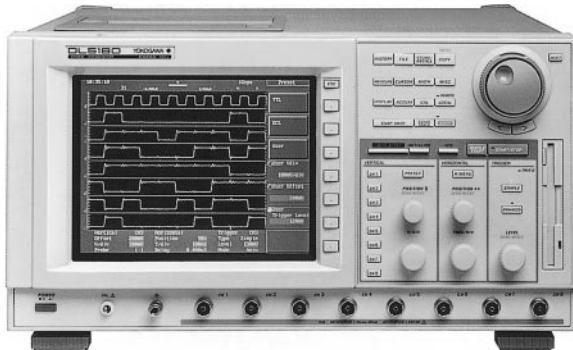


## 7005 Digital Oscilloscopes DL5140 & DL5180



**DL5180 (7005 80)**  
426 × 221 × 425mm 19kg  
(16-13/16 × 8-11/16 × 16-3/4" 41.9 lbs)



YOKOGAWA DL5140 (4-channel) and DL5180 (8-channel) digital oscilloscopes keep pace with advancing technology to bring you the full power of high-speed digital sampling with all the features and flexibility of a general purpose oscilloscope.

The DL5140 and DL5180 let you enjoy the benefits of a 1 GS/s per channel sampling rate and sophisticated color displays along with the familiar operating feel of a general-purpose oscilloscope.

### ■ DL5140 – FOUR 1 GS/S CHANNELS

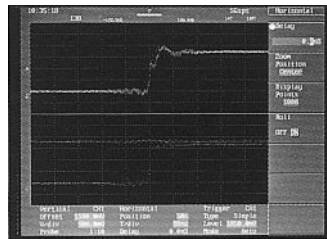
With four channels at 1 GS/s sampling rate, the DL5140 500 MHz digital oscilloscope is designed for engineers whose needs cannot be satisfied by general-purpose digital oscilloscopes or analog oscilloscopes. Despite its power, however, it is as easy to operate as an analog oscilloscope, with individual front panel knobs for vertical axis, time axis, and trigger settings that will make analog scope users feel right at home.

### ■ DL5180 – EIGHT 1 GS/S CHANNELS

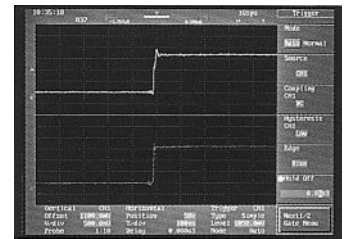
With a full eight input channels, each with its own 1 GS/s A/D converter, the DL5180 is ideal for digital circuit analysis. It simply blasts away the major bottleneck – too few input channels – that has always hindered use of digital oscilloscopes for this task. It offers you an abundant variety of triggering capabilities so essential for digital circuit logic and timing checks. Yet being a true oscilloscope, it tells you much more than logic analyzers which give you only 1's and 0's as waveform information. The DL5180 lets you do everything from the final stages of logic checkout on through investigations of analog problems, such as ground bounce and transmission-line effects with a single instrument.

### ● 1 GS/s A/D converters reveal exact relationships among complex signals

To let you see exact, detailed relationships among fast, complex signals, we worked directly with a semiconductor vendor to develop the 1 GS/s A/D converters used in the DL5140/DL5180. Being able to sample up to 1 GS/s per channel on all channels at once raises the time axis resolution high enough for high-speed circuit analysis without going into the realm of equivalent-time sampling.



Measurement with equivalent-time time

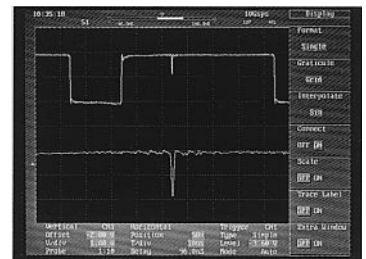


Same measurement with 1 GS/s real-time sampling

### ● DC to 500 MHz wide-band input amplifiers for repeatable glitch capture

The vertical-axis amplifiers permit selection of input options well-matched to the measurement needs of a variety of analog and high-speed digital circuit types. The DL5140/DL5180 design recognizes that no matter how broad the bandwidth of the oscilloscope itself, probing effects can render that bandwidth useless.

