Synthesized Pulse/Function Generator

- **1 mHz to 20 MHz Function Generator Range**
- **Pulses to 50 MHz**
- **Built-in Frequency Counter**
- **Square Waves to 100 MHz**
- **10 ppm Frequency Accuracy (1 ppm with TCXO Option)**
- **15 Vp-p Output into 50Ω with ±7.5V Offset**
- **Trigger, Sweep, Gate, Burst AM, FM and SCM Capability**

Wavetek's Model 91 is a compact, highly versatile synthesized pulse/function generator ideal for use on the bench or in ATE systems. The versatility of the Model 91 will be a space and money saver for you. It can be used as a function generator, pulse generator, sweep generator, frequency counter and clock source, and it has a built-in trigger generator for operation in the non-continuous modes such as trigger, gate and burst. This versatility plus the features you will read about in these pages will show you what the 91 can do for your lab or test department.

Ease of Operation

This is where Wavetek's function and pulse generator know-how pays off for you. Calculator style keypad and control knob for data entry, error messages to guide you back within correct operation limits, reset functions to reset one or all parameters to default conditions, a choice of unit-of-measure on parameters such as frequency, amplitude and offset, storage and recall of instrument setups — these are among the many ease-of-operation features that you will find on the Model 91.

ATE

Model 91 is not just a bench-top instrument; it gives you all the features you expect from dedicated systems instruments. It comes with a full IEEE 488.1 interface as a standard feature. Virtually all front panel settings can be accessed over the bus. An optional rack/handle kit allows for easy rack mounting and provides cable routing holes.

The GPIB address can be changed via the front panel. An input buffer saves the last 240 characters sent to the unit over the bus. Using the command recall function, command strings sent to the Model 91 can be analyzed for test program debugging. You can even monitor commands to other instruments in the system by changing to their GPIB address.

Key Features

To make sure the Model 91 has that feature you need, Wavetek has added these key features.

Model 91 has a high **15 Vp-p output** into 50Ω, with an amplitude dependent ±7.5V offset.

TTL, CMOS, +ECL, -ECL and user defined logic level pulses are selectable.

It has **noncontinuous modes** (trigger, gate and burst) , with burst counts selectable up to 1,000,000 cycles.

An **internal sweep generator** is also included. Continuous, triggered and manual sweep modes can provide linear, logarithmic, up, down and up/down sweeps. Sweep time and trigger frequency are selectable. A sweep output indicates sweep position.

Model 91 can be **phase locked** to an external source. Phase can also be offset ±180° in 1° increments. If the external frequency changes by more than the 2% phase-lock window, Model 91 will automatically acquire and lock on the new frequency. And, just like a frequency counter, the unit calculates and displays the new frequency.

The external frequency input can be used as an **accurate frequency counter**. Results can be read both from the front panel and over the GPIB.

Model 91 includes **modulation modes** of AM, FM and suppressed carrier modulation.

Symmetry of any waveform is adjustable between 5% and 95% up to 2 MHz, linearly decreasing to 50% at 20 MHz.

Model 91 features **selectable output impedances** of 50, 75,135 and 600Ω. Both 135 and 600Ω impedances are available as **balanced outputs** using the front panel banana jacks. All impedances can be selected from the front panel or remotely.

If your application demands extremely **high stability** frequency, an optional TCXO provides both a highly stable internal reference (1 ppm frequency accuracy) and the capability of attaching an external reference.

Finally, Model 91 has an operator's **autocalibration** routine that performs a functional check and fine tunes internal circuits to optimize waveform quality and accuracy.

WAVEFORMS

- Sine, triangle, square, dc, pulse, double pulse, delayed pulse, complementary pulse and external width.

Square Wave Rise /Fall: <9 ns (10 to 90%, max amplitude, 50Ω).

Square Wave Aberrations (Overshoot and Ringing): <(5% + 20 mV) of the p-p amplitude.

Harmonic Distortion (At 10 Vp-p, 50Ω, Sine Function)

To 20 Hz: -40 dB (<1%).
To 100 kHz: -46 dBc (<0.5%).
To 2 MHz: -40 dBc.
To 6 MHz: -30 dBc.
To 20 MHz: -25 dBc.

Triangle Linearity (10 to 90%)

To 100 kHz: ±1%.
To 2 MHz: ±2%.
To 5 MHz: ±10%.

Time Symmetry

Range & Resolution: 5 to 95% in 1% increments.
Accuracy: ±(1% + 5 ns) improves to ±(0.2% + 5 ns) when symmetry is 50%.
Frequency Coverage: 5 to 95% to 2 MHz: linearly decreasing to 50% fixed at 20 MHz.
Minimum Width: 25 ns.

PULSES

Pulse, double pulse, delayed pulse, external pulse width.

Pulse Rise/Fall Times

Variable Level Pulses: <9 ns at full amplitude.

