

SECTION 1

GENERAL INFORMATION & SPECIFICATIONS

1-1. DESCRIPTION

1-2. The EIP Model 451 Microwave Pulse Counter automatically and directly measures the frequency of pulse modulated microwave signals between 300 MHz - 18 GHz. Pulse widths can be as narrow as 100 nanoseconds, with no minimum or maximum pulse repetition frequency limits.

1-3. The 451 also measures the frequency of CW microwave signals, and carrier signals with FM modulation up to 40 MHz peak-to-peak deviation at 10 MHz modulation rates. No manual switching is required to measure CW or pulsed frequencies — the counter will automatically measure either type of signal. Sensitivity is -10 dBm to 10 GHz; -5 dBm to 18 GHz. A built-in limiter provides overload protection of up to 1 watt peak from 925 MHz - 18 GHz.

1-4. All front panel controls except SAMPLE RATE are externally programmable. One input to the counter (Band B) accepts signals over the range of 925 MHz - 18 GHz. Option P2 provides a second input (Band A) to cover the range of 300 MHz - 950 MHz.

1-5. The display on the 451 Counter provides a direct readout of the measured frequency over the entire operating range of the counter with 10 kHz resolution. The counter also includes automatic suppression of leading zeros, except during a no signal input condition.

1-6. The frequency readout of the 451 is displayed in a fixed position format that is conveniently sectionalized in GHz and MHz. Gate times are 100 μ s and 1 ms.

1-7. For applications where less resolution is required, pushbutton display blanking (RESOLUTION) is provided to simplify the readout.

1-8. To assure trouble-free performance, the 451 Pulse Counter is completely solid-state. For ease of repair and maintenance, the major portion of the counter circuitry is contained on plug-in printed circuit boards or in easily removed modules. Special test points allow monitoring of critical circuit functions.

1-9. INSTRUMENT IDENTIFICATION

1-10. The 451 Pulse Counter is identified by two number sets: the Model and Configuration Control Number (e.g: 451-CCN1001), and a specific Serial Number (e.g: 12345). Both sets of numbers should be mentioned in any correspondence or parts orders relating to the counter.

1-11. SPECIFICATIONS

1-12. Model 451 Microwave Pulse Counter specifications are given in Table 1-1.

GENERAL SPECIFICATIONS	
Frequency Range: Band A: Band B:	300 MHz to 950 MHz (Option P2) 925 MHz to 18 GHz
Pulse Characteristics: Pulse width: Pulse repetition freq.:	100 nsec min. (measured at 3 dB points) Minimum-50 Hz normal, 0 Hz rear panel selected, Maximum - No limit
Accuracy: CW or pulses > 100 μ sec: Pulse < 100 μ sec:	Time base accuracy ± 1 count Time base accuracy \pm averaging error \pm gate error
Averaging error (kHz rms):	Band A 200 $\sqrt{PW \cdot 0.03}$ Band B 100 $\sqrt{PW \cdot 0.03}$
100 μ s Gate:	
1 ms Gate:	60 $\sqrt{PW \cdot 0.03}$ 30 $\sqrt{PW \cdot 0.03}$
Gate error (max.):	$\pm \frac{40 \text{ kHz}}{PW \cdot 0.03}$ PW = pulse width in μ s.
Time Base:	Standard Option P1
Oscillator Type:	Room Temperature Crystal Temperature Compensated Crystal (TCXO)
Crystal frequency:	10 MHz
Stability: Aging rate:	$< 3 \times 10^{-7} $ / mon.
Temperature: (0-50 C)	$< 3 \times 10^{-5} $ $< 2 \times 10^{-6} $
Line voltage:	$\pm 10\%$ change produces frequency shift $< 1 \times 10^{-7} $
Warm up time:	None required

