
Agilent 54620-series Performance Characteristics

* Denotes Warranted Specifications, all others are typical. Specifications are valid after a 30-minute warm-up period and $\pm 10^\circ\text{C}$ from firmware calibration temperature.

Acquisition: Analog Channels

Max Sample rate	200 MSa/s
Max Memory Depth	4 MB interleaved, 2 MB each channel
Vertical Resolution	8 bits
Peak Detection	5 ns
Averages	selectable from 2, 4, 8, 16, 32, 64 ...to 16383
High Resolution Mode	12 bits of resolution when ≥ 500 us/div, average mode with average = 1
Filter:	Sinx/x interpolation (single shot BW = sample rate/4 or bandwidth of scope, whichever is less) with vectors on.


Acquisition: Digital Channels (on 54621D and 54622D only)

Max Sample Rate	400 MSa/s interleaved, 200 MSa/s each channel
Max Memory Depth	8 MB interleaved, 4 MB each channel
Vertical Resolution	1 bit
Glitch Detection (min pulse width)	5 ns

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Vertical System: Analog Channels

Analog channels	54621A/21D, 54622A/22D: Ch1 and 2 simultaneous acquisition 54624A: Ch 1, 2, 3, and 4 simultaneous acquisition
Bandwidth (-3dB)*	54621A/22D: dc to 60 MHz 54622A/22D/24A: dc to 100 MHz
ac coupled	54621A/21D: 3.5 Hz to 60 MHz 54622A/22D/24A: 3.5 Hz to 100 MHz
Calculated rise time (= 0.35/bandwidth)	54621A/22D: ~5.8 ns 54622A/22D/24A: ~3.5 ns
Single Shot Bandwidth	50 MHz
Range ¹	1 mV/div to 5 V/div
Maximum Input	 CAT I 300 Vrms, 400 Vpk CAT II 100 Vrms, 400 Vpk with 10074C 10:1 probe: CAT I 500 Vpk, CAT II 400 Vpk
Offset Range	$\pm 5\text{ V}$ on ranges $< 10\text{ mV/div}$ $\pm 25\text{ V}$ on ranges 10 mV/div to 199 mV/div $\pm 100\text{ V}$ on ranges $\geq 200\text{ mV/div}$
Dynamic Range	Lesser of $\pm 8\text{ div}$ or $\pm 32\text{ V}$
Input Resistance	$1\text{ M}\Omega \pm 1\%$
Input Capacitance	~ 14 pF
Coupling	ac, dc, ground
BW Limit	~ 20 MHz selectable
Channel-to-Channel Isolation (with channels at same V/div)	dc to 20 MHz $> 40\text{ dB}$ 20 MHz to max bandwidth $> 30\text{ dB}$
Probes	10:1 10074C shipped standard for each analog channel
Probe ID (Agilent/HP & Tek Compatible)	Auto probe sense

¹ 1 mV/div is a magnification of 2 mV/div setting. For vertical accuracy calculations, use full scale of 16 mV for 1 mV/div sensitivity setting.

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Vertical System: Analog Channels (continued)

ESD Tolerance	± 2 kV
Noise Peak-to-Peak	2% full scale or 1 mV, whichever is greater
Common Mode Rejection Ratio	20 dB @ 50 MHz
DC Vertical Gain Accuracy* ¹	$\pm 2.0\%$ full scale
DC Vertical Offset Accuracy	< 200 mV/div: ± 0.1 div ± 1.0 mV $\pm 0.5\%$ offset ≥ 200 mV/div: ± 0.1 div ± 1.0 mV $\pm 1.5\%$ offset value
Single Cursor Accuracy ¹	$\pm\{\text{DC Vertical Gain Accuracy} + \text{DC Vertical Offset Accuracy} + 0.2\%$ full scale ($\sim 1/2$ LSB) $\}$ <i>Example:</i> For 50 mV signal, scope set to 10 mV/div (80 mV full scale), 5 mV offset, accuracy = $\pm\{2.0\%(80\text{mV}) + 0.1 (10 \text{ mV}) + 1.0 \text{ mV} + 0.5\% (5 \text{ mV}) + 0.2\%(80 \text{ mV})\} = \pm 3.78 \text{ mV}$
Dual Cursor Accuracy* ¹	$\pm\{\text{DC Vertical Gain Accuracy} + 0.4\%$ full scale (~ 1 LSB) $\}$ <i>Example:</i> For 50 mV signal, scope set to 10 mV/div (80 mV full scale), 5 mV offset, accuracy = $\pm\{2.0\%(80 \text{ mV}) + 0.4\%(80 \text{ mV})\} = \pm 1.92 \text{ mV}$

