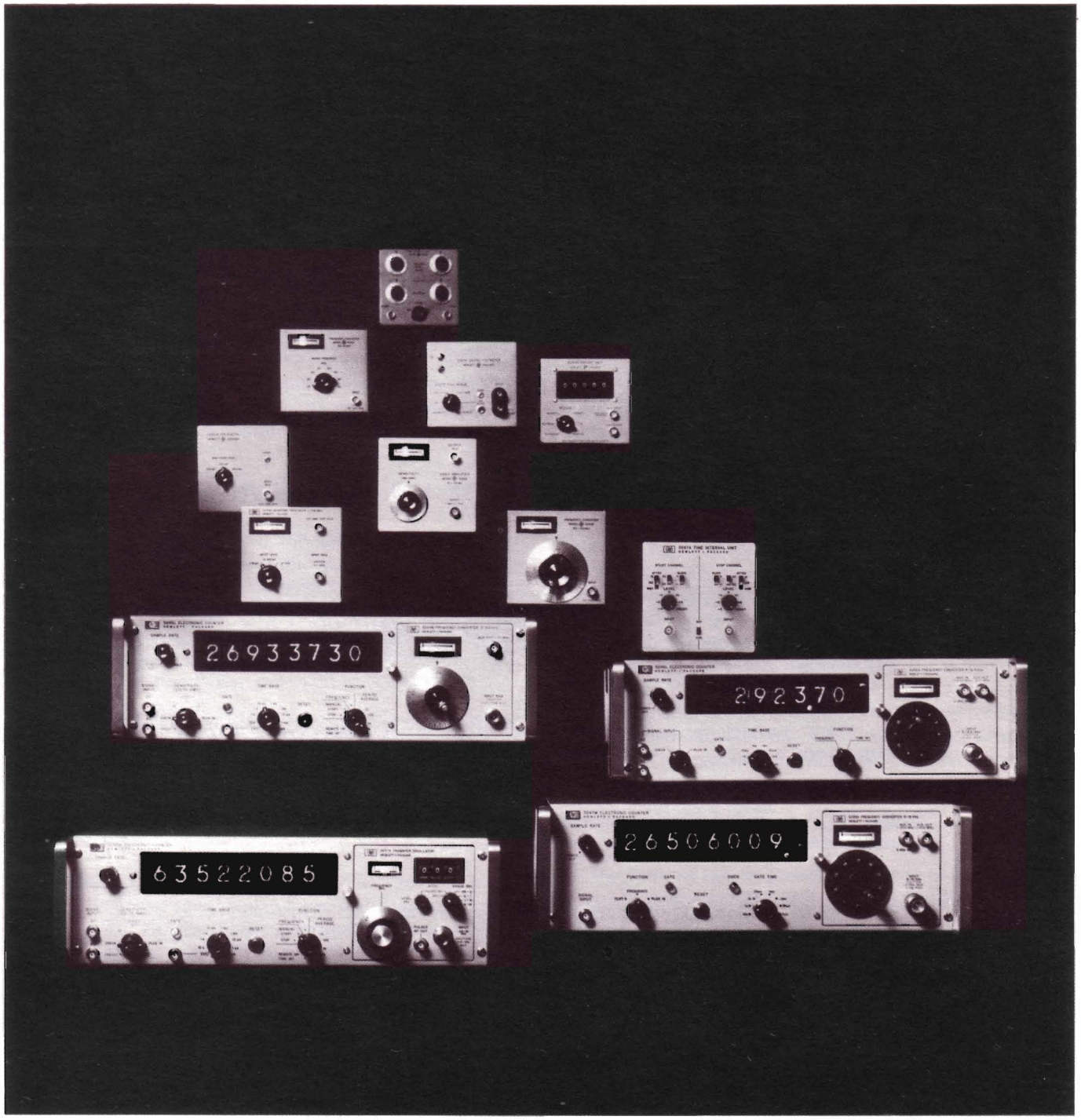
HEWLETT hp PACKARD

ELECTRONIC COUNTERS

5245L/M 5248L/M
5246L 5247M
M54-5245L/M
M54-5248L/M
and plug-ins

TECHNICAL DATA 15 JUN 69

General Purpose Counters With Unmatched Versatility . . .



General Purpose Counters With Unmatched Versatility...

WIDE SELECTION OF FRONT PANEL PLUG-INS:

50 MHz-18 GHz Transfer Oscillator has new operating principle, new versatility and convenience, highest performance.

Spurious-free heterodyne converters to 18 GHz . . . cover dc to 12.4 GHz with only two converters.

Prescalers cover dc to 350 MHz . . . 1 mV sensitivity to 200 MHz.

Time interval measurements from 10 ns to 10^8 s.

Video amplifier for 5 mV sensitivity.

Preset plug-in for units conversion, go/no-go limit control, or timing "N" events.

WIDE SELECTION OF ADD-ON HP ACCESSORIES:

Frequency Divider for automatic measurement from 0.3 to 12.4 GHz.

Digital recorders with flexible coding and formatting.

Digital-to-analog converters.

Low cost transfer oscillator.

VLF receiver to calibrate counter to U.S. National Bureau of Standards, station WWVB (60 kHz).

Choice of time bases—standard $<3 \times 10^{-9}$/day aging rate or ultra-stable $<5 \times 10^{-10}$/day unit with rapid warm-up, $<5 \times 10^{-11}$ short term stability (1 s average), and excellent output buffering.

Dual FET input amplifier gives high and constant input impedance.

Reliability under environmental extremes proven by extensive laboratory and field tests.

Spare parts and experienced service personnel at domestic and overseas HP centers, many military service centers and industrial organizations.

INTRODUCTION

From this series of accurate and versatile counters, an instrument can be selected for virtually any counting task performable by general purpose electronic counters. The most versatile models in this series measure frequency, period, multiple period average, ratio, multiples of ratio, and can be used to scale (divide) an input frequency by decades. Plug-ins, which go directly into the front panel, presently include frequency converters for measuring CW frequencies up to 18 GHz with 1 Hz resolution, prescalers beyond 350 MHz, a versatile unit for preset counting and normalizing data to engineering units, a time interval plug-in, video amplifier, and a digital voltmeter. A transfer oscillator for measuring CW or pulsed frequencies from 50 MHz to 18 GHz and a time interval plug-in with 10 ns resolution are the most recent additions to this extensive series of accessories (pages 16 and 20). The frequency converter and transfer oscillator plug-ins also operate in the new HP 5360A Computing Counter.

After extensive shock, vibration, temperature, and humidity tests, models in this versatile series have been selected for use in military environments, although they're not designed primarily as military instruments. The additional reliability margin and very wide operating temperature range provide benefits to all users at no increase in cost. If your requirements call for operation under environmental extremes or to military environmental or reliability specifications, please consult HP for further details. Many subassemblies and parts are interchangeable between all models, simplifying spare parts stocking.

BRIEF DESCRIPTION

Models 5245M (50 MHz) and 5248M (135 MHz) (page 7). Provide maximum versatility, accuracy, and convenience in a general purpose counter. Ultra-stable, fast warm-up time base extends the time between calibrations, serves as a secondary frequency standard with high stability (short-term, long-term, line, load and temperature) and high spectral purity.

Models 5245L and 5248M (page 7). Similar to 5245M and 5248M except that time base aging rate is less than 3 parts in 10^9/24 hours, compared to the 5 x 10^{-10}/24 hours for the "M" versions. This low aging rate still qualifies the 5245L and 5248M as precision frequency standards.

Model 5246L (50 MHz) (page 13). Provides same counting range and many other 5245L benefits at lowest cost. Can use all the plug-in accessories. Versatility and accuracy, which are lower than 5245L, can be increased by adding optional features.

Model 5247M (page 14). This instrument should receive consideration where the application requires: wide basic measuring range (10 Hz to 135 MHz without plug-ins); measurement of frequency only; maximum accuracy (ultra-stable fast warm-up time base as in 5245M and 5248M); minimum manual operations (accepts inputs from 100 mV to 10 V with no level control or input attenuator to adjust). It accepts all the HP frequency extending plug-ins (prescalers, converters, transfer oscillator) up to 18 GHz.

M54 versions (page 12). Meet many additional military specifications; otherwise equivalent to 5245L/M and 5248L/M.

5244L (not covered here, request separate data sheet). Provides many of the 5245L benefits at lower cost but will not accept front panel plug-in accessories. Input circuit characteristics are not as favorable as other models. Has some features not in 5246L.

GENERAL INFORMATION

MEASURING FUNCTIONS

Consult the comparison chart (page 6) to determine the functions of any specific model.

Frequency

All models will measure the average frequency of ac voltages on their ac coupled input connector. Models having dc coupling will measure both pulses and ac voltages, periodic or random, having frequencies from dc all the way up to their maximum count rate of 50 or 135 MHz. Gate times are selected with a front panel switch. The longer gate times increase the accuracy of low frequency measurements.

Period

Lower frequencies can generally be measured more accurately by measuring their period rather than frequency. The multiple period average function, which averages up to 10^5 periods of the input waveform, further increases accuracy by increasing the resolution and reducing the trigger error in proportion to the number of periods averaged. That is, if trigger error is the typical 0.3% of one period (for a minimum sensitivity 100 mV sine wave input signal with 40 dB signal-to-noise ratio), measuring the average value of 100 periods reduces the effect of trigger error to 0.003%. The period function can also be used to measure time interval between two positive- (or negative-) going wavefronts.

Ratio

The ratio of two frequencies (f_1/f_2) is measured (in the 5245L/M and 5248L/M) by connecting the lower frequency, f_2, to the Signal Input connector used for frequency measurements, while f_1 essentially serves as the counter's internal time base frequency. Multiple period averaging increases the accuracy of ratio measurement in the same manner as for period measurement, particularly when measuring ratios of frequencies that are almost identical.

Scaling

The 5245L/M, 5248L/M, and M54 versions will scale (divide) input frequencies up to 50 or 135 MHz in decade steps by factors up to 10^9. For example, a 14 MHz signal connected to the front panel input connector can be divided to 0.014 Hz. Decade selector switch and output BNC connector are on the rear panel.

Input Amplifier

A dual FET input amplifier provides 1 meg/25 pF input impedance, independent of attenuator setting throughout the entire frequency range. Therefore, one need not be concerned about input impedance changes affecting the signal source when the input attenuator switch is rotated. Also, low VSWR is more easily attainable. High impedance probes (e.g., HP Models 10000 A/C, 10001 B/D, 10002 A/B/C/D, 10003 A/B) may be directly connected to the input and used in the same manner as with high frequency oscilloscopes.

Input Signal Triggering

Models 5245L/M, 5248L/M, and M54 versions have a front panel trigger level control with both preset and adjustable modes. In Preset, trigger level is optimum for counting signals which are symmetrical about ground; it is useful for most applications, and is also automatically selected when plug-ins are used (without moving the Trigger control to Preset). In Adjustable, the Trigger control can be rotated for counting positive or negative pulses, or for unusual signal conditions.

The 5247M will automatically count all ac signals from 100 mV to 10 V without requiring any level adjustments whatsoever.

TIME BASE

Electronic counter accuracy is largely determined by the time base oscillator. The oscillator frequency constancy can be affected by temperature, line voltage, external circuit loading and undue mechanical shock. Quartz oscillators also exhibit short term instabilities and a long term accumulative drift known as aging rate. Despite the many factors which affect quartz oscillators, by very careful design they can be made extremely accurate frequency standards.

Line voltage and circuit loading effects are minimized in HP counters by careful circuit design. Temperature effects are greatly reduced by housing the oscillator in a highly precise oven. The ovens, designed and manufactured by HP, have proportional electronic temperature controllers which operate even when the counter power switch is off. Quartz crystals for counters not having an oven (e.g., Model 5246L) are specially cut for a low temperature coefficient, require no warm-up, but do not provide the accuracy of the oven-enclosed oscillators.

Aging Rate

When an oven-enclosed quartz oscillator is energized after being off for a long period, its frequency changes rapidly during a period referred to as "warm-up time." Thereafter, the rate of change of frequency decreases to a value known as the "aging rate" or "long-term stability," expressed in fractional parts per unit time such as "5 parts in 10^{10} per day." Aging causes the oscillator frequency to constantly change in the same direction, but at a rate that will decrease with time. Because of this continual aging, quartz oscillators should be aligned to a standard of known frequency* if the counter is to be of maximum accuracy. Aging rate can be expressed as an average, rms, typical or maximum value. HP specifies the maximum value, which is a "limit-of-error" value, and is therefore the most conservative value.

Short-Term Stability

Another additive, but not cumulative, factor in oscillator stability is short-term stability or random noise. Unlike aging rate, the magnitude of any short-term change in oscillator frequency varies from instant to instant. Therefore, HP specifies short-term stability in terms of the rms value of the fractional frequency deviations measured over a specific averaging time.

HP chooses a 1 second averaging time since this is realistic with respect to useful counter gate times (short-term stability figures appear much more favorable when specified for longer times, such as 10, 100, or 1000 seconds). Good short-term stability aids measurement precision, particularly when making high-resolution frequency measurements with frequency converters such as the HP 5255A, 5256A, and 5254B, which give a resolution on the order of 1 part in 10^{10} to 1 part in 10^9.

Ultra-Stable Time Base

Several years ago the time base oscillator in the 5245L, with its $< 3 \times 10^{-9}$/day aging rate, represented the state of the art in counter time bases, and it still serves as a secondary frequency standard in many applications today. Recently HP developed a compact, ultra-stable, rapid warm-up time base for use where even greater performance is required. The new time base is installed in Models 5245M, 5247M, and 5248M.

Compared to standard electronic counter time bases available previously, the ultra-stable 5 MHz time base oscillator has a significantly better short-term stability ($< 5 \times 10^{-11}$ rms for 1 s averaging) and long-term stability ($< 5 \times 10^{-10}$/day aging rate), and significantly less frequency change due to changes in line voltage, external load and temperature. The time base has rapid warm-up, excellent spectral purity, and the same usefulness as costly secondary frequency standards.

* See HP Application Notes 52 and 77-2, available upon request.

These advancements mean greater precision (particularly when using frequency converters for very high resolution measurements), lower investment for counter calibration equipment in some cases, and greater versatility because of excellent performance and convenience when employed as a secondary frequency standard. The very low aging rate of the ultra-stable oscillator extends the time between calibrations, thereby keeping the counter in use longer and reducing the time and money spent on calibration. For example, an aging rate of 5 parts in 10^{10} per 24 hours means that at least 40 days can elapse before the aging rate causes an error of 1 digit in an 8-digit counter counting 50 MHz with a 1 second gate time (1 part in 10^8 of counter full scale).

For maximum accuracy, the ultra-stable oscillator is kept energized as long as the counter power cord is plugged into an energized power receptacle, whether the front panel switch is ON or OFF. The counters have a separate, internal, regulated power supply to permit operation of the oscillator when the remainder of the counter is turned off. The 5 MHz time base output is usable while the counter is being used for measurements.

DISPLAY STORAGE

All models have readout storage, which provides a continuous display of the most recent measurement. This display is held even while the instrument is gated for a new count. If the new count differs from the stored count, the display will shift to the new reading directly. Storage can be disabled.

SAMPLE RATE

A Sample Rate control is provided which determines the length of time following the gate closure during which the gate may not be reopened. When the Function Selector is set to Frequency, the Sample Rate adjusts the time between gates from less than 0.2 sec. to at least 5 seconds (50 ms to 2 s in 5248L/M and 5247M) and is independent of gate time. The control may also be set to hold a display indefinitely.

DIGITAL OUTPUT

Electrical outputs representing the counter's reading are standard in all models except the 5246L and 5247M, wherein they are extra-cost options. Four-line BCD code is provided with assigned weights of 4-2-2-1 in 5245L/M and 8-4-2-1 in the 5248L/M. Other codes are optional.

This output is suitable for systems use or for output devices, such as Models 5050B and 562A Digital Recorders and Model 580A or 581A Digital to Analog Converter. It can also be connected to HP digital computers.

