N1000A DCA-X

Wide Bandwidth Oscilloscope Mainframe and Modules

The N1000A DCA-X performs precision measurements on high speed digital designs from 50 MBd to more than 80 GBd on up to 16 channels simultaneously. Applications include optical transceiver design and production test, electrical ASIC/FPGA/IC design and characterization, serial bus characterization, and measurements and trouble-shooting via TDR/TDT and S-parameter measurements of channels, cables and PCBs.

KEYSIGHT TECHNOLOGIES

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Introduction

Keysight offers complete Digital Communication Analyzer solutions that can be combined with or used alongside the DCA-X, including clock recovery, stand-alone Digital Communication Analyzers (DCA-M) and software. For complete information on Keysight's entire DCA family, please refer to these other helpful documents:

- Keysight DCA Wide Bandwidth Oscilloscope Family Brochure (5992-3301EN)
- Keysight DCA Family FlexDCA Sampling Oscilloscope Software Technical Overview (5992-3319EN)
- Keysight N1000A DCA Wide Bandwidth Oscilloscope Family Configuration Guide (5992-3372EN)
- Keysight DCA Family Clock Data Recovery Solutions Data Sheet (5991-1620EN)
- Keysight N1090A (5992-3655EN), N1092A/B/C/D/E (5992-3886EN), and N1094A/B (5992-3700EN) DCA-M Optical and Electrical Sampling Oscilloscope Data Sheets.

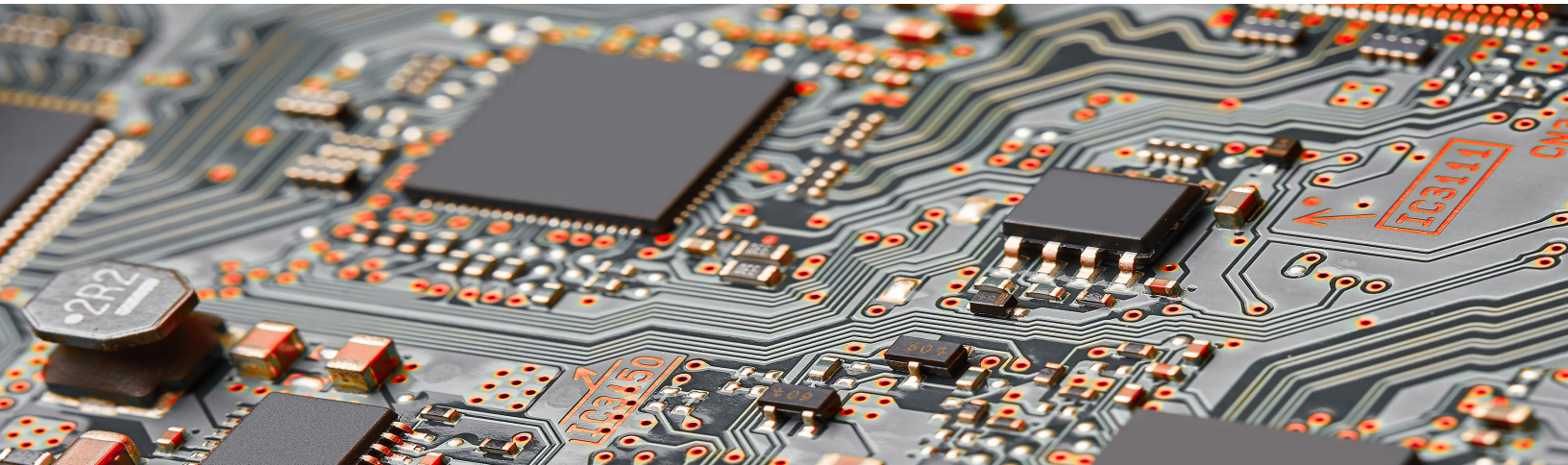
User Interface

The N1000A user interface and operating system is identical to the FlexDCA interface of the DCA-M modules (over a simple USB 2.0 or 3.0 connection) and N1010A FlexDCA on a PC.

