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INSTRUCTION MANUAL

MODELS 907A & 907AF
7 TO 12.4 GHz
SIGNAL GENERATOR

WAVETEK

WAVETEK MICROWAVE, INC.

488 Tasman Drive, Sunnyvale, CA. 94089

INSTRUCTION MANUAL

MODELS 907A & 907AF
7 TO 12.4 GHz
SIGNAL GENERATOR

Model 907AF is identical to the standard Model 907A, as described herein, except that the AC powered cooling fan is replaced by a DC powered fan and some specifications have been changed. Model 907AF data is located in Appendix B of this manual.

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Code 04 (11-87)

SAFETY

This instrument is wired for earth grounding via the facility power wiring. Do not bypass earth grounding with two wire extension cords, plug adapters, etc.

While the very low power of the rf energy generated in this instrument make it ordinarily nonhazardous, extremely close and prolonged proximity of an eye and an rf output connector could cause injury.

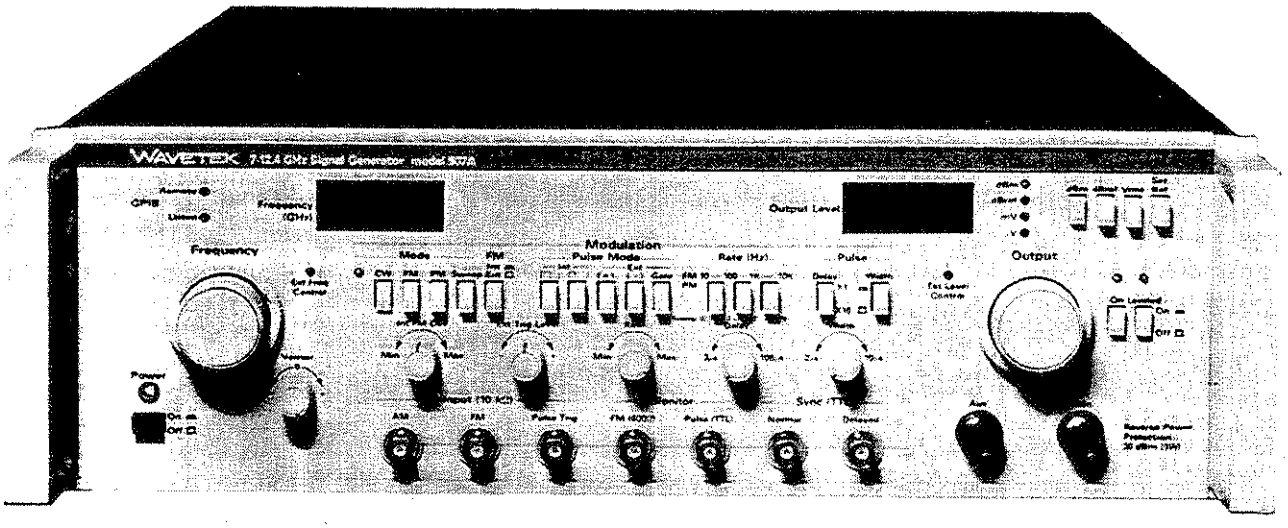
BEFORE PLUGGING IN the instrument, comply with installation instructions.

MAINTENANCE may require power on with the instrument covers removed. This should be done only by qualified personnel aware of the electrical hazards.

The instrument power receptacle is connected to the instrument safety earth terminal with a green/yellow wire. Do not alter this connection. (Reference: ⏚ or ⚠ stamped inside the rear panel near the safety earth terminal.)

WARNING notes call attention to possible injury or death hazards in subsequent operations.

CAUTION notes call attention to possible equipment damage in subsequent operations.



Model 907A 7 to 12.4 GHz Signal Generator

SECTION 1
GENERAL DESCRIPTION

1.1 MODELS 907 AND 907AF

Models 907A and 907AF Signal Generators are lightweight, compact sources of rf signals. Their 7 to 12.4 GHz frequency range is continuously variable; output is displayed on a 3½ digit LCD. Output level is continuously adjustable from +0 to −127 dBm (+0 to −127 dBm for the 907AF); a 3½ digit LCD displays the level. Modes of operation include CW, AM, FM, PM, and sweep with internal or external modulation and trigger signals. In addition to the main RF output, an auxiliary CW output is available at a fixed level. Two sync outputs and two monitor outputs allow timing and monitoring of modulation and triggering functions. Frequency and output level control is by front panel, remote analog voltages or optional GPIB.

1.2 907A SPECIFICATIONS

NOTE

The following specifications apply to the Model 907A. Refer to Appendix B for 907AF specifications.

1.2.1 Versatility

A cw signal source with AM, FM and pulse modulation and sweep capabilities. All parameters are independently adjustable.

Pulse and FM modulation signals and sweep ramp are from an internal modulation generator or external input.

Frequency and level can also be externally controlled by analog voltages or optional GPIB.

Auxiliary output and internal modulator signals are available at the front panel.

Modes

CW: Continuous RF output. Frequency and level adjustable.

FM: Internal or external signal frequency modulates the RF output. Rate and deviation adjustable.

Pulse: Internal or external signal pulse modulates the RF output. Pulse width adjustable or fixed 50% duty cycle; rate adjustable. An external gate mode allows the external input to control pulse width.

Sweep: Internal or external controlled sweep (to 15 Hz rate) over the entire RF frequency range.

1.2.2 Output

NOTE

Specifications for non-sweep modes only.

Frequency

Varied by a 10-turn potentiometer and vernier or by an external 0 to +5V. GPIB control optional.

Range: 7.0 to 12.4 GHz.

Readout: 3½ digit LCD.

Resolution: 10 MHz.

Accuracy: ±1% of reading.

Stability: 60 ppm/°C (Typical); less than 20 ppm (+5, −10% line variation).

Signal Purity

Residual FM: <15 kHz peak in a post-detection bandwidth of 100 Hz to 10 kHz.

Harmonics: < −30 dBc.

Spurious: < −55 dBc.

Level

Varied by a 10-turn potentiometer or external 0 to +13.6V (−10 dBM). GPIB control optional. Output can be unleveled or automatically leveled. Output can be switched on and off.

Range (Leveled): +0 to −127 dBm; 0.225V to 0.100μV (into 50Ω).

Range, Unleveled (Typical): > +3 to < −115 dBm.

Readout: 3½ digit LCD, calibrated in dBm, dBref and Vrms.

Resolution: 0.1 dB.

Amplitude Accuracy:

Accuracy	Range
±1 dB (typ ±0.5)	0 dBm
±2 dB	0 to −60 dBm
±3 dB	−60 to −120 dBm

Leveled power to approximately −127 dBm. Output level is continuously adjustable.

Impedance: 50Ω.

Level Flatness: ±1 dBm (> −10 dBm).

VSWR: <1.5.

Connector: Female type N coax.

Auxiliary Output Power: > −10 dBm CW signal (typical).

Reverse Power Protection (Both Outputs): +30 dBm (1 watt).

1.2.3 Frequency Sweep

Internal: Pushbutton gives full band sweep; rate adjustable.

Rate Range: 0.02 to 15 Hz.

External: Control with ramp input. 0 to +5V for full band sweep.

Sweep Range: 7 to 12.4 GHz.

Rate Range: Up to 15 Hz.

Frequency Control Monitor: Output voltage (0 to +10V nominal) proportional to RF frequency control signal. 600Ω surce impedance.

Pen Lift (TTL): Selective polarity output pulse.

1.2.4 Pulse Modulation

Transition Times: <35 ns for leading and trailing edges (typically <15 ns).

On-Off Ratio: >80 dB when main output is set at 0 dBm.

Width: 200 ns to 100 μs in 2 ranges; for greater widths, use external gated mode.

Delay Range: 3μs to 1 ms in 2 ranges, relative to normal sync. (Not applicable to gated pulse.)

Internal Mode: Fixed square wave or variable width pulses; 10 Hz to 10 kHz in 3 ranges.

External Mode: 1 Vp-p minimum, ±10V maximum trigger; slope and trigger point adjustable.

