DL1620/DL1640/DL1640L

Digital Oscilloscope

OPERATION GUIDE

YOKOGAWA ◆
Yokogawa Electric Corporation

IM 701610-02E
4th Edition

Introduction

Thank you for your purchase of the DL1620/DL1640/DL1640L 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 DL1620/DL1640/DL1640L jog shuttle.

This manual is part of a three-manual set provided with the DL1620/DL1640/DL1640L. Please use it together with the other two manuals in the set.

- Refer to the DL1620/DL1640/DL1640L User's Manual (IM 701610-01E) for full details about all of the DL1620/DL1640/DL1640L functions.
- Refer to the DL1620/DL1640/DL1640L Communication Interface Manual (IM 701610-17E) for detailed information about the DL1620/DL1640/DL1640L 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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Revisions

1st edition: August 2002
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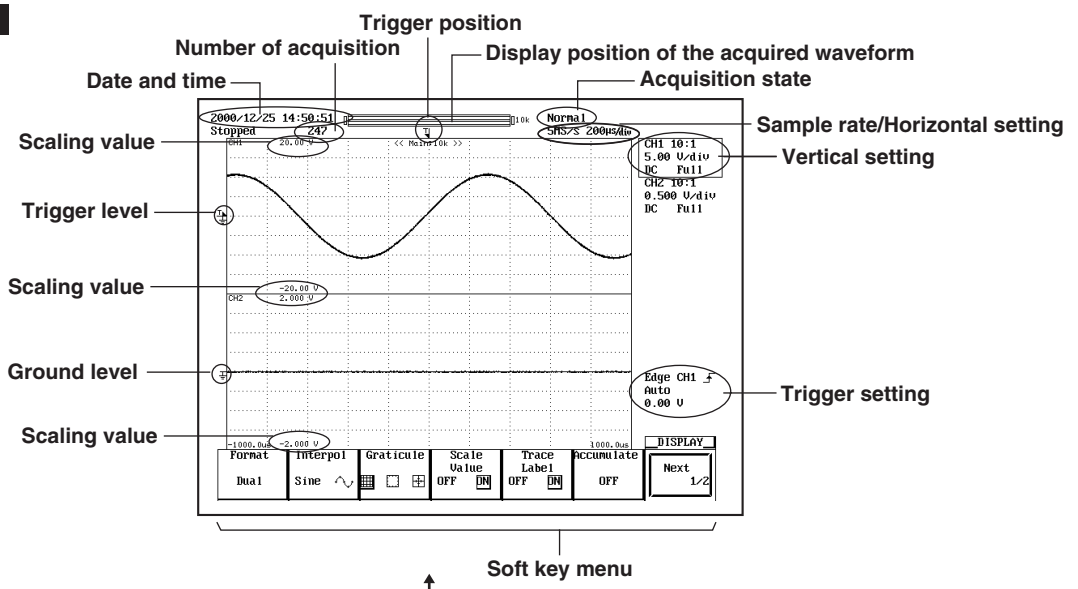
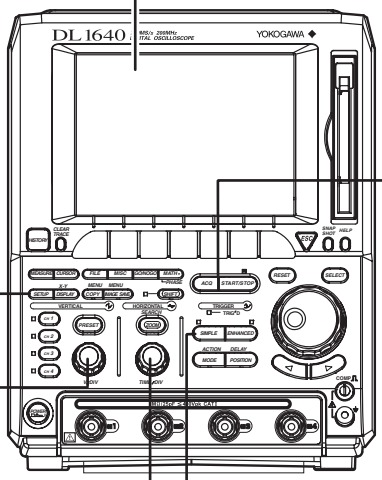
4th edition: July 2005

4th Edition : July 2005 (YK)

Basic Operations

Display





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 CH 2 CH 3 CH 4

PRESET

V/DIV

Voltage axis setting

Separate settings for each channel
(On the DL1620, the CH3 and CH4 keys are not disabled.)

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

Useful Functions

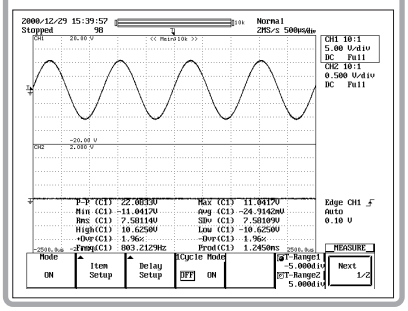
For other functions and more details on the functions mentioned hereafter, please refer to the indicated sections in the user's manual (IM701610-01E).

