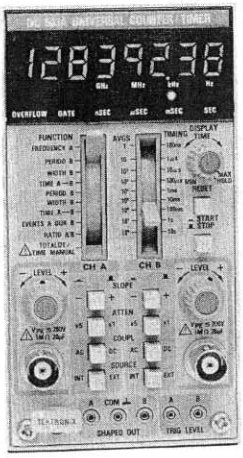
DC 503A
Universal Counter/Timer

- *125 MHz Both A and B Channels*
- *10 ps Resolution in Time–Interval Average with 10^8 Averages*
- *Measurement Functions include:* Frequency; Period and Period Average; Width and Width Average; Time A–B; Time A–B Average; Events A During B Average; Totalize; Time Manual; Ratio A/B Average
- *40 MHz Rep Rate in Time–Interval Average*
- *Trigger–Level Outputs for Accurate Trigger Setting*
- *Shaped Outputs for Ease of Triggering*
- *Designed for True Probe Compatibility*
- *High Stability Oven Time Base*



DC 503A

The DC 503A offers a broad range of measurement features at an affordable price. The instrument has two input channels, A and B, each with 125 MHz capability. Each channel has separate triggering level, triggering slope, attenuator, and coupling mode controls. Eight measurement functions are available with the DC 503A, and an averaging feature allows averaging of 1 to 10^8 occurrences of the signal of interest. Signals to be counted or timed can be applied to channels A and B via front-panel BNC connectors or through rear-interface connections. The DC 503A features an easy-access front panel and an LSI-based design for increased instrument reliability.

The DC 503A is equipped with a temperature-controlled 10 MHz crystal oscillator to obtain a highly stable and precise internal time base.

CHARACTERISTICS

Display – Eight digit LED; indicators for units, gate open, and overflow.

Display Time – ≈0.2 s to 5 s and hold.

CHANNEL A AND B INPUT

Frequency Range – 0 to ≥ MHz, dc coupled. 10 Hz to ≥125 MHz, ac coupled.

Sensitivity – 20 mV RMS sinewave to 100 MHz. 60 mV p-p at minimum pulse width (of 5 ns to 100 MHz). 35 mV RMS sinewave to 125 MHz. 100 mV p-p (minimum pulse width of 4 ns to 125 MHz).

Attenuation – Selectable 1X, 5X.

Impedance – 1 M Ω paralleled by ≈27 pF.

Dynamic Range – V p-p ≤ 3 V x attenuation.

Trigger Level Range – Adjustable ±3.5 V x attenuation

Trigger Level Output Accuracy – ±0.5% of reading for a dc input V, ±20 mV.

Independent Controls – Slope ±, Attenuation 1X/5X, Coupled ac/dc, Source Internal/ External.

Maximum Input Voltage – IX: ≤ 200 V peak; ≤ 400 V p–p from dc to 50 kHz, ≤ 15 V p-p from 1.33 to 125 MHz.

5X: ≤ 200 V peak; ≤ 400 V p-p from dc to 5 MHz, derate to ≤ 20 V p-p from 100 to 125 MHz.

Shaped Out – Shaped replica of signal being measured, aids proper triggering on complex waveforms. ≤ 200 mV p-p from 50 Ω.

FREQUENCY A

Range – 0 to 125 MHz.

Resolution – 0.1 Hz to 10 MHz in decade steps.

Accuracy – ±1 count ±Time Base Error.

PERIOD B (SINGLE SHOT)

Range – 100 ns to 10^9 s.

Resolution – 100 ns to 10 s in decade steps.

Accuracy – ±count ±Time Base Error x Period B ±1.4 x Channel B Trigger Jitter Error.

Frequency Range – 125 MHz.

PERIOD B (AVERAGE)

Range – 8 ns to 10 s.

Resolution – 1 fs (10^{-15}) to 100 ns in decade steps.

Events Averaged (N) – 1 to 10^8.

Accuracy –

$$\pm \frac{100\text{ ns}}{N} \pm \text{Time Base Error} \times \text{Period B}$$

$$\pm \frac{1.4 \times \text{Channel B Trigger Jitter Error}}{N}$$

Frequency Range – 0 to ≤ 125 MHz.

RATIO A/B

Averaged over 1 to 10^8 cycles of Channel B signal.

Frequency Range – 0 to ≤ 125 MHz (both Channel A and Channel B).

Accuracy –

$$\pm \frac{\text{Frequency B}}{\text{Frequency A} \times N}$$

$$\pm \frac{1.4 \times \text{Channel B Trig Jitter Error} \times \text{Freq A}}{N}$$

$$\pm \frac{\text{Frequency A}}{0.3 \times 10^8}$$

TIME A → B (SINGLE SHOT)

Range – 100 ns to 10^9 s.

Resolution – 100 ns to 10 s in decade steps.

Accuracy – ±1 count ±Time Base Error x Time AB ±Channel A Trigger Jitter Error ±Channel B Trigger Jitter Error ±(Channel B stop Trigger Slew Error – Channel A start Trigger Slew Error) ±4 ns.

TIME A → B (AVERAGE)

Range – 12.5 ns to 10 s.

