86100D DCA-X

Wide Bandwidth Oscilloscope Mainframe

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Table of Contents

Introduction

Also see the N1000A DCA-X Wide Bandwidth Oscilloscope Mainframe.

The 86100D 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, measurements and trouble-shooting via TDR/TDT and S-parameter measurements of channels, cables and PCBs

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
- Keysight DCA Family FlexDCA Sampling Oscilloscope Software Technical Overview
- Keysight N1000A DCA Wide Bandwidth Oscilloscope Family Configuration Guide, 5992-0038EN
- Keysight DCA Family Clock Data Recovery Solutions Data Sheet, 5991-2340EN
- Keysight N1090A, N1092A/B/C/D/E and N1094A/B DCA-M Optical and Electrical Sampling Oscilloscope Data Sheet, 5992-1454EN.

Electrical Clock Recovery Optical
Optical + Electrical Clock recovery

Optical + Electrical DCA-M

FlexDCA Software

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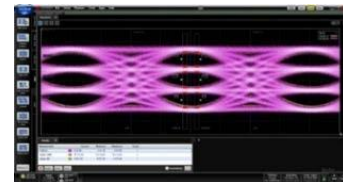
86100D DCA-X Specifications
General and mainframe

Specifications describe warranted performance over the temperature range of +10 to +40 °C (unless otherwise noted). The specifications are applicable for the temperature after the instrument is turned on for one hour, and while self-calibration is valid. Many performance parameters are enhanced through frequent, simple user calibrations. Characteristics provide useful, non-warranted information about the functions and performance of the instrument. Characteristics are printed in italic typeface. Product specifications and descriptions in this document are subject to change without notice.

Comparing Specifications

When comparing performance attributes between instruments, ensure you compare the same type of parameter. For example, compare warranted specifications from both instruments, or compare characteristics or typical performance. Warranted specifications include measurement uncertainties and are conservative compared to other types of unwarranted attributes.

Factory calibration cycle - For optimum performance, the instrument should have a complete verification of specifications once every twelve months.

General specifications

Temperature	Operating	10 to +40 °C (50 to +104 °F)
	Non-operating	–40 to +65 °C (–40 to +158 °F)
Altitude	Operating	Up to 4,600 meters (15,000 feet)
Power (max)	100/120 Vac 50/60/400 Hz	With typical modules: 150 to 230 VA at 25°C
	220/240 Vac 50/60 Hz, 700 W maximum	
Weight	Mainframe without modules	20.5 kg (43 lbs)
	Typical module	1.2 kg (2.6 lbs)
Mainframe dimensions (excluding handle)	Without front connectors and rear feet	221 mm (H) x 426 mm (W) x 530 mm (D) (7 in x 16.76 in x 20.9 in)
	With front connectors and rear feet	234 mm (H) x 426 mm (W) x 601 mm (D) (9.23 in x 16.76 in x 23.67 in)
	With front cover and rear feet	234 mm (H) x 426 mm (W) x 612 mm (D) (9.23 in x 16.76 in x 24.1 in)
Max relative humidity	80% for temperatures up to 31 °C decreasing linearly to 50% relative humidity at 40 °C	
Supply voltage variation	86100D system can operate with supply voltage fluctuations up to ± 10% of the nominal voltage	

Mainframe specifications

Horizontal system (time base)		Pattern lock
Scale factor (full scale is ten divisions)		
Minimum	100 fs/div	
Maximum	1 s/div	250 ns/div
Delays [1]		
Minimum	24 ns	40.1 ns default, 24 ns min
Maximum	1000 screen diameters or 10 s whichever is smaller	1000 screen diameters or 25.401 µs whichever is smaller
Time interval accuracy [2]	1 ps + 1.0% of Δ time reading or 8 ps, whichever is smaller	
Jitter mode operation[3]	Time interval accuracy - jitter mode operation 1 ps	
Time interval resolution	≤ (screen diameter)/(record length) or 62.5 fs, whichever is larger	
Display units	Bits or time (TDR mode–meters)	
Vertical system (channels)		
Number of channels	16 (simultaneous acquisition)	
Vertical resolution	54xxx, 83xxx, 86xxx: 14 bit A/D converter (16 or more bits with averaging). N10xx: 16 bit A/D converter	
Full resolution channel	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	
Record Length	Legacy UI: 16 to 16 K samples	
	FlexDCA without pattern lock: 16 to 64 K samples	
	FlexDCA with pattern lock: 16 up to 32 M samples [4]	

[1] Time offset relative to the front panel trigger input on the instrument mainframe.
[2] Dual marker measurement performed at a temperature within 5 °C of horizontal calibration temperature. The maximum delay setting is 100 ns and delta time does not span across (28 + Nx4) ns ± 100 ps delay setting, where N=0,1,2….18. If delta time measurement span exceeds above criteria, time interval accuracy is 8 ps +0.1% of Δ time reading.
[3] Characteristic performance. Test configuration: PRBS of length 127 bits. Data and clock 10 Gb/
[4] Maximum number of samples depends on pattern, number of active channels and available memory

