YOKOGAWA ◆

Signal Explorer

Digital Oscilloscope

DL1740/DL1720

3-Year Warranty

- ● **4-channel input (DL1740) or 2-channel input (DL1720)**
- ● **1 GS/s** ● **500 MHz analog bandwidth** ● **1MW memory length**
- ● **6.4-inch wide-angle-view TFT color LCD** ● **Compact and lightweight (approx. 5.5 kg)**
- ● **A4-size footprint** ● **Built-in Zip® drive or FDD**
- ● **USB-compliant** ● **Ethernet-connectivity (optional)**
- ● **Search functions (History Search & Zoom)** ● **Easy to use**

NEW
- ● **Thumbnail display**
- ● **I²C bus trigger and analysis functions (optional)**
- ○ **SPI bus analysis function (optional)**

SignalExplorer

The most advanced Compact Waveform Analysis solution available today!

- ● **Fast sampling**
  1 GS/s for real-time sampling
  100 GS/s for equivalent-time sampling

- ● **Wide frequency bandwidth**
  500 MHz

- ● **Long record length**
  1 MW maximum.

- ● **Wide choice of triggers**

- ● **Built-in Zip® drive**
  Supports 100/250 MB Zip® disks-as an alternative to a floppy disk drive

- ● **USB Compliant**
  USB keyboard/printer

- ● **Built-in printer (optional)**

- ● **Ethernet interface (optional)**

NEW

- ● **Thumbnail display**

- ● **I²C bus trigger and analysis functions (optional)**

- ● **SPI bus analysis function (optional)**

Our oscilloscope design focuses on the following two points:
- **Easy** and accurate capturing of complex signals;
- **High**-speed extraction and screen display of desired information from large volumes of captured data.

Here are the features packed into the DL1740 to bring these design concepts into reality:

Large recording memory and easy-to-use zoom functions for precise waveform capturing and viewing

Even a measuring instrument with higher sampling performance may fail to precisely capture waveforms, depending on the time interval of observation. This failure results from a decrease in the effective sampling rate due to shorter record lengths of memory. Large recording memory not only helps extend the observation time interval but prevents the sampling rate from degrading. This allows correct waveform observation. Using the zoom functions along with the large recording memory enables you to scrutinize part of a waveform you've caught into the memory. You can set two zoom-in areas at the same time.

Required observation time interval

When small recording memory is used:

When large recording memory is used:
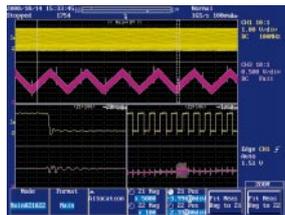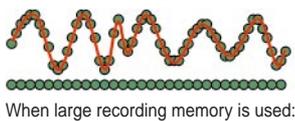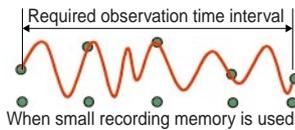
1MW, 1GS/s

All-points display and fast screen updating for reliably capturing abnormal phenomena

Information available from data significantly differs depending on the view mode even if the data is captured into the same large recording memory. This is due to a difference between display modes, i.e., whether the oscilloscope displays all of the data items the captured waveform has or only representative data items, such as interval-by-interval minimums and maximums.
Provided with the DSE chip, the DL1740 replays all-points waveforms while performing fast screen updates. Therefore, the DL1740 does not have the usual problems associated with large recording memory such as missing abnormal phenomena or poor key response.
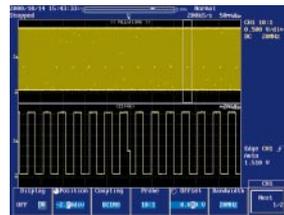
All-points display
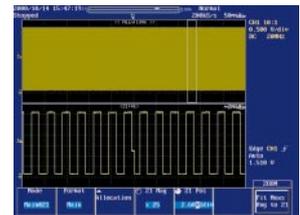
P-P compression display

Smart Search functions for finding only the necessary data among massive amounts of complex data

Search & Zoom

SEARCH ZOOM

The Search & Zoom functions automatically selects the desired pattern of a signal from captured data and allows you to zoom in on it.

