KEYSIGHT TECHNOLOGIES (AGILENT HP)

33521B

The Keysight (Agilent) 33521B is a 30 MHz single-channel arbitrary function generator utilizing Trueform signal generation technology. It offers superior signal fidelity with extremely low jitter and low total harmonic distortion compared to traditional DDS-based generators. Standard interfaces include USB, LAN (LXI-C), and GPIB, with extensive arbitrary waveform sequencing and flexible modulation options.

SPECIFICATIONS

General

Interfaces	USB 2.0 (USB-TMC488), LAN (10/100Base-T Ethernet, LXI Class C), GPIB (optional)
Display	4.3" Color TFT WQVGA (480x272) with LED backlight

Physical

Power Supply	100 V to 240 V AC, 50/60 Hz; 100 V to 120 V AC, 400 Hz (max. 45 W)
Operating Temperature	0 °C to 55 °C °C
Dimensions (W×H×D)	261.2 mm × 103.8 mm × 303.2 mm (with bumpers and handle); 212.8 mm × 88.3 mm × 272.3 mm (without bumpers and handle) mm
Weight	3.4 kg kg

Waveform and Output Channels

Number of Channels	1
Standard Waveforms	Sine, square, ramp, pulse, triangle, Gaussian noise, PRBS (Pseudorandom Binary Sequence), DC
Built-In Arbitrary Waveforms	Cardiac, exponential fall, exponential rise, Gaussian pulse, Haversine, Lorentz, D-Lorentz, negative ramp, sinc
Channel-to-Chassis Isolation	Connector shells for channel output, Sync, and Mod In are connected together but isolated from chassis
Maximum Allowable Voltage on Isolation	±42 Vpk

Frequency Characteristics

Instrument Bandwidth	30 MHz
Sine Frequency Range	Up to 30 MHz
Pulse Frequency Range	Up to 30 MHz
Arbitrary Waveform Sample Rate	1 µSa/s to 250 MSa/s
Arbitrary Waveform Sample Rate Resolution	1 µSa/s

Amplitude and Voltage Characteristics

Amplitude Range (into 50 Ω)	1 mVpp to 10 Vpp
Amplitude Range (into Open Circuit)	2 mVpp to 20 Vpp
Vertical Resolution	16 bits
Amplitude Resolution	0.1 mVpp, 0.1 mVrms, or 4 digits

Waveform Purity and Distortion

Sine Total Harmonic Distortion (THD)	< 0.04%
Sine Non-Harmonic Spurious Responses	< -75 dBc
Pulse Rise and Fall Time	8.4 ns
Arbitrary Filter Bandwidth (Filter Off)	40 MHz (nominal)
Arbitrary Filter Bandwidth (Normal Filter On)	0.27 × (Sample Rate) (nominal)
Arbitrary Filter Bandwidth (Step Filter On)	0.13 × (Sample Rate) (nominal)
Arbitrary Rise and Fall Time	0.35 / Bandwidth (10 ns min) with Normal or Step filter On

Arbitrary Waveform Characteristics

Standard Waveform Memory	1 MSa per channel
Optional Waveform Memory	16 MSa per channel (Option MEM)
Waveform Length	8 Sa to 1 MSa per channel (16 MSa with Option MEM) in increments of 1 sample
Minimum Segment Length	8 Sa
Segment Length Increment	1 sample
Waveform Sequencing Operation	Individual arbitrary waveforms (segments) can be combined into user-defined lists (sequences) to form longer, more complex waveforms
Preloaded Sequences Capacity	Up to 32 sequences totaling up to 1,024 segments preloaded into volatile memory
Sequence Length	1 to 512 steps
Segment Repeat Count	1 to 1,000,000, or infinite

Modulation, Sweep, and Burst

Operating Modes	Continuous, modulate, frequency sweep, burst, output gate
Modulation Types	AM, FM, PM, FSK, BPSK, PWM, Sum (carrier + modulation)
PRBS Pattern Generation	PN7, PN9, PN11, PN15, PN23
Variable-Bandwidth Noise	Adjustable bandwidth built-in noise generator

Sync and Marker Output

Sync Connector	Front-panel BNC, chassis-referenced
Sync Functions	Sync, sweep marker, burst marker, or arbitrary waveform marker
Sync Polarity	Normal or inverted
Sync Output Voltage (into Open Circuit)	3.3 Vpp (nominal)
Sync Output Voltage (into 50 Ω)	1.65 Vpp (nominal)
Sync Output Impedance	50 Ω (nominal)
Sync Minimum Pulse Width	16 ns (nominal)

External Trigger and Gate

External Trigger Connector	Rear-panel BNC, chassis-referenced
External Trigger Function	Input or output
External Trigger Polarity	Positive or negative slope
External Trigger Input Voltage Level	Threshold: 1.5 V (nominal)
External Trigger Output Voltage Level (into Open Circuit)	3.3 Vpp (nominal)
External Trigger Output Voltage Level (into 50 Ω)	1.65 Vpp (nominal)
External Trigger Input Impedance	10 kΩ (nominal), DC-coupled
External Trigger Output Impedance	50 Ω (nominal)
External Trigger Fanout	≤4 total 33500B Series waveform generators