	86100D with option STR	86100D with option ETR or with options ETR + PTB
Module triggering [5]		
	Not supported	Not supported
Internal trigger		
	Free run	Free run
External direct trigger (DC coupled)		
Limited bandwidth	DC to 100 MHz	DC to 100 MHz
Full bandwidth	DC to 3.2 GHz	DC to 3.2 GHz
Trigger configuration		
Triggering level adjustment	−1 V to +1 V	−1 V to +1 V
Edge select	Positive or negative	Positive or negative
Hysteresis [6]	Normal or high sensitivity	Normal or high sensitivity
Trigger sensitivity	Sinusoidal or 200 ps minimum pulse width 200 mVpp	Sinusoidal or 200 ps minimum pulse width 200 mVpp
Maximum input signal	2 Vpp	2 Vpp
System jitter	Tested at 2.5 GHz, 200 mVpp 1.5 ps rms + 50 ppm of delay setting < *1.0 ps rms + 5 ppm of delay setting (Characteristic)*	Tested at 2.5 GHz, 200 mVpp 1.5 ps rms + 50 ppm of delay setting < *1.0 ps rms + 5 ppm of delay setting (Characteristic)*
External divided trigger (AC coupled)	Not available with option STR	
Input frequency range	N/A	50 MHz - 13 GHz (effective divide by 2) *50 MHz - 15 GHz (characteristic)* **Option PTB:** 50 MHz - 32 GHz (effective divide by 1)
Pattern lock frequency range	N/A	50 MHz - 13 GHz *50 MHz - 15 GHz (characteristic)* **Option PTB:** 50 MHz - 32 GHz
Pattern lock pattern length range	N/A	1 to 2^23 UI in Scope and Eye/Mask Modes 1 to 2^16 UI in Jitter Mode
Trigger sensitivity	N/A	Slew rate > 2 V/ns: 200 mVpp
Maximum input signal	N/A	Max Trigger input: 2 Vpp **Option PTB:** Max PTB Input: 1.3 Vpp with DC offset up to + 200 mV

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[5] Module triggering enables precision waveform analyzer modules (86108 and N1060), clock recovery modules (83496) and TDR modules to be used as a trigger source. Without support for module triggering, external connections between the module and the mainframe may be required.

[6] High Sensitivity Hysteresis mode improves the high frequency trigger sensitivity but is not recommended when using noisy, low frequency signals that may result in false triggers without normal hysteresis enabled.

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	86100D with option STR	86100D with option ETR or with options ETR + PTB
External divided trigger (AC coupled)	Not available with option STR	
System jitter	N/A	Tested at 10 GHz, 200 mVpp 1.2 ps rms for time delays less than 100 ns, (Maximum) *750 fs rms at minimum delay setting, (characteristic)* **Option PTB** when PTB is enabled: Condition [7]: 2.4 GHz — < 4.0 GHz trigger, tested at 2.4 GHz, 750 mVpp *≤ 200 fs (characteristic)* *< 400 fs, with 54752, 54754, 83484, or N1045A (non Option LOJ) module (characteristic)* Condition [7]: 4 GHz — 9.0 GHz trigger, tested at 5 GHz, 750 mVpp *≤ 120 fs (characteristic)* *< 400 fs, with 54752, 54754, 83484, or N1045A (non Option LOJ) module (characteristic)* Condition [7]: > 9.0 GHz — 44.0 GHz trigger, tested at 10, 20, and 40 GHz, 500 mVpp *≤ 90 fs (characteristic)* *< 200 fs, with 54752, 54754, 83484, or N1045A (non Option LOJ) module(characteristic)*
Inputs		
Trigger input connector	2.92 mm (male) [8]	2.92 mm (male) [8] **Option PTB**: PTB input: 2.92 mm (male) [8]
Trigger input nominal impedance	50 Ω	50 Ω **Option PTB**: PTB input: 50 Ω

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[7] 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.
[8] 86100D mainframes ship with a 2.92mm (f) to (f) adapter for this port.

