DL716
Digital Scope
OPERATION GUIDE

YOKOGAWA
Yokogawa Electric Corporation

IM 701830-02E
1st Edition

Introduction

Thank you for your purchase of the DL716 Digital Scope. This Operation Guide explains the basic operations to familiarize you quickly and easily with this digital scope when using it for the first time.
Within this manual, the "  " icon means that you must set the appropriate value using the DL716's jog shuttle.
This manual is part of a three-manual set provided with the DL716. Please use it together with the other two manuals in the set.

- Refer to the DL716 User's Manual (IM 701830-01E) for full details about all of the DL716 functions.
- Refer to the DL716 Communication Interface manual (IM 701830-11E) for detailed information about the DL716 communication functions.

Notices

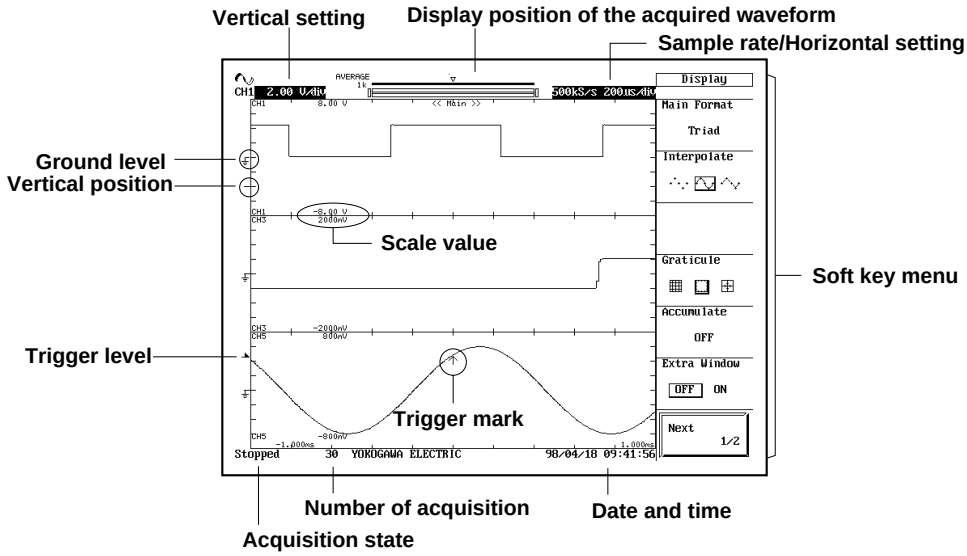
- The contents of this guide are subject to change without prior notice as a result of improvements in the instrument's performance and functions.
- Display contents illustrated in this manual may differ slightly from what actually appears on your screen.
- Every effort has been made in the preparation 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.

Revisions
First edition: January 1999

Disk No. DL24
1st Edition : January 1999 (YK)

Basic Operations

Display



Page 4

Initialization and automatic setup

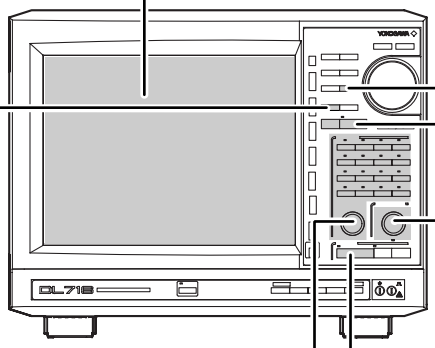
CAL SETUP

Pages 5, 13

Horizontal axis settings

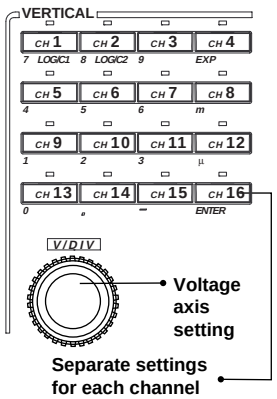
ZOOM — Waveform zoom

HORIZONTAL
TIME/DIV — Time axis setting



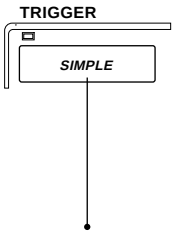
Pages 6, 7

Vertical axis settings



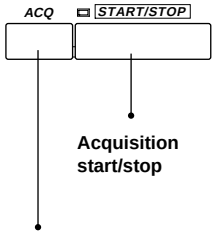
Pages 8, 9

Simple trigger settings



Pages 10 to 12

Waveform acquisition settings



Useful functions

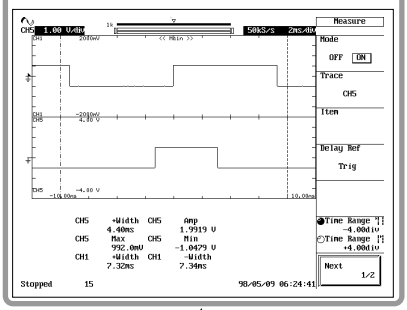
For other functions and more details on the functions mentioned hereafter, please refer to the indicated sections in the User's Manual (IM701830-01E).

Section 9.2

Automatic measurement of waveform parameters

MEASURE

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

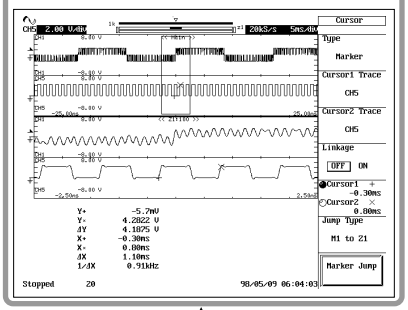


Section 9.1

Cursor measurement

CURSOR

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

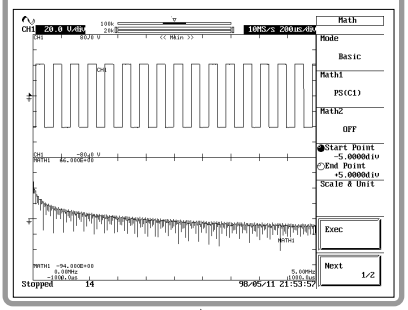


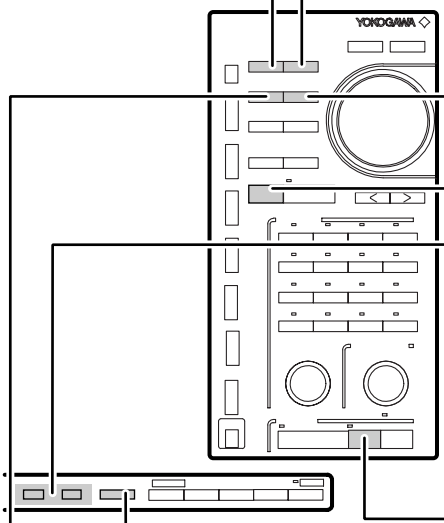
Sections 9.3 to 9.10

Waveform computations

MATH

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





Page 14

Snapshot

SNAP SHOT CLEAR

Clears the displayed waveform

Retain the displayed waveform on the screen

Page 16

Realtime record

ACQ

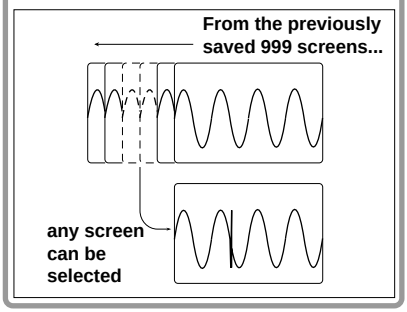
Realtime record the waveform to the built-in printer or the internal hard disk (optional)

Page 14

History function

HISTORY

History memory retains data from previous screens (up to 999 previous screens).