Externally Gated Pulse: RF output occurs for the duration that pulse trigger input signal exceeds trigger level setting.

1.2.5 FM — Frequency Modulation

Internal Sawtooth Modulator: 10 Hz to 10 kHz in 3 ranges. 0 to >5 MHz p-p deviation.

External Modulation: >1 MHz/V nominal; ±2.5V max. >5 MHz p-p deviation.

Bandwidth: >10 kHz (dc coupled).

1.2.6 AM — Amplitude Modulation

Modulation Frequency Range: 0 to 10 kHz.

Maximum Source Level: ±2V peak.

Sensitivity: 27 dB/V (nominal).

1.2.7 Modulator Outputs

FM: Signal from external or internal modulation generator. 600Ω source impedance.

Pulse: Positive TTL level pulse occurring at selected repetition rate, pulse delay and pulse width of modulator pulse.

Normal Sync: Positive TTL level pulse occurring at selected repetition rate.

Delayed Sync: Positive TTL level pulse synchronous with modulator pulse with selected delay.

1.2.8 General

Environmental
Specifications apply for 25° ±10°C after 1 hour warm-up. Instrument will operate from 0°C to +50°C, to 10,000 ft and to 90% relative humidity. Storage: −25° to +65°C.

Weight
18.2 kg (40 lb).

Dimensions
43.2 cm (17 in.) wide; 13.3 cm (5¼ in.) high; 51.4 cm (20¼ in.) deep. Adapters supplied for rack mounting.

Power
100V, 120V, 220V, 240V (+5%, −10%); 47 to 65 Hz; 130 VA maximum.

Option
001: GPIB Programming
General Purpose Interface Bus (GPIB) programming fully compatible with the IEEE Standard 488-1978 allows programming of frequency, level, CW, output on/off and leveled/unleveled.

NOTE

GPIB option requires factory installation.

SECTION 2
INITIAL PREPARATION AND INSTALLATION

2.1 MECHANICAL INSTALLATION

After unpacking the instrument, visually inspect all external parts for possible damage to connectors, surface areas, etc. If damage is discovered, file a claim with the carrier who transported the unit. The shipping container and packing material should be saved in case reshipment is required.

If the instrument is to be rack mounted, use the following procedure to prepare the instrument for mounting.

CAUTION

The following procedure allows the instrument front panel to be mounted flush with the front of a standard rack. To prevent instrument damage, its weight must be supported by shelf or slides.

1. Remove the bottom cover (4 screws), remove the rubber feet and reattach the cover.

CAUTION

Do not move the front panel relative to the chassis, since the semi-rigid coax cables may be bent. Bending these cables will adversely affect instrument performance.

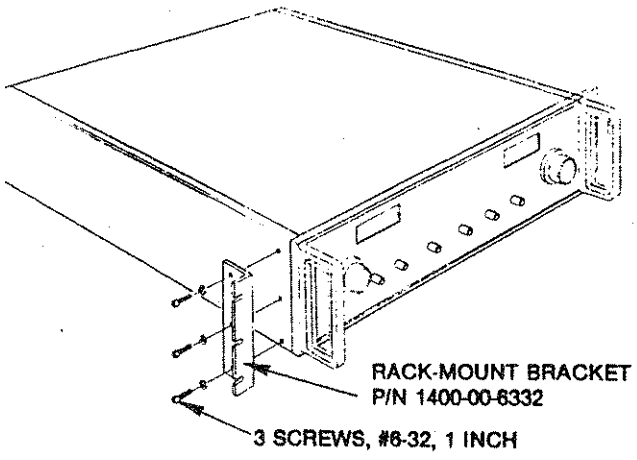


Figure 2-1. Preparation for Rack Mounting

2. Remove the three screws attaching the front panel assembly to chassis on the left side.
3. Mount one of the adapters on the left side as shown in figure 2-1. Use 1 inch 6-32 screws rather than the shorter ones just removed.
4. Similarly, on the right side, while taking care not to change front panel/chassis alignment, remove the three screws and attach the other rack mounting adapter.

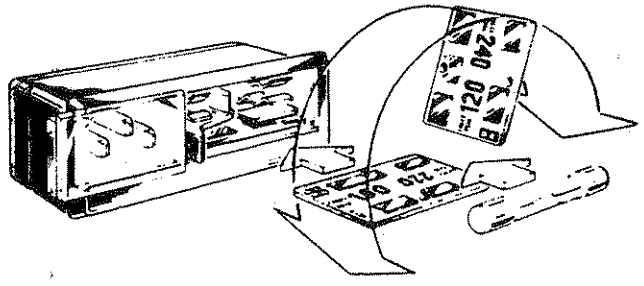
2.2 ELECTRICAL INSTALLATION

2.2.1 Power Connection

NOTE

Unless otherwise specified at the time of purchase, this instrument was shipped from the factory with the power transformer connected for operation on a 120 Vac line supply and with a 1½ amp slow blow fuse.

Conversion to other input voltages requires a change in rear panel fuse holder voltage card position and fuse (figure 2-2) according to the following procedure.



Card Position	Input Vac	Fuse (Slo-Blo)
100	90 to 105	1½ amp
120	108 to 126	1½ amp
220	198 to 231	¾ amp
240	216 to 252	¾ amp

Figure 2-2. Voltage Selector and Fuse

1. Disconnect the power cord at the instrument, open fuse holder cover door and rotate fuse-pull to left to remove the fuse.

2. Remove the small printed circuit board and select operating voltage by orienting the printed circuit board to position the desired voltage to the top left side. Push the board firmly into its module slot.

3. Rotate the fuse-pull back into the normal position and insert the correct fuse into the fuse holder. Close the cover door.

4. Connect the ac line cord to the mating connector at the rear of the unit and the power source.

2.2.2 Signal Connections

When connecting the MAIN and AUXiliary outputs to associated equipment, use 50Ω coaxial cables equipped with male type N connectors that are compatible with those specified in US MIL-C-39012.

CAUTION

Reverse power in excess of +30 dBm may damage the output circuits.

Use mating BNC connectors with 50Ω coaxial cable for all other input and output connections.

2.3 GPIB (Optional)

Refer to appendix A for GPIB preparation and installation.

2.4 INITIAL CHECKOUT PROCEDURE

The procedure of table 2-1 provides an initial operational checkout of all controls and connections for the Model 907A.

To perform an operational checkout of the Model 907AF, see appendix B. Equipment interconnection drawings are referenced in the table. An acceptance test record (table 2-2) may be copied and used for a permanent record of a unit's test.

The following test equipment, or its equivalent, is required for the operational checkout.

Equipment	Manufacturer	Model
Spectrum Analyzer	Tektronix	492
Power Meter	HP	436A with 8484A Sensor, 30 dB Pad
Test Generator	Wavetek	182A
Frequency Counter	EIP	371/575/578
Xtal Detector	HP	423A
Dual Channel Scope	Tektronix	7603
50Ω Terminations	Tektronix	011-0049-01
Cables		50_{Ω} Coax
0 to +15Vdc Source	Datel	DVC-8500

