# Agilent RF and Universal Frequency Counter Comparison Guide

## Technical Overview

*A comparison of the 53131A, 53132A, 53181A frequency counters and their replacement, the 53200 Series RF & Universal Frequency Counter/Timers*

The Agilent 53131A, 53132A, 53181A (531xxA) RF and universal frequency counters have long established the industry standard for best in class frequency and time measurements. The 53210A, 53220A and 53230A (53200 Series) counters offer a replacement for the 531xxA family, offering even more capabilities in the speed and accuracy that only frequency counters can provide, along with new and advanced capabilities for a broader variety of applications. This document compares the key capabilities and highlights those areas where there are key differences and advancements to note.


Agilent Technologies

# 53131A, 53132A, 53181A to 53200 Series Product Replacement Guide

## Transitioning from the 53131A, 53132A or 53181A Frequency Counters to the 53200 Series

| **53131A, 53132A, 53181A Counters/Timers**<br>*If you use these models:* | **NEW 53200 Series Counter/Timers**<br>*Now – order this:* |
|---|---|
| 53181A 225 MHz RF Counter (10 digits/s)<br>1 channel with optional 2nd microwave channel | 53210A 350 MHz RF Counter (10 digits/s)<br>1 channel with optional 2nd microwave channel |
| 53131A 225 MHz Universal Counter (10 digits/s, 500 ps)<br>2 channels with optional 3rd microwave channel | 53220A 350 MHz Universal Counter (12 digit/sec, 100 ps)<br>2 channels with optional 3rd microwave channel |
| 53132A 225 MHz Universal Counter (12 digits/s, 150 ps)<br>2 channels with optional 3rd microwave channel | 53220A 350 MHz Universal Counter (12 digits/s, 100 ps) or<br>53230A 350 MHz Universal Counter (12 digits/s, 20 ps)<br>2 channels with optional 3rd microwave channel |

| **Options: If you use these options:** | **Now-order this:** |
|---|---|
| 001 Medium stability time base | N/A - TCXO time base comes standard in base models |
| 010 High stability time base | 010 Ultra-high stability OCXO time base |
| 012 Ultra-high stability oven time base (53132A only) | 010 Ultra-high stability OCXO time base |
| 015 Add 1.5 GHz channel (BNC) (53181A only) | 106 Add 6 GHz CW channel (Type N) |
| 030 Add 3 GHz channel (BNC) | 106 Add 6 GHz CW channel (Type N) |
| 050 Add 5 GHz channel (Type N) | 106 Add 6 GHz CW channel (Type N) |
| 124 Add 12.4 GHz channel (Type N) | 115 Add 15 GHz CW channel (Type N) |
| 060 Baseband rear input in parallel with front input | 201 Add rear panel parallel input for baseband channel(s) |
| 061 Baseband rear input in parallel with front input, microwave input rear only | 201 Add rear panel parallel input for baseband channel(s)<br>203 Move microwave channel to rear (SMA) |
| 062 Baseband rear input in parallel with front input, microwave input front only | 201 Add rear panel parallel input for baseband channel(s)<br>NOTE: Default for microwave channels (Option 106 and 115) is front. |

**More information**

For additional details on all of the specifications of the new 53200 Series Frequency Counter/Timers, please refer to the *Agilent 53200 Series RF/Universal Counter/Timers Data Sheet* (part number 5990-6283EN). Specifications listed in the 53200 Series datasheet are ISO 17025 Compliant. Note that 53131A, 53132A and 53181A specifications are not ISO 17025 compliant.

For Agilent frequency counters product literature and additional details, please visit our web site: **www.agilent.com/find/counters**

View video demonstrations of the new 53200 Series frequency counter features and applications : **www.agilent.com/find/53200videos**

Additional 53131A, 53132A, 53181A frequency counter migration information: **www.agilent.com/find/countermigration**

