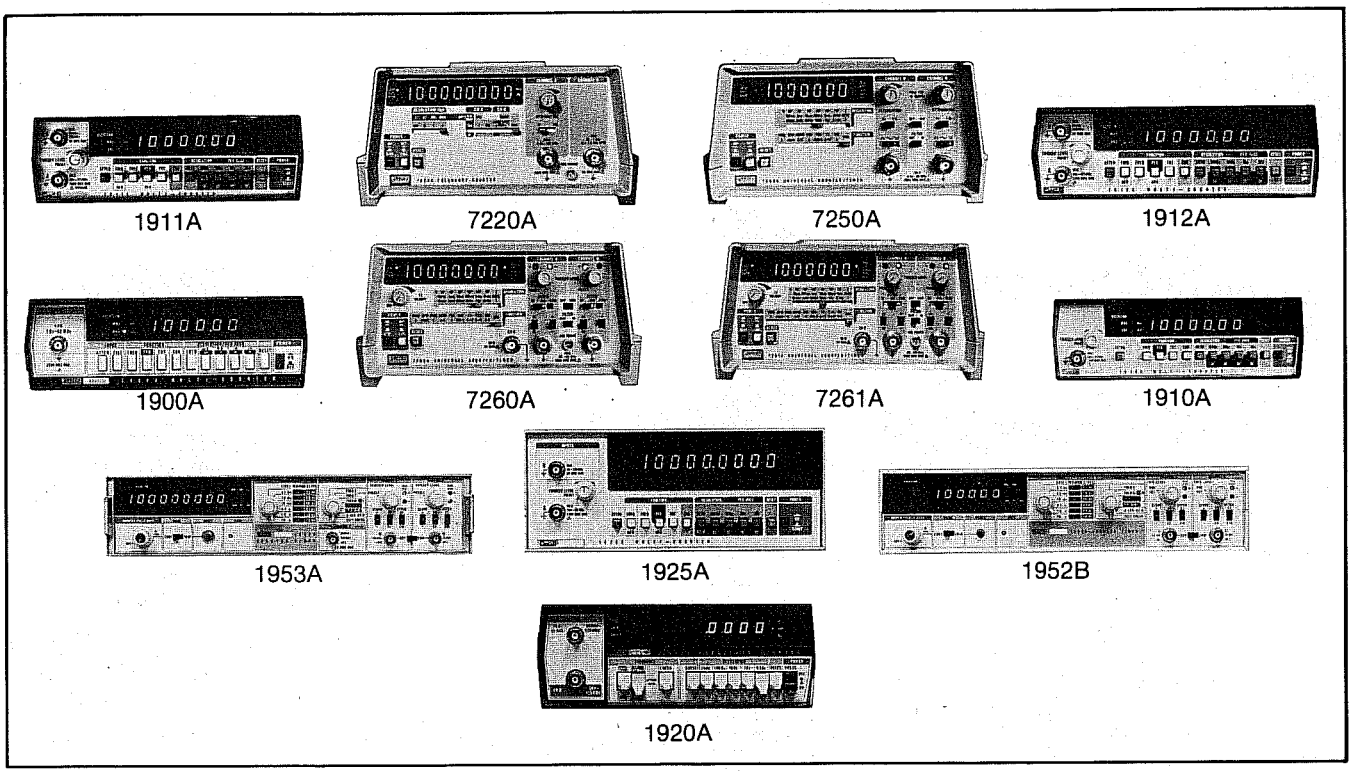
COUNTERS
Introduction

The Fluke Family of Counters



The Fluke line of electronic counters provides time and frequency measurement capability in the range of dc to 1300 MHz. Designed to meet and exceed the stringent accuracy and stability demands placed on today's digital measurement equipment, Fluke counters are reliable, cost-effective, and competitive. Included are counters designed for laboratory, field, systems, and bench use.

Frequency Measurements

The frequency of a signal is measured by determining the number of events or cycles over a known time interval. All Fluke frequency counters determine frequency by totalizing the number of events or cycles that occur during a precisely known time interval. The counter's highly accurate and stable timebase, often referred to as the clock, provides the time reference needed to set the precise measurement interval or gate time.

Period Measurements

The period of a signal is measured by determining the time required for a single cycle of the signal to occur. Fluke counters determine the period by totalizing the number of cycles of a known clock (timebase) that occur during the single-cycle period of the input signal. Period *averaging* occurs by totalizing the number of clock cycles that occur during a specific number (N) of signal cycles (e.g., 10, 100, etc.) then dividing the total by N.

Period measurements may be used to determine low frequencies more quickly and accurately than can frequency measurements. This is true because the long period of a low frequency wave allows a large number of counts to accumulate. This greatly improves resolution and accuracy on low frequency measurements, but requires a calculation because frequency is the reciprocal of period.

Time Interval Measurements

Sometimes referred to as the start-stop mode, this function provides a time interval measurement between two events on separate signals or between two separate points on one waveform.

