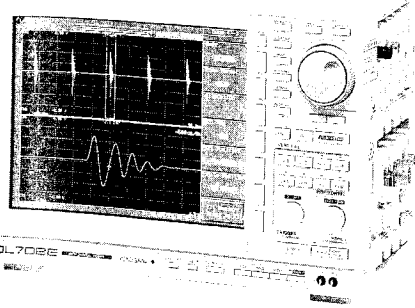
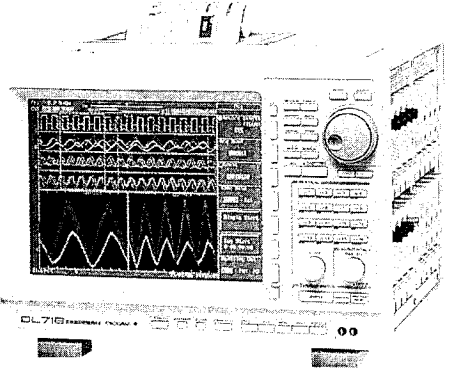


701820 & 701830 Digital Scopes DL708E & DL716



DL708E (701820)
370 x 260 x 183mm
(14-5/8 x 10-1/4 x 7-1/4")
5.3 kg(11.7 lbs);
Main unit only



DL716(701830)
355 x 260 x 305mm
(14 x 10-1/4 x 12")
9.2 kg(20.3 lbs);
Main unit only

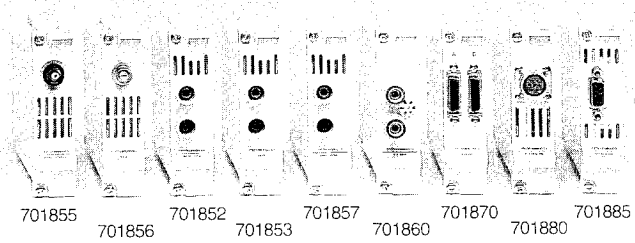


★ Safety Standards ; EN61010-1
Emission ; EN61326 Class A
Immunity Standard ; EN61326

- Up to 8 analog input channels with DL708E or 16 analog and 32 bits logic input channels with DL716
- Maximum 850 V (DC + ACpeak) isolated input
- A variety of add-on input modules
- Large (10.4-inch) color TFT display with wide viewing angle
- Maximum sampling rate: 10 MS/s A/D resolution-12 bits
- Maximum total memory: 32 M words with DL708E or 256 M words with DL716
- Maximum A/D resolution: 16 bits
- Large-capacity hard disk drive (optional)
- Various interfaces included in standard package

PLUG-IN MODULES

A variety of plug-in modules can be used with both the DL708E and DL716. Select the best module for your needs, based on signal type and frequency.



The wide variety of plug-in modules goes beyond the limits of regular oscilloscopes, giving you access to a greater range of mechatronics-related applications. Examples include:

- Maintenance and inspection of turbines and rotating machinery
- Observing engine behavior
- Monitoring large plants
- Monitoring press machine operations
- Observing vibration and impact tests
- Observing sudden, singular events
- Recording changes in temperature and electric potential
- Substation maintenance

MAIN FEATURES OF DL708E AND DL716

	DL708E	DL716
Measurement channels	Maximum 8 analog (isolated)	Maximum 16 analog (isolated) and 32 bits logic (optional)
Maximum sampling rate	10 MS/s (using high-speed module)	10 MS/s (using high-speed module)
Maximum record length	16 M words (with optional memory)	64 M words (with optional memory)
Internal hard drive (optional)	2.1 GB	9.2 GB
Screen	10.4-inch TFT color LCD	
Interfaces	GPIB, serial (RS-232), Centronics printer output, trigger I/O, and VGA output are standard. SCSI and external clock input are optional.	SCSI, GPIB, serial (RS-232), Centronics printer output, trigger I/O, external clock input, and VGA output are all standard. Ethernet (10Base-T) is optional.
Other features	Small and lightweight (approximate weight: 6.8 kg, including 8-channel high-speed isolated module) Small, lightweight design facilitates waveform measurements on lab benches, production lines, and on the road.	32-bit extended logic input (optional) Capability to simultaneously display as many as 16 analog channels and 32 logic channels

DL708E & DL716

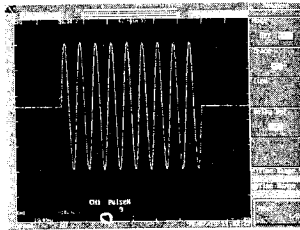
1
DIGITAL SCOPES

16-Channel Model Updated with Ultra-long Memory (DL716)

The DL716 provides as many as 16 analog and 32 bits digital input channels and can use an ultra-long memory with a capacity of 64 M words (with /M3 option).

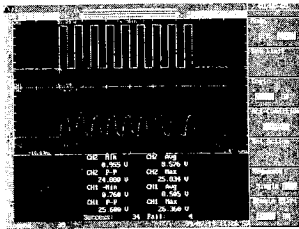
- **Pulse Count Function (DL716)**

This feature can be used to automatically calculate the number of pulses for waveforms in range specified by the cursor. It can count track error signals from optical disk and other media in order to evaluate the amount of pick up movement.



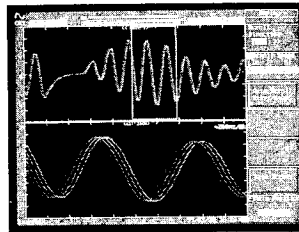
- **GO-NOGO Function (DL716)**

With this function, a waveform parameter is specified for a measured waveform, and the measured signal is evaluated to automatically determine which action to perform.



- **Replay function (DL716)**

The replay function replays an acquired waveform in a scrolling mode on the screen after the acquisition has ended. This means you can view recorded waveform data covering extended time periods (Max. 256 MW) on the screen, much as you would look at chart paper from a recorder. The replay function is very useful for checking data recorded using long memory.



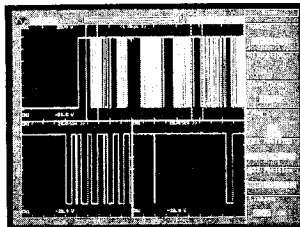
The measured waveform is "replayed" across the screen in scrolling mode after the acquisition ends. The scrolling direction and speed can be set by the user.

Waveform Capturing (DL708E and DL716)

- **Signal Capturing in Long Memory (Dramatically Improved Ultra-Long Memory)**

- **For high-fidelity signal capturing or extended waveform capturing**
The DL708E and DL716 can capture signals over longer periods of time with their dramatically improved long memory.

At a given time axis, a greater memory capacity makes it possible to capture signals at a finer time resolution so as to display higher-fidelity waveforms. Conversely, more memory can be used to increase the duration of a recording at a given sampling speed and time resolution. It is easy to store captured signals on the optional internal hard drive or output them via the SCSI interface (optional on the DL708E; standard on the DL716) to an external MO drive or other large-capacity storage device.