Indeed, Yokogawa developed the vertical axis amplifier, dedicated FET probe, dedicated passive probe, and 50Ω and 1 MΩ BNC conversion adapters all together as a matched set. The dedicated FET probe drastically reduces probing effects so that measurements can be made to the full bandwidth of the DL5140/DL5180. Moreover, offset adjustments can be made directly with the vertical axis controls even when using the dedicated FET probe. Adapters are provided in the accessories to enable input through regular BNC connectors as well.



## FEATURES

### ● 1 GS/s (per channel) 500 MHz

#### High-speed general-purpose color digital oscilloscopes DL5140/DL5180

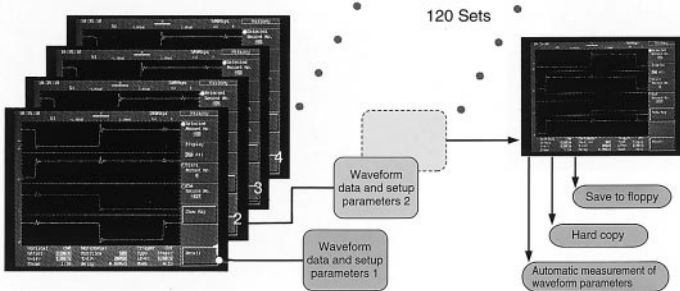
Model	Input channels	Sampling rate	Equivalent sampling rate	Record length	Frequency bandwidth	Display	Simple trigger functions	Enhanced trigger functions	Footprint dimensions (mm)	Weight (kg)
DL5140	4 CH	1GSps/CH	50 GS/s	4 kW/CH	500 MHz	640 × 480 dot TFT color LCD	⊙	⊙	approx. 426W × 425D	approx. 17.5 kg
DL5180	8 CH	1GSps/CH	50 GS/s	4 kW/CH	500 MHz	640 × 480 dot TFT color LCD	⊙	⊙	approx. 426W × 425D	approx. 19 kg

Simple trigger functions: Edge triggering; gate triggering from single source

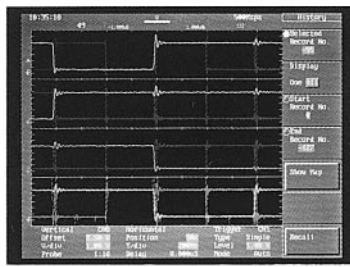
Enhanced trigger functions: Parallel pattern (AND); Edge on A; OR; A→B (n); A delay B; pulse-width triggering (including glitch triggering); Time out triggering/TV triggering (EXT triggering only) (option)

## DL5140 & DL5180

### ● History memory lets you recall waveform data anytime



The DL5140/DL5180 memories retain the waveform data and setup parameters for the current display plus 119 earlier acquisition scans. Even if you are a little late in stopping data acquisition when you finally see the problem you are looking for – not an uncommon occurrence – you can still call it back, even though it is no longer on the screen. Moreover, you can also make automatic parameter measurements on recalled waveforms, save the data to floppy disk, and even display all 120 scans of data on-screen at the same time.



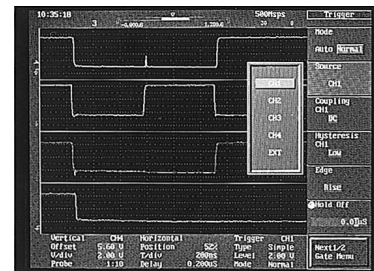
Acquisition Data in "ALL" Mode Display

Since these historical memory functions require no user setup, you never have to worry about them not being on when you need them.

When you use the Single Start function to run acquisition scans one at a time, you have free access to data and setup for any of the last 120 acquisition scans without advance action on your part. This is especially useful when you realize late in a troubleshooting test series that you might have underestimated the importance of something you saw on an earlier scan.

Although the DL5140/DL5180 let you select between 1 K point and 4 K point display modes, they always retain 4 K words of acquisition data per channel. Thus you can select the 1 K point display mode and still switch back to 4 K mode anytime without data loss.

