YOKOGAWA

signal Xplorer™

Digital Oscilloscopes

DL9000 Series

- 4 input channels
- Analog BW
  1 GHz (DL9140/DL9140L)
  1.5 GHz (DL9240/DL9240L)
- Max. sampling rate
  5 GS/s (2 channels) 2.5 GS/s (4 channels) (DL9140/DL9140L)
  10 GS/s (2 channels) 5 GS/s (4 channels) (DL9240/DL9240L)
- Max. record length
  2.5 M word/channel (DL9140/DL9240)
  6.25 M word/channel (DL9140L/DL9240L)
- Fast acquisition rate
  Max. 2.5 M waveforms/sec/ch
- History Memory function
  Review & analyze up to 2000 of the most recent waveforms after the acquisition is stopped
- Compact and light weight
  18 cm (7.1") depth, 6.5 kg (14.5 lbs.)

Prices starting at $10,995

3 year warranty

www.yokogawa.com/tm/
... and subscribe to "Newswave,"
our free e-mail newsletter

Bulletin 7013-00U

Digital Oscilloscopes

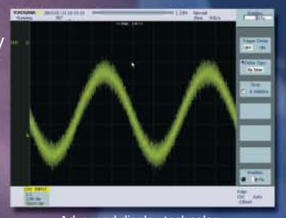
Xth Generation

signal Xplorer™

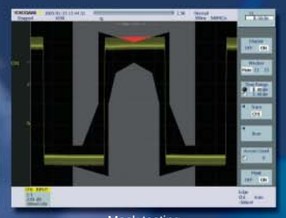
Affordable and Powerful 1 GHz/1.5 GHz Solutions Starting at $10,995

Affordable performance for full 1 GHz/1.5 GHz bandwidth measurements

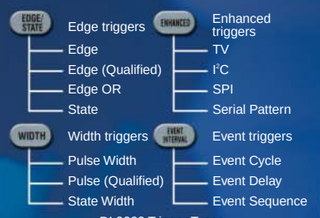
The standard DL9000 series is equipped with 2.5 M word/ch record length, dot density display technology and a wide variety of analysis and trigger functions. For full 1 GHz/1.5 GHz BW measurements, optional 2.5 GHz active probes are available. This makes the DL9000 the most affordable 1 GHz/1.5 GHz measurement system available today.



Advanced display technology
(Dot density display)



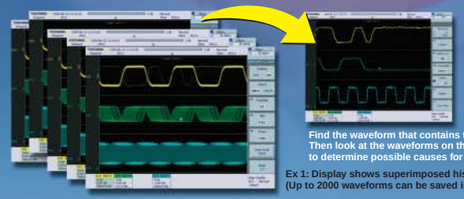
Mask testing



DL9000 Trigger Types

History memory with fast signal acquisition

Fast signal acquisition helps you avoid missing anomalies. However, simple superimposed waveform displays only tell whether or not an anomaly occurred. Such displays do not provide information about when the anomaly occurred, what events occurred before the anomaly, nor what happened after the anomaly. The DL9000's History memory function allows you to view and analyze up to 2000 previously acquired waveforms, even after the acquisition stops. This offers unparalleled insight into waveform behavior and makes troubleshooting easier.



History memory advantage #1

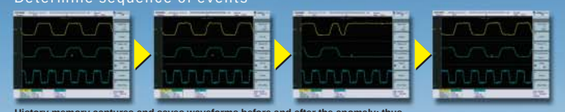
Correlate events from multiple channels

Find the waveform that contains the anomaly.
Then look at the waveforms on the other channels to determine possible causes for the anomaly.

Ex 1: Display shows superimposed history waveforms (Up to 2000 waveforms can be saved in history memory)

History memory advantage #2

Determine sequence of events



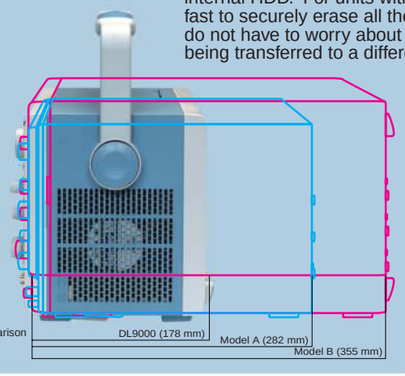
History memory captures and saves waveforms before and after the anomaly; thus providing insight into the cause and effect of the anomaly.

Security for confidential tests

The DL9000 series can be configured without the optional internal HDD. For units without the HDD, it is both easy and fast to securely erase all the data in the unit. Therefore, you do not have to worry about your confidential test results being transferred to a different location, along with the unit.

A small footprint means more room on your bench for the DUT

The DL9000 is only 35 cm wide and 18 cm deep so it does not take up all your valuable bench space. And it weighs only 6.5 kg so it is easy to move from one bench to another.



1 GHz oscilloscope depth comparison

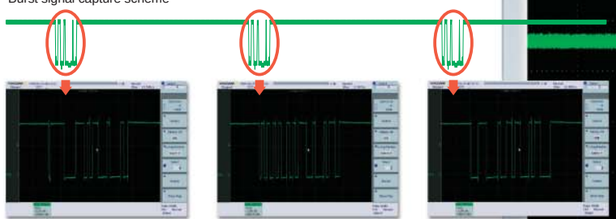
A new digital oscilloscope with 1 GHz/1.5 GHz frequency bandwidth.

