53200 Series of RF and Universal Frequency Counter/Timers

KEYSIGHT
TECHNOLOGIES

With the Keysight Technologies, Inc. 53200 RF and Universal Frequency Counters/Timers, You Get:

More bandwidth

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

More resolution and speed

– 12 digits/sec
– 20 ps single shot time interval
– Up to 75,000 frequency readings/sec, 90,000 time interval readings/sec
– Up to 1M Sa/sec gap-free frequency/timestamp

More insight

– Datalog trend plot
– Cumulative histogram
– Built-in math analysis and statistics
– 1 M reading memory

More connectivity

– LXI-C/Ethernet LAN
– USB (I/O and memory stick)
– GPIB interface
– Optional battery for timebase accuracy or environments with unstable AC power

More measurement capability (53230A only)

– Continuous gap-free measurements
– Basic modulation domain analysis (MDA) and timestamp
– Pulse microwave measurements

> *" I never expected a frequency counter to do so much, so fast."*
>
> Speed, resolution, and accuracy are just the beginning

53210A:
350 MHz RF Frequency Counter, 10 digit/sec

53220A:
350 MHz Universal Frequency Counter/Timer, 12 digit/sec, 100 ps

53230A:
350 MHz Universal Frequency Counter/Timer, 12 digit/sec, 20 ps

Find and Resolve Problems Faster

The Keysight 53200 Series frequency counter/timers give you more insight into your signals so you can solve design and manufacturing problems faster:

Application:

Crystal/oscillator components

How the 53230A helps:
Easily observe the stability of your clocks over time

Take advantage of continuous/gap-free measurements with timestamps to measure the stability of your clocks over time. See changes in the Allan Deviation over a series of measurements. (Figure 1)

– On-going insight to measurement data with graphing and built-in analysis
– All samples per trigger taken continuously
  with no lag between readings, time-stamped for further stability analysis
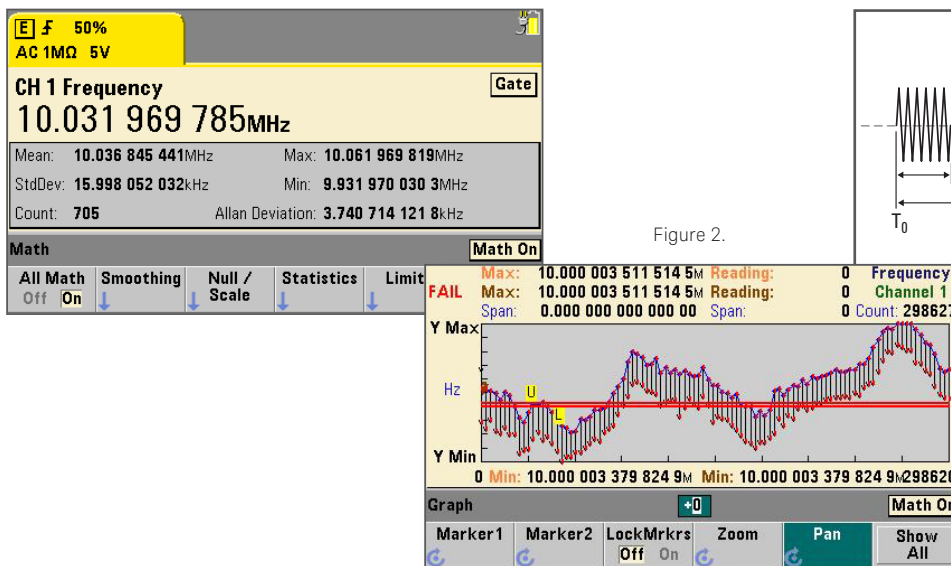
Application:

Communications equipment

How the 53200 Series helps:
Make and analyze highly accurate jitter and wander measurements without spending a fortune

Whether you're taking slow, high precision measurements over a long period of time, or fast measurements over a short time, you can use your Keysight 53200 Series frequency counter as a low-cost, highly accurate jitter and wander analysis solution (Figure 2):

– See histograms of a block of data
– Watch trends and changes of your frequency over a series of measurements
– Use markers to view specific data points
– Analyze your results with math functions: mean, standard deviation, Allan Deviation, etc.