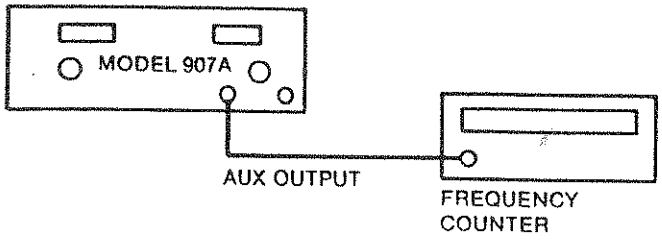


Figure 2-3. Frequency Measurement

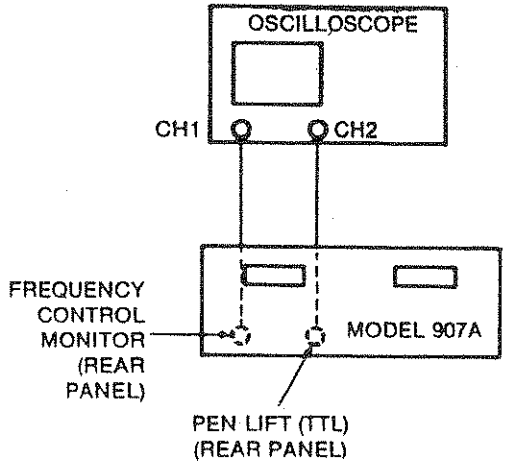


Figure 2-4. Sweep Monitoring Setup

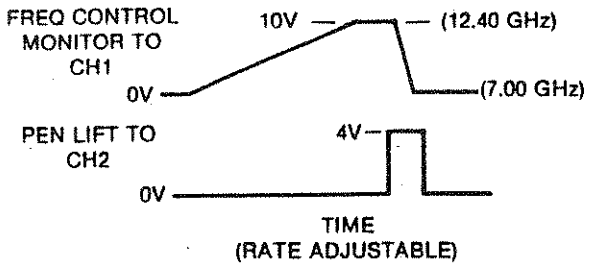


Figure 2-5. Sweep Mode Signals (One Cycle)

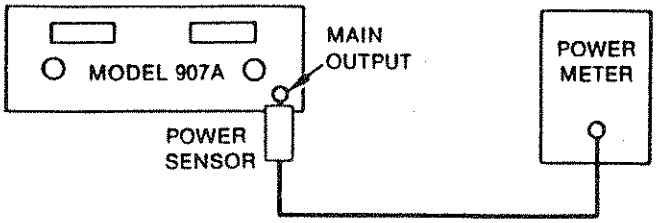


Figure 2-6. Output Level Measurement

Table 2-1. Checkout Procedure

Step	Test	Tester and Setup	Program	Desired Results
1	Primary Power	None	POWER: OFF	Verify correct fuse installed. Verify correct primary voltage selected
2			Connect to facility power source. POWER: ON	POWER ON LED is lit
3	Initial Setup		FREQ CONTROL: INT. OUTPUT LEVEL CONTROL: INT (Rear Panel Controls)	Front panel EXT FREQ CONTROL and EXT LEVEL CONTROL LEDs OFF
4			Frequency VERNIER: Centered on 0. Frequency knob: Full ccw	Display reads 7.00 GHz (±0.070 GHz)
5			Mode: CW	CW LED lit
6			dBm button: Pressed	dBm LED lit
7			Output level knob: Full cw	OUTPUT LEVEL display: (+1.0 ±0.3) dBm
8			RF output ON/OFF switch: ON. Allow 1 hour instrument warm-up	RF LED lit
9			RF output LEVELED switch: ON	LEVELED LED lit
10	Frequency Accuracy	Frequency counter: Connect to 907A AUX output (figure 2-3)	Frequency knob: From ccw to cw, then ccw.	Frequency display: 7.00 ± .04 GHz Counter: 7.00 GHz ± 70 MHz
11			Frequency knob: 8.00 GHz (on display)	Counter: 8.00 GHz ± 80 MHz
12			Frequency knob: 9.00 GHz (on display)	Counter: 9.00 GHz ± 90 MHz
13			Frequency knob: 10.00 GHz (on display)	Counter: 10.00 GHz ± 100 MHz

Table 2-1. Checkout Procedure (Continued)

Step	Test	Tester and Setup	Program	Desired Results
14			Frequency knob: cw	Frequency display: 12.4 ± .04 GHz Counter: 12.4 GHz ± 124 MHz
15	Sweep	Oscilloscope (Figure 2-4)	MODE: Sweep (CW, FM, PM Mode switches extended) RATE range: .02-.2, .2-2, then 2-20. RATE vernier: Full rotation for each RATE range.	Scope verifies nominal rate ranges. Sweep ramp and pen lift pulse as shown in figure 2-5.
16	Frequency vs Output Level	Power meter: Connect to 907A MAIN RF output (figure 2-6) Note: Account for power sensor error in order to reduce measurement errors.	MODE: CW Frequency knob: ccw. Output level knob: + 0.0 dBm (on display)	Power meter: (0 ± 1) dBm
17			Frequency knob: From 7 to 12.4 GHz (on display) in 0.1 GHz steps.	Power meter: Reading should deviate less than ± 1.0 dB.
18	Output Attenuation		Frequency knob: 9.00 GHz (on display). Output level knob: – 10 dBm (on display).	Power meter: (– 10 ± 2) dBm
19			Output level knob: – 20 dBm (on display)	Power meter: (– 20 ± 2) dBm
20			Output level knob: – 40 dBm (on display)	Power meter: (– 40 ± 2) dBm
21			Output level knob: – 60 dBm (on display)	Power meter. (– 60 ± 2) dBm
22	Unleveled Output		Output level knob: cw. LEVELED Button: Released	Power meter: Reading > + 3 dBm (typical). LEVEL LED: OFF

NOTE: Steps 18 through 21 have assured proper attenuator operation. Power measurements below – 60 dBm require methods beyond the scop of this checkout procedure.

23	CW Spectral Purity	Spectrum analyzer: Connect to MAIN output (figure 2-7)	Output level knob: + 0 dBm (on display). Frequency knob: ccw. MODE: CW	Spectrum Analyzer: Presence o fundamental at 7 GHz (nom) wi less than 15 kHz peak residual FM. Harmonics < – 30 dBc. Spurious signals are < – 55 dB CW LED lit.
24	Residual FM		Frequency knob: 9.00 GHz (on display)	Spectrum analyzer: Presence o fundmental at 9 GHz with less than 15 kHz peak residual FM: Harmonics < – 30 dBc. Spurious signals are < – 55 dB

Table 2-1. Checkout Procedure (Continued)

Step	Test	Tester and Setup	Program	Desired Results
25			Frequency knob: 10 GHz (on display)	Spectrum analyzer: Presence of fundamental at 10 GHz with less than 15 kHz peak residual FM. Harmonics < – 30 dBc. Spurious signals are < – 55 dBc.
26			Frequency knob: cw.	Spectrum analyzer: Presence of fundamental at 12.4 GHz with less than 15 kHz peak residual FM. Harmonics < – 30 dBc. Spurious signals are < – 55 dBc.
27	Spurious Output in SWEEP Mode.		MODE: Sweep (CW, FM, PM mode switches extended) RATE Range: .02 – .2 RATE Vernier: MIN	Spectrum analyzer: Spurious signals < – 55 dBc over 7 to 12.4 GHz.
28	Internal Frequency Modulation		Frequency knob: 9.00 GHz (on display). Output level knob: 0 dBm (on display). MODE: FM. (CW, PM, SWEEP mode switches extended). FM: INT. RATE range: 1K-10K. RATE vernier: MAX. INT FM DEV: MIN	Spectrum analyzer: < 100 kHz peak-to-peak deviation.

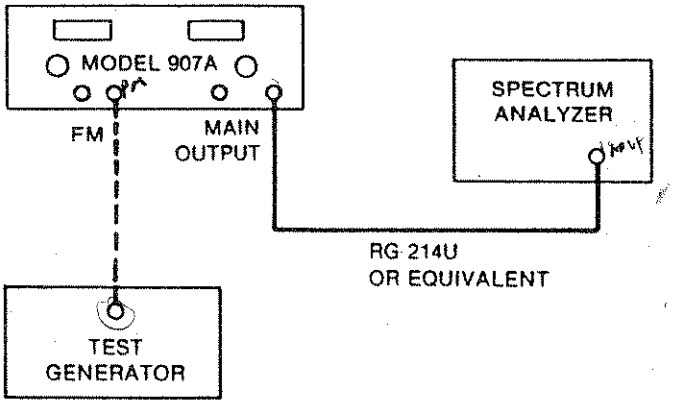


Figure 2-7. Spectrum Analyzer

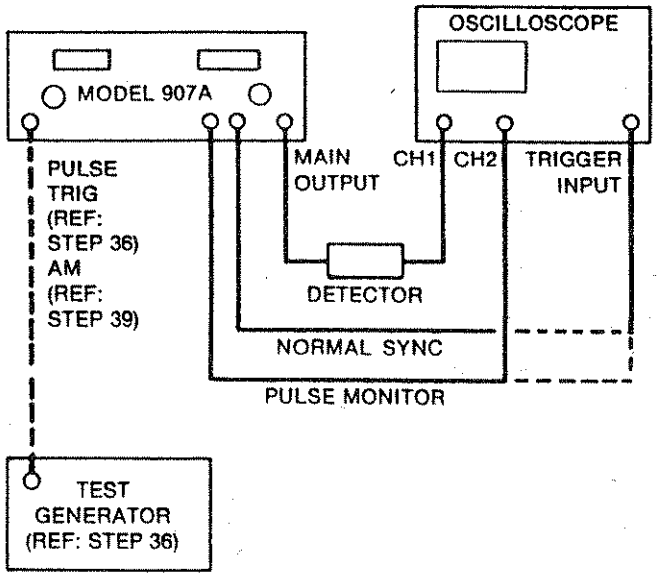


Figure 2-8. External AM Input

Table 2-1. Checkout Procedure (Continued)

