OR100E/OR300E

Handy Oscillographic Recorder

USER'S MANUAL

YOKOGAWA
Yokogawa Electric Corporation

IM OR100E-01E
1st Edition

Foreword

Thank you for purchasing the YOKOGAWA OR100E/OR300E. This User's Manual contains useful information about the instrument's functions and operating procedures as well as precautions that should be observed during use. To ensure proper use of the instrument, please read this manual thoroughly before operating it. Keep the manual in a safe place for quick reference whenever a question arises.

Notes

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

Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA representative listed on the back cover of this manual.

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Revisions

1st Edition: October 1999

Disk No. OR08
1st Edition : October 1999 (YK)

Checking the Contents of the Package

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

OR100E Main Body

Check that the model name and suffix code given on the name plate of the rear panel match those on your order. Whenever you contact the dealer from which you purchased the instrument, tell him your unit's serial No.

OR100E

Model	Suffix Code	Specifications
OR122		2-channel isolated input model
OR142		4-channel isolated input model
Display language	-2	English
Options	/PM	Carring case package. UL/CSA standard power supply code.
	/PF	Carring case package. VDA standard power supply code.
	/PR	Carring case package. SAA standard power supply code.
	/PS	Carring case package. BS standard power supply code.

OR300E

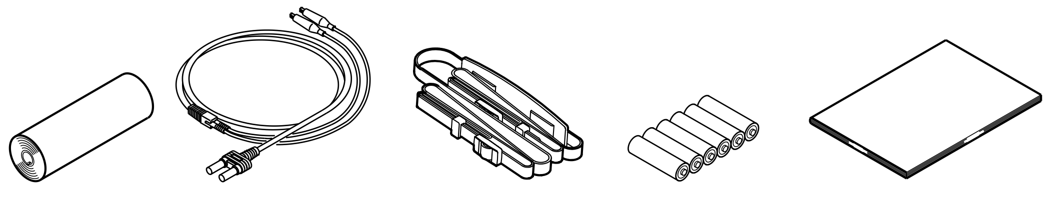
Model	Suffix Code	Specifications
OR322		2-channel isolated input model
OR342		4-channel isolated input model
Display language	-2	English
Options	/PM	Carring case package. UL/CSA standard power supply code.
	/PF	Carring case package. VDA standard power supply code.
	/PR	Carring case package. SAA standard power supply code.
	/PS	Carring case package. BS standard power supply code.

NO. (Instrument No.)

When contacting the dealer from which you purchased your instrument, please quote the instrument No.

Standard Accessories

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



Roll chart **Measurement input cable** **Belt** **AAA allaline dry cell : 6** **Users manual**

OR122,OR322 : 2

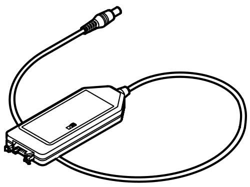
OR142,OR342 : 4

In addition to the accessories listed above, AC adapter, battery pack and carrying case are also included for models with the /PM suffix code.

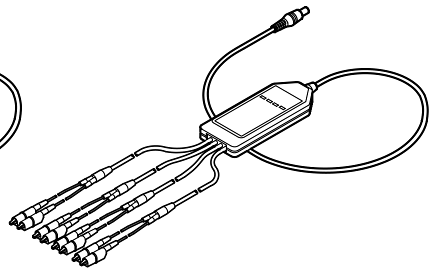
Optional Accessories

The following optional accessories are available. On receiving these optional accessories, make sure that all the items that you ordered have been supplied and that they are undamaged.
If you have any questions regarding optional accessories, or if you wish to place an order, contact the dealer from whom you purchased the instrument.

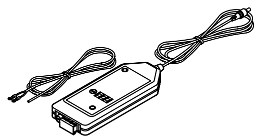
4-ch logic plobe 788031



4-ch high voltage logic plobe 788035



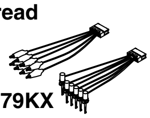
DC/DC converter
9 to 18 VDC input model : 788025-1
18 to 36 VDC input model : 788025-2
36 to 60 VDC input model : 788025-3



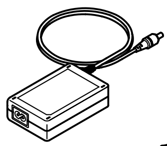
logic plobe read

B9879PX

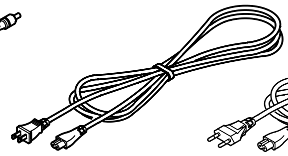
B9879KX



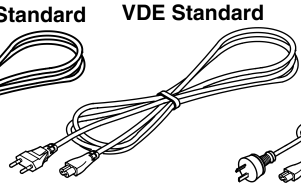
AC adapter 788011



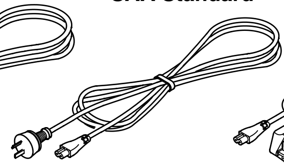
-M
UL/CSA Standard



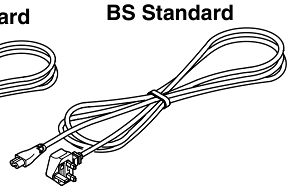
-F
VDE Standard



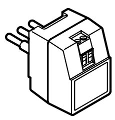
-R
SAA Standard



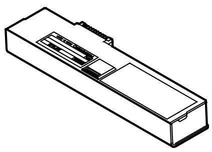
-S
BS Standard



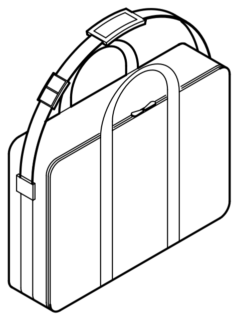
Temperature input adapter 788041



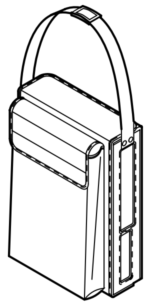
Rechargeable battery pack (NiMHbattery)
788021



Carring case 788081



Small carring case 788082



Safety Precautions

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

The following symbols are used on this instrument.

⚠ To avoid injury, death of personnel or damage to the instrument, the operator must refer to an explanation in the User's Manual or Service Manual.

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

⎓ Direct current

│ ON(power)

○ OFF(power)

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

WARNING

Power Supply

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

Do not Operate in an Explosive Atmosphere

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

Do not Remove any Covers

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

How to Use This Manual

Manual Structure

This manual is divided into 14 chapters, an appendix and an index as follows.

Chapter	Title	Description
1	Overview	Describes the functions of the OR100E, OR130 and its parts. Reading this chapter helps you to understand the operation procedures that are described in the following chapters.
2	Before Operation	Describes handling precautions, installation of the recorder, connection to the power supply, installation and recharging of the batteries, power switch, loading of the roll chart, setting of the date and time, and so on.
3	First-time Users	Describes the basic operations of the recorder. Describes easy methods to set the measurement range, sample rate, and trigger. Also describes how to display or record the captured data.
4	Setting the Measurement Range, Filter, Time Axis, and Linear Scaling	Describes how to set the measurement conditions such as the measurement range, filter, and time axis. Also describes how to set the zero adjustment and linear scaling. Describes the monitor screen.
5	Triggering	Describes how to set the normal trigger and the wave window trigger.
6	Data Capturing	Describes how to capture the measured data to the internal memory, display or record the captured data, and read or calculate values using the cursor.
7	Realtime displaying and Recording	Describes how to display and record the measurement data in realtime.
8	Data Capturing while Realtime Recording	Describes how to capture the data when a trigger occurs while recording in realtime with the built-in printer.
9	Performing Harmonic Analysis	This function is only available on the OR300E. Describes how to analyze the harmonic components on the power supply.
10	Using External Media	Describes how to save measurement data and setup data to the flash ATA memory card and how to load them. Describes how to save the data to the flash ATA memory card automatically after capturing the data.
11	Using Communication Functions	Describes how to set the RS-232 and send waveforms and digital values over the FAX modem. Describes how to send the data automatically by FAX.
12	Miscellaneous Functions	Describes how to operate multiple OR Series in synchronization, hard copy, record list of setting parameters, switch display language, set tags and comments, and so on.
13	Troubleshooting, Maintenance, and Testing	Describes probable causes of problems and their corrective measures. Describes the various messages that appear on the screen. Also describes how to test the recorder.
14	Specifications	Lists the functional specifications and general specifications of the recorder.
	Appendix	Describes the communication commands.
	Index	

Conventions Used in this Manual

Unit

k	Denotes “1000”.	Example: 100 k data
K	Denotes “1024”.	Example: 640 KB (file size)

Used Characters

Alphanumerics enclosed in double quotation marks usually refer to characters and set values that appear on the screen and panel.

Note

The following symbol marks are used to attract the operator’s attention.

Affixed to the instrument, indicating that for safety, the operator should refer to the User’s Manual.

WARNING

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

CAUTION

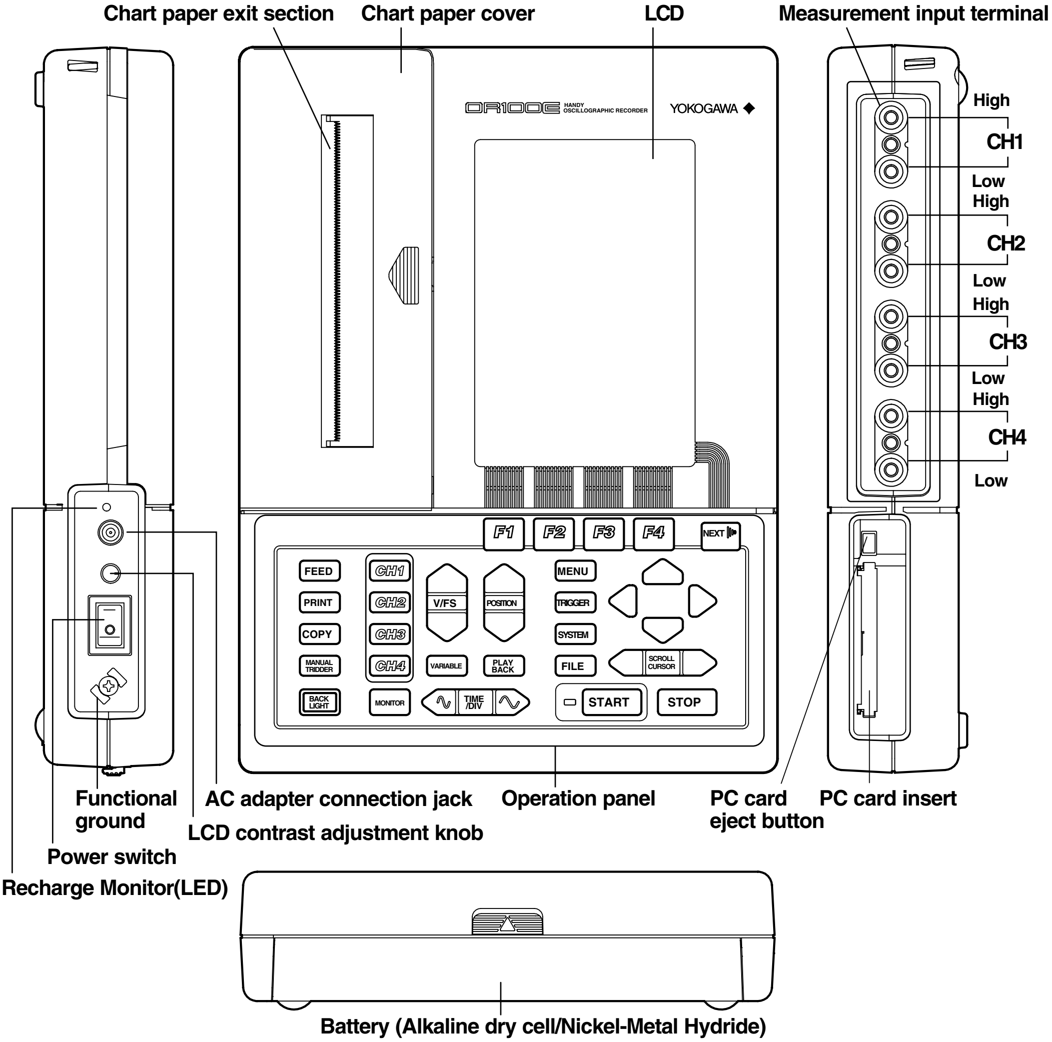
Describes precautions that should be observed to prevent damage to the instrument.

Note

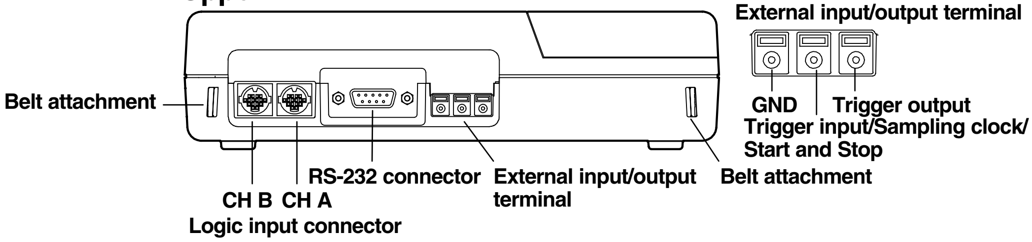
Provides information that is important for proper operation of the instrument.

Contents

1.1 Names of the Parts and Their Functions

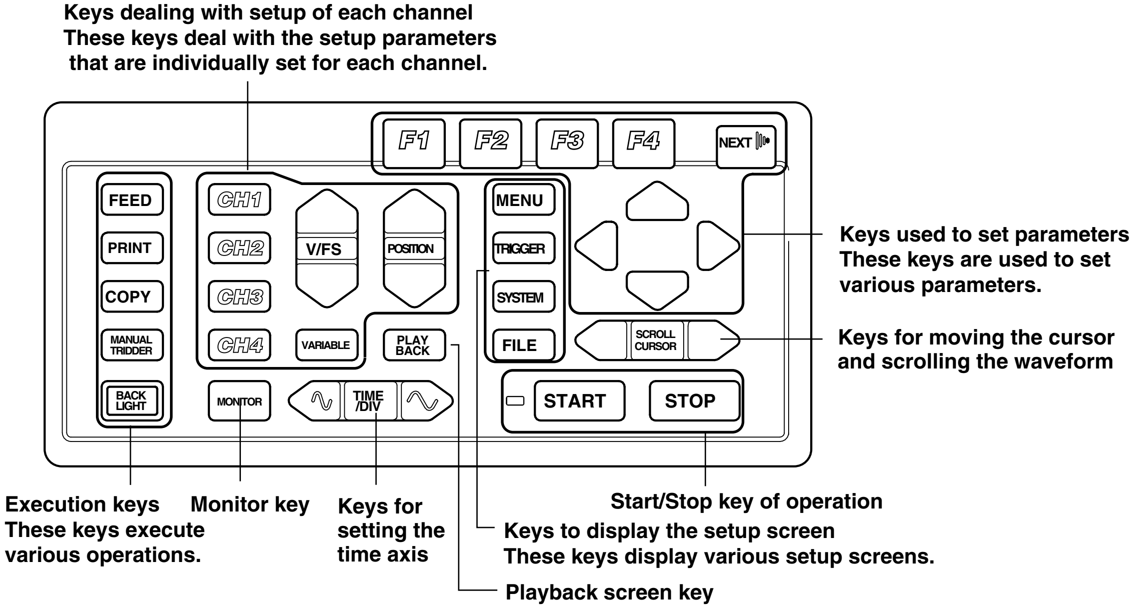


Upper



Operation Panel

The operation panel can be divided into the following groups of keys.



See next page for descriptions on the function of each

Copy key
Output the data displayed on the screen to the built-in printer/FAX modem/memory card.

Print key
Print the captured data in the memory.

Feed key
Feeds the chart.

Channel key
Displays the screen for setting the range/time axis/filter/linear scaling. On the display of captured data, this key displays the menu for turning ON/OFF the waveform display and scaling the waveform in the voltage axis direction.

Range key
Valid on the measurement range setting screen specified by the channel key. Sets the measurement range

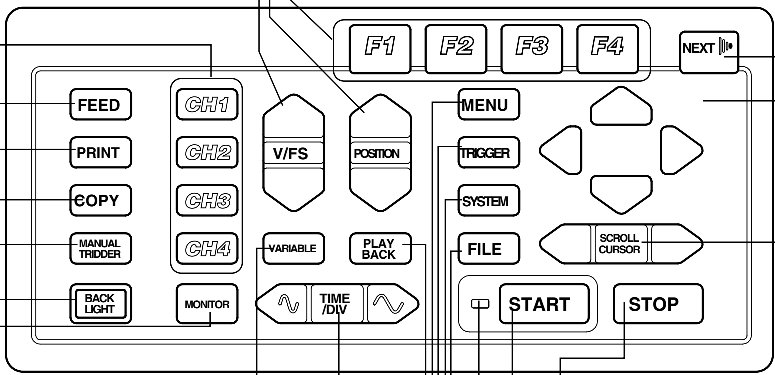
Position key
Valid on the measurement range setting screen specified by the channel key. Changes the waveform display

Setting keys
Sets the items allocated to the keys.

Scroll/Cursor key
Moves the cursor or scrolls the display waveform. Also used to select input characters.

Select key
Selects the setting item. Also used to move along the digits when inputting numbers or characters.

NEXT key
Displays the next selectable item to be displayed on the screen. Valid when " ▶ "is displayed on the right of the selectable items.



Variable key
Valid on the measurement range setting screen specified by the channel key. Scales the captured waveform display in the voltage (vertical) axis direction.

Monitor key
Monitors (Displays) the measurement input.

Back light key
Turns the LCD back lighting ON/OFF. Pressing this key for three seconds locks or unlocks the keys when key lock function is set ON.

Manual trigger key
Pressing this key sets off the trigger when in the trigger wait state.

Time axis key
Sets the time axis (Time/div) on the measurement range setting screen specified by the channel key. At the display of captured data, this key scales the waveform in the time axis direction.

Playback key
Displays the captured waveform. Displaying the cursor/specifying the block/calculating statistics on an interval can be performed.

Menu key
Displays the screen to set the conditions for capturing measurement data/display format/record format.

Stop key
Stops data capturing to the memory or stops recording to the built-in printer.

Start key
Starts data capturing to the memory or starts recording to the built-in printer.

Status indicator
Turns green during measurement.

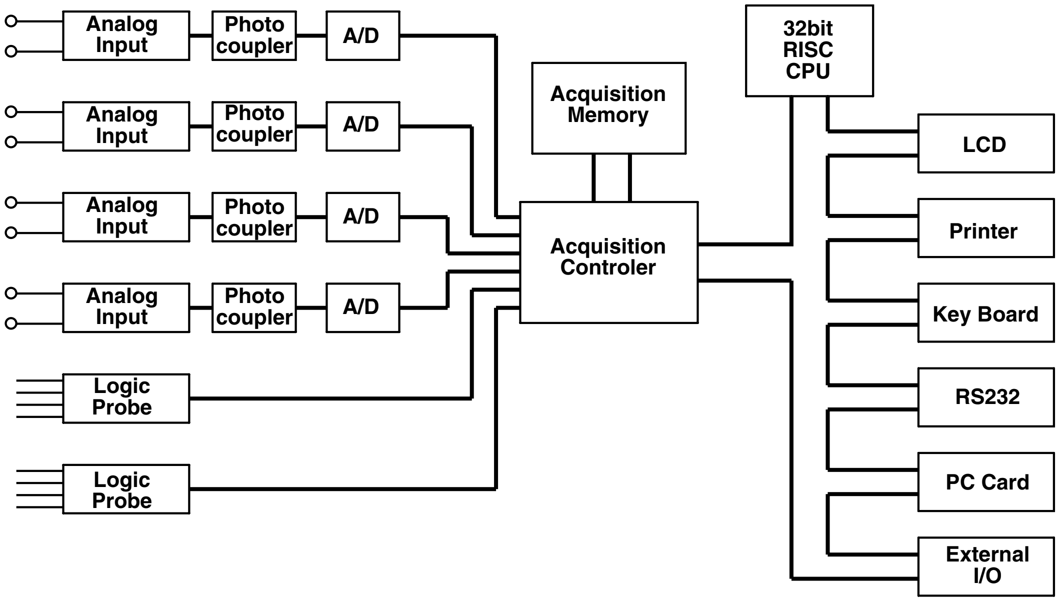
File key
Displays the screen for reading/writing the measurement data/setup data to the PC card.

System key
Displays the screen for setting the RS-232 or the FAX modem.

Trigger key
Displays the screen for setting the trigger.

1.2 System Configuration

Block Diagram



A/D Converter

Each channel has an 11-bit A/D converter with maximum sample rate of 400 kS/s (80 kS/s for wave window trigger) which ensures simultaneity of measurement data, high resolution, and wide dynamic range.

Communication Function

This instrument is equipped with an RS-232 interface. You can send the measurement data as well as the setting parameters to a personal computer. In addition, you can change setting parameters and control the recording and data capturing operations through the RS-232 interface.

PC Card Function

You can send the measurement data and screen data over the FAX modem.
You can also save measurement data (binary or ASCII format), setting parameters, and screen data (BMP data format) to a flash ATA memory card of up to 40 MB. In addition, you can read the saved measurement data from the flash ATA memory card to display and record the data or load the setting parameters and configure the OR100E/OR300E.

External Input/Output

You can input or output the following signals at the external input/output terminals located on the upper panel.

External Trigger Output

This is the trigger signal output to other equipment.

External Trigger Input

This is the signal used to externally trigger this instrument.
You can use the external trigger input/output to operate up to four OR series synchronously.

