DLM2000 Series
Mixed Signal Oscilloscope
USER'S MANUAL

YOKOGAWA
Yokogawa Electric Corporation

IM 710105-02E
1st Edition

Foreword

Thank you for purchasing the DLM2000 Series Mixed Signal Oscilloscope. This User's Manual explains how to use the DLM2000. To ensure correct use, please read this manual thoroughly before beginning operation.
Keep this manual in a safe place for quick reference in the event a question arises. The following manuals, including this one, are provided as manuals for the DLM2000. Please read all manuals.

Manual Title	Manual No.	Description
DLM2000 Series Mixed Signal Oscilloscope Features Guide	IM 710105-01E	The supplied CD contains the PDF file of this manual. The manual explains the DLM2000 features.
DLM2000 Series Mixed Signal Oscilloscope User's Manual	IM 710105-02E	This manual. The supplied CD contains the PDF file of this manual. The manual explains how to operate the DLM2000.
DLM2000 Series Mixed Signal Oscilloscope Operation Guide	IM 710105-03E	This guide explains the handling precautions and basic operations of the DLM2000.
DLM2000 Series Mixed Signal Oscilloscope Communication Interface User's Manual	IM 710105-17E	The supplied CD contains the PDF file of this manual. The manual explains the DLM2000 series communication interface features and instructions on how to use them.

Notes

- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functionality. The figures given in this manual may differ from those that actually appear 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 dealer.
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Revisions

- 1st Edition: November 2008

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DLM Models and Conventions Used in This Manual

Models Explained

This manual explains the DLM2000 series 4-channel models. Channel settings vary depending on the model.

Notes and Cautions

The notes and cautions in this manual are categorized using the following symbols.

Improper handling or use can lead to injury to the user or damage to the instrument. This symbol appears on the instrument to indicate that the user must refer to the user's manual for special instructions. The same symbol appears in the corresponding place in the user's manual to identify those instructions. In the manual, the symbol is used in conjunction with the word "WARNING" or "CAUTION."

WARNING Calls attention to actions or conditions that could cause serious or fatal injury to the user, and precautions that can be taken to prevent such occurrences.

CAUTION Calls attention to actions or conditions that could cause light injury to the user, or cause damage to the instrument or user's data, and precautions that can be taken to prevent such occurrences.

Note Calls attention to information that is important for proper operation of the instrument.

Unit

k	Denotes 1000. Example: 100 kS/s (sample rate)
K	Denotes 1024. Example: 720 KB (file size)

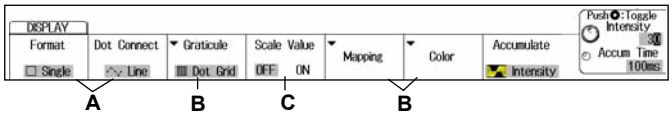
Key and Jog Shuttle Operations

Key Operations

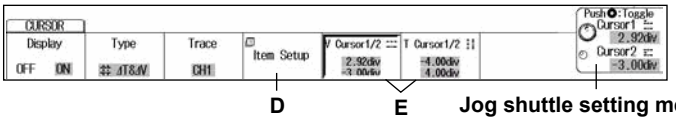
How to Use Setup Menus That Appear When Keys Are Pressed

The operation after you press a key varies depending on the key that you press.

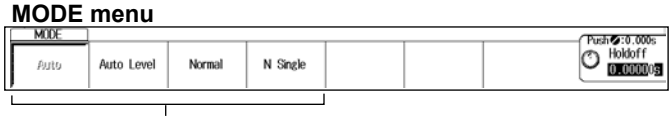
DISPLAY menu



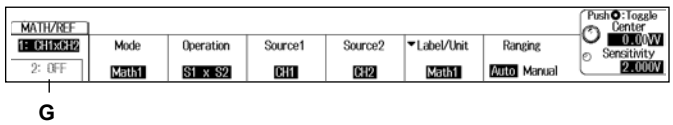
CURSOR menu



MODE menu



MATH/REF menu



A: A selection menu appears when you press the soft key.
Press the soft key that corresponds to the appropriate setting.

B: A related setup menu appears when you press the soft key.

C: The selected setting switches each time you press the soft key.

D: Displays a dialog box or a keyboard.
Use the jog shuttle and the select key to set values.

E: Pressing the soft key selects the item that you can control using the jog shuttle.
The jog shuttle setup menu, which appears at the right end of the setup menu, shows the selected item. Use the select key to move between digits and set the number.

F: Pressing a key sets the item to the setting that corresponds to that key.

G: Selects which item to configure when configuring a feature that consists of two items that operate with different settings, such as the MATH1 and MATH2 computation features.

How to Display the Setup Menus That Are Written in Purple below the Keys

In the explanations in this manual, “SHIFT+key name (written in purple)” is used to indicate the following operation.

1. Press the **SHIFT** key. The SHIFT key illuminates to indicate that the keys are shifted.
   Now you can select the setup menus written in purple below the keys.
2. Press the key that you want to display the setup menu of.

ESC key operation

If you press the ESC key when a setup menu or available settings are displayed, the screen returns to the menu level above the current one. If you press the ESC key when the highest level menu is displayed, the setup menu disappears. However, the jog shuttle setup menu remains displayed. If you press the ESC key again, the jog shuttle setup menu disappears.

Entering Values Using the Reset (⊘) and Select (O) Keys

When you use the jog shuttle to set a value, the jog shuttle setup menu shows a reset key mark or a select key mark.

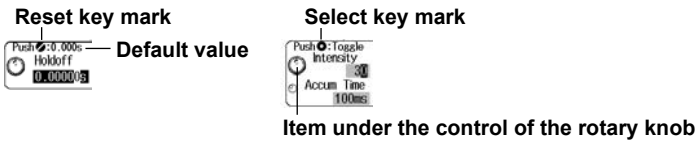
Reset Key Mark

If the reset key mark is displayed, you can press the reset key to reset the value to its default value. (The value may not return to its default value depending on the DLM2000 condition.) The default value is displayed next to the reset key mark.

Select Key Mark

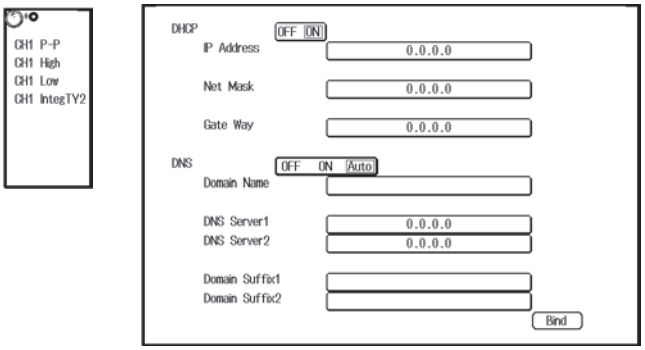
If there are two values that you need to set, the select key mark appears. Press the select key to select which value you want to set using the jog shuttle. The jog shuttle mark in front of the selected value is enlarged.

Like when the reset key mark is displayed, you can press the reset key to reset the value to its default value.



How to Enter Values in Setup Dialog Boxes

1. Use the keys to display the appropriate setup dialog box.
2. Use the **jog shuttle** or the **select** key (O) to move the cursor to the appropriate item.
3. Press the **select** key (O). The operation varies depending on the selected item.
   - A setup menu appears.
   - A check box is selected or cleared.
   - The item at the cursor is selected.



How to Clear Setup Dialog Boxes

Press the **ESC** key to clear the active setup dialog box.

Entering Values and Strings

Entering Values

Using Dedicated Knobs

You can use the following dedicated knobs to enter values directly.

- POSITION knobs (VERTICAL and HORIZONTAL)
- SCALE knob (VERTICAL)
- TIME/DIV knob
- LEVEL knob (TRIGGER)
- ZOOM magnification knob

Using the Jog Shuttle

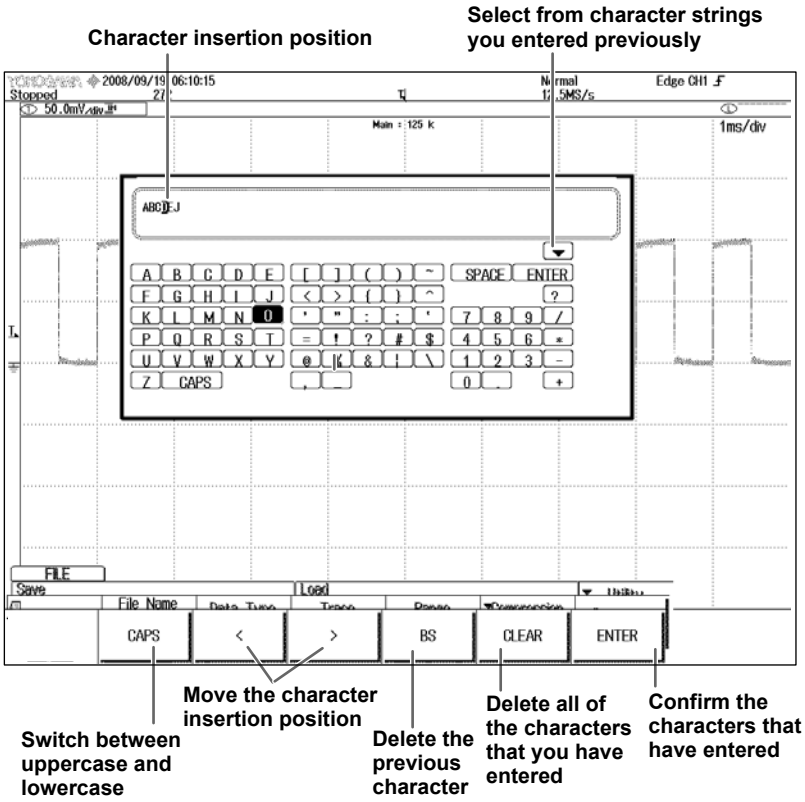
Select the appropriate item using soft keys, and change the value using the jog shuttle and the select key. This manual sometimes describes this operation simply as “using the jog shuttle.”

Note

Some items that you can set using the jog shuttle can be reset to their default values when you press the reset key.

Entering Character Strings

Use the keyboard that appears on the screen to enter file names and comments. Use the jog shuttle and the select key to control the keyboard and enter characters.



How to Operate the Keyboard

1. After bringing up the keyboard, use the jog shuttle to move the cursor to the character that you want to enter. You can also move the **select** key up, down, left, and right to move the cursor.
2. Press the **select** key to enter the selected character.
   - If a character string is already entered, use the arrow soft keys to move the cursor to the position you want to insert characters into.
   - Use the CAPS soft key to switch between uppercase and lowercase.
   - Use the BS soft key to delete the previous character.
   - Use the CLEAR soft key to clear all the entered characters.
3. Repeat steps 1 and 2 to enter all of the characters in the string.
   Select ▼ on the keyboard to display a list of character strings that you have entered previously. Use the **jog shuttle** to select a character string and press the **select** key to enter the selected character string.
4. Move the cursor to ENTER on the keyboard and press the **select** key straight down or press the **ENTER** soft key to confirm the character string and clear the keyboard.

Note

- @ cannot be entered consecutively.
- File names are not case-sensitive. Comments are case-sensitive. The following file names cannot be used due to MS-DOS limitations:
  AUX, CON, PRN, NUL, CLOCK, COM1 to COM9, and LPT1 to LPT9

Contents

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Chapter 16 Saving and Loading Data

Chapter 17 Ethernet Interface (Optional)

Chapter 18 Rear Panel Input and Output

Chapter 19 Other Operations

Chapter 20 Troubleshooting, Maintenance, and Inspection

Appendix

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1.1 Setting the Vertical Axis (Analog Signal)

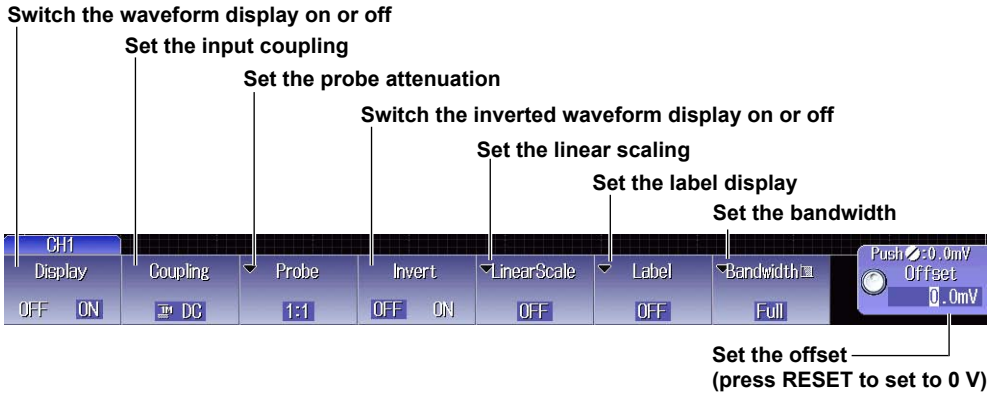
This section explains the following settings (which are related to the vertical axis for analog signals):

- Waveform display on and off
- Input coupling
- Probe attenuation
- Inverted waveform display on and off
- Linear scaling
- Label display
- Bandwidth
- Offset
- Offset cancel on and off (UTILITY menu)
- Vertical scale
- Vertical position

► "Vertical Axis (Analog Signal)" in the Features Guide.

CH Menu

Press a key from **CH1** to **CH4** to display the following menu.



Note

- Channel keys (CH1 to CH4) whose waveforms are displayed are illuminated. You can press channel keys that are not illuminated to turn the waveform display on. You can press channel keys that are illuminated turn the waveform display off.
- When interleave mode (see section 3.1 for details) is on, you cannot display the waveforms for CH2 and CH4.

Setting the Input Coupling (Coupling)

AC: Only displays the waveform produced from the input signal's AC component.

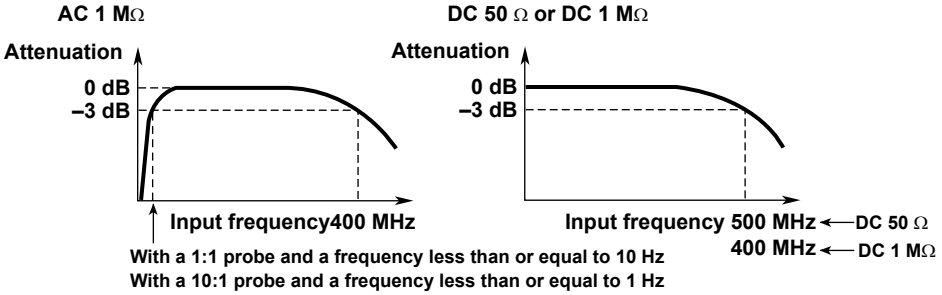
DC Displays the waveform produced from both the DC and AC components of the input signal through 1 MΩ.

DC50: Displays the waveform produced from both the DC and AC components of the input signal through 50 Ω.

GND: Displays the ground level.

Input Coupling Settings and Frequency Response

The frequency response when the DLM2000 is set to AC, DC, or DC50 is shown below.
Please note that when set to AC, the DLM2000 does not acquire low frequency signals or low frequency components, as seen in the following figure.

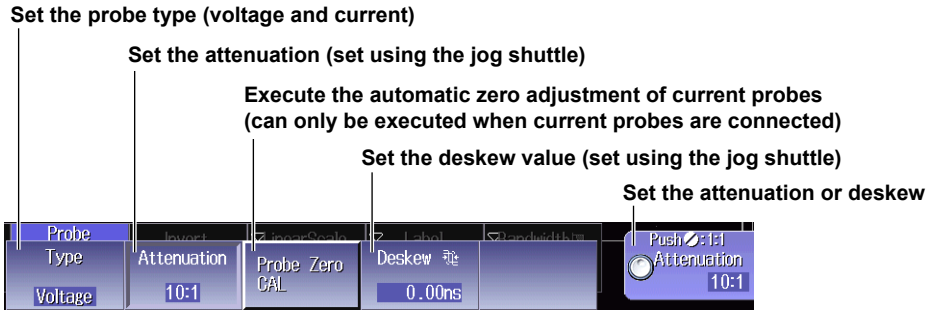


CAUTION

- The maximum input voltage for 1 MΩ input is 150 Vrms when the frequency is less than or equal to 1 kHz. Applying a greater voltage may damage the input section. For frequencies above 1 kHz, damage may occur even if the voltage is less than 150 Vrms.
- The maximum input voltage for 50 Ω input is 5 Vrms or 10 Vpeak. Applying voltage greater than either of these limits may damage the input section.

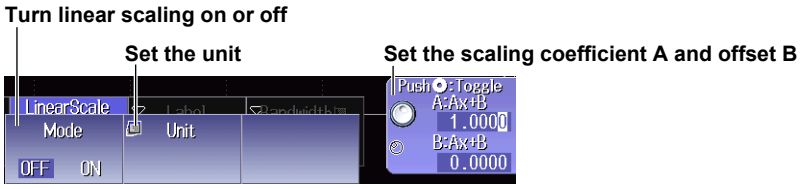
Setting the Probe Attenuation (Probe)

Press the **Probe** soft key to display the following menu.



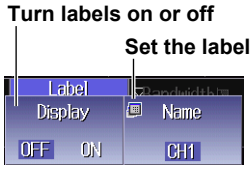
Setting the Linear Scaling (Linear Scale)

Press the **Linear Scale** soft key to display the following menu.



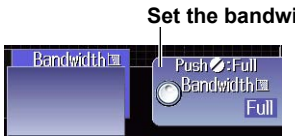
Setting the Label Display (Label)

Press the **Label** soft key to display the following menu.



Setting the Bandwidth

Press the **Bandwidth** soft key. The jog shuttle now controls the Bandwidth setting.



UTILITY Preference Menu

Press **UTILITY**, and then press the **Preference** soft key to display the following menu.

Turning Offset Cancel On or Off (Offset Cancel)

ON: The offset is subtracted from the input signal when cursor measurements, computations, and other operations are performed.

OFF: The offset is not subtracted from the input signal when cursor measurements, computations, and other operations are performed.

Setting the Vertical Scale (SCALE)

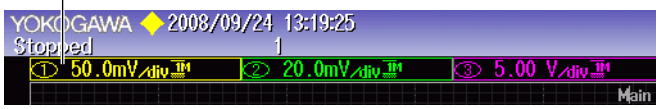
Press one of the keys from **CH1** to **CH4** to select the channel that you want to set the vertical scale for.

The LED between the SCALE and POSITION knobs illuminates in the color assigned to the selected channel (yellow, green, magenta, or cyan).

Turn the **SCALE** knob to set the vertical scale.

If you push the SCALE knob, the FINE indicator illuminates, and you can set the vertical scale with higher resolution.

Display the vertical scale and input impedance for each channel



Setting the Waveform Vertical Position (POSITION)

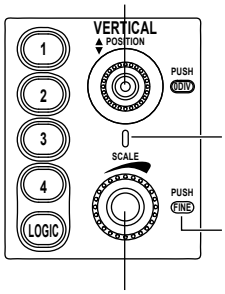
Press one of the keys from **CH1** to **CH4** to select the channel that you want to set the vertical position for.

The LED between the SCALE and POSITION knobs illuminates in the color assigned to the selected channel (yellow, green, magenta, or cyan).

Turn the **POSITION** knob to set the vertical position.

You can set the vertical position to 0 V by pressing the knob.

POSITION knob



Illuminates in the color assigned to the selected channel

When the FINE indicator is illuminated, you can set the vertical position with higher resolution. (Press the push knob to turn off the FINE indicator)

SCALE knob

Note

Preview

- If you change the vertical scale when waveform acquisition is stopped, the waveform is displayed expanded or reduced vertically.
- If you change the vertical position when waveform acquisition is stopped, only the waveform display position changes.

1.2 Setting the Vertical Axis (Logic Signal)

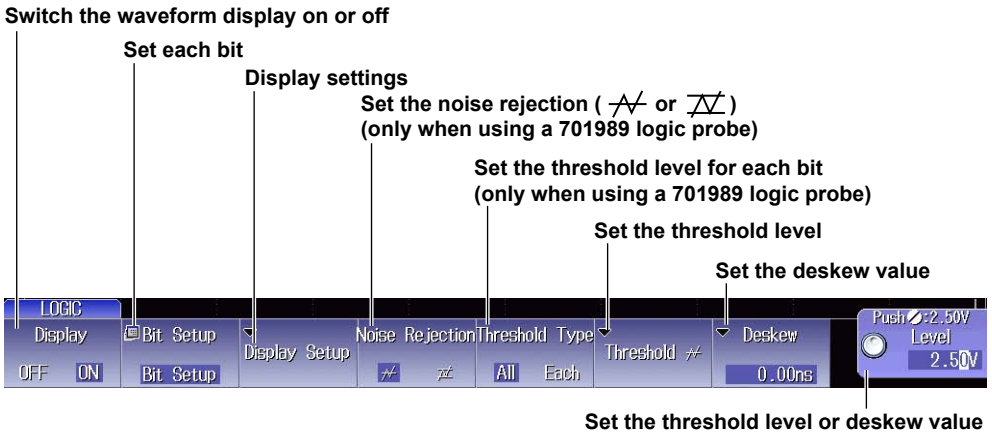
This section explains the following settings (which are related to the vertical axis for logic signals):

- Display on and off, label name, and threshold level for each bit
- Bus display, format, and bit order
- Noise rejection
- Threshold level
- Deskew

► "Vertical Axis (Logic Signal)" in the Features Guide.

LOGIC Menu

Press **LOGIC** to display the following menu.



Note

- If the LOGIC key is not illuminated, you can press it to turn the waveform display on. Logic signal waveforms are displayed in the CH4 waveform display area.
- If the LOGIC key is illuminated, you can press it to turn the waveform display off.

Setting the Bits (Bit Setup)

Press the **Bit Setup** soft key to display the following screen.

Configuring the Display (Display Setup)

Bundle: Set this to ON or OFF to show or not show the bus display, respectively.
Format: Specify Hex (hexadecimal) or Bin (binary) for the bus display format.
Bit Order: Specify the bit order for the bus display.

Setting the Threshold Level for Each Bit (Threshold Type)

When using a 701989 logic probe, you can select whether or not to set the threshold level for each bit.

All: Specify that all bits have a common threshold level.
Each: Specify that the threshold level for each bit will be set individually.

Note

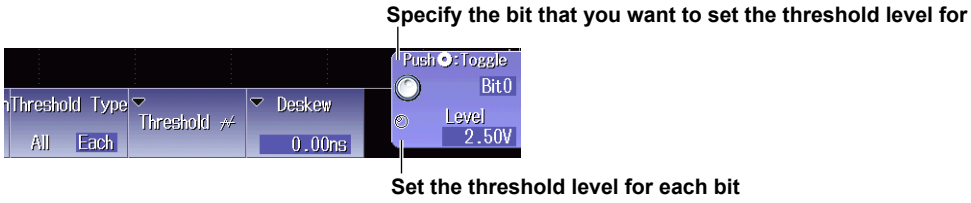
For models 701980, 701981, and 701988, Threshold Type is fixed to All.

Setting the Threshold Level (Threshold)

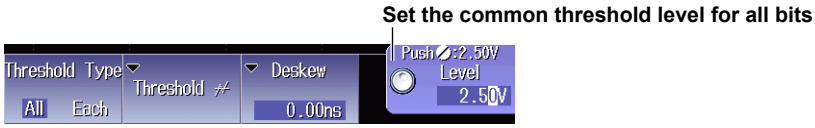
You can select the threshold level from one of the following presets. You can also use the jog shuttle to change the threshold level.
CMOS(5 V), CMOS(3.3 V), CMOS(2.5 V), CMOS(1.8 V), and ECL

Depending on the probe you are using and the Threshold Type, the setup menu differs as follows.

When Using a 701989 Logic Probe with Threshold Type Set to Each



When Using a 701989 Logic Probe with Threshold Type Set to All and Other Logic Probes



Deskew (Deskew)

Set the adjustment values for the time offsets (skew) between the logic signal and other signals, which are caused by the use of different types of probes. Deskewing is performed on all eight bits collectively.

Setting the Display Size (SCALE)

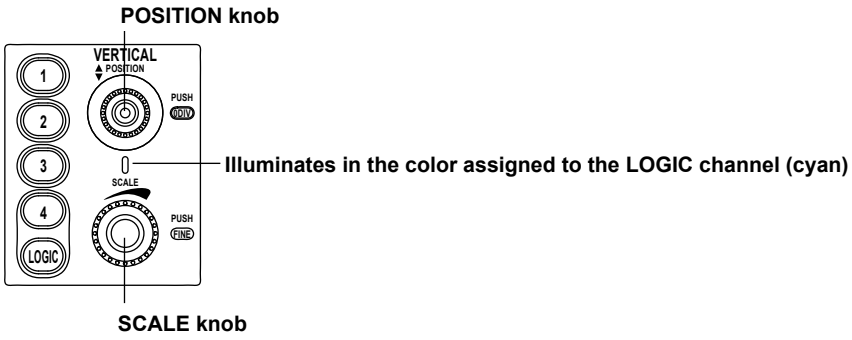
Press **LOGIC**, the SCALE knob now controls the LOGIC setting.

Turn the **SCALE** knob to set the display size.

Setting the Vertical Position (POSITION)

Press **LOGIC**, the SCALE knob now controls the LOGIC setting.

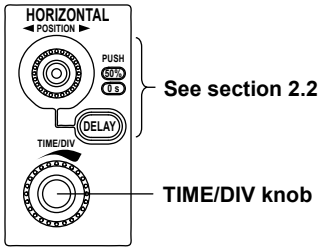
Turn the **POSITION** knob to set the vertical position.



1.3 Setting the Horizontal Axis (Time Axis)

Set the time per grid (1 division) displayed on the screen.
Turn the **TIME/DIV** knob to set the value.
If you change the TIME/DIV setting while waveform acquisition is stopped, the waveform is displayed expanded or reduced along the time axis.

► “Horizontal Axis (Time Axis)” in the Features Guide.



2.1 Setting the Trigger Mode and Trigger Hold-off Time

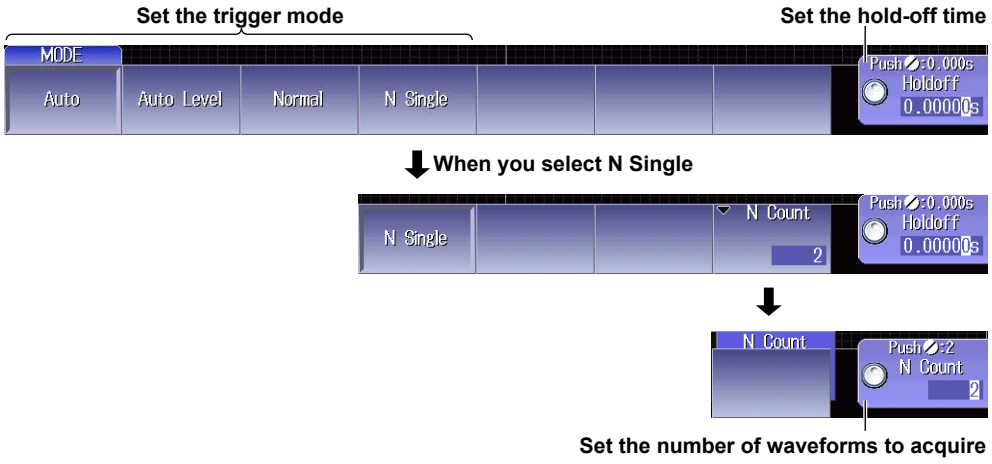
This section explains the following settings (which are used when updating the displayed waveform):

- Trigger mode
- Hold-off time

► "Trigger Mode (Trigger Mode)" and "Trigger Hold-off (Holdoff)" in the Features Guide

MODE Menu

Press **MODE** to display the following menu.



Setting the Trigger Mode (Mode)

Auto: If the trigger conditions are met within 100 ms, the DLM2000 updates the displayed waveforms on each trigger occurrence. If not, the DLM2000 automatically updates the displayed waveforms. If the time axis is set to a value that causes the display to switch to roll mode, roll mode display will be enabled.

Auto Level: If a trigger occurs before a timeout, the DLM2000 updates the waveform in the same way that it does in Auto mode. If a trigger does not occur before a timeout, the DLM2000 automatically changes the trigger level to the center value of the trigger source amplitude, triggers on that value, and updates the displayed waveform.

Normal: The DLM2000 only updates the waveform display when the trigger conditions are met.

N Single: The DLM2000 acquires signals each time the trigger conditions are met until a specified number of signals have been acquired, and then displays all of the acquired signals.

Note

Single Mode

There is also a Single trigger mode in which the DLM2000 updates the displayed waveform once and stops signal acquisition when the trigger conditions are met. Press SINGLE on the front panel to execute Single Mode waveform acquisition.

Setting the Hold-off Time (Holdoff)

The trigger hold-off feature temporarily stops the detection of the next trigger once a trigger has occurred.

2.2 Setting the Trigger Position and Trigger Delay

This section explains the following settings (which are used when updating the displayed waveform):

- Trigger position
- Trigger delay
- Delay cancel

► “Trigger Position (POSITION),” “Trigger Delay (DELAY),” and “Delay Cancel (Delay Cancel)” in the Features Guide

Setting the Trigger Position (POSITION)

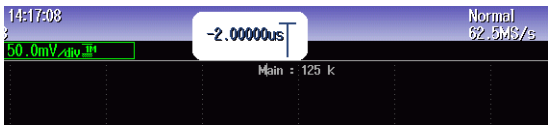
Turn the **POSITION** knob to set the trigger position.
The specified trigger position is shown at the top of the display during operation.
The display disappears approximately 3 seconds after the last operation.

You can set the trigger position even when waveforms are not being acquired.

Setting the Trigger Delay (DELAY)

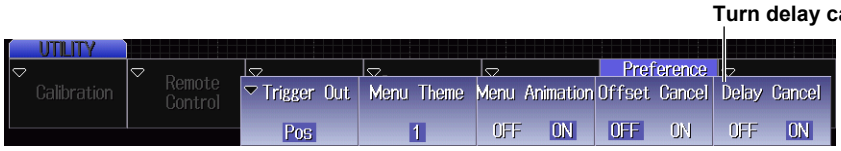
Press **DELAY**. After the DELAY key illuminates, turn the **POSITION** knob to set the trigger delay.
Press **DELAY** once more to turn off the DELAY key and enable the setting of the trigger position.
The specified trigger delay is shown at the top of the display during operation.
The display disappears approximately 3 seconds after the last operation.

You can set the trigger delay even when waveforms are not being acquired.



Turning Delay Cancel On or Off (Delay Cancel)

Press **UTILITY**, and then press the **Preference** soft key to display the following menu.



You can select whether or not to apply the specified trigger delay to the time measurement values.

ON: The DLM2000 measures time values by setting the trigger position to 0 s (the delay is not applied to time measurement values).

OFF: The DLM2000 measures time values by setting the trigger point to 0 s (the delay is applied to time measurement values).

2.3 Triggering on an Edge Trigger

This section explains the following settings (which are used when triggering on trigger source edges):

- Trigger source
  Source bit, trigger level, trigger slope, trigger coupling, HF rejection, and noise rejection
- Window comparator
- Probe attenuation
- Input range

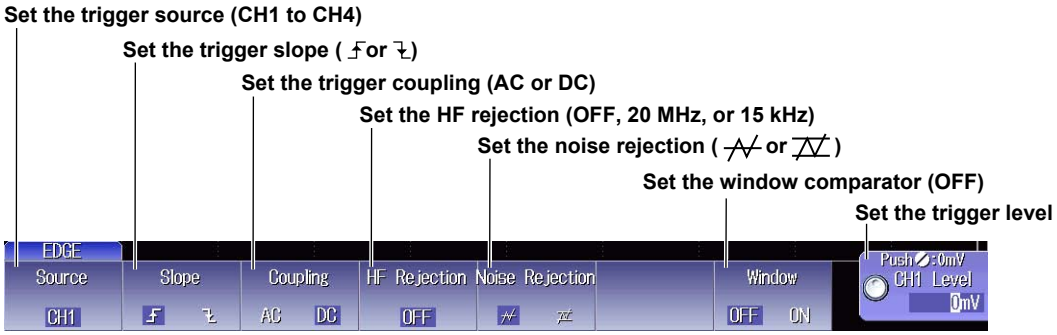
► "Edge Trigger (EDGE)," "Trigger Source (Source)," "Trigger Slope (Slope/Polarity)," "Trigger Coupling (Coupling)," "HF Rejection (HF Rejection)," "Noise Rejection (Noise Rejection)," "Window Comparator (Window)," and "Trigger Level (Level)" in the Features Guide

EDGE Menu

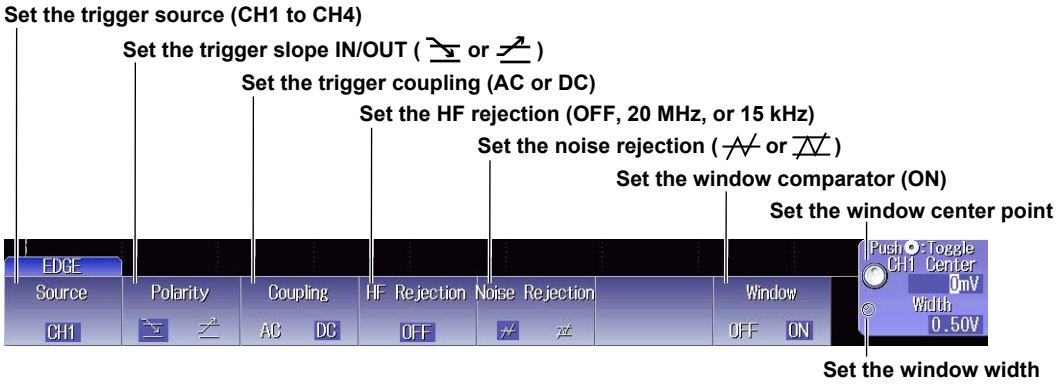
Press **EDGE** to open one of the menus shown below. The menu that appears varies depending on the specified trigger source.

When the Trigger Source Is Set to a Channel from CH1 to CH4

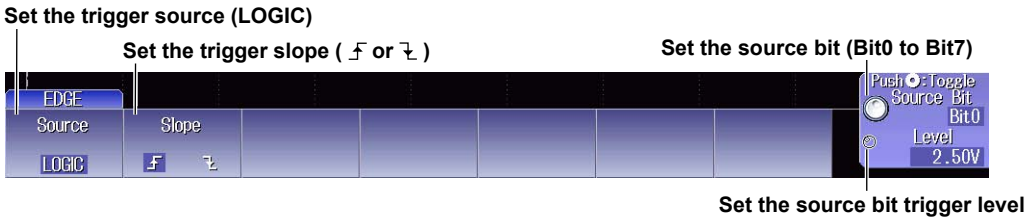
When the Window Comparator Is Off



When the Window Comparator Is On

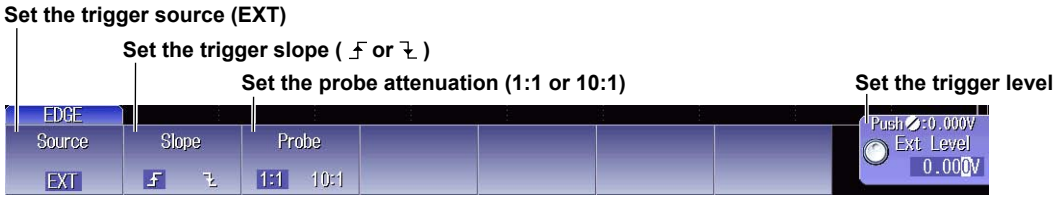


When the Trigger Source Is LOGIC (On models with the logic signal input port)

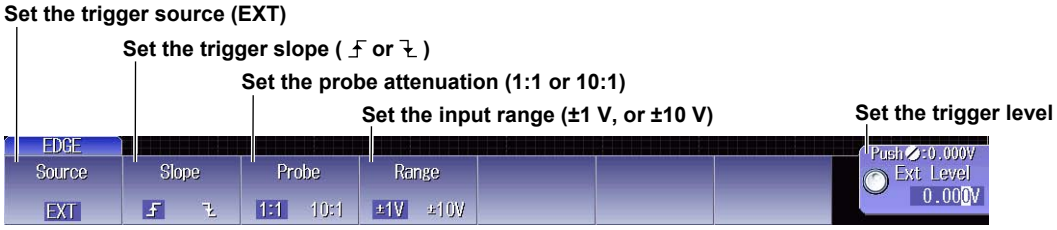


When the Trigger Source Is EXT (External trigger signal)

On 4-Channel Models



On 2-Channel Models



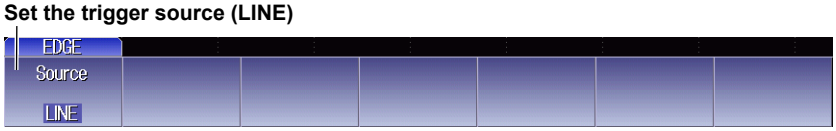
Input Range (Range)

When you set the trigger source to EXT on a 2-channel model, set the input range.
The selectable ranges vary depending on the probe attenuation setting.

1:1: ±1 V or ±10 V

10:1: ±10 V or ±100 V

When the Trigger Source Is LINE (the DLM2000 power source)



2.4 Triggering on the OR of Multiple Edge Triggers

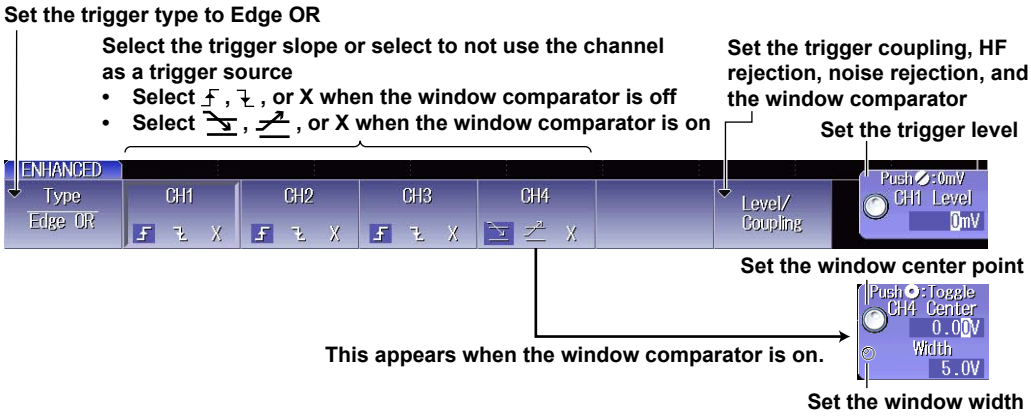
This section explains the following settings (which are used when triggering on the logical OR of multiple edge triggers):

- Trigger source
  Trigger level, trigger scope, trigger coupling, HF rejection, noise rejection
- Window comparator

► "Edge OR Trigger [ENHANCED]" in the Features Guide

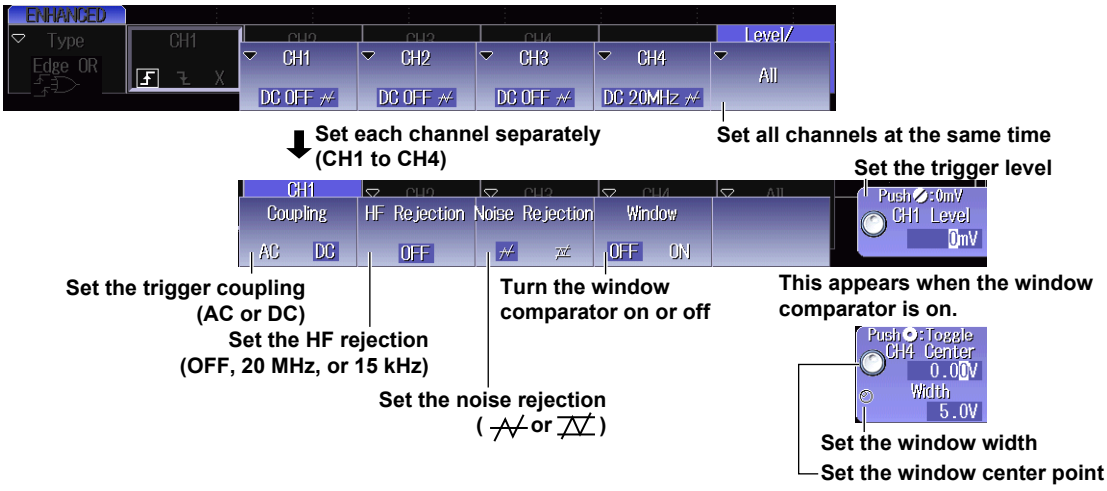
ENHANCED Edge OR Menu

Press **ENHANCED**, the **Type** soft key, and then the **Edge OR** soft key to display the following menu.



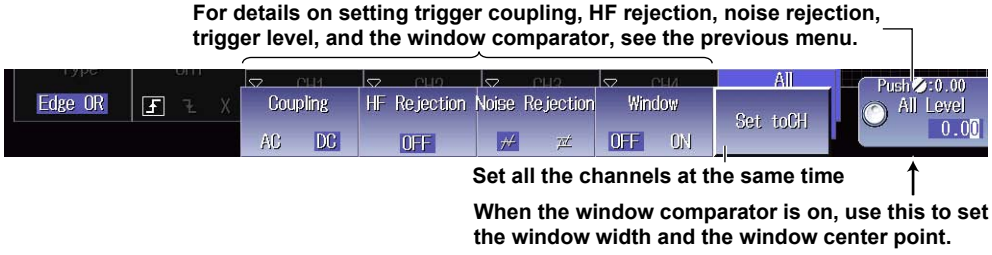
Setting the Level and Coupling for Trigger Coupling, HF Rejection, Noise Rejection, and the Window Comparator

Press the **Level/Coupling** soft key to display the following menu.



Applying Settings to All Channels

Press the **All** soft key to display the following menu.



2.5 Triggering On Edge Conditions

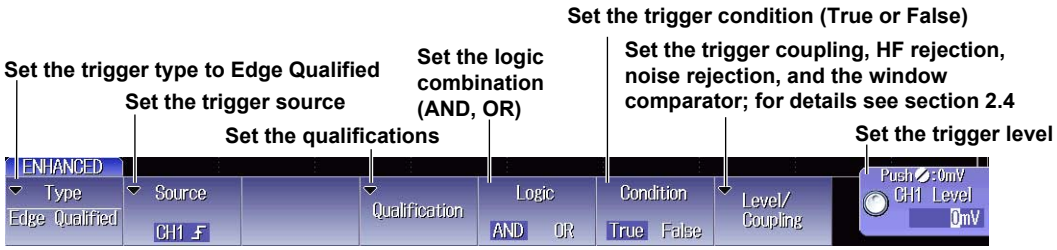
This section explains the following settings (which are used when triggering on an edge condition):

- Trigger source
  Trigger level
- Qualification
  Level used to detect signal states
- Logic combination
- Trigger condition

► “Edge Qualified Trigger [ENHANCED]” in the Features Guide

ENHANCED Edge Qualified Menu

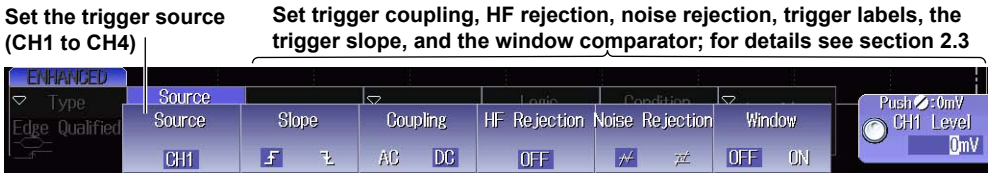
Press **ENHANCED**, the **Type** soft key, and then the **Edge Qualified** soft key to display the following menu.



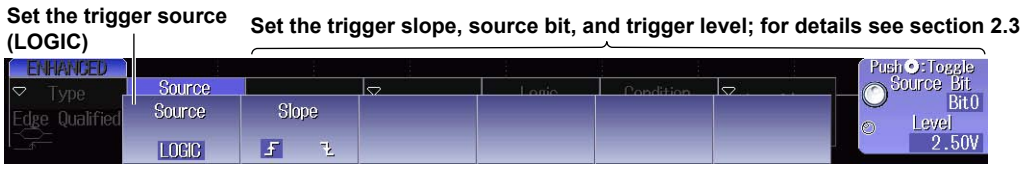
Setting the Trigger Source (Source)

Press the **Source** soft key to open one of the menus shown below. The menu that appears varies depending on the specified trigger source.

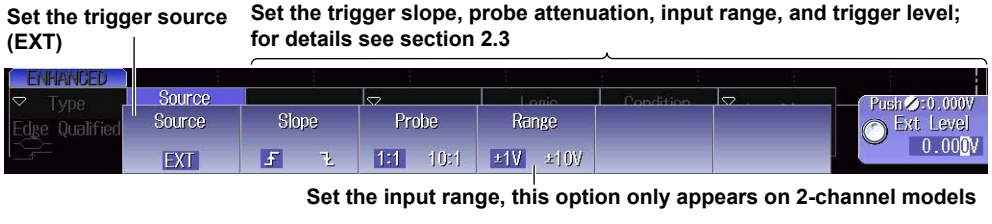
When the Trigger Source Is Set to a Channel from CH1 to CH4



When the Trigger Source Is LOGIC (On models with the logic signal input port)



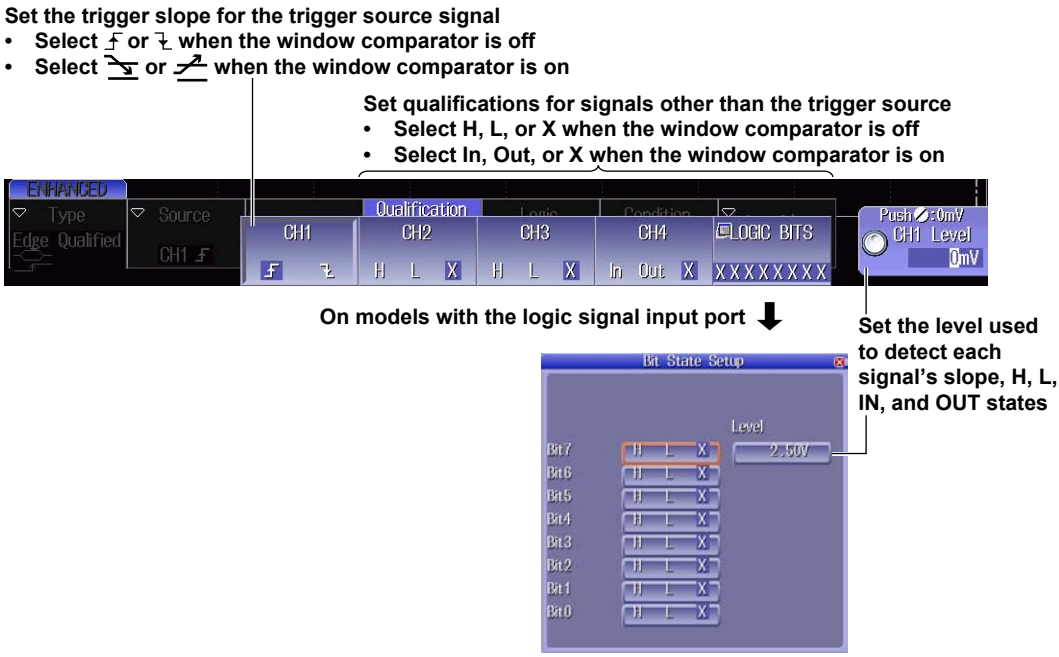
When the Trigger Source Is EXT (External trigger signal)



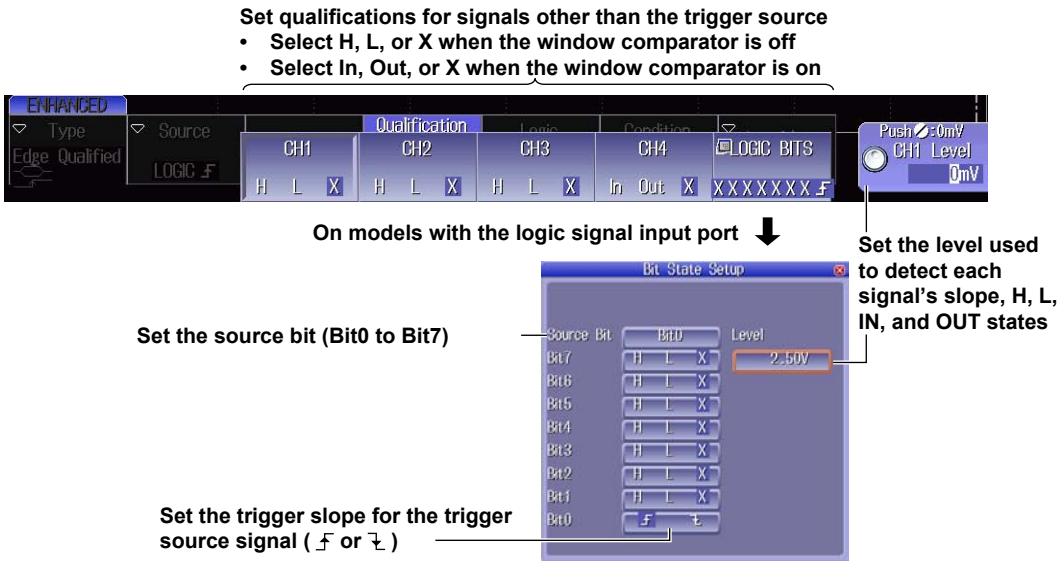
Setting the Qualifications (Qualification)

Press the **Qualification** soft key to open one of the menus shown below. The menu that appears varies depending on the specified trigger source.

When the Trigger Source Is Set to a Channel from CH1 to CH4



When the Trigger Source Is LOGIC (On models with the logic signal input port)



When the Trigger Source Is EXT (External trigger signal)

The same menu appears as that shown above for when the trigger source is set to a channel from CH1 to CH4. Because the trigger source is an external signal (EXT), you can specify all of the signal states from CH1 to CH4 and LOGIC as qualifications.

2.6 Triggering on State Conditions

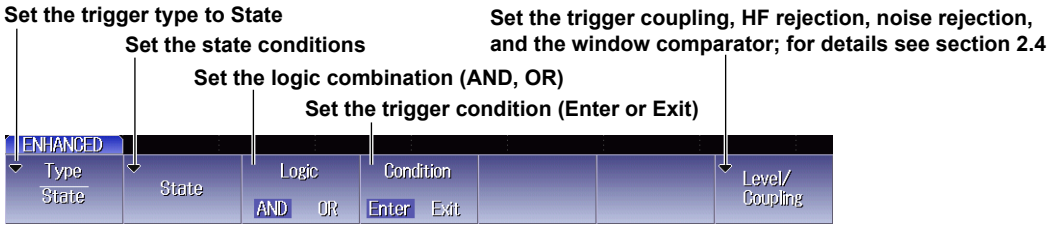
This section explains the following settings (which are used when triggering on state conditions):

- State condition
  Level used to detect the clock sources and signal states
- Logic combination
- Trigger condition

► “State Trigger [ENHANCED]” in the Features Guide

ENHANCED State Menu

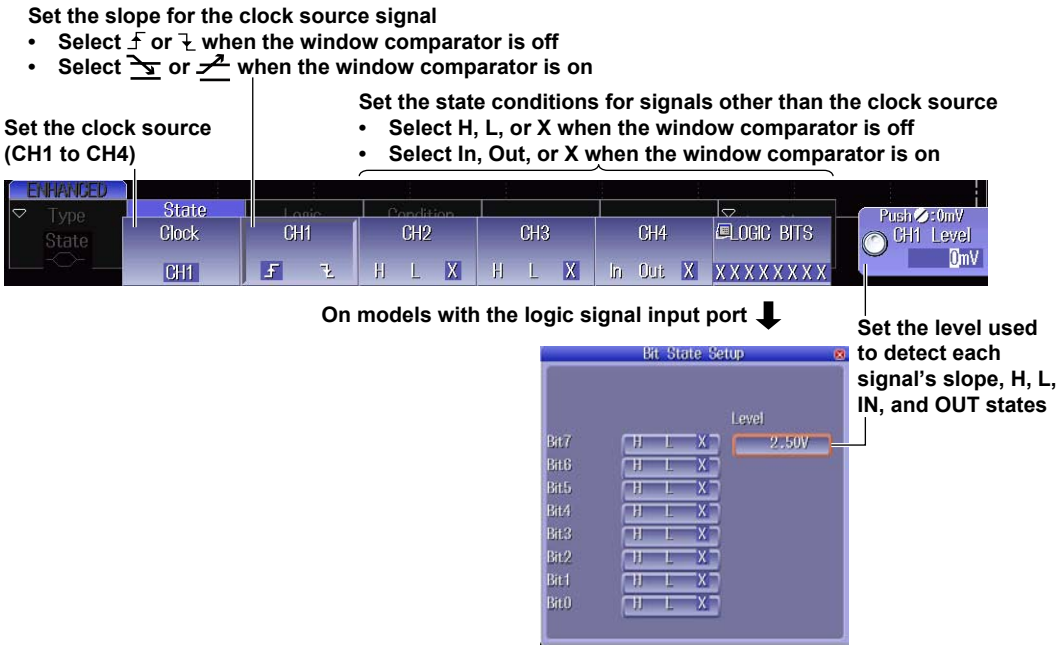
Press **ENHANCED**, the **Type** soft key, and then the **State** soft key to display the following menu.



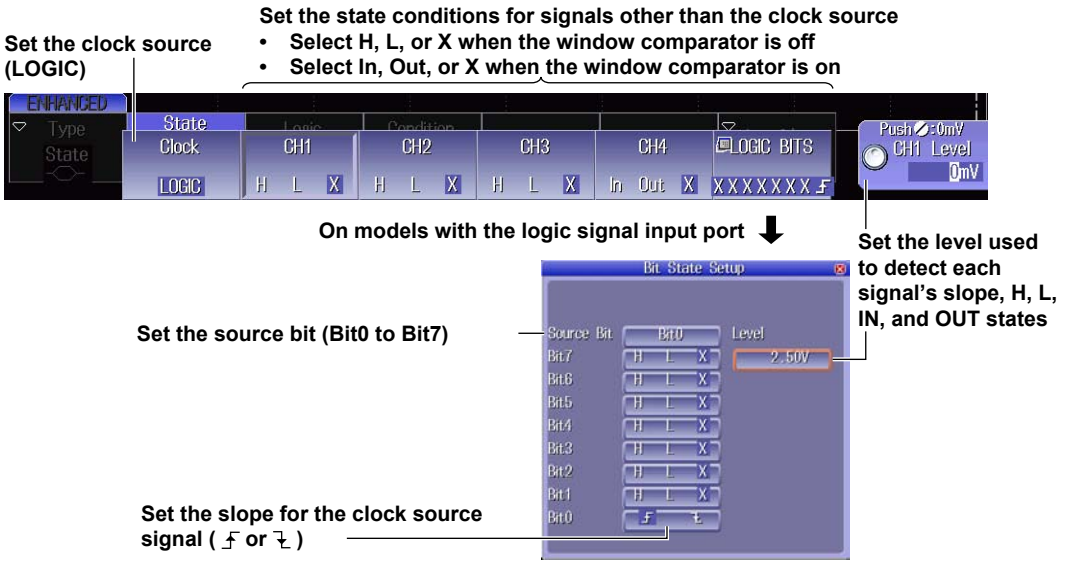
Setting the State Conditions (State)

Press the **State** soft key to open one of the menus shown below. The menu that appears varies depending on the specified clock source.

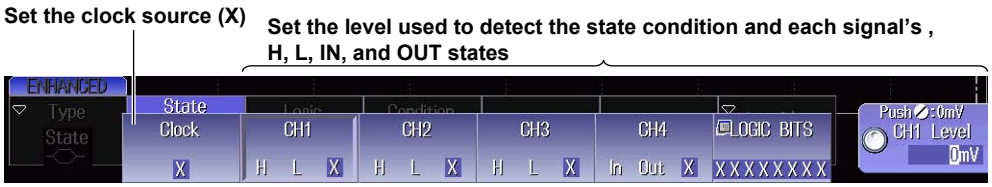
When the Clock Source Is Set to a Channel from CH1 to CH4



When the Clock Source Is LOGIC (On models with the logic signal input port)



No Clock Source



The same menu appears as that shown on the previous page for when the clock source is set to a channel from CH1 to CH4. Because there is no clock source, you can specify all of the signal states from CH1 to CH4 and LOGIC as state conditions.

2.7 Triggering On Pulse Width

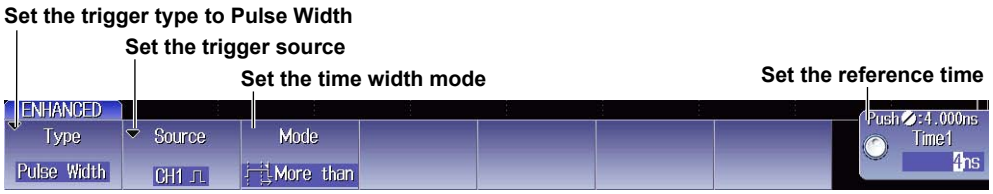
This section explains the following settings (which are used when triggering on pulse width):

- Trigger source
  Polarity
- Time width mode
  Reference time

► “Pulse Width Trigger [ENHANCED]” in the Features Guide

ENHANCED Pulse Width Menu

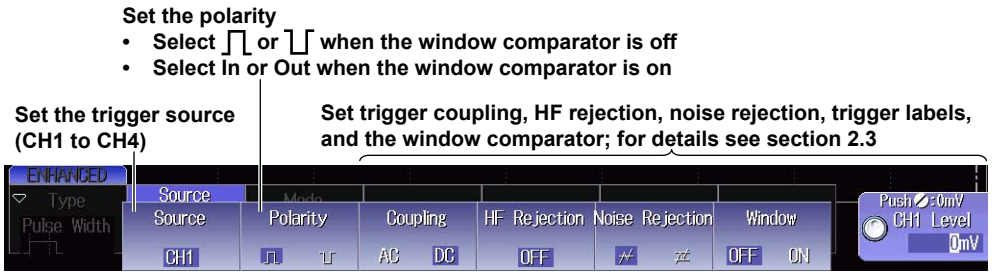
Press **ENHANCED**, the **Type** soft key, and then the **Pulse Width** soft key to display the following menu.



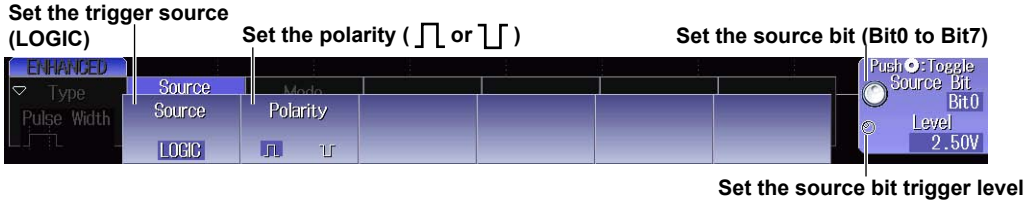
Setting the Trigger Source (Source)

Press the **Source** soft key to open one of the menus shown below. The menu that appears varies depending on the specified trigger source.

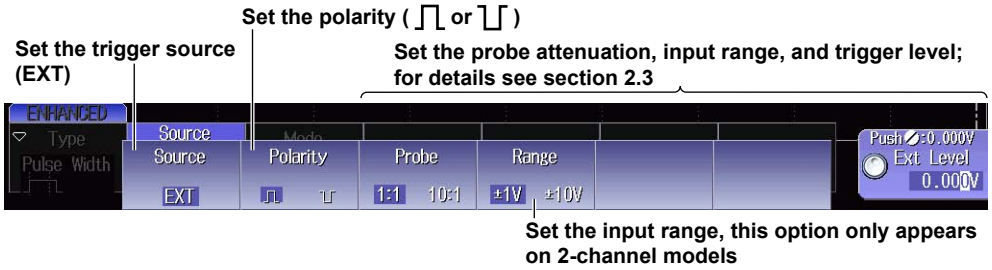
When the Trigger Source Is Set to a Channel from CH1 to CH4



When the Trigger Source Is LOGIC (On models with the logic signal input port)



When the Trigger Source Is EXT (External trigger signal)



Setting the Time Width Mode (Mode)

Press the **Mode** soft key to display the following menu.

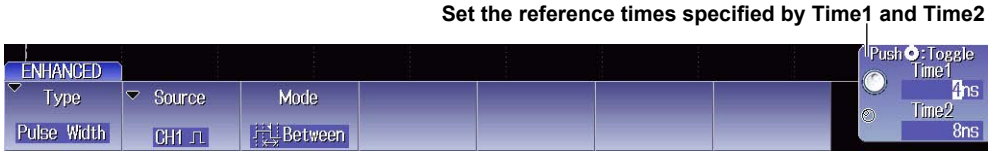
Set what kind of relationship must be established between the trigger source's pulse width and the specified reference times (Time1 and Time2) for the DLM2000 to trigger.

More than: When the pulse width is longer than the reference time specified by Time1
Less than: When the pulse width is shorter than the reference time specified by Time1
Between: When the pulse width is longer than Time1 but shorter than Time2
Out of Range : When the pulse width is shorter than Time1 or longer than Time2
Time Out: When the pulse width is longer than the reference time specified by Time1

Setting the Reference Times (Time1 and Time2)

When Time Width Mode Is More than, Less than, or Time Out

When Time Width Mode Is Between or Out Of Range



2.8 Triggering on State Width

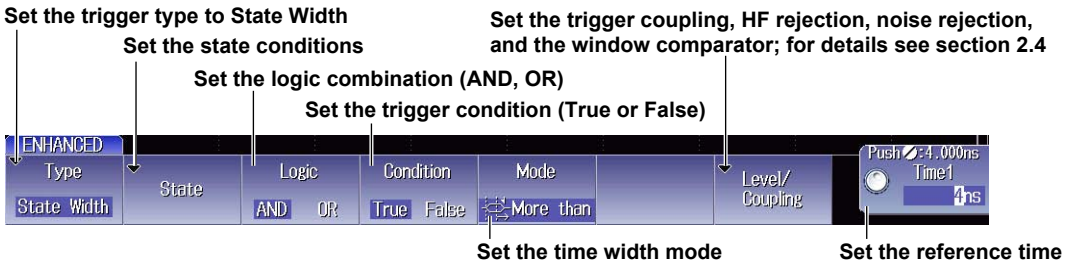
This section explains the following settings (which are used when triggering on pulse width):

- State condition
  Level used to detect the clock sources and signal states
- Logic combination
- Trigger condition
- Time width mode
  Reference time

► “State Width Trigger [ENHANCED]” in the Features Guide

ENHANCED State Width Menu

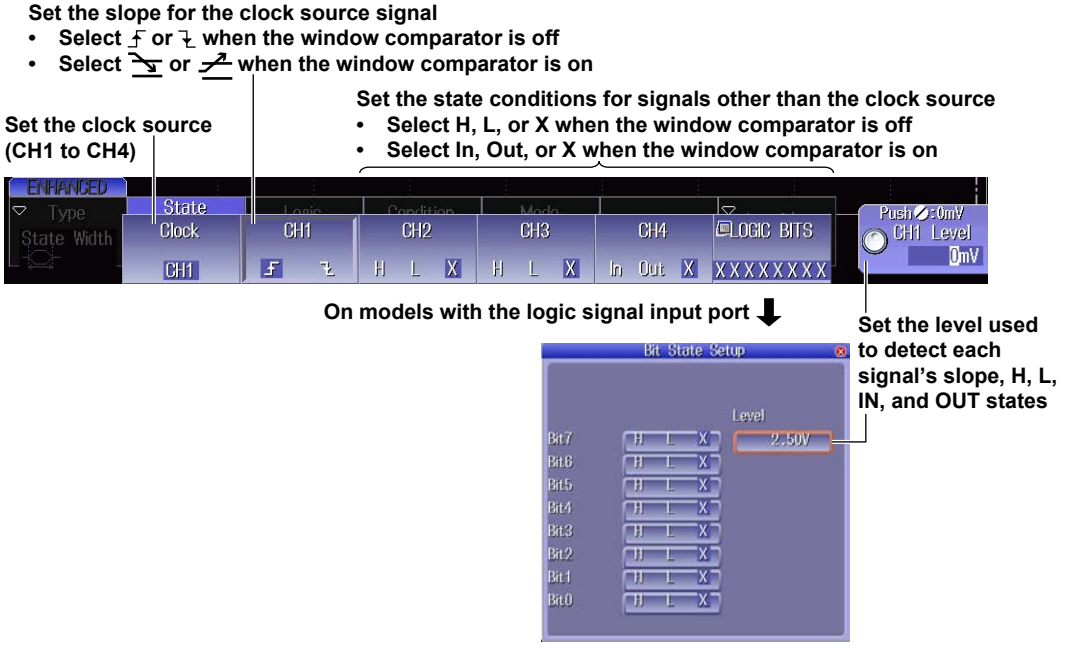
Press **ENHANCED**, the **Type** soft key, and then the **State Width** soft key to display the following menu.



