

Quartzlock

A9

10 digit
accuracy

Universal Counter/ Timer/ Calibrator

with rubidium timebase

→ 250MHz → 2.5GHz → 10.24GHz ↔ 1pps → 1,5,10MHz



FEATURES

- 10 digit accuracy (1×10^{-10})
- 10 digit resolution
- 10 storable front panel set-ups
- Auto-triggering, auto-attenuation for error free op
- 500 built in gate time intervals + external input
- Extended gate time range from 100 μ s to 1000s
- Complete GPIB programmability
- 100 ASCII-formatted readings in one second
- 13 measurement functions
- Resolves 9 digits in one second
- Complete input conditioning on both channels
- 8 x 10MHz outputs for referencing instruments
- 1MHz, 5MHz, 10MHz sine & square wave outputs
- Frequency range: 0 to 250MHz, both channels
- 2.5GHz input (2.7GHz typical)
- 10.24GHz output
- Dynamic range: ± 50 V with x10 attenuator
- Input impedance: 50 Ω or 1M Ω , switchable
- Single shot time resolution: to 1ns
- Averaged time resolution: to 1ps
- Sensitivity: 25mV to 100MHz, 50mV to 250MHz
- Phase resolution: 0.01 $^\circ$
- V peak-peak resolution: 2 x three digits
- Trigger level range: from -50Vdc to +50Vdc
- 1pps sync input
- 1pps sync output

□ = Option

APPLICATIONS

- Frequency & Time Measurements
- RF Measurements
- Microwave Measurements
- Communications
- High Speed Auto Test Systems
- Rackmount 'test solutions'

BENEFITS

- Versatility for most applications
- Multiple Measurement Parameters with 1 unit
- Simple, Fast Initial set up
- Phase/ Time/ Counter Applications
- Synchronise 6-10 Other Instruments
- Portable

STANDARD SPECIFICATIONS

Input Characteristics (Channels A & B)

RANGE
 DC coupled: 0 to 250 MHz (typically to 300 MHz).
 AC coupled: 1 M Ω , 30 Hz to 250 MHz; 50 Ω , 1 MHz to 250 MHz.

SENSITIVITY
 25 mV rms sine wave to 100 MHz,
 50 mV rms sine wave to 250 MHz,
 75 mVp-p at minimum pulse width of 5 ns.

SIGNAL OPERATING RANGE
 -5.00 Vdc to +5.00 Vdc (x attenuator).

DYNAMIC RANGE
 75 mV to 5 Vp-p, to 100 MHz; 150 mV to 2.5 Vp-p, to 250 MHz.

IMPEDANCE
 1 M Ω or 50 Ω , selectable.

LOWPASS FILTER
 100kHz NOMINAL, switchable.

TRIGGER LEVEL RANGE
 Manual (auto trigger off): Continuously adjustable over \pm 5.00 V (x attenuator), displayed in 10 mV steps (x attenuator).
 Setting Accuracy: X1, \pm (35 mV +2% of reading); X10, \pm (350 mV + 2% of reading).

Auto Trigger

DC Coupled: 100 Hz to 150 MHz.

AC Coupled: 1 M Ω , 100 Hz to 150 MHz; 50 Ω , 1 MHz to 150 MHz (typically to 225 MHz).

Auto Trigger Range: +/-280 mV to +/-50 Vp-p.

Trigger Slope: Independent selection of + or - slope.

Attenuator

Manual: X1 or X10 NOMINAL, selectable.

Auto: Attenuator is automatically enabled when in Auto Trigger Mode.

Auto Attenuator Sensitivity: Attenuator is switched when peak input signal exceeds 5.1 Vp-p.

Frequency A & Frequency B

Measurement Technique (automatically selected by the instrument)
 Reciprocal: below 120 MHz and in User Gate and Hold operating modes;
 Conventional: above 120 MHz.

Range: 0.1 Hz to 225 MHz (typically to 300 MHz).

LSD Displayed
 Reciprocal: 4 ns x frequency / gate time
 Conventional: 4 / gate time

Resolution: \pm LSD \pm (1.4 x Trig error) x Frequency / gate time

Accuracy: \pm resolution \pm Time Base Error x Frequency

Time Measurement - Single Shot

Period A, Pulse A, Time Interval A to B

Range
 Period A, Pulse A: 5 ns to 2000 s
 Time Interval A to B: 0 ns to 2000 s

LSD Displayed
 Below 20S: 1 ns
 Above 20S: 5x10E-10 x Time

Resolution
 Below 20 s: \pm 2 LSD \pm Start trigger error \pm Stop trig error
 Above 20 s: 1 LSD.

