DL1720/DL1740

Digital Oscilloscope

OPERATION GUIDE

YOKOGAWA ◆

Yokogawa Electric Corporation

Introduction

Thank you for your purchase of the DL1720/DL1740 Digital Oscilloscope. This Operation Guide explains the basic operations to familiarize you quickly and easily with this digital oscilloscope when using it for the first time.

Within this manual, the " 🔘 " icon means that you must set the appropriate value using the DL1720/DL1740's jog shuttle.

This manual is part of a three-manual set provided with the DL1720/DL1740. Please use it together with the other two manuals in the set.

• Refer to the DL1720/DL1740 User's Manual (IM 701710-01E) for full details about all of the DL1720/DL1740 functions.

• Refer to the DL1720/DL1740 Communication Interface Manual (IM 701710-17E) for detailed information about the DL1720/DL1740 communication functions.

Notices

• The contents of this guide are subject to change without prior notice as a result of improvements in the instrument's performance and functions.

• Display contents illustrated in this manual may differ slightly from what actually appears on your screen.

• Every effort has been made in the preparation of this manul to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA representative as listed on the back cover of this manual.

Trademarks

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• For purposes of this manual, the TM and ® symbols do not accompany their respective trademark names or registered trademark names.

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Revisions

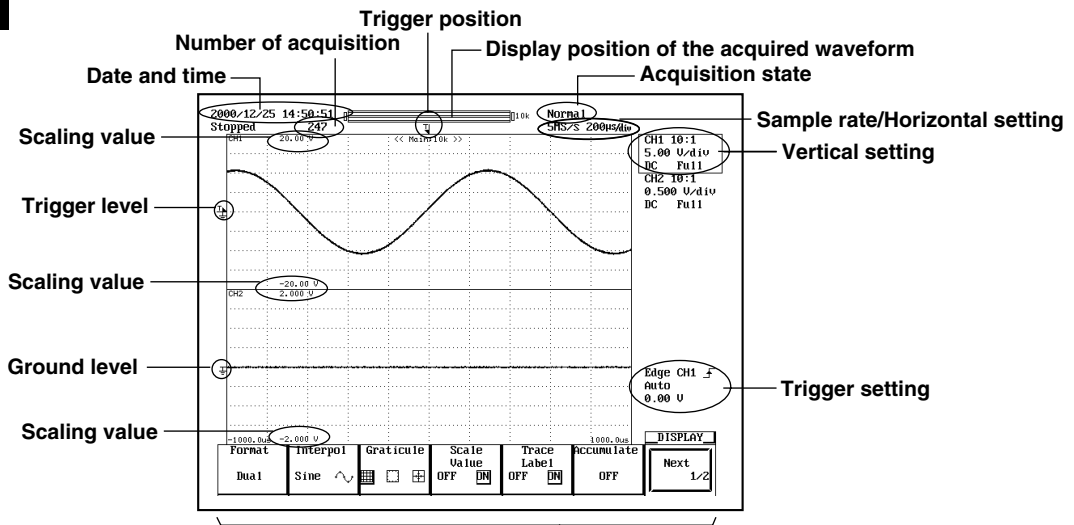1st edition: Junuary 2001

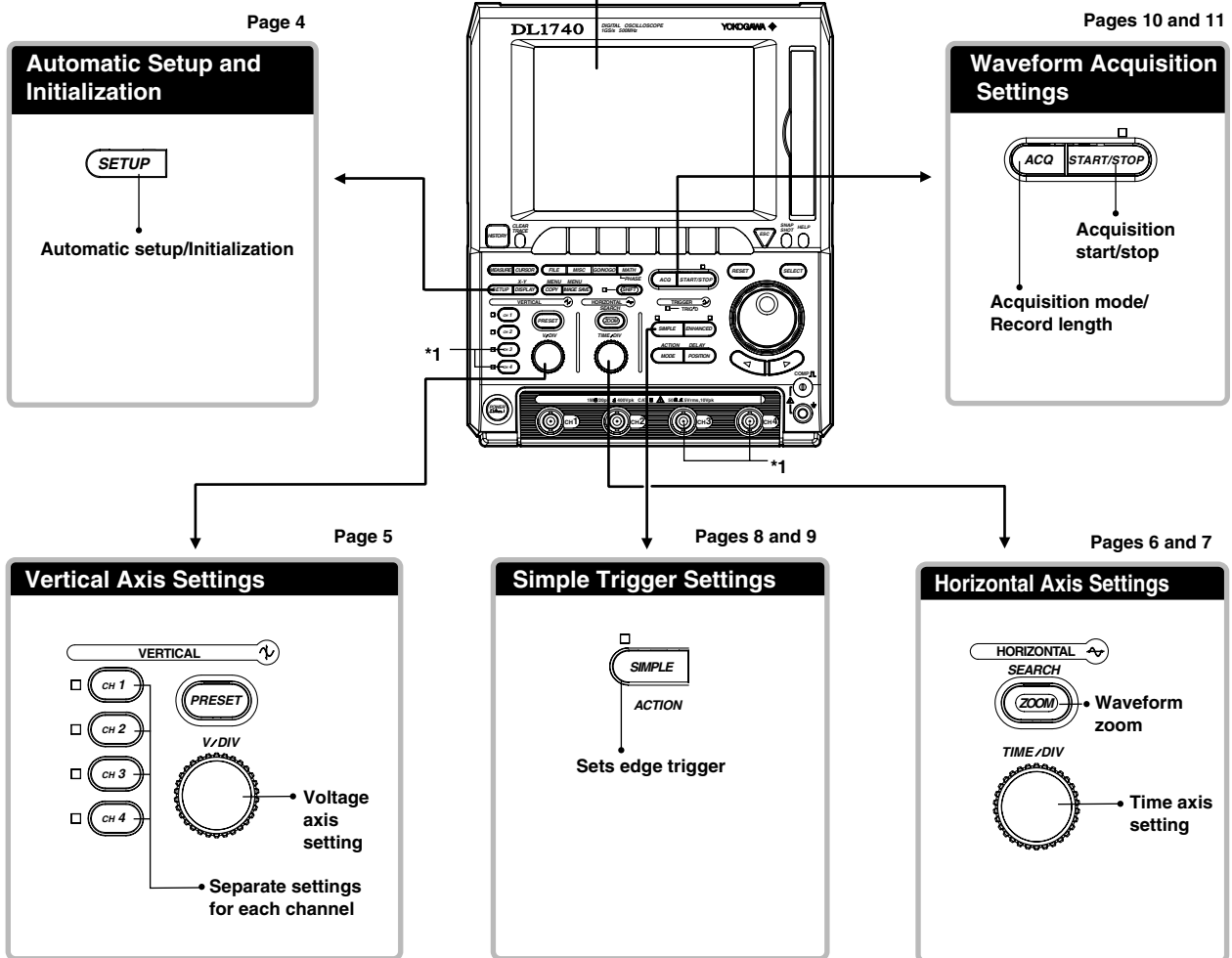2nd edition: July 2001 (supports firmware version 1.30 or later)

