they are not indicated by blue lettering, but are shown in boldface type and described along with their associated key in the following table.

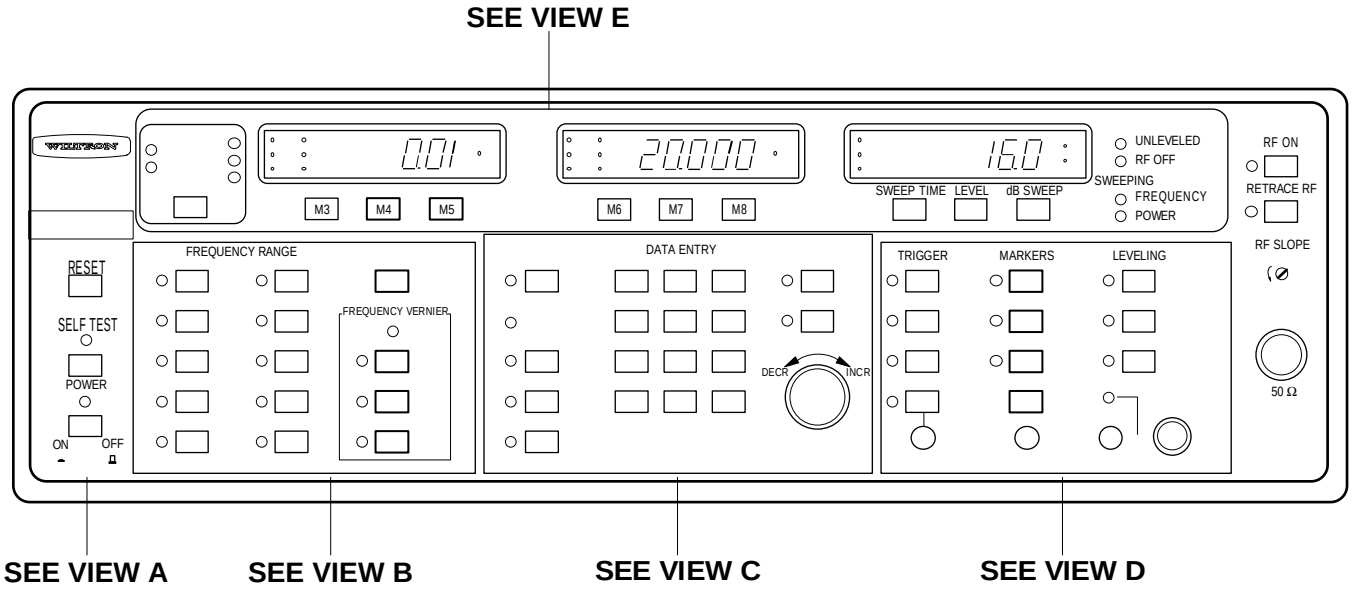
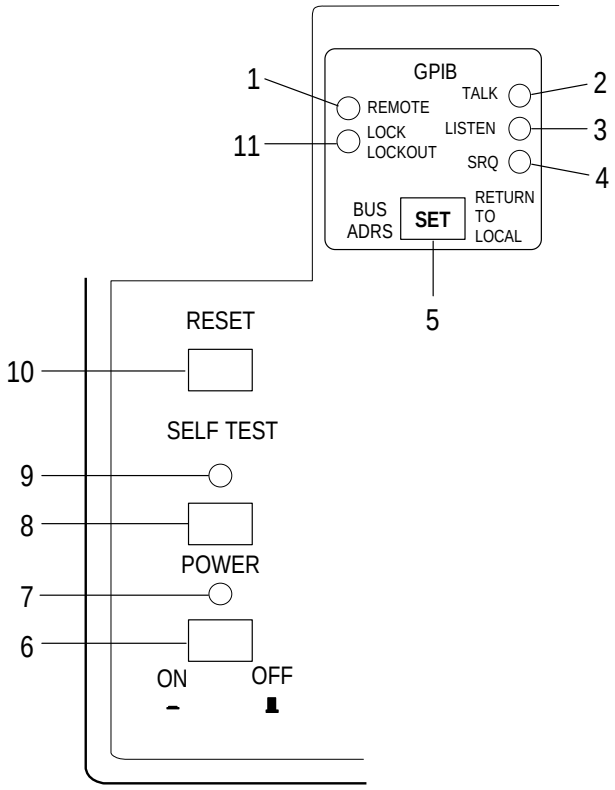


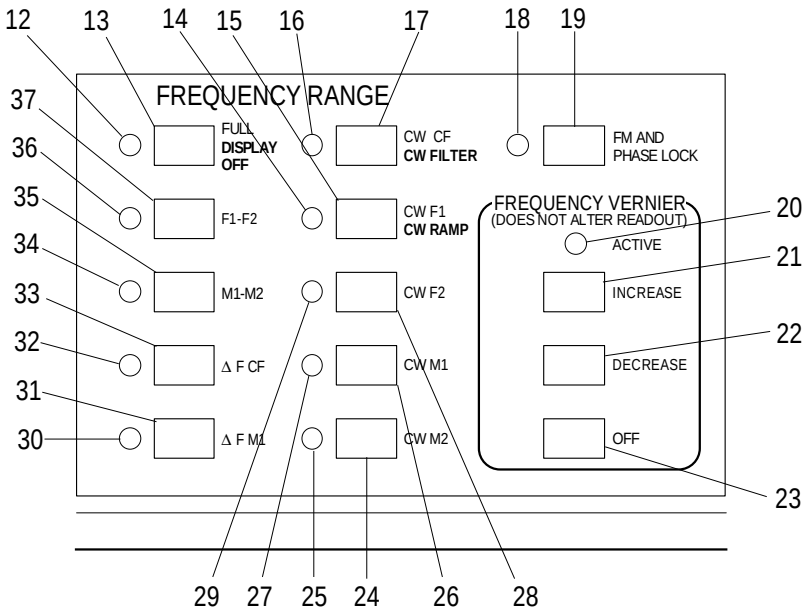
Figure 3-1. Sweep Generator Front Panel



VIEW A

Key	Control, Indicator, or Connector	Function
1	REMOTE Indicator	Indicates whether sweep generator is under GPIB control. Lights when sweep generator goes under GPIB control and remains lit until it is returned to local (front panel) control.
2	TALK Indicator	Indicates whether sweep generator is sending information to controller. Indicator remains lit while sweep generator is sending information.
3	LISTEN Indicator	Indicates whether sweep generator is receiving information from controller. Indicator remains lit while sweep generator is receiving information.
4	SRQ Indicator	Indicates whether sweep generator has sent a Service Request command to the controller. Indicator remains lit until sweep generator receives a serial poll, or until controller resets SRQ function.

Key	Control, Indicator, or Connector	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. **NOTE** 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.
5B	**SET** Key	Provides for entering a new GPIB address. To use, press **SHIFT** key (View C, key 47) then this key and enter a new address number via keypad. Address number is displayed on right-most numeric display.
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 the left-most numeric display.
7	POWER Indicator	Indicates whether sweep generator 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 sweep generator 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 (Paragraph 2-4). Press to use.
11	LOCAL LOCKOUT Indicator	Lights when sweep generator receives a local lockout message. When LOCAL LOCKOUT indicator is lit, sweep generator cannot be returned to local control via front panel controls.

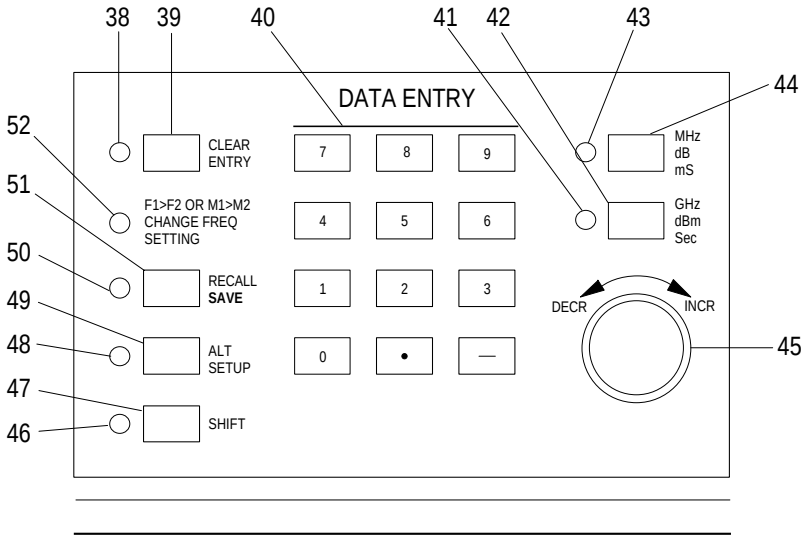


VIEW B

Key	Control, Indicator, or Connector	Function
12A	FULL Indicator	Indicates whether 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 display off mode is active. Indicator lights when **SHIFT** key plus **DISPLAY OFF** key is pressed and remains lit while mode is active.
13A	FULL Key	Selects full-band 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 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 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. 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 0-10V sweep ramp for all five CW modes at rear panel HORIZ OUTPUT connector. To use: Press **SHIFT** then this key.
16A	CW CF Indicator	Indicates whether CW CF mode is active. Indicator lights when CW CF key is pressed and remains lit while mode is active.

Key	Control, Indicator, or Connector	Function
16B	**CW FILTER** Indicator	When **SHIFT** key is pressed, indicator shows whether 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. 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, conditional-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. 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.
18	FM AND PHASELOCK Indicator	Indicates whether FM and Phaselock mode is active. Indicator lights when FM AND PHASELOCK key is pressed and remains lit while mode is active.
19	FM AND PHASELOCK 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/∅ LOCK connector and press key to activate function.
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, ΔF CF, and ΔF M1. Indicator remains lit until all affected modes have frequency-vernier correction turned off.
21	INCREASE Key	Increases frequency by a model-dependent increment for any of the following modes: CW CF, CW F1, CW F2, CW M1, CW M2. Maximum values are: 12.7 MHz in 100 kHz increments for models with high-end ≤20 GHz. 25.4 MHz in 200 kHz increments for models with high-end between 20 and 40 GHz. 38.1 MHz in 300 kHz increments for models with high-end between 40 and 60 GHz.
22	DECREASE Key	Decreases frequency as described for INCREASE key above. Operation of this key does not affect displayed LED readout value. Once made, vernier corrections to frequency remain in place, even when sweep generator is powered off. Press to use.
23	OFF Key	Cancels vernier correction being applied to selected CW output or ΔF center frequency and turns ACTIVE indicator off for that mode.
24	CW M2 Key	Selects CW M2 mode. 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 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 M1 mode. This mode provides a non-sweeping, CW signal at the frequency set for the M1 parameter. Press to use.

Key	Control, Indicator, or Connector	Function
27	CW M1 Indicator	Indicates whether CW M1 mode is active. Indicator lights when CW M1 key is pressed and remains lit while mode is active.
28	CW F2 Key	Selects CW F2 mode. This mode provides a non-sweeping, CW signal at the frequency set for the F2 parameter. Press to use.
29	CW F2 Indicator	Indicates whether CW F2 mode is active. Indicator lights when CW F2 key is pressed and remains lit while mode is active.
30A	ΔF M1 Indicator	Indicates whether ΔF M1 mode is active. Indicator lights when ΔF M1 key is pressed and remains lit while mode is active.
30B	**Shifted ΔF M1** Indicator	Indicates whether ΔF F1 mode is active. Indicator lights when **SHIFT** key and ΔF M1 key is pressed and remains lit while mode is active.
31A	ΔF M1 Key	Selects a frequency sweep that is symmetrical about the M1 frequency. Width of this sweep can go from 0% to 100% of full frequency range. Selected sweep width (ΔF) provides equal excursions about a selected center frequency. Press to use.
31B	**Shifted ΔF M1** Key	Selects a frequency sweep that is symmetrical about the F1 frequency. Width of this sweep can go from 0% to 100% of full frequency range. Sweep provides equal excursions about a selected center frequency. To use, press **SHIFT** then this key.
32A	ΔF CF Indicator	Indicates whether ΔF CF mode is active. Indicator lights when ΔF CF key is pressed and remains lit while mode is active.
32B	**Shifted ΔF CF** Indicator	Indicates whether **Shifted ΔF CF** mode is active. Indicator lights when **SHIFT** key and ΔF CF key is pressed and remains lit while mode is active.
33A	ΔF 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. Sweep provides equal excursions about a selected center frequency. Press to use.
33B	**Shifted ΔF CF** Key	Sets the Center-Frequency DAC to all ones, the ΔF DAC to 0, and selects the CW mode. Used for calibration of the CF-DAC precision op-amp offset to zero, and for diagnostic testing of the ΔF DAC precision op-amp offsets. To use, press **SHIFT** then this key.
34	M1–M2 Indicator	Indicates whether M1–M2 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 M1 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 F1–F2 sweep mode is active. Indicator lights when F1–F2 key is pressed and remains lit while mode is active.



VIEW C

Key	Control, Indicator, or Connector	Function
37	F1–F2 Key	Selects a frequency sweep from F1 to F2. This is one of two sweep modes in which start and stop frequency can be individually set. Press to use.
38	CLEAR ENTRY Indicator	Flashes when an illegal or incomplete (see below) data entry has been attempted. *Illegal 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. *Incomplete Entry:* Value entered on keypad but not terminated with MHz/dB/mS or GHz/dBm/Sec key. To clear, either press appropriate MHz/dB/mS or GHz/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 re-entered.
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 parameters, values can be entered in seconds or ms. For power level parameters, values can be entered in dB or dBm. For dB/sweep parameters, values can be entered in dB.
40A	DATA ENTRY Keypad **SHIFT-10**	Causes the model number to appear in the right LED display, the front panel firmware version in the center LED display, and the GPIB firmware version in the left LED display. If there is no GPIB board installed, the left LED display will be blank.

