YOKOGAWA ◆

SignalExplorer

Digital Oscilloscopes

DL7100/DL7200

3-Year Warranty

DL7200: Max. 2 GS/s; max. **16** MW/channel (with 701440)
4 MW/channel (with 701430)
DL7100: Max.1 GS/s; max. **8** MW/channel (with 701420)
2 MW/channel (with 701410)

- ● 4 analog input channels and 16-bit logic input (optional)
- ● 500 MHz analog bandwidth
- ● Newly developed DSE chip for high-speed screen updating
- ● Sophisticated search functions (history search, search-and-zoom)
- ● SCSI, GP-IB, RS-232, and Centronics interfaces equipped as standard
- ● Easy to use ● Ethernet connectivity (optional)

NEW
SPI bus (synchronous 8-bit serial bus) analysis function
CAN bus signal analysis function (optional) with DL7200

The YOKOGAWA SignalExplorer DL7100/DL7200 were designed to satisfy the key feature requirements for waveform measuring systems. These features are:
- Simple and accurate capturing of complex signals
- High-speed extraction and screen display of desired information from large volumes of captured data

Our goal was to create a waveform measuring system that truly meets your needs.

- **Maximum 2 GS/s (with DL7200), 1 GS/s (with DL7100); 500 MHz analog bandwidth**
- **Maximum record length: 16 MW (with DL7200), 8 MW (with DL7100)**
- **Easy to use zooming**
  Easy enlargement of images for up to two parts

- **Display of all 16 MW data at fast screen update rate**
- **4 analog input channels and 16-bit logic input (optional)**
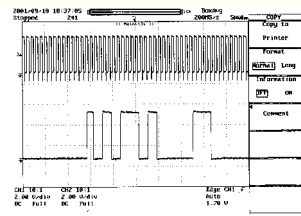 Simultaneous monitoring of waveforms of a total of 20 points

- **Smart search**
  Automatically searches through captured data and finds the information you need.

- **PC card interface (optional)**
- **Ethernet connectivity (optional)**
- **Built-in printer (optional)**
  Outputs hard copies of screen data. Can print part of an enlarged waveform as a long strip.

Example of screen hard copy printout
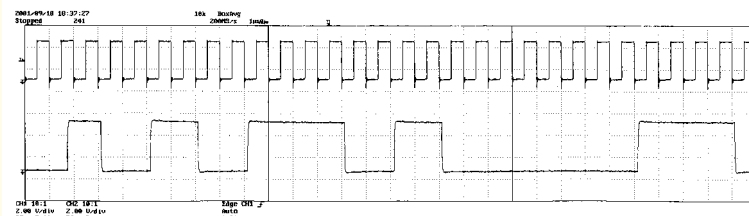
Example of long-strip printout of enlarged waveform image

NEW ● **CAN bus signal analysis function (optional, available only with DL7200)**
  Detects triggers and analyzes signals on a CAN bus widely used in the automobile industry, etc.

● **SPI bus analysis function**
  Analyzes synchronous 8-bit serial bus broadly used for inter-IC communications.

The SignalExplorers DL7100/DL7200: Designed to Meet Your Needs

Large recording memory for capturing waveforms accurately

A high-speed sampling instrument may not be able to capture waveforms accurately depending on the duration of recording: if the recording memory is limited, the actual sampling rate is reduced as the recording time increases. Thus, a larger recording memory not only prolongs the recording period but also prevents the sampling rate from dropping, thus assuring accurate waveform monitoring. You can view the enlarged images of up to two desired parts of waveforms which are accurately recorded in the large memory, for detailed simultaneous observation.

A DL7200 model with larger memory can capture an event of 16 ms long at 1 GS/s, or an event of 8 ms long at 2 GS/s.
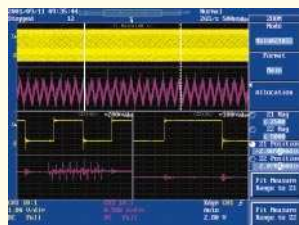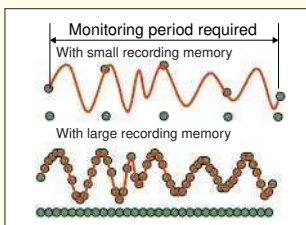

16 MW, 2 GS/s

"All-points display" so that nothing is missed

Even for the same data captured with the same large memory, the amount of information gained from the display varies greatly depending on how the data are presented. Are all the captured waveform data plotted, or are the data compressed and only the minimum and maximum values for specified intervals plotted?