Step	Test	Tester and Setup	Program	Desired Results
29			INT FM DEV: MAX	Spectrum analyzer: >5 MHz peak-to-peak deviation.
30	External FM Mode	Same as previous setup plus test generator: 10 kHz, 5 Vp-p sine wave (figure 2-7)	FM: EXT	Spectrum analyzer: >5 MHz peak-to-peak deviation.
31	Internal Pulse Mode	Xtal detector: At MAIN output. Oscilloscope: Channel 1 (50Ω) to detector output. Channel 2 to PULSE NORMAL. Trigger on Channel 2 input (figure 2-8).	MODE: PM (CW, FM, SWEEP mode switches extended). PULSE MODE: INT ⊓. RATE range: 1K-10K. RATE vernier: Centered (≈ 5 kHz). DELAY range: X1. DELAY vernier: Full ccw	Pulses on both channels should have comparable rise/fall times and a 50% ±3% duty cycle.
32		Trigger input to NORMAL SYNC (figure 2-8).	PULSE MODE: INT ⊓_. WIDTH range: X1. WIDTH vernier: Vary from full ccw to cw (0.2 to 10μs).	Channel 1: Pulse width varies from approximately 0.2μs to 10μs
33			WIDTH range: X10. WIDTH vernier: Vary from full ccw to cw (2 to 100μs)	Channel 1: Pulse width varies from approximately 2 to 100 μs
34			RATE range: 100-1K. RATE vernier: Centered (approximately 500 Hz). DELAY range: X1. DELAY vernier: Vary from full ccw to cw (3 to 100μs).	Channel 1: Pulse occurence varies with respect to scope trigger (approximately 3 to 100μs variance)
35			DELAY range: X10. DELAY vernier: Vary from full ccw to cw (30μs to 1ms).	Channel 1: Pulse occurence varies with respect to scope trigger (approximately 30μs to 1 ms)
36	External Pulse Mode	Same as previous setup plus test generator: 1 kHz, 10 Vp-p triangle connected to PULSE TRIG input. (figure 2-8)	PULSE MODE: EXT (+). WIDTH range: X10. WIDTH vernier: Full cw (100μs). DELAY range: X1. DELAY vernier: Full ccw (3μs). EXT TRIG LEVEL: Center knob	Channels 1 and 2: 100 μs pulse at 1 kHz rate
37			PULSE MODE: EXT (−)	
38	External Gate Mode	Reset test generator: 10 kHz, 10 Vp-p triangle	PULSE MODE: EXT GATE. EXT TRIG LEVEL: Vary from ccw to cw	Channels 1 and 2: Pulse whose width is relative to the EXT TRIG LEVEL setting

Table 2-1. Checkout Procedure (Continued)

Step	Test	Tester and Setup	Program	Desired Results
39	External AM Input	Reset test generator: 1 kHz, 2 Vp-p square wave. Connect to AM input (figure 2-8)	Output level knob: −27 dBm (on display)	Channel 1: Square wave with rise/fall times <35 μs.
40	External Frequency Control	DC source: Set for 0V. Connect to EXT FREQ CONTROL BNC. Frequency counter: Connect to AUX output (figure 2-9)	INT/EXT FREQ CONTROL: EXTERNAL. MODE: CW	EXT FREQ CONTROL LED: Lit. CW LED: Lit. FREQUENCY display: 7.00 ±0.04 GHz Counter: 7.00 GHz (±70 MHz)
41		Reset dc source: + 5V ±2 mVdc		FREQUENCY display: 12.4 ±0.4 GHz. Counter: 12.4 GHz (±124 MHz)
42	External Level Control	Reset dc source: 0V. Connect to EXT LEVEL CONTROL BNC (figure 2-10)	INT/EXT FREQ CONTROL: INT Frequency knob: 7.00 GHz (on display, nom). INT/EXT OUTPUT LEVEL CONTROL: EXT	EXT FREQ CONTROL LED: Out. EXT LEVEL CONTROL LED: Lit. OUTPUT LEVEL display: (+1.0 ±0.5) dBm
43		Reset dc source: + 2.00V		OUTPUT LEVEL display: (−19 ±0.5) dBm