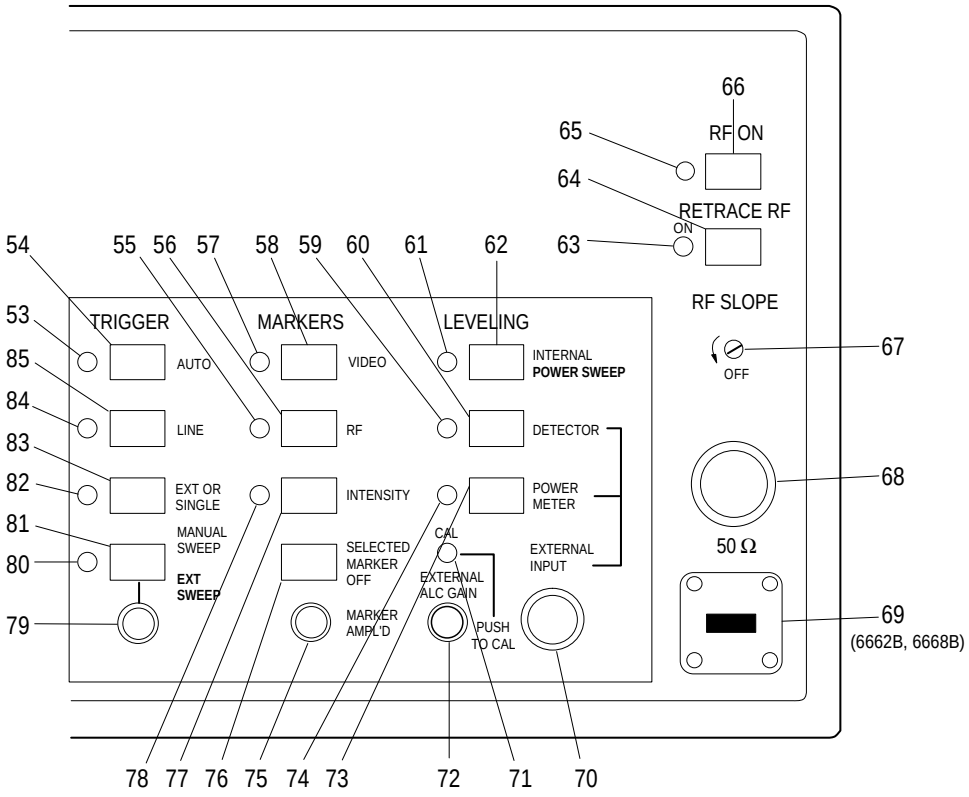
Key	Control, Indicator, or Connector	Function
40B	DATA ENTRY Keypad **SHIFT-11**	Displays all firmware related option numbers. Each number displays for about 2 seconds. Options displayed are 2, 9, 10, 11, 12, 13, 14. Additionally, Option 2 displays along with the maximum step value if it is other than 70 dB (that is, 2.110 means a 110 dB step attenuator). Option 9N, 9S or 9K are indicated as: OPTION DISPLAY 9N 9.1 9S 9.2 9K 9.3 GPIB is no longer an option. If a GPIB board is detected, it is indicated by displaying IEEE 488.
40C	DATA ENTRY Keypad **SHIFT-120**	Displays option 13 status in left LED display. DISPLAY MEANING +13 Option 13 is on –13 Option 13 is off
40D	DATA ENTRY Keypad **SHIFT-121**	Displays GPIB data terminator status in left LED display. DISPLAY MEANING CrLF The terminator is carriage return-line feed Cr The terminator is carriage return only
40E	DATA ENTRY Keypad **SHIFT-122**	Displays the status of the Power Level Entry mode in left LED display. See key 40N for a description of these modes. DISPLAY MEANING + CPL The COUPLED mode is on – CPL The UNCOUPLED mode is on
40F	DATA ENTRY Keypad **SHIFT-123**	Displays the step attenuator dB in center LED display and the power level in left LED display. If no step attenuator is installed, then center LED display is blank.
40G	DATA ENTRY Keypad **SHIFT-124**	Displays the status of the Power On Security mode in left LED display. DISPLAY MEANING + SEC the power on security mode is on – SEC the power on security mode is off
40H	DATA ENTRY Keypad **SHIFT-125**	Displays the current status of the CW filter in left LED display. DISPLAY MEANING + FIL the CW filter is currently in – FIL the CW filter is out
40I	DATA ENTRY Keypad **SHIFT-126**	Turns all front panel leds and displays on until the **SHIFT** or CLEAR key is hit.

Key	Control, Indicator, or Connector	Function
40J	DATA ENTRY Keypad **SHIFT-127**	Turns all front panel leds and displays off until the **SHIFT** or CLEAR key is hit.
40K	DATA ENTRY Keypad **SHIFT-13**	Toggles Option 13 on or off and displays status. If Option 13 is not installed, key will not turn Option 13 on. See key 40C for a description of the status display.
40L	DATA ENTRY Keypad **SHIFT-140**	Sets the GPIB address and data terminator to that programmed via the **SET** key (5B). To find out what the address and terminator changed to, use **SHIFT-121** for the terminator and BUS ADDR for the address.
40M	DATA ENTRY Keypad **SHIFT-141**	Toggles the GPIB terminator between CR only and CR LF and displays the status. See key 40D for a description of the status display.
40N	DATA ENTRY Keypad **SHIFT-142**	Toggles the Power Level Entry mode between COUPLED and UNCOUPLED and displays the status. See key 40E for a description of the status display. While in the COUPLED mode, the step attenuator is controlled automatically when setting the power level. This is the normal mode of operation. The power level range is determined by the RESET parameters of the particular instrument and step attenuator installed. While in the UNCOUPLED mode, the step attenuator and the power level setting are independent. The power level can be set over the entire range of the level loop and the step attenuator can be set from 0 to 70 or 110 dB depending on the attenuator installed using **SHIFT-143.** You can use this mode even though no step attenuator is installed to permit operating the instrument over its full level range. **NOTE** The power level accuracy specifications of the instrument are for those power levels that can be achieved while in the COUPLED mode of operation. In the UNCOUPLED mode, the power level set may not meet these accuracy specifications at all power levels.

Key	Control, Indicator, or Connector	Function
40O	DATA ENTRY Keypad **SHIFT-143**	Prompts the operator to enter a dB value for the step attenuator and displays the status. See key 40F for a description of the status display. You can use this function even in the COUPLED mode. The operator can enter up to 3 digits. If less than 3 digits are entered, one of the terminator keys (dB or dBm) must be used to complete the action. The procedure always assumes that the last number entered is a 0. Thus an entry of 76 dB will set the attenuator to 70 dB. Entering a dB value higher than the step attenuator can provide will flash the CLEAR ENTRY indicator to flag an error. If the CLEAR key is hit without any numbers being entered, or the SHIFT key at any time, the procedure exits the shift mode with the step attenuator remaining unchanged. If the CLEAR key is hit after some numbers have been entered, the display will be cleared and input starts at the beginning. If a terminator key is hit without any numbers being entered, the attenuator is set to 0 dB.
40P	DATA ENTRY Keypad **SHIFT-144**	Turns the Power-On-Security mode on and displays its status. While in this mode, the instrument will do a master reset, clearing all memory and stored setups whenever it powers up. The only way to cancel this mode is by using **SHIFT-86**. See key 40G for a description of the status display.
40Q	DATA ENTRY Keypad **SHIFT-145**	Turns the Full Secure Display mode on. This is identical to the GPIB mnemonic DS0 action.
40R	DATA ENTRY Keypad **SHIFT-86**	Initializes the front panel and puts reset in all stored setups. Also cancels the Power On Security mode. See key 40P description.
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 (GHz, dBm, Sec) 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/dB/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.

Key	Control, Indicator, or Connector	Function
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 INCR 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 1 to 99 seconds
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 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—frequency 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 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 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 0 key recalls setup that was in use prior to starting Recall function. Press to use.

Key	Control, Indicator, or Connector	Function
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 0 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 M1.) Two LED readouts displaying frequency also flash. To clear: Either re-enter frequency values so that F1 or M1 is less than F2 or M2 or select a different frequency range.



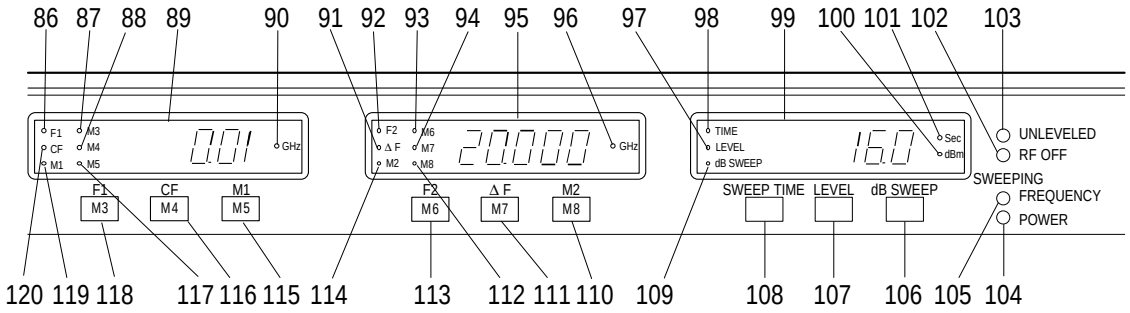
VIEW D

Key	Control, Indicator, or Connector	Function
53	AUTO Indicator	Indicates whether 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.
55	RF Indicator	Indicates whether RF markers are on. Indicator lights when RF key is pressed and remains lit while RF markers are active.
56	RF Key	Dips RF output at marker frequency (or frequencies). Dip of last-selected marker can be adjusted from 0 to approximately 10 dB using MARKER AMPL'D control. Dip of all other markers is adjustable from 0 to approximately 5 dB. Press to use.
57	VIDEO Indicator	Indicates whether video markers are active. Indicator lights when VIDEO key is pressed and remains lit while video markers are active.

Key	Control, Indicator, or Connector	Function
58	VIDEO Key	Provides positive-going video pulse at marker frequency (or frequencies). Amplitude of last-selected marker can be adjusted from 0 to +10 volts using MARKER AMPL'D control. Amplitude of all other markers can be adjusted from 0 to +5 volts. Press to use.
59	DETECTOR Indicator	Indicates whether external detector leveling is active. 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 internal leveling is active. Indicator 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 power sweep mode is active. Indicator lights when **SHIFT** key plus **POWER SWEEP** key is pressed and remains lit while modulation is active.
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.
63A	RETRACE RF Indicator	Indicates whether retrace RF function is active. Indicator lights when RETRACE RF key is pressed and remains lit while mode is active.
63B	**Shifted RETRACE RF** Indicator	Indicates whether Shifted Retrace RF function is active. Indicator lights when **SHIFT** key and RETRACE RF key is pressed and remains lit while mode is active.
64A	RETRACE RF Key	Turns RF output on and off during sweep retrace. Key is interlocked such that it cannot be turned on unless RF ON key is also on.
64B	**Shifted RETRACE RF** Key	Sets the Step DAC on the A5 PCB to all zeros and selects the Step DAC mode. Used for verification of the Step DAC at 0V. To use: Press **SHIFT** key then this key.
65A	RF ON Indicator	Indicates whether RF output is turned on. Indicator lights when RF key is pressed and remains lit while RF output is turned on.
65B	**Shifted RF ON** Indicator	Indicates whether Shifted RF output mode is turned on. Indicator lights when **SHIFT** key and RF key is pressed and remains lit while Shifted RF output is turned on.
66A	RF ON Key	Turns RF output on and off. Press to use.
66B	**Shifted RF ON** Key	Sets the Step DAC on the A5 PCB to all ones and selects the Step DAC mode. Used for verification of the Step DAC at +10V. To use: Press **SHIFT** key then this key.

Key	Control, Indicator, or Connector	Function
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. With 6662B and 6668B models, this connector provides output up to 26.5 GHz.
69	RF OUTPUT Connector	Used only with 6662B and 6668B models.
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.
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 to show when level of input signal is optimum for ALC operation. **NOTE** Do not rotate knob after gain has been adjusted for optimum operation. To do so invalidates setting.
73	POWER METER Key	Provides for leveling output power using external power meter. Sweep generator is compatible with power meters that have ±1V FS (full-scale) analog output. Press to use.
74	POWER METER Indicator	Indicates whether 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 amplitude and counterclockwise to decrease marker amplitude.
76A	SELECTED MARKER OFF Key	Causes selected marker to disappear from externally connected oscilloscope display. Press to use.
76B	**Shifted SELECTED MARKER OFF** Key	Turns all markers off. To use: Press **SHIFT** key then this key.

Key	Control, Indicator, or Connector	Function
77A	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 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 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 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 ext or single mode is active. Indicator lights when EXT OR SINGLE key is pressed and remains lit while mode is active.
83	EXT OR SINGLE Key	Provides for triggering a frequency sweep in either of two ways: (1) By using an external pulse supplied via rear panel SWEEP TRIGGER INPUT connector. (2) 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 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

Key	Control, Indicator, or Connector	Function
86	F1 Indicator	Indicates whether F1 parameter is active. Lights when F1 key is pressed and remains lit while F1 parameter is active.
87	M3 Indicator	Indicates whether M3 parameter is active. Lights when M3 key is pressed and remains lit while M3 parameter is active.
88	M4 Indicator	Indicates whether 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 ΔF parameter is active. Lights when ΔF key is pressed and remains lit while DF parameter is active.
92	F2 Indicator	Indicates whether F2 parameter is active. Lights when F2 key is pressed and remains lit while F2 parameter is active.
93	M6 Indicator	Indicates whether M6 parameter is active. Lights when M6 key is pressed and remains lit while M6 parameter is active.
94	M7 Indicator	Indicates whether M7 parameter is active. Lights when M7 key is pressed and remains lit while M7 parameter is active.
95	LED Frequency Display	Displays frequency of selected F2, ΔF, M2, M6, M7, or M8 parameter.
96	GHz Indicator	Indicates that displayed frequency numerals are in GHz.
97	LEVEL Indicator	Indicates whether LEVEL parameter is active. Lights when LEVEL key is pressed and remains lit while LEVEL parameter is active.