- From given data, find parts of a waveform that match the targeted serial or parallel pattern you've set. Then, show them in a Zoom window. **—Pattern search**
- Define the pulse width (with a high or low state) to find pulses of your interest. You can define the pulse width using one of four options: Pulse < T, Pulse > T, T1 < Pulse < T2, and Timeout. **—Pulse width search**
- Count rising and falling edges to detect edges of your interest. **—Edge search**
- Automatically scroll through the zoomed-in area. **—Auto-scroll**
- Quickly find specified addresses and data in analysis results **—Using I²C option**
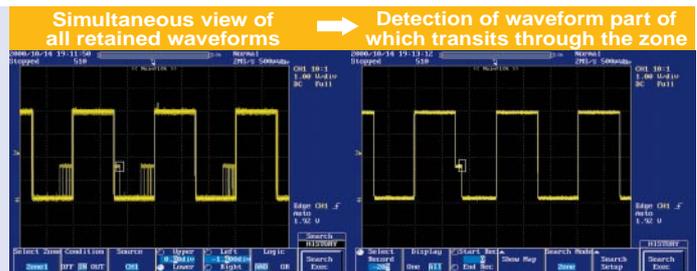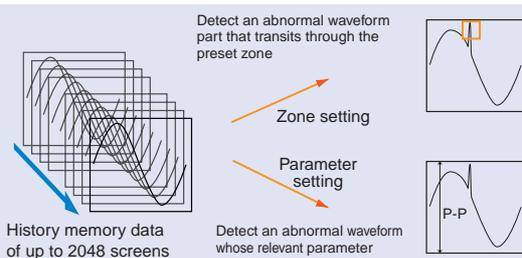- Detect specified data patterns in a captured data stream **—Using SPI option**
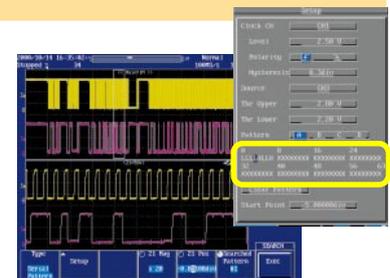
Set a desired serial pattern of up to 64 bits.

History Memory and History Search

HISTORY

Even if you press the STOP key as soon as you capture any abnormal waveform, you are too late in most cases. You'll find the waveform has already been updated and gone from the screen. The **History Memory** function partitions the large recording memory into multiple blocks. Thus, the DL1740 automatically retains data of up to 2048 screens. For 100 KW observation, the oscilloscope can retain 32 screens' worth (approximately 1 second) of waveform data. You can reliably save on-screen waveforms in memory even for phenomena for which you cannot set trigger conditions. What's more, you can use the **History Search** function to automatically identify abnormal waveforms within the history memory.

- **Zone search**: You can set a zone in a window to detect only those waveforms part of which transits (Pass) or does not transit (Bypass) through the zone. You can set a maximum of four zones.
- **Parameter search**: You can set a parameter value to detect only those waveforms whose relevant parameter matches the preset value. You can set a maximum of four parameter values.

Detect an abnormal waveform part that transits through the preset zone

Zone setting

Parameter setting

P-P

History memory data of up to 2048 screens

Detect an abnormal waveform whose relevant parameter matches the preset value.

Simultaneous view of all retained waveforms → **Detection of waveform part of which transits through the zone**

The compact oscilloscope comes packed with a wide choice of functions

Automatic measurement of waveform parameters

The DL1740 automatically measures the voltage level, frequency and RMS values of a waveform. It comes standard with the following functions, in addition to typical parameters.

Pulse count

Automatically calculates and indicates the pulse count for a range of waveform defined by the cursors.
This function is useful for counting interrupt signals, pulse signal from stepping motors and so on.
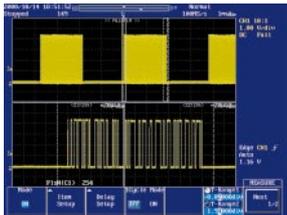
Dual area measurement

Allows you to set two areas of waveform parameter measurement at the same time.
This function is useful for comparing the overshoot at another area by a numerical value.
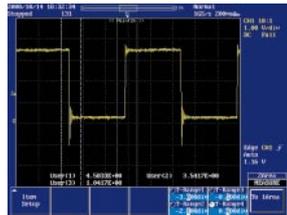
Parameter computing

Allows you to perform dyadic operations using waveform parameters and constants.
This function is useful for real-time adjustment of gain.

