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SPECIFICATIONS

GENERAL SPECIFICATIONS

Output: Square wave, triangle wave, or sine wave (selectable). Also TTL pulse, Sweep Output.
Input: Voltage controled frequency (VCF)
Frequency Range: 0.2 Hz to 2 MHz (7 ranges)
Storage Temperature: −40°C to 70°C, 70% R.H.
Operating Temperature: 0°C to 50°C, 80% R.H.

ELECTRICAL SPECIFICATIONS

At 23°C ±5°C, 70% R.H. Max. after 1 hour warmup time.

POWER CONSUMPTION 15 VA Max.

FREQUENCY RANGES WITH RANGE SETTING
AT

1 0.2 Hz to 2.0 Hz
10 2 Hz to 20 Hz
100 20 Hz to 200 Hz
1 K 0.2 kHz to 2.0 kHz
10 K 2 kHz to 20 kHz
100 K 20 kHz to 200 kHz
1 M 0.2 MHz to 2.0 MHz

FREQUENCY MULTIPLIER 0.2 to 2.0

FREQUENCY ACCURACY ±5% of full scale

VOLTAGE CONTROLLED FREQUENCY RANGE 100:1 minimum for 0 to ±10 V input

SWEEP CHARACTERISTICS

INTERNAL Linear

SWEEP RATE 0.5Hz (2 SEC Period) to 50Hz (20mSEC period), continuously variable.

SWEEP WIDTH Variable from 1:1 to 100:1

INPUT IMPEDANCE 10 K ohm ±10%

SINEWAVE DISTORTION < 1% from 10 Hz to 100 kHz

TRIANGLE LINEARITY < 1% to 100 Hz

SQUARE WAVE TIME SYMMETRY < 1% to 100 Hz

SQUARE WAVE RISE AND FALL TIME < 100 nsec.

PULSE OUTPUT RISE AND FALL TIME < 25 nsec. (20 TTL loads)
<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAIN OUTPUT AMPLITUDE</td>
<td>&gt; 20 Vp-p (open-circuit)</td>
</tr>
<tr>
<td></td>
<td>&gt; 10 Vp-p (into 50 ohm load)</td>
</tr>
<tr>
<td>IMPEDANCE</td>
<td>50 ohms ± 10%</td>
</tr>
<tr>
<td>AMPLITUDE ADJUSTMENT</td>
<td>&lt; 5 m Vp-p to &gt; 20 Vp-p open circuit (20 dB attenuator off)</td>
</tr>
<tr>
<td>ATTENUATOR</td>
<td>0 dB, -20 dB</td>
</tr>
<tr>
<td>DC OFFSET CONTROL</td>
<td>&lt; -10 V to &gt; 10 V (open circuit) &lt; -5 V to &gt; 5 V (into 50 ohm load)</td>
</tr>
<tr>
<td>DUTY CYCLE CONTROL</td>
<td>5 to 1 minimum duty cycle change (50% at max. CCW (or Cal) position)</td>
</tr>
<tr>
<td>SIZE (W x L x H)</td>
<td>24 CM x 19 CM x 6.4 CM</td>
</tr>
<tr>
<td>WEIGHT</td>
<td></td>
</tr>
</tbody>
</table>
INTRODUCTION/DESCRIPTION

The Sweep Function Generator is a versatile, low cost test instrument. Its wide range of applications include testing and calibration of audio, ultrasonic, and servo systems. Its uncomplicated, rugged design and high quality components ensure long and dependable service.

