Mixed Signal Oscilloscope

**DL9000 Series MSO Models**

- 4ch Analog + 32bit Logic + 16bit Logic

- High speed waveform acquisition and history memory
- Advanced trigger functions
- Powerful dual-window waveform zoom, search, and analysis
- Lightweight and compact

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High performance and compact Mixed Signal Oscilloscope with 4 analog channels and 16/32-bit logic input

- Simultaneous measurement and analysis of 4 analog channels + 16/32-bit logic
  - Analog: 500MHz/1GHz frequency bandwidth
  - Analog and Logic Sampling speed: up to 5 GS/s
- Memory length: 6.25 MW/ch
- Fast and powerful analysis of logic channels
- Capture and separate anomalies easily with History Memory
- Extensive trigger functions for handling the most complex waveforms
- Versatile zoom and search functions
- Lightweight and compact

Outer dimensions: Approximately 350 (W) x 200 (H) x 285 (D) mm
Weight: Approximately 8 kg

<table>
<thead>
<tr>
<th>Model</th>
<th>DL9710L</th>
<th>DL9705L</th>
<th>DL9510L</th>
<th>DL9505L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog inputs channels</td>
<td>4ch</td>
<td>4ch</td>
<td>4ch</td>
<td>4ch</td>
</tr>
<tr>
<td>Analog Frequency Bandwidth</td>
<td>1GHz</td>
<td>500MHz</td>
<td>1GHz</td>
<td>500MHz</td>
</tr>
<tr>
<td>Logic inputs channels</td>
<td>32bits</td>
<td>16bits</td>
<td>32bits</td>
<td>16bits</td>
</tr>
<tr>
<td>Max. Logic toggle frequency</td>
<td>250MHz</td>
<td>250MHz</td>
<td>250MHz</td>
<td>250MHz</td>
</tr>
<tr>
<td>Max. Sampling Speed</td>
<td>5GS (Simultaneous sampling of analog and logic)</td>
<td>5GS (Simultaneous sampling of analog and logic)</td>
<td>5GS (Simultaneous sampling of analog and logic)</td>
<td>5GS (Simultaneous sampling of analog and logic)</td>
</tr>
</tbody>
</table>

■ 4ch Analog & 32/16 bit Logic Signal Analysis

Debugging mixed signal circuits requires an expanded set of capabilities beyond what a general oscilloscope or logic analyzer can offer alone. The DL9000 series MSO models offer convenient, innovative functions for display and analysis of mixed signal characteristics.

State display and bus display functions are typically found in logic analyzers. DL9000 series MSO models support these types of logic signal display and analysis functions and help increase efficiency in the coordinated analysis of analog and logic signals. Moreover, when performing these analysis and display functions on DL9000 series MSO models, the screen display update rate is not compromised.

■ History Memory Function

Other oscilloscopes show you digitally persisted acquisitions in just one display layer. What if there is a signal buried within the “fuzz” you would like to separate?
With the DL9000, not only can you toggle digital persistence (accumulation) on or off, Yokogawa’s unique “history memory” also allows you to separate and view previously acquired data individually.

DL9000 series MSO models not only update the display at high speed, but also include a function for recalling up to 2000 screens worth of past waveforms. High-speed screen updating alone does not allow users to take full advantage of the digital oscilloscope. Rather, the ability to redisplay and analyze individual waveforms unleashes the digital oscilloscope’s full potential.

■ High Speed Response

High Speed Display and Updating at up to 2.5 Million waveforms/s and Megawords of Data from 4 Analog + 16/32-bit Logic Inputs with the least compromise

You need a fast waveform update rate to maximize your chance of catching that infrequent waveform variation. You also need an oscilloscope that doesn’t become sluggish and unresponsive with processor intensive functions or deep memory enabled.

Yokogawa's Advanced Data Stream Engine (ADSE) is unmatched in this area. Logic channel inputs, and even bus display mode, won’t affect the update rate, giving you the best possible real time display and analysis of mixed signal waveforms.

Maximum update rate:
- 2,500,000 waveforms/sec (2.5kW, N Single Trigger Mode)
- 25,000 waveforms/sec (2.5kW, Normal Trigger Mode)

Maximum update rate in math mode:
- 60 waveforms/sec (1 MW, when performing channel addition)
- 12 waveforms/sec (5 MW, when performing channel addition)

Maximum update rate in parameter measurement mode:
- 60 waveforms/sec (1 MW, when measuring a channel’s maximum value)
- 16 waveforms/sec (5 MW, when measuring a channel’s maximum value)

Note: The above rates can vary depending on the oscilloscope settings.
Waveform Acquisition —Numerous Triggers—

With a DL9000 MSO model, you not only have access to the existing DL9000 series of powerful trigger functions, but you can also set trigger conditions using a logic signal as the source.

You can restrict capture to the desired signals by combining various trigger conditions, thus reducing evaluation times and speeding up troubleshooting.