The DL7100/DL7200 can display every single waveform data captured in the large memory while maintaining a high screen update rate. Increasing the recording length will not let an abnormal event slip through, nor slow down the key response!
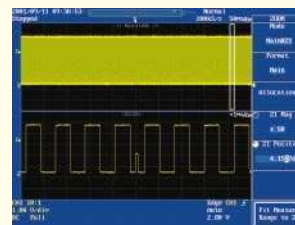

All-points display
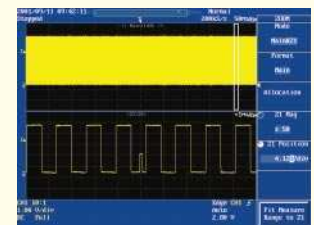
P-P compression display

4 analog channels and 16-bit logic input (optional) for monitoring mixed logic-and-analog circuits with a single instrument

The DL7100/DL7200 can measure 16-bit logic signals simultaneously with 4 channels of analog signals. No more worries about running out of channels and having to use a separate measuring instrument for multi-point logic signal measurements! The DL7100/DL7200 break new ground ... just a single DL7100 or DL7200 can handle all of these measurements that would conventionally require at least two measuring systems.
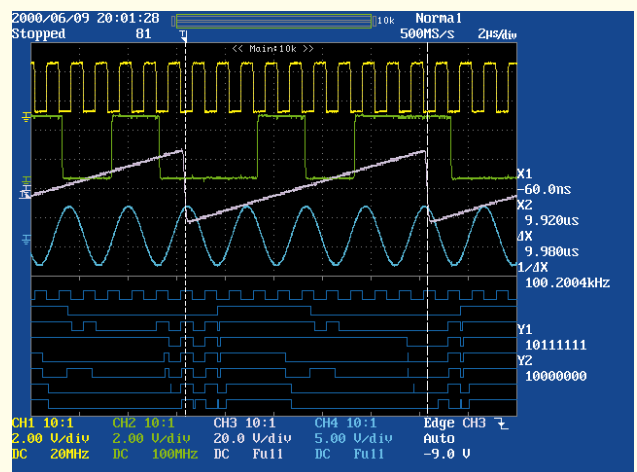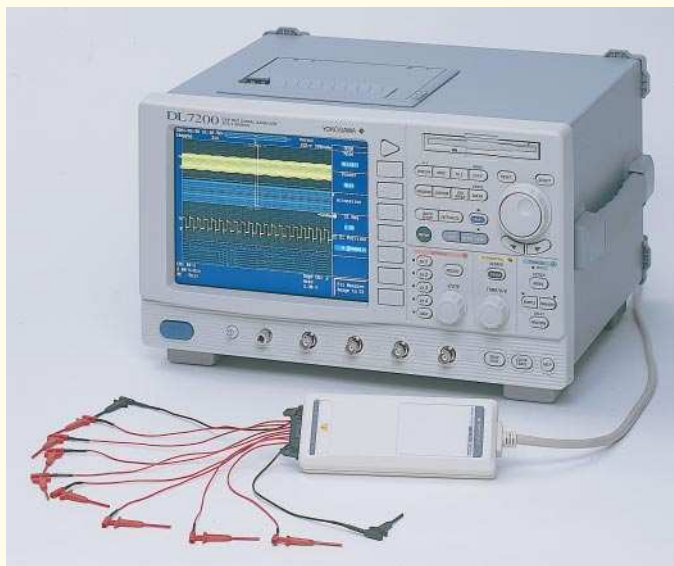
Simultaneous display the analog and logic signals

Connectors on rear panel
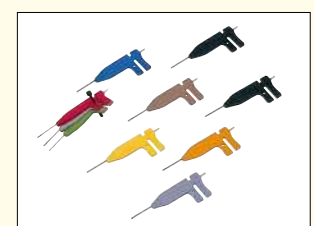
Narrow-pitch IC clips (optional)

Fast, smart searching for specific information from vast volumes of data, and SPI/CAN bus signal analysis functions

Smart search rapidly finds specific information from the huge quantity of complex data captured

Search-and-zoom

The search-and-zoom function searches for parts of data that match your specified pattern signal and automatically displays the parts as an enlarged image in a zoom window.

● **Pattern search** - searches through the captured data, finds parts that match your specified serial or parallel pattern, and displays the parts in a zoom window.