Cycle statistics

Allows you to measure the parameters of a long-time signal, cycle by cycle, that was captured into long-record-length memory. You can also take statistical measurements (maximum, minimum, average, number of the signal's cycles, and standard deviation) for cycles within a selected interval.
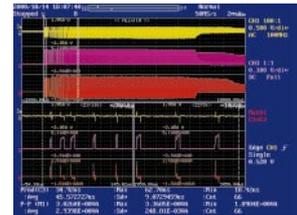
Envelope and Roll modes for simultaneously observing both slow and fast signals

Envelope mode always captures signals at the highest sampling rate, irrespective of the time-axis setting. This mode is effective when observing high-frequency noise superposed on a slow signal.
Roll mode allows you to observe signals on the screen in much the same way as you record them on a recorder chart. When in normal mode, you can set the sampling rate as high as 2 MS/s for roll mode. In addition, you can have a roll-mode view of signals in the envelope mode.
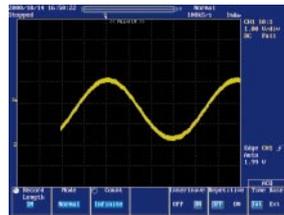
Roll-mode View in Normal Mode
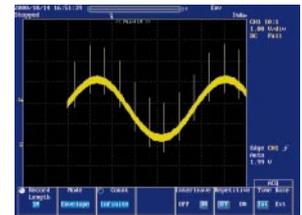
Roll-mode View in Envelope Mode

Simple and enhanced triggers for reliably capturing a variety of waveforms

Having a wide choice of triggers is extremely effective for consistently observing a variety of waveforms.

SIMPLE | ENHANCED

Edge: normal trigger enabled by an edge.

A→B (N): trigger enabled when condition B becomes true Nth time after condition A becomes true.

A Delay B: trigger enabled when condition B becomes true first time after a preset time has elapsed since condition A became true.

Pattern: trigger enabled when after setting its conditions channel by channel, the combined conditions are made true by the given edge of a clock-channel pulse.

Pulse Width: trigger enabled when a preset condition becomes true as the result of comparing an input pulse width with a specified time length. (Pulse > Time, Pulse < Time, T1 < Pulse < T2, and Timeout)

OR: trigger enabled when any of the conditions of two or more trigger sources becomes true.

TV: trigger enabled by an NTSC or PAL signal.

I²C: START, Non-ACK, addresses (optional)

GO/NO GO Judgment
— Automatic Waveform Discrimination —

Select zones or parameters for the waveform of an acquired signal. The DL1740 judges the signal being measured and automatically takes action. Actions you can choose from include: outputting image data to the destination specified in the Copy Setup menu, saving waveform data in the medium specified in the File menu, sounding the buzzer, and sending e-mail.
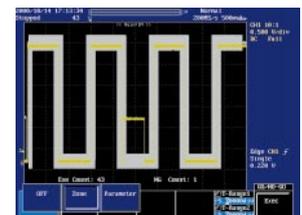
NEW

Serial Bus Analysis

Special I²C bus trigger and analysis functions (optional)

Analysis results are displayed at the same time as the signal waveform. These functions let you handle everything from I²C bus waveform observation to data analysis in a single unit.

A variety of trigger functions

Start, Non-Ack, and addresses (7 address bits and 1 Read/Write bit) can be set as triggers. When an address trigger is used, it can be combined with other data (2 bytes of data are set, and TRUE/FALSE conditions can be set independently). These special I²C triggers can also be combined with analog signals as combined triggers.

