WAVETEK

Model 275
12 MHz Programmable
Arbitrary/Function Generator

- USER DEFINED WAVE SHAPES
- 12 BIT AMPLITUDE RESOLUTION
- UP TO 8K HORIZONTAL POINTS
- 267 ns TO 267s CLOCK SPEED
- GPIB (IEEE-488) STANDARD

Model 275 is the simple solution for your complex waveform problems. This programmable Arbitrary Waveform Generator (ARB) lets you design your own unique waveforms. In addition, the Model 275 is a precision 12 MHz function generator.

In ARB modes, 12 bits of amplitude resolution and 8,192 horizontal points give you unparalleled waveform resolution. And at clock speeds from a very slow 267 seconds to a very fast 267 ns per point.

There are eleven useful modes such as *Ramp-to-Start, Triggered Hold* and *Hold-on-Breakpoint.* You can monitor the progress of a waveform, stop it at any point and return to its starting point, or on the next trigger proceed with the next waveform in memory.

Single or multiple waveforms, with varying resolutions, can be loaded into memory. They can be recalled individually or in groups.

If ARB precision and performance are what you want, the Model 275 is for you.
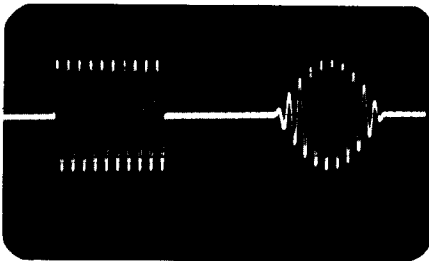
ARB APPLICATIONS

Medical

Production and R&D applications for the 275 include testing of pacemakers and other medical equipment and simulation of heartbeats, nerve responses, and EEG brainwave patterns. The high resolution of the 275 along with the ability to vary the time between waveforms make it particularly useful in these applications.
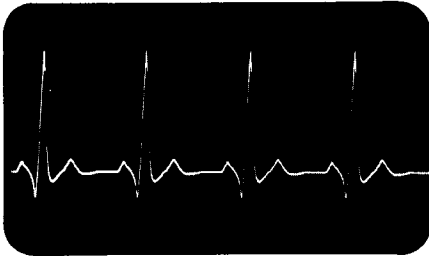

Heartbeat Simulation

Doppler

Simulated Doppler Signals

Doppler applications include underwater sound (sonar), radar IF strips, and ultra-sound (used in mechanical defect testing and medical testing). The ability of the 275 to vary time between waveforms (using the trigger-and-hold-on-breakpoint mode and internal triggering) with the cursor makes it ideal for these kinds of applications.
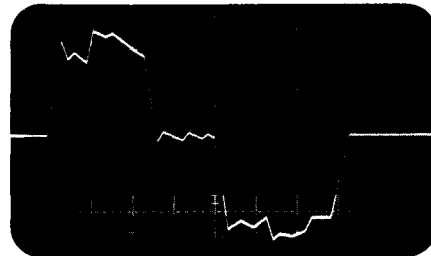
Material Testing
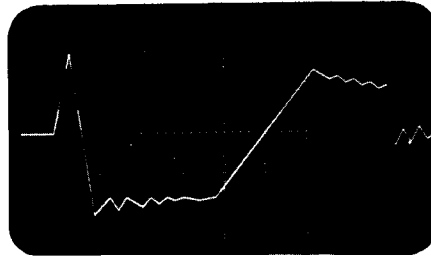
Typical Material Testing Waveform

Material testing is a traditional application for ARB generators. Ramp-to-start, hold-on-trigger, panel lockout, and ARB monitor features make the 275 more useful than previous ARB's for this application.

Electromechanical Switching

Contact Bounce Simulation

Simulation of switcher motors, solenoids and relays require special waveforms which simulate contact bounce. The Model 275 has been used to generate these special types of waveforms.