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Computer system and storage	
CPU	Intel Core i5 3550S CPU at 3.0 GHz
Mass storage	150 GB internal hard drive (default) or 80 GB removable hard drive (Option 090)
Operating system	Microsoft Windows 7 embedded standard (64 bit)
Display [9]	
Display area	210.4 mm x 157.8 mm (10.4 inch diagonal 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, variable, infinite
Waveform overlap	When two waveforms overlap, a third color distinguishes the overlap area (classic DCA-J interface only)
Connect-the-dots	On/Off selectable
Persistence	Minimum, variable (100 ms to 40 s), infinite
Graticule	On/Off
Grid intensity	0 to 100%
Dialog boxes	Opaque or transparent
Front panel inputs and outputs	
Cal output	BNC (female) and test clip, banana plug
Trigger input	2.92 mm [10]
USB [11]	Three low-power USB 2.0 ports; Voltage: 5.00 ± 0.25 V; Current: 100 mA each
Precision timebase input (Option PTB only)	2.92 mm [10]
Rear panel inputs and outputs	
Gated trigger input	TTL compatible
Video output	VGA, full color, 15 pin D-sub (female) 10
GPIB [12]	Fully programmable, complies with IEEE 488.2
RS-232	9 pin D-sub (male)
LAN	
USB	Four USB 2.0 ports; Voltage: 5.00 ± 0.25 V; Current: 500 mA each
Precision timebase delay path (Option PTB only)	Two female SMA connectors, nominal length jumper cable included

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[9] Supports external display. Supports multiple display configurations via Windows XP Pro display utility.
[10] Mainframe ships with 2.92 mm female-female connector saver (P/N 1250-4105).
[11] USB Keyboard and mouse included with mainframe.
[12] The GPIB card interface is optional. To include this interface, order 86100D-GPI.

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Module	Option	No. of electrical channels	Highest Electrical bandwidth (GHz)	Step Generator (TDR)	No. of optical channels	Wavelength range (nm)	Unfiltered optical bandwidth (GHz)	Fiber input (µm)	NRZ < 10 Gb/s	NRZ 10 Gb/s - 14 Gb/s	NRZ 20 Gb/s - 28 Gb/s	NRZ 39 Gb/s - 43 Gb/s	PAM4 26 GBd (with option IRC)	PAM4 53 GBd (with option IRC)
									Optical Reference Receiver for typical rates in this range *See specifications for details*					
54754A		2	18	2	0	-	-	-						
86105C	100	1	20	-	1	750 - 1650	8.5	62.5/125	•					
	200	1	20	-	1	750 - 1650	8.5	62.5/125		•				
	300	1	20	-	1	750 - 1650	8.5	62.5/125	•	•				
86105D	141	1	35	-	1	750 - 1650	20	62.5/125		•				
	281	1	50	-	1	750 - 1650	34	62.5/125			•		•	•
86108B	LBW	2	35	-	0	-	-	-						
	HBW	2	50	-	0	-	-	-						
86115D	002/102/142	0	-	-	2	750 - 1650	20	62.5/125		•				
	206/282	0	-	-	2	750 - 1650	34	62.5/125			•		•	•
86116C	25	1	80	-	1	1300 - 1620	40	9/125			•		•	•
	41	1	80	-	1	1300 - 1620	65	9/125				•		•
N1045A	02x	2	60	-	0	-	-	-						
	04x	4	60	-	0	-	-	-						
N1045B	02x	2	60	-	0	-	-	-						
	04x	4	60	-	0	-	-	-						
N1046A	71F	1	75	-	0	-	-	-						
	72F	2	75	-	0	-	-	-						
	74F	4	75	-	0	-	-	-						
	81F	1	85	-	0	-	-	-						
	82F	2	85	-	0	-	-	-						
	84F	4	85	-	0	-	-	-						
	11F	1	100	-	0	-	-	-						
	12F	2	100	-	0	-	-	-						
	14F	4	100	-	0	-	-	-						
N1055A	32x	2	35	2	0	-	-	-						
	34x	4	35	4	0	-	-	-						
	52x	2	50	2	0	-	-	-						
	54x	4	50	4	0	-	-	-						
N1060A	050	2	50	-	0	-	--	-						
	085	2	85	-	0	-		-						

Modules not available but supported by the 86100D DCA-X

54752A 50 GHz Dual Channel Electrical	86107A Precision Timebase Reference
83484A Dual Channel 50 GHz Electrical	86108A Precision Waveform Analyzer
83496A Optical/Electrical Clock Recovery, 50 Mb/s-7.1 Gb/s	86116C option 040
83496B Optical/Electrical Clock Recovery with Phase Noise Analysis	86117A 50 GHz Dual Channel Electrical
86112A Dual Channel 20 GHz Electrical	86118A Dual 70 GHz Remote Sampling Head

Modules not available but supported by the 86100D (Compatibility Mode)

54751A	83485B	83493A	86102U	86106A	86111U
83481A	83486A	83494A	86103A	86106B	86113A
83482A	83487A	83495A	86103B	86109A	86115B
83483A	83491A	86101A	86105A	86109B	86116A
83485A	83492A	86102A	86105B	86111A	86116B
86117A	86118A	54752	54753 (Rx only)	54754	86115D
86116C	86116C-025	86116C-040	86116C-041	83484	83496A
83496B	86105C	86105D	86107A	86108A	86108B
86109A	86112A	86112A-HBW			

Ordering Information

The below tables offer helpful information about the DCA-X software, mainframe and plug-in modules and their options but are not intended to serve as a configuration guide.