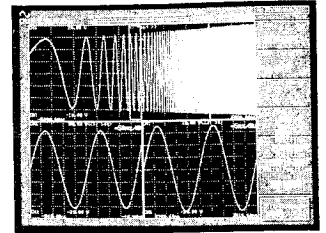


■ TWO FUNCTIONS TO MAKE LONG MEMORY MORE EFFECTIVE

- **Zoom Function**

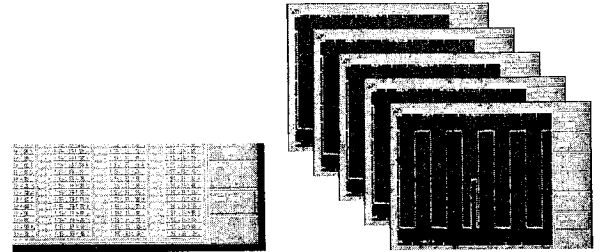
Simultaneously displays entire waveform and waveform enlargements

The DL708E and DL716 let you display an entire waveform and enlargements of selected waveform areas after capturing an extended waveform in long memory.



- **History Memory Function**

Automatically stores the most recent 1000 captured waveform screenshots



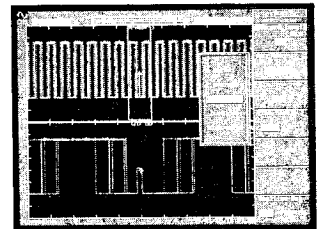
The history memory function automatically stores the most recent 1000 waveform screenshots. This lets you redisplay a waveform that disappears when the screen is refreshed.

■ TWO FUNCTIONS FOR RELIABLY CAPTURING DESIRED WAVEFORMS

- **Sequential Store Function**

Captures signals with minimal "dead time"

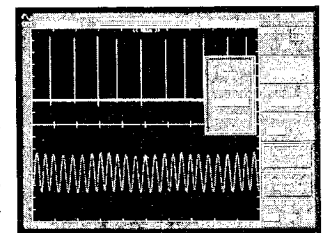
The sequential store function displays waveforms meeting certain preset conditions after they are acquired over a specified number of screens. By eliminating the need to display a waveform every time a signal is captured, the sequential store feature shortens dead time during waveform acquisition and reduces signal-capturing errors.



- **Envelope Function**

Always captures signals at the maximum sampling speed

The envelope function always captures signals at the maximum sampling speed, regardless of the time-axis setting. Peak input signal values are recorded from the sampled data. This function is effective for purposes such as reliably capturing surge signals that occur intermittently over an extended period of time.

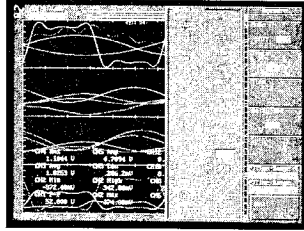


DL708E & DL716

Waveform Analysis (DL708E and DL716)

- **Automatic Waveform Parameter Measurement Function**
Makes it easy to read waveform frequency, rise time and other parameter data

This function automatically calculates parameter values based on acquired digital waveform data. It can calculate voltage-axis parameters such as maximum, minimum, and root mean square (rms); as well as time-axis parameters such as frequency, rise time, and duty ratio.

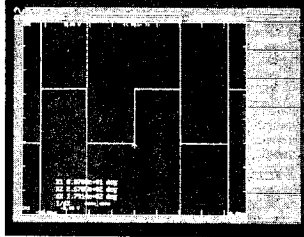


When acquisition is completed, waveform parameters for the last 512 measurements can be stored.

- **Cursor Measurement Functions**
For viewing measured waveform data (digital values) on screen

The DL708E and DL716 have a variety of cursor functions for viewing waveform data, including the following:

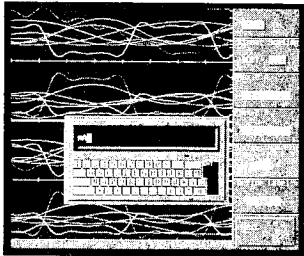
- V cursor (used to measure X-axis values)
- H cursor (used to measure Y-axis values)
- Markers (used to measure specific positions on the waveform)
- User define cursor (for viewing cursor measurements on the horizontal axis in a user-defined unit)



Cursors can be combined with the zoom function to view measurements at a higher resolution.

- **Linear Scaling Function**
Converts measured voltages to physical values for direct reading

The linear scaling function automatically calculates the following equation based on Scaling Coefficient A and Offset B:
 $Y = AX + B$ (where X is the measurement and Y is the linear scaling result)

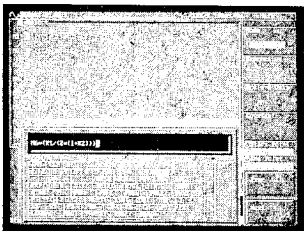


Linear scaling is useful for purposes such as the following:

- Converting a signal conditioner output to a physical value for direct reading
- Multiplying the division ratio of an external voltage divider by the measurement
- Converting voltage measurements (taken using a clamp, etc.) to current values
- Converting strain measurements to stress values

- **User Define Math Function (optional)**
Define complex calculations using math function

The standard configurations for the DL708E and DL716 both include addition, subtraction, multiplication, FFT and phase shift calculations (in which the channel-to-channel phase is shifted prior to calculation). The user define math function (optional)

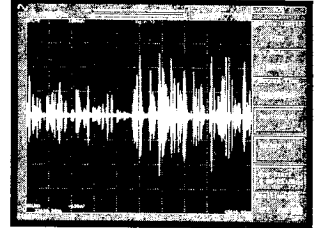


lets you define equations using a wide range of functions, including trigonometric functions, differentials, integrals, square roots, digital filters and seven different FFT functions.

Waveform Data Recording (DL708E and DL716)

- **Real-time Hard Drive Recording (with Optional Internal Hard Drive)**
Record data in real time over an extended period like a recorder

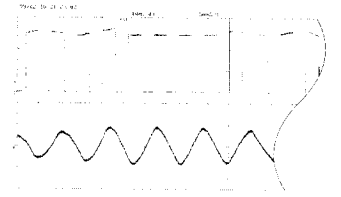
This option allows you to acquire data in real time to an internal hard drive. In the past, it was necessary to record data on paper using a chart recorder. With the DL708E and DL716, data are recorded electronically. This improves measurement reading precision and makes it easier to manage and analyze data on a PC.



- **Three Printing Options: Hard Copy, Long Copy, and Real-time Print**
Waveforms can be printed out using the built-in thermal print

Waveforms can be printed out using the built-in thermal printer. The following printout options are available:

Hard Copy: Select this option to output a screenshot hard copy.



