

**SERIES
67XXA
SWEPT FREQUENCY SYNTHESIZER
OPERATION MANUAL**

WILTRON

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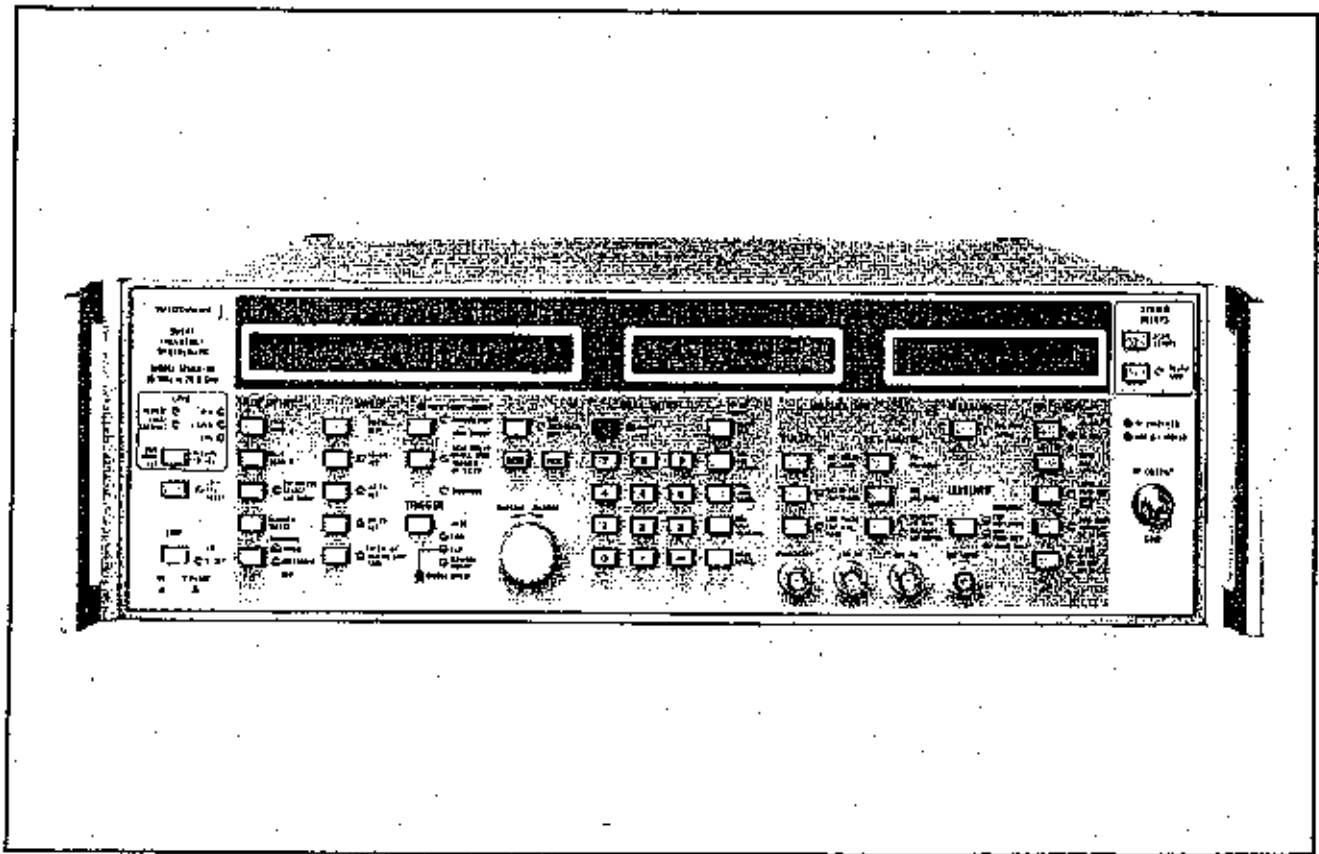


Figure 1-1. Typical Series 67XXA Swept Frequency Synthesizer

SECTION I GENERAL INFORMATION

1-1 SCOPE OF THE MANUAL

This manual provides general, installation, and operation information for all models in the Series 67XXA Swept Frequency Synthesizer family.

1-2 INTRODUCTION

Section I provides information about the equipment identification number, performance specifications, options, and related manuals.

1-3 IDENTIFICATION NUMBER

All WILTRON instruments are assigned a unique six-digit ID number, such as "405001." Each 67XXA has two ID numbers assigned, one for the basic frame and one for the RF deck. The ID number for the RF deck is affixed to the outside of the rear panel, while that for the basic frame is affixed to chassis floor, below the swing-out RF deck. The RF deck ID number, on the outside, is the primary number. Please use it when ordering parts or corresponding with the Customer Service department.

1-4 RELATED MANUALS

This is one of a two manual set that consists of an Operating Manual (OM) and a Maintenance Manual (MM). The OM provides coverage for all models in the 67XXA series. Conversely, the MMs contains model-dependent information. Because of this model dependency there are seventeen different MMs—one for each frequency model. The MMs provide performance verification, calibration, parts, and service (schematics, block diagrams, circuit description) information for the model being covered. Each frequency model may also be covered by a preliminary MM. If preliminary MMs exist, they will be discontinued when the final MM becomes available. The WILTRON part number for

Table 1-1. Maintenance Manual Part Numbers

67XX Model Number(s)	Final Manual Part Number	Preliminary Manual Part Number
6709A/-40	10370-00010	10370-00008
6717A/-20	10370-00014	10370-00012
6719A	10370-00018	10370-00016
6721A/-20	10370-00022	10370-00020
6722A/-20	10370-00082	10370-00080
6729A/-40	10370-00026	10370-00024
6729A/-20	10370-00034	10370-00032
6730A/-40	10370-00038	10370-00036
6736A	10370-00042	10370-00040
6737A/-20	10370-00046	10370-00044
6740A	10370-00076	10370-00078
6742A	10370-00050	10370-00048
6747A/-20	10370-00054	10370-00052
6753A/-10	10370-00058	10370-00056
6759A/-10	10370-00082	10370-00080
6763A	10370-00066	10370-00064
6769A	10370-00070	10370-00068

this manual is listed on the title page; the part numbers for the MMs and preliminary MMs are listed in Table 1-1.

1-5 DESCRIPTION

The Series 67XXA Swept Frequency Synthesizers are microprocessor-based, GPIB, synthesized signal sources that generate swept and CW frequencies from 10 MHz to 40 GHz. The series, which will expand as additional frequency ranges are added, presently consists of 28 models covering a variety of frequency and power ranges. Table 1-2 shows a listing of all of the present models, their frequency range, and their output power level.

Table 1-2. 67XXA Series Swept Frequency Synthesizers

67XX Model	Frequency (GHz)	Output Power
6709A 6709A-40	.01-2	+10 dBm +16 dBm
6717A 6717A-20	.01-8.4	+10 dBm +13 dBm
6719A	2-8.4	+13 dBm
6721A 6721A-20	2-12.4	+10 dBm +13 dBm
6722A 6722A-20	.01-12.4	+10 dBm +13 dBm
6728A 6728A-40	8-12.4	+13 dBm +16 dBm
6729A 6729A-20	2-20	+10 dBm +13 dBm
6730A 6730A-40	12.4-20	+13 dBm +16 dBm
6736A	18-26.5	+7 dBm
6737A 6737A-20	2-26.5	+10 dBm +13 dBm
6740A	26.5-40	+10 dBm
6742A**	18-40	+5 dBm, ≤26.5 GHz 0 dBm, >26.5 GHz
6747A 6747A-20	.01-20	+10 dBm +13 dBm
6753A 6753A-10	2-26.5	+10 dBm, ≤20 GHz +5 dBm, >20 GHz +10 dBm
6759A 6759A-10	.01-26.5	+10 dBm, ≤20 GHz +5 dBm, >20 GHz +10 dBm
6763A**	2-40	+10 dBm, ≤20 GHz +5 dBm, ≤26.5 GHz 0 dBm, ≤40 GHz
6769A**	.01-40	+10 dBm, ≤20 GHz +5 dBm, ≤26.5 GHz 0 dBm, ≤40 GHz

* Optional attenuator reduces rated power by 3 dB.
 ** Scheduled for later introduction.

1-6 OPTIONS

The following options are available:

Option 1, Rack Mount. A kit is available containing mounting brackets and chassis track slides.

Option 2A, 110 dB Step Attenuator. Each synthesizer comes supplied with a 110 dB Step Attenuator installed. Rated output power is reduced by 3 dB. This option is available only for the following models:

- 6709A/6709A-40
- 6717A/6717A-20
- 6719A
- 6721A/6721A-20
- 6728A/6728A-40

Option 2B, 90 dB Step Attenuator. Each synthesizer comes supplied with a 90 dB Step Attenuator installed. Rated output power is reduced by 3 dB. This option is available for all models having an upper frequency limit above 18 GHz.

Option 2C, 110 dB Step Attenuator. Each synthesizer comes supplied with a 110 dB Step Attenuator installed. Rated output power is reduced by 3 dB. This option is available for all models having an upper frequency limit above 18 GHz.

Option 9K, K Connector. Each synthesizer comes supplied with a rear panel K Connector™ RF Output instead of the type of connector that would normally be installed on the front panel. The front panel connector is deleted. Rated output power, flatness, and SWR are slightly degraded.

1-7 PERFORMANCE SPECIFICATIONS

Table 1-3, beginning on page 1-5, lists the performance specifications for the 67XXA series synthesizers.

1-8 RECOMMENDED TEST EQUIPMENT

Table 1-4, on page 1-9, provides a lists of recommended test equipment needed to check and service the 67XXA Series Swept Frequency Synthesizers. The entries are coded to show for which types of testing the equipment is used. These codes are described below.

Code	Type of Testing
C	Calibration
O	Operational Checkout
P	Performance Verification
T	Troubleshooting

Table 1-3. Specifications for the Series 67XXA Swept Frequency Synthesizers (1 of 5)

FREQUENCY

Frequency information is shown in Table 1-2.

CW MODE

Output: Nine independent, presettable CW frequencies.

Accuracy: Same as internal or external time base.

Internal 10 MHz Time Base Stability:

With Aging: $<1 \times 10^{-9}$ /day

With Temperature: $<\pm 5 \times 10^{-9}/^{\circ}\text{C}$ over 0°C to 50°C

Resolution:

.01 to 26.5 GHz: 1 kHz

>26.5 to 40 GHz: 2 kHz

10 MHz Reference Output: 2 V_{p-p} into 50Ω.

AC coupled, 50Ω impedance, BNC, rear panel.

External 10 MHz Reference Input: Accepts external 10 MHz ± 100 Hz, 0 to +10 dBm time base signal. Automatically disconnects internal time base. BNC, rear panel, 50Ω impedance.

High Resolution Input: Accepts 20-32.1 MHz external synthesizer signal to improve resolution to equal that of external instrument. BNC, rear panel, 50Ω impedance, 0 dBm.

Switching Time (for any step size):

<15 ms typical (25 ms max.) to be within 1 kHz

Lock Output: Provides TTL high signal when frequency is phase locked.

ANALOG SWEEP MODE

F1-F2, F3-F4, ΔF F5, and ΔF F6 Sweep Width: Independently selected, 1 MHz to full range continuous sweep. For >50 MHz sweep width, start/stop and band-switching frequencies are phase-lock-corrected during every sweep. For ≤50 MHz width, the center frequency is phase-lock-corrected.

Accuracy: The lesser of ± 30 MHz or $\pm(2 \text{ MHz} + 0.25\%$ of sweep width) for sweep speeds of ≥ 50 GHz/s.

Resolution: 1 MHz

Sweep Time Range: 30 ms to 99 s

PHASE-LOCKED STEP SWEEP MODE

F1-F2, F3-F4, ΔF F5, and ΔF F6 Sweep Width: Independently selected, 1 kHz to full range. Every frequency in sweep range is phase locked.

Accuracy: Same as internal or external time base.

Resolution (Minimum Step Size):

.01 to 26.5 GHz: 1 kHz

>26.5 to 40 GHz: 2 kHz

Number of Steps: Variable from 1 to 1800

Dwell Time Per Step: Variable from 1 ms to 99s

Switching Time (for any step size):

<15 ms typical (25 ms maximum) to be within 1 kHz.

ALTERNATE SWEEP MODE

Sweeps alternately in analog or step sweep between any two of the sweep ranges: F1-F2, F3-F4, ΔF F5, and ΔF F6.

MANUAL SWEEP MODE

Provides stepped, phase-locked adjustment of frequencies between sweep limits.

PROGRAMMABLE FREQUENCY AGILITY:

Under GPIB control, up to 512 nonsequential frequencies can be stored and then addressed as a phase-locked step sweep.

MARKERS

Up to nine independent, presettable markers.

Video Markers: TTL compatible, switch selectable high true. BNC, rear panel.

Intensity Markers (Available in Analog Sweep only): Intensified dot on trace. Obtained by momentary dwell in sweep.

Marker Accuracy: Same as sweep frequency accuracy.

Marker Resolution (Step Sweep):

01 to 26.5 GHz: 1 kHz

>26.5 to 40 GHz: 2 kHz

Marker Resolution (Analog Sweep):

Sweep Width/4096 or 1 MHz, whichever is greater

SWEEP TRIGGERING

Auto: Triggers sweep automatically.

Line: Triggers sweep from power line frequency.

External: Accepts TTL high signal of $>1 \mu\text{s}$ width to trigger, abort, or reset analog sweep. BNC, rear panel.

Single: Triggers, aborts, and resets a single sweep. Front panel pushbutton.

SWEEP-RELATED INPUTS/OUTPUTS

Sweep Dwell Input: Accepts TTL low signal to stop sweep. Sweep continues when signal is removed. BNC, rear panel.

Horizontal Sweep Output: Provides 0V at beginning and 10V at end of sweep for all sweep modes, regardless of sweep width. In CW mode, voltage is proportional to frequency between 0V at low end and 10V at high end of range. In CW mode, CW RAMP provides a repetitive, 30 ms, 0V to 10V ramp. BNC, rear panel.

V/GHz Output: Rear panel switch selects 0.5 V/GHz or 1 V/GHz up to 20V maximum. BNC, rear panel.

Bandswitch Blanking Output: Rear panel switch selects +5V or -5V signal coincident with bandswitching points. BNC, rear panel, 100Ω impedance.

Table 1-8. Specifications for the Series 67XXA Swept Frequency Synthesizers (2 of 5)

SWEEP-RELATED INPUTS/OUTPUTS (Continued)

Retrace Blanking Output: Rear panel switch selects +5V or -5V output signal coincident with sweep retrace. AUX I/O Cannon 25 pin D style, rear panel.

Pen Lift Output: Rear panel switch selects normally open or normally closed internal relay contacts during sweep retrace. BNC, rear panel.

Sequential Sync Output: Provides TTL high signal during retrace and at bandswitching points for interface to network analyzers, -5V during marker, and -10V during selected marker. BNC, rear panel.

SPECTRAL PURITY

All specifications apply to the phase-locked CW and Step Sweep Modes.

SPURIOUS SIGNALS

Subharmonics:

- .01 to 26.5 GHz: None
- >26.5 to 40 GHz: -20 dBc

Harmonics:

- .01 to 2 GHz: -30 dBc
(-20 dBc for 6709A-40, 6717A-40, and 6747A-20)
- >2 to ≤26.5 GHz: -60 dBc
- >26.5 to 40 GHz: -20 dBc

Nonharmonics:

- .01 to 2 GHz: -40 dBc
- >2 GHz: -60 dBc, typically -70 dBc

**SINGLE-SIDEBAND PHASE NOISE
(dBc, CW Mode, Typical)**

Frequency Range (GHz)	Offset From Carrier (dBc/Hz)				
	30 Hz	100 Hz	1 kHz	10 kHz	100 kHz
0.01 to 2	-69	-78	-80	-84	-107
>2 to 8	-66	-71	-73	-76	-100
>8 to 12.4	-64	-68	-70	-73	-107
>12.4 to 20	-60	-63	-67	-74	-105
>20 to 26.5	-55	-61	-64	-69	-102
>26.5 to 40	-54	-57	-61	-68	-99

**POWER LINE AND FAN ROTATION SPURIOUS
(dBc, CW Mode, Typical)**

Frequency Range (GHz)	Offset From Carrier (dBc/Hz)		
	<300 Hz	300 Hz to 1 kHz	1 kHz
0.01 to 8	-50	-60	-65
>8 to 12.4	-46	-53	-58
>12 to 20	-41	-48	-53
>20 to 26.5	-40	-47	-52
>26.5 to 40	-35	-42	-47

RESIDUAL FM

(CW Mode, 50 Hz-15 kHz BW, Typical)

Frequency Range (GHz)	Residual FM (kHz RMS)
0.01 to 2	80
>2 to 8	90
>8 to 12.4	190
>12.4 to 20	240
>20 to 26.5	280
>26.5 to 40	480

RESIDUAL FM

(Analog Sweep, 50 Hz-15 kHz BW)

Frequency Range (GHz)	Residual FM (kHz RMS)
0.01 to 8	6
>8 to 12.4	7
>12.4 to 20	10
>20 to 26.5	15
>26.5 to 40	30

RF OUTPUT

Power level specifications apply at 25' ±10'C. See Table 1-2 for model power ratings.

LEVELED OUTPUT POWER RANGE

- Without Attenuator: 12 dB
- With Option 2A, 110 dB Attenuator for Models with Upper Frequency Limit
≤12.4GHz: 122 dB
- With Option 2B, 90 dB Attenuator for Models with Upper Frequency Limit
>12.4 GHz and ≤26.5 GHz: 102 dB

ATTENUATOR INSERTION LOSS

Reduces rated output power by 3 dB max.

OUTPUT POWER RESOLUTION

- Entry Resolution: 0.01 dB
- Display Resolution: 0.1 dB

ACCURACY AND FLATNESS

See tables on next page.

Table 1-3. Specifications for the Series 67XXA Swept Frequency Synthesizers (3 of 5)

ACCURACY AND FLATNESS (Continued)

Step Sweep and CW Modes:

Attenuation Below Max Power	Frequency GHz		
	0.01 to 20	20 to 26.5	26.5 to 40
Accuracy*			
0 to 12 dB	±0.6 dB	±0.6 dB	±0.8 dB
0 to 30 dB**	±1.4 dB	±1.6 dB	N/A
30 to 60 dB**	±2.6 dB	±2.8 dB	N/A
>60 dB**	±3.1 dB	±5.0 dB	N/A
Flatness			
0 to 12 dB	±0.4 dB	±0.4 dB	±0.6 dB
0 to 30 dB**	±0.8 dB	±1.0 dB	N/A
30 to 60 dB**	±2.0 dB	±2.0 dB	N/A
>60 dB**	±2.5 dB	±3.0 dB	N/A

* Includes flatness variations.

** For models with attenuator.

Analog Sweep Modes (typical):

Attenuation Below Max Power	Frequency GHz		
	0.01 to 20	20 to 26.5	26.5 to 40
Accuracy*			
0 to 12 dB	±1.0 dB	±1.5 dB	±2.0 dB
0 to 30 dB**	±3.5 dB	±3.6 dB	N/A
30 to 60 dB**	±4.0 dB	±4.2 dB	N/A
>60 dB**	±5.0 dB	±5.2 dB	N/A
Flatness			
0 to 12 dB	±1.0 dB	±1.5 dB	±2.0 dB
0 to 30 dB**	±3.0 dB	±3.1 dB	N/A
30 to 60 dB**	±3.5 dB	±3.6 dB	N/A
>60 dB**	±4.0 dB	±4.2 dB	N/A

* Includes flatness variations.

** For models with attenuator.

OTHER POWER LEVEL SPECIFICATIONS

Power Level Stability With Temperature:

Typically 0.02 dB/°C

Power Level Switching Time (To within specified accuracy):

Without Change in Step Attenuator (Pulse Off):

<50 µs

With Change in Step Attenuator (Pulse Off):

<20 ms

Source Impedance: 50Ω

Source SWR (Internal Leveling):

Without Attenuator:

<1.7 at <2 GHz

<1.6 at <2 to 20 GHz

<2.0 at >20 GHz

With Attenuator: <2.0 typical

Level Offset: Offsets displayed power level to establish a new reference level.

RF On/Off Between Frequency Steps:

Rear panel switch selects RF On or Off during frequency switching in CW or step sweep mode.

Retrace RF On/Off: Rear panel switch selects RF On or Off during retrace.

RF Off: With RF control in Off position, oscillators are turned fully off.

Internal Leveling: Power is leveled at output connector in all modes.

External Leveling:

External Detector: Levels power at remote detector location. Front panel BNC connector, positive or negative 0.5 mV to 500 mV. EXT GAIN CAL adjusts input signal to optimum value.

External Power Meter: Levels output power at remote power sensor location. Front panel BNC connector, ±1V full scale EXT GAIN CAL adjusts input signal to optimum value.

External Leveling Bandwidth (Pulse Off):

>30 kHz typical in Detector mode

>0.7 Hz typical in Power Meter mode

Unleveled Indicator: Lights when output power is unleveled.

POWER SWEEP

Range: Sweeps between any two power levels.

Resolution: 0.01 dB/step

Accuracy: Same as output accuracy.

Number of Steps: Variable from 1 to 1000

Dwell Time per Step: Variable from 50 ms to 10s

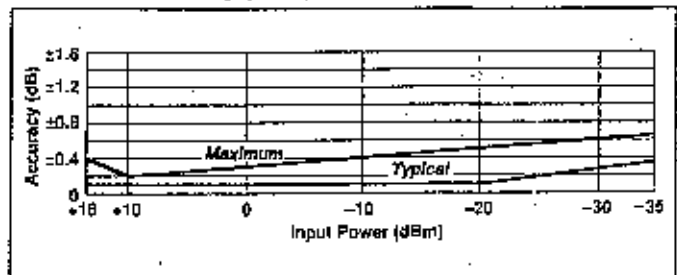
POWER METER

Built-In Power Meter Range: +18 dBm to -35 dBm. Compatible with Wiltron 560-7 or 6400-71 Series Detectors. Rear panel input.

Power Measurement Accuracy:

Power Measurement Accuracy = Meter Accuracy + Detector Frequency Response

Meter Accuracy (25°C):

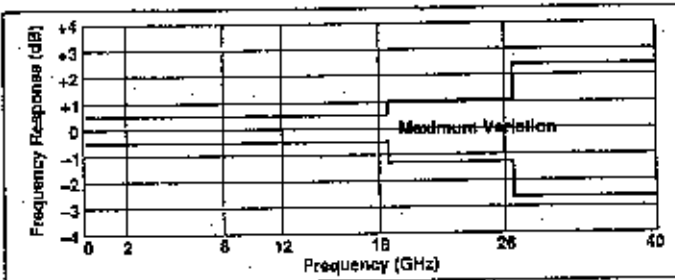


Detector Frequency Response:

See table on next page.

Table 1-3. Specifications for the Series 67XXA Swept Frequency Synthesizers (4 of 6)

POWER METER (Continued)
Detector Frequency Response:



MODULATION

AM, FM, and pulse modulation can be applied simultaneously.

PULSE MODULATION

- On/Off Ratio:
 - .01 to 20 GHz: 80 dB at ≤ 20 GHz
 - >20 to 40 GHz: 70 dB at ≤ 20 to 40 GHz
- Pulse Rise and Fall Time: <5ns typical, 10 ns max
- Pulse Overshoot and Ringing: 10% typical
- Pulse Width Compression: ± 5 ns max
- Video Feedthru: ≤ 2 mVpk typical, ± 5 mVpk max
- Accuracy of Peak Pulse Power (Relative to CW level, 100 Hz \leq PRF \leq 1 MHz):

Pulse Width	Frequency	
	<2 GHz	≥ 2 GHz
<100 ns	*	*
100 ns to <200 ns	*	± 1.5 dB
200 ns to <500 ns	*	± 1.5 dB
500 ns to <1 μ s	± 1.2 dB	± 0.8 dB
1 μ s to <2 μ s	± 0.9 dB	± 0.5 dB
2 μ s to <5 μ s	± 0.6 dB	± 0.3 dB
≥ 5 μ s	± 0.3 dB	± 0.3 dB

* RF power is controllable, but not automatically leveled for very narrow pulses.

Internal Pulse Generator

- Pulse Width Range: ≤ 25 ns to ≥ 99 ms
- Pulse Width Control Resolution:
 - Up to 100 μ s width: 25 ns
 - >100 μ s to 1 ms width: 1 μ s
 - >1ms to 10 ms width: 10 μ s
 - >10 ms to 99 ms width: 100 μ s
- Note: Specified resolution may exceed the 3-digit display resolution.
- Pulse Width Accuracy: ± 10 ns typical
- Pulse Repetition Rate: 10 Hz to 1 MHz
- Gate Width Range: 100 ns to infinity

Internal Pulse Generator (Continued)

- Pulse Input: Rear panel switch selects TTL high or low signal for triggering or gating internal pulse generator. BNC rear panel.
- Pulse Sync Output: TTL high signal, 100 ns minimum pulse width, preceding RF pulse by 100 ns. BNC, rear panel.
- External Pulse Input:
 - Pulse Width Range: 10 ns to CW
 - Pulse Repetition Rate: 10 Hz to 10 MHz
 - Delay Time: 50 ns typical

AMPLITUDE MODULATION

Specifications are measured at 1 kHz rate, 30% AM depth, with internally leveled RF at 4 dB below maximum rated output, unless otherwise noted.

- AM Input: Rear panel switch selects ac or dc coupling. BNC, front and rear panel, 600 Ω impedance.
- Sensitivity: 1%/V to 100%/V, selectable.
- Sensitivity Accuracy: $\pm 10\%$ of displayed value $\pm 1\%$ AM plus AM flatness.
- Depth: 0-90% with RF level at 6 dB below maximum rated output.
- AM Depth Metering Accuracy: Same as Sensitivity Accuracy.
- AM Bandwidth (3 dB, Pulse Off): DC to 50 kHz or 50 Hz to 50 kHz, selectable.
- AM Bandwidth with Pulse Modulation (typical):
 - 10 kHz for pulse widths of ≥ 16 μ s
 - 10 kHz times the duty factor for pulse widths of <16 μ s
- Flatness (relative to 1 kHz rate, pulse off): ± 0.3 dB from dc to 10 kHz
- Distortion: <5% typical
- Incidental Phase Modulation (100 Hz-10 kHz modulation rates): <0.4 radians, typical
- Incidental FM: Incidental phase modulation times modulation frequency.

FREQUENCY MODULATION

- FM Input: ± 1 Vpk provides full range frequency deviation. BNC, front and rear panel, 600 Ω impedance.
- Sensitivity:
 - Phase-Locked Mode: 10 kHz/V to 5 MHz/V, selectable to 3 digits.
 - Unlocked Mode: 10 kHz/V to 25 MHz/V, selectable to 3 digits.
 - Accuracy: $\pm 5\%$ at 40 kHz modulation rate.

Table 1-3. Specifications for the Series 67XXA Swept Frequency Synthesizers (5 of 5)

FREQUENCY MODULATION (Continued)**Maximum Deviation:****Phase-Locked Mode:**

±20 times the modulation rate.

Unlocked Mode: ±25 MHz**Deviation Meter Accuracy:**

±5% of full range plus FM flatness.

Modulation Rates (3 dB BW):**Phase-Locked Mode:**

100 Hz–250 kHz at ≤300 kHz/V sensitivity.

1–250 kHz at >300 kHz/V sensitivity.