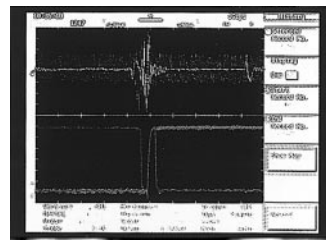
stops. As you continue to press the key, the last 120 scans of acquisition data are preserved in history memory.



Acquisition in single start mode

### ■ SEQUENTIAL STORE FUNCTION

Sequential store mode causes the scope to store acquisition data into the acquisition memory buffers sequentially, one scan at a time each time the sweep is triggered, for up to 120 scans. This is a great timesaver when you have the triggering conditions set to catch some very rare phenomenon, since you can just set this function to capture a specified number of acquisition scans, and go do something else while the scope does the work.



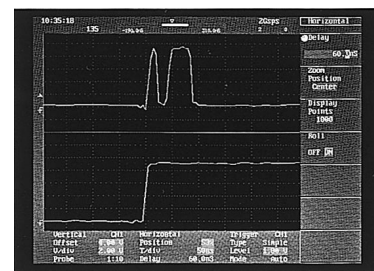
Displaying all data



Displaying individual scans

### ■ ZOOM/SCROLL FUNCTION

The zoom function lets you change range along either the time axis or the voltage axis when acquisition is stopped to expand or shrink the waveform on the screen. Operation is easy – the base point for the zoom function is always the center of the screen. Scrolling is easily done with the position keys.

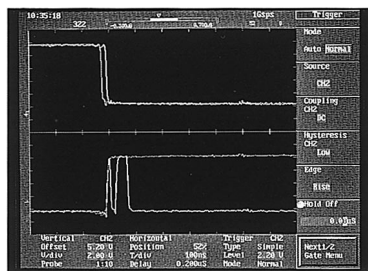


After zoom

## FUNCTIONS

### ■ SNAPSHOT FUNCTION

Pressing the snapshot key once retains the waveform currently on display. This is extremely convenient when probing multiple points on a circuit board one at a time, or when you need to lock a reference waveform on the display quickly and easily.



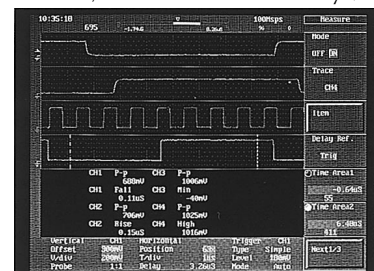
Waveform comparison using snapshots

### ■ SINGLE START FUNCTION

This key lets you run a single acquisition scan with the currently set triggering conditions without going into the setup menus. Each time you press this key, acquisition runs for one scan and

### ■ WAVEFORM PARAMETER AUTO-MEASUREMENT

The auto-measurement function lets you freely select—individually for each channel—any desired set of parameters such as amplitude, rise time, and inter-channel delay (19 types in all) for



Extra-window display

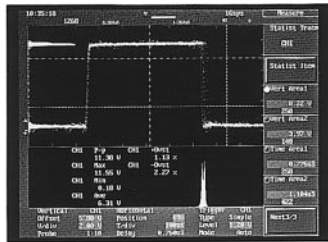
## DL5140 & DL5180

measurement. It also lets you specify, as voltage values, whatever distal, mesial, and proximal lines you want the function to use as criteria for the voltage-axis measurements. What's more, these scopes retain the last 512 sets of measurement results whenever you press the acquisition stop key, and let you save them together to a floppy disk file in ASCII format, ready for easy import into your computer spreadsheets for reporting and further analysis.

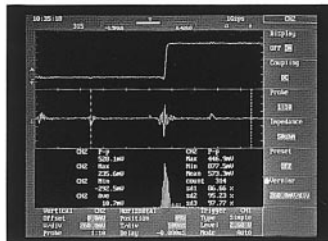
### ■ HISTOGRAM ANALYSIS FUNCTION

**The DL5140/DL5180 give you three different kinds of histogram analysis capability.**

Histogram analysis by a method similar to the color accumulation function, based on the number of times data is written to each individual pixel on the TFT color LCD screen.



Histogram analysis over a specified number of acquisition scans for an item specified with the waveform parameter auto-measurement function.