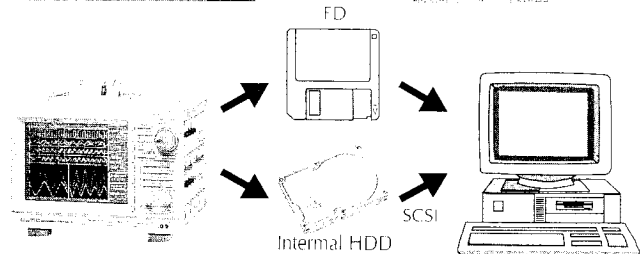
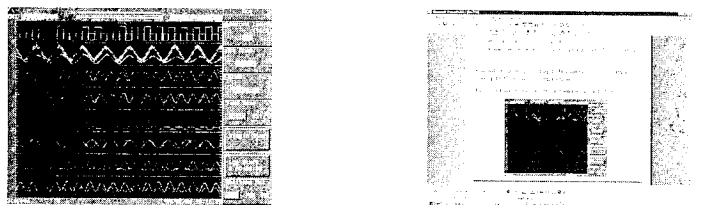
Long Copy: Select this option to output the waveform on the screen, enlarged by a factor of 2 to 50 along the time axis.

Real-time Print: Select this option to record signals in real time at chart speeds up to 20 mm/s.

- **Saving and Loading Waveforms, Settings, and Screen Images**
A wide range of data formats and powerful tools for creating reports

A variety of different data file types can be stored on internal storage media (floppy disks or hard drive). The main types of files that can be saved are listed below. (Note that the DL708E and DL716 specifications for waveform files and settings files are not compatible with each other.)

- Data Files
 - Waveform format: Files in this format can be loaded by the DL708E and DL716.
 - ASCII format: Files in this format can be opened directly in PC applications such as Excel.
- Setup Files
- Screen Image Files (BMP, TIFF, HP-GL, ThinkJet, PostScript)
 - Image files can be inserted in PC word processor documents to easily create reports containing waveforms.

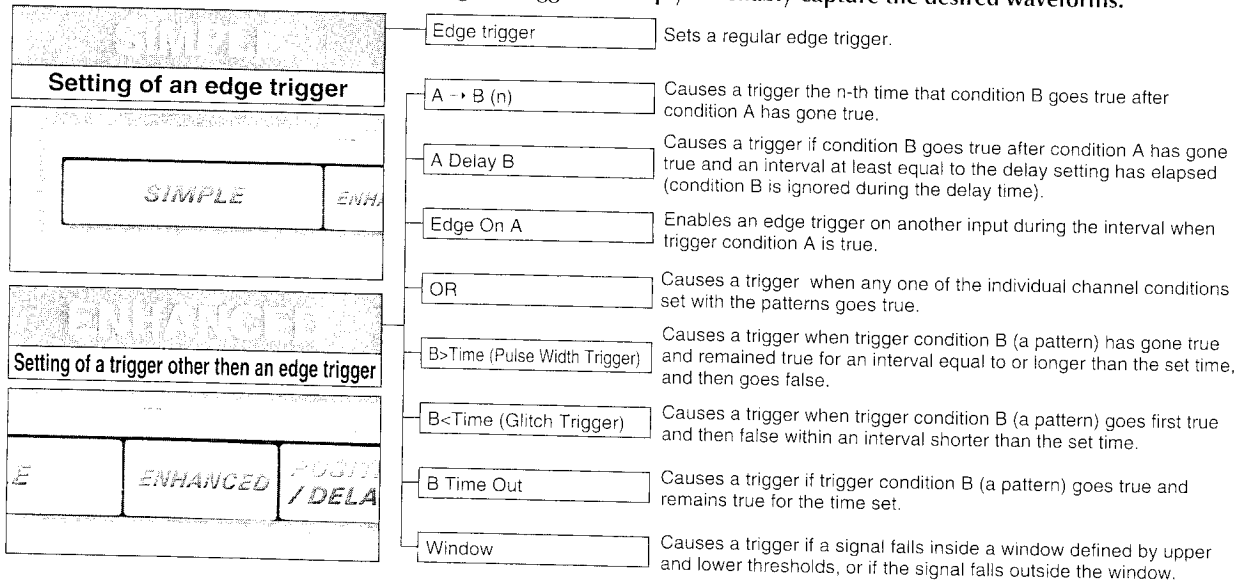


DL708E & DL716

1 DIGITAL SCOPES

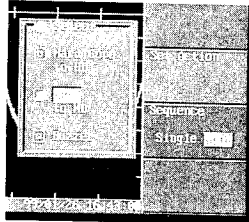
A Wide Range of Trigger Functions (DL708E and DL716)

- The DL708E and DL716 support a wide range of triggers to help you reliably capture the desired waveforms.

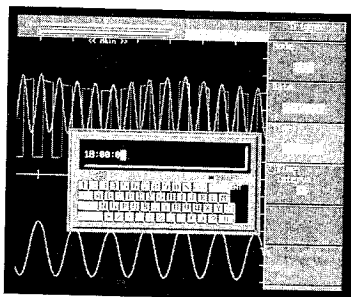
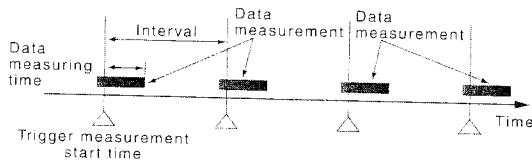


TWO FUNCTIONS TO MAKE TRIGGER FUNCTIONS MORE EFFECTIVE

- Action-on Trigger**
Automatically saves measured data
When the action-on trigger is activated, specified actions is performed each time a waveform is captured and displayed on the screen: The action-on trigger is useful for saving data reliably and automatically (e.g., when collecting data during automated, continuous tests).



- Time Trigger**
Automatically takes measurements at specified times
The time trigger is activated automatically at a specified measurement start time and at specified intervals thereafter. The time trigger function helps you narrow down the times when abnormal data appear during extended continuous tests.

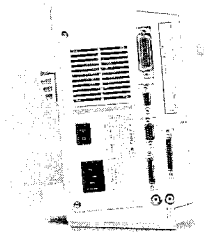


Time Trigger Setting Menu

Connections to Peripheral Devices(DL708E and DL716)

A wide range of interfaces are provided to expand the connectivity of the DL708E and DL716.

