SECTION 1
INTRODUCTION

1.1 MODEL 158

The Wavetek Model 158 Waveform Generator is a remote-control only Model 159 generator (without front panel controls and indicators). All information on the Model 159 generator also pertains to the Model 158 generator except local operation.

1.2 MODEL 159

The Wavetek Model 159 Waveform Generator is digitally controlled locally with front panel, keyboard pushbuttons, and remotely with a selection of 21 ASCII (7-level) "typing" characters (with appropriate external interface). The effect of each control is digitally displayed on the front panel with red LED (light emitting diode) indicators. Numeric readout of frequency, offset and amplitude is in 3-digit scientific notation.

Sine, triangle, square, and ramp waveforms of frequencies from 1 Hz to 3 MHz and amplitudes from 10 mV p-p to 10V p-p can be generated. Waveform generation can be continuous, triggered for just one cycle at a time, or gated for as many cycles or for as long as desired. Waveform center reference levels can be offset positive or negative from 10 mV to 5V and waveform phase, or polarity, can be inverted (180 degrees).

Along with the main 50 ohm output at the rear panel, which is the controlled waveform signal output, the generator delivers a square wave of the selected frequency for a synchronizing pulse output.

Analog inputs are received at the rear panel for a triggering input for triggered and gated operations, and a voltage controlled generator (VCG) input for frequency proportional to input dc levels. The 50Ω OUT signal can be swept in a 1000:1 frequency ratio, frequency modulated or dc programmed by the VCG input. The trigger and gate modes can be used for pulse output, one cycle output or tone bursts.

Up to nine generators can be connected in parallel with one another as a multiple unit group. Each generator is internally configured with its own address, or unit select code, from 1 to 9. For example, an installation may have one master display and keyboard panel, which is used to address and command the slave generators. The status of the addressed generator would be displayed.

1.3 INTERFACE

The generator accepts TTL ground true 7-bit ASCII "typing" characters serially; the 7 bits of each character are accepted in parallel. A clock line in parallel with the data bits is used to clock in the data characters. Computer control is accepted as is keyboard control from another generator in multiple unit groups. With computer control, the generator keyboard control panel can be locked out, or disabled, to prevent control competition.

1.4 OPTIONS

Several interface options are available for the Model 158 and 159 generators. They include input isolation, RS232 and IEEE 488 compatible data converters.

1.5 ACCESSORIES

Accessories for the generators include interfaces for several mini-computers.

1.6 PHYSICAL DESCRIPTION

The mechanical characteristics of the Models 158 and 159 are given in Paragraph 1.7.8. The standard models come equipped with a 10 foot, 3 wire detachable power cord and rack mount adapters. Interface cabling requires Molex brand connectors (see Paragraph 2.2.3); one is furnished.

1.7 SPECIFICATIONS

1.7.1 Versatility

Waveforms

Sine ∿ , triangle △ , square ⎍ , ramp ◿ (50% duty cycle), and auxiliary TTL sync pulse. All selectable waveforms may be inverted.

Frequency Range

Sine, triangle, and square from 1 Hz to 3 MHz in 7 ranges with 3-digit resolution.

10^0	1 Hz to 9.99 Hz
10^1	10 Hz to 99.9 Hz
10^2	100 Hz to 999 Hz
10^3	1 kHz to 9.99 kHz
10^4	10 kHz to 99.9 kHz
10^5	100 kHz to 999 kHz
10^6	1 MHz to 3 MHz

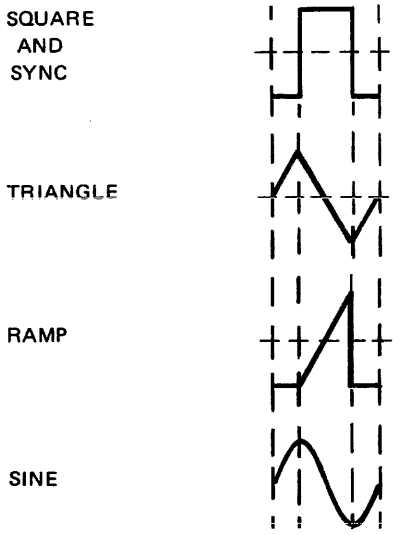
Ramp from 1 Hz to 1 MHz in 6 ranges ($10^0 \longrightarrow 10^5$).

NOTE

Generator is usable from 0.01 Hz with derated accuracies.

Main Output

Three digits of amplitude from 10 mV to 10V p-p into 50Ω (20V p-p into an open circuit) in 3 ranges (10^0, 10^{-1}, 10^{-2}).



NORMAL PHASE RELATIONSHIPS

DC Offset

Three digits of dc offset to ±5V into 50Ω. DC offset plus waveform peak value may not exceed 10V peak into open circuit or 5V peak into 50Ω.

Sync Output

A TTL compatible 0 to 2.5V square wave output, which provides 50 mA sinking current to sync up to 30 TTL loads.

Data Entry

Front panel keyboard/display and remote programming (Model 159).
Remote programming only (Model 158).