Hold-Off Requirement

To prevent the counter from taking a new reading while the digital output is in use, a hold-off voltage can be applied to the counter's digital output connector. When the hold-off voltage is removed, the counter can count again. Hold-off voltage can generally be from + 15 V to + 25 V.

Reference Voltages

Output accessories operating from the counter's digital output generally require one or two reference voltages for proper operation. These voltages, known as BCD reference levels, are supplied by the counter at the digital output connector.

REMOTE PROGRAMMING

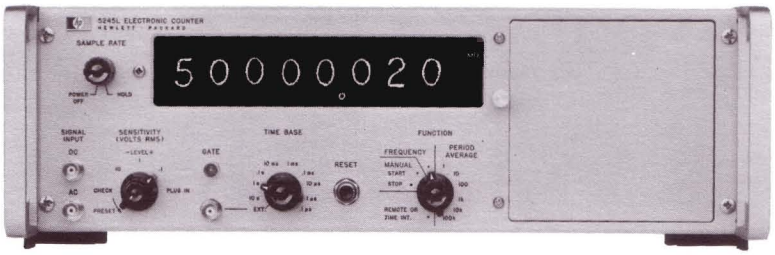
In Models 5245L/M and 5248L/M, remote programming can be obtained optionally by prefixing the model number with H65. All functions which may be programmed from the front panel controls (in normal use) may be programmed from a remote location except for the Sample Rate (as defined above) and the Sensitivity and Trigger control settings. The instrument provides (through rear panel connectors) all voltages necessary for remote control by contact closures. The programming voltages for Time Base and Function control are low level, — 15 volts dc at 5 mA per gate. Control may also be achieved by using an external — 15-volt dc supply. The position of the decimal point and measurements unit may be correctly illuminated from the remote location using + 170 volts dc from the internal or an external supply.

SUMMARY OF SPECIFICATIONS

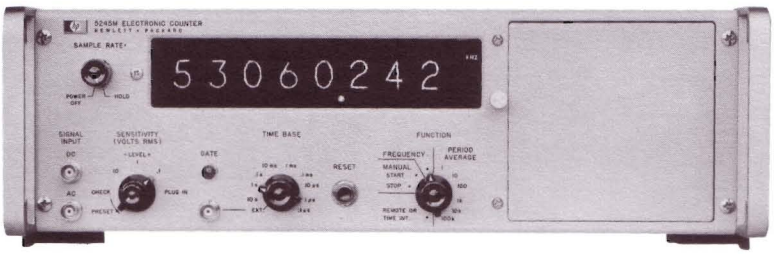
Model	5245L, M54-5245L (pp. 7, 8, 12)	5248L M54-5248L (pp. 7, 10, 12)	5248M M54-5248M (pp. 7, 10, 12)	5245M M54-5245M (pp. 7, 8, 12)	5247M (p. 14)	5246L (p. 13)	5244L (Please request data sheet)
Basic Measurement Range	0 - 50 MHz	0 - 135 MHz		0 - 50 MHz	10 Hz - 135 MHz	0 - 50 MHz	0 - 50 MHz
Digits in Readout	8				8	6 (7 or 8 optional)	7 (8 optional)
Measurement Functions F = freq., S = input R = ratio, scaling, P = period, M = multiple	F, P, R, MP, MR, S				F	F, R, MR	F, P, R, MP, MR, S
Time Base Aging Rate	$<3 \times 10^{-9}$/24 hours		$<5 \times 10^{-10}$/24 hours		$<5 \times 10^{-10}$/24 hrs.	$<2 \times 10^{-7}$/mo.[1]	$<2 \times 10^{-7}$/mo.[1]
Time Base Warm-up	Normal		Rapid		Rapid	Room Temp. xtal[1]	Room Temp. xtal[1]
Input Impedance	1 MΩ/25 pF				1 MΩ/25 pF	1 MΩ/25 pF	10 K/100 K/1 MΩ; 40/15/15 pF
Gate Times	1 μs - 10 s				1 μs - 10 s	1 μs - 1 s	1 μs - 10 s
Time Base Outputs (in decade steps)	0.1 Hz - 10 MHz		0.1 Hz - 10 MHz, Fixed 5 MHz[2]		Fixed 5 MHz[2]	Fixed 1 MHz (10 MHz special order)	0.1 Hz - 1 MHz
BCD Output	Yes				Optional	Optional	Yes
Remote Programming	Optional				Not Available	Not Available	Not Available
Input Coupling	ac or dc				ac only	ac or dc	ac or dc
Input Attenuator	Yes				Not Required	No	Yes
Trigger Level Adjustment	Yes				Not Required	No	No
Freq. Ratio Measurement (f_1/f_2); range, sensitivity, input resistance f_1	0 - 50 MHz	0 - 135 MHz, 0.1 V, 1 MΩ		0 - 50 MHz	None	0 - 50 MHz; 0.1 V, 1 MΩ	0 - 50 MHz; 0.1 V, 100 KΩ/volt
f_2	0 - 1 MHz 0.1 V, 1 MΩ					100 Hz - 1 MHz; 1 V, 500 Ω	0 - 1 MHz; 0.1 V, 100 KΩ
Compatible 5245 Series Plug-ins	All (on pages 16 to 27)				Transfer Osc., Freq. Converters, Prescalers, Video Amp.	All[3] (on pages 16 to 27)	None
Price	5245L: $2480 M54-5245L: on request	5248L: $2900 M54-5248L: on request	5248M: $3300 M54-5248M: on request	5245M: $3100 M54-5245M: on request	$3150	$1800	$1900

1 Oven enclosed crystal ($<3 \times 10^{-9}$/day aging rate) optional.
2 5 MHz output has high spectral purity; 5×10^{-11} (rms for 1 s averaging time) short term stability; is available whenever counter is connected to ac line.
3 Six digits restricts time interval range to 10^6 s (7, 8-digits optional). In 5246L, Preset Unit 5264A will only multiply and divide frequencies by N and preset count.

MODELS 5245L/M
5248L/M



5245L



5245M

Highest Performance and Versatility in General Purpose Counters □ 50 MHz or 135 MHz Basic Range Extended Through Microwave Region by Manual or Automatic Accessories □ Choice of Standard or Ultra-stable Time Base □ High, Constant Input Impedance

These four models are the most versatile and accurate general purpose electronic counters. In addition to their basic versatility, they accept the wide range of front panel plug-in accessories on pages 16 to 27 and the accessories on pages 30 and 31. This selection of accessories, and their high performance, are unsurpassed in the industry. Strongest consideration should be given to these four counters where not only performance and versatility are needed, but also where ruggedness, wide operating temperature range and field-proven reliability are required. If your application has specific reliability and environmental requirements, please consult HP.

The major differences between the four models are that the "M" versions have the ultra-stable, rapid warm-up time base, and the 5248's have a basic frequency range of 0 to 135 MHz compared to the 5245's 0 to 50 MHz range. All models have a constant impedance dual FET input amplifier for greatest freedom from input loading effects and to permit use of high impedance input probes (see page 4).

SPECIFICATIONS, 5245L, 5245M

FREQUENCY MEASUREMENT

Range: dc coupled, 0 to 50 MHz; ac coupled, 25 Hz to 50 MHz (typical response of input amplifier $<\pm 1$ dB over entire range).

Gate Time: 1 μs to 10 seconds in decade steps.

Accuracy: ± 1 count $\pm$ time base accuracy.

Readout: kHz or MHz with positioned decimal point; units annunciator in line with digital display.

Self-check: Counts 10 MHz for the gate time chosen.

PERIOD AVERAGE MEASUREMENTS

Range: Single Period .....0 to 1 MHz
Multiple Period .....0 to 300 kHz

Periods Averaged: 1 period to 10^5 periods in decade steps.

Frequency Counted:
1 and 10 Period .....1 Hz to 10 MHz in decade steps
100 Period .....10 Hz to 10 MHz
1,000 Period .....100 Hz to 10 MHz
10,000 Period .....1 kHz to 10 MHz
100,000 Period .....10 kHz to 10 MHz

Accuracy: ± 1 count $\pm$ time base accuracy $\pm$ trigger error.*

Readout: s, ms, or μs, with positioned decimal point; units annunciator in line with digital display.

Self-check: Checks operation from 1 period to 10^5 periods.

RATIO MEASUREMENTS

Displays: (f_1/f_2) times period multiplier; multiplier: 1-10^5.

Range: f_1: 0 to 50 MHz. f_2: 0 to 1 MHz in single ratio, 0 to 300 kHz in multiple ratio; ratios averaged 1 to 10^5 in decade steps.

Sensitivity: 0.1 V rms, each input (max).

Accuracy: ± 1 count of $f_1 \pm$ trigger error* of f_2. f_1 is applied to the decimal counters (enters "Ext." jack on front panel); f_2 is applied to decade dividers (enters Signal Input jack).

Readout: Dimensionless; decimal point positioned for number of periods averaged.

Self-check: Period Average Self-check applies.

SCALING

Frequency Range: 0 to 50 MHz.

Factor: By decades up to 10^9, switch selected on rear panel. For $\div 2$, $\div 4$, $\div 8$, add HP 5252A Prescaler.

Input: Front panel, Signal Input jack.

Output: In place of time base output frequencies.

GENERAL

Display: 8 digits in-line with rectangular Nixie® tubes; 99,999,999 maximum display; total width of display including units annunciator and auto-positioned decimal point indication does not exceed 7 inches.

Display Storage: Holds reading between samples; rear panel switch overrides storage.

Sample Rate: Time following a gate closing during which the gate may not be reopened is variable from less than 0.2 s to 5 s in Frequency mode, independent of gate time; display can be held indefinitely.

Signal Input

Maximum Sensitivity: 100 mV rms.

Coupling: ac or dc, separate BNC connectors. AC coupling has 600 V dc, 0.022 μF capacitor (—3 dB at approx. 7 Hz).

Impedance: 1 MΩ in parallel with approx. 25 pF, all ranges.

Attenuation: Step attenuator (SENSITIVITY switch) provides nominal sensitivities of 0.1, 1, and 10 V rms.

Trigger Level Adjustment (min.): Front panel control has ± 0.3 V trigger level range on 0.1 V position, ± 3 V range on 1 V position, ± 30 V range on 10 V position. A PRESET position automatically centers trigger level at 0 V.

Overload Protection: Diodes protect input circuit for up to 120 V rms (<1 kHz) on 0.1 V range, 240 V rms on 1 V range, 500 V rms on 10 V range. Input resistance for overload conditions (input amplitude $>$ ten times SENSITIVITY) is 100 kΩ on 0.1 V range, and is approximately 1 MΩ on other ranges.

Pulse Measurements: Front panel TRIGGER LEVEL adjustment allows counting positive or negative pulses.

External Input (selected by front panel Time Base switch):

Maximum Sensitivity: 100 mV rms.

Impedance: 1 MΩ, approx. 20 pF, dc coupled.

Overload: Diodes protect input circuit up to 120 V rms.

Digital Output: 4-line BCD 4-2-2-1, "1" state positive; includes decimal point and measurement unit. 8-4-2-1 available as Option 02 ("1" state positive) and Option 03 ("1" state negative); decimal point remains 4-2-2-1 (see J35- and J36- options below).

"0" STATE LEVEL: —8 V. "1" STATE LEVEL: +18 V.

Impedance: 100 kΩ, each line.

BCD Reference Levels: Approximately +17 V, 350 Ω source; approximately —6.5 V, 1000 Ω source.

Print Command: +13 V to 0 V step; dc-coupled.

Hold-off Requirement: +15 V min., +25 V max. from chassis ground (1000 Ω source).

Cable Connector: Amphenol 50-pin 57-30500-375, HP Part No. 1251-0086, 1 required.

Operating Temperature Range: —20°C to +65°C.

Power Supply: 115 or 230 volts $\pm 10\%$, 50 to 60 Hz; 95 watts. (5245M only: 150 W maximum during approximately first 2 minutes after power line is energized.) 50 to 400 or 1000 Hz operation, price on request.

Weight: Net, 32 lb (14,4 kg) with blank plug-in panel. Shipping, 40 lb (18,2 kg).

Connectors: BNC (except remote program and BCD out).

Accessories Furnished: 10503A Cable, 4 ft (120 cm) long, male BNC connectors. Detachable power cord, 7½ ft (230 cm) long, NEMA plug. Circuit Board Extender, rack mount conversion parts.

Dimensions: See page 15.

► **PRICES:** Model 5245L, $2,480.00.
Model 5245M. $3,100.00.

Optional and Special Features (at added cost)

Option 02. 4-line BCD 8-4-2-1, "1" state positive (for digits only) in lieu of 4-2-2-1 (identical in other respects to above specifications), add $10.00.

Option 03. 4-line BCD 8-4-2-1, "1" state negative (for digits only) in lieu of 4-2-2-1 (identical in other respects to above specifications), add $10.00.

J35-5245L/M: Similar to Option 02, except has 8-4-2-1 output, "1" state positive for measurement units and decimal point as well as digits. (Note: M47-562A/AR and 5050B Option 01 Printers are especially suitable for J35-5245L/M.) Prices available on request.

* Trigger error is $<(\pm 0.3\%$ of one period $\div$ periods averaged) for signals with 40 dB or better signal-to-noise ratio, and 100 mV rms amplitude, error decreases as signal-to-noise ratio and input level increase.

® Burroughs Corporation.

► Indicates change from prior specifications

J36-5245L/M: Similar to Option 03, except has 8-4-2-1 output, "1" state positive for measurement units and decimal point as well as digits, (Note: P64-562A/AR and 5050B Option 02 Printers are especially suitable for J36-5245L/M.) Prices available on request.

Electromagnetic Compatibility: Models H60-5245L/M meet the requirements of military specifications MIL-I-6181D. (Model numbers of plug-in accessories must also be prefixed H60.) Prices available on request.

Remote Operation: All functions which may be controlled from the front panel controls (in normal use) may be programmed from a remote location except for the "Sample Rate" (as defined above) and the sensitivity and trigger control setting. Mating half of the control connectors (2 required) is Amphenol 36 pin 57-30360. Prices, H65-5245L and H65-5245M, available on request.

M07-5245L/M: Have "GHz" added to readout and are controlled from 5260A Option 02 Automatic Frequency Divider. Readout is inhibited when 5260A "searches." All remote capabilities of H65-5245L/M are included (see above). Prices available on request.

TIME BASE, MODEL 5245L

Crystal Frequency (internal): 1 MHz.

Stability

Aging Rate: <3 parts in 10^9 per 24 hours.**

Short Term: <2 parts in 10^{10} rms with measurement averaging time of one second under constant environmental and line voltage conditions.

Temperature: <2 parts in 10^{10} per °C from -20°C to $+55$°C.

Line Voltage: $<\pm5$ parts in 10^{10} for 10% change in line voltage from 115 V or 230 V rms.

Adjustment: Fine frequency adjustment (range approximately 4 x 10^{-8}) and medium frequency adjustment (range approximately 1 x 10^{-6}) are available from the front panel through the plug-in hole. Coarse frequency adjustment (range approximately 1 x 10^{-5}) is available at the rear of the instrument.

Output Frequencies

1. **At Rear Panel:**

   0.1 Hz to 10 MHz in decade steps, selected by rear panel switch.

   All frequencies available in manual function without interruption at reset except 100 Hz, 10 Hz, 1 Hz, and 0.1 Hz which are interrupted by manual reset; 10 kHz to 10 MHz available continuously in all functions; 1 kHz available continuously for all functions except 10^5 period average.

   Stability same as internal time base.

   Output is 5 volts p-p rectangular wave with 1000 Ω source impedance at 1 MHz and lower; 1 V rms sine wave with 1000 Ω source impedance only at 10 MHz.

2. **At Front Panel:** 0.1 Hz to 1 MHz in decade steps; available at "Ext." jack, selected by Time Base switch; availability same as in paragraph 1 (above); stability same as internal time base; 1 V peak-to-peak.

External Standard Frequency: 1 MHz, 1 V rms into 1000 Ω. Can be substituted for internal time base via rear panel EXT. STD. FREQ. connector.

** Up to 72 hours continuous operation may be required to reach this aging rate after transportation or lengthy "off" periods.

