

*Signal***Explorer**

Digital Oscilloscope  
**DL7440/DL7480**



**DL7440: 4 analog channels and 16-bit logic input** (optional)  
Maximum 4 MW memory (701450) or maximum 16 MW memory (701460)

**DL7480: 8 analog channels and 16-bit logic input** (optional)  
Maximum 4 MW memory (701470) or maximum 16 MW memory (701480)

- 2 GS/s maximum speed
- 500 MHz analog bandwidth
- Supports 250 MHz logic probe
- USB compliant
- PC card interface (Type II)
- Ethernet connectivity (optional)
- User-defined math (optional)

# The DL7400 Series is designed to make complex measurements easily

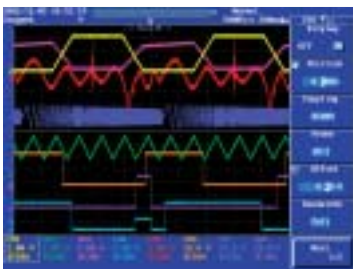
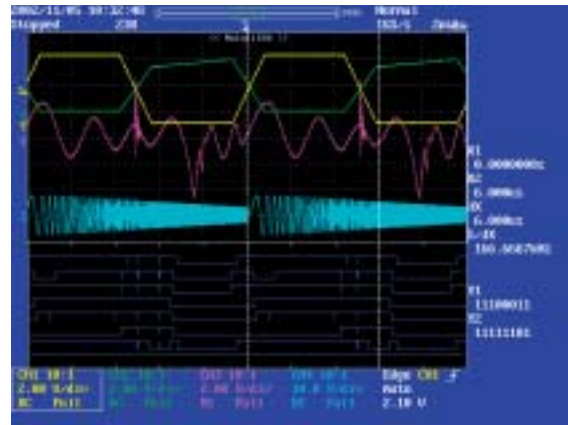


- 4/8 analog channels and 16-bit logic input
- Maximum 16 MW recording memory and history memory
- Quick zooming
- All-points display
- Fast screen updates
- Bus pattern search and analysis

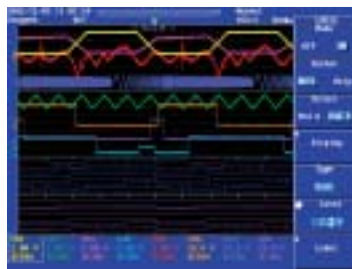
# Capture All the Signals You Want Easily, Accurately, and Reliably...

**One instrument contains everything you need to observe multiple signals on analog/logic mixed circuits:**  
**DL7440: 4 analog channels and 16-bit logic input (optional)**  
**DL7480: 8 analog channels and 16-bit logic input (optional)**

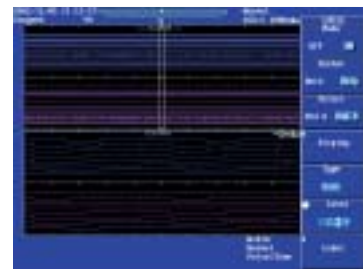
The DL7400 Series includes 8-channel analog input models in addition to 4-channel models, in a package that is nearly the same size as older models (the DL7100 and DL7200). These new models still have 16-bit logic inputs, which were a popular feature in older models. In addition to multipoint logic signal measurements, the DL7400 Series lets you simultaneously measure analog signals on 4 or more channels without needing to synchronize two separate oscilloscopes. The DL7440 and DL7480 SignalExplorer are designed for users who want an easy, efficient solution in one unit for handling measurements that required two or more units in the past.



8-channel analog display



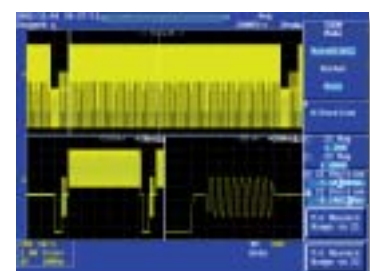
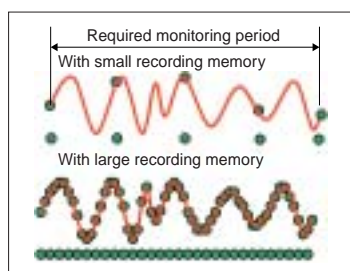
8-channel analog and 16-bit logic display



