

# Test Equipment Solutions Datasheet

Test Equipment Solutions Ltd specialise in the second user sale, rental and distribution of quality test & measurement (T&M) equipment. We stock all major equipment types such as spectrum analyzers, signal generators, oscilloscopes, power meters, logic analysers etc from all the major suppliers such as Agilent, Tektronix, Anritsu and Rohde & Schwarz.

We are focused at the professional end of the marketplace, primarily working with customers for whom high performance, quality and service are key, whilst realising the cost savings that second user equipment offers. As such, we fully test & refurbish equipment in our in-house, traceable Lab. Items are supplied with manuals, accessories and typically a full no-quibble 2 year warranty. Our staff have extensive backgrounds in T&M, totalling over 150 years of combined experience, which enables us to deliver industry-leading service and support. We endeavour to be customer focused in every way right down to the detail, such as offering free delivery on sales, covering the cost of warranty returns BOTH ways (plus supplying a loan unit, if available) and supplying a free business tool with every order.

As well as the headline benefit of cost saving, second user offers shorter lead times, higher reliability and multivendor solutions. Rental, of course, is ideal for shorter term needs and offers fast delivery, flexibility, try-before-you-buy, zero capital expenditure, lower risk and off balance sheet accounting. Both second user and rental improve the key business measure of Return On Capital Employed.

We are based near Heathrow Airport in the UK from where we supply test equipment worldwide. Our facility incorporates Sales, Support, Admin, Logistics and our own in-house Lab.

All products supplied by Test Equipment Solutions include:

- No-quibble parts & labour warranty (we provide transport for UK mainland addresses).
- Free loan equipment during warranty repair, if available.
- Full electrical, mechanical and safety refurbishment in our in-house Lab.
- Certificate of Conformance (calibration available on request).
- Manuals and accessories required for normal operation.
- Free insured delivery to your UK mainland address (sales).
- Support from our team of seasoned Test & Measurement engineers.
- ISO9001 quality assurance.

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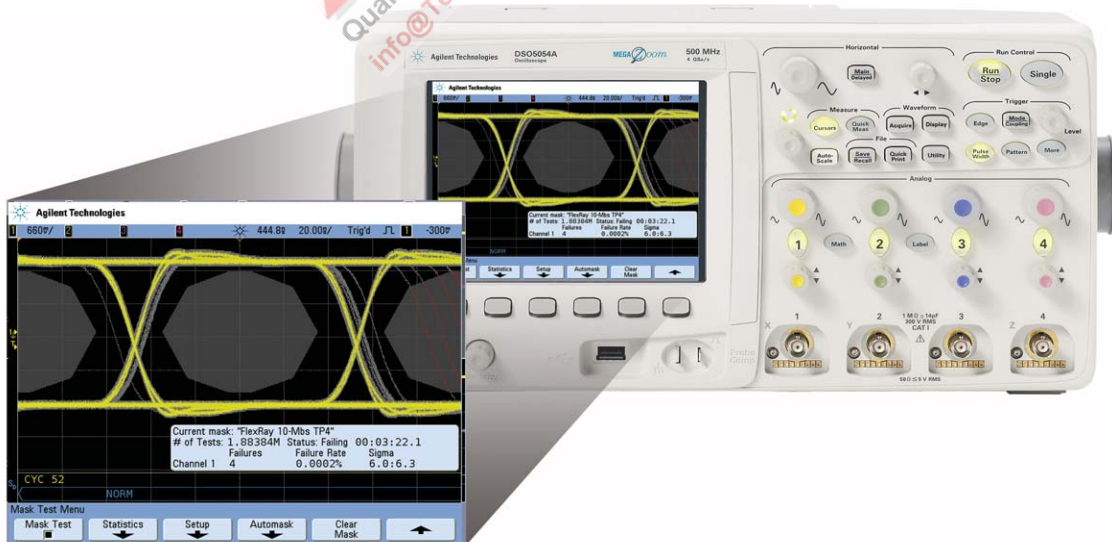


# Agilent InfiniiVision 5000 Series Portable Oscilloscopes

Data Sheet



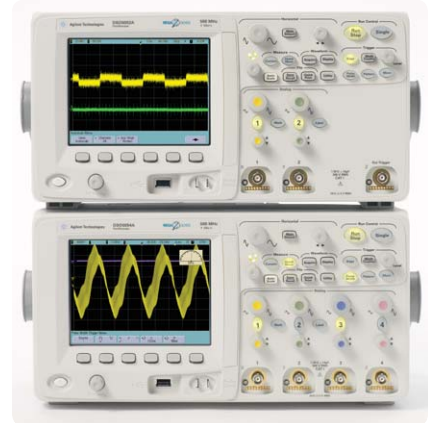
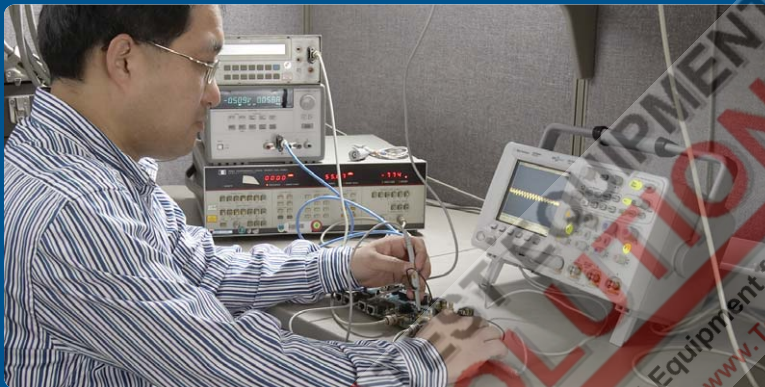
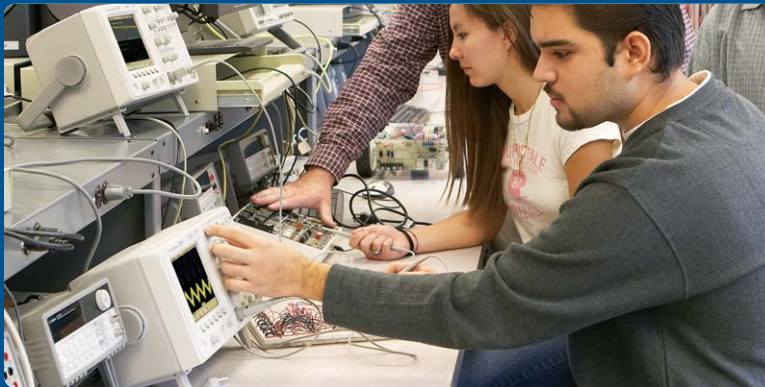
The Next Generation of Portable Oscilloscopes



Agilent Technologies



## The new standard for everyday scopes



- 100, 300, and 500 MHz bandwidths
- 2 or 4 channels
- MegaZoom III memory and display technology
  - 8 Mpts acquisition memory
  - Up to 100,000 waveforms per second real-time update rate (page 5)
  - High-definition XGA (1024 x 768) display with 256 levels of intensity grading
- Triggering and hardware accelerated decode for I<sup>2</sup>C, SPI, I<sup>2</sup>S, FlexRay, MIL-STD 1553, CAN, LIN and RS-232/UART (page 6)
- Up to 12 bits of vertical resolution, even in single-shot acquisitions (page 7)
- Complete connectivity – standard (page 6)
  - USB (2 host, 1 device), LAN, GPIB, XGA display out
  - Full remote control, including web browser
  - LXI class C compliant
- Manuals and in-scope help available in 11 languages

**Traditional bench scopes are great for characterizing things that you know about. Agilent's MegaZoom III deep memory and fast update rates help you find the bugs you don't know about.**

## If you haven't purchased an Agilent oscilloscope lately, why should you consider one now?

### Leading-edge technology for all scope users

The InfiniiVision 5000 Series oscilloscopes leverage the same third-generation MegaZoom III technology blocks used in our higher performance bench and lab oscilloscopes – **responsive deep memory, fast update rates with minimal "dead time," analog-like display systems, and integrated serial analysis** – and deliver them in a compact package, at a price similar to oscilloscopes with older technology blocks.