Key	Control, Indicator, or Connector	Function
98	TIME Indicator	Indicates whether 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 numerals are in dBm.
101	Sec Indicator	Indicates that displayed numerals are in seconds.
102	RF OFF Indicator	Indicates whether 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 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 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 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 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.
111A	ΔF Key	Selects ΔF parameter and opens it for data entry. Press to use.
111B	**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.

Key	Control, Indicator, or Connector	Function
112	**M8** Indicator	Indicates whether 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 M2 parameter is open. Indicator lights when M2 key is pressed and remains lit until a different parameter is selected.
115A	M1 Key	Selects M1 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 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	M1 Indicator	Indicates whether M1 parameter is open. Indicator lights when M1 key is pressed and remains lit until a different parameter is selected.
120	CF Indicator	Indicates whether CF parameter is open. Indicator lights when CF key is pressed and remains lit until a different parameter is selected.

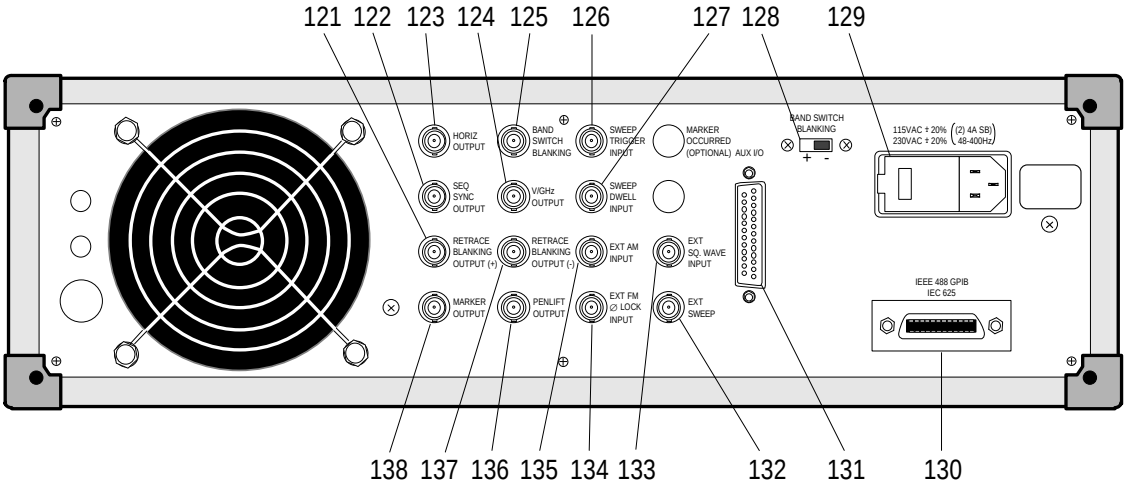


Figure 3-2. Sweep Generator Rear Panel

Key	Control, Indicator, or Connector	Function
121	RETRACE BLANKING OUTPUT (+) Connector	Provides +5V pulse during sweep retrace.
122	SEQ SYNC OUTPUT Connector	Provides direct-coupled, +5.0V rectangular pulse during sweep retrace and bandswitch points.
123	HORIZ OUTPUT Connector	Provides 0 to +10V ramp coincident with low- to high-frequency sweep.
124	V/GHz OUTPUT Connector	Provides voltage equal to output frequency, as shown below: High End Frequency 20 GHz or less: 1 V/GHz High End Frequency 20 to 40 GHz: 1/2 V/GHz High End Frequency 40 to 60 GHz: 1/3 V/GHz
125	BANDSWITCH BLANKING Connector	Provides a + or – 5V pulse during oscillator bandswitching, depending on BANDSWITCH BLANKING switch (128) setting.
126	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: <5 µs Pulse Width: >1 µs Polarity: Low true

Key	Control, Indicator, or Connector	Function
127	SWEEP DWELL INPUT Connector	Allows a TTL low to cause the sweep generator sweep to dwell.
128	BAND SWITCH BLANKING Switch	Switches polarity of bandswitch blanking signal.
129	Line Voltage Module	Provides for supplying 115 Vac or 230 Vac line voltage to sweep generator.
130	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).
131	AUX I/O Connector	Provides interface between sweep generator and WILTRON Models 560A, 561, or 562 Scalar Network Analyzer.
132	EXT SWEEP Connector	Allows external 0 to +10 V ramp to be used to sweep output frequency. EXTERNAL SWEEP key must be activated.
133	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 +10V.
134	EXT FM ∅ LOCK INPUT Connector	Provides for external FM and/or phase-lock input signal. For phase locking, front panel FM AND PHASELOCK key must be selected. Input impedance is 2 kΩ.
135	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 kΩ.
136	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.
137	RETRACE BLANKING OUTPUT (–) Connector	Provides direct-coupled, –5.0V rectangular pulse coincident in time with RF blanking.
138	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 0 to +5 volts using MARKER AMPL'D control. The last-selected marker is adjustable from 0 to +10 volts.

CHAPTER 4
FRONT PANEL OPERATION

CONTENTS

CHAPTER 4
FRONT PANEL OPERATION

4-1. INTRODUCTION

This section provides procedures for operating the sweep generator using front panel controls.

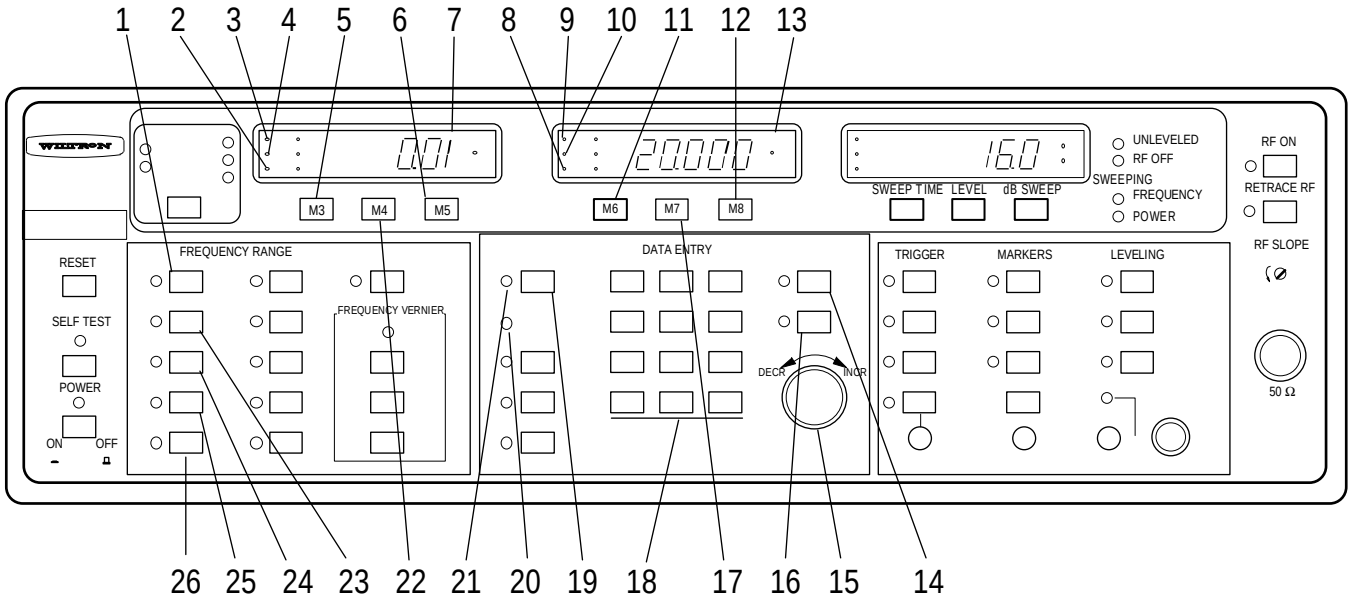
NOTE

The **SHIFT** key provides alternate functions for certain front panel keys. Shift functions are designated by blue lettering on front panel and by boldface type in this manual.

4-2. FREQUENCY SWEEP OPERATION

There are five frequency sweep modes: full, F1–F2, M1–M2, ΔF CF and ΔF M1.

- The full mode provides a fixed 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 ΔF CF and ΔF M1 modes provide for symetrically sweeping on both sides of a center frequency, CF or M1.



a. FULL-Range Sweep Mode.

1. Press FULL key (1); observe that associated indicator lights.
2. Observe that displays (7) and (13) show the full start and stop range.

b. F1–F2 or M1–M2 Sweep Modes.

1. Press F1–F2 key (23) or M1–M2 key (24); observe that associated indicator lights.
2. Press F1 key (5) (if F1–F2 key was pressed in step 1), or M1 key (6) (if M1–M2 key was pressed in step 1); observe that F1 (3) or M1 (2) indicator lights.
3. Enter start-frequency using keypad (18) or DECR-INCR control (15).
4. If keypad was used, press MHz/dB/mS key (14) or GHz/dBm/Sec key (16) to complete data entry.
5. If CLEAR ENTRY indicator (21) starts flashing, the entered value is not within the selected range. To clear, press CLEAR ENTRY key (19) and enter a new, in-range frequency value.
6. If F1>F2 OR M1>M2 CHANGE FREQ SETTING indicator (20) starts flashing, frequency F1 is greater than F2 (or M1 is greater than M2). To clear, enter new value for F1 (M1) or F2 (M2) so that F1 (M1) is lower in frequency than F2 (M2).
7. Observe that frequency is displayed (in GHz) on display (7).
8. Press F2 key (11) (if F1–F2 key was pressed in step 1), or M2 key (12) (if M1–M2 key was pressed in step 1); observe that F2 (9) or M2 (8) indicator lights.

9. Enter stop-frequency using keypad (18) or DECR-INCR control (15).
10. If keypad was used, press MHz/dB/mS key (14) or GHz/dBm/Sec key (16) to complete data entry.
11. If CLEAR ENTRY indicator (21) starts flashing, refer to step b5 for corrective action.
12. If F1>F2 OR M1>M2 CHANGE FREQ SETTING indicator (20) starts flashing, refer to step b6 for corrective action.
13. Observe that frequency is displayed (in GHz) on display (13).

c. ΔF CF or ΔF M1 Sweep Modes.

1. Press ΔF CF key (25) or ΔF M1 key (26); observe that associated indicator or lights. Also, observe that ΔF indicator (13) lights.
2. Press CF key (22) or M1 key (6); observe that CF indicator (4) or M1 indicator (2) lights.
3. Enter center-frequency for sweep using keypad (18) or DECR-INCR control (15).
4. If keypad was used, press MHz/dB/mS key (14) or GHz/dBm/Sec key (16) to complete data entry.
5. If CLEAR ENTRY indicator (21) starts flashing, refer to step b5 for corrective action.
6. Observe that frequency is displayed (in GHz) on display (7).
7. To enter new ΔF frequency, press ΔF key (17).
8. Enter sweep width using keypad (18) or DECR-INCR control (15).

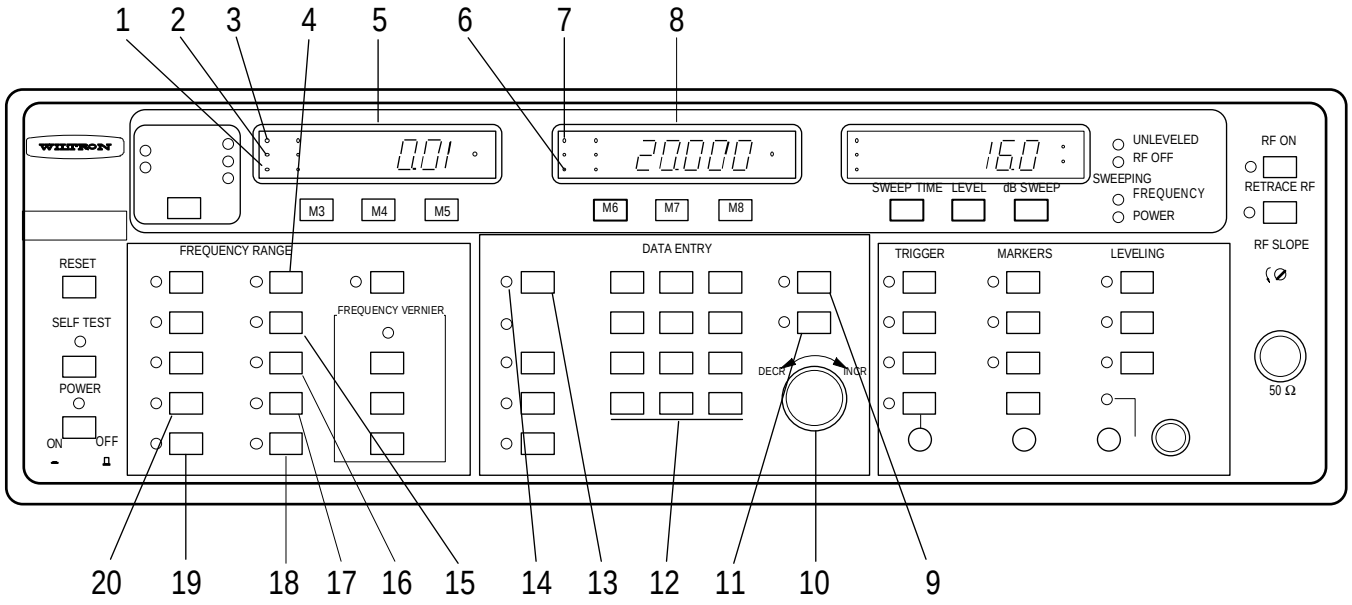
NOTE

The sweep range equals the ΔF value. For example, if the CF or M1 value is 10 GHz and the ΔF value is 2 GHz, the sweep starts at 9 GHz and ends at 11 GHz.

