SECTION II
SPECIFICATIONS AND TEST PROCEDURES

This section contains specifications for the WAVETEK instruments discussed in this handbook, and procedures for testing their accuracy. This table provides specifications for the Models 112, 112B, 115, 115B, 116 and 116B.

NOTE

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

VERSATILITY

Waveforms

Sine  , square  , triangle  , ramp  , and sync pulse.

Dynamic Frequency

0.0015 Hz to 1 MHz (10 min. to 1 μsec.).

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

Ranges

x.01 = 0.005 Hz to 0.1 Hz

x. 1 = 0.05 Hz to 1 Hz

X1 = 0.5 Hz to 10 Hz

x10 = 5 Hz to 100 Hz

X100 = 50 Hz to 1 KHz

X1K = 500 Hz to 1 KHz

X10K = 5 KHz to 100 KHz

X100K = 50 KHz to 1 MHz

Ranges (cont.)

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 = 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

Nine Simultaneous Outputs

1) ∿, ⩘, ⎍, ⎍, ∿, ⩘, ⟋ or ⟍ **selectable.**

Amplitude adjustable over at least a 50:1 range.

Output impedance 50Ω (600Ω 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 50Ω load (the attenuator should be adjusted counter-clockwise until clipping stops).

Short circuit current ±100 ma.

"B" Models: A maximum of 5 volts peak to peak at 600Ω ±20% output impedance (2.5 volts ramp).

2) 50Ω ⎍ **0.5 volt peak to peak, 10 nsec. risetime into 50Ω.**

3) 50Ω ⎍ **5 volts peak to peak, 15 nsec. risetime.**

4) 50Ω ∿ **5 volts peak to peak.**

5) 50Ω ∿ **5 volts peak to peak.**

6) 50n ⟋ 0 volts to -2. 5 volts ramp; 50% duty cycle.

7) Sync pulse: At least -10 volts into an open circuit; less than 5 μsec duration.

8) High impedance ∿ 2.5 volts peak to peak offset +1. 25 volts.

9) 50Ω ⩘, ⊓, ⩘, or ⟋ selectable.

5 volts peak to peak differential output 180° out of phase with outputs 2 through 6.

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

Trigger

Input impedance is 10 KΩ.

Trigger mode: Manual or external voltage of ±0. 5 volt will generate one cycle.

Gated mode: Discrete number of cycles may be generated by application of ±0. 5 volt gate.

Up to 100 volts may be applied without damage to the input circuitry.

Trigger level and slope are adjustable by front panel controls. (These controls are similar to trigger adjustments of an oscilloscope.)

The start-stop point of the generated waveform is adjustable through 360° for frequencies of 0.0015 Hz to 100 KHz.

A sine squared waveform is available by adjusting trigger start control to the + or - 90° position and using the offset sine wave output number 8.

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 volt ± 1% per Major dial division). Input inpedance 10KΩ.

Phase Lock - Models 115, 115B, 116, 116B Only,

Frequency range is 10 Hz to 1 MHz.

Input impedance is 10 KΩ.

Input amplitude requirements are minimum 800 mv peak to peak to lock and 5 volts peak to peak sine wave for specified accuracy.

An input of 100 volts will not damage circuitry.

Unit will frequency lock to any input within 10 to 1 of the dial frequency and will be phase locked to the fundamental of the dial frequency within specified accuracy.

Phase accuracy is ±10° from 10 Hz to 10 KHz, ±20° from 10 KHz to 1 MHz.

Indicator "phase uncalibrated" light illuminates when selected phase relationship is exceeded. Unit will maintain frequency lock even when the light is on.

HORIZONTAL PRECISION

Dial Accuracy

±1% of full scale 0.0015 Hz to 100 KHz.

±2% of full scale 100 KHz to 1 MHz.

Electronic Frequency Vernier

One turn for approximately one minor dial division.

VCG Linearity

±0.1% frequency versus input voltage (frequency error 0.1% of total deviation – best straight line method). 0.0015 Hz to 100 KHz generated frequency. From 10% to 100% of maximum dial frequency.

VCG Bandwidth

100 KHz.

Frequency Stability

Short term: Drift less than ±0.05% of setting for 10 minutes.

, Long term: Drift less than ±0.25% of setting for 24 hours.

No critical components requiring internal oven.

Jitter

±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 600Ω 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 amplitude 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%	0.0015Hz to 10KHz.
	1.0%	10KHz to 100KHz.
	2.0%	100KHz to 1MHz.
	3.0%	600KHz to 1MHz.