Optical + Electrical and Electrical Clock Recovery

Optical + Electrical DCA-M

FlexDCA Software



N1000A DCA-X Specifications

General notes

NOTE: All specifications describe warranted performance over the temperature range +10°C to + 40°C (unless otherwise noted). The specifications are applicable after the temperature is stabilized, which occurs after 1 hour of continuous operation in final setup configuration and while self calibration is valid. Many performance parameters are enhanced through frequent, simple user calibrations.

NOTE: Specifications describe warranted performance. Characteristics provide useful, nonwarranted information about the functions and performance of the instrument. Characteristics are printed in *green italics*.

NOTE: Factory Calibration Cycle. For optimum performance, the instrument should have a complete verification of specifications once every 12 months.

NOTE: Nominal Value indicates the expected, but not warranted, value of the parameter.

N1000A computer system and storage specifications

Item	Description
CPU	Intel I5 Quad Core
RAM	8 GB
Operating System	Windows 10, 64 bit
Mass Storage	240 GB internal SSD hard disk

N1000A display specifications

Item	Description
Display Area	210.4 mm x 157.8 mm 10.4 inch diagolnal color active matrix LCD module incorporating amorphous silicon TFTs.
Entire Display Resolution	1024 pixels horizontally x 768 pixels vertically
Waveform Colors	Select from over 16 colors. User may change color assignment of all traces (channels, waveform memory, and signal processing functions).
Persistence Modes	Gray scale, color grade, infinite, variable
Connect-the-dots	On/Off selectable
Persistence	Minimum, variable (100 ms to 40s), infinite
Graticule	On/Off
Grid Intensity	0 to 100%
Dialog Boxes	Opaque or transparent
Supports External Display	Supports multiple display configurations via Windows display utility.

N1000A environmental specifications

Item	Description
Use	indoor
Temperature	
Operating	10 °C to +40 °C (50 °F to +104 °F)
Non-operating	–40 °C to +70 °C (–40 °F to +158 °F)
Altitude (Operating)	Up to 4,600 meters (15,000 ft)
Humidity [1]	Type tested at 95%, +40 °C (non-condensing)
Weight	
Mainframe without modules (characteristic)	*20.5 kg (43 lb)*
Module (characteristic)	*1.2 kg (2.6 lb)*
Dimensions (excluding handle)	
Without front connectors and rear feet	221 mm H x 426 mm W x 530 mm D (8.7 inch x 16.76 inch x 20.9 inch)
With front connectors and rear feet	234 mm H x 426 mm W x 601 mm D (9.23 inch x 16.76 inch x 23.67 inch)
With front cover and rear feet	234 mm H x 426 mm W x 612 mm D (9.23 inch x 16.76 inch x 24.1 inch)

1 Samples of this product have been type tested in accordance with the Keysight Environmental Test Manual and verified to be robust against the environmental stresses of Storage, Transportation and End-use; those stresses include but are not limited to temperature, humidity, shock, vibration, altitude and power line conditions. Test Methods are aligned with IEC 60068-2 and levels are similar to MIL-PRF-28800F Class 3.

N1000A LINE power specifications

Item	Description
Line Power	100/120 Vac, 50/60/400 Hz
	220/240 Vac, 50/60 Hz
Power in Watts	700 Watts Maximum
The products can operate with mains supply voltage fluctuations up to ± 10% of the nominal voltage.	

