

Quick Tips

SELLING 53200 FREQUENCY COUNTERS



Agilent Technologies

Quick Demo

- Equipment:** 532xxA universal counter, 3352xA FG/AWG, BNC cable
- Conventions:** Hard keys are **bold** and soft keys are underlined
- Summary:** Demo uses the 532xxA universal counter to measure a 10-MHz signal with Gaussian noise

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1. Setup and turn-on the 532xxA and 3352xA.
Connect the BNC cable to chan 1 of the 532xxA and chan 1 of the 3352xA.
 2. On the 3352xA:
 - a. Press **Chan1** → Output Load → Set to High Z to match the counter input impedance.
Press Output On.
 - b. Press **Parameters** → Frequency, then use the key pad to enter 10 and press MHz.
 - c. Press **Modulate** → Type → FM → Shape → More → Noise.
Press Freq Dev, then use key pad to enter **300** and press kHz.
Press Bandwidth, then use key pad to enter **10** and press kHz.
Press Modulate On to turn on the modulation.

The 3352xA is now outputting a 10-MHz carrier with 10 kHz of Gaussian noise on it.
 3. On the 532xxA:
 - a. Press **Math** → Statistics → Statistics On.

The 532xxA is now making the following frequency measurements: current, mean, min, max, standard dev, and Allen deviation.
 - b. Press **Graph** → Histogram

The 532xxA is now displaying each reading in memory on a histogram.
 4. Switch back and forth between the two displays by pressing **Freq Period** for the statistics display and **Graph** for the histogram.

Quick Facts

- 350-MHz channel 1 and 2
- Up to 75,000 frequency and 90,000 time interval readings/Sec
- 20-picosecond single-shot measurement resolution
- Optional channel 3 up to 15 GHz
- Gapless sampling
- Optional pulsed RF/microwave capability

Agilent's New 53200 Series Frequency Counters

What makes the 53200 Series counters better than anything you've used before? Here are a few of the improvements and new capabilities:

MORE FREQUENCY

350 MHz baseband frequency, 6- or 15-GHz optional microwave channels

MORE RESOLUTION

Up to 12 digits/sec and 20-ps single-shot time interval

MORE INFORMATION ACCESSIBILITY

1 M reading memory, up to 75,000 frequency readings/sec, strip chart/trend plot, cumulative histograms

MORE CONNECTIVITY

First LXI-compliant counters (LXI/Ethernet, USB, and opt.GPIB connectivity)

MORE MEASUREMENT CAPABILITY

Basic modulation domain/time stamp and optional pulse/burst microwave measurements

Additional Resources

For more detailed demo resources, refer to the 53200 Series memory stick where you will find more useful information, including the new video demo series, a detailed demo guide, a data sheet with specifications, and more Frequency Counter hints/tips. Also, visit our Web site at:

www.agilent.com/find/FrequencyCounterSpotlight



Why Do Customers Still Use Frequency Counters?

Why do customers still buy counters instead of instruments like scopes and spectrum analyzers? Scopes and spectrum analyzers can perform many of the same frequency and timing measurements that counters can, plus so much more. Here's why: Counters provide much better accuracy, resolution, and speed for frequency and timing measurements. Also, counters are priced much lower than scopes and spectrum analyzers, so for applications that just require frequency and timing measurements, counters are a cost-effective solution.

Quick Facts

- Counters provide higher accuracy and resolution for frequency and timing measurements than scope and spectrum analyzers.
- Counters provide higher measurement speed than scopes and spectrum analyzers.
- Counters can make many of the same measurements as scopes and spectrum analyzers for a much lower cost.

Accuracy and Resolution

- Spectrum analyzers and scopes provide only 5 to 9 digits of useful measurement resolution, while the 53200 counter family can provide 10 to 12 digits of useful resolution.
- Resolution example: Agilent's 6000 and 7000 Series scopes provide just 5 digits of frequency measurement resolution.
- Accuracy example: measuring 100 MHz signal, Agilent's MXA family provides about 1000 Hz while the 53200 family can provide 10 Hz, which is over 100 times improved accuracy!
- Who cares? Communication, radar, satellite, oscillator, and high-speed digital manufacturers care about accuracy and resolution, as do calibration labs and communication and radar maintenance workers.

Measurement Speed

- An MXA can make only 250 frequency measurements per second, while the 53200 family can make up to 75,000 frequency measurements per second, which is more than 300 times faster!
- The 53200 family can make up to 90,000 time interval measurements per second.
- Who cares? High-volume manufacturers of oscillators, communication equipment, and high-speed digital circuits care about measurement speed.