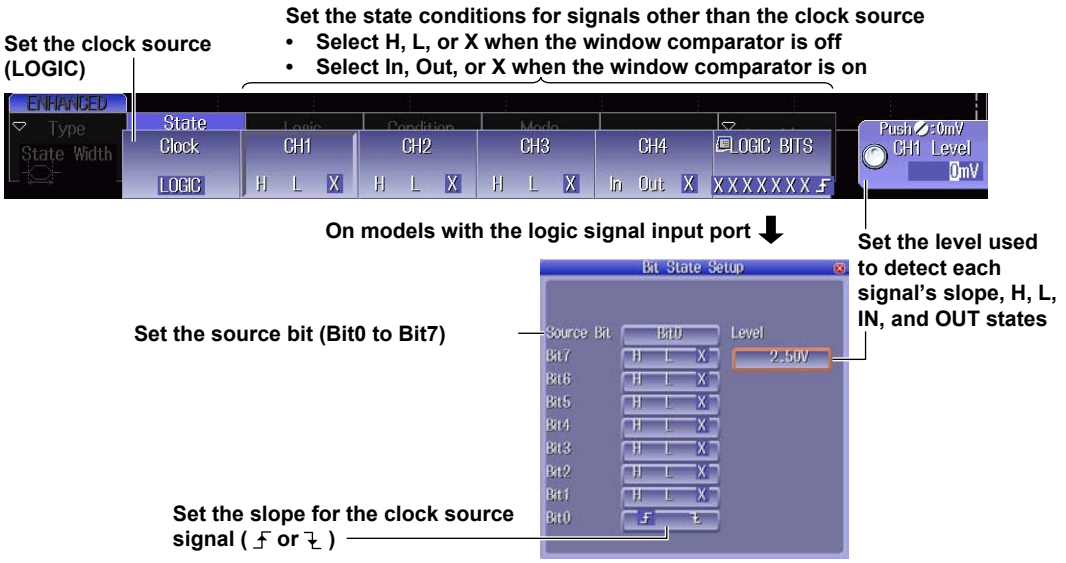
Setting the State Conditions (State)

Press the **State** soft key to open one of the menus shown below. The menu that appears varies depending on the specified clock source.

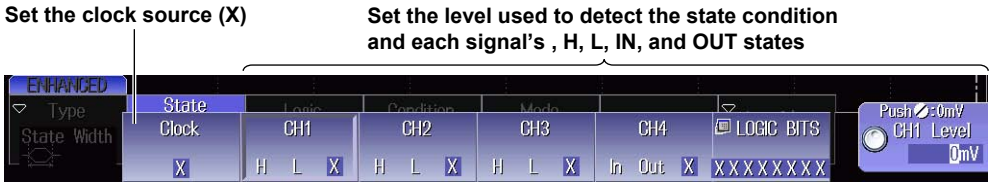
When the Clock Source Is Set to a Channel from CH1 to CH4



When the Clock Source Is LOGIC (On models with the logic signal input port)



No Clock Source



The same menu appears as that shown on the previous page for when the clock source is set to a channel from CH1 to CH4. Because there is no clock source, you can specify all of the signal states from CH1 to CH4 and LOGIC as state conditions.

Setting the Time Width Mode (Mode)

Press the **Mode** soft key to display the following menu.

Set what kind of relationship between the length of time the state condition is met or not met and the specified reference times (Time1 and Time2) will cause the DLM2000 to trigger.

More than: When the period during which the state condition is met or not met is longer than the reference time specified by Time1 and the condition changes

Less than: When the period during which the state condition is met or not met is shorter than the reference time specified by Time1 and the condition changes

Between: When the period during which the state condition is met or not met is longer than Time1 but shorter than Time2 and the condition changes

Out of Range: When the period during which the state condition is met or not met is shorter than Time1 or longer than Time2 and the condition changes

Time Out: When the period during which the state condition is met or not met is longer than the reference time specified by Time1

Setting the Reference Times (Time1 and Time2)

When Time Width Mode Is More than, Less than, or Time Out

Set the reference time specified by Time1

When Time Width Mode Is Between or Out Of Range

Set the reference times specified by Time1 and Time2

2.9 Triggering on CAN Bus Signals (Option)

This section explains the following settings (which are used when triggering on CAN bus signals):

- Trigger source
  Bit rate, recessive level, sample point, and the level used to detect the source state
- Trigger type
  Trigger condition

► “CAN Bus Triggering [ENHANCED, option]” in the Features Guide

Auto Setup

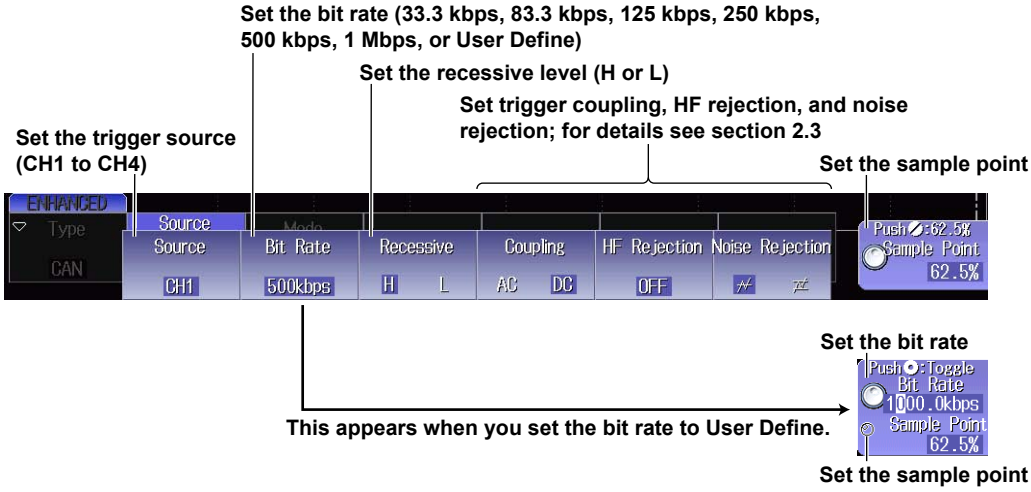
The DLM2000 can automatically set the trigger source level and bit rate from the received CAN bus signal and trigger on them. For more details, see section 12.1.

CAN Menu

Press **ENHANCED**, the **Type** soft key, the **Serial** soft key, and then the **CAN** soft key to display the following menu.

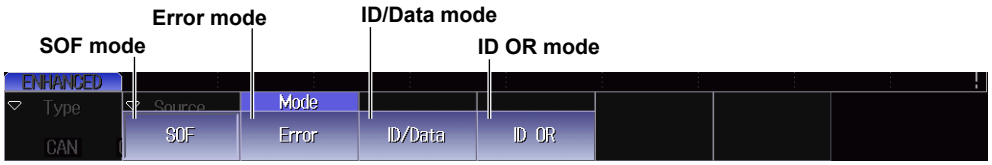
Setting the Trigger Source (Source)

Press the **Source** soft key to display the following menu.



Trigger Type (Mode)

Press the **Mode** soft key to display the following menu.



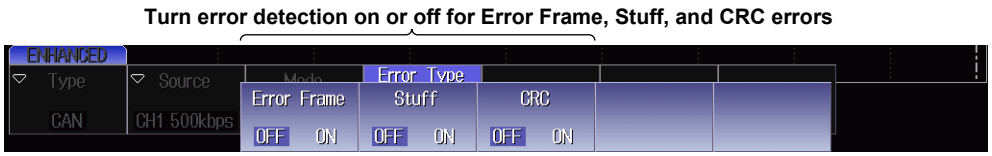
SOF (Start of Frame) Mode

Press the **SOF** soft key.

The DLM2000 triggers on the start of CAN bus signal frames.

Error Mode (Error)

Press the **Error** soft key and then the **Error Type Or** soft key to display the following menu.



The DLM2000 triggers on error frames (when the error flag is active) or when it detects various errors.

ID/Data Mode (ID/Data)

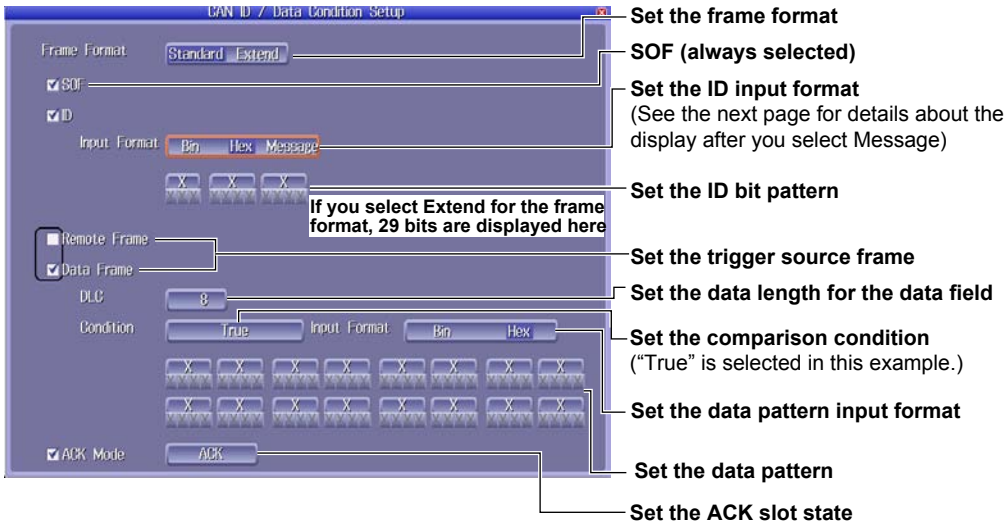
Press the **ID/Data** soft key to display the following menu.

Setting Trigger Conditions (Condition Setup)

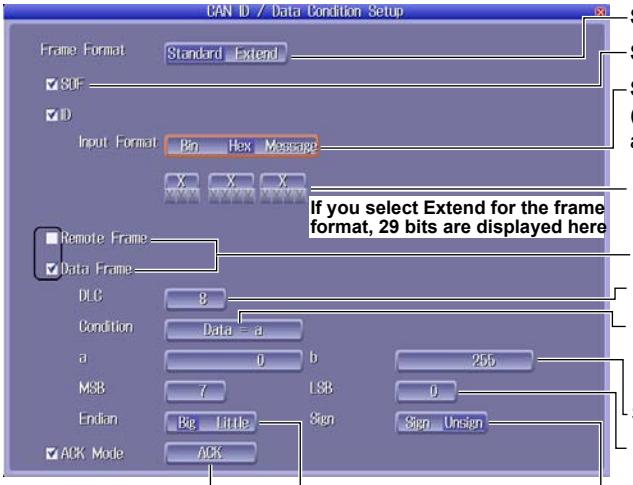
Press the **Condition Setup** soft key to display the following screen.

The DLM2000 triggers on the AND of SOF, ID, frame type (Remote Frame or Data Frame), Data, and ACK. Items whose check boxes are selected are used as trigger conditions.

- **When the Comparison Condition Is True or False**

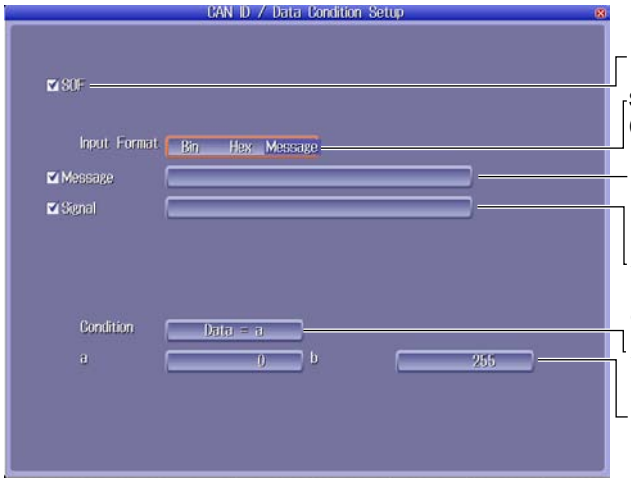


- **When the Comparison Condition Is Data = a; Data ≠ a; a ≤ Data; Data ≤ b; a ≤ Data ≤ b; or Data < a, b < Data**



Set the frame format
SOF (always selected)
Set the ID input format
(See the next section for details about the display after you select Message)
Set the ID bit pattern
Set the trigger source frame
Set the data length for the data field
Set the comparison condition
("Data = a" is selected in this example.)
Set data reference values a and b
Set the bit positions of the most significant bit (MSB) and the least significant bit (LSB) in the data that you will compare
Set whether to use a signed (Sign) or unsigned (Unsign) data format
Set the byte order
Set the ACK slot state

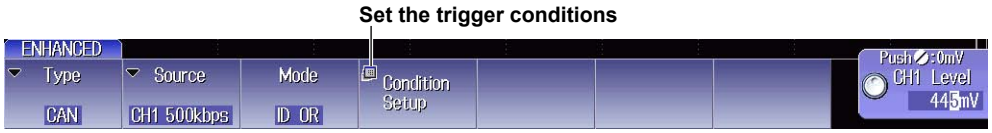
- **When ID Input Format Is Message**



SOF (always selected)
Set the ID input format
("Message" is selected in this example.)
Select an ID from the message list in the loaded physical value/symbol definition file (.sbl)
Select a data item from the signal list in the loaded physical value/symbol definition file (.sbl)
Set the comparison condition
("Data = a" is selected in this example.)
Set data reference values a and b

ID OR Mode (ID OR)

Press the **ID OR** soft key to display the following menu.

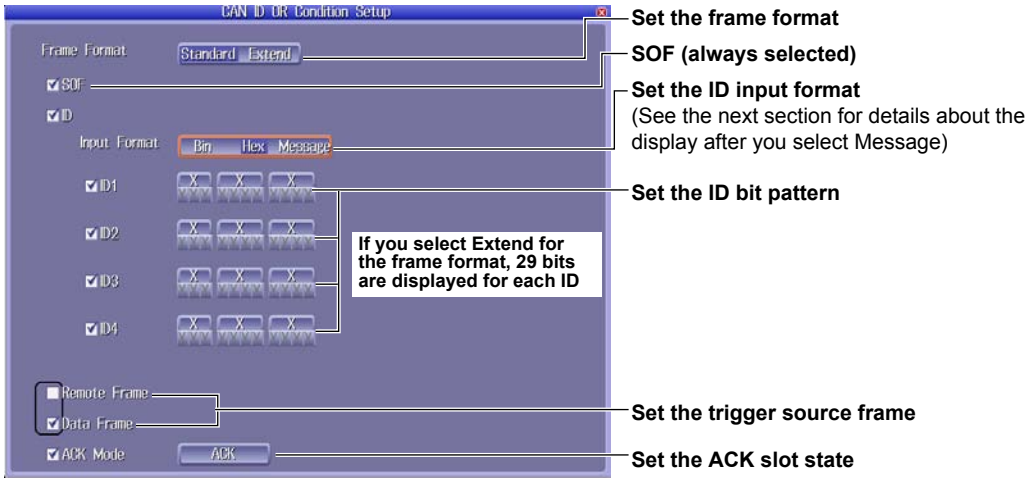


Setting Trigger Conditions (Condition Setup)

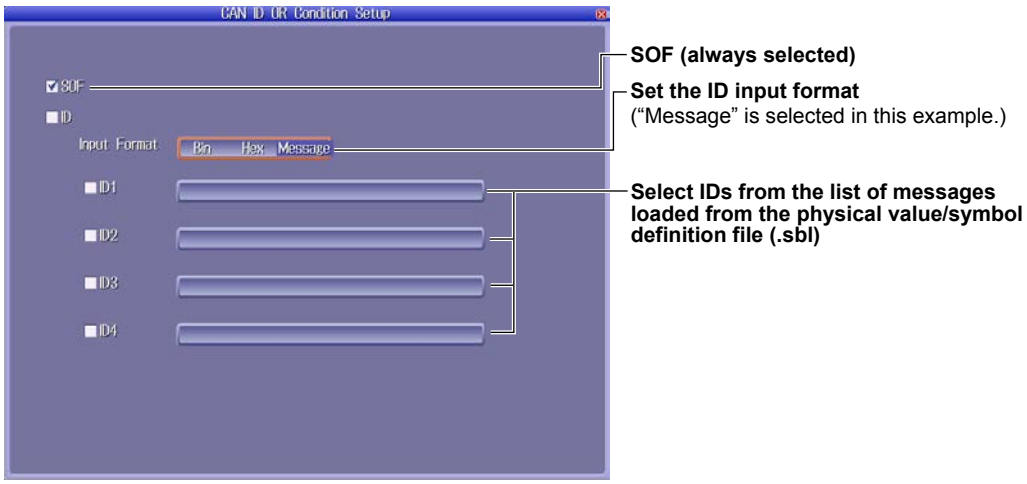
Press the **Condition Setup** soft key to display the following screen.

The DLM2000 triggers on the AND of SOF, frame type (Remote Frame or Data Frame), ACK, and one of the four IDs. Items whose check boxes are selected are used as trigger conditions.

- **When ID Input Format Is Bin or Hex**



- **When ID Input Format Is Message**



2.10 Triggering on LIN Bus Signals (Option)

This section explains the following settings (which are used when triggering on LIN bus signals):

- Trigger source
  Bit rate, sample point, and the level used to detect the source state
- Trigger type
  Trigger condition

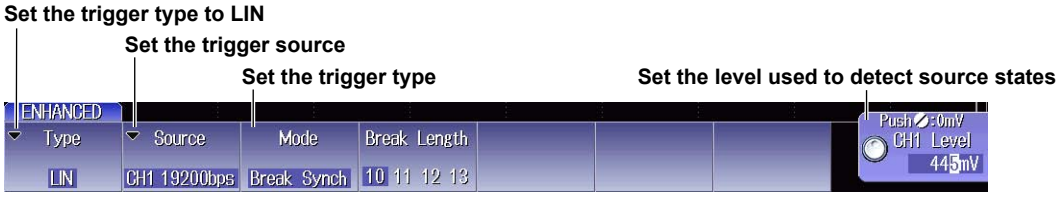
► "LIN Bus Trigger [ENHANCED, option]" in the Features Guide

Auto Setup

The DLM2000 can automatically set the trigger source level and bit rate from the received LIN bus signal and trigger on them. For more details, see section 12.2.

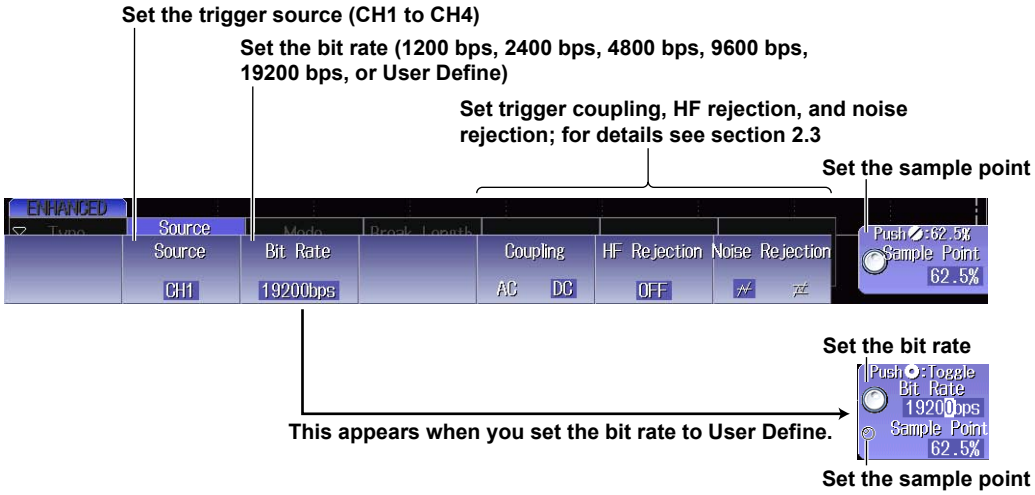
LIN Menu

Press **ENHANCED**, the **Type** soft key, the **Serial** soft key, and then the **LIN** soft key to display the following menu.



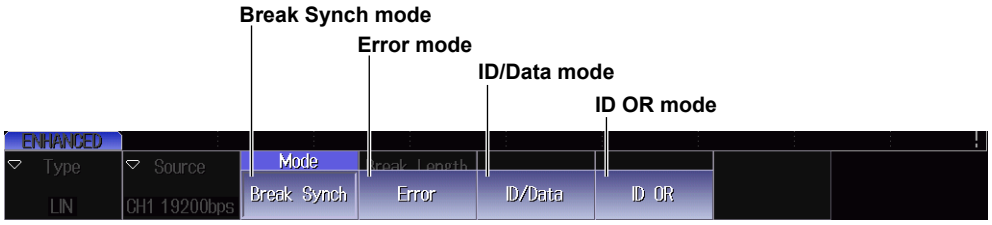
Setting the Trigger Source (Source)

Press the **Source** soft key to display the following menu.



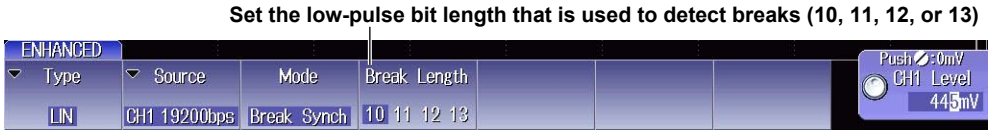
Trigger Type (Mode)

Press the **Mode** soft key to display the following menu.



Break Synch Mode

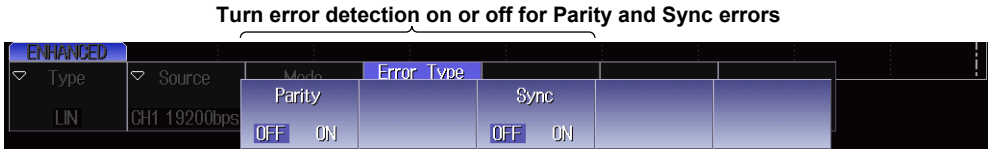
Press the **Break Synch** soft key to display the following menu.



The DLM2000 triggers when it detects a break field and then a synch field (Break Field + Synch Field).

Error Mode

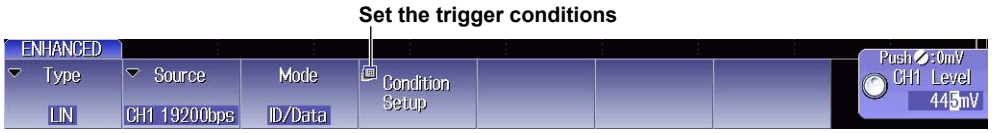
Press the **Error** soft key and then the **Error Type Or** soft key to display the following menu.



The DLM2000 triggers when it detects an error.

ID/Data Mode

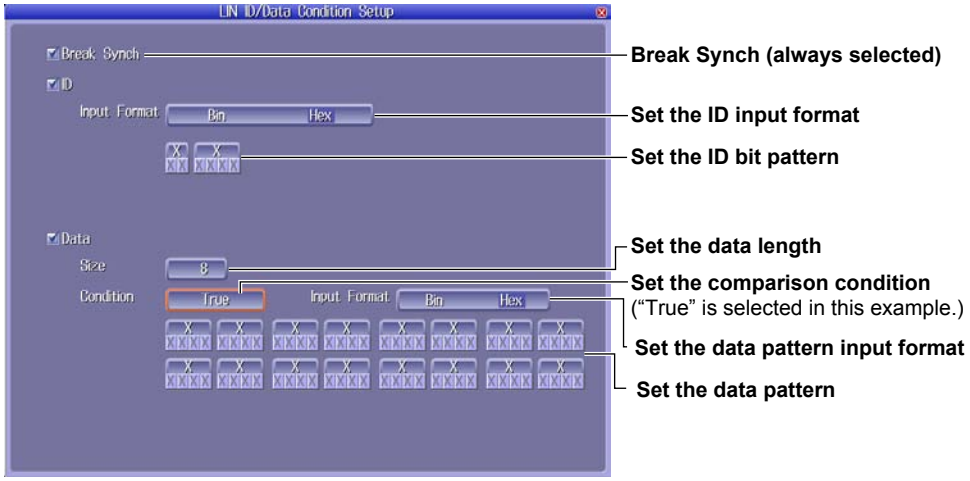
Press the **ID/Data** soft key to display the following menu.



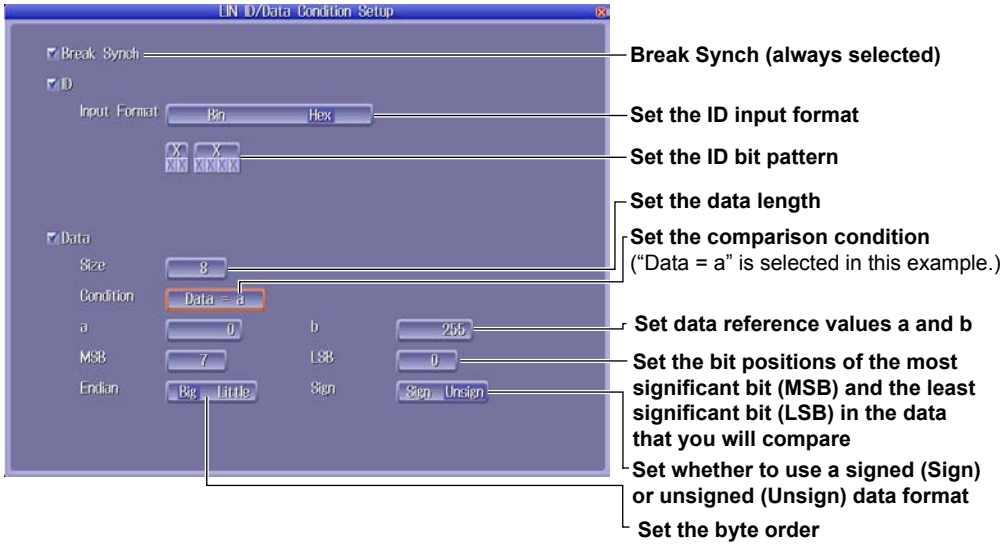
Setting Trigger Conditions (Condition Setup)

Press the **Condition Setup** soft key to display the following screen.
The DLM2000 triggers on the AND of Break Synch, ID, and Data. Items whose check boxes are selected are used as trigger conditions.

- **When the Comparison Condition Is True or False**

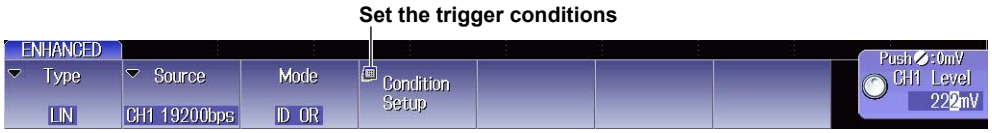


- **When the Comparison Condition Is Data = a; Data ≠ a; a ≤ Data; Data ≤ b; a ≤ Data ≤ b; or Data < a, b < Data**



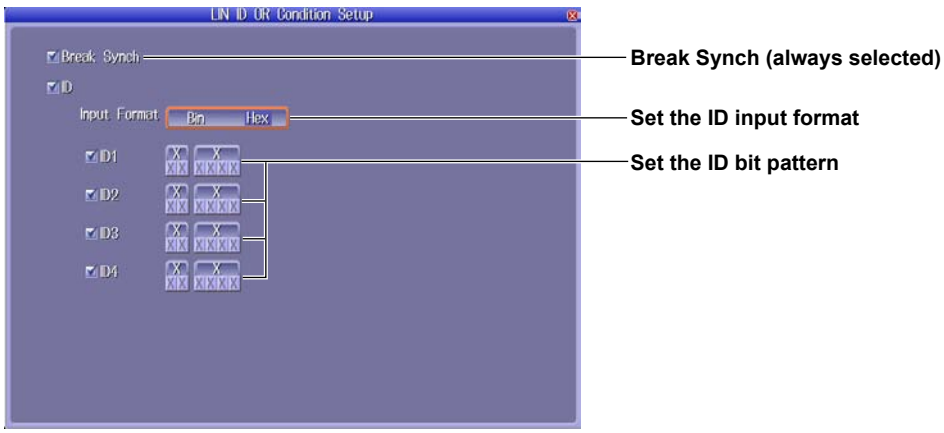
ID OR Mode

Press the **ID OR** soft key to display the following menu.



Setting Trigger Conditions (Condition Setup)

Press the **Condition Setup** soft key to display the following screen.
The DLM2000 triggers on the AND of Break Synch and one of the four IDs. Items whose check boxes are selected are used as trigger conditions.



2.11 Triggering on UART Signals (Option)

This section explains the following settings (which are used when triggering on UART signals):

- Trigger source
  Bit rate, sample point, bit order, polarity, and the level used to detect the source state
- Format
- Trigger type
  Trigger condition

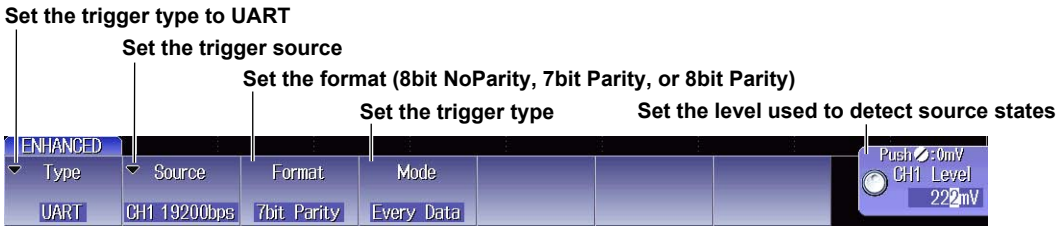
► “UART Trigger [ENHANCED, option]” in the Features Guide

Auto Setup

The DLM2000 can automatically set the trigger source level and bit rate from the received UART signal and trigger on them. For more details, see section 12.3.

UART Menu

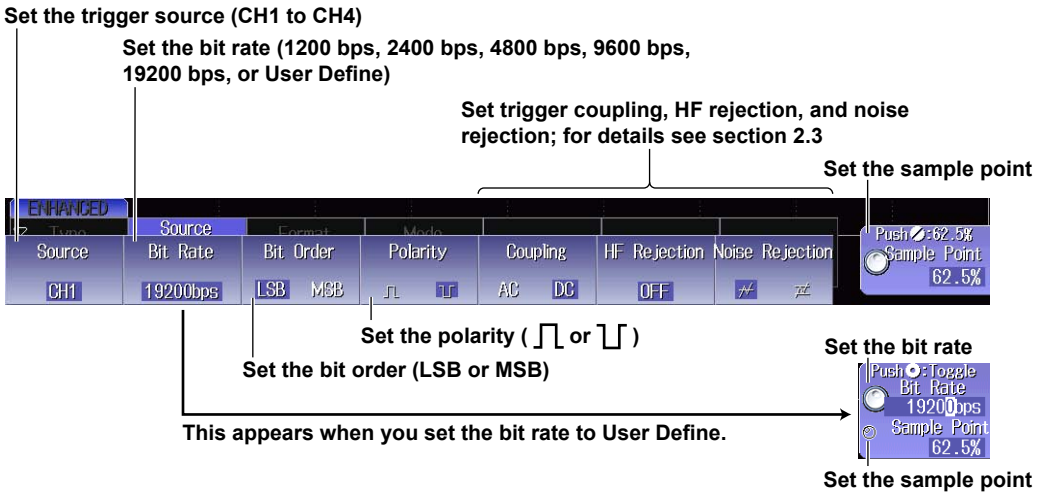
Press **ENHANCED**, the **Type** soft key, the **Serial** soft key, and then the **UART** soft key to display the following menu.



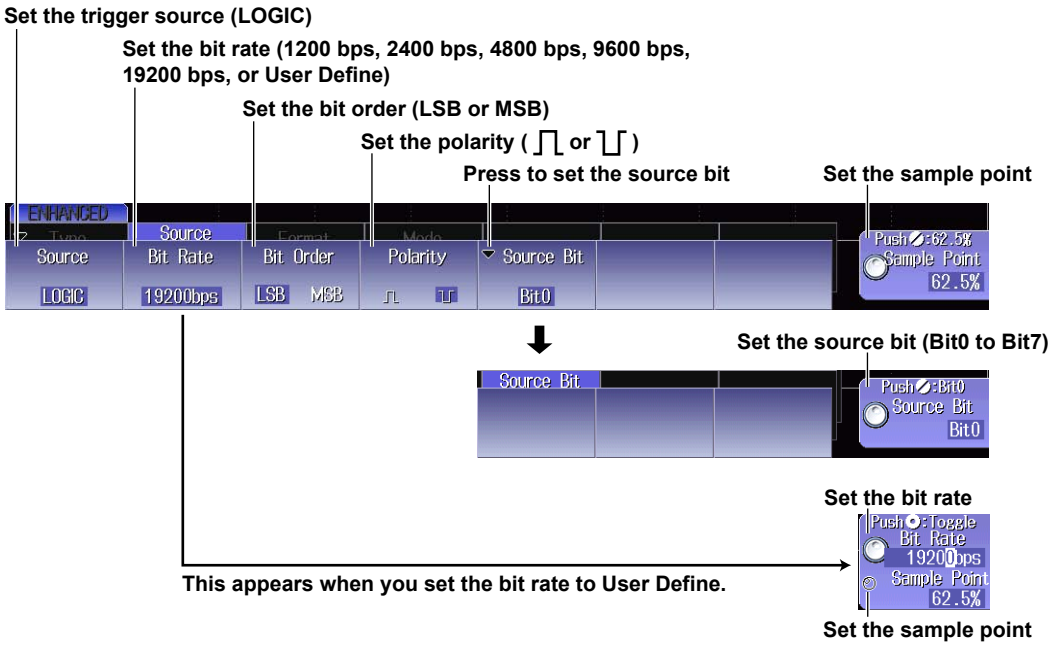
Setting the Trigger Source (Source)

Press the **Source** soft key to open one of the menus shown below. The menu that appears varies depending on the specified trigger source.

When the Source Is Set to a Channel from CH1 to CH4

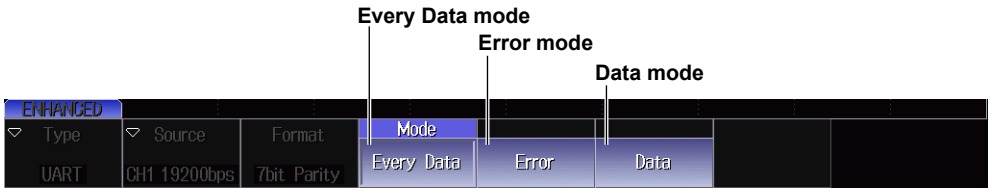


When the Source Is LOGIC (On models with the logic signal input port)



Trigger Type (Mode)

Press the **Mode** soft key to display the following menu.



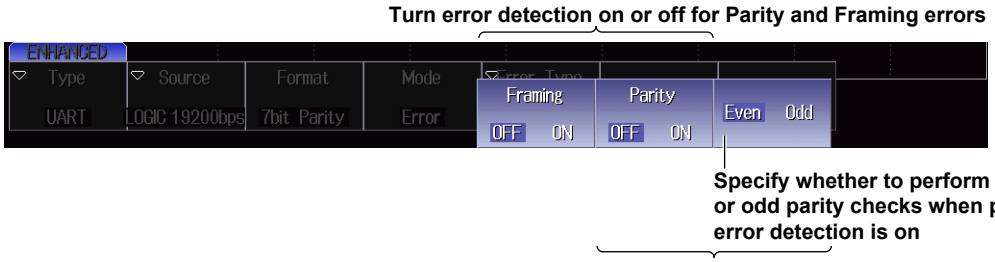
Every Data Mode

Press the **Every Data** soft key.

The DLM2000 triggers on all data.

Error Mode

Press the **Error** soft key and then the **Error Type Or** soft key to display the following menu.

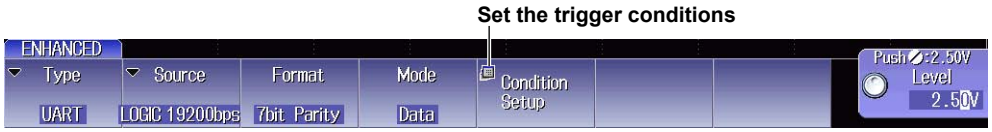


If you set the format to 8bit NoParity on the UART menu shown on the previous page, Parity OFF/ON and Even/Odd do not appear on this menu.

The DLM2000 triggers when it detects an error.

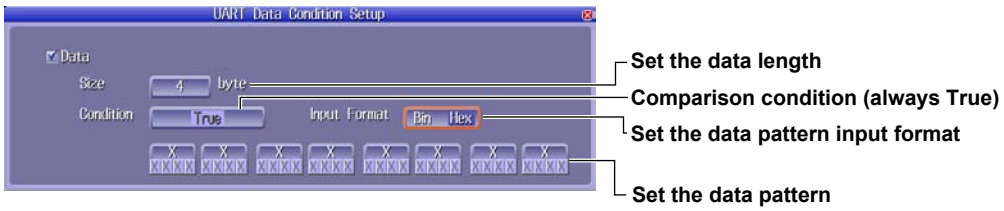
Data Mode

Press the **Data** soft key to display the following menu.



Setting Trigger Conditions (Condition Setup)

Press the **Condition Setup** soft key to display the following screen.
The DLM2000 triggers when the data pattern is matched.



2.12 Triggering on I²C Bus Signals (Option)

This section explains the following settings (which are used when triggering on I²C bus signals):

- SDA source and SCL source
  Level used to detect source states
- Trigger type
  Trigger condition

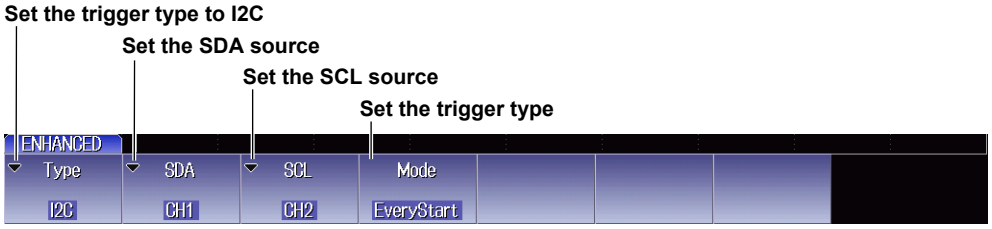
► "I²C Bus Trigger [ENHANCED, option]" in the Features Guide

Auto Setup

The DLM2000 can automatically set the source level from the received I²C bus signal and trigger on them. For more details, see section 12.4.

I2C Menu

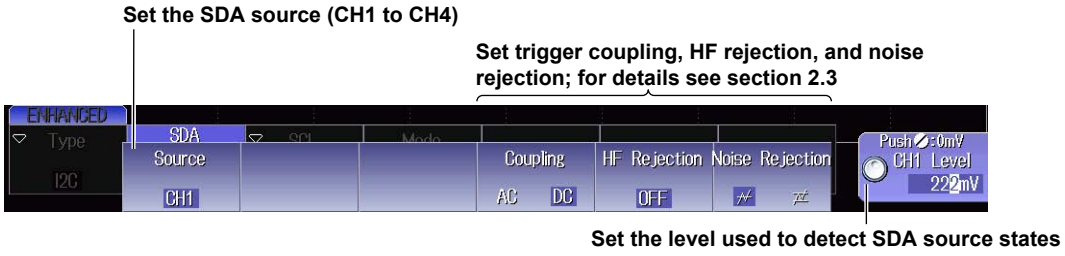
Press **ENHANCED**, the **Type** soft key, the **Serial** soft key, and then the **I2C** soft key to display the following menu.



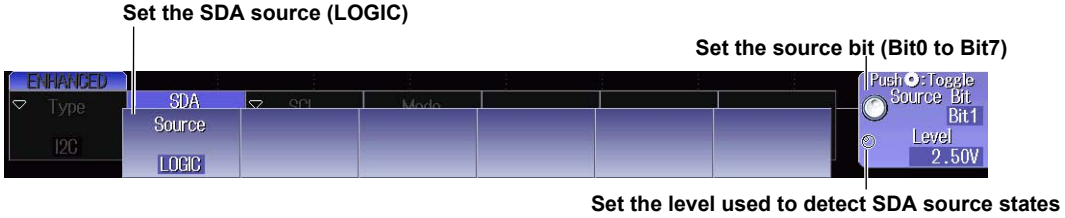
Setting the SDA Source or the SCL Source (SDA, SCL)

Press the **SDA** or **SCL** soft key to open one of the menus shown below. The menu that appears varies depending on the specified source. This section shows how to set the SDA source, you can set the SCL source in the same manner.

When the Source Is Set to a Channel from CH1 to CH4

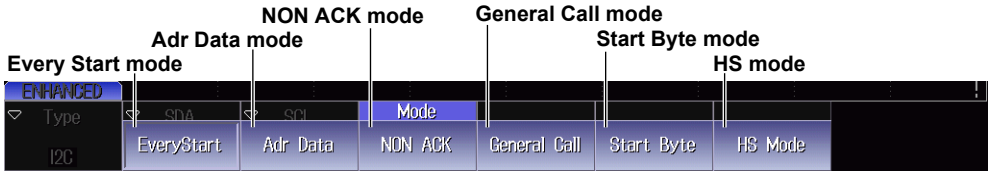


When the Source Is LOGIC (On models with the logic signal input port)



Trigger Type (Mode)

Press the **Mode** soft key to display the following menu.



Every Start Mode

Press the **Every Start** soft key.

The DLM2000 triggers when it detects a start condition.

Adr Data Mode

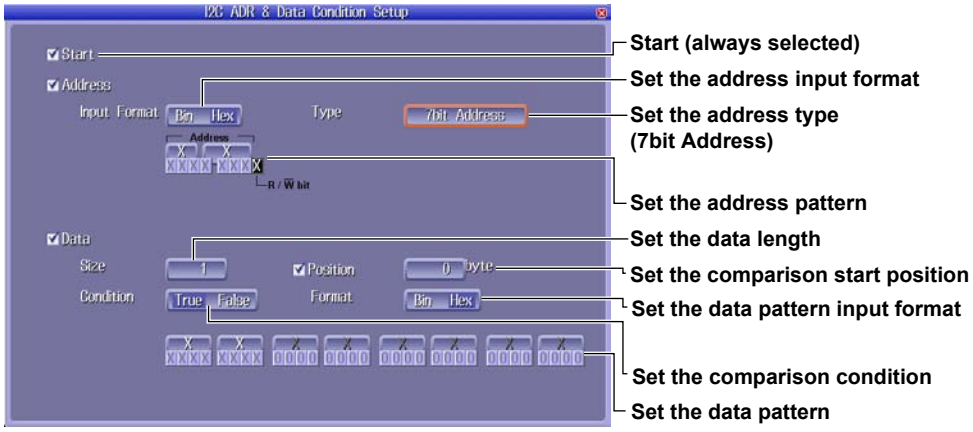
Press the **Adr Data** soft key to display the following menu.

Setting Trigger Conditions (Condition Setup)

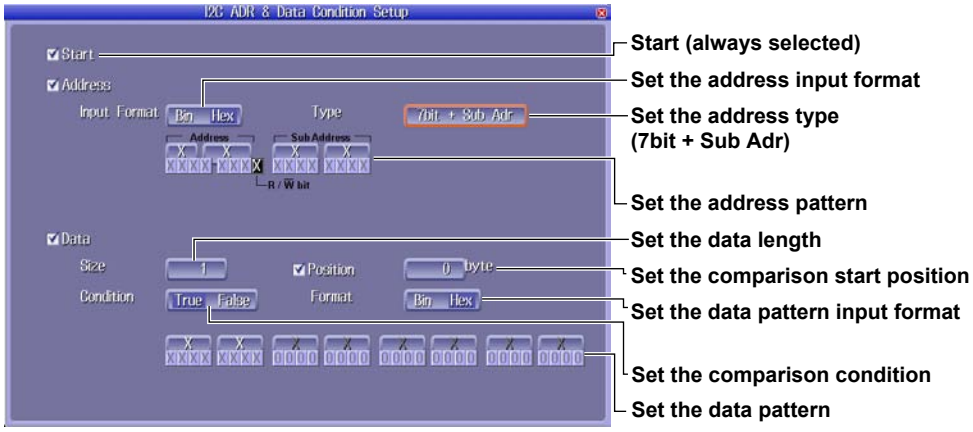
Press the **Condition Setup** soft key to display the following screen.

The DLM2000 triggers on the AND of the start, address pattern, data pattern, and comparison start position conditions. Items whose check boxes are selected are used as trigger conditions.

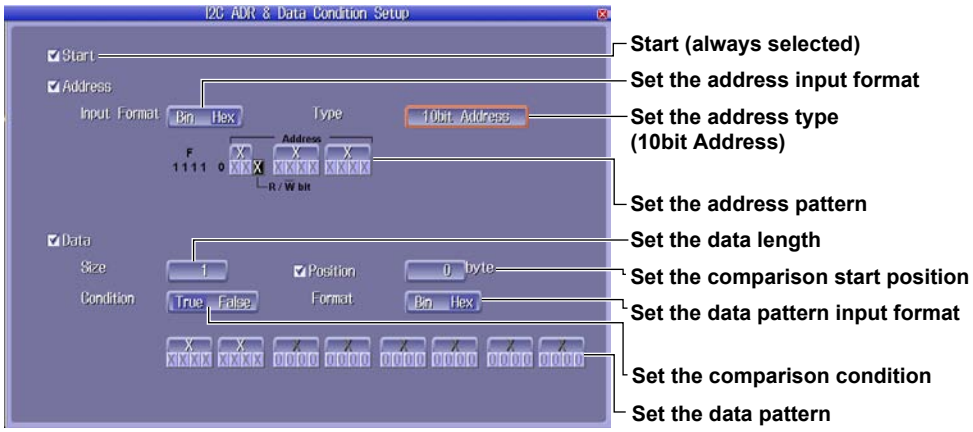
- **When Address Type Is 7bit Address**



- **When Address Type Is 7bit + Sub Adr**



- **When Address Type Is 10bit Address**



NON ACK Mode

Press the **NON ACK** soft key to display the following menu.

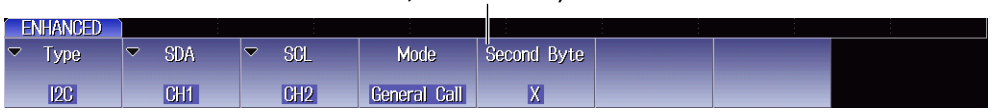
Set whether to use or ignore the acknowledge bits that belong to the start byte, HS mode master code, and read access byte

The DLM2000 triggers when the acknowledgement bit is Nack.

General Call Mode

Press the **General Call** soft key to display the following menu.

Set the Second Byte address pattern (X, 0000 0100, 0000 0110, or Master Adr)



When this is set to MasterAdr, the Condition Setup soft key appears on the menu.
If you press the **Condition Setup** soft key, the same dialog box as the one explained in the previous section, “Adr Data Mode,” appears. You can set this dialog box in the same manner as was explained in the previous section.

The DLM2000 triggers on the AND of the general call address (0000 0000), second byte address pattern, data pattern, and comparison start position conditions. Items whose check boxes are selected are used as trigger conditions.

Start Byte Mode

Press the **Start Byte** soft key.
The DLM2000 triggers when it detects the start byte master code.

HS Mode

Press the **HS Mode** soft key.
The DLM2000 triggers when it detects the high speed mode master code.

2.13 Triggering on SPI Bus Signals (Option)

This section explains the following settings (which are used when triggering on SPI bus signals):

- Wiring System (Mode)
- Clock source, data source, chip select source
  Polarity, active state, and the level used to detect source states
- Trigger condition

► "SPI Bus Trigger [ENHANCED, option]" in the Features Guide

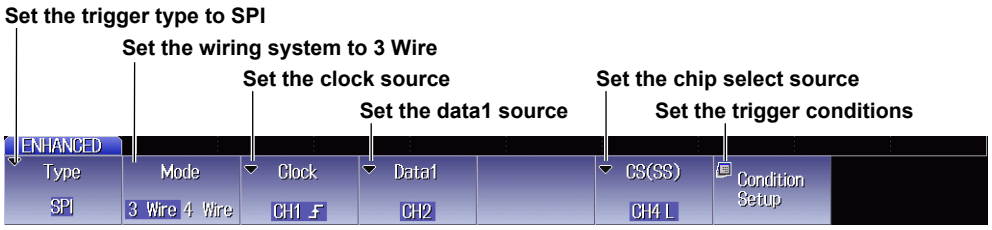
Auto Setup

The DLM2000 can automatically set the source level from the received SPI bus signal and trigger on it. For more details, see section 12.5.

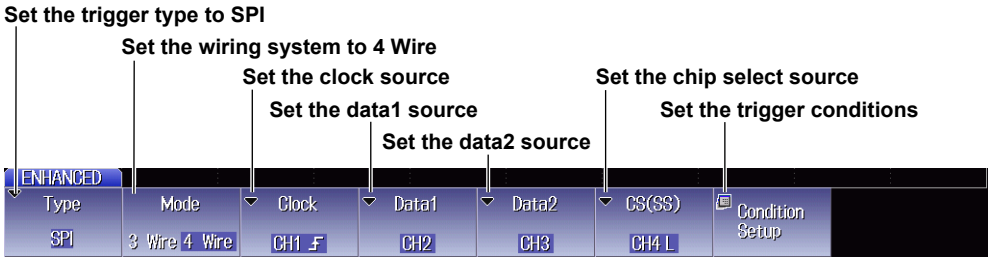
SPI Menu

Press **ENHANCED**, the **Type** soft key, the **Serial** soft key, and then the **SPI** soft key to display the following menu.

When Wiring System Is 3 Wire



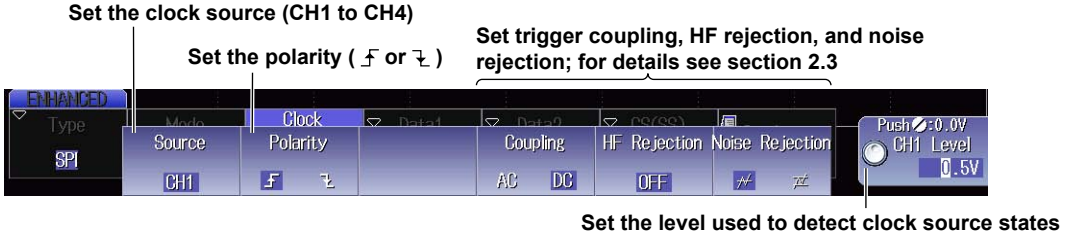
When Wiring System Is 4 Wire



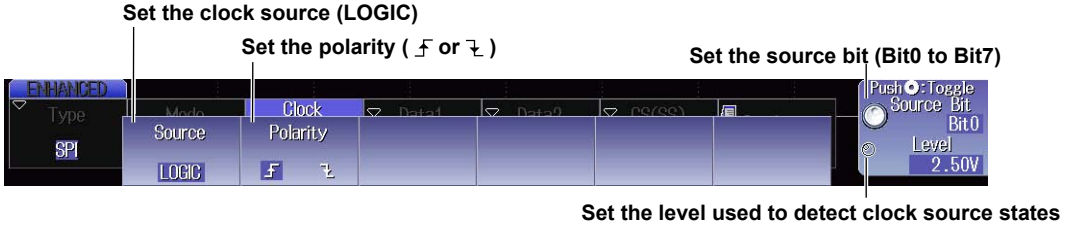
Setting the Clock Source (Clock)

Press the **Clock** soft key to open one of the menus shown below. The menu that appears varies depending on the specified clock source.

When the Source Is Set to a Channel from CH1 to CH4



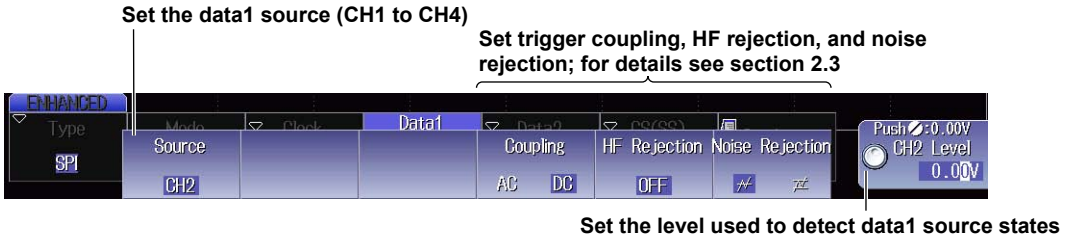
When the Source Is LOGIC (On models with the logic signal input port)



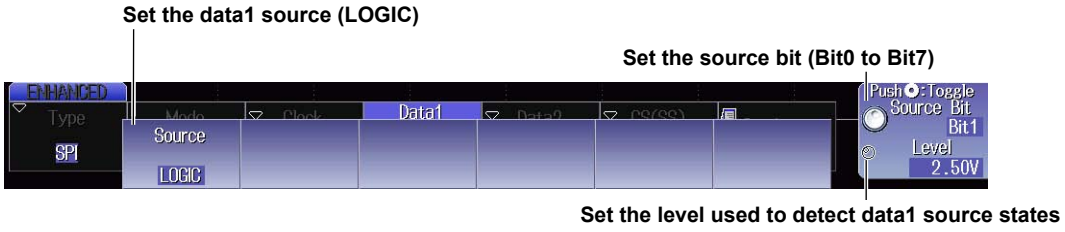
Setting the Data1 or Data2 Sources (Data1 and Data2)

Press the **Data1** or **Data2** soft key to open one of the menus shown below. The menu that appears varies depending on the specified data source. This section shows how to set the Data1 source. You can set the Data2 source in the same manner. When the wiring system is 4 Wire, set the Data2 source.

When the Source Is Set to a Channel from CH1 to CH4



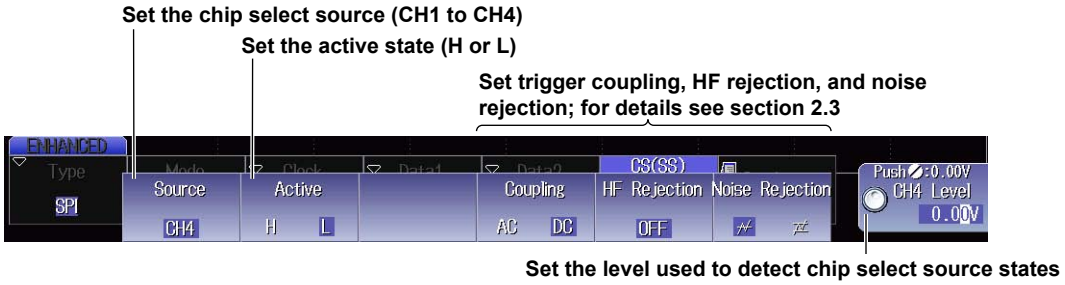
When the Source Is LOGIC (On models with the logic signal input port)



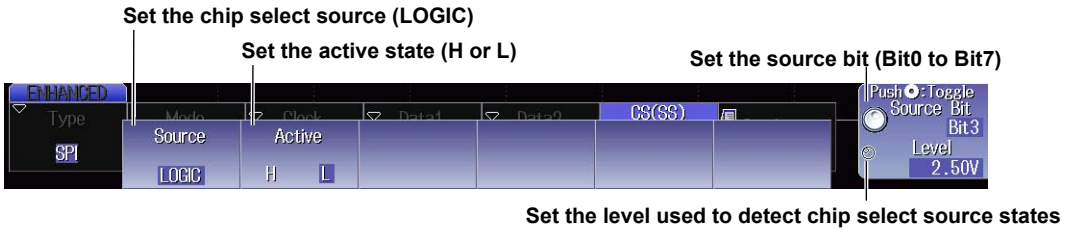
Setting the Chip Select Source (CS (SS))

Press the **CS(SS)** soft key to open one of the menus shown below. The menu that appears varies depending on the specified data source.

When the Source Is Set to a Channel from CH1 to CH4

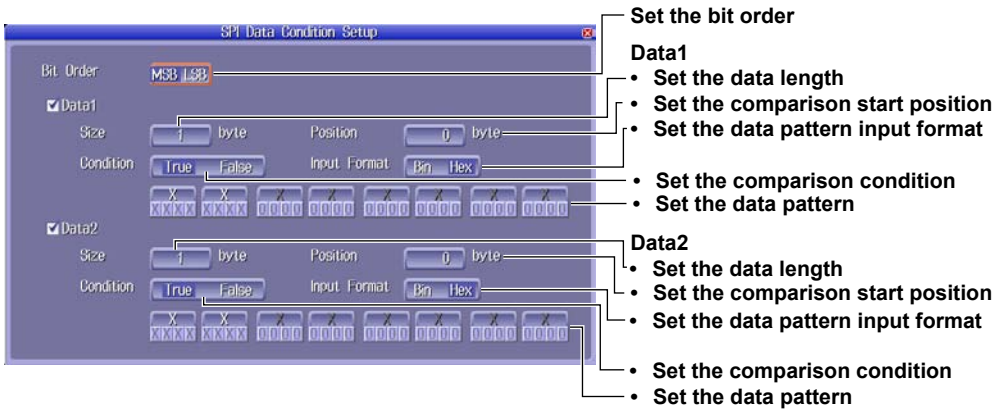


When the Source Is LOGIC (On models with the logic signal input port)



Setting Trigger Conditions (Condition Setup)

Press the **Condition Setup** soft key on the SPI Menu to display the following screen.
This section gives an explanation of the settings when the wiring system is 4 Wire. When the wiring system is 3 Wire, only set the trigger condition for Data1.



2.14 Triggering On User-Defined Serial Bus Signals

This section explains the following settings (which are used when triggering on user-defined serial bus signals):

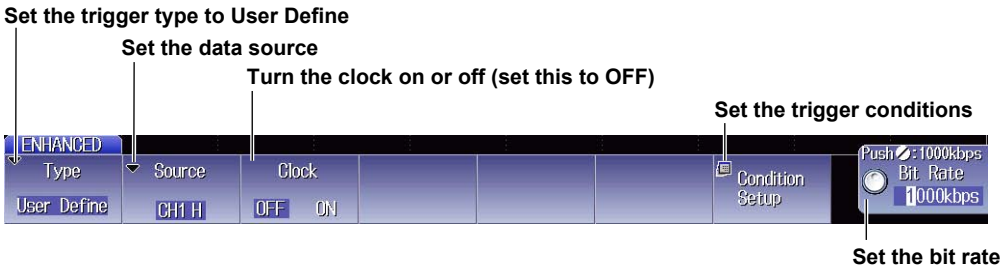
- Bit rate
- Data source, clock source, chip select source, and latch source
  Level used to detect source states
- Trigger condition

► "User-Defined Serial Bus Trigger [User Define, ENHANCED]" in the Features Guide

User Define Menu

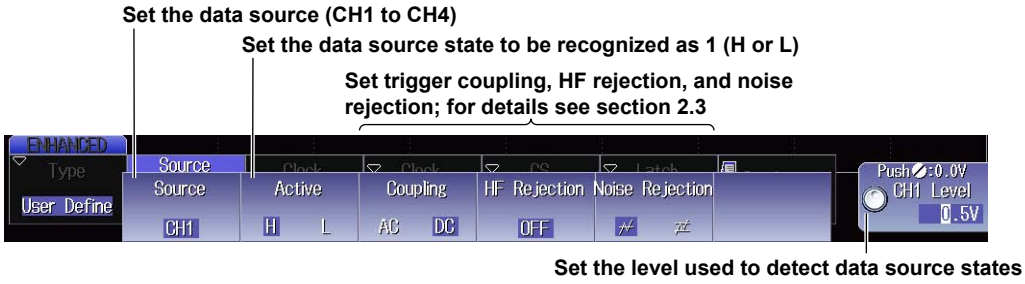
Press **ENHANCED**, the **Type** soft key, the **Serial** soft key, and then the **User Define** soft key to display one of the menus shown below. The menu that appears varies depending on whether the clock is on or off.

When the Clock Is Off



- **Setting the Data Source (Source)**

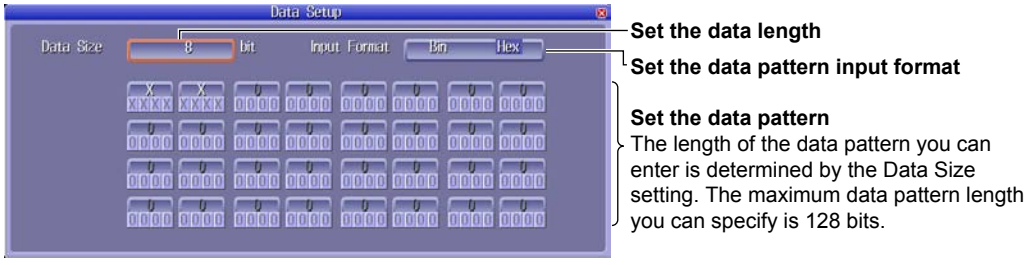
  Press the **Source** soft key to display the following menu.



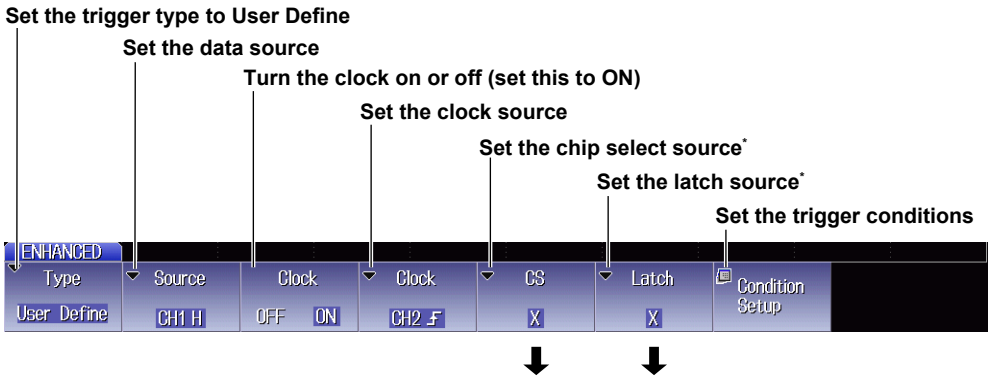
  Set the data source to compare with the pattern specified as a trigger condition.

- **Setting Trigger Conditions (Condition Setup)**

  Press the **Condition Setup** soft key to display the following screen.
  You can use data patterns as trigger conditions. The data pattern trigger condition is met when the sampled data source pattern matches the specified pattern.



When the Clock Is On



* The chip select source and latch source can only be set on 4-channel models.

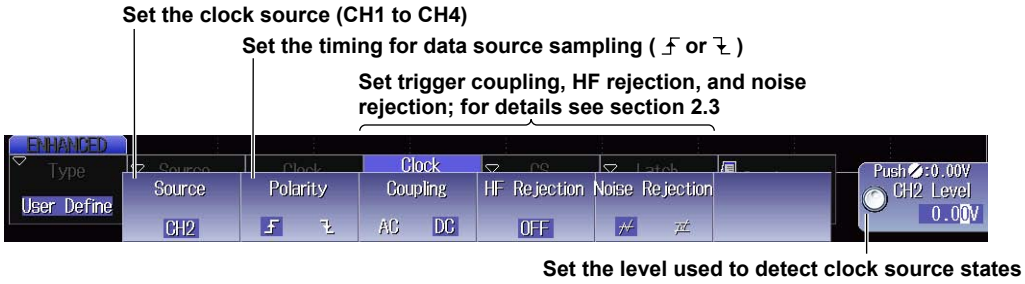
If you press the **Source** soft key and specify one of the channels from CH1 to CH4, you can then set the respective source conditions.

- **Setting the Data Source (Source)**

  The menu is the same as the one shown on the previous page for when the clock is off.

- **Setting the Clock Source (Clock)**

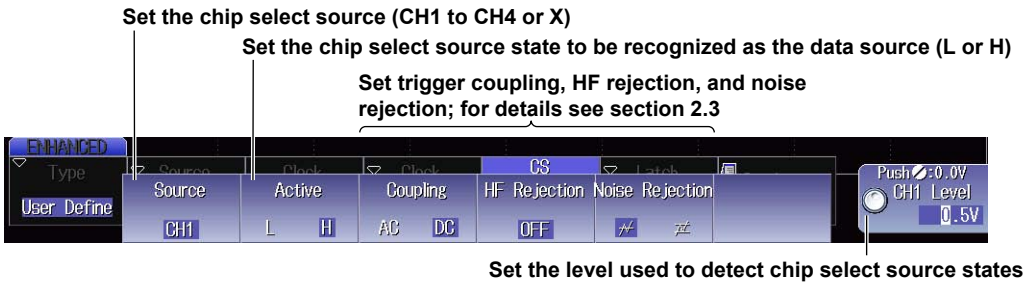
  Press the **Clock** soft key to display the following menu.



  Specify which clock source edge causes the data source to be sampled.

- **Setting the Chip Select Source (CS)**

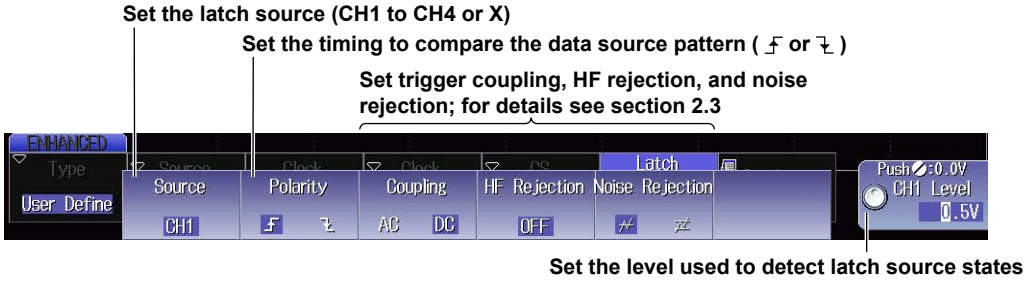
  Press the **CS** soft key to display the following menu.



  When the data source is sampled in sync with the clock source, the period for which the DLM2000 tests the data source can be controlled using the chip select source.

- **Setting the Latch Source (Latch)**

  Press the **Latch** soft key to display the following menu.



  You can specify the timing at which the data source pattern sampled in sync with the clock source is compared with the specified pattern.

- **Setting Trigger Conditions (Condition Setup)**

  The menu is the same as the one shown two pages earlier for when the clock is off.