Quick Reference

Basic Operations

Display

Trigger position
Number of acquisition
Display position of the acquired waveform
Date and time
Acquisition state

Scaling value

Sample rate/Horizontal setting
Vertical setting

Trigger level

Scaling value

Ground level

Trigger setting

Scaling value

Soft key menu

Format	Interpol	Graticule	Scale Value	Trace Label	Accumulate	DISPLAY
Dual	Sine		OFF ON	OFF ON	OFF	Next 1/2

Page 4

Automatic Setup and Initialization

SETUP

Automatic setup/Initialization

Pages 10 and 11

Waveform Acquisition Settings

ACQ START/STOP

Acquisition start/stop

Acquisition mode/ Record length

Page 5

Vertical Axis Settings

VERTICAL

CH 1 PRESET

CH 2

CH 3   V/DIV

CH 4

Voltage axis setting

Separate settings for each channel

Pages 8 and 9

Simple Trigger Settings

SIMPLE

ACTION

Sets edge trigger

Pages 6 and 7

Horizontal Axis Settings

HORIZONTAL

SEARCH

ZOOM • Waveform zoom

TIME/DIV

Time axis setting

*1 On the DL1720, the CH3 and CH4 keys are disabled.
The DL1720 is not equipped with an input terminal for CH3 or CH4. Also, the external trigger/external clock/trigger gate input terminal (labeled as EXT. on the DL1720) appears on the front panel in place of the CH4 input terminal shown above.

IM 701710-02E

Useful Functions

For other functions and more details on the functions mentioned hereafter, please refer to the indicated sections in the user's manual (IM701710-01E).

Sections 9.2 to 9.4

Automatic Measurement of Waveform Parameters `MEASURE`

Automatic measurement and statistical analysis of parameters such as rise time and pulse width.

Section 9.1

Cursor Measurement `CURSOR`

Shows values and distances directly from waveform by positioning H cursors, V cursors, markers and degree.

Sections 9.5 to 9.11

Waveform Computations `MATH` `PHASE`

Various math operations, including computations on values from different channels, binarization, phase shift, and display of power spectrum.

There is no M2(Math2) on the DL1720.

Page 12

Snapshot

`CLEAR TRACE`   `SNAP SHOT`

Retain the displayed waveform on the screen

Clears the displayed waveform

DL1740 DIGITAL OSCILLOSCOPE 1GSa 500MHz YOKOGAWA

Page 14
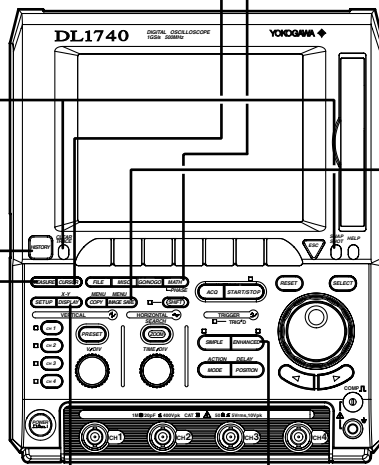
Print/Save Screen Image

`MENU COPY`   `MENU IMAGE SAVE`

Send screen image to built-in printer or external printer (COPY), and save external storage medium (IMAGE SAVE).

Pages 12 and 13

History Function `HISTORY`

History memory retains data from previous screens (up to 2048 previous screens).

From the previously saved screens...

any screen can be selected

Sections 6.8 to 6.14

Enhanced Trigger Settings `ENHANCED`

Use this function to set up an enhanced trigger.

Section 8.1

Display `X-Y` `DISPLAY`

Selects number of waveform windows on screen (1, 2, 3, 4, or 6 (or 1, 2, or 3 for the DL1720).)
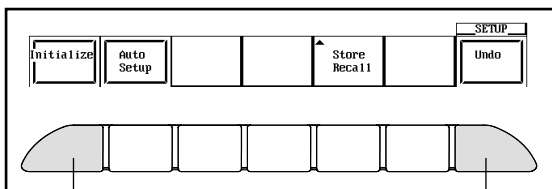
Initializing Settings / Auto Setup

Initializing

Use the front panel's the SETUP key to reset values to their defaults.
This function is useful when you need to change settings when preparing for a new signal input.

Operation   SETUP

Initialized Display

Input coupling = DC 1 MΩ
Voltage axis setting = 50 V/div (10:1)

Time-axis setting = 1 ms/div

Execute initialization.   **Undo initialization (restore previous settings).**

```
2000/12/29 16:54:41          10k   Normal
Stopped       1134                 1MS/s  1ms/div
                  << Main:10k >>              CH1 10:1
                                              50.0 V/div
                                              DC   Full
                                              CH2 10:1
                                              50.0 V/div
                                              DC   Full
                                              CH3 10:1
                                              50.0 V/div
                                              DC   Full
                                              CH4 10:1
                                              50.0 V/div
                                              DC   Full


                                              Edge CH1
                                              Auto
                                              0.0 V

                                              SETUP
Initialize  Auto          Store        Undo
            Setup         Recall
```

MEMO
- The GP-IB address and certain other settings are not initialized.
- If waveform acquisition is in STOP state at time of initialization, it restarts automatically.
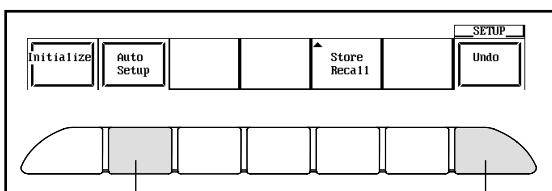
Auto Setup

The DL1720/DL1740 can automatically set vertical and horizontal axes, trigger conditions, and other parameters to match the incoming waveform. This function is useful when you want to view the waveform quickly, or when you are unclear about what settings to use.