Application:

Radar equipment

How the 53230A helps:
Minimize errors in your transmitted signals

Now there's a low-cost way to verify the accuracy of transmitted signals to increase your confidence in your target data. Use the Keysight 53230A universal frequency counter/timer to make high-resolution pulse/burst microwave frequency measurements,
(Figure 3) including carrier frequency, PRI, PRF and PW. Compared to other pulsed RF measurement solutions, the 53230A is:

– Easier to use
– Lower cost

Figure 1.

Figure 2.

Figure 3.

Pulse width (τ)

T_0 Pulse repetition period (T)
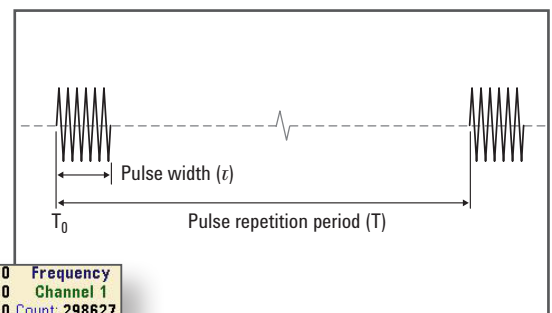
Keysight 53200 Series of RF and Universal Frequency Counter/Timers

Frequency counters are depended on in R&D and in manufacturing for the fastest, most accurate frequency and time interval measurements. The Keysight 53200 family of RF and universal frequency counter/timers expand on this expectation to allow you to get the most information, connectivity and new measurement capabilities while building on the speed and accuracy you've depended on with Keysight's time and frequency measurement experience. Three available models offer resolution capabilities up to 12 digits/sec single shot frequency resolution on a one second gate. Single shot time interval measurements can be resolved down to 20 psec.

Easy access to your basic measurement functions:

– **Freq/Period** (all models): frequency, frequency ratio, period, single period, pulse/burst measurements (53230A)
– **Time Interval** (53220A/53230A): time interval, rise/fall, duty, pulse width, phase
– **Totalize** (53220A/53230A)
– **Voltage Levels** (all models)

Pulse microwave measurements (53230A): burst carrier frequency, pulse repetition frequency (PRF), pulse repetition interval (PRI), burst width.

Continuous gap-free measurements (53230A): enable basic modulation domain analysis. Choose the number of samples (up to 1M samples) or time (up to 100,000 seconds), and collect a block of gap free measurements with pairs of delta-time timestamps for every defined number of events (for that trigger/gate). The capability is available on all channels, one channel at a time.

More insight to see the measurements, graphs and math you need with large 4.3" (109.22 mm) color graphical display.

– **Digits**
– **Graph** views of trendline/strip charts, histograms with markers to zoom in to the data you need Markers are available to read to read specific measurement values from trend and histogram charts. Colored limit lines allow you to set up your pass/fail boundaries and easily determine from the front panel when measurements have surpassed those thresholds.
– **Math** with built in statistics and analysis
– **New data logging capability** automatically saves acquisition results to non-volatile memory (75 MB, up to 5 M readings) at up to 75,000 readings/sec. Transfer readings from memory via LAN or USB as fast as 1M readings in 2 s.
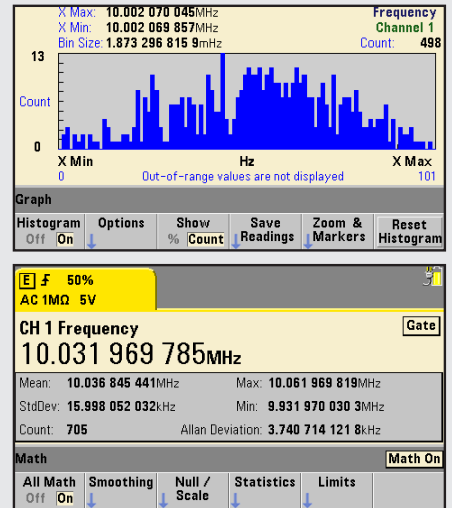
USB Memory Port to supplement 1M reading internal memory