16-bit logic display

## Large Recording Memory and Quick Zoom for Accurate Waveform Capturing and Monitoring

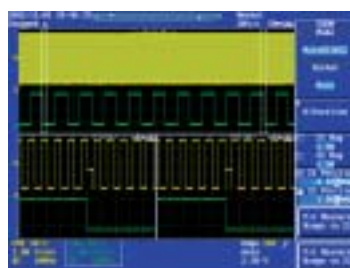
Even some oscilloscopes with high sampling rates may not be able to accurately capture waveforms if the memory size is not large enough for the required monitoring period. This limitation is due to the necessary drop in sampling rate, which occurs if the recording memory is not long enough. A larger recording memory not only increases the monitoring time, but also enables users to maintain a high sampling rate thus ensuring accurate waveform monitoring. In addition, the zoom function can be used to view enlarged images on one or two segments of a waveform captured in the large memory.



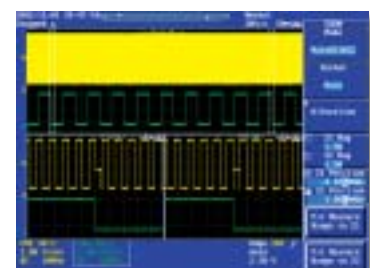
Main and dual zoom display

## All-Points Display and Fast Screen Updates Make Sure You Won't Miss Abnormal Signals

When working with data captured in the large recording memory, the amount of information appearing on the display varies greatly depending on how the data are presented. The differences occur depending on whether you choose to display all points in a captured waveform, or just major values, such as maximum and minimum values, in a given segment on the waveform. The DL7400 Series provides fast screen updating in all-points display mode, so you won't miss abnormal phenomena or have slow responses to instrument controls.



All-points display



Conventional compression display

# A Variety of Functions to Help You Find Useful Information in Large Amounts of Data

When an abnormal signal is displayed on the screen, does it disappear before you can press the STOP key?

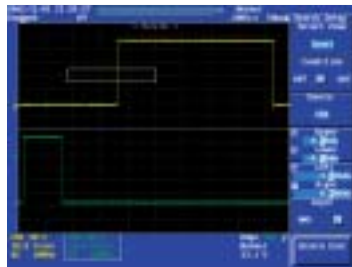
## History Memory

The history memory function divides the large recording memory into a number of blocks and automatically saves up to 4096 previously captured waveforms. You can increase the number of screens that can be saved to history memory by setting a shorter record length.



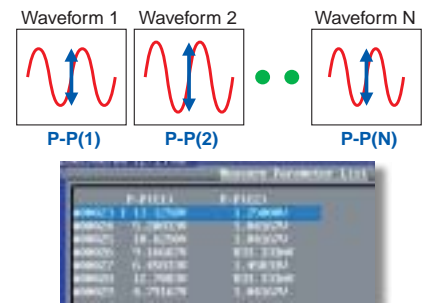
## History Search

The history search function is useful for quickly finding abnormal waveforms in the large amounts of waveform data stored in history memory. This function lets you automatically search for desired waveforms based on whether or not a signal passes through a user-defined area on the screen. You can also conduct searches based on waveform parameters.



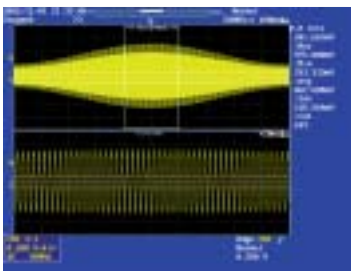
## History Statistics

Calculates statistical information based on the parameter values for waveforms stored in history memory. This function calculates and displays a parameter's maximum value, minimum value, average value, and standard deviation. You can check the parameters for every waveform in history memory.



