INSTRUCTION MANUAL

MODEL 960 SERIES
MICRO SWEEP
1 TO 18.0 GHz
MICROWAVE GENERATORS

WAVETEK

WAVETEK SAN DIEGO, INC.

9045 Balboa Ave., San Diego, CA 92123

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9045 Balboa Ave., San Diego, CA 92123
P. O. Box 85265, San Diego, CA 92138
Tel 619/279-2200 TWX 910/335-2007

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WARRANTY

Wavetek warrants that all products manufactured by Wavetek conform to published Wavetek specifications and are free from defects in materials and workmanship for a period of one (1) year from the date of delivery when used under normal operating conditions and within the service conditions for which they were furnished.

The obligation of Wavetek arising from a Warranty claim shall be limited to repairing, or at its option, replacing without charge, any product which in Wavetek's sole opinion proves to be defective within the scope of the Warranty. In the event Wavetek is not able to modify, repair or replace non-conforming defective parts or components to a condition as warrantied within a reasonable time after receipt thereof, Buyers shall be credited for their value at the original purchase price.

Wavetek must be notified in writing of the defect or nonconformity within the Warranty period and the affected product returned to Wavetek's factory or to an authorized service center within (30) days after discovery of such defect or nonconformity.

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Exclusion of Other Warranties

The Warranty described above is Buyer's sole and exclusive remedy and no other warranty, whether written or oral, is expressed or implied. Wavetek specifically disclaims the implied warranties of merchantability and fitness for a particular purpose. No statement, representation, agreement, or understanding, oral or written, made by an agent, distributor, representative, or employee of Wavetek, which is not contained in the foregoing Warranty will be binding upon Wavetek, unless made in writing and executed by an authorized Wavetek employee. **Under no circumstances shall Wavetek be liable for any direct, indirect, special, incidental, or consequential damages, expenses, losses or delays (including loss of profits) based on contract, tort, or any other legal theory.**

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 makes it ordinarily nonhazardous, extremely close and prolonged proximity of an eye to the RF output could cause injury.

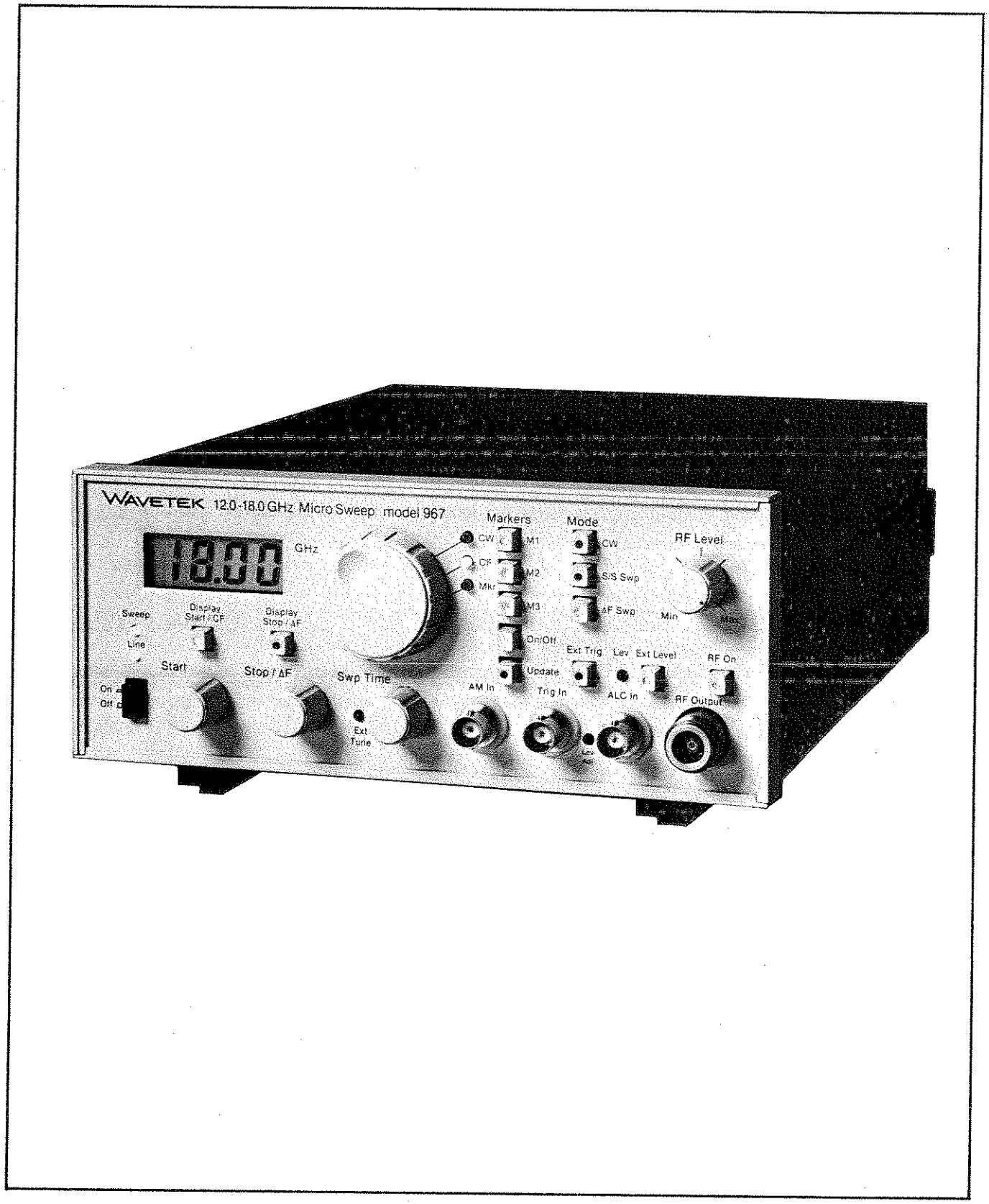
BEFORE PLUGGING IN the instrument, comply with installation instructions.

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.



Series 960 Micro Sweep

SECTION 1
GENERAL DESCRIPTION

1.1 INTRODUCTION

The 960 Micro Sweep series consist of four compact, lightweight microwave sweep generators that collectively cover the 1 to 18 GHz frequency range. These generators feature three operating modes (Start/Stop Sweep, ΔF Sweep, and CW) with three independently settable frequency markers. Frequency is displayed to 10 MHz resolution on a LCD display.

Frequency can be swept using either of two sweep modes (Start/Stop Sweep and ΔF Sweep). In Start/Stop Sweep, both the start and stop frequencies can be independently set; the Micro Sweep may be swept up or down in frequency. In ΔF Sweep, the center frequency and total frequency deviation each can be controlled; ΔF Sweep sweeps symmetrically upward only. For both sweep modes, the maximum sweep width is 100% of a Micro Sweep's frequency band, while the minimum sweep width is approximately 1%. Both sweep can be auto-triggered (continuous sweep) or triggered which allows the sweep to be started by an external signal. Furthermore, the frequency can be remotely controlled (External Tune) or frequency modulated (FM).

Three independently settable frequency markers can be used in the two sweep modes, CW, and external frequency tuning. These markers may be RF PIP, Z-Axis, or both. Internal switches select the type of marker. Plus, the polarity of the Z-Axis (Intensity markers) output can be set, using internal switches, for either positive or negative intensity control of an oscilloscope trace. In addition, marker intensity or PIP depth also can be set.

Output power is continuously variable. Maximum power is greater than +12 dBm, unleveled, or +10 dBm internally leveled. RF level control range is greater than 25 dB, unleveled, and a nominal 7dB when leveled. An optional internal leveler (Option 001) maintains the output level within ±1.0 dBm or better across the Micro Sweep's frequency band. The RF output also may be leveled using an external coupler and diode detector. The output can be amplitude modulated (AM) using an external signal.

1.2 SPECIFICATIONS

1.2.1 Frequency Characteristics

Frequency Range

The frequency ranges of the Model 960 Series Micro Sweeps are as follows:

Model 962	1.0 — 4.0 GHz
Model 964	3.7 — 8.4 GHz
Model 965	7.0 — 12.4 GHz
Model 967	12.0 — 18.0 GHz

Frequency Accuracy

When operated at 25°C ±10% and maximum RF output, the absolute frequency accuracy of the Model 960 Series Micro Sweep is better than ±1% (0.5% typical) for CW, ±1% (typical) for Markers and Center Frequency, and ±2% (typical) for Start, Stop, and ΔF.

Display Resolution

The front panel display resolution is 10 MHz.

Frequency Stability

The frequency stability (typical) of the Model 960 Series is measured after 1 hour warm-up in a constant environment. Other conditions apply as indicated.

With Temperature	0.007% per °C (0 to +50°C).
With Line Voltage	0.001% with 10% line voltage change.
With Time: Short Term	0.004% over 5 minutes (after 1 hr. warm up and 15 minutes following any frequency change).
With Time: Long Term	0.01% over 1 hr. (after 1 hr. warm up and 15 min. following any frequency change).
With Load (midband 3:1 VSWR)	0.1%.

Spectral Purity

	Model			
	962	964	965	967
Residual FM Peak (50 Hz to 15 kHz post-detection bandwidth)	8 kHz	15 kHz	20 kHz	25 kHz
Spurious	– 55 dBc	– 55 dBc	– 55 dBc	– 55 dBc
Harmonics (maximum)	– 12 dBc*	– 20 dBc	– 20 dBc	– 20 dBc

* For output levels less than – 10 dBm, the harmonic specification is – 10 dBc.

Frequency Control

Manual Tuning: A ten turn control knob sets the CW frequency, marker frequencies, and Center Frequency (CF in ΔF Swp). Two single turn control knobs set the Start, Stop, and ΔF frequencies.

External Tune: 0 to + 10V controls the Micro Sweep for the full tuning range; Swp Time control must be in the Ext Tune position for external frequency tuning.

1.2.2 Operating Modes

Start/Stop Sweep: Sweeps from the frequency set by the Start control to the frequency set by the Stop/ΔF control. Both frequencies are continuously adjustable over full range. Pressing the front panel S/S Swp pushbutton selects the Start/Stop sweep mode. Pushbuttons below the LCD readout select the frequency displayed. Minimum practical sweep width is approximately 1 % of band. Downward sweep is permitted but does not provide markers.

ΔF Sweep: Sweeps symmetrically upward, centered on the frequency (CF) set by the main tuning knob. Pressing front panel ΔF Swp pushbutton selects the ΔF sweep mode. Sweep width is set by using the Stop/ΔF sweep control, and the center frequency is set with the main tuning knob. Pushbuttons below the LCD readout select the frequency displayed. Width is adjustable from 100% to less than 1 % of the band. Sweeping beyond the frequency limits of the Micro Sweep is not permitted.

CW Operation: Single frequency RF output is controlled by the main tuning knob. Pressing front panel CW mode pushbutton selects the CW mode. An illuminated LED near the main tuning knob indicates when the knob is functioning as CW, Center Frequency, or marker frequency control.

1.2.3 Sweep Capability

Sweep Modes

The two sweep modes (Start/Stop and ΔF Swp) are described in paragraph 1.2.2.

Sweep Time Continuously adjustable from 0.02 to 20 seconds, nominal, per sweep.

Sweep Out/Ext Tune In

Internal Sweep — Sweep output is 0 to + 10V direct-coupled, modified sawtooth waveform regardless of sweep width.

CW — Sweep output is linearly proportional to frequency with 0V (lowest frequency) to + 10V (highest frequency), nominal, for full Micro Sweep bandwidth.

Frequency Markers

Three constant width markers, independently adjustable over the full frequency band of the Micro Sweep, are available for all sweep functions (Start/Stop, ΔF, and Remote) plus CW. Markers are only produced when the frequency is swept from low to high frequency.

Intensity Marker: A rectangular pulse provides a marker signal for the Z-axis input to oscilloscope. Pulse polarity is factory set for a negative-going pulse, but may be changed to a positive-going pulse via an internal switch (see paragraph 2.2.3 and figure 3-4). Retrace blanking signal will be of the opposite polarity. A front panel trim adjustment permits intensity adjustment.

Amplitude (RF PIP) Marker: The RF PIP marker is generated by momentarily reducing the RF output. (Factory set position enables this type of marker.) The RF PIP maker can be disabled with an internal switch (see paragraph 2.2.3). A front panel trim adjustment permits PIP depth adjustment.

Operation: Marker 1, Marker 2, and Marker 3 are set in any order by first pressing the pushbutton of the desired marker and displaying its frequency on the LCD readout; this activates the marker to accept other commands. The marker being displayed and operated on is identified by a flashing indicator. Markers which are off will blink with a short duty cycle, and markers which are on will blink with a long duty cycle. The marker is then toggled on or off using the On/Off pushbutton. The marker frequency is changed by pressing the Update pushbutton to "on" and then adjusting the main turning knob.

Resolution: Each marker may be set to a digitized resolution of 0.1% of the Micro Sweeps bandwidth. Display resolution is 10 MHz.

Blanking

During retrace, a +5V, nominal, direct coupled rectangular pulse provides the Z-axis input to the oscilloscope. Polarity may be changed to negative by changing an internal switch (see paragraph 2.2.4 and figure 3-4). RF blanking is not provided.

Sweep Trigger

Auto-Trigger: Sweep is automatically triggered on a continuous basis.

External Trigger: A single sweep is triggered by a signal at the front panel Trig In BNC. Pressing the Ext Trig pushbutton selects this mode as indicated by an illuminated Ext Trig pushbutton. The sweep is triggered by the falling edge (high or low) of a TTL signal or a switch contact closure to ground. A double press of the pushbutton will manually trigger a single sweep at slower sweep rates; there will be a brief delay before the sweep begins.

1.2.4 External Modulation

AM

Depth	0 to 25 dB min. (30 dB typical) for a 0 to +10V input.
Bandwidth	50 kHz typical 3dB bandwidth, dc coupled.
Input Impedance	10 kΩ nominal.

FM

Deviation	±5MHz min. deviation for ±4V input.
Bandwidth	50 kHz typical, 3dB bandwidth, dc coupled.
Input Impedance	10kΩ nominal.

1.2.5 Output Characteristics

(See table 1-1.)