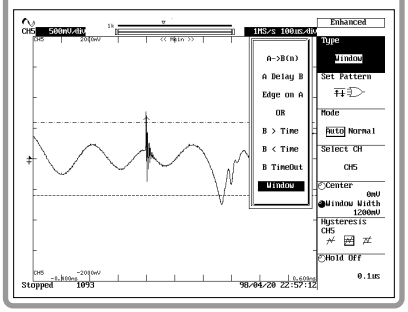


Sections 6.9 to 6.14

Enhanced trigger settings

ENHANCED

Use this function to set up an enhanced trigger.



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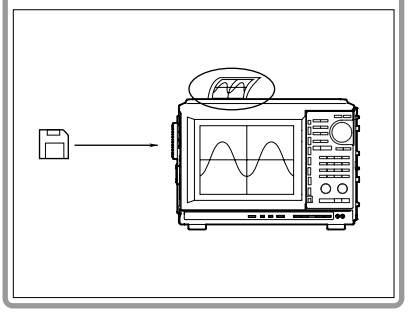
Print/Save screen image

COPY MENU

Send screen image to built-in printer or to floppy, MO, or hard disk.

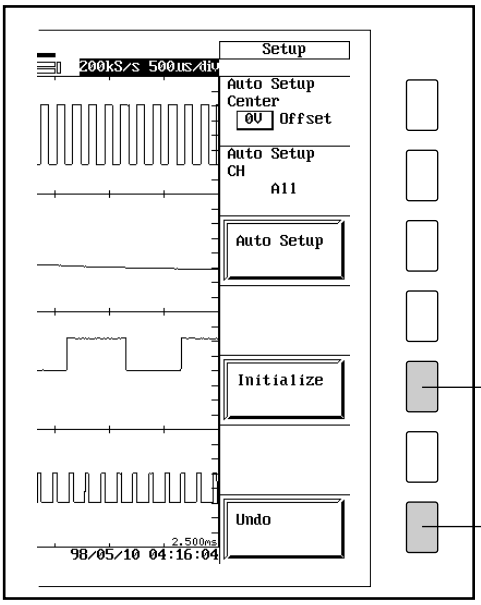


Initializing

The settings made by the key operation on the front panel are reset to their initial settings.
Initialization is convenient when resetting the parameters in correspondence with the input signal.

Operation

CAL SETUP

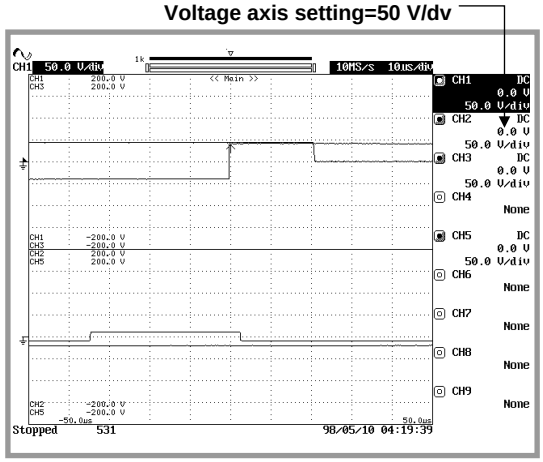


Undo initialization (restore previous settings)

Execute initialization

Initialized display

Input coupling=DC
Voltage axis setting=50 V/dv

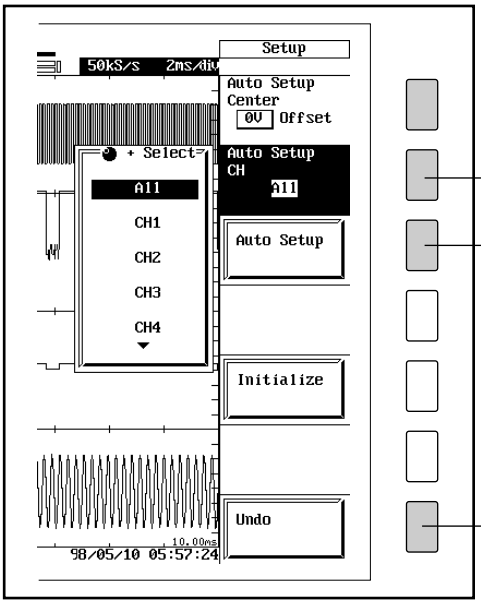


Auto setup

The DL716 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

CAL SETUP



Select channel

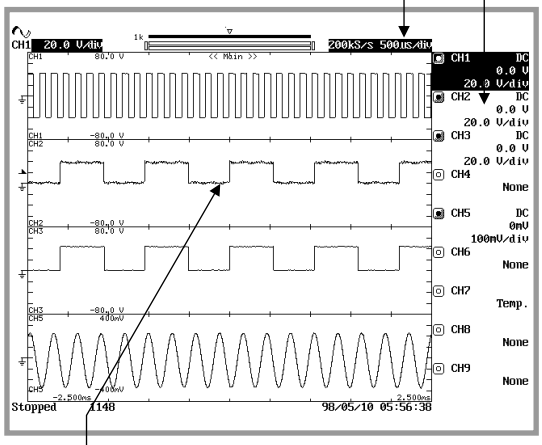
Execute auto setup

Cancel auto-setup and restore previous settings

Auto setup

Set the input coupling to DC

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



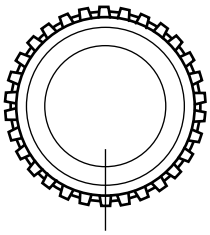
Trigger at rising edge of the weveform with the longest cycle.

Time axis

Change the time (Time/div) allotted for 1 div (1 division) on the grid.
It can be set in the range from 500 ns/div to 100 ks/div. Since the screen displays 10 div total, the time that can be displayed is defined by "time axis setting X 10."