DL9000 Series

Flexible acquisitions using a Xth generation scope

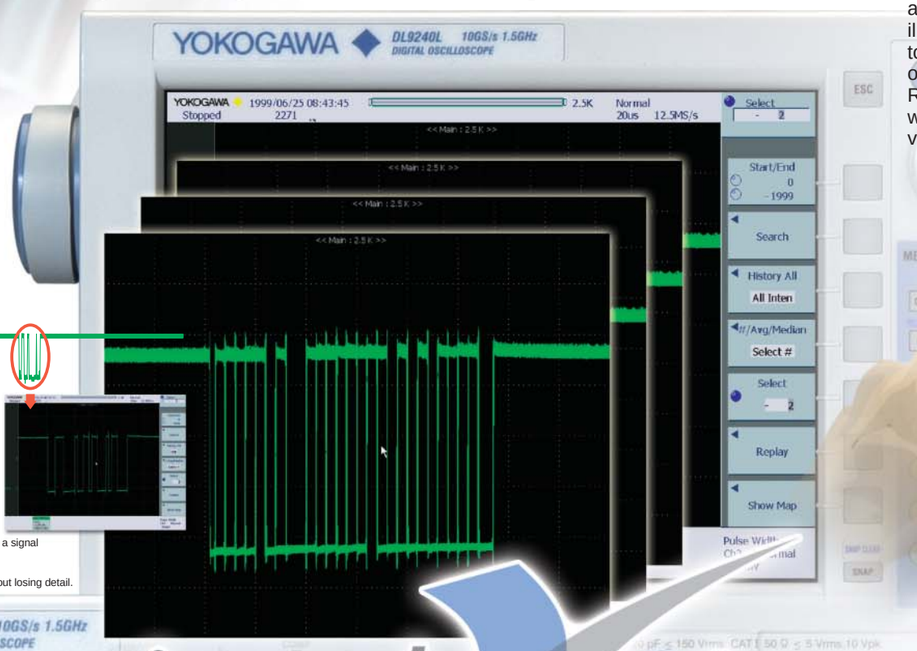
The DL9000 signalXplorer is Yokogawa's 10(X)th generation digital oscilloscope. It allows users to select the most appropriate memory setting for a given measurement and then acquires and displays long and short memory records quickly, saving the waveforms to its segmented memory. Advanced memory handling ensures that you get all the benefits of a long memory scope regardless of the record size you allocate for each acquisition. This is made possible by the state-of-the-art ADSE (advanced data stream engine) ASIC.

Burst signal capture scheme



Example of shorter memory acquisitions (I²C SDA signal capture): By skipping portions of a signal which contain no information, many frames can be acquired in the memory.

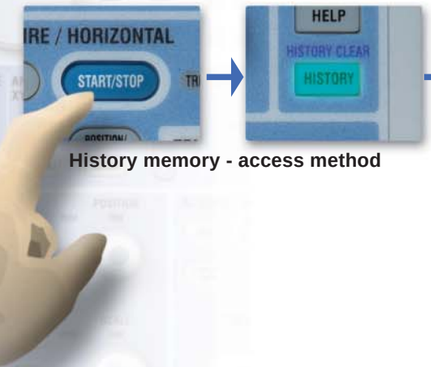
Mega word signal capture example (TV composite signal): 1 whole TV frame can be captured without losing detail.



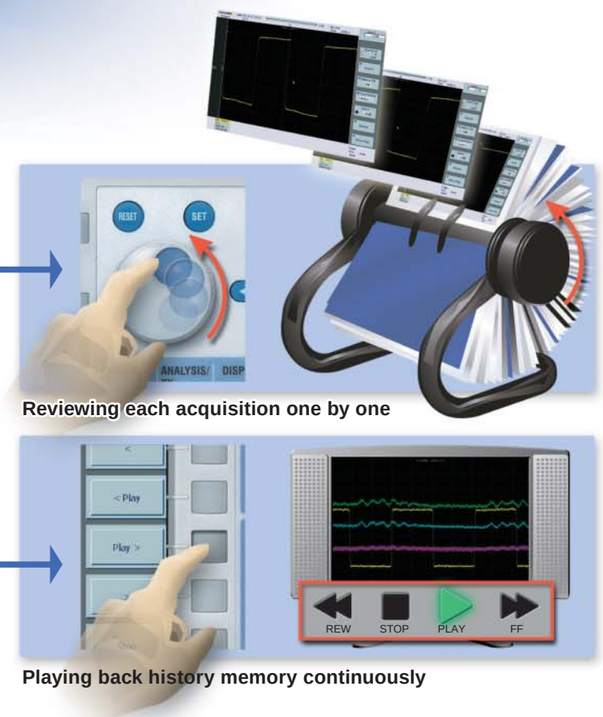
signalXplorer™

History Replay

When acquisition stops and there are more than two acquisitions in memory, the HISTORY key is illuminated. At that time, you can use the rotary knob to view every single acquisition in memory, one-by-one, and look for an anomaly. The new History Replay function allows you to play back the waveforms in memory in the same way you play back video on a DVR.



History memory - access method



Reviewing each acquisition one by one

Playing back history memory continuously

ADSE offers 2 fast signal acquisition modes

N Single Mode

When you need to observe closely-spaced waveform events consecutively, it is important to minimize the dead time between captures. The 'N single' mode on the DL9000 captures up to 1600 waveforms on each of 4 channels with as little as 400 ns of dead time between acquisitions. In the 500 ps/div range, this corresponds to an effective acquisition rate of 2.5 M waveforms/sec/ch.

New ACCUM (Accumulation) Mode

When observing long-term repetitive waveform events, the ACCUM function offers fast repetitive signal acquisition rate of up to 25 k waveforms/sec/ch (on 4 channels simultaneously) while retaining up to 2000 acquisitions in memory.

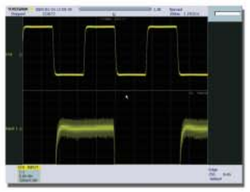
Whether you use N single or the ACCUM function, previously acquired waveforms are stored in memory and can be accessed using the History Function.

Search Function

Both Zoom search and History search functions are available in the signalXplorer. Zoom search locates an area of interest in a single acquisition. History search locates any acquisitions in history memory that meet user-selected criteria.

Dot Density Display

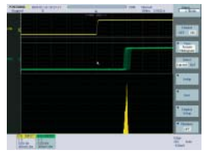
The intensity of individual display pixels are varied depending on how often a signal illuminates each pixel. Even for single shot acquisitions, Dot Density Display provides visual information about the S/N ratio of a signal. For repetitive signal acquisitions, this feature offers additional insight into the frequency of occurrence of portions of a signal over time. In short, Dot Density Display technology offers analog oscilloscope-like waveform representations on a digital scope.



Enhanced Analysis & Math

Histogram Displays

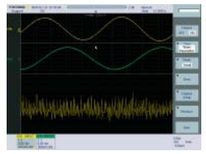
Gain new perspectives on your waveforms by using time and voltage histograms. For example, signal jitter can be shown using a time histogram, and noise on DC signals can be visualized using a voltage histogram.