External Sampling Clock

You can input a clock in this terminal to externally control the sample rate when capturing data.

Start/Stop Signal

This is an external signal used to start and atop the recorder.

1.3 Operation Mode

There are three types of operation modes on the OR100E and four types on the OR300E.

Memory mode

This instrument can save the sampled data in the internal memory (acquisition memory). This is useful in recording changes that are too fast to be recorded in realtime.
You can display the captured data in the internal memory and read the measurement value or make statistical calculation on an interval using the cursors. You can also zoom in or out on the waveform. In addition, you can record the captured data. Furthermore, you can save the captured data to a flash ATA card.
By changing the time/div and data length settings, the measurement data can be captured with the optimum conditions.

Realtime mode

The recorder displays the captured data in realtime or records the data with the built-in printer. In the realtime mode, you can record analog waveforms as well as digital values.

Realtime mode + memory mode

The recorder captures the measurement data to the memory while it displays and records the captured data in realtime. You can use the trigger function to display the waveform in realtime and capture the data to the internal memory when the trigger conditions are met.

Harmonic mode (OR300E only)

This mode is for analyzing harmonics. There are two types of analysis methods.

Waveform analysis

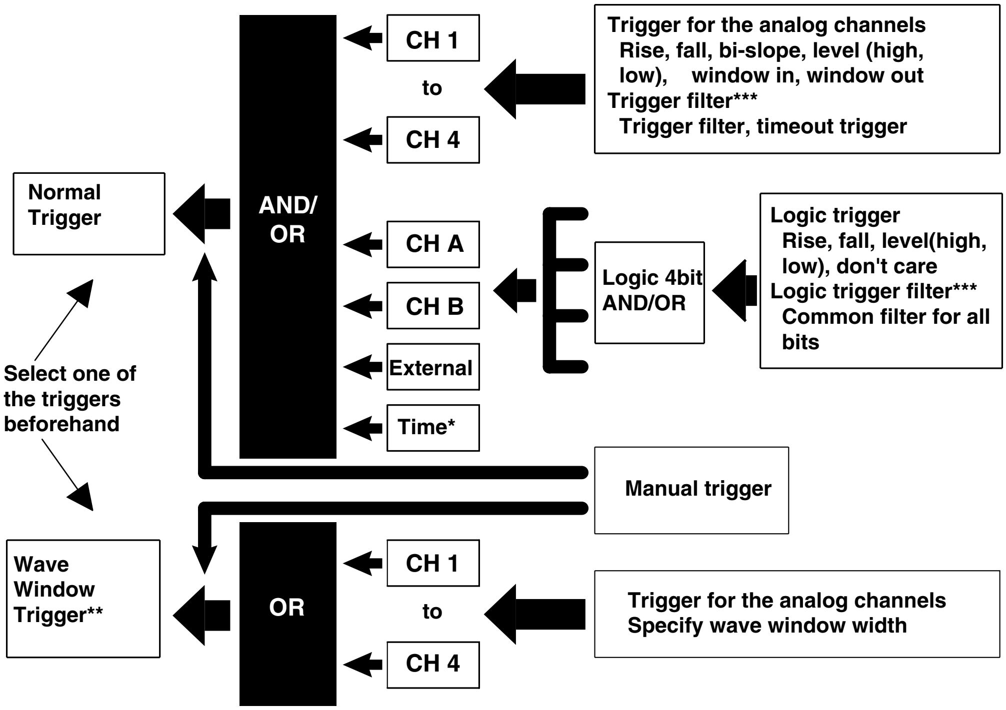
Harmonic analysis is performed over one cycle of acquired data from the point specified by the cursor. Parameters that are analyzed are RMS values, relative harmonic content, and phase. It also displays harmonic distortion (IEC, CSA) and total RMS with digital values.

Automatic analysis

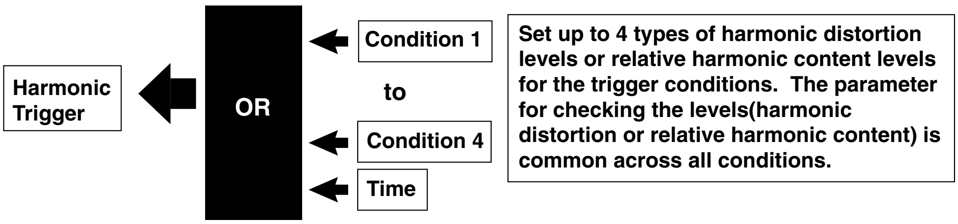
Upon acquiring one cycle of measured data, analysis is performed and the result is displayed. Parameters that are analyzed are RMS values, relative harmonic content, phase, effective power, relative power content, and power phase. It also displays active power, reactive power, apparent power, and power factor with digital values.

1.4 Trigger Function

The following diagram shows the overview of the triggers of this recorder.



* Time trigger valid only during "OR" mode
** Wave window trigger valid only during memory mode
*** Trigger filter valid during memory mode



You cannot use the manual trigger while using the harmonic trigger.

Triggering

You can set the following types of trigger conditions to trigger realtime recording and data capturing.

Types

There are three major types of triggers.

Normal trigger (Edge trigger, level trigger, external signal, time)

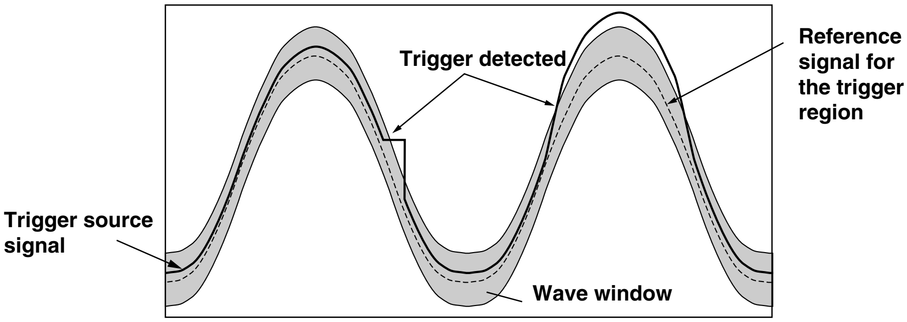
Wave window trigger

Edge trigger/level trigger

Rise :	Trigger occurs when the trigger source signal changes from below the predefined trigger level to above the trigger level.
Fall :	Trigger occurs when the trigger source signal changes from above the predefined trigger level to below the trigger level.
High :	Trigger occurs when the trigger source signal is above the predefined trigger level.
Low :	Trigger occurs when the trigger source signal is below the predefined trigger level.
Bi-slope trigger :	Trigger occurs when the trigger source signal changes from below the predefined trigger level to above the trigger level or from above the predefined level to below the trigger level.
Win-out :	Trigger occurs when the trigger source signal moves out of the predefined region.
Win-in :	Trigger occurs when the trigger source signal enters the predefined region.
Logic trigger :	You can select the following conditions on each bit: ignore(x), changes from 0 to 1 (↑), changes from 1 to 0 (↓), is 1(1), and is 0 (0).

Wave Window Trigger

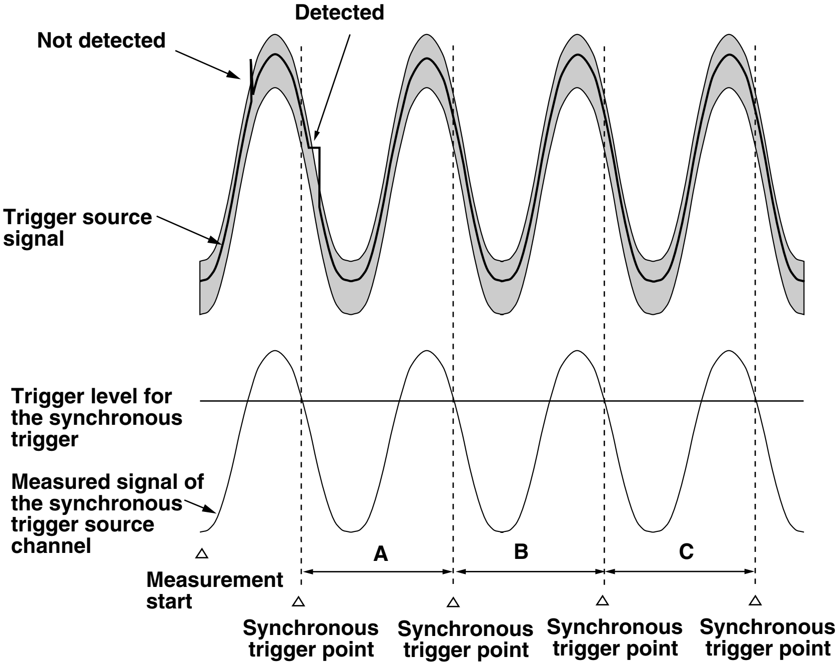
This is used to observe the 50-Hz, 60-Hz power supply signal. A wave window is created based on the ideal power supply signal (sine wave) or an actual power source signal (create a region by adding width on the reference signal). Trigger occurs if the trigger source signal moves out of the wave window.



The width and the phase of the wave window can be specified for each channel.

Synchronous Triggering

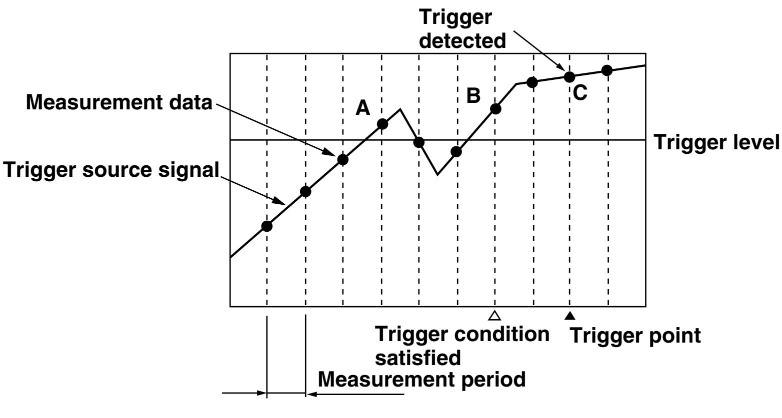
This instrument observes wave window trigger in units of one cycle. By doing this repetitively, you can set triggers on consecutive signals. The trigger used to start the one cycle trigger is called the synchronous trigger and the source channel used to set off the synchronous trigger is called the synchronous trigger source channel. You select the synchronous trigger source channel from one of the measurement channels. When the measurement data of the synchronous trigger source channel goes above a predefined level (Rise) or below the level (Fall), the synchronous trigger is set off and starts the observation of the wave window trigger. Use a signal with small distortion for the synchronous trigger source channel.
The example in the following figure shows the case when the synchronous trigger type is set to Fall. Every time the synchronous trigger triggered, it starts the observation of the wave window trigger as shown by the letters A, B, and C in the figure.
The wave window trigger cannot be detected until the first synchronous trigger occurs.



Conditions on Trigger Detection (Trigger Filter)

This feature can be used on normal triggers. The trigger occurs when the trigger conditions (High condition for Rise, Low condition for Fall) are maintained throughout the specified number of measurement counts. The actual trigger point is located the specified count of points after the point at which the trigger condition is first met. Below shows an example in which the measurement count is set to 3 and the trigger type is set to “Rise” or “High.”

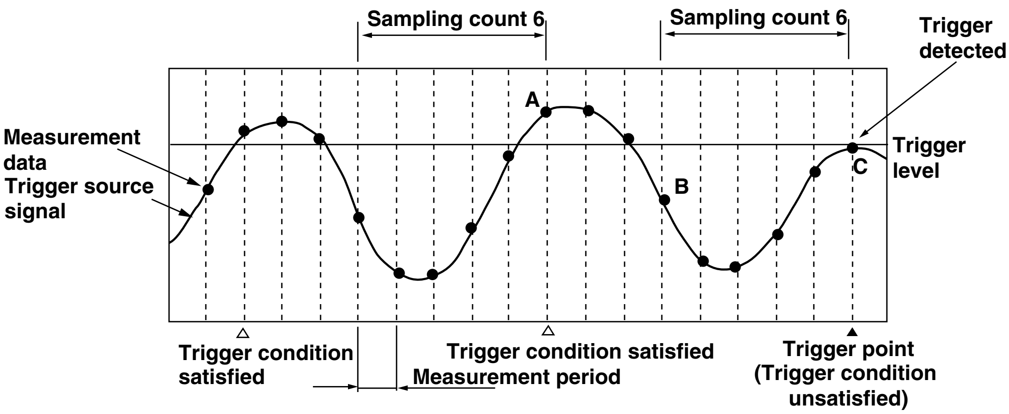
The trigger condition is met at point A, but the trigger is not set off because the signal falls below the trigger level immediately afterwards. The trigger condition is met again at point B. The trigger is set off at point C, because the signal stayed above the trigger level for the specified number of three measurement counts(point C) after point B (including point B as one count).



For “↑” and “↓” of logic trigger, trigger does not occur until the trigger conditions are met for the specified number of counts consecutively.

Timeout

Timeout can be set on normal triggers (edge trigger/level trigger). For edge triggers, the trigger is set off, if the trigger condition is not detected within the specified number of measurement counts after the first trigger detection. For level triggers, if a trigger is not detected within the specified measurement count after the first crossing of the trigger level after the detection of the previous trigger, a trigger occurs. This is useful when observing how the level changes in a periodic signal.
Below shows an example in which the sampling count is set to 6 and the trigger type is set to level trigger.
The trigger condition is met at point A and the data crosses the trigger level at point B. Since the trigger condition is not met after 6 counts (point C) from point B, the trigger occurs at point C.



Trigger of Automatic Harmonic Analysis

This trigger is valid only during the automatic analysis in harmonic mode. Trigger occurs when the harmonic distortion or the relative harmonic content exceeds the specified level.

1.5 Harmonic Analysis Function

Measures the voltage and current of the power supply and performs harmonic analysis. The results of the analysis are displayed with a bar graph or with digital values.
There are two types of analyzing methods on this recorder.

Specify the range and analyze

Harmonic analysis is performed over one cycle of acquired data from an arbitrary point. This is useful when you wish to look over the waveform before performing the analysis. The results can be saved to a file in CSV format.

Note

CSV files are data files which contain data separated by commas. These files can be opened with spreadsheet applications.

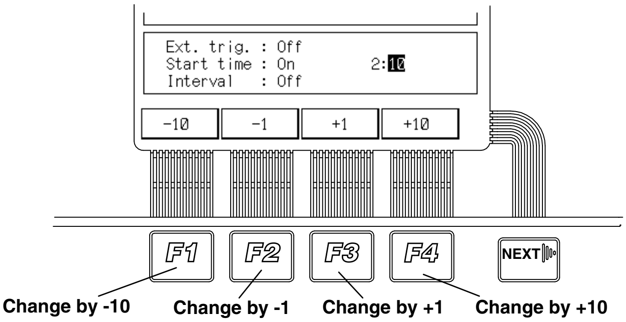
Analyze automatically

Upon acquiring one cycle of measured data, analysis is performed and the result is displayed. This operation repeats automatically. The results can be saved to the built-in PC card in ASCII format. Harmonic analysis on power can also be performed.

1.6 Input Method of Numerical Values and Characters

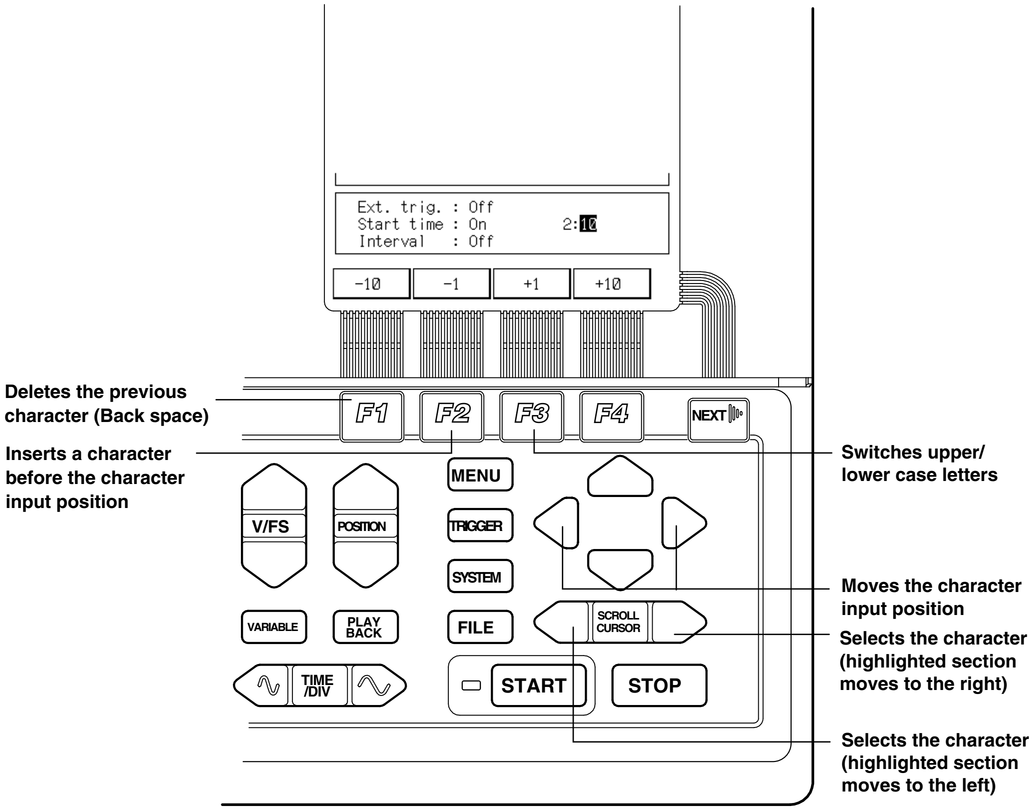
Setting the numerical value

You set the numerical value by increasing or decreasing the current setting value by 1 or 10. -10, -1, +1, +10 are assigned to F1 to F4 keys, respectively. You press the F1 to F4 keys to increase or decrease the setting value.



Character Input

When entering characters and symbols, letters and symbols are displayed on the lower section of the screen. Select the character with the scroll/cursor key and move the character position with the select key.



2.1 Handling Precautions

General Precautions on Handling

Input Terminals

Do not bring any objects charged with static electricity near the input terminals. It may damage the internal circuit.

Do not apply shock to the input terminals. The shock may be converted to electric noise and may enter the recorder.

Display Screen

Remove the protective film covering the LCD after having set up the recorder. The lifetime of the LCD is about 10,000 operating hours. Operation beyond this point may cause the back lighting brightness to go down. In this case, you need to replace the display. Contact your nearest YOKOGAWA dealer listed on the back cover of this manual to have your LCD replaced.

Cleaning

Numerous plastic parts are used on this recorder. Use a dry, soft cloth for cleaning the recorder. Do not use volatile chemicals such as benzene or thinner, as these may cause discoloration or deformation.

Protecting the Case and Operation Panel

Do not apply volatile chemicals to the case or the operation panel. Do not allow rubber or vinyl to remain in contact with the case or the operation panel for extended periods of time. Doing so may cause damage to the recorder.

When Moving the Recorder

Ensure that the power cord and input cables are disconnected. Use both hands to carry the recorder. Moving the recorder with the chart loaded may disturb the chart setting. If you move the recorder with the chart loaded, check that the chart is loaded properly by following the instructions in 2.5 “Loading the Chart”.

Unplug the power cord after Use

When the recorder is not used for a long time

If you are not going to use the recorder for a long time, remove the batteries (AA-size alkaline dry cell, NiMH battery) from the recorder.

Malfunction

Immediately stop the use of the recorder if there are any symptoms of malfunction such as unusual sounds, smell, or smoke coming from the recorder. Turn OFF the power switch and unplug the power cord. If you notice abnormal symptoms, contact your nearest YOKOGAWA dealer listed on the back cover of this manual.

Precautions on Handling the Printer Head

Printer Head's Temperature

To protect the head, the printing load will automatically be reduced if the printer head's temperature exceeds a prescribed level. When the printer head's temperature goes back down, the print intensity will return to normal.

Dirty Printer Head

The printer head may become dirty over long periods of operation, causing the printout to blur in some places. In this case, clean the printer head as described in 13.4 "Cleaning the Printer Head."

Printer Head's Life

The life of the printer head is about 50 km (about 5000 chart rolls). Operation beyond this point may cause the print quality to go down. To replace the printer head, contact your nearest YOKOGAWA dealer.

Power Save Printing

The printing density will automatically be reduced if the density gets too high. This sometimes causes fainter recording.

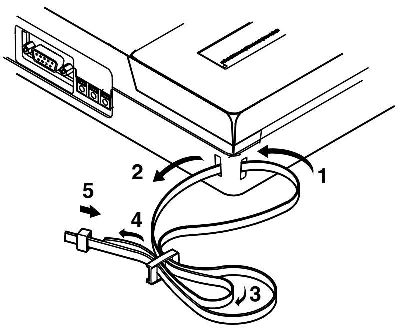
2.2 Installing the Recorder

Set the recorder in a place that meets the following conditions.