● **Pulse width search** - finds pulses whose pulse widths match your specified conditions (polarity: high or low). Four types of pulse width can be set for the search conditions: Pulse < T, pulse > T, T1 < pulse < T2, or timeout.

● **Edge search** - counts rising and falling edges and finds any edge you specify.

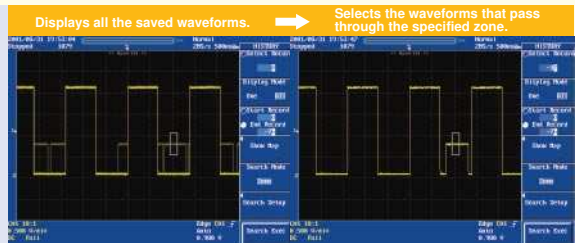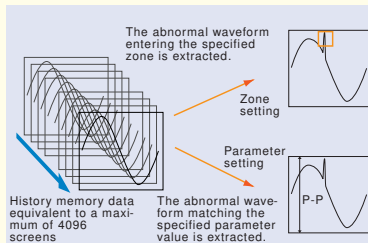● **Auto scroll** - you can set the zoom windows to scroll automatically.
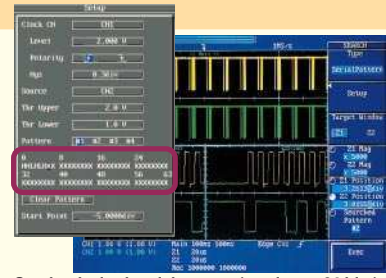
Set the desired serial pattern (maximum 64 bits).

History memory and history search

Normally, if you press the STOP key when an abnormal waveform is captured, the waveforms at that instant disappear from the screen and are updated with new waveforms. The history memory function divides the large recording memory into a number of blocks and automatically saves the equivalent of up to 4,096 screens of observed waveform data. For instance, you can save 64 screens of observed waveform data (data for nearly 2 seconds) with the record length set to 100 kW. This makes it possible to reliably store displayed waveforms in memory, even for events that are not covered by the trigger settings. The history search function automatically detects abnormal waveforms saved in history memory.

● **Zone search** - you can specify a zone on the screen and select just waveforms that pass through that zone (pass), or waveforms that do not pass through it (bypass). Up to four zones can be set.

● **Parameter search** - you can specify waveform parameter values and select just waveforms whose parameter values match them. Up to four parameters can be set.

The abnormal waveform entering the specified zone is extracted.

Zone setting

Parameter setting

History memory data equivalent to a maximum of 4096 screens

The abnormal waveform matching the specified parameter value is extracted.

P-P

Displays all the saved waveforms.

Selects the waveforms that pass through the specified zone.

NEW SPI analysis function

Analyzes synchronous 8-bit serial bus broadly used for inter-IC communications.

Clock
Data
CS

0 1 0 1 0 0 1 0
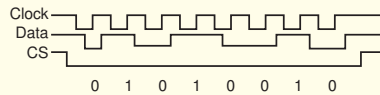
◆ **Waveform and analysis result display**
Lists data1, data2, and CS data simultaneously with the waveform. Pointing to a data value on the list using the cursor displays the corresponding frame in a zoom window.

◆ **Data search**
Automatically searches through the captured data and finds a data pattern that matches the specified criteria. The signals to be searched, data length, and data pattern can be set for the search.

◆ **Analysis settings**
Connect the individual signals to input channels. You can specify two or more Chip Select (CS) signals, so multi-slave SPI analyses are supported. For example:
Ch1: Clock   Ch2: Data1
Ch3: Data2   Ch4 & Pod1 (8 bits): CS
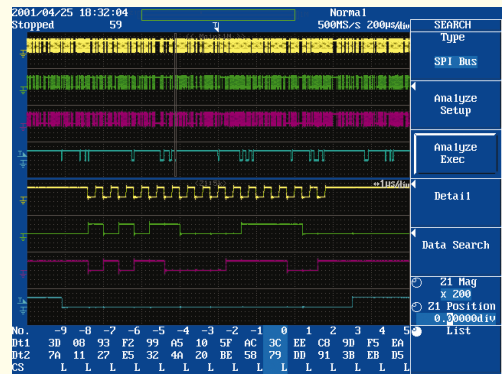
NEW CAN BUS SIGNAL ANALYZER

To analyze communication problems caused by fluctuations in signal level due to surge voltage noise or an overload at runtime in a controller area network (CAN) bus which is widely used in the automobile industry and elsewhere, the physical layer must be searched. The CAN bus signal analyzer function of the DL7100/DL7200 captures the bus signals as waveforms and analyzes them, which was almost impossible with conventional protocol analyzers.

