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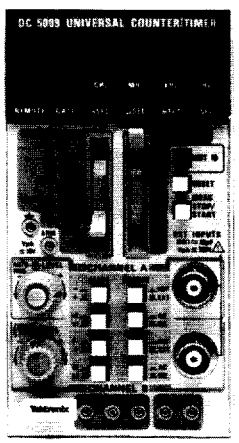
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DC 5009/DC 509
Universal Counter/Timers

- *135 MHz Both A and B Channels*
- *10 ns Single-Shot Resolution*
- *8-Digit Display*
- *5 ps Resolution, with Averaging*
- *Reciprocal-Frequency Measurement; Period; Width; Time A – B; Events B During A; Totalize; Ratio; Time Manual; Arming*
- *Auto or Selected Averaging to 10^8 in All Modes*
- *Duty – Cycle Independent Autotrigger*
- *Shaped A and B Channel Outputs*
- *Probe Compensation*
- *High Stability Oven Time Base*



GPIB* IEEE-488

**The DC 5009 complies with IEEE Standard 488.1-1987 and with Tektronix Standard Codes and Formats.*

DC 5009/DC 509

The DC 5009/DC 509 single-width Universal Counter/Timers provide all of the measurement functions of the higher performance DC 5010/DC 510 except rise time/fall time, null, and totalize A ± B.

The powerful reciprocal-frequency measurement technique allows up to eight digits of resolution of low-frequency signals in one second or less of measurement time. The DC 5009/DC 509 has the same automatic averaging feature as the DC 5010/DC 510; selected averaging of up to 10^8 events provides usable time-interval resolution of 5 ps.

The TM 5000 rear-interfacing capability allows the DP 501 to be controlled over the GPIB through the DC 5009. The DP 501 extends frequency measurements to 1.3 GHz.

CHARACTERISTICS

CHANNEL A AND B INPUT

Frequency Range – > 0 to ≥135 MHz dc coupled; ≤10 Hz to ≥135 MHz ac coupled.

Sensitivity – ≤ 20 mV RMS (56.6 mV p-p) to ≥100 MHz, 40 mV RMS (113 mV p-p) from 100 MHz to ≥135 MHz, 115 mV p-p at minimum, pulse width of 3 ns.

Attenuation – Selectable 1X, 5X.

Impedance – 1 MΩ ± 2% paralleled by ≤ 30 pF.

Trigger Level Range – +3.200 to –3.175 V with 25 mV resolution (X1), +16 to -15.875 V with 125 mV resolution (x5).

Trigger Level Accuracy – ±15 mV ± 40 μV/°C referenced to 25°C.

Dynamic Range – 3.2 ≤ input voltage ≤ +3.2. X1: Vin p-p ≤ 3 V; X5: V p-p 15 Vin (for input signal risetime p-p ≤ 3 V; X5: V p-p 15 Vin (for input signal risetimes ≤ 5 ns).

Autotrigger Frequency Range – *Sensitivity* ≤ 125 mV p-p x attenuation; ≤ 20 Hz to ≥100 MHz. Range: ±3.2 V x attenuation. Resolution: 25 mV x attenuation.

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

Maximum Input Voltage – 1X: ≤ 200 V peak; ≤ 400 V p-p from dc to 50 kHz, ≤15 V p-p at 135 MHz. 5X: ≤ 200 V peak; ≤ 400 V p-p from dc to 5 MHz, ≤ 25 V p-p at 135 MHz.

Shaped Out – Shaped replica of signal being measured, aids proper triggering on complex waveforms. Amplitude 0 V to ≥ +0.3 V from 50 Ω.

Trigger Level Out – A dc level corresponding to the actual trigger level. Accuracy within ±10 mV of internal trigger level.

Arming Input – Permits measurements of complex waveforms. A TTL high allows averaging of selected events within a measurement.

FREQUENCY A

Range – ≤100 μHz to ≥135 MHz.

Resolution –

$$\pm LSD \pm 1.4 \times \frac{\text{A Trigger Jitter Error}}{N} \times (\text{Frequency A})^2$$

Accuracy – Resolution ± (Time Base Error x Frequency A).