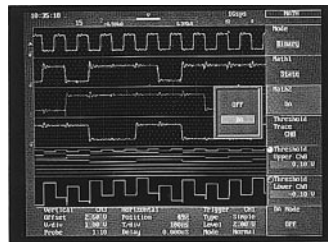


Histogram analysis of the voltage-axis values in each acquisition scan.



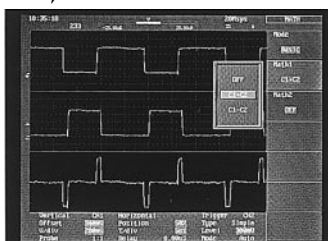
### ■ BINARIZATION FUNCTION / D/A CONVERSION FUNCTION

The binarization function lets you convert the 8-bit measured waveform to a 1/0 bit pattern based on whatever threshold levels you set. The resulting computed bit pattern can be displayed in an extra window, convenient when you wish to check just its timing. There is also a D/A conversion function that will treat the result of the binarization computation as a simulated digital input and convert it to an analog signal.



### ■ INTER-CHANNEL ADD, SUBTRACT, AND MULTIPLY

The input signals on CH2, CH3, and CH4 can be added to or subtracted from CH1, with a phase shift if desired. This is especially useful in differential logic signal observations, where it lets you do simple logic simulations right on the screen. In addition,



Channel addition and subtraction

you can perform inter-channel multiplications such as CH1 x CH2, CH1 x CH3, and CH3 x CH4, enabling comparisons of power dissipation in switching circuits.

### ■ EASY TRIGGER SETUP

The DL5140/DL5180 trigger functions are divided into simple trigger modes and enhanced trigger modes. The former provide edge triggering sufficient for most routine observations. The latter provide modes for analyses of multichannel digital circuits and of high-speed digital signal problems. Each mode group has its own front-panel key, so that you don't have to go through complex menus just to set up a simple edge trigger. Since with ever-higher circuit speeds there are cases where edge triggering alone will not do the job, we have included a single-source gate trigger mode in the simple trigger group. The menus for the simple and enhanced trigger mode groups are shown below.

#### SIMPLE

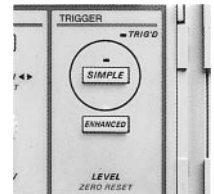
For single-source triggering

##### Edge trigger

Sets a regular edge trigger.

##### Gate trigger

Sets up a single gate ahead of the triggering point; the trigger point is enabled or disabled according to whether or not the signal passes through the gate.



#### ENHANCED

For multi-source triggering

Conditions "A" and "B" are set up as individual parallel (logical AND)

##### A → B(n)

Causes a trigger the n'th time that condition B goes true after condition A has gone true. Up to 100 million events can be set.

##### A delay B

Causes a trigger if condition B goes true after condition A has gone true and an interval at least equal to the delay setting has elapsed (condition B is ignored during the delay time).

##### Edge On A

Enables an edge trigger on another input during the interval when trigger condition A is true.

##### OR

Causes a trigger when any one of the individual channel conditions set with the patterns goes true.

##### B > Time (Pulse Width Trigger)

Causes a trigger when trigger condition B (a pattern) has gone true and remained true for an interval equal to or longer than the set time, and then goes false. Time can be set within the range between 30 ns and 1 s.

##### B < Time (Glitch Trigger)

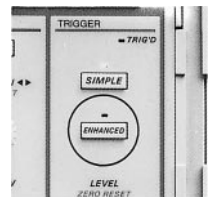
Causes a trigger when trigger condition B (a pattern) goes first true and then false within an interval shorter than the set time. The narrowest usable glitch trigger detection interval is 2 ns.

##### B Time Out

Causes a trigger if trigger condition B (a pattern) goes true and remains true for the time set.

##### TV (option)

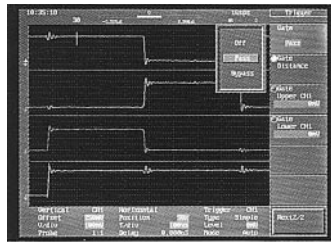
Causes a trigger on a specified raster line of an NTSC, PAL, or HDTV video signal (EXT trigger source only).