TIME BASE, MODEL 5245M

Crystal Frequency (internal): 5 MHz.

Stability

Aging Rate: <5 parts in 10^{10} per 24 hours after warm-up.**

Short Term (rms fractional frequency deviation): Better than 5 parts in 10^{11} for 1 second averaging time.

Temperature: <5 parts in 10^{11}/°C from 0°C to 50°C (<2.5 parts in 10^9 within the entire span of 0°C to 50°C).

Line Voltage: $<\pm1$ part in 10^{10} for 10% change in line voltage from 115 V or 230 V rms.

Load Stability: Typically $<\pm2$ parts in 10^{11} for any of the following external loads: open, short, 50 Ω resistive, 50 Ω inductive, 50 Ω capacitive.

Warm-up: For "off" periods up to approximately 24 hours: 1 hour typical to reach 5 parts in 10^9 of the frequency that existed when turned off. The 5 MHz crystal oscillator operates whenever the power cord is connected.

Adjustment: Fine frequency adjustment, range approx. 5 x 10^{-8}, 16-turn control accessible through plug-in accessory compartment in front panel. Coarse frequency adjustment, range approx. 1 x 10^{-6}, 20-turn control at rear panel.

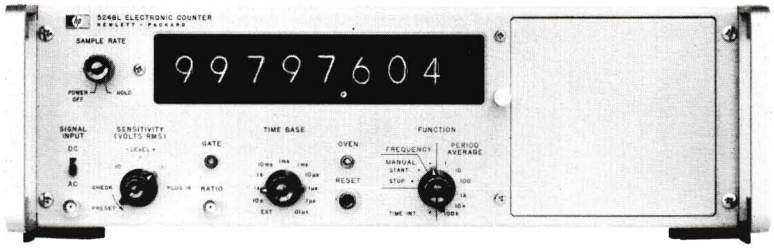
Output Frequencies

1. **At Rear Panel:** 5 MHz sine wave. 1 V rms into 50 Ω. Available at all times whenever power line cord is energized, whether front panel power switch is ON or OFF. Stability is as defined above. Signal-to-Noise Ratio typically >87 dB below rated output. Harmonic Distortion typically >40 dB below rated output. Non-harmonic components typically >80 dB below rated output.

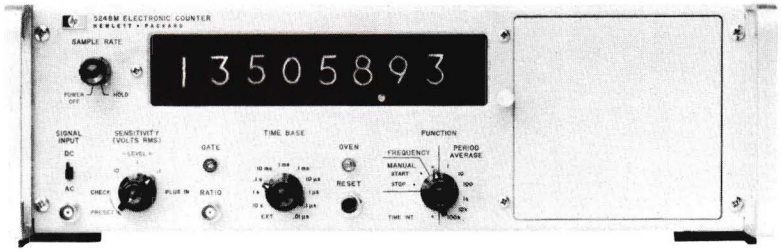
2. **At Rear Panel:** 0.1 Hz to 10 MHz in decade steps; switch selected on rear panel; all frequencies available in manual function without interruption at reset except 100 Hz, 10 Hz, 1 Hz, and 0.1 Hz which are interrupted by manual reset; 10 kHz to 10 MHz available continuously in all functions; 1 kHz available continuously for all functions except 10^5 period average; stability same as internal time base; 5 V p-p rectangular wave with 1000 Ω source impedance at 1 MHz and lower; 1 V rms sine wave with 1000 Ω source impedance only at 10 MHz.

3. **At Front Panel:** 0.1 Hz to 1 MHz in decade steps; available at "Ext." jack, selected by Time Base switch; availability same as in paragraph 2 (above); stability same as internal time base; 1 V peak-to-peak.

External Standard Frequency: 5 or 10 MHz, 1 V rms, into 1000 Ω can be substituted for internal time base via rear panel EXT. STD. FREQ. connector.



5248L



5248M

SPECIFICATIONS, 5248L, 5248M

FREQUENCY MEASUREMENT

Range: dc coupled, 0 to 135 MHz; ac coupled, 25 Hz to 135 MHz (typical response of input amplifier ±1 dB over entire range.)

Gate Time: 1 μs to 10 seconds in decade steps.

Accuracy: ±1 count ± time base accuracy.

Readout: kHz or MHz with positioned decimal point; units annunciator in line with digital display.

Self-check: Counts 100 MHz for the gate time chosen.

PERIOD AVERAGE MEASUREMENTS

Range: Single Period .....0 to 1 MHz
Multiple Period .....0 to 300 kHz

Periods Averaged: 1 period to 10^5 periods in decade steps.

Frequency Counted:
1 and 10 Period .....1 Hz to 100 MHz in decade steps
100 Period .....10 Hz to 100 MHz
1,000 Period .....100 Hz to 100 MHz
10,000 Period .....1 kHz to 100 MHz
100,000 Period .....10 kHz to 100 MHz

Accuracy: ±1 count ± time base accuracy ± trigger error.*

Readout: s, ms, μs, with positioned decimal point; units annunciator in line with digital display.

Self-check: Checks operation from 1 period to 10^5 periods.

RATIO MEASUREMENTS

Displays: (f_1/f_2) times period multiplier; multiplier: 1-10^5.

Range: f_1: 0 to 135 MHz. f_2: 0 to 1 MHz in single ratio, 0 to 300 kHz in multiple ratio; ratios averaged 1 to 10^5 in decade steps.

Sensitivity: 0.1 V rms, each input (max).

Accuracy: ±1 count of f_1 ± trigger error* of f_2. f_2 is applied to the decade dividers (enters Ratio jack on front panel), f_1 is frequency applied to decimal counters (enters Signal Input jack).

Readout: Dimensionless; decimal point positioned for number of periods averaged.

Self-check: Period average self-check applies.

SCALING

Frequency Range: 0 to 135 MHz (50 MHz max., for ÷ 10 step).

Factor: By decades up to 10^9, switch selected on rear panel. For ÷2, ÷4, ÷8, add HP 5252A Prescaler.

Input: Front panel, Signal Input.

Output: In place of time base output frequencies.

GENERAL

Display: 8 digits in-line with rectangular Nixie® tubes; 99,999,999 max. display; total width of display including units annunciator and auto-positioned decimal point indication does not exceed 7 inches.

Display Storage: Holds reading between samples; rear panel switch overrides storage.

Sample Rate: Time following a gate closing during which the gate may not be reopened is variable from less than 0.05 s to 2 s in Frequency mode, independent of gate time; display can be held indefinitely.

Signal Input

Maximum Sensitivity: 100 mV rms.

Coupling: ac or dc, selected by front panel switch. Ac coupling has 600 V dc, 0.022 μF capacitor (—3 dB at approx. 7 Hz).

Impedance: 1 meg. parallel with approx. 25 pF, all ranges.

* Trigger error is <(±0.3% of one period ÷ periods averaged) for signals with 40 dB or better signal-to-noise ratio, and 100 mV rms amplitude, error decreases as signal-to-noise ratio and input level increase.

® Burroughs Corporation.

Attenuation: Step attenuator (SENSITIVITY switch) provides nominal sensitivities of 0.1, 1, and 10 V rms.

Trigger Level Adjustment (min.): Front panel control has ±0.3 V trigger level range on 0.1 V position, ±3 V range on 1 V position, ±30 V range on 10 V position. A PRESET position automatically centers trigger level at 0 V.

Overload Protection: Diodes protect input circuit for up to 120 V rms (<1 kHz) on 0.1 V range, 250 V rms on 1 V range, 500 V rms on 10 V range. Input resistance for overload conditions (input amplitude > ten times SENSITIVITY) is 100 kΩ on 0.1 V range, and is approximately 1 MΩ on other ranges.

Pulse Measurements: Front panel TRIGGER LEVEL adjustment allows counting positive or negative pulses.

Ratio Input (front panel):

Maximum Sensitivity: 100 mV rms.

Impedance: 1 MΩ, approx. 20 pF, dc coupled.

Overload: Diodes protect input circuit up to 120 V rms.

Digital Output: 4-line BCD 8-4-2-1, "1" state positive; includes decimal point and measurement unit. "0" STATE LEVEL: −8 V. "1" STATE LEVEL: +18 V. For "1" state negative, order Option 03.

Impedance: 100 kΩ, each line.

BCD Reference Levels: Approximately +17 V, 350 Ω source; approximately −6.5 V, 1000 Ω source.

Print Command: +13 V to 0 V step, dc coupled.

Hold-off Requirement: +15 V min., +25 V max. from chassis ground (1000 Ω source).

Cable Connector: Amphenol 50-pin 57-30500-375, HP part no. 1251-0086, 1 required.

Operating Temperature Range: −20°C to +65°C.

Power Supply: 115 or 230 volts ±10%, 50 to 60 Hz; 125 watts ±10%. (50 to 400 or 1000 Hz operation, price on request.)

Weight: Net, 31 lb (14 kg) with blank plug-in panel. Shipping, 37 lb (17 kg).

Connectors: BNC (except remote program and BCD out).

Accessories Furnished: 10503A cable, 4 ft (120 cm) long, male BNC connectors. Detachable power cord, 7½ ft (230 cm) long, NEMA plug. Circuit board extender, rack mount conversion parts.

Dimensions: See page 15.

PRICES: Model 5248L, $2,900.00; Model 5248M, $3,300.00.

Optional and Special Features (at added cost):

Option 02. 4-line BCD 4-2-2-1 code, "1" state positive in lieu of 8-4-2-1 code (identical in other respects to above digital output data), add $25.00.

Option 03. 4-line BCD 8-4-2-1, "1" state negative in lieu of "1" state positive (identical in other respects to above output data), add $10.00.

Electromagnetic Compatibility: Models H60-5248L/M meet the requirements of military specification MIL-I-6181D. (Model numbers of plug-in accessories must also be prefixed H60.) Prices available on request.

Remote Operation: All functions which may be controlled from the front panel controls (in normal use) may be programmed from a remote location except for the "Sample Rate" (as defined above) and the sensitivity and trigger control setting. Mating half of the control connectors (2 required) is Amphenol 36 pin 57-30360. Prices, H65-5248L and H65-5248M, available on request.

M07-5248L/M: Have "GHz" added to readout and are controlled from 5260A Option 02 Automatic Frequency Divider. Readout is inhibited when 5260A "searches." All remote capabilities of H65-5248L/M are included (see above). Prices, M07-5248L and M07-5248M, available on request.

TIME BASE, MODEL 5248L

Crystal Frequency (internal): 1 MHz.

Stability

Aging Rate: <3 parts in 10^9 per 24 hours.**

Short Term: <2 parts in 10^{10} rms with measurement averaging time of one second under constant environment and line voltage conditions.

Temperature: <2 parts in 10^{10} per °C from −20° to +55°C.

Line Voltage: <±5 parts in 10^{10} for 10% change in line voltage from 115 V or 230 V rms.

Adjustment: Fine frequency adjustment (range approximately 4 x 10^{-8}) and medium frequency adjustment (range approximately 1 x 10^{-6}) are available from the front panel through the plug-in hole. Coarse frequency adjustment (range approximately 1 x 10^{-5}) is available at the rear of the instrument.

Output Frequencies

At Rear Panel:

0.1 Hz to 10 MHz in decade steps, switch selected on rear panel.

All frequencies available in manual function without interruption at reset except 100 Hz, 10 Hz, 1 Hz, and 0.1 Hz which are interrupted by manual reset; 10 kHz to 10 MHz available continuously in all functions; 1 kHz available continuously for all functions except 10^5 period average.

Stability same as internal time base.

Output is 5 volts p-p rectangular wave with 1000 Ω source impedance at 1 MHz and lower; 1 V rms sine wave with 1000 Ω source impedance only at 10 MHz.

Separate BNC gives 100 MHz sine wave, 100 Ω source.

External Standard Frequency: 1 MHz, 1 V rms into 1000 Ω. Can be substituted for internal time base via rear panel EXT. STD. FREQ. connector.

** Up to 72 hours continuous operation may be required to reach this aging rate after transportation or lengthy "off" periods.

TIME BASE, MODEL 5248M

Crystal Frequency (internal): 5 MHz.

Stability

Aging Rate: <5 parts in 10^{10} per 24 hours after warm-up.**

Short Term (rms fractional frequency deviation): Better than 5 parts in 10^{11} for 1 second averaging time.

Temperature: <5 parts in 10^{11}/°C from 0°C to 50°C (<2.5 parts in 10^9 within the entire span of 0°C to 50°C).

Line Voltage: <±1 part in 10^{10} for 10% change in line voltage from 115 V or 230 V rms.

Load Stability: Typically <±2 parts in 10^{11} for any of the following external loads: open, short, 50 Ω resistive, 50 Ω inductive, 50 Ω capacitive.

Warm-up: For "off" periods up to approximately 24 hours: 1 hour typical to reach 5 parts in 10^9 of the frequency that existed when turned off. The 5 MHz crystal oscillator operates whenever the power cord is connected.

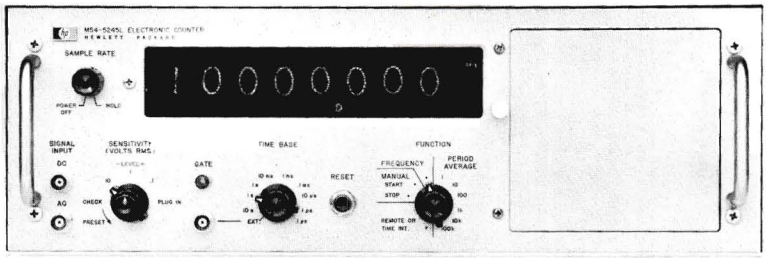
Adjustment: Fine frequency adjustment, range approx. 5 x 10^{-8}, 16-turn control accessible through plug-in accessory compartment in front panel. Coarse frequency adjustment, range approx. 1 x 10^{-6}, 20-turn control at rear panel.

Output Frequencies

1. **At Rear Panel:** 5 MHz sine wave. 1 V rms into 50 Ω. Available at all times whenever power line cord is energized, whether front panel power switch is ON or OFF. Stability is as defined above. Signal-to-Noise Ratio typically >87 dB below rated output. Harmonic Distortion typically >40 dB below rated output. Non-harmonic Components typically >80 dB below rated output.
2. **At Rear Panel:** 0.1 Hz to 10 MHz in decade steps; switch selected on rear panel; all frequencies available in manual function without interruption at reset except 100 Hz, 10 Hz, 1 Hz, and 0.1 Hz which are interrupted by manual reset; 10 kHz to 10 MHz available continuously in all functions; 1 kHz available continuously for all functions except 10^5 period average; stability same as internal time base; 5 V p-p rectangular wave with 1000 Ω source impedance at 1 MHz and lower; 1 V rms sine wave with 1000 Ω source impedance only at 10 MHz.
   Separate BNC gives 100 MHz sine wave, 100 Ω source.

External Standard Frequency: 5 or 10 MHz, 1 V rms, into 1000 Ω can be substituted for internal time base via rear panel EXT. STD. FREQ. connector.

MODELS M54-5245L/M
M54-5248L/M

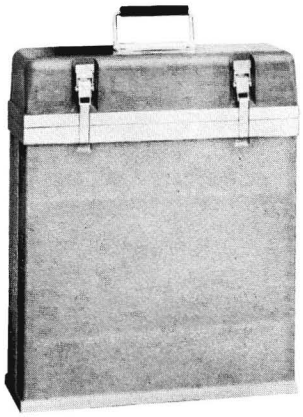


Enclosure Meets MIL Specification for RFI and Drip Proofing ☐ Operationally Identical to 5245L/M, 5248L/M ☐ Meets MIL Specification for Temperature, Humidity, Vibration, Shock, Altitude ☐ Spare Parts Stocking Almost Identical to 5245L/M, 5248L/M ☐ Easily Carried ☐ 50 to 400 Hz Power

Operation Identical to 5245L/M, 5248L/M

Functional performance and operating specifications of the M54-5245L, M54-5245M, M54-5248L, and M54-5248M are identical to the 5245L, 5245M, 5248L, and 5248M, respectively, as described on pages 7 to 11. Frequency range can be extended to 18 GHz by using plug-in units, and all of the other plug-in units for the 5245L/M and 5248L/M can be used too. Plug-ins must be ordered with "H60 modification" if they are to meet the military RFI (radio frequency interference or electromagnetic compatibility) specification MIL-I-6181D.