Analysis result list and waveform display
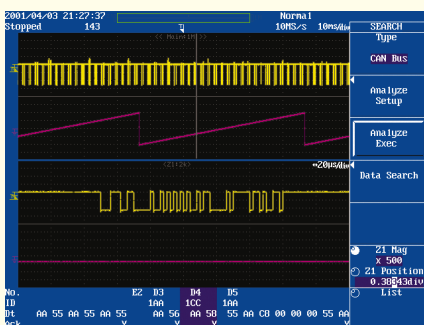
◆ **Bus signal analysis**
Performs a time series analysis of the signals captured from the bus, and lists the results from analyzing the ID and data together with the presence/absence of ACK (acknowledgment). Selecting (highlighting) a frame in the list displays the corresponding waveform in a zoom window. In the in-detail analysis mode, the frame type, trigger-to-frame time, CRC data, and error detail (only for an error frame) are also displayed at the same time.

◆ **A wealth of triggers**
The trigger can be set by combining up to five trigger conditions by using logical ANDs: start-of-frame trigger, ID field trigger, RTR trigger, data field trigger, error frame trigger.

◆ **Search**
Searches through all the captured frames, speedily finds the frame that contains the specified ID, data, CRC, or ACK, and automatically displays the corresponding waveform in a zoom window. Error frames can also be searched through.

Other useful features for waveform measurement in a variety of fields

Simple and enhanced triggers for securely capturing diverse waveforms

The many trigger types enable stable monitoring of diverse waveforms.
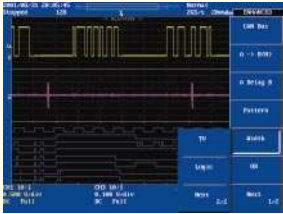
Edge trigger: A typical trigger that triggers the recording when a rise or fall edge of a specified signal is detected.

CAN Bus: Start of frame, identifier, RTR, field, error frame (optional)

A→B (N): Triggers the recording when condition B has become true specified (N) times after condition A had become true.

A Delay B: Triggers the recording when condition B has become true for the first time after condition A had become true.

Pattern: Triggers the recording when all the trigger conditions specified for the individual channels have been met at an edge of the clock channel signal.

Pulse Width: Triggers the recording when the relationship between an input pulse width and the specified time width meets the specified condition(pulse > time, pulse < time, T1 < pulse < T2, or time out).

OR: Triggers the recording when one or more of the specified trigger conditions are met.

TV: NTSC, PAL, HDTV

Logic: Triggers the recording when the specified combination of the H, L, or "Don't care" conditions for 16 POD A and B signals is met (optional).

Automatic measurement of waveform parameters

The DL7100/7200 automatically measure waveform parameters such as the voltage, frequency, and RMS value, and come with the following features as standard.

Pulse count

Automatically counts the input pulses existing within the range specified by cursors and displays the count. Useful for counting the rotation pulses from a stepping motor, the track error signals for an optical disk, the interrupt signals during software debugging, and so on.

1-cycle mode

A mode in which the cycle is obtained first, and then the values of the items related to the voltage axis and area are calculated. Useful for monitoring items for which the reading error increases depending on range setting, such as an rms and average.
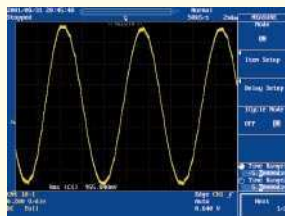
History statistics

Calculates statistics for each waveform stored in the history memory. Selecting a waveform parameter displays the maximum, minimum, average, standard deviation, and number of samples of the selected parameter. The frequency of occurrences can be graphically identified by color accumulation function.
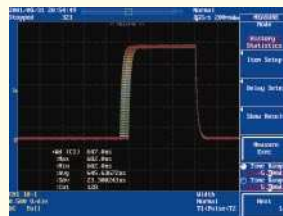
Cycle statistics

Calculates statistics (maximum, minimum, average, number of cycles, and standard deviation) of parameters in each cycle or in a specified time period within a long-time signal captured with a long recording memory setting.
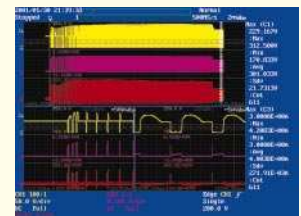
Ethernet interface

Ethernet function

• Data transfer(FTP client and server)
You can access the DL7100/DL7200 from a PC and download data from the floppy disk and PC card inserted in them. You can also save waveform data and screen images to a PC.