Unlocked Mode: DC to 250 kHz rate.**Flatness (Relative to 40 kHz rate):****Phase-Locked Mode:**

±1 dB from 200 Hz to 200 kHz

at ≤300 kHz/V sensitivity.

±1 dB from 3 kHz to 200 kHz

at 300 kHz/V sensitivity.

Unlocked Mode: ±1 dB from dc to 200 kHz**Distortion at 1 kHz: <10%****Incidental AM: ±0.2% per MHz deviation****INSTRUMENT STATUS (IEEE-488)****GPiB Indicators:**

LED lights indicate the following conditions:

Remote: Operation on GPiB**Talk:** Talking on GPiB**Listen:** Listening on GPiB**SRG:** Sending a service request**Local Lockout:** Disables the RETURN TO LOCAL pushbutton. Instrument can be placed in local mode only via GPiB.**Remote Operation:**

All front panel functions (except line power and GPiB address) are programmable via GPiB (IEEE-488). Additional programmable commands include:

Front panel settings, stored setups, error/malfunction messages, operational status and self-test diagnostics.

GPiB Speed: 15K bytes/s**GPiB Address: Selectable from front panel.****IEEE-488 Interface Functions:****Source:** SH1**Acceptor Handshake:** AH1**Talker:** T6**Listener:** L4**Service Request:** SR1**Remote Local:** RL1**Parallel Poll:** PP1**Device Clear:** DC1**Device Trigger:** DT1**GENERAL****Stored Setups:** Saves front panel settings and nine additional stored setups for approximately ten years. Setups can be recovered directly by using the RECALL function or sequentially by using the SCAN function. Whenever the instrument is turned on, control settings come on at the same functions and values existing when power was removed.**Memory Sequencing Input:** Accepts TTL low signal to sequence through nine stored setups. BNC, rear panel.**Self-Test:** Self-test is performed when power is applied or SELF TEST key is pressed. If an error is detected, a diagnostic code appears, identifying the cause and location of the error.**Secure Mode:** Front panel readouts are blanked to protect confidential test parameters.**Parameter Entry:** Instrument-controlled parameters may be entered in three ways:

Keypad, control knob, or step DECR/INCR keys, the step size of which is variable via the keypad.

Controlled parameters are frequency, power level, sweep speed, dwell time, pulse width, pulse repetition rate, AM % depth, AM sensitivity, and FM sensitivity.

Entry is terminated by pressing appropriate unit key (i.e., GHz, MHz, dBm, ms, %, etc.). Values of each are displayed on LCD readout.

Reset Control: Returns test parameters to preset default values.**Warm Up Time:****From Standby:** 30 minutes.**From AC Power Application:** 72 hours to achieve 1×10^{-9} per day frequency accuracy and stability.**Weight: 25 kg (55 lb) maximum****Dimensions:**

133 H x 429 W x 584 D mm

(5-1/4 H x 16-7/8 W x 23 D in.)

Power:

90-130V or 200-240V, 50-400 Hz, 220 VA

(30 VA in Standby)

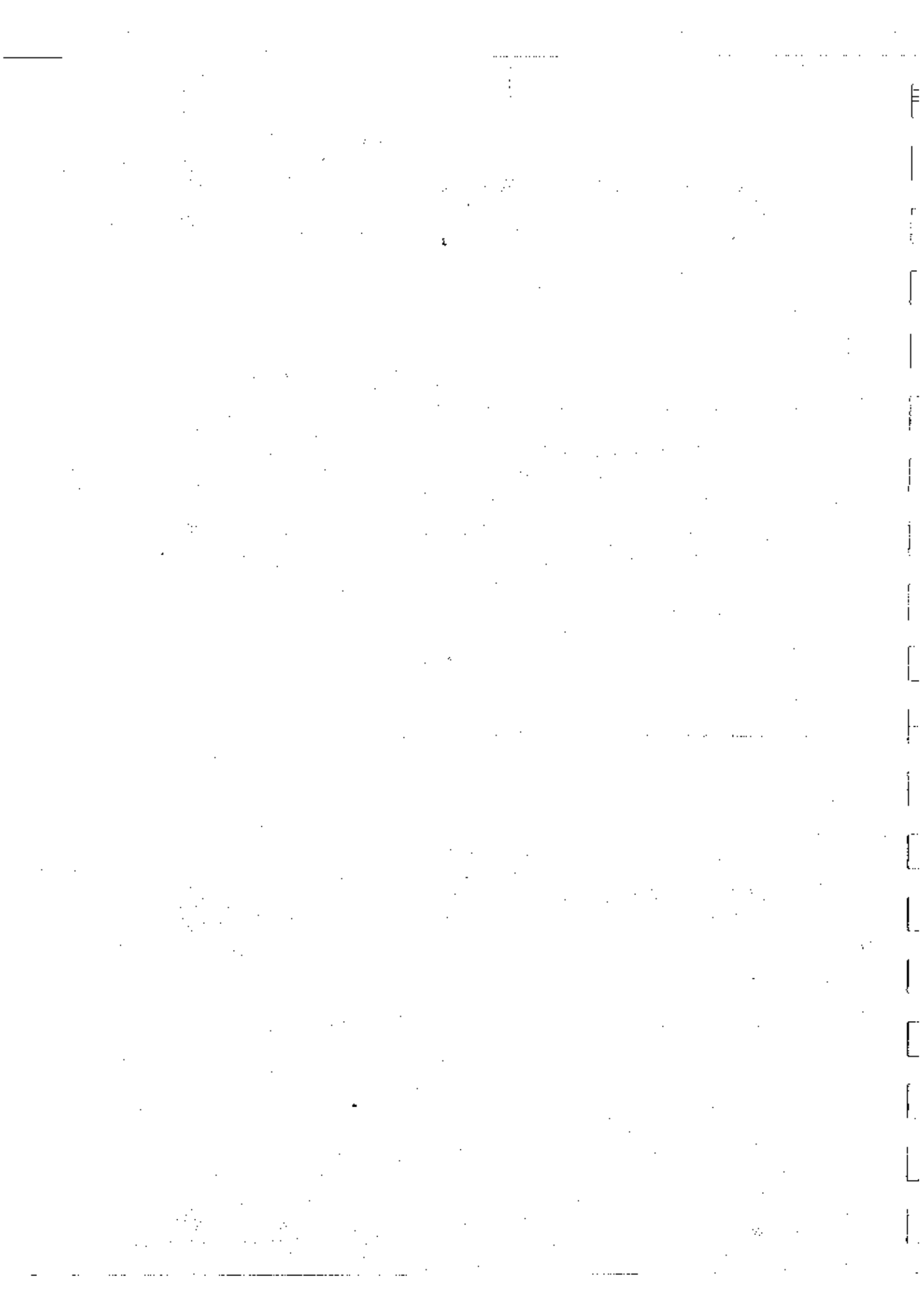
Standby: With ac line power connected, unit is placed in standby when power switch is released from the On position.**ENVIRONMENTAL****Operating Temperature Range: 0°C to 55°C****Relative Humidity: 95%****EMI:** Meets the conducted and radiated emission requirements of MIL-STD-461B CE03, RE02 Part 4 Class A3 and VDE 0871/1978, Level B. Tested for conducted and radiated susceptibility per MIL-STD-462, CS02, CS06, and RS03 with no functional failures.

Table 1-4. Recommended Test Equipment

INSTRUMENT	CRITICAL SPECIFICATION	RECOMMENDED MANUFACTURER/MODEL	USE
Spectrum Analyzer with External Mixer	Frequency: 0.01 to 100 GHz Resolution: 100 Hz	Tektronix, Model 494 With Ext. Mixer PN: 015-3085-00	P, C
Frequency Counter	Frequency: 0.01 to 40 GHz Input Impedance: 50 ohms Resolution: 1 Hz Other: Ext Time Base Input	EIP Microwave, Inc. Model 578A, Option 91	O, P, C
Power Meter	Power Range: -30 to +20 dBm Other: GPIB Controllable	Hewlett-Packard Model 436A, with Opt. 022 (HPIB)	O, P, C
Power Sensors	Frequency Range: 0.01 to 26.5 GHz 26.5 to 40 GHz	Hewlett-Packard Model 8485A, Model R8486A	O, P, C
Power Sensor	Power Range: 0.1 nW to 10 μ W	Hewlett-Packard Model 8484A	C
Digital Multimeter	Resolution: 4-1/2 digits (to 20V) DC Accuracy: 0.002% + 2 counts DC Input Impedance: 10 M Ω AC Accuracy: 0.07% + 100 counts (to 20 kHz) AC Input Impedance: 1 M Ω	John Fluke, Inc. Model 8940A With Option 8940A-09 (True RMS AC)	O, P, C
Frequency Standard	Frequency: 10 MHz Accuracy: 1×10^{-10} /day	Spectracom Corp. Model 8161	P, C
Function Generator	Output Voltage: 300 mV to 10V Functions: 200 kHz sine wave, 100 Hz square wave	Model 3311A	O, P, C
Oscilloscope	Bandwidth: DC to 150 MHz Sensitivity: 2 mV Horiz. Sensitivity: 50 ns/division	Tektronix, Inc. Model 2445	O, P, C
Modulation Meter	Frequency Input: 10 MHz (or the IF of the spectrum analyzer) FM Max. Deviation: 500 kHz FM Accuracy: $\pm 1\%$ to 100 kHz rate AM Depth: 0% to 90% AM Mod. Rates: DC to 100 kHz AM Accuracy: $\pm 3\%$ Filters: 50 Hz low pass, 15 kHz high pass	Hewlett-Packard Model 8901A	P, C
Scalar Network Analyzer	Frequency Range: 0.01 to 40 GHz	WILTRON Model 560A, with 560-7K50 Option 2 RF Detector	O, P, C
DC Block	150 MHz High-Pass Filter	Narda, Model 4564	P, C

SECTION II INSTALLATION

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SECTION II INSTALLATION

2-1 INTRODUCTION

This section provides information on initial inspection, preparation for use, and General Purpose Interface Bus (GPIB) interconnections. It also includes reshipment and storage information.

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

2-3 PREPARATION FOR USE

Preparation for use consists of checking for the correct line voltage. The line voltage selector on the rear panel enables the synthesizer to be used with either 110V or 220V ac. Before leaving the factory, each synthesizer is preset and tagged for the line voltage present in the customer's area. If the actual line voltage is different from that stated on the tag, change the LINE SELECT switch (Figure 2-1) to the correct setting and the line fuses to the correct value.

2-4 GPIB SETUP AND INTERCONNECTION

The synthesizer provides automated microwave measurements via the GPIB. The following paragraphs provide information about interface connections, cable requirements, and the addressing of the synthesizer.

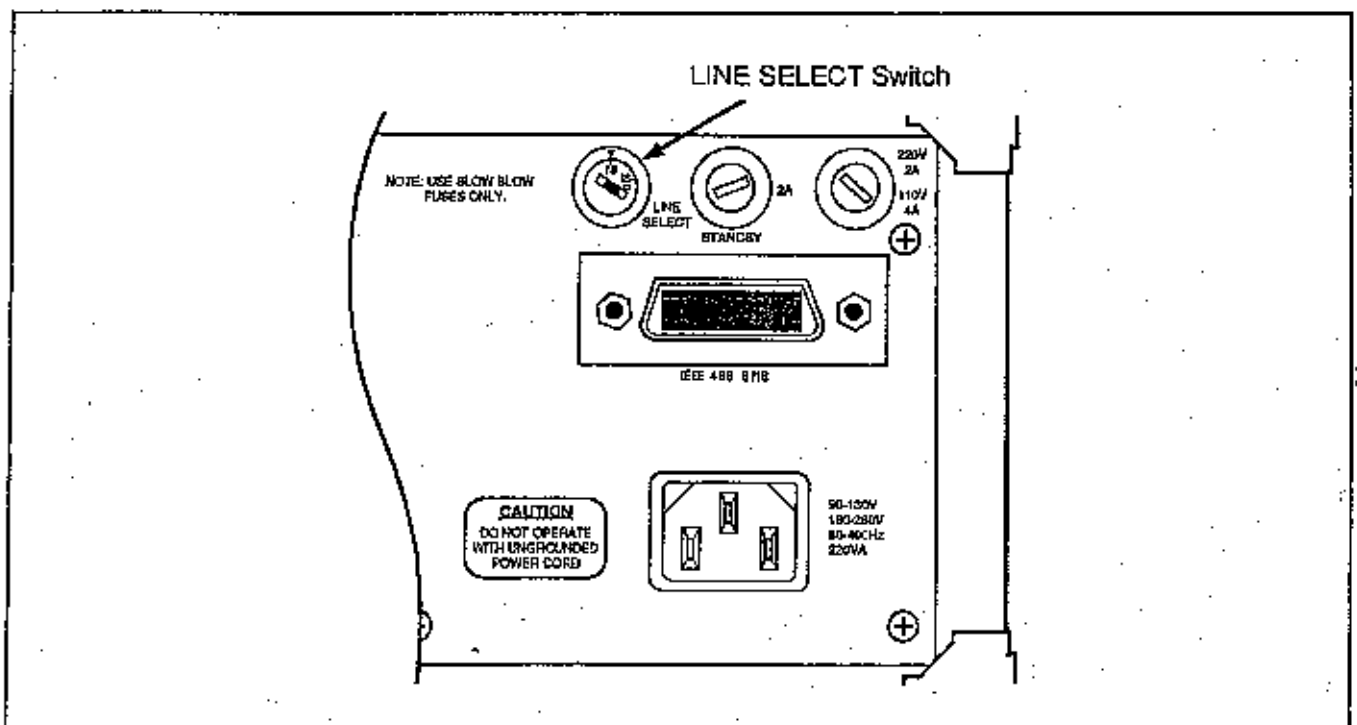


Figure 2-1. Synthesizer Rear Panel Showing LINE SELECT Switch

2-4.1 Interface Connector

Interface between the synthesizer and other devices on the GPIB is via a 24-wire interface cable. This cable uses connector shells having two connector faces. These double-faced connectors allow for the parallel connection of two or more cables to a single device. Figure 2-2 shows the pin assignments for the Type 57 GPIB connector installed on the rear panel.

2-4.2 Cable Length Restrictions

The GPIB system can accommodate up to 15 instruments at any one time. To achieve design performance on the bus, 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 two times the number of bus instruments or 20 meters—whichever is less.

NOTE

For low EMI applications, the GPIB cable should be a fully shielded type, with well-grounded metal-shell connectors

2-4.3 GPIB Interconnection

The only interconnection required for GPIB operation is between the synthesizer and the controller. This interconnection is via a special GPIB cable. The WILTRON Part number for such a cable is 2000-1, -2, or -4 (1, 2, or 4 meters in length).

2-4.4 GPIB Address

The synthesizer leaves the factory preset to address 5. If a different address is desired, it can be set from the front panel, as follows:

1. Press the Shift BUS ADRS key.
2. Observe the present address number on the LEVEL display.
3. Enter a new address number from the keypad, and terminate the entry with the

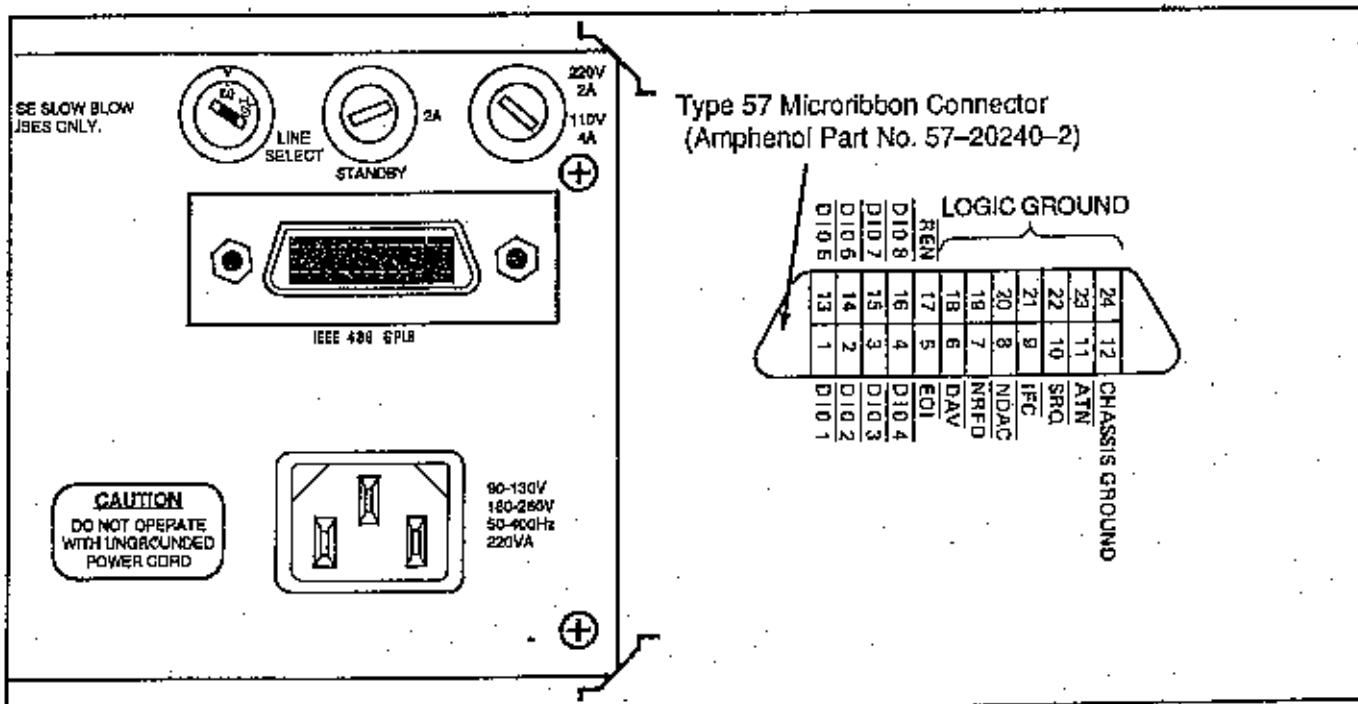


Figure 2-2. GPIB Connector Panel

2-4.5 Data Delimiting (CR-CR/LF Switch)

Data is delimited on the GPIB by either the carriage return (CR) ASCII character or both the carriage return and line feed (CR/LF) ASCII characters. Which character is used depends upon the requirements of the system controller. Most modern controllers can use either CR or CR/LF, while many older controllers require one or the other. Consult the controller's manual for its particular requirements.

A switch on the rear panel (Figure 2-3) provides for selecting the delimiting character.

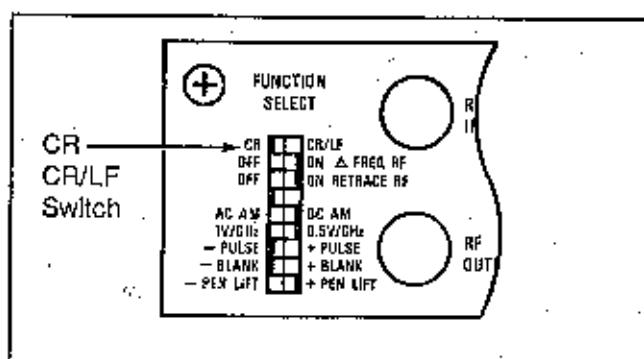


Figure 2-3. CR-CR/LF Switch

2-5 PREPARATION FOR STORAGE AND/OR SHIPMENT

Paragraphs 2-5.1 and 2-5.2 give instructions for preparing the synthesizer for storage or shipment.

2-5.1 Preparation for Storage

Preparing the synthesizer for storage consists of cleaning the unit, packing the inside with moisture-absorbing dessicant crystals, and storing the unit in a temperature environment that is maintained between -40 and +70 degrees centigrade.

2-5.2 Preparation for Shipment

To provide maximum protection against damage in transit, the synthesizer should be repackaged in the

original shipping container. If this container is no longer available and the synthesizer is being returned to WILTRON for repair, advise WILTRON Customer Service; they will send a new shipping container free of charge. In the event neither of these two options is possible, instructions for packaging and shipment are given below.

- a. **Use a Suitable Container.** Obtain a corrugated cardboard carton with a 275-pound test strength. This carton should have inside dimensions of no less than six inches larger than the instrument dimensions to allow for cushioning.
- b. **Protect the Instrument.** Surround the instrument with polyethylene sheeting to protect the finish.
- c. **Cushion the Instrument.** Cushion the instrument on all sides by tightly packing dunnage or urethane foam between the carton and the instrument. Provide at least three inches of dunnage on all sides.
- d. **Seal the Container.** Seal the carton by using either shipping tape or an industrial stapler.
- e. **Address the Container.** If the instrument is being returned to WILTRON for service, mark the WILTRON address and your return address on the carton in one or more prominent locations. For international customers, use the address of your local representative (see Table 2-1). For U.S.A. customers, use the the WILTRON address shown below.

WILTRON Company
ATTN: Customer Service
490 Jarvis Drive
Morgan Hill, CA 95037-0289

Table 2-1. WILTRON Company International Sales Representatives

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Telex: 716-22904 CMIEC CN

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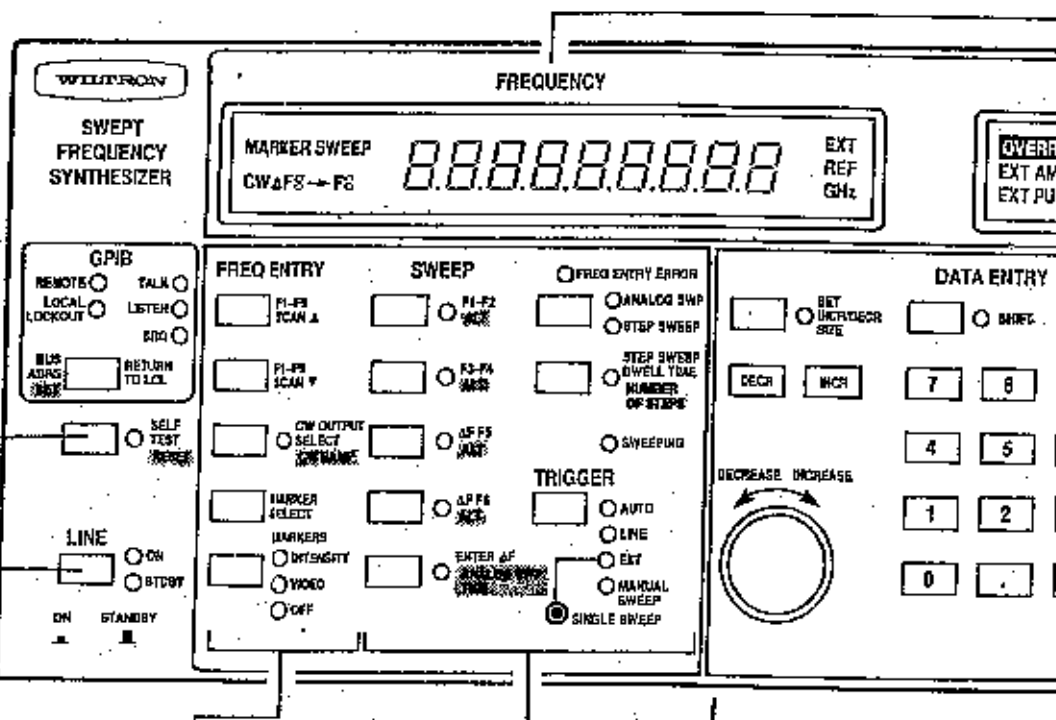
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SECTION III LOCAL (FRONT PANEL) OPERATION

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GPIB Indicators and Key. Indicators provide bus status and address information, while key provides for returning the synthesizer to front panel control.

SELF TEST/RESET keys provide for self testing the 6700A and for resetting the front panel.

LINE Key provides for turning the 6700A from STANDBY to ON.

FREQUENCY ENTRY Keys provide for (1) accessing each of the nine preset frequency parameters and opening them for updating, (2) identifying as frequency markers any or all of the nine frequency parameters, (3) outputting discrete CW frequencies, and (4) selecting marker types or turning markers off.

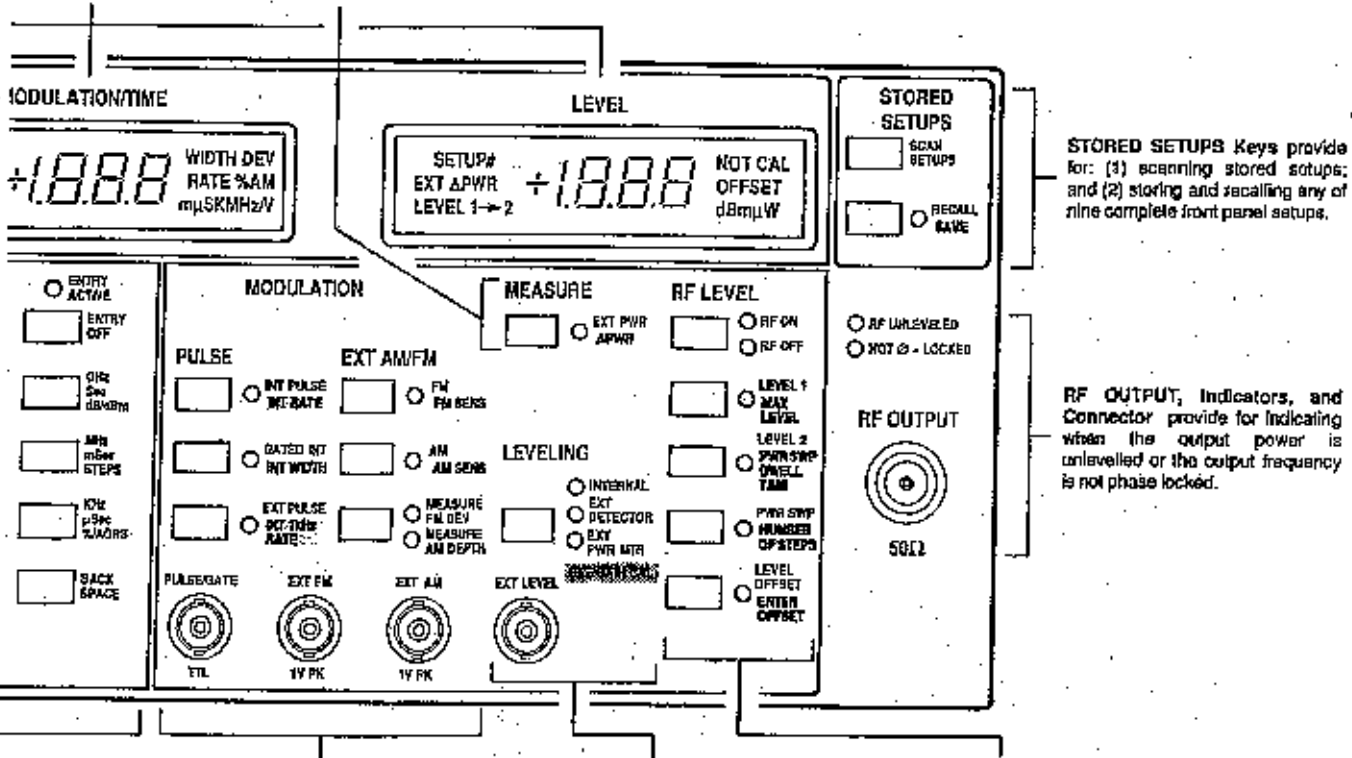
SWEEP Keys provide for (1) selecting one of the four preset frequency sweeps, (2) entering analog sweep time and ΔF frequency values, (3) selecting between analog (continuous) or phase-locked-step sweeps, and (4) selecting a sweep triggering mode. Also, the LED indicator lights to indicate when an abnormal sweep condition has been requested.