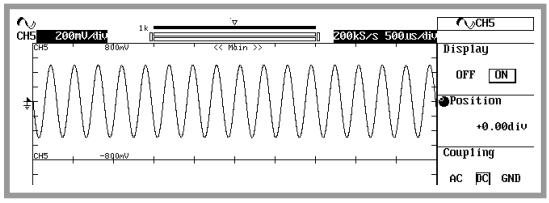
Operation

TIME/DIV



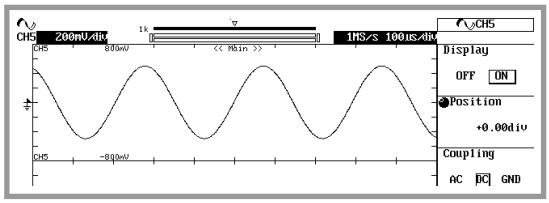
Turn right to shorten the displayed time

Adjustment example, Time/div



500 μs x 10 = 5 ms

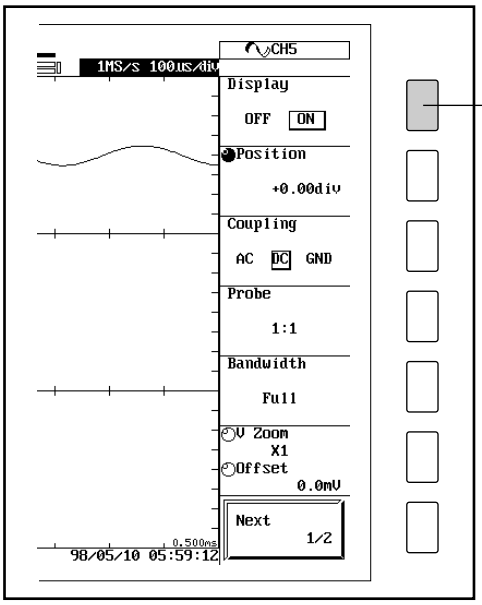
Change from 500 μs/div to 100 μs/div.



100 μs x 10 = 1 ms

Turning the waveform display ON/OFF

Operation CH 1 to CH 16



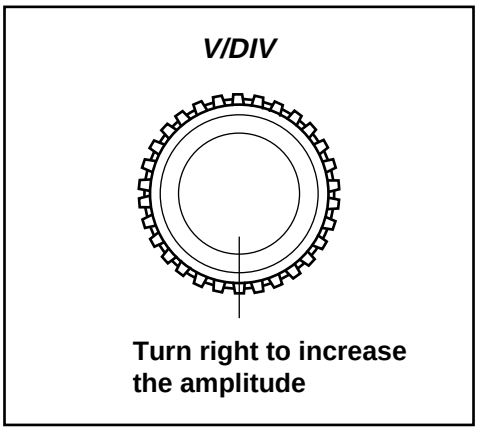
Waveform display ON/OFF

Changing the display amplitude of the waveform (for voltage modules*)

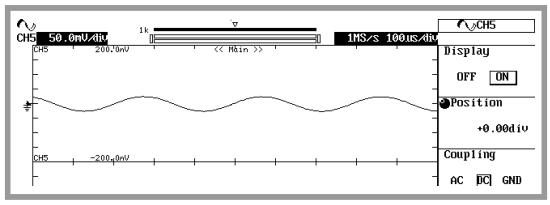
The display amplitude of the input waveform is adjusted by changing the voltage value (V/div) allotted for 1 div (1 division) on the grid. It is set for each channel.

* Voltage modules : High-Speed Isolation/ High-Speed/ High-Resolution, High-Voltage, Isolation/ High-Resolution, Isolation Modules

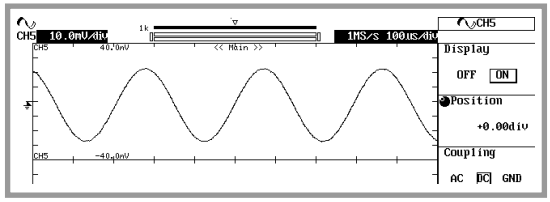
Operation CH 1 to CH 16



Adjustment example, V/div



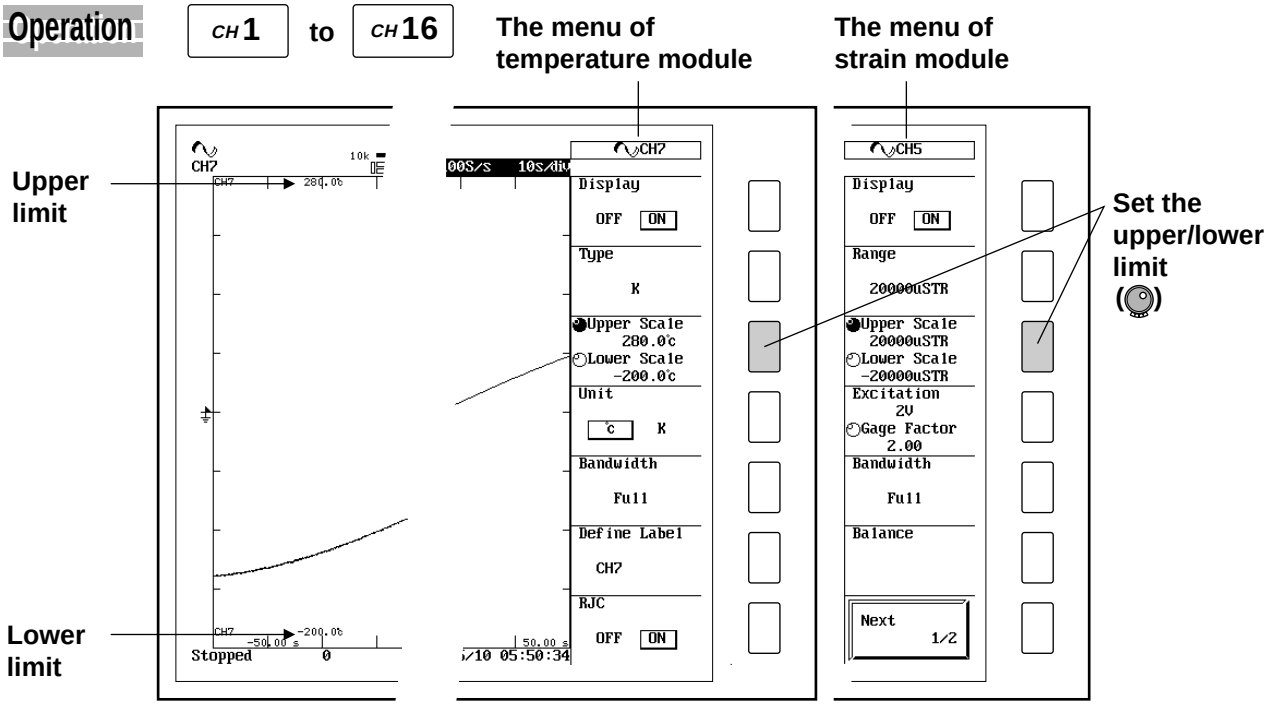
Change from
50.0 mV/div
to 10.0 mV/div



Changing the display amplitude of the waveform (for Temperature/Strain modules)

For temperature modules, the display range (upper and lower limits) is set for displaying the input waveform.