Modulation Input

Modulation Input Connector	Rear-panel BNC, isolated
Modulation Input Voltage Level	±5 V or ±10 V full scale
Modulation Input Impedance	5 kΩ (nominal)
Modulation Input Bandwidth	0 Hz to 100 kHz (-3 dB, typical)

System, Connectivity, and Control

LXI Compliance	LXI Class C (rev 1.3)
Ethernet Protocol	Sockets & VXI-11 protocol
USB Protocol	USB-TMC488 protocol (USB 2.0)
Programming Language	SCPI-1999, IEEE-488.2; Agilent 33210A / 33220A compatible
Web User Interface	Remote operation and monitoring via web browser
Real-Time Clock / Calendar	Set and read - year, month, day, hour, minute, second
Real-Time Clock Battery	CR-2032 coin-type, replaceable, >5 year life (typical)

Frequency and Timebase

Square Wave Frequency Range	1 µHz to 30 MHz
Ramp/Triangle Frequency Range	1 µHz to 200 kHz
PRBS Bit Rate Range	1 mbps to 50 Mbps
Frequency Resolution	1 µHz
Standard Timebase Frequency Accuracy	±1 ppm of setting ±15 pHz (after 1 year, 0 °C to 55 °C)
Optional Timebase (Option OCX) Accuracy	±0.1 ppm of setting ±15 pHz (after 1 year)
Standard Timebase Aging Rate	±1 ppm per year
Optional Timebase Aging Rate	±0.1 ppm per year

Jitter

Square and Pulse Jitter (Typical)	< 40 ps RMS
Arbitrary Waveform Jitter (Typical)	< 40 ps RMS

Amplitude & DC Offset

DC Offset Range (into 50 Ω)	±5 V pk AC+DC (limited by amplitude setting)
DC Offset Range (into Open Circuit)	±10 V pk AC+DC (limited by amplitude setting)
Amplitude Accuracy (at 1 kHz)	±(1% of setting + 1 mVpp) into 50 Ω
Output Impedance Selection	50 Ω (typical), Open Circuit, or Custom (1 Ω to 10 kΩ)

Phase Control

Phase Adjustment Range	-360° to +360°
Phase Resolution	0.001°

Sweep

Sweep Types	Linear, Logarithmic, List
Sweep Time Range	1 ms to 250,000 s
Sweep Trigger Sources	Internal, External, Manual, Bus

Burst

Burst Types	Counted (1 to 1,000,000 cycles, or Infinite), Gated
Burst Start Phase Range	-360° to +360°

External Reference Clock Input

External Reference Input Level Range	100 mVpp to 5 Vpp
External Reference Input Impedance	1 kΩ (typical), AC-coupled

External Reference Clock Output

External Reference Output Frequency	10 MHz
External Reference Output Level	0 dBm (nominal) into 50 Ω
External Reference Output Impedance	50 Ω (typical), AC-coupled

Storage and Memory

Non-Volatile Internal Storage Capacity	970 MB
Front Panel USB Port Type	USB Host (Type A)

Environmental and Standards

Storage Temperature Range	-40 °C to +70 °C
Operating Altitude	Up to 3,000 meters
Safety Compliance Standards	EN 61010-1, UL 61010-1, CSA C22.2 No. 61010-1
EMC Compliance Standards	EN 61326-1, ICES-001, AS/NZS CISPR 11
Warm-up Time	1 hour

Pulse Characteristics

Pulse Width Minimum	16 ns
Pulse Width Resolution	100 ps or 11 digits
Pulse Duty Cycle Range	0.01% to 99.99%
Pulse Overshoot (Typical)	< 4%

Square Wave Characteristics

Square Wave Duty Cycle Range	0.01% to 99.99% (subject to minimum width limits)

Ramp Wave Characteristics

Ramp Symmetry Range	0.0% to 100.0%
Ramp Symmetry Resolution	0.1%

Phase Noise

Phase Noise	-115 dBc/Hz @ 10 MHz carrier, 10 kHz offset (typical)

Amplitude Flatness

Amplitude Flatness (< 5 MHz)	±0.1 dB (relative to 1 kHz, 1 Vpp, 50 Ω)
Amplitude Flatness (5 to 30 MHz)	±0.15 dB (relative to 1 kHz, 1 Vpp, 50 Ω)

Internal Trigger

Internal Trigger Period Range	250 ns to 8000 s
Internal Trigger Period Resolution	4 ns
Internal Trigger Jitter (Typical)	< 200 ps

Modulation Characteristics

AM Modulation Depth Range	0.0% to 120.0%
FM Maximum Deviation	15 MHz
PM Phase Deviation Range	0° to 360°
FSK Key Rate Range	2 mHz to 1 MHz
BPSK Key Rate Range	2 mHz to 1 MHz
PWM Duty Cycle Deviation Range	0% to 50%

PRBS Generation

PRBS Polynomials	2^7-1, 2^9-1, 2^11-1, 2^15-1, 2^20-1, 2^23-1

Environmental

Operating Humidity	5% to 80% RH (non-condensing)
Acoustic Noise (Nominal)	< 35 dBA
Vibration and Shock Compliance	MIL-PRF-28800F, Class 3
Pollution Degree	Pollution Degree 2
Overvoltage Category	Overvoltage Category II

TECHNOLOGY

Trueform Signal Generation Technology

APPLICATIONS

Electronic test and measurement, signal simulation, and education