DATA ENTRY Keys, Inc and Control provide entering values for synthesizer parameters terminating the value by assigning the appropriate (MHz, GHz, dB, etc.). Pa values can be entered via the keypad or the INCR keys or rotary knob.



MODULATION and **LEVEL** Displays indicate selected functions and parameters, while **LEVEL** Display indicates frequency, time, and level values.

MEASURE Keys and Indicators provide for (1) measuring RF power with an external detector; and (2) referencing to zero the measured power at a given point.



STORED SETUPS Keys provide for: (1) scanning stored setups; and (2) storing and recalling any of nine complete front panel setups.

RF OUTPUT Indicators, and Connector provide for indicating when the output power is unlevelled or the output frequency is not phase locked.

MODULATION Keys and Connectors provide for applying external AM or FM or internal/external pulse modulation to the output signal.

LEVELING Keys, Indicators, and Connector provide for (1) leveling the output signal internally, (2) leveling the output signal externally with either a detector or a power meter, and (3) calibrating automatically the gain of the externally leveled input signal so as to provide a stable ALC loop.

RF LEVEL Keys provide for: (1) entering RF power level values, (2) selecting power sweep and offset level functions, (3) entering offset level values, (4) selecting automatically the maximum-level power for the sweep selected, and (5) turning the RF power on or off.

Figure 3-1. Front Panel, 67XXA Swept Frequency Synthesizer



SECTION III LOCAL (FRONT PANEL) OPERATION

3-1 INTRODUCTION

This section provides information and instructions for operating the 6700A Series equipment using the front panel controls. It includes a tutorial "Getting Started," in addition to a full description for each of the controls. It also includes rear panel connector and switch descriptions and a pinout diagram for the AUX I/O rear panel connector.

3-2 GETTING STARTED

3-2.1 Front Panel Layout

The 6700A controls are logically grouped by function around a centrally located data-entry section, as shown in Figure 3-1. The following paragraphs provide an overview of the functional groups. Detailed descriptions of controls within each functional group are given in paragraph 3-3.

3-2.2 General Instrument Control

a. Turning the Instrument On.

Press from STDBY to ON

When you connect the 6700A to the line power, you automatically place the instrument in standby. This provides power to the crystal oscillator heater circuitry. STANDBY operation ensures that the crystal maintains its specified frequency accuracy and stability (1×10^{-9} /day). *Even with the crystal kept warm, however, you must still allow at least a 30-minute warmup time.*

b. Self Testing the 6700A.

Press SELF TEST RESET

You can press the SELF TEST key anytime to self test the 6700A. In normal operation, however, the 6700A automatically self tests each time you switch line power from STANDBY to ON.

c. Resetting the Controls to Their Default Settings.

Press SHIFT + SELF TEST RESET

Refer to Table 3-1 for a listing of the default settings.

3-2.3 Operating the Frequency, Sweep, and Trigger Functions

a. Entering Frequency.

F1-F9 SCAN ▲
OR
Press F1-F9 SCAN ▼

to access one of the nine preset frequency parameters.

The parameter and its value is shown in the FREQUENCY display. You can change the selected parameter's value using the keypad and the appropriate terminator keys. The terminator keys are shown below.

GHz
Sec
dB/dBm

MHz
mSec
STEPS

KHz
μSec
%/ADRS

Table 3-1. RESET (Default) Parameters

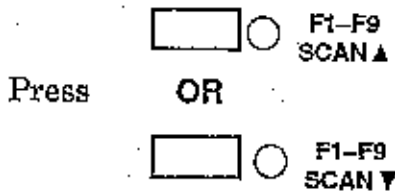
67XXA MODEL NUMBER	MIN/MAX POWER LEVEL PARAMETERS (dBm)					FREQUENCY PARAMETERS (GHz)								
	LEVEL 1 (Max.) LEVEL 2 (Min.)	Standard Model (No Atten.)	Option 2A 110 dB (for Models w/Upper Limit ≤18 GHz)	Option 2B 90 dB (for Models w/Upper Limit ≤28.5 GHz)	Option 2C 110 dB (for Models w/Upper Limit >18 GHz)	F1	F2	F3	F4	F5	F6	F7	F8	F9
6709A	LEVEL 1 LEVEL 2	+10 -2	+7 -115	+7 -95	N/A	.01	2	.25	.6	.75	1	1.25	1.5	1.75
6709A-40	LEVEL 1 LEVEL 2	+18 +4	+13 -109	+13 -89	N/A	.01	2	.25	.5	.75	1	1.25	1.5	1.75
6717A	LEVEL 1 LEVEL 2	+10 -2	+7 -115	+7 -95	N/A	.01	8.4	1	2	3	4	5	6	7
6717A-20	LEVEL 1 LEVEL 2	+18 +1	+10 -112	+10 -92	N/A	.01	8.4	1	2	3	4	5	6	7
6718A	LEVEL 1 LEVEL 2	+18 +1	+10 -112	+10 -92	N/A	2	8.4	9	9.5	4	5	6	7	8
6721A	LEVEL 1 LEVEL 2	+10 -2	+7 -115	+7 -95	N/A	2	12.4	3	5	7	8	9	10	11
6721A-20	LEVEL 1 LEVEL 2	+13 +1	+10 -112	+10 -92	N/A	2	12.4	3	5	7	8	9	10	11
6722A	LEVEL 1 LEVEL 2	+10 -2	+7 -115	+7 -95	N/A	.01	12.4	2	3	5	6	8	10	11
6722A-20	LEVEL 1 LEVEL 2	+13 +1	+10 -112	+10 -92	N/A	.01	12.4	2	3	5	6	8	10	11
6728A	LEVEL 1 LEVEL 2	+13 +1	+10 -112	+10 -92	N/A	8	12.4	8.5	9	9.5	10	10.5	11	11.5
6728A-40	LEVEL 1 LEVEL 2	+18 +4	+13 -109	+13 -89	N/A	8	12.4	8.5	9	9.5	10	10.5	11	11.5
6729A	LEVEL 1 LEVEL 2	+10 -2	N/A	+7 -95	+7 -115	8	20	10	11	13	14	18	18	18
6729A-20	LEVEL 1 LEVEL 2	+13 +1	N/A	+10 -92	+10 -112	8	20	10	11	13	14	18	18	18
6730A	LEVEL 1 LEVEL 2	+13 +1	N/A	+10 -92	+10 -112	12.4	20	13	14	15	18	17	18	19
6730A-40	LEVEL 1 LEVEL 2	+18 +4	N/A	+13 -89	+13 -109	12.4	20	13	14	15	16	17	18	19
6736A	LEVEL 1 LEVEL 2	+7 -5	N/A	+4 -98	+4 -110	18	28.5	19	20	21	22	23	24	25
6737A	LEVEL 1 LEVEL 2	+10 -2	N/A	+7 -95	+7 -115	2	20	4	7	10	11	13	15	18
6737A-20	LEVEL 1 LEVEL 2	+13 +1	N/A	+10 -92	+10 -112	2	20	4	7	10	11	13	15	18
6740A	LEVEL 1 LEVEL 2	+10 -2	N/A	+7 -95	+7 -115	18	28.5	26	30	32	33	34	36	38
6742A	LEVEL 1 LEVEL 2	See Note 2	See Note 2	See Note 2	See Note 2	18	40	22	25	28	29	32	35	37
6747A	LEVEL 1 LEVEL 2	+10 -2	N/A	+7 -95	+7 -115	.01	20	2	5	8	10	12	15	18
6747A-20	LEVEL 1 LEVEL 2	+13 +1	N/A	+10 -92	+10 -112	.01	20	2	5	8	10	12	15	18
6753A	LEVEL 1 LEVEL 2	+5 -7	N/A	+2 -100	+2 -120	2	28.5	6	8	11	14	17	20	23
6753A-10	LEVEL 1 LEVEL 2	+10 -2	N/A	+7 -95	+7 -115	2	28.5	5	8	11	14	17	20	23
6759A	LEVEL 1 LEVEL 2	+8 -7	N/A	+2 -100	+2 -120	.01	28.5	1	5	10	15	18	20	23
6759A-10	LEVEL 1 LEVEL 2	+10 -2	N/A	+7 -95	+7 -115	.01	28.5	1	5	10	15	18	20	23
6763A	LEVEL 1 LEVEL 2	+5 -7	N/A	+2 -100	+2 -120	2	40	7	11	16	21	25	32	36
6769A	LEVEL 1 LEVEL 2	+5 -7	N/A	+2 -100	+2 -120	.01	40	6	10	15	20	28	32	36

Notes: 1. Default maximum (LEVEL 1) and minimum (LEVEL 2) specified leveled power range limits at F1 frequency.
2. Information to be supplied.

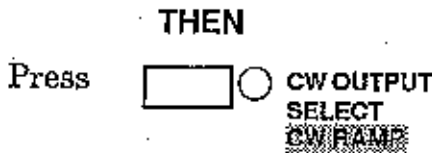
ΔF	1 GHz	Level Offset	0.0 dB
Sweep Time	50 ms	Power Sweep Dwell Time	100 ms
AM Sensitivity	30%/V	With Attenuator	50 ms
FM Sensitivity	300 kHz/V	Without Attenuator	100
Step Sweep		Number of Steps	100
Number of Steps	100		
Dwell Time	1 ms		
Internal Generator			
Pulse Width	500 μs		
Pulse Rate	1 kHz		

Frequency	0.1 GHz
Power Level	0.1 dB
Sweep Time	10 ms
Internal Generator Pulse Width	100 μs
Pulse Rate	1 kHz
Level Offset	0.1 dB
AM Sensitivity	1%/V
FM Sensitivity	10 kHz/V

b. Selecting a CW Frequency.

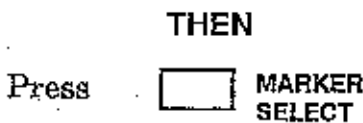
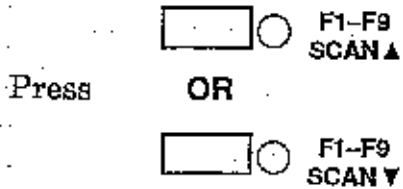


to select a frequency parameter.



to activate that parameter as the CW output frequency. Any one of the nine parameters can be so selected. In the CW mode, one of the nine frequencies is always active.

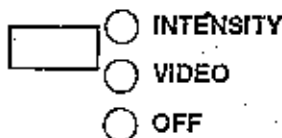
c. Using Frequency Markers.



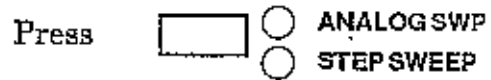
To select a frequency parameter.

1. You can select up to nine marker frequencies and turn each one on and off individually. This means that the only markers you need to have visible are the one(s) that you are currently using. Marker frequency accuracy is the same as sweep accuracy.
2. The MARKERS key (below) determines the marker type, in addition it toggles all selected markers on or off.

MARKERS



d. Selecting a Sweep.

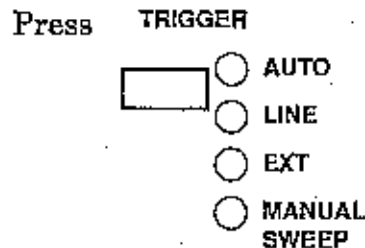


to light either the Analog or Step Sweep indicator. Analog sweep should be used when a continuous, quick sweep is desired. Each Analog Sweep is phase-lock corrected, which makes it more accurate than with a standard sweep generator. In a Step Sweep the output is a succession of phase-locked CW frequencies.

Either type of sweep (analog or step) can be selected in four ranges; F1-F2, F3-F4, ΔF F5, or ΔF F6. By having four sweep ranges available, you can preset each, then quickly switch between them as measurement needs dictate.

You can also switch between any two of your preset ranges on alternate sweeps. One application is to let you see the total band on one sweep then zoom in on a smaller area for the next sweep.

e. Triggering the Sweep.



AUTO: The sweep recurs periodically with a minimum delay (hold-off) time between sweeps.

LINE: The sweep recurs at a multiple or submultiple of the 50 or 60 Hz line frequency.

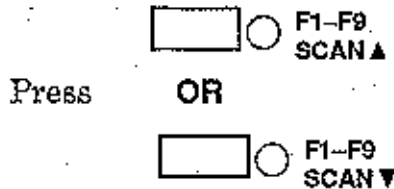
EXT: Sweep recurs when triggered externally. The sweep is triggered by either pressing the associated SINGLE SWEEP button or applying a TTL pulse to the rear panel SWEEP TRIGGER INPUT connector.

MANUAL SWEEP: Provides for manually sweeping the frequency range using the DECREASE INCREASE knob. Manual sweeps are a succession of phase-locked CW frequencies.

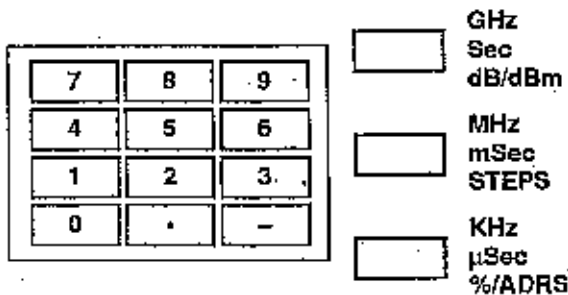
3-2.4 Entering Data

a. Using the Keypad.

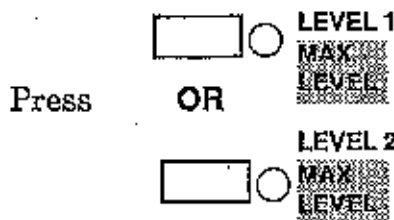
1. To enter frequency data:



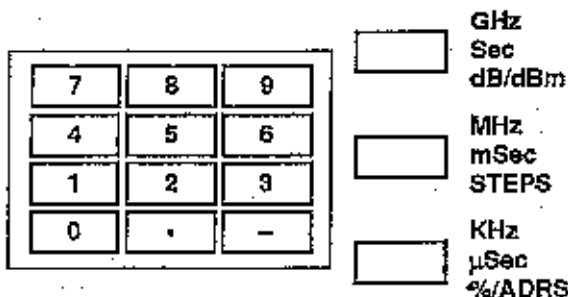
to select a frequency parameter. Then enter the desired value from the keypad and press the required terminator key.



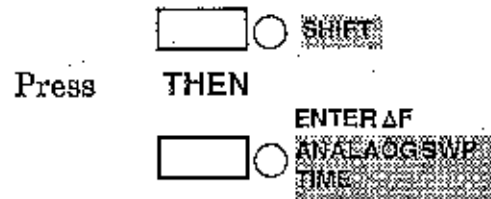
2. To enter power level data:



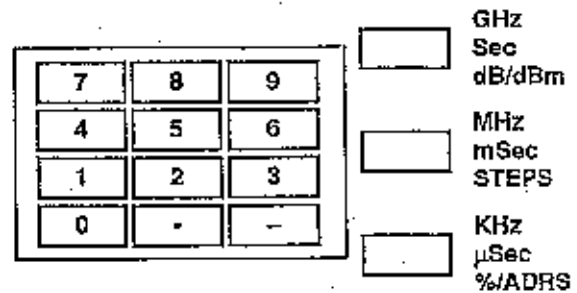
to select a level parameter. Then enter the desired value from the keypad and press the required terminator key.



3. To enter time data:

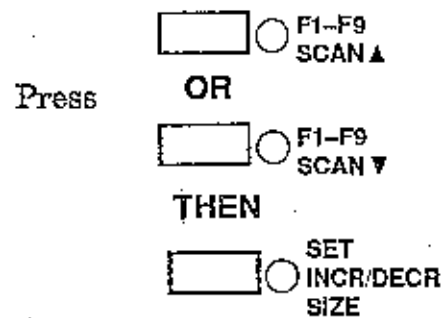


to select the sweep time parameter. Then enter the desired value from the keypad and press the required terminator key.

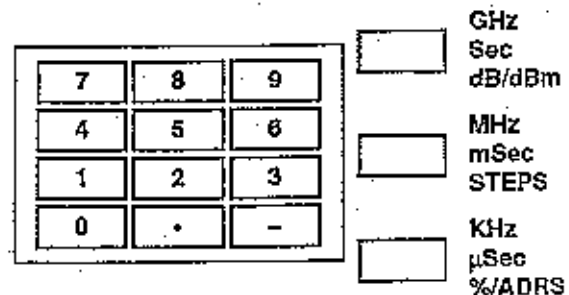


b. Using the DECR INCR Keys.

1. To select a frequency

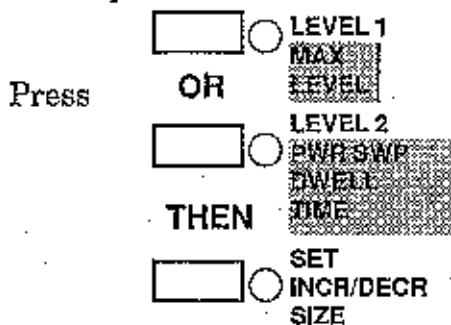


Set the incremental size using the keypad and terminator keys:



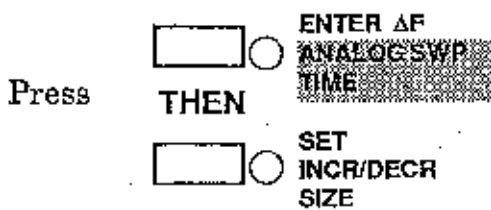
Increment the frequency using the
 keys.

2. To select a power level



Set the incremental size using the keypad and terminator keys. Increment the power level using the DECR INCR keys.

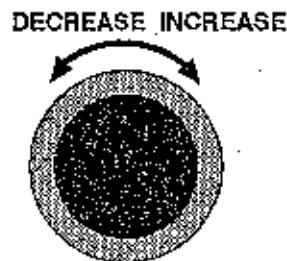
3. To select a sweep time



Set the incremental size using the keypad and terminator keys. Increment the sweep time using the DECR INCR keys.

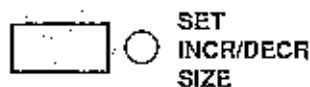
c. Using the DECREASE INCREASE Knob.

There are two methods available for increasing or decreasing a parameter's value using the DECREASE INCREASE knob. The first is to select the desired frequency, level, or time parameter—as shown above—then use the



knob to change the parameter value. Using this method, you increment or decrement the parameter by the minimum unit size: 1 kHz for frequency, 0.1 ms for time, 1 unit for step, and 0.1 dBm for RF level. Turning the knob rapidly changes the parameter in larger steps.

The second method uses this key to select the incremental size. Refer to Figure 3-2 for an example.



Example: Increase the F1 frequency first by 10 kHz then by 963 kHz.

1. Select the F1 parameter.
2. Press the SET INCR/DECR SIZE key and enter 10 kHz using the keypad and terminator keys.
3. Press the INCR key. The frequency will increase by 10 kHz.
4. Rotate the DECREASE INCREASE knob clockwise. The frequency will again increase by 10 kHz.
5. Press the SET INCR/DECR SIZE key then enter 963 kHz using the keypad and terminator keys.
6. Press the INCR key. The frequency will increase by 963 kHz.
7. Rotate the DECREASE INCREASE knob. The frequency will now increase in 100 kHz increments. Note that the DECR INCR keys change a parameter by the exact amount programmed; whereas, the DECREASE INCREASE knob changes a parameter by one count of the most-significant digit programmed.

Figure 3-2. Increasing a Parameter Using the INCREASE DECREASE Knob

3-2.5 Setting Level and Modulation

a. Controlling Pulse Modulation.

1. With the 6700A, there is no need for an external pulse modulator. Modulation capability is built into the RF deck. This feature reduces the system complexity and provides better level accuracy than would an external modulator. An internal pulse generator allows you to supply the internal modulator with your choice of pulse rate and width. Or, you can supply it with a preset 1 kHz rate, instead.

- (a) To select internal modulation at a rate and width of your choosing,

Press INT PULSE
INT RATE

to activate the internal pulse modulator. Select the desired modulation parameter by pressing

SHIFT
THEN
 INT PULSE
INT RATE

Enter the desired internal rate value using the keypad and terminator keys.

AND

SHIFT
THEN
 GATED INT
INT WIDTH

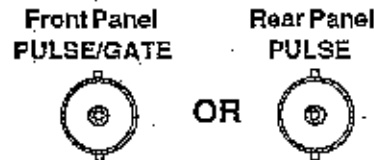
Enter the desired internal width value using the keypad and terminator keys.

- (b) To select 1 kHz preset modulation

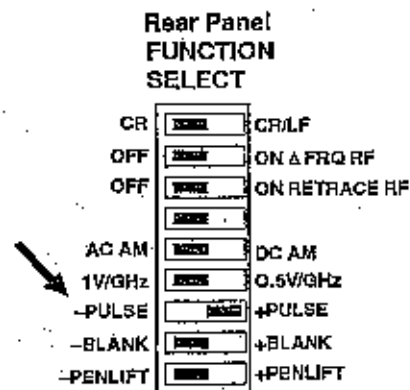
Press SHIFT
THEN
 EXT PULSE
INT 1KHZ RATE

2. You can also externally pulse modulate the internal pulse generator. To select this mode,

- (a) Connect an external pulse or function generator to



Set the rear panel FUNCTION SELECT switch to + PULSE or -PULSE to select RF ON or RF OFF for a TTL high signal at the pulse inputs.



- b. Gating the Pulse Modulation. For sophisticated applications, the internal pulse generator can be gated by an external signal to produce bursts of pulse-modulated-RF. To use this mode:

1. Connect an external pulse generator to either the front panel EXT PULSE/GATE or rear panel PULSE connector shown above.
2. Select -PULSE or +PULSE, as appropriate, on the FUNCTION SELECT switch shown above.
3. Set the internal generator rate and width values as described in step a.(1)(a) above.
4. Press GATED INT
INT WIDTH
5. Set the gating width and rate on the external generator.

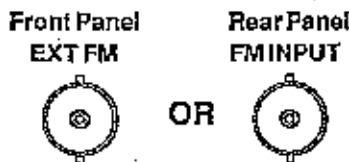
NOTE

The external gating source can be synchronized with the internal pulse generator by using the 10 MHz REF output as a frequency reference for the external generator.

- c. **Providing External Amplitude or Frequency Modulation (AM or FM).** The 6700A provides FM and AM capability. You can FM in either the phase-locked state or in a wideband unlocked mode. All three modulation methods—AM, FM, and Pulse—can be active simultaneously.

1. **Providing Frequency Modulation**

- (a) Connect an external signal generator to



- (b) Set the generator for an output of 2 volts peak-to-peak.

- (c) Press **FM**
FM SENS

to activate the external FM input. Select the sensitivity for FM deviation as follows:

- (1) Press **SHIFT**

THEN



- (2) On the keypad, enter an FM deviation-per-volt sensitivity value of between 10 kHz and 5 MHz for phase-locked operation, or between 10 kHz and 25 MHz for unlocked operation.

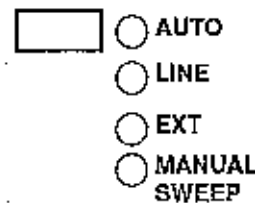
NOTE

UNLOCKED operation requires disabling the YIG lock loop. To do so, press



THEN

TRIGGER



and enter 80 on the keypad. The 6700A will then allow FM deviation sensitivities greater than 5 MHz. Be aware, that frequency accuracy and stability are seriously degraded in the UNLOCKED mode. To restore the 6700A to a locked operation, (1) reduce FM sensitivity or turn off FM, then (2) repeat the above SHIFT-TRIGGER key sequence and enter 81 on the keypad.

- (d) On the external signal generator, enter a modulating frequency as follows:

- (1) For the phase-locked mode: Enter values between 50 Hz and 250 kHz, for sensitivity values of 300 kHz/V or less; or between 1 kHz and 250 kHz, for sensitivity values of greater than 300 kHz/V.

NOTE

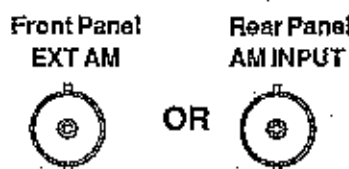
In the phaselock mode, the peak deviation should not exceed 20X the modulating rate. Consequently, the modulating generator should be set to produce a frequency that is greater than (FM SENSITIVITY) X (PEAK INPUT VOLTS)/20. An FM OVERRANGE indication in the MOD display means either that the deviation is

too great for the modulating rate or that the 1V input range has been exceeded.

- (2) For the unlocked mode: On the external signal generator, enter values between dc and 250 kHz

2. Providing Amplitude Modulation

- (a) Connect a signal generator to



- (b) Set the generator for an output of 2 volts peak-to-peak.

- (c) Press **AM**
AM SENS
to activate the external AM input.

- (d) Select the sensitivity as follows:

- (1) Press **SHIFT**
THEN
 AM
AM SENS

- (2) On the keypad, enter the desired -AM percent-per-volt sensitivity value (a number between 1 and 99.9), and press



NOTE

An AM OVERRANGE indication in the MOD display means that the 1V input range has been exceeded.

3. Leveling the Frequency Sweep

The 6700A offers three leveling modes: internal, external detector, and external power meter. The modes are described below.

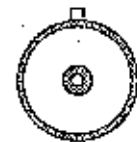
- (a) The *internal mode* uses a built-in directional coupler and detector to level the sweep at the RF OUTPUT connector. This is the default mode; it is also the mode in which you will likely make most of your measurements.



- (b) The *external detector mode*, allows you to level the output power at the point of measurement. At this point, the synthesizer output is sensed using a directional coupler and detector and fed back to the front panel EXT LEVEL connector.



- (c) The *external power meter mode*, also provides for leveling the sweep at the point of measurement. Only now, the synthesizer output is sensed using the RECORDER jack on a power meter. As with the detector mode, you feed this signal back to the front panel EXT LEVEL connector.



NOTE

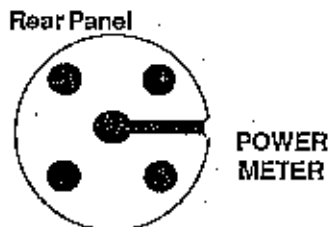
When using external leveling, you *must* adjust the leveling loop gain for compatibility with the external power detector (Figure 3-3).

4. Measuring the Output Signal

To further increase its utility, the 6700A has the capability of measuring three of its output-signal parameters—power, FM deviation, and AM depth. The sensing head for power measurements is provided by a Series 560 detector that connects to the POWER METER jack on the rear panel.

1. Connect the external leveling coupler and detector (or power meter) together.
2. Terminate the coupler throughport for best calibration.
3. Connect the detector output to the EXT INPUT connector.
4. Press the LEVEL 1 key and set for the desired output level.
5. Press the LEVELING key to light the EXT DETECTOR or EXT PWR MTR indicator, as appropriate.
6. Press SHIFT then EXT GAIN CAL to automatically calibrate the external loop gain.
7. Remove the coupler termination and connect the desired load.

Figure 3-3. External Gain Calibration Procedure



- (a) *Power Measurement Function.* This function allows you to measure the microwave power from a test device and display its value on the LEVEL display. A typical use is characterizing the loss of the cable used to connect the 6700A to a test device. After determining the loss of the cable, you can then adjust the level offset function described in paragraph 3-2.6c to compensate. By so doing, you ensure that the LEVEL display agrees with the actual power at the end of the cable. Through the use of extender cables power measurements can be made up to 200 feet from the instrument.