The environmental resistance of the already rugged 5245L/M and 5248L/M has been increased in the M54 versions by a tough, fiberglass enclosure. The main improvements are drip proofing and improved RFI specifications. The fiberglass enclosure includes a detachable front panel cover with a conveniently located carrying handle (shown below).



SPECIFICATIONS

ENVIRONMENTAL

RFI: (MIL-I-6181D) meets all four sections of the specification—limits on radiated and conducted interference generation and on susceptibility to radiated and conducted interference.

Enclosure: Meets MIL-STD-108D section on drip proof enclosures.

Operating Temperature: Operating range of −20°C to +55°C, M54-5245L and M54-5248L; −20°C to +50°C, M54-5245M and M54-5248M. Meets and exceeds MIL-E-4158C for indoor equipment and MIL-E-16400, Class 4.

Non-operating Temperature: Meets all classes of MIL-E-16400F. − 62°C to + 85°C.

Humidity: Meets MIL-E-16400F for Class 3 and 4 equipment. 95% RH over operating temperature range.

Vibration: When operating in cabinet configuration, it meets MIL-T-21200 for Class 2 and 3 equipment.
5-15 Hz at 0.06 inch double amplitude
15-25 Hz at 0.04 inch double amplitude
25-55 Hz at 0.02 inch double amplitude

Shock: Meets MIL-T-21200F for all classes of equipment. Three impact shocks of 30 G's applied to each of the six sides. Each shock has a duration of 11 ms ± 1 ms and a half sine wave shape.

Operating Altitude: Operation at 15,000 ft. meets and exceeds MIL-E-4158C up to at least + 25°C (consult HP regarding higher temperatures).

Non-operating Altitude: Exposure to 50,000 ft. altitude without ill effect; meets and exceeds MIL-E-4158C.
If additional environmental data are needed, please consult HP.

OPERATING

Operation: Identical to 5245L/M and 5248L/M, respectively (see pages 7-11).

Power Supply: 115 or 230 volts ±10%; 50 to 400 Hz; 95 watts (except is 150 W max. during first 2 minutes after power line is energized in M54-5245M and M54-5248M).

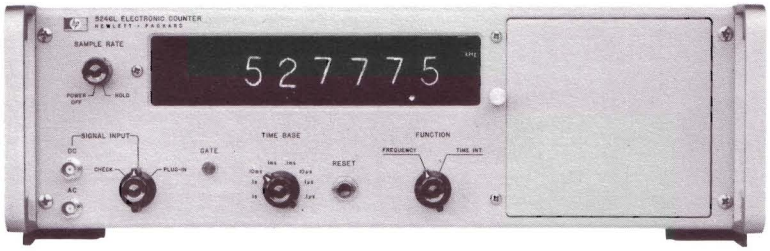
Weight: Net, 37 lb (15,5 kg).

Accessories Furnished: Fiberglass front panel cover, detachable power cord, 7½ feet (230 cm), NEMA plug.

Dimensions: 5⅞ in. (14,9 cm) high, 16 5/16 in. (43 cm) wide, 16½ in. (42 cm) deep without front panel cover, 21⅛ in. (53,8 cm) deep with front panel cover.

Prices: Available on request.

MODEL 5246L



5245L Quality and Reliability at Lower Cost ☐ Accepts All HP Counter Plug-ins ☐ AC or DC Input Coupling (DC Usable to 50 MHz) ☐ High Input Impedance ☐ Readout Storage

The 5246L offers the basic 0-50 MHz range, many of the circuit benefits, and plug-in accessory feature of the 5245L. Although, in the interest of economy, some of the 5245L capabilities are omitted from the 5246L, versatility can be increased by optional features.

The 5246L has display storage, a 6-digit readout (7 and 8 digits optional), and without any plug-ins will measure frequency and frequency ratio. BCD output and a higher stability (3×10^{-9}/day) crystal time base are optional. A dual field-effect transistor input amplifier offers almost constant 1 megohm/25 pF input impedance, and HP 10000 Series Probes can be used.

Frequency ratio (f_1/f_2) is measured by connecting signal f_2 (100 Hz to 1 MHz) in place of the counter's time base (BNC at rear), and connecting f_1 (up to 50 MHz) to the SIGNAL INPUT. Multiple ratios can be measured from 10 to 10^6 in decade steps.

SPECIFICATIONS

FREQUENCY MEASUREMENT

Range: 0 to 50 MHz (dc coupled input). 25 Hz to 50 MHz (ac coupled input, maximum sensitivity).

Gate Time: 1 μsec to 1.0 second in decade steps.

Accuracy: ± 1 count ± time base accuracy.

Readout: kHz or MHz with positioned decimal point; units annunciator in line with digital display.

TIME BASE

Frequency (internal): 1 MHz.

Stability

Aging Rate: Less than 2×10^{-7}/ mo.

Temperature: Less than ± 2 parts in 10^6 (+ 10° to + 50°C) ± 2 parts in 10^5 (0°C to 65°C).

Line Voltage: Less than ± 1 part in 10^7 for 10% change.

Output Frequency: 1 MHz, > 3 V p-p into 1 kΩ.

External Input: Sensitivity: 1 volt rms into 500 Ω, 1 kHz to 1 MHz; 2 V rms into 500 Ω, 100 Hz to 1 kHz. **With Option 06:** 1 V rms into 1000 Ω, 1 MHz (available on special order: 2 V rms, 100 Hz to 1 kHz; 1 V rms, 1 kHz to 1 MHz into 1000 Ω).

Must be 1 MHz for readout in kHz or MHz when using External Input instead of internal time base.

For frequency ratio measurements, External Input can be 100 Hz to 1 MHz with the above sensitivities.

Frequency and voltage specifications apply for sine wave inputs.

GENERAL

Display: 6 digits in-line with rectangular Nixie tubes and display storage: 999,999 max. display.

Display Storage: Holds reading between samples; rear panel switch overrides storage.

Sample Rate: Time following a gate closing during which the gate may not be reopened is continuously variable from less than 0.2 s to 5 s in Frequency mode, independent of gate time; display can be held indefinitely.

Signal Input

Maximum Sensitivity: 100 mV rms; coupling, ac or dc. Ac coupling has 0.022 μf 600 V DC capacitor (— 3 dB at approximately 7 Hz).

Impedance: 1 MΩ shunted by 25 pF.

Overload: Diode clamps in series with 100 kΩ and 0.001 μf protect input circuit for up to 120 V rms. Input resistance for overload condition (beyond approx. 1 V) is approximately 0.1 MΩ.

Self-check: Counts 10 MHz for the gate time chosen by the Time Base selector switch.

Operating Temperature Range: 0°C to + 65°C.

Power Supply: 115 or 230 volts ± 10%, 50 to 60 Hz; 95 W (50 to 400 or 1000 Hz operation, price on request).

Weight: Net, 28 lb (12,8 kg) with blank plug-in. Shipping, 36 lb (16,4 kg).

Accessories Furnished: HP 10503A Cable, 4 ft (120 cm) long, male BNC connectors. Detachable Power Cord, 7½ ft (230 cm) long, NEMA plug. Circuit Board Extender. Rack mount conversion parts.

Dimensions: See page 15.

► **PRICE:** $1,800.00.

Options

01: 7 digit readout, $100.00.

02: 8 digit readout, $200.00.

03: 4-2-2-1 "1" state positive 4-line BCD output.
"0" State Level: — 8 V.
"1" State Level: + 18 V.
Impedance: 100 K ohms, each line.
BCD Reference Levels:
Approximately + 17 V, 350Ω source.
Approximately — 6.5 V, 1000Ω source.
Print Command: + 13 V to 0 V step, dc coupled.
Hold-off Requirement: + 15 V min., + 25 V max. from chassis ground (1000Ω source).
Cable Connector: Amphenol 57-30500-375 (HP No. 1251-0086), 1 required.
Price: Option 03, $75.00.

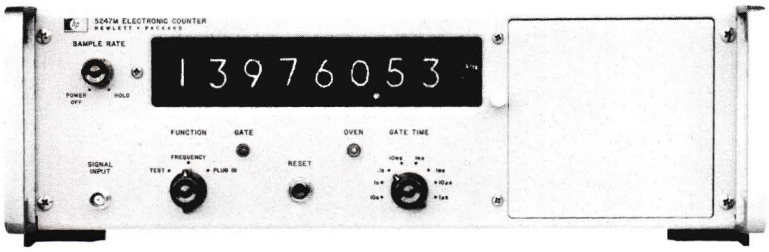
04: Similar to Option 03 except output is 1-2-4-8 "1" state negative 4-line BCD. $85.00.

05: Similar to Option 03 except output is 1-2-4-8 "1" state positive 4-line BCD. $85.00.

06: High Stability Time Base Oscillator: Specifications under "Stability," Model 5245L specifications, page 9, apply. $300.00.

► Indicates change from prior specifications

MODEL 5247M



10 Hz to 135 MHz Basic Range □ Ultra-stable, Fast Warm-up Time Base □ Plug-ins for Frequency Measurements to 18 GHz □ Wide Input Voltage Range Without Level Adjustment

The 5247M measures a wide range of frequencies with great accuracy and stability. It has a fast warm-up crystal time base which is extremely stable and useful as a secondary frequency standard. See Ultra-stable Time Base, page 4.

The unique input section accepts any input voltage level between 100 mV and 10 V rms without adjustment. This feature makes the instrument very convenient to use, particularly by untrained operators and when simple input signal waveforms are counted (i.e., sine, square, and triangular waves).

The 5247M accepts all HP frequency extending plug-ins (prescalers, frequency converters, transfer oscillator) to make frequency measurements from 10 Hz to 18 GHz.

SPECIFICATIONS

FREQUENCY MEASUREMENT

Range: 10 Hz to 135 MHz (ac coupled).

Input: 100 mV to 10 V rms; 1 MΩ shunted by 25 pF, typical.

Gate Time: 1 μs to 10.0 seconds in decade steps.

Accuracy: ± 1 count ± time base accuracy.

Readout: MHz, kHz or Hz with positioned decimal point; units annunciator in line with digital display.

TIME BASE

Crystal Frequency: 5 MHz.

Stability

Aging Rate: < 5 parts in 10^{10} per 24 hours after warm-up of 72 hours (max.) continuous operation. See also **Warm-up.**

Short Term: < 5 parts in 10^{11} for 1 second average (rms fractional frequency deviation).

Temperature: < 5 parts in 10^{11} per °C from 0° to 50°C; < 2.5 parts in 10^9 within the entire span of 0° to 50°C.

Line Voltage: $< \pm 1$ part in 10^{10} for 10% change in line voltage from 115 V or 230 V rms.

Load Stability: Typically ± 2 parts in 10^{11} for any of the following external loads — open, short, 50 Ω resistive, 50 Ω inductive, 50 Ω capacitive.

Warm-up: For "off" periods up to approximately 24 hours, 1 hour typical to reach 5 parts in 10^9 of the frequency that existed when turned off (30 min., typical, to 1 part in 10^7). Time base operates whenever power cord is connected.

Output Frequencies: Rear panel: 5 MHz sine wave. 1 V rms into 50 Ω. Available at all times whenever power line cord is energized, whether front panel power switch is ON or OFF. Stability as defined above. Signal-to-Noise Ratio typically > 87 dB at rated output. Harmonic Distortion typically > 40 dB below rated output. Non-harmonic Components typically > 80 dB below rated output.

GENERAL

Display: 8 digits in-line; rectangular display tubes.

Display Storage: Holds reading between samples; rear panel switch overrides storage.

Sample Rate: Time following a gate closing during which the gate may not be reopened is variable from less than 0.05 s to 2 s in Frequency mode, independent of gate time; display can be held indefinitely.

Signal Input

Sensitivity: 100 mV rms to 10 V rms (maximum) without level adjustment. Voltage exceeding ± 100 V dc may cause damage.

Impedance: 1 MΩ shunted by 25 pF, typical.

Connectors: BNC type.

Self-check: Counts 1 MHz for the gate time chosen by the Time Base selector switch.

Operating Temperature Range: 0°C to + 60°C.

Power Requirements: 115 or 230 volts ± 10%, 50 to 60 Hz; 95 W, except is 150 W, max., during approx. the first 2 minutes after power line is first energized.

Weight: Net, 31 lb (14 kg) with blank plug-in. Shipping, 37 lb (17 kg).

Accessories Furnished: HP 10503A Cable. 4 ft (120 cm) long, male BNC connectors. Detachable power cord, 7½ ft (230 cm) long, NEMA plug. Circuit Board Extender. Rack mount conversion parts.

Dimensions: See below.

► **PRICE:** Model 5247M, $3,150.00.

Options

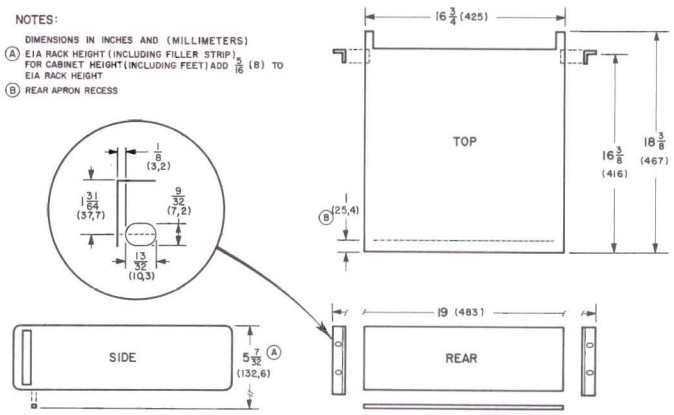
01: Digital output; 4-line BCD, 8-4-2-1, "1" state negative.
Levels: "0" state, +18 V; "1" state, −8 V.
Impedance: 100 K ohms, each line.
BCD Reference Levels:
Approximately + 17 V, 350Ω source.
Approximately — 6.5 V, 1000Ω source.
Print Command: + 13 V to 0 V step, dc coupled.
Hold-off Requirement: + 15 V min., + 25 V max. from chassis ground (1000Ω source).
Cable Connector: Amphenol 57-30500-375 (HP No. 1251-0086), 1 req'd.
Price: Option 01, $85.00.

02: Similar to Option 01 except output is "1" state positive. Price: Option 02, $85.00.

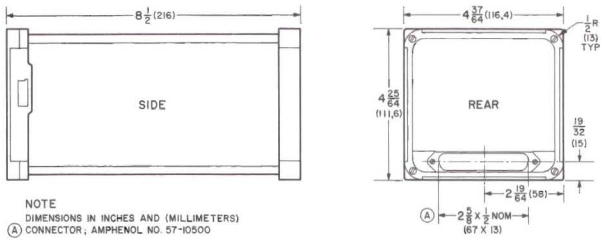
► Indicates change from prior specifications

DIMENSIONS

5245L, 5245M, 5246L, 5247M,
5248L, 5248M



PLUG-INS



ACCESSORIES AVAILABLE

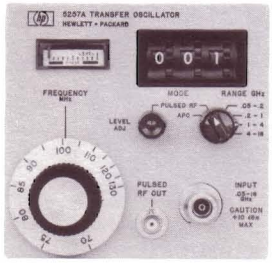
10100A

50-ohm feed-through termination provides 50 ohm-load where required at instrument inputs and outputs.

10003A

10-megohm, 10 pF, 10:1 Divider Probe facilitates measurements in high impedance circuits. Use with 5261A Video Amplifier, or at counter SIGNAL INPUT, or at TIME BASE EXT. connector when measuring frequencies and ratios. Other models down to 2.5 pF.