## Measuring Periodically Fluctuating Amplitudes

### Cycle Statistics



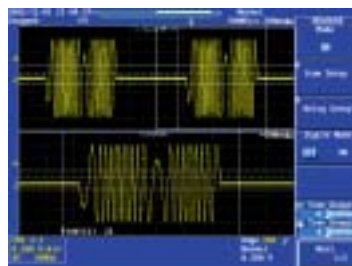
Automatically calculates the maximum value, minimum value, average value, and standard deviation of selected waveform parameters for each period of a signal. You can even find the period corresponding to the calculated maximum and minimum values and display that period in the zoom window. In some applications, like with a PWM (pulse width modulation) control signal, you may need to determine information about each waveform period for long amounts of time. The DL7400 Series with its long memory, lets you analyze a long waveform, period-by-period, based on the period of a reference signal.

### Example Applications

- Amplitude, period, and duty ratio for each period in various modulation signals
- Current, voltage, and period for each switching cycle as the load fluctuates in a switching power supply
- Each signal level in clock-synchronized CCD output
- Output level of each sensor per revolution in engine or motor

## How can I quickly count a large number of pulses in a waveform?

### Pulse Count



Automatically counts the number of pulses in the waveform data between cursors. The threshold level for recognizing a single pulse is user-definable, so you can reliably compute pulses even in signals with unstable levels. With the DL7400 Series, you'll never again have to manually count pulses on screen or on a stack of printouts.

### Example Applications

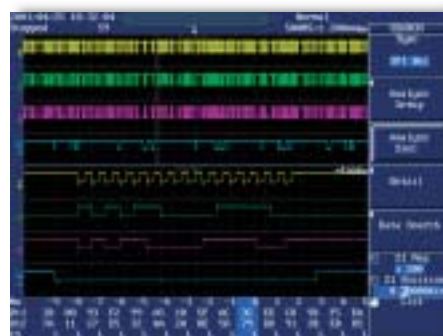
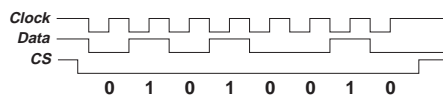
- Stepping motor revolution pulses
- Optical disk tracking error signals
- Interrupt signals from microcontrollers
- Clock count in serial data

## When I want to analyze serial bus data, do I count the "LHHLH..." pattern on the screen, or should I use a separate measuring instrument?

### Serial Peripheral Interface (SPI) Analysis Function

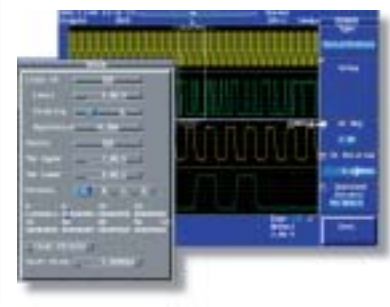
The DL7400 Series has a SPI bus analysis function. SPI is a popular bus for IC-to-IC communications.

- **Waveform and Analysis Result Display**  
Lists Data 1, Data 2, and CS (Chip Select) simultaneously with the waveform. When you select a data string on the list with the cursor, the corresponding frame is shown in the zoom window.
- **Data Search**  
Automatically searches through the captured data and finds a data pattern that matches the specified criteria. The SPI data search function will automatically find the user-defined data length and data pattern.
- **Analysis Settings**  
Connect the individual signals to input channels. You can specify two or more Chip Select (CS) signals for multi-slave SPI analyses (analysis can also be done without CS).  
CH1: Clock      CH2: Data 1  
CH3: Data 2      CH4-CH8 and PodA (8 bit): CS



### Serial Pattern Search

Detects an area in the data matching a user-defined pattern (up to 64 bits in length) and displays it in the zoom window. Searches may be done based on time instead of a synchronization clock.

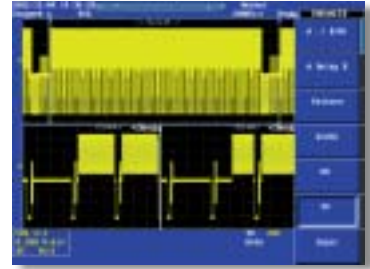


# The Best Solution for a Variety of Applications

## Simple and Enhanced Triggers

The many trigger types in the DL7400 Series enable stable monitoring of a wide range of waveforms.