N1000A horizontal (timebase) specifications

Item	Description
Scale Factor	**Full scale is ten divisions.**
Minimum	100 fs/div
Maximum	50 ms/div
Delay	**Time offset relative to the front panel trigger input on the instrument mainframe.**
Minimum	16 ns
Maximum	1s
Time Interval Accuracy	1 ps + 1% of Δ time interval for intervals from minimum delay to minimum delay + 1 ns [1], *or* 6 ps + 1% of Δ time interval [1]
	500 fs + 0.25% of Δ time interval (characteristic) [2]
Time Interval Accuracy (Pattern Lock Mode)	1 GHz to 32 GHz: 500 fs + 0.5% of 1 / (clock input frequency), *or* 5 ps (whichever is smaller) [1]
	50 MHz to 1 GHz: 500 fs + 0.5% of 1 / (clock input frequency), *or* 30 ps (whichever is smaller) [1]
	250 fs + 0.25% of 1 / (clock input frequency) (characteristic) [2]
Jitter Mode Operation	*Time interval accuracy – jitter mode operation 500 fs (characteristic).* Test configuration: PRBS of length 2^7–1 bits, Data and Clock 10 Gb/s.
Time Interval Resolution [3]	*screen diameter / record length or 60 fs, whichever is larger*
Display Units	Unit Interval or Time
Record length [4]	16 to 131,072 without pattern lock, 1 to 268,435,456 with pattern lock and "Acquire Entire Pattern"

1 Dual marker measurement performed at a temperature within ± 5 °C of horizontal calibration temperature.
2 Dual marker measurement performed at a temperature within ± 1.5 °C of horizontal calibration temperature.
3 The time interval resolution is the smallest time you can characterize between two points.
4 Maximum number of samples depends on pattern, number of active channels, available memory, pattern lock enabled, and *Acquire Entire Pattern* enabled.

N1000A front-panel inputs and outputs opecifications

Item	Description
Trigger Input, Connector	2.92 mm (male) Mainframe ships with 2.92 mm female-female connector saver (P/N 1250-4105)
Trigger Input, Impedance (Normalized)	50 Ω
Trigger Input, Maximum	2 Vpp maximum
Precision Timebase Input, Connector *(Option N1000A-PTB only)*	2.92 mm (male) Mainframe ships with 2.92 mm female-female connector saver (P/N 1250-4105).
Precision Timebase Input, Impedance (Normalized) *(Option N1000A-PTB only)*	50 Ω
Precision Timebase Input, Maximum *(Option N1000A-PTB only)*	1.3 Vpp maximum
DC Cal Output	BNC (female) Range: –2.0 V to +2.0 V
USB	Three USB 2.0 ports
Ground Connection	Banana plug

N1000A rear-panel inputs and outputs specifications

Item	Description
GPIB	Fully programmable, complies with IEEE 488.2
Display Port	For connecting external displays
VGA Port	Analog, full color, 15 pin D-sub (female)
LAN	Two Gigabit Ethernet ports
USB	Two USB 3.0 ports Two USB 2.0 ports
USB Device Port	Instrument control over USB

N1000A internal precision timebase specifications (Option PTB)

The *N1000A Internal Precision Timebase Specifications* are for Option PTB, which is the N1000A internal precision timebase. These specifications refer to the signal input to the front-panel Precision Timebase Input connector.

NOTE: If Freerun trigger mode is *not* used, a trigger input *must* also be supplied. This is in addition to the reference clock input to the front-panel Precision Timebase connector. The trigger input must be synchronous to the reference clock but may be a sub-rate of the clock based on the required frequency range for the trigger input.