TRANSFER OSCILLATOR PLUG-IN (5257A)



- ☐ **Measures frequency from 50 MHz to 18 GHz**
- ☐ **For CW, FM or pulsed carriers**
- ☐ **Simple, error-free operation**
  - **—only one dial to tune**
  - **—wide capture and phase-lock range**
  - **—no readout until tuned (CW inputs)**
  - **—simple tuning meter replaces scope pattern**
- ☐ **Direct readout in frequency—no offset to add**
- ☐ **Preserves input FM when used as down-converter**

INTRODUCTION

Utilizing a new principle in transfer oscillators, the 5257A brings a wider range and significantly greater speed and operating ease to the measurement and direct readout of high frequencies (pulsed or CW). The 5257A plugs into HP counters so frequencies from 0 to 18 GHz can be measured with a single compact package. Counter accuracy is preserved when measuring CW signals.

The new principle utilizes a wide-band sampler and variable frequency oscillator (VFO) operating in a phase-locked loop. High input sensitivity, particularly at the higher frequencies, is achieved by the wide-band sampler at the input. The harmonic generator generally used in transfer oscillators is eliminated.

OPERATION

Several simple steps result in a direct display of the input frequency by the counter's readout. The approximate procedure is: set frequency range switch (operation is satisfactory even if switch is one range away from best position), adjust level control, tune the variable frequency oscillator (VFO) dial till the tuning meter indicates zero-beat, dial harmonic number into thumbwheel switches, read the unknown input frequency direct from counter display, recheck the harmonic number if necessary. Operation is faster and simpler than conventional transfer oscillators because of the factors detailed below.

Wide Capture and Phase-Lock Range

To "capture" an input frequency, rotate the VFO tuning dial till it "goes through" the proper frequency and the wide range circuitry will lock securely and track even if the input frequency drifts; tuning is rapid and uncritical. Should lock be lost due to an intermittent input, the 5257A will automatically relock when the signal again appears without need to retune. The lock range is wide for a transfer oscillator (± 0.2% of the input frequency) and permits confident, easy measurement of noisy, heavily frequency-modulated or drifting signals.

The VFO tuning knob is a dual concentric control that gives coarse and fine tuning.

Tuning Meter

An easy-to-interpret meter replaces the complex oscilloscope pattern used to detect zero beat in conventional transfer oscillators. Zero beat can be detected as accurately with this meter as with the small oscilloscopes generally built into transfer oscillators.

For CW signals, the MODE switch is set to APC (Automatic Phase Control), and the meter needle is at mid-scale until phase-lock is achieved; whereupon it will jump and move back and forth as the VFO dial is rotated. If the dial is rotated beyond phase-lock range, the meter will go to mid-scale again and remain stationary till the next lock point is reached.

Because of the phase-lock loop, the VFO output doesn't change when the dial is rotated as long as phase-lock isn't broken. Since the VFO is phase-locked to the input signal frequency, it will track input frequency fluctuations during measurement, and the counter will read the average frequency value over the counter's gate interval, even if fluctuations are very rapid. Phase-locking also completely eliminates oscillator stability as an accuracy factor.

A LOCK DETECTOR circuit inhibits the 5257A output to cause the counter to read all zeros until the 5257A is phase-locked to the input signal. This helps prevent erroneous readings and does away with constant observation of an oscilloscope pattern to ensure that the input signal and phase-locking exist.

For pulsed signals, set the MODE switch to "Pulsed RF" and rotate the VFO dial till the meter needle reaches its peak (rightmost) position. As in all transfer oscillators, the accuracy of pulsed carrier frequency measurement depends upon pulse width, carrier frequency, accuracy of the counter, how accurately one peaks the meter, and upon VFO stability during the counter gate interval (because the VFO isn't phase-locked to the input signal for pulsed measurements). Regarding these accuracy factors: The HP counters used with the 5257A have an aging rate (long-term stability) of $< 3 \times 10^{-9}$/day or $< 5 \times 10^{-10}$/day, depending upon model, and the VFO is very stable (typically 1×10^{-7}/minute), despite its 2:1 tuning range. As mentioned earlier, zero beat can be detected as accurately with the tuning meter as with a small screen oscilloscope.

Use of the tuning meter avoids the necessity to interpret the complex oscilloscope patterns obtained

from transfer oscillators during pulsed measurements, but a large-screen oscilloscope can be connected at the "PULSED RF OUT" port for zero beat observation. The error caused by imperfect zero beat can be reduced to 0.01 cycle per pulse width (i.e., a 1×10^{-6} error for a 10 GHz carrier with 1 μs pulse width).

Since the VFO isn't phase-locked for pulsed RF measurements, the lock detector (see "CW signals," above) isn't operative in the PULSED RF mode.

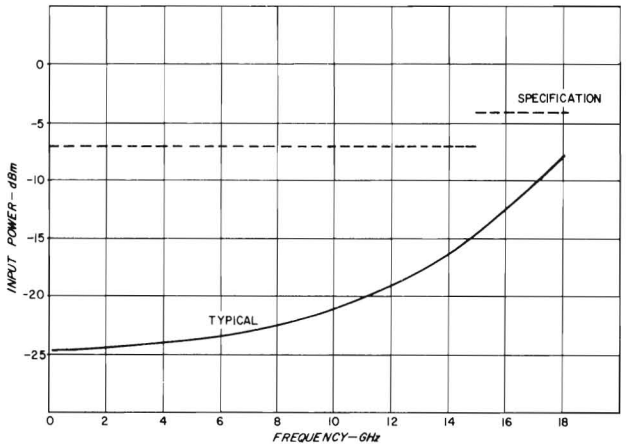
HARMONIC NUMBER

After the proper harmonic number ("N") is dialed into the 5257A thumbwheel switches and the 5257A is tuned, the counter readout will display the unknown input frequency without further calculations of any type. This is because: (1) unlike previous phase-locked manual transfer oscillators, the 5257A has no offset frequency whose value would have to be added or subtracted; and (2) dialing in N performs the one other calculation, that of multiplying the VFO frequency (which is a sub-harmonic of the unknown frequency) by the harmonic number.

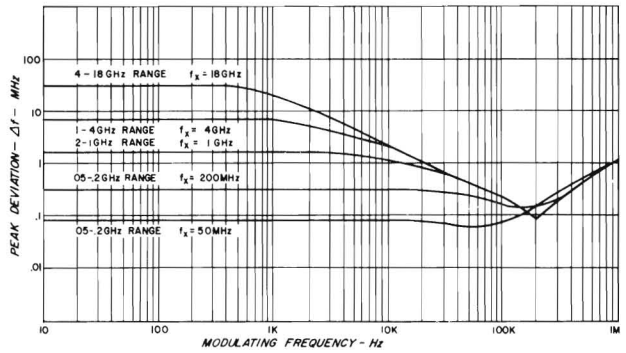
Harmonic number ("N") can be determined by the standard procedures used with all manually operated transfer oscillators. However, operation and calculation are simpler with the 5257A than with conventional transfer oscillators, including those units having charts to aid in determining "N." For complete details on determining "N" and for additional design, performance, and application details, please see Hewlett-Packard Journal, February 1968, page 9.

OTHER USES

In the 5257A's Pulsed RF mode, the input signal is "down-converted" by the sampler, and is available at the "Pulsed RF Out" port. Thus, the range of low frequency instruments (oscilloscopes, FM discriminators, etc.) can be extended to 18 GHz. Also, an oscilloscope can be connected for very precise observation of the pulsed RF zero beat.



INPUT SENSITIVITY



MAXIMUM INPUT FM PERMISSIBLE IN APC MODE

SPECIFICATIONS†

FREQUENCY RANGE: 50 MHz to 18 GHz.

INPUT SIGNAL CAPABILITY: CW Signals. Pulsed RF Signals. Signals with high FM content.

CW MEASUREMENT ACCURACY: Retains counter accuracy.

INPUT SENSITIVITY: 100 mV rms (— 7 dBm) for input frequencies of 50 MHz to 15 GHz. 140 mV rms (— 4 dBm) for input frequencies of 15 to 18 GHz and VFO FREQUENCY of 125-133.3 MHz.

INPUT IMPEDANCE: 50 ohms nominal.

MAXIMUM INPUT: + 10 dBm for CW Signals. 2 volts P-P for Pulsed RF Signals.

APC LOCK RANGE: Approximately ± 0.2% of input frequency.

METER: APC MODE—Indicates loop phase error under locked conditions. PULSED RF MODE—Zero beat indicator.

PULSED RF OUT: For external oscilloscope, 0.5 volt P-P.

► **PULSE CARRIER FREQUENCY MEASUREMENTS:** Minimum pulse width —0.5 μsec. Minimum repetition rate—10 pulses per sec. Accuracy—0.01 cycle per pulse width (typical error: ± 20 kHz or less for pulse width > 2 μs; ± 50 kHz < 2 μs).

VFO: Frequency Range—66.7 to 133.3 MHz. Drift—(With constant temperature in operational range of 0° to 55°C) typically ± 2 parts in 10^5 per minute immediately after turn on. Typically ± 1 part in 10^7 per minute after 2 hours of operation. Temperature Variation—Typically 1 part in 10^4 per degree C.

INPUT CONNECTOR: Precision Type N female.

WEIGHT: Net, 7¼ lb (3,3 kg). Shipping, 8 lb (3,7 kg).

► **PRICE:** $2,100.00.

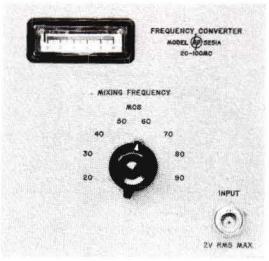
OPTION 01: Precision Type APC-7 input connector, add $25.00.

† When used with HP Electronic Counters: 5245M, 5245L (serial no. prefixed below 402 requires modification), 5246L, M54-5245L/M, M54-5248L/M, 5247M, 5248L/M, 5360A Computing Counter.

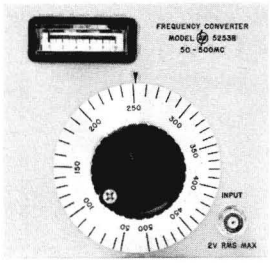
► Indicates change from prior specifications

FREQUENCY CONVERTER PLUG-INS

5251A



5253B



5254B

Retains Counter Accuracy □ Up to 1 Hz Resolution in 1 to 4 Seconds □ Easy to Operate—Has Smooth, Backlash-free, Spurious-free Tuning and a Level Indicator □ Sensitivity Is High and Relatively Constant □ AC Coupled Input in Most Models □ Cover DC to 12.4 GHz with Just 2 Converters, DC to 18 GHz with 3 □ Usable with HP 5360A Computing Counter, Too.

DESCRIPTION

Frequency converters increase the range of HP counters to 0.1, 0.5, 3, 12.4, or 18 GHz for CW signals. The stability and accuracy of the basic counter are retained in these higher frequency measurements because the converters use a multiple of the 10 MHz signal from the electronic counter crystal oscillator to beat with the signal to be measured. Operation of the equipment is simple and convenient, permitting non-technical personnel to make frequency measurements up to 18 GHz quickly and accurately. The converters have no spurious responses.

The basic measurement ranges of the counter are retained with the converter installed. Measurements to 50 MHz are obtained simply by moving the counter Sensitivity control off the "plug-in" position and connecting the input signal directly to the counter input.

The ac coupled inputs of the 5251A, 5253B, and 5245B prevent dc voltages which may be present along with the signal from affecting the measurement sensitivity or damaging the mixer circuits in the converter. The higher frequency ac coupled converters (5253B and 5254B) are unique in that the ac coupling is integrated into the input circuit, so it behaves as a transmission line with good VSWR; this results in relatively constant impedance (and converter sensitivity) over the entire frequency range. Thus, performance of these higher frequency converters is better than if ac coupling were achieved by simply using a series capacitor. The 5255A and 5256A also exhibit excellent VSWR.

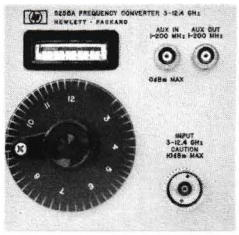
Models 5253B, 5254B, 5255A, and 5256A are cavity-tuned. Since constant bandwidth cavities are used, tuning peaks and dial "feel" (tuning peak spread) are the same over the entire dial.

OPERATION

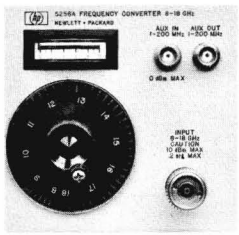
The converter subtracts multiples of 10, 50, or 200 MHz (depending upon converter model) from the CW frequency to be measured and provides the difference to be measured by the counter. For example, if a frequency of 279.25 MHz is to be measured with the 5253B, the operator tunes the converter dial upward from the lower end of the dial until the converter Level Indicator shows an acceptable voltage level. This will occur at a dial reading (mixing frequency) of 270 MHz for a 279.25 MHz input. At this dial setting, the converter will subtract 270 MHz from the input signal and pass 9.25 MHz, which the counter will measure and display. The measured frequency is then the sum of the counter and 5253B dial readings.

Readout resolution is 0.1 Hz with the counter gate time set to 10 seconds, 1 Hz at 1 second, 10 Hz at 0.1 second, etc. Counter gate time is automatically multiplied by 4 when the 5255A and 5256A are used.

5255A



5256A



Previously, only transfer oscillators could make high accuracy 3 to 18 GHz measurements. Now, the 5255A and 5256A permit measuring CW microwave frequencies with greater speed, accuracy, and simplicity at comparable price.

The 5255A and 5256A have internal prescalers that will add to your counter a direct readout range of 1 to 200 MHz with exceptionally high sensitivity (5 mV). Thus, by using a 5254B and 5255A, continuous coverage from dc to 12.4 GHz is obtained. The prescaler input is available at the AUX IN port, and inputs as low as 5 mV between 1 and 200 MHz are prescaled by 4 and displayed directly in MHz on the counter (no calculations needed). The 5255A and 5256A are also useful as down-converters; the heterodyne difference frequency is available at the AUX OUT port, so that 3 to 18 GHz inputs can be beat down to 200 MHz maximum, for oscilloscope observation, etc. Similarly, by adding a detector at AUX OUT, the units serve as microwave receivers.

If you are interested in design and performance details, please see HP Journal, September 1966.

SPECIFICATIONS

	5256A	5255A	5254B	5253B	5251A[1]
RANGE	8 to 18 GHz; as a prescaler, 1 MHz to 200 MHz	3 to 12.4 GHz; as a prescaler, 1 MHz to 200 MHz	0.2 to 3 GHz	50 to 512 MHz	20 to 100 MHz
MIXING FREQUENCIES	8 to 18 GHz in 200 MHz steps	2.8 to 12.4 GHz in 200 MHz steps	0.2 to 3 GHz in 50 MHz steps	50 to 500 MHz in 10 MHz steps	20 to 100 MHz in 10 MHz steps
INPUT VOLTAGE RANGE (min. to max., rms)	100 mV (—7 dBm) to 0.7 V (+10 dBm); as a prescaler, 5 mV (—33 dBm) to 0.22 V (0 dBm)[2]	100 mV (—7 dBm) to 0.7 V (+10 dBm); as a prescaler, 5 mV (—33 dBm) to 0.22 V (0 dBm)[2]	50 mV (—13 dBm) to 1 V (+13 dBm)	50 mV (—13 dBm) to 1 V (+13 dBm)	50 mV (—13 dBm) to 1 V (13 dBm); typical sensitivity, 20 mV
MAXIMUM INPUT OVERLOAD	0.7 V rms (+10 dBm) (as a converter) 0 dBm on AUX INPUT	0.7 V rms (+10 dBm) (as a converter) 0 dBm on AUX INPUT	2.2 V rms (+20 dBm); 125 V dc	2 V rms (+ 19 dBm), 100 V dc	2 V rms (+19 dBm), 100 V dc
NOMINAL INPUT IMPEDANCE	50 ohms	50 ohms	50 ohms	50 ohms	50 ohms
INPUT COUPLING	dc	dc	ac	ac	ac
ACCURACY	Maintains counter accuracy				
REGISTRATION	Counter display in MHz is added to converter dial reading				
LEVEL INDICATOR	Meter aids frequency selection and indicates usable signal level				
INSTALLATION	Into front panel plug-in compartment of HP Electronic Counters: 5245L,[5] 5245M, 5246L, 5247M, 5248L, 5248M, M54 versions, 5360A[7]			All models at left and 5243L[6]	
INPUT CONNECTOR	Precision Type APC-7 Connector (Option 01: Precision Type N female)[3]	Precision Type N female (APC-7, optional)	Type N female	BNC female	BNC female
WEIGHT Net Shipping	8¼ lb (3,8 kg) 10 lb (4,6 kg)	8¼ lb (3,8 kg) 10 lb (4,6 kg)	5 lb (2,3 kg) 7 lb (3,2 kg)	5 lb (2,3 kg) 7 lb (3,2 kg)	2 lb (0,9 kg) 4 lb (1,8 kg)
PRICE	► $1,950	► $1,850	$825	$500[4]	$300[4]

1 5253B is recommended since 0 to 512 MHz is thereby covered with the one plug-in (exception: the discontinued 5243L 20 MHz Counter requires both 5251A and 5253B to cover 0 to 512 MHz).