- Edge trigger: Triggers activate on a rising or falling edge.
- A → B (N) : Triggers activate when condition B is satisfied N times after condition A has been satisfied.
- A Delay B : Triggers activate when the first condition B is satisfied a set length of time after condition A has been satisfied.
- Pattern : Separate trigger conditions are set for each channel. Triggers activate when the combination of trigger conditions is satisfied at an edge of the clock channel signal.
- Width : Triggers activate when a comparison of the input pulse width and a specified time width satisfies a condition. (Pulse > Time; Pulse < Time; T1 < Pulse < T2; Time Out)
- OR : Triggers activate when one or more of the specified trigger conditions are satisfied.
- TV : NTSC, PAL, SECAM, HDTV (8 types)
- Logic : Triggers activate when the specified combination of the H, L, or "Don't care" conditions for 16 POD A and B signals is satisfied (optional).



## Ethernet

### Web Server

With an Ethernet connection, you can perform various functions using Internet Explorer.

#### • FTP

Easily copy and paste files from the internal storage device in the DL7400 Series. This internal storage device functions as one of your PC file servers.



#### • Data Capture

Perform actions such as waveform monitoring, uploading settings, and starting/stopping measurements.



#### • Measurement Trend

Automatically opens Excel, then periodically downloads waveform parameter values and graphs them. Easily monitor parameter trends during extended-period measurements.

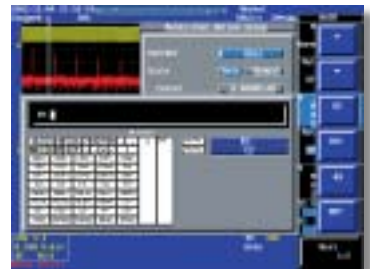


### Other Functions

- Network printing
- Email sending
- Remote control

## User-Defined Math (with the / G2 option)

The DL7440 and DL7480 include addition, subtraction, multiplication, binary conversion, inversion, differentiation, integration, and power spectrum as standard calculation functions. With the optional user-defined calculations, you can define equations using arithmetic calculations as well as a variety of other functions, including trigonometric functions, differentials, integrals, square roots, digital filters, six different FFT functions, and pulse width calculations. In addition, calculation results can be specified as parameters for other equations, so the DL7440 and DL7480 can directly handle complex computations that formerly required data to be uploaded to a PC for computation.



## USB

### Peripheral Device Connections

- The DL7400 Series can be completely controlled using a USB mouse.
- File names can be entered using a USB keyboard.
- Connect a USB printer for color printouts.



### PC Connection

You can create a PC program to remotely control your DL7400 Series through a PC, similar to remote control operations through a GP-IB interface.



Controlling the DL7400 Series using a USB mouse

## Outputting and Viewing Images

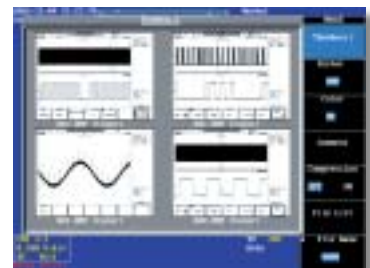
The **PRINT** key lets you print screenshots to the built-in printer, a USB printer, or a network printer.



Simply press the **IMAGE SAVE** key to save a screenshot to a PC card or other storage device. Screenshots can be saved in BMP, TIFF, PS, PNG, and JPEG formats.



Captured images can be easily checked as thumbnail icons. File names are displayed together with the thumbnail images, allowing you to check files and immediately change their names or delete them if necessary.



## Rear Panel

### Probe Power Connectors

Probe power connects for the FET probe (700939), current probes (700937, 701930), and differential probe (701920). The DL7400 Series comes standard with 4 connectors. 4 additional connectors can be added as an option.

### RGB Video Signal Output Connector

Outputs a video signal for viewing waveforms on an external monitor.

### USB-PC Connector

Complies with USB Rev. 1.0.

### USB Peripheral Device Connectors

Type A connectors: 2 ports compatible with USB keyboards, USB printers, and USB mice.

### Logic Inputs (optional)

Logic signal connectors for 16 bits (8 bits  $\times$  2), for connecting logic probes (701981; sold separately).

### Trigger Output

Outputs TTL level trigger signal.