Induced distortion due to phase lock operation:

1%	10Hz to 100KHz.
2%	100KHz to 1MHz.

Triangle and Ramp Linearity

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

Ramp Fall Time

Less than 200nsec.

Square Wave Rise and Fall Time

0.5 volt output less than 10nsec. into 50Ω termination.

5 volt output less than 15nsec.

30 volt output less than 100nsec.

5 volt adjustable (battery models) less than 100nsec.

Total Aberrations

Less than 5% (overshoot, preshoot, etc.) when properly terminated.

Tilt

Less than 0.5%

Timo 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 ± 5°C.

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

MECHANICAL

Dimensions

7-3/4 inches wide, 5-1/4 inches high, 11-1/2 inches deep

Weight

10 pounds net, 15 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), manual trigger, trigger level/slope, start-stop point, gated/continuous/trigger mode switch.

Power

Models 112, 115, 116:	**105 volts to 125 volts or 200 volts to 250 volts, 50 Hz to 400 Hz. Less than 20 watts.**

Power (cont.)

Models 112B, 115B 116B: D-C rechargeable ni-cad batteries provided with built-in charger. Eight hours of operation on the 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 30 watts.

NOTE

The covers of these instruments may be mounted flush with the front panel by removing the cover and replacing it using the alternate set of tapped holes in the spacer bars.

GENERAL INFORMATION

Specifications apply only when the dial setting is between 0. 5 and 10. Instruments should be within specifications within 30 minutes' warm-up time. All specifications are for 25°C ± 5°C and 105 to 125 volts a-c, 50 Hz to 400 Hz. All measurements must be made as described herein. Frequency stability specifications refer to constant temperature, line voltage, panel setting, and loads; testing must be made after one hour's warm-up at defined conditions.

TESTING INFORMATION

All frequency measurements should be made with the function selector switch on sine ∿ , output attenuator set in the maximum counter-clockwise most position, all outputs disconnected (and VCG input disconnected) except the 10 nsec. square wave output which should be connected to a counter through a 50Ω cable using 50Ω termination at the counter. The frequency vernier should be within specifications for all combinations of the range switch and frequency dial.

Time symmetry measurements should be made using this setup and by measuring the positive and negative half cycles of the square wave. The two half cycle measurements should differ by no more than 2% of the total one cycle measurement for 99% symmetry.

Cycle to cycle jitter measurements should be made with this same setup. An oscilloscope with a delaying sweep or frequency counter may be used for cycle to cycle time jitter measurement.

VCG linearity should be made by again using the same setup as above, with the addition of a low impedance (50Ω maximum) source connected to the VCG input.

VCG input voltage should be measured with a high accuracy voltmeter such as the WAVETEK Model 201, 202 or equivalent.

OTHER KINDS OF TESTS

All voltage measurements should be made with an accurate wide band peak measuring device. It is strongly suggested that a Tektronix type W, or type Z plug-in with an appropriate oscilloscope be used for making these voltage measurements. The measuring device should have at least 50 KΩ input impedance and sufficient band width so that waveform peaks are accurately

measurable. The measurements sould be made individually with no loads connected to the instrument.

When making very accurate peak measurements, minor aberrations will be noted on the waveform due to the switching of the square wave. The peak value is that voltage that associates immediately prior to these minor aberrations. Accurate peak waveform measurements should be made at 1 KHz with the dial set at 10. Accurate high frequency measurements are difficult to make and require considerable care in lead connection, current, and cable termination.

Lack of symmetry is defined as the difference in the plus and minus peak voltages. For example: a 5 volt signal with 1% dis-symmetry could read t2.525 volts and -2.475 volts.

All fixed outputs should be measured individually with the function selector switch on sine ∿, and the amplitude attenuator in maximum counter-clockwise position. The switch selectable output should be measured with the attenuator in maximum clockwise position and the appropriate function selected. Nothing should be connected to the binding posts when making this measurement.

When measuring the selectable output amplitude of the 112B, 115B and 116B, the measuring device should have at least 500 K input impedance. Sine distortion, triangle and ramp linearity, rise and fall time, total aberrations and tilt specifications should be made independently connecting only one output to the appropriate measuring device at a time.

BNC outputs (except sync) should be connected to the measuring device with a 50Ω cable properly terminated for making all high frequency measurements.

Sync output and selectable output should be evaluated using maximum attenuator setting commensurate with the load.

GENERAL NOTE

The Test Procedures very specifically define individually making measurements without simultaneous load of the various connectors. Simultaneous loading of all outputs will have only a minor effect on the frequency amplitude and purity performance.