2.15 Triggering on a TV Trigger

This section explains the following settings (which are used when triggering on a TV trigger):

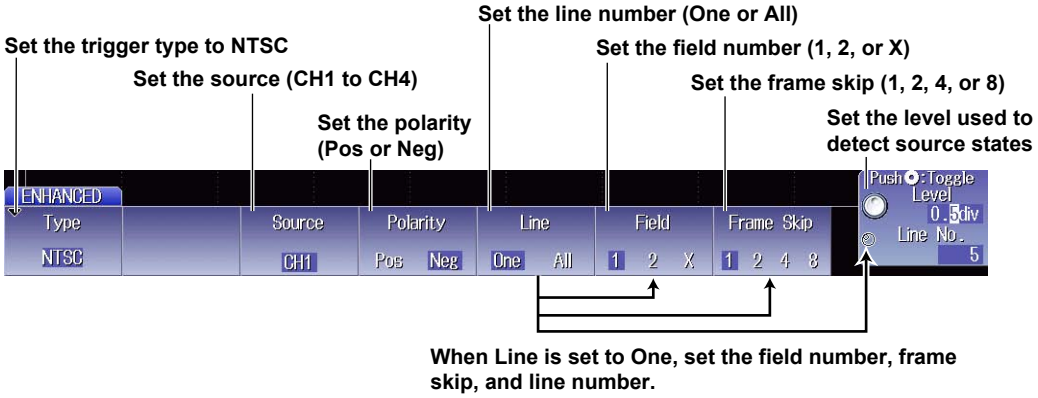
- Source
  Polarity, line number, field number, frame skip, and the level used to detect source states
- Resolution
- Horizontal sync frequency
- Sync guard frequency

► "TV Trigger [ENHANCED]" in the Features Guide

The DLM2000 provides different menus to match the selected broadcasting system.

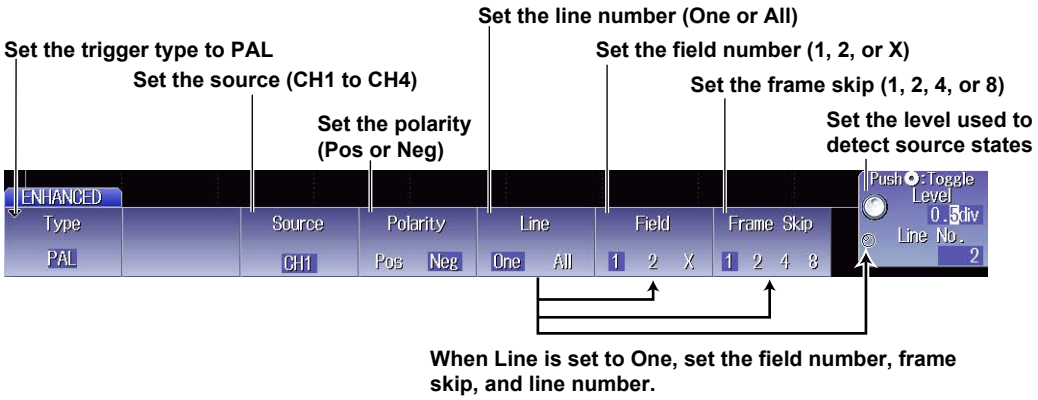
NTSC Menu

Press **ENHANCED**, the **Type** soft key, the **TV** soft key, and then the **NTSC** soft key to display the following menu.



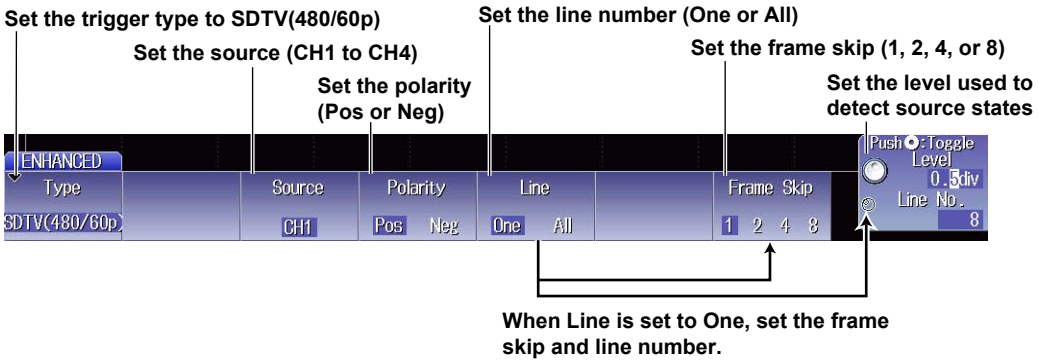
PAL Menu

Press **ENHANCED**, the **Type** soft key, the **TV** soft key, and then the **PAL** soft key to display the following menu.



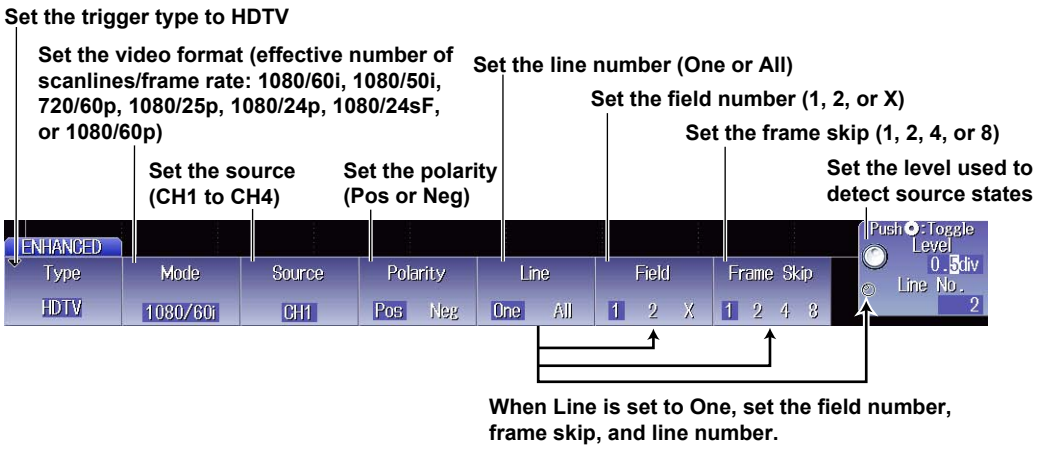
SDTV (480/60p) Menu

Press **ENHANCED**, the **Type** soft key, the **TV** soft key, and then the **SDTV(480/60p)** soft key to display the following menu.



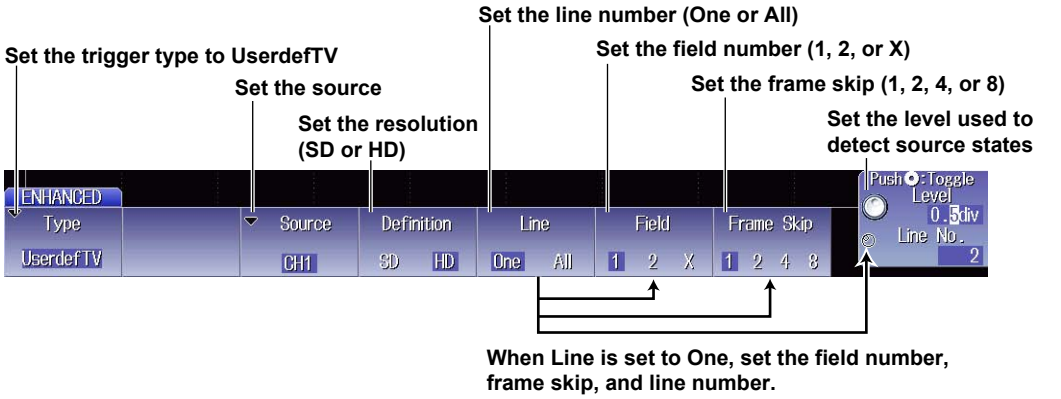
HDTV Menu

Press **ENHANCED**, the **Type** soft key, the **TV** soft key, and then the **HDTV** soft key to display the following menu.



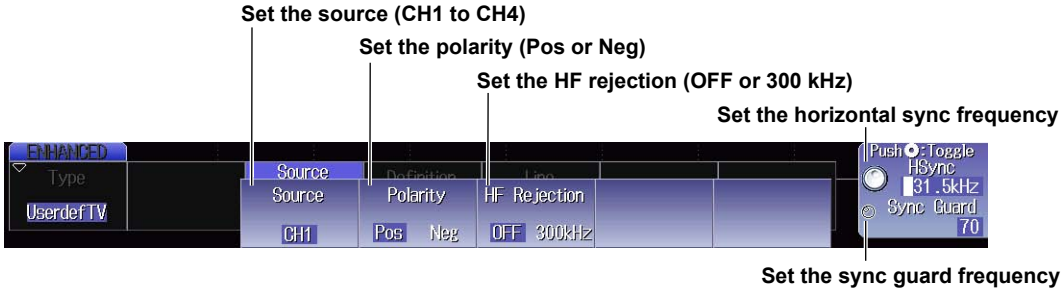
UserdefTV Menu

Press **ENHANCED**, the **Type** soft key, the **TV** soft key, and then the **UserdefTV** soft key to display the following menu.



Setting the Source (Source)

Press the **Source** soft key to display the following menu.



2.16 Triggering on Combination Triggers (B TRIG)

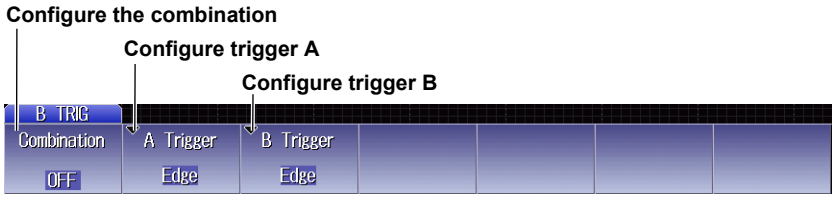
This section explains the following settings (which are used when triggering on a combination trigger):

- Combination
- A trigger: condition A
- B trigger: condition B
- Delay time for condition B
- Number of times condition B must be met

► “Trigger B (B Trigger)” in the Features Guide

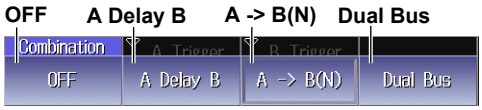
B TRIG Menu

Press **B TRIG** to display the following menu.



Setting the Combination (Combination)

Press the **Combination** soft key to display the following menu.



Note

- You can select Dual Bus when condition A is a serial bus trigger.
- On 2-channel models, the only serial bus trigger you can set is User Define.

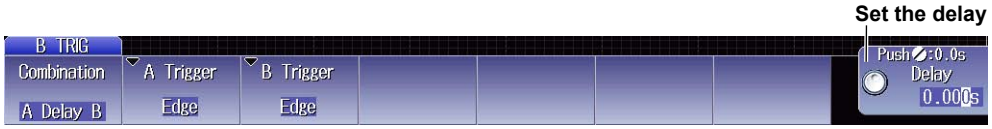
OFF

Press the **OFF** soft key.

The DLM2000 triggers when the trigger A conditions are met.

A Delay B

Press the **A Delay B** soft key to display the following menu.



After the trigger A conditions are met and the specified amount of time (the delay time) elapses, the DLM2000 triggers when the trigger B conditions are met.

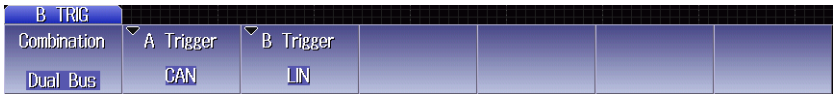
A -> B(N)

Press the **A -> B(N)** soft key to display the following menu.

After the trigger A conditions are met, the DLM2000 triggers when the trigger B conditions are met N times.

Dual Bus

Press the **Dual Bus** soft key to display the following menu.



The DLM2000 triggers when the serial bus trigger A or B conditions are met.

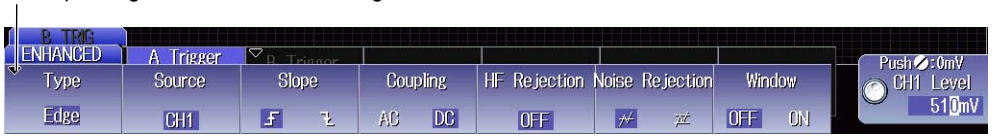
Note

- If you specify a serial bus trigger for trigger condition A and anything other than a serial bus trigger for trigger condition B and then set Combination to Dual Bus, trigger condition B becomes one of the following:
  4-channel models: CAN. 2-channel models: User Define
- On 2-channel models, the only serial bus trigger you can set is User Define.

Setting Trigger Condition A (A Trigger)

Press the **A Trigger** soft key to display the following menu.
Trigger condition A is set to the trigger condition that has been set with the EDGE key or the ENHANCED key, whichever one is illuminated. You can also set trigger condition A from the following menu.

Setting the Trigger Type
The specified trigger type menu appears. For information on setting each trigger type, see its corresponding reference in the following table.

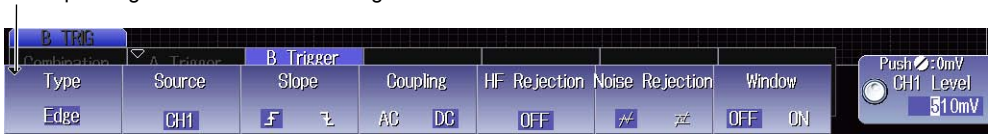


Trigger Type	Reference	Trigger Type	Reference	Trigger Type	Reference
Edge	Section 2.3	CAN	Section 2.9	TV	Section 2.15
Edge OR	Section 2.4	LIN	Section 2.10		
Edge qualified	Section 2.5	UART	Section 2.11		
State	Section 2.6	I2C	Section 2.12		
Pulse width	Section 2.7	SPI	Section 2.13		
State width	Section 2.8	User-defined serial bus	Section 2.14		

Setting Trigger Condition B (B Trigger)

Press the **B Trigger** soft key to display the following menu.
Set trigger B to one of the trigger types shown in the following table.

Setting the Trigger Type
The specified trigger type menu appears. For information on setting each trigger type, see its corresponding reference in the following table.



Trigger Type	Reference	Trigger Type	Reference
Edge	Section 2.3	CAN	Section 2.9
Edge qualified	Section 2.5	LIN	Section 2.10
State	Section 2.6	UART	Section 2.11
		I2C	Section 2.12
		SPI	Section 2.13
		User-defined serial bus	Section 2.14

2.17 Setting the Action-On-Trigger Function

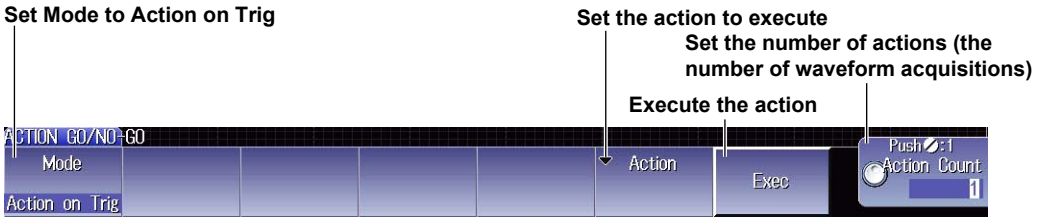
This section explains the following settings (which are used when executing the action-on-trigger function):

- Action mode
- Action to execute
- The number of actions
- Action execution

► “Executing Actions” in the Features Guide

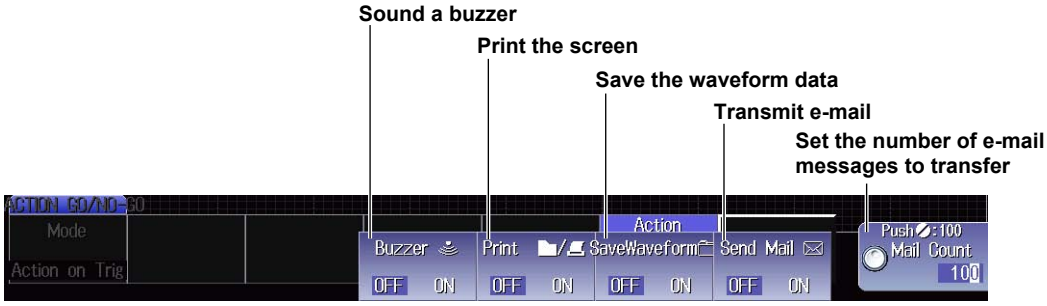
Action on Trig Menu

Press **SHIFT+MODE** (ACTION GO/NO-GO), the **Mode** soft key, and the **Action on Trig** soft key to display the following menu.



Setting the Action to Execute (Action)

Press the **Action** soft key to display the following menu.



Executing Actions (Exec)

After specifying the action mode, the action to execute, and the number of actions, press the **Exec** soft key. The DLM2000 executes the action each time it triggers until the specified number of actions has been reached.

While actions are being executed, Exec changes to Abort. If you want to stop execution, press the **Abort** soft key.

Note

When the action to execute is e-mail transmission, the DLM2000 sends the number of messages specified by either Action Count or Mail Count, whichever is lower.

2.18 Performing GO/NO-GO Determination

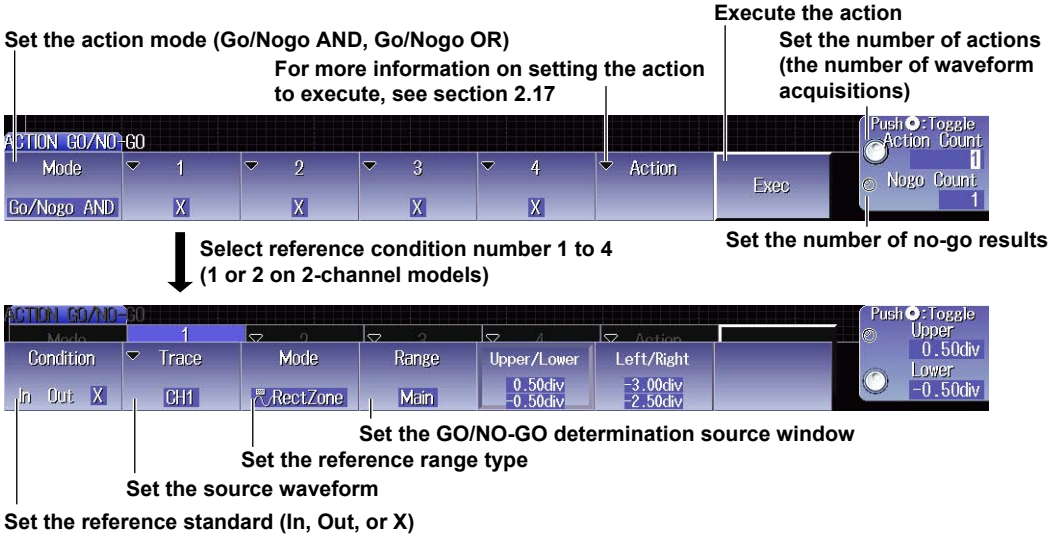
This section explains the following settings (which are used when executing the action-on-trigger function):

- Action mode
- The number of actions
- The number of NO-GO determinations
- Reference condition
  Reference standard
  Source waveform
  Reference range type
    Rectangular zone, waveform zone, polygonal zone, or waveform parameter
- GO/NO-GO determination source window
- Action execution

► “Executing Actions” in the Features Guide

Action Go/Nogo Menu

Press **SHIFT+MODE** (ACTION GO/NO-GO), the **Mode** soft key, and the **Go/Nogo AND** or **Go/Nogo OR** soft key to display the following menu.



Executing Actions (Exec)

After specifying the action mode, the action to execute, the number of actions, the number of NO-GO determinations, the reference conditions, and the GO/NO-GO determination source window, press the **Exec** soft key. The DLM2000 executes actions until either the specified number of actions or the number of NO-GO determinations is reached.

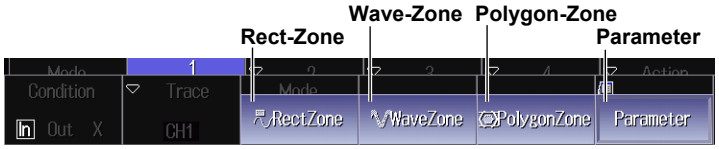
While actions are being executed, Exec changes to Abort. If you want to stop execution, press the **Abort** soft key.

Note

When the action to execute is e-mail transmission, the DLM2000 sends the number of messages specified by either Action Count or Mail Count, whichever is lower.

Setting the Reference Range Type (Mode)

Press the **Mode** soft key to display the following menu.



When the source waveform is LOGIC, XY1, XY2, FFT1, or FFT2, there are reference range types that you cannot specify.

Source Waveform	Reference Range Type			
	Rect-Zone	Wave-Zone	Polygon-Zone	Parameter
CH1 to CH4	Yes	Yes	Yes	Yes
LOGIC	No	No	No	Yes
Math1, Math2	Yes	Yes	Yes	Yes
XY1, XY2	Yes	No	Yes	Yes
FFT1, FFT2	No	No	No	Yes

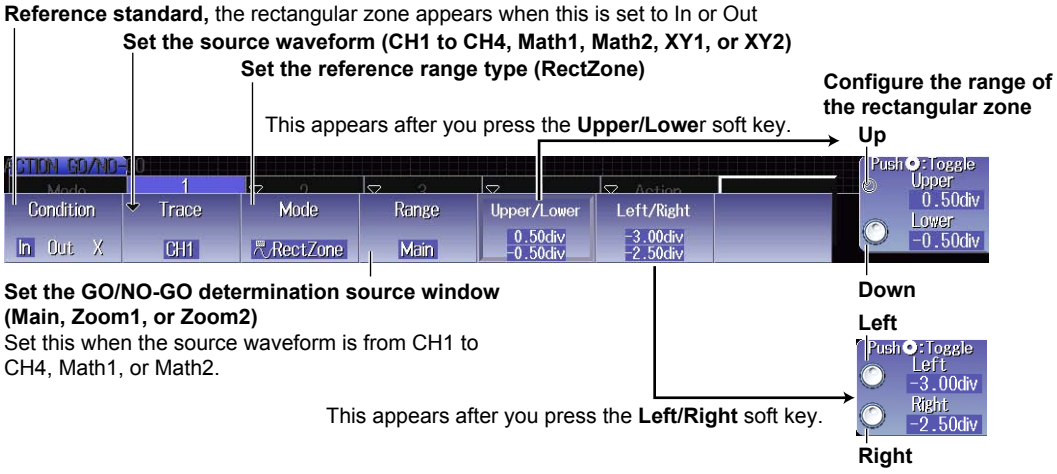
Note

Using the CH4 Terminal and Logic Signal Input Ports When You Perform GO/NO-GO Determination

When you perform GO/NO-GO determination, you cannot use the CH4 terminal and logic signal input ports as the source at the same time. Specify the source that you want to use in advance by pressing either the CH4 key or the LOGIC key.

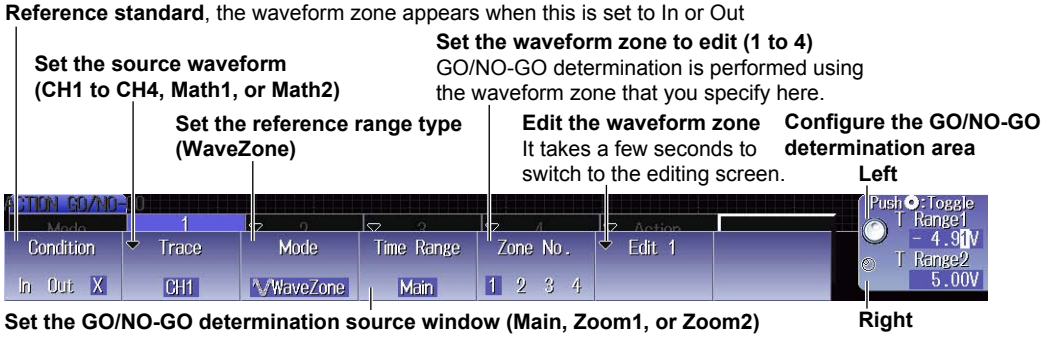
Rect-Zone

Press the **RectZone** soft key to display the following menu.



Wave-Zone

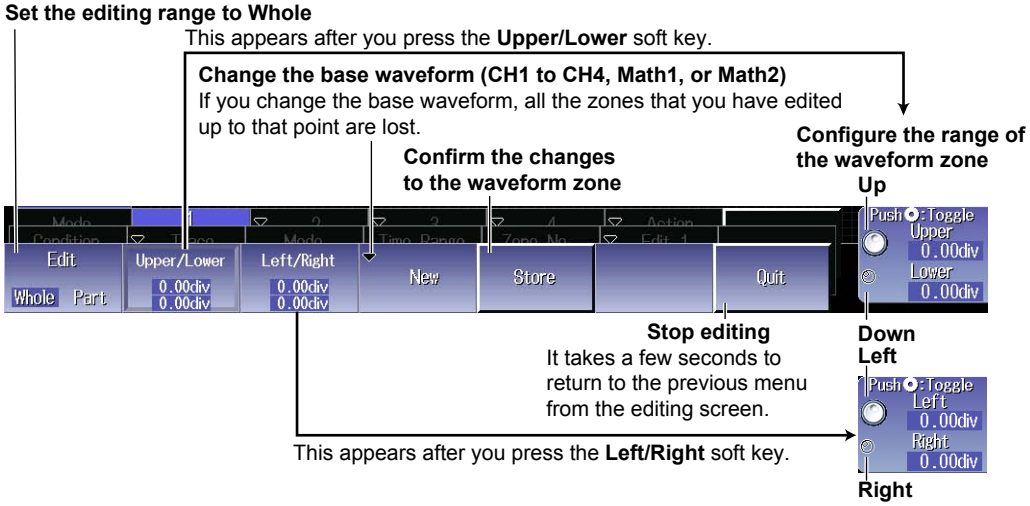
Press the **WaveZone** soft key to display the following menu.



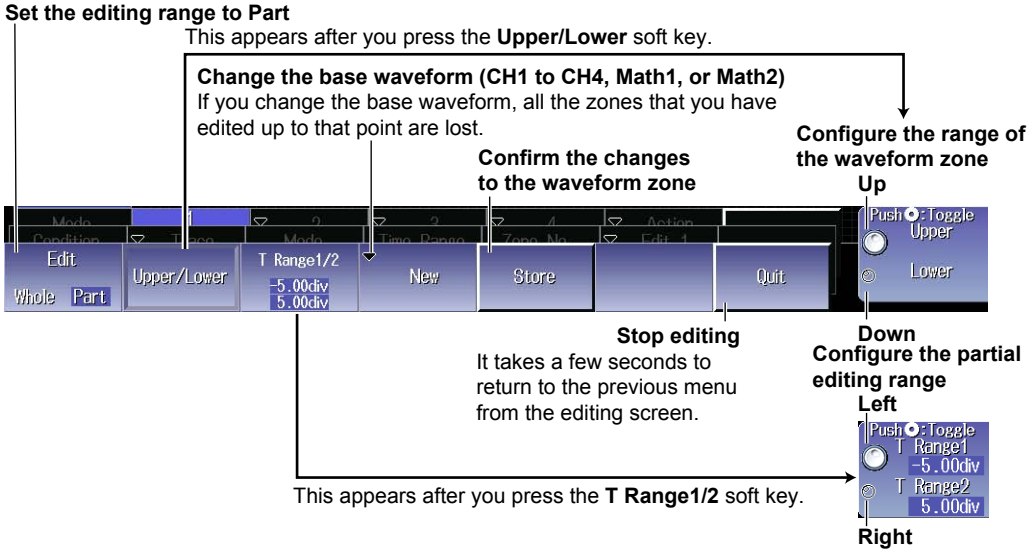
Editing a Waveform Zone (Edit1 to 4)

Press one of the soft keys from **Edit 1** to **Edit 4**, whichever is shown on the menu, to display the following menu.

- **Editing the Whole Waveform**



- **Editing a Part of the Waveform**



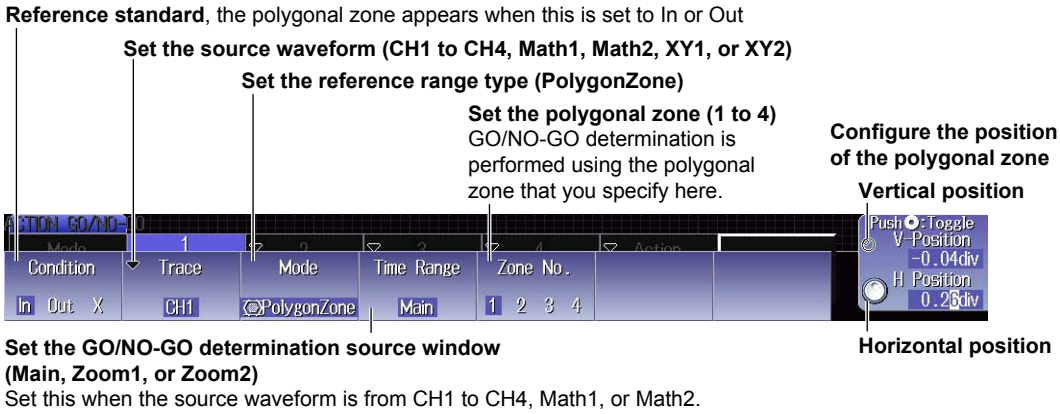
  - Changing the Base Waveform (CH1 to CH4, Math1, Math2)
    Change the base waveform when you want to use a waveform other than the GO/NO-GO determination source waveform or when you want to recreate the zone. If you change the base waveform, all the zones that you have edited up to that point are lost.
  - Confirming the Waveform Zone
    Confirm the edited waveform zone and store it in internal memory.
  - Finishing Editing
    Return to the previous menu from the editing screen. If you do not confirm the edited waveform zone by pressing the **Store** soft key, the changes that you made are lost.

Note

- If you change the base waveform, all the zones that you have edited up to that point are lost.
- When you finish editing and return to the previous menu, if you do not confirm the edited waveform zone by pressing the Store soft key, the changes that you made are lost.
- If you want to move from the editing menu to a different menu, you have to press the Quit soft key to finish editing.
- Moving to the editing screen or returning to the previous menu takes a few seconds.

Polygon-Zone

Press the **PolygonZone** soft key to display the following menu.



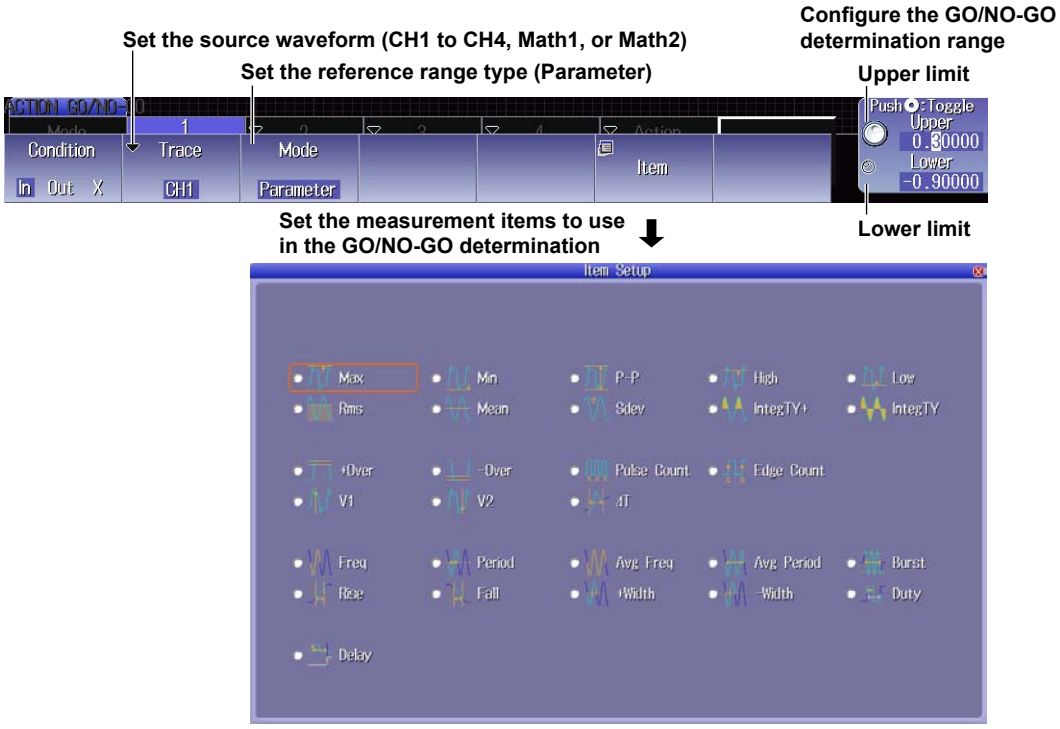
Use the Mask Editor software on a PC in advance to create the polygonal images that you will use as polygonal zones. After loading the file (see section 16.8) and loading the polygonal image into the specified zone number (Zone No. 1 to 4), configure the polygonal zone GO/NO-GO determination.

Parameter

Press the **Parameter** soft key to open one of the menus shown below. The menu that appears varies depending on the specified source waveform.

When Math1, Math2, or a Channel from CH1 to CH4 Is the Source Waveform

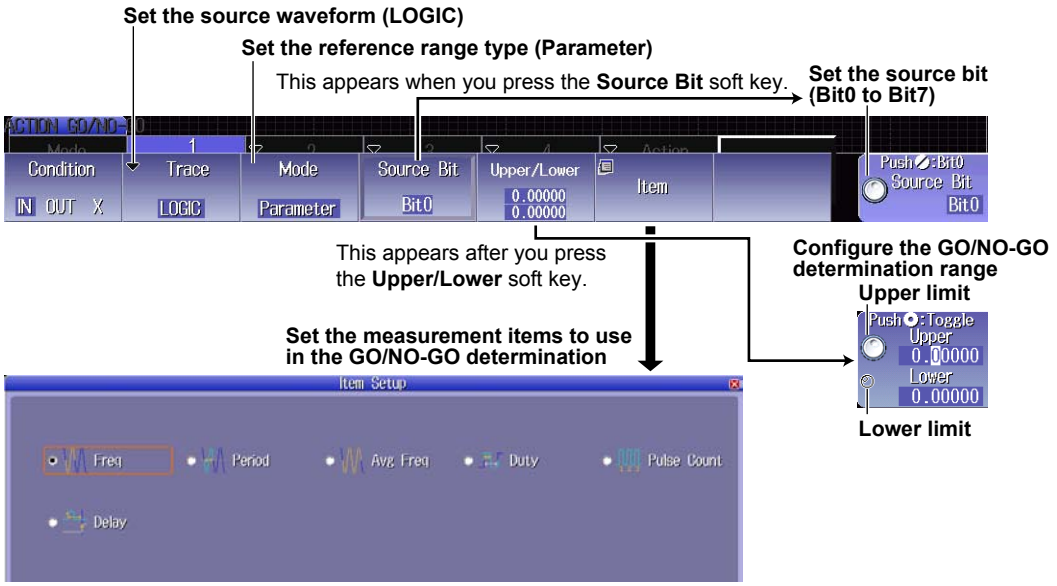
You can select the measurement items to use in the GO/NO-GO determination from all of the items used for automated measurement of waveform parameters (excluding measurement of the delay between waveforms). For information on setting automated measurement of waveform parameters, see section 9.1.



When LOGIC Is the Source Waveform

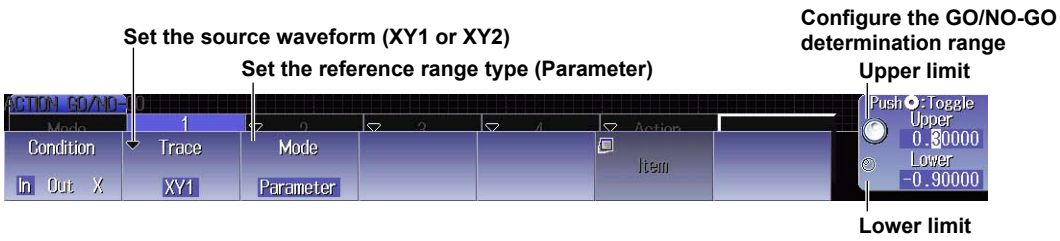
You can select the measurement item to use in the GO/NO-GO determination from the items used for time axis measurement of waveform parameters shown below. For information on setting automated measurement of waveform parameters, see section 9.1.

Freq, Period, Avg Freq, Duty, Pulse Count, and Delay



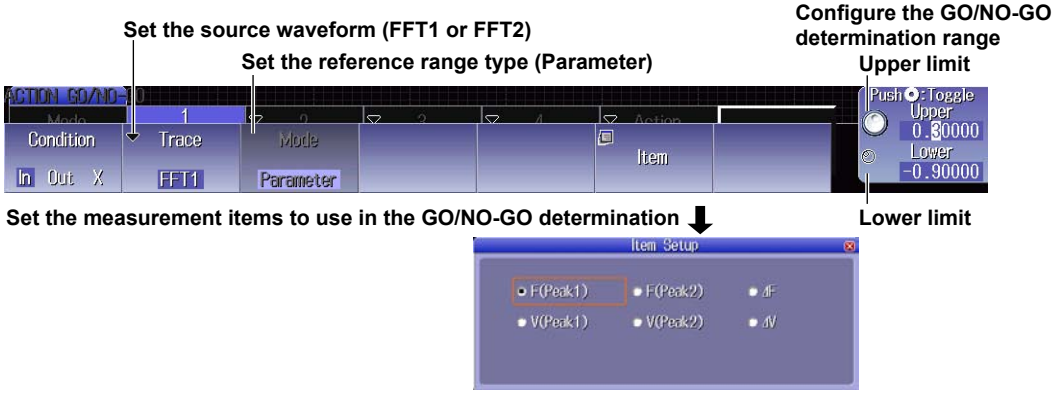
When XY1 or XY2 Is the Source Waveform

The measurement item to use in the GO/NO-GO determination is the area of XY1 or XY2. For information on setting how the XY waveform is displayed and how its area is determined, see chapter 5 and appendix 1.



When FFT1 or FFT2 Is the Source Waveform

You can select the measurement item to use in the GO/NO-GO determination from the cursor measurement items for FFT. For information on setting the cursor measurement items for FFT, see section 7.2.



3.1 Setting Conditions for Waveform Acquisition

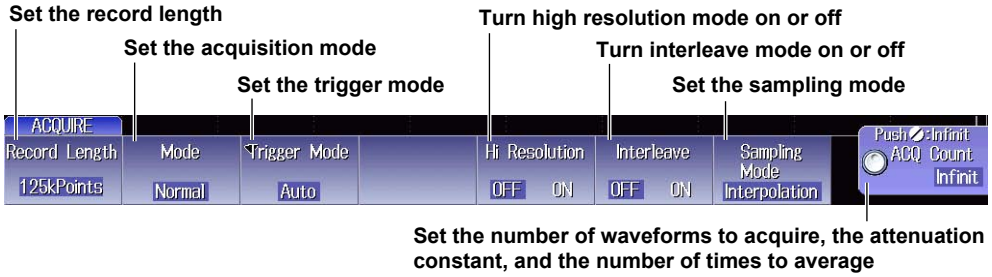
This section explains the following settings (which are used when acquiring waveforms):

- Record length
- Acquisition mode
- Trigger mode
- High resolution mode
- Interleave mode
- Sampling mode
- The number of waveforms to acquire, the attenuation constant, and the number of times to average

► "Waveform Acquisition" in the Features Guide

ACQUIRE Menu

Press **ACQUIRE** to display the following menu.



Setting the Acquisition Mode (Mode)

Normal: Displays waveforms without processing the sampled data. You can set the number of waveforms to acquire with the jog shuttle.

Envelope: Displays waveforms in envelope mode. You can set the number of waveforms to acquire with the jog shuttle.

Average: Displays averaged waveforms. You can set the attenuation constant and the number of times to average with the jog shuttle.

Setting the Trigger Mode (Trigger Mode)

The trigger mode determines the conditions for updating the displayed waveforms. You can also set the trigger mode by pressing the MODE key. You can set the trigger mode to one of the settings below.

►See section 2.1.

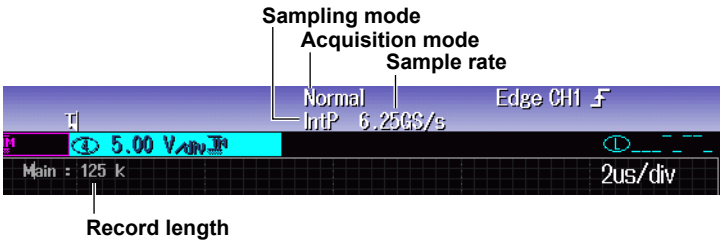
Auto, Auto Level, Normal, and N Single

Setting the Sampling Mode (Sampling Mode)

Realtime: Samples data in real-time sampling mode.

Interpolation: Samples data in interpolation mode.

Repetitive: Samples data in repetitive sampling mode.



3.2 Acquiring Waveforms

Waveform Acquisition (RUN and STOP)

Press **RUN/STOP** to start or stop waveform acquisition.
The key is illuminated while the DLM2000 is acquiring waveforms.

Waveform Acquisition (SINGLE)

Press **SINGLE**. The key illuminates and the DLM2000 updates the waveform display only once when the trigger condition is met. After that, it stops acquiring waveforms and the key turns off.

► “Waveform Acquisition (RUN and STOP)” and “Waveform Acquisition (SINGLE)” in the Features Guide

4.1 Setting Display Conditions

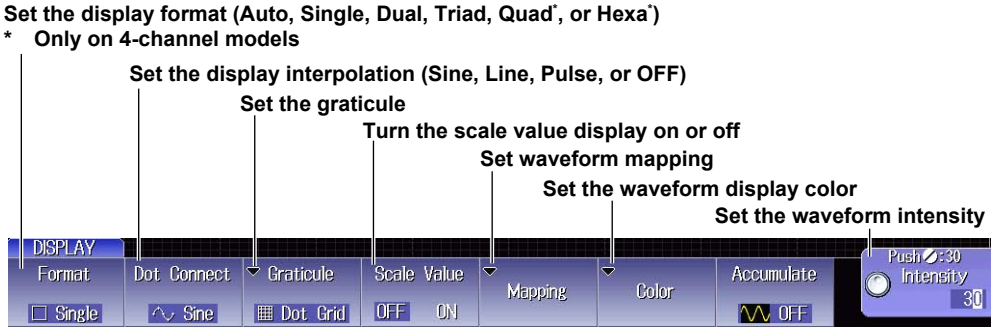
This section explains the following settings (which are used when viewing the display):

- Display format
- Display interpolation
- Graticule
- Scale value display
- Waveform mapping
- Waveform display color
- Waveform intensity

► “Display” in the Features Guide

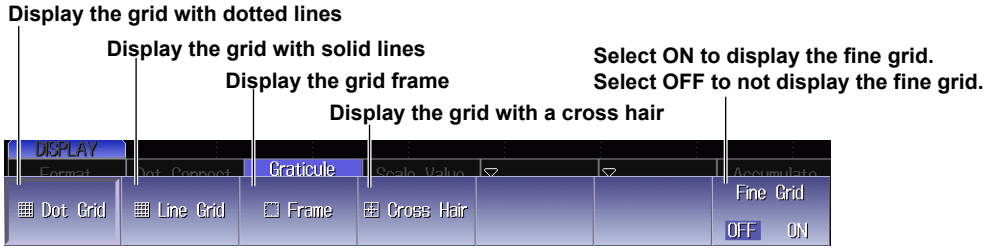
DISPLAY Menu

Press **DISPLAY** to display the following menu.



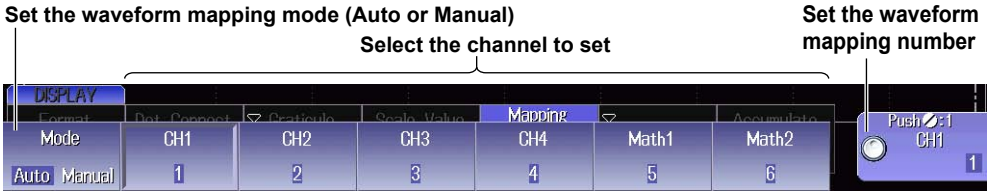
Setting the Graticule (Graticule)

Press the **Graticule** soft key to display the following menu.



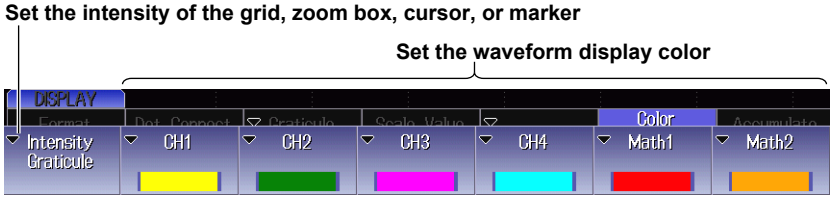
Setting Waveform Mapping (Mapping)

Press the **Mapping** soft key to display the following menu.



Setting the Waveform Display Color (Color)

Press the **Color** soft key to display the following menu.



4.2 Using the Accumulate Feature

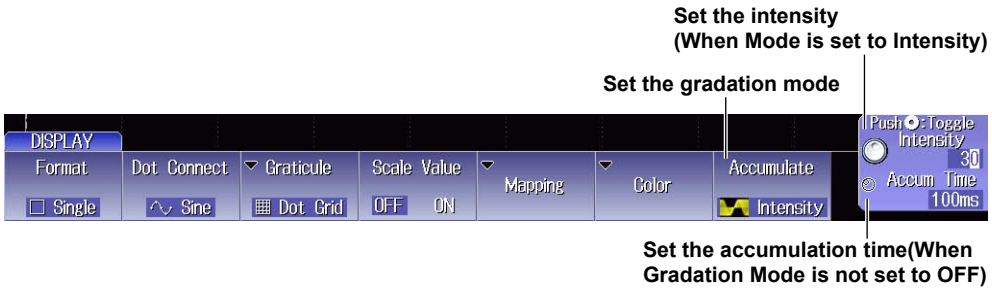
This section explains the following settings (which are used when using the accumulate feature):

- Gradation mode (accumulate display)
- Intensity level
- Accumulation time

► “Accumulate (Accumulate)” in the Features Guide

DISPLAY Menu

Press **DISPLAY** to display the following menu.



Gradation Mode (Accumulate)

Intensity: Indicates waveform frequency using different intensity levels. You can set the different intensity levels with the jog shuttle.

Color: Indicates waveform frequency using different colors.

OFF: Does not accumulate waveforms.

4.3 Using the Snapshot and Clear Trace Features

Press **SNAP SHOT** to retain the currently displayed waveform on the screen as a snapshot displayed in white. Snapshot waveforms remain on the screen until you execute a clear trace operation.

Press **CLEAR TRACE** to clear all of the waveforms that are displayed on the screen.

► “Snapshot (SNAP SHOT)” and “Clear Trace (CLEAR TRACE)” in the Features Guide

4.4 Adjusting the Backlight

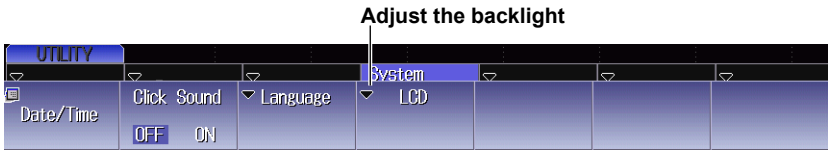
This section explains the following settings (which are used when adjusting the backlight):

- Turning off the backlight
- Automatically turning off the backlight
- Adjusting the brightness

► “System Configuration (System Configuration)” in the Features Guide

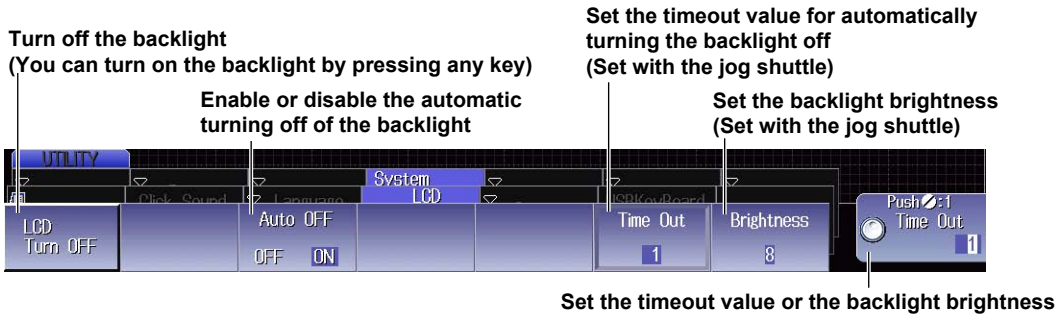
UTILITY System Configuration Menu

Press **UTILITY**, and then press the **System Configuration** soft key to display the following menu.



Adjusting the Backlight (LCD)

Press the **LCD** soft key to display the following menu.



5.1 Displaying XY Waveforms

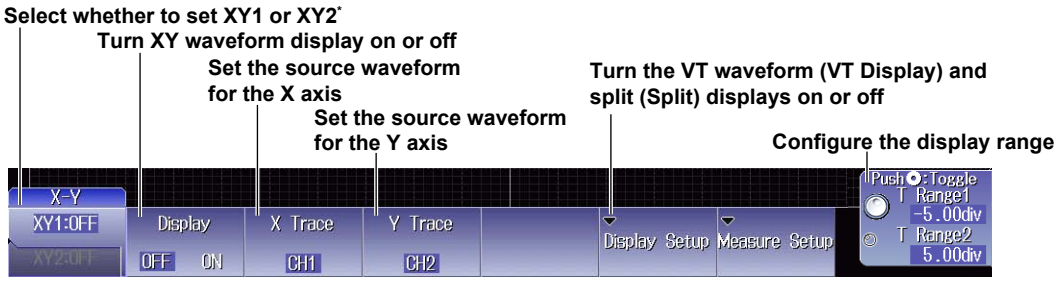
This section explains the following settings (which are used when displaying XY waveforms):

- XY waveform display
- X-axis and Y-axis source waveforms
- VT waveform display and split display
- Display range

► “Displaying XY Waveforms” in the Features Guide

XY Menu

Press **SHIFT+DISPLAY** (XY) to display the following menu.



*** XY2 is only available on 4-channel models**

5.2 Performing Cursor Measurements and Area Calculations

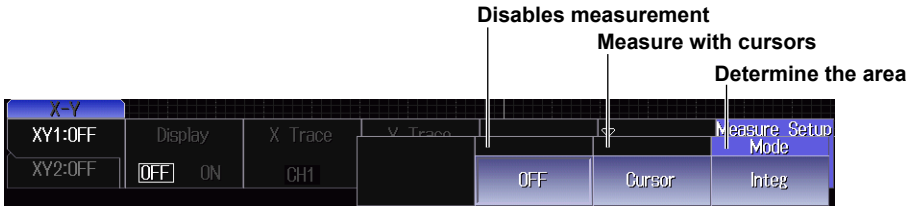
This section explains the following settings (which are used when performing cursor measurements on and determining the area of the displayed XY waveform):

- Measurement mode
- Cursor measurement
- Area determination method

► "Measurement (Measure Setup)" in the Features Guide

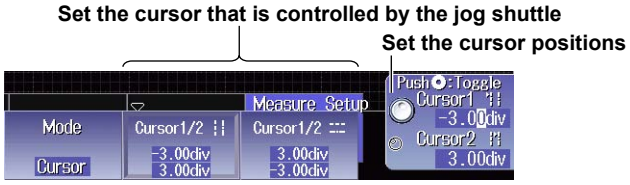
XY Measure Setup Menu

Press **SHIFT+DISPLAY**, (XY), the **Measure Setup** soft key, and then the **Mode** soft key to display the following menu.



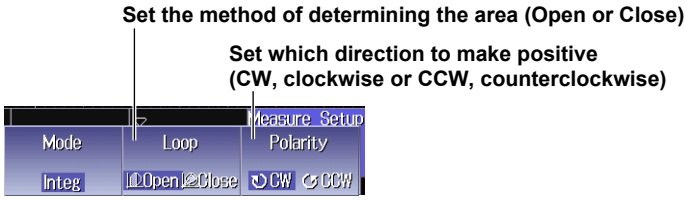
Performing Cursor Measurements (Cursor)

Press the **Cursor** soft key to display the following menu.



Performing Area Calculations (Integ)

Press the **Integ** soft key to display the following menu.



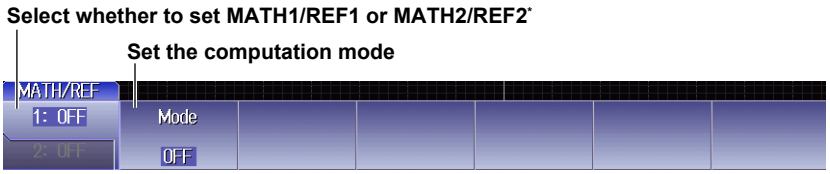
6.1 Setting the Computation Mode

This section explains how to set the computation mode.

► “Computation Mode (Mode)” in the Features Guide

MATH/REF menu

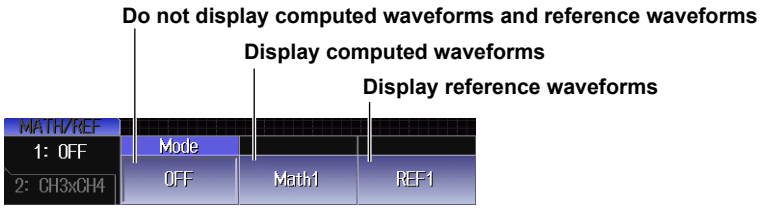
Press **MATH/REF** to display the following menu.



* **MATH2/REF2 is only available on 4-channel models**

Setting the Computation Mode (Mode)

Press the **Mode** soft key to display the following menu.



6.2 Performing Addition, Subtraction, and Multiplication

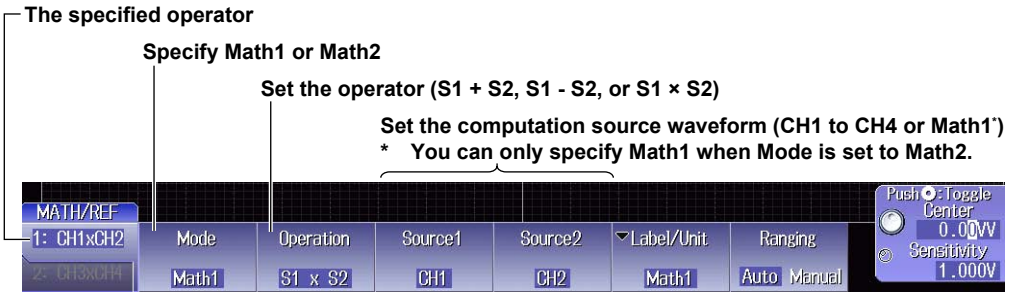
This section explains the following settings (which are used when performing addition, subtraction, and multiplication):

- Operators
- Computation source waveforms

► “Operators (Operation)” in the Features Guide

MATH/REF menu

Press **MATH/REF** to display the following menu.



6.3 Performing Filter Functions

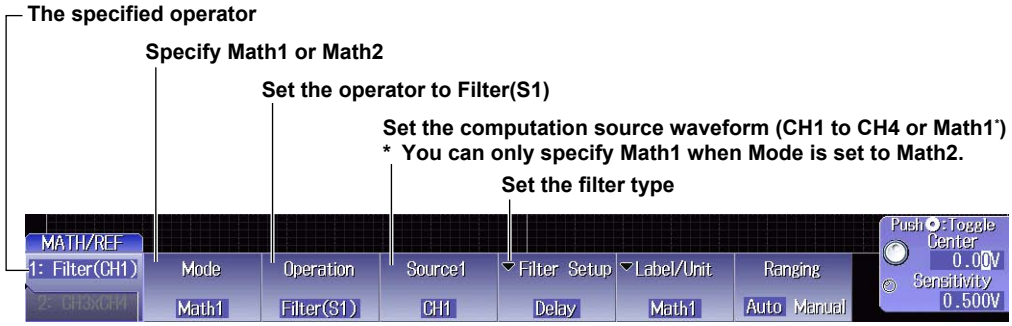
This section explains the following settings (which are used when performing the phase shift and average filter functions and when applying an IIR filter to the waveform):

- Operators
- Computation source waveforms
- Filter type

► “Operators (Operation)” in the Features Guide

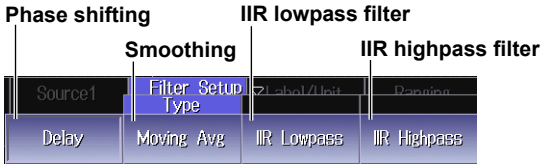
MATH/REF menu

Press **MATH/REF** to display the following menu.



Setting the Filter Type (Filter Type)

Press the **Filter Setup** soft key, then the **Type** soft key to display the following menu.



Setting Phase Shifting (Delay)

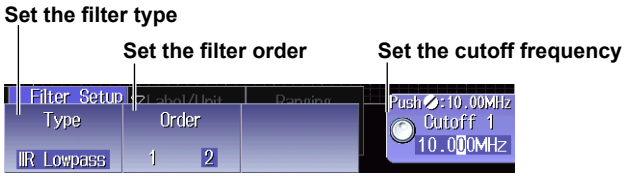
Press the **Delay** soft key to display the following menu.

Setting Smoothing (Moving Avg)

Press the **Moving Avg** soft key to display the following menu.

Setting the IIR Filter (IIR Lowpass or IIR Highpass)

Press the **IIR Lowpass** or **IIR Highpass** soft key to display the following menu.



6.4 Performing Integration

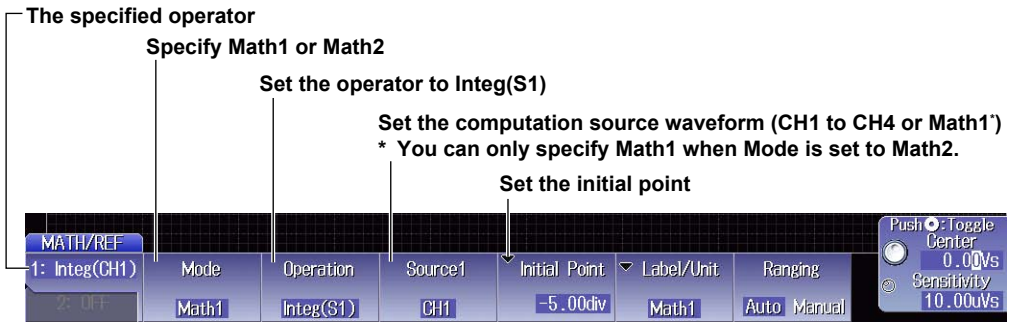
This section explains the following settings (which are used when performing integration):

- Operators
- Computation source waveforms
- Initial point

► “Operators (Operation)” in the Features Guide

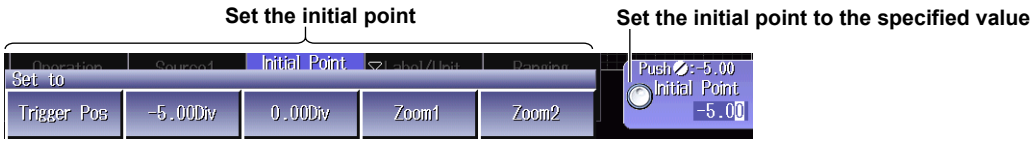
MATH/REF menu

Press **MATH/REF** to display the following menu.



Setting the Initial Point (Initial Point)

Press the **Initial Point** soft key to display the following menu.



6.5 Performing Count Computations

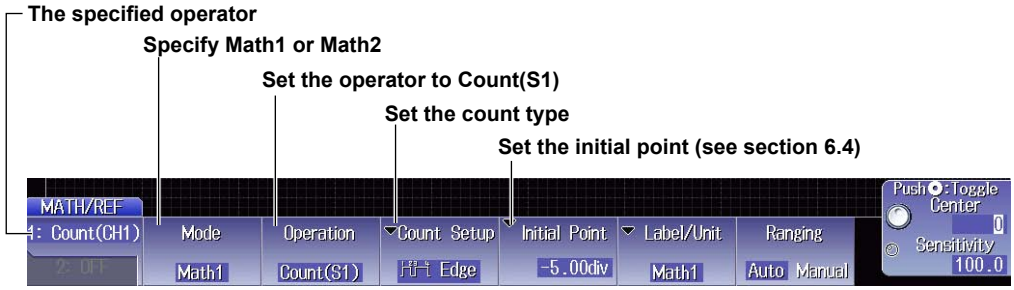
This section explains the following settings (which are used when performing edge count or rotary count):

- Operators
- Count type
- Computation source waveforms
- Initial point
- Edge count detection level, slope, and hysteresis
- Rotary count threshold level

► “Edge Count or Rotary Count (Count(S1))” in the Features Guide

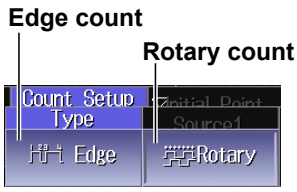
MATH/REF menu

Press **MATH/REF** to display the following menu.



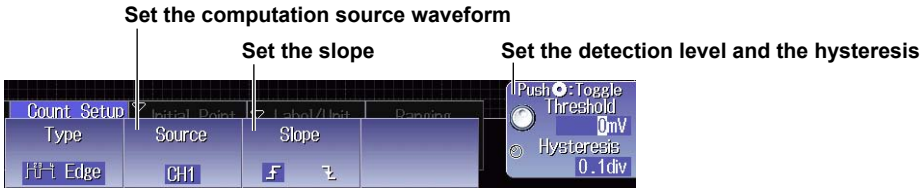
Setting the Count Type (Type)

Press the **Count Setup** soft key, then the **Type** soft key to display the following menu.



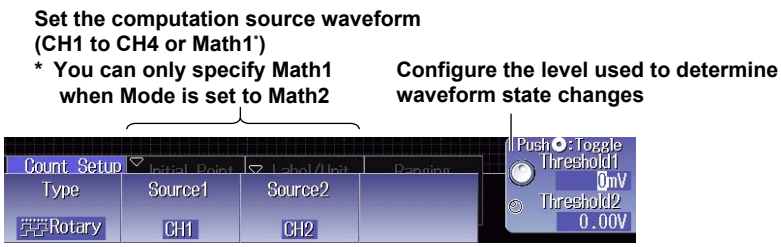
Setting the Edge Count (Edge)

Press the **Edge** soft key to display the following menu.



Setting the Rotary Count (Rotary)

Press the **Rotary** soft key to display the following menu.



6.6 Setting Labels, Units, and Scaling

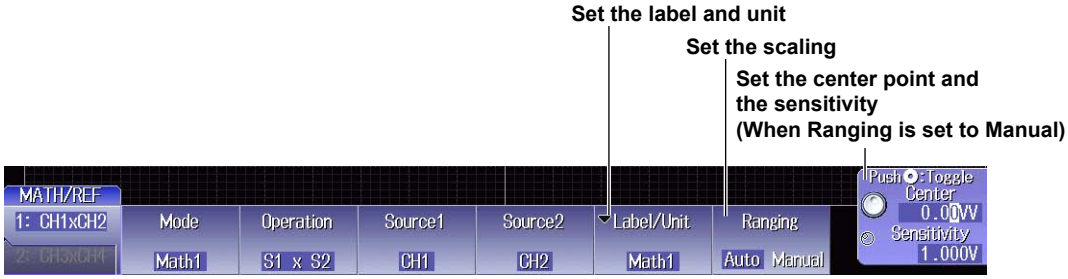
This section explains the following settings (which are used with labels, units, and scaling):

- Label
- Unit
- Scaling

► "Setting Labels and Units (Label/Unit)" and "Scaling (Ranging)" in the Features Guide

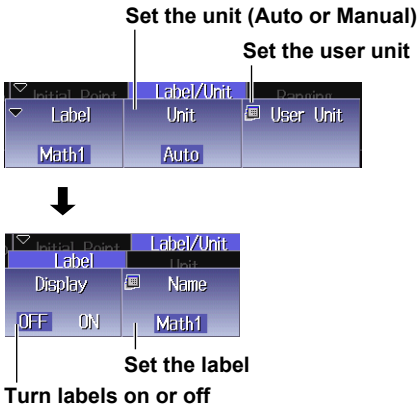
MATH/REF menu

Press **MATH/REF** to display the following menu.



Setting Labels and Units (Label/Unit)

Press the **Label/Unit** soft key to display the following menu.



Setting Scaling (Ranging)

Auto: Automatically set the vertical display range of the computed waveform.

Manual: Manually set the sensitivity (Sensitivity) and the signal level at the vertical center (Center).

6.7 Loading Reference Waveforms

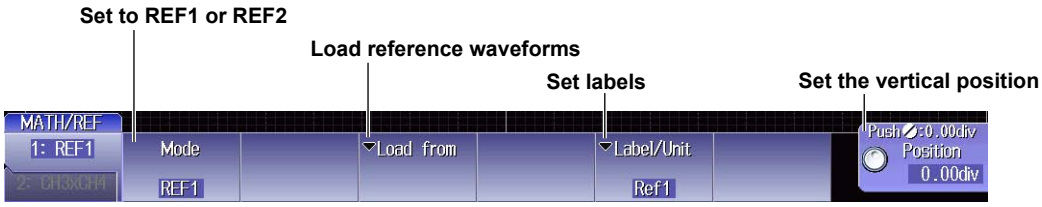
This section explains the following settings (which are used when loading reference waveforms):

- Loading reference waveforms
- Label
- Vertical position

► “Reference Waveforms” in the Features Guide

MATH/REF menu

Press **MATH/REF** to display the following menu.



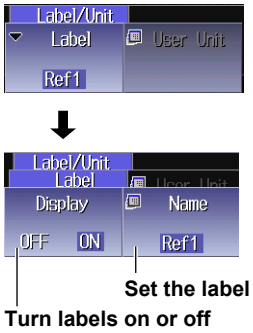
Loading the Reference Waveform (Load from)

Specify the waveform to use as the reference waveform from one of the following:
Load from CH1, Load from CH2, Load from CH3*, and Load from CH4*

* Only on 4-channel models

Setting Labels (Label/Unit)

Press the **Label/Unit** soft key to display the following menu.