### Industry-leading customer support

As the world's leading test and measurement vendor, Agilent maintains the largest network of sales engineers, application engineers, support engineers and technicians. From pre-sales collaboration, to calibration, to training and consulting, to repair and servicing, Agilent stands with you throughout the life of your product. It's no accident that Agilent has such loyal customers.

### Don't take our word for it

Compare the InfiniiVision 5000 Series with your current bench scope. Or compare it to one of our competitors' newest scopes. You'll see why Agilent has been the **fastest-growing oscilloscope supplier since 1997** (CAGR, source: Prime Data 2006 Test Instrument Industry Service Market Share Analysis).

| Model    | BW (MHz) | Channels | Maximum sample rate  | Memory                  | Update rate                                 |
|----------|----------|----------|----------------------|-------------------------|---|
| DSO5012A | 100      | 2        | 2 GSa/s              |                         |   |
| DSO5014A | 100      | 4        | 2 GSa/s              |                         |   |
| DSO5032A | 300      | 2        | 2 GSa/s              | 8 Mpts std <sup>1</sup> | Up to 100,000 waveforms per second (page 5) |
| DSO5034A | 300      | 4        | 2 GSa/s              |                         |   |
| DSO5052A | 500      | 2        | 4 GSa/s <sup>1</sup> |                         |   |
| DSO5054A | 500      | 4        | 4 GSa/s <sup>1</sup> |                         |   |

<sup>1</sup> Maximum sample rate and memory are achieved when two channels are interleaved



## Why does deep memory matter?

### See more time

Seeing more time is the most easily understood use of deep memory. The more samples you acquire, the more time you can see at a particular sample rate.

Long capture times give you better visibility into cause-effect relationships in your design, which greatly simplifies root-cause debugging. It also allows you to capture start-up events (like the start-up sequence in Figure 1) in a single acquisition.

You don't have to stitch together multiple acquisitions or set precise triggering conditions. Spend less time finding events, and more time analyzing them.

### See more details

The relationship between memory depth and acquisition rate isn't as obvious. All scopes have a "banner" maximum sample rate specification, but many can only sustain these rates at a few timebase settings.



In the case of an oscilloscope with a 5 GSa/s acquisition rate and 10-Kpts of memory (Figure 2), those 10,000 points can only fill 2  $\mu$ s of time. Since scopes have 10 time divisions, the sample rate drops at any time/div setting below 200 ns/div.

As a result, if you look at "slow/fast" events like a modulated signal, you run the risk of aliasing your signal. Or you may simply miss out on important signal details when you zoom in on it.

Deep memory oscilloscopes let you sustain a high sample rate over longer periods of time.

### Always fast, always on

MegaZoom III is the third generation of the fast and deep memory architecture that Agilent introduced in 1996. It's not a special mode, unlike other deep-memory oscilloscopes. You have access to your MegaZoom memory at all times. And the display will respond instantly to your commands as you scale the +/div setting or pan and zoom in the Delayed (or "zoom") window.



Figure 1.

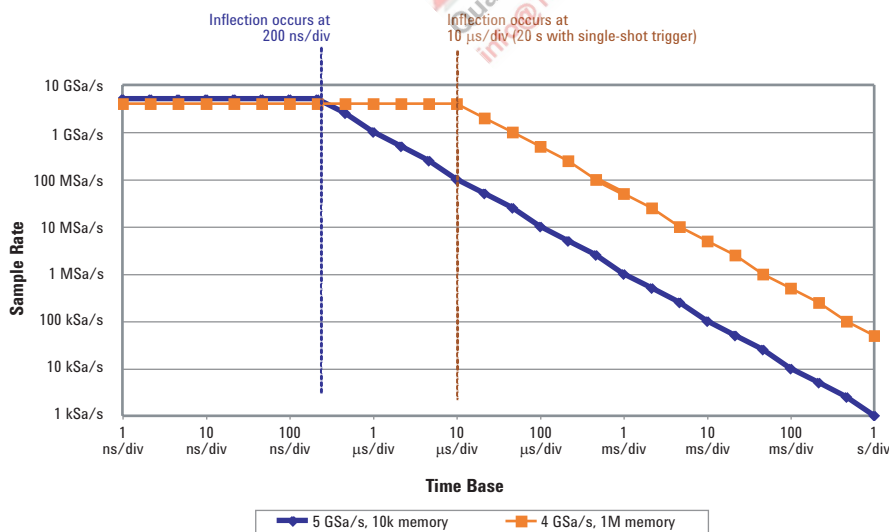


Figure 2.



## Why does a fast update rate matter?

If the human eye has trouble discerning above 30-50 frames per second, **is there really a difference between 3,600 and 100,000 waveforms per second?** If you know what you're looking for, the answer is probably "no." However, if you are hunting for unknown signal anomalies or characterizing jitter, the answer is "yes."

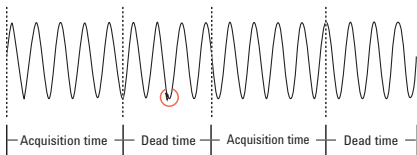


Figure 3. Reducing the dead time between acquisitions ...

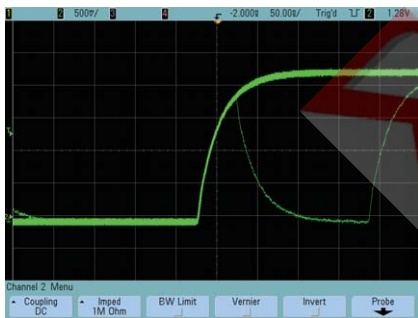


Figure 4. ... improves your chances of finding random events like glitches

If you know that there is a **glitch in your system**, it's easy to capture it using a pulse-width trigger. However, if you are just browsing through your design, your chances of finding a glitch increase as the oscilloscope's update rate increases. If a glitch occurs during the "dead time" between samples, you miss it (Figure 3). With MegaZoom III technology, the dead time is much smaller (Figure 5). A scope with a slower update rate will capture the glitch eventually (if it recurs), but most engineers and technicians don't have the time or patience to wait for their tools to catch up.

If you are **characterizing signal jitter**, a fast update rate gives you accurate results sooner. And when the fast update rate is combined with the 5000 Series' XGA high-definition display (1024 x 768, 256 intensity levels), subtle differences in these acquisitions become obvious.

And like all other aspects of MegaZoom III technology, this update rate is delivered as a default real-time acquisition mode. **It's always fast, always on.**

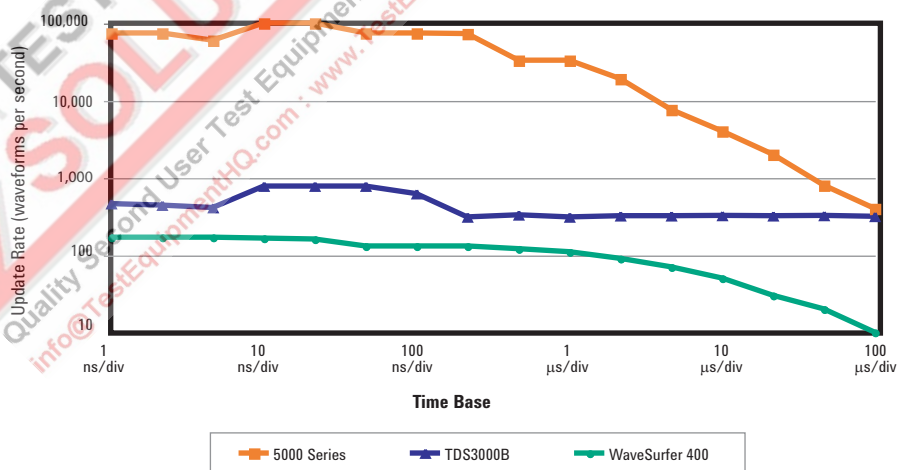


Figure 5. Update rates of popular oscilloscopes using their default real-time acquisition mode