## Comparison Summary

| | **Agilent 531xxA Series** (53181A, 53131A, 53132A) | **Agilent 53200 Series** (53210A, 53220A, 53230A) |
|---|---|---|
| Frequency bandwidth | 225 MHz, 1.5 (53181A only), 3, 5, 12.4 GHz | 350 MHz, 6, 15 GHz |
| Frequency resolution | 10 digits/s (53181A, 53131A)<br>12 digits/s (53132A) | 10 digits/s (53210A)<br>12 digits/s (53220A, 53230A) |
| Time interval resolution (single-shot resolution) | 500 ps (53131A)<br>150 ps (53132A) | 100 ps (53220A)<br>20 ps (53230A) |
| Memory | None | 1M reading internal memory<br>USB flash |
| Speed | Transactional: 200 readings/s<br>Readings to memory: N/A<br>Timestamp: N/A | Transactional: 350 - 400 readings/s<br>Readings to memory:<br>Frequency: up to 75,000 readings/s<br>Time interval: up to 90,000 readings/s<br>Timestamp: up to 1M readings/s |
| Timebase *(See detailed comparison below)* | XO (standard in all models)<br>3 OCXO options | TCXO (standard in all models)<br>1 OCXO Option |
| Connectivity | GPIB, RS232 (print only) | LXI-C/LAN, USB, GPIB |
| Display & analysis | Vacuum florescent display<br>Math and limit operations | Color graphical display<br>Full integrated math, limits, statistics, graphs |
| Rack mount dimensions | 212.6 mm (W) x 88.5 mm (H) x 348.3 mm (D) (2U x ½ width) | 212.8 mm (W) x 88.3 mm (H) x 272.3 mm (D) (2U x ½ width) |

### Time interval resolution and accuracy

One of the key advances the 53200 Series provides is the industry leading timing specifications. The single-shot resolution for the 53230A is 20 picoseconds while on the previous 531xxA generation, the fastest single-shot timing available was 150 ps (53132A). Single-shot timing represents how well the counter can resolve an event in time. It is most often associated with time interval measurements, but every counter measurement is a result of timing and accurate placement of the edge. So, the better the single-shot timing of a frequency counter, the better overall measurement performance of the counter.

### Memory and measurement reading speed

There are several ways to consider the measurement speed on frequency counters:

- **Single measurement reading throughput:** the time to take a single measurement and transfer from volatile reading memory over the I/O bus.
- **Block reading throughput:** the time to take blocks of measurements into memory and when complete, transfer from volatile reading memory over the I/O bus.

Typically, single measurement throughput is slower than block measurement throughput due to I/O processing/transfer overhead. The 531xxA frequency counters are single reading counters with no internal memory. In most applications, up to 200 readings per second is the typical single measurement reading speed on 531xxA counters. Depending on the I/O interface chosen (USB, LAN or GPIB), the single measurement throughput on the 53200 Series counters can have optimized throughput of approximately 400 readings per second.

The reading throughput potential is substantially different when block reading capabilities are considered. With the built-in memory of 1 million readings on the 53200 Series counters, speeds increase to tens of thousands of readings per second. Again, the I/O interface chosen impacts the amount of overhead on the overall throughput capabilities. The 53200 Series data sheet outlines typical reading speeds by model (part number 5990-6283EN).

# Comparison Summary

## Timebase comparisons

The following table describes and compares the timebases available with each series of counters. Typically, most timebases are compared based on their aging specification - either one month or one year. The 53200 Series comes standard with a timebase that is of equivalent performance to the Option 001 on the 531xxA model counters. There is one 53200 Series timebase option: Option 010 Ultra-High Stability Time Base. Although both 53200 Series Option 010 and 531xxA Option 012 are ultra-high stability time bases, Option 012 has the better aging performance of the two.