6.8 Performing User-Defined Computations (Optional; to be supported)

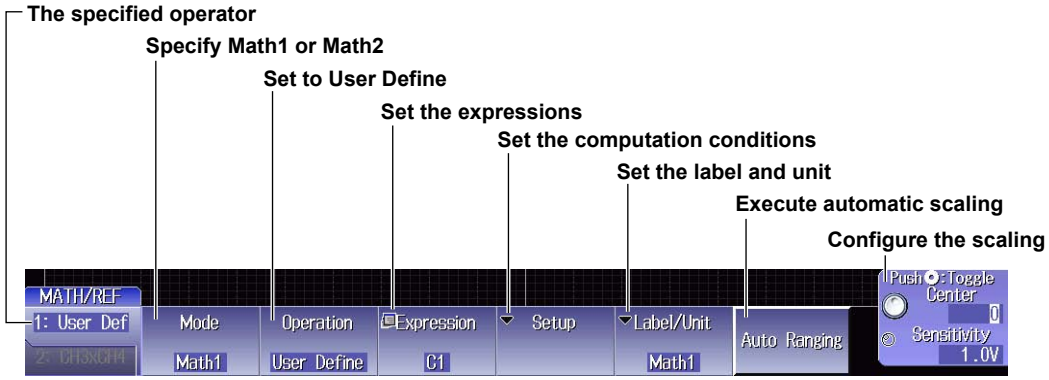
This section explains the following settings (which are used when performing user-defined computations):

- Operators
- Expressions
- Computation conditions
- Labels and units
- Auto scaling
- Scaling

► “User-Defined Computation Option (User Define)” in the Features Guide

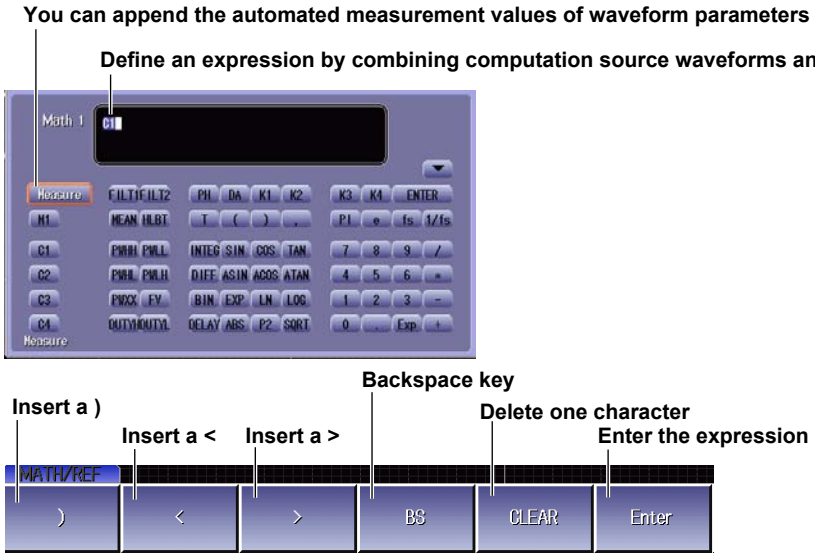
MATH/REF menu

Press **MATH/REF** to display the following menu.



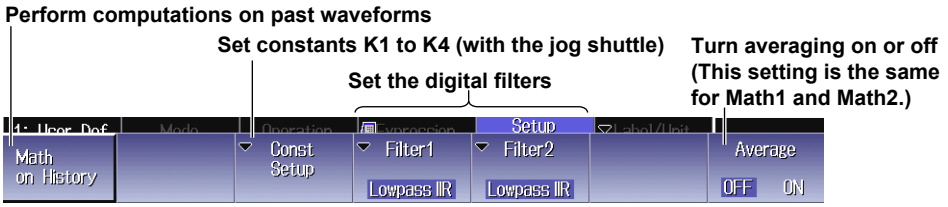
Setting Expressions (Expression)

Press the **Expression** soft key to display the following screen.



Setting Computation Conditions (Setup)

Press the **Setup** soft key to display the following menu.



Setting Digital Filters (Filter1 and Filter2)

Frequency band (Band): Set to LowPass, BandPass, or HighPass.

Filter type (Type): Set to IIR or FIR.

Cutoff frequency (Cutoff1 or Cutoff2)*: Set for Filter1 and Filter2 separately.

* Cutoff2 is only applicable when frequency band is set to BandPass.

7.1 Displaying FFT Waveforms

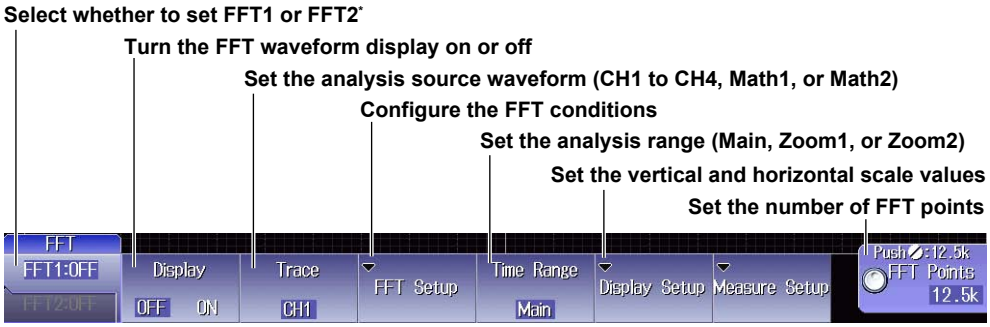
This section explains the following settings (which are used when performing FFT analysis):

- FFT waveform display
- Analysis source waveform
- FFT conditions
- Analysis range
- Vertical and horizontal scale values
- The number of FFT points

► "FFT" in the Features Guide

FFT Menu

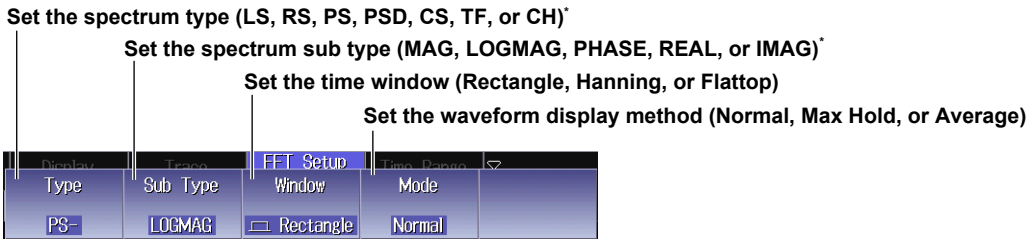
Press **SHIFT+MATH/REF** (FFT) to display the following menu.



* **FFT2 is only available on 4-channel models.**

Setting FFT Conditions (FFT Setup)

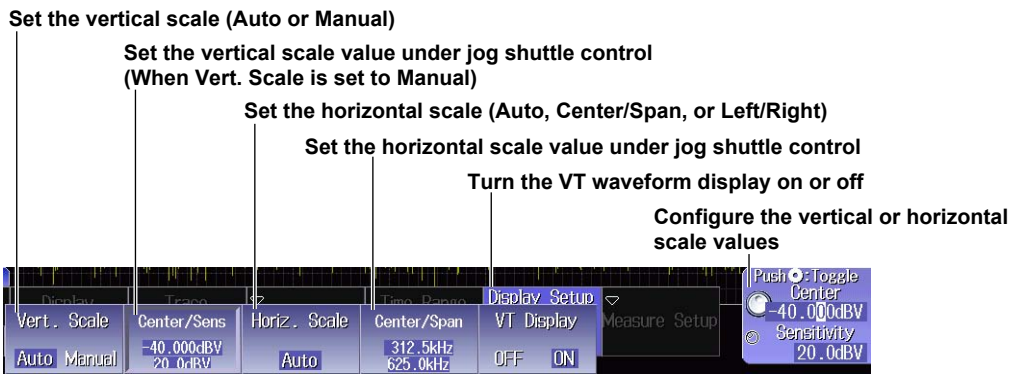
Press the **FFT Setup** soft key to display the following menu.



* **Only available on DLM2000s with the user-defined computation option**

Setting the Vertical and Horizontal Scale Values (Display Setup)

Press the **Display Setup** soft key to display the following menu.



7.2 Measuring FFT Waveforms

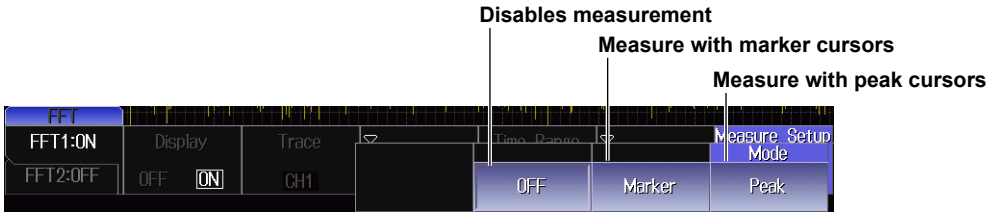
This section explains the following settings (which are used when measuring FFT waveforms):

- Cursor type
- Marker cursor measurements
- Peak cursor measurements

► “Cursor Measurement (Measure Setup)” in the Features Guide

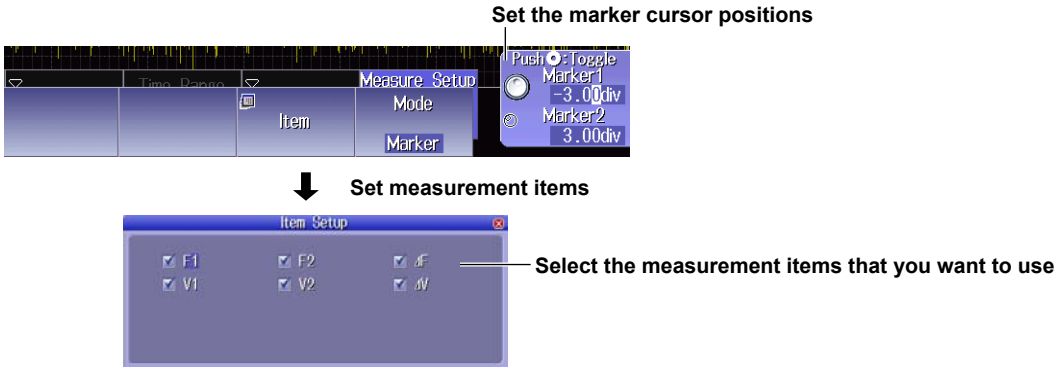
Setting the Cursor Type (Mode)

Press **SHIFT+MATH/REF** (FFT), the **Measure Setup** soft key, and then the **Mode** soft key to display the following menu.



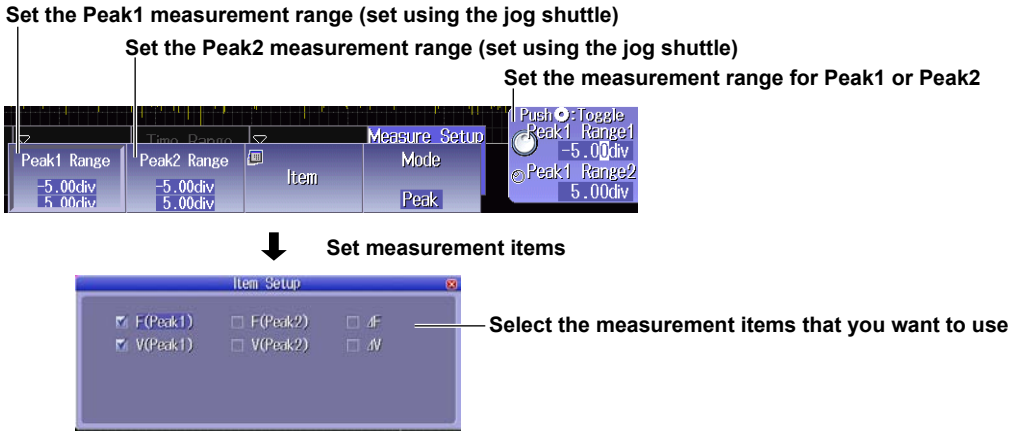
Measuring with Marker Cursors (Marker)

Press the **Marker** soft key to display the following menu.



Measuring with Peak Cursors (Peak)

Press the **Peak** soft key to display the following menu.



8.1 ΔT Cursor Measurements

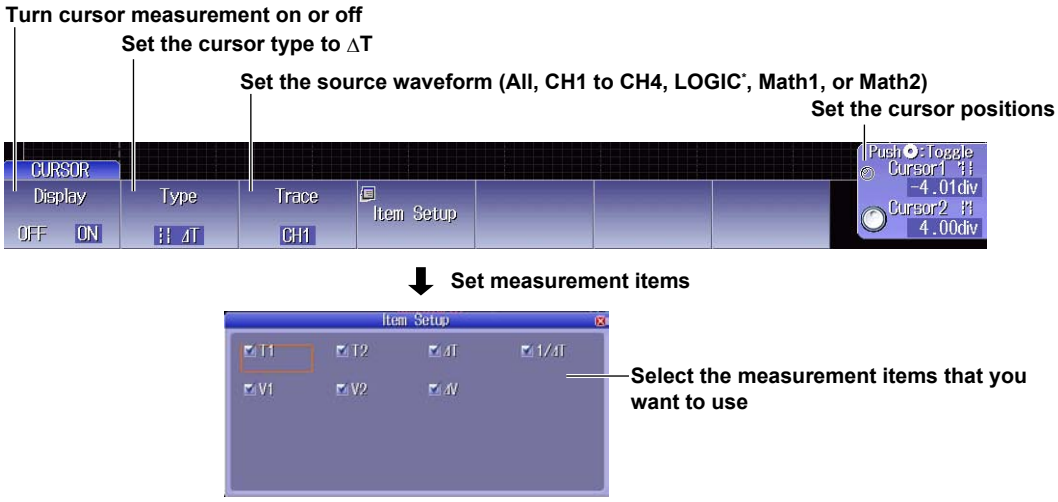
This section explains the following settings (which are used when performing ΔT cursor measurements):

- Cursor measurement
- Cursor type
- Source waveform
- Measurement items
- Cursor position

► "ΔT Cursors (ΔT)" in the Features Guide

CURSOR Menu

Press **CURSOR** to display the following menu.



* **For cursor measurement on the CH4 or LOGIC waveform, the DLM2000 measures the channel whose key is illuminated.**
Specify the channel that you want to measure in advance by pressing either the CH4 key or the LOGIC key.

8.2 ΔV Cursor Measurements

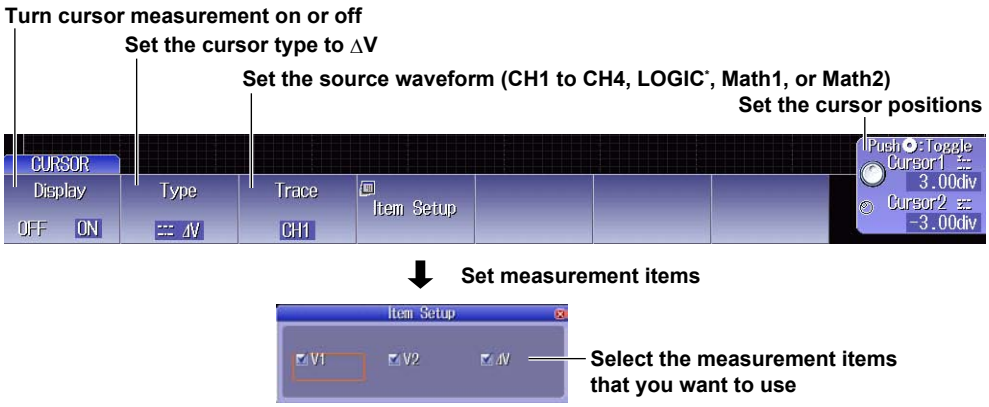
This section explains the following settings (which are used when performing ΔV cursor measurements):

- Cursor measurement
- Cursor type
- Source waveform
- Measurement items
- Cursor position

► "ΔV Cursors (ΔV)" in the Features Guide

CURSOR Menu

Press **CURSOR** to display the following menu.



* **For cursor measurement on the CH4 or LOGIC waveform, the DLM2000 measures the channel whose key is illuminated.**
Specify the channel that you want to measure in advance by pressing either the CH4 key or the LOGIC key.

8.3 ΔT&ΔV Cursor Measurements

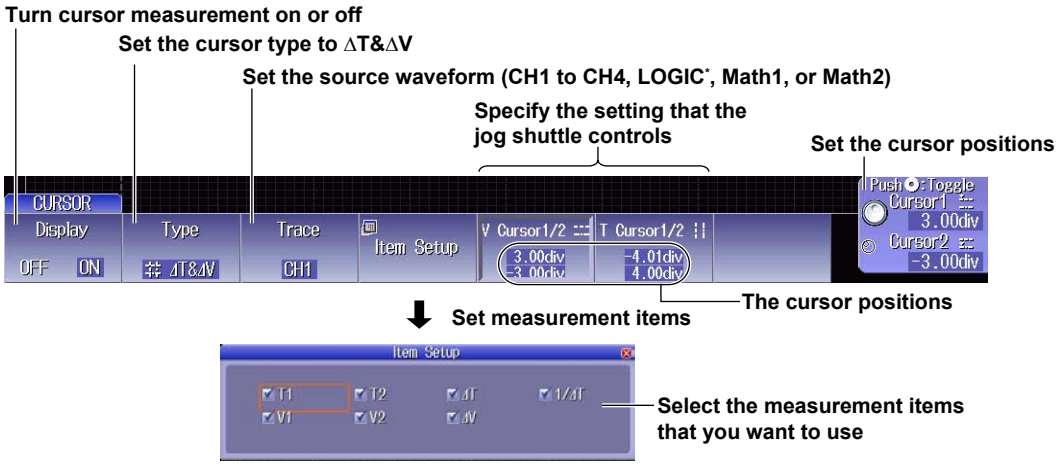
This section explains the following settings (which are used when performing ΔT&ΔV cursor measurements):

- Cursor measurement
- Cursor type
- Source waveform
- Measurement items
- Cursor position

► "ΔT&ΔV Cursors (ΔT&ΔV)" in the Features Guide

CURSOR Menu

Press **CURSOR** to display the following menu.



* **For cursor measurement on the CH4 or LOGIC waveform, the DLM2000 measures the channel whose key is illuminated.**
Specify the channel that you want to measure in advance by pressing either the CH4 key or the LOGIC key.

8.4 Marker Cursor Measurements (Marker)

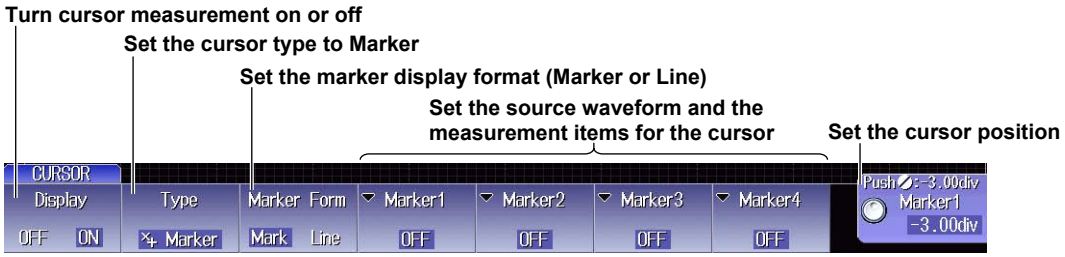
This section explains the following settings (which are used when measuring with marker cursors):

- Cursor measurement
- Cursor type
- Marker display format
- The waveform to measure using the cursors
- Measurement items
- Cursor position

► “Marker Cursors (Marker)” in the Features Guide

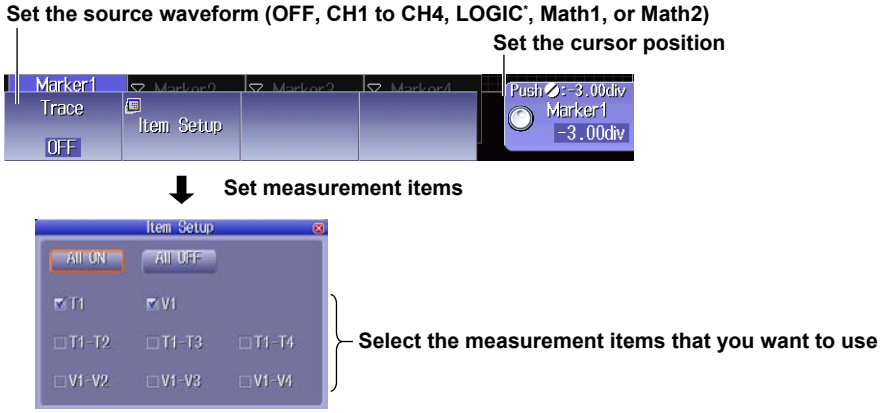
CURSOR Menu

Press **CURSOR** to display the following menu.



Selecting the Waveform to Measure and Setting the Measurement Items (Marker1, Marker2, Marker3, and Marker4)

Press a soft key from **Marker1** to **Marker4** to display the following menu.



* **For cursor measurement on the CH4 or LOGIC waveform, the DLM2000 measures the channel whose key is illuminated.**
Specify the channel that you want to measure in advance by pressing either the CH4 key or the LOGIC key.

8.5 Angle Cursor Measurements (Degree)

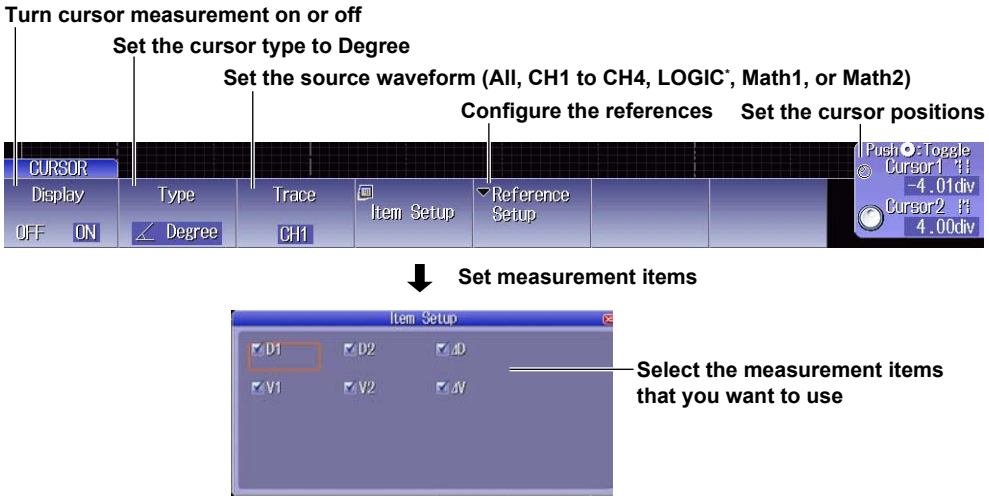
This section explains the following settings (which are used when measuring with angle cursors):

- Cursor measurement
- Cursor type
- Source waveform
- Measurement items
- References
- Cursor position

► “Angle Cursors (Degree)” in the Features Guide

CURSOR Menu

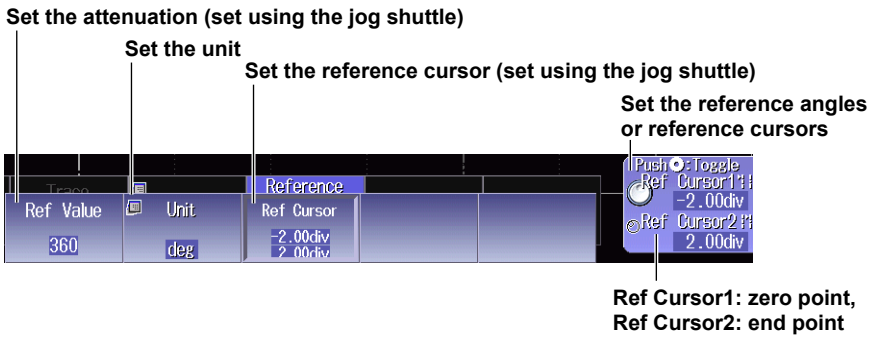
Press **CURSOR** to display the following menu.



* **For cursor measurement on the CH4 or LOGIC waveform, the DLM2000 measures the channel whose key is illuminated.**
Specify the channel that you want to measure in advance by pressing either the CH4 key or the LOGIC key.

Setting the Reference (Reference Setup)

Press the **Reference Setup** soft key to display the following menu.



9.1 Automatically Measuring Waveform Parameters

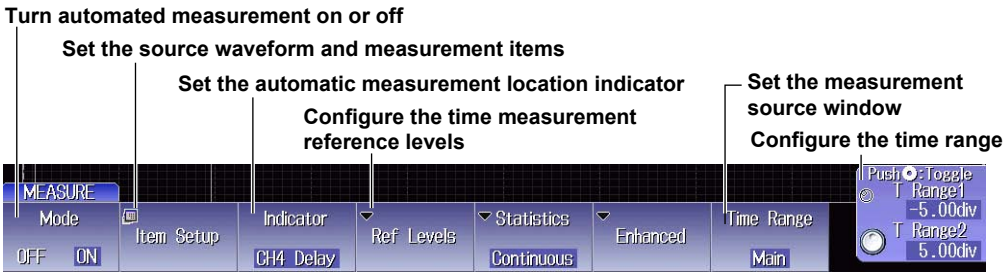
This section explains the following settings (which are used when automatically measuring waveform parameters):

- Automated measurement
- The source waveform and measurement items
- The measurement location indicator
- The reference level for time measurements
- The measurement source window and the measurement range

► "Automated Measurement of Waveform Parameters" in the Features Guide

MEASURE Menu

Press **MEASURE** to display the following menu.

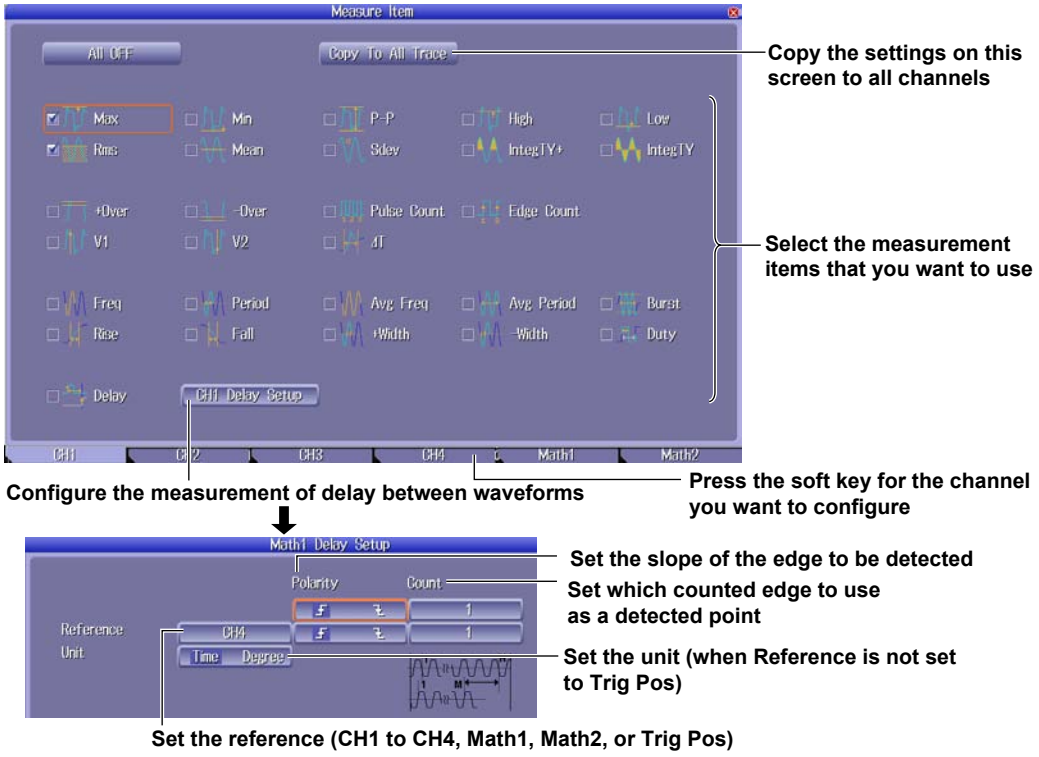


Setting the Source Waveform and the Measurement Items (Item Setup)

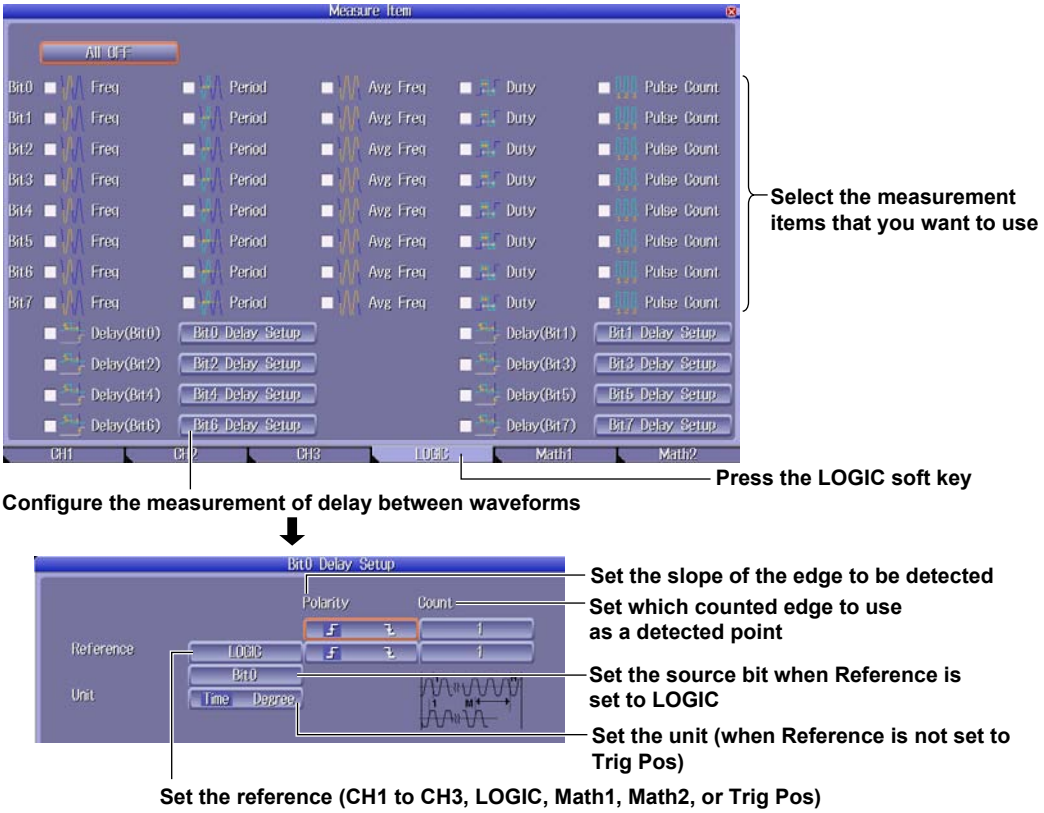
Press the **Item Setup** soft key and then a soft key from **CH1** to **CH4**, **Math1**, **Math2**, or **LOGIC*** to display the following menu.

* For cursor measurement on the CH4 or LOGIC waveform, the DLM2000 measures the channel whose key is illuminated. Specify the channel that you want to measure in advance by pressing either the CH4 key or the LOGIC key.

When You Press a soft key from CH1 to CH4, Math1, or Math2

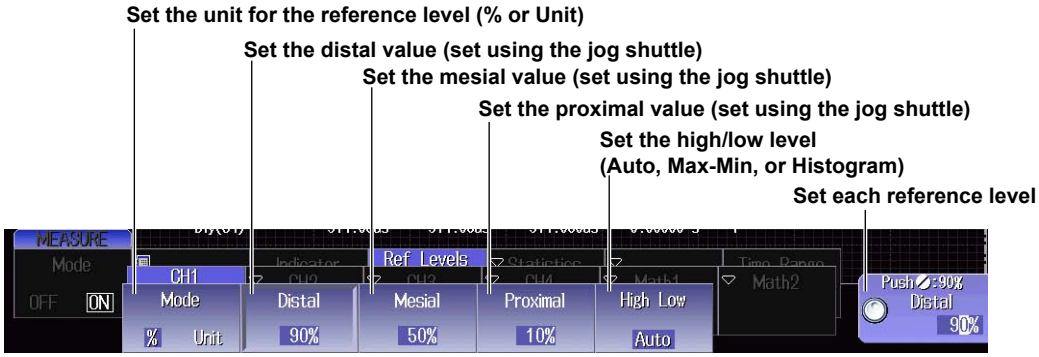


When You Press the LOGIC Soft Key



Setting the Reference Levels for Time Measurements (Ref Levels)

Press the **Ref Levels** soft key and then a soft key from **CH1** to **CH4**, **Math1**, or **Math2** to display the following menu.



Setting the Measurement Source Window (Time Range)

Main: Set the measurement source window to the Main window.
Zoom1: Set the measurement source window to the Zoom1 window.
Zoom2: Set the measurement source window to the Zoom2 window.

Setting the Measurement Time Period (Time Range or T Range1/T Range2)

Set the measurement time period within the window specified by Time Range.

Note

About the roll-mode display

- If the record length is 1.25 Mpoints or longer, measured time values appear after you stop waveform acquisition using the RUN/STOP key.
- If the record length is set such that waveform acquisition operates in Single mode (6.25 Mpoints or longer for models without a memory option), automatically measured values of waveform parameters appear when the roll mode display stops.

9.2 Processing Statistics on Automatically Measured Values

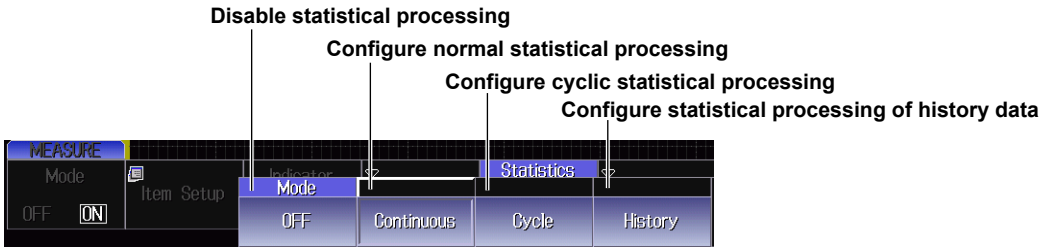
This section explains the following settings (which are used when processing statistics on automatically measured waveform parameters):

- Statistical processing mode
- Normal statistical processing
- Cyclic statistical processing
- Statistical processing of history data

► "Statistics (Statistics)" in the Features Guide

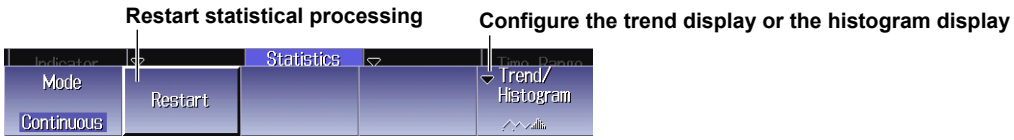
MEASURE Statistics Menu

Press **MEASURE**, the **Statistics** soft key, and then the **Mode** soft key to display the following menu.



Setting Normal Statistical Processing (Continuous)

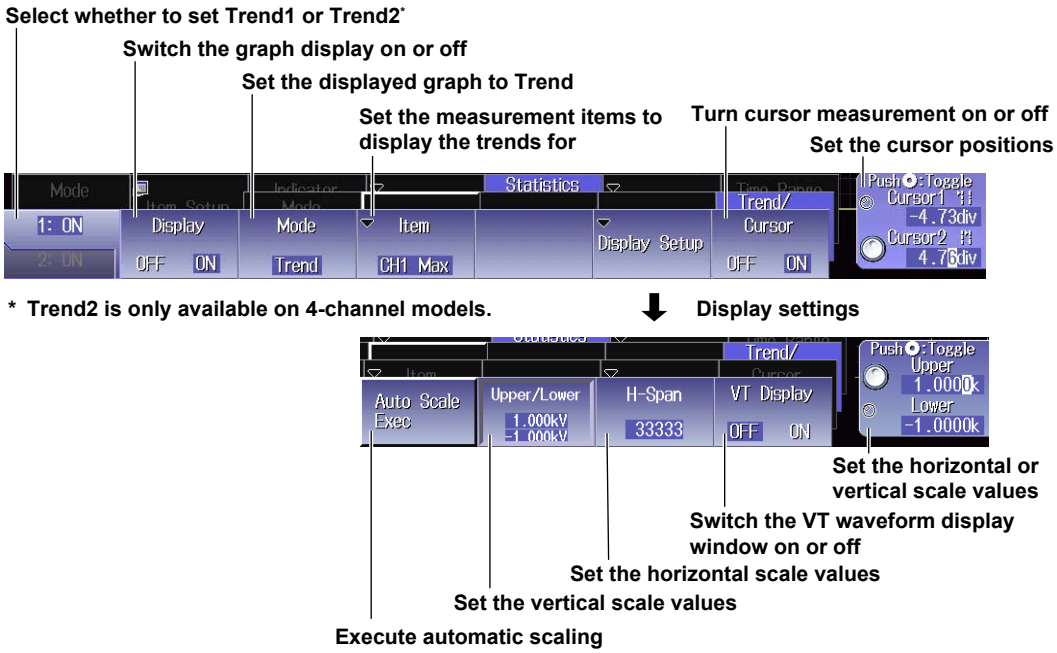
Press the **Continuous** soft key to display the following menu.



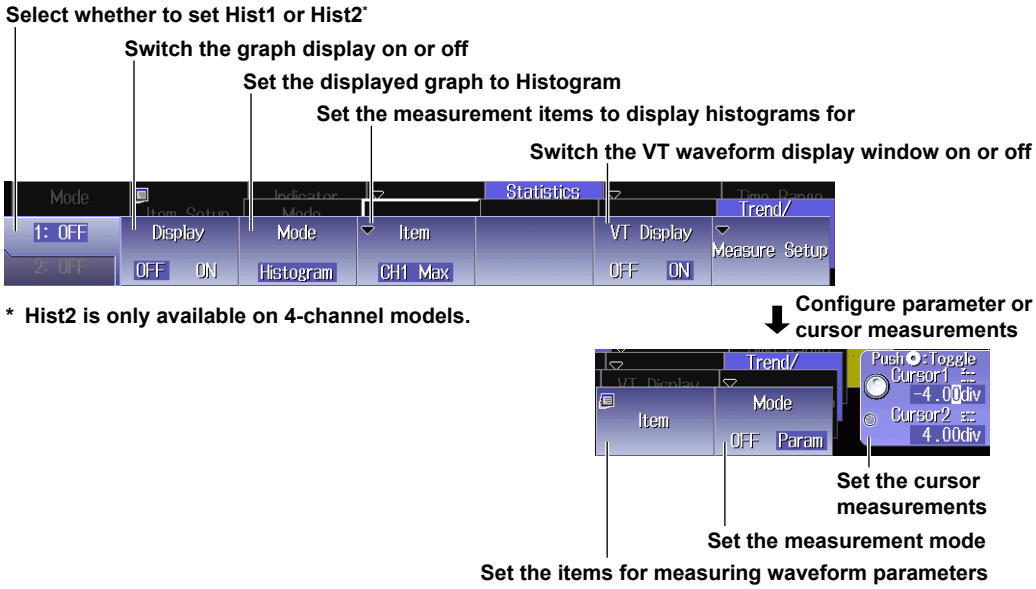
Setting the Trend Display and the Histogram Display (Trend/Histogram)

Press the **Trend/Histogram** soft key to display the following menu.

Trend Display



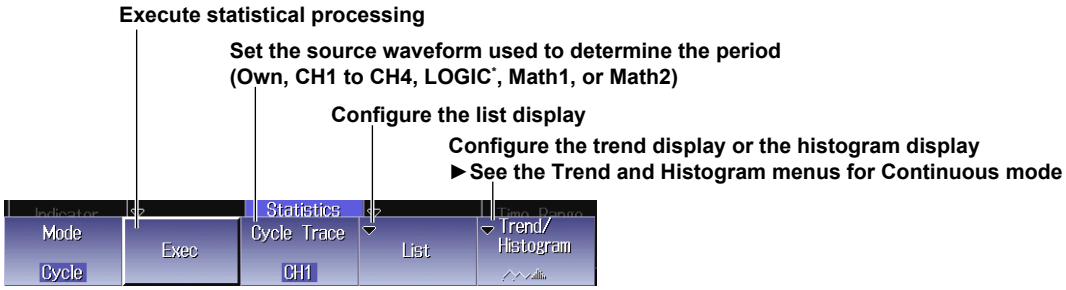
Histogram Display



* Hist2 is only available on 4-channel models.

Setting Cyclic Statistical Processing (Cycle)

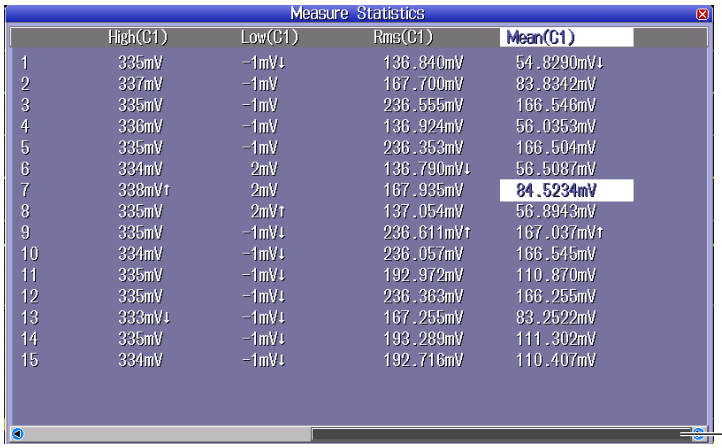
Press the **Cycle** soft key to display the following menu.



* For cursor measurement on the CH4 or LOGIC waveform, the DLM2000 measures the channel whose key is illuminated.
Specify the channel that you want to measure in advance by pressing either the CH4 key or the LOGIC key.

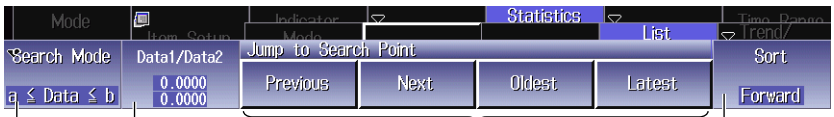
Setting the List Display (List)

Press the **List** soft key to display the following menu.



When a scroll bar appears, you can use the left, right, up, and down select keys to scroll through the list.

↑: Displayed by the maximum value of each measurement item.
↓: Displayed by the minimum value of each measurement item.



Select the sort method (Forward or Reverse)

Jumps to and highlights the specified destination

Set the value of a and b (only when Search Mode is set to Data ≤ b, a ≤ Data, or a ≤ Data ≤ b)

Set the search mode (OFF, Statistics Max, Statistics Min, Data ≤ b, a ≤ Data, or a ≤ Data ≤ b)

Setting Statistical Processing of History Data (History)

Press the **History** soft key to display the following menu.

Configure the list display
►See the List menu for Cycle mode

Configure the trend display or the histogram display
►See the Trend and Histogram menus for Continuous mode

Execute statistical processing

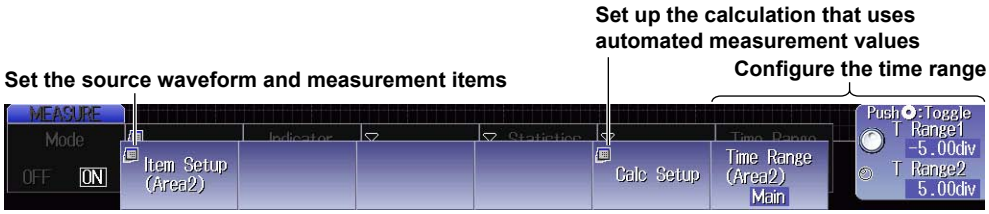
9.3 Measuring Enhanced Parameters

This section explains the settings used when performing automated measurement of the waveform parameters of two areas.

► “Enhanced Parameter Measurement (Enhanced)” in the Features Guide

MEASURE Enhanced Menu

Press **Measure**, and then the **Enhanced** soft key to display the following menu.

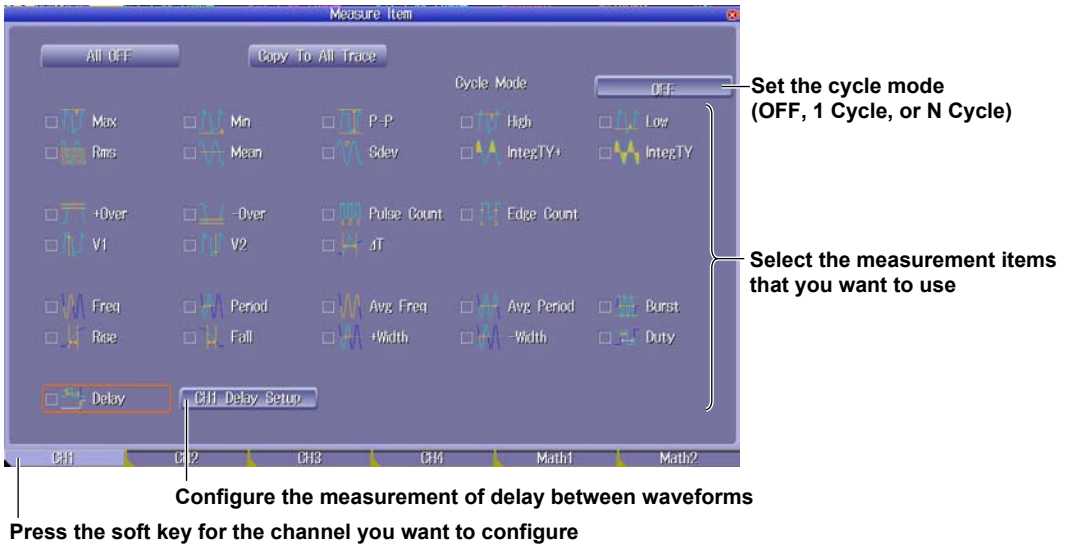


Setting the Source Waveform and the Measurement Items (Item Setup for Area2)

Press the **Item Setup (Area2)** soft key to display the following screen. Except for cycle mode, the screen is the same as the Item Setup screen shown in section 9.1.

►See section 9.1.

When You Press a Soft Key from CH1 to CH4, Math1, or Math2



Setting Calculations That Use Automated Measurement Values (Calc Setup)

Press the **Calc Setup** soft key to display the following screen.

Note

You cannot use the enhanced parameter measurement feature when the statistical processing mode is set to Cycle.

10.1 Zooming in on or out from Waveforms

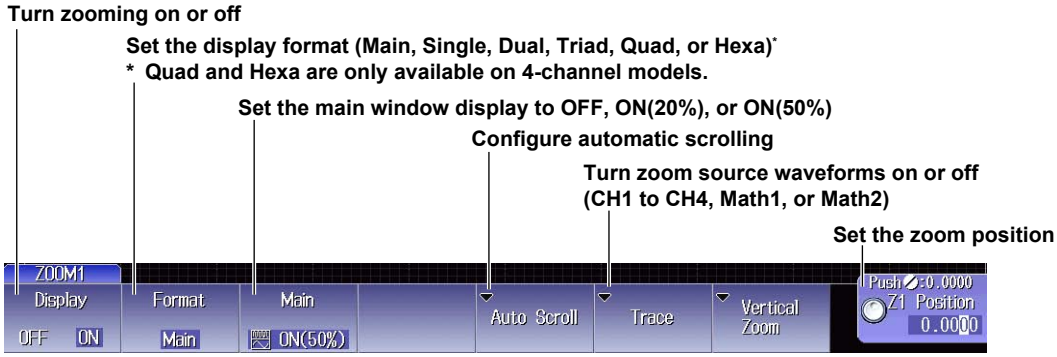
This section explains the following settings (which are used when zooming in on or out from waveforms):

- Zoom
- Display format
- Main window display
- Auto scrolling
- Zoom source waveform
- Zoom position
- Zoom factor

► "Zooming in on Waveforms" in the Features Guide

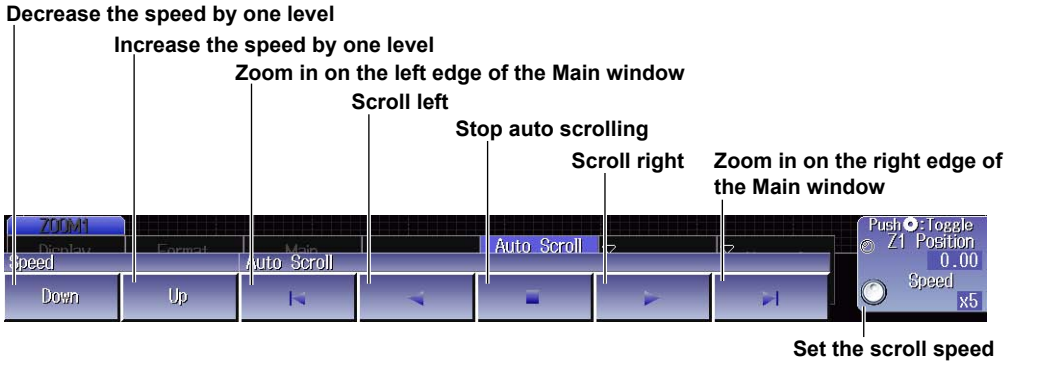
ZOOM Menu

Press **ZOOM1** or **ZOOM2** to display the following menu.



Setting Auto Scrolling (Auto Scroll)

Press the **Auto Scroll** soft key to display the following menu.

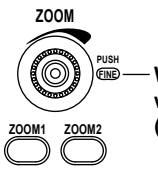


Setting the Zoom Factor (ZOOM1/ZOOM2 knob)

Use the **ZOOM** knob to set the zoom factor.

The ZOOM knob controls the waveforms in the window whose corresponding key is illuminated more brightly.

If you push the ZOOM knob, the FINE indicator illuminates, and you can set the zoom factor with higher resolution.



When the FINE indicator is illuminated, you can set the vertical position with higher resolution.
(Press the push knob to turn off the FINE indicator)

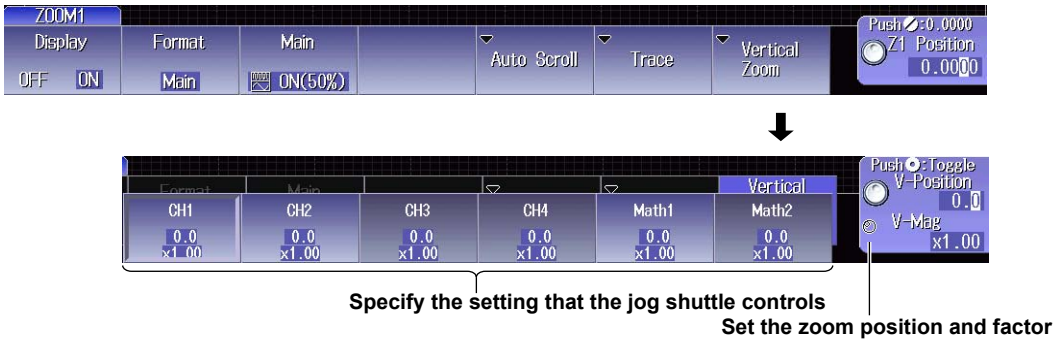
10.2 Zooming in on or out from Waveforms in the Vertical Direction

This section explains the following settings (which are used when zooming in on or out from waveforms in the vertical direction):

► “Vertical Zoom (Vertical Zoom)” in the Features Guide

ZOOM Vertical Zoom Menu

Press **ZOOM1** or **ZOOM2**, and then the **Vertical Zoom** soft key to display the following menu.



Note

You can reset the zoom factor and position by pressing the reset key.

11.1 Searching for Edges

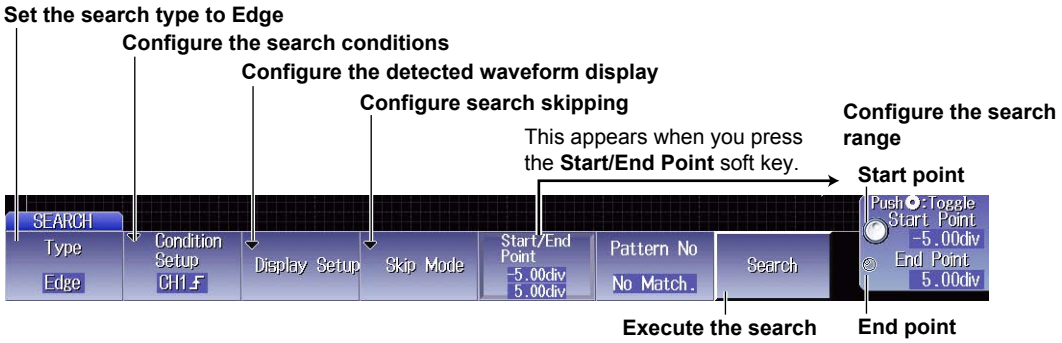
This section explains the following settings (which are used when searching for edges):

- Search type
- Search range
  Search start and end points
- Search conditions
  Source, slope, the level used to detect source states, and hysteresis
- Detected waveform display
  Detected point marks, zoom window, and zoom position
- Search skipping
- Executing searches

► “Search Type (Type)”,
“Search Range (Start/End Point)”,
“Search Conditions (Condition Setup)”,
“Displaying Detected Waveforms (Display Setup)”,
and “Search Skip (Skip Mode)”
in the Features Guide

SEARCH Edge Menu

Press **SEARCH**, the **Type** soft key, and then the **Edge** soft key to display the following menu.



Setting Search Conditions (Condition Setup)

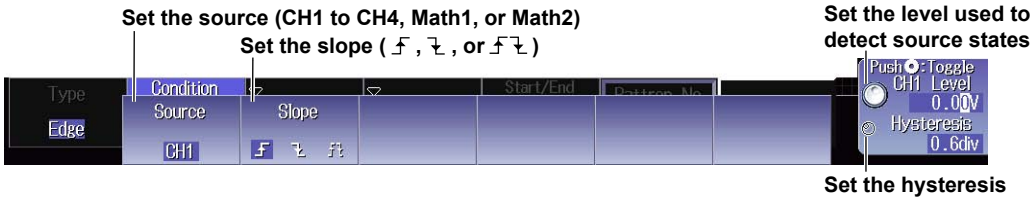
Note

Using the CH4 Terminal and Logic Signal Input Ports When You Execute Searches

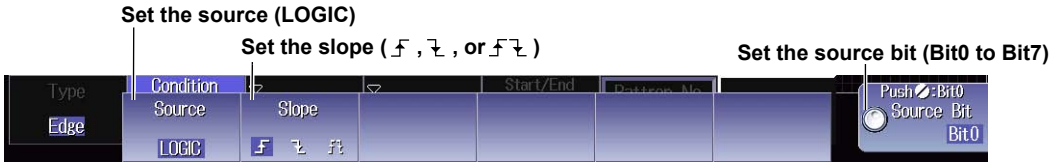
When you execute a search, you cannot use the CH4 terminal and logic signal input ports as the source at the same time. Specify the source that you want to use in advance by pressing either the CH4 key or the LOGIC key.

Press the **Condition Setup** soft key to open one of the menus shown below. The menu that appears varies depending on the specified source.

When the Source is Math1, Math2, or from CH1 to CH4

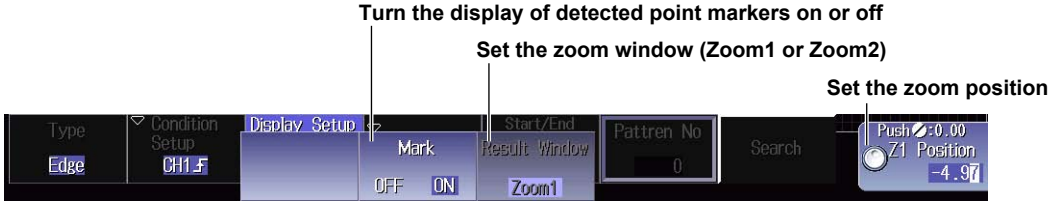


When the Source Is LOGIC (On models with the logic signal input port)



Setting the Detected Waveform Display (Display Setup)

Press the **Display Setup** soft key to display the following menu.

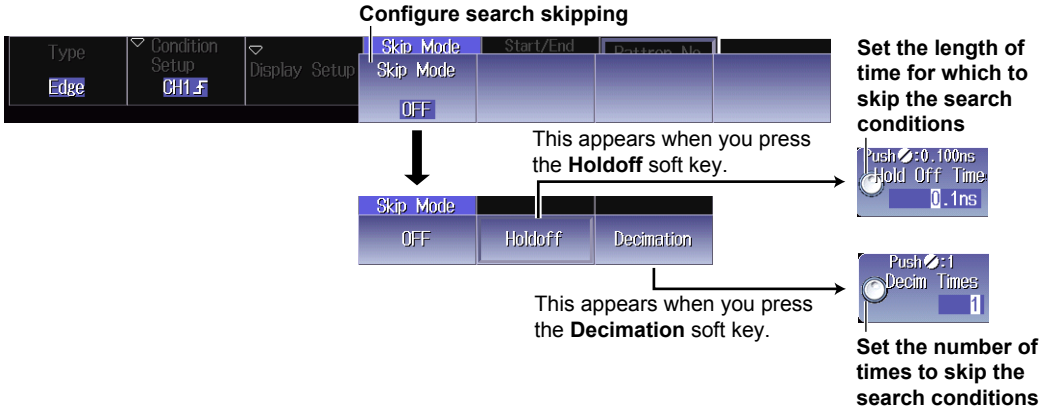


- Turning the display of detected point markers on or off
  You can display marks at the top of the main and zoom windows to clearly show the detected position on the waveform (the detected point mark). Marks that match detected point numbers are highlighted.
- Configuring the Zoom Windows
  You can configure zoom windows Zoom1 and Zoom2 when they are displayed.
- Setting the zoom position
  You can change the zoom position, which is the point on the waveform that is zoomed in on.

Configuring Search Skipping (Skip Mode)

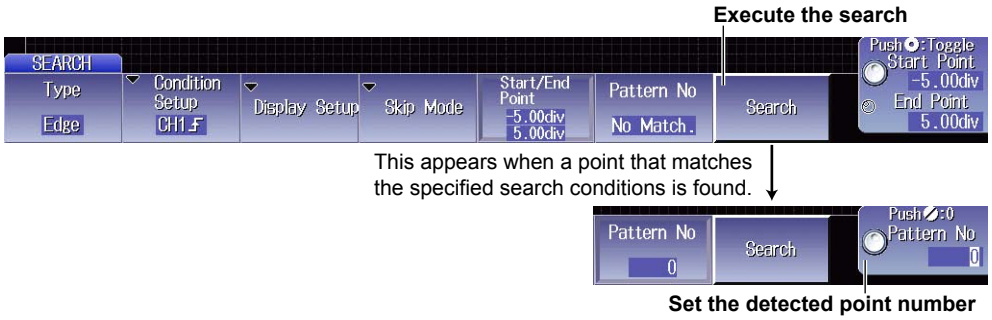
Press the **Skip Mode** soft key to display the following menu.

After a search condition is met, you can skip the detection of search conditions for the specified amount of time or the specified number of counts.



Executing a Search (Search)

Press the **Search** soft key to execute the search.



- Executing searches
  After setting the search conditions, press the **Search** soft key to execute the search. If the DLM2000 finds points that match the search conditions (detected points), it shows numbers (0, 1, 2, etc.) from the left of the waveform display in the order that the points were detected.
- Setting the detected point numbers
  After setting the detected point number, you can display the waveform for the corresponding detected point on the zoom window.

11.2 Searching for Edges Using Conditions

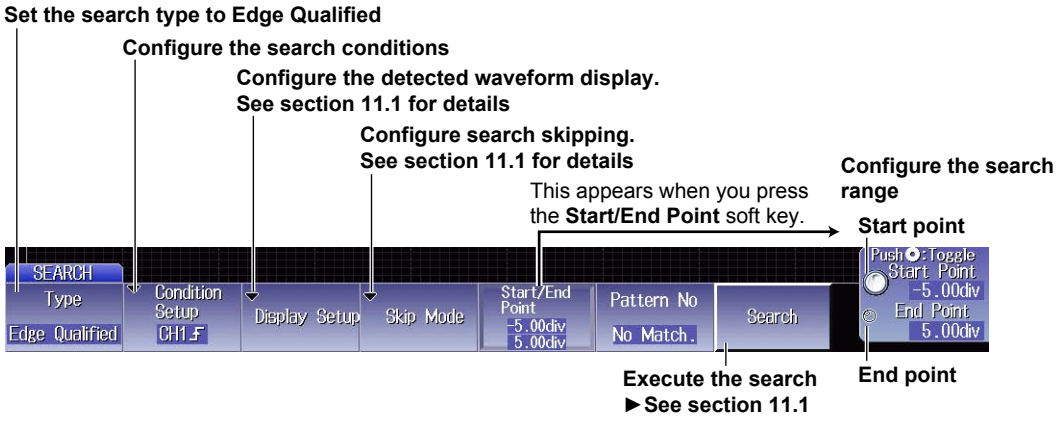
This section explains the following settings (which are used when using conditions to limit edge searches):

- Search type
- Search range
  Search start and end points
- Search conditions
  Source, slope, qualifications, logic combination, search requirements, the level used to detect signal states, and hysteresis

► "Search Type (Type)", "Search Range (Start/End Point)", and "Search Conditions (Condition Setup)" in the Features Guide

SEARCH Edge Qualified Menu

Press **SEARCH**, the **Type** soft key, and then the **Edge Qualified** soft key to display the following menu.



Setting Search Conditions (Condition Setup)

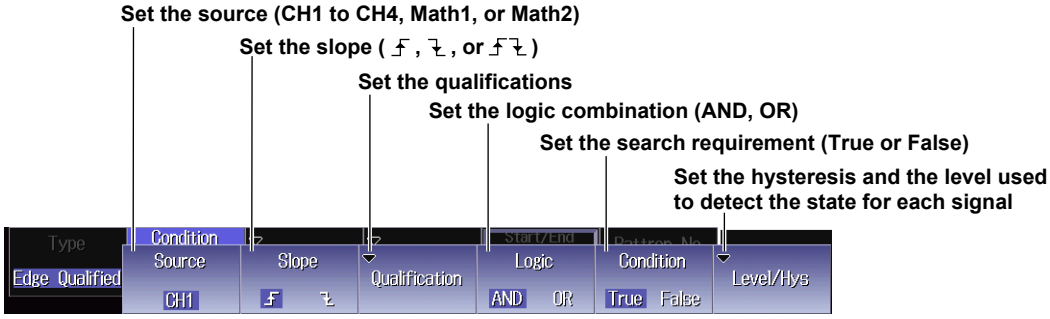
Note

Using the CH4 Terminal and Logic Signal Input Ports When You Execute Searches

When you execute a search, you cannot use the CH4 terminal and logic signal input ports as the source at the same time. Specify the source that you want to use in advance by pressing either the CH4 key or the LOGIC key.

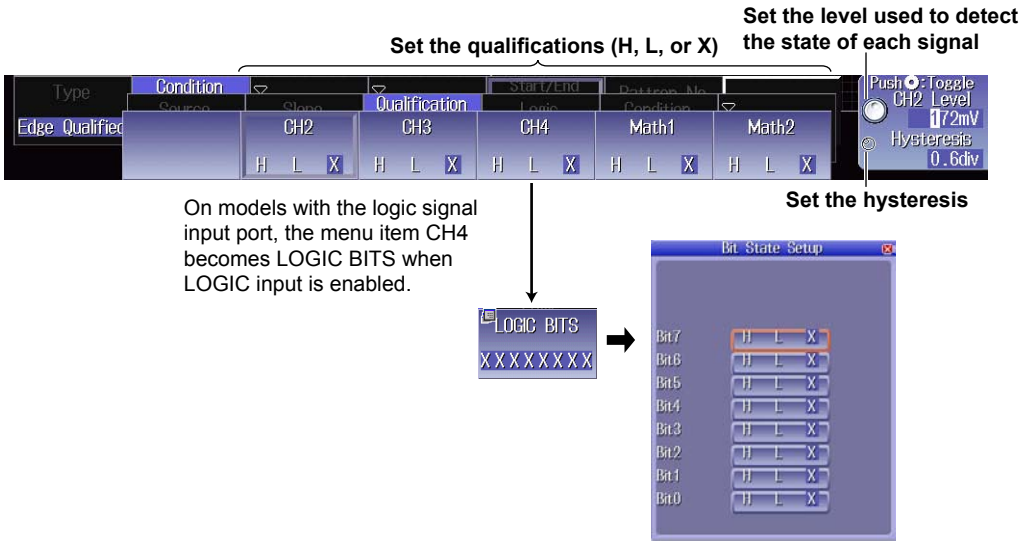
Press the **Condition Setup** soft key to open one of the menus shown below. The menu that appears varies depending on the specified source.

When the Source is Math1, Math2, or from CH1 to CH4



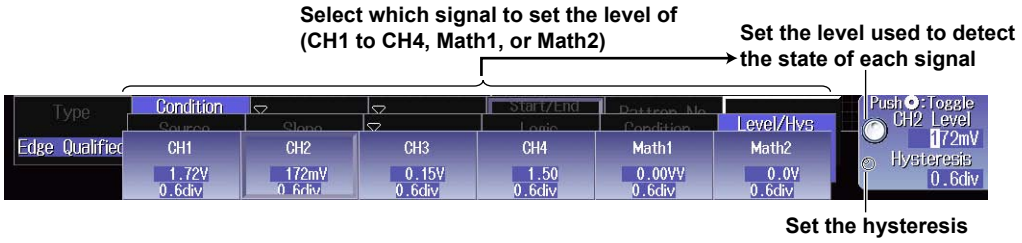
- **Setting the Qualifications (Qualification)**

  Press the **Qualification** soft key to display the following menu.