Sections 9.2 to 9.4 in the user's manual

Automatic Measurement of Waveform Parameters

MEASURE

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

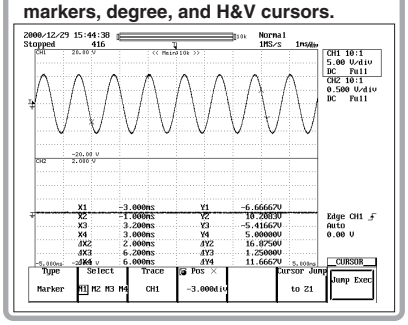


Section 9.1 in the user's manual

Cursor Measurement

CURSOR

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

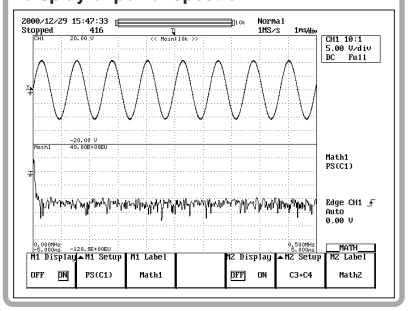


Sections 9.5 to 9.8 in the user's manual

Waveform Computations

MATH
PHASE

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



Page 12

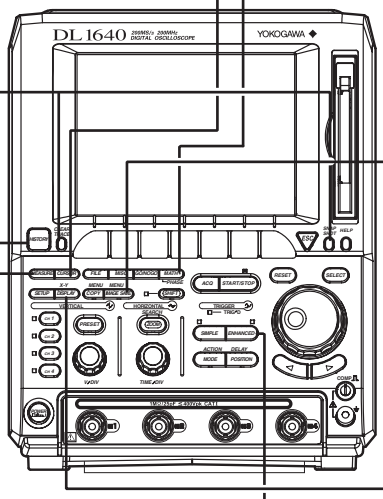
Snapshot

CLEAR TRACE

SNAP SHOT

Retain the displayed waveform on the screen

Clears the displayed waveform



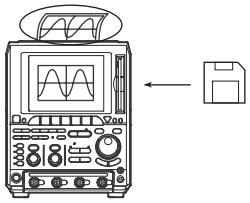
Page 14

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).

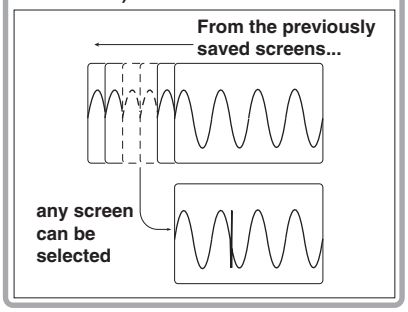


Pages 12 and 13

History Function

HISTORY

History memory retains data from previous screens (up to 16000 screens with the DL1640L, and 4000 screens with the DL1640).

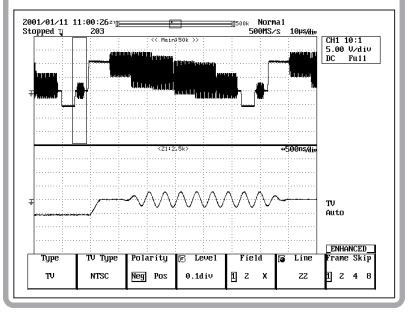


Sections 6.8 to 6.14 in the user's manual

Enhanced Trigger Settings

ENHANCED

Use this function to set up an enhanced trigger.

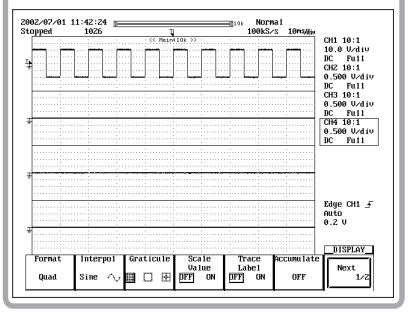


Section 8.1 in the user's manual

Display

X-Y DISPLAY

Selects number of waveform windows on screen (1, 2, or 4.)

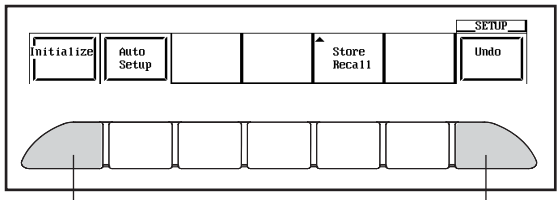


Initializing Settings / Auto Setup

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



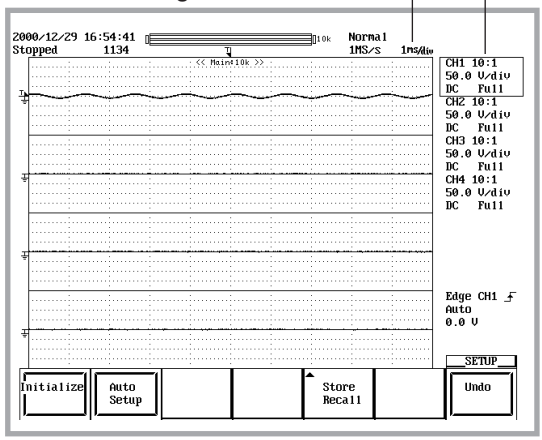
Execute initialization.