9. If keypad was used, press MHz/dB/mS key (14) or GHz/dBm/Sec key (16) to complete data entry.
10. If CLEAR ENTRY indicator (21) starts flashing, refer to step b5 for corrective action.
11. Observe that frequency is displayed (in GHz) on display (13).

4-3. CONTINUOUS WAVE (CW) OPERATION

There are five CW modes: CW CF, CW F1, CW F2, CW M1, and CW M2. All provide user-selected, fixed-frequency, CW signals.



a. CW CF Mode.

1. Press CW CF key (4); observe that both associated indicator and CF indicator (2) light.
2. Enter desired CW frequency using keypad (12) or DECR-INCR control (10).
3. If keypad was used, press MHz/dB/mS key (9) or GHz/dBm/Sec key (11) to complete data entry.
4. If CLEAR ENTRY indicator (14) starts flashing, the entered value is not within the selected range. To clear, press the CLEAR ENTRY key (13) and enter a new, in-range frequency value.
5. Observe that frequency is displayed (in GHz) on display (5).

b. CW F1 Mode.

1. Press CW F1 key (15); observe that both associated indicator and F1 indicator (3) light.
2. Enter desired CW frequency using keypad (12) or DECR-INCR control (10).
3. If keypad was used, press MHz/dB/mS key (9) or GHz/dBm/Sec key (11) to complete data entry.
4. If CLEAR ENTRY indicator (14) starts flashing, refer to step a4 for corrective action.
5. Observe that frequency is displayed (in GHz) on display (5).

c. CW F2 Mode.

1. Press CW F2 key (16); observe that both associated indicator and F2 (7) indicator light.
2. Enter desired CW frequency using keypad (12) or DECR-INCR control (10).
3. If keypad was used, press MHz/dB/mS key (9) or GHz/dBm/Sec key (11) to complete data entry.
4. If CLEAR ENTRY indicator (14) starts flashing, refer to step a4 for corrective action.
5. Observe that frequency is displayed (in GHz) on display (8).

d. CW M1 Mode.

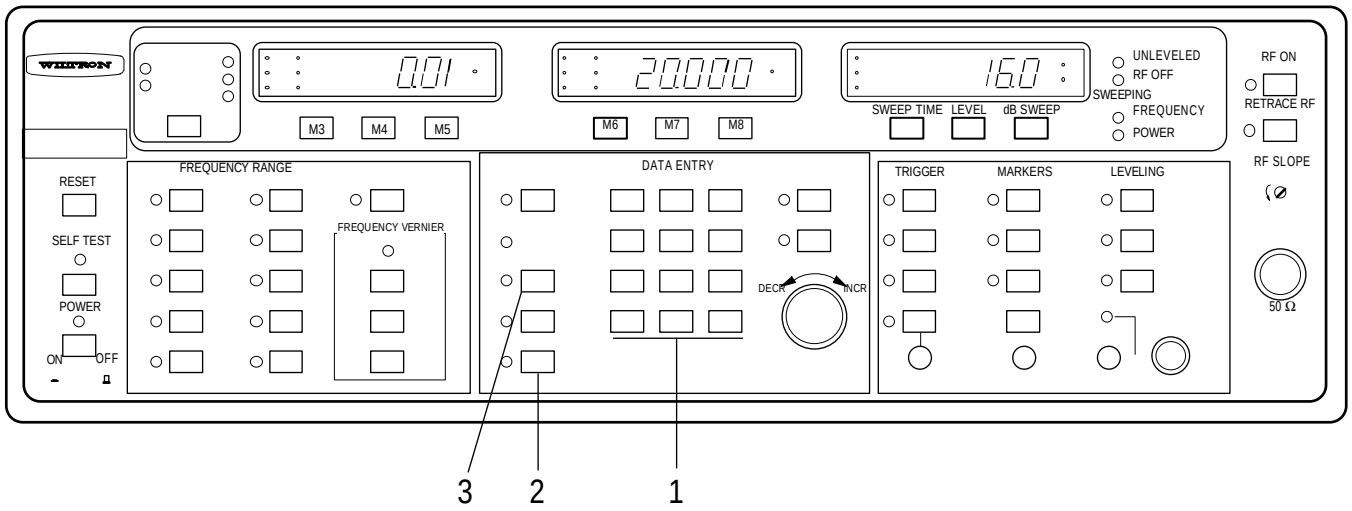
1. Press CW M1 key (17); observe that both associated indicator and M1 indicator (1) light.
2. Enter desired CW frequency using keypad (12) or DECR-INCR control (10).
3. If keypad was used, press MHz/dB/mS key (9) or GHz/dBm/Sec key (11) to complete data entry.
4. If CLEAR ENTRY indicator (14) starts flashing, refer to step a4 for corrective action.
5. Observe that frequency is displayed (in GHz) on display (5).

e. CW M2 Mode.

1. Press CW M2 key (18); observe that both associated indicator and M2 indicator (6) light.
2. Enter desired CW frequency using keypad (12) or DECR-INCR control (10).
3. If keypad was used, press MHz/dB/mS key (9) or GHz/dBm/Sec key (11) to complete data entry.
4. If CLEAR ENTRY indicator (14) starts flashing, refer to step a4 for corrective action.
5. Observe that frequency is displayed (in GHz) on display (8).

4-4. STORE/RECALL OPERATION

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



a. To store a setup:

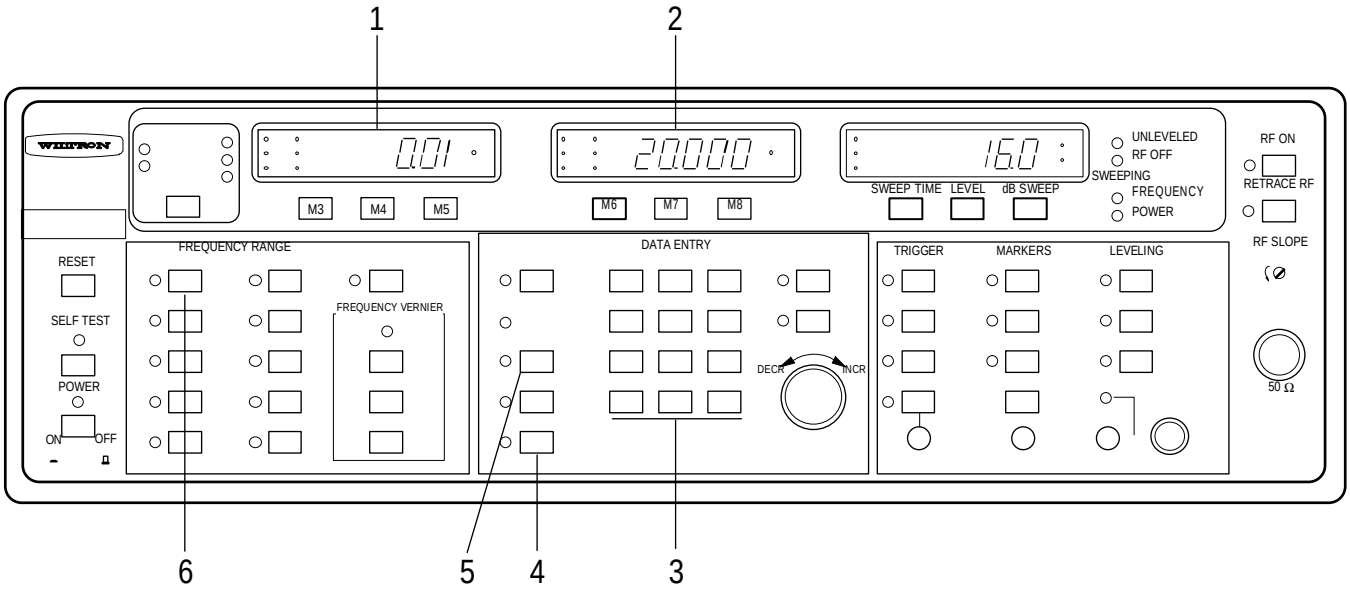
1. Sequentially press **SHIFT** key (2), **SAVE** key (3), then desired number from 1 to 9 using numeric keypad (1). If setup was previously stored at selected location (1 to 9), it will be overwritten by new setup.
2. To provide for forgiving (undoing) a setup saved in error, the setup that was overwritten is transferred to memory location 0. It can be recalled by sequentially pressing RECALL (3) then 0 (1).

b. To recall a setup:

1. Sequentially press RECALL (3) then desired number from 1 to 9 using numeric keypad (1).
2. To provide for forgiving (undoing) a setup replaced in error by a recalled setup, the setup that was in use before replacement by recalled setup is written into memory location 0. It can then be recalled by sequentially pressing RECALL (3) then 0 (1).

4-5. 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.



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

1. Sequentially press **SHIFT** key (4) then **DISPLAY OFF** key (6).
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** key (4), **SAVE** key (5), then desired number from 1 to 9 using numeric keypad (3); observe that the word "Code" appears on display (1). 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 key (5) then desired number from 1 to 9 using keypad (3).

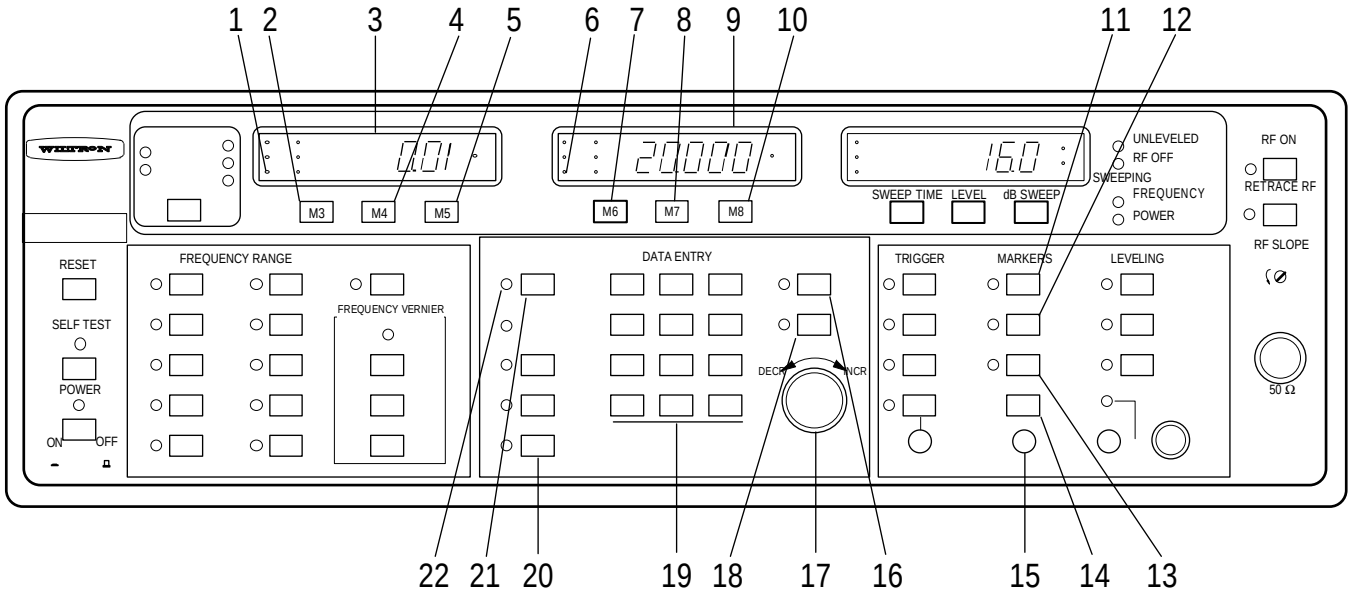
CAUTION

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).

4-6. FREQUENCY MARKER OPERATION

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



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

1. Press VIDEO key (11); observe that associated indicator lights.
2. Press M1 key (5); observe that M1 indicator (1) lights.
3. Enter desired marker-frequency value using keypad (19) or DECR-INCR control (17).
4. If keypad was used, press MHz/dB/mS key (16) or GHz/dBm/Sec key (18) to terminate data entry.

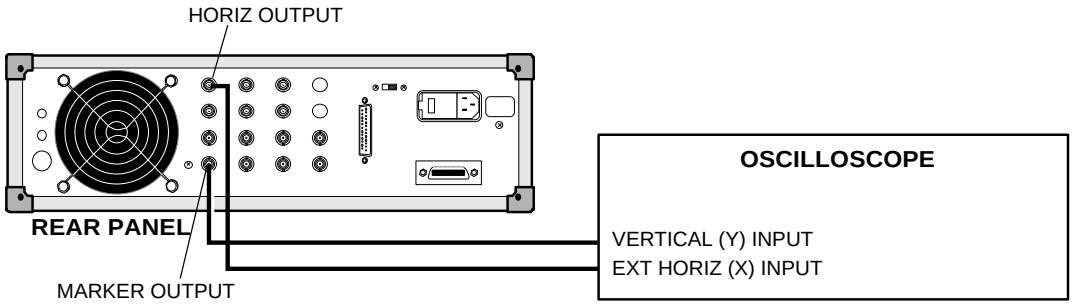
NOTE

If marker value is out of the full range, the CLEAR ENTRY indicator (22) will start flashing. To clear, press CLEAR ENTRY key (21) 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 key (10); observe that M2 indicator (6) lights.
7. Enter desired marker-frequency value using keypad (19) or DECR-INCR control (17).
8. If keypad was used, press MHz/dB/mS key (16) or GHz/dBm/Sec key (18) to terminate data entry.
9. Observe that frequency value is displayed (in GHz) on display (9).
10. Sequentially press **SHIFT** key (20) then **M3** key (2).
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. To view markers on an oscilloscope and turn a selected marker off, proceed as follows:

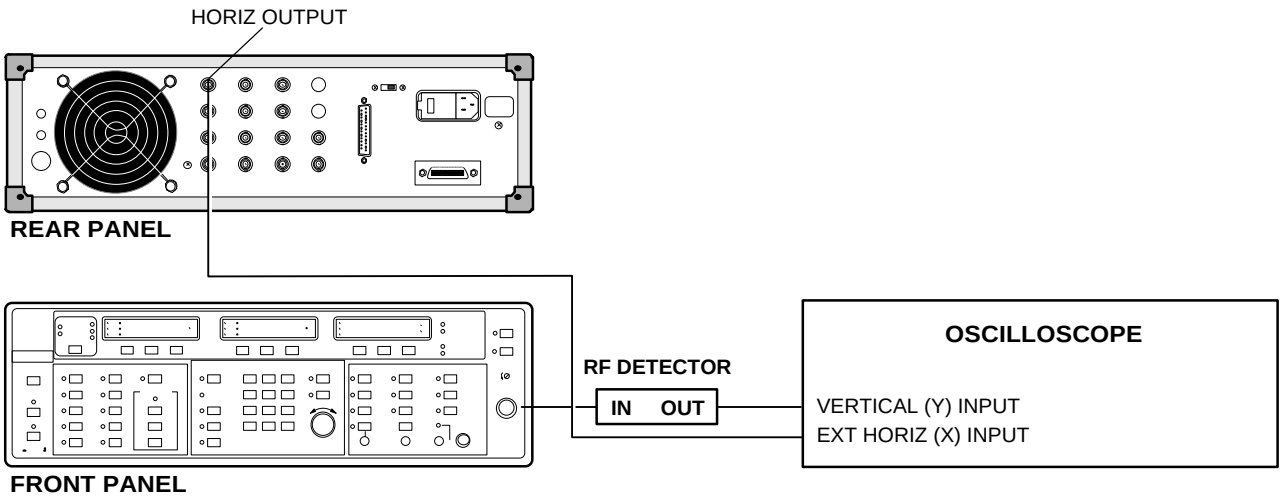
1. Connect oscilloscope to sweep generator as shown below.



