

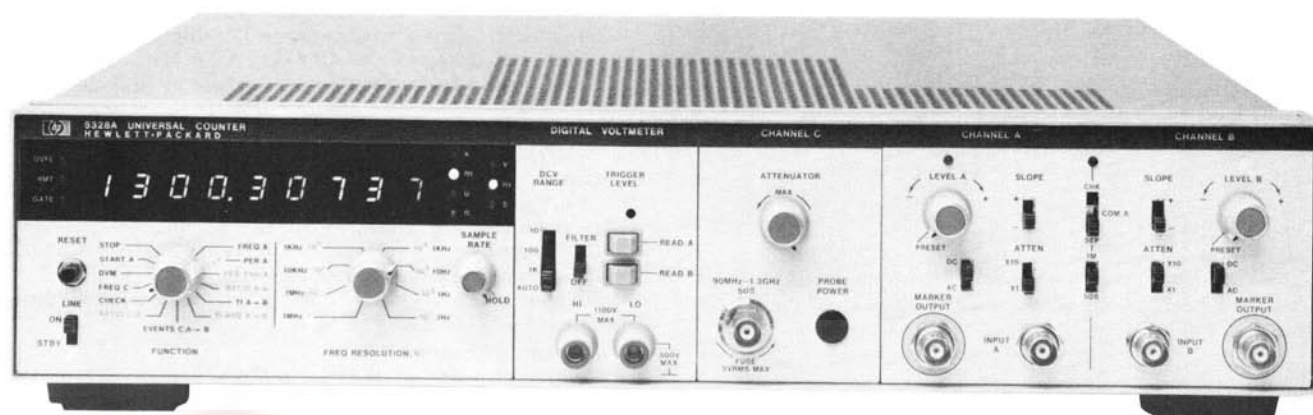


ELECTRONIC COUNTERS

100 MHz Universal counter

Model 5328A

- 100 MHz, 512 MHz and 1300 MHz
- 100 ns or 10 ns time interval
- T.I. averaging to 10 ps resolution
- "Armed" measurements
- DVM options
- HP-IB interface option



5328A with Opt 021,031,041

HP-IB

Description

The 5328A, thru the use of the latest technology (such as a ROM controlled measurement cycle) and a modular design, provides you with the optimum in universal counter price/performance. Optional modules allow you to tailor the performance of the 5328A to meet your particular measurement needs. In many instances, however, the standard 5328A offers all the capability you're ever likely to need.

Burst and CW measurements to 100 MHz: special gating circuits start a measurement only when the input signal is present, allowing burst frequencies to be measured as easily as CW signals. The option 030 channel C extends this capability to 512 MHz; option 031, to 1300 MHz.

Single shot time interval measurements: the standard universal module's 100 ns single shot resolution meets or exceeds the requirements for a wide range of applications such as mechanical and electromechanical device timing (relays), time of flight measurements (ballistics), sonar ranging, radio ranging and navigation

Time interval averaging: resolution better than 10 ps (10^{-11} seconds) for repetitive time intervals as short as 100 ps.

Period, period average, ratio, totalize, scale: extra problem solving power for your special requirements.

Armed measurements: versatile arming modes (controlled by a rear panel switch) allow real time control over when a measurement begins. Useful for measurements such as frequency burst profile and frequency sweep linearity.

Trigger lights: trigger light blinks when channel is triggering; light is ON when input is above trigger level; OFF when input is below trigger level. Simplifies trigger level adjustments

High performance marker outputs: marker outputs (operational to 100 MHz) indicate where channel is triggering in real time for oscilloscope monitoring applications. Provides measurement feedback to the operator for greatly simplified measurement set-ups.

These features and capabilities make the 5328A an excellent choice for general purpose lab use, electronic service, and production test. For more demanding applications, a variety of options offer extended performance at a modest increase in price.