Computer Disc

Computer peripherals such as disc drives and high speed printers require complex mechanical/electrical interfaces to insure proper alignments for proper data transfer. Disc drive manufacturers are using a modulated magnetic pickup technique to locate certain sync points on the spinning disc platter. The ARB simulates the spinning disc by providing the necessary sync waveforms to the pickup amplifiers. Flexibility of the ARB permits precise timing of waveforms through external triggering, as well as full level control and waveform switching. In the past, initial tune-up of these pickup amplifiers was hazardous, since an actual disc spinning at full speed was required for this precision work.
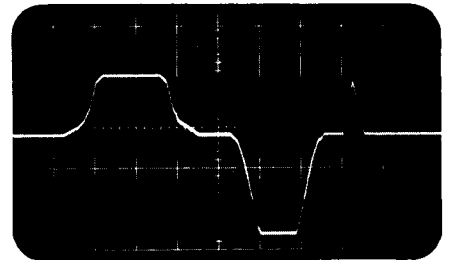
Typical Disc Sync Waveform

Operational Modes (ARB Only)
(Described in Specifications)

TRIGGERED ARB WITH RAMP-TO-START
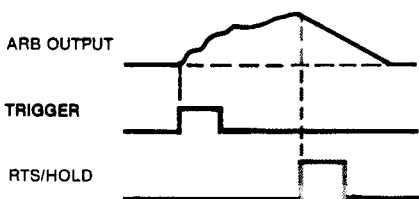
TRIGGERED ARB WITH RESET
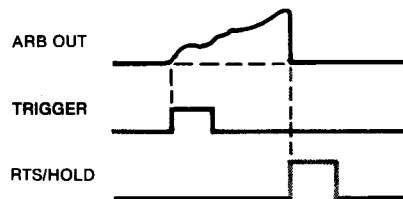
TRIGGERED ARB WITH HOLD AND TRIGGERED RTS

TRIGGERED ARB WITH HOLD AND TRIGGERED RESET

TRIGGERED ARB WITH HOLD ON BREAK POINT

NOTES

1. Single Step Mode and Examine Mode not shown.
2. Gray pulses are optional inputs. If no pulse is input, hold, reset, or ramp will occur at the ARB stop address.
3. RTS = Return-to-Start Address. (Ramp or direct, as shown.)

Specifications

WAVEFORMS (FUNCTIONS)

Programmable sine $\curlyvee$, triangle $\wedge$, square $\sqcap\!\!\sqcup$, square comp, dc, external width, arbitrary and filtered arbitrary.
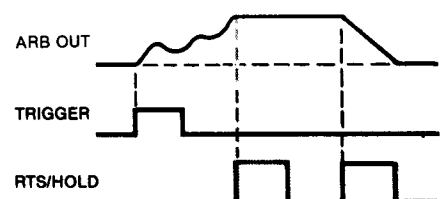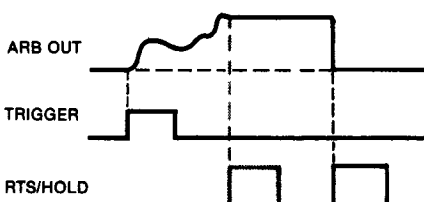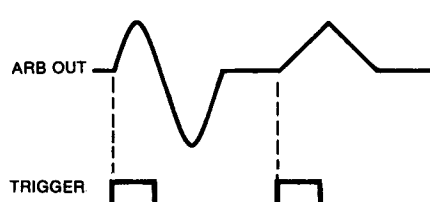
Sine Distortion (THD at 5Vp-p): <0.5% 10 mHz to 99.9 kHz. No harmonics above −40 dBc 100 kHz to 999 kHz, −30 dBc 1 MHz to 12 MHz.

Time Symmetry: ±1% ±8 ns.

Square Transition Time: <15 ns.

Square Overshoot: <4% at full amplitude.

Triangle Linearity: 99% to 100 kHz.

OPERATIONAL MODES (FOR ALL FUNCTIONS INCLUDING ARB)

Continuous: Output continuous at programmed frequency or clock rate.

Triggered: Output quiescent until triggered by internal or external signal, GPIB trigger or manual trigger, then generates one cycle at programmed frequency or clock rate.

Gated: As triggered mode except output is continuous for the duration of the gate signal. The last cycle started is completed.

Burst: As triggered mode for programmed number of cycles
Count Range: 1 to 1,048,200.
Burst Rate: 12 MHz maximum.

OPERATIONAL MODES (ARB ONLY)

(Also refer to figures on facing page.)

Triggered ARB with Ramp-to-Start: One cycle of ARB waveform is initiated on first trigger input. Second trigger (at TRIG IN or ARB RTS/HOLD IN) causes ARB output to slowly ramp to start address of ARB waveform. If return-to-start (RTS) trigger is not received before stop address is reached, RTS is initiated at stop address.

Triggered ARB with Reset: Same as *Triggered ARB With Ramp-To-Start* except the second trigger (or stop address) causes immediate reset to start address.