Undo initialization (restore previous settings).

Initialized Display

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

Time-axis setting = 1 ms/div



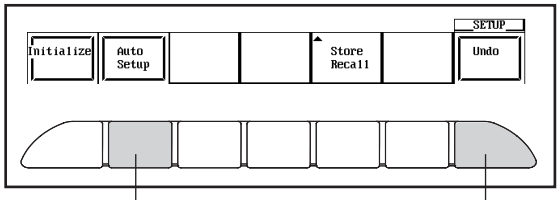
• MEMO

- 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 DL1640/1640L 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



Execute auto setup.

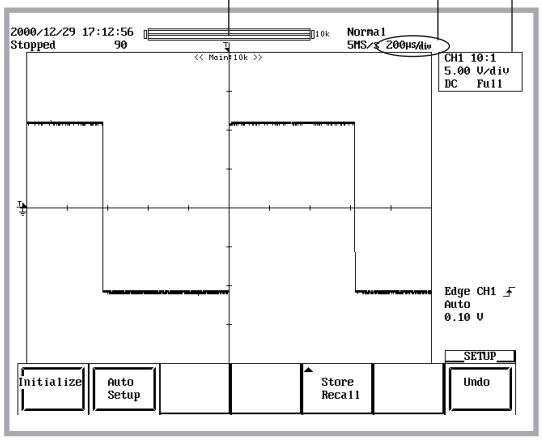
Undo auto-setup (restore previous settings).

Auto Setup

Input coupling = DC

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.



• MEMO

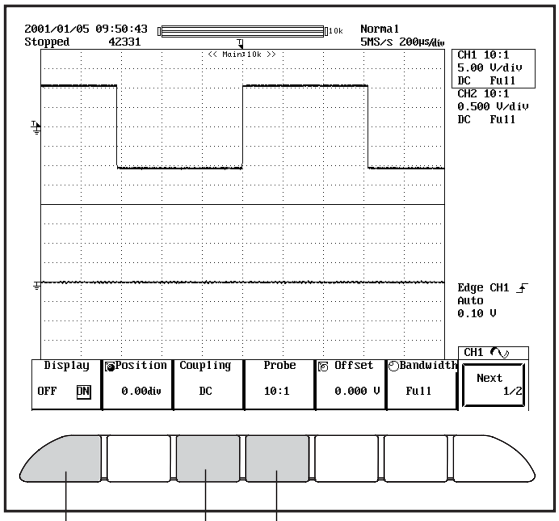
- Required input conditions for auto-setup are approximately as follows.
  Frequency : 50 Hz or more
  Maximum absolute value of input :
  Above 20 mV (assuming 1:1 probe attenuation)
  Type :Repetitive waveform
- If waveform acquisition is in STOP state at time of auto-setup, it restarts automatically.

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/DC/GND
Probe: 1:1/10:1/100:1/1000:1/10 A:1 V(0.1 V/A)/100 A:1 V(0.01 V/A)

Operation CH 1 to CH 4 (or CH 1 and CH 2 for the DL1620)



Waveform ON/OFF

Select input coupling.

Select probe attenuation.

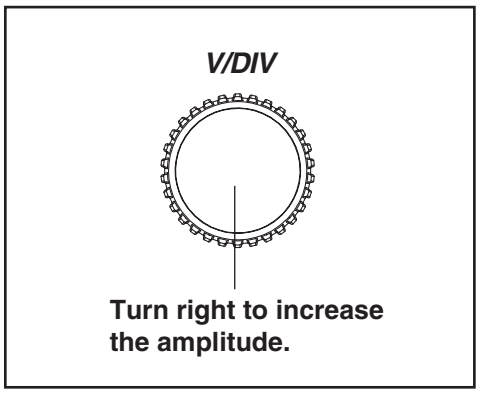
MEMO

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

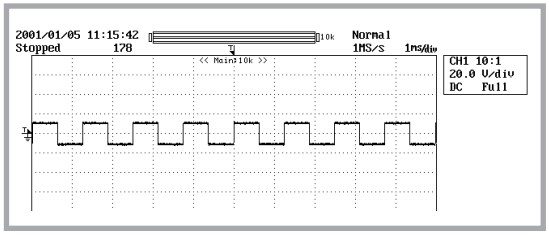
Voltage Axis Sensitivity

Use this function to adjust the displayed waveform amplitude.

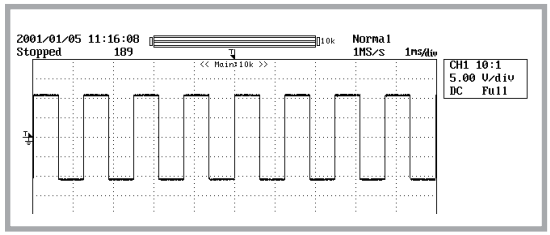
Operation CH 1 to CH 4 (or CH 1 and CH 2 for the DL1620)



Adjustment Example,V/div



Change from 20 V/div to 5 V/div.

