User's Manual

DL1640/DL1640L
Digital Oscilloscope
CAN Bus Signal Analysis Function
(Includes the SPI Bus Signal Analysis Function)

YOKOGAWA
Yokogawa Electric Corporation

IM 701610-51E
2nd Edition

Foreword

Thank you for purchasing the Digital Oscilloscope DL1640/DL1640L/F7 with the CAN bus signal analysis function and the SPI bus signal analysis function.
This User's Manual describes the CAN bus signal analysis function and SPI bus signal analysis function. For information about other functions, operating procedures, and handling precautions of the DL1640/DL1640L, see the following manuals:

Manual Name	Manual No.	Description
DL1620/DL1640/DL1640L User's Manual	IM 701610-01E	Describes all functions (except for the communications function) and their operation procedures for the instrument.
DL1620/DL1640/DL1640L Communication Interface User's Manual	IM 701610-17E	Describes the communications functions of the GP-IB, RS-232, USB, and network interface.
DL1620/DL1640/DL1640L Operation Guide	IM 701610-02E	Explains basic operations only.

Notes

- The contents of this manual are subject to change without prior notice as a result of improvements in the instrument's performance and functions. Display contents illustrated in this manual may differ slightly from what actually appears on your screen.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA representative listed on the back cover of this manual.
- Copying or reproduction of all or any part of the contents of this manual without YOKOGAWA's permission is strictly prohibited.

Trademarks

- Adobe and Acrobat are either trademarks or registered trademarks of Adobe Systems incorporated.
- For purposes of this manual, the TM and ® symbols do not accompany their respective trademark names or registered trademark names.
- Other product names are trademarks or registered trademarks of their respective holders.

Revisions

1st Edition: December 2003
2nd Edition: July 2005

2nd Edition : July 2005 (YK)

How to Use This Manual

Structure of the Manual

This user's manual consists of 3 chapters, and an Index as described below.

Chapter	Title	Content
1	CAN Bus Signal Analysis Function	Explains CAN bus signal analysis function.
2	SPI Bus Signal Analysis Function	Explains SPI bus signal analysis function.
3	Specifications	Lists the CAN bus signal analysis function and SPI bus signal analysis function specifications.
	Index	Index of contents.

Conventions Used in this Manual

Units

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

K ..... Denotes 1024.
Example: 720 KB (storage capacity of a floppy disk)

Bolded Items

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

Symbols

The following symbols are used in to this manual.

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

WARNING

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

CAUTION

Calls 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

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

Terms Used for Descriptions of Operations

The following terms are used in chapters 1 and 2 to distinguish certain features in descriptions.

Procedure

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

Explanation

Describes settings and restrictions relating to the operation.

Contents

1.1 Overview of the CAN Bus Signal Analysis Function

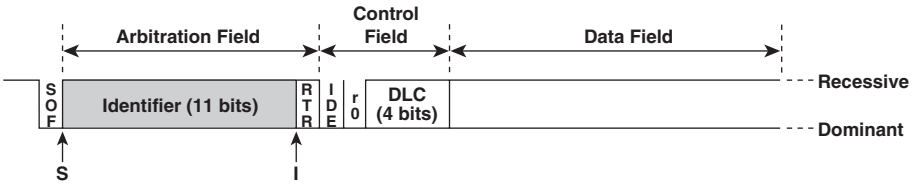
CAN Bus Signal Analysis Function

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 functions.

Trigger Function <Page 1-5>

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.

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 <Page 1-14>

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 <Page 1-23>

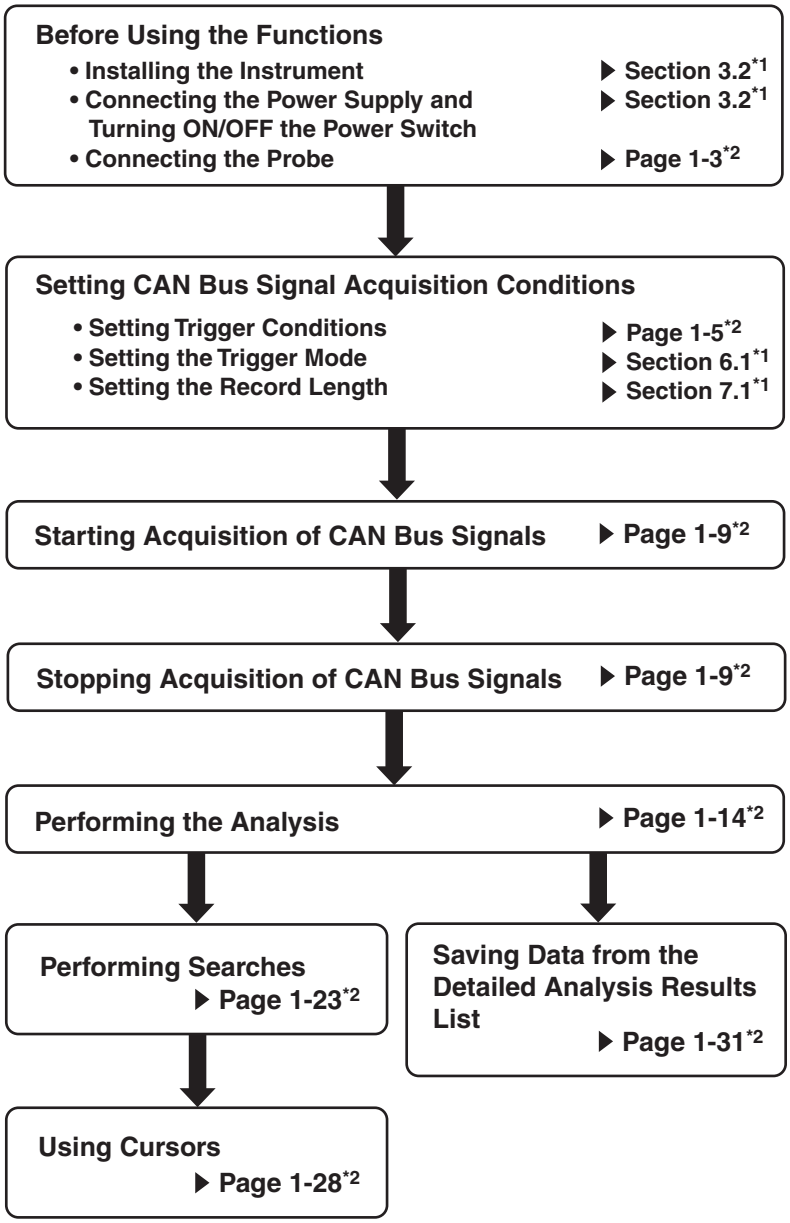
After analysis of the CAN Bus signal data acquired using the trigger function, searches for data matching data from a specific frame or field, and displays the corresponding waveforms on screen. Searches can also be performed for error frames and frames with indefinite data. Also, after the search, the 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 <Page 1-28>

Cursor1 and Cursor2 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.

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, refer to the corresponding chapter or section in the DL1620/DL1640/DL1640L user's manual (IM701610-01E) as indicated by the arrows (▶).



*1. Indicates reference sections from the DL1620/DL1640/DL1640L user's manual (IM701610-01E).
*2. Indicates reference pages from this manual.

1.2 Connecting the Probe

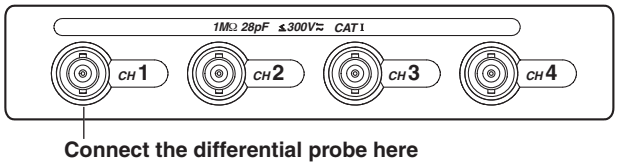
Recommended Probe

A differential probe should be used when measuring CAN Bus signals.
Recommended model of differential probe (by Yokogawa): 701922*

* To be used in conjunction with the 50 Ω terminator (model 700976).

Input Terminals

The differential probe must be connected to one of the input terminals (CH1 to CH4) located on the lower section of the front panel. The input impedance is 1 MΩ±1.0% and approximately 28 pF.



Connect the differential probe here

WARNING

To prevent fire or electric shock, do not use this instrument for category II, III, or IV measurements.

CAUTION

The maximum input voltage for 1 MΩ input is 300 VDC or 300 Vrms when the frequency is 1 kHz or less. Applying a voltage exceeding this maximum can damage the input section. If the frequency is above 1 kHz, the input section may be damaged even when the voltage is below this value.

Probe Power Supply

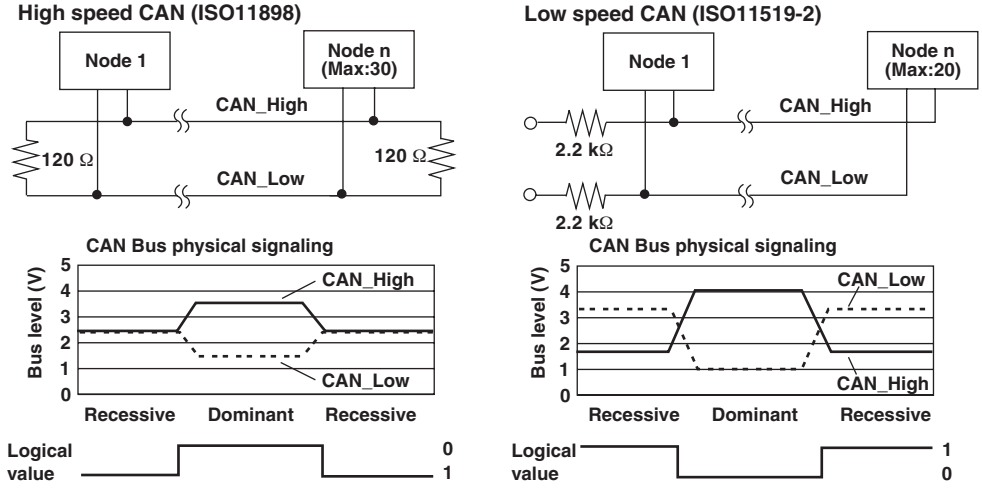
When using the differential probe from Yokogawa (model 701922), use the probe power supply (PROBE POWER) located on the rear panel of the instrument.
For more information about the probe power supply, see “Using the Current Probe (700937, 701930), and Differential Probe (701920)” in section 3.4, “Connecting a Probe” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

Points to Note When Connecting a Probe

- When connecting a probe to the instrument for the first time, perform phase correction of the probe as described in the section 3.5, “Compensating the Probe (Phase Correction)” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E). Failure to do so may result in unstable gain across different frequencies, thereby preventing correct measurement. Calibration must be performed for each channel to which the probe will be connected.
- Please note that connecting directly to the circuit under test without using a probe will result in inaccurate measurement due to the loading effect.

Differential Probe Connection Method

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



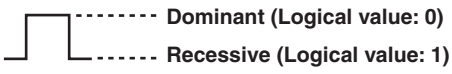
In the figure above, the bus level is determined for both High and Low speed CAN according to the difference of potential between the CAN_High and CAN_Low busses. The bus has two levels, dominant and recessive, and the signal must be at one of those levels. The instrument normally handles the dominant 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 Greater 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 trigger pattern setting dialog box (see page 1-5) and the analysis condition setting dialog box (see page 1-14). 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 700960) can be connected to CAN_High.

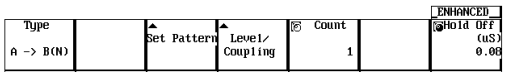
1.3 Setting CAN Bus Signal Acquisition Conditions

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

Setting the Trigger Conditions

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



3. Press the **CAN Bus** soft key.

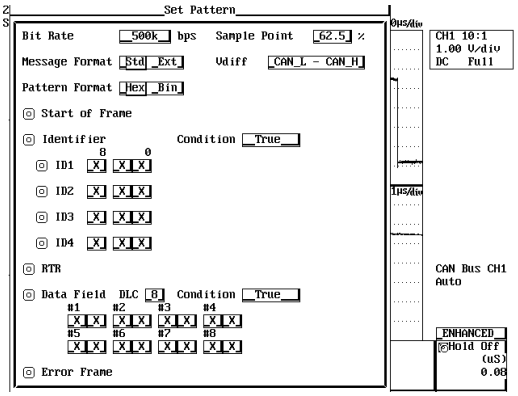
4. Press the **Set Pattern** soft key. The trigger pattern settings dialog box is displayed.

Selecting the Bit Rate

5. Turn the jog shuttle to move the cursor to Bit Rate.
6. Press **SELECT**. The Bit Rate setting is selected for editing.
7. Turn the jog shuttle and select a bit rate of 1 M, 500 k, 250 k, 125 k, 100 k, 95.2 k, 83.3 k, 50 k, or 33.3 k [bps].
   Pressing **RESET** will reset the value to 500 k (the initial value).
   To move to a different setting item, press **SELECT** or **ESC**.

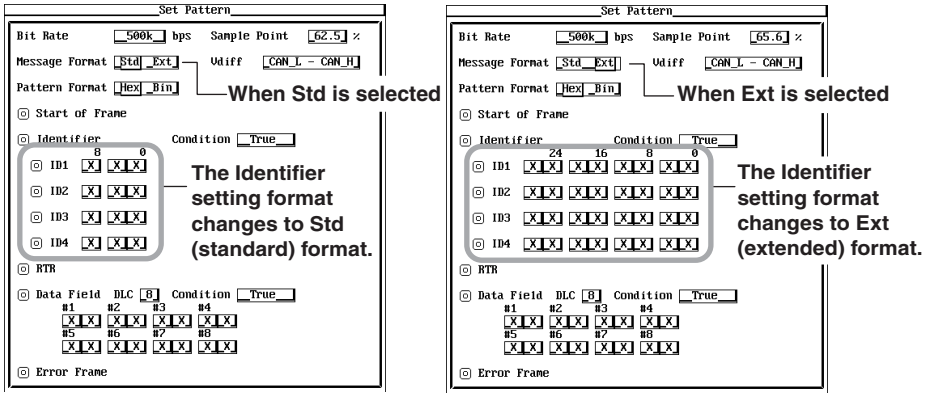
Selecting the Sample Point

8. Turn the jog shuttle to move the cursor to Sample Point.
9. Press **SELECT**. The Sample Point setting is selected for editing.
10. Turn the jog shuttle to set the sample point to a percentage between 18.8 and 90.6.
    Pressing **RESET** will reset the value to 62.5 k (the initial value).
    To move to a different setting item, press **SELECT** or **ESC**.



Selecting the Message Format

11. Turn the jog shuttle to move the cursor to Message Format.
12. Press **SELECT**, then select Std or Ext for the message format. The Identifier setting format changes to the selected format.

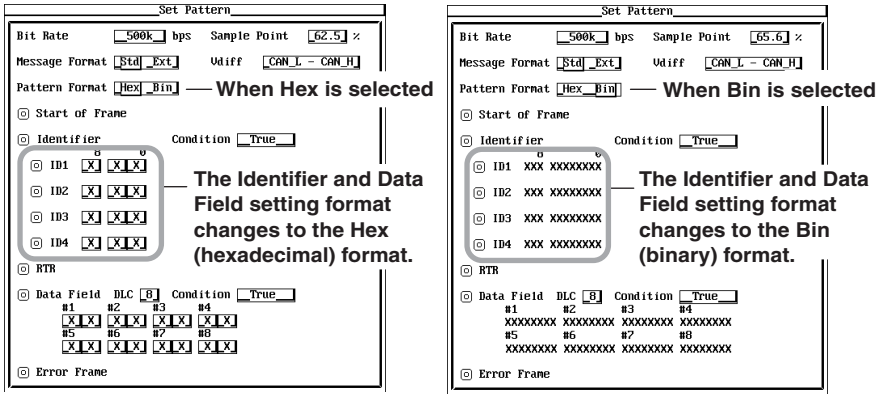


Selecting Vdiff

13. Turn the jog shuttle to move the cursor to Vdiff.
14. Press **SELECT**. The Vdiff setting is selected for editing.
15. Turn the jog shuttle to select CAN_L–CAN_H or CAN_H–CAN_L for Vdiff.
16. Press **SELECT**. The selected value is entered.

Selecting the Pattern Format

17. Turn the jog shuttle to move the cursor to Pattern Format.
18. Press **SELECT**, then select Hex or Bin for the pattern format. The Identifier and Data Field setting format changes to the selected format.



Selecting the Field or Frame Type

19. Turn the jog shuttle to move the cursor to the field type or frame type to be used as a trigger condition. Select the field/frame type from Start of Frame, Identifier, RTR, Data Field, and Error Frame.
20. Press **SELECT** to turn the selected type ON.

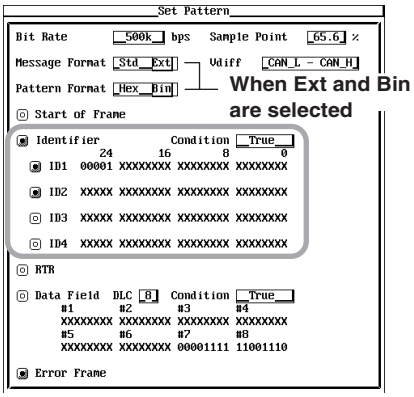
Note

Multiple types 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.

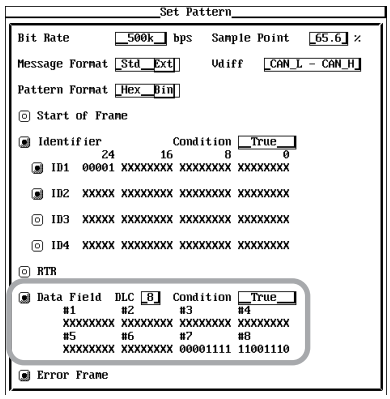
- **Selecting Identifier for the Frame/Field Type**
  21. Turn the jog shuttle to move the cursor to Condition.
  22. Press **SELECT**, then select either True or False.
  23. Turn the jog shuttle to move the cursor to the Identifier (ID1, ID2, ID3, or ID4) on which to set the bit pattern.
  24. Press **SELECT** to turn the selected Identifier ON.
  25. Turn the jog shuttle to move the cursor to the bit for which you wish to set the bit pattern and press **SELECT**.
  26. If you selected Hex for Pattern Format in steps 17 and 18, 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, press **SELECT** to select 0, 1, or X.
  27. Repeat steps 23 to 26 as many times as necessary.
      Go to step 30.

- **When Data Field Is Selected for the Frame/Field Type**
  21. Turn the jog shuttle to move the cursor to DLC.
  22. Press **SELECT**. The DLC setting is selected for editing.
  23. Turn the jog shuttle to set number of valid bytes to something between 1 and 8.
  24. Press **SELECT**. The selected value is entered.
      Pressing **RESET** will reset the value to 8 k (the initial value).
  25. Turn the jog shuttle to move the cursor to Condition.
  26. Press **SELECT**, then select either True, False, Greater, or Less for the condition.
  27. Press **SELECT**.
  28. Turn the jog shuttle to move the cursor to the bit for which you wish to set the bit pattern and press **SELECT**.
  29. If you selected Hex for Pattern Format in steps 17 and 18, 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, press **SELECT** to select 0, 1, or X.
      Go to step 30.

Setting the Identifier Bit Pattern



Setting the Data Field's Bit Pattern



  30. Press **ESC**.

Setting the Trigger Level, Coupling, and Other Parameters

31. Press the **Level/Coupling** soft key. The trigger level/hysteresis/coupling/HF rejection settings dialog box is displayed.

Note

CH1 is the only trigger source for the CAN Bus signal analysis function.

Setting the Level

32. Turn the jog shuttle to move the cursor to Level.
33. Press **SELECT**, then turn the jog shuttle to set the level.
    You can move between the digits using the arrow keys. Pressing **RESET** will reset the value to 0 V (the initial value).
34. Press **SELECT**. The selected value is entered.

Setting the Hysteresis

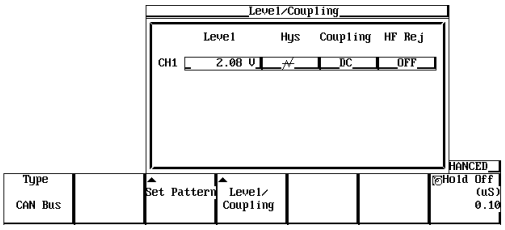
35. Turn the jog shuttle to move the cursor to Hys.
36. Press **SELECT** to select or .

Setting the Trigger Coupling

37. Turn the jog shuttle to move the cursor to Coupling.
38. Press **SELECT**, then select DC or AC for the pattern format.

Setting the HF Rejection

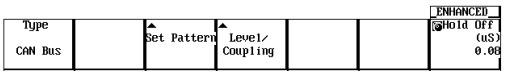
39. Turn the jog shuttle to move the cursor to HF Rej.
40. Press **SELECT**, then select OFF or ON for the HF rejection.



41. Press **ESC**.

Setting the Hold Off Time

42. Press the **Hold Off** soft key.
43. Turn the jog shuttle to set the hold off time.
    You can move between the digits using the arrow keys. Pressing **RESET** will reset the value to 0.08 μs (the initial value).