Table 1-1. Output Characteristics

	Model			
	962	964	965	967
Output Power				
Unleveled (without internal leveling option 001)	+12 dBm	+12 dBm	+12 dBm	+12 dBm
Leveled (via internal leveling option 001)	+10 dBm	+10 dBm	+10 dBm	+10 dBm
Unleveled (with internal leveling option 001 installed	+11 dBm	+11 dBm	+11 dBm	+11 dBm
RF Level Control Range				
Unleveled Operation		25 dB minimum, 30 dB typical.		
Leveled Operation		7 dB nominal.		
RF Leveling				
Internal Option		Flat ±1.0 dB, maximum.		
External Leveling (at maximum output using HP 8472A negative polarity detector and 16 dB coupler)		Flat ±0.1 dB maximum, excluding coupler/detector variations.		
Input Sensitivity		−50 dB/mV nominal, gain adjustment provided at front panel.		
Input Impedance		1kΩ nominal.		
Output Impedance		50Ωnominal.		
VSWR (with internal leveling option)	<2.5	<1.5	<1.5	<1.5

1.2.6 General

Connectors

RF Output:	Precision Type N.
AC Power:	CEE22 Type VI.
All Others:	BNC.

Environment

Operating Temperature:	0 to +50°C.
Nonoperating Temperature:	−40 to +75°C (Rate of temperature change not to exceed 1° per minute).
Humidity:	0 to 95% noncondensing.
Dimension:	21.6 cm (8½ in.) wide; 9.8 cm (3½ in.) high; 29.9 cm (11¾ in.) deep.
Weight:	5.4 kg (12 lb), nominal.
Power:	90 – 126V or 198 – 252V; 50 – 400 Hz; 40 VA.

1.2.7 Storage

Short Term (<30 days): Same as Environmental limits; see 1.2.6 General.

Long Term (>30 days): Refer to Preparation for Shipment; see 1.2.6 General.

1.2.8 Options

001 Internal Leveling

1.3 ITEMS FURNISHED

Each Micro Sweep is shipped with an instruction manual and a power cable.

1.4 ITEMS REQUIRED BUT NOT FURNISHED

50Ω BNC and 50Ω Type N coaxial cables are required to interconnect the Micro Sweep to other devices during operation. Items referenced in table 1-2 are required to perform maintenance on the Micro Sweep.

1.5 TEST EQUIPMENT

The tools and test equipment required to perform the checkout procedure, troubleshooting, and calibration procedures are contained in table 1-2.

Table 1-2. Test Equipment

Category	Recommended Equipment	Alternate Equipment	Test Equipment Parameters
Oscilloscope	Tektronix 2465	Tektronix 453 Tektronix 475	Sensitivity: 5mV/div. Rise/Fall time: <0.05 μS. Sweep rate: 50 mS/div to 5 μs/div. Trigger: Int and Line
Spectrum Analyzer	Tektronix 492	HP 8559 HP 141T	Range: 1 to 18 GHz. Freq/Division: 10 kHz/div. Bandwidth: 3kHz.
RF Counter, Phase Locking	EIP 575		Range: 5Hz to 10 kHz and 1 to 18 GHz.
RF Power	HP 436A with HP 8484A Power Sensor	Wavetek Pacific Measurements Model 7500	Response: 1 to 18 GHz. Range: +20 to −40 dBm. Readout: dBm and dBref.
Digital Voltmeter	Fluke 8600A	Fluke 8050A	Range: 19 mV to 19V full scale. Resolution: 4½ digits. Accuracy: ½ LSB.
Test Generator	Wavetek 182A		
DC Voltage Source	Fluke 332B	Datel Model DCV-8500	0.0 to +15V.
Oscilloscope Probe	Tektronix P6028	Tektronix P6101	Direct Probe (X1)
Directional Coupler	Krytar 1820	Narda 3292-1	Range: 1 to 18 GHz Coupling: −16 dB.
Crystal Detector	HP 8470B Option 012		Polarity: Negative. Range: 1 to 18 GHz. Sensitivity: >400 μV/μW.
RF Attenuators	HP 8491B HP 8491B Option 010 HP 8491B Option 040		3dB with Type N connectors, 1 to 18 GHz. 10 dB with Type N connectors, 1 to 18 GHz.
Terminations	Tektronix 5015-1003-00		50Ω, BNC connectors.
Coaxial Adapters	Pomona Model 3285	Tektronix 103-0030-00	BNC Tee.
Coaxial Cables			50Ω BNC (M) to BNC (M). 50Ω Type N (M) to Type N (M).

SECTION 2
PREPARATION FOR USE AND INSTALLATION

2.1 MECHANICAL INSTALLATION

After unpacking the instrument, visually inspect all external parts for possible damage to connectors, surface areas, etc. If damaged, file a claim with the carrier who transported the unit. Save the shipping container and packing material in the unlikely event reshipment is required.

The Model 960 Series Micro Sweep is designed primarily for benchtop use. The instrument should be positioned so it rests upon the four rubber feet. The attached tip-up feet may be used to tilt the instrument for a better view of the front panel controls.

CAUTION

When using the instrument, do not obstruct the rear panel heatsink from normal airflow. Also, do not obstruct the top cover of the unit. Both surfaces are used to remove heat from the instrument. A confined operating environment will result in a higher than normal operating temperature and may reduce operating lifetime.

Wherever possible, place the unit in an area where air currents over the rear panel heat sink remain constant. Changes in air velocity over the heat sink will result in temperature changes at the YIG-tuned oscillator and corresponding slight frequency shifts.

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 120Vac line supply and with an 1 amp slow blow fuse.

Conversion to the 220 Vac input setting requires a change in rear panel fuse holder voltage card position and fuse (figure 2-1) according to the following procedure.

Card Position	Input VAC	Fuse (Slo-Blo)
100	100 to 125	1amp
120	100 to 125	1amp
220	200 to 250	1/2 amp
240	200 to 250	1/2 amp

1. Disconnect the power cord at the rear of the instrument and open fuse holder cover door. Rotate the fuse-pull level down to remove the fuse.

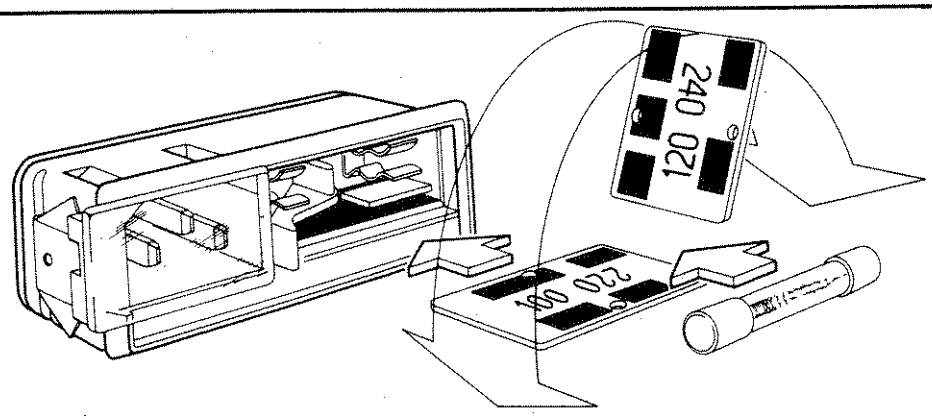


Figure 2-1. Voltage Selector and Fuse

2. Remove the small printed circuit board and select either the 120 or 220 volt positions by orienting the printed circuit board to position the desired voltage to the upper right when facing the rear of the unit. The desired voltage setting should be visible after inserting the card in the slot. Push the board firmly into its module slot.
3. Return the fuse-pull lever to the up position and insert the correct fuse into the fuse holder. Close the cover door.
4. Reconnect the power cord to the mating connector at the rear of the unit and then to the power source.

2.2.2 Signal Connection

When connecting the RF Output connector to associated equipment, use 50Ω coaxial cables equipped with male type N connectors that are compatible with those specified in U S MIL-C-39012. Use mating BNC connectors with 50Ω coaxial cable for all other input and output connections.

CAUTION

Reverse power input to the Model 960 Series in excess of 20 mW may damage the output circuits.

2.2.3 Marker Type Selection

There are two types of markers available in the 960 micro sweeps: Intensity and RF PIP. Either one of these types or both may be selected by a switch SW2 inside the micro sweep. Micro Sweeps are preset to provide Intensity and RF PIP Markers when shipped. The magnitude of the marker can be adjusted using the front panel Mkr Adj adjustment; refer to paragraph 3.1, Mkr Adj.

To select the marker.

1. Disconnect the micro sweep from the power source.
2. To remove the top cover, remove the two screws at the rear of the cover and lift the cover off. It is usually possible to set the top cover with the power supply cable still attached to the left of the Micro Sweep. If the top cover needs to be disconnected from the Micro Sweep, refer to figure 2-2.
3. Set SW2, located on the Main Board (refer to figure 2-2), for the desired marker type; refer to the following table. It may be easier to remove the WaveGen board before setting the switch SW2.

SW2 Settings

Switch Position					Marker Type
1	2	3	4*	5	
Closed	Open	Open	X	Closed	Intensity Marker only
Open	Closed	Open	X	Closed	RF PIP Marker only
Closed	Open	Closed	X	Closed	Intensity and RF PIP Markers

* Refer to paragraph 2.2.5; Tuning Filter Settings
X Do not care.

4. Connect the cables, if disconnected, and replace the top cover.

2.2.4 Z-Axis Blanking Polarity Selection

Switch SW1, located on the WaveGen board, allows selection of the Z-axis blanking pulse polarity, either positive-going (0 to +5V) or negative-going (+5 to 0V) pulse. The Micro Sweeps are shipped set for positive going blanking pulses.

To select the Z-axis blanking polarity.

1. Disconnect the Micro Sweep from the power source.
2. To remove the top cover, remove the two screws at the rear of the cover and lift the cover off. Note: the power supply module is attached to the top cover and may need to be disconnected See figure 2-2.
3. Set SW1, located on the WaveGen Board, for the desired polarity; refer to the following table.

SW1 Settings

Switch Position					Z Axis Polarity
1	2	3	4	5	
NC	Closed	Open	Open	Closed	Positive-going blanking pulse
NC	Open	Closed	Closed	Open	Negative-going blanking pulse

NC Not connected.

4. Connect the cables, if disconnected, and replace the top cover.

2.2.5 Tuning Filter Selection

SW2 position 4 allows enabling or disabling of the tuning filter in the CW mode. Micro Sweeps are preset to the enabling mode (SW2-4 closed) when shipped. To disable the filter, open SW2-4.

To select the tuning filter.

1. Disconnect the Micro Sweep from the power source.
2. To remove the top cover, remove the two screw at the rear of the cover and lift the cover off. Note: the power supply module is attached to the top cover and may need to be disconnected; see figure 2-2.
3. Set SW2 position 4, located on the Main board, to Open to disable the filter (fast tuning) and to Closed to enable the filter (low residual FM).
4. Connect the cables, if disconnected, and replace the top cover.

2.3 INITIAL CHECKOUT PROCEDURE

The procedure in table 2-1 provides an initial operational checkout of all controls, connectors, and indicators located on the front and rear panels of the Micro Sweep. Each operational test requiring test equipment has the equipment interconnection illustrated and referenced in the Equipment and Setup column. The Micro Sweep Checkout Record (table 2-2) may be copied and used for a permanent record of the unit's test.

The test equipment, or its equivalent, required for the checkout procedure is listed in table 1-1.

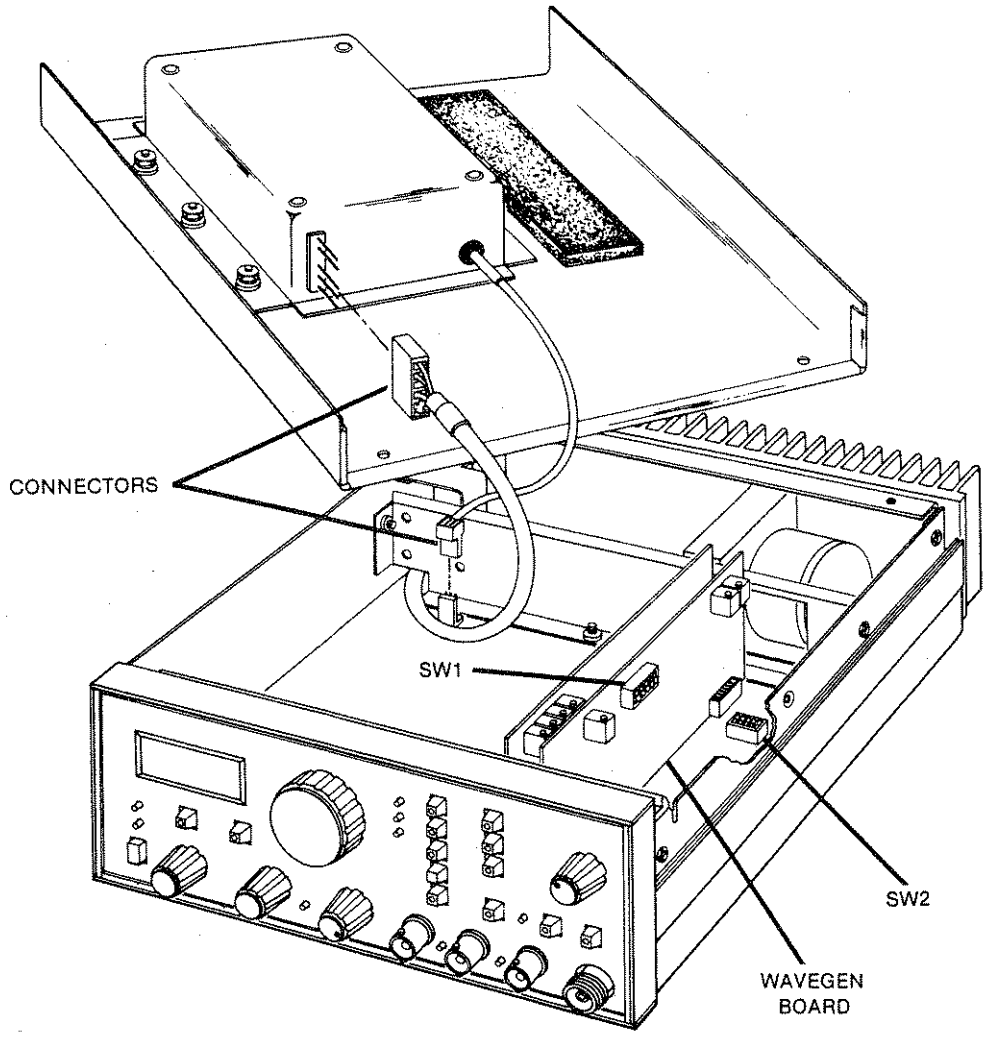


Figure 2-2. Switch Location

Table 2-1. Initial Checkout Procedure

Step	Test	Equipment/Setup	Controls and Indicators	Desired Results
1	Primary Power	None	Facility power: off.	Verify correct fuse installed. Verify correct primary voltage selected.
2		Connect Micro Sweep to facility power source.	Facility power:on. **Power** switch: On.	Line LED lit.
3	Power up conditions			CW Mode LED lit. CW indicator by main tuning knob is lit.
4	RF On		**RF On:** On. (Allow 15 minutes for Micro Sweep to warm up.)	RF On indicator is lit.
5	CW Output frequency	See figure 2-3.	Main Tuning Knob: full ccw. **Mode: CW.** **RF Level:** full cw.	Micro Sweep display reads at or below specified low end of Micro Sweep frequency range. Counter reads Micro Sweep display frequency ±1%. (Must be at or below specified low end of Micro Sweep frequency range.)
6			Main Tuning Knob: full cw.	Micro Sweep display reads at or above specified high end of Micro Sweep frequency range. Counter reads Micro Sweep display frequency ±1%. (Must be at or above specified high end of Micro Sweep frequency range.
7	Output Level Vs Frequency, Micro Sweeps without Internal Leveler (Option 001)	See figure 2-4. NOTE Account for power sensor error in order to reduce measurement errors. Do not exceed maximum input to power meter.	Main Tuning Knob: full ccw. **RF Level:** full cw. **Ext Level:** Off. **Ext Level** indicator not lit. **Lev** indicator not lit.	RF output level ≥ +12 dBm.
8			Main Tuning Knob: turn cw in 0.1 GHz (as indicated on Micro Sweep display).	RF level remains ≥ +12 dBm as frequency is varied.