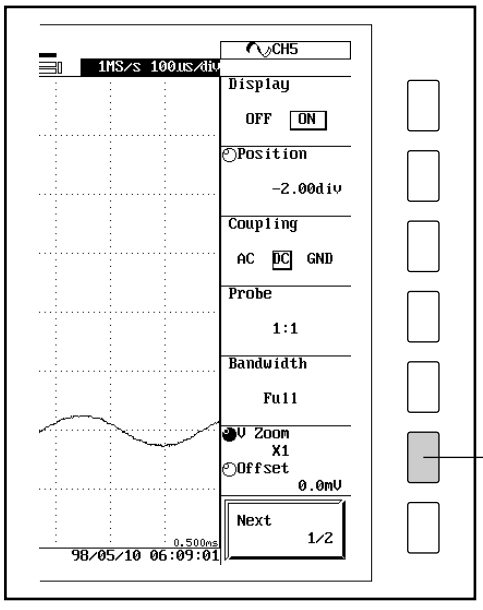
Operation CH 1 to CH 16



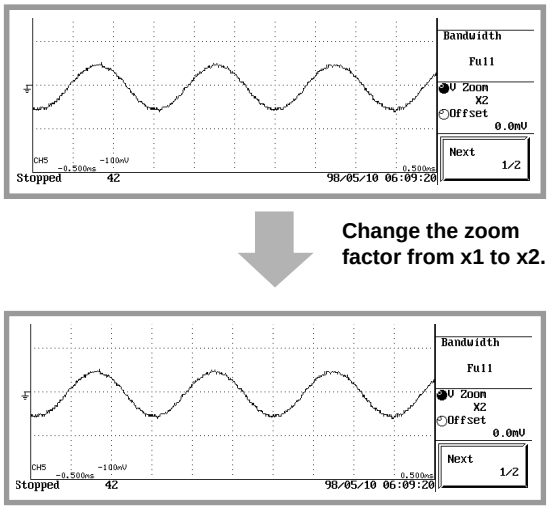
Zooming the waveform in the vertical direction

The display waveform can be scaled in the vertical direction.

Operation CH 1 to CH 16



Zoom display



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 enhanced triggers, refer to the User's Manual (IM701830-01E).

Changing the Trigger source, level, and slope

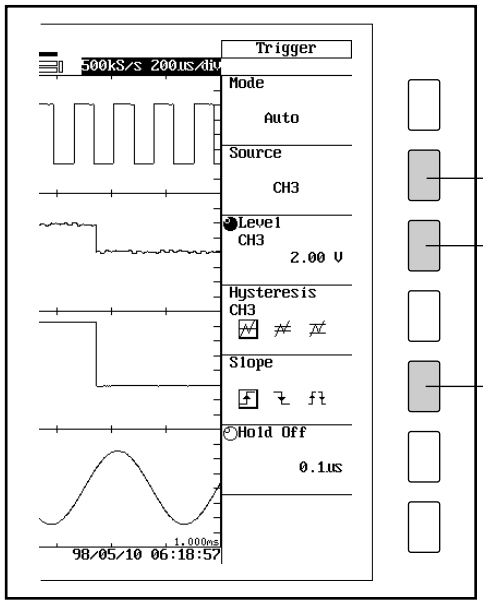
The input signal used for triggering is called the trigger source. The input signal from CH1 to CH16, as well as the external input signal (TRIG IN), the commercial power supply signal (Line) and optional 32-bits extendered logic input, can be specified as a trigger source.

: Trigger occurs when signal level drops through trigger level.

: Trigger occurs when signal level rises through trigger level.

: Trigger occurs when signal level crosses trigger level from either direction.

Operation ***SIMPLE***

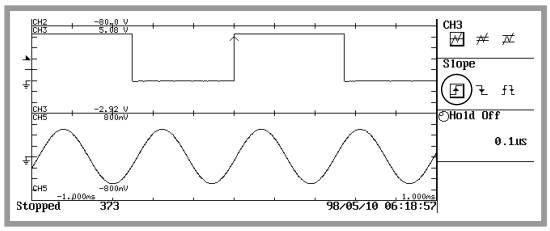


Select the trigger source

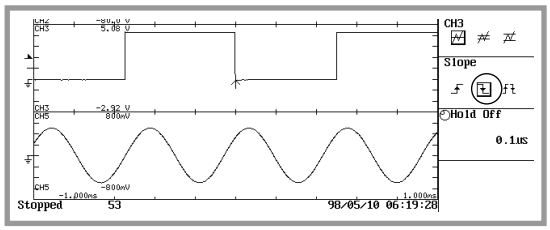
Set the trigger level ( )

Set the trigger slope condition

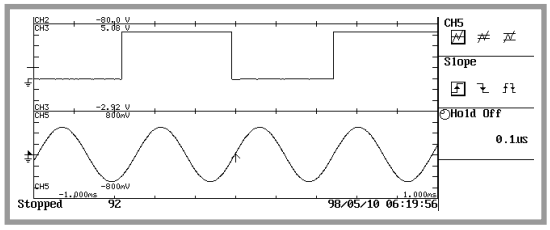
Source and slope setup example



Changing slope from to .



Changing source from square-wave channel to sine-wave channel.



Changing the trigger mode

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

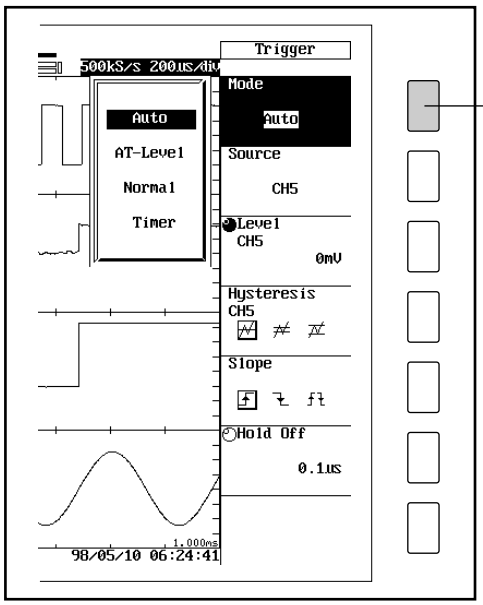
Auto : Updates the displayed waveform automatically when no trigger has been activated during a specified time.

AT-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.

Timer : The trigger is activated at the specified interval from the specified time.