Catch problems sooner and cover more of your debug checklist – our 100,000 waveforms per second update rate helps you find intermittent problems up to 100x faster than competitive scopes

## Software options

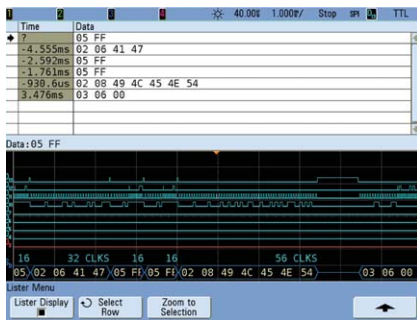


Figure 6A. On-screen serial decode of an SPI packet

### I<sup>2</sup>C/SPI serial trigger and decode (N5423A or Option LSS on new scope purchases)

This application displays real-time time-aligned decode of I<sup>2</sup>C and SPI serial buses. Hardware-assisted triggering and decode provide the industries fastest throughput and update rate. Hardware-assisted triggering and decode guarantees you will never miss a trigger event or anomaly – unlike other scopes that

have triggering dead time between acquisitions. Listing window shows a tabular view of all captures packets that match the on-screen waveform data.

This application requires a 4-channel DSO.

For more information:  
[www.agilent.com/find/I2C-SPI](http://www.agilent.com/find/I2C-SPI)

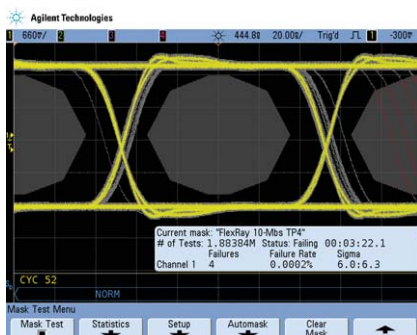


Figure 6B. Mask testing uncovers infrequent signal anomalies

### Mask testing (N5455A or Option LMT)

Agilent's mask test option (Option LMT or N5455A) for InfiniiVision Series oscilloscopes provides a fast and easy way to test your signals to specified standards, and uncover unexpected signal anomalies, such as glitches. Mask testing on other oscilloscopes is based on software-intensive processing technology, which tends to be slow. Agilent's InfiniiVision scopes can perform up to 100,000 real-time waveform pass/fail tests per second.

This provides testing throughput significantly faster than other mask test solutions, making valid pass/fail statistics available almost instantly.

For more information:  
[www.agilent.com/find/masktest](http://www.agilent.com/find/masktest)

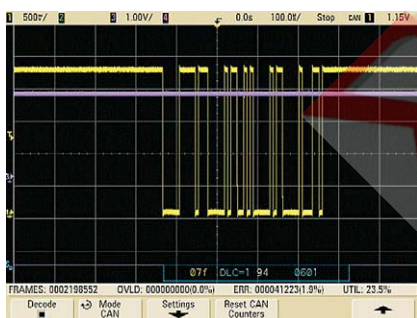


Figure 7. Real-time totalize functions provide CAN bus efficiency and quality measurement statistics

### CAN/LIN triggering and decode (N5424A or Option AMS on new scope purchases)

Trigger on and decode serially transmitted data based on CAN and LIN protocols. This application not only provides triggering on complex serial signals, but also provides unique hardware-accelerated decode capabilities. Hardware-assisted triggering and decode guarantees

you will never miss a trigger event or anomaly – unlike other scopes that have triggering dead time between acquisitions.

This application requires a 4-channel DSO.

For more information:  
[www.agilent.com/find/CAN-LIN](http://www.agilent.com/find/CAN-LIN)

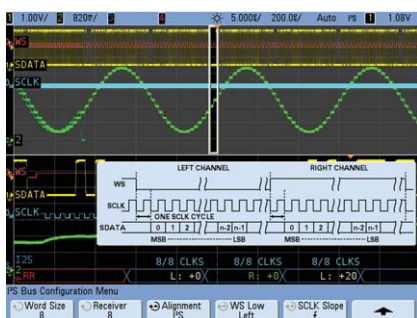


Figure 8. I<sup>2</sup>S Configuration PNG

### I<sup>2</sup>S triggering and decode (N5468A or Option SND)

Find and debug intermittent errors and signal integrity problems faster on I<sup>2</sup>S audio protocol devices. This application offers powerful triggering and our unique hardware-accelerated decode and lister window so you can more easily find errors you could miss using other serial bus decode tools.

This application requires a 4-channel DSO.

For more information:  
[www.agilent.com/find/I2S](http://www.agilent.com/find/I2S)

## Software options (continued)

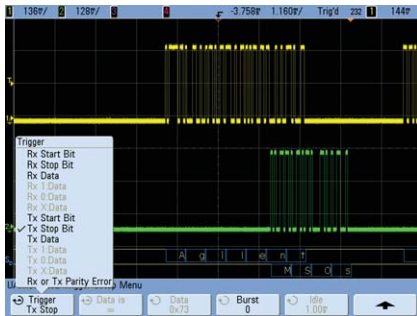


Figure 9. Trigger on and decode RS-232/UART transmission

### RS-232/UART serial decode and trigger (N5457A or Option 232 on new scope purchases)

The application lets you easily view the information sent over a RS-232 or other UART serial bus. Display real-time time-aligned decode of transmit and receive lines. The application also enables triggering on RS-232/UART conditions.

This application requires a 4-channel DSO and can use any combination of the scope or logic acquisition channels.

For more information:  
[www.agilent.com/find/RS-232](http://www.agilent.com/find/RS-232)

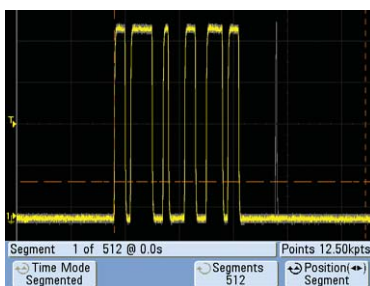


Figure 10. Use segmented memory to optimize available memory

### Segmented memory (N5454A or Option SGM on new scope purchases)

Segmented memory optimizes available memory for data streams that have long dead times between activity. The application is most useful for analyzing signal activity associated with laser pulses, serial

buses, and bursty signals such as radar. View an overlay of all signal segments, including serial decode, while highlighting the current segment. Quickly move between segments to view signal detail associated with a specific segment.

For more information:  
[www.agilent.com/find/segmented](http://www.agilent.com/find/segmented)

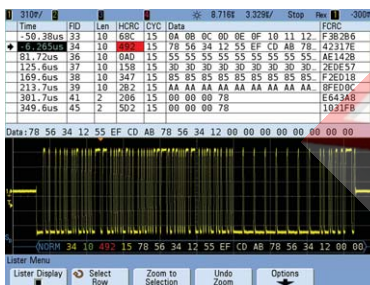


Figure 11. Time-correlated display of the FlexRay physical layer signal with protocol decoding.

### FlexRay Measurements (N5432C or Option FLX on new scope purchases)

Trigger on and time-correlate FlexRay communication with physical layer signals. With Agilent's unique hardware-accelerated decoding, it provides the fastest decode update rates in the industry while the scope remains responsive and fast. Also included with this option is FlexRay eye-diagram

mask testing and physical layer conformance test solution.

This application requires a 4-channel DSO.

For more information:  
[www.agilent.com/find/flexray](http://www.agilent.com/find/flexray)



Figure 12. Time-correlated display of the MIL-STD 1553 physical layer signal with protocol decoding.

### MIL-STD 1553 Serial Trigger and Decode (N5469A or Option 533 on new scope purchase)

This application provides integrated MIL-STD 1553 serial bus triggering, hardware-based decoding, and eye-diagram mask testing to help you debug and characterize the electrical/physical layer of MIL-STD 1553 serial buses faster

than with traditional "bit-counting" methods.