Table 2-1. Initial Checkout Procedure (Continued)

Step	Test	Equipment/Setup	Controls and Indicators	Desired Results
9	Output Level Vs Frequency, Micro Sweeps with Internal Leveler (Option 001)	See figure 2-4. NOTE Account for power sensor error in order to reduce measurement errors. Do not exceed maximum input to power meter.	Main Tuning Knob: full ccw. **RF Level:** full cw. **Ext Level:** Off. **Ext Level** indicator not lit. **Lev** indicator lit.	RF output level ≥ +10 dBm.
10			Main Tuning Knob: turn cw in 0.1 GHz steps (as indicated on Micro Sweep display).	RF level remains ≥ +10 dBm as frequency is varied.
11			Main Tuning Knob: full ccw. **Ext Level:** On. **Ext Level** indicator lit. **Lev** indicator not lit.	RF output level ≥ +11 dBm.
12			Main Tuning Knob: turn cw in 0.1 GHz steps (as indicated on Micro Sweep display).	RF level remains ≥ +11 dBm as frequency is varied.
13	Output Attenuation, Micro Sweep without Internal Leveling (Option 001)		Main Tuning Knob: full ccw. **RF Level:** full ccw. **Ext Level:** Off. **Ext Level** indicator not lit. **Lev** indicator not lit.	Power meter reads at least 25 dB less than level recorded in step 7.
14	Output Attenuation, Micro Switch with Internal Leveling (Option 001)		Main Tuning Knob: full ccw. **RF Level:** full ccw. **Ext Level:** Off. **Ext Level** indicator not lit. **Lev** indicator lit.	Power meter reads at least 7dB less than level recorded in step 10.

Table 2-1. Initial Checkout Procedure (Continued)

Step	Test	Equipment/Setup	Controls and Indicators	Desired Results
15	External Level Control	See figure 2-5. NOTE Account for power sensor error in order to reduce measurement errors. Do not exceed maximum input to power meter.	Main Tuning Knob: full ccw. **RF Level:** full cw. **Ext Level:** On. **Ext Level** indicator lit. **Lev** indicator lit.	Note RF output level reading.
16			Main Tuning Knob: turn cw in 0.1 GHz steps (as indicated on Micro Sweep display).	RF level varies less than ±1 dB as frequency is varied.
17	Sweep Out Ramp	See figure 2-6.	**Mode: S/S Swp.** **Start:** full ccw. **Stop/ΔF:** full cw. **Swp Time:** full cw.	Oscilloscope displays approximately ≤20 ms sweep time. See figure 2-7.
18			**Swp Time:** full ccw. NOTE If this control is accidentally placed in the Ext Tune position, the unit reverts to the CW mode.	Oscilloscope displays approximately ≥20 second sweep time.
19	S/S Sweep	See figure 2-8.	**Mode: S/S Swp** (indicator lit). **Start:** full ccw. **Stop/ΔF:** full cw. **Swp Time:** full cw.	Oscilloscope verifies Start/Stop frefrequency sweep. See figure 2-9.
20			**Start:** rotate cw; return to full ccw.	Start frequency increases; sweep range decreases.
21			**Stop/ΔF:** rotate ccw; return to full cw.	Stop frequency decreases; sweep range decreases.

Table 2-1. Initial Checkout Procedure (Continued)

Step	Test	Equipment/Setup	Controls and Indicators	Desired Results
22	Markers	See figure 2-8.	**Start:** full ccw. **Stop/ΔF:** full cw. **M1:** press (indicator flashes at low duty cycle). **On/Off:** press once (M1 flashes at high duty cycle). **Update:** press Main Tuning Knob: ccw to lower end of band.	Oscilloscope displays marker number 1 on left half of trace; see figure 2-9. Note It may be necessary to adjust the Mkr Adj or the marker polarity for proper display. Refer to paragraph 2.2.4.
23			**M2:** press (indicator flashes at low duty cycle). M1 indicator on continuously. **On/Off:** press once (M2 flashes at high duty cycle). **Update:** press Main Tuning Knob: cw to upper end of band.	Oscilloscope displays marker number 2 on right half of trace; see figure 2-9.
24			**M3:** press (indicator flashes at low duty cycle). M1 and M2 indicator on continuously. **On/Off:** press (M3 flashes at high duty cycle). **Update:** press Main Tuning Knob: near center of frequency band.	Oscilloscope displays marker number 3 near center of trace; see figure 2-9.
25	ΔF Sweep		**Mode: ΔF Swp.** Main Tuning Knob: center of frequency band. **Display Stop/ΔF:** press **Stop/ΔF:** center of range.	Oscilloscope verifies ΔF sweep. Marker number 3 appears in the center of the trace; see figure 2-10.

Table 2-1. Initial Checkout Procedure (Continued)

Step	Test	Equipment/Setup	Controls and Indicators	Desired Results
26	ΔF Sweep	See figure 2-8.	**Stop/ΔF:** rotate cw.	Sweep range increases as verified on oscilloscope.
27			**Stop/ΔF:** rotate ccw.	Sweep range decreases as verified on oscilloscope.
28	External Trigger	See figure 2-11.	**Mode: ΔF Swp.** Main Tuning Knob: center of frequency band. **Stop/ΔF:** full cw. **Ext Trig:** On (indicator lit). **Swp Time:** full cw.	Oscilloscope verifies externally triggered ΔF sweep.
29	Single Sweep	Figure 2-11 without TTL source TRIG IN.	**Ext Trig:** On. **Sweep Time:** center of range (12 o'clock). **Ext Trig:** press twice.	Ext Trig indicator is lit. Oscilloscope displays a single trace each time Ext Trig is pressed twice.
30	External Frequency Modulation	Set up as shown in figure 2-12.	**Mode: CW.** Main Tuning Knob: center of frequency band.	Spectrum analyzer verifies 1kHz FM signal.
31	External Amplitude Modulation	Set up as shown in figure 2-13.	**Mode: CW.** Main Tuning Knob: center of frequency band. **RF Level:** cw.	Oscilloscope displays square wave with frequency of 1kHz. (Adjust RF Level to obtain desired detection range on oscilloscope.)
32	External Frequency Control	Set up as shown in figure 2-14. DC Source: 0V	**Swp Time:** extreme ccw (Ext Tune).	Ext Tune indicator lit. Micro Sweep display reads low end of unit's frequency range.
33		DC Source: +10 ±.02V.		Micro Sweep display reads high end of unit's frequency range.

