User's Manual

# DL7440/DL7480 Digital Oscilloscope Serial Bus Signal Analysis Function

## (Includes the $I^2C$ Bus Signal/CAN Bus Signal/ SPI Bus Signal Analysis Function)

YOKOGAWA
Yokogawa Electric Corporation

IM 701450-51E
3rd Edition

Thank you for purchasing the DL7440/DL7480 Digital Oscilloscope with the Serial Bus Signal Analysis Function (/F5 option*, /F7 option*, or F8 option*). This user's manual describes only the serial bus signal analysis function ($I^2C$ Bus Signal Analysis Function, CAN Bus Signal Analysis Function, and SPI Bus Signal Analysis Function. For information about other functions, operating procedures, and handling precautions of the DL7440/DL7480, see the following manuals.

| Manual Title | Manual No. | Description |
|---|---|---|
| DL7440/DL7480 User's Manual | IM 701450-01E | Explains all functions and procedures of the DL7440/DL7480 excluding the communication functions. |
| DL7440/DL7480 Operation Guide | IM 701450-02E | Explains briefly the functions and basic operations. |
| DL7440/DL7480 Communication Interface User's Manual (CD-ROM) | IM 701450-17E | Describes the communication interface functions. |

* /F5 option: Model with the $I^2C$ Bus Signal Analysis Function and SPI Bus Signal Analysis Function
/F7 option: Model with the CAN Bus Signal Analysis Function and SPI Bus Signal Analysis Function
/F8 option: Model with the $I^2C$ Bus Signal Analysis Function, CAN Bus Signal Analysis Function, and SPI Bus Signal Analysis Function

## 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 functions. The figures given in this manual may differ from those that actually appear on your screen.
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## Revisions

- 1st Edition: February 2004
- 2nd Edition: April 2005
- 3rd Edition: June 2009

3rd Edition : June 2009 (YK)

# Conventions Used in This Manual

### Safety Markings

The following marking is used in this manual.

*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 injury or death to the user, and precautions that can be taken to prevent such occurrences.

**CAUTION** Calls attentions to actions or conditions that could cause light injury to the user or 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.

### Notations Used on Pages Describing Operating Procedures

On pages that describe the operating procedures in Chapter 1 through 3, the following notations are used to distinguish the procedures from their explanations.

***Procedure*** This subsection contains the operating procedure used to carry out the function described in the current chapter. All procedures are written with inexperienced users in mind; experienced users may not need to carry out all the steps.

***Explanation*** This section describes the setup items and the limitations regarding the procedures.

#### Notations Used in the Procedures

**Panel Keys and Soft keys**
Bold characters used in the procedural explanations indicate characters that are marked on the panel keys or the characters of the soft keys or menus displayed on the screen.

**SHIFT + Panel Key**
*SHIFT+key* means you will press the SHIFT key to turn ON the green indicator that is located above the SHIFT key and then press the panel key. The setup menu marked in purple above the panel key that you pressed appears on the screen.

**Jog Shuttle &SELECT**
*Jog shuttle & SELECT* indicates selecting or setting parameters and entering values using the jog shuttle, the SELECT key, and other keys. For details on the procedure, see section 4.1 or 4.2 in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Units

| | | |
|---|---|---|
| k | Denotes 1000. | Example: 100 kS/s |
| K | Denotes 1024. | Example: 459 KB (file data size) |

# Contents

# 1.1 Overview of the I²C Bus Signal Analysis Function

## About the I²C Bus Signal Analysis Function

I²C Bus is an abbreviation for Integrated Circuit Bus. It is a bidirectional bus for connecting ICs. By using this function, you will be able to analyze data while displaying the I²C-bus signal waveform. The I²C Bus Signal Analysis Function consists of the following three main functions.

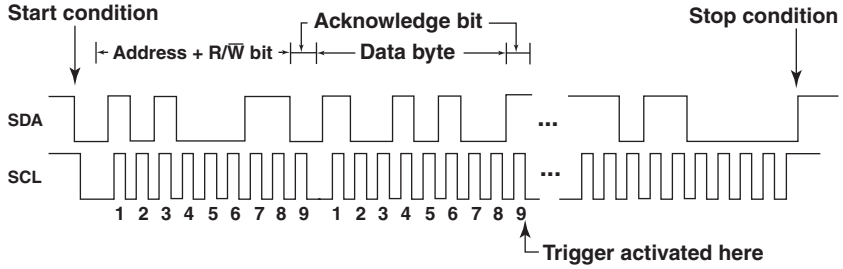
### Trigger Function <See page 1-4 for the operating procedure>

Various trigger conditions for the I²C Bus signal can be set up such as when a start condition is detected, when an Acknowledge bit is not detected, when the specified address (7 bits + R/$\overline{W}$) pattern is met, or when the data pattern is met or not met (Non-Ack trigger or address & data trigger).

Triggers can also be activated by combining the I²C Bus signal (SCL signal (CH1)/SDA signal (CH2) and the CH3 to CH8 signal (CH3 and CH4 on the DL7440) (combination trigger).

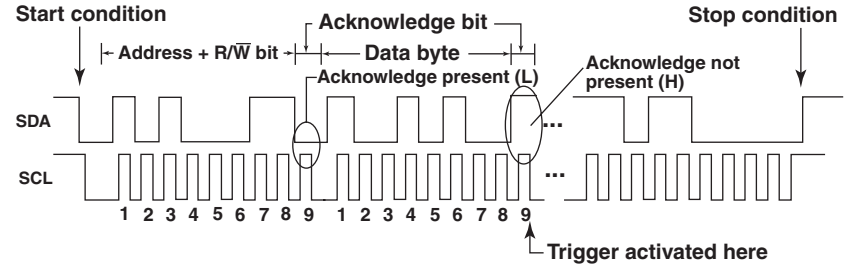
**Address & Data Trigger Example**

**• When Activating a Trigger on the Start Condition or Address Pattern/Data Pattern**




**Non-ACK Trigger Example**

**• When Activating a Trigger When the Acknowledge Bit Is Not Present (When the SDA Signal is high)**




### Analysis Function <See page 1-25 for the operating procedure>

Analyzes the I²C Bus signal that was acquired using the trigger function and lists the analysis data (hexadecimal notation) at the byte level and the status of the Acknowledge bit. When you select any analysis data on this analysis result list, the I²C Bus signal waveform corresponding to the analysis data is automatically displayed. You can view the details of the analysis result such as the position of the start condition/stop condition or the time from the analysis reference point on the detailed analysis list. You can save the detailed analysis list on a storage medium in ASCII format.

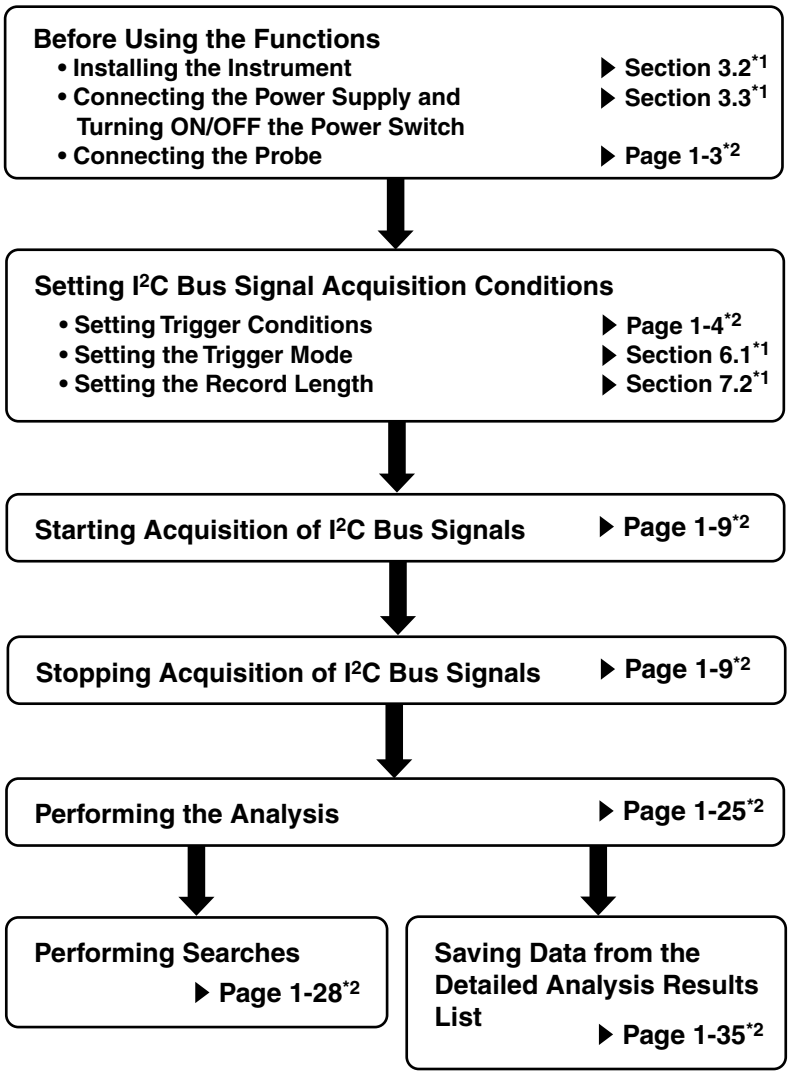
In addition, you can analyze the data by switching between two sets of I²C Bus signals (CH1: SCL and CH2: SDA or CH3: SCL and CH4: SDA).

### Search Function <See page 1-28 for the operating procedure>

After analyzing the I²C Bus signal that was acquired using the trigger function, this function searches in the forward or reverse direction for data that matches a specified address pattern, data pattern, or Acknowledge bit condition, and displays the matched data expanded on the ZOOM display. You can specify the address pattern or data pattern using binary or hexadecimal values. You can also search indefinite data.

# 1.2 Flow of Operation

The figure below provides an overview of the flow of operations when using the I²C Bus Signal Analysis Function. For details about specific items, see the referenced pages in this manual or the respective sections in the *DL7440/DL7480 User's Manual (IM701450-01E)*.




***1. Indicates reference sections from the DL7440/DL7480 user's manual (IM701450-01E).**
***2. Indicates reference pages from this manual.**

# 1.3 Connecting the Probe

## Input Terminals

Connect the probe (or other input cables such as the BNC cable) to any of the input terminals (4 terminals marked as CH1 to CH4 on the DL7440 and 8 terminals marked CH1 to CH8 on the DL7480) located on the lower section of the front panel. The input impedance is 1 MΩ±1.0% and approximately 20 pF or 50 Ω±1.0%.

**CAUTION**

- The maximum input voltage for 1-MΩ input is 400 V (DC + ACpeak) or 282 Vrms when the frequency is 1 kHz or less. Applying a voltage exceeding either of these voltages can damage the input section. If the frequency is above 1 kHz, the input section may be damaged even when the voltage is below the values specified above.
- The maximum input voltage for 50-Ω input is 5 Vrms or 10 Vpeak. Applying a voltage exceeding either of these voltages can damage the input section.

**DL7440**


**DL7480**


## Precautions to Be Taken When Connecting a Probe

- When activating triggers on the I²C Bus signal, apply the SCL (serial clock) signal and SDA (serial data ) signal to the CH1 and CH2 input terminals, respectively.
- When connecting a probe to the instrument for the first time, perform phase correction of the probe as described in section 3.5, “Compensating the Probe (Phase Correction)” in the *DL7440/DL7480 User’s Manual (IM701450-01E)*. Failure to do so may result in unstable gain across different frequencies, thereby preventing correct measurement. Calibration must be performed for each channel that is to be connected.
- Note that if the object being measured is directly connected to the instrument without using a probe, correct measurements may not be possible due to loading effects.

***Note***

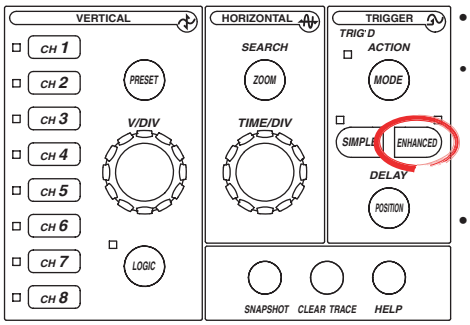
Data analysis and data search can be performed on I²C Bus signals applied to CH3 and CH4. For details, see section 1.5, “Analyzing/Searching Data.”

# 1.4 Setting the I²C Bus Signal Acquisition Conditions

I²C Bus signal is acquired using a certain condition* of the I²C Bus signal as a trigger condition.

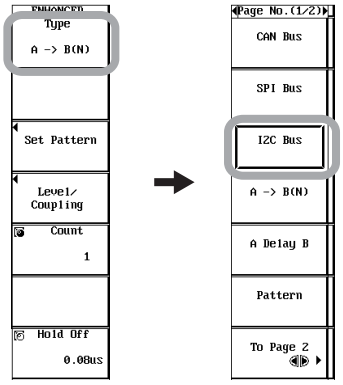
* When a start condition is detected, when an Acknowledge bit is not detected, when the specified address (7 bits + R/$\overline{W}$) pattern is met, when the data pattern is met or not met, etc.

## *Procedure*



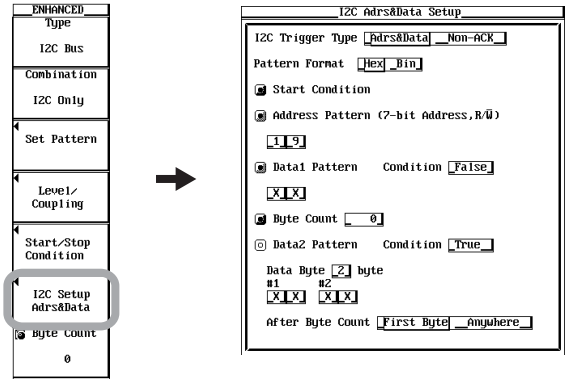

- To exit the menu during operation, press **ESC** located above the soft keys.
- In the procedural explanation below, the term *jog shuttle & SELECT* refers to the operation of selecting/setting items and entering values using the **jog shuttle**, **SELECT** and **RESET** keys. For details on the operation using the jog shuttle, SELECT, and RESET, see sections 4.1 or 4.2 in the DL7440/DL7480 User's Manual.
- For a description of the operation using a USB keyboard or a USB mouse, see section 4.3 in the DL7440/DL7480 User's Manual.

1. Press **ENHANCED**. The ENHANCED menu appears.
2. Press the **Type** soft key. The trigger type selection menu appears.
3. Press the **I²C Bus** soft key.




### Setting the Trigger Conditions of the I²C Bus Signal

4. Press the **I²C Setup** soft key. The I²C Setup dialog box opens.



To activate triggers on the start condition or address pattern/data pattern, proceed to step 5 below. To activate triggers when an Acknowledge bit is not detected (Non-Ack trigger), proceed to step 16 on the next page.

**Activating Triggers on the;Start Condition or Address Pattern/Data Pattern**

5. Use **jog shuttle & SELECT** to select Adrs&Data (I²C Trigger Type box).

- **Setting the Notation System of the Address Pattern or Data Pattern**

6. Use **jog shuttle & SELECT** to set the notation system used to set the pattern to Hex or Bin (Pattern Format box). The format used to set the Address Pattern box, Data1 Pattern box, and Data2 Pattern box are set to the specified notation system.

- **Selecting the Items Used as Trigger Conditions**

7. Use **job shuttle & SELECT** to select whether Start Condition, Address Pattern, Data1 Pattern, Byte Count, and Data2 Pattern are used as trigger conditions. If you select Address Patten, proceed to step 8. If you select Data1 Pattern, proceed to step 9. If you wish to set Byte Count, proceed to step 11. If you select Data2 Pattern, proceed to step 12.
   - Highlighting of the mark to the left of each item indicates that it is used as a trigger condition.
   - Start Condition and Byte Count items are always used as trigger conditions (the mark to the left is always highlighted).
   - If you do not wish to use byte count as a trigger condition, set Byte Count to 0 (see step 11).

- **When Using Address Pattern as a Trigger Condition**

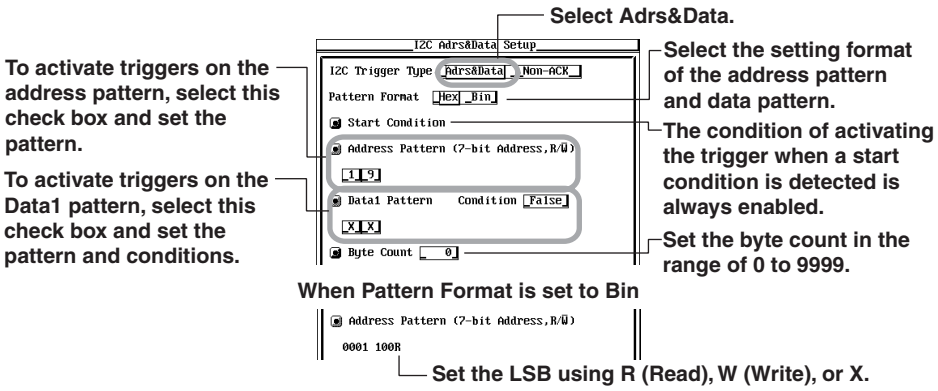
8. Use **jog shuttle & SELECT** to set the address pattern in hexadecimal or binary (Address Pattern box). When determination is not to be performed, select X.
   When using binary (BIN) notation, set the LSB using “R” (Read), “W” (Write), and “X.”

- **When Using Data1 Pattern as a Trigger Condition**

9. Use **jog shuttle & SELECT** to set the determination pattern of Data1 in hexadecimal or binary (Data1 Pattern box). When determination is not to be performed, select X.
10. Use **jog shuttle & SELECT** to set the Condition of the Data1 Pattern to True or False (Condition box).

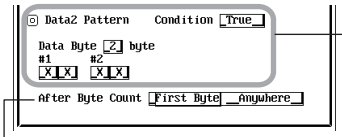
- **When Setting the Byte Count**

11. Use **jog shuttle & SELECT** to set the byte count in the range of 0 to 9999 bytes (Byte Count box).
    - If you do not wish to use byte count as a trigger condition, set the value to 0.
    - You can also set the byte count using the soft key that appears at the bottom of the ENHANCED menu (a menu that appears when you carry out steps 1 to 3 on the previous page). This byte count soft key menu appears only when I²C Trigger Type is set to Adrs&Data.



- **When Using Data2 Pattern as a Trigger Condition**

12. Use **jog shuttle & SELECT** to set the data length of the determination pattern of Data2 that is to be specified to 1 or 2 bytes (Data Byte box). The number of bytes displayed in the Data2 Pattern box is set to the number of bytes that matches the selected result.
13. Use **jog shuttle & SELECT** to set the determination pattern of Data2 in hexadecimal or binary (Data2 Pattern box). When determination is not to be performed, select X.
14. Use **jog shuttle & SELECT** to set the Condition of the Data2 Pattern to True or False (Condition box).
15. Use **jog shuttle & SELECT** to select whether to compare the Data2 Pattern to the pattern immediately after the byte count (First Byte) or continue to compare until the stop condition is detected (Anywhere) (After Byte Count box).




**To activate triggers on the Data2 pattern, select this check box and set the pattern and conditions. Set the byte count to 1 byte or 2 bytes.**

**Select whether to compare the Data2 pattern to the pattern immediately after the byte count or continue comparing until the stop condition is detected.**

Proceed to step 17.

**When Activating a Trigger When an Acknowledge Bit Is Not Detected (Non-Ack Trigger)**

16. Use **jog shuttle & SELECT** to select Non-ACK (I²C Trigger Type box).


**Select Non-ACK.**

17. Press **ESC**. The Detail dialog box closes.

## Setting the Start Condition or Stop Condition

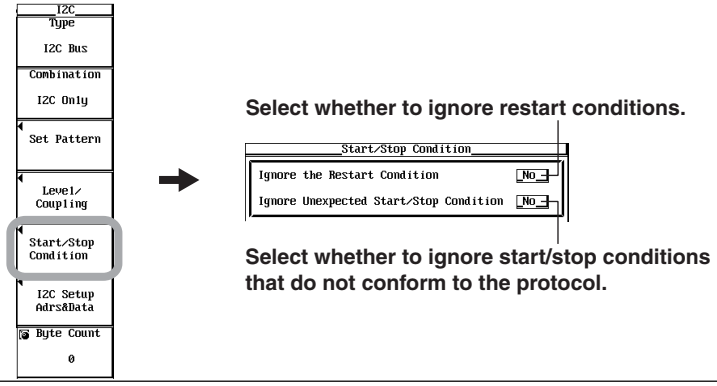
18. Press the **Start/Stop Condition** soft key. The Start/Stop Condition dialog box opens.

**Setting Whether to Ignore Restart Conditions**

19. Use **jog shuttle & SELECT** to select whether to ignore restart conditions (Ignore the Restart Condition box).

**Setting Whether to Ignore Start/Stop Conditions That Do Not Conform to the Protocol**

20. Use **jog shuttle & SELECT** to select whether to ignore start/stop conditions that do not conform to the protocol (Ignore Unexpected Start/Stop Condition box).
21. Press **ESC**. The Start/Stop Condition dialog box closes.



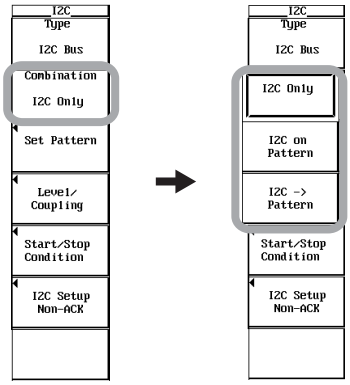

**Select whether to ignore restart conditions.**

**Select whether to ignore start/stop conditions that do not conform to the protocol.**

### Setting the Combination Trigger

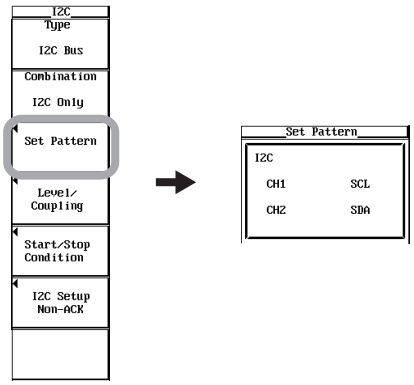
22. Press the **Combination** soft key. The Combination menu appears.
23. Press the **I²C Only**, **I²C on Pattern**, or **I²C -> Pattern** soft key.

    Select I²C Only to activate a trigger only on the trigger conditions of the I²C Bus signal. Select I²C on Pattern to activate a trigger when the trigger conditions of the I²C Bus signal are met while the trigger conditions of CH3 to CH8 (CH3 and CH4 on the DL7440) are met. Select I²C -> Pattern to activate a trigger when the trigger conditions of CH3 to CH8 (CH3 and CH4 on the DL7440) are met after the trigger conditions of the I²C Bus signal are met.




#### When I²C Only Is Selected

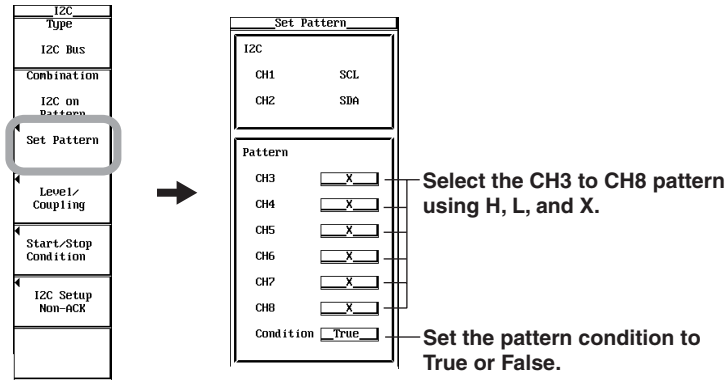
24. Press the **Set Pattern** soft key. The Set Pattern dialog box displays the assignment conditions of the I²C Bus signal of CH1 and CH2.




25. Press **ESC**. The Set Pattern dialog box closes.
    Proceed to step 29.

**When I²C On Pattern Is Selected**

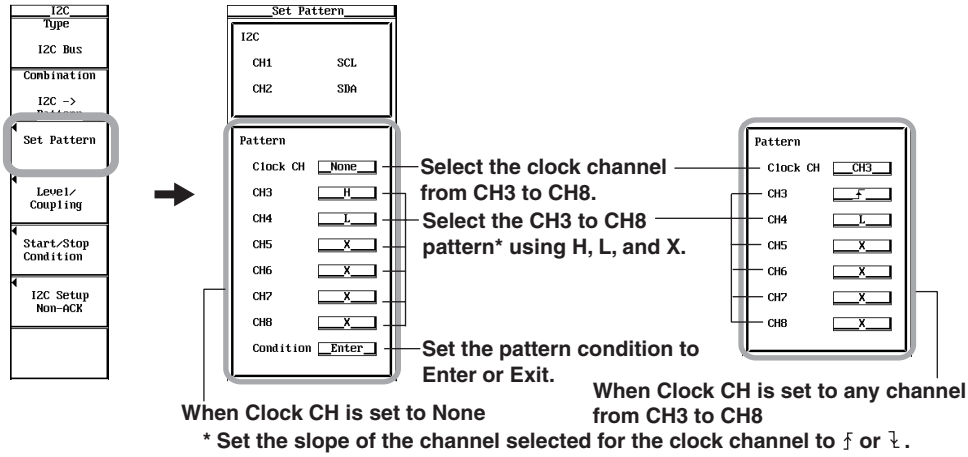
24. Press the **Set Pattern** soft key. The Set Pattern dialog box displays the assignment conditions of the I²C Bus signal of CH1 and CH2 and the setup screen for the patterns of CH3 to CH8 (CH3 and CH4 on the DL7440).
25. Use **jog shuttle & SELECT** to set the patterns of CH3 to CH8 (CH3 and CH4 on the DL7440) using H (high), L (low), and X.
26. Use **jog shuttle & SELECT** to set the pattern condition to True or False (Condition box).




27. Press **ESC**. The Set Pattern dialog box closes.
Proceed to step 29.

**When I²C -> Pattern Is Selected**

24. Press the **Set Pattern** soft key. The Set Pattern dialog box displays the assignment conditions of the I²C Bus signal of CH1 and CH2 and the setup screen for the patterns of CH3 to CH8 (CH3 and CH4 on the DL7440).
25. Use **jog shuttle & SELECT** to set the clock channel to None or any of the channels from CH3 to CH8 (CH3 and CH4 on the DL7440) (Clock CH box).
26. Use **jog shuttle & SELECT** to set the patterns of CH3 to CH8 (CH3 and CH4 on the DL7440) using H (high), L (low), and X. For the channel set as the clock channel in step 25, set the slope to ⎍ (rising edge) or ⎎ (falling edge).
27. If you set the clock channel to None in step 25, use **jog shuttle & SELECT** to set the pattern condition to Enter or Exit (Condition box).



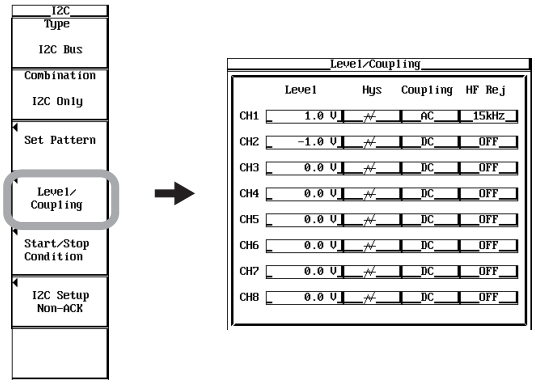

28. Press **ESC**. The Set Pattern dialog box closes.
Proceed to step 29.

***Note***

If you set Combination to I²C -> Pattern and set the patterns of CH3 to CH8 (CH3 and CH4 on the DL7440) to all Xs, triggers will not be activated. If the clock channel is set to any of the channels from CH3 to CH8 (CH3 and CH4 on the DL7440), the pattern conditions of other channels are always set to true.

### Setting the Trigger Level, Trigger Coupling, Etc.

29. Press the **Level/Coupling** soft key. The Level/Coupling dialog box opens.
30. Set the trigger level, trigger hysteresis, trigger coupling, and HF rejection of each channel. For the setup procedure, see steps 9 to 14 on page 6-16 in the *DL7440/DL7480 User's Manual (IM701450-01E)*.




31. Press **ESC**. The Level/Coupling dialog box closes.

### Setting the Trigger Mode

32. Set the trigger mode according to the procedures given in section 6.1, "Setting the Trigger Mode" in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Setting the Record Length

33. Set the record length according to the procedures given in section 7.2, "Setting the Record Length" in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Starting/Stopping the I²C Bus Signal Acquisition

34. Press **START/STOP** to start the I²C Bus signal acquisition. Triggers are activated on the specified trigger conditions.
    To proceed to the analysis, press **START/STOP** to stop the I²C Bus signal acquisition.

## *Explanation*

### Setting the Trigger Conditions of the I²C Bus Signal: I²C Setup

You can set the following conditions.

#### Trigger Type of the I²C Bus Signal: I²C Trigger Type

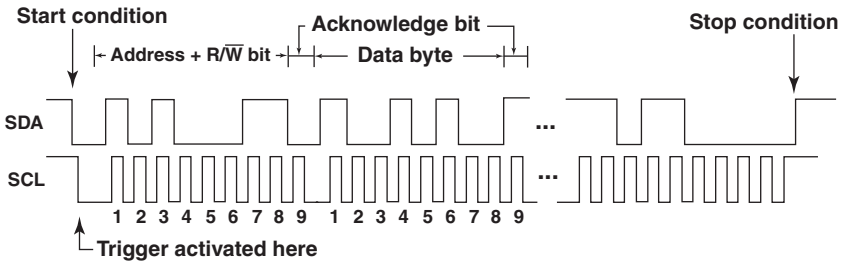
Select either of the following trigger types.

| | |
|---|---|
| Adrs&Data | When activating a trigger on the start condition or address pattern/data pattern (address & data trigger) |
| Non-ACK | When activating a trigger when an Acknowledge bit is not detected (Non-Ack trigger) |

- **Address & Data Trigger**

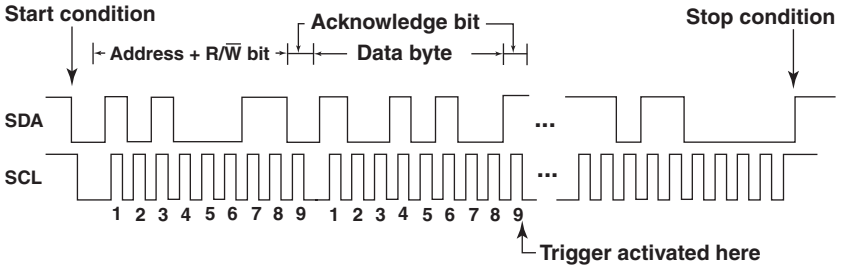
  **When activating a trigger when the start condition is detected**

  When the start condition is detected, a trigger is activated on the first rising edge of the SCL signal.




  **When Activating a Trigger on the Address Pattern/Data Pattern**

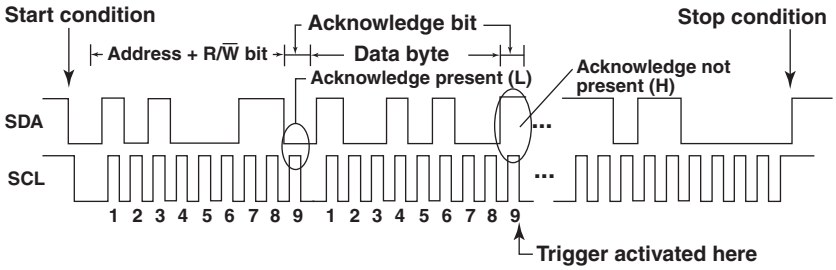
  When the data matches the specified address pattern or data pattern, a trigger is activated on the 9th falling edge of the SCL (clock) signal.




- **Non-ACK Trigger**

  **When Activating a Trigger When the Acknowledge Bit Is Not Present (When the SDA Signal is high)**

  When an Acknowledge bit is not detected, a trigger is activated on the 9th falling edge of the SCL (clock) signal.




***Note***

The Acknowledge bit of the start byte and Hs mode master code is not applicable.

If you set the trigger type to Adrs&Data, you can set the following items.

- **Pattern Format**
  Select the format of the address pattern and Data 1 Pattern/Data2 Pattern.

| | |
|---|---|
| Hex | Hexadecimal |
| Bin | Binary |

- **Address Pattern**
  Set the 7-bit address and R (read)/$\overline{W}$ (write). A trigger is activated when the specified address pattern and R/$\overline{W}$ match.

- **Data1 Pattern**
  Set the 8-bit data pattern. The data that is compared is the single byte immediately after the address.
  Select the pattern condition from below.

| | |
|---|---|
| True | A trigger is activated when Data1 Pattern is met. |
| False | A trigger is activated when Data1 Pattern is not met. |

- **Byte Count**
  Set the byte count in the range of 0 to 9999 bytes. If you do not wish to use byte count as a trigger condition, set the value to 0. You can also set the byte count from the ENHANCED menu.

- **Data2 Pattern**
  Set the 1-byte (8-bit) or 2-byte (16-bit) data. You can set the number of bytes in the Data Byte box.
  Select the pattern condition from below.

| | |
|---|---|
| True | A trigger is activated when Data2 Pattern is met. |
| False | A trigger is activated when Data2 Pattern is not met. |

  In addition, select the location of the byte data to be compared against Data2 Pattern.

| | |
|---|---|
| First Byte | Compares the byte data immediately after the byte count. |
| Anywhere | Compares from the byte data immediately after the byte count until the condition is met. |

***Note***

For address pattern and Data1 Pattern/Data2 Pattern, if there is at least one “X” bit in a group of four bits in the binary display, the corresponding hexadecimal display will show an “$.”

## Setting the Start/Stop Condition

You can set the following conditions.

### Setting Whether to Ignore Restart Conditions

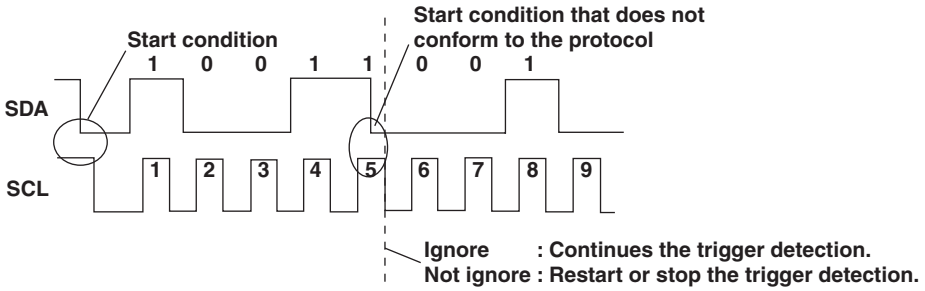
You can select whether to ignore the Restart condition that occurs after starting the trigger detection upon detecting the Start condition.

| | |
|---|---|
| Yes | Ignores the restart condition and continues with the trigger detection. |
| No | Restarts the trigger detection when a restart condition is detected. |

### Setting Whether to Ignore Start/Stop Conditions That Do Not Conform to the Protocol

You can select whether to ignore the start or stop condition that occurs in the middle of the address or data bit while detecting the trigger.

| | |
|---|---|
| Yes | Ignores the start/stop condition and continues with the trigger detection. |
| No | Restarts or stops the trigger detection when a start/stop condition is detected. |

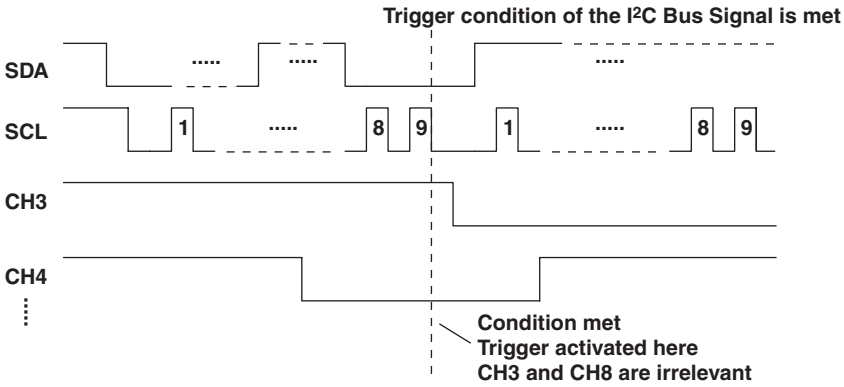



## Setting the Combination Trigger

A trigger can be activated on the combination of the trigger conditions of the I²C Bus signal and the trigger conditions of CH3 to CH8 (CH3 and CH4 on the DL7440).You can select from the following three types.

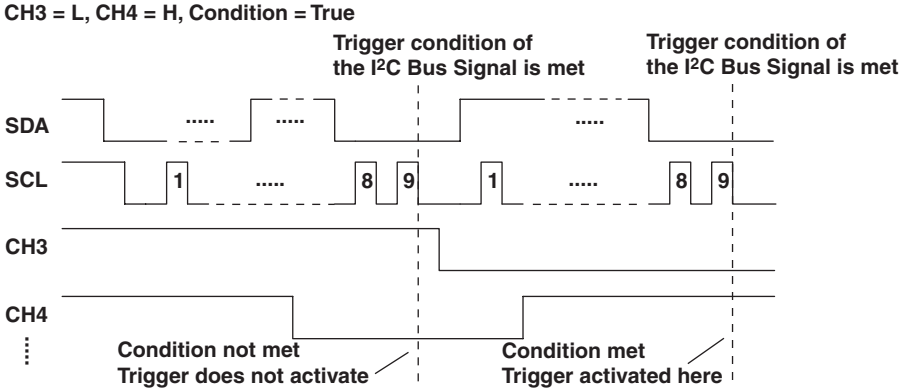
### I²C Only

Activates a trigger only on the SCL/SDA signal (trigger conditions of the I²C Bus).



### I²C on Pattern

Activates a trigger on the SCL/SDA signal and the patterns of CH3 to CH8 (CH3 and CH4 on the DL7440). A trigger is activated only when the trigger conditions of the I²C Bus are met while the trigger conditions of CH3 to CH8 (CH3 and CH4 on the DL7440) are met.




- **Patterns of CH3 to CH8 (CH3 and CH4 on the DL7440)**

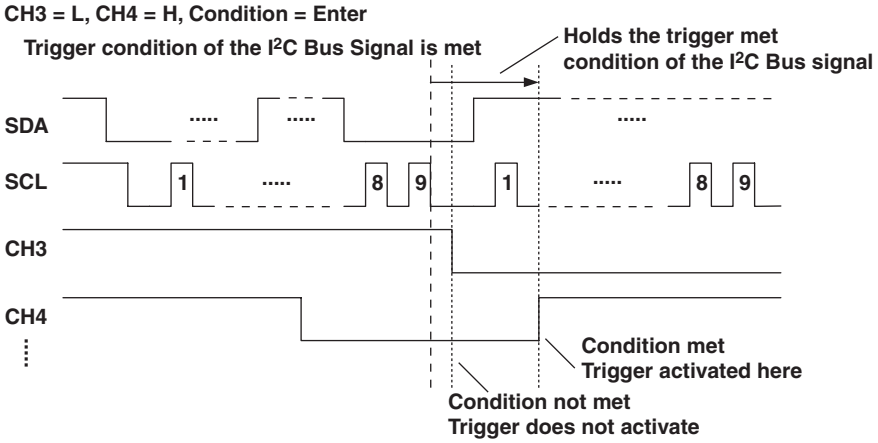
| | |
|---|---|
| H | The trigger source level is above the preset trigger level. |
| L | The trigger source level is below the preset trigger level. |
| X | Not used as a trigger source. |

- **Pattern Condition**

| | |
|---|---|
| True | A trigger is activated when the specified pattern of CH3 to CH8 (CH3 and CH4 on the DL7440) is met. |
| False | A trigger is activated when the specified pattern of CH3 to CH8 (CH3 and CH4 on the DL7440) is no longer met. |

### I²C -> Pattern

Activates a trigger on the SCL/SDA signal and the preset patterns of CH3 to CH8 (CH3 and CH4 on the DL7440). The SCL/SDA trigger met condition is held until the trigger conditions of CH3 to CH8 (CH3 and CH4 on the DL7440) are met.




- **Clock Channel**
  You can set a clock channel from CH3 to CH8 (CH3 and CH4 on the DL7440). If you do not wish to set a clock channel, select None.

- **Patterns of CH3 to CH8 (CH3 and CH4 on the DL7440)**

| | |
|---|---|
| H | The trigger source level is above the preset trigger level. |
| L | The trigger source level is below the preset trigger level. |
| X | Not used as a trigger source. |

For the channel set as the clock channel, set the slope to ⎍ (rising edge) or ⎎ (falling edge), not the pattern.

- **Pattern Condition**

You can set the pattern condition only when a clock channel is not specified. Select from the following:

| | |
|---|---|
| Enter | A trigger is activated when the specified pattern of CH3 to CH8 (CH3 and CH4 on the DL7440) is met. |
| Exit | A trigger is activated when the specified pattern of CH3 to CH8 (CH3 and CH4 on the DL7440) is no longer met. |

If you set the clock channel to any of the channels from CH3 to CH8 (CH3 and CH4 on the DL7440), the pattern condition is set to true.

### Setting the Trigger Level, Trigger Coupling, Etc.: Level/Coupling

Set the trigger level, hysteresis, trigger coupling, and HF rejection of each channel.
For details on the trigger level, hysteresis, trigger coupling, and HF rejection, see page 6-17 in section 6.8, “Setting the A->B(N) Trigger (ENHANCED)” in the *DL7440/DL7480 User’s Manual (IM701450-01E)*.

### Setting the Trigger Mode

Set the conditions for updating the displayed waveforms as a trigger mode. There are five trigger modes: auto mode, auto level mode, normal mode, single mode, and single (N) mode.
For details on the trigger modes, see section 6.1, “Selecting the Trigger Mode” in the *DL7440/DL7480 User’s Manual (IM701450-01E)*.

### Setting the Record Length

The record length sets the amount of data to be written into the acquisition memory. The selectable maximum record length varies depending on the model.

| |
|---|
| 16 MW memory model (701460 and 701480)<br>1 k, 10 k, 50 k, 100 k, 250 k, 500 k, 1 M, 2 M, 4 M, 8 M (, 16 M) |
| 4 MW memory model (701450 and 701470)<br>1 k, 10 k, 50 k, 100 k, 250 k, 500 k, 1 M, 2 M (, 4 M) |

* The value inside the parentheses is selectable only when interleave mode is ON.

For details on the record length, see section 7.2, “Setting the Record Length” in the *DL7440/DL7480 User’s Manual (IM701450-01E)*. For details on interleave mode, see section 7.3, “Using Interleave Mode.”

### Starting/Stopping the Acquisition of the I²C Bus Signal

When you start the acquisition of the I²C Bus signal, triggers are activated on the specified trigger conditions.
To proceed to the analysis, you stop the acquisition of the I²C Bus signal.

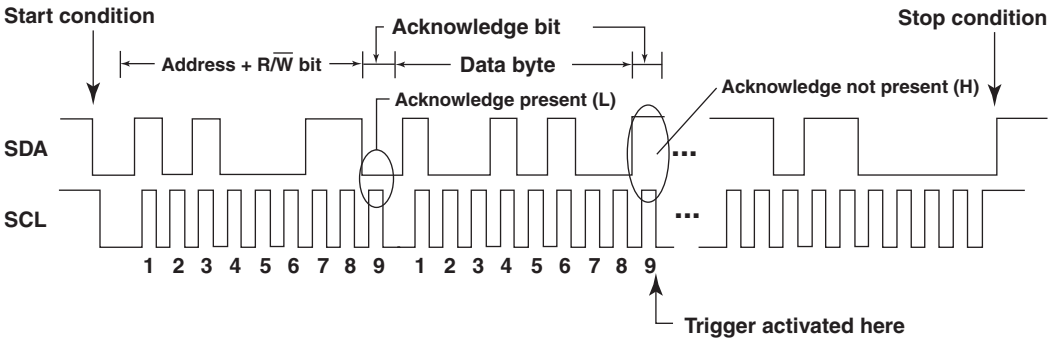
## Examples of Setting the Trigger Conditions of the I²C Bus Signal

This section will indicate the data sequence in bytes (hexadecimal notation) and indicate the position where the trigger will occur. The symbols used in the figures are as follows:

| | |
|---|---|
| S: | Start condition |
| Sr: | Restart condition |
| P: | Stop condition |
| Shaded area: | Byte pattern to be compared |

### Non-ACK Trigger

A trigger is activated when the Acknowledge bit is not present (when the SDA signal is set to "H").




***Note***

The Non-Ack trigger does not apply to start byte and Hs mode master code.

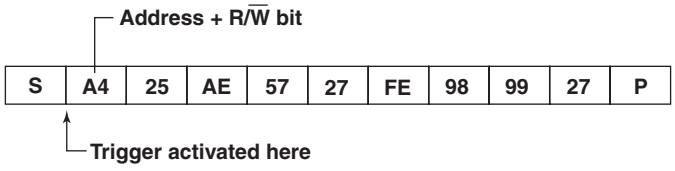
### Address & Data Trigger

- **Activate a Trigger Only on the Start Condition**

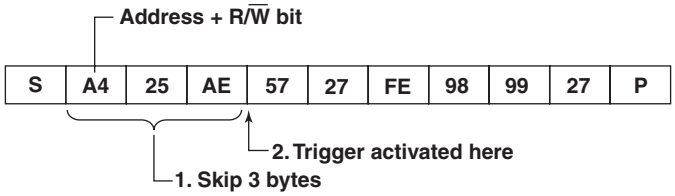
  **Trigger Condition**

| | |
|---|---|
| Address Pattern: | Not applicable |
| Data 1 Pattern: | Not applicable |
| Condition: | True |
| Data 2 Pattern: | Not applicable |
| Condition: | True |
| Ignore the Restart Condition: | No |
| Ignore Unexpected Start/Stop Condition: | No |

**<Byte Count=0>**




**<Byte Count=3>**

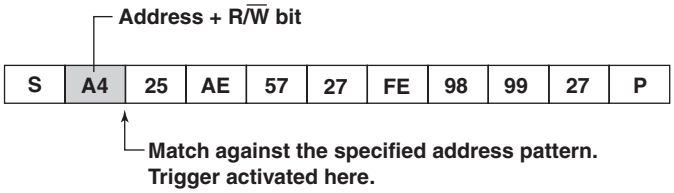


- **Activate a Trigger Only on the Address Pattern**

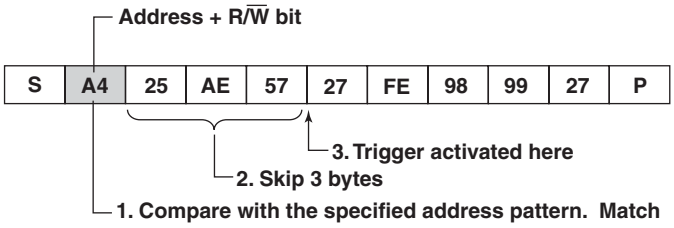
  **Trigger Condition**

| | | |
|---|---|---|
| Address Pattern: | | A4 |
| Data1 | Pattern: | Not applicable |
| | Condition: | True |
| Data2 | Pattern: | Not applicable |
| | Condition: | True |
| Ignore the Restart Condition: | | No |
| Ignore Unexpected Start/Stop Condition: | | No |

**<Byte Count=0>**




**<Byte Count=3>**

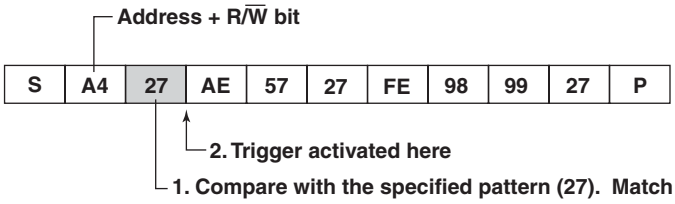



- **Activate a Trigger Only on the Data1 Pattern**

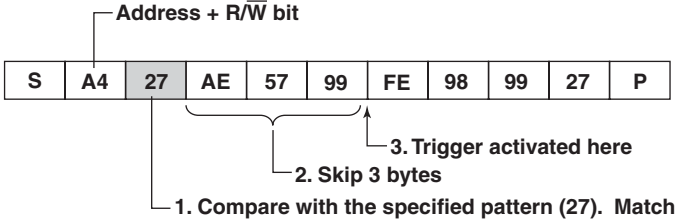
  **Trigger Condition**

| | | |
|---|---|---|
| Address Pattern: | | Not applicable |
| Data1 | Pattern: | 27 |
| | Condition: | True |
| Data2 | Pattern: | Not applicable |
| | Condition: | True |
| Ignore the Restart Condition: | | No |
| Ignore Unexpected Start/Stop Condition: | | No |

**<Byte Count=0>**




**<Byte Count=3>**

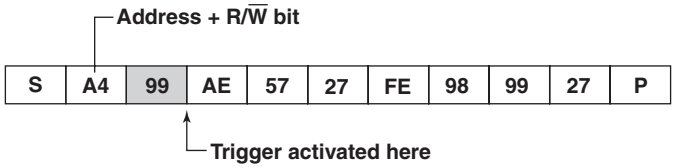


- **Activate a Trigger Only on the Data2 Pattern**

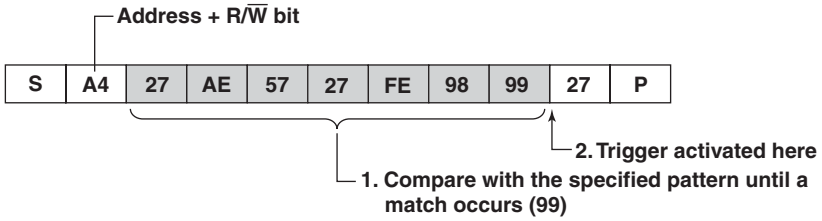
  **Trigger Condition**

  | | | |
  |---|---|---|
  | Address Pattern: | | Not applicable |
  | Data1 | Pattern: | Not applicable |
  | | Condition: | True |
  | Data2 | Pattern: | 99 |
  | | Data Byte: | 1 |
  | | Condition: | True |
  | Ignore the Restart Condition: | | No |
  | Ignore Unexpected Start/Stop Condition: | | No |

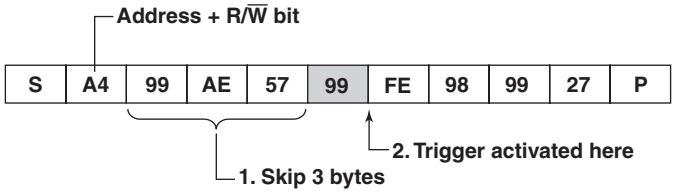
  **<Byte Count=0, Data2 After Byte Count=First Byte>**



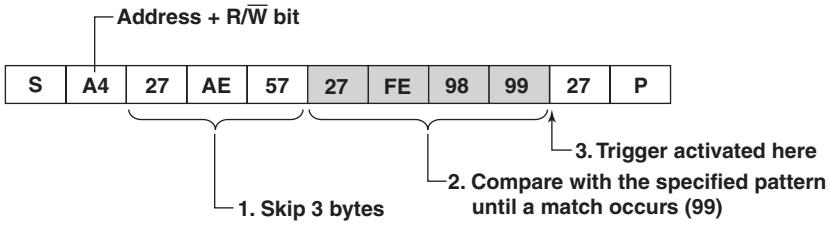

  **<Byte Count=0, Data2 After Byte Count=Anywhere>**




  **<Byte Count=3, Data2 After Byte Count=First Byte>**



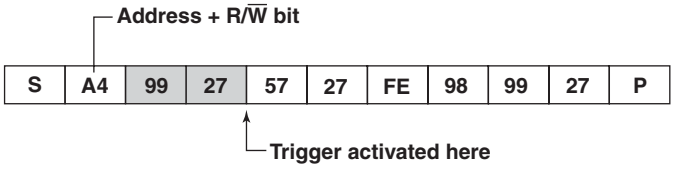

  **<Byte Count=3, Data2 After Byte Count=Anywhere>**



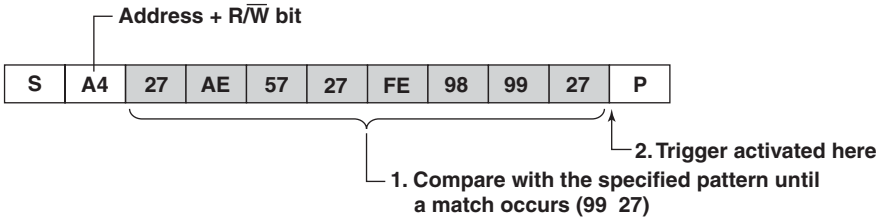
**Trigger Condition**

| | | |
|---|---|---|
| Address Pattern: | | Not applicable |
| Data1 | Pattern: | Not applicable |
| | Condition: | True |
| Data2 | Pattern: | 99 27 |
| | Data Byte: | 2 |
| | Condition: | True |
| Ignore the Restart Condition: | | No |
| Ignore Unexpected Start/Stop Condition: | | No |

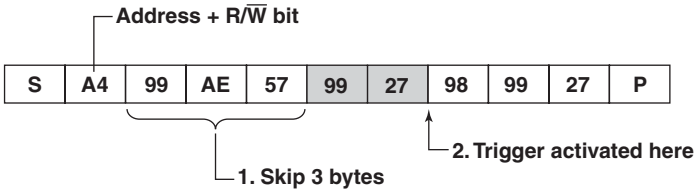
**<Byte Count=0, Data2 After Byte Count=First Byte>**



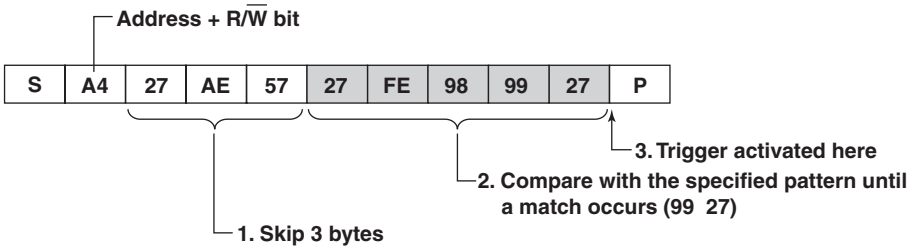

**<Byte Count=0, Data2 After Byte Count=Anywhere>**




**<Byte Count=3, Data2 After Byte Count=First Byte>**



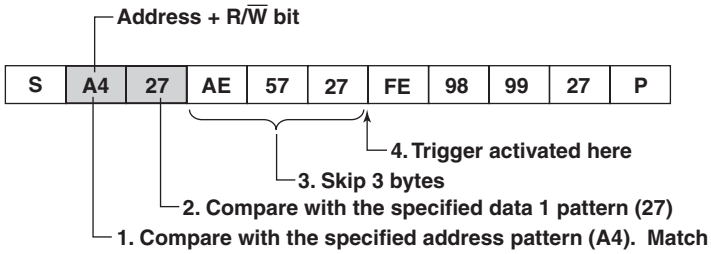

**<Byte Count=3, Data2 After Byte Count=Anywhere>**



- **Combination of Address Pattern, Data1 Pattern, and Byte Count Trigger**

  **Trigger Condition**

  Address Pattern: A4
  Data1 Pattern: 27
  Condition: True
  Data2 Pattern: Not applicable
  Condition: True
  Ignore the Restart Condition: No
  Ignore Unexpected Start/Stop Condition: No
  Byte Count: 3

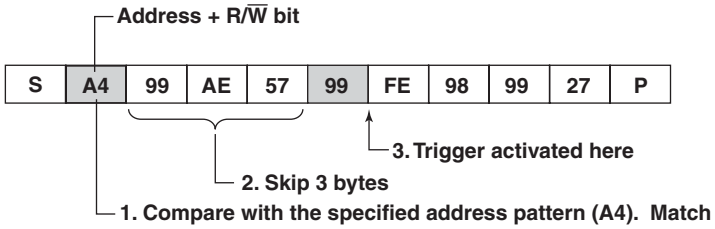



- **Combination of Address Pattern, Data2 Pattern, and Byte Count Trigger**

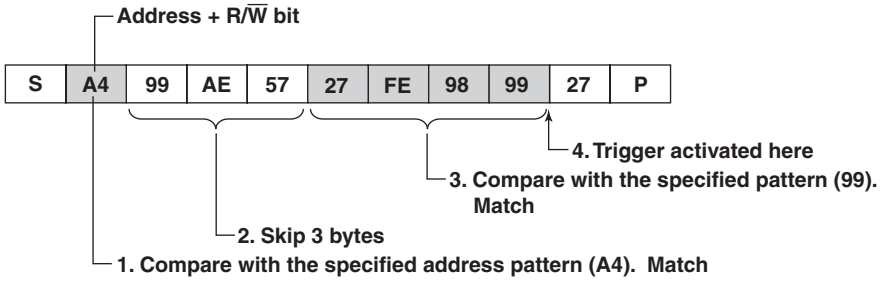
  **Trigger Condition**

  Address Pattern: A4
  Data1 Pattern: Not applicable
  Condition: True
  Data2 Pattern: 99
  Data Byte: 1
  (Date Byte: compare 2 bytes when set to 2 bytes)
  Condition: True
  Ignore the Restart Condition: No
  Ignore Unexpected Start/Stop Condition: No
  Byte Count: 3

**<After Byte Count=First Byte>**




**<After Byte Count=Anywhere>**

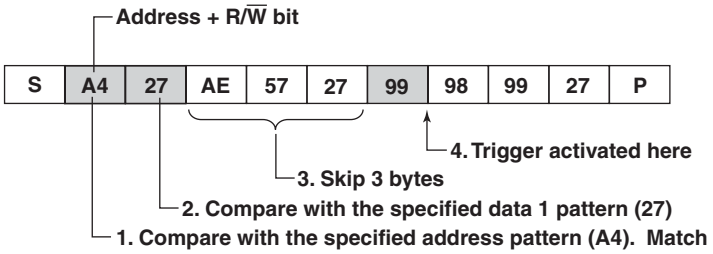


- **Combination of Address Pattern, Data1 Pattern, Data2 Pattern, and Byte Count Trigger**

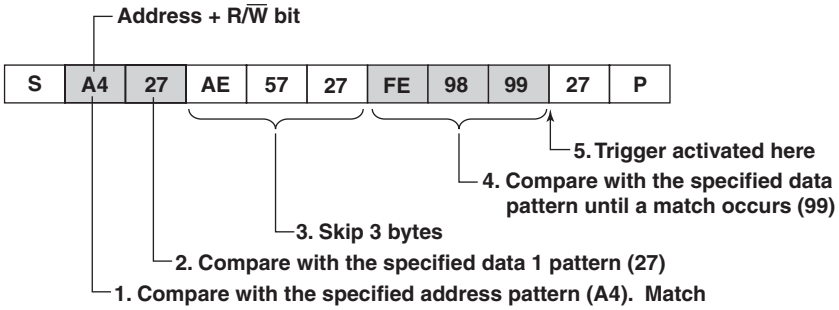
  **Trigger Condition**

  Address Pattern: A4
  Data1 Pattern: 27
  Condition: True
  Data2 Pattern: 99
  Data Byte: 1
  (Date Byte: compare 2 bytes when set to 2 bytes)
  Condition: True
  Ignore the Restart Condition: No
  Ignore Unexpected Start/Stop Condition: No
  Byte Count: 3

  **<After Byte Count=First Byte>**




  **<After Byte Count=Anywhere>**

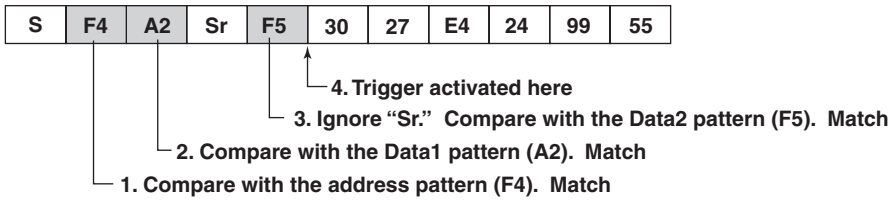


- **Ignore/Not Ignore the Restart Condition**

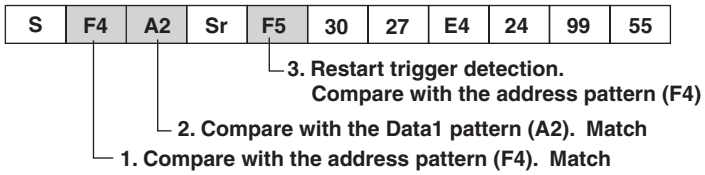
  **Trigger Condition**

  Address Pattern: F4
  Data1 Pattern: A2
  Coditon: True
  Data2 Pattern: F5
  Data Byte: 1
  Condition: True
  After Byte Count: Anywhere
  Ignore Unexpected Start/Stop Condition: No

  **<When Ignore the Restart Condition=Yes>**



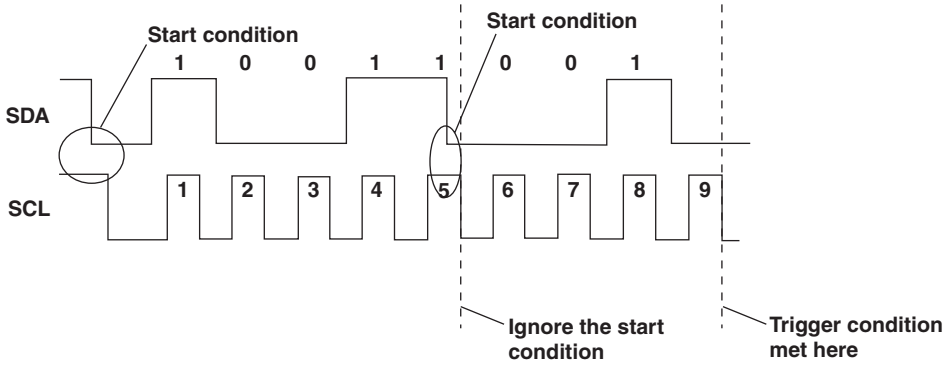

  **<When Ignore the Restart Condition=No>**



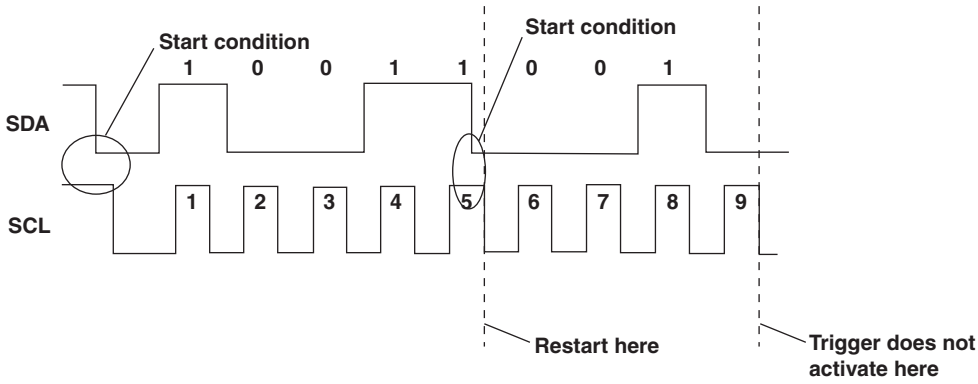
- **Ignore/Not Ignore Start/Stop Conditions That Do Not Conform to the Protocol Trigger Condition**

  Address Pattern: 99
  Data1 Pattern: Not applicable
  Condition: True
  Data2 Pattern: Not applicable
  Condition: True
  Ignore the Restart Condition: No

**<When Ignore Unexpected Start/Stop Condition=Yes>**

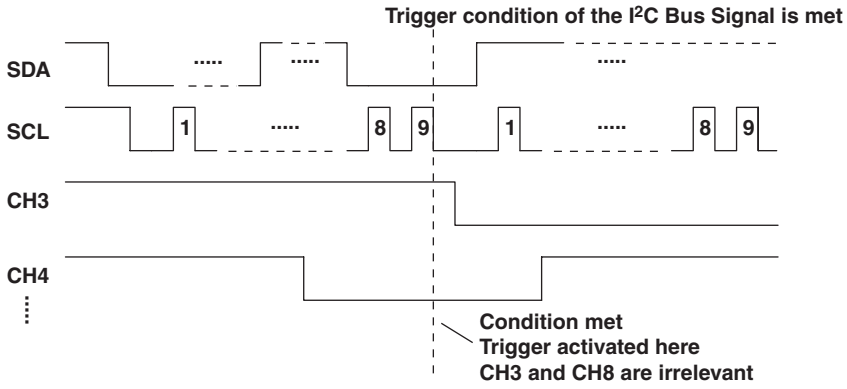



**<When Ignore Unexpected Start/Stop Condition=No>**



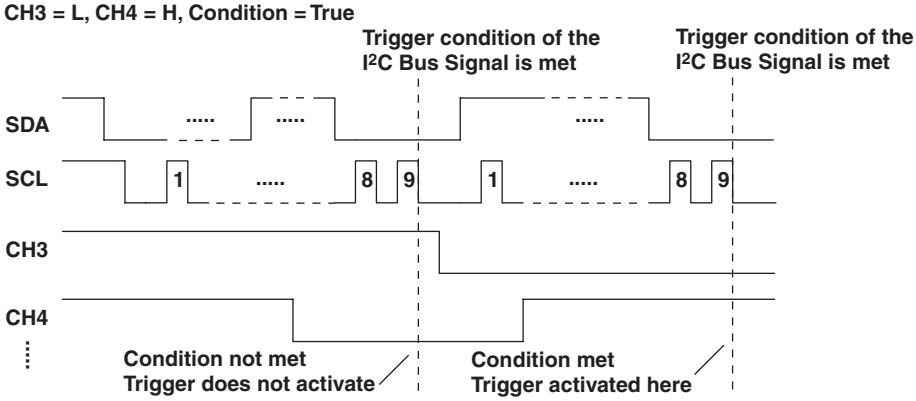
**Combination Trigger**

- **I²C Only**




- **I²C on Pattern**

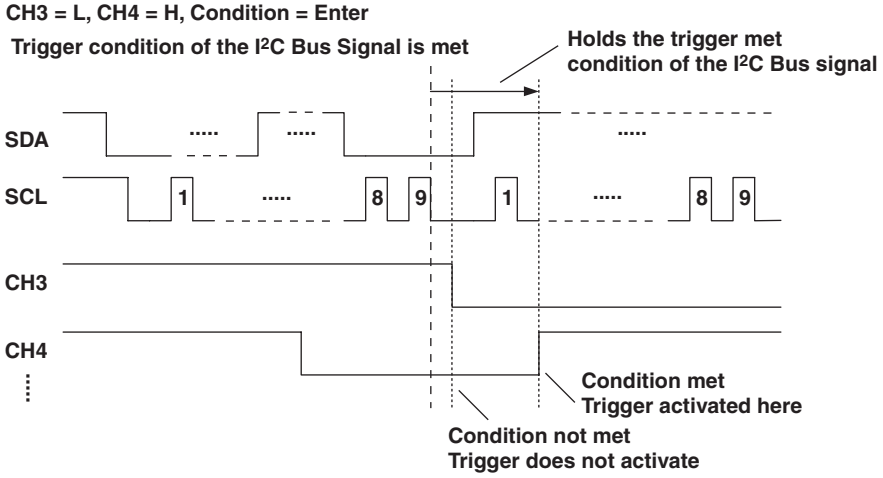
CH3 = L, CH4 = H, Condition = True



- **I²C -> Pattern**

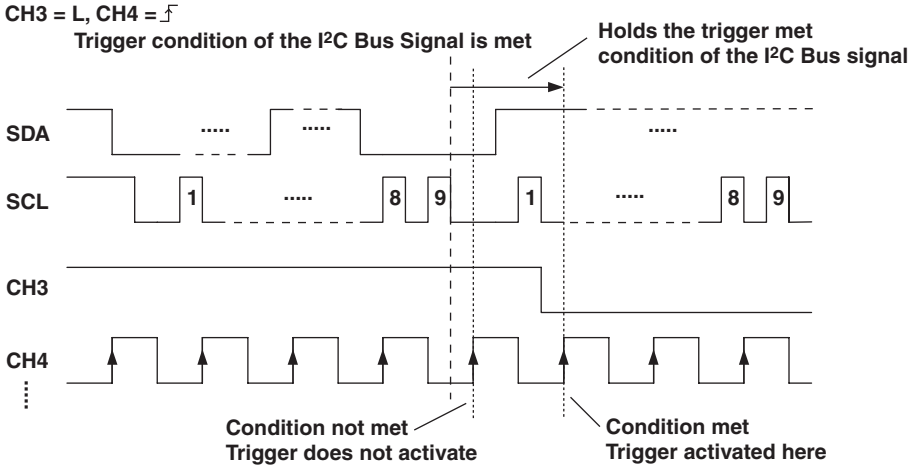
**When the Clock Channel Is Set to "None"**

**CH3 = L, CH4 = H, Condition = Enter**




**When the Clock Channel Is Set to "CH4"**

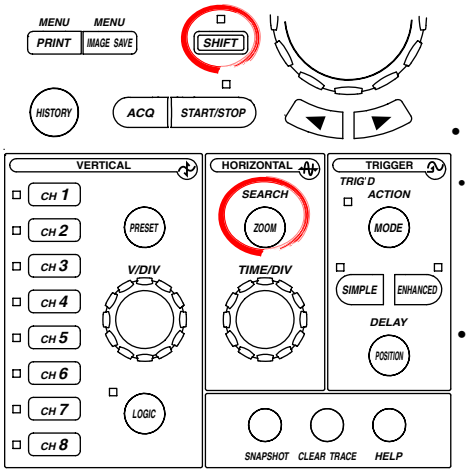
**CH3 = L, CH4 = ↓**



# 1.5 Analyzing/Searching Data

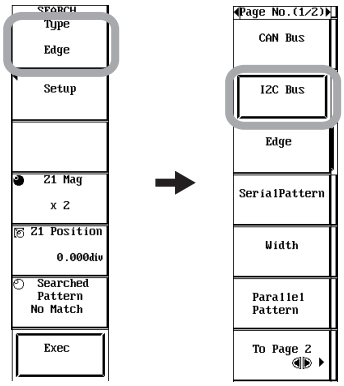
You can analyze the data of CH2 or CH4 by setting CH1 or CH3 to a clock channel. You can also search analysis data that matches a data pattern or an indefinite data condition. If analysis data that matches the specified condition is found, the zoom position moves to the corresponding section, and the waveform of the data that is found is displayed in the zoom waveform display frame.