Setting the Trigger Mode

44. Set the trigger mode according to the procedures in section 6.1, “Setting the Trigger Mode” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

Setting the Record Length

45. Set the record length according to the procedures in section 7.1, “Setting the Record Length” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

Starting/Stopping Acquisition of CAN Bus Signals

46. Press **START/STOP** to start acquisition of CAN Bus signals. The trigger is activated according to the specified trigger conditions.
    To continue on by performing analysis, press **START/STOP** to stop acquisition of CAN Bus signals.

Explanation

Setting the Trigger Conditions

Selecting the Bit Rate

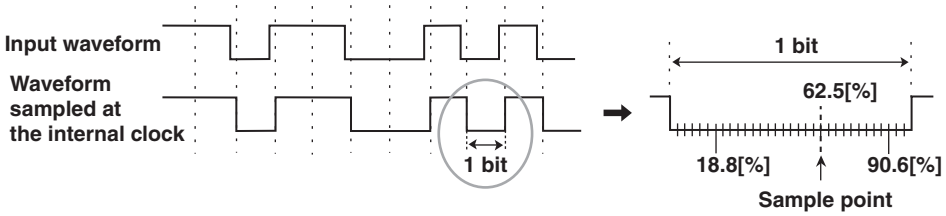
Select a data transfer rate for the CAN Bus data to be analyzed from the following.
1 M, 500 k, 250 k, 125 k, 100 k, 95.2 k, 83.3 k, 50 k, 33.3 k [bps]

Setting the 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, 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%



Setting the 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

Setting Vdiff

You can select a connection method for the differential probe from the following. 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 1.2, "Connecting the Probe."
- The bit rate setting is connected with the analysis conditions setting dialog box (see page 1-14), and the cursor menu (see page 1-28).
- The Vdiff setting is connected with the analysis conditions setting dialog box (see page 1-14).

Setting the Pattern Format

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

Hex: Hexadecimal
Bin: Binary

Selecting the Field or Frame Type

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

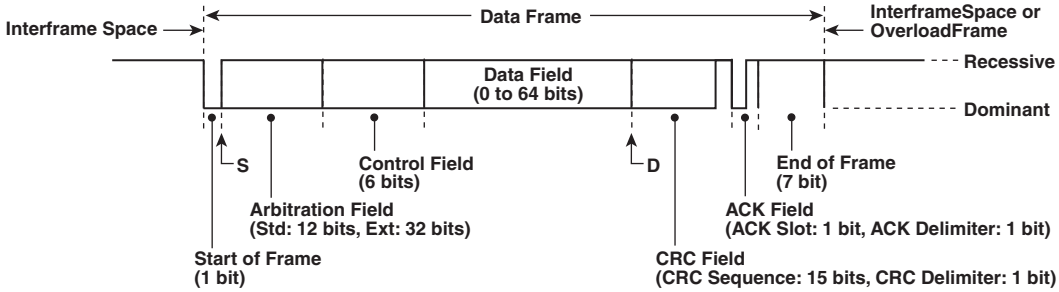
- Start of Frame
  The trigger activates on the Start of Frame (SOF). The trigger point is set to the end position of the Start of Frame.
- Identifier
  The trigger activates on an Identifier (ID) matching the specified condition. Four types of IDs can be specified. The four IDs activate triggers using an OR condition. 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 DL 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

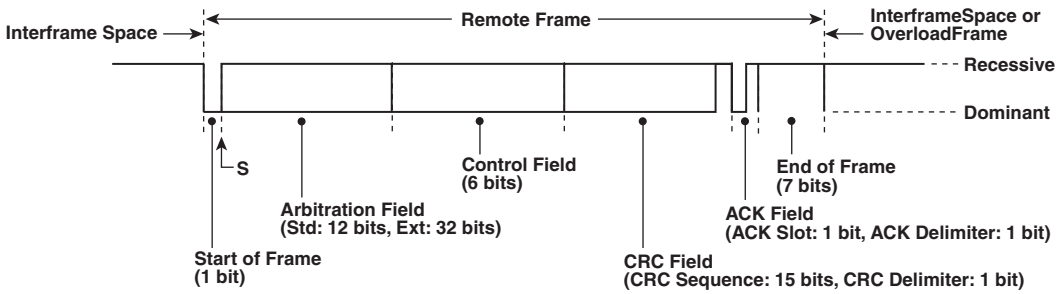
If multiple field and frame types are combined, the trigger point is set to the trigger point of the type that appeared last in the time sequence.

- **Field/Frame Formats and Trigger Position**
  The following figure shows the field and frame formats and trigger position.

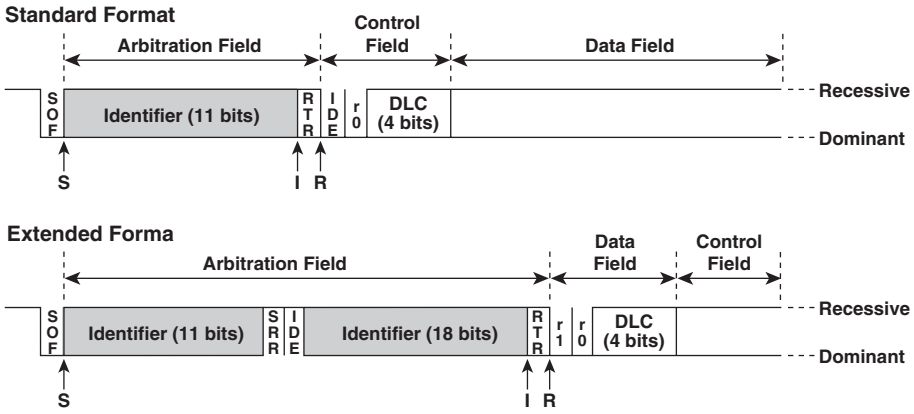
  - **Data Frame**



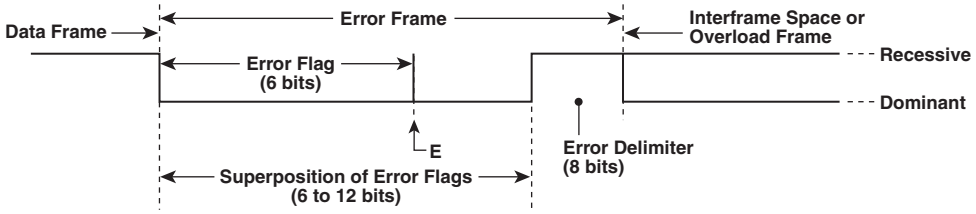
  - **Remote Frame**



- **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 Selecting Identifier for the Frame/Field Type**
  - **Selecting the 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.

  - **Setting the Bit Pattern: ID1 to ID4**

    You can set 4 types of bit patterns (ID1 to ID4).

    When Hex (hexadecimal) is selected for Pattern Format, you can enter X, 0 to 9, or A to F in units of 4 bits. When Bin (binary) is selected for Pattern Format, you can enter X, 0, or 1.

    ID1–ID4 activate triggers using an OR condition. 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 Hex (hexadecimal) is selected for Pattern Format).

    Extended format (Ext) : 29 bits (the max value is 1FFFFFFF when Hex (hexadecimal) is selected for Pattern Format).

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.

- **When Data Field Is Selected as the Frame/Field Type**
  - **Setting the Number of Valid Bytes**
    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.
  - **Selecting the Condition**
    You can choose 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.

- **Setting the 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 Trigger Level, Coupling, and Other Parameters

CH1 is the only trigger source available for the CAN Bus signal analysis function.
You can set the trigger level, hysteresis, trigger coupling, and HF rejection of CH1.

Setting the Trigger Level (Level)

Setting range : 8 div within the screen
Resolution : 0.01 div (for example, the resolution for 2 mV/div is 0.02 mV).

Setting the Hysteresis (Hys)

Sets a width to the trigger level so that triggers are not activated by small changes in the trigger signal. You can select from the following.

: Approximately 0.3 div* of hysteresis around the trigger level.

: Approximately 1 div* of hysteresis around the trigger level.

* The value above is an approximate value. It is not strictly guaranteed.

Setting the Trigger Coupling

You can select from the following.

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

DC : Uses the trigger source signal as-is.

Turn ON/OFF the HF Rejection (HF Rej)

To use a trigger signal in which harmonic components were removed from the trigger source signal, select ON.

Setting the Hold Off Time

Setting range : 0.08 μs to 10 s (initial value is 0.08 μs)

Resolution : 20 ns

For details on the hold off time, see section 6.4, “Setting the Hold Off Time” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

Setting the Trigger Mode

You can set waveform display update conditions as the 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, “Setting the Trigger Mode” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

Setting the Record Length

You can set the record length (data length) for acquiring data to the acquisition memory.

DL1640 : 1 k, 10 k, 100 k, 1 M, 4 M*, 8 M [word]

DL1640L : 1 k, 10 k, 100 k, 1 M, 10 M, 16 M*, 32 M [word]

* The record length that can be set in high resolution mode. For details on high resolution mode, see section 7.4, “Using the High-resolution Mode” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

For details on the record length, see section 7.1, “Setting the Record Length” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

Starting/Stopping Acquisition of CAN Bus Signals

When starting acquisition of CAN Bus signals, triggers are activated at the specified trigger conditions.

To continue on by performing analysis, press START/STOP to stop acquisition of CAN Bus signals.

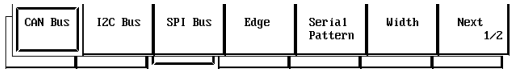
1.4 Performing the Analysis

You can analyze CAN Bus signal data acquired using the trigger function, and display the Identifier, Data Field, and Acknowledge values for each frame in a list.

Operating Procedure

1. Press **SHIFT** to set the keys in the shifted condition.
2. Press **ZOOM**.
3. Press the **Type** soft key. The type selection menu appears.

4. Press the **CAN Bus** soft key.

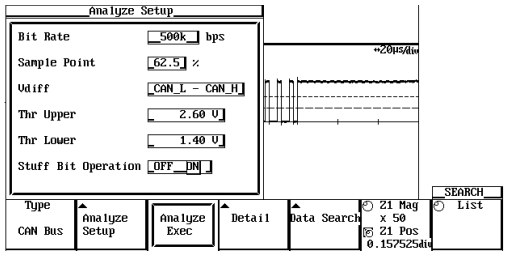


Note

- The data to be analyzed is the history data of CH1.
- When CAN Bus is set as the search method, the zoom waveform display method setting may change. Main, Z2 Only, and Main & Z2 change to Main & Z1.
  For details on the zoom waveform display method, see section 8.9, “Zooming the Waveform” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

Setting the Analysis Conditions

5. Press the **Analyze Setup** soft key. The analysis condition settings dialog box is displayed.



Selecting the Bit Rate

6. Turn the jog shuttle to move the cursor to Bit Rate and press **SELECT**.
7. Turn the jog shuttle to select 1 M, 500 k, 250 k, 125 k, 100 k, 95.2 k, 83.3 k, 50 k, or 33.3 k [bps] and press **SELECT**. Pressing **RESET** when the Bit Rate setting is selected for changing will reset the value to 500 k (the initial value).

Selecting the Sample Point

8. Turn the jog shuttle to move the cursor to Sample Point and press **SELECT**.
9. Turn the jog shuttle to set the sample point to a percentage between 18.8 and 90.6 of one bit. Pressing **RESET** when the Sample Point setting is selected for changing will reset the value to 62.5 k (the initial value).

Selecting Vdiff

10. Turn the jog shuttle to move the cursor to Vdiff and press **SELECT**.
11. Turn the jog shuttle to select CAN_H–CAN_L or CAN_L–CAN_H and press **SELECT**.

Setting the Threshold Level (Thr Upper/Thr Lower)

12. Turn the jog shuttle to move the cursor to Thr Upper and press **SELECT**.
13. Turn the jog shuttle to set the level used to judge High and press **SELECT**. You can move between the digits using the arrow keys. Pressing **RESET** when the Thr Upper setting is selected for changing will reset the value to 0 V (the initial value).
14. In the same manner, use Thr Lower to set the level used to judge Low.

Setting the Stuff Bit Computation

15. Turn the jog shuttle to move the cursor to Stuff Bit Operation.
16. Press **SELECT**, then select OFF or ON to indicate whether or not to execute stuff bit computation.

Note

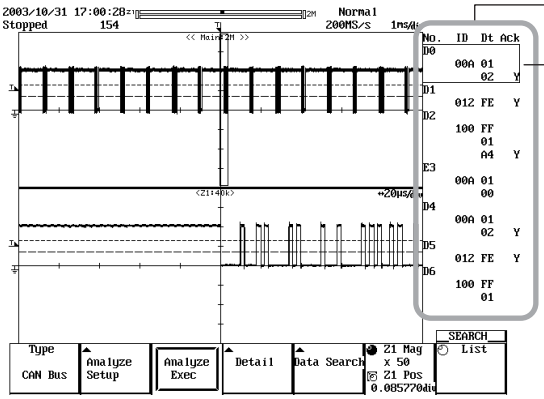
If stuff bit computation is ON, computation is executed when you press the Analyze Exec soft key. The computation result is displayed in Math1.

17. Press **ESC**.

Executing the Analysis

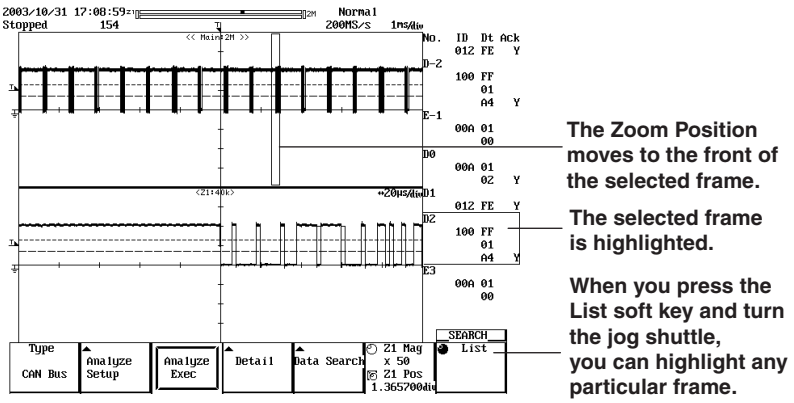
Executing the Analysis

18. Press the **Analyze Exec** soft key. Analysis is executed. After executing the analysis, the analysis results list is displayed in the left side of the screen.



Selecting an Arbitrary Frame from the Analysis Results List

19. Press the **List** soft key.
20. Turn the jog shuttle to select an arbitrary frame from the list of analysis results. The selected frame appears highlighted. The zoom position (Z1 Pos) moves to the front of the selected frame.

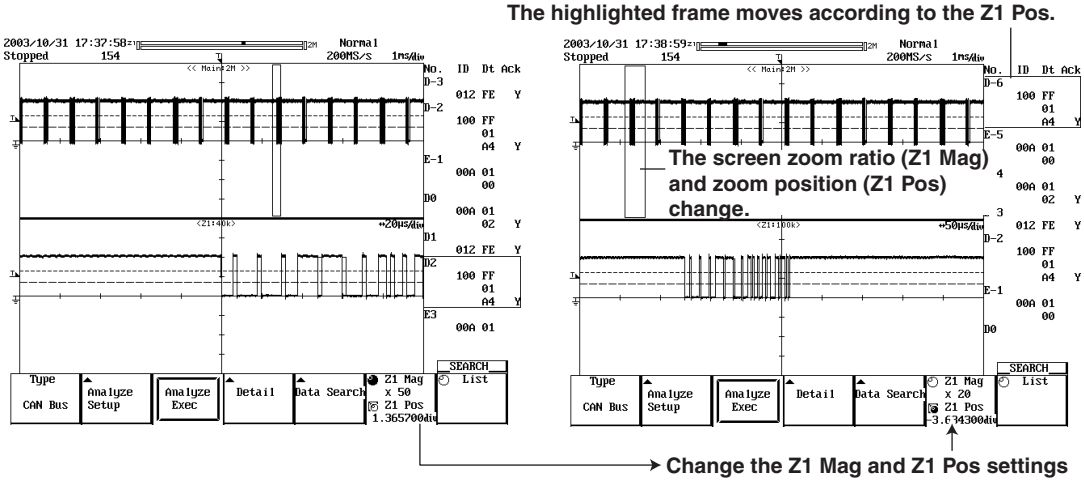


Setting the Zoom Ratio

21. Press the **Z1 Mag/Z1 Position** soft key to set the jog shuttle control to Z1 Mag.
22. Turn the jog shuttle to set the zoom ratio of the Z1 zoom box.

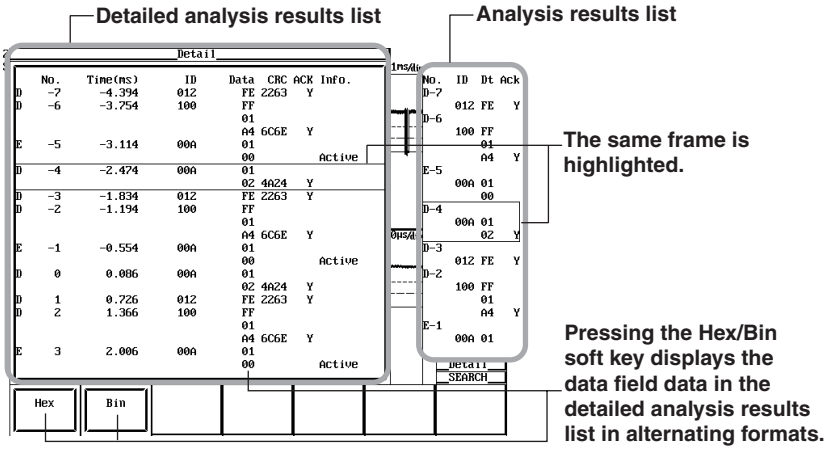
Setting the Zoom Position

23. Press the **Z1 Mag/Z1 Position** soft key to set the jog shuttle control to Z1Position.
24. Turn the jog shuttle to set the zoom position of the Z1 zoom box.
    The highlighted display of the list at the right of the screen moves to the zoom position frame.



Detailed Analysis Results List Display

25. Press the **Detail** soft key. The detailed analysis results list is displayed.
    At this point, the highlighted display is located at the same position as the highlighted frame of the list of analysis results.
26. Press the **Hex** or **Bin** soft key to select the data format. The data of the data field is displayed using the selected format.



To continue on and perform a search, go to the next section, 1.5, “Performing Searches.”

Note

- If indefinite data is present, an asterisk (*) is displayed in the ACK column.
- The detailed analysis results list can be output as-is to a file on an external storage medium in ASCII format (.txt extension). For details, see section 1.7, “Saving Data from the Detailed Analysis Results List.”

Explanation

Setting the Analysis Conditions

Channels Used

CH1: CAN Bus signal input channel. For the procedure to connect the probe, see section 1.2, “Connecting the Probe.”

Math1: Channel for displaying the stuff bit analysis results.

Items to Be Analyzed

The frames to be analyzed are of 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 DL 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.

Selecting the Bit Rate

Select a data transfer rate for the CAN Bus data to be analyzed from the following.
1 M, 500 k, 250 k, 125 k, 100 k, 95.2 k, 83.3 k, 50 k, 33.3 k [bps]

Setting the 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, 90.6 [%]

The point at which the input CA 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.

Setting Vdiff

You can select a connection method for the differential probe from the following. 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 1.2, “Connecting the Probe.”
- The bit rate setting is connected with the trigger pattern setting dialog box (see page 1-5), and the cursor menu (see page 1-28).
- The Vdiff setting is connected with the trigger pattern setting dialog box (see page 1-5).

Setting the 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 results list containing indefinite data appear with an asterisk (*).

Setting the Stuff Bit Computation (Stuff Bit Operation)

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 remains unchanged. To update the stuff bit computation waveform to the changed history waveform, you must execute analysis again.

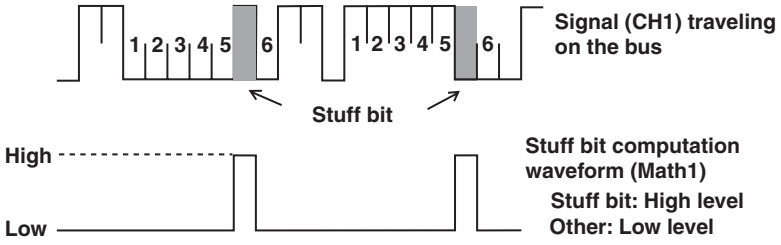
Note

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

- DL1640: For a record length of 8 MWords
- DL1640L: For a record length of 10 Mword or 32 Mwords

In the above case, if you execute analysis with the stuff bit setting turned ON, computation cannot be performed at the current record length. The message, “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 DL lets you can extract stuff bits from the CAN Bus signal waveform and display them as a Math waveform (Math1).