## DL5140 & DL5180

### ■ SIMPLE TRIGGER MODES

The DL5140/DL5180 simple trigger modes let you set a trigger on just a single input signal. They differ in this point from the enhanced trigger modes in which triggering conditions are set on patterns of interrelationships among all the input signals. The simple triggering modes include edge triggering and gate triggering. Triggering is enabled or disabled according to whether or not the signal passes through a gate set up ahead of the nominal triggering point. This is very useful, for example, when you want to allow triggering only on an edge preceded by the presence or absence of some expected level.



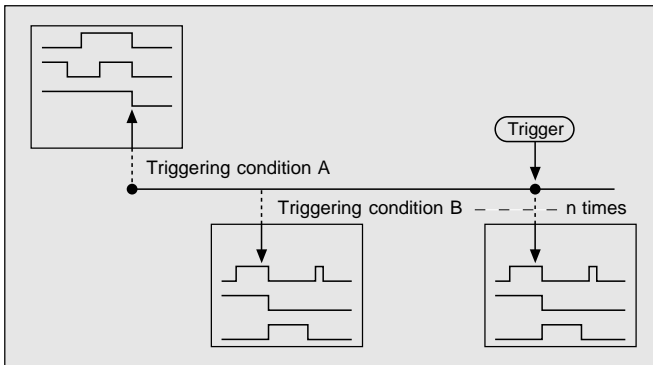
Gate trigger

### ■ ENHANCED TRIGGER MODES

The enhanced trigger modes operate on two triggering conditions "A" and "B", each of which is set up by the user as some input signal pattern combination. These enhanced trigger modes let you use the DL5140/DL5180 as a simple logic analyzer.

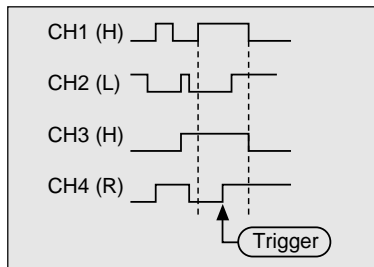
### ■ TRIGGERING ON EVENTS A → B(N)

The trigger occurs on the n'th time that condition B goes true after condition A has gone true. The counter "n" can be set to values up to 100,000,000.



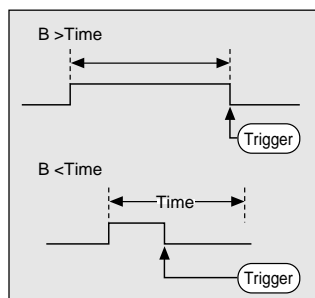
### ■ DETECTING A CLOCK-SYNCHRONIZED PATTERN (STATE) EDGE ON A

The scope will trigger on an edge occurring while a triggering condition A is true. This is useful in memory testing, for example – you can set up an address pattern as condition A, and trigger on the edge of the write signal.



### ■ TRIGGERING ON GLITCHES OR PULSE-WIDTH VARIATIONS B > TIME / B < TIME

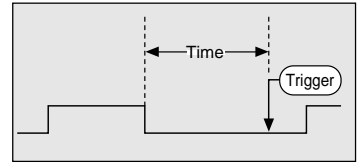
The scope will trigger on the trailing edge of the pattern set up as triggering condition B when that pattern is true for a duration either shorter (for a glitch) or longer (for pulse-width variation) than the time set. The specified time for "B < Time" can be set from 5 ns to



1 s, and for "B > Time" from 30 ns to 1 s. Time setting resolution is 10 ns increments up to 1 μs, and 40 ns increments above 1 μs. Minimum detectable glitch width for "B < Time" is 2 ns.

### ■ TRIGGERING ON MISSING SIGNALS OR DROPOUTS B TIME OUT

The trigger will occur when the pattern of triggering condition B has been true for a duration longer than the time set.



This differs from "B > Time" in that the trigger occurs as soon as the timer times out, rather than waiting for condition B to make a true-to-false transition.