## *Procedure*




- To exit the menu during operation, press **ESC** located above the soft keys.
- In the procedural explanation below, the term *jog shuttle & SELECT* refers to the operation of selecting/setting items and entering values using the **jog shuttle**, **SELECT** and **RESET** keys. For details on the operation using the jog shuttle, SELECT, and RESET, see sections 4.1 or 4.2 in the DL7440/DL7480 User's Manual.
- For a description of the operation using a USB keyboard or a USB mouse, see section 4.3 in the DL7440/DL7480 User's Manual.

1. Press **SHIFT+ZOOM (SEARCH)**. The SEARCH menu appears.
2. Press the **Type** soft key. The Type menu appears.
3. Press the **I²C Bus** soft key.



## Setting the Analysis Conditions

4. Press the **Analyze Setup** soft key. The Analyze Setup dialog box opens.

### Setting the Clock Channel

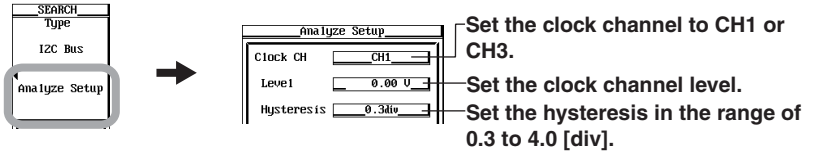
5. Use **job shuttle & SELECT** to set the clock channel to CH1 or CH3 (Clock CH box).

- **Setting the Level**

6. Use **jog shuttle & SELECT** to set the clock channel level (Level box).

- **Setting the Hysteresis**

7. Use **jog shuttle & SELECT** to set the hysteresis in the range of 0.3 to 4.0 [div] (Hysteresis box).



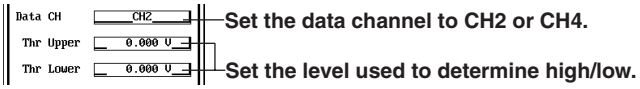

### Setting the Data Channel

8. Use **job shuttle & SELECT** to set the data channel to CH2 or CH4 (Data CH box).

   The clock channel and data channel settings are synchronized. If you set the clock channel to CH1, the data channel is set to CH2; if you set the clock channel to CH3, the data channel is set to CH4.

- **Setting the Threshold Level**

9. Use **jog shuttle & SELECT** to set the level used to determine a high level signal (Thr Upper box).
10. Likewise, use **jog shuttle & SELECT** to set the level used to determine a low level signal (Thr Lower box).




### Setting the Analysis Reference Point

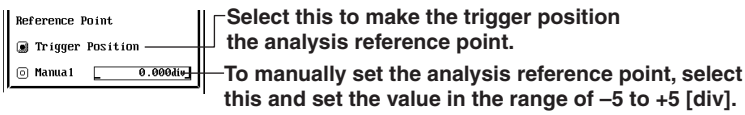
11. Use **jog shuttle & SELECT** to select the method of setting the analysis reference point: Trigger Position or Manual.

    Highlighting of the mark to the left of each item indicates that it is used as an analysis reference point.

- **When Manually Setting the Analysis Reference Point**

12. Use **jog shuttle & SELECT** to set the analysis reference point in the range of –5 to +5 [div] (Manual box).

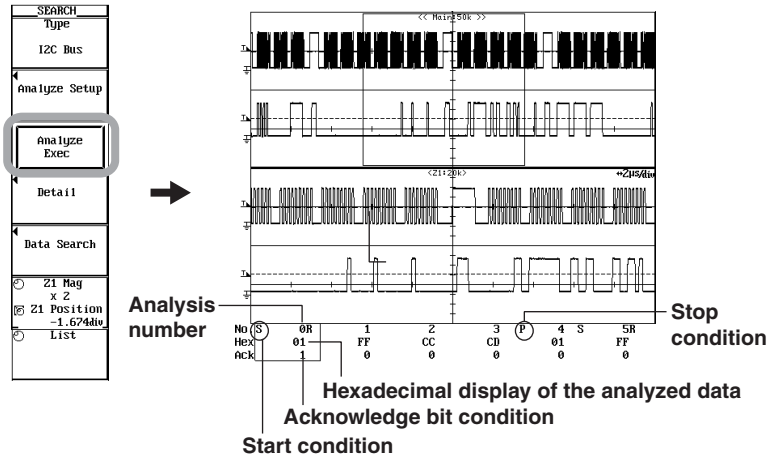
    When setting the analysis reference point manually, you can enable the translucent display. This allows you to set the analysis reference point while viewing the displayed waveform. For details on the translucent display, see section 8.10, “Turning ON/OFF the Translucent Display” in the *DL7440/DL7480 User’s Manual (IM701450-01E)*.




13. Press **ESC**. The Analyze Setup dialog box closes.

## Executing/Aborting the Analysis

14. Press the **Analyze Exec** soft key. The data analysis is executed.
    The words Analyze Exec change to Analyze Abort.
    To abort the data analysis, press the **Analyze Abort** soft key. The data analysis is aborted, and the words Analyze Abort change to Analyze Exec.
    If indefinite data exists in the analysis data, "∗" is attached to the corresponding analysis data.




## Displaying the Analysis Data

### Scrolling the List

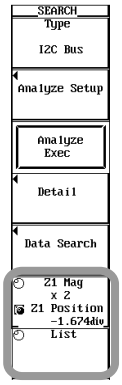
15. Press the **List** soft key.
16. Turn the **jog shuttle** to scroll the list left and right.
    Up to 6 analysis data points are displayed at once in the order of occurrence.
    By scrolling the list left and right using the **jog shuttle**, analysis data beyond 6 data points can be displayed.

### Setting the Zoom Ratio

17. Press the **Z1 Mag/Z1 Position** soft key to set the jog shuttle control to Z1 Mag.
18. Turn the **jog shuttle** to set the zoom ratio.

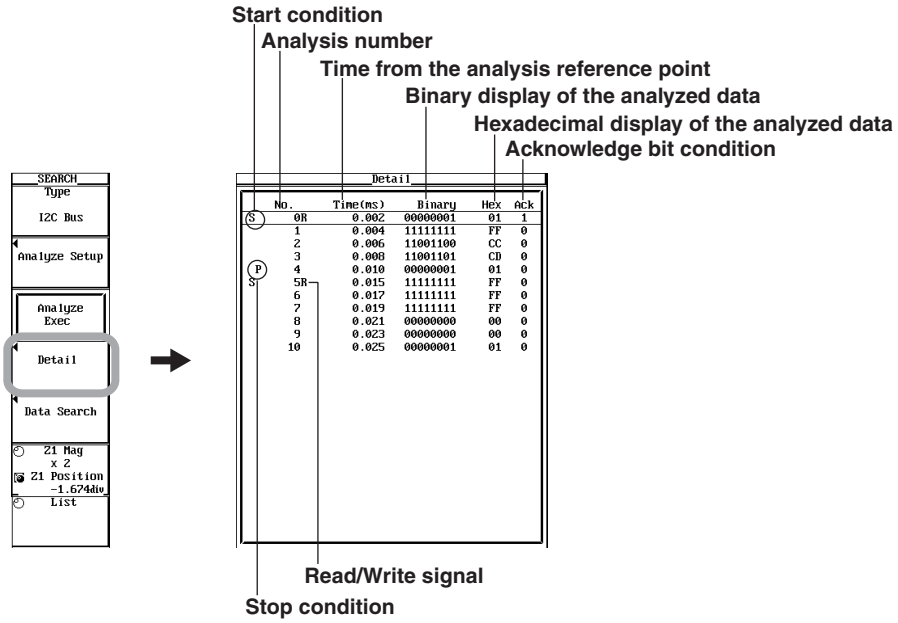
### Setting the Zoom Position

19. Press the **Z1 Mag/Z1 Position** soft key to set the jog shuttle control to Z1 Position.
20. Turn the **jog shuttle** to set the zoom position. When the center of the zoom box moves to the waveform corresponding to the analysis data on the list, the corresponding analysis data on the list is highlighted.



### Viewing the Details of the Analysis Data

21. Press the **Detail** soft key. A Detail dialog box opens. The analysis data of the same analysis number that is highlighted in the list in step 16 or step 20 is displayed highlighted.




22. Press **ESC**. The Detail dialog box closes.

***Note***

The detailed analysis list can be saved directly to an external storage medium in ASCII format (.txt extension). For details, see section 1.6, “Saving the Data of the Detailed Analysis List.”

## Setting the Search Condition

23. Press the **Data Search** soft key. The Data Search menu appears.
24. Press the **Search Setup** soft key. The Search Setup dialog box opens.

**Selecting the Search Type**

25. Use **jog shuttle & SELECT** to set the search type to Byte Pattern or Indefinite State (Type box).

    If you select Indefinite State, proceed to step 31.

26. If you set the search type to Byte Pattern, use the **jog shuttle & SELECT** to set the determination pattern to address pattern or data pattern.
    - Highlighting of the mark to the left of each item indicates that it is used as a determination pattern.
    - You can select the address pattern and data pattern simultaneously.

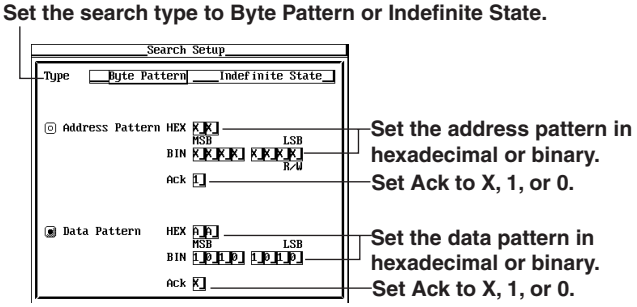
**Setting the Address Pattern**

27. Use the **job shuttle & SELECT** set the address pattern in hexadecimal (HEX) or binary (BIN) format (HEX box or BIN box). When determination is not to be performed, select X.
    - The HEX box and BIN box settings are synchronized.
    - When using binary (BIN) notation, set the LSB of the address pattern using “R” (Read), “W” (Write), and “X.”
28. Use **jog shuttle & SELECT** to set Ack to X, 1, or 0 (Ack box).

**Setting the Data Pattern**

29. Use the **job shuttle & SELECT** set the data pattern in hexadecimal (HEX) or binary (BIN) format (HEX box or BIN box). When determination is not to be performed, select X.

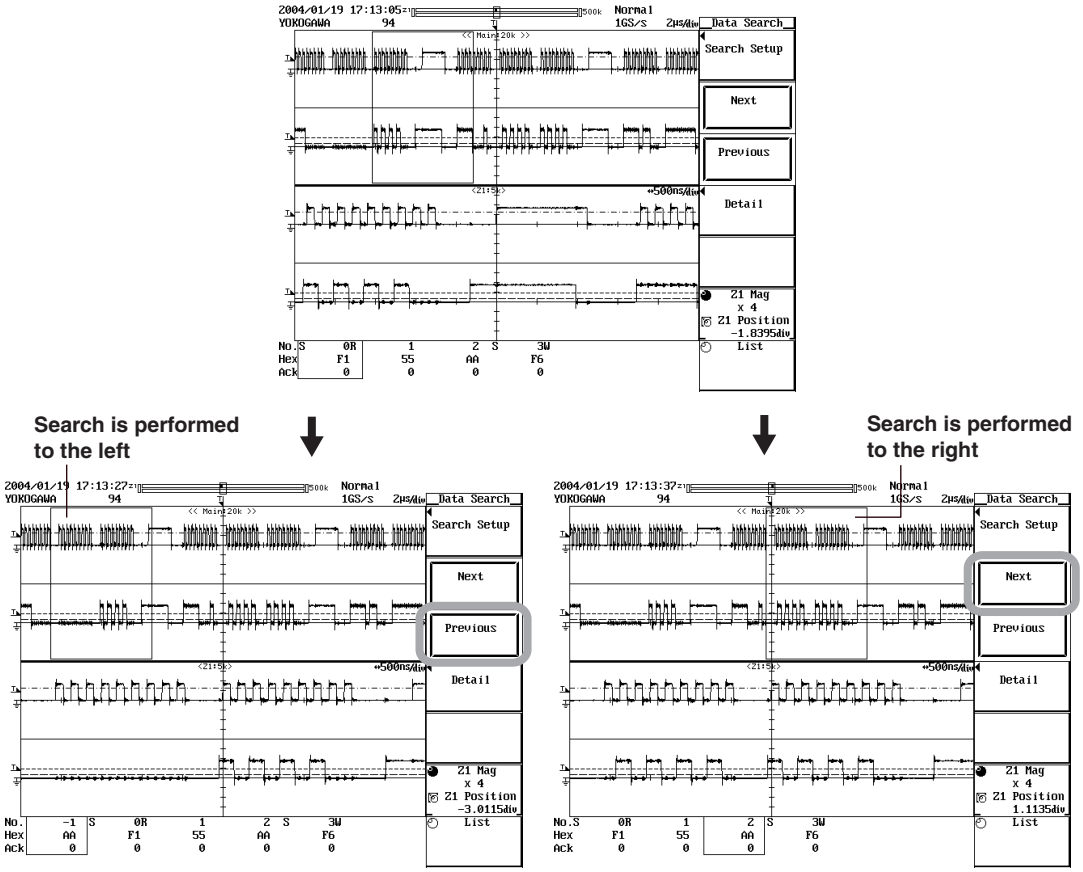
    The HEX box and BIN box settings are synchronized.
30. Use **jog shuttle & SELECT** to set Ack to X, 1, or 0.




31. Press **ESC**. The Search Setup dialog box closes.

## Executing the Search

32. Press the **Next** or **Previous** soft key. The search is executed.
    - When the data matches the determination pattern, the corresponding data (data that was found) is highlighted in the analysis data list at the bottom of the screen. The zoom box moves to the position so that the data that was found is at the center, and the zoomed waveform of the data that was found is displayed in the zoom waveform display area.
    - Pressing the Next soft key searches the data after the highlighted data (to the right) in the analysis data list at the bottom of the screen.
    - Pressing the Previous soft key searches the data before the highlighted data (to the left) in the analysis data list at the bottom of the screen.
    - If you selected Indefinite State (indefinite data) in step 26 and execute the search, indefinite data is highlighted.



## *Explanation*

### Setting the Analysis Conditions: Analyze Setup

You can set the following conditions.

#### Clock Channel

Set the clock channel to CH1 or CH3. If you set the clock channel to CH1, the data channel is set to CH2; if you set the clock channel to CH3, the data channel is set to CH4.

- **Level**
  Set the level used to determine the rising or falling edge of the clock signal.
  Selectable range: 8 divisions within the screen
  Resolution: 0.01 divisions (For example, the resolution for 2 mV/div is 0.02 mV.)
- **Hysteresis**
  Selectable range: 0.3 div to 4.0 div

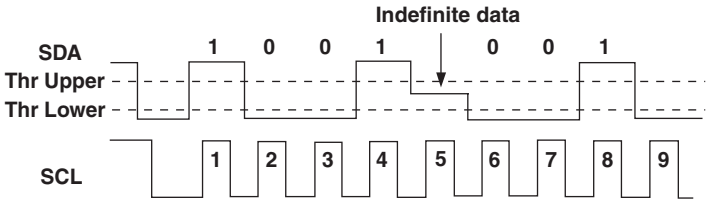
#### Data Channel

Set the data channel to CH2 or CH4. If you set the data channel to CH2, the clock channel is set to CH1; if you set the data channel to CH4, the clock channel is set to CH3.

- **Setting the Threshold Level**
  Set the level used to determine the data channel signal level (0, 1, or indefinite).

| | |
|---|---|
| Thr Upper | Signal exceeding this level is determined to be 1. |
| Thr Lower | Signal below this level is determined to be 0. |

If Thr Lower ≤ data signal level ≤ Thr Upper, the signal level is determined to be indefinite data.
If indefinite data is found, "∗" is displayed in the hexadecimal display box at the byte where the indefinite data exists on the display screen of analysis results.




#### Analysis Reference Point

Select the reference point used to start the analysis from the following:

| | |
|---|---|
| Trigger Position | Sets the reference point to the trigger position. |
| Manual | You can set the reference point in the range of –5 to +5 divisions. |

#### Items to Be Analyzed

The following types of data can be analyzed.

- Historical data.
- Data that is displayed when the waveform acquisition is stopped.
- Loaded acquisition data (ACQ data).

Analysis is performed only on the waveform selected by "Select Record" for historical data.

### Range That Can Be Analyzed

Analysis is performed on the acquisition data within the display screen. Up to 40000 bytes of the analysis results can be displayed. The displayed result varies depending on the number of bytes analyzed as follows:

- **When the total analysis result is less than or equal to 40000 bytes**
  All points are displayed regardless of the position of the Reference Point.
- **When the total analysis result is greater than 40000 bytes**
  The displayed result varies depending on the number of analysis results on the Pre* and Post* sides as follows:
  - When the Pre side=30000 and the Post side=30000 -> Displays Pre side=20000 and Post side=20000
  - When the Pre side=10000 and the Post side=50000 -> Displays Pre side=10000 and Post side=30000
  - When the Pre side=50000 and the Post side=10000 -> Displays Pre side=30000 and Post side=10000

  * Pre: Before (left of) the reference point
  Post: After (right of) the reference point

**Notes When Performing Analysis**

- Analysis and search cannot be performed while the waveform acquisition is started.
- Analysis and search cannot be performed on accumulated waveforms.

### Analysis Data List (Analysis Result List)

The following three items are displayed.

- Analysis number
- Hexadecimal display of the analyzed data
- Acknowledge bit condition

**Analysis Number: No.**

Up to 40000 points can be displayed.

**Hexadecimal Display of the Analyzed Data: Hex**

The analyzed data is displayed using hexadecimal notation. However, if a byte of data is less than 8 bits, the data is not displayed. If indefinite data exists, "∗" is displayed. Indefinite data is considered the same value as the previous bit for the analysis. If the first data is indefinite, it is considered 0 for the analysis.

**Acknowledge Bit Condition: Ack**

Displays the Acknowledge bit condition. Displays 0 if the Acknowledge bit is present; displays 1 if the Acknowledge bit is not present.

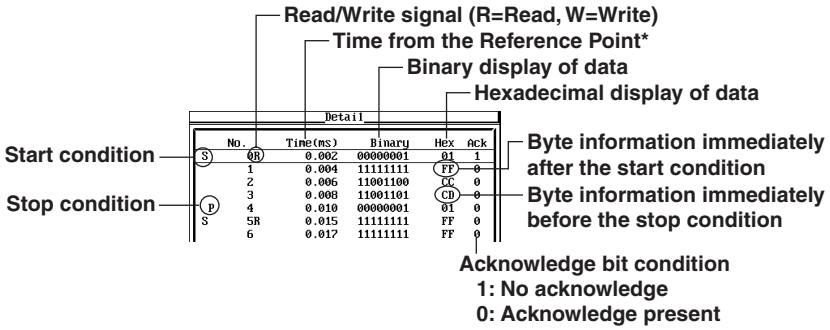
***Note***

If you execute the analysis and select (highlight) an arbitrary byte in the list of analysis results, the Zoom Position moves to the head of that byte. In addition, if you move the Zoom Position, the highlighting moves to the corresponding byte in the list of analysis results.

### Detailed List of Analysis Data: Detail

More detailed information of the analysis data can be listed. The following information can be displayed.

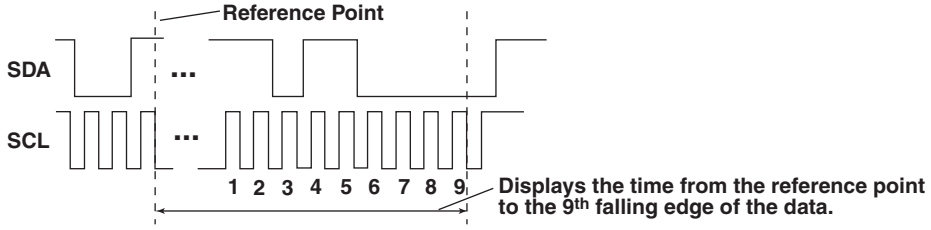
- Analysis number
- Stop condition/start condition
- Read/Write signal
- Time from the analysis reference point*
- Binary display of data
- Hexadecimal display of data
- Acknowledge bit condition




On the detailed display screen, the data corresponding to the specified number are highlighted.

On the waveform display screen, the data corresponding to the specified number is displayed in the ZOOM display.

*** About the Time(ms) display**



## Setting the Search Condition: Search Setup

You can set the following conditions.

### Search Type

You can select the search type.

Byte Pattern (Pattern Search)
Searches for analysis data that matches the byte pattern.

Indefinite State (Indefinite Data Search)
Searches indefinite data from the analysis data.

### When Search Type Is Set to Byte Pattern

Set the byte pattern to be searched in binary or hexadecimal notation. You can set the address pattern, data pattern, and Acknowledge bit condition. Bits set to "X" are not searched.
If there is at least one "X" bit in a group of four bits in the binary display, the corresponding hexadecimal display will show an "X."

### When Search Type Is Set to Indefinite State

Searches indefinite data from the analysis result. You cannot perform a pattern search and an indefinite data search simultaneously.

***Note***

Indefinite data is always considered matched to the specified status.

## Executing the Search: Next, Prev

Press the Next or Prev soft key to execute the search. The search progresses (pattern or indefinite data search) as follows depending on the search type.

- **For Pattern Searches**
  Next: Searches frames after (to the right of) the currently selected frame.
  Prev: Searches frames before (to the left of) the currently selected frame.
- **For Indefinite Data Searches**
  Next: Searches frames after (to the right of) the current zoom position (Z1 Pos).
  Prev: Searches frames before (to the left of) the current zoom position (Z1 Pos).

### Displaying the Search Result

- **For Pattern Searches**
  - **When one or more Address Pattern and/or Data Patterns are selected**
    If a waveform that matches the specified address pattern or data pattern is found, the zoom position (Z1 Pos) moves to the beginning the pattern.
  - **If both Address Pattern and Data Pattern are OFF**
    The message "Pattern is not specified." (error code: 730) appears.
- **For Indefinite Data Searches**
  The zoom position (Z1 Pos) moves to the front of the indefinite data.

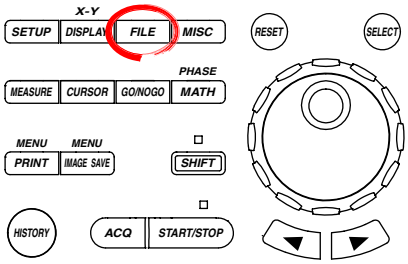
# 1.6 Saving the Data of the Detailed Analysis List

The data of the detailed analysis list can be saved to a file in ASCII format.

**CAUTION**

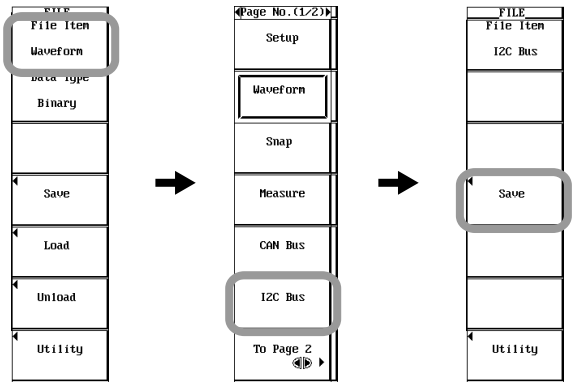
Do not remove the storage medium (disk) or turn OFF the power when the access indicator or icon of the storage medium is blinking. Doing so can damage the storage medium or destroy the data on the medium.

## *Procedure*




- To exit the menu during operation, press **ESC** located above the soft keys.
- In the procedural explanation below, the term *jog shuttle & SELECT* refers to the operation of selecting/setting items and entering values using the **jog shuttle**, **SELECT** and **RESET** keys. For details on the operation using the jog shuttle, SELECT, and RESET, see sections 4.1 or 4.2 in the DL7440/DL7480 User's Manual.
- For a description of the operation using a USB keyboard or a USB mouse, see section 4.3 in the DL7440/DL7480 User's Manual.

1. Press **FILE**. The FILE menu appears.
2. Press the **File Item** soft key. The File Item menu appears.
3. Press the **I²C Bus** soft key.
4. Press the **Save** soft key. The Save menu appears.




### Selecting Save Destination Medium and Directory

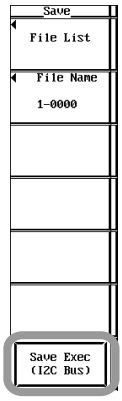
5. Carry out steps 13 to 15 on page 12-22 in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Setting the File Name and Comment

6. Carry out steps 16 to 19 on page 12-22 in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Executing the Save Operation

7. Press the **Save Exec** soft key. The data is saved to the directory indicated by Path=..... At the same time, the Save Exec soft key changes to the Abort soft key.




### Aborting the Save Operation

8. Press the **Abort** soft key. The save operation is aborted. At the same time, the Abort soft key changes to the Save Exec soft key.

### Specifying the Files to Be Displayed in the File List Window and Displaying Properties

9. Carry out steps 22 to 25 on page 12-23 in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

## *Explanation*

If you save the data, the data of the analysis results is saved to the specified destination in ASCII format. The file extension is .txt. The data size is (the number of analysis results × 47) + 47 bytes.

[Save example]

| | No | Time(ms) | Binary | Hex | Ack |
|---|---|---|---|---|---|
| S | -8R | -0.022 | 01010101 | 55 | 1 |
| P | -7 | -0.020 | 01010101 | 55 | 1 |
| S | -6W | -0.016 | 10101010 | AA | 1 |
| P | -5 | -0.014 | 10101010 | AA | 1 |
| S | -4W | -0.010 | 00000000 | 00 | 1 |
| P | -3 | -0.008 | 00000000 | 00 | 1 |
| S | -2R | -0.004 | 11111111 | FF | 1 |
| P | -1 | -0.002 | 11111111 | FF | 1 |
| S | 0R | 0.002 | 00000001 | 01 | 1 |
| | 1 | 0.004 | 11001100 | CC | 1 |
| S | 2R | 0.009 | 01010101 | 55 | 1 |
| | 3 | 0.011 | 00100010 | 22 | 1 |
| S | 4R | 0.015 | 00000001 | 01 | 1 |
| | 5 | 0.017 | 00000001 | 01 | 1 |
| | 6 | 0.019 | 00000001 | 01 | 0 |
| | 7 | 0.021 | 00000011 | 03 | 0 |
| | 8 | 0.023 | 00000001 | 01 | 0 |

**Precautions to Be Taken When Saving the Data**

- The maximum number of files that can be saved when the auto naming function is ON is 1150.
- If the total number of files and directories exceed 2500 in a single directory, the contents of the File List box are no longer displayed.

# 1.7 Error Messages

A message may appear during operation. This section describes the meanings of the messages and their corrective actions. This section lists only the error messages related to the I²C Bus signal analysis function. There are other error messages related to the DL7440/DL7480 and communications. These messages are described in the *DL7440/DL7480 User's Manual (IM701450-01E)* and the *DL7440/DL7480 Communication Interface User's Manual (IM701450-17E)*.

You can set the messages to be displayed in English or Japanese. For the procedure of setting the message language, see section 15.1, "Changing the Message Language and Turning ON/OFF the Click Sound" in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

If the corrective action requires servicing, contact your nearest YOKOGAWA dealer for repairs.

| Code | Message | Action | Page |
|---|---|---|---|
| 37 | Aborted the analysis. | – | 1-27 |
| 38 | Data not detected.<br>Execute again after changing the settings or reacquiring the waveform. | – | 1-4, 1-10, 1-25, 1-30 |
| 730 | Pattern is not specified. | Enable Address Pattern or Data Pattern in the Search Setup dialog box. | 1-29 |
| 739 | Analyzed data does not exist.<br>Execute the analysis. | Execute the analysis. | 1-27, 1-31 |
| 870 | Cannot be specified.<br>Invalid byte or bit. | Increase the number of valid bytes. | 1-6, 1-11 |

# 1.8 Communication Commands

This section contains only the communication commands related to the I²C Bus signal analysis function. For a description of other DL7440/DL7480 communication commands, see the *DL7440/DL7480 Communication Interface User's Manual (IM701450-17E).*

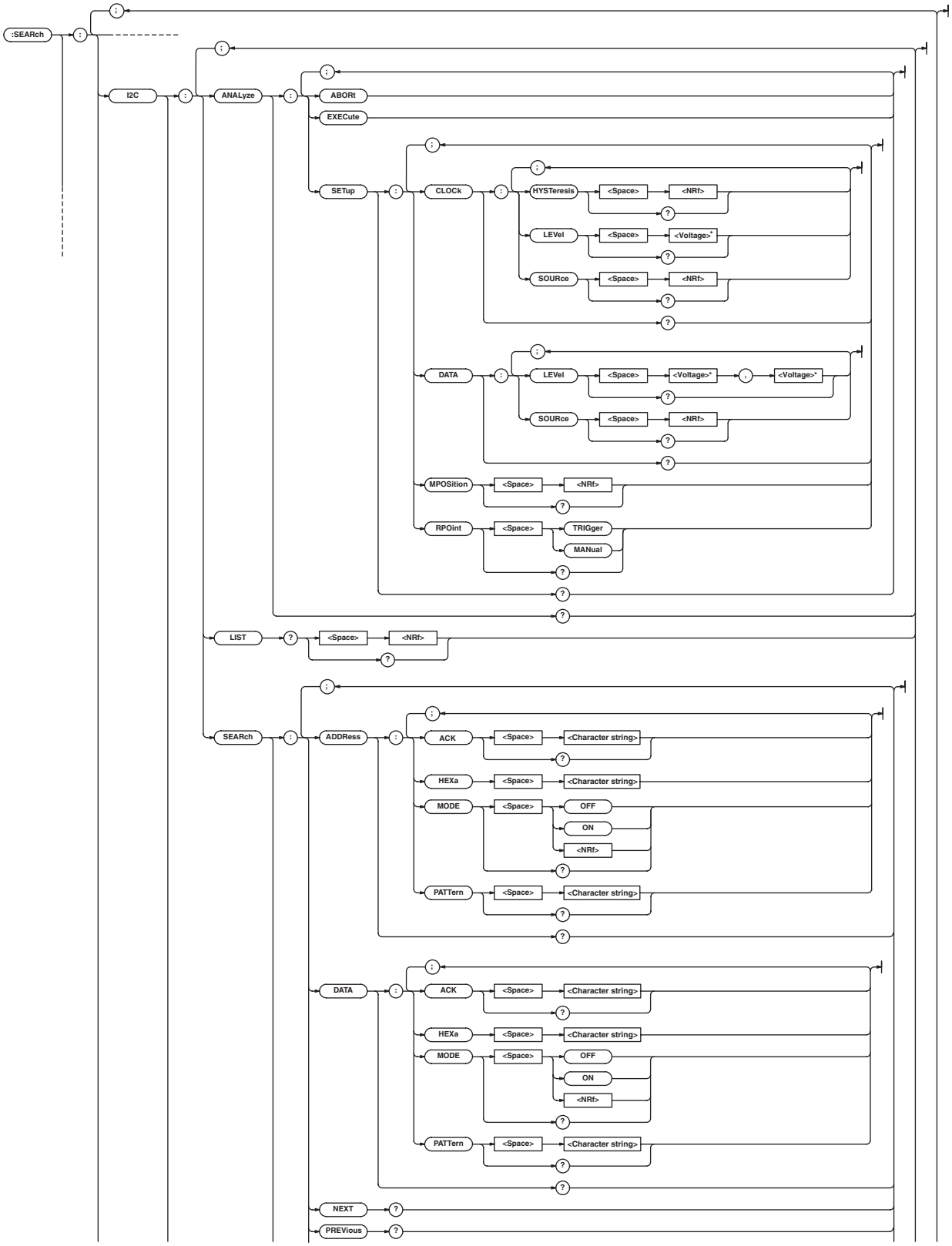
| Command | Function | Page |
|---|---|---|
| **I²C Analyze Group** | | |
| `:SEARch:I2C?` | Queries all settings related to the analysis* function. | 1-41 |
| `:SEARch:I2C:ANALyze?` | Queries all settings related to the execution of the analysis.* | 1-41 |
| `:SEARch:I2C:ANALyze:ABORt` | Aborts the execution of the Analysis.* | 1-41 |
| `:SEARch:I2C:ANALyze:EXECute` | Executes the analysis.* | 1-41 |
| `:SEARch:I2C:ANALyze:SETup?` | Queries all settings related to the analysis* conditions. | 1-41 |
| `:SEARch:I2C:ANALyze:SETup:CLOCk?` | Queries all settings related to the clock channel of the analysis* conditions. | 1-41 |
| `:SEARch:I2C:ANALyze:SETup:CLOCk:HYSTeresis` | Sets the clock channel hysteresis of the analysis* conditions or queries the current setting. | 1-41 |
| `:SEARch:I2C:ANALyze:SETup:CLOCk:LEVel` | Sets the clock channel level of the analysis* conditions or queries the current setting. | 1-42 |
| `:SEARch:I2C:ANALyze:SETup:CLOCk:SOURce` | Sets the clock channel source waveform of the analysis* conditions or queries the current setting. | 1-42 |
| `:SEARch:I2C:ANALyze:SETup:DATA?` | Queries all settings related to the data channel of the analysis* conditions. | 1-42 |
| `:SEARch:I2C:ANALyze:SETup:DATA:LEVel` | Sets the threshold level of the data channel of the analysis* conditions or queries the current setting. | 1-42 |
| `:SEARch:I2C:ANALyze:SETup:DATA:SOURce` | Sets the data channel source waveform of the analysis* conditions or queries the current setting. | 1-42 |
| `:SEARch:I2C:ANALyze:SETup:MPOSition` | Sets the reference position when the analysis* reference point is set manually or queries the current setting. | 1-42 |
| `:SEARch:I2C:ANALyze:SETup:RPOint` | Set whether to make the trigger point the analysis* reference point or set the reference point manually. | 1-43 |
| `:SEARch:I2C:LIST? {<NRf>}` | Outputs one byte of analysis* result as a character string. | 1-43 |
| `:SEARch:I2C:SEARch?` | Queries all settings related to the analysis* result search. | 1-43 |
| `:SEARch:I2C:SEARch:ADDRess?` | Queries all settings related to the address pattern search on the analysis* result. | 1-43 |
| `:SEARch:I2C:SEARch:ADDRess:ACK` | Sets the Ack condition of the address pattern search on the analysis* result or queries the current setting. | 1-43 |
| `:SEARch:I2C:SEARch:ADDRess:HEXa` | Sets the pattern of the address pattern search on the analysis* result in hexadecimal. | 1-43 |
| `:SEARch:I2C:SEARch:ADDRess:MODE` | Enables or disables the address pattern when searching the analysis* result or queries the current setting. | 1-43 |
| `:SEARch:I2C:SEARch:ADDRess:PATTern` | Sets the pattern of the address pattern search on the analysis* result in binary or queries the current setting. | 1-43 |
| `:SEARch:I2C:SEARch:DATA?` | Queries all settings related to the data pattern search on the analysis* result. | 1-43 |
| `:SEARch:I2C:SEARch:DATA:ACK` | Sets the Ack condition of the search using the data pattern on the analysis* result or queries the current setting. | 1-43 |
| `:SEARch:I2C:SEARch:DATA:HEXa` | Sets the pattern of the data pattern search on the analysis* result in hexadecimal. | 1-44 |
| `:SEARch:I2C:SEARch:DATA:MODE` | Enables or disables the data pattern when searching the analysis* result or queries the current setting. | 1-44 |
| `:SEARch:I2C:SEARch:DATA:PATTern` | Sets the pattern of the data pattern search on the analysis* result in binary or queries the current setting. | 1-44 |

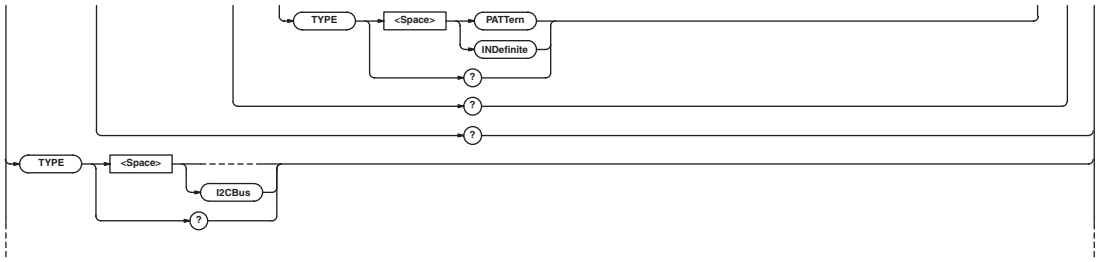
| Command | Function | Page |
|---|---|---|
| :SEARch:I2C:SEARch:NEXT? | Performs the analysis* result search on the data after the current byte and returns the search position. | 1-44 |
| :SEARch:I2C:SEARch:PREVious? | Performs the analysis* result search on the data before the current byte and returns the search position. | 1-44 |
| :SEARch:I2C:SEARch:TYPE | Sets the analysis result search type or queries the current setting. | 1-44 |
| :SEARch:TYPE | Sets the search type or queries the current setting. | 1-44 |
| **I²C File Group** | | |
| :FILE:SAVE:I2C:ABORt | Aborts the saving of the data of the detailed analysis list of the analysis.* | 1-45 |
| :FILE:SAVE:I2C[:EXECute] | Executes the saving of the data of the detailed analysis list of the analysis* (overlap command). | 1-45 |
| **I²C Trigger Group** | | |
| :TRIGger:I2C? | Queries all settings related to the trigger.* | 1-47 |
| :TRIGger:I2C:ADDRess? | Queries all settings related to the Adrs&Data trigger.* | 1-47 |
| :TRIGger:I2C:ADDRess:ABCount | Sets the byte data location for comparing the Data2 Pattern when using A drs&Data trigger* or queries the current setting. | 1-47 |
| :TRIGger:I2C:ADDRess:ADDRess? | Queries all settings related to the address pattern setting for the Adrs&Data trigger.* | 1-47 |
| :TRIGger:I2C:ADDRess:ADDRess:HEXa | Sets the address pattern for the Adrs&Data trigger* in hexadecimal. | 1-47 |
| :TRIGger:I2C:ADDRess:ADDRess:MODE | Enables or disables the address pattern for the Adrs&Data trigger* or queries the current setting. | 1-48 |
| :TRIGger:I2C:ADDRess:ADDRess:PATTern | Sets the address pattern for the Adrs&Data trigger* in binary or queries the current setting. | 1-48 |
| :TRIGger:I2C:ADDRess:DATA<x>? | Queries all settings related to each address pattern setting for the Adrs&Data trigger.* | 1-48 |
| :TRIGger:I2C:ADDRess:DATA<x>:CONDition | Sets the condition of each data pattern for the Adrs&Data trigger* or queries the current setting. | 1-48 |
| :TRIGger:I2C:ADDRess:DATA<x>:DBYTe | Sets the number of bytes of the data pattern (Data2 Pattern) for the Adrs&Data trigger* or queries the current setting. | 1-48 |
| :TRIGger:I2C:ADDRess:DATA<x>:HEXa<y> | Sets each data pattern for the Adrs&Data trigger* in hexadecimal. | 1-48 |
| :TRIGger:I2C:ADDRess:DATA<x>:MODE | Enables or disables each data pattern for the Adrs&Data trigger* or queries the current setting. | 1-48 |
| :TRIGger:I2C:ADDRess:DATA<x>:PATTern<y> | Sets each data pattern for the Adrs&Data trigger* in binary or queries the current setting. | 1-48 |
| :TRIGger:I2C:BCOunt | Sets the byte count for the Adrs&Data trigger* or queries the current setting. | 1-49 |
| :TRIGger:I2C:COMBination | Sets the combination trigger* or queries the current setting. | 1-49 |
| :TRIGger:I2C:IREStart | Sets whether to ignore the restart condition (YES/NO) of the trigger* or queries the current setting. | 1-49 |
| :TRIGger:I2C:IUNexpected | Sets whether to ignore the start/stop conditions that do not conform to the protocol (YES/NO) of the trigger* or queries the current setting. | 1-49 |
| :TRIGger:I2C:PATTern? | Queries all settings related to each channel pattern setting of the combination trigger.* | 1-49 |
| :TRIGger:I2C:PATTern:CHANnel<x> | Sets the condition (pattern or slope) of each channel of the combination trigger* or queries the current setting. | 1-49 |
| :TRIGger:I2C:PATTern:CLOCk | Sets the clock channel of the combination trigger* or queries the current setting. | 1-49 |
| :TRIGger:I2C:PATTern:CONDition | Sets the pattern condition of the combination trigger* or queries the current setting. | 1-49 |
| :TRIGger:I2C:TYPE | Sets the trigger* type or queries the current setting. | 1-49 |
| :TRIGger:TYPE | Sets the trigger type or queries the current setting. | 1-50 |

* In the explanation of the function of each command in this section, *analysis* refers to I²C Bus signal analysis. *Trigger* refers to the trigger of the I²C Bus signal analysis function.

## • I²C Analyze Group

Commands in the I²C Analyze group can be used to make the same settings, inquiries, and executions as when the I²C bus menu under the SHIFT + ZOOM key on the front panel is used.






* <Current> when a current probe is used.

### :SEARch:I2C?

Function Queries all settings related to the analysis function.

Syntax `:SEARch:I2C?`

Example
```
:SEARCH:I2C? -> :SEARCH:I2C:
ANALYZE:SETUP:CLOCK:SOURCE 1;
LEVEL 1.000E+00;HYSTERESIS 0.3;:
SEARCH:I2C:ANALYZE:SETUP:DATA:
SOURCE 2;
LEVEL 1.000E+00,0.000E+00;:
SEARCH:I2C:ANALYZE:SETUP::
RPOINT TRIGGER;MPOSITION -4.00000;:
SEARCH:I2C:SEARCH:TYPE PATTERN;
ADDRESS:MODE 1;PATTERN "X0X10X10";
ACK "X";:SEARCH:I2C:SEARCH:DATA:
MODE 1;PATTERN "10X10X10";ACK "X"
```

### :SEARch:I2C:ANALyze?

Function Queries all settings related to the execution of the analysis.

Syntax `:SEARch:I2C:ANALyze?`

Example
```
:SEARCH:I2C:ANALYZE? ->
:SEARCH:I2C:
ANALYZE:SETUP:CLOCK:SOURCE 1;
LEVEL 1.000E+00;HYSTERESIS 0.3;:
SEARCH:I2C:ANALYZE:SETUP:DATA:
SOURCE 2;
LEVEL 1.000E+00,0.000E+00;:
SEARCH:I2C:ANALYZE:SETUP::
RPOINT TRIGGER;MPOSITION -4.00000
```

### :SEARch:I2C:ANALyze:ABORt

Function Aborts the execution of the Analysis.

Syntax `:SEARch:I2C:ANALyze:ABORt`

Example `:SEARCH:I2C:ANALYZE:ABORT`

### :SEARch:I2C:ANALyze:EXECute

Function Executes the analysis.

Syntax `:SEARch:I2C:ANALyze:EXECute`

Example `:SEARCH:I2C:ANALYZE:EXECUTE`

### :SEARch:I2C:ANALyze:SETup?

Function Queries all settings related to the analysis conditions.

Syntax `:SEARch:I2C:ANALyze:SETup?`

Example
```
:SEARCH:I2C:ANALYZE:SETUP? ->
:SEARCH:I2C:ANALYZE:SETUP:CLOCK:
SOURCE 1;LEVEL 1.000E+00;
HYSTERESIS 0.3;:SEARCH:I2C:ANALYZE:
SETUP:DATA:SOURCE 2;
LEVEL 1.000E+00,0.000E+00;:
SEARCH:I2C:ANALYZE:SETUP::
RPOINT TRIGGER;MPOSITION -4.00000
```

### :SEARch:I2C:ANALyze:SETup:CLOCk?

Function Queries all settings related to the clock channel of the analysis conditions.

Syntax `:SEARch:I2C:ANALyze:SETup:CLOCk?`

Example
```
:SEARCH:I2C:ANALYZE:SETUP:CLOCK? ->
:SEARCH:I2C:ANALYZE:SETUP:CLOCK:
SOURCE 1;LEVEL 1.000E+00;
HYSTERESIS 0.3
```

### :SEARch:I2C:ANALyze:SETup:CLOCk:HYSTeresis

Function Sets the clock channel hysteresis of the analysis conditions or queries the current setting.

Syntax
```
:SEARch:I2C:ANALyze:SETup:CLOCk:
HYSTeresis {<NRf>}
:SEARch:I2C:ANALyze:SETup:CLOCk:
HYSTeresis?
```
<NRf>=0.3 to 4.0 (div, 0.1 steps)

Example
```
:SEARCH:I2C:ANALYZE:SETUP:CLOCK:
HYSTERESIS 0.5
:SEARCH:I2C:ANALYZE:SETUP:CLOCK:
HYSTERESIS? -> :SEARCH:I2C:ANALYZE:
SETUP:CLOCK:HYSTERESIS 0.5
```

### :SEARch:I2C:ANALyze:SETup:CLOCk:LEVel

Function Sets the clock channel level of the analysis conditions or queries the current setting.

Syntax
```
:SEARch:I2C:ANALyze:SETup:CLOCk:
LEVel {<Voltage>}
:SEARch:I2C:ANALyze:SETup:CLOCk:
LEVel?
```
<Voltage>=8 divisions within the screen (0.01 division steps).

Example
```
:SEARCH:I2C:ANALYZE:SETUP:CLOCK:
LEVEL 1V
:SEARCH:I2C:ANALYZE:SETUP:CLOCK:
LEVEL? -> :SEARCH:I2C:ANALYZE:
SETUP:CLOCK:LEVEL 1.000E+00
```

Description If you are setting a clock channel to which a current probe is connected, set and query using <Current>.

### :SEARch:I2C:ANALyze:SETup:CLOCk:SOURce

Function Sets the clock channel source waveform of the analysis conditions or queries the current setting.

Syntax
```
:SEARch:I2C:ANALyze:SETup:CLOCk:
SOURce {<NRf>}
:SEARch:I2C:ANALyze:SETup:CLOCk:
SOURce?
```
<NRf>=1, 3

Example
```
:SEARCH:I2C:ANALYZE:SETUP:CLOCK:
SOURCE 1
:SEARCH:I2C:ANALYZE:SETUP:CLOCK:
SOURCE? -> :SEARCH:I2C:ANALYZE:
SETUP:CLOCK:SOURCE 1
```

### :SEARch:I2C:ANALyze:SETup:DATA?

Function Queries all settings related to the data channel of the analysis conditions.

Syntax
```
:SEARch:I2C:ANALyze:SETup:DATA?
```

Example
```
:SEARCH:I2C:ANALYZE:SETUP:DATA? ->
:SEARCH:I2C:ANALYZE:SETUP:DATA:
SOURCE 2;LEVEL 1.000E+00,0.000E+00
```

### :SEARch:I2C:ANALyze:SETup:DATA:LEVel

Function Sets the threshold level of the data channel of the analysis conditions or queries the current setting.

Syntax
```
:SEARch:I2C:ANALyze:SETup:DATA:
LEVel {<Voltage>,<Voltage>}
:SEARch:I2C:ANALyze:SETup:DATA:
LEVel?
```
<Voltage>=8 divisions within the screen (0.01 division steps).

Example
```
:SEARCH:I2C:ANALYZE:SETUP:DATA:
LEVEL 1V,0V
:SEARCH:I2C:ANALYZE:SETUP:DATA:
LEVEL? -> :SEARCH:I2C:ANALYZE:
SETUP:DATA:
LEVEL 1.000E+00,0.000E+00
```

Description If you are setting a data channel to which a current probe is connected, set and query using <Current>.

### :SEARch:I2C:ANALyze:SETup:DATA:SOURce

Function Sets the data channel source waveform of the analysis conditions or queries the current setting.

Syntax
```
:SEARch:I2C:ANALyze:SETup:DATA:
SOURce {<NRf>}
:SEARch:I2C:ANALyze:SETup:DATA:
SOURce?
```
<NRf>=2, 4

Example
```
:SEARCH:I2C:ANALYZE:SETUP:DATA:
SOURCE 2
:SEARCH:I2C:ANALYZE:SETUP:DATA:
SOURCE? -> :SEARCH:I2C:ANALYZE:
SETUP:DATA:SOURCE 2
```

### :SEARch:I2C:ANALyze:SETup:MPOSition

Function Sets the reference position when the analysis reference point is set manually or queries the current setting.

Syntax
```
:SEARch:I2C:ANALyze:SETup:MPOSition
{<NRf>}
:SEARch:I2C:ANALyze:SETup:
MPOSition?
```
<NRf>=–5 to 5 divisions (10 divisions/displayed record length steps)

Example
```
:SEARCH:I2C:ANALYZE:SETUP:
MPOSITION -4.000
:SEARCH:I2C:ANALYZE:SETUP:
MPOSITION? -> :SEARCH:I2C:ANALYZE:
SETUP:MPOSITION -4.00000
```

### :SEARch:I2C:ANALyze:SETup:RPOint

Function Set whether to make the trigger point the analysis reference point or set the reference point manually.

Syntax
```
:SEARch:I2C:ANALyze:SETup:RPOint
{TRIGger|MANual}
:SEARch:I2C:ANALyze:SETup:RPOint?
```

Example
```
:SEARCH:I2C:ANALYZE:SETUP:
RPOINT TRIGGER
:SEARCH:I2C:ANALYZE:SETUP:RPOINT?
-> :SEARCH:I2C:ANALYZE:SETUP:
RPOINT TRIGGER
```

### :SEARch:I2C:LIST? {<NRf>}

Function Outputs one byte of analysis result as a character string.

Syntax
```
:SEARch:I2C:LIST? {<NRf>}
```
<NRf>=–40000 to 40000

Example
```
:SEARCH:I2C:LIST? 1 ->
"      1      0.024   00001111  0F
0"
```

### :SEARch:I2C:SEARch?

Function Queries all settings related to the analysis result search.

Syntax
```
:SEARch:I2C:SEARch?
```

Example
```
:SEARCH:I2C:SEARCH? -> :SEARCH:I2C:
SEARCH:TYPE PATTERN;ADDRESS:MODE 1;
PATTERN "X0X10X10";ACK "X";:SEARCH:
I2C:SEARCH:DATA:MODE 1;
PATTERN "10X10X10";ACK "X"
```

### :SEARch:I2C:SEARch:ADDRess?

Function Queries all settings related to the address pattern search on the analysis result.

Syntax
```
:SEARch:I2C:SEARch:ADDRess?
```

Example
```
:SEARCH:I2C:SEARCH:ADDRESS? ->
:SEARCH:I2C:SEARCH:ADDRESS:MODE 1;
PATTERN "X0X10X10";ACK "X"
```

### :SEARch:I2C:SEARch:ADDRess:ACK

Function Sets the Ack condition of the search using the address pattern on the analysis result or queries the current setting.

Syntax
```
:SEARch:I2C:SEARch:ADDRess:ACK
{<String>}
:SEARch:I2C:SEARch:ADDRess:ACK?
```
<String>='0', '1', 'X'

Example
```
:SEARCH:I2C:SEARCH:ADDRESS:ACK "X"
:SEARCH:I2C:SEARCH:ADDRESS:ACK? ->
:SEARCH:I2C:SEARCH:ADDRESS:ACK "X"
```

### :SEARch:I2C:SEARch:ADDRess:HEXa

Function Sets the pattern of the address pattern search on the analysis result in hexadecimal.

Syntax
```
:SEARch:I2C:SEARch:ADDRess:HEXa
{<String>}
```
<String>=2 characters by combining '0' to 'F' and 'X'

Example
```
:SEARCH:I2C:SEARCH:ADDRESS:
HEXA "1A"
```

### :SEARch:I2C:SEARch:ADDRess:MODE

Function Enables or disables the address pattern when searching the analysis result or queries the current setting.

Syntax
```
:SEARch:I2C:SEARch:ADDRess:MODE
{<Boolean>}
:SEARch:I2C:SEARch:ADDRess:MODE?
```

Example
```
:SEARCH:I2C:SEARCH:ADDRESS:MODE ON
:SEARCH:I2C:SEARCH:ADDRESS:MODE? ->
:SEARCH:I2C:SEARCH:ADDRESS:MODE 1
```

### :SEARch:I2C:SEARch:ADDRess:PATTern

Function Sets the pattern of the address pattern search on the analysis result in binary or queries the current setting.

Syntax
```
:SEARch:I2C:SEARch:ADDRess:PATTern
{<String>}
:SEARch:I2C:SEARch:ADDRess:PATTern?
```
<String>=8 characters by combining '0,' '1,' and 'X'
(The 8th character is the R/$\overline{W}$ bit.)

Example
```
:SEARCH:I2C:SEARCH:ADDRESS:
PATTERN "X0X10X10"
:SEARCH:I2C:SEARCH:ADDRESS:PATTERN?
-> :SEARCH:I2C:SEARCH:ADDRESS:
PATTERN "X0X10X10"
```

### :SEARch:I2C:SEARch:DATA?

Function Queries all settings related to the data pattern search on the analysis result.