Advanced triggering capabilities for gate start and stop hold off and delay based on time or events

Built-in help allows you to quickly get guidance on the functions you need

Easy compatibility with Keysight 53131A, 53132A, 53181A (531xxA) frequency counters

Select 531xxA family compatibility mode for full SCPI compatibility with Keysight's previous generation of counters. GPIB connectivity allows for full use of your existing Keysight 531xxA counter programs.

General characteristics	All models
Warm-up time	45 minutes
Display	4.3" (109.22 mm) color TFT WQVGA (480 x 272), LED backlight
User interface and help languages	English, German, French, Japanese, Simplified Chinese, Korean
Bench dimensions	261.1 mm W x 103.8 mm H x 303.2 mm D
Rack mount dimensions	212.8 mm W x 88.3 mm H x 272. 3 mm D (2U x 1/2 width)
Weight	3.9 kg (8.6 lbs) fully optioned; 3.1 kg (6.9 lbs) without Option 300 (battery option)
Operating temperature	0 ºC to +55 ºC
Power	100V - 240V ± 10%, 50-60 Hz ± 5%; 100 V - 120 V, 400 Hz ± 10%
Interfaces	LXI-C 1.3 (LAN sockets and VXI-11 protocol); USB 2.0 device port (USB-TMC488 protocol); GPIB
Battery technology (Option 300)	Internal lithium ion battery with integrated smart battery monitor and charger
Accessories included	Documentation CD including user's guide, SCPI/programmers reference, programming examples, IO library instructions
	Power line cord, 2 m USB2.0
	Certificate of calibration
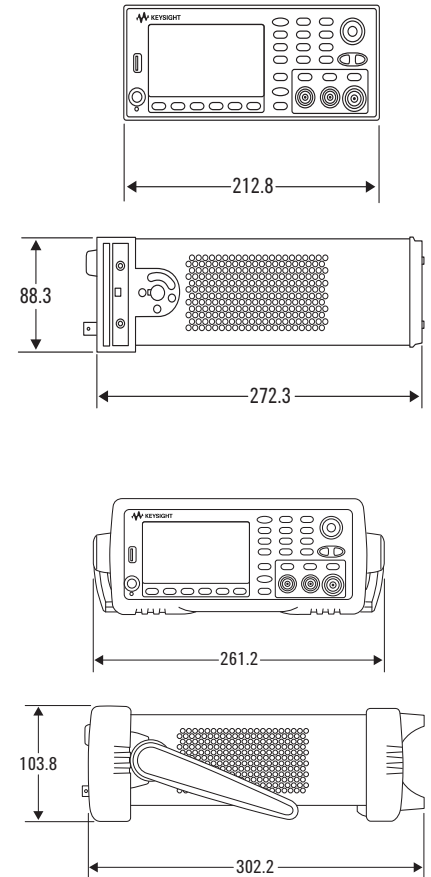
Standard TCXO timebase in every model, option to upgrade to an ultra-high stability OCXO timebase for even more accuracy, or lock to your own external timebase reference. Optional battery for continuous timebase temperature maintenance or unstable AC power environments

GPIB for system compatibility with 531xxA counters.