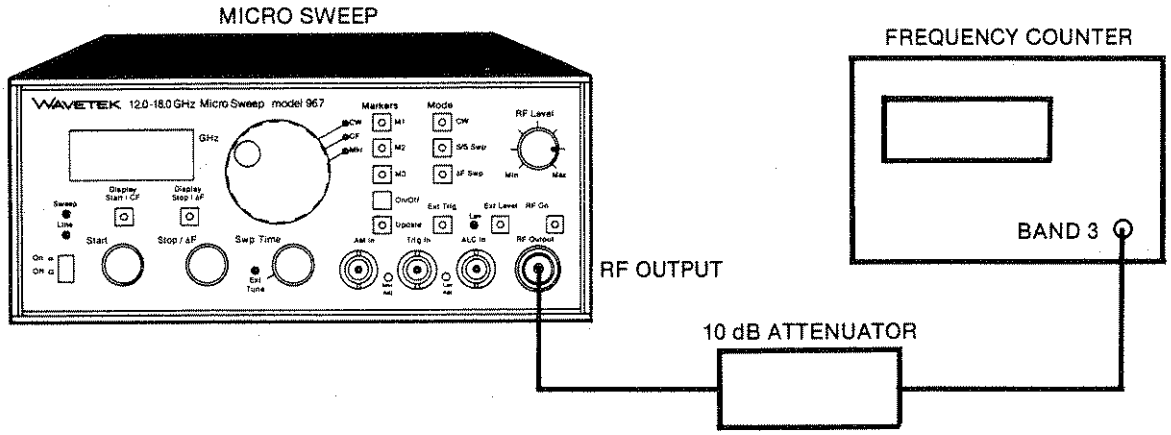


Figure 2-3. Frequency Measurement Setup

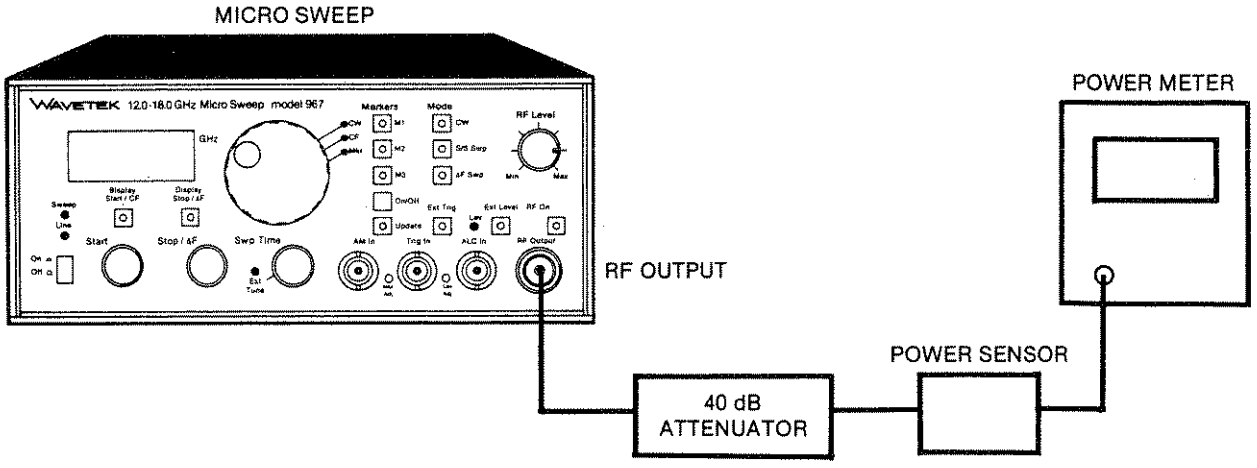


Figure 2-4. Output Level Measurement Setup

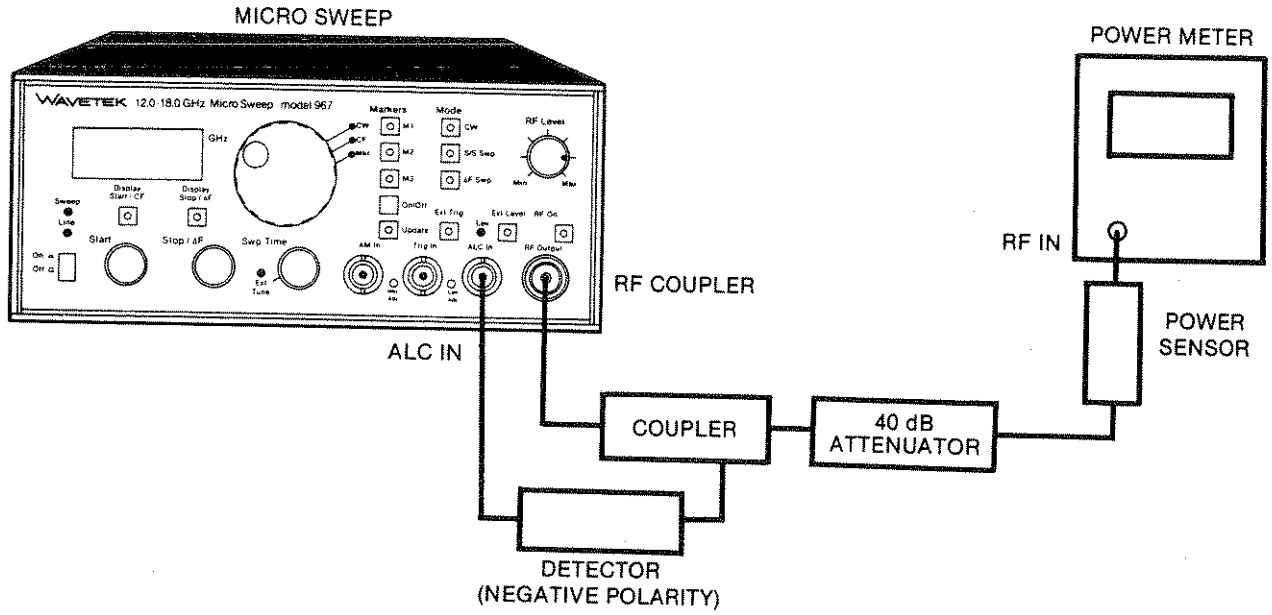


Figure 2-5. External Level Control Setup

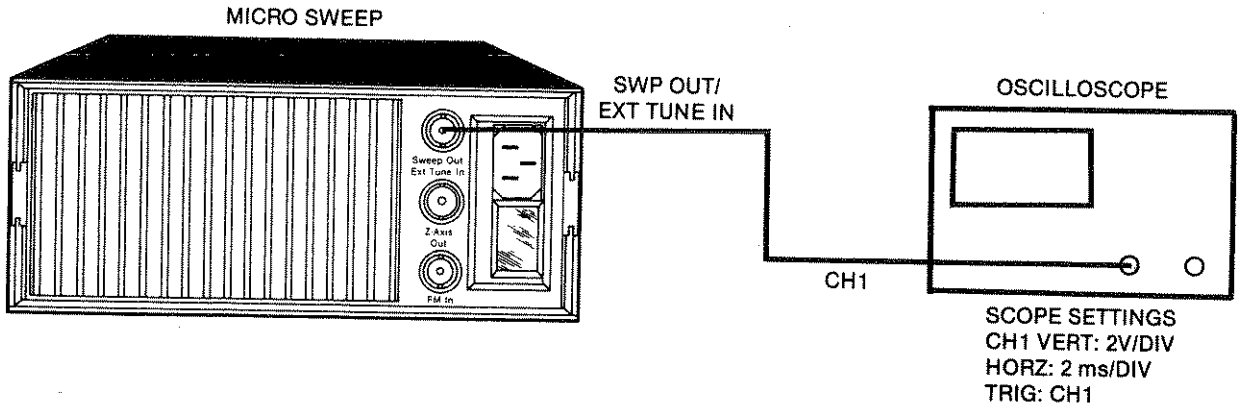


Figure 2-6. Sweep Ramp Setup

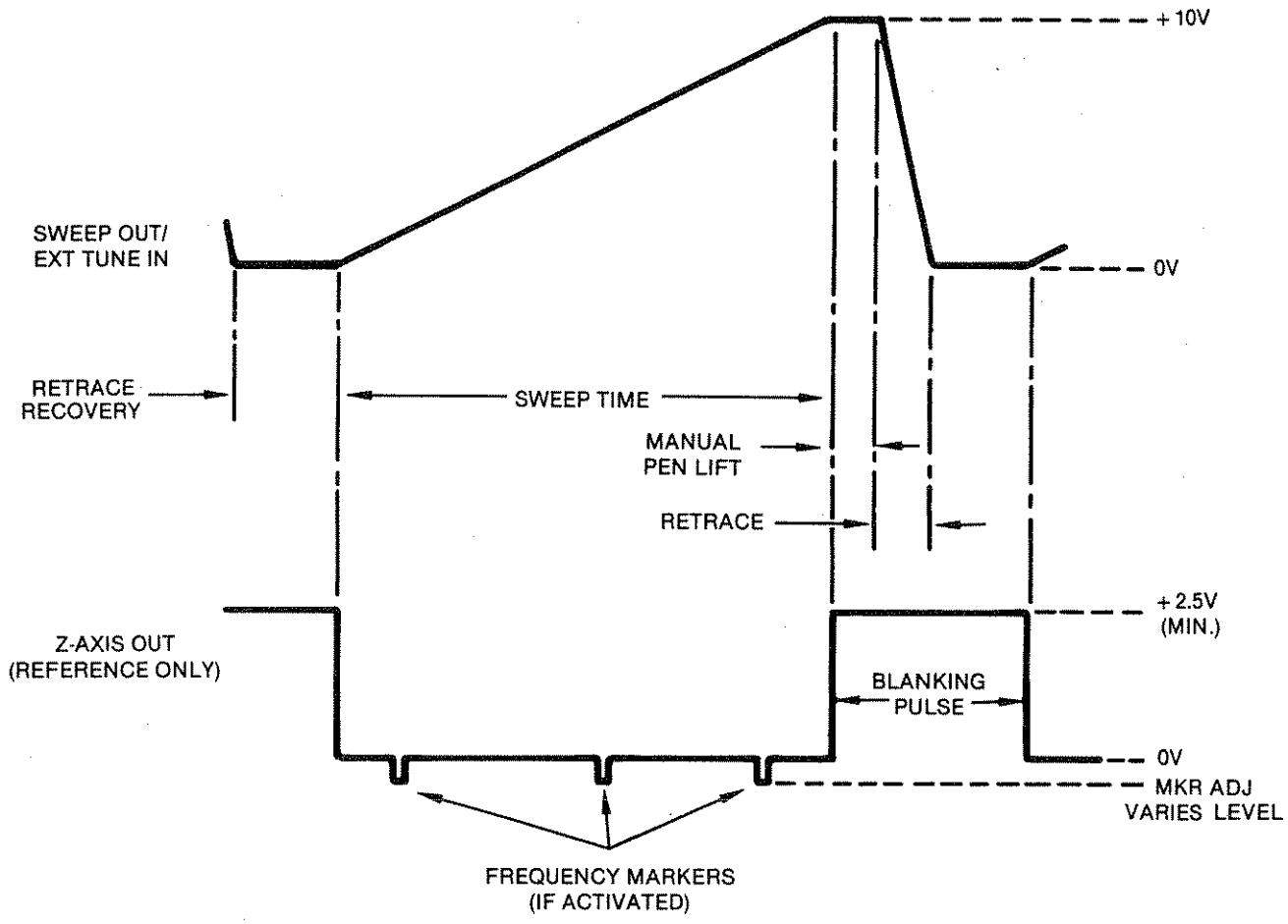


Figure 2-7. Sweep Ramp and Blanking Pulse Output

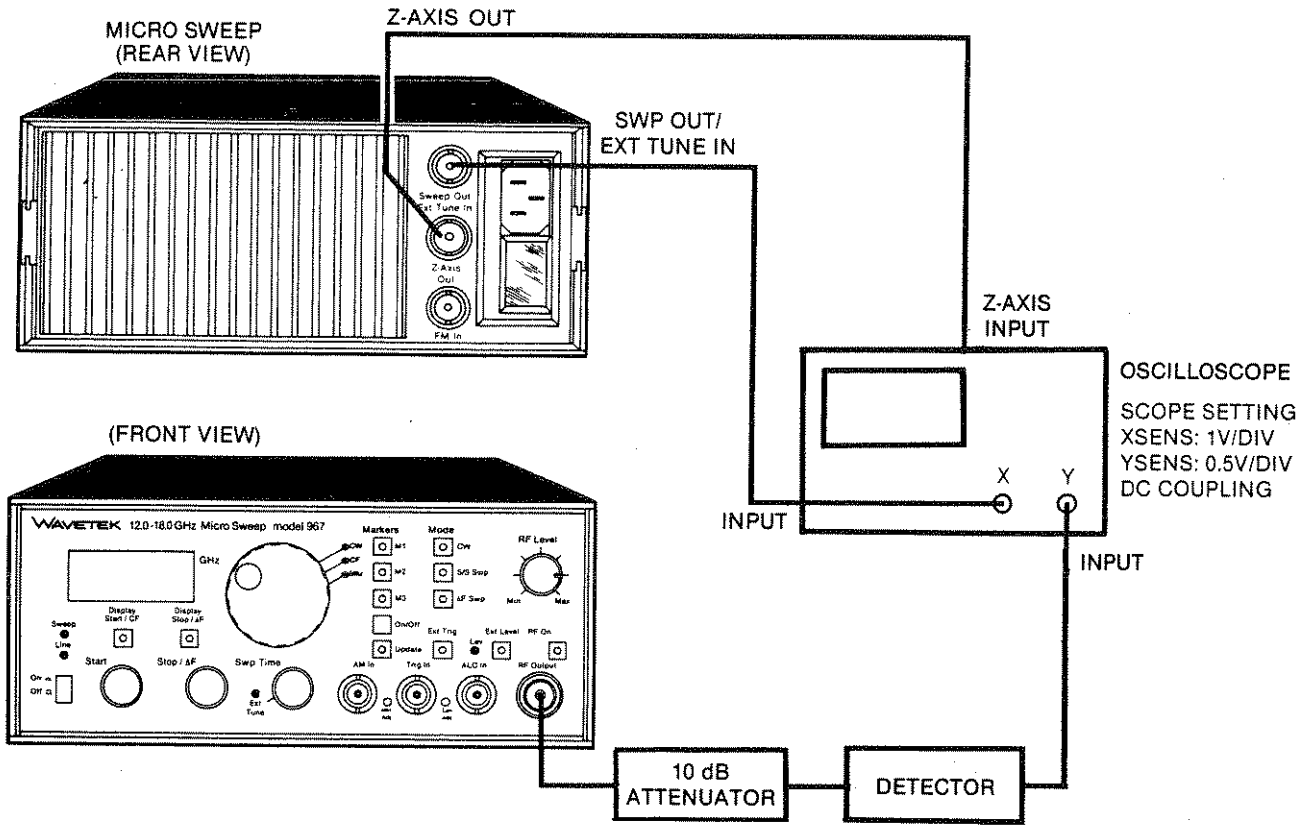


Figure 2-8. Start/Stop Sweep Setup

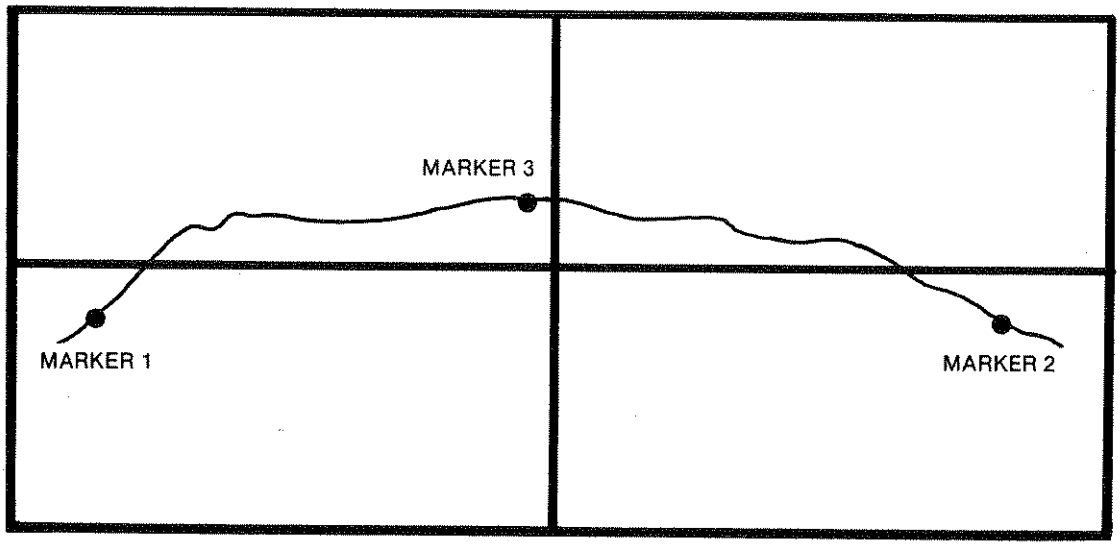


Figure 2-9. Sweep Trace

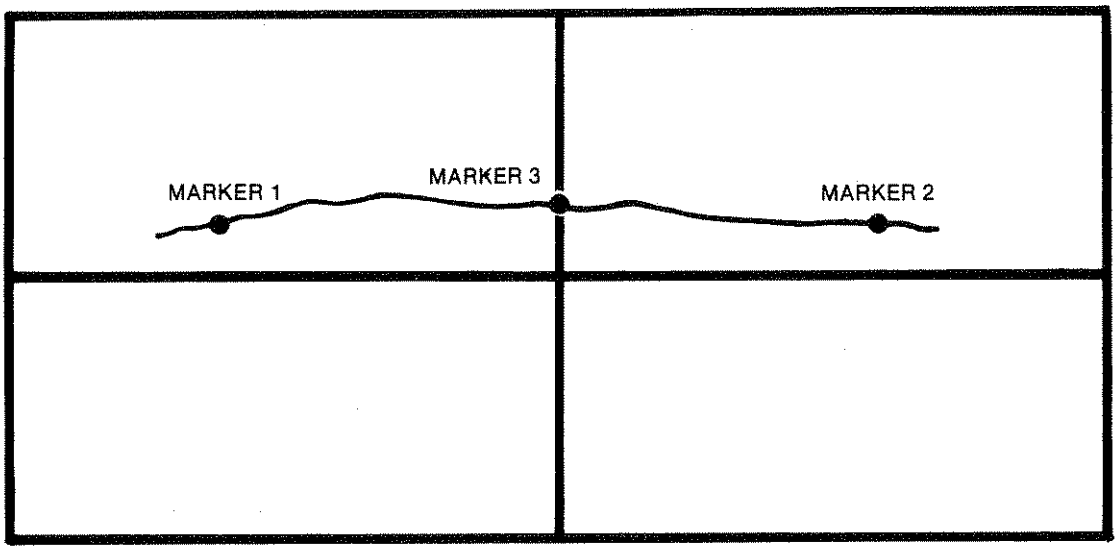


Figure 2-10. ΔF Sweep Trace

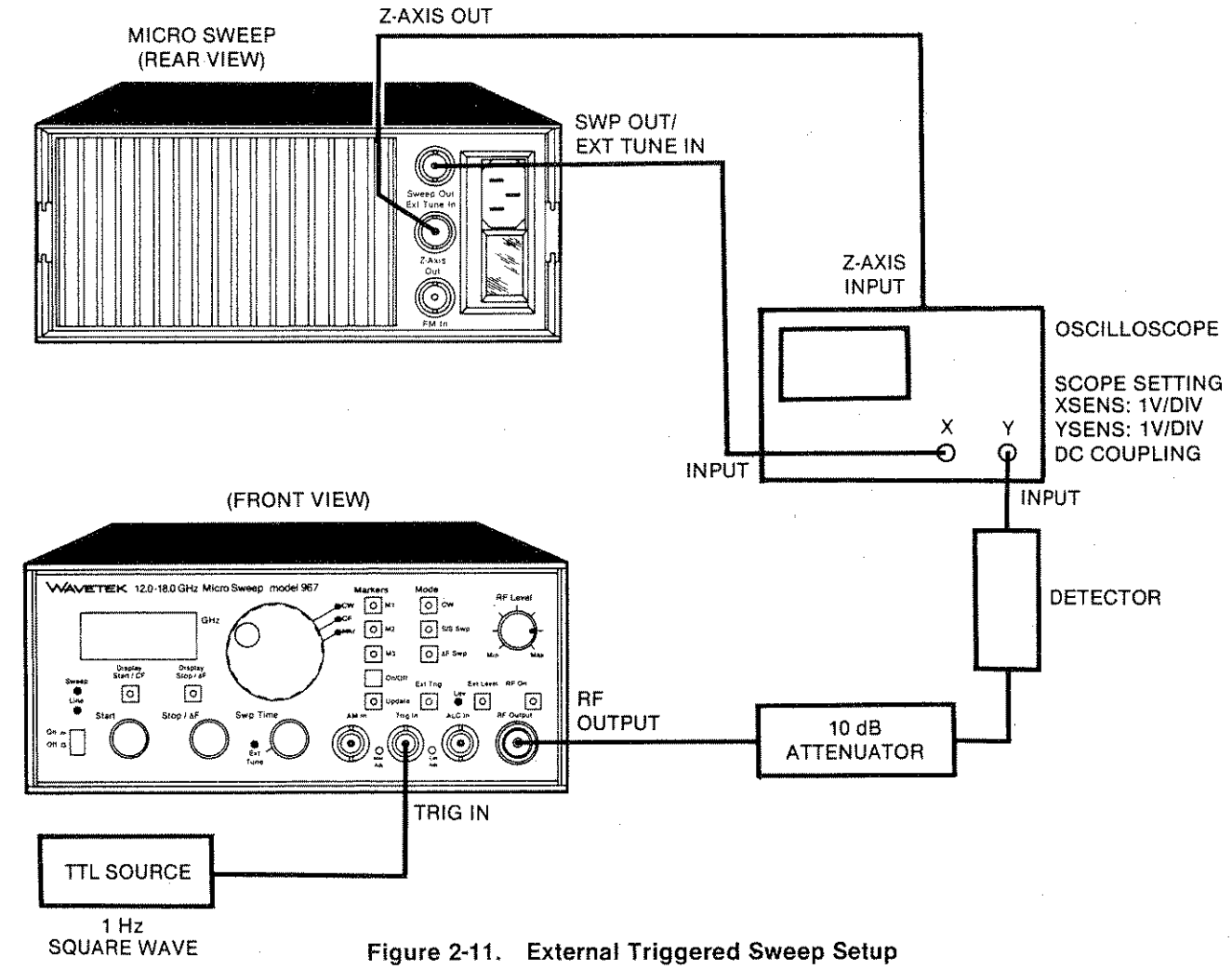


Figure 2-11. External Triggered Sweep Setup

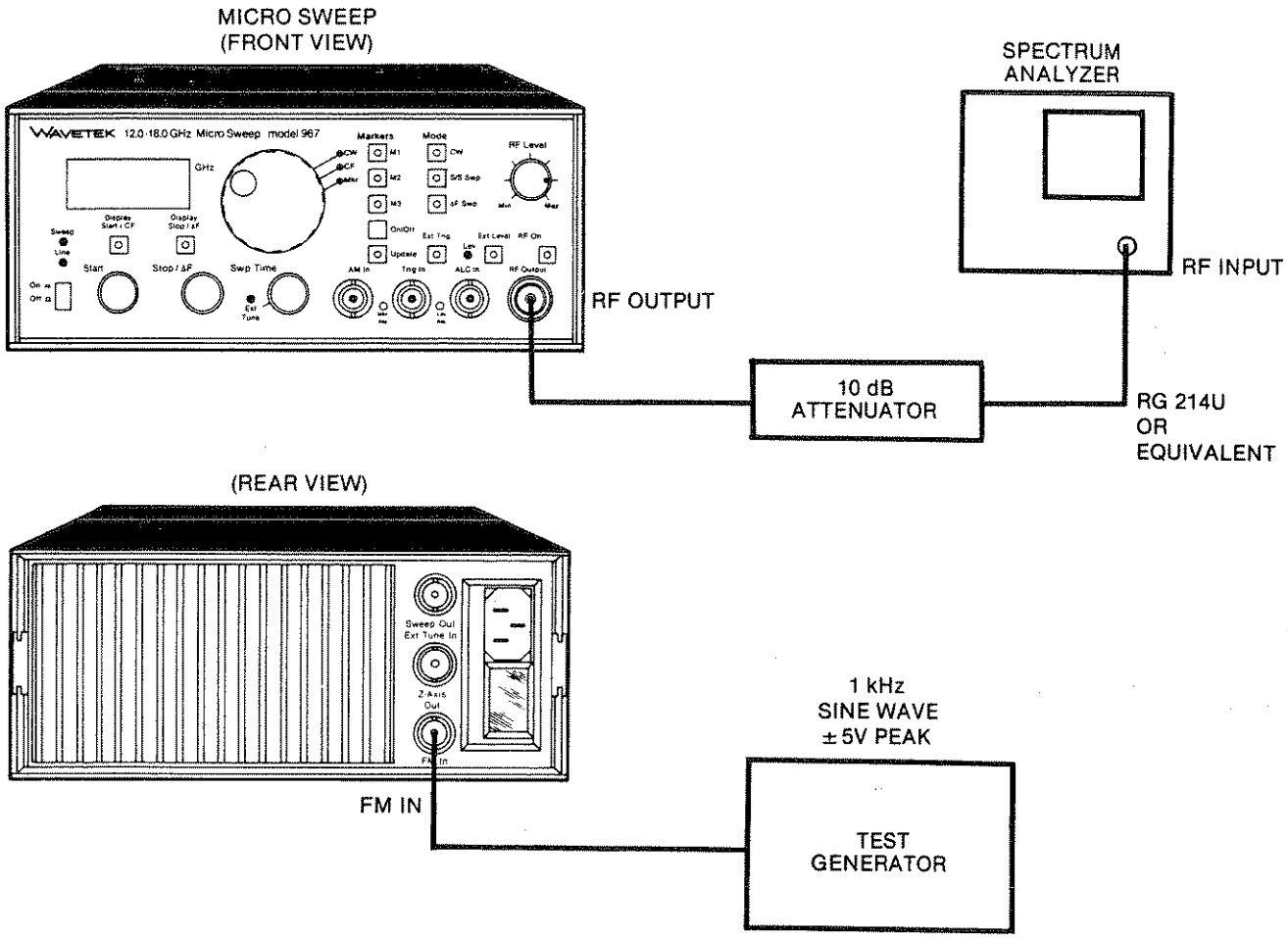


Figure 2-12. External Frequency Modulation Setup

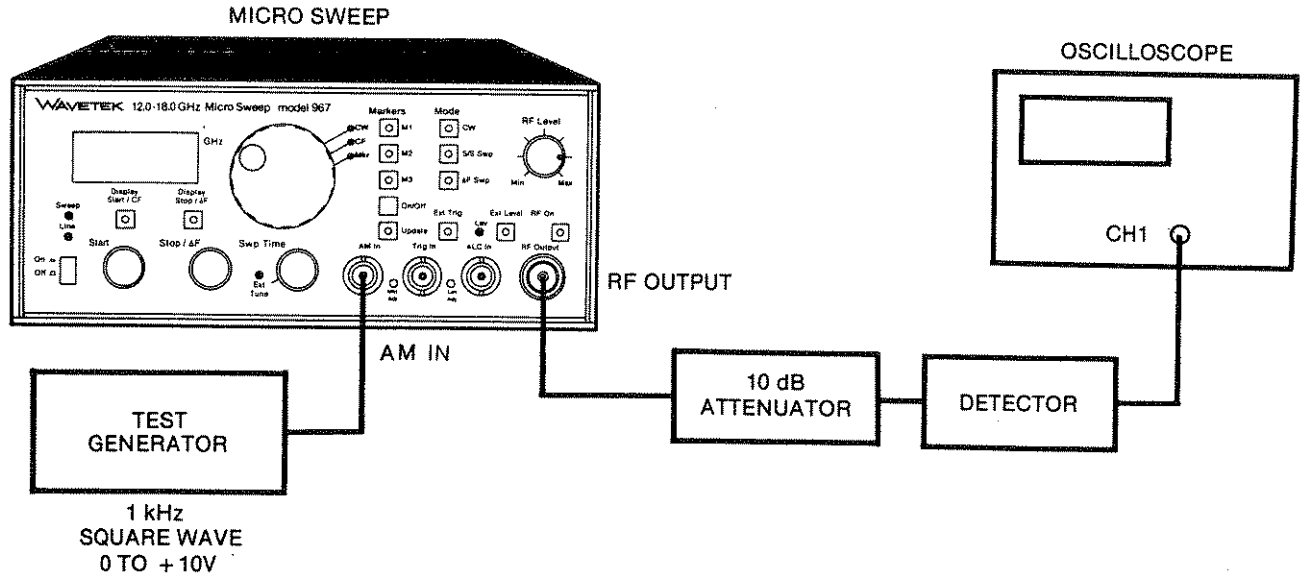


Figure 2-13. External Amplitude Modulation Setup

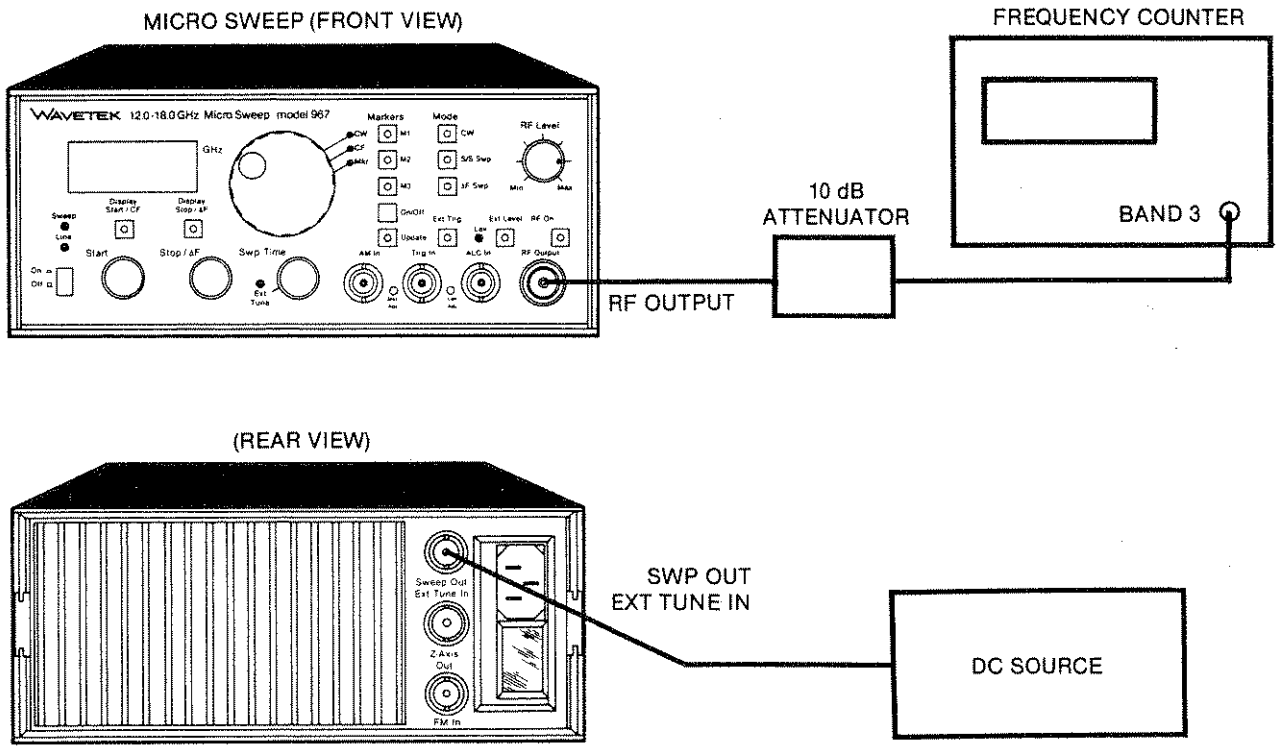


Figure 2-14. External Frequency Control Setup

Table 2-2. Micro Sweep Checkout Record

Step (Table 2-1)	Desired Results	Acceptable (✓)
1	Correct fuse installed. Correct voltage selected.	
2	Line LED lit.	
3	CW indicators lit.	
4	RF LED indicator is lit.	
5	Micro Sweep tunes to low end of frequency range. Counter reads Micro Sweep frequency ±1%.	
6	Micro Sweep tunes to high end of frequency range. Counter reads Micro Sweep frequency ±1%.	
7	Micro Sweep without Internal Leveler. RF output level ≥ +12 dBm.	
8	Micro Sweep without Internal Leveler. RF level remains ≥ +12 dBm (minimum).	
9	Micro Sweep with Internal Leveler. RF output level ≥ +10 dBm.	