- (b) *AM Measurement Function.* Setting AM SENS to a percentage value, such as 30%, only provides that percentage value if the input AM is exactly 1 volt. For example, if you had called for 30% AM but your input signal was only 0.5 volt peak, then the MODULATION/TIME display will read 15% "%AM" instead of 30%.
- (c) *FM Measurement Function.* As described for AM, above, the FM deviation values called for using the FM SENS settings are only valid when the input FM is exactly 1V peak. For example, if you had called for an FM deviation of 250 kHz but your input signal was only 0.5V peak, the MODULATION/TIME display will read 125 kHz/V "FM DEV" instead of 250 kHz/V.

To measure AM and FM modulation values, see Figure 3-4.

Measuring Percent AM

1. Supply a modulating signal to either the front or rear panel external AM connector.
2. Press AM.
3. Press the bottom EXT AM/FM key to light the MEASURE AM DEPTH indicator.
4. Read the modulation value on the MODULATION/TIME display.

Measuring FM Deviation

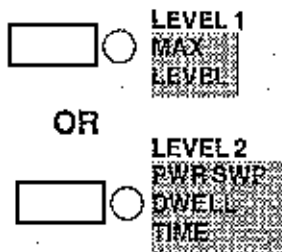
1. Supply a modulating signal to either the front or rear panel external FM connector.
2. Press FM.
3. Press the bottom EXT AM/FM key to light the MEASURE FM DEV indicator.
4. Read the deviation value on the MODULATION/TIME display.

Figure 3-4. External AM and FM Measurement Procedure

3-2.6 Using the RF LEVEL Function

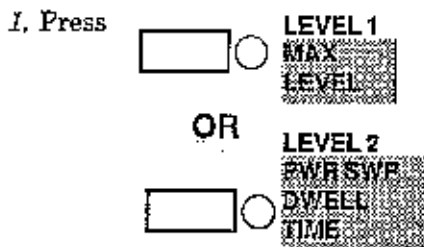
The 6700A provides three ways for setting the output power level—static, swept, or offset. These three modes are described below.

a. *Static (Non-Swept) Power Mode.* In this mode you use

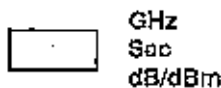


to set a static, non-varying output power level. Setting a different value for each of these keys, lets you quickly switch from one level to another—a distinct advantage when measuring devices that must be characterized at different levels. You can also use these two keys to set the end points for the power sweep described in subparagraph b, below.

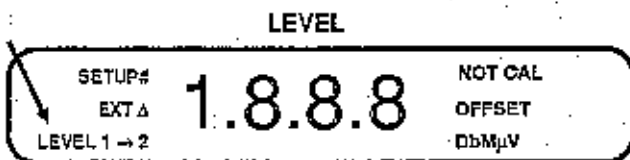
To select a static power level, proceed as follows:



2. Enter the digits of the desired level on the keypad, then press

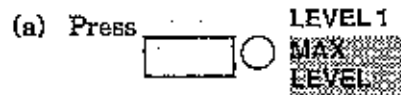


3. Observe that the requested level appears on the LEVEL display and that the appropriate LEVEL 1 or 2 annunciator appears.

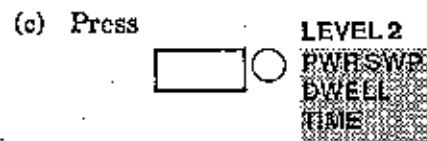
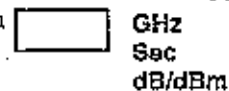


b. *Power Sweep Mode.* In this mode, the output power is swept between two power levels. This is very useful for measuring level sensitive devices such as amplifiers. In such a measurement, you would sweep from a low to a higher level and observe amplifier gain.

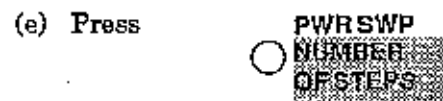
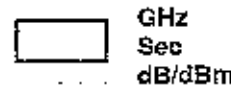
1. To power sweep:



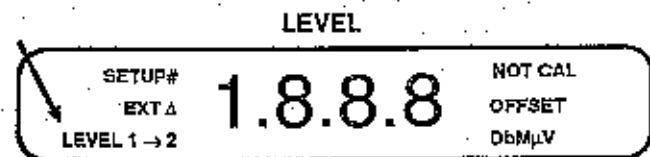
(b) Enter the low level value on the keypad, and terminate with



(d) Enter the high level value on the keypad, and terminate with



(f) Observe that the level readout on the LEVEL display sweeps from the low to the high value, and that the LEVEL 1 2 annunciator appears.



2. To change the length of time that the power remains at any one level, proceed as follows:

(a) Press **SHIFT**

THEN

**LEVEL 2
PWR SWP
DWELL
TIME**

(b) Enter the digits of the desired new value on the keypad, and terminate with

**GHz
Sec
dB/dBm**

OR

**MHz
µSec
STEPS**

(c) Observe that the MODULATION/TIME display shows the dwell time until shortly after the function has been terminated

3. To change the number of levels at which the power sweep dwells, proceed as follows:

(a) Press **SHIFT**

THEN

**PWR SWP
NUMBER
OF STEPS**

(b) Enter the digits of the desired new value on the keypad, and terminate with

**MHz
µSec
STEPS**

(c) The number of power steps is indicated in the LEVEL display until shortly after the function is terminated.

c. **Level Offset Mode** This mode allows you to compensate for a device on the output that alters the output power level (a cable or an amplifier, for instance). The displayed level can be offset by a constant so that it accurately reflects the power level at the point of interest. As an example, let us assume that you want to compensate for a 10 dB amplifier located between the 6700A output and the test device. Proceed as follows:

1. Press **LEVEL 1
MAX
LEVEL**

2. Observe that the LEVEL display indicates the power available at the RF OUTPUT connector.

3. Press **SHIFT**

THEN

**LEVEL
OFFSET
ENTER
OFFSET**

4. Enter 10 dB from the keypad.

5. Press **LEVEL
OFFSET
ENTER
OFFSET**

6. Observe that the displayed LEVEL value decreased by 10 dBm and that the OFFSET annunciator appears.

LEVEL		
SETUPS	1.8.8.8	NO CAL
EXT A		OFFSET
LEVEL 1 → 2		dBMLV

- d. **Max Level** When all the leveled power possible is needed, press



THEN

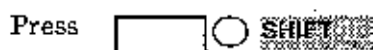


In a CW mode, this will give you the maximum leveled power at the present frequency setting. In a swept mode, within a few sweeps, this mode will give you the maximum level that can be sustained across the entire sweep.

3-2.7 Using Stored Setups

The 6700A offers the capability for storing up to nine complete front panel setups.

1. To store a setup,

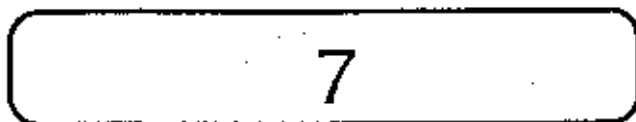


THEN

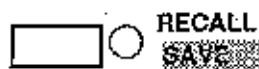


and enter the desired setup number on the keypad. The number appears on the LEVEL display.

LEVEL

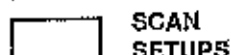


2. To recall a stored setup, press



and enter the desired setup number on the keypad. The number appears on the LEVEL display.

3. To determine what setups are stored in which memory location, use the SCAN SETUPS key.



Press this key several times and observe that the front panel settings change as the stored setups are sequentially recalled.

NOTE

Setup #0 automatically saves the current front panel if you have made any control changes. After a SCAN or RECALL, you can recover your original front panel by pressing RECALL 0 or by scanning to Setup #0. The SAVE function also writes the old contents of the memory you are updating into Setup #0. Consequently, if you accidentally write over an important stored setup, you can still recover it as Setup #0. You cannot SAVE directly to Setup #0.

3-2.8 Monitoring the Output

The lock and level status of the microwave output is automatically monitored and displayed using LED's.

- RF UNLEVELED
- NOT Ø - LOCKED

The

alert you when your RF is unleveled and when your output signal is not phase-locked.

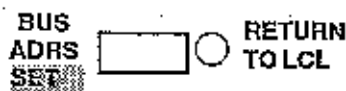
NOTE

The NOT Ø - LOCKED LED will light when ANALOG SWEEP or UNLOCKED FM modes are detected.

3-2.9 Controlling and Monitoring GPIB Status

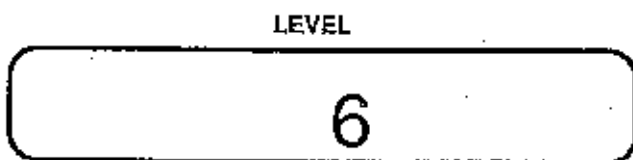
All front panel functions (except line power and GPIB address) are programmable from the IEEE-488 Bus (GPIB). Additionally, the GPIB address can be read and set from the front panel.

1. To determine what address the synthesizer is set for, press

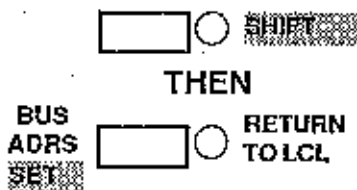


If the 6700A is not under bus control, the address number appears on the LEVEL display. When the instrument is being controlled from the bus, this key returns it to local control—provided the LOCAL LOCKOUT bus message has not been implemented.

2. To set the 6700A for a different address:

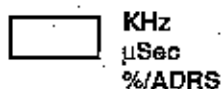


(a) Press



THEN

(b) Enter the new address number from the keypad, then press



3-3 FRONT PANEL DESCRIPTION

Detailed descriptions for the individual front panel keys and connectors are provided in the following paragraphs.

3-3.1 SELF TEST or RESET and LINE Keys (Figure 3-5)

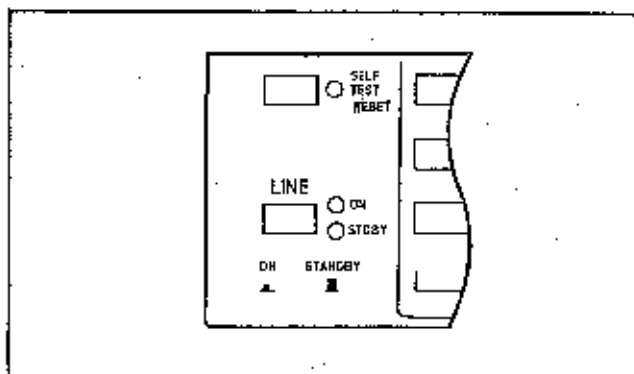


Figure 3-5. SELF TEST or RESET and LINE Keys

- a. **SELF TEST or RESET <Shifted> Key**
SELF TEST: Provides an instrument self test. If the self test is unsuccessful, an error code will appear on the FREQUENCY display.

RESET Presets the front panel to the factory-selected settings. It also clears the GPIB interface.

NOTE

Pressing this key clears the front panel setup presently in place. If that setup is needed for future testing, save it as a stored setup before pressing RESET.

- b. **LINE Key** When in the ON position, this key supplies a dc control voltage to the power supply circuits—thus activating the instrument. In standby, the instrument is deactivated, except for the 10 MHz crystal standard and oven.

CAUTION

Power is always applied to this circuit when the instrument is connected to an ac source.

Two LEDs indicate whether the 6700A is in the POWER ON or STANDBY mode.

3-3.2 FREQ ENTRY Keys (Figure 3-6)

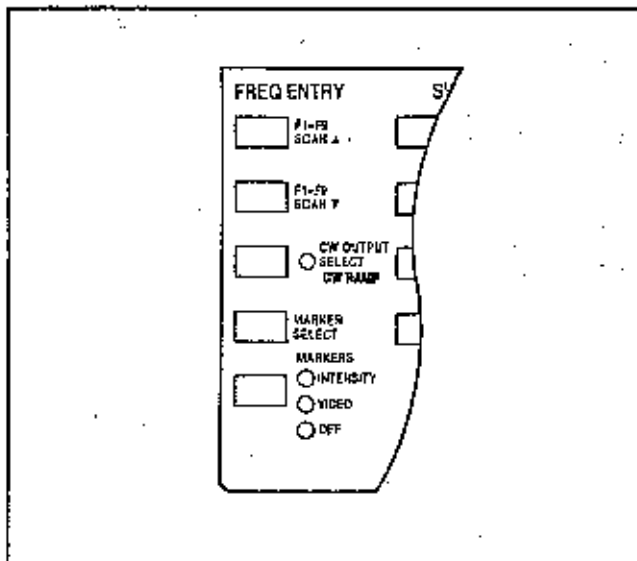


Figure 3-6. FREQ ENTRY Keys

a. F1-9 SCAN Up/Down Keys

These keys provide two functions: They sequence through each of the nine preset frequency parameters (F1-F9), and they access and open for updating the parameter that is annunciated on the RF frequency display. Pressing and releasing these keys sequence the parameters discretely, starting with the one that had been displayed when the mode was last exited. The sequencing order for the F1-F9 SCANA key is up from F1 to F9 and that for F1-F9 SCANV key is down from F9 to F1. Pressing and holding either key sequences the parameters continuously. Parameter updating is accomplished using the DATA ENTRY keys (paragraph 3-3.4).

Sequencing through the nine preset frequencies as described above, does not cause the output frequency to change. These keys allow a frequency parameter to be accessed and to have its value changed without disturbing the frequency then being output—except when the frequency being changed has been selected as an output.

b. CW OUTPUT SELECT or CW RAMP <Shifted> Key

CW OUTPUT selects the frequency displayed in the frequency display to be output at the RF OUTPUT port. It lights the associated LED to indicate that the CW function is active.

This key is interlocked with sweep keys F1-F2, F3-F4, ΔF F5, and ΔF F6 so that only one of these functions can be active.

CW RAMP causes a horizontal ramp to be applied to the rear panel HORIZONTAL OUTPUT BNC connector for driving an analyzer display.

c. MARKERSELECT Key

This key selects as a potential frequency marker the frequency parameter then being annunciated on the FREQUENCY display. The *potential* marker becomes an *actual* marker when the MARKERS key is pressed to light either the VIDEO or INTENSITY indicators. Any of the nine stored frequencies can be labeled as markers by using the F1-F9 SCAN and MARKER SELECT keys.

This key in conjunction with the MARKERS key described below allows the frequency markers to be enabled individually or altogether.

d. MARKERS VIDEO, INTENSITY, or OFF Key

The INTENSITY position enables as an intensity marker each of the frequency parameters that has been identified as a potential marker (see above)—*provided that the marker is within the sweep frequency range.*

The VIDEO position enables as a video marker each of the frequency parameters identified as a potential marker (see above)—*provided that the marker is within the sweep frequency range.* The video marker is a +5V pulse at the rear panel.

The OFF position turns off all selected markers. This key, in conjunction with the MARKERS key, allows the video markers to be enabled individually or altogether.

3-3.3 SWEEP and TRIGGER Keys and Indicators (Figure 3-7)

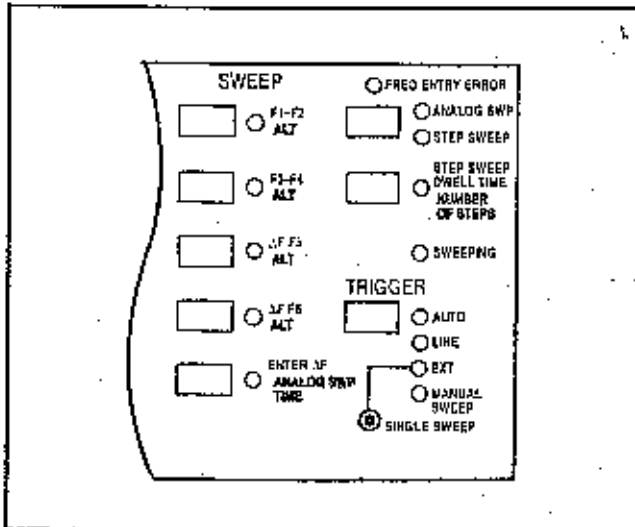


Figure 3-7. SWEEP and TRIGGER Keys and Indicators

a. F1-F2 or ALT <Shifted> Key

F1-F2 selects the F1-to-F2 sweep mode. When activated, the associated LED lights and the two frequency values, along with the SWEEP and F1-F2 annunciators, appear on the FREQUENCY display. Parameters F1 and F2 can be accessed using the F1-F9 SCAN up or down keys; their values can be changed using the DATA ENTRY keys. Nine markers are available, providing that their frequency is within the sweep range.

ALT selects anyone of the four stored sweeps to alternate with the primary sweep previously selected. The two end-point frequencies of the primary sweep, along with the sweep's annunciators, are displayed on the FREQUENCY display. The end-point frequencies of the primary sweep may be viewed using the F1-F9 SCAN up or down key without leaving the ALT sweep mode. The two frequencies may then be changed using the DATA ENTRY keys.

The associated LED lights to indicate which sweep is in progress.

b. F3-F4 or ALT <Shifted> Key

F3-F4 functions the same as F1-F2 above. All nine markers are available in this sweep mode also, provided they fall within the sweep range. Markers F3 and F4 appear at their respective ends of the sweep.

ALT functions the same as ALT above.

c. ΔF F5 or ALT <Shifted> Key

ΔF F5 selects the ΔF F5 sweep mode. In this mode, the frequency sweeps symmetrically about the F5 frequency. The width of this sweep is determined by the ΔF frequency parameter. Up to four digits of both the F5 and ΔF frequencies appear on the FREQUENCY display—the F5 frequency appears on the left and the ΔF frequency on the right.

All nine markers are available. The F5 marker, if chosen, appears at the center of the sweep.

The associated LED and the FREQUENCY display SWEEP and F5 annunciators light when the function is activated.

ALT functions the same as ALT above.

d. ΔF F6 or ALT <Shifted> Key

ΔF F6 functions the same as ΔF F5 above. All nine markers are available in this sweep mode also. The F6 marker, if chosen, appears in the middle of the sweep.

ALT functions the same as ALT above.

e. ENTER ΔF or ANALOG SWP TIME <Shift> Key

ENTER ΔF accesses the ΔF parameter and opens it for updating using the DATA ENTRY keys. Up to four digits of both the F5 and ΔF frequencies appear on the FREQUENCY display—the F5 frequency appears on the left and the ΔF frequency on the right.

The associated LED lights when this parameter is open for entry.

ANALOG SWP TIME accesses the sweep time parameter and opens it for updating using the DATA ENTRY keys. The sweep time is selectable from 30 ms to 99 s. The three most-significant digits of the sweep time appear on the MODULATION/TIME display.

The associated LED lights when this parameter is open for entry.

f. FREQ ENTRY ERROR Indicator

This indicator flashes to indicate that the selected sweep-start frequency is greater than or equal to the selected sweep-stop frequency. It will also flash if ΔF exceeds the instrument's frequency range. To clear this condition, enter the correct frequency values or select a different sweep mode.

g. ANALOG SWP or STEP SWEEP Key

This key selects either the ANALOG SWEEP or STEP SWEEP mode. Two LEDs indicate the current operating mode. In the ANALOG SWEEP mode, the output frequency is swept continuously between its F1-F2, F3-F4, ΔF F5, or ΔF F6 frequency limits. The sweep is phase-lock corrected at both the low and high ends of the band and at each bandswitch point.

In any sweep mode, when the sweep width is ≤ 50 MHz only the midpoint frequency is phase-lock corrected.

In the STEP SWEEP mode, the frequency changes in discrete, synthesized steps between the F1-F2, F3-F4, ΔF F5, or ΔF F6 frequency limits. The number of steps between endpoints and the dwell-time-per-step can be specified as outlined in paragraph 3-3.3h below.

h. STEP SWEEP DWELL TIME or NUMBER OF STEPS <Shifted> Key

STEP SWEEP DWELL TIME accesses the dwell-time parameter of the synthesized step sweep and opens it for updating using the DATA ENTRY keys. This parameter defines the length of time that the synthesized step sweep dwells at each frequency point. Dwell time is selectable from 1 ms to 99 s. The three most-significant digits appear on the MODULATION/TIME display.

The associated LED lights when this parameter is open for entry.

NUMBER OF STEPS accesses the number-of-steps parameter of the synthesized step-sweep

and opens it for updating using the DATA ENTRY keys. This parameter defines the number of discrete steps taken by the step-sweep when transiting between its low- and high-end frequencies. The parameter is selectable from 1 to 1000 steps. The step setting appears on the LEVEL display.

The associated LED and the # symbol on the LEVEL display light when this parameter is open for updating.

i. SWEEPING Indicator

The sweeping LED lights during the forward portion of each sweep. It also lights when the CW RAMP function is selected.

j. TRIGGER Key

This key sequences between the AUTO, LINE, and EXT sweep triggering modes and the MANUAL SWEEP mode. The associated LEDs indicate which one of the triggering/sweep modes has been selected.

In the AUTO mode, the sweep continually sweeps from its low- to its high-end frequency with optimal retrace time.

In the LINE mode, the sweep is triggered to start by the power-line-voltage waveform.

In the EXT mode, the sweep can be triggered to start in either of two ways: by applying an external TTL-compatible clock pulse to the rear panel SWEEP TRIGGER INPUT or by momentarily pressing the associated SINGLE SWEEP button. The sweep starts either when the button is pressed or with the positive leading edge of the clock pulse. If a sweep is in progress when either of these events occurs, it will abort and reset.

In the MANUAL SWEEP mode, the output frequency can be manually tuned from its low- to its high-end frequency using the DECREASE INCREASE knob. The output frequency changes in phase-locked steps and appears on the FREQUENCY display.

3-3.4 DATA ENTRY Keys, Indicators, and Control (Figure 3-8)

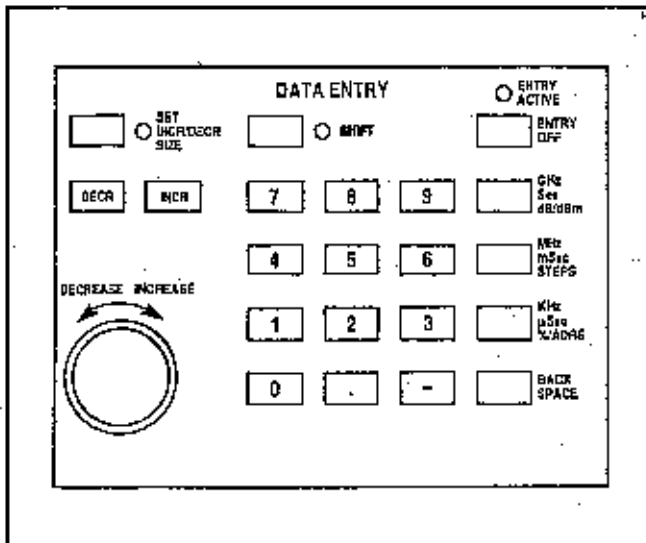


Figure 3-8. DATA ENTRY Keys Indicators, and Control

a. **SET INCR/DECR SIZE Key**
 This key accesses the increase/decrease-size parameter and opens it for updating using keypad. For example: the output frequency size is selectable in steps of from 1 kHz up to the value of the synthesizer's top-end frequency. The size, in GHz, appears on the FREQUENCY display. After entering the size value and terminating it in its proper units (kHz, dBm, ms, etc.), (1) the size parameter closes, (2) the parameter that was opened immediately prior to pressing this key reopens, and (3) the FREQUENCY display again displays that parameter's value.

A different increment-size-value can be entered for frequency, time, RF level, and # of steps.

b. **INCREASE Key**
 This key increments a frequency, time, RF level, or stop parameter by the value that has been set using the SET INCR/DECR SIZE key. Pressing and releasing the key increments the size in discrete steps. Holding the key depressed greater than 0.5 seconds increments the size at a 3 Hz rate. The increment key only affects open parameters.

c. **DECREASE Key**
 This key decrements a frequency, time, RF level,

or stop parameter in the same manner described for the INCREASE key above.

d. **DECREASE INCREASE Knob**
 This control decreases or increases a parameter's size by a preset resolution, when turned slowly. Turning the knob rapidly changes the parameter's value in larger steps. The SET INCR/DECR SIZE key can be used to change the knob's minimum resolution. See Figure 3-2, on page 3-7, for an example.

e. **Keypad**
 The numeric keypad provides for entering frequency, time, RF level, percentage, FM sensitivity, and number-of-steps values.

f. **ENTRY ACTIVE Indicator**
 This LED lights to indicate that a parameter has been accessed and is open for updating.

g. **ENTRY OFF Key**
 This key closes the parameter previously accessed. It can be used to ensure that all parameters are closed (to prevent accidental parameter changes).

h. **GHz Sec dB/dBm Key**
 This key terminates a keypad data entry and assigns the appropriate units. An F1-F9 or ΔF frequency entry may be terminated in MHz; however, it is always displayed in GHz.

i. **MHz mSec STEPS Key**
 This key terminates a keypad data entry and assigns the appropriate units. An F1-F9 or ΔF frequency entry may be terminated in MHz; however, it is always displayed in GHz.

j. **kHz uSec %/ADRS Key**
 This key terminates a data entry via the keypad and assigns the appropriate units. A frequency entry may be terminated in kHz; however, it is always displayed in GHz.

k. **BACKSPACE Key:**
 This key deletes the last number or decimal point entered from the keypad.

3-3.5 MODULATION and AM/FM Keys and MODULATION Connectors

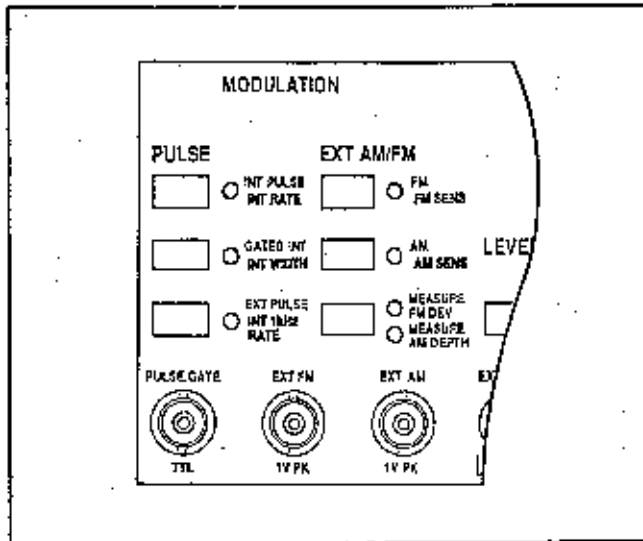


Figure 3-9. MODULATION and EXT AM/FM Keys and MODULATION Connectors

a. INT PULSE or INT RATE (Shifted) Key

INT PULSE activates the built-in pulse generator, which then controls the internal pulse modulator. In this mode, the RF output is modulated by a pulse train for which the pulse width and rate is selectable from the front panel.

The associated LED lights when this mode is selected.

INT RATE accesses the pulse-rate parameter and opens it for updating using the DATA ENTRY keys. Values of 0.01 kHz to 1 MHz may be entered.

The associated LED lights when this mode is selected.

b. GATED INT or INT WIDTH (Shifted) Key

GATED INT selects a mode whereby the internal pulse generator can be turned on and off by an externally applied TTL signal. The pulse width and rate of the internal generator are selectable from the front panel. External gating is supplied by a function generator connected to either the front panel PULSE/GATE or rear panel PULSE INPUT connector.

The associated LED lights when this mode is selected.