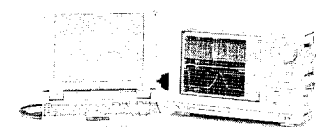
- GP-IB (standard)**
- Centronics Interface (standard)**
This interface allows you to print waveforms on regular external printers. The following printer specifications are supported:
ESC-P (black and white, color)
BJ (black and white, color)
PCL5 (black and white, color)
LIPS3, PR201, ESC-P2 (ESC-P raster: black and white, color)
- 32-bit Extended Logic Input (optional on DL716)**
Extended logic input can be installed in DL716.
- Serial (RS-232) (standard)**
- VGA Output (standard)**
Connect an external monitor to the VGA output port to display waveforms on it.
- SCSI Interface (standard on DL716, optional on DL708E)**
The SCSI interface lets you save waveform data and panel settings to external hard drives, ZIP drives, and MO drives. If your DL708E or DL716 has an internal hard drive (optional), you can connect it to a PC via a SCSI cable. This allows you to access the internal hard drive directly from the PC, making it easy to transfer data files by dragging and dropping them with your PC's mouse.
- Ethernet (Optional only DL716)**



DL708E side

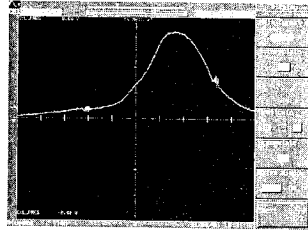


DL716 side



● **External Clock Input (standard on DL716, optional on DL708E)**

This port lets you input an external sampling clock signal for data sampling proportionate to the variable speed of a rotating system. (Example of cylinder-internal fuel pressure waveform in auto engine using external clock)



The external clock input feature cannot be used with the following modules: 701855, 701856.

● **Trigger I/O (standard)**

Use the trigger I/O port if you want to use an external signal as a trigger (trigger input) or to activate an external device using a trigger signal from the DL708E or DL716 (trigger output).

● **GO-NO GO Evaluation Output (standard on DL716)**

The waveform judgment of the GO-NO GO function is output as a TTL level signal through this port.

MAIN UNIT SPECIFICATIONS

Basic Specifications

•Input	
Type	Plug-in module (each unit has a built-in A/D converter)
Number of slots	8 (DL708E) ,16 (DL716)
Different modules can be used in combination with each other.	
•Horizontal	
Maximum record length (DL708E using two channels)	400 k words (standard) 4 M words (with /M1 option) 8 M words (with /M2 option) 16 M words (with /M3 option)
(DL716 using four channels)	1 M word (standard) 8 M words (with /M1 option) 32 M words (with /M2 option) 64 M words (with /M3 option)
Time-axis accuracy	±0.005%
Sweep time	
100 k words/channel model:	500 ns/div to 50,000 s/div (1/2/5 steps)
Other models:	500 ns/div to 100,000 s/div (1/2/5 steps)
•Acquisition Modes	
Normal	Maximum sampling rate: 10 MS/s
Envelope	Holds peak values at maximum sampling rate, regardless of Time/div.
Box average	Increases resolution of A/D converter to a maximum of four bits.
History memory	Holds the past 1000 screenshots
Sequential store	Specity between 2 and 1000 storage operations.
Roll	Works at maximum sampling rate of 100 kS/s (DL708E) or 200 kS/s (DL716).
•Triggers	
Modes	AUTO, AUTO-LEVEL, NORMAL, TIME
Pretrigger	0% to 100% (in 1% steps)
Sources	INT (1 to 8 channels for DL708E, 1 to 16 channels and LOGIC1, LOGIC2 for DL716), EXT, LINE
Slopes	Rise, Fall, Both
Types	Edge trigger, event/pattern trigger, A → B (n), A Delay B, Edge on A, Pulse Width Trigger, B > Time, B < Time, B Timeout, window trigger, OR trigger
* When you select LOGIC1, LOGIC2 or EXT as trigger source, only edge trigger is available.	
Time trigger	The measurement-start time and intervals can be specified.
•Screen Refresh Rate	
Using 1 channel	Maximum 30 Hz
Using 8 channels	Maximum 20 Hz (DL708E) Maximum 15 Hz (DL716)
Using 16 channels	Maximum 10 Hz (DL716)

Display

Display	10.4-inch TFT color LCD
Screen size	211.2 mm (W) × 158.4 mm (L)
Total number of pixels	640 × 480 (The LCD may contain approximately 0.02% defects among all the pixels in the screen.)
Number of waveform display pixels	501 × 432
Display modes	Split: Single, Dual, Quad, Hexa, Octal Zoom: Main, Main & Z1, Main & Z1 & Z2, Z1 only, Main & Z2, Z2 only, Z1 & Z2 (Z1 and Z2 are abbreviations for zoom areas 1 and 2, respectively) X-Y: TY, XY, TY & XY
Accumulation display	PERSIST: Accumulation in one color COLOR: Infinite accumulation in eight colors representing different levels of data frequency
Maximum number of displayed traces	DL708E: 24 traces (during zooming: 8 captured waveforms + 16 enlarged waveforms) DL716: 48 traces (during zooming: 16 captured waveforms + 32 enlarged waveforms)
X-Y display	DL708E: Any one of the following can be specified for the X-axis: CH1-CH8, MATH1, MATH2. DL716: Any one of the following can be selected for the X-axis: CH1-CH16, MATH1-MATH8. (The rest of the above are simultaneously displayed on the Y-axis.)

Recorder

•Built-in Printer	
Printing method	Thermal line-dot printing
Dot density	8 dots/mm
Paper width	112 mm
Effective recording width	104 mm
Recording speed	Maximum 20 mm/s
Real-time recording	Can be used on a time axis slower than 500 ms/div.
•Real-time Hard Drive Recording	
(The optional internal HDD is required to use this function.)	
Data capacity	DL708E: Maximum 128 M words DL716: Maximum 512 M words
Maximum time-axis	1 s/div
Maximum sampling rate	DL708E: 10 kS/s (using 8 channels simultaneously) 100 kS/s (using one channel only) DL716: 20 kS/s (using 16 channels simultaneously) 200 kS/s (using one or two channels)
Restriction	This function cannot be used in combination with real-time printing, average, or sequential store.