DL9000 Series MSO models’ Trigger Functions

<table>
<thead>
<tr>
<th>Edge/state triggers</th>
<th>Pulse width triggers</th>
<th>Event trigger functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edge</td>
<td>Pulse width</td>
<td>Event cycle</td>
</tr>
<tr>
<td>Edge (Qualified: conditional)</td>
<td>Pulse width (Qualified)</td>
<td>Event delay</td>
</tr>
<tr>
<td>Edge</td>
<td>Logic Pulse width</td>
<td>Event sequence</td>
</tr>
<tr>
<td>State</td>
<td>Logic Pulse width</td>
<td></td>
</tr>
<tr>
<td>Logic Edge</td>
<td>Logic Pulse width</td>
<td></td>
</tr>
<tr>
<td>Logic State</td>
<td>Logic Pulse width</td>
<td></td>
</tr>
</tbody>
</table>

Examples of Trigger Application

- Trigger-based gating: Edge (Qualified): conditional trigger
- The valid/invalid state of an edge trigger or pulse width trigger can be controlled according to the conditions of any other channel’s state (high/low).

Setup time trigger / Hold time trigger

To derive setup time/hold time conditions, event delay/event sequence triggers are set as shown in the following figure.

Enhanced triggers

- TV (NTSC/PAL (SECAM)/HDTV)
- I2C
- CAN/LIN
- Serial pattern (define patterns up to 128 bits long)

Event interval triggers

- Event cycle
- Event delay
- Event sequence

Search & Zoom

Even if waveforms are displayed at high speed and held in the oscilloscope’s acquisition memory, it does not help if it then takes time for the user to find the desired phenomena. Functions for searching and zooming acquired waveform data are key to increasing engineering efficiency.

DL9000 MSO models include powerful functions for searching the memory for desired waveforms, and zoom functions for observing these waveforms in detail. In addition to searching based on criteria such as signal edge, pulse, and multichannel state, you can search the history memory by waveform patterns and waveform parameters. You can quickly find the desired waveform data in the memory, enlarge the area with the zoom function, and scroll the data. These processes are carried out by the hardware at high speeds, eliminating wasteful wait times after operating the oscilloscope.

Dual-window Zoom function simultaneously

Zooms in on two areas

Two individual zoom factors and positions can be set with independent time scales and displayed simultaneously. Also, using the auto scroll function, you can automatically scroll waveforms captured in long memory and change the position of the zoom areas. Choose any display position with forward, backward, fast-forward, pause, and other controls.

A variety of search functions

DL9000 MSO models have a variety of waveform search functions, enabling you to detect abnormal signals or find specific serial or parallel data patterns.

Data search types include:

- State search (based on high/low states of one or more channels)
- Serial pattern search (I2C/SPI/CAN/gen-purpose pattern)
- Zone search
- Waveform window search
- Waveform parameter search (measured parameters, FFT, etc.)

Search for serial pattern

Select a waveform parameter and define a range for the parameter. Search for waveforms with parameter values inside or outside the set range.

Also enables searching of logic signal waveforms

Waveform Display —Groups and Mapping—

A DL9000 MSO model allows you to assign 32-bit logic signals to up to five groups. There is no limit to the number of bits allowed in each group. For example, you can assign all 32 bits to a single group.

Groups are assigned using a graphical interface for flexible and easy settings. For example, even in cases such as where a reconfigurable device’s pin assignments have been changed, you can make the corresponding adjustments simply by changing the mapping of the groups.

Analysis such as bus display, state display, and DA conversion can be executed on a group-by-group basis.

Display format can be specified by individual group

- Bit display
- Bus display
- State display (clock channel and edge specification)
Waveform Analysis — Serial Bus Analysis (I2C, SPI, CAN*, LIN*) —

DL9000 MSO models can perform I2C, SPI, LIN and CAN bus analysis with the different available options (F5, F7 and F8). Triggers for these bus types are standard features. These functions make it easy to discriminate between partial software failures and physical-layer waveform problems when troubleshooting systems by observing the physical-layer characteristics of signals.

Also, I2C, SPI and LIN bus analysis of logic signals are available, allowing you to simultaneously perform protocol analysis of the various buses using logic input channels, and signal analysis using 4 analog channels.

Serial data bus trigger functions
A wide range of trigger conditions can be set, including triggers based on ID-Data combinations and combinations of a serial bus trigger and a regular edge trigger.

Real-time bus analysis up to 15 updates/sec
The DL9000 displays protocol analysis results while bus signals are being captured.

Simultaneous analysis of different buses
With the Dual-window Zoom function, the DL9000 can simultaneously analyze and display the waveform of buses running at different speeds.

Decode Display
Analysis results of analog input channels can be displayed not only in a list, but also shown as a decode next to the waveform.

Logic Waveform Analysis — “Virtual D/A” Function —

Digital to Analog conversion of logic signals can be performed on a group-by-group basis. This is an invaluable tool for evaluating A/D and D/A converters along with their surrounding circuits. For even faster debugging, use it together with waveform analysis functions such as the histogram function.

Even evaluations normally requiring computation programs on the PC can be executed quickly and easily using the powerful computation built-in functions of DL9000 MSO models.

Power Supply Analysis (Optional)

Effective power supply analysis can be easily carried out using the waveform computation, statistical computation and automatic parameter measurement functions. Harmonic analysis of power supply currents based on EN61000-3-2 is also supported.