FEATURES

The Model has the following features:
1. A frequency range from 0.2 Hz to 2 MHz in seven decade increments.
2. Square, triangle, sine wave, and TTL pulse outputs.
3. Duty cycle control.
4. VCF (voltage controlled frequency) input.
5. Internal sweep frequency.
6. Variable and fixed attenuation.
7. Variable DC offset control.
8. Output amplitude control.
10. Separate TTL output.
LOCATION AND DESCRIPTION OF OPERATING CONTROLS

In order to properly utilize the full capabilities of the instrument, it is highly recommended that the user become familiar with the controls associated with this instrument. (See Figure 1)

![Front View of Operating Controls]

**FIGURE 1.** Location of operating controls.

**POWER SWITCH & LED INDICATOR (1)**
When activated, indicates that power is being supplied to the instrument.

**RANGE SELECTOR (2)**
Each of the seven interlocking pushbuttons provides the operator with a specific frequency range. When one pushbutton is depressed, the previously selected button will automatically release.
MODE SWITCHES (3)
Three interlocking pushbutton type switches enable the operator to select Sine, Triangle, or Square Wave output. When one pushbutton is depressed, the previously selected button will automatically release.

ATTENUATION SWITCH (4)
This switch will result in a fixed 20 dB attenuation of the output waveform.

INVERT SWITCH (5)
This causes the output waveform to be inverted. When the SYMMETRY control is being used, it determines which half of the output waveform will be affected. Table One (1) below illustrates the effect of the INVERT switch on various settings of the SYMMETRY control.

<table>
<thead>
<tr>
<th></th>
<th>Invert Out</th>
<th>Invert In</th>
<th>Invert Out</th>
<th>Invert In</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Symmetry CCW</td>
<td>Symmetry CCW</td>
<td>Symmetry CW</td>
<td>Symmetry CW</td>
</tr>
<tr>
<td>Square</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triangle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TTL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE 1. The effect of the invert switch on various settings of the symmetry control.

OUTPUT JACKS (6)
The two BNC connectors provide the output waveforms. Triangle, square and sine waves of up to 20 Vp-p (open circuit) are provided at the 50 ohm output and a TTL compatible pulse is obtained from the TTL connector.

AMPLITUDE CONTROL (7)
This control will provide up to 40 dB of attenuation of the output waveform. (See Electrical Specifications)

DC OFFSET CONTROL (8)
The offset control determines the polarity and magnitude of the offset of the output waveform. When the control is pulled forward and centered the DC level of the output waveform will be 0 volts. Clockwise rotation will offset the output in a positive direction, and counterclockwise rotation will add negative offset.

The amplitude of the waveform plus the amount of offset desired must not exceed the maximum peak to peak amplitude capability or clipping will result. (See Electrical Specifications)

SYMMETRY CONTROL (9)
This control determines the time symmetry of the output waveforms. When the control is pulled forward and rotated fully CCW, the output waveform will be symmetrical. Rotating this control in a CW direction changes the period of half of the waveform. The unaffected portion of the waveform will continue to be determined by the FREQUENCY MULTIPLIER and RANGE SELECTOR settings.
FREQUENCY DIAL (10)
This variable potentiometer selects a specific frequency within the preselected fixed range. The dial scale is calibrated from 0.2 to 2.0.

SWEEP SELECTOR (11)
This switch selects internal or external sweep.

SWEEP RATE CONTROL (12)
Adjusts sweep rate of internal sweep generator and repetition rate of burst gate.

SWEEP WIDTH CONTROL (13)
Adjusts magnitude of sweep.

EXT SWEEP IN (14)
This BNC connector is the VCF (voltage controlled frequency) input. This will enable the operator to externally sweep the generator frequency. Applying a DC voltage (0 to ±10 V) will sweep the generator frequency down two decades (100:1). If the DC voltage applied is negative (0 to −10 V), the output frequency will sweep up to two decades (100:1). Note that the total sweep range which can be achieved is dependent on several factors, including the range chosen, the base frequency, and the desired sweep direction.

POWER RECEPTACLE (15)
This instrument operate on line voltage of 100/120/220/240V AC ± 10% 50-60 Hz Power dissipation approx. 15VA

100/120/220/240—VOLT CONVERSION
This instrument operates from a 100V, 120V, 220V or 240V AC, 50 to 60 Hz line-voltage source. The applied voltage is indicated on the rear panel. To convert from the specified voltage to other line voltages, replace the voltage plug position on PC Board, referring to the figure below and change the rear panel applied voltage indication. Also, be sure to replace the fuse to correspond to the line voltage 0.25A fuse for 100V to 120V operation and 0.125A fuse for 220V to 240V operation. If it is not wired to your local line voltage, set the power transformer wiring as shown below.