This application requires a 4-channel DSO.

For more information:  
[www.agilent.com/find/1553](http://www.agilent.com/find/1553)



## Other nice features

### High resolution mode

Offers up to 12 bits of vertical resolution in real-time, single-shot mode. This is accomplished by serially filtering sequential data points and mapping the filtered results to the display when operating at base time settings greater than 10  $\mu\text{s}/\text{div}$ .

### Help is at your fingertips

An embedded help system – available in 11 languages – gives you quick answers if you don't understand a feature. Simply press and hold the corresponding front-panel key, and a screen pops up to explain its function (Figure 13).

### Waveform math with FFT

Analysis functions include subtract, multiply, integrate, and differentiate, as well as Fast Fourier Transforms (FFT).

### 23 automatic measurements with statistics

Get up to 4 simultaneous measurements with 5 additional statistics beyond the current value. Fast update rate provides statistical data for enabled measurements such as mean, min, max, standard deviation and count.

Pressing [QuickMeas] brings up the last four measurements selected. Cursors automatically track the most recently selected measurement.

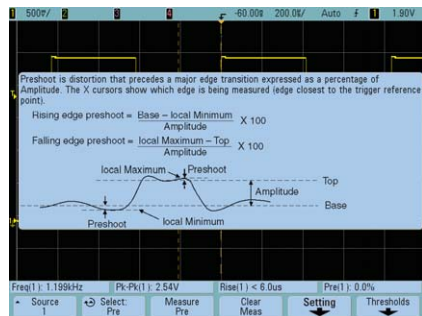


Figure 13. Press and hold a key for instant help

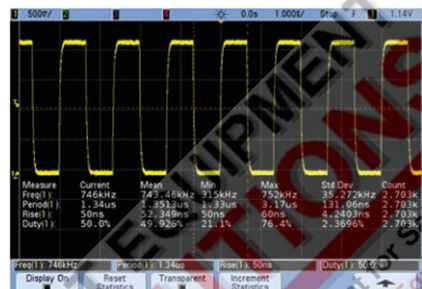


Figure 14. Measurement statistics allow you to have confidence in your measurements. Statistics can show that a measurement is not only correct at one moment, but that it has stabilized and has a low variance over time, giving it a higher statistical validity.

## Other nice features (continued)

### Peak detect

250 ps peak detect on 500-MHz models, 500 ps on 300-MHz models and 1 ns on 100-MHz models helps you find narrow glitches.

### AutoProbe interface

Automatically sets probe attenuation factors and provides power for selected Infiniium active probes, including the award-winning 1130A 1.5-GHz InfiniiMax differential active probe and 1156A 1.5-GHz single-ended active probe systems.

### 5-digit hardware counter

Measures frequency up to the bandwidth of the scope.

### Trig Out

Provides an easy way to synchronize your scope to other instruments. Use the Trig Out port to connect your scope to a frequency counter for more accurate frequency measurements or to cross trigger other instruments.

### Autoscale

Displays all active signals, and automatically sets the vertical, horizontal and trigger controls.

### HDTV trigger

The 5000 Series supports analog HDTV/EDTV triggering for standards like 1080i, 1080p, 720p and 480p as well as standard video triggering on any line within a field, all lines, all fields, and odd or even fields for NTSC, SECAM, PAL and PAL-M video signals.

### Serial Listing Display

In addition to seeing decoded packet data on the bus waveform itself, you can view all capture packets in a listing view where the decode matches the on-screen waveform data. This feature is also compatible with Agilent's Segmented Memory option (SGM)

### Oscilloscope tools

E2690B Oscilloscope tools package, licensed by Agilent Technologies from Amherst Systems Associates (ASA), makes it easy to perform in-depth analysis of captured signals. More information can be found in the *Oscilloscope Tools* data sheet (Agilent publication number 5989-3525EN).

### Offline viewing and analysis (B4610A)

Save your scope data to a USB or network drive and import the data into a PC-based offline viewer. Pan and zoom. Use searching and filtering to gain insight on analog and digital buses. Email the data to team members who can use the same tool at their PCs. ([www.agilent.com/find/InfiniiVisionOffline](http://www.agilent.com/find/InfiniiVisionOffline))

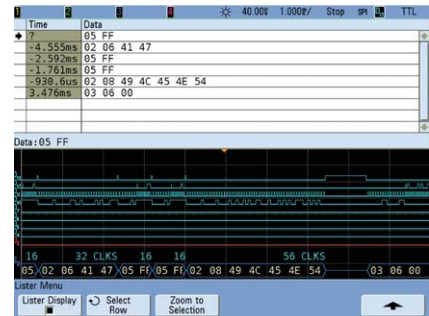


Figure 16. Serial listing display and decoded and all capture packets

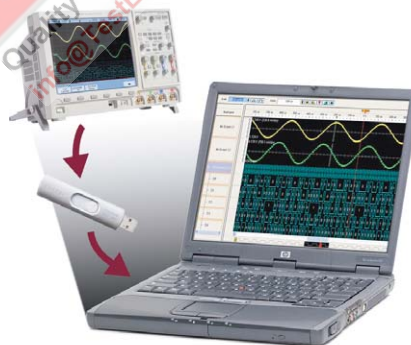
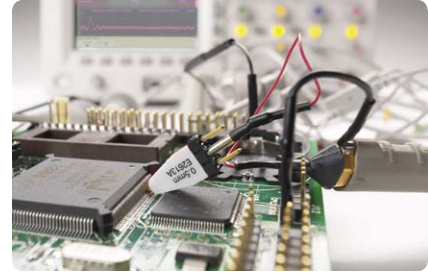


Figure 15. View and analyze previously acquired scope data on a PC-based offline tool

## Probing

To get the most out of your scope, you need the right probes and accessories for your application. That's why Agilent Technologies offers a complete family of innovative passive and active probes for the 5000 Series scopes to help you get your job done easily. For more

comprehensive information, refer to the Agilent 6000 and 5000 Series Oscilloscope Probes and Accessories Data Sheet (Agilent publication number 5968-8153EN/ENUS) or visit [www.agilent.com/find/scope\\_probes](http://www.agilent.com/find/scope_probes).



### Selection guide

|  | 10070C   | N2863A<br>(shipped with<br>100 MHz and<br>300 MHz models) | 10073C<br>(shipped with<br>500 MHz models)                                     | 10076A<br>high-voltage probe | N2771A<br>high-voltage probe              |
|--|--|---|--|------------------------------|---|
| Probe bandwidth                              | 20 MHz   | 300 MHz   | 500 MHz  | 250 MHz                      | 50 MHz                                    |
| Probe rise time (calculated)                 | < 17.5 ns  | < 1.16 ns   | < 700 ps   | < 1.4 ns                     | < 7 ns                                    |
| Attenuation ratio                            | 1:1  | 10:1  | 10:1   | 100:1                        | 1000:1                                    |
| Input resistance (when terminated into 1 MΩ) | 1 MΩ   | 10 MΩ   | 2.2 MΩ   | 66.7 MΩ                      | 100 MΩ                                    |
| Input capacitance                            | Approx. 70 pF  | Approx. 12 pF   | Approx. 12 pF  | Approx. 3 pF                 | Approx. 1 pF                              |
| Maximum input (dc+peak ac)                   | 400 Vpk CAT I<br>(mains isolated)<br>400 Vpk CAT II<br>(post receptacle mains) | 300 Vrms  | 500 Vpk CAT I<br>(mains isolated)<br>400 Vpk CAT II<br>(post receptacle mains) | 4000 Vpk                     | 15 kV dc, 10 kVrms,<br>30 kV dc + peak ac |
| Compensation range                           | None   | 5-30 pF   | 6-15 pF  | 6-20 pF                      | 7-25 pF                                   |
| Probe sense                                  | No   | Yes   | Yes  | Yes                          | No  |
| U.S. price                                   | \$175.00   | \$135.00  | \$311.00   | \$360.00                     | \$1,203.00                                |