Summary of characteristics

| Model No. | Description | Features |
|-----------|-----------------------------------|---|
| 5328A | Universal Counter | Frequency to 100 MHz; 100 ns single shot T.I.; T.I. averaging; Period; Period Avg; ratio; totalize Oven oscillator with aging rate $<5 \times 10^{-10}$ /day |
| Opt. 010 | High Stability Time Base | |
| Opt. 011 | HP-IB Interface | Allows 5328A to output data and be controlled via the HP Interface Bus. |
| Opt. 020 | DVM | Single ended DVM for trigger level and external voltage measurements |
| Opt. 021 | High Performance DVM | Floating DVM for trigger level and high accuracy external voltage measurements. |
| Opt. 030 | 512 MHz Channel C | Frequency measurements to 512 MHz; 9 digit display. |
| Opt. 031 | 1300 MHz Channel C | Frequency measurements to 1300 MHz; 9 digit display. |
| Opt. 040 | High Performance Universal Module | Same as standard 5328A but with 10 ns single shot T.I.; improved T.I. averaging; improved T.I. accuracy; measurements with delay; T.I.A-B marker; hysteresis compensation; switchable input impedance (1 M Ω /50 Ω). |
| Opt. 041 | Programmable Input Module | Full remote programming of all universal module controls thru opt. 011; 10 ns single shot T.I.; switchable 1 M Ω /50 Ω input impedance. |



5328A Option Descriptions

High Stability Time Base (Opt 010)

The standard time base for the 5328A is a room temperature 10 MHz crystal providing a long term aging rate of less than 3 parts in 10^7 per month. The option 010 oven oscillator offers excellent short term and temperature stability which can contribute to higher measurement accuracy. The low aging rate of $<5 \times 10^{-10}$ /day permits longer intervals between time base calibrations.

HP Interface Bus for Systems Use (Opt 011)

The option 011 HP-IB Interface brings the full capability and power of the HP Interface Bus. The 5328A can accept program code words over the HP-IB which remotely program various front and rear panel controls. In addition, measurement results may be output over the bus to HP-IB compatible instruments, calculators, or computers.

Remotely programmable controls include FUNCTION selection, RESOLUTION selection, ARMING, SAMPLE RATE (max. or manual), RESET, measurement modes, output modes, and display modes. Option 041 adds programming of channel A and B input signal conditioning controls.

Digital Voltmeters (Opt 020, 021)

The unique combination of an integrating digital voltmeter with a universal counter produces a superb general purpose measuring instrument. By using a voltage to frequency conversion technique, the incremental cost of adding DVM capability to the 5328A is very low.

Two DVM options are available; the option 020 DVM with single-ended input and the option 021 High Performance DVM with floating input. You can use these DVMs to measure channel A and B trigger levels and external voltages. Since a built-in DVM greatly simplifies time interval measurement set-ups, it is highly recommended that one of the DVM options be selected, particularly if time interval measurements are one of your major applications.

High Frequency Channel C (Opt 030, 031)

With a high frequency channel C module the 5328 is ideally suited for use in a wide variety of communications measurements. Option 030 gives direct count measurements to 512 MHz with 15 mV rms sensitivity; option 031 counts to a full 1300 MHz with 20 mV rms sensitivity. Typical applications include servicing, maintaining, calibrating, and monitoring communications transmitters and receivers such as found in two-way radio, radio and television broadcasting, mobile radio, and common carrier multiplexing and transmission.

Extended Capability Universal Modules (Opt 040, 041)

Options 040 and 041 give extended performance for time interval measurements. Option 040 is designed for bench use and includes "delay" capability for increased measurement versatility. Option 041 adds full programming of the input signal conditioning controls.

Both of these options generate a 100 MHz clock to give 10 ns single shot resolution for time interval measurements. This resolution is useful in applications such as computer/peripheral timing measurements, logic timing measurements, radar ranging, and optical ranging.

For improved time interval averaging performance, the options have input channels adjusted for delay matching to better than 2 ns. Additionally, options 040 and 041 use a jittered clock in T.I. AVG. function to give averaging even for those cases when the input repetition rate is synchronous with the counter's internal time base.

Selectable input impedance adapts the counter to the measurement environment: 50 Ω for fast signals in a 50 Ω environment, 1 M Ω to reduce circuit loading or to use with scope probes.

The "delay" feature of option 040 allows you to disable the inputs from triggering for selected periods of time (20 μ s to 20 ms). Delay is useful for ignoring high amplitude noise such as from chattering relays or ignoring stop pulses in multiple stop T.I. measurements.