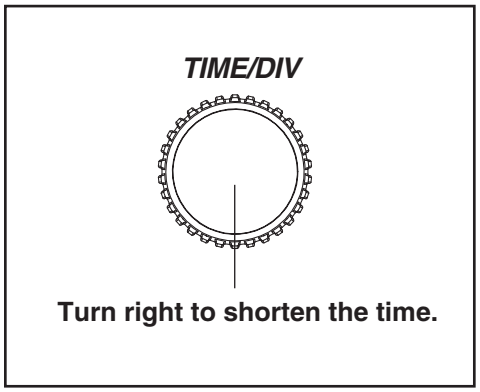


Horizontal Axis Settings

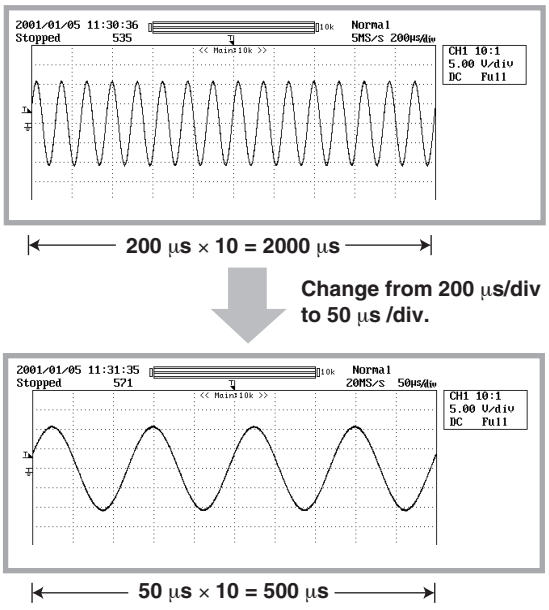
Time Axis

You can adjust the screen's time axis to any value from 2 ns/div to 800 s/div. Since the display spans 10 divisions, the time length of the displayed waveform corresponds to 10 times the setting.

Operation



Adjustment Example, Time/div

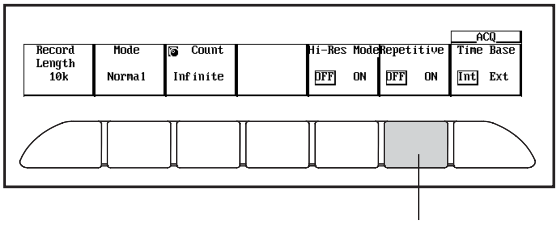


Sampling Mode

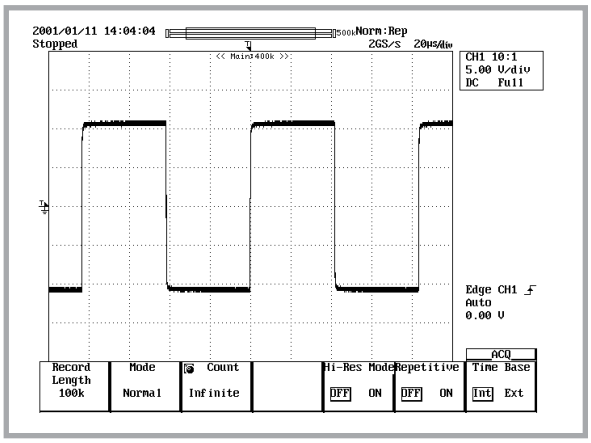
The following two methods are available to sample an input signal.
Real-time sampling mode : The input signal is sampled sequentially.
Repetitive sampling mode : Data is sampled from several waveforms and data is put in the correct order using the trigger point as reference. (An apparent sample rate of up to 50 GS/s can be used).

Operation

ACQ



Screen Appearance during Repetitive Sampling



MEMO

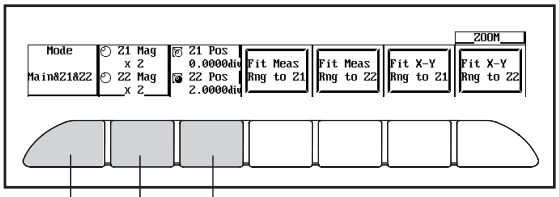
Sampling rate required to enable repetitive sampling varies according to record length and machine model. Refer to the User's Manual (Doc. IM701610-01E).