¹ 1 mV/div is a magnification of 2 mV/div setting. For vertical accuracy calculations, use full scale of 16 mV for 1 mV/div sensitivity setting.

Vertical System: Digital Channels (54621D and 54622D only)

Number of Channels	16 Digital – labeled D15 – D0
Threshold Groupings	Pod 1: D7 - D0 Pod 2: D15 - D8
Threshold Selections	TTL, CMOS, ECL, user-definable (selectable by pod)
User-Defined Threshold Range	± 8.0 V in 10 mV increments
Maximum Input Voltage 	± 40 V peak CAT I
Threshold Accuracy*	$\pm(100 \text{ mV} + 3\%$ of threshold setting)
Input Dynamic Range	± 10 V about threshold
Minimum Input Voltage Swing	500 mV peak-to-peak
Input Capacitance	~ 8 pF
Input Resistance	100 k Ω $\pm 2\%$ at probe tip
Channel-to-Channel Skew	2 ns typical, 3 ns maximum

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Horizontal

Range	5 ns/div to 50 s/div
Resolution	25 ps
Vernier	1-2-5 increments when off, 25 minor increments between major settings when on
Reference Positions	Left, Center, Right
Delay Range	
Pre-trigger (negative delay)	Greater of 1 screen width or 10 ms
Post-trigger (positive delay)	500 seconds
Analog Delta-t Accuracy Same Channel*	$\pm 0.01\%$ reading $\pm 0.1\%$ screen width ± 40 ps <i>Example:</i> for signal with pulse width of 10 us, scope set to 5 us/div (50 us screen width), delta-t accuracy = $\pm\{.01\%(10\text{ us}) + 0.1\% (50\text{ us}) + 40\text{ ps}\} = 51.04\text{ ns}$
Channel-to-Channel	$\pm 0.01\%$ reading $\pm 0.1\%$ screen width ± 80 ps
Digital Delta-t Accuracy Same Channel	(non-Vernier settings) $\pm 0.01\%$ reading $\pm 0.1\%$ screen width \pm (1 digital sample period, 2.5 or 5 ns based on sample rate of 200/400 MSa/s) <i>Example:</i> for signal with pulse width of 10 us, scope set to 5 us/div (50 us screen width), and single pod active (400 MSa/s), delta-t accuracy = $\pm\{.01\%(10\text{ us}) + 0.1\% (50\text{ us}) + 2.5\text{ ns}\} = 53.5\text{ ns}$
Channel-to-Channel	$\pm 0.01\%$ reading $\pm 0.1\%$ screen width \pm (1 digital sample period, 2.5 or 5 ns) \pm chan-to-chan skew (2 ns typical, 3 ns maximum)
Delay Jitter	10 ppm
RMS Jitter	0.025% screen width + 30 ps
Modes	Main, Delayed, Roll, XY
XY	
7 blanking	1.4 V blanks trace (use External trigger)
Bandwidth	Max bandwidth
Phase error @ 1 MHz	1.8 degrees