CHECKING OUT THE SWEEP FUNCTION GENERATOR

EQUIPMENT NEEDED:
A. BNC to BNC cable.
B. 5 MHz Bandwidth (minimum) triggered sweep oscilloscope.
4. Connect the circuit shown. (See Figure 3)

See the instrument front panel as follows:

<table>
<thead>
<tr>
<th>CONTROL</th>
<th>POSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>ON</td>
</tr>
<tr>
<td>Frequency Multiplier</td>
<td>1 K</td>
</tr>
<tr>
<td>Frequency Dial</td>
<td>1.0</td>
</tr>
<tr>
<td>Symmetry</td>
<td>CCW</td>
</tr>
<tr>
<td>DC Offset</td>
<td>Centered</td>
</tr>
<tr>
<td>Amplitude</td>
<td>Centered</td>
</tr>
<tr>
<td>Invert</td>
<td>Out</td>
</tr>
<tr>
<td>ATT 20 dB</td>
<td>Out</td>
</tr>
<tr>
<td>Mode</td>
<td>Square Wave</td>
</tr>
</tbody>
</table>

5. Turn on the scope and adjust controls so that a square wave output appears. Try depressing each of the other two remaining mode buttons to display the triangle and sine wave. Select other frequencies by setting the proper controls and displaying them on the scope screen. Once you have become familiar with the various functions you will be ready to put this unit into operation.

**APPLICATIONS**

The Function Generator with its many features and ease of operation make it a welcome addition to any lab.

The following are representative of the many test applications possible with this function generator.

1. **TRACING DIGITAL LOGIC FLOW**
   The output provides a TTL compatible pulse which can be used to inject in digital circuits.
2. AUDIO TESTING
By connecting the output to an audio amplifier one can check the high and low end
frequency response by manually injecting a signal to the input, and connecting a scope to
monitor the output of the amplifier.

3. VOLTAGE CONTROLLED GENERATOR
When the generator is used in conjunction with the VCF input, an external voltage will
produce a range of sweep frequencies which can be used in various applications as the one
shown below.

a. FREQUENCY MODULATION
Application of an external sine wave to the VCF input will produce a frequency modulated
output.

CIRCUIT DESCRIPTION
The function generator consists of a voltage controlled oscillator made up of U1, U2, U3, U4,
Q3, Q4, Q5, Q6, Q7 and Q8. The output from the VCO is a basic ramp waveform produced by a
combination of charge and discharge current through Q3, and Q4 as determined by one of the
range capacitors. This is applied to U6 and Q6, Q7 to produce a buffered TTL output as well as a
square wave output. The triangle wave is also applied to a sine wave convertor U7 and is shaped
to produce a sinusoidal output. The triangle, square and sine wave signals are then applied to
a power amp for output to a load. (See Figure 4)

![Circuit Diagram]

FIGURE 4. CKT Block diagram.

HELPFUL HINTS IN CASE OF DIFFICULTY
1. Check to see if the plug is properly inserted into power outlet.
2. Press the power switch in. At this point the unit should be on as indicated by the LED.
Should the LED fail to light at this point, or no output is obtained from the BNC connectors,
the unit may be in need of repair. See Warranty for limits of liability.
TEST AND RECALIBRATION PROCEDURE

Case Disassembly and Assembly
To open the case, turn the unit upside down with the rubber feet facing up. (See Figure 5) Remove the four rubber pads from the feet. Remove the screws from the center recess of each of the four feet.

NOTE
The flip-up leg will automatically come free with the front feet.

Carefully separate the two halves of the case and recalibrate the unit following the prescribed procedure.

To close the case, lower the case bottom and guide the front and rear panels into their slots. Position the rubber feet as illustrated and screw the two halves of the case together. Do not overtighten screws. Install the four rubber pads.

