

# signal plorer™

## Digital Oscilloscopes *DL9000 Series*



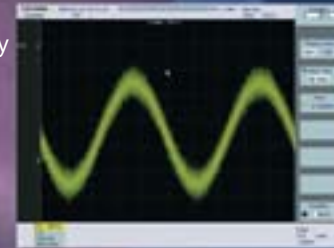
- **4 input channels**
- **Analog BW**
  - 1 GHz (DL9140/DL9140L)
  - 1.5 GHz (DL9240/DL9240L)
- **Max. sampling rate**
  - 5 GS/s (2 channels) 2.5 GS/s (4 channels) (DL9140/DL9140L)
  - 10 GS/s (2 channels) 5 GS/s (4 channels) (DL9240/DL9240L)
- **Max. record length**
  - 2.5 M word/channel (DL9140/DL9240)
  - 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.)



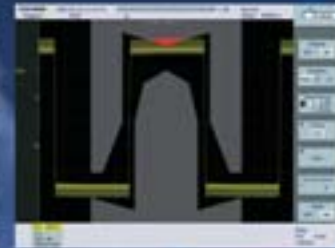
## Affordable and Powerful 1 GHz/1.5 GHz Solutions

### Affordable performance for full 1 GHz/1.5 GHz bandwidth measurements

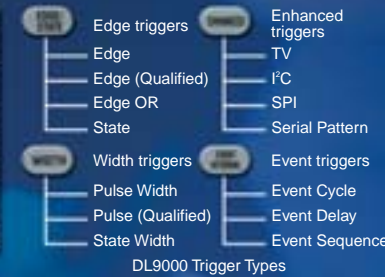
The standard DL9000 series is equipped with 2.5 M word/ch record length, dot density display technology and a wide variety of analysis and trigger functions. For full 1 GHz/1.5 GHz BW measurements, optional 2.5 GHz active probes are available. This makes the DL9000 the most affordable 1 GHz/1.5 GHz measurement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



Advanced display technology (Dot density display)



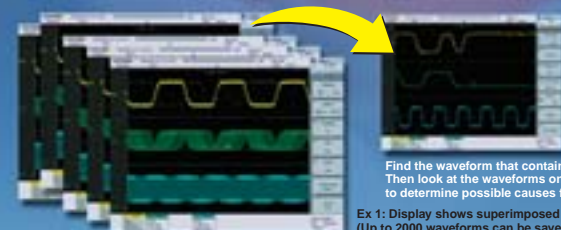
Mask testing



With 178 mm depth

### 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)

Determine sequence of events

History memory advantage #2



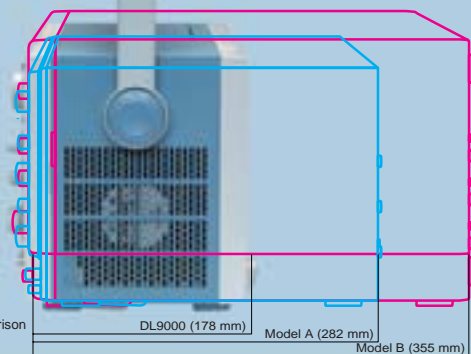
History memory captures and saves waveforms before and after the anomaly; thus providing insight into the cause and effect of the anomaly.

### 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

DL9000 (178 mm) Model A (282 mm) Model B (355 mm)

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

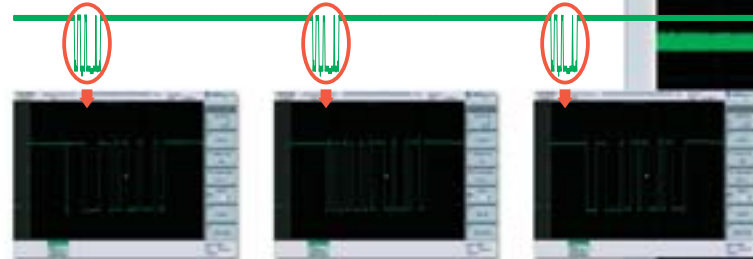
# DL9000 Series



### Flexible acquisitions using a X<sup>th</sup> generation scope

The DL9000 signalXplorer is Yokogawa's 10(X)<sup>th</sup> 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 (IC 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.