## SPECIFICATIONS

### Vertical

Number of input channels:	8 (DL5180), 4 (DL5140)
Sensitivity:	5 mV/div to 2 V/div (when connecting 700947 50Ω BNC conversion adapter)
DC accuracy:	(When connecting 700947 50Ω BNC conversion adapter) 5 mV/div ±(3% of effective data range + offset voltage accuracy)*1 Others ±(5 % of effective data range + offset voltage accuracy)*1
Vertical resolution:	Effective data range: 7.5 div (+3.75div, -3.75div) 8BIT Equivalent (32LSB/div)
Effective storage frequency	(-3 dB): (when connecting 700947 50Ω BNC conversion adapter) Repetitive mode DC to 500 MHz *2 Normal mode DC to 400 MHz *2
Input coupling:	AC/DC/GND (AC is effective only when connecting 700947/700948 50Ω BNC conversion adapter)
Input impedance:	50Ω (when connecting 700947 50Ω BNC conversion adapter) (1 MΩ input is possible by connecting 700946/700948 1 MΩ BNC conversion adapter.)
Offset range:	(when connecting 700947 50Ω BNC conversion adapter) ±1 V to ±5 V (by setting sensitivity)
Offset voltage accuracy:	±(1% of setting)*1
Maximum input voltage:	(when connecting 700947 50Ω BNC conversion adapter) 10 Vpeak, 5 Vrms (DC coupled), 35 V DC (AC coupled)
Maximum sampling rate:	1 GS/s
Interchannel isolation:	-40 dB (typ) at 100 MHz between the same ranges

### Horizontal

Sweep time:	2 ns/div to 1 s/div
Time axis accuracy:	±(0.01% + 200 ps)*2
Record length:	4 K words/ch

### Trigger

Mode:	AUTO/NORMAL (Corresponding to single with single start key)
Source:	CH1 to CH4, EXT (DL5140)/CH1 to CH8, EXT (DL5180)
Coupling:	AC/DC
External trigger input range:	±1 V
Sensitivity:	CH1 to CH8: DC to 300 MHz, 1 div p-p EXT: DC to 200 MHz, 50 mV p-p, 200 to 300 MHz, 150 mV p-p
Function:	Edge/Gate/A → B(n)/A delay B/Edge on A/OR/B>time/ B-time/B time out/TV (option; EXT triggering only; 20 mV or more synchronizing signal from the reference black level in NTSC/PAL/HDTV) Both A and B are parallel pattern condition.

### Extension functions

Computation:	Addition, subtraction, and multiplication binary coding, pseudo D/A conversion, phase shift
Automatic waveform parameter measurement:	19 items
Statistical processing:	3 kinds
GO/NO-GO function:	Data is output to a printer or an FD, by judging waveform parameters automatically.

# DIGITAL OSCILLOSCOPES & DIGITAL SCOPES



## DL5140 & DL5180

### Display

Display: 640 × 480 dots (TFT color liquid crystal)  
Size: 8.4"

### FD

3.5" one drive incorporated: 640, 720 KB / 1.2, 1.44 MB  
Compatible with MS-DOS format.

### Built-in printer (option)

Printing system: Thermal line dot method  
Dot density: 6 dots/mm  
Paper width: 112 mm

### Communication

GP-IB: Conforms to IEEE St'd 488.2-1987

### Signal output

TRIGGER OUT: TTL level  
ARM OUT: TTL level  
VGA output  
Calibration output (CAL output): Square wave of approx. 1 kHz, and approx. 1 V p-p

### General specifications

Operation temperature range: 5 to 40°C  
Operation humidity range: 20 to 85% R.H. (when not using a printer)  
35 to 85% R.H. (when using a printer)  
Power supply voltage: 90 to 132 V AC or 198 to 264 V AC  
Power supply frequency: 48 to 63 Hz  
Power requirement: 900 VA max.  
External dimensions: 426(W) × 221(H) × 425(D)mm  
(except handles and projections)  
Weight: 17.5 kg (DL5140), 19 kg (DL5180) (oscilloscope only without option, if a printer is provided, add 1 kg of weight)