Address and data trigger setting screen

Data analysis functions

These functions perform a time-series analysis on waveform data captured in long memory, and display the decoded results for each byte. There are two I²C bus groups. Data for the SCL group is input to channels 1 and 3, and data for the SDA group is input to channels 2 and 4. Analysis can be switched between these groups.
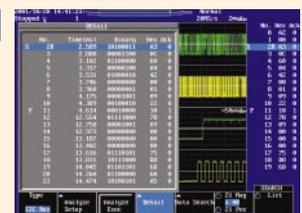
Detailed analysis display (example)

Excellent hook-up to a personal computer

USB and Ethernet

### USB (supported operating systems: Windows 98SE, Windows 2000 Pro)

● PC connection
- You can write programs (in VisualBasic 6.0 or VisualC++ 6.0) enabling PC access to the oscilloscope through the USB port, just like access using RS-232 or GP-IB protocols.
- Connecting the oscilloscope to a PC through the USB port is easy with Waveform Viewer for DL series (700919), a separately sold waveform display program.
  - Capture and save waveform data and screenshots.
  - Control the oscilloscope's START/STOP operations.
  - The Wirepuller control program lets you remotely control the oscilloscope through a PC.

● Keyboard/printer connection
USB keyboards and USB printers are supported.

Ethernet

● PC connection
- You can write programs (in VisualBasic 6.0 or VisualC++ 6.0) enabling PC access to the oscilloscope through the Ethernet port, just like access using RS-232 or GP-IB protocols.
- Connecting the oscilloscope to a PC through the Ethernet port is easy with Waveform Viewer for DL series (700919), a separately sold waveform display program.
  - Capture and save waveform data and screenshots.
  - Control the oscilloscope's START/STOP operations.
  - The Wirepuller control program lets you remotely control the oscilloscope through a PC.

● The FTP server and client functions let you transfer data between the oscilloscope and a PC, and send email from the oscilloscope.

● Network printer connection
Hard copies of screenshots can be output to a remote network printer using the Ethernet port.
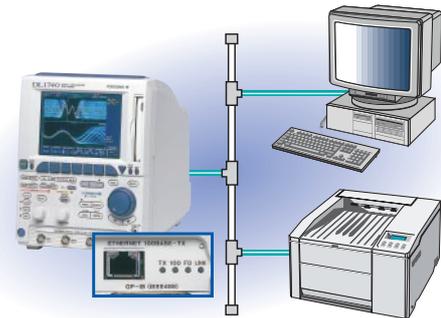
Easy and Quick Saving of Images

Just press the **IMAGE SAVE** key. The DL1740 saves on-screen images to a storage medium, such as a Zip® drive. With the **COPY** key, you can output the images to the built-in printer.

Screenshot data views

Saved image data (in TIFF, BMP, or PostScript format) can be viewed on the DL1720 screen (Thumbnail Display/Selection Preview Window). Files can be deleted or renamed directly on the DL1720, so you can directly check data needed for reports.

Thumbnail Display Window

Selection Preview Window

SPI bus analysis function (optional)

An analysis function for SPI bus (synchronous 8-bit serial bus), which is widely used for communication between ICs, is a standard feature on the DL1740 I²C Bus Analyzer.

Clock
Data
CS

0 1 0 1 0 0 1 0
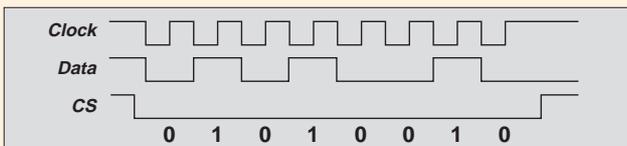
SPI bus analysis function

Data1, Data2, and CS information are shown in a list display at the same time as the waveform. When you select a listed data item with the cursor, the selected frame is displayed in the zoom window. Two different threshold levels can be set, so you can identify uncertain data.