### SCSI (optional)

### Ethernet (optional)

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

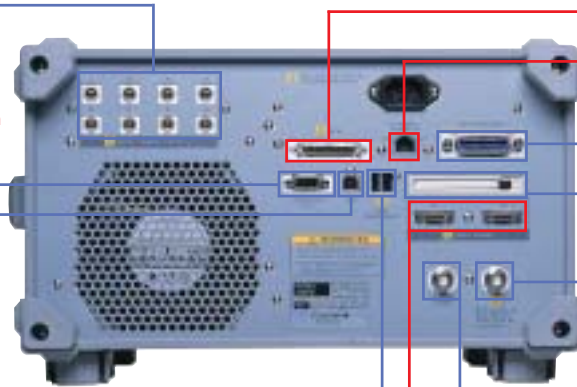
### GP-IB

### PC Card Interface

Flash ATA card (PC card Type II)

### External Trigger Input/External Clock Input/Trigger Gate Input

Inputs DC to 100 MHz signal for external triggering (external trigger input).  
Inputs clock signal from 40 Hz to 20 MHz from exterior (external clock).  
Trigger occurrence can be controlled using external signal (trigger gate input).



## Software

### Remotely Control the DL7400 Series Using a PC

#### Wirepuller (Free Software)



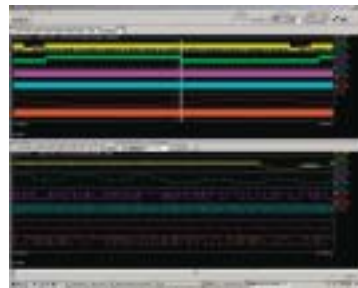
Wirepuller displays an image of the DL7400 Series front panel on your PC for monitoring waveform signals. You control the DL7400 Series by simply using your PC's mouse and keyboard to perform actions on the displayed front panel.

Interface: USB/GP-IB/Ethernet  
Supported operating systems: Windows 95/98/2000/Me/NT 4.0 or higher  
See Yokogawa's homepage for further details.

This software is free and can be downloaded from the following URL:  
<http://www.yokogawa.com/tm/Bu/DLsoft/wire/>

### View Waveform Data on Your PC

#### Waveform Viewer for DL Series (700919)



Waveform Viewer lets you view waveforms on your PC, just as you view them on the DL7400 Series screen. In addition to zoom windows, you can also use X-Y display, and history memory thumbnail displays. Data can be converted to CSV format for use in programs like Excel.

Data transfer: Floppy disk/Zip® disk/Type II PC Card/USB/GP-IB/Ethernet  
Supported operating systems: Windows 95/98/2000/Me/NT 4.0 or higher  
See Yokogawa's homepage for further details.

A trial version of this program can be downloaded from the following URL:  
<http://www.yokogawa.com/tm/Bu/700919/>

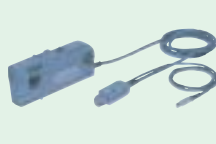
## Accessories



**900 MHz band FET probe (700939)**  
Attenuation ratio: 1/10 with 50  $\Omega$  load  
Input voltage range:  $\pm 10$  V



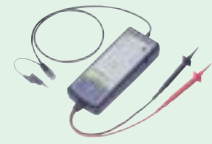
**50 MHz band current probe (700937)**  
Input range: 15 A peak



**10 MHz band current probe (701930)**  
Input range: 150 Arms



**500 MHz band differential probe (701920)**  
Attenuation ratio: 1/10 with 50  $\Omega$  load  
Input differential voltage range:  $\pm 12$  V



**100 MHz band differential probe (700924)**  
Attenuation ratio: Can be switched between 1/100 and 1/1000  
Maximum differential allowed voltage:  $\pm 1400$  V

