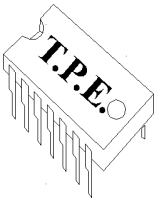
UNIVERSIDAD NACIONAL EXPERIMENTAL POLITÉCNICA
"ANTONIO JOSÉ DE SUCRE"
VICE-RECTORADO BARQUISIMETO
DEPARTAMENTO DE INGENIERÍA ELECTRÓNICA

Laboratorio de Mediciones Eléctricas

Manual del Wavetek Modelo 134



Diciembre, 2.000

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SE UTILIZÓ EN LA ASIGNATURA ''MEDICIONES ELÉCTRICAS'' DESDE 1984 HASTA 1990

CONTENTS

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Section One	SPECIFICATIONS	
	Specifications	1
Section Two	OPERATION	
	Inspection	3
	Operation Controls	4
	Operation	6
Section Three	CIRCUIT DESCRIPTION	
	General Description	10
Section Four	MAINTENANCE	
	Introduction	12
	Recommended Test Equipment	12
	Checkout and Calibration	12
	Removal of Dust Covers and Panels	12
	Troubleshooting	15
	Replacement of Switch Wafers and Potentiometer	17
	Replacement of Sine Converter	18
	Frequency Dial Alignment Procedure	18
Section Five	DATA PACKAGE	
	Introduction	19
	List of Manufacturers	19

SCOPE OF MANUAL

This manual contains instructions for operating, testing, and maintaining the Wavetek Model 134 Sweep Generator. The Wavetek product-improvement program ensures that the latest electronic developments are incorporated into the Wavetek instruments by the addition of circuit and component changes as rapidly as development and testing permit. Due to the time required to document and print this manual, it is not always possible to incorporate these changes into the manual. In this case, data will be found on engineering change sheets at the back of the manual. If there are no change sheets, the manual is correct as printed.

SCOPE OF EQUIPMENT

The Model 134 is a precision source of sine, square, triangle, and sawtooth waveforms with selectable and variable outputs over a dynamic frequency range of 0.2 Hz to 2 MHz. The instrument also offers frequency control by external voltage for either dc programming or wideband ac FM applications. Additionally, the Model 134 can be operated as a triggered or gated CW generator and as a continuous or triggered sweep generator.

SE UTILIZÓ EN LA ASIGNATURA ''MEDICIONES ELÉCTRICAS'' DESDE 1984 HASTA 1990

SECTION I
SPECIFICATIONS

VERSATILITY

Waveforms
Sine, square, triangle, and sweep.

Dynamic Frequency Range
0.2 Hz to 2 MHz.

Ranges

X10	0.2 Hz to 20 Hz
X100	2 Hz to 200 Hz
X1K	20 Hz to 2 kHz
X10K	200 Hz to 20 kHz
X100K	2 kHz to 200 kHz
X1M	20 kHz to 2 MHz

Outputs
Sine, square, triangle, and sweep, selectable; amplitude variable over 40 dB, 50Ω output impedance (600Ω available); 20 V p-p into open circuit and 10 V p-p into 50Ω load from 50Ω source impedance. Separate ramp output at 5 volts peak and 600Ω impedance.

Sync Output
Greater than 1 V p-p square wave into open circuit at 600Ω output impedance.

DC Offset
±5 V offset (±2.5 V offset into 50Ω load) controlled from rear panel; peak amplitude limited by the dynamic range of the amplifier output.

VCG—Voltage Controlled Generator
Frequency of generator may be dc-programmed or ac-modulated by external 0 to 5 V signal. Voltage control circuitry is capable of 1000:1 deviation. The VCG amplifier has a 100 kHz bandwidth and a slew rate of 0.1 V/μs. The instantaneous frequency is the result of the sum of the dial setting and the externally applied voltage.

Stability

Short term	±0.05% for 10 minutes
Long term	±0.25% for 24 hours

Percentages apply to amplitude, frequency, and dc offset.

OPERATIONAL MODES

Continuous*
Operates as a standard VCG. Frequency determined by dial/vernier/range settings in parallel with VCG input.

Trigger**
One complete cycle is generated by applying a pulse to the trigger input.

Gated**
Same as trigger except that cycles continue for the duration of input gate.

Continuous Sweep
The main generator is frequency modulated by the sweep generator. When swept, the main generator frequency rises from the frequency set by the dial and range settings to a frequency selected by the sweep-width controls. Sweep rate is set by panel controls.

*Both generators free run.
**Sweep generator free runs, main generator is triggered or gated.

Trigger Sweep
Same as continuous sweep mode except one complete sweep cycle is generated for each input trigger pulse. Main generator continues to oscillate between sweep cycles.

Tone-Burst
Main generator is gated by the sweep output (internally connected). The tone-burst rate, frequency, and length can be independently controlled.