Cost

- A counter's cost is typically 1/3 the cost of a scope and 1/14 the cost of a mid-range spectrum analyzer
- Who cares? Cost-sensitive manufacturers who need to make frequency and timing measurements care about test equipment costs.

Example Customers

Example counter customers: Raytheon, Cisco, NDK, Vectron, Rakon, U.S. Navy, and Motorola. A good way to find counter customers is to look for customers who are buying performance scopes, spectrum/signal analyzers, and power meters. If they need one or more of these instruments, chances are they need a counter.

Selling to Communication Equipment Manufacturers

The time base is critical to the accuracy of all wireless communication devices. Any inaccuracies in the time base will trickle into the transmit and receive signals, leading to bit errors and frequency band violations. To overcome challenges caused by limited frequency spectrum availability and higher data rates, today's communication devices must have higher and higher time-base accuracy. Communication device companies test their devices' time bases with counters because of their high-frequency measurement accuracy.

Quick Facts

- Customers need counters for frequency measurements in R&D, design validation, and manufacturing.
- A/D communication manufacturers need higher performance (53220A and 53230A).
- Commercial communication manufacturer's performance needs vary, and they tend to be cost sensitive.

Customer Profile and Needs

R&D:

May have one counter per bench or a couple shared units in the lab

- Used sparingly throughout the design process to check time-base accuracy
- User needs: high accuracy and resolution, ease of use, and reliability

Design validation (DV) and reliability testing:

- Needed to check time-base accuracy and stability in varying operating and environmental conditions
- User needs: High accuracy and resolution frequency measurement capability, statistical and trending capabilities

Manufacturing:

- Frequency measurements made on each time base to ensure no component defects and no problems in manufacturing process

- Customer example: Four frequency measurements made on time base in specific time interval to check accuracy and short-term stability
- User needs: For frequency measurements, typically need about 10 digits of useful resolution. In high-volume manufacturing, high-speed measurement capability is needed.

How to Win with the 53200 Series

- Three different models for more price/performance flexibility compared to competitors like Pendulum/Fluke (2 models) and Picotest (1 model)
- For aerospace defense communication companies, Agilent's product reliability, quality, and support is a big advantage
- Can make up to 75,000 frequency measurements per second for high-volume manufacturing
- Expanded capability with built-in statistical calculations, histogram, and trend chart capabilities on large LCD display
- Provides three different remote IO interfaces: GPIB, USB, and LAN (LXI). Agilent's 531xxA family provides only GPIB, and Pendulum/Fluke provides only USB and GPIB.

Example Customers

Raytheon, Motorola, Harris, Sony Ericsson, Rockwell Collins

Selling to Oscillator Manufacturers

Oscillators are defined by their frequency accuracy and their frequency stability, so a counter's ability to make frequency and timing measurements with superior accuracy and resolution makes it a popular tool with oscillator test engineers. Oscillator test can be divided into two general categories: design verification (DV)/quality assurance (QA) testing and manufacturing test. DV and QA require high accuracy and resolution. Also, DV and QA engineers make a large number of measurements for testing oscillator stability. Manufacturing test requires a balance of accuracy and speed. Oscillator manufacturing environments are typically high volume and cost sensitive.

Quick Facts

- Need counters for frequency measurements in R&D, DV, QA, and manufacturing
- Manufacturing engineers interested in high-speed testing
- QA and DV engineers interested in high accuracy, high resolution and advanced analysis capabilities
- Typically will want high-performance counters like 53230A and 53220A versus 53210A

Customer Profile and Needs

DV and QA:

- Need to make frequency accuracy and stability measurements
- Depending on oscillator quality, 9 to 12 digits of useful resolution are needed for frequency measurements
- User needs:
 - High-accuracy and -resolution frequency measurement capability
 - Statistical and trending capabilities
 - Large internal memory for frequency stability analysis

Manufacturing:

- Oscillator frequency measurement made to ensure no component defects and no problems in manufacturing process
- Oscillators manufacturing typically is high volume, so measurement speed is critical

- Cost-competitive industry, so customer often looks for discounts, but they buy multiple counters at once

How to Win with the 53200 Series

- Three different models for more price and performance flexibility compared to competitors like Pendulum/Fluke (2 models) and Picotest (1 model)
- The 53230A is ideal for high-quality oscillator and high-volume oscillator manufacturers, because:
 - Can make up to 75,000 frequency measurements per second (manufacturing)
 - Provides highest measurement accuracy of the 53200 series (DV and QA)
 - Gapless measurement capability for true Allan variance measurement (DV and QA)
- Built-in statistical calculations, histogram, and trend chart capabilities on large LCD display
- Provides three different remote IO interfaces: GPIB, USB, and LAN (LXI). Agilent's 531xxA family provides only GPIB, and Pendulum/Fluke provides only USB and GPIB.