10	Micro Sweep with Internal Leveler. RF level remains ≥ +10 dBm.	
11	Micro Sweep with Internal Leveler; Internal leveler off. RF output level ≥ +11 dBm.	
12	Micro Sweep with Internal Leveler; Internal leveler off. RF level remains ≥ +11 dBm.	
13	Micro Sweep without Internal Leveler or Micro Sweep with Internal leveler off. RF power meter reads at least 25 dB less than step 7.	
14	Micro Sweep with Internal Leveler. RF power meter reads at least 7dB less than in step 10.	
15	Note RF output level reading.	
16	RF level varies ≤ ±1 dB of reading in step 15.	

Table 2-2. Micro Sweep Checkout Record (Continued)

Step (Table 2-1)	Desired Results	Acceptable (✓)
17	Oscilloscope verifies approximately ≤20 ms sweep time.	
18	Oscilloscope verifies approximately ≥20 second sweep time.	
19	Oscilloscope verifies Start/Stop frequency sweep.	
20	Start frequency increases. Sweep range decreases.	
21	Stop frequency decreases. Sweep range decreases.	
22	Oscilloscope displays Marker 1	
23	Oscilloscope displays Marker 2	
24	Oscilloscope displays Marker 3	
25	Oscilloscope verifies ΔF Sweep.	
26	Sweep range increases as verified on oscilloscope.	
27	Sweep range decreases as verified on oscilloscope.	
28	Oscilloscope verifies External Trigger.	
29	Oscilloscope verifies manual single sweep.	
30	Spectrum Analyzer verifies 1kHz FM signal.	
31	Oscilloscope displays 1kHz square wave.	
32	Frequency counter and Micro Sweep display read low end of Micro Sweep frequency range.	
33	Frequency counter and Micro Sweep display read high end of Micro Sweep frequency range.	