![Diagram of case disassembly and assembly](image)

FIGURE 5. Case disassembly and assembly.

The Sweep Function Generator is a factory calibrated test instrument and is therefore ready to be put into operation. Should any type of maintenance be performed, the function generator should be recalibrated to maintain maximum accuracy. The following steps should be followed to assure proper recalibration:
EQUIPMENT NEEDED:
DVM
5 MHz Oscilloscope
2 MHz Frequency counter
Distortion Analyzer
DC power Supply, 0 – 10 V

Using a DVM, check for – 20 volts with reference to ground at the negative side of C43. Also check for 20 volts with reference to ground at the positive side of C41.

RECALIBRATION PROCEDURE

FUNCTION/ADJUSTMENT | UNIT UNDER TEST                  | TEST EQUIPMENT                  | PROCEDURE/RESULTS
---------------------|----------------------------------|----------------------------------|------------------------
DC Offset: Zero/R82  | Invert – Off                     | Scope                           | Adjust R82 until       |
                      | Att – Out                        | Vert Amp 10 mV/Div               | DC level = 0           |
                      | Freq Vernier – 1.0               | Sweep – 0.1 msec/Div             | Output Load = 50 Ω     |
                      | Amplitude – Min                  | Coupling – DC                    |                        |
                      |                                  | Probe – 10:1                     |                        |
Triangle Level/No Adj| Amplitude – Max, Mode            | Scope                           | Check Triangle          |
Square Wave Level R56| Amplitude – Max, Mode            | Vert Amp – 1.5 V/Div             | Amplitude ± 10Vp-p      |
                      |                                  |                                  |                        |
Sine Wave Level R74 | Amplitude – Max, Mode            | Scope                           | Adjust R56 until        |
                      |                                  | Vert Amp – 1.5 V Div             | Square Wave = ±10V      |
1 kHz Distortion R43, R46, R33 | Freq. 1 kHz, Mode | Scope                           | Adjust R74              |
                      |                                  | Distortion Analyzer              | until SineWave = ±10 Vp-p |
                      |                                  | 50Ω Load                         |                        |
Frequency/R6          | Freq. Vernier 2.0                 | Counter                          | Adjust R43, R46         |
                      | Range 100 K (VR4)                | Load 50Ω                         | until distortion is     |
                      | 10 K (VR3)                       |                                  | to a minimum. Adjust     |
                      | 100 (VR2)                        |                                  | R33 until distortion is  |
                      | 10                               |                                  | less than 0.4%          |

1) For 100K 10K 100, 10, 1 range adjust R6 to obtain ± 5%
2) For 1 M range, Adjust C8 to option Freq. 2MHz ± 100kHz
<table>
<thead>
<tr>
<th>Symmetry/No Adj</th>
<th>Freq. Vernier—2.0</th>
<th>Scope 0.5 V/Div</th>
<th>Pull out symmetry control, adjust to full CW. Time ratio of positive to negative of square wave less than 0.2.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range — 1 K Mode</td>
<td>Sweep 0.5 mS/Div</td>
<td></td>
</tr>
<tr>
<td>DC Offset/No Adj</td>
<td>Amplitude—Min.</td>
<td>Scope</td>
<td>Pull out DC offset turn to the left and right, DC level variation ± 10 V min.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rise Time/No Adj</td>
<td>Amplitude—Max.</td>
<td>Scope</td>
<td>Check rise time less than 100 nS.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1 V/Div 50 nS</td>
<td></td>
</tr>
<tr>
<td>TTL Output/No Adj</td>
<td>Range: 100 K</td>
<td>Scope</td>
<td>Check output 4 volts ± 10% and rise time less than 25 nS.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweep Input/No Adj</td>
<td>Amplitude—Max</td>
<td>0–10 V Power Supply</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DC Offset—Min</td>
<td>1) Apply 0–10 V to VCF of set.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mode—Triangle</td>
<td>2) Check Frequency variation 100:1.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Range 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Freq. Vernier—0.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Turn off the power and disconnect all cables. This concludes the recalibration procedure.