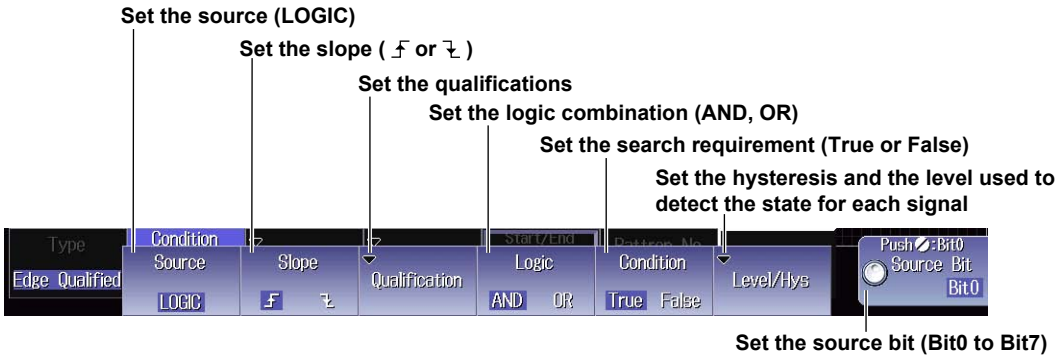


- **Setting the Hysteresis and the Level Used to Detect the Signal State for Each Signal (Level/Hys)**

  Press the **Level/Hys** soft key to display the following menu.

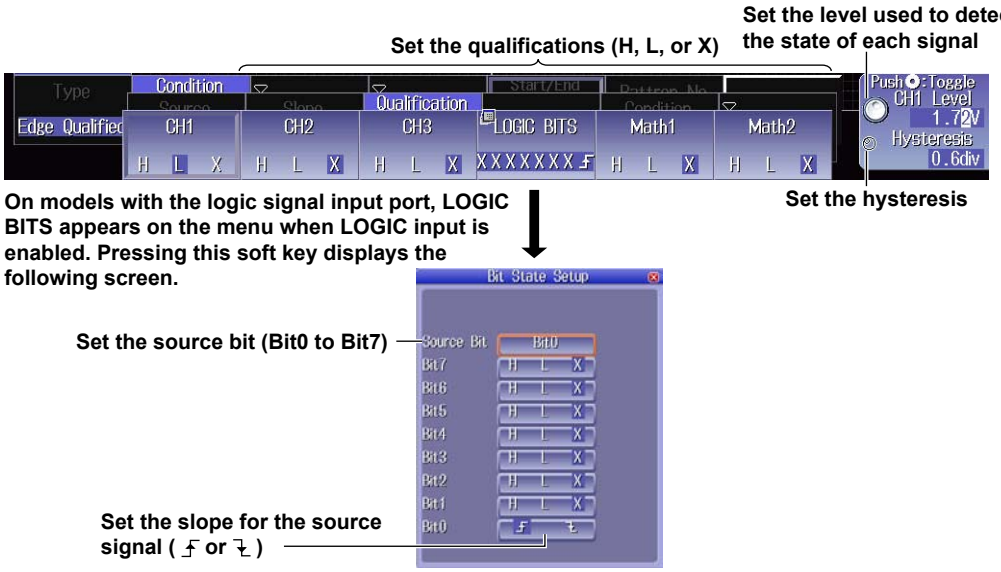


When the Source Is LOGIC (On models with the logic signal input port)



- **Setting the Qualifications (Qualification)**

  Press the **Qualification** soft key to display the following menu.



- **Setting the Hysteresis and the Level Used to Detect the Signal State for Each Signal (Level/Hys)**

  The same menu appears as that shown on the previous page for when the source is Math1, Math2, or from CH1 to CH4.

11.3 Searching for State Conditions

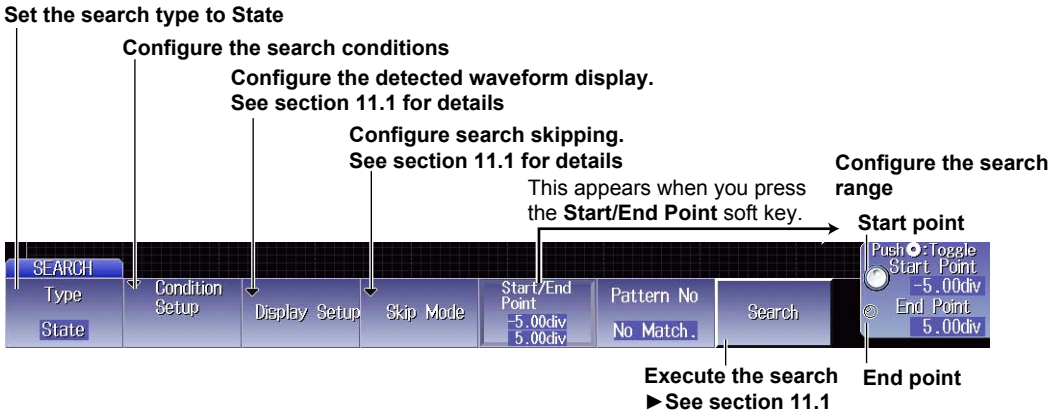
This section explains the following settings (which are used when searching for state conditions):

- Search type
- Search range
  Search start and end points
- Search conditions
  State conditions, clock source, logic combination, search requirements, the level used to detect signal states, and hysteresis

► "Search Type (Type)",
"Search Range (Start/End Point)", and
"Search Conditions (Condition Setup)"
in the Features Guide

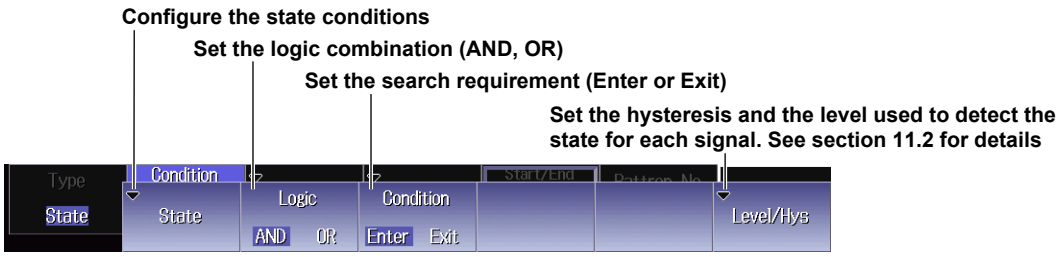
SEARCH State Menu

Press **SEARCH**, the **Type** soft key, and then the **State** soft key to display the following menu.



Setting Search Conditions (Condition Setup)

Press the **Condition Setup** soft key to display the following menu.



Setting the State Conditions (State)

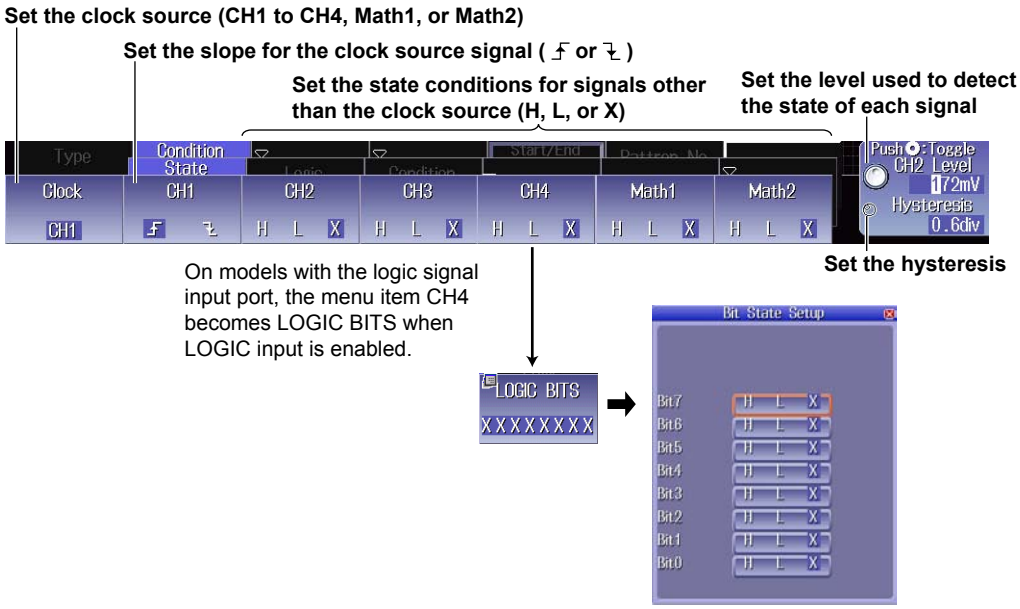
Note

Using the CH4 Terminal and Logic Signal Input Ports When You Execute Searches

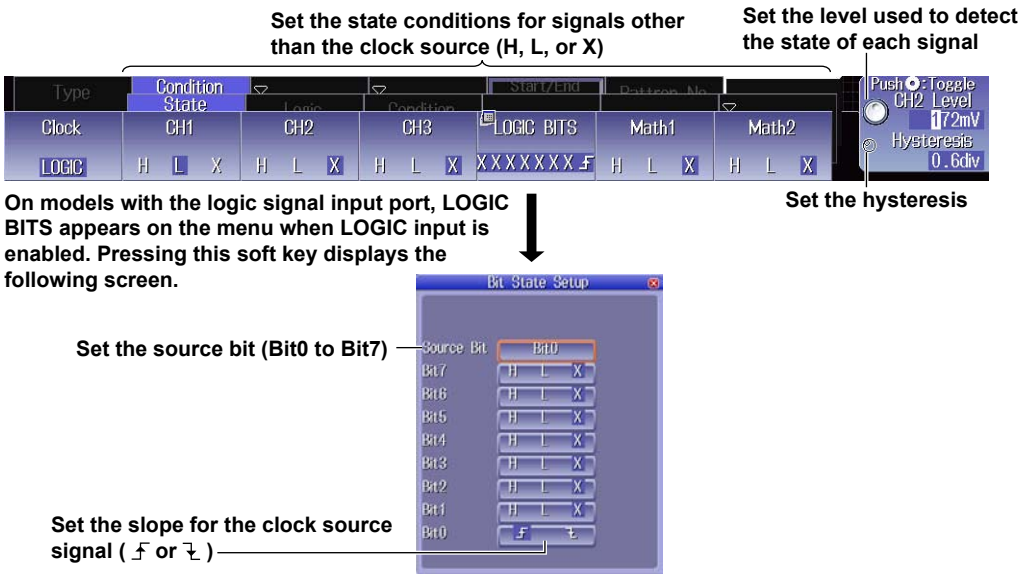
When you execute a search, you cannot use the CH4 terminal and logic signal input ports as the source at the same time. Specify the source that you want to use in advance by pressing either the CH4 key or the LOGIC key.

Press the **State** soft key to open one of the menus shown below. The menu that appears varies depending on the specified clock source.

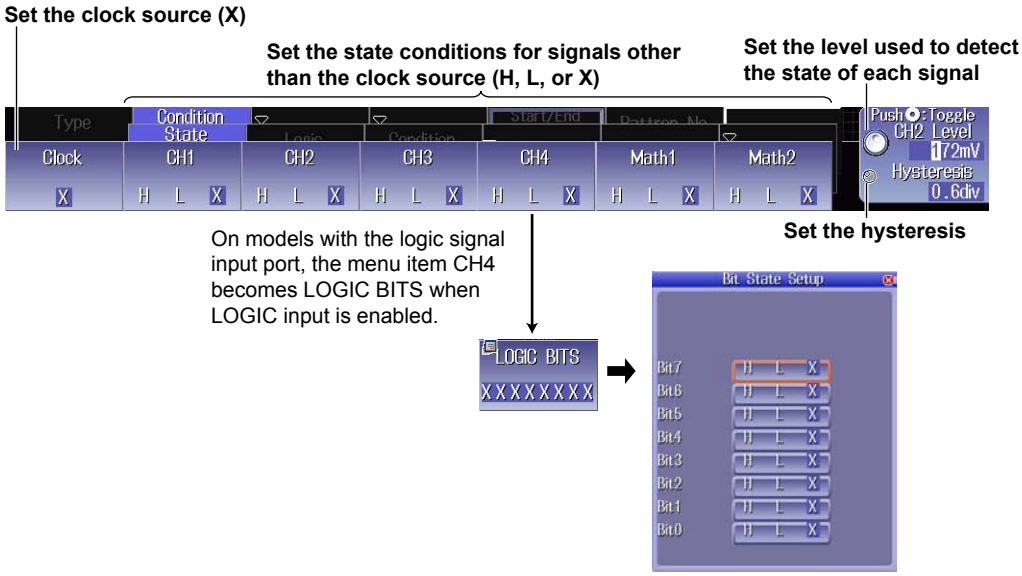
- **When the Clock Source is Math1, Math2, or from CH1 to CH4**



- **When the Source Is LOGIC (On models with the logic signal input port)**



- **When There Is No Clock Source**



The same menu appears as that shown on the previous page for when the clock source is Math1, Math2, or from CH1 to CH4. Because there is no clock source, you can specify all of the signal states for Math1, Math2, from CH1 to CH4, and LOGIC as state conditions.

11.4 Searching for Pulse Width

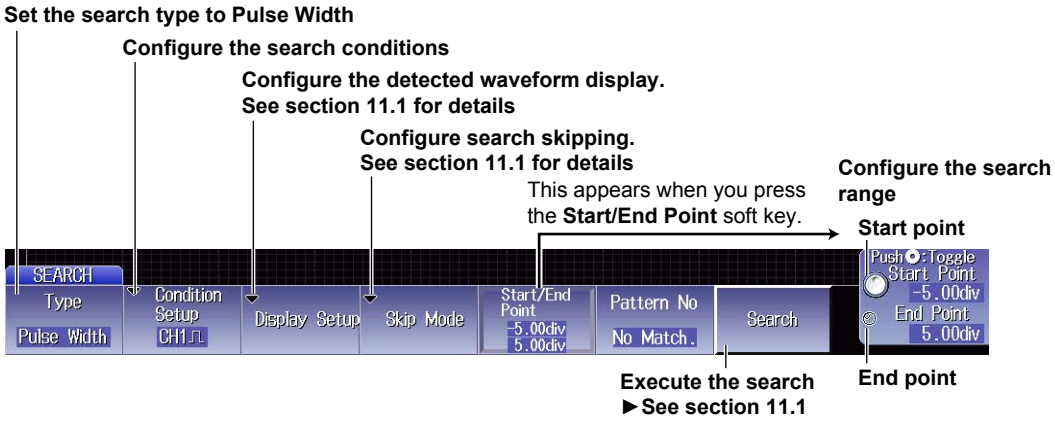
This section explains the following settings (which are used when searching for pulse width):

- Search type
- Search range
  Search start and end points
- Search conditions
  Source, polarity, time width mode, reference times, the level used to detect signal states, and hysteresis

► "Search Type (Type)", "Search Range (Start/End Point)", and "Search Conditions (Condition Setup)" in the Features Guide

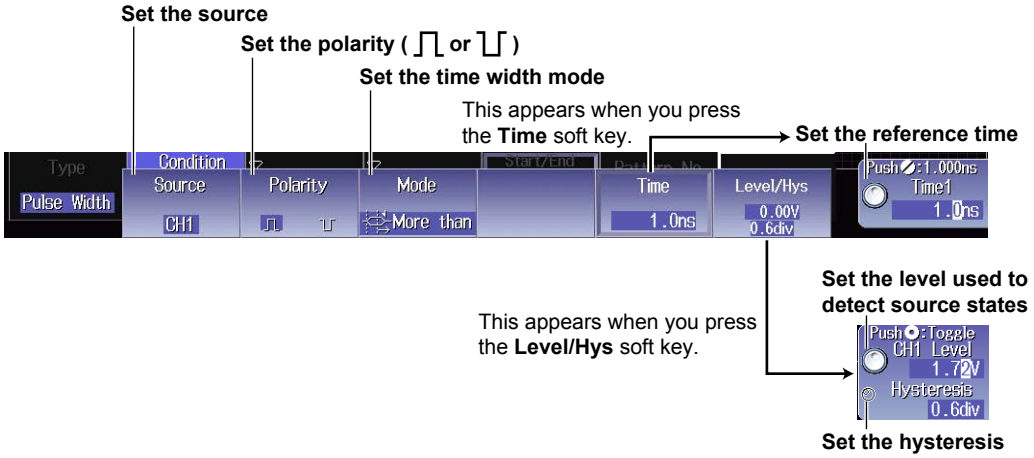
SEARCH Pulse Width Menu

Press **SEARCH**, the **Type** soft key, and then the **Pulse Width** soft key to display the following menu.



Setting Search Conditions (Condition Setup)

Press the **Condition Setup** soft key to display the following menu.



Setting the Source (Source)

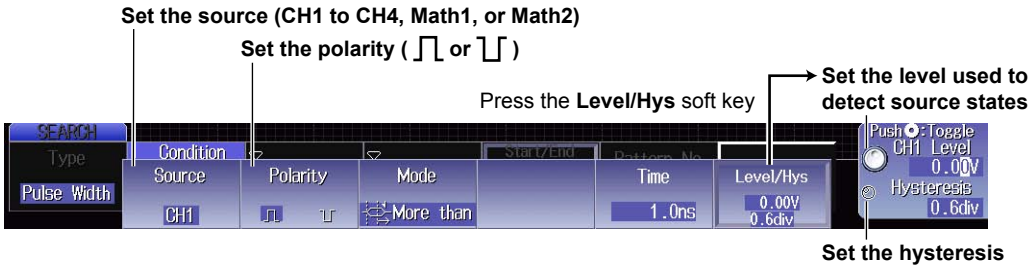
Note

Using the CH4 Terminal and Logic Signal Input Ports When You Execute Searches

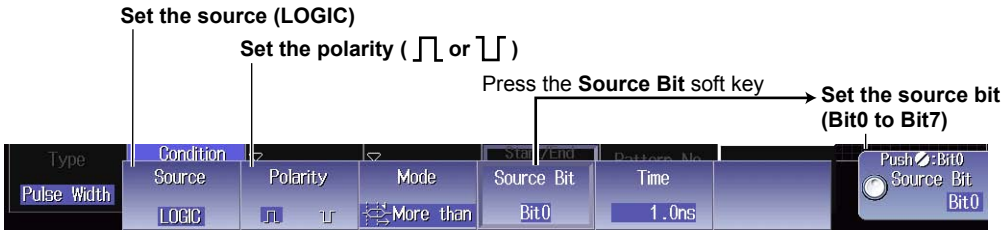
When you execute a search, you cannot use the CH4 terminal and logic signal input ports as the source at the same time. Specify the source that you want to use in advance by pressing either the CH4 key or the LOGIC key.

Press the **Source** soft key to open one of the menus shown below. The menu that appears varies depending on the specified source.

- **When the Source Is Math1, Math2, or from CH1 to CH4**



- **When the Source Is LOGIC (On models with the logic signal input port)**



Setting the Time Width Mode (Mode)

Press the **Mode** soft key to display the following menu.

Set what kind of relationship must be established between the source's pulse width and the specified reference times (Time1 and Time2) for a point to be detected.

More than: The pulse width must be longer than the reference time specified by Time1
Less than: The pulse width must be shorter than the reference time specified by Time1
Between: The pulse width must be longer than Time1 but shorter than Time2
Out of Range: The pulse width must be shorter than Time1 or longer than Time2
Time Out: The pulse width must be longer than the reference time specified by Time1

Setting the Reference Times (Time1 and Time2)

Press the **Time** soft key to open one of the menus shown below. The menu that appears varies depending on the set time width mode.

- **When the Time Width Mode is More than, Less than, or Time Out**

Set the reference time

- **When the Time Width Mode is Between or Out Of Range**

Set the reference times specified by Time1 and Time2

11.5 Searching for State Width

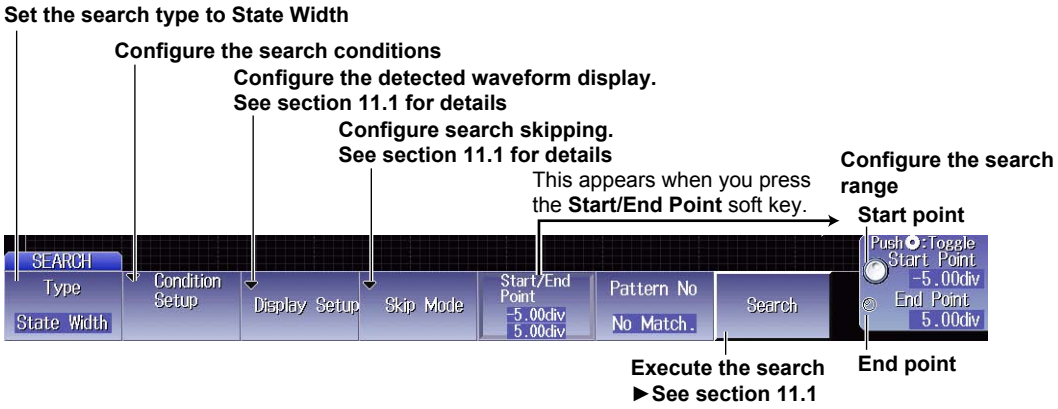
This section explains the following settings (which are used when searching for state width):

- Search type
- Search range
  Search start and end points
- Search conditions
  State conditions, clock source, logic combination, search requirements, time width mode, reference times, the level used to detect signal states, and hysteresis

► "Search Type (Type)",
"Search Range (Start/End Point)", and
"Search Conditions (Condition Setup)"
in the Features Guide

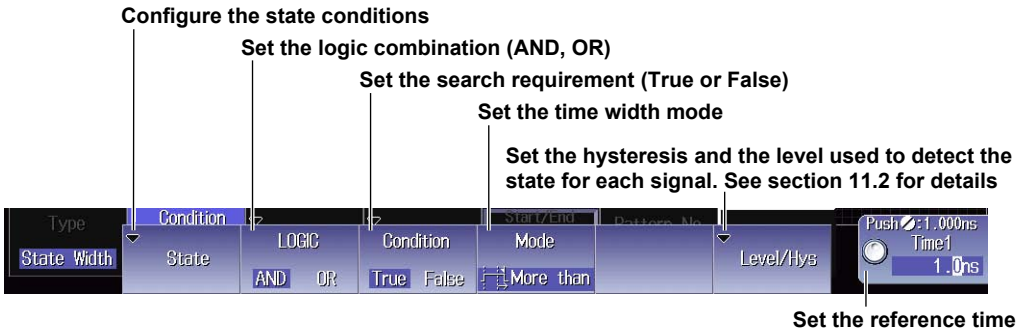
SEARCH State Width Menu

Press **SEARCH**, the **Type** soft key, and then the **State Width** soft key to display the following menu.



Setting Search Conditions (Condition Setup)

Press the **Condition Setup** soft key to display the following menu.



Setting the State Conditions (State)

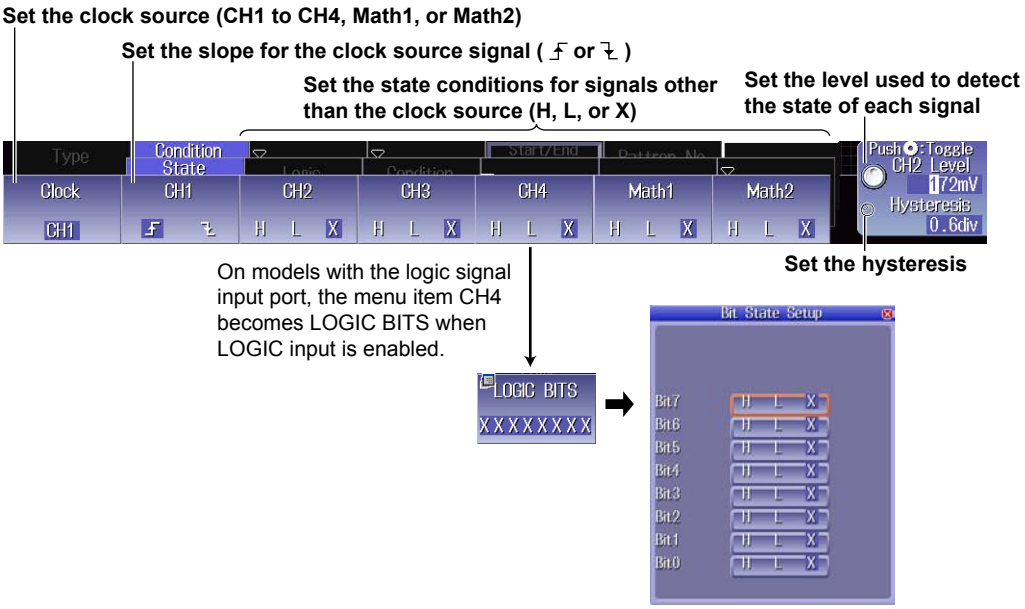
Note

Using the CH4 Terminal and Logic Signal Input Ports When You Execute Searches

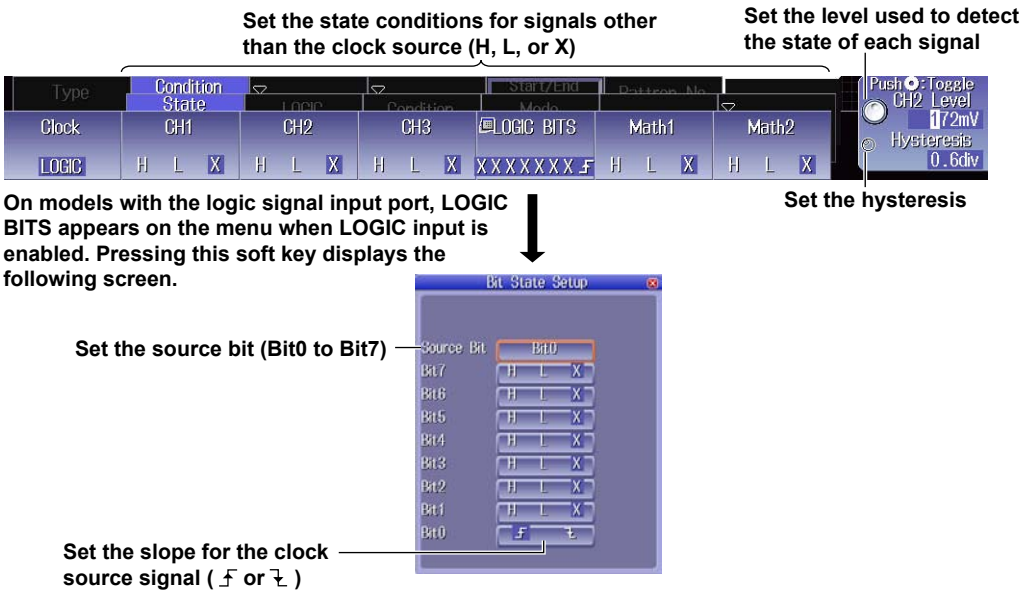
When you execute a search, you cannot use the CH4 terminal and logic signal input ports as the source at the same time. Specify the source that you want to use in advance by pressing either the CH4 key or the LOGIC key.

Press the **State** soft key to open one of the menus shown below. The menu that appears varies depending on the specified clock source.

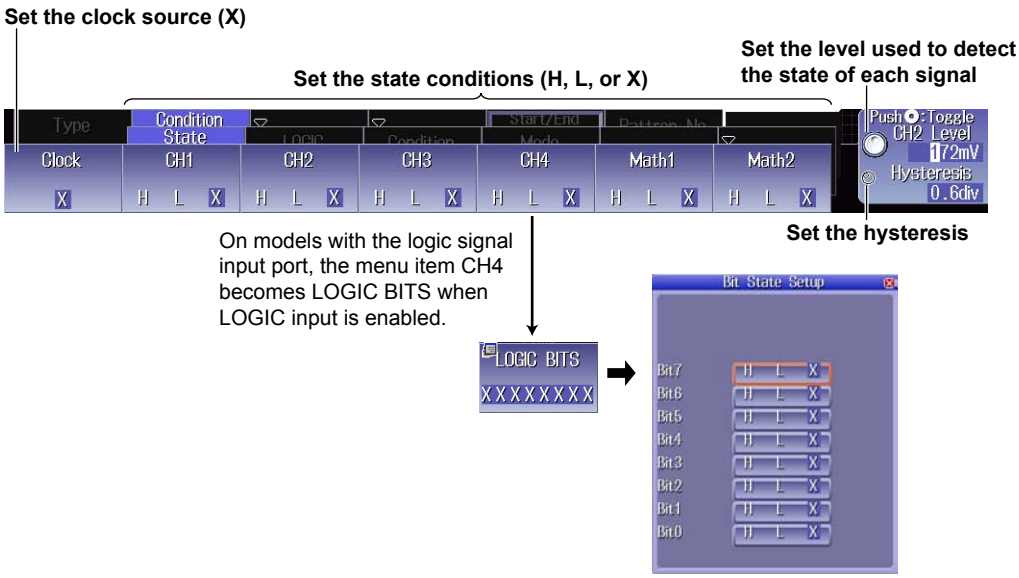
- **When the Clock Source is Math1, Math2, or from CH1 to CH4**



- **When the Source Is LOGIC (On models with the logic signal input port)**



- **When There Is No Clock Source**



The same menu appears as that shown on the previous page for when the clock source is Math1, Math2, or from CH1 to CH4. Because there is no clock source, you can specify all of the signal states for Math1, Math2, from CH1 to CH4, and LOGIC as state conditions.

Setting the Time Width Mode (Mode)

Press the **Mode** soft key to display the following menu.

Set what kind of relationship between the length of time the state condition is met or not met and the specified reference times (Time1 and Time2) will result in a detected point.

More than: The period during which the state condition is met or not met must be longer than the reference time specified by Time1 and the condition changes

Less than: The period during which the state condition is met or not met must be shorter than the reference time specified by Time1 and the condition changes

Between: The period during which the state condition is met or not met must be longer than Time1 but shorter than Time2 and the condition changes

Out of Range: The period during which the state condition is met or not met must be shorter than Time1 or longer than Time2 and the condition changes

Time Out: The period during which the state condition is met or not met must be longer than the reference time specified by Time1

Setting the Reference Times (Time1 and Time2)

The menu that appears varies depending on the set time width mode.

- **When the Time Width Mode is More than, Less than, or Time Out**

Set the reference time

- **When the Time Width Mode is Between or Out Of Range**

Set the reference times specified by Time1 and Time2

12.1 Analyzing and Searching CAN Bus Signals

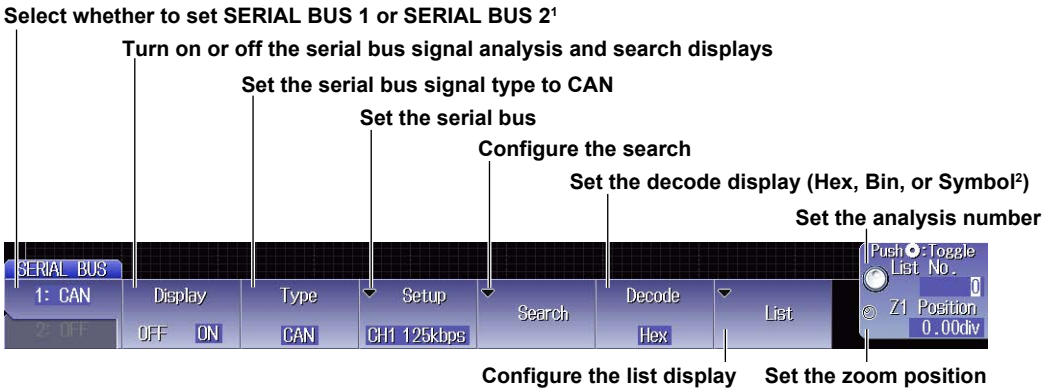
This section explains the following settings (which are used when analyzing or searching CAN bus signals):

- Serial bus signal analysis and search displays
- Serial bus signal types
- Analysis
  Auto setup, source, bit rate, recessive level, sample point, the level used to detect the source state, and hysteresis
- Decoded display
- List display
  List size and display position
- Zoom position
- Analysis number
- Search
  Jumping to the specified field, zoom window, search type, and search execution

► "Analyzing and Searching Serial Bus Signals," "Analyzing CAN Bus Signals," and "Searching CAN Bus Signals" in the Features Guide

SEARCH CAN Menu

Press **SHIFT+SEARCH** (SERIAL BUS), the **Type** soft key, and then th**e CAN** soft key to display the following menu.



1 SERIAL BUS 2 is only available on 4-channel models.
2 You can select Symbol for the decode display if you load the physical value/symbol definition file (.sbl).

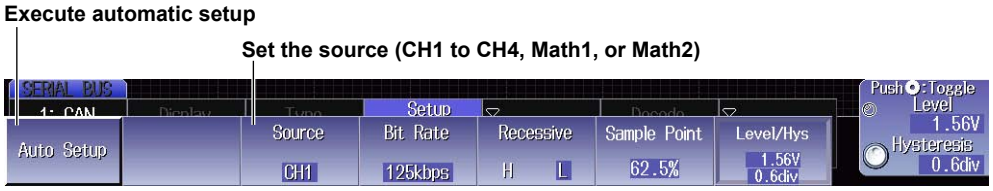
Setting the Serial Bus (Setup)

Press the **Setup** soft key to display the following menu.

Auto Setup (Auto Setup)

After setting the source, press the **Auto Setup** soft key to automatically configure the serial bus settings.

While the serial bus is being configured, Auto Setup changes to Abort. If you want to stop serial bus configuration, press the **Abort** soft key.

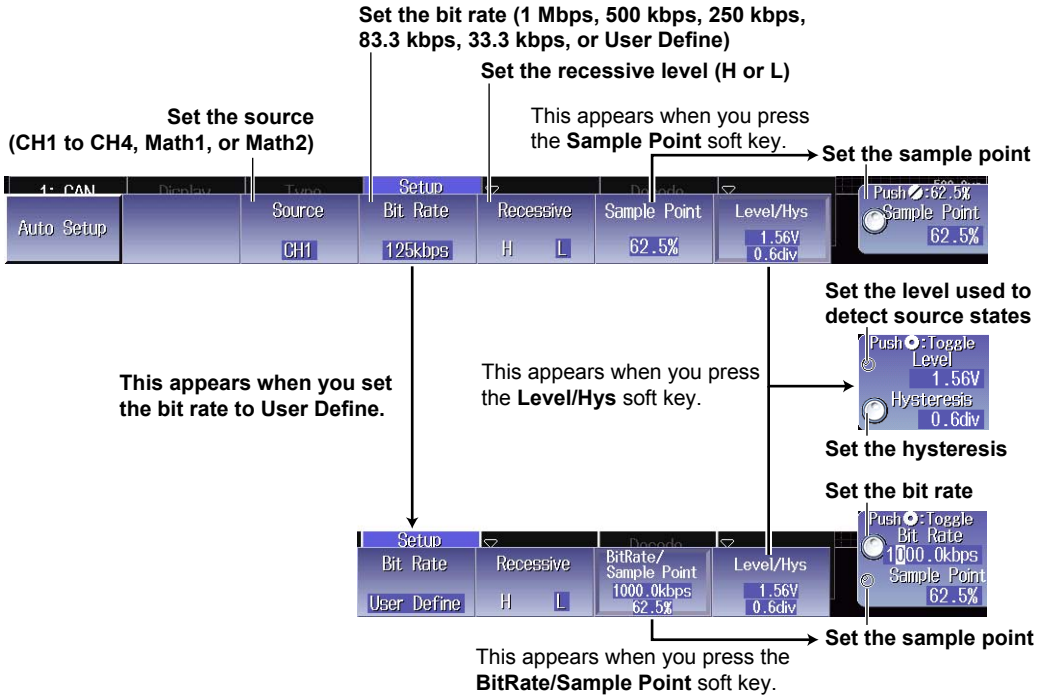


The auto setup feature automatically configures the bit rate, recessive level, sample point, level, and hysteresis and triggers on the start of frame (SOF) of the CAN bus signal.
After running auto setup, you can display decoded results and change settings by using the manual setup feature explained in the following section.
The auto setup feature will not work properly on some input signals.

Manual Setup

Note

Using the CH4 Terminal and Logic Signal Input Ports When You Perform Analyses or Execute Searches
If you perform an analysis or execute a search when using the logic signal input ports for input, you cannot specify CH4 as the source. Press the CH4 key in advance to enable input from the CH4 terminal.

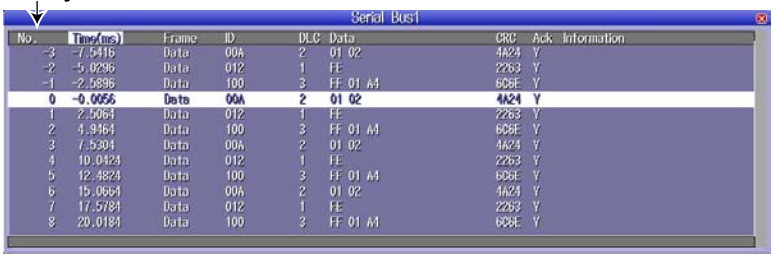


Setting the List Display (List)

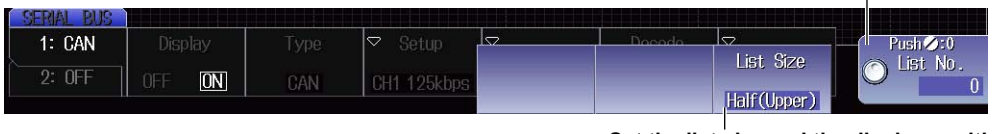
Press the **List** soft key to display the decoded results as a list.

List of analysis results

Analysis number



Set the analysis number

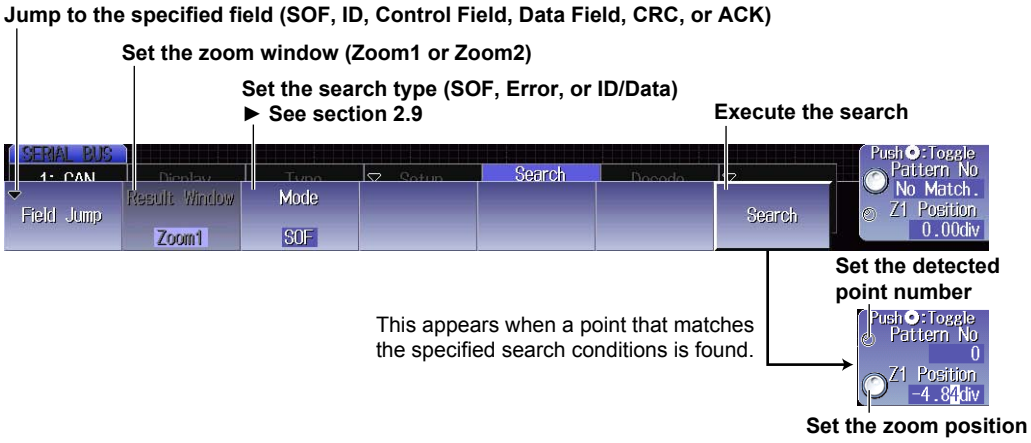


Set the list size and the display position to Full Screen, Half(Upper), or Half(Lower)

Data before the trigger position (on the left side of the waveform display) is assigned analysis numbers in descending order (–1, –2, and so on). Data after the trigger position (on the right side of the waveform display) is assigned analysis numbers in ascending order (0, 1, 2, and so on).

Search Setup (Search)

Press the **Search** soft key to display the following menu.



- Jumping to the specified field
  Jumps to the field in the data frame that corresponds to the specified detected point number (Pattern No).
- Configuring the zoom windows
  You can configure zoom windows Zoom1 and Zoom2 when they are displayed. Zoom1 is automatically displayed during the automatic setup of the analysis settings.
- Setting the search type
  You can set this setting in the same way that you set the trigger type to SOF, Error, or ID/Data. For details, see section 2.9.
- Executing searches
  After setting the search type, press the **Search** soft key to execute the search. If the DLM2000 finds points that match the search conditions (detected points), it shows numbers (0, 1, 2, etc.) from the left of the waveform display in the order that the points were detected.
- Setting the detected point numbers
  After setting the detected point number, you can display the waveform for the corresponding detected point on the zoom window.
- Setting the zoom position
  You can change the zoom position, which is the point on the waveform that is zoomed in on.

12.2 Analyzing and Searching LIN Bus Signals

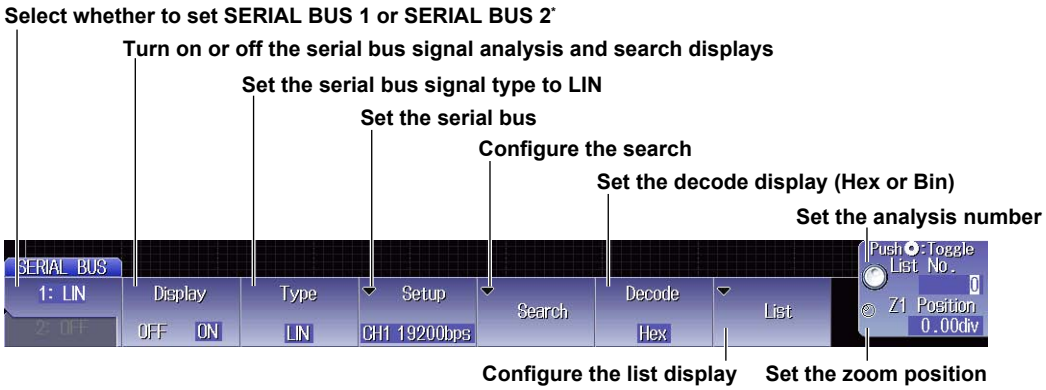
This section explains the following settings (which are used when analyzing or searching LIN bus signals):

- Serial bus signal analysis and search displays
- Serial bus signal types
- Analysis
  Auto setup, source, bit rate, revision, sample point, the level used to detect the source state, and hysteresis
- Decoded display
- List display
  List size and display position
- Zoom position
- Analysis number
- Search
  Jumping to the specified field, zoom window, search type, and search execution

► "Analyzing and Searching Serial Bus Signals," "Analyzing LIN Bus Signals," and "Searching LIN Bus Signals" in the Features Guide

SEARCH LIN Menu

Press **SHIFT+SEARCH** (SERIAL BUS), the **Type** soft key, and then the **LIN** soft key to display the following menu.



* SERIAL BUS 2 is only available on 4-channel models.

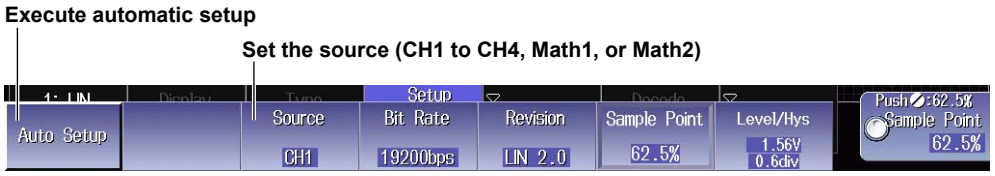
Setting the Serial Bus (Setup)

Press the **Setup** soft key to display the following menu.

Auto Setup

After setting the source, press the **Auto Setup** soft key to automatically configure the serial bus settings.

While the serial bus is being configured, Auto Setup changes to Abort. If you want to stop serial bus configuration, press the **Abort** soft key.

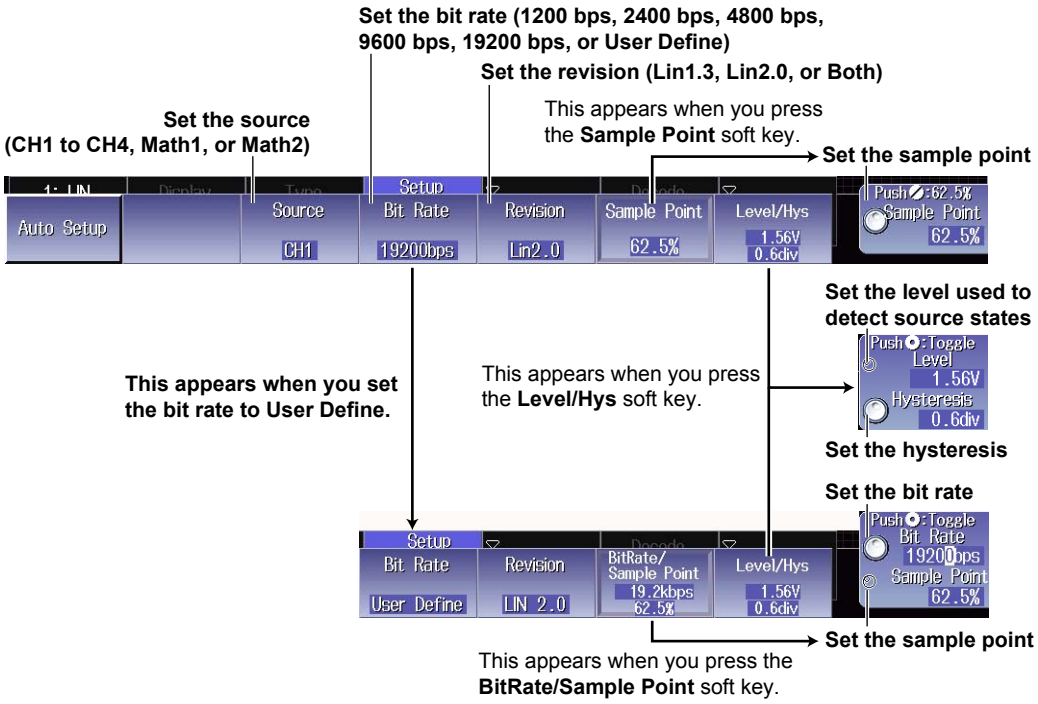


The auto setup feature automatically configures the bit rate, revision, sample point, level, and hysteresis and triggers on the LIN bus signal's Break Synch.
After running auto setup, you can display decoded results and change settings by using the manual setup feature explained in the following section.
The auto setup feature will not work properly on some input signals.

Manual Setup

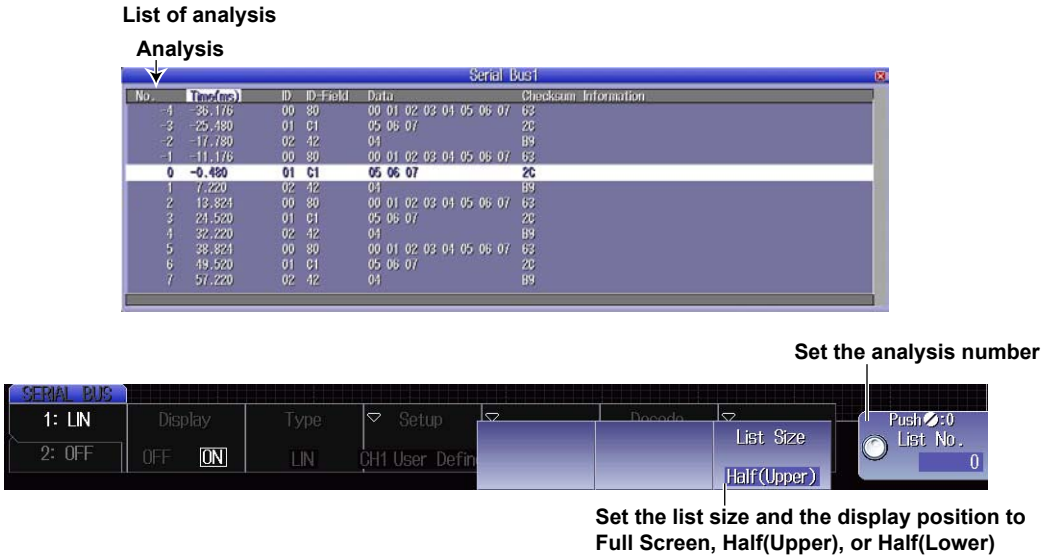
Note

Using the CH4 Terminal and Logic Signal Input Ports When You Perform Analyses or Execute Searches
If you perform an analysis or execute a search when using the logic signal input ports for input, you cannot specify CH4 as the source. Press the CH4 key in advance to enable input from the CH4 terminal.



Setting the List Display (List)

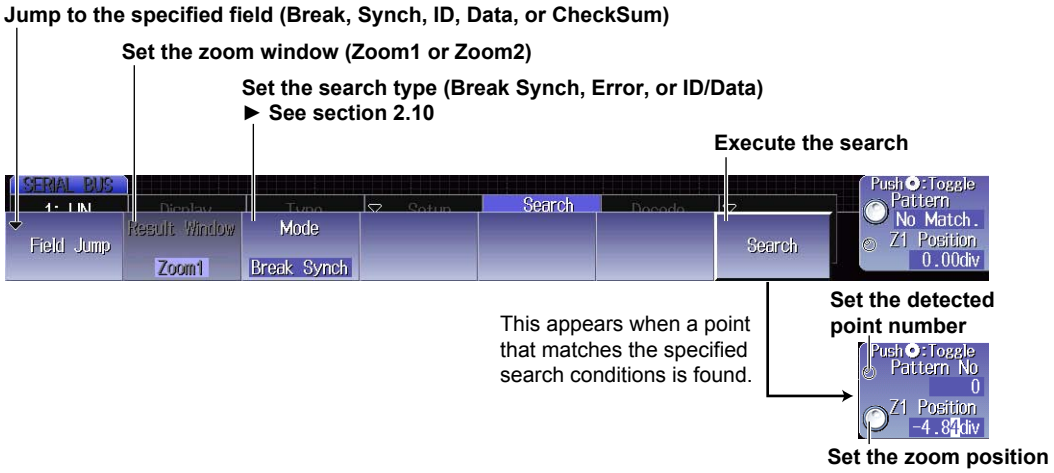
Press the **List** soft key to display the decoded results as a list.



Data before the trigger position (on the left side of the waveform display) is assigned analysis numbers in descending order (–1, –2, and so on). Data after the trigger position (on the right side of the waveform display) is assigned analysis numbers in ascending order (0, 1, 2, and so on).

Search Setup (Search)

Press the **Search** soft key to display the following menu.



- Jumping to the specified field
  Jumps to the field in the frame that corresponds to the specified detected point number (Pattern No).
- Configuring the zoom windows
  You can configure zoom windows Zoom1 and Zoom2 when they are displayed. Zoom1 is automatically displayed during the automatic setup of the analysis settings.
- Setting the search type
  You can set this setting in the same way that you set the trigger type to Break Synch, Error, or ID/Data. For details, see section 2.10.
- Executing searches
  After setting the search type, press the **Search** soft key to execute the search. If the DLM2000 finds points that match the search conditions (detected points), it shows numbers (0, 1, 2, etc.) from the left of the waveform display in the order that the points were detected.
- Setting the detected point numbers
  After setting the detected point number, you can display the waveform for the corresponding detected point on the zoom window.
- Setting the zoom position
  You can change the zoom position, which is the point on the waveform that is zoomed in on.

12.3 Analyzing and Searching UART Signals

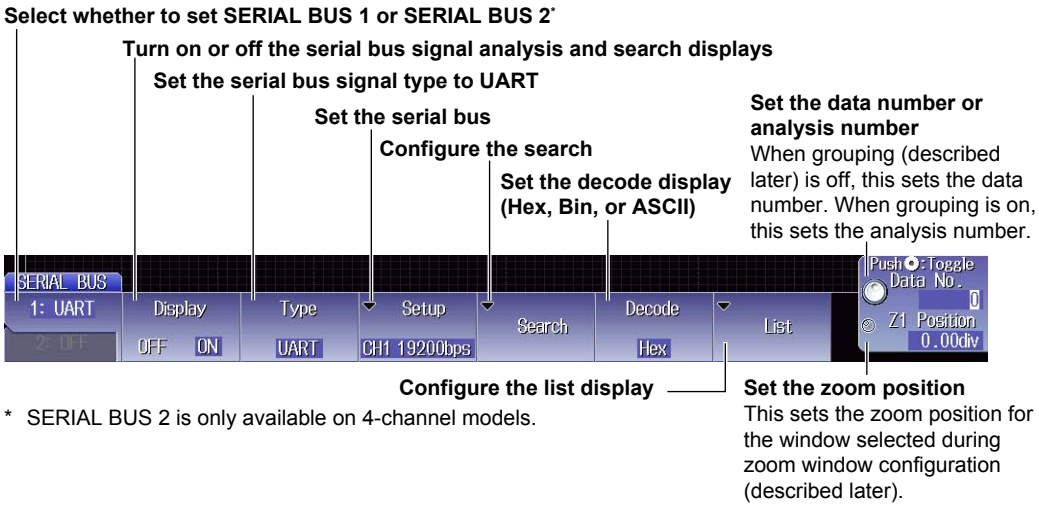
This section explains the following settings (which are used when analyzing or searching UART signals):

- Serial bus signal analysis and search displays
- Serial bus signal types
- Analysis
  Auto setup, source, format, parity, grouping, the level used to detect the source state, and hysteresis
- Decoded display
- List display
  List size and display position, grouping, and detailed display
- Zoom position
- Analysis and data numbers
- Search
  Zoom window, search type, and search execution

► "Analyzing and Searching Serial Bus Signals," "Analyzing UART Signals," and "Searching UART Signals" in the Features Guide

SEARCH UART Menu

Press **SHIFT+SEARCH** (SERIAL BUS), the **Type** soft key, and then the **UART** soft key to display the following menu.



* SERIAL BUS 2 is only available on 4-channel models.

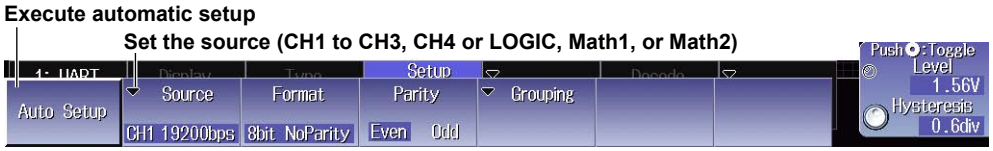
Setting the Serial Bus (Setup)

Press the **Setup** soft key to display the following menu.

Auto Setup (Auto Setup)

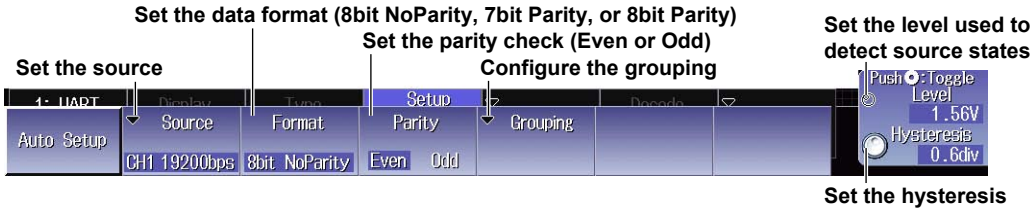
After setting the source, press the **Auto Setup** soft key to automatically configure the serial bus settings.

While the serial bus is being configured, Auto Setup changes to Abort. If you want to stop serial bus configuration, press the **Abort** soft key.



The auto setup feature automatically configures the bit rate, sample point, level, and hysteresis and then triggers on the UART signal's Stop Bit.
After running auto setup, you can display decoded results and change settings by using the manual setup feature explained in the following section.
The auto setup feature will not work properly on some input signals.

Manual Setup



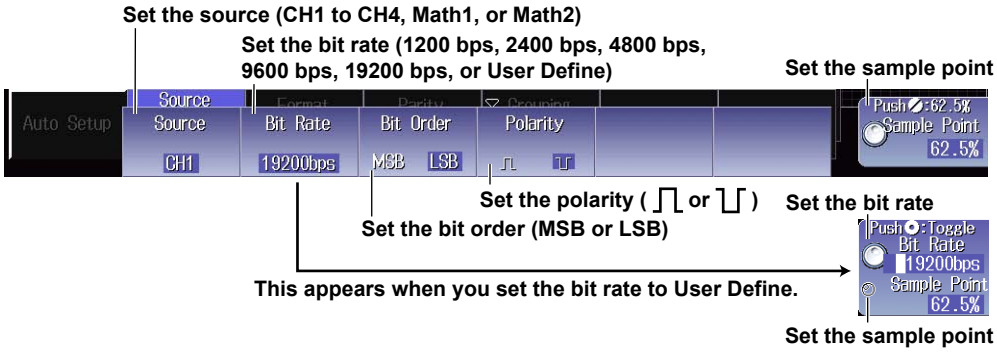
Setting the Source (Source)

Press the **Source** soft key to open one of the menus shown below. The menu that appears varies depending on the specified source.

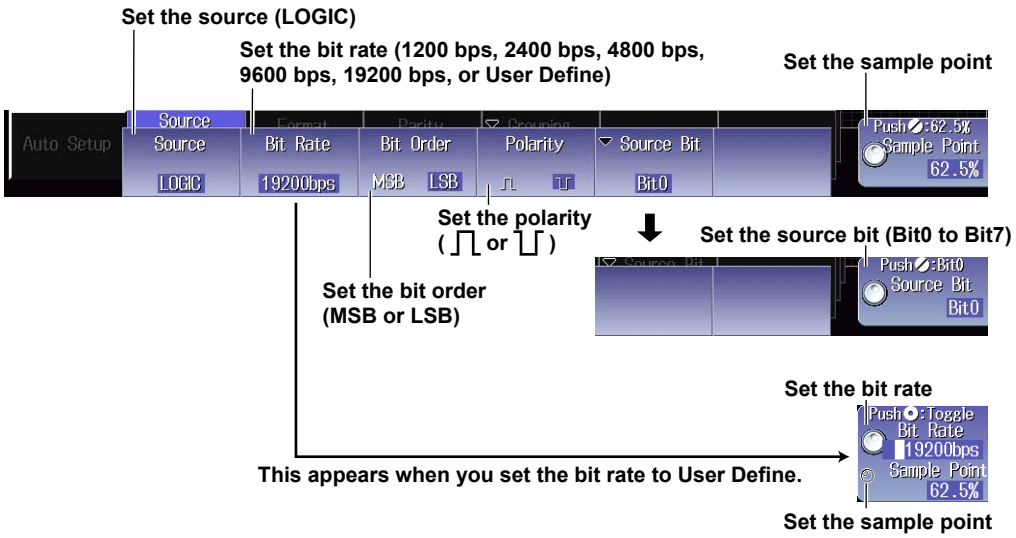
Note

Using the CH4 Terminal and Logic Signal Input Ports When You Perform Analyses or Execute Searches
When you perform an analysis or execute a search, you cannot use the CH4 terminal and logic signal input ports as the source at the same time. Specify the source that you want to use in advance by pressing either the CH4 key or the LOGIC key.

- **When the Source Is Math1, Math2, or from CH1 to CH4**



- **When the Source Is LOGIC (On models with the logic signal input port)**



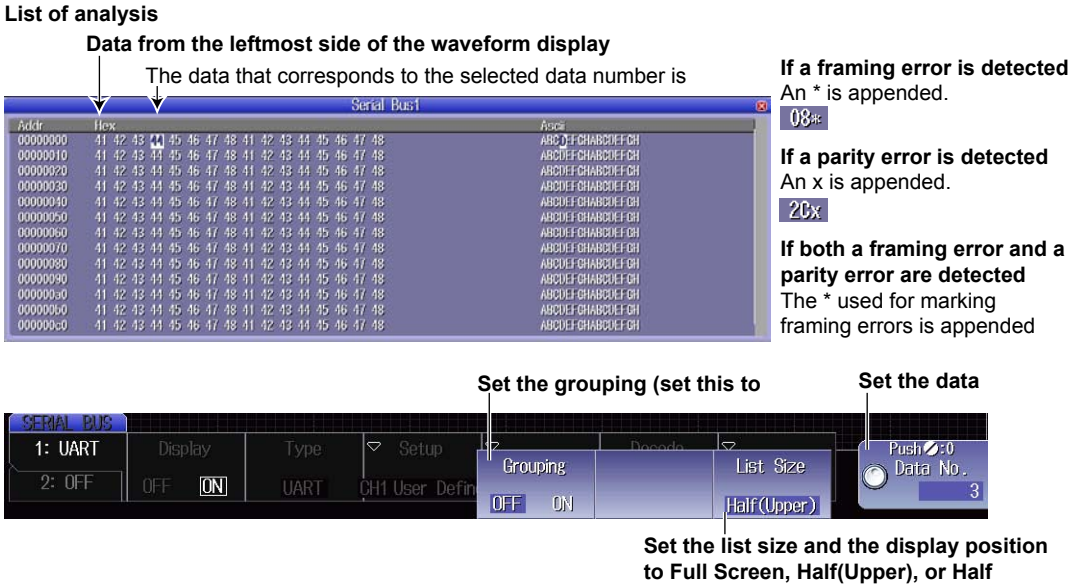
Setting the Grouping (Grouping)

Press the **Grouping** soft key to display the following menu.

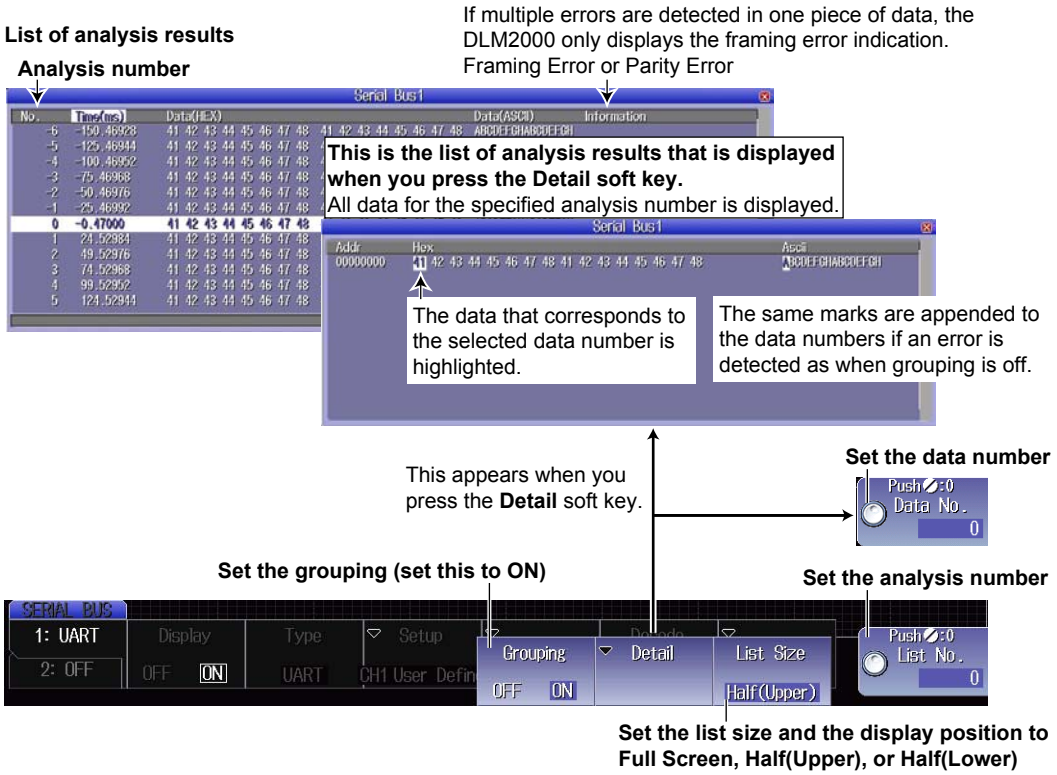
Setting the List Display (List)

Press the **List** soft key on the SEARCH UART menu to display the decoded results as a list.

When Grouping Is Set to OFF



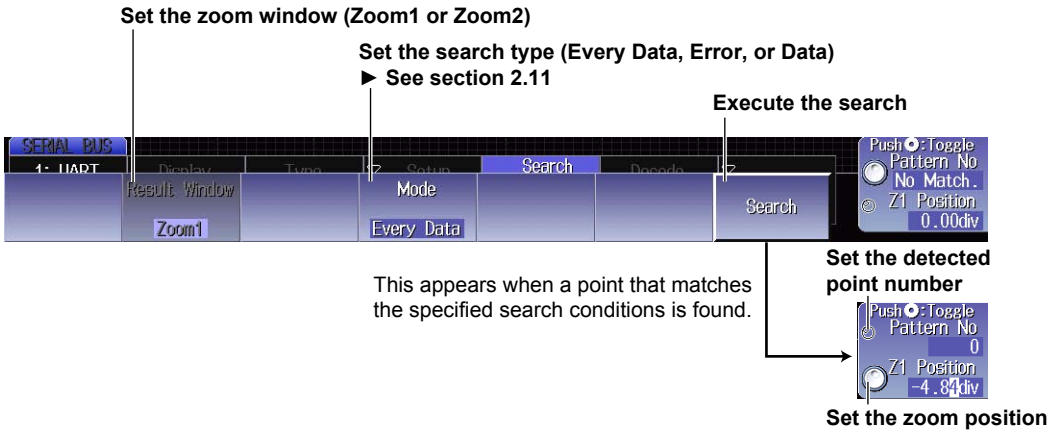
When Grouping Is Set to ON



Data before the trigger position (on the left side of the waveform display) is assigned analysis numbers in descending order (–1, –2, and so on). Data after the trigger position (on the right side of the waveform display) is assigned analysis numbers in ascending order (0, 1, 2, and so on).

Search Setup (Search)

Press the **Search** soft key on the SEARCH UART menu to display the following menu.



- Configuring the zoom windows
  You can configure zoom windows Zoom1 and Zoom2 when they are displayed. Zoom1 is automatically displayed during the automatic setup of the analysis settings.
- Setting the search type
  You can set this setting in the same way that you set the trigger type to Every Data, Error, or Data. For details, see section 2.11.
- Executing searches
  After setting the search type, press the **Search** soft key to execute the search. If the DLM2000 finds points that match the search conditions (detected points), it shows numbers (0, 1, 2, etc.) from the left of the waveform display in the order that the points were detected.
- Setting the detected point numbers
  After setting the detected point number, you can display the waveform for the corresponding detected point on the zoom window.
- Setting the zoom position
  You can change the zoom position, which is the point on the waveform that is zoomed in on.