Inter-channel Computation

Record length used for calculations	DL708E: Maximum 100 k words (using MATH1 only) Maximum 50 k words (using MATH1 and MATH2 simultaneously) DL716: Maximum 400 k words (using MATH1 and MATH2 simultaneously) Maximum 100 k words (using MATH1 through MATH8 simultaneously)
Maximum number of free definable calculation waveforms	DL708E: NA (standard) DL716 : 2 (MATH1 and MATH2; with/G2 option) 8 (MATH1 through MATH8; with /G2 option)

DL708E & DL716

1

DIGITAL SCOPES

•Standard
Operations Addition, subtraction, multiplication, FFT, and phase shift

FFT
Type Power spectrum (PS)
Number of points 1000, 2000, 10,000 (using MATH1 only: DL708E, using MATH1 and 2: DL716)
Window functions Rectangular, Hanning, Flat-Top
Start-point setting capability Possible

•User define math function (optional)
Operations Addition, subtraction, multiplication, division, ABS, SQRT, LOG, EXP, trigonometric functions, moving averages, differentials, integrals

FFT
Types PS, LS, RS, PSD, CS, CH, TF
Number of points 1000, 2000, 10,000 (using MATH1 only: DL708E, using MATH1 to 8: DL716)
Window functions Rectangular, Hanning, Flat-Top
Start-point setting capability Yes

Waveform Measurement Functions

•Cursors
Types
Marker Two markers
Horizontal Two horizontal cursors
Vertical Two vertical cursors
H&V Two horizontal and two vertical cursors
User def Cursor measurement on the horizontal axis is displayed in a unit set by the user.
Cursor measurements A marker is moved over the data, and the time and numerical value (corresponding to the measurement or calculation at the marker position) are displayed. Cursors other than markers are moved over the screen, and data on the screen are measured. Therefore, the resolution of such measurements depends on the screen resolution.

•Automatic Measurement of Waveform Parameters
Waveform parameters falling in a range set by cursors are measured.
Maximum number of measured parameters

DL708E: 8 (parameters can be set with respect to any number of pieces of data, but the total number of parameters must be 8 or less)

DL716: 16 (parameters can be set with respect to any number of pieces of data, but the total number of parameters must be 16 or less)

Measured items P-P (Peak to Peak value), Max (maximum value), Min (minimum value), High (most frequent high voltage value), Low (most frequent low voltage value), Avg (average value), Rms (root mean square), +Ovr (overshoot), -Ovr (undershoot), Rise (rise time), Fall (fall time), Freq (frequency), Period, +duty (High duty ratio), -duty (Low duty ratio), +Width (High pulse width), -Width (Low pulse width), Amp (amplitude), StdDev (standard deviation), Int1TY, Int2TY (area calculated TY), Int1XY, Int2XY (area calculated XY), Fdelay (time from trigger point to falling edge), Rdelay (time from trigger point to rising edge), Hist (voltage-axis histogram display)

•GO-NO GO judgment (DL716)
Parameter evaluation: Evaluation can be made using a combination of 16 parameters.

•Snapshot
This function lets you keep the currently displayed waveform on the screen as a snapshot.

Screen Data Output and Saving (Copying) Functions

•Output to built-in printer
Formats
Normal Outputs a hard copy of the screenshot.
Long*n Outputs the displayed waveform enlarged by a specified magnification n.
Supported magnifications (n values): X2, X5, X10, X20, X50
Split Sequential output of multiple traces (one at a time) to fill the entire paper width. (Use this format to output individual waveforms in a larger size when using multiple channels.)

•Output to GPIB interface, serial (RS-232) interface, floppy disk, internal HDD, external SCSI device
Formats HPGL, ThinkJet, PostScript, TIFF (black and white), TIFF (color), BMP (black and white), BMP (color)

•Output to Centronics interface
Formats ESC-P (black and white), ESC-P (color), BJ (black and white), BJ (color), LIPS, PR201, PCL5 (black and white), PCL5 (color), ESC-P2(ESC-P raster:Black and White), ESC-P2(color), (output covering several pages is supported)

Other Functions

•Keyboard function (DL716)
Assigns numerical keys to match the channel keys on the panel, enabling numerical input.

•Key protect function (DL716)
Locks the panel keys to prevent accidental entry.

•Backlight off function (DL716)
Allows the LCD backlight to be turned on and off.

External I/O

•Trig-IN/Trig-OUT
Connector type DL708E: RCA pin jack; DL716: BNC
I/O levels DL708E: CMOS level
DL716: CMOS level (Trig-OUT), TTL level (Trig-IN)

•EXT clock IN (optional on DL708E, standard on DL716)
Connector type DL708E: RCA pin jack (also used as Trig-OUT)
DL716: BNC
Input level DL708E: CMOS level
DL716: TTL level

Maximum input frequency 100 kHz
*This function cannot be used with 701855, 701856 modules.

•VGA video signal output
Connector type D-Sub 15-pin (VGA VIDEO OUT)
Output type VGA compatible

•GP-IB interface
Electrical and mechanical specifications
Functional specifications Conforms to IEEE std. 488-1978 (JIS C 1901-1987)
SH1, AH1, T5, L4, SR1, RL1, PP0, DC1, DT0, C0
Protocol Conforms to IEEE std. 488.2 1987.

•Serial (RS-232) interface
Connector type D-Sub 9-pin
Standard Conforms to EIA RS-232.
Baud rates 1200, 2400, 4800, 9600, 19200 bps

•Centronics interface
Connector type DL708E: Half-pitch 36-pin connector
DL716: Centronics connector (25-pin D-sub) compatible with IBM/PC
Standard Conforms to Centronics.

•SCSI interface (optional on DL708E, standard on DL716)
(Note: Standard on DL708E systems with the optional 2.1-GB internal hard drive.
Standard SCSI (Small Computer System Interface), ANS X3.131-1986
Connector type Half-pitch 50-pin (pin type)
Connector pin assignment Unbalanced (single-end)
Supported SCSI devices and conditions
HD drive: Drive formattable by the EZ-SCSI
MO drive: Up to 640MB type which is formattable by the EZ-SCSI
Zip drive: Iomega Zip drive compatible

•HP-GL Plotter Output (both GPIB and RS-232 interfaces)

•GO-NO GO Judgment Output (DL716.)
Connector type Modular jack
Output level TTL level

DL716 Ethernet Connectivity Option (/C10)

Transmission method: Ethernet (10Base-T)
Transmission rate: 10 Mbps
Communication protocol: TCP/IP
Number of ports: 1
Services supported: FTP server, FTP client, LPR (network printing), SMT (automatic e-mail transmission), DHCP, DNS
Software verifying FTP server operation*: Serv-U 2.5a (for Windows 95/98)
Software verifying FTP client operation*: Ws .ftp Limited Edition 4.00 (for Windows 95/98)
Files that can be transferred: DL716's measured data files (waveform data files, setup file, ASCII files, etc.) and display image files (BMP, TIF, etc.)
Electric and mechanical specifications: In compliance with IEEE802.3
Connector: RJ-45

Interface board (card) required on PC:

Board or card compatible with 10Base-T Ethernet connection

*Yokogawa does not guarantee the operation of these software titles.

32-bit extended logic input (Optional on DL716.)