- Placing the recorder under direct sunlight or near a heater will adversely affect the internal circuit and the case. Choose a location near room temperature (23 ˚C) with minimal temperature fluctuations. Relative humidity should be 35 to 80 % with no condensation. When the relative humidity is 35 % or below, protect the recorder from static electricity buildup by using a grounded discharge mat. Moving the recorder from a dry, cool environment to a warm, humid environment or abruptly changing the room temperature may cause condensation. In this case, let the recorder adjust to the new environment for at least an hour before use.
- Maintain the left and right sides of the recorder near horizontal position. The maximum permissible inclination from the front to the rear is ±5 degree. Angles greater than this can impede proper recording.
- Exposure to soot, steam, moisture, or corrosive gases may damage or corrode the recorder.
- If you are using a portable phone to send the measurement data, move the portable phone away from the recorder and the measurement lead by at least a meter. The electromagnetic waves of the portable phone can affect the measurement.
- Installing the recorder in a location with mechanical vibration will not only adversely affect the mechanical parts, but may cause improper recording.

Attaching the belt

When using the accessory belt, attach it as shown in the following figure.



There are two places on the top section of the recorder for attaching the belt. Make sure to attach the belt firmly at the two places.

2.3 Connecting the Signal Cable

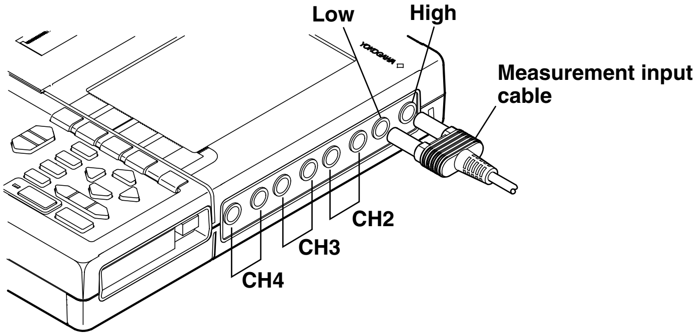
Connecting the Input Signal cable

The input signal cable for measurement is connected to the input terminals located on the right side of the recorder. The number of input channels varies according to the model as follows.

OR122/OR322 : 2 channels
OR142/OR342 : 4 channels

The input terminal is a bipolar safety terminal for the banana plug.

Connect the input signal cable as shown below.

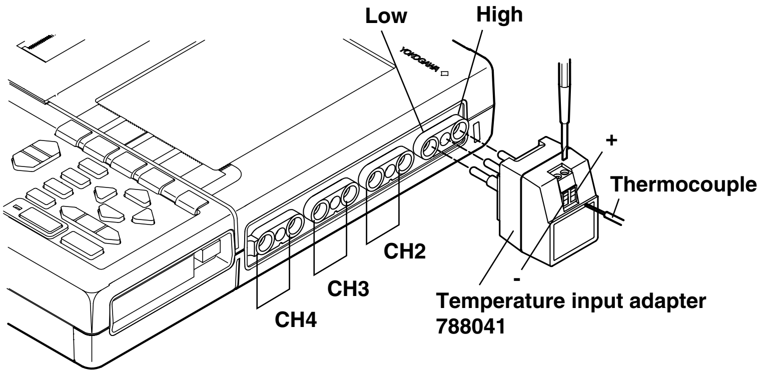


WARNING

- To avoid electric shock, always use the accessory measurement input cable to connect to the input terminals.
- Input impedance is about 1 MΩ. The signal source resistance (including the input signal line resistance) should be less than 500 Ω. If it exceeds 500 Ω, a bias current of about 2 nA will flow. Beware of the measurement errors.
- Never allow the floating voltage to exceed 500 Vrms (CAT II). If voltages exceeding this floating voltage are applied to the input terminal, it may damage the input circuit.
- Never allow the measurement input voltage (voltage difference between the measurement input terminals) to exceed the following values.
  Measurement input voltage : ±250 Vrms
  Also, never allow the sum of the floating voltage and the measurement input voltage to exceed 250 Vrms.
  If voltages exceeding these values are applied across the measurement input terminal, it may damage the input circuit.
- Use an external sensor that comply with IEC1010-1, when measuring current.
- For safety, use an external sensor that is enclosed in a case and whose wires are isolated from the case. Also make sure that the sensor has a sufficient withstand voltage against the voltage to be measured. Use of a bare sensor may cause an electric shock if the sensor is touched accidentally.
- If you are going to use a clamp-type sensor, make sure you are fully aware of the voltage to be measured, sensor's specifications and handling method, so that the possibility of dangers such as electric shocks are avoided.

For Temperature Measurement

When using a type K thermocouple to measure temperature, you will need the temperature input adapter (788041) that is sold separately.
Connect the thermocouple and the temperature input adapter in the following fashion:



Use a thermocouple with a cross sectional area between 0.14 and 2.5 mm^2.

CAUTION

Applying a voltage that exceeds the maximum input voltage (42 V (DC+AC peak)) to the input terminal can damage the input circuit.

Note

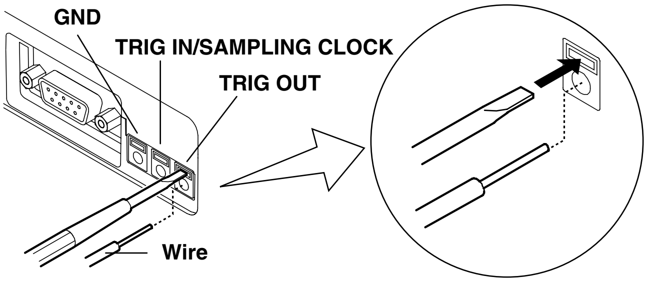
The external sensor must be selected carefully and its frequency and phase characteristics taken into account.

Connecting External I/O Signals

You can connect external signals to the "EXT INPUT/OUTPUT" terminal on the upper panel of the recorder. To meet the recorder's specifications, external equipment must comply with IEC1010-1 or CSA1010.1.

Connecting the Wire

On the top panel, press the rectangular part above the "EXT INPUT/OUTPUT" terminal with a minus screw driver and insert the wire. If you release the screw driver, the wires will be fastened.



CAUTION

Applying voltage outside the allowable input voltage (-0.5 to 5.5 V) to the input terminal may damage the input circuit.

Wires

Recommended wire: solid wire ø1.0(AWG18), cross sectional area 0.75 mm^2
Usable wires: solid wire ø0.4 to 1.0(AWG26 to 18), cross sectional area 0.3 to 0.75 mm^2(AWG22 to 20), element wire at least ø0.18
Bare wire: 10 mm

External Trigger Input (Trig in)

Input a TTL-level trigger signal into this terminal. See page 11-6 for setting the terminal. This terminal is also used when operating multiple OR100Es/OR300Es synchronously. This terminal is shared with the external sampling clock or when starting/stopping the recorder with external signals.

External Trigger Output (Trig out)

This terminal outputs a TTL-level trigger signal. This terminal is also used when operating multiple OR100Es/OR300Es synchronously.

External Sampling Clock (Ext sample)

This terminal is used to input a TTL-level sampling clock. This terminal is shared with the external trigger input.

Note

- Use cables that are 3 m or less to avoid erroneous operation due to noise.
- Separate the signal cables from power cords and cables that emit noise. Also, avoid running the cables in parallel.
- To prevent an emission of electromagnetic disturbances, separate the external I/O wires from the power supply and measurement input and logic input wires by at least 10 cm. 50 cm or more is recommended.

Connecting Logic Input Signals

Logic input consists of channels A and B. Each channel consists of 4 bits giving a total of 8 bits of input.
The accessory logic probe is used to connect to the measurement points. There are two types of logic input, normal logic probe and high-voltage logic probe.
For the normal logic probe, you can use either an alligator clip or an IC-clip to connect to the measurement point.
You can select the input level, TTL level or contact input, with the switch on the logic probe.
For the high-voltage logic probe, you can use the alligator-clip measurement lead to connect to the measurement point.
The case and the logic probe are insulated from each other.

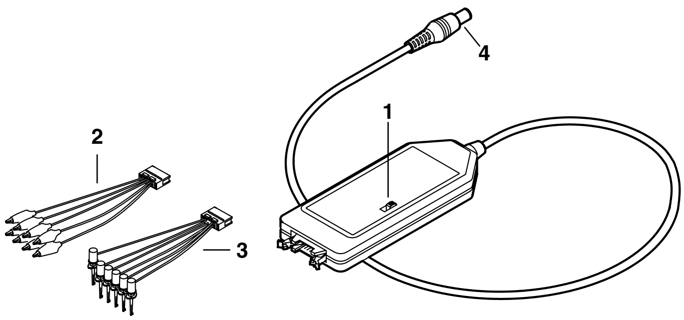
Logic Probe

788031

1. Overview

This probe is a dedicated logic probe for connecting to the logic input connector of the OR100E/OR300E.
Since the probe has a TTL-level input/contact input selector switch, wide-range of measurements can be made from electronic circuit to relay operation timing measurements.

2. Component Names



1 Input selector switch :
Used to switch between the two input formats, TTL-level (TTL) and contact (CONTACT).

2 Connection lead (alligator clip) :
Used mainly to connect to the contact circuit. There are four signal lines (red) and four ground lines (black).

3 Connection lead (IC clip) :
Used mainly to connect to the electronic circuit. There are four signal lines (red) and two ground lines (black).

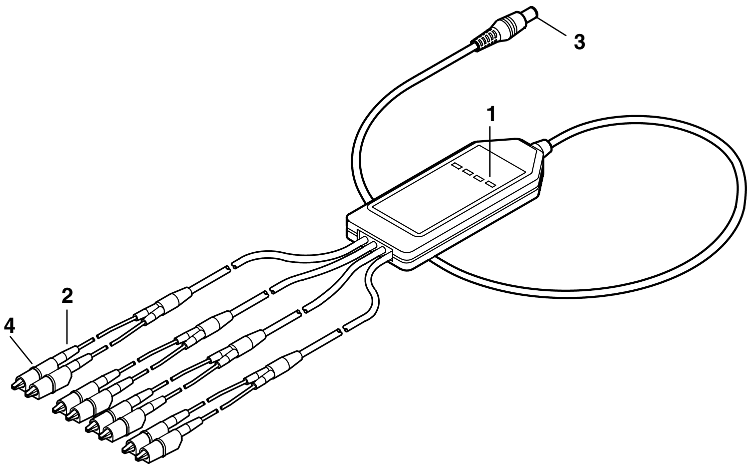
4 Round-type connector :
This is for connecting to the logic input connector of the OR100E/OR300E.

788035

1. Overview

This probe is a dedicated high-voltage logic probe for connecting to the logic input connector of the OR100E/OR300E.

2. Component Names



1 Input indicator
The indicator lights when a voltage of 30 VDC or more is applied to the probe.

2 Connection lead (alligator clip) :
Used mainly to connect to the contact circuit. There are four signal lines (red) and four ground lines (black).

3 Round-type connector :
This is for connecting to the logic input connector of the OR100E/OR300E.

4 Indication of the furthest point that should be touched
Never touch closer to the connection point beyond the indicated line while the signal is being input to the probe.

Procedure on Use

(1) Attach the accessory connection lead (IC clip or alligator clip) to the logic probe.

(2) When using the 788031, set the input selector switch. For a TTL-level input, threshold input voltage is about 1.4 V : any voltage higher than this sets the logic to “1.” For a contact input, shorting signal lines and ground lines sets the logic to “1.”

(3) Turn OFF the power switch.

(4) Connect the round-type connector to the logic input connector of the OR100E/OR300E.

(5) Turn ON the power switch.

(6) Connect individual lead clips to the measurement points.

Specifications

788031 (when connected to the OR100E/OR300E)

Input type :	Common ground within the same probe Floating between recorder and probe
Number of inputs :	4
Allowable input range :	±35 VDC
Input impedance :	10 kΩ or more
Threshold level :	About +1.4 V
Input method :	TTL level or contact input (switching type)
Withstand voltage :	Between logic probe and case: 500 VDC for one minute
Insulation resistance :	Between logic probe and case: 10 MΩ or more at 500 VDC
Maximum floating voltage :	30 Vrms AC or 60 VDC

WARNING

- Applying a floating voltage above 30 Vrms or 60 VDC may cause electric shock. Never apply voltage above 30 Vrms or 60 VDC.
- The cover should be removed by qualified personnel only.

CAUTION

- Check the selector switch before connecting.
- The four input lines on a probe are common ground. Do not apply different common voltages to them as it may damage the logic probe or the connected equipment.
- Turn OFF the OR100E/OR300E when connecting or disconnecting the round-type connector from the logic input connector.
- Never modify (extend, for example) the connection leads.
- Do not exceed the allowable input range (± 35 V including the common voltage). It may damage the logic probe or the OR100E/OR300E.

Note

If the logic probe is not connected to the OR100E/OR300E, the waveform becomes "1" (High).

Specifications 788035 (when connected to the OR100E/OR300E)

Input type :	Floating between recorder and probe Isolated channels
Number of inputs :	4
Allowable input range :	± 250 Vrms
Input impedance :	100 kΩ or more
Detection level :	60 to 250 VAC (50/60 Hz) ±30 to ±250 VDC
Undetected level :	0 to 10 VAC (50/60 Hz) 0 to ±10 VDC
Response time :	Rise 1 ms or less (100 VDC, 200 VDC) Fall 3 ms or less (100 VDC, 200 VDC)
Withstand voltage :	Between logic probe and case: 1.5 kVDC for one minute Between each channel: 1.5 kVAC for one minute
Insulation resistance :	Between logic probe and case: 10 MΩ or more at 500 VDC
Maximum floating voltage :	250 Vrms

WARNING

- Make sure that the measurement input voltage does not exceed the value indicated below. If it exceeds the value, it may damage the input section or cause electric shock.
  Measurement input voltage: ±250 Vrms (CAT II)
  Also, never allow the sum of the floating voltage and the measurement input voltage to exceed 250 Vrms.
- High voltage is applied at the connection point of the probe.
  Never touch closer to the connection point beyond the indicated line while the signal is being input to the probe.

CAUTION

- Turn OFF the OR100E/OR300E when connecting or disconnecting the round-type connector from the logic input connector.
- Never modify (extend, for example) the connection leads.
  Do not exceed the allowable input range (± V including the common voltage). It may damage the logic probe or the OR100E/OR300E.

Note

If the logic probe is not connected to the OR100E/OR300E, the waveform becomes “1” (High).

2.4 Connecting the Power Supply and ON/ OFF

This recorder can use three types of power supplies:

- AAA Alkaline dry cell
- AC Power supply You need an AC adapter sold separately.
- Rechargeable battery   You need a NiMH battery and an AC adapter for recharging. Both are sold separately.
- DC Power supply   You need a DC/DC converter sold separatery.

When using AAA Alkaline Batteries

Precaution on the Alkaline Dry Cell

CAUTION

- Place the batteries in the right direction. Otherwise, the batteries may leak or explode.
- Do not disassemble, heat, or expose to fire.
- Do not short the batteries.
- Do not recharge the batteries.
- Do not solder onto the batteries.
- Do not use the manganese dry cell.
- Use new batteries from the same manufacturer.
- When replacing the batteries, replace all six.
- Remove the batteries if not used for long time.

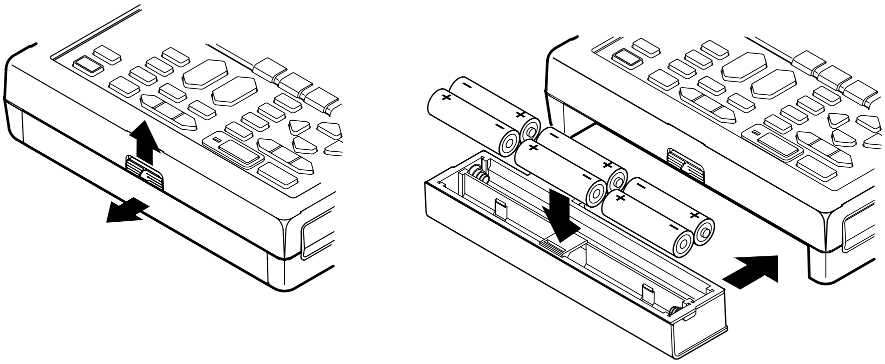
Operation time of alkaline dry cells

The operation time of alkaline dry cells depend on the environment and how it is used. See the following table for a typical figure.

Condition	Operation Time
Trigger wait condition without options	About 2 hours (OR100E) About 110 minutes (OR300E)
Recording an 1-Hz cycle waveform with 2 s/div setting	About 30 minutes (OR100E) About 20 minutes (OR300E)

Procedure on Placing the Batteries

1 Check that the power switch is turned OFF. If you are using the separately sold AC adapter, check that the AC adapter is not connected.
2 Turn the OR100E/OR300E upside down and remove the Alkaline dry cell holder located on the bottom side of the recorder.
3 Place six Alkaline batteries in the holder. Make sure to place them in the right direction (See figure below).
4 Attach the dry cell holder to the recorder.



When Using the AC Adapter

Before Connecting the Power Supply

Follow the warnings below to avoid electric shock or damaging the recorder.

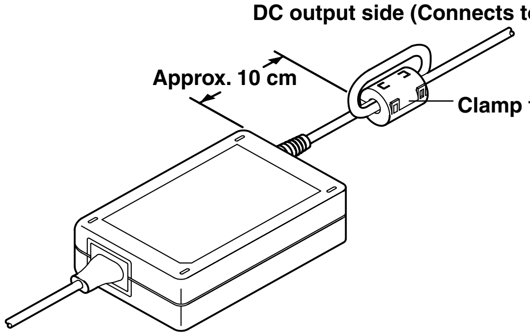
WARNING

- Use the power cord that came with the recorder.
- Before connecting the power cord, check that the voltage on the supply side matches with the voltage rating of this recorder.
- Before connecting the power cord, check that the OR100E/ OR300E is turned OFF.
- When not using the recorder for a long time, unplug the power cord of the AC adapter.
- Only use the AC adapter from YOKOGAWA (Model No. : 788011).
- Do not put objects on top of the AC adapter or the power cord. Also, do not let heat generating objects come in contact with them.
- When unplugging the power cord, do not pull on the power cord. Always hold the plug. If the power cord becomes damaged, contact your nearest YOKOGAWA dealer listed on the back cover of this manual.

Procedures on Connecting the AC Adapter

1 Check that the power switch is turned OFF.

2 Attach the clamp filter that came with the AC adapter to the output side of the cable of the AC adapter (see figure below).



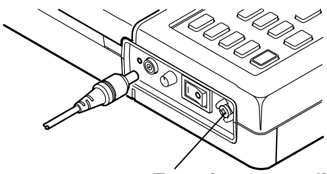
3 Connect the optional AC adapter to the AC adapter jack on the recorder.

4 Connect the power cord plug that came with the AC adapter to the power supply connector of the AC adapter.

5 Connect the plug on the other end of the power cord to a power outlet meeting the following specifications.
The power outlet should be a three-pole type with a protective grounding terminal.

Power Supply Rating

Rated power supply voltage :	100 to 240 VAC
Permissible supply voltage range :	90 to 264 VAC
Rated supply voltage frequency :	50/60 Hz
Permissible supply voltage frequency range :	48 to 62 Hz
Maximum power consumption :	70 to 90 VAC
AC adapter rated output voltage :	12 VDC
AC adapter maximum rated output current :	2.6 A



Functional grounding

When using the AC adapter, noise may be reduced if the functional ground is connected to the earth GND. Use the functional ground terminal as necessary.

When Using the NiMH Battery Pack (Sold Separately)

Installation of the Dedicated NiMH Battery Pack

Follow the warnings below when using the NiMH battery.

WARNING

- The electrolyte solution inside the battery is alkaline. When the solution comes in contact with clothing or skin due to a leakage or an explosion, it may cause damage to the clothing or the skin. The solution can cause blindness if it enters your eye. If the solution enters your eye, run clean water on the eye. Do not wipe the eye. Then, contact a physician immediately.
- When replacing the NiMH battery, turn OFF the power switch on the front panel and unplug the AC adapter from the power outlet. This will avoid accidents such as shorting the recharge circuit.
- Only use the NiMH battery pack from YOKOGAWA (Model No. 788021).
- Do not leave the battery under direct sunlight, inside a hot vehicle or near fire. It may cause leakage or lower the performance and life of the battery.
- Do not disassemble or modify the battery. It will damage the protective device inside the battery and may cause heat and explosion.
- Do not short the battery. The heat generated by the batteries may cause burns.
- Do not throw the battery into fire. The battery may explode or the electrolyte solution may spray out. This is very dangerous.
- Do not apply excessive shock such as throwing the battery. The battery may leak, heat up, or explode.
- If you are moving the battery by itself, do not carry metal objects such as paper clips together with the battery. You may short the battery.

CAUTION

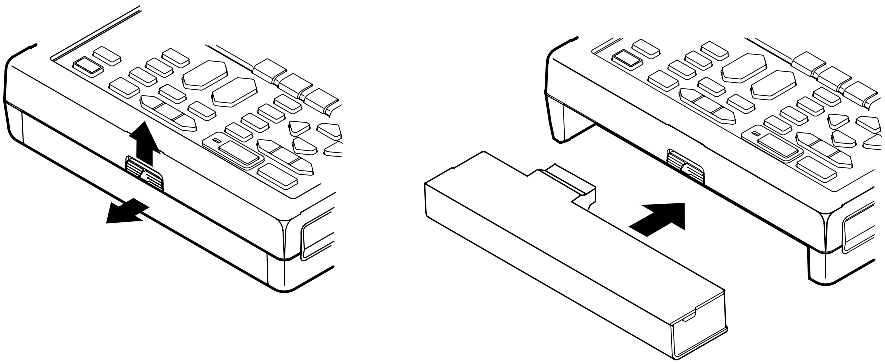
- Do not let water come in contact with the battery. It will cause heat and corrosion. It will also cause the battery to lose its function.
- It is not possible to recharge NiMH batteries once they have been over discharged.
  To prevent the battery from getting over discharged when not using it for a long period, first recharge the battery, then remove it, and store it in the following environment:
  Storage for less than 1 year: Between -20°C and +35°C, at low humidity.
  Storage for less than 3 months: Between -20°C and +45°C, at low humidity.
  Even if stored in above environment it is recommended to periodically recharge the battery.