Data search function

Set the targeted signal, data length, and data pattern, then run your search. The set data pattern is detected automatically.
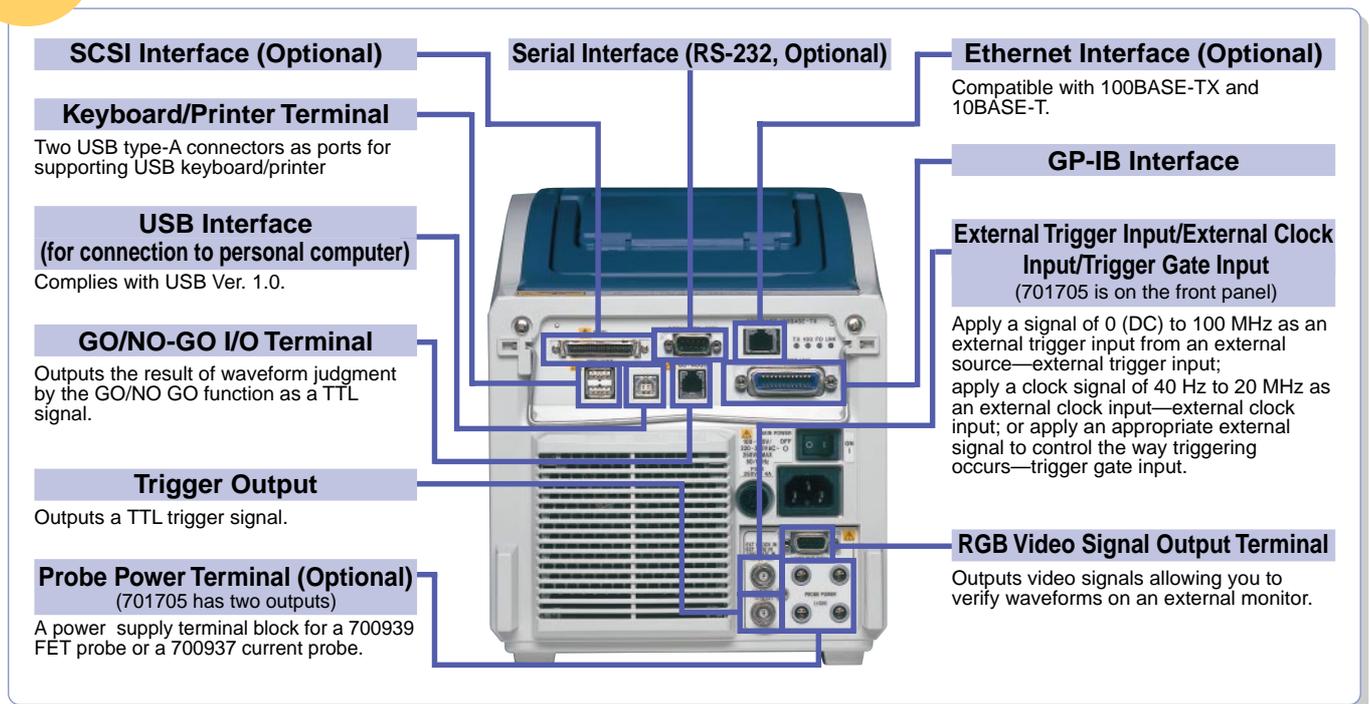
SPI bus analysis methods

CH1: Clock (SCK)
CH2: Data1 (MOSI)
CH3: Data2 (MISO)
CH4: CS (SS)

SPI bus analysis setting screen

Rear Panel Layout

SCSI Interface (Optional)

Keyboard/Printer Terminal

Two USB type-A connectors as ports for supporting USB keyboard/printer

**USB Interface
(for connection to personal computer)**

Complies with USB Ver. 1.0.

GO/NO-GO I/O Terminal

Outputs the result of waveform judgment by the GO/NO GO function as a TTL signal.

Trigger Output

Outputs a TTL trigger signal.

Probe Power Terminal (Optional)
(701705 has two outputs)

A power supply terminal block for a 700939 FET probe or a 700937 current probe.

Serial Interface (RS-232, Optional)

Ethernet Interface (Optional)

Compatible with 100BASE-TX and 10BASE-T.

GP-IB Interface

External Trigger Input/External Clock Input/Trigger Gate Input
(701705 is on the front panel)

Apply a signal of 0 (DC) to 100 MHz as an external trigger input from an external source—external trigger input; apply a clock signal of 40 Hz to 20 MHz as an external clock input—external clock input; or apply an appropriate external signal to control the way triggering occurs—trigger gate input.

RGB Video Signal Output Terminal

Outputs video signals allowing you to verify waveforms on an external monitor.

Accessories

Attenuation ratio: 1/10 (with 50 (load connected)
Input voltage range: ±10 V
700939 900-MHz bandwidth FET probe

Maximum input voltage: ±4000 V
700978 100-MHz bandwidth 100:1 probe

Attenuation ratio: 1/10 (with 50 Ω load connected)
Differential input voltage range: ±12 V
701920 500-MHz bandwidth differential probe

Attenuation ratio: Can be switched between 1/100 and 1/1000
Maximum differential allowed voltage: ±1400 V
700924 100-MHz bandwidth differential probe

Input range: 15 Apeak
700937 50-MHz bandwidth current probe

Input range: 150 Arms
701930 10-MHz bandwidth current probe

Related Software Products
(See Yokogawa's homepage for detailed information on these products.)