Trigger Input
1 V peak into 10 kΩ impedance dc coupled to 200 kHz, proportionally greater at higher frequencies.

Sweep Time
10 μs to 100 s.

Sweep Width
Up to 1000:1 with calibrated control.

SE UTILIZÓ EN LA ASIGNATURA ''MEDICIONES ELÉCTRICAS'' DESDE 1984 HASTA 1990

HORIZONTAL PRECISION

Dial Accuracy
±2% of full scale, 1 Hz to 2 MHz.

Electronic Frequency Vernier
One turn for approximately 1% of full-scale change.

Time Symmetry
±1% through X100K range.

VERTICAL PRECISION

Sine Wave Frequency Response
Amplitude change with frequency less than:
- 0.1 dB from 0.2 Hz to 200 kHz
- 0.5 dB from 0.2 Hz to 2 MHz

PURITY

Sine Wave Distortion
Less than:
- 0.5% on X10, X100, X1K, X10K ranges
- 1.0% on X100K range
- 2.0% on X1M range

Square Wave Rise and Fall Time
Less than 100 ns.

ENVIRONMENTAL

Temperature
All specifications listed, except stability, are for 25°C ±5°C. For operation from 0°C to 55°C, derate all specifications by factor of 2.

MECHANICAL

Dimensions
8-⅓ inches wide, 5-¼ inches high, 11-⅓ inches deep.

Weight
8 lb net, 11 lb shipping.

Power
105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz.
Less than 20 watts.

NOTE

All specifications apply for frequencies obtained when dial is between 0.1 and 2 and at 10 V p-p into a 50Ω load.

SE UTILIZÓ EN LA ASIGNATURA ''MEDICIONES ELÉCTRICAS'' DESDE 1984 HASTA 1990

SECTION 2
OPERATION

INSPECTION

The following procedures should be performed to assure the user that the instrument has arrived at its destination in proper operating condition. Complete calibration and checkout instructions are provided in Section 4 for determining if the instrument is within electrical specifications.

Checking Visually

After carefully unpacking the instrument, visually inspect the external parts for damage to knobs, dials, indicators, surface areas, etc. If damage is discovered, file a claim with the carrier who transported the instrument. Retain the shipping container and packing material for use in case reshipment is required.

Checking Electrically

NOTE

Instruments are normally shipped connected for 115 V power unless 230 V power is ordered. Refer to the end of this section for conversion instructions.

The procedural steps in this paragraph provide a quick checkout of instrument operation. If electrical deficiencies exist, refer to the Warranty in the front of this manual. The following test equipment, or equivalent, is recommended for performing this electrical inspection. (Refer to Operating Controls and Figure 2-1 for operating control descriptions.)

Name	Manufacturer	Model
Oscilloscope	Tektronix	544
Counter-Timer	Monsanto	101A

1. Turn FREQ HZ selector to the X1K position. (This connects ac power to the unit and establishes the frequency multiplier).
2. Connect oscilloscope to the 50Ω OUT connector with 50-ohm terminator.
3. Set frequency dial to the 1.0 mark and MODE selector to CONT.
4. Set function selector to ∿ .
5. Rotate 20 V P-P MAX control to its maximum clockwise position.
6. Check for 1-kHz sine wave with greater than 10 V p-p amplitude on oscilloscope.
7. Select ∿ and ⊓ with function selector and check for 10 V p-p amplitude on oscilloscope.
8. Turn frequency dial from maximum counterclockwise to maximum clockwise positions and check for frequency change.
9. Rotate 20 V P-P MAX control from maximum clockwise to maximum counterclockwise positions and check for decreasing amplitude.
10. Rotate VERNIER to maximum cw position. Set frequency to 20 Hz with counter. Connect 0 to +5 Vdc input to the VCG IN connector. Slowly increase voltage input from 0 to maximum and check that frequency of output waveform increases approximately from 20 Hz to 2 kHz.
11. Set MODE selector to TRIG. Disconnect power supply from VCG IN connector. Rotate TRIG LEVEL control while observing oscilloscope. One cycle of the desired waveform should appear.
12. Set MODE selector to GATED. Rotate TRIG LEVEL control while observing oscilloscope. Waveform should appear at cw position and disappear at ccw position.
13. Set MODE selector to CONT SWP. Set frequency to 20 Hz with counter. Set SWEEP WIDTH to 2.0. Set SWEEP TIME to 1S. Displayed frequency should sweep recurringly from 20 Hz to 2 kHz at a 1 Hz rate.
14. Set MODE to TRIG SWP. Rotate TRIG LEVEL control, while observing oscilloscope. Displayed frequency should sweep once from 20 Hz to 20 kHz in 1 second.
15. Set MODE selector to TONE BURST. Rotate TRIG LEVEL control, while observing oscilloscope. Tone bursts at 20 Hz should appear with burst duration varying with rotation of TRIG LEVEL control.
16. Connect oscilloscope to SWEEP OUT connector. Set MODE selector to CONT. Set SWEEP TIME to 1 mS. Oscilloscope should display a 2-kHz square wave.
17. Connect oscilloscope to SYNC OUT connector. Set frequency dial to 2.0. Oscilloscope should display a 2-kHz square wave.