When installing the dedicated NiMH battery, follow the procedure below.

1 Check that the power switch is turned OFF.

2 If you are using the AC adapter, remove the AC adapter power cord from the power outlet.

3 Turn the recorder upside down and install the battery in the battery holder on the near side of the bottom section so that the △ mark on the NiMH battery is on the top. If you were using alkaline batteries, remove them first.



Recharging the NiMH battery

The dedicated NiMH battery (sold separately) is not recharged at the time of purchase. When using the NiMH for the first time, fully recharge the battery before use.

In addition, an AC adapter (sold separately, Model No. 788011) is necessary to recharge the battery.

WARNING

- Always use the OR100E/OR300E to recharge the battery.
- Recharge the battery in an environment with a temperature between +10 to +35 ˚C. Otherwise, the battery may leak , heat up or not get fully recharged.

Procedure on Recharging

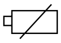
1 Install the battery as explained previously and connect the AC power supply to the recorder.

2 If you leave the power switch to OFF, the LED on the side of the AC adapter jack lights and starts recharging the NiMH battery. The LED blinks quickly when the recharging is complete.
If the power switch is ON, it will not recharge the NiMH battery. In this case, the power to the recorder is supplied from the AC adapter.

Note

- When the LED is blinking slowly (LED is on for about 1 s), recharge is on standby. Recharge is put on standby for the following conditions.
  If the battery temperature is outside +10 ˚C to 35 ˚C range.
  If the battery performance has deteriorated drastically (from over discharge, for example).
- The LED blinks rapidly to indicate that the recharge has completed. However, there are cases when the battery may not be recharged as in the following cases.
  If the battery temperature exceeded 55 ˚C while recharging.
  If the environment temperature changes drastically.

Indication to Recharge

When the battery need recharging, a "  " is displayed on the upper left of the screen. When this mark is displayed, recharge the batteries immediately.

Operation time between charges

Though it depends on how it is used. See the following table for a typical figure.

Condition	Operation Time
Trigger wait condition without options	About 3 hours and 30 minutes
Recording an 1-Hz cycle waveform with 2 s/div setting	About 3 hours

When Using the DC/DC converter

The following models are available for the different input voltages.

788025-1 For 12 VDC

788025-2 For 24 VDC

788025-3 For 48 VDC

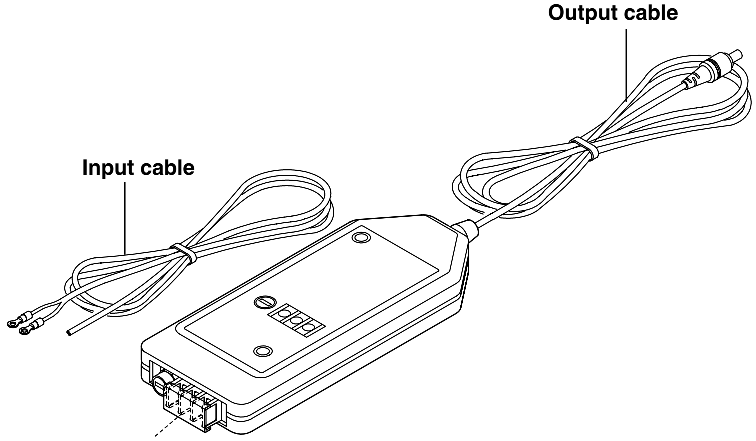
Specfication

Permissible power supply voltage :	788025-1	9 VDC to 18 VDC
	788025-2	18 VDC to 36 VDC
	788025-3	36 VDC to 60 VDC

Output voltage range :	12 VDC +/-5 % 20 VA MAX	
Operating temperature :	5 ˚C to 40 ˚C	
Operating humidity :	35 %RH to 80 %RH	
Storage temperature :	-20 ˚C to 60 ˚C	
Storage humidity :	90 %RH or less	
Withstand voltage :	Between input to output 500 VAC for 1min.	
Insulation resistance :	Between input to output 100 M ohm 500 VDC.	
Fuse :	788025-1	250 V timelag 6.3 A Ø5×20
	788025-2	250 V timelag 4 A Ø5×20
	788025-3	250 V timelag 4A (Ø5×20)
Input terminal :	Feed through terminal	
External dimensions :	About 68(W) × 26.2(H) × 167(D) mm (cable excluded)	
Weight :	Approx 400 g (cable included)	
Accessory:	Instruction Manual	

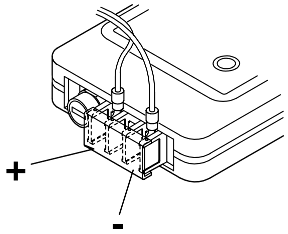
WARNING

- Use the input cables provided by YOKOGAWA for the recorder.
- To avoid electric shock, never touch the input terminals while the power is ON.
- To avoid electric shock, check the following before connecting the input cable.
  Check that the supply voltage matches the input voltage of the recorder.
  Check that the power on the supply side is turned OFF.
- Check that the OR100E/OR300E power switch is turned OFF before connecting the output cable to the OR100E/OR300E.
- Do not put objects on top of the recorder or cables, or let heat sources come in contact with the recorder or cables.
- Make sure to cover the terminals with the terminal cover during use.
- Tighten the terminal screws with a force of 0.8 N-m (8 kgf-cm).
  Also, tighten the screws periodically.



Connection

1. Connect the end of the input cable with the terminal chip to the input terminal of the DC/DC converter. The center terminal of the input terminal is not used.



2. Check that there is no current flowing to the connection terminals on the supply side, then connect the input cable to them. Make sure the polarities are correct when connecting the DC/DC converter to the supply side.
3. Connect the power cord of the DC/DC converter to the AC adapter connection jack of the OR100E/OR300E.

Power Switch ON/OFF

Before Turning ON the Power

This recorder can use AAA Alkaline dry cells, AC power supply (sold separately), DC power supply (sold separately) or NiMH battery (sold separately). Before turning ON the power, prepare the power supply as explained in the previous sections.

Note

If you are using Alkaline dry cells or NiMH battery, remove the power cord and the AC adapter. If the AC adapter is connected, the recorder will operate on the AC power supply.

Power Switch Operation

Pressing the " | " side of the power switch turns the recorder "ON." Pressing the " ○ " side of the power switch turns the recorder "OFF."

When the power switch is turned ON, the recorder will run a self-test. Then, the waveforms are displayed with the display conditions before the last time you turned OFF the power.

Adjusting the Contrast

You can adjust the contrast of the screen by turning the knob beside the power switch.

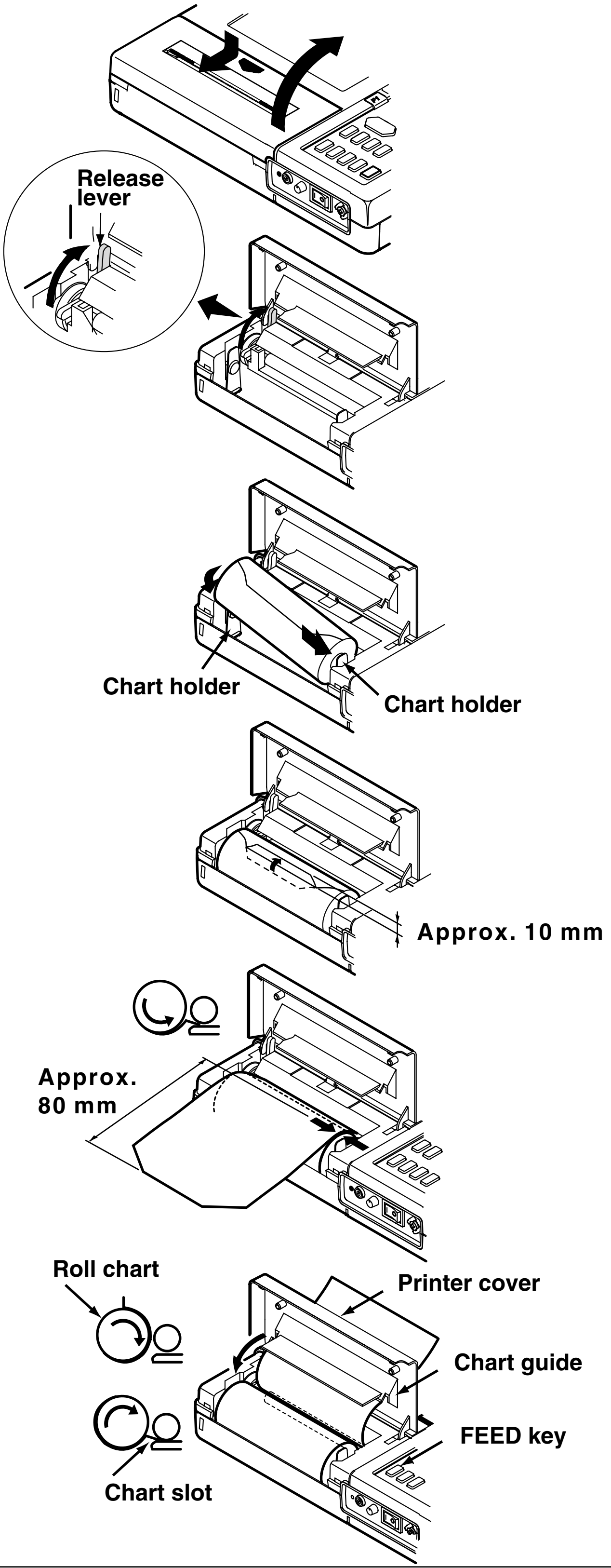
2.5 Loading the Chart

Follow the procedures below to load the roll chart. Have the power turned ON.

1. Slide the part indicated by a "△" on the chart paper cover in the direction of the arrow and open the cover.
2. Pull the release lever on the left side to a vertical position.
3. Bend the chart holder and load the chart paper in the direction as in the figure (Load the right side as you face the printer, first).
4. Fold the front end of the roll chart back about 10 mm in the direction as in the figure.
5. Rotate the roll chart in the direction as in the figure. Stop when the front end of the chart reaches the chart slot.
6. After rotating the roll chart by a small amount in the opposite direction as in step 5, press the "FEED" key to feed the chart until about 80 mm is showing from the chart paper exit section. Then, adjust it so that the section of the paper that is showing is aligned with the roll chart.
7. After pressing the release lever down firmly to the original position, slide the front end of the chart through the chart guide of the chart paper cover. Then, while gently pulling on the chart showing at the front of the product, close the chart paper cover.
8. Press the "FEED" key and check that the paper feeds properly.

Note

- The last meter of the chart has a red band to notify you that it is time to replace the chart.
- When cutting the chart paper, pull up slowly on the section of the chart to cut.
- Do not tear the record chart at the thermal head section as paper dust will enter the printer section and cause blurs in printing.
- When using the small carrying case, make sure that the chart paper is showing on the outside of the case. Otherwise, the chart may not feed properly.


Release lever
Chart holder
Chart holder
Approx. 10 mm
Approx. 80 mm
Roll chart
Printer cover
Chart guide
FEED key
Chart slot

Precautions on Handling the Charts

Storing Chart Paper

The thermal paper changes color at about 70 ˚C. Since it is affected by heat, humidity, light, and chemicals regardless of whether or not the paper has been used, beware of the following points.

- Store the chart in a cool, dry, dark place.
- After breaking the seal, use the chart paper quickly.
- Prolonged contact with plastic films which contain plasticizer (vinyl chloride film, cellophane tape and so on) can cause fading. Therefore, if the paper is to be stored in a folder, use a polypropylene type folder.
- Do not use glue which contain organic solvents such as alcohol and ether on the chart paper as this will cause discoloration.
- For long term storage, taking photocopies of the charts is recommended. Thermal paper has a tendency to fade.

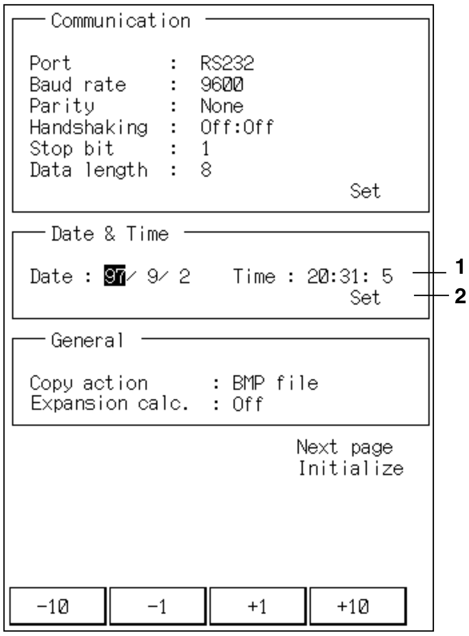
Using Chart Paper

- Only use chart paper provided by YOKOGAWA. Using other charts may cause paper jam.
- Use dry hands when touching the chart. Perspiration from the hand can cause smudging.
- Do not rub the surface with hard objects. Heat generated from friction may cause discoloration.
- Avoid contact with chemicals, oils, and other substances. It may cause discoloration and fading.

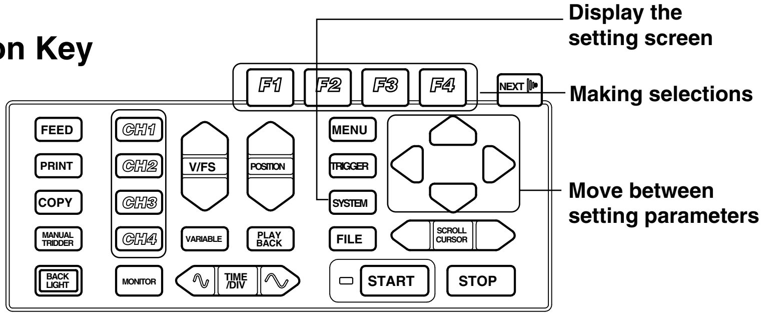
2.6 Setting the Date and Time

Setting Screen

SYSTEM



Operation Key

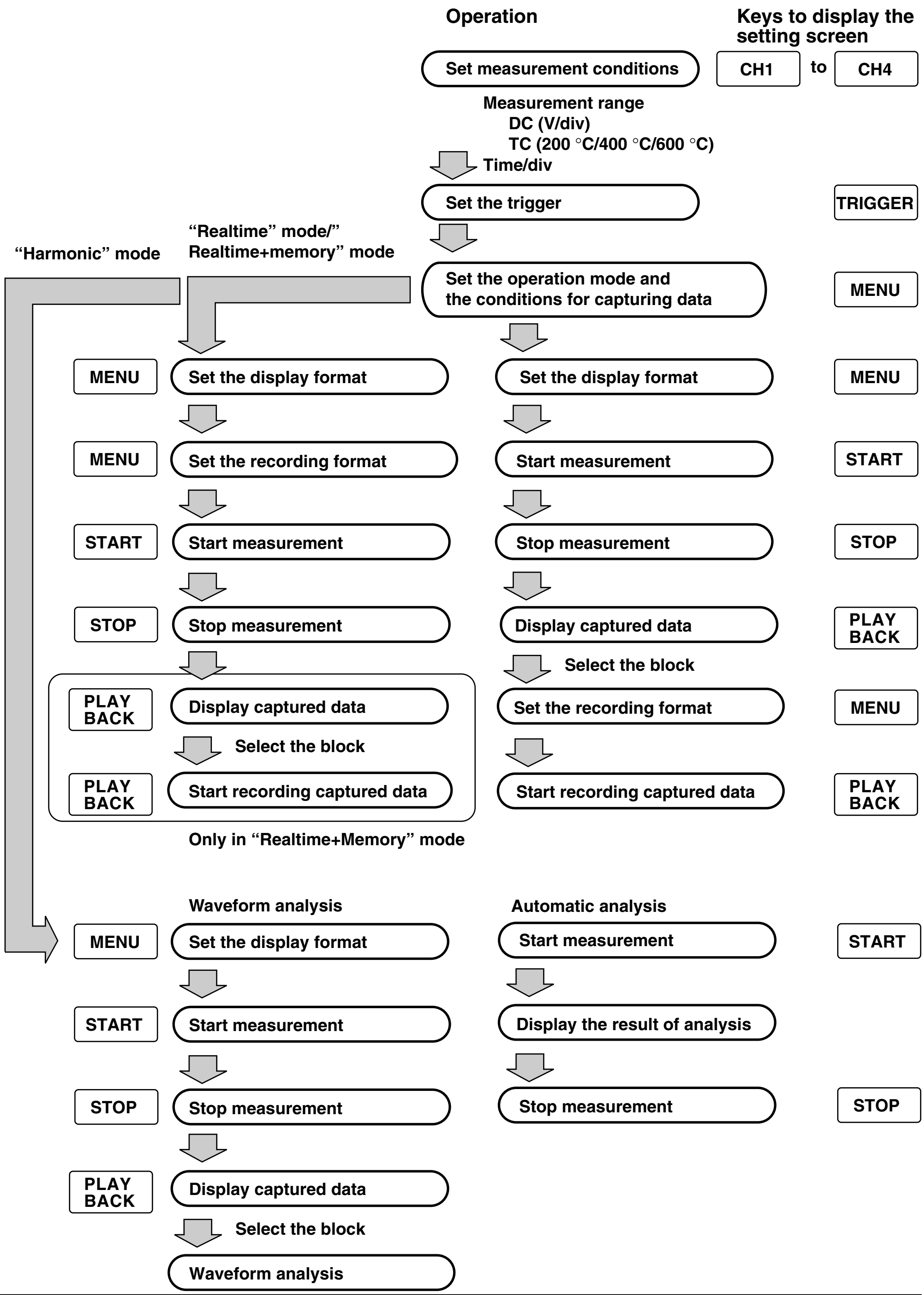


Operating Procedure

1. **Setting the date and time**
   Use the “F1” to “F4” keys to set the data and time. Date is specified in year/month/day order and the time is specified in hour/minute/second order.
2. **Confirming the setting**
   If you highlight “Set”, “Confirm” and “Cancel” will be displayed on the “F1” and “F2” keys, respectively. Confirm the setting by pressing “F1.”

3.1 Setting Procedure

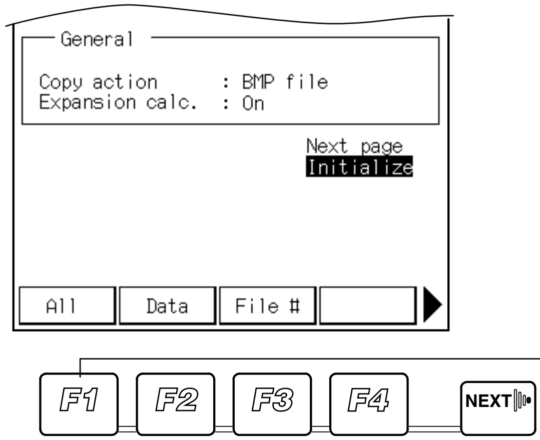
The following figure shows the flow of a standard OR100E/OR300E operation and the corresponding keys to display the setting screen.



3.2 Setting of format

This chapter describes how to change the functions that are frequently used. The descriptions are given on an assumption that you are operating the recorder from the initialized state.
First, initialize the recorder. If this is the first time you are using the recorder after purchasing, you can skip this step.
Press the “SYSTEM” key to display the setting screen.