• Network printing
With the Ethernet interface, you can easily print a color copy of the current screen image using a network printer.

• E-mail transmissions
E-mail can be automatically transmitted to preset addresses periodically as well as in response to GO/NO-GO and other action triggers, so you can check the actions and data remotely during long-time continuous measurement.

• Remote control
You can create a PC program to remotely control your DL7100/DL7200 from a PC. The combination of waveform display software, Waveform Viewer for DL Series (Model 700919), and control software, WirePuller, makes it easy to connect to a PC.

PC

TCP/IP protocol-compatible network printer

PC card interface
A slot for an ATA flash memory card, which is widely used in notebook PCs as a large-capacity removable medium, lets you save waveform data from the large memory and screen images to a card - no capacity limitations!
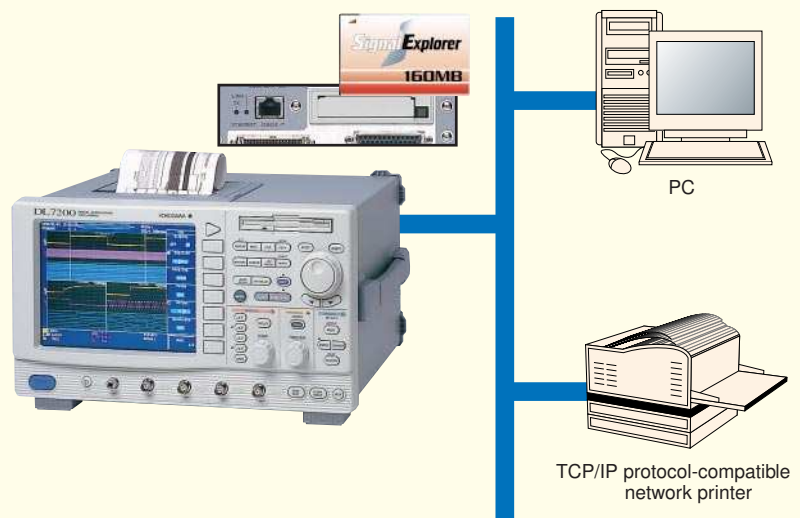
Main specifications

Basic Specifications

Input channels:	4 analog (CH1 through CH4) and 16-bit digital (optional)
Input coupling settings:	AC 1 MΩ, DC 1 MΩ, GND, DC 50 Ω
Input impedance:	1 MΩ ± 1.0%, 50 Ω ± 1.0%
Voltage axis sensitivity setting range:	
	For 50 Ω input: 2 mV/div to 1 V/div (steps of 1, 2, or 5)
	For 1 MΩ input: 2 mV/div to 10 V/div (steps of 1, 2, or 5)
Maximum input voltage:	For 1 MΩ input (frequency of 1 kHz or less): 400 V (DC + ACpeak) (282 Vrms CAT II)
	For 50 Ω input: 5 Vrms or less and 10 Vpeak or less
Frequency characteristic*1 (-3 dB attenuation point for sinewave input with amplitude equivalent to ±4 div):	For 50 Ω input: 1 V/div to 10 mV/div: DC to 500 MHz
	5 mV/div to 2 mV/div: DC to 400 MHz
	For 1 MΩ 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
A/D conversion resolution:	8 bits (24 LSB/div)
Maximum sampling rate:	Real-time sampling mode
	701430 and 701440
	Interleave mode on: 2 GS/s*2
	Interleave mode off: 1 GS/s
	701410 and 701420
	Interleave mode on: 1 GS/s*2
	Interleave mode off: 500 MS/s
	Equivalent time sampling mode: 100 GS/s
Maximum record length:	701440
	Interleave mode on: 16 MW/channel*2
	Interleave mode off: 8 MW/channel
	701430
	Interleave mode on: 4 MW/channel*2
	Interleave mode off: 2 MW/channel
	701420
	Interleave mode on: 8 MW/channel*2
	Interleave mode off: 4 MW/channel
	701410
	Interleave mode on: 2 MW/channel*2
	Interleave mode off: 1 MW/channel
DC accuracy*1:	±(1.5% of 8 div + offset voltage accuracy)
Offset voltage axis accuracy*1:	2 mV/div to 50 mV/div ±(1% of setting + 0.2 mV)
	100 mV/div to 500 mV/div±(1% of setting + 2 mV)
	1 V/div to 10 V/div ±(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*1:	±0.005%
External clock input: (EXT Clock IN)	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 CH4 (signals input to individual input terminals), LINE (connected utility power signal), EXT (signal input from EXT TRIG IN terminal)
Trigger types:	Edge, A → B(N), A delay B, OR, Pattern, Width, TV, Logic

Display

Screen updating speed:	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 and that these are not failures.