Example Customers

TDK, Vectron, Rakon, Connor Winfield, TXC, PhaseLink Corp. (frequency multipliers)

Selling to Calibration Laboratories

Calibration and counters are a natural fit: Calibration requires high-accuracy and high-resolution measurements, and that's exactly what counters provide. Every calibration lab has multiple counters for frequency and timing measurements. To increase the counter's accuracy, the lab typically will add an external time base that uses an extremely high-accuracy frequency standard, such as a rubidium frequency standard.

Quick Facts

- Interested in high accuracy and resolution, not interested in measurement speed
- Want good documentation of specifications and thorough testing of counter
- Although mainly use frequency measurements, also need timing measurements

Customer Profile and Needs

Time base calibration:

- Test and measurement instruments that create or measure a signal have an internal time base or clock (typically 10 MHz) that must be tested during calibration.
- A counter is used to measure the time base frequency to ensure it is within tolerance.
- Depending on the instrument being tested, 9 to 12 digits of useful resolution are needed.
- Example instruments with time bases that need a counter for calibration: signal generators, spectrum/signal analyzers, power meters, counters, function generators.

Frequency measurements:

- A high-accuracy instrument that outputs periodic signals will need to have its output checked at various frequencies to ensure it is in tolerance.
- A counter is used to check the output frequency at various settings.
- Example instruments that need output frequency checks: function generators, signal generators, pulse generators.

Timing measurements:

- In tests that require nanosecond or sub nanosecond timing, counters are used because scopes do not provide enough timing resolution.
- Timing measurements are needed to calibrate any instruments that create accurate pulses, such as pulse generators and function generators.

How to Win with the 53200 Series

- Customers in this market will most often want the 53220A or 53230A rather than the 53210A.
 - They offer high accuracy and resolution.
 - They offer timing measurements.
- If customers offer onsite calibration services, they will be interested in the optional battery for keeping counter warmed up during transit.
- Pendulum/Fluke offers an optional rubidium oscillator in its counter, which may be an advantage in this space.
 - If lab already has frequency standard (typical) they won't care, but may see it as a good portable frequency standard
 - Focus on how our frequency and timing accuracy beats pendulum

Example Customers

Military organizations, large tech companies that have in-house calibration labs, test and measurement companies

Selling to High-Speed Digital Customers

Counters are used to check clock frequencies. Timing measurements are used for checking digital event timing and measuring signal path delay through digital logic. Makers/users of high-speed digital semiconductors (such as Xilinx and Intel/Cisco and Cray Inc.) also need to make these measurements.

Quick Facts

- Frequency measurements are needed for checking the accuracy of clock signals.
- Resolution needs vary depending on signal frequency and intended application, typically 7 to 11 digits.
- Timing measurements serve as a debugging tool for analyzing high-speed digital events.

Customer Profile and Needs

Clock measurements:

- Frequency measurements are needed for checking accuracy of clock signals. Errors in clock signals lead to bit errors in digital signals.
- Clock may be separate or it may be embedded in a digital signal.
 - If embedded, averaging and memory are needed in counter to average out effects of data.
- Clock accuracy measurements are needed in R&D, design validation (DV), and manufacturing.

Timing measurements:

- In this R&D application, scopes and logic analyzers are the engineer's best friends.
- Counters are used for timing when an engineer needs to check the timing of two digital events with nanosecond or sub-nanosecond resolution.

- High-resolution counter application examples:

- Measuring delay in parallel signals
- Measuring signal path delay through solder runs or high-speed digital logic

How to Win with the 53200 Series

- If customer is just looking for frequency measurements, the 53210A or 53220A typically is good enough.
- Measurement speed and cost are the biggest purchase decision factors in manufacturing.
 - Keep in mind that high-speed measurement capability can reduce costs.
 - We provide faster measurement speeds than Pendulum and Picotest.
- If timing measurements are needed, the 53220A provides 100 ps of single-shot time interval resolution and the 53230A provides 20 ps.
 - Better than both Pendulum/Fluke and Picotest

Example Customers

Cisco, Lockheed Martin (satellites), Xilinx, Microchip



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