Option 041 allows remote programming of input trigger level, slope, coupling, and attenuator setting. Under remote control, the input impedance is independently selectable on the A and B channels. Also, a remote "Invert" function switches the A and B channel signals internally. "Invert" gives exceptional flexibility for two channel time interval measurements.

Measurements with Delay (Opt 040)

Delay mode is activated by the inner concentric knob on Level A control of option 040 Universal Module. A red LED indicates delay is activated. In delay mode, Channel A triggers and is then disabled from triggering again until the delay times out (disabled state occurs within 1 μ s after triggering.) Channel B is continuously disabled until the delay times out. After the delay, both A and B are enabled. The delay time may be measured by placing the counter in T.I.A \rightarrow B and the Universal Module in check (CHK).

Delay range: 20 μ s to 20 ms continuously adjustable.

Minimum dead time: 1 μ s between stop and next start (T.I. average measurements only).

General

Display: 9 digit LED display, ninth digit used only with channel C functions (FREQ. C, Ratio C/A, Events C, A \rightarrow B).

Blanking: suppresses display of unwanted zeros to left of most significant digit.

Storage: holds reading between samples; can be overridden by rear panel switch.

Sample rate: variable from less than 2 ms between measurements to HOLD which holds display indefinitely.

Gate output: rear panel output, TTL levels; high when counter gate open.

Time base output: rear panel output: TTL levels.

Check signal: with function switch in CHECK, counter should display 10 MHz \pm 1 count. With options 040 and 041, place function switch in FREQ. A and universal module in CHECK (CHK). Counter should display 100 MHz \pm 1 count.

Operating temperature: 0 $^{\circ}$ to 50 $^{\circ}$ C.

Power requirements: 100/120/220/240 V rms, +5%, -10% (switch selectable), 48-66 Hz; 150 VA max.

Time base oscillators

Standard crystal oscillator

Frequency: 10 MHz.

Aging rate: $<3 \times 10^{-7}$ /month.

Temperature: $<2.5 \times 10^{-6}$, 0 $^{\circ}$ to 50 $^{\circ}$ C.

Line voltage: $<1 \times 10^{-7}$ for 10% change.

Opt 010 oven oscillator

Frequency: 10 MHz.

Aging rate: $<5 \times 10^{-10}$ /day after 24-hour warm-up.

Short term: $<1 \times 10^{-10}$ rms/s.

Temperature: $<7 \times 10^{-9}$, 0 $^{\circ}$ to 50 $^{\circ}$ C.

Line voltage: $\pm 5 \times 10^{-9}$ for 10% variation.

Warm-up: within 5×10^{-9} of final value in 20 min.

Ext. freq. std. input: 30 kHz to 10 MHz signal of amplitude >1.0 V rms into 1 k Ω . Maximum input: 5 V p-p. With options 040 and 041 the following constraints apply: ext. freq. std. must be 10 MHz for Period Avg., T.I. Avg., Period (N = 1), and T.I. (N = 1).

HP-IB Interface (Opt 011)

Option 011 provides digital output of measurement data ("talker") as well as input for remote program control ("listener"). HP-IB cable not supplied, see page 28.

Programmable features: function, resolution, sample rate (max or manual control), arming, display modes, measurement cycle modes, output modes, and reset commands. Option 041 adds control of channel A and B trigger level, slope, attenuator, coupling, input impedance, and SEP-COM-CHECK selection.

HP-IB commands: responds to the following bus commands (see HP-IB Users Guides for definitions)—Unlisten, Untalk, Local Lockout, Device Clear, Serial Poll Enable, Serial Poll Disable, Go to Local, Selected Device Clear, and Group Execute Trigger.

Service request (SRQ): if enabled, indicates end of measurement.

Maximum data output rate: 500 readings/sec.

Accessories

5363B Time Interval Probes: solve many of the "hidden" problems of precision time interval measurements. The 5363B Time Interval Probes minimize circuit loading, give calibrated trigger level settings, increase input dynamic range, and allow differential channel delay calibration. See page 297 for more details.