INT WIDTH accesses the pulse-width parameter, and opens it for updating using the DATA ENTRY keys. Values of 0.025 μ s to 99 ms may be entered.

The associated LED lights when this parameter is open for entry.

c. EXT PULSE or INT 1 kHz RATE (Shifted) Key

EXT PULSE accesses the external modulation mode; whereby, the internal pulse modulator is driven by a TTL signal from an external function generator connected to the PULSE/GATE connector.

The associated LED lights when this parameter is open for updating.

INT 1 kHz RATE sets the internal pulse generator for 1 kHz squarewave modulation. After so doing, the front panel exits the <Shift> mode, the INT PULSE indicator lights, and the MODULATION/TIME display indicates PULSE and 1 kHz RATE

The associated LED lights when this function is active.

d. MODULATION Connectors

PULSE/GATE provides for using an external TTL level to pulse modulate the RF output or to gate the internal pulse generator. The polarity (TTL high-active or TTL low-active) of the gating signal is selectable via either the GPIB or the rear panel FUNCTION SELECT, -PULSE/+PULSE switch.

EXT FM provides for applying an FM signal to the RF output. The deviation is proportional to input voltage, with sensitivity selectable from the front panel or GPIB. Input impedance is 600 ohms.

EXT AM provides for applying a linear AM signal to the RF output. Sensitivity is front panel or GPIB controllable. It is variable between 1%/V and 99.9%/V. The usable input range is ± 1 V. Input impedance is 600 ohms.

e. FM or FM SENS (Shifted) Key

FM selects the external FM mode; whereby, the output signal can be frequency modulated via

either the front panel EXT FM or the rear panel FM INPUT connector.

FM SENS accesses the FM modulation-sensitivity parameter and opens it for updating using the DATA ENTRY keys. Sensitivity range is (1) 10 kHz/V to 5MHz/V in locked FM mode and (2) up to 25 MHz/V in unlocked FM mode. The INCR or DECR key can be used to sequence up or down through these values. Maximum usable input range is $\pm 1V$.

The associated LED lights when the function is activated.

f. AM or AM SENS (Shifted) Key

AM selects the external AM mode; whereby, the output signal can be amplitude modulated via either the front panel EXT AM or the rear panel AM INPUT connector.

The associated LED lights when the function is activated.

AM SENS accesses the AM modulation-sensitivity parameter and opens it for updating using the DATA ENTRY keys. Discrete values of 1%/V to 100%/V may be entered using the DATA ENTRY keys.

The associated LED lights when this parameter is open for updating.

g. MEASURE FM DEV and MEASURE AM DEPTH (Toggle) Key

MEASURE FM DEV enables the FM deviation measurement function, displays the measured deviation in the Modulation/Time display, and lights the MEASURE FM DEV LED. The function measures the voltages of the external modulation signal and calculates the peak frequency deviation.

MEASURE AM DEPTH enables the AM depth measurement function, displays the measured depth in the MODULATION/TIME display, and lights the MEASURE AM DEPTH LED. The function measures the voltage of the external modulation signal and calculates the percentage modulation value.

3-3.6 MEASURE Key and Indicator (Figure 3-10)

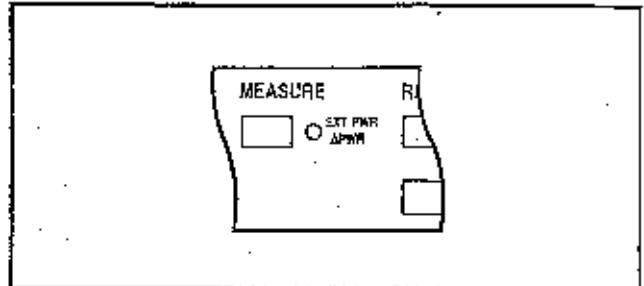


Figure 3-10. MEASURE Key and Indicator

EXT POWER selects the external power measuring function; whereby, RF power is measured and displayed on the LEVEL display. The power is measured with a 560-7 Series RF Detector connected to the rear panel POWER METER connector.

The associated LED lights when this function is selected.

APWR selects the power-difference measurement function. You must activate the MEASURE EXT PWR function before using the APWR function. Measured power at the time APWR is activated becomes a reference level and the display is set to 0 dB. Subsequent changes in measured power with respect to the reference level are then displayed in dB.

3-3.7 LEVELING or EXT GAIN CAL Key, Indicators, and Connector (Figure 3-11)

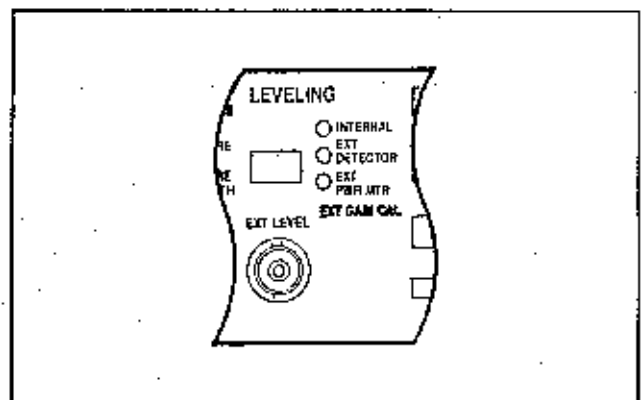


Figure 3-11. LEVELING or EXT GAIN CAL Key, Indicators, and Connector

The INTERNAL position selects the internal leveling mode; whereby, leveling is accomplished using the internal directional coupler and detector.

The EXT DETECTOR position selects a mode whereby an external detector can be used to level the output signal. The signal from this detector, which is applied to the EXT LEVEL connector, can be either positive or negative.

The EXT PWR MTR position selects a mode whereby the recorder voltage from a compatible power meter can be used to level the output signal. This voltage which is applied to the EXT LEVEL connector, can be either positive or negative. The 6700A is compatible with power meters having a $\pm 1V$ full scale analog output, such as the HP 431/432, HP 435/436, and PM 1009/1010 models.

EXT GAIN CAL adjusts the EXT LEVEL input gain to make the ALC loop stable when leveling with an external detector or power meter.

3-3.8 RF LEVEL Keys and Indicators (Figure 3-12)

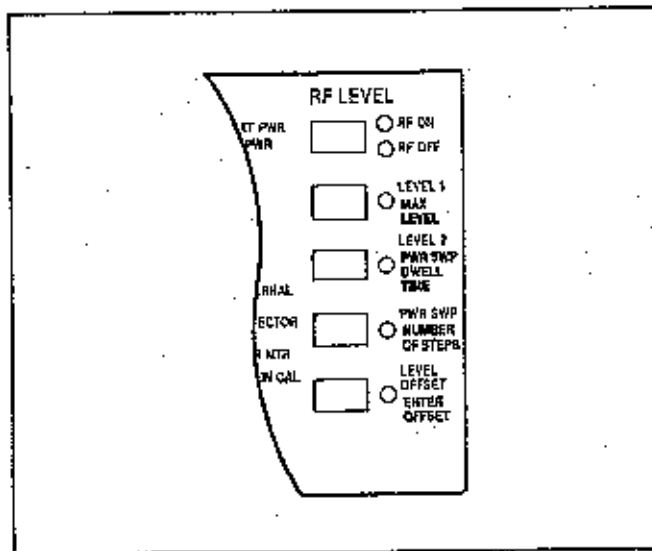


Figure 3-12. RF LEVEL Keys and Indicators

a. RF ON or RF OFF Key

This key turns the RF output power on or off.

b. LEVEL 1 or MAX LEVEL

LEVEL 1 accesses the level 1 parameter and opens it for updating using the DATA ENTRY keys. The three most-significant digits of the power-level value appear on the LEVEL display.

The associated LED lights when this parameter is open for entry.

MAX LEVEL selects the maximum leveled power function. This function sets the RF power to the maximum-leveled value that can be maintained either at the current CW frequency or across the current frequency-sweep range.

The associated LED lights momentarily when this function is selected.

c. LEVEL 2 or PWR SWP DWELL TIME <Shifted> Key.

LEVEL 2 accesses the level 2 parameter and opens it for updating using the DATA ENTRY keys. The three most-significant digits of the power level value appear on the LEVEL display.

The associated LED lights when this parameter is open for entry.

PWR SWP DWELL TIME accesses this parameter, and opens it for updating using the DATA ENTRY keys. This parameter provides for dwelling (stopping) the power sweep at each power level for a specified length of time. Dwell times of from 50 ms to 10 s may be entered; their value appears on the MODULATION/TIME display.

The associated LED lights when this parameter is open for entry.

d. PWR SWP or NUMBER OF STEPS

PWR SWP selects the power sweep mode, whereby the leveled output power sweeps between levels 1 and 2. The power level can sweep from a high level to a low level or vice versa. That is, the LEVEL 1 value can be greater or less than the LEVEL 2 value.

The associated LED lights when this mode is selected.

NUMBER OF STEPS accesses the level sweep step parameter and opens it for updating using the DATA ENTRY keys. This parameter defines the number of steps that the sweep takes when transitioning between LEVEL 1 and LEVEL 2. The step setting is displayed on the LEVEL display and can be set for any number between 1 and 1000.

The associated LED lights when this parameter is open for entry.

NOTE

The synthesizer can interleave power and frequency sweeps. If you select both frequency and power sweeps, for each step of the power sweep, a frequency sweep occurs.

e. LEVEL OFFSET or ENTER OFFSET <Shifted> Key

LEVEL OFFSET selects the level offset function. In this mode, the LEVEL display can be offset from the actual RF output level by a selectable value to compensate either for the loss of an external transmission line or for the gain of a test device.

The associated LED lights when this function is selected.

ENTER OFFSET accesses the power-offset parameter and opens it for updating using the DATA ENTRY keys. Parameter values can range between ± 99.9 dB.

NOTE

The largest number that can be displayed is plus or minus 199.9 dBm.

The associated LED lights when this parameter is open for entry.

3-3.9 RF Indicators and RF OUTPUT Connector (Figure 3-13)

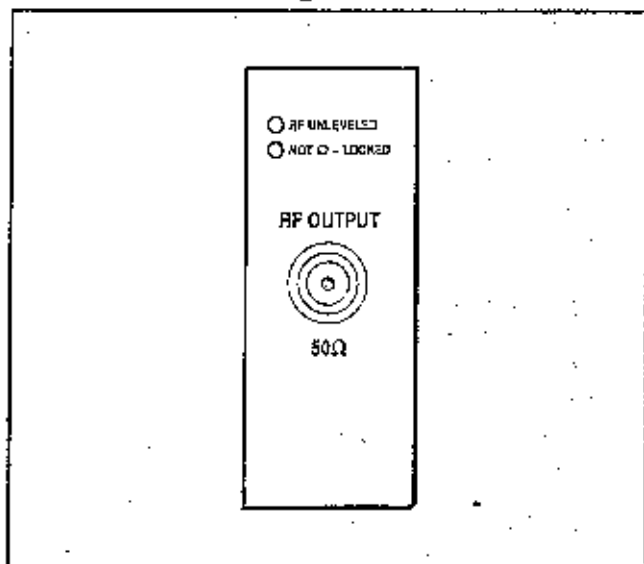


Figure 3-13. RF Indicators and RF OUTPUT Connector

a. RF UNLEVELED

The LED lights when the RF output goes un-leveled. The LEVEL display is not accurate if this indicator is lit.

b. NOT Ø - LOCKED

The LED lights when the output frequency is not phase locked. The frequency accuracy and stability of the RF output is greatly reduced if this LED is lit.

c. RF OUTPUT

The connector provides RF output from a 50Ω source.

NOTE

To prevent power losses due to an impedance mismatch, the mating connector and cable should also be rated at 50 ohms.

3-3.10 STORED SETUPS Keys (Figure 3-14)

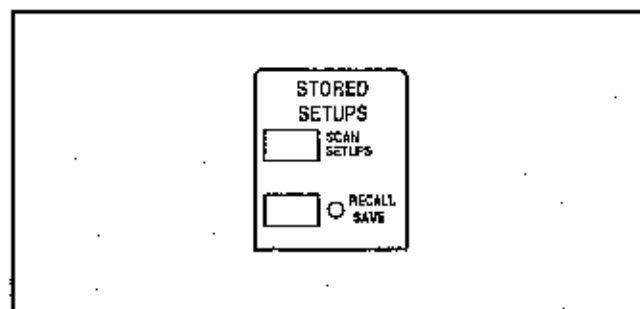


Figure 3-14. STORED SETUPS Keys

a. SCAN SETUPS Key

This key sequences upward through the nine stored setups, the numbers (#) of which appear on the LEVEL display. The upward sequence starts with the setup number following the one that appeared when the mode was last exited. An external, normally open switch connected to the rear panel MEMORY SEQ INPUT also can be used to scan the setups.

b. RECALL or SAVE <Shifted> Key

RECALL recalls a stored setup, the number of which is entered on the keypad. When you recall a new setup, the new setup replaces the previously active front panel settings. The old settings are automatically saved as Setup #0, except when the old settings are an unmodified

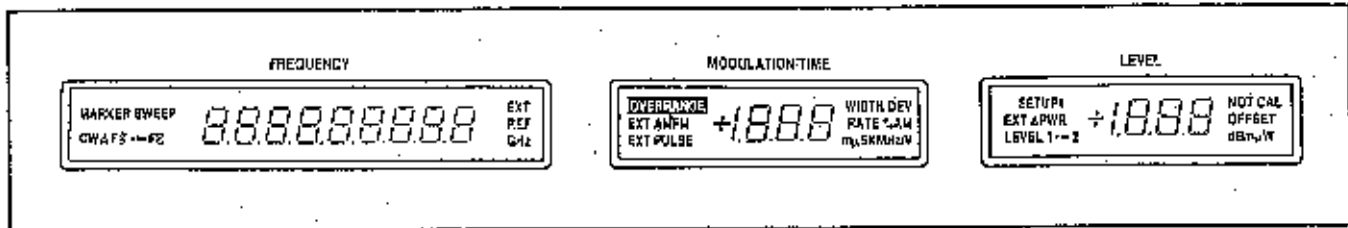


Figure 3-15. FREQUENCY, MODULATION/TIME, and LEVEL Displays

recalled setup. The number of the recalled setup is shown on the LEVEL display.

The associated LED lights when this function has been selected.

SAVE saves the current front panel settings into one of the nine available memory locations, the number of which is entered on the keypad. The setup number appears on the LEVEL display. You cannot SAVE directly to Setup #0.

3-3.11 FREQUENCY, MODULATION/TIME, and LEVEL Displays (Figure 3-15)

a. LEVEL Display

This readout displays RF output and measured power in dBm. It also displays a stored-setup number and the number-of-steps parameter. Annunciators indicate when the RF output is uncalibrated. (The NOT CAL annunciator lights when external leveling has been selected, but the EXT GAIN CAL key has not been pressed.) Annunciators also indicate which mode has been selected: LEVEL 1 or 2, OFFSET, MEASURE, and POWER SWEEP 1 → 2.

b. MODULATION/TIME Display

This readout displays the following:

- Sweep and dwell times
 - Pulse width and rate
 - FM deviation and modulation sensitivity
 - AM depth and modulation sensitivity
- sweep and dwell times appear in MHz, kHz, and Hz; FM deviation appears in MHz and kHz; and AM depth appears in %. Annunciators indicate when overrange conditions exist, and they announce what modulation mode has been selected: that is, INT PULSE, EXT PULSE, EXT FM, EXT AM.

c. FREQUENCY Display

This readout displays in GHz the nine preset RF parameters (F1-F9) and up to 4 digits of the sweep-range end-frequencies and ΔF frequency. Annunciators indicate which parameter's frequency is being displayed and whether it has been selected as a marker.

3-3.12 GPIB Indicators and BUS ADRS/RETURN TO LCL Key (Figure 3-16)

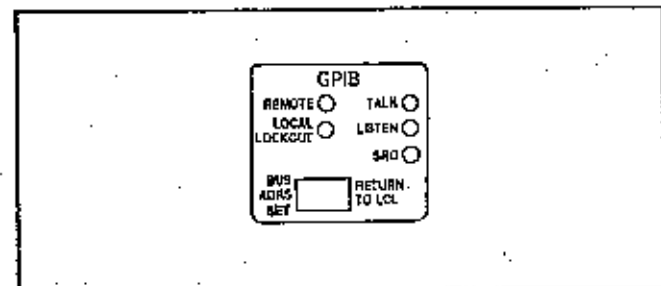


Figure 3-16. GPIB Indicators and BUS ADRS/RETURN TO LCL Key

a. REMOTE Indicator

This LED lights when the synthesizer goes under GPIB control; it remains lit until the 6700A is returned to local control.

b. LOCAL LOCKOUT Indicator

This LED lights when a local lockout message is received; it remains lit until the message is rescinded. When lit, the synthesizer cannot be returned to local control via the front panel.

c. TALK Indicator

This LED lights when the synthesizer is addressed to talk and remains lit until unaddressed.

d. LISTEN Indicator

This LED lights when the synthesizer is addressed to listen and remains lit until unaddressed.

e. SRQ Indicator

This LED lights when the synthesizer requests service from the controller (sends out an SRQ); it remains lit until a serial poll is received or the SRQ function is reset.

f. BUS ADRS SET and RETURN TO LCL Key

This key displays the 6700A bus address, when the synthesizer is in the local mode. When in the remote (GPIB) mode, this key returns the synthesizer to the local mode—provided a local lock-out bus message has not been programmed.

3-4 SELF-TEST FEATURE

The synthesizer has a self-test feature that tests most of the PCBs and other internal assemblies. Self test is entered in any of three ways: by turning the synthesizer on, pressing the front panel SELF TEST key, or sending the appropriate bus command.

If the synthesizer fails self test, an error code is displayed on the front panel or, if in the GPIB mode, on the bus controller. Descriptions of these error codes, along with a troubleshooting flowchart, are given in the appropriate 6700A Maintenance Manual (refer to Section I, paragraph 1-4).

3-5 REAR PANEL DESCRIPTION

The rear panel connectors and switch are described in Figure 3-17.

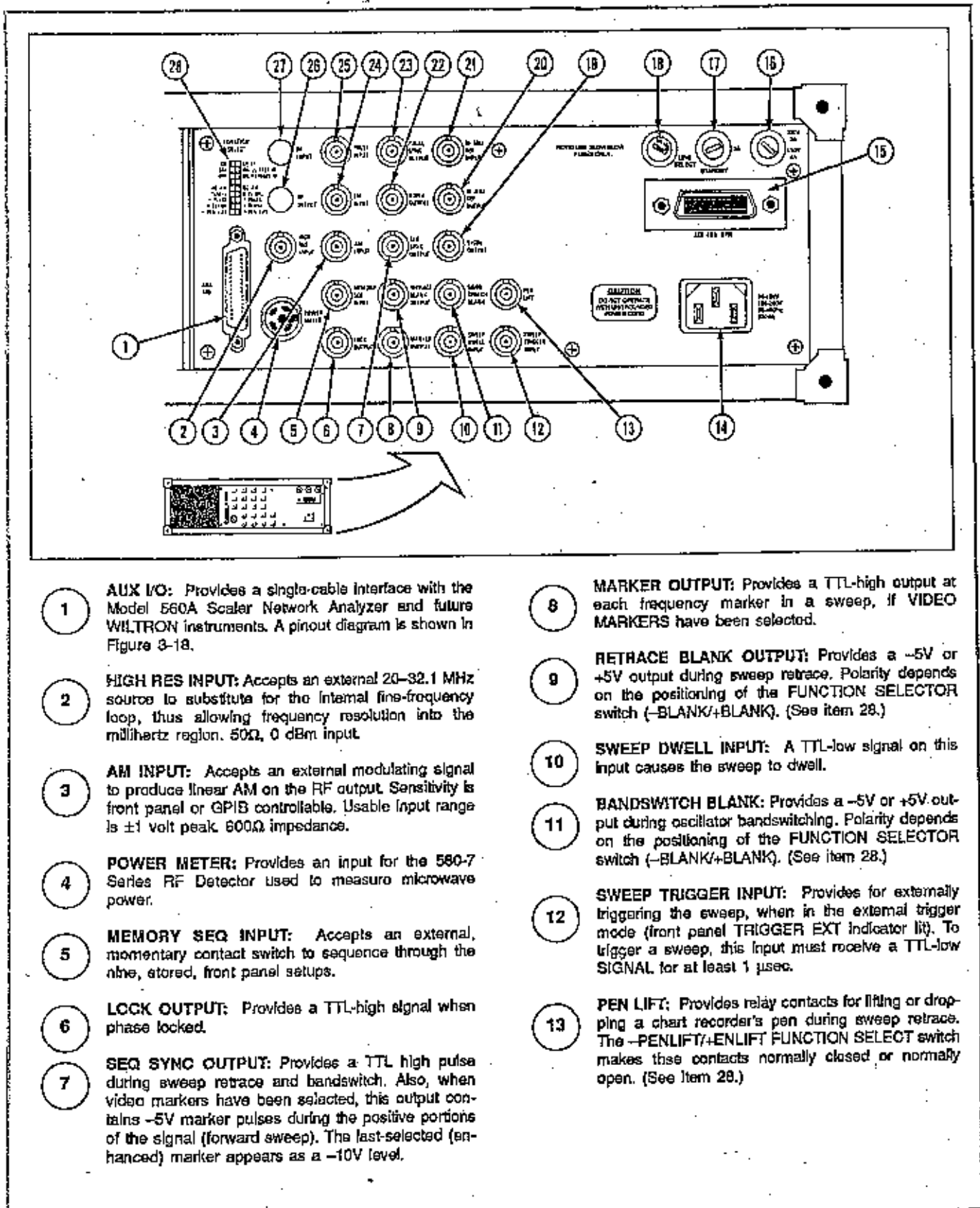


Figure 3-17. Rear Panel, 67XXA Series Swept Frequency Synthesizers (1 of 2)

- 14 **Input AC Receptacle:** Provides for connecting line power to the 67XXA.
- 15 **IEEE-488 Interface Bus Connector.** Provides input/output connections to the General Purpose Interface Bus (GPIB). For the pinout diagram, see Section II, Figure 2-2.
- 16 **Main Line Fuse:** Provides over-voltage/current protection for synthesizer circuits during operation and standby. *NOTE: Use slow blow fuses only!*
- 17 **Standby Line Fuse:** Provides overcurrent protection for synthesizer circuits during standby operation. *NOTE: Use slow blow fuses only!*
- 18 **LINE SELECT Switch:** Provides selection for 110 or 220 Vac line voltages.
- 19 **W/GHz OUTPUT:** Provides a $\leq 24V$ signal that is equal to either 0.5V/GHz or 1V/GHz of output frequency, depending on the positioning of the 0.5V/GHz--1V/GHz switch. (See item 28.)
- 20 **10 MHz REF OUTPUT:** Provides a TTL compatible 10 MHz signal from the internal frequency standard. 50 Ω impedance.
- 21 **10 MHz REF INPUT:** Accepts an external 10 MHz ± 100 Hz, 0 to +10 dBm frequency standard. Automatically disconnects the internal standard and sets front panel EXT REF indicator in FREQUENCY display. 50 Ω impedance.
- 22 **HORIZ OUTPUT:** Provides a 0V to 10V ramp during all sweep modes, and a voltage proportional to frequency for all CW modes. 50 Ω impedance.
- 23 **PULSE SYNC OUTPUT:** Provides a TTL-high 100 ns minimum-width sync pulse for the pulsed RF output. This pulse leads the output pulse by approximately 100 ns.
- 24 **FM INPUT:** Accepts an external modulating signal to produce FM on the RF output. Sensitivity is front panel or GPIB selectable. Usable input is $\pm 1V$ peak. 600 Ω impedance.
- 25 **PULSE INPUT:** Accepts an external TTL level signal to pulse modulate the RF output or to gate the internal pulse generator. The -PULSE/+PULSE FUNCTION SELECT switch determines whether RF is turned off or on when the PULSE input signal is a TTL-high (see item 28).
- 26 **RF OUTPUT:** Optional output connector in place of the front panel RF OUTPUT port. 50 Ω impedance.
- 27 **RF INPUT:** For future use.
- 28 **FUNCTION SELECT:** Miniature slide switches provide polarity, function, or sensitivity selection for certain rear panel controls, as described below. All of these functions may also be accessed from the GPIB.
- CR / CR/LF:** Selects either carriage return (CR) or carriage return and line load both (CR/LF) to be used as data delimiters over the GPIB.
- AFRO RF—OFF:** Selects RF level to be off during frequency switching in the CW or step sweep modes only. The RF is blanked before starting a frequency change and enabled when the RF is within approximately 1 kHz of the final frequency.
- RETRACE RF—OFF:** Selects the RF to be off during retrace. Has no effect in manual or external sweep mode when the RF is always on.
- AC AM/DC AM:** Selects ac or dc coupling for the EXT AM INPUT. For ac coupling, the response is attenuated 3 dB at 50 Hz.
- 1V/GHz / 0.5V/GHz:** Selects the W/GHz OUTPUT signal to be either +1V or +0.5V for each GHz in output frequency.
- PULSE/+PULSE:** When the EXT PULSE mode is activated, the +PULSE position causes RF to turn on when a TTL-high signal is applied to the PULSE input. Conversely, the -PULSE position causes RF to turn off when a TTL-high signal is applied. When the INT PULSE mode is active, the +PULSE position makes the INT WIDTH setting control RF on-time during each pulse. The INT WIDTH controls RF off-time during each pulse when in the -PULSE position.
- BLANK/+BLANK:** Switches the polarity of the 5-volt RETRACE BLANKING and BANDSWITCH BLANKING outputs at the AUX I/O connector (pins 6 and 20 respectively). Positioned to the left selects -5V output (-BLANK).
- PEN LIFT/+PEN LIFT:** Switches between normally-closed and normally-open contacts on the internal Penlift relay. Used in conjunction with the PENLIFT OUTPUT connector.