Executing the Analysis

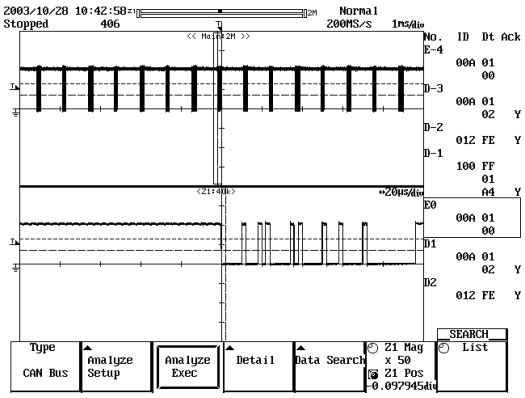
Executing the Analysis (Analyze Exec)

Analysis is performed on up to 8000 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 Results List Display

After executing the analysis, the following four items are displayed in the right side of the screen.

- 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 -8000 and 8000.
- 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.



Immediately after analysis executes, the No. 0 frame is automatically highlighted. Turn the jog shuttle to highlight select an arbitrary frame. The waveform of the frame that is highlighted is shown in the Zoom window.

Note

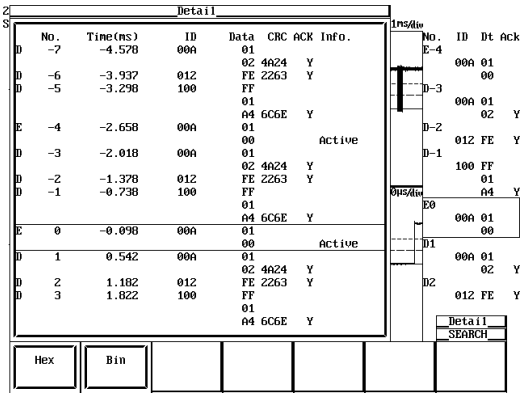
- Even if standard format and extended format are mixed in the analysis results list display, it is automatically detected.
- For items that were not analyzed due to an error detection within the frame, blank is displayed.

Detailed Analysis Results List Display

Details are displayed in the analysis results list on the right side of the screen. 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 -8000 and 8000.
- 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, 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 results list.



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

Note

The contents of the detailed analysis results list can be saved in ASCII format. For details, see section 1.7, “Saving Data from the Detailed Analysis Results List.”

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, “Time Axis Setting/Sample Rate/Record Length” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

Zoom Position (Z1 Position)

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

1.5 Performing Searches

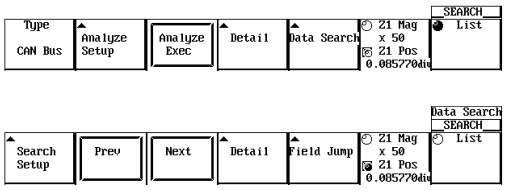
After analysis of the CAN Bus signal data acquired using the trigger function, you can search for data matching data from a specific frame or field, and search for indefinite data.

Operating Procedure

1. Perform analysis according to the procedure described in the previous section (1.4), “Performing the Analysis.”

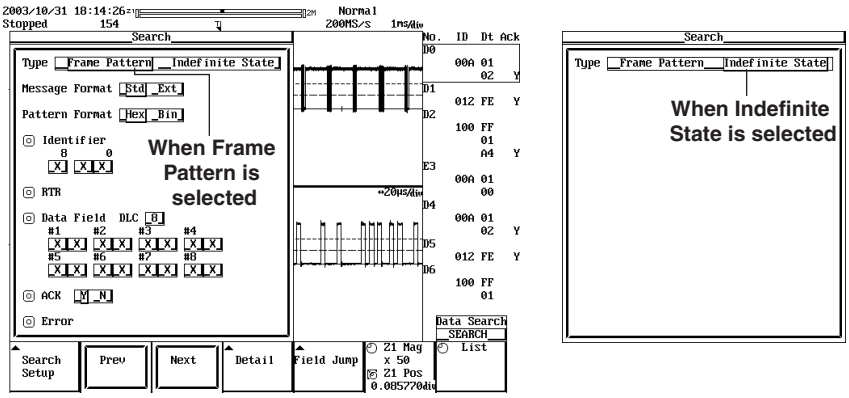
Setting the Search Conditions

2. Press the **Data Search** soft key, then the **Search Setup** soft key. The search condition settings dialog box is displayed.



Setting the Search Type

3. Turn the jog shuttle to move the cursor to **Type**.
4. Press **SELECT**, then select Frame Pattern or Indefinite State.



If you select Frame Pattern, proceed to step 5.
If you select Indefinite State, proceed to step 16.

Setting the Message Format

5. Turn the jog shuttle to move the cursor to Message Format.
6. Press **SELECT**, then select Std or Ext. The Identifier setting format changes to the selected format.

Setting the Pattern Format

7. Turn the jog shuttle to move the cursor to Pattern Format.
8. Press **SELECT**, then select Hex or Bin. The Identifier and Data Field setting format changes to the selected format.

Selecting the Field or Frame Type

9. Turn the jog shuttle to move the cursor to the field type or frame type to be used as a search condition. Select the field/frame type from Identifier, RTR, Data Field, ACK, and Error.
10. Press **SELECT** to turn the selected type ON.

Note

Multiple types 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.

- **Selecting Identifier for the Frame/Field Type**

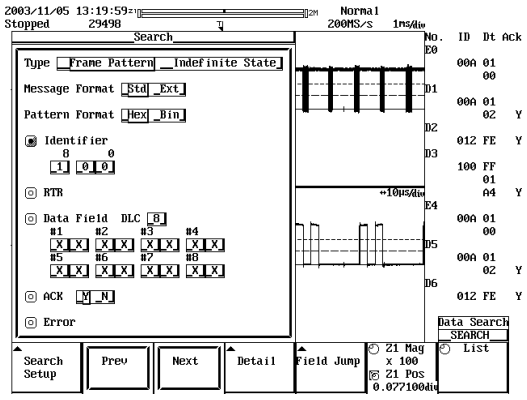
11. Turn the jog shuttle to move the cursor to the bit for which you wish to set the bit pattern and press **SELECT**.
12. If you selected Hex for Pattern Format in steps 7 and 8, turn the jog shuttle to select 0 to 9, A to F, or X, and press **SELECT**. Pressing **RESET** will reset the value to X (the initial value).
    If you selected Bin for Pattern Format, press **SELECT** to select 0, 1, or X.
    Go to step 16.

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

11. Turn the jog shuttle to move the cursor to DLC and press **SELECT**.
12. Turn the jog shuttle to set number of valid bytes to something between 1 and 8.
13. Press **SELECT**. The selected value is entered.
    Pressing **RESET** will reset the value to 8 k (the initial value).
14. Turn the jog shuttle to move the cursor to the bit for which you wish to set the bit pattern and press **SELECT**.
15. If you selected Hex for Pattern Format in steps 7 and 8, 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, press **SELECT** to select 0, 1, or X.
    Go to step 16.

- **Selecting ACK for the Frame/Field Type**

11. Turn the jog shuttle to move the cursor to the ACK selection frame.
12. Press **SELECT**, then select Y or N.
    Go to step 16.

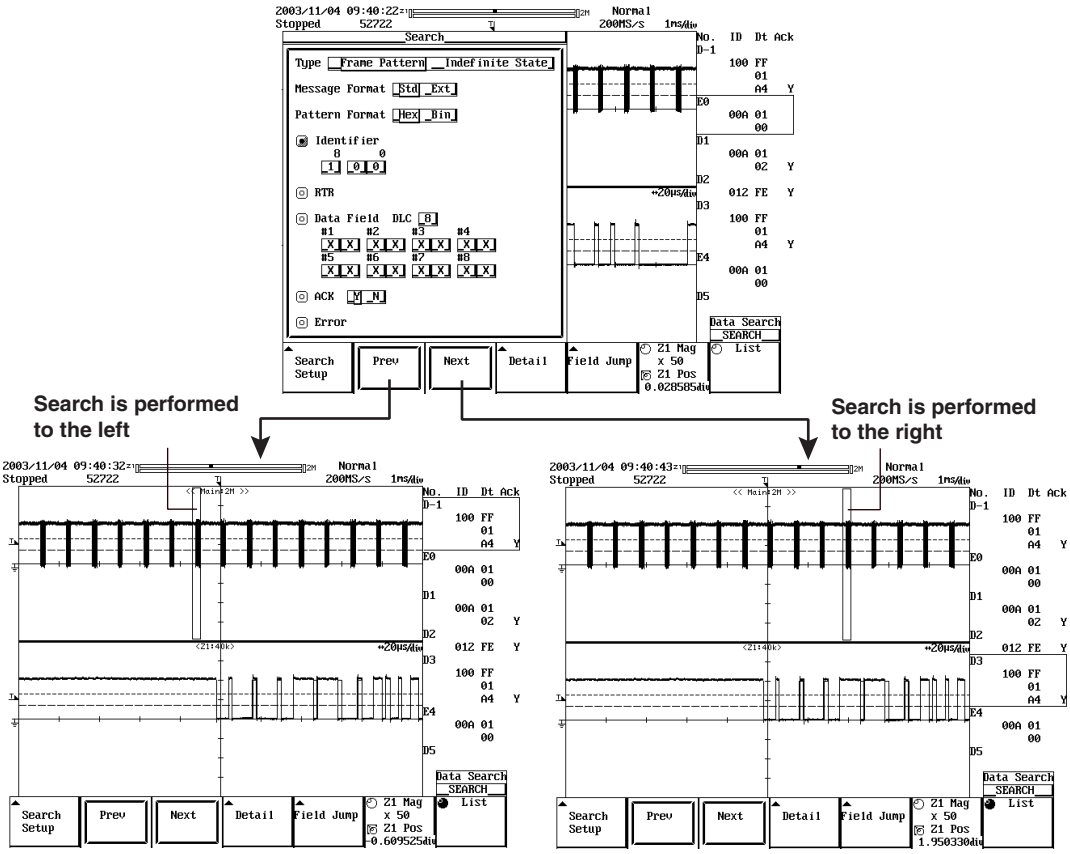


16. Press **ESC**.

Executing the Search

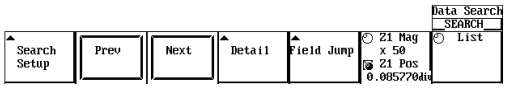
Executing the Search

17. Press the **Next** or **Prev** soft key. The search is executed to the right if Next is selected, and to the left if Prev is selected.

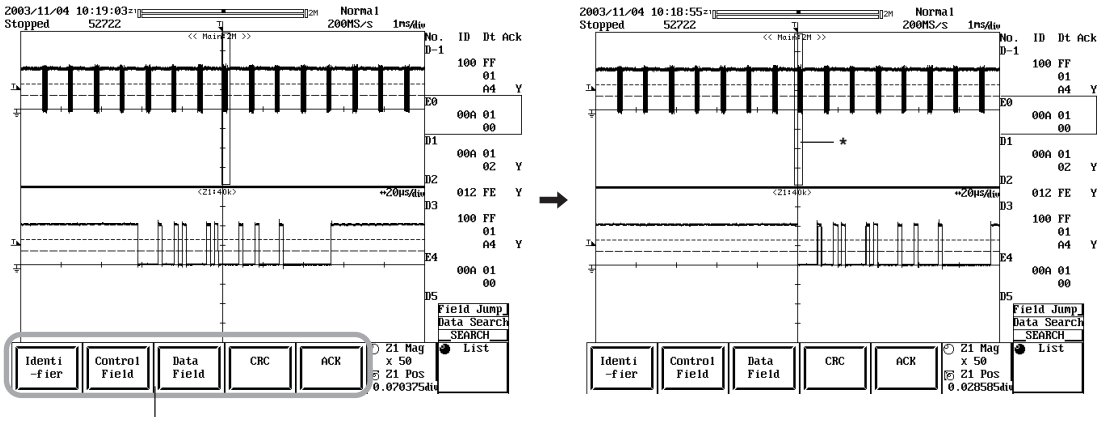


Jumping to a Specified Field (Field Jump)

18. Press the **Field Jump** soft key. The Field selection menu appears.



19. 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.



Select the field to jump to.

* The zoom position (Z1 Pos) moves to the front of the selected field.

Explanation
Setting the Search Conditions

There are two types of search, the pattern search and the indefinite data search. The former involves specifying a field or frame pattern and searching for that waveform, and the latter involves searching for indefinite data.
Pattern searches and indefinite data searches cannot be executed at the same time.

Pattern Search: Frame Pattern

You can search the waveform by specifying a field or frame pattern. When a waveform that matches the pattern is found, the Zoom Box moves to that point and displays the specified waveform.
When pattern searching for data including indefinite data, you can conduct the search such that the indefinite data is considered to be both in the 1 and 0 state (logical value).
When conducting a pattern search, set the following items.

- **Setting the 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)

- **Setting the Pattern Format**
  You can select a format for the Identifier (ID) field and the Data field from the following.
  Hex: Hexadecimal
  Bin: Binary

- **Selecting the Field or Frame Type**
  You can select the type of CAN Bus signal field pattern or frame to be used as search conditions from the following five types. 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 DL 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.

Indefinite Data Search (Indefinite State)

Searches for indefinite data.

Executing the Search

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**
    Pattern is not specified. The message, “Error code: 770” 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

1.6 Using Cursors

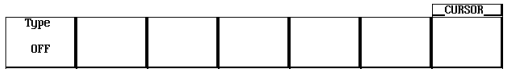
Cursor1 and Cursor2 can be moved per each CAN Bus bit rate (data transfer rate) while maintaining a bit rate of space between them. When analyzing or searching, CAN Bus signal waveform fields and frames can be checked while counting the number of bits.

Operating Procedure

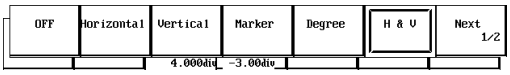
1. Press **Cursor**.

Selecting Cursor Types

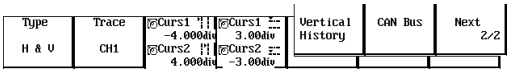
2. Press the **Type** soft key. The cursor type selection menu appears.



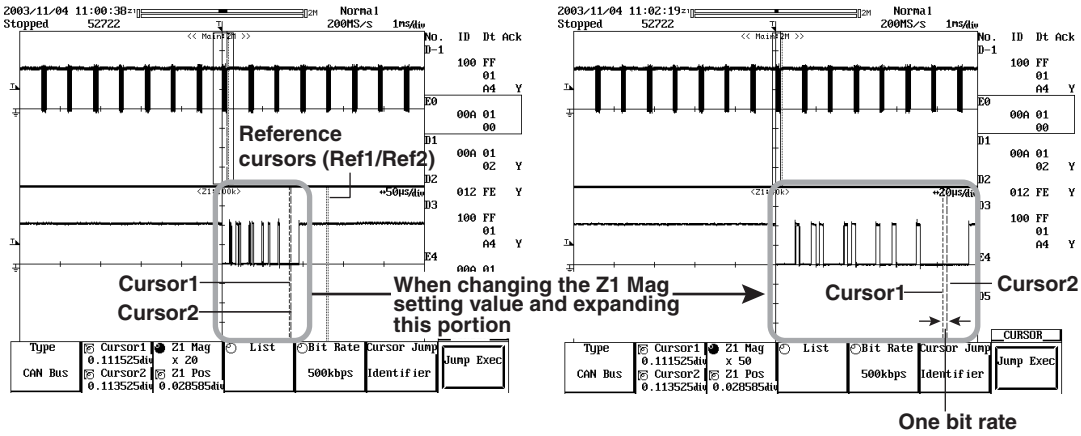
3. Press the **Next1/2** soft key to display the Next2/2 menu.



4. 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. (See step 4 below to set the bit rate.)
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 9.1, "Measuring Waveforms Using Cursors" in the DL1620/DL1640/DL1640L user's manual (IM701610-01E).

Setting the Bit Rate

5. If not changing the bit rate setting, proceed to step 6.
To change the bit rate setting, press the **Bit Rate** soft key and turn the jog shuttle to select Bit Rate.

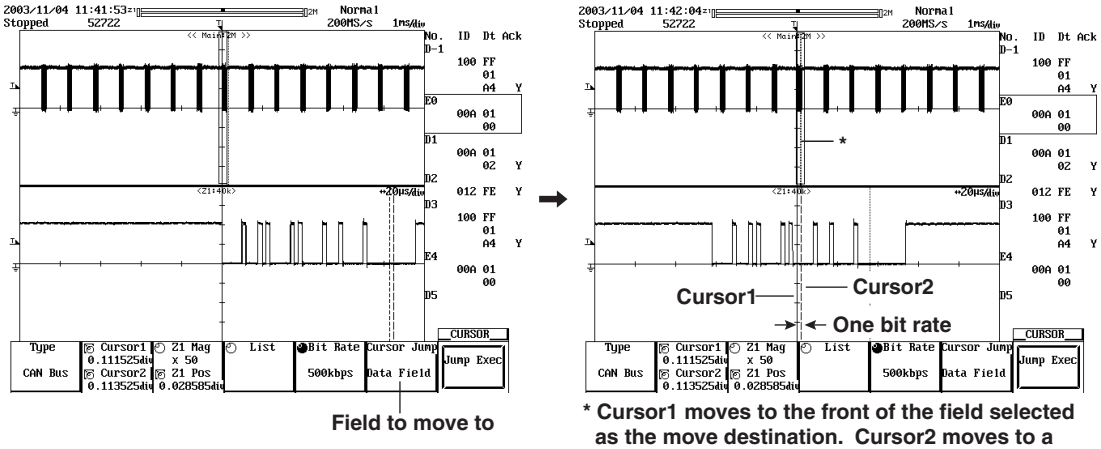
6. Turn the jog shuttle to select 1 M, 500 k, 250 k, 125 k, 100 k, 95.2 k, 83.3 k, 50 k, or 33.3 k [bps]. Cursor2 moves to a position one bit rate behind Cursor1.

Moving the Cursor to a Specified Field

7. Press the **Cursor Jump** soft key. The field selection screen appears.

8. Press the **SOF**, **Identifier**, **Control Field**, **Data Field**, **CRC**, or **ACK** soft key.

9. Press the **Jump Exec** soft key. Cursor1 moves to the front of the field selected in step 7, and Cursor2 moves to a position after Cursor1 that is one bit rate behind it.



Note

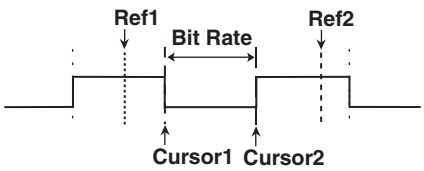
If you press the Jump Exec soft key when there is no data for analysis, the message, "No data for analysis. Execute analysis." (error code 779) appears.

10. Press the **Cursor1/Cursor2** soft key, then turn the jog shuttle to select Cursor1/ Cursor2.
11. Turn the jog shuttle to move Cursor1 and Cursor2. The cursors move while maintaining a bit rate of space between them.

Explanation

Selecting Cursor Types

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.



Setting the Bit Rate

You can select a data transfer rate for the CAN Bus data from the following.
1 M, 500 k, 250 k, 125 k, 100 k, 95.2 k, 83.3 k, 50 k, 33.3 k [bps]

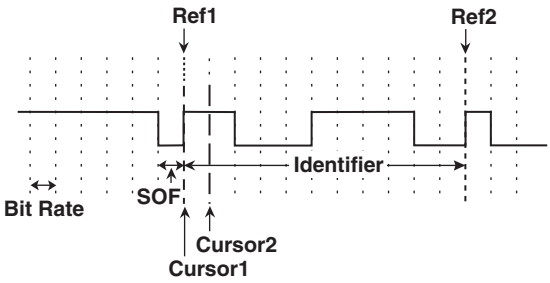
Note

The bit rate setting is connected with the trigger pattern setting dialog box (see page 1-5), and the analysis condition setting dialog box (see page 1-14).

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.

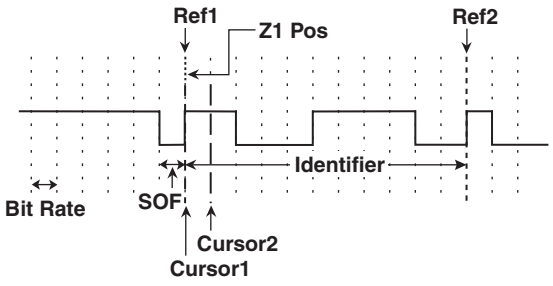
When Identifier is selected in the specified field



Note

- When analyzing the CAN bus signal with the trigger type set to Can Bus (see section 1.4, “Performing the Analysis”), 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, 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



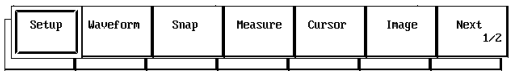
1.7 Saving Data from the Detailed Analysis Results List

The data from the detailed analysis results list can be saved in ASCII format.