## Probing (continued)

### Selection guide (continued)

| Current probes             | Description   |
|----------------------------|---|
| 1147A                      | 50-MHz 115 A current probe, AC/DC   |
| 1146A                      | 100-kHz current probe, AC/DC  |
| N2780A                     | 2-MHz/500 A current probe, AC/DC  |
| N2781A                     | 10-MHz/150 A current probe, AC/DC   |
| N2782A                     | 50-MHz/30 A current probe, AC/DC  |
| N2783A                     | 100-MHz/30 A current probe, AC/DC   |
| N2779A                     | Power supply for N278xA   |
| Active single-ended probes | Description   |
| 1141A                      | 200-MHz differential probe  |
| 1144A                      | 800-MHz active probe  |
| 1145A                      | 2-channel 750-MHz active probe  |
| 1142A                      | Power supply for 1144A/1145A  |
| 1156A                      | 1.5-GHz active probe  |
| Active differential probes | Description   |
| N2790A                     | 100 MHz, 1.4 kV high-voltage differential probe with AutoProbe interface  |
| N2791A                     | 25 MHz, 700 V high-voltage differential probe (battery or USB powered)  |
| N2792A                     | 200 MHz, +/-20 V differential probe (battery or USB powered)  |
| N2793A                     | 800 MHz, +/-15 V differential probe (battery or USB powered)  |
| 1130A                      | 1.5-GHz InfiniiMax differential probe amplifier<br>(Order one or more InfiniiMax probe heads or connectivity kits per amplifier.) |

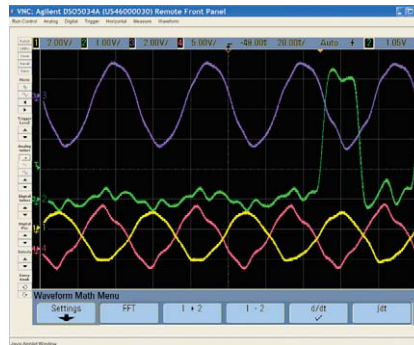
## Connectivity

Our customers tell us that oscilloscope connectivity is an increasingly important feature of their test instruments. That's why the 5000 Series scopes come with the most comprehensive hardware and software connectivity tools in their class.

### Hardware connectivity

Standard ports include:

- 2 x USB host ports (for external storage and printing devices), one on the front and one on the rear
- 1 x USB device port for high-speed PC connectivity
- 10/100 Mbit LAN for Internet/intranet connectivity
- GPIB to allow easy migration into existing test systems
- XGA out for external monitors and projectors



**Figure 17. Agilent Remote Front Panel running in a Web browser**

### LXI class C

LAN eXtensions for Instrumentation (LXI) is a standards-based architecture for test systems. By specifying the interaction of system components, LXI enables fast and efficient test system creation and reconfiguration. The 5000 Series oscilloscopes follow specified LAN protocols and adhere to LXI requirements such as a built-in Web control server, IVI-COM driver, and easy-to-use SCPI commands. The standard Agilent I/O Library Suite makes it easy to configure and integrate instruments in your system.



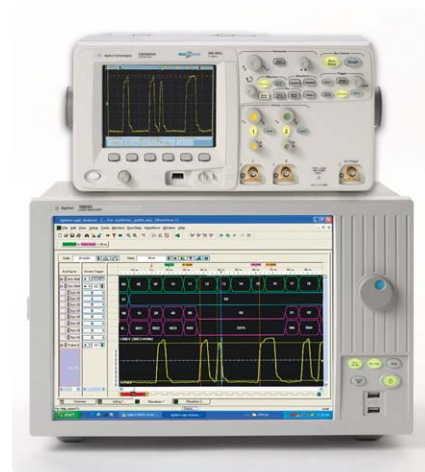
**Figure 18. The 5000 Series has just about any connection you might need – standard.**

### IntuiLink toolbars

IntuiLink gives you a quick way to move screenshots and data into Microsoft® Word and Excel. These toolbars can be installed from [www.agilent.com/find/intuilink](http://www.agilent.com/find/intuilink).

### View Scope logic analyzer and oscilloscope correlation

View Scope enables simple time-correlated measurements between an InfiniiVision 5000 Series oscilloscope and an Agilent 1680/90 or 16800/900 logic analyzer. Scope and logic waveforms are integrated into a single logic analyzer waveform display for easy analysis – all with a simple point-to-point LAN connection. You can also cross-trigger the instruments, automatically de-skew the waveforms, and maintain marker tracking between the instruments.



**Figure 19. Combine best-in-class instruments with a simple connection.**

## Performance characteristics

### Acquisition

|                             |   |
|-----------------------------|---|
| Sample rate                 | DS0501xA/503xA: 2 GSa/s each channel<br>DS0505xA: 4 GSa/s half channel <sup>1</sup> , 2 GSa/s each channel  |
| Equivalent-time sample rate | 400 GSa/s (when real-time mode is turned off)   |
| Memory depth                | Standard 8 Mpts half channel <sup>1</sup> , 4 Mpts each channel   |
| Vertical resolution         | 8 bits, up to 12 in high-resolution or averaging modes  |
| Peak detection              | DS0501xA: 1 ns peak detect<br>DS0503xA: 500 ps peak detect<br>DS0505xA: 250 ps peak detect  |
| Averaging                   | Selectable from 2, 4, 8, 16, 32, 64 ... to 65536  |
| High resolution mode        | Average mode with #avg = 1<br>12 bits of resolution when $\geq 10 \mu\text{s}/\text{div}$ , at 4 GSa/s or $\geq 20 \mu\text{s}/\text{div}$ , at 2 GSa/s |
| Filter                      | Sinx/x interpolation (single shot BW = sample rate/4 or bandwidth of oscilloscope, whichever is less) with vectors on and in real-time mode             |

### Vertical system

|  |   |
|--|---|
| Scope channels                                       | DS050x2A: 2 Ch 1 and 2 simultaneous acquisition<br>DS050x4A: Ch 1, 2, 3, and 4 simultaneous acquisition |
| Bandwidth ( $-3\text{dB}$ ) <sup>2</sup>             | DS0501xA: DC to 100 MHz<br>DS0503xA: DC to 300 MHz<br>DS0505xA: DC to 500 MHz                           |
| AC coupled   | DS0501xA: 3.5 Hz to 100 MHz<br>DS0503xA: 3.5 Hz to 300 MHz<br>DS0505xA: 3.5 Hz to 500 MHz               |
| Calculated rise time<br>(= $0.35/\text{bandwidth}$ ) | DS0501xA: 3.5 nsec<br>DS0503xA: 1.17 nsec<br>DS0505xA: 700 psec   |
| Single-shot bandwidth                                | DS0501xA: 100 MHz<br>DS0503xA: 300 MHz<br>DS0505xA: 500 MHz   |

<sup>1</sup> Half channel is when only one channel of channel pair 1-2 is turned on, or one channel of channel pair 3-4 is turned on.

<sup>2</sup> 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.