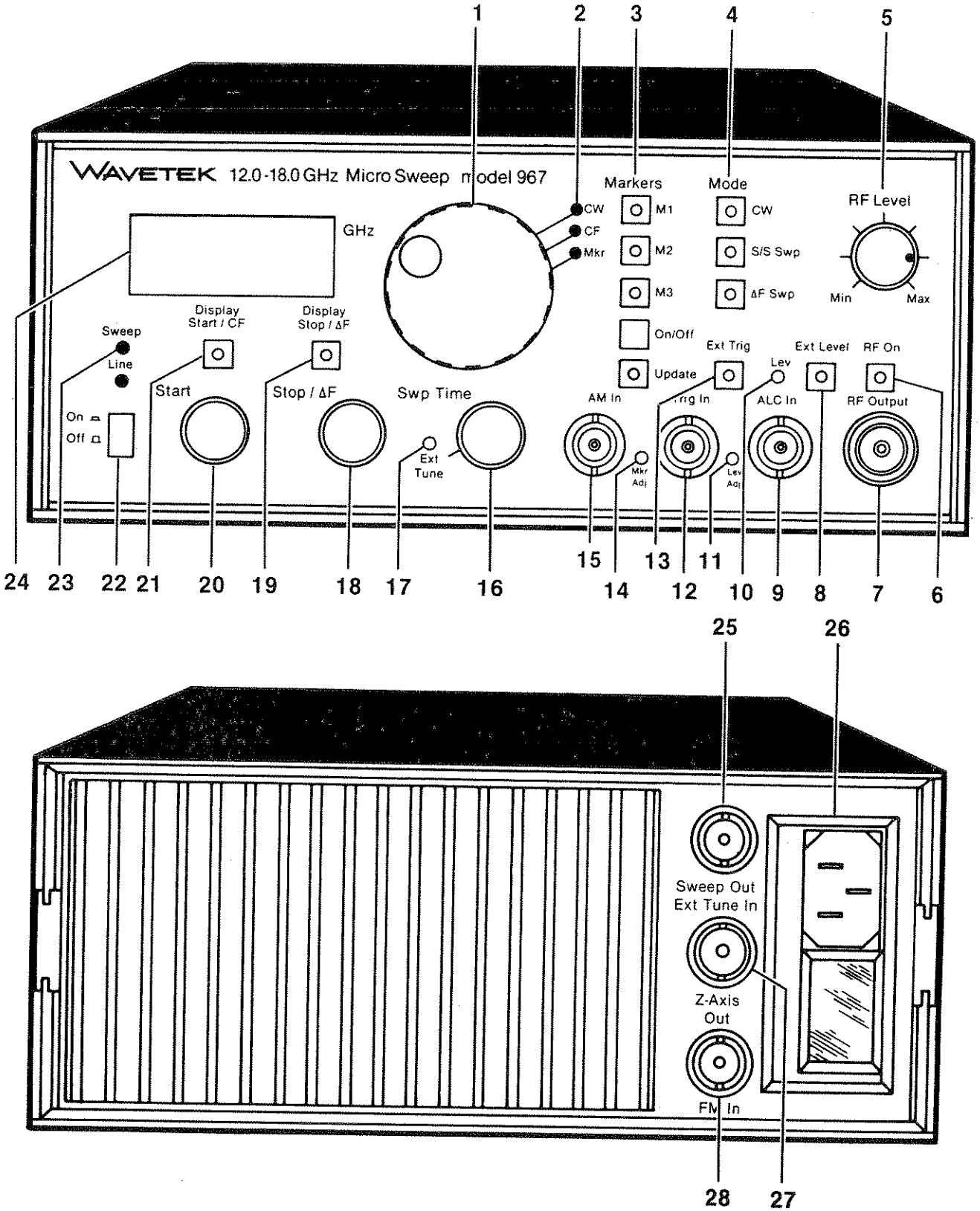


Figure 3-1. Controls, Connectors, and Indicators

SECTION 3
OPERATION

3.1 CONTROLS, CONNECTORS, AND INDICATORS

The Micro Sweeps front and rear panel controls, indicators, and connectors are shown in figure 3-1 and keyed to the following description.

1 Main Tuning Knob

This ten-turn manual frequency control knob sets three different types of frequency parameters, depending upon the operating and display mode of the instrument.

In the CW mode, it tunes the frequency of the microwave oscillator. In the ΔF sweep mode, the control sets the center frequency (CF) of the symmetrical sweep.

When a marker (M1 through M3) has been selected and the Update pushbutton **3** has been pressed, this control set the marker frequency.

Selecting the start/stop sweep mode (S/S Swp) or external tune (Ext Tune) disables the main tuning knob.

The three LED indicators to the right of the main tuning knob indicate which frequency parameter is being controlled by the knob.

2 Tuning Indicators

CW This red LED is illuminated when in the CW mode. The Main Tuning Knob **1** tunes the frequency of the microwave oscillator in the CW mode.

CF (Center Frequency) This red LED is illuminated when in the ΔF Sweep mode. The Main Tuning Knob **1** controls the center frequency in ΔF sweep.

Mkr (Marker) This red LED is illuminated when the Main Tuning Knob **1** is used to update any marker frequency. It is activated whenever the Update **3** switch is toggled on. For a marker frequency to be updated, a marker must have first been selected by pressing any of the switches M1 through M3. The Mkr LED may be on simultaneously with the CW or CF LED.

3 Marker Switches

M1 (Marker 1) This momentary contact pushbutton switch and integrated red LED indicator are used to select marker number 1 for frequency display and status change via the On/Off or Update switches. Pressing the switch displays the frequency of Marker 1 on the LCD readout, enables status change, and causes the LED to blink. If the selected marker 1 is on, the blink has a long duty cycle (mostly on). If the marker 1 is off, the blink has a short duty cycle (mostly off). If the marker is on but not selected for change, the LED is illuminated without blinking.

M2 (Marker 2) This switch and indicator functions exactly the same as the M1 marker switch and indicator, except Marker 2 is selected.

M3 (Marker 3) This switch and indicator functions exactly the same as the M1 marker switch and indicator, except Marker 3 is selected.

On/Off This momentary contact pushbutton switch changes the on/off status of a selected marker. If the selected marker is off, blinking with a mostly off (short duty) cycle, pressing the On/Off switch will turn on the marker and the blink duty cycle will become long (mostly on). If the selected marker is on, pressing the On/Off switch will turn the marker off.

Update This momentary contact pushbutton switch with integrated LED indicator activates the marker frequency tuning mode after a marker has been selected. Pressing this switch allows the Main Tuning Knob **1** to update the frequency of the selected marker. The marker update mode is indicated by the glowing LED indicator within the switch and the Mkr LED next to the Main Tuning Knob **1**. Pressing any other front panel pushbutton switch cancels the marker update mode. If the Update switch is pressed without a marker being selected, the Update indicator will glow, but no marker frequencies will be changed.

4 **Mode Switches and Indicators**

CW This momentary contact pushbutton switch with integrated LED indicator selects and indicates the CW mode of operation. Pressing the switch selects the CW tuning mode. When the CW mode has been selected, the LED inside the switch is illuminated. The CW mode is also indicated by the CW LED **2** to the right of the Main Tuning Knob **1**. When the unit has been placed into the external tune (Ext Tune) mode, the CW mode is automatically selected and the LED indicators glow. Selecting the CW or external tuning mode of operation also switches a filter into the microwave oscillator tuning circuit which improves the residual FM performance. This filter reduces the response of the oscillator to rapid changes in frequency during the CW mode. The tuning filter can be disabled by a switch within the instrument; refer to paragraph 2.2.5.

S/S Swp This momentary contact pushbutton switch with integrated LED indicator selects and indicates the Start/Stop Sweep mode. Pressing the switch selects the Start/Stop mode. When the Start/Stop mode has been selected, the LED inside the switch is illuminated.

ΔF Swp This momentary contact pushbutton switch with integrated LED indicator selects and indicates the ΔF Sweep mode of operation.

5 **RF Level Control** This single turn manual control knob sets the RF output Power level. When rotated cw, the RF output level is increased. When rotated ccw, the RF output level is decreased.

6 **RF On** The momentary pushbutton and LED indicator enables or disables the signal at RF Output **7**. If the indicator is illuminated, the RF output is on; if the indicator is out the RF output is off (the actual YIG oscillator is shut off).

7 **RF Output** This N-Type connector provides a 50Ω output for the RF signal from the instrument.

8 **Ext Level** This momentary pushbutton and LED indicator switches the unit to accept a leveling input from the front panel ALC In BNC **9**. If the LED is not glowing, the unit attempts to level with the internal leveling option, if installed.

9 **ALC In** This connector accepts a signal input which, when Ext Level **8** is selected, is used to level the RF output across the frequency band.

10 **Lev** An illuminated LED indicates that the RF output signal is leveled either internally or externally.

11 **Lev Adj** This screwdriver adjustment allows adjustment of the leveling loop gain. It has been factory preset for optimal leveling loop operation. When using different couplers and detectors, the Lev Adj may require further adjustment to optimize leveling loop performance and to prevent leveling loop oscillation.

12 **Trig In** This input allows external triggering of the sweep. Sweep is triggered by the falling edge of a TTL signal or contact closure to ground.

13 **Ext Trig** This momentary pushbutton with LED indicator selects either externally triggered sweep or auto-triggered sweep. When external trigger is selected (Ext Trig indicator lit), an external trigger signal or contact closure at the Trig In connector **12** triggers the sweep. Double pressing of this pushbutton at slower sweep rates permits single sweep operation. When auto-trigger is selected (Ext Trig indicator extinguished), the frequency is continuously swept.

14 **Mkr Adj** This front panel screwdriver adjustment adjusts the magnitude of the markers. If intensity markers are used, this control adjusts the relative brightness of the markers. If RF PIP markers are used, this control adjusts the depth of the PIP. When both markers types are used, the adjustment only affects the brightness of the intensity marker.

15 **AM In** This BNC connector provides an input port for external AM signals. A dc input at this port will remotely control the Micro Sweep's RF output level.

16 **Swp Time** This control sets the sweep time for the S/S Swp and ΔF Swp modes. The sweep time can be varied between 0.02 to 20 seconds, nominal. In addition, a detent position (Ext Tune) allows an analog signal at the Swp Out/Ext Tune In connector **25** (rear panel) to control the oscillator frequency; the unit is automatically switched to the CW mode.

17 **Ext Tune** This LED, when lit, indicates the Swp Time control **16** is set to the Ext Tune position.

18 **Stop/ΔF** This single turn control sets either the stop frequency (S/S Swp mode) or ΔF frequency (ΔF Swp mode) depending on the sweep mode as determined by the Mode switches **4**.

19 **Display Stop/ΔF** This momentary pushbutton (indicator lit) causes the display to show either the stop frequency (S/S Swp mode) or ΔF frequency (ΔF Swp) depending on the existing sweep mode. The Display Stop/ΔF pushbutton has no affect in the CW mode.

20 **Start** This control sets the start frequency in the S/S Swp mode.

21 **Display Start/CF** This momentary pushbutton (indicator lit) causes the display to show either the start frequency (S/S Swp mode) or CF frequency (ΔF Swp mode). The Display Start/CF indicator will light automatically when the S/S Swp mode or the ΔF Swp mode is initially selected.

22 **Power On/Off** This pushbutton controls the primary power to the unit. When the power is on the Line LED indicator is lit. When the power is off the Line LED indicator is extinguished.

23 **Sweep** This indicator lights for the duration of the sweep in the S/S Swp and ΔF Swp modes.

24 **(Frequency) GHz** This 3½ digit liquid crystal display (LCD) indicator displays the CW frequency (CW mode), start or stop frequency (S/S Swp mode), and center and ΔF frequencies (ΔF Swp mode). It also can be switched to display the frequencies of markers 1 through 3 and the externally tuned frequency.

25 **Swp Out/Ext Tune In** This rear panel BNC connector serves two functions depending upon the setting of the Swp Time **16** control. For internal sweep modes, this connector supplies a 0 to +10V direct-coupled, modified sawtooth waveform. The Swp Time control can be in any position except Ext Tune (detent). The signal limits are 0V (sweep beginning) and +10V (sweep end) regardless of sweep width, rate or direction. In the internal CW mode, the output is proportional to the frequency with linear 0 to +10V, nominal, for full instrument bandwidth.

When the Swp Time control is set to the Ext Tune position (detent), this connector accepts a 0 to +10V input level that tunes the microwave oscillator from the bottom of the band to the top of the band respectively.

26 **Power cord connector** This combination connector provides a line voltage selector and fuse holder as well as a connector for a modular line cord.

27 **Z-Axis Out** This BNC connector provides the rectangular marker (Intensity Marker) pulse and retrace blanking pulse for Z-Axis input to CRT display units. The polarity of the marker output is factory set to a negative pulse with a corresponding positive blanking pulse. The pulse may be changed to the opposite polarity by an internal switch; see paragraph 2.2.4.

28 **FM In** This rear panel BNC connector provides an input port for external FM or phase-lock feedback signals.

3.2 OPERATION

The following paragraphs describes how to use the 960 Series Micro Sweep. All bold numbers in the text refer to the individual controls and connectors described in paragraph 3.1. Also, paragraph 2.3 and table 2-1 provides an excellent hands-on method of understanding the 960s' operation.

3.2.1 CW Operation

In the CW mode, the Micro Sweep supplies a single frequency at the RF Output connector **7**. The main tuning knob **1** sets the output frequency. The signal can be FM modulated (FM, see paragraph 3.2.8), and AM modulated (AM, see paragraph 3.2.7). The External Tuning mode is similar to the CW mode except the frequency is controlled by an external signal. Figure 3-2 illustrates the control settings and equipment setup for the CW mode.

The following list gives the controls and connectors required for the CW operating mode.

Control/Connector	Operation
Power **22**	Press to turn unit on. Line LED is lit.
RF On **6**	Press to On (indicator lit) to enable RF signal at RF Output.
RF Level **5**	Set RF level at RF Output connector to desired output level.
Mode **4**	Press CW pushbutton (indicator lit) to select CW (if necessary).
LCD Display **24**	Shows output frequency.

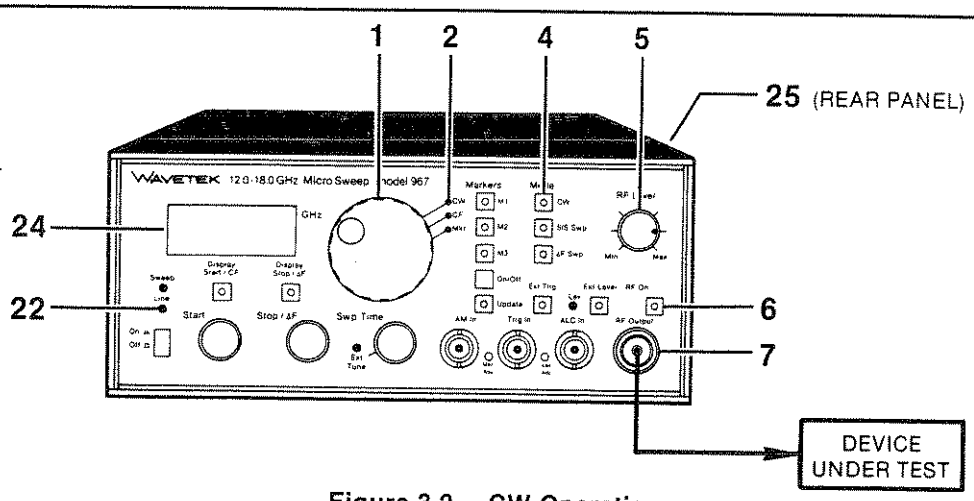


Figure 3-2. CW Operation

Control/Connector	Operation
CW LED **2**	Lit indicates that main tuning knob controls the CW frequency.
Main Tuning Knob **1**	Sets output frequency. Rotate cw to increase frequency and ccw to decrease frequency. Rotate cw to increase output level and ccw to decrease.
RF Output **7**	Signal output from the unit. 50Ω source impedance.
Swp Out/Ext Tune In (Rear Panel) **25**	A 0 to +10V dc level proportional to the output frequency main tuning knob).