When configuring a solution, please also refer to the following helpful documents:
Keysight DCA Wide-Bandwidth Oscilloscope Family Configuration Guide
Keysight DCA Family FlexDCA Sampling Oscilloscope Software Technical Overview
Keysight DCA Family Clock Data Recovery Solutions Data Sheet

86100D DCA-X Hardware Options

86100D[13]	Infiniium DCA-X mainframe
86100D-STR	Standard trigger
86100D-ETR	Enhanced trigger
86100D-PTB	Precision timebase integrated in the mainframe
86100D-GPI	GPIB card interface installed (default)
86100D-GPN	No GPIB card interface
86100D-090	Removable hard drive
86100D-092	Internal hard drive (default)

[13] Option ETR is recommended when using a DCA module equipped with a rear panel trigger circuit such as the 54754A, 83496x, 86108x, etc.

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86100D DCA-X Hardware Upgrade Options (if you already own an 86100D)

86100DU-ETR	Enhanced trigger upgrade kit
86100DU-PTB	Upgrade mainframe with integrated precision timebase
86100DU-GPI	Add GPIB card interface
86100DU-WN7	Windows 7 Upgrade

86100D DCA-X Software Feature Options

Keysight recommends use of FlexDCA software PACKAGEs, not use of software FEATURE options. Support subscriptions are available for FlexDCA software PACKAGEs which enable both bug fixes and new functionality. Software FEATURE options will get no new functionality.

86100D-xxx	Are permanent fixed-node licenses installed by the factory
86100DU-xxx	Are permanent fixed-node licenses installed by the customer (software upgrades)
86100DT-xxx	Are permanent transportable licenses installed by the customer
The "-xxx" option code provides the same functionality independent of the prefix (i.e., 86100D or 86100DU or 86100DT)	
86100D-BFP[14]	Automatic fixture removal
86100D-061	MATLAB - Basic Oscilloscope package
86100D-062	MATLAB - Standard Oscilloscope package
86100D-200[15]	Enhanced jitter analysis software
86100D-201[15]	Advanced waveform analysis software
86100D-202	Enhanced impedance and S-parameter software
86100D-300[16]	Amplitude analysis/RIN/Q-factor
86100D-400[17]	PLL and jitter spectrum software [1]
86100D-401	Advanced EYE analysis software [1]
86100D-SIM[15]	InfiniiSim-DCA software
86100D-500	Productivity package software
86100D-9FP[18]	PAM-N analysis software, fixed perpetual license

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[14] Option BFP requires Option 202.
[15] Options 200, 201, and SIM require hardware option ETR (enhanced trigger)
[16] Option 300 requires options 200 and ETR.
[17] Option 400 requires Microsoft Office Excel 2007/2010.
[18] For complete PAM4 analysis capability, Option 9FP requires Options 200/201/300/401.

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FlexDCA Software Packages

N1010100A[19]	Research and Development Package for FlexDCA
N1010200A[18]	Manufacturing Package for FlexDCA
N1010300A	Signal Integrity Package for FlexDCA

Compliance Application Software

N1012A	OIF CEI compliance and debug application
N1014A	SFF-8431 compliance and debug application
N1019A	User-defined application
N1081A	IEEE 802.3 KR/KR4 application
N1082A	IEEE 802.3bj XLAUI, CAUI-10 and nPPI; IEEE 802.3bm CAUI-4 (Option -4TP)
N1083A	IEEE 802.3 40GBASE-CR4 and 100GBASE-CR10
N1084A	IEEE802.3 KR4/CR4 application
N1085A	PAM4 Pre-Compliance Measurement application for Ethernet and OIF-CEI IEEE Measurements option 1TP OIF-CEI Measurements option 4TP
N1091BSCA	PAM4 Compliance Measurement Application for IEEE 802.3bs/cd
N1091BSUA	N1091BSUA IEEE 802.3bs/cd SW Upgrade (N1085A-1TP license must also be present)
N109256CA	PAM4 Compliance Measurement Application for CEI-56G-VSR/MR/LR
N109256UA	N109256UA OIF-CEI 4.0-56G-VSR/MR/LR SW Upgrade (N1085A-4TP license must also be present)

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[19] Requires option ETR on 86100D or option PLK on N1000A

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Warranty Options (for All Products)

R1280A	Customer return repair service
R1282A	Customer return calibration service

Accessories

See the "DCA Accessories" Guide for available accessories

Connectivity Solutions

For a wide range of test adapters to connect to one or more lanes for SFP+, QSFP+, fibre channel, PCIe and many others, please see adapters information from Wilder Technologies at: http://www.wilder-tech.com/ Call Keysight for connectivity and probing solutions not listed above.

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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