Waveform Viewer for DL series (700919)

This program displays, on a PC, data files (files with a "wvf" file extension) from measurements taken with a DL series oscilloscope. Multiple waveforms can be displayed simultaneously (up to 24 analog waveforms). You can download a trial version of this program at the following URL:
http://www.yokogawa.com/tm/Bu/700919/

Model	Product Name
700919	Waveform Viewer for DL series

Wirepuller

This program lets you use your PC to control a DL7000 or DL1700 series digital oscilloscope and save screenshots through an Ethernet, USB, or GP-IB interface.
http://www.yokogawa.com/tm/Bu/DLsoft/wire/

Performance/Function Specifications

Basic Specifications

Input channels: 4 (701710), 2 (701705)
Input coupling: AC-1 MΩ, DC-1 MΩ, DC-50 Ω, GND
Input impedance: 1 MΩ ±1.0%, 50 Ω ±1.0%
Voltage-axis sensitivity range:
- 50-Ω input: 2 mV—1 V/div (in 1, 2 or 5 mV increments)
- 1-MΩ input: 2 mV—10 V/div (in 1, 2 or 5 mV increments)

Maximum input voltage:
- 1-MΩ input (at 1 kHz or less frequencies): 400 V (DC + AC peak)—282 Vrms CAT II
- 50-Ω input: 5 Vrms max. and 10 Vpeak max.

Frequency characteristics[*1]
(-3 dB roll-off point for sine-wave input with ±4 div amplitude):
- 50-Ω input: 1 V—10 mV/div over 0 (DC) to 500 MHz, or 5 mV—2 mV/div over 0 (DC) to 400 MHz
- 1-MΩ input (defined as resistance up to the probe tip when 700988 passive probe is used): 10 V—10 mV/div over 0 (DC) to 400 MHz, or 5 mV—2 mV/div over 0 (DC) to 300 MHz

A/D conversion resolution: 8 bits (24 LSBs/div)
Maximum sampling rate:
- Real-time sampling mode
  When interleave mode is on: 1 GS/s[*2]
  When interleave mode is off: 500 MS/s
- Equivalent-time sampling mode: 100 GS/s

Maximum record length:
- When interleave mode is on: 1 MW[*2]
- When interleave mode is off: 500 KW

DC-mode accuracy[*1]: ±(1.5% of 8 divisions + voltage-axis offset accuracy)
Voltage-axis offset accuracy[*1]:
- 2 mV—50 mV/div: ±(1% of setpoint + 0.2 mV)
- 100 mV—500 mV/div: ±(1% of setpoint + 2 mV)
- 1 V—10 V/div: ±(1% of setpoint + 20 mV)

Sweep time:
- 1 ns—50 s/div (for 10-KW or longer record length)
- 1 ns—5 s/div (for 1-KW record length)

Timebase accuracy[*1]: ±0.005%
External clock input: Within the 40 Hz—20 MHz input frequency range (for continuous clock signals only)

Trigger Block

Trigger mode: AUTO, AUTO-LEVEL, NORMAL, SINGLE, SINGLE (N)
Trigger source: CH1 to CH4 (signal applied to each input terminal), LINE (signal of commercial power source connected to DL1740), EXT (signal input to EXT TRIG IN terminal)
Types of trigger: Edge, A→B (N), A Delay B, OR, Pattern, Pulse Width, TV, I²C (optional)

Display

Screen updating rate:
- 60 screens/s max. (for 10-KW, all-points view mode)
- 30 screens/s max. (for 1-MW, all-points view mode)

Display unit: 6.4-in. TFT color LCD
* The liquid crystal display may contain some pixels that are either always on or always off. Due to the properties of liquid crystal, there may be some brightness variations on the screen, but this does not mean there is a problem with the screen.