12.4 Analyzing and Searching I²C Bus Signals

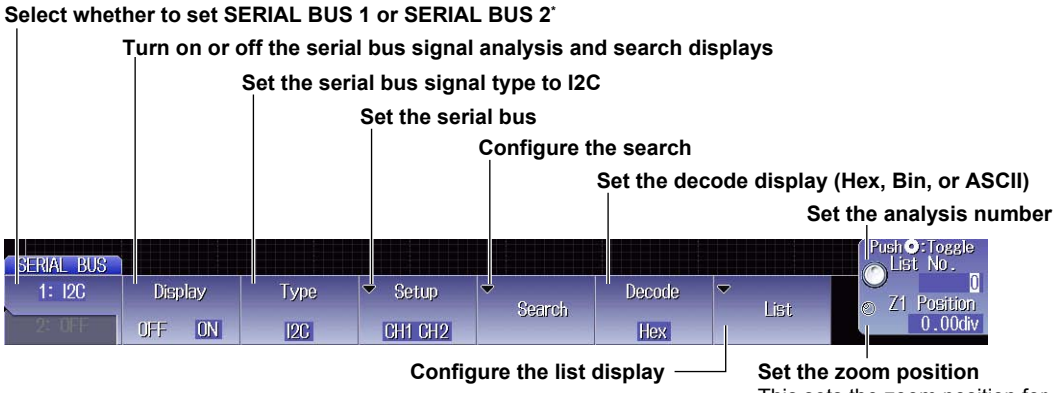
This section explains the following settings (which are used when analyzing or searching I²C bus signals):

- Serial bus signal analysis and search displays
- Serial bus signal types
- Analysis
  Auto setup, SCL source, SDA source, the level used to detect the source state, and hysteresis
- Decoded display
- List display
  List size, position, and details
- Zoom position
- Analysis number
- Search
  Zoom window, search type, and search execution

► "Analyzing and Searching Serial Bus Signals,"
"Analyzing I²C Bus Signals," and
"Searching I²C Bus Signals"
in the Features Guide

SEARCH I2C Menu

Press **SHIFT+SEARCH** (SERIAL BUS), the **Type** soft key, and then the **I2C** soft key to display the following menu.



* SERIAL BUS 2 is only available on 4-channel models.

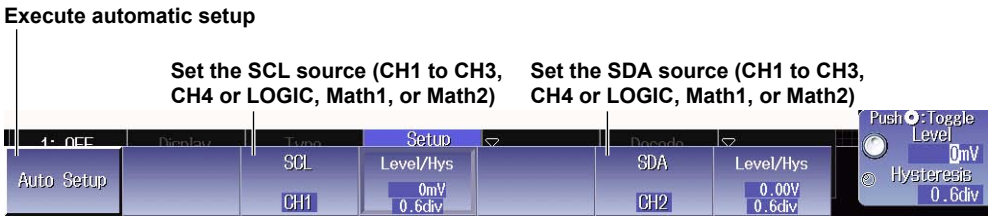
Setting the Serial Bus (Setup)

Press the **Setup** soft key to display the following menu.

Auto Setup (Auto Setup)

After setting the SCL and SDA sources, press the **Auto Setup** soft key to automatically configure the serial bus settings.

While the serial bus is being configured, Auto Setup changes to Abort. If you want to stop serial bus configuration, press the **Abort** soft key.



The DLM2000 sets the level and hysteresis and triggers on the start condition of the I²C bus signal. After running auto setup, you can display decoded results and change settings by using the manual setup feature explained in the following section.
The auto setup feature will not work properly on some input signals.

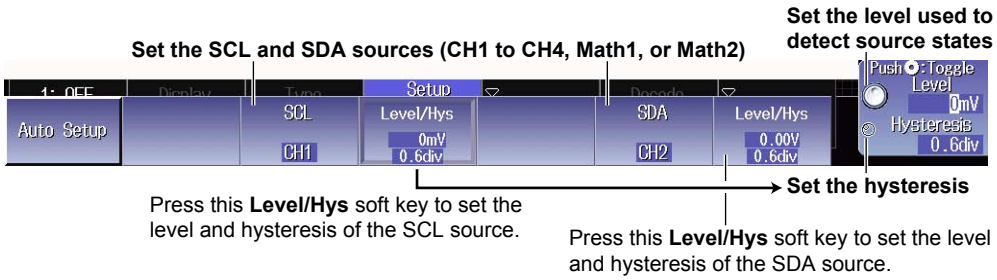
Manual Setup

Setting the SDA Source and the SCL Source (SDA, SCL)

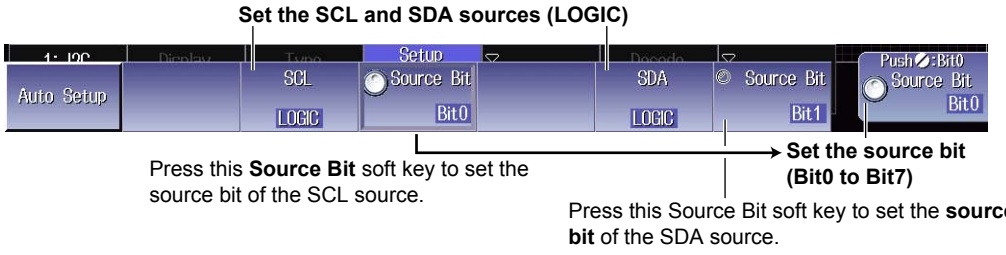
Note

Using the CH4 Terminal and Logic Signal Input Ports When You Perform Analyses or Execute Searches
When you perform an analysis or execute a search, you cannot use the CH4 terminal and logic signal input ports as the source at the same time. Specify the source that you want to use in advance by pressing either the CH4 key or the LOGIC key.

- **When the Source Is Math1, Math2, or from CH1 to CH4**

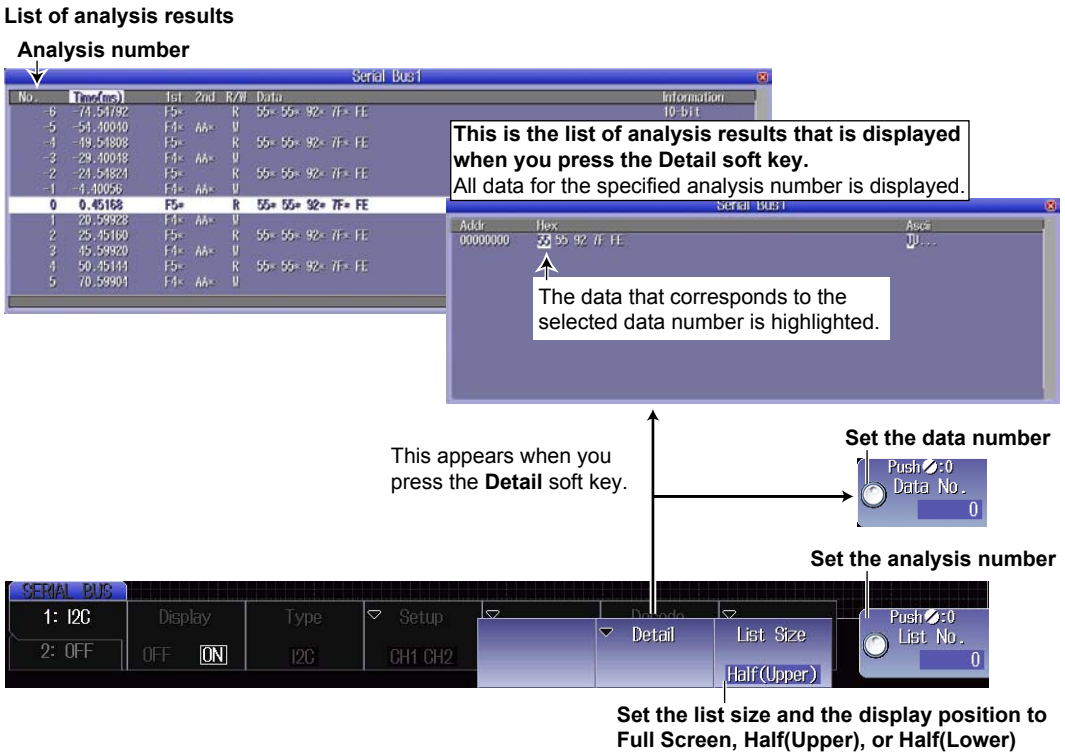


- **When the Source Is LOGIC (On models with the logic signal input port)**



Setting the List Display (List)

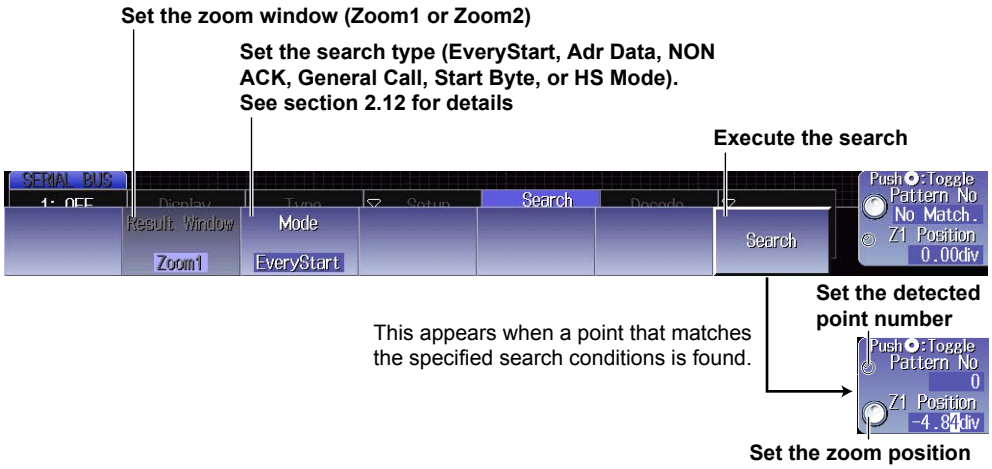
Press the **List** soft key on the SEARCH I2C menu to display the decoded results in a list.



Data before the trigger position (on the left side of the waveform display) is assigned analysis numbers in descending order (–1, –2, and so on). Data after the trigger position (on the right side of the waveform display) is assigned analysis numbers in ascending order (0, 1, 2, and so on).

Search Setup (Search)

Press the **Search** soft key on the SEARCH I2C menu to display the following menu.



- Configuring the zoom windows
  You can configure zoom windows Zoom1 and Zoom2 when they are displayed. Zoom1 is automatically displayed during the automatic setup of the analysis settings.
- Setting the search type
  You can set this setting in the same way that you set the trigger type to EveryStart, Adr Data, NON ACK, General Call, Start Byte, and HS Mode. For details, see section 2.12.
- Executing searches
  After setting the search type, press the **Search** soft key to execute the search. If the DLM2000 finds points that match the search conditions (detected points), it shows numbers (0, 1, 2, etc.) from the left of the waveform display in the order that the points were detected.
- Setting the detected point numbers
  After setting the detected point number, you can display the waveform for the corresponding detected point on the zoom window.
- Setting the zoom position
  You can change the zoom position, which is the point on the waveform that is zoomed in on.

12.5 Analyzing and Searching SPI Bus Signals

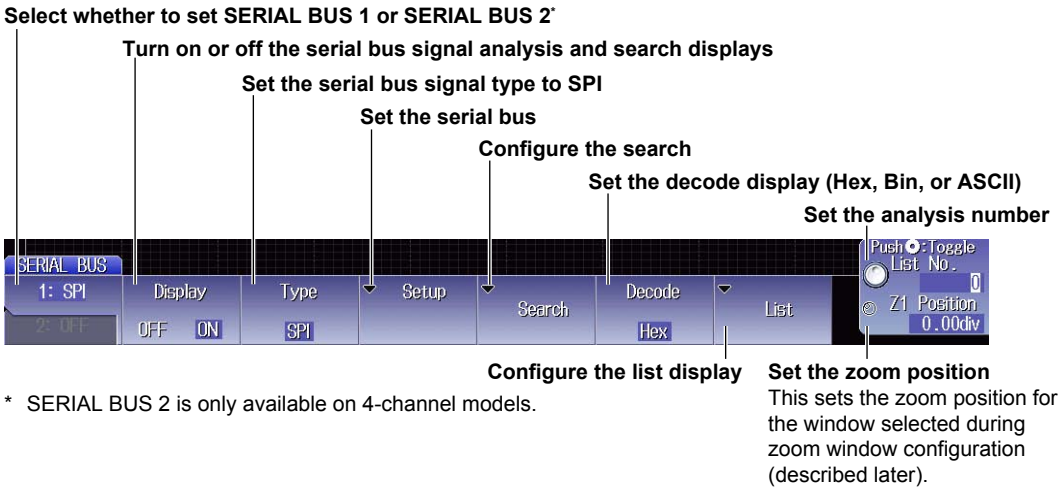
This section explains the following settings (which are used when analyzing or searching SPI bus signals):

- Serial bus signal analysis and search displays
- Serial bus signal types
- Analysis
  Auto setup, wiring system, bit order, clock source, data source, chip select source, the level used to detect the source state, hysteresis, and polarity
- Decoded display
- List display
  List size, position, and details
- Zoom position
- Analysis number
- Search
  Zoom window, search conditions, and search execution

► “Analyzing and Searching Serial Bus Signals,” “Analyzing SPI Bus Signals,” and “Searching SPI Bus Signals” in the Features Guide

SEARCH SPI Menu

Press **SHIFT+SEARCH** (SERIAL BUS), the **Type** soft key, and then the **SPI** soft key to display the following menu.



* SERIAL BUS 2 is only available on 4-channel models.

Setting the Serial Bus (Setup)

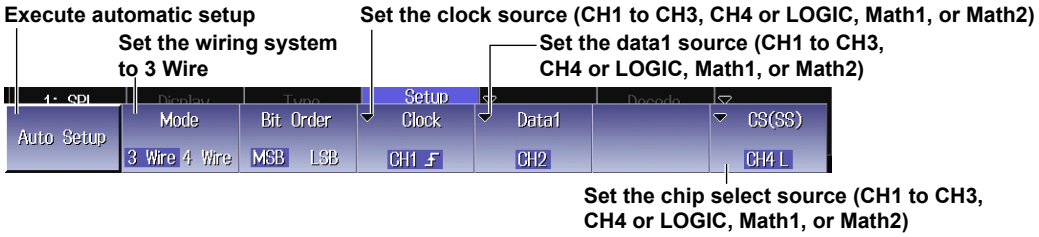
Press the **Setup** soft key to display the following menu.

Auto Setup (Auto Setup)

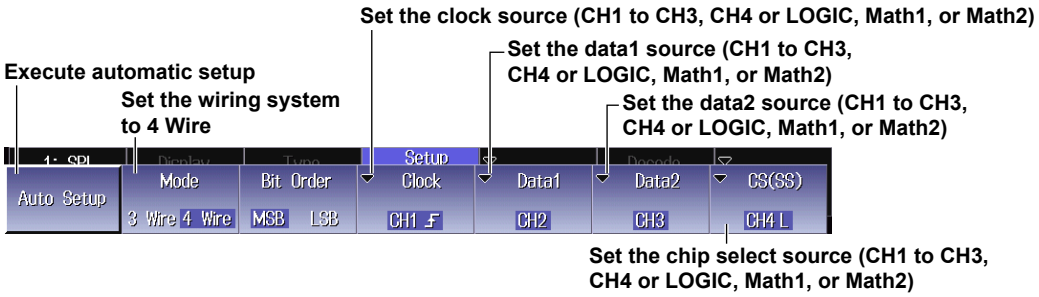
After setting the wiring system and the clock, data, and chip select sources, press the **Auto Setup** soft key to automatically configure the serial bus settings.

While the serial bus is being configured, Auto Setup changes to Abort. If you want to stop serial bus configuration, press the **Abort** soft key.

When Wiring System Is 3 Wire



When Wiring System Is 4 Wire



The auto setup feature automatically configures the level and hysteresis and then triggers on the SPI signal's first data byte.
After running auto setup, you can display decoded results and change settings by using the manual setup feature explained in the following section.
The auto setup feature will not work properly on some input signals.

Manual Setup

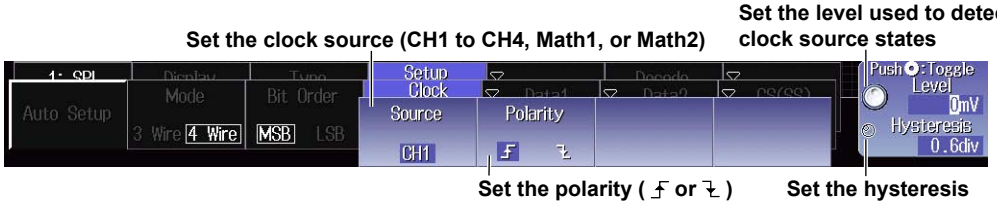
Press the **Clock**, **Data1**, **Data2**, or **CS(SS)** soft key to open one of the menus shown below. The menu that appears varies depending on the source that is specified in the pressed soft key's menu.

Note

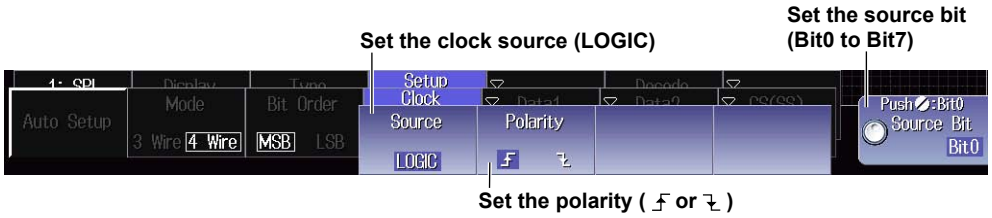
Using the CH4 Terminal and Logic Signal Input Ports When You Perform Analyses or Execute Searches
When you perform an analysis or execute a search, you cannot use the CH4 terminal and logic signal input ports as the source at the same time. Specify the source that you want to use in advance by pressing either the CH4 key or the LOGIC key.

Setting the Clock Source (Clock)

- **When the Source Is Math1, Math2, or from CH1 to CH4**



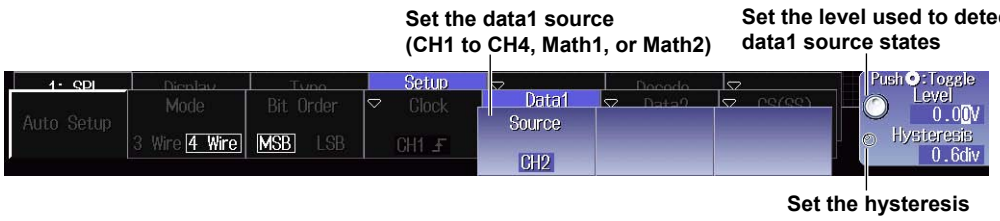
- **When the Source Is LOGIC (On models with the logic signal input port)**



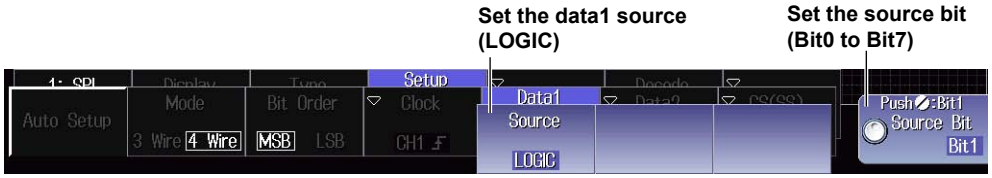
Setting the Data1 or Data2 Sources (Data1 and Data2)

This section shows how to set the Data1 source. You can set the Data2 source in the same manner. When the wiring system is 4 Wire, set the Data2 source.

- **When the Source Is Math1, Math2, or from CH1 to CH4**

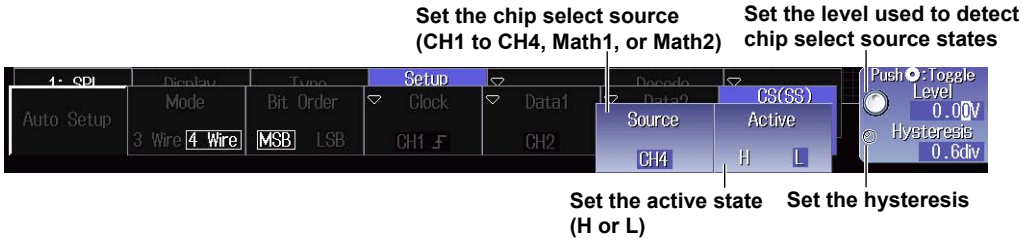


- **When the Source Is LOGIC (On models with the logic signal input port)**

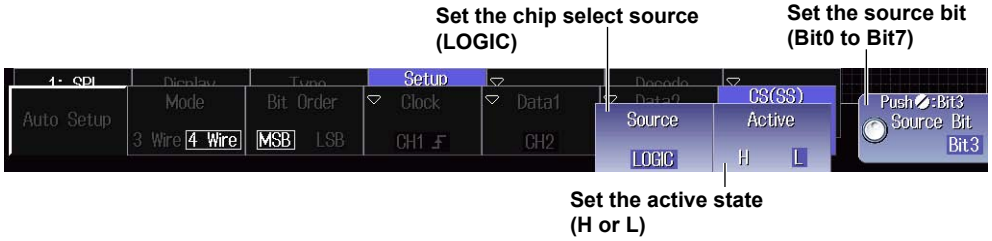


Setting the Chip Select Source (CS (SS))

- **When the Source Is Math1, Math2, or from CH1 to CH4**



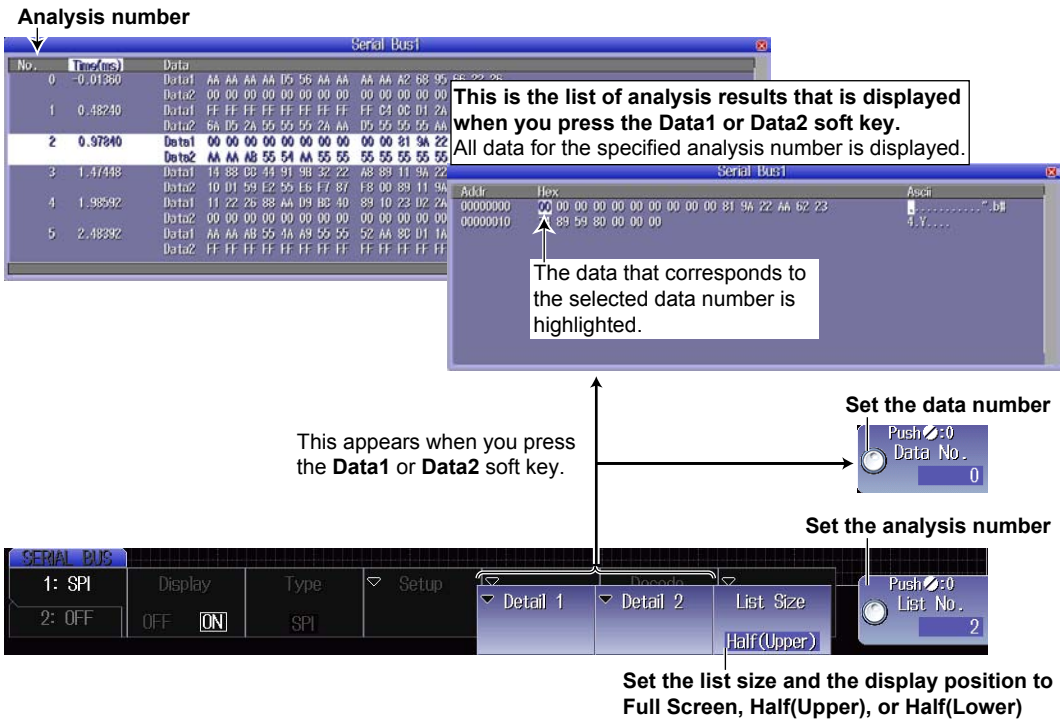
- **When the Source Is LOGIC (On models with the logic signal input port)**



Setting the List Display (List)

Press the **List** soft key on the SEARCH SPI menu to display the decoded results as a list.
In the analysis configuration shown two pages earlier, when the wiring system is set to 3 Wire, the contents of Data1 are displayed in a list. When the wiring system is set to 4 Wire, the contents of Data 1 and Data2 are both displayed in a list.

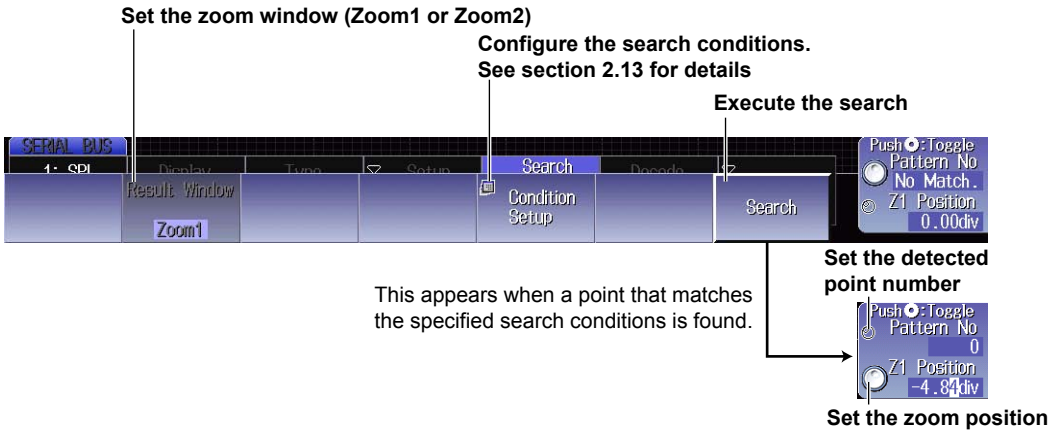
List of analysis results



Data before the trigger position (on the left side of the waveform display) is assigned analysis numbers in descending order (–1, –2, and so on). Data after the trigger position (on the right side of the waveform display) is assigned analysis numbers in ascending order (0, 1, 2, and so on).

Search Setup (Search)

Press the **Search** soft key on the SEARCH SPI menu to display the following menu.



- Configuring the zoom windows
  You can configure zoom windows Zoom1 and Zoom2 when they are displayed. Zoom1 is automatically displayed during the automatic setup of the analysis settings.
- Setting the search conditions
- You can set search conditions in the same way that you set trigger conditions. For details, see section 2.13.
- Executing searches
  After setting the search conditions, press the **Search** soft key to execute the search. If the DLM2000 finds points that match the search conditions (detected points), it shows numbers (0, 1, 2, etc.) from the left of the waveform display in the order that the points were detected.
- Setting the detected point numbers
  After setting the detected point number, you can display the waveform for the corresponding detected point on the zoom window.
- Setting the zoom position
  You can change the zoom position, which is the point on the waveform that is zoomed in on.

12.6 Analyzing and Searching User-Defined Serial Bus Signals

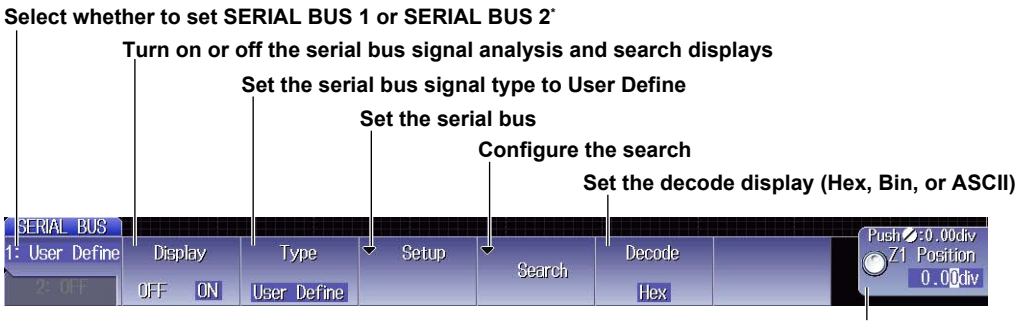
This section explains the following settings (which are used when analyzing or searching user-defined serial bus signals):

- Serial bus signal analysis and search displays
- Serial bus signal types
- Analysis
  Bit rate, data source, clock source, chip select source, latch source, the level used to detect the source state, hysteresis, and polarity
- Decoded display and decoding start point
- Zoom position
- Search
  Zoom window, search conditions, and search execution

► "Analyzing and Searching Serial Bus Signals,"
"Analyzing User-Defined Serial Bus Signals (User Define)," and
"Searching User-Defined Serial Bus Signals (User Define)"
in the Features Guide

SEARCH User Define Menu

Press **SHIFT+SEARCH** (SERIAL BUS), the **Type** soft key, and then the **User Define** soft key to display the following menu.



* SERIAL BUS 2 is only available on 4-channel models.

Set the zoom position
This sets the zoom position for the window selected during zoom window configuration (described later).

Setting the Serial Bus (Setup)

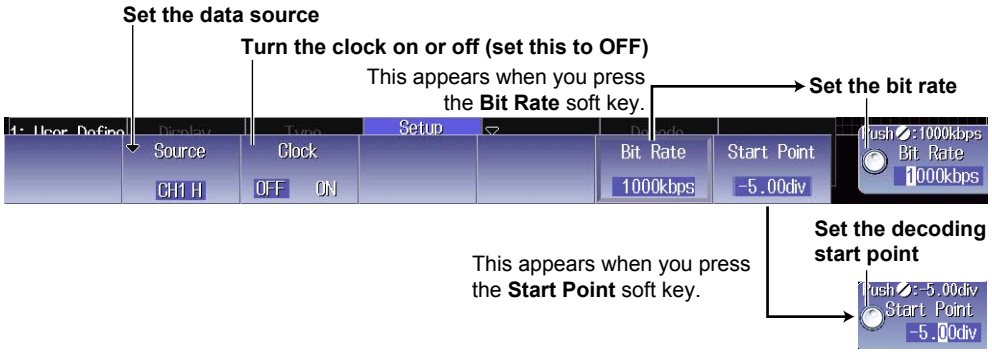
Press the **Setup** soft key to open one of the menus shown below. The menu that appears varies depending on whether the clock is on or off.

Note

Using the CH4 Terminal and Logic Signal Input Ports When You Perform Analyses or Execute Searches

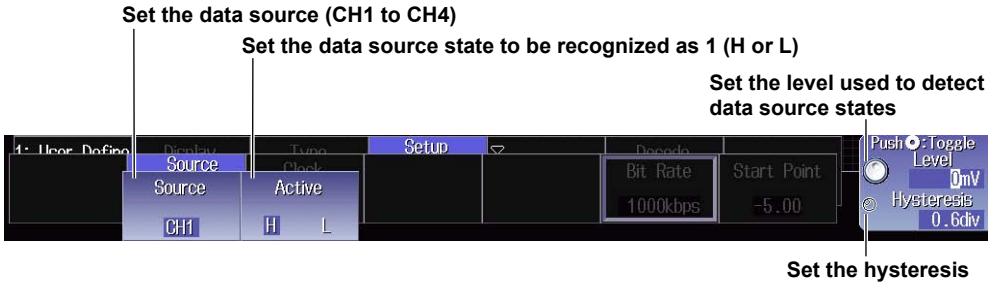
If you perform an analysis or execute a search when using the logic signal input ports for input, you cannot specify CH4 as the source. Press the CH4 key in advance to enable input from the CH4 terminal.

When the Clock Is Off



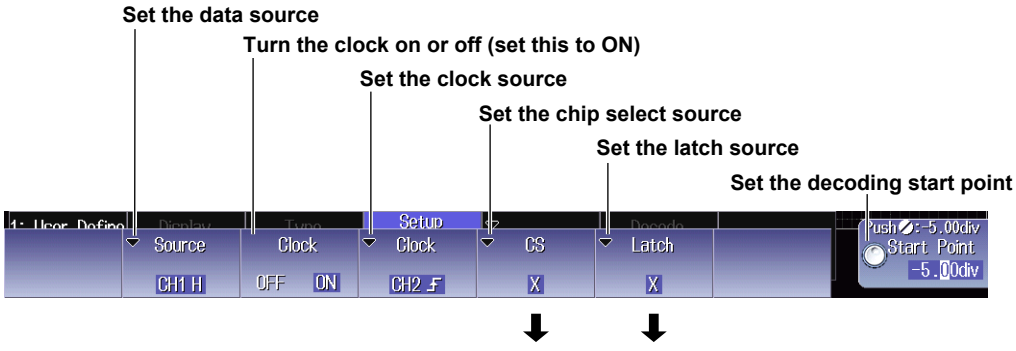
Setting the Data Source (Source)

Press the **Source** soft key to display the following menu.



Set the analysis source.

When the Clock Is On



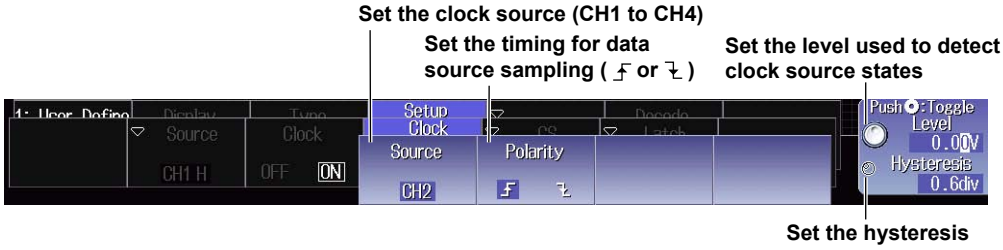
Press the **source** soft key and specify one of the channels from CH1 to CH4 to set that channel's source conditions.

- **Setting the Data Source (Source)**

  The menu is the same as the one shown above for when the clock is off.

- **Setting the Clock Source (Clock)**

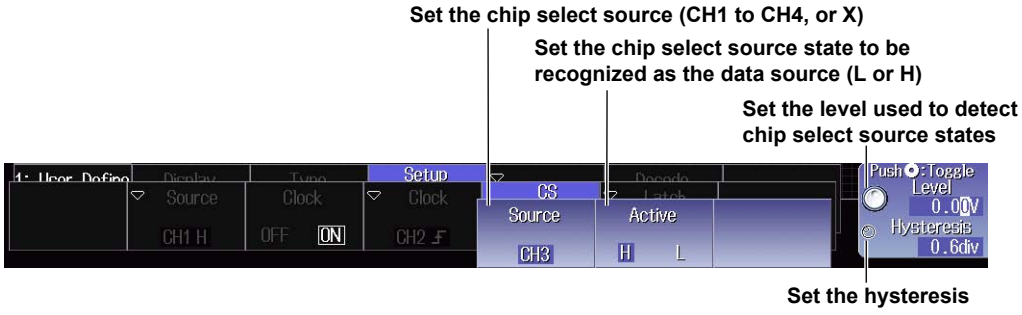
  Press the **Clock** soft key to display the following menu.



  Specify which clock source edge causes the data source to be sampled.

- **Setting the Chip Select Source (CS)**

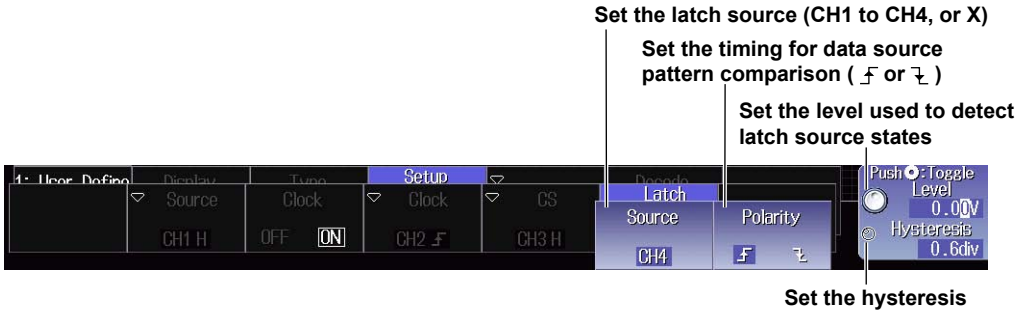
  Press the **CS** soft key to display the following menu.



  When the data source is sampled in sync with the clock source, use the chip select source to control the period for which the DLM2000 tests the data source.

- **Setting the Latch Source (Latch)**

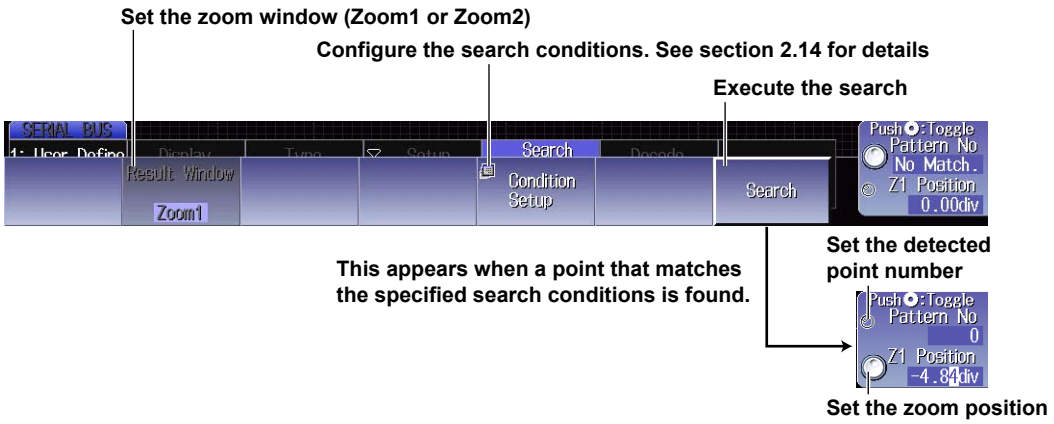
  Press the **Latch** soft key to display the following menu.



  Specify the timing at which the data source pattern sampled in sync with the clock source is compared with the specified pattern.

Search Setup (Search)

Press the **Search** soft key on the SEARCH User Define menu to display the following menu.



- Configuring the zoom windows
  You can configure zoom windows Zoom1 and Zoom2 when they are displayed. Zoom1 is automatically displayed during the automatic setup of the analysis settings.
- Setting the search conditions
- You can set search conditions in the same way that you set trigger conditions. For details, see section 2.14.
- Executing searches
  After setting the search conditions, press the **Search** soft key to execute the search. If the DLM2000 finds points that match the search conditions (detected points), it shows numbers (0, 1, 2, etc.) from the left of the waveform display in the order that the points were detected.
- Setting the detected point numbers
  After setting the detected point number, you can display the waveform for the corresponding detected point on the zoom window.
- Setting the zoom position
  You can change the zoom position, which is the point on the waveform that is zoomed in on.

13.1 Displaying Waveform Histograms

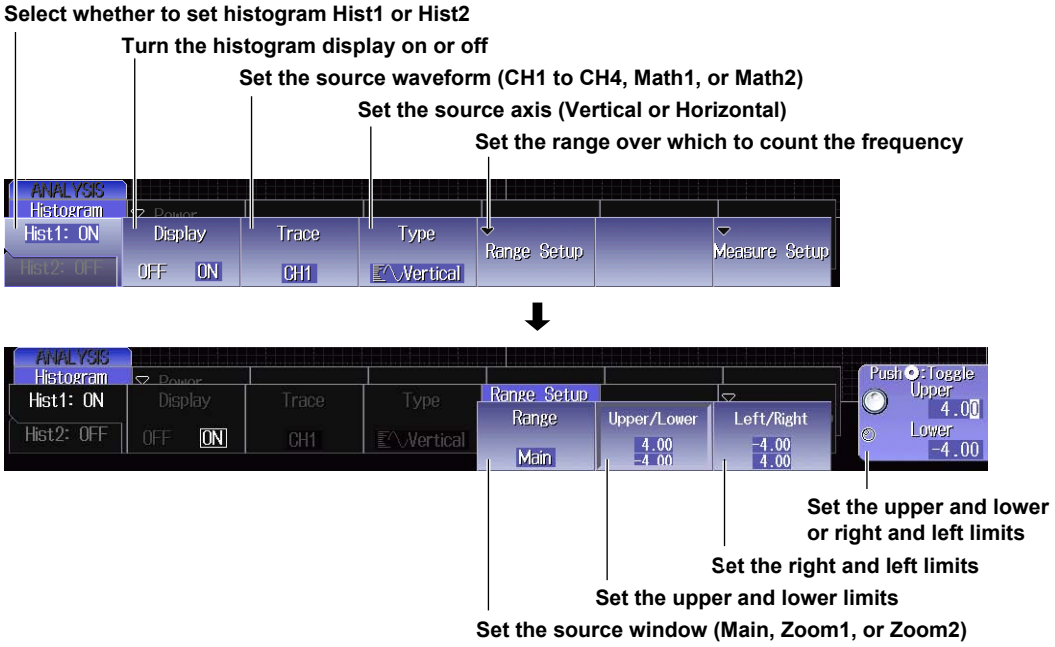
This section explains the following settings (which are used when displaying a histogram of the frequency of data occurrence in a specified area):

- Histogram
- Source waveform
- Source axis
- The range over which the frequency is counted

► "Displaying the Frequency Distribution of a Waveform" in the Features Guide

ANALYSIS Histogram Menu

Press **ANALYSIS** and then the **Histogram** soft key to display the following menu.



13.2 Measuring Histogram Parameters

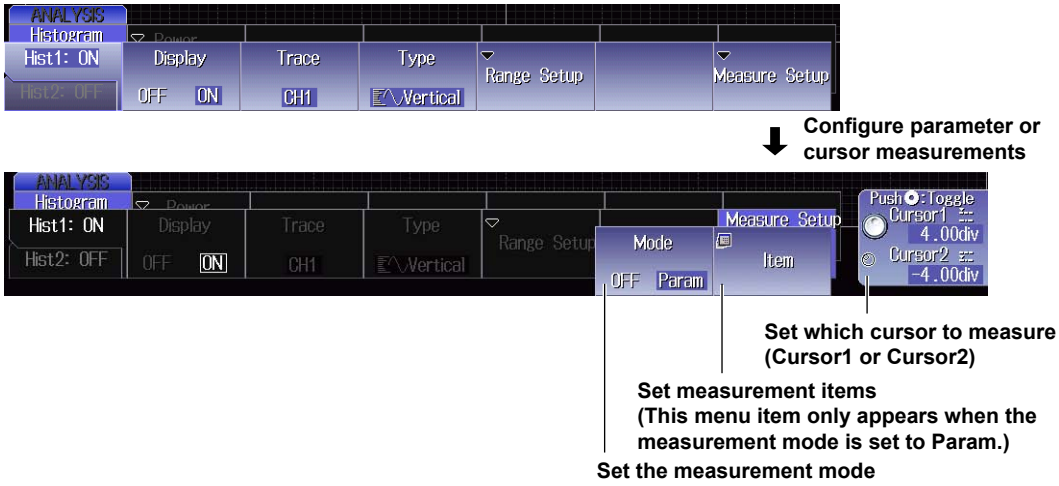
This section explains the following settings (which are used when measuring histogram parameters):

- Measurement mode
- Measurement items
- Cursor measurement

► “Measurement (Measure Setup)” in the Features Guide

ANALYSIS Histogram Menu

Press **ANALYSIS** and then the **Histogram** soft key to display the following menu.



Setting Measurement Items (Item)

Press the **Item** soft key to display the following screen.

14.1 Displaying History Waveforms

This section explains the following settings (which are used when displaying history waveforms, waveforms that were previously saved to acquisition memory):

- Display mode
- Averaging
- Highlighting of the selected record number
- Display range (start and end record numbers)
- List of timestamps
- Gradation mode

► “Displaying and Searching History Waveforms” in the Features Guide

HISTORY Menu

Press **History** (∿◷∿) to display the following menu.

Setting the Display Mode (Mode)

One: Only displays the waveform corresponding to the selected record number[1].

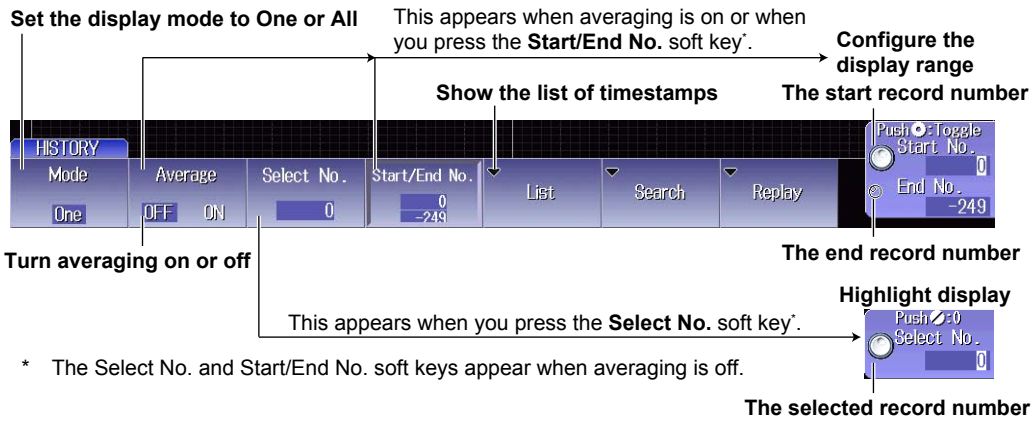
All: Overlays all selected waveforms[2]. All waveforms except the waveform corresponding to the selected record number[1] are displayed in an intermediate color.

Accumulate: Overlays all selected waveforms[2]. The frequency of data occurrence is represented by intensity (Intensity) or by color (Color).

1 Specify the highlighted waveform with Select No.

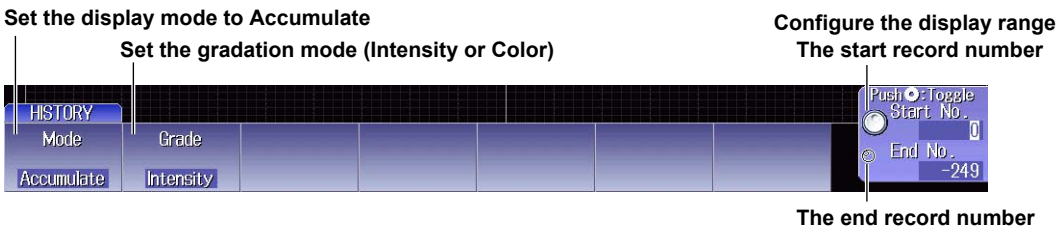
2 Specify with Start and End No.

When the Display Mode Is One or All



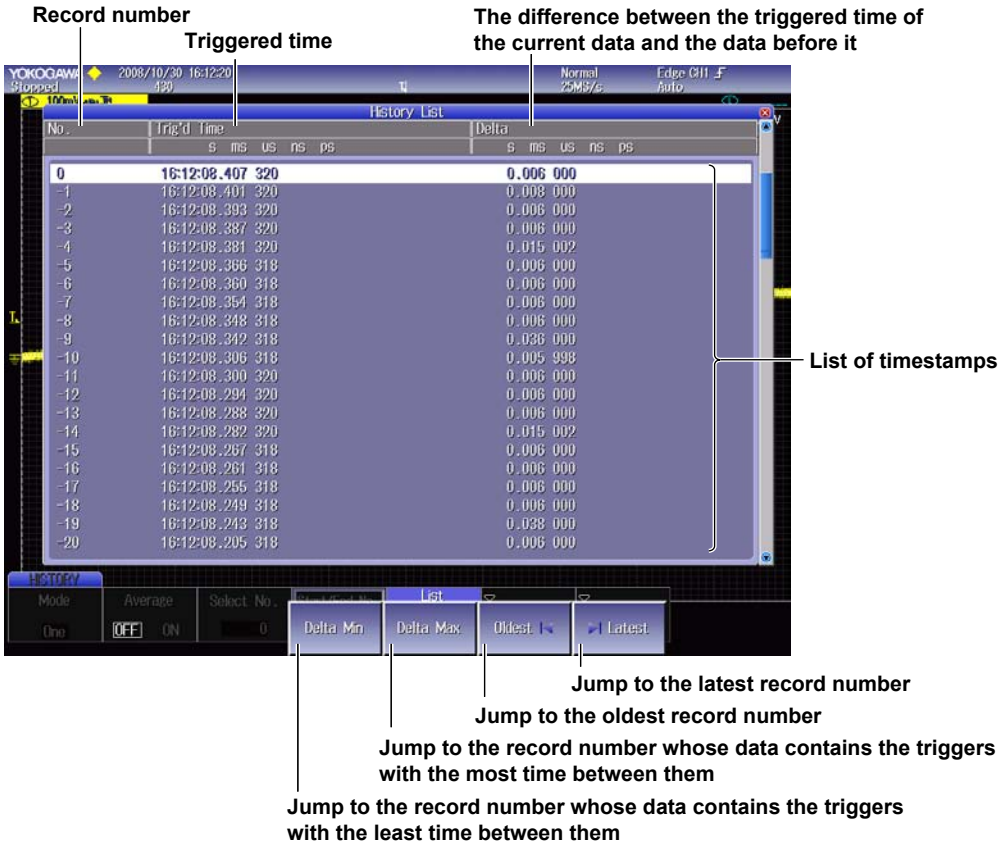
* The Select No. and Start/End No. soft keys appear when averaging is off.

When the Display Mode Is Accumulate



Displaying a List of Timestamps (List)

Press the **List** soft key to display the following screen.



Note

Notes about Configuring the History Feature

- When the acquisition mode is set to Average and the sampling mode is set to Repetitive, you cannot use the history feature.
- When the display is in roll-mode, you cannot use the history feature.
- If you stop waveform acquisition, the DLM2000 only displays waveforms that have been acquired completely.

Notes about Recalling Data Using the History Feature

- Waveform acquisition stops when you display the History menu. You cannot display history waveforms while waveform acquisition is in progress.
- You can start waveform acquisition when the History menu is displayed. However, you cannot change the history feature settings while waveform acquisition is in progress.
- The settings are restricted so that the following relationship is retained: Last record (End) ≤ Select No ≤ First record (Start).
- When you load waveform data from the specified storage medium, history waveforms up to that point are cleared. The loaded waveform data is placed in record number zero. If you load a file containing multiple waveforms, the latest waveform is placed in zero, and earlier waveforms are placed in order to record numbers –1, –2, and so on.
- Computation and automated measurement of waveform parameters are performed on the waveform of the record number specified by Select No. You can analyze old data as long as you do not overwrite the acquisition memory contents by restarting waveform acquisition. If Average is set to ON, analysis is performed on the averaged waveform.
- History waveforms are cleared when you turn the power off.

14.2 Searching History Waveforms

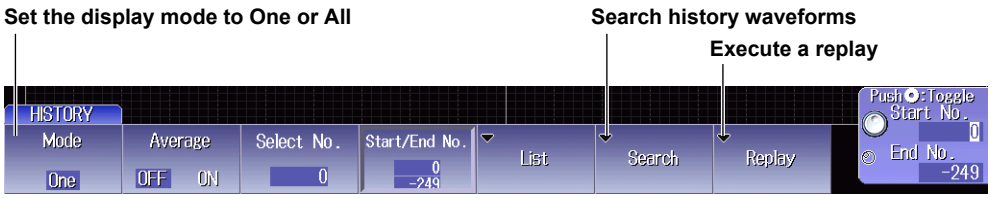
This section explains the following settings (which are used when searching history waveforms):

- Search condition
- Search Conditions (1 to 4)
  Search criterion, search waveform, search range mode, and search window
- Executing searches
- Finishing searches
- Replay

► “Searching History Waveforms (Search)” in the Features Guide

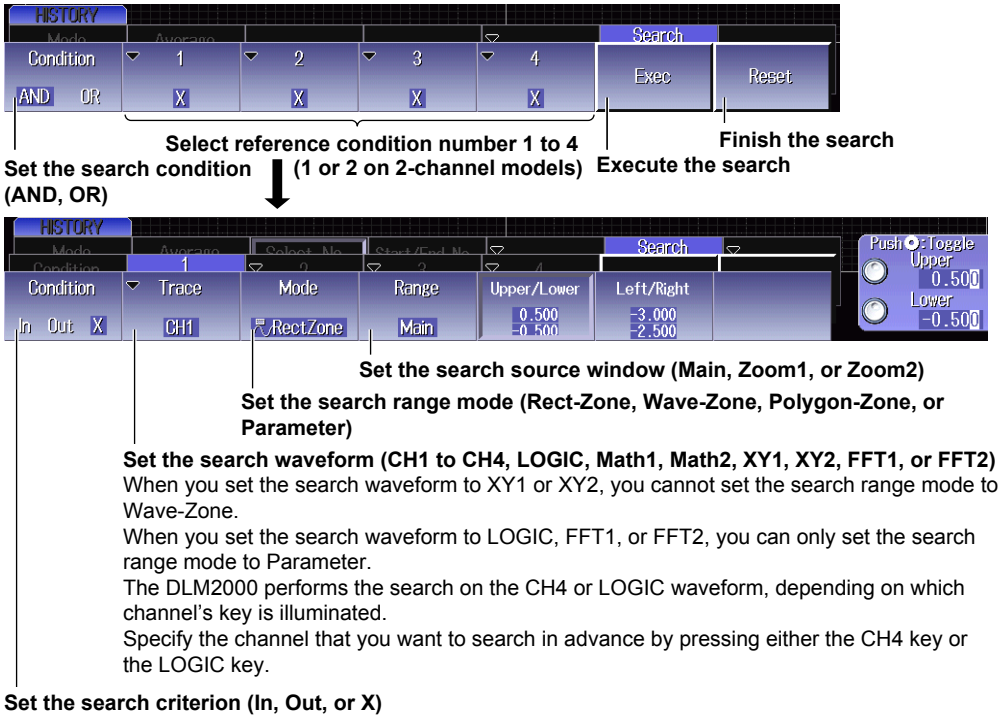
HISTORY Menu

Press **History** (∿◷∿) to display the following menu.



Searching History Waveforms (Search)

Press the **Search** soft key to display the following menu.

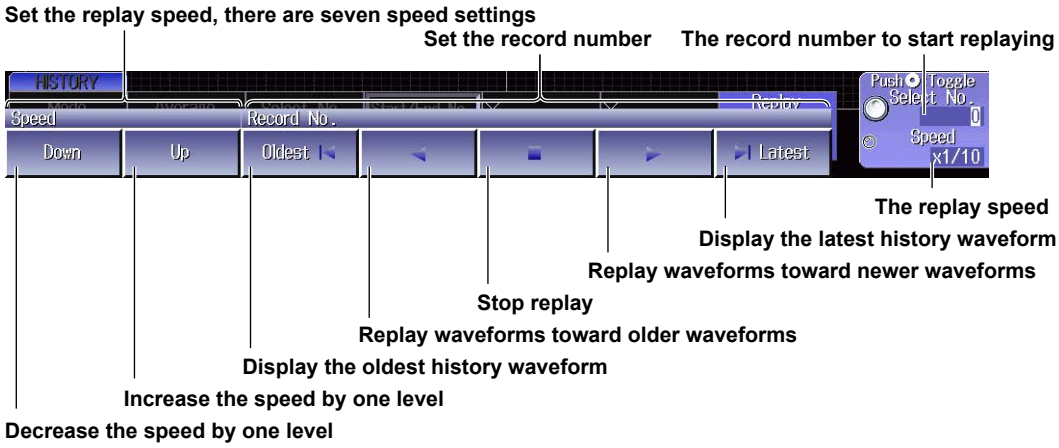


Setting the Search Range Mode (Mode)

You can set the search range mode in the same manner that you set the reference range type for GO/NO-GO determination. For more information, see section 2.18. Read all instances of “determination” as “search” in section 2.18.

Replay (Replay)

Press the **Replay** soft key to display the following menu.



Note

If you change the vertical sensitivity, vertical position, time axis setting, trigger position, or other relevant settings and then display the preview, you cannot search for or replay history waveforms.

15.1 Loading Roll Paper Into the Built-In Printer (Optional)

This section explains how to load roll paper into the optional built-in printer.

Roll Paper for Printers

Only use roll paper specifically made for use with the DLM2000 series. The DLM2000 comes with one set of roll paper included. Use this when you first load roll paper into the built-in printer. When you require a new supply of roll paper, please contact your nearest YOKOGAWA dealer.

Part Number: B9988AE
Specifications: Heat sensitive paper, 10 m
Minimum Quantity: 10 rolls

Handling Roll Paper

The roll paper is made of thermochemically colored heat sensitive paper. Please read the following points carefully.

Storage Precautions

When in use, the heat-sensitive paper changes color gradually at temperatures of approximately 70°C or higher. The paper can be affected by heat, humidity, or chemicals, whether something has been recorded on it or not. As such, please follow the guidelines listed below.

- Store the paper in a cool, dry, and dark place.
- Use the paper as quickly as possible after you break its protective seal.
- If you attach a plastic film that contains plasticizing material such as vinyl chloride film or cellophane tape to the paper for a long time, the recorded sections will fade due to the effect of the plasticizing material. Use a holder made of polypropylene to store the roll paper.
- When starching the record paper, do not use starches containing organic solvents such as alcohol or ether. Doing so will change the paper's color.
- We recommend that you make copies of the recordings if you intend to store them for a long period of time. Because of the nature of heat-sensitive paper, the recorded sections may fade.

Handling Precautions

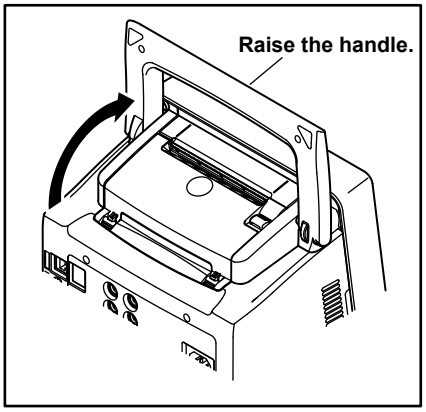
- Only use genuine, YOKOGAWA-supplied roll paper.
- If you touch the roll paper with sweaty hands, there is a chance that you will leave fingerprints on the paper, thereby blurring the recorded sections.
- If you rub the surface of the roll paper against something hard, there is a chance that the paper will change color due to frictional heat.
- If the roll paper comes into contact with products such as chemicals or oil, there is a chance that the paper will change color or that the recorded sections will disappear.

Attaching the Roll Paper

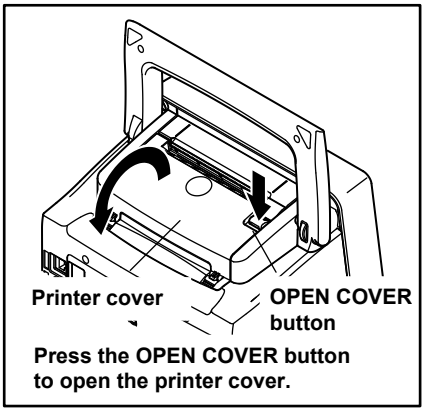
CAUTION

- Do not touch the print head. If you do, you may burn yourself.
- Do not touch the roll paper cutter section at the end of the printer cover. Doing so may cause injury.

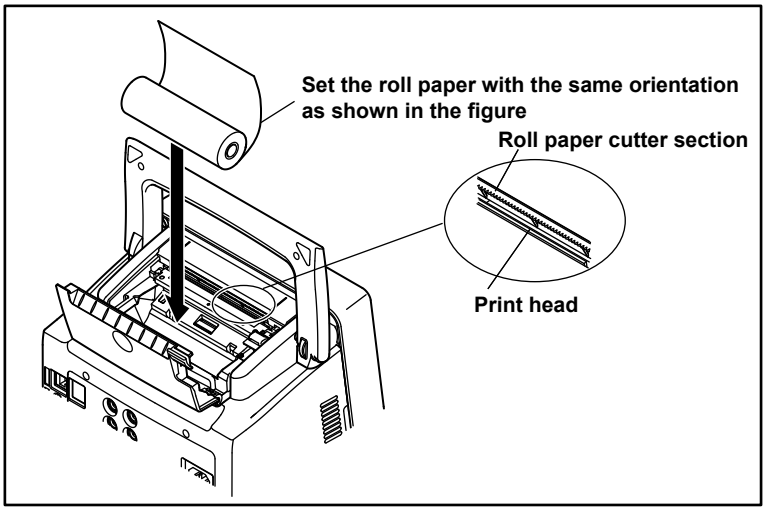
1.



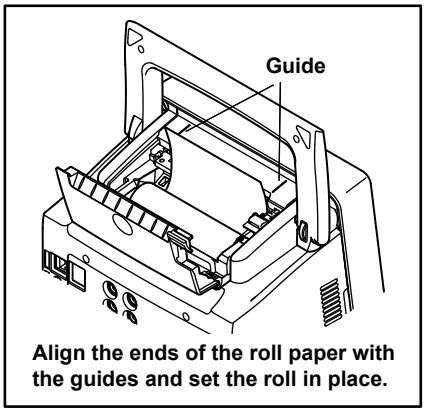
2.



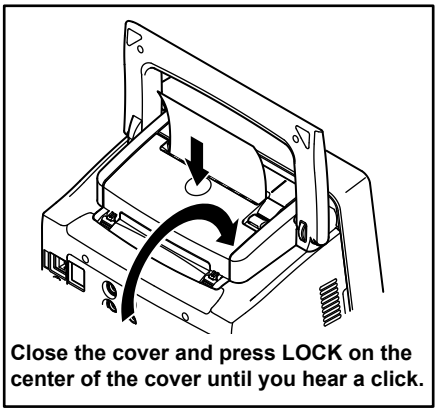
3.



4.



5.



15.2 Printing on the Built-in Printer (Optional)

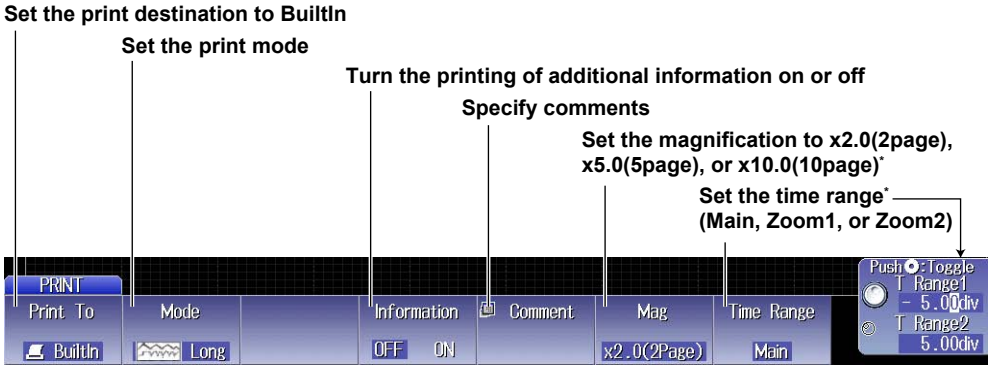
This section explains the following settings (which are used when printing on the optional built-in printer):

- Print destination
- Print mode
- Additional information
- Comments
- Magnification
- Time range

► “Printing on the Built-in Printer (Built-in)” in the Features Guide

PRINT BuiltIn Menu

Press **SHIFT+PRINT** (MENU), the **Print To** soft key, and then the **BuiltIn** soft key to display the following menu.



*** This is displayed when the print mode is set to Long.**

Setting the Print Mode (Mode)

Hardcopy: The entire DLM2000 screen is printed.

Normal: The waveform area of the DLM2000 screen is printed. The menu is not printed.

Long: As in Normal mode, the entire DLM2000 screen is printed, but the time axis is magnified from 2 to 10 times. The selectable magnification settings vary depending on the TIME/div and record length values.

15.3 Printing on a USB Printer

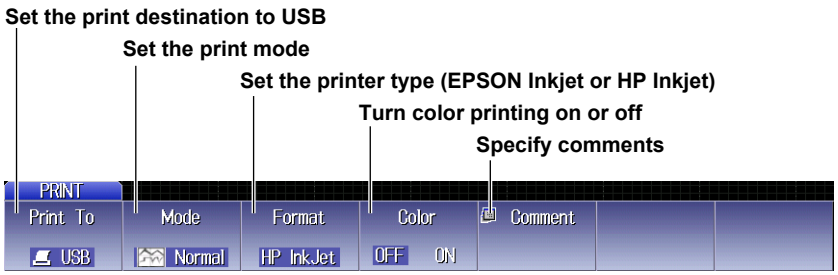
This section explains the following settings (which are used when printing on a USB printer):

- Print destination
- Print mode
- Printer type
- Color
- Comments

► “Printing on a USB Printer (USB)” in the Features Guide

PRINT USB Menu

Press **SHIFT+PRINT** (MENU), the **Print To** soft key, and then the **USB** soft key to display the following menu.



Setting the Print Mode (Mode)

Hardcopy: The entire DLM2000 screen is printed.

Normal: The waveform area of the DLM2000 screen is printed. The menu is not printed.

15.4 Printing on a Network Printer (Optional)

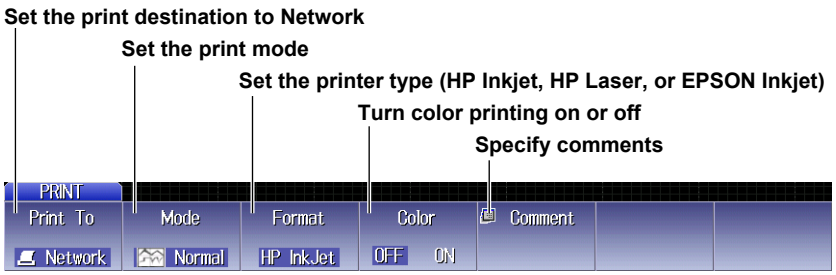
This section explains the following settings (which are used when printing on a network printer):

- Print destination
- Print mode
- Printer type
- Color
- Comments

► “Printing on a Network Printer (Network)” in the Features Guide

PRINT Network Menu

Press **SHIFT+PRINT** (MENU), the **Print To** soft key, and then the **Network** soft key to display the following menu.



Setting the Print Mode (Mode)

Hardcopy: The entire DLM2000 screen is printed.

Normal: The waveform area of the DLM2000 screen is printed. The menu is not printed.

Note

You must configure the network printer in advance by following the instructions in section 17.6.