1.7.2 Operational Modes

Continuous, triggered, and gated operation provided. In triggered mode, one cycle of selected signal output for each input trigger signal. In gated mode, signal output at selected frequency for duration of the input gate plus completion of the last cycle. Model 159 has front panel manual trigger.

Trigger/Gate Signal

Minimum	+2V
Maximum	50V
Input Impedance	1 kΩ

1.7.3 Analog Modulation Control

Frequency may be externally controlled by analog voltage (VCG) providing dc programming for FSK or wide band ac modulation. Input impedance is 5 kΩ.

VCG Control Signal

Approximately 2.5V	1000:1 frequency change
Approximately 7.5V	3000:1 frequency change (300% overrange in first 6 ranges)

VCG Small Signal Bandwidth

100 kHz

VCG Slew Rate

4% of range per μs

1.7.4 Accuracy

Horizontal Precision (Frequency Accuracy)

10 Hz to 100 kHz	±1% of program value ±1 digit
100 kHz to 1 MHz	±2% of program value ±1 digit
1 MHz to 3 MHz	±4% of program value ±1 digit

Vertical Precision (Amplitude Accuracy)

NOTE

Vertical precision stated is for 10^0 amplitude multiplier. For 10^{-1} and 10^{-2}, add 1% per step.

Vertical Precision (Amplitude Accuracy) (Continued)
Sine and Square Waveforms:
10 Hz to 100 kHz . . . ±2% of program value ±1 digit
100 kHz to 1 MHz . . . ±5% of program value ±1 digit

Triangle and Ramp Waveforms:
10 Hz to 10 kHz . . . . ±2% of program value ±1 digit

DC Offset

±2% of program value ±1 digit

Sine Wave Frequency Response

Amplitude change with frequency less than:
0.1 dB to 100 kHz
0.5 dB to 1 MHz
1.0 dB to 3 MHz

Stability

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

1.7.5 Purity

Sine Wave Distortion

Total harmonic distortion less than:
0.5% to 30 kHz . . . . . ranges 10^0 thru 10^3
1.0% to 300 kHz . . . . . ranges 10^0 thru 10^4

All harmonics:
34 dB down to 1 MHz

Time Symmetry

1% to 100 kHz

Amplitude Symmetry

All waveforms to 100 kHz are symmetrical about ground within 1% of maximum p-p amplitude.

Triangle Linearity

Greater than 99% to 100 kHz

Square Wave Rise and Fall Time

Less than 50 ns

Total Aberrations

Less than 5% of program value ±20 mV

1.7.6 Programming

Programming Transition Time

Unit accepts bytes at a 1 MHz rate. The output will become stable within 100 μs unless the range digit is changed; then output will be stable within 1 ms.

Isolation

Signal ground and program ground are common in the standard 158/159. Optical isolation is available.

Logic Level Requirements

State	Requirements
Low (Logic "1")	0V to 0.4V sinking 25 mA maximum
High (Logic "0")	2.4V or open

NOTE

1. *Open input is 3.0V.*
2. *Input is terminated by 220Ω to +5V and 330Ω to ground.*
3. *Recommended driver: SN 7438.*

Input Control Lines and Connector Layout

Mating Connector: Molex 03-09-2151 with 02-09-2118 pins

J9 Pin No.	Designation	
13	XD0	Least significant bit
11	XD1	Input data lines
8	XD2	
10	XD3	
9	XD4	
12	XD5	
14	XD6	Most significant bit
15	XCLK	Clock control
7	Common	
3	Keyboard Enable	
1	Keyboard Enable Return	

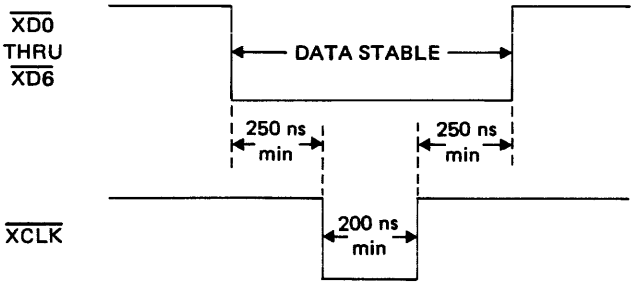
Keyboard to ASCII Conversion Table

Keyboard	ASCII
AMPL	A
UNIT	G
OFST	D
MODE	B
FUNC	C
FREQ	F

Keyboard	ASCII
MULT	(Space) or E
ON	H
OFF	I
0 thru 9	0 thru 9
CHS	– (Minus)

Timing

Direct (No Isolation)



1.7.7 Environmental

Specifications apply for 25°C ±5°C. For operation from 0°C to +55°C, derate all specifications by a factor of 2. Unit may be stored from –40°C to +75°C without damage.

1.7.8 Mechanical

May be used on the bench or in a 19 inch rack. Rack adapter hardware and program mating connectors included.

Dimensions

17¼ in./43.8 cm wide, 5¼ in./13.3 cm high, 17 in./43.2 cm deep.

Weight

15 lb/6.8 kg net, 23 lb/10.4 kg shipping.

Power

90 to 110V, 105 to 125V, 180 to 220V, or 210 to 250V; 50 to 400 Hz. Less than 45 watts.

NOTE

Specifications apply for settings from 1.00 to 9.99