Operation *SIMPLE*

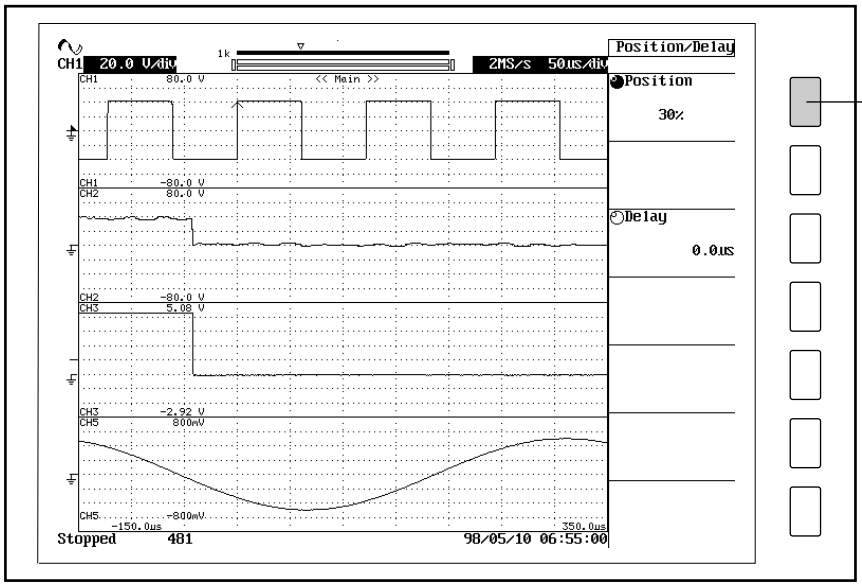


Select the trigger mode

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 / DELAY*



Change the trigger position

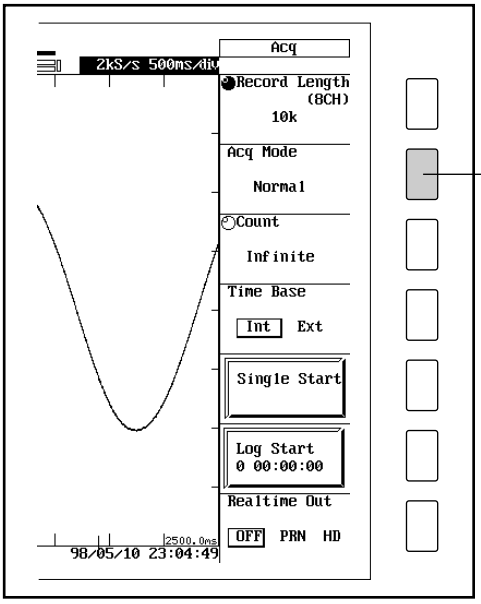
Changing the acquisition mode

The acquisition mode determines how the DL716 stores, processes, and displays the incoming sampling data. You can select from five modes.

- Normal : Values are stored and displayed as received, with no special processing.
- Envelope : Determines the maximum and minimum values in the waveform acquisition interval for the normal mode from the data sampled at the maximum sample rate of each module, and displays the waveform using those values.
- 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)
- Sequence : Stores a specified number of waveform records into acquisition memory before displaying the waveform.
- Box Average : Calculates moving averages of 10 MS/s sampling data.

Operation

ACQ

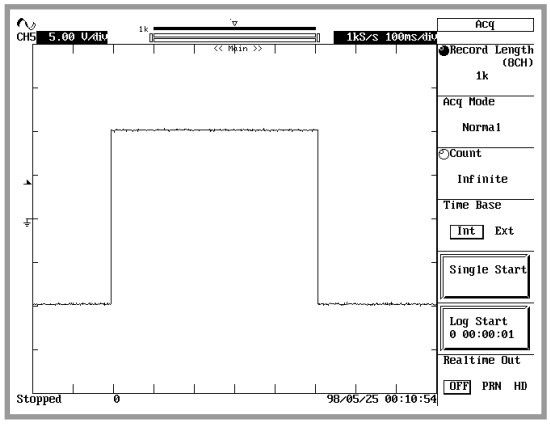


Select the acquisition mode

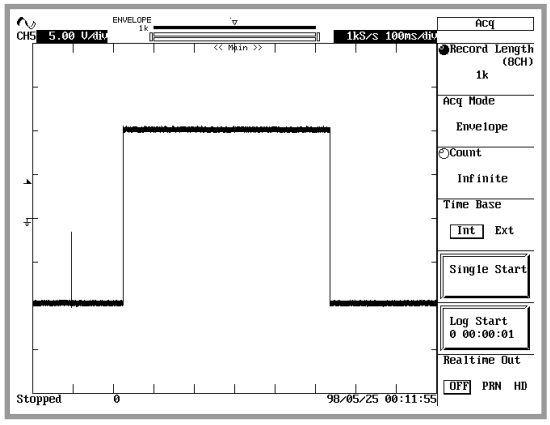
Screen examples

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



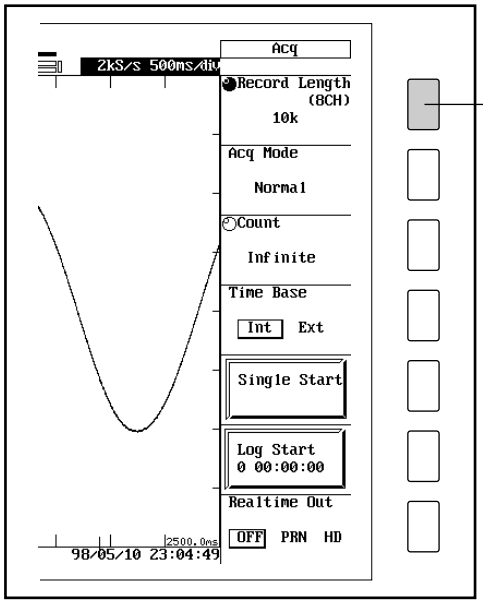
Selecting the record length

The term, record length, refers to the amount of waveform data that can be acquired in the acquisition memory. 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.
When using only four or eight channels to measure with a longer record length, install the modules in the following channels.

No. of channel used	Channels to install
4	CH1, CH5, CH9, CH13
8	CH1, CH3, CH5, CH7, CH9, CH11, CH13, CH15

Operation

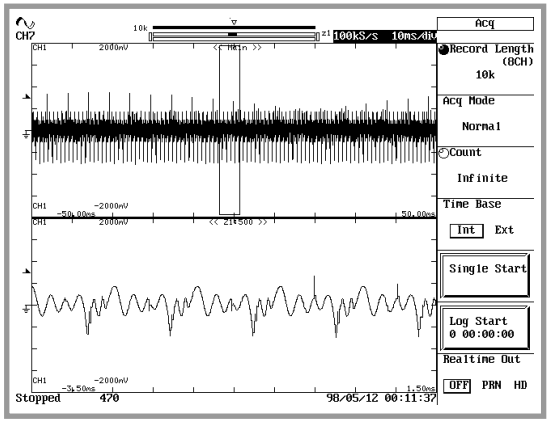
ACQ



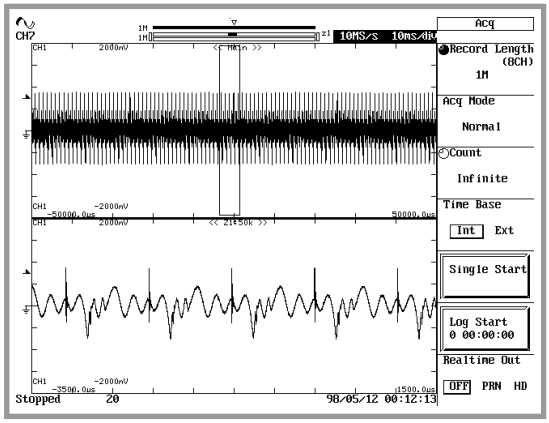
Set the record length

Record length setup example

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



Change the record length from 100 kW to 1 MW



Starting/Stopping the Waveform Acquisition

Waveform is being acquired when the indicator above the key is lit.