Pulse Width

Range: 10 ns to 2000 s.
Resolution: 4 digits, limited by 100 ps.
Accuracy: ±(1.0% + 5 ns).
Jitter: ±(0.05% + 100 ps).
Duty Cycle: 70% for periods down to 50 ns decreasing to 25% for 20 ns periods.

Pulse Delay

Range
Single Pulse: 0 ns to 2000 s.
Double Pulse: >20 ns to 2000 s.
Resolution: 4 digits, limited to 100 ps.
Accuracy: ±(1% + 5 ns).
Jitter: ±(0.05% + 100 ps).
Duty Cycle: 70% for periods down to 50 ns decreasing to 25% for 20 ns periods.

MODES

Continuous, triggered, gated, burst, sweep, AM, FM, SCM and phase lock.

Sweep

Modes: Continuous, triggered, and manual.
Characteristics: Linear, logarithmic, up, down and up/down.
Range: Up to 3 decades in selected range (of 9 ranges).
Sweep Time: 100 ms to 100 s.
Sweep Out: 0 to 42V ramp to indicate sweep position.

Trigger: External, manual, GPIB and internal trigger modes.

Burst: Burst count selectable from 1 to 1,000,000.

External Phase Lock

Range: 20 Hz to 20 MHz.
Phase Offset: ±180°.
Phase Resolution: 1°.
Phase Accuracy: ±(4° + 20 ns).

Nonsynthesized Operation

1 mHz to 19.99 Hz: Continuous, AM or SCM.
1 mHz to 20 MHz: Triggered, Gated, Burst, Sweep, or FM.

Synthesized Operation

20 Hz to 20 MHz: Continuous, AM, and SCM

FREQUENCY

Function Generator (Sine, triangle and square waveforms)

Range
Nonsynthesized: 1 mHz to 20 MHz (full range).
Synthesized: 20 Hz to 20 MHz.
With 600Ω Output Impedance: 1 mHz to 1 MHz (balanced and unbalanced outputs).
For AM +SCM: 0.1 Hz min.
Resolution
1 mHz to 19.99 Hz: 4 digits.
20 Hz to 20 MHz: 5 digits.

Pulse Generator

Range
For Synthesized Pulses: 1 mHz to 50 MHz.
For Synthesized Square Waveforms: 1 mHz to 100 MHz.
For AM+SCM: 0.1 Hz min.
Note: For frequencies >20 MHz, rear panel pulse outputs are used; available modes are continuous (to 100 MHz) and trigger (to 50 MHz).
Resolution
1 mHz to 50 MHz: 5 digits.
50.002 MHz to 100 MHz (2 kHz resolution): 4½ digits.

Frequency Accuracy

Synthesized (20 Hz to 100 MHz in Continuous, AM or SCM Mode): ±10 ppm, 20±5°C; ±1 ppm, 0° to 50°C with Option 001, TXCO.
Nonsynthesized (<20 Hz or Trig, Gated, Burst, FM or Sweep Mode) on 1:1 to 1:100 Ranges: ±3%.
Nonsynthesized on 100:1 to 1000:1 Ranges: ±3% linearly increasing to ±13% in 1000:1 range in FM and sweep modes.

Frequency Stability

VS Time
Synthesized: ±10 ppm/year.
Synthesized plus Option 001: ±1 ppm/year.
Nonsynthesized, within 10 Min: ±0.1%.
Nonsynthesized, within 24 Hr: ±0.5%.
Vs Temperature
Synthesized, 15° to 25°C: ±2 ppm/°C.
Synthesized plus Option 001, 0° to 50°C: ±1 ppm.
Nonsynthesized: <100 ppm/°C.

Frequency Counter

Input: External Frequency In BNC.
Range: 20 Hz - 20 MHz
Accuracy: ± 0.01%
Sensitivity: 600mVp-p to 30Vp-p or TTL into 10 kz.

FUNCTION GENERATORS

MODEL 91

AMPLITUDE
(50Ω into 50Ω front panel output.)
Range: 1 mVp-p to 15 Vp-p (±7.5 Vp). To 30 Vp-p into open circuit.
Resolution
To 10 Vp-p: 4 digits (1 mV minimum).
>10 Vp-p: 4½ digits
When Using Upper/Lower Level Keys: 10 mV.
Note: Resolution may be reduced when offset is used.
Accuracy (% of Programmed Amplitude)
To 100 mVp-p: ±2% + 1 mV.
To 1 Vp-p: ±2% + 2 mV.
To 15 Vp-p: ±2% + 10 mV.
Flatness (Relative to 1 kHz Reference)
Unbalanced Output (50Ω)
To 2 MHz
Sine and Square: ±0.3 dB.
Triangle: ±0.5 dB.
To 20 MHz
Sine and Square: ±0.75 dB.
Triangle: ±1.5 dB.
Balanced Outputs (135Ω, Sine Wave)
To 100 kHz: ±0.3 dB.
To 1 MHz: ±0.75 dB.