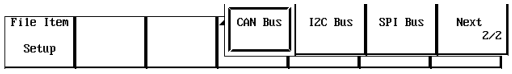
Operating Procedure

1. Press the **FILE** key.
2. Press the **File Item** soft key. The File Item menu appears.

3. Press the **Next 1/2** soft key.



4. Press the **CAN Bus** soft key. File Item changes to CAN Bus.

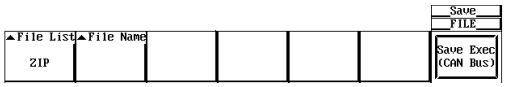


5. Press the **Save** soft key.

Setting the Save Destination

- **Selecting a Storage Medium**

6. Press the **File List** soft key. The File List box opens.

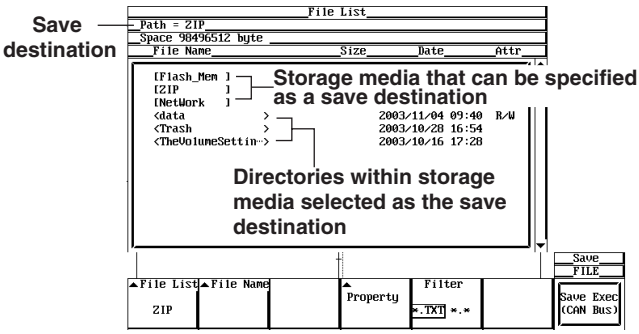


7. Turn the jog shuttle to select a storage medium. The storage media devices built-in to the instrument are displayed in brackets [ ].
8. Press **SELECT**. The contents of the selected storage media are displayed.

- **Selecting the Directory**

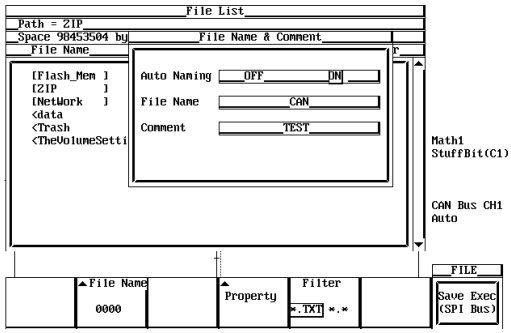
Perform these steps if the storage media selected in steps 6 through 8 have directories.

9. Turn the jog shuttle to select a save destination directory. The directories are displayed using angle brackets (< >).
10. Press **SELECT**. The directory selection is entered.
    If you select <.. >, the current directory changes to one directory higher.



Entering the File Name/Comment

11. Press the **File Name** soft key. The file name setting dialog box is displayed.



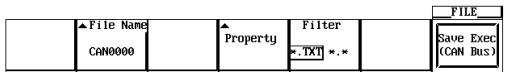
12. Turn the jog shuttle to move the cursor to **Auto Naming**.
13. Press **SELECT**, then select ON or OFF.
14. Turn the jog shuttle to move the cursor to File Name.
15. Press **SELECT**. The keyboard screen is displayed. Enter a file name of 16 characters or less. If Auto Naming was turned ON in step 13, the first twelve characters are valid.
16. Turn the jog shuttle to move the cursor to Comment.
17. Press **SELECT**. The keyboard screen is displayed. Enter a comment of 25 characters or less.
18. Press **ESC**.

Note

For details on operating the on-screen keyboard, see section 4.1, “Entering Values and Character Strings” in the DL1620/DL1640/DL1640L user’s manual IM701610-01E.

Executing the Save

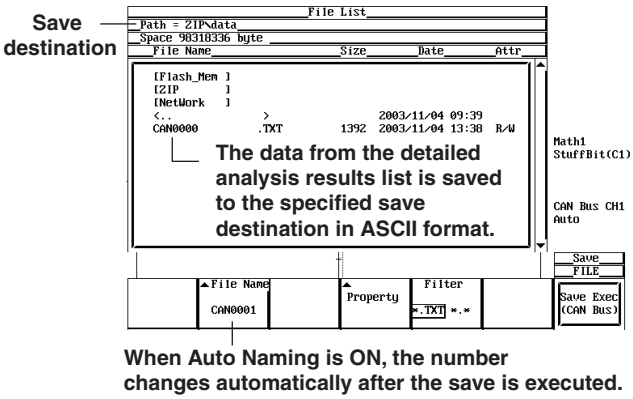
19. Press the **Save Exec** (CAN Bus) soft key. The image is saved.



At the same time, the Save Exec (CAN Bus) soft key changes to the Abort soft key.

To cancel saving, press the **Abort** soft key.

At the same time, the Abort soft key changes to the Save Exec (CAN Bus) soft key.



Explanation

Setting the Save Destination (File List)

- Selecting a Storage Medium
  The storage media that can be specified as the save destination are displayed in the File List. The storage media devices are displayed in brackets [ ].

Note

Storage Media Display Example

- [Flash_Mem]: Internal flash memory
- [PC_Card]: PC card
- [FD]: Floppy disk
- [ZIP]: ZIP disk
- [Network]: Network drive (when the Ethernet interface option is installed)
- [USB]: USB storage

- **Selecting the Directory**
  If the storage medium contains directories, you can specify a directory as the save destination. The directories are displayed using angle brackets (< >). If you select <.. >, the current directory changes to one directory higher.

  The save destination is displayed as a path in the upper left portion of the File List box.
  Example: Path=ZIP_data
  The data directory on the Zip disk is specified as the save destination.

  The save destination can be displayed by choosing the FILE > Save > File List soft keys. However, after changing the save destination in the File List box, if you do not press the ESC key once, the changed save destination is not reflected in the File List soft key.

Entering the File Name/Comment

- **Auto Naming Function**
  If Auto Naming is turned ON, files with a four-digit number from 0000 to 2399 can be automatically created when saving the screen data. You can specify a common name (up to twelve characters, specified through File Name) that is placed before the number.

Note

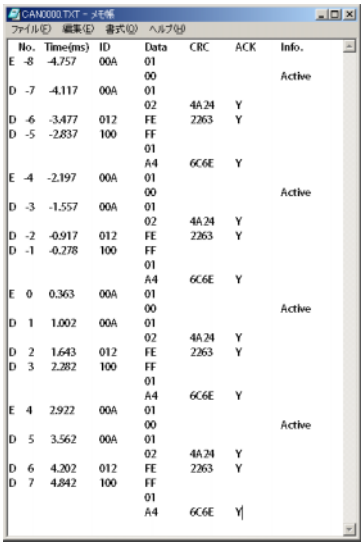
You can enter up to sixteen characters for the common name, but only the first four characters are used.

- **Entering the File Name/Comment**
  - You must enter a file name. If you execute a save without entering a file name, the message “Invalid input file name. Please check the file name.” (error code 601) appears. Also, you cannot save a file having the same name as another file existing in the same directory (overwriting not allowed).
  - You do not necessarily have to enter a comment.

Executing the Save

When you execute a save, the data from the detailed analysis results list is saved to the specified save destination in ASCII format. The extension is .txt.

Example of Saving



CAN0000.TXT - メモ帳

ファイル(F) 編集(E) 書式(O) ヘルプ(H)

	No.	Time(ms)	ID	Data	CRC	ACK	Info.
E	-8	-4.757	00A	01			
				00			Active
D	-7	-4.117	00A	01			
				02	4A24	Y	
D	-6	-3.477	012	FE	2263	Y	
D	-5	-2.837	100	FF			
				01			
				A4	6C6E	Y	
E	-4	-2.197	00A	01			
				00			Active
D	-3	-1.557	00A	01			
				02	4A24	Y	
D	-2	-0.917	012	FE	2263	Y	
D	-1	-0.278	100	FF			
				01			
				A4	6C6E	Y	
E	0	0.363	00A	01			
				00			Active
D	1	1.002	00A	01			
				02	4A24	Y	
D	2	1.643	012	FE	2263	Y	
D	3	2.282	100	FF			
				01			
				A4	6C6E	Y	
E	4	2.922	00A	01			
				00			Active
D	5	3.562	00A	01			
				02	4A24	Y	
D	6	4.202	012	FE	2263	Y	
D	7	4.842	100	FF			
				01			
				A4	6C6E	Y	

Notes When Saving

- The maximum number of files that can be saved when auto naming is enabled is 2400.
- If the total number of files and directories exceed 5000 in a single directory, the contents of the file list are no longer displayed.

1.8 Error Messages

A message may appear on the screen during operation. This section describes the meanings of the messages and their corrective actions. Only the error messages related to the CAN Bus signal analysis function are listed here. Other messages for the main unit and communication functions may also appear. For information about those messages, see the DL1620/DL1640/DL1640L user's manual (IM701610-01E) and the DL1620/LD1640/DL1640L communication interface user's manual (IM701610-17E).
You can select to display messages in either Japanese, English, or Chinese. For details on the selecting the message language, see section 14.2, "Changing the Message Language and Click Sound" in the DL1620/DL1640/DL1640L user's manual (IM701610-01E).
If servicing is required, contact your nearest YOKOGAWA dealer.

Code	Message	Corrective Action	Page
27	Executed the search, but no record was found that matched the pattern.	-	1-23, 1-26
37	Aborted the analysis.	-	-
38	Data not detected. Execute again after changing the settings or reacquiring the waveform.	-	1-5, 1-9, 1-14, 1-17
39	The corresponding field was not found.	-	-
40	The frame contains indefinite data (greater than Thr Lower but less than Thr Upper).	-	1-16, 1-18, 1-20, 1-26
744	Cannot be executed while running.	Stop the operation.	Section 4.5 in IM701610-01E
770	Pattern is not specified.	Set at least one ssearch pattern not to X.	1-23, 1-26
779	Analyzed data does not exist. Execute the analysis.	Execute the analysis.	1-15, 1-20
931	Computation can be carried out at the current record length.	Either decrease the record length, or turn stuff bit computation OFF.	Section 7.1 in IM701610-01E, 1-15, 1-18
950	Cannot be specified. Invalid byte or bit.	Increase the number of data bytes.	1-7, 1-11

1.9 Communication Commands

Only the communication commands related to the CAN Bus signal analysis function are listed here. For communication commands other than those pertaining to the CAN Bus signal analysis function for the DL1620/DL1640/DL160L, see the DL1620/DL1640/DL1640L communication interface user's manual (IM701610-17E).

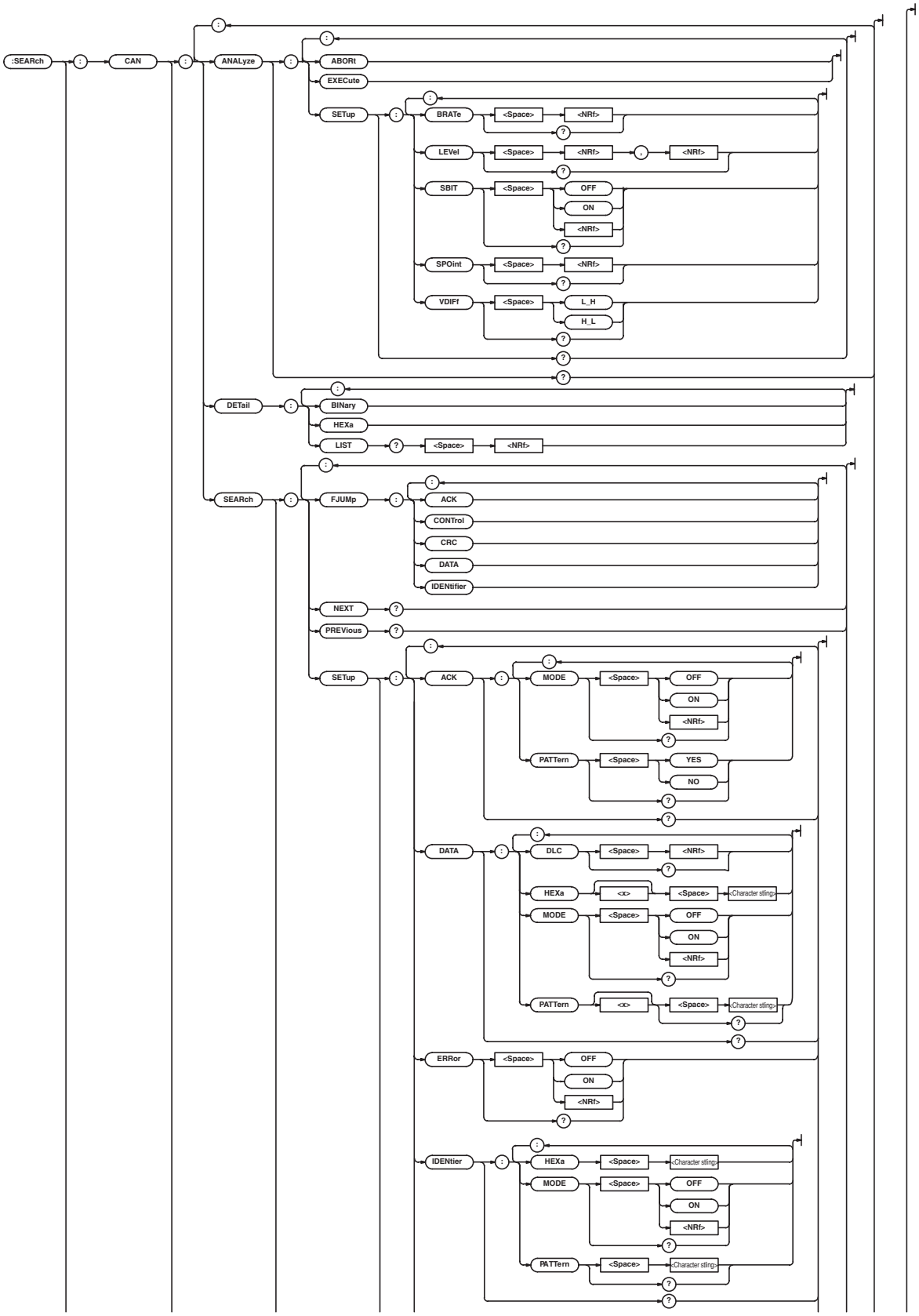
Command	Function	Page
CAN Analyze Group		
:SEARch:CAN?	Query all analysis* function settings.	1-39
:SEARch:CAN:ANALyze?	Query all analysis* execution setting values.	1-39
:SEARch:CAN:ANALyze:ABORt	Abort analysis*.	1-39
:SEARch:CAN:ANALyze:EXECute	Execute analysis*.	1-39
:SEARch:CAN:ANALyze:SETup?	Query all analysis* condition setting values.	1-39
:SEARch:CAN:ANALyze:SETup:BRATe	Enter or query the CAN bus transfer rate in the analysis* conditions.	1-39
:SEARch:CAN:ANALyze:SETup:LEVel	Enter or query the threshold in the analysis* conditions.	1-39
:SEARch:CAN:ANALyze:SETup:SBIT	Enter or query settings indicating whether stuff bit computation is ON (1) or OFF (0) in the analysis* conditions.	1-40
:SEARch:CAN:ANALyze:SETup:SPOint	Enter or query the sample point in the analysis* conditions.	1-40
:SEARch:CAN:ANALyze:SETup:VDIFf	Enter or query Vdiff in the analysis* conditions.	1-40
:SEARch:CAN:DETail:BINary	Display the Data Field values from the detailed analysis list for the analysis* results in binary .	1-40
:SEARch:CAN:DETail:HEXa	Display the Data Field values from the detailed analysis list for the analysis* results in hexadecimal.	1-40
:SEARch:CAN:DETail:LIST?	Output 1 frame's worth of analysis* results as a string.	1-40
:SEARch:CAN:SEARch?	Query all analysis* results search settings.	1-40
:SEARch:CAN:SEARch:FJUMp:ACK	Execute field jump to the ACK Field in the analysis* results.	1-40
:SEARch:CAN:SEARch:FJUMp:CONTrol	Execute field jump to the Control Field in the analysis* results.	1-40
:SEARch:CAN:SEARch:FJUMp:CRC	Execute field jump to the CRC Field in the analysis* results.	1-40
:SEARch:CAN:SEARch:FJUMp:DATA	Execute field jump to the Data Field in the analysis* results.	1-40
:SEARch:CAN:SEARch:FJUMp:IDENtifier	Execute field jump to an Identifier in the analysis* results.	1-40
:SEARch:CAN:SEARch:NEXT?	Execute a Next search of the analysis* results and query the frame number found.	1-41
:SEARch:CAN:SEARch:PREVious?	Execute a Previous search of the analysis* results and query the frame number found.	1-41
:SEARch:CAN:SEARch:SETup?	Query all analysis* results search settings.	1-41
:SEARch:CAN:SEARch:SETup:ACK?	Query all ACK setting values for pattern searches of the analysis* results.	1-41
:SEARch:CAN:SEARch:SETup:ACK:MODE	Enter or query the setting indicating whether ACK was done (1) or not done (0) for analysis* results pattern searches.	1-41
:SEARch:CAN:SEARch:SETup:ACK:PATTern	Enter or query the ACK pattern (YES/NO) for analysis* results pattern searches.	1-41
:SEARch:CAN:SEARch:SETup:DATA?	Query all Data Field setting values for analysis* results pattern searches.	1-41
:SEARch:CAN:SEARch:SETup:DATA:DLC	Enter or query the number of bytes (DLC) for analysis* results pattern searches.	1-41
:SEARch:CAN:SEARch:SETup:DATA:HEXa<x>	Enter hexadecimal settings for each byte of the Data Field search patterns of analysis* results.	1-41
:SEARch:CAN:SEARch:SETup:DATA:MODE	Enter or query the setting indicating whether data field was done (1) or not done (0) for analysis* results pattern searches.	1-42
:SEARch:CAN:SEARch:SETup:DATA:PATTern<x>	Enter settings in binary for each byte of the Data Field search patterns of analysis* results.	1-42
:SEARch:CAN:SEARch:SETup:ERRor	Enter or query the setting indicating whether Error was found (1) or was not found (0) in analysis* results pattern searches.	1-42
:SEARch:CAN:SEARch:SETup:IDENtifier?	Query all Identifier setting values for analysis* results pattern searches.	1-42
:SEARch:CAN:SEARch:SETup:IDENtifier:HEXa	Enter the Identifier search pattern for analysis* results pattern searches in hexadecimal.	1-42

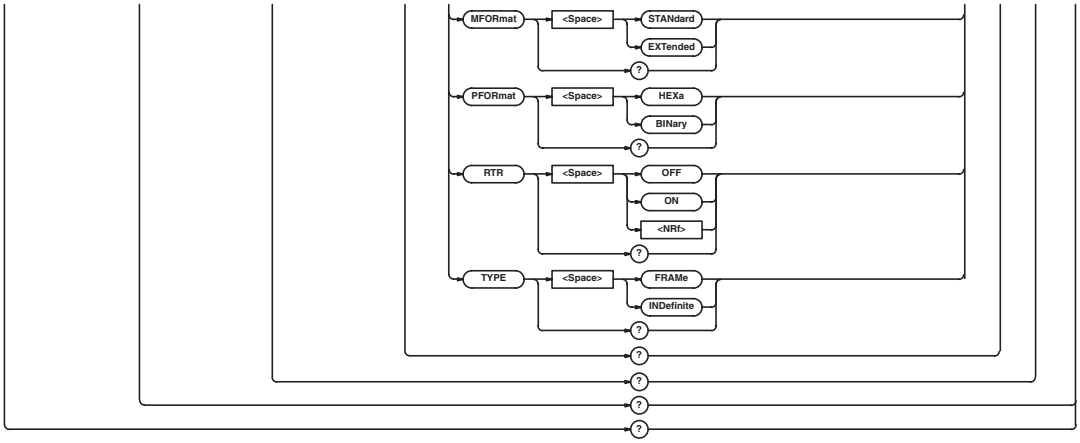
Command	Function	Page
:SEARch:CAN:SEARch:SETup:IDENtifier:MODE		
	Enter or query the setting indicating whether Identifier is used (1) or not used (0) in analysis* results pattern searches.	1-42
:SEARch:CAN:SEARch:SETup:IDENtifier:PATTern		
	Enter the Identifier search pattern for analysis* results pattern searches in binary.	1-42
:SEARch:CAN:SEARch:SETup:MFORmat	Enter or query the message format for analysis* results pattern searches.	1-42
:SEARch:CAN:SEARch:SETup:PFORmat	Enter or query the setting format for analysis* results pattern searches.	1-42
:SEARch:CAN:SEARch:SETup:RTR	Enter or query the setting indicating whether analysis* results pattern searches are performed by data frame (0) or by remote frame (1).	1-43
:SEARch:CAN:SEARch:SETup:TYPE	Enter or query the setting indicating whether to perform a CAN analysis results pattern search or an indefinite data search.	1-43
CAN File Group		
:FILE:SAVE:CAN:ABORt	Canceling Saving of Data from the Detailed Analysis Results List.	1-44
:FILE:SAVE:CAN:EXECute	Saving Data from the Detailed Analysis Results List (Overlap Command).	1-44
CAN Trigger Group		
:TRIGger:CAN?	Query all trigger* function settings.	1-46
:TRIGger:CAN:BRATe	Enter or query bit rate in the trigger* conditions.	1-46
:TRIGger:CAN:DATA?	Query all Data Field setting values in trigger* conditions.	1-46
:TRIGger:CAN:DATA:CONDition	Enter or query the Data Field condition in trigger* conditions.	1-46
:TRIGger:CAN:DATA:DLC	Enter or query settings for the Data Field's number of data bytes (DLC) in trigger* conditions.	1-46
:TRIGger:CAN:DATA:HEXa<x>	Enter byte-by-byte hexadecimal settings for the Data Field pattern in trigger* conditions.	1-46
:TRIGger:CAN:DATA:MODE	Enter or query settings indicating whether trigger activates on the Data Field in the trigger* conditions.	1-47
:TRIGger:CAN:DATA:PATTern<x>	Enter or query Data Field pattern settings in binary in trigger* conditions.	1-47
:TRIGger:CAN:EFRame	Enter or query settings indicating whether trigger activates on the Error Frame in the trigger* conditions.	1-47
:TRIGger:CAN:IDENtifier?	Query all Identifier setting values in trigger* conditions.	1-47
:TRIGger:CAN:IDENtifier:CONDition	Enter or query settings for Identifier conditions in trigger* conditions	1-47
:TRIGger:CAN:IDENtifier:ID<x>?	Query all Identifier ID<x> settings in trigger* conditions.	1-47
:TRIGger:CAN:IDENtifier:ID<x>:HEXa	Enter hexadecimal settings for the pattern of the Identifier ID<x> in CAN trigger conditions.	1-47
:TRIGger:CAN:IDENtifier:ID<x>:MODE	Enter or query the setting indicating whether trigger activates (1) or does not activate (0) on the Identifier ID<x> in trigger* conditions.	1-47
:TRIGger:CAN:IDENtifier:ID<x>:PATTern		
	Enter or query settings in binary for the pattern of the Identifier ID<x> in CAN trigger conditions.	1-47
:TRIGger:CAN:IDENtifier:MODE	Enter or query settings indicating whether trigger activates (1) or does not activate (0) on the Identifier Field in the trigger* conditions.	1-48
:TRIGger:CAN:MFORmat	Enter or query the message format in the trigger* conditions.	1-48
:TRIGger:CAN:PFORmat	Enter or query the setting format for the trigger pattern in the trigger* conditions.	1-48
:TRIGger:CAN:RTR	Enter or query settings indicating whether the trigger activates on a data frame (0) or remote frame (1) in the trigger* conditions.	1-48
:TRIGger:CAN:SOFRame	Enter or query settings indicating whether trigger activates (1) or does not activate (0) on Start of Frame in the trigger* conditions.	1-48
:TRIGger:CAN:SPOint	Enter or query the Sample Point in the trigger* conditions.	1-48
:TRIGger:CAN:VDIFf	Enter or query Vdiff in the trigger* conditions.	1-48

* In the description of command functions throughout this section, CAN Bus signal analysis function has been abbreviated as analysis. Trigger of the CAN Bus signal analysis function has been abbreviated as trigger.