Figure 3-17. Rear Panel, 67XXA Series Swept Frequency Synthesizers (2 of 2)

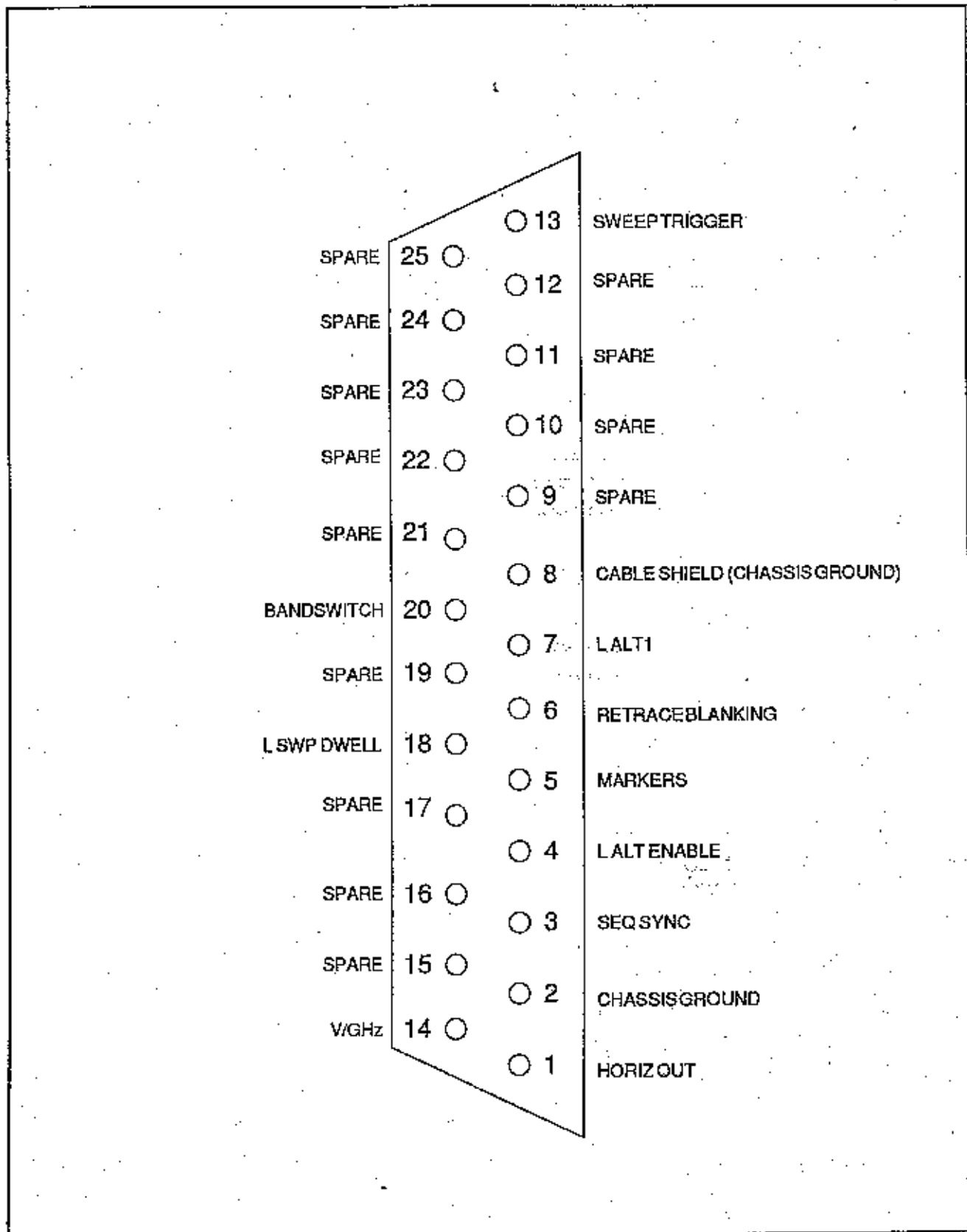
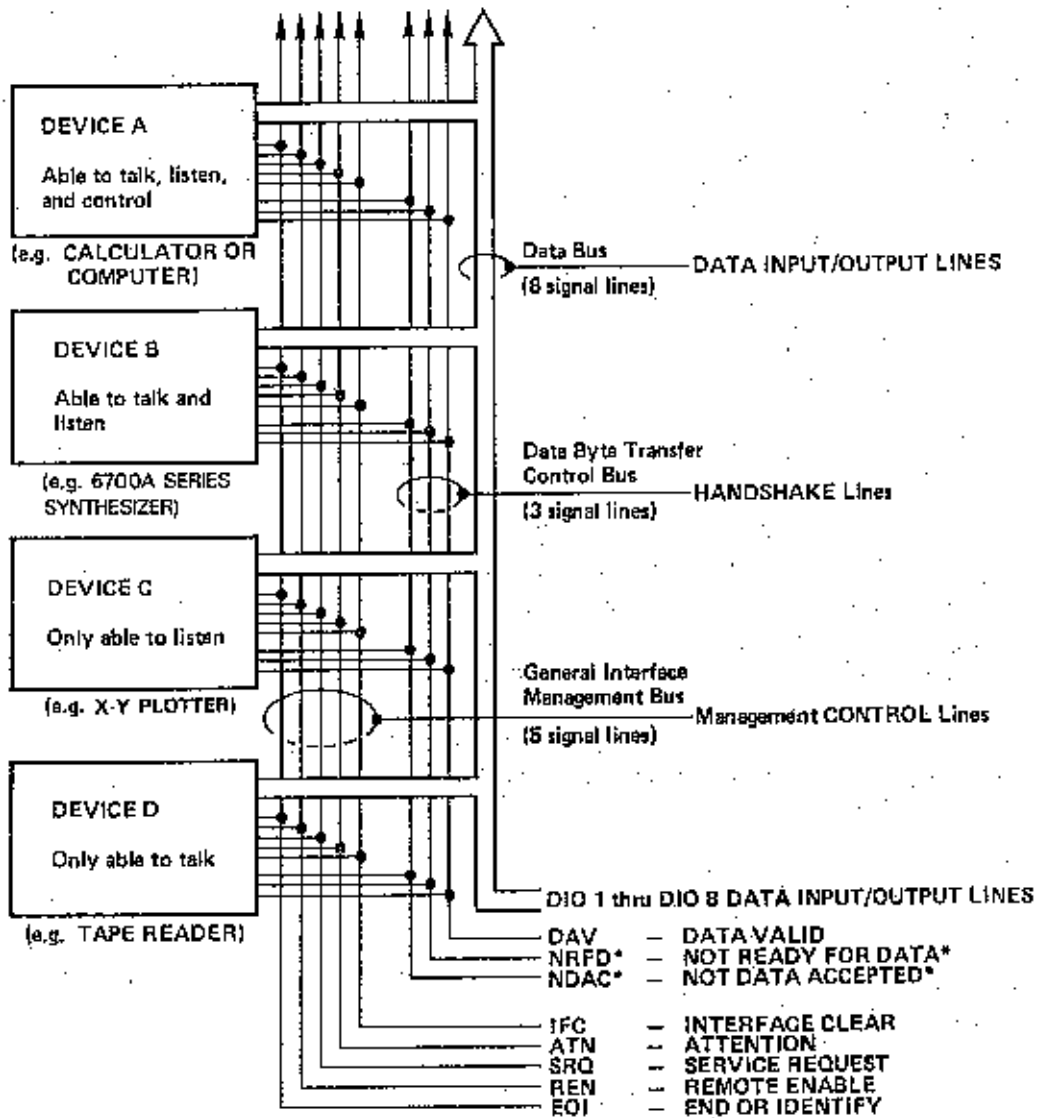


Figure 3-18. Pinout Diagram for AUX I/O Connector

SECTION IV GPIB (GPIB) OPERATION

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*INDICATES THAT NEGATION IS REPRESENTED BY LOW STATE ON THESE TWO LINES ONLY.

Figure 4-1. Interface Connections and GPIB Bus Structure

SECTION IV REMOTE (GPIB) OPERATION

4-1 INTRODUCTION

This section provides a description of the GPIB and the synthesizer command codes. It also provides several examples of bus programming.

4-2 DESCRIPTION OF THE IEEE-488 (IEC-625) INTERFACE BUS

The IEEE-488 bus (General Purpose Interface Bus—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 used. The eighth (parity) bit is not used. Data transferral 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.

4-2.1 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.

4-2.2 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 synthesizer 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 multi-byte 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 synthesizer 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 synthesizer 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.
- e. **SRQ (Service Request)**
This line is pulled LOW (true) by the synthesizer to indicate that certain preprogrammed conditions exist (paragraph 4-4.11).

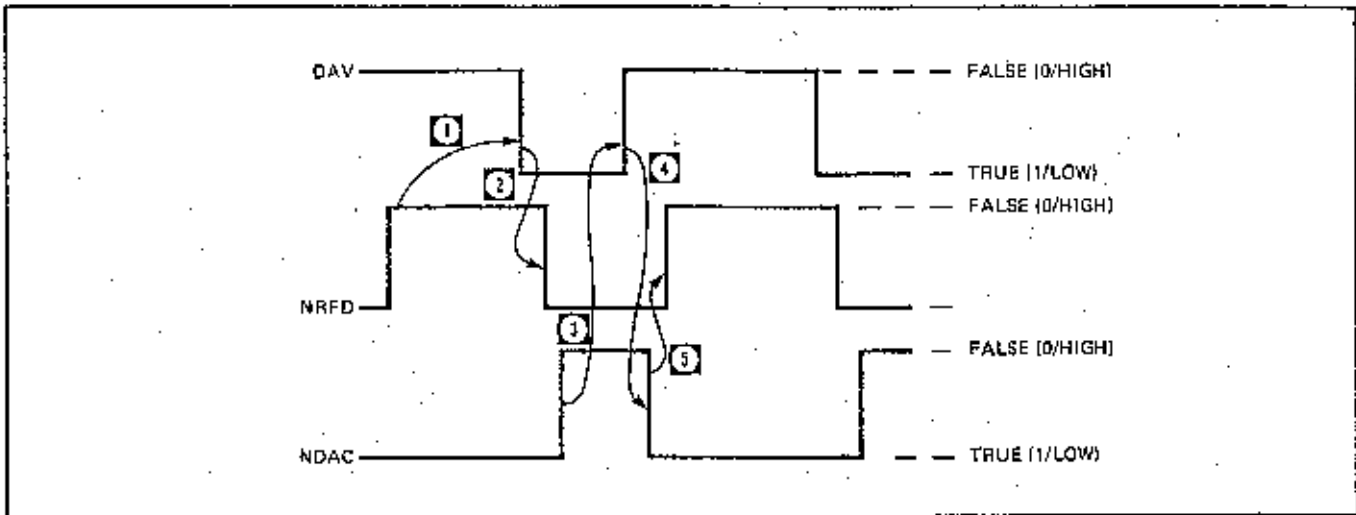


Figure 4-2. Typical Handshake Operation

4-2.3 Data Byte Transfer Control (Handshake) Bus Description

Information is transferred on the data lines by a technique called the three-wire handshake. The three handshakebus signal lines (Figure 4-2) 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.

4-3 GPIB OPERATION

All front panel keys, except for power on/standby, are bus controllable. When used on the GPIB, the synthesizer functions as both a listener and a talker. Table 4-1 provides a listing of the GPIB subset functions and gives the capability for each.

4-4 COMMAND CODES, DESCRIPTION

The command codes recognized by the synthesizer are classified and described in Table 4-2.

4-4.1 Command Codes: Inputting Restrictions and Notes

The following paragraphs (1) describe restrictions that apply to the inputting of commands into the synthesizer and (2) provide a helpful note for improving the readability of synthesizer programs.

Table 4-1. 67XXA IEEE-488 Bus Subset

GPIB SUBSET	FUNCTION	DESCRIPTION
AH1	Acceptor Handshake	Complete Capability
SH1	Source Handshake	Complete Capability
T6	Talker	No Talk Only (TON)
TE0	Talker With Address Extension	No Capability
L4	Listener	No Listen Only (LON)
LE0	Listener With Address Extension	No Capability
SR1	Service Request	Complete Capability
RL1	Remote/Local	Complete Capability
PP1	Parallel Poll	Complete Capability
DC1	Device Clear	Complete Capability
DT1	Device Trigger	Complete Capability

a. Restrictions

The synthesizer does not accept parameter or data entries in an exponential or scientific notation format. The accepted data formats are as follows:

1. A decimal or integer format for entering parameters and data.
2. A binary-byte format for entering both the status byte mask commands (paragraph 4-4.11) and the RCF and RCM stored-setup commands (paragraph 4-4.10).

b. Notes

The synthesizer recognizes 65 characters:

1. The 52 upper- and lower-case alphabetic characters. (Both cases of a character are interpreted as the same character.)
2. The minus sign (-).
3. The comma (,).
4. The decimal point (.)
5. The numerals 0 through 9.

All characters other than those 65 are ignored and can be interspersed between meaningful characters without ill effect. This feature can improve readability. For example, the two command codes shown below are interchangeable.

"F12.754GHF27.7992GHSF1SWPMK0L12DM"

"F1=2.754 GH, F2=7.792 GH, SF1, SWP, MK0, L1=2DM"

NOTE

The insertion of additional characters increases the time it takes to send the string of data to the synthesizer. In the example above, the first command string sends 33 characters, whereby the second sends 47 characters.

Table 4-2. Command Code Classes (1 of 2)

Command Class	Command Codes*	Paragraph	Table	Page
Parameter Entry Commands	F1, F2, F3 (M1), F4 (M2), F5 (Fq), F6-F9, DLF, SDT, SNS, SWT, LOS, PDT, PNS, AMS, FMS, PR, PW, CLR, SYZ, UP, DN, CLO	4-4.2	4-3	4-7
Data Entry Commands	0 thru 9, ., , DB, DM, GH, MH, KH, SEC, MS, US, GV, MV, KV, PCV, SPS	4-4.2	4-4	4-7
CW Frequency Commands	ACW, CF1, CF2, CF3 (CM1), CF4 (CM2), CF5 (CF0), CF6, CF7, CF8, CF9, SQF	4-4.3	4-5	4-10
Analog and Digital Sweep Commands	AD1, AD5 (AD0), AD8, AFU, AF1 (AFF), AF3 (AMM), AUT, DF1, DU0, DU1, DF5 (DF0), DF6, (FUL), EXT, LIN, MAN, RSS, SF1 (FF), SF3 (MM), SSP, SWP, TRS, TSS	4-4.4	4-6	4-12
Frequency Marker Commands	IM1, VM1, ME0, ME1, MK0	4-4.5	4-7	4-14
Modulation Commands	AM0, AM1, FM0, FML, FM1, FMU, IP, XP, GP, P0, SQP	4-4.6	4-8	4-14
Power Leveling Commands	L1(LVL), L2, RF0, RF1, LO0, LO1, IL1, DL1, PL1, LVO, LSP, MLP, EGO	4-4.7	4-9	4-16
Measure Function Commands	AMI, FMD, MOM, PD0, PD1, PM0, PM1	4-4.8	4-10	4-18
Output Commands	OI, OFL, OFH, OF1, OF2, OF3 (OM1), OF4 (OM2), OF5 (OF0)OF6-OF9, OL1 (OLV), OL2, OLO, OPM, OST, OPW, OSD, OPD, OSS, OPS, OAS, OFS, OPR, OMM, OSB, OES, ODF, OFF, OSE	4-4.9	4-11	4-18
Stored Setup Commands	SAF, RCF, SAM, RCM, SSN-SSN9, RSN1-RSN9, SM	4-4.10	4-12	4-21
Service Request and Status Byte Commands	FB1, FB0, ES1, ES0, UL1, UL0, LE1, LE0, PE1, PE0, SE1, SE0, SQ1, SQ0, SB1, SB0, MB0, MB1, MB2	4-4.11	4-13	4-22
Rear-Panel-Switch Override Commands	AMA, AMD, BPN, BPP, EP0, EP1, PPC, PP0, RC0, RC1, RT0, RT1, VGH, VGL	4-4.12	4-14	4-24
Group Execute Trigger (GET) Commands	GTC, GTD, GTU, GTS, GTT, GTF, GTL, GTO	4-4.13	4-15	4-24
Fast-Frequency-Switching Commands	ZL000-ZL512, ZEL, ZS000-ZS512, CAL	4-4.14	4-16	4-26

*The commands in parenthesis may also be used; they provide compatibility with 6600A and 6600B codes.

Table 4-2. Command Code Classes (2 of 2)

Command Class	Command Codes*	Paragraph	Table	Page
Self Test Commands	TST, STN	4-4.15	4-17	4-26
Miscellaneous Commands	DS1, DS0, RL, RST, (SH), CS0, CS1, HR0, HR1	4-4.16	4-18	4-26

*The commands in parentheses may also be used; they provide compatibility with 6600A and 6600B codes.

4-4.2 Command Codes: Parameter and Data Entry Commands

Table 4-3 lists the 22 commands that enable parameter entry. The table also gives the range of values permitted for each parameter, and it shows the data-terminator characters (terminators) for each. An appropriate terminator must be used to terminate a numeric-parameter entry, and it must immediately follow the numeric value. If it does not, a parameter entry error will result.

All of the commands given in Table 4-3 open a parameter for data entry. Once opened, a parameter remains open until one of the following occurs:

- Another parameter is opened.
- A function other than video markers, intensity markers, or leveling is commanded.
- The CLO (Close Parameter) command is received.

When a parameter is open for entry, its value can be changed as follows:

- By sending a numeric value followed by the appropriate terminator.
- By incrementing or decrementing its value using an associated step size. These parameter entry commands do not change the operating mode of the synthesizer—*unless the parameter being changed is also the one being output*. Any parameter, therefore, may be used to preset values without altering the output.

Example: Assume that the synthesizer is executing an F3-F4 sweep from 3 GHz to 10 GHz. Changing the value of F1 to 3 GHz with the string "F1 3 GHz" does not change the operating mode of the synthesizer. However, changing the value of F4 with the string "F4 16.01 GHz" changes the end point of the F3-F4 sweep to 16.01 GHz.

Table 4-4 lists the Data Entry codes and Figure 4-3 gives a detailed description of the SYZ command.

Table 4-3. Parameter Entry Codes (1 of 2)

Command Code	Parameter	Values	Terminator	Step Size
F1 F2 F3 F4 F5 F6 F7 F8 F9 DLF	Frequency 1 Frequency 2 Frequency 3 Frequency 4 Frequency 5 Frequency 6 Frequency 7 Frequency 8 Frequency 9 Δ F Sweep Width	Dependent on the frequency range of the instrument	GH MH KH	Yes
SDT	Dwell Time, Phase-Locked Step Sweep	1 ms to 99s	MS SEC	No
SNS	Number of Steps, Phase-Locked Step Sweep	1 to 1800	SPS	Yes
SWT	Analog Sweep Time	30 ms to 99s	NS SEC	No
LOS	Level Offset	+99.9 dB to -99.9 dB	DB	No
PDT	Dwell Time, Power Sweep	50 ms to 99s	SEC	Yes
PNS	Number of Steps, Power Sweep	1 to 1000	SPS	Yes
AMS	AM Sensitivity	1 %/V to 99 %/V	PCV	Yes
FMS	FM Sensitivity	Unlocked: 10 kHz/V—25 MHz/V Locked: 10 kHz/V—5 MHz/V	KV MV GV	Yes
PR	Pulse Rate, Internal Programmable Pulse Generator (PPG)	10 Hz to 1 MHz	KH MH	Yes
PW	Pulse Width, Internal PPG	25 ns to 99 ms	KH MH SEC	Yes
UP	Increments a frequency, time, or level parameter	N/A	N/A	Yes
DN	Decrements a frequency, time, or level parameter	N/A	N/A	Yes

Table 4-3. Parameter Entry Codes (2 of 2)

Command Code	Parameter	Values	Terminator	Step Size
SYZ	Opens the step-size parameter for updating (Figure 4-3)	N/A	N/A	N/A
CLO	Closes a parameter that had been previously opened	N/A	N/A	N/A

Table 4-4. Data Entry Commands

COMMAND TYPE	COMMAND CODE	DESCRIPTION
Data Entry or Modification	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 - .	Numerals for Parameter Value Entries Minus Sign Decimal Point.
Data Terminators	DB DM GH MH KH SEC MS US GV MV KV PCV SPS	Decibels (dB) dB referenced to 1 mW (dBm) Gigahertz (GHz) Megahertz (MHz) Kilohertz (kHz) Seconds (s) Milliseconds (ms) Microseconds (μs) GHz per volt (GHz/V) MHz per volt (MHz/V) kHz per Volt (kHz/V) Percent per volt (%/V) Steps

Six step sizes are used, with some sizes shared between parameters that have common units. Most of the parameters listed in Table 4-3 have associated step sizes. As shown, the ten frequency parameters have a common step size, as do the three level parameters (the commands to set Level 1 and Level 2 are described in paragraph 4-4.7). All other applicable parameters have individual step sizes.

To set the step size for a parameter, first send the code to open the parameter, and then send the "SYZ" command. Now the step size can be set by sending a numeric string with the proper terminator. When the terminator is received, the step size is accepted and the original parameter is again open for entry.

Example: To set the F1 frequency to 4 GHz, the step size to 10 MHz, and to increment the F1 frequency 3 times by the value of the step size, the following command codes would be sent:

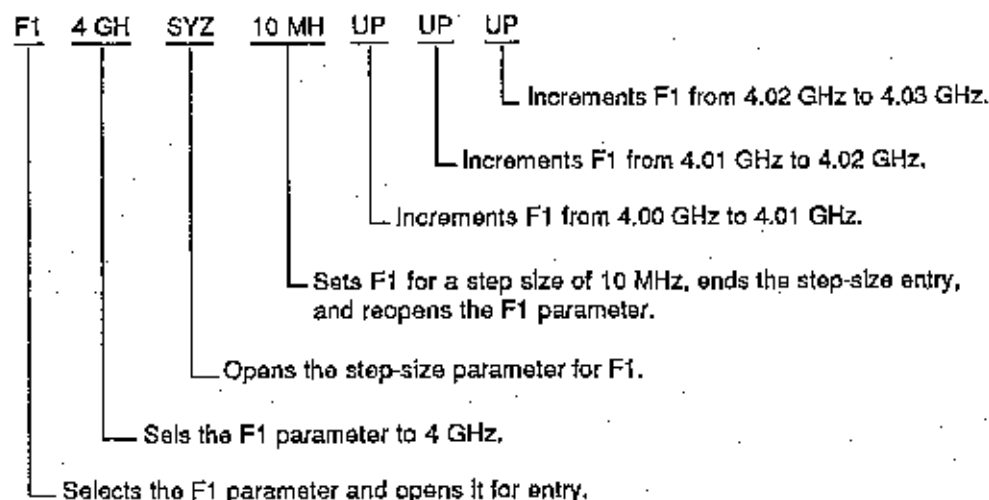


Figure 4-3. Using the SYZ (Size) Command

4-4.3 Command Codes: CW Frequency Commands

Table 4-5 lists the CW-Frequency Mode commands. These commands call up each of the nine preset (or previously set) CW frequencies.

As described for the front panel F1-9 SCAN keys, these commands both output their associated frequency and open that frequency's parameter for data entry.

The tenth command shown in Table 4-5, SQF, accesses the preset frequencies in sequential order—that is, F1 to F9.

Synthesizer response to an SQF command depends on what state it is in at the time the command is received. For example, if it is in a CW mode with the current output frequency open for entry, the SQF command (1) causes the output to change to the next next sequential frequency and (2) opens that frequency's parameter for a data entry. However, if the synthesizer is in any other state (except CW), the SQF command causes it to switch to the last CW frequency that was output and opens that parameter for data entry.

Figure 4-4 shows an example of a CW frequency command.

Table 4-5. CW Frequency Commands

Command Code	Function	Opens For Entry
CF1 CF2 CF3 CF4 CF5 CF6 CF7 CF8 CF9	1. These commands place the synthesizer in the CW mode at the preset (or a previously set) frequency. 2. Programming any of these commands will deselect any previously programmed CW command. That is, only one CW command can be active.	F1 F2 F3 F4 F5 F6 F7 F8 F9
SQF	Sequences to the next CW frequency	The CW output parameter then selected
SQU	Scan CW frequency up	Next frequency parameter
SQD	Scan CW frequency down	Next frequency parameter
ACW	Activates the currently scanned frequency as CW.	Next frequency parameter

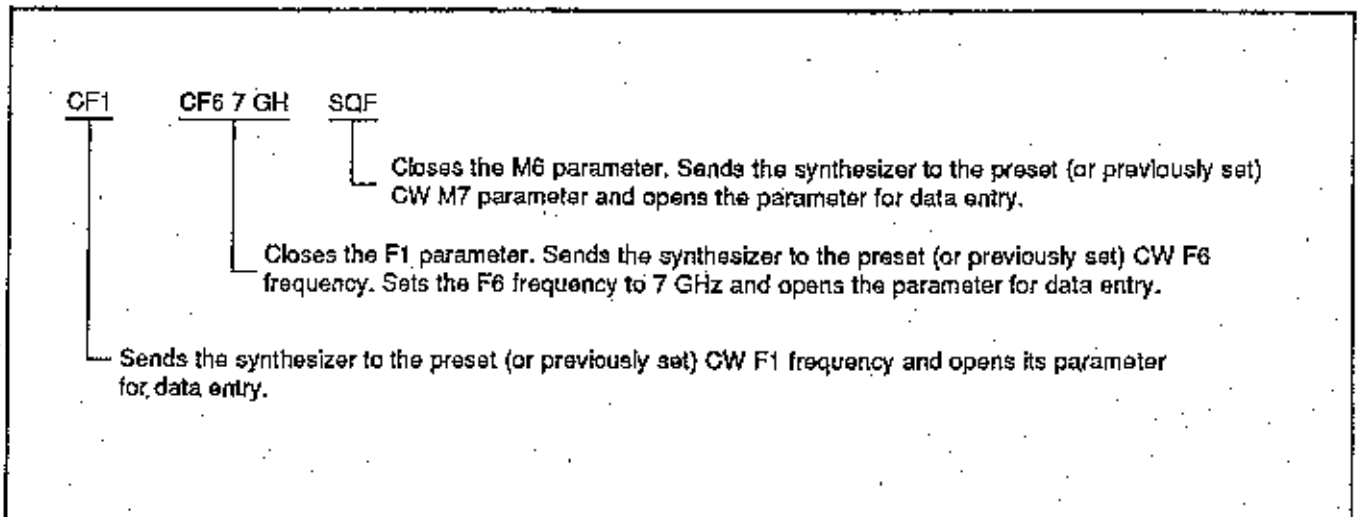


Figure 4-4. Example of a CW Frequency Command

4-4.4 Command Codes: Analog and Digital Sweep Commands

Table 4-6 lists the Analog and Digital Sweep Commands. These commands are divided into five subclasses and are described below.

a. Sweep Range

Six sweep ranges are available. The SF1, SF3, DF5, and DF6 sweeps function as described for their respective front panel counterparts in Section III. The FUL and DF1 sweeps do not have front panel counterparts; they are available only over the bus.

The FUL command causes a full-band sweep from the synthesizer's low frequency limit to its high frequency limit.

The DF1 command causes a symmetrical sweep about the F1 frequency, as described for the ΔF F5 sweep in paragraph 3-2.3c.

Examples:

1. Programming "F1 2 GH F2 8 GH SF1" sets F1 to 2 GHz, F2 to 8 GHz, and implements an F1-F2 sweep.
2. Programming "DLF 6 GH F5 7 GH DF5" sets ΔF to 6 GHz, F5 to 7 GHz and implements a ΔF F5 sweep.

Programming Note: If the commanded sweep range is invalid, a parameter error message (paragraph 4-6) will be generated, and the output of the synthesizer will not be altered.

The following are two examples of an invalid sweep range: Programming an F1-F2 sweep when the F1 frequency is greater than the F2 frequency or programming a ΔF F5 sweep when the F5 frequency plus or minus half the ΔF value exceeds the range of the synthesizer.

b. Alternate Sweep

Six alternating sweep commands are available, one for each of the six sweep ranges. As described for the front panel ALT keys, if the in-

strument is sweeping when an alternate sweep command is received, the synthesizer output will alternate between the commanded sweep and the sweep then being executed.

Example: Assume that the synthesizer had been previously programmed and was then executing an F1-F2 sweep. Programming "AF3" would then activate the F3-F4 sweep and cause it to alternate with the F1-F2 sweep.

Programming Note: An alternate sweep command will only be recognized when the synthesizer has been programmed to sweep. It will be ignored at all other times.

c. Sweep-Trigger Mode

Four sweep trigger modes are available over the bus—as from the front panel: Auto, Line, Ext/Single, and Manual. They function as described for their front panel counterparts.

d. Single-Sweep Trigger/Reset

Two single sweep commands are available; one starts the sweep and another resets it. When the External/Single sweep-trigger mode has been selected, the TRS command triggers a single sweep.