High-speed USB 2.0 connectivity
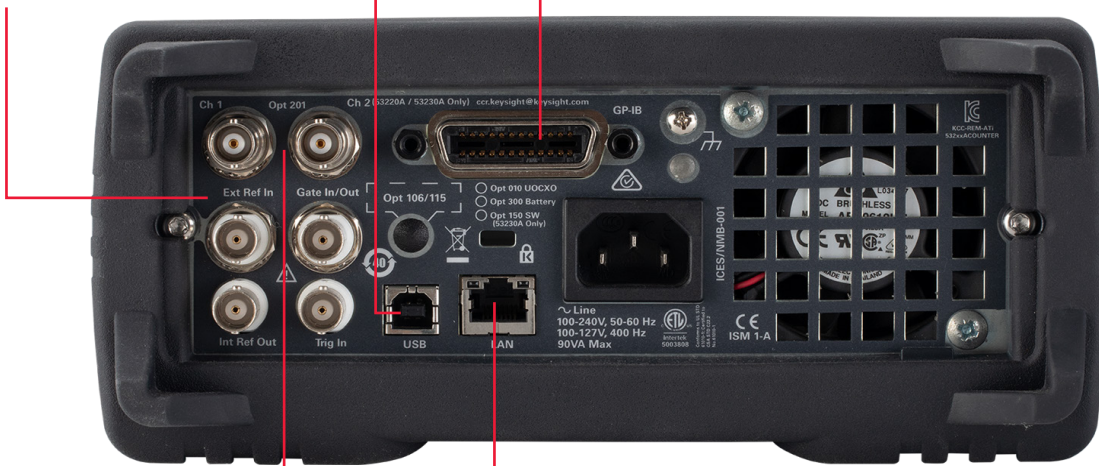
Optional rear terminal inputs

LXI-C/LAN Ethernet connectivity for remote access

Abbreviated Characteristics and Specifications[1]

	53210A 350 MHz, 10-digit/s RF counter	53220A 350 MHz, 12 digit/s, 100 ps universal frequency counter/ timer	53230A 350 MHz, 12-digit/s, 20 ps universal frequency counter/ timer
Inputs			
Standard channels (Option 201 adds parallel rear panel inputs)	Ch 1: DC – 350 MHz	Ch 1 and Ch 2: DC – 350 MHz	
Impedance, coupling	Selectable 1 M Ω ± 1.5% or 50 Ω ± 1.5% ‖ <25 pF; Selectable DC or AC coupling		
Amplitude input range	± 5 V (± 50 V) full scale ranges; ± 500 V range available with 10:1 probe on counter input		
Input event threshold level	± 5 V (± 50 V) in 2.5 mV (25 mV) steps		
Sensitivity	DC–100 MHz: 20 mVpk; > 100 MHz: 40 mVpk		
Optional microwave channel – front type N (Option 203 moves the input connector to a rear panel SMA(f))	Opt Ch 2	Opt Ch 3	
Frequency range	Opt 106: 100 MHz – 6 GHz or Opt 115: 300 MHz – 15 GHz		
Amplitude range	Opt 106: autoranged to +19 dBm max (2 Vrms) Opt 115: autoranged to +13 dBm max. (1.0 Vrms)		
Sensitivity	6 GHz (Opt 106): -27 dBm (10 mVrms); 15 GHz (Opt 115): 0.3 GHz – 2 GHz: -23 dBm / 2 GHz – 13 GHz: -26 dBm / 13 GHz – 15 GHz: -21 dBm		
Measurement range			
Frequency resolution	10 digits/sec	12 digits/sec	
Time Interval resolution	NA	100 psec	20 psec
Measurements	Frequency, period, frequency ratio, max/min/peak-to-peak input voltage	Frequency, period, frequency ratio, max/min/peak-to-peak input voltage, time interval, single period, pulse width, rise/fall time, duty cycle, phase, totalize	Frequency, period, frequency ratio, max/min/peak-to-peak input voltage, time interval, single period, pulse width, rise/fall time, duty cycle, phase, totalize, timestamp/ MDA
Pulse/burst microwave measurements	NA	NA	Carrier frequency, carrier period, pulse repetition interval (PRI), pulse repetition frequency (PRF), positive and negative width
Gate characteristics			
Source	Time, external	Time, external, advanced (gate start, stop/hold-off time or events)	
Gate time (step size)	1 ms – 1000 s (10 μs)	100 μs – 1000 s (10 μs)	1 μs – 1000 s (1 μs)
Advanced: Gate start and stop hold-off	NA	Source: internal/external/unused standard input channel Slope: positive/negative; delay and hold-off by time or events (edges)	
Trigger characteristics			
Source	Internal, external, bus, manual		
Trigger count and samples/trigger	1 to 1,000,000		
Trigger delay	0 s to 3600 s in 1 μs steps		
Math, memory, speed			
Speed characteristics (Note: Refer to pub #5990-6283EN for details	Single measurement throughput: Up to 400 readings/sec Block Reading throughput: Up to 66,500 readings/sec Maximum measurements to internal memory: 75,000 readings/sec frequency; 90,000 readings/sec time interval		
Math	Smoothing (reading moving average), scaling, Δ-change, null		
Statistics	Mean, standard deviation, max, min, peak-to-peak, count	Mean, standard deviation, max, min, peak-to-peak, count, Allan Deviation	
Graphical display	Digits, trend, histogram, limit test, markers		
Memory	Volatile reading memory: 1M readings (16 MB); data log (automatically saves acquisition results to memory) save and recall user-definable instrument set-ups; USB file system		