Minimum Dead Time – 12.5 ns (stop-to-start).

Resolution –

$$100\text{ ns} / \sqrt{N}$$

Events Averaged (N) – 1 to 10^8 in decade steps.

Accuracy –

$$\pm \frac{100\text{ ns}}{\sqrt{N}} \pm \text{Time Base Error} \times \text{Time A} \rightarrow \text{B}$$

$$\pm \frac{\text{Channel A Trigger Jitter Error}}{\sqrt{N}}$$

$$\pm \frac{\text{Channel B Trigger Jitter Error}}{\sqrt{N}}$$

+ (Channel B stop Trigger Slew Error – Channel A start Trigger Slew Error) ±4 ns

EVENTS A DURING B (AVERAGE)

Maximum A Frequency – ≤ 125 MHz.

Minimum B Pulse Width – 5 ns

Events Averaged (N) – 1 to 10^8 in decade steps.

Accuracy –

$$\pm \frac{\text{Period A}}{\text{Width B} \times \sqrt{N}}$$

$$\pm \frac{\text{Channel B start Trigger Jitter Error}}{\sqrt{N}}$$

$$\pm \frac{\text{Channel B stop Trigger Jitter Error}}{\sqrt{N}}$$

WIDTH B (SINGLE SHOT)

Range – 100 ns to 10^9 s.

Resolution – 100 ns to 10 s in decade steps.

Accuracy – ±1 count ±Time Base Error x Width B ±Channel B start Trigger Jitter Error ±Channel B stop Trigger Jitter Error ±(Channel B stop Slew Rate Error–Channel B start Slew Rate Error).

WIDTH B (AVERAGE)

Range – 5 ns to 10 s.

Resolution – 100 ns / $\sqrt{N}$

Events Averaged (N) – 1 to 10^8 in decade steps.

Accuracy –

±1 Count ±B Trig. Jit. Error (rising edge)

±B Trig. Error (falling edge) ±Time Base Error

Frequency Range – 0 to 100 MHz.

TIME MANUAL

Electronic stopwatch, accumulates and displays time between activation of front panel start/stop button or rear interface signal line. Clock rates selectable from 100 ns to 10 s in decade steps. Range 100 ns to 10^9 s.

TOTALIZE A

1 count to 99,999,999 counts at maximum rate of 125 MHz. Start, stop and reset controlled by front panel pushbuttons or rear interface signal lines.

RESOLUTION AND ACCURACY DEFINITIONS

Time Base Error is the sum of all errors specified for the time base used.

N is the number of periods averaged in Period B (AVGS) mode, the number of intervals averaged in the Time A–B (AVGS) mode, the number of widths of B averaged in Width B (AVGS) and Events A During B modes, and the number of periods of B in the Ratio A/B mode.

Trigger Jitter Error (in μs) –

$$\frac{\sqrt{(en_1)^2 + (en_2)^2}\ (V)}{\text{Input Slew Rate at Trigger Point (V/μs)}}$$

Where: e_{n1} =100 μV RMS typical internal noise

e_{n2} =RMS noise of signal input at trigger point for a 125 MHz bandwidth

Trigger Slew Rate Error (in μs) –

$$\frac{\text{Input Hysteresis (V)/2}}{\text{Input Slew Rate at set Trigger Point (V/μs)}}$$

Where: Input hysterisis = 20 mV p-p typical.

OTHER CHARACTERISTICS
HIGH STABILITY STANDARD TIME BASE

Crystal Frequency – 10 MHz.

Temperature Stability – < ±2 x 10^{-7} after warm-up, 0 to + 50°C.

Warmup Time – Within 2 x 10^{-7} of final frequency in < 10 minutes when cold started at 25°C.

Aging Rate – 1 x 10^{-8}/day at time of shipment 4 x 10^{-9}/week after 30 days of continuous operation, 1x 10^{-6}/year after 60 days of continuous operation.

Setability – Adjustable to within 2 x 10^{-8}

REAR INTERFACE

Inputs – Direct count input to 50 MHz, (50 Ω) impedance, resistor may be removed for 1 MΩ impedance, remote start/stop, reset; external time base.

Outputs – BCD serial-by-digit, decimal point overflow, scan clock; trigger level; time base reference.

ORDERING INFORMATION

DC 503A Universal Counter/Timer **$1,825**
Includes: Instruction manual (070-2971-00).

OPTIONAL COUNTER ACCESSORIES

Power Divider GR, 50 Ω –
Order 017-0082-00 **$885**
Adapters –
(GR to BNC female)
Order 017-0067-00 *1
(GR to BNC male)
Order 017-0064-00 **$115**
Cable Adapters –
(BNC to tip jack)
DC 503A, DC 509, DC 5009
Order 175-3765-01 **$55**
(BNC to RF) DC 510, DC 5010.
Order 012-0532-00 **$55**

RECOMMENDED PROBES

P6101A – 1X, dc to 34 MHz **$65**
P6106A – 10X, dc to 300 MHz **$180**
P6201 – FET, dc to 900 MHz **$1,395**
P6230 – Bias/Offset, dc to 1.5 GHz **$525**

*1 *Contact your local sales represenatative.*