PERIOD A

Range – ≤ 7.40 ns to ≥ 3.05 hrs.

Resolution –

$$\pm LSD \pm 1.4 \times \frac{\text{A Trigger Jitter Error}}{N}$$

Accuracy – Resolution ± (Time Base Error x Period A).

RATIO B/A

Range – 10^{-7} to 10^8 (Frequency Range: CH A to ≥135 MHz; CH B to ≥125 MHz).

Resolution –

$$\pm LSD \pm 1.4 \times \text{B Trigger Jitter Error} \left(\frac{\text{Frequency B}}{N}\right)$$

Accuracy – Same as Resolution.

TIME A – B

Range – ≤15 ns to ≥ 3.05 hrs.

Minimum Dead Time – 15 ns (stop to start).

Resolution –

$$\pm LSD + \frac{1}{\sqrt{N}} \begin{pmatrix} \pm \text{A Trigger Jitter Error} \\ \pm \text{B Trigger Jitter Error} \end{pmatrix}$$

Accuracy – Resolution ± (Time Base Error xTime A-B) + (B Trigger Slew Error-A Trigger Slew Error) ± (Channel Delay Mismatch).

Channel Delay Mismatch – < 2 ns between front panel inputs and < 2 ns between rear interface inputs.

Repetition Rate – < 35 MHz.

EVENTS B DURING A

Range – 10^{-7} to 10^8.

Maximum B Frequency – 125 MHz.

Minimum A Pulse Width – 15 ns.

Minimum Time Between A Pulses – 15 ns.

Minimum Time Between "A" Start Edge and First "B" Event – 15 ns.

Resolution –

$$\pm LSD + \frac{\text{Freq. B}}{\sqrt{N}} \begin{pmatrix} \pm \text{Trig. Jit. Error CH A start edge} \\ \pm \text{Trig. Jit. Error CH A stop edge} \end{pmatrix}$$

Accuracy – Resolution + Frequency B (Stop Slew Rate Error – Start Slew Rate Error).

WIDTH A

Range – ≤15 ns to ≥ 3.05 hrs.

Minimum Dead Time Between Pulses – 15 ns.

Resolution –

$$\pm LSD + \frac{1}{\sqrt{N}} \begin{pmatrix} \pm \text{Start Trigger Jitter Error} \\ \pm \text{Stop Trigger Jitter Error} \end{pmatrix}$$

Accuracy – Resolution ± (Time Base Error x Width A) + (Stop Slew Rate Error-Start Slew Rate Error) ± 5 ns.

TIME MANUAL
Range – 0 to 3.05 hrs. May be extended with GPIB.
Resolution – ±LSD (100 ms).
Accuracy – ±Resolution ±(Time Base Error x Time).

TOTALIZE A
Range – 0 to 1.09 x 1012 counts. Extended with GPIB.
Repetition Rate – > 0 to ≥135 MHz.

RESOLUTION AND ACCURACY: DEFINITIONS
For Trigger Jitter Error and Slew Rate Error definitions, see DC 503A.

N=Number of Events Averaged.

The minimum number of averages is selected by the averages control in decade steps from 1 to 10^8. At channel A repetition rates above ≈250 Hz, the number of events averaged will be:

N=[Frequency A (Hz) x 4 ms] + Averages.

N=Averages setting (below 250 Hz).

In the Auto mode, the counter measures with a fixed measurement time of about 300 ms.

N=Frequency A (Hz) x 0.3 s. (N is always ≥1).

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

STANDARD HIGH STABILITY TIME BASE
Crystal Frequency – 10 MHz.
Temperature Stability – $\pm 2 \times 10^{-7}$ 0 to + 50°C after warm-up.
Warm-up Time – $+2 \times 10^{-7}$ of final frequency in 10 minutes when cold started at 25°C.
Aging Rate – $\leq 1 \times 10^{-8}$/day at time of shipment, 4×10^{8}/week after 30 days of continuous operation, 1×10^{-6}/year after 60 days of continuous operation.
Setability – Adjustable to within $\pm 2 \times 10^{-8}$.