SYSTEM



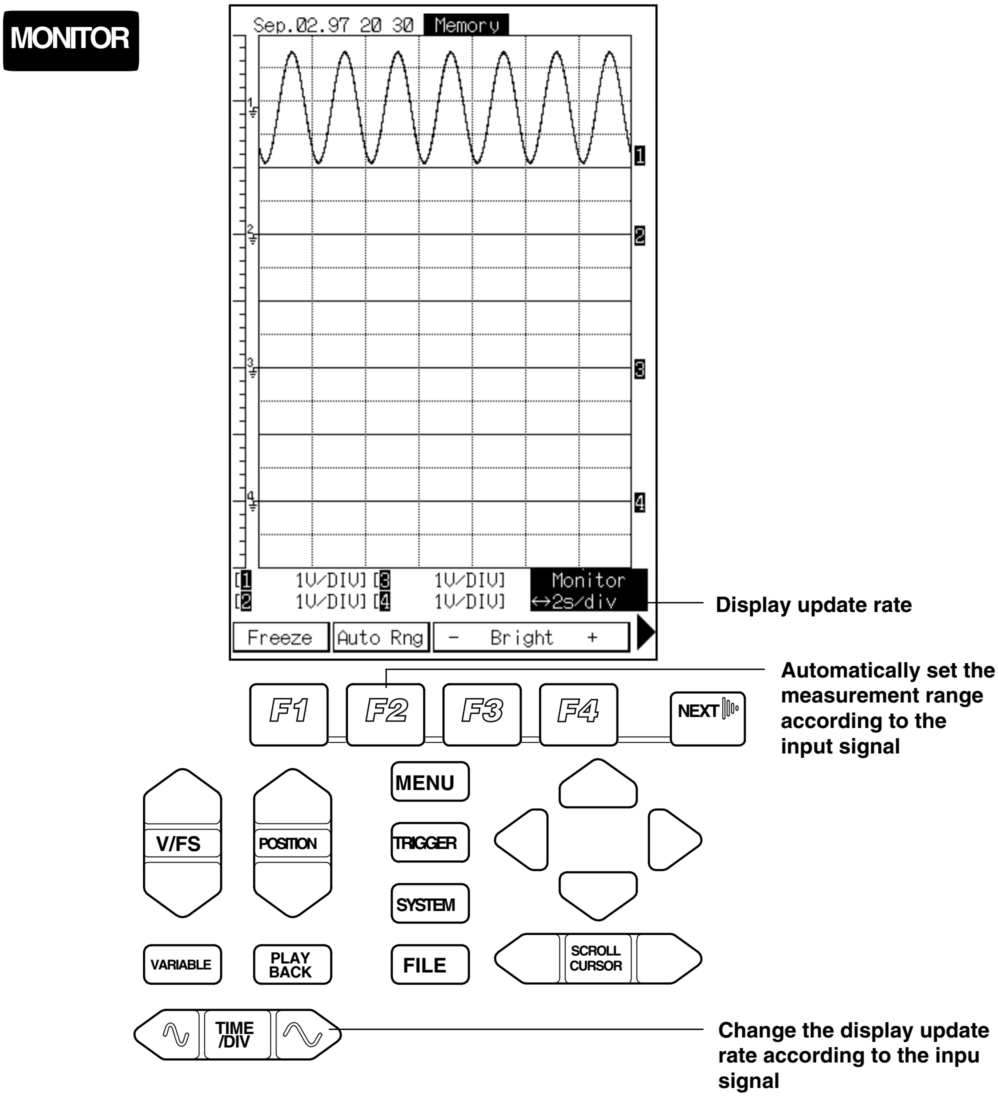
Initialize settings

Note

A complete initialization will reset the setting parameters and the measurement data in the internal memory. Save the setting parameters and measurement data to the flash ATA card as necessary. To save the data, see 10.3 “Saving Measurement Data to the PC Memory Card” or 10.5 “Saving/Loading Setup Data.”

3.3 Displaying the Waveform

Input the measurement signal to the input terminal according to the procedures in 2.3 “Connecting the Signal Cable.”
Pressing the “MONITOR” key displays the waveform.



3.4 Changing the Measurement Range and Sample Rate

Setting the Input Type

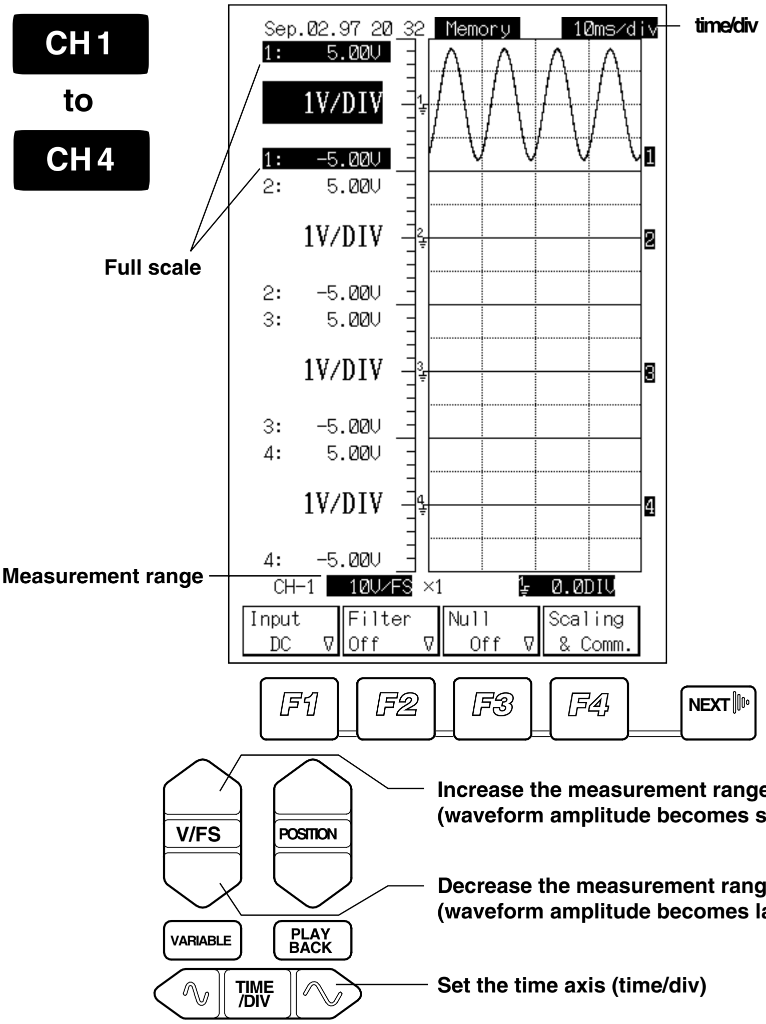
Set the input type according to the item being measured.

DC: DC voltage
TC: Type K thermocouple
RMS: Rms value of the AC voltage (OR300E only)

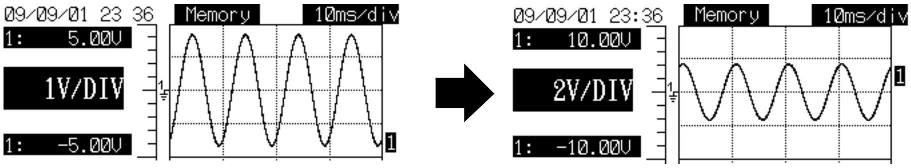
Changing the Measurement Range

Changing the measurement range changes the full scale and the amplitude of the displayed waveform.

Select the channel you wish to change by pressing the corresponding “F1” to “F4” key. A screen for setting the measurement range is displayed.



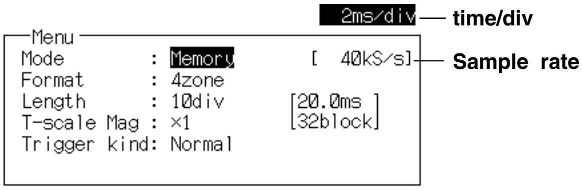
Displayed waveforms for different ranges



Changing the Sample Rate

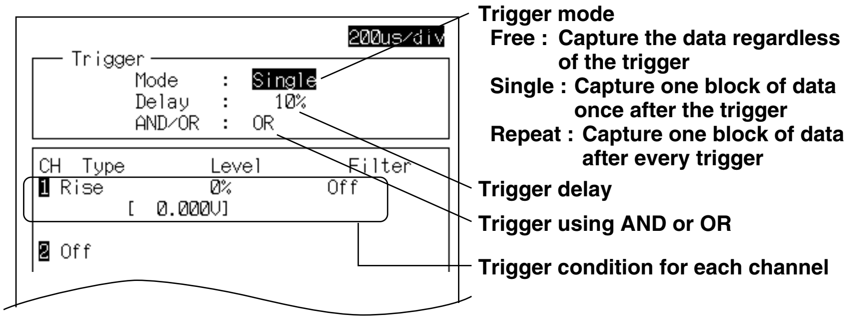
The sample rate is automatically determined by the time axis setting. The time axis is set in time/div. Time/div is the time in 1 div.

Sample rate is displayed in the upper right corner of the screen that appears when the MENU key is pressed.

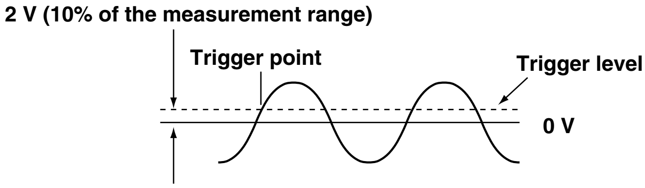


3.5 Setting the Trigger

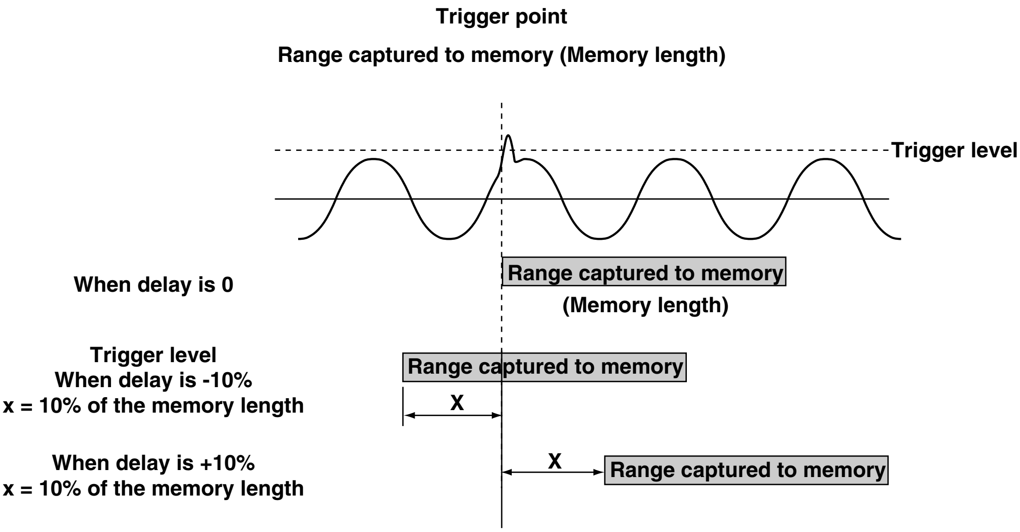
Trigger



In the above example, the trigger occurs in the following cases.



In addition, you can set a delay to start the data capturing before or after the trigger point.

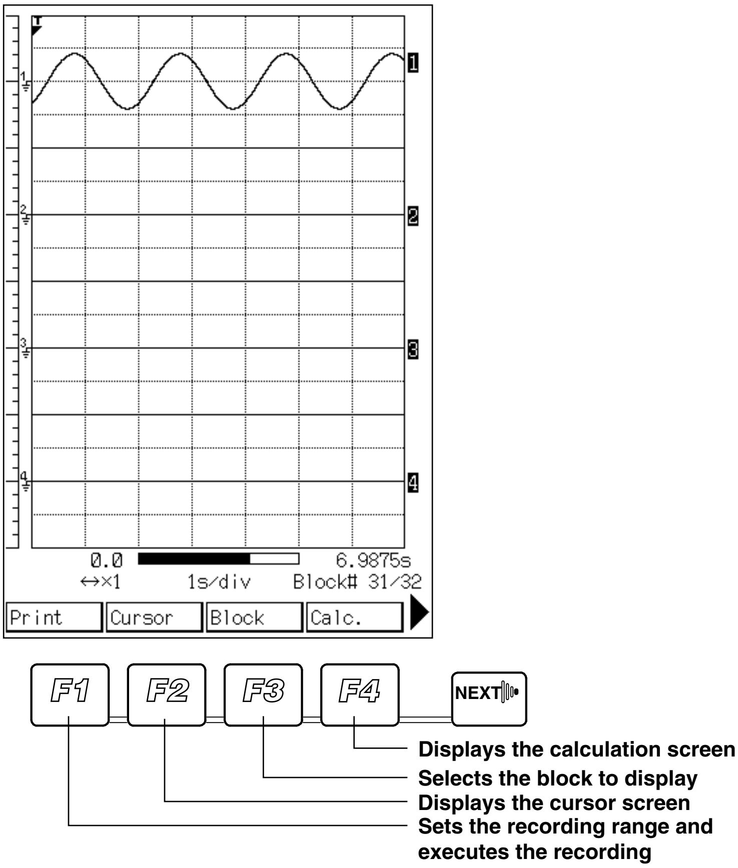


Note

If a trigger is set, measurement data is not captured until the trigger condition is satisfied.

3.6 Displaying/Recording the Captured Data

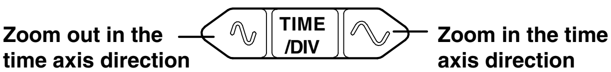
The data that was captured by pressing the “START” key, is displayed or recorded. Pressing the “Playback” key displays the current block of the measurement data.



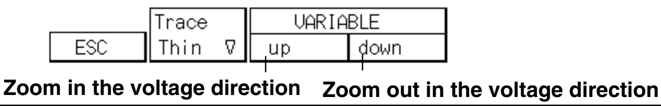
To record the capture data, press the “PRINT” key or press the “F1” key on the Playback screen. It will record the measurement data of the current displayed block.

Zooming in or out on the Waveform

Pressing the “Time axis” key will zoom in on the waveform in the time axis direction.



Zooming in the voltage axis direction is done in the waveform scale screen by pressing the channel keys (“CH1” to “CH4”).



4.1 Setting Parameters

The parameters shown below will be set in this chapter.
You will set these parameters using the screen that is displayed by pressing the "CH1" to "CH4" keys. Zero adjustment is done at the screen that appears when the "MONITOR" key is pressed.

Setting parameters	Description
Input type	Select temperature measurement using thermocouple, DC voltage, or ground.
Measurement range	Set the measurement range in V/div with the "RANGE" key.
Input coupling	Select either DC input or ground level.
Filter	Set ON/OFF using the "F2" key
NULL	Take the current input value to be 0.
Time axis	Set the time/div with the time axis TIME/DIV key.
Scaling	Linear scale to another physical value
Zero adjust	Adjust the ground level to zero.

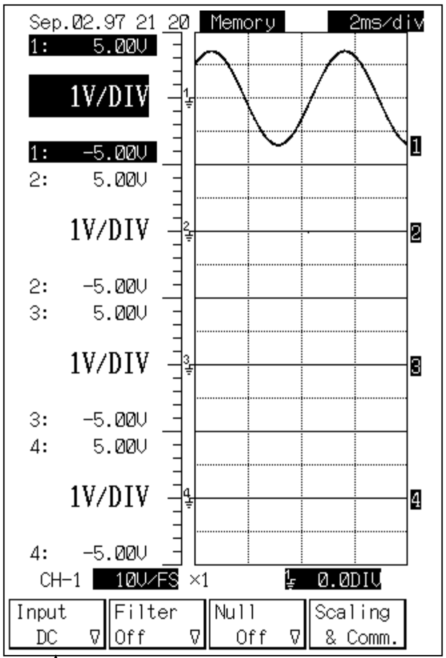
4.2 Setting the Input Coupling

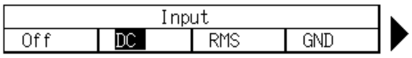
Setting Screen

CH 1

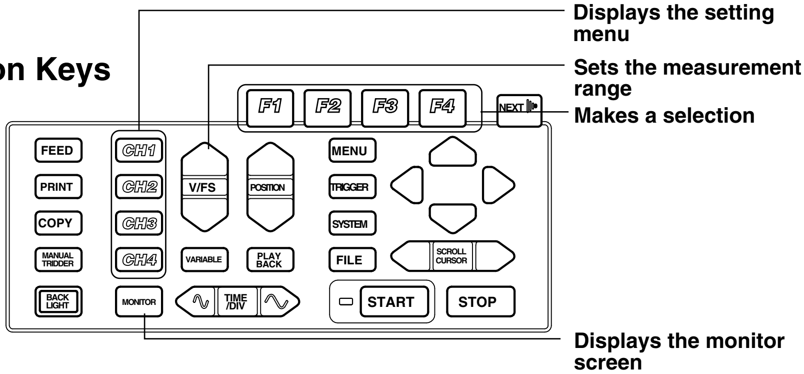
to

CH 4





Operation Keys



Operating Procedure

Setting the Input Coupling

Selects the method to couple the input signal to the vertical control circuit.

Press the “F1” key. Select the coupling method from the following.

DC : Captures the DC and AC components of the input signal.

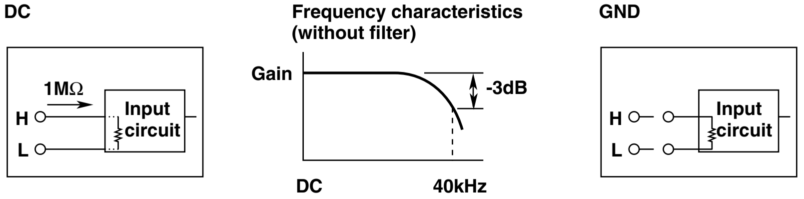
RMS : Measures the RMS value of the AC voltage. This coupling method is available only on the OR300E.

GND : Confirms the ground level.

TC: Specified when measuring the temperature using a type K thermocouple.

OFF : When not making measurements.

The input type for DC and GND is as follows.

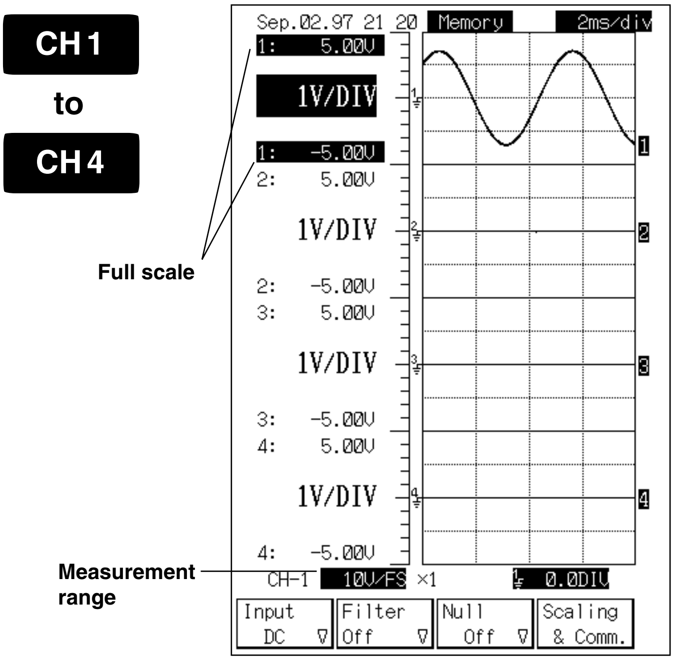


When TC (temperature measurement) is selected

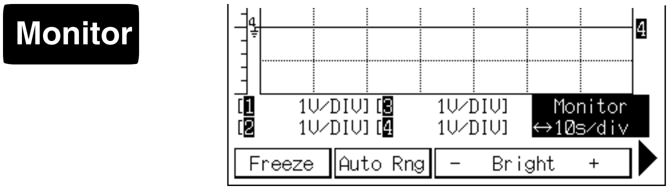
- When making temperature measurements, you will need the temperature input adapter that is sold separately.
- The type of thermocouple that can be used is K.
- Linear scaling is not possible when TC is selected.
- The filter, NULL, and auto range settings of the channel set to TC are void.
- The input type cannot be changed while data capturing or realtime recording is in progress.
- When the input type is changed to TC from a different setting or to a different setting from TC, the measurement range, position, and linear scaling settings are not maintained.
- The GND mark of the channel set to TC is not displayed.
- Temperature measurement values below -100 °C are displayed with an asterisk (*). Trigger levels below -50 °C on the trigger screen are also displayed with an asterisk (*).

4.3 Setting the Measurement Range

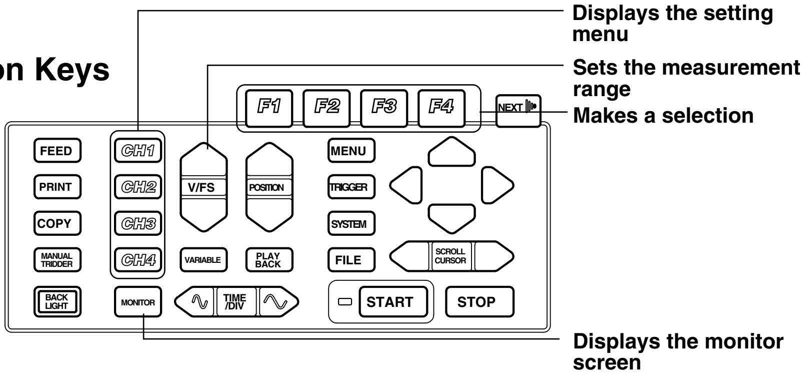
Setting Screen



Setting the Measurement Range Automatically (Auto range)



Operation Keys



Operating Procedure

1. Setting the Measurement Range

The measurement range is set according to the input signal. There are two methods to set the range, manual range and auto range.

Manual range

The range is set at the screen that appears when the channel key is pressed. The current input signal is displayed on the screen. The measurement range when the input type is set to DC or RMS is specified in terms of a voltage corresponding to 1 division of the grid displayed on the screen. Pressing the upper part of the "RANGE" button increases the measurement range. Pressing the lower part of the "RANGE" button decreases the measurement range. The relationship between the V/div and the measurement range is as follows.

V/div	Measurement range	Acrual measurement	
		DC	RMS
10 mV/DIV	100 mV	±100.0 mV	0 to 100.0 mVrms
20 mV/DIV	200 mV	±200.0 mV	0 to 200.0 mVrms
50 mV/DIV	500 mV	±500.0 mV	0 to 500.0 mVrms
0.1 V/DIV	1 V	±1.000 V	0 to 1.000 Vrms
0.2 V/DIV	2 V	±2.000 V	0 to 2.000 Vrms
0.5 V/DIV	5 V	±5.000 V	0 to 5.000 Vrms
1 V/DIV	10 V	±10.00 V	0 to 10.00 Vrms
2 V/DIV	20 V	±20.00 V	0 to 20.00 Vrms
5 V/DIV	50 V	±50.00 V	0 to 50.00 Vrms
10 V/DIV	100 V	±100.0 V	0 to 100.0 Vrms
20 V/DIV	200 V	±200.0 V	0 to 200.0 Vrms
50 V/DIV	500 V	±500.0 V	0 to 500.0 Vrms
100 V/DIV	1000 V	±500.0 V	0 to 500.0 Vrms

The measurement range setting and the actual measurement range when the input type is set to TC are as follows:

Measurement range	Acrual measurement
200°C	-50 to 200°C
400°C	-50 to 400°C
600°C	-50 to 600°C

Auto range

This is set at the screen that appears when the "MONITOR" key is pressed. Press the "F2" key. V/div is automatically set according to the current input signal.