Syntax
```
:SEARch:I2C:SEARch:DATA?
```

Example
```
:SEARCH:I2C:SEARCH:DATA? ->
:SEARCH:I2C:SEARCH:DATA:MODE 1;
PATTERN "10X10X10";ACK "X"
```

### :SEARch:I2C:SEARch:DATA:ACK

Function Sets the Ack condition of the search using the data pattern on the analysis result or queries the current setting.

Syntax
```
:SEARch:I2C:SEARch:DATA:ACK
{<String>}
:SEARch:I2C:SEARch:DATA:ACK?
```
<String>='0', '1', 'X'

Example
```
:SEARCH:I2C:SEARCH:DATA:ACK "X"
:SEARCH:I2C:SEARCH:DATA:ACK? ->
:SEARCH:I2C:SEARCH:DATA:ACK "X"
```

### :SEARch:I2C:SEARch:DATA:HEXa

Function Sets the pattern of the data pattern search on the analysis result in hexadecimal.

Syntax
```
:SEARch:I2C:SEARch:DATA:HEXa
{<String>}
```
<String>=2 characters by combining '0' to 'F' and 'X'

Example
```
:SEARCH:I2C:SEARCH:DATA:HEXA "2B"
:SEARCH:I2C:SEARCH:DATA:HEXA? ->
:SEARCH:I2C:SEARCH:DATA:HEXA "2B"
```

### :SEARch:I2C:SEARch:DATA:MODE

Function Enables or disables the data pattern when searching the analysis result or queries the current setting.

Syntax
```
:SEARch:I2C:SEARch:DATA:MODE
{<Boolean>}
:SEARch:I2C:SEARch:DATA:MODE?
```

Example
```
:SEARCH:I2C:SEARCH:DATA:MODE ON
:SEARCH:I2C:SEARCH:DATA:MODE? ->
:SEARCH:I2C:SEARCH:DATA:MODE 1
```

### :SEARch:I2C:SEARch:DATA:PATTern

Function Sets the pattern of the data pattern search on the analysis result in binary or queries the current setting.

Syntax
```
:SEARch:I2C:SEARch:DATA:PATTern
{<String>}
:SEARch:I2C:SEARch:DATA:PATTern?
```
<String>=8 characters by combining '0,' '1,' and 'X'
(The 8th character is the R/$\overline{W}$ bit.)

Example
```
:SEARCH:I2C:SEARCH:DATA:
PATTERN "10X10X10"
:SEARCH:I2C:SEARCH:DATA:PATTERN? ->
:SEARCH:I2C:SEARCH:DATA:
PATTERN "10X10X10"
```

### :SEARch:I2C:SEARch:NEXT?

Function Performs the analysis result search on the data after the current byte and returns the search position.

Syntax
```
:SEARch:I2C:SEARch:NEXT?
```

Example
```
:SEARCH:I2C:SEARCH:NEXT? -> 10
```

Description If the search is successful, a value in the range of –40000 to 40000 is returned. If it fails, "NAN" is returned.

### :SEARch:I2C:SEARch:PREVious?

Function Performs the analysis result search on the data before the current byte and returns the search position.

Syntax
```
:SEARch:I2C:SEARch:PREVious?
```

Example
```
:SEARCH:I2C:SEARCH:PREVIOUS? -> -10
```

Description If the search is successful, a value in the range of –40000 to 40000 is returned. If it fails, "NAN" is returned.

### :SEARch:I2C:SEARch:TYPE

Function Sets the analysis result search type or queries the current setting.

Syntax
```
:SEARch:I2C:SEARch:TYPE
{PATTern|INDefinite}
:SEARch:I2C:SEARch:TYPE?
```

Example
```
:SEARCH:I2C:SEARCH:TYPE PATTERN
:SEARCH:I2C:SEARCH:TYPE? ->
:SEARCH:I2C:SEARCH:TYPE PATTERN
```

### :SEARch:TYPE

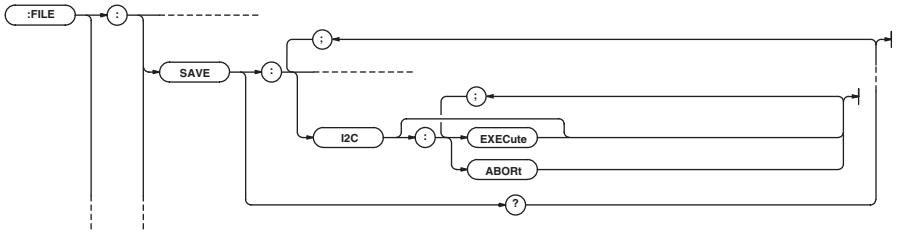
Function Sets the search type or queries the current setting.

Syntax
```
:SEARch:TYPE {SPATtern|WIDTh|EDGE|
PPATtern|ASCRoll|I2CBus|SPIBus}
:SEARch:TYPE?
```

Example
```
:SEARCH:TYPE I2CBUS
:SEARCH:TYPE? -> :SEARCH:
TYPE I2CBUS
```

## • I²C File Group

Commands in the I²C File group can be used to make the same settings, inquiries, and executions as when the I²C bus menu under the FILE key on the front panel is used.




### :FILE:SAVE:I2C:ABORt

Function Aborts the saving of the data of the detailed analysis list of the analysis.

Syntax `:FILE:SAVE:I2C:ABORt`

Example `:FILE:SAVE:I2C:ABORT`

### :FILE:SAVE:I2C[:EXECute]

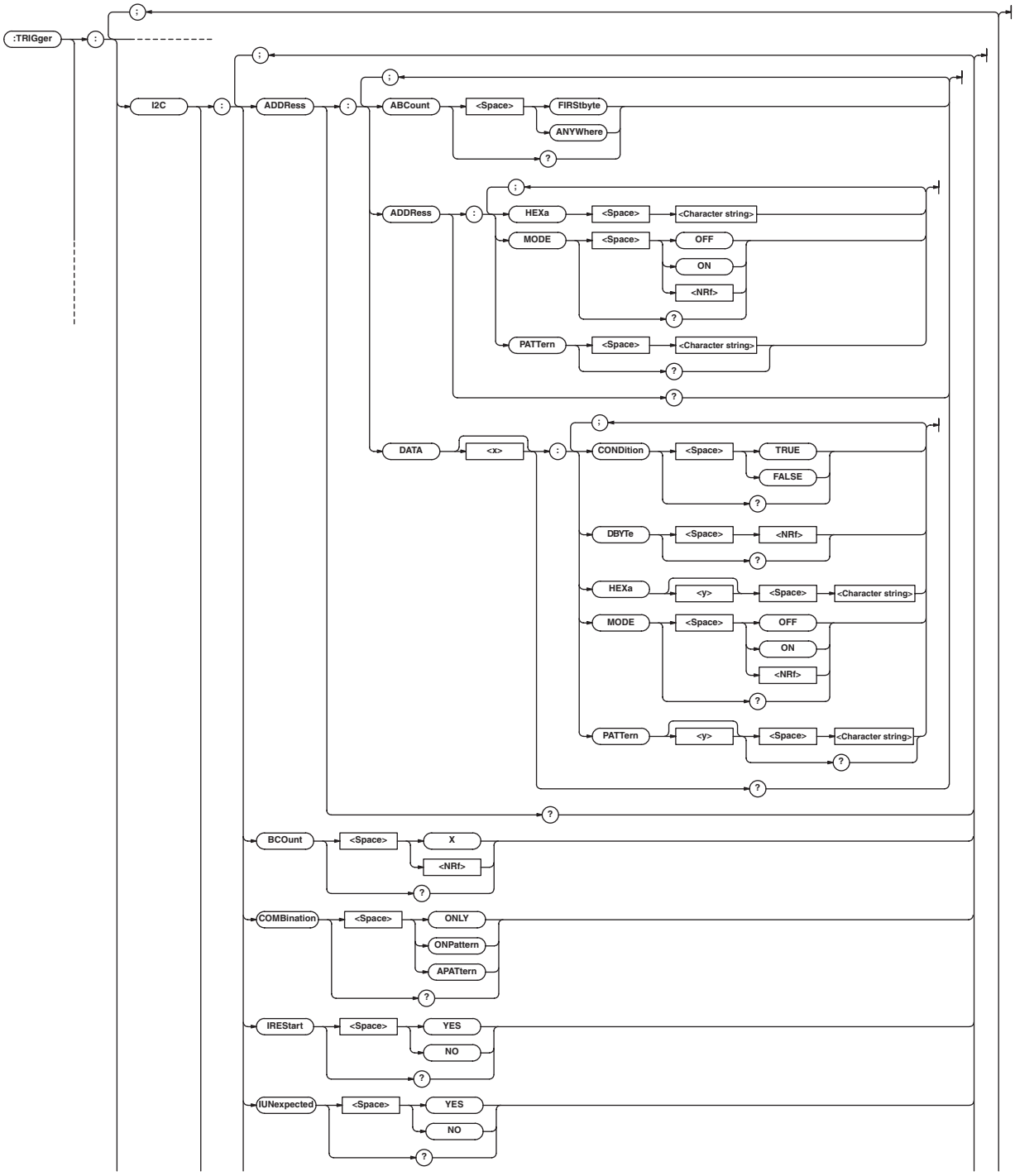
Function Executes the saving of the data of the detailed analysis list of the analysis This is an overlap command.

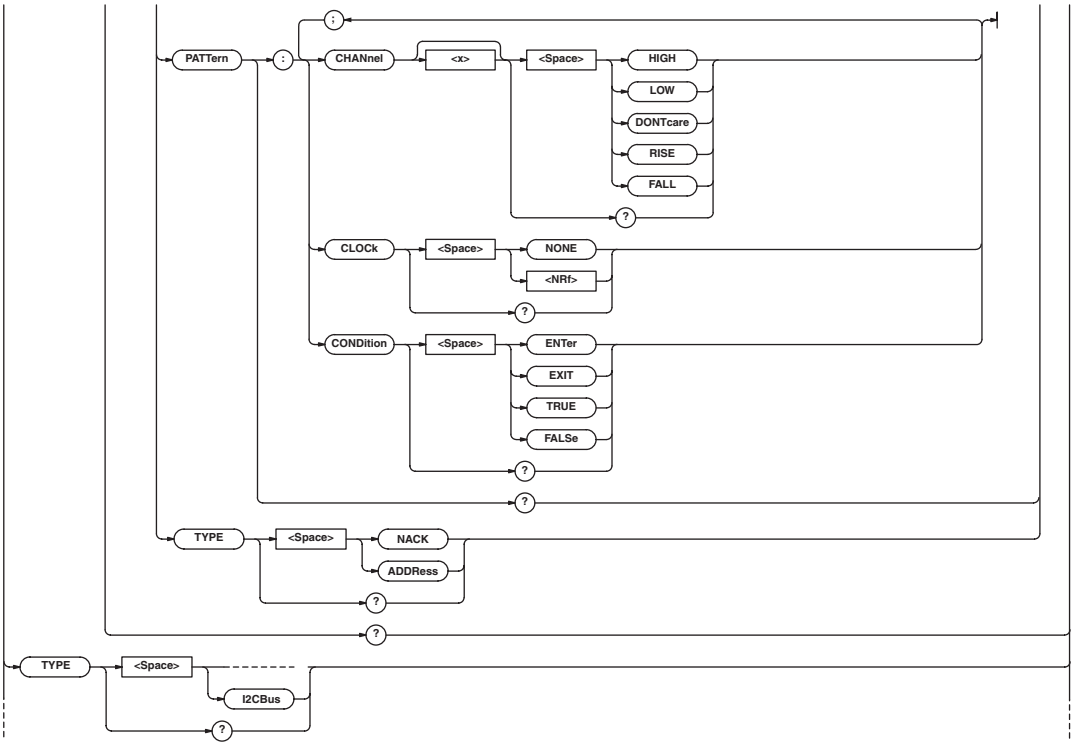
Syntax `:FILE:SAVE:I2C[:EXECute]`

Example `:FILE:SAVE:I2C:EXECUTE`

## • I²C Trigger Group

Commands in the I²C Trigger group can be used to make the same settings and inquiries as when the I²C bus menu under the ENHANCED key on the front panel is used.






### :TRIGger:I2C?

Function Queries all settings related to the trigger.

Syntax `:TRIGger:I2C?`

Example
```
:TRIGGER:I2C? -> :TRIGGER:I2C:
COMBINATION ONLY;TYPE ADDRESS;
ADDRESS:ADDRESS:MODE 0;
PATTERN "XXXXXXXX";:TRIGGER:I2C:
ADDRESS:DATA1:MODE 0;
PATTERN1 "XXXXXXXX";
CONDITION TRUE;:TRIGGER:I2C:
ADDRESS:DATA2:DBYTE 2;MODE 0;
PATTERN1 "XXXXXXXX";
PATTERN2 "XXXXXXXX";
CONDITION TRUE;:TRIGGER:I2C:
ADDRESS:ABCOUNT FIRSTBYTE;:TRIGGER:
I2C:IRESTART NO;IUNEXPECTED NO;
BCOUNT 0
```

### :TRIGger:I2C:ADDRess?

Function Queries all settings related to the Adrs&Data trigger.

Syntax `:TRIGger:I2C:ADDRess?`

Example
```
:TRIGGER:I2C:ADDRESS? -> :TRIGGER:
I2C:ADDRESS:ADDRESS:MODE 0;
PATTERN "XXXXXXXX";:TRIGGER:I2C:
ADDRESS:DATA1:MODE 0;
PATTERN1 "XXXXXXXX";
CONDITION TRUE;:TRIGGER:I2C:
ADDRESS:DATA2:DBYTE 2;MODE 0;
PATTERN1 "XXXXXXXX";
PATTERN2 "XXXXXXXX";CONDITION
TRUE;:TRIGGER:I2C:ADDRESS:
ABCOUNT FIRSTBYTE
```

### :TRIGger:I2C:ADDRess:ABCount

Function Sets the byte data location for comparing the Data2 Pattern when using Adrs&Data trigger or queries the current setting.

Syntax
```
:TRIGger:I2C:ADDRess:ABCount
{FIRStbyte|ANYWhere}
:TRIGger:I2C:ADDRess:ABCount?
```

Example
```
:TRIGGER:I2C:ADDRESS:ABCOUNT
FIRSTBYTE
:TRIGGER:I2C:ADDRESS:ABCOUNT? ->
:TRIGGER:I2C:ADDRESS:
ABCOUNT FIRSTBYTE
```

### :TRIGger:I2C:ADDRess:ADDRess?

Function Queries all settings related to the address pattern setting for the Adrs&Data trigger.

Syntax `:TRIGger:I2C:ADDRess:ADDRess?`

Example
```
:TRIGGER:I2C:ADDRESS:ADDRESS? ->
:TRIGGER:I2C:ADDRESS:ADDRESS:
MODE 0;PATTERN "X0X10X10"
```

### :TRIGger:I2C:ADDRess:ADDRess:HEXa

Function Sets the address pattern for the Adrs&Data trigger in hexadecimal.

Syntax
```
:TRIGger:I2C:ADDRess:ADDRess:HEXa
{<String>}
```
<String>=2 characters by combining '0' to 'F' and 'X'

Example
```
:TRIGGER:I2C:ADDRESS:ADDRESS:
HEXA "1A"
```

### :TRIGger:I2C:ADDRess:ADDRess:MODE

Function Enables or disables the address pattern for the Adrs&Data trigger or queries the current setting.

Syntax
```
:TRIGger:I2C:ADDRess:ADDRess:MODE
{<Boolean>}
:TRIGger:I2C:ADDRess:ADDRess:MODE?
```

Example
```
:TRIGGER:I2C:ADDRESS:ADDRESS:
MODE ON
:TRIGGER:I2C:ADDRESS:ADDRESS:
MODE? ->:TRIGGER:I2C:ADDRESS:
ADDRESS:MODE 1
```

### :TRIGger:I2C:ADDRess:ADDRess:PATTern

Function Sets the address pattern for the Adrs&Data trigger in binary or queries the current setting.

Syntax
```
:TRIGger:I2C:ADDRess:ADDRess:
PATTern {<String>}
:TRIGger:I2C:ADDRess:ADDRess:
PATTern?
```
<String>=8 characters by combining '0,' '1,' and 'X'
(The 8th character is the R/$\overline{W}$ bit.)

Example
```
:TRIGGER:I2C:ADDRESS:ADDRESS:
PATTERN "X0X10X10"
:TRIGGER:I2C:ADDRESS:ADDRESS:
PATTERN? -> :TRIGGER:I2C:ADDRESS:
ADDRESS:PATTERN "X0X10X10"
```

### :TRIGger:I2C:ADDRess:DATA<x>?

Function Queries all settings related to each address pattern setting for the Adrs&Data trigger.

Syntax
```
:TRIGger:I2C:ADDRess:DATA<x>?
```
<x>=1, 2

Example
```
:TRIGGER:I2C:ADDRESS:DATA1? ->
:TRIGGER:I2C:ADDRESS:DATA1:MODE 0;
PATTERN 1 "10X10X10";
CONDITION FALSE
```

### :TRIGger:I2C:ADDRess:DATA<x>:CONDition

Function Sets the condition of each data pattern for the Adrs&Data trigger or queries the current setting.

Syntax
```
:TRIGger:I2C:ADDRess:DATA<x>:
CONDition {TRUE|FALSE}
:TRIGger:I2C:ADDRess:DATA<x>:
CONDition?
```
<x>=1, 2

Example
```
:TRIGGER:I2C:ADDRESS:DATA1:
CONDITION TRUE:
TRIGGER:I2C:ADDRESS:DATA1:
CONDITION? -> :TRIGGER:I2C:ADDRESS:
DATA1:CONDITION TRUE
```

### :TRIGger:I2C:ADDRess:DATA<x>:DBYTe

Function Sets the number of bytes of the data pattern (Data2 Pattern) for the Adrs&Data trigger or queries the current setting.

Syntax
```
:TRIGger:I2C:ADDRess:DATA<x>:DBYTe
{<NRf>}
:TRIGger:I2C:ADDRess:DATA<x>:DBYTe?
```
<NRf>=1, 2
<x>=2

Example
```
:TRIGGER:I2C:ADDRESS:DATA2:DBYTE 2
:TRIGGER:I2C:ADDRESS:DATA2:DBYTE?
-> :TRIGGER:I2C:ADDRESS:DATA2:
DBYTE 2
```

### :TRIGger:I2C:ADDRess:DATA<x>:HEXa<y>

Function Sets each data pattern for the Adrs&Data trigger in hexadecimal.

Syntax
```
:TRIGger:I2C:ADDRess:DATA<x>:
HEXa<y> {<String>}
:TRIGger:I2C:ADDRess:DATA<x>:
HEXa<y>?
```
<String>=2 characters by combining '0' to 'F' and 'X'
<x>=1, 2
<y>=1, 2 (except when <x>=1, <y>=1 only)

Example
```
:TRIGGER:I2C:ADDRESS:DATA1:
HEXA1 "2B"
```

### :TRIGger:I2C:ADDRess:DATA<x>:MODE

Function Enables or disables each data pattern for the Adrs&Data trigger or queries the current setting.

Syntax
```
:TRIGger:I2C:ADDRess:DATA<x>:MODE
{<Boolean>}
:TRIGger:I2C:ADDRess:DATA<x>:MODE?
```
<x>=1, 2

Example
```
:TRIGGER:I2C:ADDRESS:DATA1:MODE ON
:TRIGGER:I2C:ADDRESS:DATA1:MODE? ->
:TRIGGER:I2C:ADDRESS:DATA1:MODE 1
```

### :TRIGger:I2C:ADDRess:DATA<x>:PATTern<y>

Function Sets each data pattern for the Adrs&Data trigger in binary or queries the current setting.

Syntax
```
:TRIGger:I2C:ADDRess:DATA<x>:
PATTern<y> {<String>}
:TRIGger:I2C:ADDRess:DATA<x>:
PATTern<y>?
```
<String>=8 characters by combining '0,' '1,' and 'X'
<x>=1, 2
<y>=1, 2 (except when <x>=1, <y>=1 only)

Example
```
:TRIGGER:I2C:ADDRESS:DATA1:
PATTERN1 "10X10X10"
:TRIGGER:I2C:ADDRESS:DATA1:
PATTERN1? -> :TRIGGER:I2C:ADDRESS:
DATA1:PATTERN1 "10X10X10"
```

### :TRIGger:I2C:BCOunt

Function Sets the byte count for the Adrs&Data trigger or queries the current setting.

Syntax
```
:TRIGger:I2C:BCOunt {X|<NRf>}
:TRIGger:I2C:BCOunt?
```
<NRf>=0 to 9999

Example
```
:TRIGGER:I2C:BCOUNT 1
:TRIGGER:I2C:BCOUNT? ->
:TRIGGER:I2C:BCOUNT 1
```

### :TRIGger:I2C:COMBination

Function Sets the combination trigger or queries the current setting.

Syntax
```
:TRIGger:I2C:COMBination {ONLY|
ONPattern|APATtern}
:TRIGger:I2C:COMBination?
```

Example
```
:TRIGGER:I2C:COMBIMATION ONLY
:TRIGGER:I2C:COMBIMATION? ->
:TRIGGER:I2C:COMBIMATION ONLY
```

### :TRIGger:I2C:IREStart

Function Sets whether to ignore the restart condition (YES/NO) of the trigger or queries the current setting.

Syntax
```
:TRIGger:I2C:IREStart {YES|NO}
:TRIGger:I2C:IREStart?
```

Example
```
:TRIGGER:I2C:IRESTART YES
:TRIGGER:I2C:IRESTART? ->
:TRIGGER:I2C:IRESTART YES
```

### :TRIGger:I2C:IUNexpected

Function Sets whether to ignore the start/stop conditions that do not conform to the protocol (YES/NO) of the trigger or queries the current setting.

Syntax
```
:TRIGger:I2C:IUNexpected {YES|NO}
:TRIGger:I2C:IUNexpected?
```

Example
```
:TRIGGER:I2C:IUNEXPECTED YES
:TRIGGER:I2C:IUNEXPECTED? ->
:TRIGGER:I2C:IUNEXPECTED YES
```

### :TRIGger:I2C:PATTern?

Function Queries all settings related to each channel pattern setting of the combination trigger.

Syntax
```
:TRIGger:I2C:PATTern?
```

Example
```
:TRIGGER:I2C:PATTERN? ->
:TRIGGER:I2C:PATTERN:CLOCK NONE;
CHANNEL3 DONTCARE;
CHANNEL4 DONTCARE;CONDITION ENTER
```

### :TRIGger:I2C:PATTern:CHANnel<x>

Function Sets the condition (pattern or slope) of each channel of the combination trigger or queries the current setting.

Syntax
```
:TRIGger:I2C:PATTern:CHANnel<x>
{HIGH|LOW|DONTcare|RISE|FALL}
:TRIGger:I2C:PATTern:CHANnel<x>?
```
<x>=3 to 8 (3 or 4 on the DL7440)

Example
```
:TRIGGER:I2C:PATTERN:CHANNEL3 HIGH
:TRIGGER:I2C:PATTERN:CHANNEL3? ->
:TRIGGER:I2C:PATTERN:CHANNEL3 HIGH
```

Description When set to "`:TRIGger:I2C:PATTern:CLOCk NONE`", select from `{HIGH|LOW|DONTcare}`. For all other cases, select from `{RISE|FALL}`.

### :TRIGger:I2C:PATTern:CLOCk

Function Sets the clock channel of the combination trigger or queries the current setting.

Syntax
```
:TRIGger:I2C:PATTern:CLOCk
{NONE|<NRf>}
:TRIGger:I2C:PATTern:CLOCk?
```
<NRf>=3 to 8 (3 or 4 on the DL7440)

Example
```
:TRIGGER:I2C:PATTERN:CLOCK 3
:TRIGGER:I2C:PATTERN:CLOCK? ->
:TRIGGER:I2C:PATTERN:CLOCK 3
```

Description You can set or query the clock channel only when "`:TRIGger:I2C:COMBination`" is `APATtern`.

### :TRIGger:I2C:PATTern:CONDition

Function Sets the pattern condition of the combination trigger or queries the current setting.

Syntax
```
:TRIGger:I2C:PATTern:CONDition
{ENTer|EXIT|TRUE|FALSe}
:TRIGger:I2C:PATTern:CONDition?
```

Example
```
:TRIGGER:I2C:PATTERN:
CONDITION ENTER
:TRIGGER:I2C:PATTERN:CONDITION? ->
:TRIGGER:I2C:PATTERN:
CONDITION ENTER
```

Description When "`TRIGger:I2C:COMBination`" is set to "`ONPattern`," select from `{TRUE|FALSe}`. When "`TRIGger:I2C:COMBination`" is set to "`APATtern`" and "`TRIGger:I2C:PATTern:CLOCk`" is set to "`NONE`," select from `{ENTer|EXIT}`. For all other conditions, the setting is invalid.

### :TRIGger:I2C:TYPE

Function Sets the I²C trigger type or queries the current setting.

Syntax
```
:TRIGger:I2C:TYPE {ADDRess|NACK}
:TRIGger:I2C:TYPE?
```

Example
```
:TRIGGER:I2C:TYPE ADDRess
:TRIGGER:I2C:TYPE? ->
:TRIGGER:I2C:TYPE ADDRESS
```

### :TRIGger:TYPE

Function Sets the trigger type or queries the current setting.

Syntax
```
:TRIGger:TYPE {ABN|ADB|PATTern|
WIDTh|OR|TV|SIMPle|I2CBus}
:TRIGger:TYPE?
```

Example
```
:TRIGGER:TYPE I2CBUS
:TRIGGER:TYPE? ->
:TRIGGER:TYPE I2CBUS
```

# 2.1 Overview of the CAN Bus Analysis Function



## CAN Bus Signal Analysis Function

CAN stands for Controller Area Network. It is a serial communication protocol standardized internationally by the ISO (International Organization for Standardization). In communications that use CAN, analysis of the physical layer of the CAN Bus is required when troubleshooting problems that occur due to noise caused by surge voltage and level fluctuations caused by excessive load after connection.

By using this function, data can be analyzed while displaying the signal waveforms on the CAN Bus as analog waveforms. In addition, synchronized monitoring of the data on the CAN bus and the analog waveform is possible.

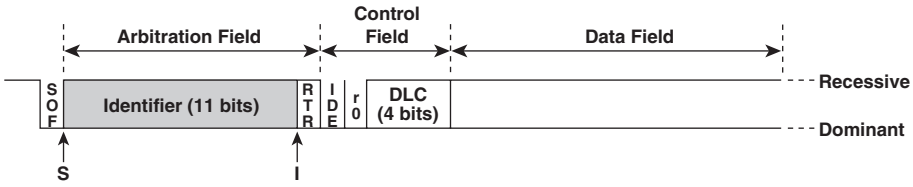
The CAN Bus signal analysis function consists of the following four main functions.

### Trigger Function <See page 2-5 for the operating procedure>

Acquires CAN Bus signals using the defined frames and fields of the CAN Bus as trigger conditions. Trigger conditions can be set to SOF, Identifier, Data Field, RTR, or Error Frame. Triggers can be activated using an AND condition, allowing trigger activation on frames with specific Identifier and Data Fields.

Triggers can also be activated by combining the trigger conditions of the CAN Bus signal and the parallel pattern of CH2 to CH8 signal (CH2 to CH4 on the DL7440) (combination trigger).

**[Example] For the Standard Format of the Data Frame**




**S: When Start of Frame is selected for the trigger condition, the Trigger activates here.**
**I: When Identifier is selected for the trigger condition, the Trigger activates here.**

### Analysis Function <See page 2-19 for the operating procedure>

Analyzes CAN Bus signal data acquired using the trigger function, and displays the Identifier, Data Field, and Acknowledge values for each frame in a list. By selecting any number of frames from this analysis results list, the CAN Bus signals for those frames can be automatically displayed. Details of the analysis results such as frame and error types can be viewed in a detailed analysis results list. The data from the detailed analysis results list can be saved to any storage medium in ASCII format. Also, stuff bits within the CAN Bus signals can be detected, and stuff bit waveforms can be displayed as math waveforms. The frames to be analyzed are data frames, remote frames, and error frames.

### Search Function <See page 2-23 for the operating procedure>

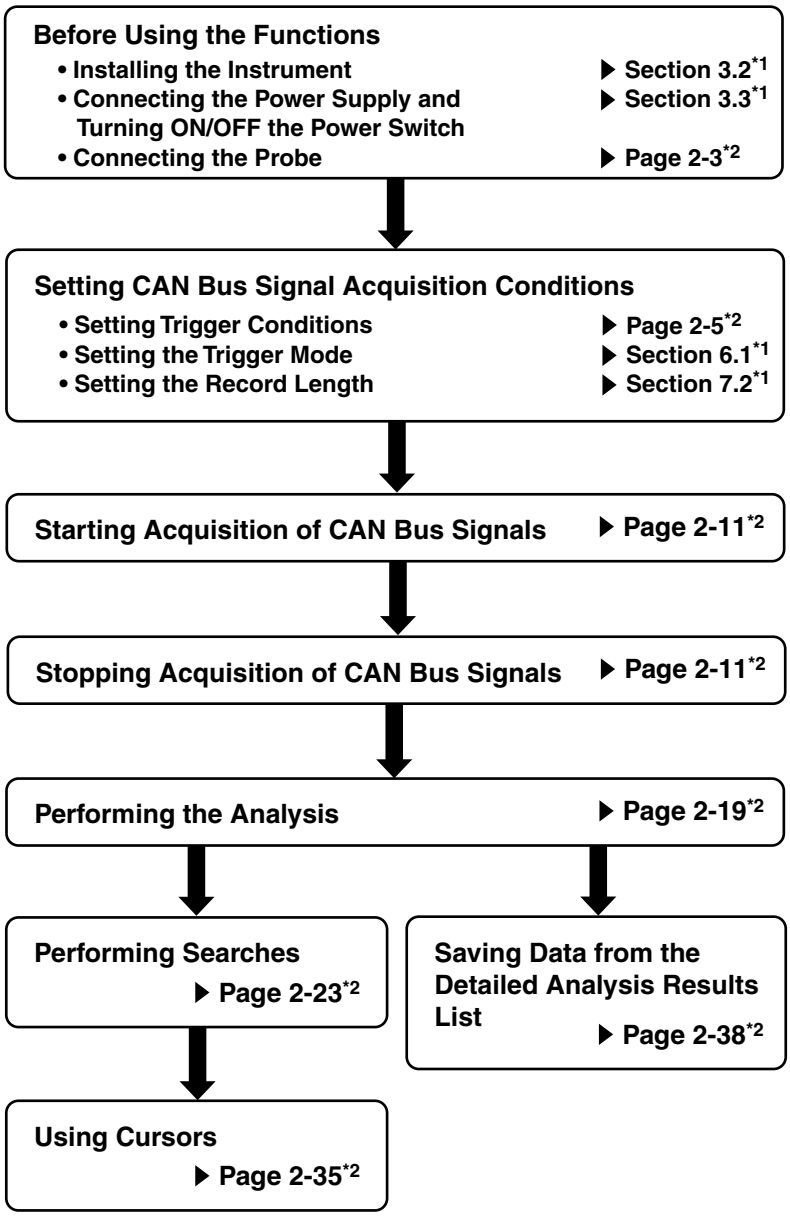
After analysis of the CAN Bus signal data acquired using the trigger function, searches for data matching data from a specific frame or field, and displays the corresponding waveforms on screen. Searches can also be performed for error frames and frames with indefinite data. Also, after the search, the beginning of the specified field within the frame can be displayed (field jump). Using this function, the desired field within the frame can be instantly displayed.

### Cursor Function <See page 2-35 for the operating procedure>

Two cursors can be moved per each CAN Bus bit rate (data transfer rate) while maintaining a bit rate of space between them. When analyzing or searching, CAN Bus signal fields and frames can be checked while counting the number of bits.

# 2.2 Flow of Operation

The figure below provides an overview of the flow of operations when using the CAN Bus signal analysis function. For details about specific items, see the referenced pages in this manual or the respective sections in the *DL7440/DL7480 User's Manual (IM701450-01E)*.




***1. Indicates reference sections from the DL7440/DL7480 user's manual (IM701450-01E).**
***2. Indicates reference pages from this manual.**

# 2.3 Connecting the Probe

## Probes That Are Used

A differential probe is used when measuring CAN Bus signals.
Recommended model of differential probe (by Yokogawa): 701920 or 701922

## Input Terminals

Connect the probe (or other input cables such as the BNC cable) to any of the input terminals (4 terminals marked as CH1 to CH4 on the DL7440 and 8 terminals marked CH1 to CH8 on the DL7480) located on the lower section of the front panel. The input impedance is 1 MΩ±1.0% and approximately 20 pF or 50 Ω±1.0%.

**CAUTION**

- The maximum input voltage for 1-MΩ input is 400 V (DC + ACpeak) or 282 Vrms when the frequency is 1 kHz or less. Applying a voltage exceeding either of these voltages can damage the input section. If the frequency is above 1 kHz, the input section may be damaged even when the voltage is below the values specified above.
- The maximum input voltage for 50-Ω input is 5 Vrms or 10 Vpeak. Applying a voltage exceeding either of these voltages can damage the input section.

**DL7440**


**DL7480**


## Probe Power Supply

When using the differential probe from Yokogawa (model 701920 or 701922), use the probe power supply (PROBE POWER) located on the rear panel of the instrument.
For more information about the probe power supply, see "When Using the FET Probe, Current Probe, or Differential Probe" in section 3.4, "Connecting the Probe" in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

## Precautions to Be Taken When Connecting a Probe

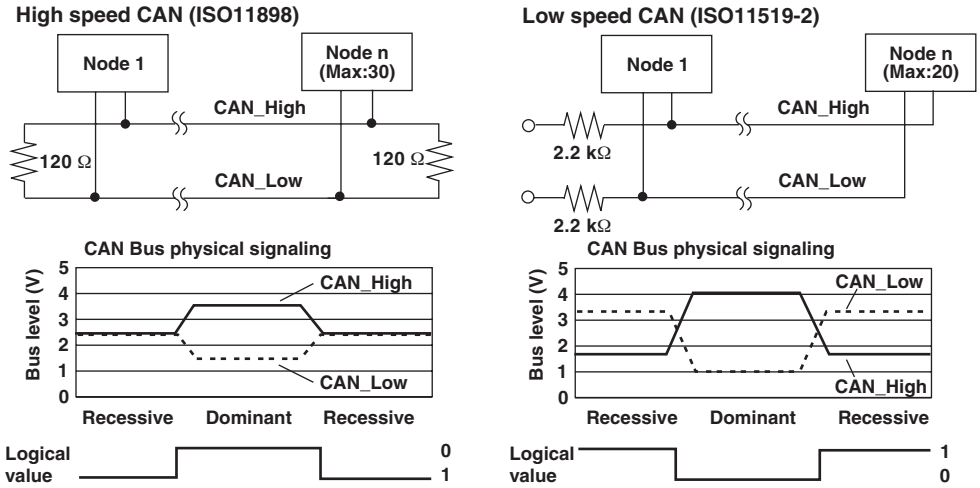
- To activate triggers using the CAN Bus signal, apply the CAN Bus signal to the CH1 input terminal.
- When connecting a probe to the instrument for the first time, perform phase correction of the probe as described in section 3.5, "Compensating the Probe (Phase Correction)" in the *DL7440/DL7480 User's Manual (IM701450-01E)*. Failure to do so will cause unstable gain across different frequencies, thereby preventing correct measurement. Calibration must be performed for each channel to which the probe will be connected.
- Note that if the object being measured is directly connected to the instrument without using a probe, correct measurements may not be possible due to the loading effect.

***Note***

Data analysis and data search can be performed on the CAN Bus signals applied to CH3. For details, see section 2.5, "Analyzing/Searching Data."

## Differential Probe Connection Method

CAN has two standards, High speed CAN (ISO11898) and Low speed CAN (ISO11519-2).



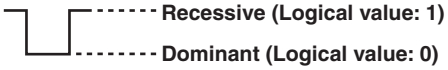

In the figure above, the bus level is determined for both High and Low speed CAN according to the difference of potential between the CAN_High and CAN_Low busses. The bus has two levels, dominant and recessive, and the signal must be at one of those levels.

The instrument normally handles the dominant logical value as 0 and the recessive logical value as 1, but depending on how the differential probe is set up, you can select whether to display the dominant or recessive as the higher voltage level.

### Connecting the Differential Probe

**When the Recessive Voltage Level is Displayed as Higher Than the Dominant Voltage Level**

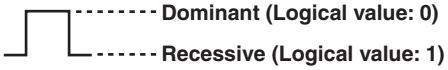
**(Vdiff: CAN_L–CAN_H[1])**




- **For a Two Wire System (Differential)**
  Connect the differential probe negative (–) to CAN_High, and the probe positive (+) to CAN_Low.
- **For a One Wire System (Single-Ended)**
  Connect the differential probe negative (–) to CAN_High, and probe positive (+) to GND (ground potential).

**When the Recessive Voltage Level is Displayed as Less Than the Dominant Voltage Level**

**(Vdiff: CAN_H–CAN_L[1])**




- **For a Two Wire System (Differential)**
  Connect the differential probe negative (–) to CAN_Low, and the probe positive (+) to CAN_High.
- **For a One Wire System (Single-Ended)[2]**
  Connect the differential probe negative (–) to GND (ground potential), and the probe positive (+) to CAN_High.

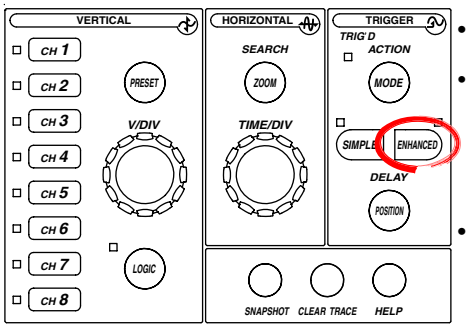
1 These items are set in the CAN Setup dialog box (see page 2-5) and the Analyze Setup dialog box (see page 2-20). Select CAN_L-CAN_H or CAN_H-CAN_L depending on how the probe is connected. For details, see the explanation for each dialog box.

2 In this case the passive probe (model 700988) can be connected to CAN_High

# 2.4 Setting CAN Bus Signal Acquisition Conditions

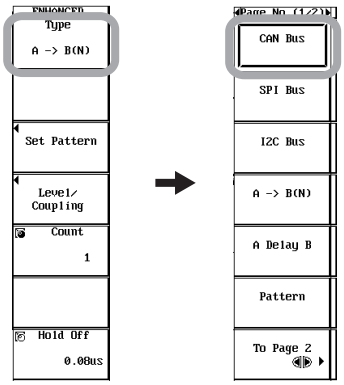
With the CAN bus signal analysis function, you can acquire CAN Bus signals using specific frames and fields of the CAN Bus as trigger conditions.

## *Procedure*



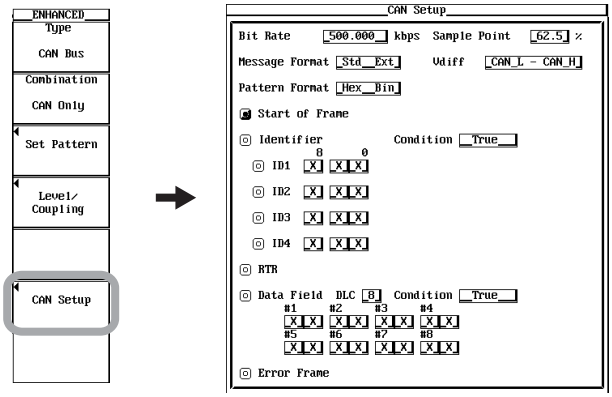

- To exit the menu during operation, press **ESC** located above the soft keys.
- In the procedural explanation below, the term *jog shuttle & SELECT* refers to the operation of selecting/setting items and entering values using the **jog shuttle**, **SELECT** and **RESET** keys. For details on the operation using the jog shuttle, SELECT, and RESET, see sections 4.1 or 4.2 in the DL7440/DL7480 User's Manual.
- For a description of the operation using a USB keyboard or a USB mouse, see section 4.3 in the DL7440/DL7480 User's Manual.

1. Press **ENHANCED**. The ENHANCED menu appears.
2. Press the **Type** soft key. The trigger type selection menu appears.
3. Press the **CAN Bus** soft key.




### Setting the Trigger Conditions of the CAN Bus Signal

4. Press the **CAN Setup** soft key. The CAN Setup dialog box opens.



**Setting the Bit Rate**

5. Use **jog shuttle & SELECT** to display the keyboard used to set the bit rate (Bit Rate box).

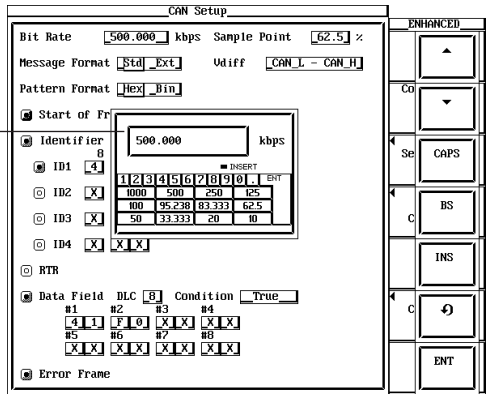
- **When Setting the Bit Rate from Predefined Values**

6. Turn the **jog shuttle** to move the cursor onto the key that corresponds to the desired bit rate (10, 20, 33.333, 50, 62.5, 83.333, 95.238, 100, 125, 250, 500, or 1000 [kbps]).
7. Press **SELECT**. The selected bit rate is reflected on the keyboard.
   Proceed to step 10.

- **When Entering the Bit Rate Using Numeric Keys**

6. Press **RESET** to clear the current bit rate.
7. Turn the **jog shuttle** to move the cursor to the highest digit of the bit rate you wish to enter.
8. Press **SELECT**.
9. Repeat steps 7 and 8 to input the bit rate in the range of 10.000 to 1000.000 [kbps]. Proceed to step 10.
10. Turn the **jog shuttle** to select ENT on the keyboard and press **SELECT**. The bit rate is entered, and the keyboard disappears.
    You can also press the **ENT** soft key to enter the bit rate and clear the keyboard.

**Keyboard used to set the bit rate**




***Note***

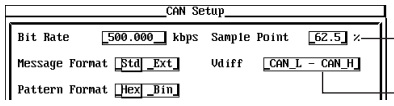
- If you input an arbitrary value using the numeric keys, the value that is actually entered may differ from the value you specified. This is because, the bit rate resolution on the instrument is set to the bit time (reciprocal of the bit rate) resolution of 0.5 [μs], and the instrument rounds the entered bit rate to the bit rate closest to the bit time conversion (see page 2-11).
- If you press RESET before the bit rate is entered, the bit rate you input is cleared.
- Other operations on the keyboard are the same as the operations on the keyboard for entering file names and comments. See page 4-4 in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Setting the Sample Point

11. Use **jog shuttle & SELECT** to set the sample point in the range of 18.8 to 90.6 (Sample Point box).

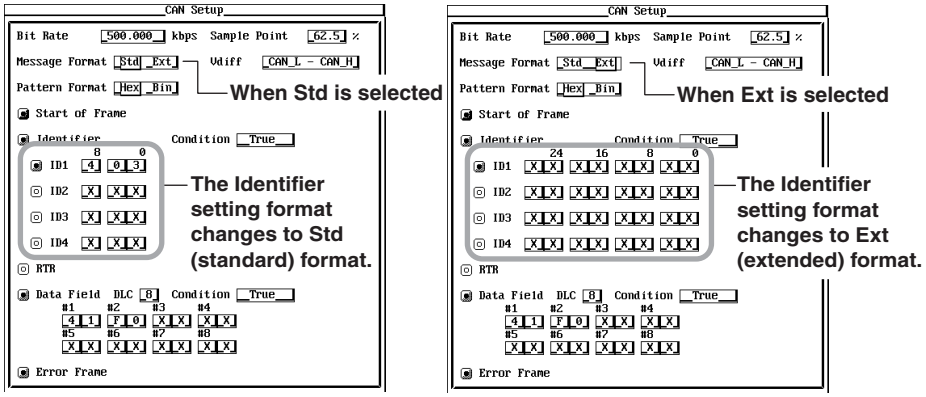
### Selecting Vdiff

12. Use **jog shuttle & SELECT** to set Vdiff to CAN_L–CAN_H or CAN_H–CAN_L (Vdiff box).



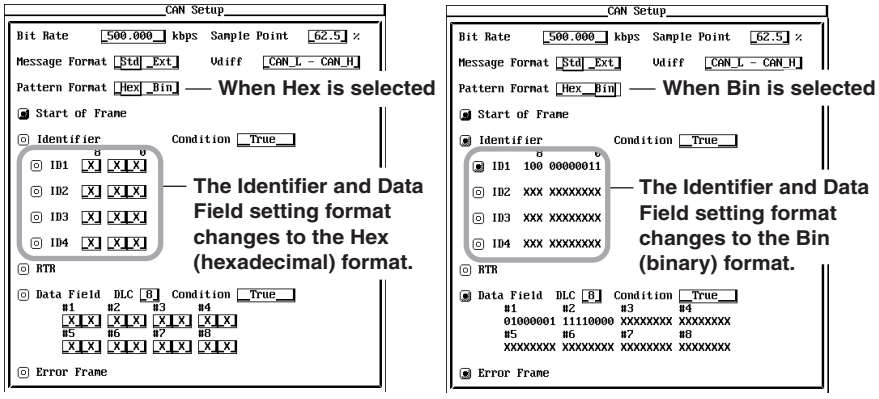

### Selecting the Message Format

13. Use **jog shuttle & SELECT** to set the message format to Std or Ext (Message Format box). The Identifier setting format changes to the selected format.




### Selecting the Pattern Format

14. Use **jog shuttle & SELECT** to set the pattern format to Hex or Bin (Pattern Format box). The Identifier and Data Field setting format changes to the selected format.



### Setting the Field or Frame Used as Trigger Conditions

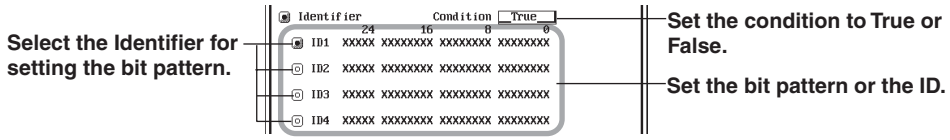
15. Use **jog shuttle & SELECT** to select whether to use the field or frame of Start of Frame, Identifier, RTR, Data Field, and Error Frame as trigger conditions.
    - Highlighting of the mark to the left of each item indicates that it is used as a trigger condition.
    - Start of Frame is always used as trigger condition (the mark to the left is always highlighted).
    - Multiple fields or frames can be selected together, but the RTR and Data Field cannot be turned ON at the same time. If either one is turned ON, the other is turned OFF.

- **When Identifier Is Selected**

16. Use **jog shuttle & SELECT** to set the condition to True or False (Condition box).
17. Use **jog shuttle & SELECT** to select the Identifier (ID1, ID2, ID3, or ID4) on which to set the bit pattern.

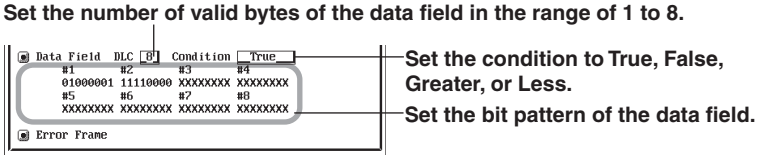
    When the mark to the left of ID1 to ID4 is highlighted, the bit pattern can be set.

18. Use **jog shuttle & SELECT** to set the bit pattern on the selected Identifier.
    - If you selected Hex for Pattern Format in step 14, turn the jog shuttle to select 0 to 9, A to F, or X, and press SELECT. Pressing RESET will reset the value to X (the initial value).
    - If you selected Bin for Pattern Format in step 14, press SELECT to select 0, 1, or X.
19. Repeat steps 17 and 18 as many times as necessary.




- **When Data Field Is Selected**

20. Use **jog shuttle & SELECT** to set the number of valid bytes of the data field to a value between 1 and 8 (DLC box).
21. Use **jog shuttle & SELECT** to set the condition to True, False, Greater, or Less (Condition box).
22. Use **jog shuttle & SELECT** to set the data field bit pattern.
    - If you selected Hex for Pattern Format in step 14, turn the jog shuttle to select 0 to 9, A to F, or X, and press SELECT. Pressing RESET will reset the value to X (the initial value).
    - If you selected Bin for Pattern Format in step 14, press SELECT to select 0, 1, or X.

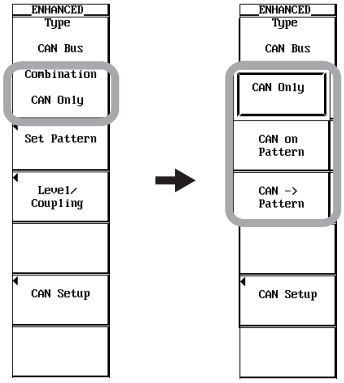



23. Press **ESC**. The CAN Setup dialog box closes.

### Setting the Combination Trigger

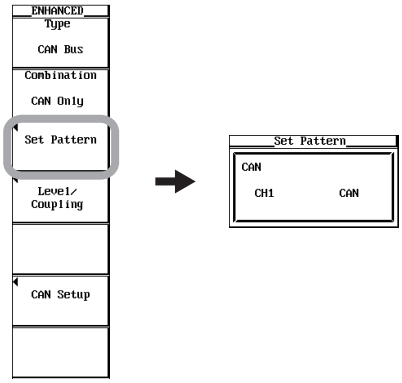
24. Press the **Combination** soft key. The Combination menu appears.
25. Press **CAN Only**, **CAN on Pattern**, or **CAN -> Pattern** soft key.

    Select CAN Only to activate a trigger only on the trigger conditions of the CAN Bus signal. Select CAN on Pattern to activate a trigger when the trigger conditions of the CAN Bus signal are met while the trigger conditions of CH2 to CH8 (CH2 to CH4 on the DL7440) are met. Select CAN -> Pattern to activate a trigger when the trigger conditions of CH2 to CH8 (CH2 to CH4 on the DL7440) are met after the trigger conditions of the CAN Bus signal are met.




#### When CAN Only Is Selected

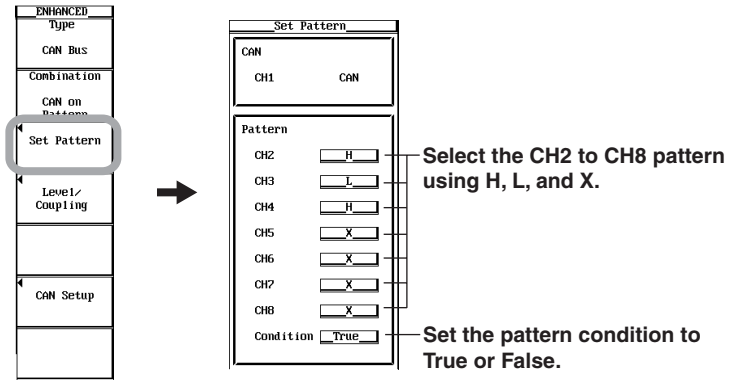
26. Press the **Set Pattern** soft key. The Set Pattern dialog box displays the assignment conditions of the CAN Bus signal of CH1.




27. Press **ESC**. The Set Pattern dialog box closes.
    Proceed to step 32.

**When CAN on Pattern Is Selected**

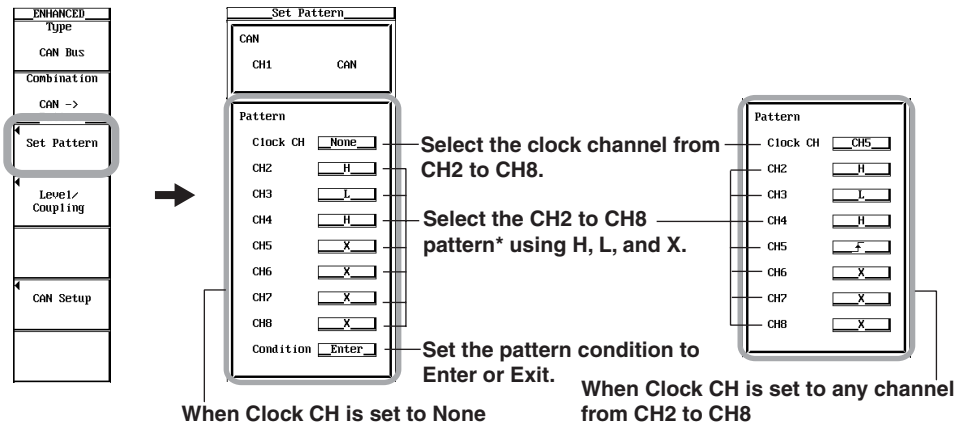
26. Press the **Set Pattern** soft key. The Set Pattern dialog box displays the assignment conditions of the CAN Bus signal of CH1 and the setup screen for the patterns of CH2 to CH8 (CH2 to CH4 on the DL7440).
27. Use **jog shuttle & SELECT** to set the patterns of CH2 to CH8 (CH2 to CH4 on the DL7440) using H (high), L (low), and X.
28. Use **jog shuttle & SELECT** to set the pattern condition to True or False (Condition box).




29. Press **ESC**. The Set Pattern dialog box closes.
Proceed to step 32.

**When CAN -> Pattern Is Selected**

26. Press the **Set Pattern** soft key. The Set Pattern dialog box displays the assignment conditions of the CAN Bus signal of CH1 and the setup screen for the patterns of CH2 to CH8 (CH2 to CH4 on the DL7440).
27. Use **jog shuttle & SELECT** to set the clock channel to None or any of the channels from CH2 to CH8 (CH2 to CH4 on the DL7440) (Clock CH box).
29. Use **jog shuttle & SELECT** to set the patterns of CH2 to CH8 (CH2 to CH4 on the DL7440) using H (high), L (low), and X. For the channel set as the clock channel in step 27, set the slope to ⎍ (rising edge) or ⎎ (falling edge).
30. If you set the clock channel to None in step 27, use **jog shuttle & SELECT** to set the pattern condition to Enter or Exit (Condition box).

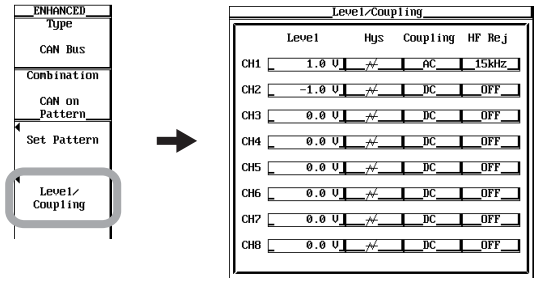



*** Set the slope of the channel selected for the clock channel to ⎍ or ⎎.**

31. Press **ESC**. The Set Pattern dialog box closes.
Proceed to step 32.

### Setting the Trigger Level, Trigger Coupling, Etc.

32. Press the **Level/Coupling** soft key. The Level/Coupling dialog box opens.
33. Set the trigger level, trigger hysteresis, trigger coupling, and HF rejection of each channel. For the setup procedure, see steps 9 to 14 on page 6-16 in the *DL7440/DL7480 User's Manual (IM701450-01E)*.




34. Press **ESC**. The Level/Coupling dialog box closes.

### Setting the Trigger Mode

35. Set the trigger mode according to the procedures given in section 6.1, "Setting the Trigger Mode" in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Setting the Record Length

36. Set the record length according to the procedures given in section 7.2, "Setting the Record Length" in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Starting/Stopping the CAN Bus Signal Acquisition

37. Press **START/STOP** to start the CAN Bus signal acquisition. Triggers are activated on the specified trigger conditions.
    To proceed to the analysis, press **START/STOP** to stop the CAN Bus signal acquisition.

## *Explanation*

### Setting the Trigger Conditions of the CAN Bus Signal: CAN Setup

You can set the following conditions.

#### Bit Rate

Select a data transfer rate for the CAN Bus data to be analyzed from the following.
10, 20, 33.333, 50, 62.5, 83.333, 95.238, 100, 125, 250, 500, or 1000 [kbps]

You can also enter an arbitrary value* from the keyboard that appears on screen.
Selectable range: 10.000 to 1000.000 [kbps]
Resolution: Bit time (reciprocal of the bit rate) resolution of 0.5 μs

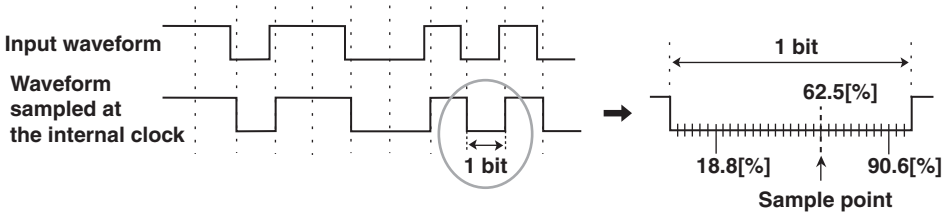
* If you enter an arbitrary value using the numeric keys, the value that is actually entered may differ from the value you specified. This is because, the bit rate resolution on the instrument is set to the bit time (reciprocal of the bit rate) resolution of 0.5 [μs], and the instrument rounds the entered bit rate to the bit rate closest to the bit time conversion.
For example, if you input a bit rate of 450 [kbps] using numeric keys, the actual bit rate that is entered is 500 [kbps]. The bit time when the bit rate is set 450 [kbps] is 2.22 [μs]. However, because the resolution is 0.5 [μs], the bit time is rounded to 2.0 [μs] which corresponds to a bit rate of 500 [kbps]. If you input a bit rate that would cause the bit time to fall in the middle of the resolution (such as 800 [kbps] which corresponds to a bit time of 1.25 [μs]), the bit rate is set a rate that corresponds to a longer bit time (in this case, 666.667 [kbps] because 1.5 [μs] is longer than 1.0 [μs]).

### Sample Point

Select a percentage for judging the bus level (recessive/dominant).
18.8, 21.9, 25.0, 28.1, 31.3, 34.4, 37.5, 40.6, 43.8, 46.9, 50.0, 53.1, 56.3, 59.4, 62.5, 65.6, 68.8, 71.9, 75.0, 78.1, 81.3, 84.4, 87.5, or 90.6 [%]

In the trigger circuits of the instrument's CAN Bus signal analysis function, the input CAN Bus signal is sampled once per the internal clock, and the point of change from recessive to dominant is detected. The detected point is taken as 0%, and the point one bit time (the reciprocal of the specified bit rate) thereafter is taken as 100%, allowing expression of the sample point as a percentage.

**When the Sample Point Is Set to 62.5%**




### Message Format

You can select a format for the Identifier (ID) field of the Arbitration field within the data frame from the following:

| | |
|---|---|
| Std | Standard format |
| Ext | Extended format |

### Vdiff

You can select a connection method for the differential probe from below. In either case, the logical value is: recessive = 1 and dominant = 0.

| | |
|---|---|
| CAN_L–CAN_H | The recessive voltage level is greater than the dominant voltage level. |
| CAN_H–CAN_L | The dominant voltage level is greater than the recessive voltage level. |

***Note***

- For the further information on connecting the differential probe, see section 2.3, "Connecting the Probe."
- The bit rate setting is connected with the setting in the Analyze Setup dialog box (see page 2-20), and the CURSOR menu (see page 2-35).
- The Vdiff setting is connected with the setting in the Analyze Setup dialog box (see page 2-20).

### Pattern Format

You can select a format for the Identifier (ID) field and the Data field from the following:

| | |
|---|---|
| Hex | Hexadecimal |
| Bin | Binary |

**Field or Frame Type**

You can select the type of CAN Bus signal field or frame to be used as trigger conditions from the five types listed below. You can use the AND condition to select multiple types at the same time. However, RTR and Data Field cannot be specified in combination.

- **Start of Frame**
  The trigger activates on the Start of Frame (SOF). The trigger point is set to the end position of the Start of Frame.
- **Identifier**
  The trigger activates on an Identifier (ID) matching the specified condition. Four types of IDs can be specified. A trigger is activated on the OR logic of the four types of IDs. The trigger point is set to the end position of the ID.
- **RTR**
  The trigger activates on a remote frame (RTR is recessive). The trigger point is set to the end position of the RTR bit.
- **Data Field**
  The trigger activates on a data field matching the specified condition. The trigger point is set to the end position of the data field.
- **Error Frame**
  The trigger activates on an error frame. The DL7440/DL7480 considers 6 successive dominant bits(logical value of 0) as an error frame trigger condition. Therefore, a trigger occurs if 6 successive dominant bits occur in an overload frame. The trigger point is set to the end position of the 6th dominant bit.

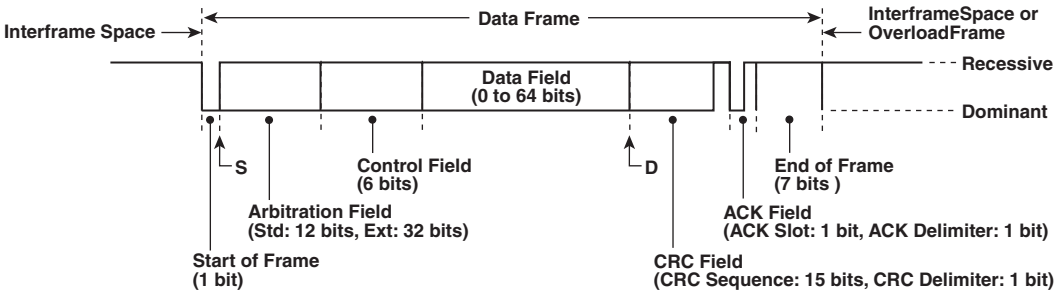
***Note***

If multiple field and frame types are combined, the trigger point is set to the trigger point of the type that appeared last in the time sequence.

