

# **DL1720/DL1740**

Digital Oscilloscope

# **USER'S MANUAL**

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## Foreword

Thank you for purchasing the DL1720/DL1740 Digital Oscilloscope. This user's manual contains useful information about the instrument's functions and operating procedures as well as precautions that should be observed during use, mainly DL1740. To ensure proper use of the instrument, please read this manual thoroughly before operating it. Keep the manual in a safe place for quick reference whenever a question arises. Three manuals are provided with the instrument, including this user's manual.

| Manual Name   | Manual No.    | Description   |
|---|---------------|---|
| DL1720/DL1740<br>User's Manual                            | IM 701710-01E | Describes all functions (except for the communications function) and their operation procedures for the instrument. |
| DL1720/DL1740<br>Communication Interface<br>User's Manual | IM 701710-17E | Describes the communications functions of the GP-IB, RS-232, USB, and network interface.                            |
| DL1720/DL1740<br>Operation Guide                          | IM 701710-02E | Explains basic operations only.   |

## Notes

- The contents of this manual 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 manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA representative listed on the back cover of this manual.
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- A guarantee card is attached to the instrument. The card will not be reissued, so please read it carefully and keep it in a safe place.
- The TCP/IP software used in this product and the documentation for that TCP/IP software are based in part on BSD Networking Software, Release 1 licensed from The Regents of the University of California.

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## Revisions

1st Edition: January 2001

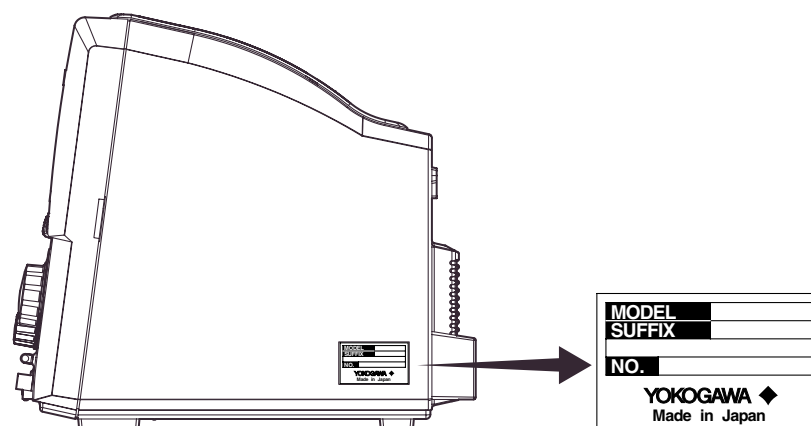
2nd Edition: July 2001 (supports firmware version 1.30 or later)

# Checking the Contents of the Package

Unpack the box and check the contents before operating the instrument. If the wrong instrument or accessories have been delivered, if some accessories are missing or if they appear abnormal, contact the dealer from which you purchased them.

## DL1720/DL1740 Main Body

Check that the model name and suffix code given on the name plate of the side panel match those on your order. Whenever you contact the dealer from which you purchased the instrument, tell the dealer your unit's serial number.



| MODEL                | SUFFIX | SPECIFICATIONS   |
|----------------------|--------|--|
| 701705 (DL1720)      |        | 2 channels   |
| 701710 (DL1740)      |        | 4 channels   |
| Power Cord           | -D     | UL/CSA standard power cord (A1006WD)<br>Maximum rated voltage: 125 V, maximum rated current: 7 A |
|                      | -F     | VDE standard power cord (A1009WD)<br>Maximum rated voltage: 250 V, maximum rated current: 10 A   |
|                      | -Q     | BS standard power cord (A1054WD)<br>Maximum rated voltage: 250 V, maximum rated current: 10 A    |
|                      | -R     | SAA standard power cord (A1024WD)<br>Maximum rated voltage: 240 V, maximum rated current: 10 A   |
| Built-in Media Drive | -J1    | Floppy disk drive <sup>*1</sup>  |
|                      | -J2    | Zip disk drive <sup>*1</sup>   |
| Options              | /B5    | Built - in printer <sup>*2</sup>   |
|                      | /C7    | SCSI+serial interface  |
|                      | /C10   | Ethernet interface   |
|                      | /E2    | Two passive probes <sup>*3</sup>   |
|                      | /P2    | Two power output connectors for the probes (for the DL1720)                                      |
|                      | /P4    | Four power output connectors for the probes (for the DL1740)                                     |

\*1 You can select a floppy disk drive or a Zip drive for the built-in media drive.

\*2 1 printer roll (B9850NX) included

\*3 Two passive probes (700988) come standard with the DL1720/DL1740.

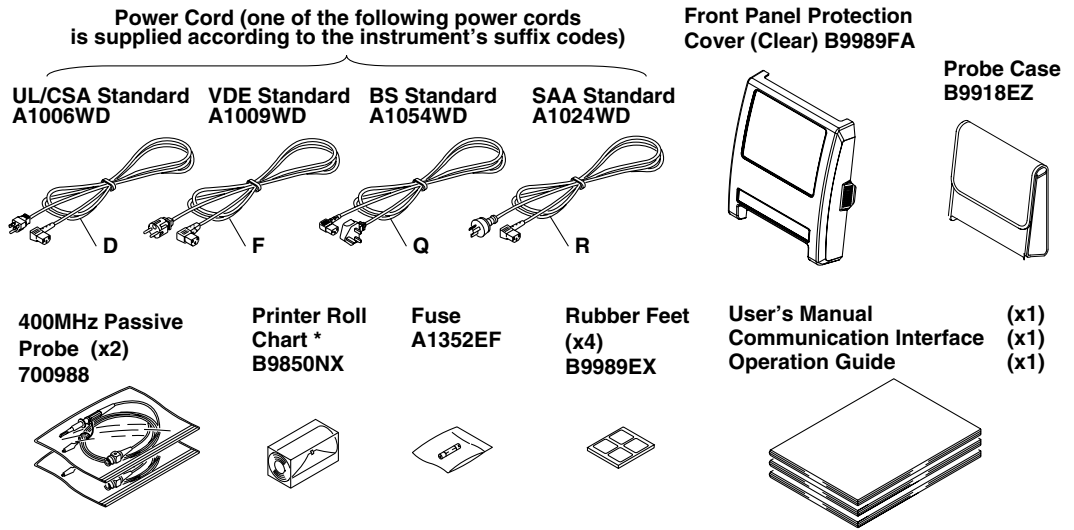
Example: UL/CSA standard power cord, and full options → 701710-D/B5/C7/C10/E2/P4

### NO. (Instrument Number)

When contacting the dealer from which you purchased your instrument, please quote the instrument number.

### Standard Accessories

The following standard accessories are supplied with the instrument. Make sure that all items are present and undamaged.

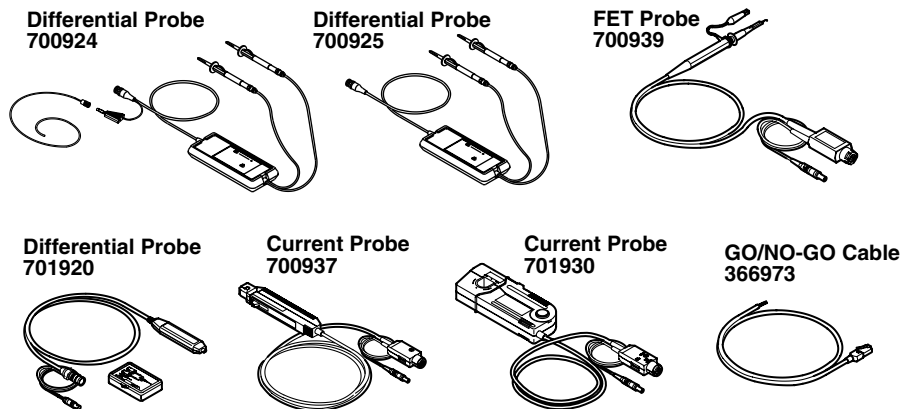


\* A roll chart will be supplied only when the instrument is equipped with a built-in printer.

### Optional Accessories

The following optional accessories are available. On receiving these optional accessories, make sure that all the items that you ordered have been supplied and that they are undamaged.

If you have any questions regarding optional accessories, or if you wish to place an order, contact the dealer from whom you purchased the instrument.



## Checking the Contents of the Package

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### Optional Spare Parts

The following optional spare parts are available. On receiving these optional spare parts, make sure that all the items that you ordered have been supplied and that they are undamaged.

If you have any questions regarding optional spare parts, or if you wish to place an order, contact the dealer from whom you purchased the instrument.

| Part Name                               | Part No. | Minimum Q'ty | Remarks   |
|---|----------|--------------|---|
| Roll chart                              | B9850NX  | 5            | Thermo-sensible paper, Total                      |
| 400 MHz passive probe                   | 700988   | 1            | Input impedance: 10 M $\Omega$ , Length:<br>1.5 m |
| Fuse                                    | A1352EF  | 2            | 4 A, 250 V  |
| Front panel protection cover<br>(clear) | B9989FA  | 1            |   |

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# Safety Precautions

This instrument is an IEC safety class I instrument (provided with terminal for protective grounding).

The following general safety precautions must be observed during all phases of operation, service and repair of this instrument. If this instrument is used in a manner not specified in this manual, the protection provided by this instrument may be impaired. Also, Yokogawa Electric Corporation assumes no liability for the customer's failure to comply with these requirements.

## The Following Symbols are Used on this Instrument.



To avoid injury, death of personnel or damage to the instrument, the operator must refer to an explanation in the user's manual or service manual.



Function grounding terminal (This terminal should not be used as a "protective grounding terminal.")



Alternating current



ON (power)



OFF (power)



In - position of a bistable push control



Out - position of a bistable push control

**Make sure to comply with the following safety precautions. Not complying might result in injury or death, or damage to the instrument.**

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### **WARNING**

#### **Power Supply**

Ensure the source voltage matches the voltage of the power supply before turning ON the power.

#### **Power Cord and Plug**

To prevent an electric shock or fire, be sure to use the power cord supplied by YOKOGAWA. The main power plug must be plugged in an outlet with a protective grounding terminal. Do not invalidate protection by using an extension cord without protective grounding.

#### **Protective Grounding**

The protective grounding terminal must be connected to ground to prevent an electric shock before turning ON the power.

#### **Necessity of Protective Grounding**

Never cut off the internal or external protective grounding wire or disconnect the wiring of the protective grounding terminal. Doing so poses a potential shock hazard.

#### **Defect of Protective Grounding and Fuse**

Do not operate the instrument when the protective grounding or fuse might be defective.

#### **Fuse**

To prevent a fire, make sure to use fuses with the specified standard (voltage, current, type). Before replacing the fuses, turn off the power and disconnect the power source. Do not use a different fuse or short-circuit the fuse holder.

#### **Do Not Operate Near Flammable Materials**

Do not operate the instrument in the presence of flammable liquids or vapors. Operation of any electrical instrument in such an environment constitutes a safety hazard.

#### **Do Not Remove Any Covers**

There are some areas inside the instrument with high voltages. Do not remove any cover if the power supply is connected. The cover should be removed by qualified personnel only.

#### **External Connection**

To ground securely, connect the protective grounding before connecting to measurement or control unit. Also, when touching the circuit, turn off the power to the circuit and check that there is no voltage being generated.

To prevent electric shock, connect the ground terminal of the probe or input connector to the protective ground of the object under measurement.

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# Structure of the Manual

## Structure of the Manual

This user's manual consists of 16 chapters, an Appendix and an Index as described below.

| Chapter | Title   | Content  |
|---------|---|--|
| 1       | <b>Functions</b>  | Introduces the unit's features, functions, and operating principles. Please read this information to familiarize yourself with the unit's capabilities. This chapter does not present operational details.                                 |
| 2       | <b>Name and Use of Each Part</b>                              | Briefly explains the significance and use of the unit's controls, connectors, and screen displays. Includes page references to help you find detailed information quickly.   |
| 3       | <b>Precautions During Use</b>                                 | Presents safety precautions, and explains how to install, connect up, and switch on the unit. Also explains how to connect the probes and how to set the date.   |
| 4       | <b>Common Operations</b>                                      | Explains basic operations, including acquisition start/stop, automatic setup, parameter reset, snapshots, trace clearing, and calibration.   |
| 5       | <b>Vertical and Horizontal Axes</b>                           | Explains settings related to vertical (voltage) and horizontal (time) axes. Vertical-axis settings include channel on/off, input coupling, probe attenuation, and voltage sensitivity.   |
| 6       | <b>Triggering</b>   | Explains how to set up and use triggers to control timing of waveform acquisition. Includes description of trigger modes, trigger types, trigger source, and trigger level.  |
| 7       | <b>Acquisition and Display</b>                                | Explains acquisition parameters (acquisition mode, sampling mode, record length, history), and use of overlapping (accumulated) waveform display.  |
| 8       | <b>Display</b>  | Explains display format, interpolation, zoom, X-Y display, graticule, and other display-related parameters.  |
| 9       | <b>Waveform Analysis</b>                                      | Explains cursor-based measurements, automatic measurements, statistical processing, mathematical operations, and GO/NO-GO determinations.  |
| 10      | <b>Output of Screen Data</b>                                  | Explains how to print screen data to internal printer, or to a printer connected through the USB interface, and how to store screen display to the storage medium.   |
| 11      | <b>Saving and Loading Data to and from the Storage Medium</b> | Explains how to save and reload waveform data and Storage medium settings to floppy disk, or external SCSI device (option).<br>Also explains related disk operations, including disk formatting, file copying, and file deletion.          |
| 12      | <b>Trigger Input/Trigger Output/RGB Video Signal Output</b>   | Explains external-trigger input, external-clock input, trigger output, and RGB video output.   |
| 13      | <b>Ethernet Interface (Option)</b>                            | Explains saving to a network drive, getting files from a floppy disk, Zip disk, or external SCSI device(option), outputting to a network printer, and receiving email transmissions.   |
| 14      | <b>Other Operations</b>                                       | Explains how to set the display colors, display language, click sound, and back light.   |
| 15      | <b>Troubleshooting, Maintenance, and Inspection</b>           | Gives troubleshooting advice; explains screen messages and self-test operation.  |
| 16      | <b>Specifications</b>   | Lists the unit's main specifications.  |
|         | <b>Appendix</b>   | Appendix 1 shows the relationships between time axis, sampling rate, and record length. Appendix 2 explains waveform area calculation. Appendix 3 gives the format for ASCII file headers. Appendix 4 presents a list of default settings. |
|         | <b>Index</b>  | Index of contents.   |

## Conventions Used in this Manual

### Units

k ..... Denotes *1000*. Example: 100 kS/s

K ..... Denotes *1024*.

Example: 720 KB (storage capacity of a floppy disk)

### Bolded Items

Characters written in bold mainly refer to characters or setting values that are displayed on the screen or panel.

### Symbols

The following symbols are used in to this manual.



Affixed to the instrument. Indicates danger to personnel or instrument and the operator must refer to the user's manual. The symbol is used in the user's manual to indicate the reference.

**WARNING**

Describes precautions that should be observed to prevent serious of injury or death to the user.

**CAUTION**

Describes precautions that should be observed to prevent minor or moderate injury, or damage to the instrument.

### Note

Provides information that is important for proper operation of the instrument.

## Terms Used for Descriptions of Operations

The following terms are used in chapters 3 to 15 to distinguish certain features in descriptions.

### **Relevant Keys**

Indicates the relevant panel keys which are necessary to carry out the operation.

### **Operating Procedure**

Carry out steps in the order shown. The operating procedures are given with the assumption that you are not familiar with the operation. Thus, it may not be necessary to carry out all the steps when changing settings.

### **Explanation**

Describes settings and restrictions relating to the operation. A detailed description of the function is not provided. For a detailed description of the function, refer to Chapter 1.

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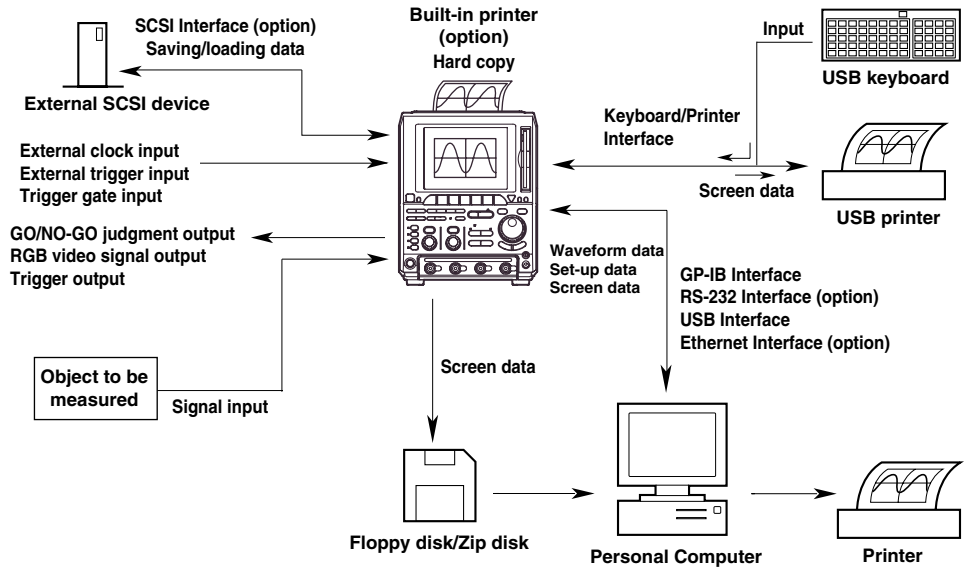
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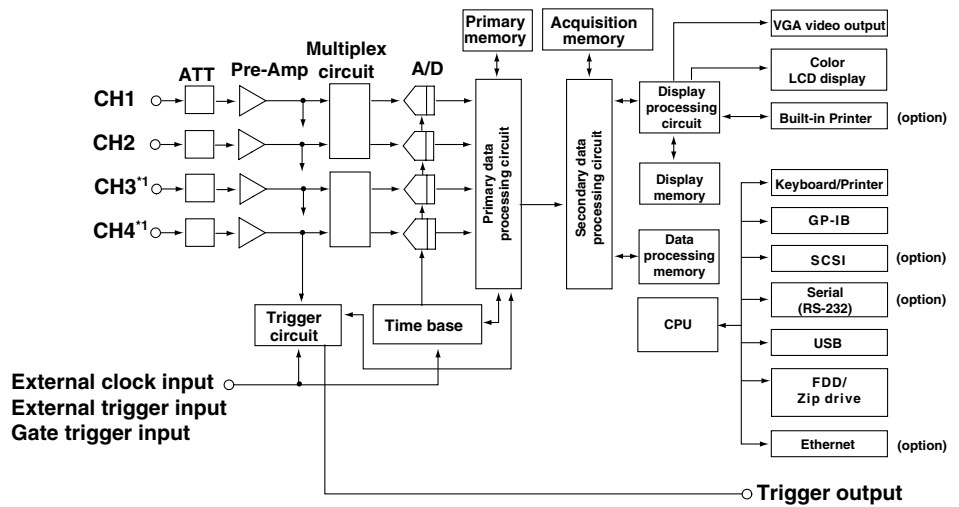
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# 1.1 Block Diagram

## System Configuration



## Block Diagram



\* The DL1720 is not equipped with channels 3 and 4. Instead, an external trigger/external clock/trigger gate multi-purpose terminal is installed in place of the CH4 terminal.

### Signal Flow

The signals to be measured enter at the input terminals and pass first to the attenuator (ATT) and preamplifier. Adjusted vertical-axis characteristics (voltage and amplitude) in accordance with the settings for input coupling, probe attenuation, V/div, and offset value are passed to the multiplexer. The multiplexer outputs each signal to the corresponding A/D converter in accordance with the time-axis settings.

The A/D converter converts the voltages into digital values. The Primary Processing Circuit then writes converted values into the primary memory at the appropriate sampling rate (as determined by the time-axis setting).

The secondary processing circuit performs averaging and other types of processing on the data in the primary memory and writes the resultant data to the acquisition memory.

The data written in the acquisition memory is then converted to waveform display data by the secondary processing circuit and transferred to the waveform processing circuit by which the data are stored in the display memory. Waveforms are displayed on the screen based on the data stored in the display memory.

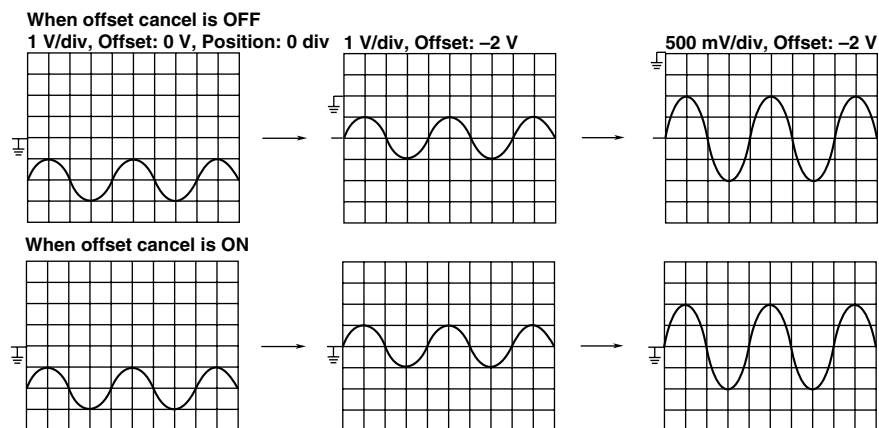


## 1.2 Setting the Vertical and Horizontal Axes

### Offset Voltage <Section 5.5>

When observing a voltage riding on top of a predetermined voltage, an offset voltage can be applied to eliminate the predetermined voltage so that only the changes in the signal can be observed with higher voltage sensitivity.

Normally, the offset voltage does not affect the cursor measurement values, automated measurement of waveform parameters, and computed values. However, you can turn ON offset cancel to apply the offset voltage to them. (See section 14.4.)



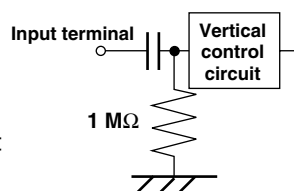
### Input Coupling <Section 5.3>

When you only want to observe the amplitude of an alternating current signal, eliminating the direct current components from the input signal makes observation easier. You may also want to check the ground level or observe the input signal waveform with the offset voltage removed. In these cases, you can change the input coupling setting. This will switch the coupling method, which determines how the input signal is input to the vertical control circuit (voltage axis).

The input coupling method can be chosen from the following:

#### AC 1 M $\Omega$

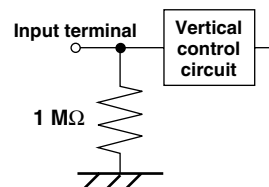
The input signal is sent through a capacitor to the attenuator in the vertical control circuit. This method can be used when you just want to observe the amplitude of the alternating current signal, eliminating the DC components from the input signal.



#### DC 1 M $\Omega$

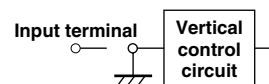
The input signal is sent directly to the attenuator in the vertical control circuit.

This method can be used when you want to observe both the DC and AC components of the vertical input signal.



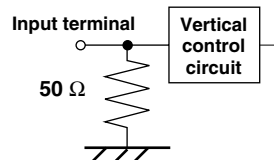
#### GND

The ground signal, not the input signal, is connected to the attenuator in the vertical control circuit. This method enables observation of the ground level on the screen.



#### DC 50 $\Omega$

This is the same as DC 1 M $\Omega$  described above, except the input impedance is 50  $\Omega$ . Please be aware of the maximum input voltage.



## 1.2 Setting the Vertical and Horizontal Axes

### Probe Attenuation <Section 5.4>

A probe is usually used to connect the circuit to be measured to an input terminal. Use of a probe provides the following advantages.

- The voltage and current of the circuit to be measured are not disturbed.
- A signal can be input without distortion.
- The measurement voltage range of the oscilloscope can be widened.

A 400 MHz passive probe is supplied with the instrument. The probe attenuates the input signal by 1/10. When a probe is used, the probe attenuation must match the instrument's attenuation setting so that the input voltage can be measured directly. DL1720/DL1740's attenuations of 1 : 1, 10 : 1, 100 : 1 and 1000 : 1 are provided. When you use a probe other than the one supplied with the instrument, set the instrument's attenuation so that it matches the probe's attenuation.

### Bandwidth Limit <Section 5.7>

High frequency noise of 20 MHz or higher, or 100 MHz or higher can be eliminated from the input signal.

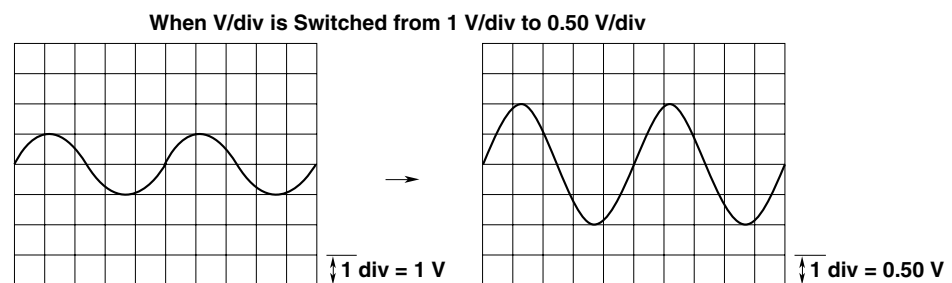
### Vertical Sensitivity <Section 5.8>

The V/div (vertical sensitivity) setting is used to adjust the amplitude of the displayed waveform so that the waveform can be observed easily.

The V/div setting is made by setting the voltage value per division on the screen grid.

The vertical sensitivity setting operates by switching to a different attenuator (attenuation rate). The setting changes in steps (1 V/div → 2 V/div → 5 V/div ...).

In addition, by performing computations on the digital data acquired using the voltage sensitivity above, the waveform can be displayed at a sensitivity of 0.4 (or 0.5) to 10 times the voltage sensitivity that was used to acquire the data (Variable).



#### Note

##### Vertical Sensitivity and Measurement Resolution

To get precise readings, it is recommended that you set the vertical sensitivity so that the waveform's maximum and minimum amplitudes are close to the top and bottom of the screen. Note that the instrument uses 8-bit A/D converters. Incoming signals are sampled at a resolution of 255 levels (LSB), or 32 levels per division.

##### Effective Data Range

The instrument uses 8-bit A/D converters. Assuming that output values range from 0 to 255, the vertical center line of the display corresponds to a value of 128. Because the A/D converter reaches full range at 255, screen level 256 is not used.

Note also that the instrument treats an A/D output value of 0 as if it were a 1.

The screen's effective display range extends approximately 5.29 divisions in each direction from the screen's center line.

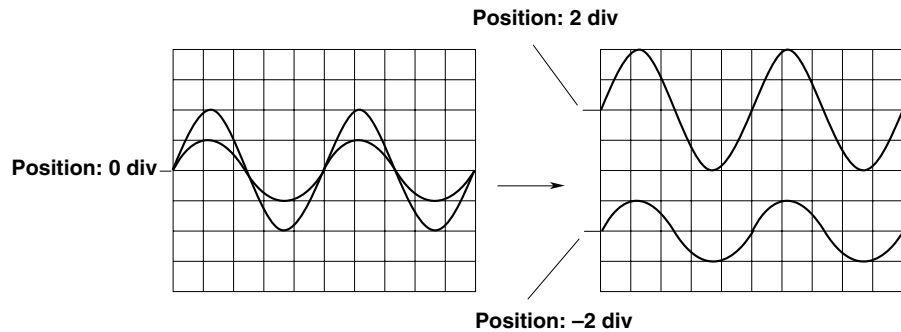
However, if the vertical axis position is moved while the data acquisition is stopped, the effective data range also moves by the same amount.

**Vertical Position <Section 5.2>**

Since a total of four input waveforms (or two for the DL1720) can be displayed, they may overlap each other making observation difficult. In this case, the waveforms can be moved in the vertical direction so that they can be observed more easily.

The vertical position mark can be set to any value in the range between  $\pm 4$  div.

Changing the V/div setting, the vertical axis setting is rescaled with respect to the vertical position.

**Time Axis <Sections 5.10 and 5.11>****Selection of the Timebase**

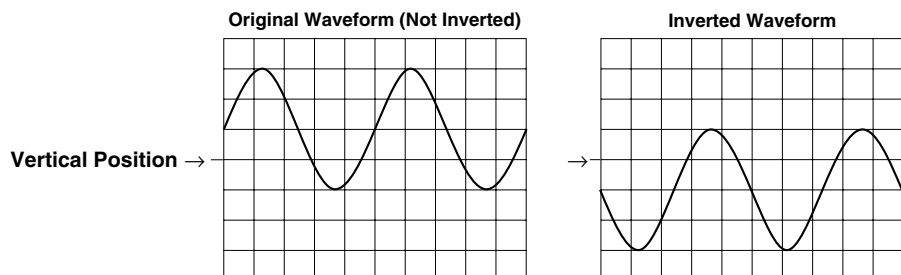
With the default settings, sampling timing is controlled by the clock signal output from the timebase circuit of the instrument (refer to the Block Diagram, section 1.1). The sampling timing can be controlled by an external clock signal instead of the clock signal from the timebase circuit.

An external clock signal can be input to the EXT CLOCK IN terminal on the rear panel.

This external clock function is useful when you are observing a signal whose period varies or when you are observing a waveform by synchronizing it with the clock signal to be measured.

**Setting the Time Axis**

When using the internal clock, set the time axis scale as a time duration per division of the grid. The setting range is 1 ns/div to 50 s/div. The time range in which waveform is displayed is "time axis setting x 10," as the display range along the horizontal axis is 10 divisions.



## 1.2 Setting the Vertical and Horizontal Axes

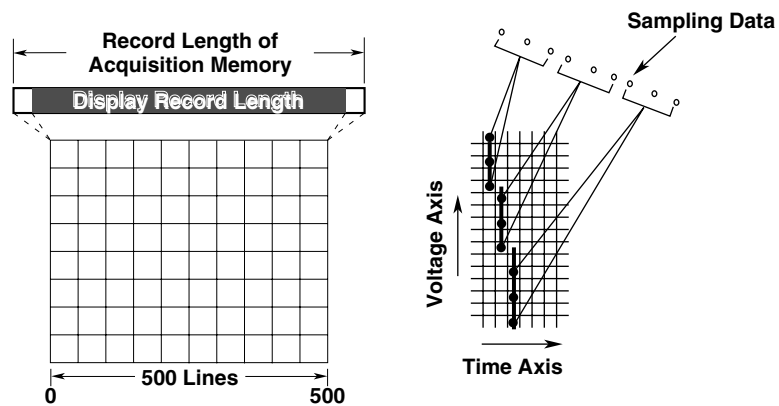
### Note

#### Display of Time Axis Direction

The sampled data is read into the acquisition memory, and a waveform is displayed based on this data. The number of data stored into the acquisition memory differs depending on settings such as time axis settings, trigger mode, and acquisition mode.

The number of display lines in the time axis direction on a 10 - div screen is 500 lines. Processing therefore varies according to record length, as described immediately below. (for more details on the relation between time axis, acquisition mode, record length of acquisition memory and displayed record length, refer to Appendix 1).

- If displayed record length exceeds number of screen display points, multiple data points are connected with a line and displayed at the same time axis position.
- If displayed record length is less than number of screen display points, the oscilloscope interpolates the data to generate the display. (See page section 1.4)



#### Relationship between the Time Axis Setting, Sample Rate and Record Length

Changing the time axis causes corresponding changes in the sampling rate and the acquisition record length. For more detailed information, refer to Appendix 1.

#### Relationship between Time Axis Setting and Sampling Mode

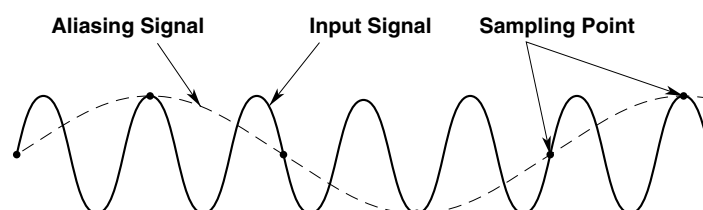
The sampling method (sampling mode) for an input signal changes according to the time axis setting as described hereafter. But note that the time - axis range over which this feature is actually available will vary according to the maximum displayable record length, as shown in Appendix 1.

#### • Real-Time Sampling Mode

Changing the time axis causes a corresponding change in the sampling rate. The maximum sampling rate is 1 GS/s (or 500 MS/s if interleave mode is OFF). For details of interleave mode, refer to section 7.5).

The input signal is sampled sequentially, and data is stored in the acquisition memory. In this mode, the waveform can only be displayed correctly at frequencies up to half the sample rate, due to Nyquist's theorem\*. Sample rate is expressed in S/s (number of samples per second). Thus, this mode is suitable for observation of a waveform which fluctuates more slowly than the sample rate.

- \* If the sample rate is higher than the frequency of the input signal, high frequency components will be lost. In this case, a phenomenon in which high frequency components change to lower frequency components occurs, due to Nyquist's theorem. This phenomenon is called aliasing. Aliasing can be avoided by setting the acquisition mode to envelope mode and acquiring the waveform.



- **Repetitive Sampling Mode**

To enable this mode, you must set the time axis so that the sampling rate is greater than 1 GS/s (interleave ON: 2 GS/s). Under this mode, the oscilloscope produces a single waveform by taking samples over several periods of a repetitive signal, so that the sampling rate appears higher than it actually is. An apparent sample rate of up to 100 GS/s can be used.

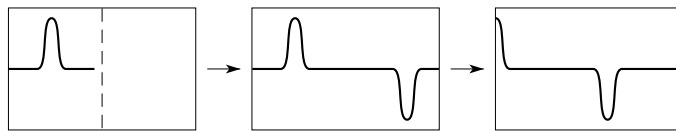
Furthermore, even in the real-time sampling mode, if the sample rate exceeds 1 GS/s (interleave ON: 2 GS/s) due to the time axis and the displayed record length settings, the sampling mode automatically changes to repetitive sampling.

There are two repetitive sampling methods: sequential sampling, in which a signal is sampled sequentially at a fixed interval, and random sampling, in which a signal is sampled at random to produce a waveform. This instrument uses a random sampling method which also enables observation of the waveform up to the trigger point.

**Time Axis Setting and Roll Mode Display**

If the time axis is set within a certain range (refer to Appendix 1), then the display will not be updated by trigger anymore (update mode), but the mode will switch to roll mode when new data is acquired. In roll mode, the oldest data is deleted, and the waveform shifts from right to left on the screen. A waveform can be observed in the same way as it is recorded on a pen recorder. This mode is useful when you are observing a signal which repeats or which fluctuates slowly. This mode is also useful when you want to detect glitches (fast spikes on a waveform) which occur intermittently.

\* Rolling display also operates during single - start acquisition, although trigger occurrence causes the waveform to stop.



# 1.3 Setting a Trigger

## Trigger Type <Chapter 6>

There are two principal trigger types which you can use with the instrument.

Simple trigger

Enhanced trigger

**Simple Trigger** → Sections 6.5 to 6.7

This is an edge trigger and the one which is used normally.

**Enhanced Trigger** → Sections 6.8 to 6.14

This is a complex trigger. The following seven types of enhanced trigger are available.

A→B(N) trigger

A Delay B trigger

Pattern trigger

Width trigger

OR Trigger

Window trigger

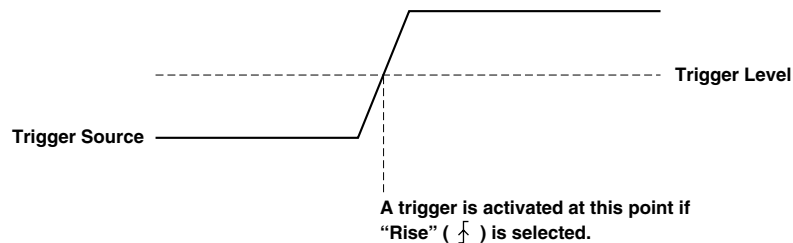
TV trigger

**Edge Trigger** → Section 6.5

The edge trigger is the simplest type of trigger and uses a single trigger source to activate a trigger. A trigger is activated when the trigger source exceeds (rises above) or drops (falls) below the preset trigger level\*.

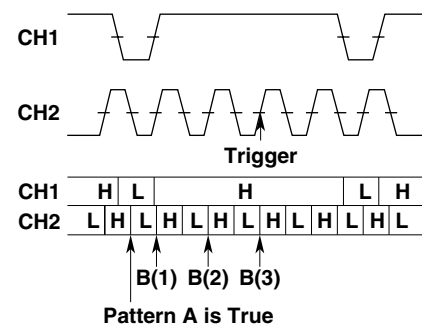
In addition to input signals (CH1 to CH4, or CH1 and CH2 for the DL1720), the external trigger input signal, the commercial power supply signal that is used by the instrument can be used as a trigger source.

\* "A trigger is activated" refers to the condition in which trigger conditions are satisfied and a waveform is displayed.



**A → B(N) Trigger (Enhanced Trigger)** → Section 6.8

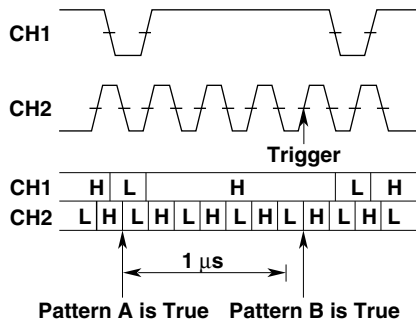
This function activates a trigger the Nth time condition B becomes true after condition A has become true.



When pattern A: CH1 = L, CH2 = L, Enter, When patternB: CH1 = H, CH2 = H, Enter, N = 3  
L: Low level, H: High level

**A Delay B Trigger (Enhanced Trigger) → Section 6.9**

This function activates a trigger the first time condition B becomes true after condition A becomes true and the specified time elapses.

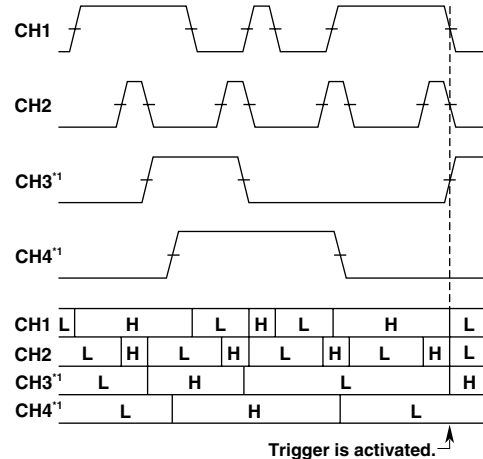


When pattern A: CH1 = L, CH2 = L, Enter, When patternB: CH1 = H, CH2 = H, Enter, Delay = 1 μs

**Pattern Trigger → Section 6.10**

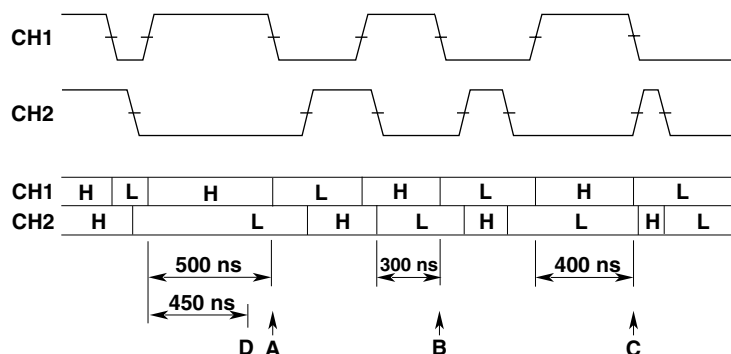
Multiple trigger sources are selected, and a trigger is activated when all of the trigger conditions set for each trigger source become true or false. Trigger conditions are established by setting combinations of the state (High or Low) of each trigger source. Furthermore, one of the trigger sources can be used as the clock signal, and triggering is synchronized with this clock signal.

Example: a trigger is activated when CH1: L, CH2: L, CH3<sup>1</sup>: L and CH4<sup>1</sup>: L (\*1 The DL1720 is not equipped with channels 3 and 4.)



**Pulse Width Trigger → Section 6.11**

The time period during which the specified condition is met or not met is compared with the specified time period. The trigger condition is set with the AND of the signal state of each channel (High, Low, or Don't Care) or the AND of the window conditions of each channel (IN, OUT, or Don't Care).



### 1.3 Setting a Trigger

The description of the figure above is as follows.

If CH1 = H, CH2 = L, CH3 = X, CH4 = X, Condition = True, Time = 350 ns: (The DL1720 is not equipped with channels 3 and 4.)

The trigger is activated at point B if Pulse < T.

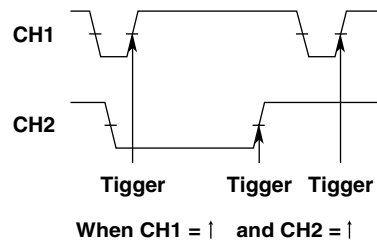
The trigger is activated at points A and C if Pulse > T.

The trigger is activated at point C if  $T1 < PLS < T2$  where Time1 = 350 ns, Time2 = 450 ns.

The trigger is activated at point D if "Time out" is specified where Time = 450 ns.

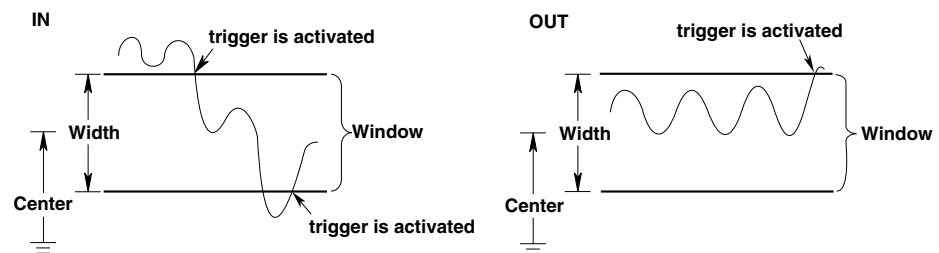
#### OR Trigger (Enhanced Trigger) → Section 6.12

A trigger is activated when any of the edge trigger conditions specified on CH1 to CH4 (or CH1 and CH2 for the DL1720) or the window condition is met. A trigger is activated by either the rising edge of CH1 or CH2.



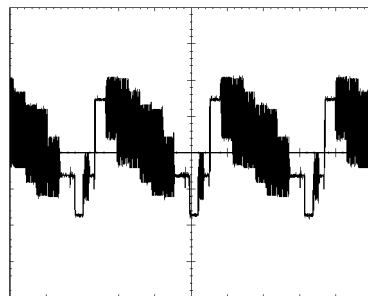
#### Window Trigger (Enhanced Trigger) → Section 6.13

A certain voltage range (window) is set and a trigger is activated when the trigger source level enters this voltage range (IN) or exits from this voltage range (OUT).



#### TV Trigger (Enhanced Trigger) → Section 6.14

The TV trigger is used when you are observing a video signal, and is compatible with NTSC and PAL broadcasting systems.





**Trigger Mode <Section 6.1>**

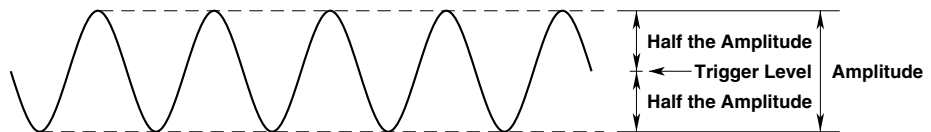
Conditions for updating displayed waveforms are set. The following five types of trigger mode are available:

**Auto Mode**

Displayed waveforms are updated each time a trigger is activated within a specified time (approximately 100 ms, referred to as the time-out period) and are updated automatically after each time-out period.

**Auto Level Mode**

Waveforms are displayed in the same way as in Auto mode if a trigger is activated within the time-out period. If no trigger is activated, the center value of the amplitude of the trigger source (section 1.3) is detected and the trigger level is changed automatically to this center value, then a (edge) trigger is activated to update the displayed waveforms.

**Normal Mode**

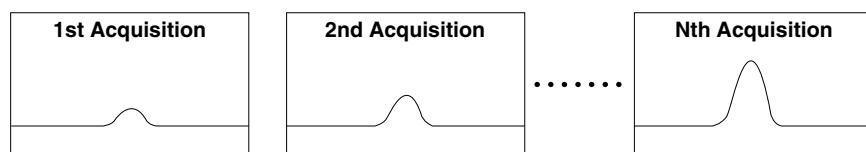
Displayed waveforms are updated only when a trigger is activated. Displayed waveforms will not be updated if no trigger is activated.

**Single Mode**

When a trigger is activated, displayed waveforms are updated only once, then acquisition stops. This mode is useful when you are observing a single-shot signal.

**Single (N) Mode**

This mode is useful when using the sequential store function (refer to section 7.3). Waveforms are acquired and stored in different memory areas each time a trigger is activated, then acquisition stops, and the waveforms are displayed. Acquisition is performed the specified number of times. Acquired waveforms can be displayed together, or they can be displayed individually. This mode is useful when you want to detect a sudden abnormality in a waveform.

**Action-On Trigger <Section 6.15>**

The displayed waveform can be output to the optional built-in printer, buzzer, or saved to a floppy disk/a Zip disk each time a trigger is activated. Also sends a mail (Ethernet interface (option)).

**Trigger Coupling <Sections 6.5, and 6.8 to 6.13>**

Input coupling can also be switched for trigger sources as it is for input signals. Select the type of input coupling which is most suitable for the trigger source signal.

The following two types of input coupling are available for trigger source signals.

- DC: The trigger source signal is used as the trigger source without any process.
- AC: The trigger source signal is used as the trigger source after DC the content has been removed from it. A trigger can always be activated if the trigger level is set to 0 V as long as the signal's amplitude is one division or more.

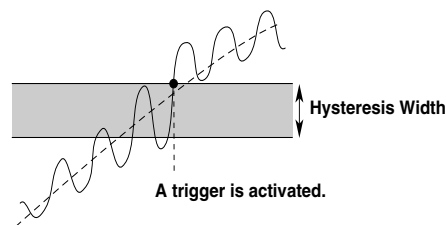
**HF Rejection <Sections 6.5, and 6.8 to 6.13>**

Set HF rejection to ON when you want to remove high frequencies exceeding 15 kHz or 20 MHz from the trigger source. This prevents a trigger from being activated unexpectedly due to high frequency noise.

**Trigger Hysteresis <Sections 6.5, and 6.8 to 6.13>**

If the trigger level width is not sufficient, the trigger point fluctuates each time a trigger is activated if noise is present in the trigger source, thereby resulting in unstable displayed waveforms. To solve this problem, a specified margin (hysteresis) can be added to the selected trigger level.

The hysteresis level can be chosen from “ $\overline{\Delta}$ ” and “ $\Delta$ .” If “ $\overline{\Delta}$ ” is selected, a wide hysteresis level is provided to eliminate fluctuation in the trigger point, thereby resulting in a stable displayed waveform. However, in this case, the trigger points become uncertain. Thus, select “ $\Delta$ ” if you want to activate a trigger to detect small fluctuations in a waveform.



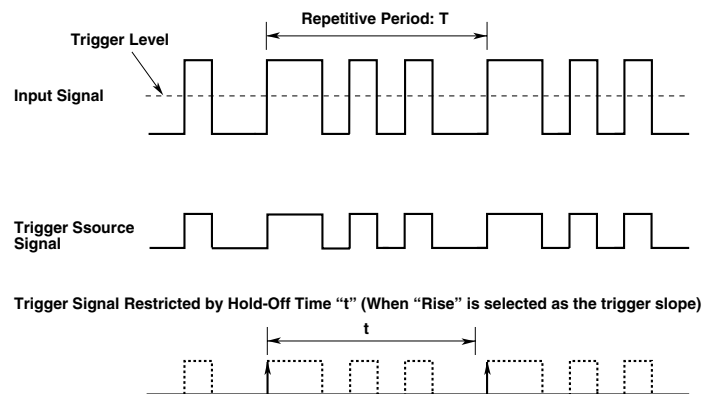
**Trigger Source and Trigger Level <Sections 6.5 to 6.13>**

**Trigger Source:** Selects the signal for the selected trigger type. The external trigger signal or the commercial power supply signal can also be used a trigger source.

**Trigger Level:** Sets the voltage level used to judge trigger conditions such as trigger slope (rise/fall of a signal).

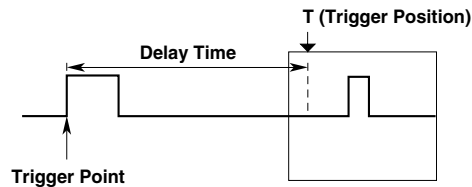
**Trigger Hold-Off <Section 6.4>**

The trigger hold-off function temporarily stops detection of the next trigger once a trigger has been activated. For example, when observing a pulse train signal, such as a PCM code, display of the waveform can be synchronized with repetitive cycles; or when using the history memory function, you may want to change the repetitive period, as shown below.



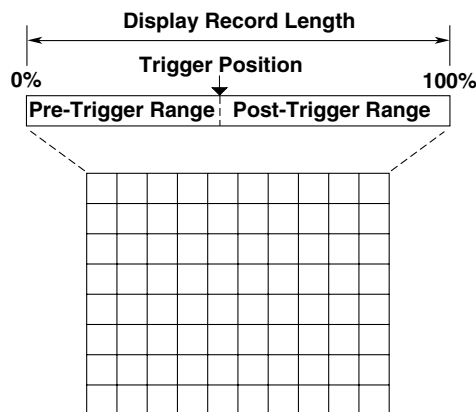
**Trigger Delay <Section 6.2>**

Normally, the waveform around the trigger point is displayed. However the trigger delay function enables display of a waveform which has been acquired after a specified time (called the delay time) has elapsed following activation of a trigger. The range for the trigger delay setting is 0 to 4 seconds.

**Trigger Position <Section 6.3>**

The trigger position indicates which position of the waveform in the acquisition memory will actually be displayed on the screen. The trigger point refers to the point at which a trigger is activated. In case the trigger delay (to be explained here after) is set to 0s, the trigger point and the trigger position refer to the same location.

You use this setting to select how much pre-trigger area and how much post-trigger area to show on the display.



## 1.4 Setting the Acquisition and Display Conditions

### Record Length <Section 7.1>

The term “record length” refers to the number of data points (per channel) acquired in the acquisition memory. “Displayed record length” refers to the number of these data points that are actually displayed on the screen. (Note that sampling rate and record length will vary according to the time-axis setting; see section 1.2) The DL1720/1740 lets you set the record length to any of the following: 1 kwords, 10 kwords, 50 kwords, 100 kwords, 250 kwords, 500 kwords, 1 Mwords.

In most cases the displayed record length is identical to the (acquisition) record length. For certain time-axis settings, however, the lengths become different. For details, refer to Appendix 1.

### Interleave Mode <Section 7.5>

This mode doubles the amount of memory per channel, while cutting the number of channels in half. If you are using an 8 - channel model, for example, then setting this mode ON will disable use of CH2 and CH4 (or CH2 only on the DL1720), while reassigning the memory for those channels to CH1 and CH3 (or CH1 only on the DL1720).

This mode doubles the maximum settings for history memory, sequential store, and record length.

Furthermore, because the maximum sample rate can be increased by sampling the input signal using two A/D converters, real-time sampling at a rate of 1 GS/s for the DL1720/DL1740.

For the relationship between the interleave mode, time axis, record length, and sample rate, see appendix 1, “Relationship between the Time Axis Setting, Sample Rate, and Record length.”

### Acquisition Modes <Section 7.2, 7.4>

When storing sampled data in the acquisition memory, it is possible to perform processing on specified data and display the resultant waveform. The following data processing methods are available.

#### Normal Mode

In this mode, sampled data are stored in the acquisition memory without processing.

#### Averaging Mode

Averaging is a process in which waveforms are acquired repeatedly to obtain the average of waveform data of the same timing (the same time in relation to the trigger point).

If this mode is active, the instrument takes the linear or exponential average of incoming data and writes the results into acquisition memory. The averaged data is then used to generate the display. You can set the attenuation constant to a value from 2 to 256 (in  $2^n$  steps), and the averaging count to a value from 2 to 65536 (in  $2^n$  steps).

#### Exponential Averaging (Count = Infinite)

$$A_n = \frac{1}{N} \{(N - 1) A_{n-1} + X_n\}$$

**A<sub>n</sub>**: Value Obtained After nth Averaging  
**X<sub>n</sub>**: nth Measured Value  
**N** : Attenuation Constant  
(2 to 256, in steps of  $2^n$ )

#### Linear Averaging (Count = 2 to 65536)

$$A_N = \frac{\sum_{n=1}^N X_n}{N}$$

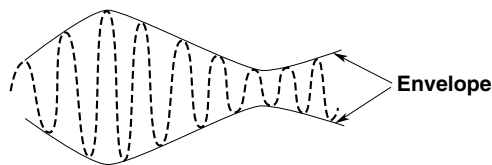
**X<sub>n</sub>**: nth Measured Value  
**N** : Number of Averaging Times  
(Acquisition Count,  
in steps of  $2^n$ )

This averaging process is useful when you want to eliminate random noise.

### Envelope Mode

In normal mode and averaging mode, the sample rate (the number of times data is acquired per second in the acquisition memory) drops if T/div is increased (refer to Appendix 1 "Relationship between the time axis setting, sample rate and record length"). However, in the envelope mode, the maximum and minimum values are determined at every time interval from the data sampled at 400 MS/s for the DL1720/DL1740 (interleave mode: 800 MS/s or 1 GS/s). The time interval used to determine the values is the twice sampling interval of the normal mode. The maximum and minimum values are paired and acquired in the acquisition memory.

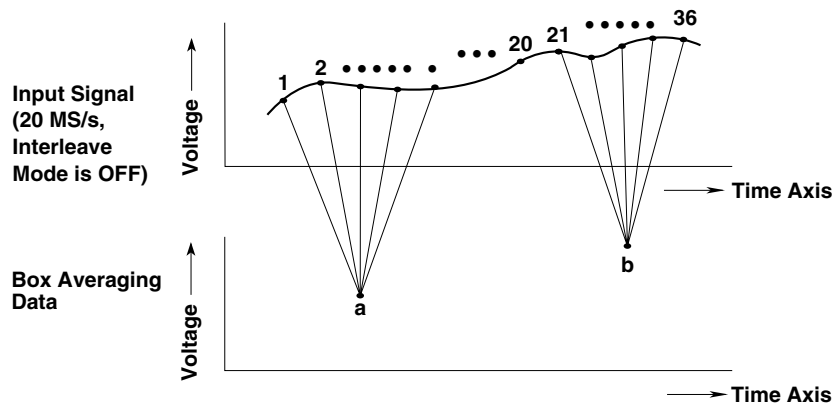
Envelope mode is useful when you want to avoid aliasing (section 1.2), since the sample rate is kept high irrespective of the time axis setting (T/div). Furthermore, envelope mode is also useful when you want to detect glitches (pulsing signals which rise very fast) or display an envelope of a modulating signal.



### Box Average

Taking the data sampled at 400 MS/s for the DL1720/DL1740 (interleave mode: 800 MS/s), the moving averages of certain number of data points are determined as shown in the following figure. These data are acquired in the acquisition memory and displayed.

Box averaging is useful for eliminating the small amount of noise on the input signal. It is also effective in removing the noise from a signal acquired only once.



### Sequential Store <Section 7.3>

In the real-time sampling mode, waveform data will be stored in the acquisition memory only a set number of times, and all waveforms can be displayed. This stops automatically after acquisition. The maximum acquisition count available with the feature varies depending on the record length.

The range for the DL1720/DL1740 is 2 to 512 times.

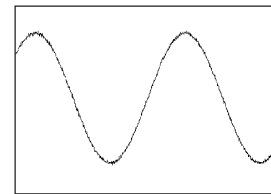
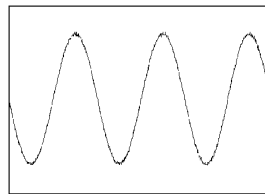
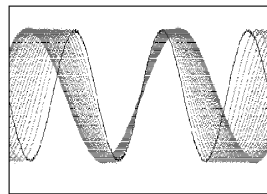
Once the specified number of waveforms have been stored, you can display any of the waveforms individually or all of them together, so that it is possible to derive a time series of the waveform variation. The drawings below illustrate how stored data can be displayed (assuming sequential storage of 100 waveforms).

#### Display Example in Case Count = 100 Times

Displaying All Waveforms  
(ALL)

Displaying Newest Waveform  
(Selected Record No. = 0)

Displaying Oldest Waveform  
(Selected Record No. = -99)



### Sampling Mode <Section 7.6>

As explained earlier in "Relationship between the time axis setting and sampling mode" (section 1.2), data sampling can be performed either in real-time or in repetitive sampling mode depending on the time axis and record length. The available time - axis range under repetitive mode varies according to the acquisition settings. For details, refer to Appendix 1.

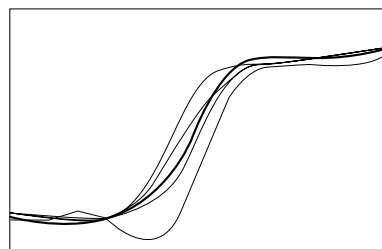
### Accumulated Waveform Display <Section 8.6>

This mode holds each waveform on the screen for a time that is longer than the update cycle, so that multiple waveforms are overlapped. The waveform age can be identified by color.

The following two modes are available.

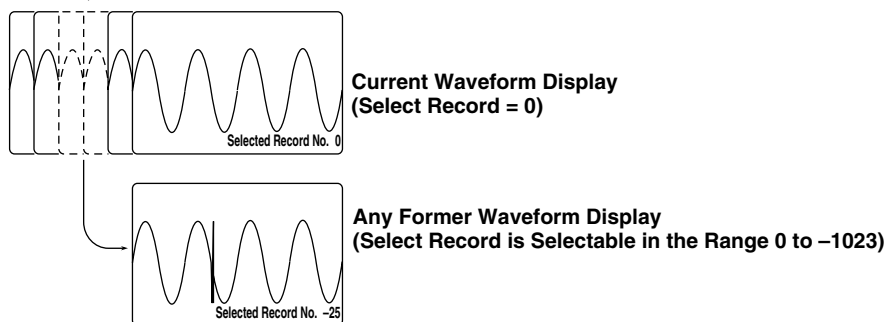
- Persist: Overlaps the display of waveforms using the display color of each channel.
- Color: Overlaps the display of waveforms using 8 colors which signify the frequency of occurrence of the data values.

This function is useful when you want to observe jitters and temporary turbulence in waveforms.



**History Memory <Section 7.7>**

The oscilloscope automatically retains the last N waveforms recorded. The value of N varies in the range 2 to 2048 for the DL1720/DL1740 depending on the record length and interleave mode. The oscilloscope retains all waveforms for the first N triggers; then, for each subsequent trigger, the oscilloscope overwrites the oldest stored waveform. You are free to switch the display from the current (newest) waveform to any of other N-1 waveforms in the history. The illustration below shows how data can be displayed, assuming N = 1024.

**Saved Waveform Data of Previous 1024 Triggers**

In addition, a particular waveform can be found from the past waveforms that are held.

**Display Settings <Chapter 8>****Display Format → Section 8.1**

- You can display waveforms from different channels in different windows. You can choose to use 1 window (Single), 2 windows (Dual), 3 windows (Triad), 4 windows (Quad) or 6 windows (Hexa). (4 windows (Quad) or 6 windows (Hexa) are not available on the DL1720.)
- You can select either of the following two methods for assigning channels to windows.
  - Auto: Channels that are set to ON are displayed in order of channel number, with the lowest channel displayed in the top window.
  - Fixed: Channels are displayed in order of channel number, regardless of whether ON or OFF.
  - User: Arbitrarily assign the channels to the split screens, regardless of whether or not the channel display is turned ON.

**Graticule → Section 8.3**

Use this feature to select use of grid, frame, or "cross" graticule.

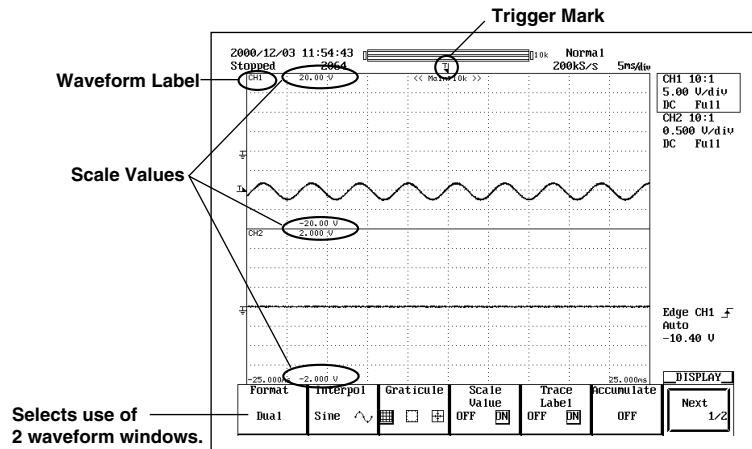
**Scale Values → Section 8.4**

If the Scale Value setting is ON, the screen displays numerical values at the top and bottom of the vertical axis and the horizontal axis.

## 1.4 Setting the Acquisition and Display Conditions

### Waveform Labels → Section 8.5

You can assign an arbitrary label (up to 8 characters) to each waveform.

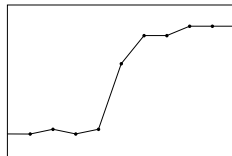


### Display Interpolation <Section 8.2>

This feature selects the type of interpolation applied in areas where there are less than 500 sample points (Less than 250 points in the zoom window when zooming on the waveform using Main & Z1 & Z2) per 10 time-axis divisions. (These areas are referred to as interpolation areas.) Three settings are available.

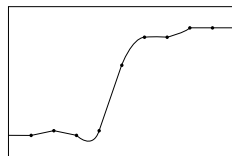
#### Line Interpolation

Interpolates between two dots using a straight line.



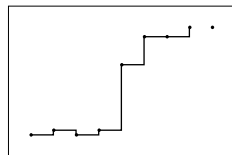
#### Sine Interpolation

Generates interpolation data using the function  $\frac{\sin x}{x}$  then interpolates between two dots using resulting sine curve. Sine interpolation is suitable for observation of sine waves.



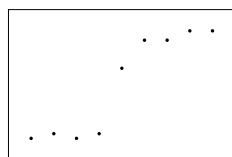
#### Pulse Interpolation

Interpolates between two dots using a step.



#### No Interpolation

Displays measurements as discrete dots, without interpolation.





**X-Y Waveform Display <Section 8.8>**

This feature plots the voltage values of one input waveform (on the X axis) against the voltage values of the others (on the Y axis, which have their display turned ON). The X-Y plot lets you view the relationship between the signal voltages. The X-Y waveforms and normal waveforms (a waveform displayed using voltage and time axes) can be displayed simultaneously.

Use of this X-Y waveform display function enables measurement of the phase angle between two sine wave signals. For example, two X-Y sine waveforms are displayed to obtain an X-Y waveform (called a Lissajous waveform), from which the phase angle can be obtained.

**Lissajous Waveform**

|                                |       |       |       |
|--------------------------------|-------|-------|-------|
| <b>Phase Angle 0°</b>          |       |       |       |
| <b>Phase Angle 45°</b>         |       |       |       |
| <b>Phase Angle 90°</b>         |       |       |       |
| <b>Frequency Ratio (X : Y)</b> | 1 : 1 | 1 : 2 | 1 : 3 |

**Expanded Waveform <Section 8.9>**

Waveforms can be expanded in the time axis direction. This function is useful when you want to change the T/div setting after the waveform has been displayed in single mode or when you want to extend the acquisition time to observe a particular part of the waveform thoroughly.

Zooming is not available on areas with less than 11 data points.

You set the zoom position according to its time-axis location.

**Zoom Display Arrangement**

You can display one or two zoom windows on the screen. Four display arrangements are available, as follows.

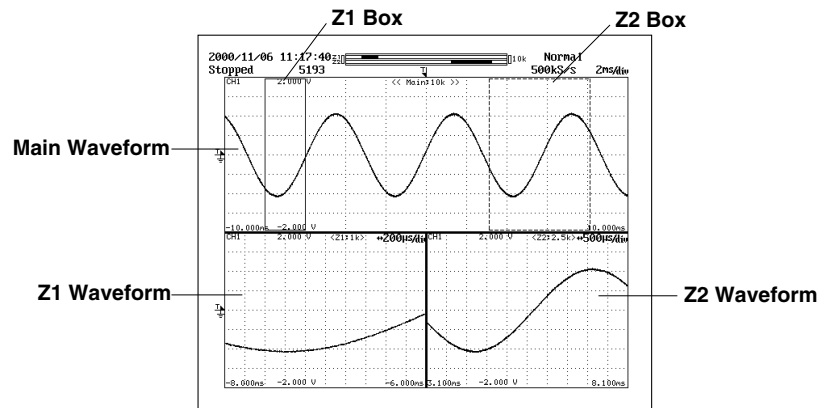
Main: Main area

Z1, Z2: Zoom area

|        |      |              |  |      |  |         |  |
|--------|------|--------------|--|------|--|---------|--|
| <Main> |      | <Main>       |  | <Z1> |  | <Z1>    |  |
| <Z1>   | <Z2> | <Z1> or <Z2> |  | <Z2> |  | or <Z2> |  |

## 1.4 Setting the Acquisition and Display Conditions

If you display the “main” area (normal waveform display) together with one or both zoom windows, the main area will include vertical lines (or “zoom boxes”) indicating the zoom area (s). The center of the zoom area corresponds to the center of the zoom box.



## 1.5 Analyzing the Waveform

### Linear Scaling <Section 5.9>

It is possible to append a scaling constant A, an offset value B and a unit to the measurement value X of cursor or automated measurements. Linear scaling is useful, when applying a voltage divider ratio to the measurement values. Linear scaling is also handy when you want your scope to automatically convert the measured voltage results into the (for example, current or temperature) measurement unit of your signal source.

$$Y(\text{UNIT}) = AX + B \quad Y = \text{result of linear scaling}$$

### Cursor Measurements <Section 9.1>

You can use the following cursor types to analyze the waveform data.

- **V Cursors (Vertical)**

Two vertical broken lines (V cursors) are displayed. The time from the trigger position to each V cursor and the time difference between the V cursors are measured.

In addition, the voltage of the signal at each cursor position and the voltage difference between the cursors are measured.

- **H Cursors (Horizontal)**

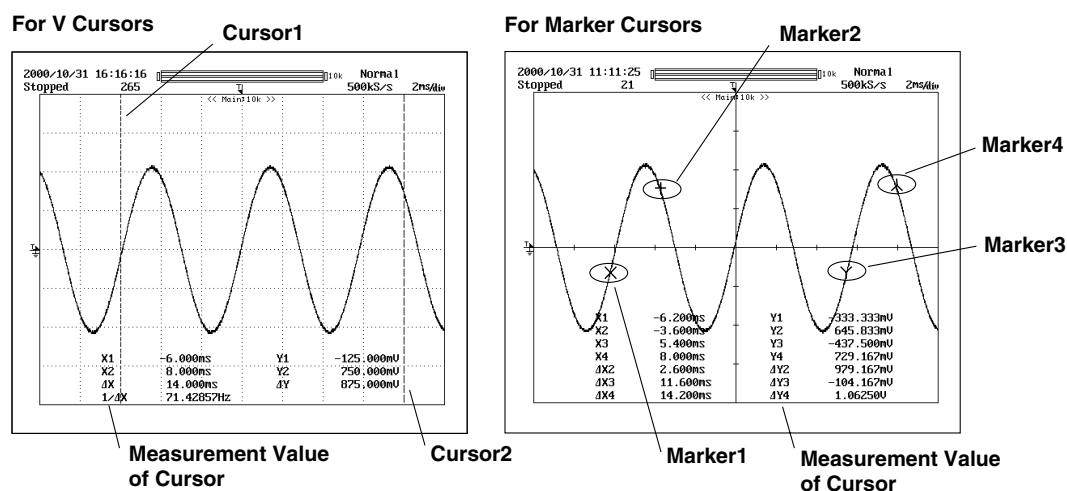
Two horizontal broken lines (H cursors) are displayed. The values in the vertical direction of each H cursor and the difference between the two are measured.

- **Marker Cursors (Markers)**

Use this feature to place one or two markers onto the waveform. You can then read the voltage value and time value (relative to trigger position) at each marker, and the voltage difference and time span between the markers.

- **Angle Cursors (Degree)**

Set the measurement zero point and the end point and then using the angle corresponding to the width between the two as a reference, measure the angle of the two angle cursors.



**Automated Measurements <Sections 9.2 to 9.4>**

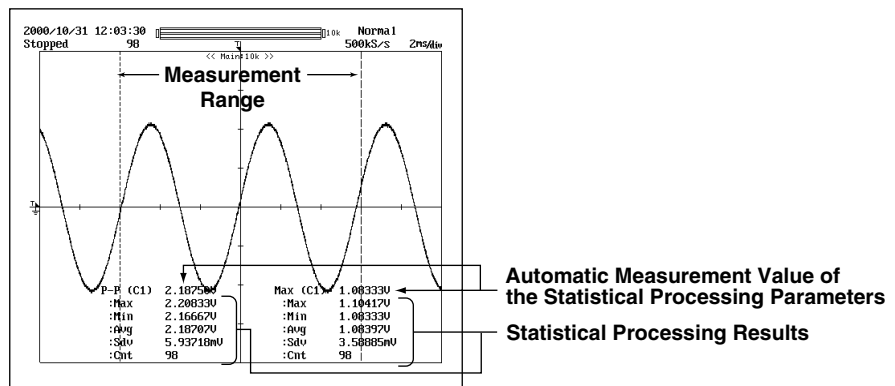
**Automatic Measurement of Waveform Parameters → Section 9.2**

This feature automatically measures selected waveform parameters, such as rise time and pulse width. You can select parameters separately for each channel, although you are limited to a total of 12 parameters to display. There are 27 parameters available for selection.

**Statistical Processing → Section 9.3**

Statistical processing is performed on the automated measured values described above. The following five statistics are determined on the two measured values of automated measurement parameters.

- Maximum value (Max)
- Minimum value (Min)
- Average value (Avg)
- Standard deviation (Sdv)
- Number of measured values used in the statistical processing (Cnt)



The following three methods are available in the statistical processing.

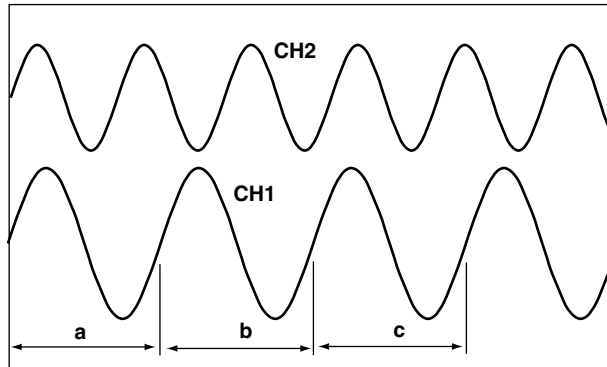
- **Normal Statistical Processing**

While acquiring waveforms, statistical processing is performed on all the waveforms acquired up to that point.

- **Statistical Processing for Each Period**

Divides the displayed waveform using a period that is automatically calculated and performs statistical processing on the measured values over the determined period. Statistical processing is performed from the oldest measured data of the displayed waveform.

**Example in which CH1 is selected as the target waveform for determining the period**



The parameters for automated measurement are measured in each range a, b, and c, and statistical processing is performed on each automated measurement parameter in the order a, b, and c.

Automated measurement parameters of other channels are also measured over each range a, b, and c.

Automated measurement can also be performed on the period of each waveform.

- **Statistical Processing of Historical Data**

Performs automated measurement of waveform parameters on the waveform that is acquired using the history memory function and performs statistical processing. Statistical processing is performed from the oldest waveform.

**Perform Automated Measurements of Waveform Parameters on Dual Areas → Section 9.4**

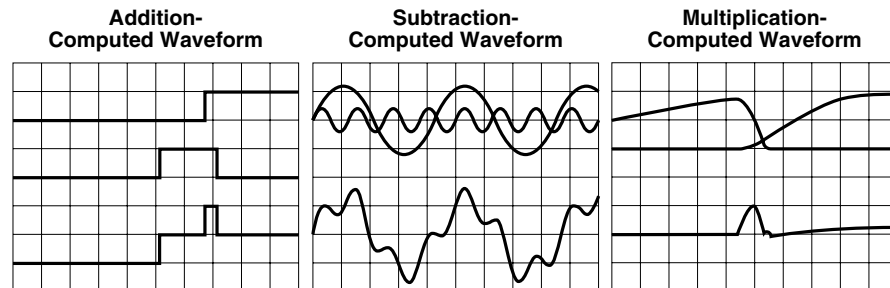
You can specify two areas and perform automated measurement of waveform parameters on each area. You can also perform computation on the parameters determined in the two areas. Statistical processing for each period is not possible.

## Waveform Math <Chapter 9>

### Addition, Subtraction, and Multiplication → Section 9.5

Addition, subtraction, and multiplication can be performed between CH1 and CH1 to CH4, CH2 and CH1 to CH4, CH3 and CH1 to CH4 or Math1, and CH4 and CH1 to CH4 or Math1 (or between CH1 and CH1 to CH2, and CH2 and CH1 to CH2 for the DL1720). The result is displayed as waveform Math1 or Math2 (or waveform Math1 on the DL1720).

Addition and subtraction are useful for comparing signals to the standard signal, checking the signal logic, and comparing signal phases. Multiplication is useful for checking power signals by applying voltage and current signals.



### Binarization → Section 9.6

Converts the selected waveform into a binarized waveform. All voltages below the threshold become 0, while voltages above the threshold become 1. This operation is available for CH1 to CH4, and the Math1 waveform (or CH1 to CH2 for the DL1720).

### Inverted Display → Section 9.7

By multiplying the measured data by  $-1$ , the waveforms are displayed with their voltage axes inverted. This operation can be performed on CH1 to CH4, and Math1 (or CH1 to CH2 for the DL1720).

### Differentiation and Integration → Section 9.8

Differentiates or integrates the waveform on the specified channel. This operation can be performed on CH1 to CH4, and Math1 (or CH1 to CH2 for the DL1720).

### Scaling of Math1 and Math2 Waveforms → Section 9.5 to 9.9

The instrument normally auto scales when displaying the computed waveform, but manual scaling can also be selected.

If you select auto scaling, the upper and lower value suitable for displaying the waveform is calculated from the voltage axis, offset voltage, type of computation, and other factors of the waveform being computed.

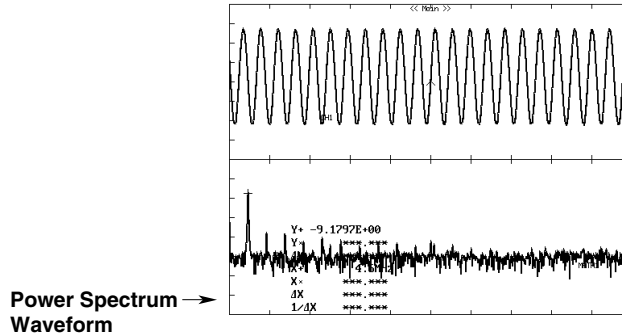
If you select manual scaling, then the upper and lower limits of the computed waveform display can be set to any desired values.

### Phase-Shifted Addition, Subtraction, and Multiplication → Section 9.11

Displays the phase-shifted waveforms of CH1 to CH4 (or CH1 to CH2 for the DL1720) or performs a computation using the phase-shifted waveforms.

**Power Spectrum Display <Section 9.9>**

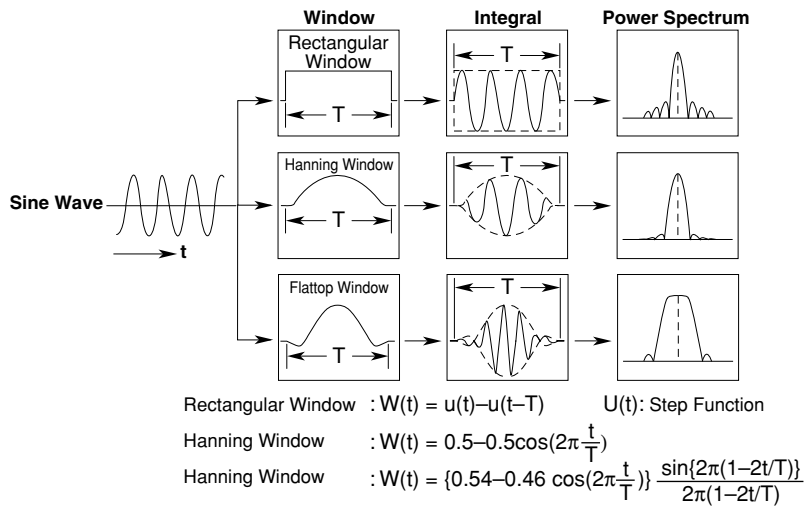
FFT (Fast Fourier Transform) computation can be performed on the input signal to display its power spectrum. This is useful when you want to check the frequency distribution of the input signal.



Three time windows are available: a Rectangular window, a Hanning window, and a Flattop window.

The Rectangular window is effective for transient signals, such as impulse waves, which attenuate completely within the time window. The Hanning window allows continuity of the signal by gradually attenuating the parts of the signal located near the ends of the time window down to the “0” level. Hence, it is effective for continuous signals. The frequency resolution of the Hanning window is higher than that of the Flattop window. However, the level accuracy of the spectrum of the Flattop window is higher than that of the Hanning window. When the waveform being analyzed is a continuous-type signal, select the appropriate window that suits the application.

FFT computation generates 1000 or 10000 measurement data points, but only half points are displayed on the screen.



**FFT Function**

When the complex result of FFT computation is  $G = R + jI$ , the power spectrum can be expressed as follows.

$$\text{Power Spectrum} = 10 \log \left( \frac{R^2 + I^2}{2} \right)$$

R: Real Part I: Imaginary Part

Reference (0dB) for Log Magnitude:  $1V_{rms}^2$

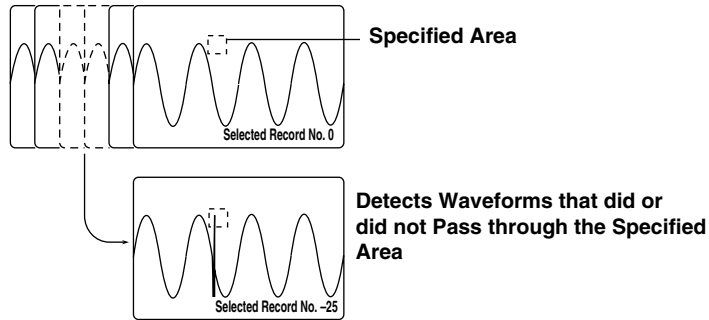
**Data Search (History Search Function) <Sections 7.8 to 7.9>**

This feature can be used to search waveforms that match the specified conditions from the history memory.

**History Memory Search Using Zone → Section 7.8**

Searches waveforms that did or did not pass through the specified area from the history memory.

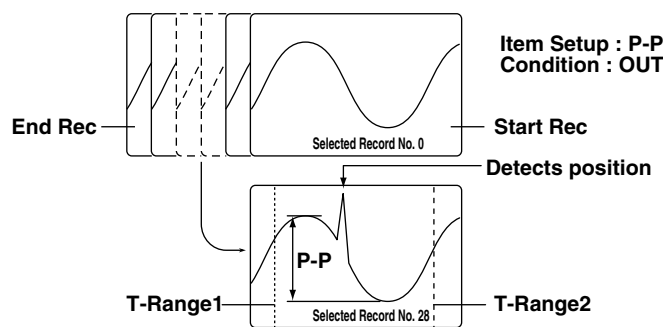
**Waveform that was Saved Using the History Memory Function**



**History Memory Search Using Waveform Parameters → Section 7.9**

Searches waveforms that did or did not satisfy the specified condition from the history memory.

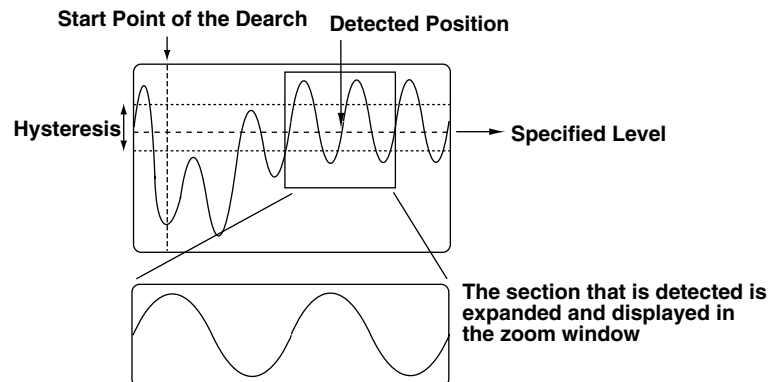
**Waveform that was saved using the history memory function**



**Data Search (Search and Zoom Function) <Section 8.10>**

**Edge Search**

Searches the position where the signal went above (rising) or below (falling) the specified level the specified number of times from the search start position. Displays the waveform expanded around the detected position in the zoom window.

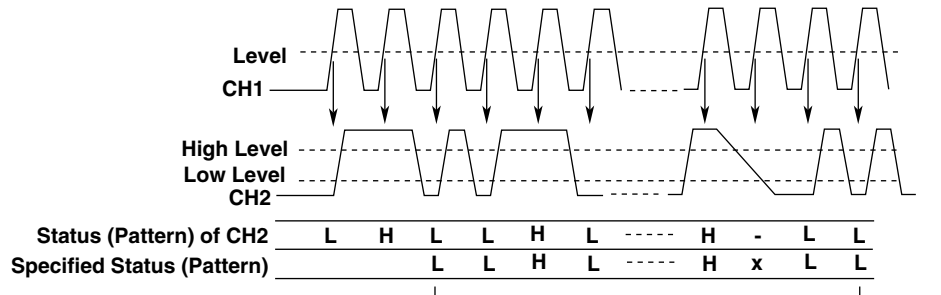


When the edge is set to rising and the count is set to 2



**Serial Pattern Search**

Searches for a section of the waveform that has the same pattern as the specified waveform pattern (specified using High or Low status or Don't Care). The status of the waveform (64 statuses) is detected at the rising or falling edge of the channel that is specified as the clock channel or at a constant time interval. The matched pattern is displayed expanded in the zoom window.



**Conditions:**  
 Clock Channel : CH1  
 Timing to Check the Status : Rising  
 Channel on which to Perform the Search : CH2

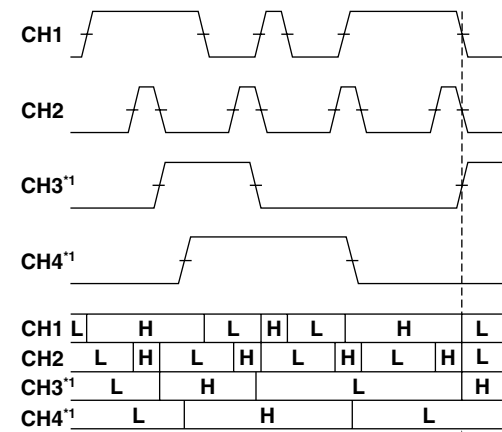
Searches Sections of the Waveform with the Same Status (up to 64 Patterns) as the Specified Waveform Pattern

The Section that is Detected is Expanded and Displayed in the Zoom Window

**Parallel Pattern Search**

Detects a section of the waveform where the status (specified as High, Low, or Don't Care) of each channel, CH1 through CH4, Math1, and Math2 (or CH1, CH2, and Math1 for the DL1720), is the same as the specified status. The status is detected at the rising or falling edge of the channel that is specified as the clock channel. If the clock channel is set to None, detection is performed on the status of all waveforms, CH1 through CH4, Math1, and Math2 (or CH1, CH2, and Math1 for the DL1720). The detected section is displayed expanded in the zoom window.

- Search Example in which the Clock Channel is Set to None and H1: L, CH2: L, CH3\*1: H, and CH4\*1: L



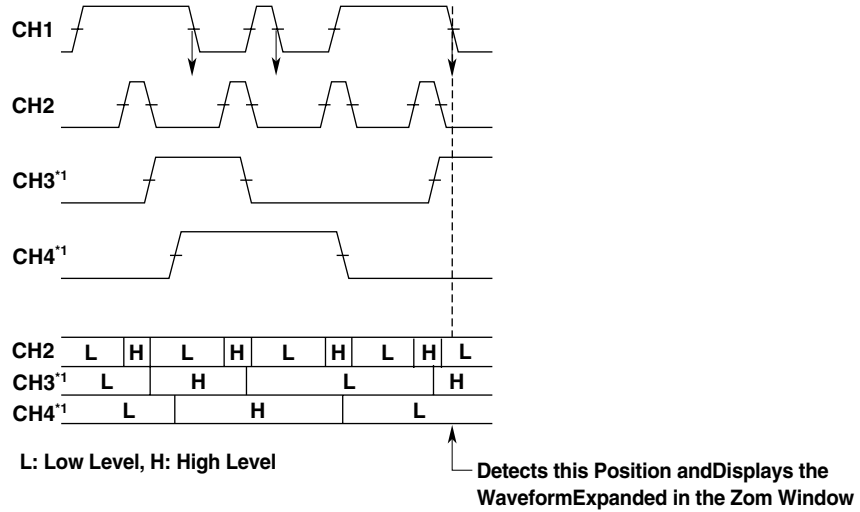
L: Low Level, H: High Level

Detects this Position and Displays the Waveform Expanded in the Zoom Window

\*1 The DL1720 is not equipped with channels 3 and 4.

## 1.5 Analyzing the Waveform

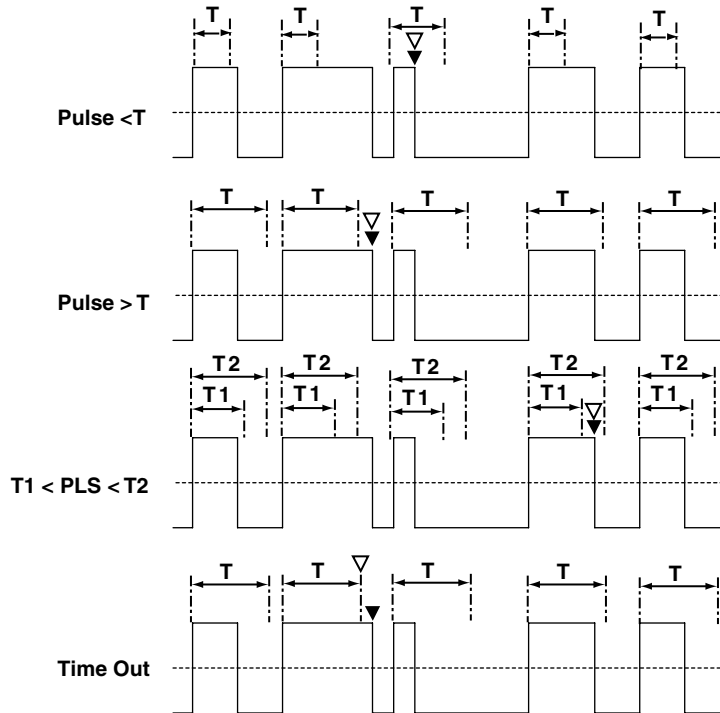
- Example in which the clock channel is set to CH1 and CH1: rising, CH2: L, CH3\*1: H, and CH4\*1: L



\*1 The DL1720 is not equipped with channels 3 and 4.

### Pulse Width Search

From the search start position, search for a portion of the waveform containing a pulse which is longer or shorter than a previously defined length of time. Expand the retrieved portion of the waveform per the zooming factor and display it in the waveform zoom display window.



- ▽ Zoom Screen Center Position
- ▼ Starting Point for Next Search

Pulse : The Length of Time a Specified Condition is Fulfilled  
T : A Specified Length of Time

### Auto Scroll

The zoom box scrolls automatically in a designated direction. You can stop the zoom box while checking zoomed waveforms.

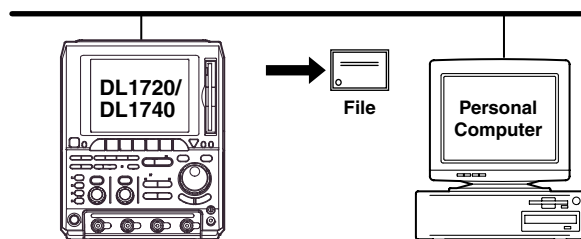
## 1.6 Communications

### Ethernet Interface (Option)

<Chapter 13 and Communication Interface User's Manual (IM701710-17E)>

#### Saving to a Network Drive (FTP Client Function) → Sections 13.3, 13.4

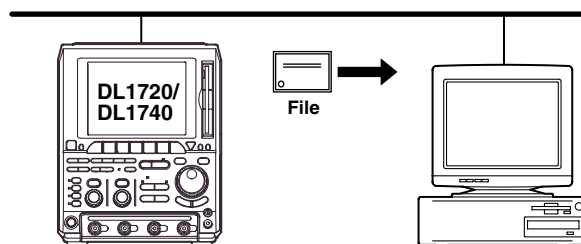
You can save, delete, and copy waveform data, screen image data, and setting information onto the hard drives of devices on the network such as a PC or workstation running the FTP server function just as you would onto internal floppy disks or Zip disks and hard disks.



#### File Retrieval from the DL1720/DL1740 Floppy Disk or Zip Disk (FTP Server Function)

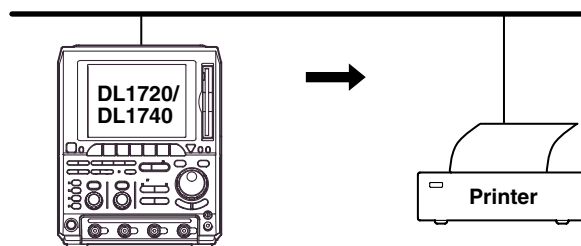
→ Section 13.8

You can download files from the internal floppy disk or Zip disk of the DL1720/DL1740 using a networked PC or workstation acting as the client.



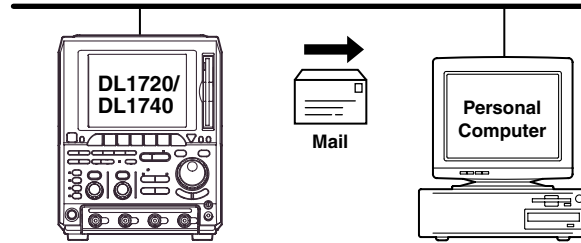
#### Outputting to a Network Printer (LPR Client Function) → Section 13.5

You can print screen images to a network printer just as you would to the DL1720/DL1740's built-in printer, or to a printer with a USB interface.



**Mail Transmission (SMTP Client Function) → Sections 13.6, 13.7**

You can send transmissions to a given email address at specified intervals. Using this function, you can periodically transmit such information as GO/NO-GO results and the measurement rate.



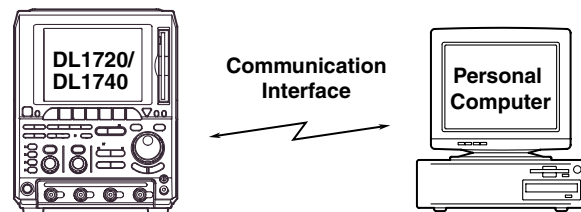
**Network Interface → Communication Interface User's Manual (IM701710-17E).**

You can output waveform data to a PC for analysis using the Ethernet interface, or perform waveform measurement by controlling the instrument with an external controller. This function is available on products with firmware version 1.30 or later.

**GP-IB Interface, Serial Interface (Option), and USB Interface**

**<The Communication Interface User's Manual (IM701710-17E)>**

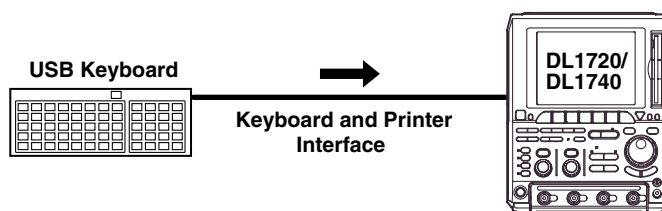
A GP-IB interface and a USB interface come standard with the DL1720/DL1740. A serial interface and a network interface are also available as an option. Through communications functions, you can output waveform data to a PC for data analysis or control the DL1720/DL1740 using an external controller to carry out waveform measurements.



## 1.7 Other Useful Functions

### Connecting a USB Keyboard <Section 4.1>

You can connect a USB keyboard for entering file names, comments, and other information. In addition, the keys on the keyboard are assigned to the keys on the front panel of the DL1720/DL1740, which allows you to operate the DL1720/DL1740 in a similar fashion. (See appendix 5.)



### Initialization <Section 4.2>

This function resets the key settings to the factory settings (default settings), and is useful when complex settings have been made and you want to cancel all of them at once.

However, settings related to communications, the SCSI ID, setting parameters on storing and recalling function are not reset, and so on.

### Auto Setup <Section 4.3>

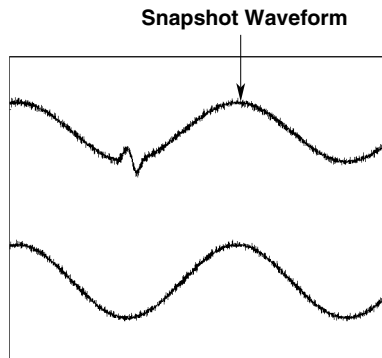
This function makes settings automatically such as vertical sensitivity, time axis and trigger settings, to suit the signal to be measured. This is useful when the signal to be measured is unknown. However, there might be particular signals for which the auto set-up function may not work properly.

### Storing and Recalling Setting Parameters <Section 4.4>

You can store setting parameters to the internal memory. The stored parameters can also be recalled to modify the settings on the instrument.

### Snapshot <Section 4.6>

If single start is not selected, a waveform is updated at the specified intervals or is displayed in roll mode. Thus, to retain the currently displayed waveform, acquisition must be stopped. Use of the snapshot function allows the currently displayed waveforms to remain temporarily on the screen without acquisition being stopped. To activate this function, just press **SNAP SHOT** without stopping acquisition. The currently displayed waveform will be retained. This waveform is called a snapshot waveform. The snapshot waveform is displayed separately in white making comparison between the two easier. Snapshot waveforms are screen image data, so they cannot be used for cursor measurement or automated measurement. However, screen image data output (hard copy) is possible.



### Clear Trace <Section 4.6>

This function clears all waveforms other than the loaded waveforms and restarts the averaging, repetitive sampling, and accumulation in a signal operation.

### Preset <Section 5.6>

This feature automatically sets the V/div, input coupling, trigger level, and other parameters to appropriate values for TTL, ECL, or the Current probes 700937 or 701930 (Optional Accessories).

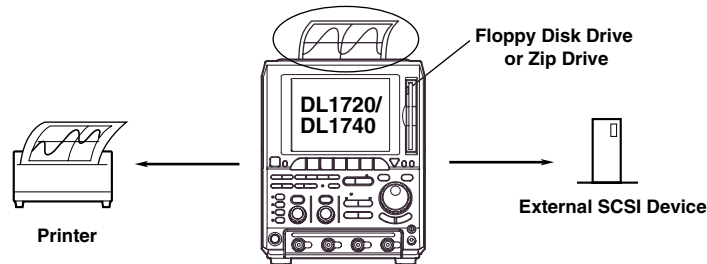
### GO/NO-GO Determination <Section 9.12, 9.13>

The GO/NO-GO function is useful when you want to inspect signals and track down abnormal symptoms on a production line making electronic equipment. Two determinations are available: GO/NO-GO operation using the Measurement of Waveform Parameters, and using the zone. This function detects whether an automatically measured value falls within the specified range, and responds accordingly, either by sounding the buzzer, saving the waveform data to internal memory or disk, printing out the screen image (option), or sending a mail (Ethernet interface option). In addition, the determination results can be output by an external signal.

## Displayed Data Output Functions <Chapter 10>

You use these functions to print the screen image to the optional built-in printer, or an external USB printer or a network printer, to save the image data to the storage medium (floppy disk, Zip disk, external SCSI device (option) or network drive (Ethernet interface option)).

Also, the instrument can display a thumbnail (miniature sample) of the screen data saved to the storage medium. This is useful for checking the contents of saved image data files. This function is available on products with firmware version 1.30 or later.



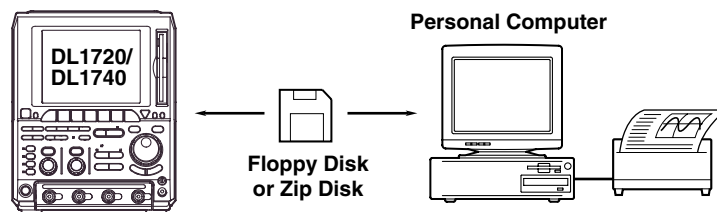
### Note

The instrument provides a function which enables you to use the keyboard displayed on the screen or the USB keyboard to enter and display a comment. If you enter a comment which indicates the contents of the displayed waveforms before printing a hard-copy, it will help you to distinguish between different print-outs.

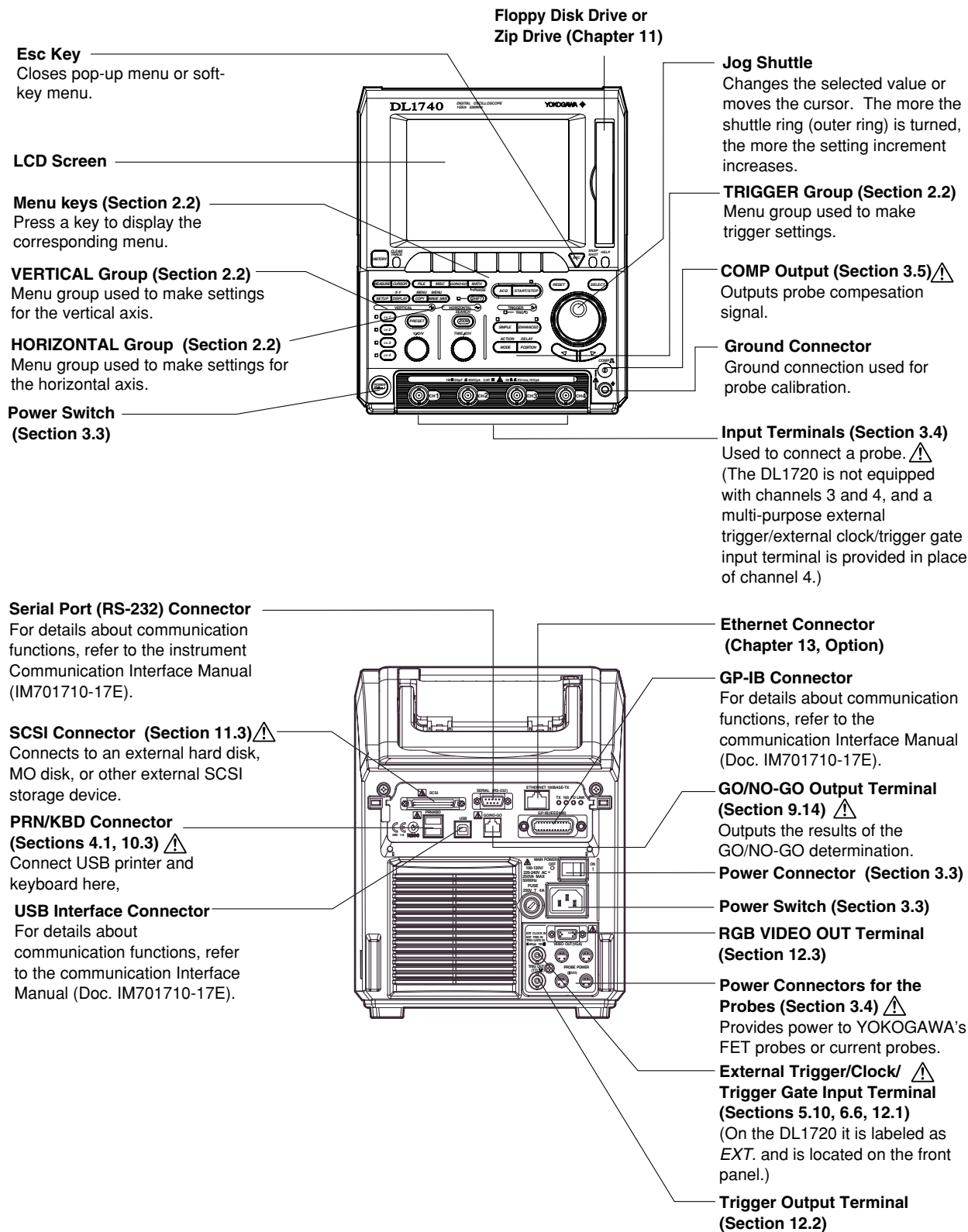
## Storage Medium Saves and Loads <Chapter 11>

The instrument standard configuration includes a built-in floppy disk drive or a built-in Zip drive, and the optional configuration includes a SCSI connector and an Ethernet connector. You can also choose to install an optional MO drive. It is also possible to save data to an external SCSI device or network drive.

You can save data in any of the following formats: Postscript, TIFF, and BMP. This means that you can easily insert the saved images into documents produced by conventional DTP software packages.



## 2.1 Front Panel/Rear Panel

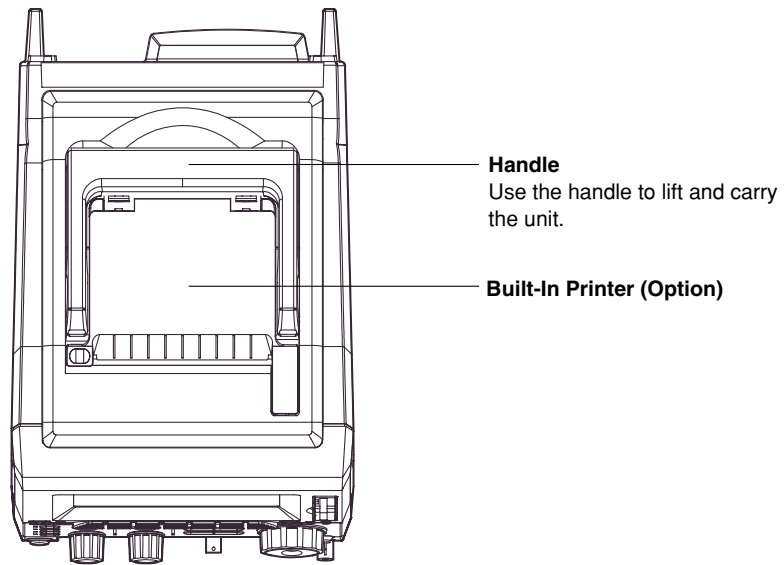




## 2.1 Front Panel/Rear Panel

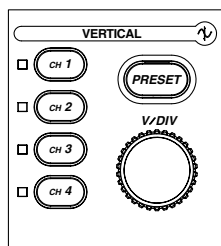
---

### Top View



## 2.2 Operation Keys/Jog Shuttle/Knobs

### VERTICAL Group



#### CH1 to CH4 Keys (Sections 5.1 to 5.5, 5.7 to 5.9)

**On the DL1720, the CH3 and CH4 keys are disabled.**

Displays a menu used to turn ON/OFF the display on each channel, set the vertical position, coupling, probe attenuation, offset voltage, bandwidth limit, expansion/reduction of the vertical axis, linear scaling, and waveform labels. In addition, by pressing this key before operating the V/DIV knob, the channel that is to be controlled by the V/DIV knob can be selected.

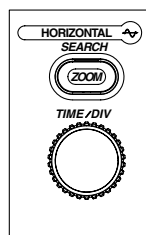
#### PRESET Key (Section 5.6)

Displays the preset menu that sets the V/div, input coupling, probe attenuation and trigger level to the optimum TTL level, ECL level, or the current probe (700937, 701930) (or preset level) automatically. This preset menu allows you to set all channels or the selected channels at once.

#### V/DIV Knob (Section 5.8)

Turning this knob during acquisition (i.e. while the START indicator is lit) sets the voltage axis sensitivity. Before turning this knob, be sure to select the channel you want to adjust by pressing the corresponding channel key (CH1 to CH4 (or CH1 to CH2 for the DL1720)).

### HORIZONTAL Group



#### TIME/DIV Knob (Section 5.11)

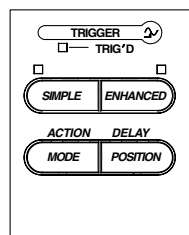
Use this knob to set the time scale. If you change the scale while acquisition is suspended, the new value becomes effective when acquisition resumes.

#### (SHIFT +) ZOOM Key (Sections 8.9, 8.10)

Displays a menu related to the waveform zoom display.

Pressing the ZOOM key after pressing the SHIFT key displays a menu related to data searching (Search and Zoom Function).

### TRIGGER Group



#### (SHIFT +) MODE Key (Sections 6.1, 6.15, 7.3)

Displays a menu used to select the trigger mode.

Pressing the MODE key after pressing the SHIFT key displays a menu related to action-on-trigger.

#### SIMPLE Key (Sections 6.4 to 6.7)

Displays the menu for the simple trigger mode, which provides normal triggers such as the edge trigger. Simple trigger mode is selected when the indicator located above this key is lit.

#### ENHANCED Key (Sections 6.4, 6.8 to 6.14)

Displays the menu for enhanced trigger mode, which provides complex triggers such as the pattern trigger. Enhanced trigger mode is selected when the indicator located above this key is lit.

#### (SHIFT +) POSITION Key (Sections 6.2, 6.3)

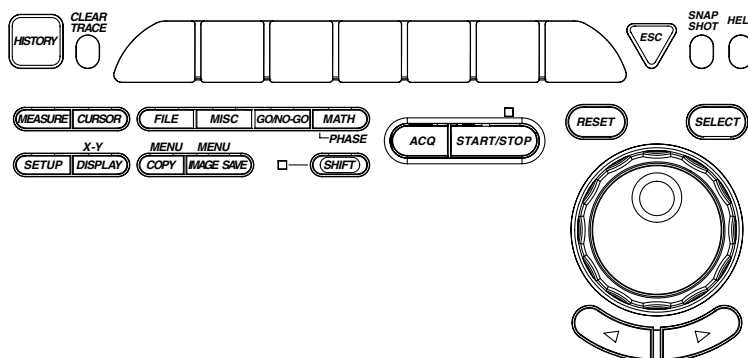
Used to set the trigger position.

You can set the trigger delay by pressing the POSITION key after pressing the SHIFT key.

#### TRG'D Indicator

Lights up when a trigger is activated.

Other Menus



**DISPLAY Key (Sections 8.1 to 8.8)**

Displays the screen display menu.

Press SHIFT + DISPLAY to produce the menu for X-Y display setup.

**MISC Key (Sections 3.6, 4.7, 6.16, 11.5; Chapters 13, 14, 15; IM701710-17E)**

Displays the menu for selecting GO/NO-GO judgment, communication interface, system configuration settings, system status check, screen saver setting, and the self-diagnostic function.

**FILE Key (Sections 11.4, and 11.6 to 11.12)**

Displays menu that you use to save to, load from, or execute file operations on floppy disk, Zip disk, MO disk, or external SCSI device.

**(SHIFT+) COPY Key (Sections 10.2, 10.3, 13.5)**

Used for printing out hard copy of the screen data.

If you press SHIFT + COPY, the screen displays a menu that you can use to print or save the screen image. For the save location, you can select any of the following: internal printer (option), and USB printer.

**(SHIFT+) IMAGE SAVE Key (Sections 10.4, 13.4)**

You can store the screen image to an external storage medium. Press the SHIFT key followed by the IMAGE SAVE key to display a menu used to save the screen image data to a floppy disk, Zip disk, an external SCSI device (option), or a network drive (when the Ethernet interface is installed).

**MEASURE Key (Sections 9.2 to 9.4)**

Displays the menu for performing automatic measurement of waveform parameters.

**CURSOR Key (Section 9.1)**

Displays the menu for cursor measurement.

**(SHIFT+) MATH Key (Sections 9.5 to 9.11)**

Displays the menu for waveform computation.

Pressing the MATH key after pressing the SHIFT key displays a menu used to shift the phase.

**GO/NO-GO Key (Sections 9.12, 9.13)**

Displays a menu related to GO/NO-GO.

**SETUP Key (Sections 4.2 to 4.4)**

Displays a menu used to initialize the settings to factory defaults, perform auto setup, which automatically sets the DL1720/DL1740 according to the input signal, store or recall setting parameters, and so on.

**SHIFT Key**

Used to make the functions that are marked in purple on the panel operative. Pressing this key activates shift mode, pressing it again releases shift mode. While the indicator above this key is lit, shift mode is active.

**HISTORY Key (Sections 7.7 to 7.9)**

Displays a menu used to recall data using the history memory function.

**ACQ Key (Sections 5.10, 7.1, 7.2, and 7.4 to 7.6)**

Displays the acquisition method menu.

**START/STOP Key (Section 4.5)**

Starts or stops acquisition according to the selected trigger mode. The indicator above this key is lit during acquisition.

**Jog and Shuttle Dials (“jog shuttle”)**

You use these dials to set numerical values, move the measurement cursors, select items from menus, and perform other such selection operations.

The jog dial changes the value in fixed steps as you rotate it. With the shuttle dial, the step size increases as you turn the dial further.

**RESET Key**

Resets values that you have changed using the jog and shuttle dials.

**SELECT Key**

Activates the menu item that you have highlighted using the jog or shuttle dial.

**Arrow Keys (< > keys)**

Use these keys to shift the column position of the numerical value to be set by the jog or shuttle dial.

**SNAP SHOT Key (Section 4.6)**

Repeats acquisition while retaining the currently displayed waveform on the screen.

**CLEAR TRACE Key (Section 4.6)**

Deletes the currently displayed waveform.