Operation   SETUP

Auto Setup

Input coupling
Over DC 50 Ω: DC 1 MΩ, DC 50 Ω: DC 50 Ω.

Time axis is set so that the waveform with the longest cycle shows 2 to 4 cycles on the screen.

Trigger at rising edge of the waveform with the longest cycle.

Execute auto setup.   **Undo auto-setup (restore previous settings).**

```
2000/12/29 17:12:56          10k   Normal
Stopped       90                   5MS/s  200µs/div
                  << Main:10k >>              CH1 10:1
                                              5.00 V/div
                                              DC   Full




                                              Edge CH1
                                              Auto
                                              0.10 V

                                              SETUP
Initialize  Auto          Store        Undo
            Setup         Recall
```
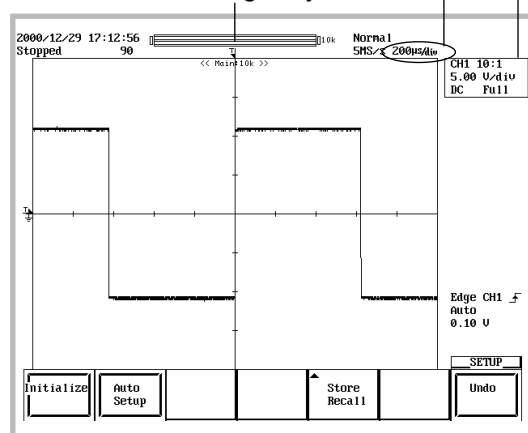
MEMO
- Required input conditions for auto-setup are approximately as follows.
  Frequency : 50 Hz or more
  Maximum absolute value of input :
      Above 20 mV (assuming 1:1 probe attenuation)
  Type :Repetitive waveform
- If waveform acquisition is in STOP state at time of auto-setup, it restarts automatically.

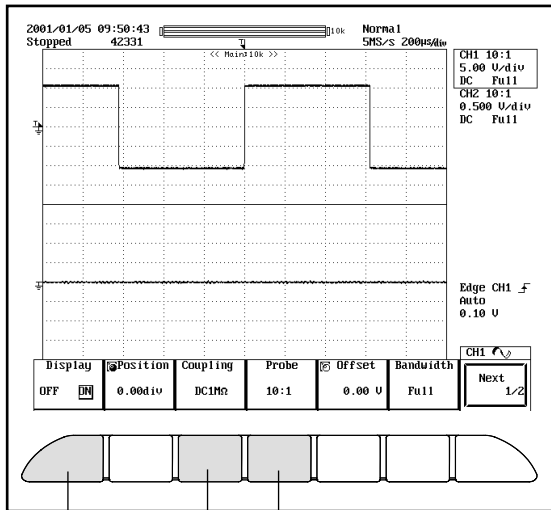# Vertical Axis Settings

Waveform ON/OFF, Coupling Select, and Probe Attenuation

You can set input coupling and the probe attenuation for each channel to the following values.

Coupling: AC 1 MΩ/DC 1 MΩ/DC 50 Ω/GND

Probe: 1:1/10:1/100:1/1000:1

Operation　(CH 1) to (CH 4)　(or (CH 1) to (CH 2) for the DL1720)


```
2001/01/05 09:50:43          10k   Normal
Stopped      42331                 5MS/s 200µs/div
              << Main:10k >>            CH1 10:1
                                        5.00 V/div
                                        DC    Full
                                        CH2 10:1
                                        0.500 V/div
                                        DC    Full



                                        Edge CH1
                                        Auto
                                        0.10 V
                                               CH1
Display  Position  Coupling  Probe  Offset  Bandwidth  Next
OFF  ON  0.00div   DC1MΩ     10:1   0.00 V  Full        1/2
```

Waveform ON/OFF

Select input coupling.

Select probe attenuation.

●MEMO

Attenuation must be set to match the probe you are using. Improper setting will result in incorrect cursor readings.

Voltage Axis Sensitivity

Use this function to adjust the displayed waveform amplitude.

Operation　(CH 1) to (CH 4)

(or (CH 1) to (CH 2) for the DL1720)

V/DIV

Turn right to increase the amplitude.

Adjustment Example, V/div


```
2001/01/05 11:15:42          10k   Normal
Stopped      178                   1MS/s  1ms/div
              << Main:10k >>            CH1 10:1
                                        20.0 V/div
                                        DC    Full
```
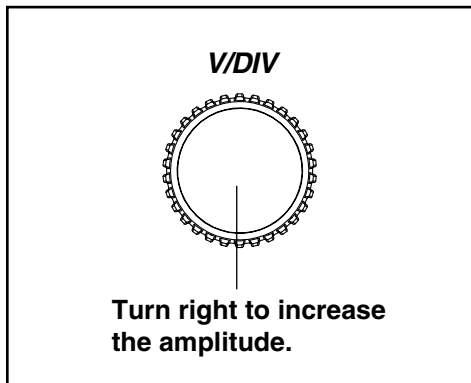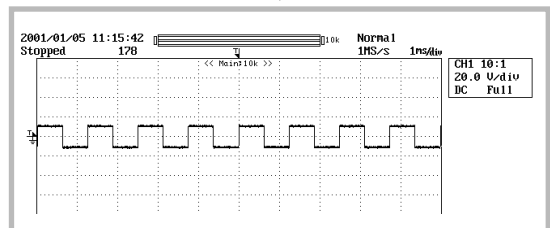
Change from 20 V/div to 5 V/div.


```
2001/01/05 11:16:08          10k   Normal
Stopped      189                   1MS/s  1ms/div
              << Main:10k >>            CH1 10:1
                                        5.00 V/div
                                        DC    Full
```
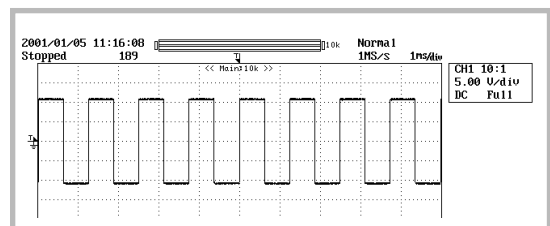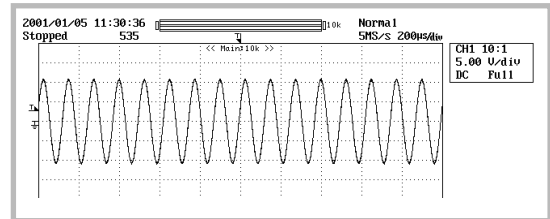
Horizontal Axis Settings