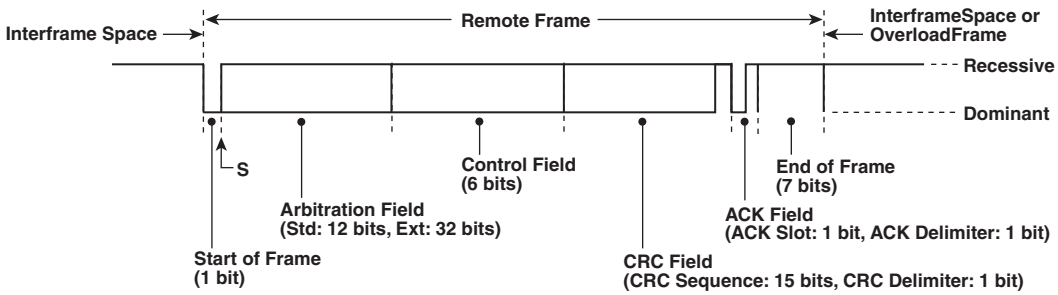
**Field/Frame Formats and Trigger Position**

The following figure shows the field and frame formats and trigger position.

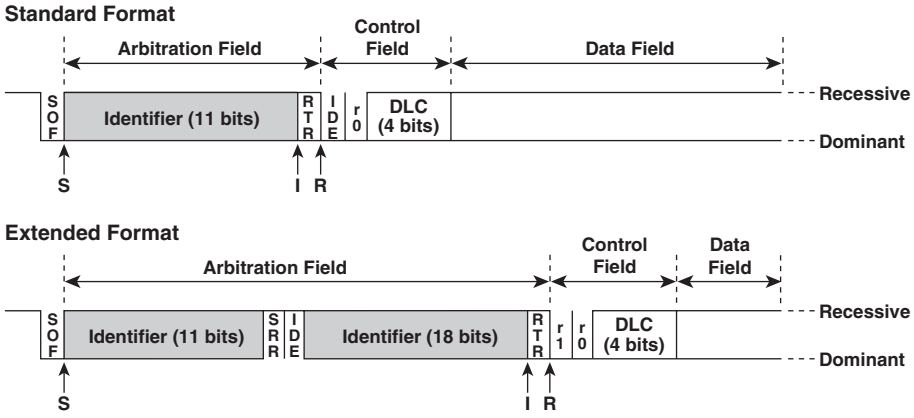
- **Data Frame**



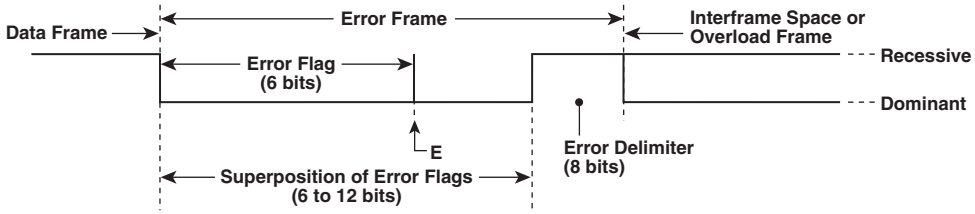

- **Remote Frame**



- **Standard Format and Extended Format of the Data Frame and Remote Frame**




- **Error Frame**




S: Trigger position for Start of Frame
I: Trigger position for Identifier
R: Trigger position for RTR
D: Trigger position for Data Frame
E: Trigger position for Error Frame

**When Identifier Is Selected for the Frame/Field Type**

- **Condition**

You can select from the following:

| | |
|---|---|
| True | Trigger is activated when one bit pattern from ID1 to ID4 is met. |
| False | Trigger is activated when a bit pattern other than ID1 to ID4 is met. |

- **Bit Pattern: ID1 to ID4**

You can set 4 types of bit patterns (ID1 to ID4).
When Pattern Format is set to Hex (hexadecimal), you can enter X, 0 to 9, or A to F in units of 4 bits. When Pattern Format is set to Bin (binary), you can enter X, 0, or 1.
The trigger is activated on the OR condition of ID1 to ID4. The number of specified bits varies depending on the message format type as follows:

| | |
|---|---|
| Standard format (Std) | 11 bits (the max value is 7FF when Pattern Format is set to Hex (hexadecimal)). |
| Extended format Ext) | 29 bits (the max value is 1FFFFFFF when Pattern Format is set to Hex(hexadecimal)). |

***Note***

- If Identifier is selected (ON) and all the bits from ID1 to ID4 are set to X, the trigger does not occur. The trigger does not occur even when combined with other field and frame types in this condition.
- When X is included in the ID1 to ID4 bit pattern, the trigger point is set to the end of the Identifier (ID) in the same fashion as when 0, 1 is set to the bit pattern.
- For ID1 to ID4 and Data Field bit patterns, if there is at least one “X” bit in a group of four bits in the binary display, the corresponding hexadecimal display will show a “$.”

**When Data Field Is Selected for the Frame/Field Type**

- **The Number of Valid Bytes: DLC**
  You can set the number of valid bytes in the range from 1 to 8. Only the frames having a data field of the specified number of valid bytes can activate triggers.

- **Condition**
  Select the from the following four types.

| | |
|---|---|
| True | Trigger is activated when the bit pattern is met. |
| False | Trigger is activated when the bit pattern is not met. |
| Greater | Trigger is activated when the value of the data flowing on the bus is greater than the specified value. |
| Less | Trigger is activated when the value of the data flowing on the bus is less than the specified value. |

***Note***

Greater and Less can be used only when the data flows from the highest byte (big endian) on the bus.

- **Bit Pattern: #1 to #8**
  The Data field pattern can be set with up to 64 bits.
  The numbers/characters set varies depending on the pattern format type as follows:

| | |
|---|---|
| Hex (hexadecimal): | X, 0 to 9, A to F, -* (in units of 4 bits) |
| Bin (binary): | X, 0, 1, -* |

* If the number of valid bytes is less than 7, the invalid byte is displayed as “-” and cannot be changed.

***Note***

- If Data Field is selected (ON) and all the Data Field bits are set to X, the trigger does not occur. The trigger does not occur even when combined with other field and frame types in this condition.
- When X is included in the Data Field bit pattern, the trigger point is set to the end position of the Data Field in the same fashion as when 0, 1 is set to the bit pattern.

**Notes When Setting the Field or Frame Type**

- RTR and Data Field cannot be turned ON simultaneously.
  If Data Field is selected when RTR is selected, the RTR selection is cancelled; if RTR is selected when Data Field is selected, the Data Field selection is cancelled.
- The trigger function does not support CAN Busses with mixed standard and extended formats. If two formats exist, triggers will not activate correctly.

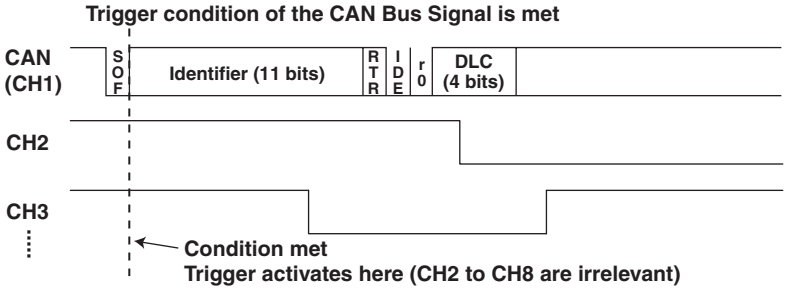
## Setting the Combination Trigger

A trigger can be activated on the combination of the trigger conditions of the CAN Bus signal and the trigger conditions of CH2 to CH8 (CH2 to CH4 on the DL7440). You can select from the following three types.

### CAN Only

Activates a trigger only on the trigger conditions of the CAN bus signal.

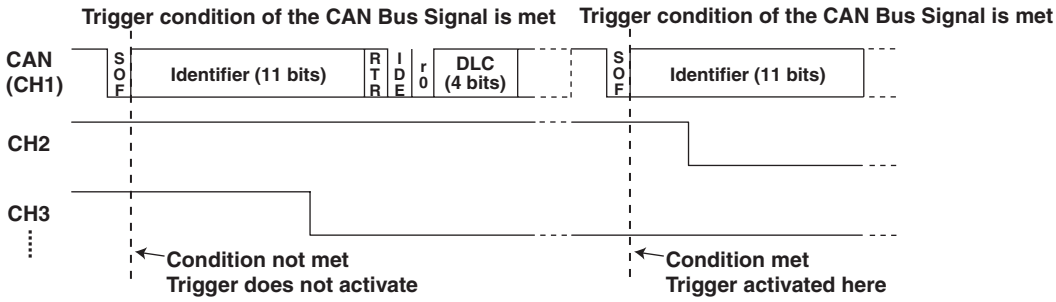
**To activate a trigger on the Start of Frame (SOF)**




### CAN on Pattern

Activates a trigger only when the trigger conditions of the CAN Bus signal are met while the trigger conditions of CH2 to CH8 (CH2 to CH4 on the DL7440) are met.

**To activate a trigger when CH2 = H, CH3 = L, Condition = True, Start of Frame (SOF)**




- **Patterns of CH2 to CH8 (CH2 to CH4 on the DL7440)**

  You can set the pattern as follows:

| | |
|---|---|
| H | The trigger source level is above the preset trigger level. |
| L | The trigger source level is below the preset trigger level. |
| X | Not used as a trigger source. |

- **Pattern Condition**

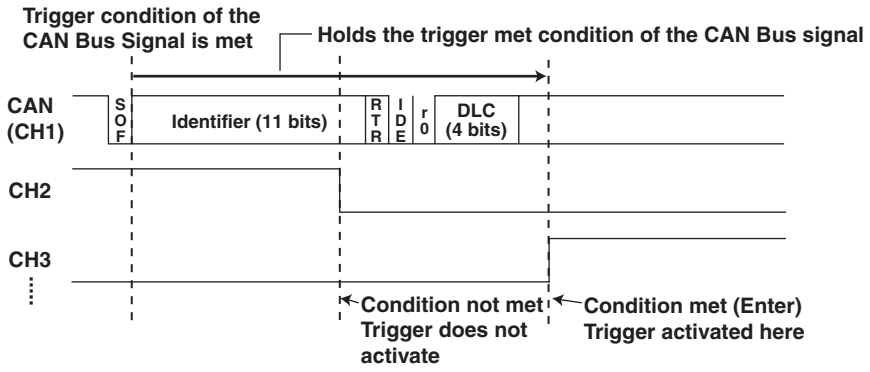
  Select the condition from the following.

| | |
|---|---|
| True | A trigger is activated when the specified pattern of CH2 to CH8 (CH2 to CH4 on the DL7440) is met. |
| False | A trigger is activated when the specified pattern of CH2 to CH8 (CH2 to CH4 on the DL7440) is no longer met. |

**CAN -> Pattern**

Activates a trigger when the trigger conditions of CH2 to CH8 (CH2 to CH4 on the DL7440) are met after the trigger conditions of the CAN Bus signal are met. The CAN Bus trigger met condition is held until the trigger conditions of CH2 to CH8 (CH2 to CH4 on the DL7440) are met.

**To activate a trigger when CH2 = L, CH3 = H, Condition = Enter, Start of Frame (SOF)**




- **Clock Channel**

  You can set a clock channel from CH2 to CH8 (CH2 to CH4 on the DL7440). If you do not wish to set a clock channel, select None.

- **Patterns of CH2 to CH8 (CH2 to CH4 on the DL7440)**

  You can set the pattern as follows:

| | |
|---|---|
| H | The trigger source level is above the preset trigger level. |
| L | The trigger source level is below the preset trigger level. |
| X | Not used as a trigger source. |

  For the channel set as the clock channel, set the slope to ⎍ (rising edge) or ⎎ (falling edge), not the pattern.

- **Pattern Condition**

  You can set the pattern condition only when a clock channel is not specified. Select from the following:

| | |
|---|---|
| Enter | A trigger is activated when the specified pattern of CH2 to CH8 (CH2 to CH4 on the DL7440) is met. |
| Exit | A trigger is activated when the specified pattern of CH2 to CH8 (CH2 to CH4 on the DL7440) is no longer met. |

  If you set the clock channel to any of the channels from CH2 to CH8 (CH2 to CH4 on the DL7440), the pattern condition is set to true.

### Setting the Trigger Level, Trigger Coupling, Etc.: Level/Coupling

Set the trigger level, hysteresis, trigger coupling, and HF rejection of each channel.
For details on the trigger level, hysteresis, trigger coupling, and HF rejection, see page 6-17 in section 6.8, “Setting the A->B(N) Trigger (ENHANCED)” in the *DL7440/DL7480 User’s Manual (IM701450-01E)*.

### Setting the Trigger Mode

Set the conditions for updating the displayed waveforms as a trigger mode. There are five trigger modes: auto mode, auto level mode, normal mode, single mode, and single (N) mode.
For details on the trigger modes, see section 6.1, “Selecting the Trigger Mode” in the *DL7440/DL7480 User’s Manual (IM701450-01E)*.

### Setting the Record Length

The record length sets the amount of data to be written into the acquisition memory. The selectable maximum record length varies depending on the model.

| |
|---|
| 16 MW memory model (701460 and 701480)<br>1 k, 10 k, 50 k, 100 k, 250 k, 500 k, 1 M, 2 M, 4 M, 8 M (, 16 M) |
| 4 MW memory model (701450 and 701470)<br>1 k, 10 k, 50 k, 100 k, 250 k, 500 k, 1 M, 2 M (, 4 M) |

* The value inside the parentheses is selectable only when interleave mode is ON.

For details on the record length, see section 7.2, “Setting the Record Length” in the *DL7440/DL7480 User’s Manual (IM701450-01E)*. For details on interleave mode, see section 7.3, “Using Interleave Mode.”

### Starting/Stopping the CAN Bus Signal Acquisition

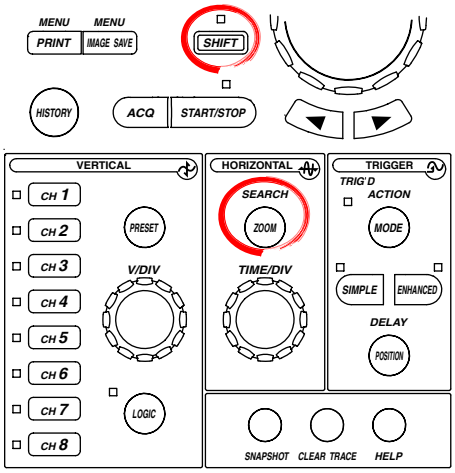
When you start the CAN Bus signal acquisition, triggers are activated on the specified trigger conditions.

To proceed to the analysis, you stop the CAN Bus signal acquisition.

# 2.5 Analyzing/Searching Data

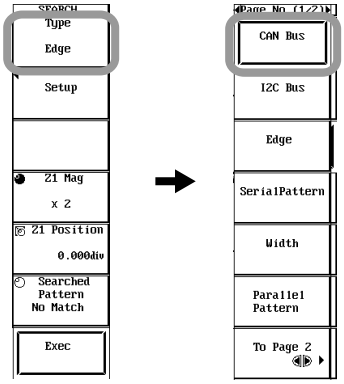
By setting analysis conditions, the CAN signal data stored to the acquisition memory can be analyzed. You can also search analysis data that matches a data pattern or an indefinite data condition. If analysis data that matches the specified condition is found, the zoom position moves to the corresponding section, and the waveform of the data that is found is displayed in the zoom waveform display frame.

## *Procedure*




- To exit the menu during operation, press **ESC** located above the soft keys.
- In the procedural explanation below, the term *jog shuttle & SELECT* refers to the operation of selecting/setting items and entering values using the **jog shuttle**, **SELECT** and **RESET** keys. For details on the operation using the jog shuttle, SELECT, and RESET, see sections 4.1 or 4.2 in the DL7440/DL7480 User's Manual.
- For a description of the operation using a USB keyboard or a USB mouse, see section 4.3 in the DL7440/DL7480 User's Manual.

1. Press **SHIFT+ZOOM (SEARCH)**. The SEARCH menu appears.
2. Press the **Type** soft key. The Type menu appears.
3. Press the **CAN Bus** soft key.



## Setting the Analysis Conditions

4. Press the **Analyze Setup** soft key. The Analyze Setup dialog box opens.

### Selecting the Analysis Source

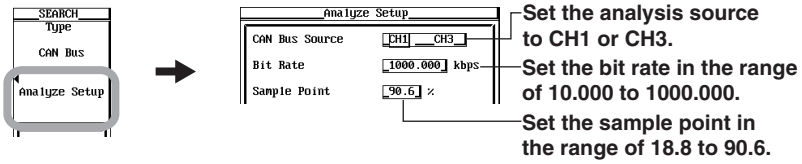
5. Use **job shuttle & SELECT** to set the analysis source to CH1 or CH3 (CAN Bus Source box).

### Setting the Bit Rate

6. Use **jog shuttle & SELECT** to set the bit rate (Bit Rate box).
   The procedure of setting the bit rate is the same as the procedure described in section 2.4, “Setting CAN Bus Signal Acquisition Conditions.” See page 2-6.

### Setting the Sample Point

7. Use **jog shuttle & SELECT** to set the sample point within a bit in the range of 18.8 to 90.6 (Sample Point box).




### Setting Vdiff

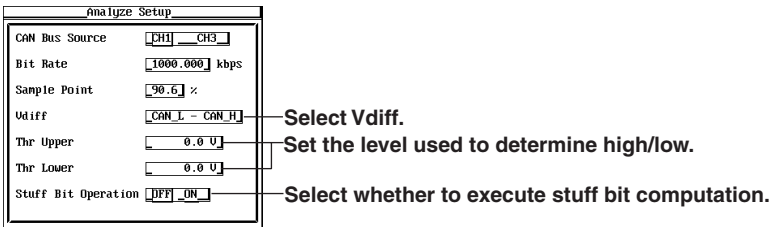
8. Use **jog shuttle & SELECT** to set Vdiff to CAN_H–CAN_L or CAN_L–CAN_H (Vdiff box).

### Setting the Threshold Level

9. Use **jog shuttle & SELECT** to set the level used to determine a high level signal (Thr Upper box).
10. Likewise, use **jog shuttle & SELECT** to set the level used to determine a low level signal (Thr Lower box).

### Setting the Stuff Bit Computation

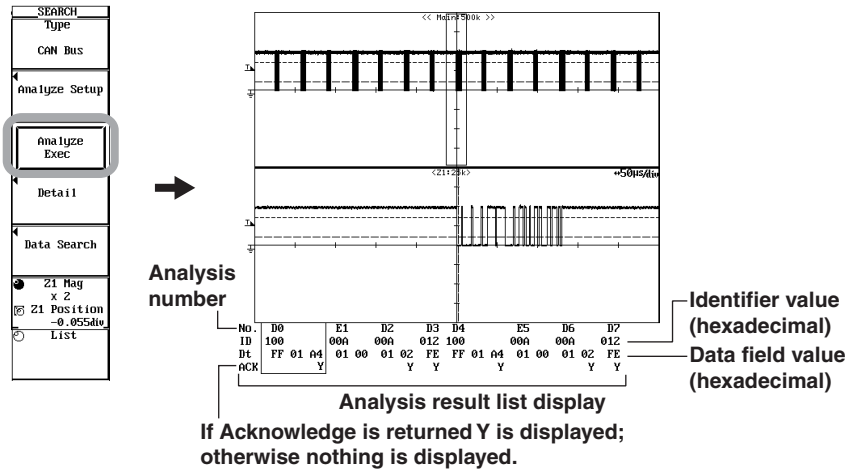
11. Use **jog shuttle & SELECT** to select whether to execute stuff bit computation (Stuff Bit Operation box).
    If stuff bit computation is ON, computation is executed when you press the Analyze Exec soft key. The computation result is displayed in Math1.




12. Press **ESC**. The Analyze Setup dialog box closes.

## Executing/Aborting the Analysis

13. Press the **Analyze Exec** soft key. The data analysis is executed. The words Analyze Exec change to Analyze Abort.
    To abort the data analysis, press the **Analyze Abort** soft key. The data analysis is aborted, and the words Analyze Abort change to Analyze Exec.
    If indefinite data exists in the analysis data, "∗" is attached to the corresponding analysis data.




## Displaying the Analysis Data

### Scrolling the List

14. Press the **List** soft key.
15. Turn the **jog shuttle** to scroll the list left and right.
    Up to 18 analysis data points are displayed at once in the order of occurrence. By scrolling the list left and right using the **jog shuttle**, analysis data up to 18 data points can be displayed at a time.

### Setting the display position of the head of the frame (firmware version 2.40 or later)

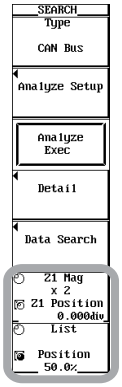
16. Press the **List/Position** soft key to set the jog shuttle control to Position.
17. Turn the **jog shuttle** to set the display position of the head of the frame in the range of 0 to 50%.
    The left edge and the center of the waveform display area are 0% and 50%, respectively.

### Setting the Zoom Ratio

18. Press the **Z1 Mag/Z1 Position** soft key to set the jog shuttle control to Z1 Mag.
19. Turn the **jog shuttle** to set the zoom ratio.

### Setting the Zoom Position

20. Press the **Z1 Mag/Z1 Position** soft key to set the jog shuttle control to Z1 Position.
21. Turn the **jog shuttle** to set the zoom position. When the center of the zoom box moves to the waveform corresponding to the analysis data on the list, the corresponding analysis data on the list is highlighted.

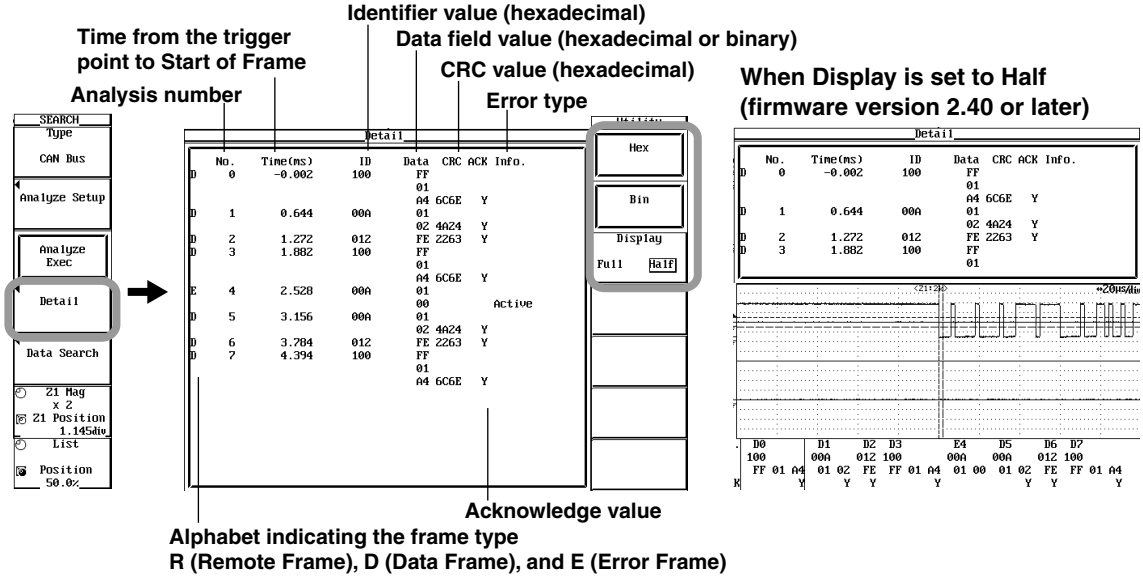


**Viewing the Details of the Analysis Data**

22. Press the **Detail** soft key. A Detail dialog box opens. The analysis data of the same analysis number that is highlighted in the list in step 15 or step 19 is displayed highlighted.
23. Press the **Hex** or **Bin** soft key to select the notation used to display the analysis data.

**Displaying the Details of the Analysis Data and the Zoom Waveform of the Frame Simultaneously (firmware version 2.40 or later)**

24. Press the **Display** soft key to set the size of the Detail dialog box to Full or Half.
    If you select Half, the size of the Detail dialog box decreases to half of its original size allowing you to view the zoom waveform of the highlighted (selected) frame.



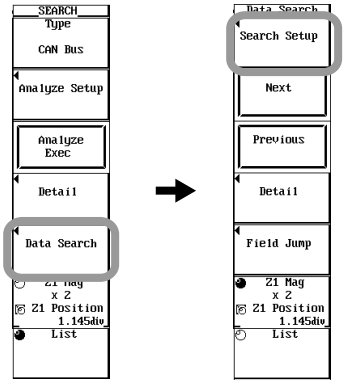

25. Press **ESC**. The Detail dialog box closes.

***Note***

- If indefinite data is present, * is displayed in the ACK column.
- The detailed analysis list can be saved directly to an external storage medium in ASCII format (.txt extension). For details, see section 2.7, “Saving the Data of the Detailed Analysis List.”

## Setting the Search Condition

23. Press the **Data Search** soft key. The Data Search menu appears.
24. Press the **Search Setup** soft key. The Search Setup dialog box opens.




### Selecting the Search Type

25. Use **jog shuttle & SELECT** to set the search type to Frame Pattern or Indefinite State (Type box).

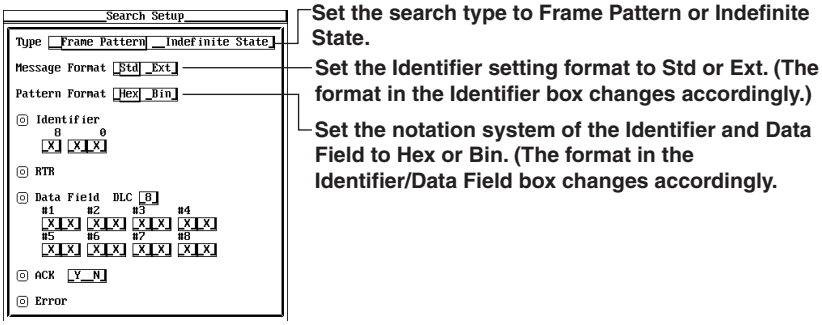
    If you select Indefinite State, proceed to step 33.

### Selecting the Identifier Setting Format

26. Use **jog shuttle & SELECT** to set the Identifier setting format to Std or Ext (Message Format box). The format in the Identifier box changes accordingly.

### Selecting the Notation System of the Determination Pattern

27. Use **jog shuttle & SELECT** to set the notation system used to set the determination pattern to Hex or Bin (Pattern Format box). The format in the Data Pattern box changes accordingly.



**Setting the Field or Frame to Be Used as a Search Condition**

28. Use **jog shuttle & SELECT** to select whether to use the field or frame of Identifier, RTR, Data Field, ACK and Error Frame as search conditions.
    - Highlighting of the mark to the left of each item indicates that it is used as a search condition.
    - Multiple fields or frames can be selected together, but the RTR and Data Field cannot be turned ON at the same time. If either one is turned ON, the other is turned OFF.

- **When Identifier Is Selected**

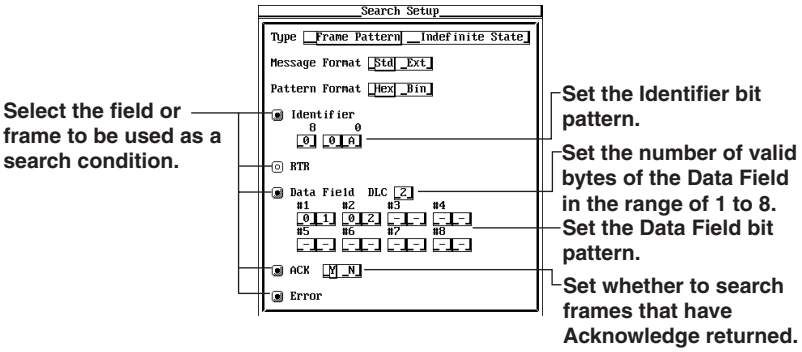
29. Use **jog shuttle & SELECT** to set the Identifier bit pattern.
    - If you selected Hex for Pattern Format in step 27, turn the jog shuttle to select 0 to 9, A to F, or X, and press SELECT. Pressing RESET will reset the value to X (the initial value).
    - If you selected Bin for Pattern Format in step 27, press SELECT to select 0, 1, or X.

- **When Data Field Is Selected**

30. Use **jog shuttle & SELECT** to set the number of valid bytes of the data field to a value between 1 and 8 (DLC box).
31. Use **jog shuttle & SELECT** to set the data field bit pattern.
    - If you selected Hex for Pattern Format in step 27, turn the jog shuttle to select 0 to 9, A to F, or X, and press SELECT. Pressing RESET will reset the value to X (the initial value).
    - If you selected Bin for Pattern Format in step 27, press SELECT to select 0, 1, or X.

- **When ACK Is Selected**

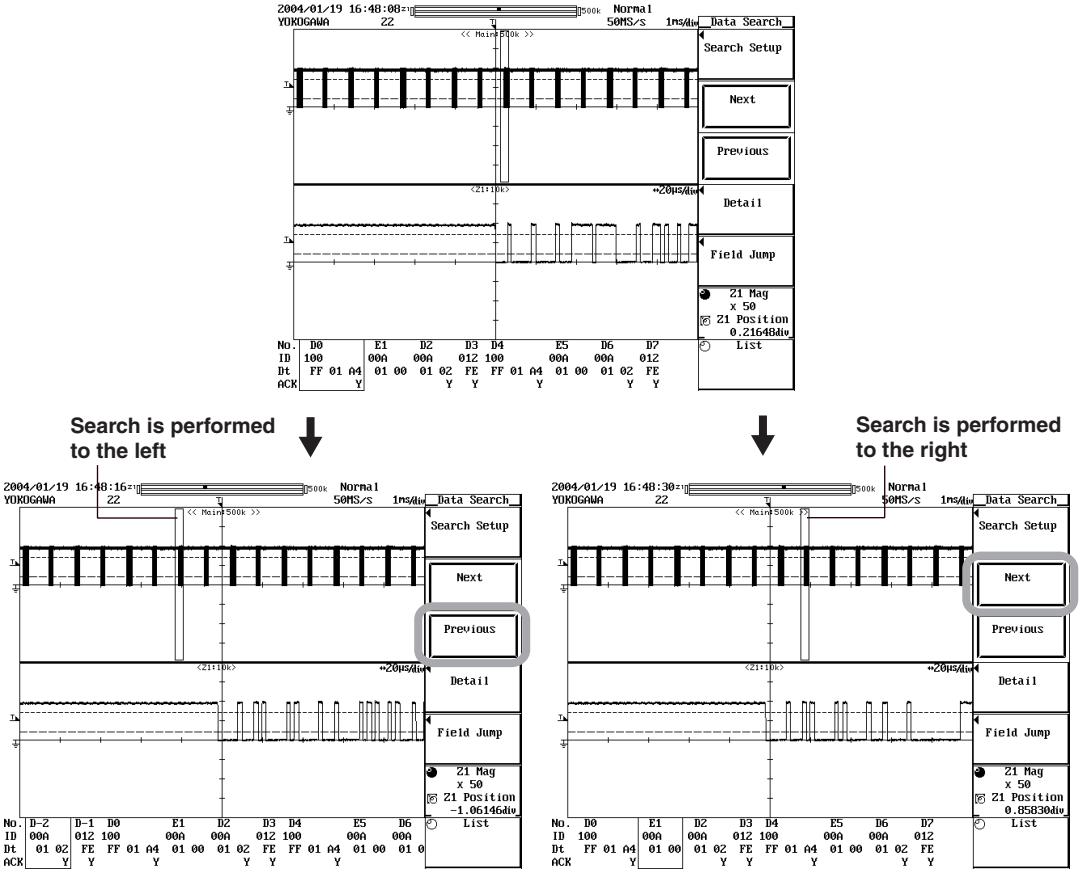
32. Use **jog shuttle & SELECT** to select whether to search for frames returning Acknowledge (Y) or frames not returning Acknowledge (N) (ACK box).




33. Press **ESC**. The Search Setup dialog box closes.

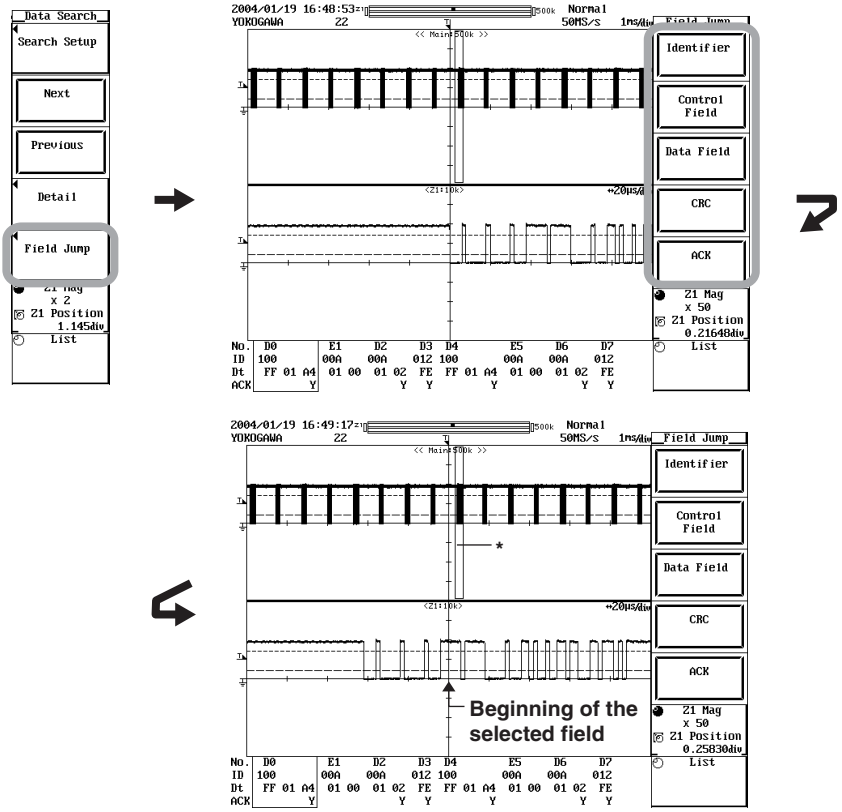
## Executing the Search

34. Press the **Next** or **Previous** soft key. The search is executed.
    - When the data matches the determination pattern, the corresponding data (data that was found) is highlighted in the analysis data list at the bottom of the screen. The zoom box moves to the position so that the data that was found is at the center, and the zoomed waveform of the data that was found is displayed in the zoom waveform display area.
    - Pressing the Next soft key searches the data after the highlighted data (to the right) in the analysis data list at the bottom of the screen.
    - Pressing the Previous soft key searches the data before the highlighted data (to the left) in the analysis data list at the bottom of the screen.
    - If you selected Indefinite State (indefinite data) in step 25 and execute the search, indefinite data is highlighted.



### Jumping to a Specified Field (Field Jump)

35. Press the **Field Jump** soft key. The field selection menu appears.
36. Press the **Identifier**, **Control Field**, **Data Field**, **CRC**, or **ACK** soft key The zoom position (Z1 Pos) moves to the front of the selected field.




*** The zoom position (Z1 Pos) moves to the beginning of the selected field. The above example is for the case when the Data Field soft key is pressed.**

## *Explanation*

### Setting the Analysis Conditions: Analyze Setup

You can set the following conditions.

**Channels Used**

Select CH1 or CH3 for the CAN Bus signal input channel.
In addition, Math1 is used to display the results of stuff bit computation.

**Items to Be Analyzed**

The frames to be analyzed are the following three types.

- **Remote Frame**
  Detects the Identifier value, CRC value, and the presence of Acknowledge.
- **Data Frame**
  Detects the Identifier value, Data value, CRC value, and the presence of Acknowledge.
- **Error Frame**
  Detects the Identifier value*, Data value*, CRC value*, the presence of Acknowledge*, and the error type.

  * If an error is detected in a frame, the analysis on the frame ends at that point, and the next frame is analyzed. Therefore, the Identifier value, Data value, CRC value, and the presence of Acknowledge after error detection are not analyzed.

The DL7440/DL7480 classifies the error types into the following five types.

- **Active Error**
  - When 6 or more successive dominant (logical value of 0) bits appear on the bus.
  - Error flag (6 dominant bits) output by an error active (normal) unit and 6 or more successive dominant bits appear in bit error and stuff error.
- **Passive Error**
  - When 6 or more successive recessive (logical value of 1) bits appear on the bus.
  - Error flag (6 recessive bits) output by an error passive (error-prone condition) unit and 6 or more successive recessive bits appear in bit error and stuff error.
- **Form Error**
  - When an illegal format is present in a fixed-format* bit field.
  - When a violation occurs in one of the following formats.
    - When the reserve bit (r0 or r1) is dominant
    - When DLC is between 0 and 8

  * The following three fixed formats are available.
    - CRC delimiter is recessive
    - ACK delimiter is recessive
    - End of Frame is recessive
- **CRC Error**
  When the CRC calculated from the retrieved waveform data and the retrieved CRC sequence value differ.
- **Acknowledge Error**
  When the ACK slot is recessive.

**Bit Rate**

Select a data transfer rate for the CAN Bus data to be analyzed from the following.
10, 20, 33.333, 50, 62.5, 83.333, 95.238, 100, 125, 250, 500, or 1000 [kbps]

You can also enter an arbitrary value from the keyboard that appears on screen.
Selectable range: 10.000 to 1000.000 [kbps]
Resolution: Bit time (reciprocal of the bit rate) resolution of 0.5 μs

**Sample Point**

Select a percentage for judging the bus level (recessive/dominant).
18.8, 21.9, 25.0, 28.1, 31.3, 34.4, 37.5, 40.6, 43.8, 46.9, 50.0, 53.1, 56.3, 59.4, 62.5, 65.6, 68.8, 71.9, 75.0, 78.1, 81.3, 84.4, 87.5, or 90.6 [%]

The point at which the input CAN Bus signal waveform changes from recessive to dominant is taken as 0%, and the point one bit time (the reciprocal of the specified bit rate) thereafter is taken as 100%, thereby allowing expression of the sample point as a percentage.

**Vdiff**

You can select a connection method for the differential probe from below. In either case, the logical value is: recessive = 1 and dominant = 0.

| | |
|---|---|
| CAN_L–CAN_H | The recessive voltage level is greater than the dominant voltage level. |
| CAN_H–CAN_L | The dominant voltage level is greater than the recessive voltage level. |

***Note***

- For the further information on connecting the differential probe, see section 2.3, “Connecting the Probe.”
- The bit rate setting is connected with the setting in the CAN Setup dialog box (see page 2-5), and the CURSOR menu (see page 2-35).
- The Vdiff setting is connected with the setting in the CAN Setup dialog box (see page 2-5).

**Threshold Level (Thr Upper/Thr Lower)**

To analyze the indefinite data on the signal, specify two signal levels, Thr Upper and Thr Lower. By comparing the measured data against the threshold levels, 0, 1, or indefinite data is determined. The data is determined as follows according to the Vdiff setting.

- **When Vdiff = CAN_L–CAN_H**
  When measured data < Thr Lower: 0
  When measured data > Thr Upper: 1
  When Thr Lower ≤ measured data ≤ Thr Upper: Indefinite data
- **When Vdiff = CAN_H–CAN_L**
  When measured data < Thr Lower: 1
  When measured data > Thr Upper: 0
  When Thr Lower ≤ measured data ≤ Thr Upper: Indefinite data

Bits determined to be indefinite data are considered to have the same value as the previous bit, and the results are displayed. Also, frames in the analysis results list and the detailed analysis list containing indefinite data appear with an asterisk (*).

### Stuff Bit Computation

You can specify whether to perform stuff bit computation in parallel with analysis.

| | |
|---|---|
| OFF | Do not perform stuff bit computation. |
| ON | Perform stuff bit computation. |

- The stuff bit computation result is displayed as the Math1 waveform.
- Scaling is fixed to ±2.0.
  Stuff bit: High level (+1.0)
  Other than stuff bit: Low level (0.0)

### Notes When Executing Stuff Bit Computation

If you change Select Record in the History menu while the stuff bit waveform is displayed, the changed history waveforms are displayed on channels other than the stuff bit computation waveform (Math1), but Math1 is cleared. To update the stuff bit computation waveform to the changed history waveform, you must execute analysis again.

***Note***

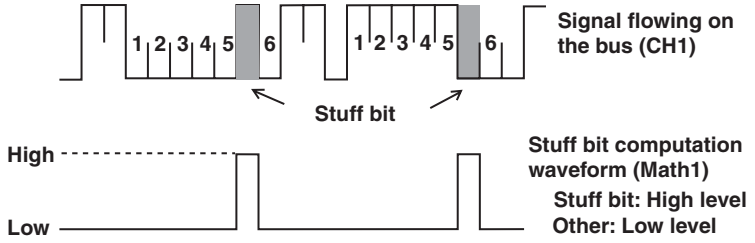
Stuff bit computation cannot be performed for the following record lengths.

- 16 MW memory model (701460 and 701480)
  When Interleave Mode is ON: 8 MW
  When Interleave Mode is OFF: 4 MW
- 4 MW memory model (701450 and 701470)
  4 MW

In the above case, if you execute analysis with the stuff bit setting turned ON, the message "Computation cannot be carried out at the current record length." (error code: 851) appears.

### Stuff Bit

The CAN Bus is designed to prevent burst errors by disallowing 6 continuous bits or more from having the same level. On the sending side, if 5 or more continuous bits between the Start of Frame and CRC fields are at the same level, CAN inserts a bit(stuff bit) having the opposite logical value of the 5 previous bits for the next bit (6th bit). On the receiving side, this bit is deleted prior to receiving the signal.
The DL7440/DL7480 lets you extract stuff bits from the CAN Bus signal waveform and display them as a Math waveform (Math1).



### Executing the Analysis (Analyze Exec)

Analysis is performed on up to 16000 frames before and after the trigger target frame. If the trigger point is between frames, the frame immediately after the trigger point becomes the triggering frame. Analysis is not performed if there is no Start of Frame on the screen. In addition, if an error is detected in a frame, the analysis on the frame ends at that point, and the next frame is analyzed.

### Analysis Data List (Analysis Result List)

The following four items are displayed.

- **Analysis Number (No.)**
  Alphabetic characters showing the frame type are displayed with the frame number.
  [Screen display example] R0, D1, E-2
  Frame type: R (Remote Frame), D (Data Frame), and E (Error Frame)
  Frame no.: With the trigger target frame set to 0, the frame is numbered No. -1, No. -2, and so on before the target frame and No. 1, No. 2, and so on after the target frame. Displayed in the range between –16000 and 16000.
- **ID**
  The Identifier value (in standard format (11 bits) or extended format (29 bits)) is displayed in hexadecimal.
- **Dt**
  The Data field value is displayed in Hex (hexadecimal). Eight bits are displayed in 1 frame.
- **ACK**
  The Acknowledge value is displayed as Y. (If Acknowledge is returned Y is displayed, and if Acknowledge is not returned, nothing is displayed.)
  If indefinite data is present within the frame, an asterisk (*) is displayed.

#### Selecting the Frame (List)

Frame number 0 is automatically highlighted immediately after executing the analysis in the analysis results list. The waveform of the highlighted frame is displayed in the zoom box. Turn the jog shuttle to highlight an arbitrary frame.

#### Display Position of the Head of the Frame (Position)

The display position of the head of the selected frame moves horizontally. The Position is selectable only when firmware version is 2.40 or later.

Selectable range: 0 to 50% (The left edge and the center of the waveform display area are 0% and 50%, respectively.)

***Note***

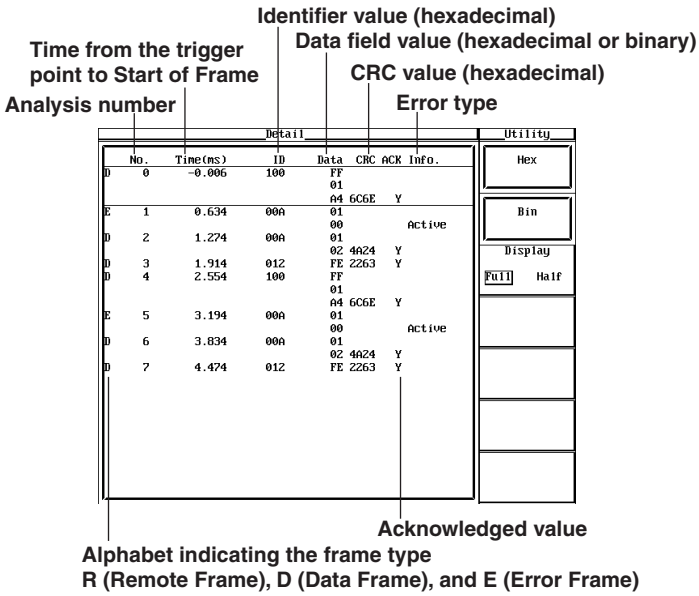
- Even if standard format and extended format are mixed in the analysis results list display, it is automatically detected.
- For items that were not analyzed due to an error detection within the frame, blank is displayed.

### Detailed List of Analysis Data: Detail

Details of the analysis results list on the lower section of the screen are displayed. The following eight items are displayed.

- **Frame Type**
  R (Remote Frame), D (Data Frame), and E (Error Frame)
- **No.**
  With the trigger target frame set to 0, the frame is numbered No. -1, No. -2, and so on before the target frame and No. 1, No. 2, and so on after the target frame. Displayed in the range between –16000 and 16000.
- **Time (ms)**
  The time from the trigger point to the Start of Frame is displayed.
- **ID**
  The Identifier value (in standard format (11 bits) or extended format (29 bits)) is displayed in hexadecimal.
- **Data**
  The Data field value is displayed in Hex (hexadecimal) or Bin (binary).
- **CRC**
  The CRC value is displayed in Hex (hexadecimal).
- **ACK**
  The Acknowledge value is displayed as Y. (If Acknowledge is returned Y is displayed, and if Acknowledge is not returned, nothing is displayed.)
  If indefinite data is present within the frame, an asterisk (*) is displayed.
- **Info.**
  An error type of one of the following five types is displayed.
  Active, Passive, Form, CRC, or ACK (Acknowledge)

* Hex (hexadecimal) or Bin (binary) can be selected in the Hex/Bin setting menu displayed at the same time as the detailed analysis list.




Immediately after analysis executes, the No. 0 frame is automatically highlighted. Turn the jog shuttle to highlight select an arbitrary frame. Display of the detailed analysis list and analysis results list are linked.

***Note***

The contents of the detailed analysis list can be saved in ASCII format. For details, see section 2.7, “Saving the Data of the Detailed Analysis List.”

**Selecting the Size of the Detail Analysis Results List (Display) (firmware version 2.40 or later)**

You can select whether to set the size of the display frame (Detail dialog box) of the detailed analysis results list to full screen or half screen. If you select Half, the size of the Detail dialog box decreases to half of its original size allowing you to view the zoom waveform of the highlighted (selected) frame.

**Zoom Ratio (Z1 Mag)**

You can set the zoom ratio in the Z1 zoom box. The upper limit of the zoom ratio is determined from the display record length as follows:
(Zoom ratio upper limit) = (Display record length) ÷ 50 (or 40)

The displayed record length does not necessarily match the set record length.
For details on the display record length, see appendix 1, “Relationship between the Time Axis Setting, Sample Rate and Record Length” in the *DL7440/DL7480 User’s Manual (IM701450-01E)*.

**Zoom Position (Z1 Position)**

The zoom position can be set by specifying the zoom center position (center of the Z1 zoom box) in the range –5 to +5 divisions with the center of the waveform display frame set to 0 divisions. The resolution is as follows:
(Selectable steps of zoom position) = (T/div) × 10 ÷ (display record length)

## Setting the Search Condition: Search Setup

You can set the following conditions.

**Search Type**

You can select the search type.

| | |
|---|---|
| Frame Pattern (Pattern Search) | Search the waveform by specifying a field or frame pattern. |
| Indefinite State (Indefinite Data Search) | Search indefinite data from the analysis data. |

**When Search Type Is Set to Frame Pattern**

Search the waveform by specifying a field or frame pattern. If a waveform that matches the pattern is found, the zoom box moves to that point and displays the specified waveform.
If a pattern search is performed on data that contains indefinite data, the indefinite data is considered both 1 and 0 (logical value) for the search. You cannot perform a pattern search and an indefinite data search simultaneously.
When performing a pattern search, set the following items.

- **Message Format**

  You can select a format for the Identifier (ID) field of the Arbitration field within the data frame from the following:

| | |
|---|---|
| Std | Standard format (11 bits) |
| Ext | Extended format (29 bits) |

- **Pattern Format**

  You can select a format for the Identifier (ID) field and the Data field from the following:

| | |
|---|---|
| Hex | Hexadecimal |
| Bin | Binary |

- **Field or Frame to Be Used as a Search Condition**
  You can select the CAN Bus signal field pattern or frame type to be used as search conditions from the five types listed below. You can use the AND condition to select multiple types at the same time (combination trigger) and search for data that fulfills all the pattern conditions. However, RTR and Data Field cannot be specified in combination.
  - **Identifier**
    Searches for an Identifier (ID) matching the specified pattern.
  - **RTR**
    Searches for a remote frame (RTR is recessive).
  - **Data Field**
    Searches for an Data field matching the specified pattern.
  - **ACK**
    Select Y to search for frames returning Acknowledge, and N for frames not returning Acknowledge.
  - **Error Frame**
    Searches for error frames. The DL7440/DL7480 considers 6 successive dominant bits (logical value of 0) as an error frame. Therefore, even if 6 successive dominant bits occur in an overload frame, it is searched as an error frame.

**When Search Type Is Set to Indefinite State**
Searches for indefinite data in the analysis data.

### Executing the Search: Next, Prev

Press the Next or Prev soft key to execute the search. The search progresses (pattern or indefinite data search) as follows depending on the search type.

- **For Pattern Searches**
  Next: Searches frames after (to the right of) the currently selected frame.
  Prev: Searches frames before (to the left of) the currently selected frame.
- **For Indefinite Data Searches**
  Next: Searches frames after (to the right of) the current zoom position (Z1 Pos).
  Prev: Searches frames before (to the left of) the current zoom position (Z1 Pos).

**Displaying the Search Result**

- **For Pattern Searches**
  - **When 1 or more of the frame types Identifier, RTR, Data Field, ACK, and Error are selected.**
    The zoom position (Z1 Pos) moves to the front of the set field. If you specify multiple types, the Zoom Position moves to the front of the field that was found last in the time sequence. However, for the Identifier and Data field, if the pattern is set to all Xs, it is equivalent to not specifying a pattern. Thus, a search is not performed.
  - **When All Field/Frame Types (Identifier, RTR, Data Field, ACK, and Error) are OFF**
    The message “Pattern is not specified.” (error code: 730) appears.
- **For Indefinite Data Searches**
  The zoom position (Z1 Pos) moves to the front of the indefinite data.

**Jumping to a Specified Field (Field Jump)**

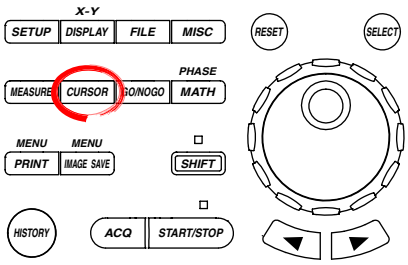
Moves the Zoom position (Z1 Pos) to the front of a particular field within the current frame. The applicable fields are of the following five types.

- Identifier
- Control Field
- Data Field
- CRC
- ACK

# 2.6 Using Cursors

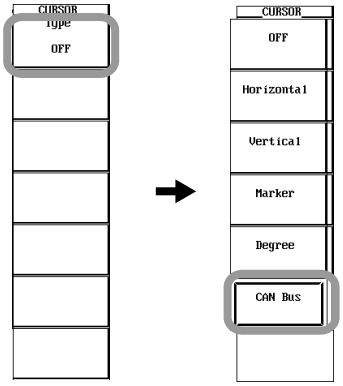
Cursor1 and Cursor2 can be moved per each CAN Bus bit rate (data transfer rate) while maintaining a bit rate of space between them. With firmware version 2.40 or later, the spacing between Cursor1 and Cursor2 can be set in bit level. When analyzing or searching, CAN Bus signal waveform fields and frames can be checked while counting the number of bits.

## *Procedure*



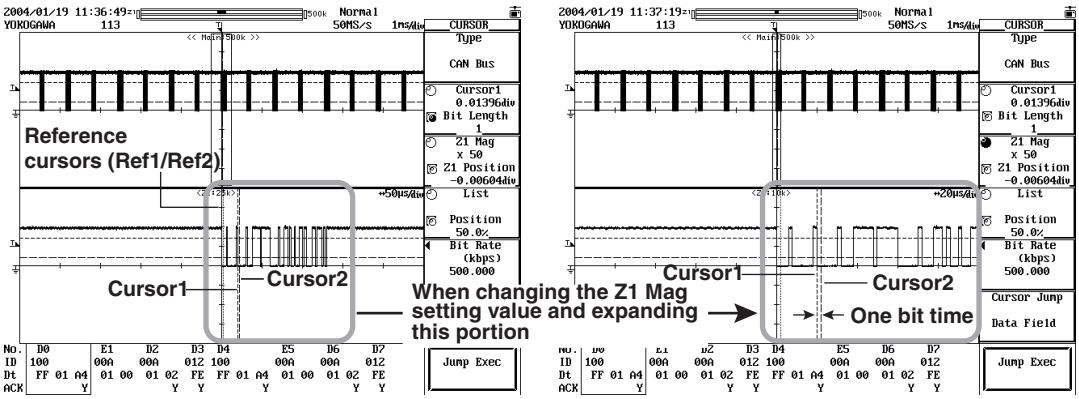

- To exit the menu during operation, press **ESC** located above the soft keys.
- In the procedural explanation below, the term *jog shuttle & SELECT* refers to the operation of selecting/setting items and entering values using the **jog shuttle**, **SELECT** and **RESET** keys. For details on the operation using the jog shuttle, SELECT, and RESET, see sections 4.1 or 4.2 in the DL7440/DL7480 User's Manual.
- For a description of the operation using a USB keyboard or a USB mouse, see section 4.3 in the DL7440/DL7480 User's Manual.

1. Press **CURSOR**. The CURSOR menu appears.
2. Press the **Type** soft key. The Type menu appears.
3. Press the **CAN Bus** soft key.




If you select CAN Bus, Cursor1 moves to the same position as when selecting Vertical cursor*, but Cursor2 moves to only one bit rate behind that of Cursor1. (For changing the bit rate and setting the spacing between Cursor1 and Cursor2, see next page.)

The positions of reference cursors Ref1 and Ref2 remain at their previous settings.



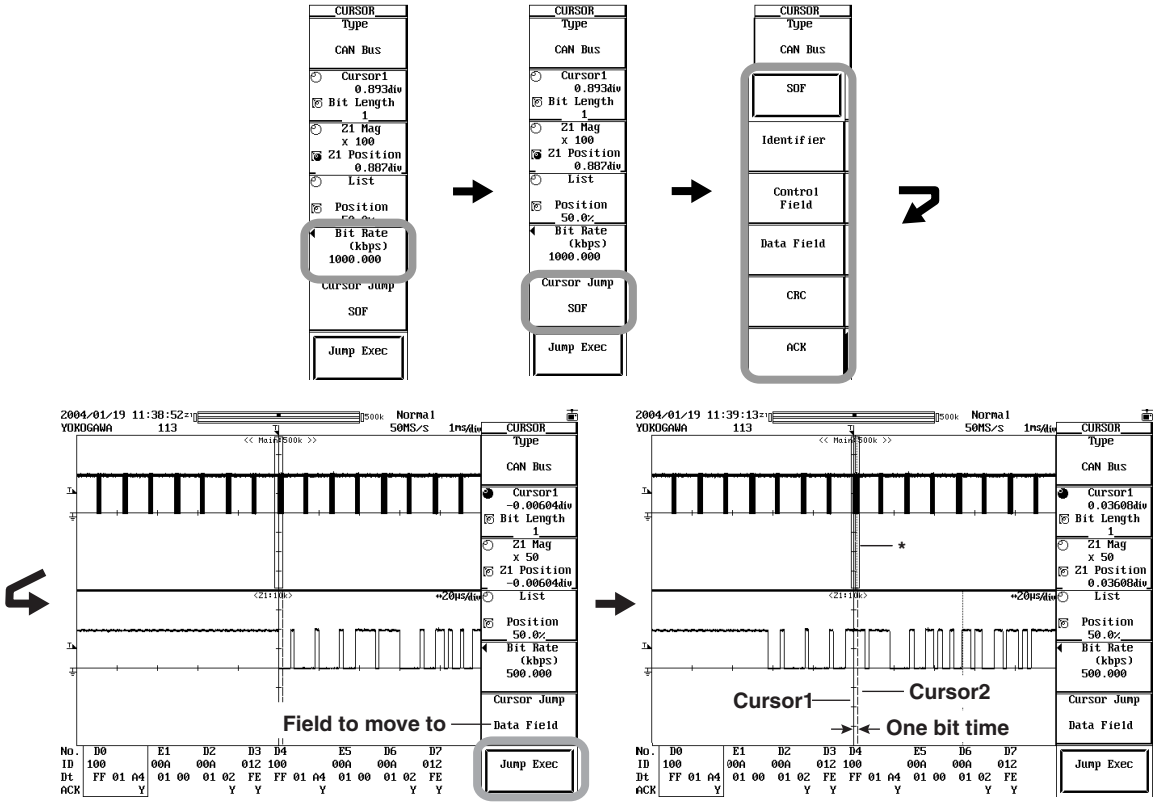

* For details on cursors other than the CAN Bus signal analysis function cursors, see section 10.5, "Making Cursor Measurements" in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Changing the Bit Rate

4. Press the **Bit Rate** soft key to display the keyboard used to set the bit rate. The procedure of setting the bit rate is the same as the procedure described in section 2.4, “Setting CAN Bus Signal Acquisition Conditions.” See page 2-6.
   If you change the bit rate, Cursor2 moves to a position one bit rate behind Cursor1.

### Moving the Cursor to a Specified Field

5. Press the **Cursor Jump** soft key. The destination field selection screen appears.
6. Press the **SOF**, **Identifier**, **Control Field**, **Data Field**, **CRC** or **ACK** soft key
7. Press the **Jump Exec** soft key. Cursor1 moves to the front of the field selected in step 6, and Cursor2 moves to a position after Cursor1 that is one bit rate behind it.




*** Cursor1 moves to the front of the field selected as the move destination. Cursor2 moves to a position just one bit rate behind Cursor1.**

***Note***

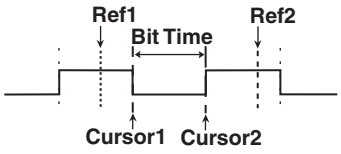
If you press the Jump Exec soft key when there is no data for analysis, the message, “No data for analysis. Execute analysis.” (error code 739) appears.

### Setting the spacing between Cursor1 and Cursor2/ Moving the Cursor

8. Select the **Cursor1/Bit Length** soft key to set the jog shuttle control to Bit Length.
9. Turn the **jog shuttle** to set the spacing between Cursor1 and Cursor2 (Bit Length).
10. Select the **Cursor1/Bit Length** soft key to set the jog shuttle control to Cursor1.
11. Turn the **jog shuttle** to move Cursor1. Cursor1 and Cursor2 move at the bit time resolution while maintaining the spacing between them.

## *Explanation*

If you select CAN Bus for the cursor type, Cursor1 moves to the same position as when you select Vertical cursors. Cursor2 moves to a position just one bit rate behind Cursor1. The positions of reference cursors Ref1 and Ref2 remain at their previous settings.




**Spacing between Cursor1 and Cursor2 (Bit Length)**

You can change the spacing between Cursor1 and Cursor2 (firmware version 2.40 or later).
Selectable range: 1 to 1000 bits

**Bit Rate**

Select a data transfer rate for the CAN Bus data to be analyzed from the following.
10, 20, 33.333, 50, 62.5, 83.333, 95.238, 100, 125, 250, 500, or 1000 [kbps]
You can also enter an arbitrary value from the keyboard that appears on screen.
Selectable range: 10.000 to 1000.000 [kbps]
Resolution: Bit time (reciprocal of the bit rate) resolution of 0.5 μs

***Note***

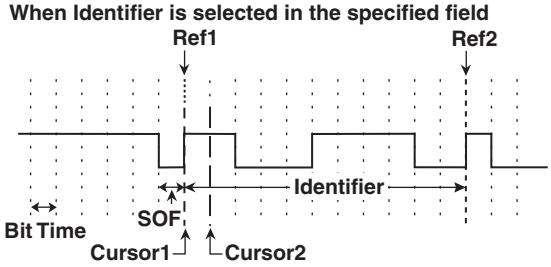
The bit rate setting is connected with the setting in the CAN Setup dialog box (see page 2-5), and the Analyze Setup dialog box (see page 2-20).

**Moving the Cursor to a Specified Field (Cursor Jump)**

Cursor1 is displayed on the front of the specified field (SOF, Identifier, Control Field, Data Field, CRC, or ACK). Cursor2 moves to a position just one bit rate* behind Cursor1. The cursors move while maintaining a bit rate of space between them. You can also display Ref1 at the front of the specified field, and Ref2 at the very back of the specified field.

* With firmware version 2.40 or later, the spacing between Cursor1 and Cursor2 is set to “a bit rate x bit length.”

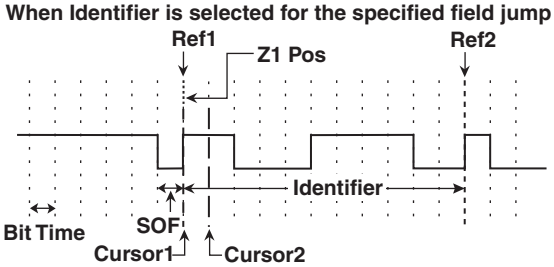
**When Identifier is selected in the specified field**




***Note***

- When analyzing the CAN bus signal with the cursor type set to CAN Bus (see section 2.5), Cursor1 moves to the front of the SOF field. Cursor2 moves to a position just one bit rate behind Cursor1.
- With the cursor type set to CAN Bus, when executing a jump to the specified field (See “Jumping to a Specified Field” on page 2-26 and 2-34 in section 2.5), Z1 Pos, Cursor1, and Ref1 move to the front of the specified field jump destination, Cursor2 moves to a position one bit rate behind Cursor1, and Ref2 moves to the very end of the specified field jump destination.