| | **531xxA Series** | | | | **53200 Series** | |
|---|---|---|---|---|---|---|
| Timebase | Standard XO | Option 001 medium oven | Option 010 high oven | Option 012 (53132A only) ultra-high oven | Standard TCXO | Option 010 ultra-high stability OCXO |
| Aging | | | | | | |
| 24-hour, $T_{CAL}$ ± 1 °C | | 40 ppb ($4 \times 10^{-8}$) | 0.5 ppb ($5 \times 10^{-10}$) | 0.1 ppb ($1 \times 10^{-10}$) | | ± 0.3 ppb ($3 \times 10^{-10}$) |
| 30-day, $T_{CAL}$ ± 5 °C | 0.3 ppm ($3 \times 10^{-7}$) | 0.2 ppm ($2 \times 10^{-7}$) | 15 ppb ($1.5 \times 10^{-8}$) | 3 ppb ($3 \times 10^{-9}$) | ± 0.2 ppm ($2 \times 10^{-7}$) | ± 10 ppb ($10 \times 10^{-9}$) |
| 1-year, $T_{CAL}$ ± 5 °C | | | | 20 ppb ($2 \times 10^{-8}$) | ± 1 ppm ($1 \times 10^{-6}$) | ± 50 ppb ($50 \times 10^{-9}$) |
| Temperature (typical) | | | | | | |
| 0 to 55 °C relative to 25 °C | 5 ppm ($5 \times 10^{-6}$) | 0.2 ppm ($2 \times 10^{-7}$) | 2.5 ppb ($2.5 \times 10^{-9}$) | 2.5 ppb ($2.5 \times 10^{-9}$) | ± 1 ppm ($1 \times 10^{-6}$) | ± 5 ppb ($5 \times 10^{-9}$) |
| $T_{CAL}$ ± 5 °C | | | | | ± 0.5 ppm ($5 \times 10^{-7}$) | ± 0.5 ppb ($5 \times 10^{-10}$) |

53200 Series Option 010 is available on all models and has accuracy between that of 531xxA Options 010 (available on all models) and 012 (only available on the 53132A).

Like the 531xxA counters, the 53200 Series also accepts an external reference (1, 5 or 10 MHz) if higher timebase stability is required. Additionally, the 53200 Series also offers an internal lithium ion battery pack and charger (Option 300) if use requires disconnecting the counter from power while maintaining timebase stability.

## Connectivity, interfaces and programming compatibility

The standard I/O connectivity on the 531xxA counters was GPIB. RS-232 was also available as a talk-only interface for printer support and could also be set as a hardware limit out indicator to flag when a measurement drifts out of limits.

The 53200 Series offers 10/100/1000 LAN/LXI-C (Sockets and VXI-11 protocol), USB 2.0, and GPIB connectivity. RS-232 output and hardware limit out capability will need to be replicated via software control.
The new 53200 Series counters have a built-in emulation mode that enables the Agilent 531xxA Standard Commands for Programmable Instruments (SCPI) command set to be used with a 53200 Series counter.

With 531xxA Series compatibility mode selected, all programming is through the counter's remote interface (LAN, USB, GPIB). The counter display responds according to the remote commands received. When in emulation mode, you get 53200 Series precision and measurement accuracy. The emulation mode is a SCPI language substitution (commands and syntax operation) to enable you to utilize existing programs. NOTE: Pressing any front panel key while in 531xxA compatibility mode returns the counter to 53200 Series mode.

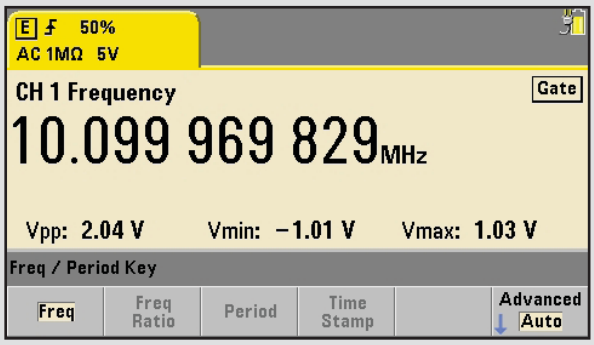
For more details, please refer to the *Agilent RF & Universal Frequency Counter/Timers Programming Comparison Guide* (part number 5990-6570EN).


53200A Series rear panel

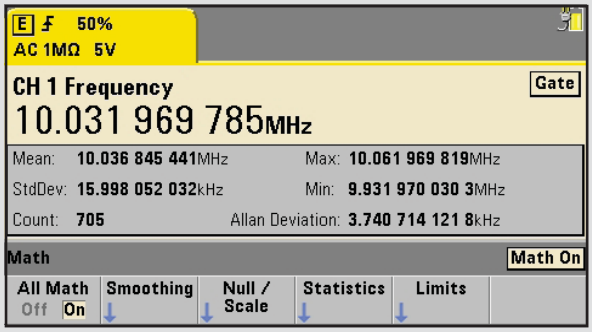
## Set-up and built-in math/statistics

The 53200 Series frequency counters offer an intuitive user interface with a large color graphical display.