## Performance characteristics (continued)

### Vertical system (continued)

|  |   |
|--|---|
| Range <sup>1</sup>                     | 2 mV/div to 5 V/div (1 M $\Omega$ or 50 $\Omega$ )  |
| Maximum input                          | Maximum input voltage for analog inputs:<br>CAT I 300 Vrms, 400 Vpk; transient overvoltage 1.6 kVpk<br>CAT II 100 Vrms, 400 Vpk<br>with N2863A 10:1 probe: CAT I 600 V, CAT II 300 V (DC + peak AC)<br>with 10073C 10:1 probe: CAT I 500 Vpk, CAT II 400 Vpk<br>with 50 $\Omega$ input: 5 Vrms, CAT I   |
| Offset range                           | $\pm 5$ V on ranges < 10 mV/div;<br>$\pm 20$ V on ranges 10 mV/div to 200 mV/div;<br>$\pm 75$ V on ranges > 200 mV/div  |
| Dynamic range                          | $\pm 8$ div   |
| Input impedance                        | 1 M $\Omega$ $\pm$ 1%    12 pF or 50 $\Omega$ $\pm$ 1.0%, selectable  |
| Coupling                               | AC, DC  |
| BW limit                               | 25 MHz selectable   |
| Channel-to-channel isolation           | DC to max bandwidth > 40 dB   |
| Standard probes                        | DSO501xA: 10:1 N2863A shipped standard for each oscilloscope channel<br>DSO503xA: 10:1 N2863A shipped standard for each oscilloscope channel<br>DSO505xA: 10:1 10073C shipped standard for each oscilloscope channel  |
| Probe ID                               | Auto probe sense and AutoProbe interface<br>Agilent- and Tektronix-compatible passive probe sense   |
| ESD tolerance                          | $\pm 2$ kV  |
| Noise, RMS, input shorted              | DSO501xA: 0.5% full scale or 250 $\mu$ V, whichever is greater<br>DSO503xA: 0.5% full scale or 300 $\mu$ V, whichever is greater<br>DSO505xA: 0.5% full scale or 360 $\mu$ V, whichever is greater  |
| DC vertical gain accuracy <sup>2</sup> | $\pm 2.0\%$ full scale  |
| DC vertical offset accuracy            | $\leq 200$ mV/div: $\pm 0.1$ div $\pm 2.0$ mV $\pm 0.5\%$ offset value;<br>> 200 mV/div: $\pm 0.1$ div $\pm 2.0$ mV $\pm 1.5\%$ offset value  |
| Single cursor accuracy <sup>1</sup>    | $\pm \{\text{DC vertical gain accuracy} + \text{DC vertical offset accuracy} + 0.2\% \text{ full scale } (\sim 1/2 \text{ LSB})\}$<br><i>Example:</i> for 50 mV signal, oscilloscope set to 10 mV/div (80 mV full scale), 5 mV offset,<br>accuracy = $\pm \{2.0\% (80 \text{ mV}) + 0.1 (10 \text{ mV}) + 2.0 \text{ mV} + 0.5\% (5 \text{ mV}) + 0.2\% (80 \text{ mV})\} = \pm 4.785 \text{ mV}$ |
| Dual cursor accuracy <sup>1</sup>      | $\pm \{\text{DC vertical gain accuracy} + 0.4\% \text{ full scale } (\sim 1 \text{ LSB})\}$<br><i>Example:</i> for 50 mV signal, oscilloscope set to 10 mV/div (80 mV full scale), 5 mV offset,<br>accuracy = $\pm \{2.0\% (80 \text{ mV}) + 0.4\% (80 \text{ mV})\} = \pm 1.92 \text{ mV}$   |

<sup>1</sup> 2 mV/div is a magnification of 4 mV/div setting. For vertical accuracy calculations, use full scale of 32 mV for 2 mV/div sensitivity setting.

<sup>2</sup> Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period and  $\pm 10$  °C from firmware calibration temperature.

## Performance characteristics (continued)

### Horizontal

|                              |  |
|------------------------------|--|
| Range                        | DSO501xA: 5 nsec/div to 50 sec/div<br>DSO503xA: 2 nsec/div to 50 sec/div<br>DSO505xA: 1 nsec/div to 50 sec/div   |
| Resolution                   | 2.5 psec   |
| Time scale accuracy*         | Specification: 25 ppm from 0 °C to 40 °C<br>Characteristic: 25 ppm + 1 ppm per °C from 40 °C to 55 °C  |
| Vernier                      | 1-2-5 increments when off, ~25 minor increments between major settings when on   |
| Delay range                  | Pre-trigger (negative delay): Greater of 1 screen width or 125 µs<br>Post-trigger (positive delay): 1 s to 500 seconds   |
| Channel delta-t accuracy     | Same channel: $\pm 0.0025\%$ reading $\pm 0.1\%$ screen width $\pm 20$ ps<br>Channel-to-channel: $\pm 0.0025\%$ reading $\pm 0.1\%$ screen width $\pm 40$ ps<br><i>Same channel example (DSO505xA):</i> For signal with pulse width of 10 µs, oscilloscope set to 5 µs/div (50 µs screen width), delta-t accuracy = $\pm\{0.0025\% (10 \mu s) + 0.1\% (50 \mu s) + 20 \text{ ps}\} = 50.27 \text{ ns}$ |
| Modes                        | Main, delayed, roll, XY  |
| XY                           | Bandwidth: Max bandwidth<br>Phase error at 1 MHz: < 0.5 degrees<br>Z Blanking: 1.4 V blanks trace (use external trigger on DSO50x2A, channel 4 on DSO50x4A)  |
| Reference positions          | Left, center, right  |
| Segmented memory re-arm time | 8 µs (minimum time between trigger events)   |
| <b>Trigger system</b>        |  |
| Sources                      | DSO50x2A: Ch 1, 2, line, ext<br>DSO50x4A: Ch 1, 2, 3, 4, line, ext   |
| Modes                        | Auto, normal (triggered), single   |
| Holdoff time                 | ~60 ns to 10 seconds   |
| Trigger jitter               | 15 ps rms  |

\* Denotes warranted specification. Specifications are valid after a 30 minute warm-up period and  $\pm 10$  °C from firmware calibration procedure.

## Performance characteristics (continued)

### Trigger system (continued)

|                  |   |
|------------------|---|
| Selections       | Edge, pulse width, pattern, TV, duration  |
| Edge             | Trigger on a rising, falling, or alternating edge of any source   |
| Pulse width      | <p>Trigger when a positive- or negative-going pulse is less than, greater than, or within a specified range on any of the source channels.</p> <p>Minimum pulse width setting:</p> <p>5 ns (DSO501xA)</p> <p>2 ns (DSO503xA, DSO505xA)</p> <p>Maximum pulse width setting: 10 s</p>   |
| Pattern          | Trigger at the beginning of a pattern of high, low, and don't care levels and/or a rising or falling edge established across any of the channels, but only after a pattern has been established for a minimum of 2 nsec. The channel's high or low level is defined by that channel's trigger level.  |
| Sequence         | Arm on Event A, trigger on Event B (edge or pattern), with option to reset on Event C or time delay   |
| TV               | Trigger using any oscilloscope channel on most analog progressive and interlaced video standards including HDTV/EDTV, NTSC, PAL, PAL-M or SECAM broadcast standards. Select either positive or negative sync pulse polarity. Modes supported include Field 1, Field 2, all fields, all lines, or any line within a field. TV trigger sensitivity: 0.5 division of sync signal. Trigger holdoff time can be adjusted in half field increments. |
| Duration         | <p>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, or inside or outside of a set of time values.</p> <p>Minimum duration setting: 2 ns</p> <p>Maximum duration setting: 10 s</p>   |
| CAN              | Trigger on CAN (Controller Area Network) version 2.0A and 2.0B signals. Trigger on the start of frame (SOF) bit (standard). N5424A option supports triggering on remote frame ID (RTR), data frame ID (~RTR), remote or data frame ID, data frame ID and data, error frame, all errors, acknowledge error and overload frame.   |
| FlexRay          | Trigger on FlexRay Frames, errors, events and cycle-multiplexed triggering. N5432C or option FLX supports also triggering on particular frame types symbolically, such as Startup frames, Null frame, Sync frame, etc., as well as Boolean NOT frame types.   |
| LIN              | Trigger on LIN (Local Interconnect Network) sync break at beginning of message frame (standard). N5424A option supports triggering on frame ID.   |
| I <sup>2</sup> C | Trigger on I <sup>2</sup> C (Inter-IC bus) serial protocol at a start/stop condition or user defined frame with address and/or data values. Also trigger on missing acknowledge, address with no acq. restart, EEPROM read, and 10-bit write.   |
| SPI              | Trigger on SPI (Serial Protocol Interface) data pattern during a specific framing period. Supports positive and negative Chip Select framing as well as clock Idle framing and user-specified number of bits per frame.   |
| RS-232/UART      | View the information sent over a RS-232 serial bus. Display real-time time-aligned decode of transmit and receive lines. The application also enables triggering on RS-232/UART conditions.   |
| MIL-STD 1553     | Trigger on specific Command/Status Words, Data Words, and error conditions.   |
| AutoScale        | Finds and displays all active channels, sets edge trigger mode on highest-numbered channel, sets vertical sensitivity on channels, time base to display ~1.8 periods. Requires minimum voltage > 10 mVpp, 0.5% duty cycle and minimum frequency > 50 Hz.  |