Functions

● **Vertical/horizontal axis setting function**

Input filters:	100 MHz or 20 MHz band limits can be set independently for CH1 through CH4.
Scroll mode:	Scroll 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, Averaging, Envelope, 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**

Signal analysis:	SPI
Search-and-zoom:	Edge, serial pattern, parallel pattern, pulse width, auto scroll, SPI
History search:	Zone, parameter
Cursor measurements:	Marker, Horizontal, Vertical, Degree
Automatic measurement of waveform parameters:	
	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
	The following statistical processes can also be performed.
	Covered parameters: Those listed above.
	Statistic types: Min, Max, Avg, Cnt, Sdv
	Statistic mode: Normal, Cycle, History
Mathematical functions:	Addition, subtraction, multiplication, binary conversion, differentiation, integration, power spectrum, inversion
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
	Outputs hard copies of screen data.
External printers:	Output to external printers through the Centronics or Ethernet port*3
	Supported printer commands: PostScript (only via Ethernet), ESC/P, ESC/P2, LIPS3, PCL5, BJ
Formats of data output to floppy disk/SCSI drive/network drive*3/ATA flash memory card*4:	PostScript, TIFF, BMP

CAN Bus Signal Analyzer Function (optional with DL7200)

Compatible bus specifications:	CAN Bus: CAN Version 2.0B
	Bit rate: 33.3, 50, 83.3, 125, 250 and 500 Kbps, and 1 Mbps
Triggers:	Trigger source: CH1 (used with a differential probe)
	Trigger type: SOF trigger, ID Field trigger, selectable from 4 types of IDs, RTR trigger, Data Field trigger, configurable up to 8 bytes, Error Frame trigger, Combination trigger (based on a combination of these five types of triggers)
Analysis function:	Number of analyzable frames: 8000 maximum
	Analysis results display: Listing and waveform display of analysis results
Analysis-supporting functions:	Data search, field jump, stuff bit display
Analysis result output function:	Export of the displayed detailed analysis results to an ASCII text file having the filename extension of TXT

Rear Panel I/O

Interfaces:	SCSI, GP-IB, RS-232, Centronics, Ethernet (10BASE-T, 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 700985 logic probe (8 bits)
	Number of inputs: 16 (using two logic probes)
Probe power terminals:	Output terminals: 4
	Output voltage: ±12 V

General Specifications

Power supply frequency:	50/60 Hz
Maximum power consumption:	290 VA
External dimensions:	373 mm (W) × 210.5 mm (H) × 306 mm (D) (when the printer cover is closed; does not include knobs and protrusions)
Weight:	Approximately 9 kg (19.8 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 ±2°C
	Ambient humidity: 55 ±10% RH
	Supply voltage/frequency tolerance: Within 1% of rating

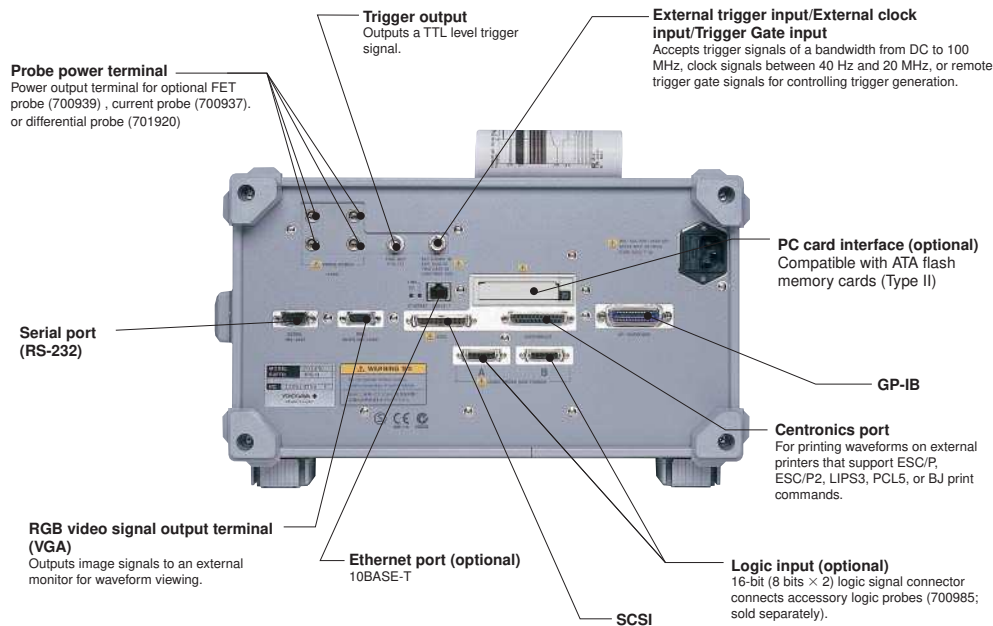*2: When interleave mode is on, the number of available channels is half (2 ch) the installed number of channels.