Time Axis

You can adjust the screen's time axis to any value from 1 ns/div to 50 s/div. Since the display spans 10 divisions, the time length of the displayed waveform corresponds to 10 times the setting.
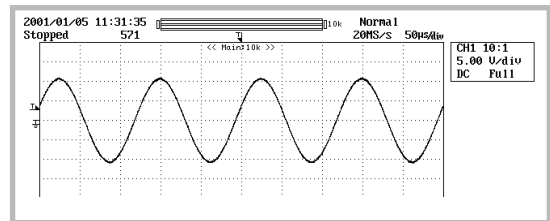
Operation

TIME/DIV

Turn right to shorten the time.
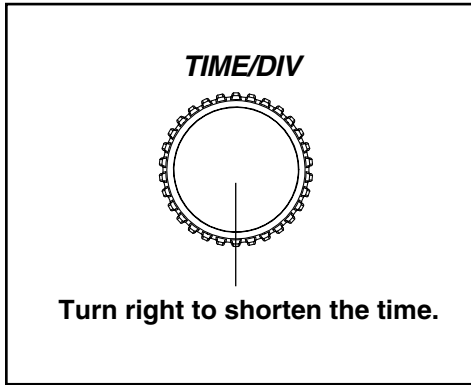
Adjustment Example, Time/div

200 μs × 10 = 2000 μs

Change from 200 μs/div to 50 μs /div.

50 μs × 10 = 500 μs

Sampling Mode

The following two methods are available to sample an input signal.
Real-time sampling mode :   The input signal is sampled sequentially.
Repetitive sampling mode :   Data is sampled from several waveforms and data is put in the correct order using the trigger point as reference. (An apparent sample rate of up to 100 GS/s can be used).

Operation   ACQ
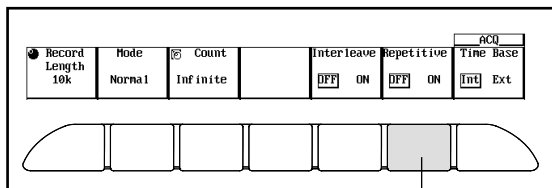
Set repetitive sampling mode ON/OFF.

Screen Appearance during Repetitive Sampling
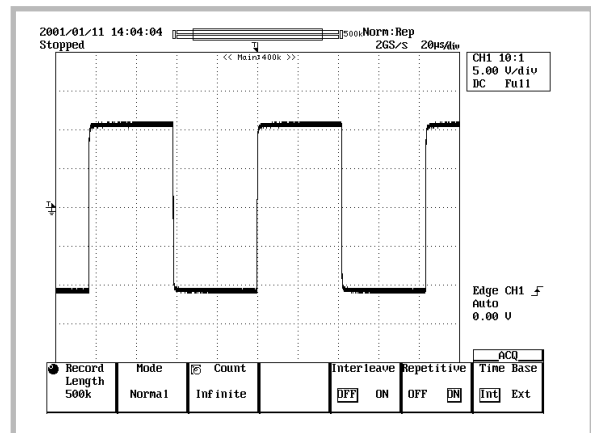
MEMO

Sampling rate required to enable repetitive sampling varies according to record length and machine model. Refer to the User's Manual (Doc. IM701710-01E).

Expanding the Waveform

The displayed waveform can be expanded in the time axis direction.
Two zoom positions can be specified on this instrument.

Operation   (ZOOM)
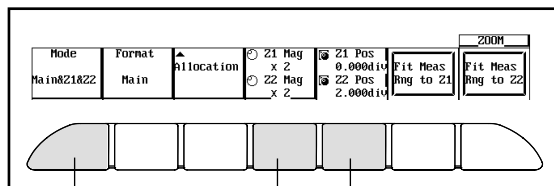
Select the display mode.

Select position of Z1 or Z2 area. ( )

Select the zoom factor of Z1 or Z2 area. ( )

Zoom Display

Zoom position of Z1   Zoom position of Z2
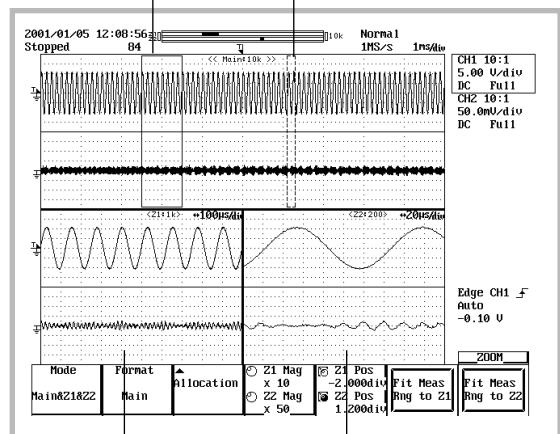
Expanded waveform of Z1 (×10)

Expanded waveform of Z2 (×50)

MEMO

- Zoom is not available if the displayed waveform contains less than 50 or 40 data points.
- If there are less than 50 points per division, the DL1720/DL1740 adds interpolation to the zoomed display. Note that interpolated points do not reflect actual sample values.