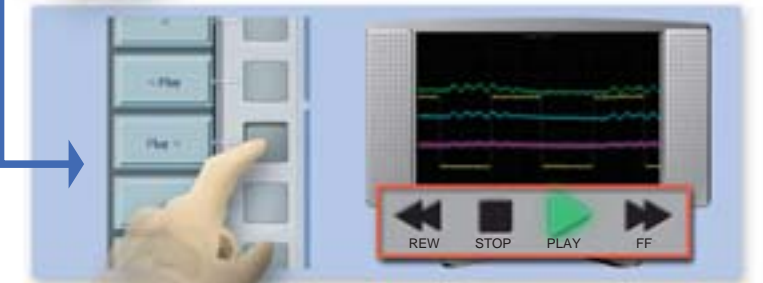


### History Replay

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.



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.

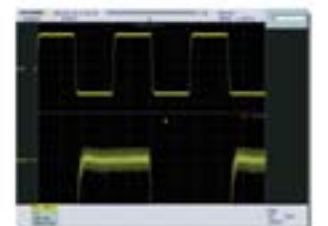


### Search Function

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.

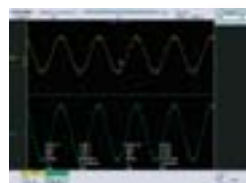


Example: Result of time histogram

### 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.

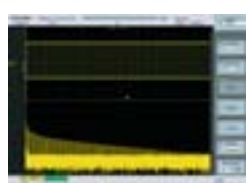


Example: Cycle statistics

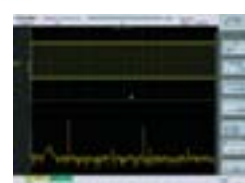
### FFT



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

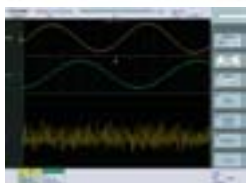


Scaled FFT result

### 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

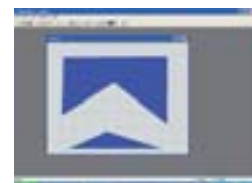
### Mask Testing



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

### 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.

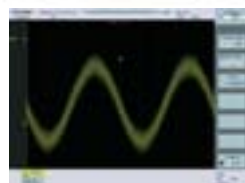


Math trace example

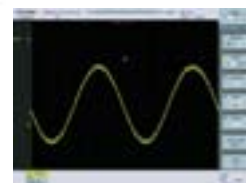
### Real-Time Analog/Digital Filtering



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



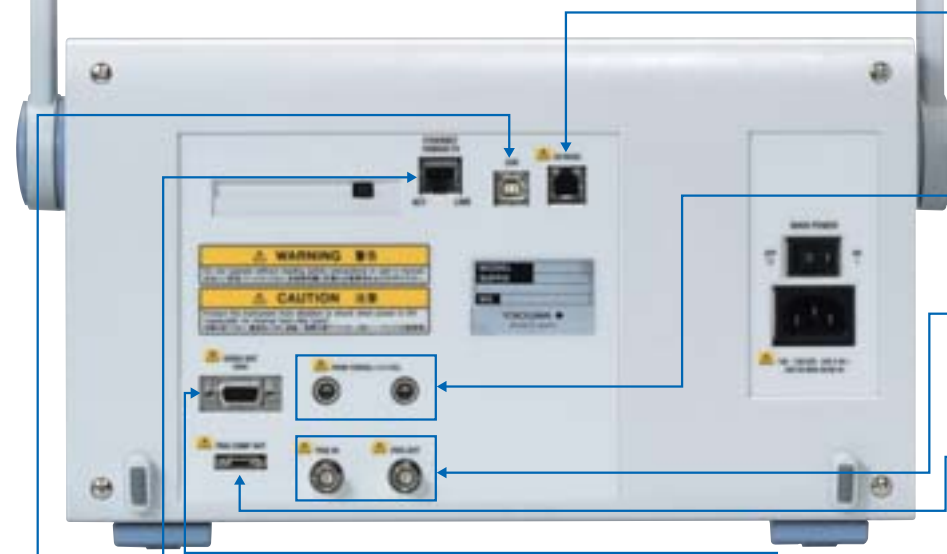
Signal with filter

## 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.

**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

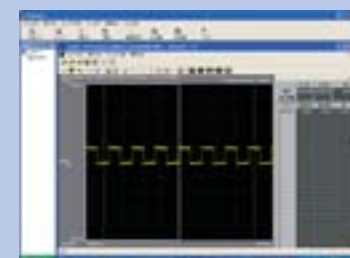


Supports USB mouse/keyboard

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.



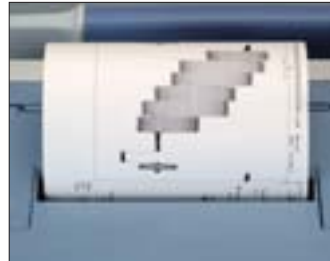
#### DL Series Library (freeware)

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.

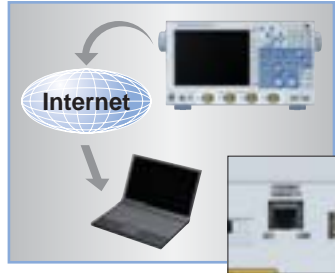
### Probe power (/P2)



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

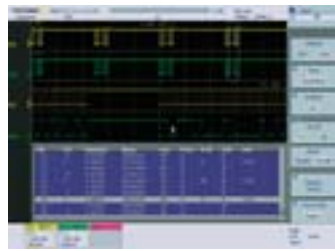
Note: You do not need this option to power the 2.5 GHz active probe (PBA2500).