Item	Description
Maximum Input Signal	1.3 Vpp
Input DC Offset Range	± 200 mV
Input Signal Type The internal precision timebase works with typical digital clock signals, such as a BERT output, as well as sine waves. If the rise time or fall time of the clock signal is less than 15% of the period of the clock (for example, less than 15 ps for a 10 GHz clock), reduce the edge speed by using an external low-pass filter or length of cable. For the lowest jitter, use a signal that is as close as possible to the maximum signal amplitude (1.3 Vpp) and minimize any sub-harmonics.	
Jitter (Input ≥ 750 mVpp, sinusoidal) ***(Characteristic)***	
2.4 GHz to < 4.0 GHz trigger (tested at 2.4 GHz, 750 mVpp)	*≤ 200 fs rms* *< 400 fs rms*, with 54XXX, 8348X, or N1045A *(non Option LOJ)* module
4 GHz to 9.0 GHz trigger (tested at 5 GHz, 750 mVpp)	*≤ 120 fs rms* *< 400 fs rms*, with 54XXX, 8348X, or N1045A *(non Option LOJ)* module
> 9.0 GHz to 44.0 GHz trigger (tested at 10, 20, and 40 GHz, 500 mVpp)	*≤ 90 fs rms* *< 200 fs rms*, with 54XXX, 8348X, or N1045A *(non Option LOJ)* module
Precision Timebase Input	
Nominal Impedance	*50 Ω*
Connector Type	2.92 mm (male)

N1000A general trigger specifications

Item	Description
Maximum Trigger Signal	2 V peak-to-peak
Trigger Input	
Nominal Impedance	*50 Ω*
Reflection	*10% for 100 ps rise time*
Connector Type	2.92 mm (male)

N1000A internal trigger mode specifications

Item	Description
Freerun	Freerun trigger mode internally generates an asynchronous trigger that allows viewing the sampled signal amplitude without an external trigger signal but provides no timing information. Freerun is useful in troubleshooting external trigger problems.

N1000A clock trigger / pattern lock mode specifications

Item	Description [1]
Clock Trigger	50 MHz to 32 GHz, effective divide-by-one, AC coupled
Pattern Lock (Option PLK)	50 MHz to 32 GHz, AC coupled
Pattern Lock Length (Option PLK)	1 to 2^{23} (8,388,608) symbols
Jitter	
50 MHz to < 500 MHz	1.0 ps rms + 10 PPM of horizontal position (maximum) *< 800 fs rms + 5 PPM of horizontal position (typical)*
500 MHz to 32 GHz [2,3] (Option STB)	450 fs rms (maximum) *400 fs rms (typical)*
500 MHz to 32 GHz [2,3] (Option LOJ)	250 fs rms (maximum) *200 fs rms (typical)*
Trigger Sensitivity	200 mV p-p
Trigger Slew rate	≥ 2 V/ns

1 These specifications refer to the signal input to the front-panel Trigger Input connector. The sampled input signal timing is recreated by using an externally supplied trigger signal that is synchronous with the sampled signal input.
2 Verified at 10 GHz with a clock and signal slew rate ≥ 15 V/ns.
3 Verified at 28 GHz with a clock and signal slew rate ≥ 20 V/ns.

N1000A edge trigger mode specifications

Item	Description [1]
Input	DC to 2.5 GHz
Jitter [2]	1.0 ps rms + 10 PPM horizontal position (maximum) *< 800 fs rms + 5 PPM horizontal position (characteristic)*
Trigger Sensitivity	200 mV p-p (sinusoidal input or 200 ps minimum pulse width)
Triggering Level Adjustment	–1 V to +1 V
Edge Select	Positive or negative

1 These specifications refer to the signal input to the front-panel Trigger Input connector. The sampled input signal timing is recreated by using an externally supplied trigger signal that is synchronous with the sampled signal input.
2 Verified at 2.5 GHz with a clock and signal slew rate ≥ 2 V/ns.

N1000A vertical (channel) specifications

Item	Description
Sample Rate	Up to 250 kHz
Number of Channels	Up to 16 channels
Vertical Resolution	16 bit hardware A/D converter for N10xx-series modules. 14 bit hardware A/D converter for 861xx, 54xxx, and 8348x-series modules.
Full Resolution Channel Scales	Adjusts in a 1-2-5-10 sequence for coarse adjustment or fine adjustment resolution from the front panel knob.
Adjustments	Scale, offset, activate filter, sampler bandwidth, attenuation factor, transducer conversion factors