SE UTILIZÓ EN LA ASIGNATURA ''MEDICIONES ELÉCTRICAS'' DESDE 1984 HASTA 1990

NOTE

It is possible to adjust the controls of the Model 134 in the X1M range, beyond the specified limits of the generator —and the instrument will stop oscillating. This condition is easily corrected by turning the frequency VERNIER control in a clockwise direction until oscillation again occurs. This condition is well below 1/1000th of the top of the dial.

It is also possible to stop the generator from oscillating by applying a negative voltage to the VCG summing node when the MODE selector switch is set to TRIG SWP and the SWEEP WIDTH control is set to maximum. If the generator stops oscillating, turn the frequency dial counterclockwise until oscillation again occurs. This condition is well below 1/1000th of the top of the dial. Do not attempt to purposely stop the generator in this manner.

OPERATING CONTROLS

The operating controls and electrical connections for the Model 134 are shown in Figure 2-1. The listing below discusses each control and its function.

1. **FREQ HZ/Power Switch** — This 7-position switch selects the generator frequency range. The extreme counter-clockwise position is the power off position.

2. **FREQUENCY VERNIER** — This control allows precision control over the output frequency. When frequency dial is set at .02 (1/100 of range) VERNIER controls frequency to approximately .002 (1/1000 of range). When in the full clockwise position (CAL), the settings on the main dial will be calibrated.

3. **FREQUENCY DIAL** — The main frequency control. The setting on this dial multiplied by the frequency range setting (above) equals the output frequency of the generator. The frequency VERNIER also affects the generator frequency.

4. **FREQUENCY INDEX** — The scribe line indicates the frequency dial setting. The index is illuminates when the unis is on.

5. **FUNCTION SELECTOR** — This selects the waveform that appears at the 50Ω OUT connector. The waveforms are sine ∿, triangle ∿, square ⊓⊔, or sweep /|.

6. **AMPLITUDE VERNIER** — A vernier control of the output amplitude. Maximum clockwise position gives the full output amplitude of 20 V peak-to-peak into an open circuit or 10 V p-p into a 50Ω load. Counter-clockwise rotation will continuously reduce the output amplitude. The control gives a minimum of 40 dB variation (100:1). For maximum output amplitude this vernier must be full clockwise.

7. **50Ω OUT** — This connector provides the selected generator output function. The generator may operate into an open circuit providing 20 V peak-to-peak maximum, or into a 50Ω load providing a 10 V peak-to-peak output.

8. **SWEEP OUT** — When the generator is in CONT, TRIG, GATED, CONT SWP, or TONE BURST mode, output provides a fixed 0 to +5 V sawtooth output. The frequency of this output is controlled by the SWEEP TIME controls (9). When the generator is in TRIG SWP mode, the output becomes a single cycle sawtooth, triggered by the TRIG IN (13).

9. **SWEEP TIME and VARIABLE** — Determines the frequency of the sawtooth generator appearing at the SWEEP OUT. The frequency of this generator is independent of the frequency of the main generator. When in any of the sweep modes, this sawtooth determines the duration of the sweep cycle. The SWEEP TIME (larger) knob determines the frequency range and the VARIABLE (smaller) knob provides a fine adjustment. Note that the larger switch detent position is located between two time ranges. With the VARIABLE in the full clockwise position, the sweep time is equal to the time to the right of the detent setting. However, moving the VARIABLE to the full counter clockwise results in the sweep time approximately 100 times the SWEEP TIME.

10. **SWEEP WIDTH and VARIABLE** — Determines the amount of sweep when in CONT SWP or TRIG SWP. The SWEEP WIDTH (large) knob has ten detent positions which are located between two sweep widths. With the VARIALBE in the full clockwise position the sweep

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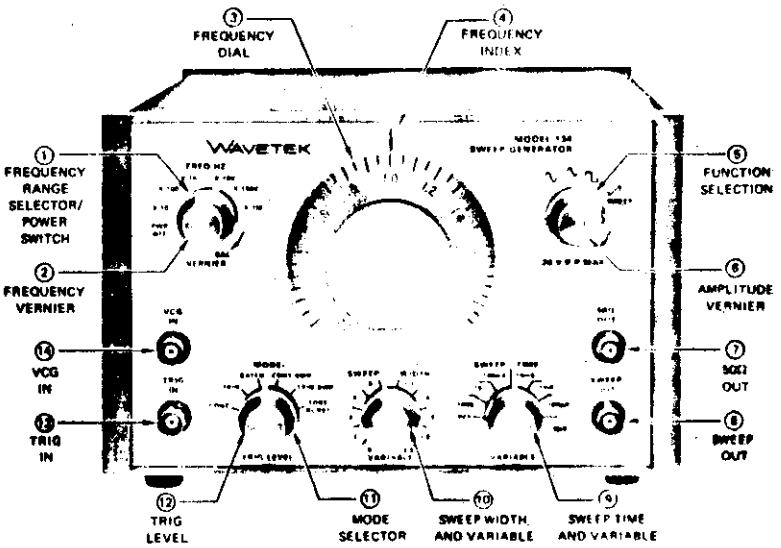