In time interval measurements, the main gate is controlled by two independent inputs: the start input (A) and the stop input (B). When one external signal is applied to input A, the main gate is opened and clock pulses from the timebase are accumulated. When the stop signal is applied, the main gate closes and the accumulated count shows the time between the start and stop signals. The resolution of the measurement depends on the timebase frequency. A 10 MHz clock provides 100 ns resolution.

Ratio Measurements

When ratio measurements are made, two input signals are connected to the counter. One signal is fed into the A input. The other signal is fed into the B input and controls the main gate. Normally, the higher of the two frequencies to be ratioed is fed into the A input. To achieve high resolution, averaging techniques similar to period averaging are employed.

The ratio measurement is useful in production testing to compare two frequencies. Other applications include measuring gear ratios and testing frequency dividers or multipliers.

Totalizing Measurements

In totalize mode, the timebase is not used. The main gate is left in the open position and the input signal is simply fed into the counter for a period determined by the user. In some instances, the gate can be controlled remotely for semi-automated totalizing measurements. The counter will display the number of pulses received during the interval between opening and closing the gate.

Resolution Multiplication

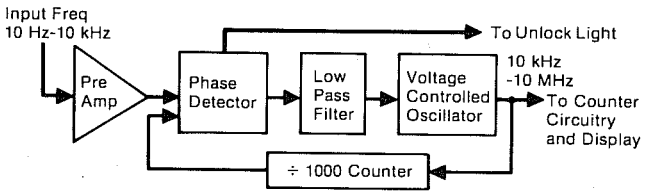
Conventional measurement of low frequency signals of less than 10 kHz typically does not provide the desired degree of resolution, so other methods of improving the low frequency resolution have been adopted. An example is period mode, which is the reciprocal of frequency. However, if frequency is the required parameter, then some calculation is inevitable when the period of the input is measured. Some manufacturers have incorporated reciprocal arithmetic circuitry where period is really measured but is converted to frequency for the display. Obviously, in using the reciprocal method the resolution varies inversely with the frequency, with the lowest frequency providing the best resolution.

In the Fluke 1920A Frequency Counter a resolution multiplier option is available which provides each range with a constant 1000 times increase in resolution without any increase in measurement time. The technique for high resolution measurement of low frequency signals (10 Hz to 10 kHz) is achieved through an electronic phase locked servo-loop, voltage-controlled oscillator, and a divide-by-1000 counter (refer to diagram).

The frequency and phase are compared with the divided-down frequency of the voltage controlled oscillator (VCO) and a resultant filtered correction voltage is fed to the VCO to change its frequency to match the input frequency. If the phase of the input signal changes, the phase detector output voltage increases or decreases just enough to change the divided-down frequency to again match the incoming frequency.

By routing the direct VCO output to the decimal counting and display circuitry a thousand times increase in measured resolution is achieved. Thus, a 1 Hz resolution range (ls gate time) is improved to 0.001 Hz for the same measurement time.

Resolution Multiplier Used in Fluke 1920A Frequency Counter



Counter Selection Guide

CHARACTERISTICS	7250A	7260A	7261A	7220A	1900A	1910A	1911A	1912A	1920A	1925A	1952B	1953A
Measurement												
Channel A Frequency (MHz)	80	125	125	1300	80	125	250	520	520	125	80	125
Optional Channel (C)	—	1300*	1300*	—	—	—	—	—	1250*†	520	—	1250*†
Frequency Ratio A/B	●	●	●	—	—	**	**	**	**	**	●	●
Period and T.I. Resolution	100 ns	100 ns	10 ns	—	100 ns	100 ns	100 ns	100 ns	—	100 ns	100 ns	100 ns
Period Average Resolution	1 ps	1 ps	0.1 ps	—	100 ps	100 ps	100 ps	100 ps	—	100 ps	100 ps	1 ps
Time-Interval-Average Res.	—	316 ps	31.6 ps	—	—	—	—	—	—	—	—	—
Modulated Timebase Option	—	—	●	—	—	—	—	—	—	—	—	—
Counts per Minute	●	●	●	—	—	—	—	—	—	—	—	—
Totalize A,	●	●	●	—	●	●	●	●	—	●	●	●
Triggering												
AC or DC Coupling	AC	Both	Both	AC	AC	AC	AC	AC	AC	AC	Both	Both
+ or - Slope	●	●	●	—	—	—	—	—	—	—	—	—
50 MHZ Sensitivity (rms)	10 mV	10 mV	10 mV	10 mV	25 mV	15 mV	15 mV	15 mV	15 mv	15 mV	50 mV	30 mV
Noise Filter	●	●	●	●	●	—	—	—	—	—	●	●
10x, 100x Attenuation	(1)	Both	Both	(1)	10x	10x	10x	10x	—	10x	10x	10x
Trigger Level Control	(2)	●	●	—	—	●	●	●	—	●	●	●
Trigger Level Lights	—	●	●	—	—	—	—	—	—	—	●	●
Trigger Level Output	—	●	●	—	—	—	—	—	—	—	—	—
Marker Output	—	●	●	—	—	—	—	—	—	—	●	●
Time Interval Holdoff	—	●	●	—	—	—	—	—	—	—	—	—
Timebase												
TCXO Option	●	●	●	●	—	●	●	●	Std.	Std.	●	Std.
Oven Options	Two	Two	Two	Two	—	—	—	—	—	One	—	Two
External Input	●	●	●	●	—	●	●	●	●	●	●	●
Internal Output	—	●	●	●	—	—	—	—	—	—	—	●
Miscellaneous												
Number of Digits	7	8	8	9	6	7	7	7	9	9	7 or 8	9
Autoranging or Manual	●	●	●	●	●	●	●	●	—	●	—	—
Battery Option	●	●	●	●	●	●	●	●	●	—	—	—
Data Output Option	●	●	●	●	●	●	●	●	●	Std.	—	●
IEEE-488 Option	(3)	(3)	(3)	(3)	—	—	—	—	—	—	—	●
RFI Shielding (MIL-STD-462)	●	●	●	●	—	—	—	—	—	●	—	—
USA Basic Price	$675	$850	$995	$995	$365	$395	$495	$620	$1095	$880	$1195	$1295