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Trigger System

Sources:	54621A/22A: Ch 1, 2, line, ext 54621D/22D: Ch 1, 2, line, ext, D15 - D0 54624A: Ch 1, 2, 3, 4, line, ext
Modes	Auto, Auto level, Triggered (normal), Single
Holdoff Time	~60 ns to 10 seconds
Selections	Edge, Pattern, Pulse Width, CAN, Duration, I ² C, LIN, Sequence, SPI, TV, USB
Edge	Trigger on a rising or falling edge of any source.
Pattern	Trigger on a pattern of high, low, and don't care levels and a rising or falling edge established across any of the sources. The analog channel's high or low level is defined by that channel's trigger level.
Pulse Width	Trigger when a positive- or negative-going pulse is less than, greater than, or within a specified range on any of the source channels. Minimum pulse width setting: 5 ns Maximum pulse width setting: 10 s
CAN	Trigger on CAN (Controller Area Network) version 2.0A and 2.0B signals. It can trigger on the Start of Frame bit of a data frame, a remote transfer request frame, or an overload frame.
Duration	Trigger on a multi-channel pattern whose time duration is less than a value, greater than a value, greater than a time value with a timeout value, or inside or outside of a set of time values. Minimum duration setting: 5 ns Maximum duration setting: 10 s
I ² C	Trigger on I ² C (Inter-IC bus) serial protocol at a start/stop condition, a restart, a missing acknowledge, or user defined frame with address and/or data values. Also trigger on Missing Acknowledge, Restart, EEPROM read, and 10-bit write.
LIN	Trigger on LIN (Local Interconnect Network) sync break at beginning of message frame.
Sequence	Find event A, trigger on event B, with option to reset on event C or time delay.
SPI	Trigger on SPI (Serial Peripheral Interface) a data pattern during a specific framing period. Support positive and negative Chip Select framing as well as clock Idle framing and user-specified number of bits per frame.
USB	Trigger on USB (Universal Serial Bus) Start of Packet, End of Packet, Reset Complete, Enter Suspend, or Exit Suspend on the differential USB data lines. USB low speed and high speed are supported.
TV	Trigger on any analog channel for NTSC, PAL, PAL-M, or SECAM broadcast standards on either positive or negative composite video signals. Modes supported include Field 1, Field 2, or both, all lines, or any line within a field. Also supports triggering on non-interlaced fields. TV trigger sensitivity: 0.5 division of synch signal.
Autoscale	Finds and displays all active analog and digital (for 54621D/54622D) channels, sets edge trigger mode on highest numbered channel, sets vertical sensitivity on analog channels and thresholds on digital channels, time base to display ~1.8 periods. Requires minimum voltage >10 mVpp, 0.5% duty cycle and minimum frequency >50 Hz.

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Analog Channel Triggering

Range (Internal)	± 6 div from center screen
Sensitivity*	Greater of 0.35 div or 2.5 mV
Coupling	AC (~3.5 Hz), DC, noise reject, HF reject and LF reject (~ 50 kHz)

Digital (D15 - D0) Channel Triggering (54621D and 5462 2D)

Threshold Range (used defined)	± 8.0 V in 10 mV increments
Threshold Accuracy*	$\pm (100$ mV + 3% of threshold setting)
Predefined Thresholds	TTL = 1.4 V, CMOS = 2.5 V, ECL = -1.3 V

External (EXT) Triggering

Input Resistance	1 M Ω $\pm 3\%$
Input Impedance	~ 14 pF
Maximum Input	 CAT I 300 Vrms, 400 Vpk CAT II 100 Vrms, 400 Vpk with 10074C 10:1 probe: CAT I 500 Vpk, CAT II 400 Vpk
Range	± 10 V
Sensitivity	dc to 25 MHz, < 75 mV 25 MHz to max bandwidth, < 150 mV
Coupling	AC (~ 3.5 Hz), DC, noise reject, HF reject and LF reject (~ 50 kHz)
Probe ID (Agilent/HP & Tek Compatible)	Auto probe sense for 54621A/22A

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Display System

Display	7-inch raster monochrome CRT
Throughput of Analog Channels	25 million gray scale vectors/sec per channel
Resolution	255 vertical by 1000 horizontal points (waveform area) 32 levels of gray scale
Controls	Waveform intensity on front panel Vectors on/off; infinite persistence on/off 8 x 10 grid with continuous intensity control
Built-in Help System	Key-specific help in 11 languages displayed by pressing and holding key or softkey of interest
Real Time Clock	Time and date (user settable)