The RSS command resets the sweep to the start frequency, whenever the command is received while a single sweep is in progress.

e. Analog/Digital Sweep Select

Two commands are available; one selects an analog sweep and the other a digital sweep. The selected sweep mode applies to all sweep ranges.

Programming Note: Commanding either SWP or SSP does not, in itself, provide a swept output. It only determines whether the swept output will be analog or digital. If, on the other hand, the synthesizer is then outputting a sweep when one of these commands is received, that sweep will assume the commanded mode.

Figure 4-5 shows an example of sweep frequency programming.

Table 4-6. Analog and Digital Sweep Commands

COMMAND CODE	FUNCTION	OPENS FOR ENTRY
SF1 SF3 FUL DF1 DF5 DF6	<i>Sweep Range</i> Selects the F1-F2 Sweep Mode Selects the F3-F4 Sweep Mode Selects the Full Band Sweep Mode Selects the ΔF F1 Sweep Mode Selects the ΔF F5 Sweep Mode Selects the ΔF F6 Sweep Mode	None None None None None None
AF1 AFU AF3 AF5 AF6 AD1	<i>Alternate Sweep</i> Selects Alternate Sweep: F1-F2 Full F3-F4 ΔF F5 ΔF F6 ΔF F1	None None None None None None
AUT LIN EXT	<i>Sweep Trigger</i> Selects Auto Trigger Selects Line Trigger Selects External/Single Trigger	None None None
MAN TRS RSS	<i>Single-Sweep Trigger/Reset</i> Selects Manual Sweep Trigger a Single Sweep Resets a Single Sweep	None None None
SWP SSP DU0 DU1 TSS	<i>Analog/Digital-Sweep Select</i> Selects Analog Sweep Selects Phase-Locked Step Sweep Selects computer-controlled step sweep Deselects computer-controlled step sweep Step to next point	None None None None None

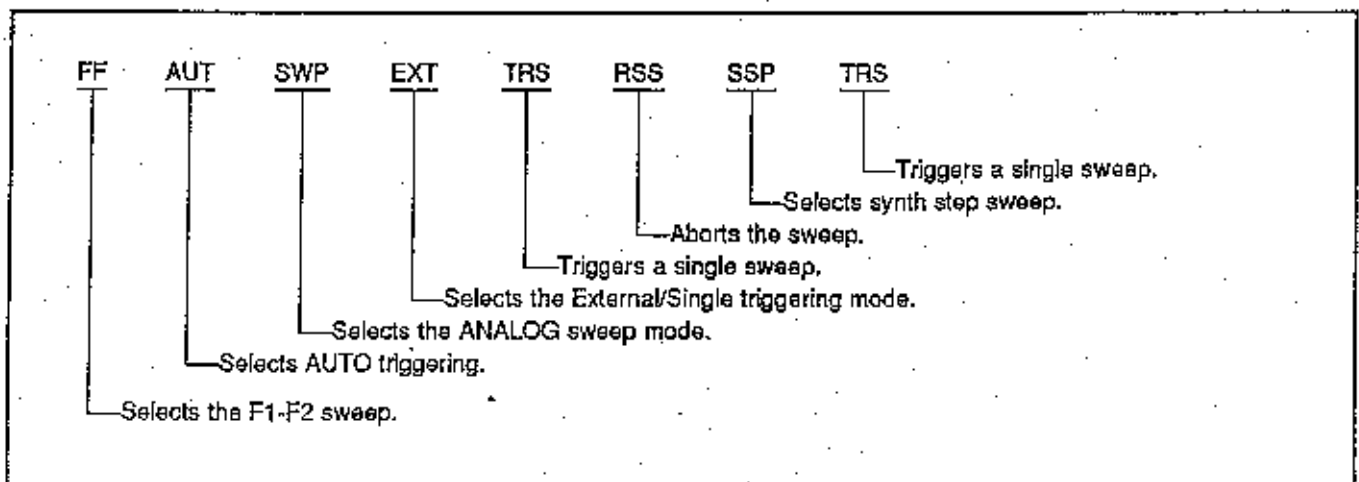


Figure 4-5. Example of a Sweep Command

Table 4-7. Frequency Marker Commands

Command Code	Function	Opens For Entry
ME1	Enables marker at the active frequency, F1-F9	None
ME0	Disables markers at the active frequency	None
IM1	Turns on Intensity Markers	None
VM1	Turns on Video Markers	None
MK0	Turns Off Markers Enabled markers remain enabled, but are not active.	None

4-4.5 Command Codes: Frequency Marker Commands

Table 4-7 lists the Frequency Marker Commands. As described for the front panel marker keys, these commands provide for (1) selecting a CW frequency as a potential marker, (2) selecting a potential marker as an active marker, and (3) individually turning markers on and off.

The ME1 command will enable a marker at the current frequency that is open for update. Conversely, the ME0 command will disable that same marker. If a frequency parameter is not open, no action will be taken. The VM1 and IM1 commands will turn on their respective intensity and video markers, and the MK0 commands will turn all markers off.

Programming Note: Only one marker mode can be active. Consequently, if the intensity mode is active and the video mode is programmed, the displayed markers will change to video markers. Either mode can be turned off with the MK0 command.

Figure 4-6 shows an example of frequency marker programming.

4-4.6 Command Codes: Modulation Commands

Table 4-8 lists the Modulation Commands. These commands provide for modulating the output signal with AM, FM, or pulse modulation.

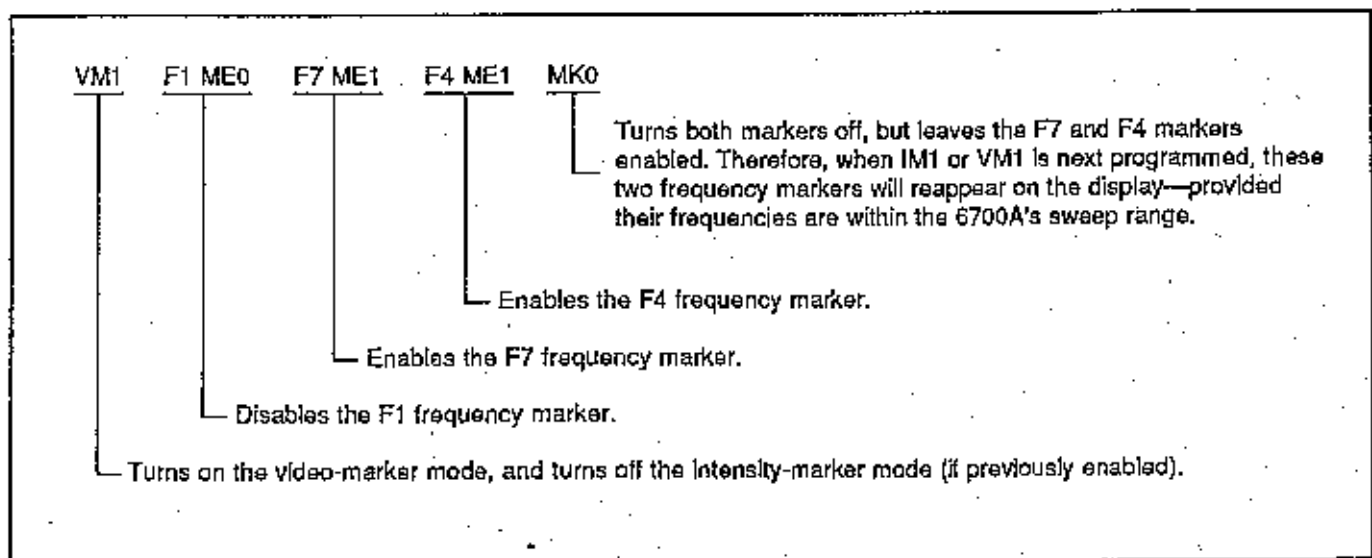


Figure 4-6. Example of Frequency Marker Programming

Table 4-8. Modulation Commands

Command Code	Function
AM1	Enables the external AM function and disables the FM function, had the latter function been previously programmed.
AM0	Disables the external AM function. This is the default mode.
FM0	Disables the external FM function and re-establishes phase lock, had the FMU command (see below) been previously programmed. This is the default mode.
FML	Enables the output signal to be modulated by an external FM input applied to either the front panel EXT FM jack or the rear panel FM INPUT jack. In this mode, the synthesizer output is phase locked. This is the default mode.
FMU	Enables the output signal to be modulated by an external FM input applied to either the front panel EXT FM jack or the rear panel FM INPUT jack. In this mode, the synthesizer output is not phase locked. This mode can be used for frequency deviations of up to ± 25 MHz. In the locked-FM mode, deviations are limited to 20 times the rate (20 x rate).
IP	<ol style="list-style-type: none"> 1. Turns on the internal programmable pulse generator (PPG) and enables the internal pulse modulator to modulate the RF output. 2. Disables the external pulse modulation or externally gated pulse modulation, had either of those modes been previously programmed.
XP	<ol style="list-style-type: none"> 1. Enables an external pulse modulation signal to modulate the RF output. 2. Turns off the internal PPG and disables the internal pulse modulator, had the IP command been previously programmed. 3. Turns off the internal PPG and disables the externally gated mode, had the GP command been previously programmed.
GP	Turns on the internal PPG, and enables an external pulse modulation signal to gate the PPG.
PO	Disables all pulse modulation.
SQP	<ol style="list-style-type: none"> 1. Turns on the internal PPG, sets the PPG to produce a 1 kHz square wave, and enables the internal pulse modulator to modulate the RF output. 2. Also disables the external pulse modulation or the externally gated pulse modulation, had either of those modes been previously programmed. <p><i>Programming Note:</i> The SQP command produces the same results as the command string "IP PR 1 KH PW .5 MS CLO" and has been included to make setting up a 1 kHz square wave more convenient.</p>

4-4.7 Command Codes: Output Power Leveling Commands

Table 4-9 lists the Output Power Leveling Commands. These commands provide (1) for turning the power leveling off or (2) for leveling the output power using any of the following:

- The internal leveling detector.

- An external detector connected to the front panel EXT LEVEL jack.
- An external power meter connected to the front panel EXT LEVEL jack.

Figure 4-7 shows an example of output-power-level programming.

Table 4-9. Power Leveling Commands (1 of 2)

Command Code	Function	Opens For Entry
L1	1. Selects the Level 1 power value as the RF output power level. 2. Deselects the Level 2 parameter, had it been previously programmed.	LEVEL 1
L2	1. Selects the Level 2 power value as the RF output power level. 2. Deselects the Level 1 parameter, had it been previously programmed.	LEVEL 2
RF1 RF0	Turns on the RF output. Turns off the RF output.	None
LO1	Turns on the Level Offset function. When on, the value of the Level Offset parameter is added to the level measured by the internal leveling loop; the resultant value is displayed.	
LO0	Turns off the Level Offset function.	None
IL1	1. Selects the Internal leveling function, whereby the internal detector is used to level the output power. 2. Turns off (deselects) the DL1 and PL1 functions, had either been previously programmed.	None
DL1	1. Selects the External Detector leveling function, whereby the positive or negative output from an external detector can be used to level the output power. 2. Turns off (deselects) the IL1 or PL1 functions, had either been previously programmed.	None
PL1	1. Selects the External Power Meter function, whereby the positive or negative output from an external power meter can be used to level the output power. 2. Turns off (deselects) the IL1 or DL1 functions, had either been previously programmed.	None
EGC	Selects the External Gain CALIBRATE for use with the DL1 and PL1 codes	None

Table 4-9. Power Leveling Commands (2 of 2)

Command Code	Function	Opens For Entry
LV0	Turns off the power leveling functions. The maximum power available from the synthesizer is output. <div style="text-align: center;"> [CAUTION] For some models, this power level can exceed 100 mW (+20 dBm). </div>	None
LSP	Selects the Power Sweep mode. The power level will sweep as determined by the preset (or previously set) dwell-time and number-of-steps parameters. See the example in Figure 4-7.	None
MLP	Sets the applicable Level 1 or Level 2 value to the maximum leveled available power for the frequency sweep or CW frequency then being output. <div style="text-align: center;"> [CAUTION] For some models, this power level can exceed 100 mW (+20 dBm). </div>	None.

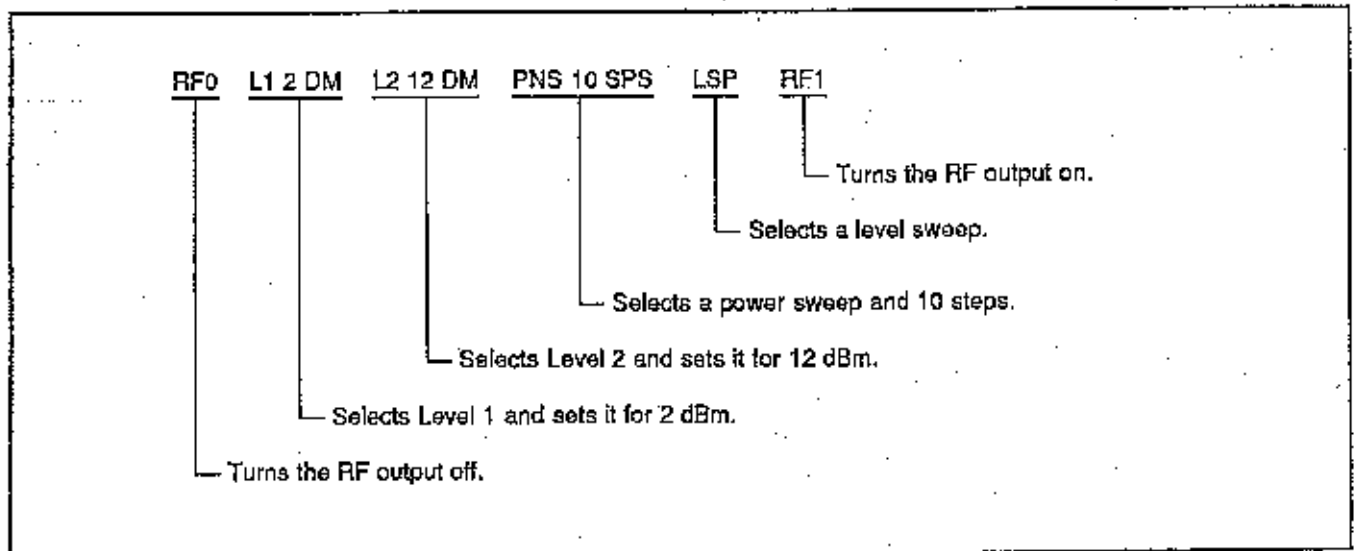


Figure 4-7. Example of Power Level Programming

4-4.8 Command Codes: Measure Function Commands

Table 4-10 lists the Measure Function Commands. These commands provide for measuring any of the following:

- The actual modulation depth of the output signal, as caused by an external AM signal connected to either the front panel EXT AM jack or the rear panel AM INPUT jack.
- The actual frequency deviation of the output signal, as caused by an external FM signal connected to either the front panel EXT FM jack or the rear panel FM INPUT jack.

- The actual RF power of an external source, via a 560-7 Series Detector connected to the rear panel POWER METER jack.

4-4.9 Command Codes: Output Commands

Table 4-11 lists the Output Commands. These commands provide for outputting data from the synthesizer to the controller. Figure 4-8 shows an example of output-command programming.

Table 4-10. Measure Function Commands

Command Code	Function
AMI	Selects the AM Measurement mode, whereby the synthesizer measures the depth of the external AM input. The measurement results will be sent to the controller upon receipt of an OMM command (Table 4-11).
FMD	Selects the FM Measurement mode, whereby the synthesizer measures the deviation of the external FM input. The measurement results will be sent to the controller upon receipt of an OMM command. When either AMI or FMD is received, measurements are continuously taken until the mode is exited by receipt of the MOM command.
MOM	Turns off the modulation measurement modes.
PM1	Selects the Power Meter Measurement mode, whereby RF power can be measured at an external source by a 560-7 Series Detector connected to the rear panel POWER METER connector. The measurement results will be sent to the controller upon receipt of an OPM command. Power measurements can be taken simultaneously with modulation measurements.
PM0	Turns off the Power Meter Measurement mode.
PD1	Selects the Δ PWR Power Meter mode. Turn on the power meter with the PM1 command.
PD0	Turns off Δ PWR Power Meter mode.

Table 4-11. Output Commands (1 of 2)

Command Code	Function
OI	Causes the sweep generator to identify itself by sending certain parameter information over the bus. This parameter information consists of the model number, low-end frequency, high-end frequency, minimum output-power level, maximum output-power level, software revision number, and serial 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. The string is 34 characters long.
OFL	Returns the low-end frequency value to the controller. The units are in MHz.
OFH	Returns the high-end frequency value to the controller. The units are in MHz.
OF1	Returns the F1 frequency value to the controller. The units are in MHz.
OF2	Returns the F2 frequency value to the controller. The units are in MHz.
OF3	Returns the F3 frequency value to the controller. The units are in MHz.
OF4	Returns the F4 frequency value to the controller. The units are in MHz.
OF5	Returns the F5 frequency value to the controller. The units are in MHz.
OF6	Returns the F6 frequency value to the controller. The units are in MHz.
OF7	Returns the F7 frequency value to the controller. The units are in MHz.
OF8	Returns the F8 frequency value to the controller. The units are in MHz.
OF9	Returns the F9 frequency value to the controller. The units are in MHz.
OL1	Returns the LEVEL 1 power value to the controller. The units are in dBm.
OL2	Returns the LEVEL 2 power value to the controller. The units are in dBm.
OL0	Returns the Level Offset power value to the controller. The units are in dB.
OPM	Returns the power measurement value to the controller. The units are in dBm.
OST	Returns the sweep time value to the controller. The units are in ms.
OPW	Returns the pulse width of the internal programmable pulse generator (PPG) to the controller. The units are in ms.
OSD	Returns the dwell time of the digital sweep to the controller. The units are in seconds.
OPD	Returns the dwell time of the power sweep to the controller. The units are in seconds.
OSS	Returns the number-of-steps parameter of the digital sweep to the controller. The units are in steps.
OAS	Returns the AM sensitivity value to the controller. The units are in percent per volt (%/V).

Table 4-11. Output Commands (2 of 2)

Command Code	Function
OFS	Returns the FM sensitivity value to the controller. The units are in MHz per volt (MHz/V).
OFS	Returns the bit status of the Primary Status Byte and both Extended Status Bytes to the controller.
OPR	Returns the pulse rate of the internal PPG to the controller. The units are in MHz.
OMM	1. Returns the AM measurement value to the controller, when the AMI command either has been or is also programmed. The units are in percent (%). 2. Returns the FM measurement value to the controller, when the FMD command either has been or is also programmed. The units are in MHz.
OSB	Returns the bit status of the Status Byte (Figure 4-9) to the controller.
OES	Returns the bit status of the Primary Status Byte and both Extended Status Bytes to the controller. Returns the frequency of the fine loop oscillator in MHz.
OSE	Returns the parameter that had a syntax error to the controller.
ODF	Returns the value for delta-F (ΔF) to the controller.

```

760 OUTPUT 705;"OF1"
770 ENTER 705;R
780 PRINT "F1 is set at ";R;" MHz"

1050 OUTPUT 705;"OSS"
1060 ENTER 705;R
1070 PRINT "Digital Sweep has ";R;" Steps"

```

Figure 4-8. Example of Output Command Programming

4-4.10 Command Codes: Stored Setup Commands

Table 4-12 lists the Stored Setup Commands. These commands provide for saving a front panel setup and recalling it for use. The commands SSN1 thru SSN9, RSN1 thru RSN9, and SM duplicate the functions of the SAVE, RECALL, and SCAN SETUPS front panel keys respectively.

If more than nine setups are needed, or if it is desirable to store the setups in the controller instead of the synthesizer memory, the synthesizer can be commanded to output and accept stored setups over the bus.

The SAF and RCF commands save and recall the current front panel setup by outputting or receiving a 300-byte (approximately) data string that describes the instrument state.

The SAM and RCM commands perform the same two functions as described for the SAF and RCF commands, except that all of the stored setups are included in the data string along with the then current front panel setup. For these commands, the data string is approximately 3000 bytes long.

Table 4-12. Stored Setup Commands

Command Code	Function
SAF	Commands the synthesizer to output the then-current front panel setup.
RCF	Readies the synthesizer to receive a new front panel setup. The SAF and RCF commands save and recall the current front panel setup by outputting or receiving a 300-byte (approximately) data string that describes the instrument state. The SAM and RCM commands perform identical functions, except that all of the stored setups are also included in the data string. For these commands, the data string is approximately 3000 bytes long.
SAM	Commands the synthesizer to output both the then-current front panel setup and all stored setups.
RCM	Readies the synthesizer to receive a new front panel setup and new stored setups.
SSN1-SSN9	Saves the then-current front panel setup in memory location 1 thru 9, based on the numeral sent with the command.
RSN1-RN9	Recalls to the front panel the synthesizer setup stored in memory location 1 thru 9, based on the numeral sent to the front panel with the command.
SM	Recalls the next stored setup in sequence
	<p style="text-align: center;">NOTE</p> <p>SAF and SAM output binary data. The string is terminated with "EOI" on the last byte sent (no CR or LF is sent).</p> <p><i>Example</i></p> <p>10 DIM A\$ [300] 20 OUTPUT 705; "SAF" 30 ENTER 795 USING "#%, #%K"; A\$ (Requires EOI to be the terminator of the read.) 40 OUTPUT 705; "RCF"; A\$ (A\$ must follow the SAF.)</p>

4-4.11 Command Codes: Service Request (SRQ) and Status Byte Commands

Table 4-13 lists the Service Request and Status Byte Commands. These commands enable the synthesizer to request service from the controller when certain, predefined conditions exist.

The synthesizer contains three status bytes: the primary and two extended bytes. These status bytes are shown and their bits identified in Figure 4-9.

The synthesizer responds to a serial poll by sending the primary status byte. Any bit in this byte can cause an SRQ to be generated, provided the bit has been so enabled. (See the FB1, ES1, LE1, PE1, SE1, and SB1 commands). However, regardless of

whether a bit has been enabled to cause an SRQ, the bit will still be set (and read by the controller) when the condition on which it reports has been detected.

Bits in the primary status byte can be enabled to cause an SRQ by either of two methods. The first uses the 16 commands described in Table 4-13 to individually enable or disable each bit. The second method uses a single 8-bit byte (SM0) to mask (Figure 4-10) any or all of the status-byte bits to cause an SRQ.

Example: Sending the command "MB0" (CHR\$(80)) enables status byte bits 4 and 6 to generate an SRQ.

Table 4-13. Service Request (SRQ) Commands (1 of 2)

Command Code	Function
ES1	Enables an SRQ to be generated when Status Byte bit 1 is set (end of a single sweep, Figure 4-9)
ES0	Inhibits an SRQ from being generated at the end of a single sweep. This is the default mode.
FB1	Enables an SRQ to be generated when Status Byte bit 0 (Extended Status Byte 1) is set.
FB0	Inhibits an SRQ from being generated when the Extended Status Byte 1 bit is set. This is the default mode.
LE	Enables an SRQ to be generated when Status Byte bit 3 (Lock Error) is set.
LE0	Inhibits an SRQ from being generated when the Lock Error bit is set. This is the default mode.
MB0	Sets the enable mask byte (Figure 4-10), thereby allowing any or all of the bits in the Primary Status Byte to generate an SRQ using one 8-bit byte. This command can be equivalent to sending ES1, FB1, LE1, PE1, SE1, SB1, and UL1.
MB1	Sets the enable mask byte for Extended Status Byte 1.
MB2	Sets the enable mask byte for Extended Status Byte 2.
PE1	Enables an SRQ to be generated when Status Byte bit 4 (Parameter Range Error) is set.
PE0	Inhibits an SRQ from being generated when the Parameter Range Error bit is set. This is the default mode.
SE1	Enables an SRQ to be generated when Status Byte bit 5 (Syntax Error) is set.
SE0	Inhibits an SRQ from being generated when the Syntax Error bit is set. This is the default mode.

Table 4-13. Service Request (SRQ) Commands (2 of 2)

Command Code	Function
SB1	Enables an SRQ to be generated when Status Byte bit 7 (Extended Status Byte 2) is set.
SB0	Inhibits an SRQ from being generated when the Extended Status Byte 2 bit is set. This is the default mode.
SQ1	Turns on the SR mode. That is, this command allows an enabled bit (as described above) to pull the SRQ line low and request service from the controller.
SQ0	Turns off the SRQ mode. This is the default mode.
UL1	Enables an SRQ to be generated when Status Byte bit 2 (RF Unlevelled) is set.
UL0	Inhibits an SRQ from being generated when the RF Unlevelled bit is set. This is the default mode. <p style="text-align: center;">NOTE</p> <p>All status bytes are latched except those indicated with the "*" in Figure 4-9. Once set, an OES or OSB command must be received before condition will be reset. SRQ (Bit 6) is cleared by serial poll only.</p> <p><i>Example</i></p> <p>OUTPUT 705; "OES" ENTER 705 USING "#, B"; A, B, C MAIN = A 1 EXT = B 2 EXT = C</p>

PRIMARY STATUS BYTE

STATUS BIT 2 Bit 7	SRQ Bit 6	SYNTAX ERROR Bit 5	PARAMETER RANGE ERROR Bit 4	UNLOCK ERROR 2 Bit 3	RF UNLEVELLED 2 Bit 2	END OF SWEEP Bit 1	STATUS BIT 1 Bit 0
-----------------------	--------------	-----------------------	--------------------------------	-------------------------	--------------------------	-----------------------	-----------------------

EXTENDED STATUS BYTE 1

NOT USED Bit 7	NOT USED Bit 6	NOT USED Bit 5	EXTERNAL* FINE LOOP IN USE Bit 4	NOT USED Bit 3	NOT USED Bit 2	MODULATION RANGE ERROR Bit 1	SELF TEST FAILED Bit 0
-------------------	-------------------	-------------------	-------------------------------------	-------------------	-------------------	---------------------------------	---------------------------

EXTENDED STATUS BYTE 2

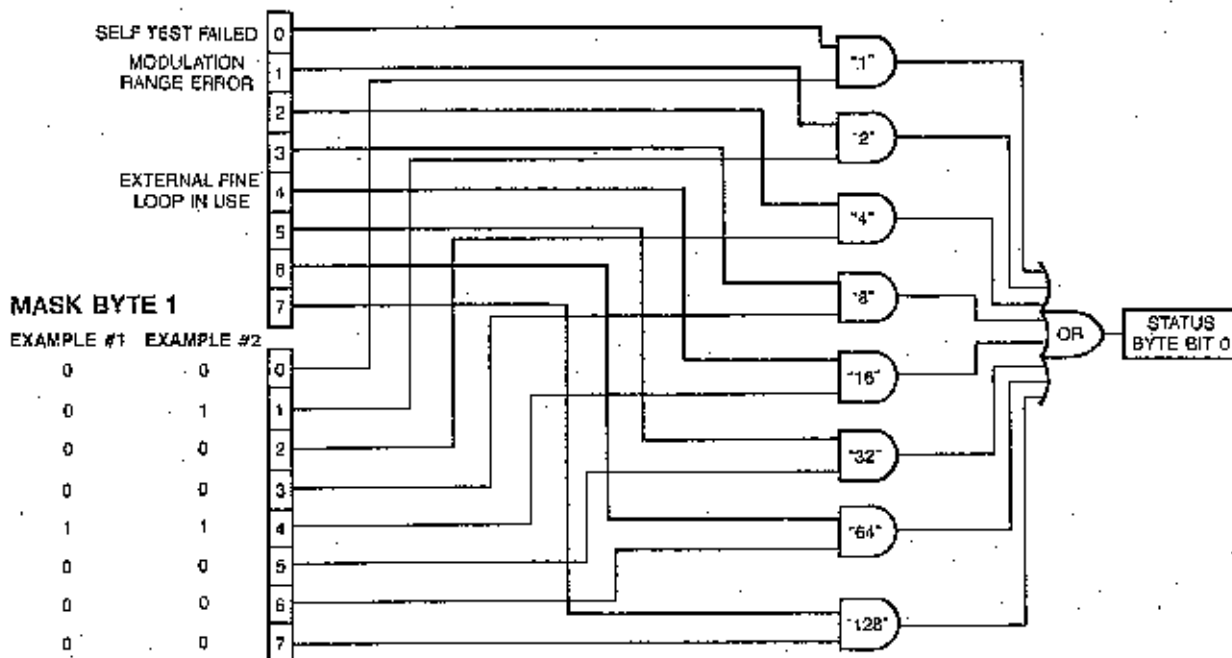
NOT USED ** Bit 7	CAL FINISHED Bit 6	ANALOG SWEEP LOCK ERROR Bit 5	RF* UNLOCKED Bit 4	NOT USED Bit 3	NOT USED Bit 2	MODULATION MEASUREMENT COMPLETE Bit 1	POWER MEASUREMENT COMPLETE Bit 0
----------------------	-----------------------	----------------------------------	-----------------------	-------------------	-------------------	--	-------------------------------------

* Non-latched bit;
EL1 enables RF UNLOCKED bit in Extended Status Byte 2;
EL0 disables RF UNLOCKED bit in Extended Status Byte 2 (this is the default).
** For factory use only.