- Input settings such as trigger threshold, input impedance, input range, etc can be easily viewed from the front panel.

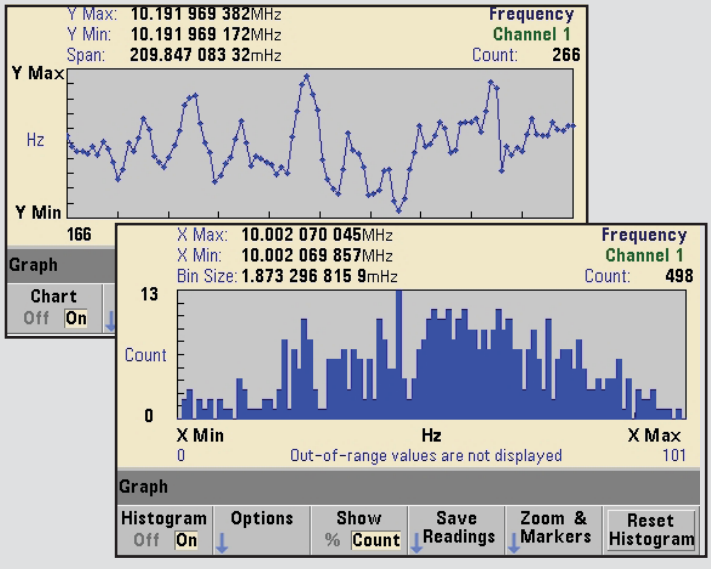



- Built-in statistics, math and limit functions are readily available.




- Graphics functions compute and display histograms and trend charts of real time measurement data.

- The front panel datalogging function enables logging and analysis of up to one million readings. Front panel USB flash memory access makes storing measurement results and analyzing via your PC fast and simple.



## Additional 53200 Series capabilities

In addition to the built-in math and statistic features, the 53230A model provides new measurement capability not available in previous generation counters.

- Continuous, gap-free measurements for true Allan Deviation computations. In this mode, all samples are taken within a single gate open/gate close sequence and computed back-to-back. There is no gap between readings that otherwise occurs with the per sample gate open/gate close sequence.
- Time stamp measurements to record events (edges) as they occur on the counter input channels. Timestamp measurement speed is up to one million samples per second.
- Microwave burst/pulse measurements are available on optional channel 3 with the pulse/burst measurement software (Option 150). Measurements include: Burst carrier frequency, pulse repetition interval (PRI), pulse repetition frequency (PRF), positive (on) width, and negative (off) width.

**www.agilent.com**
**www.agilent.com/find/countermigration**

### Agilent Email Updates

**www.agilent.com/find/emailupdates**
Get the latest information on the products and applications you select.

### LXI

**www.lxistandard.org**
LAN eXtensions for Instruments puts the power of Ethernet and the Web inside your test systems. Agilent is a founding member of the LXI consortium.

### Agilent Channel Partners

**www.agilent.com/find/channelpartners**
Get the best of both worlds: Agilent's measurement expertise and product breadth, combined with channel partner convenience.

Agilent Advantage Services

Agilent Advantage Services is committed to your success throughout your equipment's lifetime. We share measurement and service expertise to help you create the products that change our world. To keep you competitive, we continually invest in tools and processes that speed up calibration and repair, reduce your cost of ownership, and move us ahead of your development curve.

**www.agilent.com/find/advantageservices**

Agilent Electronic Measurement Group
KEMA Certified
ISO 9001:2008
Quality Management System

**www.agilent.com/quality**

For more information on Agilent Technologies' products, applications or services, please contact your local Agilent office. The complete list is available at:

**www.agilent.com/find/contactus**

**Americas**

| | |
|---|---|
| Canada | (877) 894 4414 |
| Brazil | (11) 4197 3500 |
| Mexico | 01800 5064 800 |
| 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 |
| Other AP Countries | (65) 375 8100 |

**Europe & Middle East**

| | |
|---|---|
| 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 |
| United Kingdom | 44 (0) 118 9276201 |

*For other unlisted Countries:*
**www.agilent.com/find/contactus**

Revised: October 14, 2010

Product specifications and descriptions in this document subject to change without notice.


Printed in USA, April 7, 2011
5990-7861EN

Agilent Technologies