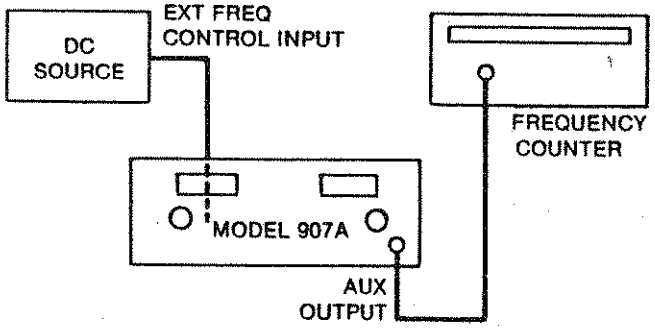


Figure 2-9. External Frequency Control

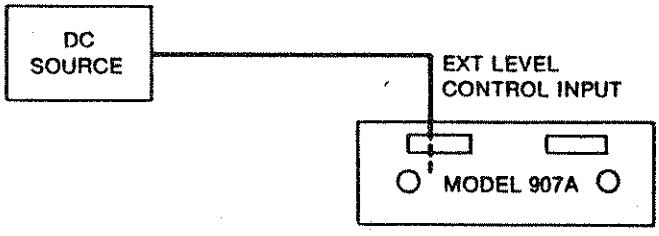


Figure 2-10. External Level Control

Table 2-2. Model 907A Acceptance Test Record. S/N _____

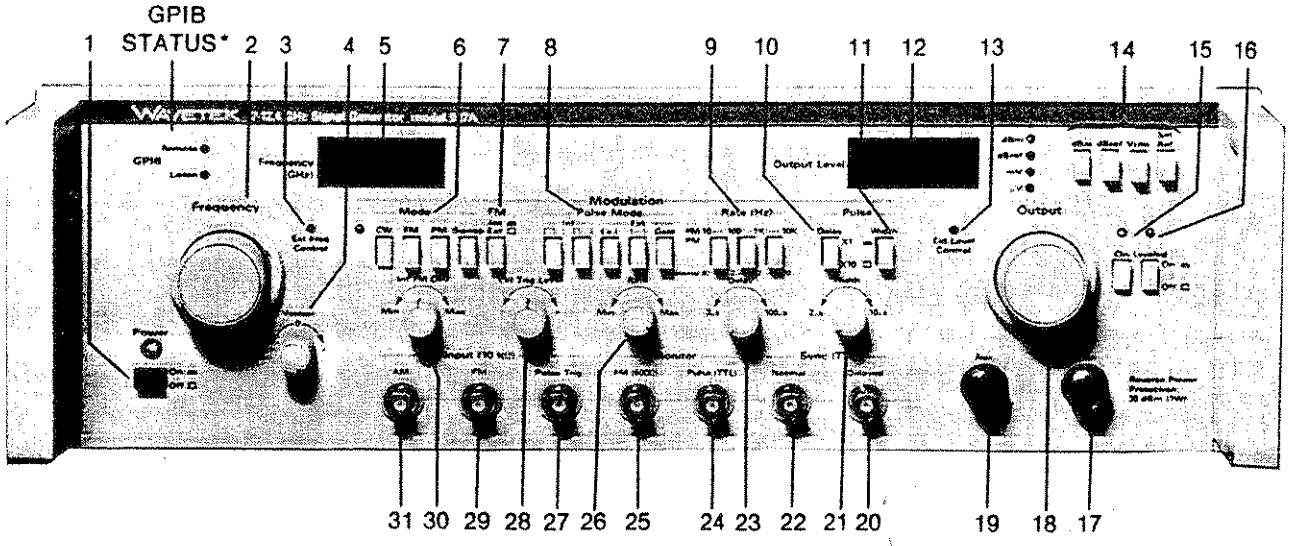
Step (Table 2-1)	Frequency Accuracy	Counter Reading	Acceptable (✓)
10	7.00 GHz (±70 MHz)	_____	( )
11	8.00 GHz (±80 MHz)	_____	( )
12	9.00 GHz (±90 MHz)	_____	( )
13	10.00 GHz (±100 MHz)	_____	( )
14	12.40 GHz (±124 MHz)	_____	( )
15	**Sweep**		( )
	Frequency vs Output Level	**Power Meter Reading**	
16	7 GHz: (0 ±1) dBm	_____	( )
17	7-to-12.4 GHz: (0 ±1) dBm	_____	( )
	Output Attenuation	**Power Meter Reading**	
18	(−10 ±2) dBm	_____	( )
19	(−20 ±2) dBm	_____	( )
20	(−40 ±2) dBm	_____	( )
21	(−60 ±2) dBm	_____	( )
	Unleveled Output	**Power Meter Reading**	
22	>+3 dBm (typical)	_____	( )
	CW Spectral Purity	**Analyzer Reading**	
23	7.00 GHz, <15 kHz peak residual FM, harmonics < −30 dBc	_____	( )
24	9.00 GHz, <15 kHz peak residual FM, harmonics < −30 dBc	_____	( )
25	10.00 GHz, <15 kHz peak residual FM, harmonics < −30 dBc	_____	( )
26	12.40 GHz <15 Hz peak residual FM, harmonics < −30 dBc	_____	( )
	Spurious Output	**Analyzer Reading**	
27	7 to 12.4 GHz, spurious < −55 dBc	_____	( )
	Internal Frequency Modulation	**Analyzer Reading**	
28	Minimum FM deviation <100 kHz p-p	_____	( )
29	Maximum FM deviation >5 MHz p-p	_____	( )

Table 2-2. Model 907A Acceptance Test Record (Continued) S/N _____

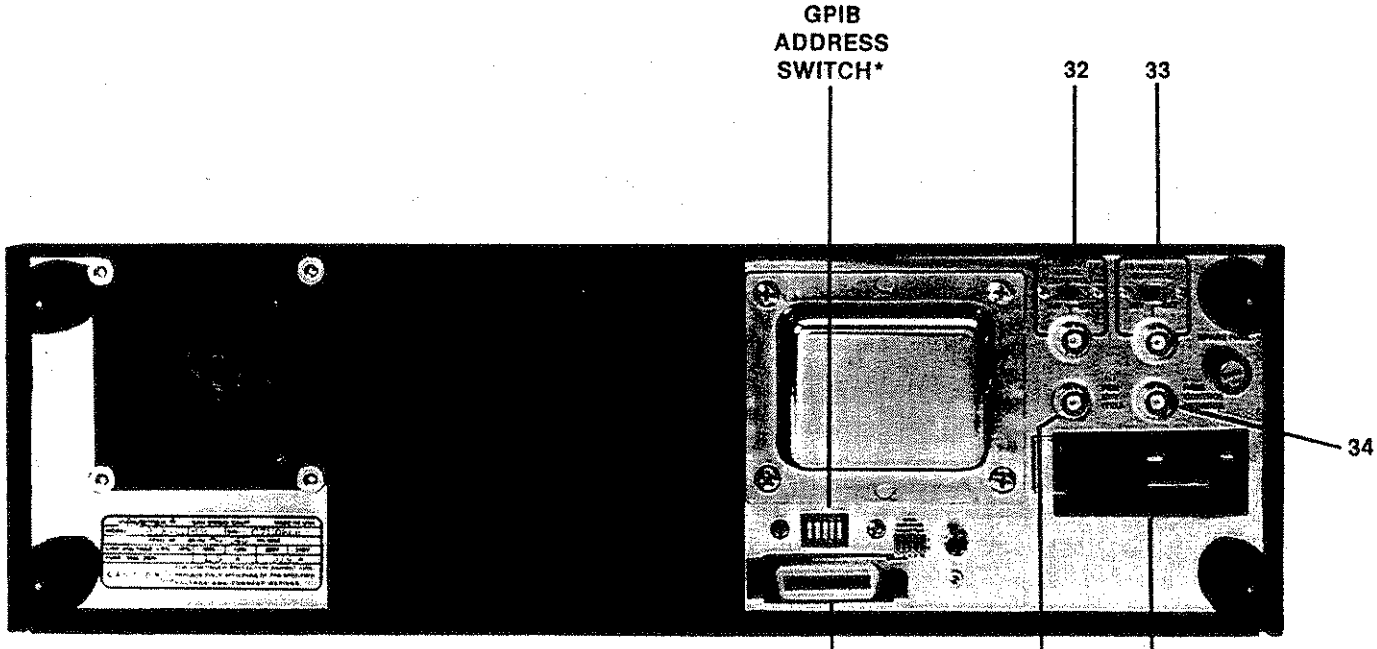
Step (Table 2-1)	External FM Mode	Analyzer Reading	Acceptable (✓)
30	5 Vp-p gives >5 MHz p-p dev.	_____	( )
	Internal Pulse Mode		
31-35	Internal Pulse		( )
	External Pulse Mode		
36	Ext (+)		( )
37	Ext (−)		( )
38	Ext Gate		( )
	Ext AM Input	**Oscilloscope Reading**	
39	Rise/Fall Times <35 μs	_____	( )
	Ext Frequency Control	**Counter Reading**	
40	0V: 7.00 GHz (±70 MHz)	_____	( )
41	+ 5V: 12.4 GHz (±124 MHz)	_____	( )
	Ext Level Control	**Display Reading**	
42	0V: (1 ±0.5) dBm	_____	( )
43	+ 2V: (−19 ±0.5) dBm	_____	( )

Comments

Technician _____ **Date** _____



FRONT PANEL



*GPIB OPTION.
REFER TO APPENDIX A

REAR PANEL

Figure 3-1. Controls and Connectors

SECTION 3
OPERATION

3.1 CONTROLS AND CONNECTORS

Controls and Connectors are illustrated in figure 3-1. The following descriptions are keyed to this figure.

1 **POWER Button and Indicator** — Turns line power on and off. Indicator is lit when power is on.

2 **FREQUENCY Control Knob** — A ten turn knob with locking ring to continuously adjust RF frequency **16 18** and readout **5** from 7 to 12.4 GHz.

3 **EXT FREQ CONTROL Indicator** — Lights when frequency is being controlled externally (remotely) rather than by front panel control.

4 **Frequency VERNIER Knob** — An adjustment (± 4 MHz typical) to the output RF frequency **16 18** and displayed value **5.**

5 **FREQUENCY (GHz) Readout** — A 3½ digit LCD display showing in GHz the frequency setting. Decimal point is fixed with two digits to its right (10 MHz resolution).

6 **MODE Buttons** — Three buttons set the mode to continuous wave output (CW), frequency modulated output (FM), pulse modulation output (PM) or swept output (SWEEP). Submodes to FM and PM are further selected by **7** and **8** respectively. The CW mode LED indicator lights when CW is selected. The operating mode can be any combination of AM, FM, PM and sweep; however, CW mode selection overrides all other modes. Buttons are press-to-hold, press-to-release. Should all three buttons be released, the mode will be CW (but indicator will not be lit).