*3: Only with the /C10 option

*4: Only with the /C9 or /C10 option

Rear Panel

Probe power terminal
Power output terminal for optional FET probe (700939), current probe (700937), or differential probe (701920)

Trigger output
Outputs a TTL level trigger signal.

External trigger input/External clock input/Trigger Gate input
Accepts trigger signals of a bandwidth from DC to 100 MHz, clock signals between 40 Hz and 20 MHz, or remote trigger gate signals for controlling trigger generation.

PC card interface (optional)
Compatible with ATA flash memory cards (Type II)

Serial port (RS-232)

GP-IB

Centronics port
For printing waveforms on external printers that support ESC/P, ESC/P2, LIPS3, PCL5, or BJ print commands.

RGB video signal output terminal (VGA)
Outputs image signals to an external monitor for waveform viewing.

Ethernet port (optional)
10BASE-T

Logic input (optional)
16-bit (8 bits × 2) logic signal connector connects accessory logic probes (700985; sold separately).

SCSI
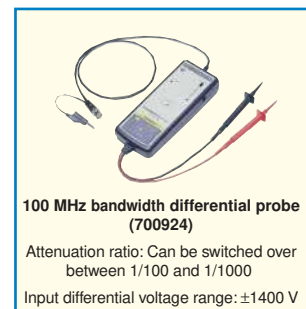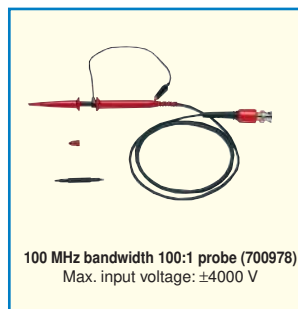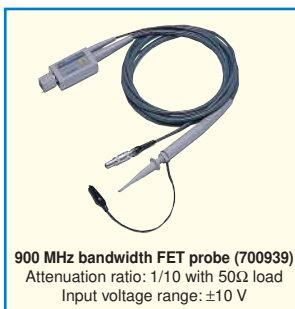
Note: Interfaces other than the logic input, Ethernet port, and PC card slot are all provided in the standard package.

Accessories

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

100 MHz bandwidth 100:1 probe (700978)
Max. input voltage: ±4000 V

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

100 MHz bandwidth differential probe (700924)
Attenuation ratio: Can be switched over between 1/100 and 1/1000
Input differential voltage range: ±1400 V

50 MHz bandwidth current probe (700937)
Input range: 15 Apeak

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

Logic probe (700985)
8 input bits
Toggle frequency: 80 MHz

Narrow-pitch IC clip set (B9852ES)

Related Software (http://www.yokogawa.com/tm/Bu/software.htm)

• **Waveform Viewer for DL Series (700919)**
Displays waveform data that has been measured with a DL series oscilloscope and saved to a WVF file, at a PC. Can display multiple waveforms (up to 24 analog waveforms) simultaneously.

• **Wirepuller**
Controls a DL7000/DL1700 series digital oscilloscope from a PC via Ethernet, USB, or GP-IB interface, and saves screen images remotely.