Example: Result of time histogram

Trend Displays

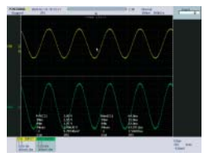
Track long-term waveform parameter trends using the trend display. The Trend display can be used to visualize fluctuations of a selected parameter.



Example: Trend display of P-P values

Statistics

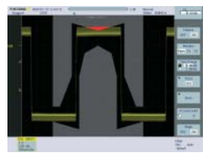
Use the statistics functions to generate statistical information (max, min, avg, std dev, etc.) about waveform parameters. Continuous statistics (running statistics on selected parameters during acquisition), Cycle statistics (statistical information about a waveform on a cycle-by-cycle basis) and History statistics (statistics on waveforms captured in history memory) are all available.



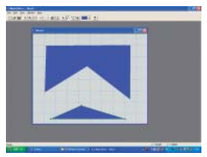
Example: Cycle statistics

Mask Testing

With free Mask Editor software, you can define a mask and then test to see whether or not the measured signal falls in/out of the mask. Masks for a variety of communication signals can be defined.



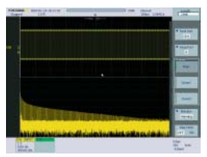
Example: Telecom test



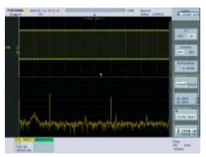
Example: Mask Editor software

FFT

The DL9000 series can calculate FFT waveforms using up to 250 k points. To scale the results, you can specify the center frequency and the frequency span, just like you would do with a spectrum analyzer.



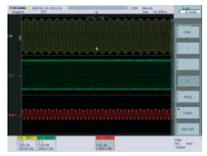
250 k point FFT



Scaled FFT result

Waveform Math

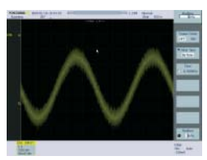
Define up to 8 math traces. Functions include: filtering, +, -, x, Integration, Edge Count and Rotary Count. Basic arithmetic functions are performed using the ADSE (hardware) and results are displayed in real time.



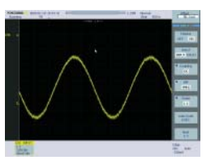
Math trace example

Real-Time Analog/Digital Filtering

200 MHz and 20 MHz analog low pass filters and 8 MHz, 4 MHz, 2 MHz, 1 MHz, 500 kHz, 250 kHz, 125 kHz, 62.5 kHz, 32 kHz, 16 kHz and 8 kHz digital low pass filters are available for real-time filtering. These filters can be applied to live signals without slowing down the signal acquisition rate. Additional types of digital filtering is available using the math function.



Signal without filter



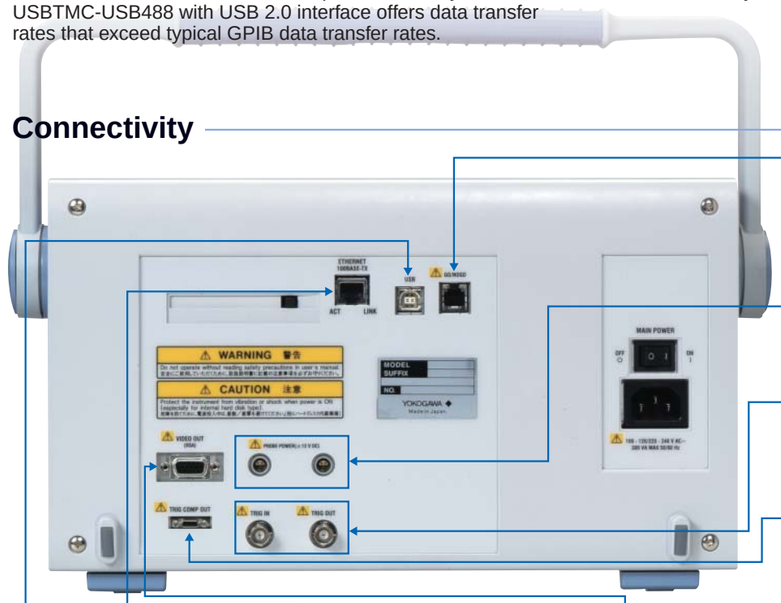
Signal with filter

Connectivity & Software

Use USB 2.0 interface (standard), 100BaseTX/10BaseT (option), or GPIB (available using a National Instruments NI PCMCIA-GPIB card) to remotely control the DL9000 and to transfer waveform data from the scope. The industry standard USBTMC-USB488 with USB 2.0 interface offers data transfer rates that exceed typical GPIB data transfer rates.

For data storage, you can use a PC card drive (available in both front and rear panels) or USB interface. These interfaces support media such as, CompactFlash, PC Card type II HDD, and USB memory.

Connectivity



GO/NO GO I/O
Output the results of either GO/NO GO tests or mask tests as a TTL level signal. You can also assign this port as an input and apply a signal to initiate the test.

Probe power (option)

Trigger IN/OUT
Separate ports available for external trigger input and output.

Trigger comparator OUT
Trigger types not supported in the DL9000 can be realized with external circuits using these signals.

GPIB Interface
(2 PC Card interfaces are standard. However, a NI PCMCIA- GPIB card is required for communication. You can use the front or back panel PC Card interface for this purpose.)

USB communication port
Control the instrument and transfer waveform data from the DL9000 to an external PC.

100BaseTX/10BaseT Ethernet (option)

Video output
Display screen images on an external monitor.

PC Card/USB Interfaces

Supports flash ATA/HDD Card

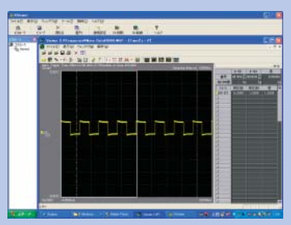
Supports USB storage/memory

Supports USB mouse/keyboard

Use popular, and widely available, large capacity media such as CompactFlash or USB HDD to save and transfer waveform data captured with the DL9000.
A USB mouse and/or keyboard can be used to facilitate operation of the unit. The front USB port can also be used to connect to a USB printer.