CAN Analyze Group

The CAN Analyze group lets you perform settings and queries in the same manner as the SHIFT + ZOOM key combination on the front panel.





:SEARch:CAN?

Function Query all analysis function settings.

Syntax `:SEARch:CAN?`

Example
```
:SEARch:CAN? -> :SEACH:CAN:ANALYZER:
SETUP: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;DLC8;
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:ANALyze?

Function Query all analysis execution settings.

Syntax `:SEARch:CAN:ANALyze?`

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

:SEARch:CAN:ANALyze:ABORt

Function Abort analysis execution.

Syntax `:SEARch:CAN:ANALyze:ABORt`

Example `:SEARch:CAN:ANALyze:ABORt`

:SEARch:CAN:ANALyze:EXECute

Function Execute analysis.

Syntax `:SEARch:CAN:ANALyze:EXECute`

Example `:SEARch:CAN:ANALyze:EXECute`

:SEARch:CAN:ANALyze:SETup?

Function Query all CAN analysis conditions setting values.

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

Example
```
:SEARch:CAN:ANALyze:SETup? ->
:SEARCH:CAN:ANALYZE:SETUP: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 Enter or query the CAN bus transfer rate in the analysis conditions.

Syntax
```
:SEARch:CAN:ANALyze:SETup:BRATe
{<NRf>}
:SEARch:CAN:ANALyze:SETup:BRATe?
<NRf>=33300,50000,83300,95200,100000,125000,
250000,500000,1000000
```

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 Enter or query the threshold in the analysis conditions.

Syntax
```
:SEARch:CAN:ANALyze:SETup:LEVel
{<Voltage>,<Voltage>|<Current>,<Current>}
:SEARch:CAN:ANALyze:SETup:LEVel?
```

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
```

:SEARch:CAN:ANALyze:SETup:SBIT

Function Enter or query settings indicating whether stuff bit computation is ON (1) or OFF (0) in the analysis conditions.

```
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:SPOint

Function Enter or query the sample point in the analysis conditions.

```
Syntax  :SEARch:CAN:ANALyze:SETup
        :SPOint {<NRf>}
        :SEARch:CAN:ANALyze:SETup:SPOint?
        <NRf>=18.8-90.6
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 Enter or query the Vdiff (CAN_L-CAN_H/CAN_H-CAN_L) in the analysis conditions.

```
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 Display the Data Field values in the detailed analysis list for the analysis results in binary.

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

:SEARch:CAN:DETail:HEXa

Function Display the Data Field values in the detailed analysis list for the analysis results in hexadecimal.

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

:SEARch:CAN:DETail:LIST?

Function Output 1 frame's worth of analysis results as a string.

```
Syntax  :SEARch:CAN:DETail:LIST? {<NRf>}
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 Query all analysis results search settings.

```
Syntax  :SEARch:CAN:SEARch?
Example :SEARch:CAN:SEARch? ->
        :SEARCH:CAN:SEARCH:SETUP:TYPE FRAME;
        MFORMAT STANDARD;PFORMATHEXA;
        IDENTIFIER:MODE 0;
        PATTERN"XXXXXXXXXXX";:SEARCH:CAN:
        SEARCH:SETUP:RTR 0;DATA:MODE 0;DLC8;
        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:FJUMp:ACK

Function Execute field jump to the ACK Field in the analysis results.

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

:SEARch:CAN:SEARch:FJUMp:CONTrol

Function Execute field jump to the Control Field in the analysis results.

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

:SEARch:CAN:SEARch:FJUMp:CRC

Function Execute field jump to the CRC Field in the analysis results.

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

:SEARch:CAN:SEARch:FJUMp:DATA

Function Execute field jump to the Data Field in the analysis results.

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

:SEARch:CAN:SEARch:FJUMp:IDENtifier

Function Execute field jump to an Identifier in the analysis results.

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

:SEARch:CAN:SEARch:NEXT?

Function Execute a Next search of the analysis results and query the frame number found.

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

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

:SEARch:CAN:SEARch:PREVious?

Function Execute a Previous search of the analysis results and query the frame number found.

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

Example `:SEARch:CAN:SEARch:PREVious? -> -1`

:SEARch:CAN:SEARch:SETup?

Function Query all analysis results search settings.

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

Example

```
:SEARch:CAN:SEARch:SETup? ->
:SEARCH:CAN:SEARCH:SETUP:TYPE FRAME;
MFORMATSTANDARD;PFORMAT HEXA;
IDENTIFIER:MODE0;PATTERN“XXXXXXXXXX”;:
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:SETup:ACK?

Function Query 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 Enter or query the active (1) or inactive (0) setting for analysis results pattern searches.

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 Enter or query the ACK search pattern (YES/NO) for analysis results.

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 Query all Data Field setting values for analysis results pattern searches.

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 Enter or query the data length (DLC) for analysis results pattern searches.

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 Enter byte-by-byte hexadecimal settings for Data Field search patterns of analysis results.

Syntax

```
:SEARch:CAN:SEARch:SETup:DATA:
HEXa<x> {<Character string>}
<x>=0-8
```

Example

```
:SEARch:CAN:SEARch:SETup:DATA:HEXa1
“A3”
```

:SEARch:CAN:SEARch:SETup:DATA:MODE

Function Enter or query the setting indicating whether data field was done (1) or not done (0) for analysis* results pattern searches.

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 Enter byte-by-byte settings in binary for Data Field search patterns of analysis results.

Syntax
```
:SEARch:CAN:SEARch:SETup:DATA:PATTern<x> {<Character string>}
:SEARch:CAN:SEARch:SETup:DATA:PATTern<x>?
<x>=0-8
```

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 Enter or query the setting indicating whether Error is active (1) or inactive (0) in analysis results pattern searches.

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 Query 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 Enter the Identifier search pattern for analysis results in hexadecimal.

Syntax
```
:SEARch:CAN:SEARch:SETup:IDENtifier:HEXa {<Character string>}
```

Example
```
:SEARch:CAN:SEARch:SETup:IDENtifier:HEXa “7FF”
```

:SEARch:CAN:SEARch:SETup:IDENtifier:MODE

Function Enter or query the setting indicating whether Identifier is active (1) or inactive (0) in analysis results pattern searches.

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 Enter the Identifier search pattern for analysis results in binary.

Syntax
```
:SEARch:CAN:SEARch:SETup:IDENtifier:PATTern {<Character string>}
:SEARch:CAN:SEARch:SETup:IDENtifier:PATTern?
```

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 Enter or query the message format (Standard/Extended) in the analysis results.

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 Enter or query the setting format for analysis results pattern searches.

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 Enter or query the setting indicating whether analysis results pattern searches are performed by data frame (0) or by remote frame (1).

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

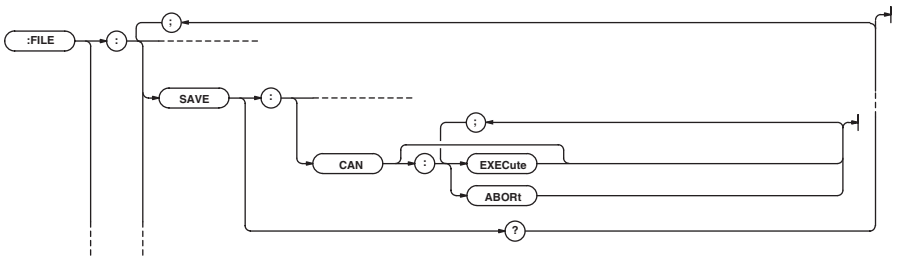
Function Enter or query the setting indicating whether to perform a analysis results pattern search or an indefinite data search.

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
```

CAN File Group

The CAN File group lets you execute/cancel saving of data from the CAN Bus signal detailed analysis results list in the same manner as when using the FILE key on the front panel.



:FILE:SAVE:CAN:ABORt

Function Canceling Saving of Data from the Detailed Analysis Results List.

Syntax `:FILE:SAVE:CAN:ABORt`

Example `:FILE:SAVE:CAN:ABORt`

:FILE:SAVE:CAN:EXECute

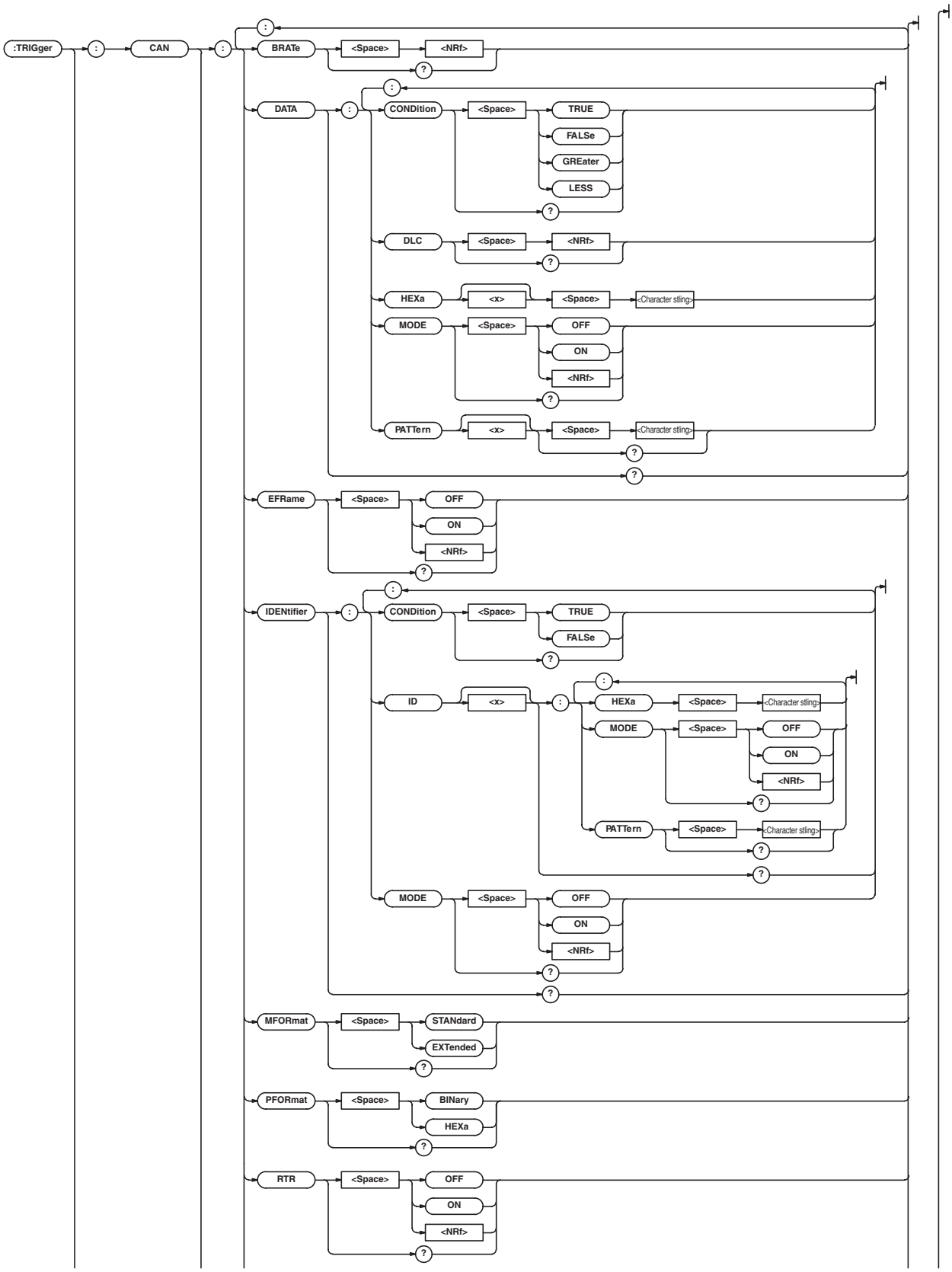
Function Saving Data from the Detailed Analysis Results List (Overlap Command).

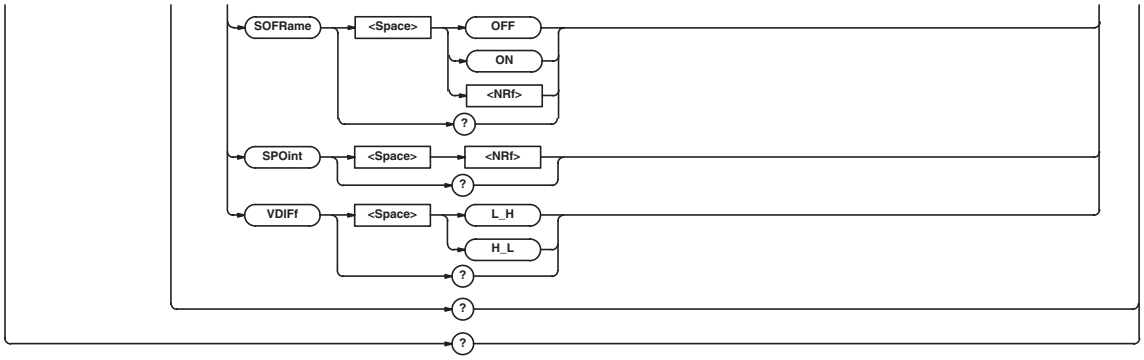
Syntax `:FILE:SAVE:CAN:EXECute`

Example `:FILE:SAVE:CAN:EXECute`

CAN Trigger Group

The CAN Trigger group lets you perform trigger settings and queries in the same manner as when using the ENHANCED key on the front panel.





:TRIGger:CAN?

Function Query all trigger function settings.

```
Syntax   :TRIGger:CAN?
Example  :TRIGger:CAN? -> :TRIGGER:CAN:BRATE
         500.0E+03;SPOINT 62.5;MFORMAT
         STANDARD;VDIFF L_H;PFORMAT
         HEXA;SOFRAME 0;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:RTR 0;DATA:MODE 1;DLC 6;
         PATTERN1 “10X10X10”;
         PATTERN2 “XXXXXXXX”;
         PATTERN3 “XXXXXXXX”;
         PATTERN4 “XXXXXXXX”;
         PATTERN5 “XXXXXXXX”;
         PATTERN6 “11111111”;
         PATTERN7 “XXXXXXXX”;
         PATTERN8 “XXXXXXXX”;
         CONDITION FALSE;:TRIGGER:CAN:EFRAME
         1
```

:TRIGger:CAN:BRATe

Function Enter or query bit rate in the trigger conditions.

```
Syntax   :TRIGger:CAN:BRATe {<NRf>}
TRIGger  :CAN:BRATe? ->
         <NRf>=33300,50000,83300,95200,100000,125000,
         250000,500000,1000000
Example  :TRIGger:CAN:BRATe 500000
         TRIGger:CAN:BRATe? ->
         :TRIGGER:CAN:BRATE 500.0E+03
```

:TRIGger:CAN:DATA?

Function Query all Data Field setting values in 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 Enter or query the Data Field condition (True/False/Greater/Less) in trigger conditions.

```
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 Enter or query settings for the Data Field’s number of data bytes (DLC) in trigger conditions.

```
Syntax   :TRIGger:CAN:DATA:DLC {<NRf>}
         :TRIGger:CAN:DATA:DLC?
         <NRf>=1-8
Example  :TRIGger:CAN:DATA:DLC 6
         :TRIGger:CAN:DATA:DLC? ->
         :TRIGGER:CAN:DATA:DLC 6
```

:TRIGger:CAN:DATA:HEXa<x>

Function Enter hexadecimal settings for each byte of the Data Field pattern in trigger conditions.

```
Syntax   :TRIGger:CAN:DATA:HEXa<x>
         {<Character string>}
         <x>=1-8
Example  :TRIGger:CAN:DATA:HEXa1 “A3”
```

:TRIGger:CAN:DATA:MODE

Function Enter or query settings indicating whether trigger activates on the Data Field in the trigger conditions.

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 Enter hexadecimal settings for each byte of the Data Field pattern in trigger conditions.

Syntax
```
:TRIGger:CAN:DATA:PATTern<x>
{<Character string>}
:TRIGger:CAN:DATA:PATTern<x>?
<x>=1-8
```

Example
```
:TRIGger:CAN:DATA:PATTern1
“10X10X10”
:TRIGger:CAN:DATA:PATTern1? ->
:TRIGGER:CAN:DATA:PATTERN1
“10X10X10”
```

:TRIGger:CAN:EFRame

Function Enter or query settings indicating whether trigger activates on the Data Field in the trigger conditions.

Syntax
```
:TRIGger:CAN:EFRame {<Boolean>}
:TRIGger:CAN:EFRame?
```

Example
```
:TRIGger:CAN:EFRame 1
:TRIGger:CAN:EFRame? ->
:TRIGGER:CAN:EFRAME 1
```

:TRIGger:CAN:IDENtifier?

Function Query all Identifier setting values in trigger conditions.

Syntax
```
:TRIGger:CAN:IDENtifier?
```

Example
```
:TRIGger:CAN:IDENtifier? ->
:TRIGGER:CAN:IDENTIFIER:MODE
1;CONDITION FALSE;ID1:MODE 1;
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 Enter or query the Identifier Field condition (True/False) in trigger conditions.

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 Query all Identifier ID<x> settings in trigger conditions.

Syntax
```
:TRIGger:CAN:IDENtifier:ID<x>?
<x>=1-4
```

Example
```
:TRIGger:CAN:IDENtifier:ID1? ->
:TRIGGER:CAN:IDENTIFIER:ID1:MODE
1;PATTERN “11111101100”
```

:TRIGger:CAN:IDENtifier:ID<x>:HEXa

Function Enter hexadecimal settings for the pattern of the Identifier ID<x> in trigger conditions.

Syntax
```
:TRIGger:CAN:IDENtifier:ID<x>:
HEXa {<Character string>}
<x>=1-4
```

Example
```
:TRIGger:CAN:IDENtifier:ID1:HEXa
“7FF”
```

:TRIGger:CAN:IDENtifier:ID<x>:MODE

Function Enter or query the setting indicating whether trigger activates (1) or does not activate (0) on the Identifier ID<x> in CAN trigger conditions.

Syntax
```
:TRIGger:CAN:IDENtifier:ID<x>:MODE
{<Boolean>}
:TRIGger:CAN:IDENtifier:ID<x>:MODE?
<x>=1-4
```

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 Enter or query settings in binary for the pattern of the Identifier ID<x> in trigger conditions.