3.2.2 Start/Stop Sweep

In Start/Stop Sweep (S/S Swp), the frequency sweeps linearly between a set Start frequency and a set Stop frequency. The Start knob **20** controls the start frequency, and the Stop/ΔF knob controls the stop frequency. The Display Start/CF **21** and Display Stop/ΔF **19** selects either the Start or Stop frequency for display. The Swp Time (Sweep Time) knob **16** sets the sweep rate. Frequency markers can be used with Start/Stop Sweep; refer to paragraph 3.2.5. Figure 3-3 illustrates the controls and equipment setup for the Start/Stop Sweep operation.

The following list gives the controls and connectors required for the Start/Stop Sweep operating mode.

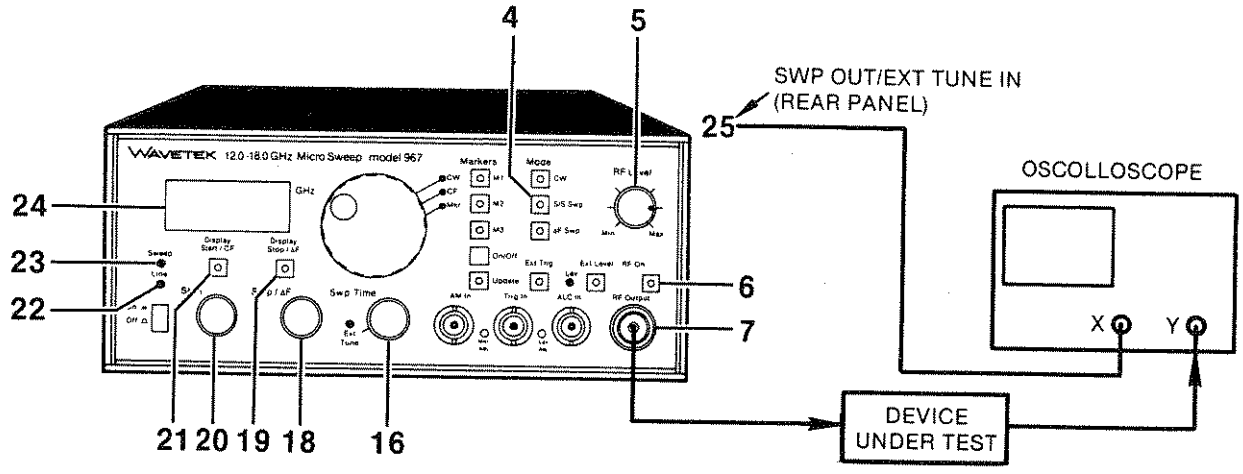


Figure 3-3. Start/Stop Sweep Operation

Control/Connector	Operation
Power **22**	Press to turn unit on. Line LED is lit.
RF On **6**	Press to On (indicator lit) to enable RF signal at RF Output.
RF Level **5**	Set RF level at RF Output connector. Rotate cw to increase output level and ccw to decrease.
RF Output **7**	Signal output from the unit. 50Ω source impedance.
Mode **4**	Press S/S Swp pushbutton (indicator lit) to select Start/Stop Sweep mode.
Display Start/CF **21**	Press to display Start frequency (indicator lit); this pushbutton need not be pressed if the indicator is lit.
LCD Display **24**	Shows the start frequency.
Start **20**	Sets the start frequency. Rotate cw to increase the frequency, and rotate ccw to decrease the frequency. Downward sweeps are permitted.
Display Stop/ΔF **19**	Press to display Stop frequency (indicator lights); this pushbutton need not be pressed if the indicator is lit.
LCD Display **24**	Shows the stop frequency.
Stop/ΔF **18**	Sets the stop frequency. Rotate cw to increase frequency and ccw to decrease frequency.
Swp Time **16**	Set the sweep rate; can be varied between 0.02 (cw position) to 20 (ccw position) seconds per sweep. Do not rotate the switch to the detent position (Ext Tune).
Sweep LED **23**	Blinks at sweep rate.
Swp Out/Ext Tune In (rear panel) **25**	A 0 to +10V dc coupled, modified sawtooth wave; see figure 3-4.

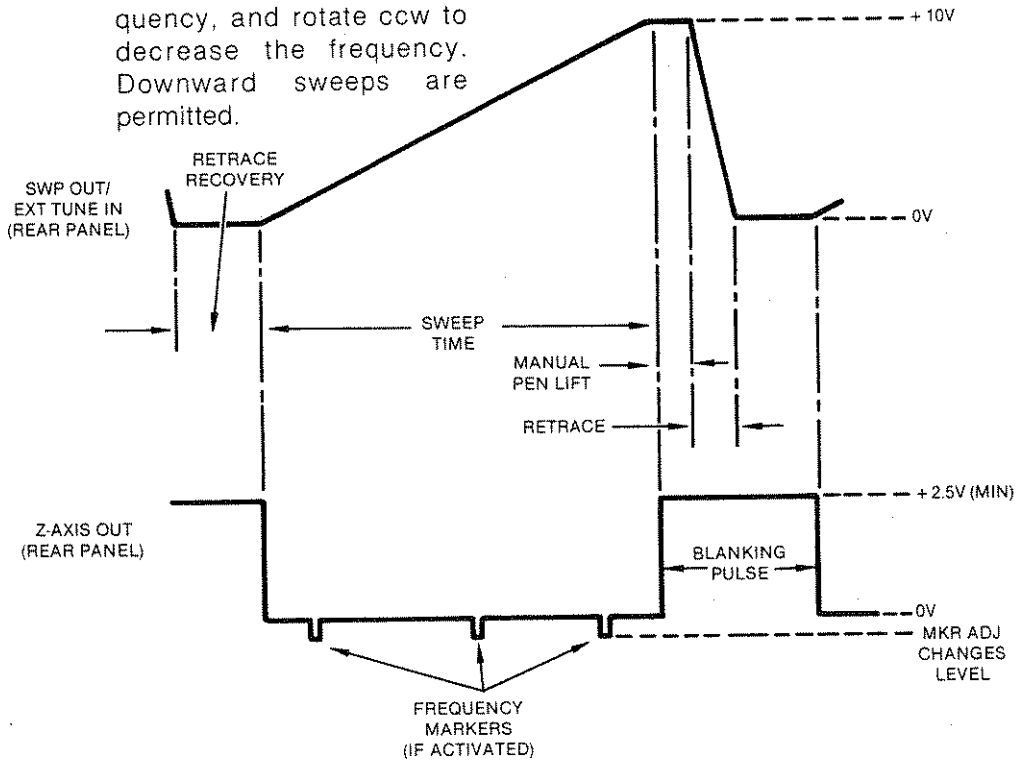


Figure 3-4. Sweep Sawtooth and Blanking Pulse Output

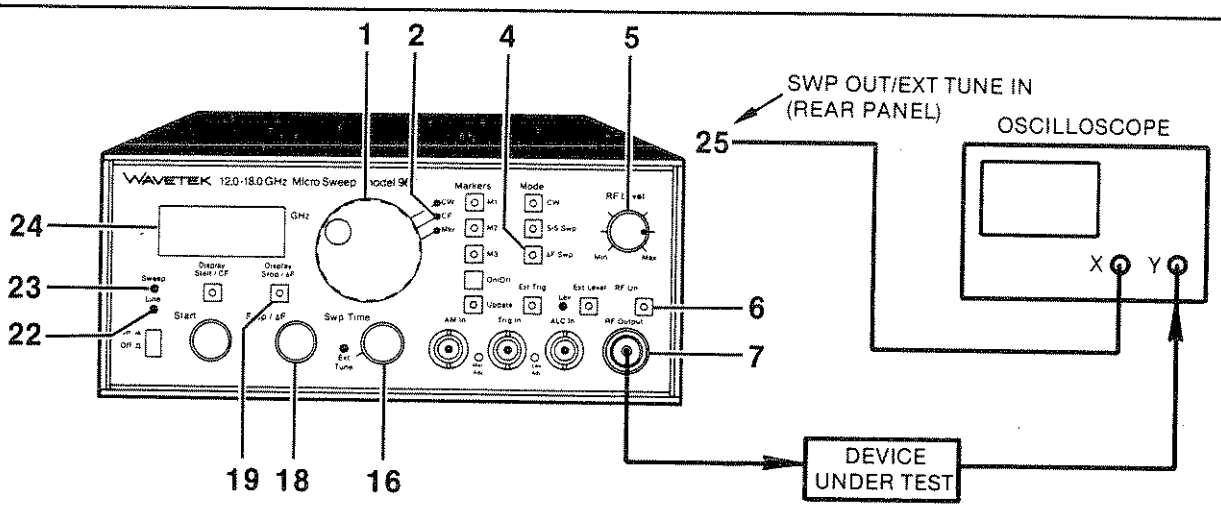


Figure 3-5. ΔF Sweep Operation

3.2.3 ΔF Sweep

In the ΔF Sweep mode, the frequency sweeps symmetrically upward centered on the center frequency (CF). The Main Tuning knob **1** sets the center frequency, while the Stop/ΔF knob **18** sets the total frequency deviation. The Swp Time knob controls the sweep rate. Frequency markers can be used with ΔF Sweep; refer to paragraph 3.2.5. Figure 3-5 indicates the primary controls for the ΔF Sweep operation.

The following list gives the controls and connectors required for the ΔF Sweep operating mode.

Control/Connector	Operation
Power **22**	Press to turn unit on. Line LED is lit.
RF On **6**	Press to On (indicator lit) to enable RF signal at RF Output.
RF Level **5**	Set RF level at RF Output connector. Rotate cw to increase output level and ccw to decrease.
RF Output **7**	Signal output from the unit. 50Ω source impedance.
Mode **4**	Press ΔF Swp pushbutton (indicator lit) to select ΔF Sweep mode. CF LED **2** is lit.
Display Start/CF **21**	Press to display center frequency (indicator lit); this pushbutton need not be pressed if the indicator is lit.
LCD Display **24**	Shows the center frequency.
Main Tuning Knob **1**	Sets the center frequency. Rotate cw to increase frequency and ccw to decrease frequency.
Display Stop/ΔF **19**	Press to display total frequency deviation (indicator lights).
LCD Display **24**	Shows the total frequency deviation.
Stop/ΔF **18**	Sets the total frequency deviation. Rotate cw for maximum deviation and ccw for minimum deviation.
Swp Time **16**	Sets the sweep rate; can be varied between 0.02 (cw position) to 20 (ccw position) seconds. If the Swp Time switch is accidentally placed in the Ext Tune position, the unit reverts to the CW mode.
Sweep LED **23**	Blinks at sweep rate.
Swp Out/Ext Tune In (rear panel) **25**	A 0 to +10V dc coupled, modified sawtooth wave; see figure 3-4.

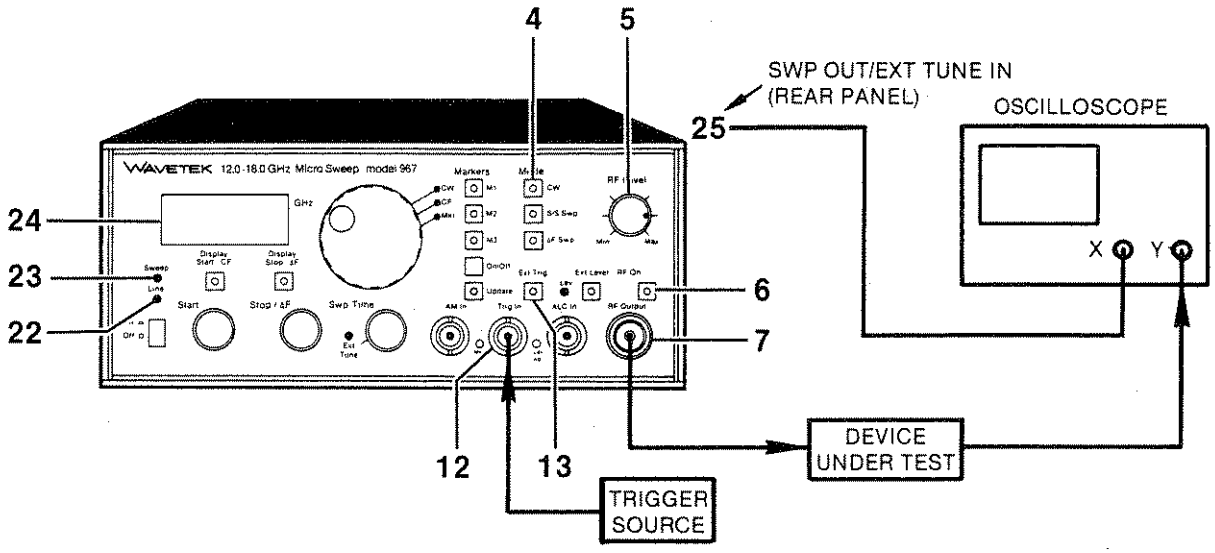


Figure 3-6. External Triggered Sweep Operation

3.2.4 External Triggered Sweep

The unit may be externally triggered by applying an signal at the Trig In BNC or manually triggered using the Ext Trig pushbutton. When triggered, the unit sweeps, either Start/Stop Sweep or ΔF Sweep, one time and returns to the original point. Figure 3-6 shows the controls and connectors required for the external triggered sweep mode.

The following list gives the controls and connectors required for triggered sweep.

Control/Connector	Operation
Power **22**	Press to turn unit on. Line LED is on.
RF On **6**	Press to On (indicator lit) to enable RF signal at RF Output.
RF Level **5**	Set RF level at RF Output connector. Rotate cw to increase output level and ccw to decrease.
RF Output **7**	Signal output from the unit. 50Ω source impedance.
Mode **4**	Select the desired sweep mode. For Start/Stop Sweep, refer to paragraph 3.2.2. For ΔF Sweep, refer to paragraph 3.2.3.
Ext Trig **13**	Press to select externally triggered sweep, indicator is lit.
Trig In **12**	To initiate a triggered sweep, apply a high to low TTL signal or contact closure to ground.

To manually trigger the sweep in external trigger, press the Ext Trig pushbutton twice. In order to effectively manually trigger, the sweep time must be slower than the rate at which the pushbutton is pressed. There is an initial retrace recovery delay before the sweep begins.