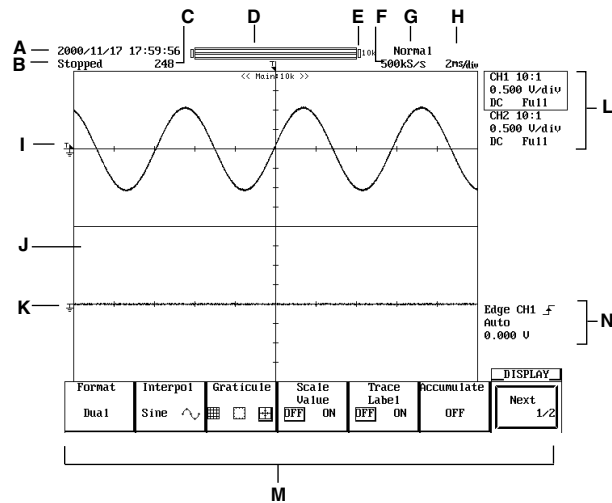
**HELP Key (Section 4.8)**

Sets help window ON or OFF.

**Soft Keys**

Selects the menu that is displayed at the bottom of the screen.

## 2.3 Screens



### A Date and Time

For the procedures used to set the date and time, see section 3.6, “Setting the Date and Time.”

### B Operation State

Displays “Running” when data acquisition is in progress and “Stopped” when it is stopped.

### C Waveform Acquisition State and the Number of Acquisitions

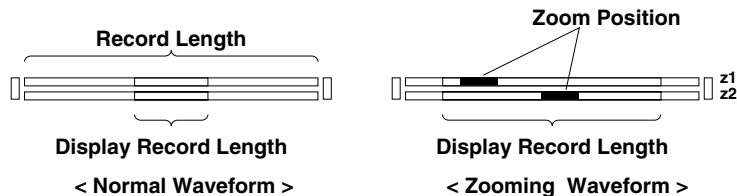
Waiting for Trigger : trigger wait state

Pre... : pre-trigger

Post... : post-trigger

Value : the number of waveforms acquired

### D Display Position



### E Record Length

### F Sample Rate

### G Sampling Mode

Varies depending on the T/div and record length settings.

Normal/Env/Avg/BoxAvg : Realtime sampling mode

Norm: Rep : Repetitive sampling mode

Avg: Rep : Repetitive sampling mode in the averaging mode

### H T/div Setting that has been Changed after Waveform Acquisition

### I Trigger Level

### J Display Format

1, 2, 3, 4, and 6 windows are possible (or 1, 2, and 3, windows for the DL1720). (see section 8.1)

### K Ground Level

### L Probe Attenuation, V/div, Input Coupling, and Bandwidth Limit Settings

**M Soft Key Menu**

**N Trigger Level, Trigger Mode, Trigger Type, and Trigger Source Settings**

**Note**

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In some cases, up to 0.02% of the total number of pixels of the LCD can be defective.

---

## 3.1 Precautions During Use

### Safety Precautions

When you are using this instrument, read "Safety Precautions" on page v thoroughly, as well as the following points.

#### **Do not Remove the Cover from the Instrument**

Some parts of the instrument use high voltages, which are extremely dangerous. When the instrument needs internal inspection or adjustment, contact your dealer or nearest YOKOGAWA representative, as listed on the back cover of this manual.

#### **In Case of Irregularity**

If you notice smoke or unusual odors coming from the instrument, immediately turn OFF the power and unplug the power cord. If such an irregularity occurs, contact your dealer or the nearest YOKOGAWA representative as listed on the back cover of this manual.

#### **Power Cord**

Nothing should be placed on the power cord. Also, it should be kept away from any heat sources. When unplugging the power cord from the AC outlet, never pull the cord itself. Always hold the plug and pull it. If the power cord is damaged, contact your dealer. Refer to page ii for the part number to use when placing an order.

### General Handling Precautions

Observe the following precautions when handling the instrument.

#### **Never Place Anything on Top of the Instrument**

Never place other equipment or objects containing water on top of the instrument, otherwise a breakdown may occur.

#### **Do not Cause Shock to the Input Connectors or Probes**

Shock to the input connectors or probes may turn into electrical noise and enter the instrument via the signal lines.

#### **Do not Damage the LCD Screen**

Since the LCD screen is very vulnerable and can be easily scratched, do not allow any sharp objects near it. Also it should not be exposed to vibrations and shocks.

#### **When the Instrument is not going to be Used for a Long Period**

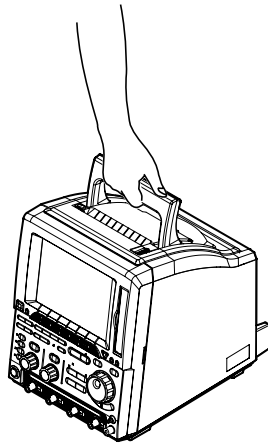
Unplug the power cord from the AC outlet.

### 3.1 Precautions During Use

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#### **Carrying the Instrument**

Before carrying the instrument remove the power cord and other cables. Always carry the instrument by the handles or carry it with both hands (see below).



#### **Cleaning**

When cleaning the case or the operation panel, unplug the power cord from the plug first, then wipe with a dry, soft, clean cloth. Do not use volatile chemicals such as benzene or thinner for cleaning, as this may lead to discoloration or deformation.



## 3.2 Installation

### Installation Conditions

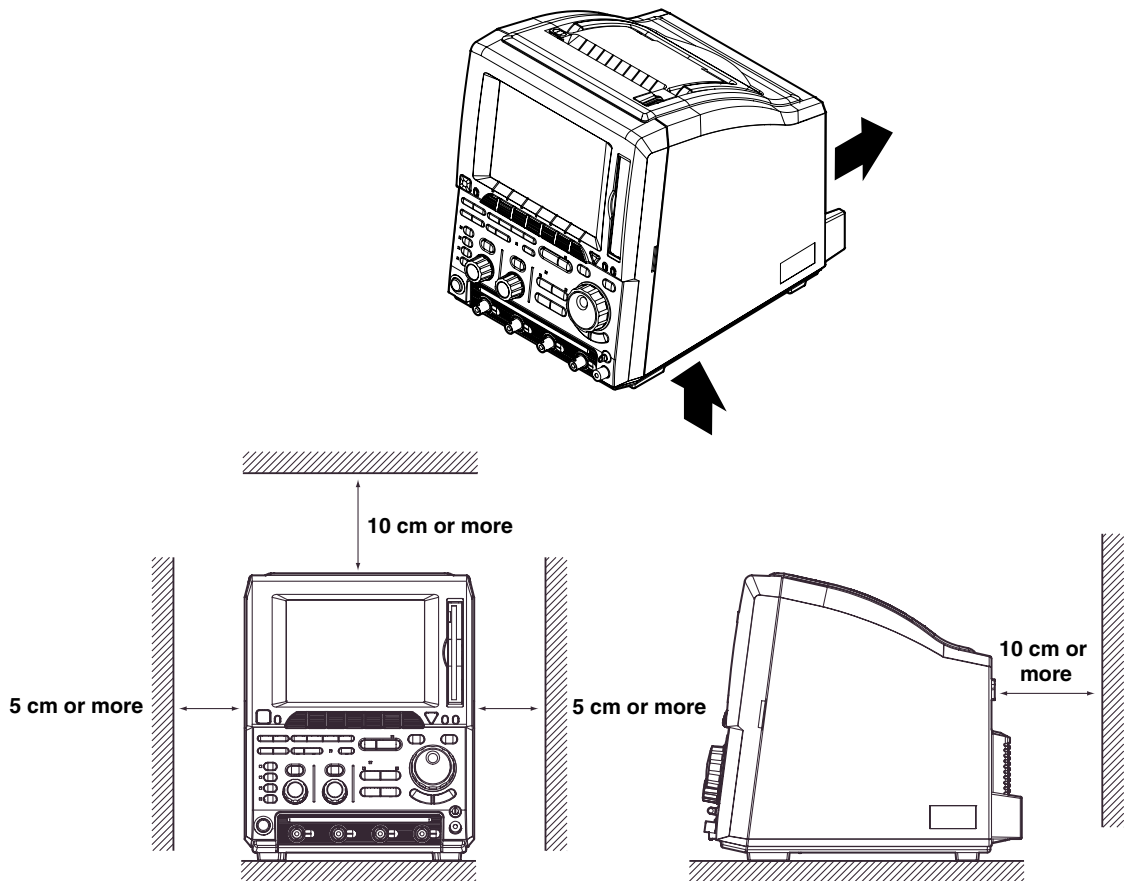
The instrument must be installed in a place where the following conditions are met.

#### Flat Location

Set the oscilloscope in the proper direction and in a level and stable place. If placed in an unstable place, printing quality decreases.

#### Well-Ventilated Location

Vent holes are situated on the bottom. In addition, vent holes for the cooling fans are also situated in the rear sides. To prevent a rise in the internal temperature, the vent holes should not be blocked and sufficient clearance should be maintained around them. If a printer comes with your DL1720/DL1740, allow extra space for operation and do not place objects on top of the printer.



## 3.2 Installation

---

### Ambient Temperature and Humidity

Ambient Temperature : 5 to 40°C

Ambient Humidity : 20 to 80% RH (when not using the printer)

35 to 80% RH (when using the printer)

No condensation should be allowed.

### Note

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- To ensure high measurement accuracy, the instrument should only be used under the following conditions.  
Ambient temperature:  $23 \pm 2^\circ\text{C}$   
Ambient humidity:  $55 \pm 10\% \text{ RH}$
  - Internal condensation may occur if the instrument is moved to another place where both the ambient temperature and humidity are higher, or if the temperature changes rapidly. In such cases allow the instrument to acclimatize to its new environment for at least one hour before starting operation.
- 

### Never Install the Instrument in the Following Places

In direct sunlight or near heat sources

Where an excessive amount of soot, steam, dust or corrosive gases are present.

Near magnetic field sources

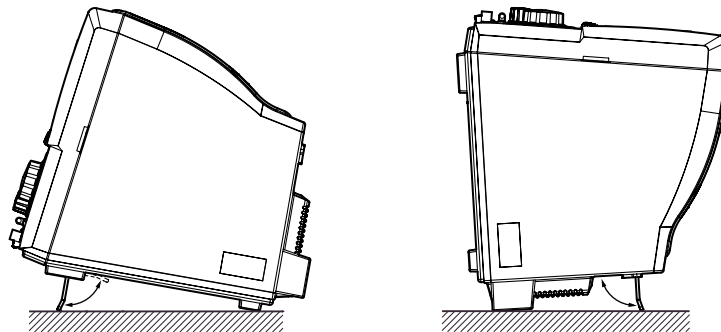
Near high voltage equipment or power lines

Where the level of mechanical vibration is high

In an unstable place

### Installation Position

Place the instrument in a horizontal position or tilted using the stand, as shown below. When you use the stand, pull it forwards until it locks. To return the stand to its original position, push it backwards. When installing the DL1720/DL1740 with the rear panel down, use the stand on the rear panel.



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### CAUTION

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Do not use the Zip drive when the DL1720/DL1740 is installed with the rear panel down.

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### Rubber Feet

If the instrument is installed in the tilted position, rubber feet can be attached to prevent slipping. Four pieces of rubber feet are included in the package.

## 3.3 Connecting the Power Cord

### Before Connecting the Power

Make sure that you observe the following points before connecting the power. Failure to do so may cause electric shock or damage to the instrument.



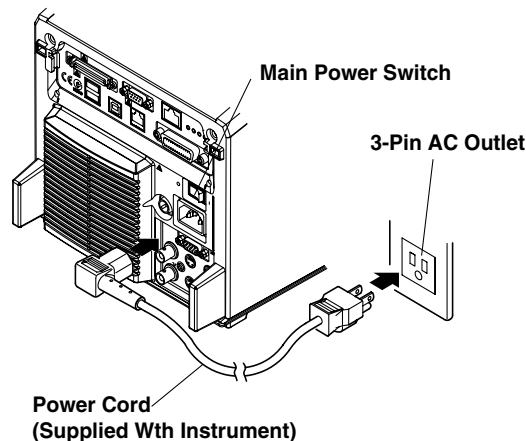
### WARNING

- Connect the power cord after confirming that the voltage of the power supply complies to the rated electric power voltage for the instrument.
- Connect the power cord after confirming that the instrument power switch is OFF.
- Always use protective ground to prevent electric shock. Connect the instrument power cord to the 3-pin power outlet with grounding terminal.
- Do not use non-grounding extension cords or other measures that defeat the protective grounding.
- Never use an extension cord that does not have a protective grounding, otherwise the protection feature will be invalidated.

### Connecting the Power Cord

1. Make sure that main power switch and power switch are OFF.
2. Plug the power cord into the power connector socket on the rear panel of the instrument.
3. Plug the other end of the power cord into an AC outlet that meets the following conditions. The AC outlet must be of 3-pin type with a protective grounding terminal.

|  |                               |
|--|-------------------------------|
| Rated supply voltage:  | 100 to 120 VAC/220 to 240 VAC |
| Permitted supply voltage range:                                | 90 to 132 VAC/198 to 264 VAC  |
| Rated supply voltage frequency:                                | 50/60 Hz                      |
| Permitted supply voltage frequency range:                      | 48 to 63 Hz                   |
| Maximum power consumption (when the built-in printer is used): | 200 VA                        |



### 3.3 Connecting the Power Cord

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#### Turning ON/OFF the Main Power Switch

Main power switch (rear panel on the right): Press the switch to the right to turn it ON; press the switch to the left to turn it OFF.

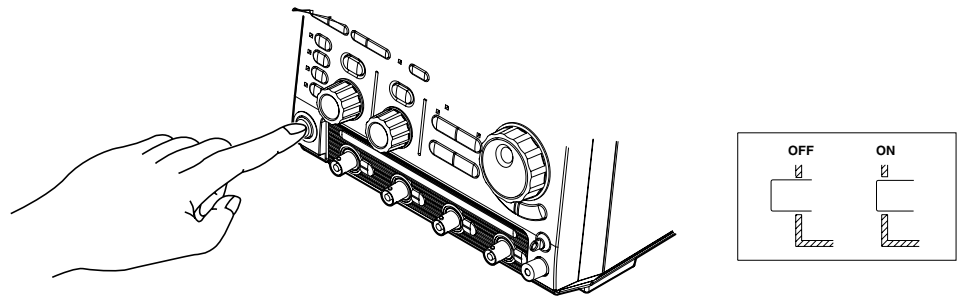
#### Turning ON/OFF the Power Switch

##### Items to be Checked before Turning ON the Power

Check that the instrument is installed correctly as instructed in section 3.2, "Installing."  
Check that the power cord is connected correctly as shown in section 3.3, "Connecting the Power Cord."

##### Turning the Power ON/OFF

POWER switch: The power is turned ON and OFF alternately as the switch is pressed.



#### Response at Power ON

Self test and calibration start automatically when the power switch is turned ON. If the check results are satisfactory, the normal waveform display screen will appear.

##### Note

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- Wait at least 10 seconds after turning the power OFF before turning it back ON again.
- If calibration does not start when the power is turned ON, or if the normal waveform display screen does not appear, check the following points.
  - Check that the power cord is plugged in properly.
  - Check that the main power switch is turned ON.
  - Check that the correct voltage is being supplied from the AC outlet. (Refer to section 3.3)
  - Check that the fuse is not blown. (Refer to section 15.5)

If there is still no power even after the above points have been checked, contact your nearest YOKOGAWA representative as listed on the back cover of this manual.

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#### For Accurate Measurement

Turn the power switches ON and allow the unit to warm up for at least 30 minutes.  
After warm-up is complete, perform calibration. (Refer to section 4.7)

#### Response at Power OFF

Settings made prior to turning OFF the power are retained (even if the power cord is removed). This allows display of waveforms using those saved settings the next time the power is turned ON.

##### Note

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The settings are backed up by a lithium battery. The battery lasts for approximately 5 years if it is used at an ambient temperature of 23°C. When the battery voltage drops below the specified level, a message will appear on the screen. In this case, the battery needs to be replaced immediately. The battery cannot be replaced by the user, so contact the nearest YOKOGAWA representative listed on the back cover of this manual.

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## 3.4 Connecting a Probe

### Input Terminals

A probe (or an input cable such as a BNC cable) must be connected to one of the input terminals\* (CH1 to CH4 (or CH1 and CH2 for the DL1720)) located on the lower section of the front panel.

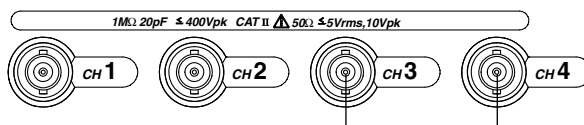
The input impedance is  $1\text{ M}\Omega \pm 1.0\%$  and approximately  $20\text{ pF}$  or  $50\ \Omega \pm 1.0\%$ .

\* The number of input terminals varies according to the instrument model.



### CAUTION

- The maximum allowable input voltage is 400 V (DC + AC peak) or 282 Vrms when the frequency is 1 kHz or less. Never input a voltage exceeding this level, as it could damage the input section of the instrument. If the frequency exceeds 1 kHz, the input section may be damaged even when the voltage is below 400 V.
- The maximum allowable input voltage is 5 Vrms or 10 Vpeak when using 50- $\Omega$  input. Never input voltage exceeding this level, as it could damage the input section of this instrument.



The DL1720 is not equipped with channels 3 and 4, and a multi-purpose external trigger/external clock/trigger gate input terminal is provided in place of channel 4.

### Points to Note when Connecting a Probe

- When connecting a probe to the instrument for the first time, perform phase correction of the probe as described in the section 3.5. Failure to do so may result in unstable gain across different frequencies, thereby preventing correct measurement. Calibration must be performed for each channel.
- If the object to be measured is connected to the instrument directly, without using a probe, correct measurement cannot be performed due to the load effect.

**Probe**

**Specifications for the probe (700988) supplied with the instrument (after calibration)**

| Item                            | Specifications<br>Setting 10 : 1  | Setting 1 : 1              | Conditions                        |
|---------------------------------|---|----------------------------|-----------------------------------|
| Input impedance/<br>capacitance | 10 MΩ ±2%, approx. 14 pF  | 1 MΩ ±1.0%, approx. 150 pF | When used with<br>this instrument |
| Attenuation ratio               | 10 : 1 ±3%  | —                          | When used with<br>this instrument |
| Frequency band                  | DC to 400 MHz   | DC to 6 MHz                | When used with<br>this instrument |
| Rise time                       | 900 ps or less  | 58 ns or less              | When used with<br>this instrument |
| Maximum<br>input voltage        | 600 V (DC + AC peak) <sup>*1</sup><br>or 424 Vrms,<br>Frequency is 100 kHz or lower | —                          |                                   |
| Connector type                  | BNC   | BNC                        | —                                 |
| Total length                    | 1.5 m   | 1.5 m                      | —                                 |

\*1 When the probe's attenuation is "1 : 1," never input voltage exceeding the maximum input voltage of this instrument.

**When Using a Probe other than the One Supplied with the Instrument**

- To measure a signal which contains harmonics of approximately 500 MHz, use a probe with a frequency band of 500 MHz or higher.
- Correct measured values cannot be displayed if the probe's attenuation ratio is not "1 : 1," "10 : 1," "100 : 1" or "1000 : 1."

**Setting the Probe Attenuation**

Follow the operating procedure given in section 5.4, "Selecting Probe Attenuation" so that the probe's attenuation matches the one displayed below **Probe** in the soft key menu. If they do not match, measured values cannot be read correctly.

**When Using the FET Probe (700939), the Current Probe (700937, 701930), or the Differential Probe (701920)**

When using YOKOGAWA's FET probe (700939), current probe (700937, 701930), or differential probe (701920) use the power supply for the probe provided on the rear panel of the instrument.

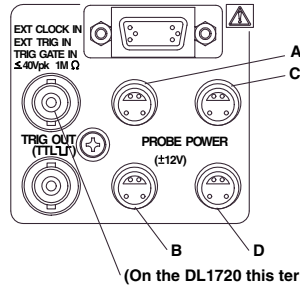


**CAUTION**

Use the power connectors for the probes on the rear panel only for powering probes 700939, 700937, 701930, or 701920. Using the power connectors for any other purpose can damage the DL1720/ DL1740 or the device that is connected.

**Precautions to be Taken when Using the FET Probe (700939), the Current Probe (700937, 701930), or the Differential Probe (701920)**

When connecting the FET probe (700939), the current probe (700937 or 701930), or the differential probe (701920) to the probe power supply terminal on the rear panel, make sure that the current does not exceed the range shown below. Otherwise, the DL1720/DL1740 operation may become unstable due to the activation of the excessive current protection circuit.

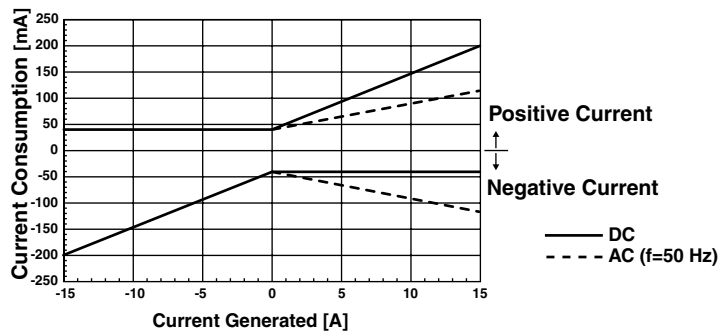


When each terminal is assigned names A through D  
 (Current Consumption of A) + (Current Consumption B) ≤ 400 mA  
 (Current Consumption of C) + (Current Consumption D) ≤ 400 mA  
 (Total Current Consumption of A Through D) ≤ 600 mA  
 (The DL1720 is not equipped with terminals C and D.)

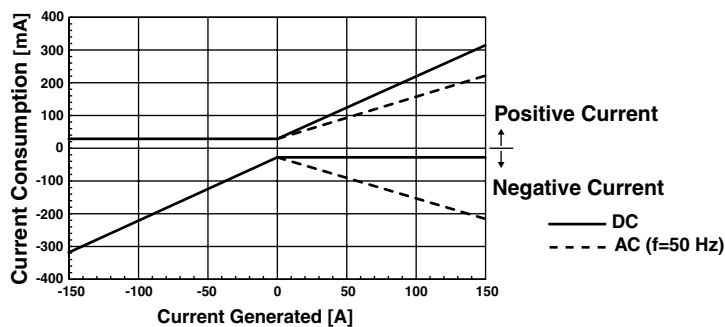
(On the DL1720 this terminal is labeled as EXT. and is located on the front panel.)

When using the current probe (700937 or 701930), the number of probes that can be used is limited by the current generated by the device under measurement. Examples of current consumption measurement using an active probe that can be connected to the DL1720/DL1740 are shown below.

**Current Probe (700937)**



**Current Probe (701930)**



Calculate the positive and negative current consumption of the FET probe (model 700939), or the differential probe (model 701920) at a maximum of 125 mA.

## 3.5 Compensating the Probe (Phase Correction)

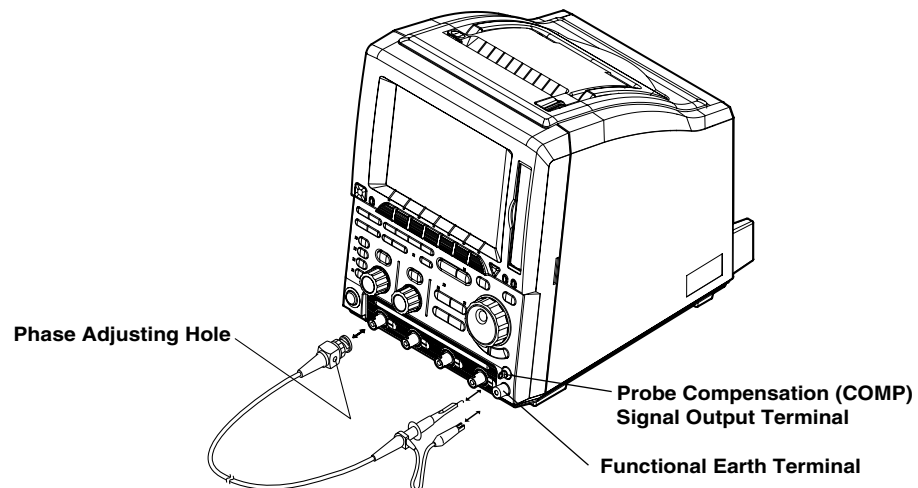


### CAUTION

Never apply an external voltage to the COMP terminal, as damage to the instrument may result.

#### *Operating Procedure*

1. Turn ON the power switch.
2. Connect the probe to the input terminal to which the signal is to be applied.
3. Touch the probe's tip against the probe compensation signal output terminal and connect the grounding wire to the functional earth terminal.
4. Perform auto setup using the procedure described in section 4.3.
5. Insert a screwdriver into the trimmer adjusting hole in the probe and turn the trimmer so that the displayed waveform becomes square.





**Explanation****Reason for Probe Compensation**

If the probe's input capacitance is outside the specified range, the gain will not be constant across different frequencies, preventing display of the correct waveforms. The input capacitance varies depending on the probe used, so the variable capacitor (trimmer) provided on the probe must be adjusted.

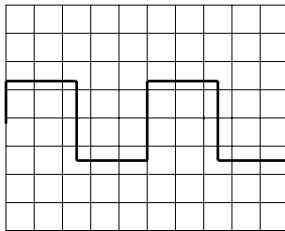
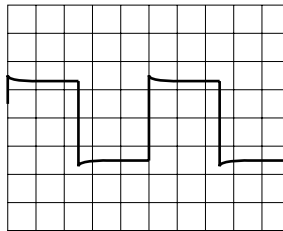
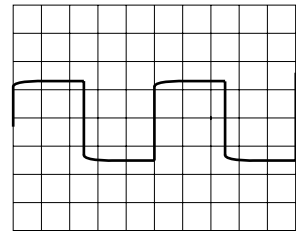
Probe compensation must be performed when the probe is to be used for the first time. Moreover, the appropriate input capacitance varies according to which channel is used, so probe compensation is required when the probe is switched from one channel to another.

**Calibration Signal**

A probe compensation signal (square waveform) of the following characteristics is output from the CAL terminal on the front panel.

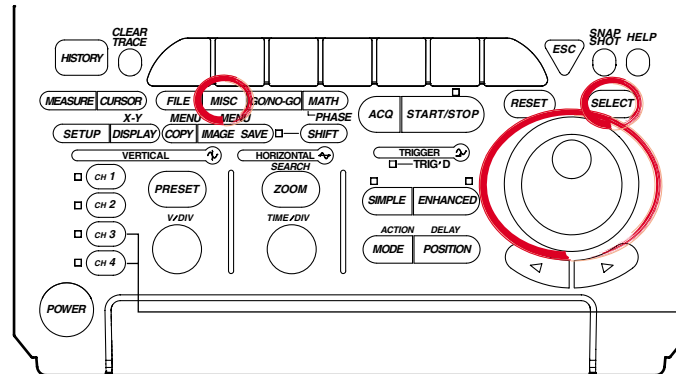
Frequency: approx. 1 kHz

Amplitude: approx. 1 V

**Waveform Differences****Correct Waveform****Over-Compensated  
(Gain is too High at High Frequency)****Under-Compensated  
(Gain is too Low at High Frequency)**

## 3.6 Setting the Date and Time

### Relevant Keys

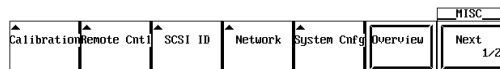


The DL1720 is not equipped with an input terminal for CH3 or CH4.

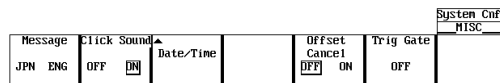
### Operating Procedure

#### Displaying the System Configuration Menu

1. Press **MISC**.
2. Press the **System Cnfg** soft key to display the system configuration menu.

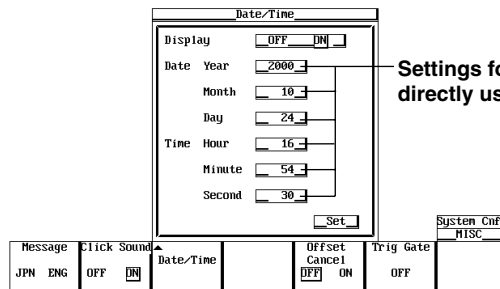


3. Press the **Date/Time** soft key to display the date and time display/setting menu.



#### Turning ON/OFF the Date and Time Display

4. Select ON or OFF by pressing **SELECT**.



Settings for these items can be input directly using a USB keyboard. (Ⓜ)

#### Setting the Date and Time

5. Turn the jog shuttle to move the cursor to Year.
6. Press **SELECT** to display the Year input box.
7. Set the year using the jog shuttle.
8. In a similar fashion, set the Month, Day, Hour, Minute, and Second.
9. Turn the jog shuttle to move the cursor to Set and press **SELECT** to confirm the settings.

**Explanation**

**Date (YY / MM / DD)**

The last two digits of the year are used to set the year (YY).

**Time (HH : MM : SS)**

The 24 - hour clock is used.

**Note**

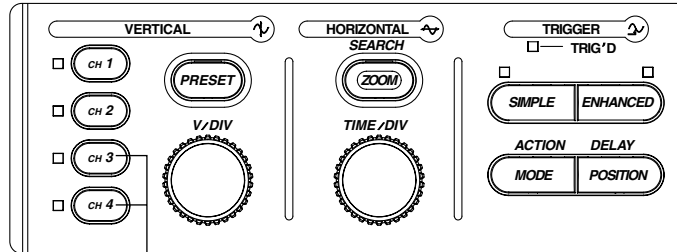
- 
- The date and time are backed up by the built-in lithium battery.
  - Leap years are taken into account.
-

# 4.1 Entering Values and Character Strings

## Entering a Value

### Direct Entry Using the Special Knob

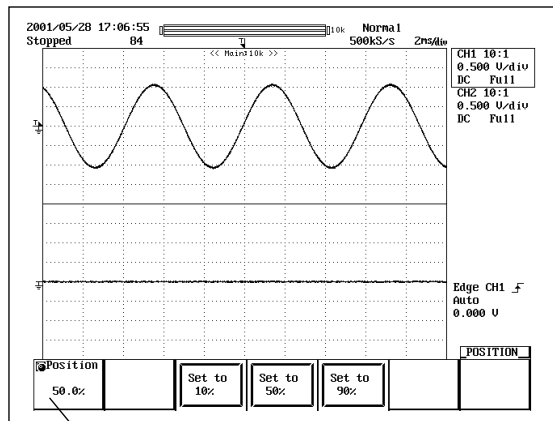
The following knobs can be used to directly enter values simply by turning them. V/DIV and TIME/DIV knobs



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Entry Using the Jog Shuttle

Before using the jog shuttle to enter a value, you must select the desired parameter by pressing the corresponding soft key. The jog shuttle ring (the outer ring of the jog shuttle) allows you to enter values in larger steps than the jog shuttle dial. The size of the step depends on the angle by which the shuttle ring is turned. For some parameters you can use the arrow keys below the jog shuttle to shift from one digit to the next.



Parameter for Setting with the Jog Shuttle

### Note

If you make an incorrect change with the jog shuttle, you can undo the change by pressing **RESET**.

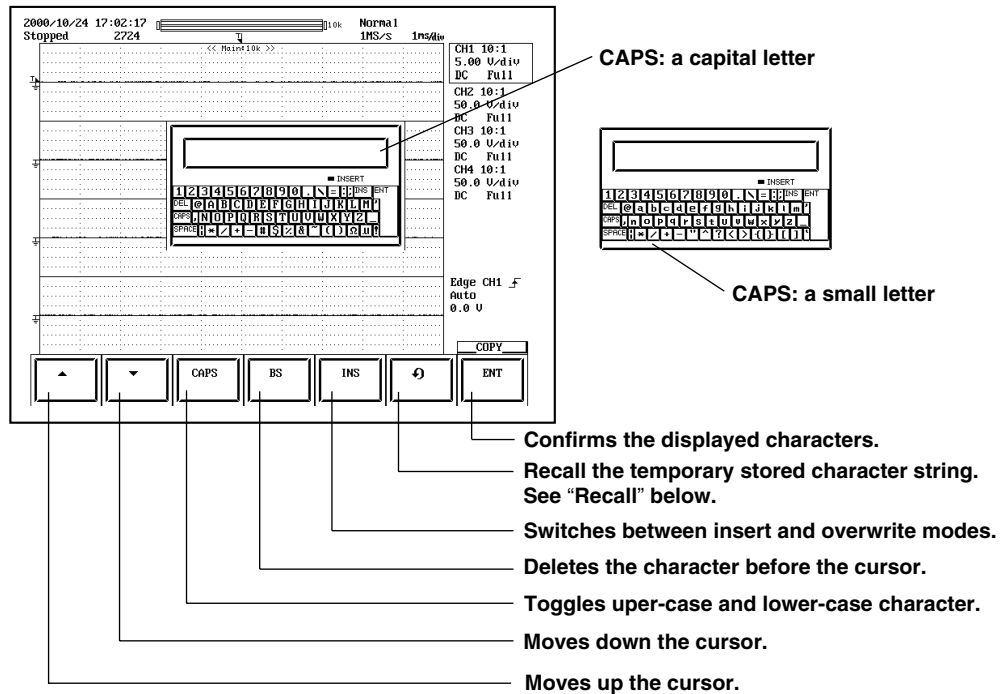
## 4.1 Entering Values and Character Strings

### Entering a Character String

The date/time, file name, and comment can be entered using the keyboard displayed on the screen. Operate the keyboard using the jog shuttle, the SELECT key and arrow key to enter a character string as follows.

#### Keyboard Operation

1. Turn the jog shuttle and move the cursor to the character you wish to enter. The ▲ and ▼ soft keys can be used to move the cursor up and down.
2. Press **SELECT** to confirm the character entry.  
If a character string is already entered, use the arrow keys to move the cursor to the position at which you wish to enter the character.
3. Repeat steps 1 and 2 to enter all the characters.
4. ENT on the keyboard and press **SELECT**. The character string is confirmed and the keyboard disappears. The **ENT** soft key can be used to confirm the string (and hide the keyboard). At this point, the confirmed string is temporarily stored.)  
If **RESET** is pressed before confirming the character string, the entire string is cleared.



#### • Operation to Temporarily Store Character Strings

The strings that are previously confirmed are sequentially sent to the subsequent memories. When the number of confirmed strings exceeds eight, the strings are deleted in order starting from the oldest string. The 0 - 7 symbols are not displayed on the screen.

| Symbol indicating the memory storing the string | 0         | 1                   | 2                   | .....                     | 7          |
|---|-----------|---------------------|---------------------|---------------------------|------------|
| When string "AA" is confirmed first             | Stores AA |                     |                     |                           |            |
| When string "BB" is confirmed next              | Stores BB | Moves and stores AA |                     |                           |            |
| When string "CC" is confirmed next              | Stores CC | Moves and stores BB | Moves and stores AA |                           |            |
| .....   |           |                     |                     |                           |            |
| When string "HH" is confirmed next              | Stores HH | Moves and stores GG | Moves and stores FF | ..... Moves and stores AA |            |
| When string "JJ" is confirmed next              | Stores JJ | Moves and stores HH | Moves and stores GG | ..... Moves and stores BB | Deletes AA |

- **Recall**

(Note that the string that is displayed in the entry box of the keyboard is overwritten when a string is recalled using the procedure in step 1 below.)

1. When you press the  $\mathcal{O}$  soft key repeatedly, the eight most recently confirmed and stored strings are displayed one at a time from newest to oldest in the keyboard entry box. If the  $\mathcal{O}$  soft key is pressed again after the eighth string, the display will return to the first string.
2. Make appropriate corrections to the recalled string and confirm it according to steps 1 to 4 that were described above in “Entering a Character String,” and “Operation to Temporarily Store Character Strings.” At this point, the confirmed string is temporarily stored.

#### Keys other than Characters

- DEL: Deletes the character on the cursor.
- INS: Switches between insert and overwrite modes. The indicator is lit when in insert mode.
- SPACE: Enters a space.
- ENT: Confirms the displayed characters.
- CAPS: Toggles uppercase and lowercase characters.

#### Number of Characters and Types Available

| Number of Characters  | Available Characters   |
|-----------------------|--|
| Date, time            | Specified number 0 to 9 ( / : )                                |
| File name             | 1 to 8 0 to 9, A to Z, %, _ , ( , )                            |
| Display image comment | 0 to 20 All characters (including space)                       |
| File comment          | 0 to 25 All characters (including space)                       |
| Mail address          | 0 to 40 All ASCII characters on the keyboard (including space) |
| User name/Login name  | 0 to 15 All ASCII characters on the keyboard (including space) |
| Password              | 0 to 15 All ASCII characters on the keyboard (including space) |

#### Note

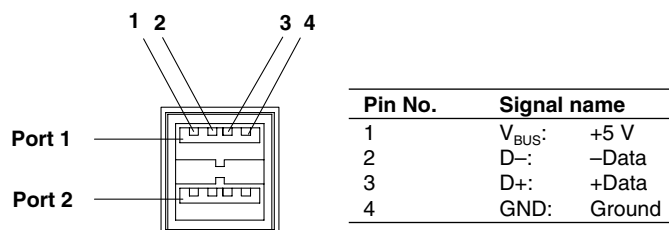
- Comments and file names can both contain both uppercase and lowercase letters. However, file names are *not* case sensitive. The following five file names are not allowed due to MS - DOS restrictions.  
AUX, CON, PRN, NUL and CLOCK
- You cannot enter two or more atmarks (@) in succession.

## Connecting a USB Keyboard

You can connect a USB keyboard for entering file names, comments, and other information. In addition, the keys on the keyboard are assigned to the keys on the front panel of the DL1720/DL1740, which allows you to operate the DL1720/DL1740 in a similar fashion. (See appendix 5.)

#### PRN/KBD Terminal

When connecting a USB keyboard to the DL1720/DL1740, connect a USB cable to the PRN/KBD terminal. There are two PRN/KBD terminals.



## 4.1 Entering Values and Character Strings

### Keyboards that can be Used

The keyboards that can be used depend on the type of message language that you selected in section 14.2 (English or Japanese). A 104 USB keyboard (English) or a 109 USB keyboard (Japanese) that conforms to USB Human Interface Devices (HID) Class Ver. 1.1 can be used.

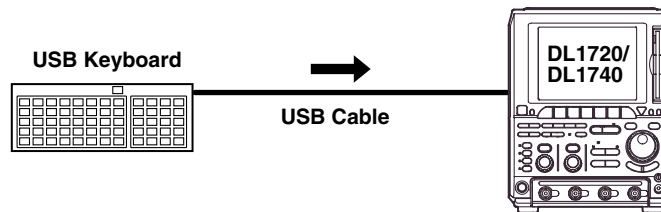
- When the message language is English: 104 keyboard
- When the message language is Japanese: 109 keyboard

### Note

- Connect only the keyboards that are allowed. However, operation of USB keyboards connected to a USB hub or those that have mouse connectors is not guaranteed.
- For USB keyboards that have been tested for compatibility, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual.

### Connection Procedure

When connecting a USB keyboard, directly connect the keyboard to the DL1720/DL1740 with a USB cable as shown below. You can connect the USB cable regardless of the power ON/OFF state of the DL1720/DL1740 (supports hot-plug). Connect the type A connector of the USB cable to the DL1720/DL1740; connect the type B connector to the keyboard. When the power switch is ON, the keyboard is detected and enabled approximately 6 seconds after it is connected.



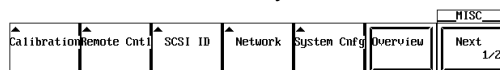
### Note

- Connect the keyboard directly without going through a USB hub.
- Connect only a USB keyboard or printer to the PRN/KBD terminals.
- Do not connect multiple keyboards. You can connect a single keyboard and a single printer.
- Even if you continuously depress a key the character will not be input repeatedly.

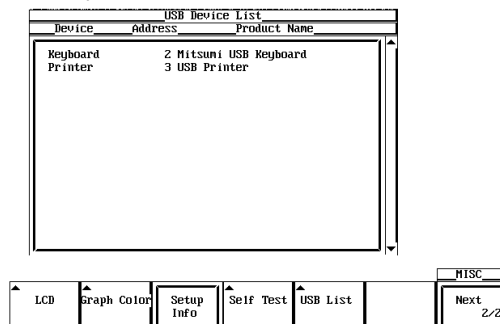
### Confirming the Type of Keyboard that is Connected

To confirm the type of keyboard that is connected to the DL1720/DL1740, carry out the procedure below.

1. Press **MISC**.
2. Press the **Next1/2** soft key.



3. Press the **USB List** soft key to display the USB Device List. Check the type of USB keyboard that is connected.





**Entering File Names, Comments, etc.**





When the soft keyboard is displayed on the screen, you can enter the file name, comment, and so on using a USB keyboard. The character that is entered through each key of the keyboard varies depending on the keyboard type. For details, see appendix 5.

**Executing Functions Corresponding to the Keys on the Front Panel of the DL1720/DL1740**

The functions corresponding to the keys on the front panel of the DL1720/DL1740 are assigned to the keys on the USB keyboard. By pressing the keys on the keyboard, you can operate the DL1720/DL1740 in a similar fashion. The assignment of functions varies depending on the keyboard type. For details, see appendix 5.

**Entering Numerical Values Using a USB Keyboard (This function is available on products with firmware version 1.30 or later.)**

Numerical values for menu items preceded by the  or  symbol can be input directly using a USB keyboard.

| Display |  Position | Coupling | Probe |  Offset | Bandwidth | CH1  |
|---------|--|----------|-------|--|-----------|---|
| OFF     |  0.00div  | DC1Hz    | 10:1  | 0.0mV  | Full      | Next 1/2  |

Press the corresponding soft key, enter the values with the USB keyboard, then press the Enter key. The entered values are displayed in the upper part of the screen.

- Inputting a Units Prefix**

If unit prefixes are displayed (such as m for Offset in the example above), you can input the character for the prefix as well as the numerical value using the USB keyboard. Prefixes can be entered for units of voltage (V) and time (s). Also, the prefixes that can be used are determined by the allowable input range.

**Input Example**

- If you type 1 then Enter for the Offset, this means 1 V so 1000 mV is displayed on the screen.
- If you type 1, 0, then m, this means 10 mV so 10 mV is displayed on the screen. If you enter a prefix for the units, it is not necessary to press the Enter key.

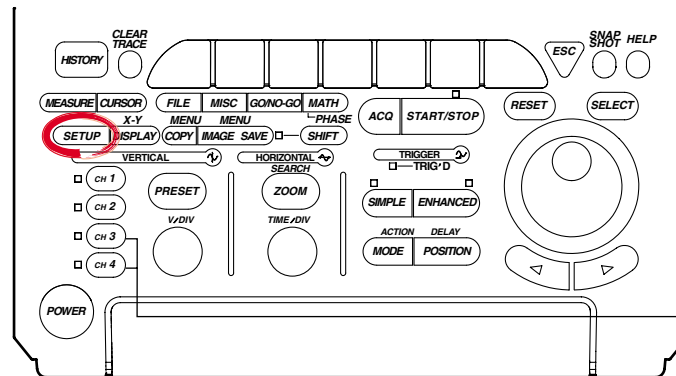
The available unit prefixes are as follows:

| Key    | Prefix     |
|--------|------------|
| K or k | $10^3$     |
| m      | $10^{-3}$  |
| U or u | $10^{-6}$  |
| N or n | $10^{-9}$  |
| P or p | $10^{-12}$ |



## 4.2 Initializing Settings

### Relevant Keys

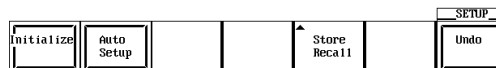


The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Performing Initialization

1. Press **SETUP**.
2. Press the **Initialize** soft key to start initialization.



#### Canceling Initialization

3. Press the **Undo** soft key. This will restore the previous settings that were in effect before initialization.

#### Note

The Undo operation remains available only while power stays on. The setting parameters that existed immediately before initialization are cleared if you execute auto setup after initialization.

### **Explanation**

The initialization function allows you to reset parameter values which have been set using panel keys to the default (factory settings). This is very convenient when you have to cancel the previous settings or when you have to restart measurement from the beginning.

#### **Initialization**

Initialization means resetting parameters to their factory setting values. For details on factory settings, refer to the Appendix.

#### **Settings which cannot be Initialized**

- Date and time
- Communication or ethernet interface related settings
- SCSI ID number
- Setting parameters on storing and recalling function
- Setting the message language (English or Japanese)

#### **Canceling Initialization**

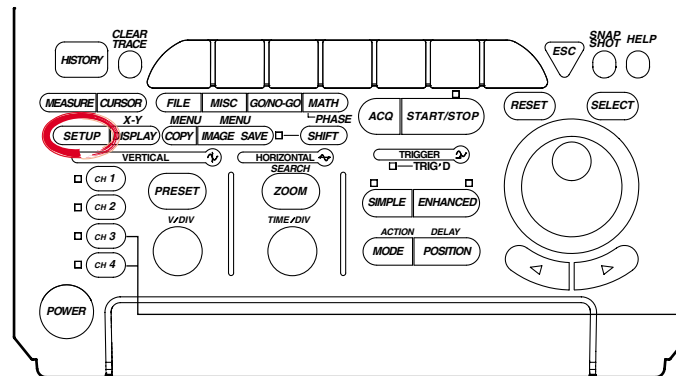
If you have performed initialization by mistake, press the **Undo** soft key. This will restore the previous settings used before the initialization was performed.

#### **Initializing All Settings**

Turning the power switch ON while holding down **RESET** will start initialization. This also initializes settings relating to the communication or ethernet interface, SCSI ID No. setting, settings stored to the internal memory using the store/recall function, and so on. If settings are initialized using this method, you will not be able to restore the previous settings.

## 4.3 Performing Auto Setup

### Relevant Keys

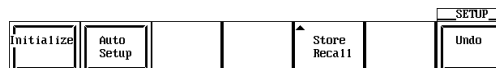


The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Performing Auto Setup

1. Press **SETUP**.
2. Press the **Auto Setup** soft key to perform auto setup.  
When auto set-up is executed, waveform acquisition starts automatically.

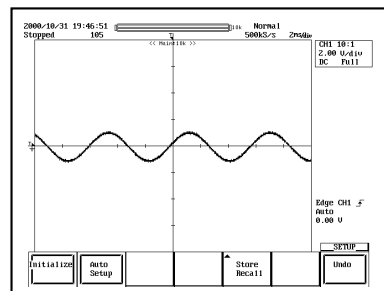


#### Canceling Auto Setup

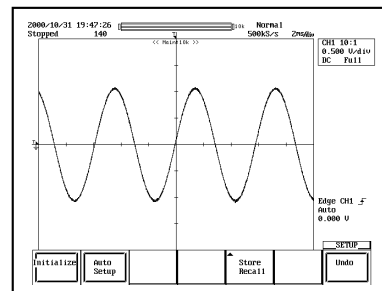
3. Press the **Undo** soft key to restore the settings that existed immediately before auto setup.

### Explanation

The key settings such as V/div, T/div, and trigger levels are automatically set to optimum values for the input signal.



Before Auto Setup



After Auto Setup

#### Center Position

The center position after auto setup is set to 0 V.

#### Target Channels

Auto setup is performed on all channels.

**Canceling Auto Setup**

By pressing the **Undo** soft key, the settings can be set back to the values that existed immediately before auto setup was performed. However, settings which existed before auto setup are erased when the power is turned OFF. In this case, the Undo operation will have no effect. The setting parameters that existed immediately before auto setup are cleared if you execute initialization after auto setup.

**Waveforms that can be Automatically Setup**

|                               |  |
|-------------------------------|--|
| Frequency:                    | Approx. 50 Hz or more  |
| Maximum Absolute Input Value: | Approx. 20 mV or more (assuming 1 : 1 probe attenuation)                             |
| Type:                         | Repetitive waveforms that are not complex<br>When the input coupling is set to "DC." |

**Note**

The auto setup function may not operate properly in some cases such as when the waveform contains a large DC offset or high frequency components.

**Settings Made by Auto Setup****Waveform Acquisition and Display**

|                   |                           |
|-------------------|---------------------------|
| Acquisition Mode  | Normal                    |
| Acquisition Count | Infinite                  |
| Record Length     | 10 k                      |
| Interleave Mode   | OFF                       |
| Timebase          | Int                       |
| Accumulation Mode | OFF                       |
| Zoomed Waveforms  | Traces set ON for display |

**Vertical - Axis Settings**

|                |  |
|----------------|--|
| V/div          | Set to a value so that the absolute value of the input waveform is between 1.6 div to 4 div. (approximately) |
| Offset Voltage | 0 V (If Adjust Mode is 0 V)  |
| Coupling       | Other than DC 50 Ω: DC 1 MΩ, DC 50 Ω: DC 50 Ω  |
| Bandwidth      | FULL   |
| Display ON/OFF | Turns ON the channels of which the absolute value of the amplitude is at least 20 mV (1 : 1)                 |
| Position       | 0 div  |

**Horizontal - Axis Settings**

|       |   |
|-------|---|
| T/div | Set so that screen displays 1.6 to 4 periods of the auto - setup waveform with the shortest period. |
|-------|---|

**Trigger Settings**

|                         |  |
|-------------------------|--|
| Trigger Mode            | Auto   |
| Trigger Type            | Simple   |
| Trigger Source          | Channel with the longest period and an amplitude of at least 1 div |
| Trigger Level and Slope | Level is 1/2 the trigger source amplitude. Slope is "rising."      |
| Trigger Coupling        | The center level of the maximum and minimum values/<br>rising      |
| HF Rejection            | OFF  |
| Hysteresis              | $\nabla$   |
| Holdoff Time            | 80 ns  |
| Trigger Position        | 50%  |
| Trigger Delay           | 0 s  |
| Trigger Gate            | OFF  |

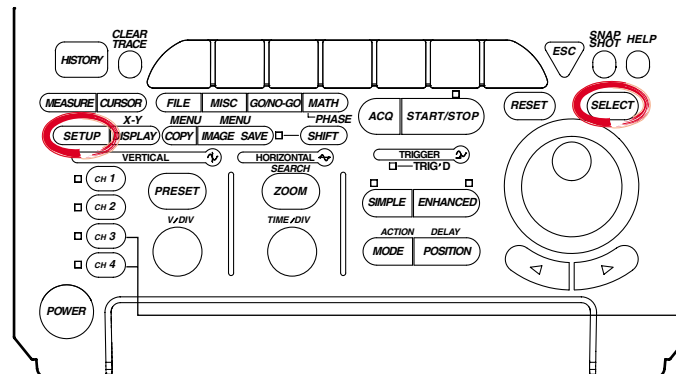
**Math Setting**

|         |      |
|---------|------|
| Scaling | Auto |
|---------|------|

Automatic setup affects only the settings listed above. All other settings remain unchanged.

## 4.4 Storing and Recalling Setting Parameters

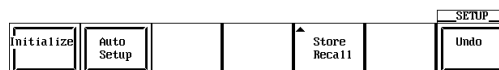
### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **SETUP**.
2. Press the **Store Recall** soft key.



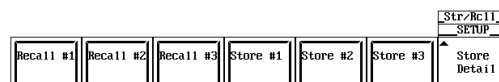
### Recalling

3. After step 2, press the soft key corresponding to the memory number to be retrieved (**Recall #1** through **Recall #3**) to execute the recall operation.



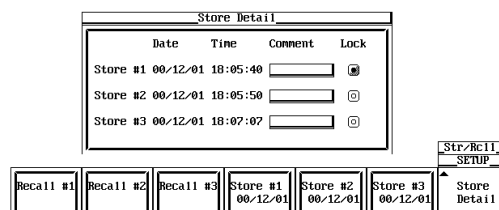
### Storing

3. After step 2, press the soft key corresponding to the memory number to be stored (**Store #1** through **Store #3**) to execute the store operation. The execution date of the store operation is also displayed.



4. Press the **Store Detail** soft key to display the details of the store operation. To enter a comment, follow the procedure described in section 4.1, "Entering a Character String."

There is a lock switch that you can use to prevent (lock) overwriting of the stored data. Turn the jog shuttle to move the cursor to the lock button corresponding to the store number that you wish to lock. Press **SELECT** to lock the data. Press **SELECT** again to release the lock.



**Explanation****Items that are Stored**

Stores all information that you entered using the soft key menu or jog shuttle menu, START/STOP, and the ON/OFF conditions of channels.

**Selecting the Storage Destination of the Setting Parameters**

You can store the setting parameters to three memory locations, Store #1 through Store #3. If the setting parameters are already stored to the selected number, the previous data is overwritten. However, an error message is displayed if the data is locked.

**Selecting the Setting Parameters to be Recalled**

Select the setting parameters that are stored in the three memory locations, Recall #1 through Recall #3. You can only select memory locations that have setting parameters stored.

**Note**

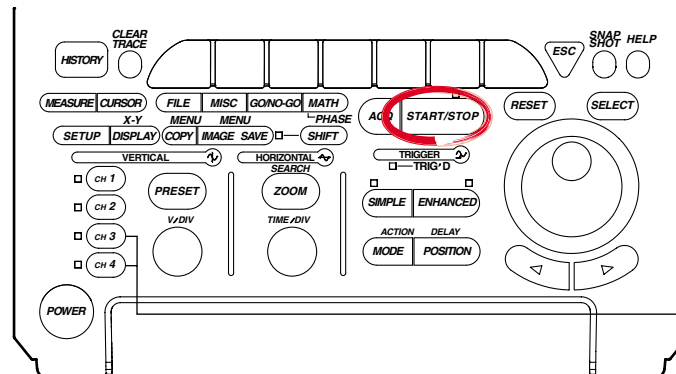
---

The stored setting parameters are not cleared even if you initialize the settings on the DL1720/DL1740.

---

## 4.5 Starting/Stopping Waveform Acquisition

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Pressing **START/STOP** starts or stops the waveform acquisition. Waveform acquisition is in progress when the indicator above the key is lit.

### Explanation

**START/STOP** is pressed when starting or stopping waveform acquisition.

- When the indicator to the upper right of **START/STOP** is ON, waveform acquisition is started.
- When the indicator to the upper right of **START/STOP** is OFF, waveform acquisition is stopped. Stopped is displayed on the upper left corner of the screen.

#### Operation when the Acquisition Mode is Set to Averaging Mode

- When the waveform acquisition is stopped, the averaging process also stops.
- When the waveform acquisition is restarted, a new averaging process starts.

#### START/STOP Operation while Accumulation is in Progress

When the waveform acquisition is stopped, accumulation is temporarily suspended. When the waveform acquisition is restarted, accumulation resumes.

#### Conditions in which the START/STOP is Disabled

- When the instrument is in the remote mode, controlled via communication.
- When the instrument is printing or auto setup is in progress.

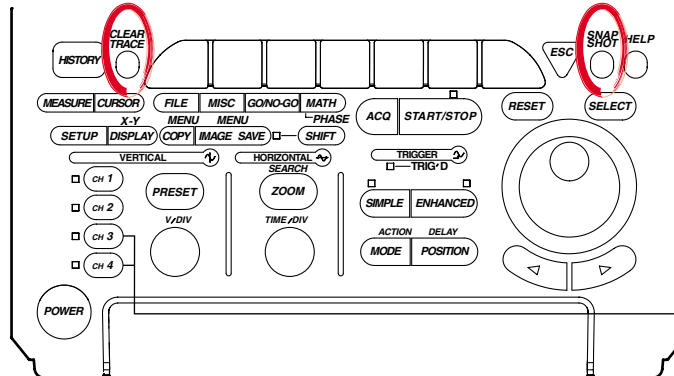
#### Note

- Pressing **FILE** or **HISTORY** while the waveform acquisition is in progress stops the waveform acquisition.
- If the waveform acquisition conditions are changed and the acquisition is restarted, previously acquired data are cleared.
- The snapshot function can also be used to retain the waveforms that are currently displayed on the screen. The display can be updated without having to stop the waveform acquisition (see next section).

## 4.6 The Snapshot and Clear Trace Functions

<For a description of this function, refer to page 1-32>

### Relevant Keys



### Operating Procedure

#### Snapshot

Press **SNAP SHOT**. The snapshot process will start.

#### Clear Trace

Press **CLEAR TRACE**. The clear trace process will start.

Averaging and measurement will also be started from the scratch. (The count is reset to 0.)

### Explanation

#### Snapshot

This function retains the waveforms currently displayed on the screen. To activate this function, just press **SNAP SHOT** without stopping acquisition. The currently displayed waveform will be retained. Hence it is very useful when you want to compare waveforms.

The following operations are not available for snapshot waveforms.

- Cursor measurements and automatic measurements
- Zoom and math operations

The snapshot waveforms can be saved or loaded.

For details, see section 11.8, "Saving Snap Shot Waveforms."

#### Clear Trace

This function clears every waveform currently displayed on the screen.

If the trace is cleared while waveform acquisition is in progress, it is restarted from the first trace.

The instrument is performing GO/NO-GO determination, action-on-trigger, or waveform search.

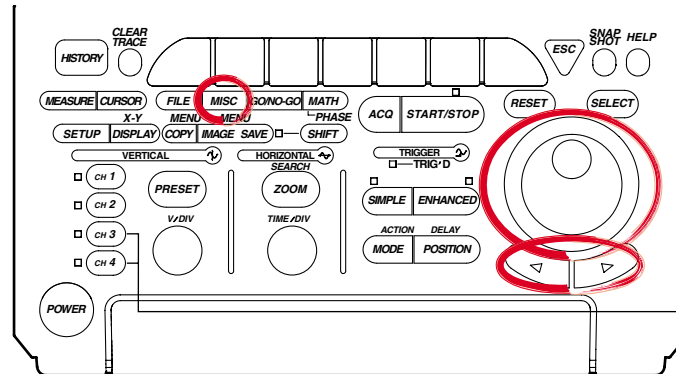
#### The SNAP SHOT and CLEAR TRACE are not Operative in the Following Cases.

- The instrument is in remote state, controlled via the communication interface.
- The instrument is performing an operation, for example, it is in the process of printing out or performing auto set-up, determining GO/NO-GO, performing an action on trigger, or searching data.



# 4.7 Calibration

## Relevant Keys

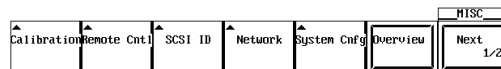


The DL1720 is not equipped with an input terminal for CH3 or CH4.

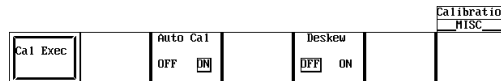
## Operating Procedure

### Performing Calibration

1. Press **MISC**. The MISC menu will appear.
2. Press the **Calibration** soft key.



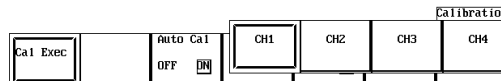
3. Press the **Auto Cal** soft key to select either ON or OFF.



4. Press the **Deskew** soft key to select either ON or OFF.
5. If ON is selected in step 4, select the desired channel.  
Pressing the **Target CH** soft key displays a menu used to select the channel.



6. Press the soft key corresponding to the desired channel to select the channel.  
(CH3 and CH4 are not displayed on the DL1720.)



7. Turn the jog shuttle to set the Deskew Time.
8. Press the **Cal Exec** soft key to start calibration.



## Explanation

### Calibration

The following parameters can be calibrated. Perform calibration when highly accurate measurements are required.

- Ground level offset
- A/D converter gain
- Trigger threshold
- Time axis for repetitive sampling mode
- The oscillation frequency of the startup oscillator for the pulse width trigger

### Points for Attention

- Always allow the instrument to warm up for at least 30 minutes after the power is turned ON before starting calibration. If calibration is performed immediately after the power is turned ON, the calibration may be inaccurate due to drift caused by fluctuation in the temperature of the instrument.
- Calibration must be performed when the temperature of the instrument is stable and is between 5°C and 40°C (preferably at 23°C  $\pm$ 2°C).
- When performing calibration, remove the input signals. Otherwise, proper calibration may not result.

### Note

- The above calibration is performed automatically when power is turned ON.
- If the V/div knob has been turned, perform calibration for all parameters except the time axis for repetitive sampling mode.

### Auto Calibration (Auto Cal)

Calibration is performed automatically after the times shown below elapse after turning ON the power, when the T/div setting is changed, or when waveform acquisition is started.

- After 3 minutes
- After 10 minutes
- After 30 minutes
- After one hour and every hour thereafter

If the DL1720/DL1740 is auto-calibrated while input takes place, it is recommended that you disconnect the input and then repeat calibration.

### Deskew

Corrects the CH1 to CH4 (or CH1 to CH2 for the DL1720) delays.

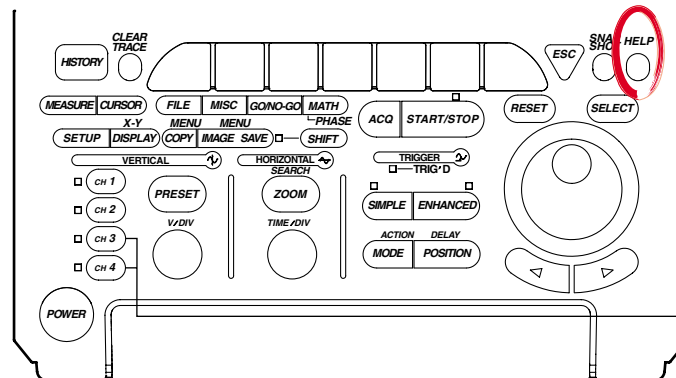
### Deskew Time Setting Range

The correction time is set within the following range.

–100 ns to 100 ns

## 4.8 Using the Help Function

### Relevant Keys



### Operating Procedure

#### Displaying a Help Window

1. Press **HELP**.
2. Press the function key or soft key for which you want help.

#### Clearing the Help Window

3. Press **HELP** again to close the window.

### Explanation

#### Displaying a Help Window

Pressing **HELP** displays the soft key menu which was in effect before **HELP** was pressed, or displays a help window which contains information related to jog shuttle menu settings.

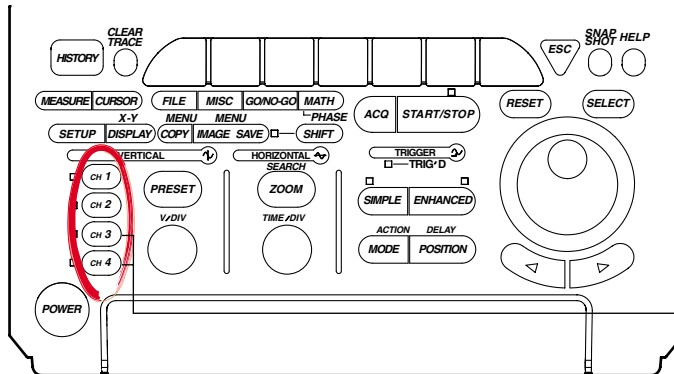
If a key is pressed or the jog shuttle is turned while a help window is displayed, the help window relating to the displayed soft key menu or the jog shuttle menu will appear.

#### Clearing the Help Window

Pressing **HELP** again while a help window is displayed will clear the help window.

# 5.1 Turning Channels ON/OFF

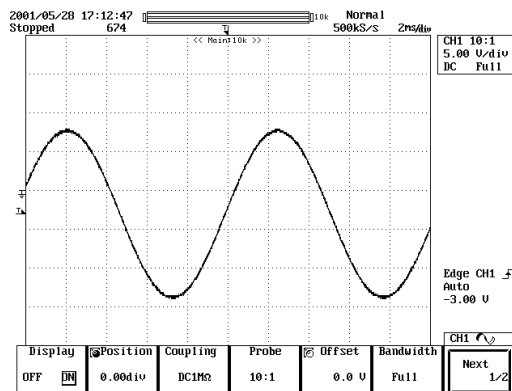
## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

1. Press one of **CH 1** to **CH 4** (or **CH 1** to **CH 2** for the DL1720) to select the desired channel.
  2. Press the **Display** soft key to select ON or OFF.
- CH 1** to **CH 4** (or **CH 1** to **CH 2** for the DL1720) can be pressed twice to turn the channels ON or OFF.



## Explanation

The channels CH1 to CH4 (or CH1 to CH2 for the DL1720) can be displayed simultaneously.

When turned ON, the indicators to the left of the channel keys light.

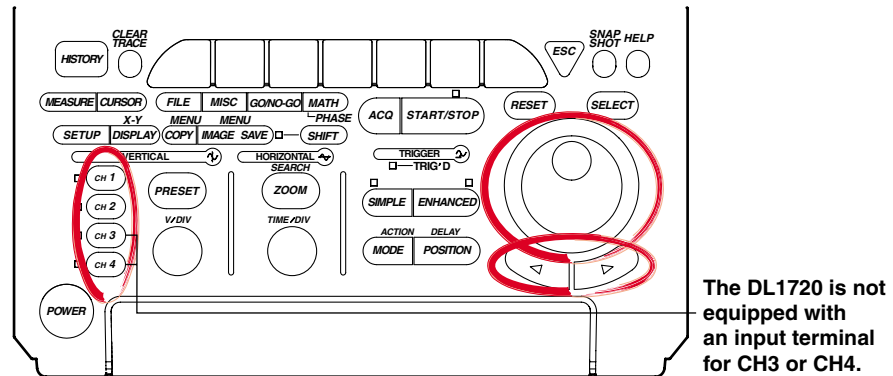
## Note

- The screen can be split into up to six display areas (or 1 to 3 areas for the DL1720). (Refer to section 8.1) A scaling value and waveform label name for each display area (refer to sections 8.4, 8.5) can also be displayed.
- If a waveform or waveforms are loaded from history memory, store memory, floppy disk or Zip disk, the input waveform cannot be displayed. To compare waveforms, use the snapshot function.

## 5.2 Setting the Vertical Position of a Waveform

<For a description of this function, refer to page 1-4>

### Relevant Keys



### Operating Procedure

1. Press one of the keys from **CH 1** to **CH 4** (or **CH 1** to **CH 2** for the DL1720) to select the desired channel.
2. Press the **Position** soft key to set the jog shuttle action to Position.

| Display | Position | Coupling | Probe | Offset | Bandwidth | CH1      |
|---------|----------|----------|-------|--------|-----------|----------|
| OFF     | 0.000jv  | DC1Ms    | 10:1  | 0.0 V  | Full      | Next 1/2 |

3. Turn the jog shuttle to set the vertical position.  
You can change the setting a digit using the arrow keys (located below the jog shuttle).

**Explanation****Range of Movement**

The vertical position can be moved in the range between  $\pm 4$  div from the center position in the waveform display frame.

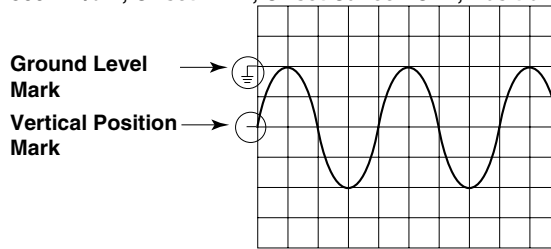
**Setting Resolution**

0.01 div

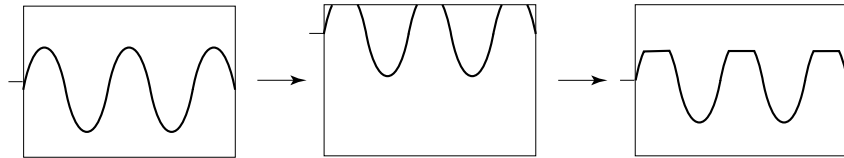
**Confirming the Vertical Position**

For input waveforms and computed waveforms, the ground level and vertical position are marked on the left of the waveform display frame.

500 mV/div, Offset: -1 V, Offset Cancel: OFF, Position: 0 div

**Note**

- The data which go out of the waveform display frame from moving the vertical position are handled as overflow data.
- If the display waveform goes out of the waveform display frame from moving the vertical position during the waveform acquisition is starting, a chopped waveform is displayed as shown in the following figure even if the vertical position is returned to its original position after stopping the acquisition.

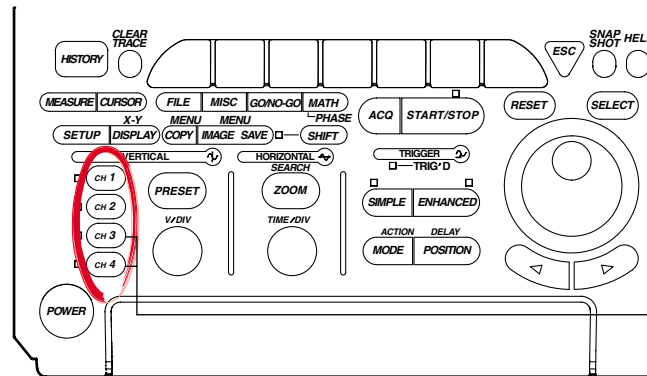


- If the vertical position is moved, the effective data range also changes. For details, see section 1.2.

## 5.3 Selecting Input Coupling

<For a description of this function, refer to page 1-2>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press one of the keys from **CH 1** to **CH 4** (or **CH 1** to **CH 2** for the DL1720) to select the channel.
2. Press the **Coupling** soft key to display the menu used to select the coupling.

| Display | Position | Coupling      | Probe | Offset | Bandwidth | CH1      |
|---------|----------|---------------|-------|--------|-----------|----------|
| OFF     | 0.00jv   | DC1M $\Omega$ | 10:1  | 0.0 V  | Full      | Next 1/2 |

3. Press the soft key corresponding to the desired coupling.

| Display | AC1M $\Omega$ | DC1M $\Omega$ | DC50 $\Omega$ | GND | Bandwidth | CH1      |
|---------|---------------|---------------|---------------|-----|-----------|----------|
| OFF     |               |               |               |     | Full      | Next 1/2 |

If DC 50  $\Omega$  is selected, a confirmation menu is displayed. Press the **Set to DC 50** or **Cancel** soft key.

| CH1 |  |  |                      |        |  |
|-----|--|--|----------------------|--------|--|
|     |  |  | Set to DC50 $\Omega$ | Cancel |  |

**Explanation****Input Coupling**

The following three types of input coupling are available.

AC 1 M $\Omega$ : Acquires and displays only the AC content of the input signal.

DC 1 M $\Omega$ : Acquires and displays both the DC and the AC content of the input signal (1 M $\Omega$ ).

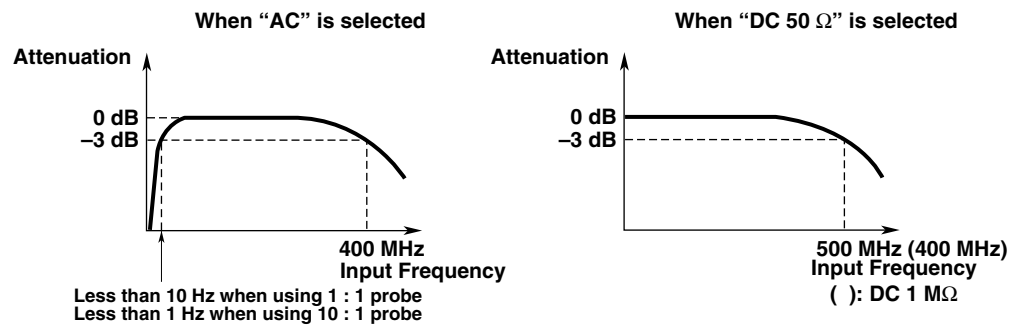
DC 50  $\Omega$ : Acquires and displays both the DC and the AC content of the input signal (50  $\Omega$ ).

GND: Checks the ground level.

**Input Coupling and Frequency Characteristic**

The frequency characteristic when AC or DC is selected is shown below.

Note that low-frequency signals and low-frequency contents are not acquired if AC 1 M $\Omega$  is selected.

**CAUTION**

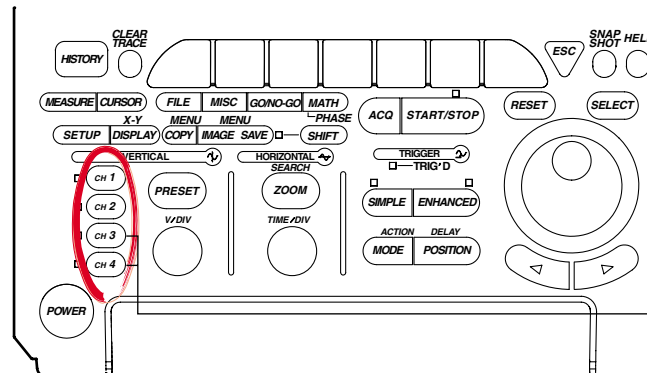
The maximum input voltage when the frequency is less than or equal to 1 kHz is 400 V (DC+AC<sub>peak</sub>) when using 1-M $\Omega$  input and 5 V<sub>rms</sub> or 10 V<sub>peak</sub> when using 50- $\Omega$  input. Applying a voltage that exceeds these values can damage the input section. When the frequency exceeds 1 kHz, voltages below these values can also sometimes damage the input section.



## 5.4 Selecting Probe Attenuation

<For a description of this function, refer to page 1-3>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press one of the keys from **CH 1** to **CH 4** (or **CH 1** to **CH 2** for the DL1720) to select the desired channel.
2. Press the **Probe** soft key to display the menu used to select the attenuation.

| Display | Position | Coupling | Probe | Offset | Bandwidth | CH1      |
|---------|----------|----------|-------|--------|-----------|----------|
| OFF     | IN       | 0.00div  | DC1Ms | 10:1   | 0.0V      | Full     |
|         |          |          |       |        |           | Next 1/2 |

3. Press the soft key corresponding to the desired attenuation.

| Display | Position | 1:1     | 10:1 | 100:1 | 1000:1 | CH1      |
|---------|----------|---------|------|-------|--------|----------|
| OFF     | IN       | 0.00div |      |       |        | Next 1/2 |

### Explanation

Probe attenuation for each channel can be selected from the following.

1 : 1, 10 : 1, 100 : 1, or 1000 : 1

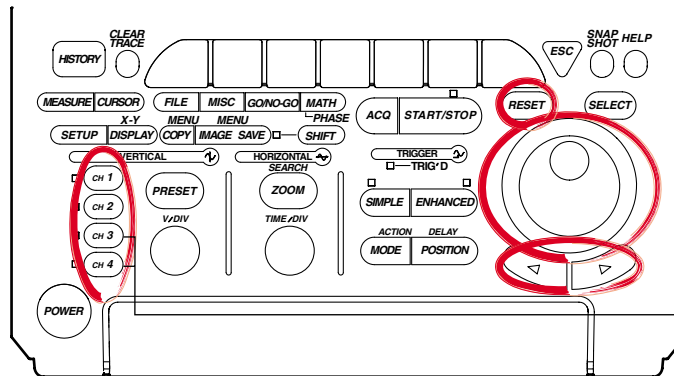
### Note

If an incorrect attenuation has been selected, V/div will also be incorrect. If you set the attenuation to 1 : 1 when using a 10 : 1 probe, for example, the displayed value for automatically measured amplitude will be 1/10 the true value.

## 5.5 Setting the Offset Voltage

<For a description of this function, refer to page 1-2>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Setting the Offset Value

1. Press one of the keys from **CH 1** to **CH 4** (or **CH 1** to **CH 2** for the DL1720) to select the channel.
2. Press the **Offset** soft key.
3. Turn the jog shuttle to set the offset value.  
You can change the setting a digit using the arrow keys (located below the jog shuttle).

|         |          |          |       |        |           |          |
|---------|----------|----------|-------|--------|-----------|----------|
| Display | Position | Coupling | Probe | Offset | Bandwidth | CH1      |
| OFF     | IN       | 0.00div  | DC1MΩ | 10:1   | 0.0 V     | Full     |
|         |          |          |       |        |           | Next 1/2 |

#### Resetting the Offset Value (Set to 0 V)

4. Press **RESET** to set the offset value to 0 V.

### Explanation

The offset voltage setting applies to all input couplings (AC 1 MΩ, DC 1 MΩ, DC 50Ω, and GND couplings).

#### Offset Voltage Setting Range

| Sensitivity Range (Probe = 1 : 1) | Offset Voltage Setting Range                |
|-----------------------------------|---|
| 2 mV/div to 50 mV/div             | -1.0 V to 1.0 V                             |
| 0.1 V/div to 0.5 V/div            | -10.0 V to 10.0 V                           |
| 1 V/div to 10 V/div               | -100.0 V to 100.0 V (DC 50 Ω: 1 V/div only) |

The setting resolution is 0.01 div. If the voltage scale is 2 mV/div, for example, the setting resolution will be 0.02 mV.

#### Resetting the Offset Voltage

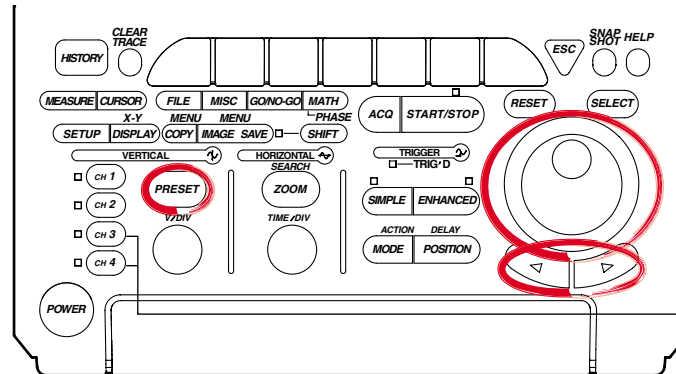
You can return the offset to 0V by pressing **RESET**.

#### Important Points

- Setting the offset voltage while acquisition is stopped will change the display position only. The newly set offset voltage will come into effect when acquisition is restarted.
- You can select whether or not the offset voltage is reflected in the results of cursor measurements, automatic measurements, or math computations.
- If you change the probe attenuation, the offset changes proportionally to reflect the new attenuation rate.
- Changing the voltage sensitivity does usually not affect the offset value. Only if the change would cause the offset to go out of range, the offset moves to the nearest range limit. If you then return to the original sensitivity, the offset returns to its original setting as well (provided that you have not explicitly changed the value in the meantime).

## 5.6 The Preset Function

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Selecting the Channel

1. Press **PRESET**.
2. Press the **Select** soft key to display the channel menu.

| Select | Type | Probe |  |  |  | PRESET |
|--------|------|-------|--|--|--|--------|
| a11    | TTL  | 10:1  |  |  |  | Exec   |

3. Press the soft key corresponding to the desired channel. Pressing All will select all the channels. (CH3 and CH4 are not displayed on the DL1720.)

| Select | Type | Probe |     |     |  | PRESET |
|--------|------|-------|-----|-----|--|--------|
| a11    | CH1  | CH2   | CH3 | CH4 |  | Exec   |

#### Selecting the Preset Type

4. Press the **Type** soft key to display the preset type selection menu.

| Select | Type | Probe |  |  |  | PRESET |
|--------|------|-------|--|--|--|--------|
| a11    | TTL  | 10:1  |  |  |  | Exec   |

5. Set the type by pressing the soft key corresponding to **TTL**, **ECL**, **User**, **Current (700937)**, or **Current (701930)**.

| Select | Type | Probe |      |                  |                  | PRESET |
|--------|------|-------|------|------------------|------------------|--------|
| a11    | TTL  | ECL   | User | Current (700937) | Current (701930) | Exec   |

#### Selecting the Probe Attenuation (for TTL, ECL, or User Preset)

6. Press the **Probe** soft key to display a menu used to select the attenuation.

| Select | Type | Probe |  |  |  | PRESET |
|--------|------|-------|--|--|--|--------|
| a11    | TTL  | 10:1  |  |  |  | Exec   |

7. Press the soft key corresponding to the desired attenuation.

| Select | Type | Probe |       |        |  | PRESET |
|--------|------|-------|-------|--------|--|--------|
| a11    | 1:1  | 10:1  | 100:1 | 1000:1 |  | Exec   |

**Setting the V/div, Offset Voltage, and Trigger Level (When the Preset Type is User)**

8. Press the **Type** soft key to display the preset type selection menu.

|        |      |       |  |  |  |        |
|--------|------|-------|--|--|--|--------|
| Select | Type | Probe |  |  |  | PRESET |
| All    | TTL  | 10:1  |  |  |  | Exec   |

Press the **User** soft key.

|        |     |     |      |                  |                  |        |
|--------|-----|-----|------|------------------|------------------|--------|
| Select | TTL | ECL | User | Current (700937) | Current (701930) | PRESET |
| All    |     |     |      |                  |                  | Exec   |

9. Press the **V/div** soft key to highlight the jog shuttle icon.  
 10. Turn the jog shuttle to set the V/div value.

|        |      |       |        |        |          |        |
|--------|------|-------|--------|--------|----------|--------|
| Select | Type | Probe | V/div  | Offset | Trig Lvl | PRESET |
| All    | User | 10:1  | 50.0 V | 0.0 V  | 0.0 V    | Exec   |

11. Press the **Offset** soft key to select Offset, then turn the jog shuttle to set the Offset value.

|        |      |       |        |        |          |        |
|--------|------|-------|--------|--------|----------|--------|
| Select | Type | Probe | V/div  | Offset | Trig Lvl | PRESET |
| All    | User | 10:1  | 50.0 V | 0.0 V  | 0.0 V    | Exec   |

12. In a similar fashion, set the Trig Lvl.  
 You can change the setting a digit using the arrow keys (located below the jog shuttle).

**Executing the Preset**

13. Press the **Exec** soft key to execute the preset.

|        |      |       |        |        |          |        |
|--------|------|-------|--------|--------|----------|--------|
| Select | Type | Probe | V/div  | Offset | Trig Lvl | PRESET |
| All    | User | 10:1  | 50.0 V | 0.0 V  | 0.0 V    | Exec   |

**Explanation**

The preset function automatically sets each key setting, such as the V/div, input coupling and trigger level, to the optimum value for measurement of TTL or ECL signals (or to an arbitrary value). Also, you can automatically set the appropriate values for use with the current probe 700937, 701930 (sold separately). This function allows you to make settings for a selected channel or for all channels at the same time.

**Settings Made by a Preset**

|                  | TTL  | ECL                      | User                    |
|------------------|--|--------------------------|-------------------------|
| Input Coupling   | DC 1 M $\Omega$                                  | DC 1 M $\Omega$          | DC 1 M $\Omega$         |
| Trigger Coupling | DC   | DC                       | DC                      |
| Probe            | 1 : 1, 10 : 1, 100 : 1 or 1000 : 1 is available. |                          |                         |
| V/div            | 1 V/div <sup>*1</sup>                            | 200 mV/div <sup>*1</sup> | Arbitrary <sup>*2</sup> |
| Offset Voltage   | 2.5 V  | -1.3 V                   | Arbitrary <sup>*2</sup> |
| Trigger Level    | 1.4 V  | -1.3 V                   | Arbitrary <sup>*2</sup> |

\*1 2 V/div when probe setting is 1000 : 1.

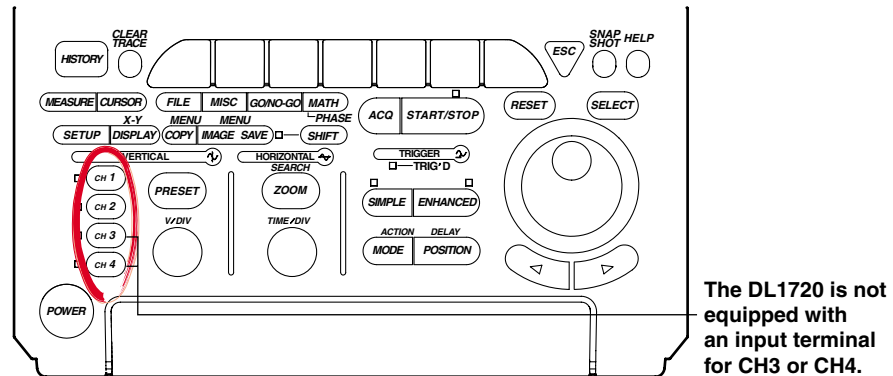
\*2 For details about the setting ranges, see Sections 5.5, 5.8, and 6.5.

|                            | Current (700937)                          | Current (701930)                          |
|----------------------------|---|---|
| Input Copuling             | DC1 M $\Omega$                            | DC1 M $\Omega$                            |
| Probe                      | 1 : 1                                     | 1 : 1                                     |
| Linear Scaling             | ON  | ON  |
| Linear Scaling Coefficient | ValueA: +1.0000E+01<br>ValueB: 0.0000E+00 | ValueA: +1.0000E+02<br>ValueB: 0.0000E+00 |
| Units                      | A   | A   |
| Scale Value Display        | ON  | ON  |

## 5.7 Setting the Bandwidth

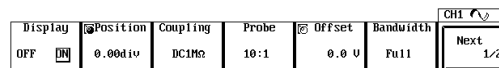
<For a description of this function, refer to page 1-3>

### Relevant Keys

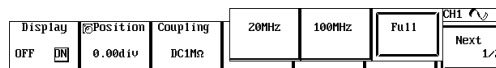


### Operating Procedure

1. Press one of the keys from **CH1** to **CH4** (or **CH 1** to **CH 2** for the DL1720) to select the channel.
2. Press the **Bandwidth** soft key to display the bandwidth menu.



3. Press a soft key corresponding to **20 MHz**, **100 MHz**, or **Full** to select the bandwidth.



4. Repeat steps 1 to 3 as necessary to set other channels.

### Note

The bandwidth is set for each channel. Set the bandwidth on all necessary channels.

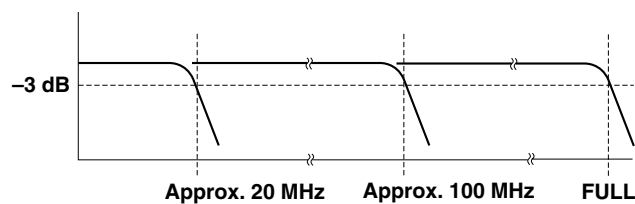
### Explanation

Use this function to remove high frequency components (20 MHz or more or 100 MHz or more) from the input signal.

The bandwidth is set for each channel.

### Bandwidth

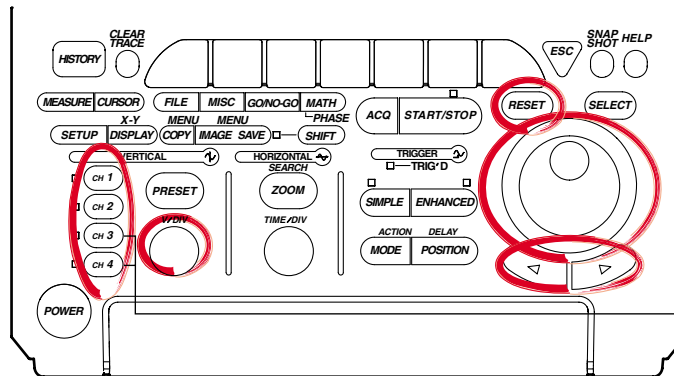
Two frequency bandwidths, 20 MHz and 100 MHz are available. The following figure shows how the bandwidth affects the frequency characteristics. When Full is selected, the bandwidth is Max. 500 MHz (50 Ω input) or Max. 400 MHz (1 MΩ input).



## 5.8 Setting V/div

<For a description of this function, refer to page 1-4>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Setting the V/div Using the V/div Knob

1. Press one of the keys from **CH 1** to **CH 4** (or **CH 1** to **CH 2** for the DL1720) to select the channel.
2. Turn the V/DIV knob to set the V/div value.

#### Note

- Changing the V/DIV setting while the waveform acquisition is stopped will not change the displayed waveform. The new V/div value takes effect the next time waveform acquisition is started.
- When the waveform acquisition is stopped, the cursor measurement value and automated measurement of waveform parameters will show values using the old V/div setting even if the V/DIV knob is turned.

#### Setting the V/div Using the Variable Parameter

1. Press one of the keys from **CH 1** to **CH 4** (or **CH 1** to **CH 2** for the DL1720) to select the channel.
2. Press the **Next 1/2** soft key.

| Display | Position | Coupling | Probe | Offset | Bandwidth | CH1      |
|---------|----------|----------|-------|--------|-----------|----------|
| OFF     | IN       | 0.00div  | DC1M  | 10:1   | 0.0 V     | Full     |
|         |          |          |       |        |           | Next 1/2 |

3. Press the **Variable** soft key.

| Variable | Linear Sci | Label | CH1      |
|----------|------------|-------|----------|
| 50.0 V   | OFF ON     | CH1   | Next 2/2 |

4. Turn the jog shuttle to set the V/div value.  
You can change the setting a digit using the arrow keys (located below the jog shuttle).

#### Note

- If the V/div setting is changed by rotating the V/DIV knob, the Variable value is set to the modified V/div value.
- If Variable is reset with **RESET**, the V/div setting returns to the value set with the V/div knob.

**Explanation**

The V/div (voltage axis sensitivity) setting is used to adjust the amplitude of the displayed waveform so that the waveform can be observed easily. The V/div setting is made by setting the voltage value per division on the screen grid.

There are two methods available in setting the V/div.

**Setting the V/div Using the V/div Knob**

The settings are “1 V/div,” “2 V/div,” “5 V/div,” and their tenfold multiples.

This setting will become the reference for the range that can be set using the Variable parameter (described next) and the resolution.

- **V/div Setting Range**

The V/div setting range for each probe attenuation value is shown in the table below.

| Probe Attenuation | Setting Range (DC 1 MΩ) | Setting Range (DC 50 Ω) |
|-------------------|-------------------------|-------------------------|
| 1 : 1             | 2 mV/div to 10 V/div    | 2 mV/div to 1 V/div     |
| 10 : 1            | 20 mV/div to 0.1 kV/div | 20 mV/div to 10 V/div   |
| 100 : 1           | 0.2 V/div to 1 k V/div  | 0.2 V/div to 0.1 kV/div |
| 1000 : 1          | 2 V/div to 10 k V/div   | 2 V/div to 1 kV/div     |

**Setting the V/div Using the Variable Parameter in the CH Menu**

You can set the V/div using a resolution that is finer than the resolution provided by the V/div knob and vertically expand or reduce the displayed waveform.

The waveform acquisition can be started with the changed V/div setting.

- **Range**

The following table shows the range when the probe attenuation setting is 10 : 1.

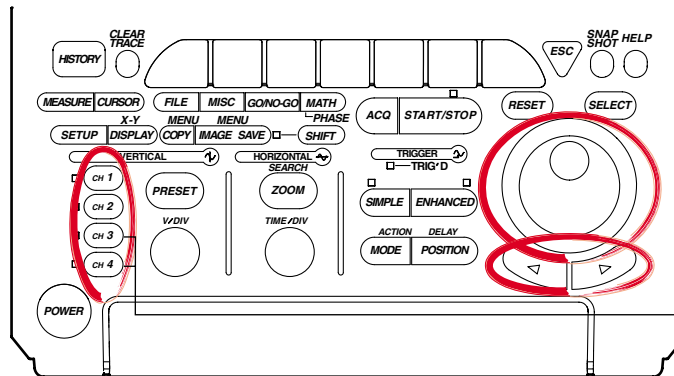
| V/div Setting with V/div Knob | Setting Range of Variable | Setting Resolution |
|-------------------------------|---------------------------|--------------------|
| 20 mV/div                     | 2.0 mV to 50.0 mV         | 0.2 mV             |
| 50 mV/div                     | 5.0 mV to 100.0 mV        | 0.5 mV             |
| 100 mV/div                    | 10 mV to 200 mV           | 1 mV               |
| 200 mV/div                    | 20 mV to 500 mV           | 2 mV               |
| 500 mV/div                    | 50 mV to 1000 mV          | 5 mV               |
| 1 V/div                       | 0.10 V to 2.00 V          | 0.01 V             |
| 2 V/div                       | 0.20 V to 5.00 V          | 0.02 V             |
| 5 V/div                       | 0.50 V to 10.00 V         | 0.05 V             |
| 10 V/div                      | 1.0 V to 20.0 V           | 0.1 V              |
| 20 V/div                      | 2.0 V to 50.0 V           | 0.2 V              |
| 50 V/div                      | 5.0 V to 100.0 V          | 0.5 V              |
| 100 V/div                     | 10 V to 200 V             | 1 V                |

\* When the probe attenuation is “1 : 1,” “100 : 1,” and “1000 : 1,” the values are 1/10, 10, and 100 times, respectively.

## 5.9 Using the Linear Scaling Function

<For a description of this function, refer to page 1-21>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press one of the keys from **CH 1** to **CH 4** (or **CH 1** to **CH 2** for the DL1720) to select the channel.
2. Press the **Next 1/2** soft key.

| Display | Position | Coupling | Probe | Offset | Bandwidth | CH1      |
|---------|----------|----------|-------|--------|-----------|----------|
| OFF     | 0.00div  | DC1MΩ    | 10:1  | 0.0 U  | Full      | Next 1/2 |

3. Press the **Linear Sci AX+B** soft key to select ON.

| Variable | Linear Sci  | A                             | Unit | Label | CH1      |
|----------|-------------|-------------------------------|------|-------|----------|
| 50.0 U   | AX+B<br>OFF | 1.0000E+00<br>B<br>0.0000E+00 |      | CH1   | Next 2/2 |

4. Press the **A/B** soft key.

| Variable | Linear Sci  | A                             | Unit | Label | CH1      |
|----------|-------------|-------------------------------|------|-------|----------|
| 50.0 U   | AX+B<br>OFF | 1.0000E+00<br>B<br>0.0000E+00 |      | CH1   | Next 2/2 |

5. Turn the jog shuttle to set the value of A.  
You can use the arrow keys to move between the digits.
6. In a similar fashion, set the value B.
7. If necessary, press the **Unit** soft key to display the keyboard and enter the unit.

### Note

- Linear scaling is not available for the following waveforms.  
Snapshot waveforms  
Accumulated waveforms (except for newest waveform)
- You can set linear scaling separately for each channel.
- The A and B values remain in memory after you switch the linear scaling function OFF, and are restored if you switch the function back on.
- Mathematical computations operate with respect to the scaling results.



## 5.9 Using the Linear Scaling Function

---

### **Explanation**

This function lets you apply linear scaling to the measurement values. If you set this feature ON, the screen displays the scaled results rather than the original measurements. The scaling relationship is

$$Y = AX + B$$

where X is the measurement value and Y is the scaled value. Note that you can select the dimensional unit for the scaled display.

### **Scaling Coefficient (A) and Offset (B)**

Range for A, B:  $-9.9999E+30$  to  $+9.9999E+30$

Default      A:  $1.0000E+00$

                  B:  $0.0000E+00$

### **Dimensional Unit**

Unit identifier (alphanumeric string) of up to four characters.

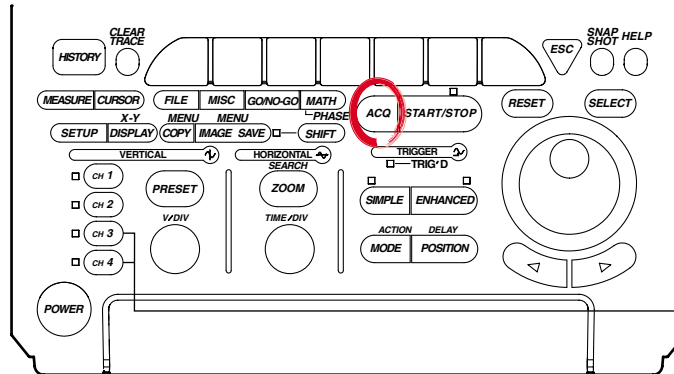
### **Displaying the Scale Value**

The linearly scaled values of the upper and lower limits of the vertical axis of each channel can be displayed. (See section 8.4, "Turning ON/OFF the Scale Value Display.")

## 5.10 Selecting the Timebase

<For a description of this function, refer to page 1-5>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **ACQ**.
2. Press the **Time Base** soft key to select Int or Ext.

| Record Length | Mode   | Count    | Interleave | Repetitive | ACQ Time Base |
|---------------|--------|----------|------------|------------|---------------|
| 10k           | Normal | Infinite | OFF ON     | OFF ON     | Int Ext       |

### Threshold Setting (If EXT Clock)

3. If you have selected use of an external clock, you must now set the threshold level. This setting is identical to the trigger-level setting; refer to Section 6.5, "Setting the Edge Trigger," for the procedure. Note that you must set the trigger source to EXT before setting the level.

**Explanation**

**Selectable Timebases**

Timebase can be selected from the following three types.

- INT Internal clock signal
- EXT IN Clock signal input to the EXT TRIG IN/EXT CLOCK IN/TRIG GATE IN terminal

**When EXT IN is Selected**


Input a clock signal to the EXT CLOCK IN/EXT TRIG IN/TRIG GATE IN terminal on the rear panel (or the terminal labeled *EXT.* on the front panel of the DL1720). The clock signal must conform to the specifications given below.

| Item                              | Specifications   |
|-----------------------------------|--|
| Connector Type                    | BNC  |
| Maximum Permissible Input Voltage | $\pm 40$ V (DC + ACpeak) or 28 Vrms, 10 kHz or less  |
| Frequency Range                   | 40 Hz to 20 MHz (continuous clock only)  |
| Minimum Input Level               | 0.1Vp-p  |
| Input Impedance                   | Approx. 1 M $\Omega$ and 18 pF (1 M $\Omega$ and 20 pF for the DL1720)   |
| Threshold Level                   | $\pm 2$ V in 5 mv resolution (for the DL1740)<br>$\pm 1$ V in 5 mv resolution (for the DL1720 with the $\pm 1$ V range selected)<br>$\pm 10$ V in 50 mv resolution (for the DL1720 with the $\pm 10$ V range selected) |
| Sampling Jitter                   | 1.25 ns or less  |
| Minimum Pulse Width               | 10 ns or more for both High and Low levels   |

**[Input Terminal]**

< DL1740 >


EXT CLOCK IN  
EXT TRIG IN  
TRIG GATE IN  
 $\leq 40$ Vpk 1M $\Omega$



< DL1720 >

1M $\Omega$  / 20pF  $\leq$  40Vpk

EXT.



**(On the DL1740 it is located on the rear panel,  
or on the DL1720 it is located on the front panel.)**



**CAUTION**

If a clock signal exceeding the above maximum permissible input voltage is input to the EXT TRIG IN/EXT CLOCK IN/TRIG GATE IN terminal (or the EXT. terminal for the DL1720), damage to the internal circuits of the instrument may result.

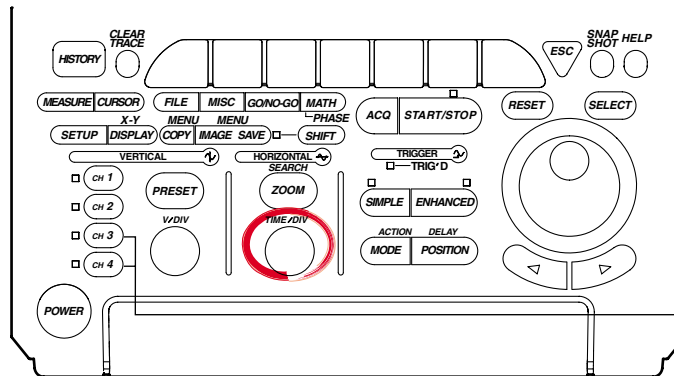
**Points to Note when Sampling Using an External Clock**

- The clock signal must be continuous. No burst signal is allowed.
- Only real-time sampling mode is available.
- Envelope mode and Box Average mode cannot be set.
- Display of waveforms is not possible in roll mode.
- No function to divide the clock signal is available.
- Since the time axis setting cannot be changed, expand the time axis if you want to change the display range. For a description of expanding waveforms, refer to section 8.9.
- Trigger delay cannot be set.
- Deskew function cannot be used.
- The time measured by the cursor measurement or automated measurement function is expressed in the number of pulses of the clock signal. No unit is displayed.

## 5.11 Setting T/div

<For a description of this function, refer to page 1-5>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Turn the TIME/DIV knob to set the desired T/div.

### Note

- Turning the TIME/DIV knob while acquisition is stopped displays the new T/div value in parentheses on the upper right of the screen. The new setting will come into effect the next time the acquisition is started.
- When repetitive sampling mode is OFF (see section 7.6), the maximum sampling rate is 500 MS/s (or 1 GS/s when interleave mode is ON).
- Even when the repetitive sampling is turned OFF, there are cases in which the mode automatically changes to the repetitive sampling mode when the T/div is changed. For the relationship between the T/div setting and the sample rate, see appendix 1, "Relationship between the Time Axis Setting, Sample Rate, and Record length."

### Explanation

The T/div setting is made by setting the time per division on the screen grid.

#### Setting Range

Record Length is 10 kwords or more: 1 ns/div to 50 s/div(1 - 2 - 5 steps)

Record Length is 1 kwords: 1 ns/div to 5 s/div(1 - 2 - 5 steps)

#### T/div and Sampling Mode

Use of repetitive sampling mode lets you get the sample rate of 1 GS/s and above (or 100 GS/s and above if interleave is also ON). But note that the allowable time-scale settings vary according to record length. For details, see appendix 1.

#### T/div and Roll Mode

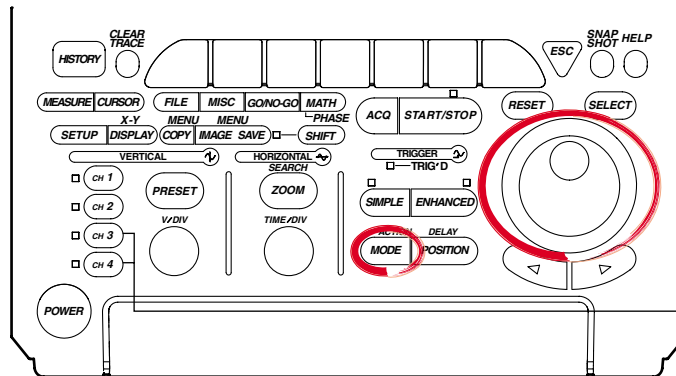
When acquisition count is infinite, acquisition mode is not average, or the trigger mode is auto, auto level, or single, roll mode display is enabled at the following T/div settings.

| Record Length       | T/div                 |
|---------------------|-----------------------|
| 1 kword             | 50 ms/div to 5 s/div  |
| 10 kword to 1 Mword | 50 ms/div to 50 s/div |

# 6.1 Setting the Trigger Mode

<For a description of this function, refer to page 1-11>

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

1. Press **MODE**.
2. Press the soft key corresponding to the desired mode to set the trigger mode.

|      |            |        |        |           |  |      |
|------|------------|--------|--------|-----------|--|------|
|      |            |        |        |           |  | MODE |
| Auto | Auto Level | Normal | Single | Single(N) |  |      |

3. If Single(N) is selected, turn the jog shuttle to set the number of times to acquire the waveform.

|      |            |        |        |           |  |                         |
|------|------------|--------|--------|-----------|--|-------------------------|
|      |            |        |        |           |  | MODE                    |
| Auto | Auto Level | Normal | Single | Single(N) |  | Single(N)<br>Count<br>2 |

## Explanation

### Auto Mode

If the trigger condition is met within the 100-ms timeout period, the waveform is updated on each trigger occurrence. If the trigger condition is not met after the timeout period elapses, the waveform is automatically updated. If the time axis setting is in the range in which the display mode is set to roll mode, the display is set to roll mode.

### Auto Level Mode

If a trigger occurs within the timeout period, the waveform is displayed in the same fashion as in the auto mode. If a trigger does not occur within the timeout period, the center value of the amplitude of the trigger source is detected, the trigger level is automatically changed to the center value, and the trigger is generated to update the displayed waveform. The auto-level mode is valid only if the trigger is a simple trigger and the trigger source is CH1 to CH4 (or CH1 to CH2 for the DL1720). For all other cases, the operation is the same as the auto mode.

If the time axis setting is in the range in which the display mode is set to roll mode, the display is set to roll mode.

### Normal Mode

The display is updated only when the trigger conditions are met. The display will not be updated if no trigger is caused. Therefore, to check the waveform or ground level when no trigger is detected, use auto mode.

## 6.1 Setting the Trigger Mode

---

### **Single Mode**

The display is updated once when the trigger conditions are met and the waveform acquisition stops.

In the time axis setting range in which the display mode is set to roll mode, the display is set to roll mode. When a trigger occurs, the specified record length of data is acquired and the displayed waveform stops.

### **Single (N) Mode**

The display is updated according to the number of times specified when the trigger conditions are met and the waveform acquisition stops. This mode is used when acquiring a waveform using the sequential store function. If the repetitive mode turn ON, this mode is automatically changed to single mode.

### **Note**

---

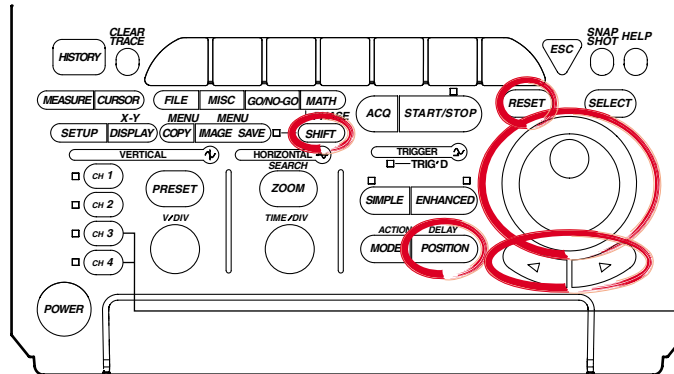
The trigger mode setting applies to both simple and enhanced triggers.

---

## 6.2 Setting the Trigger Delay

<For a description of this function, refer to page 1-13>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **SHIFT** to set the keys in the shifted condition. Functions marked in purple on the panel become active.
2. Press **POSITION**.
3. Units, ms, us, ns, and ps are displayed on the screen. Press the soft key corresponding to the desired unit. Turn the jog shuttle to set the trigger delay. You can move between the digits using the arrow keys. Pressing **RESET** resets delay to 0 s.

|    |    |    |    | DELAY  |  |
|----|----|----|----|--------|--|
| ms | us | ns | ps | Delay  |  |
| 0  | 0  | 0  | 0  | 0.00us |  |

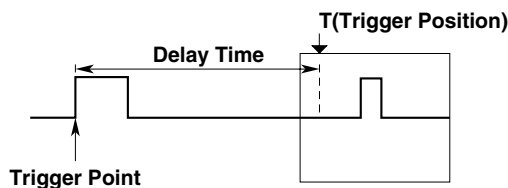
Also for instruments with firmware version 1.30 or later, you can set the trigger delay by pressing the **Delay** soft key and turning the jog shuttle.

### Explanation

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.

#### Setting Range for Trigger Delay

0 to 4 s (Resolution is  $1 \div$  sample rate)



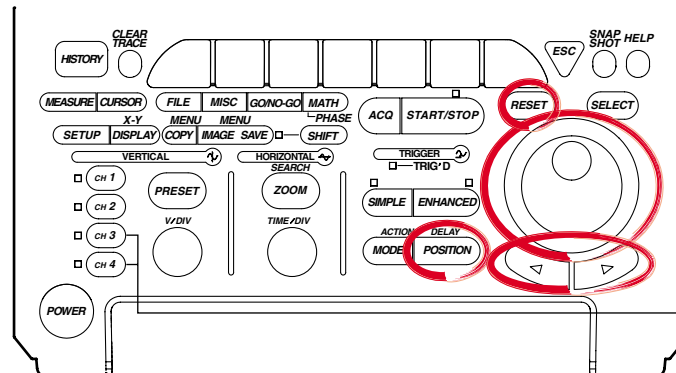
#### Points for Attention

- When T/div is changed, the trigger delay remains unchanged. However, its position in relation to the overall record length changes.
- If the timebase is provided by an external clock, the trigger delay is fixed at 0s (no delay).

## 6.3 Setting the Trigger Position

<For a description of this function, refer to page 1-13>

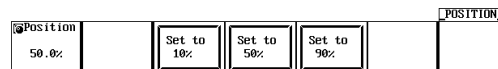
### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **POSITION**.
2. Turn the jog shuttle to set the trigger position.  
You can use the arrow keys to move between the digits.  
If you wish to select 10%, 50%, or 90%, you can press the corresponding soft key.

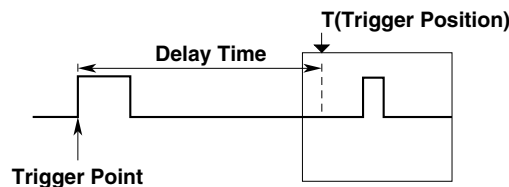


In addition, pressing **RESET**, resets the position to 50%.

### Explanation

#### Trigger Position

The trigger position is the waveform position that results when the trigger delay is added to the trigger point. If the trigger delay is 0 s, therefore, the trigger position is equivalent to the trigger point. You can select the location of the trigger position on the screen.

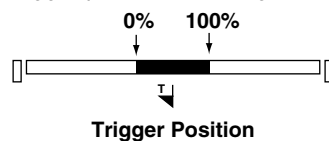


#### Setting Range for Trigger Position

0 to 100% of record length, in 1% steps

#### Position Marker

A position marker (marker) appears above the bar at the top of the screen. The marker indicates the trigger position with respect to the total record length. You can shift the trigger position to the right or left on the screen.





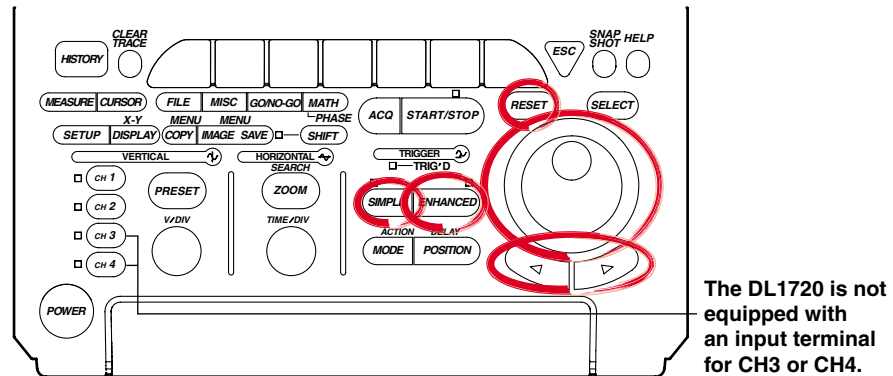
### Points for Attention

- If you change the trigger position while waveform acquisition is suspended, the new setting will not become effective until acquisition is resumed and the waveform is updated.
- Note that cursor time measurements are with respect to the trigger position. Changing the trigger position therefore changes the measurement values (except during roll-mode display).
- When you change the T/div setting, the time axis setting is rescaled with respect to the trigger position.