Setting a Simple Trigger

The trigger settings determine the input conditions required to update the waveform display. You can select from a wide variety of trigger conditions and types. This section introduces the trigger source, trigger level, trigger mode, and trigger position settings. For more information about these settings, and for details about gate triggers and enhanced triggers, refer to the User's Manual (IM701710-01E).
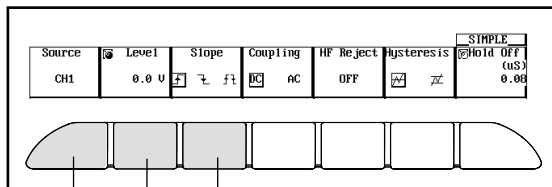
Changing the Trigger Source, Level, and Slope

The trigger source is the channel that provides the trigger signal. You can select any channel (CH1 to CH4(or CH1 to CH2 for the DL1720)) as the source, or you can select an external trigger (EXT TRIG IN) or the power signal trigger(LINE).
A trigger occurs when the trigger source signal crosses the specified trigger level in the specified direction, as determined by the slope setting.

$\int$: Trigger occurs when signal level rises through trigger level.

γ : Trigger occurs when signal level drops through trigger level.

$\int \gamma$: Trigger occurs when signal level crosses trigger level from either direction.
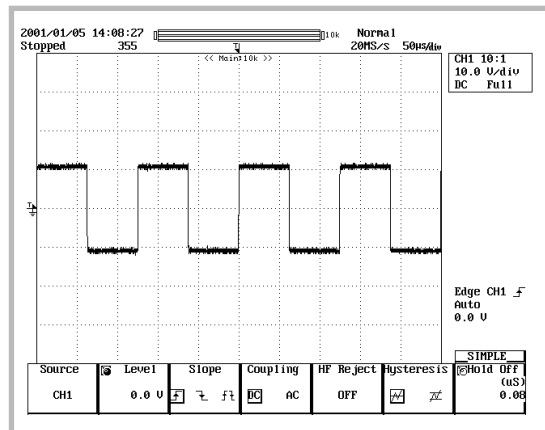
Operation ⟮SIMPLE⟯
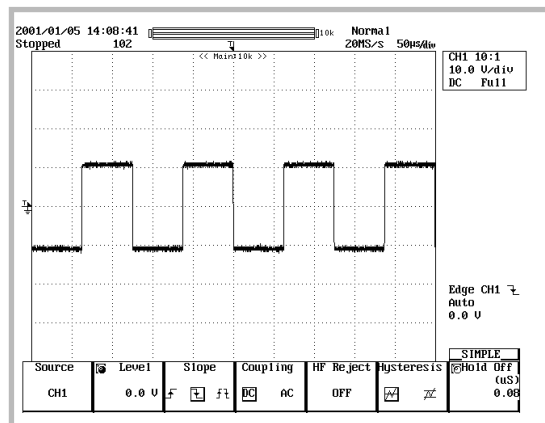

Set the trigger slope.

Set the trigger level. (⟳)

Set the trigger source.

Source and Slope Setup Example


Changing slope from $\int$ to γ .

Changing the Trigger Mode

Sets the condition to update the displayed waveform. A selection can be made from the following modes.

Auto : Updates the displayed waveform automatically when no trigger has been activated during a specified time.

Auto Level: If the trigger is not activated for a certain amount of time, the trigger level is automatically changed to the center value of the waveform. The trigger is activated using the new level and the waveform is automatically updated.

Normal : Updates the displayed waveform only when a trigger is activated.

Single : When a trigger is activated, the waveform is updated only once and then waveform acquisitioning stops.

Single(N) : Updates the displayed waveform only a pre-set number of times when a trigger is occurs and then waveform acquisitioning stops.

Operation   `MODE`

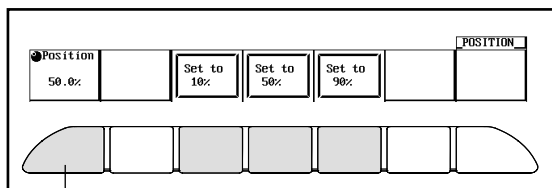| Auto	Auto Level	Normal	Single	Single(N)		MODE
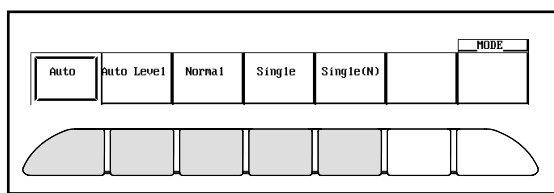
Select the trigger mode.

Changing the Trigger Position

Determines where on the time axis position to display the data that is sampled when the trigger is activated (trigger point).
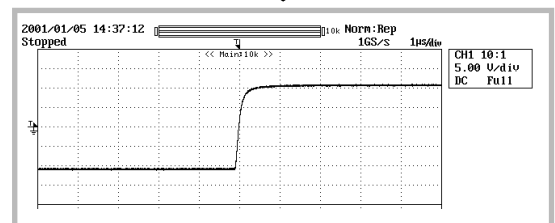It is specified in terms of %, taking the entire record length to be 100%.
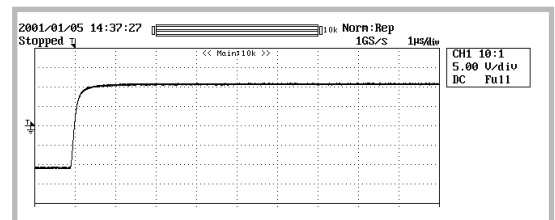
Operation   `POSITION`

Position 50.0%		Set to 10%	Set to 50%	Set to 90%		POSITION

Change the trigger position. (○)

Set the trigger position to 10%, 50%, or 90% with 1 single operation.

Changing Trigger Position

2001/01/05 14:37:12 Stopped 10k Norm:Rep 1GS/s 1μs/div
CH1 10:1
5.00 V/div
DC Full

Change the trigger position from 50% to 10%.