15.5 Saving Screen Captures to Files

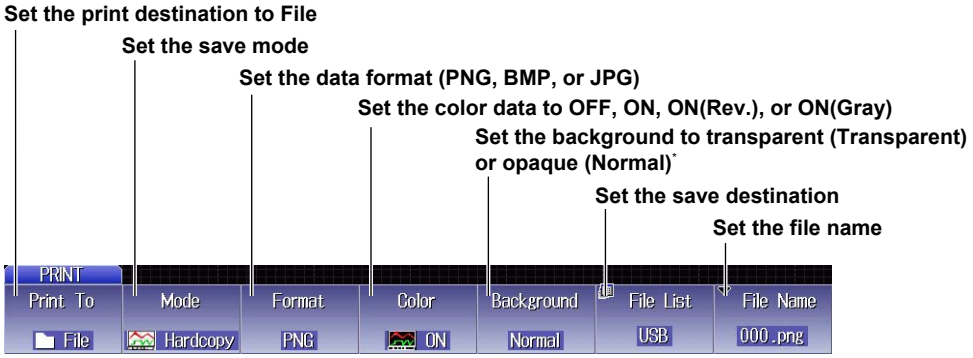
This section explains the following settings (which are used when saving screen captures to files):

- Print destination
- Save mode
- Data format
- Color data
- Background transparency (transparent or opaque)
- Save destination
- File name

► “Saving Screen Captures to Files (File)” in the Features Guide

PRINT File Menu

Press **SHIFT+PRINT** (MENU), the **Print To** soft key, and then the **File** soft key to display the following menu.



* **This appears when the data format is set to PNG.**

Setting the Save Mode (Mode)

Hardcopy: The entire DLM2000 screen is saved.
Normal: The waveform area of the DLM2000 screen is saved. The menu is not saved.
Wide: As in Normal mode, the entire DLM2000 screen is saved, but the time axis is magnified by a factor of two.

Setting the Save Destination (File List)

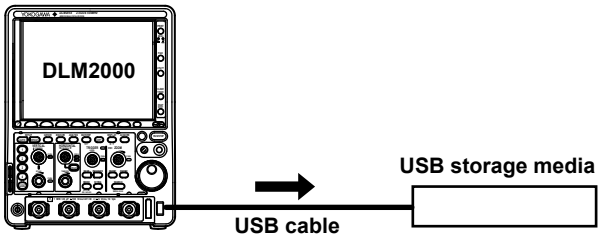
Specify the drive or folder to save files to in the same way as for the file feature.
For details, see section 16.2.

Assigning File Names (File Name)

As with the file feature, you can save files with automatically generated names using sequence numbers or dates, or save the files with specific file names.
For details, see section 16.2.

16.1 Connecting USB Storage Media to the USB Port

When connecting a USB storage medium to the DLM2000 USB port, connect the USB cable directly as shown in the figure below. You can connect/disconnect a USB cable at any time regardless of whether the DLM2000 is on or off (hot-plugging is supported). Connect the type A connector of the USB cable to the DLM2000, and connect the type B connector to the storage medium. If you connect a USB storage device when the power switch is on, the device becomes available for use after the DLM2000 identifies it.



Note

- Connect USB storage media directly, not through a USB hub.
- Only connect a compatible USB keyboard, mouse, printer, or storage device to the USB connector for peripherals.
- Do not connect and disconnect multiple USB devices repetitively. Provide a 10-second interval between removal and connection.
- Do not connect or remove USB cables from the time when the DLM2000 is turned on until key operation becomes available (approximately 20 to 30 seconds).
- You can use USB storage media that are compatible with USB Mass Storage Class Ver. 1.1.
- The DLM2000 can handle up to two storage media. If the connected medium is partitioned, the DLM2000 treats each partition as a separate storage medium. As such, the DLM2000 can handle up to two partitions.

Confirming What Connected USB Storage Media Can Be Used

Press **FILE**, and then press the **Utility** soft key to display the media that can be used.

16.2 Saving Waveform Data

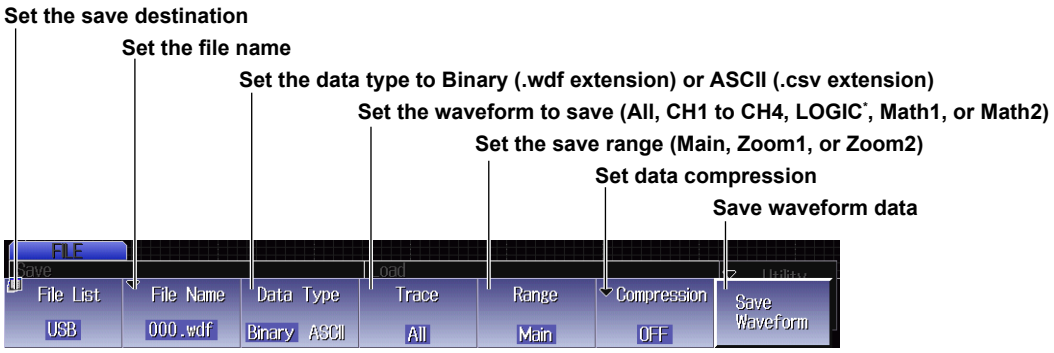
This section explains the following settings (which are used when saving waveform data):

- Save destination
- File name
- Data format
- Waveform to save
- Save range
- Data compression
- Saving waveform data

► “Saving Data (Save)” in the Features Guide

File Waveform (Save) Menu

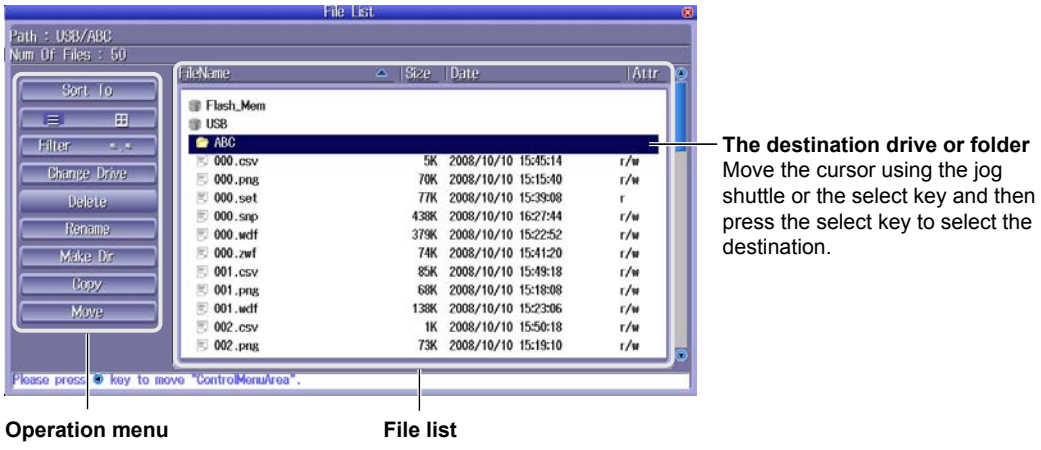
Press **File** and then the **Waveform(Save)** soft key to display the following menu.



* The DLM2000 saves data from the CH4 or LOGIC waveform, depending on which channel’s key is illuminated.
Specify the channel that you want to save in advance by pressing either the CH4 key or the LOGIC key.

Setting the Save Destination (File List)

Press the **File List** soft key to display the following screen.



For more information on file operations, see section 16.8.

Note

You can also set the save destination drive by using the Change Drive item on the operations menu.

Assigning File Names (File Name)

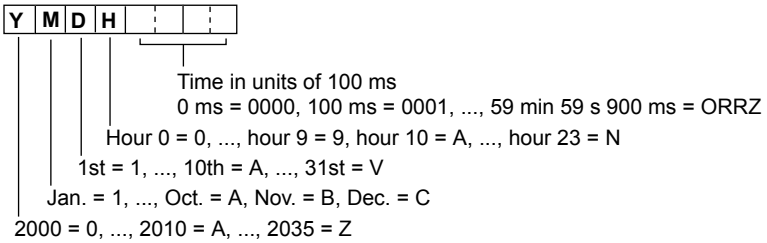
Press the **File Name** soft key to display the following menu.

Setting Auto Naming (Auto Naming)

OFF: Disables the auto naming feature. The name that you specify using the File Name setting is used. If there is a file with the same name in the save destination folder, you cannot save the data.

Numbering: The DLM2000 automatically adds a three-digit number between 000 to 999 after the common name specified using the File Name setting (up to five characters) when it saves files.

Date: The DLM2000 uses an 8-character file name that is produced based on the date and time using base-36 numbers (0 to 9 and A to Z). The file name specified using the File Name setting is not used.



Assigning File Names (File Name)

You can set the file name that is used when the auto naming feature is turned off or the common file name that is used when the auto naming feature is set to Numbering.

Setting Data Compression (Compression)

You can save waveform data by compressing or sampling it. If you want to save waveform data whose record length exceeds is 1.25 Mpoints to a file in ASCII format, the data must be compressed.

OFF: All of the data in the specified range is saved without compression or sampling.

P-P: The waveform data is P-P compressed so that the number of data points is equal to the specified number and then saved. You cannot load compressed data into the DLM2000.

Decim: The data is sampled (decimated) so that the number of data points is equal to the specified number and then saved. You cannot load sampled data into the DLM2000.

16.3 Saving Setup Data

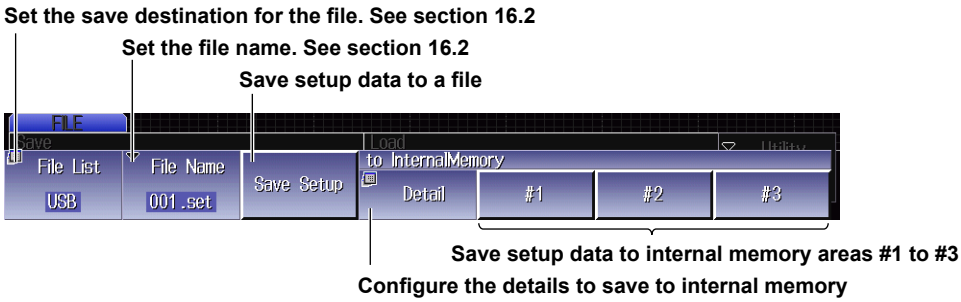
This section explains the following settings (which are used when saving setup data):
You can save setup data to a file or to three different internal memory locations.

- Save destination
- File name
- Internal memory details
- Saving setup data

► “Saving Data (Save)” in the Features Guide

File Setup (Save) Menu

Press **File** and then the **Setup(Save)** soft key to display the following menu.



Saving Setup Data (Save Setup)

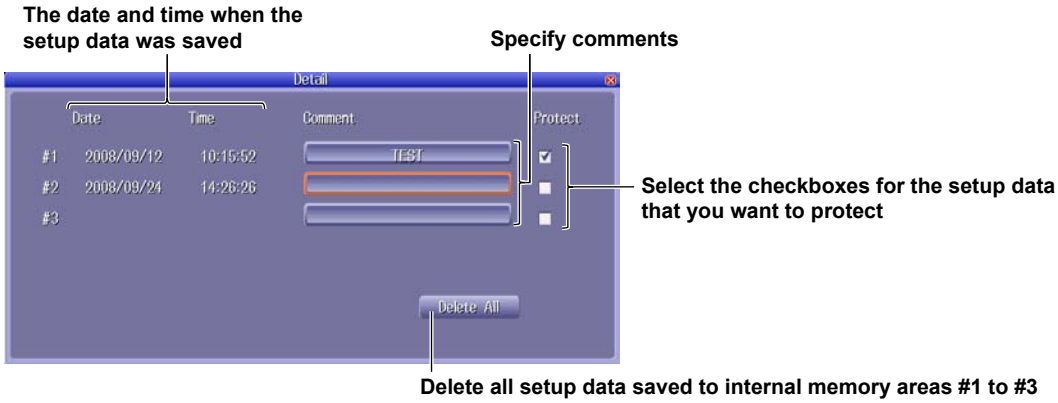
Save setup data to a file with a .set extension.

Saving Setup Data (to InternalMemory; from #1 to #3)

Save setup data to internal memory areas #1 to #3.

Setting Internal Memory Details (to InternalMemory; Detail)

Press the **Detail (to InternalMemory)** soft key to display the following screen.



16.4 Saving Other Types of Data

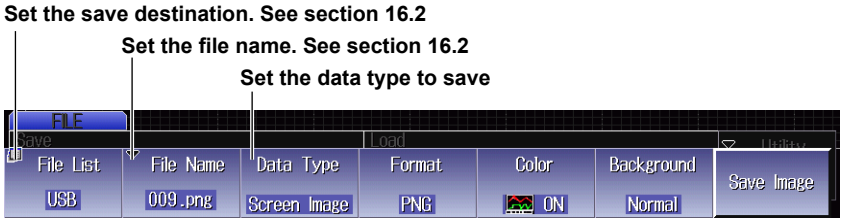
This section explains the following settings (which are used when saving screen image data, waveform zone data, snapshot waveform data, automated measurement values of waveform parameters, serial bus analysis results, FFT results, and histogram data):

- Save destination
- File name
- Data type to save
- Data format
- Color data
- Waveform zone number
- Serial bus
- FFT
- Histogram
- Saving data

► “Saving Data (Save)” in the Features Guide

File Others (Save) Menu

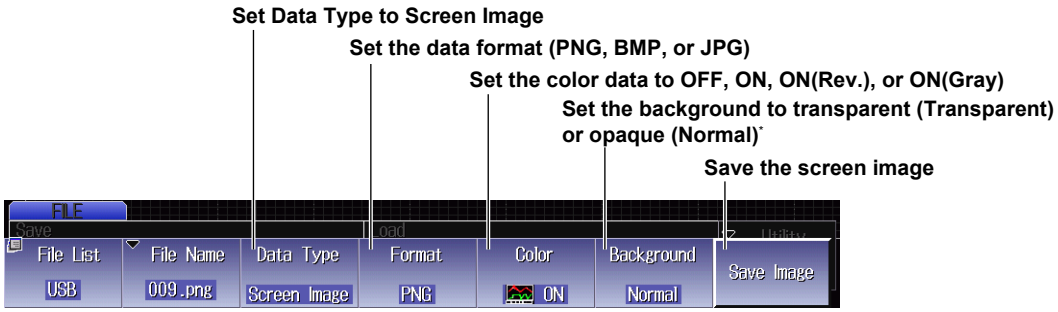
Press **File** and then the **Others(Save)** soft key to display the following menu.



Setting the Data Type to Save (Data Type)

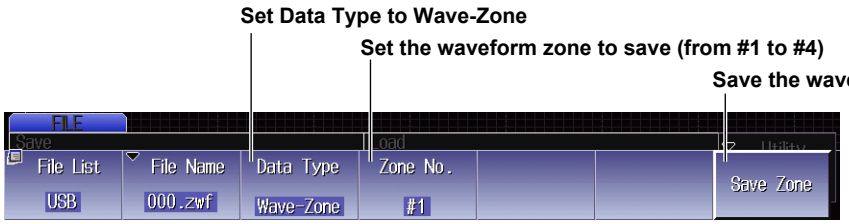
Screen Image:	Save the display to a PNG, BMP, or JPEG file.
Wave-Zone:	Save the waveform zone to a file with a .zwf extension.
Snap:	Save the waveform data captured in a snapshot to a file with a .snp extension.
Measure:	Save the results of automatic waveform parameter measurement to a file in CSV format.
Serial Bus:	Save the results of the serial bus analysis specified by S.Bus1 or S.Bus2 to a file in CSV format.
FFT:	Save the computed result specified by FFT1 or FFT2 to a file in CSV format. Up to 250 Kpoints of data can be saved.
Histogram:	Save the waveform or waveform parameter histogram specified by Hist1 or Hist2 to a file in CSV format.

When Data Type Is Screen Image



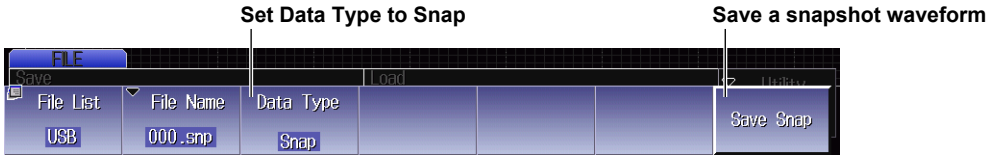
* **This appears when the data format is set to PNG.**

When Data Type Is Wave-Zone

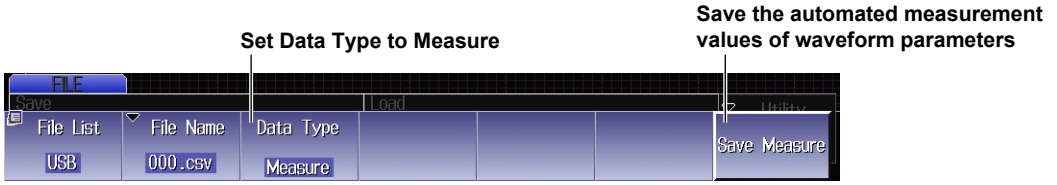


You can save waveform zones #1 to #4 to different files.

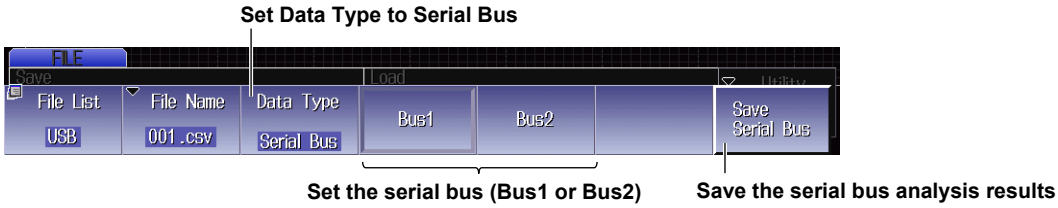
When Data Type Is Snap



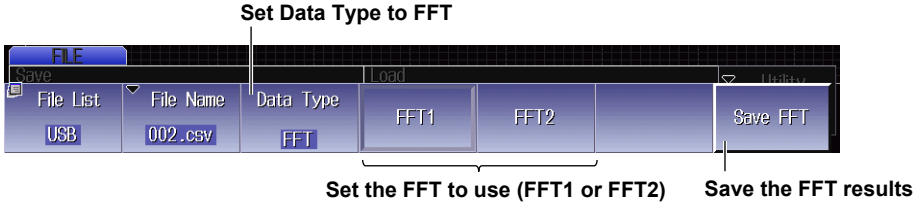
When Data Type Is Measure



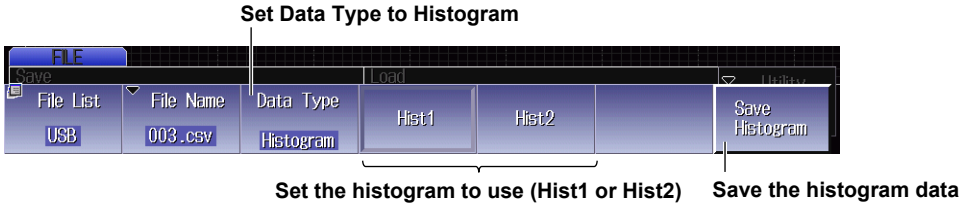
When Data Type Is Serial Bus



When Data Type Is FFT



When Data Type Is Histogram



16.5 Loading Waveform Data

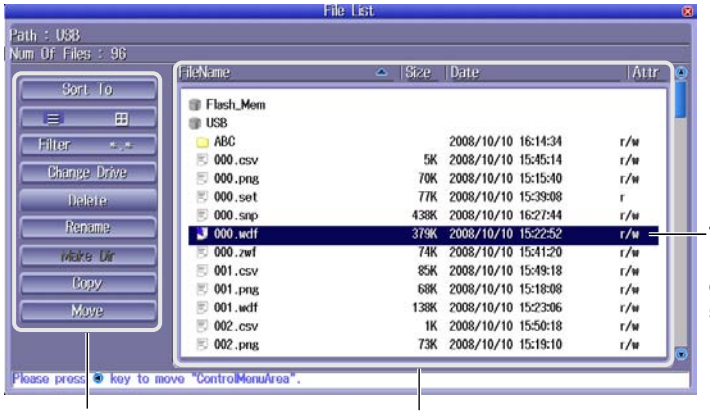
This section explains the following settings (which are used when loading waveform data):

- Displaying file information
- Loading waveform data into reference waveforms
- Loading waveform data into channels

► “Loading Data (Load)” in the Features Guide

File Waveform (Load) Menu

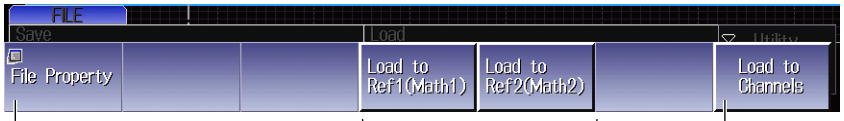
Press **File** and then the **Waveform(Load)** soft key to display the following menu.



The file to load
Move the cursor using the jog shuttle or the select key and then press the select key to select the file.

Operation menu

File list



Display file information

Load waveform data into reference waveforms Ref1(Math1) or Ref2(Math2)

Load waveform data into channels

Selecting Files

Select the file to load from the file list. ► See section 16.8.

Loading Waveform Data into Reference Waveforms (Load to Ref1(Math1), Load to Ref2(Math2))

You can specify waveform data files that have .wdf extensions and load them as reference waveforms. Reference waveforms are treated as part of the computation feature. They can be displayed by setting the Math1 or Math2 Mode to REF1 or REF2.

Loading Waveform Data into Channels (Load to Channels)

You can specify waveform data files that have .wdf extensions and load them with setup data. Loaded data is cleared when you start measurement.

Note

To load a file saved from the waveform data of multiple channels as a reference waveform, use Load to Channels to load the waveform into channels, and then load the waveform as a computation reference waveform. For details, see section 6.7.

16.6 Loading Setup Data

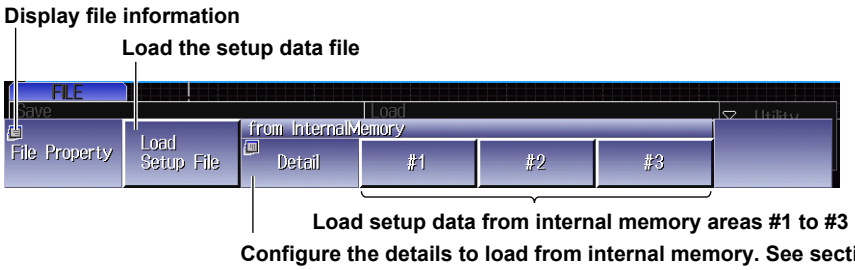
This section explains the following settings (which are used when loading setup data):
Both the method for loading setup data that has been saved to a file and the method for loading setup data that has been saved in the internal memory are explained.

- Displaying file information
- Internal memory details
- Loading setup data

► “Loading Data (Load)” in the Features Guide

File Setup (Load) Menu

Press **File** and then the **Setup(Load)** soft key to display the following menu.



Selecting Files

Select the file to load from the file list. ► See section 16.8.

Loading Setup Data (Load Setup File)

Select a setup data file that has a .set extension and load it.

Loading Setup Data (from InternalMemory; from #1 to #3)

Load setup data from internal memory areas #1 to #3.

16.7 Loading Other Types of Data

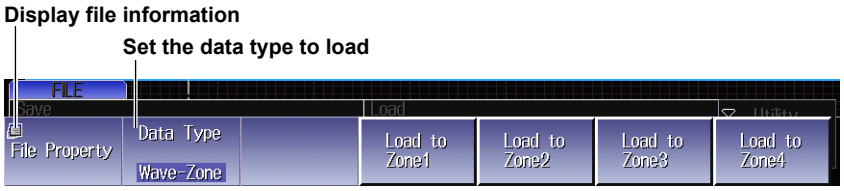
This section explains the following settings (which are used when loading waveform zones, polygonal zones, snapshot waveforms, or serial bus waveform symbol data):

- Displaying file information
- Data type to load
- Loading data

► “Loading Data (Load)” in the Features Guide

File Others (Load) Menu

Press **File** and then the **Others(Load)** soft key to display the following menu.



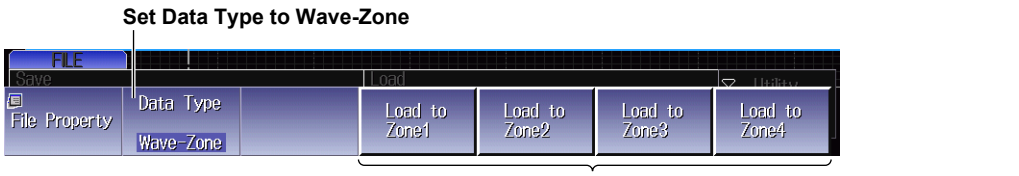
Selecting Files

Select the file to load from the file list. ► See section 16.8.

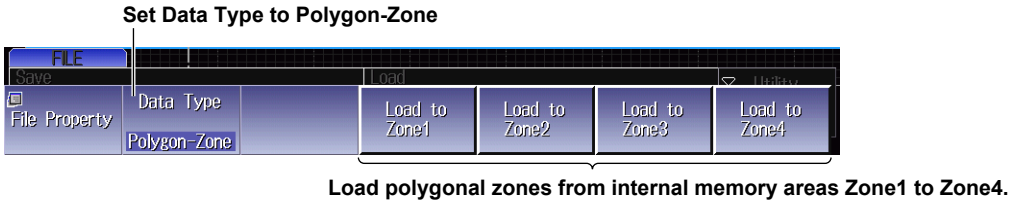
Setting the Data Type to Load (Data Type)

Wave-Zone:	Load waveform zone files that have .zwf extensions that you created on the DLM2000 into internal memory areas Zone1 to Zone4.
Polygon-Zone:	Load polygonal zone files that have .msk extensions that you created with the Mask Editor software into internal memory areas Zone1 to Zone4.
Snap:	Load snapshot waveform files that have .snp extensions that you have saved.
Symbol:	Load physical value/symbol definition files that have .sbl extensions that you have edited using the Symbol Editor tool.

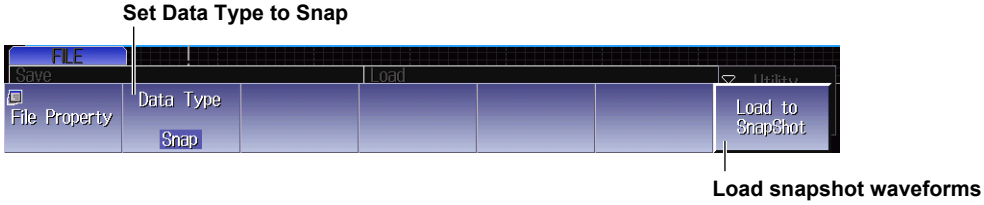
When Data Type Is Wave-Zone



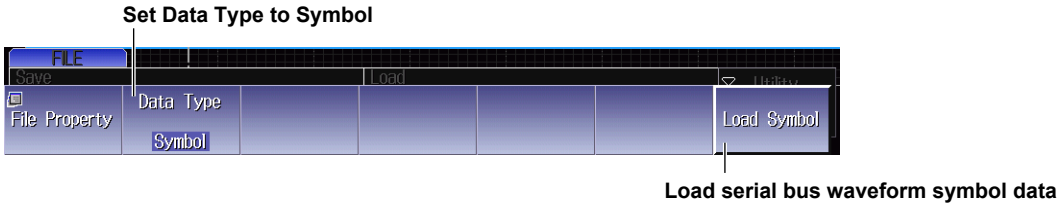
When Data Type Is Polygon-Zone



When Data Type Is Snap



When Data Type Is Symbol



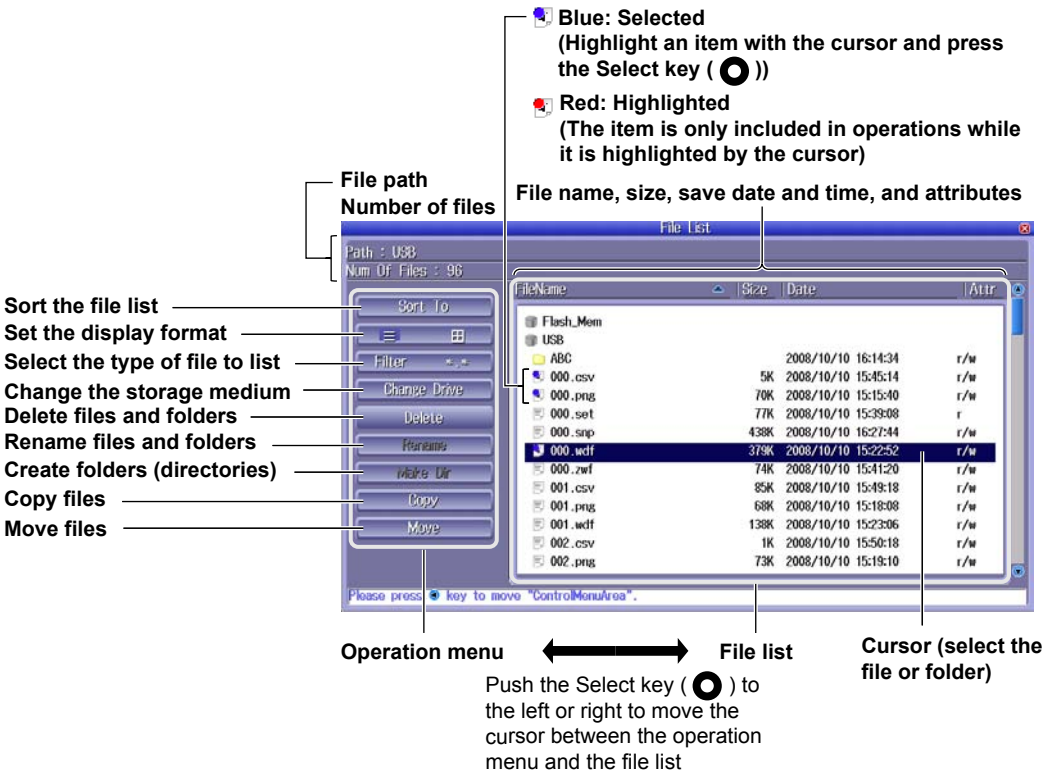
16.8 File Operations

This section explains the following settings (which are used when performing various file operations from the file list or the file utility menu):

- Sorting the file list
- Display format
- Selecting the type of file to list
- Changing storage media
- Deleting files and folders
- Changing file and folder names
- Creating folders (directories)
- Copying files
- Moving files
- Displaying file information
- File protection
- Selecting files (All Set/All Reset and Set/Reset)

► “File Operations (Utility)” in the Features Guide

The File List (File List)



Switching Between the Operation Menu and the File List

Push **Select** ( ) to the left or right.

Moving the Cursor

Rotate the **jog shuttle** or push **Select** ( ) up or down in either the operation menu or the file list.

Selecting Items

To select the item highlighted by the cursor, push **Select** ( ) straight in. When you select the item highlighted by the cursor, the following blue icon appears: .

Sorting the List (Sort To)

Select **Sort To** on the operation menu to display the following screen.

Sort by file name in ascending order

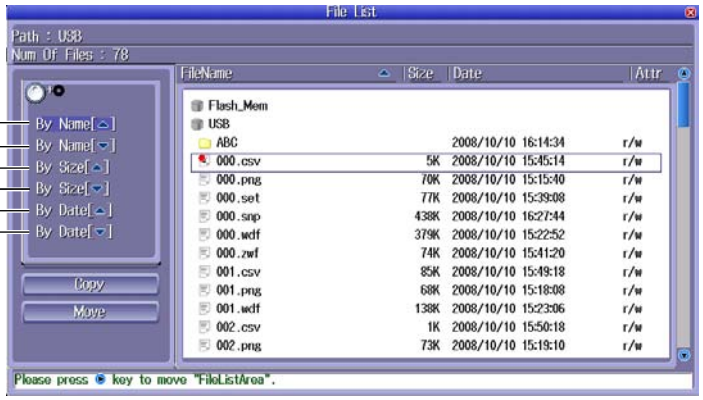
Sort by file name in descending order

Sort by file size in ascending order

Sort by file size in descending order

Sort by date in ascending order

Sort by date in descending order



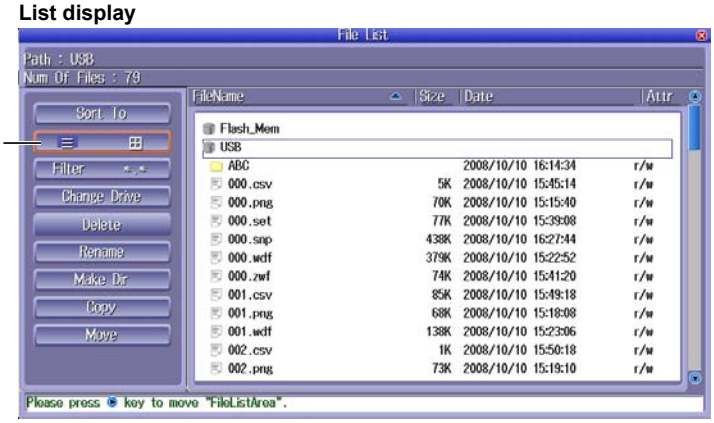
Display Format

Select a display format on the operation menu to display one of the following screens.

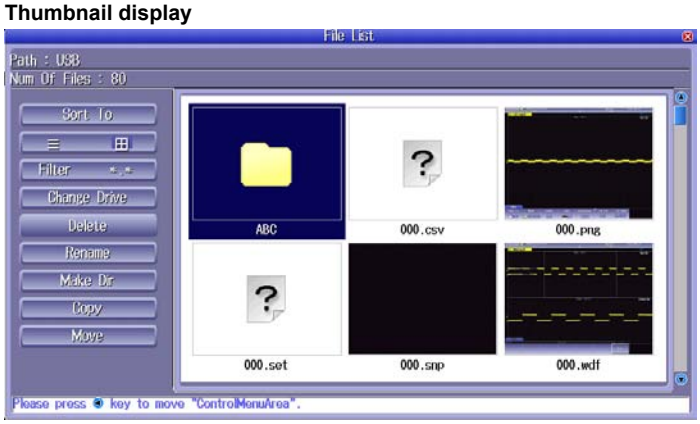
Press **Select** to switch between display formats.

Display format (list and thumbnail displays, in that order)

List display

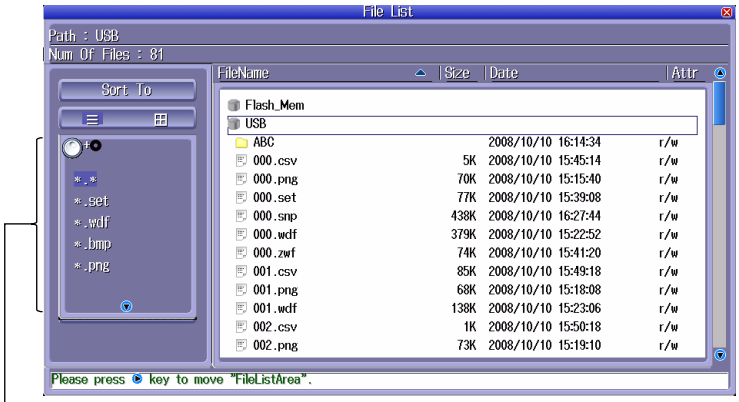


Thumbnail display



Selecting the Type of File to List (File Filter)

Select **Filter** on the operation menu to display the following screen.

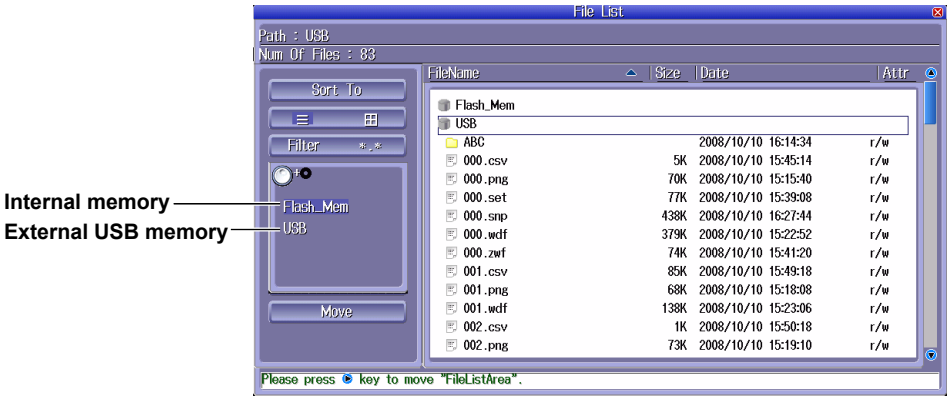


Select the type of file to list

***.*: All files**
***.set: Setup files**
***.wdf: Waveform files**
***.bmp: Image files (bmp)**
***.png: Image files (png)**
***.jpg: Image files (jpg)**
***.zwf: Waveform zone files**
***.msk: Polygonal zone files**
***.snp: Snapshot waveform files**
***.sbl: Symbol definition files**
***.csv: CSV files**

Changing the Storage Medium (Change Drive)

Select **Change Drive** on the operation menu to display the following screen.



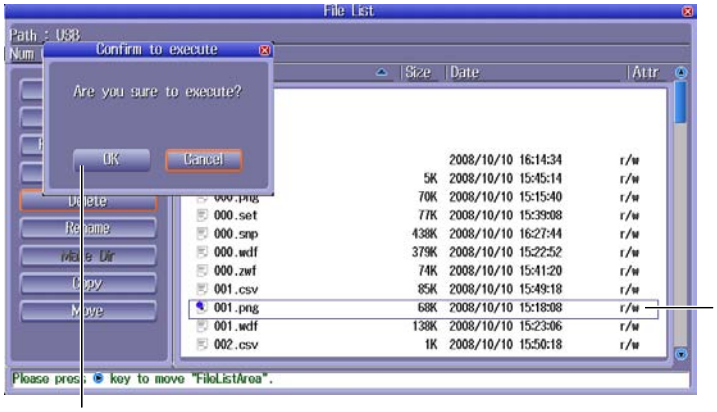
Note

You can also change the storage medium by highlighting the drive you want to change in the file list and pressing the Select key.

Deleting Files and Folders (Delete)

Select the file or folder that you want to delete from the file list.

Select **Delete** on the operation menu to display the following screen.



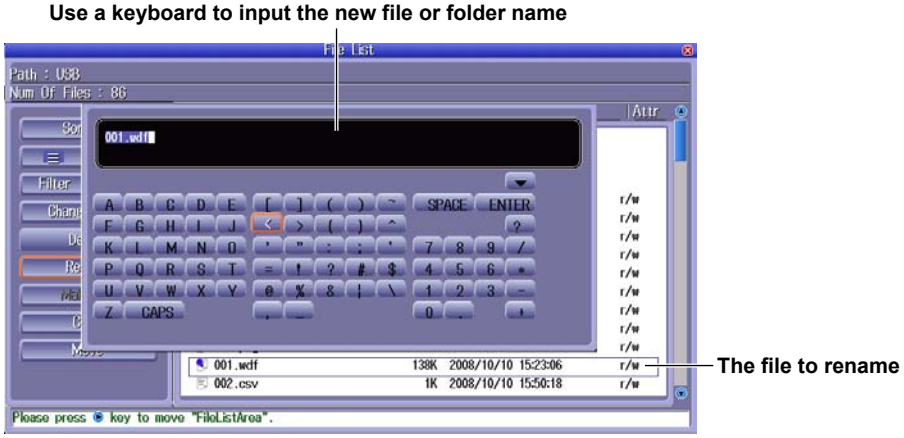
Note

You can delete multiple files at the same time by selecting them with the jog shuttle and the Select key.

Renaming Files and Folders (Rename)

Select the file or folder that you want to rename from the file list.

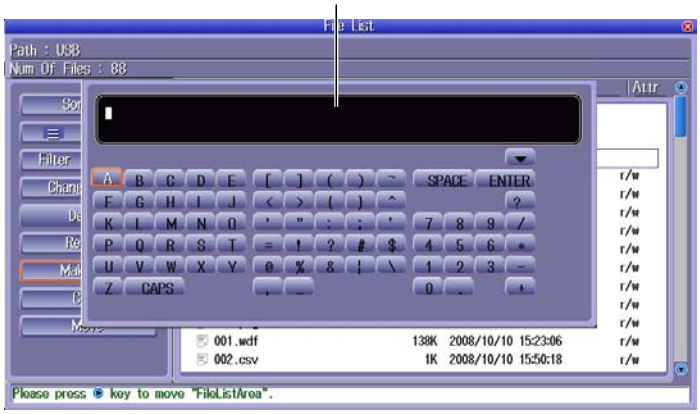
Select **Rename** on the operation menu to display the following screen.



Making Folders (Make Dir)

Select the drive or folder that you want to make the new folder in from the file list.
Select **Make Dir** on the operation menu to display the following screen.

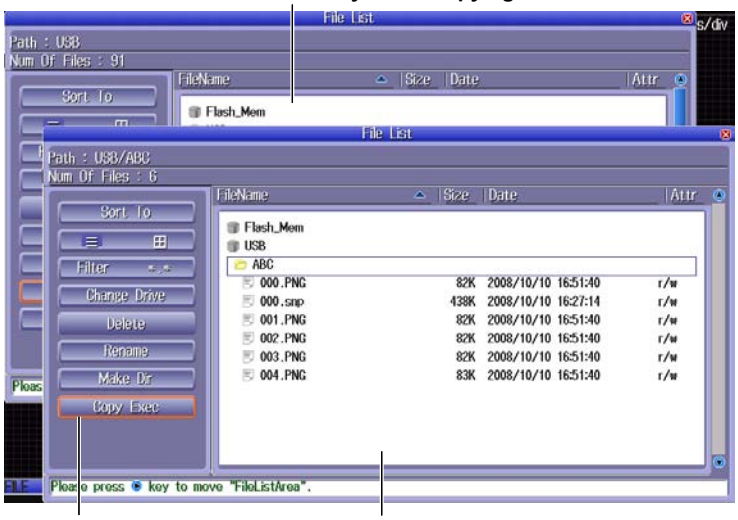
Use a keyboard to input the new folder name



Copying Files (Copy)

Select the file that you want to copy from the file list.
Select **Copy** on the operation menu to display the following screen.

File list you are copying from



Execute the copy operation **File list you are copying to**

Select the drive and folder on the file list that you are copying to.
Select **Copy Exec** on the operation menu to display the following screen.

Copy the file

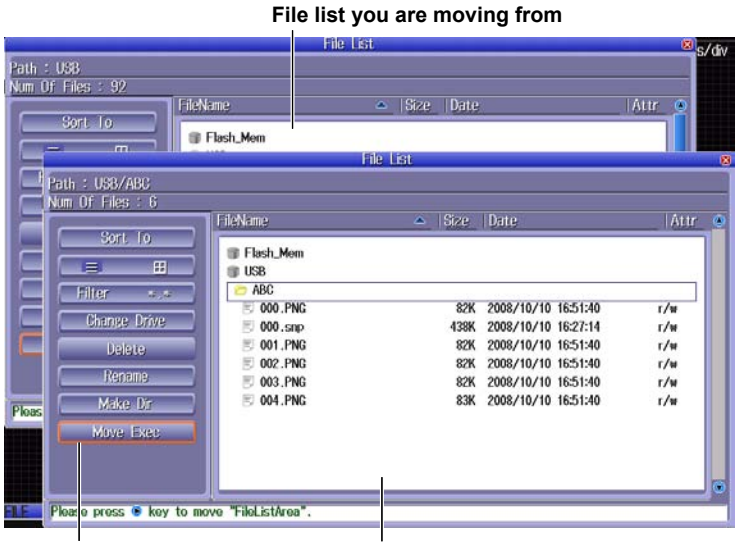
Note

- You can copy multiple files at the same time by selecting them with the jog shuttle and the Select key.
- You can perform file operations on the file list that you are copying to as well.

Moving Files (Move)

Select the file that you want to move from the file list.

Select **Move** on the operation menu to display the following screen.



Select the drive and folder on the file list that you are moving to.

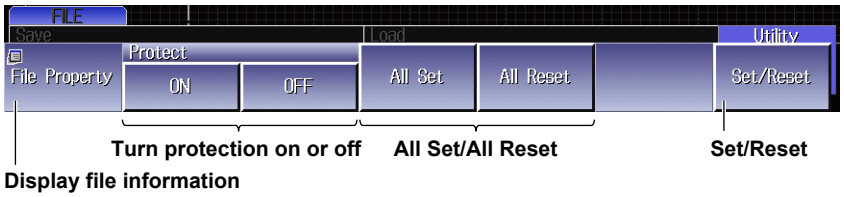
Select **Move Exec** on the operation menu to display the following screen.

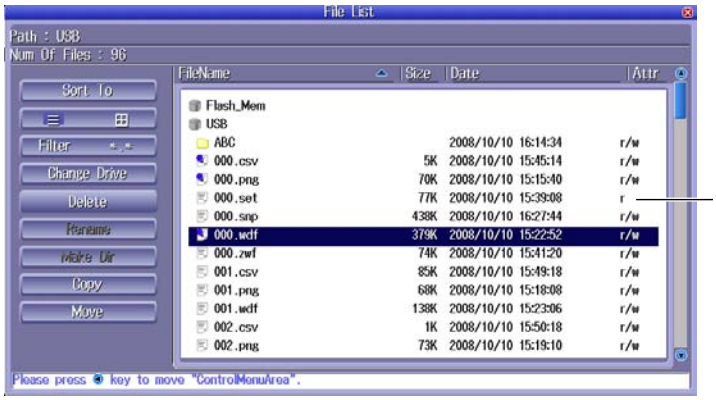
Note

- You can move multiple files at the same time by selecting them with the jog shuttle and the Select key.
- You can perform file operations on the file list that you are moving files to as well.

File Utility Menu

Press **File**, and then press the **Utility** soft key to display the following menu.





Turning Protection On or Off (Protect ON/OFF)

Turn protection on or off for the selected file. The change is reflected in the file attributes, displayed under the Attr column in the file list.

Protection	File Attribute	Description
ON	r	File protection is on for the selected file. The file has read-only access, it is write-protected and cannot be deleted.
OFF	r/w	File protection is off for the selected file. The file has read and write access.

All Set/All Reset

All Set: Select all files displayed. Selected file icons are displayed in blue.

All Reset: Deselect all files displayed.

Set/Reset

Set/Reset: Invert the selection status of the file highlighted by the cursor. This is the same function as when you press the Select key. Selected file icons are displayed in blue.

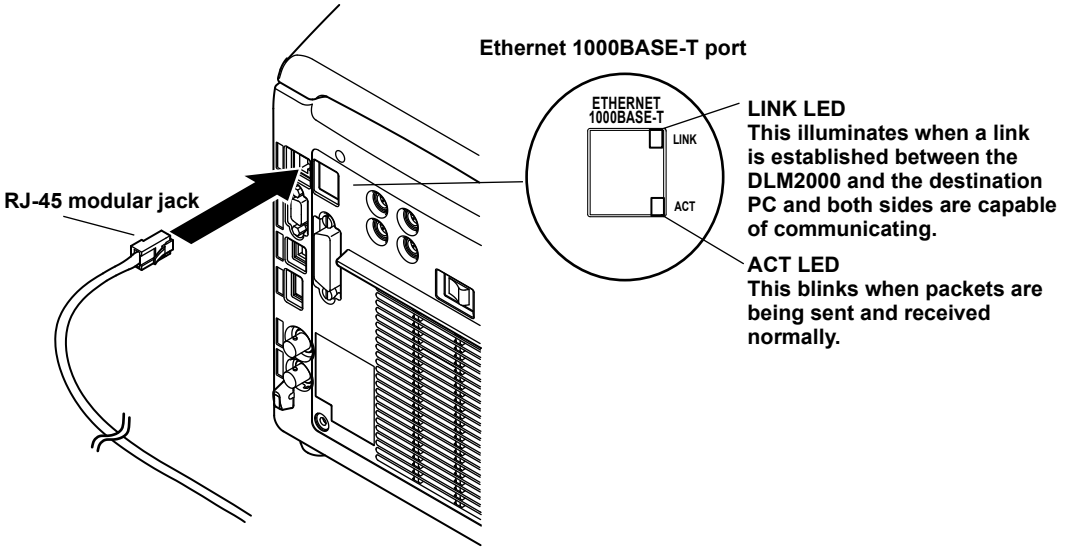
17.1 Connecting the DLM2000 to a Network

This section explains how to connect the DLM2000 to a network.

Optional Ethernet Interface Specifications

There is a 1000BASE-T port located on the rear panel of the DLM2000.

Item	Specifications
Ports	1
Electrical and mechanical specifications	IEEE802.3
Transmission system	Ethernet (1000BASE-T, 100BASE-TX, 10BASE-T)
Communication protocol	TCP/IP
Supported services	Server: FTP and VXI-11 Client: SMTP, SNTP, LPR, DHCP, and DNS
Connector type	RJ-45



Items Required to Connect the DLM2000 to a Network

Cable

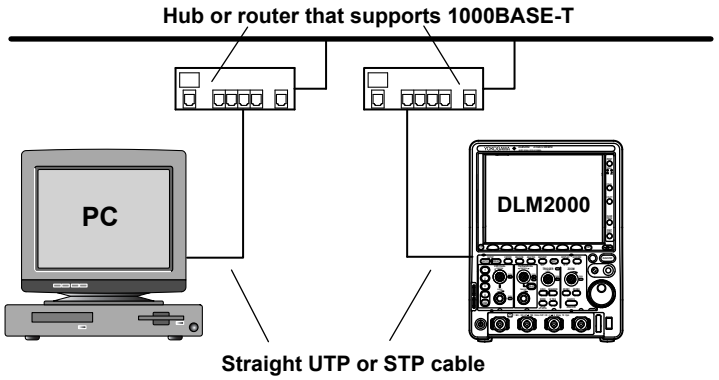
Use one of the following types of network cable that conforms to the transfer speed of your network.

- A UTP (Unshielded Twisted-Pair) cable
- An STP (Shielded Twisted-Pair) cable

Connection Procedure

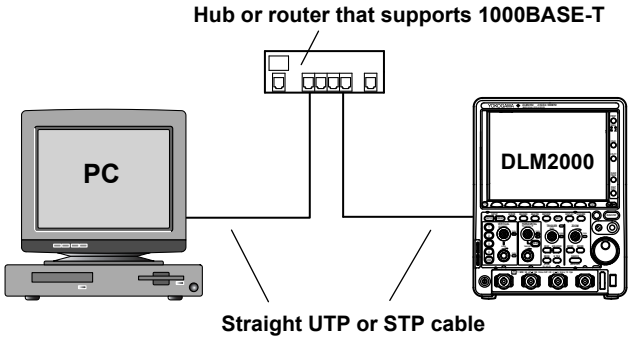
To Connect to a PC over a Network

1. Turn off the DLM2000.
2. Connect one end of a UTP (or STP) cable to the ETHERNET 1000BASE-T port on the rear panel.
3. Connect the other end of the UTP (or STP) cable to a hub or router.
4. Turn on the DLM2000.



To Connect to a PC through a Hub or Router

1. Turn off the DLM2000.
2. Connect one end of a UTP (or STP) cable to the ETHERNET 1000BASE-T port on the rear panel.
3. Connect the other end of the UTP (or STP) cable to a hub or router.
4. Connect the PC to the hub or router in the same way.
5. Turn on the DLM2000.



Note

- Use a hub or router that conforms to the transfer speed of your network.
- When you connect a PC to the DLM2000 through a hub or router, the PC must be equipped with an auto switching 1000BASE-T/100BASE-TX/10BASE-T network card.
- Do not connect the DLM2000 to a PC directly. Direct communication without a hub or router is not guaranteed to work.

17.2 Configuring TCP/IP Settings

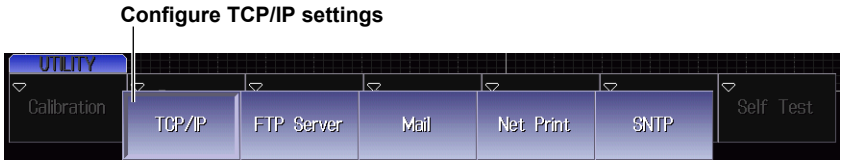
This section explains the following TCP/IP settings (which are used when connecting to a network):

- DHCP (IP address, subnet mask, and default gateway)
- DNS (domain name, DNS server IP address, and domain suffix)

► "TCP/IP (TCP/IP)" in the Features Guide

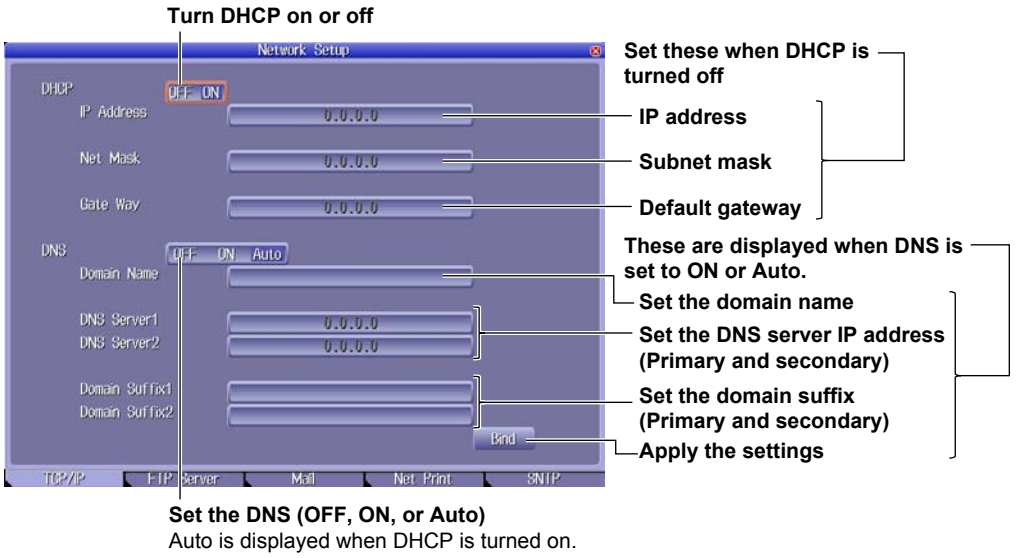
UTILITY Network Menu

Press **UTILITY** and then press the **Network** soft key to display the following menu.



TCP/IP Settings (TCP/IP)

Press the **TCP/IP** soft key to display the following screen.



DNS Settings (DNS)

OFF: Disable the DNS.

ON: Enable the DNS. Set the domain name, the DNS server IP address, and the domain suffix.

Auto: Enable the DNS. After you set the domain suffix, the domain name and the DNS server IP address are set automatically. This option can only be selected when DHCP is on.

17.3 Accessing the DLM2000 from a PC (FTP Server)

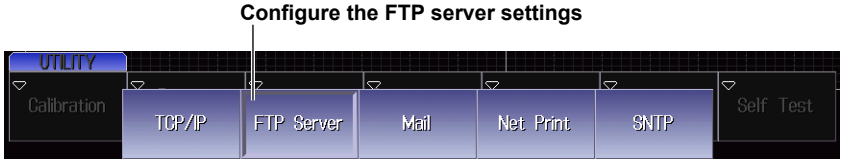
This section explains the following settings (which are used when accessing the DLM2000 from a PC on a network):

- User name
- Password
- Timeout

► “FTP Server (FTP Server)” in the Features Guide

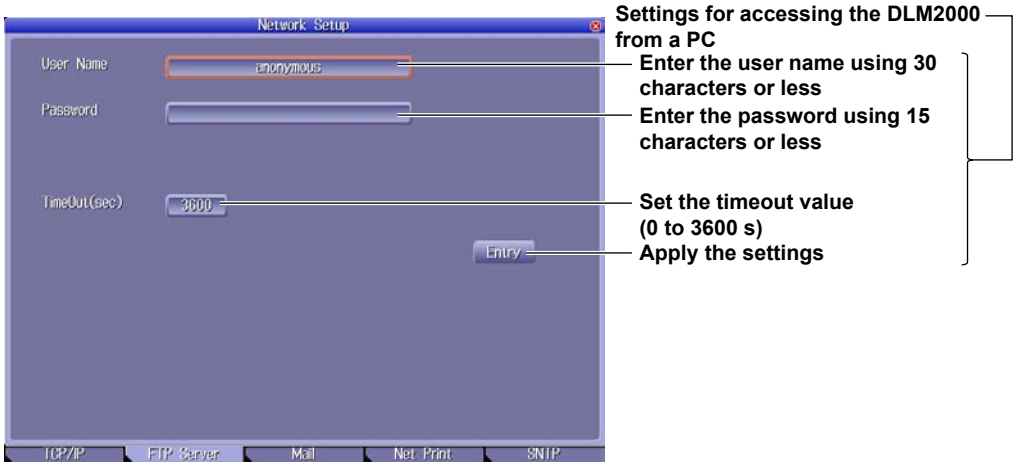
UTILITY Network Menu

Press **UTILITY** and then press the **Network** soft key to display the following menu.



FTP Server Settings (FTP Server)

Press the **FTP Server** soft key to display the following screen.



17.4 Configuring Mail Transmission (SMTP client function)

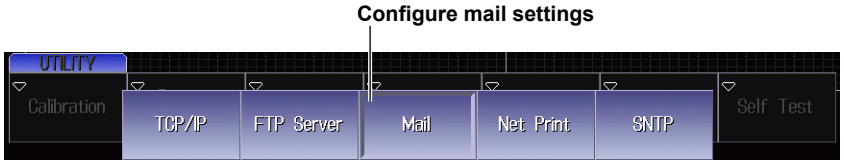
This section explains the following settings (which are used when transmitting mail to a specified mail address on a network):

- Mail server
- Mail address
- Comments
- Attaching image files
- Timeout
- Sending a test mail

► “Mail (Mail)” in the Features Guide

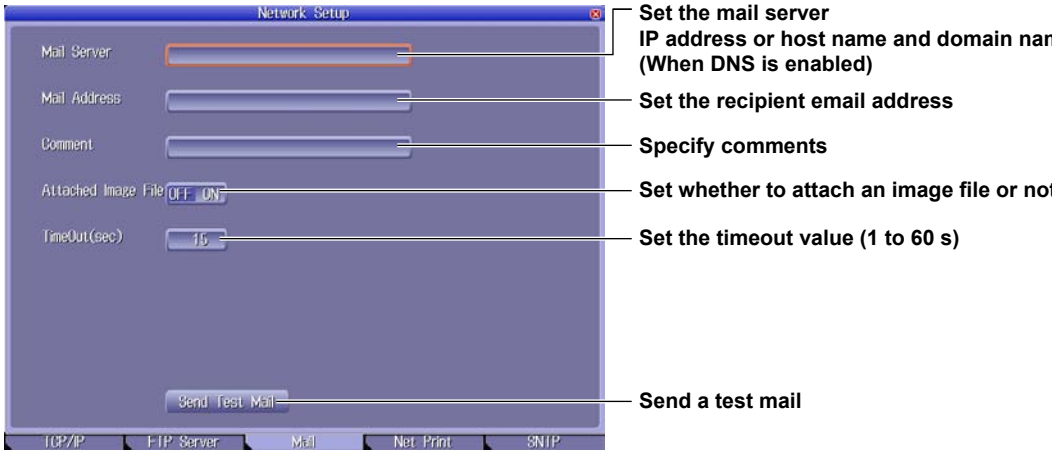
UTILITY Network Menu

Press **UTILITY** and then press the **Network** soft key to display the following menu.



Mail Settings (Mail)

Press the **Mail** soft key to display the following screen.



17.5 Using SNTP to Set the Date and Time

This section explains how to use SNTP to set the date and time of the DLM2000.

- SNTP server
- Timeout
- Executing time adjustment
- Automatic adjustment

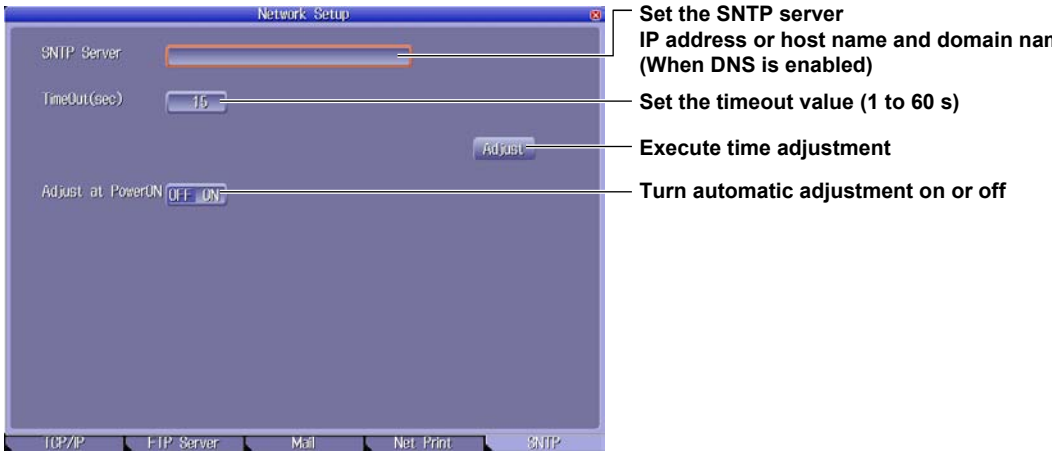
► “SNTP (SNTP)” in the Features Guide

UTILITY Network Menu

Press **UTILITY** and then press the **Network** soft key to display the following menu.

SNTP Settings (SNTP)

Press the **SNTP** soft key to display the following screen.



17.6 Setting a Network Printer

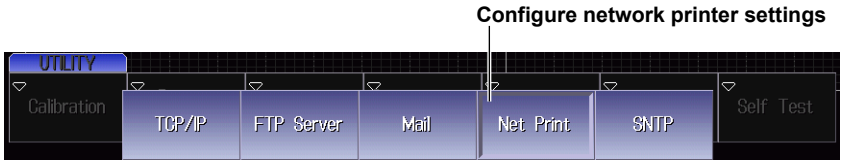
This section explains the following settings (which are used when printing screen images to a network printer):

- LPR server
- LPR name
- Timeout

► “Network Printer (Net Print)” in the Features Guide

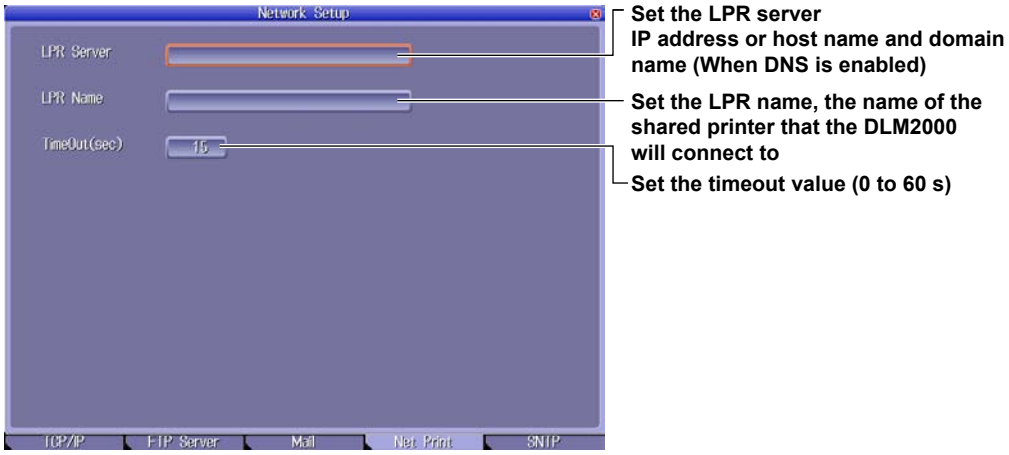
UTILITY Network Menu

Press **UTILITY** and then press the **Network** soft key to display the following menu.



Network Printer Settings (Net Print)

Press the **Net Print** soft key to display the following screen.



18.1 External Trigger Input (TRIG IN/EXT)

CAUTION

Only apply signals that meet the following specifications. Signals that do not meet the specifications may damage the DLM2000, because of factors such as excessive voltage.

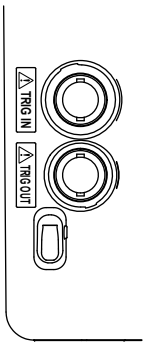
External Trigger Input Terminal

This terminal is used when an external signal is used as the trigger source.
The external trigger input terminal is the terminal labeled TRIG IN on the rear panel of the DLM2024, DLM2034, and DLM2054. It is the terminal labeled EXT on the front panel of the DLM2022, DLM2032, and DLM2052.

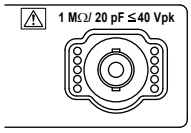
Item	Specifications
Connector type	BNC
Maximum input voltage	±40 V (DC + ACpeak) or 28 Vrms when the frequency is 10 kHz or less
Input frequency bandwidth	DC to 100 MHz
Input impedance	Approx. 1 MΩ, approx. 20 pF
Input range	±2 V (DLM2024, DLM2034, and DLM2054) ±1 V (for the ±1 V range on the DLM2022, DLM2032, and DLM2052) ±10 V (for the ±10 V range on the DLM2022, DLM2032, and DLM2052)
Trigger sensitivity	0.1 Vp-p (DLM2024, DLM2034, and DLM2054) 0.1 Vp-p (for the ±1 V range on the DLM2022, DLM2032, and DLM2052) 1 Vp-p (for the ±10 V range on the DLM2022, DLM2032, and DLM2052)
Trigger level	±2 V. The resolution is 5 mV (on the DLM2024, DLM2034, and DLM2054). ±1 V The resolution is 5 mV (for the ±1 V range on the DLM2022, DLM2032, and DLM2052). ±10 V The resolution is 50 mV (for the ±10 V range on the DLM2022, DLM2032, and DLM2052).

Input Terminal

DLM2024, DLM2034, and DLM2054 (On the rear panel)



DLM2022, DLM2032, and DLM2052 (On the front panel)



18.2 Trigger Output (TRIG OUT)

CAUTION

Do not short the TRIG OUT terminal or apply external voltage to it. Doing so may damage the DLM2000.

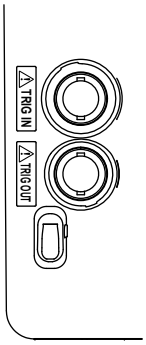
Trigger Output Terminal

A 3.3 V CMOS level signal is output when the DLM2000 triggers. The signal level is normally high but goes low when the DLM2000 triggers.