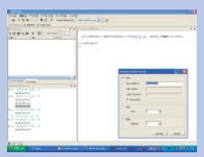
Software Tools

Additional details about Yokogawa's software tools and information for downloading trial versions of the software can be found at:
http://www.yokogawa.com/tm/tm-softdownload.htm



Xviewer (sold separately)

Xviewer runs on a PC and can be used for viewing saved waveform data, converting binary data to ASCII and for calculating automatic waveform parameters. With the Math edition of Xviewer you can calculate up to 10 math waveforms based on waveform data and do FFT calculations using up to 2 M points.



MATLAB Control Tool Kit (sold separately)

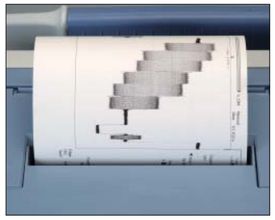
The MATLAB tool kit enables DL series oscilloscopes to easily interface with MATLAB. The software can be used to control supported DL series instruments from MATLAB or to transfer data from DL series instruments to MATLAB via GPIB, USB or Ethernet.

DL Series Library (freeware)

This API lets you control or receive waveform data from the DL9000 remotely. The API is available as a DLL and can be called from your program.

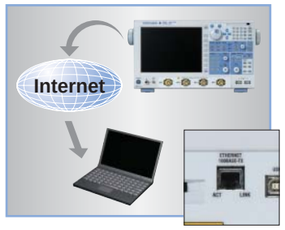
Factory Installed Options

Built-in printer (/B5)



This built-in thermal paper printer provides a convenient way to print out what is shown on the DL9000's display.

100BaseTX/10BaseT Ethernet (/C10)
100BaseTX/10BaseT Ethernet + internal HDD (/C8)



Network file server/client functions and network printing is supported through Microsoft network file sharing. The SMTP client allows you to send e-mail from the unit. (/C8, /C10)
The /C8 option includes an internal 30 GB HDD which can be used to store waveforms and setup files.

Probe power (/P2)

These ports supply power to the following current probes (701932, 701933) and the following differential probes (701920, 701921, 701922, 700924, 700925)

Note: You do not need this option to power the 2.5 GHz active probe (PBA2500).

I²C and SPI bus analyzer (/F5)

This option enables, analysis, and search on I²C and SPI serial data bus signals. Observing the physical signals of these buses allows you to more effectively separate hardware related problems from software related problems.

(I²C and SPI triggers are standard)

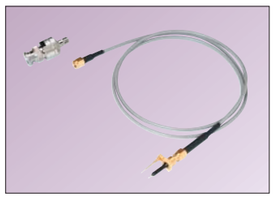
Accessories

PBA2500 2.5 GHz active probe

Use this 10:1 active probe with the DL9000 to realize system measurements up to 1.5 GHz BW.

Bandwidth: DC to 2.5 GHz (-3 dB)
Attenuation: 10:1 (±2%)
Input resistance: 100 kΩ (±2%)
Input capacitance: Approx 0.9 pF (typ.)
Dynamic range: ±7 V
Max. input voltage: ±25 V DC + AC peak
Offset voltage: ±10 V

PBL5000 5 GHz low capacitance probe



This 10:1 and 20:1 selectable passive probe is used with the 50 ohm input setting on the DL9000. The change in attenuation is realized by changing resistance on the tip of the probe.

Bandwidth: DC to 5 GHz (-3 dB)
Attenuation: 10:1 or 20:1 (±2%)
Input resistance: 450 Ω or 950 Ω (±1%)
Input capacitance: Approx 0.25 pF (typ. 450 Ω), 0.4 pF (typ. 950 Ω)
Max. input voltage: 20 Vrms

PB500 500 MHz passive probe

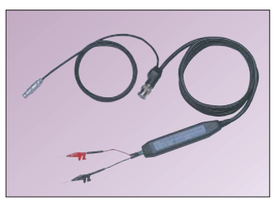
This probe can be used for general purpose day-to-day measurements up to 500 MHz BW. The DL9000 series comes standard with 4 PB500 probes.

Attenuation: 10:1 (±2%)(When used with the DL9000)
Input resistance: 10 MΩ ±2%
Input capacitance: Approx 14 pF (typ.) (When used with the DL9000)
Max. Input range: ±600 V DC + AC peak

701975 50 ohm DC block

This DC block can be used to remove the DC component from an incoming signal. Use this block if you want to remove bias voltage from reaching the PBL5000 probe.

701920 500 MHz differential probe



For differential signal measurements. Order the DL9000 with the /P2 option to directly power the probe off the scope.

Attenuation: 10:1 (±3%)
Input resistance (typ.) 100 kΩ
Input capacitance (typ.) 2.5 pF
Max. allowable differential voltage:
±12 V DC + AC peak
Max. common mode voltage:
±30 V DC + AC peak

701932 100MHz current probe

Clamp-type current probe. Order the DL9000 with the /P2 option to directly power the probe off the scope.

Bandwidth: DC to 100 MHz (-3 dB)
Max. continuous input range: 30 Arms, 50 A peak

Specifications

Models

Model name (No.)	Max. sampling rate	Freq. bandwidth	Max. record length
DL9140 (701310)	5 GS/s	1 GHz	2.5 MW
DL9140L (701311)	5 GS/s	1 GHz	6.25 MW
DL9240 (701312)	10 GS/s	1.5 GHz	2.5 MW
DL9240L (701313)	10 GS/s	1.5 GHz	6.25 MW