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

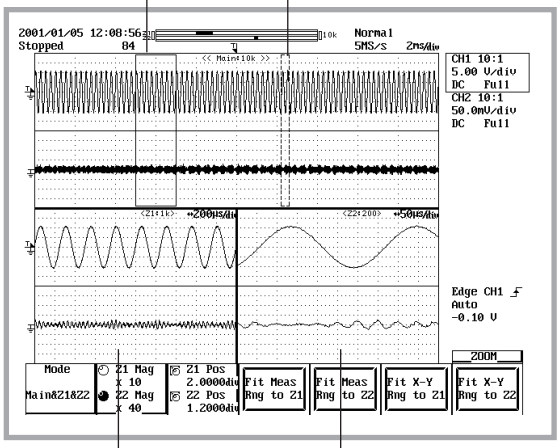


Select position of Z1 or Z2 area. (◎)

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

Select the display mode.

Zoom Display



Expanded waveform of Z1 (×10)

Expanded waveform of Z2 (×40)

• 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 DL1640/DL1640L 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 (IM701610-01E).

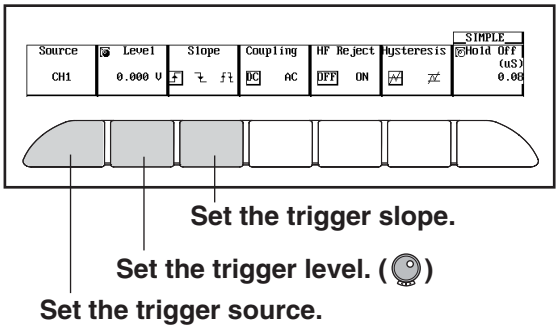
Changing the Trigger Source, Level, and Slope

The trigger source is the channel that provides the trigger signal. You can select any channel (CH1 to CH4 (or CH1 and CH2 for the DL1620)) 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.

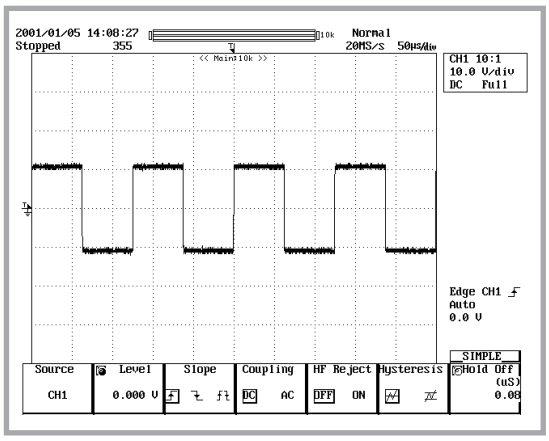
- ↑ : Trigger occurs when signal level rises through trigger level.
- ↓ : Trigger occurs when signal level drops through trigger level.
- ↑↓ : Trigger occurs when signal level crosses trigger level from either direction.

Operation

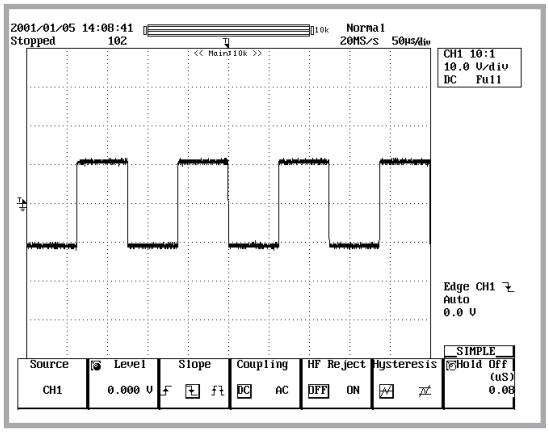
SIMPLE



Source and Slope Setup Example



Changing slope from ↑ to ↓.



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.

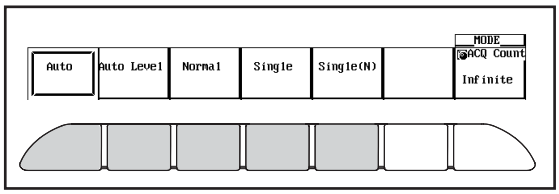
Normal : Updates the displayed waveform only when a trigger is activated.

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

Single(N) : Updates the displayed waveform only a preset number of times when a trigger occurs and then waveform acquisition and display stop.

Operation

MODE



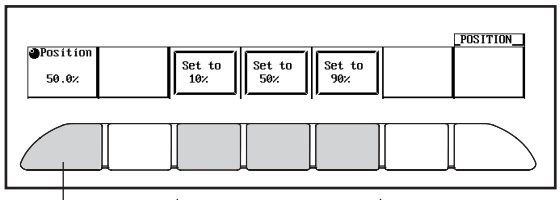
Select the trigger mode.