Figure 2-1. Operating Controls

width is equal to the sweep width to the right of the detent setting. Moving the VARIABLE to the full counter clockwise results in the approximate sweep width to the left of the detent. Clockwise rotation of either knobs increases sweep width, counter clockwise rotation decreases sweep width.

11. **MODE SELECTOR** — Selects the operating mode of the main generator as follows:
   a) CONT = Continuous Mode. The generator operates at a fixed frequency and runs continuously. The SWEEP OUT is a fixed 0 to +5 V sawtooth.
   b) TRIG = Trigger Mode — The generator will give one complete cycle of output for each pulse applied to the TRIG IN connector. Since the SWEEP OUT can be operated independently, it can be used as a convenient source. Manual triggering can be accomplished by rotating the Trig Level Control (12) from full CCW to full CW. The SWEEP OUT is a fixed 0 to +5 V sawtooth.
   c) GATED = Gated Mode — Operates the same as triggered mode except that the generator will continue to have output for the full time that the signal at the TRIG IN connector, exceeds the gating level. See TRIG LEVEL (12). The SWEEP OUT is a fixed 0 to +5 V sawtooth.
   d) CONT SWP = Continuous with Sweep Mode. The main generator operates continuously and repetitively sweeps from the minimum to maximum frequency as determined by the sweep controls.
   e) TRIG SWP = Triggered Sweep Mode — The main generator oscillates at the start or low frequency until a trigger signal is applied. The frequency then sweeps to the maximum frequency as determined by sweep width control and then returns to the low frequency until another trigger is applied. The SWP OUT is a single cycle sawtooth, triggered by the TRIG IN (13).
   f) TONE BURST = Internal Gated Mode — Operates the same as the GATED mode with no TRIG IN input.

12. **TRIG LEVEL** — Adjusts the sensitivity of the trigger input circuitry. When in the full counter clockwise position, approximately −7.5 V is required for triggering. In the full clockwise position approximately +7.5 V is required for triggering. At the mid point, extremely low voltages will trigger the instrument. By rotating the knob, it is possible to manually trigger the generator. In the GATED mode, the generator will begin to run continuously as the control is rotated past the mid-point in a clockwise direction.

SE UTILIZÓ EN LA ASIGNATURA ''MEDICIONES ELÉCTRICAS'' DESDE 1984 HASTA 1990

13. **TRIG IN** – DC coupled input with 10 kΩ input impedance. The TRIG LEVEL control adjusts the sensitivity of the generator to this input signal.

14. **VCG IN** – This connector allows external control of frequency. With 0 volts in, the generator output frequency is determined by the frequency range selected and the frequency dial setting. A positive VCG voltage will increase this frequency, and a negative voltage will decrease the frequency. Input impedance is 5 kΩ.

DC OFFSET – This rear panel control adjusts the amount of dc or baseline offset above or below signal ground. The detent position gives normal vertical symmetry and as the control is through zero offset to maximum positive offset.

SYNC OUT – This rear panel output provides a synchronizing wave output at the same frequency of the main generator. The output amplitude is greater than 1 V p-p into open circuit at 600Ω output impedance.

GENERAL NOTES

One-half hour warmup is required for generator to stabilize at specified accuries.

A 50-ohm termination results in 10 V p-p maximum output level. Open-circuit termination gives 20 V p-p. Loads between these limits provide intermediate maximum output levels.

The frequency VERNIER control must be in full cw position for calibrated-frequency operation over the .1 to 2 dial range. If this control is in full ccw position, dial range is uncalibrated, but extended to approximately 1/1000 of full scale.

A 1-volt peak signal is required for trigger rates up to 200 kHz. Proportionally higher voltage is required for higher frequencies.

OPERATION

The Model 134 Sweep Generator can operate in the following six operational modes, as selected by the mode switch setting.

CONT – Continuous Frequency Operation provides a fixed-frequency output for the selected frequency, amplitude, and waveform. The output frequency is determined by the FREQ HZ range selector and frequency dial settings. Output amplitude is controlled with the 20 V P-P MAX continuously-variable potentiometer, and the waveform is selected by the function selector.