1. Please refer to Datasheet pub #5990-6283EN for details on specification, characteristic and typical value definitions.

Abbreviated Characteristics and Specifications, *continued*

	Standard TCXO	Ultra-high Stability OCXO Option 010
Aging		
24-hour		± 0.3 ppb (typ)
30-day	± 0.2 ppm (typ)	± 10 ppb
1-year	± 1 ppm	± 50 ppb
Temperature		
0 ºC to 55 ºC relative to 25 ºC	± 1 ppm	± 5 ppb
Timebase characteristics		
Timebase reference	Internal, external, auto	
External timebase input		
Impedance	1k Ω, AC coupled	
Level	100 mVrms to 2.5 Vrms	
Lock frequencies and range	10 MHz, 5 MHz, 1 MHz ±1 ppm (±0.1 ppm for Option 010 U-OCXO timebase)	
Timebase output		
Signal	10 MHz sinewave	
Impedance	50 Ω ± 5% at 10 MHz	
Level	0.5 Vrms into a 50 Ω load 1.0 Vrms into a 1 k Ω load	

Accuracy Example

± [(k * Random Uncertainty) + Systematic Uncertainty + Timebase Uncertainty]

See extended specifications document
5990-6283EN for complete expression
of measurement uncertainty

Example 1-year basic accuracy with Opt 010 ultra-high stability OCXO timebase:

Accuracy ≈ Time base error ≈ ± 50 ppb

Ordering Information

Model numbers	
53210A	350 MHz, 10-digit/s RF frequency counter
53220A	350 MHz, 12 digit/s, 100 ps universal frequency counter/time
53230A	350 MHz, 12-digit/s, 20 ps universal frequency counter/timer
Available options	
Option 010	Ultra-high-stability OCXO timebase
Option 106	6 GHz microwave input
Option 115	15 GHz microwave input
Option 201	Add rear panel parallel inputs for baseband channels
Option 203	Optional microwave input – rear panel SMA(f) connector
Option 300	Add internal lithium ion smart battery and charger for unstable AC power or timebase stability
Recommended accessories	
34190A	Rack mount kit
34194A	Dual-lock link kit
34191A	2U dual flange kit
34131A	Transit case
1250-1476	BNC(f) to Type-N adapter
N2870A	Passive probe, 1:1, 35 MHz, 1.3 m
N2873A	Passive probe, 10:1, 500 MHz, 1.3 m
N2874A	Passive probe, 10:1, 1.5 GHz, 1.3 m

For detailed specifications, see the *Keysight 53200 RF and Universal Frequency Counter/Timers* data sheet:
http://literature.cdn.keysight.com/litweb/pdf/5990-6283EN.pdf

Learn more at: www.keysight.com

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

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