## 6.4 Setting the Hold Off Time

<For a description of this function, refer to page 1-12>

### Relevant Keys



### Operating Procedure

#### During Simple Trigger

1. Press **SIMPLE**.
2. If the jog shuttle control is not set to Hold Off, press the **Hold Off** soft key.

| Source | Level | Slope                         | Coupling | HF Reject | Hysteresis | SIMPLE<br>Hold Off (μS) |
|--------|-------|-------------------------------|----------|-----------|------------|-------------------------|
| CH1    | 0.0 U | f <sub>L</sub> f <sub>H</sub> | AC       | OFF       | z/z        | 0.00                    |

3. Turn the jog shuttle to set the hold off period.  
You can use the arrow keys to move between the digits. In addition, pressing **RESET**, resets the value to 0.08 μs (0.08 μs.)

| Source | Level | Slope                         | Coupling | HF Reject | Hysteresis | SIMPLE<br>Hold Off (μS) |
|--------|-------|-------------------------------|----------|-----------|------------|-------------------------|
| CH1    | 0.0 U | f <sub>L</sub> f <sub>H</sub> | AC       | OFF       | z/z        | 0.00                    |

#### During Enhanced Trigger

1. Press **ENHANCED**.
2. If the jog shuttle control is not set to Hold Off, press the **Hold Off** soft key.

| Type     | Set Pattern | Level/<br>Coupling | Count | ENHANCED<br>Hold Off (μS) |
|----------|-------------|--------------------|-------|---------------------------|
| A → B(N) |             |                    | 1     | 0.00                      |

3. Turn the jog shuttle to set the hold off period.  
You can use the arrow keys to move between the digits. In addition, pressing **RESET**, resets the value to 0.08 μs (0.08 μs.)

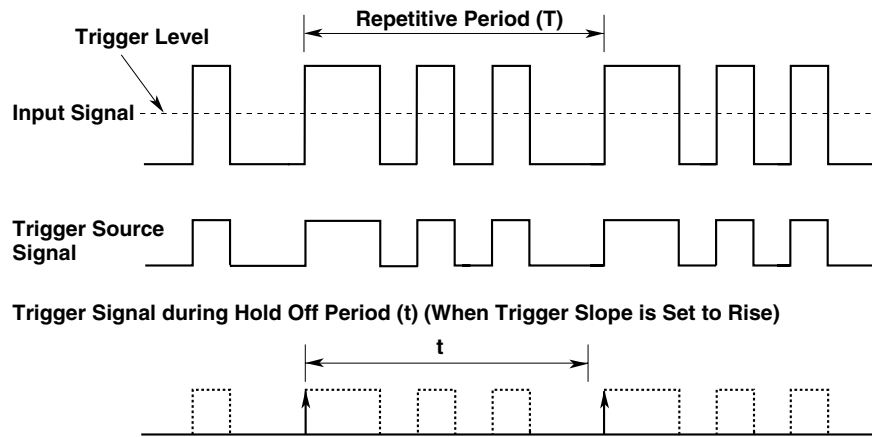
| Type     | Set Pattern | Level/<br>Coupling | Count | SIMPLE<br>Hold Off (μS) |
|----------|-------------|--------------------|-------|-------------------------|
| A → B(N) |             |                    | 1     | 0.00                    |

#### Note

The hold off time setting applies to simple trigger and enhanced trigger.

### Explanation

This function prevents a trigger from being activated for a specified time, even if the trigger conditions are met during this time. The following two methods can be used to prevent the trigger. This is useful when you wish to activate the trigger in sync with a signal that is periodic as shown in the figure below.



#### Hold Off Time Setting Range

80 ns to 10 s (default: 80 ns).

The setting resolution is 20 ns.

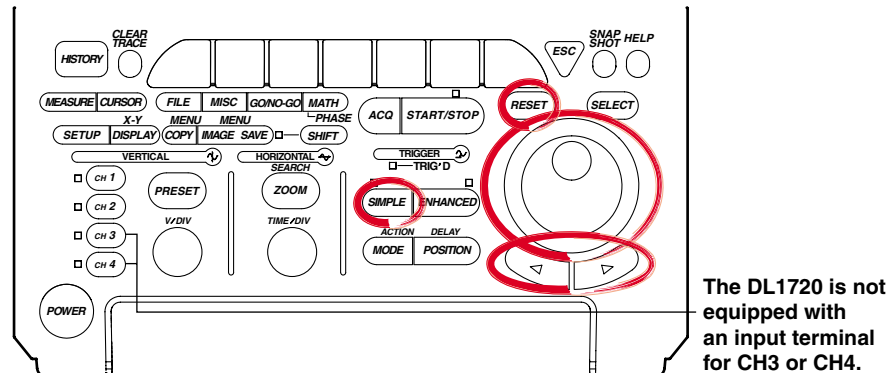
#### Points for Attention

- Updating of the waveform may be slow in repetitive sampling mode. In this case set the hold off time to a smaller value.
- If holdoff time is set to 100 ms or above, the trigger mode should be set to *normal*.
- When used with the A→B(N) or A Delay B trigger, the holdoff time operates with respect to condition A only.

## 6.5 Setting the Edge Trigger (SIMPLE)

<For a description of this function, refer to page 1-8>

### Relevant Keys



### Operating Procedure

#### Setting the Trigger Source

1. Press **SIMPLE**.
2. Press the **Source** soft key to display the trigger source menu.

| Source | Level | Slope    | Coupling | HF Reject | Hysteresis | SIMPLE Hold Off (uS) |
|--------|-------|----------|----------|-----------|------------|----------------------|
| CH1    | 0.0 U | f, l, fl | DC AC    | OFF       | zz zz      | 0.00                 |

3. Press the soft key corresponding to the channel to be set as the trigger source. (CH3 and CH4 are not displayed on the DL1720.)

| CH1 | CH2 | CH3 | CH4 | Ext | Line | SIMPLE Hold Off (uS) |
|-----|-----|-----|-----|-----|------|----------------------|
| CH1 |     |     |     |     |      | 0.00                 |

#### Setting the Trigger Level

4. If the jog shuttle control is not set to Level, press the **Level** soft key.

| Source | Level | Slope    | Coupling | HF Reject | Hysteresis | SIMPLE Hold Off (uS) |
|--------|-------|----------|----------|-----------|------------|----------------------|
| CH1    | 0.0 U | f, l, fl | DC AC    | OFF       | zz zz      | 0.00                 |

5. Turn the jog shuttle to set the trigger level.  
You can use the arrow keys to move between the digits. In addition, pressing **RESET** resets the trigger level to the current offset voltage value.

#### Note

The trigger level setting applies to simple trigger and enhanced trigger.

#### Setting the Trigger Slope

6. Press the **Slope** soft key to select f, l, or fl.

#### Setting the Trigger Coupling

7. Press the **Coupling** soft key to select DC or AC.

#### Note

The trigger coupling setting applies to simple trigger and enhanced trigger.

**Setting the HF Rejection**

8. Pressing the **HF Reject** soft key displays an HF rejection menu.
9. Press the soft key corresponding to the desired frequency to select HF rejection.

|        |       |       |          |     |       |       |
|--------|-------|-------|----------|-----|-------|-------|
| Source | Level | Slope | Coupling | OFF | 20MHz | 15kHz |
| CH1    | 0.0 V | f     | AC       |     |       |       |

**Setting the Hysteresis**

10. Press the **Hysteresis** soft key to select  $\overline{A}$  or  $\overline{V}$ .

**Setting the Hold Off**

11. Set the hold off time according to the procedures given in 6.4, "Setting the Hold Off Time."

**Explanation**

An edge trigger is generated when the trigger source signal crosses a specified level.

**Selecting the Trigger Source**

Select from the following list of choices.

- CH1 to CH4 (or CH1 to CH2 for the DL1720)
- Ext (EXT TRIG IN terminal on the rear panel (or EXT. terminal on the front panel of the D1720), see section 6.6, "Setting the External Trigger (SIMPLE)")
- Line (power signal, see section 6.7, "Generating a Trigger Using the Power Signal (SIMPLE)")

**Setting the Trigger Level**

Range: 8 div within the screen

Resolution: 0.01 div

For example, the resolution is 0.02 mV when the V/DIV setting is 2 mV/div.

You can also reset the trigger level to the current offset voltage with one key operation.

**Setting the Trigger Slope**

Select the trigger activation method relative to changes in trigger source level from the following three choices.

- f : Activated when the trigger source changes from below the trigger level to above the trigger level (rising).
- $\overline{f}$  : Activated when the trigger source changes from above the trigger level to below the trigger level (falling).
- f $\overline{f}$  : Activated on either a rising edge or falling edge.

**Setting the Trigger Coupling**

Select from the following list of choices.

- AC: Uses a signal that is obtained by removing the DC component from the trigger source signal.
- DC: Uses the trigger source signal as the trigger signal.

**Setting the HF Rejection**

Set 15 kHz or 20 MHz when you wish to use a signal source that is obtained by removing the high frequency components (frequency components greater than or equal to approximately 15 kHz or 20 MHz) from the trigger signal as the trigger source.

## 6.5 Setting the Edge Trigger (SIMPLE)

---

### Setting the Hysteresis

Sets a width to the trigger level so that the trigger is not activated by small changes in the trigger signal.

$\overline{\Delta}$ : Approx. 0.3 div\* of hysteresis around the trigger level.

$\underline{\Delta}$ : Approx. 1 div\* of hysteresis around the trigger level.

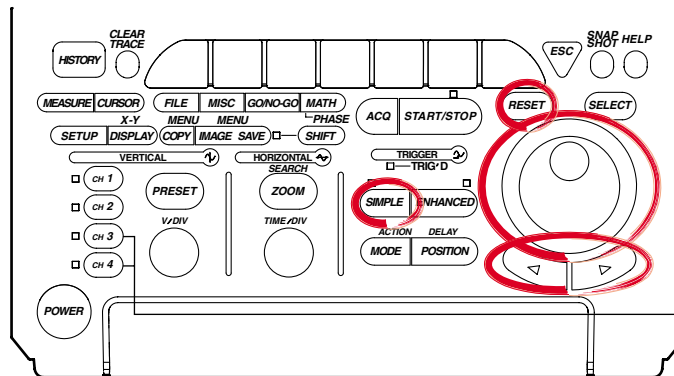
\*: The value above are estimated values. They are not strictly guaranteed.

### Setting the Hold Off

See section 6.4, "Setting the Hold Off Time."

## 6.6 Setting the External Trigger (SIMPLE)

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Setting the Trigger Source

1. Press **SIMPLE**.
2. Pressing the **Source** soft key to display the trigger source menu.

| Source | Level | Slope | Coupling | HF Reject | Hysteresis | SIMPLE Hold Off (uS) |
|--------|-------|-------|----------|-----------|------------|----------------------|
| CH1    | 0.0 U | f     | AC       | OFF       |            | 0.00                 |

3. Press the **Ext** soft key. (CH3 and CH4 are not displayed on the DL1720.)

| CH1 | CH2 | CH3 | CH4 | Ext | Line | SIMPLE Hold Off (uS) |
|-----|-----|-----|-----|-----|------|----------------------|
|     |     |     |     |     |      | 0.00                 |

#### Setting the Trigger Level

4. If the jog shuttle control is not set to Level, press the **Level** soft key.

| Source | Level   | Slope | Probe | SIMPLE Hold Off (uS) |
|--------|---------|-------|-------|----------------------|
| Ext    | 0.000 U | f     | 1:1   | 0.00                 |

On the DL1720, the **Range** soft key is displayed in this box.

5. Turn the jog shuttle to set the trigger level.  
You can use the arrow keys to move between the digits. In addition, pressing **RESET**, sets the trigger level to 0 V.

#### Setting the Trigger Slope

6. Press the **Edge** soft key to select **f**, **↓**, or **f↓**.

#### Setting the probe attenuation

7. Press the **Probe** soft key to select 1 : 1 or 10 : 1.

#### Setting the Range (DL1720 only)

8. Press the **Range** soft key, then select the range.  
±1 V or ±10 V (When Probe is set to 1:1), ±10 V or ±100 V (When Probe is set to 10:1)

| Source | Level   | Slope | Range    | Probe | SIMPLE Hold Off (uS) |
|--------|---------|-------|----------|-------|----------------------|
| Ext    | 0.000 U | f     | ±10 ±100 | 1:1   | 0.00                 |

## 6.6 Setting the External Trigger (SIMPLE)

---

### Setting the Hold Off

9. Set the hold off time according to the procedures given in 6.4, "Setting the Hold Off Time."

### Explanation

The external signal that is input through the EXT TRIG IN terminal (or the EXT. terminal on the front panel of the DL1720) on the rear panel of this instrument can be used to generate triggers.

### Note

For details related to the specifications of the EXT TRIG IN terminal (or the EXT. terminal for the DL1720), see section 12.1.

---

### Selecting the Trigger Source

Select Ext.

### Setting the Trigger Level

Range:        $\pm 2$  V (for the DL1740)  
               $\pm 1$  V (for the DL1720 with the  $\pm 1$  V range selected)  
               $\pm 10$  V (for the DL1720 with the  $\pm 10$  V range selected)  
Resolution:  5 mV (for the DL1740)  
              5 mV (for the DL1720 with the  $\pm 1$  V range selected)  
              50 mV (for the DL1720 with the  $\pm 10$  V range selected)

### Setting the Trigger Slope

Select the trigger activation method relative to changes in trigger source level from the following three choices.

- $\nearrow$  : Activated when the trigger source changes from below the trigger level to above the trigger level (rising).
- $\searrow$  : Activated when the trigger source changes from above the trigger level to below the trigger level (falling).
- $\nearrow\searrow$  : Activated on either a rising edge or falling edge.

### Setting the Probe Attenuation

When applying a trigger input signal to the EXT TRIG IN terminal (or the EXT. terminal on the front panel of the DL1720) via a probe, select an attenuation that matches the probe attenuation.

1 : 1, 10 : 1

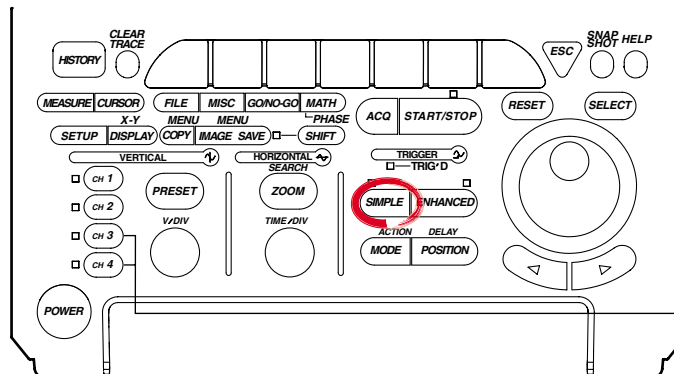
### Setting the Hold Off

See section 6.4, "Setting the Hold Off Time."



## 6.7 Generating Triggers on the Power Signal (SIMPLE)

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Setting the Trigger Source

1. Press **SIMPLE**.
2. Pressing the **Source** soft key displays the trigger source menu.

| Source | Level | Slope | Coupling | HF Reject | Hysteresis | SIMPLE<br>Hold Off<br>(uS) |
|--------|-------|-------|----------|-----------|------------|----------------------------|
| CH1    | 0.0 U | f     | AC       | OFF       |            | 0.00                       |

3. Press the **Line** soft key. (CH3 and CH4 are not displayed on the DL1720.)

| CH1 | CH2 | CH3 | CH4 | Ext | Line | SIMPLE<br>Hold Off<br>(uS) |
|-----|-----|-----|-----|-----|------|----------------------------|
|     |     |     |     |     |      | 0.00                       |

#### Setting the Hold Off

4. Set the hold off time according to the procedures given in 6.4, "Setting the Hold Off Time."

| Source | Level | Slope | Coupling | HF Reject | Hysteresis | SIMPLE<br>Hold Off<br>(uS) |
|--------|-------|-------|----------|-----------|------------|----------------------------|
| Line   |       |       |          |           |            | 0.00                       |

### Explanation

Triggers can be generated on the rising edge of the power signal that is being supplied to the instrument. Waveforms can be observed in sync with the commercial power supply frequency (50 Hz or 60 Hz).

#### Selecting the Trigger Source

Select Line.

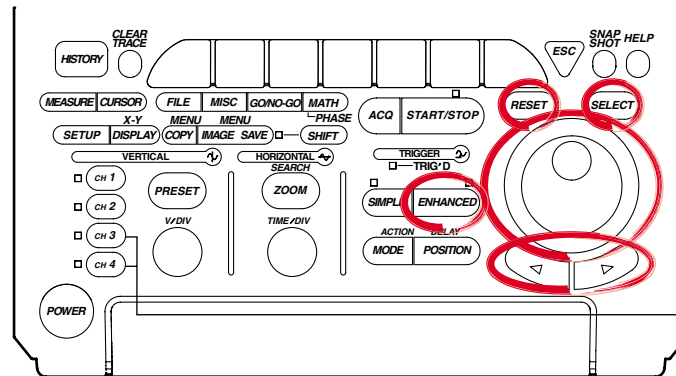
#### Setting the Hold Off

See section 6.4, "Setting the Hold Off Time."

## 6.8 Setting the A→B(N) Trigger (ENHANCED)

<For a description of this function, refer to page 1-8>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Setting the Trigger Type

1. Press **ENHANCED**.
2. Pressing the **Type** soft key to display the trigger type menu.

| Type     | Set Pattern | Level/<br>Coupling | Count | ENHANCED | Hold Off<br>( $\mu$ S) |
|----------|-------------|--------------------|-------|----------|------------------------|
| A → B(N) |             |                    | 1     |          | 0.00                   |

3. Press the **A→B(N)** soft key.

| A → B(N) | A Delay B | Pattern | Width | OR | TV | ENHANCED | Hold Off<br>( $\mu$ S) |
|----------|-----------|---------|-------|----|----|----------|------------------------|
|          |           |         |       |    |    |          | 0.00                   |

#### Setting the Status and Condition for Conditions A and B

4. Pressing the **Set Pattern** soft key displays a menu used to set the status and condition for conditions A and B. (On the DL1720, settings for CH3 and CH4 are not displayed.)

| Type     | Set Pattern | Level/<br>Coupling | Count | ENHANCED | Hold Off<br>( $\mu$ S) |
|----------|-------------|--------------------|-------|----------|------------------------|
| A → B(N) |             |                    | 1     |          | 0.00                   |

| Set Pattern |             |
|-------------|-------------|
| A           | B           |
| CH1         | H L X       |
| CH2         | X L H       |
| CH3         | X L X       |
| CH4         | X L X       |
| Condition   | Enter Enter |

5. Set condition A. Turn the jog shuttle to move the cursor to the channel to which the status of condition A will be set.
6. Press **SELECT** to select H, L, or X.
7. Turn the jog shuttle to move the cursor to the Condition position of condition A.
8. Press **SELECT** to select Enter or Exit.
9. In a similar fashion, set condition B.

**Setting the Level**

10. Pressing the **Level/Coupling** soft key displays a menu used to set the level, coupling, hysteresis, and HF rejection. (On the DL1720, settings for CH3 and CH4 are not displayed.)

| Level/Coupling |       |          |        |  |  |
|----------------|-------|----------|--------|--|--|
| Level          | Hys   | Coupling | HF Rej |  |  |
| CH1            | 0.0 V | DC       | OFF    |  |  |
| CH2            | 0.0 V | DC       | OFF    |  |  |
| CH3            | 0.0 V | DC       | OFF    |  |  |
| CH4            | 0.0 V | DC       | OFF    |  |  |

| Type     | Set Pattern | Level/Coupling | Count | ENHANCED HOLD OFF (uS) |
|----------|-------------|----------------|-------|------------------------|
| A → B(N) |             |                | 1     | 0.00                   |

The Level setting for each channel can be input directly using a USB keyboard. (⌨)

11. Turn the jog shuttle to move the cursor to the channel on which the level is to be set.
12. Press **SELECT** to display the level setting menu.
13. Turn the jog shuttle to set the level.  
You can use the arrow keys to move between the digits. In addition, pressing **RESET** sets the trigger level to 0 V.

**Setting the Hysteresis**

14. Turn the jog shuttle to move the cursor to the channel on which hysteresis is to be set.
15. Press **SELECT** to select  $\nabla$  or  $\nabla$ .

**Setting the Trigger Coupling**

16. Turn the jog shuttle to move the cursor to the channel on which the coupling is to be set.
17. Press **SELECT** to select DC or AC.

**Setting the HF Rejection**

18. Turn the jog shuttle to move the cursor to the channel on which the HF rejection (HF Rej) is to be set.
19. Press **SELECT** to select OFF, 20 MHz, or 15 kHz.

**Setting the Number of Times Condition B is to be Met**

20. If the jog shuttle control is not set to Count, press the **Count** soft key.

| Type     | Set Pattern | Level/Coupling | Count | ENHANCED HOLD OFF (uS) |
|----------|-------------|----------------|-------|------------------------|
| A → B(N) |             |                | 1     | 0.00                   |

21. Turn the jog shuttle to set the count.  
You can use the arrow keys to move between the digits. Pressing **RESET** resets the value to 1.

**Setting the Hold Off**

22. Set the hold off time according to the procedures given in 6.4, "Setting the Hold Off Time."

**Note**

- The status setting of conditions A and B applies to all trigger types.
- The trigger level, hysteresis, trigger coupling, and HF rejection settings apply to simple trigger and enhanced trigger.

## 6.8 Setting the A→B(N) Trigger (ENHANCED)

---

### Explanation

This function activates a trigger on the nth time condition B becomes true after condition A becomes true.

#### Setting Conditions A and B

- **Channel Status**

Select the status of the channel from the following three choices.

H: Above the specified trigger level

L: Below the specified trigger level

X: Don't care

- **Condition**

Select from the following two conditions.

Enter: Trigger is activated when all channels meet the specified status.

Exit: Trigger is activated when at least one channel no longer meets the specified status.

#### The Number of Times Pattern B is to be Met

1 to  $10^8$  times

#### Setting the Trigger Level

Range: 8 div within the screen

Resolution: 0.01 div

For example, the resolution is 0.02 mV when the V/DIV setting is 2 mV/div.

#### Setting the Hysteresis

Sets a width to the trigger level so that the trigger is not activated on small changes.

$\nabla$ : Approximately 0.3 div\* of hysteresis around the trigger level.

$\nabla$ : Approximately 1 div\* of hysteresis around the trigger level.

\*: The value above are estimated values. They are not strictly guaranteed.

#### Setting the Trigger Coupling

Select from the following list of choices.

AC: Uses a signal that is obtained by removing the DC component from the trigger source signal as the trigger signal.

DC: Uses the trigger source signal as the trigger signal.

#### Turning ON/OFF the HF Rejection

Select 15 kHz or 20 MHz when you wish to use a signal source that is obtained by removing the high frequency components (frequency components greater than or equal to approximately 15 kHz or 20 MHz) from the trigger signal as the trigger source.

#### Setting the Hold Off

See section 6.4, "Setting the Hold Off Time."

#### Note

---

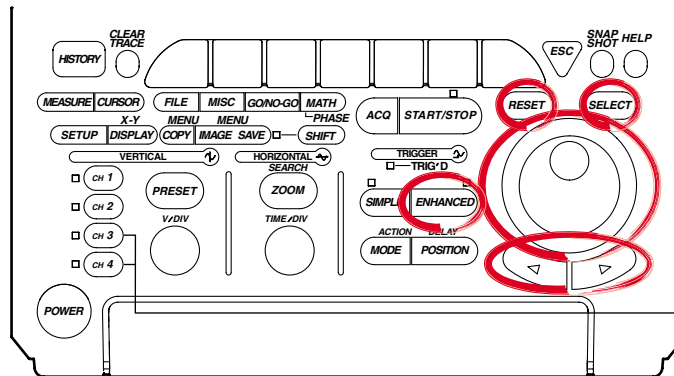
If you wish to use only one pattern condition to activate the trigger, use the pattern trigger. If the status for condition A and condition B are set to Xs (Don't care), the trigger will not be activated.

---

## 6.9 Setting the A Delay B Trigger (ENHANCED)

<For a description of this function, refer to page 1-9>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Setting the Trigger Type

1. Press **ENHANCED**.
2. Pressing the **Type** soft key to display the trigger type menu.

| Type      | Set Pattern | Level/<br>Coupling | Count | ENHANCED<br>Hold Off<br>(uS)<br>0.00 |
|-----------|-------------|--------------------|-------|--------------------------------------|
| A -> B(N) |             |                    | 1     |                                      |

3. Press the **A Delay B** soft key.

| A -> B(N) | A Delay B | Pattern | Width | OR | TV | ENHANCED<br>Hold Off<br>(uS)<br>0.00 |
|-----------|-----------|---------|-------|----|----|--------------------------------------|
|           |           |         |       |    |    |                                      |

#### Setting the Status and Condition for Conditions A and B

4. Pressing the **Set Pattern** soft key displays a menu used to set the status and condition for conditions A and B. (On the DL1720, settings for CH3 and CH4 are not displayed.)

| Type      | Set Pattern | Level/<br>coupling | Delay(uS) | ENHANCED<br>Hold Off<br>(uS)<br>0.00 |
|-----------|-------------|--------------------|-----------|--------------------------------------|
| A Delay B |             |                    | 0.003     |                                      |

| Set Pattern               |     |
|---------------------------|-----|
| A                         | B   |
| CH1                       | H X |
| CH2                       | X H |
| CH3                       | X X |
| CH4                       | X X |
| Condition [Enter] [Enter] |     |

5. Set condition A. Turn the jog shuttle to move the cursor to the channel to which the status of condition A will be set.
6. Press **SELECT** to select H, L, or X.
7. Turn the jog shuttle to move the cursor to the Condition position of condition A.
8. Press **SELECT** to select Enter or Exit.
9. In a similar fashion, set condition B.

## 6.9 Setting the A Delay B Trigger (ENHANCED)

### Setting the Level, Hysteresis, Trigger Coupling, and HF Rejection

10. Pressing the **Level/Coupling** soft key displays a menu used to set the level, coupling, hysteresis, and HF rejection. (On the DL1720, settings for CH3 and CH4 are not displayed.)

The setting also applies to A→B(N) trigger. See section 6.8.

| Level/Coupling |       |          |        |     |
|----------------|-------|----------|--------|-----|
| Level          | Hys   | Coupling | HF Rej |     |
| CH1            | 0.0 V | AC       | DC     | OFF |
| CH2            | 0.0 V | AC       | DC     | OFF |
| CH3            | 0.0 V | AC       | DC     | OFF |
| CH4            | 0.0 V | AC       | DC     | OFF |

| Type      | Set Pattern | Level/Coupling | Delay (μs) | ENHANCED Hold Off (μs) |
|-----------|-------------|----------------|------------|------------------------|
| A Delay B |             |                | 0.003      | 0.00                   |

The Level setting for each channel can be input directly using a USB keyboard. (Ⓜ)

### Setting the Delay Time

11. If the jog shuttle control is not set to Delay, press the **Delay** soft key.

| Type      | Set Pattern | Level/Coupling | Delay (μs) | ENHANCED Hold Off (μs) |
|-----------|-------------|----------------|------------|------------------------|
| A Delay B |             |                | 0.003      | 0.00                   |

12. Turn the jog shuttle to set the delay time.  
You can use the arrow keys to move between the digits. Pressing **RESET** resets the value to 0.003 μs.

### Setting the Hold Off

13. Set the hold off time according to the procedures given in 6.4, "Setting the Hold Off Time."

### Note

- The status setting of condition A and B applies to all trigger types.
- The trigger level, hysteresis, trigger coupling, and HF rejection settings apply to simple trigger and enhanced trigger.

**Explanation**

This function activates a trigger the first time condition B becomes true after condition A becomes true and the specified time elapses.

**Setting Conditions A and B**

- **Channel Status**

Select the status of the channel from the following three choices.

H: Above the specified trigger level

L: Below the specified trigger level

X: Don't care

- **Condition**

Enter: Trigger is activated when all channels meet the specified status.

Exit: Trigger is activated when at least one channel no longer meets the specified status.

**Delay Time**

3 ns to 5 s (resolution: 1 ns)

**Setting the Trigger Level**


Range: 8 div within the screen


Resolution: 0.01 div

For example, the resolution is 0.02 mV when the V/DIV setting is 2 mV/div.

**Setting the Hysteresis**

Sets a width to the trigger level so that the trigger is not activated on small changes.

: Approximately 0.3 div\* of hysteresis around the trigger level.

: Approximately 1 div\* of hysteresis around the trigger level.

\*: The value above are estimated values. They are not strictly guaranteed.

**Setting the Trigger Coupling**

Select from the following list of choices.

AC: Uses a signal that is obtained by removing the DC component from the trigger source signal as the trigger signal.

DC: Uses the trigger source signal as the trigger signal.

**Turning ON/OFF the HF Rejection**

Select 15 kHz or 20 MHz when you wish to use a signal source that is obtained by removing the high frequency components (frequency components greater than or equal to approximately 15 kHz or 20 MHz) from the trigger signal as the trigger source.

**Setting the Hold Off**

See section 6.4, "Setting the Hold Off Time."

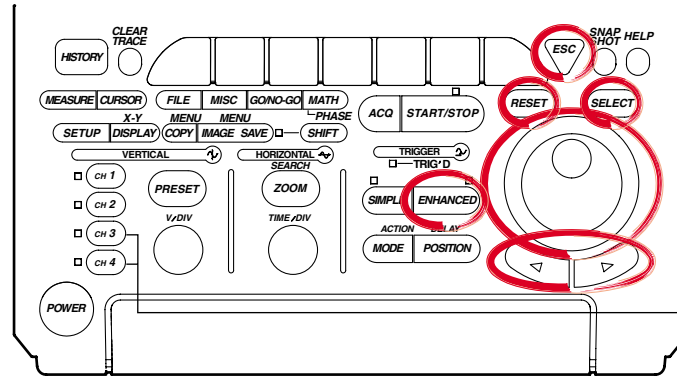
**Note**

If you wish to use only one pattern condition to activate the trigger, use the pattern trigger. If the status for condition A and condition B are set to Xs (Don't care), the trigger will not be activated.

# 6.10 Setting the Pattern Trigger (ENHANCED)

<For a description of this function, refer to page 1-9>

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

### Setting the Trigger Type

1. Press **ENHANCED**.
2. Pressing the **Type** soft key displays the trigger type menu.

|          |             |                |       |                    |
|----------|-------------|----------------|-------|--------------------|
| Type     | Set Pattern | Level/Coupling | Count | ENHANCED           |
| A → B(N) |             |                | 1     | Hold Off (uS) 0.06 |

3. Press the **Pattern** soft key.

|          |           |         |       |    |    |                    |
|----------|-----------|---------|-------|----|----|--------------------|
| A → B(N) | A Delay B | Pattern | Width | OR | TV | ENHANCED           |
|          |           |         |       |    |    | Hold Off (uS) 0.06 |

### Setting the Status and Condition

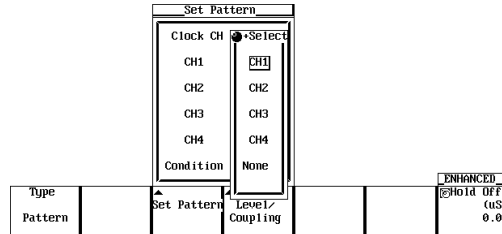
4. Pressing the **Set Pattern** soft key displays a menu used to set the status and condition. (On the DL1720, settings for CH3 and CH4 are not displayed.)

|   |             |                |  |                    |
|---|-------------|----------------|--|--------------------|
| Set Pattern                                     |             |                |  |                    |
| Clock CH <input type="text" value="CH1"/>       |             |                |  |                    |
| CH1 <input type="checkbox"/>                    |             |                |  |                    |
| CH2 <input checked="" type="checkbox"/>         |             |                |  |                    |
| CH3 <input checked="" type="checkbox"/>         |             |                |  |                    |
| CH4 <input checked="" type="checkbox"/>         |             |                |  |                    |
| Condition <input type="checkbox" value="True"/> |             |                |  |                    |
| Type  | Set Pattern | Level/Coupling |  | ENHANCED           |
| Pattern   |             |                |  | Hold Off (uS) 0.06 |



**When Activating the Trigger Only on the Status Pattern**

5. Turn the jog shuttle to move the cursor to Clock CH.
6. Pressing **SELECT** displays the clock channel setting menu.
7. Turn the jog shuttle to select None. (CH3 and CH4 are not displayed on the DL1720.)



8. Press **ESC** and turn the jog shuttle to move the cursor to the channel on which the status is to be set.
9. Press **SELECT** to select H, L, X.
10. Turn the jog shuttle to move the cursor to Condition.
11. Press **SELECT** to select Enter or Exit.  
Go to step 14.

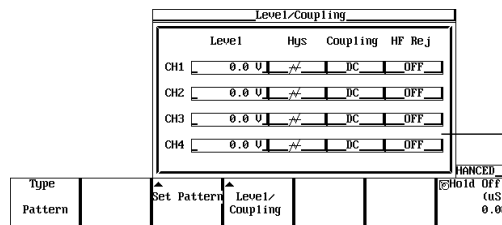
**When Activating the Trigger in Sync with the Clock Channel**

5. Turn the jog shuttle to move the cursor to Clock CH.
6. Pressing **SELECT** displays the clock channel setting menu.
7. Turn the jog shuttle to set the clock channel.
8. Press **ESC** and turn the jog shuttle to move the cursor to the channel that was set as the clock channel.
9. Press **SELECT** to select  $\overline{f}$  or  $\overline{l}$ .
10. Turn the jog shuttle to move the cursor to the channel to which the status to be set.
11. Press **SELECT** to select H, L, or X.
12. Turn the jog shuttle to move the cursor to Condition.
13. Press **SELECT** to select True or False.

**Setting the Level, Hysteresis, Trigger Coupling, and HF Rejection of the Clock CH**

14. Pressing the **Level/Coupling** soft key displays a menu used to set the level, coupling, hysteresis, and HF rejection. (On the DL1720, settings for CH3 and CH4 are not displayed.)

The setting also applies to the A→B(N) trigger. See section 6.8.



The Level setting for each channel can be input directly using a USB keyboard. (⌨)

**Setting the Hold Off**

15. Set the hold off time according to the procedures given in 6.4, "Setting the Hold Off Time."

**Note**

The trigger level, hysteresis, trigger coupling, and HF rejection settings apply to simple trigger and enhanced trigger.

## 6.10 Setting the Pattern Trigger (ENHANCED)

### Explanation

This function activates the trigger when all conditions set to multiple trigger sources become true or when all conditions become false.

#### Setting the Trigger Source and Trigger Status

Set the trigger status of the trigger source from the following three choices.

- H: The trigger source level is greater than or equal to the trigger level.
- L: The trigger source level is less than or equal to the trigger level.
- X: Do not set as a trigger source.

#### Selecting the Clock Channel: Clock CH

- Select None if the trigger is not to be activated in sync with the signal.
- Select the clock channel from CH1 to CH4 (or CH1 to CH2 for the DL1720) if the trigger is to be activated in sync with the signal.
- Select the trigger slope from the following.
  - ↗: Rising
  - ↘: Falling

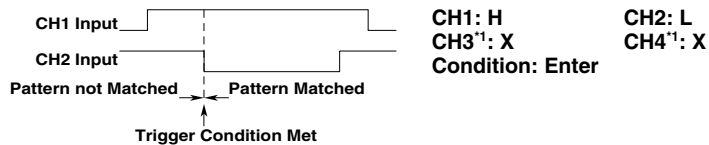
#### Selecting the Trigger Condition

##### • When Activating the Trigger Only on the Status Pattern

Select the trigger condition from the following list of choices.

Enter: Trigger is activated when the specified combination (pattern) is met.

Exit: Trigger is activated when the specified pattern is no longer met.



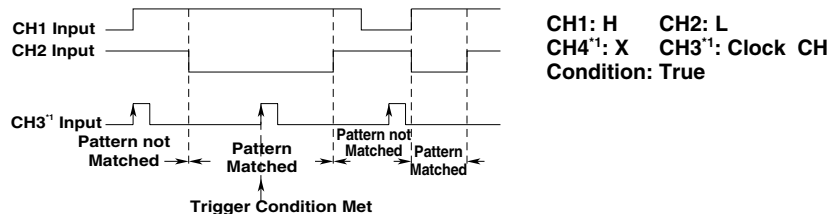
\*1 The DL1720 is not equipped with channels 3 and 4.

##### • When Activating the Trigger in Sync with the Clock Channel

Set the trigger condition from the following list of choices.

True: Trigger is activated on the rising or falling edge of the clock channel while the status pattern is being matched.

False: Trigger is activated on the rising or falling edge of the clock channel while the status pattern match condition is not satisfied.



\*1 The DL1720 is not equipped with channels 3 and 4.

#### Setting the Trigger Level

Range: 8 div within the screen

Resolution: 0.01 div

For example, the resolution is 0.02 mV when the V/DIV setting is 2 mV/div.

#### Setting the Hysteresis

Sets a width to the trigger level so that the trigger is not activated on small changes.

∩: Approximately 0.3 div\* of hysteresis around the trigger level.

∩: Approximately 1 div\* of hysteresis around the trigger level.

\*: The value above are estimated values. They are not strictly guaranteed.

**Setting the Trigger Coupling**

Select from the following list of choices.

AC: Uses a signal that is obtained by removing the DC component from the trigger source signal as the trigger signal.

DC: Uses the trigger source signal as the trigger signal.

**Turning the HF Rejection ON/OFF**

Select 15 kHz or 20 MHz when you wish to use a signal source that is obtained by removing the high frequency components (frequency components greater than or equal to approximately 15 kHz or 20 MHz) from the trigger signal as the trigger source.

**Setting the Hold Off**

See section 6.4, "Setting the Hold Off Time."

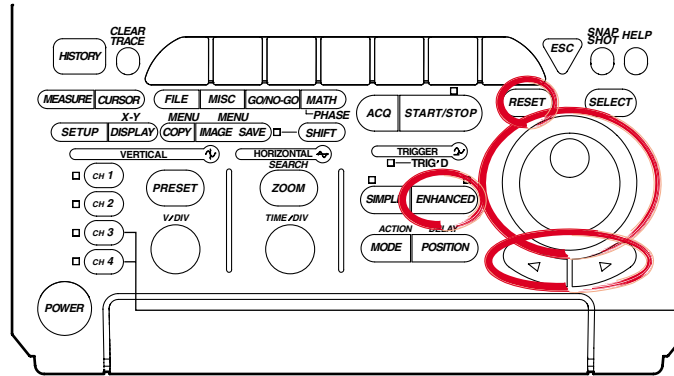
**Precautions to be Taken when Setting the Pattern Trigger**

- When the trigger type setting is changed, the pattern trigger setting is no longer valid. However, if the pattern trigger is selected again, the previous settings are enabled.
- Even if the trigger mode is set to auto level mode, the operation will be in auto mode.
- Set the trigger status on all trigger sources. If the channel selected is a clock channel, select the trigger slope.
- When activating the trigger in sync with the clock signal, specify at least 1 ns for the pattern to setup and at least 1 ns for the hold time.

# 6.11 Setting the Width (Pulse<T, Pulse>T, T1<PLS<T2, Time Out) Trigger (ENHANCED)

<For a description of this function, refer to page 1-9>

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

### Setting the Trigger Type

1. Press **ENHANCED**.
2. Pressing the **Type** soft key displays the trigger type menu.

| Type      | Set Pattern | Level/Coupling | Count | ENHANCED Hold Off (uS) |
|-----------|-------------|----------------|-------|------------------------|
| A -> B(N) |             |                | 1     | 0.00                   |

3. Press the **Width** soft key.

| A -> B(N) | A Delay B | Pattern | Width | OR | TU | ENHANCED Hold Off (uS) |
|-----------|-----------|---------|-------|----|----|------------------------|
|           |           |         |       |    |    | 0.00                   |

### Setting the Width Type

4. Pressing the **Width Type** soft key displays a menu used to select the width type.

| Type  | Width Type | Set Pattern | Level/Coupling | @Time(uS) | Window | ENHANCED Hold Off (uS) |
|-------|------------|-------------|----------------|-----------|--------|------------------------|
| Width | Pulse<T    |             |                | 0.001     | OFF ON | 0.00                   |

5. Press the soft key corresponding to the desired type from **Pulse > T**, **Pulse < T**, **T1 < PLS < T2**, or **Time Out**.

| Type  | Width Type | Set Pattern | Level/Coupling | @Time(uS) | Window | ENHANCED Hold Off (uS) |
|-------|------------|-------------|----------------|-----------|--------|------------------------|
| Width | Pulse<T    |             |                |           | OFF ON | 0.00                   |

## 6.11 Setting the Width (Pulse<T, Pulse>T, T1<PLS<T2, Time Out) Trigger (ENHANCED)

### Setting the Conditions of Each Channel

- Press the **Set Pattern** soft key to display the trigger setting menu. (On the DL1720, settings for CH3 and CH4 are not displayed.)

| Type  | Width   | Type | Set Pattern | Level/<br>Coupling | @Time(μS) | Window | ENHANCED<br>@Hold OFF<br>(μS) |
|-------|---------|------|-------------|--------------------|-----------|--------|-------------------------------|
| Width | Pulse<T |      | Set Pattern | Level/<br>Coupling | 0.001     | OFF ON | 0.00                          |

Set Pattern

CH1  H  L  X

CH2  X

CH3  X

CH4  X

Condition  True  False

- Turn the jog shuttle to move the cursor to the channel to be set.
- Press **SELECT** to select H, L, X (when the Window is ON, IN, OUT, or X).
- Turn the jog shuttle to move the cursor to Condition.
- Press **SELECT** to select True or False.

### Setting the Level, Hysteresis, Trigger Coupling, and HF Rejection

- Pressing the **Level/Coupling** soft key displays a menu used to set the level, coupling, hysteresis, and HF rejection. (On the DL1720, settings for CH3 and CH4 are not displayed.)

| Type  | Width   | Type | Set Pattern | Level/<br>Coupling | @Time(μS) | Window | ENHANCED<br>@Hold OFF<br>(μS) |
|-------|---------|------|-------------|--------------------|-----------|--------|-------------------------------|
| Width | Pulse<T |      | Set Pattern | Level/<br>Coupling | 0.001     | OFF ON | 0.00                          |

Level/Coupling

| Level                                 | Hys | Coupling | HF Rej |
|---------------------------------------|-----|----------|--------|
| CH1 0.0 V <input type="checkbox"/> // | DC  | OFF      | OFF    |
| CH2 0.0 V <input type="checkbox"/> // | DC  | OFF      | OFF    |
| CH3 0.0 V <input type="checkbox"/> // | DC  | OFF      | OFF    |
| CH4 0.0 V <input type="checkbox"/> // | DC  | OFF      | OFF    |

The Level setting for each channel can be input directly using a USB keyboard. (⌨)

The setting also applies to A→B(N) trigger. See section 6.8.

When the Window is ON, set the window position, width, trigger coupling, and HF rejection. The settings are the same as the window trigger. See section 6.13, "Setting the Window Trigger."

### Note

The trigger level, hysteresis, trigger coupling, and HF rejection settings apply to simple trigger and enhanced trigger.

## 6.11 Setting the Width (Pulse<T, Pulse>T, T1<PLS<T2, Time Out) Trigger (ENHANCED)

### Setting the Pulse Width

12. If the jog shuttle control is not set to Time press the **Time** soft key.

| Type  | Width Type | Set Pattern | Level/<br>Coupling | Time(μS) | Window | ENHANCED<br>Hold OFF<br>(μS) |
|-------|------------|-------------|--------------------|----------|--------|------------------------------|
| Width | Pulse<T    |             |                    | 0.001    | OFF ON | 0.00                         |

If the Width Type is T1 < PLS < T2, press the **Time1/Time2** soft key.

| Type  | Width Type | Set Pattern | Level/<br>Coupling | Time1(μS) | Time2(μS) | Window | ENHANCED<br>Hold OFF<br>(μS) |
|-------|------------|-------------|--------------------|-----------|-----------|--------|------------------------------|
| Width | T1<PLS<T2  |             |                    | 0.001     | 0.002     | OFF ON | 0.00                         |

13. Turn the jog shuttle to set the pulse width.  
You can use the arrow keys to move between the digits. Pressing **RESET** resets the pulse width to 0.001 μs (Time2 is reset to 0.002 μs).

### Setting the Window

14. Press the **Window** soft key to select either ON or OFF.  
When the Window is turned OFF, a trigger is activated on the time period over which the parallel pattern of the channel state (H, L, and X) is met or not met.  
When the Window is turned ON, a trigger is activated on the time period over which the parallel pattern of the window condition of each channel is met or not met.

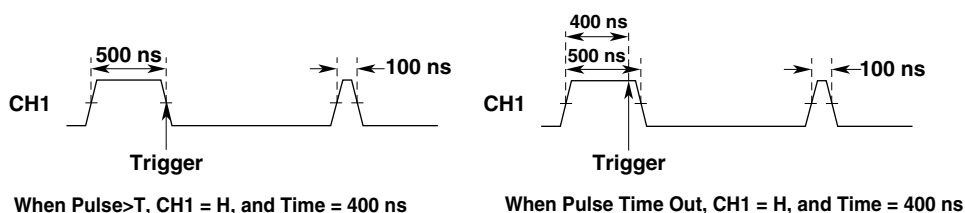
| Type  | Width Type | Set Pattern | Level/<br>Coupling | Time(μS) | Window | ENHANCED<br>Hold OFF<br>(μS) |
|-------|------------|-------------|--------------------|----------|--------|------------------------------|
| Width | Pulse<T    |             |                    | 0.001    | OFF ON | 0.00                         |

### Setting the Hold Off

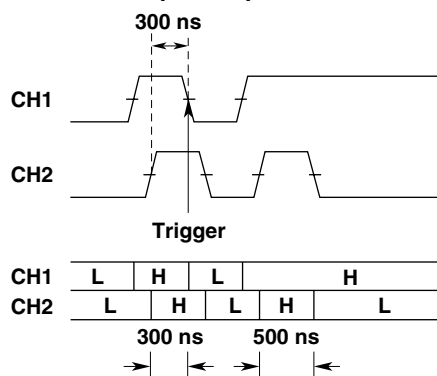
15. Set the hold off time according to the procedures given in 6.4, "Setting the Hold Off Time."

**Explanation**

- Pulse > T: When the time during which the status pattern is met is longer than the specified pulse width, the trigger is activated when the condition changes.
  - Pulse < T: When the time during which the status pattern is met is shorter than the specified pulse width, the trigger is activated.
  - T1<PLS<T2: When the time during which the status pattern is met is in between the two specified pulse widths, the trigger is activated.
  - Time Out: The trigger is activated when the time during which the status pattern is met becomes longer than the specified pulse width.
- The point at which the trigger is activated differs between Pulse > T and Time Out as indicated in the figure below.



**Pulse<T Setup Example**



Pulse<T, Condition: CH1 = H, CH2 = H, Time = 400 ns

**Conditions of Each Channel**

When the window trigger turned OFF, the conditions same as the A→B(N) trigger. See section 6.8.

Same as the window trigger when the window is ON (IN/OUT/X).

For details regarding the window trigger, see section 6.13, "Setting the Window Trigger."

**Pulse Width**

1 ns to 1 s

**Precautions to be Taken when Setting the Width Trigger**

The trigger may not operate properly if the time between two pulses is less than 2 ns or if the pulse width is less than 2 ns. The time accuracy of the pulse width in the standard operating condition after calibration is ±(0.5% of the setting\* + 1 ns).

\*: When set to T1<PLS<T2, the value of T2.

**Correlation with the Window Trigger**

When the Window is turned ON, a trigger is activated based on the time period during which the parallel pattern of the window condition of each channel is met or not met.

## 6.11 Setting the Width (Pulse<T, Pulse>T, T1<PLS<T2, Time Out) Trigger (ENHANCED)

---

### Setting the Trigger Level


Range: 8 div within the screen


Resolution: 0.01 div

For example, the resolution is 0.02 mV when the V/DIV setting is 2 mV/div.

### Setting the Hysteresis

Sets a width to the trigger level so that the trigger is not activated on small changes.

: Approximately 0.3 div\* of hysteresis around the trigger level.

: Approximately 1 div\* of hysteresis around the trigger level.

\*: The value above are estimated values. They are not strictly guaranteed.

### Setting the Trigger Coupling

Select from the following list of choices.

AC: Uses a signal that is obtained by removing the DC component from the trigger source signal as the trigger signal.

DC: Uses the trigger source signal as the trigger signal.

### Turning ON/OFF the HF Rejection

Select 15 kHz or 20 MHz when you wish to use a signal source that is obtained by removing the high frequency components (frequency components greater than or equal to approximately 15 kHz or 20 MHz) from the trigger signal as the trigger source.

### Setting the Hold Off

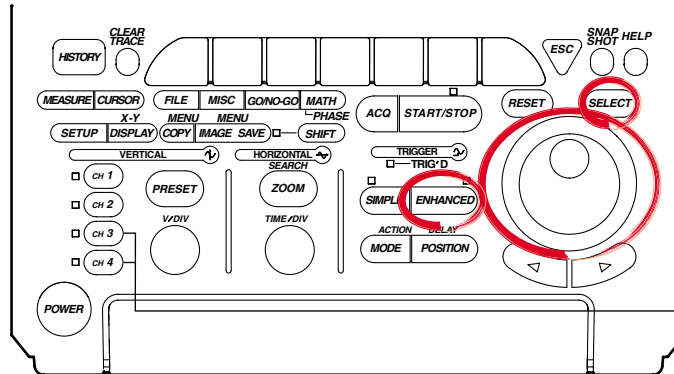
See section 6.4, "Setting the Hold Off Time."



## 6.12 Setting the OR Trigger

<For a description of this function, refer to page 1-10>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Setting the Trigger Type

1. Press **ENHANCED**.
2. Pressing the **Type** soft key displays the trigger type menu.

| Type     | Set Pattern | Level/Coupling | Count | ENHANCED HOLD OFF (uS) |
|----------|-------------|----------------|-------|------------------------|
| A → B(N) |             |                | 1     | 0.00                   |

3. Press the **OR** soft key.

| A → B(N) | A Delay B | Pattern | Width | OR | TV | ENHANCED HOLD OFF (uS) |
|----------|-----------|---------|-------|----|----|------------------------|
|          |           |         |       |    |    | 0.00                   |

#### Setting the Edge Trigger of Each Channel

4. Press the **Set Pattern** soft key to display the trigger setting menu. (On the DL1720, settings for CH3 and CH4 are not displayed.)

| Type | Set Pattern | Level/Coupling | Window | ENHANCED HOLD OFF (uS) |
|------|-------------|----------------|--------|------------------------|
| OR   |             |                | OFF ON | 0.00                   |

| Set Pattern |   |
|-------------|---|
| CH1         | f |
| CH2         | — |
| CH3         | — |
| CH4         | — |

5. Turn the jog shuttle to move the cursor to the channel to be set.
6. Press **SELECT** to select f, ↵, or — (when the Window is ON, IN, OUT, or —).

## 6.12 Setting the OR Trigger

### Setting the Level, Hysteresis, Trigger Coupling, and HF Rejection

- Pressing the **Level/Coupling** soft key displays a menu used to set the level, coupling, hysteresis, and HF rejection. (On the DL1720, settings for CH3 and CH4 are not displayed.)

| Level/Coupling |      |     |          |     |     |  |
|----------------|------|-----|----------|-----|-----|--|
| Level          |      | Hys | Coupling | HF  | Rej |  |
| CH1            | 0.00 | μV  | DC       | OFF |     |  |
| CH2            | 0.00 | μV  | DC       | OFF |     |  |
| CH3            | 0.00 | μV  | DC       | OFF |     |  |
| CH4            | 0.00 | μV  | DC       | OFF |     |  |

| Type | Set Pattern | Level/Coupling | Window | ENHANCED Hold Off (μS) |
|------|-------------|----------------|--------|------------------------|
| OR   |             |                | OFF ON | 0.00                   |

The Level setting for each channel can be input directly using a USB keyboard. (F3)

The setting also applies to A→B(N) trigger. See section 6.8.

When the Window is ON, set the window position, width, trigger coupling, and HF rejection. The settings are the same as the window trigger. See section 6.13, "Setting the Window Trigger."

### Note

The trigger level, hysteresis, trigger coupling, and HF rejection settings apply to simple trigger and enhanced trigger.

### Setting the Window

- Press the **Window** soft key to select either ON or OFF.  
If OFF is selected, triggers are activated on the OR of the channel edge.  
If ON is selected, triggers are activated on the OR of the channel's window conditions.

| Type | Set Pattern | Level/Coupling | Window | ENHANCED Hold Off (μS) |
|------|-------------|----------------|--------|------------------------|
| OR   |             |                | OFF ON | 0.00                   |

### Setting the Hold Off

- Set the hold off time according to the procedures given in 6.4, "Setting the Hold Off Time."

**Explanation**

This function activates a trigger on the OR of each channel's edge trigger.

**Setting the Edge Trigger of Each Channel**

Select from the following.

- ↗ : Rising
- ↘ : Falling
- : Don't care

**Setting the Trigger Level**


Range: 8 div within the screen


Resolution: 0.01 div

For example, the resolution is 0.02 mV when the V/DIV setting is 2 mV/div.

**Setting the Hysteresis**

Sets a width to the trigger level so that the trigger is not activated on small changes.

: Approximately 0.3 div\* of hysteresis around the trigger level.

: Approximately 1 div\* of hysteresis around the trigger level.

\*: The value above are estimated values. They are not strictly guaranteed.

**Setting the Trigger Coupling**

Select from the following list of choices.

AC: Uses a signal that is obtained by removing the DC component from the trigger source signal as the trigger signal.

DC: Uses the trigger source signal as the trigger signal.

**Turning ON/OFF the HF Rejection**

Select 15 kHz or 20 MHz when you wish to use a signal source that is obtained by removing the high frequency components (frequency components greater than or equal to approximately 15 kHz or 20 MHz) from the trigger signal as the trigger source.

**Setting the Hold Off**

See section 6.4, "Setting the Hold Off Time."

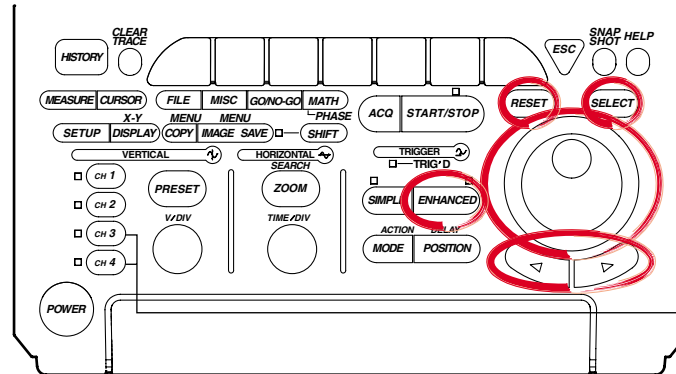
**Correlation with the Window Trigger**

If the window is turned ON, the trigger is activated when either the OR trigger or the window trigger becomes true. For details related to window trigger, see section 6.13, "Setting the Window Trigger."

## 6.13 Setting the Window Trigger (ENHANCED)

<For a description of this function, refer to page 1-10>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Setting the Trigger Type

1. Press **ENHANCED**.
2. Pressing the **Type** soft key displays the trigger type menu.

| Type     | Set Pattern | Level/<br>Coupling | Count | ENHANCED           |
|----------|-------------|--------------------|-------|--------------------|
| A → B(N) |             |                    | 1     | Hold OFF (uS) 0.06 |

3. Press the **OR** or **Width** soft key.

| A → B(N) | A Delay B | Pattern | Width | OR | TV | ENHANCED           |
|----------|-----------|---------|-------|----|----|--------------------|
|          |           |         |       |    |    | Hold OFF (uS) 0.06 |

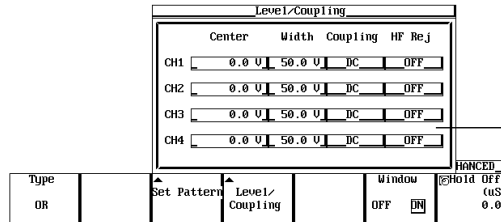
#### Setting the Window Trigger

4. Press the **Window** soft key to select ON.  
Set the status and trigger conditions of each channel according to the procedures given in section 6.11, "Setting the Width (Pulse<T, Pulse>T, T1<PLS<T2, Time Out)" or 6.12, "Setting the OR Trigger (ENHANCED)."

| Type | Set Pattern | Level/<br>Coupling | Window | ENHANCED           |
|------|-------------|--------------------|--------|--------------------|
| OR   |             |                    | OFF ON | Hold OFF (uS) 0.06 |

**Setting the Center Level and Window Width**

- Pressing the **Level/Coupling** soft key displays a dialog box used to set the center level, window width, trigger coupling, and HF rejection. (On the DL1720, settings for CH3 and CH4 are not displayed.)



The Center and Width settings for each channel can be input directly using a USB keyboard.

- Turn the jog shuttle to move the cursor to the channel on which to set the window center level (Center).
- Press **SELECT** to display the center level menu.
- Turn the jog shuttle to set the center level. You can use the arrow keys to move between the digits. Pressing **RESET** sets the window center level to 0 V.
- Turn the jog shuttle to move the cursor to the channel on which to set the window width.
- Press **SELECT** to display the window width menu.
- Turn the jog shuttle to set the window width. You can use the arrow keys to move between the digits. Pressing **RESET** resets the value to the initial value.

**Setting the Trigger Coupling and HF Rejection**

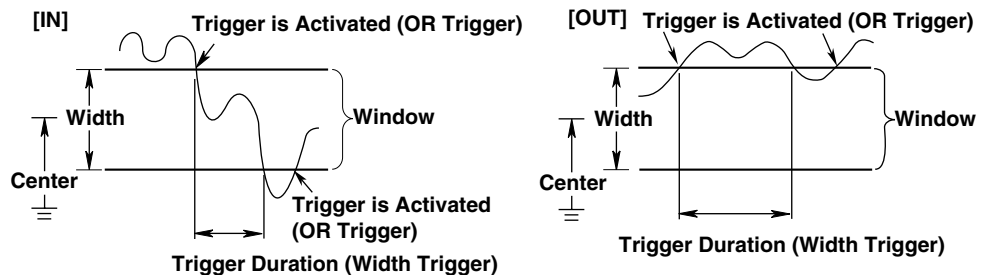
- The coupling and HF rejection settings also apply to the A→B(N) trigger. See section 6.8.

**Explanation**

This function sets up a window trigger for the CH1 to CH4 (or CH1 to CH2 for the DL1720) input signal.

**Trigger Condition**

- Width trigger
  - IN: The time during the trigger source enters the window is trigger duration.
  - OUT: The time during the trigger source exits the window is trigger duration.
- OR trigger
  - IN: Trigger is activated when the trigger source enters the window (the area between two preset levels).
  - OUT: Trigger is activated when the trigger source exits the window.



## 6.13 Setting the Window Trigger (ENHANCED)

---

### Window Setting

You define the window by its center level and width.

- “Center” Setting Range : Anywhere within the 8 screen divisions, in resolution of 0.01 div. (Example: If the scale is 1 V/div, resolution is 0.01 V).
- “Width” Setting Range : Up to  $\pm 4$  div from center, in resolution of 0.02 div. (Example: If the scale is 1 V/div, resolution is 0.02 V).

### Note

---

If you set the window so that the top or bottom is off the screen, the trigger will occur at the level for the corresponding screen edge (the level at  $\pm 4$  divisions from screen center) rather than at the “missing” top or bottom. Therefore it is recommended not to exceed  $\pm 4$  div when setting the window.

---

### Setting the Trigger Coupling

Select from the following list of choices.

- AC: Uses a signal that is obtained by removing the DC component from the trigger source signal as the trigger signal.
- DC: Uses the trigger source signal as the trigger signal.

### Turning ON/OFF the HF Rejection

Select 15 kHz or 20 MHz when you wish to use a signal source that is obtained by removing the high frequency components (frequency components greater than or equal to approximately 15 kHz or 20 MHz) from the trigger signal as the trigger source.

### Setting the Hold Off

See section 6.4, “Setting the Hold Off Time.”

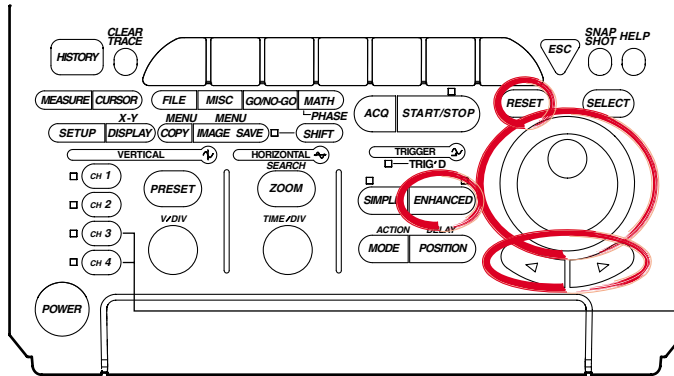
### Correlation with the OR Trigger or Width Trigger

*OR* and *Width* are the trigger types on which the window trigger can be used. When using the window trigger of a single channel, set the window conditions of all other channels to “-” or “x.”

# 6.14 Setting the TV Trigger (ENHANCED)

<For a description of this function, refer to page 1-10>

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

### Inputting the Video Signal

Connect the probe (cable) used to input the video signal to the CH1 input terminal.

### Selecting the TV Trigger

1. Press **ENHANCED**.
2. Pressing the **Type** soft key displays the trigger type menu.

|           |             |                |       |                        |
|-----------|-------------|----------------|-------|------------------------|
| Type      | Set Pattern | Level/Coupling | Count | ENHANCED Hold Off (uS) |
| A -> B(N) |             |                | 1     | 0.00                   |

3. Press the **TV** soft key.

|           |           |         |       |    |          |            |
|-----------|-----------|---------|-------|----|----------|------------|
| A -> B(N) | A Delay B | Pattern | Width | OR | ENHANCED | Frame Skip |
|           |           |         |       |    | TV       | 2 4 8      |

### Selecting the Broadcasting System of the Video Signal to be Monitored

4. Pressing the **TV Type** soft key displays a menu used to select the broadcasting system.

|      |         |          |        |       |      |          |            |
|------|---------|----------|--------|-------|------|----------|------------|
| Type | TV Type | Polarity | Level  | Field | Line | ENHANCED | Frame Skip |
| TV   | NTSC    | Neg Pos  | 0.5div | 2 X   | 5    | 2 4 8    |            |

5. Press the soft key corresponding to the desired broadcasting system to select **NTSC** or **PAL**.

|      |      |     |        |       |      |          |            |
|------|------|-----|--------|-------|------|----------|------------|
| Type | NTSC | PAL | Level  | Field | Line | ENHANCED | Frame Skip |
| TV   |      |     | 0.5div | 2 X   | 5    | 2 4 8    |            |

### Selecting the Polarity

6. Press the **Polarity** soft key to select the polarity.

|      |         |          |        |       |      |          |            |
|------|---------|----------|--------|-------|------|----------|------------|
| Type | TV Type | Polarity | Level  | Field | Line | ENHANCED | Frame Skip |
| TV   | NTSC    | Neg Pos  | 0.5div | 2 X   | 5    | 2 4 8    |            |

## 6.14 Setting the TV Trigger (ENHANCED)

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### Setting the Trigger Level

7. If the jog shuttle control is not set to Level, press the **Level** soft key.
8. Turn the jog shuttle to set the trigger level.  
You can use the arrow keys to move between the digits. Pressing **RESET** sets the trigger level to 0.5 div.

### Selecting the Field Number

9. Press the **Field** soft key to select the number.

### Selecting the Line Number

10. If the jog shuttle control is not set to Line, press the **Line** soft key.

| Type | TV Type | Polarity | Level  | Field | Line | ENHANCED<br>Frame Skip |
|------|---------|----------|--------|-------|------|------------------------|
| TU   | NTSC    | Neg Pos  | 0.5div | 2 X   | 5    | 2 4 8                  |

11. Turn the jog shuttle to set the line.  
You can use the arrow keys to move between the digits. Pressing **RESET** sets the line No. to 5 (NTSC) or 2 (PAL).

### Selecting Frame Skip

12. Press the **Frame Skip** soft key repeatedly to select the frame skip.

## Explanation

This function lets you set a trigger for video signal input into Channel 1. Settings and functions are as follows.

### Broadcasting Systems with which the TV Trigger can be Used

NTSC, PAL

### Selecting the field No.: Field

- 1 Detects a field in which the vertical synchronizing pulse and the line start at the same time.
- 2 Detects a field in which the vertical synchronizing pulse starts 1/2H (H: horizontal scan time) after the line starts.
- X Detects both of the above types of field.

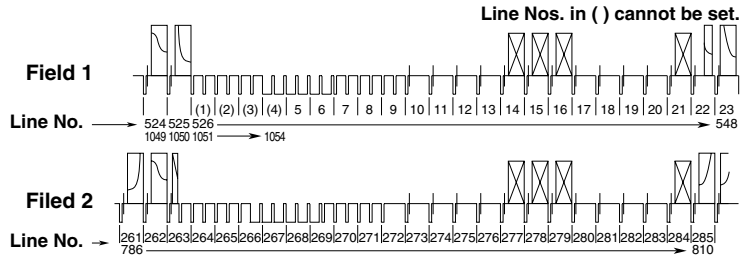


**Selecting the Line No.: Line**

A trigger is activated at the beginning of the selected line.

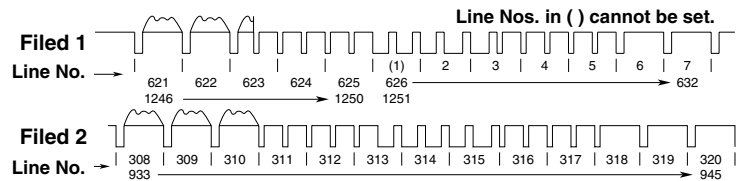
• **NTSC: 5 to 1054**

Field 1 starts at line No. "5." (Field 2 starts at line No. "268.")

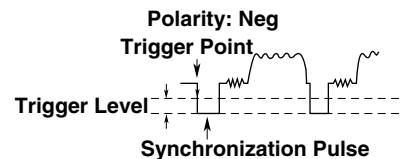
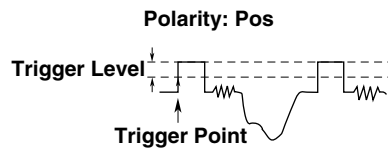


• **PAL: 2 to 1251**

Field 1 starts at line No. "2." (Field 2 starts at line No. "315.")



**Selecting the Polarity**



**Setting the Trigger Level: Level**

Set the difference between the beginning of the synchronization pulse and the level at which the trigger level is judged.

The setting range is from 0.1 div to 2.0 div. The setting resolution is 0.1 div.

The default setting is 0.5 div.

**Setting the Frame Skip: Frame**

This is a function for skipping frames when the color burst is inverted on every frame.

You can select how many frames to skip from the following choices.

Frame1: Trigger every frame at the specified field.

Frame2: Trigger every two frames at the specified field.

Frame4: Trigger every four frames at the specified field.

Frame8: Trigger every eight frames at the specified field.

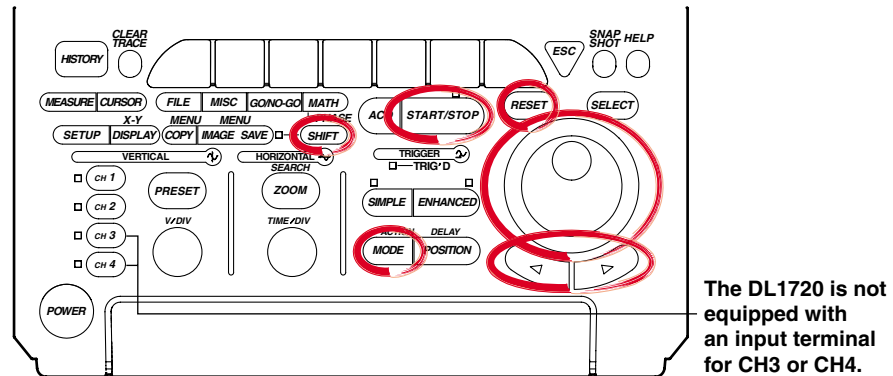
**Precautions to be Taken when Setting the TV Trigger**

- Video signals can only be input to CH1. All other channels do not support video signals.
- Hold-off, trigger coupling, and HF rejection settings are ignored.

## 6.15 Setting the Action-On Trigger

<For a description of this function, refer to page 1-11>

### Relevant Keys



### Operating Procedure

1. Press **SHIFT** to activate shift mode.  
Functions marked in purple on the panel become active.
2. Press **MODE**.

#### Turning ON/OFF the Action

3. Press the soft key corresponding to the action you wish to enable and select ON.

|        |              |           |            |           |           |            | ACTION |
|--------|--------------|-----------|------------|-----------|-----------|------------|--------|
| Buzzer | Save to File | Hard Copy | Image Save | Acq Count | Send Mail | Mail Count | Exec   |
| OFF    | ON           | OFF       | ON         | OFF       | ON        | 100        |        |

#### Selecting the Number of Waveform Acquisitions

4. Turn the jog shuttle to set the waveform acquisition count.  
You can use the arrow keys to move between the digits. In addition, pressing **RESET** sets the count to Infinite.

#### Executing the Action-On-Trigger

5. Pressing the **Exec** soft key starts the waveform acquisition and executes the action-on-trigger.

#### Aborting the Action-On-Trigger

6. Pressing the **Abort** soft key or **START/STOP** stops the waveform acquisition and aborts the action-on-trigger.

**Explanation****Operation to Perform when the Trigger is Activated:**

The specified operation from the following list is performed every time a trigger is activated.

**Hard Copy:** Outputs the screen image data to the destination (Built-in, USB, or Net Print (Ethernet interface option)) that was specified in “Copy to” of the Copy menu.

**Image Save:** Saves the screen image data to the output destination (FD, Zip disk, or SCSI (when SCSI and serial interface option are installed) that you specified in the Image Save menu.

**Save to File:** Saves the waveform data, the automated measurement value of waveform parameters, or snapshot waveforms to the storage medium (FD, Zip disk, or SCSI (option) and so on) specified in the File menu.

**Buzzer:** Sounds an alarm.

**Send Mail:** Sends a mail (Ethernet Interface option): For details, see section 13.7, “Using the Mail Function (Action Mail Function).”

**Note**

When the action-on-trigger is started, the specified operation is performed when the trigger is activated in the normal mode regardless of the trigger mode setting.

**Number of Operations: ACQ Count**

1 to 65536: Repeats the operation the specified number of times.

Infinite: Repeats the operation until the waveform acquisition is stopped.

**Save to File/Hard Copy/Image Save Operation**

Operates according to the settings in the FILE, COPY, or Image Save menu.

**File name of Image Save or Save to File.**

Saved using AUTO Name. For details, see section 10.4, “Storing Screen Image to the Storage Medium” or section 11.6, “Saving/Loading Waveform Data.”

**Send Mail Operation**

Sends e-mail messages to the address specified through MISC > Network > Mail Setup > Mail Address.

**Precautions to be Taken when Setting the Action-On-Trigger**

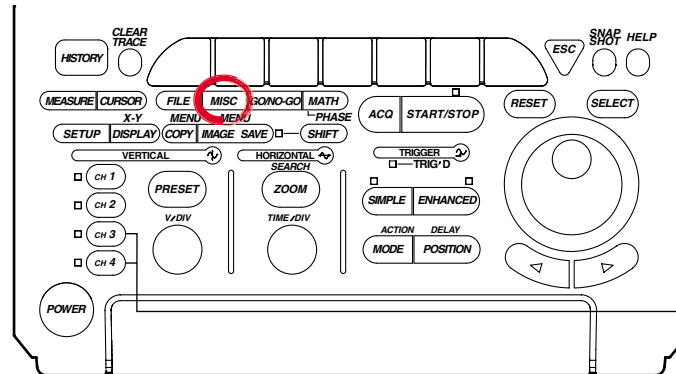
- Action-on-trigger cannot be used when the action mode is Average or Box Average.
- The settings cannot be changed during an action-on-trigger.

**Trigger Mode**

The trigger mode is set to Single.

## 6.16 Setting the Trigger Gate

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **MISC**.
2. Pressing the **System Cnfg** soft key displays the system configuration menu.

| MISC        |             |         |         |             |          |
|-------------|-------------|---------|---------|-------------|----------|
| Calibration | Remote Cntl | SCSI ID | Network | System Cnfg | Overview |
|             |             |         |         |             | Next 1/2 |

3. Press the **Trigger Gate** soft key to select **Active H**, **Active L**, or **OFF**.

| System Cnfg |             |           |               |           |  |
|-------------|-------------|-----------|---------------|-----------|--|
| MISC        |             |           |               |           |  |
| Message     | Click Sound | Date/Time | Offset Cancel | Trig Gate |  |
| JPN ENG     | OFF ON      |           | OFF ON        | OFF       |  |

The default setting is OFF.

| System Cnfg |             |           |               |           |                   |
|-------------|-------------|-----------|---------------|-----------|-------------------|
| Message     | Click Sound | Date/Time | Offset Cancel | Trig Gate |                   |
| JPN ENG     | OFF ON      |           | OFF ON        | OFF       |                   |
|             |             |           |               | OFF       | Active H Active L |

## Explanation

The trigger gate is used to set the timing to enable the specified trigger conditions.

OFF: Waveforms are acquired when the trigger conditions are met.

Active High: When the external signal is Low, waveforms are not acquired even if the trigger conditions are met. When the external signal is High, waveforms are acquired when the trigger conditions are met.

Active Low: When the external signal is High, waveforms are not acquired even if the trigger conditions are met. When the external signal is Low, waveforms are acquired when the trigger conditions are met.

When trigger gate is active, A→B(N) trigger and A delay B trigger can not be specified.

### Level

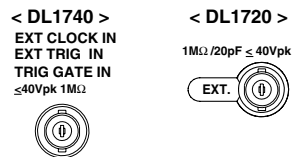
High and low are determined based on the external trigger level. See section 6.6.

The external signal is applied to the terminal on the rear panel (or the front panel for the DL1720) that is shared between external triggers, external clock, and trigger gate.

## Trigger Gate Input Terminal

The external trigger input terminal or external clock input terminal is also used as a trigger gate terminal. If you wish to enable the trigger using an external signal, apply an external signal to this terminal.

### [Input Terminal]



(On the DL1740 it is located on the rear panel,  
or on the DL1720 it is located on the front panel.)

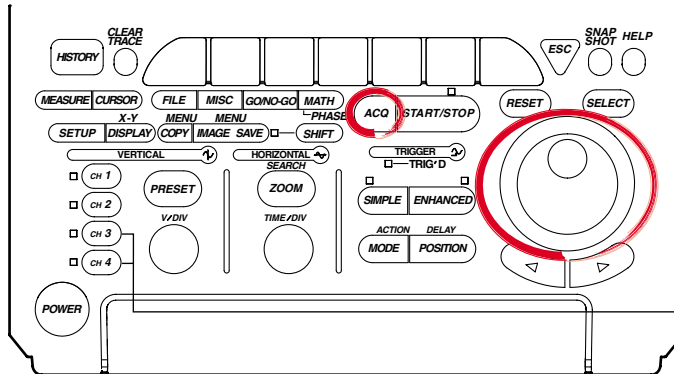
### Specifications

|                          |  |
|--------------------------|--|
| Connector Type:          | BNC  |
| Maximum Input Voltage:   | ±40 V(DC + AC <sub>peak</sub> ) or 28 V <sub>rms</sub> when the frequency is less than or equal to 10 kHz  |
| Frequency Range:         | DC to 50 MHz   |
| Input Impedance:         | Approx. 1 MΩ, approx. 18 pF (1 MΩ and 20 pF for the DL1720)  |
| Input Range:             | ±2 V (for the DL1740)<br>±1 V (for the DL1720 with the ±1 V range selected)<br>±10 V (for the DL1720 with the ±10 V range selected)  |
| Minimum Input Amplitude: | 0.1 V <sub>p-p</sub> (for the DL1740)<br>0.1 V <sub>p-p</sub> (for the DL1720 with the ±1 V range selected)<br>1 V <sub>p-p</sub> (for the DL1720 with the ±10 V range selected) |
| Minimum Pulse Width:     | At least 10 ns for both High and Low   |

# 7.1 Setting the Record Length

<For a description of this function, refer to page 1-14>

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

1. Press **ACQ**.
2. Press the **Record Length** soft key to set the jog shuttle action to Record Length.

| Record Length |  | Mode   |  | Interleave |    | Repetitive |    | Time Base |     |
|---------------|--|--------|--|------------|----|------------|----|-----------|-----|
| 10k           |  | Normal |  | OFF        | ON | OFF        | ON | Int       | Ext |

3. Select the length by turning the jog shuttle. choose 1 k to 1 M.

## Explanation

The record length sets the amount of data to be written into the acquisition memory. Available length settings are as follows:  
 1 kwords, 10 kwords, 50 kwords, 100 kwords, 250 kwords, 500 kwords, (1 Mwords)  
 (Value in parenthesis is available only if interleave mode is ON.)

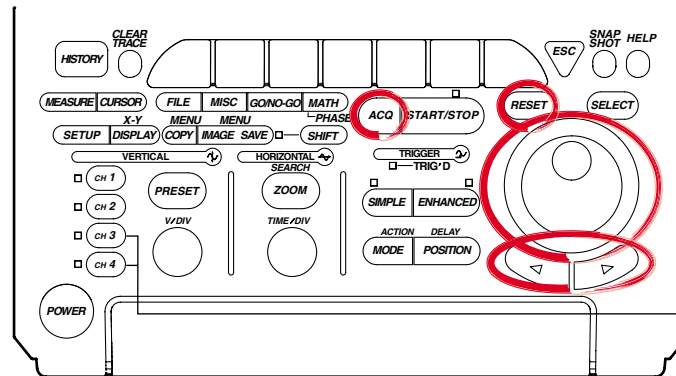
### Setting Precautions

- The sampling rate and displayed record length vary according to the T/div setting. For details, see appendix 1.
- The maximum record length for box average is half the record length indicated above.

## 7.2 Acquisition Mode

<For a description of this function, refer to page 1-14>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Setting the Acquisition Mode

1. Press **ACQ**.
2. Press the **Mode** soft key to display the acquisition mode menu.

|               |        |          |            |            |           |     | ACQ |  |
|---------------|--------|----------|------------|------------|-----------|-----|-----|--|
| Record Length | Mode   | Count    | Interleave | Repetitive | Time Base |     |     |  |
| 10k           | Normal | Infinite | OFF        | ON         | INT       | Ext |     |  |

3. Press the soft key corresponding to the desired mode ranging from **Normal** to **Box Avg**.

You may not be able to select some modes depending on the record length and sample rate settings.

|               |        |          |            |            |           |     | ACQ |  |
|---------------|--------|----------|------------|------------|-----------|-----|-----|--|
| Record Length | Mode   | Count    | Interleave | Repetitive | Time Base |     |     |  |
| 10k           | Normal | Infinite | OFF        | ON         | INT       | Ext |     |  |

#### Setting the Acquisition Count

4. Press the **Count** soft key.  
This is not available when the trigger mode is Single or Single (N).

|               |        |          |            |            |           |     | ACQ |  |
|---------------|--------|----------|------------|------------|-----------|-----|-----|--|
| Record Length | Mode   | Count    | Interleave | Repetitive | Time Base |     |     |  |
| 10k           | Normal | Infinite | OFF        | ON         | INT       | Ext |     |  |

5. Turn the jog shuttle to set the acquisition count.  
You can use the arrow keys to move between the digits.  
In addition, pressing **RESET** sets the count to Infinite.  
When the acquisition mode is Average and you have selected Infinite, go to step 6.

|               |        |          |            |            |           |     | ACQ |  |
|---------------|--------|----------|------------|------------|-----------|-----|-----|--|
| Record Length | Mode   | Count    | Interleave | Repetitive | Time Base |     |     |  |
| 10k           | Normal | Infinite | OFF        | ON         | INT       | Ext |     |  |

#### Setting the Attenuation (When the Acquisition Mode is Average and the Count is Set to Infinite)

6. Press the **Weight** soft key.

|               |         |          |        |            |            |           | ACQ |  |
|---------------|---------|----------|--------|------------|------------|-----------|-----|--|
| Record Length | Mode    | Count    | Weight | Interleave | Repetitive | Time Base |     |  |
| 10k           | Average | Infinite | 16     | OFF        | ON         | INT       | Ext |  |

7. Turn the jog shuttle to set the attenuation.

## Explanation

You can select any of five acquisition modes, as follows. The default selection is Normal.

### Normal

The instrument writes sample data into acquisition memory without performing 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.

- **Setting Restriction**

This mode can be selected in normal mode when the time axis is 200 MS/s or lower (500 MS/s for the interleave mode). For all other cases, the acquisition mode is set to normal even if envelope is specified.

### Average

The instrument calculates average values and writes these into the acquisition memory. If the acquisition count is set to Infinite, the instrument uses exponential averaging, and you are required to set a Weight value. If the count is set to a numerical value (from 2 to 65536), the instrument calculates simple averages using the specified number of readings.

#### Exponential Averaging(Count=Infinite)

$$A_n = \frac{1}{N} \{(N - 1)A_{n-1} + X_n\}$$

**A<sub>n</sub>** : Value Obtained after nth Averaging  
**X<sub>n</sub>** : nth Measured Value  
**N** : Attenuation Constant  
 (2 to 256, in Steps of 2<sup>n</sup>)

#### Linear Averaging(Count=2 to 65536)

$$A_N = \frac{\sum_{n=1}^N X_n}{N}$$

**X<sub>n</sub>** : nth Measured Value  
**N** : Number of Averaging Times  
 (Acquisition Count,  
 in Steps of 2<sup>n</sup>)

Exponential averaging cannot be used when trigger mode is single or single (N).

Simple averaging cannot be used with repetitive sampling. The maximum record length is 500 k (1 M) Word during simple averaging. (Value in parenthesis is available only if interleave mode is ON.)

For more information about the relationship when roll mode or repetitive sampling mode is active or trigger mode is single or single (N), refer to appendix 1.

### Box Average

For details, see section 7.4.

### Acquisition Count

The available count settings are indicated below. If you set the value to Infinite, acquisition will continue until you switch it off with **START/STOP**.

The default count is Infinite. You cannot change the acquisition count during measurement. The new value is activated when the measurement is stopped.

- If Normal, Envelope, or BoxAverage mode  
2 to 65536 (in steps of 1), Infinite
- If Average mode  
2 to 65536 (in steps of 2<sup>n</sup>), Infinite



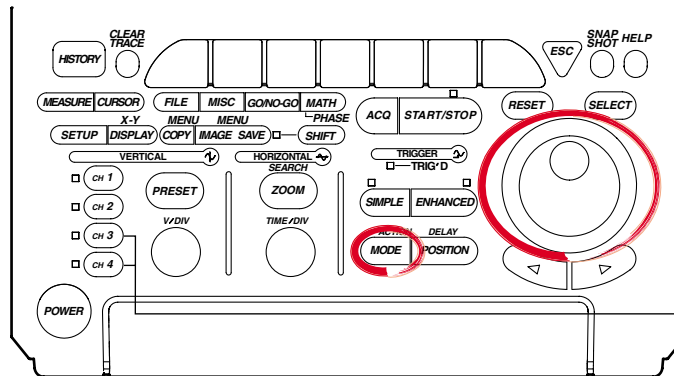
### Important Information about the Averaging Mode

- Averaging mode is useful when working with repetitive waveforms.
- Correct averaging is not possible if the waveform has imperfect triggering, since synchronization will be poor and the displayed waveform will be distorted. When working with this type of signal, set the trigger mode to Normal, so that the waveform display is updated only when the trigger occurs. (See section 6.1)
- Roll mode display is disabled during averaging.
- If you stop waveform acquisition by pressing **START/STOP**, the averaging process also stops. Averaging restarts from the beginning when acquisition resumes.
- If you are using simple averaging, the DL1720/DL1740 terminates acquisition automatically when it completes the specified number of acquisitions (as set by the acquisition count).
- During repetitive sampling mode, only the exponential averaging is performed.

## 7.3 Using Sequential Store Function

<For a description of this function, refer to page 1-16>

### Relevant Keys

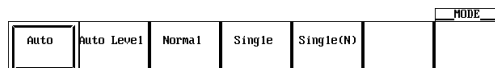


The DL1720 is not equipped with an input terminal for CH3 or CH4.

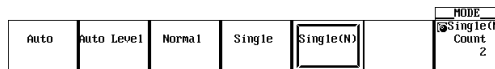
### Operating Procedure

#### Setting the Trigger Mode

1. Press **MODE**.
2. Press the **Single(N)** soft key to set the trigger mode to Single(N).



3. Turn the jog shuttle to set the **Single(N) Count**.



### Explanation

By setting the trigger mode to Single(N), the sequential store function can be used.

#### Acquisition Count

Available numerical settings are as follows. The setting range varies according to the record length.

| Record Length | Normal Mode    | Box Average Mode |
|---------------|----------------|------------------|
| 1 kwords      | 1 to 256 (512) | 1 to 128 (256)   |
| 10 kwords     | 1 to 32 (64)   | 1 to 16 (32)     |
| 50 kwords     | 1 to 8 (16)    | 1 to 4 (8)       |
| 100 kwords    | 1 to 4 (8)     | 1 to 2 (4)       |
| 250 kwords    | 1 to 2 (4)     | 1 to 1 (2)       |
| 500 kwords    | 1 (2)          | (1)              |
| 1 Mwords      | (1)            | —                |

\* ( ) = This setting available only when interleave mode is ON.

#### Waveform Display Method

You can recall waveforms from memory in the same way as you do when working with the history function. For details, refer to section 7.7, "Using the History Memory."

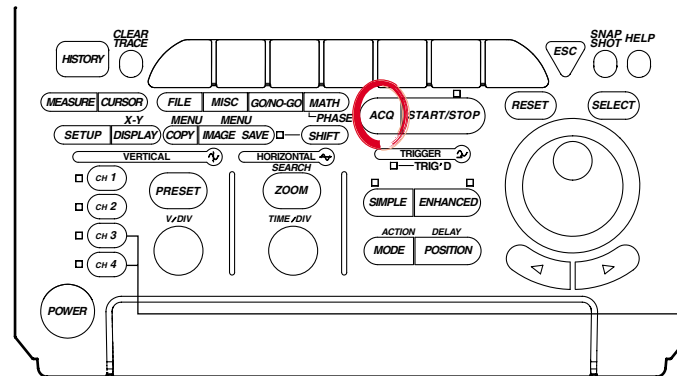
#### Restrictions and Precautions

- You can not use this mode together with repetitive sampling or roll mode.
- If you stop waveform acquisition by pressing **START/STOP**, sequential storage also stops. It then restarts again from the beginning when acquisition resumes.

## 7.4 Box Average Mode

<For a description of this function, refer to page 1-15>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **ACQ**.
2. Press the **Mode** soft key to display the acquisition mode menu.

| Record Length | Mode   | Interleave | Repetitive | ACQ       |
|---------------|--------|------------|------------|-----------|
| 10k           | Normal | OFF        | ON         | [int] Ext |

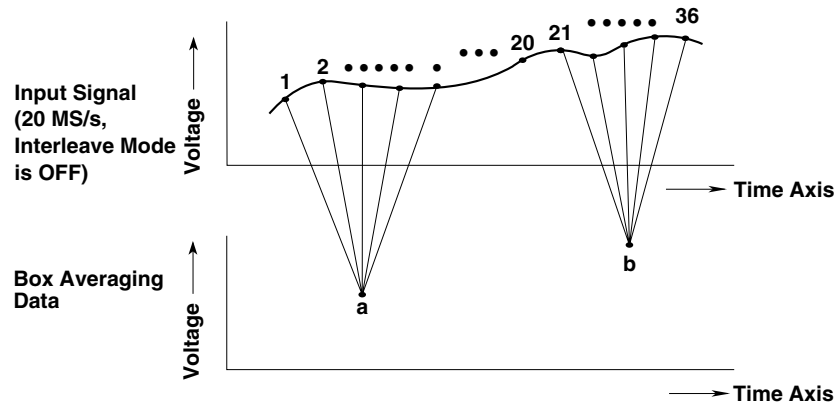
3. Press the **Box Avg** soft key to select it.

| Record Length | Mode   | Envelope | Average | Box Avg | Repetitive | ACQ |           |
|---------------|--------|----------|---------|---------|------------|-----|-----------|
| 10k           | Normal | Envelope | Average | Box Avg | OFF        | ON  | [int] Ext |

## Explanation

Under most conditions the instrument samples the input signal at a true (internal) sampling rate of 400 MS/s (1 GS/s or 800 MS/s during interleave mode), extracts values from this “sample stream” at the effective sample rate required by the T/div setting, and writes the extracted values into the acquisition memory.

When you use box-average mode, however, the operation is different. Instead of pulling values from the sample stream, the instrument computes average values for adjacent groups of true sampling data, and writes the resulting averages into acquisition memory. The following drawing illustrates the process.



### Data Samples Used for Averages

|                  | Interleave OFF                           | Interleave ON                             |
|------------------|--|---|
| 500 MS/s         | —  | 2 points every 2 points of 1 GS/s         |
| 200 MS/s         | 2 points every 2 points of 400 MS/s      | 4 points every 4 points of 800 MS/s       |
| 100 MS/s         | 4 points every 4 points of 400 MS/s      | 8 points every 8 points of 800 MS/s       |
| 50 MS/s          | 8 points every 8 points of 400 MS/s      | 16 points every 20 points of 800 MS/s     |
| 20 MS/s          | 16 points every 20 points of 400 MS/s    | 32 points every 40 points of 800 MS/s     |
| 10 MS/s          | 32 points every 40 points of 400 MS/s    | 64 points every 80 points of 800 MS/s     |
| 5 MS/s           | 64 points every 80 points of 400 MS/s    | 128 points every 200 points of 800 MS/s   |
| 2 MS/s           | 128 points every 200 points of 400 MS/s  | 256 points every 400 points of 800 MS/s   |
| 1 MS/s           | 256 points every 400 points of 400 MS/s  | 256 points every 800 points of 800 MS/s   |
| 500 kS/s or less | 256 points every 800* points of 400 MS/s | 256 points every 1600* points of 800 MS/s |

\* Re-sampling interval is shifted by the sample rate. The maximum number of data points to perform BoxAverage process is 256.

### Record-Length Setting Limit

Not above 500 kWord (1 MWord with interleave ON)

### Sampling-Rate Setting Limit

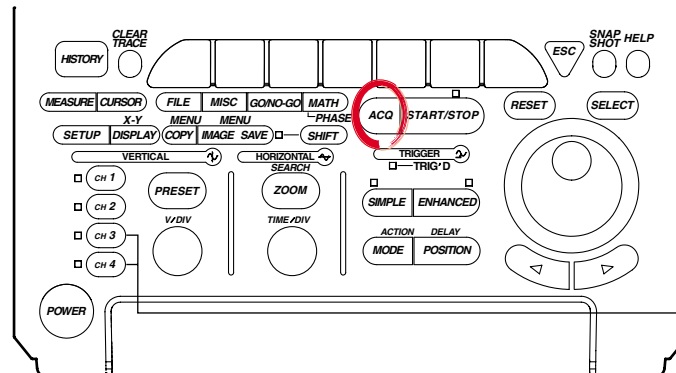
Not above 200 MS/s (or 500 MS/s with interleave ON).

If the sample rate exceeds 200 MS/s (500 MS/s when interleave is ON), the mode is set to normal mode even if box average is specified.

## 7.5 Using Interleave Mode

<For a description of this function, refer to page 1-14>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **ACQ**.
2. Press the **Interleave** soft key to select ON or OFF.

| Record Length | Mode   | Interleave | Repetitive | ACQ Time Base |
|---------------|--------|------------|------------|---------------|
| 10k           | Normal | OFF ON     | OFF ON     | [Int] Ext     |

### Explanation

This mode doubles the amount of memory per channel, while cutting the number of channels in half. In particular, this mode doubles the maximum settings for history memory, sequential store, and record length, and allows you to set the realtime sampling rate to 1 GS/s.

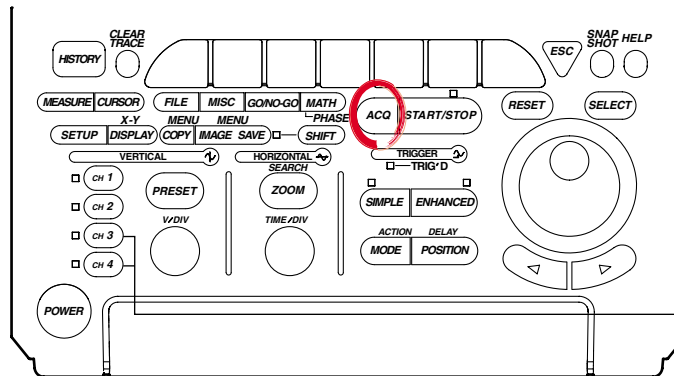
Setting interleave ON, however, disables CH2 and CH4 (or CH2 for the DL1720).

For details about restrictions on the sampling rate and record length while interleave is ON, see appendix 1.

## 7.6 Setting Repetitive Sampling Mode ON/OFF

<For a description of this function, refer to pages 1-7 and 1-16>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **ACQ**.
2. Press the **Repetitive** soft key to select ON or OFF.

| Record Length | Mode   | Interleave | Repetitive | Time Base |
|---------------|--------|------------|------------|-----------|
| 10k           | Normal | OFF        | ON         | Int Ext   |

### Explanation

You can select whether or not to use repetitive sampling. If the repetitive sampling mode is ON, the sampling rate (for certain T/div settings) is set to 1 GS/s or above (2 GS/s or above when the interleave mode is ON).

If repetitive sampling mode is OFF, the maximum available sampling rate is 500 MS/s (or 1 GS/s with interleave ON), and the instrument will add interpolation to the displayed waveform if the number of display points is less than 500.

However, even if the repetitive sampling is turned OFF, the mode is set to repetitive sampling depending on the time axis setting.

#### T/div for Repetitive Sampling

If repetitive mode is ON, the sampling mode is switched to repetitive sampling for T/div settings as follows.

Available T/div setting varies according to the record length.

| Record Length | T/div  |
|---------------|--|
| 1 kwords      | 1 ns/div to 100 ns/div (1 ns/div to 50 ns/div) |
| 10 kwords     | 1 ns/div to 1 ms/div (1 ns/div to 500 ns/div)  |
| 50 kwords     | 1 ns/div to 5 ms/div (1 ns/div to 2 ms/div)    |
| 100 kwords    | 1 ns/div to 10 ms/div (1 ns/div to 5 ms/div)   |
| 250 kwords    | 1 ns/div to 20 ms/div (1 ns/div to 10 ms/div)  |
| 500 kwords    | 1 ns/div to 50 ms/div (1 ns/div to 20 ms/div)  |
| 1 Mwords      | (1 ns/div to 50 ms/div)                        |

\* You cannot use repetitive sampling if the record length is set 500 kwords or above. Values in parentheses above are available only if interleave mode is ON.

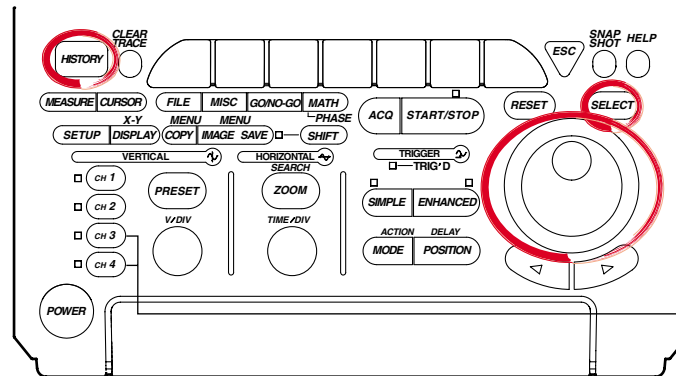
#### Restriction

During repetitive sampling, waveform acquisition is not possible when the trigger mode is Single (N).

## 7.7 Using the History Memory

<For a description of this function, refer to page 1-17>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Recalling Data from the History Memory

1. Press **HISTORY**.
2. Press the **Select Record** soft key.

|   |   |   |          |             |         |
|---|---|---|----------|-------------|---------|
| <input checked="" type="checkbox"/> Select Record | Display                                     | <input checked="" type="checkbox"/> Start Rec | Show Map | Search Mode | HISTORY |
| 0   | One <input checked="" type="checkbox"/> All | 0   |          | OFF         |         |
|   |   | <input checked="" type="checkbox"/> End Rec   |          |             |         |
|   |   | 0   |          |             |         |

3. Turn the jog shuttle to set the record number that you wish to recall. Specify a record number in the range Start Rec to End Rec.
4. Press the **Display Mode** soft key to select One or All. Go to step 5 if you selected All. Otherwise, go to step 8.

#### Setting the Accumulation Range (When Display Mode is All)

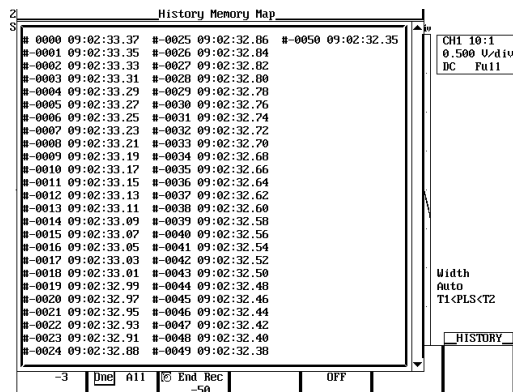
5. Press the **Start Rec/End Rec** soft key.

|   |   |   |          |             |         |
|---|---|---|----------|-------------|---------|
| <input checked="" type="checkbox"/> Select Record | Display                                     | <input checked="" type="checkbox"/> Start Rec | Show Map | Search Mode | HISTORY |
| 0   | One <input checked="" type="checkbox"/> All | 0   |          | OFF         |         |
|   |   | <input checked="" type="checkbox"/> End Rec   |          |             |         |
|   |   | 0   |          |             |         |

6. Turn the jog shuttle to set the first record number to be accumulated.
7. In a similar fashion, set the end record number (End Rec).

### Display a List of Time Stamps

- Pressing the **Show Map** soft key displays a list of acquired data numbers and the time at acquisition end.



- Turn the jog shuttle to select the waveform to be displayed and press **SELECT**.

### Explanation

The acquisition memory retains waveform records generated by the most recent triggers. If a trigger is activated beyond the number of triggers that can be held, the oldest waveform data are cleared. Once the history becomes full, each new trigger causes loss of the oldest waveform record in the memory.

#### Selected Record Number

You can display any waveform from the history by entering its record number. The newest (current) waveform is Record 0, the immediately previous waveform is Record -1, and so on. The range for Selected Record No. is therefore [0 to -(retained waveforms - 1)]. The number of retained waveforms (triggers) depends on the record length, as follows.

| Record Length | Count            |
|---------------|------------------|
| 1 kwords      | 1 to 1024 (2048) |
| 10 kwords     | 1 to 128 (256)   |
| 50 kwords     | 1 to 32 (64)     |
| 100 kwords    | 1 to 16 (32)     |
| 250 kwords    | 1 to 8 (16)      |
| 500 kwords    | 1 to 4 (8)       |
| 1 Mwords      | 1 to 2 (4)       |

\* For each count of the trigger, only the displayed waveform is preserved; past waveform data is not preserved.

( ) = The setting range when interleave mode is ON.

When performing box averaging, the available setting range is 250 kwords or less (or 500 kwords or less with interleave mode ON).

#### Display

- Set to One to display the selected record only.  
Select the waveform to be displayed using Select Record from the specified range between Start Rec and End Rec.
- Set to All to generate overlapped display of all history records from the Start Rec No. to the End Rec No. The waveform corresponding to the Selected Record No. will appear brighter than the other waveforms.



### Show Map (A List of Time Stamps)

You can list the number of the waveform data stored in the acquisition memory and the time at acquisition end.

One screen displays 75 data points of information. You can scroll through the data by using the jog shuttle.

### Precautions and Restrictions

- You cannot use the history function while the acquisition mode is set to Average. (Displayed history records will be meaningless.)
- The history memory function cannot be used in repetitive sampling mode.
- If you suspend waveform acquisition before the current record has been fully read, the record will not be recorded in the history.
- You cannot use the history function while roll mode is selected.
- History records are not lost when waveform acquisition is stopped and then restarted, provided that acquisition conditions remain unchanged.
- If you change the acquisition settings, history memory is cleared when you restart acquisition using the new settings.
- If **CLEAR TRACE** is pressed during waveform acquisition or after the waveform acquisition is stopped, data in the history memory are cleared when the data acquisition is restarted.

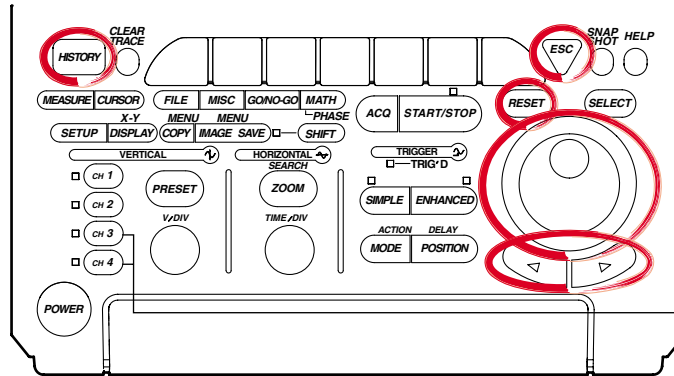
### Precautions to be Taken when Recalling Data from the History Memory

- Acquisition will stop when the history memory menu is displayed. It is not possible to recall waveform data from the history memory while acquisition is in progress.
- Acquisition can be restarted while the history memory menu is displayed. However, it is not possible to change history memory settings such as Selected Record No., while acquisition is in progress.
- Settings are restricted by the following formula.  
$$\text{End Rec No.} \leq \text{Selected Record No.} \leq \text{Start Rec No.}$$
- If you load a waveform record from floppy disk, or external storage device, the loaded waveform becomes Record 0. In the case of multiple records (sequential store), the records will be loaded sequentially, with the latest record as 0.
- Computation and automatic measurement of waveform parameters are always performed on the currently displayed waveform, i.e. the waveform identified by the record No. designated for Selected Record No. Analysis of old data is possible as long as the history memory content remains unchanged after acquisition is restarted.
- In roll mode only the record most recently acquired when acquisition was stopped will be loaded into record No. 0.
- Time at acquisition end is displayed under Show map.
- Turning OFF the power will delete the entire contents of the history memory.

## 7.8 Searching the Historical Data Using Zone (History Search Function)

<For a description of this function, refer to page 1-26>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Selecting the Search Mode

1. Press **HISTORY**.
2. Pressing the **Search Mode** soft key displays the search mode selection menu.

|               |          |           |          |             |         |
|---------------|----------|-----------|----------|-------------|---------|
| Select Record | Display  | Start Rec | Show Map | Search Mode | HISTORY |
| 0             | Time All | 0 End Rec |          | OFF         |         |

3. Press the **Zone** soft key.

|               |          |           |          |      |           |
|---------------|----------|-----------|----------|------|-----------|
| Select Record | Display  | Start Rec | Show Map | Zone | Parameter |
| 0             | Time All | 0 End Rec |          | OFF  |           |

#### Selecting the Search Zone (Select Zone)

4. Pressing the **Search Setup** soft key displays the search condition setting menu.

|               |          |           |          |             |              |             |
|---------------|----------|-----------|----------|-------------|--------------|-------------|
| Select Record | Display  | Start Rec | Show Map | Search Mode | Search Setup | HISTORY     |
| 0             | Time All | 0 End Rec |          | Zone        |              | Search Exec |

5. Press the **Select Zone** soft key to display the search condition selection menu.

|             |            |        |           |            |        |             |
|-------------|------------|--------|-----------|------------|--------|-------------|
| Select Zone | Condition  | Source | Upper     | Left       | Logic  | Search      |
| Zone1       | OFF IN OUT | CH1    | 0.50d iv  | -3.000d iv | AND OR | HISTORY     |
|             |            |        | -0.50d iv | -2.500d iv |        | Search Exec |

6. Press one of the soft keys corresponding to **Zone1** to **Zone4**.

|       |       |       |           |            |        |             |
|-------|-------|-------|-----------|------------|--------|-------------|
| Zone1 | Zone2 | Zone3 | Zone4     | Left       | Logic  | Search      |
|       |       |       | -0.50d iv | -3.000d iv | AND OR | HISTORY     |
|       |       |       |           | -2.500d iv |        | Search Exec |

#### Setting the Search Conditions (Condition)

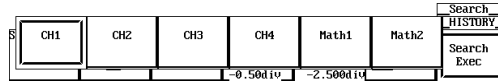
7. Press the **Condition** soft key several times to select OFF, IN, or OUT. Selecting IN or OUT displays a search window in the area displaying the Source channel.

|             |            |        |           |            |        |             |
|-------------|------------|--------|-----------|------------|--------|-------------|
| Select Zone | Condition  | Source | Upper     | Left       | Logic  | Search      |
| Zone1       | OFF IN OUT | CH1    | 0.50d iv  | -3.000d iv | AND OR | HISTORY     |
|             |            |        | -0.50d iv | -2.500d iv |        | Search Exec |

## 7.8 Searching the Historical Data Using Zone (History Search Function)

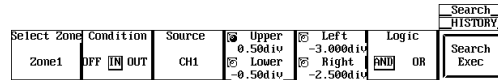
### Setting the Source Channel (Source)

8. Pressing the **Source** soft key displays the source channel selection menu.
9. Press the soft key corresponding to the desired channel to select the source channel. (The CH3, CH4, and Math2 soft keys are not displayed on the DL1720.)

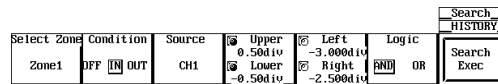


### Setting the Search Window

10. Press the **Upper Lower** soft key.



11. Turn the jog shuttle to set the top of the search range. You can use the arrow keys to move between the digits. Pressing **RESET** resets the value to the default value.
12. Press the **Upper Lower** soft key.
13. Turn the jog shuttle to set the end of the search range. You can use the arrow keys to move between the digits. Pressing **RESET** resets the value to the default value.
14. By controlling both Upper and Lower using the jog shuttle, you can move the search window up and down without changing the vertical width.



15. In a similar fashion, set the horizontal range of the search window.
16. Repeat steps 6 to 15 to set Zone1 to Zone4.

### Setting the Logic

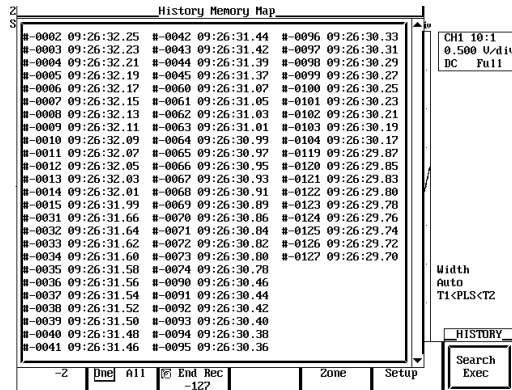
17. Press the **Logic** soft key to select AND or OR.

### Executing the Search

18. Press the **Search Exec** soft key to execute the search.

**Displaying the Waveforms that are Found**

19. Press **ESC** to return to the HISTORY menu.
20. Press the **Show Map** soft key to display a list of the numbers of the acquired waveform data and time at acquisition end.



21. Turn the jog shuttle to select the waveform to be displayed and press **SELECT**.

**Resetting the Search Results**

22. Select **HISTORY > Search Mode > OFF** or turn OFF Zone 1 to Zone 4 and execute the search to reset the search results.

**Explanation**

You can search for a waveform that matches the specified conditions from the past waveforms in the acquisition memory and display it.

**Search Parameters**

Four types of search parameters can be registered in Zone1 to Zone4. You can change the channel that is to be searched, the search condition, and the search range for each search zone.

**Search Condition: Condition**

- IN: Searches for waveforms that pass through the specified search window.
- OUT: Searches for waveforms that do not pass through the specified window.
- OFF: Do not search for waveforms.

**Source Channel: Source**

Search is carried out on the channel that is specified as the Source. Waveforms of other channels are also displayed.

**The Vertical Range of the Search Window (Upper/Lower)**

The range is  $\pm 4$  div. The resolution is 0.01 div. Upper must always be greater than or equal to Lower.

**The Horizontal Range of the Search Window (Left/Right)**

The range is  $\pm 5$  div. The resolution is (10 div/displayed record length). Right must always be greater than or equal to left.

**Search Logic: Logic**

- AND: Searches for waveforms that meet all search conditions from Zone1 to Zone4.
- OR: Searches for waveforms that meet any one of the search conditions from Zone1 to Zone4.

## **7.8 Searching the Historical Data Using Zone (History Search Function)**

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### **Search Range of the Historical Data**

The search range is between the Start Rec and the End Rec.

### **Search Order**

The search is carried out from the newest waveform to the oldest waveform.