Auto range is not possible on channels for which the input is set to TC.

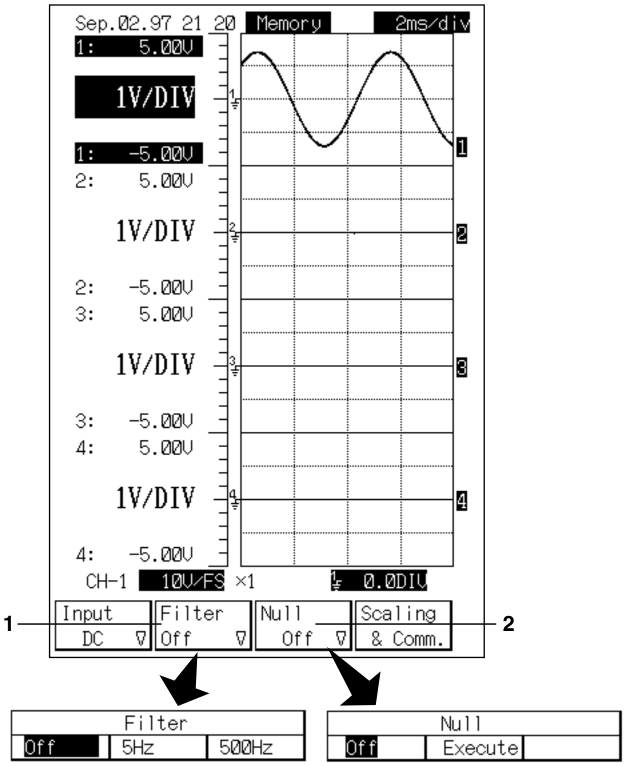
4.4 Setting the Filter, NULL, Position and Zoom Factor

Setting Screen

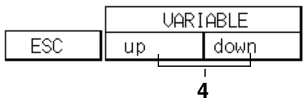
CH 1

to

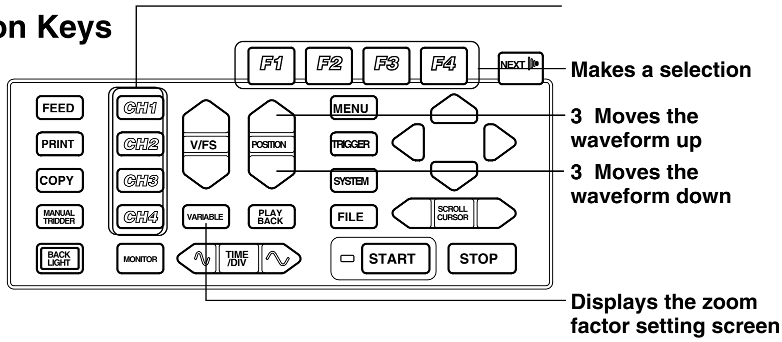
CH 4



VARIABLE



Operation Keys



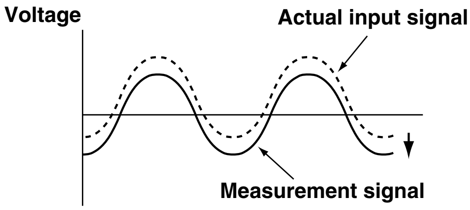
Operating Procedure

1. Setting the Filter

The filter cannot be specified for the following cases:
When the input type is set to TC or RMS (OR300E).
When the OR300E is in the harmonic mode.
Press the "F2" (Filter) key. A screen is displayed for selecting the filter. Select the filter by pressing "F1" (Off) key, "F2" (5 Hz) key, or "F3" (500 Hz) key.
If you set the input to RMS on the OR300E or harmonic mode, you cannot set the filter.
The 5-Hz low-pass filter is always activated for thermocouples.

2. Setting NULL (only when necessary)

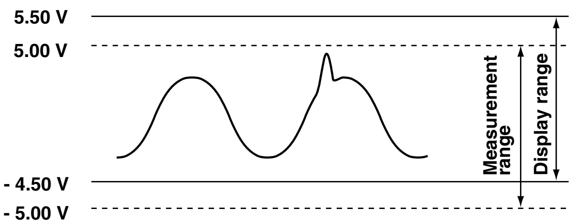
If the input type is set to TC, you cannot specify NULL.
Press the "F3" (Null) key. A screen is displayed for setting NULL. To assign the current input value to "0," press the "F2" (Execute) key. Pressing "F1" (Off) will cancel the setting. This is valid when the difference between the input value and "0" is less than or equal to 10 % of the measurement range.
When NULL is executed, the difference between the current input value and "0" is added to or subtracted from the input signal. The result is considered to be the measurement data.



If you set the input to RMS on the OR300E, you cannot set NULL.
If you change the input type during data capturing, the NULL setting is cancelled.

3. Adjusting the position

Press the "POSITION" key to adjust the position of the current input waveform.
Adjusting the position changes the upper and lower limits of the scale values by the corresponding amount, but the measurement range is not changed.
The following example shows the case when the waveform position is moved lower by 0.5 V at 5 V range.



If you change the input from DC to RMS or vice versa on the OR300E, position setting is reset.

4. Setting the zoom factor of the voltage axis of the displayed waveform

Pressing the "Zoom" key at the screen that appears when one the "CH1" to "CH4" keys is pressed, displays a screen for setting the zoom factor of the voltage axis. Select the zoom factor using the "F2" (up) and "F3" (down) keys.
Changing the zoom factor changes the V/DIV setting.

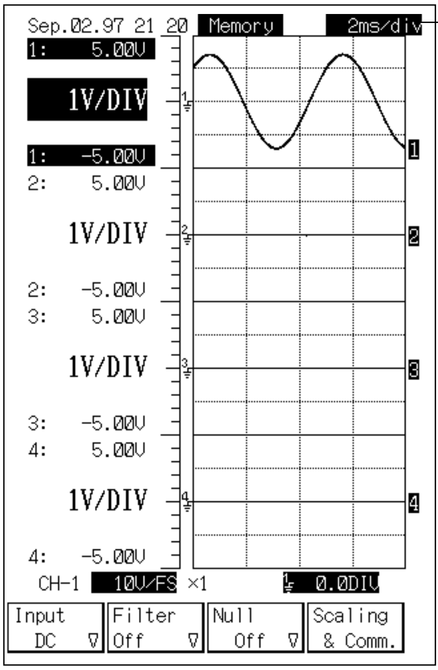
4.5 Setting the Time Axis (Sample Rate/ Chart Speed)

Setting Screen

CH 1

to

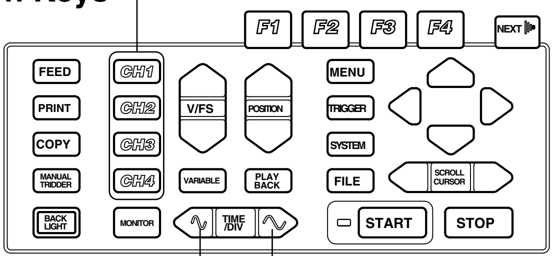
CH 4



time/div

Operation Keys

Displays the setting menu



Decreases the time/div

Increases the time/div

Operating Procedure

Setting the time axis

The time axis is set in terms of the time with respect to 1 div. Press the “time axis” key at the measurement range setting screen that appears when the one of the “CH1” to “CH4” keys is pressed. Pressing the right side of the key decreases the time/div (sample rate/chart speed are increased). Pressing the left side of the key increases the time/div (sample rate/chart speed are decreased). The time axis setting in the harmonic mode is determined automatically from the frequency of the target waveform.

Note

- The time axis can be set on the following screens.
  Screen that appears when one of the “CH1” to “CH4” keys is pressed.
  Screen that appears when the “MENU” key is pressed.
  Screen that appears when the “TRIGGER” key is pressed.
- If you press the “time axis” key on the playback screen it will zoom in or out on the waveform. Sample rate does not change.
- The range for setting the time/div varies depending on the measurement mode.
  When the measurement mode is “Memory” or “Memory & Realtime”: 200 µs to 2 min.
  When the measurement mode is “Realtime”: 2 s to 1 hour.
- Changing the time/div at the screen that appears when one of the “CH1” to “CH4” keys is pressed, does not change the waveform that is displayed on the screen. The waveform displayed on the screen changes depending on the display update rate, which is located at the screen that appears when the “MONITOR” key is pressed.
- External is set when using an external sampling clock.
- When using wave window trigger, select the time axis from 1 ms/div, 2 ms/div, 5 ms/div, or 10 ms/div.

Relationship between Time/Div and Sample Rate

In the “Memory” mode or the “Realtime+Memory” mode, the recorder captures 80 measurement data per 1 div. By setting the time/div, the sample rate (the number times the data is captured in 1 s) is automatically determined.

Sample rate = 80 / (time/div)   The unit of time/div is seconds.

Relationship between Time/Div and Chart Speed

In the “Realtime recording” mode, data is recorded by considering 1 div to be 10 mm. The following table shows the relationship.

time/div	Chart speed
2 s/div	5 mm/s
5 s/div	2 mm/s
10 s/div	1 mm/s
30 s/div	20 mm/min
1 min/div	10 mm/min
2 min/div	5 mm/min
5 min/div	2 mm/min
10 min/div	1 mm/min
30 min/div	20 mm/hour
1 hour/div	10 mm/hour

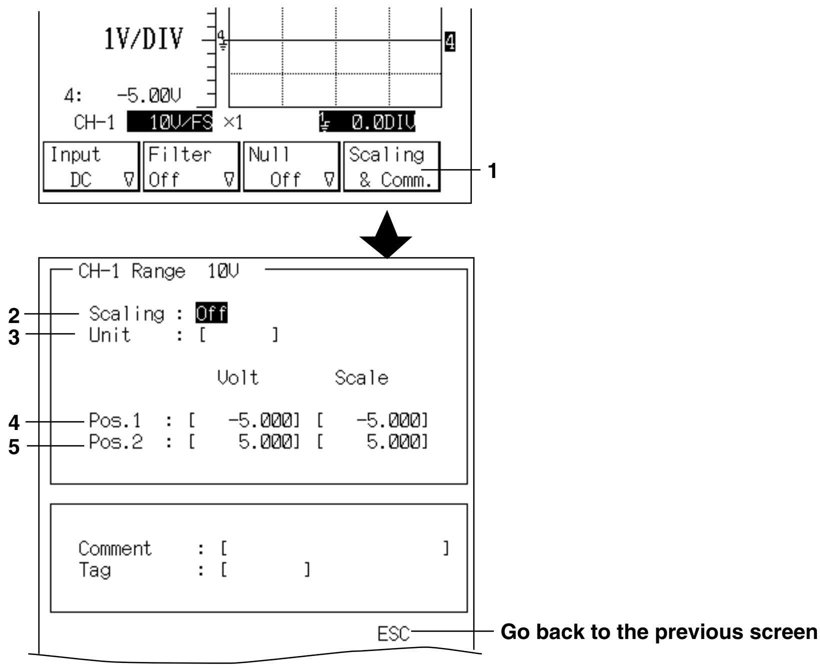
4.6 Setting the Linear Scaling

Setting Screen

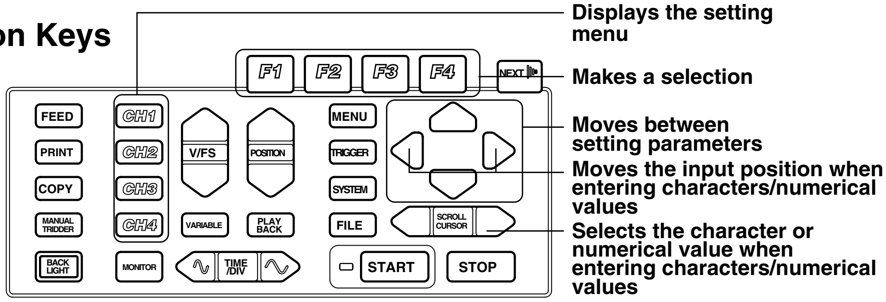
CH 1

to

CH 4



Operation Keys



Operating Procedure

1. Displaying the linear scaling setting screen

Press the “F4” (Scaling & Comm.) key.

2. Setting ON/OFF

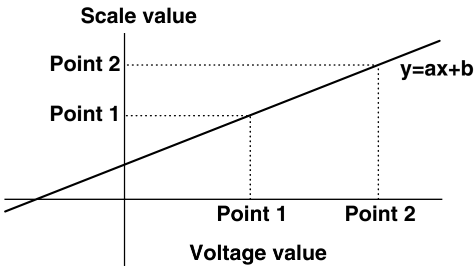
Press the “F2” (On) key or the “F3” (751550) key (when using YOKOGAWA 751550 (OR300E only, scheduled release)) to perform linear scaling. Press the “F1” (Off) key not to perform linear scaling.

3. Setting the unit.

Set the unit with six characters or less.

4. Setting Point1 (P1)

As shown in the figure below, by setting scale values to the two arbitrary measured voltages, the scale converting equation (y=ax+b) is determined.



Enter the voltage value (measured value) at Point1 and the corresponding physical value. There are two ways to enter the voltage.

Entering the value directly

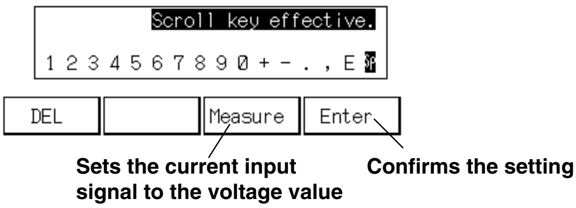
Use the panel keys to enter the value.

Entering the current input voltage as the voltage value

Press the “F3” (Measure) key to enter the current input signal value.

If you selected 751550 in step 2, the scale value matching the output of YOKOGAWA 751550 (clamp probe) is entered.

After entering the voltage value and the physical value, press the “F4” (Enter) key.



Note

- **The ranges for setting the voltage value and the scaling value are as follows.**
  $-1.0\times10^{+9} < x < -1.0\times10^{-9}$, 0, $1.0\times10^{-9} < x < 1.0\times10^{+9}$
- **Set exponential representation using E.**
  $1.0E + 8 = 1.0\times10^{+8}$
- Linear scaling is not possible when the input type is set to TC.

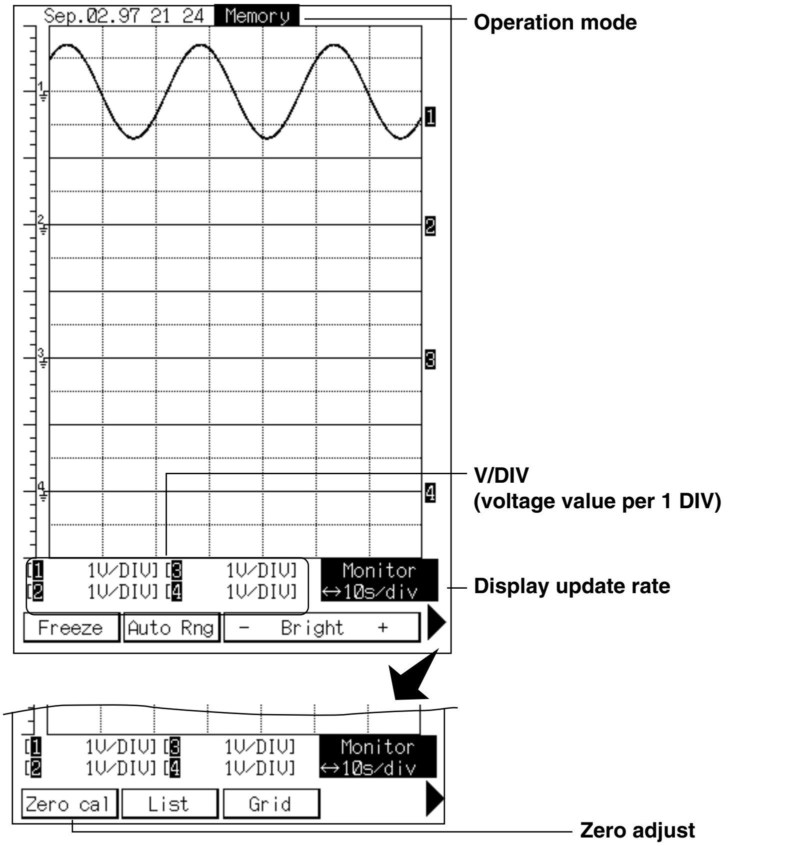
5. Setting Point2 (P2)

Enter the values in the similar way as entering the values for Point1.

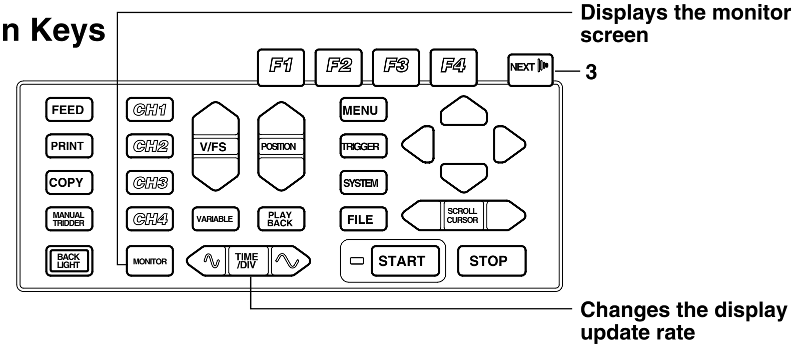
4.7 Monitor Display/Zero Adjust

Setting Screen

MONITOR



Operation Keys



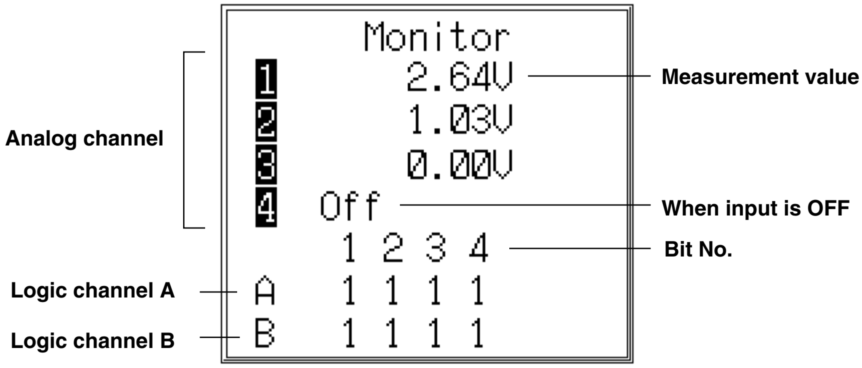
Operating Procedure

1. Monitor displaying

Pressing the "MONITOR" key, sets the screen to the monitor display screen. The current input can be confirmed on the screen. The data is not saved.

Switching between the analog waveform display and digital value display

Pressing the "MONITOR" key again in the monitor display screen switches the analog waveform display and the digital value display.



2. Pause the waveform display

Press the "F1" (Freeze) key on the monitor screen. The waveform display updating stops. To resume, press the "F1" (Release) key.

3. Zero adjusting

Execute zero adjust to obtain a high precision measurement.
Press the "NEXT" key on the monitor screen, then "F1" (Zero cal) key.
The ground level will be adjusted to zero.

About the Display Update Rate

Pressing the "time/div" key on the monitor screen changes the rate waveforms are displayed, but does not actually change the time/div when measuring the data.
The display update rate set at the monitor screen is the rate used on the screen that appears when one of the "CH1" to "CH4" keys is pressed.

5.1 Setting Parameters

This chapter describes the methods to set the trigger. The relevant parameters are listed below. You will set these parameters using the screen that appears when the "TRIGGER" key is pressed. The setting parameters for the normal trigger and the wave window trigger (trigger for detecting abnormalities in the power supply signal) are different. Select normal trigger or wave window trigger before setting the trigger parameters. You can select between the normal trigger and the wave window trigger at the screen that appears when the "MENU" key is pressed.

Normal Trigger

Setting parameter	Description
Mode	Set the trigger operation. Free: Ignore triggers. Single: Capture the data once after the trigger. Repeat: Capture the data after every trigger.
Delay	Pre-trigger/trigger delay is set in the range from -100 % to +100 % where 100 % is the time necessary to capture the data.
AND/OR	Set whether to trigger on the AND or OR of the trigger conditions.
Type	Set the trigger type.
Level	Set the trigger level as a percentage of the measurement range.
Filter	Set the condition for detecting triggers.
Logic trigger	Set the trigger for the logic input.
External trigger	Set whether or not to use the external signal as a trigger.
Start time	Set whether or not to consider the specified time as satisfying the trigger condition.
Interval time	Set whether or not to consider every specified time interval as satisfying the trigger condition.