**When Identifier is selected for the specified field jump destination**



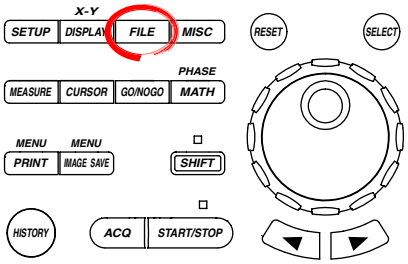
# 2.7 Saving the Data of the Detailed Analysis List

The data of the detailed analysis list can be saved to a file in ASCII format.

**CAUTION**

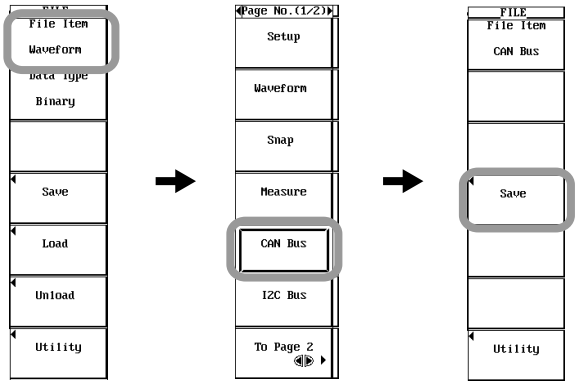
Do not remove the storage medium (disk) or turn OFF the power when the access indicator or icon of the storage medium is blinking. Doing so can damage the storage medium or destroy the data on the medium.

### *Procedure*




- To exit the menu during operation, press **ESC** located above the soft keys.
- In the procedural explanation below, the term *jog shuttle & SELECT* refers to the operation of selecting/setting items and entering values using the **jog shuttle**, **SELECT** and **RESET** keys. For details on the operation using the jog shuttle, SELECT, and RESET, see sections 4.1 or 4.2 in the DL7440/DL7480 User's Manual.
- For a description of the operation using a USB keyboard or a USB mouse, see section 4.3 in the DL7440/DL7480 User's Manual.

1. Press **FILE**. The FILE menu appears.
2. Press the **File Item** soft key. The File Item menu appears.
3. Press the **CAN Bus** soft key.
4. Press the **Save** soft key. The Save menu appears.




### Selecting Save Destination Medium and Directory

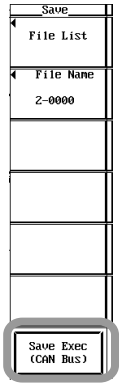
5. Carry out steps 13 to 15 on page 12-22 in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Setting the File Name and Comment

6. Carry out steps 16 to 19 on page 12-22 in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Executing the Save Operation

7. Press the **Save Exec** soft key. The data is saved to the directory indicated by Path=..... At the same time, the Save Exec soft key changes to the Abort soft key.




### Aborting the Save Operation

8. Press the **Abort** soft key. The save operation is aborted. At the same time, the Abort soft key changes to the Save Exec soft key.

### Specifying the Files to Be Displayed in the File List Window and Displaying Properties

9. Carry out steps 22 to 25 on page 12-23 in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

## *Explanation*

If you save the data, the data of the analysis results is saved to the specified destination in ASCII format. The extension is .txt.

[Save example]

| No. | Time(ms) | ID | Data | CRC | ACK | Info. |
|---|---|---|---|---|---|---|
| E -7 | -4.486 | 00A | 01 | | | |
| | | | 00 | | | Active |
| D -6 | -3.846 | 00A | 01 | | | |
| | | | 02 | 4A24 | Y | |
| D -5 | -3.206 | 012 | FE | 2263 | Y | |
| D -4 | -2.566 | 100 | FF | | | |
| | | | 01 | | | |
| | | | A4 | 6C6E | Y | |
| E -3 | -1.926 | 00A | 01 | | | |
| | | | 00 | | | Active |
| D -2 | -1.286 | 00A | 01 | | | |
| | | | 02 | 4A24 | Y | |
| D -1 | -0.646 | 012 | FE | 2263 | Y | |
| D 0 | -0.006 | 100 | FF | | | |
| | | | 01 | | | |
| | | | A4 | 6C6E | Y | |
| E 1 | 0.634 | 00A | 01 | | | |
| | | | 00 | | | Active |
| E 2 | 1.274 | 01A | | | | Active |
| E 3 | 1.913 | 016 | | | | Active |
| E 4 | 2.554 | 10C | | | | Active |
| E 5 | 3.193 | 00A | | | | Form |
| E 6 | 3.834 | 08A | 01 | | | |
| | | | 02 | 4A29 | | CRC |
| D 7 | 4.473 | 012 | FE | 2263 | Y | |

#### Precautions to Be Taken When Saving the Data

- The maximum number of files that can be saved when the auto naming function is ON is 1150.
- If the total number of files and directories exceed 2500 in a single directory, the contents of the File List box are no longer displayed.

# 2.8 Error Messages

A message may appear during operation. This section describes the meanings of the messages and their corrective actions. This section lists only the error messages related to the CAN Bus analysis function. There are other error messages related to the DL7440/DL7480 and communications. These messages are described in the *DL7440/DL7480 User's Manual (IM701450-01E)* and the *DL7440/DL7480 Communication Interface User's Manual (IM701450-17E)*.

You can set the messages to be displayed in English or Japanese. For the procedure of setting the message language, see section 15.1, "Changing the Message Language and Turning ON/OFF the Click Sound" in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

If the corrective action requires servicing, contact your nearest YOKOGAWA dealer for repairs.

| Code | Message | Action | Page |
|---|---|---|---|
| 27 | Executed the search, but no record was found that matched the pattern. | – | 2-23, 2-32 |
| 37 | Aborted the analysis. | – | 2-21 |
| 38 | Data not detected.<br>Execute again after changing the settings or reacquiring the waveform. | – | 2-5, 2-11, 2-19, 2-27 |
| 39 | The corresponding field was not found. | – | 2-25 |
| 704 | Cannot be executed while running. | Stop the acquisition. | Section 7.1 in IM701450-01E |
| 730 | Pattern is not specified. | Select at least one field or frame type.<br>Set at least one of the search pattern to a value other than X. | 2-23, 2-32 |
| 739 | Analyzed data does not exist.<br>Execute the analysis. | Execute the analysis. | 2-21, 2-30 |
| 851 | Computation can be carried out at the current record length. | Shorten the record length or turn OFF the stuff bit computation. | Section 7.2 in IM701450-01E<br>2-20, 2-29 |
| 870 | Cannot be specified.<br>Invalid byte or bit. | Increase the number of valid bytes. | 2-8, 2-15 |

# 2.9 Communication Commands



This section contains only the communication commands related to the CAN Bus signal analysis function.
For a description of other DL7440/DL7480 communication commands, see the *DL7440/DL7480 Communication Interface User's Manual (IM701450-17E)*.

| Command | Function | Page |
|---|---|---|
| **CAN Analyze Group** | | |
| :SEARch:CAN? | Queries all settings related to the analysis.* | 2-45 |
| :SEARch:CAN:ANALyze? | Queries all settings related to the execution of the analysis.* | 2-45 |
| :SEARch:CAN:ANALyze:ABORt | Aborts the execution of the Analysis.* | 2-45 |
| :SEARch:CAN:ANALyze:EXECute | Executes the analysis.* | 2-45 |
| :SEARch:CAN:ANALyze:SETup? | Queries all settings related to the analysis* conditions. | 2-45 |
| :SEARch:CAN:ANALyze:SETup:BRATe | Sets the bit rate (data transfer rate) of the analysis* conditions or queries the current setting. | 2-46 |
| :SEARch:CAN:ANALyze:SETup:LEVel | Sets the threshold level of the analysis* conditions or queries the current setting. | 2-46 |
| :SEARch:CAN:ANALyze:SETup:SBIT | Enables/Disables the stuff bit computation of the analysis* conditions or queries the current setting. | 2-46 |
| :SEARch:CAN:ANALyze:SETup:SOURce | Sets the analysis* source channel or queries the current setting. | 2-46 |
| :SEARch:CAN:ANALyze:SETup:SPOint | Sets the sample point of the analysis* conditions or queries the current setting. | 2-46 |
| :SEARch:CAN:ANALyze:SETup:VDIFf | Sets Vdiff of the analysis* conditions or queries the current setting. | 2-46 |
| :SEARch:CAN:DETail:BINary | Executes the binary display of the Data Field value of the detailed analysis list. | 2-46 |
| :SEARch:CAN:DETail:HEXa | Executes the hexadecimal display of the Data Field value of the detailed analysis list. | 2-46 |
| :SEARch:CAN:DETail:LIST? | Outputs one frame of analysis* result as a character string. | 2-46 |
| :SEARch:CAN:SEARch? | Queries all settings related to the analysis* result search. | 2-47 |
| :SEARch:CAN:SEARch:FJUMp:ACK | Executes the field jump to the ACK Field in the analysis* result. | 2-47 |
| :SEARch:CAN:SEARch:FJUMp:CONTrol | Executes the field jump to the Control Field in the analysis* result. | 2-47 |
| :SEARch:CAN:SEARch:FJUMp:CRC | Executes the field jump to the CRC Field in the analysis* result. | 2-47 |
| :SEARch:CAN:SEARch:FJUMp:DATA | Executes the field jump to the Data Field in the analysis* result. | 2-47 |
| :SEARch:CAN:SEARch:FJUMp:IDENtifier | Executes the field jump to the Identifier in the analysis* result. | 2-47 |
| :SEARch:CAN:SEARch:NEXT? | Executes a Next search of the analysis* results and queries the frame number found. | 2-47 |
| :SEARch:CAN:SEARch:PREVious? | Executes a Previous search of the analysis* results and queries the frame number found. | 2-47 |
| :SEARch:CAN:SEARch:SETup? | Queries all settings related to the analysis* result search. | 2-47 |
| :SEARch:CAN:SEARch:SETup:ACK? | Queries all ACK setting values for pattern searches of the analysis* results. | 2-47 |
| :SEARch:CAN:SEARch:SETup:ACK:MODE | Enables or disables the pattern search ACK of the analysis* result or queries the current setting. | 2-48 |
| :SEARch:CAN:SEARch:SETup:ACK:PATTern | Sets the ACK pattern (YES/NO) for analysis* results pattern searches or queries the current setting. | 2-48 |
| :SEARch:CAN:SEARch:SETup:DATA? | Queries all Data Field setting values for analysis* results pattern searches or queries the current setting. | 2-48 |
| :SEARch:CAN:SEARch:SETup:DATA:DLC | Sets the number of bytes (DLC) for analysis* results pattern searches or queries the current setting. | 2-48 |
| :SEARch:CAN:SEARch:SETup:DATA:HEXa<x> | Sets each byte of the Data Field search patterns of analysis* results in hexadecimal. | 2-48 |
| :SEARch:CAN:SEARch:SETup:DATA:MODE | Enables or disables the pattern search Data Field of the analysis* result or queries the current setting. | 2-48 |

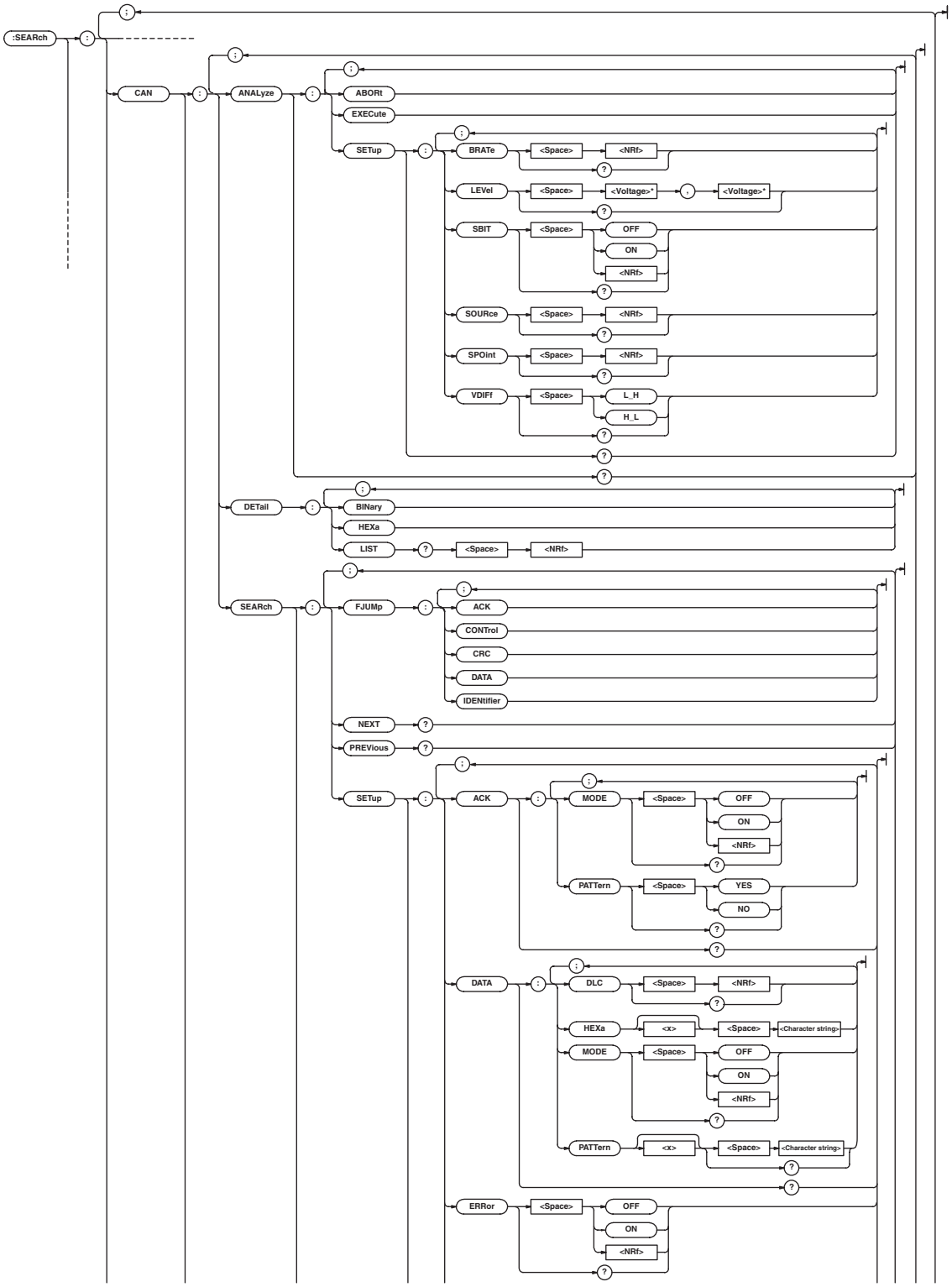
| Command | Function | Page |
|---|---|---|
| :SEARch:CAN:SEARch:SETup:DATA:PATTern<x> | | |
| | Sets each byte of the Data Field search patterns of analysis* results in binary or queries the current setting. | 2-48 |
| :SEARch:CAN:SEARch:SETup:ERRor | Enables or disables the pattern search Error of the analysis* result or queries the current setting. | 2-48 |
| :SEARch:CAN:SEARch:SETup:IDENtifier? | | |
| | Queries all Identifier setting values for analysis* results pattern searches. | 2-49 |
| :SEARch:CAN:SEARch:SETup:IDENtifier:HEXa | | |
| | Sets the Identifier search pattern for analysis* results pattern searches in hexadecimal. | 2-49 |
| :SEARch:CAN:SEARch:SETup:IDENtifier:MODE | | |
| | Enables or disables the pattern search Identifier of the analysis* result or queries the current setting. | 2-49 |
| :SEARch:CAN:SEARch:SETup:IDENtifier:PATTern | | |
| | Sets the Identifier pattern for analysis* results pattern searches in binary or queries the current setting. | 2-49 |
| :SEARch:CAN:SEARch:SETup:MFORmat | Sets the message format for analysis* results pattern searches or queries the current setting. | 2-49 |
| :SEARch:CAN:SEARch:SETup:PFORmat | Enters the setting format for analysis* results pattern searches or queries the current setting. | 2-49 |
| :SEARch:CAN:SEARch:SETup:RTR | Sets whether analysis* results pattern searches are performed by data frame (0) or by remote frame (1) or queries the current setting. | 2-49 |
| :SEARch:CAN:SEARch:SETup:TYPE | Sets the analysis* result search type (pattern search or indefinite data search) or queries the current setting. | 2-50 |
| :SEARch:TYPE | Sets the search type or queries the current setting. | 2-50 |
| **CAN Cursor Group** | | |
| :CURSor:TY:CAN? | Queries all settings related to the CAN Cursor.* | 2-51 |
| :CURSor:TY:CAN:BRATe | Sets the bit rate (data transfer rate) of the CAN Cursor* or queries the current setting. | 2-51 |
| :CURSor:TY:CAN:JUMP | Executes the jumping of the CAN Cursor* to a specified field. | 2-51 |
| :CURSor:TY:CAN:POSition<x> | Sets the CAN Cursor* position or queries the current setting. | 2-51 |
| :CURSor:TY:TYPE | Sets the cursor type or queries the current setting. | 2-51 |
| **CAN File Group** | | |
| :File:SAVE:CAN:ABORt | Aborts the saving of the data of the detailed analysis list of the analysis.* | 2-52 |
| :File:SAVE:CAN[:EXECute] | Executes the saving of the data of the detailed analysis list of the analysis* (overlap command). | 2-52 |
| **CAN Trigger Group** | | |
| :TRIGger:CAN? | Queries all settings related to the trigger* function. | 2-54 |
| :TRIGger:CAN:BRATe | Sets the bit rate (data transfer rate) in the trigger* conditions or queries the current setting. | 2-54 |
| :TRIGger:CAN:COMBination | Sets the combination trigger* or queries the current setting. | 2-54 |
| :TRIGger:CAN:DATA? | Queries all settings related to the Data Field in the trigger* conditions. | 2-55 |
| :TRIGger:CAN:DATA:CONDition | Sets the Data Field condition in the trigger* conditions or queries the current setting. | 2-55 |
| :TRIGger:CAN:DATA:DLC | Sets the number of valid bytes (DLC) of the Data Field in the trigger* conditions or queries the current setting. | 2-55 |
| :TRIGger:CAN:DATA:HEXa<x> | Sets each byte of the Data Field patterns in the trigger* conditions in hexadecimal. | 2-55 |
| :TRIGger:CAN:DATA:MODE | Sets whether trigger activates on the Data Field in the trigger* conditions or queries the current setting. | 2-55 |
| :TRIGger:CAN:DATA:PATTern<x> | Sets the Data Field pattern in the trigger* conditions in binary or queries the current setting. | 2-55 |
| :TRIGger:CAN:EFRame | Sets whether trigger activates on the Error Frame in the trigger* conditions or queries the current setting. | 2-55 |

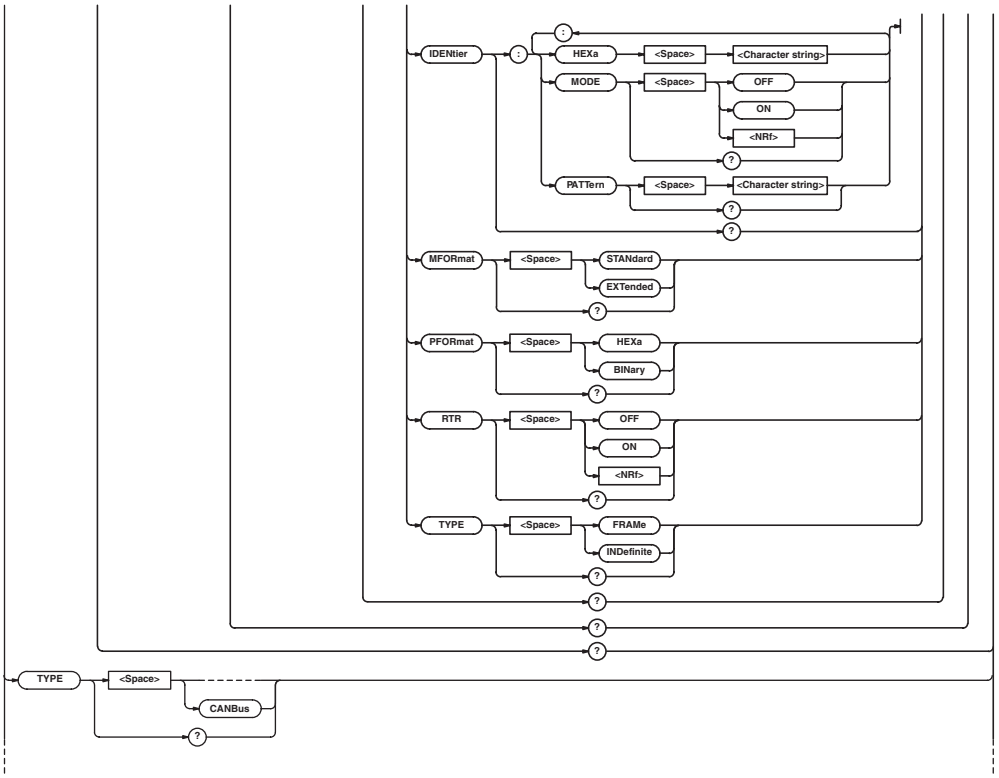
| Command | Function | Page |
|---|---|---|
| :TRIGger:CAN:IDENtifier? | Queries all settings related to the Identifier in the trigger* conditions. | 2-55 |
| :TRIGger:CAN:IDENtifier:CONDition | Sets the Identifier condition in the trigger* conditions or queries the current setting. | 2-55 |
| :TRIGger:CAN:IDENtifier:ID<x>? | Queries all settings related to the Identifier ID<x> in the trigger* conditions. | 2-56 |
| :TRIGger:CAN:IDENtifier:ID<x>:HEXa | Sets the pattern of the Identifier ID in the trigger* conditions in hexadecimal. | 2-56 |
| :TRIGger:CAN:IDENtifier:ID<x>:MODE | Enables or disables the Identifier ID<x> in the trigger* conditions or queries the current setting. | 2-56 |
| :TRIGger:CAN:IDENtifier:ID<x>:PATTern | Sets the Identifier ID<x> pattern in the trigger* conditions in binary or queries the current setting. | 2-56 |
| :TRIGger:CAN:IDENtifier:MODE | Sets whether trigger activates on the Identifier in the trigger* conditions or queries the current setting. | 2-56 |
| :TRIGger:CAN:MFORmat | Sets the message format in the trigger* conditions or queries the current setting. | 2-56 |
| :TRIGger:CAN:PATTern? | Queries all settings related the pattern setting of the combination trigger.* | 2-56 |
| :TRIGger:CAN:PATTern:CHANnel<x> | Sets the condition (pattern or slope) of each channel of the combination trigger* or queries the current setting. | 2-57 |
| :TRIGger:CAN:PATTern:CLOCk | Sets the clock channel of the combination trigger* or queries the current setting. | 2-57 |
| :TRIGger:CAN:PATTern:CONDition | Sets the pattern condition of the combination trigger* or queries the current setting. | 2-57 |
| :TRIGger:CAN:PFORmat | Sets the pattern format in the trigger* conditions or queries the current setting. | 2-57 |
| :TRIGger:CAN:RTR | Sets whether the trigger activates on a data frame (0) or remote frame (1) in the trigger* conditions or queries the current setting. | 2-57 |
| :TRIGger:CAN:SPOint | Sets the sample point in the trigger* conditions or queries the current setting. | 2-57 |
| :TRIGger:CAN:VDIFf | Sets Vdiff in the trigger* conditions or queries the current setting. | 2-57 |
| :TRIGger:TYPE | Sets the trigger type or queries the current setting. | 2-57 |

* In the explanation of the function of each command in this section, *analysis* refers to CAN Bus signal analysis. *Trigger* refers to the trigger of the CAN Bus signal analysis function. *Cursor* refers to the cursor of the CAN Bus signal analysis function.

## • CAN Analyze Group

Commands in the CAN Analyze group can be used to set and query the CAN Bus signal analysis function in the same fashion as the SHIFT + ZOOM key on the front panel.






* <Current> when a current probe is used.

### :SEARch:CAN?

Function Queries all settings related to the analysis function.

Syntax `:SEARch:CAN?`

Example
```
:SEARCH:CAN? -> :SEARCH:CAN:
ANALYZE:SETUP:SOURCE 1;
BRATE 250.0E+03;SPOINT 81.3;
VDIFF L_H;
LEVEL -1.900000E+00,-3.500000E+00;
SBIT 0;:SEARCH:CAN:SEARCH:SETUP:
TYPE FRAME;MFORMAT STANDARD;
PFORMAT HEXA;IDENTIFIER:MODE 0;
PATTERN “XXXXXXXXXXX”;:SEARCH:CAN:
SEARCH:SETUP:RTR 0;DATA:MODE 0;
DLC 8;PATTERN1 “XXXXXXXX”;
PATTERN2 “XXXXXXXX”;
PATTERN3 “XXXXXXXX”;
PATTERN4 “XXXXXXXX”;
PATTERN5 “XXXXXXXX”;
PATTERN6 “XXXXXXXX”;
PATTERN7 “XXXXXXXX”;
PATTERN8 “XXXXXXXX”;:SEARCH:CAN:
SEARCH:SETUP:ACK:MODE 0;
PATTERN YES;:SEARCH:CAN:SEARCH:
SETUP:ERROR0
```

### :SEARch:CAN:ANALyze?

Function Queries all settings related to the execution of the analysis.

Syntax `:SEARch:CAN:ANALyze?`

Example
```
:SEARCH:CAN:ANALYZE? ->
:SEARCH:CAN:ANALYZE:SETUP:SOURCE 1:
BRATE 1.000E+06;SPOINT 62.5;
VDIFF L_H;LEVEL 0.0E+00,0.0E+00;
SBIT 0
```

### :SEARch:CAN:ANALyze:ABORt

Function Aborts the execution of the Analysis.

Syntax `:SEARch:CAN:ANALyze:ABORt`

Example `:SEARCH:CAN:ANALYZE:ABORT`

### :SEARch:CAN:ANALyze:EXECute

Function Executes the analysis.

Syntax `:SEARch:CAN:ANALyze:EXECute`

Example `:SEARCH:CAN:ANALYZE:EXECUTE`

### :SEARch:CAN:ANALyze:SETup?

Function Queries all settings related to the analysis conditions.

Syntax `:SEARch:CAN:ANALyze:SETup?`

Example
```
:SEARCH:CAN:ANALYZE:SETUP? ->
:SEARCH:CAN:ANALYZE:SETUP:SOURCE 1;
BRATE 1.000E+06;SPOINT 62.5;
VDIFF L_H;LEVEL 0.0E+00,0.0E+00;
SBIT 0
```

### :SEARch:CAN:ANALyze:SETup:BRATe

Function Sets the bit rate (data transfer rate) of the analysis conditions or queries the current setting.

Syntax
```
:SEARch:CAN:ANALyze:SETup:BRATe
{<NRf>}
:SEARch:CAN:ANALyze:SETup:BRATe?
```
<NRf>=10000 to 1000000 (except, the resolution is the reciprocal of 0.5 μs)

Example
```
:SEARCH:CAN:ANALYZE:SETUP:
BRATE 250000
:SEARCH:CAN:ANALYZE:SETUP:BRATE? ->
:SEARCH:CAN:ANALYZE:SETUP:
BRATE 250.0E+03
```

### :SEARch:CAN:ANALyze:SETup:LEVel

Function Sets the threshold level of the analysis conditions or queries the current setting.

Syntax
```
:SEARch:CAN:ANALyze:SETup:
LEVel {<Voltage>,<Voltage>}
:SEARch:CAN:ANALyze:SETup:LEVel?
```
<Voltage>=8 divisions within the screen (0.01 division steps).

Example
```
:SEARCH:CAN:ANALYZE:SETUP:
LEVEL 1.0,-1.0
:SEARCH:CAN:ANALYZE:SETUP:LEVEL? ->
:SEARCH:CAN:ANALYZE:SETUP:
LEVEL 1.000000E+00,-1.000000E+00
```

Description If you are setting a channel to which a current probe is connected, set and query using <Current>.

### :SEARch:CAN:ANALyze:SETup:SBIT

Function Enables/Disables the stuff bit computation of the analysis conditions or queries the current setting.

Syntax
```
:SEARch:CAN:ANALyze:SETup:
SBIT {<Boolean>}
:SEARch:CAN:ANALyze:SETup:SBIT?
```

Example
```
:SEARCH:CAN:ANALYZE:SETUP:SBIT 1
:SEARCH:CAN:ANALYZE:SETUP:SBIT? ->
:SEARCH:CAN:ANALYZE:SETUP:SBIT 1
```

### :SEARch:CAN:ANALyze:SETup:SOURce

Function Sets the analysis source channel or queries the current setting.

Syntax
```
:SEARch:CAN:ANALyze:SETup:SOURce
{<NRf>}
:SEARch:CAN:ANALyze:SETup:SOURce?
```
<NRf>=1, 3

Example
```
:SEARCH:CAN:ANALYZE:SETUP:SOURCE 1
:SEARCH:CAN:ANALYZE:SETUP:SOURCE?
-> :SEARCH:CAN:ANALYZE:SETUP:
SOURCE 1
```

### :SEARch:CAN:ANALyze:SETup:SPOint

Function Sets the sample point of the analysis conditions or queries the current setting.

Syntax
```
:SEARch:CAN:ANALyze:SETup
:SPOint {<NRf>}
:SEARch:CAN:ANALyze:SETup:SPOint?
```
<NRf>=18.8 to 90.6

Example
```
:SEARCH:CAN:ANALYZE:SETUP:
SPOINT 62.5
:SEARCH:CAN:ANALYZE:SETUP:SPOINT?
-> :SEARCH:CAN:ANALYZE:SETUP:
SPOINT 62.5
```

### :SEARch:CAN:ANALyze:SETup:VDIFf

Function Sets Vdiff (CAN_L-CAN_H/CAN_H-CAN_L) of the analysis conditions or queries the current setting.

Syntax
```
:SEARch:CAN:ANALyze:SETup:
VDIFf {L_H|H_L}
:SEARch:CAN:ANALyze:SETup:VDIFf?
```

Example
```
:SEARCH:CAN:ANALYZE:SETUP:VDIFF L_H
:SEARCH:CAN:ANALYZE:SETUP:VDIFF? ->
:SEARCH:CAN:ANALYZE:SETUP:VDIFF L_H
```

### :SEARch:CAN:DETail:BINary

Function Executes the binary display of the Data Field value of the detailed analysis list.

Syntax
```
:SEARch:CAN:DETail:BINary
```

Example
```
:SEARCH:CAN:DETAIL:BINARY
```

### :SEARch:CAN:DETail:HEXa

Function Executes the hexadecimal display of the Data Field value of the detailed analysis list.

Syntax
```
:SEARch:CAN:DETail:HEXa
```

Example
```
:SEARCH:CAN:DETAIL:HEXA
```

### :SEARch:CAN:DETail:LIST?

Function Outputs one frame of analysis result as a character string.

Syntax
```
:SEARch:CAN:DETail:LIST? {<NRf>}
```
<NRf>=–16000 to 16000

Example
```
:SEARCH:CAN:DETAIL:LIST? 0 ->
"D     0  -0.460 18F23200
00,00,FF,FF,80,25,FF,FF 1533   Y"
```

### :SEARch:CAN:SEARch?

Function Queries all settings related to the analysis result search.

Syntax `:SEARch:CAN:SEARch?`

Example
```
:SEARCH:CAN:SEARCH? -> :SEARCH:CAN:
SEARCH:SETUP:TYPE FRAME;
MFORMAT STANDARD;PFORMAT HEXA;
IDENTIFIER:MODE 0;
PATTERN “XXXXXXXXXXX”;:SEARCH:CAN:
SEARCH:SETUP:RTR 0;DATA:MODE 0;
DLC 8;PATTERN1 “XXXXXXXX”;
PATTERN2 “XXXXXXXX”;
PATTERN3 “XXXXXXXX”;
PATTERN4 “XXXXXXXX”;
PATTERN5 “XXXXXXXX”;
PATTERN6 “XXXXXXXX”;
PATTERN7 “XXXXXXXX”;
PATTERN8" XXXXXXXX”;:SEARCH:CAN:
SEARCH:SETUP:ACK:MODE 0;
PATTERN YES;:SEARCH:CAN:SEARCH:
SETUP:ERROR 0
```

### :SEARch:CAN:SEARch:FJUMp:ACK

Function Executes the field jump to the ACK Field in the analysis result.

Syntax `:SEARch:CAN:SEARch:FJUMp:ACK`

Example `:SEARCH:CAN:SEARCH:FJUMP:ACK`

### :SEARch:CAN:SEARch:FJUMp:CONTrol

Function Executes the field jump to the Control Field in the analysis result.

Syntax `:SEARch:CAN:SEARch:FJUMp:CONTrol`

Example `:SEARCH:CAN:SEARCH:FJUMP:CONTROL`

### :SEARch:CAN:SEARch:FJUMp:CRC

Function Executes the field jump to the CRC Field in the analysis result.

Syntax `:SEARch:CAN:SEARch:FJUMp:CRC`

Example `:SEARCH:CAN:SEARCH:FJUMP:CRC`

### :SEARch:CAN:SEARch:FJUMp:DATA

Function Executes the field jump to the Data Field in the analysis result.

Syntax `:SEARch:CAN:SEARch:FJUMp:DATA`

Example `:SEARCH:CAN:SEARCH:FJUMP:DATA`

### :SEARch:CAN:SEARch:FJUMp:IDENtifier

Function Executes the field jump to the Identifier in the analysis result.

Syntax `:SEARch:CAN:SEARch:FJUMp:IDENtifier`

Example `:SEARCH:CAN:SEARCH:FJUMP:IDENTIFIER`

### :SEARch:CAN:SEARch:NEXT?

Function Executes a Next search of the analysis results and queries the frame number found.

Syntax `:SEARch:CAN:SEARch:NEXT?`

Example `:SEARCH:CAN:SEARCH:NEXT? -> 1`

Description If the search is successful, a value in the range of –16000 to 16000 is returned. If it fails, “NAN” is returned.

### :SEARch:CAN:SEARch:PREVious?

Function Executes a Previous search of the analysis results and queries the frame number found.

Syntax `:SEARch:CAN:SEARch:PREVious?`

Example `:SEARCH:CAN:SEARCH:PREVIOUS? -> -1`

Description If the search is successful, a value in the range of –16000 to 16000 is returned. If it fails, “NAN” is returned.

### :SEARch:CAN:SEARch:SETup?

Function Queries all settings related to the analysis result search.

Syntax `:SEARch:CAN:SEARch:SETup?`

Example
```
:SEARCH:CAN:SEARCH:SETUP? ->
:SEARCH:CAN:SEARCH:SETUP:
TYPE FRAME;MFORMAT STANDARD;
PFORMAT HEXA;IDENTIFIER:MODE0;
PATTERN”XXXXXXXXXXX”;:SEARCH:CAN:
SEARCH:SETUP:RTR 0;DATA:MODE 0;
DLC 8;PATTERN1 “XXXXXXXX”;
PATTERN2 “XXXXXXXX”;
PATTERN3 “XXXXXXXX”;
PATTERN4 “XXXXXXXX”;
PATTERN5 “XXXXXXXX”;
PATTERN6 “XXXXXXXX”;
PATTERN7 “XXXXXXXX”;
PATTERN8 “XXXXXXXX”;:SEARCH:CAN:
SEARCH:SETUP:ACK:MODE0;PATTERNYES;:
SEARCH:CAN:SEARCH:SETUP:ERROR 0
```

### :SEARch:CAN:SEARch:SETup:ACK?

Function Queries all ACK setting values for pattern searches of the analysis results.

Syntax `:SEARch:CAN:SEARch:SETup:ACK?`

Example
```
:SEARCH:CAN:SEARCH:SETUP:ACK? ->
:SEARCH:CAN:SEARCH:SETUP:ACK:
MODE 0;PATTERN YES
```

### :SEARch:CAN:SEARch:SETup:ACK:MODE

Function Enables or disables the pattern search ACK of the analysis result or queries the current setting.

Syntax
```
:SEARch:CAN:SEARch:SETup:ACK:MODE {<Boolean>}
:SEARch:CAN:SEARch:SETup:ACK:MODE?
```

Example
```
:SEARCH:CAN:SEARCH:SETUP:ACK:MODE 1
:SEARCH:CAN:SEARCH:SETUP:ACK:MODE?
-> :SEARCH:CAN:SEARCH:SETUP:ACK:
MODE 1
```

### :SEARch:CAN:SEARch:SETup:ACK:PATTern

Function Sets the ACK pattern (YES/NO) for analysis results pattern searches or queries the current setting.

Syntax
```
:SEARch:CAN:SEARch:SETup:ACK:
PATTern {YES|NO}
:SEARch:CAN:SEARch:SETup:ACK:
PATTern?
```

Example
```
:SEARCH:CAN:SEARCH:SETUP:ACK:
PATTERN YES
:SEARCH:CAN:SEARCH:SETUP:ACK:
PATTERN? -> :SEARCH:CAN:SEARCH:
SETUP:ACK:PATTERN YES
```

### :SEARch:CAN:SEARch:SETup:DATA?

Function Queries all Data Field setting values for analysis results pattern searches or queries the current setting.

Syntax
```
:SEARch:CAN:SEARch:SETup:DATA?
```

Example
```
:SEARCH:CAN:SEARCH:SETUP:DATA? ->
:SEARCH:CAN:SEARCH:SETUP:DATA:
MODE 0;DLC 8;PATTERN1 “XXXXXXXX”;
PATTERN2 “XXXXXXXX”;
PATTERN3 “XXXXXXXX”;
PATTERN4 “XXXXXXXX”;
PATTERN5 “XXXXXXXX”;
PATTERN6 “XXXXXXXX”;
PATTERN7 “XXXXXXXX”;
PATTERN8 “XXXXXXXX”
```

### :SEARch:CAN:SEARch:SETup:DATA:DLC

Function Sets the number of bytes (DLC) for analysis results pattern searches or queries the current setting.

Syntax
```
:SEARch:CAN:SEARch:SETup:DATA:DLC {<NRf>}
:SEARch:CAN:SEARch:SETup:DATA:DLC?
```

Example
```
:SEARCH:CAN:SEARCH:SETUP:DATA:DLC 6
:SEARCH:CAN:SEARCH:SETUP:DATA:
DLC? -> :SEARCH:CAN:SEARCH:SETUP:
DATA:DLC 6
```

### :SEARch:CAN:SEARch:SETup:DATA:HEXa<x>

Function Sets each byte of the Data Field search patterns of analysis results in hexadecimal.

Syntax
```
:SEARch:CAN:SEARch:SETup:DATA:
HEXa<x> {<String>}
```
<String>=2 characters by combining ‘0’ to ‘F’ and ‘X’
<x>=0 to 8

Example
```
:SEARCH:CAN:SEARCH:SETUP:DATA:
HEXA1 “A3”
```

### :SEARch:CAN:SEARch:SETup:DATA:MODE

Function Enables or disables the pattern search Data Field of the analysis result or queries the current setting.

Syntax
```
:SEARch:CAN:SEARch:SETup:DATA:MODE {<Boolean>}
:SEARch:CAN:SEARch:SETup:DATA:MODE?
```

Example
```
:SEARCH:CAN:SEARCH:SETUP:DATA:
MODE 0
:SEARCH:CAN:SEARCH:SETUP:DATA:MODE?
-> :SEARCH:CAN:SEARCH:SETUP:DATA:
MODE 0
```

### :SEARch:CAN:SEARch:SETup:DATA:PATTern<x>

Function Sets each byte of the Data Field search patterns of analysis results in binary or queries the current setting.

Syntax
```
:SEARch:CAN:SEARch:SETup:DATA:
PATTern<x> {<String>}
:SEARch:CAN:SEARch:SETup:DATA:
PATTern<x>?
```
<String>=8 characters by combining ‘0,’ ‘1,’ and ‘X’
<x>=0 to 8

Example
```
:SEARCH:CAN:SEARCH:SETUP:DATA:
PATTERN1 “10X10X10”
:SEARCH:CAN:SEARCH:SETUP:DATA:
PATTERN1? -> :SEARCH:CAN:SEARCH:
SETUP:DATA:PATTERN1 “10X10X10”
```

### :SEARch:CAN:SEARch:SETup:ERRor

Function Enables or disables the pattern search Error of the analysis result or queries the current setting.

Syntax
```
:SEARch:CAN:SEARch:SETup:ERRor {<Boolean>}
:SEARch:CAN:SEARch:SETup:ERRor?
```

Example
```
:SEARCH:CAN:SEARCH:SETUP:ERROR 1
:SEARCH:CAN:SEARCH:SETUP:ERROR? ->
:SEARCH:CAN:SEARCH:SETUP:ERROR 1
```

### :SEARch:CAN:SEARch:SETup:IDENtifier?

Function Queries all Identifier setting values for analysis results pattern searches.

Syntax
```
:SEARch:CAN:SEARch:SETup:
IDENtifier?
```

Example
```
:SEARCH:CAN:SEARCH:SETUP:
IDENTIFIER? -> :SEARCH:CAN:SEARCH:
SETUP:IDENTIFIER:MODE 0;
PATTERN "XXXXXXXXXXX"
```

### :SEARch:CAN:SEARch:SETup:IDENtifier:HEXa

Function Sets the Identifier search pattern for analysis results pattern searches in hexadecimal.

Syntax
```
:SEARch:CAN:SEARch:SETup:
IDENtifier:HEXa {<String>}
```
- When the message format is standard <String>=3 characters by combining '0' to 'F' and 'X' (except the highest character is '0' to '7', and 'x')
- When the message format is extended <String>=8 characters by combining '0' to 'F' and 'X' (except the highest character is '0' to '1', and 'x')

Example
```
:SEARCH:CAN:SEARCH:SETUP:
IDENTIFIER:HEXA "7FF"
```

### :SEARch:CAN:SEARch:SETup:IDENtifier:MODE

Function Enables or disables the pattern search Identifier of the analysis result or queries the current setting.

Syntax
```
:SEARch:CAN:SEARch:SETup:
IDENtifier:MODE {<Boolean>}
:SEARch:CAN:SEARch:SETup:
IDENtifier:
MODE?
```

Example
```
:SEARCH:CAN:SEARCH:SETUP:
IDENTIFIER:MODE 1
:SEARCH:CAN:SEARCH:SETUP:
IDENTIFIER:MODE? -> :SEARCH:CAN:
SEARCH:SETUP:IDENTIFIER:MODE 1
```

### :SEARch:CAN:SEARch:SETup:IDENtifier:PATTern

Function Sets the Identifier pattern for analysis results pattern searches in binary or queries the current setting.

Syntax
```
:SEARch:CAN:SEARch:SETup:
IDENtifier:PATTern {<String>}
:SEARch:CAN:SEARch:SETup:
IDENtifier:PATTern?
```
- When the message format is standard <String>=11 characters by combining '0,' '1,' and 'X'
- When the message format is extended <String>=29 characters by combining '0,' '1,' and 'X'

Example
```
:SEARCH:CAN:SEARCH:SETUP:
IDENTIFIER:PATTERN "10X10X10X10"
:SEARCH:CAN:SEARCH:SETUP:
IDENTIFIER:PATTERN? -> :SEARCH:CAN:
SEARCH:SETUP:IDENTIFIER:
PATTERN "10X10X10X10"
```

### :SEARch:CAN:SEARch:SETup:MFORmat

Function Sets the message format for analysis results pattern searches or queries the current setting.

Syntax
```
:SEARch:CAN:SEARch:SETup:MFORmat
{STANdard|EXTended}
:SEARch:CAN:SEARch:SETup:MFORmat?
```

Example
```
:SEARCH:CAN:SEARCH:SETUP:
MFORMAT EXTENDED
:SEARCH:CAN:SEARCH:SETUP:MFORMAT?
-> :SEARCH:CAN:SEARCH:SETUP:
MFORMAT EXTENDED
```

### :SEARch:CAN:SEARch:SETup:PFORmat

Function Enters the setting format for analysis results pattern searches or queries the current setting.

Syntax
```
:SEARch:CAN:SEARch:SETup:PFORmat
{BINary|HEXa}
:SEARch:CAN:SEARch:SETup:PFORmat?
```

Example
```
:SEARCH:CAN:SEARCH:SETUP:PFORMAT
HEXA
:SEARCH:CAN:SEARCH:SETUP:PFORMAT?
-> :SEARCH:CAN:SEARCH:SETUP:
PFORMAT HEXA
```

### :SEARch:CAN:SEARch:SETup:RTR

Function Sets whether analysis results pattern searches are performed by data frame (0) or by remote frame (1) or queries the current setting.

Syntax
```
:SEARch:CAN:SEARch:SETup:RTR
{<Boolean>}
:SEARch:CAN:SEARch:SETup:RTR?
```

Example
```
:SEARCH:CAN:SEARCH:SETUP:RTR 1
:SEARCH:CAN:SEARCH:SETUP:RTR? ->
:SEARCH:CAN:SEARCH:SETUP:RTR 1
```

### :SEARch:CAN:SEARch:SETup:TYPE

Function Sets the analysis result search type (pattern search or indefinite data search) or queries the current setting.

Syntax
```
:SEARch:CAN:SEARch:SETup:TYPE
{FRAMe|INDefinite}
:SEARch:CAN:SEARch:SETup:TYPE?
```

Example
```
:SEARCH:CAN:SEARCH:SETUP:
TYPE INDEFINITE
:SEARCH:CAN:SEARCH:SETUP:TYPE? ->
:SEARCH:CAN:SEARCH:SETUP:
TYPE INDEFINITE
```

### :SEARch:TYPE

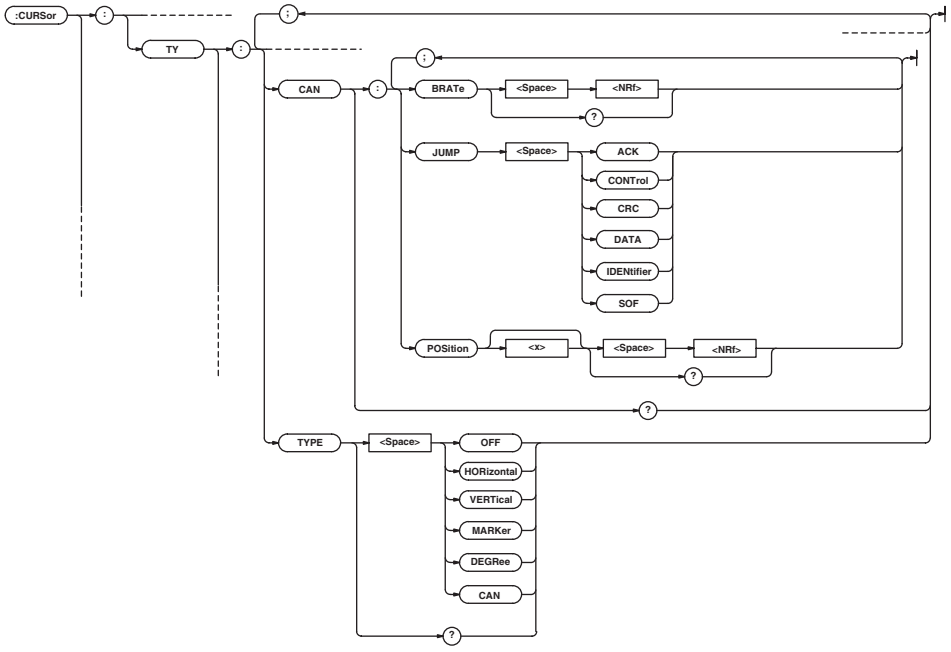
Function Sets the search type or queries the current setting.

Syntax
```
:SEARch:TYPE {SPATtern|WIDTh|EDGE|
PPATtern|ASCRoll|CANBus|SPIBus}
:SEARch:TYPE?
```

Example
```
:SEARCH:TYPE CANBUS
:SEARCH:TYPE? ->
:SEARCH:TYPE CANBUS
```

## • CAN Cursor Group

Commands in the CAN CURSor group can be used to set and query the cursor of the CAN Bus signal analysis function in the same fashion as the CURSOR key on the front panel.




### :CURSor:TY:CAN?

Function Queries all settings related to the CAN Cursor.

Syntax `:CURSor:TY:CAN?`

Example
```
:CURSOR:TY:CAN? -> :CURSOR:TY:CAN:
BRATE 500.000E+03;
POSITION1 -4.0000000;
POSITION2 -3.9980000
```

### :CURSor:TY:CAN:BRATe

Function Sets the bit rate (data transfer rate) of the CAN Cursor or queries the current setting.

Syntax
```
:CURSor:TY:CAN:BRATe {<NRf>}
:CURSor:TY:CAN:BRATe?
```
<NRf>=10000 to 1000000 (except, the resolution is the reciprocal of 0.5 μs)

Example
```
:CURSOR:TY:CAN:BRATE 500000
:CURSOR:TY:CAN:BRATE? ->
:CURSOR:TY:CAN:BRATE 500.000E+03
```

### :CURSor:TY:CAN:JUMP

Function Executes the jumping of the CAN Cursor to a specified field.

Syntax
```
:CURSor:TY:CAN:JUMP {SOF|
IDENtifier|CONTrol|DATA|CRC|ACK}
```

Example `:CURSOR:TY:CAN:JUMP SOF`

### :CURSor:TY:CAN:POSition<x>

Function Sets the CAN Cursor position or queries the current setting.

Syntax
```
:CURSor:TY:CAN:POSition<x> {<NRf>}
:CURSor:TY:CAN:POSition<x>?
```
<x>=1, 2
<NRf>=–5 to 5 (10 div/displayed record length steps)

Example
```
:CURSOR:TY:CAN:POSITION1 4
:CURSOR:TY:CAN:POSITION1? ->
:CURSOR:TY:CAN:POSITION1 -4.0000000
```

### :CURSor:TY:TYPE

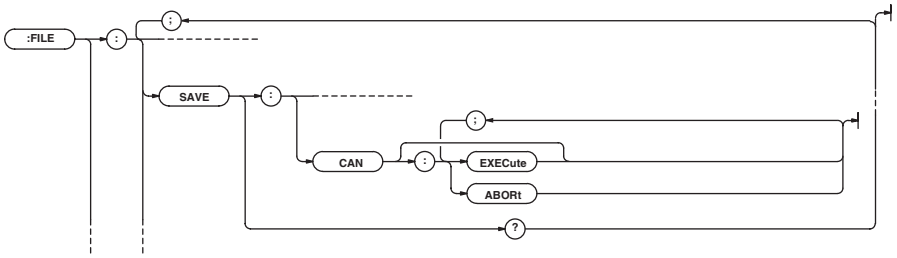
Function Sets the cursor type of the T-Y display or queries the current setting.

Syntax
```
:CURSor:TY:TYPE {OFF|HORizontal|
VERTical|MARKer|DEGRee|CAN}
:CURSor:TY:TYPE?
```

Example
```
:CURSOR:TY:TYPE CAN
:CURSOR:TY:TYPE? ->
:CURSOR:TY:TYPE CAN
```

## • CAN File Group

The commands in the CAN File Group can be used to execute/abort the saving of the data of the detailed analysis list of the CAN Bus signal in the same fashion as the FILE key on the front panel.




### :FILE:SAVE:CAN:ABORt

Function Aborts the saving of the data of the detailed analysis list of the analysis in ASCII format.

Syntax `:FILE:SAVE:CAN:ABORt`

Example `:FILE:SAVE:CAN:ABORT`

### :FILE:SAVE:CAN[:EXECute]

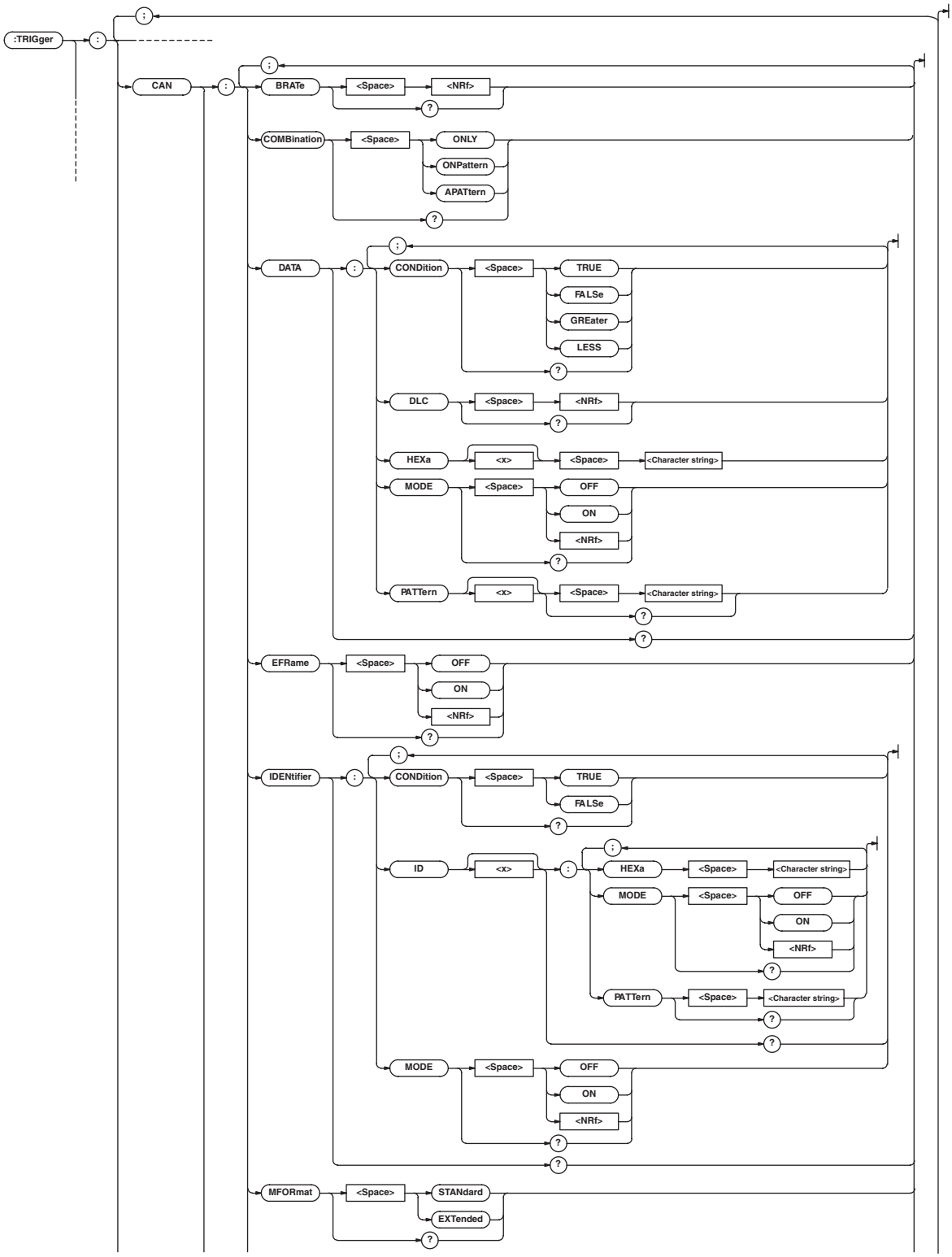
Function Executes the saving of the data of the detailed analysis list of the analysis in ASCII format. This is an overlap command.

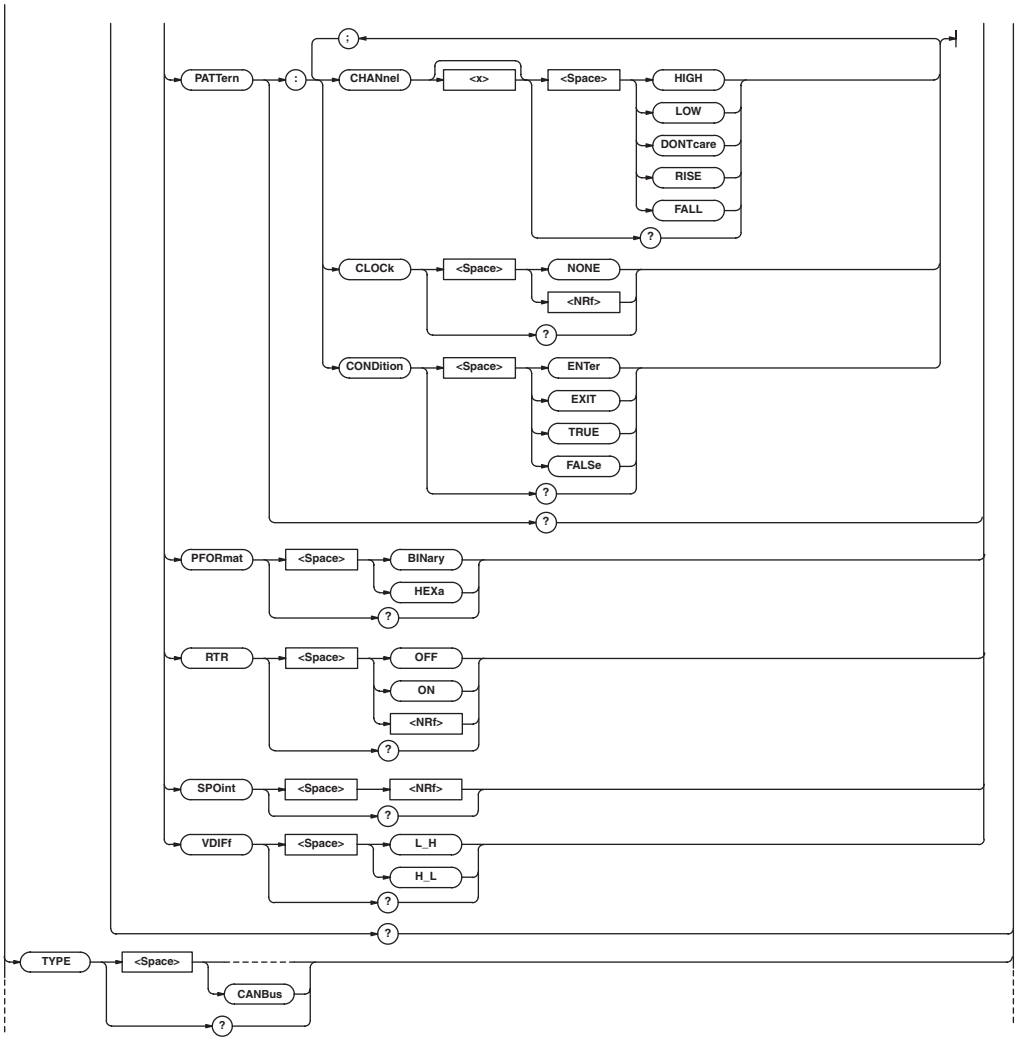
Syntax `:FILE:SAVE:CAN:EXECute`

Example `:FILE:SAVE:CAN:EXECUTE`

- **CAN Trigger Group**

  Commands in the CAN Trigger group can be used to set and query the trigger of the CAN Bus signal analysis function in the same fashion as the ENHANCED key on the front panel.






### :TRIGger:CAN?

Function Queries all settings related to the trigger function.

Syntax `:TRIGger:CAN?`

Example
```
:TRIGGER:CAN? -> :TRIGGER:CAN:
BRATE 500.0E+03;COMBINATION ONLY;
SPOINT 62.5;MFORMAT STANDARD;
VDIFF L_H;PFORMAT HEXA;IDENTIFIER:
MODE 0;CONDITION TRUE;ID1:MODE 0;
PATTERN “XXXXXXXXXXX”;:TRIGGER:CAN:
IDENTIFIER:ID2:MODE 0;
PATTERN “XXXXXXXXXXX”;:TRIGGER:CAN:
IDENTIFIER:ID3:MODE 0;
PATTERN “XXXXXXXXXXX”;:TRIGGER:CAN:
IDENTIFIER:ID4:MODE 0;
PATTERN “XXXXXXXXXXX”;:TRIGGER:CAN:
RTR 0;DATA:MODE 0;DLC 8;
PATTERN1 “XXXXXXXX”;
PATTERN2 “XXXXXXXX”;
PATTERN3 “XXXXXXXX”;
PATTERN4 “XXXXXXXX”;
PATTERN5 “XXXXXXXX”;
PATTERN6 “XXXXXXXX”;
PATTERN7 “XXXXXXXX”;
PATTERN8 “XXXXXXXX”;
CONDITION TRUE;:TRIGGER:CAN:
EFRAME 0
```

### :TRIGger:CAN:BRATe

Function Sets the bit rate (data transfer rate) in the trigger conditions or queries the current setting.

Syntax
```
:TRIGger:CAN:BRATe {<NRf>}
:TRIGger:CAN:BRATe?
```
<NRf>=10000 to 1000000 (except, the resolution is the reciprocal of 0.5 μs)

Example
```
:TRIGGER:CAN:BRATE 500000
:TRIGGER:CAN:BRATE? ->
:TRIGGER:CAN:BRATE 500.0E+03
```

### :TRIGger:CAN:COMBination

Function Sets the combination trigger or queries the current setting.

Syntax
```
:TRIGger:CAN:COMBination
{ONLY|ONPattern|APATtern}
:TRIGger:CAN:COMBination?
```

Example
```
:TRIGGER:CAN:COMBINATION ONLY
:TRIGGER:CAN:COMBINATION?
-> :TRIGGER:CAN:COMBINATION ONLY
```

### :TRIGger:CAN:DATA?

Function Queries all settings related to the Data Field in the trigger conditions.