### Accessories

- 700944 passive probe  
Attenuation ratio: 10 : 1  
Input impedance: 10 MΩ/14 pF  
Maximum input: 500 V DC + AC peak  
Frequency band: DC to 300 MHz \*2  
(Passive probe is used in combination with 700946 adapter.)
- 700943 FET probe  
Input impedance: 2.5 MΩ/1.8 pF  
Frequency band (−3 dB): DC to 900 MHz \*2  
Sensitivity: 50 mV/div to 2 V/div \*3  
Offset range: ±16 V \*3  
Maximum input: ±50 V
- 700946 1 MΩ BNC conversion adapter  
Input impedance: 1 MΩ 7 pF  
Frequency band(−3 dB): DC to 300 MHz \*2  
Sensitivity: 10 mV/div to 400 mV/div \*3  
Offset range: ±1.6 V \*3  
Maximum input: ±50 V
- 700947 50Ω BNC conversion adapter  
Refer to the specifications of the main frame.  
1 MΩ BNC conversion adapter <2> 700948  
Input impedance : 1MΩ in parallel with 7 pF  
Frequency band (-3dB) : DC to 300 MHz\*2  
Sensitivity : 500 mV/div to 10 V/div\*3  
Offset range : ±80 V\*3  
Maximum input : ±50 V
- 700949 Extension cable  
Length: 1000 ± 50mm

\*1 : Standard operating conditions (23 ±2°C, 55 ±10% R.H.)  
Calibration after 30 minutes warm-up

\*2 : Standard operating conditions (23 ±2°C, 55 ±10% R.H.)  
30 minutes warm-up

\*3 : Settable range when using it in combination with DL5140 or DL5180.

Liquid crystal display may include defects of about 0.02% for all the picture elements.

### Standard Accessories

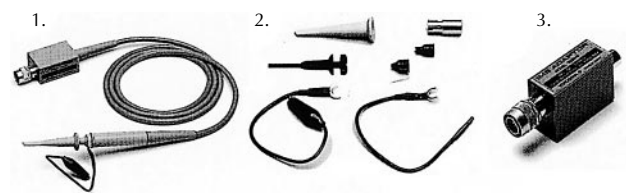
- Power cable ..... 1 pc
- 50Ω BNC conversion adapter (700947) ..... 2 pcs
- Probe BNC adapter (700972) ..... 1 pc
- Rubber pads to prevent rear leg slippage ..... 2 pads
- Manuals ..... 1 set
- 3.5-inch floppy disk ..... 1 disk

### AVAILABLE MODELS

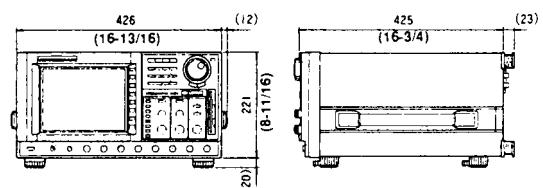
Model	Suffix code	Description
700540		DL5140 4-channel model
700580		DL5180 8-channel model
Power voltage	−1	100 to 120 V AC
	−5	220 to 240 V AC
Power cable	−K	UL, CSA standard with 3-prong-to-2-prong adapter
	−F	VDE standard
	−S	BS standard
	−R	SAA standard
Options	/B5	Built-in printer
	/D1	TV triggering
	/E1	1 MΩ BNC conversion adapter 700946 (×4), Passive probe 700944 (×4)
	/E2	1 MΩ BNC conversion adapter 700946 (×8), Passive probe 700944 (×8)
	/E3	FET probe 700943 (×4)
	/E4	FET probe 700943 (×8)

### Optional Accessories

No.	Item	Code	Description	Order q'ty
—	3.5-inch floppy disks	705900	2HD (1 disk/unit)	10
—	Printer paper roll	B9850NX	30 m (1 roll/unit)	5
—	DL5140/DL5180 passive probe	700944	300 MHz/10 MΩ/14pF when used with 1 MΩ BNC conversion adapter (700946)	1
1.	FET probe for DL5140/DL5180	700943	900 MHz/2.5 MΩ/1.8 pF, including 700977 (×1)	1
2.	Accessory set for FET probe 700943	700977	—	1
3.	1 MΩ BNC conversion adapter for DL5140/DL5180	700946	300 MHz/1 MΩ/7 pF	1
—	1MΩ BNC conversion adapter <2> for DL5140/5180	700948	300MHz/1MΩ/7pF 500mV/div to 10V/div (1:1 conversion)	1
3.	50Ω BNC conversion adapter for DL5140/DL5180	700947	—	1
—	Extension cable for DL5140/DL5180	700947	1000 ± 50mm	1



### DIMENSIONS



Unit: mm  
(inch)