Triggered ARB with Hold and Triggered Ramp-to-Start: One cycle of ARB waveform is initiated on first trigger input. Second trigger causes ARB to hold. Third trigger causes ramp-to-start. If stop address is reached before second trigger then stop address causes hold and next trigger causes RTS.

Triggered ARB with Hold and Triggered Reset: One cycle of ARB waveform is initiated on first trigger input. Second trigger causes ARB to hold. Third trigger causes immediate reset to start. If stop address is reached before second trigger, then stop address causes hold and next trigger causes reset.

Single Step: Same as *Continuous* mode except when Arbitrary function is selected, ARB clock rate is replaced by trigger input so that ARB clock can be supplied externally or with function generator.

Examine: When Arbitrary function is selected, output will be voltage (data value) present at address specified on address program. This allows ARB waveform to be examined one point at a time by specifying address of desired point.

Triggered ARB with Hold on Breakpoint: ARB waveform is initiated upon trigger input and held at programmed breakpoints. Each successive trigger then causes the instrument to advance to the next breakpoint. Start and stop addresses are ignored in this mode after the first trigger.

FREQUENCY

Range: 10 mHz to 12 MHz for sine, triangle, square, square complement. >15 MHz for external width. ARB range dependent upon clock rate and block size. Clock rate 267.5 ns to 267s.

Block size: 2 points to 2048 points (option to 8192 steps).

Resolution: 3 digits.

Accuracy: ±2% for non-ARB modes, ±0.2% for ARB modes.

Repeatability (24 hr): ±1% for non-ARB modes, 0.01% for ARB modes.

Jitter: ≤0.1% ±100 ps.

Control: Frequency may be controlled by programmed value or external VCG input.

Value: Frequency value is keyboard or GPIB programmable with automatic range selection.

VCG (Voltage Controlled Generator): AC or dc input controls frequency. +0.01 to +12V into 10 kΩ for up to 1200:1 frequency change in each of 9 frequency ranges (ranges must be programmed). Slew rate is limited to 1V/μs.

AMPLITUDE

Range: 0.01 to 10 Vp-p into 50Ω (0.02 to 20 Vp-p into ≥50 kΩ) from main output. Absolute peak amplitude plus offset may not exceed 5V into 50Ω (10V into >50 kΩ).

Resolution: 3 digits or 10 mV when absolute peak amplitude plus offset >0.5V; 3 digits or 1 mV when absolute peak amplitude plus offset ≤0.5V.

Accuracy: ±2% of programmed value and:
±5 mV for 0.1 to 1V (peak amplitude + offset <0.5V),
±20 mV for 1.01 to 10V,
±50 mV for all other.

Repeatability (24 hr): ±1% ± 10 mV.

Flatness (At 5 Vp-p): 0.1 dB to 100 kHz, 1.5 dB to 12 MHz.

OFFSET

Range: DC or offset programmable from −5V to +5V into 50Ω (−10V to +10V into ≥50 kΩ). Absolute peak amplitude plus offset may not exceed 5V into 50Ω (10V into ≥50 kΩ).

Resolution: 3 digits or 10 mV when absolute peak amplitude plus offset >0.5V, 3 digits or 1 mV when absolute peak amplitude plus offset ≤0.5V.

Accuracy: ±40 mV in dc function.

Repeatability (24 hr): ±20 mV.

OUTPUTS

Function Output: Source-of primary waveforms. Program Control Provides: Output On, 50Ω source impedance; Output Off, High Z (>500 kΩ); output Off, Low Z (approximately 50Ω termination).

Protection: Output protected to 140 Vac or 200 Vdc without internal damage.

Sync Output: Sync signal is at programmed frequency and TTL level.

Level: ≤0.4V to ≥2.4V into 50Ω, ≤0.8V to ≥4.8V into ≥50 kΩ.

Source Impedance: 50Ω.

Timing: Concurrent with function output in square; lags sine and triangle by 90°.

Over/Undershoot: <10% into 50Ω.

Protection: Output protected from short circuit to any voltage between ±15 Vdc input minimum.

ARB Sync Output: 0 to +5V into 600Ω, programmable phase control. RCL 4000 initiates positive ARB sync; RCL 4001 initiates negative ARB sync.

Source Impedance: 600Ω.

Protection: Output protected from short circuit to any voltage between ±15V.