TRIG – Trigger Operation provides a one-cycle output of the selected waveform with the application of an external trigger. The external signal may be either ac or stepped dc from +1 volt to +12 volts, applied at the TRIG IN connector. The TRIG LEVEL control is used to establish the threshold bias.

GATED – Gated Operation provides a multicycle output of the selected waveform, frequency, and amplitude when an external signal is applied to the TRIG IN connector. Burst duration is a function of external signal duration.

CONT SWP – Continuous Sweep Operation provides an internally-generated, sweep frequency output of the selected waveform, amplitude, and low-end frequency. Sweep width and sweep time are selected in conjunction with the low-frequency limit established by the setting of the frequency dial and FREQ HZ range selector. The output frequency increases from the lower frequency to the upper frequency, which is established by the setting of the SWEEP WIDTH selector, at the rate set by the SWEEP TIME selector. When the upper frequency is reached, the output frequency returns rapidly to the lower limit and the cycle is repeated.

TRIG SWP – Trigger Sweep Operation provides a sweep-frequency output at the selected frequency, amplitude, and waveform each time an external signal is applied to the TRIG IN connector. Sweep width and time are selectable as in continuous sweep operation, but the sweep cycle is not repeated until another external trigger arrives.

TONE BURST – Tone Burst Operation provides internally-generated, recurring bursts of fixed frequencies. Burst duration is adjustable with the TRIG LEVEL control. Frequency, amplitude, and waveform are selected as in continuous frequency operation.

SE UTILIZÓ EN LA ASIGNATURA ''MEDICIONES ELÉCTRICAS'' DESDE 1984 HASTA 1990

Operating as a Function Generator

1. Set MODE selector to CONT position.
2. Set function selector for desired waveform.
3. Set FREQ HZ range selector to desired multiplier.
4. Set desired frequency dial mark under illuminated index.
5. Set 20 V P-P MAX control for desired output level.
6. If triggered/gated operation is desired, inject a 1-volt peak signal into TRIG IN connector with MODE selector in TRIG or GATED position. Trigger operation provides one cycle of the selected waveform for each step-voltage input. Gated operation produces a tone burst with its duration equal to the duration of the step voltage.

Operating as a Voltage Controlled Generator (VCG)

1. Set MODE selector to CONT position.
2. Set function selector for desired waveform.
3. Set FREQ HZ range selector to desired multiplier.
4. Connect external voltage source (dc programming or wideband ac signal) to VCG IN connector.

NOTE

VCG input requires 0 to ±5 volts for operation over full-scale range, but can withstand many times maximum input.

A negative voltage applied to the VCG input with the dial at the bottom may cause the generator to stop oscillating. Operation in such a manner is not recommended.

5. Set frequency dial as follows:
   a. For frequency modulation with ac input, set dial for center frequency.
   b. For increasing frequency sweep with positive dc input, set dial to lower frequency limit.
   c. For decreasing frequency sweep with negative dc input, set dial to upper frequency limit.
6. Set 20 V P-P MAX control for desired output level.
7. The nomograph in Figure 2-2 shows the characteristics of the VCG circuit. Column A gives the frequency dial setting; column B, the VCG input voltage; and column C, the approximate resultant dial frequency. Column C must be multiplied by the frequency range multiplier for the actual output frequency.

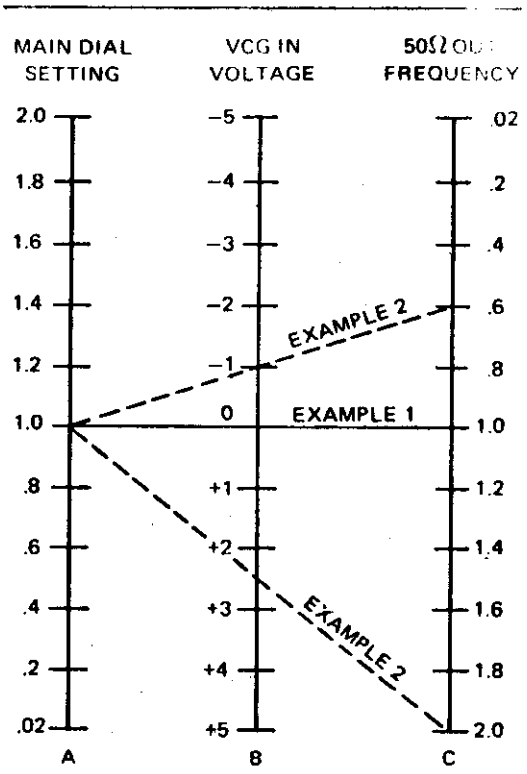


Figure 2-2 - VCG Voltage-to-Frequency Nomograph

In example 1, the dial is set at 1, and 0 volts is applied to the VCG input. Extend a straight line from 1 (dail setting) through 0 volts (VCG voltage) and obtain a dial frequency of 1. For the total output frequency multiply the range by 1 with the same dial setting, example 2 shows the results of using a ramp from −1 volts to +2.5 volts for the VCG voltage. This results in a swept output from .6 to 2.0 on the dial. Remember to multiply the dial times the range.