3.2.5 Frequency Markers

The Micro Sweep can supply up to three constant width frequency markers for CW, Start/Stop Sweep, ΔF Sweep, and Remote frequency control. Each marker is independently adjustable over the entire frequency band. The unit supplies two types of markers: Oscilloscope Z-Axis Intensity and Amplitude (RF PIP). The marker type can be selected using an internal switch; refer to paragraph 2.2.3. Frequency markers are provided only when the sweep is from a lower to higher frequency.

Intensity markers, a rectangular pulse, provides a marker signal for Z-axis input to oscilloscopes. The marker pulse is factory set for a negative-going pulse (⊔), but may be changed to positive-going pulse (⊓) using an internal switch; refer to paragraph 2.2.4. Retrace blanking signal will be of the opposite polarity.

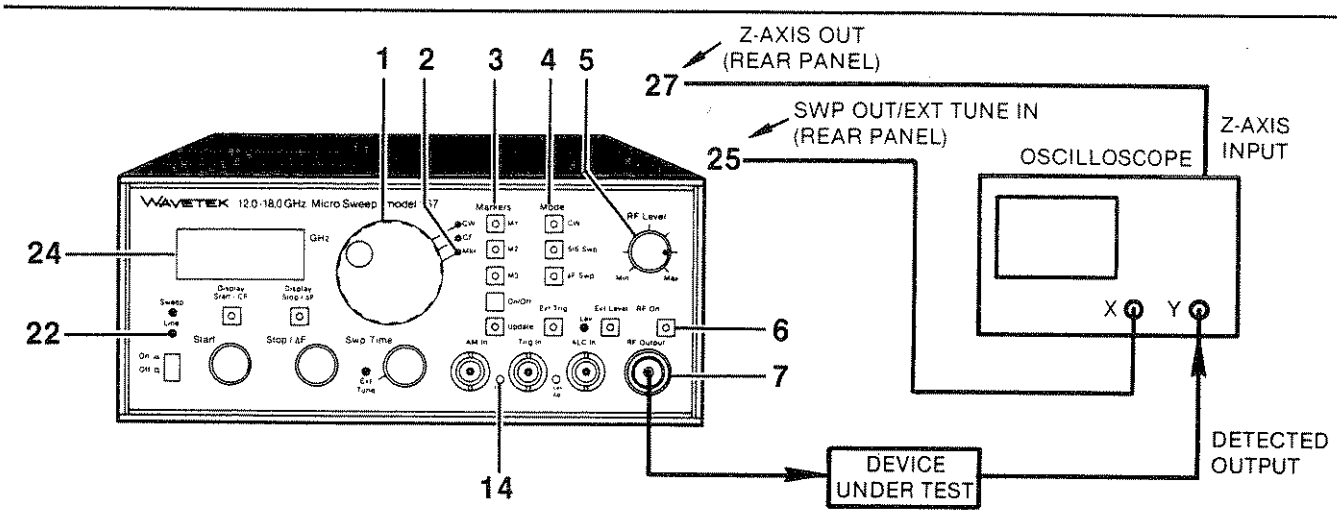


Figure 3-7. Frequency Markers Operation

Amplitude (RF PIP) marker is generated by momentarily reducing the RF output. The factory set position enables the amplitude marker, however, it can be disabled with an internal switch; refer to paragraph 2.2.4.

Figure 3-7 shows the controls required to set the frequency markers. Controls required to set Start/Stop Sweep or ΔF Sweep are described in paragraphs 3.2.2 and 3.2.3 respectively.

The following list gives the controls and connectors required to set frequency markers. There is a specific order to selecting, enabling, and changing the markers.

This example sets marker number 1, the other two markers (M2 and M3) are set the same way.

Control/Connector	Operation
Power **22**	Press to turn unit on. Line LED is on.
RF On **6**	Press to On (indicator lit) to enable RF signal at RF Output.
RF Level **5**	Set RF level at RF Output connector. Rotate cw to increase output level and ccw to decrease.
RF Output **7**	Signal output from the unit. 50Ω source impedance.
Mode **4**	Select the desired sweep mode. For Start/Stop Sweep, refer to paragraph 3.2.2. For ΔF Sweep, refer to paragraph 3.2.3. For Ext Tune, refer to paragraph 3.2.9.
M1 **3**	Press to select Marker 1. The M1 indicator flashes with a low duty cycle (mostly off).
LCD Display **24**	Shows the frequency of Marker 1.
On/Off **3**	Press once to turn on marker 1. M1 indicator blinks at a high duty cycle (mostly on).
Update **3**	Press once to update marker 1. The Update indicator lights; the M1 indicator remains flashing. Mkr LED **2** is lit which indicates the main tuning knob controls the marker.
Main Tuning Knob **1**	Turn cw or ccw to set marker 1 to desired frequency as shown on the LCD Display **23**.
Mode **4**, Display Start/CF **21**, or Display Stop/ΔF **19**	Press any mode or display button to leave the marker set-up mode. M1 indicator stops flashing and remains lit.
Z-Axis Out **27**	A rectangular pulse to intensity modulate an oscilloscope; see Intensity Modulation in this paragraph and figure 3-4.
Mrk Adj **14**	Adjust for proper intensity on oscilloscope.

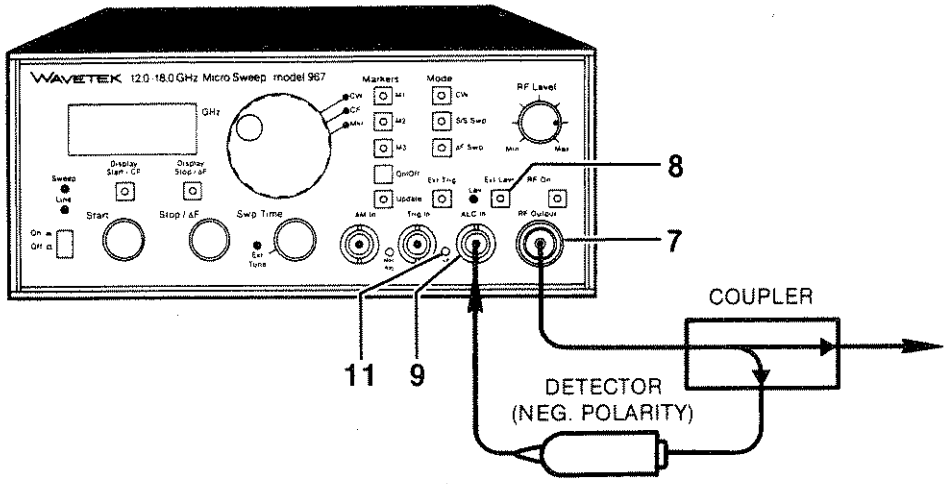


Figure 3-8. External Leveling Operation

3.2.6 ALC/Leveling

Leveling allows the RF output signal to be flat over the entire unit's frequency band. There are two types of leveling in the Micro Sweep: Internal (Option 001 required) and External. Leveling can be used with all modes of operation.

With Option 001 installed, internal leveling is automatic whenever external leveling is not selected and the RF power is on. The Lev indicator is lit. Refer to paragraph 1.2.4 for level limitations.

To use external leveling, setup the Micro Sweep as shown in figure 3-8, then press the Ext Level **8** so its indicator is lit. The Lev indicator **10** will light when a proper leveling signal is present at the ALC In connector. The Lev Adj control **11** sets the leveling loop gain.

3.2.7 Amplitude Modulation (AM)

The output level may be amplitude modulated by using external signal at the AM In. This signal may be either ac or dc. A dc level at the AM In connector may be used to remotely control the output level. The Micro Sweep will respond unidirectionally and logarithmically to the external modulating signal. For example: a 0 to + 10V input (+ 10V is maximum attenuation) will decrease the signal level, while a 0 to -10V input will have no affect. To achieve maximum depth of modulation, set the RF Level to full cw. Figure 3-9 shows the controls and connectors required for Amplitude Modulation. The unit may be amplitude modulated in any mode.

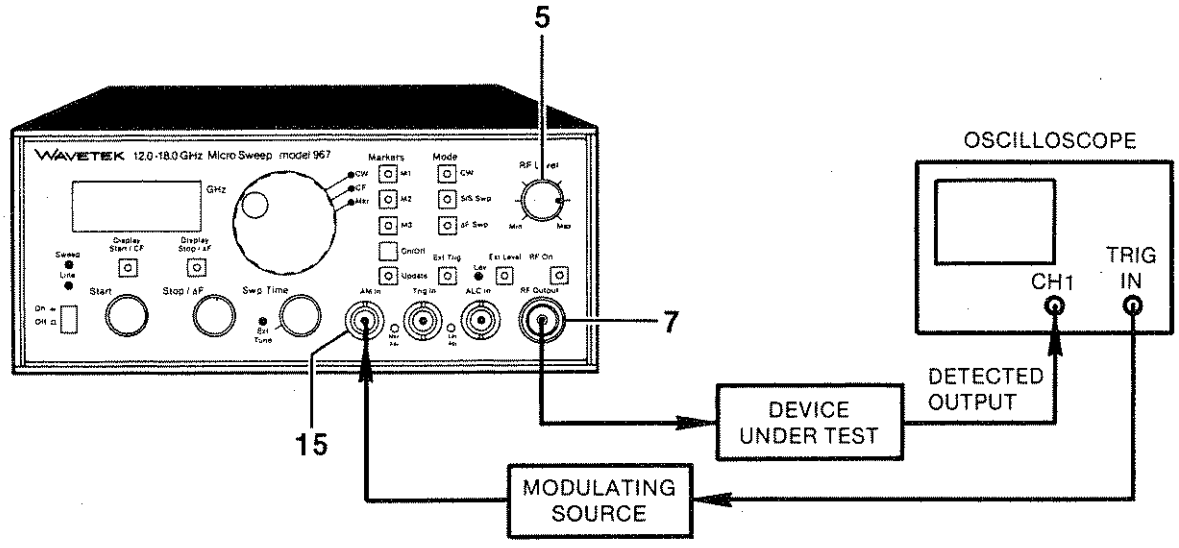


Figure 3-9. Amplitude Modulation Operation

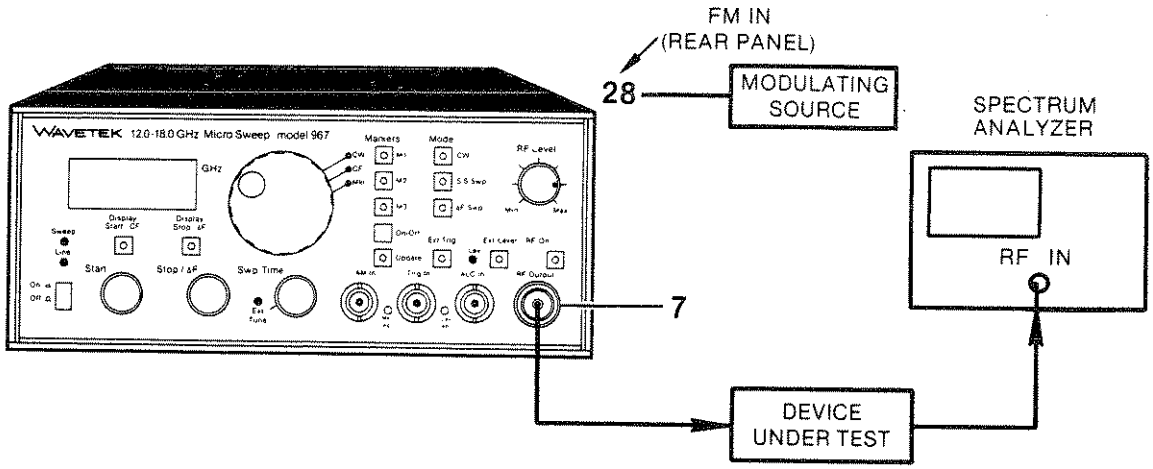


Figure 3-10. Frequency Modulation Operation

3.2.8 Frequency Modulation

The micro source's frequency may be modulated by an ac or dc signal. Figure 3-10 shows the controls and connectors required for frequency modulation. In addition, the FM In can be connected to the phase lock output of a phase locking counter to achieve the frequency accuracy of the counter's internal time base.

3.2.9 External Tuning

When the Swp Time knob is set to Ext Tune (the detent position), an external level controls the frequency of the microwave oscillator. Selecting Ext Tune automatically places the Micro Sweep in the CW mode. A 0V (minimum frequency) to + 10V (maximum frequency) level controls the oscillator. Figure 3-11 shows the controls and connections required for external frequency tuning. An internal tuning filter which filters the YIG tuned oscillator tuning current, can be switched in or out; see paragraph 2.2.6. If the external tuning signal is changing at a fast rate (>1V/second) or it is important to optimize frequency tracking during switching, the filter should be switched out (reduced filtering). When external tuning is used in conjunction with a source locking counter or any application requiring low residual FM, the filter should be switched in (maximum filtering); this is the factory setting.

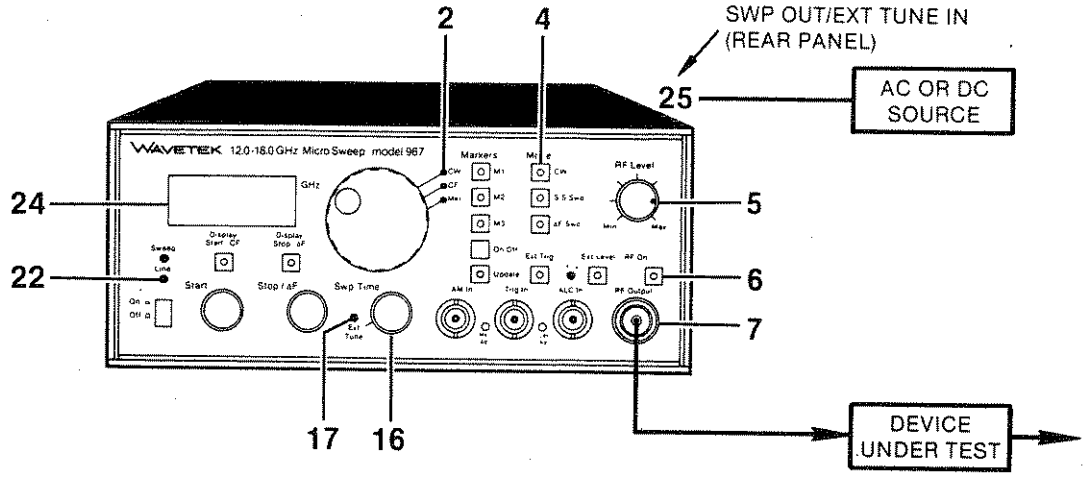


Figure 3-11. External Frequency Tuning Operation