

## SECTION II

# SPECIFICATIONS AND TEST PROCEDURES




This section contains specifications for the WAVETEK instruments discussed in this manual and procedures for testing their accuracy. Table 2-1 provides specifications for the Models 110 and 110B Function Generators, and Table 2-2 provides specifications for the Models 111 and 111B Voltage Controlled Generators.

### NOTE

Specifications apply 10% to 100% of maximum amplitude setting.

### VERSATILITY

#### Waveforms

Sine , square , triangle  and sync pulse.

#### Dynamic Frequency

0.005 Hz to 1 MHz (3.3 min. to 1  $\mu$ sec).

NOTE: Dial is a high quality composition potentiometer allowing true continuously variable frequency control.

#### Ranges

X.01 = 0.005 Hz to 0.1 Hz.

X0.1 = 0.05 Hz to 1 Hz.

X1.0 = 0.5 Hz to 10 Hz.

X10 = 5 Hz to 100 Hz.

X100 = 50 Hz to 1 KHz.

X1K = 500 Hz to 10 KHz.

X10K = 5 KHz to 100 KHz.

X100K = 50 KHz to 1 MHz.

### Six Simultaneous Outputs:

- 1)  $\sim$ ,  $\square$  or  $\wedge$  selectable.

Amplitude adjustable over at least a 50:1 range.

Output impedance  $50\Omega$  ( $600\Omega$  output impedance available by removing one jumper wire).

At least 30 volts peak to peak into an open circuit.

At least 10 volts peak to peak into a  $50\Omega$  load (the attenuator should be adjusted counter-clockwise until clipping stops).

Short circuit current  $\pm 100$  ma.

Model 110B: A maximum of 5 volts peak to peak at  $600\Omega$  output impedance.

- 2)  $50\Omega$   $\square$  0.5 volt peak to peak, 10 nsec. risetime into  $50\Omega$ .
- 3)  $50\Omega$   $\square$  5 volts peak to peak, 15 nsec. risetime.
- 4)  $50\Omega$   $\sim$  5 volts peak to peak.
- 5)  $50\Omega$   $\wedge$  5 volts peak to peak.
- 6) Sync pulse: At least -10 volts into open circuit; less than 5  $\mu$ sec. duration.

NOTE: All outputs may be shorted to signal ground without damage to the instrument.

### HORIZONTAL PRECISION

#### Dial Accuracy

$\pm 1\%$  of full scale 0.005 Hz to 100 KHz.

$\pm 2\%$  of full scale 100 KHz to 1 MHz.

#### Frequency Stability

Short term: Drift less than  $\pm 0.05\%$  of setting for 10 minutes.

Long term: Drift less than  $\pm 0.25\%$  of setting for 24 hours.

No critical components requiring internal oven.

#### Jitter

$\pm 0.025\%$  cycle to cycle stability.

### VERTICAL PRECISION

#### Frequency Response

Amplitude change with frequency less than 0.1 db 0.005 Hz to 10 KHz, 0.2 db 10 KHz to 100 KHz, 0.5 db 100 KHz to 1 MHz.

#### Peak to Peak Voltage Accuracy

$\pm 1\%$  for 5-volt outputs.

$\pm 1\%$  for 30-volt output into a 600 $\Omega$  load at maximum gain.

$\pm 10\%$  for 0.5-volt output into 50 $\Omega$ .

#### Amplitude Stability

Short term:  $\pm 0.05\%$  of maximum peak to peak values for 10 minutes.

Long term:  $\pm 0.25\%$  of maximum peak to peak values for 24 hours.

#### Symmetry

All waveforms are symmetrical about ground within  $\pm 1\%$  of maximum peak to peak amplitude (external zero adjust rear-panel control provided for output number 1).

#### D-C Offset Stability

Short term:  $\pm 0.05\%$  of maximum peak to peak amplitude for 10 minutes.

Long term:  $\pm 0.25\%$  of maximum peak to peak amplitude for 24 hours.

## PURITY

### Sine Wave Distortion

Less than:	0.5%	0.005 Hz to 10 KHz.
	1.0%	10 KHz to 100 KHz.
	2.0%	100 KHz to 1 MHz.