Operating as a Sweep Generator.

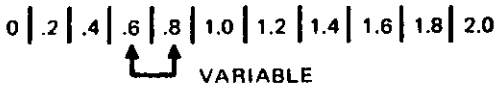
1. Set MODE selector to CONT SWP.
2. Set function selector for desired waveform.
3. Set FREQ HZ range selector to desired multiplier.
4. Set the SWEEP TIME control to the desired sweep time. The sweep time control operates in the following manner. The larger knob provides the coarse adjustment. There are 7 detent positions covering sweep times from 100 s to 10 μs. The VARIABLE control is a vernier covering

SE UTILIZÓ EN LA ASIGNATURA ''MEDICIONES ELÉCTRICAS'' DESDE 1984 HASTA 1990

sweep times between one or more detent positions. When the VARIABLE control is in the full CW position, the sweep time is equal to the time indicated at the right of detent mark.

5. Set the SWEEP WIDTH to the desired sweep width. This control is operated as described below.

   To read the sweep width control, notice that the larger knob has ten detent positions located between the numbers appearing on the panel.



   The VARIABLE vernier covers the range between the numbers on either side of the detent. For example, if the detent is set between .6 and .8, the VARIABLE in the full CCW position gives a sweep width of .6 and in the full CW position, a width of .8.

   The sweep width is determined by adding the frequency set by the main dial to the value determined by the sweep width control. Here are two examples:

Example 1

Suppose you want to sweep from 10 kHz to 30 kHz. Set the main dial on 1.0 and the range on X10K. The starting frequency is now set at 10K. Now determine what number must be added to the number on the dial so that the sum times the frequency range multiplier equals the top frequency of 30 kHz. Therefore 1.0 (dial value) +2.0 (sweep width) equal 3.0 and X10 kHz = 30 kHz. Set the SWEEP WIDTH knob in the detent between 1.8 and 2.0 with the VARIABLE in the CW position to give a sweep width of 2.0.

Example 2

Now sweep from 20 Hz to 20 kHz. Since this is a sweep range of 1000:1 the dial must be set at the bottom. The reason for this is that the top frequency cannot exceed the top of the dial multiplied times the range. Therefore, the bottom of the dial is set at .02 and the frequency vernier is rotated maximum CCW to give the additional 10:1. The frequency range switch is set at X10K since 10K times .002 equals 20 Hz, the starting frequency. As in the previous example, the SWEEP WIDTH must be set to 2.0 since .02 (dial) + 2.0 (sweep width) equals 2.02 and X10 kHz (range multiplier) = 20 kHz, the top frequency.

6. Set 20 V P-P MAX control for desired output level.
7. If triggered-sweep operation is desired, inject a 1 volt peak signal into the TRIG IN connector with MODE selector in TRIG SWP position. Trigger-sweep operation provides one frequency excursion of the selected waveform for each step-voltage input.

Operating as a Tone Burst Generator

1. Set the MODE selector to TONE BURST.
2. Set function selector to desired waveform.
3. Set the frequency of the carrier by the main dial.
4. Set the duration of the burst (number of cycles per burst by varying the TRIG LEVEL.
5. Set the repetition rate with the SWEEP TIME control.
6. Set the 20 V P-P MAX control for the desired output level.

Operating as a Ramp Generator

1. Connect coaxial cable between SYNC OUT (on rear panel) and TRIG IN connectors.
2. Set function selector to sweep ⟋ .
3. Set SWEEP WIDTH to 0.
4. Set SWEEP MODE to TRIG SWP.
5. Adjust TRIG LEVEL control for sweep generator firing point.
6. Set ramp parameters as follows:
   a. Repetition rate with FREQ HZ selector and frequency dial.
   b. Ramp amplitude with 20 V P-P MAX control.
   c. Ramp slope with SWEEP TIME controls.
   d. Ramp baseline with DC OFFSET potentiometer.

Converting to 230-Volt Line Power

The Model 134 Sweep Generator is shipped from the factory with the power transformer connected for 115-volt line power, unless ordered for 230-volt use. Converting a 115-volt unit for 230-volt operation is a simple matter:

1. Remove power cord.
2. Loosen two captive thumb screws on rear panel and remove panel.
3. The conversion switch is located on the chassis. Use a thin-bladed screwdriver to move the 115-230 switch to the 230 position.
4. Replace 1/4-ampere fuse with a 1/8-ampere fuse of the same type.