Model	Description
700919	Waveform Viewer for DL series

DL7100/DL7200 model and suffix codes

Model	Suffix Code	Description
701410		DL7100 digital oscilloscope with maximum 2 MW/channel memory
701420		DL7100 digital oscilloscope with maximum 8 MW/channel memory
701430		DL7200 digital oscilloscope with maximum 4 MW/channel memory
701440		DL7200 digital oscilloscope with maximum 16 MW/channel memory
Power cable	-D	UL and CSA standard
	-F	VDE standard
	-Q	BS standard
	-R	SAA standard
Options	/B5	Built-in printer
	/N1	701410 logic input (*1)
	/N2	701420 logic input (*1)
	/N3	701430 logic input (*1)
	/N4	701440 logic input (*1)
	/E2	Two additional passive probes (*2)
	/E3	Two FET probes (*3)
	/C9	PC card interface (*4)
	/C10	Ethernet and PC card interfaces (*4, 5)
	/F7	CAN bus signal analysis function (*6)

*1: Specify /N1 for model 701410; specify /N2 for model 701420; specify /N3 for model 701430; specify /N4 for model 701440. Logic probes are sold separately. Accessory logic probes (700985) must be purchased separately.
*2: The digital oscilloscope packages come standard with two passive probes (700988).
*3: The digital oscilloscope packages include power output terminals (4) for FET probes (700939) and current probes (700937).
*4: Compatible with ATA flash memory cards (Type II). Memory cards sold separately. /C9 and /C10 cannot both be specified.
*5: Specifying /C10 provides both an Ethernet port and a PC card slot.
*6: Can only be specified for models 701430 and 701440.

Standard accessories

Name	Q'ty
Power cable	1
Passive probes (700988)	2
Power fuses	2
Printer roll paper (when option /B5 is specified)	1
User's manual (one set)	1
Front cover (B9969BY)	1
Soft carrying case (for probes, etc.)	1

Optional accessories

Name	Model	Specifications
Passive probe	700988	10 MΩ (10:1) 400 MHz, 1.5 meters (one per unit)
FET probe	700939	900 MHz bandwidth
Logic probe	700985	8-bit input, toggle frequency: 80 MHz
100:1 probe	700978	100 MHz bandwidth
Front cover	701481	Transparent type, for both DL7100/DL7200
IC clip set	B9852ES	2 block clips and 8 differently colored clips

Consumables

Name	Model	Specifications	Order Q'ty
Printer roll paper	B9850NX	30 meters (1 roll per unit)	5

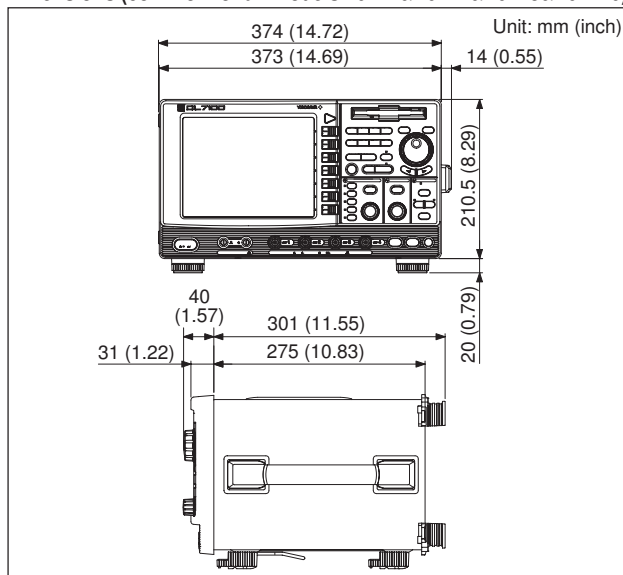## Differential probes

Name	Model	Specifications
Differential probe	700925	DC to 15 MHz bandwidth
Differential probe	700924	DC to 100 MHz bandwidth
Differential probe	701920	DC to 500 MHz bandwidth

Red and black pincher chips (one each) are included (standard)

Current probe

Name	Model	Specifications
Current probe	700937	DC to 50 MHz bandwidth, 15 Apeak
Current probe	701930	DC to 10 MHz bandwidth, 150 Arms

Dimensions (common for all models 701410/701420/701430/701440)

Unit: mm (inch)

374 (14.72)
373 (14.69)
14 (0.55)
210.5 (8.29)
20 (0.79)
40 (1.57)
301 (11.55)
31 (1.22)
275 (10.83)

NOTICE
● Before operating the product, read the instruction manual thoroughly for proper and safe operation.

Related models

DL1700 Series Digital Oscilloscopes

DL708E/DL716 Digital Scopes

Global environmental protection efforts
• YOKOGAWA products are developed and manufactured in facilities that have been given ISO14001 approval.
• To protect the global environment, these products are designed to satisfy the Environmentally Friendly Product Design Guidelines and Product Design Assessment Standards established by YOKOGAWA.

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