### Triangle Linearity

Greater than:	99%	0.005 Hz to 100 KHz.
	95%	100 KHz to 1 MHz.

### Square Wave Rise and Fall Time

0.5-volt output less than 10 nsec. into 50 $\Omega$  termination.

5-volt output less than 15 nsec.

30-volt output less than 100 nsec.

5-volt adjustable (Model 110B) less than 100 nsec.

### Total Aberrations

Less than 5% (overshoot, preshoot, etc.).

### Tilt

Less than 0.5%.

### Time Symmetry

All waveforms:	99%	0.005 Hz to 100 KHz.
	98%	100 KHz to 1 MHz.

## ENVIRONMENTAL

### Temperature

All specifications listed, except stability, are for 25°C  $\pm$  5°C.

For operation from 0°C to 55°C, derate all specifications by a factor of 2.

## MECHANICAL

### Dimensions

7 and 3/4 inches wide, 5 and 1/4 inches high, 7 and 1/2 inches deep.

### Weight

7 pounds net, 10 pounds shipping.

### Color

Clear anodized aluminum.

### Controls

ON-OFF power switch, frequency range switch, frequency dial, function selector switch, amplitude attenuator, d-c zero adjustment (rear). All-silicon semiconductors, modular plug-in construction.

### Power

Model 110: 105 volts to 125 volts or 200 volts to 250 volts, 50 Hz to 400 Hz. Less than 10 watts.

Model 110B: D-C rechargeable ni-cad batteries provided with built-in charger. Eight hours of operation on batteries for every 16 hours of charge; simultaneous operation and charge.

105 volts to 125 volts or 200 volts to 250 v lts, 50 Hz to 400 Hz. Less than 10 watts.

## VERSATILITY

### Waveforms

Sine , square , triangle , ramp  and sync pulse.

### Dynamic Frequency

0.0015 Hz to 1 MHz (10 min. to 1  $\mu$ sec).

### Ranges

X.01 = 0.005 Hz to 0.1 Hz.

X0.1 = 0.05 Hz to 1 Hz.

X1.0 = 0.5 Hz to 10 Hz.

X10 = 5 Hz to 100 Hz.

X100 = 50 Hz to 1 KHz.

X1K = 500 Hz to 10 KHz.

X10K = 5 KHz to 100 KHz.

X100K = 50 KHz to 1 MHz.

X.003 = 0.0015 Hz to 0.03 Hz.

X.03 = 0.015 Hz to 0.3 Hz.

X.3 = 0.15 Hz to 3 Hz.

X3.0 = 1.5 Hz to 30 Hz.

X30 = 15 Hz to 300 Hz.





X300 = 150 Hz to 3 KHz.

X3K = 1.5 KHz to 30 KHz.

X30K = 15 KHz to 300 KHz.

Table 2-2. Models 111 and 111B Specifications  
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### Seven Simultaneous Outputs:

- 1)  ,  ,  or  selectable.

Amplitude adjustable over at least a 50:1 range.






Output impedance  $50\Omega$  ( $600\Omega$  output impedance available by removing one jumper wire).

At least 30 volts peak to peak (15 volts ramp) into an open circuit.

At least 10 volts peak to peak (5 volts ramp) into a  $50\Omega$  load (the attenuator should be adjusted counter-clockwise until clipping stops).

Short circuit current  $\pm 100$  ma.

Model 111B: A maximum of 5 volts peak to peak at  $600\Omega$  output impedance (2.5 volts ramp).

- 2)  $50\Omega$   0.5 volt peak to peak, 10 nsec. risetime into  $50\Omega$ .
- 3)  $50\Omega$   5 volts peak to peak, 15 nsec. risetime.
- 4)  $50\Omega$   5 volts peak to peak.
- 5)  $50\Omega$   5 volts peak to peak.
- 6)  $50\Omega$   0 volts to -2.5 volts ramp; 50% duty cycle.
- 7) Sync pulse: At least -10 volts into open circuit; less than 5  $\mu$ sec. duration.

NOTE: All outputs may be shorted to signal ground without damage to the instrument.