2. Adjust MARKER AMPL'D control (15), 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 key (14).
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 sweep generator as shown below.



NOTE

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

2. Press RF key (12); observe that associated indicator lights.
3. Adjust MARKER AMPL'D control (15), if necessary, to obtain a marker.
4. Press INTENSITY key (13); observe that associated indicator lights.

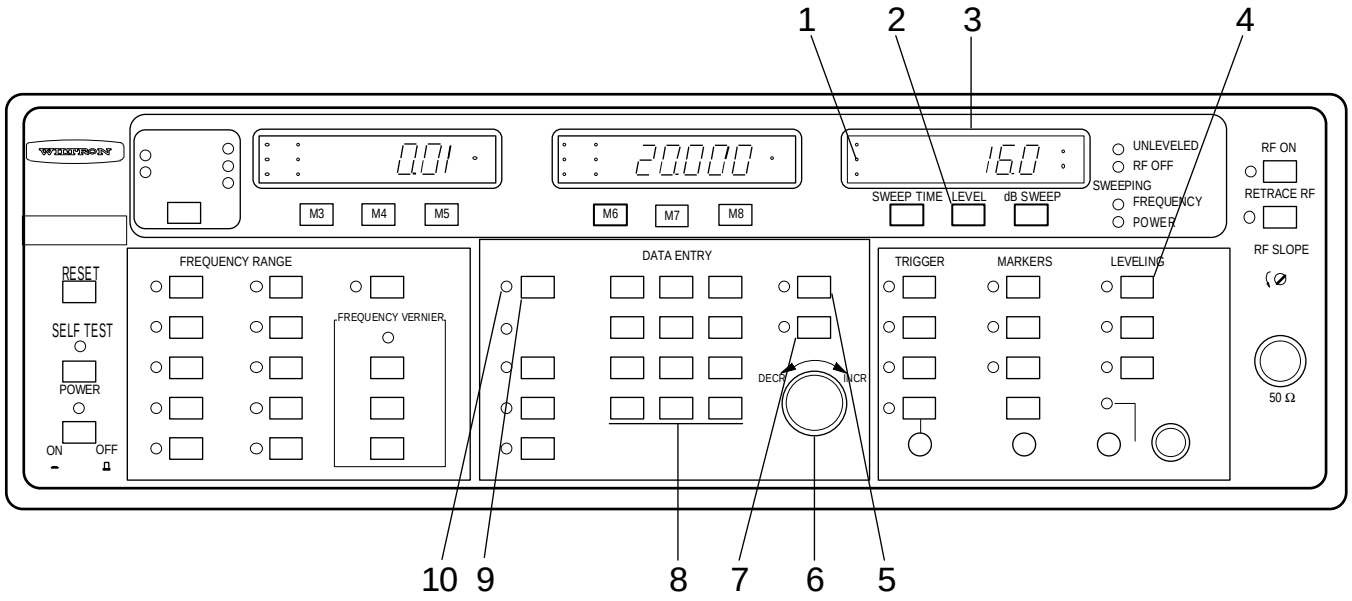
NOTE

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 control (15).

4-7. INTERNAL POWER LEVELING OPERATION

The sweep generator provides internally leveled RF output power over a 10 dB range.



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

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

NOTE

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

2. Press LEVEL key (2); observe that LEVEL indicator (1) lights.
3. Enter desired power-level value using keypad (8) or DECR-INCR control (6).
4. If the keypad was used, press GHz/dBm/Sec key (7) to terminate data entry.

NOTE

If power-level value is out range, the CLEAR ENTRY indicator (10) flashes. To clear, press CLEAR ENTRY key (9) 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 key (2).

2. Using keypad (8) or DECR-INCR control (6), enter desired power-level-difference value (as an example, use –5).
3. If the keypad was used, press MHz/dB/mS key (5) to terminate data entry.

NOTE

If decrease goes below low power-range value, display (3) and CLEAR ENTRY indicator (10) flash. To clear condition, press CLEAR ENTRY key (9) and re-enter a value that causes power to stay above low power-range value.

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

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

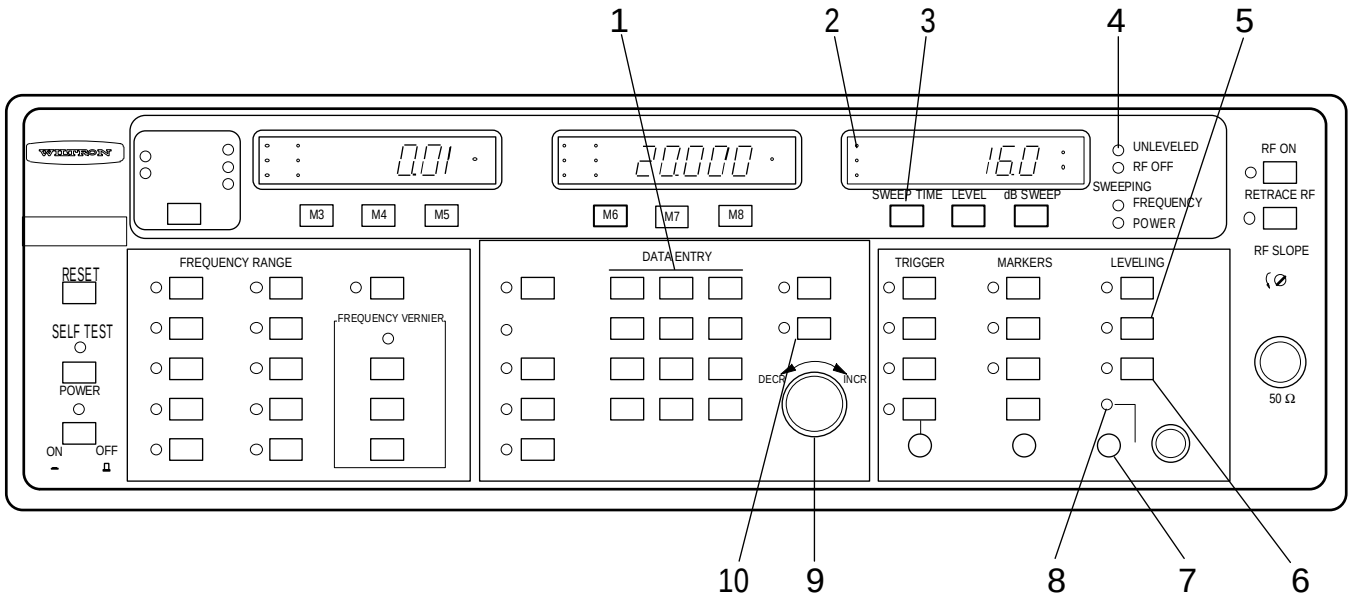
1. Press LEVEL key (2); observe that LEVEL indicator (1) lights.
2. Enter desired power-level value using keypad (8) or DECR-INCR control (6) (as an example, use +5).
3. If the keypad was used, press MHz/dB/mS key (6) to terminate data entry.
4. Observe that, for the example, power-level value appearing on right display (3) increased by 5 dB.

NOTE

If increase exceeds high power-range value, display (3) and CLEAR ENTRY indicator (10) flash. To clear condition, press CLEAR ENTRY key (9) and re-enter a value that causes increase in power to stay below power-range value.

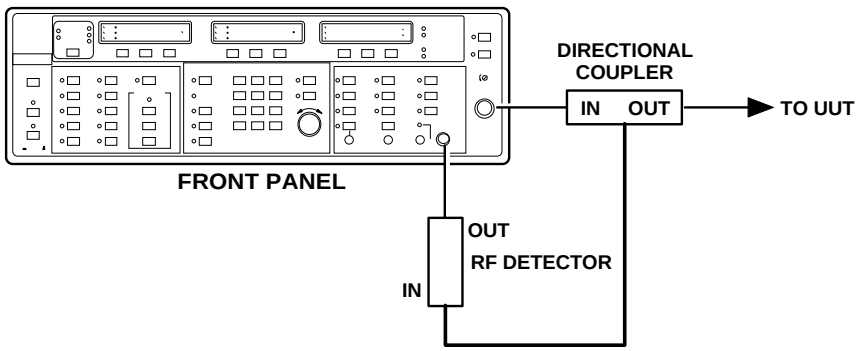
4-8. EXTERNAL POWER LEVELING OPERATION

The sweep generator provides for leveling the RF output power using the output from an external directional-coupler and either a detector or a power meter.



a. To level RF 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 within the full range of the sweep generator model in use.



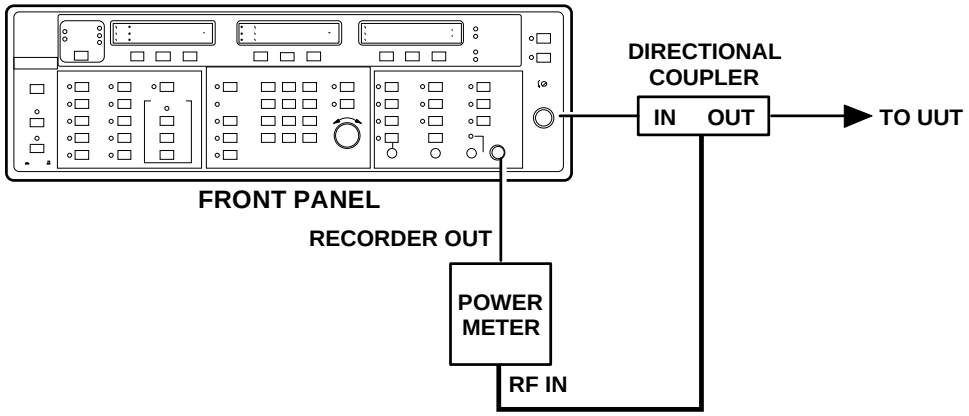
2. Set sweep generator to sweep a range of frequencies within the coupler range (Paragraph 4-2).
3. Press DETECTOR key (5); observe that associated indicator lights.
4. Push in EXTERNAL ALC GAIN control (7) and turn in one direction or the other until the CAL indicator (8) just comes on and remains on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

NOTE

Do not allow EXTERNAL ALC GAIN control (7) 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 within the sweep generator's full range.



2. Set sweep generator to sweep a range of frequencies within the coupler range (Paragraph 4-2).

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 second) sweep speed.

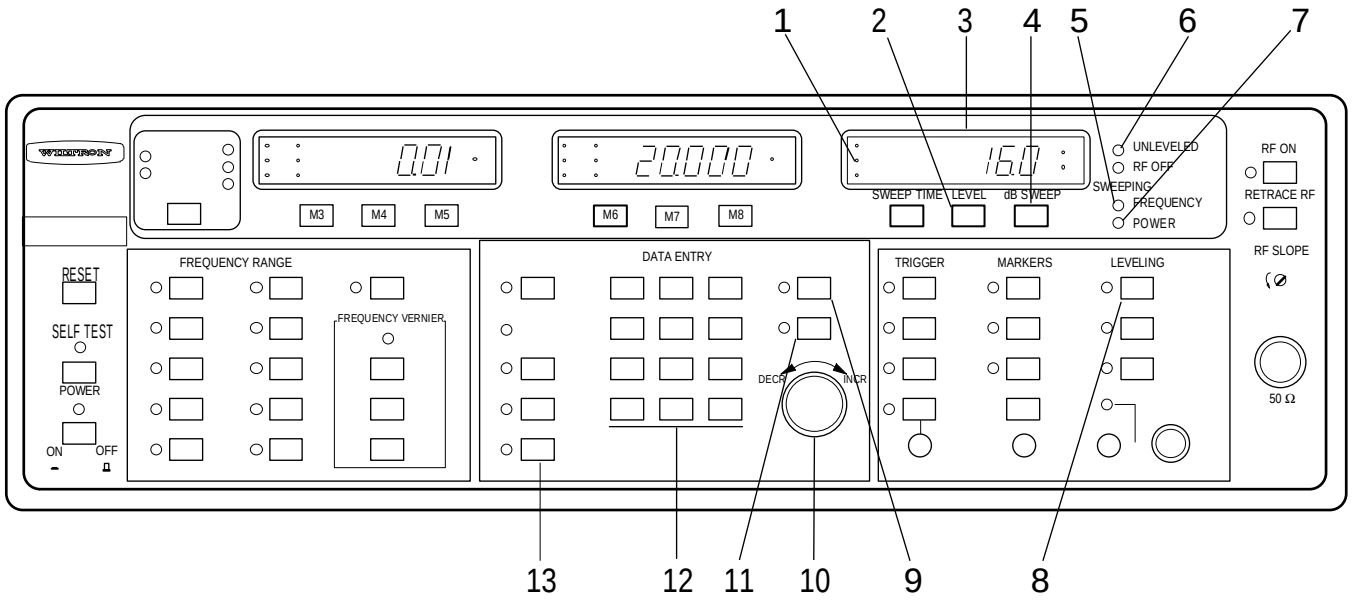
3. To level using CW, set sweep generator for CW CF mode (Paragraph 4-3a) and CF parameter to frequency equal to midband frequency of directional coupler. Go to step 5.
4. To level using a slowly sweeping signal, proceed as follows:
   - Select F1-F2 sweep and set F1 and F2 parameters for a sweep range that is within the range of the directional coupler (Paragraph 4-2).
   - Press SWEEP TIME key (3); observe that TIME indicator (2) lights.
   - Using keypad (1) or INCR-DECR control (9), set sweep time for 99-second sweep.
   - If keypad was used, terminate data entry with GHz/dBm/Sec key (10).
5. Press POWER METER (6) key; observe that associated indicator lights.
6. Push in EXTERNAL ALC GAIN control (7) and turn in one direction or the other until the CAL indicator (8) just comes on and remains on continuously.
7. Release EXTERNAL ALC GAIN control (7).