Figure 4-9. Status Bytes

The 67XXA contains a software mask (see below) that allows the three status bytes to be manipulated over the bus. Such manipulation is accomplished by sending the command codes SM0, SM1, SM2, or all three at once, followed by an argument that assigns an on/off condition for each bit in the byte. Two examples of such commands are shown below:

EXTENDED STATUS BYTE 1



EXAMPLE 1 "SM1" (CHR \$(16)) Sets bit 4 in Mask Byte 1 to 1 and all other bits to 0, thus enabling bit 4 in Extended Status Byte 1 to be read from the bit 0 position in the Primary Status Byte.

EXAMPLE 2 "SM1" (CHR \$(18)) Sets bits 1 and 4 in Mask Byte 1 to 1 and all other bits to 0, thus enabling bits 1 and 4 in Extended Status Byte 1 to be read from the bit 0 position in the Primary Status Byte.

Figure 4-10. Status Byte Mask

4-4.12 Command Codes: Rear Panel Override Commands

Table 4-14 lists the Rear Panel Override Commands. These commands permit the eight functions associated with the rear panel FUNCTION SELECT switch to be controlled over the bus.

When a switch function is set from the bus, the function will remain in that condition until it is changed or until the synthesizer is returned to local control. When the synthesizer is returned to local control, the FUNCTION SELECT switch positions will be read and the instrument will be set to the appropriate state.

4-4.13 Command Codes: Group Execute Trigger Mode Commands

Table 4-15 lists the Group Execute Trigger (GET) Commands. These commands allow the GET bus message (Table 4-19) to be used to trigger certain synthesizer functions and thus speed up bus operations.

In its default state, the synthesizer responds to a GET message by triggering a single sweep.

Table 4-14. Rear Panel Switch Override Commands

Command Code	Function
AMA	External AM Input, AC Coupled
AMD	External AM Input, DC Coupled
BPN	Blanking Pulse, -5 Volts
BPP	Blanking Pulse, +5 Volts
EP0 EP1	External Pulse Input, TTL High Is RF Off External Pulse Input, TTL High Is RF On
PPC PP0	Pen Lift Relay, Contacts Normally Closed Pen Lift Relay, Contacts Normally Open
RC0 RC1	RF Off During Frequency Switching RF On During Frequency Switching
RT0 RT1	RF Off During Retrace RF On During Retrace
VGH VGL	VGHz Output is 1 Volt per GHz VGHz Output is 0.5 Volts per GHz

Table 4-15. Group Execute Trigger Commands

Command Code	Function
GTC	Configures the synthesizer to execute an SQF command (Table 4-5) each time a GET message is received.
GTD	Configures the synthesizer to execute a DN command (Table 4-4) each time a GET message is received.
GTU	Configures the synthesizer to execute a UP command (Table 4-4) each time a GET message is received.
GTS	Configures the synthesizer to execute a TRS (Table 4-6) command each time a GET bus message is received. This is the default mode.
GTT	Configures the synthesizer to execute a TST command (Table 4-17) each time a GET message is received.
GTF	Configures the synthesizer to execute a fast frequency-switching function (Table 4-16) each time a GET message is received.
GTL GTO	Configures the synthesizer to execute a TSS command on GET. Disables the GET functions.
Y	Sending "Y" is the same as sending GET.

4-4.14 Command Codes: Fast Frequency Commands

Table 4-16 lists the Fast Frequency-Switching Commands. These commands provide for reducing the time (approximately) that it takes to switch between two CW frequencies (from 15 ms to 12 ms).

In the fast frequency-switching mode, up to 512 frequencies can be loaded into a stack. A stack pointer can then be set and the synthesizer commanded to switch from the pointed-to frequency to the bottom of the stack.

4-4.15 Command Codes: Self Test Commands

Table 4-17 lists the Self Test Commands. These commands provide for executing a complete or partial synthesizer self test.

4-4.16 Command Codes: Miscellaneous Commands

Table 4-18 is a list of miscellaneous commands that do not fit into any of the other classifications. These commands provide the following operations:

- Blanking and restoring the front panel LCDs
- Returning the synthesizer to local control
- Resetting the synthesizer
- High Resolution
- CW Ram

Table 4-16. Fast-Frequency-Switching Commands

Command Code	Function
ZL000-ZL512	Loads a CW frequency-value into the a stack, the position of which is indicated by the 000 thru 512 numerals.
ZS000-ZS512	Sets the pointer for the next frequency in the stack.
ZEL	Ends frequency loading. <i>Example:</i> OUTPUT 705; "ZL000" Set pointer for load OUTPUT 705; "10 GH, 11 GH, 12 GH, 13 GH" OUTPUT 705; "ZEL" NEW OUTPUT 705; "ZS000" Set pointer to start TRIGGER 705; Sets 10 GHz TRIGGER 705; Sets 11 GHz TRIGGER 705; Sets 12 GHz TRIGGER 705; Sets 13 GHz GO TO NEW
CAL	Causes 67XXA to initiate a SELF CAL routine. If FAST FREQ is active, it will recalculate the values for each point. This should be done if a lock error occurs.

Table 4-17. Self Test Commands

Command Code	Function
TST	Executes a complete synthesizer self test. Bit 0 in Extended Status Byte 1 is set if self test fails.
STN00-STN99	Identifies the test that is to be executed when the TST command is received. The self test function is described in the Series 67XXA Maintenance Manual (67XXA MM).

Table 4-18. Miscellaneous Commands

COMMAND CODE	FUNCTION
DS0 DS1	Turns off the front panel LCDs, preventing unauthorized persons from determining operating frequency. Turns the front panel LCDs back on. The LCDs can also be restored by resetting the synthesizer.
RL	Returns the synthesizer to local (front panel) control.
RST	Resets the synthesizer to its default settings (Table 3-1). NOTE Sending this command clears the synthesizer setup then in place. If this setup is needed for future testing, save it as a stored setup (paragraph 4-4.10) before sending RST.
HR1 HR0	Turns on the high-resolution mode. Turns off the high-resolution mode.
CS0 CS1	Turns off the CW ramp. Turns on the CW ramp.

4-5. BUS MESSAGES, SYNTHESIZER RESPONSE TO

Table 4-19 lists the bus messages recognized by the synthesizer. Table 4-20 lists programming state-

ments showing how the WILTRON 85 and the HP Series 200 bus controllers implement the recognized bus messages.

Table 4-19. Bus Messages Recognized by the 67XXA Series (1 of 2)

Bus Messages	How Message Is Used By the Synthesizer
Device Clear	Resets the synthesizer to its default state. Sending this message is equivalent to sending the RST command.
Go to Local	Returns the synthesizer to local (front panel) control.
Group Execute Trigger	<ol style="list-style-type: none"> 1. Triggers a new sweep, if the EXT and the GTS commands (Tables 4-6 and 4-15, respectively) are both programmed. 2. Increments the selected parameter by the amount programmed using the SYZ command, provided that the GTU command (Table 4-15) has also been programmed. 3. Decrements the selected parameter by the amount programmed using the SYZ command, provided that the GTD command (Table 4-15) has also been programmed. 4. Sequences to the next CW frequency, provided that the GTC command (Table 4-15) has also been programmed. 5. Provides a fast frequency change (12 ms), provided that the GTF command (Table 4-15) has also been programmed. 6. Executes a self test, provided that the GTT (Table 4-15) command has also been programmed.
Interface Clear	Stops the synthesizer GPIB interface from listening or talking. The front panel controls are not cleared.

Table 4-19. Bus Messages Recognized by the 67XXA Series (2 of 2)

Bus Messages	How Message Is Used By the Synthesizer
Local Lockout	Prevents the front panel RETURN TO LOCAL key or the RL bus command (Table 4-18) from returning the synthesizer to local (front panel) control.
Remote Enable	<p>Places the synthesizer under remote (GPIB) control if the REN line is TRUE and the synthesizer has been addressed to listen.</p> <p style="text-align: center;">NOTE</p> <p>If the synthesizer is placed in remote and not supplied with program data, its operation is determined by the positions in which the front panel controls were set immediately prior to going remote.</p>
Service Request Messages	The synthesizer has been equipped with an SRQ capability. It will respond to both serial- and parallel-poll messages. Responses to these messages are described below.
Serial-Poll Enable (SPE) Serial-Poll Disable (SPD)	The SPE message causes the controller to respond Enable (SPE) decimally-coded status byte (Figure 4-9).
Parallel-Poll Configure (PPC) Parallel-Poll Enable (PPE) Parallel-Poll Unconfigure (PPU) Parallel-Poll Disable (PPD)	<p style="text-align: center;"><i>Parallel Poll Operation</i></p> <p>When queried by a parallel-poll message (PPOLL, Table 4-20), the synthesizer (if configured for parallel-poll operation) responds by setting its assigned data bus line to the logical state (1, 0) that indicates its correct SRQ status.</p> <p>To configure a bus device that is (1) built for parallel-poll operation and (2) designed to be remotely configured via the bus, the controller sends a two-byte parallel-poll configure and enable (PPC and PPE) message.</p> <p>The PPC byte configures the device to respond to a message, such as PPOLL. The PPE byte assigns the logical sense (1, 0) that the parallel-poll response will take. When the synthesizer receives the PPC/PPE message, it configures itself to properly respond to the message.</p> <p>The PPU (or PPD) message is sent by the controller when a parallel-poll response is no longer needed. This message causes the synthesizer to become unconfigured for a parallel-poll response.</p>

Table 4-20. Methods of Generating Bus Commands

FUNCTION	METHOD OF EXECUTION	
	WILTRON 85	HP SERIES 200
Go to Local (GTL)	LOCAL 7 LOCAL 705	LOCAL 7 LOCAL 705
Group Execute Trigger (GET)	TRIGGER 7 TRIGGER 705	TRIGGER 7 TRIGGER 705
Interface Clear (IFC)	ABORTIO 7	ABORT 7
Device Clear (DC) (SDC)	CLEAR 7 CLEAR 705	CLEAR 7 CLEAR 705
Local Lockout (LLO)	LOCAL LOCKOUT 7	LOCAL LOCKOUT 7
Remote Enable (REN)	REMOTE 7 REMOTE 705	REMOTE 7 REMOTE 705
Serial Poll	A=SPOLL (705)	A=SPOLL (705)
Parallel Poll Configure (PPC)	SEND 7; UNL LISTEN 5 CMD 3 SCG 5	PPOLL CONFIGURE 705;4
Parallel Poll	A=PPOLL (7)	A=PPOLL (7)
Parallel Poll Unconfigure (PPU)	SEND 7; CMD 21 SEND 7; UNL LISTEN 5 CMD 21	PPOLL UNCONFIGURE 7 PPOLL UNCONFIGURE 705

4-6 PROGRAM ERRORS

Two types of errors can occur in bus programming: invalid-parameter and syntax. These two error types are described below.

a. Invalid-Parameter Error

Invalid parameter errors are those that cause the front panel CLEAR, SWEEP WIDTH or SWEEP RANGE ERROR, GHz/S/dB/dBm/%, MHz/mS/STEPS, or kHz/ μ S indicators to flash. These errors include:

1. Programming a frequency sweep where F1 is greater than F2 or F3 is greater than F4.
2. Attempting to enter a frequency, sweep-time, or RF level parameter that exceeds the limits of the synthesizer.

3. Failing to properly end a parameter entry with a suitable terminator (i.e.: ME, DB, MS, etc.).

Invalid-parameter errors cause the front panel indicators to flash.

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 synthesizer ignores all portions of the command statement following the syntax error. All commands are ignored until the synthesizer receives the Unlisten command (ASCII 63; "?" character) over the bus or until the synthesizer is addressed to talk.

4-7 RESET PROGRAMMING AND DEFAULT CONDITIONS

Table 4-21 describes the five methods that can be used to reset the synthesizer. They provide a means for quickly returning the synthesizer to its default (preprogrammed) operational state.

The default settings for the numeric frequency, sweep time, and output-power level parameters are the same as those given for the INSTR RESET key (Tables 3-3 and 3-9).

Figure 4-11 provides a recommended sequence for programming a reset command. Using this com-

mand sequence ensures that all parameters and commands assume their preprogrammed state each time reset is desired.

4-8 PROGRAMMING EXAMPLES

Tables 4-22 thru 4-24 provide three examples of GPIB programming using the synthesizer command codes. These programs have been written to run on the HP200 Series computers.

Figure 4-12 provides a test equipment setup for running these programs.

Table 4-21. Resetting the 67XXA GPIB Interface Circuits

Methods of Resetting GPIB Interface Circuits	Functions Affected	Default Conditions
1. Pressing the front panel RETURN TO LOCAL key.	Bus Messages	Local
2. Pressing the front panel RESET key.	Service Request Modes	ES0, FB0, LE0, PE0, SB0, SE0, SQ0, UL0, SB0 GTS Local and Local Lockout
3. Sending the RST command over the bus.	Same as 2 above	Same as 2 above except that the local bus message is not reset.
4. Executing the interface message Device Clear.	Same as 2 above	Same as 2 above except that the local bus message is not reset.
5. Turning the POWER switch on and off.	Same as 2 above	Places the GPIB into the power-on state. Device state does not change.

<i>Line</i>	<i>Purpose</i>
10	Sends Device Clear Bus Message. This message clears the sweep generator GPIB interface.
20	Sends new front panel settings: Full Sweep, Internal Levelling, and Output-Power Level of 10.

```

10 CLEAR 705
20 OUTPUT 705 ; "FUL IL1 L1 00M"
        
```

Figure 4-11. Reset Programming Statements

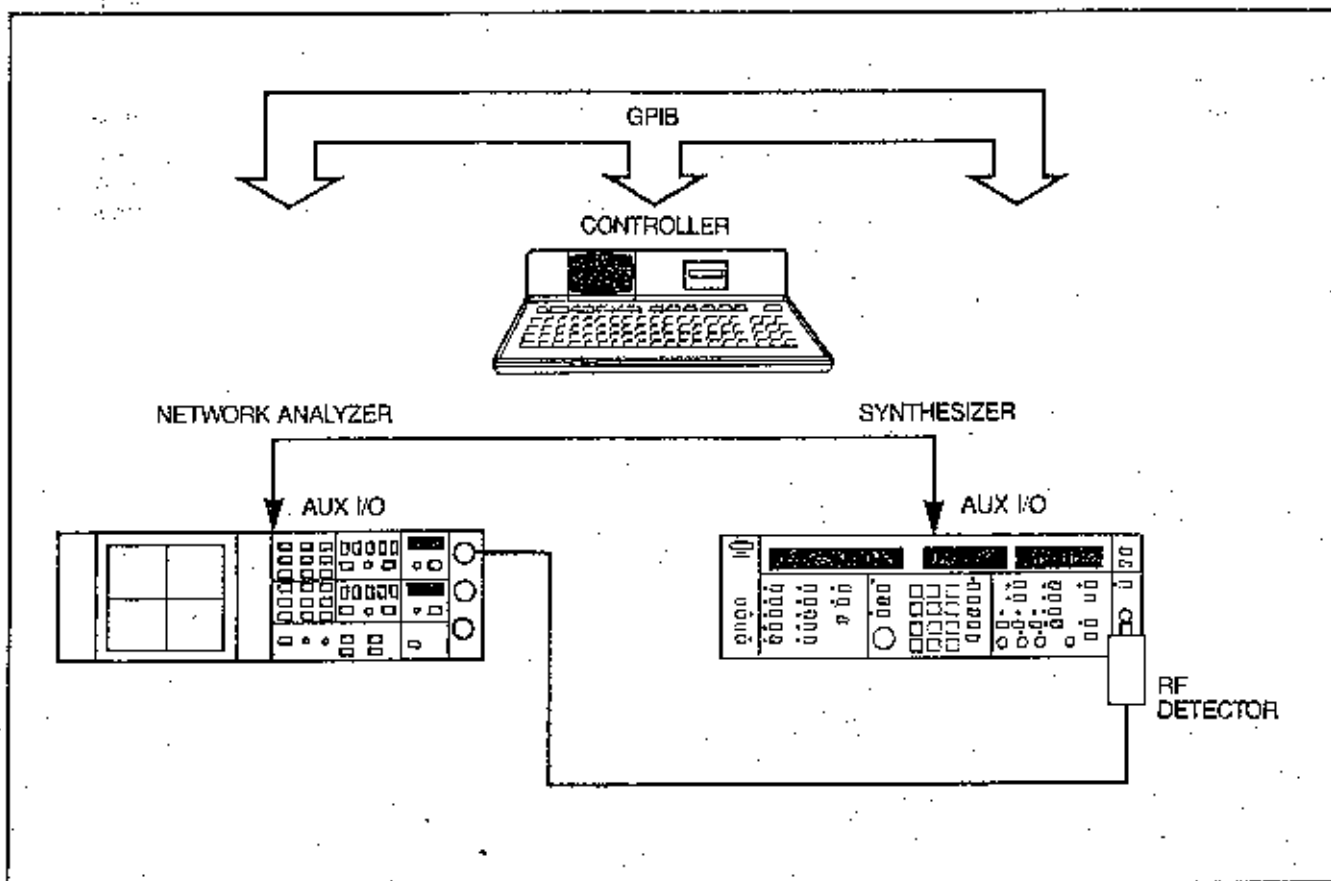


Figure 4-12. Test Equipment Setup for Running GPIB Program Examples

Table 4-22. Using the Output Identify Command

The following subroutine uses the output identify (OI) command to identify the synthesizer's model number, minimum and maximum frequencies, and minimum and guaranteed power levels. This subroutine is used in the programs in Tables 4-23 thru 4-24 to read the limits of the synthesizer. This subroutine can also be used to identify a WILTRON Series 6600 Programmable Sweep Generator.

```

10 ! "GET OI"
20 ! Gets the output id string
30 ! from a 6700A SYNTH
100 OUTPUT 705 ; "OI"
110 DIM A$(35)
120 ENTER 705 ; A$
130 M$=A$(1,4) ! Model Number
140 F1$=A$(5,9) ! F low
150 F2$=A$(10,14) ! F high
160 L2$=A$(15,20) ! Min Power
170 L1$=A$(21,24) ! Guar Power
180 S$=A$(25,28) ! Soft Ver
190 S1$=A$(29,34) ! Serial Num
200 PRINT "Model Number :";M$
210 PRINT "Serial Number :";S1$
220 PRINT "Low Freq :";F1$
230 PRINT "High Freq :";F2$
240 PRINT "Guar Power :";L1$
250 PRINT "Min Power :";L2$
260 PRINT "Software Ver :";S$
270 END

```

PROGRAM EXPLANATION

- Line 100:* Sends the "OI" command.
- Line 110:* Dimensions the variable.
- Line 120:* Gets the "OI" string.
- Line 130:* Sets M\$ to the model number.
- Line 140:* Sets F1\$ to the synthesizer low-end frequency.
- Line 150:* Sets F2\$ to the synthesizer high-end frequency.
- Line 160:* Sets L2\$ to the minimum power point.
- Line 170:* Sets L1\$ to the maximum specified power point.
- Line 180:* Sets S\$ to the software version number.
- Line 190:* Sets S1\$ to the serial number.
- Lines 200-260:* Prints the data obtained.

Table 4-23. Controlling CW Frequency/Parameter Entries

The following program:

- (1) receives entries from the keyboard to set initial frequency and step-size parameters, and
- (2) activates the soft keys on the controller so that they can step the frequency up or down.

```

20  ! PARAMETER ENTRY, SYZ, UP, AND DN COMMANDS
30  Address=705
40  CALL Iddev(Address,Model,Fmin,Fmax,Pmin,Pmax)
50  OFF KEY
60  DISP "ENTER FREQUENCY IN GHZ";
70  INPUT Freq
80  IF Freq>Fmax OR Freq<Fmin THEN
90    DISP "FREQUENCY OUT OF RANGE - ";
100   GOTO 60
110  END IF
120  DISP "ENTER STEP SIZE IN GHZ";
130  INPUT Stepsize
140  IF Stepsize>Fmax-Fmin OR Stepsize<.000001 THEN
150    DISP "ILLEGAL STEP SIZE - ";
160    GOTO 120
170  END IF
180  OUTPUT Address;"CF1";Freq;"GH SYZ";Stepsize;"GH"
190  ON KEY 0 LABEL "STEP" GOTO 300
200  ON KEY 5 LABEL " UP " GOTO 300
210  ON KEY 1 LABEL "STEP" GOTO 320
220  ON KEY 6 LABEL "DOWN" GOTO 320
230  ON KEY 2 LABEL "NEW " GOTO 50
240  ON KEY 7 LABEL "FREQ" GOTO 50
250  GOTO 250
300  OUTPUT Address;"UP"
310  GOTO 250
320  OUTPUT Address;"DN"
330  GOTO 250
340  END
1010 SUB Iddev(Address,Model,Fmin,Fmax,Pmin,Pmax)
1020 DIM Ident$(28)
1030 OUTPUT Address;"OI"
1040 ENTER Address;Ident$
1050 Model=VAL(Ident$(1,4))
1060 Fmin=VAL(Ident$(5,9))
1070 Fmax=VAL(Ident$(10,14))
1080 Pmin=VAL(Ident$(15,20))
1090 Pmax=VAL(Ident$(21,24))
1100 SUBEND

```

PROGRAM EXPLANATION

Line 30: Sets the address of the synthesizer.

Line 40: Calls the device identification subroutine described in line 1010 (Table 4-22).

Line 50: Turns off the key definitions.

Lines 60-110: Prompts the user for the starting frequency, checks the frequency's validity, and tells the user if the frequency is valid.

Line 180: Sets the synthesizer to the starting frequency and step size.

Lines 190-240: Set up keys and key labels.

Line 250: Waits for a key to be pressed.

Line 300: Reports that the STEP UP key was pressed; sends the UP command.

Line 310: Waits for the next key.

Line 320: Reports that the STEP DOWN key was pressed; sends the DN command.

Line 330: Waits for the next key.

Line 340: Ends the main program.

Lines 1010-1090: Identify the synthesizer address, model, frequency range, and power range.

Table 4-24. Controlling Power Level and Power Sweep

The following program accepts user inputs for (1) power sweep starting and ending levels, (2) numbers of steps in the sweep, and (3) sweep dwell times. After accepting such inputs, the program then commands the synthesizer to obtain a display of the power sweep.

The synthesizer should be connected to a scalar network analyzer as shown in Figure 4-12.

```

30  Address:=705
40  CALL Iddev(Address,Model,Fmin,Fmax,Pmin,Pmax)
60  DISP "ENTER POWER SWEEP STARTING LEVEL (dBm) ";
70  INPUT Powerstart
80  IF Powerstart>Pmax OR Powerstart<Pmin THEN
90    DISP "POWER OUT OF RANGE - ";
100   GOTO 60
110  END IF
120  DISP "ENTER POWER SWEEP ENDING LEVEL (dBm)";
130  INPUT Powerstop
140  IF Powerstop>Pmax OR Powerstop<Pmin THEN
150    DISP "POWER OUT OF RANGE - ";
160    GOTO 120
170  END IF
180  DISP "ENTER NUMBER OF STEPS";
190  INPUT Noofsteps
200  IF Noofsteps<1 OR Noofsteps>1000 THEN
210    DISP "NUMBER OF STEPS OUT OF RANGE - ";
220    GOTO 180
230  END IF
240  DISP "ENTER DWELL TIME AT EACH STEP (mS)";
250  INPUT Dwell
260  IF Dwell<100 OR Dwell>10000 THEN
270    DISP "DWELL TIME OUT OF RANGE - ";
280    GOTO 240
290  END IF
300  OUTPUT Address;"L1";Powerstart;"dB.L2";Powerstop;"DM PHS";Noofsteps;"SPS"
310  OUTPUT Address;"PDT";Dwell;"MS LSP"
340  END
1010 SUB Iddev(Address,Model,Fmin,Fmax,Pmin,Pmax)
1020 DIM Ident$(28)
1030 OUTPUT Address;"01"
1040 ENTER Address;Ident$
1050 Model=VAL(Ident$(1,4))
1060 Fmin=VAL(Ident$(5,9))
1070 Fmax=VAL(Ident$(10,14))
1080 Pmin=VAL(Ident$(15,20))
1090 Pmax=VAL(Ident$(21,24))
1100 SUBEND

```

PROGRAM EXPLANATION

- Line 30: Sets the synthesizer to address 5.
- Line 40: Calls the subroutine to identify the device described in line 1010 (Table 4-22).
- Lines 60-110: Accept the starting power level entry and checks its validity.
- Lines 120-170: Accept the ending power level entry and checks its validity.
- Lines 180-230: Accept the power sweep number-of-steps entry and checks its validity.
- Lines 240-290: Accept the power sweep dwell time entry and checks its validity.
- Lines 300-310: Set the synthesizer to perform the above defined power sweep.
- Line 340: Ends the main program.
- Lines 1010-1090: Identify the synthesizer model.

MANUAL ERRATA

MANUAL:

Title: Series 67XXA Swept Frequency Synthesizer Operation Manual
Part Number: 10370-00002
Rev. Ltr/Date: C/Dec. 1988

ERRATA PACKET

Part Numbers: 10901-00037

INSTRUCTIONS

1. Make all errata changes. Errata changes are listed in numerical order by page number.
2. Replacement pages are provided for all errata changes. The black bar or bars in the margins of the replacement page show the area in which the changes were made.

ERRATA 1, November 1989 (GP1B)

1. **Pages 4-6 thru 4-9**
Replace with enclosed pages 4-5 thru 4-10, Changed: November 1989
2. **Page 4-13**
Replace with enclosed pages 4-13 and 4-14, Changed: November 1989
3. **Pages 4-16 and 4-17, 4-19 and 4-20**
Replace with enclosed pages 4-15 thru 4-20, Changed: November 1989
4. **Pages 4-22 and 4-23, 4-26**
Replace with enclosed pages 4-21 thru 4-26, Changed: November 1989