CW — Continuous RF output; frequency and level are adjustable.

FM — Internal or external signal frequency modulates the RF output. Rate **9, 26** and deviation **30** are adjustable for internal FM **7**.

PM — A selectable internal or external signal pulse **8** modulates RF output.

SWEEP — Repeated 7 to 12.4 GHz frequency sweep at rate selected by **9** and **26**.

7 **FM (INT/EXT)** — Submode selector of FM **6**. When pressed, modulation source is the front panel controlled internal sawtooth generator. When the button is extended, the modulator source is the externally applied signal at **29**. (Ref: Figure 3-2.)

8 **PULSE MODE — Submodes of PM 6.**

INT ⊓ — Pulsed RF output at 50% duty cycle controlled by the internal pulse generator whose rate is set by **9** and **26**. (Ref: Figure 3-2.)

INT ⊓⊔ — Pulsed RF output controlled by the internal generator whose rate is set by **9** and **26** and whose width is set by **11** and **21**. Delay relative to NORMAL SYNC **22** is adjusted by **10** and **23**. (Ref: Figure 3-2.)

EXT [+] — Pulsed RF output controlled by and external source at **27**. Pulse is triggered on when the external signal crosses from below to above the level determined by **28**. Width and delay are adjustable by **11, 21, 10** and **23**.

EXT [−] — Same as EXT [+] except the pulse is triggered on when the external signal crosses from above to below the level determined by **28**.

EXT GATE — The main RF output **17** is on while the external signal applied to pulse trigger input **27** exceeds threshold adjusted by the external trigger level **28**. Other the main RF output is off (isolation state).

9 **RATE (Hz) Buttons** — Selects the frequency range of the internal modulation generator: 10 to 100Hz, 100Hz to 1kHz, or 1 to 10kHz for all

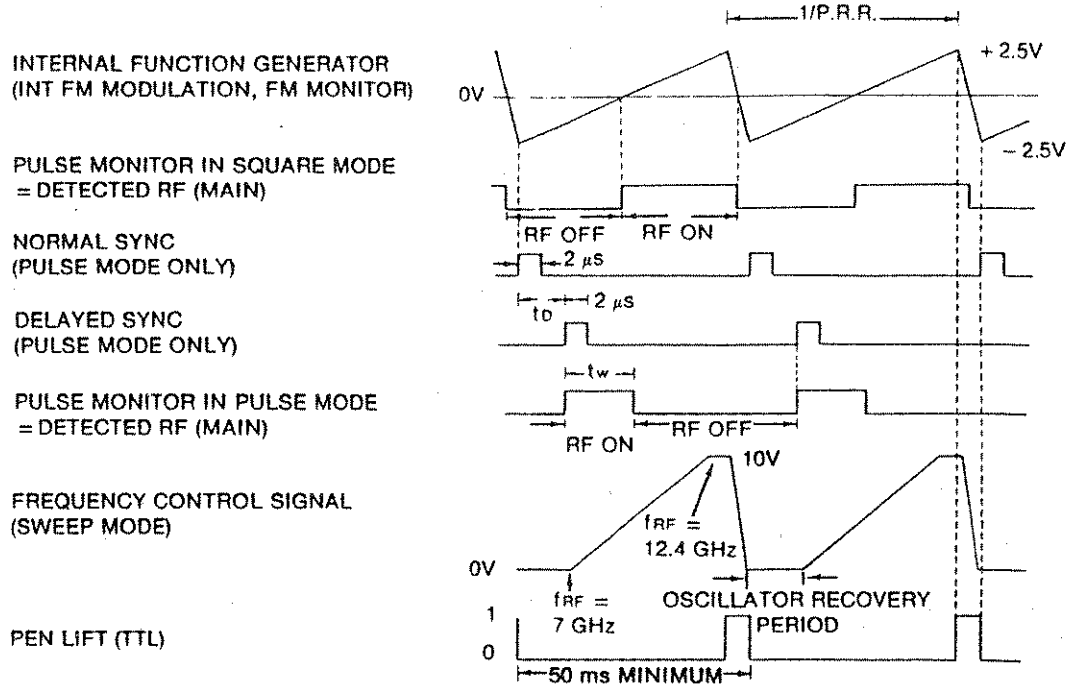


Figure 3-2. Pulse Mode/Sweep Timing Diagram

modulation modes except sweep, which has rates of 0.02 to 0.2Hz, 0.2Hz and 2 to 20Hz. Frequency within a range is set by **26**. In terms of RF output: When in internal FM mode, these buttons set the range for FM deviation rate. When in internal pulse modes, these buttons set the range for the repetition rate of pulsed RF. When in sweep mode these buttons set the sweep rate range.

10 PULSE DELAY Button — Selects the delay multiplier of **23**: X1 or X10. Delay control delays the occurrence of the pulsed RF output relative to NORMAL SYNC **22**.

11 PULSE WIDTH Button — Selects the pulse width multiplier of **21**: X1 or X10. Width control varies the width of the internally or externally triggered pulse, which in turn varies the width of the pulsed RF output.

12 OUTPUT LEVEL Readout — A 3½ digit display of output level setting. Unit of measure is dB, mV or µV as indicated by LED indicators. Actual output level and readout correspond when output is 50Ω loaded and output RF switch **15** is ON.

13 EXT LEVEL CONTROL Indicator — Lights when the level is being controlled externally **32**.

14 Output Level Display Mode Buttons —

Vrms/dBm Buttons — Alternate action. When dBm is pressed, the RF output level is displayed in decibels referenced to 1 milliwatt. When Vrms is pressed the RF output level is displayed in volts(rms).

dBref/SET REF Buttons — The decibel reference (dBref) mode, when selected, allows any level to become the reference level (rather than 0 dBm, a 1 milliwatt reference). When SET REF is pressed, the present output level becomes the reference level; readout changes to +0.0.

15 OUTPUT RF OFF/ON Button and Indicator —When button is depressed RF oscillator is enabled. LED indicates oscillator RF power. If LED indicator is lit, RF is output at **17** and **19**; when button is extended, RF oscillator is off and no RF output is generated.

16 RF OUTPUT LEVELED ON/OFF Button and Indicator — When button is depressed, LED is lit and output is leveled to accuracies specified (ref: paragraph 1.2.2); e.g., ±1.0 dB at 0 dBm setting. When button is extended output is unleveled; actual output level is greater than 2 dB above indicated level; e.g., at +1 dBm setting,

actual output is greater than + 3 dBm. Note that the LEVELED LED will not light unless the RF ON LED is lit.

17 **MAIN RF OUTPUT "N" Connector** — The primary output of RF signal; affected by both frequency and level controls.

18 **LEVEL Control Knob** — A ten turn knob with locking ring to continuously adjust RF output level **17** and readout **12** from + 0 to − 127 dBm. Actual output level and readout correspond (within stated tolerances) when the output is 50Ω loaded.

19 **AUX RF OUTPUT "N" Connector** — The source of RF oscillator signal without attenuation. Signal is at the same frequency as the main RF output **17** and cannot be pulsed. Output level is greater than − 10 dBm.

20 **DELAYED SYNC (TTL) BNC Connector** —Positive TTL level pulse synchronous with the RF pulse from the main RF output **17**. (Ref: Table 3-1.)

21 **WIDTH Vernier Knob**—Varies the pulse width for the internally or externally triggered pulse within the range set by **11**. The pulse width controls vary the duty cycle of the pulsed RF output **17**. Overall width range is 0.2 to 100 μs.

22 **NORMAL SYNC (TTL) BNC Connector** —Positive TTL level pulse synchronous with the pulse repetition rate and used as primary reference when delaying the pulsed RF output. (Ref: Table 3-1.)

23 **DELAY Vernier Knob** — Varies the delay of the pulsed RF output **17** within the range set by **10**. Overall delay range is 3μs to 1ms. Has no effect in external gate and square pulse modes.

24 **PULSE MONITOR (TTL) BNC Connector** —Positive TTL level signal synchronous with the modulator pulse with selected delay, modulator pulse repetition rate and width. (Ref: Table 3-1.)