NOTE

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

4-9. POWER SWEEP OPERATION

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



a. Enter Power Sweep.

1. Press LEVEL key (2); observe that LEVEL indicator (1) lights.
2. Enter desired power-level value using keypad (12) or INCR-DECR control (10).
3. If keypad was used, press GHz/dBm/Sec key (11).

NOTE

If power-level value is out of range, the CLEAR ENTRY indicator (15) will start flashing. To clear, press CLEAR ENTRY key (14) and enter a new, in-range level value (steps 1 to 3).

4. Observe that the 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 sweep generator 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 key (4).
6. Enter desired power-sweep value using keypad (12) or INCR-DECR control (10).
7. If keypad was used, press MHz/dB/mS key (9).
8. Observe that sweep value is displayed on display (3).

CAUTION

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

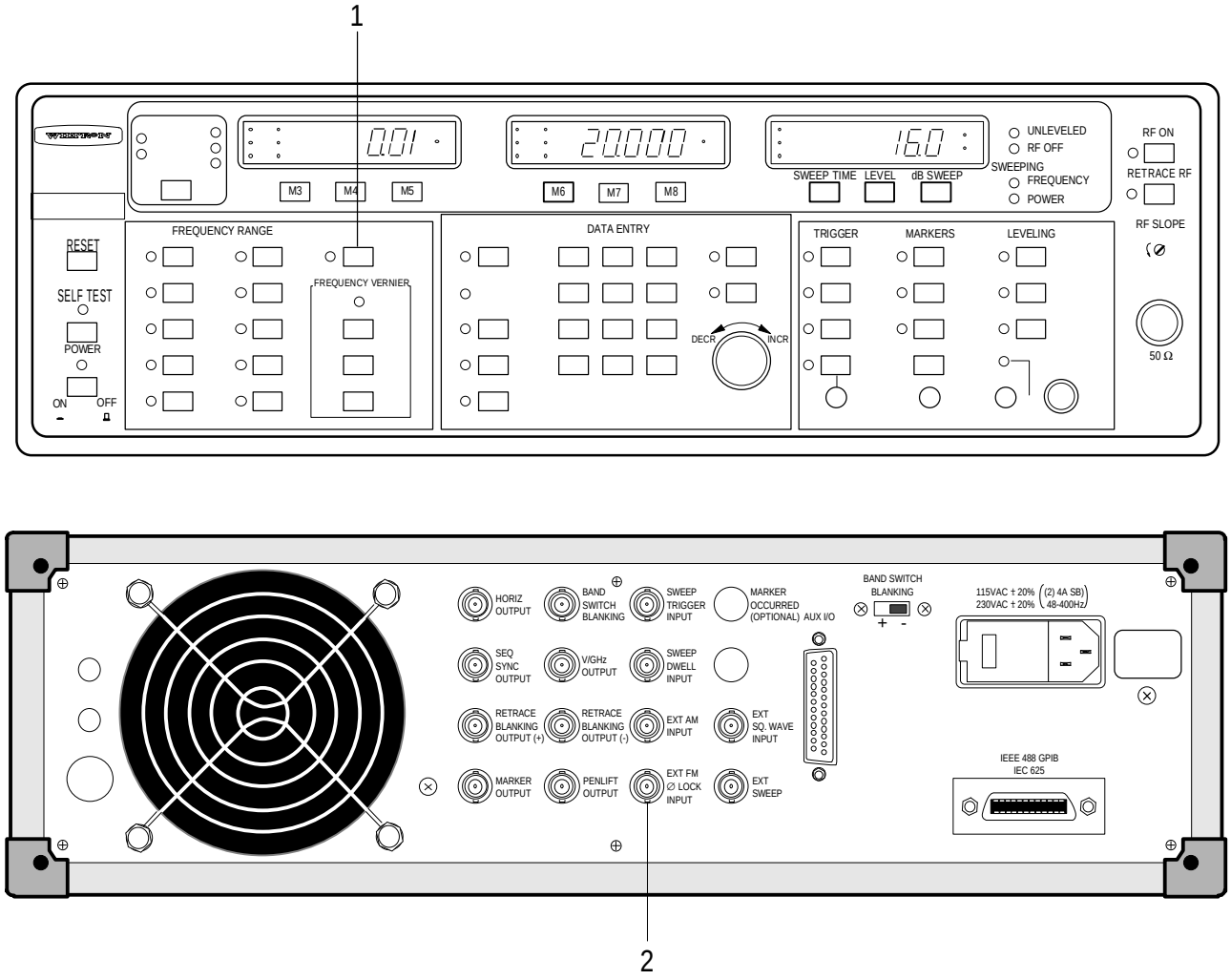
9. Sequentially press **SHIFT** key (13) then **POWER SWEEP** key (8).
10. Observe that SWEEPING POWER indicator (7) blinks to indicate that sweeping is occurring. If a frequency sweep is also selected (Paragraph 4-2), both SWEEPING indicators—FREQUENCY (5) and POWER (7)—blink.
11. If UNLEVELED indicator (6) blinks, sequentially press **SHIFT** key (13) then POWER SWEEP key (8) to exit the power-sweep mode.

NOTE

If RF output power goes unleveled, recheck power sweep settings to ensure that high-end excursion of power sweep does not exceed the RESET power for the frequency in use.

4-10. FREQUENCY MODULATION (FM) OPERATION

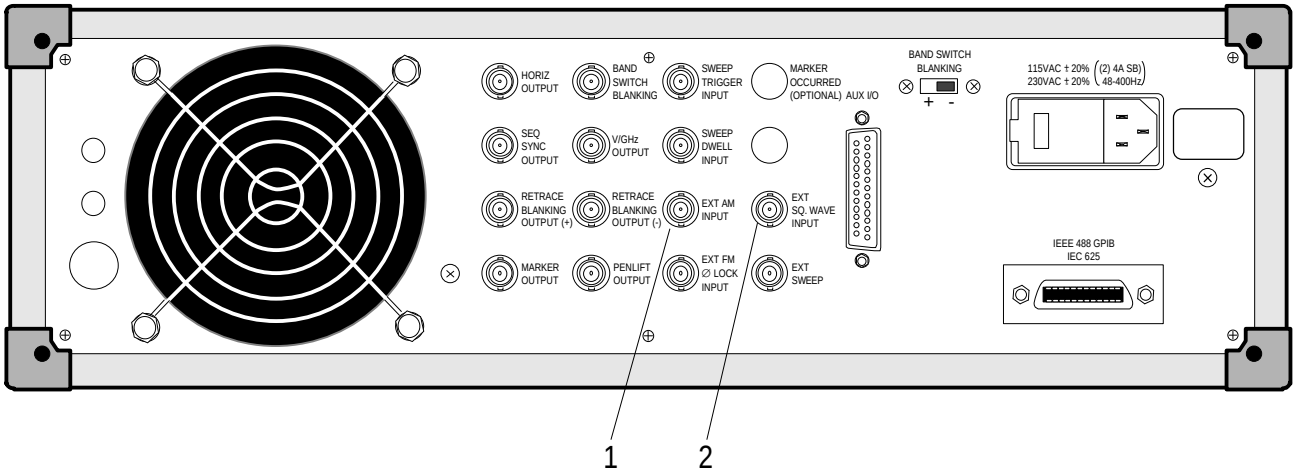
The sweep generator provides for frequency modulating the output frequency.



1. Connect FM signal source to rear panel EXT FM/∅LOCK INPUT connector (2).
2. Set sweep generator for CW output using any of the five CW modes (Paragraph 4-3).
3. Press FM AND PHASELOCK key (1); observe that associated indicator lights.

4-11. AMPLITUDE MODULATION (AM) OPERATION

The sweep generator provides for amplitude modulating the output frequency using either linear or on/off (square wave) input.



1. To provide linear AM, connect AM signal source to rear panel EXT AM INPUT connector (1). For on/off AM, connect square-wave input to EXT SQ WAVE INPUT connector (2).
2. Set sweep generator for CW output using any of the five CW modes (Paragraph 4-3).

CHAPTER 5
GPIB DESCRIPTION

CONTENTS

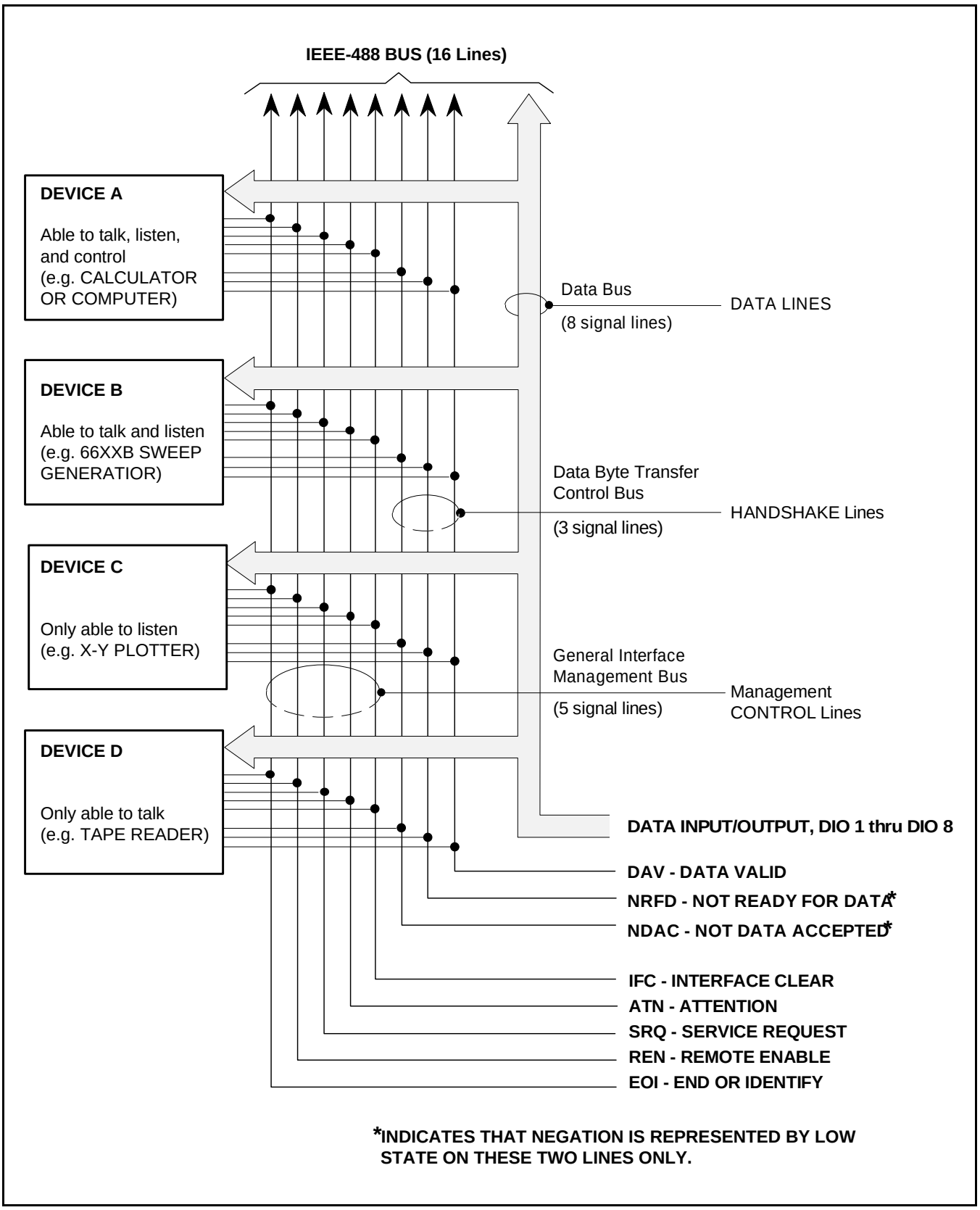


Figure 5-1. Bus Structure, IEEE-488 Interface Bus

CHAPTER 5
GPIB DESCRIPTION

5-1. INTRODUCTION

This section provides a general description of the IEEE-488 Interface Bus, which is also known as the General Purpose Interface Bus (GPIB).

5-2. GENERAL

The GPIB is an instrumentation interface for integrating instruments, calculators, and computers into systems. The bus uses 16 signal lines to effect transfer of data and commands to as many as 15 instruments.