2001/01/05 14:37:27 Stopped 10k Norm:Rep 1GS/s 1μs/div
CH1 10:1
5.00 V/div
DC Full

MEMO

Although the display usually shows the waveform before and after the trigger point, using the delay function, it is possible to display the acquired waveform after a fixed time period elapses, as shown in the figure on the right.

T (trigger position)

Delay

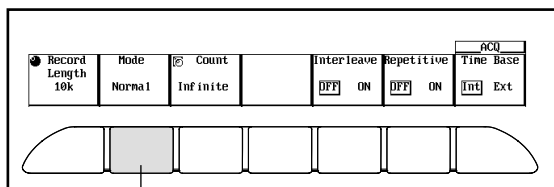Trigger point
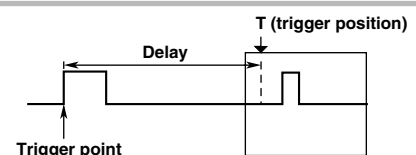
Waveform Acquisition Settings

Changing the Acquisition Mode

The acquisition mode determines how the DL1720/DL1740 stores, processes, and displays the incoming sampling data. You can select from four modes.

- Normal : Values are stored and displayed as received, with no special processing.
- Envelope : The instrument finds the maximum and minimum sampled values per interval of 400 MS/s (1 GS/s or 800 MS/s: interleave mode ON). It then writes these values into acquisition memory, and generates an "envelope" waveform showing max/min levels for each point.
- Average : Displays averages of values obtained at each time point of waveform (based on time difference from trigger point).
  Two methods are available.
  Exponential : Count = Infinite
  Linear : Count = 2^n (2 to 65536)
- Box Average : Calculates moving averages of 400 MS/s (Interleave ON: 800 MS/s or 1 GS/s).
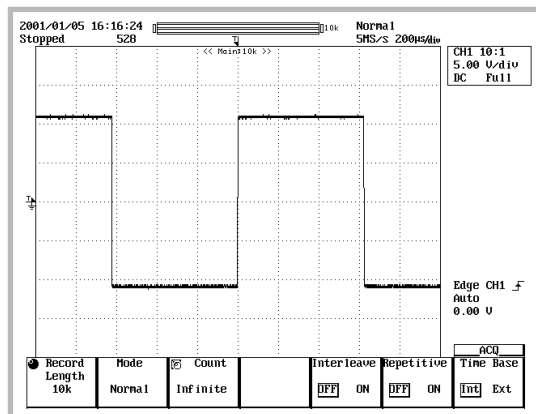
Operation

ACQ

```
                                        ┌──ACQ──┐
 ● Record   Mode    ⟳ Count        Interleave Repetitive Time Base
   Length                          ┌───┐      ┌───┐     ┌───┐
   10k      Normal  Infinite       │OFF│ ON   │OFF│ ON  │Int│ Ext
```

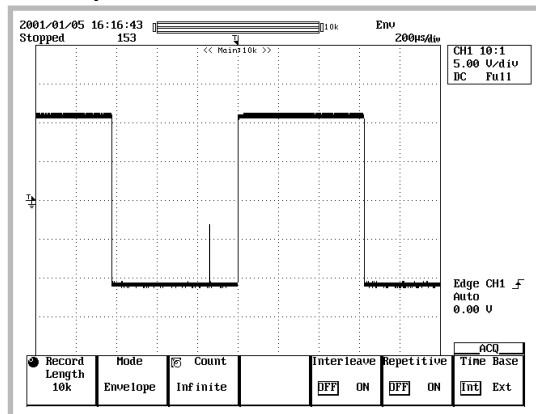**Select the acquisition mode.**

Screen Examples

When observing the same input signal using the normal mode and the envelope mode, the glitch that could not be acquired in the normal mode was acquired in the envelope mode.

Normal Mode

Envelope Mode

IM 701710-02E

Selecting the Record Length

The term, record length, refers to the amount of waveform data that can be acquired in the acquisition memory.
Of the waveform data in the acquisition memory, the amount of waveform that is displayed on the screen is called the display record length.
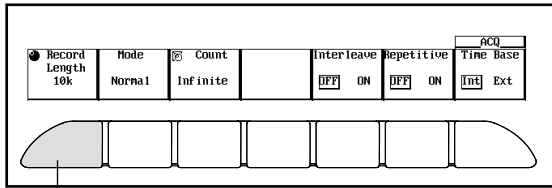Word is used as a unit to describe the record length. One word is equivalent to one sampling data.
By setting a long record length, the waveform can be observed at a high sample rate without changing the time axis setting.
Depending on the time axis setting, the record length and the display record length may differ.
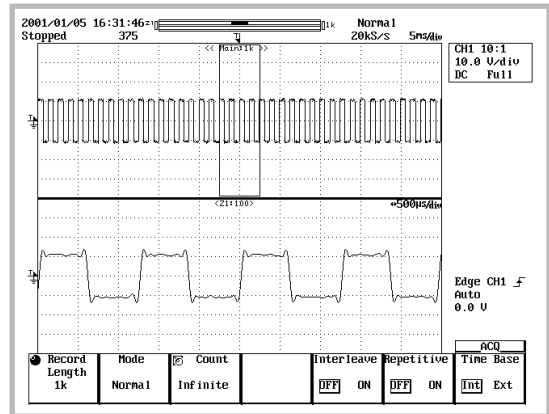
Operation   (ACQ)
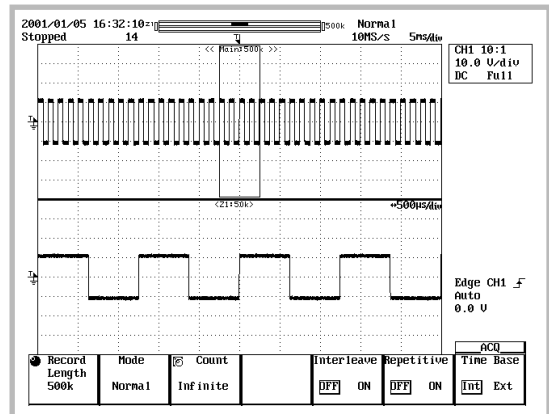
| Record Length 10k | Mode Normal | Count Infinite | | Interleave OFF ON | Repetitive OFF ON | Time Base Int Ext |