# Specifications

## Basic Specifications

Input channels:	4/8 analog (depends on model), and 16-bit logic (optional)
Input coupling settings:	AC 1 M $\Omega$ , DC 1 M $\Omega$ , GND, DC 50 $\Omega$
Input impedance:	1 M $\Omega$ $\pm$ 1.0%, 50 $\Omega$ $\pm$ 1.0%
Voltage axis sensitivity setting range:	
For 1 M $\Omega$ input:	2 mV/div to 10 V/div (steps of 1, 2, or 5)
For 50 $\Omega$ input:	2 mV/div to 1 V/div (steps of 1, 2, or 5)
Maximum input voltage:	
For 1 M $\Omega$ input (frequency of 1 kHz or less):	400 V (DC + ACpeak) (282 Vrms CAT II)
For 50 $\Omega$ input:	5 Vrms or less and 10 Vpeak or less
Frequency characteristic <sup>1</sup> :	
For 1 M $\Omega$ input: (using passive probe model 700988; specified at probe tip)	10 V/div to 10 mV/div: DC to 400 MHz 5 mV/div to 2 mV/div: DC to 300 MHz
For 50 $\Omega$ input:	1 V/div to 10 mV/div: DC to 500 MHz 5 mV/div to 2 mV/div: DC to 400 MHz
A/D conversion resolution:	8 bits (24 LSB/div)
Maximum sampling rate:	Real-time sampling mode: Interleave mode on: 2 GS/s <sup>2</sup> Interleave mode off: 1 GS/s Equivalent time sampling mode: 100 GS/s
Maximum record length:	
701450/701470	Interleave mode on: 4 MW/channel <sup>2</sup> Interleave mode off: 2 MW/channel
701460/701480	Interleave mode on: 16 MW/channel <sup>2</sup> Interleave mode off: 8 MW/channel
DC accuracy <sup>1</sup> :	$\pm$ (1.5% of 8 div + offset voltage accuracy)
Offset voltage axis accuracy <sup>1</sup> :	2 mV/div to 50 mV/div $\pm$ (1% of setting + 0.2 mV) 100 mV/div to 500 mV/div $\pm$ (1% of setting + 2 mV) 1 V/div to 10 V/div $\pm$ (1% of setting + 20 mV)
Time axis setting range:	1 ns/div to 50 s/div (for record length of 10 kW or greater) 1 ns/div to 5 s/div (for record length of 1 kW)
Time base accuracy <sup>1</sup> :	$\pm$ 0.005%
External clock input:	Input frequency range: 40 Hz to 20 MHz (continuous clock signal only)

## Trigger

Trigger modes:	Auto, Auto Level, Normal, Single, Single (N)
Trigger sources:	CH1 through CH8 (the number of channels depends on the model; signals input to individual input terminals), LINE (connected utility power signal), EXT (signal input from EXT TRIG IN terminal)
Trigger types:	Edge, A $\rightarrow$ B (N), A Delay B, OR, Pattern, Pulse Width, TV, Logic

## Display

Screen updating rate:	Maximum 60 times per second (for 10 kW all-points display) Maximum 30 times per second (for 1 MW all-points display)
Display:	8.4-inch color TFT liquid crystal display
* Note that an LCD may contain some pixels which always glow or never glow or may have uneven brightness due to its characteristics. These are not indications of an equipment problem.	

## Functions

- Vertical/horizontal axis setting function
 

Input filters:	100 MHz or 20 MHz band limits can be set independently for CH1 through CH8 (the number of channels depends on the model).
Roll mode:	Roll mode display on the time axes shown below when trigger mode is Auto, Auto Level, or Single For record length of 1 MW or less: 50 ms/div to 50 s/div (or 50 ms to 5 s/div for 1 kW) For record length of 2 MW: 100 ms/div to 50 s/div For record length of 4 MW: 200 ms/div to 50 s/div For record length of 8 MW: 500 ms/div to 50 s/div For record length of 16 MW: 1 s/div to 50 s/div
- Waveform acquisition/display functions
 

Acquisition modes:	Normal, Envelope, Averaging, Box Average
Zoom:	Zoom in on displayed waveforms along the time axis (one or two zoom windows with separate enlargement ratios)
X-Y display:	Two X-Y waveform displays (XY1 and XY2)