OFFSET/DC FUNCTION (50Ω INTO 50Ω)
Range: ±7.5V (±15V into open circuit).
Note: Peak amplitude plus offset may not exceed ±7.5V.
Resolution: 4 digits. May be reduced if both offset and amplitude are programmed.
Accuracy (% of Programmed Offset)
To 9.99 mV: ±(2% + 1 mV).
To 0.999V: ±(2% + 2 mV).
To 7.5V: ±(2% + 10 mV).

INPUTS
Ext Freq In (10 kΩ): For external phase lock, or frequency counting.
Mod In (10 kΩ): For FM, AM, and SCM.
Trig In (1 kΩ): External trigger input.
Ref In (1 kΩ): Option 001. For ext 10 MHz reference. On rear panel.

OUTPUTS
Sync Out (50Ω): TTL level pulse output at programmed frequency and symmetry in phase with the square function.
Sweep Out (600Ω): 0 to ≈6V ramp to indicate sweep position.
Ref Out (50Ω): Option 001. TTL level at 10 MHz. On rear panel.
Unbalanced Out: Function output. Programmable as 600Ω to 1 MHz or as 50 or 75Ω to 20 MHz. Not simultaneously available with balanced output.
Impedance Accuracy (50, 75, and 600Ω): ± 1%.
Balanced Out: Dual banana-jacks for differential output of selected function at either 135 or 600Ω to 1 MHz.
Impedance Accuracy (135 and 600Ω): ± 1%.
Pulse/Pulse Complement Out (50Ω): Selected pulse outputs at four fixed and one custom (user defined) levels. Pulse Complement Output is inverse of Pulse Output pulse.
Programmable Levels (Specified into 50Ω Termination):

Logic Selection	Upper Level	Lower Level	Rise/Fall
TTL	+2.5V	0V	3.75 ns
CMOS	+4.0V	0V	5 ns
+ECL	+4.1V	+3.2V	3.5 ns
-ECL	-0.9V	-1.8V	3.5 ns
Custom	-1.4 to +4.2V	-1.8 to +3.8V	2.5 ns + (1.5 ns/V)

Accuracy: ±(2% + 75 mV).
Resolution: 0.1V (2 digits).

GENERAL
Stored Settings: Five complete front panel setups in nonvolatile memory. Last user setup is also retained at power down.
Remote Operation: IEEE 488.1 (GPIB) interface is standard. Address selection via front panel.
Subsets: SH1, AH1, SR1, RL1, PP0, DC1, DT0, C0, T6, L4, TE0, LE0, and E1.
Grounding: 42V floating signal common.
Display: 1 line by 16-character vacuum florescent.
Environment: Conforms to MIL-T-28800C, class 5 environmental safety and EMI/EMC..
Temperature Range
Operation: 0° to +50°C.
Storage: -40° to +71°C.
Humidity: Operating temperature restrictions for relative humidity.
95% RH: 11° to 30°C.
75% RH: 31° to 40°C.
45% RH: 41° to 50°C.
Altitude
Operation: To 10,000 ft. (3050 m).
Non-operating: To 15,000 ft. (4570 m).
Vibration: Operates with a vibration level of 0.013 in. from 5 to 55 Hz (2g acceleration at 55 Hz).
Shock (Non-operating): 40g, 9 ms ½ sine
Electromagnetic Compatibility: Complies with MIL-STD-461A Notice 4 (EL) and meets the emission and susceptibility requirements of CE02, CE04, CS02, CS06, RE01, RE02, RE02.1, and RS03.
Dimensions: 35.6 cm (14 in.) wide, 13.2 cm (5.2 in.) high and 39.4 cm (15.5 in.) deep.
Weight: 10 kg (22 lb) net; 14.1 kg (31 lb) shipping.
Power
Input Ranges: 90 to 108, 108 to 126, 198 to 231, or 216 to 252 Vrms.
Frequency: 48 to 466 Hz, 1 phase.
Consumption: <130 VA.

OPTIONS
001: TCXO Reference: TCXO crystal with ±1 ppm stability over operating temperature range (0° to 50°C). Aging rate 1 ppm/year. Two rear panel BNC connectors for ext. reference input and output. Ref In (1 kΩ) accepts sinusoidal input of <500 mVp-p or TTL compatible pulse at 10 MHz. REF Out provides TTL compatible pulse train into 50Ω at 10 MHz.
003: Handles and Rack Adapter: For mounting Model 91 in a standard 19-in. rack. Features BNC feed through holes for each side and optional handles.
004: Service Kit. Extender boards make circuit boards accessible for maintenance. Includes temperature-stabilizing calibration cover.
EW-1: Extended Warranty: Extends standard 12 month warranty an additional 12 months.

Note: Unless otherwise stated, these specifications apply to the 50Ω unbalanced output after 20 min. warm-up at the temperature of the last AutoCal ±10°C.

ORDERING INFORMATION

Model 91	**$4,795**
Option 001	**$395**
Option 003	**$125**
Option 004	**$295**
Option EW-1	**$335**

Factory/FOB: San Diego, CA

For a demonstration contact your local Wavetek representative (page 146).