REAR INTERFACE
Inputs – Channel A and Channel B input to 50 MHz (50 Ω impedance, maximum input 3.6 V peak); arming; reset; external time base (1,5, or 10 MHz), prescale.
Outputs – Channel A and Channel B shaped outputs; Channel A and Channel B trigger level outputs; 10 MHz clock; gate out.

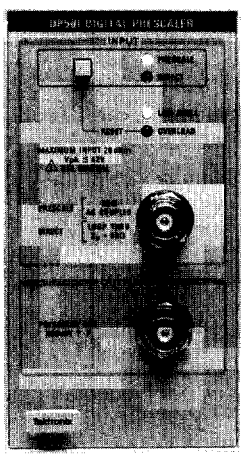
OTHER CHARACTERISTICS
Power Consumption – 15 W.
GPIB Data Output Rate – ≈10 readings/s maximum (DC 5009 only).

ORDERING INFORMATION

DC 5009 Programmable Universal Counter/Timer **$2,250**
Includes: Tip jack to BNC adapter cable (175-3765-01); instrument interfacing guide (070-4612-00); reference guide (070-3560-01); instruction manual (070-3888-00).
DC 509 Universal Counter/Timer **$2,450**
Includes: Instruction Manual (070-3464-00).

CONVERSION KIT (DC 509)
IEEE Standard 488 Capability –
Order 040-0957-05 **$450**

OPTIONAL ACCESSORIES
See page 221.



DP 501

The DP 501 Digital Prescaler adds 1.3 GHz frequency-counting capability to most counters, though it was designed specifically for use with the DC 503A, DC 509/DC 5009, and the DC 5010/DC 510 Universal Counter/Timers.

The DP 501 is placed in the signal line between the source and the counter's signal input and can be operated in either the Direct or the Prescale mode. The ÷16 prescaling function can be activated manually, with a front panel pushbutton, or via the GPIB when used with the DC 5009 or DC 5010.

Input sensitivity in the Prescale mode is 20-mV RMS to 1 GHz and 30-mV RMS to 1.3 GHz. A Low-Level indicator alerts the user if the input signal amplitude is too low for error-free counting. An automatic gain-control circuit provides optimum immunity to signal noise in the Prescale mode.

CHARACTERISTICS

PRESCALE MODE INPUT
Frequency Range – ≤ 100 MHz to ≥ 1.3 GHz.
Sensitivity – 100 MHz to 1 GHz is ≤ 20 mV RMS (–21 dBm). 1 to 1.3 GHz is ≤ 30 mV RMS (–17 dBm).
Impedance – 50 Ω, ac coupled; vswr ≤ 2.2:1.
Output – Amplitude into 50 Ω is ≤ 200 mV, p-p. Unterminated is 2X terminated value.

DIRECT MODE INPUT
(Connected directly to output.)
Frequency Range – 0 to > 350 MHz.
Impedance – Loop through characteristic impedance is 50 Ω; nonterminated capacitance ≈20 pF (no connection to output).
Output – Connected directly to input. < 1 dB insertion loss up to 350 MHz. Powers up in direct mode.

GENERAL
Overload Protection – Prescale: Input disconnects when input signal exceeds + 20 dBm ±5 dBm.
Damage Level – Prescale: Input may be damaged if signal level exceeds + 25 dBm. Direct: 42 V peak maximum. Maximum current is 250 mA.
Input Attenuation – Automatic: Up to 40 dB range.
Low Level Indicator – Lights when input signal is below that required for error-free counting.

DP 501
Digital Prescaler

- *Extends Counter Frequency – Measurement Capability to 1.3 GHz*
- *Compatible with Most TM 500 and TM 5000 Counters*
- *AGC*
- *Low-Level Indicator*
- *GPIB Programmability with DC 5009 and DC 5010*

ORDERING INFORMATION

DP 501 Digital Prescaler **$995**
Includes: Instruction manual (070-4332-00).

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