2 Output voltage from AUX OUTPUT of 5255A and 5256A is typically > 20 mV (into 50Ω load) for minimum countable input voltage.

3 It is not safe to assume flat, non-resonant operation of coaxial systems over the complete 12.4 to 18 GHz band. The APC-7 connector is beneficial in this respect and is therefore recommended.

4 Accessory furnished: HP 10503A Cable, 4 ft. (122 cm) long, male BNC connectors.

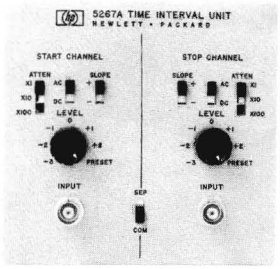
5 5245L serial number must be prefixed 402 or higher, or counter modification will be required.

6 Model 5243L is a discontinued product.

7 Model 10536A Adapter required for use with Model 5360A Computing Counter.

► Indicates change from prior specifications

TIME INTERVAL UNIT (5267A)



Resolution to 10 ns □ Measures Time Interval, Pulse Length, Pulse Spacing, Delays □ Triggers from Separate or Common Signals; Even Measures Consecutive, Like-polarity Events Occurring on Common Line □ Oscilloscope Z-Axis Markers

Model 5267A Time Interval Plug-in converts the 135 MHz HP Models 5248L, 5248M, and M54-5248L/M Counters into accurate time interval counters with a resolution down to 10 nanoseconds. It can also be used with other HP counters that have a front panel accessory compartment, but then only gives 100 ns resolution. It will measure the length of or spacing between electrical events regardless of wave shape, in a precise straightforward manner, even where the events occur in two different circuits. Intervals between consecutive, like-polarity events can be measured even when the pulses occur on a single input line. Time is read directly on the counter with the units and decimal indicated. Since the counted signal is derived from its precise oscillator, counter time base accuracy is retained. High input impedance (constant on all ranges) and high sensitivity permit measurements on high-impedance, low-voltage circuits.

Marker pulses, generated each time the input signal crosses the threshold set by the dual trigger level controls, are available on the rear panel of the counter for oscilloscope intensity (Z-axis) modulation. These marker dots identify the measured interval on the displayed input waveform.

By combining all the above capabilities in one relatively inexpensive plug-in, the 5267A offers a flexibility that was previously unavailable in most special-purpose time interval counters and counter plug-ins.

OPERATION

The count is started by a signal applied to the "Start" channel of the 5267A and is stopped by a signal applied to the "Stop" channel. To ensure maximum versatility in time interval measurement, the 5267A has separate threshold controls for each channel. These controls select the magnitude and polarity of the voltage as well as the slope of the signal required to actuate the channels. In addition, either separate waveforms or the same waveform can operate the channels since separate input connectors are provided for the "Start" and "Stop" channels. The inputs can be connected together, when preferred, by a front panel SEP-COM switch of the 5267A.

SPECIFICATIONS

RANGE:
100 ns to 10^8 s with HP 5248L/M or M54-5248L/M Counter.
1 μs to 10^8 s with 5245L, 5245M, M54-5245L/M, or 5243L Counter.
1 μs to 10^6 s with 6-digit 5246L Counter.

RESOLUTION:
To 10 ns with HP 5248L/M or M54-5248L/M Counter.
To 0.1 μs with 5245L, 5245M, M54-5245L/M, 5246L, or 5243L Counter.

INPUT REPETITION RATE: 5 MHz, max.

INPUT COUPLING: ac or dc (front panel switch for each channel).

STANDARD FREQUENCY COUNTED: 100 MHz to 1 Hz* in decade steps in HP 5248L or M or M54-5248L or M Counter.

INPUT SENSITIVITY: 0.3 V p-p (min.) x ATTENUATOR setting.

INPUT IMPEDANCE: 1 MΩ/35 pF for peak input voltages up to 3 times the ATTENUATOR setting.

MAXIMUM INPUT:
120 V rms for X1 ATTEN. setting.
250 V rms for X10 ATTEN. setting.
500 V rms for X100 ATTEN. setting.

ACCURACY (pulse): ±1 period of standard frequency counted ± time base accuracy.

REGISTRATION: On counter.

START-STOP: Independent or common channels.

TRIGGER SLOPE: Positive or negative on Start and Stop channels, independently selected.

TRIGGER AMPLITUDE: Both channels adjustable from −300 to +300 V peak.

MARKERS: Separate output pulses coincident with Start and Stop trigger points on input waveforms; −10 volt amplitude, 1.5 μs width (referred to a 0.1 MHz repetition rate), from source impedance of approximately 1.5 kΩ; available at rear panel of counter.

READS IN: μs, ms, sec, with measurements unit indicated and decimal point positioned.

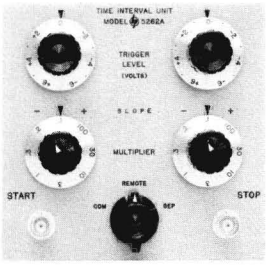
ACCESSORIES FURNISHED: 10503A Cable Assembly, male BNC to male BNC, 48 inches (122 cm) long.

WEIGHT: Net, 1.6 lb (710 gms). Shipping, 3.5 lb (1,6 kg).

PRICE: $400.00.

* 10 MHz to 1 Hz in HP 5245L/M, M54-5245L/M, 5246L, or 5243L Counter.

TIME INTERVAL UNIT (5262A)



Resolution to 0.1 μs □ Measures Time Interval, Pulse Length, Pulse Spacing, Delays □ Triggers from Separate or Common Signals

DESCRIPTION

Model 5262A Time Interval Unit Plug-in converts HP counters into accurate time interval counters with a resolution of 0.1 microsecond. You can measure pulse length, pulse spacing, and time between electrical events, such as a delay time, in a precise straightforward manner, even where the events occur in different circuits. Time is read directly on the counter with the units and decimal indicated. Since the counted signal is derived from its precise oscillator, counter time base accuracy is retained. Further, you can use the Model 5262A as an amplitude discriminator for the counter so that only signals meeting the requirements set by the trigger level controls are counted.

OPERATION

TIME INTERVAL MEASUREMENT

The count is started by a signal applied to the "Start" channel of the 5262A and is stopped by a signal applied to the "Stop" channel. To assure maximum versatility in time interval measurement, the 5262A has separate threshold controls for each channel. These controls select the magnitude and polarity of the voltage as well as the slope of the signal required to actuate the channels. In addition, either separate waveforms or the same waveform can operate the channels since individual input connectors are provided which may be connected together, when preferred, by the front panel switch of the 5262A. However, the interval between two like-polarity events on a common input will not be measured (use 5267A, p. 20). Marker pulses, generated each time the input signal crosses the threshold set by the trigger level controls, are available on the rear panel of the counter. The hysteresis of each trigger is multiplied by the multiplier dial setting. For oscilloscope intensity (Z-axis) modulation, a special model (H01-5262A) supplies both a ± 7V rectangular wave and − 14V pulses coincident with start and stop gates.

With the 5262A, the counter time base switch is manually controlled when using the H65-5245M counter (remote control option); for remotely controlled time base, use the H18-5262A (price upon request).

FREQUENCY-PERIOD MEASUREMENT

Model 5262A can also be used as an amplitude discriminator for determining the frequency or period of signals which exceed the settings of the Time Interval Unit's trigger level controls. The frequency of signals passing the start channel is counted simply by turning the function switch to Frequency; period average is likewise measured by setting the function switch to a Period Average position. Signals applied to the stop channel may also be counted by connecting the stop marker pulse output to the counter Signal Input and setting the sensitivity control to 0.1. Thus, two independently discriminated signals can be measured simply by changing the sensitivity control between the two adjacent positions of plug-in and 0.1 volt.

SPECIFICATIONS*

RANGE: 1 μs to 10^8 s (to 10^6 s with 6-digit 5246L).

RESOLUTION: Down to 0.1 μs.

STANDARD FREQUENCY COUNTED: 10^7 to 1.0 Hz in decade steps from counter or externally applied frequency to 50 MHz.

INPUT VOLTAGE: 0.3 volt, P-P, minimum, direct coupled input.

INPUT IMPEDANCE AND OVERLOAD: Input Impedance (constant up to 40 volts times Multiplier setting):

Multiplier	Input Impedance		Overload (Max. Input)
	Resistance	Capacitance	
× 0.1	10 K	80 pF	50 V rms ± 150 V peak
× 0.2	10 K	80 pF	
× 0.3	30 K	40 pF	
× 1	100 K	20 pF	150 V rms ± 250 V peak
× 3	300 K	20 pF	
× 10	1 meg	20 pF	250 V rms ± 250 V peak
× 30	3 meg	20 pF	
× 100	10 meg	20 pF	

ACCURACY (pulse): ± 1 period of standard frequency counted ± time base accuracy.

REGISTRATION: On counter.

START STOP: Independent or common channels.

TRIGGER SLOPE: Positive or negative on Start and Stop channels, independently selected.

TRIGGER AMPLITUDE: Both channels adjustable from − 250 to + 250 V.

FREQUENCY RANGE: 0 to above 2 MHz when used as input signal discriminator.

MARKERS: Separate output voltage steps, 0.5 volt peak-to-peak from source impedance of approximately 7K ohms, 100 pF; available at rear panel of counter with negative step coincident with trigger points on input waveforms for positive slope and positive step coincident for negative slope.

READS IN: μs, Ms, sec with measurements unit indicated and decimal point positioned.

ACCESSORIES FURNISHED: 10503A Cable Assembly, male BNC to male BNC, 48 inches (122 cm) long.

WEIGHT: Net, 2½ lb (1,4 kg). Shipping, 4¼ lb (1,9 kg).

PRICE: $250.00.

* When used with HP Electronic Counters: 5245L/M, 5246L, 5248L/M, M54-5245L/M, M54-5248L/M, or 5243L.

PRESCALER (5252A)
DC to 350 MHz

Direct Readout and Printout □ Counts Any Waveform or Random Pulses □ Retains Counter Accuracy □ Automatic—No Tuning Needed

DESCRIPTION

Model 5252A Prescaler Plug-in extends counting capability to 350 MHz with direct readout in frequency. Input frequency prescaling (dividing) is accomplished, without tuning, by transistor binary dividers. Since the prescaler operates down to dc, the average frequency of continuous or random waveforms and pulses can be counted. The TRIGGER LEVEL and MAX COUNT RATE controls provide valuable versatility when unusual measurement conditions are encountered. Otherwise, these controls need not be touched. The 5252A can remain connected when the counter is used for scaling input frequencies thereby extending the counter's scaling by factors of 2, 4, or 8.

TRIGGER LEVEL

The screwdriver-adjusted front panel trigger level control has a range of approximately ± 1 volt. It is set at the factory for optimum operation on input signals which are symmetrical about ground, but can be adjusted to discriminate against unwanted signals or for operation on either positive or negative inputs.

MULTIPLE SCALE FACTORS

Multiple scale factors permit optimizing measurement speed according to the maximum frequency measured. The factors are selected by the MAX COUNT RATE switch, which selects the factor by which the input is divided (prescaled) and by which the counter gate time is adjusted. The gate time adjustment causes readout and printout to be directly in frequency. In the 100 MHz position the input frequency is divided by 2 and the counter gate time is increased by 2. At the 200 MHz and 350 MHz positions, scale factors are 4 and 8. The switch can be left at 350 MHz for any input from dc to 350 MHz, but the other positions increase measurement speed, with no sacrifice in accuracy.

CONVENIENT USE

Measurements are displayed directly in megahertz on the counter's readout with the correct decimal point and a "kHz" or "MHz" symbol. Measurement and decimal point are also available in BCD form at the rear panel of counters equipped with a digital output connector.

If desired, separate inputs can remain connected to the prescaler and the counter's main frame at all times; the prescaler input will be selected for counting when the SIGNAL INPUT switch is at the PLUG-IN position, and the main frame input will be selected in the other switch positions. Or, the input can be connected to the 5252A only, then frequencies from dc to 350 MHz can be measured without changing any control settings on the counter or prescaler.

SPECIFICATIONS*

OPERATING FREQUENCY RANGE: DC to above 350 MHz.

ACCURACY: Same as the basic counter.

INPUT SENSITIVITY: 100 mV rms.

MAXIMUM INPUT: 2 volts rms, + 20 dBm, or 100 mW.

INPUT IMPEDANCE: 50 ohms (nominal).

OPERATING TEMPERATURE RANGE: — 20°C to + 55°C.

SCALED OUTPUT: 100 mV rms into 50 ohms available at AUX A output BNC connector of 5245L/M or 5248L/M.

DOUBLE PULSE RESOLUTION: 2.8 ns.

MINIMUM PULSE AMPLITUDE: 280 mV.

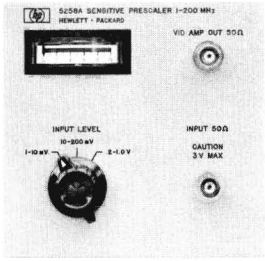
ACCESSORY FURNISHED: HP 10503A Cable Assembly, male BNC connectors, 48 inches (122 cm) long.

WEIGHT: Net, 2.2 lb (1 kg). Shipping, 4 lb (1,8 kg).

PRICE: $685.00.

* When used with HP Counters: 5245M, 5245L (serial no. below 402 requires modification), 5246L, 5247M, 5248L/M, M54-5245L/M, or M54-5248L/M.

SENSITIVE PRESCALER (5258A)
1 to 200 MHz



Direct Readout and Printout □ Sensitivity to 1 mV □ Automatic—No Tuning Needed □ Retains Counter Accuracy □ Meter Indicates Signal Level □ Video Amplifier Output

DESCRIPTION

Model 5258A Sensitive Prescaler Plug-in extends the direct counting capability of HP electronic counters to 200 MHz and greatly increases the input sensitivity. It can also be used as a video amplifier. Input frequency prescaling (dividing) is accomplished, without tuning, by transistor binary dividers operating over the frequency range from 1 MHz to 200 MHz. The prescaler also adjusts the counter's time base an equal amount to provide direct readout in frequency.

OPERATION

The input signal is applied to a broadband amplifier and tunnel diode trigger prior to reaching the transistor binary dividers. The circuitry is stable and independent of frequency, and no adjustments are needed over the entire frequency range. An input attenuator switch on the front panel enables the prescaler to be used with inputs over the range of 1 mV to 1 V. A front panel meter indicates a deflection in the green area when an adequate voltage is present at the input. The counter is inhibited if the unknown signal is not adequate to operate the counter. A video output connection permits using the 5258A as a video amplifier or for oscilloscope monitoring of the unknown signal being measured.

Separate input cables can remain connected to the prescaler and the main frame of the counter at all times. Then, the input signal connected through the prescaler will be selected for counting when the SIGNAL INPUT switch is at the PLUG-IN position, and the main frame input will be selected in the other switch positions.

SPECIFICATIONS*

OPERATING FREQUENCY RANGE: 1 MHz to 200 MHz.

ACCURACY: Same as basic counter.

INPUT SENSITIVITY: 1 mV/10 mV/0.2 V rms as selected by front panel switch.