The instruments on the bus are connected in parallel, as shown in Figure 4-1 (facing page). Eight of the signal lines (DIO 1 thru DIO 8) are used for the transfer of data and other messages in a byte-serial, bit-parallel form. The remaining eight lines are used for communications timing (handshake), control, and status information. Data are transmitted on the eight GPIB data lines as a series of eight-bit characters, referred to as bytes. Normally, a seven-bit ASCII (American Standard Code for Information Interchange) code is use. The eighth (parity) bit is not used. Data transfer is by means of an interlocked handshake technique.

This technique permits asynchronous communications over a wide range of data rates. The following paragraphs provide an overview of the data and handshake buses, and describe how these buses interface with the synthesizer.

5-3. DATA BUS DESCRIPTION

The data bus is the conduit for transmitting information and data between the controller and the synthesizer. It contains eight bi-directional, active-low signal lines—DIO 1 thru DIO 8. One byte of information (eight bits) is transferred over the bus at a time. DIO 1 represents the least-significant bit (LSB) in this byte and DIO 8 represents the most-significant bit (MSB). Each byte represents a peripheral address (either primary or secondary), a control word, or a data byte. Data bytes are usually formatted in ASCII code, without parity.

5-4. MANAGEMENT BUS DESCRIPTION

The management bus is a group of five lines used to control the operation of the bus system. Functional information regarding the individual control lines is provided below.

a. ***ATN (Attention)***

When this line is TRUE, the sweep generator responds to appropriate interface messages—such as, device clear and serial poll—and to its own listen/talk address.

b. ***EOI (End or Identify)***

When this line is TRUE, the last byte of a multibyte message has been placed on the line. Also used in conjunction with ATN to indicate a parallel poll.

c. ***IFC (Interface Clear)***

When this line is TRUE, the sweep generator interface functions are placed in a known state—such as, unaddressed to talk, unaddressed to listen, and service request idle.

d. ***REN (Remote Enable)***

When this line is TRUE the sweep generator is enabled—upon receipt of its listen address—for entry into the remote state. The mode is exited either when the REN line goes FALSE (high) or when the synthesizer receives a Go-To-Local (GTL) message or a Return-To-Local (RL) command.

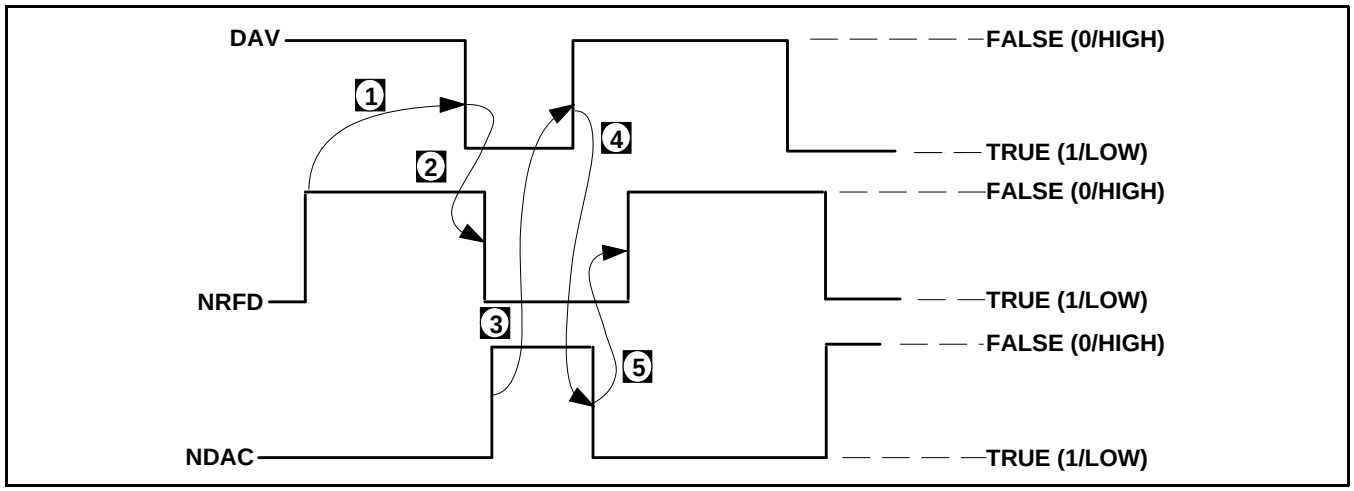


Figure 5-2. Handshake Bus

e. ***SRQ (Service Request)***

This line is pulled LOW (true) by the sweep generator to indicate that certain preprogrammed conditions exist.

5-5. DATA BYTE TRANSFER CONTROL BUS DESCRIPTION

Information is transferred on the data lines by a technique called the three-wire handshake. The three handshake bus signal lines (Figure 5-2) are described below.

a. ***DAV (Data Valid)***

This line goes TRUE (arrow 1) when the talker has (1) sensed that NRFD is FALSE, (2) placed a byte of data on the bus, and (3) waited an appropriate length of time for the data to settle.

b. ***NRFD (Not Ready for Data)***

This line goes TRUE (arrow 2) when a listener indicates that valid data has not yet been accepted. The time between the events shown by arrows 1 and 2 is variable and depends upon the speed with which a listener can accept the information.

c. ***NDAC (Not Data Accepted)***

This line goes FALSE to indicate that a listener has accepted the current data byte for internal processing. When the data byte has been accepted, the listener releases its hold on NDAC and allows the line to go FALSE. However, since the GPIB is constructed in a wired-OR configuration, NDAC will not go FALSE until all listeners participating in the interchange have also released the line. As shown by arrow 3, when NDAC goes FALSE, DAV follows suit a short time later. The FALSE state of DAV indicates that valid data has been removed; consequently, NDAC goes LOW in preparation for the next data interchange (arrow 4).

Arrow 5 shows the next action in time: NRFD going FALSE after NDAC has returned TRUE. The FALSE state of NRFD indicates that all listeners are ready for the next information interchange. The time between these last two events is variable and depends on how long it takes a listener to process the data byte. In summation, the wired-OR construction forces a talker to wait for the slowest instrument to accept the current data byte before placing a new data byte on the bus.

CHAPTER 6
GPIB OPERATION

CONTENTS

CHAPTER 6
GPIB OPERATION

6-1. INTRODUCTION

This chapter provides specific information regarding implementation of the General Purpose Interface Bus (GPIB) with the sweep generator. It also provides a listing and descriptions for sweep generator command codes.

6-2. GPIB SETUP AND INTERCONNECTION

The sweep generator 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 sweep generator 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.

PIN No.	Line Description	PIN No.	Line Description
1	$\overline{\text{DIO 1}}$	13	$\overline{\text{DIO 5}}$
2	$\overline{\text{DIO 2}}$	14	$\overline{\text{DIO 6}}$
3	$\overline{\text{DIO 3}}$	15	$\overline{\text{DIO 7}}$
4	$\overline{\text{DIO 4}}$	16	$\overline{\text{DIO 8}}$
5	$\overline{\text{EOI}}$	17	$\overline{\text{REN}}$
6	$\overline{\text{DAV}}$	18	LOGIC GROUND
7	$\overline{\text{NRFD}}$	19	LOGIC GROUND
8	$\overline{\text{NDAC}}$	20	LOGIC GROUND
9	$\overline{\text{IFC}}$	21	LOGIC GROUND
10	$\overline{\text{SRQ}}$	22	LOGIC GROUND
11	$\overline{\text{ATN}}$	23	LOGIC GROUND
12	CHASSIS GROUND	24	LOGIC GROUND

b. Cable Length Restrictions. The GPIB can accomodate 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 sweep generator and the bus controller.

d. GPIB Address. The sweep generator 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.

6-3. 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 6-4, the six classes of commands are described in paragraphs 6-5 thru 6-10 respectively. The bus messages recognized by the sweep generator are discussed in paragraph 6-11. In addition to bus commands and bus messages, the three types of errors that can occur with bus programming are discussed in paragraph 6-12. The sweep generator's default from-reset-or-turn-on states are described in paragraph 6-13. An alphabetical index to bus command mnemonics is provided in paragraph 6-14.

6-4. COMMAND STRING

This paragraph provides a definition of a command string, as it applies to the sweep generator, 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 sweep generator firmware recognizes the following end 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 sweep generator is at address 05.