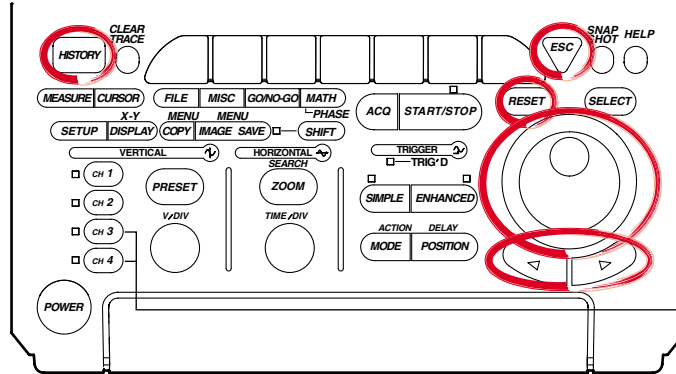
### **Show Map (A List of Time Stamps)**

Only the waveforms that are found are displayed in Show Map. If the Search Mode is turned OFF, all waveforms are displayed.

# 7.9 Searching the Historical Data Using Parameters (History Search Function)

<For a description of this function, refer page 1-26>

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

### Select the Search Mode

1. Press **HISTORY**.
2. Press the **Search Mode** soft key to display the search mode selection menu.

|               |         |           |          |             |         |
|---------------|---------|-----------|----------|-------------|---------|
| Select Record | Display | Start Rec | Show Map | Search Mode | HISTORY |
| 0             | All     | 0         |          | OFF         |         |
|               |         | End Rec   |          |             |         |
|               |         | -94       |          |             |         |

3. Press the **Parameter** soft key.

|               |         |           |          |     |      |           |
|---------------|---------|-----------|----------|-----|------|-----------|
| Select Record | Display | Start Rec | Show Map | OFF | Zone | Parameter |
| 0             | All     | 0         |          |     |      |           |
|               |         | End Rec   |          |     |      |           |
|               |         | -94       |          |     |      |           |

### Select the Search Criteria (Select Param)

4. Press the **Search Setup** soft key to display the Search Criteria Setting menu.

|               |         |           |          |             |              |         |
|---------------|---------|-----------|----------|-------------|--------------|---------|
| Select Record | Display | Start Rec | Show Map | Search Mode | Search Setup | HISTORY |
| 0             | All     | 0         |          | Parameter   |              |         |
|               |         | End Rec   |          |             |              |         |
|               |         | -94       |          |             |              |         |

5. Press the **Select Param** soft key to display the search criteria selection menu.

|              |           |            |       |       |           |         |
|--------------|-----------|------------|-------|-------|-----------|---------|
| Select Param | Condition | Item Setup | Upper | Logic | T-Range1  | Search  |
| Param1       | OFF       | CH1        | XXX   | AND   | -5.000d10 | HISTORY |
|              | IN        | P-P        | Lower | OR    | T-Range2  | Search  |
|              | OUT       |            | XXX   |       | 5.000d10  | Exec    |

6. Press one of the soft keys for **Param1 - Param4** to select the search criterion.

|        |        |        |        |       |           |         |
|--------|--------|--------|--------|-------|-----------|---------|
| Param1 | Param2 | Param3 | Param4 | Logic | T-Range1  | Search  |
|        |        | P-P    | XXX    | AND   | -5.000d10 | HISTORY |
|        |        |        |        | OR    | T-Range2  | Search  |
|        |        |        |        |       | 5.000d10  | Exec    |

### Setting the Condition

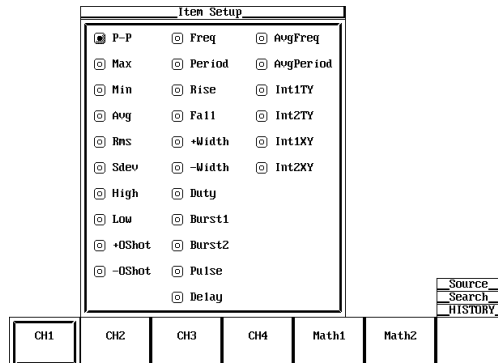
7. Press the **Condition** soft key to select OFF, IN, or OUT.

|              |           |            |       |       |           |         |
|--------------|-----------|------------|-------|-------|-----------|---------|
| Select Param | Condition | Item Setup | Upper | Logic | T-Range1  | Search  |
| Param1       | OFF       | CH1        | XXX   | AND   | -5.000d10 | HISTORY |
|              | IN        | P-P        | Lower | OR    | T-Range2  | Search  |
|              | OUT       |            | XXX   |       | 5.000d10  | Exec    |

## 7.9 Searching the Historical Data Using Parameters (History Search Function)

### Setting the Parameter (Item Setup)

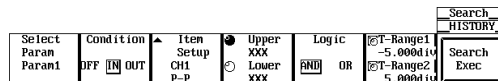
8. Press the **Item Setup** soft key to display the parameter selection menu.
9. Press the soft key corresponding to the channel that you wish to set as the source channel for the parameter search. (The CH3, CH4, and Math2 soft keys are not displayed on the DL1720.)



10. Use the jog shuttle to highlight the parameter to be used in the search, then press **SELECT** to assign the parameter to the channel.

### Set the Condition Range

11. Press the **Upper Lower** soft key to highlight the Upper jog shuttle icon.



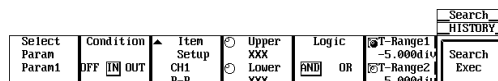
12. Turn the jog shuttle to set the upper edge of the condition range. Use the arrow keys to move between the digits. Press **RESET** to return to the initial value (XXX).
13. Press the **Upper Lower** soft key to highlight the Lower jog shuttle icon.
14. Turn the jog shuttle to set the lower edge of the condition range. Use the arrow keys to move between the digits. Press **RESET** to return to the initial value (XXX).
15. Repeat steps 6 - 14 to set Param1 through Param4.

### Setting the Logic

16. Press the **Logic** soft key to select AND or OR.

### Setting the Parameter Measuring Range

17. Press the **T-Range1/T-Range2** soft key to highlight T-Range1.



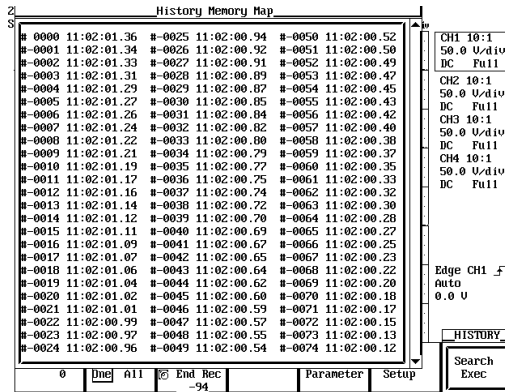
18. Turn the jog shuttle to set the left edge of the measuring range. Use the arrow keys to move between the digits. Press **RESET** to return to the initial value (XXX).
19. Press the **T-Range1/T-Range2** soft key to highlight T-Range2.
20. Turn the jog shuttle to set the right edge of the measuring range. Use the arrow keys to move between the digits. Press **RESET** to return to the initial value (XXX).

**Executing the Search**

21. Press the **Search** soft key to execute the search.

**Displaying the Searched Waveform**

22. Press **ESC** to return to the HISTORY menu.
23. Press the **Show Map** soft key to display a list of the numbers of the searched waveform data and time at acquisition end.



24. Turn the jog shuttle to select the waveform to be displayed and press **SELECT**.

**Resetting the Search Results**

25. If you set the Search Mode to OFF in the HISTORY menu, or if you perform a search with all of the parameters (Param1-Param4) set to OFF, the search results will be reset.

**Explanation**

Search for waveforms from the history memory function and display only the waveforms that fulfill specified conditions of particular parameters.

**Search Criterion**

You can store various kinds of search criteria in Param1-Param4. Within those four search criteria, you can specify the channel to be searched, the search conditions, and the searching range.

**Condition**

- IN: Search for a waveform entering the specified range of the specified parameter.
- OUT: Search for a waveform extending outside the specified range of the specified parameter.
- OFF: Do not search for a waveform.

**Item Setup**

Assign search parameters to each source channel. Choose (only) one of the automated waveform measurement parameters.

**Condition Range (Upper/Lower)**

Set the range that defines the specified parameter's condition.

**Logic Search**

- AND: Search for waveforms fulfilling all of the search criterion in Param1- Param4.
- OR: Search for waveforms fulfilling at least one of the search criterion in Param1- Param4.



## 7.9 Searching the Historical Data Using Parameters (History Search Function)

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### **Parameter Measuring Range (T-Range1/T-Range2)**

Set the measuring range of the specified parameter. This is the portion of the waveform used to determine the values of the parameter.

### **Search Range of the Historical Data**

The search range extends from the Start Rec to the End Rec.

### **Search Method**

Search in order starting with the newest waveform.

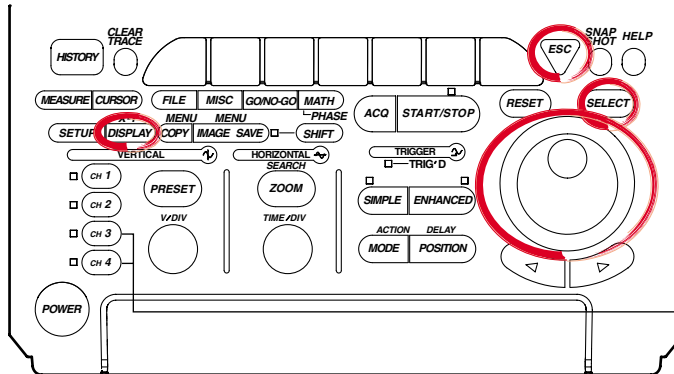
### **Show Map (Timestamp List)**

Only searched waveforms are displayed in Show map. When Search Mode is OFF, all waveforms are displayed.

# 8.1 Changing the Display Format

<For a description of this function, refer to page 1-17>

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

1. Press **DISPLAY**.
2. Pressing the **Format** soft key displays the format menu.

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

3. Press the soft key corresponding to the desired format. (Quad and Hexa are not displayed on the DL1720.)

| Single | Dual | Triad | Quad | Hexa | Accumulate | DISPLAY  |
|--------|------|-------|------|------|------------|----------|
|        |      |       |      |      | OFF        | Next 1/2 |

4. Press the **Next 1/2** soft key to display the Next 2/2 menu.

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

Press the **Mapping** soft key to select **Auto**, **Fixed**, or **User**.

| Translucent | Mapping |      |  |  |  | DISPLAY  |
|-------------|---------|------|--|--|--|----------|
| OFF         | ON      | Auto |  |  |  | Next 2/2 |

| Translucent | Mapping | Auto | Fixed | User |  | DISPLAY  |
|-------------|---------|------|-------|------|--|----------|
| OFF         | ON      |      |       |      |  | Next 2/2 |

5. Pressing the **Set Mapping** soft key displays a menu used to assign the waveforms. (On the DL1720, the CH3, CH4, and Math2 settings are not displayed.)

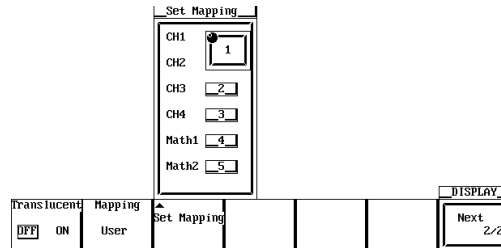
| Translucent | Mapping | Set Mapping |             |  |  | DISPLAY  |
|-------------|---------|-------------|-------------|--|--|----------|
| OFF         | ON      | User        | Set Mapping |  |  | Next 2/2 |

| Set Mapping |   |
|-------------|---|
| CH1         | 0 |
| CH2         | 1 |
| CH3         | 2 |
| CH4         | 3 |
| Math1       | 4 |
| Math2       | 5 |

## 8.1 Changing the Display Format

6. Turn the jog shuttle to move the cursor to the desired channel.
7. Pressing **SELECT** displays a menu used to set the number.



8. Turn the jog shuttle to select a number. Pressing **ESC** closes the menu.
9. Repeat steps 5 to 7 as necessary.

### Explanation

#### Main Format

Single: 1 waveform window      Quad: 4 waveform windows (DL1740 only)  
 Dual: 2 waveform windows      Hexa: 6 waveform windows (DL1740 only)  
 Triad: 3 waveform windows

#### Mapping

Auto<sup>\*1</sup>: Windows are arranged from top to bottom in order: CH1, CH2, ..., Math1, Math2. But no windows are shown for channels whose display is set to OFF.  
 Fixed<sup>\*1</sup>: Channels are displayed, regardless of whether their display setting is ON or OFF, in order of channel number. The Math2 window is at the bottom with the Math1 window directly above it.  
 User<sup>\*1</sup>: Assign numbers from 0 to 5 to CH1, CH2, ..., Math1, and Math2. The display position varies depending on the assigned numbers.

\*1 The DL1720 is not equipped with channels 3, 4, or Math2.

#### Assignment Example when the Display Format is Set to Dual

|                      |                     |         |
|----------------------|---------------------|---------|
| CH1,                 | CH1, CH4            | 0, 2, 4 |
| CH2, CH4             | CH2,                | 1, 3, 5 |
| Fixed (If CH3 = OFF) | Auto (If CH3 = OFF) | User    |

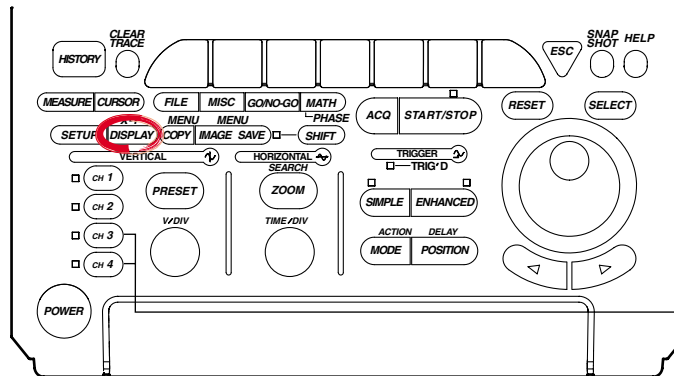
The number of points that can be displayed vertically for each channel varies as follows according to the display format. However, the vertical resolution remains unchanged.

Single(□): 384 points      Quad(☐): 96 points  
 Dual(☐): 192 points      Hexa(☐): 64 points  
 Triad(☐): 128 points

## 8.2 Setting the Interpolation Method

<For a description of this function, refer to page 1-18>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Set the Interpolation Method

1. Press **DISPLAY**.
2. Press the **Interpol** soft key to display the interpolation method menu.

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

3. Press the soft key corresponding to the desired interpolation method.

| Format | Interpol | Graticule | Scale Value | Trace Label | Accumulate | DISPLAY  |
|--------|----------|-----------|-------------|-------------|------------|----------|
| Dual   | OFF      | Sine      | Line        | Pulse       | OFF        | Next 1/2 |

### Explanation

#### Interpolate

Any area along the time axis having less than 500 points per 10 divisions (less than 250 points in the Z1 and Z2 window when displaying Main & Z1 & Z2) is recognized as an interpolation area. If you leave interpolation off, these points will appear as discrete dots (so that the display will show gaps between dots or vertical lines). If you set interpolation on, however, the DL1720/DL1740 will connect the points. Three interpolation settings are available.

Sine (): Interpolates between two dots using a sin x/x function.

Line (): Interpolates between two dots in a straight line.

PULSE (): Draws a horizontal line to a point directly above or below the next data point and then interpolates using two dots so that the end of the horizontal line is connected to the next data point by a vertical line.

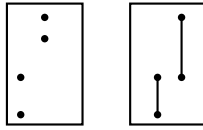
OFF (): No interpolation

## 8.2 Setting the Interpolation Method

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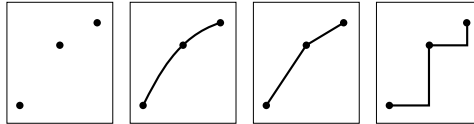
### Outside the Interpolation Area

If interpolation is set to Sine, Line, or Pulse the instrument draws lines between points that are aligned vertically.



Interpolate:    **OFF**    **Sine/Line/Pulse**

### Within the Interpolation Area

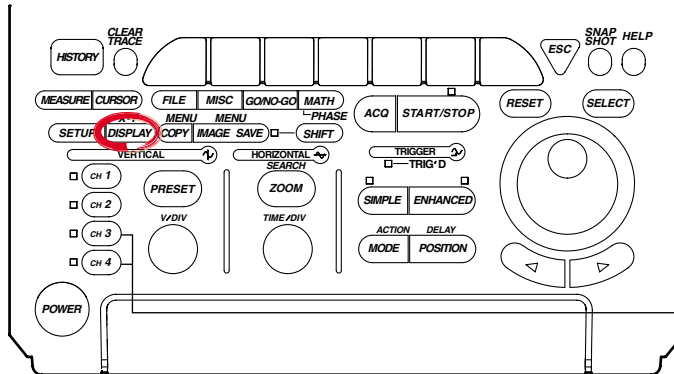


Interpolate:    **OFF**    **Sine**    **Line**    **Pulse**

## 8.3 Changing the Graticule

<For a description of this function, refer to page 1-17>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

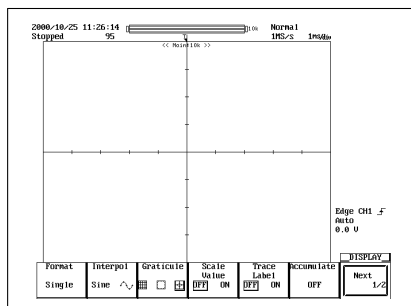
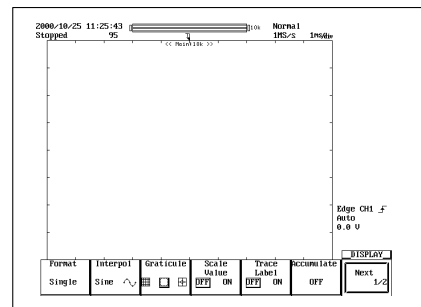
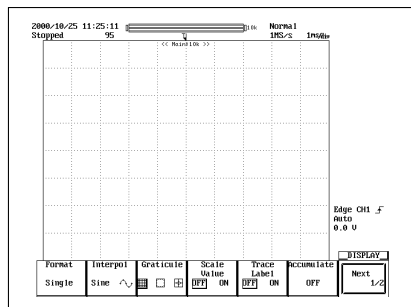
### Operating Procedure

1. Press **DISPLAY**.
2. Press the **Graticule** soft key to select one of the three graticule types.

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

### Explanation

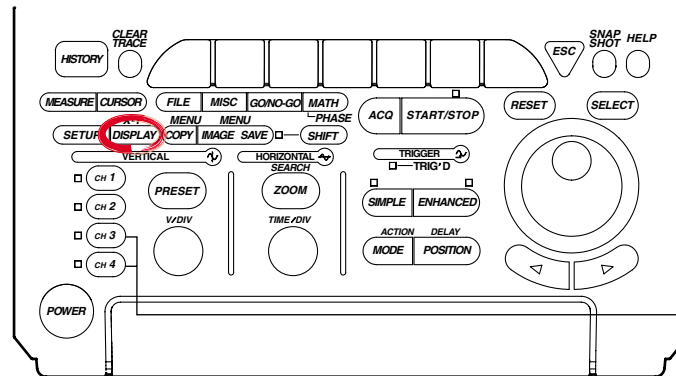
The graticule type can be selected from the following 3 types.



## 8.4 Turning Display of the Scaling Value ON/OFF

<For a description of this function, refer to page 1-17>

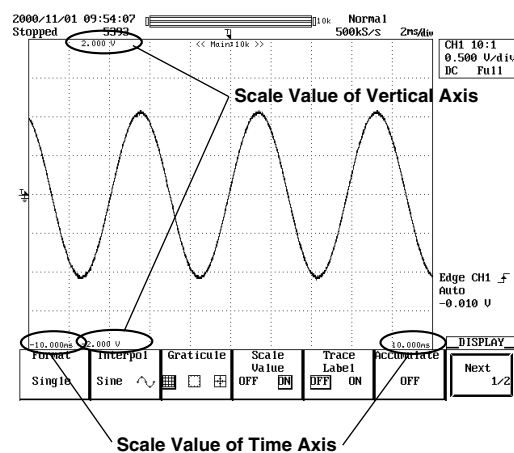
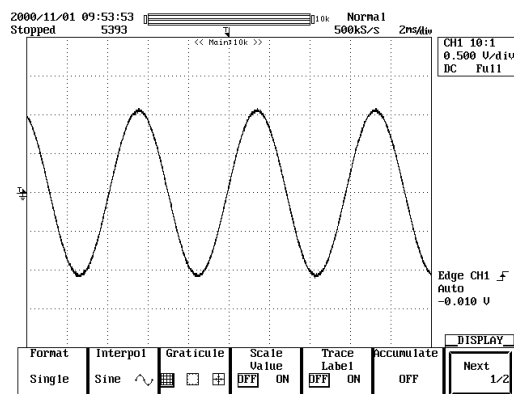
### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **DISPLAY**.
2. Press the **Scale Value** soft key to select ON or OFF.



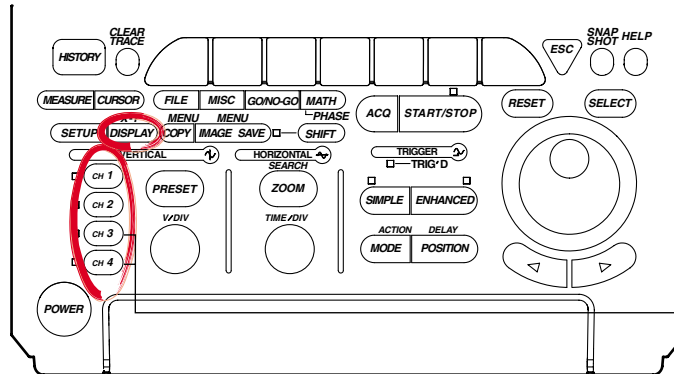
### Explanation

You can display the upper and lower limits of the vertical axis or the axis horizontal of each channel.

## 8.5 Setting the Waveform Labels

<For a description of this function, refer to page 1-18>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Setting the Waveform Label

1. Press one of the keys from **CH 1** to **CH 4** (or **CH 1** to **CH 2** for the DL1720) to select the desired channel.
2. Press the **Next 1/2** soft key to display the Next 2/2 menu.

| Display | Position | Coupling | Probe         | Offset | Bandwidth | CH1      |
|---------|----------|----------|---------------|--------|-----------|----------|
| OFF     | IN       | 0.004iv  | DC1M $\Omega$ | 10:1   | 0.0 V     | Full     |
|         |          |          |               |        |           | Next 1/2 |

3. Press the **Label** soft key to display a keyboard, and enter the waveform label according to the procedures described in section 4.1.

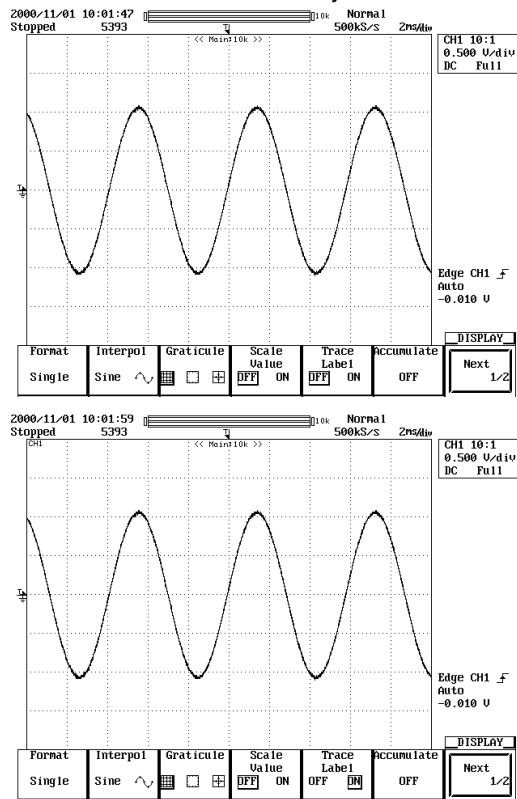
| Variable | Linear Sci | Label | CH1      |
|----------|------------|-------|----------|
| 50.0 v   | OFF ON     | CH1   | Next 2/2 |



## 8.5 Setting the Waveform Labels

### Turning ON/OFF the Waveform Label

4. Press **DISPLAY**.
5. Press the **Trace Label** soft key to select ON or OFF.



### Explanation

#### Label Display ON/OFF (Trace Label)

Use this parameter to select whether or not to include waveform labels (channel identification labels) on the display.

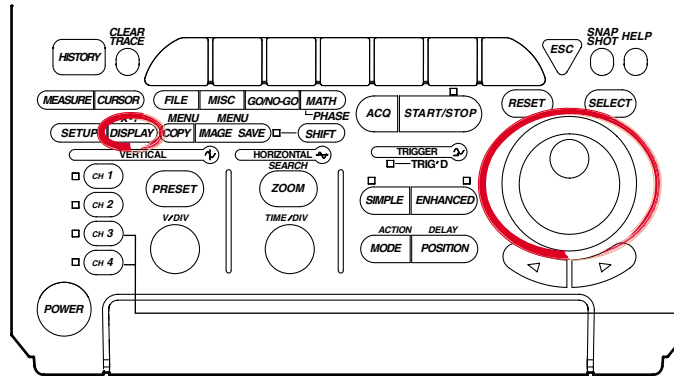
#### Entering Customized Labels

You can use the Define Label feature to enter customized labels for each channel. Each label is a character string of up to eight alphanumeric characters. You can set the label display ON/OFF using the Trace Label function; the label appears in the scale-value display and with measurement results.

## 8.6 Accumulated Waveform Display

<For a description of this function, refer to page 1-16>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Selecting Averaging Mode

1. Press **DISPLAY**.
2. Press the **Accumulate** soft key to display the accumulate mode menu.

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

3. Press the corresponding to the desired accumulate mode.

| DISPLAY |          |           |             |     |         | Next  |
|---------|----------|-----------|-------------|-----|---------|-------|
| Format  | Interpol | Graticule | Scale Value | OFF | Persist | Color |
| Quad    | Sine     |           | OFF ON      |     |         |       |

Proceed to step 4 if you have selected Persist, or to step 5 if you have selected Color.

#### Setting the Accumulative Time (When Persist has been Selected)

4. Turn the jog shuttle to set the desired accumulative time.

| DISPLAY |          |           |             |             |              | Next |
|---------|----------|-----------|-------------|-------------|--------------|------|
| Format  | Interpol | Graticule | Scale Value | Trace Label | Accumulate   | 1/2  |
| Quad    | Sine     |           | OFF ON      | OFF ON      | Persist Time |      |
|         |          |           |             |             | 100ms        |      |

#### Setting the Grade Width (When Color has been Selected)

5. Turn the jog shuttle to set the desired color width.

| DISPLAY |          |           |             |             |             | Next |
|---------|----------|-----------|-------------|-------------|-------------|------|
| Format  | Interpol | Graticule | Scale Value | Trace Label | Accumulate  | 1/2  |
| Quad    | Sine     |           | OFF ON      | OFF ON      | Color Grade |      |
|         |          |           |             |             | 16          |      |

## 8.6 Accumulated Waveform Display

### Explanation

During normal operation, the display is updated every time the trigger is activated making it difficult to capture transient conditions such as sudden distortion of waveforms. By using the accumulate function, the waveform display of the acquired data remains on the screen for the specified time.

#### Accumulate Mode

**Persist:** Accumulate using each channel color. Displayed for the specified time period by gradually lowering the brightness.

**Color:** Accumulate using eight colors that indicate the frequency of waveforms in the data.

#### Accumulation Period (During Persist Mode)

When using the persistence mode, select the period over which waveforms are accumulated from the list below. If you select infinite, the accumulation is carried out infinitely. The default value is 100 ms.

100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, 20 s, 50 s, and Infinite

#### Grade Width (for Color Grade Mode)

In color grade mode, the frequency of data value occurrence is indicated in eight colors as illustrated below. The grade width can be set within the range given below. The default setting is 16.

Overlapping display is performed indefinitely in color grade mode.

2 to 2048 (steps of  $2^n$ )

#### Higher Frequency

|        |            |        |             |
|--------|------------|--------|-------------|
| Red    | 28 or more | Red    | 896 or more |
| Pink   | 24 to 27   | Pink   | 768 to 895  |
| Orange | 20 to 23   | Orange | 640 to 767  |
| Yellow | 16 to 19   | Yellow | 512 to 639  |
| White  | 12 to 15   | White  | 384 to 511  |
| Cyan   | 8 to 11    | Cyan   | 256 to 383  |
| Green  | 4 to 7     | Green  | 128 to 255  |
| Blue   | 1 to 3     | Blue   | 1 to 127    |
| Black  | 0          | Black  | 0           |

When Grade Width = 4

When Grade Width = 128

For example, a dot which has appeared on the screen 100 times is displayed in red if the grade width is 4, or in blue if the grade width is 128.

#### Points for Attention

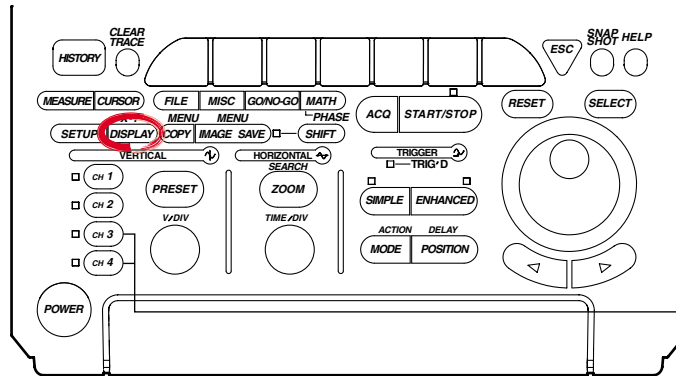
- Automatic measurement of waveform parameters and GO/NO-GO judgment are performed on the latest waveform.
- When displaying all waveforms in the history memory during accumulation, the historical waveforms are displayed using the specified accumulation mode. However the waveform display becomes slow.
- When printing accumulated waveforms using the optional built-in printer, they are printed using two tones.
- Only the latest waveform can be output to an external printer.
- If the waveform acquisition is forcibly stopped by pressing **START/STOP**, the accumulation is temporarily suspended. When the acquisition is restarted, the display is cleared and accumulation continues.

#### Clearing Accumulated Waveforms

You can clear accumulated waveforms by pressing **CLEAR TRACE**.

# 8.7 Turning Translucent Mode ON/OFF

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

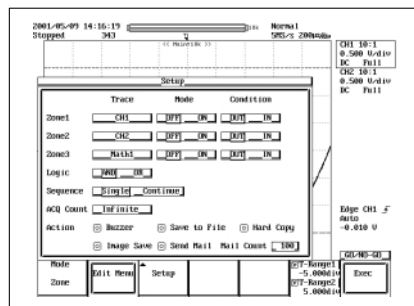
1. Press **DISPLAY**.
2. Press the **Next 1/2** soft key to display the Next 2/2 menu.

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

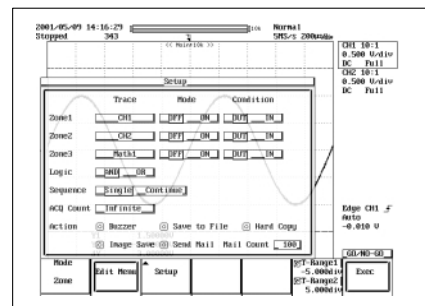
3. Press the **Translucent** soft key to select **ON** or **OFF**.

| Translucent | Mapping |  |  |  |  | DISPLAY  |
|-------------|---------|--|--|--|--|----------|
| OFF ON      | Auto    |  |  |  |  | Next 2/2 |

Translucent: OFF



Translucent: ON



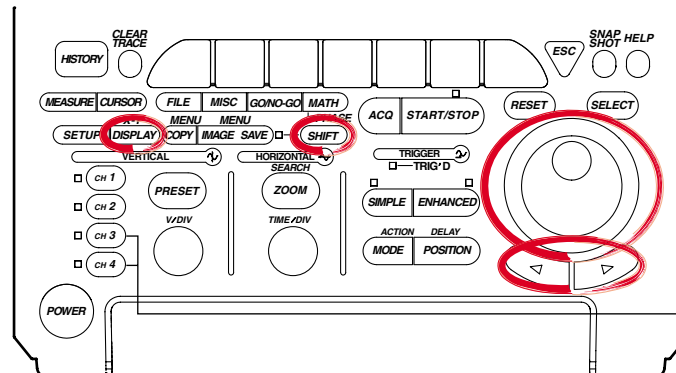
## Explanation

When this is turned to ON, the pop-up menu becomes translucent. The contents underneath the pop-up menu can be seen.

## 8.8 X-Y Waveform Display

<For a description of this function, refer to page 1-19>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **SHIFT** to activate shift mode.  
Functions marked in purple on the panel become active.
2. Press **DISPLAY**.

#### Selecting the Display Format

3. Press the **Mode** soft key to display the mode selection menu.

|      |  |  |  |  |  |     |
|------|--|--|--|--|--|-----|
| Mode |  |  |  |  |  | X-Y |
| T-Y  |  |  |  |  |  |     |

4. Press the **T-Y**, **X-Y**, or **T-Y&X-Y** soft key to set the mode.

|     |     |           |  |  |  |     |
|-----|-----|-----------|--|--|--|-----|
| T-Y | X-Y | T-Y & X-Y |  |  |  | X-Y |
|-----|-----|-----------|--|--|--|-----|

Continue with steps 5 - 12 below if you selected X-Y or T-Y&X-Y.

#### Selecting the X-Axis Mode (DL1740 only)

5. Press the **X Axis** soft key to select Single or Dual.

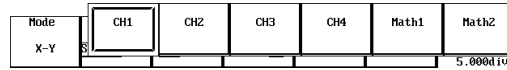
|      |             |         |         |         |         |   |
|------|-------------|---------|---------|---------|---------|---|
| Mode | X Axis      | Select  | Display | X Trace | Y Trace | X-Y   |
| X-Y  | Single Dual | XYZ XYZ | OFF ON  | CH1     | CH2     | T-Range1<br>-5.000div<br>T-Range2<br>5.000div |

#### Selecting the X-Y Waveform (DL1740 only)

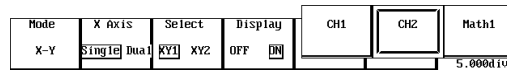
6. Press the **Select** soft key to select the desired X-Y waveform.
7. Press the **Display** soft key to select whether or not to display the X-Y waveform that was selected in step 4.

**Setting the X and Y Axes**

8. Pressing the **X Trace** soft key displays the channel menu.
9. Press the soft key corresponding to the desired channel that you wish to set to the X axis. (The CH3, CH4, and Math2 soft keys are not displayed on the DL1720.)



10. In a similar fashion, set the Y axis by pressing the **Y Trace** soft key.



**Setting the Display Range**

11. Press the **T-Range1/T-Range2** soft key.  
Turn the jog shuttle to set the display T-Range1.
12. In a similar fashion, press the **T-Range1/T-Range2** soft key to set the display T-Range-2.

**Explanation**

**Selecting the X-Axis Mode (DL1740 only)**

Single: Set the X-axis trace of XY1 and XY2 common.  
Dual: Set the X-axis trace individually for XY1 and XY2.

**Assigning X (Horizontal) and Y (Vertical) Axes**

The channels that can be assigned to the X axis and Y axis depending on the X-axis mode as follows:

**DL1740**

| X Axis Mode | X-Y | X Axis                   | Y Axis           |
|-------------|-----|--------------------------|------------------|
| Single      | XY1 | CH1 to CH4, Math1, Math2 | CH1, CH2, Math 1 |
|             | XY2 | CH1 to CH4, Math1, Math2 | CH3, CH4, Math 2 |
| Dual        | XY1 | CH1, CH2, Math1          | CH1, CH2, Math 1 |
|             | XY2 | CH3, CH4, Math2          | CH3, CH4, Math 2 |

**DL1720**

| X Axis Mode | X-Y | X Axis          | Y Axis          |
|-------------|-----|-----------------|-----------------|
| -           | XY1 | CH1, CH2, Math1 | CH1, CH2, Math1 |

**Number of X-Y Waveforms that can be Displayed**

The number of X-Y waveforms that can be displayed is two (XY1, XY2) (or one for the DL1720, XY1). The display of each X-Y waveform can be turned ON/OFF.

**Selecting the Display Format: Mode**

You can choose from the following three display formats.

- T-Y&X-Y: The top window displays normal (T-Y) waveforms. The bottom window displays X-Y waveforms.
- X-Y: Displays only X-Y waveforms.
- T-Y: Displays only T-Y waveforms.

## 8.8 X-Y Waveform Display

---

### Selecting the X-Y Waveform Display Range: T-Range1/T-Range2

The X-Y display shows the range selected on the T-Y waveform.

You can set the start (fine dashed line) and end (coarse dashed line) positions in the range -5 to +5 div from the center of the waveform display frame. The start and end positions are not displayed on the X-Y waveform.

The resolution is as follows.

Resolution:  $T/\text{div} \times 10/\text{displayed record length}$

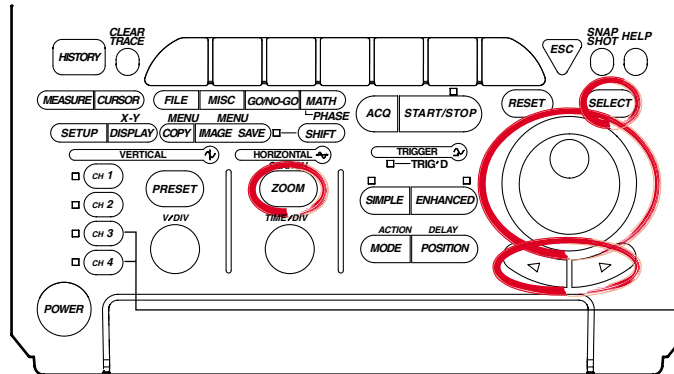
### Precautions to be Taken when Displaying X-Y Waveforms

- The divided windows of the T-Y waveform display when using the T-Y & X-Y format are displayed in accordance with the Format setting specified with **DISPLAY**.
- The zoom function applies only to T-Y waveforms. In addition, Main, Z1, or Z2 can be selected for the T-Y waveform display.
- When expanding the X-Y waveform, change the Variable parameter of each channel. The waveform can be expanded or reduced artificially.

## 8.9 Zooming the Waveform

<For a description of this function, refer to page 1-19>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Selecting the Display Mode

1. Press **ZOOM**.
2. Pressing the **Mode** soft key displays the display format menu.

|      |  |  |  |  |  |      |
|------|--|--|--|--|--|------|
| Mode |  |  |  |  |  | ZOOM |
| Main |  |  |  |  |  |      |

3. Press the soft key corresponding to the desired display format.

|      |         |         |         |         |       |            |
|------|---------|---------|---------|---------|-------|------------|
| Main | Z1 Only | Z2 Only | Main&Z1 | Main&Z2 | Z1&Z2 | Main&Z1&Z2 |
|------|---------|---------|---------|---------|-------|------------|

#### Selecting the Display Format of Zoomed Waveforms.

4. Pressing the **Format** soft key displays the format menu.  
(If you set Mode to Main, the Format selection menu is not displayed.)

|            |        |            |            |                 |                     |                     |
|------------|--------|------------|------------|-----------------|---------------------|---------------------|
| Mode       | Format |            |            |                 |                     | ZOOM                |
| Main&Z1&Z2 | Main   | Allocation | Z1 Mag x 2 | Z1 Pos 0.000div | Fit Meas Ring to Z1 | Fit Meas Ring to Z2 |
|            |        |            | Z2 Mag x 2 | Z2 Pos 0.000div |                     |                     |

5. Press the soft key corresponding to the desired format. (Quad and Hexa are not displayed on the DL1720.)

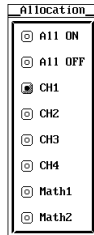
|      |        |      |       |          |      |                     |
|------|--------|------|-------|----------|------|---------------------|
| Main | Single | Dual | Triad | Quad     | Hexa | ZOOM                |
|      |        |      | x 2   | 0.000div |      | Fit Meas Ring to Z2 |



## 8.9 Zooming the Waveform

### Selecting the Zoomed Trace

- Pressing the **Allocation** soft key displays the zoomed trace setting menu. (CH3, CH4, and Math2 are not displayed on the DL1720.)



| Mode       | Format | Allocation | Z1 Mag        | Z1 Pos             | Fit Meas              | ZOOM                  |
|------------|--------|------------|---------------|--------------------|-----------------------|-----------------------|
| Main&Z1&Z2 | Main   | Allocation | Z1 Mag<br>x 2 | Z1 Pos<br>0.000div | Fit Meas<br>Rng to Z1 | Fit Meas<br>Rng to Z2 |
|            |        |            | Z2 Mag<br>x 2 | Z2 Pos<br>0.000div |                       |                       |

- Turn the jog shuttle to move the cursor to the desired trace.
- Press **SELECT** to select the trace.  
Selecting All ON selects all traces that are currently displayed.

### Setting the Zoom Rate

- Press the **Z1 Mag/Z2 Mag** soft key.  
Turn the jog shuttle to set the zoom rate of Z1 zoom box (If you set Mode to Z1, Z1 Mag is displayed. If you select Z2, Z2 Mag is displayed. If you select Z1 and Z2, Z1 Mag/Z2 Mag is displayed.)

| Mode       | Format | Allocation | Z1 Mag        | Z1 Pos             | Fit Meas              | ZOOM                  |
|------------|--------|------------|---------------|--------------------|-----------------------|-----------------------|
| Main&Z1&Z2 | Main   | Allocation | Z1 Mag<br>x 2 | Z1 Pos<br>0.000div | Fit Meas<br>Rng to Z1 | Fit Meas<br>Rng to Z2 |
|            |        |            | Z2 Mag<br>x 2 | Z2 Pos<br>0.000div |                       |                       |

- In a similar fashion, press the **Z2 Mag** soft key to set the zoom rate of Z2 zoom box.

### Selecting the Zoom Position

- Press the **Z1 Pos/Z2 Pos** soft key. (If you set Mode to Z1, Z1 Pos is displayed. If you select Z2, Z2 Pos is displayed. If you select Z1 and Z2, Z1 Pos/Z2 Pos is displayed.)  
Turn the jog shuttle to set the zoom position of the Z1 zoom box.

| Mode       | Format | Allocation | Z1 Mag        | Z1 Pos             | Fit Meas              | ZOOM                  |
|------------|--------|------------|---------------|--------------------|-----------------------|-----------------------|
| Main&Z1&Z2 | Main   | Allocation | Z1 Mag<br>x 2 | Z1 Pos<br>0.000div | Fit Meas<br>Rng to Z1 | Fit Meas<br>Rng to Z2 |
|            |        |            | Z2 Mag<br>x 2 | Z2 Pos<br>0.000div |                       |                       |

- In a similar fashion, press the **Z2 Pos** soft key to set the zoom position of Z2 zoom box.  
By setting the jog shuttle control to both Z1 Pos and Z2 Pos, the zoom positions of both Z1 and Z2 can be moved simultaneously.

### Changing the Range of the Automated Measurement of Waveform Parameters

- Press the **Fit Meas Rng to Z1** or **Fit Meas Rng to Z2** soft key (depending on the display format of the zoom waveform) to set the range of the automated measurement of waveform parameters to the zoom range of Z1 or Z2, respectively.

**Explanation**

The zoomed waveform of two locations can be displayed simultaneously (dual zoom). You can also select which channel to zoom.

Note that if the number of displayed points is less than or equal to 50 (or 40), zooming is not possible.

**Selecting the Display Mode of Zoomed Waveforms: Mode**

Main: Displays only the main (unzoomed) waveform.

Z1 Only: Displays only the zoomed waveform of zoom box Z1.

Z2 Only: Displays only the zoomed waveform of zoom box Z2.

Main&Z1: Displays the main waveform in the top window and zoomed waveform of zoom box 1 in the bottom window.

Main&Z2: Displays the main waveform in the top window and zoomed waveform of zoom box 2 in the bottom window.

Z1&Z2: Displays the zoomed waveform of zoom box 1 in the top window and the zoomed waveform of zoom box 2 in the bottom window.

Main&Z1&Z2: Displays the main waveform in the top window, the zoomed waveform of zoom box 1 in the lower left window and the zoomed waveform of zoom box 2 in the lower right window.

**Selecting the Zoomed Trace: Allocation**

The traces (CH1 to CH4, Math1, Math2 (or CH1, CH2, and Math1 for the DL1720)) whose Allocation is turned ON are zoomed. If the allocation is OFF, the trace is not zoomed.

You cannot allocate channels whose display is turned OFF.

**Display Format of Zoomed Waveforms: Format**

Similar to the main waveform, 6 types (or 4 types for the DL1720) of display formats are available. You cannot set different formats for Z1 and Z2.

Main\*, Single, Dual, Triad, Quad (DL1740 only), Hexa (DL1740 only)

\*: Selecting Main results in the same format as when "Format" is specified for "DISPLAY."

**Zoom Rate: Z1 Mag/Z2 Mag**

- The maximum zoom rate varies depending on the displayed record length.

Maximum zoom rate: (displayed record length)/50 (or 40)

Note that the displayed record length is not necessarily the same as the record length of the acquisition memory.

For details regarding the displayed record length, see appendix 1, "Relationship between the Time Axis Setting, Sample Rate, and Record length."

- You can change the zoom rate for Z1 and Z2 (zoomed waveforms of two locations).

**Zoom Position: Z1 Position and Z2 Position**

- The zoom position can be set by specifying the center position in the range -5 to +5 div from the center of the waveform display frame.

The resolution is as follows.

Zoom position resolution:  $(T/div \times 10)/(displayed\ record\ length)$

- The zoom box enclosed by solid lines is Z1 and the one enclosed by dashed lines is Z2. Since each box is independent, you can set the position separately.

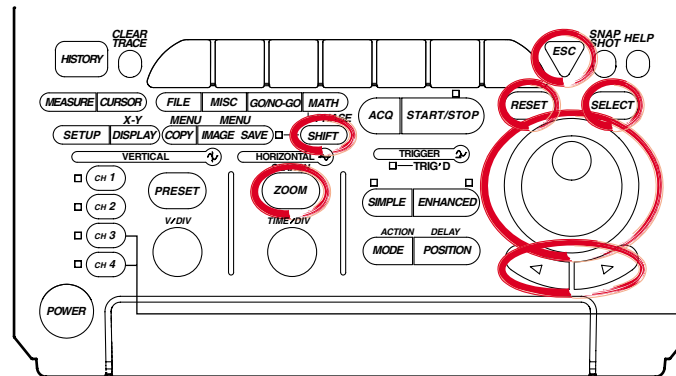
**Changing the Range of the Automated Measurement of Waveform Parameters: Fit Meas Rng to Z1/Fit Meas Rng to Z2**

Sets the range of the automated measurement of waveform parameters to the zoom range of Z1 or Z2. This is valid even if the automated measurement of waveform parameters is turned OFF.

# 8.10 Search Data Using Search and Zoom Function

<For a description of this function, refer to page 1-26>

## Relevant Keys



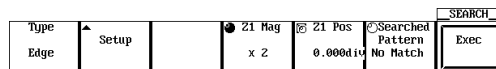
The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure When Performing a Edge Search

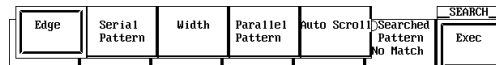
1. Press **SHIFT** to activate shift mode.  
Functions marked in purple on the panel become active.
2. Press **ZOOM**.

### Selecting the Search Method (Type)

3. Pressing the **Type** soft key displays the search method menu.

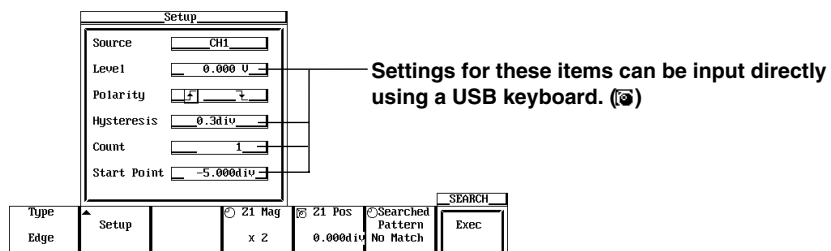


4. Press the **Edge** soft key to select the search method.



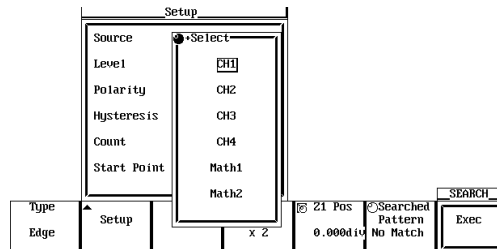
### Setting the Search Condition

5. Pressing the **Setup** soft key displays the search condition setting dialog box. Turn the jog shuttle to select the parameter. Pressing **SELECT** displays a menu used to set the item or changes the selected item.



- **Setting the Source**

6. Turn the jog shuttle to move the cursor to the channel to be searched and press **SELECT**. (CH3, CH4, and Math2 are not displayed on the DL1720.)



- **Setting the Level**

7. Turn the jog shuttle to set the level and press **SELECT**. You can use the arrow keys to move between the digits.  
Pressing **RESET** resets the level to 0 V.

- **Setting the Polarity**

8. Press **SELECT** to select  $\uparrow$  or  $\downarrow$ .

- **Setting the Hysteresis**

9. Turn the jog shuttle to set the hysteresis and press **SELECT**. You can use the arrow keys to move between the digits.  
Pressing **RESET** resets the hysteresis to 0.3 div.

- **Setting the Count**

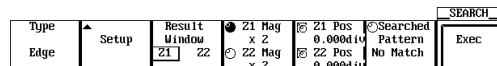
10. Turn the jog shuttle to set the count and press **SELECT**. You can use the arrow keys to move between the digits.  
Pressing **RESET** resets the count to 0.

- **Setting the Start Point**

11. Turn the jog shuttle to set the start position of the search. Press **SELECT**. You can use the arrow keys to move between the digits.  
Pressing **RESET** sets the position to -5 div.
12. Press **ESC** to close the search condition setting dialog box.

### Setting the Display Position of the Search Results (When Zoom Mode is Z1 & Z2 or Main & Z1 & Z2)

13. Press the **Result Window** soft key to select Z1 or Z2.



### Executing the Search

14. Pressing the **Exec** soft key starts the search. The search results are displayed in the zoomed waveform display position selected in step 13.  
You can search 1000 times using the same conditions.

### Displaying the Previous Search Results

15. Press the **Searched Pattern** soft key.
16. Turn the jog shuttle to select the number of the search result to be displayed.  
Newer search results are displayed with higher numbers (result 2 is newer than result 1).

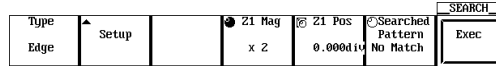
## 8.10 Search Data Using Search and Zoom Function

### When Performing a Serial Pattern Search

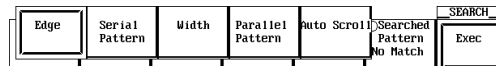
1. Press **SHIFT** to activate shift mode.  
Functions marked in purple on the panel become active.
2. Press **ZOOM**.

### Selecting the Search Method (Type)

3. Pressing the **Type** soft key displays the search method menu.

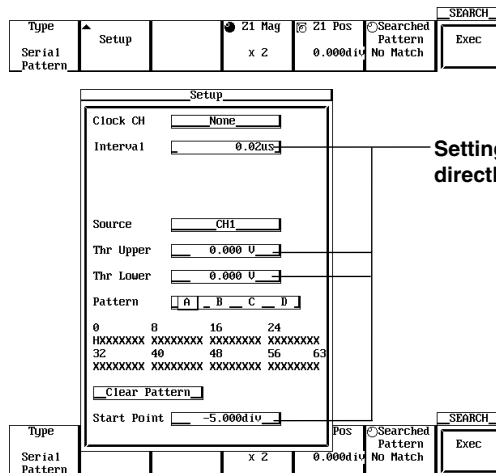


4. Press the **Serial Pattern** soft key to select the search method.



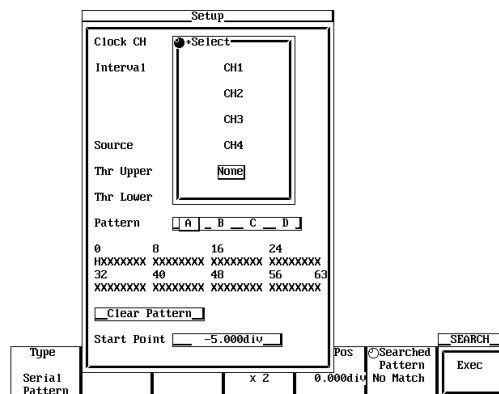
### Setting the Search Conditions

5. Pressing the **Setup** soft key displays the search condition setting dialog box. Turn the jog shuttle to select the parameter. Pressing **SELECT** displays a menu used to set the item or changes the selected item.



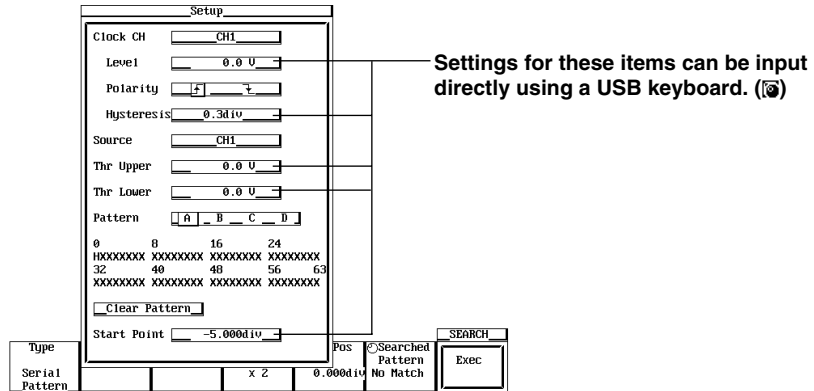
- **Setting the Clock CH**

6. Turn the jog shuttle to move the cursor to the clock channel and press **SELECT**. If you selected CH1 to CH4 (or CH1 to CH2 for the DL1720), go to step 7. If you selected None, go to step 10.



• **Setting the Level (When Clock CH is Set to CH1-CH4)**

7. Turn the jog shuttle to set the level and press **SELECT**. You can use the arrow keys to move between the digits.  
Pressing **RESET** resets the level to 0 V.



• **Setting the Polarity (When Clock CH is Set to CH1-CH4)**

8. Press **SELECT** to select  $\uparrow$  or  $\downarrow$ .

• **Setting the Hysteresis (When Clock CH is Set to CH1-CH4)**

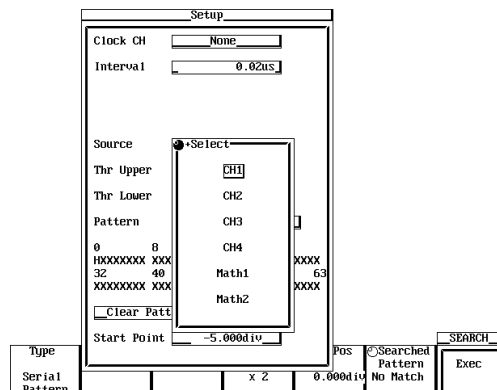
9. Turn the jog shuttle to set the hysteresis and press **SELECT**. You can use the arrow keys to move between the digits.  
Pressing **RESET** resets the hysteresis to 0.3 div.

• **Setting the Interval (When Clock CH is Set to None)**

10. Turn the jog shuttle to set the interval at which to check the pattern and press **SELECT**. You can use the arrow keys to move between the digits.  
Pressing **RESET** resets the interval to the default value.

• **Setting the Source**

11. Turn the jog shuttle to move the cursor to the channel to be searched and press **SELECT**. (CH3, CH4, and Math2 are not displayed on the DL1720.)



• **Set the Thr Upper**

12. Turn the jog shuttle to set the level used to determine Low and press **SELECT**.  
You can use the arrow keys to move between the digits.  
Pressing **RESET** resets the level to 0 V.

• **Set the Thr Lower**

13. Turn the jog shuttle to set the level used to determine High and press **SELECT**.  
You can use the arrow keys to move between the digits.  
Pressing **RESET** resets the level to 0 V.

## 8.10 Search Data Using Search and Zoom Function

- **Set the Pattern**

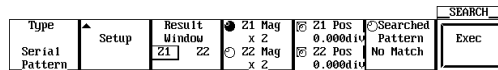
14. Press **SELECT** to select the pattern number A to D.
15. Turn the jog shuttle to move the cursor to the desired bit position.
16. Press **SELECT** to select H, L, or X. If you click Clear Pattern all bits are set to X.
17. Set other pattern numbers as necessary.

- **Setting the Start Point**

18. Turn the jog shuttle to set the start position of the search. Press **SELECT**. You can use the arrow keys to move between the digits.  
Pressing **RESET** sets the position to -5 div.
19. Press **ESC** close the search condition setting dialog box.

### Setting the Display Position of the Search Results (When Zoom Mode is Z1 & Z2 or Main & Z1 & Z2)

20. Press the **Result Window** soft key to select Z1 or Z2.



### Executing the Search

21. Pressing the **Exec** soft key starts the search. The search results are displayed in the zoomed waveform display position selected in step 17.  
You can search 1000 times using the same conditions.

### Displaying the Previous Search Results

22. Press the **Searched Pattern** soft key.
23. Turn the jog shuttle to select the number of the search result to be displayed.  
Newer search results are displayed with higher numbers (result 2 is newer than result 1)

### Changing the Zoom Rate and Position

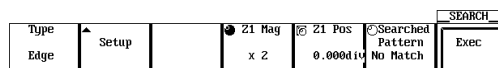
24. As in the zoomed waveform, you can change the zoom rate of Z1 and Z2 by pressing the **Z1 Mag/Z2 Mag** soft key and turning the jog shuttle.
25. As in the zoomed waveform, you can move the section that is being zoomed by pressing the **Z1 Pos/Z2 Pos** soft key and turning the jog shuttle.

## When Performing a Parallel Pattern Search

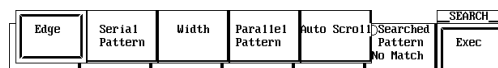
1. Press **SHIFT** to activate shift mode.  
The functions printed in purple letters on the front panel become activated.
2. Press **ZOOM**.

### Selecting the Search Method Type

3. Press the **Type** soft key to display the search method selection menu.

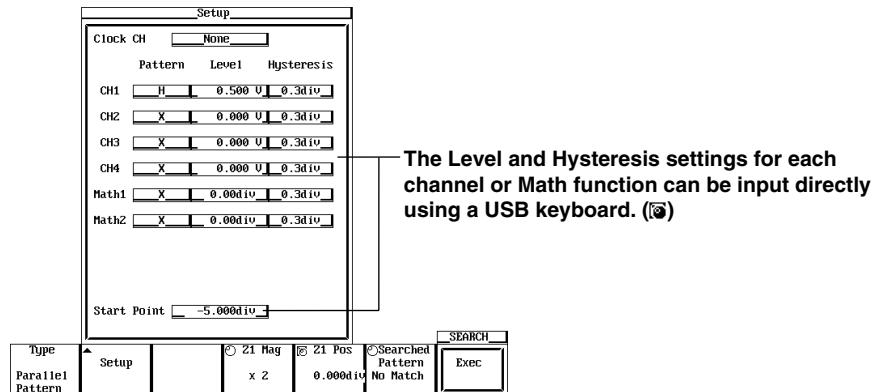


4. Press the **Parallel Pattern** soft key to select the search method.



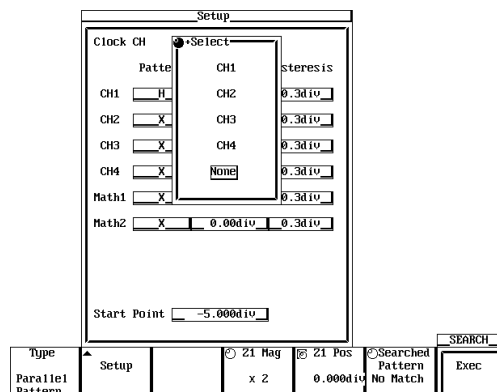
### Setting the Search Criteria

- Press the **Setup** soft key to display the search criteria settings dialog box. Turn the jog shuttle to select the setting item. When you press **SELECT**, the settings menu for the selected item is displayed, or the selected value is changed. (On the DL1720, the CH3, CH4, and Math2 settings are not displayed.)



### Setting the Clock CH

- Move the cursor over to the clock channel with the jog shuttle, then press **SELECT**. When selecting CH1-CH4 (or CH1 to CH2 for the DL1720), proceed to step 7. If you select None, skip to step 10.



### Setting the Clock Channel Pattern

- Use the jog shuttle to move the cursor to the Pattern of the channel set as the clock channel. Press **SELECT** to select  $f$  or  $\downarrow$ .

### Setting the Clock CH Level

- Use the jog shuttle to move the cursor to the Level of the channel set as the clock channel. Press **SELECT**, then use the jog shuttle to set the level, and press **SELECT** again. Use the arrow keys to move between the digits. If you press **RESET**, the setting will be restored to 0 V.

### Setting the Hysteresis of the Clock Channel

- Use the jog shuttle to move the cursor to the Hysteresis of the channel set as the clock channel. Press **SELECT**, use the jog shuttle to set the hysteresis, then press **SELECT** again. Use the arrow keys to move between the digits. If you press **RESET**, the setting will be restored to 0.3 div.

### Setting the Pattern for Each Channel

- Use the jog shuttle to move the cursor to the Pattern of the channel you wish to set. Press **SELECT** key to select H, L, or X.



## 8.10 Search Data Using Search and Zoom Function

- **Setting the Level for Each Channel**

11. Use the jog shuttle to move the cursor to the Level of the channel you wish to set. Press **SELECT**, then use the jog shuttle to set the Level and press **SELECT** again. Use the arrow keys to move between the digits. If you press **RESET**, the setting will be restored to 0 V.

- **Setting the Hysteresis for Each Channel**

12. Use the jog shuttle to move the cursor to the Hysteresis of the channel you wish to set. Press **SELECT**, then use the jog shuttle to set the hysteresis, and press **SELECT** again. Use the arrow keys to move between the digits. If you press **RESET**, the setting will be restored to 0.3 div.

- **Setting the Start Point**

13. Use the jog shuttle to move the cursor to the start point, then press **SELECT**. Use the jog shuttle to select the start point, then press **SELECT** again. Use the arrow keys to move between the digits. If you press **RESET**, the setting will be restored to -5 div.
14. Press **ESC** to close the dialog box.

### Setting the Display Position for the Search Results (When Zoom Mode is Z1&Z2 or Main&Z1&Z2)

15. Press the **Results Window** soft key to select Z1 or Z2.

| Type             | Setup | Result Window | Z1 Mag     | Z1 Pos               | Searched Pattern | SEARCH |
|------------------|-------|---------------|------------|----------------------|------------------|--------|
| Parallel Pattern |       | Z1 Z2         | x Z<br>x Z | 0.000div<br>0.000div | No Match         | Exec   |

### Executing the Search

16. Press the **Exec** soft key to perform the search. The results are displayed in the zoom waveform display position selected in step 15. You can perform a search using the same search criteria 1000 times.

### Displaying Previous Search Results

17. Press the **Searched Pattern** soft key to highlight the jog shuttle icon.
18. Turn the jog shuttle to select the number of the search results to be displayed. The most recent search has the highest number.

### Changing the Zooming Factor and Position

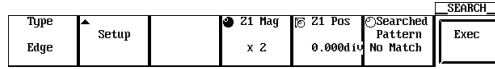
19. As you did with the zoomed waveform, press the **Z1 Mag/Z2 Mag** soft key, then turn the jog shuttle to change the zooming factor of Z1 and Z2.
20. As you did with the zoomed waveform, press the **Z1 Pos/Z2 Pos** soft key, then turn the jog shuttle to change the position of the zoom box for Z1 and Z2.

**When Performing a Pulse Width Search**

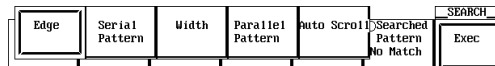
1. Press **SHIFT** to activate shift mode. The functions printed in purple letters on the front panel become activated.
2. Press **ZOOM**.

**Selecting the Search Method**

3. Press the **Type** soft key to display the search method selection menu.

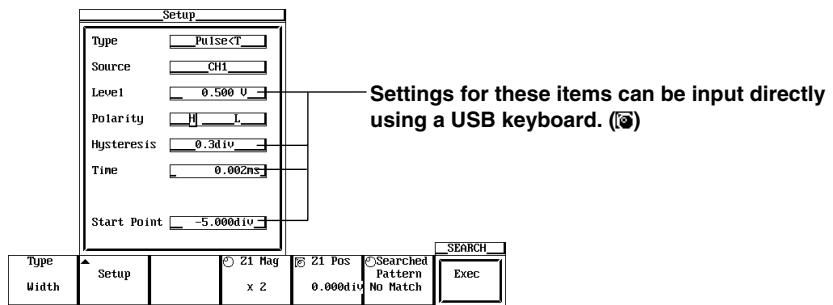


4. Press the **Width** soft key to select the search method.



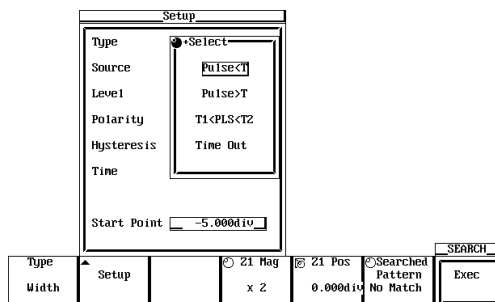
**Setting the Search Criteria**

5. When you press the **Setup** soft key the search criteria settings dialog box is displayed. Turn the jog shuttle to select a setting item. Press **SELECT** to display the setting menu for the selected item, or change the current setting.



- **Setting the Type**

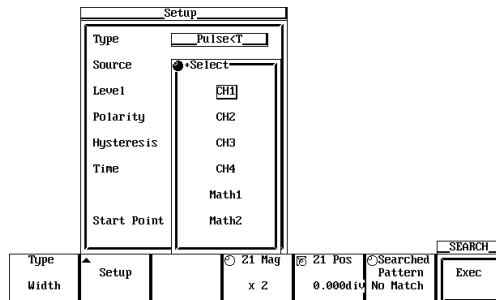
6. Use the jog shuttle to choose either Pulse < T, Pulse > T, T1 < PLS < T2, or Time Out, then press **SELECT**.



## 8.10 Search Data Using Search and Zoom Function

- **Setting the Source**

7. Use the jog shuttle to move the cursor to the desired source channel then press **SELECT**. (CH3, CH4, and Math2 are not displayed on the DL1720.)



- **Setting the Level**

8. Use the jog shuttle to set the level, then press **SELECT**. Use the arrows to move between the digits. Pressing **RESET** restores the value to 0 V.

- **Setting the Polarity**

9. Press **SELECT** to select H or L.

- **Setting the Hysteresis**

10. Use the jog shuttle to set the hysteresis, then press **SELECT**. Use the arrow keys to move the arrows between the digits. Pressing **RESET** restores the value to 0.3 div.

- **Setting the Time**

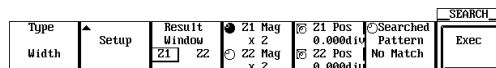
11. Use the jog shuttle to set the count, then press **SELECT**. Use the arrow keys to move the arrows between the digits. Pressing **RESET** restores the value to minimum resolution (1/sample rate). Set Time1 and Time2 if you selected T1<PLS<T2 in step 6.

- **Setting the Start Point**

12. Use the jog shuttle to set the search start position, then press **SELECT**. Use the arrow keys to move the arrows between the digits. Pressing **RESET** restores the value to -5 div.
13. Press **ESC** to close the dialog box.

### Setting the Search Results Display Position (When Zoom Mode is Z1&Z2 or Main&Z1&Z2)

14. Press the **Result Window** soft key to select Z1 or Z2.



### Executing the Search

15. Press the **Exec** soft key to perform the search. The search results are displayed in the zoom waveform display position selected in step 14. You can search 1000 times using the same conditions.

### Displaying Previous Search Results

16. Press the **Searched Pattern** soft key to highlight the jog shuttle icon.
17. Turn the jog shuttle to select one of the displayed search results numbers. The higher the number the more recent the search result.

### When Performing an Auto Scroll Search

1. Press **SHIFT** to activate the shift mode.
2. Press **ZOOM**.

#### Selecting the Search Method (Type)

3. Press the **Type** soft key to display the search method selection menu.

| Type | Setup | Z1 Mag | Z1 Pos   | Searched Pattern | SEARCH |
|------|-------|--------|----------|------------------|--------|
| Edge |       | x 2    | 0.000div | No Match         | Exec   |

4. Press the **Auto Scroll** soft key to select the search method.

| Edge | Serial Pattern | Width | Parallel Pattern | Auto Scroll | Searched Pattern | SEARCH |
|------|----------------|-------|------------------|-------------|------------------|--------|
|      |                |       |                  |             | No Match         | Exec   |

#### Selecting the Scroll Direction

5. Press the **Direction** soft key to set the scrolling direction.

| Type        | Direction | Result Window | Z1 Mag | Z1 Pos   | Speed | SEARCH |
|-------------|-----------|---------------|--------|----------|-------|--------|
| Auto Scroll | << >>     | Z1 Z2         | x 2.5  | 0.000div | 4     | Exec   |
|             |           |               | x 2.5  | 0.000div |       |        |

#### Setting the Search Results Display Position (When Zoom Mode is Z1&Z2 or Main&Z1&Z2)

6. Press the **Results Window** soft key to select Z1 or Z2.

| Type        | Direction | Result Window | Z1 Mag | Z1 Pos   | Speed | SEARCH |
|-------------|-----------|---------------|--------|----------|-------|--------|
| Auto Scroll | << >>     | Z1 Z2         | x 2.5  | 0.000div | 4     | Exec   |
|             |           |               | x 2.5  | 0.000div |       |        |

#### Changing the Zooming Factor and Position

7. As you did with the zoomed waveform, press the **Z1 Mag/Z2 Mag** soft key, then turn the jog shuttle to change the part which is expanded and displayed in Z1 and Z2.
8. As you did with the zoomed waveform, press the **Z1 Pos/Z2 Pos** soft key, then turn the jog shuttle to change the part which is expanded and displayed in Z1 and Z2.

#### Setting the Scroll Speed

9. Press the **Speed** soft key, then use the jog shuttle to set the scroll speed from 1 to 7.

#### Executing the Scroll

10. Press the **Exec** soft key to perform the Scroll. Press the key again to stop the Scroll.

### Explanation

When the data acquisition is stopped, a section of the waveform can be searched and displayed expanded.

#### Search Method: Type

The following two search methods are available.

- Edge: Searches the position where the signal went above (rising) or below (falling) the specified level the specified number of times from the search start position.
- Serial Pattern: Searches for a section of the waveform that has the same pattern as the specified waveform pattern (High or Low status or Don't Care).
- Parallel Pattern: Searches by using a status (High, Low, or Don't Care) of each channel, CH1 through CH4, Math1, and Math2 (or CH1, CH2, and Math1 for the DL1720).
- Pulse Width: Searches for a particular section of the current displayed waveform. Searches for a section of the waveform of which the pulse width is shorter or longer than the specified time width from the search start position.
- Auto Scroll: The zoom position automatically moves (auto scroll) in the specified direction. You can scroll through the zoomed waveform and stop the scrolling at the desired position.

#### Search Condition: Setup

##### • When the Type is Edge

- Source: Select the channel to be searched. You can also select Math1 and Math2 (or Math1 for the DL1720).
- Level: Set the level used to determine the rising or falling edge. The range is 8 div within the screen. The resolution is 0.01 div.
- Polarity: Select the polarity from the following list.
- ↕: Search by the number of times the waveform passes from below the specified level to above the specified level.
  - ↕: Search by the number of times the waveform passes from above the specified level to below the specified level.
- Hys: Set the hysteresis. The range is 0.3 div to 4 div.
- Count: Set the number of times ↕ or ↕ is to be met. The range is 1 to 1000000.
- Start Point: Set the starting position of the search. The range is from -5 to 5 div.

##### • When the Type is Serial Pattern

- Clock CH: Select the clock channel, from CH1 to CH4 (or CH1 to CH2 for the DL1720), that is used as a timing reference in searching the status. When None is selected, the status is searched at a predetermined interval.
- Source: Select the channel to be searched. You can also select Math1 and Math2 (or Math1 for the DL1720).
- Thr Upper: Set the level used to determine Low (L).
- Thr Lower: Set the level used to determine High (H).
- Pattern: Four different types of patterns can be registered. Set the pattern with 64 bits of H, L, X (Don't Care) symbols.
- H: When the value is greater than or equal to Thr Lower.
  - L: When the value is less than or equal to Thr Upper.
  - X: Do not determine.
- Start Point: Set the start position of the search. The range is from -5 to 5 div.

**When CH1 to CH4 (or CH1 to CH2 for the DL1720) is Set as the Clock Channel**

Level: Set the level used to determine the rising or falling edge. The range is 8 div within the screen. The resolution is 0.01 div.

Polarity: Select the polarity from the following list.

⌈: Search the status when the waveform changes from below the specified level to above the specified level.

⌋: Search the status when the waveform changes from above the specified level to below the specified level.

Hys: Set the hysteresis. The range is 0.3 div to 4 div.

**When None is Set as the Clock Channel**

Interval: Set the interval at which to search the status.

- **When the Type is Parallel Pattern**

Clock CH: Select a clock channel from CH1 to CH4 (or CH1 to CH2 for the DL1720) that will provide the standard timing for searching the status. Select NONE to check the status of all the data.

Start Point: Set the starting position for the search. The range for this setting is -5 to 5 div.

**Channels Specified as Clock Channels**

Level: Set the level for determining rising and falling. The range for the setting is an on-screen 8 div, and the resolution is 0.01 div.

Pattern: Choose from the following:

⌈: Check the pattern when the waveform changes from above to below the specified level.

⌋: Checks the pattern when the waveform changes from below to above the specified level.

Hysteresis: Set the hysteresis. The range for the setting is 0.3 to 4 div.

**Channels Other than Clock Channels**

Pattern: Set using the H, L, or X (Don't Care) symbols.

H: When the value is greater than the level.

L: When the value is less than the level.

X: Do not determine.

Level: Set the levels to determine H and L.

Hysteresis: Set the hysteresis. The range for this setting is 0.3 div to 4 div.

- **When the Type is Pulse Width**

- Type: Select the relationship between the specified time and the measured waveform.
- Pulse < T: Detects a section of the waveform whose pulse width (Pulse) is shorter than the specified time (T).
- Pulse > T: Detects a section of the waveform whose pulse width (Pulse) is longer than the specified time (T).
- T1 < PLS < T2: Detects a section of the waveform whose pulse width (Pulse) is within the specified times (T1 to T2).
- Timeout: Detects a section of the waveform whose pulse width (Pulse) exceeds the specified time (T). The displayed position in the zoom display differs from the Pulse > T case.
- Source: Select the source channel for the search. You can also select Math1 and Math2 (or Math1 for the DL1720).
- Level: Set the level for determining High and Low. The setting range is an on-screen 8 div, and the resolution is 0.01 div.
- Polarity: Choose from the following:  
High: When the waveform is higher than the specified level.  
Low: When the waveform is lower than the specified level.
- Hysteresis: Set the hysteresis. The range for this setting is 0.3 div to 4 div.
- Time: Set the determination time, "T." The range for this setting is 1/sample rate display range.
- Start Point: Set the starting position for the search. The range for this setting is -5 to 5 div.

### **Display Position of the Searched Waveform: Result Window**

When the zoom mode is set to Z1 & Z2 or Main & Z1 & Z2, you can select whether to display the searched waveform in the Z1 or Z2 window.

### **Search Count**

The search can be carried out up to 1000 times. When the type is edge, the rising or falling edge is counted from the previous search position. In addition, the past search results can also be displayed.

### **Changing the Zoom Rate and Position**

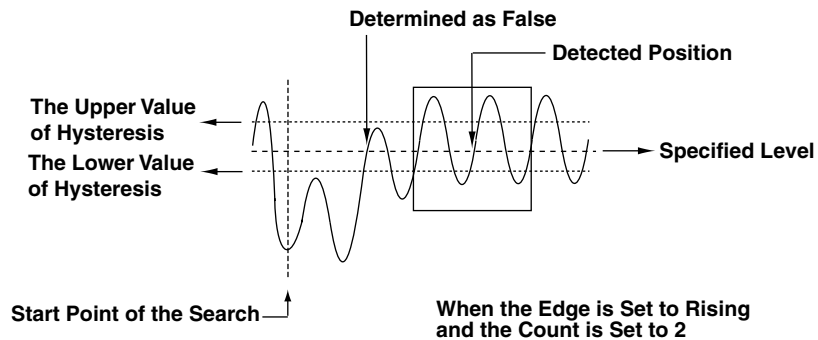
The search results are displayed in the zoomed waveform display area. As in the zoomed waveform, the zoom rate and position can be changed.

**Precautions to be Taken when Searching**

- Searching is not possible while the data acquisition is in progress.
- Searching is not possible on the computed results of the power spectrum.
- The search result is void if the following operations, are carried out:  
Starting data acquisition.  
Changing the Search Setup setting.  
Shifting the phase of the source or the clock.
- Searching is not possible when setting CH2 or CH4 (or CH2 only for the DL1720) as the clock channel while in interleave mode.
- Searching is not possible when all patterns are set to X.
- Patterns from undisplayed waveforms will not be referenced during searches.

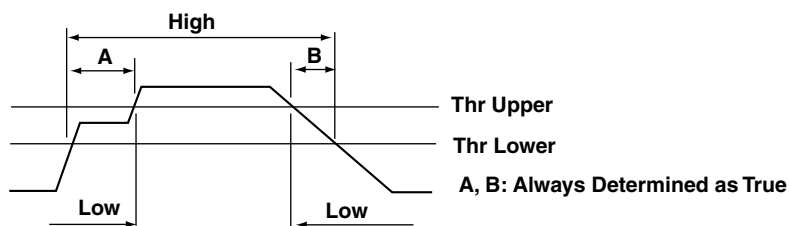
**Determination when Using the Edge for the Search**

When the peak immediately after the rising edge of the waveform is less than or equal to the upper limit of the hysteresis or when the peak immediately after the falling edge is greater than or equal to the lower limit of the hysteresis, it is determined as false (not counted as a specified edge).



**Determination when Searching Using a Serial Pattern**

The points between the Thr Upper and Thr Lower are always determined to be true (matches the specified status). If such a point is included at the time the pattern is checked, a message is displayed as a notification.

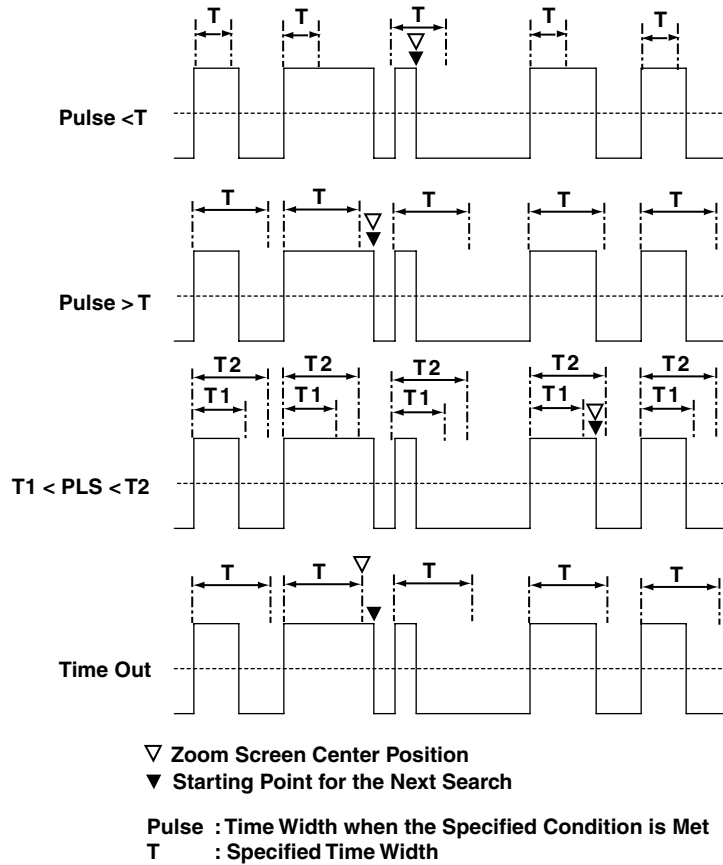






**Display Position for Pulse Width Searches**

The position of the waveform displayed in the zoom screen will change in the following manner depending on the Type setting: An example in which the polarity is H is shown below.



The center position of the waveform displayed in the zoom screen differs between Pulse > T and Time Out.

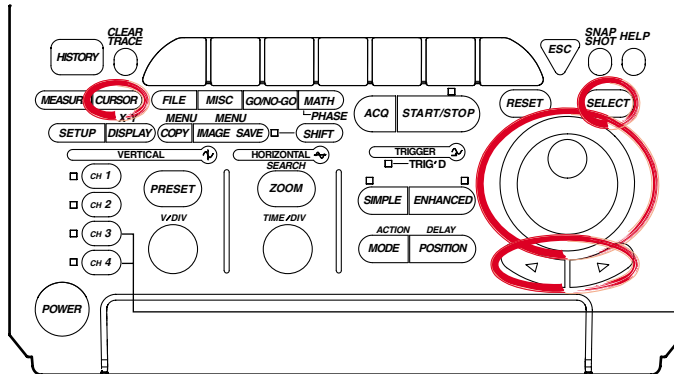
**Auto Scroll**

Set the scroll speed choosing from one of 7 steps. The higher the number, the faster the scrolling. You cannot set any settings other than direction and speed while auto scrolling.

# 9.1 Measuring Waveforms Using Cursors

<For a description of this function, refer to page 1-21>

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

### Selecting the Cursor Type

1. Press **CURSOR**.
2. Pressing the **Type** soft key displays the cursor type menu.

|      |  |  |  |  |  |        |
|------|--|--|--|--|--|--------|
| Type |  |  |  |  |  | CURSOR |
| OFF  |  |  |  |  |  |        |

3. Press the soft key corresponding to the desired cursor type to select the cursor.

### When not Displaying the X-Y Waveform

|     |            |          |        |        |  |        |
|-----|------------|----------|--------|--------|--|--------|
| OFF | Horizontal | Vertical | Marker | Degree |  | CURSOR |
|     |            |          |        |        |  |        |

### When Displaying the X-Y Waveform

|     |            |          |        |  |  |        |
|-----|------------|----------|--------|--|--|--------|
| OFF | Horizontal | Vertical | Marker |  |  | CURSOR |
|     |            |          |        |  |  |        |

## For H (Horizontal) Cursors (When Not Displaying the X-Y Waveform)

### Selecting the Waveform to be Measured

Refer to steps 1-3 to set the **Type** to **Horizontal**.

|     |            |          |        |        |  |        |
|-----|------------|----------|--------|--------|--|--------|
| OFF | Horizontal | Vertical | Marker | Degree |  | CURSOR |
|     |            |          |        |        |  |        |

4. Pressing the **Trace** soft key displays the waveform menu.

|            |       |          |  |  |  |        |
|------------|-------|----------|--|--|--|--------|
| Type       | Trace | Cursor1  |  |  |  | CURSOR |
| Horizontal | CH1   | 3.00d10  |  |  |  |        |
|            |       | Cursor2  |  |  |  |        |
|            |       | -3.00d10 |  |  |  |        |

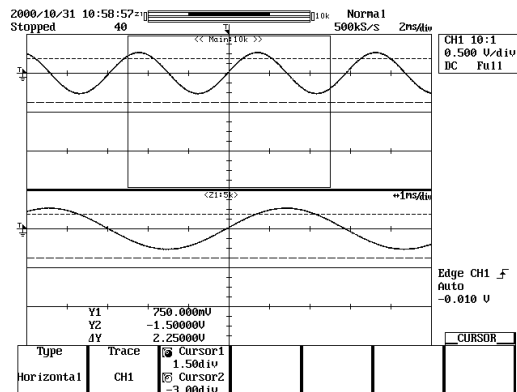
5. Press the soft key corresponding to the desired waveform. (The CH3, CH4, and Math2 soft keys are not displayed on the DL1720.)

|            |     |          |     |     |       |       |
|------------|-----|----------|-----|-----|-------|-------|
| Type       | CH1 | CH2      | CH3 | CH4 | Math1 | Math2 |
| Horizontal |     | -3.00d10 |     |     |       |       |

## 9.1 Measuring Waveforms Using

### Moving the Cursor

- Press the **Cursor1/Cursor2** soft key to set the jog shuttle control to Cursor1.
- Turn the jog shuttle to move Cursor1.

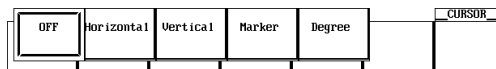


- Move Cursor2 in a similar fashion.  
If the jog shuttle control is set to both Cursor1 and Cursor2, both cursors are moved.

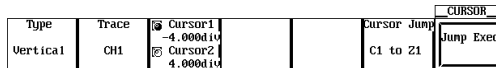
## For V (Vertical) Cursors (When Not Displaying the X-Y Waveform)

### Selecting the Waveform to be Measured

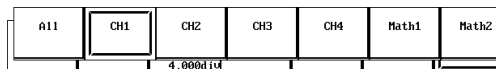
Refer to steps 1-3 to set the **Type** to **Vertical**.



- Press the **Trace** soft key to display the waveform selection menu.

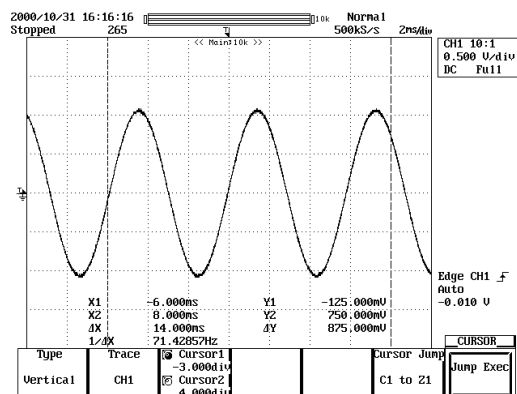


- Press the soft key corresponding to the desired waveform to select it. (The CH3, CH4, and Math2 soft keys are not displayed on the DL1720.)



### Moving the Cursor

- Press the **Cursor1/Cursor2** soft key to highlight the jog shuttle icon for Cursor1.
- Move Cursor1 using the jog shuttle.



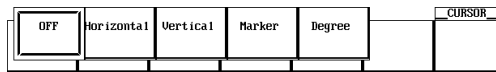
- In the same manner, move Cursor2. If you highlight the jog shuttle icon for Cursor1 and Cursor2, you can move them at the same time.



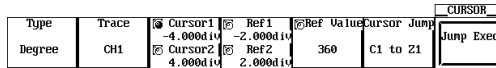
### For Angle (Degree) Cursors (When Not Displaying the X-Y Waveform)

#### Selecting the Waveform to be Measured

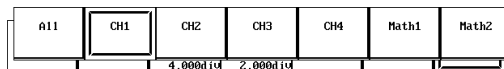
Follow steps 1-3 to set the **Type** to **Degree**.



4. Pressing the **Trace** soft key displays the waveform menu.



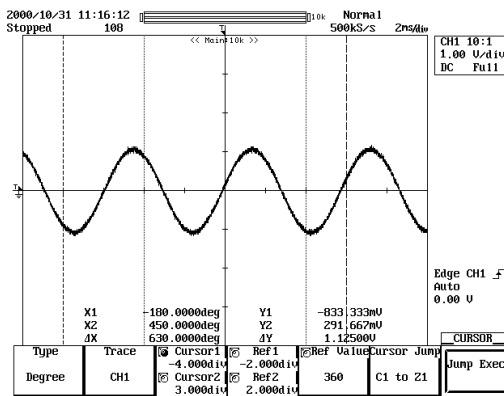
5. Press the soft key corresponding to the desired waveform. (The CH3, CH4, and Math2 soft keys are not displayed on the DL1720.)



#### Moving the Cursor

6. Press the **Cursor1/Cursor2** soft key to set the jog shuttle control to Cursor1.

7. Turn the jog shuttle to move Cursor1.



8. Move Cursor2 in a similar fashion.  
 If the jog shuttle control is set to both Cursor1 and Cursor2, both cursors are moved.

#### Moving the Reference Cursor

9. Press the **Ref1/Ref2** soft key to set the jog shuttle control to Ref1.

10. Turn the jog shuttle to move Ref1.

11. Move Ref2 in a similar fashion.

If the jog shuttle control is set to both Ref1 and Ref2, both cursors are moved.

#### Setting the Reference Angle

12. Press the **Ref Value** soft key.

13. Turn the jog shuttle to set the reference angle.

### Cursor Jump (for V-Cursor, Marker Cursor, and Angle Cursor: Only when Not Displaying the X-Y Waveform)

Follow steps 1-3 to set the **Type** to **Vertical**, **Marker**, or **Degree**.

- Pressing the **Cursor Jump** soft key displays a menu used to select the cursor you wish to jump and the jump destination.

| Type     | Trace | Cursor1   | Cursor2  | Cursor Jump |
|----------|-------|-----------|----------|-------------|
| Vertical | CH1   | -4.000div | 4.000div | C1 to Z1    |

| Type   | Select      | Trace | Pos       | Cursor Jump |
|--------|-------------|-------|-----------|-------------|
| Marker | M1 M2 M3 M4 | CH1   | -3.100div | to Z1       |

| Type   | Trace | Cursor1   | Ref1      | Ref Value | Cursor Jump |
|--------|-------|-----------|-----------|-----------|-------------|
| Degree | CH1   | -4.000div | -2.000div | 360       | C1 to Z1    |

- Press the soft key corresponding to the desired jump type and select the cursor to jump and the jump destination.

| Type     | Trace | Cursor1   | C1 to Z1 | C1 to Z2 | C2 to Z1 | C2 to Z2 |
|----------|-------|-----------|----------|----------|----------|----------|
| Vertical | CH1   | -4.000div |          |          |          |          |

| Type   | Select      | Trace | Pos       | to Z1 | to Z2 |
|--------|-------------|-------|-----------|-------|-------|
| Marker | M1 M2 M3 M4 | CH1   | -3.100div |       |       |

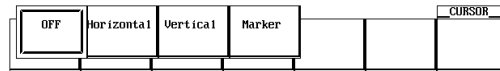
| Type   | Trace | Cursor1   | C1 to Z1 | C1 to Z2 | C2 to Z1 | C2 to Z2 |
|--------|-------|-----------|----------|----------|----------|----------|
| Degree | CH1   | -4.000div |          |          |          |          |

- Pressing the **Jump Exec** soft key moves the cursor to the jump destination.

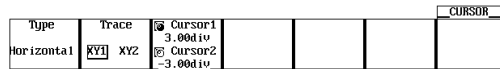
### For H (Horizontal) Cursors (When Displaying the X-Y Waveform)

#### Selecting the waveform to be measured

Refer to steps 1-3 to set the **Type** to **Horizontal**.

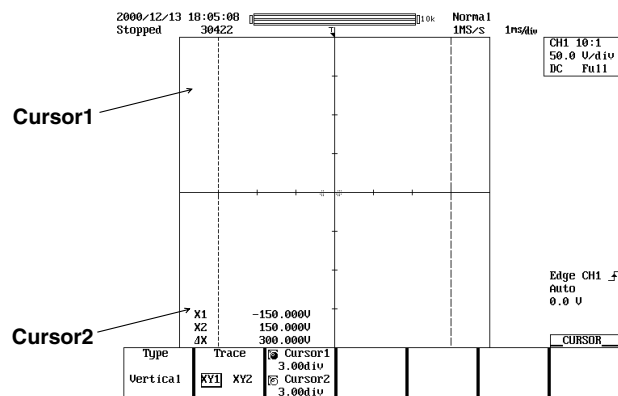


4. Press the **Trace** soft key to select the desired waveform. (XY2 is not available on the DL1720, so there is no Trace setting.)



#### Moving the Cursor

5. Press the **Cursor1/Cursor2** soft key to set the jog shuttle control to Cursor1.
6. Turn the jog shuttle to move Cursor1.
7. Move Cursor2 in a similar fashion.



If the jog shuttle control is set to both Cursor1 and Cursor2, both cursors are moved.



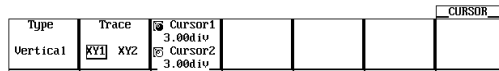
**For V (Vertical) Cursors (When Displaying the X-Y Waveform)**

**Selecting the Waveform to be Measured**

Refer to steps 1-3 to set the **Type** to **Horizontal**.

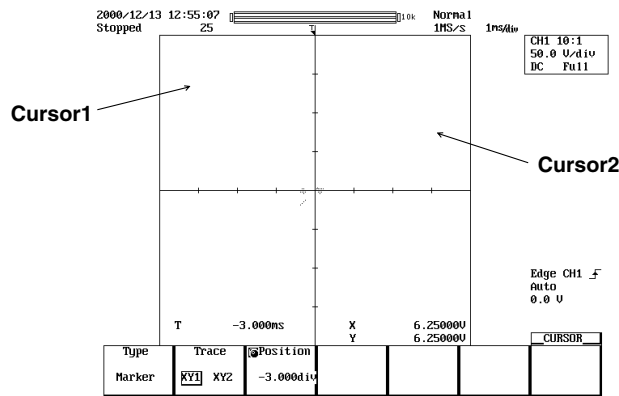


4. Press the **Trace** soft key to select the desired waveform. (XY2 is not available on the DL1720, so there is no Trace setting.)



**Moving the Cursor**

5. Press the **Cursor1/Cursor2** soft key to set the jog shuttle control to Cursor1.
6. Turn the jog shuttle to move Cursor1.
7. Move Cursor2 in a similar fashion.

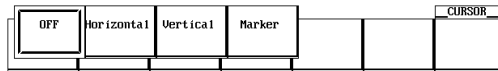


If the jog shuttle control is set to both Cursor1 and Cursor2, both cursors are moved.

**For Marker Cursors (When Displaying the X-Y Waveform)**

**Selecting the Marker**

Refer to steps 1-3 to set the **Type** to **Marker**.

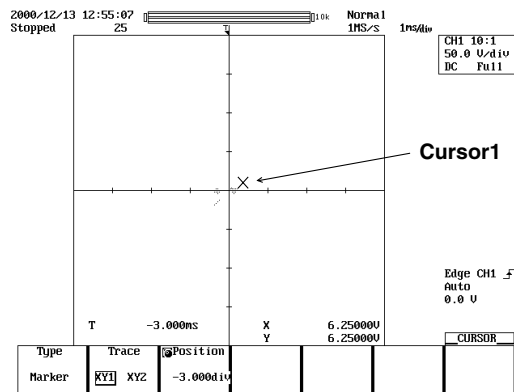


4. Press the **Trace** soft key to select the desired waveform. (XY2 is not available on the DL1720, so there is no Trace setting.)



**Moving the Cursor**

5. Press the **Position** soft key to set the jog shuttle control to Position.
6. Turn the jog shuttle to move the cursor. As the cursor is moved, the displayed value of Position changes.



**Explanation**

**Restrictions**

Cursor measurements cannot be made on the following waveforms.

- Snapshot waveforms
- Accumulated waveforms other than the newest waveform

**Cursor Types and Measurement Items: Type (When Not Displaying the X-Y Waveform)**

- H (Horizontal) Cursor
  - Measures the Y-axis value at the cursor
  - Y1: The Y-axis value at Cursor1
  - Y2: The Y-axis value at Cursor2
  - DY: The difference between the Y-axis values at Cursor1 and Cursor2
- V (Vertical) Cursor
  - Measures the X-axis value at the cursor.
  - Also choose the order of the data.
  - X1: The X-axis value at Cursor1
  - X2: The X-axis value at Cursor2
  - DX : The difference between the Y-axis values at Cursor1 and Cursor2
  - 1/DX: The inverse or the difference between the Y-axis values at Cursor1 and Cursor2
  - Y1: The Y-axis value at Cursor1
  - Y2: The Y-axis value at Cursor2
  - DY: The difference between the Y-axis values at Cursor1 and Cursor2

- Marker Cursors

Move the cursor on the waveform data and measure the waveform data values.

M1 (Marker 1) to M4 (Marker 4) can be set on different waveforms.

Y1 to Y4: The Y-axis values of M1 to M4

DY2: The difference between the Y-axis values of M1 and M2

DY3: The difference between the Y-axis values of M1 and M3

DY4: The difference between the Y-axis values of M1 and M4

X1 to X4: The X-axis values of M1 to M4

DX2: The difference between the X-axis values of M1 to M2

DX3: The difference between the X-axis values of M1 to M3

DX4: The difference between the X-axis values of M1 to M4

- Angle Cursor (Degree)

Set the measurement zero point (position of reference cursor Ref1) and the end point (position of the reference cursor Ref2) on the X-axis within the screen and assign an angle corresponding to the width of Ref1 and Ref2. Using this angle as a reference, this function measures the angle of the two angle cursors (Cursor1 and Cursor2).

DX1: The angle of Cursor1 from Ref1

DX2: The angle of Cursor2 from Ref1

DDX: The angle difference between Cursor1 and Cursor2

DY1: The Y-axis value of Cursor1

DY2: The Y-axis value of Cursor2

DDY: The difference between the Y-axis values of Cursor1 and Cursor2

Range of reference width: 1 to 720°

### Cursor types and Measurement Items: Type (When Displaying the X-Y Waveform)

- H (Horizontal) Cursor

Measures the Y-axis value at the cursor

Y1: The Y-axis value at Cursor1

Y2: The Y-axis value at Cursor2

DY: The difference between the Y-axis values at Cursor1 and Cursor2

- V (Vertical) cursor

Measures the X-axis value at the cursor

When measuring the logic waveform with the V Cursor, select a binary or 16-base measurement value. Also choose the order of the data.

X1: The X-axis value at Cursor1

X2: The X-axis value at Cursor2

DX: The difference between the X-axis values at Cursor1 and Cursor2

- Marker Cursors

Move the cursor on the waveform data and measure the waveform data values.

T: The time difference from the trigger point at the cursor

X: The X-axis value at Cursor

Y: The Y-axis value at Cursor

### Movement Range of the Cursors (When Not Displaying the X-Y Waveform)

H Cursors can be moved in the range from -4 to +4 div from the center of the screen.

The resolution is 0.01 div.

V Cursors, marker cursors, and angle cursors can be moved in the range from -5 to +5 div from the center of the screen. The resolution is as follows:

Resolution:  $T/\text{div} \times 10/\text{displayed record length}$

## 9.1 Measuring Waveforms Using

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### **Movement Range of the Cursors (When Displaying the X-Y Waveform)**

H Cursors and V Cursors can be moved in the range from -4 to +4 div from the center of the screen. The resolution is 0.01 div.

Marker cursors can be moved in the range from -5 to +5 div from the center of the screen. The resolution is as follows:

Resolution:  $T/\text{div} \times 10/\text{displayed record length}$

### **Cursor Jump (When Not Displaying the X-Y Waveform)**

You can make Marker cursors, V cursors, and angle cursors jump to the center of the zoom window. The cursors can be jumped in the following manner.

For marker cursors

to Z1: Make the selected marker jump to the Z1 window.

to Z2: Make the selected marker jump to the Z2 window.

V cursor and angle cursor

C1 to Z1: Make Cursor1 jump to the Z1 window

C1 to Z2: Make Cursor1 jump to the Z2 window

C2 to Z1: Make Cursor2 jump to the Z1 window

C2 to Z2: Make Cursor2 jump to the Z2 window

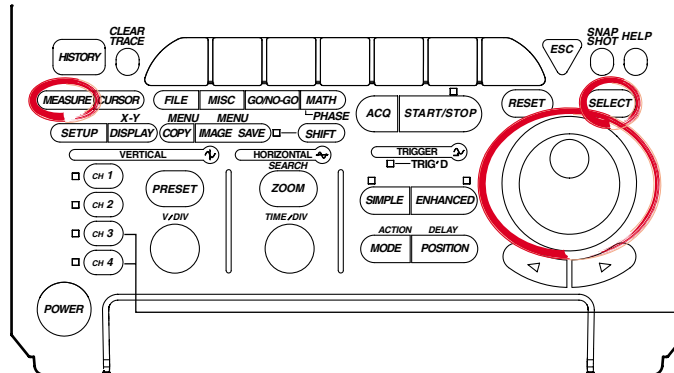
### **Notes when Making Cursor Measurements**

- The time axis values are measured from the trigger position.
- The measured value will display “\*\*\*,” if the measurement is not possible.

## 9.2 Automated Measurement of Waveform Parameters

<For a description of this function, refer to page 1-22>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **MEASURE**.
2. Pressing the **Mode** soft key displays the automated measurement mode menu.

|      |            |             |            |           |          |
|------|------------|-------------|------------|-----------|----------|
| Mode | Item Setup | Delay Setup | Cycle Mode | T-Range1  | MEASURE  |
| OFF  |            |             | OFF ON     | -5.000d14 | Next 1/2 |
|      |            |             |            | 5.000d14  |          |

3. Press the **ON** soft key to set the automated measurement mode.

|     |    |            |                  |                    |           |          |
|-----|----|------------|------------------|--------------------|-----------|----------|
| OFF | ON | Statistics | Cycle Statistics | History Statistics | T-Range1  | MEASURE  |
|     |    |            |                  |                    | -5.000d14 | Next 1/2 |
|     |    |            |                  |                    | 5.000d14  |          |

### Selecting the Measurement Parameter

4. Pressing the **Item Setup** soft key displays the measurement parameter dialog box and the measurement channel dialog box.

|      |            |             |            |           |          |
|------|------------|-------------|------------|-----------|----------|
| Mode | Item Setup | Delay Setup | Cycle Mode | T-Range1  | MEASURE  |
| ON   |            |             | OFF ON     | -5.000d14 | Next 1/2 |
|      |            |             |            | 5.000d14  |          |

5. Press the soft key corresponding to the desired measurement channel. (The CH3, CH4, and Math2 soft keys are not displayed on the DL1720.)

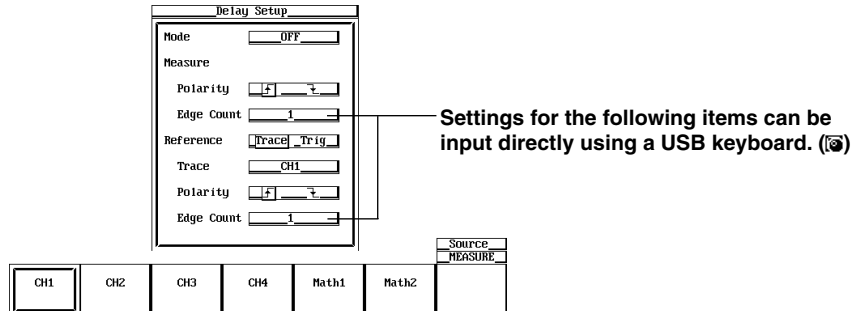
|                                 |                                 |                                    |     |       |       |           |
|---------------------------------|---------------------------------|------------------------------------|-----|-------|-------|-----------|
| Item Setup                      |                                 |                                    |     |       |       | Source    |
| <input type="checkbox"/> P-P    | <input type="checkbox"/> Freq   | <input type="checkbox"/> AvgFreq   |     |       |       | MEASURE   |
| <input type="checkbox"/> Max    | <input type="checkbox"/> Period | <input type="checkbox"/> AvgPeriod |     |       |       | Dual Area |
| <input type="checkbox"/> Min    | <input type="checkbox"/> Rise   | <input type="checkbox"/> Int1TY    |     |       |       | OFF ON    |
| <input type="checkbox"/> Avg    | <input type="checkbox"/> Fall   | <input type="checkbox"/> Int2TY    |     |       |       |           |
| <input type="checkbox"/> Rms    | <input type="checkbox"/> +Width | <input type="checkbox"/> Int1XY    |     |       |       |           |
| <input type="checkbox"/> Sdev   | <input type="checkbox"/> -Width | <input type="checkbox"/> Int2XY    |     |       |       |           |
| <input type="checkbox"/> High   | <input type="checkbox"/> Duty   |                                    |     |       |       |           |
| <input type="checkbox"/> Low    | <input type="checkbox"/> Burst1 |                                    |     |       |       |           |
| <input type="checkbox"/> +GShot | <input type="checkbox"/> Burst2 |                                    |     |       |       |           |
| <input type="checkbox"/> -GShot | <input type="checkbox"/> Pulse  |                                    |     |       |       |           |
| All Clear                       |                                 | Copy To All Trace                  |     |       |       |           |
| CH1                             | CH2                             | CH3                                | CH4 | Math1 | Math2 |           |

6. Turn the jog shuttle to move the cursor to the parameter you wish to turn ON. You can turn OFF all parameters at once by selecting All Clear. You can copy the current parameter settings to all traces by selecting Copy to All Trace.
7. Press **SELECT** to turn ON the parameter
8. Repeat steps 5 to 7 as necessary.

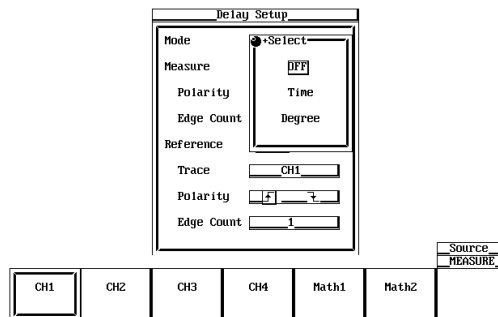
## 9.2 Automated Measurement of Waveform Parameters

### Setting the Delay (Delay Setup)

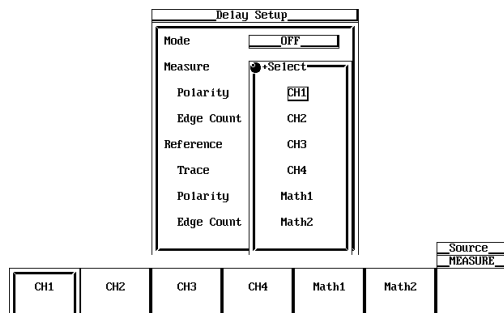
9. Pressing the **Delay Setup** soft key displays the delay setting menu and the measurement channel dialog box.
10. Press the soft key corresponding to the desired measurement channel. (The CH3, CH4, and Math2 soft keys are not displayed on the DL1720.)



11. Turn the jog shuttle to move the cursor to Mode.
12. Press **SELECT** to select ON.



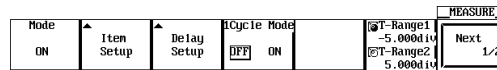
13. Turn the jog shuttle to move the cursor to Polarity under Measure.
14. Press **SELECT** to select whether to measure the rising edge (↑) or the falling edge (↓).
15. Turn the jog shuttle to move the cursor to Edge Count under Measure.
16. Press **SELECT**, and turn the jog shuttle to select on which rising or falling edge to make measurements.
17. Turn the jog shuttle to move the cursor to Reference.
18. Press **SELECT** to select whether the trace or the trigger is to be the reference.
19. Turn the jog shuttle to move the cursor to Trace.
20. Pressing **SELECT** displays the reference waveform menu.
21. Turn the jog shuttle to select the reference waveform, then press **SELECT**. (CH3, CH4, and Math2 are not displayed on the DL1720.)



22. Turn the jog shuttle to move the cursor to Polarity under Reference.
23. Press **SELECT** to select whether to make the rising (↗) or the falling (↘) edge the reference.
24. Turn the jog shuttle to move the cursor to Edge Count under Reference.
25. Press **SELECT** to select which rising or falling edge to make the reference.

**Setting the 1 Cycle Mode**

26. Press the **1 Cycle Mode** soft key to select ON or OFF.

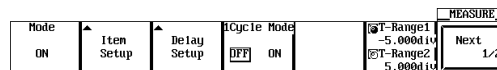


**Setting the Measurement Range**

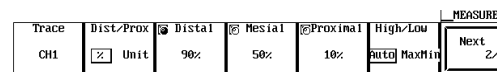
27. Press the **T-Range1/T-Range2** soft key to set the jog shuttle control to T-Range1.
28. Turn the jog shuttle to set the start of the measurement range.
29. Press the **T-Range1/T-Range2** soft key to set the jog shuttle control to T-Range2.
30. Turn the jog shuttle to set the end of the measurement range.

**Selecting the Target Waveform for Distal, Mesial, and Proximal Points**

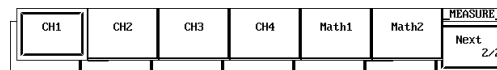
31. Press the **Next 1/2** soft key to display the Next 2/2 menu.



32. Pressing the **Trace** soft key displays the measured waveform menu.

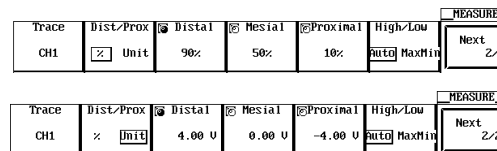


33. Press the soft key corresponding to the desired waveform. (The CH3, CH4, and Math2 soft keys are not displayed on the DL1720.)



**Setting the Distal, Mesial, and Proximal Unit (Dist/Prox)**

34. Press the **Next 1/2** soft key to display the Next 2/2 menu.
35. Press the **Dist/Prox** soft key to select the distal, mesial, or proximal unit.



**Setting the Distal, Mesial, and Proximal Points (Distal, Mesial, Proximal)**

36. Press the **Next 1/2** soft key to display the Next 2/2 menu.
37. Press the **Distal**, **Mesial**, or **Proximal** soft key.
38. Turn the jog shuttle to set the distal, mesial, or proximal point.

**Setting the High/Low Point**

39. Press the **Next 1/2** soft key to display the Next 2/2 menu.
40. Press the **High/Low** soft key to select Auto or MaxMin.