25 **FM MONITOR (600Ω) BNC Connector** — Buffered FM modulator signal from internal or external source. Source impedance is 600Ω. (Ref: Table 3-1.)

26 **RATE Vernier Knob** — Sets frequency of the internal ramp generator within a range set by **9**. In terms of RF output: When in internal FM mode, this control sets the rate of FM deviation. When in internal pulse modes, this control sets the repetition rate of pulsed RF. When in sweep mode this control sets the sweep rate. Overall rate range is 10Hz to 10kHz except for sweep rate, which is 0.02 to 20 Hz.

Table 3-1. Sync, Pen Lift and Monitor Outputs for Individual Modes

Mode	Sync		Pen Lift	Monitor		
	Normal	Delayed		FM	Pulse	Freq Cntl
None[1]	No	No	No	No	No	Yes
CW	No	No	No	No	No	Yes
FM-INT	No	No	No	Yes[2]	No	Yes
FM-EXT	No	No	No	Yes	No	Yes
PM-INT ⊓⊔	No	No	Yes[3]	No	Yes[2]	Yes
PM-INT ⊓	Yes[2]	Yes[2]	Yes[3]	No	Yes[2]	Yes
PM-EXT(+/−)	Yes[4]	Yes[2]	Yes[3]	No	Yes	Yes
PM-EXT GATE	No	No	Yes[3]	No	Yes	Yes
SWEEP	No	No	Yes	No	No	Yes[2]

NOTES:
[1]All mode switches are extended.
[2]Ref: Figure 3-2.
[3]Signal is present, but not synchronous with MAIN (RF) OUTPUT pulse.
[4]Ref: Figure 3-3.

27 PULSE TRIG INPUT (10KΩ) BNC Connector —Receives ± 10V (maximum) signal to trigger or gate pulsed RF output according to pulse mode **8**. The external trigger level control **28** determines what level of input will trigger or gate RF output. Pulse width and delay are set by **21** and **23** respectively.

28 EXT TRIG LEVEL Knob — Determines the threshold voltage of the input waveform **27** which will trigger the delay and width or external gate circuitry(± 10V range). See Figure 3-4.

29 FM INPUT (10KΩ) BNC Connector — Receives a signal to frequency modulate the RF output signal **17 19** up to 5MHz peak to peak deviation. Input frequency determines deviation rate. Sensitivity is nominally 1 MHz/V.

30 INT FM DEV Knob — Varies the amplitude of the internal ramp waveform, thereby varying the frequency deviation above and below the center frequency of the RF output signal. Maximum RF output deviation is >5 MHz peak to peak.

31 AM INPUT (10KΩ BNC Connector) — Receives a ± 2V peak range of 0 to 10kHz signal to amplitude modulate the RF output signal at 27.2 dB/V (nominal).

32 OUTPUT LEVEL CONTROL INT/EXT Slide Switch and BNC Connector — Switch selects front panel control **18** or external voltage input at this rear panel BNC to control output level of RF signal **17** and readout **12**. Zero to +13.6V covers the +1 to −135 dBm range (−10 dB/V). Switch position indicated by **13**.

33 FREQ CONTROL INT/EXT Slide Switch and BNC Connector—Switch selects the front panel control **2** or external voltage input at this rear panel BNC to control RF frequency output **17, 19** and readout **3**. Zero to +5V covers the 7 to 12.4 GHz range. Switch position indicated by **3**.

34 FREQ CONTROL MONITOR BNC Connector — Output of 0 to +10V derived from the RF frequency control signal regardless of the source. Output impedance is 600Ω.

35 Power Receptacle/Fuse Holder — Fuse compartment also houses input voltage selection card whose position, as well as the fuse value, must be compatible with the input voltage (ref: paragraph 2.2.1). To ensure no applied power while changing fuse or selector card, the sliding plastic cover for fuse access blocks the power cord receptacle during fuse or card access.

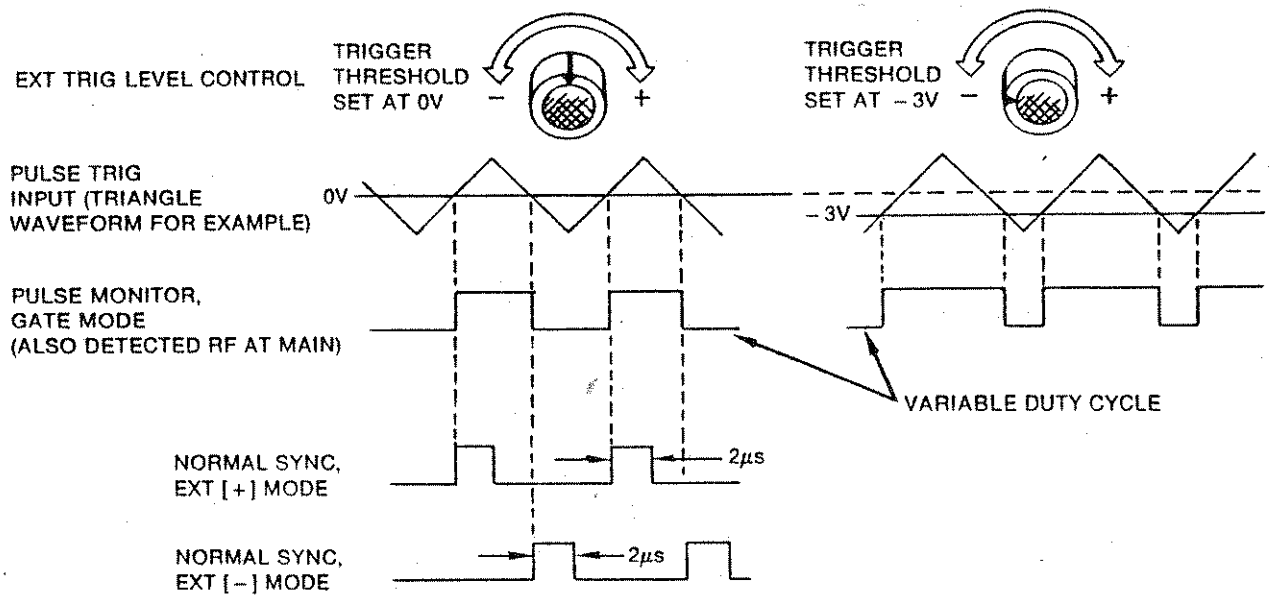


Figure 3-3. Effect of External Trigger Level Control

36 **PEN LIFT (TTL) BNC Connector** — Output of 0 to +4V driven by the internal modulation generator. Polarity is selected by user. (P60 on Mainboard PCA.)

3.2 OPERATION

The following operation is discussed in terms of modes (CW, FM, PM and sweep), external trigger, and gated pulse, external AM and FM inputs and external frequency and level controls along with the related controls and connections.

NOTE

In FM, PM and sweep modes, the RF output may be amplitude modulated by providing an external signal source at the AM INPUT connector.

The FM, PM and sweep modes can be selected independently or simultaneously. The CW mode is exclusive and, should other mode buttons be pressed, the CW mode has precedence over the other modes. AM input has no effect in CW mode.

It is important to observe proper signal termination when using the Model 907A. The input and output impedances of the generator are listed below:

Connector	Impedance
MAIN	50Ω
AUX	50Ω termination recommended
FM INPUT	10kΩ
AM INPUT	10kΩ
PULSE TRIG (INPUT)	10kΩ
FM MONITOR	600Ω
PULSE MONITOR	TTL
NORMAL SYNC (OUTPUT)	TTL
DELAY SYNC (OUTPUT)	TTL
EXT FREQ CONTROL (INPUT)	10kΩ
EXT OUTPUT LEVEL CONTROL	10 kΩ
FREQ CONTROL MONITOR	600Ω
PEN LIFT (OUTPUT)	TTL

TTL outputs can drive up to 20 TTL loads. The TTL low level is between 0V and 0.4V and high level is between 2.4V and 5V.