## Performance characteristics (continued)

### Channel triggering

|                          |  |
|--------------------------|--|
| Range (internal)         | ±6 div from center screen  |
| Sensitivity <sup>1</sup> | < 10 mV/div: greater of 1 div or 5mV; ≥ 10 mV/div: 0.6 div       |
| Coupling                 | AC (~10 Hz), DC, noise reject, HF reject and LF reject (~50 kHz) |

<sup>1</sup> Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period and ±10° C from firmware calibration temperature.

| External (EXT) triggering | DS050x2A  | DS050x4A              |
|---------------------------|---|-----------------------|
| Input impedance           | 1 MΩ ±3%    12 pF or 50 Ω ±1%   | 1.015 kΩ ±5%          |
| Maximum input             | CAT I 300 Vrms, 400 Vpk; transient overvoltage 1.6 kVpk<br>CAT II 100 Vrms, 400 Vpk<br>with N2863A 10:1 probe: CAT I 600 V, CAT II 300 V (DC + peak AC)<br>with 10073C 10:1 probe: CAT I 500 Vpk, CAT II 400 Vpk<br>5 Vrms with 50-Ω input, CAT I | ±15 V                 |
| Range                     | DC coupling: trigger level ± 1 V and ± 8 V  | ±5 V                  |
| Sensitivity               | For ± 1V range setting:<br>DC to 100 MHz, 100 mV, >100 MHz to bandwidth of the oscilloscope, 200 mV<br>For ±8 V range setting:<br>DC to 100 MHz, 250 mV; >100 MHz to bandwidth of the oscilloscope, 500 mV  | DC to 100 MHz, 500 mV |
| Coupling                  | AC (~10 Hz), DC, noise reject, HF reject and LF reject (~50 kHz)  |                       |
| Probe ID                  | Auto probe sense and AutoProbe interface<br>Agilent- and Tektronix-compatible passive probe sense   |                       |
| <b>Display system</b>     |   |                       |
| Display                   | 6.3-inch (161 mm) diagonal color TFT LCD  |                       |
| Display update rate       | Up to 100,000 waveforms/sec in real-time mode   |                       |
| Resolution                | XGA:<br>768 vertical by 1024 horizontal points (screen area);<br>640 vertical by 1000 horizontal points (waveform area)<br>256 levels of intensity scale  |                       |
| Controls                  | Waveform intensity on front panel. Vectors on/off; infinite persistence on/off, 8 x 10 grid with intensity control  |                       |
| Built-in help system      | Key-specific help displayed by pressing and holding key or softkey of interest  |                       |
| Real-time clock           | Time and date (user adjustable)   |                       |

## Performance characteristics (continued)

### Measurement features

|                        |  |
|------------------------|--|
| Automatic measurements | Measurements are continuously updated. Cursors track last selected measurement.  |
| Voltage                | Peak-to-peak, maximum, minimum, average, amplitude, top, base, overshoot, preshoot, RMS, standard deviation, Ratio (dB)  |
| Time                   | Frequency, period, + width, – width and duty cycle on any channel. Rise time, fall time, X at max Y (time at max volts), X at min Y (time at min volts), delay, and phase on oscilloscope channels only.   |
| Counter                | Built-in 5-digit frequency counter on any channel. Counts up to the oscilloscope's bandwidth.  |
| Threshold definition   | Variable by percent and absolute value; 10%, 50%, 90% default for time measurements  |
| Cursors                | Manually or automatically placed readout of horizontal (X, $\Delta X$ , $1/\Delta X$ ) and vertical (Y, $\Delta Y$ ). Tracking Cursors provides an additional mode for cursor positioning beyond the current manual method. When cursor tracking is enabled, changing a cursor's x-axis position results in the y-axis cursor tracking the corresponding y-axis (voltage, current, etc.) value. Additionally logic or scope channels can be displayed as binary or hex values. |
| Waveform math          | $f(g(t))$<br>$g(t)$ : { 1, 2, 3, 4, 1-2, 1+2, 1x2, 3-4, 3+4, 3x4 }<br>$f(t)$ : { 1-2, 1+2, 1x2, 3-4, 3+4, 3x4, FFT(g(t)), differentiate $d/dt g(t)$ , integrate $\int g(t) dt$ , square root $\sqrt{g(t)}$ } Where 1,2,3,4 represent analog input channels 1, 2, 3, and 4<br>Note: Channels 3 and 4 only available on DS05xx4A models  |
| Measurement Statistics | Statistical data for enabled measurements such as mean, min, max, standard deviation and count   |
| <b>FFT</b>             |  |
| Points                 | Up to 10 kpts in precision mode  |
| Source of FFT          | 1, 2, 1+2, 1-2, 1x2, DS05xx4A: 3, 4, 3+4, 3-4, 3x4;<br>where 1, 2, 3, 4 represent the analog channel inputs 1, 2, 3, and 4   |
| Window                 | Rectangular, flattop, hanning, Blackman Harris   |
| Noise floor            | –50 to –90 dB depending on averaging   |
| Amplitude              | Display in dBV, dBm at 50 $\Omega$   |
| Frequency resolution   | 0.05/time per div  |
| Maximum frequency      | 50/time per div  |

### Storage

|                         |   |
|-------------------------|---|
| Save/recall             | 10 setups and traces can be saved and recalled using internal non-volatile memory. Optional secure environment mode ensures setups and traces are stored to internal volatile memory so data is erased when power is removed. Compliant to NISPOM Chapter 8 requirements. |
| Storage type and format | USB 1.1 host ports on front and rear panels<br>Image formats: BMP (8-bit), BMP (24-bit), PNG (24-bit)<br>Data formats: X and Y (time/voltage) values in CSV format, ASCII XY format, BIN format<br>Trace/setup formats: Recalled  |

### I/O

|                       |   |
|-----------------------|---|
| Standard ports        | USB 2.0 high speed device, two USB 1.1 host ports, 10/100-BaseT LAN, IEEE488.2 GPIB, XGA video output   |
| Max transfer rate     | IEEE488.2 GPIB: 500 kbytes/sec<br>USB (USBTMC-USB488): 3.5 Mbytes/sec<br>100 Mbps LAN (TCP/IP): 1 Mbytes/sec  |
| Printer compatibility | Current printer support can be found at <a href="http://agilent.com/find/InfiniiVision-printers">http://agilent.com/find/InfiniiVision-printers</a> |

## Performance characteristics (continued)

### General characteristics

|                               |   |
|-------------------------------|---|
| Physical size                 | 35.4 cm wide x 18.8 cm high x 17.4 cm deep (without handle)<br>38.5 cm wide x 18.8 cm high x 17.4 cm deep (with handle) |
| Weight                        | Net: 4.1 kg (9 lbs)<br>Shipping: approximately 9 kgs (20 lbs)   |
| Probe comp output frequency ~ | 1.2 kHz, amplitude ~2.5 V   |
| Trigger out                   | 0 to 5 V into open circuit (~23 ns delay)<br>0 to 2.5 V into 50 $\Omega$  |
| Kensington lock               | Connection on rear panel for security   |

### Power requirements

|                    |  |
|--------------------|--|
| Line voltage range | 100-120 V, 50/60/400 Hz; 100-240V, 50/60 Hz auto ranging |
| Line frequency     | 50/60 Hz, 100-240 VAC; 440 Hz, 100-132 VAC               |
| Power usage        | 120 W max  |