Operation

START/STOP

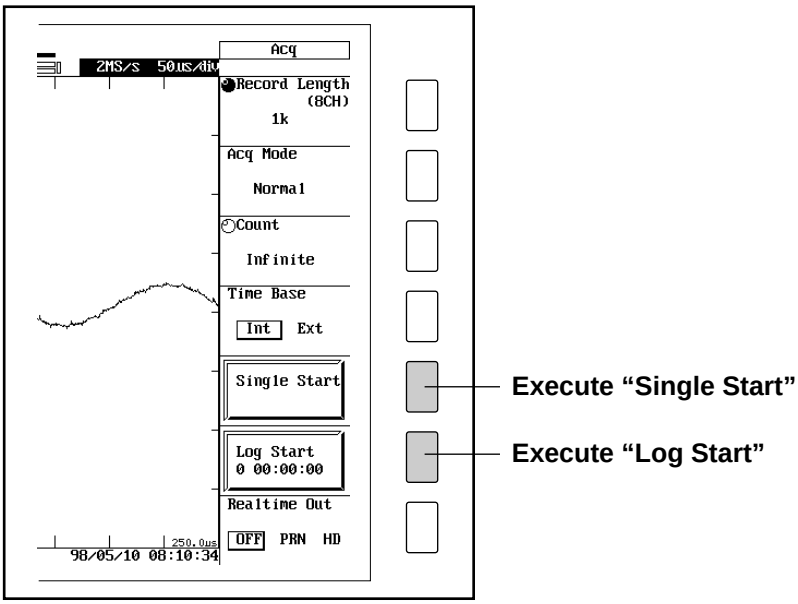
Acquiring the waveform once

"Single Start" : After pressing the soft key, the waveform is acquired for the set record length when the trigger is activated, and the result is displayed.

"Log Start" : The waveform is acquired for the set record length when the soft key is pressed, and the result is displayed.

Operation

ACQ

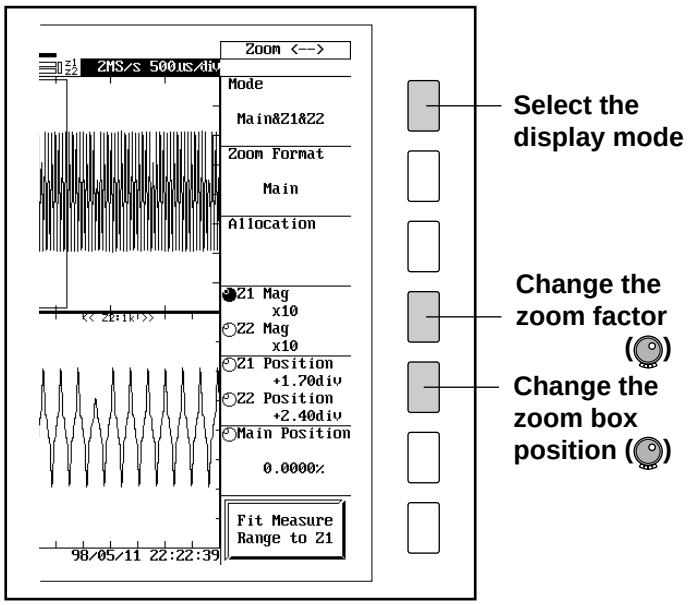


Zooming the Waveform

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

Operation

ZOOM

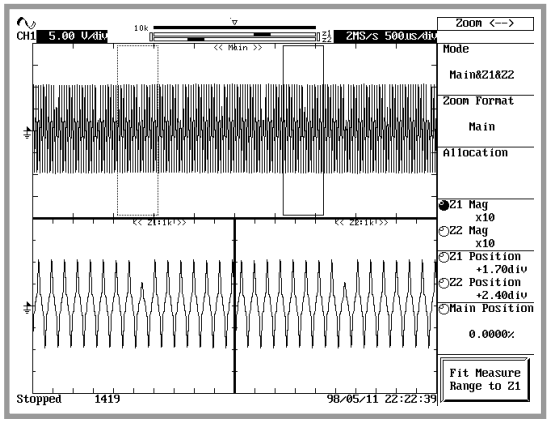


Select the display mode

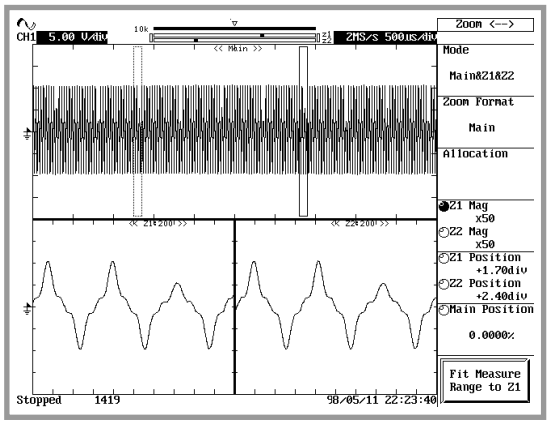
Change the zoom factor ( )

Change the zoom box position ( )

Zoom display



Change the zoom factor from x10 to x50.



Snapshots

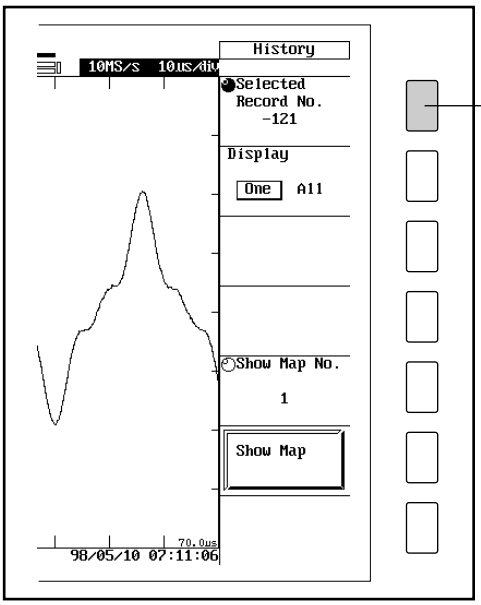
By pressing the SNAP SHOT key, the waveform that is currently displayed (referred to as the snap shot waveform) remains on the screen. Pressing the CLEAR key clears the snap shot waveform.

Operation *SNAP SHOT*

Recalling images from history memory

The DL716's history memory stores up to 1000 previously displayed waveforms (the exact number depends on the machine model and the acquisition settings). 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.