**Also 520 MHz option available.*
(1) 1x to 10x variable plus 10x switch.
(2) Three switch-selectable levels.
(3) Via Fluke 1120A IEEE-488 Translator.
*** Using external timebase input.*
† Also 1000 MHz option.

Options

Battery Pack (-010)
Type: Nickel-Cadmium, size F
Operating Time: 3.5 hours continuous, decreasing to 3 hours, typical worst case with Option -131 or -132 ovenized oscillators installed.
Charge Time: 16 hours at room temperature
Charge Protection: Thermistor-actuated shutdown of charging circuit if battery temperature exceeds 65°C.
Discharge Protection: Automatic low-voltage shutdown to prevent over discharge

Data Ouput (-521)
Type: Serial BCD output of all 7 digits and measurement units
Levels: TTL, "1" state low

IEEE-488 Interface (-529)
Description: Interfaces the 7250A to IEEE-488 via the Fluke 1120A IEEE-488 Translator. (Note: 1120A must be purchased separately.) Provides full measurement output capability, and limited triggering and reset of a measurement.
Repertoire: SH1, AH1, TE0, L4, LE0, SR1, RL2, PP0, DC1, DT1, C0

Model

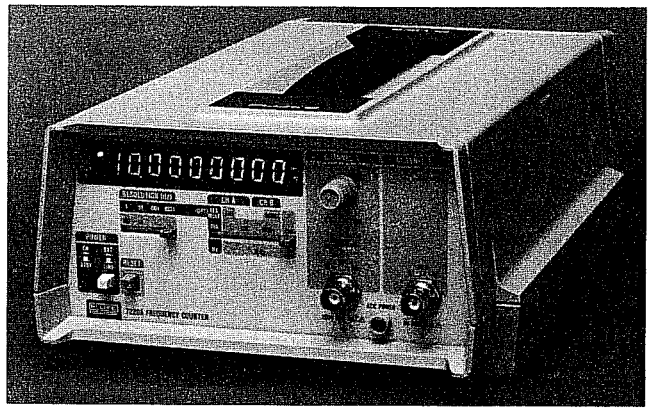
7250A Universal Counter/Timer $675

Options

72XXA-010 Battery Pack, NiCad Rechargeable 275
72XXA-112 TCXO, 2 ppm 200
72XXA-131 Low Power Oven 275
72XXA-132 Superior Low Power Oven 395
72XXA-521 Counter Digital Interface 150
72XXA-522K Personality Card 195
72XXA-529 IEEE-488 Interface 295
**Includes parts needed to interface the 7250A to IEEE-488. Parts can only be used in conjunction with Fluke 1120A IEEE-488 Translator. Includes Counter Digital Interface Unit, Y7203 2 ft. ribbon cable, and personality card for 1120A.*

Accessories

Y7201 Attenuator/Filter 50
Y2014 5¼" Rack Adapter, Single 35
Y2015 5½" Rack Adapter, Double 45
Y7203 2 ft. Ribbon Cable 45
Y7204 5 ft. Ribbon Cable 60
1120A IEEE-488 Translator 325



7220A

The 7220A is a 9-digit frequency counter with 1300 MHz performance at 500 MHz prices. It is very similar to the 7261A counter equipped with a 50Ω input for 100 MHz and higher frequencies. It does not make period, time, ratio, or totalize measurements, but does have a burst mode. The available options have the same characteristics as for the 7261A.

Abridged Specifications

Channel A
Range: 10 Hz to 125 MHz, ac coupled
Sensitivity: 10 mV rms, 10 Hz to 50 MHz, 15 mV rms from 50 MHz to 100 MHz, 35 mV from 100 MHz - 125 MHz
Attenuation: X1 or X10
Channel B
Range: 100 MHz to 1300 MHz
Sensitivity: 5 mV rms from 100 MHz to 500 MHz, 10 mV from 500 MHz to 1000 MHz, 20 mV from 1000 MHz to 1300 MHz
Maximum Input: 5V rms
VSWR: 2.5:1

Model

7220A Frequency Counter $995

Options

7220A-111 1 ppm TCXO
7220A-351 1000-Times Resolution Multiplier
All other options the same as for 7260A.
Availability information early 1980.