Set the record length. (◎)

Record Length Setup Example

**(Top window shows normal waveform;
bottom window shows zoomed segment).**

2001/01/05 16:31:46   Normal
Stopped   375   20kS/s   5ms/div
CH1 10:1
10.0 V/div
DC   Full
<< Main:1k >>
<Z1:100>   500μs/div
Edge CH1
Auto
0.0 V

| Record Length 1k | Mode Normal | Count Infinite | | Interleave OFF ON | Repetitive OFF ON | Time Base Int Ext |

**Change the record
length from 1 kW
to 500 kW.**

2001/01/05 16:32:10   Normal
Stopped   14   10MS/s   5ms/div
CH1 10:1
10.0 V/div
DC   Full
<< Main:500k >>
<Z1:50k>   500μs/div
Edge CH1
Auto
0.0 V

| Record Length 500k | Mode Normal | Count Infinite | | Interleave OFF ON | Repetitive OFF ON | Time Base Int Ext |

Snapshots and History Memory

Snapshots

By pressing the SNAP SHOT key, the waveform that is currently displayed (referred to as the snap shot waveform) remains on the screen. Pressing the CLEAR TRACE key clears the snap shot waveform.
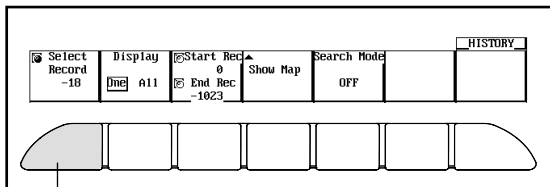
Operation

SNAP SHOT

Recalling Images from History Memory

The history memory stores up to 2048 previously displayed waveforms (the exact number depends on the machine model and the acquisition settings). When 1000 previously displayed waveforms is stored by history memory, you can recall any of these waveform images by selecting the corresponding number with the jog or shuttle dial: –999 for the oldest waveform, –1 for the immediately preceding waveform, or 0 for the current waveform.
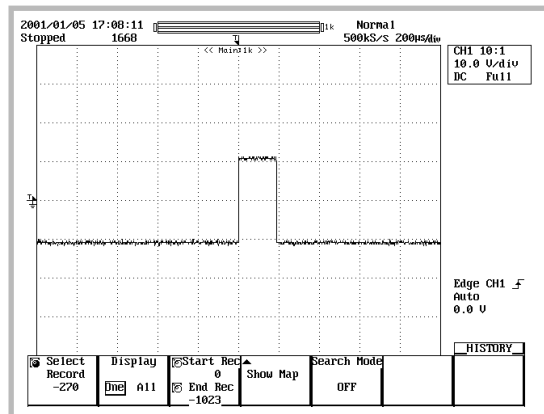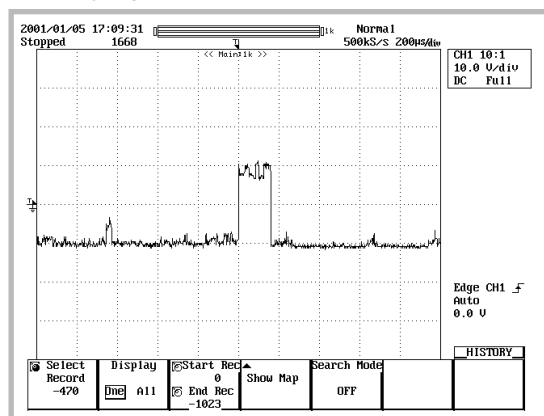
Operation   HISTORY

Select Record
-18
Display   One A11
Start Rec   0
End Rec   -1023
Show Map
Search Mode   OFF
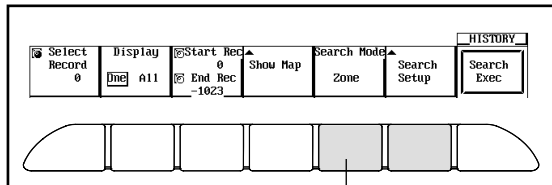HISTORY

Select the record number. ( )

● MEMO

• If you set Display to "One," the screen displays a single waveform from the history. If you set Display to "All," the screen shows all waveforms within a selected range of the history.
• You can display a list of the stored waveforms and their trigger times.

History Display

Displaying "–270"

2001/01/05 17:08:11   Normal
Stopped   1668   500kS/s 200µs/div
<< Main:1k >>
CH1 10:1
10.0 V/div
DC   Full

Edge CH1
Auto
0.0 V
HISTORY

Select Record
-270
Display   One A11
Start Rec   0
End Rec   -1023
Show Map
Search Mode   OFF

Displaying "–470"

2001/01/05 17:09:31   Normal
Stopped   1668   500kS/s 200µs/div
<< Main:1k >>
CH1 10:1
10.0 V/div
DC   Full

Edge CH1
Auto
0.0 V
HISTORY

Select Record
-470
Display   One A11
Start Rec   0
End Rec   -1023
Show Map
Search Mode   OFF
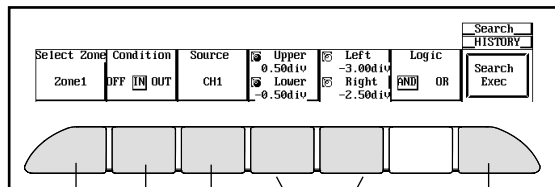
Search the Waveform

History Search Function

Searches waveforms that did or did not pass the specified area from the history memory (search using zone), and that did or did not satisfy the specified condition from the history memory (search using parameter).
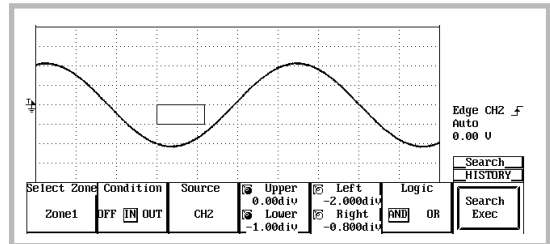
Operation   `HISTORY`