### 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.

### I<sup>2</sup>C and SPI bus analyzer (/F5)



This option enables, analysis, and search on I<sup>2</sup>C 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.

(I<sup>2</sup>C and SPI triggers are standard)

## Accessories

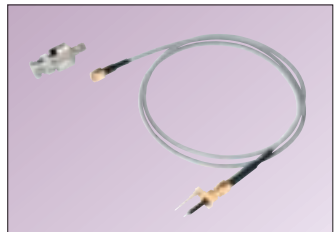
### PBA2500 2.5 GHz active probe



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

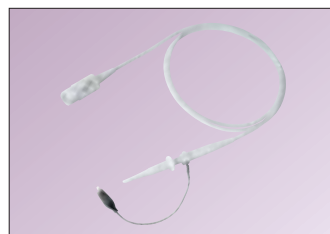
### PBL5000 5 GHz low capacitance probe



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.

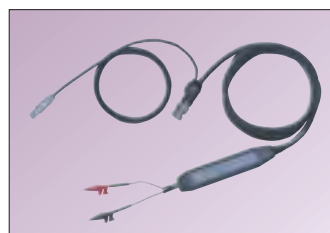
Attenuation: 10:1 (±2%) (When used with the DL9000)  
Input resistance: 10 MΩ ±2%  
Input capacitance: Approx 14 pF (typ.) (When used with the DL9000)  
Max. input range: ±600 V DC + AC peak

### 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 <sup>1</sup> 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 <sup>1</sup>	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 <sup>1,2</sup>	For 50 Ω input DL9140/DL9140L DL9240/DL9240L (Attenuation point of -3 dB when inputting a sinuswave of amplitude ±2 div or equivalent)		
Residual noise level <sup>3</sup>	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 0.4 mV rms or 0.05 div rms, whichever is larger (typical value <sup>4</sup> )		
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	
Time axis setting range	500 ps/div to 50 s/div (steps of 1-2-5)		
Time base accuracy <sup>1</sup>	±0.001%		
Time axis measurement accuracy <sup>1</sup>	± (0.01% + 10 ps + 1 sample interval)		
Max. acquisition rate <sup>5</sup>	When using 1.25 MW, 60 waveforms/sec/ch When using 12.5 kW, 9000 waveforms/sec/ch When using 2.5 kW, 25000 waveforms/sec/ch		
Min. dead time (N single) <sup>6</sup>	400 ns or less		