Basic Specifications

Input channels	4 (CH1 to CH4)		
Input coupling	AC, DC, GND, DC50Ω		
Input impedance	1 MΩ ±1.0% approx. 20 pF (when using PB500 probe, 10 MΩ ±2.0%, approx. 14 pF)		
	50 Ω ±1.5%		
Voltage axis sensitivity ranges	For 1 MΩ input: 2 mV/div to 5 V/div (steps of 1-2-5)		
	For 50 Ω input: 2 mV/div to 500 mV/div (steps of 1-2-5)		
Maximum input voltage	For 1 MΩ input: 150 Vrms CAT I		
	For 50 Ω input: 5 Vrms or less and 10 Vpeak or less		
DC offset max. setting range (When probe attenuation set to 1:1)	For 1 MΩ input		
	2 mV/div to 50 mV/div:	±1 V	
	100 mV/div to 500 mV/div:	±10 V	
	1 V/div to 5 V/div:	±100 V	
	For 50 Ω input		
	2 mV/div to 50 mV/div:	±1 V	
	100 mV/div to 500 mV/div:	±5 V	
Vertical (voltage) axis sensitivity			
DC accuracy[1]	For 1 MΩ input: ±(1.5% of 8 div + offset voltage accuracy)		
	For 50 Ω input: ±(1.5% of 8 div + offset voltage accuracy)		
Offset voltage axis accuracy[1]	2 mV/div to 50 mV/div:	±(1% of setting + 0.2 mV)	
	100 mV/div to 500 mV/div:	±(1% of setting + 2 mV)	
	1 V/div to 5 V/div:	±(1% of setting + 20 mV)	
Voltage standing-wave ratio (VSWR)	1.5 or less within frequency bandwidth		
Frequency characteristics[1, 2] (Attenuation point of -3 dB when inputting a sinewave of amplitude ±2 div or equivalent)	For 50 Ω input	DL9140/DL9140L	DL9240/DL9240L
	0.5 V/div to 10 mV/div:	DC to 1 GHz	DC to 1.5 GHz
	5 mV/div:	DC to 750 MHz	DC to 1 GHz
	2 mV/div:	DC to 600 MHz	DC to 750 MHz
	For 1 MΩ input (from the probe tip when using the dedicated passive probe (PB500))		
	5 V/div to 10 mV/div:	DC to 500 MHz	DC to 500 MHz
	5 mV/div to 2 mV/div:	DC to 400 MHz	DC to 400 MHz
Residual noise level[3]	0.4 mV rms or 0.05 div rms, whichever is larger (typical value[4])		
A/D conversion resolution	8-bit (25 LSB/div)		
	Maximum 13 bit (when in High-Res. mode)		
Bandwidth limit	For each channel, select FULL, 200 MHz, 20 MHz, 8 MHz, 4 MHz, 2 MHz, 1 MHz, 500 kHz, 250 kHz, 125 kHz, 62.5 kHz, 32 kHz, 16 kHz, 8 kHz.		
	Limit implemented with analog (200 MHz, 20 MHz) and digital filters (IIR+ FIR).		
Max. sampling rate	DL9140/DL9140L	DL9240/DL9240L	
Real time sampling mode			
Interleave mode ON:	5 GS/s	10 GS/s	
Interleave mode OFF:	2.5 GS/s	5 GS/s	
Repetitive sampling mode:	2.5 TS/s	2.5 TS/s	
Maximum record length	DL9140/DL9240	DL9140L/DL9240L	
	2.5 MW	6.25 MW	
Time axis setting range	500 ps/div to 50 s/div (steps of 1-2-5)		
Time base accuracy[1]	±0.001%		
Time axis measurement accuracy[1]	± (0.01% + 10 ps + 1 sample interval)		
Max. acquisition rate[5]	When using 1.25 MW,	60 wareforms/sec/ch	
	When using 12.5 kW,	9000 wareforms/sec/ch	
	When using 2.5 kW,	25000 wareforms/sec/ch	
Min. dead time (N single)[5]	400 ns or less		

Trigger Section

Trigger modes	Auto, Auto Level, Normal, Single, and N Single	
Trigger source		
CH1 to CH4:	Signals applied to measurement input terminals[1]	
LINE:	Connected commercial power signal (only available with Edge trigger)	
EXT:	Signal input from EXT TRIG IN terminal	
Trigger level range		
CH1 to CH4:	±4 divisions from the screen center	
EXT:	±2 V (1:1), ±20 V (10:1 when used with a probe)	
Trigger level setting resolution		
CH1 to CH4:	0.01 div	
EXT:	5 mV (1:1), 50 mV (10:1 when used with a probe)	
Window comparator	Channels CH1 to CH4, or individual channels	
Center:	±4 divisions from the screen center	
Width:	±4 divisions from Center	
Trigger level accuracy		
CH1 to CH4[1]	±(0.2 div + 10% of trigger level)	
EXT[1]	±(50 mV + 10% of trigger level)	
Trigger sensitivity (When hysterisis is small)		
CH1 to CH4[1]	DC to 1 GHz	1 divp-p
EXT[1]	DC to 100 MHz	100 mVp-p
Edge OR	DC to 50 MHz	1 divp-p

Trigger types

- **Edge/State**
  - Edge: Trigger occurs on the edge of a single trigger source.
  - Edge (Qualified): Trigger occurs on the edge of a single trigger source when Qualification condition is true.
  - Edge OR: Trigger occurs on the OR logic of the edge conditions set to multiple trigger sources.
  - State: Trigger occurs on ENTER/EXIT when the state condition is true.
- **Width**
  - Pulse: Trigger occurs on a width of a single trigger source.
  - Pulse (Qualified): Trigger occurs on a width of a single trigger source when Qualification condition is true.
  - Pulse State: Trigger occurs on a width when the state condition is true.
  - Time width setting mode
    - More than: Trigger occurs upon change in condition when the condition remains true longer than time T1.
    - Less than: Trigger occurs upon change in condition when the condition remains true shorter than time T1.
    - Between: Trigger occurs upon change in condition when the condition remains true longer than time T1 and shorter than time T2.
    - Out of Range: Trigger occurs upon change in condition when the condition remains true shorter than time T1 and longer than time T2.
    - Time out: Trigger occurs when the condition is true for duration longer than time T1.
  - Specified time (T1/T2): 1 ns to 10 s, 500 ps resolution
  - Time accuracy: ±(0.2% of setting + 1 ns)
- **Event Interval**
  - Event Cycle: Trigger occurs when the event cycle is within the specified time range.
  - Event Delay: After Event 1 occurs, trigger occurs on 1st occurrence of Event 2 that satisfies the timing constrains. The trigger process is reset if Event 1 or Event 2 occurs before the timing constrains are satisfied.
  - Event Sequence: After Event 1 occurs, trigger occurs on 1st occurrence of Event 2 that satisfies the timing constrains. The trigger process is reset if Event 1 occurs before the timing constrains are satisfied.
  - Time width setting mode: Function identical to the time width setting mode for Width
  - Specified time (T1/T2): 1.5 ns to 10 s, 500 ps resolution
  - Time accuracy: ±(0.2% of setting + 1 ns)
  - Event types: Events can be selected from any but the following: Edge, Edge Qualified, State, Pulse, Pulse Qualified, Pulse State, I²C, SPI, Serial, or TV, Edge OR.
- **Enhanced**
  - TV: Trigger occurs on video signals of various broadcasting system formats
    - Mode: NTSC, PAL, HDTV, USER
    - Input CH: CH1-CH4
    - Sync Guard: Hsync 60 to 90% (steps of 1%)
    - Line: 5-1054 (NTSC), 2-1251 (PAL), 2-1251 (HDTV), 2-2048 (USER)
    - Field: 1/2/X
    - Frame Skip: 1/2/4/8
  - I²C: Triggers on I²C bus signals
    - Mode: NON ACK, Every Start, General Call, (Start byte/HS Mode), ADR&DATA
  - SPI: Triggers on SPI (serial peripheral interface) bus signals
    - Mode: 3 wire, 4 wire
  - Serial pattern: Triggers on general purpose serial communication signals.
    - Max. bit rate: 50 Mbps
    - Max. bit length: 128 bits