RESOLUTION: 1 Hz in 4 sec., 10 Hz in 0.4 sec., etc.

INPUT IMPEDANCE: 50 ohms.

INPUT SCALING FACTOR: ÷ 4.

OPERATING TEMPERATURE RANGE: — 20°C to + 65°C.

SCALED OUTPUT: 100 mV rms into 50 ohms is available at the AUX A output BNC connector of the basic counter (5245L/M, 5248L/M).

AS A VIDEO AMPLIFIER: 30 dB maximum gain on 1 mV setting.

ACCESSORY FURNISHED: HP 10503A Cable Assembly, male BNC connectors, 48 inches (122 cm) long.

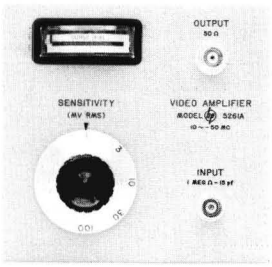
WEIGHT: Net, 4.75 lb (2,16 kg). Shipping, 6.75 lb (3,1 kg).

► **PRICE:** $900.00.

* When used with HP Counters: 5245M, 5245L (serial no. prefix below 402 requires modification), 5246L, 5247L, 5248L/M, M54-5245L/M, or M54-5248L/M.

► Indicates change from prior specifications

VIDEO AMPLIFIER PLUG-IN (5261A)



Increased Sensitivity and Input Impedance for HP Electronic Counters □ Measure Frequency of Small Signals □ Meter Indicates Signal Level to Simplify Measurements □ Oscilloscope Output to Monitor Signal

DESCRIPTION

The 5261A Video Amplifier increases the electronic counter's sensitivity to 1 millivolt rms over the range of 10 Hz to 50 MHz (20 MHz, 5243L), and has an input resistance of 1 megohm. Thus it makes possible frequency measurements of low-level signals. When using the 5261A on the most sensitive ranges, precaution should be taken to exclude the presence of stray radiation from the immediate measurement area, as the unit will respond to signals as low as 1 millivolt, with a resolution of 20nsec (50nsec in the 5243L) and spurious signals may affect accuracy. A meter is provided so that the operator can be sure that the unknown voltage is adequate to operate the counter. A useful feature of the 5261A is a 50-ohm output for oscilloscope monitoring of the unknown signal being measured. A 10-megohm, 10:1 divider probe is available as an accessory to facilitate measurements in high impedance circuits.

SPECIFICATIONS*

BANDWIDTH: 10 Hz to 50 MHz with 5245L; 10 Hz to 20 MHz with 5243L.

INPUT SENSITIVITY: 1 mV to 300 mV rms.

MAXIMUM INPUT: 100 V dc; 5 V rms (ranges: 1, 3, 10, 30, 100 mV).

INPUT IMPEDANCE: Approximately 1 megohm, 15 pF shunt. 10003A Probe increases impedance to 10 megohms, 10 pF shunt.

MONITOR: Meter shows when the signal level is acceptable to the counter.

ACCURACY: Retains accuracy of electronic counter.

AUXILIARY OUTPUT: Separate BNC front panel output for oscilloscope monitoring or for driving external equipment; 50-ohm source impedance. On amplifier's most sensitive attenuator range, 1 mV rms at input results in at least 100 mV rms at auxiliary output into 50-ohm load. Maximum undistorted output is 300 mV rms into a 50-ohm load.

ACCESSORY FURNISHED: 10507A Low Microphonic 50-ohm cable, 48 inches (122 cm) long, BNC connectors.

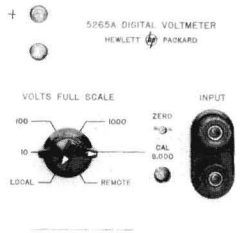
ACCESSORIES AVAILABLE:
10003A 10:1 Probe, 10 pF shunt, 600 V maximum, $30.00.
10100A 50-ohm Feed-Thru Termination, $15.00.

WEIGHT: Net, 2 lb (0,90 kg). Shipping, 4 lb (1,8 kg).

PRICE: $325.00.

* When used with HP Electronic Counters: 5245L/M, 5246L, 5247M, 5248L/M, M54-5245L/M, or 5243L.

DVM PLUG-IN (5265A)



Adds Digital Voltmeter Capability to HP Counters □ 6-digit Presentation of DC Voltages □ Accuracy ± 0.1% of Reading □ High Input Resistance, 10.2 Megohms □ Automatic Polarity Selection and Indication

DESCRIPTION

Model 5265A Digital Voltmeter Plug-in quickly converts your HP counter to an accurate dc digital voltmeter. It can be easily operated by nontechnical personnel for production-type voltage measurements. Operation is straightforward—simply set range switch, connect the voltage to be measured, and read. Decimal points are properly positioned and polarity is automatically indicated.

Fundamentally, the 5265A is a voltage to time interval converter which uses a linear voltage ramp and voltage coincidence circuits to define the time interval. Since the ramp is linear with time, the time interval is directly proportional to input voltage, and is measured by counting a 10 MHz signal from the counter's time base.

A Local-Remote switch permits remote selection of the DVM mode or the regular electronic counter functions (with Remote Operation, H65 prefix, pp. 9 and 11).

SPECIFICATIONS*

VOLTAGE RANGE: Six-digit presentation of 10.0000, 100.000, and 1000.00 volts full scale with 5% overrange capability.

REGISTRATION: On electronic counter.

READS IN: DC volts with decimal point positioned by range switch; automatic polarity indicator.

ACCURACY (0 to + 50°C): ± 0.1% of reading above 1/10 full scale; ± 0.01% of full scale below 1/10 full scale.**

INTERNAL CALIBRATION REFERENCE: Zener diode.

SAMPLE RATE: 5 per second to 1 per 5 seconds, with storage between samples and Hold for sampling on Command.

RANGE SELECTION: Manual.

PROGRAMMING: DVM mode or counter functions may be selected remotely (remote operation requires H65-5245M or H65-5245L).

INPUT RESISTANCE: 10.2 megohms to DC on all ranges.

INPUT FILTER
AC Rejection: 30 dB at 60 Hz, increasing at 12 dB per octave.
Response Time: To a step function input, less than 450 msec to achieve 99.95% of final value.

DIGITAL OUTPUT: Measurement, polarity, and decimal point are supplied in BCD form; see counter specifications, page 7.

ACCESSORY FURNISHED: 5060-0630 22-pin extender board.

WEIGHT: Net, 2½ lb (1,1 kg). Shipping, 4¼ lb (1,9 kg).

► **PRICE:** $625.00.

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* When used with HP Electronic Counters: 5245M, 5245L (serial no. prefix below 402 requires modification), 5246L, 5248L/M, M54-5245L/M, M54-5248L/M, or 5243L (serial no. prefix below 327 requires modification).

** Within 24 hours and ± 10°C temperature change since front panel calibration adjustments and within 6 months of internal zener reference calibration.

► Indicates change from prior specifications

PRESET UNIT (5264A)

Normalized Measurements—Read Directly in Engineering Units □ Divide Input Frequency by N □ Use for High Speed Batch Counting and Control

DESCRIPTION

When plugged into an HP 5245L/M, 5246L, or 5248L/M counter, the 5264A extends the versatility of the counter's time base. In addition to retaining the basic measurement functions and range of the counter, the 5264A also makes possible:

Frequency measurements for N units of time (N × FREQ)

Measurement of time for N events to occur (N × PERIOD)*

Ratio and Normalized Ratio measurements (N × RATIO)*

Counting N events (PRESET)

Division of input frequency by N

In these measurements N may be any integer from 1 to 100,000 (N = 100,000 when all N switches are set to 0).

Such versatility is achieved by using a set of decade dividers in the 5264A Preset Unit to control the gate of the counter. These decade dividers, which may be preset to any integer from 1 to 100,000, open the counter's gate when the first pulse is received and close the gate when the Nth pulse is received. Separate output signals from the counter are available to operate other equipment whenever the gate opens or closes.

N × FREQUENCY MEASUREMENTS

In N x frequency measurements, gate time is controlled by the preset decades (N) and the setting of the counter's Time Base switch (10μs to 10sec†). The gate is held open for N periods (N = 1 to N = 100,000) of the time base setting. For example, when the Time Base switch is set to 10μs, the gate time is set from 10μs to 1 sec in 10μs steps; setting the Time Base to 10 sec can give a gate as long as 10^6 seconds.

This selectable gate time makes possible normalized readings, or conversion of frequencies into practical units. For instance, if a tachometer generator, which produces 100 pulses per revolution, is connected to a rotating shaft, a gate setting of 10.0000ms (0.01sec) will measure RPS directly or a setting of 600.00ms (0.6sec) will measure RPM.

The long gate times that are available (up to 10^6 seconds) permit measurement of low frequencies with high accuracy.

RATIO, N × RATIO MEASUREMENTS*

Model 5264A permits ratio measurements over a wide range of frequencies and with a choice of normalizing factors from 1 to 100,000 in one-digit steps. The higher frequency signal (f_1) is connected to the counter's Ext. Time Base input and is counted by the readout decades; the lower frequency signal (f_2) is connected to the counter's signal input, is divided down by the preset decades, and controls the gate.

Thus, f_1 is counted for N periods of f_2 and the counter displays $Nf_1 \div f_2$.

DIVIDING BY N

Another operation provided by the 5264A is division of any input frequency up to 100 kHz by N. (Even higher division ratios are possible by using the counter to prescale the input signal in decade steps. Using this technique, frequencies as high as the maximum rate of the counter can be divided by a five-digit number so long as the frequency supplied the Preset Unit does not exceed 100 kHz.*)

N × PERIOD MEASUREMENTS*

In the N x PERIOD mode of the 5264A, the counter measures the time for N events to occur. The measurement may be made in increments of 0.1μs to 10 seconds, depending on the setting of the counter's Time Base switch.

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* Not with Model 5246L Electronic Counter.

† To 1 sec with Model 5246L Electronic Counter.

Period and multiple period measurements are also easily made with the mode switch in the N x PERIOD position. Period average is determined by dividing the time reading by N. The ability to choose the number of input cycles measured and to choose time increments allows the operator to achieve the greatest accuracy possible, or to obtain a required accuracy in the shortest measurement time.

PRESET COUNTING

When the mode switch of the 5264A is set to PRESET, N events are counted. The first event opens the gate; the Nth closes the gate. This feature is useful in batching, as the gate signal can be used to control external circuitry or relays.

SPECIFICATIONS*

N × FREQUENCY (Counter Signal Input)

RANGE:

5245L/M, 5248L/M, M54-5245L/M, M54-5248L/M, 5246L: 0 to 50 MHz.

5243L: 0 to 20 MHz.

GATE TIME: (set by counter Time Base and "N" switches)
10 μsec to 1 sec in 10-μsec steps
100 μsec to 10 sec in 100-μsec steps
1 msec to 100 sec in 1-msec steps
10 msec to 10^3 sec in 10-msec steps
0.1 sec to 10^4 sec in 0.1-sec steps
1 sec to 10^5 sec in 1-sec steps
10 sec to 10^6 sec in 10-sec steps†

ACCURACY: ± 1 count ± time base accuracy.

MAXIMUM SENSITIVITY: 0.1 volt rms.

ATTENUATOR: 3-position, 0.1, 1, and 10 V.

INPUT IMPEDANCE: Connected to, and therefore same as, Signal Input of HP counter.

N × RATIO†

f_1 (Counter Ext. Time Base Input)

FREQUENCY RANGE: 5245L/M, 5248L/M, M54-5245L/M, M54-5248L/M, 0 to 50 MHz; 5243L, 0 to 20 MHz.

SENSITIVITY: 0.1 volt rms.

INPUT IMPEDANCE: 1 M ohm; 20 pF shunt.

f_2 (Counter Signal Input)

FREQUENCY RANGE: 0 Hz to 100 kHz.

MAXIMUM SENSITIVITY: 0.1 volt.

ATTENUATOR: 3-position, 0.1, 1, and 10 V.

INPUT IMPEDANCE: Connected to, and therefore same as, Signal Input of HP counter.

READS: N x f_1/f_2.

ACCURACY: ± 1 count of f_1.

DIVIDE by N (5264A Auxiliary Input, f/N)

FREQUENCY RANGE: 20 Hz to 100 kHz (sinusoidal).

SENSITIVITY: 0.1 V rms.

OVERLOAD: Signals in excess of 10 V rms may damage the instrument.

PRESCALING: The prescaling feature of the 5245L/M, 5248L/M, M54-5245L/M, M54-5248L/M can be used to scale a frequency to below 100 kHz so it can be further scaled by the f/N function of the 5264A. See specifications, SCALING, pages 8 and 10.

OUTPUT: 0.2 V peak-to-peak centered at 0 volts, into high impedance load. Rise time < 1 μsec, duration approximately 5 μsec.

INPUT IMPEDANCE: 1 M ohm, 50 pF shunt.

N × PERIOD (Counter Signal Input)†

INPUT FREQUENCY RANGE: 0 Hz to 100 kHz.

MAXIMUM SENSITIVITY: 0.1 volt rms.

ATTENUATOR: 3-position, 0.1, 1, and 10 V.

INPUT IMPEDANCE: Connected to, and therefore same as, Signal Input of HP counter.

TIME UNITS: 0.1 μsec to 10 sec in decade steps.

ACCURACY: ± 1 count ± time base accuracy ± trigger error.**

PRESET (5264A Auxiliary Input)

INPUT FREQUENCY RANGE: 20 Hz to 100 kHz.

MAXIMUM SENSITIVITY: 0.1 volt rms.

OVERLOAD: Signals in excess of 10 V rms may damage the instrument.

INPUT IMPEDANCE: 1 M ohm, 50 pF shunt.

OUTPUT: Approximately + 10 volts on gate open, approximately — 10 volts on gate closed, source impedance 18K ohms.

PRESET RANGE: 1 to 99,999 in steps of one.

GENERAL

PROGRAMMING: All MODE switch positions can be remotely programmed when 5264A is used with H65-5245L/M or H65-5248L/M (see Remote Operation, pages 9 and 11). N may not be remotely preset.

WEIGHT: Net, 3 lb (1,4 kg). Shipping, 4¾ lb (2,2 kg).

ACCESSORY FURNISHED: 10503A Cable, 4 ft. (122 cm) long, male BNC connectors.

PRICE: $650.00.

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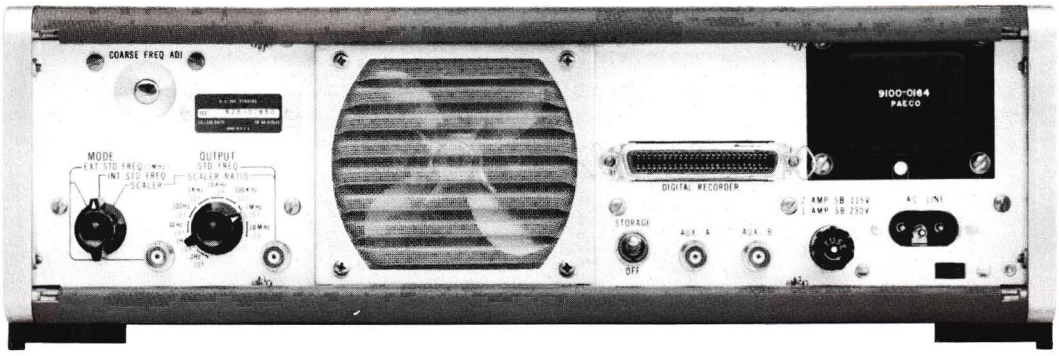
* When used with HP Electronic Counters: 5245M, 5245L (modification required for serial no. prefix below 402), 5246L, 5248L/M, M54-5245L/M, M54-5248L/M, or 5243L, except as noted above and below.