Functions

● **Vertical/Horizontal Axis Setting Functions**
Input filter: Bandwidth can be limited to 100 MHz or 20 MHz for each of channels CH1 through CH4 separately.
Roll mode: Roll-mode view is enabled for the following range of timebase setpoints when the trigger mode is Auto, Auto Level or Single: 50 ms to 50 s/div (or 50 ms to 5 s/div for 1-KW record length only)

● **Waveform Acquisition/Display Functions**
Acquisition mode: Normal, Averaging, Envelop, Box Average
Zoom: Zooms in on an on-screen waveform along the timebase. (This function is available for up to two areas of the waveform, each with a different magnification.)
X-Y display: Available in two waveform view modes—XY1 and XY2.

● **Analysis Functions**
Signal analysis: I²C (optional), SPI (optional)
Search and Zoom: Edge, Serial Pattern, Parallel Pattern, Pulse Width, Auto Scroll, I²C (optional), SPI (optional)
History Search: Zone, Parameter
Cursor measurements : Marker, Horizontal, Vertical, Degree
Automatic waveform parameter measurement:
P-P, Max, Min, High, Low, Avg, Rms, +OShot, -OShot, Sdev, Rise, Fall, Freq, Period, Duty,

+Width, -Width, Int1TY, Int2TY, Int1XY, Int2XY, Pulse, Burst1, Burst2, AvgFreq, AvgPeriod.
In addition, the following statistical processing is possible:
- Supported data items: Above-listed parameters
- Statistical data items: Min, Max, Avg, Cnt, Sdv
- Statistics mode: Normal, Cycle, History

Computation: +, -, ×, Binarization, Differentiation, Integration, Power Spectrum, Invert
GO/NO GO judgment: Executed by means of automatically measured waveform parameters and waveform zones

● **Image Data Output**
Built-in printer (optional): Provides hardcopies of on-screen images using 112-mm wide print paper.
External printer: Outputs the image data through a USB interface or via Ethernet[*3]. This function supports : Postscript, ESC/P, ESC/P2, LIPS3, PCL5 and BJ commands.
Floppy/Zip®/SCSI-drive output data formats: Postscript, TIFF, BMP
Network drive (via Ethernet[*3])

Specifications for I²C bus analysis function option (option for DL1740 only)

● **Applicable bus**
I²C bus: Bus transfer rate: Maximum 3.4 Mbps
Address mode: 7 bits
SM bus: Complies with System Management Bus

● **Analysis functions**
Waveform and data display: Simultaneous display of data (hexadecimal display) and waveforms
Detailed data display: Data transfer time starting at trigger point, data (simultaneous binary and hex display) and acknowledgement exist / not exist
Maximum analyzed data bytes: 5000 bytes
Analyzed channels: SCL: CH1, CH3; SDA: CH2, CH4
The two pairs of SCL and SDA can be switched to analyze.

● **Triggers**
Trigger sources: CH1: SCL
CH2: SDA
CH3, CH4: Analog signal input
Start trigger: Trigger is activated by start condition.
Non-ACK trigger: Trigger is activated if there is no ACK.
Address trigger: Addresses are compared with a set address.
Byte count: Count can be set as high as 9999.
Combination triggers: Combination triggers can be set by combining the CH3 and CH4 analog signals with the I²C bus analysis trigger.

Rear-panel I/O Block

Communication interfaces: GP-IB, Keyboard/Printer ports (for USB keyboard/printer), USB (Ver. 1.0, for connection to personal computer), Ethernet (100BASE-TX and 10BASE-T, optional), SERIAL (RS-232, optional), SCSI (optional)
Signal I/Os: External trigger input/external clock input/trigger gate input, trigger output, RGB video signal output, GO/NO GO I/O
Probe power terminals (optional):
- Output terminals: 4 (701710), 2 (701705)
- Output voltage: ±12 V

General Specifications

Source voltage: 100 to 120 V AC / 220 to 240 V AC (switches automatically)
Power supply frequency: 50/60 Hz
Maximum power consumption: 200 VA
External dimensions: 220 (W) × 265.8 (H) × 264.1 (D) (mm)
8.66 (W) × 10.46 (H) × 10.40 (D) (inch)
(when measured with the printer cover shut in place and protrusions and the handle excluded)
Weight: Approx. 6 kg (13.23 lbs; including the printer), or Approx. 5.5 kg (12.13 lbs; excluding options)
Operating temperature range: 5—40°C

*1 Measured with the timebase set to the internal clock, after the DL1740 under test has been warmed up under the following standard operating conditions and then calibrated.
Standard operating conditions:
- Ambient temperature: 23 ±2°C
- Ambient humidity: 55 ±10%RH
- Supply-voltage/frequency errors: 1% max. of ratings
*2 When the interleave mode is on, the number of available channels reduces to half (2 channels).
*3 True for DL1740 s with the "/C10" option.