Syntax
```
:TRIGger:CAN:IDENtifier:ID<x>:PATTern
{<Character string>}
:TRIGger:CAN:IDENtifier:ID<x>:
PATTern?
<x>=1-4
```

Example
```
:TRIGger:CAN:IDENtifier:ID1:PATTern
“10X10X10X10”
:TRIGger:CAN:IDENtifier:ID1:PATTern?
-> :TRIGGER:CAN:IDENTIFIER:ID1:
PATTERN “10X10X10X10”
```

:TRIGger:CAN:IDENtifier:MODE

Function Enter or query settings indicating whether trigger activates (1) or does not activate (0) on the Identifier in the trigger conditions.

```
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 Enter or query the message format (Standard/Extended) in the trigger conditions.

```
Syntax   :TRIGger:CAN:MFORmat {STANdard/
         EXTended}
         :TRIGger:CAN:MFORmat?
Example  :TRIGger:CAN:MFORmat EXTended
         :TRIGger:CAN:MFORmat? ->
         :TRIGGER:CAN:MFORMAT EXTENDED
```

:TRIGger:CAN:PFORmat

Function Enter or query the setting format for the trigger pattern in the trigger conditions.

```
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 Enter or query settings indicating whether the trigger activates on a data frame (0) or remote frame (1) in the trigger conditions.

```
Syntax   :TRIGger:CAN:RTR {<Boolean>}
         :TRIGger:CAN:RTR?
Example  :TRIGger:CAN:RTR 1
         :TRIGger:CAN:RTR? ->
         :TRIGGER:CAN:RTR 1
```

:TRIGger:CAN:SOFRame

Function Enter or query settings indicating whether trigger activates (1) or does not activate (0) on Start of Frame in the trigger conditions.

```
Syntax   :TRIGger:CAN:SOFRame {<Boolean>}
         :TRIGger:CAN:SOFRame?
Example  :TRIGger:CAN:SOFRame 1
         :TRIGger:CAN:SOFRame? ->
         :TRIGGER:CAN:SOFRAME 1
```

:TRIGger:CAN:SPOint

Function Enter or query the Sample Point in the trigger conditions.

```
Syntax   :TRIGger:CAN:SPOint {<NRf>}
         :TRIGger:CAN:SPOint?
         <NRf>=18.8-90.6
Example  :TRIGger:CAN:SPOint 78.1
         :TRIGger:CAN:SPOint? ->
         :TRIGGER:CAN:SPOINT 78.1
```

:TRIGger:CAN:VDIFf

Function Enter or query Vdiff in the trigger conditions.

```
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
```

2.1 Overview of the SPI Bus Signal Analysis Function

About the SPI Bus Signal Analysis Function

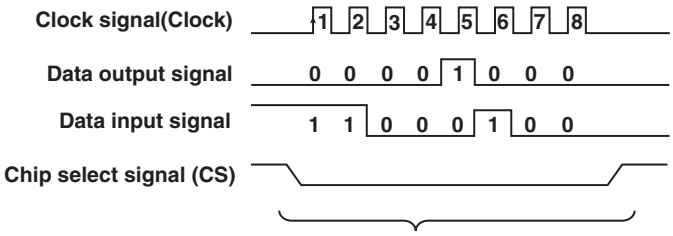
By using this function, you will be able to analyze data while displaying the SPI bus signal waveform. The main functions are as follows:

Analysis Function <Page 2-7>

You can analyze the data and other information that are displayed when the acquisition of historical data, acquisition data, or waveform is stopped.
The analysis results are listed on the right side of the screen. In addition, the analysis results can be displayed using hexadecimal or binary notation. The analysis results and waveforms can be displayed simultaneously.

Search Function <Page 2-7>

From the acquired data (the currently displayed data), you can search in the forward or reverse direction for data that matches a specified data pattern and display the matched data expanded on the ZOOM display. You can specify the data pattern using binary or hexadecimal values and set the data length to a value between 1 and 8 bytes. You can also search indefinite data.



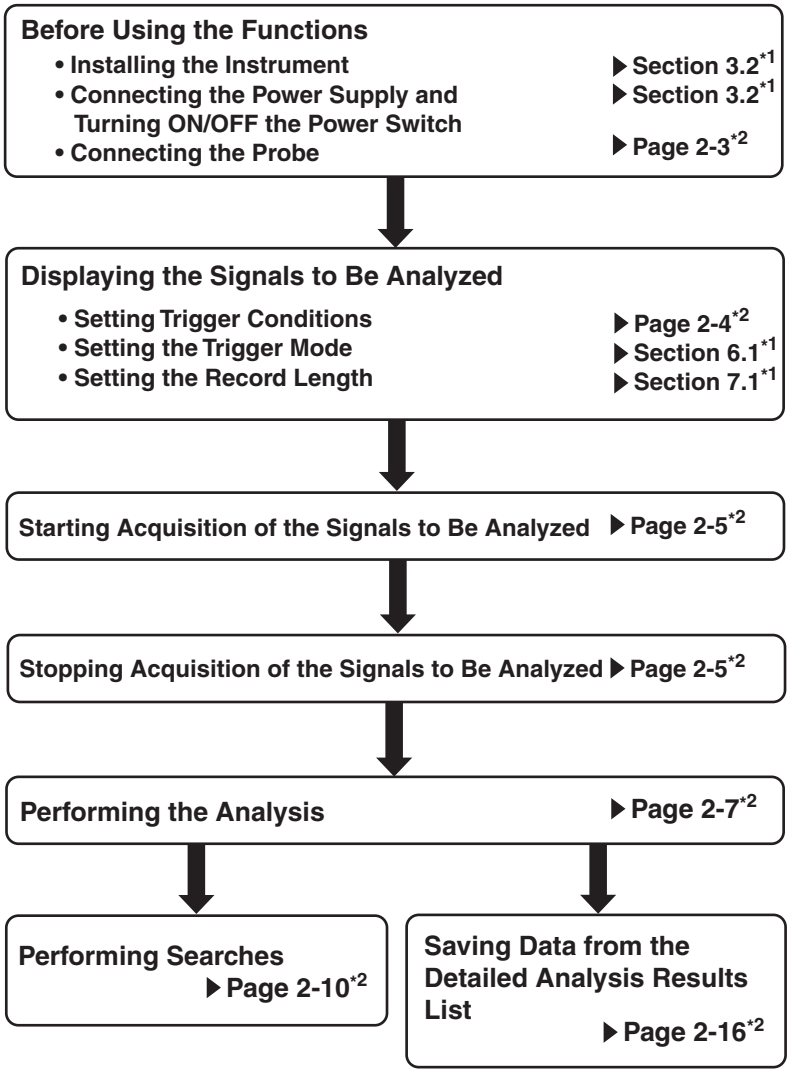
Analysis result	**Byte number:**	**0**
	Data output signal:	**08(HEX)**
	Data input signal:	**C4(HEX)**
	Chip select signal:	**L**
	Bit order:	**MSB First**

Note

- On the DL1640/DL1640L, the clock signal is input to CH1; the data input signal (Data1 and Data2) to CH2 and CH3; and the chip select signal (CS) to CH4.
- Data is transmitted in units of bytes (8 bits) by synchronizing to the clock signal. Consequently, the SPI signal is analyzed or searched at the byte level.
- The SPI bus signal analysis function does not have a dedicated trigger.

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, refer to the corresponding chapter or section in the DL1620/DL1640/DL1640L user's manual (IM701610-01E) as indicated by the arrows (▶).



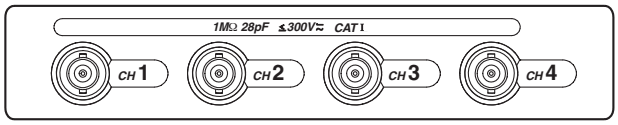
***1. Indicates reference sections from the DL1620/DL1640/DL1640L user's manual (IM701610-01E).**

***2. Indicates reference pages from this manual.**

2.2 Connecting the Probe

Input Terminals

Connect the probe to one of the input terminals located at the lower section of the front panel. The input impedance is 1 MΩ±1.0% and approximately 28 pF.



WARNING

To prevent fire or electric shock, do not use this instrument for category II, III, or IV measurements.

CAUTION

The maximum input voltage for 1 MΩ input is 300 VDC or 300 Vrms when the frequency is 1 kHz or less. Applying a voltage exceeding this maximum can damage the input section. If the frequency is above 1 kHz, the input section may be damaged even when the voltage is below this value.

Precautions to Be Taken When Connecting a Probe

- When performing SPI Bus Signal Analysis, connect the signals to the input terminals as follows:
  CH1: Clock signal
  CH2: Data input/output signal (Data1)*
  CH3: Data input/output signal (Data2)*
  CH4: Chip select signal (CS)

  * CH2 and CH3 can be connected to either the data input signal or the data output signal. The DL1640/DL1640L handles the data of the signal connected to CH2 and CH3 as Data1 and Data2, 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 DL1620/DL1640/DL1640L User’s Manual IM 701610-01E. Failure to do so may result in unstable gain across different frequencies, thereby preventing correct measurement. Calibration must be performed for each channel.
- 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.

2.3 Displaying the Signals to Be Analyzed

The SPI Bus Signal Analysis function does not have a dedicated trigger. Therefore, the following section will describe the method of activating the trigger on the falling edge of the CS signal (CH4). For details, see section 6.5, “Setting the Edge Trigger (SIMPLE)” in the User’s Manual IM 701610-01E. If you are activating the trigger using other conditions, see chapter 6, “Triggering” in the DL1620/DL1640/DL1640L User’s Manual IM 701610-01E.

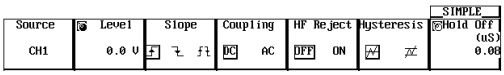
Procedure

Setting the Trigger Conditions

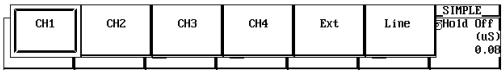
1. Press **SIMPLE**.

Setting the Trigger Source

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

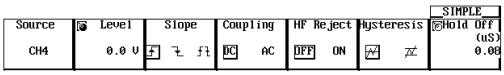


3. Press the **CH4** soft key.



Setting the Trigger Level

4. Press the **Level** soft key.



5. Turn the jog shuttle to set the trigger level.
   You can move between the digits using the arrow keys.
   Pressing **RESET** resets the trigger level to the current offset voltage.

Setting the Trigger Slope

6. Press the **Slope** soft key to select ↴.

Setting the Trigger Coupling

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

Setting the HF Rejection

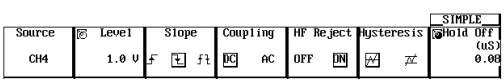
8. Press the **HF Reject** soft key to select ON or OFF.

Setting the Hysteresis

9. Press the **Hysteresis** soft key to select ⩘ or ⩙.

Setting the Hold Off Time

10. Press the **Hold Off** soft key.
11. Turn the jog shuttle to set the hold off time.
    You can move between the digits using the arrow keys. Pressing **RESET** resets the value to 0.08 μs.



Setting the Trigger Mode

12. Set the trigger mode according to the procedures in section 6.1, “Setting the Trigger Mode” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

Setting the Lecord Length

13. Set the record length according to the procedures in section 7.1, “Setting the Record Length” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

Starting/Stopping Acquisition of the Signals to Be Analyzed

14. Press **START/STOP** to start acquisition of the Signals to Be Analyzed. The trigger is activated according to the specified trigger conditions.
    To continue on by performing analysis, press **START/STOP** to stop acquisition of the Signals to Be Analyzed.

Explanation

Setting the Trigger Conditions

Selecting the Trigger Source

To activate the trigger on the falling edge of the CS signal (CH4), set the trigger source to CH4.

Setting the Trigger Level

Selectable range: 8 divisions within the screen
Resolution: 0.01 divisions (For example, the resolution for 2 mV/div is 0.02 mV.)

Setting the Trigger Slope

Select how the trigger source is to cross the specified level for activating the trigger from the following three choices. To activate the trigger on the edge falling of the CS signal (CH4), set the trigger slope to ↓.

↑: Trigger when the signal changes from below the trigger level to above the trigger level (rising)
↓: Trigger when the signal changes from above the trigger level to below the trigger level (falling)
↑↓: Trigger on either the rising or falling edge.

Setting the Trigger Coupling

Select the trigger coupling from the following. To activate the trigger on the edge falling of the CS signal (CH4), set the trigger coupling to DC.

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

Setting the HF Rejection

Specify “ON” if you wish to use a signal that is obtained by removing the high frequency components (frequency components greater than 15 kHz) from the trigger source signal as the trigger source.

Setting the Hysteresis

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

: Approximately 0.3 divisions* of hysteresis around the trigger level.
: Approximately 1 divisions* of hysteresis around the trigger level.

* The value above is an approximate value. It is not strictly warranted.

Setting the Hold Off Time

Selectable range: 0.08 μs to 10 s (the initial value is 0.08 μs)
Resolution: 20 ns
For details, see section 6.4, “Setting the Hold Off Time” in the DL1620/DL1640/DL1640L User’s Manual IM 701610-01E.

Setting the Trigger Mode

You can set waveform display update conditions as the 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, “Setting the Trigger Mode” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

Setting the Record Length

You can set the record length (data length) for acquiring data to the acquisition memory.
DL1640 : 1 k, 10 k, 100 k, 1 M, 4 M*, 8 M [word]
DL1640L : 1 k, 10 k, 100 k, 1 M, 10 M, 16 M*, 32 M [word]

* The record length that can be set in high resolution mode. For details on high resolution mode, see section 7.4, “Using the High-resolution Mode” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

For details on the record length, see section 7.1, “Setting the Record Length” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

Starting/Stopping Acquisition of the Signals to Be Analyzed

When starting acquisition of the signals to be analyzed, triggers are activated at the specified trigger conditions.
To continue on by performing analysis, press START/STOP to stop acquisition of the signals to be analyzed.

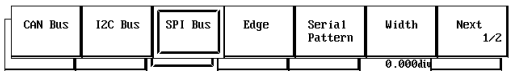
2.4 Analyzing/Searching Data

You can analyze the data of the signals to be analyzed acquired using the trigger function, and display the time from a Reference Point, data, and CS signal state in a list. After analysis, you can search for data matching data of a specific pattern (pattern search), or search for indefinite data.

Procedure

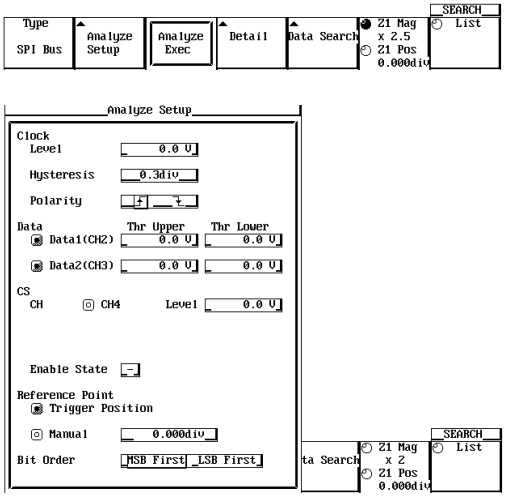
1. Press **SHIFT** to set the keys in the shifted condition.
2. Press **ZOOM**.
3. Press the **Type** soft key. The analysis type selection menu appears.

4. Press the **SPI Bus** soft key.



Setting the Analysis Conditions

5. Press the **Analyze Setup** soft key. The Analyze Setup dialog box appears.



Setting Clock (CH1)

- **Setting the Level**
  6. Turn the jog shuttle to select Clock Level.
  7. Press **SELECT** to display the entry box.
  8. Turn the jog shuttle to set the level.
  9. Press **SELECT** or **ESC** to close the entry box. The value will be confirmed.

- **Setting the Hysteresis**
  10. Turn the jog shuttle to select Hysteresis.
  11. Set the hysteresis in a similar fashion as described in steps 7 through 9.

- **Setting the Polarity**
  12. Turn the jog shuttle to move the cursor to Polarity.
  13. Press **SELECT** to select ⎍ or ⎎.

Setting Data1 (CH2)

14. Turn the jog shuttle to select Data1(CH2).
15. Press **SELECT**. The button to the left of Data1 (CH2) is highlighted.

- **Setting the Threshold Level**

16. Turn the jog shuttle to select Thr Upper of Data1 (CH2).
17. Press **SELECT** to display the entry box.
18. Turn the jog shuttle to set the value.
19. Press **SELECT** or **ESC** to close the entry box. The value will be confirmed.
20. Set Thr Lower of Data1 (CH2) in a similar fashion as described in steps 16 through 19.

Setting Data2 (CH3)

21. Set Thr Upper and Thr Lower of Data2 (CH3) in a similar fashion as described in steps 14 through 20.

Note

In the factory default condition, the buttons to the left of Data1 (CH2) and Data2 (CH3) are highlighted.

Setting CS (CH4)

22. To set CH4 to the CS signal, turn the jog shuttle to select CS CH4.
23. Press **SELECT**. The button to the left of CH4 is highlighted.

- **Setting the Level**

24. Turn the jog shuttle to select CS Level.
25. Set the level in a similar fashion as described in steps 7 through 9.

- **Setting the CS Signal State**

26. Turn the jog shuttle to select Enable State.
27. If you had set CH4 to the CS signal in steps 22 and 23, press **SELECT** to select L, H, or X.
    If you did not set CH4 to the CS signal, "-" is displayed in the Enable State box.

Setting the Reference Point

- **When Setting the Trigger Position to the Analysis Reference Point**

28. Turn the jog shuttle to select Trigger Position.
29. Press **SELECT**. The button to the left of Trigger Position is highlighted and the analysis reference point is set to the trigger position. Proceed to step 32.

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

28. Turn the jog shuttle to select Manual.
29. Press **SELECT**. The button to the left of Manual is highlighted.
30. Turn the jog shuttle to select the box to the right Manual.
31. Set the value in a similar fashion as described in steps 7 through 9. Proceed to step 32.

Note

If you set the display to translucent mode when manually setting the analysis reference point, you can set the analysis reference point while viewing the waveform display. For details on the translucent mode display, see section 8.7, "Turning Translucent Mode ON/OFF" in the DL1620/DL1640/DL1640L User's Manual IM 701610-01E.

Setting the Bit Order

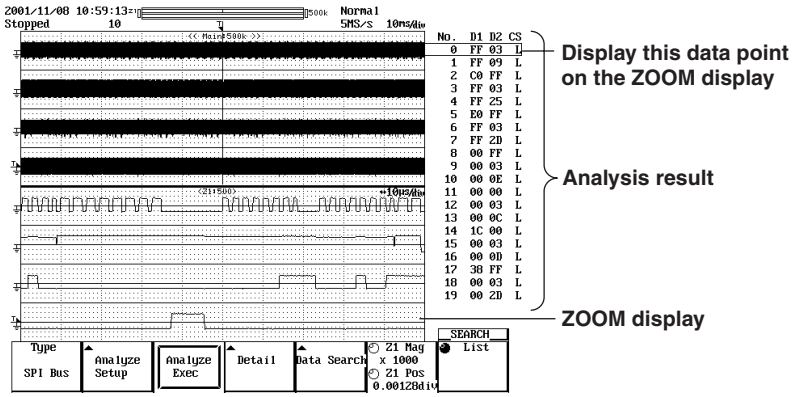
32. Turn the jog shuttle to select Bit Order.
33. Press **SELECT** to select MSB First or LSB First.
34. Press **ESC** to close the dialog box.

Executing the Analysis

Executing the Analysis

35. Press the **Analyze Exec** soft key. The waveform is analyzed, and the result is displayed on the right side of the screen.

If you select the analysis number by pressing the **List** soft key and turning the jog shuttle, the data corresponding to the selected analysis number is displayed expanded on the ZOOM display.

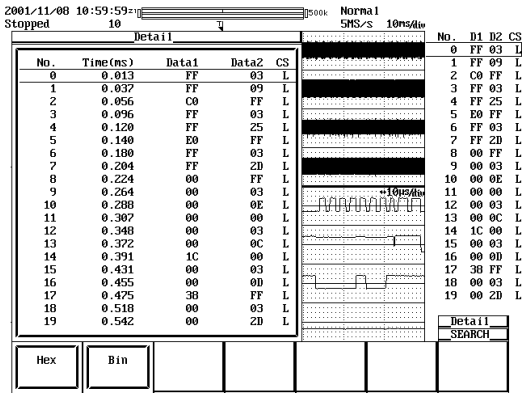


Note

If the analysis result contains indefinite data, "*" is displayed in the Data1 and Data2 boxes.

Detailed Analysis Results List Display

36. Press the **Detail** soft key. The detailed display of analysis results appears.



37. Press the **Hex** or **Bin** soft key to select the data format. Data1 and Data2 are displayed in the selected data format.
    Press **ESC** to close the detailed display.

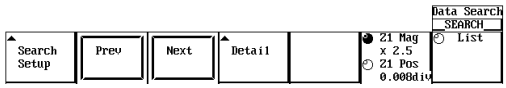
Note

- If you select the analysis number by turning the jog shuttle, the byte corresponding to the selected analysis number is displayed expanded on the ZOOM display.
- The analysis number of the detailed display corresponds to the analysis number of the analysis result display on the right side of the screen.