Changing the Trigger Position

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

Operation

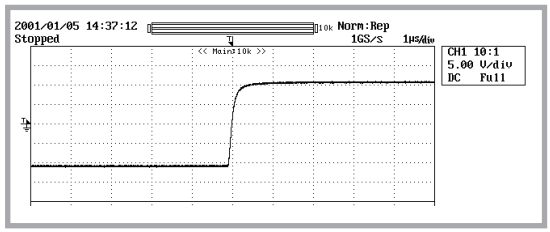
POSITION



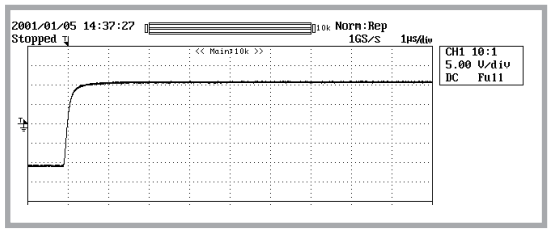
Change the trigger position. ( )

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

Changing Trigger Position

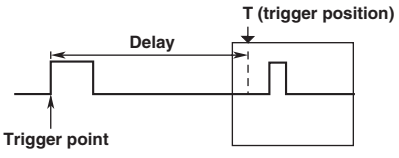


Change the trigger position from 50% to 10%.



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.



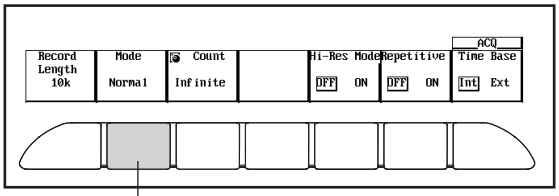
Changing the Acquisition Mode

The acquisition mode determines how the DL1640 stores, processes, and displays the incoming sampling data. You can select from three 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 200 MS/s (100 MS/s: high-resolution 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)

Operation

ACQ

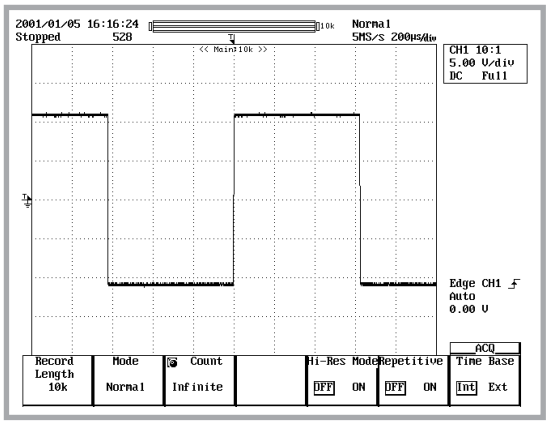


Select the acquisition mode.

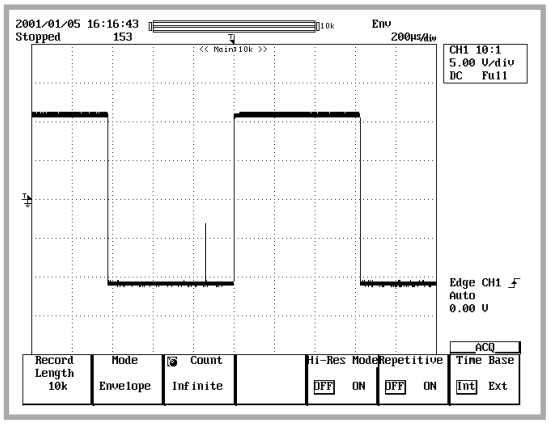
Screen Examples

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

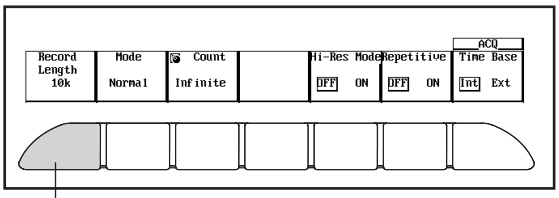


Selecting the Record Length

The term, record length, refers to the amount of waveform data that can be acquired in the acquisition memory.
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 set record length and the display record length may differ.

Operation

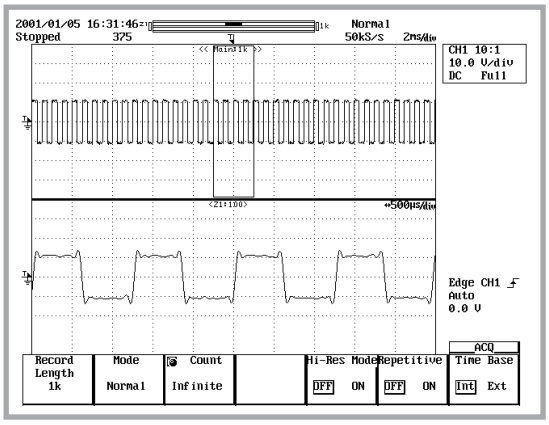
ACQ



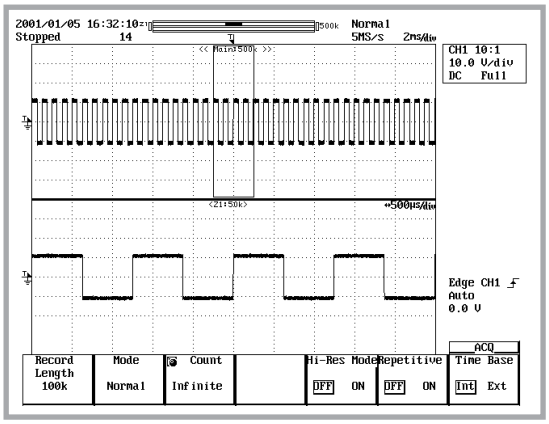
Select the record length. ( )

Record Length Setup Example

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



Change the record length from 1 kW to 100 kW.