Accuracy: \pm (Time Base error x Time) \pm Trigger level timing error \pm 1 ns \pm resolution.

Time Delay

Internal: 500 internal pre-programmed delay intervals, ranging from 100 μ s to 100 s, can be inserted between START and STOP of Time Interval A to B. Inputs during delay are ignored.

External: User selectable delay intervals, ranging from 100 μ s to 10E5 s, can be applied through rear panel BNC connector.

Time Measurement - Averaged

Period A

Range: 8 ns to 10 s

LSD Displayed: 4 ns x Period / gate time

Resolution: \pm LSD \pm (1.4 x Trig error) x Period / gate time

Accuracy: \pm resolution \pm Time Base error x Period

Number of Periods Averaged: N = gate time / Period

Pulse A, Time Interval A to B

Range
 Pulse A: 5 ns to 10 s.
 Time Interval A to B: -3 ns to 10 s.
 LSD Displayed: 4 ns / N
 Resolution: \pm (1 LSD + 10 ps)
 Accuracy: \pm (Time Base Error x Time) \pm 1ns \pm (resolution \pm Trig error) / N

Dead Time Stop to Start: 20 ns minimum.

Number of Samples Averaged: N = gate time x Frequency A.

Phase A to B

Range: 0 to 360 degrees x (1 - 20 ns x Freq A).

Frequency Range: 0.1 Hz to 25 MHz.

LSD Displayed: 4 ns x 360 degrees x (1 + N) / gate time or 0.01 degrees, whichever is greater

Resolution: \pm 1 LSD.

Accuracy: \pm resolution \pm (1 ns x Freq A x 360 degrees) \pm (Trigger error x Freq A x 360 degrees) / N

Number of Cycles Averaged: N = gate time x Frequency A

Min Amplitude: 100 mV rms sine wave.

Totalize B

Frequency Range: 0 to 120 MHz.

Totalling Range: 0 to 10¹⁶ - 1

Gate Modes

Infinite: Totalling on B indefinitely.
Gated by A: Totalling on B between a pair of two consecutive transitions of the opposite direction on A.
Gated by AA: Totalling on B between a pair of two consecutive transitions of the same direction on A.

Gating Transition: Positive or Negative transitions, selectable.

Dead Time Stop to Start: 20 ns minimum.

LSD Displayed: 1 count of input signal.

Accuracy

Infinite: Same as LSD.
Gated by A, Gated by AA: \pm pulse rep rate B x Trig error A / total counts B.

Ratio A/B, Ratio C/B

Frequency Range
 A: 0.1 Hz to 225 MHz;
 B: 0.1 Hz to 125 MHz;
 C: 50 MHz to 2.4 GHz (Channel C optional).

LSD displayed: 4 x Ratio / Freq B x gate time

STANDARD SPECIFICATIONS

Resolution and Accuracy

C/B: \pm LSD;
A/B: \pm LSD \pm Trigger error B x Ratio / gate time

V Peak A

Frequency Range: 40 Hz to 10 MHz.

Dynamic Range: 280 mVp-p to 51 Vp-p

Resolution: x1, 10 mV; x10, 100 mV. Attenuator is activated automatically

Accuracy: \pm resolution \pm 0.1(Vpos pk - Vneg pk) \pm 35 mV

Gate Time

Internal: 500 pre-programmed gate time intervals, ranging from 100 μ s to 100s

External: User selectable gate time intervals, ranging from 100 μ s to 1000s

External Input: Positive true TTL levels

External Gate Delay: <10 us

External Arming (Trigger)

Function: Arms the instrument when set to HOLD

Trigger Delay: <50 μ s

Minimum Pulse Width: 10 μ s

External Input: Positive true TTL levels

Time Base

Frequency: 10 MHz

Aging Rate: 1 x 10E-7/month

Stability: 1 x 10E-6, 0 to 50 degree C

External Time Base Input: 10 MHz, TTL level.

GPIB Interface

Programmable Controls: All front panel controls except POWER switch.