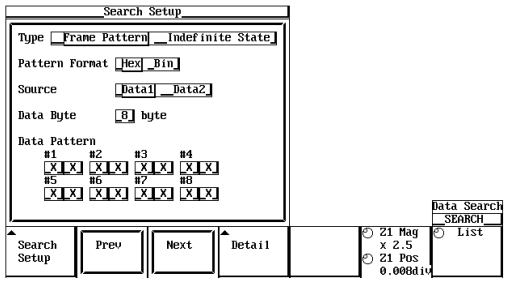
Setting the Search Conditions

38. Press the **Data Search** soft key.

39. Press the **Search Setup** soft key. The Search Setup dialog box appears.



40. Turn the jog shuttle to move the cursor to Type.



41. Press **SELECT** to select Frame Pattern or Indefinite State.

When Frame Pattern (Pattern Search) Is Selected

- **Setting the Pattern Format**
  42. Turn the jog shuttle to move the cursor to Pattern Format.
  43. Press **SELECT** to select Hex or Bin.

- **Setting the Source**
  44. Turn the jog shuttle to move the cursor to Source.
  45. Press **SELECT** to select Data1 or Data2.

- **Setting the Data Byte**
  46. Turn the jog shuttle to move the cursor to Data Byte.
  47. Press **SELECT** to display the entry box.
  48. Turn the jog shuttle to set a value between 1 and 8. Pressing **RESET** resets the number to “8.”

- **Setting the Data Pattern**
  49. Turn the jog shuttle to move the cursor to the bit for setting the Data Pattern.
  50. Press **SELECT** to display the entry box.
  51. Turn the jog shuttle to set the value. Bits set to “X” will not be used as a search condition. Press **SELECT** or **ESC** to close the entry box. The value will be confirmed.
      Press **ESC** to close the dialog box. Proceed to step 52.

When Indefinite State (Indefinite Data Search) Is Selected

You do not have to set any items.
Press **ESC** to close the dialog box. Proceed to step 52.

Executing the Search

52. Press the **Prev** soft key to search data existing before the current position. Press the **Next** soft key to search data existing after the current position. When a match is found in a pattern search, the corresponding byte in the analysis result display on the right side of the screen is highlighted, and the ZOOM display moves accordingly. In an indefinite data search, the byte in which indefinite data is present in Data1 or Data2 is highlighted.

Explanation

Setting the Analysis Conditions

Setting Clock (CH1)

- **Setting the 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.)

- **Setting the Hysteresis**

  Selectable range: 0.3 divisions to 4.0 divisions

- **Setting the Polarity**

  ⎍: Reads the data input/output signal when the signal changes from below the specified level to above the specified level.
  ⎎: Reads the data input/output signal when the signal changes from above the specified level to below the specified level.

Setting Data1 (CH2) and Data2 (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 Data1 or Data2 display box at the byte where the indefinite data exists on the display screen of analysis results.

Setting the Chip Select Signal (CS)

To set the CS signal, specify CH4.

- **Setting the Level**

  Set the level used to determine whether the CH4 signal is high or low as follows:
  Selectable range: 8 divisions within the screen
  Resolution: 0.01 divisions (For example, the resolution for 2 mV/div is 0.02 mV.)

- **Selecting the CS Signal State (Enable State)**

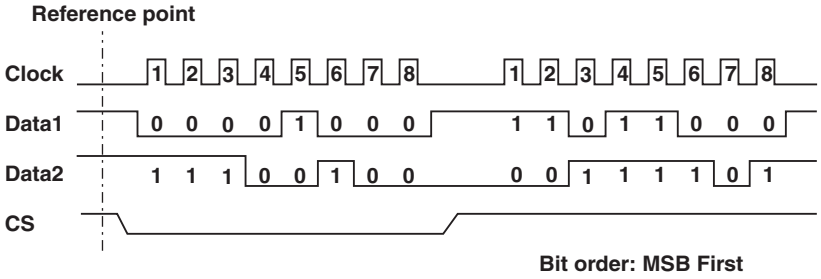
  Select the state from the following:
  H: Analyzes the data input/output signal when the CS signal is high.
  L: Analyzes the data input/output signal when the CS signal is low.
  X: All data input/output signals are analyzed. The byte boundary of the analyzed signal is the point where the CS signal changes from high to low or low to high.
  –: This can be used when the CS signal is not selected. All data input/output signals are analyzed. The data input/output signal that is delimited byte-wise is analyzed from the Reference Point.

Setting the Reference Point

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

Trigger Position: Set the reference point to the trigger position.

Manual: Set the reference point in the range of –5 to +5 divisions.



- **When Clock (CH1) = ⨍ and CS (CH4) = L**
  Analysis number (No.): 0
  Data1 hexadecimal display (Dt1): 08
  Data2 hexadecimal display (Dt2): E4
  Enable state of the CS signal (CS): L

- **When Clock (CH1) = ⨍ and CS (CH4) = H**
  Analysis number (No.): 0
  Data1 hexadecimal display (Dt1): D8
  Data2 hexadecimal display (Dt2): 3D
  Enable state of the CS signal (CS): H

- **When Clock (CH1) = ⨍ and CS (CH4) = X**

Analysis number (No.):	0	1
Data1 hexadecimal display (Dt1):	08	D8
Data2 hexadecimal display (Dt2):	E4	3D
Enable state of the CS signal (CS):	L	H

Setting the Bit Order

Select MSB or LSB according to the data flowing through the bus.

MSB First: Select this when the data input/output signal is flowing through the bus MSB first.

LSB First: Select this when the data input/output signal is flowing through the bus LSB first.

When set to MSB First: E831
When set to LSB First: 71C8

Items to Be Analyzed

The following 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.

Analysis Range

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 → Pre side = 20000 and Post side = 20000
  - When the Pre side = 10000 and the Post side = 50000 → Pre side = 10000 and Post side = 30000
  - When the Pre side = 50000 and the Post side = 10000 → Pre side = 30000 and Post side = 10000

* Pre: Start from the reference point and display back (to the left)
Post: Start from the reference point and display forward (to the right)

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.

Executing the Analysis

Executing the Analysis (Analyze Exec)

When analysis is performed, the results are listed on the right side of the screen.

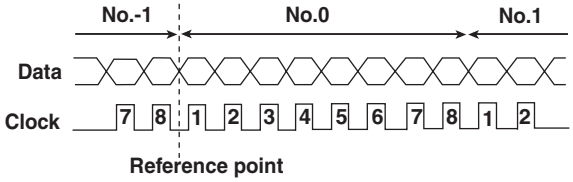
Analysis Results List Display

The following four items are displayed.

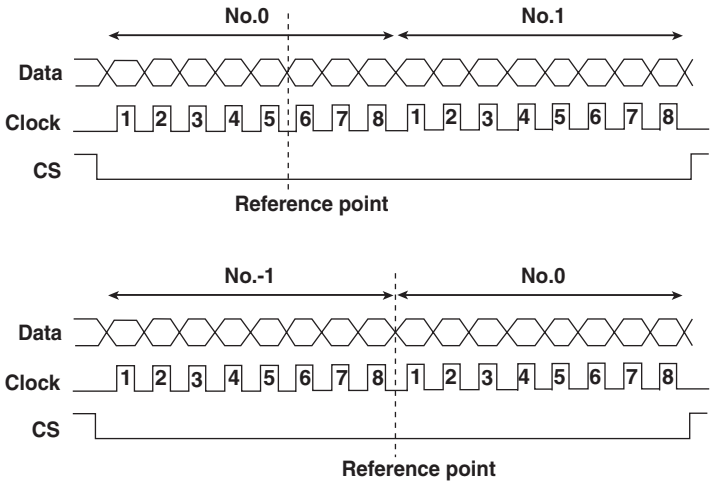
- No.*: Up to 40000 points can be displayed.
- Dt1 and Dt2: The data of Data1 and Data2 is displayed using hexadecimal notation. However, if a byte of data is less than 8 bits, the data is not displayed. If indefinite data exists, "*" is displayed. Indefinite data is considered the same value as the previous bit for the analysis. If the first data is indefinite, it is considered 0.
- CS: Displays the CS signal state. Displays blank when the CS signal is not set. Displays "H" or "L" when the CS signal is set.

Depending on whether the CS signal is set, the 0th byte varies as follows:

- **When the CS Signal Is not Set**
  The first detected byte after the reference point



- **When the CS Signal Is Set**
  Byte containing the reference point (However, if the reference point is located between two bytes, the first detected byte after the reference point)

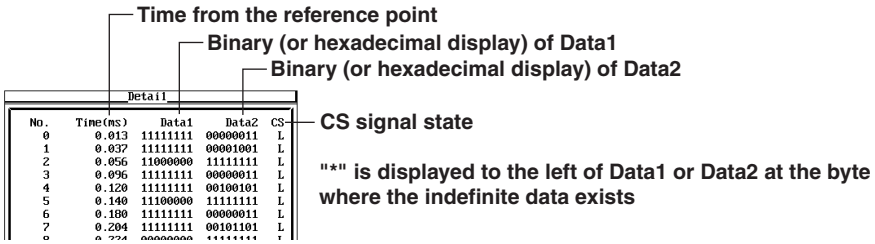


Note

- 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.
- If the CS signal is set and the CS signal waveform on the Main screen does not contain points of change from H to L or L to H, the data input/output signal is not analyzed.

Detailed Analysis Results List Display

The figure below shows the detailed display of the analysis results.



In the detailed display screen, the data corresponding to the specified number is highlighted.
In the waveform display screen, the data corresponding to the specified number is displayed in the ZOOM display.

Setting the Search Conditions

There are two types of search, the field/frame pattern search and the indefinite data search. The former involves specifying a field or frame pattern and searching for that waveform, and the latter involves searching for indefinite data.
Pattern searches and indefinite data searches cannot be executed at the same time.

Pattern Search (Frame Pattern)

You can specify a data pattern of Data1 or Data2 in units of bytes and search the waveform. When a waveform that matches the specified pattern is found, the Zoom Position moves to that point and displays the searched waveform in the Zoom window. Set the pattern to be searched in binary or hexadecimal notation. Bits set to "X" are not searched.
The items to be specified are as follows:

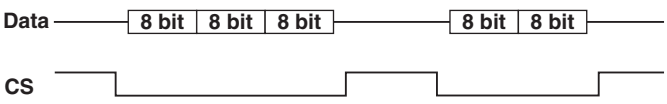
Pattern Format: Specify the pattern display format. Select Hex (hexadecimal display) or Bin (binary display).
Source: Set the target waveform to perform the pattern search to Data1 or Data2.
Data Byte: Set the number of data bytes from 1 to 8 (bytes).
Data Pattern: Set the search pattern using hexadecimal or binary format. The bit order is set to the format that was specified for the analysis. If the specified bit contains an X, it is displayed as "$" in hexadecimal format.

Indefinite Data Search (Indefinite State)

Searches indefinite data from the analysis result.

Note

- Indefinite data is always considered matched to the specified status.
- If analysis is performed on a channel of which a CS signal is selected, the data is considered to be delimited at the point where the state of the CS signal changes. In this case, data search is also performed by considering the data to be delimited at that point. For example, when a 5-byte data shown in the following figure is analyzed, the search operation varies depending on the CS channel specification during the analysis.
  - When analysis is performed by specifying a CS channel
    Data search across two CS intervals cannot be performed. Therefore, search is not possible by setting Data Byte to 4 or 5. (Cannot conclude from the analyzed data.)
  - When analysis is performed without specifying the CS channel
    Independent of the chip select interval. Search can be performed by setting Data Byte to 4 or 5.
    Example (Enable State = L)



Executing the Search

Executing the Search (Next, Prev)

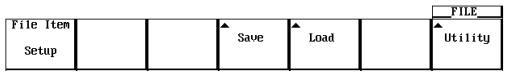
Searches data that matches the specified search condition in forward (Prev) and reverse (Next) directions. When the data matches the search pattern, the corresponding data in the detailed analysis display on the right side of the screen is highlighted. In addition, the matched data is displayed expanded in the ZOOM display.

2.5 Saving Data from the Detailed Analysis Results List

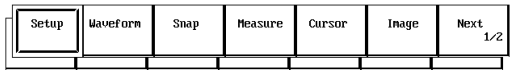
The data from the detailed analysis results list can be saved in ASCII format.

Procedure

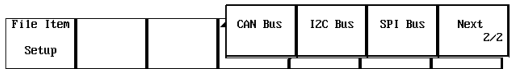
1. Press **FILE**.
2. Press the **File Item** soft key. The File Item selection menu appears.



3. Press the **Next 1/2** soft key to display the Next 2/2 menu.



4. Press the **SPI Bus** soft key.

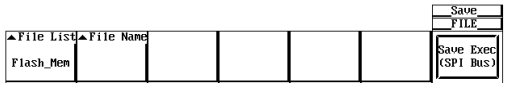


5. Press the **Save** soft key.

Setting the Save Destination

- **Selecting a Storage Medium**

6. Press the **File List** soft key. The File List box opens.

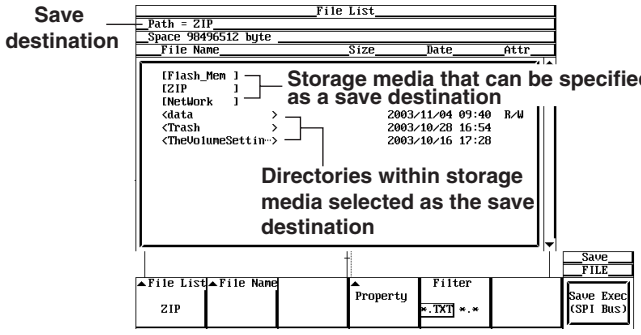


7. Turn the jog shuttle to select a storage medium. The storage media devices built-in to the instrument are displayed in brackets [ ].
8. Press **SELECT**. The contents of the selected storage media are displayed.

- **Selecting the Directory**

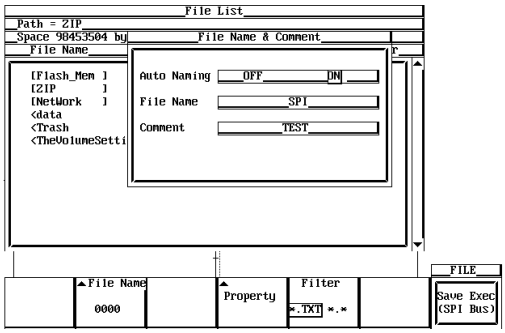
Perform these steps if the storage media selected in steps 6 through 8 have directories.

9. Turn the jog shuttle to select a save destination directory. The directories are displayed using angle brackets (< >).
10. Press **SELECT**. The directory selection is entered.
    If you select <.. >, the current directory changes to one directory higher.



Entering the File Name/Comment

11. Press the **File Name** soft key. The file name setting dialog box is displayed.



12. Turn the jog shuttle to move the cursor to Auto Naming.
13. Press **SELECT**, then select ON or OFF.
14. Turn the jog shuttle to move the cursor to File Name.
15. Press **SELECT**. The keyboard screen is displayed. Enter a file name of 16 characters or less. If Auto Naming was turned ON in step 13, the first twelve characters are valid.
16. Turn the jog shuttle to move the cursor to Comment.
17. Press **SELECT**. The keyboard screen is displayed. Enter a comment of 25 characters or less.
18. Press **ESC**.

Note

For details on operating the on-screen keyboard, see section 4.1, “Entering Values and Character Strings” in the DL1620/DL1640/DL1640L user’s manual IM701610-01E.

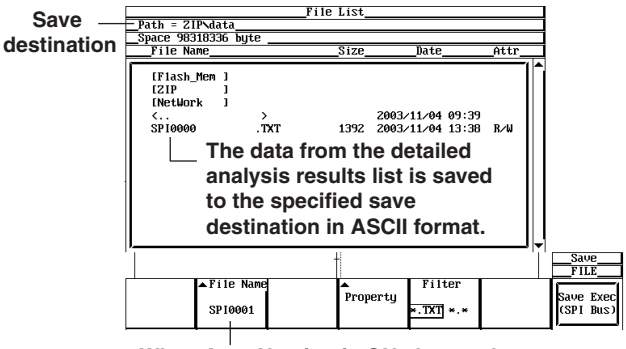
Executing the Save

19. Press the **Save Exec** (SPI Bus) soft key. The image is saved.

At the same time, the Save Exec (SPI Bus) soft key changes to the Abort soft key.

To cancel saving, press the **Abort** soft key.

At the same time, the Abort soft key changes to the Save Exec (SPI Bus) soft key.



Explanation

Setting the Save Destination (File List)

- Selecting a Storage Medium
  The storage media that can be specified as the save destination are displayed in the File List. The storage media devices are displayed in brackets [ ].

Note

Storage Media Display Example

- [Flash_Mem]: Internal flash memory
- [PC_Card]: PC card
- [FD]: Floppy disk
- [ZIP]: ZIP disk
- [Network]: Network drive (when the Ethernet interface option is installed)
- [USB]: USB storage

- **Selecting the Directory**
  If the storage medium contains directories, you can specify a directory as the save destination. The directories are displayed using angle brackets (< >). If you select <.. >, the current directory changes to one directory higher.

  The save destination is displayed as a path in the upper left portion of the File List box.
  Example: Path=ZIP_data
  The data directory on the Zip disk is specified as the save destination.

  The save destination can be displayed by choosing the FILE > Save > File List soft keys. However, after changing the save destination in the File List box, if you do not press the ESC key once, the changed save destination is not reflected in the File List soft key.

Entering the File Name/Comment

- **Auto Naming Function**
  If Auto Naming is turned ON, files with a four-digit number from 0000 to 2399 can be automatically created when saving the screen data. You can specify a common name (up to twelve characters, specified through File Name) that is placed before the number.

Note

You can enter up to sixteen characters for the common name, but only the first four characters are used.

- **Entering the File Name/Comment**
  - You must enter a file name. If you execute a save without entering a file name, the message “Invalid input file name. Please check the file name.” (error code 601) appears. Also, you cannot save a file having the same name as another file existing in the same directory (overwriting not allowed).
  - You do not necessarily have to enter a comment.

Saving the Detailed Analysis Results

You can store the analysis results of the SPI bus signal to the storage medium that is selected in the FILE menu in ASCII format.

Extension: .TXT

Data size: (Number of bytes per data point × number of analysis results) + 44 bytes*2

*1 The number of bytes per data varies depending on the data.
- Analysis data without CS: 40 bytes minimum.
- Analysis data with CS set to CH4: 44 bytes maximum.

*2 The data size of the title is 44 bytes.

Notes When Saving

- The maximum number of files that can be saved when auto naming is enabled is 2400.
- If the total number of files and directories exceed 5000 in a single directory, the contents of the file list are no longer displayed.

2.6 Error Messages

A message may appear on the screen during operation. This section describes the meanings of the messages and their corrective actions. Only the error messages related to the SPI Bus signal analysis function are listed here. Other messages for the main unit and communication functions may also appear. For information about those messages, see the DL1620/DL1640/DL1640L user's manual (IM701610-01E) and the DL1620/LD1640/DL1640L communication interface user's manual (IM701610-17E).
You can select to display messages in either Japanese, English, or Chinese. For details on the selecting the message language, see section 14.2, "Changing the Message Language and Click Sound" in the DL1620/DL1640/DL1640L user's manual (IM701610-01E).
If servicing is required, contact your nearest YOKOGAWA dealer.

Code	Message	Corrective Action	Page
37	Analysis aborted.	-	-
38	Data not detected. Execute again after changing the settings or reacquiring the waveform.	-	2-4, 2-7, 2-11
779	Specified data does not exist. Execute the analysis.	Execute the analysis.	2-9, 2-13
950	Cannot be specified. Invalid byte or bit.	-	2-10, 2-15
951	Cannot be set when CS channels are not specified.	-	2-8, 2-11

2.7 Communication Commands

Only the communication commands related to the SPI Bus signal analysis function are listed here. For communication commands other than those pertaining to the SPI Bus signal analysis function for the DL1620/DL1640/DL160L, see the DL1620/DL1640/DL1640L communication interface user's manual (IM701610-17E).