### VCG - Voltage Controlled Generator

Over 20:1 frequency ratio (selectable in ranges of 3:1 allowing excellent range overlap). 4.75 volts input for 20:1 frequency ratio (0.5 volts per major dial division). Input impedance 10K.

## HORIZONTAL PRECISION

### Dial Accuracy

$\pm 1\%$  of full scale 0.0015 Hz to 100 KHz.

$\pm 2\%$  of full scale 100 KHz to 1 MHz.

NOTE: Dial is a high quality composition potentiometer  
allowing true continuously variable frequency control.

### Electronic Frequency Vernier

One turn for approximately one minor dial division.

### VCG Linearity

$\pm 0.1\%$  frequency versus input voltage (frequency error  $\pm 0.1\%$   
of total frequency deviation - best straight line method). 0.0015  
Hz to 100 KHz generated frequency. From 10% to 100% of maxi-  
mum dial frequency.

### VCG Bandwidth

100 KHz.

### Frequency Stability

Short term: Drift less than  $\pm 0.05\%$  of setting for 10 minutes.

Long term: Drift less than  $\pm 0.25\%$  of setting for 24 hours.

No critical components requiring internal oven.

### Jitter

$\pm 0.025\%$  cycle to cycle stability.

## VERTICAL PRECISION

### Frequency Response

Amplitude change with frequency less than 0.1 db 0.0015 Hz  
to 10 KHz, 0.2 db 10 KHz to 100 KHz, 0.5 db 100 KHz to 1 MHz.



### Peak to Peak Voltage Accuracy

±1% for 5-volt and 2.5-volt outputs.

±1% for 30-volt output into a 600 $\Omega$  load at maximum gain.

±10% for 0.5-volt output.

### Amplitude Stability

Short term: ±0.05% of maximum peak to peak values for 10 minutes.

Long term: ±0.25% of maximum peak to peak values for 24 hours.

### Symmetry

All waveforms, except ramp, are symmetrical about ground within ±1% of maximum peak to peak amplitude (external zero adjust rear-panel control provided for output number 1).

### D-C Offset Stability

Short term: ±0.05% of maximum peak to peak amplitude for 10 minutes.

Long term: ±0.25% of maximum peak to peak amplitude for 24 hours.

### PURITY

#### Sine Wave Distortion

Less than:	0.5%	0.0015 Hz to 10 KHz.
	1.0%	10 KHz to 100 KHz.
	2.0%	100 KHz to 1 MHz.

#### Triangle and Ramp Linearity

Greater than:	99%	0.0015 Hz to 100 KHz.
	95%	100 KHz to 1 MHz.

### Ramp Fall Time

Less than 200 nsec.

### Square Wave Rise and Fall Time

0.5-volt output less than 10 nsec into 50 $\Omega$  termination.

5-volt output less than 15 nsec.

30-volt output less than 100 nsec.

5-volt adjustable (Model 111B) less than 100 nsec.

### Total Aberrations

Less than 5% (overshoot, preshoot, etc.).

### Tilt

Less than 0.5%

### Time Symmetry

All Waveforms:      99%      0.0015 Hz to 100 KHz.

98%      100 KHz to 1 MHz.

## ENVIRONMENTAL

### Temperature

All specifications listed, except stability, are for 25°C  $\pm$  5°C.

For operation from 0°C to 55°C, derate all specifications by a factor of 2.

## MECHANICAL

### Dimensions

7 and 3/4 inches wide, 5 and 1/4 inches high, 7 and 1/2 inches deep.

Weight

7 pounds net, 10 pounds shipping.

Color

Clear anodized aluminum.

Controls

OFF X.3-X1 power/dial multiplier switch, frequency range switch, frequency dial, frequency vernier, function selector switch, amplitude attenuator, d-c zero adjustment (rear).

All-silicon semiconductors, modular plug-in construction.

Power

Model 111: 105 volts to 125 volts or 200 volts to 250 volts, 50 Hz to 400 Hz. Less than 10 watts.

Model 111B: D-C rechargeable ni-cad batteries provided with built-in charger. Six hours of operation on batteries for every 16 hours of charge; simultaneous operation and charge. 105 volts to 125 volts or 200 volts to 250 volts, 50 Hz to 400 Hz. Less than 10 watts.