Syntax
```
:TRIGger:CAN:DATA?
```

Example
```
:TRIGGER:CAN:DATA? -> :TRIGGER:CAN:
DATA:MODE 1;DLC 8;
PATTERN1 “XXXXXXXX”;
PATTERN2 “XXXX0000”;
PATTERN3 “XXXXXXXX”;
PATTERN4 “XXXXXXXX”;
PATTERN5 “XXXXXXXX”;
PATTERN6 “XXXXXXXX”;
PATTERN7 “XXXXXXXX”;
PATTERN8 “11111111”;CONDITION TRUE
```

### :TRIGger:CAN:DATA:CONDition

Function Sets the Data Field condition (True/False/Greater/Less) in the trigger conditions or queries the current setting.

Syntax
```
:TRIGger:CAN:DATA:CONDition
{TRUE|FALSe|GREater|LESS}
:TRIGger:CAN:DATA:CONDition?
```

Example
```
:TRIGGER:CAN:DATA:CONDITION FALSE
:TRIGGER:CAN:DATA:CONDITION? ->
:TRIGGER:CAN:DATA:CONDITION FALSE
```

### :TRIGger:CAN:DATA:DLC

Function Sets the number of valid bytes (DLC) of the Data Field in the trigger conditions or queries the current setting.

Syntax
```
:TRIGger:CAN:DATA:DLC {<NRf>}
:TRIGger:CAN:DATA:DLC?
```
<NRf>=1 to 8

Example
```
:TRIGGER:CAN:DATA:DLC 6
:TRIGGER:CAN:DATA:DLC? ->
:TRIGGER:CAN:DATA:DLC 6
```

### :TRIGger:CAN:DATA:HEXa<x>

Function Sets each byte of the Data Field patterns in the trigger conditions in hexadecimal.

Syntax
```
:TRIGger:CAN:DATA:HEXa<x>
{<String>}
```
<x>=1 to 8

Example
```
:TRIGGER:CAN:DATA:HEXA1 “A3”
```

### :TRIGger:CAN:DATA:MODE

Function Sets whether trigger activates on the Data Field in the trigger conditions or queries the current setting.

Syntax
```
:TRIGger:CAN:DATA:MODE {<Boolean>}
:TRIGger:CAN:DATA:MODE?
```

Example
```
:TRIGGER:CAN:DATA:MODE 1
:TRIGGER:CAN:DATA:MODE? ->
:TRIGGER:CAN:DATA:MODE 1
```

### :TRIGger:CAN:DATA:PATTern<x>

Function Sets the Data Field pattern in the trigger conditions in binary or queries the current setting.

Syntax
```
:TRIGger:CAN:DATA:PATTern<x>
{<String>}
:TRIGger:CAN:DATA:PATTern<x>?
```
<x>=1 to 8

Example
```
:TRIGGER:CAN:DATA:
PATTERN1 “10X10X10”
:TRIGGER:CAN:DATA:PATTERN1? ->
:TRIGGER:CAN:DATA:
PATTERN1 “10X10X10”
```

### :TRIGger:CAN:EFRame

Function Sets whether trigger activates on the Error Frame in the trigger conditions or queries the current setting.

Syntax
```
:TRIGger:CAN:EFRame {<Boolean>}
:TRIGger:CAN:EFRame?
```

Example
```
:TRIGGER:CAN:EFRAME 1
:TRIGGER:CAN:EFRAME? ->
:TRIGGER:CAN:EFRAME 1
```

### :TRIGger:CAN:IDENtifier?

Function Queries all settings related to the Identifier in the trigger conditions.

Syntax
```
:TRIGger:CAN:IDENtifier?
```

Example
```
:TRIGGER:CAN:IDENTIFIER? ->
:TRIGGER:CAN:IDENTIFIER:MODE 1;
CONDITION FALSE;ID1:MODE 1;
PATTERN “11111101100”;:TRIGGER:CAN:
IDENTIFIER:ID2:MODE 0;
PATTERN “XXXXXXXXXXX”;:TRIGGER:CAN:
IDENTIFIER:ID3:MODE 0;
PATTERN “XXXXXXXXXXX”;:TRIGGER:CAN:
IDENTIFIER:ID4:MODE 0;
PATTERN “XXXXXXXXXXX”
```

### :TRIGger:CAN:IDENtifier:CONDition

Function Sets the Identifier condition (True/False) in the trigger conditions or queries the current setting.

Syntax
```
:TRIGger:CAN:IDENtifier:CONDition
{TRUE|FALSe}
:TRIGger:CAN:IDENtifier:CONDition?
```

Example
```
:TRIGGER:CAN:IDENTIFIER:
CONDITION FALSE
:TRIGGER:CAN:IDENTIFIER:CONDITION?
-> :TRIGGER:CAN:IDENTIFIER:
CONDITION FALSE
```

### :TRIGger:CAN:IDENtifier:ID<x>?

Function Queries all settings related to the Identifier ID<x> in the trigger conditions.

Syntax
```
:TRIGger:CAN:IDENtifier:ID<x>?
```
<x>=1 to 4

Example
```
:TRIGGER:CAN:IDENTIFIER:ID1? ->
:TRIGGER:CAN:IDENTIFIER:ID1:MODE 1;
PATTERN "11111101100"
```

### :TRIGger:CAN:IDENtifier:ID<x>:HEXa

Function Sets the pattern of the Identifier ID in the trigger conditions in hexadecimal.

Syntax
```
:TRIGger:CAN:IDENtifier:ID<x>:HEXa
{<String>}
```
- When the message format is standard <String>=3 characters by combining '0' to 'F' and 'X' (except the highest character is '0' to '7', and 'x')
- When the message format is extended <String>=8 characters by combining '0' to 'F' and 'X' (except the highest character is '0' to '1', and 'x')

<x>=1 to 4

Example
```
:TRIGGER:CAN:IDENTIFIER:ID1:
HEXA "7FF"
```

### :TRIGger:CAN:IDENtifier:ID<x>:MODE

Function Enables or disables the Identifier ID<x> in the trigger conditions or queries the current setting.

Syntax
```
:TRIGger:CAN:IDENtifier:ID<x>:MODE
{<Boolean>}
:TRIGger:CAN:IDENtifier:ID<x>:MODE?
```
<x>=1 to 4

Example
```
:TRIGGER:CAN:IDENTIFIER:ID1:MODE 1
:TRIGGER:CAN:IDENTIFIER:ID1:MODE?
-> :TRIGGER:CAN:IDENTIFIER:ID1:
MODE 1
```

### :TRIGger:CAN:IDENtifier:ID<x>:PATTern

Function Sets the Identifier ID<x> pattern in the trigger conditions in binary or queries the current setting.

Syntax
```
:TRIGger:CAN:IDENtifier:ID<x>:
PATTern {<String>}
:TRIGger:CAN:IDENtifier:ID<x>:
PATTern?
```
- When the message format is standard <String>=11 characters by combining '0,' '1,' and 'X'
- When the message format is extended <String>=29 characters by combining '0,' '1,' and 'X'

<x>=1 to 4

Example
```
:TRIGGER:CAN:IDENTIFIER:ID1:
PATTERN "10X10X10X10"
:TRIGGER:CAN:IDENTIFIER:ID1:PATTERN?
-> :TRIGGER:CAN:IDENTIFIER:ID1:
PATTERN "10X10X10X10"
```

### :TRIGger:CAN:IDENtifier:MODE

Function Sets whether trigger activates on the Identifier in the trigger conditions or queries the current setting.

Syntax
```
:TRIGger:CAN:IDENtifier:MODE
{<Boolean>}
:TRIGger:CAN:IDENtifier:MODE?
```

Example
```
:TRIGGER:CAN:IDENTIFIER:MODE 1
:TRIGGER:CAN:IDENTIFIER:MODE? ->
:TRIGGER:CAN:IDENTIFIER:MODE 1
```

### :TRIGger:CAN:MFORmat

Function Sets the message format in the trigger conditions or queries the current setting.

Syntax
```
:TRIGger:CAN:MFORmat {STANdard|
EXTended}
:TRIGger:CAN:MFORmat?
```

Example
```
:TRIGGER:CAN:MFORMAT EXTENDED
:TRIGGER:CAN:MFORMAT? ->
:TRIGGER:CAN:MFORMAT EXTENDED
```

### :TRIGger:CAN:PATTern?

Function Queries all settings related the pattern setting of the combination trigger.

Syntax
```
:TRIGger:CAN:PATTern?
```

Example
```
:TRIGGER:CAN:PATTERN? ->
:TRIGGER:CAN:PATTERN:CLOCK NONE;
CHANNEL2 HIGH;CHANNEL3 DONTCARE;
CHANNEL4 DONTCARE;
CHANNEL5 DONTCARE;
CHANNEL6 DONTCARE;
CHANNEL7 DONTCARE;
CHANNRL8 DONTCARE;CONDITION ENTER
```

### :TRIGger:CAN:PATTern:CHANnel<x>

Function Sets the condition (pattern or slope) of each channel of the combination trigger or queries the current setting.

Syntax
```
:TRIGger:CAN:PATTern:CHANnel<x>
{HIGH|LOW|DONTCARE|RISE|FALL}
:TRIGger:CAN:PATTern:CHANnel<x>?
```
<x>=2 to 8 (2 to 4 on the DL7440)

Example
```
:TRIGGER:CAN:PATTERN:CHANNEL2 HIGH
:TRIGGER:CAN:PATTERN:CHANNEL2? ->
:TRIGGER:CAN:PATTERN:CHANNEL2 HIGH
```

Description If the channel is a clock channel, select from {RISE|FALL}; otherwise, select from {HIGH|LOW|DONTCARE}.

### :TRIGger:CAN:PATTern:CLOCk

Function Sets the clock channel of the combination trigger or queries the current setting.

Syntax
```
:TRIGger:CAN:PATTern:CLOCk {<NRf>}
:TRIGger:CAN:PATTern:CLOCk?
```
<NRf>=2 to 8 (2 to 4 on the DL7440)

Example
```
:TRIGGER:CAN:PATTERN:CLOCK 2
:TRIGGER:CAN:PATTERN:CLOCK? ->
:TRIGGER:CAN:PATTERN:CLOCK 2
```

Description You can set or query the clock channel only when ":TRIGger:CAN:COMBination" is APATtern.

### :TRIGger:CAN:PATTern:CONDition

Function Sets the pattern condition of the combination trigger or queries the current setting.

Syntax
```
:TRIGger:CAN:PATTern:CONDition
{ENTer|EXIT|TRUE|FALSe}
:TRIGger:CAN:PATTern:CONDition?
```

Example
```
:TRIGGER:CAN:PATTERN:
CONDITION ENTER
:TRIGGER:CAN:PATTERN:CONDITION? ->
:TRIGGER:CAN:PATTERN:
CONDITION ENTER
```

Description When "TRIGger:CAN:COMBination" is set to "ONPattern," select from {TRUE|FALSe}. When "TRIGger:CAN:COMBination" is set to "APATtern" and "TRIGger:CAN:PATTern:CLOCk" is set to "NONE," select from {ENTer|EXIT}. For all other conditions, the setting is invalid.

### :TRIGger:CAN:PFORmat

Function Sets the pattern format in the trigger conditions or queries the current setting.

Syntax
```
:TRIGger:CAN:PFORmat {BINary|HEXa}
:TRIGger:CAN:PFORmat?
```

Example
```
:TRIGGER:CAN:PFORMAT HEXA
:TRIGGER:CAN:PFORMAT? ->
:TRIGGER:CAN:PFORMAT HEXA
```

### :TRIGger:CAN:RTR

Function Sets whether the trigger activates on a data frame (0) or remote frame (1) in the trigger conditions or queries the current setting.

Syntax
```
:TRIGger:CAN:RTR {<Boolean>}
:TRIGger:CAN:RTR?
```

Example
```
:TRIGGER:CAN:RTR 1
:TRIGGER:CAN:RTR? ->
:TRIGGER:CAN:RTR 1
```

### :TRIGger:CAN:SPOint

Function Sets the sample point in the trigger conditions or queries the current setting.

Syntax
```
:TRIGger:CAN:SPOint {<NRf>}
:TRIGger:CAN:SPOint?
```
<NRf>=18.8 to 90.6

Example
```
:TRIGGER:CAN:SPOINT 78.1
:TRIGGER:CAN:SPOINT? ->
:TRIGGER:CAN:SPOINT 78.1
```

### :TRIGger:CAN:VDIFf

Function Sets Vdiff in the trigger conditions or queries the current setting.

Syntax
```
:TRIGger:CAN:VDIFf {L_H|H_L}
:TRIGger:CAN:VDIFf?
```

Example
```
:TRIGGER:CAN:VDIFF L_H
:TRIGGER:CAN:VDIFF? ->
:TRIGGER:CAN:VDIFF L_H
```

### :TRIGger:TYPE

Function Sets the trigger type or queries the current setting.

Syntax
```
:TRIGger:TYPE {ABN|ADB|PATTern|
WIDTh|OR|TV|SIMPle|CANBus}
:TRIGger:TYPE?
```

Example
```
:TRIGGER:TYPE CANBUS
:TRIGGER:TYPE? ->
:TRIGGER:TYPE CANBUS
```

# 3.1 Overview of the SPI Bus Signal Analysis Function

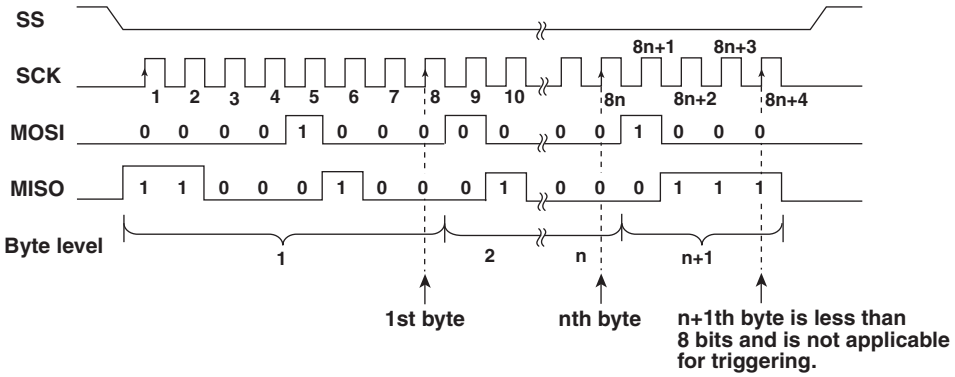
## About the SPI Bus Signal Analysis Function

The SPI (Serial Peripheral Interface) Bus is a synchronized serial bus that is widely used for inter-IC communications and data communications.
By using this function, you will be able to analyze data while displaying the SPI Bus signal waveform.
The SPI Bus signal analysis function consists of the following three main functions.

### Trigger Function <See page 3-5 for the operating procedure>

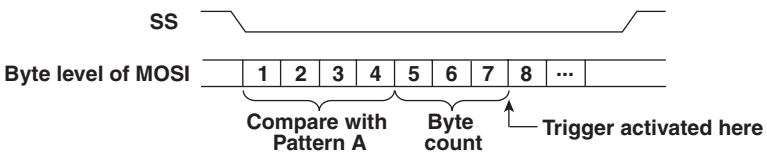
Acquires SPI Bus signals by comparing the specified conditions with the master output slave input signal (MOSI)* or master input slave output signal (MISO)* at the byte level (8 bits). MOSI or MISO data is divided into 8 bits from the valid edge of the clock signal (SCK)* immediately after the assertion of the slave select signal (SS).* If the number of bits is not an integer multiple of 8, data is compared every 8 bits from the first edge, but the last data that is less than 8 bits is not compared.

* On the DL7440/DL7480, the SCK (clock signal), MOSI (master output slave input signal), MISO (master input slave output signal), and SS (slave select signal) are applied to CH1, CH2, CH3, and CH4, respectively.




To activate triggers on the DL7440/DL7480, you will set pattern A/B and/or byte count. Triggers can be activated in various ways such as when the MOSI data pattern matches pattern A; the specified byte count after the MOSI data pattern matches pattern A; or when the MISO data pattern matches pattern B after the specified byte count elapses after the MOSI data pattern matches pattern A.

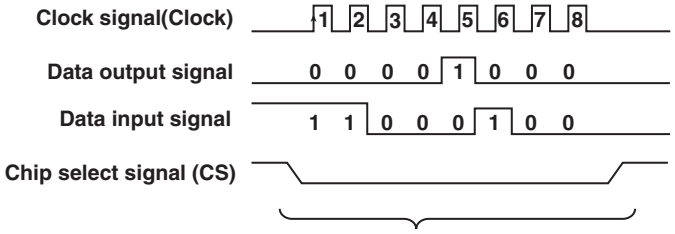
**To activate a trigger the specified byte count after MOSI matches Pattern A (Number of bytes of Pattern A: 4, byte count: 3)**




On the DL7480, triggers can also be activated by combining the trigger conditions of the SPI Bus signal and the parallel pattern of CH5 to CH8.

### Analysis Function <See page 3-23 for the operating procedure>

When the SPI Bus signal acquisition is stopped, the signal data stored to the acquisition memory (including the data stored as history waveforms) can be analyzed Analysis is performed at the byte level (8 bits) by synchronizing to the clock signal.
When the analysis is executed, an analysis result list is displayed on the lower section of the screen. The analysis data can be displayed in hexadecimal or binary. The analysis data and the SPI Bus signal can be displayed simultaneously.




| | | |
|---|---|---|
| **Analysis result** | **Byte number:** | **0** |
| | **Data output signal:** | **08(HEX)** |
| | **Data input signal:** | **C4(HEX)** |
| | **Chip select signal:** | **L** |
| | **Bit order:** | **MSB First** |

***Note***

The notation of the SPI Bus signal on the DL7440/DL7480 differs between the trigger condition setup menu and the analysis condition setup menu as follows:

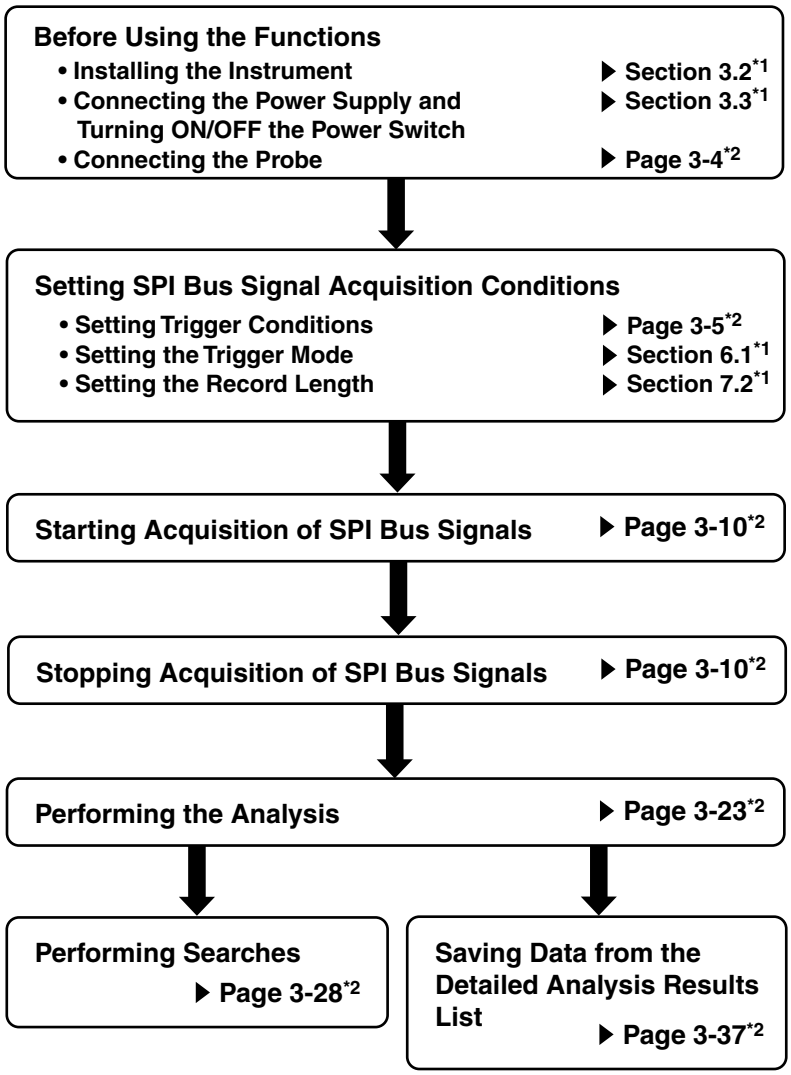
| Channel | Notation on the trigger condition setup menu | Notation on the analysis condition setup menu |
|---|---|---|
| CH1 | SCK (clock signal) | Clock (clock signal) |
| CH2 | MOSI (master output slave input signal) | Data1 (data input/output signal) |
| CH3 | MISO (master input slave output signal) | Data2 (data input/output signal) |
| CH4 | SS (slave select signal) | CS (chip select signal) |

### Search Function <See page 3-28 for the operating procedure>

Data that matches a specified determination pattern can be searched from the analysis data (forward search and backward search), and the data that is found can be displayed expanded on the zoom display. You can set the determination pattern in hexadecimal or binary and the data length in the range of 1 to 8 bytes. You can also search indefinite data.

# 3.2 Flow of Operation

The figure below provides an overview of the flow of operations when using the SPI Bus signal analysis function. For details about specific items, see the referenced pages in this manual or the respective sections in the *DL7440/DL7480 User's Manual (IM701450-01E)*.




***1. Indicates reference sections from the DL7440/DL7480 user's manual (IM701450-01E).**
***2. Indicates reference pages from this manual.**

# 3.3 Connecting the Probe

## Input Terminals

Connect the probe (or other input cables such as the BNC cable) to any of the input terminals (4 terminals marked as CH1 to CH4 on the DL7440 and 8 terminals marked CH1 to CH8 on the DL7480) located on the lower section of the front panel. The input impedance is 1 MΩ±1.0% and approximately 20 pF or 50 Ω±1.0%.

**CAUTION**

- The maximum input voltage for 1-MΩ input is 400 V (DC + ACpeak) or 282 Vrms when the frequency is 1 kHz or less. Applying a voltage exceeding either of these voltages can damage the input section. If the frequency is above 1 kHz, the input section may be damaged even when the voltage is below the values specified above.
- The maximum input voltage for 50-Ω input is 5 Vrms or 10 Vpeak. Applying a voltage exceeding either of these voltages can damage the input section.

**DL7440**


**DL7480**


## Precautions to Be Taken When Connecting a Probe

- When activating triggers on the SPI Bus signal, connect the signals to the input terminals as follows:
  CH1: Clock signal (SCK)
  CH2: Master output slave input signal (MOSI)*
  CH3: Master input slave output signal (MISO)*
  CH4: Slave select signal (SS)*

  * • When performing analysis, CH2 and CH3 can be connected to MOSI or MISO.
  • During the analysis, the DL7440/DL7480 handles the data of the signal connected to CH2 and CH3 as Data1 and Data2, respectively. The slave select signal is displayed as CS on the analysis condition setup menu and can be applied to any channel between CH4 and CH8 or any Pod A bit (A0 to A7) of the logic input (optional).
  • To activate triggers on the SPI Bus signal, be sure to apply the slave select signal (SS) to CH4.

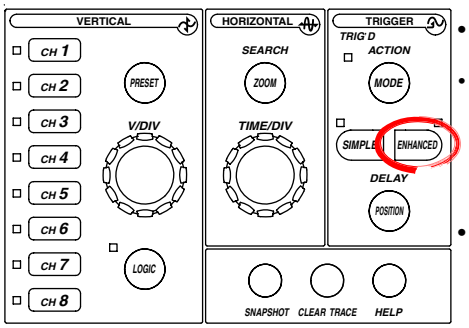
- When connecting a probe to the instrument for the first time, perform phase correction of the probe as described in section 3.5, “Compensating the Probe (Phase Correction)” in the *DL7440/DL7480 User’s Manual (IM701450-01E)*. Failure to do so may result in unstable gain across different frequencies, thereby preventing correct measurement. Calibration must be performed for each channel that is to be connected.
- Note that if the object being measured is directly connected to the instrument without using a probe, correct measurements may not be possible due to the loading effect.

# 3.4 Setting SPI Bus Signal Acquisition Conditions

The SPI Bus signal is acquired using the conditions of the four SPI bus signals* as trigger conditions.

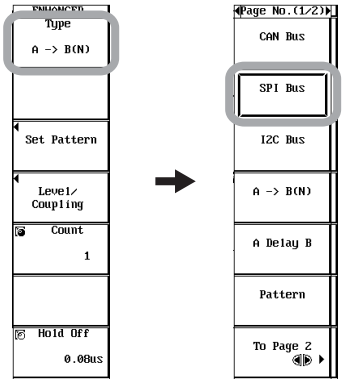
* SCK (clock signal), MOSI (master output slave input signal), MISO (master input slave output signal), and SS (slave select signal)

## *Procedure*




- To exit the menu during operation, press **ESC** located above the soft keys.
- In the procedural explanation below, the term *jog shuttle & SELECT* refers to the operation of selecting/setting items and entering values using the **jog shuttle**, **SELECT** and **RESET** keys. For details on the operation using the jog shuttle, SELECT, and RESET, see sections 4.1 or 4.2 in the DL7440/DL7480 User's Manual.
- For a description of the operation using a USB keyboard or a USB mouse, see section 4.3 in the DL7440/DL7480 User's Manual.

1. Press **ENHANCED**. The ENHANCED menu appears.
2. Press the **Type** soft key. The Type menu appears.
3. Press the **SPI Bus** soft key.

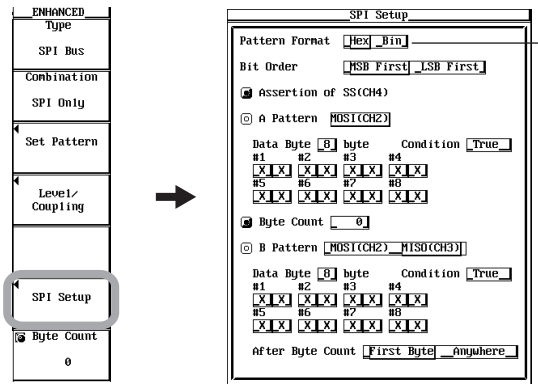



### Setting the Trigger Conditions of the SPI Bus Signal

4. Press the **SPI Setup** soft key. The SPI Setup dialog box opens.

#### Setting the Notation System of Pattern A and Pattern B

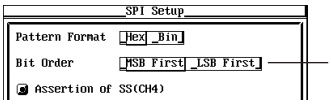
5. Use **jog shuttle & SELECT** to set the notation system used to set Pattern A and Pattern B to Hex or Bin (Pattern Format box). The format in the A Pattern and B Pattern boxes changes accordingly.




**Set the notation system of Pattern A and Pattern B to Hex or Bin.**

**Selecting the Read Direction of the I/O Data Bits**

6. Use **jog shuttle & SELECT** to set the read direction of the I/O data bits to MSB First or LSB First (Bit Order box).

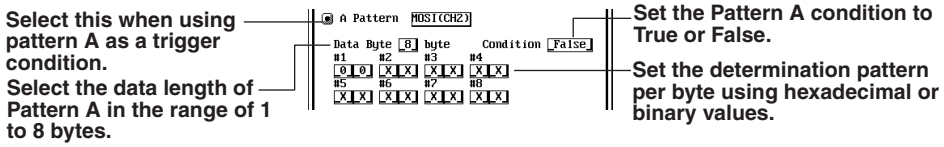



**Selecting the Items Used as a Trigger Condition**

7. Use **job shuttle & SELECT** to select whether Assertion of SS (CH4), A Pattern, Byte Count, and B Pattern are used as trigger conditions. If A Pattern is turned ON, proceed to step 8. To set the Byte Count, proceed to step 11. If B Pattern is turned ON, proceed to step 12.
   - Highlighting of the mark to the left of each item indicates that it is used as a trigger condition.
   - Assertion of SS (CH4) and Byte Count items are always used as trigger conditions (the mark to the left is always highlighted).
   - If you do not wish to use byte count as a trigger condition, set Byte Count to 0 (see step 11).

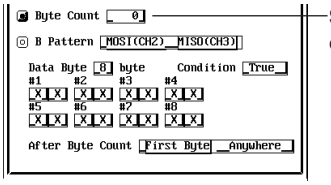
- **When Using Pattern A as a Trigger Condition**

8. Use **jog shuttle & SELECT** to set the data length of the determination pattern to be specified from 1 to 8 bytes (Data Byte box). The number of bytes displayed in the A Pattern box is set to the number of bytes that matches the selected result.
9. Use **jog shuttle & SELECT** to set the determination pattern for each byte in hexadecimal or binary (A Pattern box). When determination is not to be performed, select X.
10. Use **jog shuttle & SELECT** to set the condition of Pattern A to True or False (Condition box).



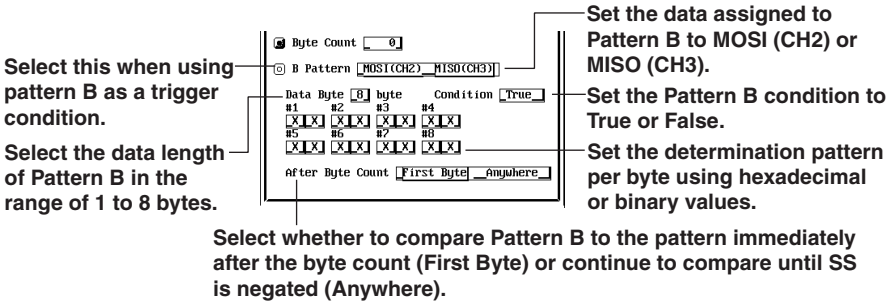

- **When Setting the Byte Count**

11. Use **jog shuttle & SELECT** to set the byte count in the range of 0 to 1000 bytes (Byte Count box).
   - If you do not wish to use byte count as a trigger condition, set the value to 0.
   - You can also set the byte count using the soft key that appears at the bottom of the ENHANCED menu (a menu that appears when you carry out steps 1 to 3 on the previous page).



- **When Using Pattern B as a Trigger Condition**

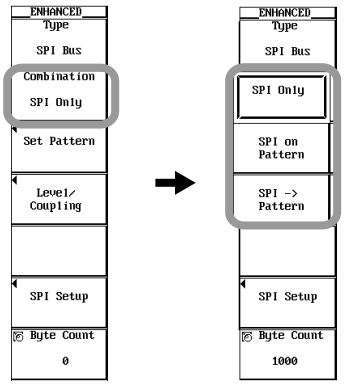
12. Use **jog shuttle & SELECT** to set the pattern MOSI (CH2) or MISO (CH3) to be assigned to Pattern B.
13. Use **jog shuttle & SELECT** to set the data length of the determination pattern to be specified from 1 to 8 bytes (Data Byte box). The number of bytes displayed in the B Pattern box is set to the number of bytes that matches the selected result.
14. Use **jog shuttle & SELECT** to set the determination pattern for each byte in hexadecimal or binary (B Pattern box). When determination is not to be performed, select X.
15. Use **jog shuttle & SELECT** to set the condition of Pattern B to True or False (Condition box).
16. Use **jog shuttle & SELECT** to select whether to compare the Pattern B to the pattern immediately after the byte count (First Byte) or continue to compare until SS is negated (Anywhere) (After Byte Count box).




17. Press **ESC**. The SPI Setup dialog box closes.

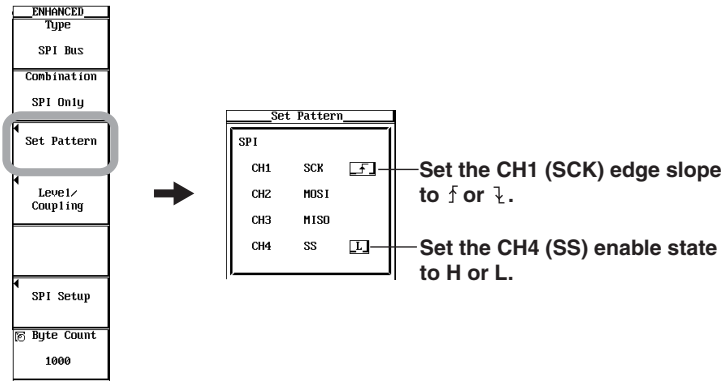
### Setting the Combination Trigger

18. Press the **Combination** soft key. The Combination menu appears.
19. Press **SPI Only**, **SPI on Pattern**, or **SPI -> Pattern** soft key.
    - Select SPI Only to activate a trigger only on the trigger conditions of the SPI Bus signal. Select SPI on Pattern to activate a trigger when the trigger conditions of the SPI Bus signal are met while the trigger conditions of CH5 to CH8 are met. Select SPI -> Pattern to activate a trigger when the trigger conditions of CH5 to CH8 are met after the trigger conditions of the SPI Bus signal are met.
    - Only SPI Only is selectable on the DL7440.



**When SPI Only Is Selected**

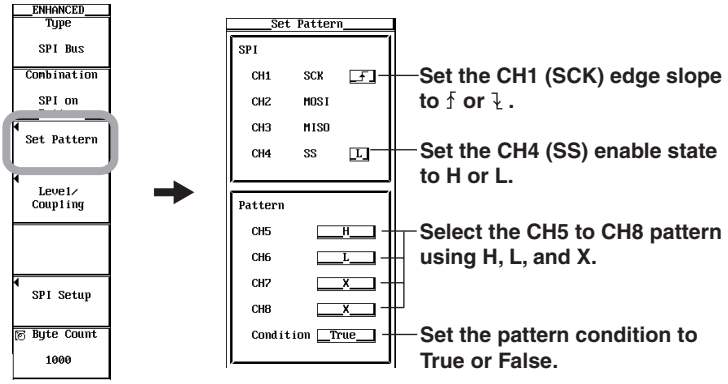
20. Press the **Set Pattern** soft key. The Set Pattern dialog box displays the assignment conditions of the SPI Bus signals of CH1 to CH4.
21. Use **jog shuttle & SELECT** to set the slope of the CH1 (SCK) edge to ⨍ (rising edge) or ⨍ (falling edge).
22. Use **jog shuttle & SELECT** to set the CH4 (SS) enable state to H (high) or L (low).




23. Press **ESC**. The Set Pattern dialog box closes.
Proceed to step 27.

**When SPI on Pattern Is Selected**

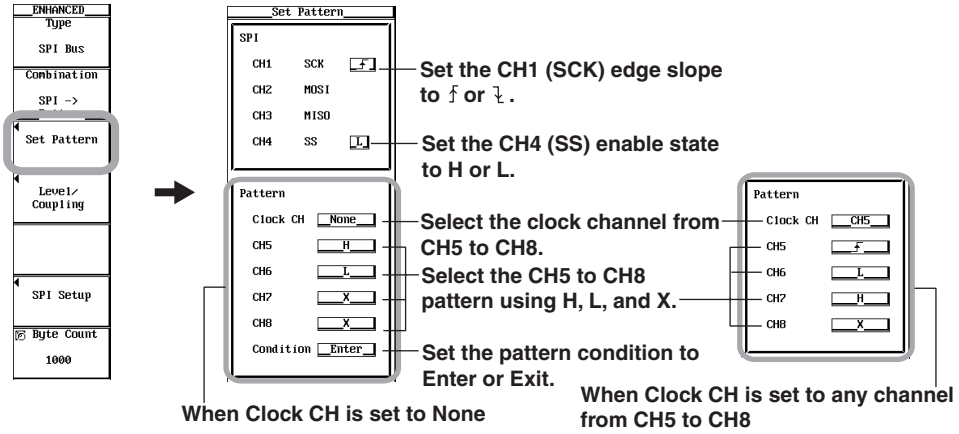
20. Press the **Set Pattern** soft key. The Set Pattern dialog box displays the assignment conditions of the SPI Bus signals of CH1 to CH4 and the pattern setup screen of CH5 to CH8.
21. Use **jog shuttle & SELECT** to set the slope of the CH1 (SCK) edge to ⨍ (rising edge) or ⨍ (falling edge).
22. Use **jog shuttle & SELECT** to set the CH4 (SS) enable state to H (high) or L (low).
23. Use **jog shuttle & SELECT** to set the patterns of CH5 to CH8 using H (high), L (low), and X.
24. Use **jog shuttle & SELECT** to set the pattern condition to True or False (Condition box).




25. Press **ESC**. The Set Pattern dialog box closes.
Proceed to step 27.

**When SPI -> Pattern Is Selected**

20. Press the **Set Pattern** soft key. The Set Pattern dialog box displays the assignment conditions of the SPI Bus signals of CH1 to CH4 and the pattern setup screen of CH5 to CH8.
21. Use **jog shuttle & SELECT** to set the slope of the CH1 (SCK) edge to ⤴ (rising edge) or ⤵ (falling edge).
22. Use **jog shuttle & SELECT** to set the CH4 (SS) enable state to H (high) or L (low).
23. Use **job shuttle & SELECT** to set the clock channel to None or any channel from CH5 or CH8 (Clock CH box).
24. Use **jog shuttle & SELECT** to set the patterns of CH5 to CH8 using H (high), L (low), and X. For the channel set as the clock channel in step 23, set the slope to ⤴ (rising edge) or ⤵ (falling edge).
25. If you set the clock channel to None in step 23, use **jog shuttle & SELECT** to set the pattern condition to True or False (Condition box).




*** Set the slope of the channel selected for the clock channel to ⤴ or ⤵.**

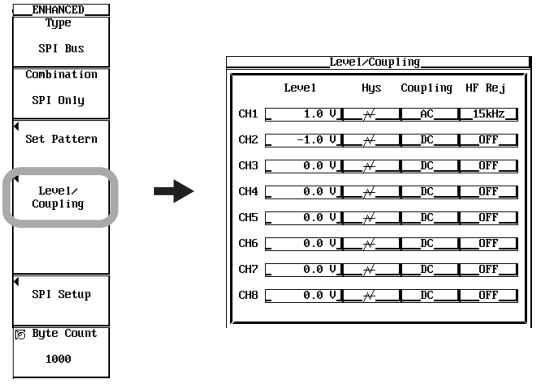
26. Press **ESC**. The Set Pattern dialog box closes.
Proceed to step 27.

***Note***

If you set Combination to SPI -> Pattern and set the patterns of CH5 to CH8 to all Xs, triggers will not be activated. If the clock channel is set to any of the channels from CH5 to CH8, the pattern conditions of other channels are always set to true.

### Setting the Trigger Level, Trigger Coupling, Etc.

27. Press the **Level/Coupling** soft key. The Level/Coupling dialog box opens.
28. Set the trigger level, trigger hysteresis, trigger coupling, and HF rejection of each channel. For the setup procedure, see steps 9 to 14 on page 6-16 in the *DL7440/DL7480 User's Manual (IM701450-01E)*.




29. Press **ESC**. The Level/Coupling dialog box closes.

### Setting the Trigger Mode

30. Set the trigger mode according to the procedures given in section 6.1, "Setting the Trigger Mode" in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Setting the Record Length

31. Set the record length according to the procedures given in section 7.2, "Setting the Record Length" in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Starting/Stopping the SPI Bus Signal Acquisition

32. Press **START/STOP** to start the SPI Bus signal acquisition. Triggers are activated on the specified trigger conditions.
    To proceed to the analysis, press **START/STOP** to stop the SPI Bus signal acquisition.

## *Explanation*

### Setting the Trigger Conditions of the SPI Bus Signal: SPI Setup

You can set the following conditions.

**Pattern Format**

Select the format for Pattern A and Pattern B from the following:

| | |
|---|---|
| Hex | Hexadecimal |
| Bin | Binary |

**Bit Order**

You can select the bit order of Pattern A and Pattern B according to the signal flow of the input/output data. When setting the pattern in binary, set the data in the order of the flow regardless of the bit order setting. When setting the pattern in hexadecimal, enter the pattern according to the bit order setting, separated every four bits in the order of the flow.

| | |
|---|---|
| MSB First | Select this when the I/O data signal is flowing MSB first. |
| LSB First | Select this when the I/O data signal is flowing LSB first. |

***Note***

The bit order setting is connected with the setting in the Analyze Setup dialog box (see page 3-26).

**Type of the SPI Bus Signal Trigger Condition**

You can select the type of the SPI Bus signal trigger condition from the four types listed below. You can use the AND condition to select multiple types at the same time. However, Assertion of SS and Byte Count are always selected.

- **Assertion of SS(CH4)**
  The trigger function of the SPI Bus signal counts the valid edges of SCK (CH1) after SS (CH4) is asserted and divides MOSI (CH2) or MISO (CH3) into bytes. Therefore, Assertion of SS (CH4) is always selected.
- **A Pattern**
  Set the bit pattern used to compare with the command or address sent from the master to the slave. The pattern is compared with the bit pattern of MOSI (CH2) that is present immediately after SS (CH4) is asserted.
- **Byte Count**
  You can activate a trigger after the specified number of bytes elapses after the assertion of SS (CH4) (after the condition of Pattern A is met when Pattern A is selected). You can set the byte count in the range of 0 to 1000. The Byte Count item is always selected. If you do not wish to use Byte Count as a trigger condition, set the value to 0.
- **B Pattern**
  Set the bit pattern used to compare with the data written by the master to the slave or the data read by the master from the slave. You can select write data (MOSI) or read data (MISO) to be compared. The pattern is compared with the bit pattern the byte count after the assertion of SS (CH4).

***Note***

If multiple types are combined, the trigger point is set to the trigger point of the type that appeared last in the time sequence.

**When the Type of SPI Bus Signal Trigger Condition Is Set to A Pattern**

- **Data Byte**
  Select the data length of A Pattern in the range of 1 to 8 bytes.
- **Bit Pattern**
  You can set the bit pattern. When Pattern Format is set to Hex (hexadecimal), you can enter X, 0 to 9, or A to F in units of 4 bits. When Pattern Format is set to Bin (binary), you can enter X, 0, or 1.
- **Condition**
  You can select from the following:

| | |
|---|---|
| True | A trigger is activated when A Pattern is met. |
| False | A trigger is activated when A Pattern is not met. |

**When the Type of SPI Bus Signal Trigger Condition Is Set to B Pattern**

- **Selecting the data**
  Select the data to be used for B Pattern from the following:

| | |
|---|---|
| MOSI (CH2) | Data written by the master to the slave |
| MISO (CH3) | Data read by the master from the slave |

- **Data Byte**
  Select the data length of B Pattern in the range of 1 to 8 bytes.
- **Bit Pattern**
  You can set the bit pattern. When Pattern Format is set to Hex (hexadecimal), you can enter X, 0 to 9, or A to F in units of 4 bits. When Pattern Format is set to Bin (binary), you can enter X, 0, or 1.
- **Condition**
  You can select from the following:

| | |
|---|---|
| True | A trigger is activated when B Pattern is met. |
| False | A trigger is activated when B Pattern is not met. |

- **After Byte Count**
  You can select from the following:

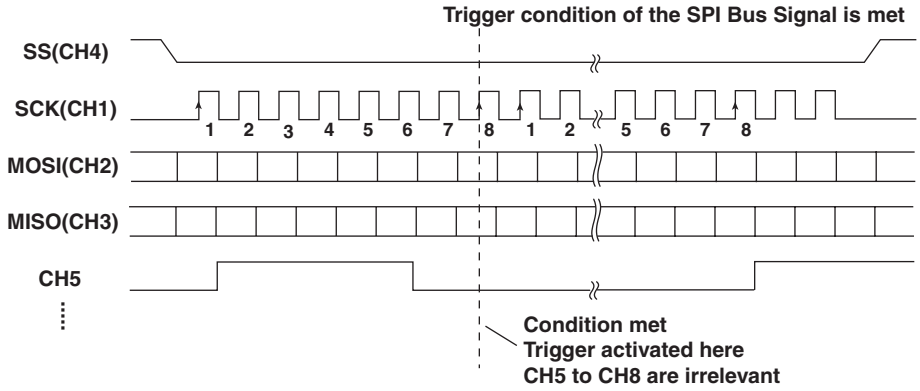
| | |
|---|---|
| First Byte | Compares Pattern B to the bit pattern the byte count after the assertion of SS. |
| Anywhere | Continues to compare Pattern B until SS (CH4) is negated. |

### Setting the Combination Trigger

A trigger can be activated on the combination of the trigger conditions of the SPI Bus signal and the trigger conditions of CH5 to CH8. You can select from the following three types.

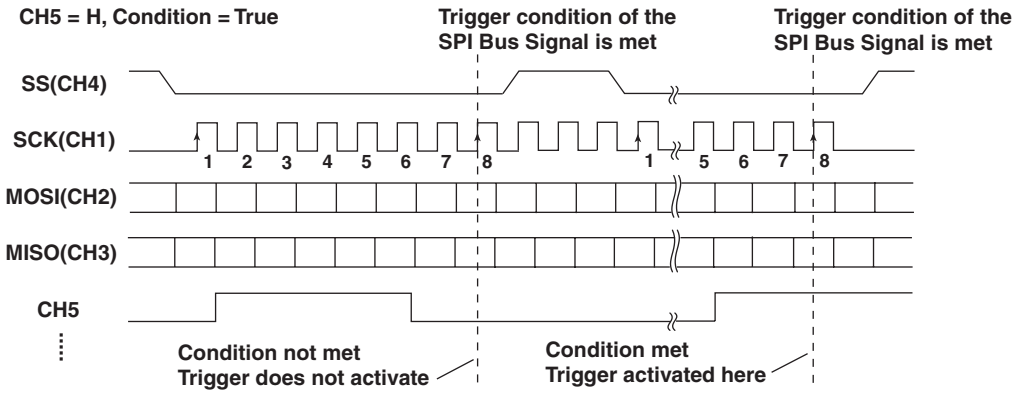
#### SPI Only

Activates a trigger only on the trigger conditions of the SPI Bus signal. Only SPI Only is selectable on the DL7440.




#### SPI on Pattern

Activates a trigger only when the trigger conditions of the SPI Bus signal are met while the trigger conditions of CH5 to CH8 are met.




- **Slope of CH1 (SCK) Edge**

  Select the slope from the following:

| | |
|---|---|
| ⎍ | Rising edge |
| ⎎ | Falling edge |

- **Enable State of CH4 (SS)**

  Select the state from the following:

| | |
|---|---|
| H | Status when the SS signal is above the trigger level. A trigger is activated when the SS signal is high. |
| L | Status when the SS signal is below the trigger level. A trigger is activated when the SS signal is low. |

- **CH5 to CH8 Pattern**

  You can set the pattern as follows:

| | |
|---|---|
| H | The trigger source level is above the preset trigger level. |
| L | The trigger source level is below the preset trigger level. |
| X | Not used as a trigger source. |

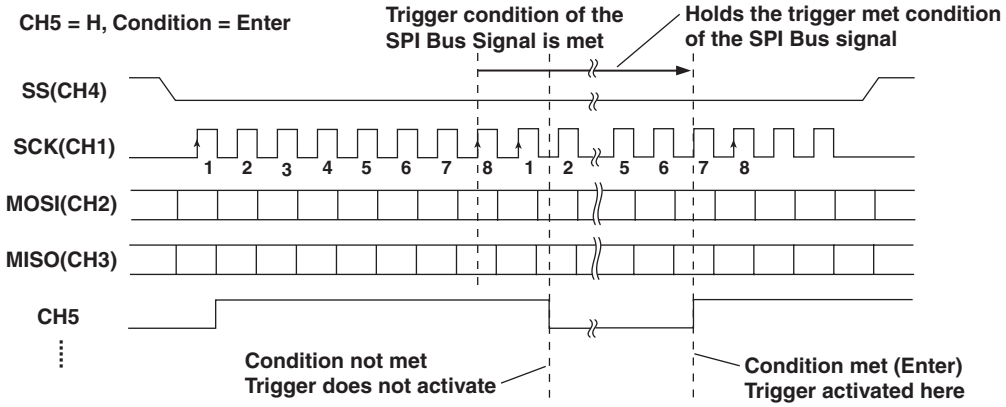
- **Pattern Condition**

  Select the condition from the following.

| | |
|---|---|
| True | Activates a trigger when the specified CH5 to CH8 pattern is met. |
| False | Activates a trigger when the specified CH5 to CH8 pattern is no longer met. |

**SPI -> Pattern**

Activates a trigger when the trigger conditions of CH5 to CH8 are met after the trigger conditions of the SPI Bus signal are met. The SPI trigger met condition is held until the CH5 to CH8 trigger condition is met.




- **Slope of CH1 (SCK) Edge**

  Select the slope from the following:

| | |
|---|---|
| ⎍ | Rising edge |
| ⎎ | Falling edge |

- **Enable State of CH4 (SS)**

  Select the state from the following:

| | |
|---|---|
| H | Status when the SS signal is above the trigger level. A trigger is activated when the SS signal is high. |
| L | Status when the SS signal is below the trigger level. A trigger is activated when the SS signal is low. |

- **Clock Channel**

  You can set the clock channel to any channel from CH5 to CH8. If you do not wish to set a clock channel, select None.

- **CH5 to CH8 Pattern**

  You can set the pattern as follows:

| | |
|---|---|
| H | The trigger source level is above the preset trigger level. |
| L | The trigger source level is below the preset trigger level. |
| X | Not used as a trigger source. |

For the channel set as the clock channel, set the slope to ⎍ (rising edge) or ⎎ (falling edge), not the pattern.

- **Pattern Condition**
  You can set the pattern condition only when a clock channel is not specified. Select from the following:

| | |
|---|---|
| Enter | Activates a trigger when the specified CH5 to CH8 pattern is met. |
| Exit | Activates a trigger when the specified CH5 to CH8 pattern is no longer met. |

If you set the clock channel to any channel from CH5 to CH8, the pattern condition is set to True.



### Setting the Trigger Level, Trigger Coupling, Etc.: Level/Coupling

Set the trigger level, hysteresis, trigger coupling, and HF rejection of each channel.
For details on the trigger level, hysteresis, trigger coupling, and HF rejection, see page 6-17 in section 6.8, “Setting the A->B(N) Trigger (ENHANCED)” in the *DL7440/DL7480 User’s Manual (IM701450-01E)*.

### Setting the Trigger Mode

Set the conditions for updating the displayed waveforms as a trigger mode. There are five trigger modes: auto mode, auto level mode, normal mode, single mode, and single (N) mode.
For details on the trigger modes, see section 6.1, “Selecting the Trigger Mode” in the *DL7440/DL7480 User’s Manual (IM701450-01E)*.

### Setting the Record Length

The record length sets the amount of data to be written into the acquisition memory. The selectable maximum record length varies depending on the model.

| |
|---|
| 16 MW memory model (701460 and 701480)<br>1 k, 10 k, 50 k, 100 k, 250 k, 500 k, 1 M, 2 M, 4 M, 8 M (, 16 M) |
| 4 MW memory model (701450 and 701470)<br>1 k, 10 k, 50 k, 100 k, 250 k, 500 k, 1 M, 2 M (, 4 M) |

* The value inside the parentheses is selectable only when interleave mode is ON.

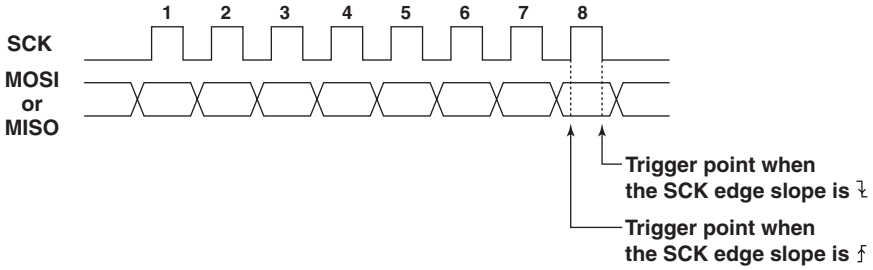
For details on the record length, see section 7.2, “Setting the Record Length” in the *DL7440/DL7480 User’s Manual (IM701450-01E)*. For details on interleave mode, see section 7.3, “Using Interleave Mode.”

### Starting/Stopping the SPI Bus Signal Acquisition

When you start the SPI Bus signal acquisition, triggers are activated on the specified trigger conditions.
To proceed to the analysis, you stop the SPI Bus signal acquisition.

### Examples of SPI Bus Signal Trigger Conditions

The trigger point is set to the position below depending on the SCK edge slope setting (see page 3-7).



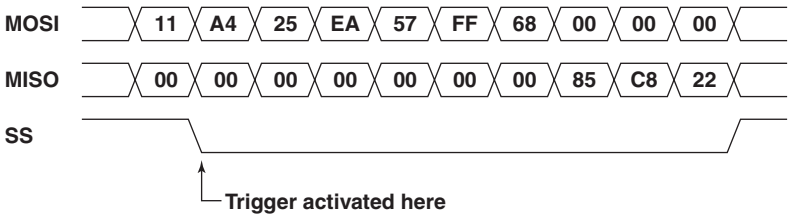

This section will indicate the data sequence at the byte level in hexadecimal and indicate the position where the trigger will occur.
The shaded section is the figure indicates the byte pattern (sequence) that is compared.

- **Slave Select Assert Trigger**

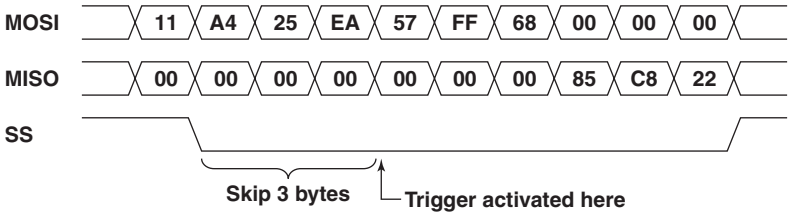
  **Trigger Condition**

  SS: L
  A Pattern (MOSI): Not applicable
  B Pattern: Not applicable

  **<Byte Count=0>**



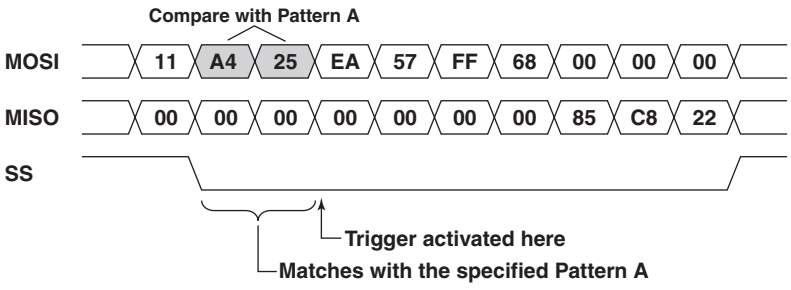

  **<Byte Count=3>**




- **Activate a Trigger Only on Pattern A**

  **Trigger Condition**

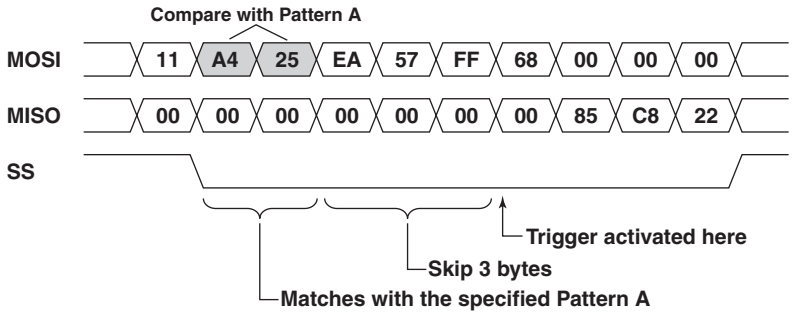
  SS: L
  A Pattern (MOSI): A4 25
  Data Byte: 2
  Condition: True
  B Pattern: Not applicable



- **Combination of Pattern A and Byte Count Trigger**

  **Trigger Condition**

  SS: L
  A Pattern (MOSI): A4 25
  Data Byte: 2
  Condition: True
  Byte Count: 3
  B Pattern: Not applicable

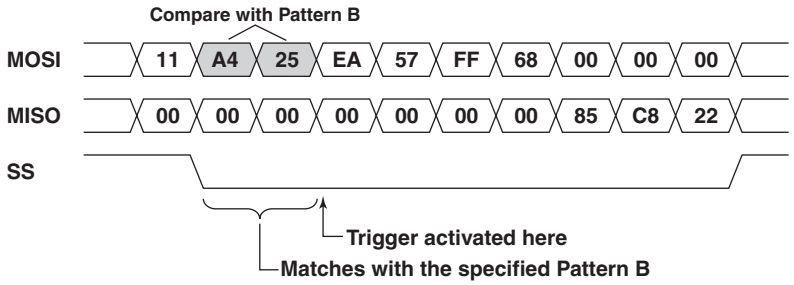



- **Activate a Trigger Only on Pattern B (MOSI)**

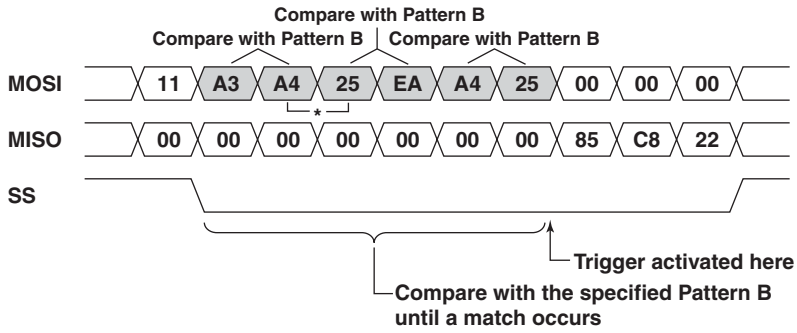
  **Trigger Condition**

  SS: L
  A Pattern (MOSI): Not applicable
  B Pattern (MOSI): A4 25
  Data Byte: 2
  Condition: True

  **<After Byte Count=First Byte>**




  **<After Byte Count=Anywhere>**




*** Trigger does not activate on "A4" and "25", because the comparison is made on 2 bytes.**

- **Activate a Trigger Only on Pattern B (MISO)**

  **Trigger Condition**

  SS: L

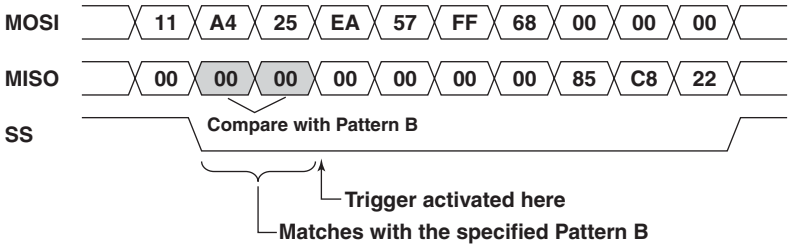
  A Pattern (MOSI): Not applicable

  B Pattern (MISO): See below.