## ● Analysis functions

- SPI signal analysis and search functions:
- |   |   |
|---|---|
| Analysis function:                            | Analyzes and searches for data based on the following inputs: CH1: CLOCK, CH2: DATA1, CH3: DATA2, CH4-CH8 or PODA: CS<br>DATA1, DATA2 and CS statuses are displayed in increments of serial data bytes (8 bits). Analysis results can be output to files.   |
| Search function:                              | Automatically searches for undefined values or specified byte pattern based on analysis results.  |
| Search-and-zoom functions:                    | Edge, serial pattern, parallel pattern, pulse width, auto scroll  |
| History search functions:                     | Zone, parameter   |
| Cursor measurements:                          | Horizontal, Vertical, Marker, Degree  |
| Automatic measurement of waveform parameters: | P-P, Max, Min, Ave, Rms, Sdev, High, Low, +OShot, -OShot, Freq, Period, Rise, Fall, +Width, -Width, Duty, Burst1, Burst2, Pulse, AveFreq, AvePeriod, Int1TY, Int2TY, Int1XY, Int2XY, Delay (between channels)<br>The following statistical processes can also be performed.<br>Covered parameters: Those listed above.<br>Statistic types: Min, Max, Ave, Cnt, Sdv<br>Statistic modes: Normal, Cycle, History |
| Mathematical functions:                       | Addition, subtraction, multiplication, binary conversion, inversion, differentiation, integration, power spectrum   |
| User-defined calculations (optional):         | Equations can be set based on user-defined combinations of operators.<br>Addition, subtraction, multiplication, division, ABS, SQR, LOG, EXP, NEG, SIN, COS, TAN, ATAN, PH, DIF, INTG, BIN, P2, P3, F1, F2, FV, PWHH, PWHL, PWLH, PWLL, PWXX, FILT1, FILT2, HLB, MEAN, MAG, LOGMAG, PHASE, REAL, IMAG<br>FFT types: LS, PS, PSD, CS, TF, CH   |
| GO/NO-GO judgment:                            | Evaluation based on automatically measured waveform parameter values and waveform zones   |

## ● Screen data output

- |   |  |
|---|--|
| Built-in printer (optional):                              | Paper width: 112 mm<br>Output formats: Normal, Long  |
| External printers:  | Output to external printers through the USB peripheral port or Ethernet port.<br>Supported printer commands: ESC/P, ESC/P2, LIPS3, PCL5, B.J, PostScript (through Ethernet only) |
| Floppy disk/Zip <sup>®</sup> /SCSI/Network drive/PC card: | Output formats: PostScript, TIFF, BMP, JPEG, PNG   |

## Rear Panel I/O

Interfaces:	GP-IB, USB-PC connector, USB peripheral connector, Ethernet (100BASE-TX, 10BASE-T; optional), SCSI (optional)
Signal I/O:	One for external trigger input/external clock input/trigger gate input, one trigger output, one RGB video signal output (VGA)
Logic input (optional):	Measured with 701981 logic probe (8 bits). Number of inputs: 16 bits (using two logic probes)
Logic probe (701981, sold separately)	
Number of inputs:	8
Maximum foggie frequency:	250 MHz
Input voltage range:	$\pm$ 10 V (DC + AC peak)
Probe power connectors:	Output connectors: 4 (an additional 4 are available as an option with 701470 and 701480)
Output voltage:	$\pm$ 12 V

## General Specifications

Rated supply voltage:	100-120 VAC/220-240 VAC (switches automatically)
Rated supply frequency:	50/60 Hz
Maximum power consumption:	320 VA
External dimensions:	373 mm (W) $\times$ 210.5 mm (H) $\times$ 355.3 mm (D) (when the printer cover is closed; does not include knobs and protrusions)
Weight:	Approximately 11 kg (24.2 lbs, including printer; does not include logic inputs)

1: Measurements are obtained following calibration with the internal clock as the time base after the warmup period under the reference operating conditions (see below).  
Reference operating conditions

Ambient temperature: 23  $\pm$  2°C  
Ambient humidity: 55  $\pm$  10% RH  
Supply voltage/frequency tolerance: Within 1% of rating

2: When interleave mode is on, the number of available channels is half the installed number of channels.