Information on the features and functions of Yokogawa's DL Series is also available at our homepage.

http://www.yokogawa.com/tm/Bu/DL1700/

Product and Suffix Codes of Model DL1740

Product Code	Suffix Code	Description
701705		DL1720 digital oscilloscope (2-channel input model)
701710		DL1740 digital oscilloscope (4-channel input model)
Power cable	-D	UL and CSA standard
	-F	VDE standard
	-Q	BS standard
	-R	SAA standard
Built-in drive	J1	Floppy drive
	J2	Zip drive
Options	/B5	Built-in printer
	/E2	Two additional passive probes (*1)
	/P2	Probe tower for 701705 (*2)
	/P4	Probe tower for 701710 (*2)
	/C7	SCSI and serial interfaces
	/C10	Ethernet interface
	/F5	I²C bus analysis functions (*3)

*1: The oscilloscope is standard-equipped with two 700988 passive probes.
*2: Select /P2 for model 701705, or /P4 for model 701710.
*3: The I²C bus analysis functions include the SPI analysis functions.
　I²C only be specified for model 701710.

Standard Accessories

Product	Q'ty
Power cord	1
700988 passive probe (400MHz)	2
Power fuse	1
Transparent front cover	1
Printer roll paper (when "/B5" option is included)	1
User's manual (one set)	1

Spare Parts

Product	Product Code	Remarks	Min. Order Q'ty
Printer roll paper	B9850NX	30 m long roll	5
Passive probe	700988	10 MΩ (10:1), 400 MHz bandwidth, 1.5 m long	1
Front cover	B9989FA	For protecting of LCD and front panel.	1

Related Products

Product	Product Code	Bandwidth
FET probe	700939	900 MHz
100:1 probe	700978	100 MHz
Differential probes	700925	DC to 15 MHz
	700924	DC to 100 MHz
	701920	DC to 500 MHz
Current probe	701930	DC to 10 MHz
	700937	DC to 50 MHz

External View and Dimensions

Unit: mm (inch)
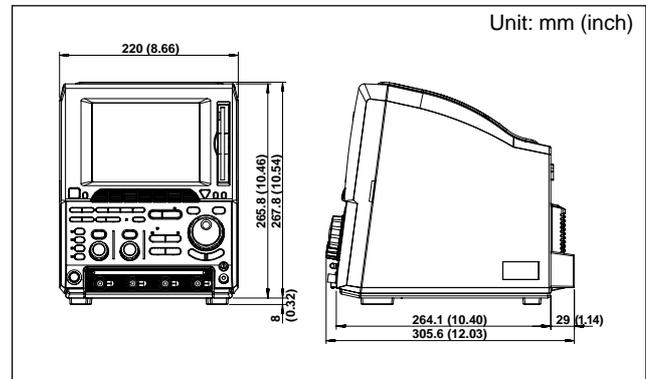
Related Oscilloscope Models

DL7100/7200 Digital Oscilloscopes

DL708E/716 Digital Scopes

Yokogawa's approach toward preserving the global environment

● Yokogawa Electric's products are developed and manufactured in places of business certified as conforming to the ISO 14001 standard.

● The aforementioned products are designed in due accordance with the *Environment-friendly Product Design Guideline* and the *Environmental Assessment Standard for Product Design* prescribed by Yokogawa Electric Corporation.

- *SignalExplorer* is a registered trademark of Yokogawa Electric Corporation.

- Zip is either a trademark or a registered trademark of Iomega Corporation in the U.S.A. and other countries.

- The TCP/IP software used in this product and the documentation for that TCP/IP software are based in part on BSD Networking Software, Release 1 licensed from The Regents of the University of California.

NOTICE
● Before operating the product, read the instruction 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.

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