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SECTION 1

INTRODUCTION

1.1 PURPOSE OF THE EQUIPMENT

The Model 142 HF VCG Generator provides sine, square, triangle, positive pulse, and negative pulse outputs (with a separate sync output) over a 0.0005 Hz to 10 MHz frequency range. Frequency range selection is provided in ten decades; and a vernier control permits adjustment to within approximately 1% of the range selected.

The symmetry of any output waveform is continuously adjustable from 1:19 to 19:1 (5%-95% to 95%-5%). Pulse outputs as narrow as 50 nanoseconds having repetition rates as high as 1 MHz (on-off ratio as great as 19:1) can be generated in either polarity. Varying the symmetry of the triangle function will produce a sawtooth or "ramp" signal with a rise or fall time as steep as 50 nanoseconds at a recurring rate of 1 MHz. Even the symmetry of the sine wave may be varied over this 1:19 to 19:1 range if desired. When the symmetry control is used, however, the indicated frequency is divided by a factor of approximately 10.

A VCG input allows the output to be frequency modulated, dc programmed, or swept over a 1000:1 ratio. The dc offset of the 30V p-p maximum signal output can be controlled manually or electronically. A 60 dB calibrated step attenuator and a 20 dB vernier provide an overall attenuation of 80 dB; permitting signal levels as low as 1.5 mV p-p. Both the output waveform and the dc offset are attenuated by the 60 dB step attenuator.

With this instrument it is possible to simultaneously program and sweep the output frequency, select the output symmetry desired, and manually or electronically vary the dc offset. This capability, coupled with the variety of waveforms available and precision output amplitude control, makes the Model 142 an extremely versatile instrument for engineering, manufacturing, and laboratory applications.

1.2 GENERAL PHYSICAL DESCRIPTION






Weighing approximately 8 pounds (12 pounds when shipped) the Model 142 is 8-½ inches wide, 5-¼ inches high, and 11-½ inches deep. Housed in a compact, ruggedized, portable case; the Model 142 is normally



shipped with a 10-foot, 3-wire, detachable line cord and one copy of this instruction manual.

1.3 SPECIFICATIONS

1.3.1 Versatility

WAVEFORMS

Selectable sine , square , triangle , positive pulse , and negative pulse  outputs.

Symmetry of all outputs continuously adjustable from 1:19 to 19:1. Varying triangle symmetry provides a sawtooth  or  output. Separate sync with variable symmetry (see Sync Output specifications below).

OPERATING FREQUENCY RANGE

0.0005 Hz to 10 MHz in ten decades as tabulated below:

Ranges

X.001	0.0005 Hz to .01 Hz
X.01	0.005 Hz to .1 Hz
X.1	0.05 Hz to 1 Hz
X1	0.1 Hz to 10 Hz
X10	1 Hz to 100 Hz
X100	10 Hz to 1000 Hz
X1K	100 Hz to 1000 Hz
X10K	1000 Hz to 10000 Hz
X100K	10000 Hz to 100000 Hz
X1M	100000 Hz to 1000000 Hz

Note: When Symmetry control is used, indicated frequency is divided by a factor of approximately 10.

MAIN OUTPUT

Sine, square, triangle, positive pulse, and negative pulse; selectable. Maximum output 30 V p-p into open circuit (15 V p, pulse) with calibrated 15 V p-p into 50-ohm load. Precision output attenuator calibrated in 10 dB steps to -60 dB with a 20 dB vernier, giving an overall attenuation of -80 dB. Output impedance is 50-ohms. Short circuit current is ±150 milliamps.

SYNC OUTPUT

Amplitude greater than 4 V p-p into open circuit; 2 V p-p into 50 ohms. Square waveform for symmetrical outputs; rectangular waveform for pulse and ramp outputs. Sync pulse polarity is opposite that of output square wave.

DC OFFSET

Can be controlled manually using the front panel control, or electronically by applying an external voltage. Adjustable range is ± 10 Vdc into open circuit (± 5 Vdc into 50-ohm load) with peak output, at the output, limited to ± 15 Vdc into open circuit (± 7.5 Vdc into 50 Ω). External offset sensitivity is approximately -0.4 V/V with output connected to 50-ohm load. DC offset and output waveform are attenuated proportionately by the 60 dB output attenuator.

1.3.2 Horizontal Precision

FREQUENCY ACCURACY (Dial Accuracy) Symmetrical Waveforms

0.01 Hz to 1 MHz $\pm(1\%$ of setting + 1% of full scale).
1 MHz to 10 MHz $\pm(2\%$ of setting +2% of full scale).

VERNIER

Permits frequency adjustment of approximately 1% of range.

TIME SYMMETRY

10 Hz to 100 kHz $\pm 0.5\%$
0.01 Hz to 500 kHz $\pm 1.0\%$

1.3.3 Voltage-Controlled Generator

VCG CONTROL RANGE

Up to 1000:1 frequency change with external voltage input. Upper frequency is limited to maximum of selected range. Required external signal for full voltage control is 5 volts with input impedance of 5 k Ω .

VCG INPUT FREQUENCY

VCG Bandwidth 100 kHz
VCG Slew Rate 2% of range/microsecond

VCG LINEARITY

10 Hz to 100 kHz $\pm 0.2\%$ of full scale
0.001 Hz to 1 MHz $\pm 0.5\%$ of full scale

1.3.4 Vertical Precision

SINE WAVE FREQUENCY RESPONSE

Amplitude change with frequency less than:

0.1 dB to 100 kHz
0.2 dB to 1 MHz
2.0 dB to 10 MHz

STEP ATTENUATOR ACCURACY

± 0.25 dB/10 dB

STABILITY

Short term $\pm 0.05\%$ for 10 minutes
Long term $\pm 0.25\%$ for 24 hours
Percentages apply to amplitude, frequency, and dc offset.

AMPLITUDE SYMMETRY

All waveforms (except pulse) are symmetrical about ground within $\pm 1\%$ of maximum peak-to-peak amplitude.

1.3.5 Purity

SINE WAVE DISTORTION

10 Hz to 100 kHz less than 0.5% (typically 0.25%)
100 kHz to 1 MHz less than 1.0%
1 MHz to 10 MHz all harmonics at least 30 dB down

TRIANGLE LINEARITY

0.002 Hz to 100 kHz greater than 99% by using the best straight line method

SQUARE WAVE RISE AND FALL TIME (terminated in 50 Ω load)

Less than 20 nanoseconds; limited to 500 V/microsecond.

TOTAL ABERRATIONS

Less than 5%

1.3.6 Environmental

TEMPERATURE

All specifications listed, except for stability, are for 25 $^{\circ}$ C $\pm 5^{\circ}$ C. For operation from 0 $^{\circ}$ C to 55 $^{\circ}$ C, derate all specifications by a factor of 2.