For further details, visit our homepage at

<http://www.yokogawa.com/tm/Bu/DL7400/>

## Model and Suffix Codes

Model	Suffix Code	Description
701450		DL7440 digital oscilloscope with 4 CH input and maximum 4 MW memory
701460		DL7440 digital oscilloscope with 4 CH input and maximum 16 MW memory
701470		DL7480 digital oscilloscope with 8 CH input and maximum 4 MW memory
701480		DL7480 digital oscilloscope with 8 CH input and maximum 16 MW memory
Power cable	-D	UL and CSA standard
	-F	VDE standard
	-Q	BS standard
	-R	SAA standard
Internal storage drive	-J1	Floppy disk drive <sup>1</sup>
	-J2	Zip <sup>®</sup> drive <sup>1</sup>
Options	/B5	built-in printer
	/E4	Four additional passive probes(701470, 701480 only) <sup>2</sup>
	/P4	Four additional probe power connectors(701470, 701480 only) <sup>3</sup>
	/N3	Logic input for 701450/701470 <sup>4</sup>
	/N4	Logic input for 701460/701480 <sup>4</sup>
	/G2	User-defined math

1: Select one only.

2: The DL7400 Series is standard-equipped with four passive probes (700988).

3: The DL7400 Series is standard-equipped with four probe power connectors.

4: Select /N3 for models 701450 and 701470, and /N4 for models 701460 and 701480. Logic probes are sold separately. Purchase logic probe model 701981 (shown below under "Accessories (Optional)").

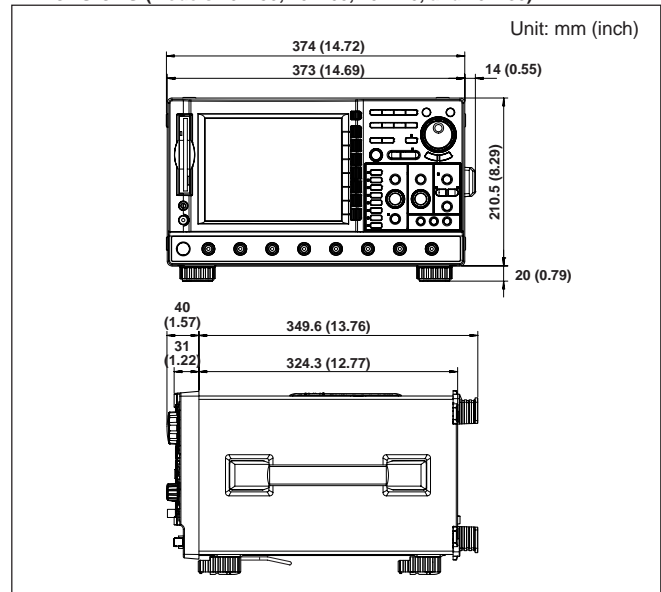
## Standard Accessories

Name	Q'ty
Power cable	1
Passive probes (700988)	4
Printer roll paper (when option /B5 is specified)	1
User's manual (one set)	1
Front cover (transparent)	1
Soft carrying case (for probes, etc.)	1

## Accessories (Optional)

Name	Model	Specifications
Passive probe	700988	10 M $\Omega$ (10:1), 400 MHz, 1.5 meters (one per unit)
FET probe	700939	900 MHz band
Logic probe (for DL7400)	701981	8-bit input, 250 MHz toggle frequency
100:1 probe	700978	100 MHz band
Differential probe	700925	DC to 15 MHz band
Differential probe	700924	DC to 100 MHz band
Differential probe	701920	DC to 500 MHz band
Current probe	700937	DC to 50 MHz band, 15 A peak
Current probe	701930	DC to 10 MHz band, 150 Arms

## Dimensions (Models 701450, 701460, 701470, and 701480)



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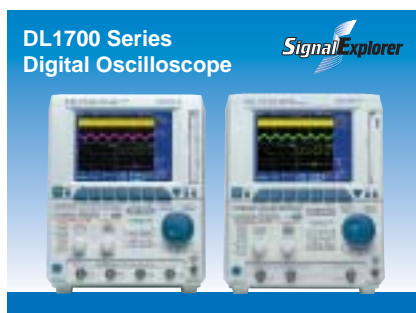
Zip is a registered trademark or trademark of Iomega Corporation in the US and other countries. This product's TCP/IP software and documentation on TCP/IP software were developed/manufactured by Yokogawa based on BSD Networking Software, Release 1, under license from the University of California.

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### NOTICE

- 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.

## Related Products



## 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.

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