Interface Functions: SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C0, E1

Data Output

Single Shot: One reading processed after trigger
Normal Mode: Four readings/second, formatted
Fast Mode: Up to 100 reading/second, formatted
Address Selection: Front panel programming

General

Arming: Each channel is armed by it's own signal

Reset: Clears display and re-cycles measurement

Trigger Level

Outputs: DC Outputs via rear panel terminals, not adjusted for attenuators

Displayed Digits: Selectable from 3 to 9 digits

Stored Set-ups: Stores ten front panel set-ups

Operating Temp: 0 to 50 degree C

Power: 115/230 Vac, 50-60 Hz, 25 W

Internal Rubidium

Output

Frequency: 10MHz

Voltage (into 50 Ω): 0.5-1.0Vrms

Accuracy at Shipment

\pm 5E-11

Aging

1 month: 4E-11

1 year: 5E-10

Warm Up Time to 1E-9

5 mins

Phase Noise, dBc/Hz

10 Hz: -100

100 Hz: -125

Distortion, dBc

Harmonic: -40

Non-harmonic: -80

1 kHz: 135

10 kHz: 145

Frequency Stability

1 s: 3E-11

10 s: 1E-11

100 s: 3E-12

Temperature

Operating (Ambient): 0 $^{\circ}$ C - +50 $^{\circ}$ C

Storage: -25 $^{\circ}$ C - +65 $^{\circ}$ C

Frequency offset over operating temperature range: \pm 5E-10

Frequency Converter and Distribution Amplifier

Frequency standard outputs

1MHz, 5MHz, 10MHz sine wave @ 8dBm +/- 2dBm

1MHz, 5MHz, 10MHz square wave @ >2V ttl hcmos 50 Ω

Distribution amplifier outputs

6 x 10MHz @ 12dBm, 50 Ω

Time sync output

1pps

Timing input sync

1pps

19" Rackmount Version



DESCRIPTION

The Model A9 is a ten-digit, three-channel Universal Counter/Timer. It is microprocessor based, fully programmable, and has a rubidium oscillator timebase. The instrument measures with a very high resolution and precision the following parameters: frequency A, Frequency B, Frequency C, Period A, Pulse-width, Time interval A to B, Total counts B, Ratio A/B, Ratio C/B, Phase A to B and Amplitude peaks. An averaging function is available for improved resolution in time measurement, giving resolution intervals of Pico seconds. Various repetitive tests, no matter how complex, are greatly simplified by utilizing any of the 10 pre-programmed front panel set-ups. Set-ups are stored in a non-volatile memory and can be recalled by a simple keystroke.

The A9 utilises a combination of two measurement techniques in order to always achieve maximum display resolution. Some functions, such as Frequency measurement function, can be displayed with up to ten digits. Resolution can be gained from frequencies as low as 0.01 Hz to more than 300 MHz. The reciprocal technique is being used in low frequency measurements, up to exactly 120 MHz, where the measurement technique is changed to the conventional measurement technique. Model A9 measures frequencies of input signals with minimum resolution of nine digits in one second of gate time.

In the A9, the traditionally featured decade steps of gate times, are replaced by a more flexible variable gate time. This feature permits a choice from 500 internally pre-selected gate intervals, or any external gate interval which is applied to a rear panel BNC connector. Internal gate times range from 100µs to 100s. The external gate expands this range to 1000s. Trigger level may be selected manually or left to be automatically adjusted, by the instrument, to the optimum level, eliminating false triggering on unknown signals.

Options

There are several options available with Model A9:

- 1 Multi frequency outputs 1, 5 & 10MHz Sine & Square Wave (14 outputs total). 1pps sync input and 1pps sync output. 8x10MHz
- 2 2.5 GHz C Channel input (typically 2.7GHz)
- 3 Analog output
- 4 Microwave calibration output: 1.28GHz, 10.24GHz - +10dBm +/-1dB @ 20-25°C. Level calib to 0.1dB. Low phase noise.

Options may be ordered with new instruments from the factory, or separately for future installation. There are no software upgrades necessary when installing the options. The instrument automatically senses the presence of the new option and allows access to parameters that are associated with the newly installed option.

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Issue 130902.3. Replaces all previous issues
This specification does not form any part of a contract

PERIPHERALS

A7 Measurement System

- Frequency, Phase & Phase Noise
- Very high resolution
- Very low noise
- Ultra fast measurement time
- A7-A (Analogue) simple to use E-13 resolution
- A7-M (Metrology) best available E-16 resolution
- Selectable filters, resolutions & tau's
- 24V battery back up glitchless switch built in

A6 Frequency Converter

- A5 design criteria for stability and low noise
- All outputs synchronised
- A5...4 output OEM Modules provides multiple outputs
- 24Vdc or 90...240Vac operation
- Hydrogen Maser Compatible Performance
- 1 Hz / 1pps sync input

A5 Distribution Amplifier

- 4...32 Outputs
- 1-100MHz frequency input range (sine)
- Phase Noise: -160 dBc/Hz @ >100Hz
- Temperature Stability <10ps/°C
- Hydrogen Maser Compatible Performance
- STS 1x10⁻¹³/t^{1/2}
- Low Harmonic Distortion
- High input/input and input/output isolation
- Low 1/f AM and PM noise