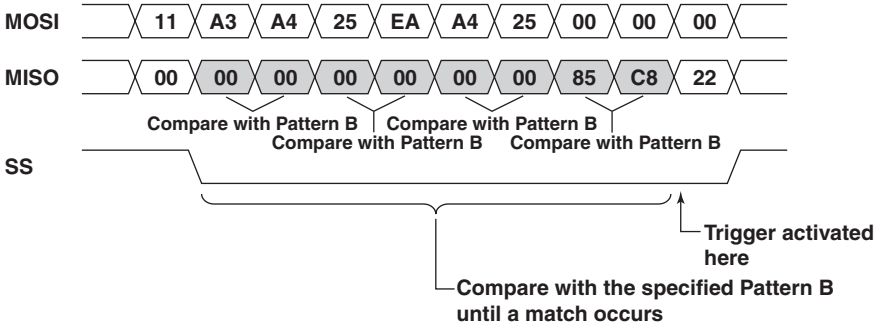
  Data Byte: 2

  Condition: True

**<B Pattern (MISO): 00 00, After Byte Count=First Byte>**




**<B Pattern (MISO): 85 C8, After Byte Count=Anywhere>**

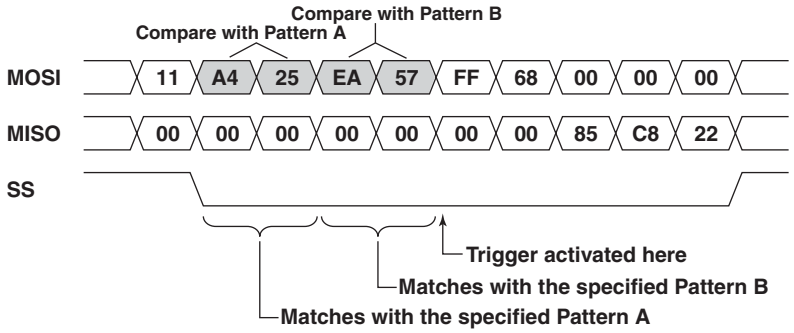


- **Combination of Pattern A and Pattern B (MOSI)**

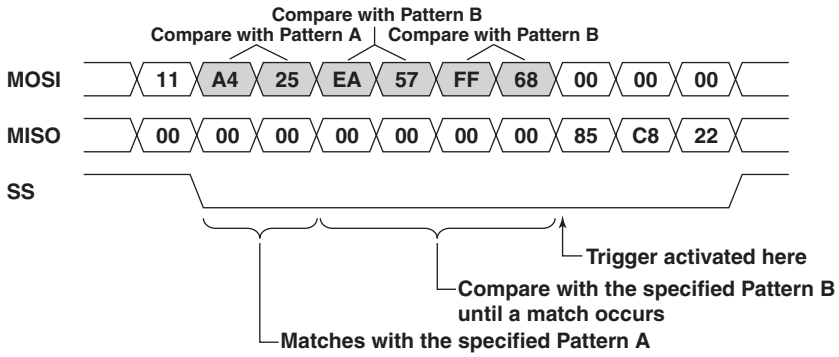
  **Trigger Condition**

  SS: L
  A Pattern (MOSI): A4 25
  Data Byte: 2
  Condition: True
  B Pattern (MOSI): See below.
  Data Byte: 2
  Condition: True

**<B Pattern (MOSI):EA 57, After Byte Count=First Byte>**




**<B Pattern (MOSI): FF 68, After Byte Count=Anywhere>**

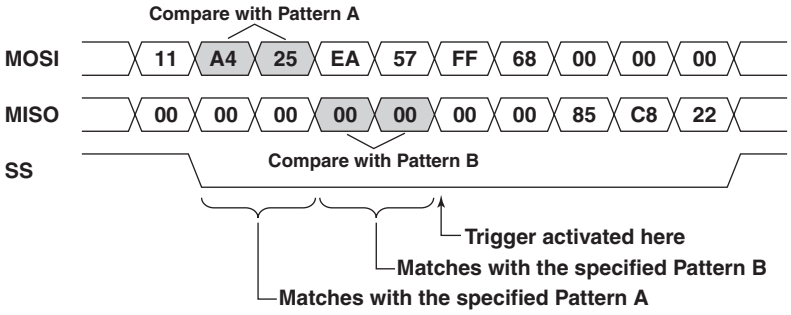


- **Combination of Pattern A and Pattern B (MISO)**

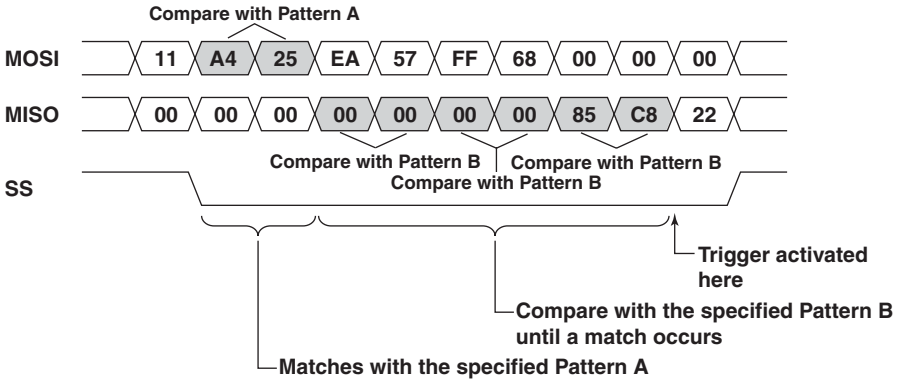
  **Trigger Condition**

  SS: L
  A Pattern (MOSI): A4 25
  Data Byte: 2
  Condition: True
  B Pattern (MISO): See below.
  Data Byte: 2
  Condition: True

**<B Pattern (MISO): 00 00, After Byte Count=First Byte>**




**<B Pattern (MISO): 85 C8, After Byte Count=Anywhere>**

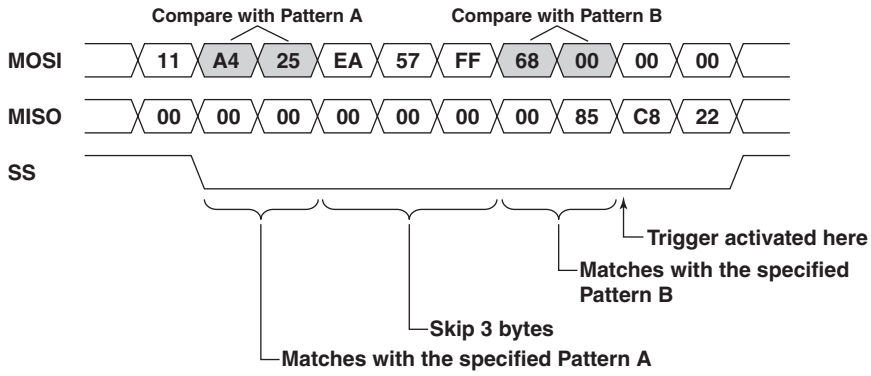


- **Combination of Pattern A, Byte Count Trigger, and Pattern B (MOSI)**

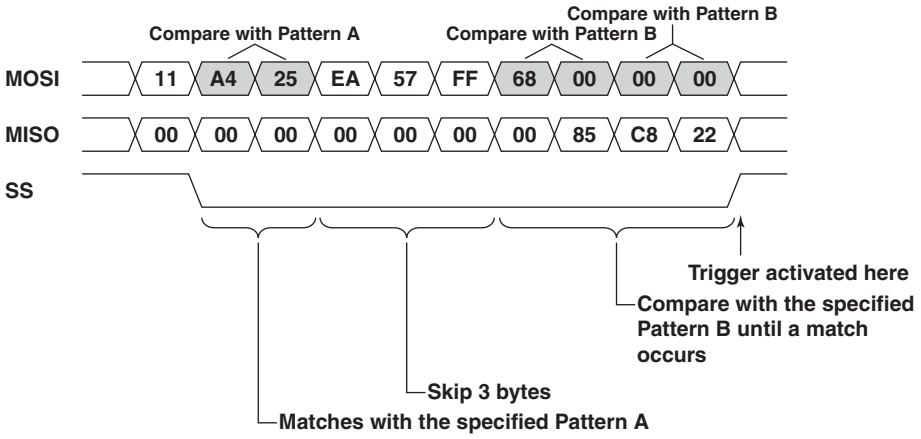
  **Trigger Condition**

  SS: L
  A Pattern (MOSI): A4 25
  Data Byte: 2
  Condition: True
  Byte Count: 3
  B Pattern (MOSI): See below.
  Data Byte: 2
  Condition: True

**<B Pattern (MOSI): 68 00, After Byte Count=First Byte>**




**<B Pattern (MOSI): 00 00, After Byte Count=Anywhere>**

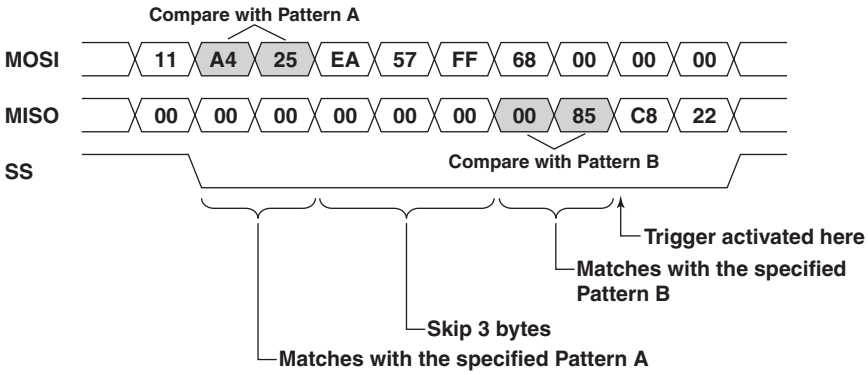


- **Combination of Pattern A, Byte Count Trigger, and Pattern B (MISO)**

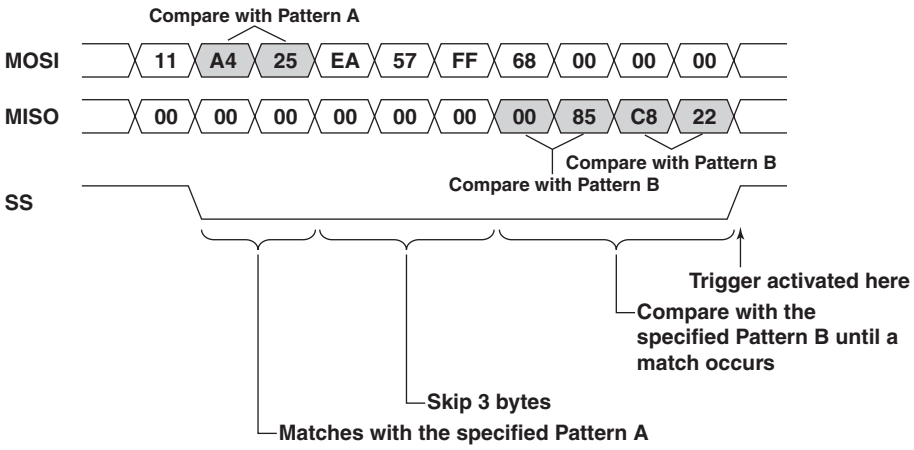
  **Trigger Condition**

  SS: L
  A Pattern (MOSI): A4 25
  Data Byte: 2
  Condition: True
  Byte Count: 3
  B Pattern (MISO): See below.
  Data Byte: 2
  Condition: True

  **<B Pattern (MISO): 00 85, After Byte Count=First Byte>**



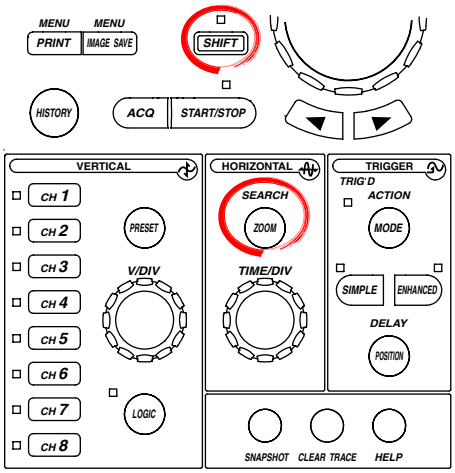

  **<B Pattern (MISO): C8 22, After Byte Count=Anywhere>**



# 3.5 Analyzing/Searching Data

By setting analysis conditions, the SPI signal data stored to the acquisition memory can be analyzed. You can also search analysis data that matches a data pattern or an indefinite data condition. If analysis data that matches the specified condition is found, the zoom position moves to the corresponding section, and the waveform of the data that is found is displayed in the zoom waveform display frame.

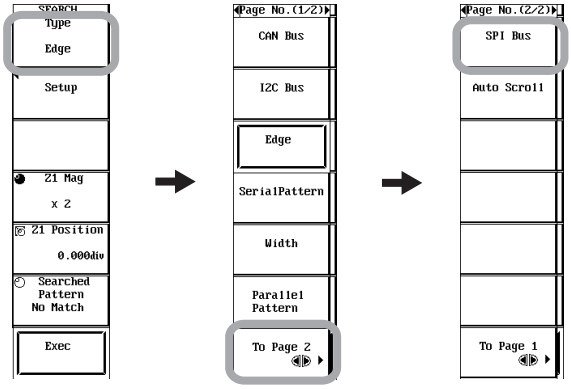
## *Procedure*




- To exit the menu during operation, press **ESC** located above the soft keys.
- In the procedural explanation below, the term *jog shuttle & SELECT* refers to the operation of selecting/setting items and entering values using the **jog shuttle**, **SELECT** and **RESET** keys. For details on the operation using the jog shuttle, SELECT, and RESET, see sections 4.1 or 4.2 in the DL7440/DL7480 User's Manual.
- For a description of the operation using a USB keyboard or a USB mouse, see section 4.3 in the DL7440/DL7480 User's Manual.

1. Press **SHIFT+ZOOM (SEARCH)**. The SEARCH menu appears.
2. Press the **Type** soft key. The Type menu appears.
3. Press the **To Page 2** soft key.
4. Press the **SPI Bus** soft key.

   Depending on the model, the SPI Bus item may appear under the Type menu (Page No. (1/2)) without having to press the To Page 2 soft key.

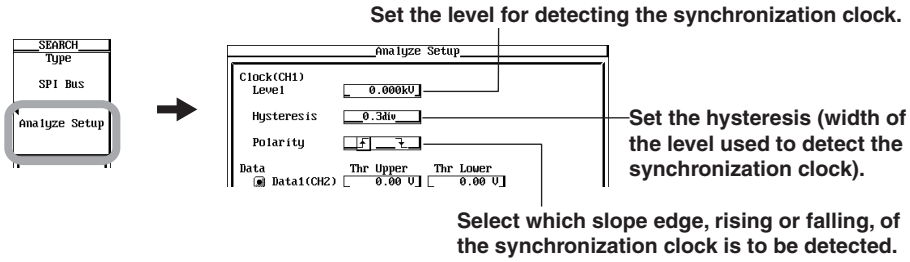


## Setting the Analysis Conditions

5. Press the **Analyze Setup** soft key. The Analyze Setup dialog box opens.

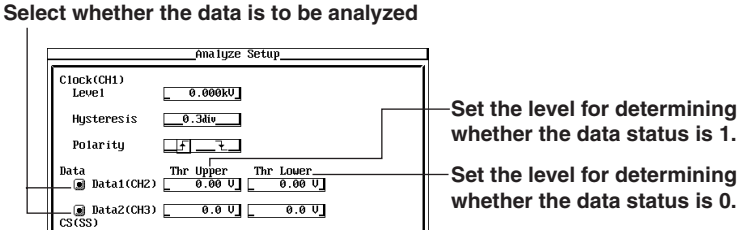
### Setting the Detection Level, Hysteresis, and Slope of the Synchronization Clock Signal (CH1)

6. Use **jog shuttle & SELECT** to set the level for detecting the synchronization clock (Level box).
7. Use **jog shuttle & SELECT** to set the hysteresis (width of the level used to detect the synchronization clock) (Hysteresis box).
8. Use **jog shuttle & SELECT** to select the slope, rising or falling, for detecting the synchronization clock (Polarity box).




### Setting the Level for Determining the Status (1 or 0) of the I/O Data

9. Use **jog shuttle & SELECT** to select whether Data1 (CH2) is to be analyzed (ON/OFF) (Data1 (CH2) box).
   - Data1 (CH2) will be analyzed when the mark to the left is highlighted.
   - When interleave mode is ON, you cannot set Data1 (CH2).
10. Use **jog shuttle & SELECT** to set the level for determining whether the status of Data1 (CH2) is 1 (Thr Upper box).
11. Use **jog shuttle & SELECT** to set the level for determining whether the status of Data1 (CH2) is 0 (Thr Lower box).
    - When the data exceeds the specified level (Thr Upper), it is determined to be 1.
    - When the data is below the specified level (Thr Lower), it is determined to be 0.
    - When the data is between the levels specified by Thr Upper and Thr Lower (including the Thr Upper and Thr Lower values), it is determined to be indefinite data.
12. Repeat steps 9 to 11 to set the level for determining the status of Data2 (CH3).



**Setting the Chip Select Signal (CS)**

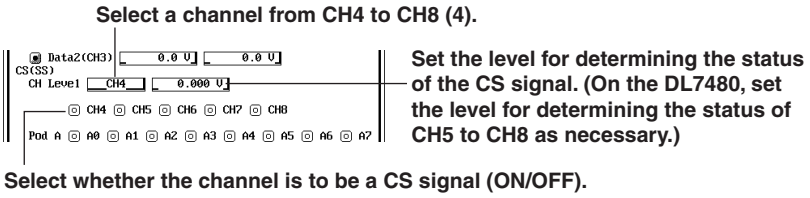
- **When Using CH4 to CH8 (CH4 on the DL7440) for the CS Signal**

  13. Use **jog shuttle & SELECT** to select the CS signal from CH4 to CH8 (CH4) (CH Level box).

      The only channel that can be used on the DL7440 is CH4. You can select from CH4 to CH8 on the DL7480.

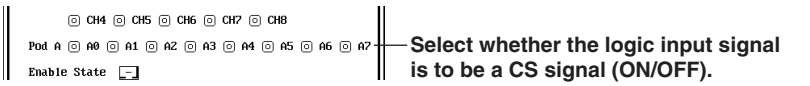
  14. Use **jog shuttle & SELECT** to set the level for determining the status of the CS signal (CH level box on the right).
  15. On the DL7480, repeat steps 13 and 14 as necessary to set the level for determining the status of CH5 to CH8 as necessary.
  16. Use **jog shuttle & SELECT** to select whether to make the channel a CS signal (ON/OFF) (each CH box).

      The channel is enabled as a CS signal when the mark to the left of the channel is highlighted.



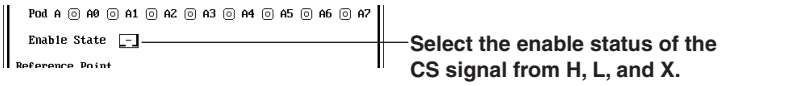

- **When Using the Logic Input (Optional) Signal for the CS Signal**

  17. Use **jog shuttle & SELECT** to select whether to make the logic input a CS signal (ON/OFF) (A0 to A7 box).




- **Selecting the Enable Status of the CS Signal**

  18. Use **jog shuttle & SELECT** to select the enable status of the CS signal from H, L, or X (Enable State box). I/O data is analyzed when the CS signal matches the selected status.
      - If multiple CS signals are ON, select the enable status of the CS signal from H and L. X cannot be selected.
      - The setting in the Enable State box applies to all CS signals.
      - If none of the CS signal is ON, the Enable State box displays "–".



### Setting the Reference Point of the Analysis

19. Use **jog shuttle & SELECT** to set the reference point to Trigger Position or Manual (Trigger Position or Manual button).

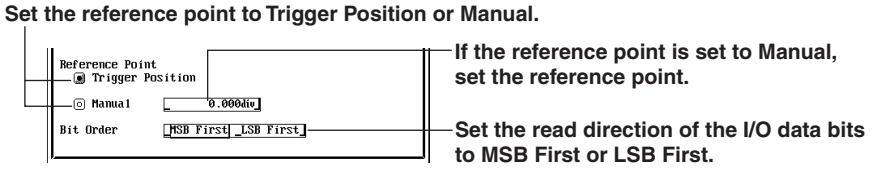
    The reference point is set to the one whose mark to the left is highlighted (Trigger Position or Manual).

20. If the reference point is set to Manual, use **jog shuttle & SELECT** to set the reference point (Manual box on the right).

    When setting the reference point using Manual, you can set the reference point while checking the displayed waveform by enabling translucent display. For a description of the translucent display, see section 8.10 in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Selecting the Read Direction of the I/O Data Bits

21. Use **jog shuttle & SELECT** to set the read direction of the I/O data bits to MSB First or LSB First (Bit Order box).



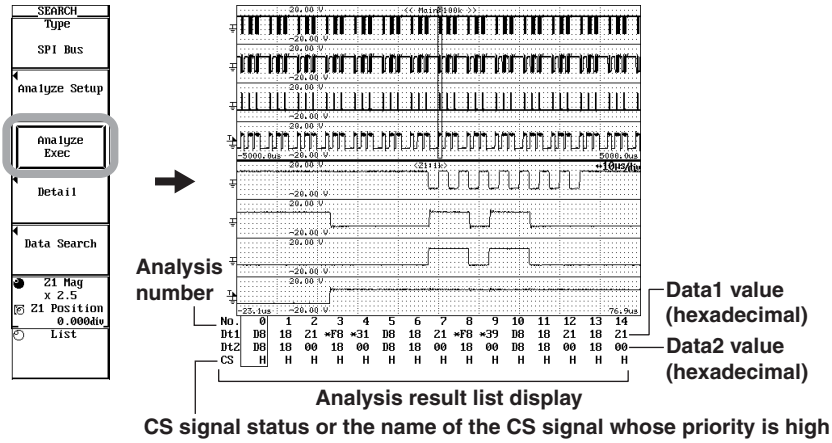

22. Press **ESC**. The Analyze Setup dialog box closes.

## Executing/Aborting the Analysis

23. Press the **Analyze Exec** soft key. The analysis of the I/O data is executed. The words Analyze Exec change to Analyze Abort.

    To abort the analysis of the I/O data, press the Analyze Abort soft key. The analysis of I/O data is aborted, and the words Analyze Abort change to Analyze Exec.

    If indefinite data exists in the analysis data, "*" is attached to the corresponding analysis data.




## Displaying the Analysis Data

### Scrolling the List

24. Press the **List** soft key.

25. Turn the **jog shuttle** to scroll the list left and right.

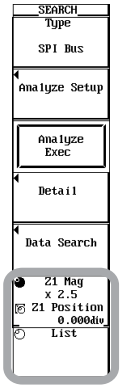
    Up to 15 analysis data points are displayed at once in the order of occurrence. By scrolling the list left and right using the jog shuttle, analysis data beyond 15 data points can be displayed.

**Setting the Zoom Ratio**

26. Press the **Z1 Mag/Z1 Position** soft key to set the jog shuttle control to Z1 Mag.
27. Turn the **jog shuttle** to set the zoom ratio

**Setting the Zoom Position**

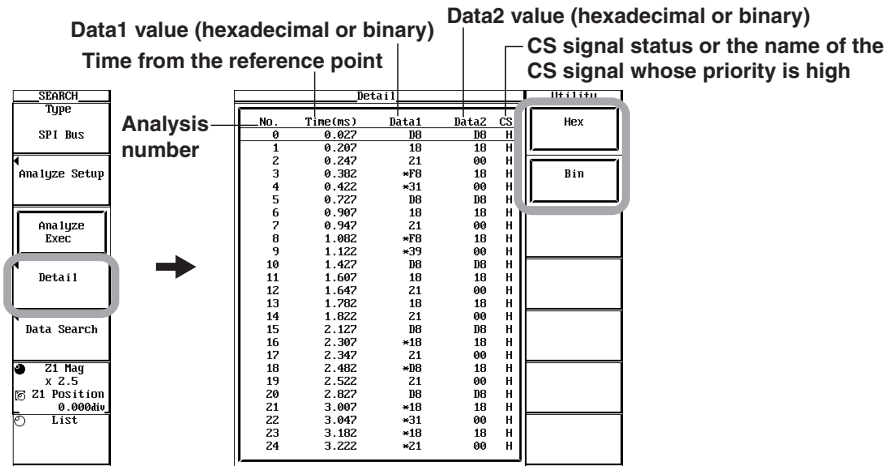
28. Press the **Z1 Mag/Z1 Position** soft key to set the jog shuttle control to Z1 Position.
29. Turn the **jog shuttle** to set the zoom position. When the center of the zoom box moves to the waveform corresponding to the analysis data on the list, the corresponding analysis data on the list is highlighted.




**Viewing the Details of the Analysis Data**

30. Press the **Detail** soft key. A Detail dialog box opens. The analysis data of the same analysis number that is highlighted in the list in step 25 or step 29 is displayed highlighted.
31. Press the **Hex** or **Bin** soft key to select the notation used to display the analysis data (Data1 and Data2).

    If indefinite data exists in the data, "∗" is attached to the corresponding analysis data.



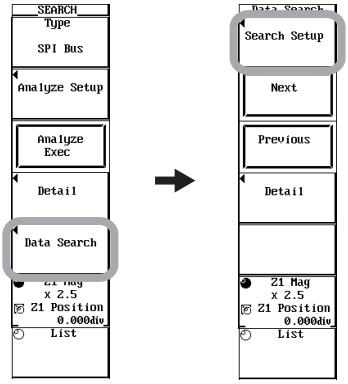

32. Press **ESC**. The Detail dialog box closes.

***Note***

The detailed analysis list can be saved directly to an external storage medium in ASCII format (.txt extension). For details, see section 3.6, "Saving the Data of the Detailed Analysis List."

### Setting the Search Condition

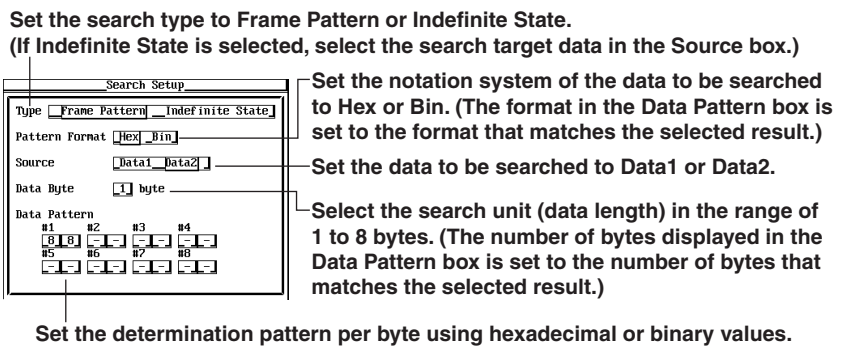
33. Press the **Data Search** soft key. The Data Search menu appears.
34. Press the **Search Setup** soft key. The Search Setup dialog box opens.




35. Use **jog shuttle & SELECT** to set the search type to Frame Pattern or Indefinite State (Type box).

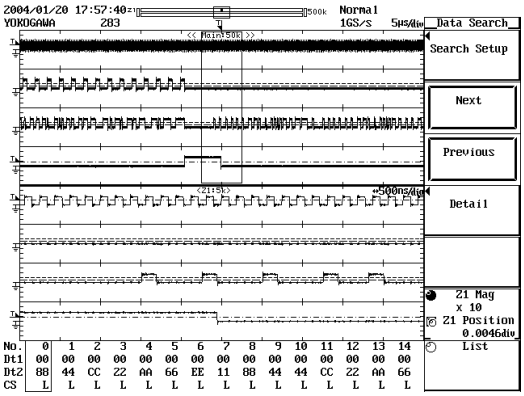
    If you select Indefinite State, proceed to step 37.
36. Use **jog shuttle & SELECT** to set the notation system used to set the determination pattern to Hex or Bin (Pattern Format box). The format in the Data Pattern box changes accordingly.
37. Use **jog shuttle & SELECT** to set the data to be searched to Data1 or Data2 (Source box).

    If you selected Indefinite State in step 35, proceed to step 40.
38. Use **jog shuttle & SELECT** to set the data length of the determination pattern to be specified from 1 to 8 bytes (Data Byte box). The number of bytes displayed in the Data Pattern box is set to the number of bytes that matches the selected result.
39. Use **jog shuttle & SELECT** to set the determination pattern for each byte in hexadecimal or binary (Data Pattern box). When determination is not to be performed, select X.
40. Press **ESC**. The Detail dialog box closes.

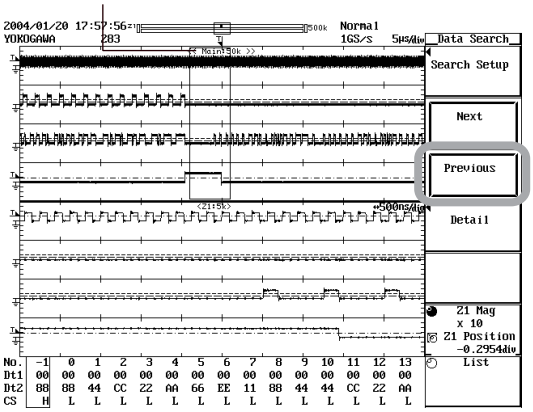


### Executing the Search Operation

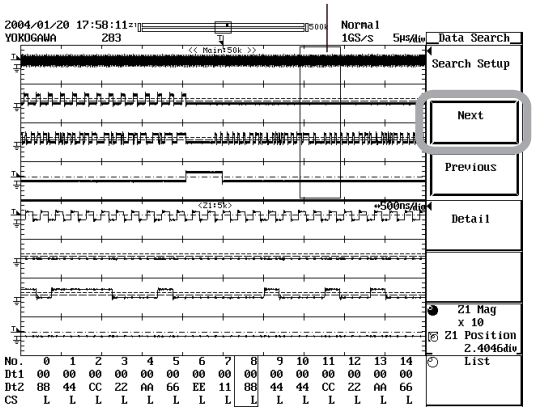
41. Press the **Next** or **Previous** soft key. The search is executed.
    - When the data matches the determination pattern, the corresponding data (data that was found) is highlighted in the analysis data list at the bottom of the screen. The zoom box moves to the position so that the data that was found is at the center, and the zoomed waveform of the data that was found is displayed in the zoom waveform display area.
    - Pressing the Next soft key searches the data after the highlighted data (to the right) in the analysis data list at the bottom of the screen.
    - Pressing the Previous soft key searches the data before the highlighted data (to the left) in the analysis data list at the bottom of the screen.
    - If you selected Indefinite State (indefinite data) in step 35 and execute the search, indefinite data is highlighted.




Search is performed to the left




Search is performed to the right



## *Explanation*

### Setting the Analysis Conditions: Analyze Setup

You can set the following conditions.

**Clock Signal: Clock (CH1)**

Apply the clock signal on the SPI Bus to CH1. The status of the I/O data is determined by synchronizing to the clock signal. You can set the detection level, slope, and hysteresis of the clock signal.

- **Level**
  You can set the level for detecting the synchronization clock. The selectable range is eight divisions within the screen. The resolution is 0.01 V/div.
- **Hysteresis**
  You can set the hysteresis on the level for detecting the synchronization clock. The selectable range is 0.3 divisions to 4.0 divisions. The resolution is 0.1 divisions.
  - When the level of the clock signal changes from below the specified lower limit of hysteresis to above and including the upper limit of hysteresis, it is detected as a synchronization clock.
  - When the level of the clock signal changes from above the specified upper limit of hysteresis to below and including the lower limit of hysteresis, it is detected as a synchronization clock.
  - For all other cases, it is not detected as a synchronization clock.
- **Slope: Polarity**
  You can select which slope edge, rising or falling, of the synchronization clock is to be detected.

| | |
|---|---|
| ⎍ | Rising slope |
| ⎎ | Falling slope |

**Data to Be Analyzed**

The data that can be analyzed is the I/O data signal on the SPI Bus (Data1 and Data2). The data in the following display range can be analyzed. Apply the Data1 and Data2 signals to CH2 and CH3.

- Waveform data that is displayed when waveform acquisition is stopped.
- History waveform data (waveform selected by Select Record on the History menu).
- Waveform data loaded from a storage medium.

- **Level Used to Determine the Status of the Data to Be Analyzed: Thr Upper/Thr Lower**
  You can set the level for determining the status of the data to be analyzed. The selectable range is eight divisions within the screen. The resolution is 0.01 V/div. Thr Upper must be greater than or equal to Thr Lower.

| | |
|---|---|
| Level for determining 1 (Thr Upper) | You can set the level for determining the status 1. When the data being analyzed exceeds the specified level, it is determined to be 1. |
| Level for determining 0 (Thr Lower) | You can set the level for determining the status 0. When the data being analyzed is below the specified level, it is determined to be 0. |
| Between Thr Upper and Thr Lower | The status when the data being analyzed is between the levels specified by Thr Upper and Thr Lower (including the Thr Upper and Thr Lower values) is determined to be indefinite data. |

**Chip Select Signal: CS (SS)**

You can select the signals of CH4 to CH8 or logic input (A0 to A7 of Pod A) for the CS signal on the SPI Bus. CH5 to CH8 can be used on the DL7480. The logic input is optional.

- **Level for Determining the Status of the CS Signal: CH Level**
  When the channel signal is set to be the CS signal, you can set the level for determining the high (H) or low (L) status of the CS signal for each channel. The selectable range is eight divisions within the screen. The resolution is 0.01 V/div.
- **Use/Not Use as a CS Signal**
  You can select whether the channel is to be a CS signal (ON/OFF) for each channel CH4 to CH8 or logic input (A0 to A7 of Pod A).
- **Enable Status of CS Signal: Enable State**
  You can select the enable status of the CS signal. The setting applies to all CS signals.

| | |
|---|---|
| H | For a channel signal, this is the status when the signal is higher than the level for determining the status of the CS signal. For a logic input signal, this is the status when the signal is 1. The I/O data is analyzed when the CS signal is H. |
| L | For a channel signal, this is the status when the signal is less than the level for determining the status of the CS signal. For a logic input signal, this is the status when the signal is 0. The I/O data is analyzed when the CS signal is L. |
| X | Select this status when not determining the status. All the I/O output data are analyzed. The byte boundary of the data being analyzed is the point where the CS signal changes from high to low or low to high. This status cannot be selected when multiple signals are enabled as CS signals. |
| – | When none of the signals are enabled as a CS signal, this indicator is displayed and cannot be changed. All the I/O output data are analyzed. The data to be analyzed is the I/O data that is divided at the byte level from the analysis reference point (see the next page). Select this status when analyzing the I/O data without using the CS signal. |

- **Priority**
  Priority exists in the CS signals. When multiple CS signals are enabled, the I/O data corresponding to the CS signal with a high priority is analyzed. The priority in descending order is CH4, CH5, ... , CH8, PodA A0, A1, ..., and A7. When the analysis data is displayed, the name of the CS signal (CH4, CH5, ... , CH8, PodA A0, A1, ..., and A7) that was used when the I/O data was analyzed is displayed in the location where the enable status of the CS signal is displayed.

**Analysis Reference Point**

You can set the reference point where the analysis is to start. The first analysis data as viewed from this reference point is assigned the analysis number 0. For details on the assignment of the analysis number, see “Analysis Numbers” on the next page.

| | |
|---|---|
| Trigger | Sets the reference point to the trigger position. |
| Manual | You can set the reference point in the range of ±5 divisions. The resolution is 10 division ÷ display record length. |

#### Read Direction of the I/O Data Bits: Bit Order

You can select the read direction of the bits according to the signal flow. When analysis data is displayed in binary, the data is displayed in the order of the flow regardless of the bit order setting. When analysis data is displayed in hexadecimal, the data is displayed according to the setting, separated every four bits in the order of the flow.

| | |
|---|---|
| MSB First | Select this when the I/O data signal is flowing MSB first. |
| LSB First | Select this when the I/O data signal is flowing LSB first. |


**When set to MSB First: E831**
**When set to LSB First: 71C8**

***Note***

The bit order setting is connected with the setting in the ENHANCED menu in the Analyze Setup dialog box (see page 3-6).

### Range That Can Be Analyzed

Up to 80000 bytes of analysis data can be displayed. The displayed result varies depending on the number of bytes analyzed as follows:

- When the total analysis data is less than or equal to 80000 bytes
  All points are displayed regardless of the position of the reference point.
- When the total analysis data is greater than 80000 bytes:
  The displayed result varies depending on the number of analysis data in the Pre* and Post* sections as follows:

| |
|---|
| When the Pre section contains 44000 points and the Post section contains 44000 points, 40000 data points in the Pre section and 40000 data points in the Post section are displayed. |
| When the Pre section contains 8000 points and the Post section contains 80000 points, 8000 data points in the Pre section and 72000 data points in the Post section are displayed. |
| When the Pre section contains 80000 points and the Post section contains 8000 points, 72000 data points in the Pre section and 8000 data points in the Post section are displayed. |

* Pre: Before (left of) the reference point, Post: After (right of) the reference point

### Analysis Data List (Analysis Result List)

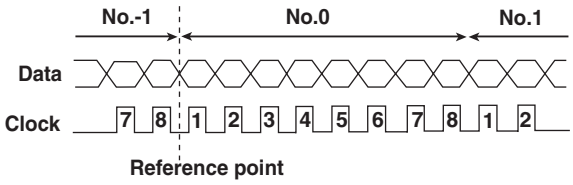
The following four items are displayed.

- Analysis number
- Data1 value (hexadecimal)
- Data2 value (hexadecimal)
- CS signal status or the name of the CS signal whose priority is high

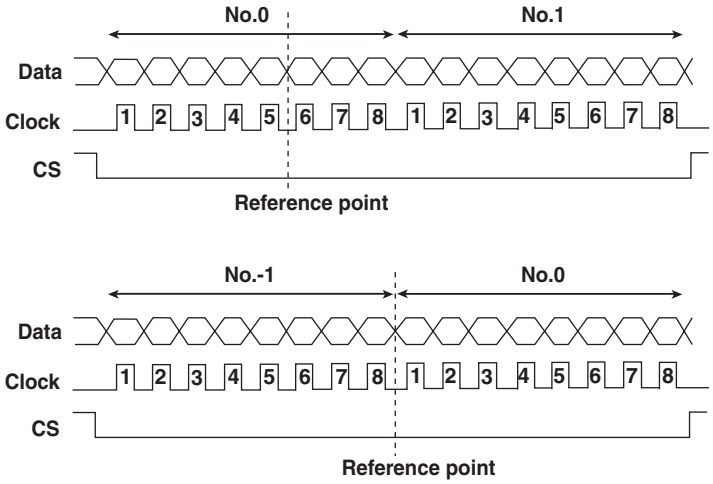
#### Analysis Numbers

Up to 80000 bytes can be displayed. Depending on whether the CS signal is ON, the data of analysis number 0 (byte level) is defined as follows: The data points that are newer than the data point of analysis number 0 (to the right on the screen) are assigned numbers 1, 2, 3, and so on as the data points get newer. The data points that are older than the data point of analysis number 0 (to the left on the screen) are assigned numbers –1, –2, –3, and so on as the data points get older.

- **When None of the CS Signals Is ON**
  The first detected data after the reference point becomes analysis number 0.



- **When the CS Signal Is ON**
  The data containing the reference point becomes analysis number 0. However, if the reference point is between two data points, the first detected data after the reference point becomes analysis number 0.




***Note***

If you set the reference point to Trigger Position, the data containing the trigger point is analysis number 0. However, if a trigger is activated on the trigger conditions of the SPI Bus signal, the trigger point is the data boundary. Hence, the analysis number of the data on which the trigger is activated is 0 or –1.

**Data1 and Data2 Values**

The Data1 and Data2 values are displayed in hexadecimal. However, below are some exceptions.

- When the data is less than 8 bits, "–" is displayed.
- When indefinite data (bit whose status is neither 1 or 0) exists, "∗" is displayed. Indefinite data is considered the same status as the previous bit for the analysis. If the first bit (left most bit in the display range) is indefinite data, it is analyzed as 0.

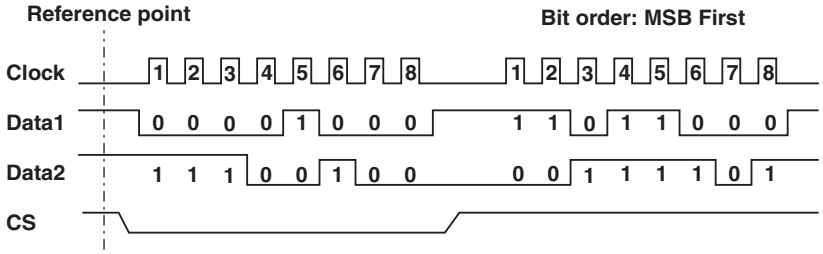
**CS**

Displays the CS signal enable status. Note the following:

- When none of the CS signal is ON, blank is displayed.
- When only one CS signal is ON, the status H or L of the CS signal is displayed.
- When multiple CS signals are ON, the name of the CS signal with high priority is displayed. For a description of the priority, see page "Priority" on page 3-31.

**Display Example of Analysis Data**

Examples of analysis using different analysis conditions are indicated below.



- **Analysis Condition Clock (CH1)=↓ and CS (CH4)=L**

| Display Items | Analysis Data Display |
|---|---|
| Analysis number (No.) | 0 |
| Hexadecimal display of Data1 (Dt1) | 08 |
| Hexadecimal display of Data2 (Dt2) | E4 |
| Status of the CS signal (CS) | L |

- **Analysis Condition Clock (CH1)=↓ and CS (CH4)=H**

| Display Items | Analysis Data Display |
|---|---|
| Analysis number (No.) | 0 |
| Hexadecimal display of Data1 (Dt1) | D8 |
| Hexadecimal display of Data2 (Dt2) | 3D |
| Status of the CS signal (CS) | H |

- **Analysis Condition Clock (CH1)=↓ and CS (CH4)=X**

| Display Items | Analysis Data Display | |
|---|---|---|
| Analysis number (No.) | 0 | 1 |
| Hexadecimal display of Data1 (Dt1) | 08 | D8 |
| Hexadecimal display of Data2 (Dt2) | E4 | 3D |
| Status of the CS signal (CS) | L | H |

***Note***

- If an arbitrary data is selected (highlighted) in the analysis data slit, the zoom position moves to the beginning of the data. Conversely, if you move the zoom position, the data corresponding to the zoom position is highlighted.
- If the CS signal is ON and the CS signal on the main waveform display screen does not contain a transition point from H to L or L to H, the I/O data is not analyzed.
- Analysis and search is not possible while waveform acquisition is in progress.
- Analysis and search cannot be performed on accumulated waveforms. However, analysis and search are possible on the accumulated waveform remaining as a history waveform.

### Detailed List of Analysis Data: Detail

More detailed information of the analysis data can be listed. The following information can be displayed.

- Analysis number
- Time from the reference point
  Displays the time from the reference point to the first bit of each data point.
- Data1 and Data2 values
  You can display the values by selecting hexadecimal or binary for the notation system. However, if the data does not consist of 8 bits or if indefinite data exists, the display is the same as “Data1 and Data2 Values” on page 3-33.
- CS signal status or the name of the CS signal whose priority is high

## Setting the Search Condition: Search Setup

You can set the following conditions.

### Search Type

You can select the search type.

| | |
|---|---|
| Frame Pattern (Pattern Search) | Searches the analysis data of Data1 or Data2 that matches the determination pattern specified at the byte level. |
| Indefinite State (Indefinite Data Search) | Searches indefinite data from the analysis data of Data1 or Data2. |

### When Search Type Is Set to Frame Pattern

You can search the analysis data of Data1 or Data2 that matches the determination pattern specified at the byte level. Specify the following items.

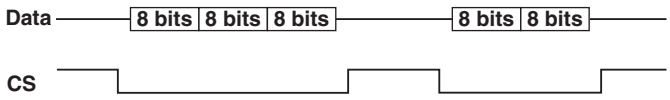
- **Notation System of Determination Pattern: Pattern Format**
  Set the notation system of the specified determination pattern to hexadecimal or binary. The notation of the determination pattern described later changes accordingly.
- **Data to Be Searched: Source**
  Set the data to be searched to Data1 or Data2.
- **Data Length of the Determination Pattern: Data Byte**
  Select the data length of the determination pattern in the range of 1 to 8 bytes. The number of specified bytes of the determination pattern described later changes accordingly.
- **Determination Pattern: Data Pattern**
  Set the determination pattern according to the notation system setting (hexadecimal or binary).
  - Bits that are set to “X” are not determined. Such bits are always handled as though the data matches the determination pattern regardless of the status.
  - If there are bits set to X in binary, $ is displayed when the notation system is changed to hexadecimal.
  - The read direction of the bits is the same as the setting for the analysis (see section 3-32).

**When Search Type Is Set to Indefinite State**

You can search indefinite data from the analysis data of Data1 or Data2 at the byte level. Set the data to be searched to Data1 or Data2.

***Note***

- Indefinite data is always considered matched to the specified status.
- If analysis is performed with CS signal set to ON, the data being analyzed is considered to be delimited at the point where the status of the CS signal changes. In this case, search is also performed by considering the data to be delimited at that point. For example, if a total of 5 bytes consisting of the data to be analyzed and CS signal as shown in the following figure is analyzed by changing the CS signal setting, search cannot be performed using the same conditions.
- Analyzing with the CS signal set to ON (enable status of the CS signal is set to L)
  Because data cannot be searched over two CS intervals, search cannot be performed with the data length of the determination pattern to 4 or 5 bytes.
- Analyzing with None of the CS signals set to ON
  The data length of the data to be searched and the CS interval are independent.
  Searching is possible with the data length of the determination pattern set to 4 or 5 bytes.




## Executing the Search: Next, Prev

Press the Next or Prev soft key to execute the search. The search progresses (pattern or indefinite data search) as follows depending on the search type.

- **For Pattern Searches**
  Next: Searches frames after (to the right of) the currently selected frame.
  Prev: Searches frames before (to the left of) the currently selected frame.
- **For Indefinite Data Searches**
  Next: Searches frames after (to the right of) the current zoom position (Z1 Pos).
  Prev: Searches frames before (to the left of) the current zoom position (Z1 Pos).

**Displaying the Search Result**

- **For Pattern Searches**
  If a waveform that matches the specified data pattern (Data1 or Data2 pattern) is found, the zoom position (Z1 Pos) moves to the beginning the pattern.
  If all patterns are set to “X,” the message “Pattern is not specified.” (error code: 730) appears.
- **For Indefinite Data Searches**
  The zoom position (Z1 Pos) moves to the front of the indefinite data.

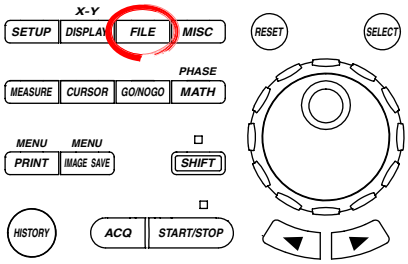
# 3.6 Saving the Data of the Detailed Analysis List

The data of the detailed analysis list can be saved to a file in ASCII format.

**CAUTION**

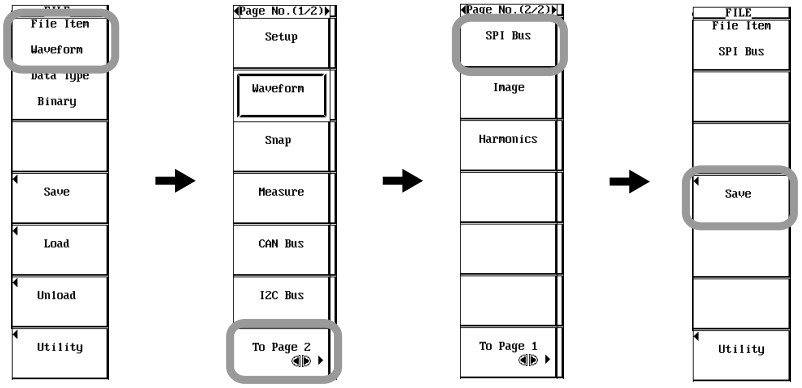
Do not remove the storage medium (disk) or turn OFF the power when the access indicator or icon of the storage medium is blinking. Doing so can damage the storage medium or destroy the data on the medium.

## *Procedure*




- To exit the menu during operation, press **ESC** located above the soft keys.
- In the procedural explanation below, the term *jog shuttle & SELECT* refers to the operation of selecting/setting items and entering values using the **jog shuttle**, **SELECT** and **RESET** keys. For details on the operation using the jog shuttle, SELECT, and RESET, see sections 4.1 or 4.2 in the DL7440/DL7480 User's Manual.
- For a description of the operation using a USB keyboard or a USB mouse, see section 4.3 in the DL7440/DL7480 User's Manual.

1. Press **FILE**. The FILE menu appears.
2. Press the **File Item** soft key. The File Item menu appears.
3. Press the **To Page 2** soft key.
4. Press the **SPI Bus** soft key.
   Depending on the model, the SPI Bus item may appear under the File Item menu (Page No. (1/2)) without having to press the Top Page 2 soft key.
5. Press the **Save** soft key. The Save menu appears.




### Selecting Save Destination Medium and Directory

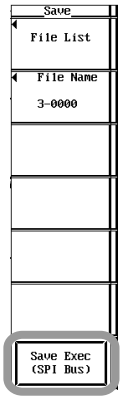
6. Carry out steps 13 to 15 on page 12-22 in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Setting the File Name and Comment

7. Carry out steps 16 to 19 on page 12-22 in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

### Executing the Save Operation

8. Press the **Save Exec** soft key. The data is saved to the directory indicated by Path=..... At the same time, the Save Exec soft key changes to the Abort soft key.




### Aborting the Save Operation

9. Press the **Abort** soft key. The save operation is aborted. At the same time, the Abort soft key changes to the Save Exec soft key.

### Specifying the Files to Be Displayed in the File List Window and Displaying Properties

10. Carry out steps 22 to 25 on page 12-23 in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

## *Explanation*

The analysis results of SPI signals can be saved to a file in ASCII format. The contents of the detailed analysis list of the SPI signal are saved as-is to the file. The extension is .txt.

The file size is as follows:

File size = (number of bytes per data point[1] × number of analysis results) + 44 bytes[2]

1 The number of bytes per data varies depending on the data type.
- 40 bytes (Data2) minimum.: Analysis data without CS
- 44 bytes (CS) maximum.: Analysis data with multiple CSs and CS is set to CH4

2 The data size of the title is 44 bytes.

[Save example]

| No. | Time(ms) | Data1 | Data2 | CS |
|---|---|---|---|---|
| -7 | -0.005 | *00 | *BB | |
| -6 | -0.004 | *00 | AA | |
| -5 | -0.003 | *00 | A9 | |
| -4 | -0.003 | *00 | *54 | |
| -3 | -0.002 | *00 | 55 | |
| -2 | -0.001 | *0F | 7A | |
| -1 | -0.001 | *3F | *BF | |
| 0 | 0.000 | *C0 | 57 | |
| 1 | 0.001 | *40 | *F5 | |
| 2 | 0.001 | *03 | *F7 | |
| 3 | 0.002 | *80 | *E9 | |
| 4 | 0.003 | *40 | D5 | |
| 5 | 0.003 | *08 | *FE | |
| 6 | 0.004 | *00 | *7A | |

**Precautions to Be Taken When Saving the Data**

- The maximum number of files that can be saved when the auto naming function is ON is 1150.
- If the total number of files and directories exceed 2500 in a single directory, the contents of the File List box are no longer displayed.

# 3.7 Error Messages

A message may appear during operation. This section describes the meanings of the messages and their corrective actions. This section lists only the error messages related to the SPI Bus signal analysis function. There are other error messages related to the DL1740 and communications. These messages are described in the *DL7440/DL7480 User's Manual (IM701450-01E)* and the *DL7440/DL7480 Communication Interface User's Manual (IM701450-17E)*.

You can set the messages to be displayed in English or Japanese. For the procedure of setting the message language, see section 15.1, "Changing the Message Language and Turning ON/OFF the Click Sound" in the *DL7440/DL7480 User's Manual (IM701450-01E)*.

If the corrective action requires servicing, contact your nearest YOKOGAWA dealer for repairs.

| Code | Message | Action | Page |
|---|---|---|---|
| 37 | Aborted the analysis. | – | 3-26 |
| 38 | Data not detected.<br>Execute again after changing the setting or reacquiring the waveform. | – | 3-5, 3-11, 3-24, 3-30 |
| 739 | Analyzed data does not exist.<br>Execute the analysis. | Execute the analysis. | 3-26, 3-32 |
| 870 | Cannot be specified. Invalid byte or bit. | Increase the number of bytes. | 3-6, 3-12 |
| 871 | Cannot be set when CS channels are not specified. | – | 3-25, 3-31 |

# 3.8 Communication Commands

This section contains only the communication commands related to the SPI Bus signal analysis function. For a description of other DL7440/DL7480 communication commands, see the *DL7440/DL7480 Communication Interface User's Manual (IM701450-17E).*

| Command | Function | Page |
|---|---|---|
| **SPI Analyzer Group** | | |
| `:SEARch:SPI?` | Queries all settings related to the analysis* function. | 3-44 |
| `:SEARch:SPI:ANALyze?` | Queries all settings related to the execution of the analysis.* | 3-44 |
| `:SEARch:SPI:ANALyze:ABORt` | Aborts the execution of the Analysis.* | 3-45 |
| `:SEARch:SPI:ANALyze:EXECute` | Executes the analysis.* | 3-45 |
| `:SEARch:SPI:ANALyze:SETup?` | Queries all settings related to the analysis* conditions. | 3-45 |
| `:SEARch:SPI:ANALyze:SETup:BITorder` | Sets the bit order of analysis* data or queries the current setting. | 3-45 |
| `:SEARch:SPI:ANALyze:SETup:CLOCk?` | Queries all settings related the clock signal in the analysis.* | 3-45 |
| `:SEARch:SPI:ANALyze:SETup:CLOCk:HYSTeresis` | Sets the hysteresis for the detection level of the clock signal in the analysis* or queries the current setting. | 3-45 |
| `:SEARch:SPI:ANALyze:SETup:CLOCk:LEVel` | Sets the detection level of the clock signal in the analysis* or queries the current setting. | 3-45 |
| `:SEARch:SPI:ANALyze:SETup:CLOCk:POLarity` | Sets the slope of the clock signal in the analysis* or queries the current setting. | 3-45 |
| `:SEARch:SPI:ANALyze:SETup:CS?` | Queries all settings related the chip select signal (CS) in the analysis.* | 3-46 |
| `:SEARch:SPI:ANALyze:SETup:CS:CHANnel<x>?` | Queries all settings related to each channel of the chip select signal (CS) in the analysis.* | 3-46 |
| `:SEARch:SPI:ANALyze:SETup:CS:CHANnel<x>:LEVel` | Sets the level of each channel of the chip select signal (CS) in the analysis* or queries the current setting. | 3-46 |
| `:SEARch:SPI:ANALyze:SETup:CS:CHANnel<x>:MODE` | Sets whether to handle the channel as a chip select signal (ON/OFF) in the analysis* or queries the current setting. | 3-46 |
| `:SEARch:SPI:ANALyze:SETup:CS:LOGic?` | Queries all settings related to the logic input of the chip select signal (CS) in the analysis.* | 3-46 |
| `:SEARch:SPI:ANALyze:SETup:CS:LOGic:{A0\|A1\|A2\|A3\|A4\|A5\|A6\|A7}` | Sets whether to handle each bit of the logic input as a chip select signal (ON/OFF) in the analysis* or queries the current setting. | 3-46 |
| `:SEARch:SPI:ANALyze:SETup:CS:ESTate` | Sets the enable status of the chip select signal (CS) in the analysis* or queries the current setting. | 3-47 |
| `:SEARch:SPI:ANALyze:SETup:DATA<x>?` | Queries all settings related to the data input/output signal (Data1/Data2) in the analysis.* | 3-47 |
| `:SEARch:SPI:ANALyze:SETup:DATA<x>:LEVel` | Sets the threshold level of the data input/output signal (Data1/Data2) in the analysis* or queries the current setting. | 3-47 |
| `:SEARch:SPI:ANALyze:SETup:DATA<x>:MODE` | Enables/Disables the data input/output signal (Data1/Data2) in the analysis* or queries the current setting. | 3-47 |
| `:SEARch:SPI:ANALyze:SETup:MPOSition` | Sets the reference point when the reference point of the analysis* is set to manual or queries the current setting. | 3-47 |
| `:SEARch:SPI:ANALyze:SETup:RPOint` | Sets whether to set the reference point of the analysis* to the trigger position or set it manually or queries the current setting. | 3-47 |
| `:SEARch:SPI:LIST?` | Outputs one byte of analysis* result as a character string. | 3-47 |
| `:SEARch:SPI:SEARch?` | Queries all settings related to the analysis* result search. | 3-48 |

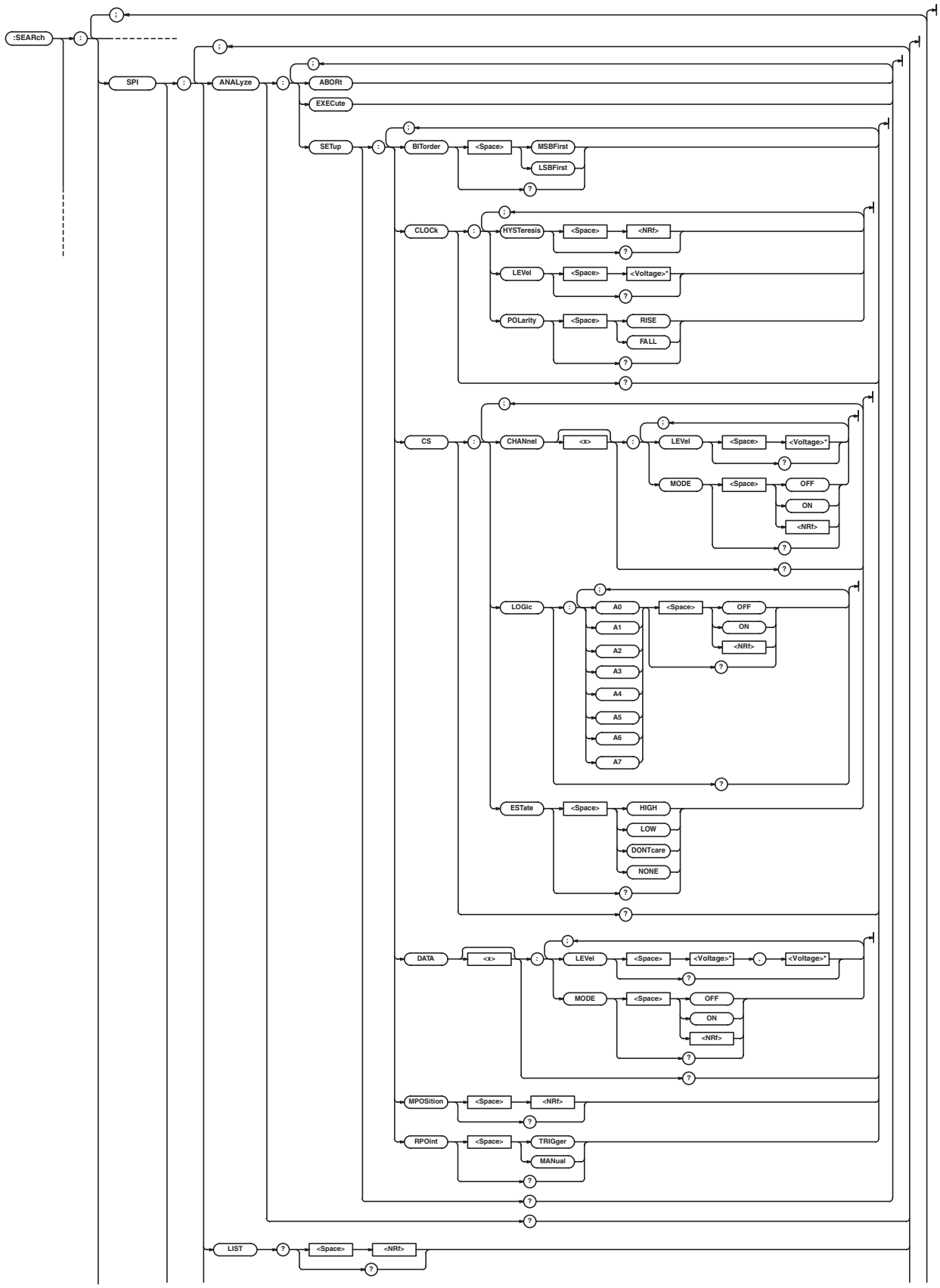
| Command | Function | Page |
|---|---|---|
| :SEARch:SPI:SEARch:DATA? | Queries all settings related to the data pattern search on the analysis* result. | 3-48 |
| :SEARch:SPI:SEARch:DATA:BYTE | Sets the number of bytes of the data pattern search on the analysis* result or queries the current setting. | 3-48 |
| :SEARch:SPI:SEARch:DATA:HEXa<x> | Sets the pattern of the data pattern search on the analysis* result in hexadecimal. | 3-48 |
| :SEARch:SPI:SEARch:DATA:PATTern<x> | Sets the pattern of data pattern search on the analysis* result in binary or queries the current setting. | 3-48 |
| :SEARch:SPI:SEARch:NEXT? | Executes the search on the data after the current byte on the analysis* result. | 3-48 |
| :SEARch:SPI:SEARch:PFORmat | Sets the pattern format of the data pattern search on the analysis* result or queries the current setting. | 3-48 |
| :SEARch:SPI:SEARch:PREVious? | Executes the search on the data before the current byte on the analysis* result. | 3-48 |
| :SEARch:SPI:SEARch:SOURce | Sets the data to be searched on the analysis* result or queries the current setting. | 3-48 |
| :SEARch:SPI:SEARch:TYPE | Sets the analysis* result search type or queries the current setting. | 3-49 |
| :SEARch:TYPE | Sets the search type or queries the current setting. | 3-49 |
| **SPI File Group** | | |
| :FILE:SAVE:SPI:ABORt | Aborts the saving of the data of the detailed analysis list of the analysis.* | 3-50 |
| :FILE:SAVE:SPI[:EXECute] | Executes the saving of the data of the detailed analysis list of the analysis* (overlap command). | 3-50 |
| **SPI Trigger Group** | | |
| :TRIGger:SPI? | Queries all settings related to the trigger.* | 3-52 |
| :TRIGger:SPI:BCOunt | Sets the trigger* byte count or queries the current setting. | 3-52 |
| :TRIGger:SPI:COMBination | Sets the combination trigger* or queries the current setting. | 3-52 |
| :TRIGger:SPI:PATTern? | Queries all settings related the pattern setting of the combination trigger.* | 3-52 |
| :TRIGger:SPI:PATTern:CHANnel<x> | Sets the condition (pattern or slope) of each channel of the combination trigger* or queries the current setting. | 3-52 |
| :TRIGger:SPI:PATTern:CLOCk | Sets the clock channel of the combination trigger* or queries the current setting. | 3-53 |
| :TRIGger:SPI:PATTern:CONDition | Sets the pattern condition of the combination trigger* or queries the current setting. | 3-53 |
| :TRIGger:SPI:SETup? | Queries all settings related to the trigger.* | 3-53 |
| :TRIGger:SPI:SETup:ABCount | Sets the method of comparing Pattern B of the trigger* or queries the current setting. | 3-53 |
| :TRIGger:SPI:SETup:APATtern? | Queries all settings related to Pattern A of the trigger* or queries the current setting. | 3-53 |
| :TRIGger:SPI:SETup:APATtern:BYTE | Sets the number of bytes of Pattern A of the trigger* or queries the current setting. | 3-54 |
| :TRIGger:SPI:SETup:APATtern:CONDition | Sets the Pattern A condition of the trigger* or queries the current setting. | 3-54 |
| :TRIGger:SPI:SETup:APATtern:HEXa<x> | Sets the Pattern A pattern of the trigger* at the byte level in hexadecimal. | 3-54 |
| :TRIGger:SPI:SETup:APATtern:MODE | Enables/Disables Pattern A of the trigger* or queries the current setting. | 3-54 |
| :TRIGger:SPI:SETup:APATtern:PATTern<x> | Sets the Pattern A pattern of the trigger* at the byte level in binary or queries the current setting. | 3-54 |
| :TRIGger:SPI:SETup:BITorder | Sets the bit order of the pattern of the trigger* or queries the current setting. | 3-54 |
| :TRIGger:SPI:SETup:BPATtern? | Queries all settings related to Pattern B of the trigger* or queries the current setting. | 3-54 |
| :TRIGger:SPI:SETup:BPATtern:BYTE | Sets the number of bytes of Pattern B of the trigger* or queries the current setting. | 3-54 |
| :TRIGger:SPI:SETup:BPATtern:CONDition | Sets the Pattern B condition of the trigger* or queries the current setting. | 3-55 |

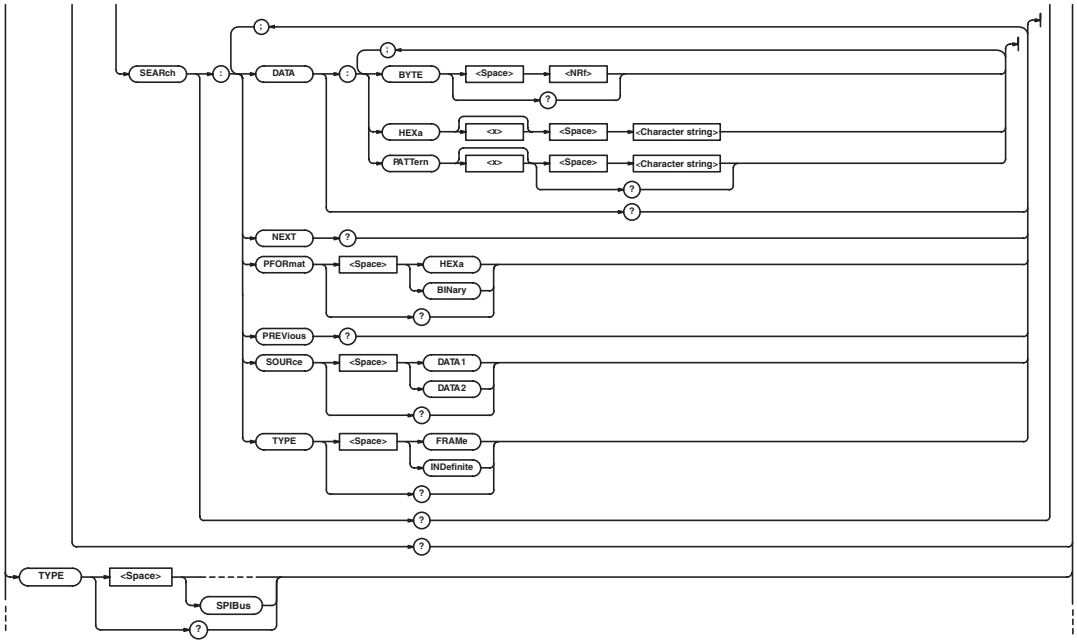
| Command | Function | Page |
|---|---|---|
| :TRIGger:SPI:SETup:BPATtern:HEXa<x> | Sets the Pattern B pattern of the trigger* at the byte level in hexadecimal. | 3-55 |
| :TRIGger:SPI:SETup:BPATtern:MODE | Enables/Disables Pattern B of the trigger* or queries the current setting. | 3-55 |
| :TRIGger:SPI:SETup:BPATtern:PATTern<x> | Sets the Pattern B pattern of the trigger* at the byte level in binary or queries the current setting. | 3-55 |
| :TRIGger:SPI:SETup:BPATtern:TRACe | Sets the data to be used as Pattern B of the trigger* or queries the current setting. | 3-55 |
| :TRIGger:SPI:SETup:SPOLarity | Sets the edge slope of the clock signal (SCK) of the trigger* or queries the current setting. | 3-55 |
| :TRIGger:SPI:SETup:SSENable | Sets the enable state of the slave select signal (SS) of the trigger* or queries the current setting. | 3-55 |
| :TRIGger:TYPE | Sets the trigger type or queries the current setting. | 3-56 |

* In the explanation of the function of each command in this section, *analysis* refers to SPI Bus signal analysis. *Trigger* refers to the trigger of the SPI Bus signal analysis function.