Number of inputs	32 (8 bits × 4)
Connector type	Half-pitch 26-pin connector × 4
Maximum record length	200 k words × 32 bits (standard models) 2 M words × 32 bits (models with "M1" option) 8 M words × 32 bits (models with "M2" option) 16 M words × 32 bits (models with "M3" option)
Maximum sampling rate	10 MS/s
Compatible probes	700986, 700987

External Media

Internal floppy drive

Number of drives	1
Size	3.5 inches
Capacity	640 KB, 720 KB, 1.2 MB, 1.44 MB (MS-DOS format)

Internal hard disk drive (optional)

Number of drives	1
Size	3.5 inches
Capacity	2.1 GB (SCSI drive for DL708E), 9.2 GB (SCSI drive for DL716)
Windows compatibility	The internal hard disk drive can be connected to a PC running Windows 95, Windows98 or Windows NT via the SCSI interface.

General Specifications

Reference Operating Conditions

Ambient temperature	23 ±5°C
Ambient humidity	55 ±10% RH
Supply voltage and frequency tolerance	±1% of rating Allow the system to warm up for at least 30 minutes before calibrating it.

Storage temperature range	-20 to 60°C
Storage humidity range	20 to 85% RH (no condensation)
Operating temperature range	5 to 40°C
Operating humidity range	20 to 85% RH when not using printer 35 to 85% RH when using printer

Rated supply voltage	100 to 120 V AC (100-V power supply; for DL708E) Automatic switching between 100 to 120 V AC and 200 to 240 V AC (DL716)
----------------------	---

Rated supply frequency	50/60 Hz
------------------------	----------

Allowable supply voltage range	90 to 132 V AC (100 V power supply), 180 to 264 V AC (200 V power supply)
--------------------------------	--

Allowable fluctuation in supply frequency	48 to 63 Hz
---	-------------

Maximum power consumption	250 VA (DL708E, DL716)
---------------------------	------------------------

Withstand voltage	1500 V AC for one minute (between power supply and ground)
-------------------	--

Insulation resistance	Minimum 10 MΩ at 500 V DC (between power supply and ground)
-----------------------	---

External dimensions

DL708E:	Approximately 370 mm (W) × 260 mm (H) × 183 mm (D) (excluding handle and projections)
---------	--

DL716:	Approximately 355 mm (W) × 260 mm (H) × 305 mm (D) (excluding handle and projections)
--------	--

Weight	DL708E: Approximately 6.8 kg (including 8-channel high-speed isolation module) or 5.3 kg (main unit only)
--------	---

DL716:	Approximately 12.4 kg (including 16-channel high-speed isolation module) or 9.2 kg (main unit only)
--------	---

INPUT PLUG-IN MODULE SPECIFICATIONS

High-speed Isolation Module (with 12-bit A/D resolution) (701855)

Number of input channels	1
Input couplings	DC, AC, GND
A/D conversion resolution	12 bits (maximum 16 bits with box average on)
Maximum sampling rate	10 MS/s
Input type	Isolated unbalanced
Frequency band (-3 dB)**	DC to 1 MHz
Input range (8 div/display)	In combination with 700929 probe 200 V/div to 50 mV/div (1/2/5 steps) Main unit alone 20 V/div to 5 mV/div (1/2/5 steps)
Maximum input voltage (1 kHz or less)	In combination with 700929 probe (between tip H and L*) 850 V (DC + AC peak) (CAT I & II, 600 Vrms) Main unit only (between H and L*) 250 V (DC + AC peak) (CAT I & II, 177 Vrms)
Maximum allowable in-phase voltage	In combination with 700929 probe (between probe tip H or L and case ground*) 400 Vrms (CAT I & II) Main unit only (between signal L and case ground*) 42 V (DC + AC peak) (1 kHz or less) (CAT I & II, 30 Vrms)
DC accuracy** (20 V/div to 10 mV/div) (main unit only)	±(1.5% of 8 div + offset voltage accuracy)
Offset voltage accuracy**	±(0.04% of offset voltage range + 1% of setting)
Input impedance	1 MΩ ±1% (approximately 30 pF)
Connector type	Isolated BNC connector
Input filters	OFF, 500 kHz, 50 kHz, 5 kHz, 500 Hz

High-speed Module (with 12-bit A/D resolution) (701856)

Number of input channels	1
Input couplings	DC, AC, GND
A/D conversion resolution	12 bits (maximum 16 bits with box average on)
Maximum sampling rate	10 MS/s
Input type	Nonisolated unbalanced
Frequency band (-3 dB)**	DC to 4 MHz
Input range (8 div/display)	20 V/div to 5 mV/div (1/2/5 steps)
Maximum input voltage (1 kHz or less)	250 V (DC + AC peak) (CAT I & II, 177 Vrms)
DC accuracy**	20 V/div to 20 mV/div ±(1.2% of 8 div + offset voltage accuracy)
Offset voltage accuracy**	±(0.04% of offset voltage range + 1% of setting)
Input impedance	1 MΩ ±1% (approximately 30 pF)
Connector type	BNC connector
Input filters	OFF, 500kHz, 50kHz, 5kHz, 500Hz

High-resolution High-voltage Isolation Module (701852)

Number of input channels	1
Input couplings	DC, AC, GND
A/D conversion resolution	16 bits
Maximum sampling rate	100 kS/s
Input type	Isolated unbalanced
Frequency band (-3 dB)**	DC to 40 kHz (200 V/div to 100 mV/div) DC to 30 kHz (50 mV/div)
Input range (8 div/display)	200 V/div to 50 mV/div (1/2/5 steps)
Maximum input voltage (1 kHz or less)(between signal H and L*)	850 V (DC + AC peak) (CAT I & II, 600 Vrms)
Maximum allowable in-phase voltage (between signal H or L and case ground**)	400 Vrms (CAT I & II)
DC accuracy** *± (excluding when input filter is set to Auto)	200 V/div to 100 mV/div ±(0.5% of 8 div) 50 mV/div ±(1% of 8 div)
Input impedance	1 MΩ ±1%
Connector type	Safety connector (banana plug)
CMRR	80 dB (50/60 Hz) or higher
Temperature coefficient (excluding when input filter is set to Auto)	Zero point ±(0.02% of 8 div)/°C Gain ±(0.02% of 8 div)/°C
Input filters (LPF)	OFF, Auto, 4 kHz, 400 Hz, 40 Hz
FFT anti-aliasing filter	OFF, 40 kHz to 20 Hz

High-resolution Isolation Module (701853)

Number of input channels	1
Input couplings	DC, AC, GND
A/D conversion resolution	16 bits
Maximum sampling rate	100 kS/s
Input type	Isolated unbalanced
Frequency band (-3 dB)**	DC to 40 kHz (20 V/div to 10 mV/div) DC to 30 kHz (5 mV/div)