Display

Display	8.4-inch (21.3 cm) color TFT liquid crystal display
Display screen size	170.5 mm (width) × 127.9 mm (height)
Total number of pixels	1024 × 768 (XGA)
Waveform display resolution	800 × 640

Functions

Waveform Acquisition/Display Functions

Acquisition modes	Select from three acquisition modes: Normal, Envelope, and Average.
High resolution mode	Vertical resolution is increased to max. 13 bits.
Repetitive sampling mode	Allows switching between realtime and repetitive sampling in certain time axis settings.
Interpolate function	Interpolates actual sampled data by up to 1000 times (or

	up to 2000 times in High-Res. mode) and increases the time resolution (up to 2.5 TS/s)
Record length	
DL9140L/DL9240L:	2.5 kW, 62.5 kW, 12.5 kW, 25 kW, 62.5 kW, 125 kW, 250 kW, 625 kW, 1.25 MW, 2.5 MW, 6.25 MW
DL9140/DL9240:	2.5 kW, 62.5 kW, 12.5 kW, 25 kW, 62.5 kW, 125 kW, 250 kW, 625 kW, 1.25 MW, 2.5 MW
Accumulation	Accumulates waveforms on the display. Choose Count/Time and Inten/Color.
Snapshot	Retains the current displayed waveform on the screen.
SNAP Clear	Clears Snaped traces
ACCUM Clear	Clears accumulated traces
History Clear	Clears History traces

Vertical/Horizontal Axis Settings

Turn channels ON or OFF	Independently on channels CH1 to CH4
Input filter	Limits bandwidths independently on channels CH1 to CH4
Roll mode	Roll mode display is enabled when the trigger mode is set to Auto, Auto Level, or Single at the following time axis setting: 100 ms/div to 50 s/div

Analysis Functions

Search and Zoom function	Zooms the displayed waveform along the time (Horizontal Zoom) and voltage (Vertical Zoom) axes. Independent zooming factors can be applied to two zoom areas.
Voltage axis zoom factor:	1 to 10 times
Time axis zoom factor:	1 time to 1data/div
Auto scroll function:	Automatically scrolls the zoom window along the time axis
Search function:	Searches the currently displayed waveform for a specified portion occurring beyond a specified time, and displays the zoomed result on screen
Search types:	Edge, Edge Qualified, State, Pulse, Pulse Qualified, Pulse State, Serial Pattern, I²C (optional), SPI (optional)
History memory/Single (N)	
Max data:	DL9140L/DL9240L: 2000 (2.5 kW), when using history 1600 (2.5 kW), when in N single mode DL9140/DL9240: 1000 (2.5 kW), when using history 800 (2.5 kW), When in N single mode
History search:	Search for and display waveforms from the history memory that meet specified conditions.
Search types:	Rect, WAVE, Polygon, Parameter (Measure/FFT/XY)
Replay:	Automatically replays history waveforms.
Display:	Selected acquisition (#) or Average (Avg)
Cursor measurements	The following five cursors can be selected: Vertical, Horizontal, VT, Marker, Serial
Automatic measurement of Waveform Parameters function	
	Performs automated measurement of the following waveform parameters.
	Items unrelated to cycle which will be derived out of all data in the range. MAX, MIN, HIGH, LOW, P-P, HIGH-LOW, +OVER, -OVER, RMS, MEAN, Sdev, IntegTY
	Items related to cycle which will be derived out of all data in the range. C.rms, C.mean, C.Sdev, C.IntegTY, (1/FREQ), FREQ, COUNT, BURST
	Items which will be derived from the first encounter from the beginning of the specified range. +WIDTH, -WIDTH, PERIOD, DUTY, RISE, FALL, DELAY
Telecom Test	Performs mask test and eye pattern measurement
Mask test items:	Wave Count, Wave Count%, Sample Point Count, Sample Point Count%
Eye pattern items:	Vtop, Vbase, σtop, σbase, Tcrossing1, Tcrossing2, σcrossing1, σcrossing2, Vcrossing, Crossing%, Eye Height, Eye Width, Q Factor, Jitter, Jitter6σ, Duty Cycle Distortion, Duty Cycle Distortion%, Ext Rate, Ext Rate%, Ext Rate dB, Rise/Fall
Computation functions	Computes up to eight traces (CH1-CH4/M1-M4) +, -/*, INTEG, COUNT (EDGE), COUNT (ROTARY), Through, Delay, Moving Avg, LowPass, High Pass
Reference functions	Display and analysis (computation and cursors) on up to four traces (M1-M4) of the saved waveform data. Waveforms including history can also be loaded for history searches or replay. Various parameters can be changed (however waveforms are not affected by T/Div changes).
Action-on-trigger	Automatically measured waveform parameters and waveform zones are determined, and the selected action is carried out each time conditions are met.
Modes:	OFF, All Condition, (GO/NOGO Zone/Param), GO/NOGO Telecom Test)
Actions:	Buzzer, Print, Save, Mail
All condition:	After EXEC is pressed, the specified action is performed upon each acquisition
GO/NOGO zone:	Determines whether or not the acquired waveform passes through the specified area
Zone types:	RECT, Polygon, WAVE
GO/NOGO parameter:	Determines whether or not the specified parameter of the acquired waveform is within the specified range
Param:	Choose Measure, FFT, or XY
GO/NOGO telecom test:	Performs judgment using the conditions specified in the telecom test.
ANALYSIS	Selectable from XY, FFT, Wave Parameter, Accum Histogram and Serial Bus
X-Y	displays XY1, XY2 and T-Y simultaneously
FFT	supports up to 250 k points FFT
Wave parameter	One wave parameter can be viewed in one of the following formats. (Histogram, Trend and List)
Accum histogram	Histogram of the selected area can be displayed for continuous signal.
Serial bus	Analysis results of I²C SPI can be displayed.