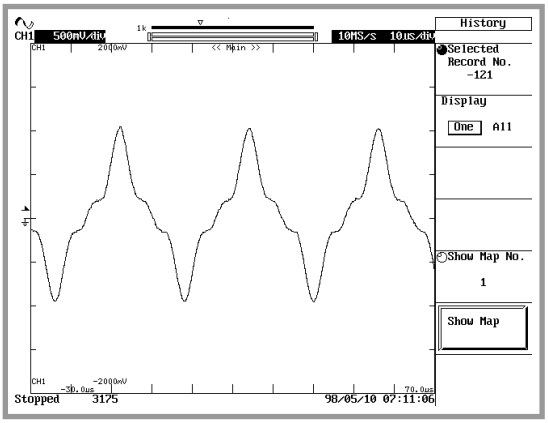
Operation *HISTORY*



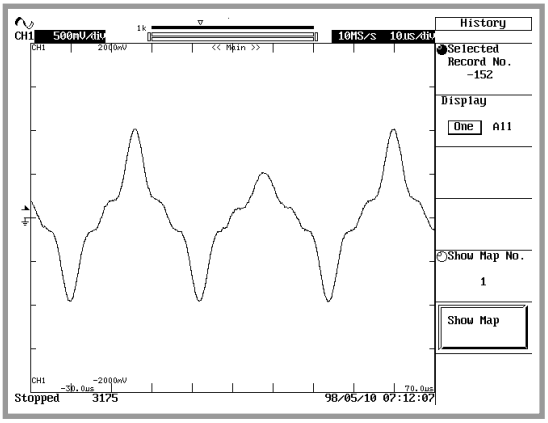
Select the screen number

History display

Displaying "-121"



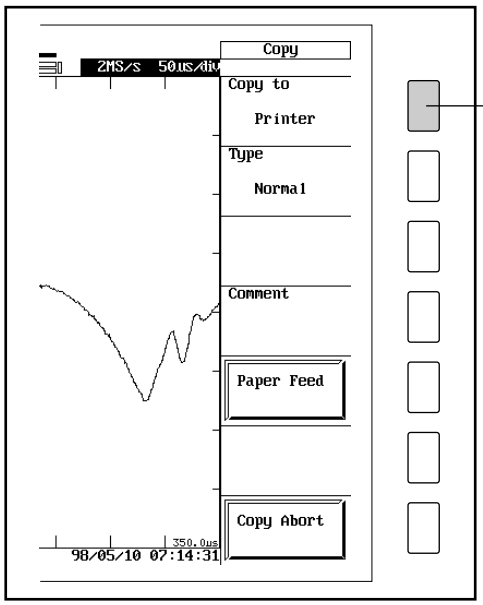
Displaying "-152"



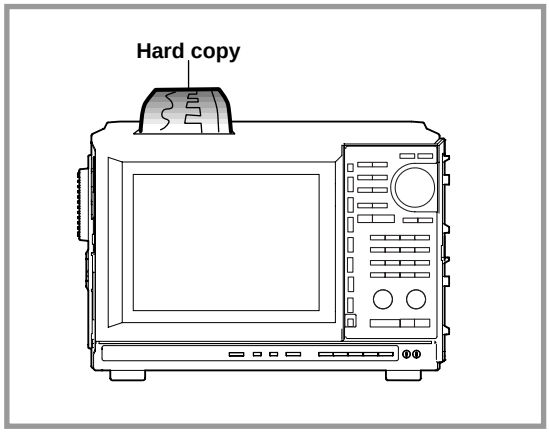
Printing the screen image

At the initial setting, the screen image data can be hard copied to the built-in printer by simply pressing the *COPY MENU* key.

Operation *SHIFT key* + *COPY MENU*



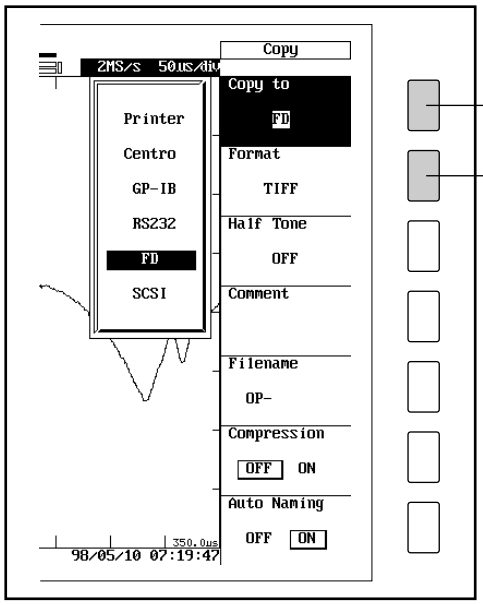
Printout from built-in printer



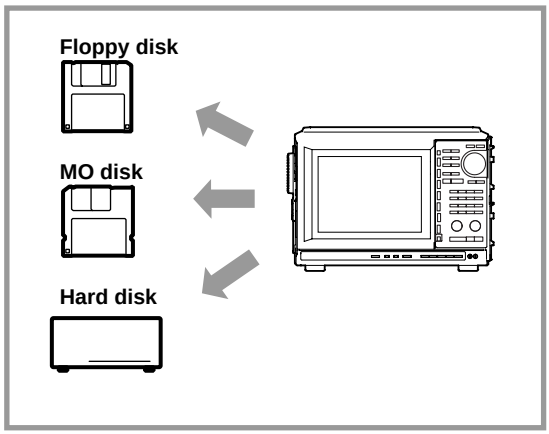
Saving the screen image to disk

After setting up as described below, you can execute repeated saves by pressing the *COPY MENU* key as required.

Operation *SHIFT key* + *COPY MENU*



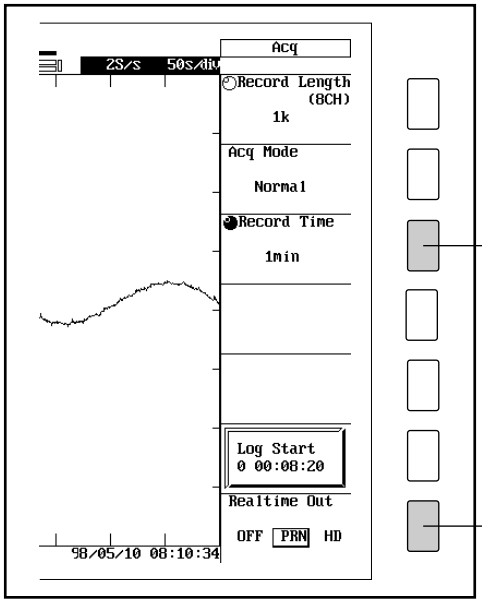
Save to selected disk type



Printing to the printer in realtime

The waveform (screen image data) is continuously printed to the built-in printer as in a recorder.
Pressing the START/STOP key starts the print.
The number indicated on the lower part of the “Log Start” soft key menu is the maximum time that can be printed.

Operation ACQ / START/STOP



Set the time duration to print

Set the record destination to the built-in printer

Valid time axis setting for realtime print and the paper feeding speed (chart speed)

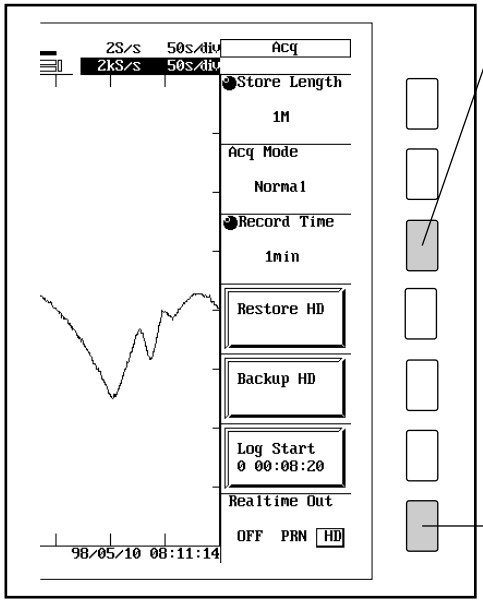
T/div	Chart speed*
500 ms/div	20 mm/s
1 s/div	10 mm/s
2 s/div	5 mm/s
5 s/div	2 mm/s
10 s/div	1 mm/s
20 s/div	0.5 mm/s
⋮	⋮
100 ks/div	0.006 mm/min

*Chart speed = 10 mm ÷ (number of seconds in 1 div on the time axis)

Recording to the internal hard disk (optional) in realtime

Records the waveform data to the internal hard disk in realtime.
Pressing the START/STOP key starts the record.
The number indicated on the lower part of the “Log Start” soft key menu is the maximum time that can be recorded.