Main Functions
- Measurement and statistical computation of parameters specific to power supply analysis such as electric energy and power factor
- Measurement of switching loss with history statistics
- Computation functions required for power supply analysis such as active power, impedance, and Joule-integral
- Harmonic analysis of power supply current based on EN61000-3-2

Example of simultaneous analysis and waveform (decode) display of CAN and LIN bus signals

*CAN trigger and CAN analysis are supported by the analog input channels.
**Main Specification**

<table>
<thead>
<tr>
<th>Model name/No.</th>
<th>Freq.</th>
<th>BW</th>
<th>Logic input</th>
<th>Max. record length</th>
<th>Logic input</th>
<th>Max. sampling rate</th>
<th>Logic input</th>
<th>Max. record length</th>
</tr>
</thead>
<tbody>
<tr>
<td>DL9000/9010L(701320)</td>
<td>500 MHz</td>
<td>5Gs/s</td>
<td>16ch</td>
<td>6.25MW</td>
<td>16ch</td>
<td>50MHz</td>
<td>16ch</td>
<td>6.25MW</td>
</tr>
<tr>
<td>DL9000/9011L(701321)</td>
<td>1GHz</td>
<td>5Gs/s</td>
<td>16ch</td>
<td>6.25MW</td>
<td>16ch</td>
<td>50MHz</td>
<td>16ch</td>
<td>6.25MW</td>
</tr>
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<td>1GHz</td>
<td>5Gs/s</td>
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<td>6.25MW</td>
</tr>
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</table>

**Xviewer (701992, sold separately)**

This software tool allows you to control the DL9000 series from an external program or to transfer the DL9000 series’ data to a PC through an intuitive man-machine interface.

**Logic signals can be rendered on screen in a waveform, bus, or DA display, and can also be displayed for comparisons with analog waveforms. You can freely define on-screen display methods to match your objectives and ensure easy-to-see, easy-to-evaluate display of multichannel signals.**

**MATLAB Control Tool Kit (Optional software)**

With the MATLAB tool kit, you can easily deal with waveform data captured using the DL series oscilloscope in a MATLAB environment. The software can be used to control the DL series’ panel settings or transfer data from the DL series to MATLAB.

**Accessory software**

This API lets you control the DL9000 series from an external program. It provides simple control and transfer of waveform data to a PC through an intuitive man-machine interface.

**Versatile Connectivity**

**Probe power (Factory-set option)**

**GGNO-GO IO (Factory-set option)**

Can be used to output the results of either GGNO-GO tests or mask tests for communication purposes as a TTL level signal.

**USB-PC connection port**

Can be used to control DL9000.
Choose either one. UART, I2C, CAN, LIN and SPI triggers are standard.

Choose either one

Please order /P4 option if you use either current probes or differential probes such as 701920,

Not available for DL9500 series

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Digital Oscilloscopes
DL9000 series

Digital Oscilloscopes
DL1700E series

Digital Oscilloscopes
DL1600 series

Digital Oscilloscopes
DL7400 series

Standard Accessories

Name
Power Cable
3 prong-to-2 prong adapter
PS5000 passive probe
Logic probe 701981 (when -L0 is specified)
Logic probe 701981 (when -L2 is specified)
Logic probe 701981 (when -L4 is specified)
Printer roll paper (when option /B5 is specified)
User's manual (1 set)
Front panel cover
Rubber leg cap (2 per order)
Soft case

Qty
1
1
4
—
2
4
1
1
1
2
1

Accessories (Optional)

Name
PB5000 (10:1 passive probe)
PB9200 (2.5 GHz active probe)
PB1500 (1 GHz active probe)
PB1000 (1 GHz active probe)
PBD2000 (2 GHz differential probe)
Miniature passive probe
dc to 400 MHz, 1.2 m
DC to 200 MHz, 3 m
PB1500 (5 GHz probe)
DC block
FET probe
Logic probe
Logic probe
Logic probe
Differential probe
Differential probe
Differential probe
Differential probe
Current probe
Current probe
Printer roll
Klock mount kit for DL9000 series MSO models
MATLAB tool kit
Probe stand

Model
701943
701913
701914
701912
701923
701944
701945
701974
701975
700139
701980
701981
701922
700924
700939
701941
701923
701912
701913
701991

Specification
10 MΩ/10 pf, 100 MHz toggle frequency
10 MΩ/9 pf, 250 MHz toggle frequency
DC to 100 MHz BW/Max. ±700 V
DC to 200 MHz BW/Max. ±20 V
DC to 100 MHz BW/Max. ±1400 V
DC to 500 MHz BW/Max. ±30 V
DC to 50 MHz BW, 30 Arms
DC to 100 MHz BW, 30 Arms
30 m roll, 5 rolls/order
EIA-standard-compliant
JIS standard-compliant
For DL series
For DLW/E series, standard type
For DLW/E series, with computation function
Circular Base, 1 arm

Note
* Before operating the product, read the user's manual thoroughly for proper and safe operation.

Yokogawa's Approach to Preserving the Global 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 Guidelines and Product Design Assessment Criteria.