Sensitivity: Band A (Opt. P2): Band B:	300 to 950 MHz -10 dBm peak 925 MHz to 10 GHz -10 dBm peak 10 GHz to 18 GHz -5 dBm peak
FM Tolerance Band B (minimum):	CW: 40 MHz p-p deviation for mod. rates DC-10 MHz. PULSE (w/o Input Inhibit): 20 MHz max. freq. shift across pulse. FREQUENCY PROFILE (using Input Inhibit): 20 MHz max. freq. shift during input inhibit pulse.
Maximum Input Level (peak): Band A: 300 to 950 MHz (Opt. P2) Band B: 925 MHz to 18 GHz	Operating Burnout Level +10 dBm +27 dBm +10 dBm +30 dBm
Input Impedance: Connector:	Band A (Opt. P2) Band B 50 Ω nom. 50 Ω nom. BNC Type N precision
Measurement Speed (Band B Only): Acquisition Time: PRF > 100 Hz: PRF < 100 Hz:	100 msec + 50 msec/GHz 100 msec + $\frac{5}{PRF}$ sec/GHz
Reading Time Band B (sec): 100 μ s Gate: 1 ms Gate:	Band A Band B 400 100 $\frac{(PW)(PRF)}{4000}$ $\frac{(PW)(PRF)}{1000}$ $\frac{(PW)(PRF)}{4000}$ $\frac{(PW)(PRF)}{1000}$ PW = pulse width (μ sec) PRF = pulse repetition frequency (Hz)
Display:	7 digit LED with fixed decimal point. Leading zero suppression.
Resolution:	10 kHz, 100 kHz, 1 MHz
Power:	100/120/220/240 VAC $\pm 10\%$, 50-60 Hz, 100 watts nominal.

GENERAL SPECS. CONT'D.	
Operating Temperature:	0 to 50°C
Weight:	Net 25 lbs. Shipping 30 lbs.
Dimensions:	3.5" high and 16.75" wide and 19" deep
Accessories Furnished:	8 foot power cord and instruction manual
Accessories Available:	Model 400 Delay Generator. Carrying Case. P/N 5700001 Rack Mtg. Kit. P/N 2010008

TABLE 1-1. SPECIFICATIONS - 451 MICROWAVE PULSE COUNTER

FRONT PANEL:	
Controls:	
Sample Rate/Hold:	Varies display reading time from 0.1 sec/reading to 10 sec/reading. "Hold" displays last reading.
Test-200 MHz:	Displays 200 MHz internal test frequency.
Display Test:	Tests all LED numeral segments.
Resolution:	(1 MHz, 100 kHz, 10 kHz): Sets display resolution.
1 ms Gate:	Selects 1 ms gate.
Band Select (A or B):	Switch selects either Band A (Opt. P2) or Band B input.
Auto/Manual (Band B):	
Auto Mode:	Band B searches upward for input signal beginning 100 MHz above preset number.
Manual Mode:	Inhibits search. Signal must lie between 100 MHz and 325 MHz above preset number.
Thumbwheel Switch (Band B):	
Auto Mode:	Sets start point of frequency sweep (100 MHz above preset number.)
Manual Mode:	Sets operating frequency range (100 MHz to 325 MHz above preset number.)
Indicators:	
Level:	Indicates sufficient input level.
Lock:	Indicates signal acquired.
Gate:	Indicates measurement in process.
Remote:	Indicates Remote Programming (Option P4) active.
Reduce Signal (Band B):	Indicates excess signal level.
Connectors:	
Band A input:	Type BNC female - 300 to 950 MHz (Option P2)
Band B input:	Type N precision female - 925 MHz to 18 GHz

REAR PANEL:	
Controls:	
Power input:	Power module containing AC connector, fuse, and voltage control for 100, 120, 220, or 240 VAC.
Storage (On/Off):	Normally on. In off position, display updates continuously during measurement cycle.
Min. PRF = (50 Hz/0):	Normally in 50 Hz position. In 0 position, allows measurements of very low PRF signal.
Connectors:	
10 MHz reference output:	1 V peak-to-peak min. into 50 Ω
Gate Output:	-0.5v min. into 50 Ω corresponding to counter gate.
Signal Threshold Output:	-0.5v min. into 50 Ω corresponding to signal exceeding threshold.
Inhibit Input:	ECL high (-0.9v) inhibits. ECL low (-1.7v) enables. From 50 Ω source, 0 volts will inhibit, -1v will enable. Input impedance: 50 Ω to -2 volts.

MODEL / OPTIONS:	
Model 451	Microwave Pulse Counter
P1:	TCXO - temperature compensated crystal oscillator
P2:	Band A: 300 - 950 MHz
P3:	Rear panel inputs: Band A and B
P4:	BCD output/remote programming Remote programming: provides rear panel programming of all front panel controls except SAMPLE RATE. Requires ground contact closure; one control line per function (T ² L and DTL compatible). Digital output: 7 data digits in parallel form. 1-2-4-8 "1" state positive.
P5	GPiB: System interface per IEEE STD 488-1975.

TABLE 1-1 (Continued). SPECIFICATIONS - 451 MICROWAVE PULSE COUNTER