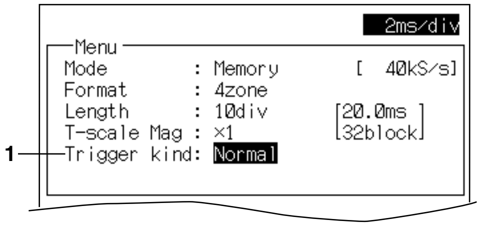
Wave Window Trigger (Trigger for Detecting Abnormalities in the Power Supply Signal)

Setting parameter	Description
Mode	Set the trigger operation. Free: Capture the measurement data regardless of the trigger. Single: Capture the data once after the trigger. Repeat: Capture the data after every trigger.
Reference wave	Set the reference signal to create the trigger region.
Delay	Pre-trigger/trigger delay is set in the range from -100 % to +100 % where 100 % is the time necessary to capture the data.
Frequency	Set the frequency (50 Hz/60 Hz) of the input signal.
Synchronous trigger	Set the trigger condition to synchronize the reference signal and the input signal. CH: Synchronous trigger source channel. Edge: Trigger type. Level: Trigger level.
Type	Set the trigger ON/OFF.
Condition	Set the width of the trigger range as a percentage of the measurement range. If the reference wave is set to "Ideal," set the following parameters also. Peak: Set the width of the trigger region at the peak value in % of the measurement range. Offset: Set the offset value as a percentage of the measurement range. Phase: Set the phase difference of the input signal with respect the ideal signal.

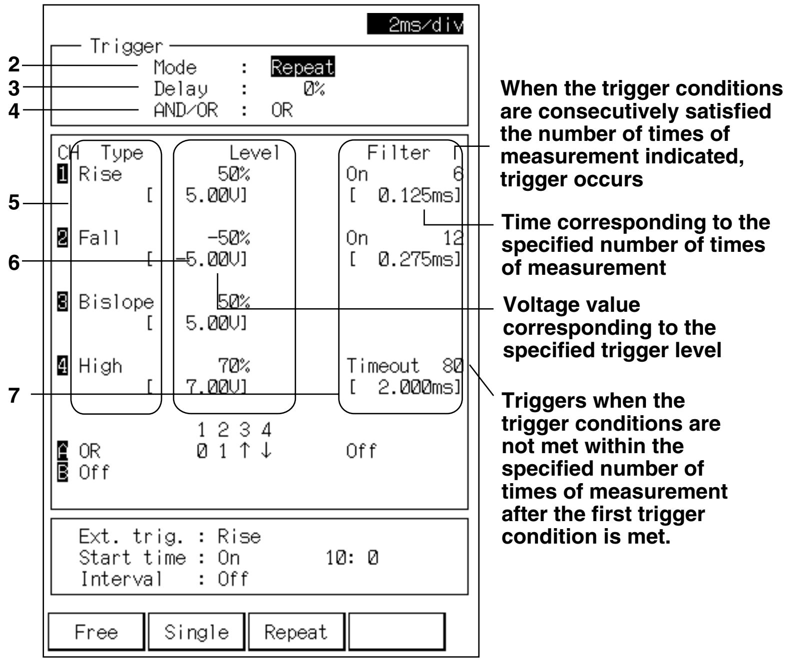
5.2 Setting the Normal Trigger

Setting Screen

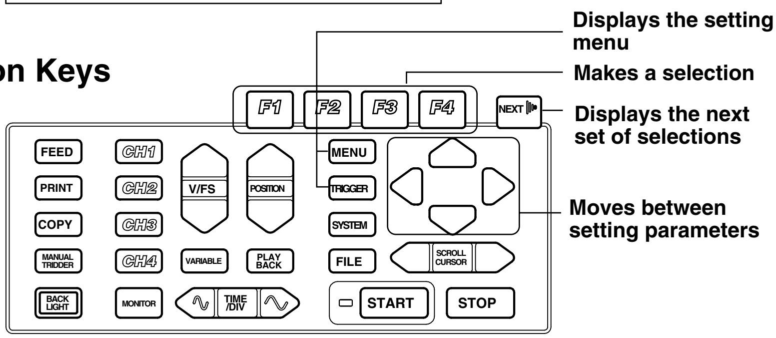
MENU



TRIGGER



Operation Keys



Operating Procedure

1. Setting the kind of trigger.

Set the kind of trigger to "Normal" ("F1" key) at the screen that appears when the "MENU" key is pressed.

2. Setting the trigger mode

Set the trigger mode with the "F1" to "F3" keys at the screen that appears when the "TRIGGER" key is pressed.

- Free : Pressing the "START" key starts the data capturing regardless of the trigger conditions. Pressing the "STOP" key stops the data capturing.
- Single : When the trigger occurs, data is captured/recorded once.
- Repeat : Data is captured every time the trigger occurs. Stops when the STOP key is pressed or when the internal memory becomes full. Cannot be specified when the memory length is set to "PC card."

3. Setting the trigger delay

Set the Pre-trigger/trigger delay as a percentage of the memory length. -100 % to -1 % is pre-trigger, and 1 % to 100 % is trigger delay. Fixed to 0% when the memory length is set to "PC card."

4. Setting AND/OR

Set whether the trigger is set off when all the trigger conditions are met (AND) or when any of the trigger conditions is met (OR) with the "F1" or "F2" key. Logic trigger, external trigger, start time trigger, and interval time trigger are included.

5. Setting the trigger type

Select the trigger type from the following list using the "F1" to "F4" and "NEXT" keys.

- Off : Disable trigger function.
- Rise : Triggers when the trigger level is crossed on the leading edge.
- Fall : Triggers when the trigger level is crossed on the trailing edge.
- High level : Triggers when above the trigger level.
- Low level : Triggers when the signal is the trigger level or below.
- Bi-slope : Triggers when Rise or Fall is satisfied.
- Win_out : Triggers when the signal exits the window.
- Win_in : Triggers when the signal enters the window.

6. Setting the trigger level

Set the trigger level as a percentage of the measurement range with the "F1" to "F4" keys. Set a positive trigger level on channels that have the input set to RMS on the OR300E.

7. Setting the filter

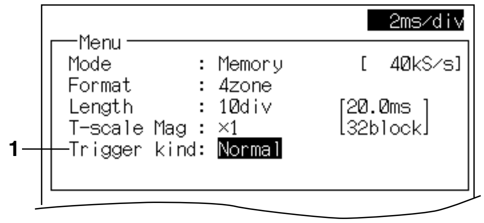
Set the filter with the "F1" to "F3" keys.

- Off : Disable the filter function.
- On : Triggers when the trigger conditions are consecutively satisfied the specified number of times of measurement.
- Timeout : Triggers when the trigger conditions are not satisfied within the specified number of times of measurement.

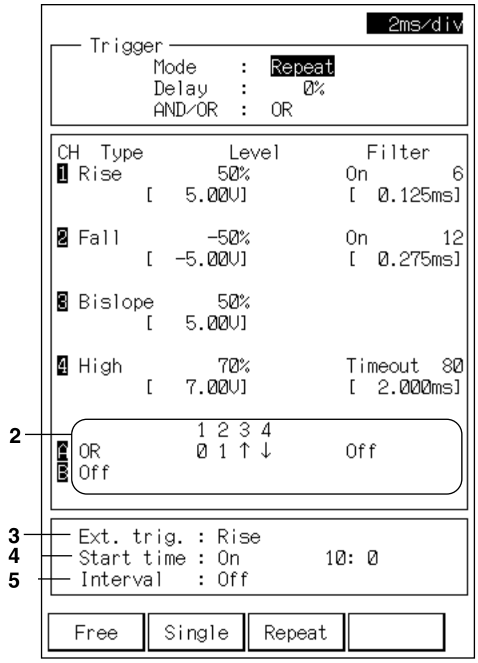
5.3 Setting the Logic Trigger, and Other Triggers

Setting Screen

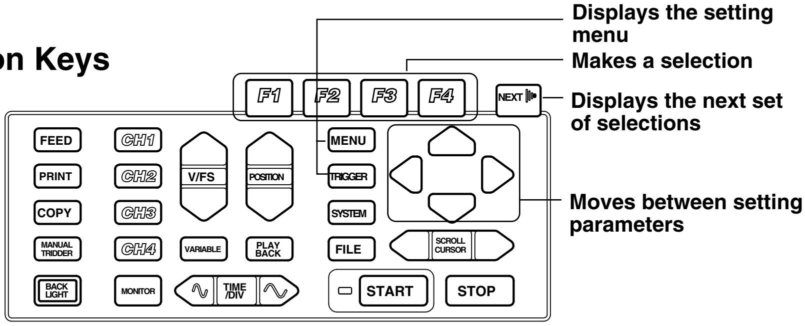
MENU



TRIGGER



Operation Keys



Operating Procedure

1. Setting the kind of trigger

Set the kind of trigger to “Normal” (“F1” key) at the screen that appears when the “MENU” key is pressed.

2. Setting the logic trigger

Set the logic trigger.
At the screen that appears when the “TRIGGER” key is pressed, set the AND/OR between the bits of the logic channel with the “F1” to “F3” keys.

Off : Disable the trigger function.
OR : Triggers if the trigger condition of any one bit is met.
AND : Triggers if the trigger conditions of all bits are met.

Set the trigger condition of each bit from the following list with the “F1” to “F4” and “NEXT” keys.

0 : Triggers on 0.
1 : Triggers on 1.
↑ : Triggers on the leading edge.
↓ : Triggers on the trailing edge.
x : Ignore the bit.

3. Setting the filter

Set the filter with the “F1” to “F3” keys.

Off : Disable the filter function.
On : Triggers when the trigger conditions are consecutively satisfied the specified number of times of measurement.
Timeout : Triggers when the trigger conditions are not satisfied within the specified number of times of measurement.

4. Setting the external trigger

Set the trigger condition of the external trigger with the “F1” to “F3” keys.

Off : Disable external trigger.
Rise : Triggers on the leading edge.
Fall : Triggers on the trailing edge.

When using an external trigger, input a trigger signal at the trigger-in terminal.

5. Setting the time trigger

Set the start time trigger to ON/OFF with the “F1” and “F2” keys. If “On” is selected, select the time to set the trigger with the “F1” to “F4” keys.
Cannot be specified when the memory length is set to “PC card.”

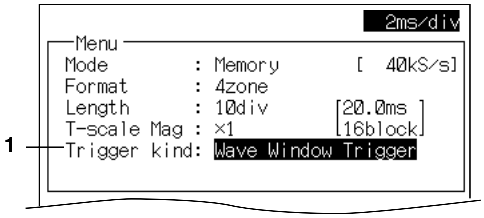
6. Setting the interval time trigger.

Set the time interval with the “F1” to “F4” keys. Select Off, 10-min, 1-hour, or 24-hour intervals.
Interval time is set only when the AND/OR setting (see page 5-3) is set to “OR.”
Cannot be specified when the memory length is set to “PC card.”

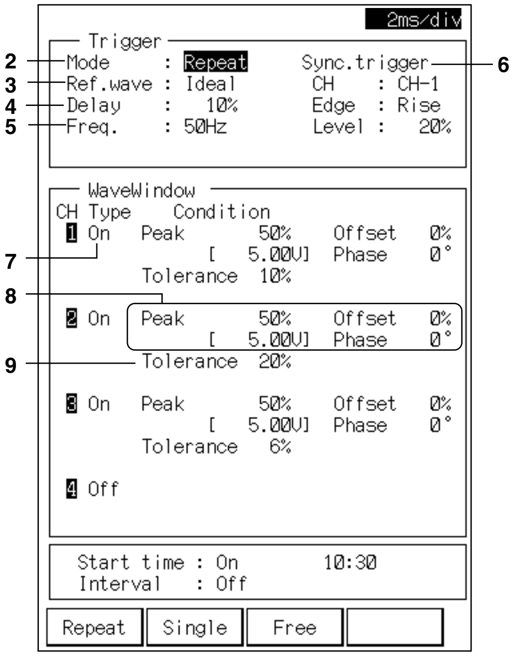
5.4 Setting the Wave Window Trigger

When Creating the Wave Window with the Ideal Signal Setting Screen

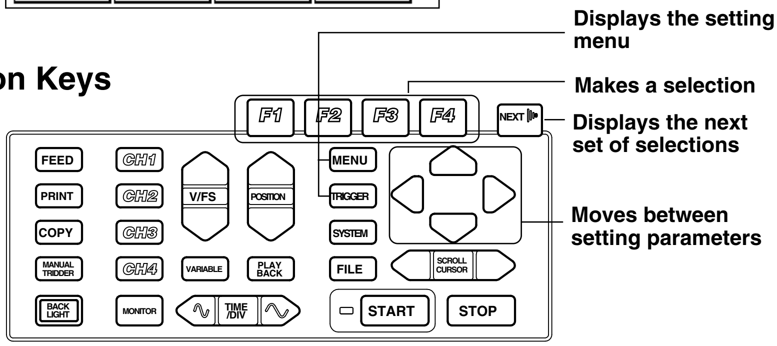
MENU



TRIGGER



Operation Keys



Operating Procedure

1. Setting the kind of trigger

Set the kind of trigger to “WW-Trg” (“F2” key) at the screen that appears when the “MENU” key is pressed.

The time/div setting available during wave window trigger is 2, 5, or 10 ms/div.

2. Setting the trigger mode

Set the trigger mode with the “F1” to “F3” keys at the screen that appears when the “TRIGGER” key is pressed.

Repeat : Data is captured every time the trigger occurs. Stops when the STOP key is pressed or when the internal memory becomes full. Cannot be specified when the memory length is set to “PC card.”

Single : When the trigger occurs, data is captured/recorded once.

Free : Pressing the “START” key starts the data capturing regardless of the trigger conditions. Pressing the “STOP” key stops the data capturing.

3. Setting the reference signal

Select whether to base the reference signal off an ideal sine wave or an actual input signal. Here, select the ideal sine wave (“F1” key).

4. Setting the trigger delay

Set the Pre-trigger/trigger delay as a percentage of the memory length. -100 % to -1 % is pre-trigger, and 1 % to 100 % is trigger delay.

5. Setting the frequency

Select 50/60 Hz according to the measurement signal.

6. Setting the synchronous trigger

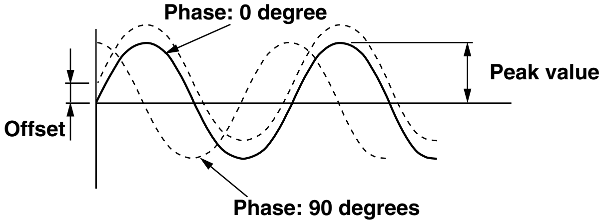
Set the trigger (synchronous trigger) to synchronize the start of the wave window trigger. Select the source channel of the synchronous trigger from the measurement input. Select “Rise” or “Fall” for the trigger condition. Set the trigger level as a percentage of the measurement range of the source channel of the synchronous trigger.

7. Setting ON/OFF

Set the wave window trigger to ON/OFF for each channel.

8. Setting parameters relating to the reference signal

Set the reference signal for the wave window for each channel. Set the peak value and offset as a percentage of the measurement range.



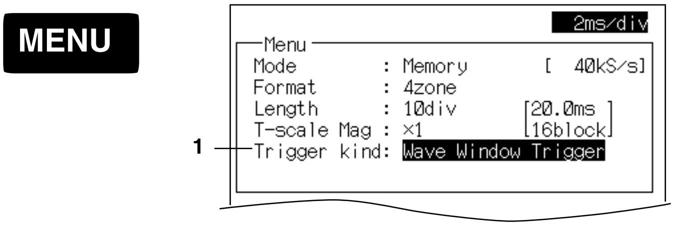
9. Setting the width of the wave window

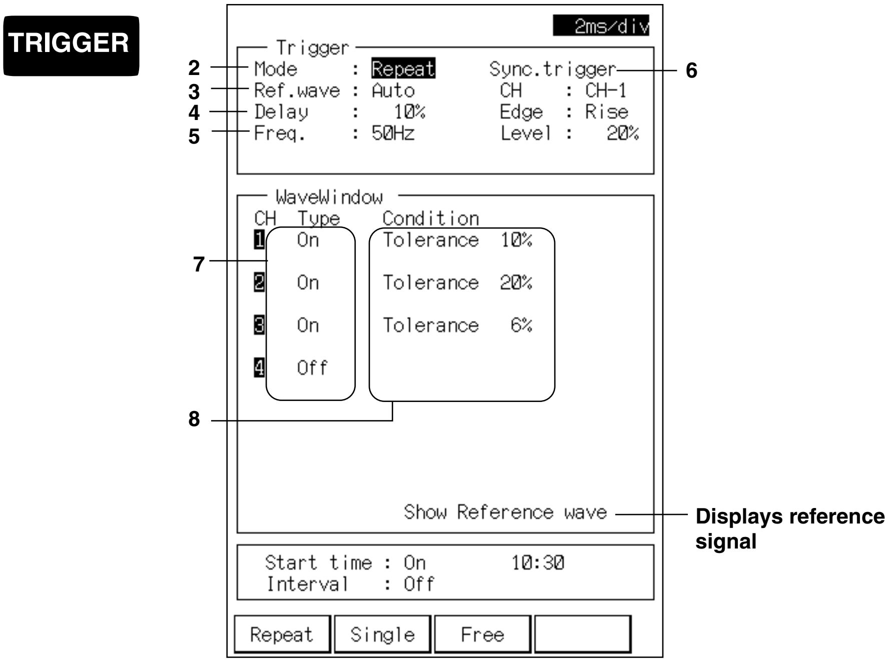
Set the width of the wave window as a percentage of the measurement range.

10. Setting the time trigger

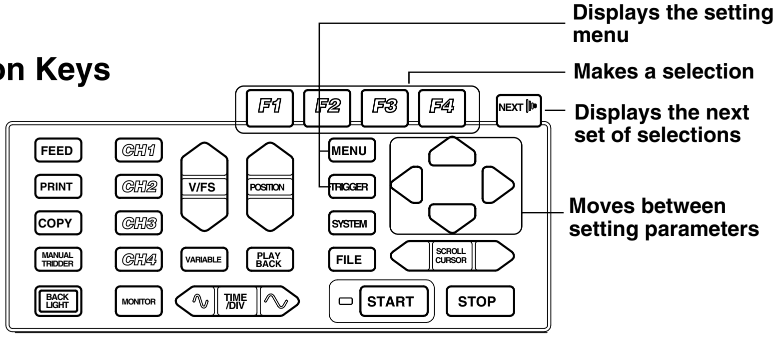
For information about the time trigger setting, see page 5-5.

When Creating the Wave Window with the Input Signal Setting Screen





Operation Keys



Operating Procedure

1. Setting the kind of trigger

Set the kind of trigger to “WW-Trg” (“F2” key) at the screen that appears when the “MENU” key is pressed.

The time/div setting available during wave window trigger is 2, 5, or 10 ms/div.

2. Setting the trigger mode

Set the trigger mode with the “F1” to “F3” keys at the screen that appears when the “TRIGGER” key is pressed.

Repeat : Data is captured every time the trigger occurs. Stops when the STOP key is pressed or when the internal memory becomes full. (See)

Single : When the trigger occurs, data is captured/recorded once.

Free : Pressing the “START” key starts the data capturing regardless of the trigger conditions. Pressing the “STOP” key stops the data capturing.

3. Setting the reference signal

Select whether to base the reference signal off an ideal sine wave or an actual input signal. Here, select the actual input signal (“F2” key).

4. Setting the trigger delay

Set the Pre-trigger/trigger delay as a percentage of the memory length. -100 % to -1 % is pre-trigger, and 1 % to 100 % is trigger delay.

5. Setting the frequency

Select 50/60 Hz according to the measurement signal.

6. Setting the synchronous trigger

Set the trigger (synchronous trigger) to synchronize the start of the wave window trigger. Select the source channel of the synchronous trigger from the measurement input. Select “Rise” of “Fall” for the trigger condition. Set the trigger level as a percentage of the measurement range of the source channel of the synchronous trigger.

7. Setting ON/OFF

Set the wave window trigger to ON/OFF for each channel.

8. Setting the width of the wave window

Set the width of the wave window as a percentage of the measurement range.

9. Setting the time trigger

For information about the time trigger setting, see page 5-5.

Note

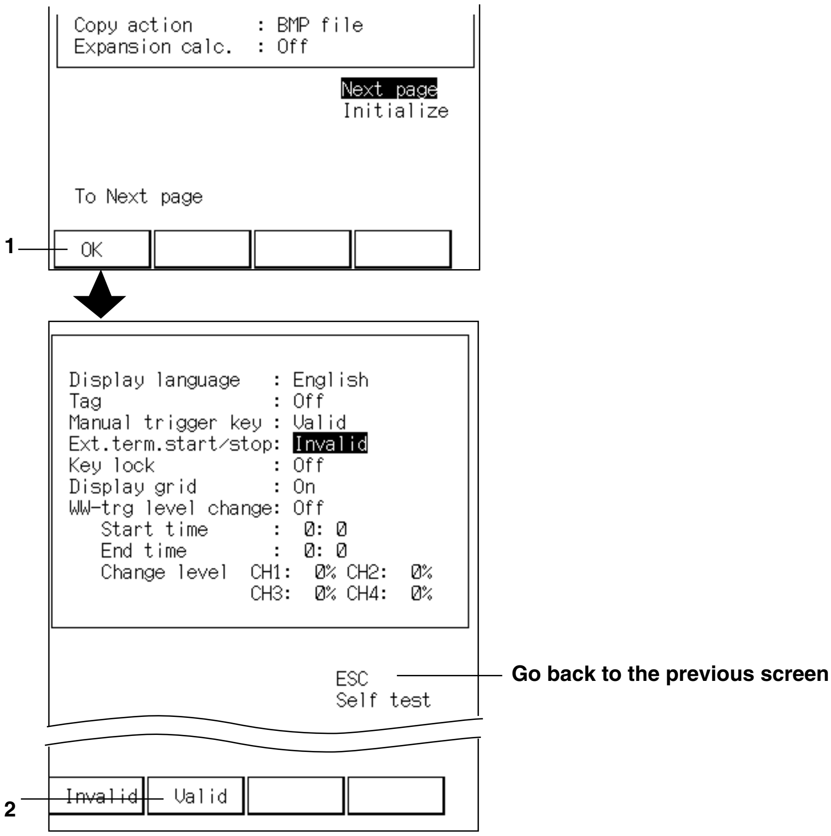
- Highlighting “Show Reference wave” and pressing “F1” (Go) displays the wave window. To go back to the setting screen, press the “F1” (Back) key.