Snapshots and History Memory

Snapshots

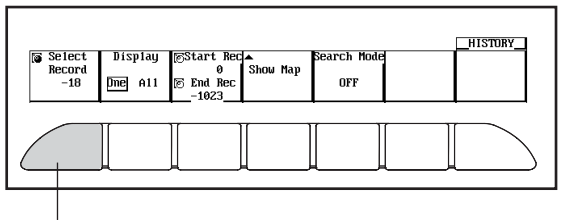
By pressing the SNAP SHOT key, the waveform that is currently displayed (referred to as the snap shot waveform) remains on the screen. Pressing the CLEAR TRACE key clears the snap shot waveform.

Operation

Recalling Images from History Memory

The history memory of the DL1640L stores up to 16000 previously displayed waveforms and the DL1640 up to 4000 (the exact number depends on 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.

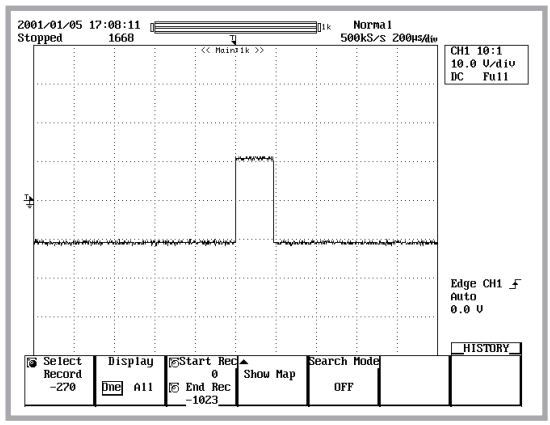
Operation



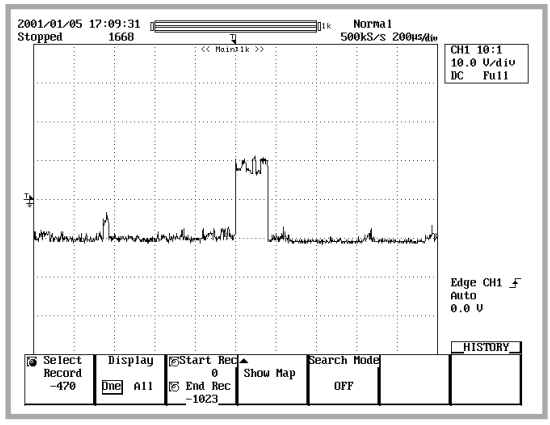
Select the record number. ( )

History Display

Displaying “–270”



Displaying “–470”



• MEMO

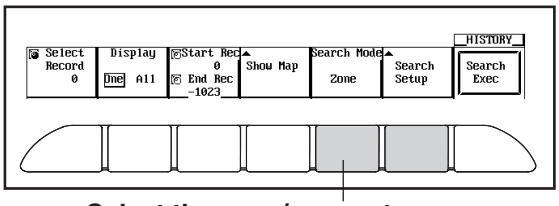
- If you set Display to “One,” the screen displays a single waveform from the history. If you set Display to “All,” the screen shows all waveforms within a selected range of the history.
- You can display a list of the stored waveforms and their acquisition times.

Search the Waveform

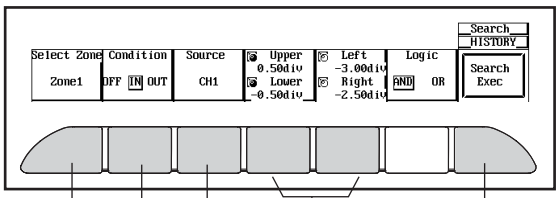
History Search Function

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

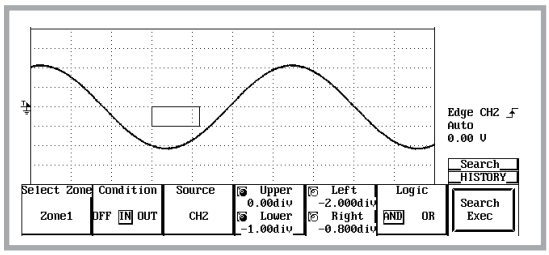


Select the zone/parameter.