INPUTS

External Trigger: Trigger of input circuit is programmable for a + or − signal slope and required threshold level.

Level: −10 to +10V.

Resolution: 20 mV.

Accuracy: ±500 mV.
Input Impedance: 10 kΩ.
Maximum Trigger Rate: 12 MHz (15 MHz for External Width).
Minimum Trigger Width: 20 ns.
Minimum Amplitude: 500 mVp-p to 1 MHz, 1 Vp-p to 15 MHz.
Protection: Input protected to ±50V.
VCG In: Voltage control of generator frequency. See frequency.
  Range: 0.01 to 12V.
  Impedance: 10 kΩ.
  Protection: Input protected to ±50V.
ARB RTS/Hold Input: Trig input and RTS/Hold input are internally common. Having two inputs provides processing for independently generated trigger and RTS/Hold signals.
  Protection: Input protected from short circuit to any voltage between ±15V.

INTERNAL TRIGGER
Non-ARB Functions:
  Range: 3.75 mHz to 3.75 MHz
  Resolution: 4 digits.
  Accuracy: 0.2%.
ARB Functions:
  Range: 10 mHz to 3.75 MHz.
  Resolution: 3 digits.
  Accuracy: 2%.

ARB CHARACTERISTICS
Horizontal Resolution: 2048 points standard; 8192 points optional
Vertical Resolution: 12 bits (−2048 to +2047).
Auto-line: Allows a straight line to be drawn between the last two data points specified.
Programmable Filter on ARB Waveforms:
  Non-filtered ARB waveform: Settling time: <1.5μs.

Filtered ARB waveform: Settling time approximately 0.6 ms.
Programmable Ramp-to-Start Rate:
  Fast: approximately 5 ms/bit;
  Slow: approximately 20 ms/bit.
Programmable 3 Digit ARB Clock: Period Ranges from 267s to 267 ns with 0.2% accuracy.

GPIB PROGRAMMING
IEEE 488-1978 compatible. Non-isolated. Double buffered.
Address: 0−30, keyboard or internal switch selectable. Internal switch can lock out keyboard selection. Power-up address is internal setting.
Subsets: SH1, AH1, T6, TE0, L4, SR1, RL1, PP0, DC1, C0, E2.
Interface Timing:

Frequency	16 ms
Amplitude	13 ms
Offset	14 ms
Mode	6 ms
Function	5 ms
Int/Ext	5 ms
Execute	20 ms to 4 sec
Store	11 ms
Output	10 ms
Slope	5 ms
Burst Count	10 ms
Rate	35 ms
Recall	185 ms
Reset	185 ms
Start	20 ms
Stop	20 ms
GET Mode	5 ms to 4 sec
Adrs	10 ms
Data	15 ms
Auto-line	20 ms to 2 sec

GENERAL
Stored Settings: Non-volatile memory will store 75 settings as standard.

Environmental:
  Temperature Range: 25°C ± 10°C for specified operation, operates 0°C to 50°C, −50°C to +75°C for storage.
Warm-up Time: 20 minutes for specified operation.
Altitude: Sea level to 10,000 ft for operation. Sea level to 40,000 ft for storage.
Relative Humidity: 95% at 20°C and at sea level (non-condensing).
Dimensions: 21.7 cm (8.54 in) wide (half-rack), 13.3 cm (5.25 in) high, 39.4 cm (15.5 in) deep.
Weight: 5.9 kg (13 lb) net. 7.2 kg (16 lb) shipping.
Power: 90 to 105, 108 to 126, 198 to 231, or 216 to 252 volts rms; 48 to 66 Hz; 1 phase; <40 watts.

OPTIONS
002: Rear Panel Connectors: Front panel BNC's relocated to rear panel.
004: Extended Block Size: Extends block size to 8192 points.

ACCESSORIES
Style 12: Single Rack Adapter Kit: Allows any 270 series instrument to be right or left mounted in a standard 19 inch rack. 5¼ inches high.
Style 13: Dual Rack Adapter Kit: Allows any 270 series instrument to be mounted side-by-side in a standard 19 inch rack. 5¼ inches high.

ORDER INFORMATION
(FOB San Diego)

Model 275	**$3750**
Option 002	**$ 100**
Option 004	**$ 400**
Style 12	**$ 75**
Style 13	**$ 125**

Terms: Net 30 days.
Prices apply only to domestic U.S. customers.
Prices and specifications are subject to change.

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