Program Sequence

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

Sweep Generator returns the value of F2

Remarks. The first command string, "OI" (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 OSB"
30 ENTER 05; A$
40 DISP ASC (A$)
```

Sweep Generator Returns 0

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 "OSB". For example: OUTPUT 05; "XYZ OSB F2" is valid. The OSB command sends the correct status reflecting the syntax error, but "XYZ F2 OSB" does not. *Reason:* F2 resets the status byte.

6-5. RESERVED WORDS

The following list of words are reserved for factory use. Use of these words within a program may cause the sweep generator to hang up or its state to become unpredictable.

BF0	XM0	OPB	QSL	PTC	MRE
BF1	XM1	DLT	QLZ	PT0	PRW
WR	II0	ULT	GTQ	PT1	PRE
RE	II1	QLD	PTL	MWR	

6-6. GPIB COMMANDS: FRONT PANEL CONTROLS

The GPIB commands used to activate front-panel-control functions are listed in Table 6-1. Programming examples that demonstrate the use of these commands are shown in Figure 6-1 (page 6-9).

Table 6-1. Front Panel Control Related Commands (1 of 4)

Front Panel Keys	Bus Command	Notes
A. **DATA ENTRY**		
1. Parameter Entry		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.
CF	CFFxxxxGH (or MH)	
F1	F1xxxxGH (or MH)	
F2	F2xxxxGH (or MH)	
M1-M8	MnxxxxGH (or MH)	
ΔF	DLFxxxxGH (or MH)	
SWEEP TIME	SWTxxxSEC (or MS)	
RF LEVEL	LVLxxxxDM (or DB)	
dB/SWEEP	PSWxxDB (or DM)	
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 (DS0).
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.
ΔF CF	DCF	Selects the ΔF CF sweep range.
ΔF M1	DLM	Selects the ΔF M1 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 M1	CM1	Selects the CW M1 function.
CW M2	CM2	Selects the CW M2 function.

Table 6-1. Front Panel Control Related Commands (2 of 4)

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	MK0	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	LV0	Turns leveling off.
F. **RF Output**		
RF OFF	RF0	Turns RF off.
RF ON	RF1	Turns RF on.
RETRACE RF: Off	RT0	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 sweep generator is set to address 05)*

Table 6-1. Front Panel Control Related Commands (3 of 4)

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	 FM0 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 "0" 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 0. ***Code*** — ***Comments*** SVS5 — Assume this code was sent in error, and it inadvertently overwrote a still-needed setup. RCS0, SVS5 — Accesses the setup previously stored in location 5, and restores it to location 5. RCS0, SVS4 — Accesses the setup that was accidently stored in location 5. (This data was moved to location 0 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 (0 to 9) with which the present setup is to alternate.

Table 6-1. Front Panel Control Related Commands (4 of 4)

Front Panel Control	Bus Command	Notes
M. **Front Panel Display** Off	DS0 (This code is similar but not identical to the front panel SH FULL command. This command extinuishes 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 f*ront panel displays and LEDs are turned off, and (2) the sweep generator returns non-meaningful responses to the Output Frequency commands (OF1, OF2, OFL, OFH, table 6-5) **NOTE** Front panel displays cannot be restored except through use of the RST command. A secured front panel 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: ΔFCF
CF Frequency: 2 GHz
ΔF Frequency: 10 MHz
TRIGGER: AUTO
FM: On
Set Vernier: –7.5 MHz
LEVELING: INTERNAL
RF: On

Figure 6-1. GPIB Front Panel Programming Examples

6-7. 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 ΔF sweep) are selected using the front-panel-control command statements described in Table 6-1. 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 Figure 6-2.

The step sweep commands are given in Table 6-2.

Table 6-2. 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 0 to 4095. Zero (the low-end frequency) is STS0E (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 6-6) will increment the selected parameter. Digits (x's) may be between 0 and 4095; where 0 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 TO 4 30 • 40 • Input Statements, etc. 50 • 60 OUTPUT 05; "N" 70 NEXT I **Assumes sweep generator is at address is 05.*

Formula

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

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 folllowing formula.

Nsts + (N_{size} x number of times the N command has been executed.)

For example, assume the following:

a. *Sweep Range Programming:*

Sweep Range ΔF, with CF = 10 GHz and ΔF = 100 MHz

Command: DCF CF10GH DLF 100 MH

b. *Step Sweep Programming:*

Sweep Start = F_{start}

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 + (819 x 0)

F= 9.950 GHz

Calculation to Find 2nd Frequency Point:

N = 0 + (819 x 1) = 819

$$F= 9.950 + [\frac{819}{4095} x (10.050 - 9.950)] = 9.970 \quad GHz$$

Calculation to Find 3rd Frequency Point:

N = 0 + (819 x 2) = 1638

$$F= 9.950 + [\frac{1638}{4095} x (10.050 - 9.950)] = 9.990 \quad GHz$$

Calculation to Find 4th through 6th Frequency Points:

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

4th point = 10.010 GHz
5th point = 10.030 GHz
6th point = 10.050 GHz

Figure 6-2. Step Sweep Step-to-Frequency Conversion Formula

6-7. GPIB COMMANDS: GET 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 6-3.

Table 6-3. 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 6-6) each time a GET bus message is received.
Decrement Selected Parameter	GTD	Configures the sweep generator to execute a "DN" command (Table 6-6) each time a GET bus message is received.
Go to Next Step	GTN	Configures the sweep generator to execute an "N" command (Table 6-2) each time a GET bus message is received.

6-8. 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 6-4.

Table 6-4. Service Request (SRQ) Commands (1 of 3)

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 SQ1 are both programmed, the SRQ line is pulled LOW (true), and Status Byte (Figure 6-3) bits 0 and 6 are set HIGH (decimal 65). When DW1 and SQ0 are both programmed, only the Status Byte is generated; the

Table 6-4. Service Request (SRQ) Commands (2 of 3)

Name	Command	Function
Dwell-at-Marker Mode (Continued):		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 6-4. Service Request (SRQ) Commands (3 of 3)

Name	Command	Function
Syntax Error Mode:		
On	SE1	Activates the syntax error mode. When SE1 and SQ1 are both programmed, a syntax error (paragraph 6-11) causes the SRQ line to be pulled LOW (true) and Status Byte bits 5 and 6 to be set HIGH (decimal 96). When SE1 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 *WT = 128	SRQ BIT 6 DECIMAL WT = 64	SYNTAX BIT 5 DECIMAL WT = 32	PARAMETER BIT 4 DECIMAL WT = 16	BUFFER OVERFLOW BIT 3 DECIMAL WT = 8	UNLEVELED RF BIT 2 DECIMAL WT = 4	END OF SWEEP BIT 1 DECIMAL WT = 2	INT MKR OCCURRED BIT 0 DECIMAL WT = 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 0 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 0 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.

* "WT" stands for bit weight.

Figure 6-3. Status Byte Coding

6-9. 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 6-5.

Table 6-5. Output Commands (1 of

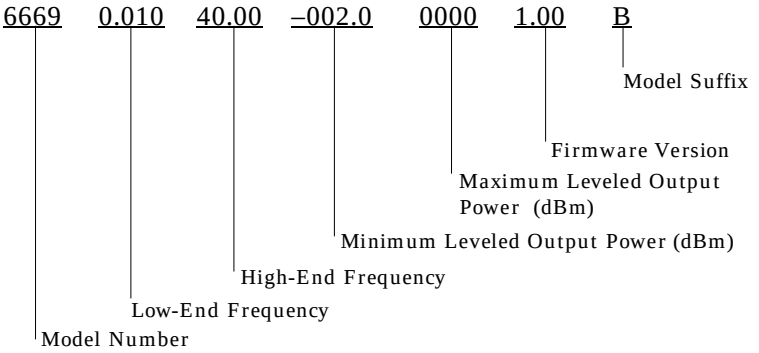
Name	Command	Function
Output Identity	OI	Causes the sweep generator to identify itself by returning certain parameter information to the controller. This parameter information consists of model number, low-end frequency, high-end frequency, minimum leveled output power, maximum leveled output power, 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 OI string is shown below: 
Output Attenuator Setting.	OAT	Returns the value of the current step attenuator setting in tenths of a dB per the format as defined by the OLV command.
Output ΔF Parameter	ODF	Returns the value of the ΔF 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 power level entry mode status.	OCM	Returns either the string 'COUPLED' or 'UNCOUPLED' depending on the status.
Output F1 Parameter	OF1	Returns the F1 frequency value in MHz.

Table 6-5. Output Commands (2 of

Name	Command	Function
Output F2 Parameter	OF2	Returns the F2 frequency value in MHz.
Output F_{low}	OFL	Returns the low-end frequency value in MHz.
Output F_{high}	OFH	Returns the high-end frequency value in MHz.
Output M1-M8 Parameter	OM1-OM8	Returns the M1 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 Option String.	OOS	Returns a string containing fields separated by spaces. Each field identifies one the the options installed in the instrument. See description in Chapter 3 for numeric keypad index 40B (**SHIFT-11**) for a discussion of these fields. If the instrument does not have any options installed, the string NONE is returned. The field IEEE 488 is not included in the string.
Output High Power Limit	OPH	Returns the high power limit. The output string generated is in the normal power output format defined by OLV.
Output Low Power Limit	OPL	Returns the low power limit. When in the UNCOUPLED power level entry mode, the OPL string changes to reflect a value that is 25.5 dB below highest power. The low power level limit in the OI string does not change.
Output Status Byte	OSB	Returns the SRQ Status Byte (Figure 6-3) to the controller.
Output Sweep Time	OST	Returns the sweep time value to the controller. Value is given in milliseconds.
Output Version String	OVS	Returns a string with 3 fields separated by spaces as shown below: *Example:* 6647B 8.14 8.04 The first field is the “special” field, the second is the front panel firmware version, and the third is the GPIB firmware version. In most cases, the special field returns the model number of the instrument. However, if the front panel or GPIB firmware is special, the special number will be returned in this field (thus the name). If this field contains a number other than one within the 66XX range, it is a special number.

6-10. 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 6-6.

Table 6-6. Miscellaneous Commands (1 of 4)

Name	Command	Function
Set Attenuator	ATT	Sets the step attenuator to the value that follows the command. Command syntax is ATTnnnE.
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.
Output Coupled with Attenuator	CPL	Causes the power output to be coupled with the attenuator. While in the COUPLED mode, the step attenuator is controlled automatically when setting the power level. This is the normal mode of operation. The power level range is determined by the RESET parameters of the particular instrument and step attenuator installed.
Output Uncoupled with Attenuator	UNC	Causes the power output to be uncoupled with the attenuator. While in the UNCOUPLED mode, the step attenuator and the power level setting are independent. The power level can be set over the entire range of the level loop (P_{max} to P_{max} – 25.5dB) and the step attenuator can be set from 0 to either 70 dB or 110 dB depending on the type of attenuator installed.
Return to Local	RL	Causes the Sweep Generator to return to local (front panel) control, provided that a local lockout message (Table 6-7) is not in effect.
Turn Dummy Character On	DO1 x	Turns on dummy character “x” used as fill to send to controller when sweep generator is addressed to talk but has nothing to say.
Turn Dummy Character Off	DO0	Turns off dummy character turned on using DO1x command.

Table 6-6. Miscellaneous Commands (2 of 4)

Name	Command	Function
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 (F1xxxxGH, 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.
CW Filter: Automatic	FL1	Enables CW filter unconditionally, except when wide FM is selected.
Out	FL0	Disables CW filter unconditionally. **NOTE** CW filter state remains unchanged when entering REMOTE mode from LOCAL mode.
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 that is currently 483 bytes long. The SAV command can be used to store the front-panel-control settings for a measurement test setup for future use. In response to the command SAV, the sweeper sends a string of characters. The first 5 characters form a header: ZxxxE Where xxx = a 3 digit decimal number, which is the number of characters which are to follow.

Table 6-6. Miscellaneous Commands (3 of 4)

Name	Command	Function
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). To recall a setup, send this command followed by the string that came with the SAV command (above). If the character count in the header does not agree with the number for which the A1 PCB is looking (dictated by the firmware version), the command will be ignored. If the syntax error bit is enabled to send a service request, sending a string with an invalid header or too few characters following the header will generate a service request.
Horizontal Output During CW: On Off	 CS1 CS0	 Enables horizontal ramp during CW. Disables horizontal ramp during CW. (Default mode.)
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.
Turn Off Selected Marker	SM0	Appends a marker command to turn the last programmed marker off. For example, programming “M1 SM0” or “M2 3GH M1 SM0” turns the M1 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 #0. Operator can recover the previous contents of a setup by sending an “RCS 0” command.
Power Sweep	PSW PSWxxxDB	Toggles power sweep on or off. 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”,"10DB".

Table 6-6. Miscellaneous Commands (4 of 4)

Name	Command	Function
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.

6-11. BUS MESSAGES

The sweep generator 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 6-7.

Table 6-7. Bus Messages Recognized by the Sweep Generator (1 of 2)

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.

Table 6-7. Bus Messages Recognized by theSweep Generator (2 of 2)

Bus Messages	How Message is Used By Sweep Generator
Serial-Poll Enable (SPE) Serial-Poll Disable (SPD)	*Serial Poll Operation* The SPE message causes the sweep generator to respond with a decimally-coded status byte (Figure 6-3). 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.
Parallel-Poll Configure (PPC) Parallel-Poll Enable (PPE) Parallel-Poll Unconfigure (PPU) Parallel-Poll Disable (PPD)	*Parallel-Poll Operation* When queried by a parallel-poll message command the sweep generator (if configured for parallel-poll operation; see below) responds by setting its assigned data bus line to the logical state (1, 0) that indicates its correct SRQ status. 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, 0) 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. 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.

6-12. 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 M1 > 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 M1 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 Figure 6-4.

6-13. 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 66XXB

- RETURN TO LOCAL Key.
  - If local lockout has been programmed, this key is ignored.
  - If local lockout is not in effect, and if the sweep generator 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"
60 30 ENTER 05; A$
70 DISP ASC (A$)

Sweep Generator Returns: 8
```

Figure 6-4. 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, resets the 66XXB, and resets the status byte register 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.

6-14. INDEX OF SWEEP GENERATOR GPIB COMMAND CODES

An alphabetical index of the sweep generator GPIB command codes is given in Table 6-8. This table lists the command mnemonic, the name of the command, and the table number where the command is described.

Table 6-8. Sweep Generator Command Codes (1 of 2)

Code	Name	Table No.	Code	Name	Table No.
ALT	Alternate Setup	6-1	DW1	Dwell at Marker Mode On	6-4
ATT	Set Attenuator	6-1	ES0	End of Sweep SRQ Off	6-4
AUT	Auto Trigger	6-1	ES1	End of Sweep SRQ On	6-4
CCF	Enter Parameter CF	6-1	ESW	External Sweep Mode	6-6
CF1	CW Select F1	6-1	EXT	External Trigger	6-1
CF2	CW Select F2	6-1	F1	Enter Parameter F1	6-1
CLR	Clear Keypad	6-1	F2	Enter Parameter F2	6-1
CM1	CW Select M1	6-1	FF	Sweep Range F1-F2	6-1
CM2	CW Select M2	6-1	FL0	CW Filter Off	6-6
CNT	Continue Sweep	6-6	FL1	CW Filter Enabled	6-6
CPL	Output Coupled with Attenuator	6-6	FM0	FM Off	6-1
CS0	Horizontal Output Off During CW Operation	6-6	FM1	FM On	6-1
			FUL	Sweep Range Full	6-1
CS1	Horizontal Output On During CW Operation	6-6	FV0	Frequency Vernier Off	6-1
			FVS	Set Frequency Vernier	6-1
DB	dB Data Terminator	6-1	GH	GHz Data Terminator	6-1
DCF	Sweep Range ΔF CF	6-1	GTD	GET Mode Execute “DN” Command	6-3
DLM	Sweep Range ΔF M1	6-1			
DL1	Detector Leveling	6-1	GTN	GET Mode Execute “N” Command	6-3
DLF	Enter ΔF Frequency	6-1	GTS	Get Mode Trigger Sweep	6-3
DM	dBm Data Terminator	6-1	GTU	GET Mode Execute “UP” Command	6-3
DN	Decrement Selected Parameter	6-6			
DO0	Turn Dummy Characters Off	6-6	IL1	Internal Leveling	6-1
DO1	Turn Dummy Characters On	6-6	IM1	Intensity Marker	6-1
DS0	Front Panel Display Off	6-1	LIN	Line Trigger	6-1
DW0	Dwell at Marker Mode Off	6-4	LV0	Leveling Off	6-1

Table 6-8. Sweep Generator Command Codes (2 of 2)

Code	Name	Table No.
LVL	Enter Level Parameter	6-1
M1-M8	Enter Markers M1 thru M8	6-1
MAN	Manual Sweep	6-1
MH	MHz Data Terminator	6-1
MK0	Markers Off	6-1
MM	Sweep Range M1-M2	6-1
MS	Millisecond Data Terminator	6-1
N	Go to Next Increment (Digital Sweep)	6-2
OAT	Output Attenuator Setting	6-5
OCF	Output CF Frequency	6-5
OCM	Output Power Level Entry Mode Status	6-5
ODF	Output ΔF Frequency	6-5
OI	Identify Instrument	6-5
OF1	Output F1 Frequency	6-5
OF2	Output F2 Frequency	6-5
OFL	Output Low-End Frequency	6-5
OFH	Output High-End Frequency	6-5
OLV	Output RF Level	6-5
OLP	Output Power Level	6-5
OM1-OM8	Output M1 Frequency thru Output M8 Frequency	6-5
OOS	Output Option String	6-5
OPH	Output High Power Limit	6-5
OPL	Output Low Power Limit	6-5
OSB	Output Status Byte	6-5
OST	Output Sweep Time	6-5
OVS	Output Version String	6-5
PE0	Parameter Entry Error SRQ Off	6-4
PE1	Parameter Entry Error SRQ On	6-4
PL1	Power Meter Leveling	6-1
PSW	Power Sweep Mode	6-6
RCL	Recall Front Panel Setup (from controller)	6-6
RCS 0	Recall Setup 0 (from external storage)	6-1
RCS n	Recall Setup n (from external storage)	6-1
RF0	RF Off	6-1
RF1	RF On	6-1
RL	Return to Local	6-6
RM1	RF Marker On	6-1
RSS	Reset Sweep	6-6
RST	Reset Front Panel	6-1
RT0	RF During Retrace Off	6-1
RT1	RF During Retrace On	6-1
SAV	Save Front Panel Setup	6-6
SE0	Syntax Error Mode Off	6-4
SE1	Syntax Error Mode On	6-4
SEC	Seconds Data Terminator	6-1
SH	Shift	6-1
SIZ	Increment Size	6-2
SM0	Turn Selected Marker Off	6-6
SQ0	SRQ Mode Off	6-4
SQ1	SRQ Mode On	6-4
STP	Step Sweep	6-2
STS	Step Select	6-2
SV0	Buffer Overflow SRQ Off	6-4
SV1	Buffer Overflow SRQ On	6-4
SVS n	Store Setup n (to internal storage)	6-6
SWT	Enter Sweep Time Parameter	6-1
TRS	Trigger Sweep	6-1
TST	Self Test	6-1
UL0	Unleveled Condition Mode Off	6-4
UL1	Unleveled Condition Mode On	6-4
UNC	Output Uncoupled with Attenuator	6-6
UP	Increment Selected Parameter	6-6
VM1	Video Marker On	6-1