### **Explanation**

This function allows automated measurement of various parameters of the data stored in the acquisition memory. Up to 2400 data points of the result of the automated measurement can also be saved to a file. (See section 11.9, "Saving the Results of the Automated Measurement of Waveform Parameters.")

### **Restrictions**

Automated measurement of waveform parameters cannot be performed on the following waveforms.

- Snapshot waveforms
- Accumulated waveforms other than the newest waveform

### **Auto Measurement Mode**

ON: Measures the specified item.

Statistic: Performs statistical computation on the measured result of the specified item.  
See section 9.3, "Statistical Processing."

### **Selecting the High/Low Method: High-Low**

*High* and *Low* correspond to the 100% level and the 0% level, respectively, that are used to measure rise and fall times and other parameters. Select one of the two methods used to set the High and Low levels.

- Auto  
Based on the frequency of voltage levels of the waveform within the measurement range, the higher amplitude level is set to High and the lower amplitude level is set to Low taking into account the occurrences of ringing and spikes. This method is most suitable for measuring square waves and pulse waves.
- MaxMin  
The maximum and minimum values within the measurement range are set to High and Low, respectively. This method is most suitable for measuring sine waves and saw waves. It is not suited to the measurement of waveforms that have ringing and spikes.

### **Setting the Distal, Proximal, and Mesial Values: Distal/Prox**

Select the appropriate method to set the three levels that are to be used as reference for such measurements as rise and fall times.

- % (Percentage)  
The distal, mesial, and proximal values are set in terms of percentages when High of any trace (CH1 to CH4, Math1, Math2 (or CH1, CH2, and Math1 for the DL1720)) and Low are taken to be 100% and 0%, respectively.
- Unit  
Set the distal, mesial, and proximal values of any trace (CH1 to CH4, Math1, Math2 (or CH1, CH2, and Math1 for the DL1720)) to arbitrary voltage values.

### **Setting the Measurement Range: T-Range**

With the default setting, the  $\pm 5$  div of the time axis display frame is the measurement range. However, this range can be shortened. The measurement range is set using two vertical cursors. The position of the fine dashed line is the measurement start point and the position of the coarse dashed line is the end point.



**Measurement Parameters: Items**

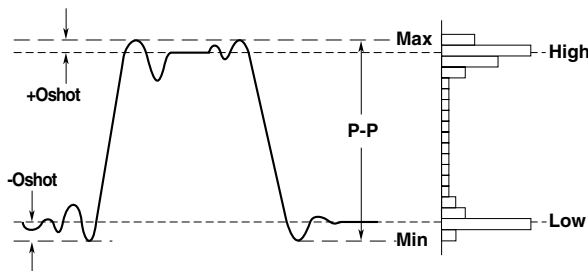
You can select among the 26 types of measurement parameters shown below and delay between channels. Up to 24000 combinations of parameters of all traces (CH1 to CH4, Math1, Math2 (or CH1, CH2, and Math1 for the DL1720)) can be saved. The parameters that can be displayed are as follows:

| Auto Measurement Mode | Displayed Parameters   |
|-----------------------|--|
| ON                    | Up to 12 parameters from all traces. The parameters of channels having smaller channel numbers have precedence. The parameters that appear higher in the parameter setting menu have precedence. |
| Statistics            | Up to 2 parameters from all traces. Displays statistical data. Channels having smaller channel numbers have precedence.  |

• Voltage-Axis Parameters

- P-P : Peak to Peak Value (MAX - MIN) [V]
- Max : Maximum Voltage [V]
- Min : Minimum Voltage [V]
- Rms : Root Mean Square Value  $(1/\sqrt{n})(\sum(xi)^2)^{1/2}$  [V]
- Avg : Average Voltage  $(1/n)\sum xi$  [V]
- Sdev: Standard Deviation  $(SDV)^* (1/n(\sum xi^2 - (\sum xi)^2/n))^{1/2}$
- Oshot : Undershoot Value  $(-Ovr)^* (LOW - MIN)/(HIGH - LOW) \times 100$  [%]
- +Oshot : Overshoot Value  $(+Ovr)^* (MAX - HIGH)/(HIGH - LOW) \times 100$  [%]
- High : High Level Voltage [V]
- Low : Low Level Voltage [V]

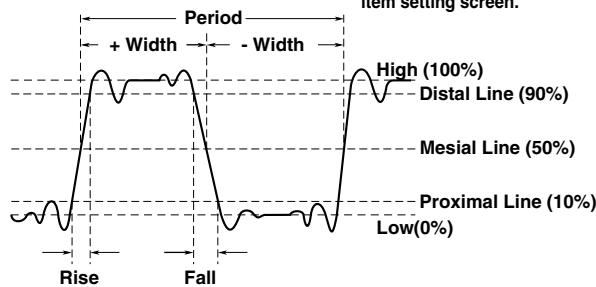
\*( ) shows the corresponding name at the measurement item setting screen.



• Time-Axis Parameters

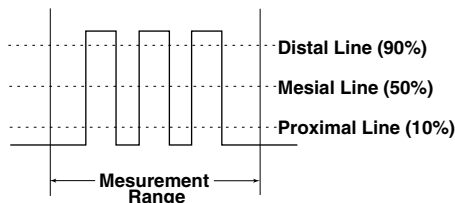
- Rise : Rise Time [s]
- Fall : Fall Time [s]
- Freq : Frequency [Hz], 1/PERIOD
- Period : Period [s]
- (Prod)\*
- Avg Freq : Mean Frequency in Measuring Range [Hz]
- (FR-A)\*
- Avg Period: Mean Period in Measuring Range [s]
- (PR-A)\*
- +Width : Width (s) Greater than the Mesial Value  $(+Wd)^*$
- Width : Width (s) Smaller than the Mesial Value  $(-Wd)^*$
- Duty : Duty Ratio + Width/Period x 100 [%]

\*( ) shows the corresponding name at the measurement item setting screen.

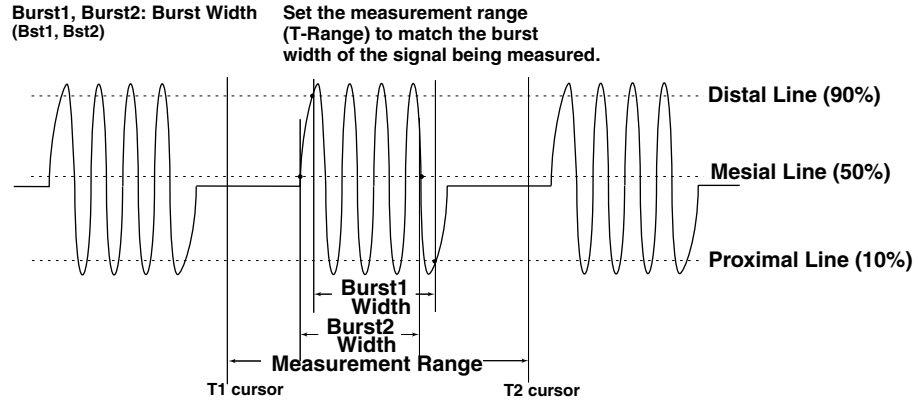


Pulse : Pulse Count (PlsN) Set the measurement range (T-Range) to match the pulse width of the signal being measured.

When Pulse=3



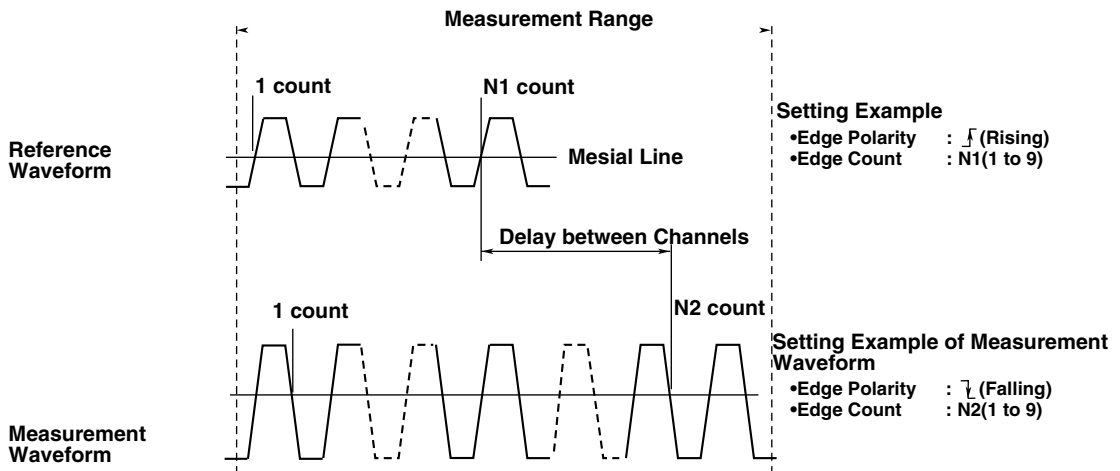
## 9.2 Automated Measurement of Waveform Parameters



- Other Measurement Parameters
  - Int1TY: The area under the positive amplitude
  - Int2TY: (The area under the positive amplitude) - (the area under the negative amplitude)
  - Int1XY: The summation of the triangular area of the X-Y waveform
  - Int2XY: The summation of the trapezoidal area of the X-Y waveform
- \* For details regarding the area calculations, see Appendix 2, "How to Calculate the Area of a Waveform."

### Delay between Channels:

The time difference between the rising or falling edges of trace waveforms or trigger points is called the *delay between channels*.



- If Mode is set to Time or Degree, measurements will be made. The default setting is OFF.
  - Time: Display the delay between channels as a time
  - Degree: Display the delay between channels as a degree  

$$\text{Degree} = \text{Delay (s)} / \text{Period (s)} \times 360 \text{ (deg)}$$
 The period is that of a standard waveform.
- Select rising  $\uparrow$  or falling  $\downarrow$  for the slope of the edge to be detected in Edge Polarity. The default setting is rising  $\uparrow$ .
- Set the number of edges to detect before actually considering it a detection point in Edge Count. The range is an integer from 1 to 9. The default setting is 1.
- The voltage level at the detection point is the mesial point.

- The parameter name when the measured value is displayed is (Dly).

### Note

If the Mode is set to Degree and the reference waveform is Trig, the measured value shows "\*\*\*\*."

### Setting Proximal, Mesial, and Distal: Dist/Prox

Unit: According to Dist/Prox setting.

Proximal Range: 0 to 100 (resolution: 1%) or voltage corresponding to  $\pm 8$  div (resolution:  $V/\text{div} \times 1/100$ )

Mesial Range: 0 to 100 (resolution: 1%) or voltage corresponding to  $\pm 8$  div (resolution:  $V/\text{div} \times 1/100$ )

Distal Range: 0 to 100 (resolution: 1%) or voltage corresponding to  $\pm 8$  div (resolution:  $V/\text{div} \times 1/100$ )

### Notes when Making Automated Measurement of Waveform Parameters

- The measured value will display "\*\*\*\*," if the measurement is not possible.
- If the waveform is of small amplitude, measurements may not produce correct results.
- If there are two or more cycles of a waveform in the measurement range, the measurement is made on the first waveform.

### 1 Cycle Mode

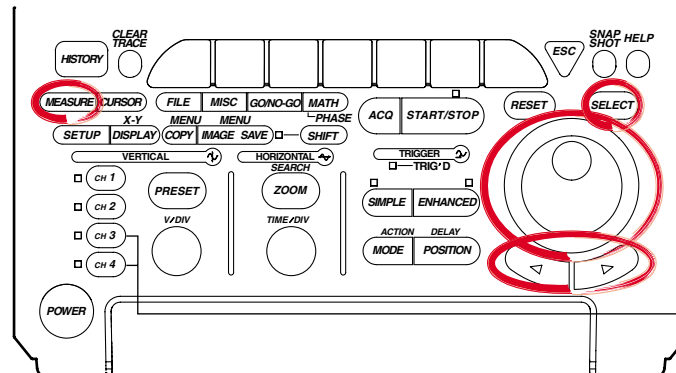
This mode is used to compute items related to the voltage axis or the area over one cycle after determining the cycle. This is suited to items such as Rms and Avg that produce errors depending on the measurement range.

This does not affect the items related to the time axis or the area of the X-Y waveforms.

## 9.3 Statistical Processing

<For a description of this function, refer to page 1-22>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Statistical Processing

1. Press **MEASURE**.
2. Pressing the **Mod** soft key displays the automated measurement mode menu.

| Mode | Item Setup | Delay Setup | Cycle | Mode | MEASURE                               |
|------|------------|-------------|-------|------|---------------------------------------|
| OFF  |            |             | OFF   | ON   | Next 1/2                              |
|      |            |             |       |      | Range1 -5.000d iv<br>Range2 5.000d iv |

3. Press the **Statistics** soft key to select the statistical processing.

| OFF | ON | Statistics | Cycle      | History    | MEASURE                               |
|-----|----|------------|------------|------------|---------------------------------------|
|     |    | Statistics | statistics | Statistics | Next 1/2                              |
|     |    |            |            |            | Range1 -5.000d iv<br>Range2 5.000d iv |

4. Pressing the **Item Setup** soft key displays the measurement parameter menu and the measurement channel menu.

| Mode       | Item Setup | Delay Setup | Cycle | Mode | MEASURE                               |
|------------|------------|-------------|-------|------|---------------------------------------|
| Statistics | Item Setup |             | OFF   | ON   | Next 1/2                              |
|            |            |             |       |      | Range1 -5.000d iv<br>Range2 5.000d iv |

5. Press the soft key corresponding to the desired measurement channel. (The CH3, CH4, and Math2 soft keys are not displayed on the DL1720.)

| Item Setup                     |                                 |                                    |     |       |       | Source  |
|--------------------------------|---------------------------------|------------------------------------|-----|-------|-------|---------|
| <input type="checkbox"/> P-P   | <input type="checkbox"/> Freq   | <input type="checkbox"/> AvgFreq   |     |       |       | MEASURE |
| <input type="checkbox"/> Max   | <input type="checkbox"/> Period | <input type="checkbox"/> AvgPeriod |     |       |       | Area1   |
| <input type="checkbox"/> Min   | <input type="checkbox"/> Rise   | <input type="checkbox"/> Int1TY    |     |       |       |         |
| <input type="checkbox"/> Avg   | <input type="checkbox"/> Fall   | <input type="checkbox"/> Int2TY    |     |       |       |         |
| <input type="checkbox"/> Rms   | <input type="checkbox"/> +Width | <input type="checkbox"/> Int1XY    |     |       |       |         |
| <input type="checkbox"/> Sdev  | <input type="checkbox"/> -Width | <input type="checkbox"/> Int2XY    |     |       |       |         |
| <input type="checkbox"/> High  | <input type="checkbox"/> Duty   |                                    |     |       |       |         |
| <input type="checkbox"/> Low   | <input type="checkbox"/> Burst1 |                                    |     |       |       |         |
| <input type="checkbox"/> +Shot | <input type="checkbox"/> Burst2 |                                    |     |       |       |         |
| <input type="checkbox"/> -Shot | <input type="checkbox"/> Pulse  |                                    |     |       |       |         |
| All Clear Copy To All Trace    |                                 |                                    |     |       |       |         |
| CH1                            | CH2                             | CH3                                | CH4 | Math1 | Math2 | OFF ON  |

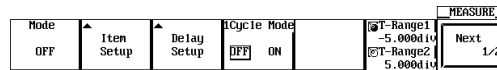
6. Turn the jog shuttle to move the cursor to the parameter you wish to turn ON. You can turn OFF all parameters at once by selecting All Clear. You can copy the current parameter settings to all traces by selecting Copy to All Trace.
7. Press **SELECT** to select ON.

- Repeat steps 5 to 7 as necessary.

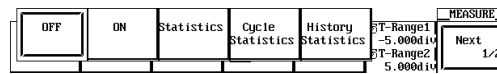
The setting of other parameters is the same as that of normal automated measurements (See section 9.2).

### Statistical Processing by Period

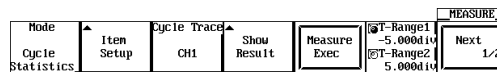
- Press **MEASURE**.
- Press the **Mode** soft key to display the automatic measurement mode selection menu.



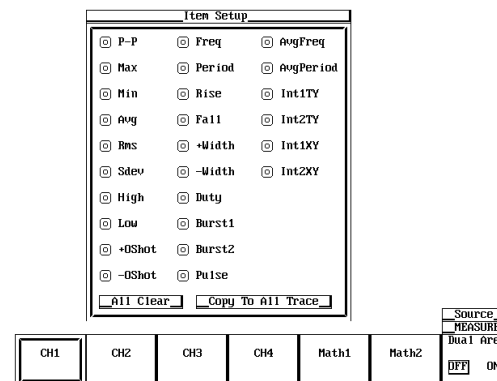
- Press the **Cycle Statistics** soft key to select the statistical processing by period.



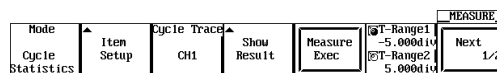
- Press the **Item Setup** soft key to display the measuring item dialog box and the measurement source channel selection menu.



- Press the soft key corresponding to the desired measurement source channel to select it. (The CH3, CH4, and Math2 soft keys are not displayed on the DL1720.)

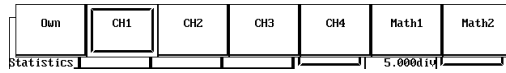


- Using the jog shuttle, move the cursor to the item that you wish to set to ON. If you select All Clear, all items are turned OFF. If you select Copy to All Trace, you can copy the current settings to all the traces.
- Press **SELECT** to turn ON an item.
- Repeat steps 5-7 as many times as necessary. Press **ESC** to return to the automatic measurement mode selection menu.
- Press the **Cycle Trace** soft key to display the period waveform selection menu.



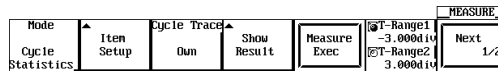
### 9.3 Statistical Processing

- Press the soft key corresponding to the source channel for the period. If Own is selected, each waveform's own period is used for its statistical processing. (The CH3, CH4, and Math2 soft keys are not displayed on the DL1720.)



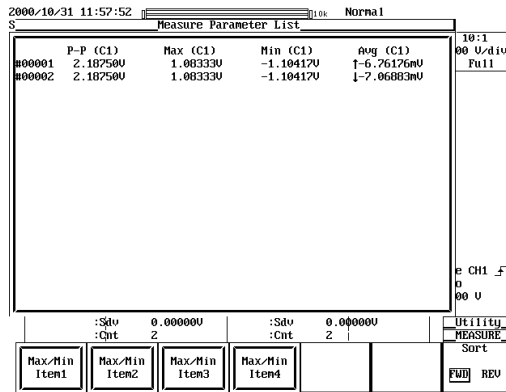
The other settings are the same as for normal automatic measurement (please see section 9.2).

- Press the **Measure Exec** soft key to perform the statistical processing. Press the key again to stop statistical processing.



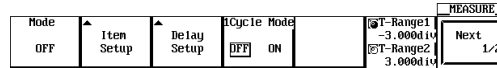
- Press the **Show Results** soft key to display a list of the automatic measurement results. Use the arrow keys to scroll the list horizontally, and the jog shuttle to scroll vertically.

Press the **Max/Min Item1 - Max/Min Item4** soft keys to move the cursor to the maximum and minimum values. From the left of the displayed parameters are Item1, Item2, Item3, and Item4. You can change the order to ascending (FWD) or descending (REV) with the **Sort** soft key.

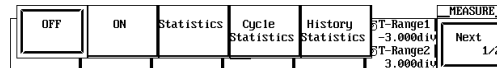


**Statistical Processing with History Data**

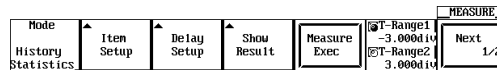
1. Press **MEASURE**.
2. Press the **Mode** soft key to display the automatic measurement mode selection menu.



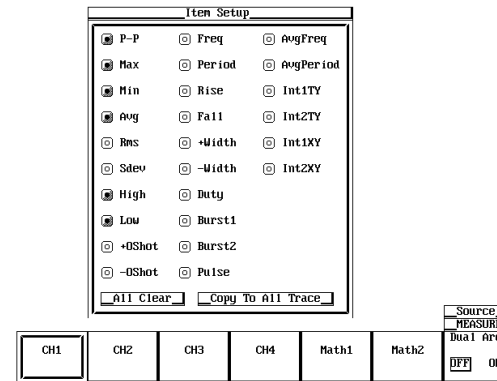
3. Press the **History Statistics** soft key to select the statistical processing with history data.



4. Press the **Item Setup** soft key to display the measurement item dialog box and the measuring source channel selection menu.



5. Press the soft key corresponding to the measuring source channel to select it. (The CH3, CH4, and Math2 soft keys are not displayed on the DL1720.)

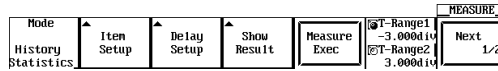


6. Using the jog shuttle, move the cursor to the item you wish to turn ON. If you select All Clear, you can turn OFF all the items at once. If you select Copy to All Trace, you can copy the current settings to all of the traces.
7. Press **SELECT** to turn ON the item.
8. Repeat steps 5-7 as many times as necessary. Press **ESC** to return to the automatic measurement mode selection menu.

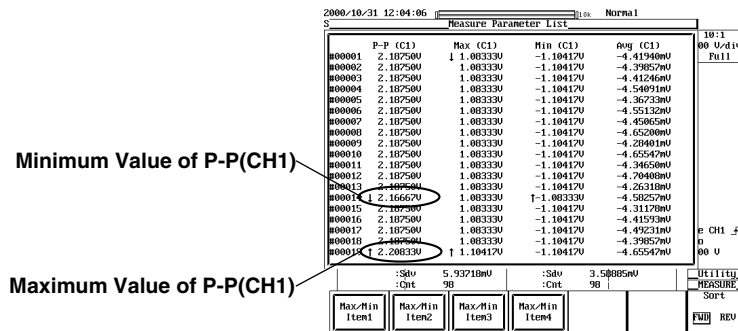
The other settings are the same as for normal automatic measurement.

### 9.3 Statistical Processing

- Press the **Measure Exec** soft key to execute the statistical processing. Press the key again to stop the statistical processing.



- Press the **Show Result** soft key to list the automatic measurement results. Use the arrow keys to scroll the list horizontally, and the jog shuttle to scroll it vertically. Press the **Max/Min Item1 - Max/Min Item4** soft keys to move the cursor to the maximum and minimum values of each parameter. From the left side of the displayed parameter is Item1, Item2, Item3, and Item4. Press **SELECT** to list the history waveform indicated by the cursor.



### Explanation

Performs statistical processing on the same measurement parameters as those of the automated measurement of waveform parameters. The following five statistics are determined on the two measured values of automated measurement parameters.

- Max: Maximum value
- Min: Minimum value
- Avg: Average value
- Sdv: Standard deviation
- Cnt: Number of measured values used in the statistical processing

For example, if you selected P-P of CH1 as an automated measurement parameter, the maximum, minimum, average, standard deviation, and the number of measured values used in the statistical processing of the P-P of CH1 are displayed.

The result of statistical processing that can be displayed is two parameters of automated measurement. If you selected three or more parameters for automated measurement, the first two parameters in the automated measurement parameter selection menu under Item Setup (P-P, Max, Min, ..., Init1XY, and Init2XY) are displayed starting from the smallest-numbered channel.

For example, if you selected P-P of CH1, Min of CH2, and Max of CH3, P-P of CH1 and Min of CH2 are displayed. The results of statistical processing that are not displayed can be loaded into a PC using the communication function. For details, see the communications interface user's manual.



The following three methods of statistical processing are available:

- **Normal Statistical Processing (Statistics)**

Statistical processing is performed on all acquired waveforms while acquiring waveforms. If you stop waveform acquisition and start it again, statistical processing continues from where it left off.

Statistical processing is performed on the selected parameters for automated measurement that are not displayed. Therefore, if you exclude statistical processing on the automated measurement parameter that is being displayed while waveform acquisition is in progress, the result of the statistical processing of the next selected parameter for automated measurement is displayed. The number of measured values used in the statistical processing (Cnt) is the number of waveforms that have been acquired up to that point.

If you add statistical processing on a new automated measurement parameter while waveform acquisition is in progress or when it is stopped, the number of measured values used in the statistical processing (Cnt) is the number of waveforms that have been acquired since the parameter was added.

- **Statistical Processing for Each Period**

Determines the period of the displayed waveform from the oldest data, measures the selected parameters for automated measurement on the data within the period, and performs statistical processing. The period is determined in the same fashion as the period for the waveform parameter. You can select whether to apply the period of the specified waveform to all waveforms or determine the period for each waveform.

CH1 to CH4, Math1, Math2: Apply the period of the specified waveform to all relevant (or CH1, CH2, and Math1 waveforms and perform statistical processing. for the DL1720)

Own: Determine the period for each relevant waveform and perform statistical processing.

Statistical processing is performed from the oldest data of the displayed waveform in blocks of periods.

It can not be used with the 1 cycle mode at the same time.

In addition, the following waveform parameters are not measured:

For waveforms whose period is measured:

Avg Freq (average frequency), Avg Period (average period), PlsN (pulse count), Int1XY (area), Int2XY (area), and Delay.

For other waveforms: Int1XY (area), Int2XY (area), and Delay.

### Note

Statistical processing for each period is not possible on automated measurement of waveform parameters on dual areas described in section 9.4.

- **Statistical Processing of Historical Data**

Performs automated measurement of waveform parameters on waveforms that were acquired using the history memory function and performs statistical processing.

Statistical processing is performed from the oldest waveform. The range on which the statistics are measured is the waveform that is displayed on Show Map.

It can be used with Delay and 1 cycle mode.

### Target Waveforms

CH1 to CH4, Math1, Math2 (or CH1, CH2, and Math1 for the DL1720)

### Automated Measurement Parameters for Statistical Processing

Items of statistical processing per period are given in section 9.2. Items of other statistical processing are indicated in section 9.2 and 9.4. The result of statistical processing that can be displayed is only two parameters of automated measurement.

### Measurement Range during Statistical Processing

The measurement range is the same as that specified for normal automated measurement (see section 9.2 and 9.4).

### Show Results

If you perform statistical processing for each period or statistical processing of historical data, a list of measured results can be displayed for the selected automated measurement parameters.

The waveforms are numbered from the oldest historical data, and the corresponding results of automated measurement are displayed.

The maximum and minimum values of each waveform parameter are displayed with the ↑ (maximum) and ↓ (minimum) symbols. If there are multiple points that are of the same value, the maximum and minimum values are marked on the oldest data.

The number of data points that can be listed is 24000. If this value is exceeded, the most recent 24000 points of automated measurement parameters of historical waveforms or data are displayed. In this case, the maximum and minimum values may exist outside the displayed list. In such cases, the maximum ↑ and minimum ↓ values outside the range are not displayed.

In the list of statistical processing of historical data, you can select a waveform using the jog shuttle and press **SELECT** to display the selected historical waveform.

For the statistical processing per period, statistical processing is performed only on the data that can be listed.

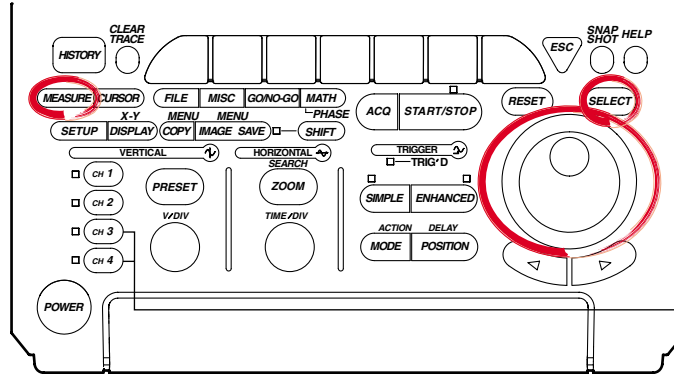
### Notes when Performing Statistical Processing

All soft keys except the **Measure Abort** soft key are disabled while the statistical processing is in progress.

## 9.4 Performing Automated Measurements of Waveform Parameters on Dual Areas

<For a description of this function, refer to page 1-23>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **MEASURE**.
2. Press the **Mode** soft key to display the automated measurement mode menu.

|      |            |             |            |           |          |
|------|------------|-------------|------------|-----------|----------|
| Mode | Item Setup | Delay Setup | Cycle Mode | T-Range1  | MEASURE  |
| OFF  |            |             | OFF ON     | -5.000d14 | Next 1/2 |
|      |            |             |            | 5.000d14  |          |

3. Press the **ON** soft key to set the automated measurement mode.

|     |    |            |                  |                    |           |          |
|-----|----|------------|------------------|--------------------|-----------|----------|
| OFF | ON | Statistics | Cycle Statistics | History Statistics | T-Range1  | MEASURE  |
|     |    |            |                  |                    | -5.000d14 | Next 1/2 |
|     |    |            |                  |                    | 5.000d14  |          |

### Selecting the Measurement Parameter

4. Press the **Item Setup** soft key. **Dual Area** is displayed at the right end of the soft key menu.

|      |            |             |            |           |          |
|------|------------|-------------|------------|-----------|----------|
| Mode | Item Setup | Delay Setup | Cycle Mode | T-Range1  | MEASURE  |
| ON   |            |             | OFF ON     | -5.000d14 | Next 1/2 |
|      |            |             |            | 5.000d14  |          |

5. Press the **Dual Area** soft key to turn it ON. (To return to the usual automated measurement screen, press the Dual Area soft key again to turn it OFF.) (The CH3, CH4, and Math2 soft keys are not displayed on the DL1720.)

|                                |                                 |                                    |     |       |       |           |
|--------------------------------|---------------------------------|------------------------------------|-----|-------|-------|-----------|
| Item Setup                     |                                 |                                    |     |       |       | Source    |
| <input type="checkbox"/> P-P   | <input type="checkbox"/> Freq   | <input type="checkbox"/> AvgFreq   |     |       |       | MEASURE   |
| <input type="checkbox"/> Max   | <input type="checkbox"/> Period | <input type="checkbox"/> AvgPeriod |     |       |       | Dual Area |
| <input type="checkbox"/> Min   | <input type="checkbox"/> Rise   | <input type="checkbox"/> Int1TY    |     |       |       | OFF ON    |
| <input type="checkbox"/> Avg   | <input type="checkbox"/> Fall   | <input type="checkbox"/> Int2TY    |     |       |       |           |
| <input type="checkbox"/> Rms   | <input type="checkbox"/> +Width | <input type="checkbox"/> Int1XY    |     |       |       |           |
| <input type="checkbox"/> Sdev  | <input type="checkbox"/> -Width | <input type="checkbox"/> Int2XY    |     |       |       |           |
| <input type="checkbox"/> High  | <input type="checkbox"/> Duty   |                                    |     |       |       |           |
| <input type="checkbox"/> Low   | <input type="checkbox"/> Burst1 |                                    |     |       |       |           |
| <input type="checkbox"/> +Shot | <input type="checkbox"/> Burst2 |                                    |     |       |       |           |
| <input type="checkbox"/> -Shot | <input type="checkbox"/> Pulse  |                                    |     |       |       |           |
| All Clear                      |                                 | Copy To All Trace                  |     |       |       |           |
| CH1                            | CH2                             | CH3                                | CH4 | Math1 | Math2 |           |

## 9.4 Performing Automated Measurements of Waveform Parameters on Dual Areas

- Press the **Item Setup** soft key to display the waveform parameter dialog box.

| Area1  |            | Area2  |            |
|--------|------------|--------|------------|
| Mode   | Trace      | Item   | Ope        |
| User1  | OFF ON     | CH1    | P-P        |
| User2  | OFF ON     | CH3    | Min        |
| User3  | OFF ON     | Math1  | Period     |
| User4  | OFF ON     | None   | Int1XY     |
| Const1 | 1.0000E+00 | Const2 | 1.0000E+00 |
| Const3 | 1.0000E+00 | Const4 | 1.0000E+00 |

|            |  |  |  |           |           |          |           |
|------------|--|--|--|-----------|-----------|----------|-----------|
| Item Setup |  |  |  | Range1    | Range3    | Range4   | Dual Area |
|            |  |  |  | -5.000div | -5.000div | 5.000div | MEASURE   |
|            |  |  |  | 5.000div  | 5.000div  |          | OFF ON    |

- Turn the jog shuttle to move the cursor to Mode of User1 and press **SELECT** to turn it ON.
- Turn the jog shuttle to move the cursor to Trace of Area1 of User1 and press **SELECT** to select the trace from CH1 through CH4, Math1, Math2, None, and Const1 through Const4 (or CH1 to CH2, Math1, None, and Const1 to Const4 for the DL1720). If you select None or Const1 through Const4, waveform parameters are not measured in Area1.

- Turn the jog shuttle to move the cursor to Item of Area1 of User1 and press **SELECT** to select the measurement parameter from P-P through Int2XY.

- Turn the jog shuttle to move the cursor to Ope of User1 and press **SELECT** to select the computation from +, -, \*, and /.

- Set Trace, Item, and Unit for Area2 in a similar fashion.
- To set constants, turn the jog shuttle to move the cursor to Const1 through Const4.
- Press **SELECT**, and set the constant using the jog shuttle. You can set up to four constants.

## 9.4 Performing Automated Measurements of Waveform Parameters on Dual Areas

14. To set User2 through User4, repeat steps 7 through 13 as necessary.

| Item Setup |            |      |        |            |        |           |  |  |  |
|------------|------------|------|--------|------------|--------|-----------|--|--|--|
| Area1      |            |      |        |            | Area2  |           |  |  |  |
| Mode       | Trace      | Item | Op     | Trace      | Item   | Unit      |  |  |  |
| User1      | OFF DN     | CH1  | P-P    | +          | Const1 | Avg       |  |  |  |
| User2      | OFF DN     | CH1  | Min    | +          | CH2    | Min       |  |  |  |
| User3      | OFF DN     | CH1  | Avg    | +          | None   | AvgPeriod |  |  |  |
| User4      | OFF DN     | None | Int1XY | /          | Const1 | Int2XY    |  |  |  |
| Const1     | 1.0000E+00 |      | Const2 | 1.0000E+00 |        |           |  |  |  |
| Const3     | 1.0000E-00 |      | Const4 | 1.0000E+00 |        |           |  |  |  |

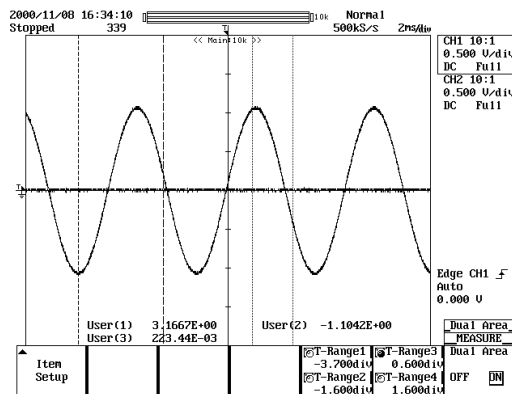
| Item Setup |  | T-Range1  | T-Range2  | T-Range3  | T-Range4  | Dual Area MEASURE |
|------------|--|-----------|-----------|-----------|-----------|-------------------|
|            |  | -5.000d1v | -5.000d1v | -5.000d1v | -5.000d1v | OFF DN            |
|            |  | 5.000d1v  | 5.000d1v  | 5.000d1v  | 5.000d1v  |                   |

### Setting the Measurement Range

15. Press **ESC**.
16. To set the measurement range of Area1, press the **T-Range1/T-Range2** soft key.

| Item Setup |  | T-Range1  | T-Range2  | T-Range3  | T-Range4  | Dual Area MEASURE |
|------------|--|-----------|-----------|-----------|-----------|-------------------|
|            |  | -5.000d1v | -5.000d1v | -5.000d1v | -5.000d1v | OFF DN            |
|            |  | 5.000d1v  | 5.000d1v  | 5.000d1v  | 5.000d1v  |                   |

17. Set the measurement start point of Area1. If the jog shuttle action is not set to T-Range1, press the **T-Range1/T-Range2** soft key to set the action to T-Range1.
18. Turn the jog shuttle to set the start point of the measurement range.
19. Set the measurement end point of Area1. Press the **T-Range1/T-Range2** soft key to set the jog shuttle action to T-Range2.
20. Turn the jog shuttle to set the end point of the measurement range.
21. Set the measurement range of Area2 in a similar fashion by pressing the **T-Range3/T-Range4** soft key.



## 9.4 Performing Automated Measurements of Waveform Parameters on Dual Areas

### Selecting the Target Waveform of Distal, Mesial, and Proximal Points

22. Press **ESC**.
23. Press the **Next 1/2** soft key to display the Next 2/2 menu.

|      |            |             |        |      |           |           |          |
|------|------------|-------------|--------|------|-----------|-----------|----------|
| Mode | Item Setup | Delay Setup | RCycle | Node | T-Range1  | T-Range2  | MEASURE  |
| ON   |            |             | OFF    | ON   | -3.700div | -1.600div | Next 1/2 |

24. Press the **Trace** soft key to display the target waveform selection menu.

|       |           |        |        |          |             |          |
|-------|-----------|--------|--------|----------|-------------|----------|
| Trace | Dist/Prox | Distal | Mesial | Proximal | High/Low    | MEASURE  |
| CH1   | Unit      | 90%    | 50%    | 10%      | Auto MaxMin | Next 2/2 |

25. Press the soft key corresponding to the desired waveform to select the target waveform. (The CH3, CH4, and Math2 soft keys are not displayed on the DL1720.)

|     |     |     |     |       |       |          |
|-----|-----|-----|-----|-------|-------|----------|
| CH1 | CH2 | CH3 | CH4 | Math1 | Math2 | MEASURE  |
|     |     |     |     |       |       | Next 2/2 |

### Unit for Distal, Mesial, and Proximal Points (Dist/Prox)

26. Press the **Next 1/2** soft key to display the Next 2/2 menu.
27. Press the **Dist/Prox** soft key to select the unit for distal, mesial, and proximal points.

|       |           |        |        |          |             |          |
|-------|-----------|--------|--------|----------|-------------|----------|
| Trace | Dist/Prox | Distal | Mesial | Proximal | High/Low    | MEASURE  |
| CH1   | Unit      | 90%    | 50%    | 10%      | Auto MaxMin | Next 2/2 |

### Setting the Distal, Mesial, and Proximal Points (Distal, Medial, and Proximal)

28. Press the **Next 1/2** soft key to display the Next 2/2 menu.
29. Press the **Distal**, **Mesial**, or **Proximal** soft key.

|       |           |        |        |          |             |          |
|-------|-----------|--------|--------|----------|-------------|----------|
| Trace | Dist/Prox | Distal | Mesial | Proximal | High/Low    | MEASURE  |
| CH1   | Unit      | 4.00 U | 0.00 U | -4.00 U  | Auto MaxMin | Next 2/2 |

30. Set the distal point, mesial point, and proximal point using the jog shuttle.

### Setting the High and Low Points

31. Press the **Next 1/2** soft key to display the Next 2/2 menu.
32. Press the **High/Low** soft key to select Auto or MaxMin.

|       |           |        |        |          |             |          |
|-------|-----------|--------|--------|----------|-------------|----------|
| Trace | Dist/Prox | Distal | Mesial | Proximal | High/Low    | MEASURE  |
| CH1   | Unit      | 4.00 U | 0.00 U | -4.00 U  | Auto MaxMin | Next 2/2 |

### Explanation

You can perform automated measurement of various measurement parameters (waveform parameters) on the data retrieved in the acquisition memory over two areas. You can also perform computation on the measurement parameter (waveform parameter) values that are determined in the two areas.

#### Waveforms Excluded from Measurements

The following waveform measurements are not possible in the automated measurement of waveform parameters.

- Snapshot waveforms
- Accumulated waveforms other than the newest waveform.

#### Automated Measurement Mode

ON: Performs computation between arbitrary items in Area1 and Area2.

Statistics: Performs statistical processing on the computed results between arbitrary items in Area1 and Area2. See section 9.3, "Statistical Processing."

#### Note

Statistical processing for each period (Cycle Statistics) is not possible.

#### Selecting the High/Low Assignment Method: High-Low

High indicates the 100% level in measurements such as the rise or fall time. And, Low indicates the 0% level. Select the assignment method of High and Low from the following two methods.

- Auto  
Sets the higher amplitude level to High and lower level to Low within the measurement range based on the voltage level frequency of the waveform by taking the effects of ringing, spikes, etc. into consideration. This method is best-suited when measuring rectangular waveforms and pulse waveforms.
- MaxMin  
Sets the maximum value to High and lowest value to Low in the measurement range. This method is best-suited when measuring sine waveforms, ramp waveforms, etc. It is not suited for measurement of waveforms with ringing and spikes.

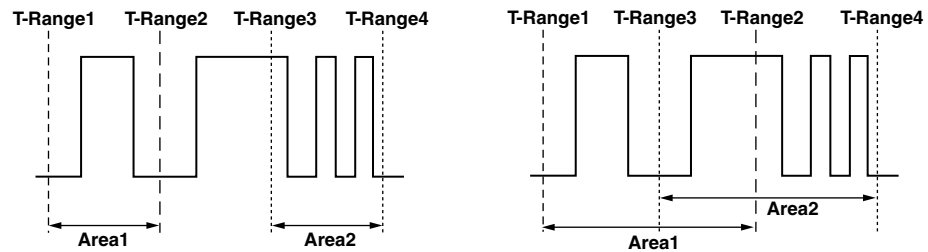
#### Setting the Distal, Proximal, and Mesial Values: Distal/Prox

Select the method of assigning the three levels that are used as references in measurements such as the rise and fall times.

- % (Percentage)  
Set the distal value, mesial value, and proximal value using a percentage with respect to an arbitrary trace (CH1 through CH4, Math1, and Math2 (or CH1, CH2, and Math1 for the DL1720)) with High set to 100% and Low set to 0%.
- Unit  
Set the distal value, mesial value, and proximal value of an arbitrary trace (CH1 through CH4, Math1, and Math2 (or CH1, CH2, and Math1 for the DL1720)) to an arbitrary voltage.

**Setting the Measurement Range: T-Range**

Set the measurement range of Area1 using T-Range1 and T-Range2. Set the measurement range of Area2 using T-Range3 and T-Range4. In the initial setting, the measurement range is  $\pm 5$  divisions of the display frame on the time axis. You can limit this range. The measurement range is specified using two vertical cursors for each area. In Area1, the measurement start point is the position where the fine dotted line is located, and the measurement end point is the position where the coarse dotted line is located. In Area2, both the measurement start point and measurement end point are where the fine dotted line is located. The measurement ranges of Area1 and Area2 can be specified redundantly.



**Dual Area Measurement Mode: Mode**

If you set the mode in the Item Setup menu to ON, the measurement result is displayed in the two areas. You can select User1 through User4.

**Measurement Trace: Trace**

You can select the trace from 11 types (or from 8 types on the DL1720: CH1 to CH2, Math1, None, and Const1 through Const4.): CH1 through 4, Math1, Math2, None, and Const1 through Const4. Const1 through Const4 are constants that can be specified arbitrarily.

**Measurement Parameters: Items**

Select from 27 types of measurement parameters (P-P, Max, Min, Rms, Avg, Sdev, High, Low, +OShot, -OShot, Freq, Period, Rise, Fall, +Width, -Width, Duty, Burst1, Burst2, Pulse, Delay, AvgFreq, AvgPeriod, Int1TY, Int2TY, Int1XY, and Int2XY). For details on each item, see the “Measurement Parameters: Items” and “Delay between channels: Delay Setup” sections in section 9.2. If you set the measurement trace to None or Const1 through Const4, you cannot select the measurement parameter.

**Computation: Ope**

Select the computation to be performed between items of Area1 and Area2. You can select +, -, \*, or /. If you set the measurement trace to None, the computation is not performed. In this case, the value of the measurement parameter in the other area is displayed.

**Setting Proximal, Mesial, and Distal: Dist/Prox**

- Unit: Dist/Prox
- Selectable Range of Proximal: 0 to 100 (1% steps) or voltage corresponding to  $\pm 8$  divisions (1/100 of V/div steps)
- Selectable Range of Mesial: 0 to 100 (1% steps) or voltage corresponding to  $\pm 8$  divisions (1/100 of V/div steps)
- Selectable Range of Distal: 0 to 100 (1% steps) or voltage corresponding to  $\pm 8$  divisions (1/100 of V/div steps)



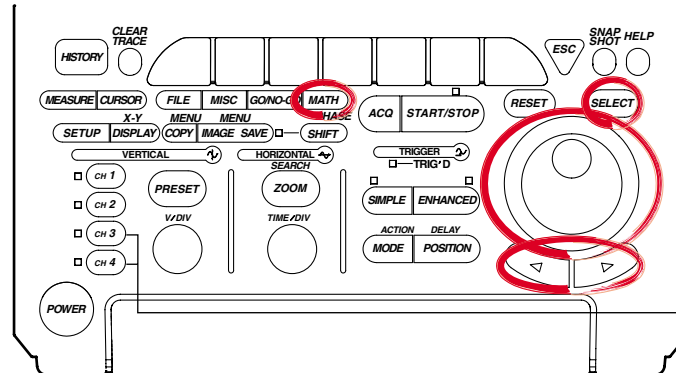
### Precautions to be Taken when Performing Automated Measurement of Waveform Parameters

- The measurement value displays “\*\*\*\*” if the measurement is not possible.
- For waveforms of small amplitude, correct measurements may not be possible.
- If there are two or more periods of waveform in the measurement range, the measurement is performed on the first period.

## 9.5 Adding, Subtracting, and Multiplying Waveforms

<For a description of this function, refer to page 1-24>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Turn ON/OFF the display

1. Press **MATH**.
2. Press the **M1 Display** soft key and select ON to display Math1 and OFF to not display M1.

| M1 Display | M1 Setup | M1 Label | M2 Display | M2 Setup | M2 Label | MATH  |       |
|------------|----------|----------|------------|----------|----------|-------|-------|
| OFF        | ON       | C1+C2    | Math1      | OFF      | ON       | C3+C4 | Math2 |

Math2 is not available on the DL1720, so these soft keys are not displayed.

#### Selecting the Channel on which to Perform Computation

3. Press the **M1 Setup** soft key to display the computation dialog box.
4. Turn the jog shuttle to move the cursor to Source1.

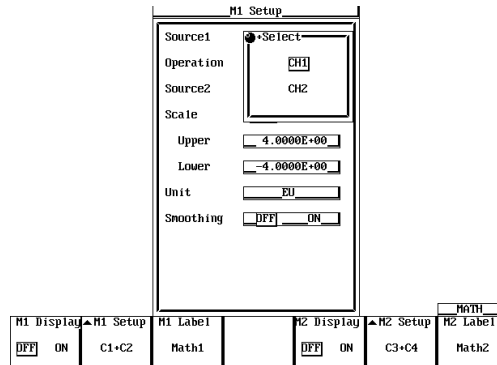
| M1 Setup  |             |  |  |  |  |  |
|-----------|-------------|--|--|--|--|--|
| Source1   | CH1         |  |  |  |  |  |
| Operation | +           |  |  |  |  |  |
| Source2   | CH2         |  |  |  |  |  |
| Scale     | Auto Manual |  |  |  |  |  |
| Upper     | 4.0000E+00  |  |  |  |  |  |
| Lower     | -4.0000E+00 |  |  |  |  |  |
| Unit      | EU          |  |  |  |  |  |
| Smothing  | OFF ON      |  |  |  |  |  |

| M1 Display | M1 Setup | M1 Label | M2 Display | M2 Setup | M2 Label | MATH  |       |
|------------|----------|----------|------------|----------|----------|-------|-------|
| OFF        | ON       | C1+C2    | Math1      | OFF      | ON       | C3+C4 | Math2 |

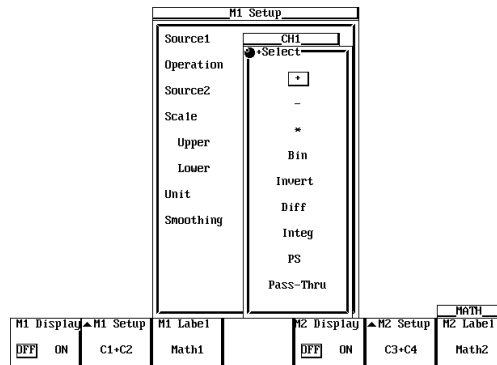
5. Pressing **SELECT** displays the channel menu.

- Turn the jog shuttle to select the channel on which to perform the computation and press **SELECT**.



**Setting the Operator**

- Turn the jog shuttle to move the cursor to Operation.
- Pressing **SELECT** displays the operator setting menu.
- Turn the jog shuttle to select +, -, or \* and press **SELECT**.



**Selecting the Channel on which to Perform Computation**

- Similar to steps 4 to 6, set Source2.

**Scaling**

- Turn the jog shuttle to move the cursor to Scale.
- Press **SELECT** to select Auto or Manual. If you select Auto, go to step 17.
- If you selected Manual, turn the jog shuttle to move the cursor to Upper.
- Pressing **SELECT** displays a menu used to set the upper limit of the waveform display.
- Turn the jog shuttle to set the upper limit and press **SELECT**.
- Set Lower in a similar fashion.

**Note**

If you select Auto, you cannot set Upper and Lower.

**Setting the Unit**

- Turn the jog shuttle to move the cursor to Unit.
- Using the keyboard that appears when **SELECT** is pressed enter the unit using four characters or less.

## 9.5 Adding, Subtracting, and Multiplying Waveforms

### Smoothing

19. Turn the jog shuttle to move the cursor to Smoothing.
20. Press **SELECT** to select ON or OFF.

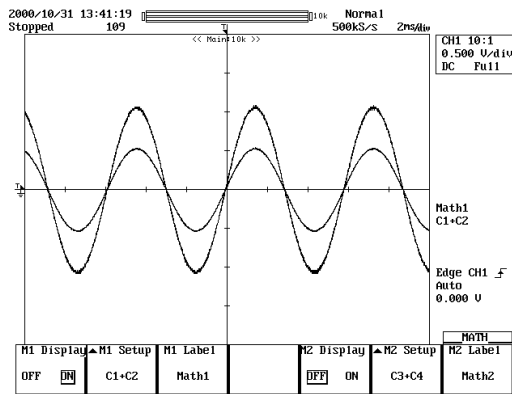
### Note

For details regarding smoothing, see section 9.10, "Smoothing."

### Entering Labels

21. Press the **M1 Label** soft key to display the keyboard, then enter a label. See section 8.5, "Setting the Waveform Labels" for information about displaying labels.

Set Math2 in a similar manner as necessary.



### Explanation

Addition, subtraction, and multiplication can be performed between the following channels.

#### DL1740

Math1: CH1 + (CH1 to CH4), CH2 + (CH1 to CH4)

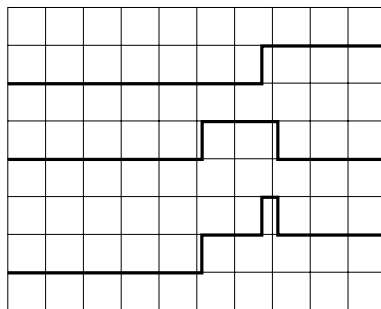
Math2: CH3 + (CH1 to CH4, Math1), CH4 + (CH1 to CH4, Math1)

Math1 and Math2 can be computed simultaneously.

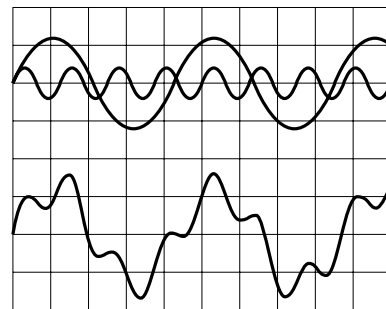
#### DL1720

Math1: CH1+ (CH1 or CH2), CH2+ (CH1 or CH2)

+ Computed Waveform



- Computed Waveform



### Scaling

Set the upper and lower limits on computations.

Auto: The upper and lower limits are set according to the computed result.

Manual: The upper and lower limits can be set arbitrarily. The range is  $-9.9999\text{E}+30$  to  $9.9999\text{E}+30$ .

### **Unit**

Unit can be set arbitrarily using up to four characters. The specified characters are reflected in the scale values.

### **Smoothing**

See section 9.10, "Smoothing."

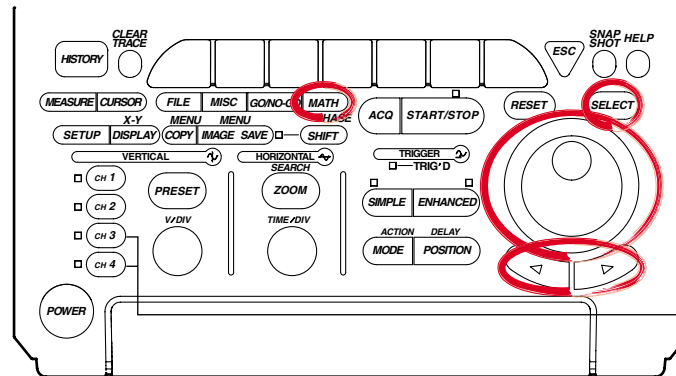
### **About Linear Scaling**

When performing computation on a channel that has linear scaling set, the computation is performed on the scaled value.

# 9.6 Binary Computation

<For a description of this function, refer to page 1-24>

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

### Turning the Display ON/OFF

1. Press **MATH**.
2. Press the **M1 Display** soft key and select ON to display Math1 and OFF to not display Math1.

| M1 Display |    | M1 Setup |       | M1 Label |  | M2 Display |    | M2 Setup |       | M2 Label |  | MATH |
|------------|----|----------|-------|----------|--|------------|----|----------|-------|----------|--|------|
| DIFF       | ON | C1+C2    | Math1 |          |  | DIFF       | ON | C3+C4    | Math2 |          |  |      |

Math2 is not available on the DL1720, so these soft keys are not displayed.

### Setting the Operator

3. Press the **M1 Setup** soft key to display the computation dialog box.
4. Turn the jog shuttle to move the cursor to Operation.

| M1 Display |    | M1 Setup |       | M1 Label |  | M2 Display |    | M2 Setup |       | M2 Label |  | MATH |
|------------|----|----------|-------|----------|--|------------|----|----------|-------|----------|--|------|
| DIFF       | ON | C1+C2    | Math1 |          |  | DIFF       | ON | C3+C4    | Math2 |          |  |      |

| M1 Display |    | M1 Setup |       | M1 Label |  | M2 Display |    | M2 Setup |       | M2 Label |  | MATH |
|------------|----|----------|-------|----------|--|------------|----|----------|-------|----------|--|------|
| DIFF       | ON | C1+C2    | Math1 |          |  | DIFF       | ON | C3+C4    | Math2 |          |  |      |

5. Pressing **SELECT** displays the operator setting menu.
6. Turn the jog shuttle to select Bin and press **SELECT**.

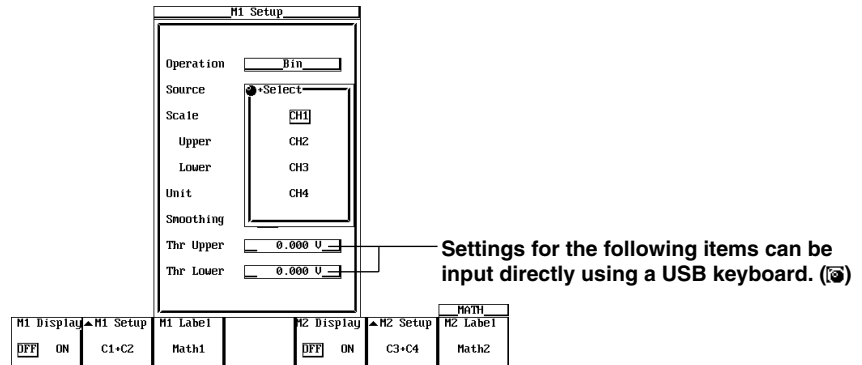
| M1 Display |    | M1 Setup |       | M1 Label |  | M2 Display |    | M2 Setup |       | M2 Label |  | MATH |
|------------|----|----------|-------|----------|--|------------|----|----------|-------|----------|--|------|
| DIFF       | ON | C1+C2    | Math1 |          |  | DIFF       | ON | C3+C4    | Math2 |          |  |      |

| M1 Display |    | M1 Setup |       | M1 Label |  | M2 Display |    | M2 Setup |       | M2 Label |  | MATH |
|------------|----|----------|-------|----------|--|------------|----|----------|-------|----------|--|------|
| DIFF       | ON | C1+C2    | Math1 |          |  | DIFF       | ON | C3+C4    | Math2 |          |  |      |

**Selecting the Channel on which to Perform Computation**

7. Turn the jog shuttle to move the cursor to Source.
8. Pressing **SELECT** displays the channel setting menu.
9. Turn the jog shuttle to select the channel on which to perform computation and press **SELECT**. (CH3 and CH4 are not displayed on the DL1720.)

**Scaling**

The upper limit and lower limit of scaling are fixed to +2 and -2, respectively.

**Setting the Unit**

10. Turn the jog shuttle to move the cursor to Unit.
11. Using the keyboard that appears when **SELECT** is pressed enter the unit using four characters or less.

**Smoothing**

12. Turn the jog shuttle to move the cursor to Smoothing.
13. Press **SELECT** to select ON or OFF.

**Note**

For details regarding smoothing, see section 9.10, "Smoothing."

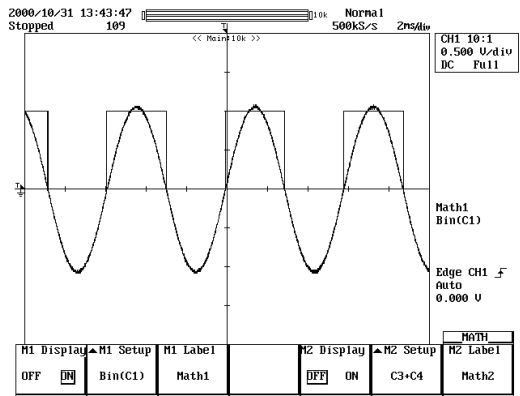
**Entering Labels**

14. Press the **M1 Label** soft key to display the keyboard, then enter a label. See section 8.5, "Setting the Waveform Labels" for information on displaying Labels.

**Setting the Threshold Level**

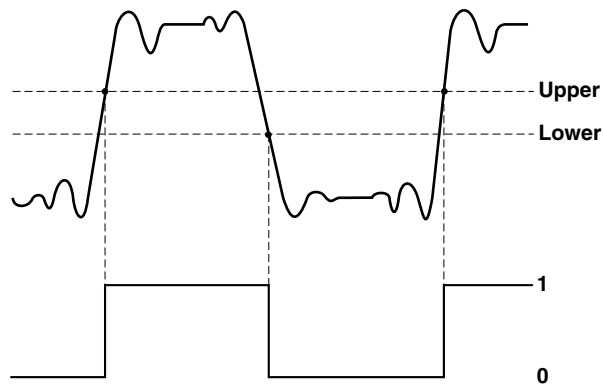
15. Turn the jog shuttle to move the cursor to Thr Upper.
16. Pressing **SELECT** displays the threshold level setting menu.
17. Turn the jog shuttle to set the threshold level and press **SELECT**.
18. Set Thr Lower in a similar fashion.

Set Math2 in a similar manner as necessary.



**Explanation**

This function converts CH1 to CH4 or Math1 waveform (or CH1 to CH2 waveform for the DL1720) to a digital signal (1 s and 0 s) according to the specified threshold level.



**Unit**

Unit can be set arbitrarily using up to four characters. The specified characters are reflected in the scale values.

**Smoothing**

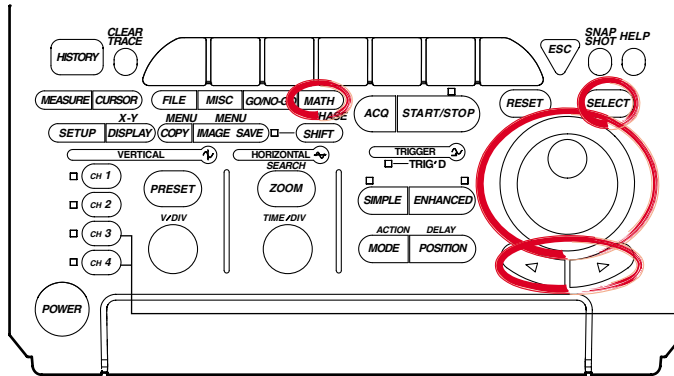
See section 9.10, "Smoothing."



# 9.7 Inverting the Waveform Display

<For a discription of this function, refer to page 1-24>

## Relevant Keys

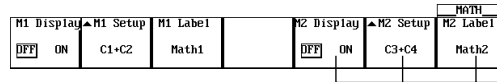


The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

### Turning ON/OFF the Display

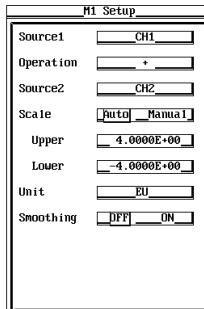
1. Press **MATH**.
2. Press the **M1 Display** soft key and select ON to display Math1 and OFF to not display Math1.



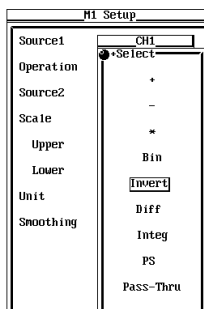
Math2 is not available on the DL1720, so these soft keys are not displayed.

### Setting the Operator

3. Press the **M1 Setup** soft key to display the computation dialog box.
4. Turn the jog shuttle to move the cursor to Operation.



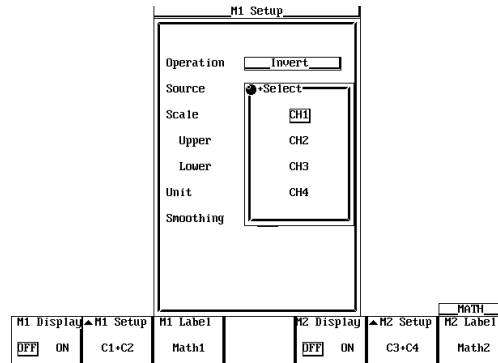
5. Pressing **SELECT** displays the operator setting menu.
6. Turn the jog shuttle to select Invert and press **SELECT**.



## 9.7 Inverting the Waveform Display

### Selecting the Waveform to be Inverted

- Turn the jog shuttle to move the cursor to Source.
- Pressing **SELECT** displays the channel setting menu.
- Turn the jog shuttle to select the channel on which to perform computation and press **SELECT**. (CH3 and CH4 are not displayed on the DL1720.)



### Scaling

- Turn the jog shuttle to move the cursor to Scale.
- Press **SELECT** to select Auto or Manual.
- If you selected Manual, turn the jog shuttle to move the cursor to Upper.
- Pressing **SELECT** displays a menu used to display the upper limit of the waveform.
- Turn the jog shuttle to set the upper limit and press **SELECT**.
- Set Lower in a similar fashion.

### Setting the Unit

- Turn the jog shuttle to move the cursor to Unit.
- Using the keyboard that appears when **SELECT** is pressed enter the unit using four characters or less.

### Smoothing

- Turn the jog shuttle to move the cursor to "Smoothing."
- Press **SELECT** to select ON or OFF.

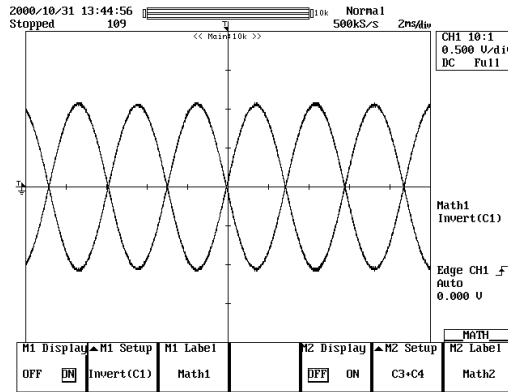
### Note

For details regarding smoothing, see section 9.10, "Smoothing."

**Entering Labels**

20. Press the **M1 Label** soft key to display the keyboard. See section 8.5, “Setting Waveform Labels” for information about displaying labels.

Set Math2 in a similar manner as necessary.



**Explanation**

**Waveforms that can be Inverted**

The waveform is inverted by multiplying CH1 to CH4 and Math1 (or CH1 to CH2 for the DL1720) by  $-1$ .

**Scaling**

Set the upper and lower limits on computations.

Auto: The upper and lower limits are set according to the computed result.

Manual: The upper and lower limits can be set arbitrarily. The range is  $-9.9999E+30$  to  $9.9999E+30$ .

**Unit**

Unit can be set arbitrarily using up to four characters. The specified characters are reflected in the scale values.

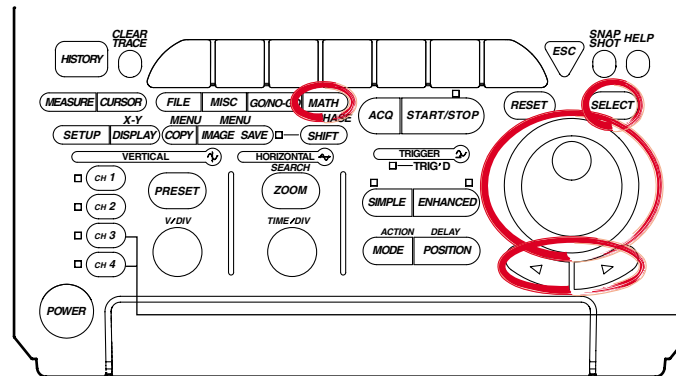
**Smoothing**

See section 9.10, “Smoothing.”

# 9.8 Differentiating and Integration Waveforms

<For a discription of this function, refer to page 1-24>

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

### Turning ON/OFF the Display

1. Press **MATH**.
2. Press the **M1 Display** soft key and select ON to display Math1 and OFF to not display Math1.

| M1 Display |       |       | M2 Display |       |       | MATH  |       |       |
|------------|-------|-------|------------|-------|-------|-------|-------|-------|
| Label      | Setup | Label | Label      | Setup | Label | Label | Setup | Label |
| OFF        | ON    | C1-C2 | Math1      |       |       | OFF   | ON    | C3-C4 |
|            |       |       |            |       |       |       |       | Math2 |

Math2 is not available on the DL1720, so these soft keys are not displayed.

### Setting the Operator

3. Press the **M1 Setup** soft key to display the computation dialog box.
4. Turn the jog shuttle to move the cursor to Operation.

**M1 Setup**

Source1

Operation

Source2

Scale

Upper

Lower

Unit

Snoothing

| M1 Display |       |       | M2 Display |       |       | MATH  |       |       |
|------------|-------|-------|------------|-------|-------|-------|-------|-------|
| Label      | Setup | Label | Label      | Setup | Label | Label | Setup | Label |
| OFF        | ON    | C1-C2 | Math1      |       |       | OFF   | ON    | C3-C4 |
|            |       |       |            |       |       |       |       | Math2 |

5. Pressing **SELECT** displays the operator setting menu.
6. Turn the jog shuttle to select Diff (differentiation) or Integ (integration) and press **SELECT**.

**M1 Setup**

Source1

Operation

Source2

Scale

Upper

Lower

Unit

Snoothing

PS

Pass-Thru

| M1 Display |       |       | M2 Display |       |       | MATH  |       |       |
|------------|-------|-------|------------|-------|-------|-------|-------|-------|
| Label      | Setup | Label | Label      | Setup | Label | Label | Setup | Label |
| OFF        | ON    | C1-C2 | Math1      |       |       | OFF   | ON    | C3-C4 |
|            |       |       |            |       |       |       |       | Math2 |

**Setting the Channel on which to Perform Computation**

7. Turn the jog shuttle to move the cursor to Source.
8. Pressing **SELECT** displays the channel setting menu.
9. Turn the jog shuttle to select the channel on which to perform computation and press **SELECT**. (CH3 and CH4 are not displayed on the DL1720.)

**Diff**

M1 Setup

Operation

Source

Scale

Upper

Lower

Unit

Smoothing

**Integ**

M1 Setup

Operation

Source

Scale

Upper

Lower

Unit

Smoothing

Start Point

|            |          |          |       |  |  |  |      |
|------------|----------|----------|-------|--|--|--|------|
| M1 Display | M1 Setup | M1 Label |       |  |  |  | MATH |
| DIFF       | ON       | C1-C2    | Math1 |  |  |  |      |

The numerical values for this item can be input directly using a USB keyboard. (Ⓜ)

**Scaling**

10. Turn the jog shuttle to move the cursor to Scale.
11. Press **SELECT** to select Auto or Manual.
12. If you selected Manual, turn the jog shuttle to move the cursor to Upper.
13. Pressing **SELECT** displays a menu used to set the upper limit of the waveform.
14. Turn the jog shuttle to set the upper limit and press **SELECT**.
15. Set Lower in a similar fashion.

**Setting the Unit**

16. Turn the jog shuttle to move the cursor to Unit.
17. Using the keyboard that appears when **SELECT** is pressed enter the unit using four characters or less.

**Smoothing**

18. Turn the jog shuttle to move the cursor to Smoothing.
19. Press **SELECT** to select ON or OFF.

**Setting the Start Point (When Integ is Selected)**

20. Turn the jog shuttle to move the cursor to Start Point.
21. Press **SELECT**, set the start point using the jog shuttle, then press **SELECT** again.

**Note**

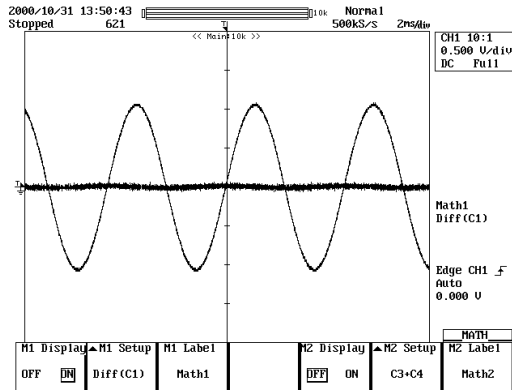
For details regarding smoothing, see section 9.10, "Smoothing."

## 9.8 Differentiating and Integration Waveforms

### Entering Labels

22. Press the **M1 Label** soft key to display the keyboard. See section 8.5, “Setting the Waveform Labels” for information about displaying labels.

Set Math2 in a similar manner as necessary. (Math2 is not available on the DL1720.)



### Explanation

#### Waveforms to be Differentiated or Integrated

CH1 to CH4 and Math1 waveforms (or CH1 to CH2 waveform for the DL1720) can be differentiated or integrated.

#### Scaling

Set the upper and lower limits on computations.

Auto: The upper and lower limits are set according to the computed result.

Manual: The upper and lower limits can be set arbitrarily. The range is  $-9.9999E+30$  to  $9.9999E+30$ .

#### Unit

Unit can be set arbitrarily using up to four characters. The specified characters are reflected in the scale values.

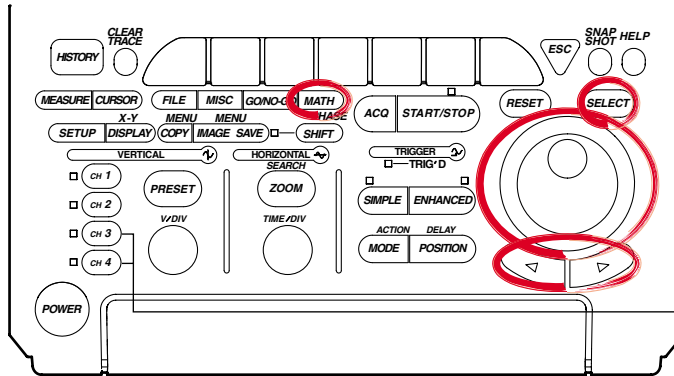
#### Smoothing

See section 9.10, “Smoothing.”

# 9.9 Displaying the Power Spectrum

<For a description of this function, refer to page 1-25>

## Relevant Keys

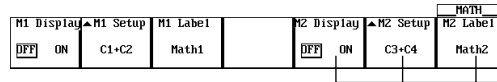


The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

### Turning ON/OFF the Display

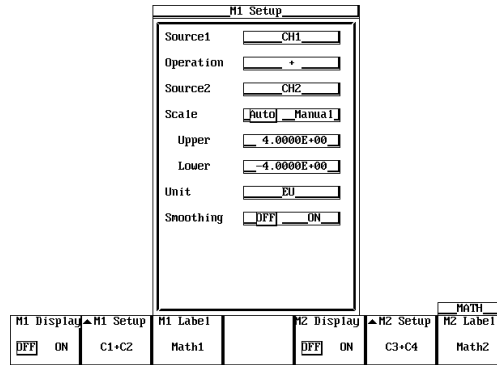
1. Press **MATH**.
2. Press the **M1 Display** soft key and select ON to display Math1 and OFF to not display Math1.



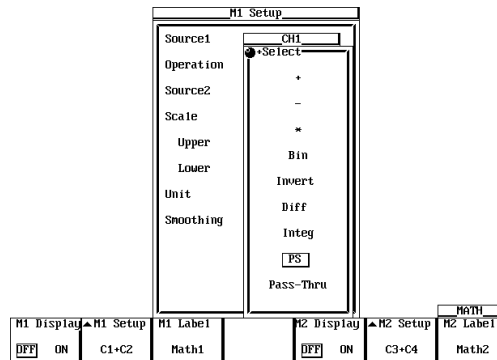
Math2 is not available on the DL1720, so these soft keys are not displayed.

### Setting the Operator

3. Press the **M1 Setup** soft key to display the computation dialog box.
4. Turn the jog shuttle to move the cursor to Operation.



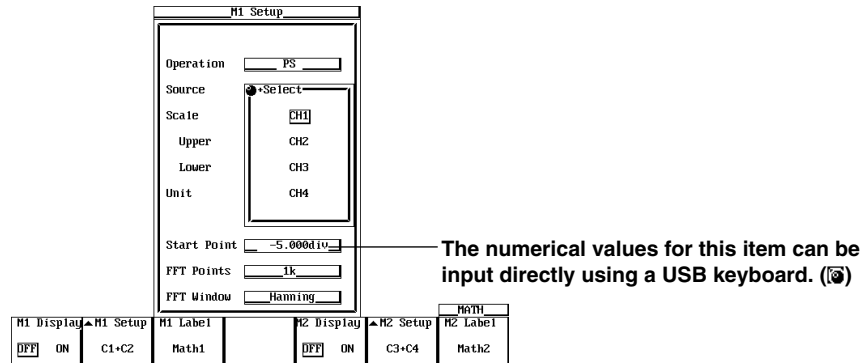
5. Pressing **SELECT** displays the operator setting menu.
6. Turn the jog shuttle to select PS and press **SELECT**.



## 9.9 Displaying the Power Spectrum

### Selecting the Channel on which to Perform Computation

7. Turn the jog shuttle to move the cursor to Source.
8. Pressing **SELECT** displays the channel setting menu.
9. Turn the jog shuttle to select the channel on which to perform computation and press **SELECT**. (CH3 and CH4 are not displayed on the DL1720.)



### Scaling

10. Turn the jog shuttle to move the cursor to Scale.
11. Press **SELECT** to select Auto or Manual.
12. If you select Manual, turn the jog shuttle to move the cursor to Upper.
13. Pressing **SELECT** displays a menu used to set the upper limit of the waveform display.
14. Turn the jog shuttle to set the upper limit and press **SELECT**.
15. Set Lower in a similar fashion.

### Setting the Unit

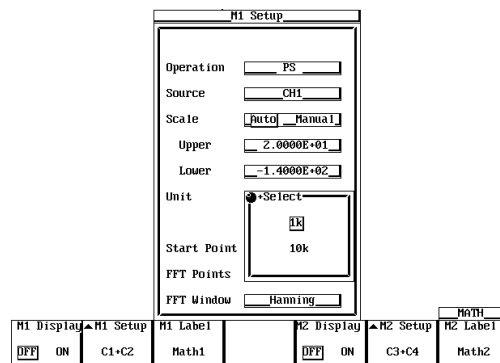
16. Turn the jog shuttle to move the cursor to Unit.
17. Using the keyboard that appears when **SELECT** is pressed enter the unit using four characters or less.

### Setting the Start Point

18. Turn the jog shuttle to move the cursor to Start Point.
19. Pressing **SELECT** displays a menu used to set the FFT start point.
20. Turn the jog shuttle to set the start point and press **SELECT**.

### Setting the Number of FFT Points

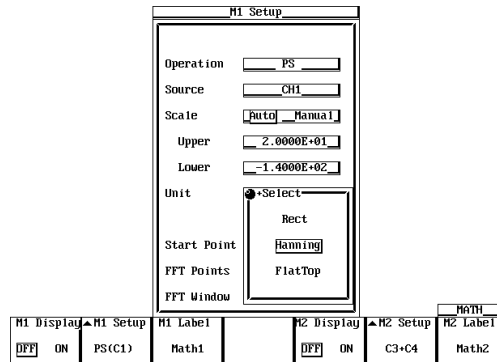
21. Turn the jog shuttle to move the cursor to FFT Points.
22. Pressing **SELECT** displays a menu used to select the number of points on which to take the FFT.
23. Turn the jog shuttle to select 1 k or 10 k and press **SELECT**.



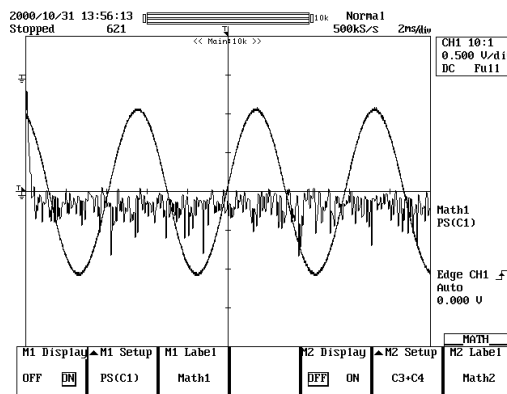


**Selecting the Time Window**

24. Turn the jog shuttle to move the cursor to FFT Window.
25. Pressing **SELECT** displays the time window menu.
26. Turn the jog shuttle to select Rect, Hanning, or FlatTop and press **SELECT**.

**Entering Labels**

27. Press the **M1 Label** soft key to display the keyboard. See section 8.5, “Setting the Waveform Labels” for information about displaying labels.

**Explanation**

This function displays the power spectrum of CH1 to CH4 and Math1 waveforms (or CH1 to CH2 waveform for the DL1720).

**Number of Computing Points: Point**

Select 1000 or 10000.

Using the number of computing points from the specified Start point, an FFT is performed and the power spectrum is displayed.

**Selecting the Time Window: Window**

Select from the following windows.

Rect (Rectangular): Best suited for transient signals that attenuate completely within the time window.

Hanning (Hanning): Best suited for continuous and non-periodic signals.

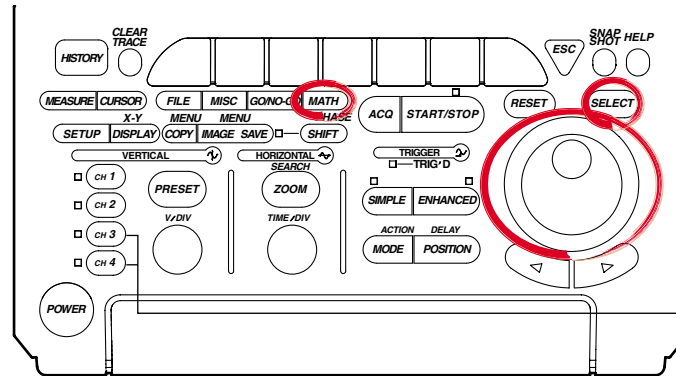
FlatTop (Flat Top): Best suited for improve the accuracy of the level even if the frequency resolution is to be compromised.

**Notes when Displaying Power Spectrums**

- Cannot be executed if the displayed record length is less than number of computation points (Point).

# 9.10 Smoothing

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

### Turning ON/OFF the Display

1. Press **MATH**.
2. Press the **M1 Display** soft key and select ON to display Math1 and OFF to not display Math1.

| M1 Display |    | M1 Setup |  | M1 Label |  | M2 Display |    | M2 Setup |  | M2 Label |  |
|------------|----|----------|--|----------|--|------------|----|----------|--|----------|--|
| OFF        | ON | C1+C2    |  | Math1    |  | OFF        | ON | C3+C4    |  | Math2    |  |

Math2 is not available on the DL1720, so these soft keys are not displayed.

### Setting the Operator

3. Press the **M1 Setup** soft key to display the computation dialog box.

| M1 Display |    | M1 Setup |  | M1 Label |  | M2 Display |    | M2 Setup |  | M2 Label |  |
|------------|----|----------|--|----------|--|------------|----|----------|--|----------|--|
| OFF        | ON | C1+C2    |  | Math1    |  | OFF        | ON | C3+C4    |  | Math2    |  |

| M1 Setup  |             |  |  |  |  |  |  |  |  |  |  |
|-----------|-------------|--|--|--|--|--|--|--|--|--|--|
| Source1   | CH1         |  |  |  |  |  |  |  |  |  |  |
| Operation | +           |  |  |  |  |  |  |  |  |  |  |
| Source2   | CH2         |  |  |  |  |  |  |  |  |  |  |
| Scale     | Auto        |  |  |  |  |  |  |  |  |  |  |
| Upper     | 4.0000E+00  |  |  |  |  |  |  |  |  |  |  |
| Lower     | -4.0000E+00 |  |  |  |  |  |  |  |  |  |  |
| Unit      | EU          |  |  |  |  |  |  |  |  |  |  |
| Snoothing | OFF         |  |  |  |  |  |  |  |  |  |  |

To smooth the measured data, set Operation to Pass-Thru.

| M1 Display |    | M1 Setup |  | M1 Label |  | M2 Display |    | M2 Setup |  | M2 Label |  |
|------------|----|----------|--|----------|--|------------|----|----------|--|----------|--|
| OFF        | ON | C1+C2    |  | Math1    |  | OFF        | ON | C3+C4    |  | Math2    |  |

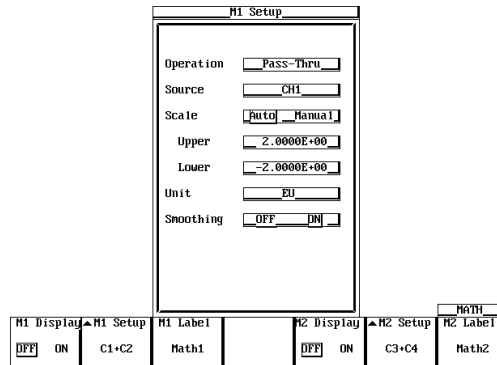
| M1 Setup  |           |  |  |  |  |  |  |  |  |  |  |
|-----------|-----------|--|--|--|--|--|--|--|--|--|--|
| Source1   | CH1       |  |  |  |  |  |  |  |  |  |  |
| Operation | Select    |  |  |  |  |  |  |  |  |  |  |
| Source2   | -         |  |  |  |  |  |  |  |  |  |  |
| Scale     | *         |  |  |  |  |  |  |  |  |  |  |
| Upper     | Bin       |  |  |  |  |  |  |  |  |  |  |
| Lower     | Invert    |  |  |  |  |  |  |  |  |  |  |
| Unit      | Diff      |  |  |  |  |  |  |  |  |  |  |
| Snoothing | Integ     |  |  |  |  |  |  |  |  |  |  |
|           | PS        |  |  |  |  |  |  |  |  |  |  |
|           | Pass-Thru |  |  |  |  |  |  |  |  |  |  |

**Note**

If an operator other than Through is selected, the computation is performed on the smoothed value.

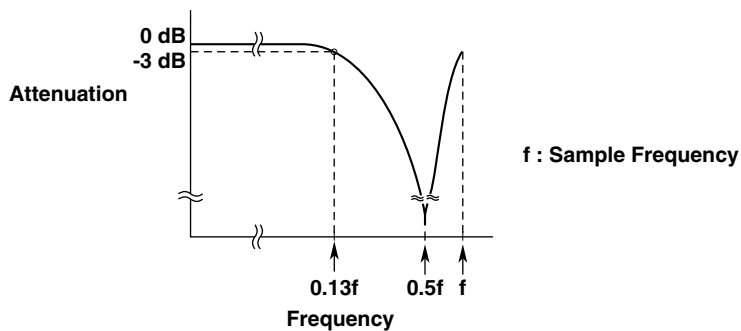
**Smoothing**

4. Turn the jog shuttle to move the cursor to Smoothing.
5. Press **SELECT** to select ON.



**Explanation**

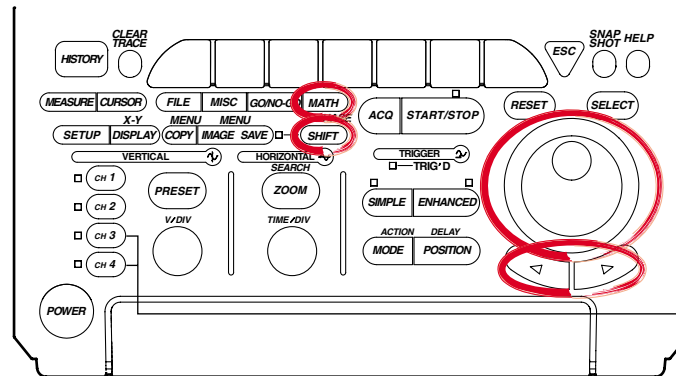
The moving average is determined every five data samples, and the waveform is displayed based on the results. Since this process is performed on the data stored in the acquisition memory, it can be executed even when the waveform acquisition is stopped. This smoothing process has the following frequency characteristics with respect to the sample rate. The -3dB point is at approximately 13% of the sample rate.



# 9.11 Phase-Shifted Display

<For a discription of this function, refer to page 1-24>

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

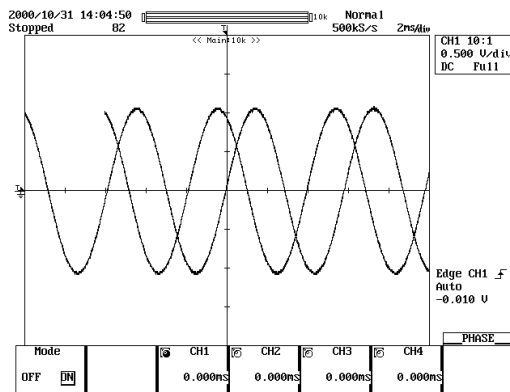
### Setting the Computation Mode

1. Press **SHIFT** to activate shift mode. Functions marked in purple on the panel become active.
2. Press **MATH**.
3. Press the **Mode** soft key to select ON or OFF.

| Mode | CH1 | CH2     | CH3     | CH4     | PHASE   |
|------|-----|---------|---------|---------|---------|
| OFF  | ON  | 0.000ns | 0.000ns | 0.000ns | 0.000ns |

These soft keys are not displayed on the DL1720.

4. Press the soft key corresponding to the channel whose phase is to be shifted.
5. Turn the jog shuttle to set the shifted time.



## Explanation

The phase of CH1 to CH4 waveforms (or CH1 to CH2 waveform for the DL1720) is shifted and the result is displayed. Computation can also be carried out on phase-shifted waveforms.

### Allowable Shift Range

The phase can be shifted in the following range.  
 Time value between  $-(\text{record length}/2)$  to  $(\text{record length}/2)$  (resolution:  $1/\text{sample rate}$ )  
 The sample rate varies depending on the record length or T/div setting. For details, see appendix 1, "Relationship between the Time Axis Setting, Sample Rate, and Record Length."

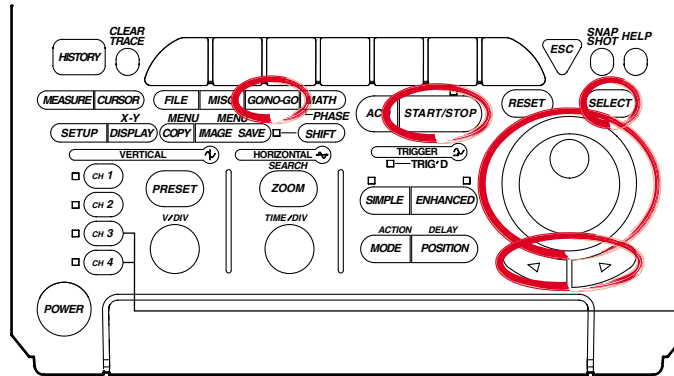
### Notes when Shifting the Phase

If you change the T/div setting after shifting the phase, the shift on the screen does not change, but the specified time value change in accordance with the T/div setting.

## 9.12 GO/NO-GO Determination Using the Measurement of Waveform Parameters

<For a description of this function, refer to page 1-32>

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Setting the Mode

1. Press **GO/NO-GO**.
2. Pressing the **Mode** soft key displays a menu used to set the GO/NO-GO determination mode.

|      |  |  |  |  |  |          |
|------|--|--|--|--|--|----------|
| Mode |  |  |  |  |  | GO/NO-GO |
| OFF  |  |  |  |  |  |          |

3. Press the **Parameter** soft key to set the GO/NO-GO determination mode.

|     |      |           |  |  |  |          |
|-----|------|-----------|--|--|--|----------|
| OFF | Zone | Parameter |  |  |  | GO/NO-GO |
|-----|------|-----------|--|--|--|----------|

#### Setting Param1

4. Pressing the **Setup** soft key displays the determination criteria menu.

|           |  |       |  |           |      |          |
|-----------|--|-------|--|-----------|------|----------|
| Mode      |  |       |  | T-Range1  | Exec | GO/NO-GO |
| Parameter |  | Setup |  | -5.000d14 |      |          |
|           |  |       |  | T-Range2  |      |          |
|           |  |       |  | 5.000d14  |      |          |

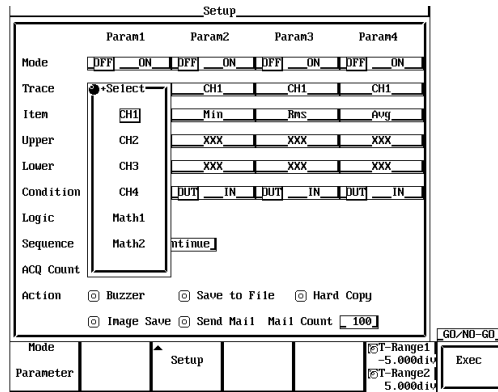
5. Turn the jog shuttle to move the cursor to Mode under Param1.

|           | Param1  | Param2 | Param3 | Param4 |
|-----------|---|--------|--------|--------|
| Mode      | OFF ON  | OFF ON | OFF ON | OFF ON |
| Trace     | CH1   | CH1    | CH1    | CH1    |
| Item      | Max   | Min    | Rms    | Avg    |
| Upper     | XXX   | XXX    | XXX    | XXX    |
| Lower     | XXX   | XXX    | XXX    | XXX    |
| Condition | OUT IN  | OUT IN | OUT IN | OUT IN |
| Logic     | AND OR  |        |        |        |
| Sequence  | Single Continue   |        |        |        |
| ACQ Count | Infinite  |        |        |        |
| Action    | <input type="checkbox"/> Buzzer <input type="checkbox"/> Save to File <input type="checkbox"/> Hard Copy<br><input type="checkbox"/> Image Save <input type="checkbox"/> Send Mail   Mail Count 100 |        |        |        |

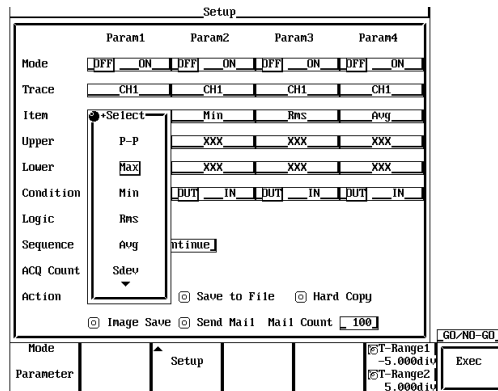
Settings for the following items can be input directly using a USB keyboard. (Ⓜ)

## 9.12 GO/NO-GO Determination Using the Measurement of Waveform Parameters

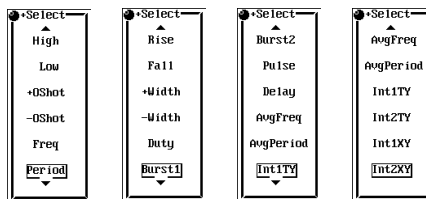
6. Press **SELECT** to select ON or OFF. If OFF is selected, Param1 will be excluded from the determination criteria.
7. Turn the jog shuttle to move the cursor to Trace.
8. Pressing **SELECT** displays the channel menu. (CH3, CH4, and Math2 are not displayed on the DL1720.)
9. Turn the jog shuttle to select the channel and press **SELECT**.



10. Turn the jog shuttle to move the cursor to Item.
11. Pressing **SELECT** displays the automated measurement item menu.



12. Turn the jog shuttle to select the item and press **SELECT**.



13. Turn the jog shuttle to move the cursor to Upper.
14. Pressing **SELECT** displays the upper limit setting menu.
15. Turn the jog shuttle to select the upper limit and press **SELECT**.
16. Set Lower in a similar fashion.
17. Turn the jog shuttle to move the cursor to Condition.
18. Press **SELECT** to select IN or OUT.
19. Set Param2 to Param4 as necessary.

**Setting the Logic**

- 20. Turn the jog shuttle to move the cursor to Logic.
- 21. Press **SELECT** to select AND or OR.

**Setting the Sequence**

- 22. Turn the jog shuttle to move the cursor to Sequence.
- 23. Press **SELECT** to select Single or Continue.

**Setting the ACQ Count**

- 24. Turn the jog shuttle to move the cursor to ACQ Count.
- 25. Pressing **SELECT** a menu used to set the number of waveform acquisitions.
- 26. Turn the jog shuttle to set the number of waveform acquisitions and press **SELECT**.

**Selecting the Action to Take when the Condition is not Met**

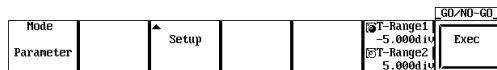
- 27. Turn the jog shuttle to move the cursor to Action.
- 28. Press **SELECT** to turn the action ON or OFF.

**Setting the Determination Range**

- 29. Press the **T-Range1/T-Range2** soft key to set the jog shuttle control to T-Range1.
- 30. Turn the jog shuttle to set the start point of the determination range.
- 31. In a similar fashion, set the end point of the determination range with T-Range2.

**Executing the GO/NO-GO Determination**

- 32. Press the **Exec** soft key to execute the GO/NO-GO determination.



When the determination terminates, the waveform acquisition is automatically stopped.

To forcibly stop the operation, press **START/STOP** or the **Abort** soft key to stop the acquisition.

**Explanation**

**Waveform Parameters that can be Determined using GO/NO-GO Operation: Item**

This function is applicable to the all of waveform parameters (27 items) in section 9.2. Up to four types of parameters can be determined simultaneously.

**Mode**

- OFF: Does not perform GO/NO-GO determination
- ON: Performs GO/NO-GO determination

**Upper and Lower Limits of Parameters: Upper/Lower**

The upper and lower limits depends on the parameters. They can be set in the range – 9.9999E+30 to 9.9999E+30.

**Setting the Condition**

- IN: When the value is inside the upper and lower limits.
- OUT: When the value is outside the upper or lower limits.

### Setting the Logic

AND: Executes the Action when all parameter conditions (1 to 4 types) are met.

OR: Executes the Action when any one of the parameter conditions (1 to 4 types) is met.

### Action to Take when the Condition is Met (not Met): Action

Buzzer: Sounds the buzzer.

Save to File: Saves the waveform data to the storage medium (FD, Zip disk, SCSI (option) and so on) specified in the FILE menu.

Hard Copy: Outputs the screen image data to the destination (Built-in, USB, Net Print (Ethernet interface option)) specified by Copy to in the Copy setting menu.

Image Save: Saves the screen image data to the output destination (FD, Zip disk, or SCSI (when SCSI and serial interface option are installed)) that you specified in the Image Save menu.

Send Mail: Sends a mail (Ethernet Interface option). For details, see section 13.7, "Using the Mail Function (Action Mail Function)."

### Number of Actions: Sequence

Single: Executes the Action once and terminates.

Continue: Repeats the execution of the Action up to the number of acquisition count specified in ACQ Count (until the acquisition is stopped if infinite is specified).

### Number of Waveform Acquisitions: ACQ Count

Set the number of waveform acquisitions.

Infinite: Continues until the waveform acquisition is stopped with **START/STOP**.

1 to 65536: Stops when the specified number of waveforms is acquired.

### Executing/Aborting GO/NO-GO Operation

The operation starts when you press the **Exec** soft key. Waveform acquisition is automatically stopped when the determination is complete. To forcibly stop the operation, press **START/STOP** or press the **Abort** soft key.

### Save to File/Hard Copy/Image Save Operation

Operates according to the settings in the File menu, the Copy menu, or the Image Save menu.

### File Name when Action is Set to Save to File or Image Save

The file is saved with AutoName under the File menu or the Image Save menu. For details, see section 10.4, "Outputting to Storage Medium" or section 11.6, "Saving/Loading Waveform Data."

### Notes when Performing GO/NO-GO Determination

- The determination results (the number of successes and failures) are displayed.
- All keys other than **START/STOP** and the **Abort** soft key are disabled during the determination.
- When GO/NO-GO determination is executed, the trigger mode is automatically changed to Single.
- Determination is not possible when the acquisition mode is set to Average.

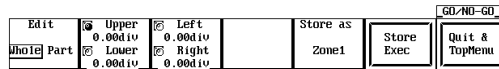




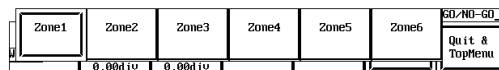
## 9.13 GO/NO-GO Determination Using Zones

### Editing All Zones

7. When Edit is set to something other than Whole, press the **Edit** and select Whole.



8. Press the **Upper/Lower** or **Left/Right** soft keys to select the zone setting direction.  
 9. Turn the jog shuttle to create a zone.  
 10. Repeat steps 8 and 9 to edit the zones.  
 11. Press the **Store as** soft key to open the store as setting menu for the edited zone.  
 12. Press the soft key corresponding to a storage location **Zone1 - Zone6** (or **Zone1 - Zone3** for the DL1720) to select it.

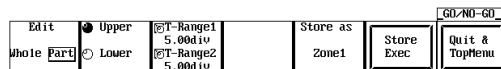


13. Press the **Store Exec** soft key to save the zone. Proceed to step 14 to edit a partial zone, or skip to step 22 to quit.

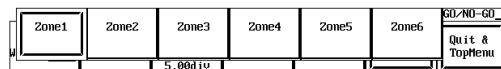


### Editing a Partial Zone

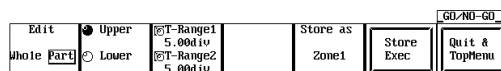
14. Press the **Edit** soft key to select Part.



15. Press the **T-Range1/T-Range2** soft key to select the right or left cursor.  
 16. Turn the jog shuttle to set the right and left edges of the partial zone.  
 17. Press the **Upper/Lower** soft key to select the direction for setting the zone, then use the jog shuttle to create the zone.  
 18. Repeat steps 15-17 to edit the zone.  
 19. Press the **Store as** soft key to open the store as setting menu for the edited zone.  
 20. Press the soft key corresponding to a storage location **Zone1 - Zone6** (or **Zone1 - Zone3** for the DL1720) to select it.



21. Press the **Store Exec** soft key to save the zone.



### Quit Zone Editing

22. Press the **Quit & TopMenu** soft key to return to the menu in step 3. If you press the **Quit & TopMenu** soft key before pressing the **Store Exec** soft key, the settings made up to that point will be inactive, and you will return to the menu in step 3.



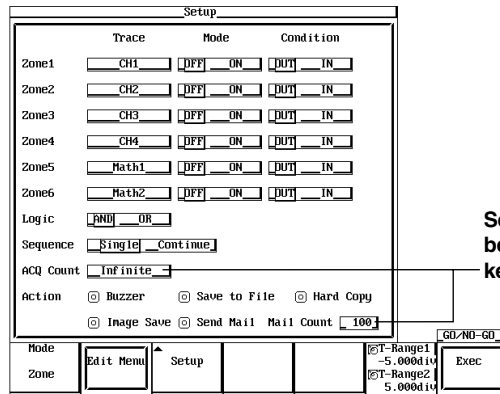
**Editing Existing Zones**

Edit zones that have been previously created.

- 23. In step 5, press the **Redraw** soft key.
- 24. Repeat steps 6-22 to edit the zones.

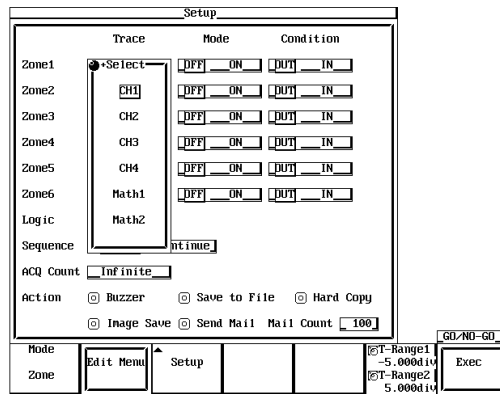
**Selecting a Determination Waveform**

- 25. Press the **Setup** soft key to display the Setup menu.
- 26. Turn the jog shuttle to move the cursor to Trace of Zone1.



Settings for the following items can be input directly using a USB keyboard. (Ⓜ)

- 27. Press **SELECT** to select CH1 through CH4, MATH1, or MATH2 (or CH1, CH2, and Math1 for the DL1720).



- 28. Use the jog shuttle to move the cursor to Mode under Zone1.
- 29. Press **SELECT** to select On or Off.
- 30. Use the jog shuttle to move the cursor to Condition under Zone1.
- 31. Press **SELECT** to select In or Out.
- 32. Set Zone2 - Zone6 (or Zone2 - Zone3 for the DL1720) as necessary.

**Setting the Logic**

- 33. Move the cursor to Logic with the jog shuttle.
- 34. Press **SELECT** to select AND or OR.

**Setting the Sequence**

- 35. Use the jog shuttle to move the cursor to Sequence.
- 36. Press **SELECT** to select Single, or Continue.

### Setting the ACQ Count

37. Use the jog shuttle to move the cursor to ACQ Count.
38. Press **SELECT** to display the waveform acquisition count setting menu.
39. Use the jog shuttle to set the waveform acquisition count, then press **SELECT**.

### Selecting the Action for Condition not Met

40. Use the jog shuttle to move the cursor to Action.
41. Press **SELECT** to turn action ON or OFF.

### Setting the Determination Range

42. Press the **T-Range1/T-Range2** soft key to highlight the T-Range1 jog shuttle icon.
43. Use the jog shuttle to set the head of the determination range.
44. In the same manner, set the tail of the range to T-Range2.

### Executing Determination

45. Press the **Exec** soft key to execute the determination. The **Exec** changes to the **Abort** soft key. When the determination is completed, acquisition automatically stops. You can force a stop by pressing **START/STOP** or the **Abort** soft key.

## Explanation

Create zones using a standard waveform as a base, and from those zones let GO/NO-GO be determined by whether a waveform extends outside or inside of the zone.

### Waveform for GO/NO-GO Determination/Determination criteria: Setup

You can select a waveform from input signals (CH1-CH4 (or CH1 to CH2 for the DL1720)) and from math waveforms (Math1, Math2 (or Math1 only for the DL1720)). You can use multiple waveforms for GO/NO-GO determination. Select from the following determination standards for each waveform:

- IN: When the specified waveform enters the zone.  
OUT: When the specified waveform is outside the zone.  
OFF: Do not determine.

### Selecting the Reference Waveform: Edit Menu

Select a reference waveform for creating a zone. The basic waveform will be displayed as a trace, and you can select from the following types.

- Input signal waveform
- Math waveform

### Creating a Determination Zone: Redraw/New

You can set up to six (or three for the DL1720) determination zones. The following are the setting ranges.

- Up-down setting range:  $\pm 8$  div from the reference waveform
- Left-right setting range:  $\pm 5$  div from the center of the screen

You can select input signal waveforms (CH1 through CH4 (or CH1 to CH2 for the DL1720)) and computed waveforms (Math1 and Math2 (or Math1 only for the DL1720)) for the waveforms that are to be determined in the determination zones that are registered in Zone1 through Zone6 (or Zone1 through Zone3 for the DL1720). The screen displays the active zones depending on the settings in Setup.

### Setting Logic

- AND: when all parameter conditions 1 - 6 are met, GO/NO-GO Action is performed  
OR: when at least one parameter condition from 1 - 6 are met, GO/NO-GO Action is performed

**Action to Take when the Condition is Met (not Met): Action**

Buzzer: Sounds the buzzer.

Save to File: Saves the waveform data to the storage medium (FD, Zip disk, SCSI (option) and so on) specified in the FILE menu.

Hard Copy: Outputs the screen image data to the destination (Built-in, USB, Net Print (Ethernet interface option)) specified by Copy to in the Copy setting menu.

Image Save: Saves the screen image data to the output destination (FD, Zip disk, or SCSI (when SCSI and serial interface option are installed)) that you specified in the Image Save menu.

Send Mail: Sends a mail (Ethernet Interface option). For details, see section 13.7, "Using the Mail Function (Action Mail Function)."

**Action Count: Sequence**

Single: Conclude after one instance of the Action.

Continue: Repeat the Action the number of times specified as the sampling count in ACQ Count (if set to Infinite, Action repeats until determination stops).

**Waveform Sampling Count: ACQ Count**

Set the waveform sampling count.

Infinite: Sampling continues until determination stops, or until **START/STOP** or **Abort** soft key is pressed.

1-65536: Sampling stops after the specified count has been reached.

**Start/Stop GO/NO-GO Determination**

Press the **Exec** soft key to execute the determination. Determination will stop automatically when finished, or you can press **START/STOP** or **Abort** soft key to force a stop.

**Save to File/Hard Copy/Image Save Operation**

Operates according to the settings in the File menu, the Copy menu, or the Image Save menu.

**File Name when Action is Set to Save to File or Image Save**

The file is saved with AutoName under the File menu or the Image Save menu. For details, see section 10.4, "Outputting to Storage Medium" or section 11.6, "Saving/Loading Waveform Data."

**Notes about GO/NO-GO Determination**

Determination results (number of successes, failures) are displayed on screen.

Functions other than **START/STOP** and **Abort** soft key are inactive during determination.

When performing GO/NO-GO determination, the trigger mode is automatically set to Single.

Determination is not possible when acquisition mode is set to Average.

**Note**

The zone waveform you created is stored as setting information onto the floppy disk, Zip disk, the internal ROM and so on.

# 9.14 Using the GO/NO-GO Signal Output Function

## Output Signal

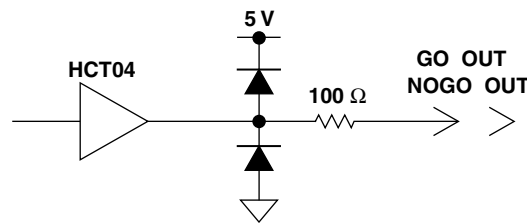
### NO-GO OUT Signal

The output signal level (TTL level) changes from high(H) to low (L) temporarily when a NO-GO determination is made.

### GO OUT Signal

The output signal level (TTL level) changes from high (H) to low (L) temporarily when a GO determination is made.

### Signal Output Circuit Diagram



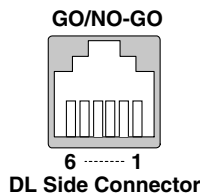
## Output Connector

The format and pin arrangement of the output connector on the DL1720/DL1740 are as follows:

- **Format**

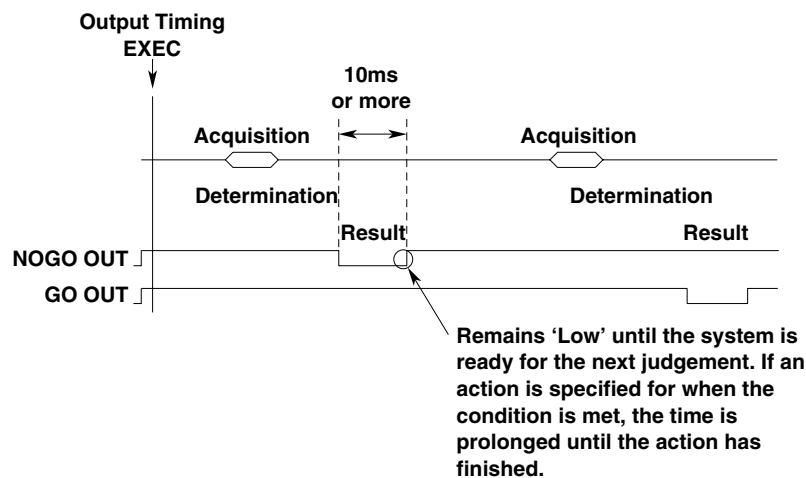
The connector uses a modular jack (RJ12). Use the optional accessory 36973 (sold separately) for the cable. If you are using a commercially sold cable (4 contact modular cable for telephone circuits), wire the pins according to the following figure.

- **Pin Arrangement**



| Pin Number | Signal           | Logic    |
|------------|------------------|----------|
| 1          | NC (Unconnected) |          |
| 2          | NC (Unconnected) |          |
| 3          | GO OUT           | Negative |
| 4          | NO-GO OUT        | Negative |
| 5          | GND              |          |
| 6          | NC (Unconnected) |          |

## Output Timing



## Connecting to Another Instrument

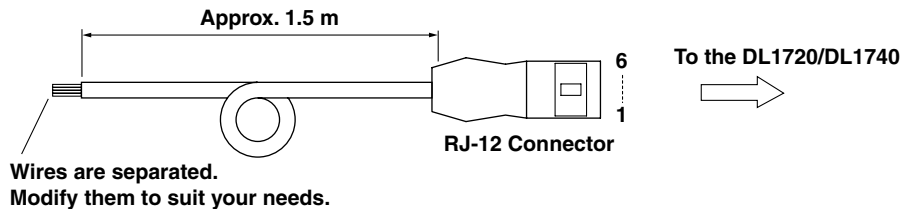
### CAUTION

- Never apply an external voltage to the NO-GO OUT and GO OUT terminals, otherwise damage to the instrument may result.
- When connecting the GO/NO-GO signal output externally, make sure not to connect other signal pins by mistake. Errors in connection may cause damage to this instrument or to the other connected instrument.
- Do not mistakenly insert the USB cable to the GO/NO-GO output terminal. This may cause damage to the DL1720/DL1740.