Operation ACQ / START/STOP



Set the time duration to record

Channels used (Possible record length)	Time axis setting
16 CH (all channels)	5 s/div to 100 ks/div
(1 MW to 16 MW)	(20 kS/s or less)
8 CH (any 8 channels)	2 s/div to 100 ks/div
(1 MW to 32 MW)	(50 kS/s or less)
4 CH (any 4 channels)	1 s/div to 100 ks/div
(1 MW to 64 MW)	(100 kS/s or less)
2 CH (any 2 channels)	500 ms/div to 100 ks/div
(1 MW to 128 MW)	(200 kS/s or less)
1 CH (any 1 channel)	500 ms/div to 100 ks/div
(1 MW to 256 MW)	(200 kS/s or less)

Set the record destination to the hard disk

A list of Measurement Ranges

Measurement ranges in the vertical direction

Vertical position / V/div	-4 div	0 div	+4 div
5 mV	0 mV to 40 mV	–20 mV to 20 mV	–40 mV to 0 mV
10 mV	0 mV to 80 mV	–40 mV to 40 mV	–80 mV to 0 mV
20 mV	0 mV to 160 mV	–80 mV to 80 mV	–160 mV to 0 mV
50 mV	0 mV to 400 mV	–200 mV to 200 mV	–400 mV to 0 mV
100 mV	0 mV to 800 mV	–400 mV to 400 mV	–800 mV to 0 mV
200 mV	0 mV to 1600 mV	–800 mV to 800 mV	–1600 mV to 0 mV
500 mV	0 mV to 4000 mV	–2000 mV to 2000 mV	–4000 mV to 0 mV
1 V	0 V to 8 V	–4 V to 4 V	–8 V to 0 V
2 V	0 V to 16 V	–8 V to 8 V	–16 V to 0 V
5 V	0 V to 40 V	–20 V to 20 V	–40 V to 0 V
10 V	0 V to 80 V	–40 V to 40 V	–80 V to 0 V

Measurement ranges in the horizontal direction

Record length / T/div	1MW	2MW	4MW	8MW	16MW	32MW	64MW
100ks*	11d 13h 46min 40s	23d 3h 33min 20s	46d 7h 6min 40s	92d 14h 13min 20s	185d 4h 26min 40s	370d 8h 53min 20s	740d 17h 46min 40s
50ks*	5d 18h 53min 20s	11d 13h 46min 40s	23d 3h 33min 20s	46d 7h 6min 40s	92d 14h 13min 20s	185d 4h 26min 40s	370d 8h 53min 20s
20ks*	2d 7h 33min 20s	4d 15h 6min 40s	9d 6h 13min 20s	18d 12h 26min 40s	37d 53min 20s	75d 1h 46min 40s	150d 3h 33min 20s
10ks*	1d 3h 46min 40s	2d 7h 33min 20s	4d 15h 6min 40s	9d 6h 13min 20s	18d 12h 26min 40s	37d 53min 20s	75d 1h 46min 40s
5ks*	13h 53min 20s	1d 3h 46min 40s	2d 7h 33min 20s	4d 15h 6min 40s	9d 6h 13min 20s	18d 12h 26min 40s	37d 53min 20s
2ks*	5h 33min 20s	11h 6min 40s	22h 13min 20s	1d 20h 26min 40s	3d 16h 53min 20s	7d 9h 46min 40s	14d 19h 33min 20s
1ks*	2h 46min 40s	5h 33min 20s	11h 6min 40s	22h 13min 20s	1d 20h 26min 40s	3d 16h 53min 20s	7d 9h 46min 40s
500s*	1h 23min 20s	2h 46min 40s	5h 33min 20s	11h 6min 40s	22h 13min 20s	1d 20h 26min 40s	3d 16h 53min 20s
200s*	33min 20s	1h 6min 40s	2h 13min 20s	4h 26min 40s	8h 53min 20s	17h 46min 40s	1d 11h33min 20s
100s	16min 40s	33min 20s	1h 6min 40s	2h 13min 20s	4h 26min 40s	8h 53min 20s	17h 46min 40s
50s	8min 20s	16min 40s	33min 20s	1h 6min 40s	2h 13min 20s	4h 26min 40s	8h 53min 20s
20s	3min 20s	6min 40s	13min 20s	26min 40s	53min 20s	1h 46min 40s	3h 33min 20s
10s	1min 40s	3min 20s	6min 40s	13min 20s	26min 40s	53min 20s	1h 46min 40s
5s	50s	1min 40s	3min 20s	6min 40s	13min 20s	26min 40s	53min 20s
2s	20s	40s	1min 20s	2min 40s	5min 20s	10min 40s	21min 20s
1s	10s	20s	40s	1min 20s	2min 40s	5min 20s	10min 40s
500ms	5s	10s	20s	40s	1min 20s	2min 40s	5min 20s
200ms	2s	4s	8s	16s	32s	1min 4s	2min 8s
100ms	1s	2s	4s	8s	16s	32s	1min 4s
50ms	500ms	1s	2s	4s	8s	16s	32s
20ms	200ms	400ms	800ms	1600ms	3200ms	6400ms	12800ms
10ms	100ms	200ms	400ms	800ms	1600ms	3200ms	6400ms
5ms	50ms	100ms	200ms	400ms	800ms	1600ms	3200ms
2ms	20ms	40ms	80ms	160ms	320ms	640ms	1280ms
1ms	10ms	20ms	40ms	80ms	160ms	320ms	640ms
500µs	5ms	10ms	20ms	40ms	80ms	160ms	320ms
200µs	2ms	4ms	8ms	16ms	32ms	64ms	128ms
100µs	1ms	2ms	4ms	8ms	16ms	32ms	64ms
50µs	500µs	1ms	2ms	4ms	8ms	16ms	32ms
20µs	200µs	400µs	800µs	1600µs	3200µs	6400µs	12800µs
10µs	100µs	200µs	400µs	800µs	1600µs	3200µs	6400µs
5µs	50µs	100µs	200µs	400µs	800µs	1600µs	3200µs
2µs	20µs	40µs	80µs	160µs	320µs	640µs	1280µs
1µs	10µs	20µs	40µs	80µs	160µs	320µs	640µs
500ns	5µs	10µs	20µs	40µs	80µs	160µs	320µs

d: abbreviation for day, h: abbreviation for hour

*Some of the T/div settings cannot be specified when the set record length is less than 1 MW.