History Memory Search

```
┌─────────────────────────────────────────────┐
│ ◉ Select  Display  ⬚Start Rec▲         HISTORY│
│   Record           ◉End Rec  Show Map  Search  │
│   0      [One] All       0   Zone     Setup  Exec│
│                    -1023                       │
└─────────────────────────────────────────────┘
```

Select the zone/parameter.

```
┌─────────────────────────────────────────────┐
│                                        Search │
│                                        HISTORY │
│Select Zone Condition Source ◉Upper ⬚Left Logic Search│
│                        0.50div -3.00div      Exec │
│ Zone1     OFF [IN] OUT  CH1  ◉Lower ⬚Right [AND] OR│
│                        -0.50div -2.50div      │
└─────────────────────────────────────────────┘
```

Setting the zone. (◉)
Execute the search.
Select the source channel.
Select the search condition.
Select the zone.

History Memory Search figure

Searches waveforms that pass the specified area.

```
Select Zone Condition Source ◉Upper ⬚Left Logic Search
                        0.00div -2.000div      Exec
 Zone1     OFF [IN] OUT  CH2  ◉Lower ⬚Right [AND] OR
                        -1.00div -0.800div
```
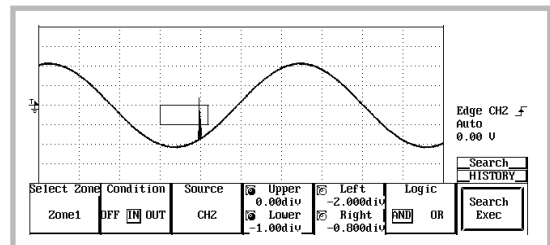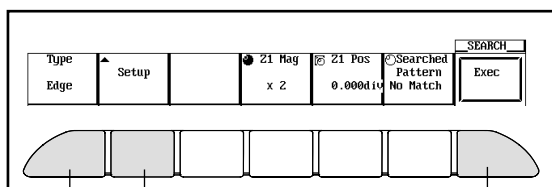
Search and Zoom Function

Searches waveforms by the specified area or level from the start point of the search.
Choose from the following five search methods: Edge, Serial pattern, Parallel pattern, Pulse width, or Auto scroll.
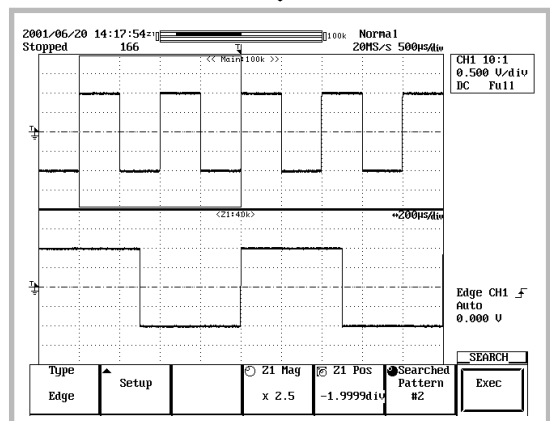
Operation   *SHIFT key* + `ZOOM`

Edge Search

```
┌─────────────────────────────────────────────┐
│                                        SEARCH │
│ Type            ◉Z1 Mag ⬚Z1 Pos ◎Searched    │
│      Setup                      Pattern  Exec │
│ Edge            x 2  0.000div  No Match       │
└─────────────────────────────────────────────┘
```

Select the search condition.
Execute the search.
Select the search type.

Edge Search figure

```
Type            ◉Z1 Mag ⬚Z1 Pos ◎Searched  SEARCH
     Setup                      Pattern    Exec
Edge            x 2.5 -1.9999div  #2
```

Search Condition (Search Count : 2 times)
Source : CH1,   Level   : 0V
Polarity : ⎍ **, Hysteresis : 0.3div**
Count   : 1,   Start Point : -5div
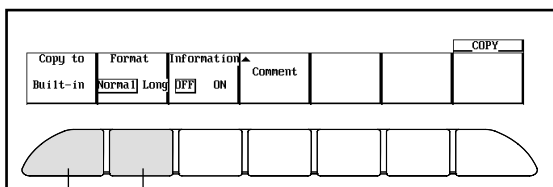
Saving and Printing

Printing the Screen Image

The screen image data can be hard copied to the built-in printer, an external printer or a network printer by simply pressing the **MENU COPY** key.

Operation   *SHIFT key* + **MENU COPY**
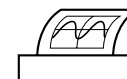
Copy to	Format	Information▲					COPY
Built-in	Normal Long	OFF ON	Comment				

└─ **Select format for output file.**

└─ **Select printer.**

Printout from Specified Printer

Built-in printer

USB printer or network printer

> **MEMO**
>
> You can use the long copy function to generate an enlarged printout (2x to 200000x enlargement) of the displayed waveform.
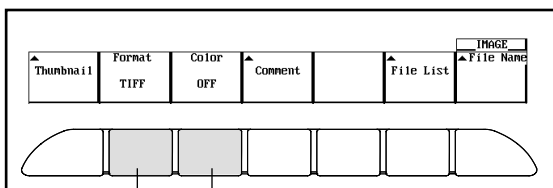
Saving the Screen Image to the Storage Medium

The screen image data can be saved to the external storage medium by simply pressing the **MENU IMAGE SAVE** key.
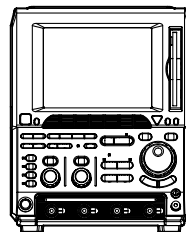
Operation   *SHIFT key* + **MENU IMAGE SAVE**

▲ Thumbnail	Format TIFF	Color OFF	▲ Comment		▲ File List	IMAGE ▲ File Name

└─ **Select "Color".**

└─ **Select format for save file.**

Save to Selected Storage Medium

Floppy disk or Zip disk

> **MEMO**
>
> If you select the autoname function, the DL1720/DL1740 automatically assigns filenames to your saved files.