To connect the DL1720/DL1740 to external equipment, use the GO/NO-GO cable (366973, sold separately).

Do not use the GO/NO-GO cable (366973, sold separately) for any other purpose than for carrying out GO/NO-GO determination on the DL1720/DL1740.

- **About the GO/NO-GO Cable (366973, Sold Separately)**



| Color  | Pin No. | Signal Name | Logic    |
|--------|---------|-------------|----------|
| Yellow | 2       | NC          |          |
| White  | 3       | GO OUT      | Negative |
| Green  | 4       | NO-GO OUT   | Negative |
| Blue   | 5       | GND         |          |

## 10.1 Loading the Paper Roll into the Built-in Printer (Option)

### Printer Roll Chart

Use only YOKOGAWA's roll charts. When you are using the printer for the first time, use the roll chart supplied with the instrument. When your roll charts have run out, purchase more from your dealer or YOKOGAWA sales offices listed on the back cover of this manual.

Part No.: B9850NX  
Specification: Thermo-sensible, 30 m  
Minimum Quantity: 5 rolls

### Handling the Roll Chart

Thermosensible roll charts produce color using a thermal reaction, therefore the following precautions must be taken.

#### Storage Precautions

The roll chart begins to develop color at approximately 70°C. It is very sensitive to heat, damp, light and chemicals both before and after use.

- Keep roll charts in a dry, cool and dark place.
- Once the package is opened, use the roll chart as soon as possible.
- If the roll chart is left in contact with plastic films containing plasticizer (for instance, vinyl chloride film, cellophane tape etc.) for a long period of time, discoloration will occur on the recording area of the chart due to the plasticizer. If you are going to keep the roll chart in a holder, for instance, use a polypropylene holder.
- When you use adhesive on the roll chart, never use adhesive which contains an organic solvent such as alcohol or ether, otherwise color may develop on the chart.
- When you are going to store recorded roll charts for a long period of time, we suggest you make a copy of the charts since discoloration may occur.

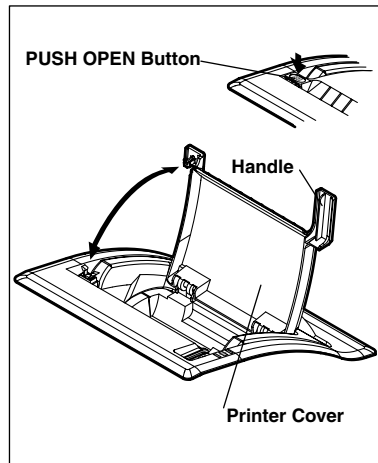
#### Usage Precautions

- Use only YOKOGAWA's genuine roll charts.
- Do not touch the roll chart with sweaty hands, otherwise it may become stained with your fingerprints, and information may be lost.
- Do not rub the surface of the roll chart strongly with a firm object, color development may occur due to frictional heat.
- Do not allow chemicals or oil to come into contact with the roll chart, otherwise color development or loss of information may result.

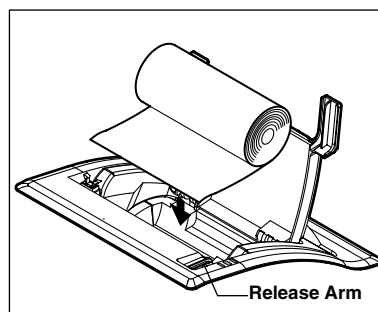


## 10.1 Loading the Paper Roll into the Built-in Printer (Option)

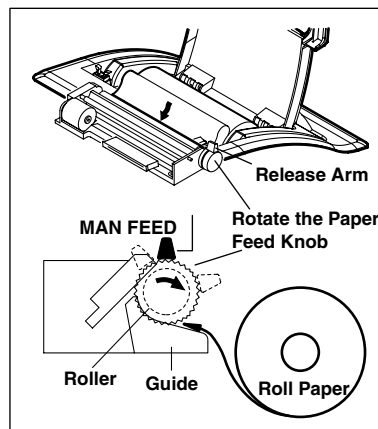
### Operating Procedure



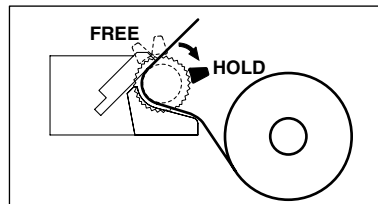
Press the PUSH OPEN button, and lift the handle on the right of the printer cover and open the cover.



Move the release arm, located on the right near the front, to the MAN FEED position. Have the inner side of the roll paper (the side that is not glossy) showing on top for the following procedure. Set the core of the roll paper to the holder on the right.

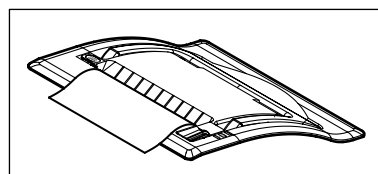


Insert the edge of the roll paper evenly in the space between the roller and the black guide, then rotate the paper feed knob away from you until about 10 cm of the roll sheet is showing from the top of the roller.



Move the release arm to the FREE position and straighten out the roll sheet. Then, move the release arm to the HOLD position.

The printing will fail with an error message, if the release arm is in the FREE or MAN FEED position during operation.



Pull the printer cover back to its original position and close the cover. Make sure that the edge of the roll sheet is showing from the opening of the printer cover.

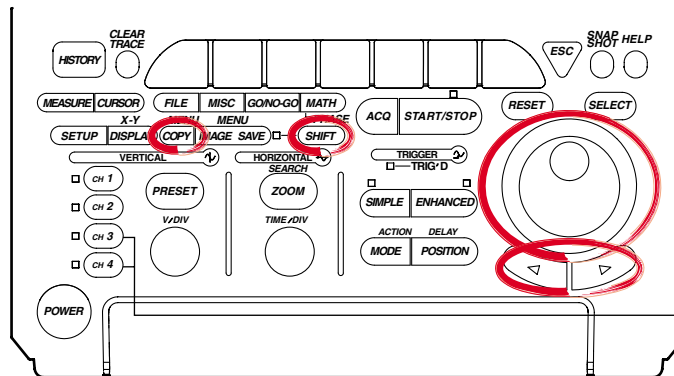
Push the printer cover down firmly until it clicks into place.

### Note

After loading the roll paper, the paper feed may be unstable. Print out 2 or 3 screen images before using the printer in your work.

## 10.2 Outputting to the Built-in Printer (Option)

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

#### Selecting the Printer

1. Press **SHIFT** to activate shift mode.  
Functions marked in purple on the panel become active.
2. Press **COPY**.
3. Pressing the **Copy to** soft key displays the output medium menu.

| Copy to  | Format | Information | Comment |    |  |  | COPY |
|----------|--------|-------------|---------|----|--|--|------|
| Built-in | Normal | Long        | OFF     | ON |  |  |      |

4. Press the **Built-in** soft key. (Net Print is displayed only when the Ethernet interface option is installed.)

| Copy to  | Format | Information | Comment |  |  |  | COPY |
|----------|--------|-------------|---------|--|--|--|------|
| Built-in | USB    | Net Print   |         |  |  |  |      |

#### Setting the Output Format

5. Press the **Format** soft key to select Normal or Long.

| Copy to  | Format | Information | Comment |    |  |  | COPY |
|----------|--------|-------------|---------|----|--|--|------|
| Built-in | Normal | Long        | OFF     | ON |  |  |      |

6. Press the **Information** soft key to select ON or OFF.

#### Setting Comments

7. Pressing the **Comment** soft key displays a keyboard.
8. Enter comments according to the procedures described in section 4.1.

#### Setting the Magnification Ratio (When the Output Format is Set to Long)

9. If you selected Long in step 5, set the magnification ratio using the jog shuttle.  
Press the **Mag** soft key to set the jog shuttle control to Mag.

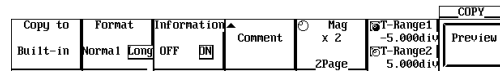
| Copy to  | Format | Information | Comment | Mag | T-Range1 | T-Range2  | Preview  | COPY |
|----------|--------|-------------|---------|-----|----------|-----------|----------|------|
| Built-in | Normal | Long        | OFF     | ON  | x 2      | -5.000d14 | 5.000d14 |      |
|          |        |             |         |     | 2Page    |           |          |      |

10. Turn the jog shuttle to set the magnification ratio. The number of output pages is displayed according to the ratio.

## 10.2 Outputting to the Built-in Printer (Option)

### Setting the Output Range (When the Output Format is Set to Long)

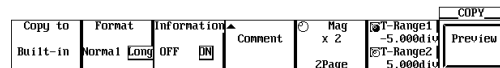
- If you selected Long in step 5, set the output range.  
Press the **T-Range1/T-Range2** soft key to set the jog shuttle control to T-Range1.



- Turn the jog shuttle to set the start point of the output range.
- In a similar fashion, set the end point of the output range in T-Range2.

### Previewing (Long Copy)

- Pressing the **Preview** soft key displays the output image on the screen.

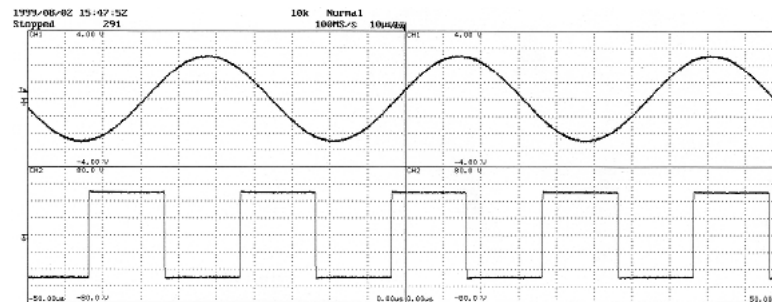


- Turning the jog shuttle changes the displayed page.
- Pressing the **Quit** soft key returns to the original screen.

### Executing Print Out

- Pressing **COPY** outputs a hard copy of the screen.  
Pressing **COPY** again aborts the output.

### Output Example when Mag is Set to Long



**Explanation****Output Format**

In addition to normal size, long copy is possible in which the displayed waveform is magnified 2 to 20000 times before printing. The magnification ratio varies depending on the T/div and record length settings.

**Outputting Optional Information**

Outputs the results of the setup information at the same time as the waveform.

**Comments**

You can output a comment string consisting of up to 20 characters in the lower section.

**Print Range**

Sets the range to output to the printer from -5 div to 5 div .

**Preview**

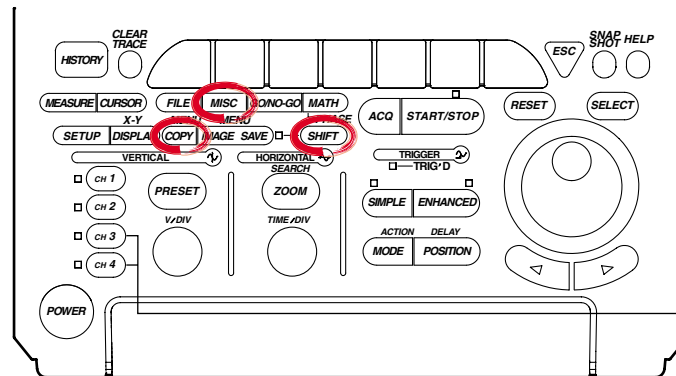
The output image can be previewed using the specified output format.

**Precautions to be Taken when Printing with the Built-in Printer**

- Printing is not possible while the waveform acquisition is in progress.
- Only the main waveform is long copied.
- When displaying a waveform using the history memory function, only the waveform selected for Selected Record No. is long copied.
- Long copy is not possible when displaying X-Y waveforms.
- Long copy of snapshot waveforms and accumulated waveforms is not possible.

## 10.3 Outputting Screen Images to a USB Printer

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

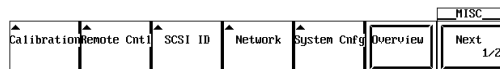
### Operating Procedure

1. Connect the DL1720/DL1740 and a USB printer using a USB cable. For details, see the explanation, page 10-8.

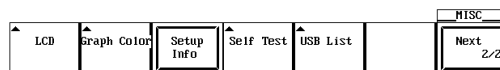
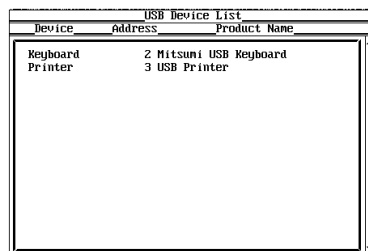
#### Confirming the Type of Printer that is Connected

To confirm the type of printer that is connected to the DL1720/DL1740, carry out the procedure below.

2. Press **MISC**.
3. Press the **Next 1/2** soft key.

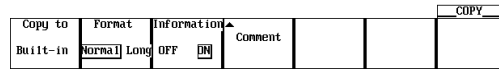


4. Press the **USB List** soft key to display the USB Device List. Check the printer that is connected.

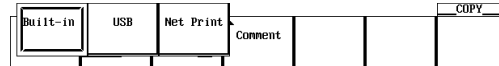


**Selecting the Printer**

5. Press **SHIFT** to activate shift mode. Functions marked in purple on the panel become active.
6. Press **COPY**.
7. Press the **Copy to** soft key to display the output medium selection menu.

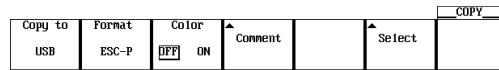


8. Press the **USB** soft key to select USB.

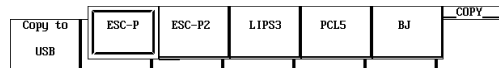


**Selecting the Type**

9. Press the **Format** soft key to display the menu used to select the output command type.



10. Press the soft key corresponding to the desired command type.



**Setting the Color**

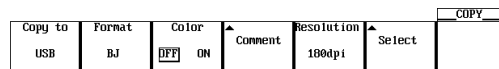
11. Press the **Color** soft key to select ON or OFF.

**Setting Comments**

12. Press the **Comment** soft key. A keyboard appears on the screen.
13. Enter the comment string according to the procedure given in section 4.1.

**Setting the Resolution (When Format is Set to BJ)**

14. Press the **Resolution** soft key to display the resolution menu.



15. Press one of the soft keys corresponding to **180 dpi**, **300 dpi**, and **360 dpi** to set the resolution.



**Executing Hard Copy**

16. Press **COPY** to output a hard copy of the screen. Press **COPY** again to stop the output.

## 10.3 Outputting Screen Images to a USB Printer

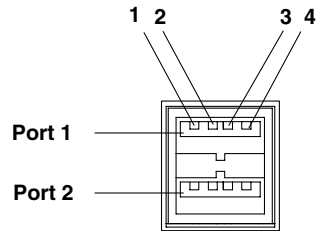
---

### Explanation

On the DL1720/DL1740, you can print the screen image data to a USB printer via the USB interface. You can also print the screen image to a network printer via the Ethernet network (when the Ethernet interface option is installed). For details, see section 13.5, "Printing the Screen Image to a Network Printer."

#### PRN/KBD Terminal

When connecting a USB printer to the DL1720/DL1740, connect a USB cable to the PRN/KBD terminal. There are two PRN/KBD terminals.



| Pin No. | Signal Name             |
|---------|-------------------------|
| 1       | V <sub>BUS</sub> : +5 V |
| 2       | D <sub>-</sub> : -Data  |
| 3       | D <sub>+</sub> : +Data  |
| 4       | GND: Ground             |

#### Printers that can be Used

USB printers conforming to USB Printer Class Ver. 1.0 that support the following output commands can be used.

#### Note

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- Connect only the printers that are allowed.
  - For USB printers that have been tested for compatibility, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual.
- 

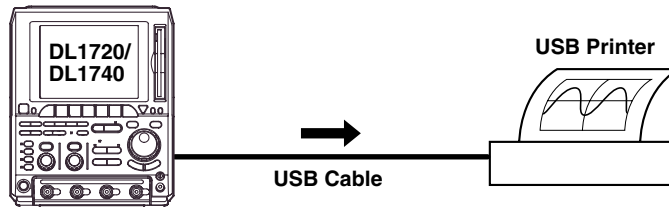
#### Format

You can select the type of command that is output to the USB printer from the following list of choices.

- ESC-P
- LIPS3
- BJ (can be used on models that support the BJC-35V native commands)
- PCL5
- ESC-P2

**Connection Procedure**

When connecting a USB printer, directly connect the keyboard to the DL1720/DL1740 with a USB cable as shown below. You can connect the USB cable regardless of the power ON/OFF state of the DL1720/DL1740 (supports hot-plug). Connect the type A connector of the USB cable to the DL1720/DL1740; connect the type B connector to the printer. When the power switch is ON, the printer is detected and enabled approximately 6 seconds after it is connected.

**Note**

- Connect the printer directly without going through a hub.
- Connect only a USB keyboard or printer to the PRN/KBD terminals.
- Do not connect multiple printers. You can connect a single printer and a single keyboard.
- Never turn OFF the printer or remove the USB cable while the printer is printing.

**Output Resolution when Printing using the BJ Format**

When printing the screen image data to a USB BJ printer, select the output resolution from 180 dpi, 300 dpi, and 360 dpi.

**Comments**

A comment string of up to 20 characters that is displayed at the lower right corner of the screen can be printed.

**Color**

Select from the following list of choices.

- ON: Prints the image using the same colors as the screen (no background color, grid printed in black).
- OFF: Prints the image using the same colors as the image printed using the built-in printer.

**Precautions when Printing on a USB Printer**

- Images may not print properly on some printers. Use USB printers that have been tested for compatibility.
- You can also print to a USB printer that is connected to your PC. Save the screen image data to a floppy disk or a Zip disk according to the procedure given in section 10.4, "Storing Screen Image to the External Storage Medium." Then, load the data on the PC and print it.

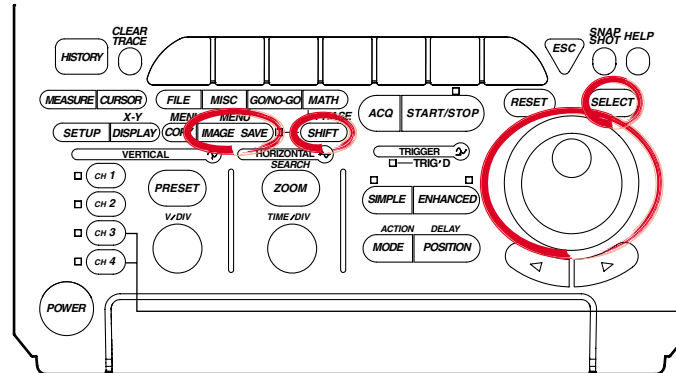
**Note**

The DL1720/DL1740 does not detect "out of paper" and printer errors on the USB printer. If you executed printing on the DL1720/DL1740 when the USB printer is in such condition, press **COPY** to stop the printing.



# 10.4 Storing Screen Image to the External Storage Medium

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

1. Press **SHIFT** to set the keys in the shifted condition. Functions marked in purple on the panel become active.
2. Press **IMAGE SAVE**.

### Selecting the Format

3. Pressing the **Format** soft key.

|           |        |       |         |           |                 |
|-----------|--------|-------|---------|-----------|-----------------|
| Thumbnail | Format | Color | Comment | File List | IMAGE File Name |
|           | TIFF   | OFF   |         |           |                 |

4. Press the soft key corresponding to the type of format to be selected.

|           |      |     |    |           |                 |
|-----------|------|-----|----|-----------|-----------------|
| Thumbnail | TIFF | BMP | PS | File List | IMAGE File Name |
|           |      |     |    |           |                 |

### Setting the Color (for TIFF and BMP)

5. Press the **Color** soft key to select **ON**, **ON(Revers)**, **ON(Gray)**, or **OFF**.

|           |        |       |         |            |                 |
|-----------|--------|-------|---------|------------|-----------------|
| Thumbnail | Format | Color | Comment | File List  | IMAGE File Name |
|           | TIFF   | OFF   | ON      | ON(Revers) | ON(Gray)        |

### Setting Comments

6. Pressing the **Comment** soft key displays a keyboard.
7. Enter comments according to the procedures described in section 4.1.

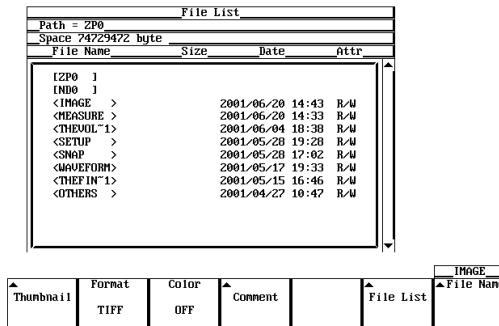
### Setting the Compression (for BMP (Color is ON))

8. Press the **Compression** soft key select **ON** or **OFF**. (When Compression is **ON**, you cannot store to Network Drive.)

|           |        |       |         |             |           |                 |
|-----------|--------|-------|---------|-------------|-----------|-----------------|
| Thumbnail | Format | Color | Comment | Compression | File List | IMAGE File Name |
|           | BMP    | ON    |         | OFF ON      |           |                 |

**Setting the Storing Destination**

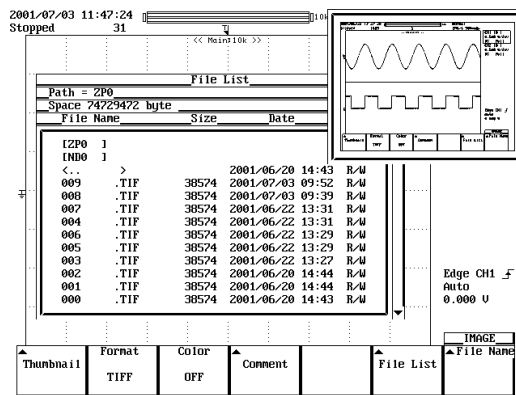
9. Pressing the **File List** soft key displays the output destination setting menu.
10. Turn the jog shuttle to select the save destination. The floppy disk or Zip disk inserted in the built-in drive or external SCSI devices is displayed in brackets [ ]. Directories are displayed in angle brackets < >.



11. Pressing **SELECT** displays the contents of the selected storage medium or the directory.  
For details related to setting the storing destination, see section 11.6.

**Display of Compressed Images (Firmware Version 1.30 or Later)**

12. When Image is selected under File Item, selecting a screen image data file (files with the .tif, .bmp, or .ps extensions) in the File List window and pressing **SELECT** causes the screen image file's compressed image to appear in the upper right portion of the file list.



If compressed image (thumbnail) data does not exist for the selected file, an error message appears. Pressing **ESC** clears the error message.

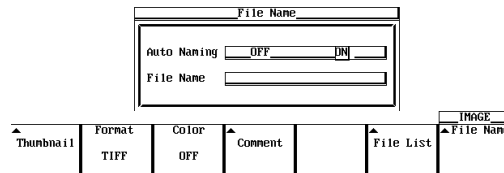
**Note**

- The following procedure clears the compressed image from the screen.
- Move the cursor using the jog shuttle.

## 10.4 Storing Screen Image to the External Storage Medium

### Selecting the File Name

13. Pressing the **File Name** soft key displays the file name setting menu.
14. Turn the jog shuttle to move the cursor to Auto Naming.



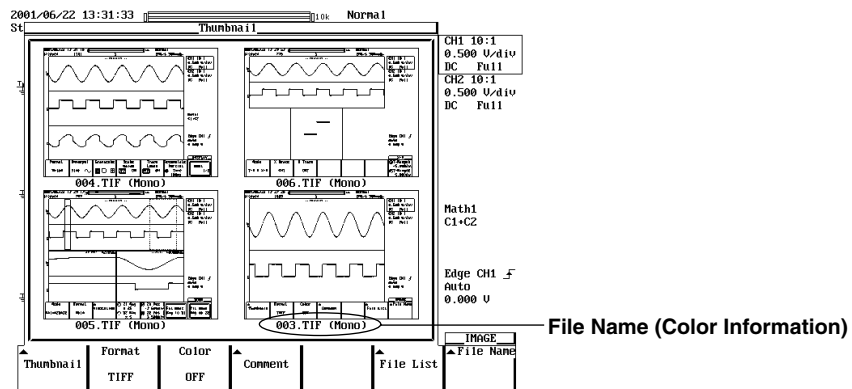
15. Press **SELECT** to select ON or OFF.
16. Turn the jog shuttle to move the cursor to File Name.
17. Pressing **SELECT** displays a keyboard. Enter the file name using up to eight characters according to the procedures given on section 4.1. If you turned ON the auto naming function, the first five characters are valid.

### Executing the Storing

18. Pressing **IMAGE SAVE** store the screen image.  
Pressing **IMAGE SAVE** aborts the storing.

### Displaying the Thumbnail Preview Window (This function is available on products with firmware version 1.30 or later.)

19. Pressing the **Thumbnail** soft key causes a thumbnail of the screen image data located in the output directory specified in step 10 to be displayed (four thumbnails are displayed together). Pressing **ESC** closes the preview window.



When no files supporting the thumbnail feature are present on the storage medium, an error message is displayed. Pressing **ESC** clears the error message.

### Scrolling the Thumbnail Window

20. When five or more files supporting the thumbnail feature are present, you can scroll the window using the jog shuttle. To scroll the window upwards, turn the jog shuttle in the minus direction (counterclockwise). To scroll the window downwards, turn the jog shuttle in the plus direction (clockwise).

### Note

Files supporting the thumbnail feature are scrolled two at a time.

**Explanation**

The screen image can be stored to storage medium (a floppy disk, a Zip disk, an external SCSI device (option) or Network drive (Ethernet interface option)). For details, see Section 13.4, "Saving Screen Image Data to a Network Drive."

**Storing Data Format**

You can store the output data in the following formats. The file extensions and file sizes (reference value) that are automatically assigned are also listed.

| Output Data Format | Extension | File Size*                        |
|--------------------|-----------|-----------------------------------|
| TIFF               | *.TIF     | 38,574 bytes (approx. 300 Kbytes) |
| BMP                | *.BMP     | 38,462 bytes (approx. 300 Kbytes) |
| Post Script        | *.PS      | 79,061 bytes (approx. 300 Kbytes) |

\*: When the color is turned OFF (reference value)

The file sizes inside the parentheses are the sizes when the color is ON.

**Color (for TIFF and BMP)**

Select ON, ON(Revers), or OFF.

ON : Outputs in 256 colors

ON (Revers) : Background color is not output

ON (GRAY) : Outputs in 16 shade greyscale.

OFF : Outputs in Black & White

**Comments**

You can add a comment string consisting of up to 20 characters on the screen and save the information.

**Data Compression (for BMP Files)**

BMP formats can be compressed in RLE formats, respectively, and output.

However, if color is OFF, data in BMP format cannot be compressed.

- **Save Destination**

A list of available storage media is displayed in the File List dialog box.

**Examples**

FD0 : Floppy disk

ZP0 : Zip disk

SC5 : SCSI device with an ID number of 5

SC5\_1 : Partition number 1 on SCSI device number 5

ND0 : Network drive (available with the Ethernet interface option)

**Floppy Disk, Zip Disk and External SCSI Device (Option)**

The floppy disk, the Zip disk, and external SCSI device (option) are described in chapter 11. For the procedures related to formatting, see chapter 11.

**Auto Naming Function**

If you use Auto Naming, files are automatically created with three digit numbers from 000 to 999 in their file name. You can place a common name in front of the numbers (up to 5 characters, specified in File Name).

**Note**

You can enter up to eight characters for the common name, but the last three characters are discarded.

## 10.4 Storing Screen Image to the External Storage Medium

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### Notes when Saving the File

- The maximum number of files that can be saved using the auto naming function is 1000.
- When the total number of files and directories in one directory exceeds 2400, the file list will no longer be displayed.

Also, a thumbnail window for screen image data can be displayed.

### Thumbnail

- **Thumbnail Window**

The instrument can display a thumbnail window containing screen image files (with the .tif, .bmp, and .ps extensions) located in the directory selected from the File List under the IMAGE SAVE menu. The data used to generate the thumbnail is separate from the screen image data itself, but they are created at the same time. The extension of the thumbnail data depends on the extension of the original image data, and is shown as follows:

.tif files : .ttd

.bmp files : .btd

.ps files : .ptd

Each of these files is approx. 17 KB in size.

- **Thumbnail Window Items**

The following three items are displayed in the thumbnail window.

- A compressed image of the waveform
- File name
- Color information

The file name and color information appear on the bottom of the compressed waveform image.

- **Thumbnail Display Window Format**

Four thumbnails can be displayed in the window. The order in which the files are displayed is the same as that in the File List dialog box. Files are displayed from left to right and top to bottom.

- **Scrolling the Thumbnail Window**

If the number of files compatible with the thumbnail feature is greater than four, you can scroll the thumbnail window one row (2 thumbnails) at a time. To scroll the files upwards, turn the jog shuttle in the minus direction (counterclockwise). To scroll the files downwards, turn the jog shuttle in the plus direction (clockwise).

- **Displaying Compressed Images in the File List**

Selecting screen image data files from the File List causes a compressed image of the screen data to appear in the upper right portion of the File List. Also, file name and color information are not displayed in the compressed image.

## 11.1 Floppy Disks

### Floppy Disks that can be Used

The following types of 3.5 inch floppy disk can be used. Floppy disks can be formatted on this instrument.

2HD: 1.44 MB (MS-DOS format)

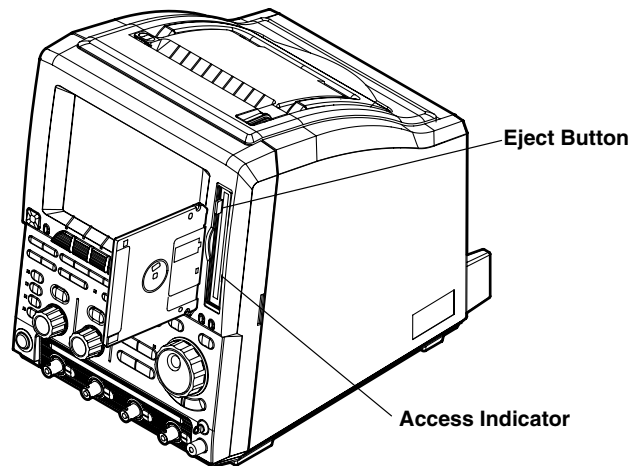
2DD: 720 KB (MS-DOS format)

### Inserting a Floppy Disk into the Drive

Hold the floppy disk with the label facing left, and insert it with the shutter section facing the drive. Insert the floppy disk until the eject button pops out.

### Removing the Floppy Disk from the Drive

Check that the access indicator is not lit, then press the eject button.



---

### **CAUTION**

Removing the floppy disk while the access indicator is lit can damage the drive's magnetic head or destroy the data on the disk.

---

### General Handling Precautions

For general handling precautions, see the instructions that came with the floppy disk.

---

## 11.2 Zip Disks

### Zip Disks that can be Used

The following types can be used. You can format the zip disk on the DL1720/DL1740.

Size: 100 MB and 250 MB

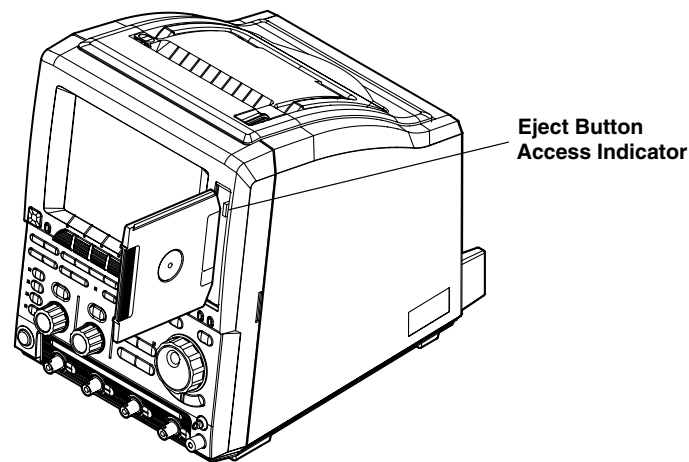
Format: FDISK 1 partition (hard disk format)

### Inserting the Zip Disk in the Zip Drive

With the label facing left, insert the disk from the side with the shutter.

### Removing the Zip Disk from the Zip Drive

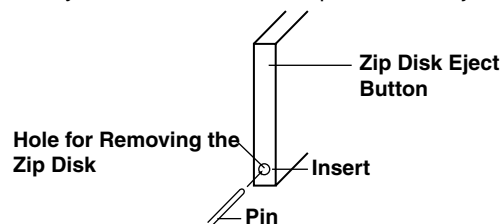
With the DL1720/DL1740 turned ON, check that the access indicator is turned OFF and press the eject button.



### Procedure when the Zip Disk cannot be Ejected

If the Zip disk cannot be removed by performing the steps given above in "Removing the Zip Disk from the Zip Drive", carry out the following steps to remove it.

Insert a pin of approximately 1 mm in diameter into the eject button hole and press slowly. This will cause the Zip disk to be ejected.



---

**CAUTION**

---

- Removing the Zip disk while the access indicator is ON may damage the data on the Zip disk.
  - Do not use the Zip drive with the rear panel facing down. This may damage the data on the Zip disk.
  - When turning ON/OFF the DL1720/DL1740, have the Zip disk removed from the drive.
  - Immediately after inserting the Zip disk, the access indicator lights. Do not use the instrument while the access indicator is lit as this may cause a malfunction.
- 

**General Handling Precautions of Zip Disks**

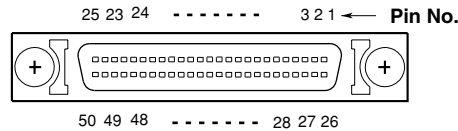
For the general handling precautions of the Zip drive, read the instruction manual that came with the Zip disk.



# 11.3 Connecting MO Disk Drives or Hard Disks to the SCSI Interface (Option)

## SCSI Specifications

| Item                      | Specification  |
|---------------------------|--|
| Interface Standard        | SCSI (Small Computer System Interface), ANSI X3.131-1986 |
| Connector Type            | 50-pin half pitch (pin type)                             |
| Connector Pin Assignments | Unbalanced (single-ended), see below                     |



| Pin No.  | Signal | Pin No. | Signal  |
|----------|--------|---------|---------|
| 1 to 12  | GND    | 38      | TERMPWR |
| 13       | NC     | 39, 40  | GND     |
| 14 to 25 | GND    | 41      | -ATN    |
| 26       | -DB0   | 42      | GND     |
| 27       | -DB1   | 43      | -BSY    |
| 28       | -DB2   | 44      | -ACK    |
| 29       | -DB3   | 45      | -RST    |
| 30       | -DB4   | 46      | -MSG    |
| 31       | -DB5   | 47      | -SEL    |
| 32       | -DB6   | 48      | -C/D    |
| 33       | -DB7   | 49      | -REQ    |
| 34       | -DBP   | 50      | -I/O    |
| 35 to 37 | GND    |         |         |

## Items Necessary for Connection

### Cable

Use a commercially sold cable that is 3 m or less in length, that has a ferrite core on each end of the cable, and that has a characteristic impedance between 90 and 132 W.

### Connection Procedure

1. Connect the SCSI cable to the SCSI connector on the rear panel of the instrument.
2. Turn ON the SCSI device and the instrument (in that order).

If you need to format the medium, follow the procedures given in the next section 11.4, "Formatting the Recording Medium."

### SCSI Devices that can be Connected

Most SCSI devices (MO disk drive and hard disk) can be connected to the instrument, but there are some exceptions.

For details on which devices can be connected, please ask your YOKOGAWA dealer.

For general handling precautions for the connected SCSI device, see the instruction manual that is provided with the device.

### Note

- When connecting multiple SCSI devices in a chain, attach a SCSI terminator to the device at the other end of the chain.
- Hard disks (including the internal hard disk) that are formatted with the instrument cannot be read using the NEC PC-9800 Series computers.

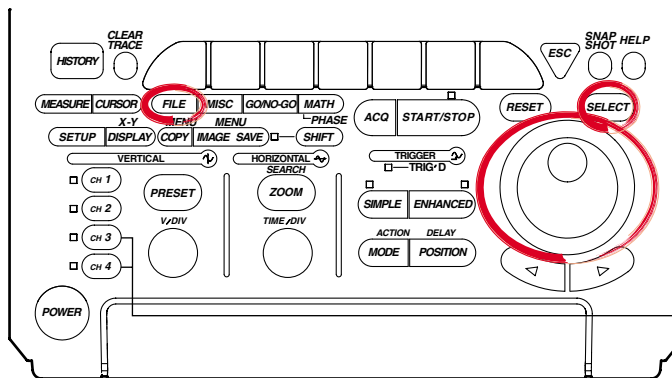
# 11.4 Formatting the Storage Medium



## CAUTION

- Never remove the medium (disk) or turn OFF the power while the access indicator or, the floppy disk or the Zip disk icon is blinking. This can damage the medium or destroy the data on the medium.
- When the instrument cannot read a pre-formatted medium, reformat the formatting the medium. All data will be erased.

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **FILE**.
2. Pressing the **Utility** soft key displays the utility setting menu and the file list dialog box.

|           |  |  |      |      |  |                 |
|-----------|--|--|------|------|--|-----------------|
| File Item |  |  | Save | Load |  | FILE<br>Utility |
| Setup     |  |  |      |      |  |                 |

### Selecting the Medium to be Formatted

3. Pressing the **Function** soft key displays the file function menu.

|          |           |         |          |           |      |                                   |
|----------|-----------|---------|----------|-----------|------|-----------------------------------|
| Function | Set/Reset | All Set | Property | Filter    | Attr | Utility<br>FILE<br>Delete<br>Exec |
| Delete   |           |         |          | *.SET *.* |      |                                   |

4. Pressing the **Format** soft key displays a list of media in the file list dialog box. (Net Drive cannot be formatted.)

|        |      |        |          |        |      |                                   |
|--------|------|--------|----------|--------|------|-----------------------------------|
| Delete | Copy | Rename | Make Dir | Format | Attr | Utility<br>FILE<br>Delete<br>Exec |
|        |      |        |          |        |      |                                   |

## 11.4 Formatting the Storage Medium

- Turn the jog shuttle to select the medium to be formatted.  
If no external SCSI devices (option) are detected and only the floppy disk or the Zip disk is inserted in the drive, only FD0 or ZP0 is displayed.

| File List |         |         |
|-----------|---------|---------|
| File Name | Size    | Space   |
| FD0       | 1457664 | 1332224 |

|          |            |        |  |  |                 |
|----------|------------|--------|--|--|-----------------|
| Function | Media Info | Format |  |  | Utility<br>FILE |
| Format   |            |        |  |  |                 |

### Selecting the FD Format

- Pressing the **Format** soft key displays the format menu.

|          |            |        |  |  |                 |
|----------|------------|--------|--|--|-----------------|
| Function | Media Info | Format |  |  | Utility<br>FILE |
| Format   |            |        |  |  |                 |

- Turn the jog shuttle to select the format 2DD 720 K or 2HD 1.44 M.  
Go to step 9.

|          |            |           |  |  |                           |
|----------|------------|-----------|--|--|---------------------------|
| Function | Media Info | FD Format |  |  | Format<br>Utility<br>FILE |
| Format   |            | 2HD 1.44M |  |  | Exec                      |

### Selecting the Format Type for the Zip Disk

- Pressing the **Format** soft key displays the format menu.

|          |            |        |  |  |                 |
|----------|------------|--------|--|--|-----------------|
| Function | Media Info | Format |  |  | Utility<br>FILE |
| Format   |            |        |  |  |                 |

- Press the **Format Type** soft key to select Norm or Quick.

|          |            |        |             |  |                           |
|----------|------------|--------|-------------|--|---------------------------|
| Function | Media Info | Format | Format Type |  | Format<br>Utility<br>FILE |
| Format   |            |        | Norm Quick  |  | Exec                      |

### Selecting the Format Type for the SCSI Device (Option)

- Pressing the **Format** soft key displays the format menu.

|          |            |        |  |  |                 |
|----------|------------|--------|--|--|-----------------|
| Function | Media Info | Format |  |  | Utility<br>FILE |
| Format   |            |        |  |  |                 |

- Selecting the Number of Partitions**

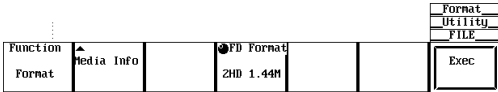
- Turn the jog shuttle to select a value from 1 to 5.

|          |            |           |             |  |                           |
|----------|------------|-----------|-------------|--|---------------------------|
| Function | Media Info | Partition | Format Type |  | Format<br>Utility<br>FILE |
| Format   |            | 2         | Norm Quick  |  | Exec                      |

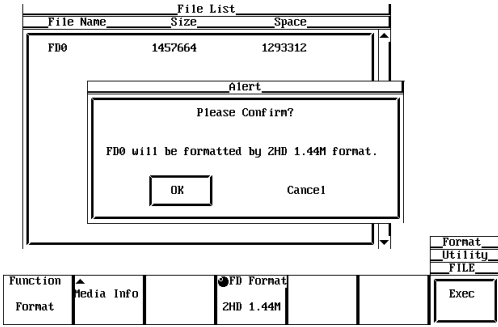
- Selecting the Format Type**

- Press the **Format Type** soft key to select Norm or Quick.

- **Executing/Canceling the Format Operation (OK/Cancel)**
  9. Pressing the **Exec** soft key displays the alert dialog box.
  10. Turn the jog shuttle to select OK or Cancel.



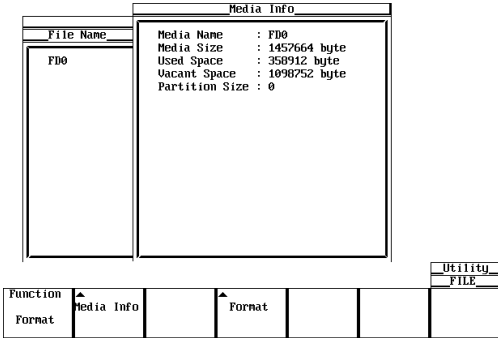
11. Selecting OK and pressing **SELECT** starts the format operation. Selecting Cancel and pressing **SELECT** cancels the format operation.



**Viewing the Media Information**

Follow steps 1-5 to select a media.

6. Pressing the **Media Info** soft key displays information about the medium that was selected in step 5.



**Explanation**

**Formatting a Floppy Disk**

When using a new floppy disk, you must format it first. Select the appropriate format for the floppy disk from the following choices.

2DD 720 K

Formats the 2DD floppy disk to 720 KB/9 sectors.

2HD 1.44 M

Formats the 2HD floppy disk to 1.44 MB/18 sectors.

**Formatting a Zip Disk**

If you are using a new Zip disk, you need to format it. The format for 250 MB and 100 MB disks is as follows:

FDISK 1 partition (hard disk format)

### Formatting a the SCSI Device

The formats of media connected via SCSI (option) are as follows.

- MO/PD  
Semi-IBM format. Handled as removable disk.
- Zip/JAZ  
Hard disk format. Handled as fixed disk.
- Hard Disk  
IBM compatible format.

### Selecting the Format Mode

When formatting a medium in a Zip disk or an external SCSI device, the following format modes are available.

- Norm  
Executes physical format and logical format. Formatting 100-MB Zip disks using this method is not supported.
- Quick  
Executes only the logical format.

### Selecting the Number of Partitions

You can set partitions on the external SCSI device (option), except for removable disk. 1 to 5 partitions can be selected.

### Information about the Medium

The following information is listed for the selected medium.

Media Name: Name of the medium  
Media Size: Total capacity  
Used Space: Used space  
Vacant Space: Free space  
Partition Size: Number of partitions

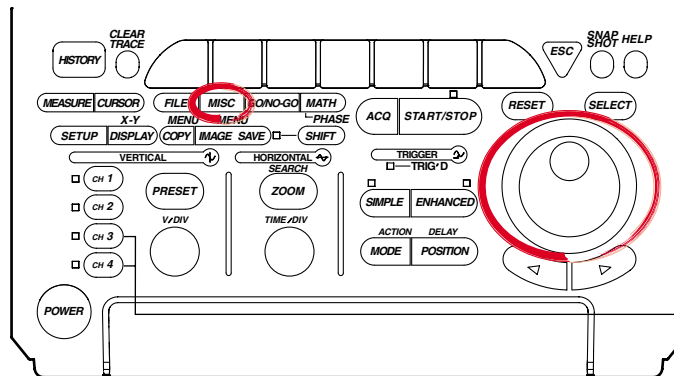
### Note

---

- Formatting a medium containing data erases the data completely.
  - The time it takes to format a floppy disk is approximately one and a half minutes.
  - The time needed to format a 250-MB Zip disk is approximately 15 minutes for Norm, approximately 10 s for Quick.
  - A floppy disk cannot be formatted if it is write protected.
  - Never format when the instrument is connected to a PC via a SCSI cable.
  - Floppy disks having a format other than the ones listed in this section cannot be used.
  - If an error message appears after the format operation, the floppy disk may be damaged.
  - Disks formatted to MS-DOS format on a PC can also be used.
  - The Quick (logical) format only clears (initializes) the directory entry and FAT information. If you need to check for bad sectors, do a physical format (Normal).
  - When data are written to an external SCSI device that has bad sectors, access error (604 Media failure) may occur in which case no more data can be written. When you are using a medium for the first time or if the medium can no longer be read, do a "Norm" format. If you want to format a disk that you have been using before, do a "Quick" format.
  - This function can not be used in conjunction with FTP server function, FTP client function, or LPR client function.
-

# 11.5 Changing the SCSI ID Number

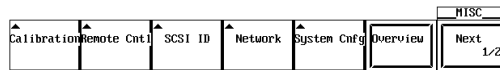
## Relevant Keys



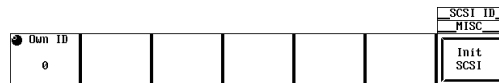
The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

1. Press **MISC**.
2. Pressing the **SCSI ID** soft key displays the SCSI number setting menu.



3. Press the **Own ID** soft key.



4. Turn the jog shuttle to select a value from 0 to 7.
5. Press the **Init SCSI** soft key. The ID number is changed to the new number. An icon blinks at the upper right of the screen while the change is being made. When the change is complete, the icon disappears.

## Explanation

The SCSI ID number is used to distinguish between the various devices connected to the SCSI chain. Make sure not to use duplicate ID numbers on any of the connected devices.

### Range of Own ID Numbers

Select this instrument's ID (Own ID) from the range 0 to 7. The default ID is 7.

### Note

- When changing the Own ID number, make sure to press the "Init SCSI" soft key.
- Assign numbers that are different from the ID numbers of the external SCSI devices attached to the instrument.
- The SCSI ID numbers of external SCSI devices are automatically detected at power up.
- If an ID number is changed, make sure to execute "Init SCSI" in order to detect the new ID number.

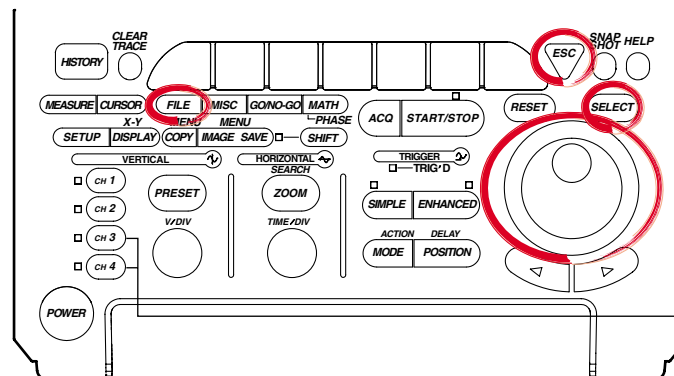
## 11.6 Saving/Loading Waveform Data



### CAUTION

Never remove the medium (disk) or turn OFF the power while the access indicator or, the floppy disk or the Zip disk icon is blinking. This can damage the medium or destroy the data on the medium.

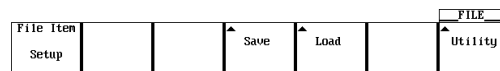
### Relevant Keys



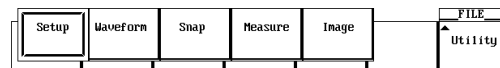
The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **FILE**.
2. Pressing the **File Item** soft key displays the file time setting menu.



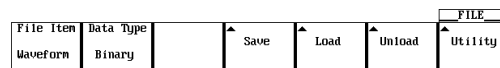
3. Press the soft key corresponding to **Waveform**.



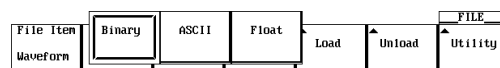
### Saving the Waveform Data

#### Selecting the Data Type

4. Pressing the **Data Type** soft key displays the data type menu.



5. Press the one of the soft keys corresponding to **Binary**, **ASCII**, or **Float** to select the data type.



Data saved in Binary are only the data that can be loaded as described later in this chapter.

**Selecting the Waveform to be Saved.**

6. Pressing the **Save** soft key displays the save setting menu.

|           |           |  |      |      |        |         |
|-----------|-----------|--|------|------|--------|---------|
| File Item | Data Type |  | Save | Load | Unload | FILE    |
| Waveform  | Binary    |  |      |      |        | Utility |

7. Pressing the **Trace** soft key displays the waveform menu.

|           |           |       |       |         |          |                    |
|-----------|-----------|-------|-------|---------|----------|--------------------|
| File List | File Name | Trace | Range | History | P-P Comp | Save FILE          |
|           |           | a11   | Main  | One a11 | OFF ON   | Save Exec (Binary) |

8. Press the soft key corresponding to the channel you wish to save. (CH3, CH4, and Math2 are not displayed on the DL1720.)

|     |     |     |     |     |       |       |      |
|-----|-----|-----|-----|-----|-------|-------|------|
| a11 | CH1 | CH2 | CH3 | CH4 | Math1 | Math2 | Save |
|-----|-----|-----|-----|-----|-------|-------|------|

**Selecting the Range of the Waveform to be Saved**

- 9. Pressing the **Range** soft key displays the save range selection menu.
- 10. Press one of the **Main to Z1 & Z2** soft keys to select the range of waveforms to be saved.

|           |           |       |      |    |    |       |      |
|-----------|-----------|-------|------|----|----|-------|------|
| File List | File Name | Trace | Main | Z1 | Z2 | Z1&Z2 | Save |
|           |           | a11   |      |    |    |       |      |

11. Press the **History** soft key to select whether to save all the data in the history memory (All) or only the currently displayed waveform (One).

**Compressing the Data and Saving (When Data Type is Set to Binary)**

12. Press the **P-P Comp** soft key to select ON (compress and save) or OFF (do not compress and save).

Compressed data cannot be loaded.

If P-P Comp is turned ON when saving waveform data, only the maximum and minimum values of the multiple data points existing at the same time position are saved. In this way, the file size can be reduced.

**Selecting the Destination Medium/Directory**

- 13. Pressing the **File List** soft key displays the file list dialog box.
- 14. Turn the jog shuttle to select the save destination medium (displayed with parentheses).

| File List         |       |       |                  |      |  |  |
|-------------------|-------|-------|------------------|------|--|--|
| Path = F10        |       |       |                  |      |  |  |
| Space 787456 byte |       |       |                  |      |  |  |
| File Name         | byte  | Size  | Date             | Attr |  |  |
| (F10 )            |       |       |                  |      |  |  |
| <THEVOL">         |       |       | 2000/10/31 09:25 | R/W  |  |  |
| 016 .TIF          | 38574 | 38574 | 2000/10/31 17:54 | R/W  |  |  |
| 015 .TIF          | 38574 | 38574 | 2000/10/31 17:54 | R/W  |  |  |
| 014 .TIF          | 38574 | 38574 | 2000/10/31 17:53 | R/W  |  |  |
| 013 .TIF          | 38574 | 38574 | 2000/10/31 17:53 | R/W  |  |  |
| 012 .TIF          | 38574 | 38574 | 2000/10/31 17:52 | R/W  |  |  |
| 011 .TIF          | 38574 | 38574 | 2000/10/31 17:51 | R/W  |  |  |
| 010 .TIF          | 38574 | 38574 | 2000/10/31 17:50 | R/W  |  |  |
| 009 .TIF          | 38574 | 38574 | 2000/10/31 17:50 | R/W  |  |  |
| 008 .TIF          | 38574 | 38574 | 2000/10/31 17:49 | R/W  |  |  |
| 007 .TIF          | 38574 | 38574 | 2000/10/31 17:48 | R/W  |  |  |
| 006 .TIF          | 38574 | 38574 | 2000/10/31 17:46 | R/W  |  |  |

|           |          |        |                    |
|-----------|----------|--------|--------------------|
| File Name | Property | Filter | Save FILE          |
|           |          | .WVF   | Save Exec (Binary) |

15. Press **SELECT** to confirm the selection.



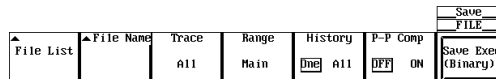
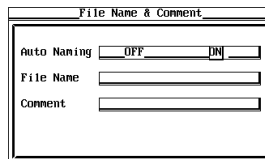
**Selecting the Destination Directory**

(Use this only when there are directories on the medium.)

- 16. Turn the jog shuttle to select the save destination directory (displayed in angle brackets < >).
- 17. Press **SELECT** to confirm the selection.  
The Path=\_\_\_ box on the top left corner of the File List dialog box displays the selected medium/directory.  
Selecting <..> moves to a higher level directory.

**Setting the File Name/Comment**

- 18. Pressing the **File Name** soft key displays the file name setting menu.
- 19. Turn the jog shuttle to select Auto Naming.



- 20. Press **SELECT** to select ON or OFF.
- 21. Turn the jog shuttle to select File Name.
- 22. Pressing **SELECT** displays a keyboard.
- 23. Enter the file name according to the procedures given in section 4.1.
- 24. Turn the jog shuttle to select Comment.
- 25. Pressing **SELECT** displays a keyboard.
- 26. Enter the file comment according to the procedures given in section 4.1.
- 27. Press **ESC** to close the file name setting dialog box.

**Saving the File**

- 28. Press the **Save Exec** soft key to save the file to the directory indicated in Path=\_\_\_\_. The name of the **Save Exec** soft key changes to Abort.

**Canceling the Saving Operation**

- 29. Press the **Abort** soft key to cancel the save operation. The name of the **Abort** soft key changes to Save Exec.

**Specifying the File to be Displayed in the File List Dialog Box and Viewing its Properties**

- 30. In the File List dialog box, press the **Filter** soft key to select \*.extension or \*.\*.
- 31. In the File List dialog box, turn the jog shuttle to select the desired file.
- 32. Pressing the **Property** soft key displays the properties of the selected file.
- 33. Pressing **ESC** closes the window displaying the properties.

### Loading the Waveform Data

Set the data type to Binary. For the procedures, see steps 4 and 5 in the section “Saving the Waveform Data” on page 11-14.

- Pressing the **Load** soft key displays the load setting menu and the file list dialog box.

| File Item | Data Type |  | Save | Load | Unload | FILE    |
|-----------|-----------|--|------|------|--------|---------|
| Waveform  | Binary    |  |      |      |        | Utility |

#### Selecting the Source Medium/Directory

- Select the directory according to steps 13 to 17.

#### Selecting the File to be Loaded

- Turn the jog shuttle to select a file.

#### Loading the File

- Press the **Load Exec** soft key to load the file from the directory indicated in Path=\_\_\_\_. The name of the **Load Exec** soft key changes to Abort.

#### Canceling the Loading Operation

- Press the **Abort** soft key to cancel the loading operation. The name of the **Abort** soft key changes to Load Exec.

#### Specifying the File to be Displayed in the File List Dialog Box, Viewing the Properties

The procedures are the same as steps 30 and 31.

### Unloading Waveforms

#### Selecting the File to be Unloaded

- Continuing from step 5 in “Saving the waveform data,” press the **Unload** soft key to display the Unload menu.

| File Item | Data Type |  | Save | Load | Unload | FILE    |
|-----------|-----------|--|------|------|--------|---------|
| Waveform  | Binary    |  |      |      |        | Utility |

- Pressing the **Trace** soft key displays a menu used to select the channels to be unloaded.

|  |  |       |  |  |  | Unload               |
|--|--|-------|--|--|--|----------------------|
|  |  |       |  |  |  | FILE                 |
|  |  | Trace |  |  |  | Unload Exec (Binary) |
|  |  | All   |  |  |  |                      |

- Press the soft key corresponding to the desired channel to select the channel. If All is selected, all channels are unloaded. (CH3, CH4, and Math2 are not displayed on the DL1720.)

|     |     |     |     |     |       | Unload |
|-----|-----|-----|-----|-----|-------|--------|
| All | CH1 | CH2 | CH3 | CH4 | Math1 | Math2  |

#### Unloading the File

- Press the **Unload Exec** soft key.

### Explanation

#### Selecting the Data Type, File Extension

##### Binary

- The sampled data in the acquisition memory are saved in binary format.
- The data that are saved can be loaded to display the waveform and compute numerical data.
- A header file is automatically created. The header file is used when analyzing the waveform on a PC. The header file cannot be opened using this instrument. For the header file format, see appendix 3, "ASCII Header File Format."
- The file extension is .WVF. The file extension of the header file is .HDR.
- When saving waveform data in binary format, a header file is automatically created with the extension .HDR. When the DL1720/DL1740 is used to copy, delete, change filenames, or change file ownership of waveform data files (files with the extension, .WVF), the header files are automatically updated to reflect the changes. Do not delete the header file only or the waveform data file only as this may cause a system malfunction.

##### ASCII

- The sampled data in the acquisition memory are saved in ASCII format. The data can be used to analyze the waveform on a PC.
- Data in this format cannot be loaded on this instrument.
- The file extension is .CSV.

##### Float

- The sampled data in the acquisition memory are saved in 32 bit floating point format. The data can be used to analyze the waveform on a PC.
- Data in this format cannot be loaded on this instrument.
- The file extension is .FLD.

##### Data Size

The following list shows the data size when the record length is set to 100 kwords, waveform data of CH1 to CH4 are saved, and Math1 and Math2 are turned OFF

| Data Type | Extension | Data Size (Bytes)   |
|-----------|-----------|---|
| Binary    | .WVF      | Approx. 800 K ((100 kwords + 32) × 4 channels × number of history waveform × 2)                         |
|           | .HDR      | Approx. 2 K (approx. 3 K if Math1 and Math2 are ON.)  |
| ASCII     | .CSV      | Approx. 6 M (depends on the input signal condition.)<br>It takes more than 10 minutes to save the file. |
| Float     | .FLD      | Approx. 1.6 M ((100 kwords + 32) × 4 channels × number of history waveform × 4)                         |

#### Selecting the Waveform to be Saved

- You can save all waveforms or the specified waveforms from CH1 to CH4, Math1, Math2 (or CH1, CH2, and Math1 for the DL1720).
- The vertical and horizontal axes and trigger settings of the waveform being saved are also saved.
- For waveforms that are loaded using the history memory function, you can select whether to save all of the history data or just the current displayed waveform on the screen. You can also save only the search results of the data in the history memory. For details regarding data search of the history memory, see sections 7.8 to 7.9.
- For snapshot waveforms, see section 11.8, "Saving/Loading the Snap Shot Waveforms."

**Selecting the Range of the Waveform to be Saved**

Select the range (region) of the waveform from the following list of choices. Only the data that have been saved by selecting Binary above in “Selecting the data type, file extension, data size” can be loaded in this instrument.

- Main  
The range of the normal (Main) waveform. It is the range defined by the displayed record length (range displayed on the screen).
- Z1  
The range of zoom waveform Z1.
- Z2  
The range of zoom waveform Z2.
- Z1 & Z2  
The range of zoom waveform Z1 & Z2.

**Data Compression**

- You can select whether or not to P-P compress the waveform data before saving.
- Power spectrum computation data cannot use P-P compression.

**Selecting the Medium and Directory**

The storage medium that can be used to save and load waveform data are displayed in the File List dialog box.

**Display Example of Storage Medium**

FD0 : Floppy disk  
 ZP0 : Zip disk  
 SC5 : SCSI device with an ID number of 5  
 SC5\_1 : Partition 1 of the SCSI device with an ID number of 5  
 ND0 : Network drive (available with the Ethernet interface option)

**File Name and Comments**

- You must specify a file name. Comments can be omitted.
- You cannot save to a file name that is already in use in the same directory (no overwriting).

**Number and Types of Characters that can be Used**

| Item      | Number of Characters | Characters that Can be Used                            |
|-----------|----------------------|--|
| File name | 1 to 8 chars.        | 0 to 9, A to Z, %, _, ( ) (parenthesis), -(minus sign) |
| Comment   | 0 to 25 chars.       | All characters (including spaces),                     |

**Auto Naming Function**

When Auto Naming is turned ON, files with three digit numbers from 000 to 999 are automatically created. Specify the common name (maximum of five characters, specify at the Filename item) that is placed before the three digit number.

**Specifying the Files to Display in the File list Dialog Box**

You can specify the type of files to display.

- \*.WVF, \*.CSV, or \*.FLD  
Displays only the files that have the same file format as the file being saved.
- \*.\*  
Displays all files on the medium.

**Properties**

Lists the file name.extension, file size, the date it was saved, the attributes, and the comment for the selected file.

## 11.6 Saving/Loading Waveform Data

### Unload

If the loaded waveform is being displayed, newly acquired waveform is not displayed even if the data acquisition is started. In order to display the newly acquired waveforms, loaded data must be unloaded from the appropriate channels.

### Note

- If a key other than the Abort key is pressed during saving or loading, an error occurs.
- You cannot save or load while the data acquisition is in progress.
- If you change the file extension on a PC, for an example, you will not be able to load that file.
- A maximum of 36 characters can be displayed in Path.
- File names are not case sensitive. Comments are case sensitive. In addition, the following file names cannot be used due to limitations of MS-DOS.  
AUX, CON, PRN, NUL, CLOCK
- The waveform data loaded from a file overwrites the data in the acquisition memory. Once the memory is overwritten, the old data cannot be recovered. It is recommended that the current waveform data be saved before loading data from a file.
- Loaded waveforms are cleared only if Unload, Initialize, or Auto Setup is executed or the data acquisition conditions are changed.
- When the total number of files and directories in one directory exceeds 2400, the file list will no longer be displayed.
- This function can not be used in conjunction with FTP server function or LPR client function.
- Waveform (.wvf) and header (.hdr) files are saved as file pairs. If you set the filter of the files displayed in the file list to \*.\* then process (Delete, Rename, Copy) each file individually, the files become unloadable.

### Data Format when Storing Multiple Records

When multiple records are stored (history memory, for example), the following data format is used.

ASCII Format: CR+LF is inserted between records.

```

<Header>
Measured data 1-1 of CH1, Measured data 1-1 of CH2, Measured data 1-1 of CH3, . . . ., [ CR+LF]
Measured data 1-2 of CH1, Measured data 1-2 of CH2, Measured data 1-2 of CH3, . . . ., [ CR+LF]
      |
      |
      |
Measured data 1-m of CH1, Measured data 1-m of CH2, Measured data 1-m of CH3, . . . ., [ CR+LF]
[ CR+LF]
Measured data 2-1 of CH1, Measured data 2-1 of CH2, Measured data 2-1 of CH3, . . . ., [ CR+LF]
Measured data 2-2 of CH1, Measured data 2-2 of CH2, Measured data 2-2 of CH3, . . . ., [ CR+LF]
      |
      |
      |
Measured data 2-n of CH1, Measured data 2-n of CH1, Measured data 2-n of CH1, . . . ., [ CR+LF]
[ CR+LF]
      |
      |
      |
  
```

} Record 1

} Record 2

Float Format: Stored in blocks of channels.

|                                  |
|----------------------------------|
| Measured data of record 1 of CH1 |
| Measured data of record 2 of CH1 |
| ⋮                                |
| Measured data of record N of CH1 |
| Measured data of record 1 of CH2 |
| Measured data of record 2 of CH2 |
| ⋮                                |
| Measured data of record N of CH2 |
| ⋮                                |

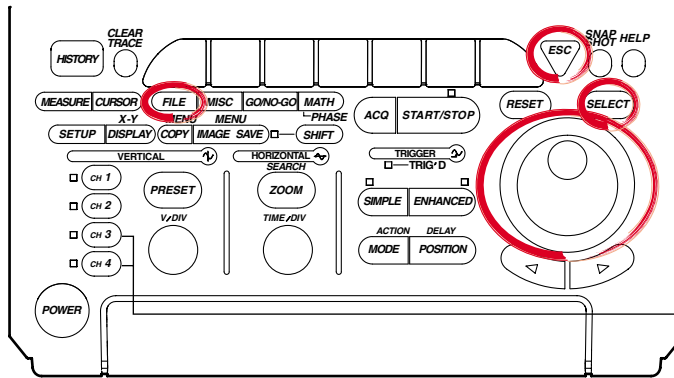
# 11.7 Saving/Loading Setup Data



## CAUTION

Never remove the medium (disk) or turn OFF the power while the access indicator, or the floppy disk or the Zip disk icon is blinking. This can damage the medium or destroy the data on the medium.

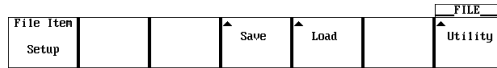
### Relevant Keys



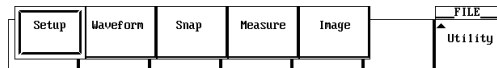
The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **FILE**.
2. Pressing the **File Item** soft key displays the file item setting menu.



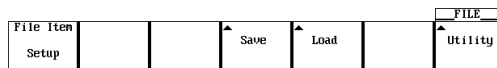
3. Press the **Setup** soft key.



### Selecting the Setup Data

#### Selecting the Destination Medium

4. Pressing the **Save** soft key displays the save setting menu.

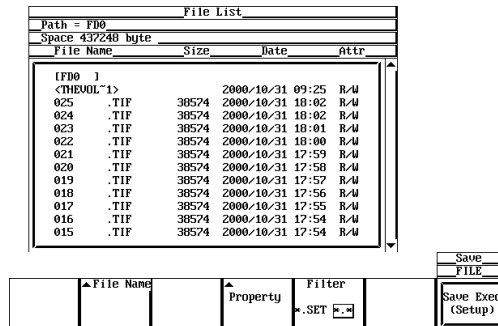


5. Pressing the **File List** soft key displays the file list dialog box.



## 11.7 Saving/Loading Setup Data

- Turn the jog shuttle to select the save destination medium (displayed with parentheses).



- Press **SELECT** to confirm the selection.

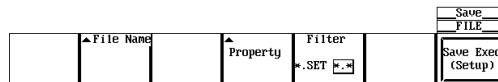
### Selecting the Destination Directory

(Use this only when there are directories on the medium.)

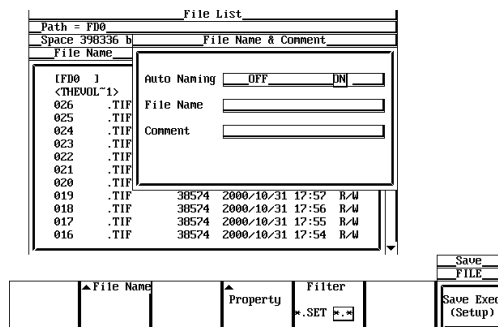
- Turn the jog shuttle to select the save destination directory (displayed in angle brackets < >).
- Press **SELECT** to confirm the selection.  
The Path=\_\_\_ box on the top left corner of the File List dialog box displays the selected medium/directory.  
Selecting <..> moves to a higher level directory.

### Setting the File Name/Comment

- Pressing the **File Name** soft key displays the file name setting menu.



- Turn the jog shuttle to select Auto Naming.



- Press **SELECT** to select ON or OFF.
- Turn the jog shuttle to select File Name.
- Pressing **SELECT** displays a keyboard.
- Enter the file name according to the procedures given in section 4.1.
- Turn the jog shuttle to select Comment.
- Pressing **SELECT** displays a keyboard.
- Enter the file comment according to the procedures given in section 4.1.
- Press **ESC** to close the file name setting dialog box.

**Saving the File**

20. Press the **Save Exec** soft key to save the file to the directory indicated in Path=\_\_\_\_. The name of the **Save Exec** soft key changes to Abort.

**Canceling the Saving Operation**

21. Press the **Abort** soft key to cancel the save operation. The name of the **Abort** soft key changes to Save Exec.

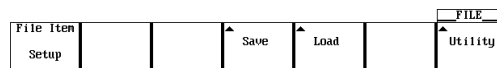
**Specifying the File to be Displayed in the File List Dialog Box, and Viewing its Properties**

22. In the File List dialog box, press the **Filter** soft key to select \*.SET or \*.\*.  
 23. In the File List dialog box, turn the jog shuttle to select the desired file.  
 24. Pressing the **Property** soft key displays information regarding the selected file.  
 25. Pressing **ESC** closes the window displaying the information.

**Loading the Setup Data**

Display the menu used to save/load setup data according to steps 1 to 3.

4. Pressing the **Load** soft key displays the load setting menu and the file list dialog box.

**Selecting the Source Medium/Directory**

5. Select the directory according to steps 13 to 17 on section 11.6.

**Selecting the File to be Loaded**

6. Turn the jog shuttle to select a file.

**Loading the File**

7. Press the **Load Exec** soft key to load the file from the directory indicated in Path=\_\_\_\_. The name of the **Load Exec** soft key changes to Abort.

**Canceling the Loading Operation**

8. Press the **Abort** soft key to cancel the loading operation. The name of the **Abort** soft key changes to Load Exec.

**Specifying the File to be Displayed in the File List Dialog Box, Viewing the Properties**

The procedures are the same as steps 22 to 25.

**Explanation****Setup Data that are Saved**

The setup data of each key existing at the time of the saving operation are saved. However, date and time, communication parameters, and SCSI ID numbers are not saved.

**Number of Bytes Necessary in Saving the Setup Data**

Approximately 13 Kbytes

**Selecting the Medium and Directory**

The storage medium that can be used to save and load waveform data are displayed in the File List dialog box.



- **Display Example of Storage Medium**

- FD0 : Floppy disk
- ZP0 : Zip disk
- SC5 : SCSI device with an ID number of 5
- SC5\_1 : Partition 1 of the SCSI device with an ID number of 5
- ND0 : Network drive (available with the Ethernet interface option)

**File Name and Comments**

You must specify a file name. Comments can be omitted.

You cannot save to a file name that is already in use in the same directory (no overwriting).

- **Number and Types of Characters that can be Used**

---

| Item      | Number of Characters | Characters that can be Used                             |
|-----------|----------------------|---|
| File name | 1 to 8 chars.        | 0 to 9, A to Z, %, _ , ( ) (parenthesis), -(minus sign) |
| Comment   | 0 to 25 chars.       | All characters (including spaces),                      |

---

- **Notes when Saving Setup Data**

You cannot save while the data acquisition is in progress. Press **START/STOP** to stop the acquisition.

When the total number of files and directories in one directory exceeds 2400, the file list will no longer be displayed.

**File Extension**

The File extension .SET is automatically appended to the file.

**Auto Naming Function**

When Auto Naming is turned ON, files with three digit numbers from 000 to 999 are automatically created. Specify the common name (maximum of five characters, specify at the Filename item) that is placed before the three digit number.

**Specifying the Files to Display in the File List Dialog Box**

You can specify the type of files to display.

- \*.SET  
Displays only the setup data files.
- \*.\*  
Displays all files on the medium.

**Properties**

Lists the file name.extension, file size, the date it was saved, the attributes, and the comment for the selected file.

**Note**

---

- If a key other than the Abort key is pressed during saving or loading, an error occurs.
  - You cannot save or load while the data acquisition is in progress.
  - If you change the file extension on a PC, for an example, you will not be able to load that file.
  - A maximum of 36 characters can be displayed in Path.
  - File names are not case sensitive. Comments are case sensitive. In addition, the following file names cannot be used due to limitations of MS-DOS.  
AUX, CON, PRN, NUL, CLOCK
  - When the setup parameters are loaded from a file, the setup parameters of each key are overwritten with the loaded settings and cannot be set back to their previous settings. It is recommended that the current setup parameters be saved before loading setup parameters from a file.
  - The date and time, communication parameters and SCSI ID numbers are not saved. Therefore, when setup parameters are loaded from a file, these parameters do not change.
  - This function can not be used in conjunction with FTP server function or LPR client function.
-

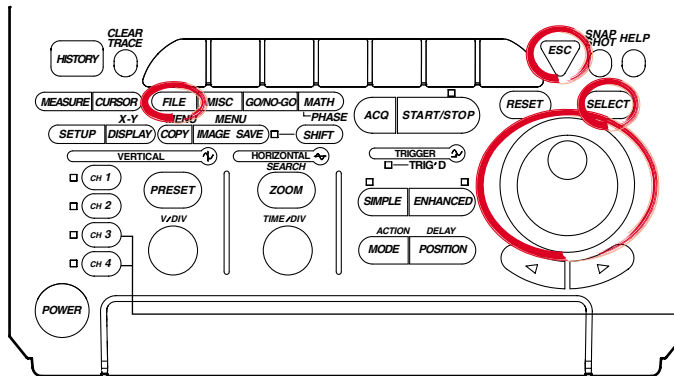
# 11.8 Saving/Loading Snapshot Waveforms



## CAUTION

Never remove the medium (disk) or turn OFF the power while the access indicator, or the floppy disk or the Zip disk icon is blinking. This can damage the medium or destroy the data on the medium.

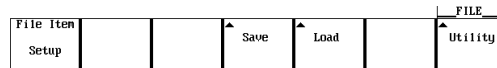
### Relevant Keys



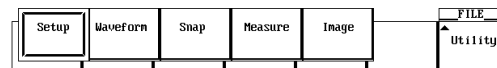
The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **FILE**.
2. Pressing the **File Item** soft key displays the file item setting menu.



3. Press the **Snap** soft key.



### Saving Snapshot Waveforms

#### Selecting the Destination Medium/Directory

The procedures are the same as steps 13 to 17 in section 11.6, "Saving/Loading Waveform Data."

#### Setting the File name/Comment

The procedures are the same as steps 18 to 27 in section 11.6, "Saving/Loading Waveform Data."

#### Saving the File

4. Press the **Save Exec** soft key to save the file to the directory indicated in Path=\_\_\_\_. The name of the **Save Exec** soft key changes to Abort.



## 11.8 Saving/Loading Snapshot Waveforms

### Canceling the Saving Operation

- Press the **Abort** soft key to cancel the saving operation. The name of the **Abort** soft key changes to **Save Exec**.

### Specifying the File to be Displayed in the File List Dialog Box, Viewing the Properties

The procedures are the same as steps 30 to 33 in section 11.6, "Saving/Loading Waveform Data."

### Loading Snapshot Waveforms

Follow steps 1-3 to select snapshot data waveforms.

- Pressing the **Load** soft key displays the load setting menu and the file list dialog box.

|           |  |  |      |      |        |         |
|-----------|--|--|------|------|--------|---------|
| File Item |  |  | Save | Load | Unload | FILE    |
| Snap      |  |  |      |      |        | Utility |

### Selecting the Source Medium/Directory

The procedures are the same as steps 13 to 17 in section 11.6, "Saving/Loading Waveform Data."

### Selecting the File to be Loaded

- Turn the jog shuttle to select a file.

### Selecting the Snapshot Waveform to be Loaded

- Press the **Destination** soft key to display a menu used to select the snapshot waveform.

| File List         |       |                  |      |
|-------------------|-------|------------------|------|
| Path = F00        |       |                  |      |
| Space 164064 byte |       |                  |      |
| File Name         | Size  | Date             | Attr |
| (F00 J            |       |                  |      |
| CTHEVOL1>         |       | 2000/10/31 09:25 | R/W  |
| CHAPT001.TIF      | 38574 | 2000/10/31 18:13 | R/W  |
| CHAPT000.TIF      | 38574 | 2000/10/31 18:12 | R/W  |
| 030 .TIF          | 38574 | 2000/10/31 18:09 | R/W  |
| 029 .TIF          | 38574 | 2000/10/31 18:08 | R/W  |
| 028 .TIF          | 38574 | 2000/10/31 18:07 | R/W  |
| 027 .TIF          | 38574 | 2000/10/31 18:04 | R/W  |
| 026 .TIF          | 38574 | 2000/10/31 18:03 | R/W  |
| 025 .TIF          | 38574 | 2000/10/31 18:02 | R/W  |
| 024 .TIF          | 38574 | 2000/10/31 18:02 | R/W  |
| 023 .TIF          | 38574 | 2000/10/31 18:01 | R/W  |
| 022 .TIF          | 38574 | 2000/10/31 18:00 | R/W  |

|             |          |         |                  |
|-------------|----------|---------|------------------|
| Destination | Property | Filter  | Load             |
| Snap1       |          | *.SNP F | FILE             |
|             |          |         | Load Exec (Snap) |

- Press the soft key corresponding to the desired snapshot waveform to make the selection.

|  |  |       |       |       |       |                  |
|--|--|-------|-------|-------|-------|------------------|
|  |  | Snap1 | Snap2 | Snap3 | Snap4 | Load             |
|  |  |       |       |       |       | FILE             |
|  |  |       |       |       |       | Load Exec (Snap) |

### Loading the File

- Press the **Load Exec** soft key to load the file from the directory indicated in Path=\_\_\_\_. The name of the **Load Exec** soft key changes to **Abort**.

|  |  |             |          |         |                  |
|--|--|-------------|----------|---------|------------------|
|  |  | Destination | Property | Filter  | Load             |
|  |  | Snap1       |          | *.SNP F | FILE             |
|  |  |             |          |         | Load Exec (Snap) |

**Canceling the Loading Operation**

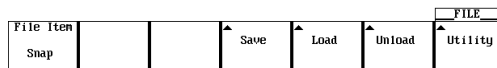
- Press the **Abort** soft key to cancel the loading operation. The name of the **Abort** soft key changes to Load Exec.

**Specifying the File to be Displayed in the File List Dialog Box, Viewing the Properties**

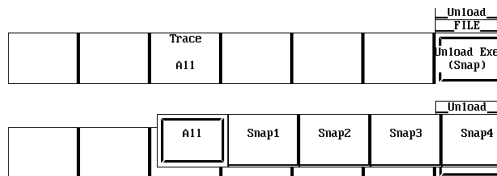
The procedures are the same as steps 30 to 33 in section 11.6, "Saving/Loading Waveform Data."

**Clearing the Waveform**

- Pressing the **Unload** soft key displays a menu used to select the waveform to be cleared.



- Press the **Trace** soft key and press the soft key corresponding to the waveform to be cleared.



- Pressing the **Unload Exec** soft key clears the selected waveform.



**Explanation**

You can take snap shots of the waveform and save the image to the file. You can also load the snapshot waveform.

**Data Size**

Approx. 40 K Bytes

**File Extension**

The file extension is .SNP.

The selection of the medium and directory, file name, comments, auto naming function, specification of the files to be displayed in the File List dialog box, and properties are the same as those for saving/loading normal waveform data. For explanation and procedures, see section 11.6, "Saving/Loading Waveform Data."

**Loading the Snapshot Waveform**

The snapshot waveform can be load as four waveforms, Snap1 to Snap4.

**Clearing the Waveform**

The loaded snapshot waveform is cleared when unload, initialize, or auto setup is performed.

**Note**

- If a key other than the Abort key is pressed during saving or loading, an error occurs.
- This function can not be used in conjunction with FTP server function or LPR client function.

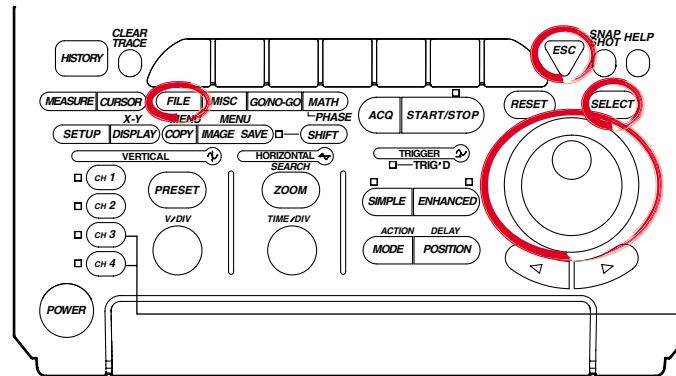
# 11.9 Saving the Results of the Automated Measurement of Waveform Parameters



## CAUTION

Never remove the medium (disk) or turn OFF the power while the access indicator, or the floppy disk or the Zip disk icon is blinking. This can damage the medium or destroy the data on the medium.

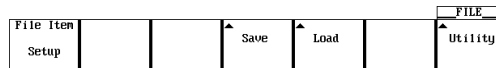
### Relevant Keys



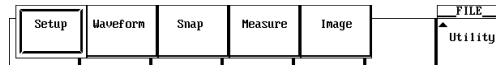
The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **FILE**.
2. Pressing the **File Item** soft key displays the file item setting menu.



3. Press the soft key corresponding to Measure.



#### Selecting the Destination Medium/Directory

The procedures are the same as steps 13 to 17 in section 11.6, "Saving/Loading Waveform Data."

#### Setting the File Name/Comment

The procedures are the same as steps 18 to 27 in section 11.6, "Saving/Loading Waveform Data."

#### Saving the File

4. Press the **Save Exec** soft key to save the file to the directory indicated in Path=\_\_\_\_. The name of the **Save Exec** soft key changes to Abort.



**Canceling the Saving Operation**

5. Press the **Abort** soft key to cancel the saving operation. The name of the **Abort** soft key changes to Save Exec.

**Specifying the File to be Displayed in the File List Dialog Box, Viewing the Properties**

The procedures are the same as steps 30 to 33 in section 11.6, "Saving/Loading Waveform Data."

**Explanation**

The results of the automated measurement of waveform parameters can be saved in CSV format (.CSV file extension) to a floppy disk, a Zip disk, or external SCSI device (option).

A CSV file is a comma-separated format file. The CSV file is one of the common file formats used to exchange data between spreadsheet and database applications.

The data that are saved are the measurement results of the parameters that are specified in the automated measurement of waveform parameters.

**Notes when Saving the Results of the Automated Measurement of Waveform Parameters**

The restrictions are as follows.

- Up to (24000/the number of items that are turned ON) data points before the point at which the save operation is executed are saved. However, the data points that are saved are limited to those that are acquired after fixing T/div, V/div, and Measure settings.

- Output example

| CH1 P-P,<br>v, | CH1 Max,<br>v, | CH1 Min,<br>v, | CH2 P-P<br>v |             |
|----------------|----------------|----------------|--------------|-------------|
| 0.199E+00,     | 0.199E+00,     | 0.000E+00,     | 0.02E-06     | Oldest data |
| 0.207E+00,     | 0.207E+00,     | 0.000E+00,     | 0.02E-06     |             |
| 0.377E+00,     | 0.152E+00,     | -0.125E+00,    | 0.02E-06     |             |
| •              | •              | •              | •            | ↓           |
| •              | •              | •              | •            |             |
| •              | •              | •              | •            |             |
| •              | •              | •              | •            | Newest data |

For information related to the automated measurement of waveform parameters, see section 9.2, "Automated Measurement of Waveform Parameters."

**Data Size**

Data size = Number of item × 15 × number of history waveform

**File Extension**

The file extension is .CSV.

The selection of the medium and directory, file name, comments, auto naming function, specification of the files to be displayed in the File List dialog box, and properties are the same as those for saving/loading normal waveform data. For explanation and procedures, see section 11.6, "Saving/Loading Waveform Data."

**Note**

- If a key other than the Abort key is pressed during saving, an error occurs.
- This function can not be used in conjunction with FTP server function or LPR client function.

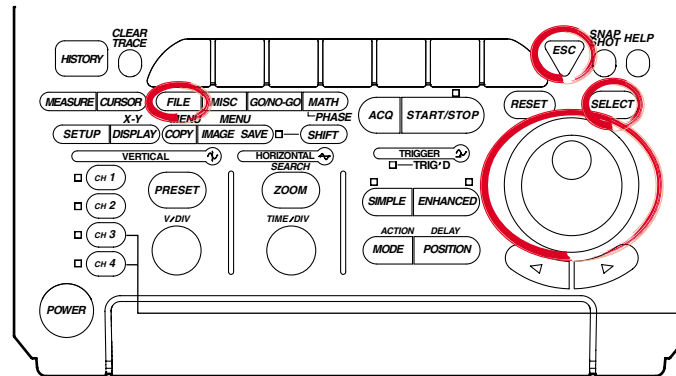
# 11.10 Changing the File Attributes, Deleting Files



## CAUTION

Never remove the medium (disk) or turn OFF the power while the access indicator, or the floppy disk or the Zip disk icon is blinking. This can damage the medium or destroy the data on the medium.

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **FILE**.
2. Pressing the **Utility** soft key displays the utility setting menu and the file list dialog box.

|           |  |  |      |      |  |         |
|-----------|--|--|------|------|--|---------|
| File Item |  |  |      |      |  | FILE    |
| Setup     |  |  | Save | Load |  | Utility |

### Selecting the Destination Medium/Directory

The procedures are the same as steps 13 to 17 in section 11.6, "Saving/Loading Waveform Data."

### Changing the File Attributes

3. Pressing the **Function** soft key displays the file function menu.

|          |            |  |        |  |  |         |
|----------|------------|--|--------|--|--|---------|
| Function |            |  |        |  |  | Utility |
| Format   | Media Info |  | Format |  |  | FILE    |

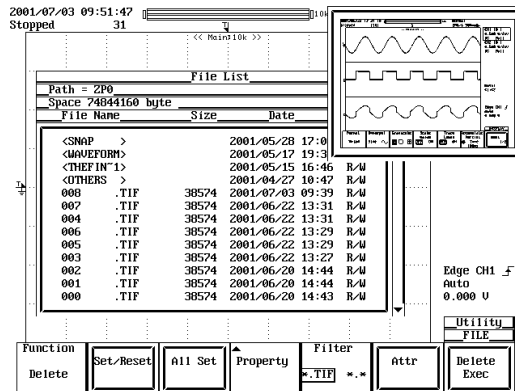
4. Press the **Delete** soft key.

|        |      |        |          |        |  |         |
|--------|------|--------|----------|--------|--|---------|
| Delete | Copy | Rename | Make Dir | Format |  | Utility |
|        |      |        |          |        |  | FILE    |

5. Turn the jog shuttle to select a file.

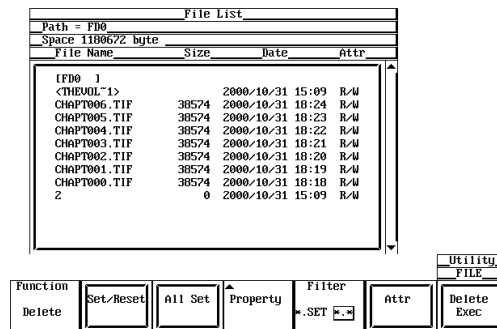
**Note**

By selecting a screen image data file (files with the .tif, .bmp, or .ps extensions) in the File List window and pressing **SELECT**, the selected screen image file's compressed image appears in the upper right portion of the file list.



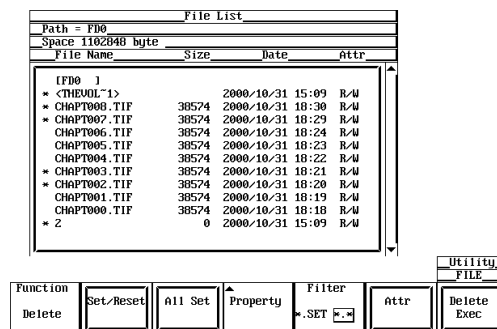
- If compressed image (thumbnail) data does not exist for the selected file, an error message appears. Pressing ESC clears the error message.
- The following procedure clears the compressed image from the screen.
  - Move the cursor using the jog shuttle.

6. Pressing the **Attr** soft key changes the attribution of the selected file.



**Selecting the Files to be Deleted One at a Time**

7. Turn the jog shuttle to select a file.
8. Pressing the **Set/Reset** soft key places an asterisk (\*) to the left of the selected file. The file will be deleted. Pressing the **Set/Reset** soft key again removes the asterisk (\*) to the left of the selected file. The file will not be deleted.



Go to step 12.



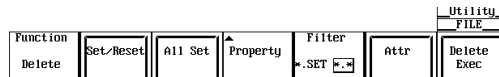
## 11.10 Changing the File Attributes, Deleting Files

### Selecting All Files to be Deleted

9. Turn the jog shuttle to select a file, a directory, or a medium.
10. Pressing the **All Set** soft key places an asterisk to the left of every file in the directory containing the selected file or directory. These files will be deleted. The name of the **All Set** soft key changes to All Reset.
11. Pressing the **All Set** soft key removes the asterisk to the left of every file in the directory containing the selected file or directory. These files will not be deleted. The name of the **All Reset** soft key changes to All Set.

### Deleting the Files

12. Press the **Delete Exec** soft key. All files with the asterisks are deleted.



### Specifying the File to be Displayed in the File List Dialog Box, Viewing the Properties

The procedures are the same as steps 30 to 33 in section 11.6, "Saving/Loading Waveform Data."

## Explanation

### Selecting the Medium and Directory

The storage medium that can be used to save and load waveform data are displayed in the File List dialog box.

- **Display Example of Storage Medium**

- FD0 : Floppy disk
- ZP0 : Zip disk
- SC5 : SCSI device with an ID number of 5
- SC5\_1 : Partition 1 of the SCSI device with an ID number of 5
- ND0 : Network drive (available with the Ethernet interface option)

### Selecting the File Attributes (Excepting Net Drive)

Select the attributes for each file from the following choices.

- R/W  
Read and write possible.
- R  
Read only. Cannot write to the file or delete the file.

### Selecting the Files to be Deleted

You can delete all files that have an asterisk to the left of the file name. There are two methods available to select the files that are to be deleted.

- **Selecting the Files One at a Time**

Place an asterisk to the left of the file names one at a time, using the **Set/Reset** soft key.

- **Selecting All Files at Once**

Selecting a file or directory and pressing the **All Set** soft key places an asterisk on every file in the directory containing the selected file or directory.

### Specifying the File to be Displayed in the File List Dialog Box

You can specify the type of files to display.

- \*. extension

Displays only the data file that was selected in the File Item setting menu and the data type menu.

- \*.\*

Displays all the files on the medium.

### Properties

Lists the file name.extension, file size, the date it was saved, the attributes, and the comment for the selected file.

### Displaying Compressed Images in the File List

Selecting screen image data files from the File List causes a compressed image of the screen data to appear in the upper right portion of the File List. Screen image data is the only type of compressed image that is displayed. The compressed images of waveform and setting data are not displayed. Also, file name and color information are not displayed in the compressed image.

### Note

---

- You cannot delete files while data acquisition is in progress
  - Deleted data cannot be recovered. Make sure not to erase the wrong files.
  - Directories can be deleted if there are no files in them.
  - If an error occurs while deleting multiple files, the files after the error will not be deleted.
  - Directory attributes cannot be changed.
  - This function can not be used in conjunction with FTP server function or LPR client function.
  - Screen image data and thumbnail display data is saved together as a file pairs. If you set the designation (filter) of the files displayed in the file list to \*.\* then process (Delete, Rename, Copy) each file individually, the thumbnail function becomes disabled.
-

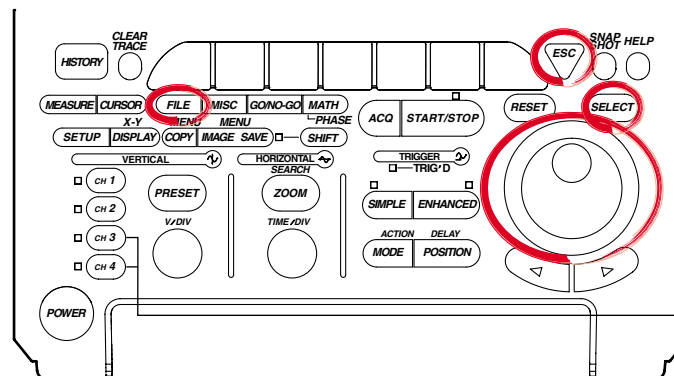
## 11.11 Copying Files



### CAUTION

Never remove the medium (disk) or turn OFF the power while the access indicator, or the floppy disk or the Zip disk icon is blinking. This can damage the medium or destroy the data on the medium.

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **FILE**.
2. Pressing the **Utility** soft key displays the utility setting menu and the file list dialog box.

|           |  |      |      |  |  |         |
|-----------|--|------|------|--|--|---------|
| File Item |  |      |      |  |  | FILE    |
| Setup     |  | Save | Load |  |  | Utility |

3. Pressing the **Function** soft key displays the file function menu.

|          |            |        |  |  |  |         |
|----------|------------|--------|--|--|--|---------|
| Function |            |        |  |  |  | Utility |
| Format   | Media Info | Format |  |  |  | FILE    |

4. Press the **Copy** soft key.

|        |      |        |          |        |  |         |
|--------|------|--------|----------|--------|--|---------|
| Delete | Copy | Rename | Make Dir | Format |  | Utility |
|        |      |        |          |        |  | FILE    |

### Selecting the Source Medium/Directory

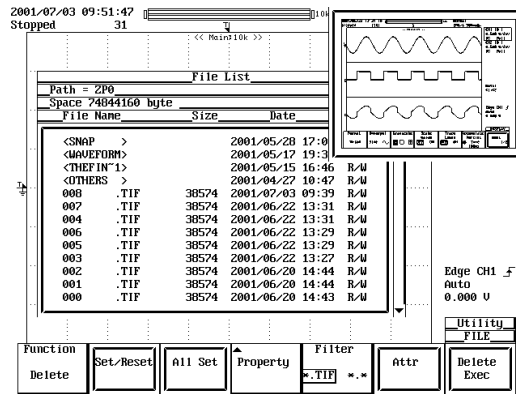
5. The procedures are the same as steps 13 to 17 in section 11.6, "Saving/Loading Waveform Data."

**Selecting the Source File One at a Time**

6. Turn the jog shuttle to select a file.

**Note**

By selecting a screen image data file (files with the .tif, .bmp, or .ps extensions) in the File List window and pressing **SELECT**, the selected screen image file's compressed image appears in the upper right portion of the file list.

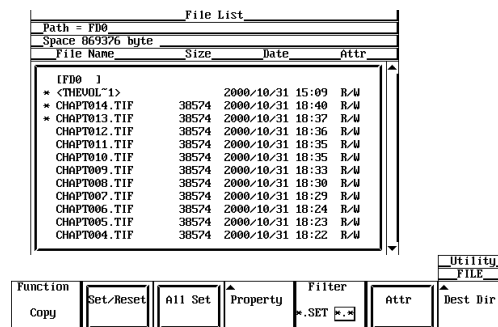


- If compressed image (thumbnail) data does not exist for the selected file, an error message appears. Pressing ESC clears the error message.
- The following procedure clears the compressed image from the screen.
  - Move the cursor using the jog shuttle.

7. Press the **Set/Reset** soft key. If an asterisk is displayed to the left of the file name in the File List dialog box, the file will be copied.

If you press the **Set/Reset** soft key, the asterisk to the left of the file name disappears. This file will not be copied.

Go to step 11.



**Selecting All Copy Source Files at Once**

8. Turn the jog shuttle to select a file, a directory, or a medium.

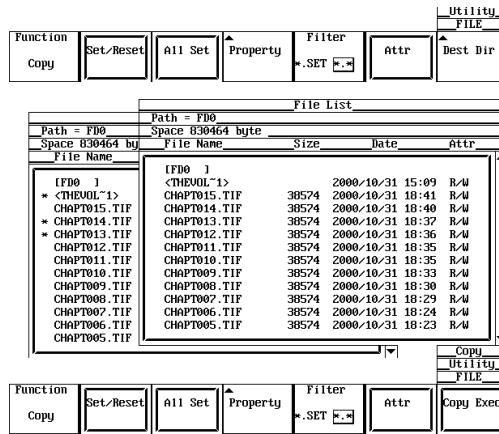
9. Pressing the **All Set** soft key places an asterisk to the left of every file in the directory containing the selected file or directory. These directories and files will be copied. The name of the **All Set** soft key changes to All Reset.

**Resetting All Selected Copy Source**

10. Pressing the **All Set** soft key removes the asterisk to the left of every file in the directory containing the selected file or directory. The directories and files will not be copied. The name of the **All Reset** soft key changes to All Set.

**Selecting the Copy Destination**

11. Press the **Dest Dir** soft key. The copy execution menu and the copy destination file list dialog box appear.

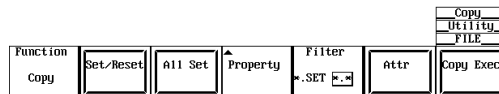


**Selecting the Destination Medium/Directory**

12. The procedures are the same as steps 13 to 17 in section 11.6, "Saving/Loading Waveform Data."

**Executing the Copy Operation**

13. Press the **Copy Exec** soft key to copy all source files that have an asterisk.



**Specifying the File to be Displayed in the File List Dialog Box and Viewing its Properties**

The procedures are the same as steps 30 to 33 in section 11.6, "Saving/Loading Waveform Data."

**Explanation**

**Selecting the Copy Source Files**

You can copy all files that have an asterisk to the left of the file name. There are two methods available to select the files that are to be copied.

- **Selecting the Files One at a Time**  
Place an asterisk to the left of the file names one at a time, using the **Set/Reset** soft key.
- **Selecting All Files at Once**  
Selecting a file or directory and pressing the **All Set** soft key places an asterisk on every file in the directory containing the selected file or directory.

**Specifying the File to be Displayed in the File List Dialog Box**

You can specify the type of files to display.

- \*. extension  
Displays only the data file that was selected in the File Item setting menu and the data type menu.
- \*.\*  
Displays all the files on the medium.

**Properties**

Lists the file name.extension, file size, the date it was saved, the attributes, and the comment for the selected file.

**Displaying Compressed Images in the File List**

Selecting screen image data files from the File List causes a compressed image of the screen data to appear in the upper right portion of the File List. Screen image data is the only type of compressed image that is displayed. The compressed images of waveform and setting data are not displayed. Also, file name and color information are not displayed in the compressed image.

**Note**

---

- You cannot copy files while the data acquisition is in progress.
  - If an error occurs while copying multiple files, the files after the error will not be copied.
  - Directory attributes cannot be changed.
  - If a file with the same name exists at the destination, copying is not allowed.
  - You cannot copy the same files to another directory immediately after copying those files. You must again select the files you wish to copy.
  - This function can not be used in conjunction with FTP server function or LPR client function.
  - Screen image data and thumbnail display data is saved together as a file pairs. If you set the designation (filter) of the files displayed in the file list to \*.\* then process (Delete, Rename, Copy) each file individually, the thumbnail function becomes disabled.
-

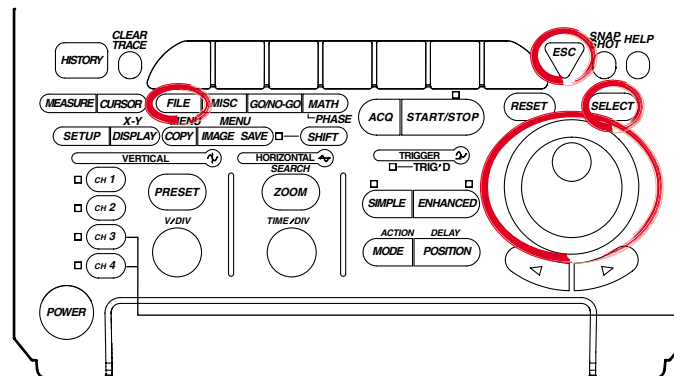
## 11.12 Changing the Directory/File Name of the Storage Medium and Creating a Directory



### CAUTION

Never remove the medium (disk) or turn OFF the power while the access indicator, or the floppy disk or the Zip disk icon is blinking. This can damage the medium or destroy the data on the medium.

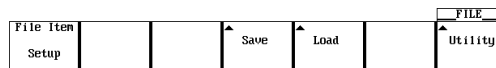
### Relevant Keys



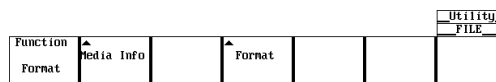
The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

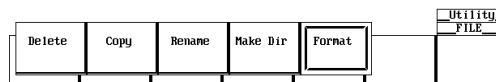
1. Press **FILE**.
2. Pressing the **Utility** soft key displays the utility setting menu and the file list dialog box.



3. Pressing the **Function** soft key displays the file function menu.



4. Press the **Rename** soft key.



### Changing the Directory/File Name of the Storage Medium

#### Selecting the Medium/Directory

5. The procedures are the same as steps 13 to 17 in section 11.6, "Saving/Loading Waveform Data."

#### Changing the File Attributes

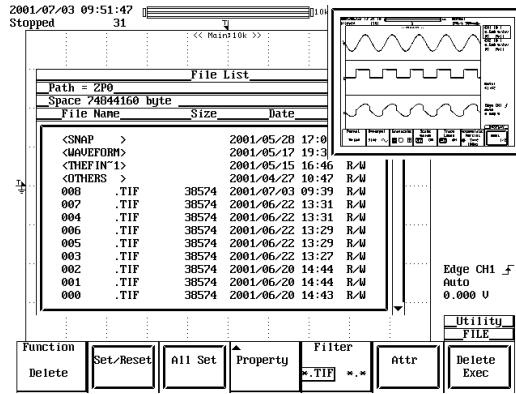
6. The procedures are the same as steps 6 and 7 in section 11.10, "Changing the File Attributes, Deleting Files."

**Changing the directory/file name of the recording medium (excepting Net Drive)**

7. Turn the jog shuttle to select directory, or file.

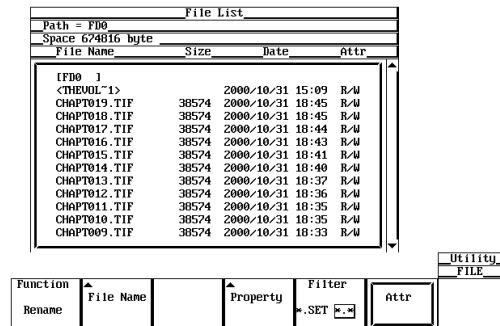
**Note**

By selecting a screen image data file (files with the .tif, .bmp, or .ps extensions) in the File List window and pressing **SELECT**, the selected screen image file's compressed image appears in the upper right portion of the file list.



- If compressed image (thumbnail) data does not exist for the selected file, an error message appears. Pressing ESC clears the error message.
- The following procedure clears the compressed image from the screen.
- Move the cursor using the jog shuttle.

8. Pressing the **File Name** soft key displays a keyboard. The name of directory/file is displayed in the entry box of the keyboard.



9. Enter the directory/file name according to the procedures given in section 4.1.

**Specifying the File to be Displayed in the File List Dialog Box, Viewing the Properties**

The procedures are the same as steps 30 to 33 in section 11.6, "Saving/Loading Waveform Data."

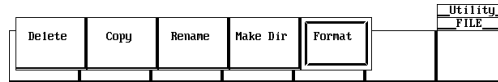


## 11.12 Changing the Directory/File Name of the Storage Medium and Creating a Directory

### Creating a Directory

Follow steps 1-3 to display the file function selection menu.

- Press the soft key corresponding to Make Dir.

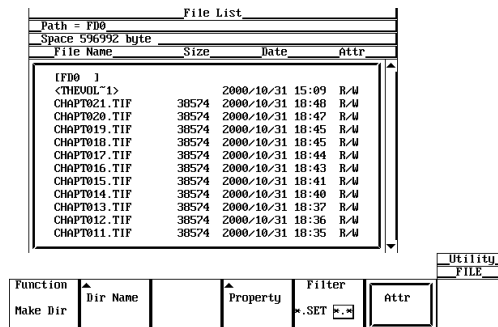


### Selecting the Medium/Directory

- The procedures are the same as steps 13 to 17 in section 11.6, "Saving/Loading Waveform Data."

### Creating the Directory

- Turn the jog shuttle to select a medium or a directory.
- Pressing the **Dir Name** soft key displays a keyboard.



- Enter the directory/file name according to the procedures given in section 4.1.

### Specifying the File to be Displayed in the File List Dialog Box, Viewing the Properties

The procedures are the same as steps 30 to 33 in section 11.6, "Saving/Loading Waveform Data."

## Explanation

### Selecting the Medium and Directory

The storage medium that can be used to save and load waveform data are displayed in the File List dialog box.

#### • Display Example of Storage Medium

- FD0 : Floppy disk
- ZP0 : Zip disk
- SC5 : SCSI device with an ID number of 5
- SC5\_1 : Partition 1 of the SCSI device with an ID number of 5
- ND0 : Network drive (available with the Ethernet interface option)

### Selecting the File Attributes

Select the attributes for each file from the following choices.

- R/W  
Read and write possible.
- R  
Read only. Cannot write to the file or delete the file.

### Changing the Directory/File Name of the storage medium

Number and types of characters that can be used

| Item      | Number of Characters | Characters that can be Used                            |
|-----------|----------------------|--|
| File name | 1 to 8 chars.        | 0 to 9, A to Z, %, _, ( ) (parenthesis), -(minus sign) |
| Comment   | 0 to 25 chars.       | All characters (including spaces),                     |

### Creating a Directory

A new directory can be created on a medium. See above for the assignment of the directory name when creating a new directory.

### Specifying the File to be Displayed in the File List Dialog Box

You can specify the type of files to display.

- \*. extension  
Displays only the data file that was selected in the File Item setting menu and the data type menu.
- \*.\*  
Displays all the files on the medium.

### Properties

Lists the file name.extension, file size, the date it was saved, the attributes, and the comment for the selected file.

### Displaying Compressed Images in the File List

Selecting screen image data files from the File List causes a compressed image of the screen data to appear in the upper right portion of the File List. Screen image data is the only type of compressed image that is displayed. The compressed images of waveform and setting data are not displayed. Also, file name and color information are not displayed in the compressed image.

### Note

---

- You cannot rename a directory/file or create a new directory while the data acquisition is in progress (START/STOP indicator is ON).
  - Directory attributes cannot be changed.
  - If a file with the same name exists in the same directory, renaming is not allowed.
  - If a directory with the same name exists in the same directory, the directory cannot be created.
  - This function can not be used in conjunction with FTP server function or LPR client function.
  - Screen image data and thumbnail display data is saved together as a file pairs. If you set the designation (filter) of the files displayed in the file list to \*.\* then process (Delete, Rename, Copy) each file individually, the thumbnail function becomes disabled.
-

## 12.1 External Trigger Input, External Clock Input



### CAUTION

Never apply signals that do not meet the following specifications as this may damage the instrument (due to overvoltage, for example).

### External Trigger Input Terminal

#### [Input Terminal]

< DL1740 >  
EXT CLOCK IN  
EXT TRIG IN  
TRIG GATE IN  
≤40Vpk 1MΩ



< DL1720 >

1MΩ/20pF ≤ 40Vpk



(On the DL1740 it is located on the rear panel,  
or on the DL1720 it is located on the front panel.)

This terminal is used when an external signal is used as a trigger source. (See section 6.2)

#### Specifications

|                        |   |
|------------------------|---|
| Connector Type:        | BNC   |
| Maximum Input Voltage: | at ±40 V (DC + AC peak) or 28 Vrms, when the frequency is 10 kHz or less.   |
| Frequency Range:       | DC to 100 MHz   |
| Input Impedance:       | approx. 1 MΩ and 18 pF for the DL1740<br>approx. 1 MΩ and 20 pF for the DL1720  |
| Input Range:           | ±2 V (for the DL1740)<br>±1 V (for the DL1720 at the ±1 V range)<br>±10V (for the DL1720 at the ±10 V range)  |
| Trigger Sensitivity:   | 0.1 Vp-p (for the DL1740)<br>0.1 Vp-p (for the DL1720 at the ±1 V range)<br>1 Vp-p (for the DL1720 at the ±10 V range)  |
| Trigger Level:         | ±2 V in 5 mv resolution (for the DL1740)<br>±1 V in 5 mv resolution (for the DL1720 at the ±1 V range)<br>±10 V in 50 mv resolution (for the DL1720 at the ±10 V range) |

### External Clock Input Terminal

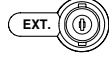
#### [Input Terminal]

< DL1740 >  
EXT CLOCK IN  
EXT TRIG IN  
TRIG GATE IN  
≤40Vpk 1MΩ



< DL1720 >

1MΩ / 20pF ≤ 40Vpk  
EXT.



(On the DL1740 it is located on the rear panel,  
or on the DL1720 it is located on the front panel.)

The external trigger input terminal can also be used as an external clock input terminal. If you wish to drive the instrument with an external clock, connect a clock signal to this terminal.

#### Specifications

|                          |   |
|--------------------------|---|
| Connector Type:          | BNC   |
| Maximum Input Voltage:   | at ±40 V (DC + AC peak) or 28 Vrms, when the frequency is 10 kHz or less.   |
| Frequency Range:         | 40 Hz to 20 MHz (continuous clock only)   |
| Input Impedance:         | approx. 1 MΩ and 18 pF for the DL1740<br>approx. 1 MΩ and 20 pF for the DL1720  |
| Input Range:             | ±2 V (for the DL1740)<br>±1 V (for the DL1720 at the ±1 V range)<br>±10V (for the DL1720 at the ±10 V range)  |
| Threshold Level:         | ±2 V in 5 mv resolution (for the DL1740)<br>±1 V in 5 mv resolution (for the DL1720 at the ±1 V range)<br>±10 V in 50 mv resolution (for the DL1720 at the ±10 V range) |
| Minimum Input Amplitude: | 0.1 Vp-p (for the DL1740)<br>0.1 Vp-p (for the DL1720 at the ±1 V range)<br>1 Vp-p (for the DL1720 at the ±10 V range)  |
| Minimum Pulse Width:     | 10 ns for both High and Low.  |

## 12.2 Trigger Output (TRIG OUT)



### CAUTION

Never apply an external voltage to the TRIG OUT terminal. This may damage the instrument.