- **SPI Analyzer Group**

  Commands in the SPI Analyze group can be used to set and query the SPI Bus signal analysis function in the same fashion as the SHIFT + ZOOM key on the front panel.






* <Current> when a current probe is used.

## :SEARch:SPI?

Function Queries all settings related to the analysis function.

Syntax :SEARch:SPI?

Example
```
:SEARCH:SPI? -> :SEARCH:SPI:
ANALYZE:SETUP:CLOCK:LEVEL 0.0E+00;
HYSTERESIS 0.30;POLARITY RISE;:
SEARCH:SPI:ANALYZE:SETUP:DATA1:
MODE 1;LEVEL 0.0E+00,0.0E+00;:
SEARCH:SPI:ANALYZE:SETUP:DATA2:
MODE 1;LEVEL 0.0E+00,0.0E+00;:
SEARCH:SPI:ANALYZE:SETUP:CS:
CHANNEL4:MODE 0;LEVEL 0.0E+00;:
SEARCH:SPI:ANALYZE:SETUP:CS:
CHANNEL5:MODE 0;LEVEL 0.0E+00;:
SEARCH:SPI:ANALYZE:SETUP:CS:
CHANNEL6:MODE 0;LEVEL 0.0E+00;:
SEARCH:SPI:ANALYZE:SETUP:CS:
CHANNEL7:MODE 0;LEVEL 0.0E+00;:
SEARCH:SPI:ANALYZE:SETUP:CS:
CHANNEL8:MODE 0;LEVEL 0.0E+00;:
SEARCH:SPI:ANALYZE:SETUP:CS:LOGIC:
A0 0;A1 0;A2 0;A3 0;A4 0;A5 0;A6 0;
A7 0;:SEARCH:SPI:ANALYZE:SETUP:
CS:ESTATE NONE;:SEARCH:SPI:
ANALYZE:SETUP:RPOINT TRIGGER;
MPOSITION 0.0000000;
BITORDER MSBFIRST;:SEARCH:SPI:
SEARCH:TYPE FRAME;PFORMAT HEXA;
SOURCE DATA1;DATA:BYTE 8;
PATTERN1 “XXXXXXXX”;
PATTERN2 “XXXXXXXX”;
PATTERN3 “XXXXXXXX”;
PATTERN4 “XXXXXXXX”;
PATTERN5 “XXXXXXXX”;
PATTERN6 “XXXXXXXX”;
PATTERN7 “XXXXXXXX”;
PATTERN8 “XXXXXXXX”
```

## :SEARch:SPI:ANALyze?

Function Queries all settings related to the execution of the analysis.

Syntax :SEARch:SPI:ANALyze?

Example
```
:SEARCH:SPI:ANALYZE? -> :SEARCH:
SPI:ANALYZE:SETUP:CLOCK:
LEVEL 0.0E+00;HYSTERESIS 0.30;
POLARITY RISE;:SEARCH:SPI:
ANALYZE:SETUP:DATA1:MODE 1;
LEVEL 0.0E+00,0.0E+00;:SEARCH:SPI:
ANALYZE:SETUP:DATA2:MODE 1;
LEVEL 0.0E+00,0.0E+00;:SEARCH:SPI:
ANALYZE:SETUP:CS:CHANNEL4:MODE 0;
LEVEL 0.0E+00;:SEARCH:SPI:ANALYZE:
SETUP:CS:CHANNEL5:MODE 0;
LEVEL 0.0E+00;:SEARCH:SPI:ANALYZE:
SETUP:CS:CHANNEL6:MODE 0;
LEVEL 0.0E+00;:SEARCH:SPI:ANALYZE:
SETUP:CS:CHANNEL7:MODE 0;
LEVEL 0.0E+00;:SEARCH:SPI:ANALYZE:
SETUP:CS:CHANNEL8:MODE 0;
LEVEL 0.0E+00;:SEARCH:SPI:ANALYZE:
SETUP:CS:LOGIC:A0 0;A1 0;A2 0;A3 0;
A4 0;A5 0;A6 0;A7 0;:SEARCH:SPI:
ANALYZE:SETUP:CS:ESTATE NONE;:
SEARCH:SPI:ANALYZE:SETUP:
RPOINT TRIGGER;MPOSITION 0.0000000;
BITORDER MSBFIRST
```

### :SEARch:SPI:ANALyze:ABORt

Function Aborts the execution of the Analysis.

Syntax `:SEARch:SPI:ANALyze:ABORt`

Example `:SEARCH:SPI:ANALYZE:ABORT`

### :SEARch:SPI:ANALyze:EXECute

Function Executes the analysis.

Syntax `:SEARch:SPI:ANALyze:EXECute`

Example `:SEARCH:SPI:ANALYZE:EXECUTE`

### :SEARch:SPI:ANALyze:SETup?

Function Queries all settings related to the analysis.

Syntax `:SEARch:SPI:ANALyze:SETup?`

Example
```
:SEARCH:SPI:ANALYZE:SETUP? ->
:SEARCH:SPI:ANALYZE:SETUP:CLOCK:
LEVEL 0.0E+00;HYSTERESIS 0.30;
POLARITY RISE;:SEARCH:SPI:
ANALYZE:SETUP:DATA1:MODE 1;
LEVEL 0.0E+00,0.0E+00;:SEARCH:SPI:
ANALYZE:SETUP:DATA2:MODE 1;
LEVEL 0.0E+00,0.0E+00;:SEARCH:SPI:
ANALYZE:SETUP:CS:CHANNEL4:MODE 0;
LEVEL 0.0E+00;:SEARCH:SPI:ANALYZE:
SETUP:CS:CHANNEL5:MODE 0;
LEVEL 0.0E+00;:SEARCH:SPI:ANALYZE:
SETUP:CS:CHANNEL6:MODE 0;
LEVEL 0.0E+00;:SEARCH:SPI:ANALYZE:
SETUP:CS:CHANNEL7:MODE 0;
LEVEL 0.0E+00;:SEARCH:SPI:ANALYZE:
SETUP:CS:CHANNEL8:MODE 0;
LEVEL 0.0E+00;:SEARCH:SPI:ANALYZE:
SETUP:CS:LOGIC:A0 0;A1 0;A2 0;A3 0;
A4 0;A5 0;A6 0;A7 0;:SEARCH:SPI:
ANALYZE:SETUP:CS:ESTATE NONE;:
SEARCH:SPI:ANALYZE:SETUP:
RPOINT TRIGGER;MPOSITION 0.0000000;
BITORDER MSBFIRST
```

### :SEARch:SPI:ANALyze:SETup:BITorder

Function Sets the bit order of analysis data or queries the current setting.

Syntax
```
:SEARch:SPI:ANALyze:SETup:BITorder
{MSBFirst|LSBFirst}
:SEARch:SPI:ANALyze:SETup:BITorder?
```

Example
```
:SEARCH:SPI:ANALYZE:SETUP:
BITORDER
MSBFIRST:SEARCH:SPI:ANALYZE:
SETUP:BITORDER? -> :SEARCH:SPI:
ANALYZE:SETUP:BITORDER MSBFIRST
```

### :SEARch:SPI:ANALyze:SETup:CLOCk?

Function Queries all settings related to the clock signal in the analysis.

Syntax `:SEARch:SPI:ANALyze:SETup:CLOCk?`

Example
```
:SEARCH:SPI:ANALYZE:SETUP:CLOCK? ->
:SEARCH:SPI:ANALYZE:SETUP:CLOCK:
LEVEL 1.000E+00;HYSTERESIS 0.3;
POLARITY RISE
```

### :SEARch:SPI:ANALyze:SETup:CLOCk:HYSTeresis

Function Sets the hysteresis for the detection level of the clock signal in the analysis or queries the current setting.

Syntax
```
:SEARch:SPI:ANALyze:SETup:CLOCk:
HYSTeresis {<NRf>}
:SEARch:SPI:ANALyze:SETup:CLOCk:
HYSTeresis?
```
<NRf>=0.3 to 4.0 (div, 0.1 steps)

Example
```
:SEARCH:SPI:ANALYZE:SETUP:CLOCK:
HYSTERESIS 0.5
:SEARCH:SPI:ANALYZE:SETUP:CLOCK:
HYSTERESIS? -> :SEARCH:SPI:ANALYZE:
SETUP:CLOCK:HYSTERESIS 0.5
```

### :SEARch:SPI:ANALyze:SETup:CLOCk:LEVel

Function Sets the detection level of the clock signal in the analysis or queries the current setting.

Syntax
```
:SEARch:SPI:ANALyze:SETup:CLOCk:
LEVel {<Voltage>}
:SEARch:SPI:ANALyze:SETup:CLOCk:
LEVel?
```
<Voltage>=8 divisions within the screen (0.01 division steps).

Example
```
:SEARCH:SPI:ANALYZE:SETUP:CLOCK:
LEVEL1V:SEARCH:SPI:ANALYZE:SETUP:CLOCK:
LEVEL?-> :SEARCH:SPI:ANALYZE:SETUP:
CLOCK:LEVEL 1.000E+00
```

Description When a current probe is set to CH1, this command sets or queries the <Current> value.

### :SEARch:SPI:ANALyze:SETup:CLOCk:POLarity

Function Sets the slope of the clock signal in the analysis or queries the current setting.

Syntax
```
:SEARch:SPI:ANALyze:SETup:CLOCk:
POLarity {RISE|FALL}
:SEARch:SPI:ANALyze:SETup:CLOCk:
POLarity?
```

Example
```
:SEARCH:SPI:ANALYZE:SETUP:CLOCK:
POLARITY RISE
:SEARCH:SPI:ANALYZE:SETUP:CLOCK:
POLARITY? -> :SEARCH:SPI:ANALYZE:
SETUP:CLOCK:POLARITY RISE
```

### :SEARch:SPI:ANALyze:SETup:CS?

Function Queries all settings related the chip select signal (CS) in the analysis.

Syntax `:SEARch:SPI:ANALyze:SETup:CS?`

Example
```
:SEARCH:SPI:ANALYZE:SETUP:CS? ->
:SEARCH:SPI:ANALYZE:SETUP:CS:CHANNEL4:
MODE 0;LEVEL 0.0E+00;:SEARCH:SPI:
ANALYZE:SETUP:CS:CHANNEL5:MODE 0;
LEVEL 0.0E+00;:SEARCH:SPI:ANALYZE:
SETUP:CS:CHANNEL6:MODE 0;
LEVEL 0.0E+00;:SEARCH:SPI:ANALYZE:
SETUP:CS:CHANNEL7:MODE 0;
LEVEL 0.0E+00;:SEARCH:SPI:ANALYZE:
SETUP:CS:CHANNEL8:MODE 0;
LEVEL 0.0E+00;:SEARCH:SPI:ANALYZE:
SETUP:CS:LOGIC:A0 0;A1 0;A2 0;A3 0;
A4 0;A5 0;A6 0;A7 0;:SEARCH:SPI:
ANALYZE:SETUP:CS:ESTATE NONE
```

### :SEARch:SPI:ANALyze:SETup:CS:CHANnel<x>?

Function Queries all settings related to each channel of the chip select signal (CS) in the analysis.

Syntax
```
:SEARch:SPI:ANALyze:SETup:CS:
CHANnel<x>?
```
<x>=4 to 8 (4 on the DL7440)

Example
```
:SEARCH:SPI:ANALYZE:SETUP:CS:
CHANNEL4?-> :SEARCH:SPI:ANALYZE:
SETUP:CS:CHANNEL4:MODE 1;
LEVEL 1.000E+00
```

### :SEARch:SPI:ANALyze:SETup:CS:CHANnel<x>:LEVel

Function Sets the level of each channel of the chip select signal (CS) in the analysis or queries the current setting.

Syntax
```
:SEARch:SPI:ANALyze:SETup:CS:
CHANnel<x>:LEVel {<Voltage>}
:SEARch:SPI:ANALyze:SETup:CS:
CHANnel4:LEVel?
```
<x>=4 to 8 (4 on the DL7440)
<Voltage>=8 divisions within the screen (0.01 division steps).

Example
```
:SEARCH:SPI:ANALYZE:SETUP:CS:
CHANNEL4:LEVEL 1V
:SEARCH:SPI:ANALYZE:SETUP:CS:
CHANNEL4:LEVEL? -> :SEARCH:SPI:
ANALYZE:SETUP:CS:CHANNEL4:
LEVEL 1.000E+00
```

Description When a current probe is used, this command sets or queries the <Current> value.

### :SEARch:SPI:ANALyze:SETup:CS:CHANnel<x>:MODE

Function Sets whether to handle the channel as a chip select signal (ON/OFF) in the analysis or queries the current setting.

Syntax
```
:SEARch:SPI:ANALyze:SETup:CS:
CHANnel4:MODE {<Boolean>}
:SEARch:SPI:ANALyze:SETup:CS:
CHANnel4:MODE?
```
<x>=4 to 8 (4 on the DL7440)

Example
```
:SEARCH:SPI:ANALYZE:SETUP:CS:
CHANNEL4:MODE ON
:SEARCH:SPI:ANALYZE:SETUP:CS:
CHANNEL4:MODE? -> :SEARCH:SPI:
ANALYZE:SETUP:CS:CHANNEL4:MODE 1
```

### :SEARch:SPI:ANALyze:SETup:CS:LOGic?

Function Queries all settings related to the logic input of the chip select signal (CS) in the analysis.

Syntax `:SEARch:SPI:ANALyze:SETup:CS:LOGic?`

Example
```
:SEARCH:SPI:ANALYZE:SETUP:CS:LOGIC?
-> :SEARCH:SPI:ANALYZE:SETUP:CS:
LOGIC:A0 0;A1 0;A2 0;A3 0;A4 0;
A5 0;A6 0;A7 0
```

Description An error occurs if the logic input (optional) is not installed.

### :SEARch:SPI:ANALyze:SETup:CS:LOGic:{A0|A1|A2|A3|A4|A5|A6|A7}

Function Sets whether to handle each bit of the logic input as a chip select signal (ON/OFF) in the analysis or queries the current setting.

Syntax
```
:SEARch:SPI:ANALyze:SETup:CS:LOGic:
{A0|A1|A2|A3|A4|A5|A6|A7}
{<Boolean>}
:SEARch:SPI:ANALyze:SETup:CS:LOGic:
{A0|A1|A2|A3|A4|A5|A6|A7}?
```

Example
```
:SEARCH:SPI:ANALYZE:SETUP:CS:LOGIC:
A0 ON
:SEARCH:SPI:ANALYZE:SETUP:CS:LOGIC:
A0? -> :SEARCH:SPI:ANALYZE:SETUP:
CS:LOGIC:A0 1
```

### :SEARch:SPI:ANALyze:SETup:CS:ESTate

Function Sets the enable status of the chip select signal (CS) in the analysis or queries the current setting.

Syntax
```
:SEARch:SPI:ANALyze:SETup:CS:ESTate
{HIGH|LOW|DONTcare}
:SEARch:SPI:ANALyze:SETup:CS:
ESTate?
```

Example
```
:SEARCH:SPI:ANALYZE:SETUP:CS:
ESTATE LOW
:SEARCH:SPI:ANALYZE:SETUP:CS:
ESTATE? -> :SEARCH:SPI:ANALYZE:
SETUP:CS:ESTATE LOW
```

### :SEARch:SPI:ANALyze:SETup:DATA<x>?

Function Queries all settings related to the data input/output signal (Data1/Data2) in the analysis.

Syntax
```
:SEARch:SPI:ANALyze:SETup:DATA<x>?
```
<x>=1, 2

Example
```
:SEARCH:SPI:ANALYZE:SETUP:DATA1? ->
:SEARCH:SPI:ANALYZE:SETUP:DATA1:
MODE 1;LEVEL 1.000E+00,0.000E+00
```

### :SEARch:SPI:ANALyze:SETup:DATA<x>:LEVel

Function Sets the threshold level of the data input/output signal (Data1/Data2) in the analysis or queries the current setting.

Syntax
```
:SEARch:SPI:ANALyze:SETup:DATA<x>:
LEVel {<Voltage>,<Voltage>}
:SEARch:SPI:ANALyze:SETup:DATA<x>:
LEVel?
```
<Voltage>=8 divisions within the screen (0.01 division steps).
<x>=1, 2

Example
```
:SEARCH:SPI:ANALYZE:SETUP:DATA1:
LEVEL1V,0V
:SEARCH:SPI:ANALYZE:SETUP:DATA1:
LEVEL? -> :SEARCH:SPI:ANALYZE:
SETUP:DATA1:
LEVEL 1.000E+00,0.000E+00
```

Description When <x>=1, the CH2 input is the data signal. When <x>=2, the CH3 input is the data signal. When a current probe is set to CH2 or CH3, this command sets or queries the <Current> value.

### :SEARch:SPI:ANALyze:SETup:DATA<x>:MODE

Function Enables/Disables the data input/output signal (Data1/Data2) in the analysis or queries the current setting.

Syntax
```
:SEARch:SPI:ANALyze:SETup:DATA<x>:
MODE {<Boolean>}
:SEARch:SPI:ANALyze:SETup:DATA<x>:
MODE?
```
<x>=1, 2

Example
```
:SEARCH:SPI:ANALYZE:SETUP:DATA1:
MODE ON
:SEARCH:SPI:ANALYZE:SETUP:DATA1:
MODE? -> :SEARCH:SPI:ANALYZE:SETUP:
DATA1:MODE 1
```

### :SEARch:SPI:ANALyze:SETup:MPOSition

Function Sets the reference point when the reference point of the analysis is set to manual or queries the current setting.

Syntax
```
:SEARch:SPI:ANALyze:SETup:MPOSition
{<NRf>}
:SEARch:SPI:ANALyze:SETup:
MPOSition?
```
<NRf>=–5 to 5 divisions (10 divisions/displayed record length steps)

Example
```
:SEARCH:SPI:ANALYZE:SETUP:
MPOSITION -4.000
:SEARCH:SPI:ANALYZE:SETUP:
MPOSITION? -> :SEARCH:SPI:ANALYZE:
SETUP:MPOSITION -4.00000
```

### :SEARch:SPI:ANALyze:SETup:RPOint

Function Sets whether to set the reference point of the analysis to the trigger position or set it manually or queries the current setting.

Syntax
```
:SEARch:SPI:ANALyze:SETup:RPOint
{TRIGger|MANual}
:SEARch:SPI:ANALyze:SETup:RPOint?
```

Example
```
:SEARCH:SPI:ANALYZE:SETUP:
RPOINT TRIGGER
:SEARCH:SPI:ANALYZE:SETUP:RPOINT?
-> :SEARCH:SPI:ANALYZE:SETUP:
RPOINT TRIGGER
```

### :SEARch:SPI:LIST?

Function Outputs one byte of analysis result as a character string.

Syntax
```
SEARch:SPI:LIST? {<NRf>}
```
<NRf>=–40000 to 40000

Example
```
:SEARCH:SPI:LIST? 1 ->
" 10.024 01010101 00000010 L"
```

### :SEARch:SPI:SEARch?

Function Queries all settings related to the analysis result search.

Syntax `:SEARch:SPI:SEARch?`

Example
```
SEARCH:SPI:SEARCH? -> :SEARCH:SPI:
SEARCH:TYPE FRAME;PFORMAT BINARY;
SOURCE DATA1;DATA:BYTE 8;
PATTERN1 “10X10X10”;
PATTERN2 “0X10X10X”;
PATTERN3 “X10X10X1”;
PATTERN4 “01X01X01”;
PATTERN5 “1X01X01X”;
PATTERN6 “X01X01X0”;
PATTERN7 “X10X10X1”;
PATTERN8 “11010101”
```

### :SEARch:SPI:SEARch:DATA?

Function Queries all settings related to the data pattern search on the analysis result.

Syntax `:SEARch:SPI:SEARch:DATA?`

Example
```
:SEARCH:SPI:SEARCH:DATA? ->
:SEARCH:SPI:SEARCH:DATA:BYTE 8;
PATTERN1 “10X10X10”;
PATTERN2 “0X10X10X”;
PATTERN3 “X10X10X1”;
PATTERN4 “01X01X01”;
PATTERN5 “1X01X01X”;
PATTERN6 “X01X01X0”;
PATTERN7 “X10X10X1”;
PATTERN8 “11010101”
```

### :SEARch:SPI:SEARch:DATA:BYTE

Function Sets the number of bytes of the data pattern search on the analysis result or queries the current setting.

Syntax
```
:SEARch:SPI:SEARch:DATA:BYTE
{<NRf>}
:SEARch:SPI:SEARch:DATA:BYTE?
```
<NRf>=1 to 8

Example
```
:SEARCH:SPI:SEARCH:DATA:BYTE 8
:SEARCH:SPI:SEARCH:DATA:BYTE? ->
:SEARCH:SPI:SEARCH:DATA:BYTE 8
```

### :SEARch:SPI:SEARch:DATA:HEXa<x>

Function Sets the pattern of the data pattern search on the analysis result in hexadecimal.

Syntax
```
:SEARch:SPI:SEARch:DATA:HEXa<x>
{<String>}
```
<String>=2 characters by combining ‘0’ to ‘F’ and ‘X’

<x>=1 to 8

Example `:SEARCH:SPI:SEARCH:DATA:HEXA1 “1A”`

### :SEARch:SPI:SEARch:DATA:PATTern<x>

Function Sets the pattern of data pattern search on the analysis result in binary or queries the current setting.

Syntax
```
:SEARch:SPI:SEARch:DATA:PATTern<x>
{<String>}
:SEARch:SPI:SEARch:DATA:PATTern<x>?
```
<String>=8 characters by combining ‘0,’ ‘1,’ and ‘X’

<x>=1 to 8

Example
```
:SEARCH:SPI:SEARCH:DATA:
PATTERN1 “10X10X10”
:SEARCH:SPI:SEARCH:DATA:PATTERN1?
-> :SEARCH:SPI:SEARCH:DATA:
PATTERN1 “10X10X10”
```

### :SEARch:SPI:SEARch:NEXT?

Function Executes the search on the data after the current byte on the analysis result.

Syntax `:SEARch:SPI:SEARch:NEXT?`

Example
```
:SEARCH:SPI:SEARCH:NEXT? -> 10
```

Description If the search is successful, a value in the range of –40000 to 40000 is returned. If it fails, “NAN” is returned.

### :SEARch:SPI:SEARch:PFORmat

Function Sets the pattern format of the data pattern search on the analysis result or queries the current setting.

Syntax
```
:SEARch:SPI:SEARch:PFORmat
{HEXa|BINary}
:SEARch:SPI:SEARch:PFORmat?
```

Example
```
:SEARCH:SPI:SEARCH:PFORMAT BINARY
:SEARCH:SPI:SEARCH:PFORMAT? ->
:SEARCH:SPI:SEARCH:PFORMAT BINARY
```

### :SEARch:SPI:SEARch:PREVious?

Function Performs the analysis result search on the data before the current byte and returns the search position.

Syntax `:SEARch:SPI:SEARch:PREVious?`

Example
```
:SEARCH:SPI:SEARCH:PREVIOUS? -> -10
```

Description If the search is successful, a value in the range of –40000 to 40000 is returned. If it fails, “NAN” is returned.

### :SEARch:SPI:SEARch:SOURce

Function Sets the data to be searched on the analysis result or queries the current setting.

Syntax
```
:SEARch:SPI:SEARch:SOURce
{DATA1|DATA2}
:SEARch:SPI:SEARch:SOURce?
```

Example
```
:SEARCH:SPI:SEARCH:SOURCE DATA1
:SEARCH:SPI:SEARCH:SOURCE? ->
:SEARCH:SPI:SEARCH:SOURCE DATA1
```

### :SEARch:SPI:SEARch:TYPE

Function Sets the analysis result search type or queries the current setting.

Syntax
```
:SEARch:SPI:SEARch:TYPE
{FRAMe|INDefinite}
:SEARch:SPI:SEARch:TYPE?
```

Example
```
:SEARCH:SPI:SEARCH:TYPE FRAME
:SEARCH:SPI:SEARCH:TYPE? ->
:SEARCH:SPI:SEARCH:TYPE FRAME
```

### :SEARch:TYPE

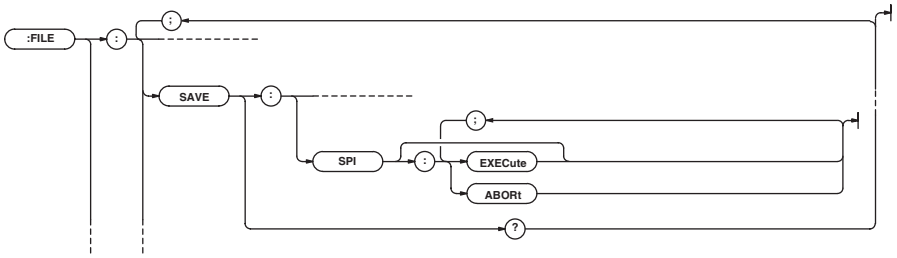
Function Sets the search type or queries the current setting.

Syntax
```
:SEARch:TYPE {SPATtern|WIDTh|EDGE|
PPATtern|ASCRoll|SPIBus}
:SEARch:TYPE?
```

Example
```
:SEARCH:TYPE SPIBUS
:SEARCH:TYPE? ->
:SEARCH:TYPE SPIBUS
```

## • SPI File Group

The commands in the SPI File Group can be used to execute/abort the saving of the data of the detailed analysis list of the SPI Bus signal in the same fashion as the FILE key on the front panel.




### :FILE:SAVE:SPI:ABORt

Function Aborts the saving of the data of the detailed analysis list of the analysis in ASCII format.

Syntax `:FILE:SAVE:SPI:ABORt`

Example `:FILE:SAVE:SPI:ABORT`

### :FILE:SAVE:SPI[:EXECute]

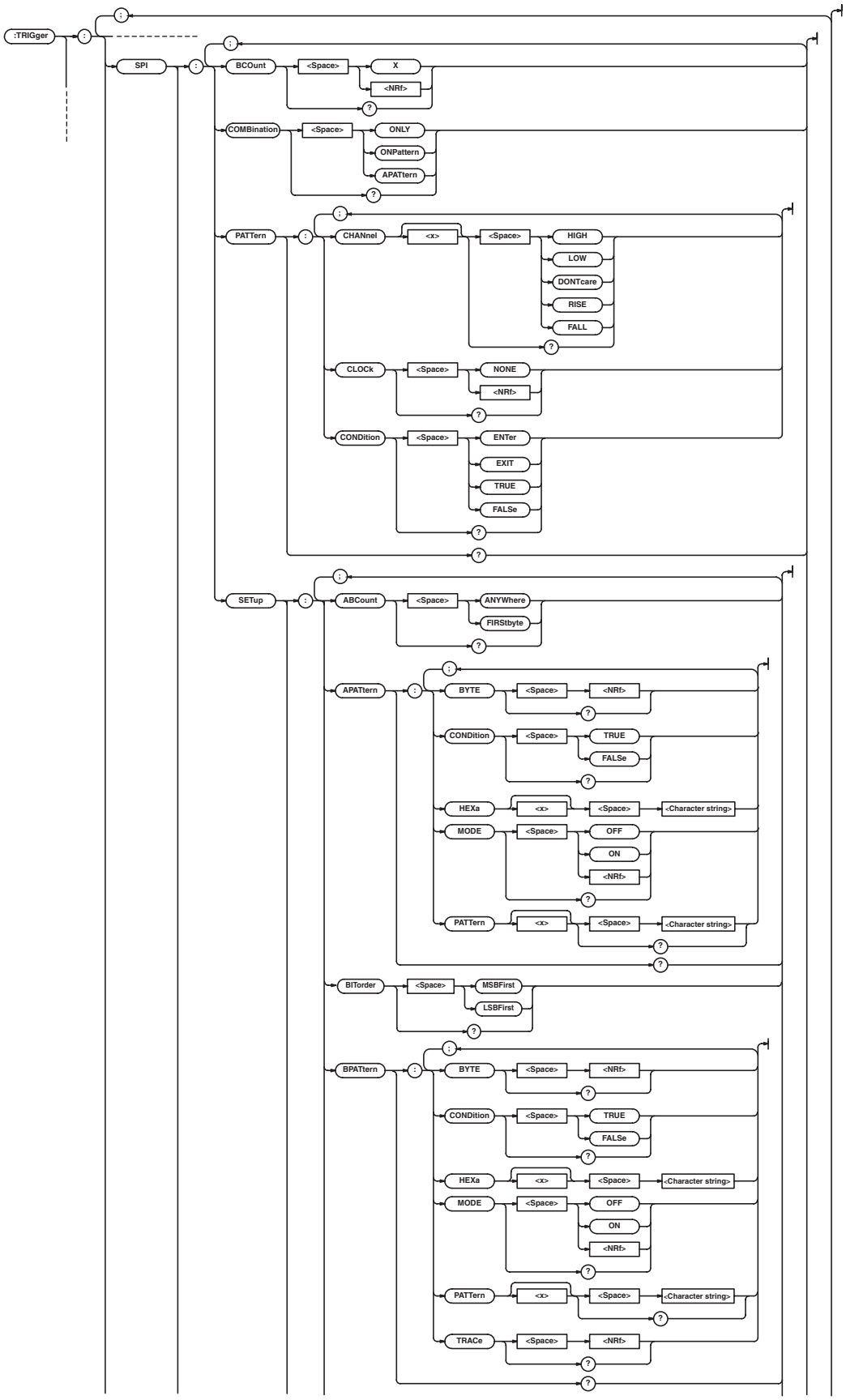
Function Executes the saving of the data of the detailed analysis list of the analysis in ASCII format. This is an overlap command.

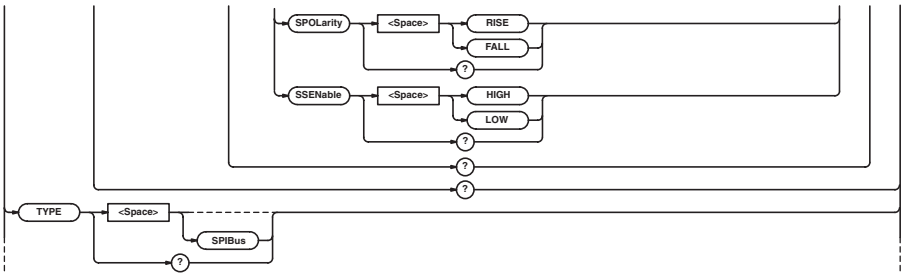
Syntax `:FILE:SAVE:SPI[:EXECute]`

Example `:FILE:SAVE:SPI:EXECUTE`

## • SPI Trigger Group

Commands in the SPI Trigger group can be used to set and query the trigger of the SPI Bus signal analysis function in the same fashion as the ENHANCED key on the front panel.






### :TRIGger:SPI?

Function Queries all settings related to the trigger.

Syntax `:TRIGger:SPI?`

Example
```
:TRIGGER:SPI? -> :TRIGGER:SPI:
COMBINATION ONLY;SETUP:
SPOLARITY RISE;APATTERN:MODE 0;
BYTE 8;CONDITION TRUE;
PATTERN1 “XXXXXXXX”;
PATTERN2 “XXXXXXXX”;
PATTERN3 “XXXXXXXX”;
PATTERN4 “XXXXXXXX”;
PATTERN5 “XXXXXXXX”;
PATTERN6 “XXXXXXXX”;
PATTERN7 “XXXXXXXX”;
PATTERN8 “XXXXXXXX”;:
TRIGGER:SPI:SETUP:BPATTERN:TRACE 2;
MODE 0;BYTE 8;CONDITION TRUE;
PATTERN1 “XXXXXXXX”;
PATTERN2 “XXXXXXXX”;
PATTERN3 “XXXXXXXX”;
PATTERN4 “XXXXXXXX”;
PATTERN5 “XXXXXXXX”;
PATTERN6 “XXXXXXXX”;
PATTERN7 “XXXXXXXX”;
PATTERN8 “XXXXXXXX”;:TRIGGER:SPI:
SETUP:ABCOUNT FIRSTBYTE;:TRIGGER:
SPI:BCOUNT 0
```

### :TRIGger:SPI:BCOunt

Function Sets the trigger byte count or queries the current setting.

Syntax
```
:TRIGger:SPI:BCOunt {<NRf>|<x>}
:TRIGger:SPI:BCOunt?
```
<NRf>=0 to 1000

Example
```
:TRIGGER:SPI:BCOUNT 1
:TRIGGER:SPI:BCOUNT? ->
:TRIGGER:SPI:BCOUNT 1
```

### :TRIGger:SPI:COMBination

Function Sets the combination trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:COMBination
{ONLY|ONPattern|APATtern}
:TRIGger:SPI:COMBination?
```

Example
```
:TRIGGER:SPI:COMBINATION ONLY
:TRIGGER:SPI:COMBINATION? ->
:TRIGGER:SPI:COMBINATION ONLY
```

Description Setting and Query are possible only on the DL7480.
The command can be used only to set “ONLY” on the DL7440.

### :TRIGger:SPI:PATTern?

Function Queries all settings related the pattern setting of the combination trigger.

Syntax `:TRIGger:SPI:PATTern?`

Example
```
:TRIGGER:SPI:PATTERN? ->
:TRIGGER:SPI:PATTERN:CLOCK NONE;
CHANNEL5 DONTCARE;
CHANNEL6 DONTCARE;
CHANNEL7 DONTCARE;
CHANNEL8 DONTCARE;CONDITION ENTER
```

Description Setting and Query are possible only on the DL7480.

### :TRIGger:SPI:PATTern:CHANnel<x>

Function Sets the condition (pattern or slope) of each channel of the combination trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:PATTern:CHANnel<x>
{HIGH|LOW|DONTCARE|RISE|FALL}
:TRIGger:SPI:PATTern:CHANnel<x>?
```
<x>=5 to 8

Example
```
:TRIGGER:SPI:PATTERN:CHANEL5 HIGH
:TRIGGER:SPI:PATTERN:CHANEL5? ->
:TRIGGER:SPI:PATTERN:CHANEL5 HIGH
```

Description Setting and Query are possible only on the DL7480.
If the channel is a clock channel, select from {RISE|FALL}; otherwise, select from {HIGH|LOW|DONTCARE}.

### :TRIGger:SPI:PATTern:CLOCk

Function Sets the clock channel of the combination trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:PATTern:CLOCk {<NRf>}
:TRIGger:SPI:PATTern:CLOCk?
```
<NRf>=5 to 8

Example
```
:TRIGGER:SPI:PATTERN:CLOCK 5
:TRIGGER:SPI:PATTERN:CLOCK? ->
:TRIGGER:SPI:PATTERN:CLOCK 5
```

Description You can set or query the clock channel on the DL7480 only when "`:TRIGger:SPI:COMBination`" is `APATtern`.

### :TRIGger:SPI:PATTern:CONDition

Function Sets the pattern condition of the combination trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:PATTern:CONDition
{ENTer|EXIT|TRUE|FALSe}
:TRIGger:SPI:PATTern:CONDition?
```

Example
```
:TRIGGER:SPI:PATTERN:
CONDITION ENTER
:TRIGGER:SPI:PATTERN:CONDITION? ->
:TRIGGER:SPI:PATTERN:
CONDITION ENTER
```

Description Setting and Query are possible only on the DL7480.
When "`TRIGger:SPI:COMBination`" is set to "`ONPattern`," select from {`TRUE`|`FALSe`}.
When "`TRIGger:SPI:COMBination`" is set to "`APATtern`" and "`TRIGger:SPI:PATTern:CLOCk`" is set to "`NONE`," select from {`ENTer`|`EXIT`}. For all other conditions, the setting is invalid.

### :TRIGger:SPI:SETup?

Function Queries all settings related to the trigger.

Syntax
```
:TRIGger:SPI:SETup?
```

Example
```
:TRIGGER:SPI:SETUP? -> :TRIGGER:
SPI:SETUP:SPOLARITY RISE;APATTERN:
MODE 0;BYTE 8;CONDITION TRUE;
PATTERN1 “XXXXXXXX”;
PATTERN2 “XXXXXXXX”;
PATTERN3 “XXXXXXXX”;
PATTERN4 “XXXXXXXX”;
PATTERN5 “XXXXXXXX”;
PATTERN6 “XXXXXXXX”;
PATTERN7 “XXXXXXXX”;
PATTERN8 “XXXXXXXX”;:TRIGGER:SPI:
SETUP:BPATTERN:TRACE 2;MODE 0;
BYTE 8;CONDITION TRUE;
PATTERN1 “XXXXXXXX”;
PATTERN2 “XXXXXXXX”;
PATTERN3 “XXXXXXXX”;
PATTERN4 “XXXXXXXX”;
PATTERN5 “XXXXXXXX”;
PATTERN6 “XXXXXXXX”;
PATTERN7 “XXXXXXXX”;
PATTERN8 “XXXXXXXX”;:TRIGGER:SPI:
SETUP:ABCOUNT FIRSTBYTE
```

### :TRIGger:SPI:SETup:ABCount

Function Sets the method of comparing Pattern B of the trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:SETup:ABCount
{FIRStbyte|ANYWhere}
:TRIGger:SPI:SETup:ABCount?
```

Example
```
:TRIGGER:SPI:SETUP:
ABCOUNT FIRSTBYTE
:TRIGGER:SPI:SETUP:ABCOUNT? ->
:TRIGGER:SPI:SETUP:
ABCOUNT FIRSTBYTE
```

### :TRIGger:SPI:SETup:APATtern?

Function Queries all settings related to Pattern A of the trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:SETup:APATtern?
```

Example
```
:TRIGGER:SPI:SETUP:APATTERN? ->
:TRIGGER:SPI:SETUP:APATTERN:MODE 0;
BYTE 8;CONDITION TRUE;
PATTERN1 “XXXXXXXX”;
PATTERN2 “XXXXXXXX”;
PATTERN3 “XXXXXXXX”;
PATTERN4 “XXXXXXXX”;
PATTERN5 “XXXXXXXX”;
PATTERN6 “XXXXXXXX”;
PATTERN7 “XXXXXXXX”;
PATTERN8 “XXXXXXXX”
```

### :TRIGger:SPI:SETup:APATtern:BYTE

Function Sets the number of bytes of Pattern A of the trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:SETup:APATtern:BYTE
{<NRf>}
:TRIGger:SPI:SETup:APATtern:BYTE?
```
<NRf>=1 to 8

Example
```
:TRIGGER:SPI:SETUP:APATTERN:BYTE 1
:TRIGGER:SPI:SETUP:APATTERN:BYTE?
-> :TRIGGER:SPI:SETUP:APATTERN:
BYTE 1
```

### :TRIGger:SPI:SETup:APATtern:CONDition

Function Sets the Pattern A condition of the trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:SETup:APATtern:
CONDition {TRUE|FALSe}
:TRIGger:SPI:SETup:APATtern:
CONDition?
```

Example
```
:TRIGGER:SPI:SETUP:APATTERN:
CONDITION TRUE
:TRIGGER:SPI:SETUP:APATTERN:
CONDITION? -> :TRIGGER:SPI:SETUP:
APATTERN:CONDITION TRUE
```

### :TRIGger:SPI:SETup:APATtern:HEXa<x>

Function Sets the Pattern A pattern of the trigger at the byte level in hexadecimal.

Syntax
```
:TRIGger:SPI:SETup:APATtern:HEXa<x>
{<String>}
:TRIGger:SPI:SETup:APATtern:
HEXa<x>?
```
<String>=2 characters by combining '0' to 'F' and 'X'
<x>=1 to 8

Example
```
:TRIGGER:SPI:SETUP:APATTERN:
HEXA1 "1A"
:TRIGGER:SPI:SETUP:APATTERN:HEXA1?
-> :TRIGGER:SPI:SETUP:APATTERN:
HEXA1 "1A"
```

### :TRIGger:SPI:SETup:APATtern:MODE

Function Enables/Disables Pattern A of the trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:SETup:APATtern:MODE
{<Boolean>}
:TRIGger:SPI:SETup:APATtern:MODE?
```

Example
```
:TRIGGER:SPI:SETUP:APATTERN:MODE ON
:TRIGGER:SPI:SETUP:APATTERN:MODE?
 -> :TRIGGER:SPI:SETUP:APATTERN:
MODE 1
```

### :TRIGger:SPI:SETup:APATtern:PATTern<x>

Function Sets the Pattern A pattern of the trigger at the byte level in binary or queries the current setting.

Syntax
```
:TRIGger:SPI:SETup:APATtern:
PATTern<x> {<String>}
:TRIGger:SPI:SETup:APATtern:
PATTern<x>?
```
<String>=8 characters by combining '0,' '1,' and 'X'
<x>=1 to 8

Example
```
:TRIGGER:SPI:SETUP:APATTERN:
PATTERN1 "10X10X10"
:TRIGGER:SPI:SETUP:APATTERN:
PATTERN1? -> :TRIGGER:SPI:SETUP:
APATTERN:PATTERN1 "10X10X10"
```

### :TRIGger:SPI:SETup:BITorder

Function Sets the bit order of the pattern of the trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:SETup:BITorder
{MSBFirst|LSBFirst}
:TRIGger:SPI:SETup:BITorder?
```

Example
```
:TRIGGER:SPI:SETUP:
BITORDER MSBFIRST
:TRIGGER:SPI:SETUP:BITORDER? ->
:TRIGGER:SPI:SETUP:
BITORDER MSBFIRST
```

### :TRIGger:SPI:SETup:BPATtern?

Function Queries all settings related to Pattern B of the trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:SETup:BPATtern?
```

Example
```
:TRIGGER:SPI:SETUP:BPATTERN? ->
:TRIGGER:SPI:SETUP:BPATTERN:
TRACE 2;MODE 0;BYTE 8;
CONDITION TRUE;PATTERN1 "XXXXXXXX";
PATTERN2 "XXXXXXXX";
PATTERN3 "XXXXXXXX";
PATTERN4 "XXXXXXXX";
PATTERN5 "XXXXXXXX";
PATTERN6 "XXXXXXXX";
PATTERN7 "XXXXXXXX";
PATTERN8 "XXXXXXXX"
```

### :TRIGger:SPI:SETup:BPATtern:BYTE

Function Sets the number of bytes of Pattern B of the trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:SETup:BPATtern:BYTE
{<NRf>}
:TRIGger:SPI:SETup:BPATtern:BYTE?
```
<NRf>=1 to 8

Example
```
:TRIGGER:SPI:SETUP:BPATTERN:BYTE 1
:TRIGGER:SPI:SETUP:BPATTERN:BYTE?
-> :TRIGGER:SPI:SETUP:BPATTERN:
BYTE 1
```

### :TRIGger:SPI:SETup:BPATtern:CONDition

Function Sets the Pattern B condition of the trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:SETup:BPATtern:
CONDition {TRUE|FALSe}
:TRIGger:SPI:SETup:BPATtern:
CONDition?
```

Example
```
:TRIGGER:SPI:SETUP:BPATTERN:
CONDITION TRUE
:TRIGGER:SPI:SETUP:BPATTERN:
CONDITION? -> :TRIGGER:SPI:SETUP:
BPATTERN:CONDITION TRUE
```

### :TRIGger:SPI:SETup:BPATtern:HEXa<x>

Function Sets the Pattern B pattern of the trigger at the byte level in hexadecimal.

Syntax
```
:TRIGger:SPI:SETup:BPATtern:HEXa<x>
{<String>}
:TRIGger:SPI:SETup:BPATtern:
HEXa<x>?
```
<String>=2 characters by combining '0' to 'F' and 'X'
<x>=1 to 8

Example
```
:TRIGGER:SPI:SETUP:BPATTERN:
HEXA1 "1B"
:TRIGGER:SPI:SETUP:BPATTERN:HEXA1?
-> :TRIGGER:SPI:SETUP:BPATTERN:
HEXA1 "1B"
```

### :TRIGger:SPI:SETup:BPATtern:MODE

Function Enables/Disables Pattern B of the trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:SETup:BPATtern:MODE
{<Boolean>}
:TRIGger:SPI:SETup:BPATtern:MODE?
```

Example
```
:TRIGGER:SPI:SETUP:BPATTERN:MODE ON
:TRIGGER:SPI:SETUP:BPATTERN:MODE?
-> :TRIGGER:SPI:SETUP:BPATTERN:
MODE 1
```

### :TRIGger:SPI:SETup:BPATtern:PATTern<x>

Function Sets the Pattern B pattern of the trigger at the byte level in binary or queries the current setting.

Syntax
```
:TRIGger:SPI:SETup:BPATtern:
PATTern<x> {<String>}
:TRIGger:SPI:SETup:BPATtern:
PATTern<x>?
```
<String>=8 characters by combining '0,' '1,' and 'X'
<x>=1 to 8

Example
```
:TRIGGER:SPI:SETUP:BPATTERN:
PATTERN1 "10X10X10"
:TRIGGER:SPI:SETUP:BPATTERN:
PATTERN1? -> :TRIGGER:SPI:SETUP:
BPATTERN:PATTERN1 "10X10X10"
```

### :TRIGger:SPI:SETup:BPATtern:TRACe

Function Sets the data to be used as Pattern B of the trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:SETup:BPATtern:TRACe
{<NRf>}
:TRIGger:SPI:SETup:BPATtern:TRACe?
```
<NRf>=2, 3

Example
```
:TRIGGER:SPI:SETUP:BPATTERN:TRACE 2
:TRIGGER:SPI:SETUP:BPATTERN:TRACE?
-> :TRIGGER:SPI:SETUP:BPATTERN:
TRACE 2
```

### :TRIGger:SPI:SETup:SPOLarity

Function Sets the edge slope of the clock signal (SCK) of the trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:SETup:SPOLarity
{RISE|FALL}
:TRIGger:SPI:SETup:SPOLarity?
```

Example
```
:TRIGGER:SPI:SETUP:SPOLARITY RISE
:TRIGGER:SPI:SETUP:SPOLARITY? ->
:TRIGGER:SPI:SETUP:SPOLARITY RISE
```

### :TRIGger:SPI:SETup:SSENable

Function Sets the enable state of the slave select signal (SS) of the trigger or queries the current setting.

Syntax
```
:TRIGger:SPI:SETup:SSENable
{HIGH|LOW}
:TRIGger:SPI:SETup:SSENable?
```

Example
```
:TRIGGER:SPI:SETUP:SSENABLE HIGH
:TRIGGER:SPI:SETUP:SSENABLE? ->
:TRIGGER:SPI:SETUP:SSENABLE HIGH
```

### :TRIGger:TYPE

Function Sets the trigger type or queries the current setting.

Syntax
```
:TRIGger:TYPE {ABN|ADB|PATTern|
WIDTh|OR|TV|SIMPle|SPIBus}
:TRIGger:TYPE?
```

Example
```
:TRIGGER:TYPE SPIBUS
:TRIGGER:TYPE? ->
:TRIGGER:TYPE SPIBUS
```

# 4.1 $I^2C$ Bus Signal Analysis Function

## Applicable Bus

| Item | Specifications |
|---|---|
| $I^2C$ bus | Bus transfer rate: Up to 3.4 Mbits/s<br>Address mode: 7 bits |
| SM bus | Conforms to the System Management Bus. |

## Trigger Function

| Item | Specifications |
|---|---|
| Trigger source | CH1: SCL<br>CH2: SDA<br>CH3 to CH8*: Analog signal input |
| Start/Stop conditions for $I^2C$ bus signal trigger | Select the start/stop conditions from the following:<br>• Ignore/Not ignore restart conditions<br>• Ignore/Not ignore start/stop conditions that do not conform to the protocol |
| $I^2C$ bus signal trigger | Select from the following two trigger types.<br>• Address&Data: Activates the trigger based on the comparison of the specified address and data.<br>• Non-ACK: Activates a trigger when an acknowledge is not present.<br>For Address&Data trigger, a trigger is activated on the combination (AND logic) of the five items below. Start Condition and Byte Count are always applicable (enabled). Address, Data 1 and Data 2 can be enabled or disabled.<br>• Start Condition: Activates a trigger on the start condition.<br>• Address: Activates a trigger on the true/false condition of the result of the comparison with the address (total of 8 bits comprised of the 7-bit address and R/$\overline{W}$).<br>• Data 1: Activates a trigger on the true/false condition of the result of the comparison with the data immediately after the address. The length of data that is compared is 1 byte.<br>• Byte Count: Activates a trigger at the specified number of bytes after the start condition (after the address if the address is enabled and after Data 1 if Data 1 is enabled). The selectable range is 0 or 9999.<br>• Data 2: Activates a trigger on the true/false condition of the result of the comparison with the data that is present after the byte count passes. The length of data that is compared can be set to 1 or 2 bytes. Select whether to compare the data immediately after the byte count passes or continue comparing until the stop condition. |
| Combination trigger | Possible to activate triggers by combining the CH3 to CH8* analog signals and the $I^2C$ bus signal (CH1 and CH2).<br>• $I^2C$ Only: Activates a trigger only on the trigger conditions of the $I^2C$ bus signal.<br>• $I^2C$ on Pattern: Activates a trigger when the trigger conditions of the $I^2C$ bus are met on the true or false condition of the CH3 to CH8* parallel pattern.<br>• $I^2C$ -> Pattern: Activates a trigger when the trigger conditions of the parallel pattern of CH3 to CH8* are met after the trigger conditions of the $I^2C$ Bus signal are met. |

* CH3 to CH4 on the DL7440

## Analysis Function

| Item | Specifications |
|---|---|
| Signal input | Select CH1 (SCL), CH2 (SDA) or CH3 (SCL), CH4 (SDA). |
| Number of data points that can be analyzed and displayed | Up to 40000 bytes (Analysis numbers are assigned in the range of –40000 to 40000 with respect to the reference point position.) |
| Display of the analysis results | Displays the analysis results using the following two methods.<br>• Waveform and the list of analysis results<br>Simultaneously displays the waveform and the list of analysis results (No. (analysis number), Hex (hexadecimal display of analysis data), and Ack (Acknowledge bit condition).<br>• List of detailed analysis results<br>Displays No. (analysis number and start/stop conditions), Time (time from the analysis reference), Binary (binary display of the analysis data), Hex (hexadecimal display of analysis data), and Ack (Acknowledge bit condition). |

## Search Function

| Item | Specifications |
|---|---|
| Data search | The following two types of search are possible. However, they cannot be used simultaneously.<br>• Pattern search (Byte Pattern)<br>Set the address pattern, data pattern, and Acknowledge bit condition and search the waveform. If a waveform that matches the condition is found, the zoom box moves to that point and displays the specified waveform.<br>• Indefinite data search (Indefinite State)<br>Indefinite data can be searched. |

## Analysis Result Save Function

| Item | Specifications |
|---|---|
| Data storage of the list of detailed analysis results | Saves the list of detailed analysis results to a file in ASCII format (.txt extension). |

# 4.2 CAN Bus Signal Analysis Function

## Supported CAN Bus

| Item | Specifications |
|---|---|
| CAN Bus | CAN Version 2.0B |
| Bit rate | Set any of the following bit rates: 1 M, 500 k, 250 k, 125 k, 100 k, 95.238 k, 83.333 k, 62.5 k, 50 k, 33.333 k, 20 k, or 10 k [bps] or an arbitrary bit rate between 1 M to 10 k [bps] (The resolution is the bit time (reciprocal of the bit rate of 0.5 μs).<br>Supports High speed CAN(ISO11898) and Low speed CAN(ISO11519-2) |

## Trigger Function

| Item | Specifications | |
|---|---|---|
| Trigger source | CH1: | CAN bus signal<br>(Input CAN_H and CAN_L signals via differential probes.) |
| | CH2 to CH8*: | Analog signal input |
| CAN bus signal trigger | Activates a trigger on the combination (AND logic) of the five items below. Start of Frame is always enabled. Identifier, RTR, Data Field, and Error Frame can be enabled or disabled. However, the combination of RTR and Data Field is not allowed. | |
| | • Start of Frame: | Activates a trigger on the Start of Frame (SOF). The trigger point is at the end of the Start of Frame. |
| | • Identifier: | Activates a trigger on the Identifier (ID: up two four types can be specified) that matches the specified conditions. A trigger is activated on the OR logic of the four types of IDs. The trigger point is at the end of the ID. |
| | • RTR: | Activates a trigger on a remote frame (RTR is recessive). The trigger point is at the end of the RTR bit. |
| | • Data Field: | Activates a trigger at the data field that matches the specified conditions (up to 8 bytes can be specified). The trigger point is at the end of data field. |
| | • Error Frame: | Activates a trigger on an error frame. An error frame trigger applies to the case when 6 successive dominant (logical value: 0) bits are detected. A trigger also occurs if 6 successive dominant bits occur in an overload frame. The trigger point is at the end of the 6th dominant bit. |
| Combination trigger | Possible to activate triggers by combining the CH2 to CH8* analog signals and the CAN bus signal (CH1). | |
| | • CAN Only: | Activates a trigger only on the trigger conditions of the CAN bus signal. |
| | • CAN on Pattern: | Activates a trigger when the CAN trigger conditions are met on the true or false condition of the CH2 to CH8* parallel pattern. |
| | • CAN -> Pattern: | Activates a trigger when the trigger conditions of the parallel pattern of CH2 to CH8* are met after the trigger conditions of the CAN Bus signal are met. |

* CH2 to CH4 on the DL7440

## Analysis Function

| Item | Specifications |
|---|---|
| Signal input | Select CH1 or CH3. |
| Number of frames that can be analyzed and displayed | Up to 16000 bytes (Analysis numbers are assigned in the range of –16000 to 16000 with respect to the reference point position. |
| Frames that are analyzed | Three types: Remote Frame, Data Frame, and Identifier. |
| Display of the analysis results | Displays the analysis results using the following two methods.<br>• Waveform and the list of analysis results<br>Simultaneously displays the waveform and the list of analysis results (No. (frame type and No.), ID (Identifier value (standard format or extended format), Dt (hexadecimal display of the data field value), and ACK (Acknowledge bit condition).<br>• List of detailed analysis results<br>Displays No. (frame type and No.), Time (time from the trigger point to Start of Frame), ID (Identifier value (standard format or extended format)), Data (hexadecimal or binary display of the data field value), CRC (hexadecimal display of the CRC value), ACK (Acknowledge bit condition), and Info. (error type). |
| Stuff bit computation | Extracts stuff bits from the CAN Bus waveform and displays them as a Math waveform (Math1). |

## Search Function

| Item | Specifications |
|---|---|
| Data search | The following two types of search are possible. However, they cannot be used simultaneously.<br>• Pattern search (Frame Pattern)<br>Search the waveform by specifying a field or frame pattern. If a waveform that matches the pattern is found, the zoom box moves to that point and displays the specified waveform.<br>• Indefinite data search (Indefinite State)<br>Indefinite data can be searched. |
| Field jump | Moves the zoom position (Z1 Pos) to the beginning of a certain field within the current frame. Applicable fields are Identifier, Control Field, Data Field, CRC, and ACK. |

## Analysis Result Save Function

| Item | Specifications |
|---|---|
| Data storage of the list of detailed analysis results | Saves the list of detailed analysis results to a file in ASCII format (.txt extension). |

# 4.3 SPI Bus Signal Analysis Function

## Trigger Function

| Item | Specifications | |
|---|---|---|
| Trigger source | CH1: | SCK |
| | CH2: | MOSI |
| | CH3: | MISO |
| | CH4: | SS |
| | CH5 to CH8: | Analog signal input (only for the DL7480) |
| SPI bus signal trigger | Activates a trigger on the combination (AND logic) of the following four items. Assertion of SS and Byte Count are always applicable (enabled). A Pattern and B Pattern can be enabled or disabled. | |
| | • Assertion of SS: | Activates a trigger on the assertion of SS. |
| | • A Pattern: | Activates a trigger on true/false condition of the result of the comparison with the MOSI data immediately after the assertion of SS. The length of data that is compared can be set to 1 or 8 bytes. |
| | • Byte Count: | Activates a trigger the specified bytes after the assertion of SS (after the A pattern if A Pattern is enabled). The selectable range is 0 or 1000. |
| | • B Pattern: | Activates a trigger on the true/false condition of the result of the comparison with the data that is present after the byte count passes. The data to be compared is selectable between MOSI and MISO. The data length can be set to 1 to 8 bytes.<br>Select whether to compare the data immediately after the byte count passes or continue comparing until the negation of SS. |
| Combination trigger* | Possible to activate triggers by combining CH5 to CH8 analog signals and the SPI bus signal (CH1 to CH4). | |
| | • SPI Only: | Activates a trigger only on the trigger conditions of the SPI bus signal. |
| | • SPI on Pattern: | Activates a trigger when the trigger conditions of the SPI bus signal are met on the true or false condition of the CH5 to CH8* parallel pattern. |
| | • SPI -> Pattern: | Activates a trigger when the trigger conditions of the parallel pattern of CH5 to CH8 are met after the trigger conditions of the SPI Bus signal are met. |

* Only SPI Only is selectable on the DL7440.

## Analysis Function

| Item | Specifications | |
|---|---|---|
| Signal input | CH1: | Clock signal (SCK) |
| | CH2: | Data 1 (MOSI) |
| | CH3: | Data 2 (MISO) |
| | CH4 to CH8[*1] or logic input[*2]: | CS signal (SS) |
| Number of data points that can be analyzed and displayed | Up to 80000 bytes (Analysis numbers are assigned in the range of –80000 to 80000 with respect to the reference point position.) | |
| Analysis Result Display | Displays the analysis results using the following two methods.<br>• Waveform and the list of analysis results<br>Simultaneously displays the waveform and the list of analysis results (No. (analysis number), Dt1 (hexadecimal display of the Data 1 value), Dt2 (hexadecimal display of the Data 2 value), and CS (CS signal status or the CS signal name with high precedence).<br>• List of detailed analysis results<br>Displays No. (analysis number), Time (time from the analysis reference point), Dt1 (hexadecimal or binary display of the Data 1 value), Dt2 (hexadecimal or binary display of the Data 2 value), CS (CS signal status or the CS signal name with high precedence). | |

*1 The maximum number of channels varies depending on the model.
*2 The logic input is optional.

## Search Function

| Item | Specifications |
|---|---|
| Data search | The following two types of search are possible. However, they cannot be used simultaneously.<br>• Pattern search (Frame Pattern)<br>Search the waveform by specifying a data pattern. If a waveform that matches the pattern is found, the zoom box moves to that point and displays the specified waveform.<br>• Indefinite data search (Indefinite State)<br>Indefinite data can be searched. |

## Analysis Result Save Function

| Item | Specifications |
|---|---|
| Data storage of the list of detailed analysis results | Saves the list of detailed analysis results to a file in ASCII format (.txt extension). |

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