### Environmental characteristics

|                     |  |
|---------------------|--|
| Ambient temperature | Operating -10 °C to +55 °C; non-operating -40 °C to +70 °C   |
| Humidity operating  | 95% RH at 40 °C for 24 hour; non-operating 90% RH at 65 °C for 24 hour   |
| Altitude            | Operating to 4,570 m (15,000 ft); non-operating to 15,244 m (50,000 ft)  |
| Vibration           | Agilent class GP and MIL-PRF-28800F; Class 3 random  |
| Shock               | Agilent class GP and MIL-PRF-28800F (operating 30 g, 1/2 sine, 11-ms duration, 3 shocks/axis along major axis. Total of 18 shocks) |
| Pollution degree    | Normally only dry non-conductive pollution occurs. Occasionally a temporary conductivity caused by condensation must be expected.  |
| Indoor use          | Rated for indoor use only  |

### Other

|                           |   |
|---------------------------|---|
| Measurement categories    | CAT I   |
| Regulatory information    | Safety IEC 61010-1:2001 / EN 61010-1:2001<br>Canada: CSA C22.2 No. 61010-1:2004<br>USA: UL 61010-1:2004   |
| Supplementary information | The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC, and carries the CE-marking accordingly.<br>The product was tested in a typical configuration with HP/Agilent test systems.<br>Product specifications, characteristics, and descriptions in this document are subject to change without notice. |



## Ordering information

### Available models

| Product number | Description                              |
|----------------|--|
| DSO5012A       | 100 MHz, 2-channel portable oscilloscope |
| DSO5014A       | 100 MHz, 4-channel portable oscilloscope |
| DSO5032A       | 300 MHz, 2-channel portable oscilloscope |
| DSO5034A       | 300 MHz, 4-channel portable oscilloscope |
| DSO5052A       | 500 MHz, 2-channel portable oscilloscope |
| DSO5054A       | 500 MHz, 4-channel portable oscilloscope |

### Standard features

| Product number             | Description   |
|----------------------------|---|
| Warranty                   | 3-year return-to-Agilent warranty   |
| Hardcopy user's guide      |   |
| ABA                        | Printed user's guide in English   |
| ABD                        | Printed user's guide in German  |
| ABF                        | Printed user's guide in French  |
| ABZ                        | Printed user's guide in Italian   |
| ABJ                        | Printed user's guide in Japanese  |
| AC6                        | Printed user's guide in Korean  |
| AB9                        | Printed user's guide in Portuguese  |
| AKT                        | Printed user's guide in Russian   |
| AB2                        | Printed user's guide in simplified Chinese  |
| ABE                        | Printed user's guide in Spanish   |
| AB0                        | Printed user's guide in traditional Chinese   |
| Power cord                 |   |
| 900                        | United Kingdom  |
| 901                        | Australia/New Zealand   |
| 902                        | Continental Europe  |
| 903                        | United States/Canada  |
| 906                        | Switzerland   |
| 912                        | Denmark   |
| 917                        | South Africa/India  |
| 918                        | Japan   |
| 919                        | Israel  |
| 920                        | Argentina   |
| 921                        | Chile   |
| 922                        | China   |
| 927                        | Brazil/Thailand   |
| Probes                     | One probe per channel<br>DSO501x, DSO503x: N2863A<br>DSO505x: 10073C                    |
| Software                   | Agilent IO Libraries  |
| Interface language support | GUI menus: English, simplified Chinese, traditional Chinese, Korean, Japanese           |
| Other documentation        | Service guide (CD-ROM, English), Certificate of Calibration, Declaration of Conformance |
| Miscellaneous              | Protective front cover  |

## Ordering information (continued)

### Options

| Product number | Description  |
|----------------|--|
| SEC            | Secure environment mode – Provides compliance with National Industrial Security Program Operating Manual (NISPOM) Chapter 8 requirements |
| A6J            | ANSI Z540-compliant calibration  |
| 080            | 8 Mpts memory upgrade (from base 1 Mpts)   |

### Serial data analysis applications

| Option number – user installed | Option number – factory installed | Description   |
|--------------------------------|-----------------------------------|---|
| N5424A                         | AMS                               | CAN/LIN automotive triggering and decode (4-channel models only)      |
| N5423A                         | LSS                               | I <sup>2</sup> C/SPI serial decode option (for 4-channel models only) |
| N5457A                         | 232                               | RS-232/UART triggering and decode (4 channel models only)             |
| N5468A                         | SND                               | I2S Audio Triggering and decode (4 channel models only)               |
| N5454A                         | SGM                               | Segmented memory  |
| N5455A                         | LMT                               | Mask limit testing  |

### Available software

| Product number               | Description  |
|------------------------------|--|
| Oscilloscope Tools<br>E2690B | Oscilloscope Tools software (U.S. and Canada)  |
| N5385B                       | Oscilloscope Tools software (International)  |
| E2693B                       | 1 year update subscription for oscilloscope tools (U.S. and Canada)  |
| N5388B                       | 1 year update subscription for oscilloscope tools (International)  |
|                              | (You will order Option 005 – Scope Guide. High-bandwidth Agilent oscilloscopes support more comprehensive versions of Oscilloscope Tools. Please refer to Agilent Publication 5989-3525EN: <i>E2690B Oscilloscope Tools</i> for more details.) |
| N5427A                       | Secure environment mode- provides compliance with National Industrial Security Program Operating Manual (NISPOM) Chapter 8 requirements (after purchase option)  |
| N2762A                       | 8 Mpts acquisition memory upgrade  |

### Accessories

| Product number | Description  |
|----------------|--|
| N2916B         | Rackmount kit for 6000 and 5000 Series oscilloscopes                     |
| N2917B         | Transit case for 6000 and 5000 Series oscilloscopes                      |
| N2760A         | Soft carrying case for 5000 Series oscilloscopes                         |
| N2790A         | 100 MHz, 1.4 kV high-voltage differential probe with AutoProbe interface |
| N2791A         | 25 MHz, 700 V high-voltage differential probe (battery or USB powered)   |
| N2792A         | 200 MHz, +/-20 V differential probe (battery or USB powered)             |
| N2793A         | 800 MHz, +/-15 V differential probe (battery or USB powered)             |

### Cable

| Product number | Description          |
|----------------|----------------------|
| 10833A         | GPIB cable, 1 m long |



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|---------------|----------------|
| Canada        | (877) 894-4414 |
| Latin America | 305 269 7500   |
| United States | (800) 829-4444 |

#### Asia Pacific

|           |                |
|-----------|----------------|
| Australia | 1 800 629 485  |
| China     | 800 810 0189   |
| Hong Kong | 800 938 693    |
| India     | 1 800 112 929  |
| Japan     | 0120 (421) 345 |
| Korea     | 080 769 0800   |
| Malaysia  | 1 800 888 848  |
| Singapore | 1 800 375 8100 |
| Taiwan    | 0800 047 866   |
| Thailand  | 1 800 226 008  |

#### Europe & Middle East

|         |                       |
|---------|-----------------------|
| Austria | 43 (0) 1 360 277 1571 |
| Belgium | 32 (0) 2 404 93 40    |
| Denmark | 45 70 13 15 15        |
| Finland | 358 (0) 10 855 2100   |
| France  | 0825 010 700*         |

\*0.125 €/minute

|                           |                      |
|---------------------------|----------------------|
| Germany                   | 49 (0) 7031 464 6333 |
| Ireland                   | 1890 924 204         |
| Israel                    | 972-3-9288-504/544   |
| Italy                     | 39 02 92 60 8484     |
| Netherlands               | 31 (0) 20 547 2111   |
| Spain                     | 34 (91) 631 3300     |
| Sweden                    | 0200-88 22 55        |
| Switzerland               | 0800 80 53 53        |
| United Kingdom            | 44 (0) 118 9276201   |
| Other European Countries: |                      |

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