Measurement Features

Automatic Measurements	Measurements are continuously updated Cursors track current measurement
Voltage (analog channels only)	Peak-to-Peak, Maximum, Minimum, Average, Amplitude, Top, Base, Overshoot, Preshoot, RMS (DC)
Time	Frequency, Period, + Width, - Width, and Duty Cycle on any channels. Rise time, Fall time, X at Max (Time at max volts), X at Min (Time at min volts), Delay, and Phase on analog channels only.
Counter	Built-in 5-digit frequency counter on any channel. Counts up to 125 MHz
Threshold Definition	Variable by percent and absolute value; 10%, 50%, 90% default for time measurements
Cursors	Manually or automatically placed readout of Horizontal (X, ΔX , 1/ ΔX) and Vertical (Y, ΔY). Additionally digital or analog channels can be displayed as binary or hex values
Waveform Math	1-2, 1*2, FFT, differentiate, integrate. Source of FFT: differentiate, integrate, analog channels 1 or 2 (or 3 or 4 for 54624A), 1-2, 1+2, 1*2

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FFT

Points	Fixed at 2048 points
Source of FFT	Analog channels 1 or 2 (or 3 or 4 for 54624A), 1+2, 1-2, 1*2
Window	Rectangular, Flattop, Hanning
Noise Floor	-70 to -100 dB depending on averaging
Amplitude Display	In dBV
Frequency Resolution:	0.097656/(time per div)
Maximum Frequency	102.4/(time per div)

Storage

Save/Recall (non-volatile)	3 setups and traces can be saved and recalled internally
Floppy Disk	3.5" 1.44 MB double density
Image formats	TIF, BMP
Data formats	X and Y (time/voltage) values in CSV format
Trace/setup formats	Recalled

I/O

RS-232 (serial) standard port	1 port, XON or DTR, 8 data bits; 1 stop bits; parity=none; 9600, 19200, 38400, 57600 baud rates
Parallel standard port	Printer support
Printer Compatibility	HP DeskJet, HP LaserJet with HP PCL 3 or greater compatibility Compatibility— black and white @150x150 dpi gray scale @ 600x600 dpi Epson—black and white @180x180 dpi Seiko—DPIJ-414 black and white
Optional GPIB Interface Module	Fully programmable with IEEE488.2 compliance Typical GPIB throughput of 20 measurements or twenty 2000-point records per second.

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General Characteristics

Physical:	
Size	32.26 cm wide x 17.27 cm high x 31.75 cm deep (without handle)
Weight	6.35 kgs (14 lbs)
Calibrator Output	Frequency ~1.2 kHz; Amplitude ~5 V
Trigger Out	0 to 5 V with 50 Ω source impedance; delay ~ 55 ns
Printer Power	7.2 to 9.2 V, 1 A
Kensington lock	Connection on rear panel for security

Power Requirements

Line Voltage Range	100 - 240 VAC $\pm 10\%$, CAT II, automatic selection
Line Frequency	47 to 440 Hz
Power Usage	100 W max

Environmental Characteristics

Ambient Temperature	Operating -10 °C to +55 °C Non-operating -51 °C to +71 °C
Humidity	Operating 95% RH at 40 °C for 24 hr Non-operating 90% RH at 65 °C for 24 hr
Altitude	Operating to 4,570 m (15,000 ft) Non-operating to 15,244 m (50,000 ft)
Vibration	HP/Agilent class B1 and MIL-PRF-28800F Class 3 random
Shock	HP/Agilent class B1 and MIL-PRF-28800F (operating 30 g, 1/2 sine, 11-ms duration, 3 shocks/axis along major axis. Total of 18 shocks)
Pollution degree2	Normally only dry non-conductive pollution occurs. Occasionally a temporary conductivity caused by condensation must be expected.
Indoor use only	This instrument is rated for indoor use only

Installation categories	CAT I: Mains isolated CAT II: Line voltage in appliance and to wall outlet
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