### Trigger Section

Trigger modes	Auto, Auto Level, Normal, Single, and N Single		
Trigger source	Signals applied to measurement input terminals <sup>1</sup>		
CH1 to CH4:	Connected commercial power signal (only available with Edge trigger)		
LINE:	Signal input from EXT TRIG IN terminal		
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 <sup>1</sup> : ±(0.2 div + 10% of trigger level) EXT <sup>1</sup> : ±(50 mV + 10% of trigger level)		

Trigger sensitivity (When hysteresis is small)  
CH1 to CH4<sup>1</sup> DC to 1 GHz 1 div-p  
EXT<sup>1</sup> DC to 100 MHz 100 mVp-p  
Edge OR DC to 50 MHz 1 div-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, I<sup>2</sup>C, 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: 1/2X  
Frame Skip: 1/2/4/8  
I<sup>2</sup>C:  
Triggers on I<sup>2</sup>C bus signals  
Mode: NON ACK, Every Start, General Call, (Start byte/HS Mode), ADDR&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, I<sup>2</sup>C (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,  $\sigma$ top,  $\sigma$ base, Tcrossing1, Tcrossing2,  $\sigma$ crossing1,  $\sigma$ crossing2, Vcrossing, Crossing%, Eye Height, Eye Width, Q Factor, Jitter, Jitter6 $\sigma$ , 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 I<sup>2</sup>C SPI can be displayed.

#### I<sup>2</sup>C Analysis Functions (Optional)

Applicable bus  
I<sup>2</sup>C 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 Ver.1.1 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)

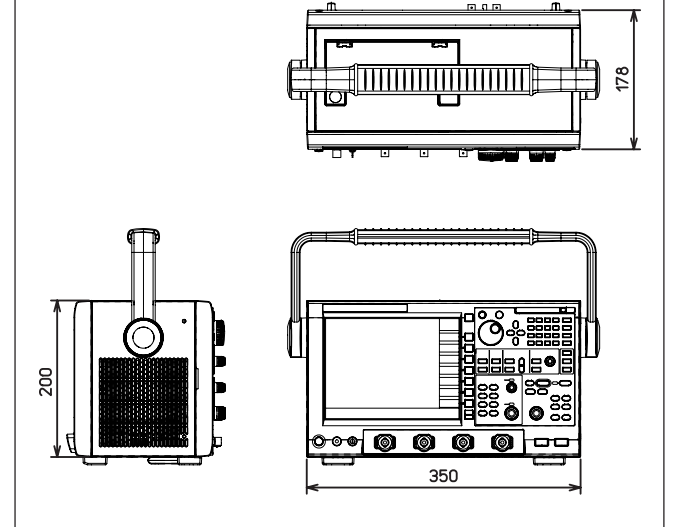
Attenuation ratio  
1/10 ±2.0%, 1/20 ±2.0%  
(selectable by changing the resistance)

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
	-F	VDE standard
	-Q	BS standard
	-R	AS standard
	-H	GB standard
Help menu language	-HE	English Help
Options	/B5	Built-in printer
	/P2 <sup>1</sup>	Probe power connections on rear panel (2 outputs for current probes, differential probes)
	/C10 <sup>2</sup>	Ethernet interface
	/C8 <sup>2</sup>	Built-in HDD + Ethernet interface
	/F5 <sup>3</sup>	I <sup>2</sup> C + 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 capacitance probe, this option is not necessary.  
2: Choose either one.  
3: I<sup>2</sup>C 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 M $\Omega$ , 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 $\Omega$ 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. $\pm$ 700 V
Differential probe	701922	DC to 200 MHz BW/Max. $\pm$ 20 V
Differential probe	700925	DC to 15 MHz BW/Max. $\pm$ 500 V
Differential probe	700924	DC to 100 MHz BW/Max. $\pm$ 1400 V
Differential probe	701920	DC to 500 MHz BW/Max. $\pm$ 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



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### 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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