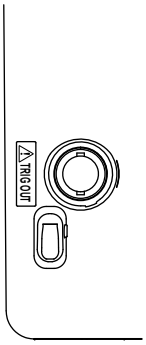
Item	Specifications
Connector type	BNC
Output level	3.3 V CMOS
Output impedance	Approx. 50 Ω
Output logic	Negative logic (⊓) and positive logic (⊔) switchable
Output delay	50 ns or less
Output hold time	For negative logic, the low level is 800 ns min. and the high level is 50 ns min. For positive logic, the high level is 800 ns min. and the low level is 50 ns min.

Output Terminal

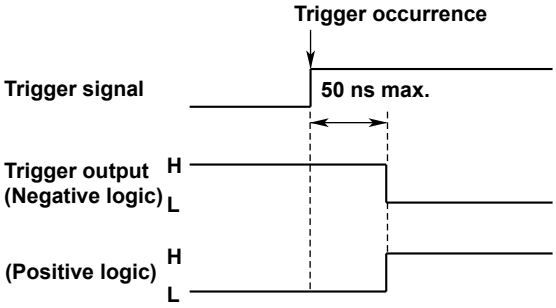
DLM2024, DLM2034, and DLM2054



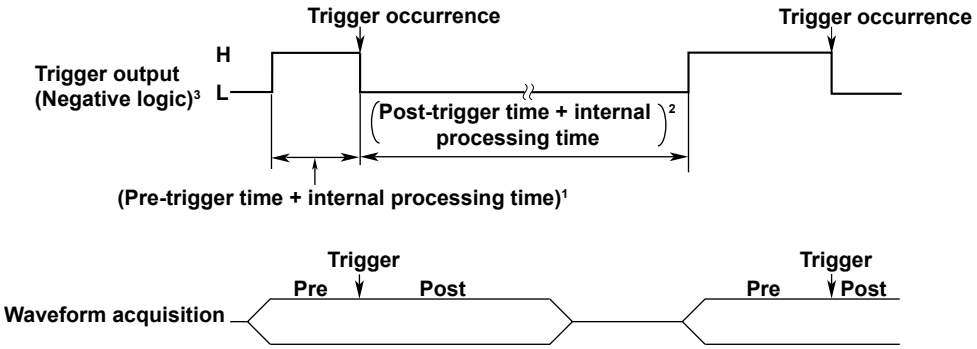
DLM2022, DLM2032, and DLM2052



Output Timing



Low Level and High Level Hold Times



1 HIGH (high level)[3] period: The sum of pre-trigger time and internal processing time. The minimum period is 50 ns.

2 LOW (low level)[3] period: The sum of post-trigger time and internal processing time. The minimum period is 800 ns.

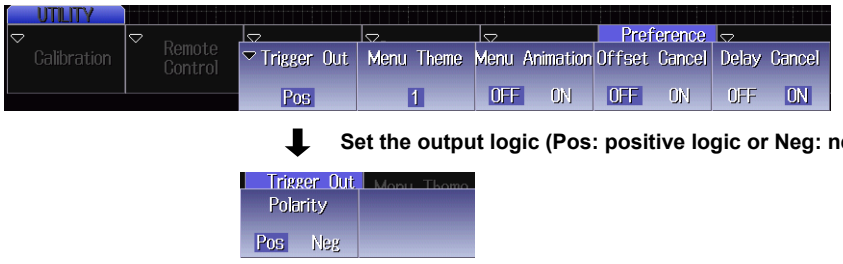
3 When you select positive logic, the definitions of high and low given here are reversed.

Setting the Output Logic

You can set the output logic for the signal transmitted from the trigger output terminal.

UTILITY Preference Menu

Press **UTILITY** and then press the **Preference** soft key to display the following menu.



Set the output logic (Pos: positive logic or Neg: negative logic)

18.3 Video Signal Output (VIDEO OUT)

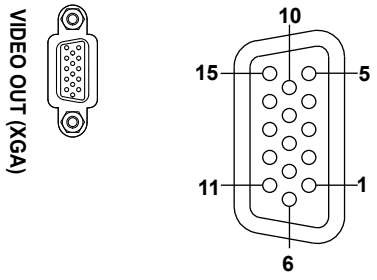
CAUTION

- Only connect the DLM2000 to a monitor after turning both the DLM2000 and the monitor off.
- Do not short the VIDEO OUT terminal or apply external voltage to it. Doing so may damage the DLM2000.

Video Signal Output Terminal

You can use video signal output to display the DLM2000 screen on a monitor. Any multisync monitor that supports XGA can be connected.

Pin No.	Signal Name	Specifications
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 sync signal	Approx. 47.9 kHz, TTL negative logic (⊓⊔)
14	Vertical sync signal	Approximately 60 Hz, TTL negative logic (⊓⊔)
15	–	



D-Sub 15-pin receptacle

Connecting to a Monitor

1. Turn off the DLM2000 and the monitor.
2. Connect the DLM2000 and the monitor using an RGB cable.
3. Turn on the DLM2000 and the monitor.

Note

- An RGB video signal is always running through the VIDEO OUT terminal.
- The monitor display may flicker if you place the DLM2000 or some other device close to it.
- Depending on the type of monitor, parts of the DLM2000 display may be cut off.

18.4 GO/NO-GO Signal Output

Output signal

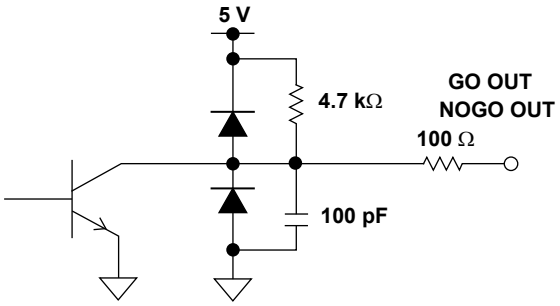
NO-GO OUT Signal

When the determination result is NO-GO, the output signal level (the TTL level) temporarily changes from high level (H) to low level (L).

GO OUT Signal

When the determination result is GO, the output signal level (the TTL level) temporarily changes from high level (H) to low level (L).

Signal Output Circuit Diagram



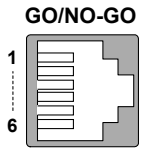
Output Connector

The format of the signal output connector and the pin arrangement are explained below.

Format

The connector uses an RJ-12 modular jack. Use a cable designed for GO/NO-GO determination, such as optional accessory 366973.

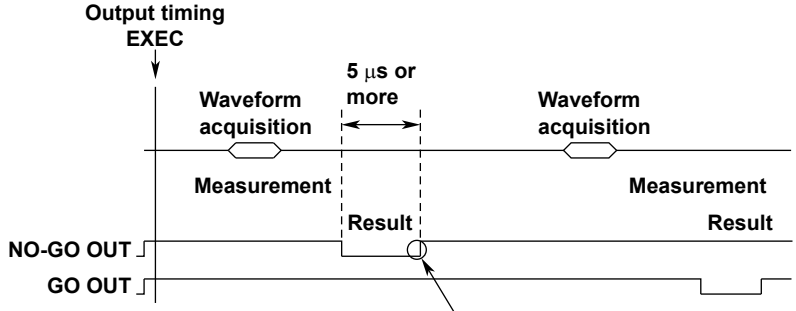
Pin Arrangement



Connector on the DLM2000

Pin No.	Signal Name	Logic
1	NC (no connection)	
2	NC (no connection)	
3	GO OUT	Negative logic
4	NO-GO OUT	Negative logic
5	GND	
6	NC (no connection)	

Output Timing



The signal remains low until the DLM2000 is ready to accept the next measurement. If you have specified an action to perform when conditions are true, this time is extended until that action is complete.

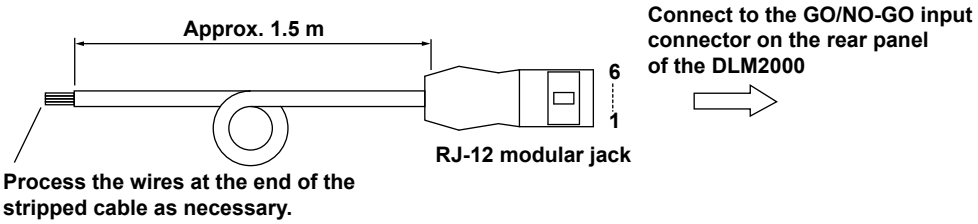
Connecting to Other Instruments

CAUTION

- Do not apply external voltage to the NO-GO OUT and GO OUT output pins. Doing so may damage the DLM2000.
- When connecting the GO/NO-GO determination signal output to another instrument, do not connect the wrong signal pin. Doing so may damage the DLM2000 or the connected instrument.
- Do not connect a USB cable to the GO/NO-GO output terminal. Doing so may damage the DLM2000.

When connecting to an external instrument, use a cable designed for GO/NO-GO determination, such as optional accessory 366973.
Do not use this cable for any purpose other than performing GO/NO-GO determination with the DLM2000.

Specifications of the GO/NO-GO Cable (Optional accessory 366973)



Color	Pin No.	Signal Name	Logic
Yellow	2	NC	
White	3	GO OUT	Negative logic
Green	4	NO-GO OUT	Negative logic
Blue	5	GND	

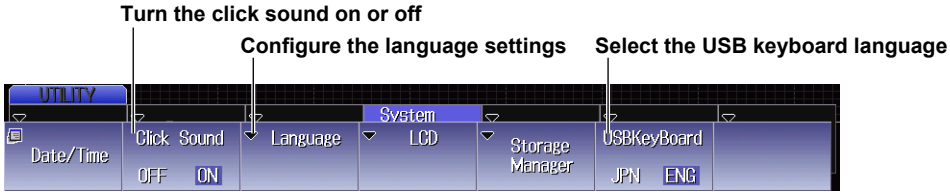
19.1 Changing the Message Language, Menu Language, USB Keyboard Language, and Turning the Click Sound On or Off

This section explains the settings that you can use to change the message language, menu language, USB keyboard language, and when turning click sound on or off.

► "System Configuration (System Configuration)" in the Features Guide

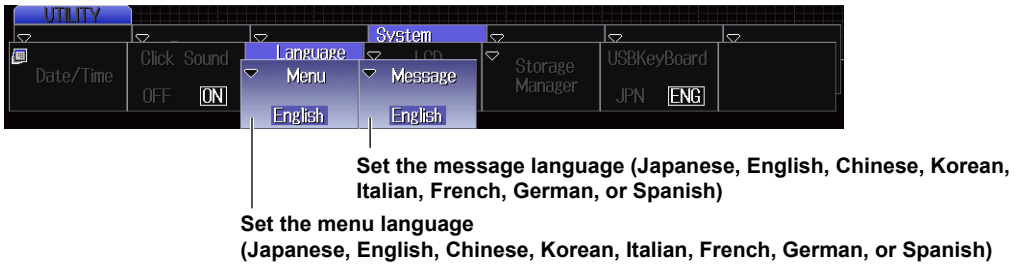
UTILITY System Configuration Menu

Press **UTILITY** and then press the **System Configuration** soft key to display the following menu.



Setting the Language (Language)

Press the **Language** soft key to display the following menu.



Note

Some terminology is always displayed in English.

Setting the USB Keyboard Language (USBKeyBoard)

You can use the following keyboards conforming to USB Human Interface Devices (HID) Class Ver. 1.1.

ENG: 104-key keyboards

JPN: 109-key keyboards

For details on how DLM2000 keys are mapped to the keys on a USB keyboard see appendix 4.

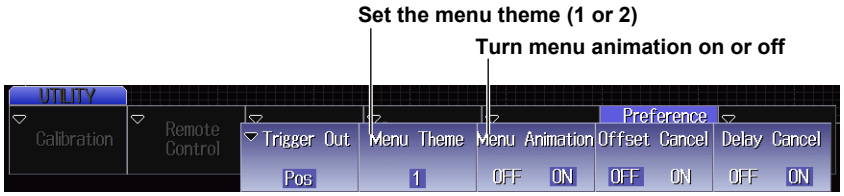
19.2 Configuring the Menu Display

This section explains the following settings (which are used when setting the menu display):

- Menu theme
- Menu animation

UTILITY Preference Menu

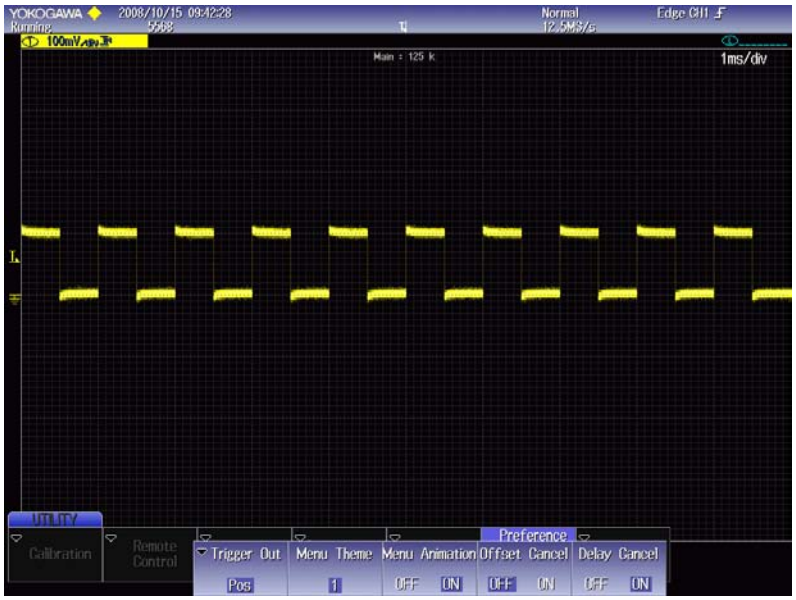
Press **UTILITY** and then press the **Preference** soft key to display the following menu.



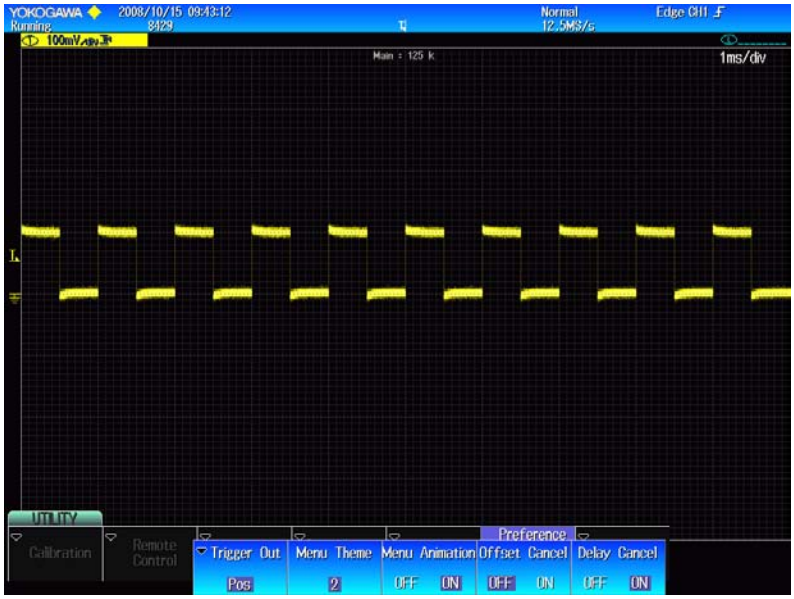
Setting the Menu Theme (Menu Theme)

You can set the color that the menu is displayed in.

Menu Theme 1



Menu Theme 2



Setting Menu Animation (Menu Animation)

OFF: Menus are displayed quickly.

ON: Menus are displayed slowly.

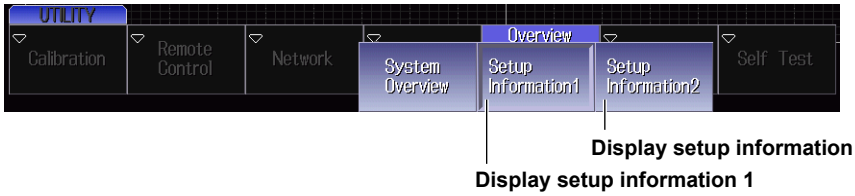
19.3 Viewing Setup Information (Overview)

This section explains how to view the current DLM2000 setup information.

► “Overview (Overview)” in the Features Guide

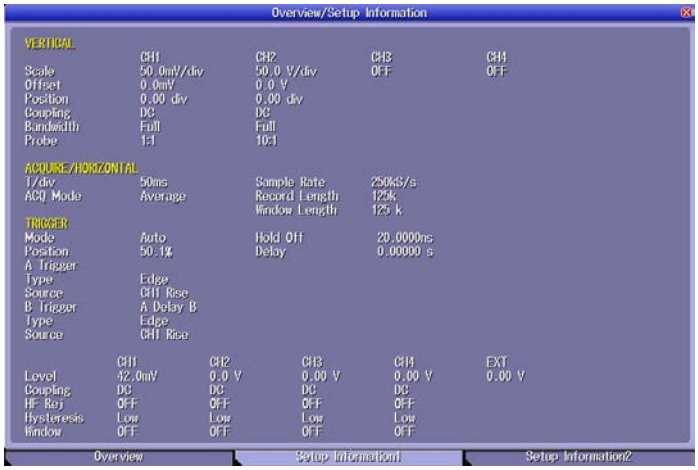
UTILITY Overview Menu

Press **UTILITY** and then press the **Overview** soft key to display the following menu.



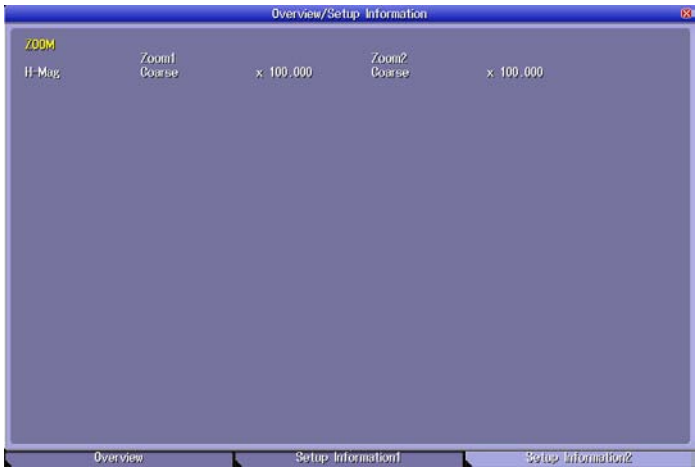
Displaying Setup Information 1 (Setup Information1)

Press the **Setup Information1** soft key to display the following screen.



Displaying Setup Information 2 (Setup Information2)

Press the **Setup Information2** soft key to display the following screen.



20.1 If a Problem Occurs

Faults and Corrective Actions

- If a message appears on the screen, see the following pages for reference.
- If servicing is necessary, or if the instrument does not operate properly even after you have attempted to deal with the problem according to the instructions in this section, contact your nearest YOKOGAWA dealer.

Description	Probable Cause	Corrective Action	Reference Section
The DLM2000 does not power on.	Using a power supply outside the ratings.	Use a correct power supply.	2.3*
Nothing is displayed.	The backlight is turned off.	Press any key.	4.4
	The screen is displayed with inappropriate colors.	Turn the power off, and then turn the power on again while pressing **RESET**.	3.6*
The display is odd.	The system is not operating properly.	Turn off the DLM2000 and then turn it back on.	2.3*
Keys do not work.	The keys are malfunctioning.	Perform a key test. If the test fails, servicing is required.	20.3
Triggering does not work.	The trigger settings are not appropriate.	Set the trigger conditions correctly.	Chapter 2 and section 4.3*
The measured values are not correct.	Insufficient warm-up.	Warm up the DLM2000 for 30 minutes after turning on the power.	—
	The DLM2000 has not been calibrated.	Calibrate the DLM2000.	3.8*
	The probe's phase has not been corrected.	Perform phase correction properly.	2.5*
	The probe attenuation is not correct.	Set an appropriate value.	1.1
	Offset voltage is applied.	Set the offset voltage to 0 V.	1.1
	Other causes.	Calibrate the DLM2000. If the measured values are still not correct, servicing is required.	3.8*
Cannot print to the built-in printer.	The printer head is damaged or worn out.	Servicing is required.	—
Cannot save to the specified storage medium.	The storage medium is not formatted.	Format the storage medium.	20.5
	No more free space on the storage medium.	Delete unneeded files or use another storage medium.	—
Unable to configure or control the DLM2000 through the communication interface.	The DLM2000 address used by the program is different from the specified address.	Match the address used in the program to the DLM2000 address.	Communication Interface User's Manual (IM 710105-17E)
	The interface is not used in a way that conforms to the electrical or mechanical specifications.	Use the interface in a way that conforms to the specifications.	

* Operation Guide IM 710105-03E

20.2 Messages and Corrective Actions

Messages

Messages may appear on the screen during operation. This section describes the error messages and how to respond to them. You can display the messages in the language that you specify through the operations explained in section 19.1. If servicing is necessary to solve the problem indicated by a message, contact your nearest YOKOGAWA dealer.

In addition to the following error messages, there are also communications error messages. These messages are explained in the *Communication Interface User's Manual (IM 710105-17E)*.

Information

Code	Message and Corrective Action	Section
2	Turned on pressing the RESET key. All the settings will be initialized.	3.6*
3	Firmware is updated. All the settings are initialized.	—
4	Hardcopy is aborted.	—
5	File access is aborted.	—
6	Action-on-trigger is aborted.	2.17
7	Search aborted.	—
8	Search execution is completed, but no record was found that matched the conditions.	—
9	Search execution is completed, but no record was found that matched the pattern.	—
10	Statistical measurement is aborted.	Chapter 9
11	Analysis is aborted.	—
12	Data not detected. Execute again after changing settings or reacquiring waveforms.	—
13	The corresponding field was not found.	—
14	Action-on-trigger is completed.	2.17
15	The instrument is set to remote mode by the communication control. Press the SHIFT + CLEAR TRACE key tochange to local mode.	—
16	Local lockout is set by the communication control. To operate using the keys, release the lockout using the communication control.	—
17	Firmware will be updated. Do you want to proceed? Note: It will take approx. 5 minutes. Please DO NOT power off the unit until the completion. Once the procedure is completed, the unit will reboot itself. We recommend you to save the setups before updating the firmware.	—
18	Updating Firmware. Note: Please DO NOT power off the unit. Once the procedure is completed, the unit will reboot itself.	—
19	Firmware is updated. Will be rebooted.	—
20	Any serial bus signal can not be detected.	Chapter 12
21	Serial bus automatic setting was aborted.	Chapter 12
22	The symbol/physical value file(.sbl) has not been loaded.	16.7
23	A contradiction in bit numbers of logic setting and symbol definition was detected. Check the symbol/ physical value file(.sbl).	—
24	Check the input voltage level and attenuation ratio.	Chapter 12

* Operation Guide IM 710105-03E

File Errors

Code	Message and Corrective Action	Section
500	Data size larger than remaining capacity in media. Delete unnecessary files or use other media.	Chapter 16
501	File does not exist. Check the file name.	Chapter 16
502	Assigned path does not exist or no media. Check the path name and media.	Chapter 16
503	Writing prohibited in the media. Unlock write protection of the media.	Chapter 16
504	Insufficient remaining capacity in media. Delete unnecessary files or use other media.	Chapter 16
505	File not compatible. Check the file, firmware version of the unit or model name of the unit.	—
506	Save data do not exist. Check the content to be saved.	—
507	Save data do not exist. Check the content to be saved.	—

Code	Message and Corrective Action	Section
508	Unable to open file. The may be opened by other process. Try to open file later. If the problem still exist, service may be necessary.	Chapter 17
509	Access denied.	Chapter 16
510	File system error. Service is required.	—
511	Media error. Service is required.	—
512	Directory can not be deleted.	Chapter 16
513	File or Directory can not be moved to other media. If the problem occurs on other media, service may be required.	Chapter 16
514	Directory entry does not exist.	—
515	Media error. Service is required.	—
516	Media error. Service is required.	—
517	End of the file.	—
518	The same file or directory name exist. Remove the file/directory or change the current path.	Chapter 16
519	Target file of Move or Copy has a read only property.	Chapter 16
520	Assigned path does not exist or no media. Check the path name and media.	Chapter 16
521	Destination folder assigned to Copy / Move is the same as the origin or sub folder. Change the destination folder.	Chapter 16
522	No file name. Type in file name.	Chapter 16
523	Auto file name failure. Change the type of auto file name or change the header of the auto name.	Chapter 16
524	Improper file or path name. Check file / path name.	Chapter 16
525	Improper file or path name. Check file / path name.	Chapter 16
526	File is disintegrated. Check the file.	—
527	File system error. Service is required.	—
528	Illegal file name. The name contains prohibited characters. Change it to a different name.	Chapter 16
529	Illegal file name. The name is reserved by the system. Change it to a different name.	Chapter 16
530	Load failure. Number of vortex exceeded the maximum. Redefine the mask data.	—
531	Unable to open file. The may be opened by other process. Try to open file later. If the problem still exist, service may be necessary.	—
532	Unable to save. Compressed record size exceeded current record size. Change the compressed record size and execute again.	—
533	Assigned path does not exist. Check the network setting and configuration.	Chapter 17
534	Assigned path does not exist. Check the network setting and configuration.	Chapter 17
535	Assigned path does not exist. Check the network setting and configuration.	Chapter 17
536	File operation not supported in root directory. Please verify the path name.	Chapter 16
537	A file which contains multiple saved traces can not be loaded into Ref. Please load it into ACQ.	Chapter 16
538	A file which contains compressed waveform can not be loaded into the ACQ. Please load it into Ref.	Chapter 16
539	Unable to load a logic waveform to the reference waveform.	Chapter 16
540	Unable to load a file containing logic waveforms.	Chapter 16
541	Unable to load that file. Its extention is invalid.	Chapter 16
543	There is already a file. Do you overwrite?	Chapter 16
544	A file which contains multiple saved traces can not be loaded into Ref. Please load it into Channels.	Chapter 16
545	The data of the record length more than 1.25M cannot save all data in ASCII(CSV form). Please do a compression save or a partial save by Zoom.	Chapter 16

Printer Errors

Code	Message and Corrective Action	Section
550	Printer error. Confirm the printer status.	—
551	Cannot detect printer. Turn ON the printer. Check connectors.	—
552	Communication error. Check all connections and make sure all devices are on.	—
553	Paper not loaded correctly. Set the paper correctly.	15.1
554	Temperature error. Power off immediately.	—
555	Close the printer cover.	15.1
556	No built-in printer on this model. Check the specifications to see whether or not the optional printer is provided.	20.4
557	Image creation failure. Working memory space may be insufficient. Maintenance service is required.	—

Network Errors

Code	Message and Corrective Action	Section
600	Invalid network parameter settings. Check the network parameters.	Chapter 17
601	Unable to connect to the server. Check the network settings and configuration.	Chapter 17
602	Invalid file server settings. Check the file server settings.	Chapter 17
603	Invalid fire wall settings. Check the fire wall settings.	Chapter 17

Execution Errors

Code	Message and Corrective Action	Section
650	Running. Stop and execute again.	3.7*
651	Accessing file. Abort or wait until it is completed, and execute again.	—
652	Printing. Abort or wait until it is completed, and execute again.	—
653	Processing action-on-trigger. Abort or wait until it is completed, and execute again.	2.17
654	Processing zoom search. Abort or wait until it is completed, and execute again.	Chapter 11
655	Processing auto scroll. Abort or wait until it is completed, and execute again.	—
656	Processing history search. Abort or wait until it is completed, and execute again.	Chapter 14
657	Processing history replay. Abort or wait until it is completed, and execute again.	Chapter 14
658	Processing statistical measurement. Abort or wait until it is completed, and execute again.	Chapter 9
659	Analyzing serial bus data. Abort or wait until it is completed, and execute again.	Chapter 12
660	Zone edit in process. Terminate editing.	Chapter 2
661	Processing self test. Wait until it is completed.	—
662	Acquisition in process in N Single trigger mode. Press Start/Stop key or wait until the process is completed.	Chapter 2
663	Retrievable settings does not exist. The settings is created by either Initialize or Auto Setup.	—
664	Failed to execute statistical measurement. Waveform data may not exist. In Cycle statistic mode, improper setting may result in failure to recognize the cycle.	Chapter 9
665	Search target data does not exist. Execute search after analysis is completed.	—
666	Improper action setting. The saved data type is either Waveform group or Analysis group. This can be assigned from File menu.	Chapter 16
667	Retrievable data not found.	—
668	Failed to update firmaware. Either the data file could be inappropriate or damaged.	—
669	Sending E-Mail. Wait until it is completed.	—
670	The corresponding field was not found.	—
671	Cannot be executed when the current probe setting is 100A:1V. Change the probe setting on the channel menu or the Power Analysis Setup menu.	Chapter 1
672	Auto Deskew was canceled because input signals were not detected. Check signals and settings and try again.	Chapter 1
673	Processing math on history. Abort or wait until it is completed, and execute again.	Chapter 14
674	Cannnot store because the data is locked. Release the lock through Store Detail.	Chapter 16
675	Serial bus automatic setting is in progress. Please wait.	Chapter 12
677	Cannot execute the user defined math function during roll mode. After acquisition stop, it will be executed.	3.7*
678	Cannot execute the search function during roll mode.	—
679	The data length that is necessary for FFT is short. Please make Time/div late.	Chapter 1
680	The data length that is necessary for the user defined math function is short. Please lower the order of the MEAN operator or change setting of Filter1(Filter2).	Chapter 6
681	The data length that is necessary for the harmonics analysis function is short.	—
682	The decode cannot be displayed, because the threshold level is not appropriate.	—
683	Cannot execute the math function, because the display of source is OFF.	Chapter 6
684	It's not available while running.	3.7*

* Operation Guide IM 710105-03E

Setting Errors

Code	Message and Corrective Action	Section
800	Improper Date / Time setting.	3.4*
801	Not allowed unless waveforms are shown. Display waveforms.	Chapter 1
802	Source waveforms do not exist. Display source waveforms.	Chapter 3
803	Zone waveforms do not exist.	Chapter 2
804	Illegal expression.	Chapter 6
806	Invalid bit assignment in the logic group.	1.2
807	Unable to enable the trigger conditions. Set the clock source to another group or assign bits to the group.	2.6, 2.8
808	Cannot set this parameter with maximum record length.	—
809	Cannot change the setting of the Math operation, because power analysis is set.	—
810	Cannot set this parameter when A-trigger is not serial bus.	Chapter 2
811	This setting is necessary only in the case of ON display of Zoom1 and Zoom2.	Chapter 10
812	Cannot set this parameter during interleave mode.	—
813	This option is not available.	—
814	The Userdefined Math option is not available.	—
815	The LOGIC input option is not available.	—
816	This function is not supported.	—

* Operation Guide IM 710105-03E

System Errors

Code	Message and Corrective Action	Section
900	Failed to backup setup data. Initializing will be executed. The setting data are not saved, because doing the main power supply(rear panel) OFF before doing the power switch (front panel) OFF.	20.6
901	Fan stopped. Power off immediately. Maintenance service is required.	20.6
902	Backup battery is low. Maintenance service is required to replace the back-up battery.	20.6
903	Calibration failure. Disconnect the input and execute again. If it fails again, servicing is necessary.	—
904	Invalid Command.	—
905	This error No. is not defined.	—
906	Failed to update firmaware. The internal media may be damaged. Maintenance service is required.	—
907	Calibration failure. Set V/div to the highest sensitivity and turn the coarse adjustment trimmer of the current probe so that the signal is within ±2 division from the center of the screen. If the calibration still fails, servicing is required.	Chapter 1
908	There is a problem to a probe power supply. Maintenance service is required.	—

20.3 Carrying Out Self-Tests (Selftest)

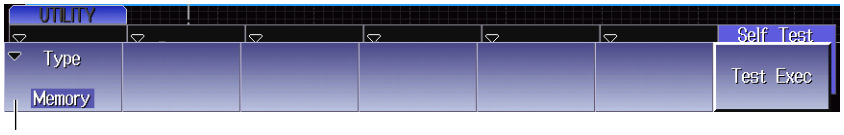
This section explains the following settings (which are used when testing whether or not the DLM2000's memory, keyboard, and printer are functioning properly):

- Test type
- Test execution

► "Self-Test (Selftest)" in the Features Guide

UTILITY Self Test Menu

Press **UTILITY** and then press the **Self Test** soft key to display the following menu.



Set the test type

Setting the Test Type (Type)

Memory: Tests whether or not the internal CPU board RAM and ROM are operating properly. If they are operating properly, "Success" appears. If an error occurred, "Fail" appears.

Key Board: Tests whether or not the front panel keys are operating correctly and whether or not the soft keyboard accepts input properly. The front panel keys are operating properly if the names of the keys that you press are highlighted. The soft keyboard is operating properly if you can enter the specified characters.

Printer: Tests whether or not the optional built-in printer is operating properly. The built-in printer is operating properly if the print density is correct. The built-in printer does not print properly if an error occurs.

Note

Accuracy, Test1 (Service), and Test2 (Service) are service test items. Under normal circumstances, you do not need to perform these tests.

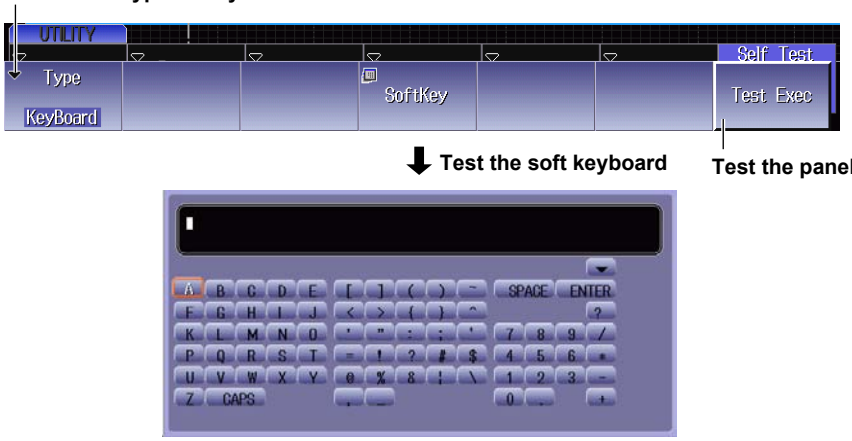
Executing the Memory Test

Set the test type to Memory

Test the internal memory

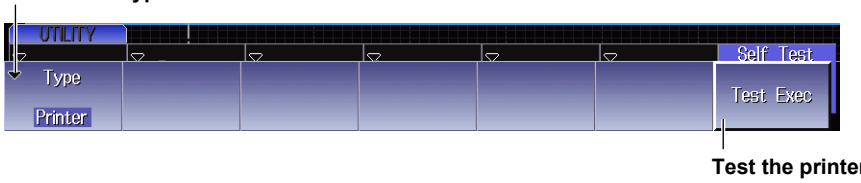
Executing the Keyboard Test

Set the test type to KeyBoard



Executing the Printer Test

Set the test type to Printer



If an Error Occurs during a Self-Test

If an error occurs even after you carry out the following procedure, contact your nearest YOKOGAWA dealer.

- Execute the self-test again several times.
- Confirm whether or not the media being tested is properly inserted.
- Check that the paper is set properly in the built-in printer and that paper is not jammed.

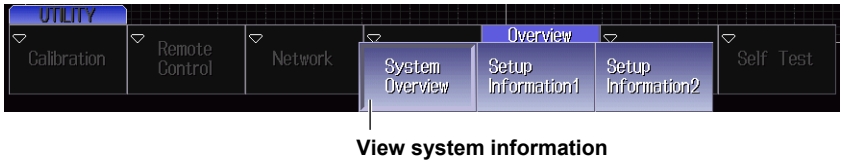
20.4 Viewing System Information (Overview)

This section explains how to view the DLM2000 system information.

► “Overview (Overview)” in the Features Guide

UTILITY Overview Menu

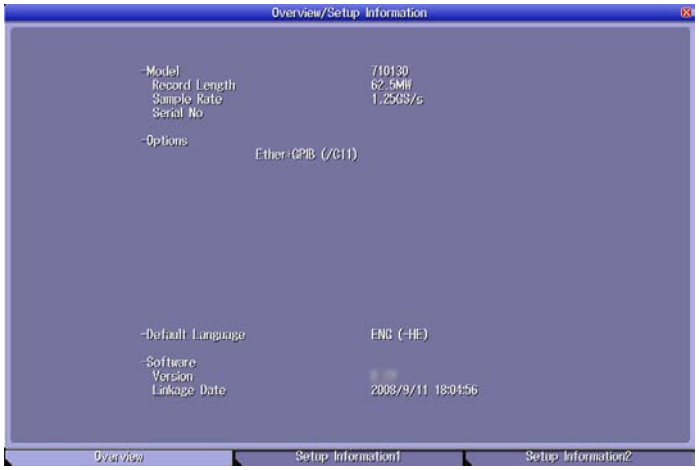
Press **UTILITY** and then press the **Overview** soft key to display the following menu.



View system information

Viewing System Information (System Overview)

Press the **System Overview** soft key to display the following screen.



Display Details

Model	Model
Record Length	Record length
Sample Rate	Maximum sample rate
Serial No.	Serial number
Options	Optional features installed on the DLM2000
Default Language	Default language
Software Version	Firmware version number
Software Linkage Date	Firmware version date

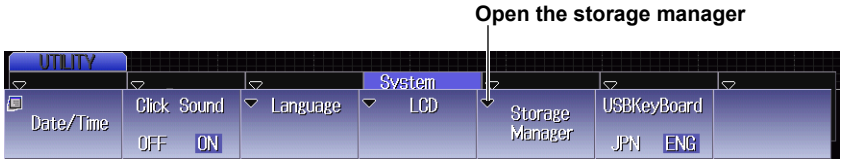
20.5 Formatting Internal Memory

This section explains the following settings (which are used when formatting the DLM2000's internal memory):

- Storage management
- Formatting internal memory

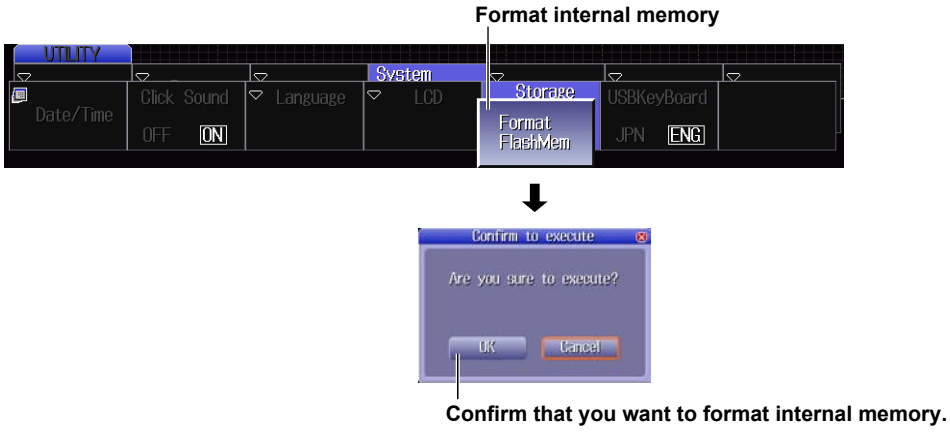
UTILITY System Configuration Menu

Press **UTILITY** and then press the **System Configuration** soft key to display the following menu.



Storage Management (Storage Manager)

Press the **Storage Manager** soft key to display the following menu.



CAUTION

If you format the internal memory, all saved data is erased.

20.6 Recommended Part Replacement

The three-year warranty applies only to the DLM2000 (starting from the day of delivery) and does not cover any other parts nor consumable parts.
For part replacement, contact your nearest YOKOGAWA dealer.

Part Name	Lifetime
Built-in printer	Under normal conditions of use, equivalent of 360 rolls of printer paper (part number: B9988AE)
LCD backlight	Under normal conditions of use, approximately 25,000 hours

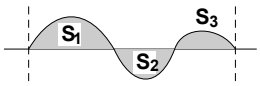
The following are consumable parts. We recommend replacing them at the following intervals. For part replacement, contact your nearest YOKOGAWA dealer.

Part Name	Recommended Replacement Interval
Cooling fan	3 years
Backup battery (lithium battery)	5 years

Appendix 1 How to Calculate the Area of a Waveform

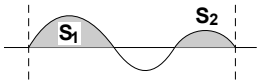
IntegTY

Sum of the positive and negative curve areas: $S_1 + S_3 - S_2$



IntegTY+

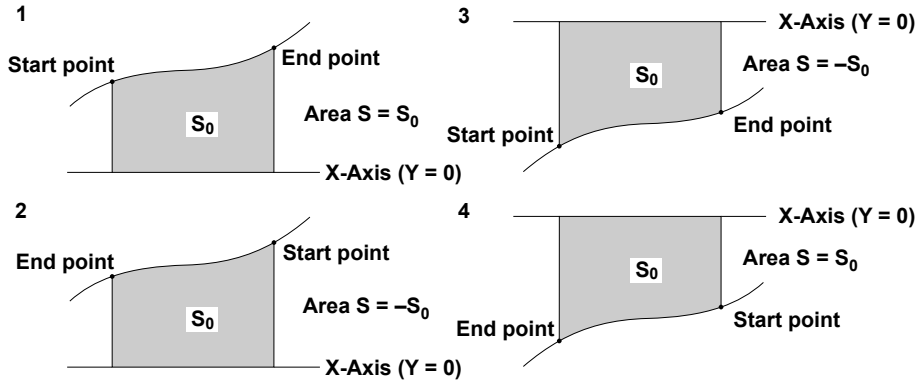
Sum of only the positive curve areas: $S_1 + S_2$



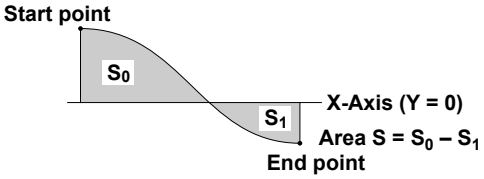
Integ for XY Display

Open

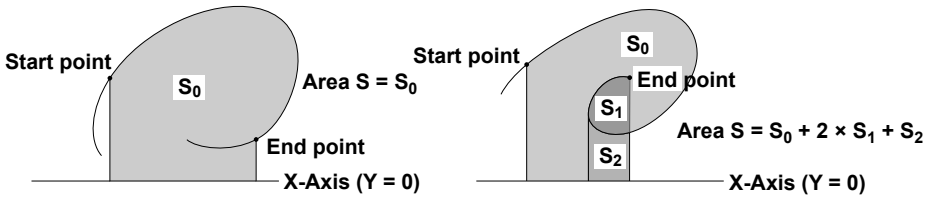
(1) When Each Y Data Point Corresponds to a Single X Data Point



(2) When the Waveform Extends into the Negative Side

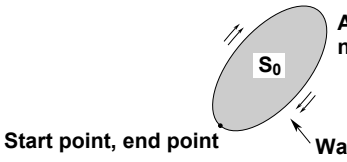


(3) When Multiple Y Data Corresponds to X Data

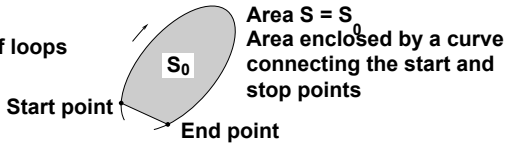


Close

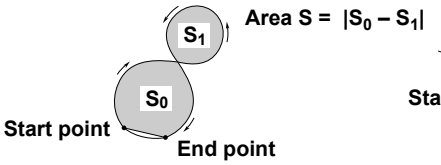
(1) Multiple Loops



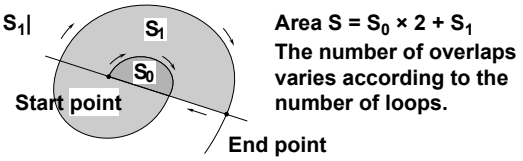
(2) Non-Closed Curve



(3) Loop Tracing a Figure-Eight



(4) Loop Tracing a Spiral



Appendix 2 User-Defined Computation

Digital Filter

Type

Type	Bandwidth
FIR	Lowpass, highpass, or bandpass
IIR	Lowpass, highpass, or bandpass

Filter Order

See the following table for the filter orders.

		2%	5%	10%	20%	30% (Cutoff*)
Sharp	Lowpass	88	36	18	9	8
	Highpass	159	65	33	17	13
FIR	Lowpass	4	4	4	3	2
	Highpass	4	4	4	4	3

* The cutoff percentage is with respect to the sample rate.

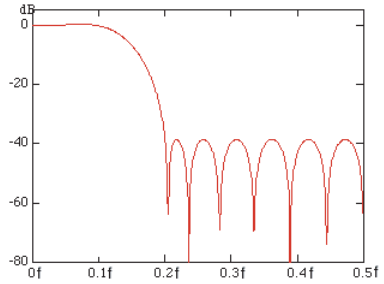
Filter Response

Filter	Pass-band Ripple	Attenuation Slope	Attenuation at the Stop-band	Phase
FIR	±0.3 dB	–40 dB at 1 oct (Lowpass), –40 dB at –1 oct (Highpass)	–40 dB	Linear phase
IIR	0 dB	–5 dB at 1/6 oct (Lowpass), –20 dB at –1 oct (Highpass)	—	Non-linear phase

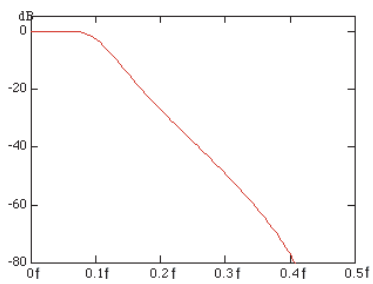
Examples of Filter Frequency Response

f: Frequency (Hz)

FIR (low pass; 10% cutoff)



IIR (low pass; 10% cutoff)



Note

Computations take more time with higher filter orders.

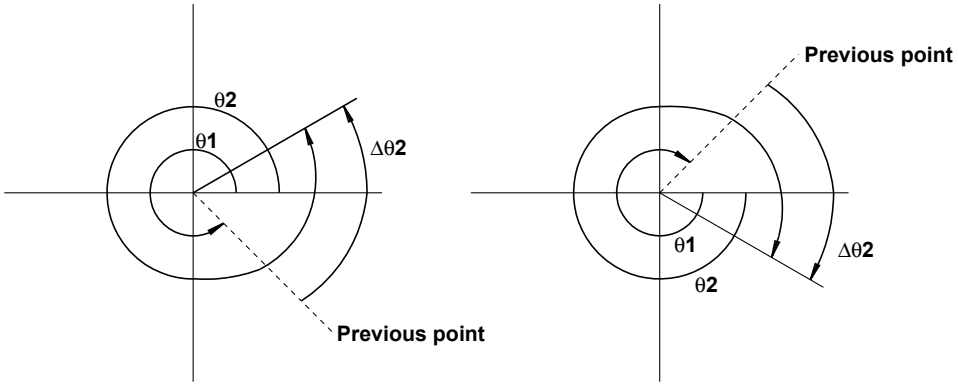
Hilbert Function (HLBT)

Normally, when we analyze real-time signals, it is useful to think of these signals as the real part of functions of complex variables, and to carry out the actual signal analysis using such functions.
If the real-time signal is considered to be the real part of the function, the imaginary part can be determined with the Hilbert transform of the real part.
The Hilbert transform does not change the order of the individual variables. Hilbert transform of a time signal results in another time signal.
The Hilbert transform procedure is as follows.
When a time-domain signal is transformed, the signal is first transformed into the frequency domain through Fourier transform. Next, the phase of each frequency component is shifted by –90 degrees if the frequency is positive and +90 degrees if the frequency is negative. Lastly, taking the inverse Fourier transform completes the Hilbert transform.
Example

- The Hilbert transform can be used to analyze an envelope waveform.
  AM (amplitude modulation): SQRT(C1 × C1 + HLBT(C1) × HLBT(C1))
  Demodulation of an FM Signal: DIF(PH(C1, HLBT(C1)))

Phase Function (PH)

Phase function PH(X1, Y1) computes $\tan^{-1}$(X1/Y1).
The phase function takes the phase of the previous point into consideration and continues to sum even when the value exceeds $\pm\pi$ (the ATAN function reflects at $\pm\pi$).
The unit is radians.



Differentiation and Integration

The computation of the differentiated value uses the 5th order Lagrange interpolation formula to derive a point of data from the five points of data before and after the target point.
The following equations use data f_0 to f_n with respect to sampling time x_0 to x_n. The derivative and integrated values corresponding to these data points are computed as follows:

Differentiation (DIFF)

Point x_k $f_k' = \frac{1}{12h}$ $[f_{k-2} - 8f_{k-1} + 8f_{k+1} - f_{k+2}]$

h = Δx is the sampling interval (sec) (example: h = 200 × 10^{-6} at 5 kHz)

Integration (INTEG)

Point x_0 $I_0 = 0$

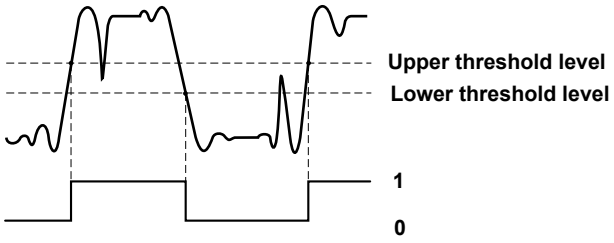
Point x_1 $I_1 = \frac{1}{2}(f_0 + f_1)h$

Point x_2 $I_2 = \frac{1}{2}(f_0 + f_1)h + \frac{1}{2}(f_1 + f_2)h = I_1 + \frac{1}{2}(f_1 + f_2)$

Point x_n $I_n = I_{n-1} + \frac{1}{2}(f_{n-1} + f_n)h$

Binary Conversion(BIN)

Performs binary conversion using the specified threshold levels.



Pulse Width Computation

The signal is converted to binary values by comparing to the preset threshold level, and the time of the pulse width is plotted as the Y-axis value for that interval.

You can set the interval to one of the settings below.

PWHH: From a rising edge to the next rising edge.

PWHL: From a rising edge to the next falling edge.

PWLH: From a falling edge to the next rising edge.

PWLL: From a falling edge to the next falling edge.

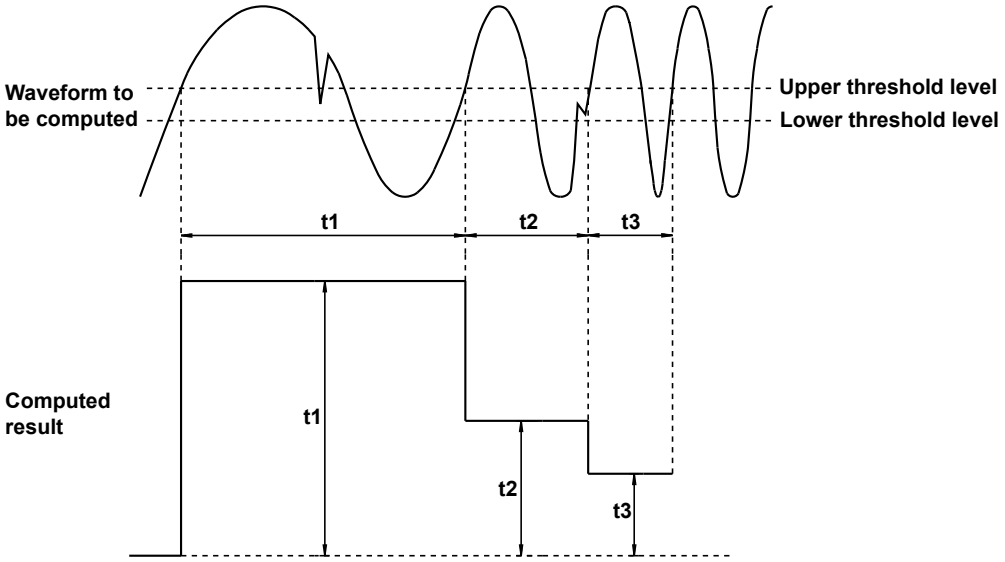
PWXX: From a rising or falling edge to the next rising or falling edge.

FV: The inverse of PWHH.

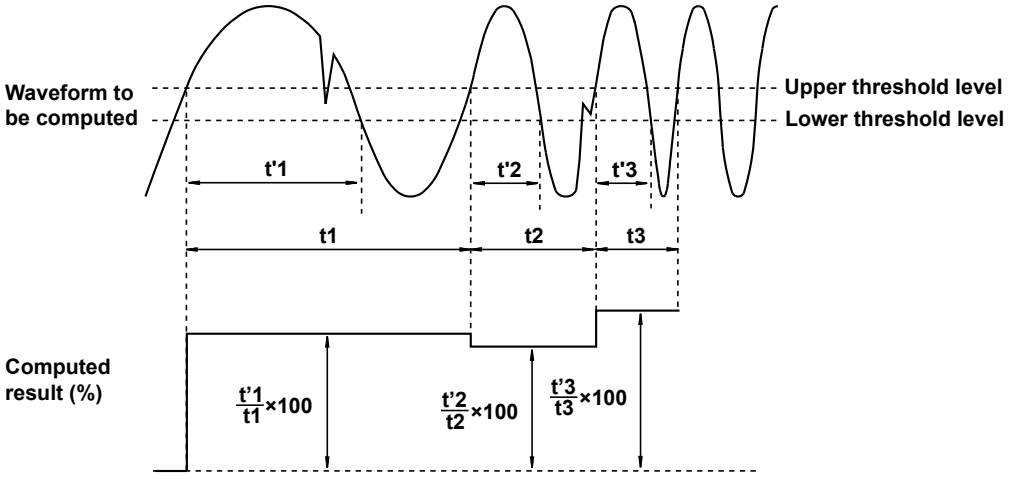
DUTYH: Duty ratio of the high side of each period of the specified waveform.

DUTYL: Duty ratio of the low side of each period of the specified waveform.

Example 1, When the Interval Is Set to PWHH



Example 2, When the Interval Is Set to DUTYH



FFT Function

Each frequency component G of a linear spectrum is represented by G=R + jI, where R is the real part and I is the imaginary part.

Linear Spectrum

The linear spectrum can be directly determined with the FFT. Through this spectrum, the magnitude and phase of each frequency component included in the measured waveform can be found. The power spectrum and cross spectrum can also be determined from one or two linear spectrums. Because the FFT is a complex function, the linear spectrum produces the real part and imaginary part of the frequency components. The magnitude and phase of the linear spectrum can also be determined from this result.

The DLM2000 can determine the following spectrums.

Item	Equation	Computation
Real part	LS-REAL	R
Imaginary part	LS-IMAG	I
Magnitude	LS-MAG	$\sqrt{(R^2 + I^2)}$
Log magnitude	LS-LOGMAG	$20 \times \log (\sqrt{(R^2 + I^2)})$
Phase	LS-PHASE	$\tan^{-1}(I/R)$

Log magnitude reference (0 dB): 1 Vpeak

Power Spectrum

The power spectrum expresses the power (squared value) of each frequency component included in the measured signal. It is determined by taking the product of the linear spectrum and its complex conjugate. It does not contain phase information.

The DLM2000 can determine the following spectrums.

Item	Equation	Computation	
Magnitude	PS-MAG	DC component	$R^2 + I^2$
		AC component	$(R^2 + I^2)/2$
Log magnitude	PS-LOGMAG	DC component	$10 \times \log(R^2 + I^2)$
		AC component	$10 \times \log \{(R^2 + I^2)/2\}$

Log magnitude reference (0 dB): 1 $Vrms^2$

Power Spectrum Density

The power spectrum density expresses the power spectrum per unit frequency. It is determined by dividing the power spectrum by the frequency resolution Δf found during the analysis of the power spectrum. The computation varies depending on the window function.

Power spectrum density is used to compare power spectrums analyzed at different frequency bands. However, it is not necessary for signals having a line spectrum such as sine waves.

The DLM2000 can determine the following spectrums.

Item	Equation	Computation
Magnitude	PSD-MAG	For rectangular windows: PS-MAG/Δf
		For Hanning windows: PS-MAG/1.5Δf
Log magnitude	PSD-LOGMAG	For rectangular windows: 10 × logPS-MAG/Δf
		For Hanning windows: 10 × logPS-MAG/1.5Δf

Log magnitude reference (0 dB): 1 $Vrms^2$

Cross Spectrum

The cross spectrum is determined from two signals. It is found by taking the product of the linear spectrum of one signal (Gy) and the complex conjugate (Gx^*) of the linear spectrum of the other signal (Gx).

If the linear spectrums of the two signals are represented by

$Gx = Rx + jIx$

$Gy = Ry + jIy$

then the cross spectrum Gyx is

$Gyx = Gy \times Gx^*$

$= (Ry + jIy)(Rx - jIx) = Ryx + jIyx$

where $Ryx = RyRx + IyIx$ and $Iyx = RxIy - RyIx$

The DLM2000 can determine the following spectrums.

Item	Equation	Computation	
Real part	CS-REAL	DC component	Ryx
		AC component	Ryx/2
Imaginary part	CS-IMAG	DC component	Iyx
		AC component	Iyx/2
Magnitude	CS-MAG	DC component	$\sqrt{(Ryx^2 + Iyx^2)}$
		AC component	$\sqrt{(Ryx^2 + Iyx^2)}/2$
Log magnitude	CS-LOGMAG	DC component	$10 \times \log\sqrt{(Ryx^2 + Iyx^2)}$
		AC component	$10 \times \log (\sqrt{(Ryx^2 + Iyx^2)}/2)$
Phase	CS-PHASE		$\tan^{-1}(Iyx/Ryx)$

Transfer Function

The transfer function expresses the frequency response of the input to and the output from the transfer system. The transfer function is determined by the ratio of the output linear spectrum (Gy) and the input spectrum (Gx) at each frequency. Also, as can be seen from the following equation, the transfer function can be defined as the ratio of the cross spectrum of the input and output (Gyx) and the input power spectrum (Gxx).

Transfer function $= Gy/Gx = (Gy \times Gx^*)/(Gx \times Gx^*) = Gyx/Gxx$

$= (Ryx + jIyx)/(Rx^2 + Ix^2)$

The DLM2000 can determine the following items.

Item	Equation	Computation
Real part	TF-REAL	$Ryx/(Rx^2 + Ix^2)$
Imaginary part	TF-IMAG	$Iyx/(Rx^2 + Ix^2)$
Magnitude	TF-MAG	$\sqrt{(Ryx^2 + Iyx^2)}/(Rx^2 + Ix^2)$
Log magnitude	TF-LOGMAG	$20 \times \log\sqrt{(Ryx^2 + Iyx^2)}/(Rx^2 + Ix^2)$
Phase	TF-PHASE	$\tan^{-1}(Iyx/Ryx)$

The magnitude of the transfer function shows the ratio of the magnitudes of the output linear spectrum and the input linear spectrum while the phase shows the phase difference of the two.

Coherence Function

The coherence function expresses the ratio of the output power generated by the input signal to the transfer system and the total output power.

Coherence function $= Gyx \times Gyx^*/(Gxx \times Gyy)$

Item	Equation	Computation
Magnitude	CH-MAG	$(Ryx^2 + Iyx^2)/(Gxx \times Gyy)$

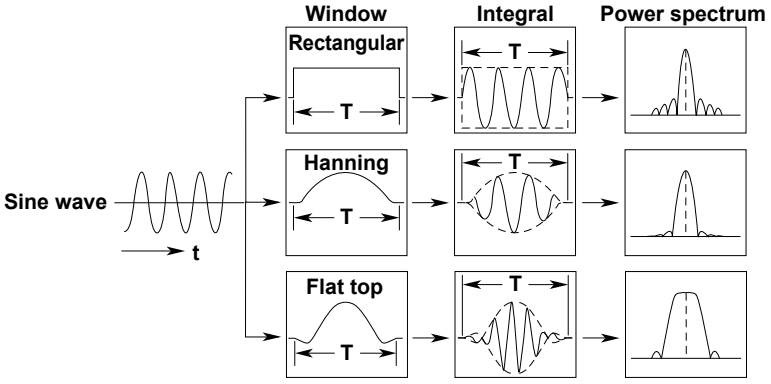
If the output signal is due entirely to the input signal, the coherence function becomes 1. As the ratio decreases, it falls below 1. Thus, the coherence function always takes on a value between 0 and 1.

Note

On one data acquisition, the coherence function becomes 1 across all frequencies. Make sure to take the frequency average of the computation.

Time Windows

You can select from rectangular, Hanning, or flattop time windows.
The rectangular window is best suited to transient signals, such as impulse waves, which attenuate completely within the time window. The Hanning and flattop windows allow 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, they are best suited to continuous signals. The Hanning window provides a higher frequency resolution compared to the flattop window. However, the flattop window has a higher level of accuracy. When the waveform being analyzed is a continuous signal, consider the above characteristics in selecting the proper window to be applied.



Rectangular window: $W(t) = u(t) - u(t - T)$ U(t) : **Step function**

Hanning window: $W(t) = 0.5 - 0.5\cos(2\pi \frac{t}{T})$

Flat top window: $W(t) = \{0.54 - 0.46\cos(2\pi \frac{t}{T})\} \frac{\sin\{2\pi(1 - 2t/T)\}}{2\pi(1 - 2t/T)}$

Notes When Executing the FFT Computation

Computation is normally performed on the sampled data in the acquisition memory. However, for waveforms that have been acquired in envelope mode, computation is performed on the maximum and minimum values per acquisition interval.

Appendix 3 ASCII Data File Format

The DLM2000 can save waveform data to ASCII files. The format of such files is given below.

	A	B	C	D	E
1	Header Size	15			
2	Model Name	DLM2000			
3	Comment				
4	BlockNumber	1	1	1	1
5	TraceName	CH1	CH2	CH3	CH4
6	BlockSize	12500	12500	12500	12500
7	VUnit	V	V	V	V
8	SampleRate	6250000	6250000	6250000	6250000
9	HResolution	1.60E-07	1.60E-07	1.60E-07	1.60E-07
10	HOffset	-1.00E-03	-1.00E-03	-1.00E-03	-1.00E-03
11	HUnit	s	s	s	s
12	DisplayBlockSize	12500	12500	12500	12500
13	DisplayPointNo.	1	1	1	1
14	"Date"	2008/9/25	2008/9/25	2008/9/25	2008/9/25
15	Time	20:52.3	20:52.3	20:52.3	20:52.3
16					
17	Data	6.30E-02	-1.00E-01	1.00E-01	1.00E-01
18		7.70E-02	-1.00E-01	1.00E-01	-2.00E-01
19		8.70E-02	0.00E+00	1.00E-01	1.00E-01
20		9.10E-02	-4.00E-01	2.00E-01	0.00E+00
21		9.40E-02	-2.00E-01	0.00E+00	-2.00E-01
22		9.60E-02	0.00E+00	1.00E-01	0.00E+00

Header Size	The number of header lines.
Model Name	Name of the instrument (DLM2000).
Comment	Comment attached at the time the data file was saved.
BlockNumber	Block number for this group. When the block numbers vary depending on the waveform, this is the maximum block number.
TraceName	Name of each waveform.
BlockSize	The number of data points in one block for each waveform.
VUnit	Each waveform's Y-axis unit (this has no effect on the data).
Sample Rate	The sample rate at the time of waveform acquisition.
HResolution	Each waveform's X-axis conversion coefficient, HResolution. X-axis value = HResolution × (Data No. – 1) + HOffset
HOffset	Each waveform's X-axis conversion coefficient, HOffset. X-axis value = HResolution × (Data No. – 1) + HOffset
HUnit	Each waveform's X-axis unit (this has no effect on the data).
DisplayBlockSize	The length of the data displayed on the screen (the display record length).
DisplayPointNo.	This number shows what point in memory is displayed on the left-most side of the display record length.
"Date"	Date when waveform acquisition completed.
Time	Time when waveform acquisition completed.

Appendix 4 USB Keyboard Key Assignments

DLM2000	USB Keyboard
ACQ menu	CTRL+A
MATH menu	CTRL+B
Execute COPY	CTRL+C
DISPLAY menu	CTRL+D
ENHANCED menu	CTRL+E
FILE menu	CTRL+F
ACTION, GO/NOGO menu	CTRL+G
HISTORY menu	CTRL+H
Execute default setup	CTRL+I
Execute auto setup	CTRL+J
ANALYSIS menu	CTRL+K
LOGIC menu	CTRL+L
MEASURE menu	CTRL+M
CURSOR menu	CTRL+N
Set the trigger level to 50%	CTRL+PERIOD
HELP menu	CTRL+P
Execute CLEAR TRACE	CTRL+Q
Execute RESET	CTRL+R
SHIFT on	CTRL+S
TRIGMODE menu	CTRL+T
UTILITY menu	CTRL+U
Toggle the SCALE knob between Fine and Coarse	CTRL+V
EDGE menu	CTRL+W
ZOOM2 menu	CTRL+X
Toggle the ZOOM knob between Fine and Coarse	CTRL+Y
ZOOM1 menu	CTRL+Z
CH1 menu	CTRL+1
CH2 menu	CTRL+2
CH3 menu	CTRL+3
CH4 menu	CTRL+4
Return (Enter) or Select	CTRL+ENTER
Escape	CTRL+ESC
Select soft key 1	F1
Select soft key 2	F2
Select soft key 3	F3
Select soft key 4	F4
Select soft key 5	F5
Select soft key 6	F6
Select soft key 7	F7
Escape	F8
SINGLE	F11
START/STOP	F12
Increase the magnification (ZOOM knob)	CTRL+INSERT
Increase the vertical position (VERTICAL POSITION knob)	CTRL+HOME
Increase the trigger position (HORIZONTAL POSITION knob)	CTRL+PAGE UP
Decrease the magnification (ZOOM knob)	CTRL+DELETE
Decrease the vertical position (VERTICAL POSITION knob)	CTRL+END
Decrease the trigger position (HORIZONTAL POSITION knob)	CTRL+PAGE DOWN
Move ○ right	CTRL+RIGHT
Move ○ left	CTRL+LEFT
Move ○ down	CTRL+DOWN
Move ○ up	CTRL+UP
Increase the trigger level	INSERT
Decrease the trigger level	DELETE
Increase the vertical scale (SCALE knob)	HOME
Decrease the vertical scale (SCALE knob)	END
Increase the time axis setting (TIME/DIV)	PAGE UP
Decrease the time axis setting (TIME/DIV)	PAGE DOWN

Index

Symbol

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Z