DIGITAL SCORES

DL708E & DL716

1
DIGITAL SCORES

Input range (8 div/display)	20 V/div to 5 mV/div (1/2/5 steps)
Maximum input voltage (1 kHz or less)(between signal H and L**)	100 V (DC + AC peak) (CAT I & II, 70 Vrms)
Maximum allowable in-phase voltage (between signal H or L and case ground**10)	400 Vrms (CAT I & II)
DC accuracy** 112 (excluding when input filter is set to Auto)	
20 V/div to 20 mV/div	±(0.3% of 8 div)
10 mV/div	±(0.5% of 8 div)
5 mV/div	±(1% of 8 div)
Input impedance	1 MΩ ±1%
Connector type	Safety connector (banana plug)
CMRR	80 dB (50/60 Hz) or higher
Temperature coefficient (excluding when input filter is set to Auto)	
Zero point	±(0.02% of 8 div)/°C
Gain	±(0.02% of 8 div)/°C
Input filters (LPF)	OFF, Auto, 4 kHz, 400 Hz, 40 Hz
FFT anti-aliasing filter	OFF, 40 kHz to 20 Hz

Temperature Module (701860)

Number of input channels	1
Data updating rate	Approximately 135 Hz
Input type	Isolated unbalanced
Applicable sensor	Thermocouple
Measurement range/accuracy** 111	

Type	Measurement range	Accuracy
K	-200 to 1300°C	±(0.2% of reading + 1.5°C)
E	-200 to 800°C	except: -200 to 0°C : ±(0.5% of reading ± 1.5°C)
J	-200 to 1100°C	
T	-200 to 400°C	
L	-200 to 900°C	
U	-200 to 400°C	
N	0 to 1300°C	
R	0 to 1700°C	±(0.2% of reading + 3°C)
S	0 to 1700°C	except: 0 to 200°C : 8°C 200 to 800°C ± 5°C
B	400 to 1800°C	±(0.2% of reading + 4°C) except: 400 to 700°C : ± 8°C
W	0 to 2300°C	±(0.2% of reading + 3°C)
KP vs Au7Fe	0 to 300K	0 to 50K : ± 8.0K 50 to 300K : ± 4.5K

Maximum input voltage (1 kHz or less) (between signal H and L)	42 V (DC + AC peak) (CAT I & II, 30 Vrms)
Maximum allowable in-phase voltage (1 kHz or less) (between signal H or L and case ground)	42 V (DC + AC peak) (CAT I & II, 30 Vrms)
Input connector	Binding post
Input impedance	Approximately 1 MΩ
Vertical resolution	0.1°C
Temperature coefficient	±(0.02% of FS)/°C
Reference junction compensation accuracy (when input terminal temperature is balanced)	±1°C (K, E, J, T, L, U, N) ±1.5°C (R, S, B, W) ±1K (KP vs Au7Fe)
Input filters	OFF, 2 Hz, 8 Hz

Logic Input Module (701870)

Number of inputs	16 (8 bits × 2)
Maximum sampling rate	10 MS/s (response speed depends on the response time of the logic probe)
Compatible probes	700986, 700987

High-speed Logic Probe (700986)

Number of inputs	8
Input type	Nonisolated (common ground for all bits; logic module and bits share common ground)
Maximum input voltage (1 kHz or less) (between probe tip and case ground)	42 V (DC + AC peak) (CAT I & II, 30 Vrms)
Response time	1 μs or less
Input impedance	Approx. 100 kΩ
Threshold level	Approx. 1.4 V

Isolation Logic Probe (700987)*13

Number of inputs	8
Input type	Isolated (all individual bits are isolated)
Input connector	Safety connector (banana plug) × 8

Input switching capability	AC/DC input switching for each bit
Input signal display	H/L for each bit can be checked on LEDs
Applicable input ranges	
DC input:	H/L detection for 10 V DC to 250 V DC
AC input:	H/L detection (50/60 Hz) for 80 V AC to 250 V AC
Threshold levels	
DC input:	6 V DC ±50%
AC input:	50 V AC ±50%
Response times	
DC input:	1 ms or less
AC input:	20 ms or less
Maximum input voltage (1 kHz or less) (between H and L of each bit)	250 Vrms*12 (CAT I & II)
Maximum allowable in-phase voltage (1 kHz or less) (between H or L of each bit and ground)	250 Vrms*12 (CAT I & II)
Maximum allowable voltage between bits	250 Vrms*12 (CAT I & II)
Insulating resistance	Approx. 100 kΩ

Strain Module (701880)

Number of input channels	1
Input types	DC bridge input (automatic balancing), balanced differential input, DC amplifier (floating)
Used gauge resistance	120-1000Ω
Gauge rate	1.90-2.20 (variable in steps of 0.01)

Measurement range	Measurable range (FS)	Accuracy** 114
1000 × 10 ⁻⁶ strain	±1000 × 10 ⁻⁶ strain	±1% of FS ±40 × 10 ⁻⁶ strain
2000 × 10 ⁻⁶ strain	±2000 × 10 ⁻⁶ strain	±1% of FS ±40 × 10 ⁻⁶ strain
5000 × 10 ⁻⁶ strain	±5000 × 10 ⁻⁶ strain	±1% of FS ±40 × 10 ⁻⁶ strain
10000 × 10 ⁻⁶ strain	±10000 × 10 ⁻⁶ strain	±1% of FS ±40 × 10 ⁻⁶ strain
20000 × 10 ⁻⁶ strain	±20000 × 10 ⁻⁶ strain	±1% of FS ±40 × 10 ⁻⁶ strain

Bridge voltages	2 V, 5 V DC (variable)**
Automatic balancing method	Electronic auto-balancing
Automatic balancing range	±10000 × 10 ⁻⁶ strain
Maximum allowable input voltage	5 V (DC + AC peak)
Input resistance	10 MΩ or higher
Frequency band	DC to 20 kHz (-3 dB)**
Temperature coefficients	
Zero point	±5 × 10 ⁻⁶ strain/°C (input-converted; after auto-calibration)
Gain	±(0.05% of FS)/°C (after auto-calibration)
Internal filter	Low-pass filter; can be turned ON/OFF.
Cutoff frequencies	10 Hz, 100 Hz, 1 kHz
Cutoff characteristic	-12 dB/oct
A/D resolution	14 bits
Maximum sampling rate	100 kS/s
Maximum allowable in-phase voltage	42 V (DC + AC peak) (CAT I & II; 30 Vrms)
CMRR	Minimum 80 dB (50/60 Hz, signal source resistance of 1 kΩ)
Input connector	NDIS standard
Bridge resistance	External
Recommended bridge heads	700932 (bridge resistance of 120 Ω) 700933 (bridge resistance of 350 Ω)
Included accessory	Cable connector (A1002JC)
Weight	Approx. 200 g

Caution! Only connect a strain measurement bridge (bridge head) or strain gauge converter.