### TRIG OUT Terminal

TRIG OUT  
(TTL ⚡)

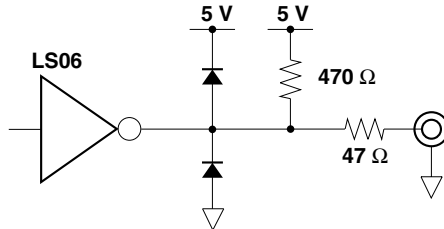


This trigger outputs a TTL level signal when a trigger occurs. The signal level is normally high, but goes low when a trigger occurs.

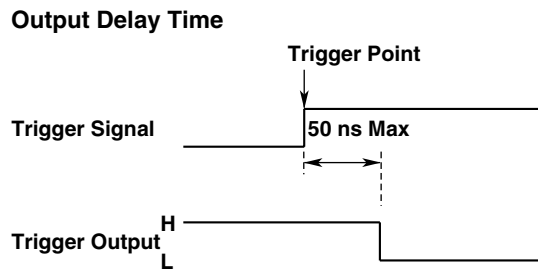
#### Specifications

|                    |   |
|--------------------|---|
| Connector Type:    | BNC   |
| Output Level:      | TTL   |
| Output Logic:      | ⌋(negative)                                     |
| Output Delay Time: | 50 ns or less                                   |
| Output Hold Time:  | 1 μs min at low level, 100 ns min at high level |

### Output Circuit Diagram



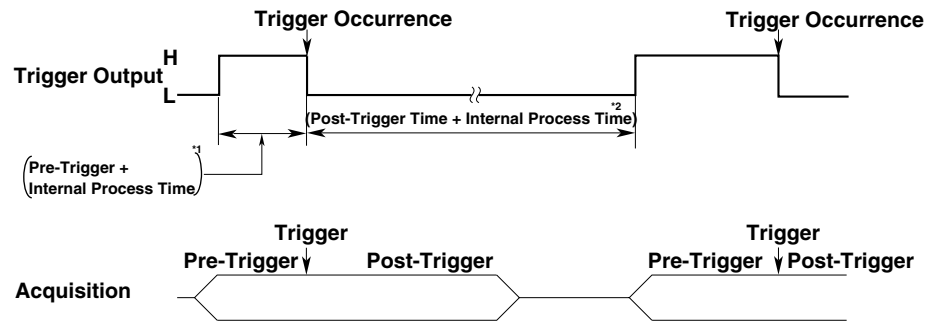
### Timing Chart



## 12.2 Trigger Output (TRIG OUT)

---

### Low Level/High Level Hold Time



\*1: HIGH (High Level) Period

Indicates the pre-trigger and internal processing time. 100 ns minimum.

\*2: LOW (Low Level) Period

Indicates the post-trigger and internal processing time. 1  $\mu$ s minimum.

## 12.3 RGB Video Signal Output (RGB VIDEO OUT)



### CAUTION

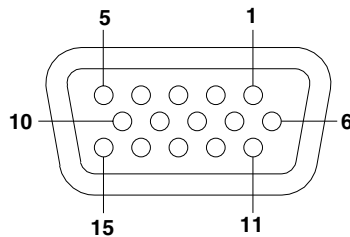
- When making a connection, turn OFF the DL1720/DL1740 and the monitor.
- Never short circuit the RGB VIDEO OUT terminal or apply an external voltage. This may damage the instrument.

### RGB VIDEO OUT Terminal



Through RGB output, the contents displayed on the instrument can be displayed on an external monitor. Monitors that can be connected are VGA monitors or multi-synchronous monitors that can display VGA.

### Specifications



D-Sub 15-Pin Receptacle

| Pin No. | Signal                        | Specification                        |
|---------|-------------------------------|--------------------------------------|
| 1       | Red                           | 0.7 Vp-p                             |
| 2       | Green                         | 0.7 Vp-p                             |
| 3       | Blue                          | 0.7 Vp-p                             |
| 4       | —                             |                                      |
| 5       | —                             |                                      |
| 6       | GND                           |                                      |
| 7       | GND                           |                                      |
| 8       | GND                           |                                      |
| 9       | —                             |                                      |
| 10      | GND                           |                                      |
| 11      | —                             |                                      |
| 12      | —                             |                                      |
| 13      | Horizontal synchronous signal | Approx. 31.3 kHz, TTL negative logic |
| 14      | Vertical synchronous signal   | Approx. 60 Hz, TTL negative logic    |
| 15      | —                             |                                      |

## 12.3 RGB Video Signal Output (RGB VIDEO OUT)

---

### Connecting the Monitor

1. Turn OFF the DL1720/DL1740 and the monitor.
2. Connect the monitor to the DL1720/DL1740 using an analog RGB cable.
3. Turn ON the DL1720/DL1740 and the monitor. The instrument's screen is displayed on the monitor.

#### **Note**

---

- The RGB VIDEO OUT terminal outputs RGB video signal at all times.
  - The picture on the monitor may flicker if the DL1720/DL1740 or another instrument is brought too close to the monitor.
  - The ends of the screen may be cut off on some monitors.
-

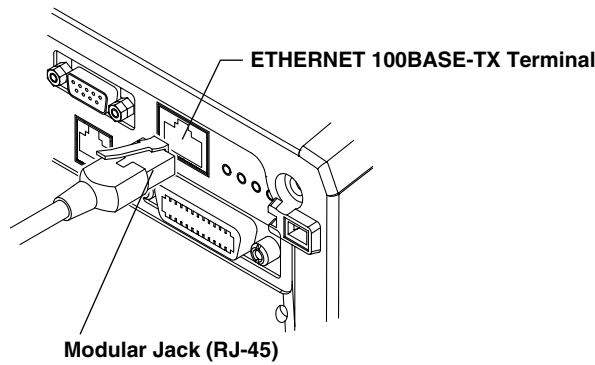


# 13.1 Connecting the DL1720/DL1740 to a Personal Computer

## Ethernet Interface Specifications

A 100BASE-TX port is provided on the rear panel of the DL1720/DL1740.

| Item                                 | Specifications  |
|--------------------------------------|---|
| Communication Port Number            | 1   |
| Electrical-Mechanical Specifications | IEEE 802.3 standards  |
| Transmission Method                  | Ethernet (100BASE-TX/10BASE-T)  |
| Transmission Rate                    | Max. 100 Mbps   |
| Communication Protocol               | TCP/IP  |
| Supported Services                   | FTP server, FTP client (network drive), LPR client (network printer), SMTP client (mail transmission), DHCP, DNS. |
| Connector Type                       | RJ-45 connector   |



## Items Necessary for Connection

### Cable

Use only the following cables for connection.

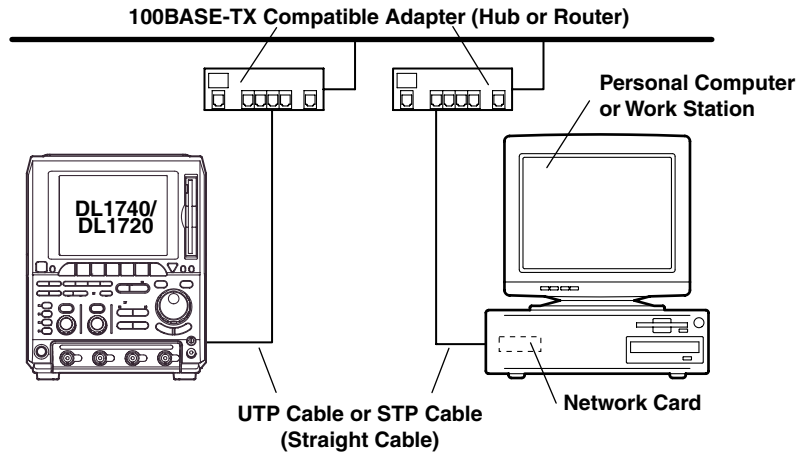
- UTP (unshielded twisted-pair) cable (category 5)
- STP (shielded twisted-pair) cable

## 13.1 Connecting the DL1720/DL1740 to a Personal Computer

### Connection Method

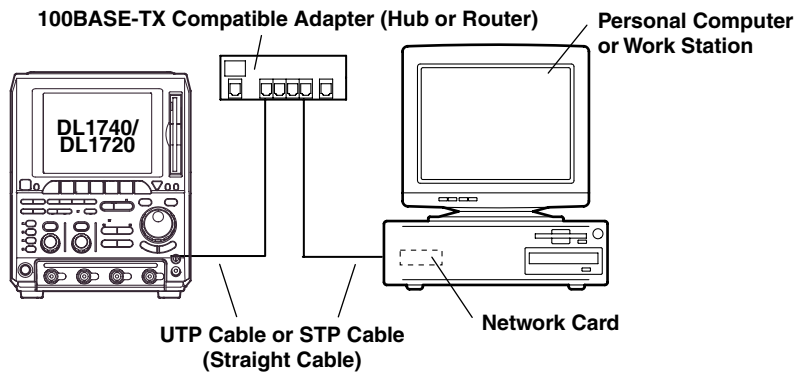
#### When Connecting to a Network PC or Workstation

1. Turn OFF the power to the instrument.
2. Connect one side of the UTP (or STP) cable to the ETHERNET 100BASE-TX terminal on the rear panel.
3. Connect the other end of the UTP (or STP) cable to a hub or router.
4. Turn ON the power to the instrument.



#### When Making a One-to-One Connection to the PC or Workstation

1. Turn OFF the power to the instrument and PC or workstation.
2. Connect one side of the UTP (or STP) cable to the ETHERNET 100BASE-TX terminal on the rear panel.
3. Connect the other end of the UTP (or STP) cable to a hub or router.
4. In the same manner, connect the PC or workstation to a hub or router.
5. Turn ON the power to the instrument.

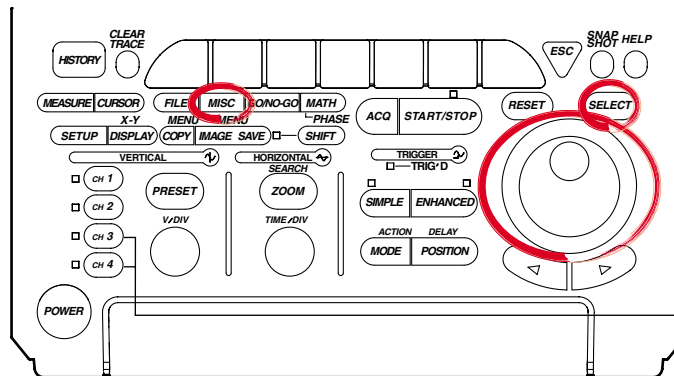


#### Note

- When connecting the PC or workstation one-to-one, a network card (a 10BASE-T/100BASE-TX autoswitching card) is required for the PC or workstation.
- When using a UTP cable (straight cable), be sure to use only a category 5 cable.
- Avoid connecting the PC or workstation directly to the instrument without going through the hub or router. We cannot guarantee results using a direct connection.

## 13.2 Configuring the Ethernet Interface (TCP/IP)

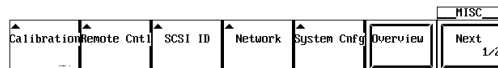
### Relevant Keys



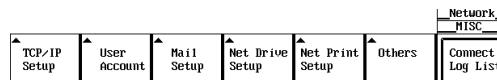
The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **MISC**.
2. Press the **Network** soft key to display the Network menu.

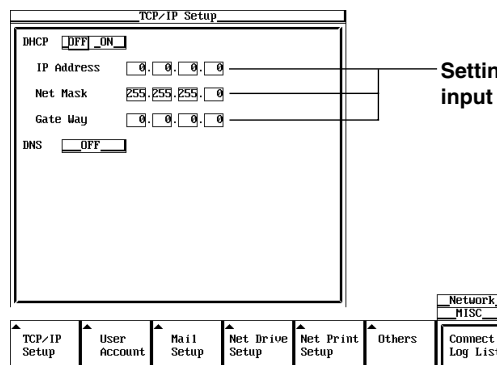


3. Press the **TCP/IP Setup** soft key to display the TCP/IP settings menu.



#### DHCP ON/OFF

4. Move the cursor to DHCP using the jog shuttle and press **SELECT** to turn DHCP ON or OFF. If you select ON, then it is not necessary to set the IP address, subnet mask, and default gateway. If you wish to set up the DNS, please skip to step 11. If you do not wish to set up the DNS, check the network cable connection and restart the DL1720/DL1740. The IP address, subnet mask, and default gateway are automatically set.



Settings for the following items can be input directly using a USB keyboard. (Ⓜ)

#### Setting the IP Address

Set the IP address if you turned DHCP OFF in step 4.

5. Move the cursor to the IP Address field with the jog shuttle, and press **SELECT** to display the settings menu.
6. Enter the IP address values from 0 to 255 using the jog shuttle.

## 13.2 Configuring the Ethernet Interface (TCP/IP)

### Setting the Subnet Mask

Set the subnet mask if you turned DHCP OFF in step 4.

7. Move the cursor to the Net Mask field using the jog shuttle, and press **SELECT** to display the settings menu.
8. Enter the subnet mask address values from 0 to 255 using the jog shuttle.

### Setting the Default Gateway

Set the default gateway if you turned DHCP OFF in step 4.

9. Move the cursor to the Gate Way field with the jog shuttle, and press **SELECT** to display the settings menu.
10. Enter the default gateway address values from 0 to 255 using the jog shuttle.

### Setting the DNS

11. Move the cursor to DNS by turning the jog shuttle.
12. Press **SELECT** to display the DNS setting menu.

The screenshot shows the 'TCP/IP Setup' menu. At the top, 'DHCP' is set to 'OFF'. Below are fields for 'IP Address' (0.0.0.0), 'Net Mask' (255.255.255.0), and 'Gate Way' (0.0.0.0). The 'DNS' option is selected, and a sub-menu is displayed with 'OFF' and 'ON' options. At the bottom, there is a navigation bar with buttons for 'TCP/IP Setup', 'User Account', 'Mail Setup', 'Net Drive Setup', 'Net Print Setup', 'Others', and 'Network MISC'. The 'Network MISC' button is highlighted, and a sub-menu with 'Connect Log List' is visible.

13. Press **SELECT** to set the DNS to ON, OFF, or AUTO (AUTO available only when DHCP is ON). When DNS is set to AUTO, the domain name and DNS server name are automatically set by restarting the instrument. If DNS is set to ON, the domain name, DNS server name, and domain suffix are displayed. If DNS is set to OFF, check the network cable connection and restart the DL1720/DL1740.

The screenshot shows the 'TCP/IP Setup' menu with 'DNS' set to 'ON'. Below are fields for 'Domain Name', 'DNS Server1' (0.0.0.0), 'DNS Server2' (0.0.0.0), 'Domain Suffix1', and 'Domain Suffix2'. A callout box with a pointer to the DNS fields contains the text: 'Settings for the following items can be input directly using a USB keyboard. (F10)'. The navigation bar at the bottom is the same as in the previous screenshot.

14. Move the cursor to Domain Name by turning the jog shuttle.
15. Press **SELECT** to display the keyboard.
16. Input the domain name.
17. Move the cursor with the jog shuttle to the DNS Server 1 field, and press **SELECT** to display the setting menu.
18. Set the primary DNS server values from 0 to 255 using the jog shuttle.

19. In the same manner, set the secondary DNS server in the DNS Server 2 field.
20. Move the cursor to Domain Suffix1 by turning the jog shuttle.
21. Press **SELECT** to display the keyboard.
22. Input the primary domain suffix.
23. In the same manner, set the secondary domain suffix in the domain suffix 2 field.

**Note**


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For keyboard (soft keyboard) operation see section 4.1, "Entering Values and Character Strings."

---

**Turning the Power ON/OFF**

24. You must restart the DL1720/DL1740 for the settings to take affect. After all the settings are complete, turn the power to the DL1720/DL1740 OFF, then back ON again.

**Explanation**

The following TCP/IP settings must be entered to use the Ethernet communications functions on the DL1720/DL1740.

- IP Address
- Subnet Mask
- Default Gateway

**IP Address (Internet Protocol Address)**

Assign an IP address to the instrument. The default setting is 0.0.0.0.

A unique IP address must be assigned to each PC on an IP network such as the internet or an intranet. The address is a 32-bit value normally expressed with four values (0-255), each separated by a period as in 192.168.111.24.

Obtain an IP address from your network administrator. The settings are automatically configured in environments using DHCP.

**Subnet Mask**

Specify the mask that is used to determine the network address from the IP address. The default setting is 255.255.255.0.

Huge TCP/IP networks such as the internet are often divided up into smaller networks called subunits. The subnet mask is a 32 bit value that specifies whether to use an IP address containing some number of bits that identify the network address. The portion other than the network address is the host address that identifies which computer on the network the address belongs to.

Consult the network administrator for the subnet mask setting value. In some cases, this setting may not be necessary. The settings are automatically configured in environments using DHCP.

**Default Gateway**

Set the IP address of the gateway (default gateway) for communicating with machines on different networks. The default setting is 0.0.0.0.

The default gateway has control functions that handle protocol exchanges when communicating on multiple networks, and that smoothly carry out sending and receiving of data.

Consult your network administrator for the default gateway setting values. In some cases, this setting may not be necessary. The settings are automatically configured in environments using DHCP.

### **DHCP (Dynamic Host Configuration Protocol)**

DCHP is a protocol that allocates necessary setting information to all PCs connected to the network. When DHCP is ON, the following settings are automatically assigned.

- IP Address
- Subnet Mask
- Default Gateway
- DNS

To use DHCP, you must have a DHCP server installed on the network. Inquire with your network administrator to find out if you can use DCHP.

When DHCP is set to ON, different settings may be assigned each time the power is turned ON. Therefore when using the FTP server function (see section 13.8), be sure to check the IP address and other settings of the instrument on the PC or workstation each time you turn ON the instrument.

### **DNS (Domain Name System)**

The DNS is a system that correlates the host name/domain name to the IP address. (Given AAA.BBBBB.co.jp, AAA is the hostname, and BBBBB.co.jp is the domain name.) The host/domain name can be used instead of a numeric IP address when accessing the network.

On the DL1720/DL1740, you can specify the host by name instead of by IP address when using the FTP client function (see sections 13.3 and 13.4) or the LPR client function (see section 13.5).

Set the domain name, the DNS server address (default is 0.0.0.0), and the domain suffix. In networks that support DHCP, these settings can be configured automatically. Consult your network administrator for details on the settings.

- **DNS Server**

Up to two DNS servers can be specified (primary and secondary). If the primary server is down, the secondary server is used to search the host name/domain name and IP address.

- **Domain Suffix**

If the IP address corresponding to the domain name described in the previous paragraph is not found on the DNS server, then it may be that the system is configured to use another domain name. Set this other domain name as a domain suffix. Up to two domain suffixes can be specified, DomainSuffix1 (primary), and DomainSuffix2 (secondary).

### **Note**

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- To change this menu setting, you must restart the DL1720/DL1740.
- When the Ethernet cable is not connected, if you turn ON the power to the DL1720/DL1740 while DCHP is ON, there is a possibility of malfunction in the communications or file functions. Turn DHCP OFF and restart the instrument.

- **Configuring the TCP/IP Settings of the PC**

Communications parameters such as the IP address must be specified also on the PC side. Communications parameters are specified for each Ethernet NIC that is installed in the PC. Here, the settings of the NIC for connecting your PC and the DL1720/DL1740 are explained. If the IP address and other parameters are to be obtained dynamically using the DHCP server, the following settings are not necessary. In this case, select Obtain an IP address automatically under the IP Address tab of the TCP/IP Properties dialog box.

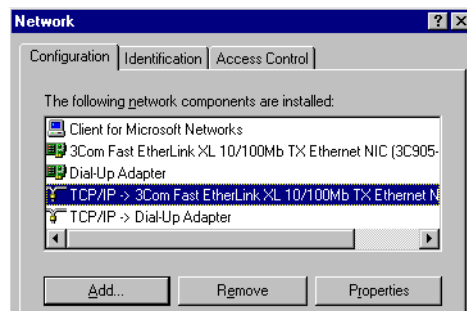
For example, if you are connecting a PC and the DL1720/DL1740 to an independent Ethernet network, you can specify parameters as indicated in the next table.

For details on the parameters, consult your system or network administrator.

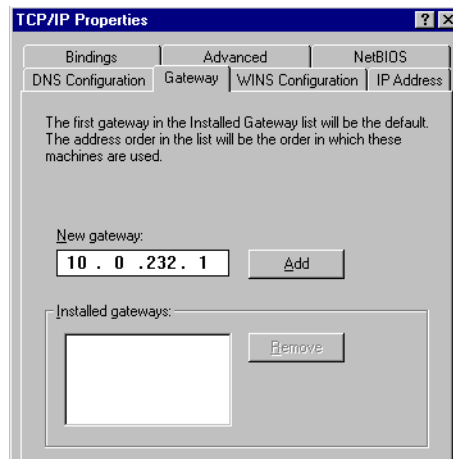
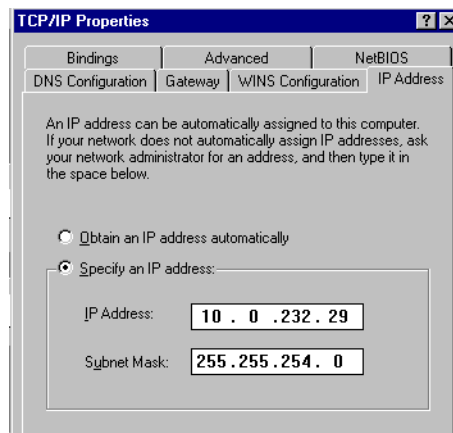
| Parameter   | Value                   | Note  |
|-------------|-------------------------|---|
| IP Address  | Example: 192.168.21.128 | IP address for the PC   |
| Subnet Mask | Example: 255.255.255.0  | Set the same value as the subnet mask that was specified for the DL1720/DL1740. |
| Gateway     | None                    |   |
| DNS         | Disable                 |   |
| WINS        | Disable                 |   |

The following procedure describes the steps for Windows 95/98. If you are using Windows NT/2000 Pro carry out equivalent steps according to your operating system.

1. Select Settings > Control Panel from the Start menu to open the Control Panel folder.
2. Double-click the Network icon to display the following Network dialog box.
3. Click the Configuration to select the TCP/IP connection corresponding to the Ethernet NIC that is connected to the PC and click Properties to display the TCP/IP properties dialog box.



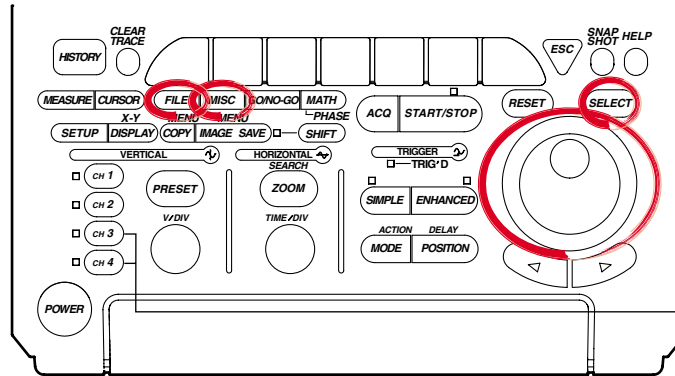
4. Set the parameters such as the IP address according to the table on the previous page and click OK.



# 13.3 Saving Waveform and Setting Data to a Network Drive (FTP Client Function)

<For a description of this function, refer to page 1-29>

## Relevant Keys

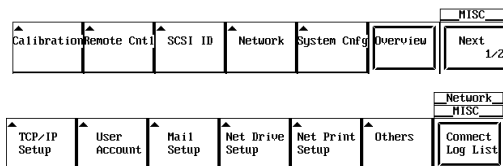


The DL1720 is not equipped with an input terminal for CH3 or CH4.

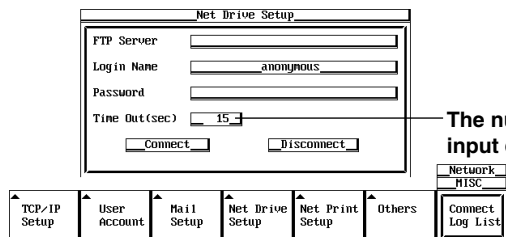
## Operating Procedure

### Entering Settings for a Network Drive

1. Press **MISC**.
2. Press the **Network** soft key and press the **Net Drive Setup** soft key to display the settings menu.



3. Use the jog shuttle to move the cursor to **FTP Server**, then press **SELECT** to display the keyboard.

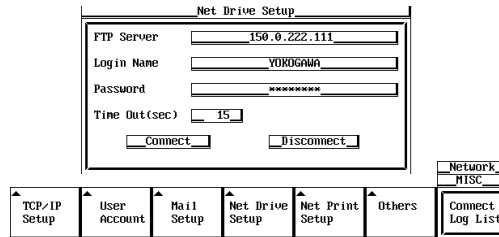


4. Enter the IP address of the FTP server. When using DNS, you can specify it by name.
5. Use the jog shuttle to move the cursor to Login Name, then press **SELECT** to display the keyboard.
6. Enter a login name of 15 characters or less.
7. Use the jog shuttle to move the cursor to Password, then press **SELECT** to display the keyboard.



### 13.3 Saving Waveform and Setting Data to a Network Drive (FTP Client Function)

- Enter a password of 15 characters or less for the login name. If the login name is anonymous, you don't need to enter a password.





- Use the jog shuttle to move the cursor to Timeout. Press **SELECT** to set the timeout time. The available setting range is 0 to 3600(s).

**Note**

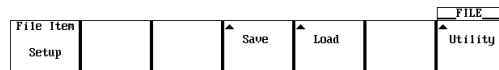
- For keyboard (soft keyboard) operation see section 4.1, "Entering Values and Character Strings."
- If Login Name is set to anonymous, it is not necessary to enter a password.

**Connecting/Disconnecting to a Network Drive**

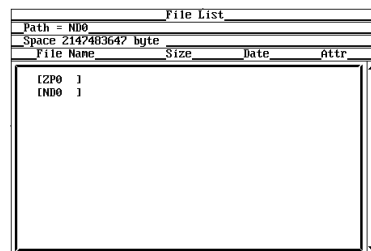
- Use the jog shuttle to move the cursor to Connect, then press **SELECT** to make the connection. If the connection has been made successfully the  icon appears in the upper right part of the screen.  
Use the jog shuttle to move the cursor to Disconnect, then press **SELECT** to close the connection. The  icon in the upper right of the screen is turned off.

**Saving the Waveform and the Setting Data**

- Press **FILE** and press the **Utility** soft key to display the File List.



- Use the jog shuttle to move the cursor to ND0 (Net Drive Zero).



- For the remaining procedures, please refer to section 11.7, "Saving/Loading Setup Data" through section 11.12, "Changing the Storage Medium/Directory/File Name and Creating a Directory."

## 13.3 Saving Waveform and Setting Data to a Network Drive (FTP Client Function)

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### Note

- You must run FTP server software on PCs and workstations that will be connected to the network. Also, please note the following regarding the server software:
    - Use UNIX format for list output (character strings returned by the *dir* command).
    - Make the home directory and its subdirectories writable.
    - You can't change to a higher directory than the home directory.
    - The newest file is not necessarily displayed at the top of the file list.
    - You cannot access files or directories having names longer than nine or more characters.
    - Depending on the server, the < . . > notation for the top directory may not be displayed.
  - In the following cases, the time information in a file list will not be displayed accurately:
    - When WindowsNT uses an AM or PM timestamp.
    - When using a server that returns kanji or other non-ASCII character strings in a list.
  - The following are not possible:
    - Turning file protect ON and OFF on saved files.
    - Formatting a network drive.
    - Copying between network drives.
    - Renaming a file on the network.
  - This function can not be used in conjunction with FTP server function.
  - Before saving data to a network drive, you must configure TCP/IP (see 13.2, "Configuring the Ethernet Interface (TCP/IP)").
  - When connected to the network, you must disconnect then reconnect for settings to take effect.
  - When you are disconnected by the server when using the FTP client, you will be automatically reconnected if you perform a file operation (save, load etc.) This is the same if NDO is selected for Save to File when using an action trigger or GO/NO-GO.
- 

### Explanation

You can save data such as waveform and settings data to network drives via Ethernet in the same manner as with floppy disks or Zip disks.

#### Entering Settings for a Network Drive

- **FTP Server**

Input the IP address of the FTP server (the PC or workstation running the FTP server) on the network to which waveform and setting data will be saved. On networks supporting DNS, you can specify the host and domain by name instead of by IP address.
- **Login Name**

Enter a login name of 15 characters or less. The default value is anonymous. The available characters consist of all ASCII characters on the keyboard (including space).
- **Password**

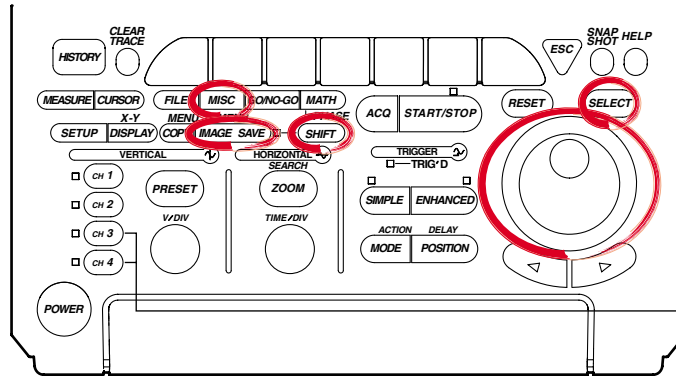
Enter a password corresponding to the login name using 15 characters or less. The available characters consist of all ASCII characters on the keyboard (including space).
- **Time Out**

When accessing the FTP server from this instrument, if can't receive even after a fixed time (the timeout time) elapses, this means that the instrument is unable to send to or receive from the FTP server, and the connection will close. The available setting range is 0 to 3600 s. The default setting is 15 s.

# 13.4 Saving Screen Image Data to a Network Drive (FTP Client Function)

<For a description of this function, refer to page 1-29>

## Relevant Keys

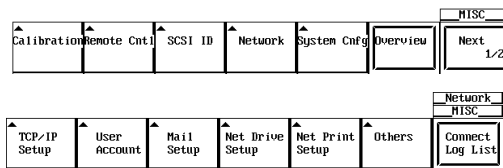


The DL1720 is not equipped with an input terminal for CH3 or CH4.

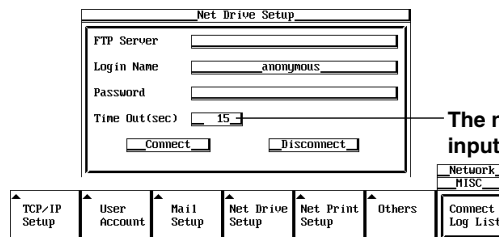
## Operating Procedure

### Entering Settings for a Network Drive

1. Press **MISC**.
2. Press the **Network** soft key and press the **Net Drive Setup** soft key to display the settings menu.



3. Use the jog shuttle to move the cursor to **FTP Server**, then press **SELECT** to display the keyboard.



The numerical values for this item can be input directly using a USB keyboard. (Ⓜ)

4. Enter the IP address of the FTP server address. If you are using DNS, you can specify it by name.
5. Use the jog shuttle to move the cursor to Login Name, then press **SELECT** to display the keyboard.
6. Enter a login name of 15 characters or less.
7. Use the jog shuttle to move the cursor to Password, then press **SELECT** to display the keyboard.

## 13.4 Saving Screen Image Data to a Network Drive


8. Enter the password of 15 characters or less for the login name.

9. Use the jog shuttle to move the cursor to Timeout, then press **SELECT** to set the timeout time. The available setting range is 0 to 3600(s).

### Note

- For keyboard (soft keyboard) operation see section 4.1, "Entering Values and Character Strings."
- If Login Name is set to anonymous, it is not necessary to enter a password.

### Connecting to a Network Drive

10. Use the jog shuttle to move the cursor to Connect, then press **SELECT** to make the connection. If the connection was made successfully, the  icon appears in the upper right of the screen.

### Saving the Screen Image

- Press **SHIFT** to activate shift mode. Functions marked in purple on the panel become active.
- Press **IMAGE SAVE**.
- Press the **File List** soft key to display the File List, and select ND0 (Net Drive Zero).

14. For the remaining procedures, please refer to 11.7, "Saving/Loading Setup Data" through section 11.12, "Changing the Storage Medium/Directory/File Name and Creating a Directory."

**Note**

- You must run FTP server software on PCs and workstations that will be connected to the network. Also, please note the following regarding the server software:
  - Use UNIX format for list output (character strings returned by the *dir* command).
  - Make the home directory and its subdirectories writable.
  - You can't change to a higher directory than the home directory.
  - The newest file is not necessarily displayed at the top of the file list.
  - You cannot access files or directories having names longer than nine or more characters.
  - Depending on the server, the < . . > notation for the top directory may not be displayed.
- In the following cases, the time information in a file list will not be displayed accurately:
  - When WindowsNT uses an AM or PM timestamp.
  - When using a server that returns kanji or other non-ASCII character strings in a list.
- The following are not possible:
  - Turning file protect ON and OFF on saved files.
  - Formatting a network drive.
  - Copying between network drives.
  - Renaming a file on the network.
- This function can not be used in conjunction with FTP server function.
- Before saving data to a network drive, you must configure TCP/IP (see "13.2 Configuring the Ethernet Interface (TCP/IP)").
- When connected to the network, you must disconnect then reconnect for settings to take effect.
- When you are disconnected by the server when using the FTP client, you will be automatically reconnected if you perform a file operation (save, load etc.) This is the same if NDO is selected for Save to File when using an action trigger or GO/NO-GO.

**Explanation**

You can save a screen image to a network drive via Ethernet just as you would to a floppy disk drive or Zip drive.

**Entering Settings for a Network Drive**

- **FTP Server**

Input the IP address of the FTP server (the PC or workstation running the FTP server) on the network to which screen image data will be saved. On networks supporting DNS, you can specify the host and domain by name instead of by IP address.
- **Login Name**

Enter a login name of 15 characters or less. The default value is anonymous. The available characters consist of all ASCII characters on the keyboard (including space).
- **Password**

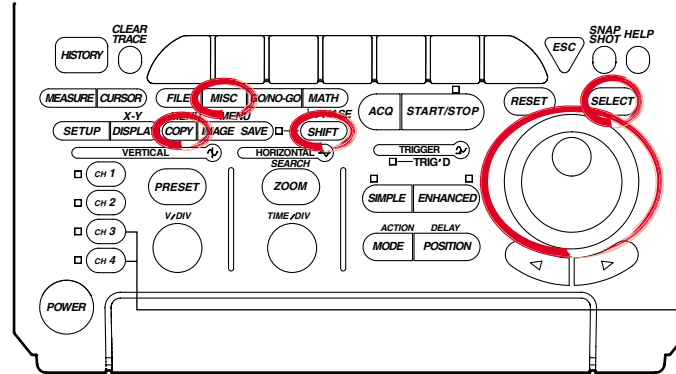
Enter a password corresponding to the login name using 15 characters or less. The available characters consist of all ASCII characters on the keyboard (including space).
- **Time Out**

When accessing the FTP server from this instrument, if can't receive even after a fixed time (the timeout time) elapses, this means that the instrument is unable to send to or receive from the FTP server, and the connection will close. The available setting range is 0 to 3600 s. The default setting is 15 s.

# 13.5 Sending Screen Image Data to a Network Printer (LPR Client Function)

<For a description of this function, refer to page 1-29>

## Relevant Keys

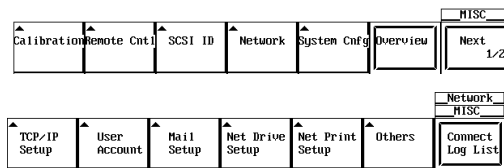


The DL1720 is not equipped with an input terminal for CH3 or CH4.

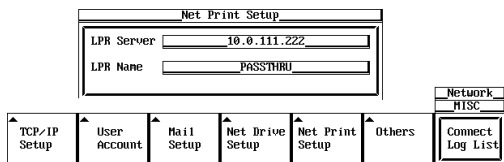
## Operating Procedure

### Entering Settings for a Network Printer

1. Press **MISC**.
2. Press the **Network** soft key, then press the **Net Print Setup** soft key to display the settings menu.



3. Use the jog shuttle to move the cursor to LPR Server, then press **SELECT** to display the keyboard.



4. Enter the printer server address. If you are using a DNS, specify it by name.
5. Use the jog shuttle to move the cursor to LPR Name, then press **SELECT** to display the keyboard.
6. Enter the printer name.

### Note

For keyboard (soft keyboard) operation see section 4.1, "Entering Values and Character Strings."

### Outputting the Screen Image Data

7. Press **SHIFT** to set the keys in the shifted condition. Functions marked in purple on the panel become active.
8. Press **COPY**.

9. Press the **Copy to** soft key to select **Net Print**.

|          |        |             |         |    |         |  |      |
|----------|--------|-------------|---------|----|---------|--|------|
| Copy to  | Format | Information |         |    |         |  | COPY |
| Built-in | Normal | Long        | OFF     | ON | Comment |  |      |
| Built-in | USB    | Net Print   |         |    |         |  | COPY |
|          |        |             | Comment |    |         |  |      |

10. For the remaining procedures, please refer to 10.3, “Outputting Screen Image to an USB Printer.”

However, when NetPrint is selected, PS is added to the Format item.

|           |        |       |      |         |        |    |      |
|-----------|--------|-------|------|---------|--------|----|------|
| Copy to   | Format | Color |      |         |        |    | COPY |
| Net Print | ESC-P  | OFF   | ON   | Comment |        |    |      |
| Copy to   | PS     | LIPS3 | PCL5 | ESC-P   | ESC-P2 | BJ |      |
| Net Print |        |       |      |         |        |    |      |

**Note**

- Before working with this function, enter the TCP/IP settings as described in “Configuring the Ethernet Interface.”
- You can output to any TCP/IP compatible printer.
- This function can not be used in conjunction with FTP server function or File operation.

**Explanation**

You can send screen images simultaneously to a network printer via Ethernet, and the built in printer (optional).

**Entering Settings for a Network Printer**

• **LPR Server**

Specify the IP address of the network printer server. On networks supporting DNS, you can specify the host and domain by name instead of by IP address.

• **Printer Name (LPR Name)**

Specify the name of the printer to which screen images will be output.

**Printer Format**

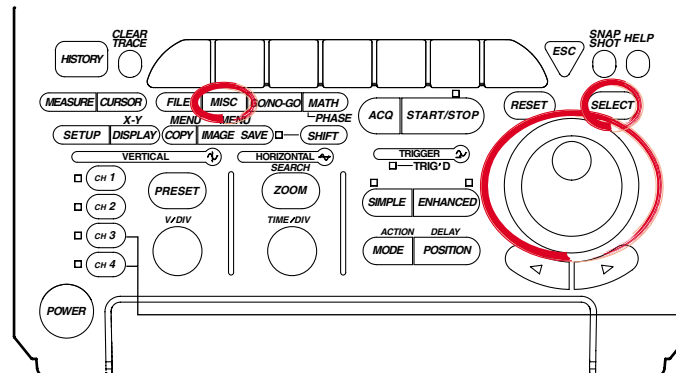
The following six printer formats are supported.

- ESC-P
- ESC-P2
- LIPS3
- PCL5
- BJ
- PS (PostScript)

## 13.6 Using the Mail Function (Fixed Interval)

<For a description of this function, refer to page 1-30>

### Relevant Keys

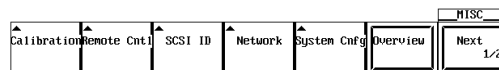


The DL1720 is not equipped with an input terminal for CH3 or CH4.

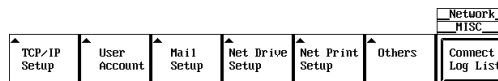
### Operating Procedure

#### Mail Settings

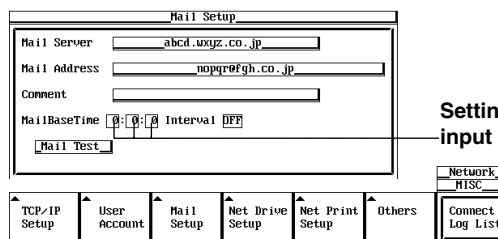
1. Press **MISC**.
2. Press the **Network** soft key to display the Network menu.



3. Press the **Mail Setup** soft key to display the mail settings menu.



4. Move the cursor to Mail Server using the jog shuttle, then press **SELECT** to display the keyboard.



Settings for the following items can be input directly using a USB keyboard. (Ⓜ)

5. Enter the mail server name. If you are using a DNS, specify it by name.
6. Move the cursor to Mail Address using the jog shuttle, then press **SELECT** to display the keyboard.
7. Enter the mail address of 40 characters or less.
8. If necessary, move the cursor to Comment using the jog shuttle, then press **SELECT** to display the keyboard.
9. Enter a comment or 30 characters or less.
10. Move the cursor to Mail Base Time using the jog shuttle, then press **SELECT** to display the keyboard.
11. Enter the mail transmission time.
12. Move the cursor to Interval using the jog shuttle, then press **SELECT** to select the mail interval.



**Sending a Test Mail Transmission**

13. Move the cursor to Mail Test with the jog shuttle, then press **SELECT** to send a test transmission to the specified mail recipient.

**Note**

- For keyboard (soft keyboard) operation see section 4.1, "Entering Values and Character Strings."
- For mail sent by this instrument, the sender's address will be the same as the specified recipient address.
- When error history is included in the mail's contents, the most recent errors appear at the top.
- Before using this function, refer to section 13.2, "Configuring the Ethernet Interface (TCP/IP)" and enter the TCP/IP settings.
- If you set [Interval] to OFF, mail is not transmitted at specified intervals.

**Explanation**

You can transmit DL1720/DL1710 status information to a specified email address on the network at periodic intervals.

**Mail Settings**• **Mail Server**

Specify the IP address of the network mail server. On networks supporting DNS, you can specify the host and domain by name instead of by IP address.

• **Mail Address**

Enter the address of the mail recipient using 40 characters or less.

• **Comment**

The comment appears on the first line of mails that are sent. Comments are optional. Use 30 characters or less for the comment.

• **MailBaseTime**

Specify the time to start transmitting the -mail messages. Set the time in units of hour : minute : second in the following range.

0 : 0 : 0 to 23 : 59 : 59

• **Interval**

The allowable mail transmission intervals are as follows:

Off / 1H / 2H / 3H / 4H / 6H / 8H / 12H / 24H

When OFF is selected, transmission at specified intervals is not possible.

**Sending a Test Mail**

Sends a test mail to the address specified by Mail Address.

**Data Sent from the DL1720/DL1740**

The following four items are sent.

• **Acquisition status**

Start/Stop, trigger status, acquisition counter

• **Error log information**

Error number, and up to 16 lines of the English error message text

• **GO/NO-GO success/fail information**

Time of GO/NO-GO determination only (see section 9.12 and 9.13)

• **Results of waveform parameter measurement**

Automatic measurement of waveform parameters (see sections 9.2 and 9.4), and the time of GO/NO-GO determination by waveform parameters only (see section 9.12)

## 13.6 Using the Mail Function (Fixed Interval)

---

### Sample Transmission:

[Comment]    aaaaaa

[ACQ Status]    Stopped    162

[GO/NOGO Status]    Success: 140    Fail: 21

Max (C1)    4.16667V

SDv (C2)    697.941mV

Freq(C3)    500.0000kHz

+Wd (C4)    1.00us>

ErrNo 004 Exit from GO/NO-GO mode.

ErrNo 806 Cannot change settings during GO/NO-GO.  
Stop the GO/NO-GO.

ErrNo 004 Exit from GO/NO-GO mode.

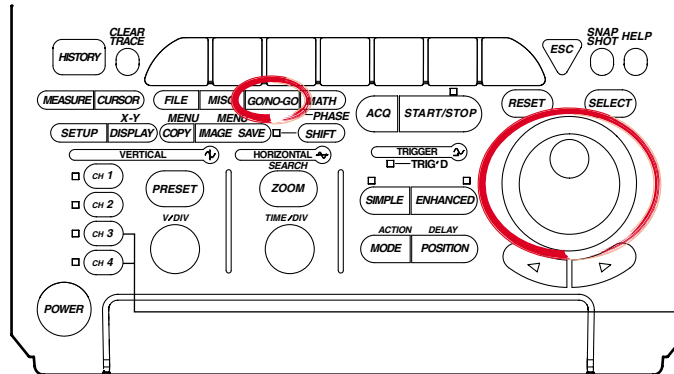
ErrNo 806 Cannot change settings during GO/NO-GO.  
Stop the GO/NO-GO.

ErrNo 602 No SCSI device or no media inserted.  
Check the SCSI device connection and  
the SCSI ID, and make sure that the storage  
medium is inserted (if applicable).

# 13.7 Using the Mail Function (Action Mail Function)

<For a description of this function, refer to page 1-30>

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

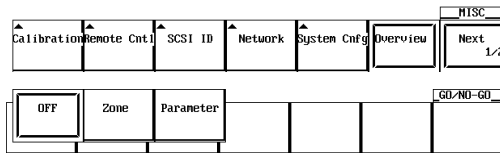
## Operating Procedure

### Mail Settings

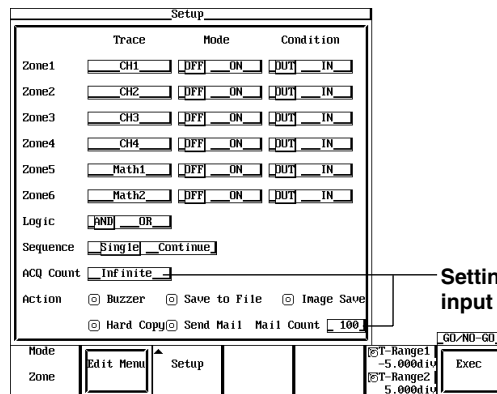
1. Follow steps 1 through 9 in section 13.6, "Using the Mail Function (Fixed Interval)" to input the MailServer, MailAddress, and a Comment if necessary.
2. It is not necessary to set the MailBaseTime and Interval using the action mail function. However, turn Interval OFF when only using the action mail function without using the fixed interval mail function.

### Setting the Action

3. Press **GO/NO-GO**.
4. Press the **MODE** soft key then select **Zone** or **Parameter**.



5. Press the **Setup** soft key to display the GO/NO-GO setting menu.

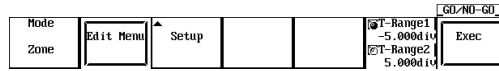


Settings for the following items can be input directly using a USB keyboard. (Ⓜ)

## 13.7 Using the Mail Function (Action Mail Function)

---

6. Use the jog shuttle to move the cursor to Action, and select Send Mail.
7. Select Mail Count to set a limit for the number of mails that are sent.
8. Press the **Exec** soft key to start GO/NO-GO.



### Note

---

- The email destination is the Mail Address set in MISC, Network, Mail Setup.
  - For mail sent by this instrument, the sender's address will be the same as the specified recipient address.
  - This function can be used in conjunction with 13.6, "Using the Mail Function (Fixed Interval.)" Turn the Interval OFF only when using the action mail function.
  - Before using this function, refer to section 13.2, "Configuring the Ethernet Interface (TCP/IP)" and enter the TCP/IP settings.
- 

### Explanation

You can send the trigger time and other information to the specified network mail address as the action of a GO/NO-GO determination or an action trigger.

#### Mail Settings

For details, see section 13.6, "Using the Mail Function (Fixed Interval)."

#### Data Sent from the DL1720/DL1740

The following five items are sent.

- **Acquisition status**  
Start/Stop, acquisition counter
- **Trigger time**
- **GO/NO-GO success/fail information**  
Time of GO/NO-GO determination only (see section 9.12 and 9.13)
- **Cause of failure**  
Time of GO/NO-GO determination only (see section 9.12 and 9.13)
- **Results of waveform parameter measurement**  
Automatic measurement of waveform parameters (see sections 9.2 and 9.4), and the time of GO/NO-GO determination by waveform parameters only (see section 9.12)

#### Sample Transmission Report

```
[Comment]      aaaaaa

[ACQ Status]    Stopped    1

[Trigger Date and Time]    2000/07/17    17:28:59.38

[GO/NOGO Status]    Success: 9    Fail: 1

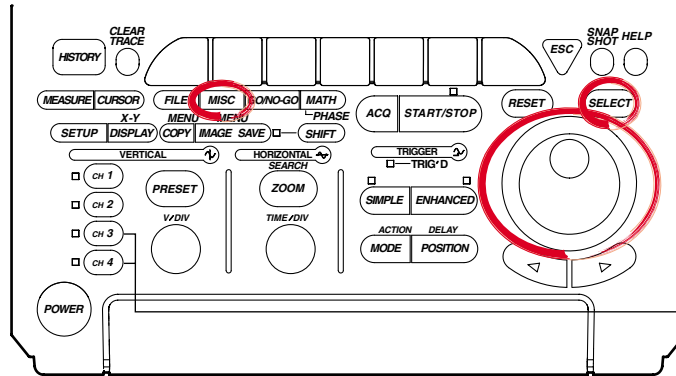
[NOGO Factor]    Param4 (Ch4,tWd )

Max (C1)    4.16667V
SDv (C2)    697.941mV
Freq(C3)    500.0000kHz
+Wd (C4)    1.00us>
```

# 13.8 Accessing DL1720/DL1740 Drives from a Network Drive (FTP Server Function)

<For a description of this function, refer to page 1-29>

## Relevant Keys

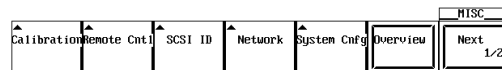


The DL1720 is not equipped with an input terminal for CH3 or CH4.

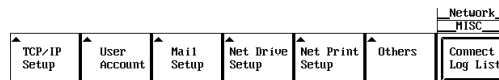
## Operating Procedure

### User Account Settings

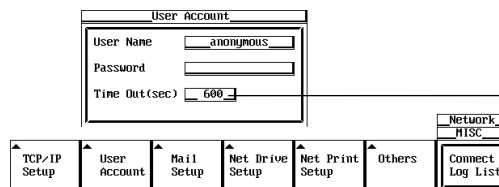
1. Press **MISC**.
2. Press the **Network** soft key to display the Network menu.



3. Press the **User Account** soft key to display the account settings menu.



4. Move the cursor to **User Name** using the jog shuttle, then press **SELECT** to display the keyboard.



The numerical values for this item can be input directly using a USB keyboard. (Ⓜ)

5. Enter the user name. If you do not wish to limit access, use the anonymous setting. If access is to be limited, enter a user name of 15 characters or less.
6. Move the cursor to Password using the jog shuttle, then press **SELECT** to display the keyboard.
7. Enter the password. Enter the same password again. If the user name is set to anonymous, it is not necessary to enter a password.
8. Move the cursor to Timeout using the jog shuttle, then press **SELECT**.
9. Enter the Timeout time using the jog shuttle. If the DL1720/DL1740 is not being accessed at the Timeout time, the connection to the network will be automatically closed.

### Note

For keyboard (soft keyboard) operation see section 4.1, "Entering Values and Character Strings."

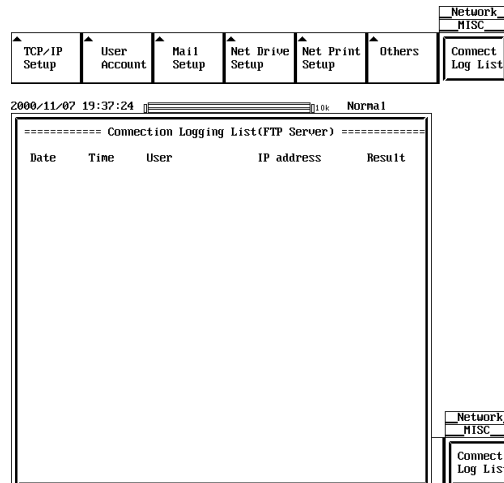
## 13.8 Accessing DL1720/DL1740 Drives from a Network Drive (FTP Server Function)

### Executing the FTP Client Software


- Execute the FTP client software from a personal computer or workstation. Perform file operations using the username specified in step 6.

### Displaying the Connection Logging List

- When you press the **Connection Logging List** soft key, the 25 most recent access times, user names, and IP addresses are displayed.



### Note

- The DL1720/DL1740 can only support one client.
- When the DL1720/DL1740 is being accessed from a PC or workstation (i.e. when it's logged on),  is displayed in the upper right part of the screen.
- This function can not be used in conjunction with FTP client function, LPR client function, or File operation.
- The floppy disk or the Zip disk is displayed as FDO or ZP0 in the root directory. Other devices connected via SCSI are displayed as SCn (where n is the SCSI ID number).
- The log is cleared when the power is turned OFF.
- Before accessing a drive, refer to 13.2, "Configuring the Ethernet Interface (TCP/IP)" and enter the TCP/IP settings.
- You must restart the DL1720/DL1740 for the settings to take effect.

### Explanation

You can access the DL1720/DL1740's Zip drive, floppy drive, or SCSI drive (optional) from a PC or workstation via Ethernet.

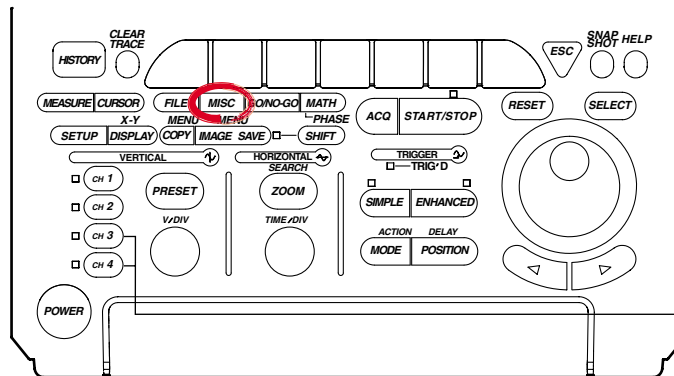
In order to access these devices, you must be running FTP client software on the PC or workstation.

### User Account Settings

- User Name**  
15 characters or less may be used. The default value is anonymous.  
The available characters consist of all ASCII characters on the keyboard (including space).
- Password**  
15 characters or less may be used.  
The available characters consist of all ASCII characters on the keyboard (including space).
- Time Out**  
If the instrument is not being accessed at the time specified here, the connection to the network will be automatically closed.

# 13.9 Viewing the Ethernet Interface Option and MAC Address

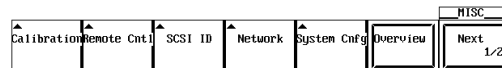
## Relevant Keys



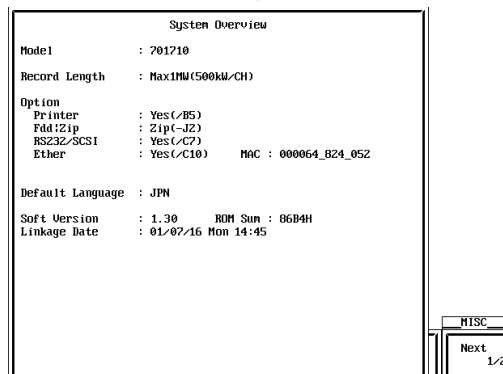
The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

1. Press **MISC**.
2. Press the **Overview** soft key.



3. When Ether:Yse(/C7) appears for the Option item in the overview screen, this indicates that the Ethernet interface is installed. The number on the right side is the MAC address (in the example, MAC:000064\_824\_052).



## Note

- Ether: Yes (/C7) is only displayed if the Ethernet interface option is installed.
- If XXXXXX\_XXX\_XXX is displayed for your MAC address, contact your nearest YOKOGAWA dealer.

## Explanation

Check the MAC address, and whether the Ethernet interface (optional) is installed.

### The Presence of the Ethernet Interface (Option)

The presence of the Ethernet interface is displayed under Ethernet in the Information window.

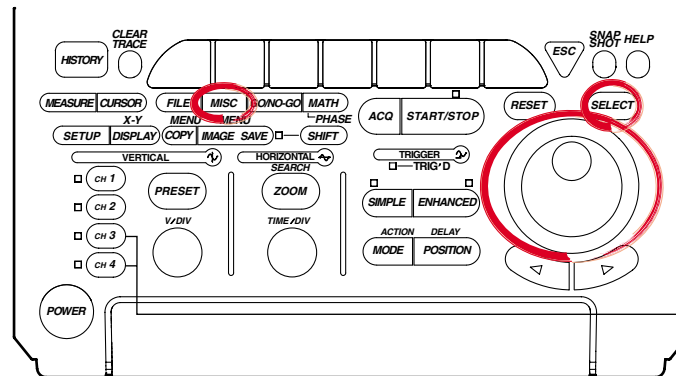
- If Yes is displayed, the Ethernet interface is installed.
- If No is displayed, the Ethernet interface is not installed.

### MAC Address

The MAC address is a unique address that has already been set on the instrument, and is necessary for transmission between nodes.

# 13.10 Setting the FTP Passive Mode and LPR/SMTMP Timeout

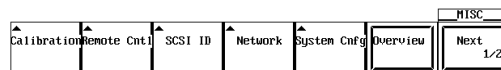
## Relevant Keys



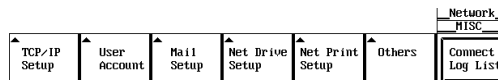
The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

1. Press **MISC**.
2. Press the **Network** soft key to display the Network menu.

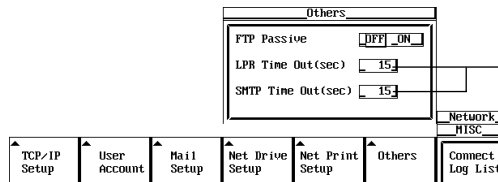


3. Press the **Others** soft key to display the Others settings menu.



### Turning ON/OFF the FTP Passive Mode

4. Turn the jog shuttle to select FTP Passive.



Settings for the following items can be input directly using a USB keyboard. (Ⓚ)

5. Press **SELECT** to select ON or OFF.

### Setting the LPR Timeout Time

4. Turn the jog shuttle to select LPR Time Out.
5. Press **SELECT** to display the timeout time selection box.
6. Turn the jog shuttle to set the timeout time.
7. Press **SELECT** or **ESC** to close the box.

### Setting the SMTP Timeout Time

4. Turn the jog shuttle to select SMTP Time Out.
5. Press **SELECT** to display the timeout time selection box.
6. Turn the jog shuttle to set the timeout time.
7. Press **SELECT** or **ESC** to close the box.



**Explanation**

Enters special settings related to the FTP client, LPR, and SMTP. Normally, these parameters do not need to be specified.

**Turning ON/OFF the FTP Passive Mode**

Turn this function ON when using the DL1720/DL1740 behind a firewall that requires the passive mode. The default setting is OFF.

(A firewall is furnished on a system that has security features. It prevents intrusion from the outside into the network system.)

**Setting the LPR Timeout Time**

The DL1720/DL1740 closes the connection to the printer if there is no response from the printer for a certain period of time (timeout time) when it accesses the printer.

Select the value in the range of 0 to 3600 s. The default value is 15 s.

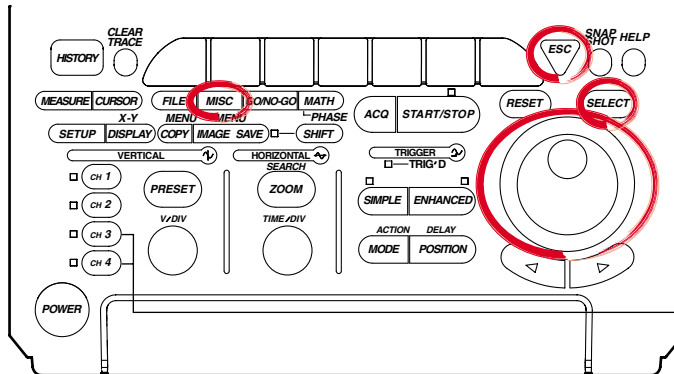
**Setting the SMTP Timeout Time**

When a mail server is accessed from the DL1720/DL1740 and connection cannot be established after a certain period of time (timeout time), the DL1720/DL1740 decides that the connection to the mail server is not possible and closes the connection.

Select the value in the range of 0 to 3600 s. The default value is 15 s.

# 14.1 Setting the Screen Color and Brightness

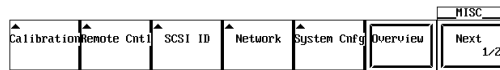
## Relevant Keys



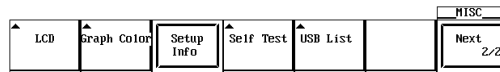
The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

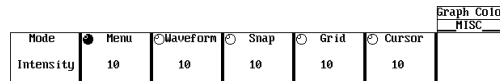
1. Press **MISC**.
2. Press the **Next 1/2** soft key.



3. Pressing the **Graphic Color** soft key displays a menu used to set the display color and brightness.

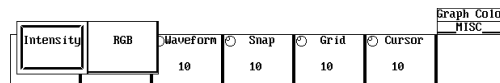


4. Pressing the **Mode** soft key displays a menu used to select the settings.

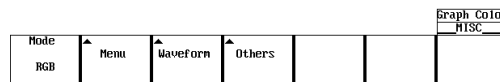


## Setting the Color

5. Pressing the **RGB** soft key displays the display color setting menu.

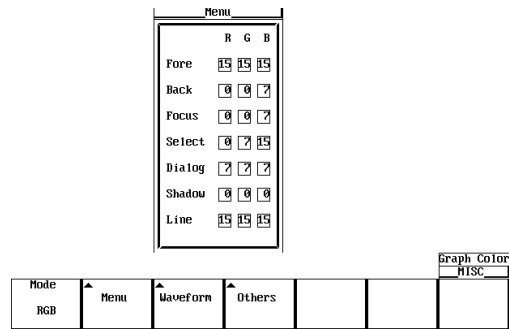


6. Pressing the **Menu** soft key displays a dialog box used to set the display color of the menu items.

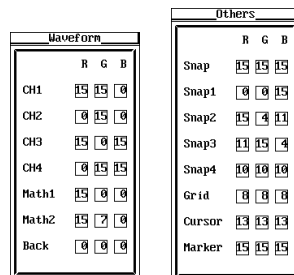


## 14.1 Setting the Screen Color and Brightness

- Turn the jog shuttle to move the cursor to the desired item.

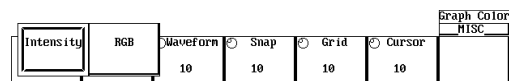


- Pressing **SELECT** displays the color setting menu.
- Turn the jog shuttle to set the color.
- Pressing **SELECT** closes the color setting menu.
- Pressing **ESC** closes the dialog box used to set the display color of the menu items.
- In a similar fashion, set the colors for the Waveform and Others items. (CH3, CH4, and Math2 are not displayed on the DL1720.)

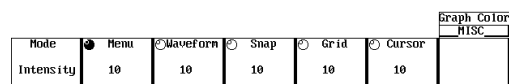


### Setting the Brightness

- Pressing the **Intensity** soft key displays the brightness setting menu.



- Press the **Menu** soft key.



- Turn the jog shuttle to set the brightness of the menu screen.
- In a similar fashion, set the brightness for Waveform, Snap, Grid, and Cursor items.

**Explanation****Screen Color**

You can set arbitrary colors for the following items. The colors are set using R (red), G (green), and B (blue) ratios from 0 to 15.

**Menu Screen**

|          |                                       |
|----------|---------------------------------------|
| Fore:    | Selected menu item                    |
| Back:    | Background                            |
| Focus:   | Selected cursor                       |
| Select : | Selected menu                         |
| Dialog:  | Dialog box                            |
| Shadow:  | Background color of the selected menu |
| Line:    | Lines on the menu screen              |

**Waveform**

|             |   |
|-------------|---|
| CH1 to CH4: | Waveform (or CH1 to CH2 for the DL1720)       |
| Back:       | Background color of the waveform display area |

**Others**

|             |                           |
|-------------|---------------------------|
| Snap:       | Snapshot waveform         |
| Snap1 to 4: | Loaded snapshot waveforms |
| Grid:       | Grid                      |
| Cursor:     | Cursor                    |
| Marker:     | Marker                    |

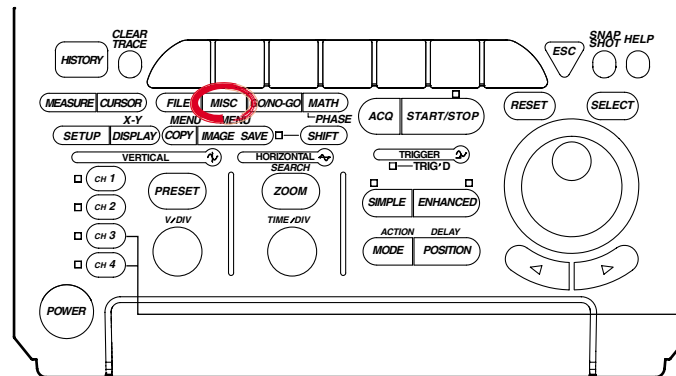
**Brightness**

You can set the brightness for the following items from 1 to 15 steps.

|           |                   |
|-----------|-------------------|
| Menu:     | Menu screen       |
| Waveform: | Waveform          |
| Snap:     | Snapshot waveform |
| Grid:     | Grid              |
| Cursor:   | Cursor            |

# 14.2 Changing the Message Language and Click Sound

## Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

1. Press **MISC**.
2. Pressing the **System Cnfg** soft key displays the system configuration menu.

|             |             |         |         |             |          |      |      |     |
|-------------|-------------|---------|---------|-------------|----------|------|------|-----|
| Calibration | Remote Cntl | SCSI ID | Network | System Cnfg | Overview | MISC | Next | 1/2 |
|-------------|-------------|---------|---------|-------------|----------|------|------|-----|

### Selecting the Message Language

3. Press the **Message** soft key to select ENG or JPN.

|         |             |           |               |           |             |      |
|---------|-------------|-----------|---------------|-----------|-------------|------|
| Message | Click Sound | Date/Time | Offset Cancel | Trig Gate | System Cnfg | MISC |
| JPN     | ENG         | OFF       | ON            | OFF       | ON          | OFF  |

### Setting the Click Sound

3. Press the **Click Sound** soft key to select ON or OFF.

|         |             |           |               |           |             |      |
|---------|-------------|-----------|---------------|-----------|-------------|------|
| Message | Click Sound | Date/Time | Offset Cancel | Trig Gate | System Cnfg | MISC |
| JPN     | ENG         | OFF       | ON            | OFF       | ON          | OFF  |

## Explanation

### Selecting the Message Language

A message appears when an error occurs. You can set whether to display these messages in English or Japanese. The message codes are the same for both languages.

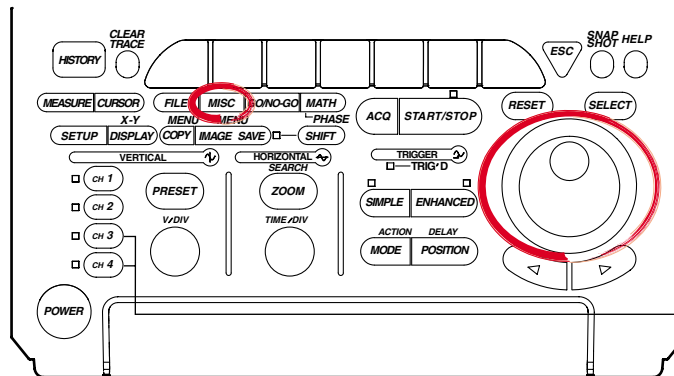
For messages, see section 15.2.

### Turning ON/OFF the Click Sound

Set whether or not to make click sounds when the jog shuttle is turned. The default setting is ON.

# 14.3 Turning OFF the Backlight and Setting the Brightness of the Backlight

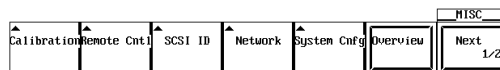
## Relevant Keys



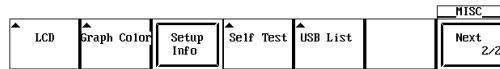
The DL1720 is not equipped with an input terminal for CH3 or CH4.

## Operating Procedure

1. Press **MISC**.
2. Press the **Next 1/2** soft key.



3. Press the **LCD** soft key to display the backlight ON/OFF menu.

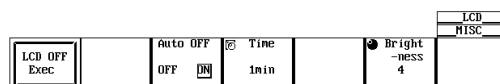


### Setting Auto OFF

4. Press the **Auto OFF** soft key to select either ON or OFF.



5. If Auto OFF is turned ON, press the **Time** soft key. Using the jog shuttle, set the time at which the backlight will automatically turn OFF.

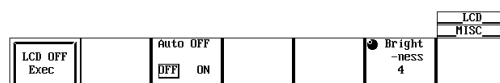


### Setting the Brightness of the Backlight

6. Press the **Brightness** soft key. Using the jog shuttle, adjust the brightness of the backlight.

### Turning ON/OFF the Backlight

7. Press the **LCD OFF Exec** soft key to turn OFF the backlight.



Press any key to return to the measurement screen.

## 14.3 Turning OFF the Backlight and Setting the Brightness of the Backlight

---

### ***Explanation***

#### **Turning ON/OFF the backlight (LCD OFF)**

Turns ON/OFF the LCD backlight. If a key is pressed when the backlight is OFF, the screen returns to the measurement screen.

#### **Automatically Turning OFF the Backlight (Auto OFF)**

The backlight automatically turns OFF, if there is no key operation for the specified time.

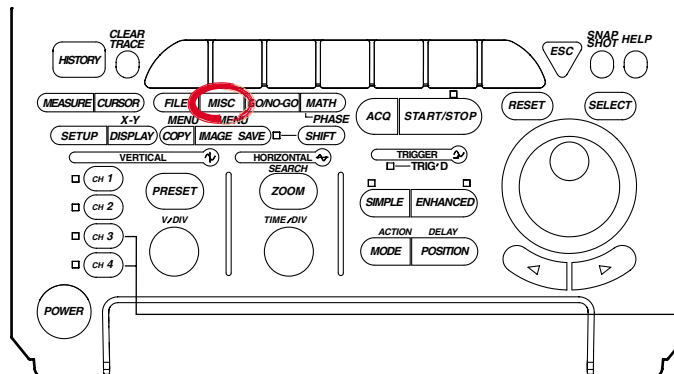
#### **Brightness of the Backlight (Brightness)**

You can also change the brightness of the backlight.

The lifetime of the backlight can be prolonged by dimming the backlight or turning OFF the backlight when it is not necessary.

## 14.4 Canceling the Offset Voltage

### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **MISC**.
2. Pressing the **System Cnfg** soft key displays the system configuration menu.

|             |             |         |         |             |          |                     |
|-------------|-------------|---------|---------|-------------|----------|---------------------|
| Calibration | Remote Cntl | SCSI ID | Network | System Cnfg | Overview | MISC<br>Next<br>1/2 |
|-------------|-------------|---------|---------|-------------|----------|---------------------|

3. Press the **Offset Cancel** soft key to select ON or OFF.  
The default value is OFF.

|         |             |           |               |           |    |                     |
|---------|-------------|-----------|---------------|-----------|----|---------------------|
|         |             |           |               |           |    | System Cnfg<br>MISC |
| Message | Click Sound | Date/Time | Offset Cancel | Trig Gate |    |                     |
| UPN     | ENG         | OFF       | DN            | OFF       | ON | OFF                 |

### Explanation

You can select whether or not the offset voltage that is specified for each channel is reflected in the results of computations and automated measurement of waveform parameters.

**OFF:** Does not reflect the offset voltages in the results of computations and automated measurement of waveform parameters.

The vertical position of the display screen corresponds to the offset voltage.

**ON:** Reflect the offset voltages in the results of computations and automated measurement of waveform parameters.

The waveform that has offset voltage (DC voltage) removed from the input signal can be observed. In this case, the vertical position becomes 0 V.

### Note

- Offset cancel applies to all channels.
- To set whether or not to cancel the offset for each channel, use linear scaling.



# 15.1 Troubleshooting

## Troubleshooting

For corrective actions when a message appears on the screen, read the following pages. If servicing is required or if the instrument does not operate properly after taking the following corrective actions, contact your nearest YOKOGAWA dealer.

| Problem  | Possible Cause  | Corrective Action  | Reference Section                                    |
|--|---|--|--|
| The power cannot be turned ON.   | The source voltage is outside the rated range.  | Use a correct power supply.  | 3.3  |
|  | The main power switch on the rear panel is not turned ON.   | Turn ON the main power switch.   |  |
| Nothing is displayed.  | The backlight is turned OFF.  | Press any key.   | 14.3   |
|  | The screen colors are not appropriate.  | Select appropriate colors for the screen.  | 13.1   |
| The display is abnormal.   | The system is not operating correctly.  | Turn ON the power again.   | 3.3  |
| The waveform display is not updated.   | Loaded waveform data from an external storage medium.   | Unload the loaded waveform.  | 11.6   |
| Keys do not work.  | The instrument is in the remote mode.   | Press <b>SHIFT + CLEAR TRACE</b> activate local mode.                                      | —  |
|  | Other causes.   | Execute a key test. If the test fails, servicing is required.                              | 15.3   |
| Triggering does not occur.   | The trigger gate is enabled.  | Turn OFF the trigger gate.   | 6.16   |
|  | The trigger settings are not appropriate.   | Set correct trigger settings.  | Chapter 6  |
| The measured values are odd.   | Did not allow adequate warm-up time.  | Allow at least 30 minutes for the instrument to warm-up after turning ON the power.        | —  |
|  | The instrument has not been calibrated.   | Perform calibration.   | 4.6  |
|  | The probe's phase has not been corrected.   | Correct the phase properly.  | 3.5  |
|  | The probe attenuation is not correct.   | Set to the correct value.  | 5.4  |
|  | An offset voltage is added.   | Set the offset voltage to zero.  | 5.5  |
|  | Other causes  | Perform calibration. If the measured values are still odd, servicing is required.          | 4.6  |
| Cannot output to the internal printer.   | The printer head is damaged or worn out.  | Servicing is required.   | 15.6   |
| Cannot save to the medium.   | The medium has not been formatted.  | Format the medium.   | 11.4   |
|  | The medium is write protected.  | Remove the write protection from the medium.   | —  |
|  | Insufficient space on the medium.   | Delete unnecessary files or use a new medium.  | 11.10  |
| The instrument cannot be configured or controlled via the communication interface. | The address used in the program is different from the actual address.<br>The GP-IB interface is not being used according to the electrical and mechanical specifications. | Use the same address in the program and the instrument.<br>Comply with the specifications. | Communication Interface User's Manual (IM701710-17E) |

## 15.2 Messages and Corrective Actions

### Error Messages

If an error occurs during operation, an error code may appear on the screen. This section describes the meanings of the error messages and the corrective actions which they require. The messages can be displayed either in English or Japanese (see section 14.2). If the corrective action requires servicing, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual for repairs.

In addition to the error messages listed in this section, there are also communication related error messages. These messages are described in the Communication Interface User's Manual (IM701710-17E).

### Status Messages

| Code | Message  | Description  | Reference Section |
|------|--|--|-------------------|
| 0    | Aborted hard copy.   | —  | 10.2              |
| 1    | Aborted file operation.  | —  | Chapter 11        |
| 2    | Completed data store.  | —  | 4.4               |
| 3    | Completed data recall.   | —  | 4.4               |
| 4    | Completed GO/NO-GO.  | —  | 9,12, 9.13        |
| 10   | Set to remote mode by communication commands.  | Press <b>SHIFT+ CLEAR TRACE</b> to change to local mode.                 | —                 |
| 11   | Local lockout by communication commands.   | To allow key operation, release the lockout using communication commands | —                 |
| 13   | All settings will be initialized. Power up with the RESET key depressed.   | —  | 4.2               |
| 21   | Completed action-on-trigger.   | —  | 6.15              |
| 22   | Executed unload.   | —  | 11.6, 11.8        |
| 23   | Release the Preview mode.  | —  | 10.2              |
| 24   | Some of the channels are set to 50-Ω DC input. To keep the settings, press the SELECT key. Pressing any other key will change the settings to 1 MΩ DC input. | —  | 5.3               |
| 25   | Aborted the search.  | —  | 7.8, 7.9, 8.9     |
| 26   | Executed the search, but no record was found that matched the conditions.  | —  | 7.8, 7.9          |
| 27   | Executed the search, but no pattern was found that matched the conditions.   | —  | 8.9               |
| 28   | Pattern contains points that are between Thr Lower and Thr Upper.  | —  | 8.9               |
| 29   | FFT will be performed on all records. Abort the operation by setting the history Display Mode to One.  | —  | —                 |
| 30   | Aborted the recalculation of the FFT.  | —  | —                 |
| 32   | Aborted statistical measurement processing.  | —  | 9.3               |
| 36   | Key invalid for this model.  | —  | —                 |

**Error in Execution (600 to 799)**

| Code                   | Message   | Corrective Action   | Reference Section   |
|------------------------|---|---|---------------------|
| 601                    | Invalid file name or SCSI ID.                                     | Check the file name and the SCSI ID.  | 11.5 to 11.9, 11.12 |
| 602, 603               | No SCSI device or no storage media inserted.                      | Check the SCSI device connection, the SCSI ID number, and the existence of a medium in the drive.                         | 11.3, 11.5          |
| 604                    | Storage media failure.  | Check the medium.   | —                   |
| 605                    | File not found.   | Check the filename and the medium.  | Chapter 11          |
| 606                    | Storage media is protected.                                       | Set the disk's write protect switch to OFF.   | —                   |
| 607                    | Storage media failure.  | Check the medium.   | —                   |
| 608 to 610             | Invalid file name or SCSI ID.                                     | Check the file name and the SCSI ID.  | 11.5 to 11.9, 11.12 |
| 611, 612               | Storage media full.   | Delete unnecessary files or use another disk. The number of bytes necessary is given in the pages indicated on the right. | 11.10               |
| 613                    | Cannot delete a directory if there are files in the directory.    | Delete all files in the directory before deleting the directory.  | 11.10               |
| 614                    | File is protected.  | Clear the write disable (*) mark.   | 11.10               |
| 615                    | Physical format error.  | Reformat the medium. If the same error occurs, this instrument cannot format the medium.                                  | 11.4                |
| 616 to 620             | File system failure.  | Check using another medium. If the same message still appears, servicing is required.                                     | —                   |
| 621                    | File is damaged.  | Check the file.   | —                   |
| 622 to 641, 656 to 663 | File system failure.  | Check using another medium. If the same message still appears, servicing is required.                                     | —                   |
| 642                    | No storage media exists in SCSI device.                           | Check that the medium is correctly inserted into the SCSI device  | —                   |
| 646 to 653             | Storage media failure.  | Check the medium  | —                   |
| 654                    | Storage media failure.  | Check the floppy disk's format type.  | 11.4                |
| 665                    | Cannot load this file format.                                     | Files stored on other models (DL/AG series) cannot be loaded.   | —                   |
| 666                    | File is now being accessed. Wait a moment.                        | Execute after accessing is finished.  | —                   |
| 667                    | Cannot be executed while data acquisition is in progress.         | Press <b>START/STOP</b> to stop the waveform acquisition.   | 4.5                 |
| 668                    | Cannot find '.HDR' file.  | Check the file.   | 11.6                |
| 669                    | Cannot load the specified file on this ROM version or this model. | Upgrade the ROM version (upper compatible).   | —                   |
| 671                    | Save data not found.  | Check the presence of data to be stored.  | —                   |
| 673                    | SCSI controller failure.  | Servicing is required.  | —                   |
| 676                    | Unknown file format.  | Check whether the data file in a format that is supported. Change the file extension.                                     | 11.12               |
| 677                    | P-P compression cannot be used to save FFT waveforms.             | Turn OFF the P-P compression.   | 11.6                |
| 679                    | Data that have been P-P compressed and saved cannot be loaded.    | —   | —                   |
| 680                    | Illegal printer head position.                                    | Set the release arm to the "HOLD" position.   | 10.1                |
| 681                    | Paper empty.  | Load a paper roll.  | 10.1                |
| 682                    | Printer overheated.   | Turn OFF the power immediately. Servicing is required.  | —                   |
| 683                    | Printer overheated.   | Turn OFF the power immediately. Servicing is required.  | —                   |
| 684                    | Printer is not installed.   | Check that the printer is installed.  | 2                   |
| 685                    | Printer time out.   | Servicing is required.  | —                   |
| 691                    | The printer has malfunctioned.                                    | Servicing is required.  | —                   |
| 692                    | Printer error. Turn the power of the printer from OFF to ON.      | —   | —                   |

## 15.2 Messages and Corrective Actions

| Code | Message   | Corrective Action   | Reference Section |
|------|---|---|-------------------|
| 693  | Printer offline.  | —   | —                 |
| 694  | Out of paper.   | —   | —                 |
| 695  | Printer is in use.  | —   | —                 |
| 696  | Cannot detect printer. Turn ON the printer. Check connectors.   | —   | —                 |
| 697  | No files supporting the thumbnail display window.   | —   | 10.4              |
| 701  | Cannot be executed while data acquisition is in progress.   | Press <b>START/STOP</b> to stop the waveform acquisition.                         | 4.5               |
| 703  | There is no data to be undone.  | Cannot undo because the data were cleared during initialization or auto setup.    | 4.2, 4.3          |
| 704  | Cannot be executed while data acquisition is in progress.   | Press <b>START/STOP</b> to stop the waveform acquisition.                         | 4.5               |
| 705  | This data cannot be backed up.  | —   | —                 |
| 706  | There is no data to be recalled.  | —   | 4.4               |
| 707  | Cannot start during data output.  | Wait until data output is complete.   | Chapter 10        |
| 711  | Cannot access file while hard-copying.  | Wait until the hard copy completes.   | 10.2              |
| 712  | Cannot compress this screen image. Turn off the compression switch.   | Turn OFF the compression setting.   | 10.3              |
| 713  | Calibration failure. Disconnect the input and execute again. If it fails again, servicing is required.  | Servicing is required.  | —                 |
| 726  | Cannot start when loading waveform data that has been saved in history All mode.  | Unload the files.   | 11.6              |
| 727  | Insufficient output data. Increase Mag or widen the Time Range interval.  | Increase Mag or widen the Time Range interval.                                    | 10.2              |
| 728  | Hard copying. Abort or wait until it is complete.   | Pressing <b>Copy</b> again aborts the operation.                                  | 10.2              |
| 729  | Cannot perform calibration while waveform data is loaded.   | Unload the loaded files from the FILE menu.                                       | 11.6              |
| 730  | Pattern is not specified.   | Set at least one search pattern not to X.   | 8.9               |
| 731  | Cannot start when waveform data that has been acquired in the linear average mode is loaded.  | Unload the loaded files from the FILE menu.                                       | 11.6              |
| 732  | Cannot be executed while computation is in progress.  | Aborted when Math/Display is turned Off.  | 9.5               |
| 733  | Failed to measure statistics. The target waveform data exists or the measured waveform data may not exist. If Cycle Statistic is specified, the instrument may be configured in a way that fails to detect the cycle. | Check that there is at least one period of waveform within the measurement range. | 9.3               |
| 735  | Cannot store because the data is locked. Release the lock through Store Detail.   | Release the lock through Store Detail.  | 4.4               |
| 736  | The File item is inappropriate. Select Waveform, Snap, or Measure.  | Select Waveform, Snap, or Measure.  | —                 |
| 737  | Executing file Load, Save, or Format. Abort or wait until it is complete.   | —   | —                 |
| 738  | Hard copying or saving image. Abort or wait until it is complete.   | —   | —                 |
| 750  | Cannot connect to the server.   | Confirm the network settings and connection.                                      | Chapter 13        |
| 751  | Not yet connected to the ftp server.  | Confirm the network settings and connection.                                      | Chapter 13        |
| 752  | This ftp function in not supported.   | —   | Chapter 13        |
| 753  | FTP Error: Rwd  | Confirm the network settings and connection.                                      | Chapter 13        |
| 754  | FTP Error: Cwd  | Confirm the network settings and connection.                                      | Chapter 13        |
| 755  | FTP Error: Rm   | Confirm the network settings and connection.                                      | Chapter 13        |

| Code | Message  | Corrective Action  | Reference Section |
|------|--|--|-------------------|
| 756  | FTP Error: List  | Confirm the network settings and connection.                 | Chapter 13        |
| 757  | FTP Error: Mkdir   | Confirm the network settings and connection.                 | Chapter 13        |
| 758  | FTP Error: Rmdir   | Confirm the network settings and connection.                 | Chapter 13        |
| 759  | FTP Error: Get   | Confirm the network settings and connection.                 | Chapter 13        |
| 760  | FTP Error: Put   | Confirm the network settings and connection.                 | Chapter 13        |
| 761  | FTP Error: GetData   | Confirm the network settings and connection.                 | Chapter 13        |
| 762  | FTP Error: PutData   | Confirm the network settings, connection, and disk capacity. | Chapter 13        |
| 763  | FTP Error: AppendData  | Confirm the network settings, connection, and disk capacity. | Chapter 13        |
| 764  | FTP Error: Client Handle   | Confirm the network settings and connection.                 | Chapter 13        |
| 765  | FTP Error: Others  | Confirm the network settings and connection.                 | Chapter 13        |
| 785  | Cannot send data to a network printer.                                   | Confirm the network settings and connection.                 | Chapter 13        |
| 786  | Cannot send the e-mail message.  | Confirm the network settings and connection.                 | Chapter 13        |
| 797  | Connecting to a NetDrive.<br>Wait until connection has been established. | —  | Chapter 13        |

### Error in Setting (800 to 899)

| Code | Message  | Corrective Action  | Reference Section           |
|------|--|--|-----------------------------|
| 800  | Illegal date/time.   | Set a correct date and time  | 3.6                         |
| 801  | Illegal file name.   | The file name contains characters that are not allowed or the file name is restricted in MS-DOS. | 4.1                         |
| 804  | Cannot change this parameter while data acquisition is in progress.  | Press <b>START/STOP</b> to the waveform acquisition.   | 4.5                         |
| 806  | GO/NO-GO is in execution. Please press the Abort key.  | All keys other than <b>START/STOP</b> are disabled during GO/NO-GO determination.                | 9.12, 9.13                  |
| 814  | Duplicated label.  | Set a different label.   | 8.5                         |
| 819  | Cannot change when Channel Display is OFF or Math settings are invalid.  | Turn ON the channel display or set Math operation.   | 5.1<br>Sections 9.5 to 9.10 |
| 821  | Cannot change when ExtClock is active.   | Change the timebase to Internal.   | 5.10                        |
| 836  | Cannot change settings during action-on-trigger.   | Select Abort or press <b>START/STOP</b> .  | 4.5, 6.15                   |
| 840  | Cannot set the acquisition mode to Average when the trigger mode is set to Single or Single(N).                          | Change the acquisition mode or the trigger mode.   | 6.1, 7.2                    |
| 841  | It is not possible to make a setting that will result in the repetitive mode when the trigger mode is set to Single (N). | Setting or set the trigger mode to a different mode.   | 6.1                         |
| 842  | Cannot specify A→B(N) and A Delay B when the trigger gate is active.   | Turn OFF the trigger gate.   | 6.16                        |
| 843  | Cannot set the trigger mode to Single or Single(N) when the acquisition mode is Average.                                 | Change the acquisition mode or the trigger mode.   | 6.1, 7.2                    |
| 846  | Cannot set the trigger mode to Single(N) during repetitive sampling mode.  | Turn OFF the repetitive sampling mode, lower the T/div setting, or shorten the record length.    | 5.11, 7.1                   |
| 847  | Cannot set this parameter during repetitive sampling mode.   | Turn OFF the repetitive sampling mode, lower the T/div setting, or shorten the record length.    | 5.11, 7.1                   |
| 848  | Not possible during the interleave mode.   | Turn OFF the interleave mode.  | 7.5                         |
| 850  | Not possible in the current record length.   | Change the record length.  | 7.1                         |
| 851  | Cannot carry out computation at the current record length.   | Change the record length.  | 7.1                         |

## 15.2 Messages and Corrective Actions

| Code | Message   | Corrective Action  | Reference Section |
|------|---|--|-------------------|
| 852  | The operation is not possible when waveforms are loaded.<br>Unload the loaded files from the FILE menu.   | Unload the files.  | 11.6              |
| 853  | Setting or executing is not possible during the search operation.   | Abort the search.  | 7.8, 7.9          |
| 854  | Search pattern does not exist.<br>Execute the search.   | Change the search conditions.  | 8.9               |
| 855  | Settings cannot be changed or executed during the history search operation.   | Abort the search.  | 7.8, 7.9          |
| 856  | The record cannot be selected   | Check the record number using Show Map.  | 7.8, 7.9          |
| 857  | History record does not exist.  | History record is not created in the average mode, repetitive sampling mode, or roll mode. | 7.2               |
| 858  | Setting or executing is not possible during FFT recalculation.<br>Abort the operation by setting the history Display Mode to One.   | Set the history Display Mode to One.   | 7.7               |
| 860  | Cannot be configured or executed while updating the history all display.<br>Aborted when history display mode is set to One.  | Set the history Display Mode to One.   | 7.7               |
| 861  | Cannot output color in this format.   | Turn OFF the color.  | 10.3              |
| 862  | Zones cannot be edited in the following cases:<br>• When the main window is not displayed.<br>• When the target waveform is not displayed.  | Display the main window and the target waveform.   | 9.12              |
| 863  | The zone waveform does not exist.   | Create the zone waveform.  | 9.12              |
| 864  | The zone is being edited.<br>To perform other operations, select Quit to exit zone editing.   | Select Quit to exit zone editing.  | 9.12              |
| 865  | Zones determination is not possible in the following cases:<br>• When the main window is not displayed.<br>• When the target waveform is not displayed.<br>• When the zone waveform does not exist. | Display the main window and the target window and create the zone waveform.                | 9.12              |
| 868  | Processing statistics.<br>To perform other operations, abort the statistical processing.  | Abort statistical processing.  | 9.3               |

### System Operation Errors (900 to 908, 912 to 914)

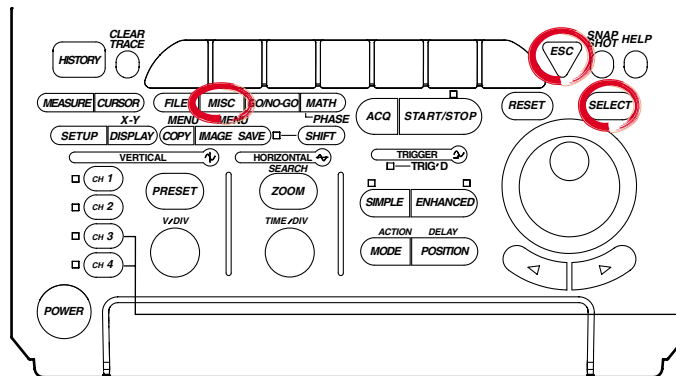
| Code | Message  | Corrective Action  | Reference Section |
|------|--|--|-------------------|
| 901  | Failed to backup setup data.<br>Will initialize. | Check the condition of the built-in lithium battery using the overview screen.<br>Servicing is required. | —                 |
| 906  | Fan stopped ;<br>Turn off the power immediately  | Turn OFF the power immediately.<br>Servicing is required.  | —                 |
| 907  | Backup battery is flat                           | Servicing is required to replace the battery.  | —                 |
| 912  | Fatal error in the communication driver          | Servicing is required.   | —                 |

#### Note

When servicing is required, double-check by initializing the instrument.

# 15.3 Self-Diagnostic Test (Self Test)

## Relevant Keys

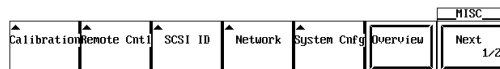


The DL1720 is not equipped with an input terminal for CH3 or CH4.

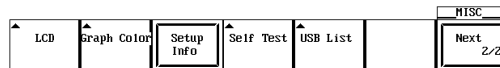
## Operating Procedure

### Displaying the Self Test Menu

1. Press **MISC**.
2. Press the **Next 1/2** soft key to display the self test soft key menu.



3. Press the **Self test** soft key to display the self test menu.  
Go to step 4 for a memory test, step 9 for a key test, step 13 for a printer test, and step 16 for a floppy disk drive test, a SCSI test, or a accuracy test.

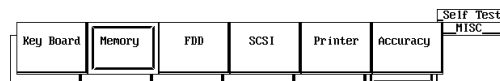


### Execute the Memory Test

4. Pressing the **Test Item** soft key displays the test item menu.



5. Press the **Memory** soft key to be tested.



6. Pressing the **Test Exec** soft key executes the memory test.



## 15.3 Self-Diagnostic Test (Self Test)

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### Executing the Key Test

- After step 3, press the **Test Item** soft key to display the test item menu.
- Press the **Key Board** soft key to be test.

|           |        |     |      |         |          |                   |
|-----------|--------|-----|------|---------|----------|-------------------|
| Key Board | Memory | FDD | SCSI | Printer | Accuracy | Self Test<br>MISC |
|-----------|--------|-----|------|---------|----------|-------------------|

- Pressing the **Test Exec** soft key executes the key test.

|           |  |          |  |  |           |                   |
|-----------|--|----------|--|--|-----------|-------------------|
| Test Item |  | Soft Key |  |  | Test Exec | Self Test<br>MISC |
| Key Board |  | COPYTEST |  |  |           |                   |

- Press all the keys. To terminate the key test, press **ESC** twice.

### Testing the Soft Keys

- Pressing the **Soft Key** soft key displays a keyboard.
- Using the jog shuttle and **SELECT**, check that the characters on the keyboard can be entered correctly. Pressing **ESC** twice clears the keyboard.

### Executing the Printer Test

- After step 3, press the **Test Item** soft key to display the test item menu.
- Press the **Printer** soft key to be test.

|           |        |     |      |         |          |                   |
|-----------|--------|-----|------|---------|----------|-------------------|
| Key Board | Memory | FDD | SCSI | Printer | Accuracy | Self Test<br>MISC |
|-----------|--------|-----|------|---------|----------|-------------------|

- Pressing the **Test Exec** soft key executes the printer test.

|           |  |  |  |  |           |                   |
|-----------|--|--|--|--|-----------|-------------------|
| Test Item |  |  |  |  | Test Exec | Self Test<br>MISC |
| Printer   |  |  |  |  |           |                   |

### Testing the FDD, Zip Drive, SCSI (Option), or Accuracy

- After step 3, press the **Test Item** soft key to display the test item menu.
- Press the soft key corresponding to the **FDD**, **ZIP**, **SCSI**, or **Accuracy** to be test.

|           |        |     |      |         |          |                   |
|-----------|--------|-----|------|---------|----------|-------------------|
| Key Board | Memory | FDD | SCSI | Printer | Accuracy | Self Test<br>MISC |
|-----------|--------|-----|------|---------|----------|-------------------|

- Pressing the **Test Exec** soft key executes the floppy disk drive test, SCSI test, or Accuracy test.

|           |  |  |  |  |           |                   |
|-----------|--|--|--|--|-----------|-------------------|
| Test Item |  |  |  |  | Test Exec | Self Test<br>MISC |
| Accuracy  |  |  |  |  |           |                   |

### Note

- Insert a floppy disk or a Zip disk before executing FDD or Zip test.
  - Please note the following when performing the SCSI self-test:
    - Only test unpartitioned SCSI devices
    - Set the SCSI ID to 5
-



**Explanation****Memory Test**

This test checks the internal ROM. The ROM is functioning correctly, if Pass is displayed. If Failed is displayed, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual.

**Key Test**

Tests whether or not the front panel keys are operating correctly. If the name of the key that is pressed is highlighted, then it is operation correctly. If it does not, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual.

**Floppy Disk Drive/Zip Drive Test**

This test checks the floppy disk drive or the Zip drive. If Failed is displayed, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual.

**SCSI Test**

This test checks SCSI. If Failed is displayed, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual.

**Printer Test**

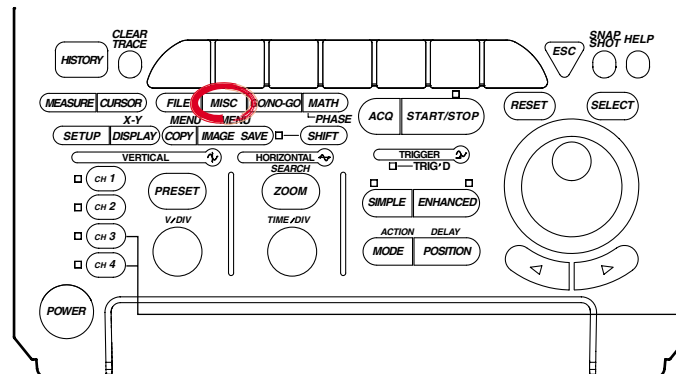
This test checks the optional built-in printer. The printer is functioning correctly if gray shading is printed properly. If it is not, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual.

**Accuracy Test**

This test checks A/D accuracy. If Failed is displayed, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual.

## 15.4 Checking the System Condition

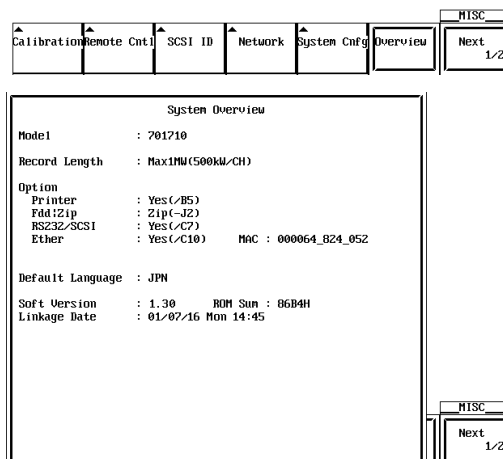
### Relevant Keys



The DL1720 is not equipped with an input terminal for CH3 or CH4.

### Operating Procedure

1. Press **MISC**.
2. Pressing the **Overview** soft key displays the overview screen. Pressing any key clears the overview screen.



### Note

- Backup battery  
Displays OK if the built-in lithium battery is normal, Empty if the battery is flat. If Empty is displayed, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual.

### Explanation

This function allows you to check the ROM version, model, and installed options. The screen is shown in the procedure.

## 15.5 Replacing the Power Fuse



### WARNING

- To prevent the possibility of fire, use only a fuse having the specified rating (voltage, current, and type).
- Make sure to turn OFF the instrument and unplug the power cord before replacing the fuse.
- Never short the fuse holder.

### Specified Rating

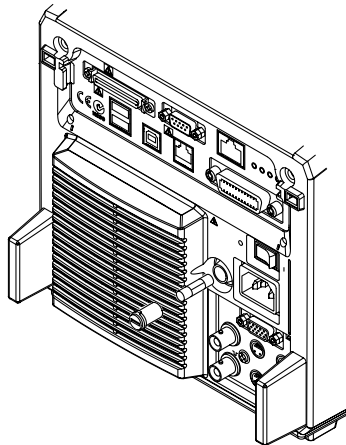
The power fuse used on this instrument is specified as follows.

- Maximum Rated Voltage: 250 V
- Maximum Rated Current: 4 A
- Type: Time lag
- Standard: VDE/SEMKO/UL/CSA/SEV certified
- Part Number: A1352EF

### Replacement Procedures

Follow the procedures below to replace the power fuse.

1. Turn OFF the main power switch (rear panel on the right).
2. Unplug the power cord from the power outlet.
3. Press the dented fuse holder section of the rear panel with a Philips screwdriver, and turn it in order to remove the fuse holder.
4. Remove the burned out fuse from the tip of the fuse holder.
5. Place a new fuse in the fuse holder, and place the fuse holder back in its original position.



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## 15.6 Recommended Replacement Parts

The three-year warranty applies only to the main unit of the instrument (starting from the day of delivery) and does not cover any other items such as expendable items (items which wear out). Contact your nearest YOKOGAWA dealer for replacement parts.

| <b>Parts Name</b> | <b>Limited Life</b>  |
|-------------------|--|
| Built-In Printer  | Under normal usage, 120 rolls of paper (part No.: B9850NX) |
| LCD Back Light    | Approx. 25000 hours when used continuously                 |

The following parts are wear out parts. We recommend you replace them periodically as indicated below. Contact your nearest YOKOGAWA dealer for replacement parts.

| <b>Parts Name</b>                | <b>Recommended Replacement Period</b> |
|----------------------------------|---------------------------------------|
| Cooling Fan                      | 3 years                               |
| Backup Battery (Lithium Battery) | 5 years                               |

# 16.1 Input Section

| Item  | Specifications  |
|---|---|
| Number of Input Channels  | 4 (CH1 to CH4) , or 2 (CH1 to CH2) for the DL1720   |
| Input Coupling Settings   | AC 1 M $\Omega$ , DC 1 M $\Omega$ , DC 50 $\Omega$ , GND  |
| Input Connector   | BNC   |
| Input Impedance   | 1 M $\Omega$ $\pm$ 1.0%, approx. 20 pF<br>50 $\Omega$ $\pm$ 1.0% (VSWR 1.4 or less (DC to 500 MHz))   |
| Voltage-Axis Sensitivity Setting  | 1 M $\Omega$ input : 2 mV/div to 10 V/div (1-2-5 steps)<br>50 $\Omega$ input : 2 mV/div to 1 V/div (1-2-5 steps)  |
| Maximum Input Voltage   | 1 M $\Omega$ input (at 1 kHz or less): 400 V (DC + AC peak) (282 Vrms CATII)<br>50 $\Omega$ input : 5 Vrms or less and 10 Vpeak or less   |
| DC Offset Range (Max)<br>(At 1 : 1 probe attenuation)                       | 2 mV/div to 50 mV/div : $\pm$ 1 V<br>100 mV/div to 500 mV/div : $\pm$ 10 V<br>1 V/div to 10 V/div : $\pm$ 100 V   |
| Vertical (Voltage) Axis Precision   |   |
| DC Precision <sup>*1</sup>  | : $\pm$ (1.5% of 8 div + offset voltage precision)  |
| Offset Axis Precision <sup>*1</sup>   | 2 mV/div to 50 mV/div : $\pm$ (1% of set value + 0.2 mV)<br>100 mV/div to 500 mV/div : $\pm$ (1% of set value + 2 mV)<br>1 V/div to 10 V/div : $\pm$ (1% of set value + 20 mV)  |
| Frequency Characteristics <sup>*1*2</sup>                                   | 50 $\Omega$ input<br>(-3dB point when sine wave of amplitude $\pm$ 4 div is input)<br>1 V/div to 10 mV/div : DC to 500 MHz<br>5 mV/div to 2 mV/div : DC to 400 MHz<br>1 M $\Omega$ input (defined at the tip of the probe when using the passive probe 700988)<br>10 V/div to 10 mV/div : DC to 400 MHz<br>5 mV/div to 2 mV/div : DC to 300 MHz |
| -3dB Point for AC Coupling Used   | 10 Hz or less (When using the 10 : 1 probe (standard accessory), 1 Hz or less)  |
| Interchannel Skew<br>(with identical settings)                              | 1 ns or less  |
| Residual Noise <sup>*3</sup>  | Larger of $\pm$ 1.25 mV or $\pm$ 0.15 div (typical <sup>*4</sup> )  |
| Interchannel Isolation<br>(at identical voltage sensitivity, DC to 500 MHz) | -34 dB (typical <sup>*4</sup> )   |
| A/D Conversion Resolution   | 8 bits (24 LSB/div)   |
| Probe Attenuation Settings  | 1 : 1, 10 : 1, 100 : 1, 1000 : 1  |
| Bandwidth   | 100 MHz or 20 MHz band limit ON/OFF   |
| Maximum Sample Rate   | Realtime sampling mode<br>With interleave ON : 1 GS/s<br>With interleave OFF : 500 MS/s<br>Repetitive sampling mode: 100 GS/s   |
| Maximum Record Length   | With interleave ON : 1 Mwords/CH<br>With interleave OFF : 500 kwords/CH   |

\*1 As measured following calibration (after 30-minute warmup), with internal-clock timebase, under standard operating conditions as described on section 16.11.

\*2 For repetitive events  
The frequency region for single shot is DC to sampling frequency/2.5 or the frequency region for the repetitive event, whichever is less.

\*3 Measured under following conditions: input block shorted; 10 kWord record length; Normal acquisition mode; accumulation OFF; 1 : 1 probe attenuation

\*4 The typical value is a representative or standard value. It is not a warranted value.

## 16.2 Trigger Section

| Item                                  | Specifications   |
|---------------------------------------|--|
| Trigger Mode                          | Auto, Auto Level, Normal, Single, Single(N)  |
| Trigger Source                        | CH1 to CH4 (or CH1 to CH2 for the DL1720), EXT ,LINE   |
| Trigger Coupling                      | CH1 to CH4 (or CH1 to CH2 for the DL1720) : DC/AC<br>EXT : DC  |
| HF Rejection                          | 20 kHz or 15 kHz band limit ON/OFF for trigger source (CH1 to CH4, or CH1 to CH2 for the DL1720)   |
| Trigger Hysteresis                    | Select the trigger hysteresis width (CH1 to CH4, or CH1 to CH2 for the DL1720)   |
| Trigger Level Setting Range           | CH1 to CH4 : $\pm 4$ div from screen center<br>(CH1 to CH2 for the DL1720)<br>EXT : $\pm 2$ V for the DL1740<br>: $\pm 1$ V for the DL1720 with the $\pm 1$ V range selected<br>: $\pm 10$ V for the DL1720 with the $\pm 10$ V range selected   |
| Trigger Level Resolution              | CH1 to CH4 : 0.01 div<br>(CH1 to CH2 for the DL1720)<br>EXT : 5 mV for the DL1740<br>: 5 mV for the DL1720 with the $\pm 1$ V range selected<br>: 50 mV for the DL1720 with the $\pm 10$ V range selected  |
| Trigger Level Precision <sup>*1</sup> | CH1 to CH4 <sup>*1</sup> : $\pm(1 \text{ div} + 10\% \text{ of trigger level})$ for the DL1740<br>(CH1 to CH2 for the DL1720)<br>EXT <sup>*2</sup> : $\pm(50 \text{ mV} + 10\% \text{ of trigger level})$ for the DL1740<br>: $\pm(50 \text{ mV} + 10\% \text{ of trigger level})$<br>for the DL1720 with the $\pm 1$ V range selected<br>: $\pm(500 \text{ mV} + 10\% \text{ of trigger level})$<br>for the DL1720 with the $\pm 10$ V range selected |
| External-Trigger Probe Attenuation    | 1 : 1, 10 : 1  |
| Trigger Sensitivity <sup>*2</sup>     | CH1 to CH4 : 1 divp-p (at DC to 500 MHz)<br>(CH1 to CH2 for the DL1720)<br>EXT : 100 mVp-p (at DC to 100 MHz) for the DL1740<br>: 100 mVp-p (at DC to 100 MHz)<br>for the DL1720 with the $\pm 1$ V range selected<br>: 1 Vp-p (at DC to 100 MHz)<br>for the DL1720 with the $\pm 10$ V range selected   |
| Trigger Position                      | Can be set in 1% increments of record length   |
| Trigger Delay Setting Range           | 0 to 4 s   |
| Hold Off Time Range                   | 80 ns to 10 s  |
| Trigger Slope                         | Rise, Fall, Rise/Fall (with edge trigger)  |

| Item         | Specifications   |
|--------------|--|
| Trigger Type | <p>Edge : Activate the trigger on the edge of a single trigger source.</p> <p>A → B(N) : Trigger occurs nth time condition B becomes true after condition A becomes true.<br/>           Count : 1 to 10<sup>8</sup><br/>           Condition A: Enter, Exit<br/>           Condition B: Enter, Exit</p> <p>A Delay B : Trigger occurs first time condition B becomes true after specified delay following condition A true.<br/>           Delay : 3 ns to 5 s<br/>           Condition A: Enter, Exit<br/>           Condition B: Enter, Exit, Both</p> <p>OR : Trigger occurs on the OR of trigger conditions that are specified on multiple trigger sources.<br/>           The trigger condition can either be edge or window. Rise (IN), Fall (OUT), or Don't Care can be specified on each channel from CH1 to CH4 (or CH1 to CH2 for the DL1720).</p> <p>Pattern : Trigger occurs on the edge of the clock channel based on the True/False condition of the parallel pattern that is specified on multiple trigger sources. If the clock channel is set to Don't Care, then the trigger occurs only on the True/False condition (Enter/Exit) of the parallel pattern.<br/>           The parallel pattern is the AND of the channel states of each channel.</p> <p>Pulse Width : Trigger occurs on the width of the True/False condition of the parallel pattern that is specified on multiple trigger sources. The parallel pattern is the AND of the channel states of each channel or the AND of the window conditions of each channel.<br/>           Pulse&gt;T : Triggers when the width above is greater than T.<br/>           Pulse&lt;T : Triggers when the width above is less than T.<br/>           T1&lt;PLS&lt;T2 : Triggers when the width above is greater than T1 and less than T2.<br/>           Time out : Triggers when the width above exceeds Time.<br/>           Time range : 1 ns to 1 s<br/>           Time accuracy*<sup>1</sup> : ±(0.5% of setting*<sup>3</sup> + 1 ns)<br/>           Minimum detectable time*<sup>2</sup> : 2 ns (typical value*<sup>4</sup>)</p> <p>TV : Trigger for video signal, in NTSC or PAL format. Input channel must be CH1. User can select field no. and line no.</p> <ul style="list-style-type: none"> <li>• Conditions A and B are parallel pattern conditions that are set separately to High, Low, or "Don't Care" for each channel (CH1 to CH4 for the DL1740, or CH1 to CH2 for the DL1720) and for EXT input.</li> </ul> |
| Trigger Gate | <p>The trigger is activated only when the trigger conditions are met while the input applied to the trigger gate input terminal (TRIG GATE IN) is active.<br/>           Select High or Low for the active level.</p>  |

\*1 As measured immediately after calibration, under standard operating conditions (see section 16.11), with machine warmed up.