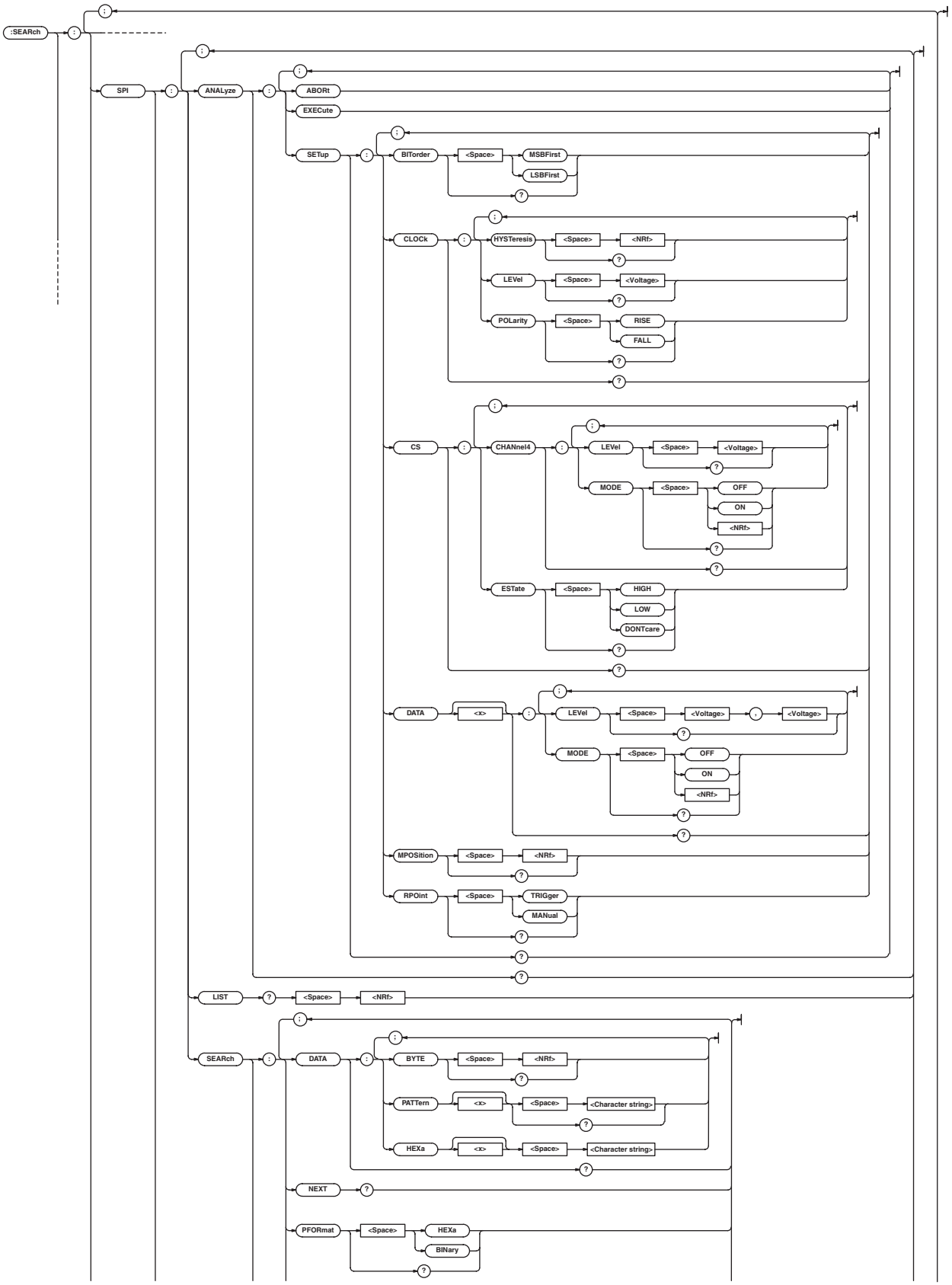
Command	Function	Page
SPI Analyze Group		
:SEARch:SPI?	Queries all settings related to the analysis*.	2-24
:SEARch:SPI:ANALyze?	Queries all settings related to the analysis*.	2-24
:SEARch:SPI:ANALyze:ABORt	Aborts the analysis* execution.	2-24
:SEARch:SPI:ANALyze:EXECute	Executes the analysis*.	2-24
:SEARch:SPI:ANALyze:SETup?	Queries all settings related to the analysis* conditions.	2-24
:SEARch:SPI:ANALyze:SETup:BITorder	Sets the bit order of the display of the analysis* data results or queries the current setting.	2-24
:SEARch:SPI:ANALyze:SETup:CLOCk?	Queries all settings related to the clock channel of the analysis* conditions.	2-25
:SEARch:SPI:ANALyze:SETup:CLOCk:HYSTeresis	Sets the clock channel hysteresis of the analysis* conditions or queries the current setting.	2-25
:SEARch:SPI:ANALyze:SETup:CLOCk:LEVel	Sets the clock channel level of the analysis* conditions or queries the current setting.	2-25
:SEARch:SPI:ANALyze:SETup:CLOCk:POLarity	Sets the edge of the clock channel to be analyzed of the analysis* conditions or queries the current setting.	2-25
:SEARch:SPI:ANALyze:SETup:CS?	Queries all settings related to the CS signal of the analysis* conditions.	2-25
:SEARch:SPI:ANALyze:SETup:CS:CHANnel4?	Queries all settings related to CH4 of the analysis* CS signal conditions.	2-25
:SEARch:SPI:ANALyze:SETup:CS:CHANnel4:LEVel	Sets the level of CH4 of the analysis* CS signal conditions.	2-25
:SEARch:SPI:ANALyze:SETup:CS:CHANnel4:MODE	Sets whether to handle CH4 as a CS signal (ON/OFF) in the analysis* conditions or queries the current setting.	2-25
:SEARch:SPI:ANALyze:SETup:CS:ESTate	Sets the enable state of the CS signal of the analysis* conditions or queries the current setting.	2-26
:SEARch:SPI:ANALyze:SETup:DATA<x>?	Queries all settings related to the data channel of the analysis* conditions.	2-26
:SEARch:SPI:ANALyze:SETup:DATA<x>:LEVel	Sets the threshold level of the data channel of the analysis* conditions or queries the current setting.	2-26
:SEARch:SPI:ANALyze:SETup:DATA<x>:MODE	Enables or disables the data channel (ON/OFF) of the analysis* conditions or queries the current setting.	2-26
:SEARch:SPI:ANALyze:SETup:MPOSition	Sets the reference position when the SPI reference position is set to manual or queries the current setting.	2-26
:SEARch:SPI:ANALyze:SETup:RPOint	Sets the analysis* reference position to the trigger position or manual or queries the current setting.	2-26
:SEARch:SPI:LIST?	Outputs one byte of analysis* result as a character string.	2-26
:SEARch:SPI:SEARch?	Queries all settings related to the analysis* result search.	2-26
:SEARch:SPI:SEARch:DATA?	Queries all settings related to the Data search of the analysis* results.	2-27
:SEARch:SPI:SEARch:DATA:BYTE	Sets the number of data bytes to be searched for the Data search of the analysis* results.	2-27

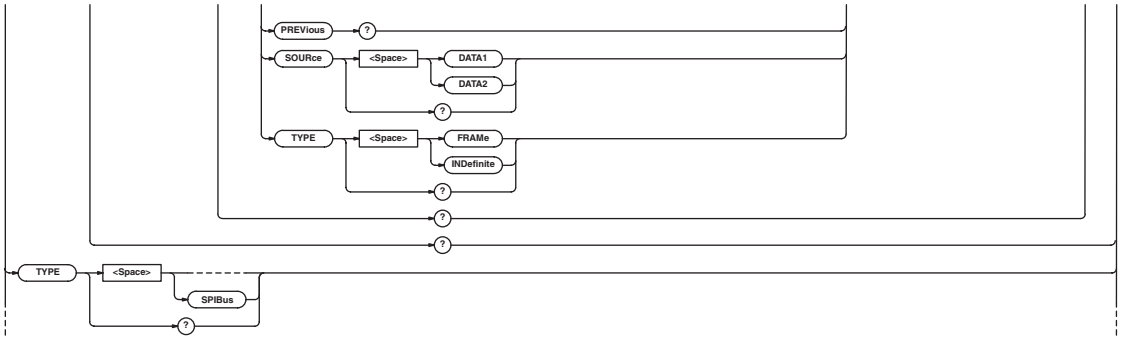
Command	Function	Page
:SEARch:SPI:SEARch:DATA:HEXa<x>	Sets the Data search pattern of the analysis* results in hexadecimals.	2-27
:SEARch:SPI:SEARch:DATA:PATTern<x>	Sets the Data search pattern of the analysis* results in binary or queries the current setting.	2-27
:SEARch:SPI:SEARch:NEXT?	Performs the analysis* result search after the current byte and returns the search position.	2-27
:SEARch:SPI:SEARch:PFORmat	Sets the format of the search pattern of the analysis* results or queries the current setting.	2-27
:SEARch:SPI:SEARch:PREVious?	Performs the analysis* result search before the current byte and returns the search position.	2-27
:SEARch:SPI:SEARch:SOURce	Sets the data source for performing the analysis* result search or queries the current setting.	2-27
:SEARch:SPI:SEARch:TYPE	Sets the type of analysis* result search or queries the current setting.	2-27
:SEARch:TYPE	Sets the search type of queries the current setting.	2-28
SPI File Group		
:FILE:SAVE:SPI[:EXECute]	Executes the store operation of analysis* results (overlap command).	2-28
:FILE:SAVE:SPI:ABORt	Aborts the store operation of analysis* results.	2-28

* In the description of command functions throughout this section, SPI Bus signal analysis function has been abbreviated as analysis.

SPI Analyze Group

Commands in the SPI Analyze group can be used to make the same settings, inquiries, and executions as when the SPI bus menu under the SHIFT key + ZOOM key on the front panel 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 1.000E+00;
HYSTERESIS 0.3;POLARITY RISE;:
SEARCH:SPI:ANALYZE:SETUP:DATA1:
MODE 1;LEVEL 1.000E+00,0.000E+00;:
SEARCH:SPI:ANALYZE:SETUP:DATA2:
MODE 1;LEVEL 1.000E+00,0.000E+00;:
SEARCH:SPI:ANALYZE:SETUP:CS:CHANNEL4:
MODE 1;ESTATE LOW;LEVEL 1.000E+00;:
SEARCH:SPI:ANALYZE:SETUP:CS:
ESTATE LOW;:SEARCH:SPI:ANALYZE:
SETUP:RPOINT TRIGGER;
MPOSITION 0.00000;
BITORDER MSBFIRST;: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:ANALyze?

Function Queries all settings related to the analysis execution.

Syntax :SEARch:SPI:ANALyze?

Example
```
:SEARCH:SPI:ANALYZE? -> :SEARCH:SPI:
ANALYZE:SETUP:CLOCK:LEVEL 1.000E+00;
HYSTERESIS 0.3;POLARITY RISE;:
SEARCH:SPI:ANALYZE:SETUP:DATA1:
MODE 1;LEVEL 1.000E+00,0.000E+00;:
SEARCH:SPI:ANALYZE:SETUP:DATA2:
MODE 1;LEVEL 1.000E+00,0.000E+00;:
SEARCH:SPI:ANALYZE:SETUP:CS:CHANNEL4:
MODE 1;ESTATE LOW;LEVEL 1.000E+00;:
SEARCH:SPI:ANALYZE:SETUP:CS:
ESTATE LOW;:SEARCH:SPI:ANALYZE:
SETUP:RPOINT TRIGGER;
MPOSITION 0.00000;BITORDER MSBFIRST
```

:SEARch:SPI:ANALyze:ABORt

Function Aborts the analysis execution.

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 conditions.

Syntax :SEARch:SPI:ANALyze:SETup?

Example
```
:SEARCH:SPI:ANALYZE:SETUP? ->
:SEARCH:SPI:ANALYZE:SETUP:CLOCK:
LEVEL 1.000E+00;HYSTERESIS 0.3;
POLARITY RISE;:SEARCH:SPI:ANALYZE:
SETUP:DATA1:MODE 1;
LEVEL 1.000E+00,0.000E+00;:SEARCH:
SPI:ANALYZE:SETUP:DATA2:MODE 1;
LEVEL 1.000E+00,0.000E+00;:SEARCH:
SPI:ANALYZE:SETUP:CS:CHANNEL4:
MODE 1;ESTATE LOW;LEVEL 1.000E+00;:
SEARCH:SPI:ANALYZE:SETUP:CS:
ESTATE LOW;:SEARCH:SPI:ANALYZE:
SETUP:RPOINT TRIGGER;
MPOSITION 0.00000;BITORDER MSBFIRST
```

:SEARch:SPI:ANALyze:SETup:BITorder

Function Sets the bit order of the display of the analysis data results 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 channel of the analysis conditions.

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 clock channel hysteresis of the analysis conditions 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 clock channel level of the analysis conditions 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:
LEVEL 1V
:SEARCH:SPI:ANALYZE:SETUP:CLOCK:
LEVEL? -> :SEARCH:SPI:ANALYZE:SETUP:
CLOCK:LEVEL 1.000E+00
```

:SEARch:SPI:ANALyze:SETup:CLOCk:POLarity

Function Sets the edge of the clock channel to be analyzed of the analysis conditions 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 to the CS signal of the analysis conditions.

Syntax
```
:SEARch:SPI:ANALyze:SETup:CS?
```

Example
```
:SEARCH:SPI:ANALYZE:SETUP:CS? ->
:SEARCH:SPI:ANALYZE:SETUP:CS:CHANNEL4:
MODE 1;LEVEL 1.000E+00;:SEARCH:SPI:
ANALYZE:SETUP:CS:ESTATE LOW
```

:SEARch:SPI:ANALyze:SETup:CS:CHANnel4?

Function Queries all settings related to CH4 of the analysis CS signal conditions.

Syntax
```
:SEARch:SPI:ANALyze:SETup:CS:
CHANnel4?
```

Example
```
:SEARCH:SPI:ANALYZE:SETUP:CS:
CHANNEL4? -> :SEARCH:SPI:ANALYZE:
SETUP:CS:CHANNEL4:MODE 1;
LEVEL 1.000E+00
```

:SEARch:SPI:ANALyze:SETup:CS:CHANnel4:LEVel

Function Sets the level of CH4 of the analysis CS signal conditions.

Syntax
```
:SEARch:SPI:ANALyze:SETup:CS:
CHANnel4:LEVel {<voltage>}
:SEARch:SPI:ANALyze:SETup:CS:
CHANnel4:LEVel?
<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
```

:SEARch:SPI:ANALyze:SETup:CS:CHANnel4:MODE

Function Sets whether to handle CH4 as a CS signal (ON/OFF) in the analysis conditions or queries the current setting.

Syntax
```
:SEARch:SPI:ANALyze:SETup:CS:
CHANnel4:MODE {<Boolean>}
:SEARch:SPI:ANALyze:SETup:CS:
CHANnel4:MODE?
```

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:ESTate

Function Sets the enable state of the CS signal of the analysis conditions 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 channel of the analysis conditions.

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 channel of the analysis conditions 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:
LEVEL 1V,0V
:SEARCH:SPI:ANALYZE:SETUP:DATA1:
LEVEL? -> :SEARCH:SPI:ANALYZE:
SETUP:DATA1:
LEVEL 1.000E+00,0.000E+00
```

:SEARch:SPI:ANALyze:SETup:DATA<x>:MODE

Function Enables or disables the data channel (ON/OFF) of the analysis conditions 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 position when the SPI reference position 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 the analysis reference position to the trigger position or manual 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 -> “      1
0.024 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 search of the analysis results.

```
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 data bytes to be searched for the Data search of the analysis results.

```
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 Data search pattern of the analysis result in hexadecimals.

```
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 Data search pattern of the analysis results 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 Performs the analysis result search after the current byte and returns the search position.

```
Syntax  :SEARch:SPI:SEARch:NEXT?
Example :SEARCH:SPI:SEARCH:NEXT? -> 10
```

Description When 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 format of the search pattern of the analysis results 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 before the current byte and returns the search position.

```
Syntax  :SEARch:SPI:SEARch:PREVious?
Example :SEARCH:SPI:SEARCH:PREVIOUS? -> -10
```

Description When 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 source for performing the analysis result search 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 type of analysis result search 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

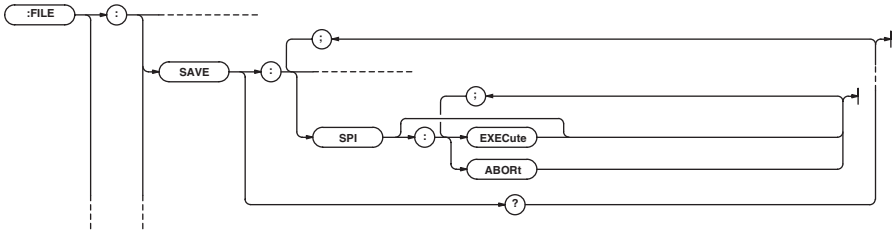
Function Sets the search type or queries the current setting.

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

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

SPI File Group

The SPI File group lets you execute/cancel saving of data from the SPI Bus signal detailed analysis results list in the same manner as when using the FILE key on the front panel.



:FILE:SAVE:SPI[:EXECute]

Function Executes the store operation of analysis results. This is an overlap command.

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

Example `:FILE:SAVE:SPI:EXECUTE`

:FILE:SAVE:SPI:ABORt

Function Aborts the store operation of analysis results.

Syntax `:FILE:SAVE:SPI:ABORt`

Example `:FILE:SAVE:SPI:ABORT`

3.1 CAN Bus Signal Analysis Function

Applicable CAN Bus

Item	Specifications
CAN Bus	CAN Version 2.0B
Bit Rate	1 Mbps, 500 kbps, 250 kbps, 125 kbps, 100 kbps, 95.2 kbps, 83.3 kbps, 50 kbps, 33.3 kbps High Speed CAN(ISO11898), Low Speed CAN(ISO11519-2)

Trigger Function

Item	Specifications
Trigger Source	CH1: CAN Bus signal input channel. The CAN_H and CAN_L signals are both input using a differential probe.
Trigger Type	Trigger on a combination (AND condition) of the five trigger types below. However, a combination of RTR and Data Field is not allowed. • Start of Frame: Triggers on the Start of Frame (SOF). The trigger point is set to the end position of the Start of Frame. • Identifier: Triggers on an Identifier (ID, up to four can be set) matching the specified condition. The four IDs trigger using an OR condition. The trigger point is set to the end position of the ID. • RTR: Triggers on a remote frame (RTR is recessive). The trigger point is set to the end position of the RTR bit. • Data Field: Triggers on a Data field matching the specified condition (up to 8 bytes can be specified). The trigger point is set to the end position of the Data field. • Error Frame: Triggers on an error frame. A potential error frame trigger has 6 successive dominant bits (logical value of 0). Triggers if 6 successive dominant bits occur in an overload frame. The trigger point is set to the end position of the 6th dominant bit.

Analysis Function

Item	Specifications
Number of Analyzable Frames	8000 frames before and after the trigger target frame (16001 frames maximum)
Frames to Be Analyzed	Three types of frames are analyzed, Remote Frames, Data Frames, and Identifiers.
Analysis Results Display	Analysis results can be displayed using one of the following two methods. • Waveform and Analysis Results List Analysis results list: On the right side of the screen, the following is displayed: (Frame type and number)/ID (value of Identifier (standard or extended format)/Dt (value of data field)/ACK. • Detailed Analysis Results List Details of the Analysis Results List The following is displayed: (Frame type and number)/Time (ms)/ID (value of Identifier (standard or extended format)/Data (value of Data field)/CRC/ACK/ Info. (error type).
Stuff Bit Computation	Extracts stuff bits from the CAN Bus signal waveform and displays them as a Math waveform (Math1).

Search Function

Item	Specifications
Data Search	The following two types of search are available. However, two searches cannot be executed at the same time. • Pattern Search (Frame Pattern) Search the waveform by specifying a field or frame pattern. When a waveform that matches the pattern is found, the Zoom Box moves to that point and displays the specified waveform. • Indefinite State Search Searches for indefinite data
Field Jump	You can move the Zoom position (Z1 Pos) to the front of a particular field within the current frame. There are five available fields: Identifier, Control Field, Data Field, CRC, and ACK.

Analysis Result Save Function

Item	Specifications
Saving Data from the Detailed Analysis Results List	The data from the detailed analysis results list can be saved in ASCII format (extension .txt).

For specifications other than those pertaining to the CAN Bus signal analysis function for the DL1620/DL1640/DL160L, see chapter 16, “Specifications” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

3.2 SPI Bus Signal Analysis Function

Analysis Function

Item	Specifications
Signal Input	CH1: Clock signal (SCK) CH2: Data1 (MOSI) CH3: Data2 (MISO) CH4: CS signal (SS)
Number of Data Points That Can Be Analyzed	Up to 40000 bytes (20000 bytes before and after the reference point)
Analysis Results Display	Analysis results can be displayed using one of the following two methods. • Waveform and Analysis Results List You can display data (Hex display) and waveforms at the same time. • Detailed Analysis Results List Details of the Analysis Results List You can display the time from the Reference Point, Data (displayed in binary or hex as selected) and CS signal state.

Search Function

Item	Specifications
Data Search	The following two types of search are available. However, two searches cannot be executed at the same time. • Pattern Search (Frame Pattern) You can search the waveform by specifying a data pattern. When a waveform that matches the pattern is found, the Zoom Box moves to that point and displays the specified waveform. • Indefinite State Search Searches for indefinite data.

Analysis Result Save Function

Item	Specifications
Saving Data from the Detailed Analysis Results List	The data from the detailed analysis results list can be saved in ASCII format (extension .txt).

For specifications other than those pertaining to the SPI Bus signal analysis function for the DL1620/DL1640/DL160L, see chapter 16, “Specifications” in the DL1620/DL1640/DL1640L user’s manual (IM701610-01E).

Index

R

S

T

V

Z