SE UTILIZÓ EN LA ASIGNATURA ''MEDICIONES ELÉCTRICAS'' DESDE 1984 HASTA 1990

Connecting Signal and Chassis Grounds

The instrument is shipped from the factory with the signal ground floating above chassis ground, unless otherwise specified. A common signal/chassis ground can be obtained as follows:

1. Remove power cord.
2. Loosen two captive thumb screws on rear panel. Remove panel and cover.
3. Solder a jumper wire between the ground lugs (green wires) of the SYNC OUT connector and the power connector (Figure 2-3).

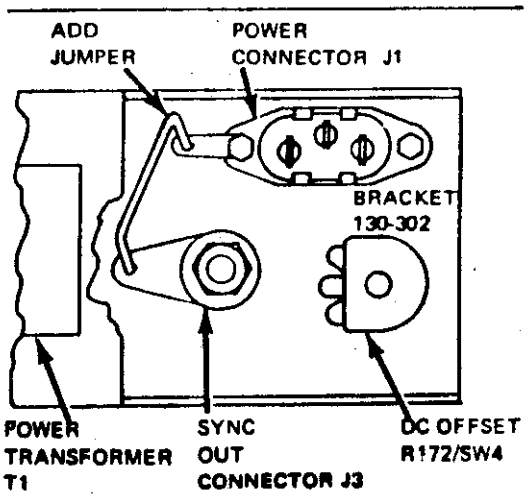


Figure 2-3. Common Ground Connection Diagram

SE UTILIZÓ EN LA ASIGNATURA ''MEDICIONES ELÉCTRICAS'' DESDE 1984 HASTA 1990

SECTION 3
CIRCUIT DESCRIPTION

GENERAL DESCRIPTION

Main Generator

The basic generator circuitry (Figure 3-1) consists of the integrator and hysteresis/output switch. The square wave from the output switch is applied to the VCG circuit where it gates a current, which is proportional to the sum of the VCG input, frequency dial, and vernier control voltages, into the integrator summing node. The integrator transforms the square wave into a triangle wave that is applied to the hysteresis switch. The hysteresis/output switch functions similarly to a Schmitt trigger with its limit points set far apart. When a limit point is reached, the hysteresis/output switch fires and reverses the polarity of the square wave into the integrator, causing the triangle waves of the same frequency, having the positive portion of the square wave coincident with the negative slope of the triangle.

Oscillation frequency is determined by a timing capacitor selected by the frequency range switch and the integrating current controlled by the frequency/vernier potentiometers. The main generator trigger circuit is disconnected in the continuous-frequency operation just described. When a triggered, gated, or tone-burst operation is selected, this circuit places a shunt path between the integrator input and output. Therefore, there is no output at the 50-ohm BNC until an external trigger/gate signal is applied to the trigger input connector; or, for tone burst mode, an internal gate voltage is generated by the sweep circuitry. A trigger input enables the generator for one complete cycle of the selected waveform, than the main generator is disabled again until another trigger arrives. A gate input allows the generator to function for the duration of the gate. For tone bursts, the selected waveform appears automatically at the 50-ohm BNC as a gated signal with the gate duration established by the internally-generated sawtooth waveform.

The triangle output of the integrator is transformed into a sine wave by the sine converter circuitry. The selected waveform is amplified by the output amplifier and connected to the 50-ohm BNC.