The MONITOR and SYNC outputs may be used as needed. Signal characteristics are discussed in paragraph 3.1.

3.2.1 CW Operation

In the CW mode, the RF output is unmodulated (neither AM or FM). The following controls, as discussed in paragraph 3.1 and figure 3-1, affects CW operation.

Control or Connector	Key
MODE set to CW	**6**
FREQUENCY	**2, 3, 4, 5, 33, 34**
OUTPUT	**12, 13, 14, 15, 16 17, 18, 19, 32, 36**

3.2.2 FM Operation

NOTE

Be aware that FM, PM and sweep, pulse operation and amplitude modulation can occur simultaneously. Ensure that the MODE buttons are extended for undesired modes and that no signal is applied to the AM INPUT connector if AM is not desired.

In the FM mode, the RF output is frequency modulated by an internal rate generator or an external FM signal source.

The following controls, as discussed in paragraph 3.1, affect FM operation.

Internal FM operation: All controls as in CW mode (except MODE is set to FM) plus these additional controls affect internal FM operation.

Control or Connector	Key
MODE set to FM	**6**
FM set to INT	**7**
RATE	**9, 26**
INT FM DEV	**28**
FM MONITOR	**25**

External FM operation: All controls as in CW mode plus these additional controls affect external FM operation.

MODE set to FM	**6**
FM set to EXT	**7**
FM INPUT (up to ±2.5 volt signal; 1 MHz change per volt input)	**29**
FM MONITOR	**25**

3.2.3 Pulse Operation

NOTE

Be aware that FM, PM and sweep operation, pulse operation and amplitude modulation can occur simultaneously. Ensure that the MODE buttons are extended for undesired modes and that no signal is applied to the AM INPUT connector if AM is not desired.

In the pulse mode, the RF output is modulated between two output levels: the level control setting (pulse "on" time) and > −80 dB from the level control setting (pulse "off" time).

The following controls, plus the controls used in the CW mode, affect ulse modulation. (Controls are discussed in paragraph 3.1.)

Square wave pulse modulation:

Control or Connector	Key
MODE set to PULSE	**6**
INT set to ⊓	**8**
RATE	**9, 26**
PULSE MONITOR	**24**

Internal pulse modulation:

MODE set to PULSE	**6**
INT set to ⊓⊔	**8**
RATE	**9, 26**
DELAY	**10, 23**
WIDTH	**11, 21**
SYNC	**20, 22**
PULSE MONITOR	**24**

External pulse modulation:

MODE set to PULSE	**6**
PULSE MODE set to EXT (+) or (−)	**8**
DELAY	**10, 23**
WIDTH	**11, 21**
EXT TRIG LEVEL	**28**
PULSE TRIG INPUT	**27**
SYNC	**20, 22**
PULSE MONITOR	**24**

External gate operation:

MODE set to PULSE	**6**
PULSE MODE set to EXT GATE	**8**
EXT TRIG LEVEL	**28**
PULSE TRIG INPUT	**27**
PULSE MONITOR	**24**

3.2.4 Sweep Operation

NOTE

Be aware that FM, PM and sweep operation and amplitude modulation can occur simultaneously. Ensure that the MODE buttons are extended for undesired modes and that no signal is applied to the AM INPUT connector if AM is not desired.

In sweep mode, the internal ramp generator varies the RF frequency from 7 to 12.4 GHz repeatedly. The sweep rate is selectable to a maximum of 15 Hz. The controls listed below affect sweep operation (the controls are discussed in paragraph 3.1 and shown in figure 3-1).

Control or Connector	Key
MODE set to SWEEP	**6**
RATE	**9, 26**
OUTPUT	**12, 13, 14, 15, 16 17, 18, 19, 32, 36**

3.2.5 External Output Level and Frequency Control

Frequency and output level can be remote controlled by providing analog inputs to the EXT FREQ CONTROL BNC **33** and EXT OUTPUT LEVEL CONTROL **32** on the rear panel. (GPIB Option: These inputs are disabled when instrument is under GPIB control.)

3.2.6 GPIB Interface Option

The optional GPIB interface allows the 907A to be programmed remotely by an external controller. Operation of the 907A on the GPIB bus is described in appendix A.

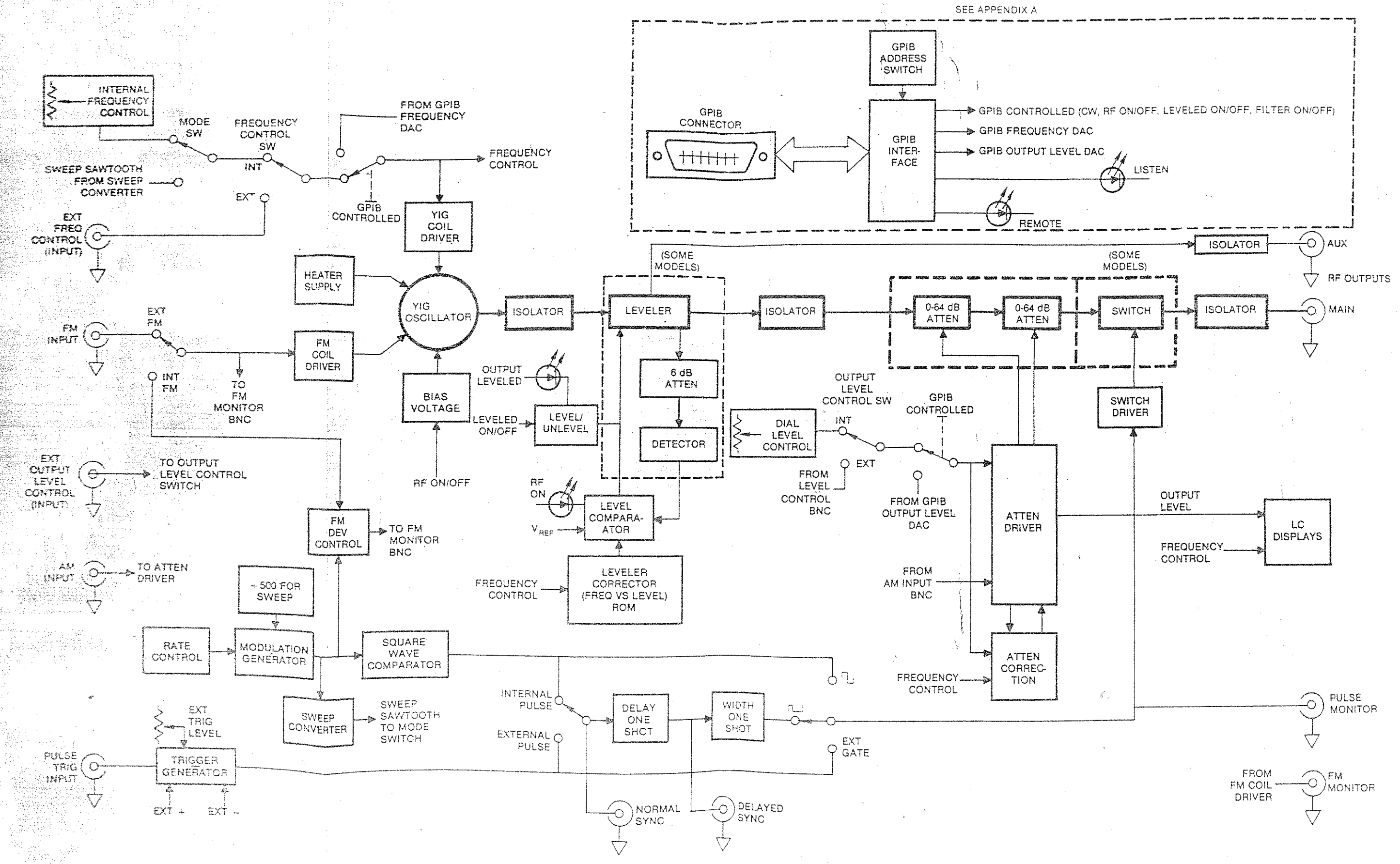


Figure 4-1. Simplified Block Diagram

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