Bridge Head (700932, for 701880)

Bridge resistance:	120 Ω
Wiring type	1 gauge / 1 gauge 3 wire / 2 gauge (neighbor side) / 2 gauge (opposite side) / 2 gauge 3 wire (opposite side) / 4 gauge
External dimension	Approx. 37 mm (W) × 97 mm (H) × 30 mm (D)
Weight	Approx. 85 g (main unit only)
Included accessory	NDIS cable (5 m)

Bridge Head (700933, for 701880)

Bridge resistance:	350 Ω
Wiring type	1 gauge / 1 gauge 3 wire / 2 gauge (neighbor side) / 2 gauge (opposite side) / 2 gauge 3 wire (opposite side) / 4 gauge
External dimensions	Approx. 37 mm (W) × 97 mm (H) × 30 mm (D)
Weight	Approx. 85 g (main unit only)
Included accessory	NDIS cable (5 m)

DL708E & DL716

Strain module (with shunt cal) (701885)

Number of input channels	1
Input types	DC bridge input (automatic balancing), balanced differential input, DC amplifier (floating)
Used gauge resistances	120-1000 Ω (bridge voltage of 2 V DC) 350-1000 Ω (bridge voltages of 5 V, 10 V DC)
Gauge rate	1.90-2.20 (variable in steps of 0.01)

Measurement Ranges and Accuracy

Measurement range	Measurable range (FS)	Accuracy ^{*1} ^{**2}
1000×10^{-6} strain	$\pm 1000 \times 10^{-6}$ strain	$\pm 1\%$ of FS $\pm 40 \times 10^{-6}$ strain
2000×10^{-6} strain	$\pm 2000 \times 10^{-6}$ strain	$\pm 1\%$ of FS $\pm 40 \times 10^{-6}$ strain
5000×10^{-6} strain	$\pm 5000 \times 10^{-6}$ strain	$\pm 1\%$ of FS $\pm 40 \times 10^{-6}$ strain
10000×10^{-6} strain	$\pm 10000 \times 10^{-6}$ strain	$\pm 1\%$ of FS $\pm 40 \times 10^{-6}$ strain
20000×10^{-6} strain	$\pm 20000 \times 10^{-6}$ strain	$\pm 1\%$ of FS $\pm 40 \times 10^{-6}$ strain

Bridge voltages	2 V, 5 V, 10 V DC (variable) ^{*1}
Automatic balancing method	Electronic auto-balance
Automatic balancing range	$\pm 10000 \times 10^{-6}$ strain
Maximum allowable input voltage	10 V (DC + AC peak)
Input resistance	Minimum 10 M Ω
Frequency band	DC to 20 kHz (-3 dB) ^{*1}
Temperature coefficients	
Zero point	$\pm 5 \times 10^{-6}$ strain/ $^{\circ}$ C (input-converted; after auto-calibration)
Gain	$\pm (0.05\%$ of FS) $^{\circ}$ C (after auto-calibration)
Internal filter	Low-pass filter; can be turned ON/OFF.
Cutoff frequencies	10 Hz, 100 Hz, 1 kHz, 4 kHz
Cutoff characteristic	-12 dB/oct
A/D resolution	14 bits
Maximum sampling rate	100 kS/s
Maximum allowable in-phase voltage	42 V (DC + AC peak) (CAT I & II, 30 Vrms)
CMRR	Minimum 80 dB (50/60 Hz, signal source resistance of 1 k Ω)
Input connector	D-Sub 9-pin
Bridge resistance	External
Recommended bridge head	700967 (bridge resistance of 120 Ω) 700968 (bridge resistance of 350 Ω)
Weight	Approx. 200 g

Caution! Only connect a strain measurement bridge (bridge head) or strain gauge converter.

Bridge Head (700967, for 701885)

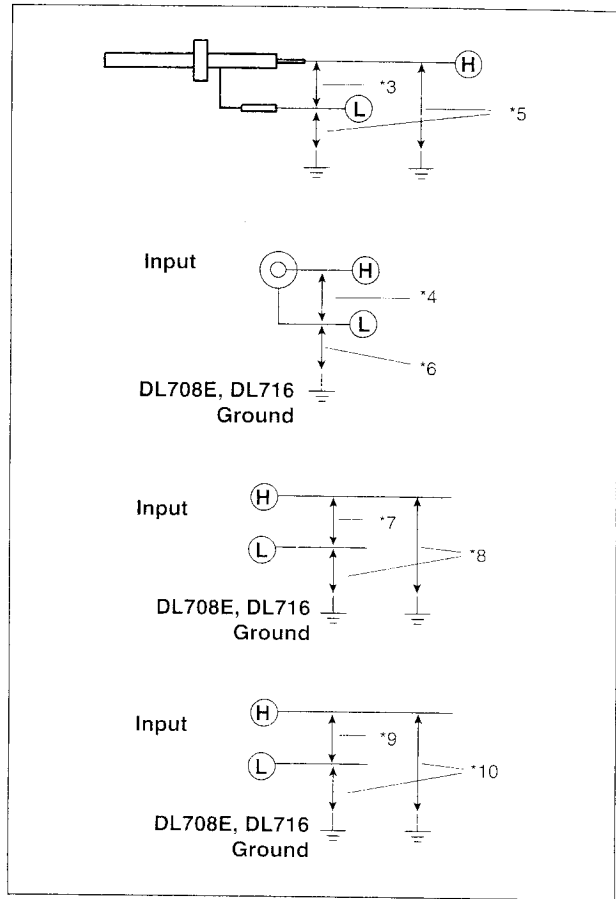
Gauge resistance	120 Ω
Wiring type	1 gauge / 1 gauge 3 wire / 2 gauge (neighbor side) / 2 gauge (opposite side) / 2 gauge 3 wire (opposite side) / 4 gauge
External dimension	Approx. 50 mm (W) \times 104 mm (H) \times 29 mm (D)
Weight	Approx. 100 g (main unit only)
Included accessory	D-Sub 9-pin cable (5 m)

Bridge Head (700968, for 701885)

Gauge resistance	350 Ω
Wiring type	1 gauge / 1 gauge 3 wire / 2 gauge (neighbor side) / 2 gauge (opposite side) / 2 gauge 3 wire (opposite side) / 4 gauge
External dimension	Approx. 50 mm (W) \times 104 mm (H) \times 29 mm (D)
Weight	Approx. 100 g (main unit only)
Included accessory	D-Sub 9-pin cable (5 m)

*1 Under reference operating conditions

*2 At position center



*11 Excludes reference set temperature compensation accuracy.

*12 AC Peak voltage must not exceed 353 V, and DC voltage must not exceed 250 V.

*13 Excludes measurement leads. For signal measurements, 366961 (up to 42 V), or 758917 and either 758922 or 758929 is required.

*14 Gauge rate is 2 (accuracy for strain module only).