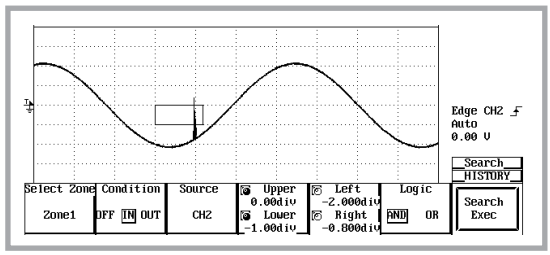


Setting the zone. (◎)
Execute the search.
Select the source channel.
Select the search condition.
Select the zone.

History Memory Search



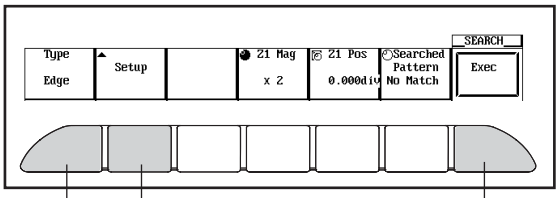
Searches waveforms that pass the specified area.



Search and Zoom Function

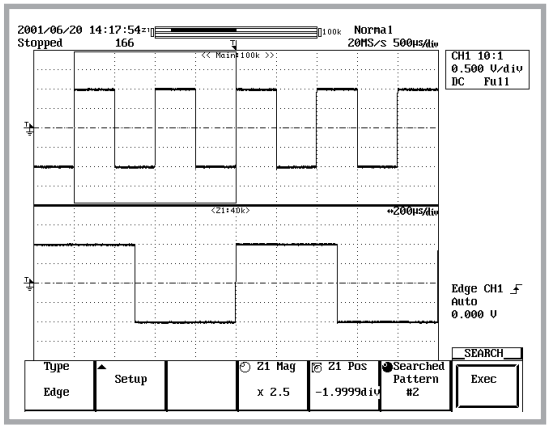
Searches waveforms by the specified area or level from the start point of the search.
Choose from the following five search methods: Edge, Serial pattern, Parallel pattern, Pulse width, or Auto scroll.

Operation *SHIFT key* + ZOOM



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

Edge Search

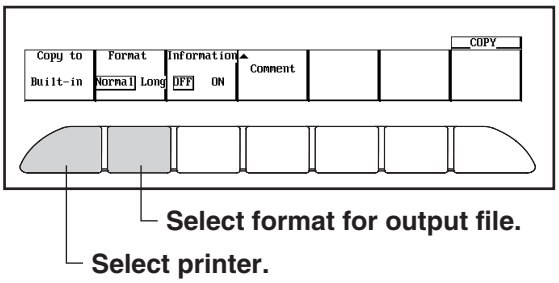


Search Condition (Search Count : 2 times)
Source : CH1, Level : 0 V
Polarity : ⊓, Hysteresis : 0.3 div
Count : 1, Start Point : -5 div

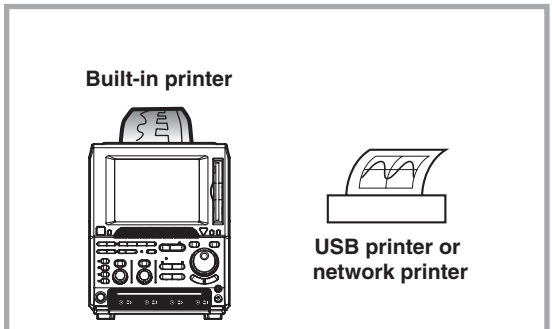
Printing the Screen Image

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



Printout from Specified Printer



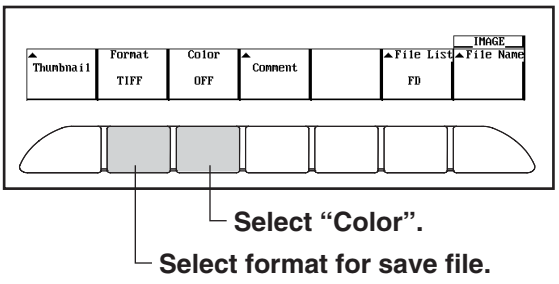
MEMO

You can use the long copy function to generate an enlarged printout (2x to 800000x enlargement) of the displayed waveform.

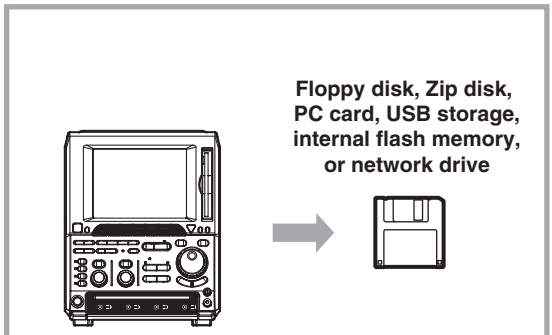
Saving the Screen Image to the Storage Medium

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



Save to Selected Storage Medium



MEMO

If you select the autoname function, the DL1640/DL1640L automatically assigns filenames to your saved files.