I²C Analysis Functions (Optional)

Applicable bus	I²C bus	bus speed: Max. 3.4 Mbit/s Address mode: 7 bit/10 bit
	SM bus	complies with System Management bus
Trigger function (Standard)		
Source:	SCL:	Ch1 to Ch4
	SDA:	Ch1 to Ch4
Type:	Address & data:	trigger on combination of assigned address & data pattern
	Non-Ack:	trigger on non acq condition
	Every start:	trigger on start condition
	General Call:	trigger on general call and the following byte
	Start byte / HS mode:	trigger on Start byte and HS mode
Analysis		
Signal input:	Ch1 to Ch4, M1 to M4 can be configured	
Display of analysis results:	Display the analysis result using the following 2 methods * Simple analysis result: Hex data, R/W, start condition, Ack, Address or Data * List of detailed analysis results, R/W, Address or Data, start condition Displays No., Time, Binary, Hex and Ack	
Search function		
Pattern search:	Set the address pattern, data pattern and Acknowledge bit condition and Search the waveform.	
Number of analysis data points	Max. 5 k byte	
Analysis result save function:	Save the list of the detailed analysis to a file in ASCII format	

SPI Analysis Functions (Optional)

Trigger function		
Mode:	3 wire/4 wire	
Bit order:	MSB/LSB	
Analysis		
Signal input:	Clock (SCK) :	Ch1 to Ch4
	Data1 (MOSI):	Ch1 to Ch4
	Data2 (MISO):	Ch1 to Ch4
	CS signal (SS):	Ch1 to Ch4
Display of analysis results:	Display the analysis results using the following 2 methods * simple analysis result: Hex CS status * List of detailed analysis result Displays No., Time, Dt1, Dt2 and CS	
Search function		
Pattern search:	Set the waveform by specified data pattern (Frame pattern)	
Number of analysis data points	Max. 5 k byte	
Analysis result save function:	Save the list of the detailed analysis to a file in ASCII format	

Built-in Printer (/B5 Option)

Printing method	Thermal line-dot
Paper width	112 mm
Effective print width	104 mm (832 dots)

Auxiliary I/O Section

Rear panel I/O signal	Ext. trigger input, ext. trigger output, Trigger comparator output, GO/NO-GO I/O, video output
Probe interface terminal (front panel)	
No. of terminals:	4
Supported probes:	PBA2500
Probe power terminal (/P2 option, rear panel)	
No. of terminals:	2
Supported probes:	FET probe (700939), current probes (701932, 701933), and differential probes (701920, 701922)

Storage

Internal Storage Media

Capacity	32 MB
Uses	Saving and loading waveforms and panel settings
Memory type	Flash ROM

Internal Hard Drive (/C8 Option)

Capacity/file system	30 GB FAT32
File name	Supports long file names of up to 256 ASCII characters

USB Peripheral Support

Connector	USB type A connector (receptacle) × 2
Electrical and mechanical specifications	Conforms to USB Revision 2.0
Supported transmission standards	LS (Low Speed) mode (1.5 Mbps), FS (Full Speed) mode (12 Mbps)
Supported devices	USB HID Class Ver1.1 compliant mouse/104 keyboard USB Printer Class Ver.1.0 compliant printers EPSON: Ink Jet Printers Canon: Ink Jet Printers HP: PCL Ink Jet Printers USB Mass Storage Class Ver.1.1 compliant mass storage device USB HUB Device (1 unit only) support.
* Please contact your local Yokogawa representative for model names of verified devices	
Max. No. of devices	4

PC Card Interfaces

Number of ports	2 (front panel (1), rear panel (1))
Supported cards	GPIB National Instruments NI PCMCIA-GPIB card Storage cards Flash ATA memory card (PC card TYPE II), PC card types, CF card + adapter card, and hard disk type PC cards

USB-PC Connections

Connector	USB type B connector (receptacle) × 1
Electrical and mechanical specifications	Conforms to USB Revision 2.0
Supported transmission standards	HS (High Speed) mode (480 Mbps), FS (Full Speed) mode (12 Mbps)
Supported class	Operates as a multifunctional device supporting two of the following protocols simultaneously. USBTMC-USB488 (USB Test and Measurement Class Ver.1.0) Accepts GPIB commands while using a USB bus Mass Storage Class Ver.1.1 The DL's internal storage media and hard disk, PC card, and USB MSC can be accessed (read/write) from the PC (formatting is not supported).