\*2 As measured under standard operating conditions (see section 16.11) after warmed up.

\*3 When set to T1<Pulse<T2, the value of T2.

\*4 The typical value is a representative or standard value. It is not a warranted value.

## 16.3 Time Axis

| Item                              | Specifications  |                |     |                       |  |                       |   |                           |                  |                     |   |                 |  |                 |   |                     |  |
|-----------------------------------|---|----------------|-----|-----------------------|--|-----------------------|---|---------------------------|------------------|---------------------|---|-----------------|--|-----------------|---|---------------------|--|
| Time Axis Range                   | 1 ns/div to 50 s/div (record length is 10 k words or more)<br>1 ns/div to 5 s/div (record length is 1 k words)  |                |     |                       |  |                       |   |                           |                  |                     |   |                 |  |                 |   |                     |  |
| Time Base Precision <sup>*1</sup> | ±(0.005%)   |                |     |                       |  |                       |   |                           |                  |                     |   |                 |  |                 |   |                     |  |
| Time Axis Precision <sup>*1</sup> | ±(0.005% + 50 ps + 1 digit) <sup>*2</sup>   |                |     |                       |  |                       |   |                           |                  |                     |   |                 |  |                 |   |                     |  |
| EXT CLOCK IN <sup>*3</sup>        | <table border="0"> <tr> <td>Connector Type</td> <td>BNC</td> </tr> <tr> <td>Maximum Input Voltage</td> <td>±40 V(DC + ACpeak) or 28Vrms, 10 kHz or less</td> </tr> <tr> <td>Input Frequency Range</td> <td>40 Hz to 20 MHz (continuous clock only)</td> </tr> <tr> <td>Sampling Jitter not above</td> <td>±1.25 ns or less</td> </tr> <tr> <td>Minimum Input Level</td> <td>0.1 Vp-p for the DL1740, or the DL1720 with the ±1 V range selected<br/>1 Vp-p for the DL1720 with the ± 10 V range selected</td> </tr> <tr> <td>Threshold Level</td> <td>±2 V (5 mV resolution) for the DL1740<br/>±1 V (5 mV resolution) for the DL1720 with the ± 1 V range selected<br/>±10 V (50 mV resolution) for the DL1720 with the ± 10 V range selected</td> </tr> <tr> <td>Input Impedance</td> <td>Approx. 1 MΩ, 18 pF (or Approx. 1 MΩ, 20 pF for the DL1720)</td> </tr> <tr> <td>Minimum Pulse Width</td> <td>At least 10 ns (for both High and Low)</td> </tr> </table> | Connector Type | BNC | Maximum Input Voltage | ±40 V(DC + ACpeak) or 28Vrms, 10 kHz or less | Input Frequency Range | 40 Hz to 20 MHz (continuous clock only) | Sampling Jitter not above | ±1.25 ns or less | Minimum Input Level | 0.1 Vp-p for the DL1740, or the DL1720 with the ±1 V range selected<br>1 Vp-p for the DL1720 with the ± 10 V range selected | Threshold Level | ±2 V (5 mV resolution) for the DL1740<br>±1 V (5 mV resolution) for the DL1720 with the ± 1 V range selected<br>±10 V (50 mV resolution) for the DL1720 with the ± 10 V range selected | Input Impedance | Approx. 1 MΩ, 18 pF (or Approx. 1 MΩ, 20 pF for the DL1720) | Minimum Pulse Width | At least 10 ns (for both High and Low) |
| Connector Type                    | BNC   |                |     |                       |  |                       |   |                           |                  |                     |   |                 |  |                 |   |                     |  |
| Maximum Input Voltage             | ±40 V(DC + ACpeak) or 28Vrms, 10 kHz or less  |                |     |                       |  |                       |   |                           |                  |                     |   |                 |  |                 |   |                     |  |
| Input Frequency Range             | 40 Hz to 20 MHz (continuous clock only)   |                |     |                       |  |                       |   |                           |                  |                     |   |                 |  |                 |   |                     |  |
| Sampling Jitter not above         | ±1.25 ns or less  |                |     |                       |  |                       |   |                           |                  |                     |   |                 |  |                 |   |                     |  |
| Minimum Input Level               | 0.1 Vp-p for the DL1740, or the DL1720 with the ±1 V range selected<br>1 Vp-p for the DL1720 with the ± 10 V range selected   |                |     |                       |  |                       |   |                           |                  |                     |   |                 |  |                 |   |                     |  |
| Threshold Level                   | ±2 V (5 mV resolution) for the DL1740<br>±1 V (5 mV resolution) for the DL1720 with the ± 1 V range selected<br>±10 V (50 mV resolution) for the DL1720 with the ± 10 V range selected  |                |     |                       |  |                       |   |                           |                  |                     |   |                 |  |                 |   |                     |  |
| Input Impedance                   | Approx. 1 MΩ, 18 pF (or Approx. 1 MΩ, 20 pF for the DL1720)   |                |     |                       |  |                       |   |                           |                  |                     |   |                 |  |                 |   |                     |  |
| Minimum Pulse Width               | At least 10 ns (for both High and Low)  |                |     |                       |  |                       |   |                           |                  |                     |   |                 |  |                 |   |                     |  |

\*1 As measured under standard operating conditions (see section 16.11) after warmed up.

\*2 1 digit may be unreliable depending on the sampling.

\*3 "EXT CLOCK IN/EXT TRIG IN/TRIG GATE IN" terminal for the DL1740 or "EXT." terminal for the DL1720

## 16.4 Display

| Item                                 | Specifications                              |
|--------------------------------------|---|
| Display                              | 6.4 - inch color TFT liquid crystal display |
| Screen Size                          | 130.6 mm (width) × 97.0 mm (height)         |
| Total Picture Elements <sup>*1</sup> | 640 × 480 dots                              |
| Waveform Picture Elements            | 500 × 384 dots                              |

\*1 Liquid crystal display may include defects of about 0.02% of all picture elements.

## 16.5 Functions

### Acquisition/Display

| Item                    | Specifications   |
|-------------------------|--|
| Acquisition Mode        | Select from four modes: Normal, Averaging, Envelope, Box Average.                                      |
| Sampling Mode           | Select realtime or repetitive sampling. (Availability depends on time-axis settings.)                  |
| Record Length           | 1 k words, 10 k words, 50 k words, 100 k words, 250 k words, 500 k words, 1 M words                    |
| Zoom                    | Can zoom up to 2 time-axis ranges of displayed waveform(s).  |
| Display Format          | 1, 2, 3, 4, or 6 waveform windows (or 1, 2, or 3 waveform windows for the DL1720)                      |
| Interpolation           | Display samples using dot display, "sine" interpolation, linear interpolation, or pulse interpolation. |
| Graticule               | Select from three graticule types.   |
| Auxiliary Display Items | Select display or nondisplay of scale values, waveform labels, or trigger mark.                        |
| X - Y Display           | Display two X-Y waveform (XY1 or XY2) (or one X-Y waveform (XY1) for the DL1720)                       |
| Accumulation            | Displays multiple iterations of waveform, in either "persistence mode" or "color-grade mode."          |
| Snapshot                | Freezes the current waveform on screen. Saves or loads the snapshot waveforms.                         |
| Trace Clear             | Removes the currently displayed waveform.  |



## Vertical/Horizontal Axis Setting

| Item                      | Specifications  |
|---------------------------|---|
| Channel ON/OFF            | Independent ON/OFF for each channel (CH1 to CH4, or CH1 to CH2 for the DL1720).   |
| Input Filter              | Set 20 MHz or 100 MHz band limit ON/OFF independently for each channel (CH1 to CH4, or CH1 to CH2 for the DL1720).  |
| Vertical Position Setting | Waveforms can be moved vertically in the range $\pm 4$ div from the center of the waveform display frame.   |
| Linear Scaling            | Set scaling coefficient, offset, and unit separately for each channel (CH1 to CH4, or CH1 to CH2 for the DL1720).   |
| Roll Mode                 | The roll display mode is enabled when the trigger mode is auto, auto-level, or single and the time axis is as follows.<br>50 ms/div to 50 s/div (except 50 ms/div to 5 s/div for 1 k words) |

## Analysis

| Item  | Specifications  |
|---|---|
| Search and Zoom Function                              | Search for, then expand and display a portion of the displayed waveform. Choose from the following five search methods.<br>Edge : Count the rising or falling edges, and automatically search either edge.<br>Serial Pattern : Automatically search a serial pattern (up to 64 bits) with a synchronized or unsynchronized clock.<br>Parallel Pattern : Automatically search a parallel pattern from CH1-CH4, MATH1, MATH2 (or CH1-CH2, MATH1 for the DL1720).<br>Pulse Width : Automatically search for parts where a pulse width meets specified conditions.<br>Auto Scroll : Automatically scroll the zoom position.   |
| History Search Function                               | You can search for and display waveforms from the history memory that satisfy specified conditions. Choose from the following two search methods.<br>Zone : Set an area on the screen, then extract and display only those waveforms that pass through the area (Pass mode), or do not pass through the area (By Pass mode).<br>Parameter : Extract and display only the automatic measurement results of the waveform parameters which meet the specified conditions.  |
| Cursor Measurement Function                           | Allows selection of cursor type from Marker, Horiz, Vert, H&V, and Degree.  |
| Automatic Measurement of Waveform Parameters Function | Capable of performing automated measurement of waveform parameters.<br>Automated measurement of waveform parameters within one period (P-P through Int2XY), statistical processing of waveform parameters, and statistical processing on the waveform parameters of historical data.<br>P-P, Max, Min, Ave, Rms, Sdev, High, Low, +OShot, -OShot, Int1TY, Int2TY, Int1XY, Int2XY, Freq, Period, Rise, Fall, +Width, -Width, Duty, Burst1, Burst2, Pulse, AvgFreq, AvgPeriod, and Delay (between channels).<br>Statistical processing results.<br>Statistics: Min, Max, Avg, Cnt, and Sdv.<br>Waveform parameter computation.<br>Operation between waveform parameters and constants. Operators are +, -, *, and /.<br>Measure waveform parameters in different areas on the same channel. |
| Computing Functions                                   | +, -, x, binary computation, differentiation, integration, power spectrum, inversion<br>However, select the range for the power spectrum (1 k words/10 k words).  |
| Phase Shift   | The phase of CH1 to CH4 (or CH1 to CH2 for the DL1720) can be shifted for monitoring.<br>Computation is performed using the phase-shifted result.   |
| GO/NO-GO Function                                     | Judgment is made on the automatically measured value of waveform parameters and the results are output to the printer or to a floppy disk/a Zip disk/external SCSI device, buzzer, or send a mail.* <sup>1</sup>  |

\*<sup>1</sup> This function can be used when the Ethernet interface (option) is installed.

## 16.5 Functions

### Screen Data Output

| Item   | Specifications   |
|--|--|
| Built-in Printer (Option)                              | Outputs hard copy of screen.   |
| External Printer                                       | Print the screen image to an external parallel printer (via keyboard/printer interface or Ethernet* <sup>1</sup> ). Supports ESC/P, ESC/P2, LIPS3, PCL5, BJ commands, and PostScript (Ethernet interface option* <sup>1</sup> ). |
| Floppy Disk/Zip Disk/SCSI /Network Drive* <sup>1</sup> | Output data formats : PostScript, TIFF, BMP  |

\*1 This function can be used when the Ethernet interface (option) is installed.

### Data Storage

| Item   | Specifications  |
|--|---|
| History Memory   | Interleave mode ON : Retain max. 2048 waveforms recorded.<br>Interleave mode OFF : Retain max. 1024 waveforms recorded. |
| Floppy Disk/Zip Disk/SCSI /Network Drive* <sup>1</sup> | Save and restore waveform data, settings, other data.   |

\*1 This function can be used when the Ethernet interface (option) is installed.

### Other Functions

| Item                                      | Specifications   |
|---|--|
| Initialization Function                   | Automatically resets key settings to the factory settings. (Excludes date/time settings, settings related to the communication interface, SCSI ID number setting, settings stored to the internal memory using the store/recall function, and setting the message language.) |
| Auto setup Function                       | Automatically sets key settings to the optimum values for the input signals.   |
| Store/Recall                              | Store and recall up to three arbitrary settings.   |
| Preset Function                           | Sets V/div and trigger level etc. to the optimum values for TTL or ECL signal measurement, for the user settings and the current probe 700937 or 701930 (sold separately).   |
| Action on Trigger                         | Hard Copy, Save to File, Buzzer and Send Mail are performed every time a trigger is activated.   |
| Send Mail* <sup>1</sup>                   | Sending mails for DL1720/DL1740 condition via Ethernet interface.  |
| Calibration                               | Auto calibration and manual calibration are possible.  |
| Environment Setting Function              | Allows setting of screen color, date/time, message language, click sound ON/OFF.   |
| Probe Compensation Signal Output Function | Outputs a square calibration waveform signal (approx. 1 Vp-p, approx. 1 kHz) from the probe compensation signal output terminal on the front panel.  |
| Overview Function                         | Shows system configuration.  |
| Self Test Function                        | Allows memory test, key test, printer test, FDD/Zip drive test, SCSI test, or a Accuracy test.   |
| Help Function                             | Displays help about settings.  |
| Thumbnail                                 | Displays the thumbnail preview window containing screen image files.   |

\*1 This function can be used when the Ethernet interface (option) is installed.

## 16.6 Built-in Printer (Option)

| Item            | Specifications          |
|-----------------|-------------------------|
| Printing System | Thermal line dot method |
| Dot Density     | 8 dots/mm               |
| Paper Width     | 112 mm                  |

## 16.7 Storage

### Built-in Storage

#### • Floppy Disk Drive

| Item          | Specifications |
|---------------|----------------|
| No. of Drives | 1              |
| Drive Size    | 3.5 inch       |
| Capacity      | 720 KB/1.44 MB |

#### • Zip Drive

| Item          | Specifications |
|---------------|----------------|
| No. of Drives | 1              |
| Capacity      | 100 MB/250 MB  |

### External Storage Interface

#### • SCSI (Option)

| Item                      | Specifications  |
|---------------------------|---|
| Standard                  | SCSI (Small Computer System Interface) ANSI X3.131-1986 |
| Connector                 | Half - pitch 50 - pin                                   |
| Connector Pin Assignments | Unbalanced (single end)                                 |

## 16.8 Keyboard and Printer Interface

| Item                                     | Specification  |
|--|--|
| Connector Type                           | Type A connector (receptacle)  |
| Electrical and Mechanical Specifications | Conforms to USB Rev.1.0  |
| Supported Keyboards                      | 104 keyboard (US) and 109 keyboard (Japanese) that conform to USB HID Class Ver.1.1  |
| Supported Printers                       | ESC/P, ESC/P2, LIPS3, PCL5, and BJ (can be used on models that support the BJC-35V native commands) that support USB (USB Printer Class Ver.1.0) |
| Power Supply                             | 5 V, 500 mA (per port)   |
| Number of Ports                          | 2  |

## 16.9 Auxiliary Input/Output Section

### External Trigger Input<sup>1</sup>/Trigger Gate input<sup>1</sup>

| Item                  | Specifications  |
|-----------------------|---|
| Connector Type        | BNC   |
| Input Bandwidth       | External Trigger Input : DC to 100 MHz<br>Trigger Gate input : DC to 50 MHz   |
| Input Impedance       | Approx. 1 M $\Omega$ , 18 pF (or Approx. 1 M $\Omega$ , 20 pF for the DL1720)   |
| Maximum Input Voltage | $\pm 40$ V (DC + AC peak) or 28Vrms, 10 kHz or less   |
| Trigger Level         | $\pm 2$ V (5 mV measurement resolution) for the DL1740<br>$\pm 1$ V (5 mV measurement resolution) for the DL1720 with the $\pm 1$ V range selected<br>$\pm 10$ V (50 mV measurement resolution) for the DL1720 with the $\pm 10$ V range selected |

<sup>1</sup>The EXT TRIG IN terminal also operates as an EXT CLOCK IN terminal. Specifications for external - clock input appear on section 16.3. This terminal is labeled "EXT CLOCK IN/EXT TRIG IN/TRIG GATE IN" for the DL1740 or "EXT." for the DL1720.

### Trigger Output (TRIG OUT)

| Item              | Specifications   |
|-------------------|--|
| Connector Type    | BNC  |
| Output Level      | TTL  |
| Output Logic      | Negative logic   |
| Output Delay Time | 50 ns max.   |
| Output Hold Time  | 1 $\mu$ s min. for low level, 100 ns min. for high level |

### RGB Video Signal Output (RGB VIDEO OUT)

| Item           | Specifications      |
|----------------|---------------------|
| Connector Type | D-Sub 15-pin socket |
| Output Type    | VGA compatible      |

### GO/NO-GO Output (NO-GO OUT, GO OUT)

|                |                         |
|----------------|-------------------------|
| Connector Type | RJ-12 modular jack      |
| Output Level   | TTL compatible          |
| Signal         | NO-GO OUT, GO OUT       |
| Cable          | Four-wire modular cable |

### Power Connectors for the Probes (Option)

|                  |  |
|------------------|--|
| Number of Output | 4 (or 2 for the DL1720)  |
| Output Voltage   | $\pm 12$ V   |
| Usable Probe     | FET probe 700939, Current probe 700937 and 701930, Differential probe 701920 |

## 16.10 Computer Interface

### GP-IB

| Item                                     | Specifications  |
|--|---|
| Electrical and Mechanical Specifications | Conforms to IEEE St'd 488-1978 (JIS C 1901-1987).   |
| Interface Functions                      | SH1, AH1, T5, L4, SR1, RL1, PP0, DC1, DT0, C0   |
| Protocol                                 | Conforms to IEEE St'd 488.2-1992.   |
| Code                                     | ISO (ASCII) code  |
| Mode                                     | Addressable mode  |
| Address Setting                          | Listener and talker addresses 0 to 30 are settable.   |
| Remote Mode Clear                        | Remote mode can be cleared by pressing the SHIFT key +the CLEAR TRACE key (except when local lockout has been set). |

For details refer to the Communication Interface User's Manual (IM701710-17E).

### Serial (RS-232, Option)

| Item                      | Specifications   |
|---------------------------|--|
| Connector Type            | Half pitch interface cable (D-Sub 9-pin plug)                      |
| Electrical Specifications | Conforms to EIA 574 Standard (EIA-232 (RS-232) Standard for 9-pin) |
| Connection Format         | Point to point   |
| Communication Format      | Full duplex  |
| Synchronizing Format      | Start-stop asynchronous transmission                               |
| Baud Rate                 | 1200/2400/4800/9600/19200/38400/57600                              |

For details refer to the Communication Interface User's manual (IM0701710-17E).

### USB

| Item                                     | Specifications  |
|--|---|
| Connector                                | Type B connector (receptacle)   |
| Electrical and Mechanical Specifications | Conforms to USB Rev.1.0   |
| Speed                                    | Max. 12 Mbps  |
| Number of Ports                          | 1   |
| Supported Systems                        | PC system supported. Models with a standard USB port that operates on Windows 98 SE or Windows 2000 (A separate driver is required for connecting to a PC.) |

### Ethernet (Option)

| Item                                 | Specifications  |
|--------------------------------------|---|
| Communication Port Number            | 1   |
| Electrical-Mechanical Specifications | IEEE 802.3 standards  |
| Transmission Method                  | Ethernet (100BASE-TX/10BASE-T)  |
| Transmission Rate                    | Max. 100 Mbps   |
| Communication Protocol               | TCP/IP  |
| Supported Services                   | FTP server, FTP client (network drive), LPR client (network printer), SMTP client (mail transmission), DHCP, DNS. |
| Connector Type                       | RJ-45 connector   |

## 16.11 General

| Item  | Specifications   |
|---|--|
| Standard Operating Conditions                         | Ambient Temperature : 23 ±2°C<br>Ambient Humidity : 55 ±10% RH<br>Power Voltage and Frequency : Less than 1% of the rated voltage/frequency fluctuation  |
| Warm-up Time  | 30 min. or more  |
| Storage Conditions                                    | Temperature : -20 to 60°C, -20 to 50°C (-J2 (built-in Zip drive) model)<br>Humidity : 20 to 80% RH (no condensation allowed)   |
| Operating Conditions                                  | Temperature : 5 to 40°C<br>Humidity : 20 to 80% RH (without a printer)<br>35 to 80% RH (with a printer)  |
| Storage Altitude                                      | 3000 m or below  |
| Operating Altitude                                    | 2000 m or below  |
| Rated supply Voltage                                  | 100 to 120 VAC/220 to 240 VAC  |
| Permissible Supply Voltage Range                      | 90 to 132 VAC/198 to 264 VAC   |
| Rated Supply Voltage Frequency                        | 50/60 Hz   |
| Permissible Supply Voltage Frequency                  | 48 to 63 Hz  |
| Fuse  | 250 V 4 A time lag; VDE/SEMKO/UL/CSA/SEV approved.   |
| Maximum Power Consumption                             | 200 VA (when the built-in printer is used)   |
| Withstand Voltage (between power supply and case)     | 1.5 k VAC for 1 minute   |
| Insulation Resistance (between power supply and case) | 10 MΩ or more at 500 VDC   |
| External Dimensions (details on next page)            | 220 (W) × 266 (H) × 306 (D) mm<br>(with printer cover closed, projections excluded)  |
| Weight (including printer)                            | Approx. 5.5 kg   |
| Cooling Method  | Forced air cooling, air discharged from rear   |
| Installation Position                                 | Horizontally (the stand can be used), vertically (cannot use the Zip drive), and no stacking.  |
| Battery Back-up                                       | Set-up data and internal clock are backed up by a built-in lithium battery.<br>Battery life: Approx. 5 years (at ambient temperature of 23°C)  |
| Accessories   | <ul style="list-style-type: none"> <li>• 1 power cord</li> <li>• 400 MHz passive probes (2)</li> <li>• Electrical fuses (1) : A1352EF</li> <li>• 1 roll of printer paper (Only on models with "/B5" suffix)</li> <li>• 4 rubber pads for bottom legs : B9989EX</li> <li>• Front cover (1) : B9989FA</li> <li>• User's Manual (this manual)</li> <li>• Operation Guide</li> <li>• Communication Interface Manual</li> </ul> |

| Item            | Specifications  |
|-----------------|---|
| Safety Standard | <p>Complying Standard EN61010-1</p> <ul style="list-style-type: none"> <li>• Overvoltage category(Installation category) II*<sup>1</sup></li> <li>• Pollution degree 2*<sup>2</sup></li> </ul>  |
| Emission        | <p>Complying Standard</p> <ul style="list-style-type: none"> <li>• EN61326 Class A, C-Tick AS/NZS 2064 (apply for 701705, 701710, 700988, 700939)</li> <li>• EN61000-3-2</li> <li>• EN61000-3-3<br/>This product is a Class A (for industrial environment) product. Operation of this product in a domestic environment may cause radio interference in which case the user is required to correct the interference.</li> </ul> <p>Cable Requirement</p> <ul style="list-style-type: none"> <li>• External Trigger/ External Clock/Trigger Gate Input Terminal<br/>Use a BNC cable*<sup>3</sup>. Attach a ferrite core (TDK: ZCAT2035-0930A, YOKOGAWA: A1190MN) to the end of the cable on the instrument side.</li> <li>• Trigger Output Terminal<br/>Same as the above external trigger input terminal.</li> <li>• RGB VIDEO OUT Terminal<br/>Use a D-Sub 15-pin VGA shielded cable*<sup>3</sup>.</li> <li>• Serial(RS-232) Interface Connector<br/>Use an RS-232 shielded cable*<sup>3</sup> and attach a ferrite core (TDK: ZCAT2035-0930A, YOKOGAWA: A1190MN)to the end of the cable on the instrument side.</li> <li>• SCSI Connector<br/>Use a SCSI shielded cable*<sup>3</sup> and attach a ferrite core (TDK: ZCAT2035-0930A, YOKOGAWA: A1190MN) to the end of the cable on the instrument side.</li> <li>• PRN/KBD Connector<br/>Use a USB cable*<sup>3</sup>. Attach a ferrite core (TDK: ZCAT1325-0530A, YOKOGAWA: A1181MN) to the end of the cable on the instrument side.</li> <li>• USB Interface Connector<br/>Use a USB cable*<sup>3</sup>. Attach a ferrite core (TDK: ZCAT1325-0530A, YOKOGAWA: A1181MN) to the end of the cable on the instrument side.</li> <li>• GO/NO-GO Output Terminal<br/>Use a GO/NOGO cable (YOKOGAWA model 366973, sold separately). Attach a ferrite core (TDK: ZCAT1325-0530A, YOKOGAWA: A1181MN) to the end of the cable on the instrument side.</li> <li>• Ethernet Connector<br/>Use a Ethernet cable*<sup>3</sup>. Attach a ferrite core (TDK: ZCAT1325-0530A, YOKOGAWA: A1181MN) to the end of the cable on the instrument side.</li> <li>• Power Connectors for the Probes<br/>Attach a ferrite core (TDK: ZCAT1325-0530A, YOKOGAWA: A1181MN) to the end of the cable on the instrument side.</li> </ul> |
| Immunity*1      | <p>Complying Standard EN61326 Industrial environment(apply for 701705, 701710, 700988, 700939)</p> <p>Influence in the Immunity Environment</p> <ul style="list-style-type: none"> <li>• Noise Increase <ul style="list-style-type: none"> <li>· <math>\leq \pm 80</math> mV, when using 700988</li> <li>· <math>\leq \pm 400</math> mV, when using 700939</li> </ul> </li> <li>• Test Condition <ul style="list-style-type: none"> <li>When using 700988<br/>500 MS/s, envelope mode, 20 MHz BWL, input coupling: 1 MW, 20 mV/div (probe attenuation setting: 10:1), terminate the probe at 50 MW.</li> <li>When using 700939<br/>500 MS/s, envelope mode, 20 MHz BWL, input coupling: 50 MW, 100 mV/div (probe attenuation setting: 10:1), terminate the probe at 50 MW.<br/>Attach a ferrite core (TDK: ZCAT2035-0930A, YOKOGAWA: A1190MN) to each end of the signal cable.</li> </ul> </li> <li>• Cable Requirement<br/>Same requirement as above for emission.</li> </ul>  |

\*1 "Overvoltage category(Installation category)" describes a number which defines a transient overvoltage condition. It implies the regulation for impulse withstand voltage. "II" applies to electrical equipment which is supplied from the fixed installation like distribution board.

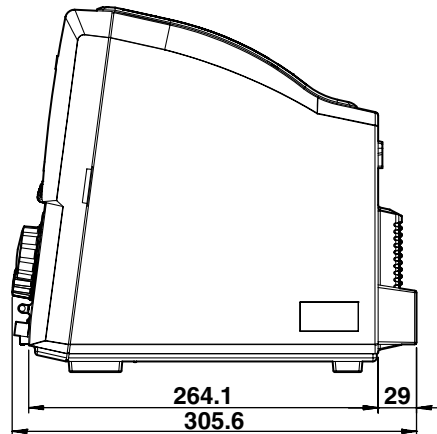
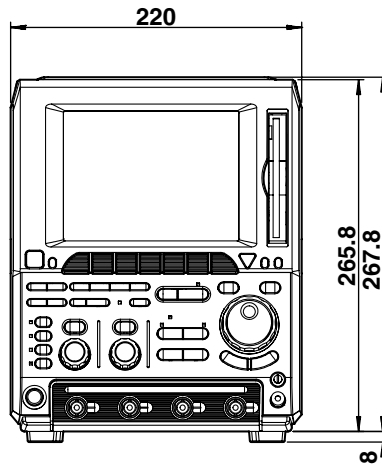
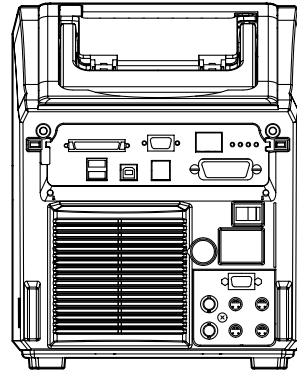
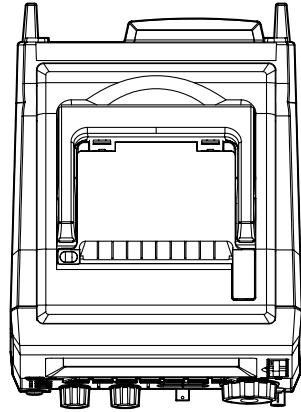
\*2 "Pollution degree" describes the degree to which a solid, liquid, or gas which deteriorates dielectric strength or surface resistivity is adhering. "2" applies to normal indoor atmosphere. Normally, only non-conductive pollution occurs.

\*3 The cable length is less than 3 m.

## 16.12 External Dimensions

Dimensions: mm

**Rear View**



Unless otherwise specified, tolerance is  $\pm 3\%$ .

(Tolerance is always  $\pm 0.3$  mm when the dimension is under 10 mm.)



# Appendix 1 Relationship between the Time Axis Setting, Sample Rate and Record Length

Record length: 1 kwords

Rep: Repetitive sampling mode

| Setting<br>T/div  | When Mode other than Envelope Mode is Active |                                 |                   |                                 |                    |                                 |                   |                                 | When Envelope Mode is Active                                  |                                 |                    |                                 |
|-------------------|--|---------------------------------|-------------------|---------------------------------|--------------------|---------------------------------|-------------------|---------------------------------|---|---------------------------------|--------------------|---------------------------------|
|                   | Interleave mode OFF                          |                                 |                   |                                 | Interleave mode ON |                                 |                   |                                 | Interleave mode OFF   |                                 | Interleave mode ON |                                 |
|                   | Rep: [OFF]                                   |                                 | Rep: [ON]         |                                 | Rep: [OFF]         |                                 | Rep: [ON]         |                                 | Sample rate (S/s)   | Displayed record len gth (word) | Sample rate (S/s)  | Displayed record len gth (word) |
|                   | Sample rate (S/s)                            | Displayed record len gth (word) | Sample rate (S/s) | Displayed record len gth (word) | Sample rate (S/s)  | Displayed record len gth (word) | Sample rate (S/s) | Displayed record len gth (word) | Sample rate (S/s)   | Displayed record len gth (word) | Sample rate (S/s)  | Displayed record len gth (word) |
| 50 s              | It is not possible to set these T/div.       |                                 |                   |                                 |                    |                                 |                   |                                 |   |                                 |                    |                                 |
| 20 s              |  |                                 |                   |                                 |                    |                                 |                   |                                 |   |                                 |                    |                                 |
| 10 s              |  |                                 |                   |                                 |                    |                                 |                   |                                 |   |                                 |                    |                                 |
| 5 s <sup>*2</sup> | 20   | 1 k                             | 20                | 1 k                             | 20                 | 1 k                             | 20                | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 2 s               | 50   | 1 k                             | 50                | 1 k                             | 50                 | 1 k                             | 50                | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 1 s               | 100  | 1 k                             | 100               | 1 k                             | 100                | 1 k                             | 100               | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 500 ms            | 200  | 1 k                             | 200               | 1 k                             | 200                | 1 k                             | 200               | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 200 ms            | 500  | 1 k                             | 500               | 1 k                             | 500                | 1 k                             | 500               | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 100 ms            | 1 k  | 1 k                             | 1 k               | 1 k                             | 1 k                | 1 k                             | 1 k               | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 50 ms             | 2 k  | 1 k                             | 2 k               | 1 k                             | 2 k                | 1 k                             | 2 k               | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 20 ms             | 5 k  | 1 k                             | 5 k               | 1 k                             | 5 k                | 1 k                             | 5 k               | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 10 ms             | 10 k   | 1 k                             | 10 k              | 1 k                             | 10 k               | 1 k                             | 10 k              | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 5 ms              | 20 k   | 1 k                             | 20 k              | 1 k                             | 20 k               | 1 k                             | 20 k              | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 2 ms              | 50 k   | 1 k                             | 50 k              | 1 k                             | 50 k               | 1 k                             | 50 k              | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 1 ms              | 100 k  | 1 k                             | 100 k             | 1 k                             | 100 k              | 1 k                             | 100 k             | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 500 μs            | 200 k  | 1 k                             | 200 k             | 1 k                             | 200 k              | 1 k                             | 200 k             | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 200 μs            | 500 k  | 1 k                             | 500 k             | 1 k                             | 500 k              | 1 k                             | 500 k             | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 100 μs            | 1 M  | 1 k                             | 1 M               | 1 k                             | 1 M                | 1 k                             | 1 M               | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 50 μs             | 2 M  | 1 k                             | 2 M               | 1 k                             | 2 M                | 1 k                             | 2 M               | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 20 μs             | 5 M  | 1 k                             | 5 M               | 1 k                             | 5 M                | 1 k                             | 5 M               | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 10 μs             | 10 M   | 1 k                             | 10 M              | 1 k                             | 10 M               | 1 k                             | 10 M              | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 5 μs              | 20 M   | 1 k                             | 20 M              | 1 k                             | 20 M               | 1 k                             | 20 M              | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 2 μs              | 50 M   | 1 k                             | 50 M              | 1 k                             | 50 M               | 1 k                             | 50 M              | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 1 μs              | 100 M  | 1 k                             | 100 M             | 1 k                             | 100 M              | 1 k                             | 100 M             | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 500 ns            | 200 M  | 1 k                             | 200 M             | 1 k                             | 200 M              | 1 k                             | 200 M             | 1 k                             | 400 M   | 1 k                             | 800 M              | 1 k                             |
| 200 ns            | 500 M  | 1 k                             | 500 M             | 1 k                             | 500 M              | 1 k                             | 500 M             | 1 k                             |   |                                 | 1 G                | 1 k                             |
| 100 ns            | 500 M  | 500                             | 1 G               | 1 k                             | 1 G                | 1 k                             | 1 G               | 1 k                             | Changes to normal mode, even when envelope mode has been set. |                                 |                    |                                 |
| 50 ns             | 500 M  | 250                             | 2 G               | 1 k                             | 1 G                | 500                             | 2 G               | 1 k                             |   |                                 |                    |                                 |
| 20 ns             | 500 M  | 100                             | 5 G               | 1 k                             | 1 G                | 200                             | 5 G               | 1 k                             |   |                                 |                    |                                 |
| 10 ns             | 10 G   | 1 k                             | 10 G              | 1 k                             | 10 G               | 1 k                             | 10 G              | 1 k                             |   |                                 |                    |                                 |
| 5 ns              | 20 G   | 1 k                             | 20 G              | 1 k                             | 20 G               | 1 k                             | 20 G              | 1 k                             |   |                                 |                    |                                 |
| 2 ns              | 50 G   | 1 k                             | 50 G              | 1 k                             | 50 G               | 1 k                             | 50 G              | 1 k                             |   |                                 |                    |                                 |
| 1 ns              | 100 G  | 1 k                             | 100 G             | 1 k                             | 100 G              | 1 k                             | 100 G             | 1 k                             | *1  |                                 |                    |                                 |

\*1: For the setting enclosed by the bold line, repetitive sampling is active.

\*2: Roll mode display is available in shaded sections.

**Appendix 1 Relationship between the Time Axis Setting, Sample Rate and Record Length**

**Record length: 10 kwords**

**Rep: Repetitive sampling mode**

| Setting<br><br>T/div | When Mode other than Envelope Mode is Active |                                |                   |                                |                    |                                |                   |                                | When Envelope Mode is Active   |                                |                    |                                |
|----------------------|--|--------------------------------|-------------------|--------------------------------|--------------------|--------------------------------|-------------------|--------------------------------|--|--------------------------------|--------------------|--------------------------------|
|                      | Interleave mode OFF                          |                                |                   |                                | Interleave mode ON |                                |                   |                                | Interleave mode OFF  |                                | Interleave mode ON |                                |
|                      | Rep: [OFF]                                   |                                | Rep: [ON]         |                                | Rep: [OFF]         |                                | Rep: [ON]         |                                | Sample rate (S/s)  | Displayed record length (word) | Sample rate (S/s)  | Displayed record length (word) |
|                      | Sample rate (S/s)                            | Displayed record length (word) | Sample rate (S/s) | Displayed record length (word) | Sample rate (S/s)  | Displayed record length (word) | Sample rate (S/s) | Displayed record length (word) |  |                                |                    |                                |
| 50 s <sup>*2</sup>   | 20   | 10 k                           | 20                | 10 k                           | 20                 | 10 k                           | 20                | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 20 s                 | 50   | 10 k                           | 50                | 10 k                           | 50                 | 10 k                           | 50                | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 10 s                 | 100  | 10 k                           | 100               | 10 k                           | 100                | 10 k                           | 100               | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 5 s                  | 200  | 10 k                           | 200               | 10 k                           | 200                | 10 k                           | 200               | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 2 s                  | 500  | 10 k                           | 500               | 10 k                           | 500                | 10 k                           | 500               | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 1 s                  | 1 k  | 10 k                           | 1 k               | 10 k                           | 1 k                | 10 k                           | 1 k               | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 500 ms               | 2 k  | 10 k                           | 2 k               | 10 k                           | 2 k                | 10 k                           | 2 k               | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 200 ms               | 5 k  | 10 k                           | 5 k               | 10 k                           | 5 k                | 10 k                           | 5 k               | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 100 ms               | 10 k   | 10 k                           | 10 k              | 10 k                           | 10 k               | 10 k                           | 10 k              | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 50 ms                | 20 k   | 10 k                           | 20 k              | 10 k                           | 20 k               | 10 k                           | 20 k              | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 20 ms                | 50 k   | 10 k                           | 50 k              | 10 k                           | 50 k               | 10 k                           | 50 k              | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 10 ms                | 100 k  | 10 k                           | 100 k             | 10 k                           | 100 k              | 10 k                           | 100 k             | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 5 ms                 | 200 k  | 10 k                           | 200 k             | 10 k                           | 200 k              | 10 k                           | 200 k             | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 2 ms                 | 500 k  | 10 k                           | 500 k             | 10 k                           | 500 k              | 10 k                           | 500 k             | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 1 ms                 | 1 M  | 10 k                           | 1 M               | 10 k                           | 1 M                | 10 k                           | 1 M               | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 500 μs               | 2 M  | 10 k                           | 2 M               | 10 k                           | 2 M                | 10 k                           | 2 M               | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 200 μs               | 5 M  | 10 k                           | 5 M               | 10 k                           | 5 M                | 10 k                           | 5 M               | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 100 μs               | 10 M   | 10 k                           | 10 M              | 10 k                           | 10 M               | 10 k                           | 10 M              | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 50 μs                | 20 M   | 10 k                           | 20 M              | 10 k                           | 20 M               | 10 k                           | 20 M              | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 20 μs                | 50 M   | 10 k                           | 50 M              | 10 k                           | 50 M               | 10 k                           | 50 M              | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 10 μs                | 100 M  | 10 k                           | 100 M             | 10 k                           | 100 M              | 10 k                           | 100 M             | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 5 μs                 | 200 M  | 10 k                           | 200 M             | 10 k                           | 200 M              | 10 k                           | 200 M             | 10 k                           | 400 M  | 10 k                           | 800 M              | 10 k                           |
| 2 μs                 | 500 M  | 10 k                           | 500 M             | 10 k                           | 500 M              | 10 k                           | 500 M             | 10 k                           |  |                                | 1 G                | 10 k                           |
| 1 μs                 | 500 M  | 5 k                            | 1 G               | 10 k                           | 1 G                | 10 k                           | 1 G               | 10 k                           |  |                                |                    |                                |
| 500 ns               | 500 M  | 2.5 k                          | 2 G               | 10 k                           | 1 G                | 5 k                            | 2 G               | 10 k                           | <b>Changes to normal mode, even when envelope mode has been set.</b> |                                |                    |                                |
| 200 ns               | 500 M  | 1 k                            | 5 G               | 10 k                           | 1 G                | 2 k                            | 5 G               | 10 k                           |  |                                |                    |                                |
| 100 ns               | 500 M  | 500                            | 10 G              | 10 k                           | 1 G                | 1 k                            | 10 G              | 10 k                           |  |                                |                    |                                |
| 50 ns                | 500 M  | 250                            | 20 G              | 10 k                           | 1 G                | 500                            | 20 G              | 10 k                           |  |                                |                    |                                |
| 20 ns                | 500 M  | 100                            | 50 G              | 10 k                           | 1 G                | 200                            | 50 G              | 10 k                           |  |                                |                    |                                |
| 10 ns                | 100 G  | 10 k                           | 100 G             | 10 k                           | 100 G              | 10 k                           | 100 G             | 10 k                           |  |                                |                    |                                |
| 5 ns                 | 100 G  | 5 k                            | 100 G             | 5 k                            | 100 G              | 5 k                            | 100 G             | 5 k                            |  |                                |                    |                                |
| 2 ns                 | 100 G  | 2 k                            | 100 G             | 2 k                            | 100 G              | 2 k                            | 100 G             | 2 k                            |  |                                |                    |                                |
| 1 ns                 | 100 G  | 1 k                            | 100 G             | 1 k                            | 100 G              | 1 k                            | 100 G             | 1 k                            | *1   |                                |                    |                                |

\*1: For the setting enclosed by the bold line, repetitive sampling is active.

\*2: Roll mode display is available in shaded sections.

**Appendix 1 Relationship between the Time Axis Setting, Sample Rate and Record Length**

**Record length: 50 kwords**

**Rep: Repetitive sampling mode**

| Setting<br><br>T/div | When Mode other than Envelope Mode is Active |                                |                   |                                |                    |                                |                   |                                | When Envelope Mode is Active |                                |                    |                                |
|----------------------|--|--------------------------------|-------------------|--------------------------------|--------------------|--------------------------------|-------------------|--------------------------------|------------------------------|--------------------------------|--------------------|--------------------------------|
|                      | Interleave mode OFF                          |                                |                   |                                | Interleave mode ON |                                |                   |                                | Interleave mode OFF          |                                | Interleave mode ON |                                |
|                      | Rep: [OFF]                                   |                                | Rep: [ON]         |                                | Rep: [OFF]         |                                | Rep: [ON]         |                                | Sample rate (S/s)            | Displayed record length (word) | Sample rate (S/s)  | Displayed record length (word) |
|                      | Sample rate (S/s)                            | Displayed record length (word) | Sample rate (S/s) | Displayed record length (word) | Sample rate (S/s)  | Displayed record length (word) | Sample rate (S/s) | Displayed record length (word) |                              |                                |                    |                                |
| 50 s <sup>*2</sup>   | 100  | 50 k                           | 100               | 50 k                           | 100                | 50 k                           | 100               | 50 k                           | 400 M                        | 50 k                           | 800 M              | 50 k                           |
| 20 s                 | 200  | 40 k                           | 200               | 40 k                           | 200                | 40 k                           | 200               | 40 k                           | 400 M                        | 40 k                           | 800 M              | 40 k                           |
| 10 s                 | 500  | 50 k                           | 500               | 50 k                           | 500                | 50 k                           | 500               | 50 k                           | 400 M                        | 50 k                           | 800 M              | 50 k                           |
| 5 s                  | 1 k  | 50 k                           | 1 k               | 50 k                           | 1 k                | 50 k                           | 1 k               | 50 k                           | 400 M                        | 50 k                           | 800 M              | 50 k                           |
| 2 s                  | 2 k  | 40 k                           | 2 k               | 40 k                           | 2 k                | 40 k                           | 2 k               | 40 k                           | 400 M                        | 40 k                           | 800 M              | 40 k                           |
| 1 s                  | 5 k  | 50 k                           | 5 k               | 50 k                           | 5 k                | 50 k                           | 5 k               | 50 k                           | 400 M                        | 50 k                           | 800 M              | 50 k                           |
| 500 ms               | 10 k   | 50 k                           | 10 k              | 50 k                           | 10 k               | 50 k                           | 10 k              | 50 k                           | 400 M                        | 50 k                           | 800 M              | 50 k                           |
| 200 ms               | 20 k   | 40 k                           | 20 k              | 40 k                           | 20 k               | 40 k                           | 20 k              | 40 k                           | 400 M                        | 40 k                           | 800 M              | 40 k                           |
| 100 ms               | 50 k   | 50 k                           | 50 k              | 50 k                           | 50 k               | 50 k                           | 50 k              | 50 k                           | 400 M                        | 50 k                           | 800 M              | 50 k                           |
| 50 ms                | 100 k  | 50 k                           | 100 k             | 50 k                           | 100 k              | 50 k                           | 100 k             | 50 k                           | 400 M                        | 50 k                           | 800 M              | 50 k                           |
| 20 ms                | 200 k  | 40 k                           | 200 k             | 40 k                           | 200 k              | 40 k                           | 200 k             | 40 k                           | 400 M                        | 40 k                           | 800 M              | 40 k                           |
| 10 ms                | 500 k  | 50 k                           | 500 k             | 50 k                           | 500 k              | 50 k                           | 500 k             | 50 k                           | 400 M                        | 50 k                           | 800 M              | 50 k                           |
| 5 ms                 | 1 M  | 50 k                           | 1 M               | 50 k                           | 1 M                | 50 k                           | 1 M               | 50 k                           | 400 M                        | 50 k                           | 800 M              | 50 k                           |
| 2 ms                 | 2 M  | 40 k                           | 2 M               | 40 k                           | 2 M                | 40 k                           | 2 M               | 40 k                           | 400 M                        | 40 k                           | 800 M              | 40 k                           |
| 1 ms                 | 5 M  | 50 k                           | 5 M               | 50 k                           | 5 M                | 50 k                           | 5 M               | 50 k                           | 400 M                        | 50 k                           | 800 M              | 50 k                           |
| 500 μs               | 10 M   | 50 k                           | 10 M              | 50 k                           | 10 M               | 50 k                           | 10 M              | 50 k                           | 400 M                        | 50 k                           | 800 M              | 50 k                           |
| 200 μs               | 20 M   | 40 k                           | 20 M              | 40 k                           | 20 M               | 40 k                           | 20 M              | 40 k                           | 400 M                        | 40 k                           | 800 M              | 40 k                           |
| 100 μs               | 50 M   | 50 k                           | 50 M              | 50 k                           | 50 M               | 50 k                           | 50 M              | 50 k                           | 400 M                        | 50 k                           | 800 M              | 50 k                           |
| 50 μs                | 100 M  | 50 k                           | 100 M             | 50 k                           | 100 M              | 50 k                           | 100 M             | 50 k                           | 400 M                        | 50 k                           | 800 M              | 50 k                           |
| 20 μs                | 200 M  | 40 k                           | 200 M             | 40 k                           | 200 M              | 40 k                           | 200 M             | 40 k                           | 400 M                        | 40 k                           | 800 M              | 40 k                           |
| 10 μs                | 500 M  | 50 k                           | 500 M             | 50 k                           | 500 M              | 50 k                           | 500 M             | 50 k                           |                              |                                | 1 G                | 50 k                           |
| 5 μs                 | 500 M  | 25 k                           | 1 G               | 50 k                           | 1 G                | 50 k                           | 1 G               | 50 k                           |                              |                                |                    |                                |
| 2 μs                 | 500 M  | 10 k                           | 2 G               | 40 k                           | 1 G                | 20 k                           | 2 G               | 40 k                           |                              |                                |                    |                                |
| 1 μs                 | 500 M  | 5 k                            | 5 G               | 50 k                           | 1 G                | 10 k                           | 5 G               | 50 k                           |                              |                                |                    |                                |
| 500 ns               | 500 M  | 2.5 k                          | 10 G              | 50 k                           | 1 G                | 5 k                            | 10 G              | 50 k                           |                              |                                |                    |                                |
| 200 ns               | 500 M  | 1 k                            | 20 G              | 40 k                           | 1 G                | 2 k                            | 20 G              | 40 k                           |                              |                                |                    |                                |
| 100 ns               | 500 M  | 500                            | 50 G              | 50 k                           | 1 G                | 1 k                            | 50 G              | 50 k                           |                              |                                |                    |                                |
| 50 ns                | 500 M  | 250                            | 100 G             | 50 k                           | 1 G                | 500                            | 100 G             | 50 k                           |                              |                                |                    |                                |
| 20 ns                | 500 M  | 100                            | 100 G             | 20 k                           | 1 G                | 200                            | 100 G             | 20 k                           |                              |                                |                    |                                |
| 10 ns                | 100 G  | 10 k                           | 100 G             | 10 k                           | 100 G              | 10 k                           | 100 G             | 10 k                           |                              |                                |                    |                                |
| 5 ns                 | 100 G  | 5 k                            | 100 G             | 5 k                            | 100 G              | 5 k                            | 100 G             | 5 k                            |                              |                                |                    |                                |
| 2 ns                 | 100 G  | 2 k                            | 100 G             | 2 k                            | 100 G              | 2 k                            | 100 G             | 2 k                            |                              |                                |                    |                                |
| 1 ns                 | 100 G  | 1 k                            | 100 G             | 1 k                            | 100 G              | 1 k                            | 100 G             | 1 k                            |                              |                                |                    |                                |

**Changes to normal mode, even when envelope mode has been set.**

**\*1: For the setting enclosed by the bold line, repetitive sampling is active.**

**\*2: Roll mode display is available in shaded sections.**

## Appendix 1 Relationship between the Time Axis Setting, Sample Rate and Record Length

Record length: 100 kwords

Rep: Repetitive sampling mode

| Setting<br><br>T/div | When Mode other than Envelope Mode is Active |                                |                   |                                |                    |                                |                   |                                | When Envelope Mode is Active                                  |                                |                    |                                |
|----------------------|--|--------------------------------|-------------------|--------------------------------|--------------------|--------------------------------|-------------------|--------------------------------|---|--------------------------------|--------------------|--------------------------------|
|                      | Interleave mode OFF                          |                                |                   |                                | Interleave mode ON |                                |                   |                                | Interleave mode OFF   |                                | Interleave mode ON |                                |
|                      | Rep: [OFF]                                   |                                | Rep: [ON]         |                                | Rep: [OFF]         |                                | Rep: [ON]         |                                | Sample rate (S/s)   | Displayed record length (word) | Sample rate (S/s)  | Displayed record length (word) |
|                      | Sample rate (S/s)                            | Displayed record length (word) | Sample rate (S/s) | Displayed record length (word) | Sample rate (S/s)  | Displayed record length (word) | Sample rate (S/s) | Displayed record length (word) |   |                                |                    |                                |
| 50 s <sup>*2</sup>   | 200  | 100 k                          | 200               | 100 k                          | 200                | 100 k                          | 200               | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 20 s                 | 500  | 100 k                          | 500               | 100 k                          | 500                | 100 k                          | 500               | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 10 s                 | 1 k  | 100 k                          | 1 k               | 100 k                          | 1 k                | 100 k                          | 1 k               | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 5 s                  | 2 k  | 100 k                          | 2 k               | 100 k                          | 2 k                | 100 k                          | 2 k               | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 2 s                  | 5 k  | 100 k                          | 5 k               | 100 k                          | 5 k                | 100 k                          | 5 k               | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 1 s                  | 10 k   | 100 k                          | 10 k              | 100 k                          | 10 k               | 100 k                          | 10 k              | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 500 ms               | 20 k   | 100 k                          | 20 k              | 100 k                          | 20 k               | 100 k                          | 20 k              | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 200 ms               | 50 k   | 100 k                          | 50 k              | 100 k                          | 50 k               | 100 k                          | 50 k              | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 100 ms               | 100 k  | 100 k                          | 100 k             | 100 k                          | 100 k              | 100 k                          | 100 k             | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 50 ms                | 200 k  | 100 k                          | 200 k             | 100 k                          | 200 k              | 100 k                          | 200 k             | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 20 ms                | 500 k  | 100 k                          | 500 k             | 100 k                          | 500 k              | 100 k                          | 500 k             | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 10 ms                | 1 M  | 100 k                          | 1 M               | 100 k                          | 1 M                | 100 k                          | 1 M               | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 5 ms                 | 2 M  | 100 k                          | 2 M               | 100 k                          | 2 M                | 100 k                          | 2 M               | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 2 ms                 | 5 M  | 100 k                          | 5 M               | 100 k                          | 5 M                | 100 k                          | 5 M               | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 1 ms                 | 10 M   | 100 k                          | 10 M              | 100 k                          | 10 M               | 100 k                          | 10 M              | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 500 μs               | 20 M   | 100 k                          | 20 M              | 100 k                          | 20 M               | 100 k                          | 20 M              | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 200 μs               | 50 M   | 100 k                          | 50 M              | 100 k                          | 50 M               | 100 k                          | 50 M              | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 100 μs               | 100 M  | 100 k                          | 100 M             | 100 k                          | 100 M              | 100 k                          | 100 M             | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 50 μs                | 200 M  | 100 k                          | 200 M             | 100 k                          | 200 M              | 100 k                          | 200 M             | 100 k                          | 400 M   | 100 k                          | 800 M              | 100 k                          |
| 20 μs                | 500 M  | 100 k                          | 500 M             | 100 k                          | 500 M              | 100 k                          | 500 M             | 100 k                          |   |                                | 1 G                | 100 k                          |
| 10 μs                | 500 M  | 50 k                           | 1 G               | 100 k                          | 1 G                | 100 k                          | 1 G               | 100 k                          | Changes to normal mode, even when envelope mode has been set. |                                |                    |                                |
| 5 μs                 | 500 M  | 25 k                           | 2 G               | 100 k                          | 1 G                | 50 k                           | 2 G               | 100 k                          |   |                                |                    |                                |
| 2 μs                 | 500 M  | 10 k                           | 5 G               | 100 k                          | 1 G                | 20 k                           | 5 G               | 100 k                          |   |                                |                    |                                |
| 1 μs                 | 500 M  | 5 k                            | 10 G              | 100 k                          | 1 G                | 10 k                           | 10 G              | 100 k                          |   |                                |                    |                                |
| 500 ns               | 500 M  | 2.5 k                          | 20 G              | 100 k                          | 1 G                | 5 k                            | 20 G              | 100 k                          |   |                                |                    |                                |
| 200 ns               | 500 M  | 1 k                            | 50 G              | 100 k                          | 1 G                | 2 k                            | 50 G              | 100 k                          |   |                                |                    |                                |
| 100 ns               | 500 M  | 500                            | 100 G             | 100 k                          | 1 G                | 1 k                            | 100 G             | 100 k                          |   |                                |                    |                                |
| 50 ns                | 500 M  | 250                            | 100 G             | 50 k                           | 1 G                | 500                            | 100 G             | 50 k                           |   |                                |                    |                                |
| 20 ns                | 500 M  | 100                            | 100 G             | 20 k                           | 1 G                | 200                            | 100 G             | 20 k                           |   |                                |                    |                                |
| 10 ns                | 100 G  | 10 k                           | 100 G             | 10 k                           | 100 G              | 10 k                           | 100 G             | 10 k                           |   |                                |                    |                                |
| 5 ns                 | 100 G  | 5 k                            | 100 G             | 5 k                            | 100 G              | 5 k                            | 100 G             | 5 k                            |   |                                |                    |                                |
| 2 ns                 | 100 G  | 2 k                            | 100 G             | 2 k                            | 100 G              | 2 k                            | 100 G             | 2 k                            |   |                                |                    |                                |
| 1 ns                 | 100 G  | 1 k                            | 100 G             | 1 k                            | 100 G              | 1 k                            | 100 G             | 1 k                            | *1  |                                |                    |                                |

\*1: For the setting enclosed by the bold line, repetitive sampling is active.

\*2: Roll mode display is available in shaded sections.

**Appendix 1 Relationship between the Time Axis Setting, Sample Rate and Record Length**

**Record length: 250 kwords**

**Rep: Repetitive sampling mode**

| Setting<br><br>T/div | When Mode other than Envelope Mode is Active |                                |                   |                                |                    |                                |                   |                                | When Envelope Mode is Active   |                                |                    |                                |
|----------------------|--|--------------------------------|-------------------|--------------------------------|--------------------|--------------------------------|-------------------|--------------------------------|--|--------------------------------|--------------------|--------------------------------|
|                      | Interleave mode OFF                          |                                |                   |                                | Interleave mode ON |                                |                   |                                | Interleave mode OFF  |                                | Interleave mode ON |                                |
|                      | Rep: [OFF]                                   |                                | Rep: [ON]         |                                | Rep: [OFF]         |                                | Rep: [ON]         |                                | Sample rate (S/s)  | Displayed record length (word) | Sample rate (S/s)  | Displayed record length (word) |
|                      | Sample rate (S/s)                            | Displayed record length (word) | Sample rate (S/s) | Displayed record length (word) | Sample rate (S/s)  | Displayed record length (word) | Sample rate (S/s) | Displayed record length (word) | Sample rate (S/s)  | Displayed record length (word) | Sample rate (S/s)  | Displayed record length (word) |
| 50 s <sup>*2</sup>   | 500  | 250 k                          | 500               | 250 k                          | 500                | 250 k                          | 500               | 250 k                          | 400 M  | 250 k                          | 800 M              | 250 k                          |
| 20 s                 | 1 k  | 200 k                          | 1 k               | 200 k                          | 1 k                | 200 k                          | 1 k               | 200 k                          | 400 M  | 200 k                          | 800 M              | 200 k                          |
| 10 s                 | 2 k  | 200 k                          | 2 k               | 200 k                          | 2 k                | 200 k                          | 2 k               | 200 k                          | 400 M  | 200 k                          | 800 M              | 200 k                          |
| 5 s                  | 5 k  | 250 k                          | 5 k               | 250 k                          | 5 k                | 250 k                          | 5 k               | 250 k                          | 400 M  | 250 k                          | 800 M              | 250 k                          |
| 2 s                  | 10 k   | 200 k                          | 10 k              | 200 k                          | 10 k               | 200 k                          | 10 k              | 200 k                          | 400 M  | 200 k                          | 800 M              | 200 k                          |
| 1 s                  | 20 k   | 200 k                          | 20 k              | 200 k                          | 20 k               | 200 k                          | 20 k              | 200 k                          | 400 M  | 200 k                          | 800 M              | 200 k                          |
| 500 ms               | 50 k   | 250 k                          | 50 k              | 250 k                          | 50 k               | 250 k                          | 50 k              | 250 k                          | 400 M  | 250 k                          | 800 M              | 250 k                          |
| 200 ms               | 100 k  | 200 k                          | 100 k             | 200 k                          | 100 k              | 200 k                          | 100 k             | 200 k                          | 400 M  | 200 k                          | 800 M              | 200 k                          |
| 100 ms               | 200 k  | 200 k                          | 200 k             | 200 k                          | 200 k              | 200 k                          | 200 k             | 200 k                          | 400 M  | 200 k                          | 800 M              | 200 k                          |
| 50 ms                | 500 k  | 250 k                          | 500 k             | 250 k                          | 500 k              | 250 k                          | 500 k             | 250 k                          | 400 M  | 250 k                          | 800 M              | 250 k                          |
| 20 ms                | 1 M  | 200 k                          | 1 M               | 200 k                          | 1 M                | 200 k                          | 1 M               | 200 k                          | 400 M  | 200 k                          | 800 M              | 200 k                          |
| 10 ms                | 2 M  | 200 k                          | 2 M               | 200 k                          | 2 M                | 200 k                          | 2 M               | 200 k                          | 400 M  | 200 k                          | 800 M              | 200 k                          |
| 5 ms                 | 5 M  | 250 k                          | 5 M               | 250 k                          | 5 M                | 250 k                          | 5 M               | 250 k                          | 400 M  | 250 k                          | 800 M              | 250 k                          |
| 2 ms                 | 10 M   | 200 k                          | 10 M              | 200 k                          | 10 M               | 200 k                          | 10 M              | 200 k                          | 400 M  | 200 k                          | 800 M              | 200 k                          |
| 1 ms                 | 20 M   | 200 k                          | 20 M              | 200 k                          | 20 M               | 200 k                          | 20 M              | 200 k                          | 400 M  | 200 k                          | 800 M              | 200 k                          |
| 500 μs               | 50 M   | 250 k                          | 50 M              | 250 k                          | 50 M               | 250 k                          | 50 M              | 250 k                          | 400 M  | 250 k                          | 800 M              | 250 k                          |
| 200 μs               | 100 M  | 200 k                          | 100 M             | 200 k                          | 100 M              | 200 k                          | 100 M             | 200 k                          | 400 M  | 200 k                          | 800 M              | 200 k                          |
| 100 μs               | 200 M  | 200 k                          | 200 M             | 200 k                          | 200 M              | 200 k                          | 200 M             | 200 k                          | 400 M  | 200 k                          | 800 M              | 200 k                          |
| 50 μs                | 500 M  | 250 k                          | 500 M             | 250 k                          | 500 M              | 250 k                          | 500 M             | 250 k                          |  |                                | 1 G                | 250 k                          |
| 20 μs                | 500 M  | 100 k                          | 1 G               | 200 k                          | 1 G                | 200 k                          | 1 G               | 200 k                          | <b>Changes to normal mode, even when envelope mode has been set.</b> |                                |                    |                                |
| 10 μs                | 500 M  | 50 k                           | 2 G               | 200 k                          | 1 G                | 100 k                          | 2 G               | 200 k                          |  |                                |                    |                                |
| 5 μs                 | 500 M  | 25 k                           | 5 G               | 250 k                          | 1 G                | 50 k                           | 5 G               | 250 k                          |  |                                |                    |                                |
| 2 μs                 | 500 M  | 10 k                           | 10 G              | 200 k                          | 1 G                | 20 k                           | 10 G              | 200 k                          |  |                                |                    |                                |
| 1 μs                 | 500 M  | 5 k                            | 20 G              | 200 k                          | 1 G                | 10 k                           | 20 G              | 200 k                          |  |                                |                    |                                |
| 500 ns               | 500 M  | 2.5 k                          | 50 G              | 250 k                          | 1 G                | 5 k                            | 50 G              | 250 k                          |  |                                |                    |                                |
| 200 ns               | 500 M  | 1 k                            | 100 G             | 200 k                          | 1 G                | 2 k                            | 100 G             | 200 k                          |  |                                |                    |                                |
| 100 ns               | 500 M  | 500                            | 100 G             | 100 k                          | 1 G                | 1 k                            | 100 G             | 100 k                          |  |                                |                    |                                |
| 50 ns                | 500 M  | 250                            | 100 G             | 50 k                           | 1 G                | 500                            | 100 G             | 50 k                           |  |                                |                    |                                |
| 20 ns                | 500 M  | 100                            | 100 G             | 20 k                           | 1 G                | 200                            | 100 G             | 20 k                           |  |                                |                    |                                |
| 10 ns                | 100 G  | 10 k                           | 100 G             | 10 k                           | 100 G              | 10 k                           | 100 G             | 10 k                           |  |                                |                    |                                |
| 5 ns                 | 100 G  | 5 k                            | 100 G             | 5 k                            | 100 G              | 5 k                            | 100 G             | 5 k                            |  |                                |                    |                                |
| 2 ns                 | 100 G  | 2 k                            | 100 G             | 2 k                            | 100 G              | 2 k                            | 100 G             | 2 k                            |  |                                |                    |                                |
| 1 ns                 | 100 G  | 1 k                            | 100 G             | 1 k                            | 100 G              | 1 k                            | 100 G             | 1 k                            | *1   |                                |                    |                                |

\*1: For the setting enclosed by the bold line, repetitive sampling is active.

\*2: Roll mode display is available in shaded sections.

**Appendix 1 Relationship between the Time Axis Setting, Sample Rate and Record Length**

**Record length: 500 kwords**

**Rep: Repetitive sampling mode**

| Setting<br><br>T/div | When Mode other than Envelope Mode is Active |                                |                   |                                |                    |                                |                   |                                | When Envelope Mode is Active |                                |                    |                                |
|----------------------|--|--------------------------------|-------------------|--------------------------------|--------------------|--------------------------------|-------------------|--------------------------------|------------------------------|--------------------------------|--------------------|--------------------------------|
|                      | Interleave mode OFF                          |                                |                   |                                | Interleave mode ON |                                |                   |                                | Interleave mode OFF          |                                | Interleave mode ON |                                |
|                      | Rep: [OFF]                                   |                                | Rep: [ON]         |                                | Rep: [OFF]         |                                | Rep: [ON]         |                                | Sample rate (S/s)            | Displayed record length (word) | Sample rate (S/s)  | Displayed record length (word) |
|                      | Sample rate (S/s)                            | Displayed record length (word) | Sample rate (S/s) | Displayed record length (word) | Sample rate (S/s)  | Displayed record length (word) | Sample rate (S/s) | Displayed record length (word) |                              |                                |                    |                                |
| 50 s <sup>*2</sup>   | 1 k  | 500 k                          | 1 k               | 500 k                          | 1 k                | 500 k                          | 1 k               | 500 k                          | 400 M                        | 500 k                          | 800 M              | 500 k                          |
| 20 s                 | 2 k  | 400 k                          | 2 k               | 400 k                          | 2 k                | 400 k                          | 2 k               | 400 k                          | 400 M                        | 400 k                          | 800 M              | 400 k                          |
| 10 s                 | 5 k  | 500 k                          | 5 k               | 500 k                          | 5 k                | 500 k                          | 5 k               | 500 k                          | 400 M                        | 500 k                          | 800 M              | 500 k                          |
| 5 s                  | 10 k   | 500 k                          | 10 k              | 500 k                          | 10 k               | 500 k                          | 10 k              | 500 k                          | 400 M                        | 500 k                          | 800 M              | 500 k                          |
| 2 s                  | 20 k   | 400 k                          | 20 k              | 400 k                          | 20 k               | 400 k                          | 20 k              | 400 k                          | 400 M                        | 400 k                          | 800 M              | 400 k                          |
| 1 s                  | 50 k   | 500 k                          | 50 k              | 500 k                          | 50 k               | 500 k                          | 50 k              | 500 k                          | 400 M                        | 500 k                          | 800 M              | 500 k                          |
| 500 ms               | 100 k  | 500 k                          | 100 k             | 500 k                          | 100 k              | 500 k                          | 100 k             | 500 k                          | 400 M                        | 500 k                          | 800 M              | 500 k                          |
| 200 ms               | 200 k  | 400 k                          | 200 k             | 400 k                          | 200 k              | 400 k                          | 200 k             | 400 k                          | 400 M                        | 400 k                          | 800 M              | 400 k                          |
| 100 ms               | 500 k  | 500 k                          | 500 k             | 500 k                          | 500 k              | 500 k                          | 500 k             | 500 k                          | 400 M                        | 500 k                          | 800 M              | 500 k                          |
| 50 ms                | 1 M  | 500 k                          | 1 M               | 500 k                          | 1 M                | 500 k                          | 1 M               | 500 k                          | 400 M                        | 500 k                          | 800 M              | 500 k                          |
| 20 ms                | 2 M  | 400 k                          | 2 M               | 400 k                          | 2 M                | 400 k                          | 2 M               | 400 k                          | 400 M                        | 400 k                          | 800 M              | 400 k                          |
| 10 ms                | 5 M  | 500 k                          | 5 M               | 500 k                          | 5 M                | 500 k                          | 5 M               | 500 k                          | 400 M                        | 500 k                          | 800 M              | 500 k                          |
| 5 ms                 | 10 M   | 500 k                          | 10 M              | 500 k                          | 10 M               | 500 k                          | 10 M              | 500 k                          | 400 M                        | 500 k                          | 800 M              | 500 k                          |
| 2 ms                 | 20 M   | 400 k                          | 20 M              | 400 k                          | 20 M               | 400 k                          | 20 M              | 400 k                          | 400 M                        | 400 k                          | 800 M              | 400 k                          |
| 1 ms                 | 50 M   | 500 k                          | 50 M              | 500 k                          | 50 M               | 500 k                          | 50 M              | 500 k                          | 400 M                        | 500 k                          | 800 M              | 500 k                          |
| 500 μs               | 100 M  | 500 k                          | 100 M             | 500 k                          | 100 M              | 500 k                          | 100 M             | 500 k                          | 400 M                        | 500 k                          | 800 M              | 500 k                          |
| 200 μs               | 200 M  | 400 k                          | 200 M             | 400 k                          | 200 M              | 400 k                          | 200 M             | 400 k                          | 400 M                        | 400 k                          | 800 M              | 400 k                          |
| 100 μs               | 500 M  | 500 k                          | 500 M             | 500 k                          | 500 M              | 500 k                          | 500 M             | 500 k                          |                              |                                | 1 G                | 500 k                          |
| 50 μs                | 500 M  | 250 k                          | 1 G               | 500 k                          | 1 G                | 500 k                          | 1 G               | 500 k                          |                              |                                |                    |                                |
| 20 μs                | 500 M  | 100 k                          | 2 G               | 400 k                          | 1 G                | 200 k                          | 2 G               | 400 k                          |                              |                                |                    |                                |
| 10 μs                | 500 M  | 50 k                           | 5 G               | 500 k                          | 1 G                | 100 k                          | 5 G               | 500 k                          |                              |                                |                    |                                |
| 5 μs                 | 500 M  | 25 k                           | 10 G              | 500 k                          | 1 G                | 50 k                           | 10 G              | 500 k                          |                              |                                |                    |                                |
| 2 μs                 | 500 M  | 10 k                           | 20 G              | 400 k                          | 1 G                | 20 k                           | 20 G              | 400 k                          |                              |                                |                    |                                |
| 1 μs                 | 500 M  | 5 k                            | 50 G              | 500 k                          | 1 G                | 10 k                           | 50 G              | 500 k                          |                              |                                |                    |                                |
| 500 ns               | 500 M  | 2.5 k                          | 100 G             | 500 k                          | 1 G                | 5 k                            | 100 G             | 500 k                          |                              |                                |                    |                                |
| 200 ns               | 500 M  | 1 k                            | 100 G             | 200 k                          | 1 G                | 2 k                            | 100 G             | 200 k                          |                              |                                |                    |                                |
| 100 ns               | 500 M  | 500                            | 100 G             | 100 k                          | 1 G                | 1 k                            | 100 G             | 100 k                          |                              |                                |                    |                                |
| 50 ns                | 500 M  | 250                            | 100 G             | 50 k                           | 1 G                | 500                            | 100 G             | 50 k                           |                              |                                |                    |                                |
| 20 ns                | 500 M  | 100                            | 100 G             | 20 k                           | 1 G                | 200                            | 100 G             | 20 k                           |                              |                                |                    |                                |
| 10 ns                | 100 G  | 10 k                           | 100 G             | 10 k                           | 100 G              | 10 k                           | 100 G             | 10 k                           |                              |                                |                    |                                |
| 5 ns                 | 100 G  | 5 k                            | 100 G             | 5 k                            | 100 G              | 5 k                            | 100 G             | 5 k                            |                              |                                |                    |                                |
| 2 ns                 | 100 G  | 2 k                            | 100 G             | 2 k                            | 100 G              | 2 k                            | 100 G             | 2 k                            |                              |                                |                    |                                |
| 1 ns                 | 100 G  | 1 k                            | 100 G             | 1 k                            | 100 G              | 1 k                            | 100 G             | 1 k                            |                              |                                |                    |                                |

**Changes to normal mode, even when envelope mode has been set.**

**\*1**

**\*1: For the setting enclosed by the bold line, repetitive sampling is active.**

**\*2: Roll mode display is available in shaded sections.**

## Appendix 1 Relationship between the Time Axis Setting, Sample Rate and Record Length

Record length: 1 Mwords

Rep: Repetitive sampling mode

| Setting<br><br>T/div | When Moed other than Envelope Mode is Active                        |                                 |                   |                                 |                    |                                 |                   |                                 | When Envelope mode is Active                              |                                 |                    |                                 |   |     |
|----------------------|---|---------------------------------|-------------------|---------------------------------|--------------------|---------------------------------|-------------------|---------------------------------|---|---------------------------------|--------------------|---------------------------------|---|-----|
|                      | Interleave mode OFF   |                                 |                   |                                 | Interleave mode ON |                                 |                   |                                 | Interleave mode OFF                                       |                                 | Interleave mode ON |                                 |   |     |
|                      | Rep: [OFF]  |                                 | Rep: [ON]         |                                 | Rep: [OFF]         |                                 | Rep: [ON]         |                                 | Sample rate (S/s)   | Displayed record len gth (word) | Sample rate (S/s)  | Displayed record len gth (word) |   |     |
|                      | Sample rate (S/s)   | Displayed record len gth (word) | Sample rate (S/s) | Displayed record len gth (word) | Sample rate (S/s)  | Displayed record len gth (word) | Sample rate (S/s) | Displayed record len gth (word) | Sample rate (S/s)   | Displayed record len gth (word) | Sample rate (S/s)  | Displayed record len gth (word) |   |     |
| 50 s                 | *2<br><br>This record length cannot be used when interleave is OFF. |                                 |                   |                                 | 2 k                | 1 M                             | 2 k               | 1 M                             | This record length cannot be used when interleave is OFF. |                                 |                    |                                 |   |     |
| 20 s                 |   |                                 |                   |                                 | 5 k                | 1 M                             | 5 k               | 1 M                             |   |                                 |                    |                                 | 800 M   | 1 M |
| 10 s                 |   |                                 |                   |                                 | 10 k               | 1 M                             | 10 k              | 1 M                             |   |                                 |                    |                                 | 800 M   | 1 M |
| 5 s                  |   |                                 |                   |                                 | 20 k               | 1 M                             | 20 k              | 1 M                             |   |                                 |                    |                                 | 800 M   | 1 M |
| 2 s                  |   |                                 |                   |                                 | 50 k               | 1 M                             | 50 k              | 1 M                             |   |                                 |                    |                                 | 800 M   | 1 M |
| 1 s                  |   |                                 |                   |                                 | 100 k              | 1 M                             | 100 k             | 1 M                             |   |                                 |                    |                                 | 800 M   | 1 M |
| 500 ms               |   |                                 |                   |                                 | 200 k              | 1 M                             | 200 k             | 1 M                             |   |                                 |                    |                                 | 800 M   | 1 M |
| 200 ms               |   |                                 |                   |                                 | 500 k              | 1 M                             | 500 k             | 1 M                             |   |                                 |                    |                                 | 800 M   | 1 M |
| 100 ms               |   |                                 |                   |                                 | 1 M                | 1 M                             | 1 M               | 1 M                             |   |                                 |                    |                                 | 800 M   | 1 M |
| 50 ms                |   |                                 |                   |                                 | 2 M                | 1 M                             | 2 M               | 1 M                             |   |                                 |                    |                                 | 800 M   | 1 M |
| 20 ms                |   |                                 |                   |                                 | 5 M                | 1 M                             | 5 M               | 1 M                             |   |                                 |                    |                                 | 800 M   | 1 M |
| 10 ms                |   |                                 |                   |                                 | 10 M               | 1 M                             | 10 M              | 1 M                             |   |                                 |                    |                                 | 800 M   | 1 M |
| 5 ms                 |   |                                 |                   |                                 | 20 M               | 1 M                             | 20 M              | 1 M                             |   |                                 |                    |                                 | 800 M   | 1 M |
| 2 ms                 |   |                                 |                   |                                 | 50 M               | 1 M                             | 50 M              | 1 M                             |   |                                 |                    |                                 | 800 M   | 1 M |
| 1 ms                 |   |                                 |                   |                                 | 100 M              | 1 M                             | 100 M             | 1 M                             |   |                                 |                    |                                 | 800 M   | 1 M |
| 500 μs               |   |                                 |                   |                                 | 200 M              | 1 M                             | 200 M             | 1 M                             |   |                                 |                    |                                 | 800 M   | 1 M |
| 200 μs               |   |                                 |                   |                                 | 500 M              | 1 M                             | 500 M             | 1 M                             |   |                                 |                    |                                 | 1 G   | 1 M |
| 100 μs               |   |                                 |                   |                                 | 1 G                | 1 M                             | 1 G               | 1 M                             |   |                                 |                    |                                 | Changes to normal mode, even when envelope mode has been set. |     |
| 50 μs                |   |                                 |                   |                                 | 1 G                | 500 k                           | 2 G               | 1 M                             |   |                                 |                    |                                 |   |     |
| 20 μs                |   |                                 |                   |                                 | 1 G                | 200 k                           | 5 G               | 1 M                             |   |                                 |                    |                                 |   |     |
| 10 μs                | 1 G   | 100 k                           | 10 G              | 1 M                             |                    |                                 |                   |                                 |   |                                 |                    |                                 |   |     |
| 5 μs                 | 1 G   | 50 k                            | 20 G              | 1 M                             |                    |                                 |                   |                                 |   |                                 |                    |                                 |   |     |
| 2 μs                 | 1 G   | 20 k                            | 50 G              | 1 M                             |                    |                                 |                   |                                 |   |                                 |                    |                                 |   |     |
| 1 μs                 | 1 G   | 10 k                            | 100 G             | 1 M                             |                    |                                 |                   |                                 |   |                                 |                    |                                 |   |     |
| 500 ns               | 1 G   | 5 k                             | 100 G             | 500 k                           |                    |                                 |                   |                                 |   |                                 |                    |                                 |   |     |
| 200 ns               | 1 G   | 2 k                             | 100 G             | 200 k                           |                    |                                 |                   |                                 |   |                                 |                    |                                 |   |     |
| 100 ns               | 1 G   | 1 k                             | 100 G             | 100 k                           |                    |                                 |                   |                                 |   |                                 |                    |                                 |   |     |
| 50 ns                | 1 G   | 500                             | 100 G             | 50 k                            |                    |                                 |                   |                                 |   |                                 |                    |                                 |   |     |
| 20 ns                | 1 G   | 200                             | 100 G             | 20 k                            |                    |                                 |                   |                                 |   |                                 |                    |                                 |   |     |
| 10 ns                | 100 G   | 10 k                            | 100 G             | 10 k                            |                    |                                 |                   |                                 |   |                                 |                    |                                 |   |     |
| 5 ns                 | 100 G   | 5 k                             | 100 G             | 5 k                             |                    |                                 |                   |                                 |   |                                 |                    |                                 |   |     |
| 2 ns                 | 100 G   | 2 k                             | 100 G             | 2 k                             |                    |                                 |                   |                                 |   |                                 |                    |                                 |   |     |
| 1 ns                 | 100 G   | 1 k                             | 100 G             | 1 k                             | *1                 |                                 |                   |                                 |   |                                 |                    |                                 |   |     |

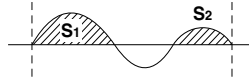
\*1: For the setting enclosed by the bold line, repetitive sampling is active.

\*2: Roll mode display is available in shaded sections.

# Appendix 2 How to Calculate the Area of a Waveform

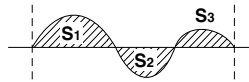
## Integ1TY

Total Area for Positive Side Only:  $S_1+S_2$



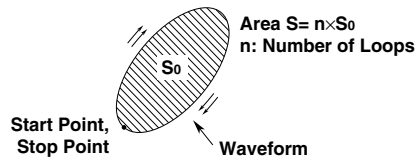
## Integ2TY

Total Area for both Positive and Negative Sides:  $S_1+S_3-S_2$

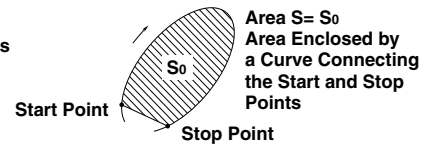


## Integ1XY

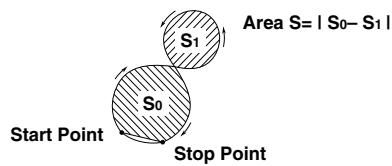
(1) Multiple Loops



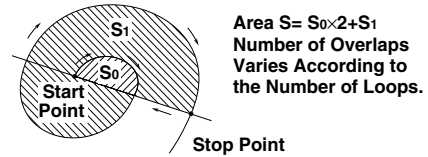
(2) Non-Closed Curve



(3) Loop Tracing a Figure-Eight



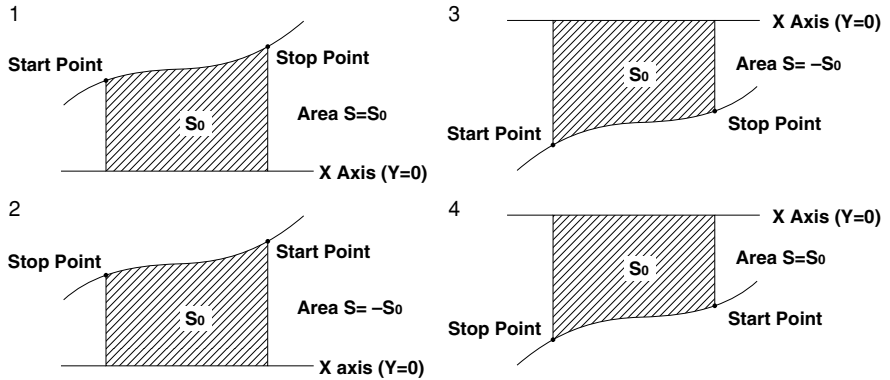
(4) Spiral Loop



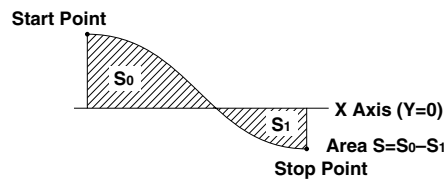


**Integ2XY**

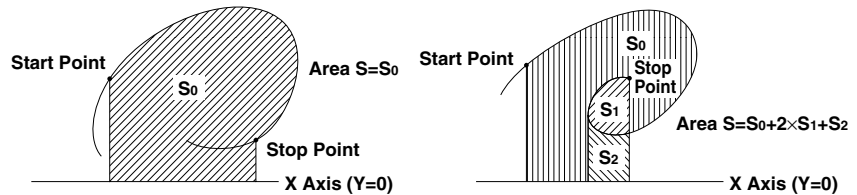
(1) When Only One Y Data Corresponds to X Data



(2) When the Waveform Extends into the Negative Side



(2) When Two or more Y Data Correspond to X Data



## Appendix 3 ASCII Header File Format

//YOKOGAWA ASCII FILE FORMAT

\$PublicInfo

FormatVersion 1.11  
Model DL1740  
Endian Big  
DataFormat TRACE  
GroupNumber 3  
TraceTotalNumber 10  
DataOffset 0

\$Group1

|                |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|
| TraceNumber    | 4              |                |                |                |
| BlockNumber    | 1              |                |                |                |
| TraceName      | CH1            | CH2            | CH3            | CH4            |
| BlockSize      | 1002           | 1002           | 1002           | 1002           |
| VResolution    | 1.5625000E+00  | 1.5625000E+00  | 1.5625000E+00  | 1.5625000E+00  |
| VOffset        | 0.0000000E+00  | 0.0000000E+00  | 0.0000000E+00  | 0.0000000E+00  |
| VDataType      | IS2            | IS2            | IS2            | IS2            |
| VUnit          | V              | V              | A              | V              |
| VPlusOverData  | 32768          | 32768          | 32768          | 32768          |
| VMinusOverData | -32769         | -32769         | -32769         | -32769         |
| VIllegalData   | -32769         | -32769         | -32769         | -32769         |
| VMaxData       | 32767          | 32767          | 32767          | 32767          |
| VMinData       | -32768         | -32768         | -32768         | -32768         |
| HResolution    | 5.0000000E-09  | 5.0000000E-09  | 5.0000000E-09  | 5.0000000E-09  |
| HOffset        | -2.5000000E-06 | -2.5000000E-06 | -2.5000000E-06 | -2.5000000E-06 |
| HUnit          | s              | s              | s              | s              |
| Date           | 2001/07/25     | 2001/07/25     | 2001/07/25     | 2001/07/25     |
| Time           | 01:45:00       | 01:45:00       | 01:45:00       | 01:45:00       |

```

$Group2
TraceNumber      2
BlockNumber      1
TraceName        MATH1          MATH2
BlockSize        1002          1002
VResolution      6.1035156E-03  1.2207031E+00
VOffset          -7.7000000E+01  2.0000000E+04
VDataType        IS2           IS2
VUnit            DB           V
VPlusOverData    32768          32768
VMinusOverData   -32769          -32769
VIllegalData     -32769          -32769
VMaxData         32767          32767
VMinData         -32768          -32768
HResolution      2.0000000E-01  5.0000000E-09
HOffset          0.0000000E+00  -2.5000000E-06
HUnit            Hz           s

Date             2001/07/25      2001/07/25
Time             01:45:00      01:45:00
    
```

```

$PrivateInfo
ModelVersion     1.02
DisplayBlockSize 10020          10020          10020          10020
DisplayPointNo.  1             1             1             1
PhaseShift       0             0             0             0
    
```

**Note**

- The same header file format is used by all YOKOGAWA measuring instruments, so it may contain some data which is not necessary for the instrument.
- The DL1720 is not equipped with channels 3, 4, or Math2.

- **\$PublicInfo (Common Information)**

FormatVersion: Version No. of header file format  
Model: Model name  
Endian: Endian mode (Big/Ltl)<sup>\*1</sup>  
DataFormat: Storage format (Trace / Block) of binary file waveform data<sup>\*2</sup>  
GroupNumber: Number of the \$Group  
TraceTotalNumber: Total number of selected waveforms  
DataOffset: Start position of binary file waveform data<sup>\*3</sup>

- **\$Group1 (Group Information)**

TraceNumber: Number of waveforms in the group  
BlockNumber: Number of blocks in the group<sup>\*4</sup>  
TraceName: Name of each waveform  
BlockSize: Data size of each block of waveform  
VResolution: Resolution coefficient of Y axis conversion equation for each waveform<sup>\*5</sup>  
VOffset: Offset coefficient of Y axis conversion equation for each waveform  
VDataType: Type of binary file waveform data for each waveform<sup>\*6</sup>  
VUnit: Units used for Y axis of each waveform (no effect on data)  
VPlusOverData: Data error occurs when binary data for a waveform exceeds this value.  
VMinusOverData: Data error occurs when binary data for a waveform is below this value.  
VMaxData: Maximum value of binary data for each waveform  
VMinData: Minimum value of binary data for each waveform  
HResolution: Resolution coefficient of X axis conversion equation for each waveform<sup>\*7</sup>  
HOffset: Offset coefficient of X axis conversion equation for each waveform  
HUnit: Units used for X axis for each waveform (no effect on data)  
Date: Date when waveform acquisition was completed  
Time: Time when waveform acquisition was completed  
For \*1 to \*7, refer to the next page.

- **\$PrivateInfo (Information Indigenous to Model)**

ModelVersion: Version No. of the model  
MathBlockNo.: Block No. of block to be computed  
FormMath1: Waveform for Math1 and its contents  
FormMath2: Waveform for Math2 and its contents  
DisplayBlockSize: Length of the data displayed on the screen (display record length)  
DisplayPointNo: Value which indicates which point of the memory is the left end of the display record length (display offset is 1 when record length = display record length)  
PhaseShift: Phase information (lead: -, delay: +)

\* Calculation of the actual display offset of the phase-shifted waveform = DisplayPointNo. - PhaseShift

## Creation of an ASCII Header File

When waveform data (Waveform) is stored on a floppy disk or a Zip disk, the following files will be created automatically in the DL\_WAVE directory.

- Waveform data file (\*.WVF)
- ASCII header file (\*.HDR)

The waveform data file can be recalled to the instrument using the file menu, but the ASCII header file cannot; therefore it cannot be viewed on the instrument. However, it can be used when you analyze the waveform using a personal computer.

### \*1: Endian Mode for Storage

Big: Data for Motorola 68000 series

Ltl: Data for Intel 86 series

### \*2: Binary File Storage Format

Trace: Groups into blocks, each block for a single waveform.

Block: Groups into blocks, each block for a given time interval.

### \*3: Binary File Start Position

Offset from the beginning of the file

### \*4: Maximum Number of Blocks per Group

Maximum number of blocks applies if the number of blocks varies between waveforms.

### \*5: Y Axis Conversion Equation for Each Waveform

Y axis value = VResolution x Raw data + VOffset

### \*6: Data Type

ISn: n-byte signed integer

IUn: n-byte unsigned integer

FSn: n-byte signed real number

FUn: n-byte unsigned real number

Bm: m-byte data

### \*7: X Axis Conversion Equation for Each Waveform

X axis value = HResolution x (Data No. -1) + HOffset

## Appendix 4 List of Defaults

| Menu Key                                     | Soft Key      | Default Setting |
|--|---------------|-----------------|
| <b>CH1 to 4 (or CH1 to 2 for the DL1720)</b> |               |                 |
|  | Display       | ON              |
|  | Position      | 0 div           |
|  | Cupling       | DC 1 MΩ         |
|  | Probe         | 10:1            |
|  | Offset        | 0V              |
|  | Band Width    | Full            |
|  | Variable      | 50 V            |
|  | Linear Scale  | OFF             |
|  | Label         | CH1 ....CH4     |
| <b>V/div</b>                                 |               |                 |
|  |               | 50 V            |
| <b>T/div</b>                                 |               |                 |
|  |               | 1 ms/div        |
| <b>PRESET</b>                                |               |                 |
|  | Select        | All             |
|  | Type          | TTL             |
|  | Prove         | 10 : 1          |
| <b>ACQ</b>                                   |               |                 |
|  | Record Length | 10 k            |
|  | Mode          | Normal          |
|  | Count         | Infinite        |
|  | Repetitive    | OFF             |
|  | Interleave    | OFF             |
|  | Time Base     | Int             |
| <b>TRIGGER</b>                               |               |                 |
|  | SIMPLE        |                 |
|  | Source        | CH1             |
|  | Level         | 0V              |
|  | Slope         | Rise            |
|  | Coupling      | DC              |
|  | HF Rejection  | OFF             |
|  | Hysteresis    | $\nabla$        |
|  | Hold Off      | 0.08 μs         |
| <b>HISTORY</b>                               |               |                 |
|  | Select Record | 0               |
|  | Display Mode  | One             |
|  | Start Record  | 0               |
|  | End Record    | latest          |
|  | Show Map No.  | 1               |
|  | Search Mode   | OFF             |
| <b>FILE</b>                                  |               |                 |
|  | File Item     | Set up          |
|  | File Name     |                 |
|  | Auto Naming   | ON              |
| <b>COPY(MENU)</b>                            |               |                 |
|  | Copy to       | Built-in        |
|  | Format        | Normal          |
|  | Information   | OFF             |
| <b>IMAGE SAVE (MENU)</b>                     |               |                 |
|  | Format        | TIFF            |
|  | Color         | OFF             |
|  | File Name     |                 |
|  | Auto Naming   | ON              |

| Menu Key        | Soft Key   | Default Setting               |
|-----------------|--|-------------------------------|
| <b>MEASURE</b>  |  |                               |
|                 | Mode   | OFF                           |
|                 | Item Setup   |                               |
|                 | Source   | CH1                           |
|                 | Item   | OFF                           |
|                 | Dual Area  | OFF                           |
|                 | Delay Setup  |                               |
|                 | Source   | CH1                           |
|                 | Mode   | OFF                           |
|                 | 1 cycle mode                                       | OFF                           |
|                 | Time Range 1                                       | -5 div                        |
|                 | Time Range 2                                       | 5 div                         |
|                 | Trace  | CH1                           |
|                 | Distal   | 90%                           |
|                 | Mesial   | 50%                           |
|                 | Proximal   | 10%                           |
|                 | High/Low Mode                                      | AUTO                          |
| <b>CURSOR</b>   |  |                               |
|                 | Type   | OFF                           |
| <b>MATH</b>     |  |                               |
|                 | <b>The DL1720 is not equipped with M2 (Math2).</b> |                               |
|                 | M1 Display   | OFF                           |
|                 | M1 Setup   | C1+C2                         |
|                 | M1 Label   | Math1                         |
|                 | M2 Display   | OFF                           |
|                 | M2 Setup   | C3+C4                         |
|                 | M2 Label   | Math2                         |
| <b>DISPLAY</b>  |  |                               |
|                 | Format   | Quad (or Dual for the DL1720) |
|                 | Interpolation                                      | Sin                           |
|                 | Graticule  | Grid                          |
|                 | Mapping  | Auto                          |
|                 | Translucent  | OFF                           |
|                 | Scale Value  | OFF                           |
|                 | Trace Label  | OFF                           |
|                 | Accumulate   | OFF                           |
| <b>ZOOM</b>     |  |                               |
|                 | Mode   | Main                          |
| <b>POSITON</b>  |  |                               |
|                 | Position   | 50%                           |
| <b>DELAY</b>    |  |                               |
|                 | Delay  | 0 S                           |
| <b>GO/NO-GO</b> |  |                               |
|                 | Mode   | OFF                           |
| <b>SEARCH</b>   |  |                               |
|                 | Type   | Edge                          |
|                 | Z1 Mag   | ×2                            |
|                 | Z position   | 0 div                         |
| <b>ACTION</b>   |  |                               |
|                 | Buzzer   | OFF                           |
|                 | Save to File                                       | OFF                           |
|                 | Hard Copy  | OFF                           |
|                 | Image Save   | OFF                           |
|                 | ACQ Count  | Infinite                      |
|                 | Send Mail  | OFF                           |
|                 | Mail Count   | 100                           |

# Appendix 5 Assignment of Keys on the USB Keyboard

## 104 Keyboard (US)

| Key        | When Pressed with the Control Key |                  | When the Soft Keyboard Is Displayed |                  | Other |                  |
|------------|-----------------------------------|------------------|-------------------------------------|------------------|-------|------------------|
|            |                                   | +Shift Operation |                                     | +Shift Operation |       | +Shift Operation |
| a          | ACQ menu                          | Same as left     | a                                   | A                |       |                  |
| b          | MATH menu                         | Same as left     | b                                   | B                |       |                  |
| c          | COPY                              | Same as left     | c                                   | C                |       |                  |
| d          | DISPLAY menu                      | Same as left     | d                                   | D                |       |                  |
| e          | ENHANCED menu                     | Same as left     | e                                   | E                |       |                  |
| f          | FILE menu                         | Same as left     | f                                   | F                |       |                  |
| g          | GO/NOGO menu                      | Same as left     | g                                   | G                |       |                  |
| h          | HISTORY menu                      | Same as left     | h                                   | H                |       |                  |
| i          | IMAGE SAVE menu                   | Same as left     | i                                   | I                |       |                  |
| j          | PRESET menu                       | Same as left     | j                                   | J                |       |                  |
| k          |                                   |                  | k                                   | K                |       |                  |
| l          |                                   |                  | l                                   | L                |       |                  |
| m          | MEASURE menu                      | Same as left     | m                                   | M                |       |                  |
| n          |                                   |                  | n                                   | N                |       |                  |
| o          |                                   |                  | o                                   | O                |       |                  |
| p          | POSITION menu                     | Same as left     | p                                   | P                |       |                  |
| q          | CLEAR TRACE                       | Same as left     | q                                   | Q                |       |                  |
| r          | RESET                             | Same as left     | r                                   | R                |       |                  |
| s          | SHIFT condition                   | Same as left     | s                                   | S                |       |                  |
| t          | TRIGMODE menu                     | Same as left     | t                                   | T                |       |                  |
| u          | CURSOR menu                       | Same as left     | u                                   | U                |       |                  |
| v          |                                   |                  | v                                   | V                |       |                  |
| w          | SIMPLE menu                       | Same as left     | w                                   | W                |       |                  |
| x          |                                   |                  | x                                   | X                |       |                  |
| y          |                                   |                  | y                                   | Y                |       |                  |
| z          | ZOOM menu                         | Same as left     | z                                   | Z                |       |                  |
| 1          | CH1 menu                          |                  | 1                                   | !                |       |                  |
| 2          | CH2 menu                          |                  | 2                                   | @                |       |                  |
| 3          | CH3 menu                          |                  | 3                                   | #                |       |                  |
| 4          | CH4 menu                          |                  | 4                                   | \$               |       |                  |
| 5          |                                   |                  | 5                                   | %                |       |                  |
| 6          |                                   |                  | 6                                   | ^                |       |                  |
| 7          |                                   |                  | 7                                   | &                |       |                  |
| 8          |                                   |                  | 8                                   | *                |       |                  |
| 9          |                                   |                  | 9                                   | (                |       |                  |
| 0          |                                   |                  | 0                                   | )                |       |                  |
| Enter      | Return (Enter), Select            | Same as left     | Return (Enter)                      | Same as left     |       |                  |
| Esc        | Escape                            | Same as left     | Escape                              | Same as left     |       |                  |
| Back Space |                                   |                  | Back Space                          | Same as left     |       |                  |
| Tab        |                                   |                  |                                     |                  |       |                  |
| Space Bar  |                                   |                  | Space Bar                           | Same as left     |       |                  |
| -          |                                   |                  | -                                   | _                |       |                  |
| =          |                                   |                  | =                                   | +                |       |                  |
| [          |                                   |                  | [                                   | {                |       |                  |
| ]          |                                   |                  | ]                                   | }                |       |                  |
| \          | SETUP                             | Same as left     | \                                   |                  |       |                  |
| ;          |                                   |                  | ;                                   | :                |       |                  |
| '          |                                   |                  | '                                   | "                |       |                  |
| ,          |                                   |                  | ,                                   | <                |       |                  |
| .          |                                   |                  | .                                   | >                |       |                  |
| /          | MISC menu                         | HELP             | /                                   | ?                |       |                  |
| Caps Lock  |                                   |                  | Caps Lock                           | Same as left     |       |                  |

## Appendix 5 Assignment of Keys on the USB Keyboard

|              |                     |                     |                     |              |                       |                     |
|--------------|---------------------|---------------------|---------------------|--------------|-----------------------|---------------------|
| F1           | Select Soft key1    | Same as left        | Select Soft key1    | Same as left | Select Soft key1      | Same as left        |
| F2           | Select Soft key2    | Same as left        | Select Soft key2    | Same as left | Select Soft key2      | Same as left        |
| F3           | Select Soft key3    | Same as left        | Select Soft key3    | Same as left | Select Soft key3      | Same as left        |
| F4           | Select Soft key4    | Same as left        | Select Soft key4    | Same as left | Select Soft key4      | Same as left        |
| F5           | Select Soft key5    | Same as left        | Select Soft key5    | Same as left | Select Soft key5      | Same as left        |
| F6           | Select Soft key6    | Same as left        | Select Soft key6    | Same as left | Select Soft key6      | Same as left        |
| F7           | Select Soft key7    | Same as left        | Select Soft key7    | Same as left | Select Soft key7      | Same as left        |
| F8           | Escape              | Same as left        | Escape              | Same as left | Escape                | Same as left        |
| F9           |                     |                     |                     |              |                       |                     |
| F10          |                     |                     |                     |              |                       |                     |
| F11          |                     |                     | μ                   | Same as left |                       |                     |
| F12          | START/STOP          | Same as left        | Ω                   | Same as left | START/STOP            | Same as left        |
| Print Screen | COPY                | Same as left        |                     |              |                       |                     |
| Scroll Lock  | IMAGE SAVE          | Same as left        |                     |              |                       |                     |
| Pause        | SNAPSHOT            | Same as left        |                     |              |                       |                     |
| Insert       |                     |                     | Insert mode         | Same as left |                       |                     |
| Home         | Increment V/Div     | Same as left        |                     |              | Increment V/Div       | Same as left        |
| Page Up      | Increment T/Div     | Same as left        |                     |              | Increment T/Div       | Same as left        |
| Delete       |                     |                     | Delete              | Same as left |                       |                     |
| End          | Decrement V/Div     | Same as left        |                     |              | Decrement V/Div       | Same as left        |
| Page Down    | Decrement T/Div     | Same as left        |                     |              | Decrement T/Div       | Same as left        |
| →            | Cursor to the right | Same as left        | Cursor to the right | Same as left | Cursor to the right   | Same as left        |
| ←            | Cursor to the left  | Same as left        | Cursor to the left  | Same as left | Cursor to the left    | Same as left        |
| ↓            | Jogshuttle down     | Same as left        | Select Soft key6    | Same as left | Jogshuttle down       | Same as left        |
| ↑            | Jogshuttle up       | Same as left        | Select Soft key6    | Same as left | Jogshuttle up         | Same as left        |
| Numeric      |                     |                     |                     |              |                       |                     |
| Num Lock     |                     |                     |                     |              |                       |                     |
| /            |                     |                     | /                   | Same as left |                       |                     |
| *            | START/STOP          | Same as left        | *                   | Same as left | START/STOP            | Same as left        |
| -            |                     |                     | -                   | Same as left |                       |                     |
| +            |                     |                     | +                   | Same as left |                       |                     |
| Enter        |                     |                     | Return (Enter)      | Same as left | Return (Enter),Select | Same as left        |
| 1            | CH1 menu            | Decrement V/Div     | 1                   |              |                       | Decrement V/Div     |
| 2            | CH2 menu            | Jogshuttle down     | 2                   |              |                       | Jogshuttle down     |
| 3            | CH3 menu            | Decrement T/Div     | 3                   |              |                       | Decrement T/Div     |
| 4            | CH4 menu            | Cursor to the left  | 4                   |              |                       | Cursor to the left  |
| 5            |                     |                     | 5                   |              |                       |                     |
| 6            |                     | Cursor to the right | 6                   |              |                       | Cursor to the right |
| 7            |                     | Increment V/Div     | 7                   |              |                       | Increment V/Div     |
| 8            |                     | Jogshuttle up       | 8                   |              |                       | Jogshuttle up       |
| 9            |                     | Increment T/Div     | 9                   |              |                       | Increment T/Div     |
| 0            |                     |                     | 0                   | Insert mode  |                       |                     |
| .            |                     |                     | .                   | DELETE       |                       |                     |



109 Keyboard (Japanese)

| Key        | When Pressed with the Control Key |                  | When the Soft Keyboard Is Displayed |                  | Other |                  |
|------------|-----------------------------------|------------------|-------------------------------------|------------------|-------|------------------|
|            |                                   | +Shift Operation |                                     | +Shift Operation |       | +Shift Operation |
| a          | ACQ menu                          | Same as left     | a                                   | A                |       |                  |
| b          | MATH menu                         | Same as left     | b                                   | B                |       |                  |
| c          | COPY                              | Same as left     | c                                   | C                |       |                  |
| d          | DISPLAY menu                      | Same as left     | d                                   | D                |       |                  |
| e          | ENHANCED menu                     | Same as left     | e                                   | E                |       |                  |
| f          | FILE menu                         | Same as left     | f                                   | F                |       |                  |
| g          | GO/NOGO menu                      | Same as left     | g                                   | G                |       |                  |
| h          | HISTORY menu                      | Same as left     | h                                   | H                |       |                  |
| i          | IMAGE SAVE menu                   | Same as left     | i                                   | I                |       |                  |
| j          | PRESET menu                       | Same as left     | j                                   | J                |       |                  |
| k          |                                   |                  | k                                   | K                |       |                  |
| l          |                                   |                  | l                                   | L                |       |                  |
| m          | MEASURE menu                      | Same as left     | m                                   | M                |       |                  |
| n          |                                   |                  | n                                   | N                |       |                  |
| o          |                                   |                  | o                                   | O                |       |                  |
| p          | POSITION menu                     | Same as left     | p                                   | P                |       |                  |
| q          | CLEAR TRACE                       | Same as left     | q                                   | Q                |       |                  |
| r          | RESET                             | Same as left     | r                                   | R                |       |                  |
| s          | SHIFT condition                   | Same as left     | s                                   | S                |       |                  |
| t          | TRIGMODE menu                     | Same as left     | t                                   | T                |       |                  |
| u          | CURSOR menu                       | Same as left     | u                                   | U                |       |                  |
| v          |                                   |                  | v                                   | V                |       |                  |
| w          | SIMPLE menu                       | Same as left     | w                                   | W                |       |                  |
| x          |                                   |                  | x                                   | X                |       |                  |
| y          |                                   |                  | y                                   | Y                |       |                  |
| z          | ZOOM menu                         | Same as left     | z                                   | Z                |       |                  |
| 1          | CH1 menu                          |                  | 1                                   | !                |       |                  |
| 2          | CH2 menu                          |                  | 2                                   | "                |       |                  |
| 3          | CH3 menu                          |                  | 3                                   | #                |       |                  |
| 4          | CH4 menu                          |                  | 4                                   | \$               |       |                  |
| 5          |                                   |                  | 5                                   | %                |       |                  |
| 6          |                                   |                  | 6                                   | &                |       |                  |
| 7          |                                   |                  | 7                                   | '                |       |                  |
| 8          |                                   |                  | 8                                   | (                |       |                  |
| 9          |                                   |                  | 9                                   | )                |       |                  |
| 0          |                                   |                  | 0                                   |                  |       |                  |
| Enter      | Return (Enter), Select            | Same as left     | Return (Enter)                      | Same as left     |       |                  |
| Esc        | Escape                            | Same as left     | Escape                              | Same as left     |       |                  |
| Back Space |                                   |                  | Back Space                          | Same as left     |       |                  |
| Tab        |                                   |                  |                                     |                  |       |                  |
| Space Bar  |                                   |                  | Space Bar                           | Same as left     |       |                  |
| -          |                                   |                  | -                                   | =                |       |                  |
| ^          |                                   |                  | ^                                   | ~                |       |                  |
| @          |                                   |                  | @                                   | '                |       |                  |
| [          |                                   |                  | [                                   | {                |       |                  |
| ;          |                                   |                  | ;                                   | +                |       |                  |
| :          |                                   |                  | :                                   | *                |       |                  |
| ]          |                                   |                  | ]                                   | }                |       |                  |
| ,          |                                   |                  | ,                                   | <                |       |                  |
| .          |                                   |                  | .                                   | >                |       |                  |
| /          | MISC menu                         | HELP             | /                                   | ?                |       |                  |
| Caps Lock  |                                   |                  | Caps Lock                           | Same as left     |       |                  |

## Appendix 5 Assignment of Keys on the USB Keyboard

|              |                     |                     |                     |              |                        |                     |
|--------------|---------------------|---------------------|---------------------|--------------|------------------------|---------------------|
| F1           | Select Soft key1    | Same as left        | Select Soft key1    | Same as left | Select Soft key1       | Same as left        |
| F2           | Select Soft key2    | Same as left        | Select Soft key2    | Same as left | Select Soft key2       | Same as left        |
| F3           | Select Soft key3    | Same as left        | Select Soft key3    | Same as left | Select Soft key3       | Same as left        |
| F4           | Select Soft key4    | Same as left        | Select Soft key4    | Same as left | Select Soft key4       | Same as left        |
| F5           | Select Soft key5    | Same as left        | Select Soft key5    | Same as left | Select Soft key5       | Same as left        |
| F6           | Select Soft key6    | Same as left        | Select Soft key6    | Same as left | Select Soft key6       | Same as left        |
| F7           | Select Soft key7    | Same as left        | Select Soft key7    | Same as left | Select Soft key7       | Same as left        |
| F8           | Escape              | Same as left        | Escape              | Same as left | Escape                 | Same as left        |
| F9           |                     |                     |                     |              |                        |                     |
| F10          |                     |                     |                     |              |                        |                     |
| F11          |                     |                     | μ                   | Same as left |                        |                     |
| F12          | START/STOP          | Same as left        | Ω                   | Same as left | START/STOP             | Same as left        |
| Print Screen | COPY                | Same as left        |                     |              |                        |                     |
| Scroll Lock  | IMAGE SAVE          | Same as left        |                     |              |                        |                     |
| Pause        | SNAPSHOT            | Same as left        |                     |              |                        |                     |
| Insert       |                     |                     | Insert mode         | Same as left |                        |                     |
| Home         | Increment V/Div     | Same as left        |                     |              | Increment V/Div        | Same as left        |
| Page Up      | Increment T/Div     | Same as left        |                     |              | Increment T/Div        | Same as left        |
| Delete       |                     |                     | Delete              | Same as left |                        |                     |
| End          | Decrement V/Div     | Same as left        |                     |              | Decrement V/Div        | Same as left        |
| Page Down    | Decrement T/Div     | Same as left        |                     |              | Decrement T/Div        | Same as left        |
| →            | Cursor to the right | Same as left        | Cursor to the right | Same as left | Cursor to the right    | Same as left        |
| ←            | Cursor to the left  | Same as left        | Cursor to the left  | Same as left | Cursor to the left     | Same as left        |
| ↓            | Jogshuttle down     | Same as left        | Select Soft key6    | Same as left | Jogshuttle down        | Same as left        |
| ↑            | Jogshuttle up       | Same as left        | Select Soft key6    | Same as left | Jogshuttle up          | Same as left        |
| \            | SETUP menu          | Same as left        | \                   |              |                        |                     |
| \            |                     |                     | \                   | -            |                        |                     |
| Numeric key  |                     |                     |                     |              |                        |                     |
| Num Lock     |                     |                     |                     |              |                        |                     |
| /            |                     |                     | /                   | Same as left |                        |                     |
| *            | START/STOP          | Same as left        | *                   | Same as left | START/STOP             | Same as left        |
| -            |                     |                     | -                   | Same as left |                        |                     |
| +            |                     |                     | +                   | Same as left |                        |                     |
| Enter        |                     |                     | Return (Enter)      | Same as left | Return (Enter), Select | Same as left        |
| 1            | CH1 menu            | Decrement V/Div     | 1                   |              |                        | Decrement V/Div     |
| 2            | CH2 menu            | Jogshuttle down     | 2                   |              |                        | Jogshuttle down     |
| 3            | CH3 menu            | Decrement T/Div     | 3                   |              |                        | Decrement T/Div     |
| 4            | CH4 menu            | Cursor to the left  | 4                   |              |                        | Cursor to the left  |
| 5            |                     |                     | 5                   |              |                        |                     |
| 6            |                     | Cursor to the right | 6                   |              |                        | Cursor to the right |
| 7            |                     | Increment V/Div     | 7                   |              |                        | Increment V/Div     |
| 8            |                     | Jogshuttle up       | 8                   |              |                        | Jogshuttle up       |
| 9            |                     | Increment T/Div     | 9                   |              |                        | Increment T/Div     |
| 0            |                     |                     | 0                   | Insert mode  |                        |                     |
| .            |                     | DELETE prev. char   | .                   | DELETE       |                        |                     |

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## Symbols

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