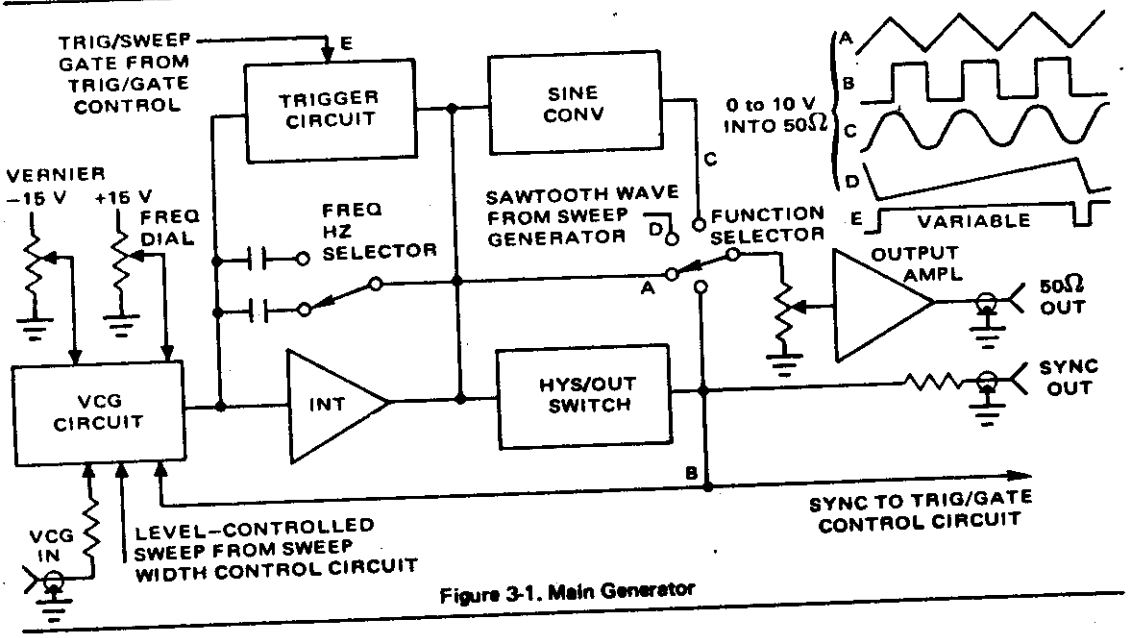


Figure 3-1. Main Generator

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Sweep Generator

Figure 3-2 presents a functional block diagram of the sweep/gating circuitry to supplement the following discussion. When operating in the continuous frequency, continuous sweep, or triggered sweep mode, the output of the trigger/gate control circuit disconnects the main-generator trigger circuit and the main generator initially produces an output frequency that is a function of the frequency dial setting, frequency-range selector, frequency-vernier control, and VCG input voltage. In triggered-sweep operation, the output frequency begins to increase when a trigger pulse is applied to the trigger input BNC. Rate of change from the low to high limit is a function of the sweep time control settings. This switch connects different values of capacitance into the feedback path of the sweep integrator so that its sawtooth output varies in frequency and produces the selected time interval. The output sawtooth of the sweep generator is connected to the sweep output BNC, to the function selector, and to the sweep width control. This control connects different values of resistors to the VCG input circuit so that the sawtooth input varies in peak current as a function of the selected sweep width. If the frequency controls are set for 2 kHz (X 100 kHz range), sweep time for 1 ms, and sweep width for 2.0, the selected waveform at the 50-ohm BNC will swing from 2 kHz to 200 kHz in 1 ms each time a trigger occurs. Continuous sweep operation with these settings produces a recurring 2 kHz to 200 kHz output at a 1 kHz repetition rate. The mode switch disconnects the sawtooth from the VCG circuit in the continuous, triggered, gated, and tone-burst modes. Gated operation direct couples the external gating pulse from the trigger input BNC to the trigger/gate control circuit which, in turn, disconnects the main generator trigger circuit for the duration of the external signal. Trigger operation places capacitance between the comparator and control circuit to differentiate the external pulse and momentarily disconnects the trigger circuit, allowing one cycle of the selected frequency to be produced by the main generator.

During tone-burst operation, the sweep generator output is connected to the trigger comparator input. Since the sweep-width control circuit disconnects the sawtooth from the VCG input in this mode, the tone-burst output is a fixed frequency with the burst duration established by the setting of the trigger level control.

The hysteresis/output switch synchronizing pulse applied to the trigger/gate control circuit prevents this circuit from reconnecting the main generator disable before a full cycle is completed.

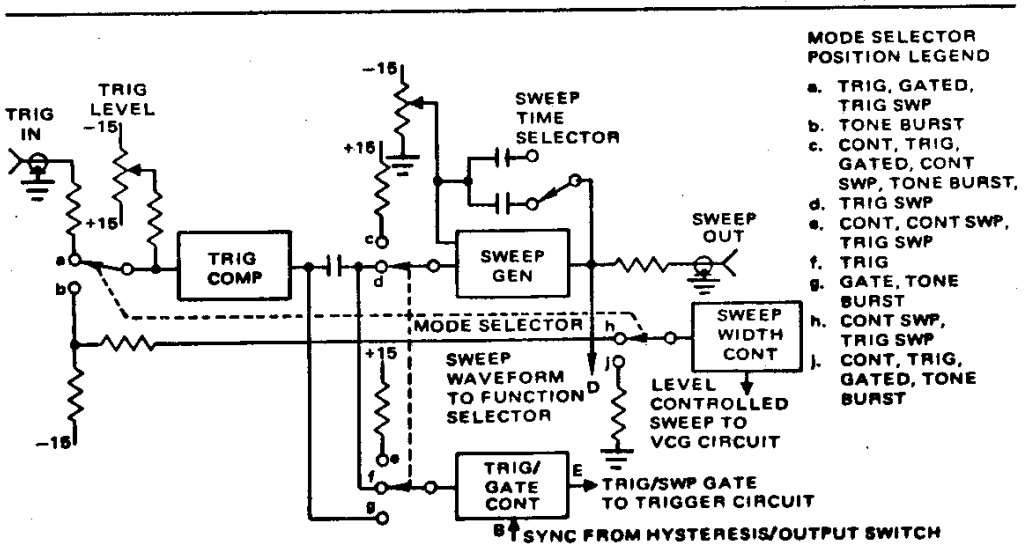


Figure 3-2. Sweep Generator