Ethernet Communication (/C10 and /C8 Options)

Connector type	RJ-45 connector
Electrical and mechanical specifications	Conforms to IEEE802.3
Transmission method	Ethernet (100BASE-TX/10BASE-T)
Communication protocol	TCP/IP
Supported services	SMTP client, DHCP, DNS, Microsoft network file sharing server and client SNTP client, Fire Wall

General Specifications

Rated supply voltage	100 to 120 VAC/200 to 240 VAC (switches automatically)
Allowed supply voltage fluctuation range	90 to 132 VAC/180 to 264 VAC
Rated supply frequency	50/60 Hz
Allowable power supply frequency variation	48 to 63 Hz
Maximum power consumption	300 VA
Withstanding voltage (between power supply and case)	1.5 kVAC for one minute.
External dimensions	350 (W) × 200 (H) × 178 (D) mm (when printer cover is closed, excluding handle and protrusions)
Weight (including printer)	Approximately 6.5 kg.
Battery backup	Setup data and clock are backed up with an internal lithium battery
Battery life:	Approximately 5 years (at ambient temperature of 25°C)
Operating temperature range	5-40°C

1. Measured value under standard operating conditions after 30-minute warm-up and performing calibration.
   Standard operating conditions: Ambient temperature: 23 ±5°C; Ambient humidity: 55 ±10%; Error in supply voltage and frequency: Within 1% of rating
2. Value in the case of a repetitive signal
   The frequency bandwidth of a single-shot phenomenon is the smaller of the two values, DC to sampling frequency/2.5 or the frequency bandwidth of the repetitive phenomenon.
3. When the input section is shorted, the acquisition mode is set to normal, interleave mode is OFF, accumulation is OFF, and the probe attenuation is set to 1:1.
4. Typical value represents a typical or average value. It is not strictly warranted.
5. The parallel acquisition architecture of the DL9000 series ensures no decrease in acquisition rate for multi-channel use.

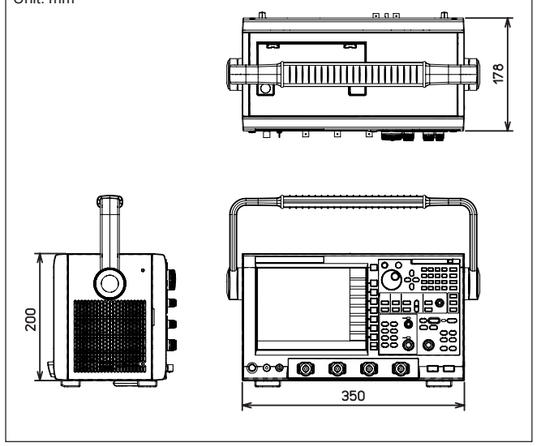
PBA2500 (Optional Accessory)

Length	1.2 m
Bandwidth	DC to 2.5 GHz (-3 dB)
Attenuation ratio	1/10 ±2.0%
Input resistance	100 kΩ ±2.0%
Input capacitance	Approx. 0.9 pF (typical)
Dynamic range	±7 V
Operational range	±15 V
Offset range	±10 V
Max. input voltage	±25 V DC + AC peak

PBL5000 (Optional Accessory)

Length	0.95 m
Bandwidth	DC to 5 GHz (-3 dB)
Attenuation ratio	1/10 ±2.0%,1/20 ±2.0% (selectable by changing the resistance)
Input resistance	450 Ω ±1.0%, 950 Ω ±1.0%,
Input capacitance	Approx. 0.25 pF (typical, with 450 Ω), 0.4 pF (typical, with 950 Ω)
Max. input voltage	20 V rms

Unit: mm



For detailed specifications, visit our homepage at
http://www.yokogawa.com/tm/DL9000

Model and Suffix Codes

Model	Suffix Codes	Description
701310		Digital Oscilloscope DL9140 4 ch, 1 GHz, max. 5 GS/s (2.5 GS/s/ch), 2.5 Mword/ch
701311		Digital Oscilloscope DL9140L 4 ch, 1 GHz, max. 5 GS/s (2.5 GS/s/ch), 6.25 Mword/ch
701312		Digital Oscilloscope DL9240 4 ch, 1.5 GHz, max. 10 GS/s (5 GS/s/ch), 2.5 Mword/ch
701313		Digital Oscilloscope DL9240L 4 ch, 1.5 GHz, max. 10 GS/s (5 GS/s/ch), 6.25 Mword/ch
Power cable	-D	UL/CSA standard
Help menu language	-HE	English Help
Options	/B5	Built-in printer
	/P2 [1]	Probe power connections on rear panel (2 outputs for current probes, differential probes)
	/C10 [2]	Ethernet interface
	/C8 [2]	Built-in HDD + Ethernet interface
	/F5 [3]	I²C + SPI bus analyzer

1: Please order /P2 option if you use either current probes or differential probes from Yokogawa. For 2.5 GHz active probe and 5 GHz low capacitence probe, this option is not necessary.
2: Choose either one
3: I²C and SPI triggers are standard.

Standard Accessories

Name	Q'ty
Power cable	1
PB500 (500 MHz passive probe)	4
Printer roll paper (when option/B5 is specified)	3
User's manual (1 set)	1
Front cover (transparent)	1

Accessories (Optional)

Name	Model	Specifications
PB500 (10:1 passive probe)	701943	10 MΩ, 500 MHz BW
PBA2500 (2.5 GHz active probe)	701913	2.5 GHz BW
PBL5000 (5 GHz low capacitance probe)	701974	5 GHz BW
DC block	701975	for 50 Ω input, SMA connector
FET probe (900 MHz)	700939	900 MHz BW
100:1 probe	700978	100 MHz BW
Differential probe	701921	DC to 100 MHz BW/ Max. ±700 V
Differential probe	701922	DC to 200 MHz BW/Max. ±20 V
Differential probe	700925	DC to 15 MHz BW/Max. ±500 V
Differential probe	700924	DC to 100 MHz BW/Max. ±1400 V
Differential probe	701920	DC to 500 MHz BW/Max. ±30 V
Current probe	701933	DC to 50 MHz BW, 30A peak
Current probe	701932	DC to 100 MHz BW, 30A peak
Printer roll paper	B9988AE	10 m roll, 10 rolls/1 unit
Rack mount kit	701984-01	EIA standard
Trigger comparator output cable	701976	for Trigger comparator OUT

Related Products

Note

- Before operating the product, read the user's manual thoroughly for proper and safe operation.
- If this product is for use with a system requiring safeguards that directly involve personnel safety, please contact the Yokogawa sales offices.

Yokogawa's Approach to Preserving the Environment

- Yokogawa's electrical products are developed and produced in facilities that have received ISO14001 approval.
- In order to protect the global environment, Yokogawa's electrical products are designed in accordance with Yokogawa's Environmentally Friendly Product Design Guideline and Product Design Assessment Criteria.

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