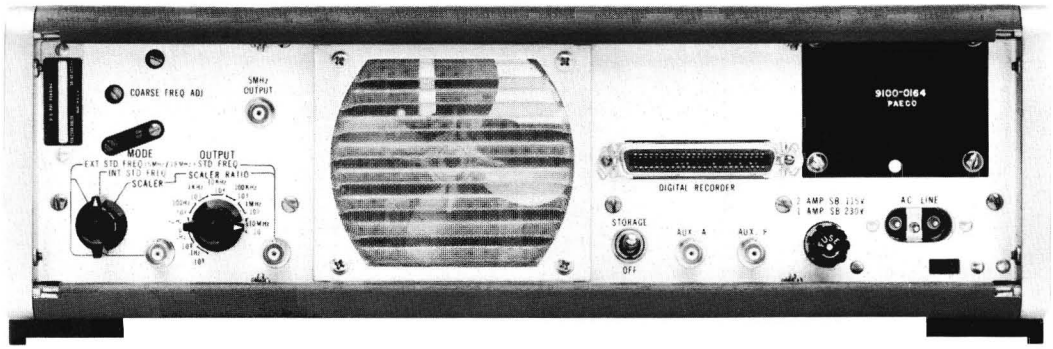
** Trigger error (sine wave) < 0.3% of one period ÷ N for > 40 dB signal-to-noise ratio on > 100 mV input signal. Trigger error decreases with increased signal amplitude and slope.

† Not with 5246L Electronic Counter.

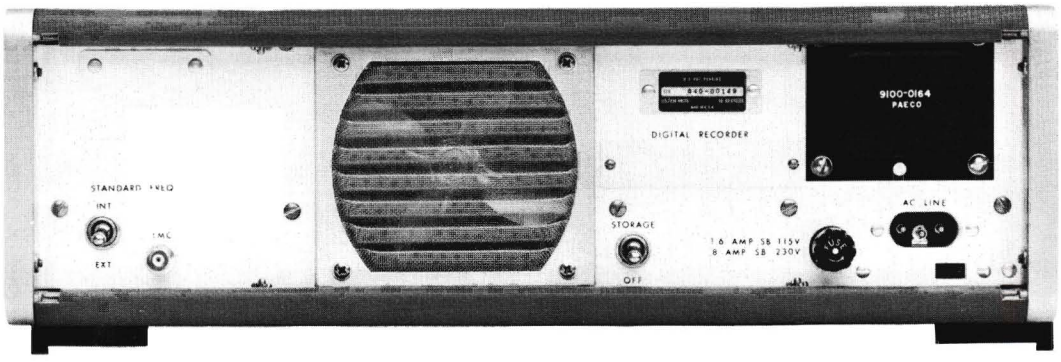
REAR PANELS



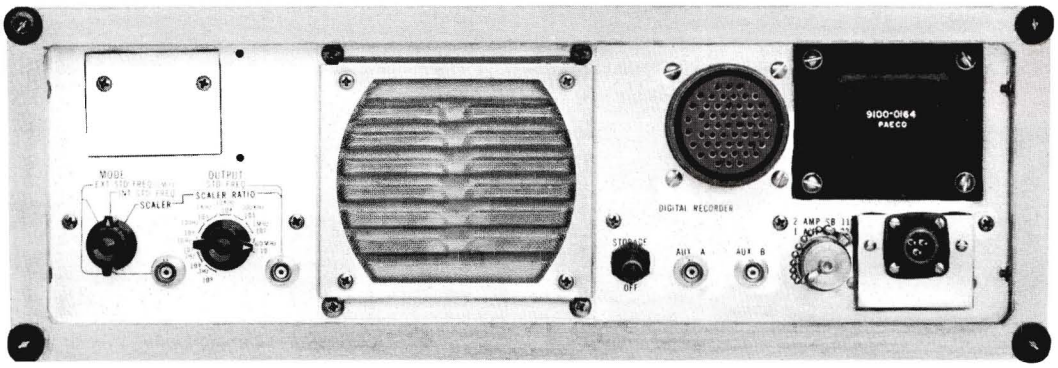
5245L



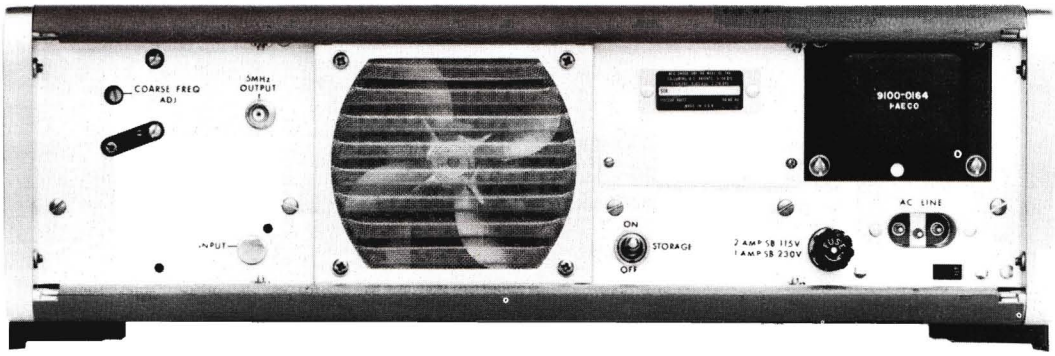
5245M



5246L

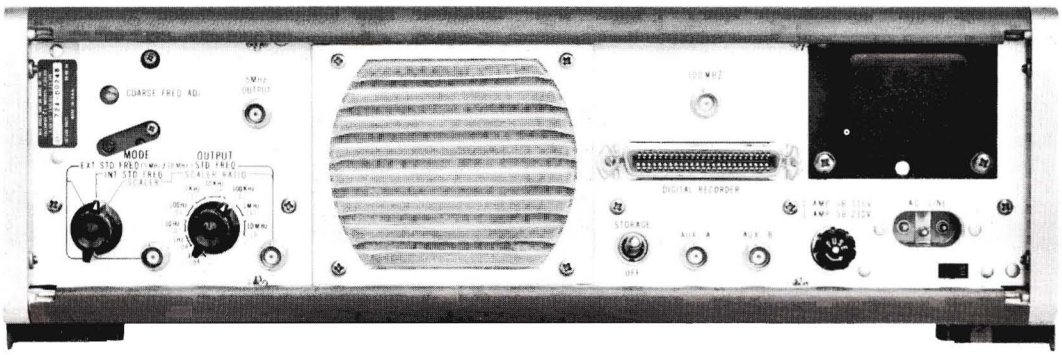


M54-5245L



5247M

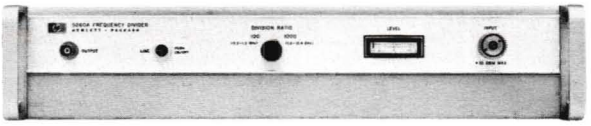
5248L



5248M

COMPLEMENTARY EQUIPMENT

5260A Automatic Frequency Divider



The 5260A permits fast, automatic, frequency measurement with direct readout from 0.3 to 12.4 GHz with any 12.4 MHz counter. It divides CW input frequencies by 100 or 1000 and retains counter accuracy. For automatically positioned decimal point and a "GHz" symbol in the counter's readout, order 5260A Option 02 and M07 modification to 5245L/M and 5248L/M Electronic Counter. Counters with M07- prefix also have H65 remote control capabilities (see counter specifications). **Price:** 5260A, $3,700.00.

2590B Microwave Frequency Converter

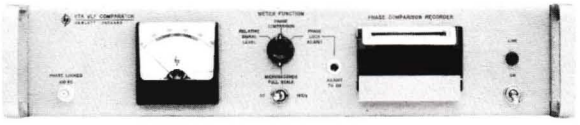
The 2590B provides phase-locking of an internal transfer oscillator to the signal frequency, thereby achieving a frequency measurement accuracy equal to that of the counter time base. When used with an HP 50 MHz counter* with 5253B Frequency Converter or 5252A Prescaler, a complete system is formed. May also be used for observation of jitter, PM, and AM on drifting signals, for the measurement of deviation rate, and the frequency of pulsed signals. **Price:** 2590B, $2,150.00.

* 5246L counter must bear H29- prefix.

540B Transfer Oscillator

Measures frequencies from 10 MHz to 12.4 GHz with a counter and 5252A or 5253B plug-in (to 18 GHz with accessory P932 Harmonic Mixer). Measures center frequency and deviation of FM signals using built-in oscilloscope. Accurately measures carrier frequency of pulsed signal with external oscilloscope. Clean CW signals can be measured to 1 part in 10^7; without a counter 10 MHz to 4 GHz can be measured to about $\pm$ 0.5%. **Price:** $1,150.00.

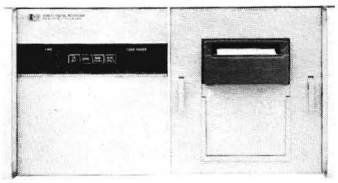
117A VLF Comparator



Here is a VLF receiver and phase comparator for calibrating your counter time base (or other frequency standards) to the standard frequency signals from U.S. National Bureau of Standards Station WWVB (60 kHz). Built-in strip chart recorder plots phase difference, permits realizing full accuracy built into the counter and using counter time base as a calibrated frequency standard. Comes complete with loop antenna and preamplifier.
Price: $1,400.00.

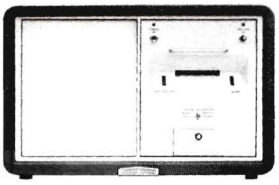
COMPLEMENTARY EQUIPMENT

5050B Digital Recorder



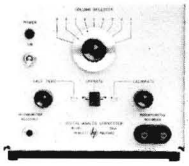
Asynchronously prints up to 18 columns of data, 20 lines/sec, max. Operates from BCD data. Quiet, reliable. Formats and codes changed mechanically without expensive electronic changes.
Price: $1,900.00 without the electronic circuit boards, which are an additional $100.00 for each 2 columns ordered. Option 51, data storage (< 100 μs transfer time, 1.3 V input) for 10 columns, $200.00; Option 50, storage for all columns, $400.00. Option 55, digital clock, $950.00. Standard input cables, $50.00 to $65.00.

562A Digital Recorder



Up to 11 columns of data printing from HP counters, digital voltmeters, etc., 5 lines/sec, max. Plug-in electronic circuit boards for parallel entry BCD or 10-line codes. Storage and 2 ms transfer time for BCD inputs.
Price: 562A (rack mount), $1,715.00 for 6-column BCD input, $2,183.00 for 11 columns (typical). Add $25.00 for 562A (cabinet mount). Auxiliary analog output to operate recorders, galvanometers, $175.00.

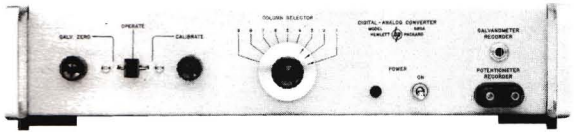
Digital-Analog Converters



581A

Convert 4-line BCD digital data from HP counters to analog dc voltages for strip chart or X-Y recorders. Any three successive digits (or right-hand two) may be chosen for conversion. Transfer time, 1 ms. Accuracy, 0.5%. Potentiometer Output, 100 mV full scale into 20 KΩ. Galvanometer Output, 1 mA full scale into 1500 Ω.
Price: 580A (for rack or bench), $550.00. 581A (bench), $575.00.

580A



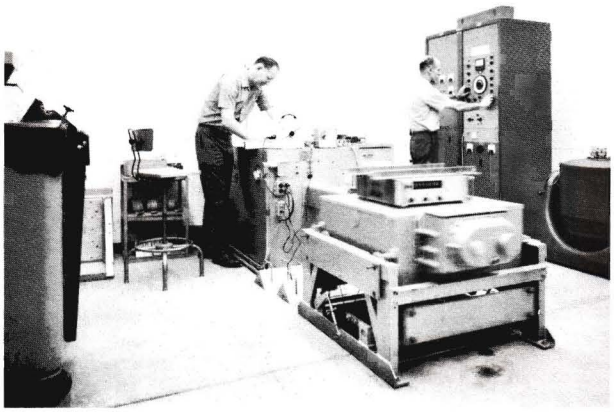
E40-5245L DC to 40 GHz System

This system offers highest performance and greatest convenience of any digital frequency measurement method covering this range. Provides all benefits of the 5245L Counter and 5257A Transfer Oscillator from dc to 18 GHz. From 12 GHz to 40 GHz it offers: wide phase lock range (±0.1%) for easy tuning and measuring noisy or FM signals; high local oscillator frequency of 2 to 4 GHz to avoid crowded lock points and permit using one convenient harmonic number (10) from 20 to 40 GHz; accurate l.o. calibration for faster more certain operation; typical sensitivity −30 dBm. System uses standard HP instruments: 5245L Counter, 5257A Transfer Oscillator, 8690A/H15-8692 Sweep Oscillator, 8709A Synchronizer — all usable separately, too. **Price:** $10,500.00 complete; or if you already own some of these instruments, buy only the missing ones.

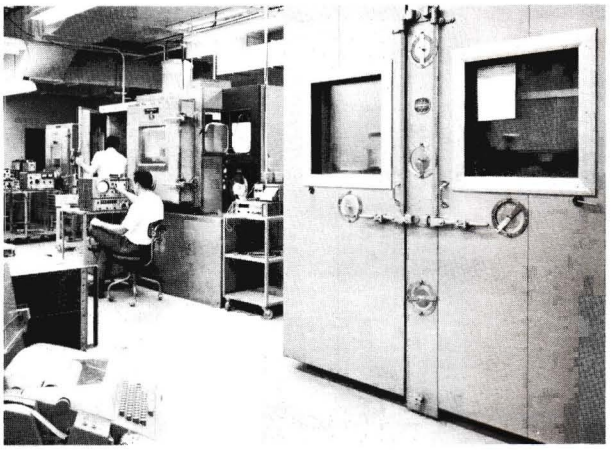
RELIABILITY AND ENVIRONMENTAL TESTING

HP counters are subjected to tests in environments that are much more stringent than normally expected for commercially priced equipment. All instruments in development undergo extensive tests such as shock, vibration, high and low temperature, humidity, electromagnetic compatibility (RFI), and changes in line voltage and frequency. Components undergo environmental tests in the HP Components Evaluation Laboratory. Quality audits are performed regularly to ensure that original performance and quality standards are being met. Finally, each 5245 Series Counter gets severe temperature testing before shipment.

Standard HP counters have passed military environmental tests and have been assigned MIL nomenclature (data upon request).

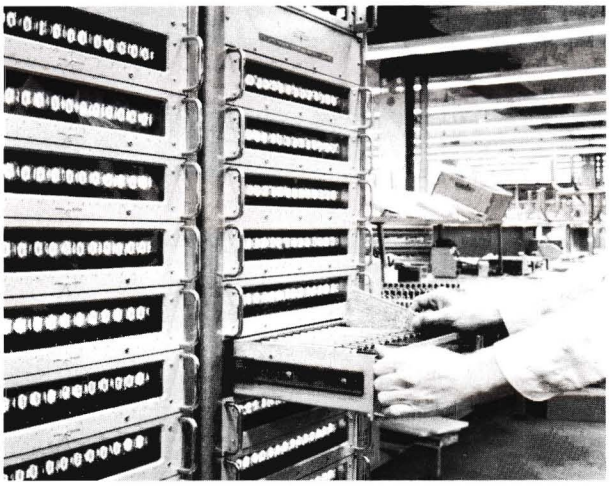


To force any marginal components to fail before shipment, all 5245-46-47-48 Counters are operated at +65°C for at least 16 hours in heated cabinets.



Here's part of HP's extensive in-house test facility where instruments are tested under extreme shock, vibration, temperature, humidity, and electromagnetic conditions.

In one of numerous tests, all Model 5245, 5247, and 5248 crystal oscillator assemblies are operated and observed for two weeks to determine aging rates.



Decade counting assemblies for all 5245-46-47-48 Counters undergo a temperature of 80°C for 2 hours to force failure of any marginal components. The assemblies are then operated for 22 hours at room temperature.

For more information, call your local HP Sales Office or East (201) 265-5000 • Midwest (312) 677-0400 • South (404) 436-6181
West (213) 877-1282. Or, write: Hewlett-Packard, 1501 Page Mill Road Palo Alto, California 94304 In Europe, 1217 Meyrin-Geneva

Printed in U.S.A.

5952-0500