5.5 Triggering with the Manual Trigger Key

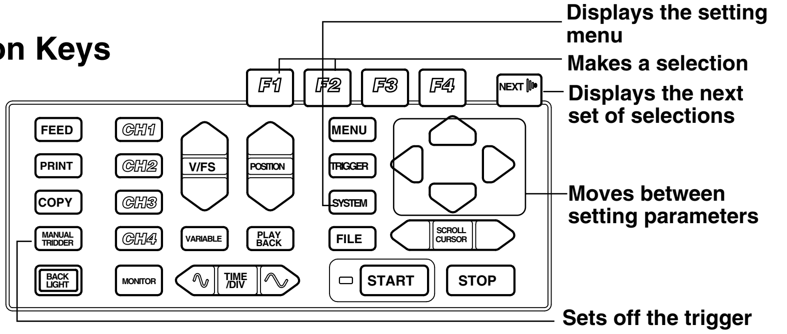
You can capture one block of measurement data by pressing the “Manual Trigger” key, even if the specified trigger condition is not met.

Setting Screen

SYSTEM



Operation Keys



Operating Procedure

1. Displaying the setup screen

At the screen that appears when the "SYSTEM" key is pressed, highlight "Next page" and press the "F1" (OK) key. A screen for enabling/disabling the manual trigger is displayed.

2. Enabling the manual trigger

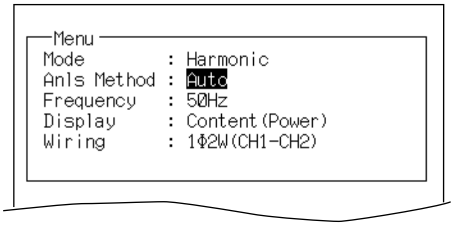
Set the manual trigger key to "Enable" with the "F2" (Enable) key.

With the above operation, the manual trigger is enabled.
Pressing the "Manual Trigger" key during trigger wait condition sets off the trigger.
"Manual Trigger" key is not valid when the trigger mode is free or when the measurement is stopped.
You cannot use the manual trigger while using the harmonic trigger.

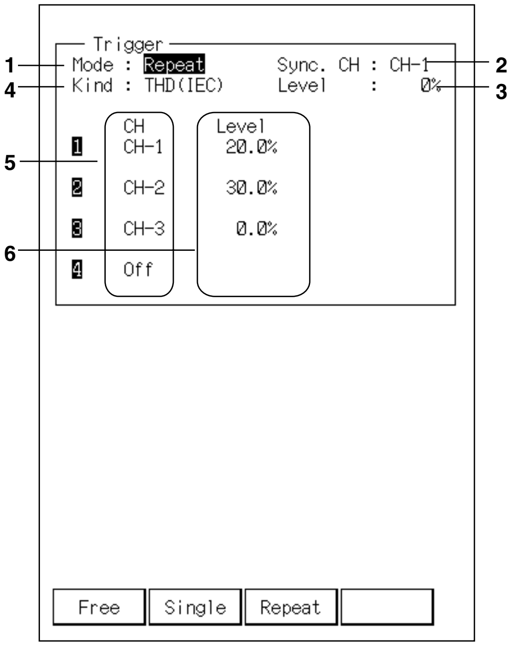
5.6 Setting Trigger for Automatic Analysis of Harmonics

Setting screen

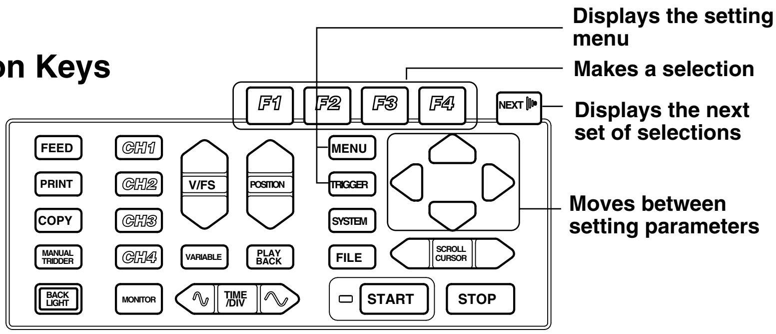
MENU



TRIGGER



Operation Keys



Operating Procedure

1. Setting the trigger mode

Set the trigger with the “F1” to “F3” keys at the screen that appears when the “TRIGGER” key is pressed.

Free: Pressing the “START” key starts the data capturing regardless of the trigger conditions. Pressing the “STOP” key stops the data capturing.

Single: When the trigger occurs, data are captured/recorded once.

Repeat: Data are captured every time the trigger occurs. Stops when the “STOP” key is pressed or when the internal memory becomes full. Cannot be specified when the memory length set to “PC card.”

2. Setting synchronous channels

Set the synchronous channels for capturing the data to be analyzed with “F1” to “F4” keys.

3. Setting levels of synchronous channels

Set the levels of the synchronous channels in terms of percentages of the measurement range with “F1” to “F4” keys. Data acquisition starts when the measured value of the synchronous channels exceeds this level.

If the trigger mode is free, you are finished with the settings. For single and repeat, continue with the following steps.

4. Setting the kind of analysis

Set the kind of analysis with “F1” to “F3” keys.

The parameter set here will be the trigger source. When the result of the analysis exceeds the level that is set in the latter step, measured data and result of the analysis are saved.

5. Setting channels

Set the channels for triggering with “F1” to “F4” keys.

6. Setting trigger level

Set the trigger level in terms of percentages with “F1” to “F4” keys.

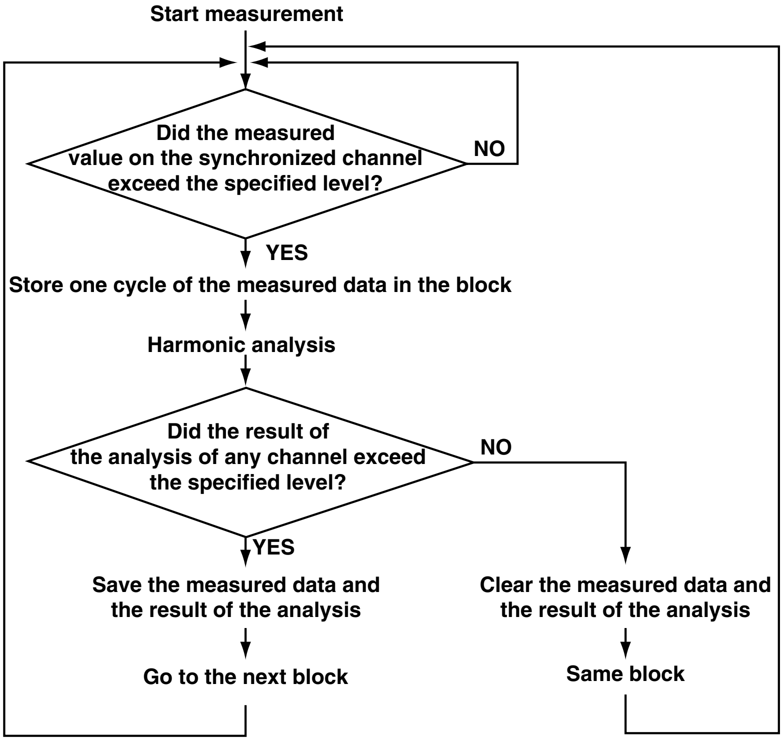
If the parameter to be analyzed is “relative harmonic content,” then set the corresponding harmonic order.

Note

Trigger type is fixed to rise. Trigger delay is 0%.

Trigger for Automatic Analysis of Harmonics

The following flow chart shows the operation when the trigger mode is set to repeat.



If the trigger mode is set to single, the measurement stops after saving or clearing the measured data and the result of the analysis.

6.1 Setting Parameters

This chapter describes the methods to capture the measurement data into memory and display and record the captured data. The relevant parameters are listed below. You will set these parameters using the screen that appears when the "MENU" key is pressed.

Conditions on capturing the measurement data

Setting parameters	Description
Operation mode	Select whether to save the measurement data to memory or realtime record with the built-in printer. Select "Memory."
Memory length	The number of data points to capture in one data capture. Set in terms of div (80 data/div) except for X-Y format in which case set in terms of data points.
Kind of Trigger	Select normal trigger or wave window trigger. When using X-Y format, it is fixed to normal trigger.
Clear memory at start	Select whether or not to clear the measurement data captured previously at the start of the measurement.
Condition to stop repeat trigger	When the trigger mode is repeat, select whether to press the "STOP" key to stop the measurement or stop the measurement after capturing enough data to fill the internal memory.
Operation after data capturing	Set the operation after capturing the data once.

Setting the display format

Setting parameters	Description
Format	Select 1 zone, 2 zone, 4 zone, or XY.
T-axis zoom	Set the T-axis zoom factor for the display screen
Accumulate display	Select whether or not to accumulate the waveform
Logic	Set the display of each bit to ON/OFF and the display position of the logic channel. However, it cannot be displayed when using X-Y format
Channel selection	Set only when using X-Y format. Set the Y-axis to channel 2, 3, or 4.

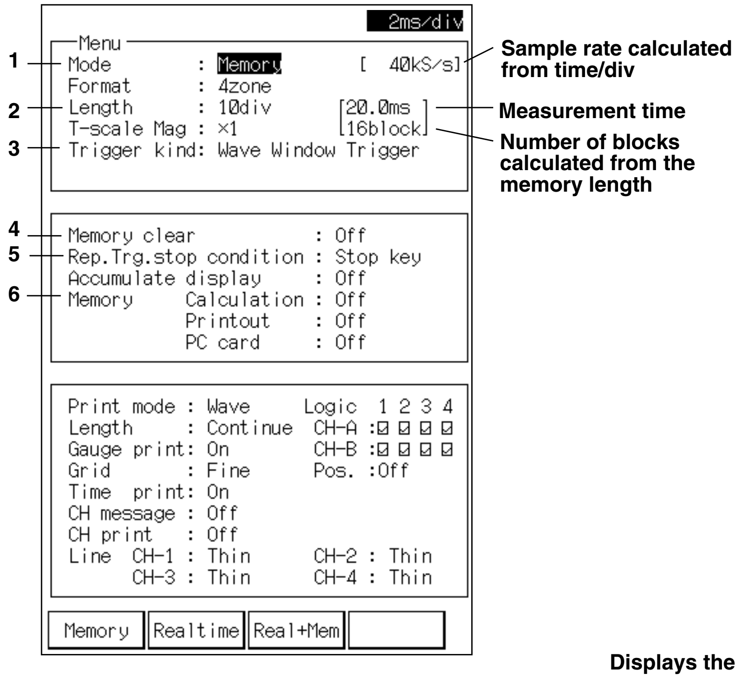
Setting the recording format

Setting parameters	Description
Format	Select 1 zone, 2 zones, 4 zones, or XY.
Record mode	Select whether to record the analog waveform or the digital values. This parameter is invalid when using X-Y format.
Record length	Select whether to record the captured data with the same zoom factor as the display zoom factor or expand/reduce to A4 or A5 size to record. This parameter is invalid when recording digital values or when using X-Y format.
Interval time	Set only when recording digital values. Sets the recording interval.
Gauge record	Select whether or not to record the scale value for each channel at the end of the recording.
Grid	Select the grid type.
Time record	Set whether or not to record the time record of the captured data.
Channel message	Select whether or not to record comments or measurement range information.
Channel record	Select whether or not to record the channel numbers or tags.
Line	Set the thickness of the line used to record the analog waveform.
Logic	Set the display of each bit to ON/OFF and the record position of the logic channel. However, it cannot be recorded when using X-Y format.
Style	Set only when using X-Y format. Set the line style to record.
Channel selection	Set only when using X-Y format. Set the Y-axis to channel 2, 3, or 4.

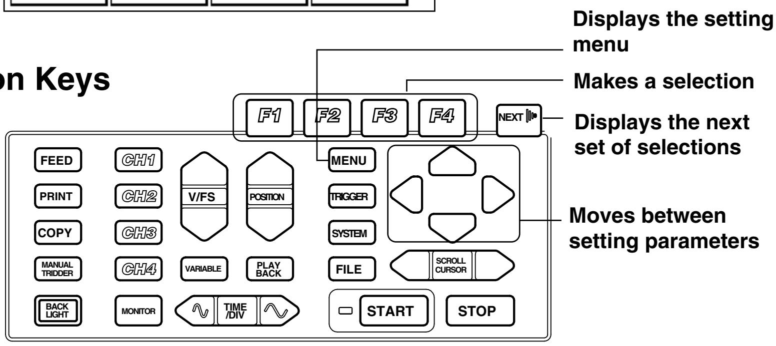
6.2 Setting the Conditions on Capturing the Measurement Data

Setting screen

MENU



Operation Keys



Operating Procedure

1. Setting the operation mode

Set the operation mode to “Memory” with the “F1” (Memory) key.

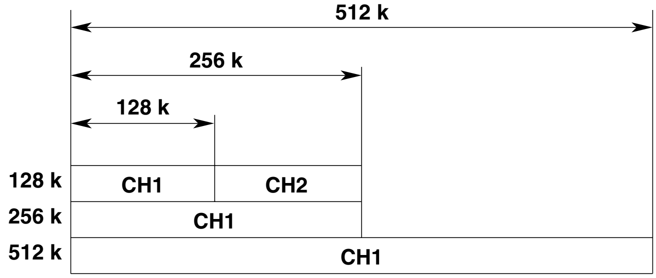
2. Setting the memory length

Sets the memory length with the “F1” to “F4” keys. Pressing the “NEXT” key will show the next set of selections. The memory length is specified in div units. The measurement time and the number of blocks are calculated from the memory length and displayed.
When “PC card” is specified, the measured data can automatically be written to the flash ATA memory card while capturing the data. For details, see section 10.4, “Writing Data Simultaneously to the Flash ATA Memory Card.”

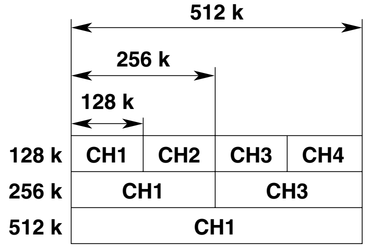
Block and Memory Linking

This instrument divides the internal memory by the specified memory length, and captures the data sequentially to the divided memory. One unit of the divided memory is called a block. By setting the memory length, the number of blocks is automatically determined from the length and the internal memory capacity (memory capacity for one channel)
If the memory length is larger the internal memory capacity, memories of other channels are linked to capture the data. Memory linking limits the number of channels that can be used as shown in the figure below. When memories are linked, the number of blocks is one.

OR122/OR322



OR142/OR342



For logic channels, channel B cannot be used only when the maximum memory capacity is 512 K.

Memory length

The relationship between the memory length and the number of data points that is saved in one block is as follows.

Memory length	Number of data points captured in memory
10 div	800 data points
20 div	1600 data points
50 div	4000 data points
100 div	8000 data points
200 div	16000 data points
400 div	32000 data points
800 div	64000 data points
1600 div	128000 data points
3200 div*1	256000 data points
6400 div*2	512000 data points

*1: Two channels are linked. Only odd channels can be used
*2: Four channels are linked. Only one channel can be used

3. Setting the kind of trigger

Select the kind of trigger with the "F1" and "F2" keys. See chapter 5 "Setting the Trigger."

4. Setting how to handle the memory at the start of the data capture

Select ON or OFF with the "F1" and "F2" keys.

On : Clear the measurement data captured previously

Off : Capture the data to the next block after the previous data.

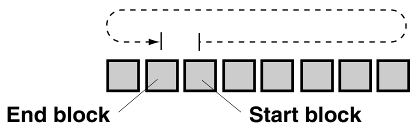
5. Setting the condition to stop the repeat trigger

Set only when the trigger is set to repeat.

Set the stop condition with the "F1" and "F2" keys.

Stop Key : Overwrite the data until the "STOP" key is pressed.

Memory Full : Stop the measurement after capturing enough data to fill the memory.
If you start the data capture in the middle of the internal memory, the data is captured up to the block immediately before the block you started on.



6. Setting the operation after data capturing

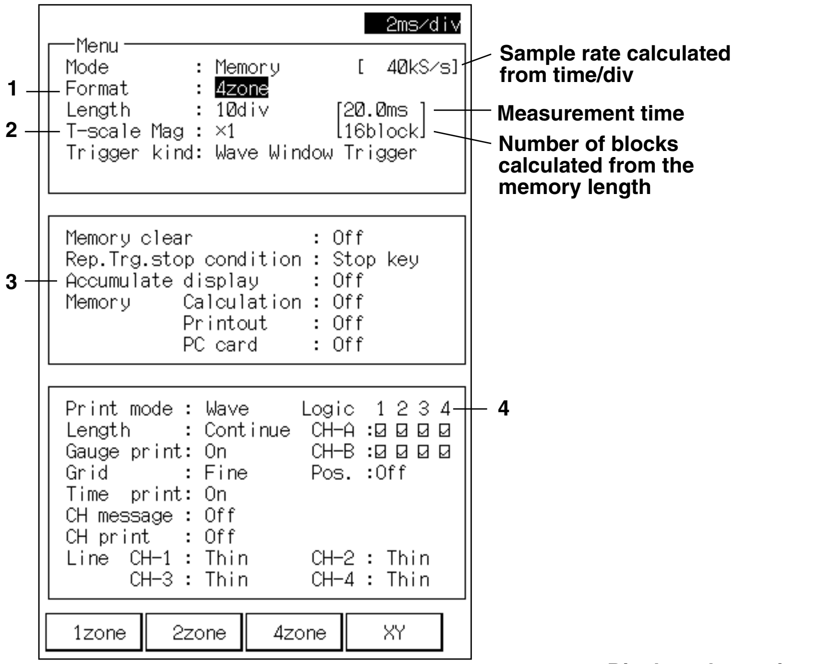
The following operation is performed automatically after capturing one block of measurement data. Use the “F1” (Off) and “F2” (On) keys to set the operation.

Interval calculation :	Displays the maximum, minimum values. If expansion calc. is ON, the RMS value and the calculated area are also displayed.
Print output :	Record with the built-in printer. The recording format is the format specified in 6.5 “Recording the Captured Data.”
PC card :	Send the measurement data over FAX modem or save the data to the PC card. For details, see 9.3 “Saving the Measurement Data to the PC Memory Card,” or 11.9 “Sending the Measurement Data over the FAX Modem.”

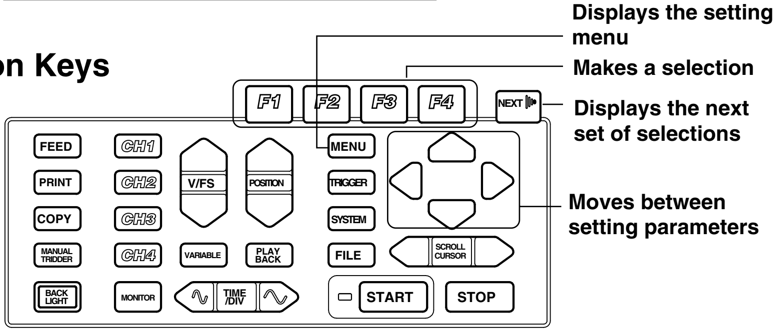
6.3 Setting the Display Format

Setting screen

MENU



Operation Keys



Operating Procedure

1. Setting the display format

Set the display format with the “F1” to “F4” keys.

1 zone : Display/Record every channel in one zone.

On the 4-channel model, display/record channels 1 and 2 in the upper zone and channels 3 and 4 in the lower zone.

On the 2-channel model, display/record channel 1 in the upper zone and channel 2 in the lower zone.

4 zone : Display/Record channels 1, 2, 3, and 4 in order from the top zone.

XY : Display/Record X-Y (See 6.4 “Setting the X-Y Display Format.”)

2. Setting the T-axis Zoom factor

Set the time-axis zoom factor for the display/recording with the “F1” and “F2” keys. Pressing the “F1” (Cut down) key decreases the zoom factor and pressing the “F2” (Expand) key increases the zoom factor. The zoom factors that can be specified depends on the data length.

3. Setting the accumulate display

Set the accumulate display to ON/OFF. This is valid when the trigger mode is set to repeat. The accumulated display disappears when the screen is scrolled or when the time/div or the voltage axis is changed.

Off : Do not accumulate.

On : Display/Record the waveforms from the start of the measurement to the end by overlapping them.

It is convenient to have the accumulate display set to ON such as when comparing the waveform with the previously measured waveform.

4. Setting the logic channel

Set whether or not to display/record the logic inputs. Also, set the display positions. Set the display/record to ON/OFF for each bit. When a check mark is in the check box it is ON. Otherwise, it is OFF.

Select the position of the display/record from the following.

Off : Do not display/record.

Both : Display/Record channel A in the upper section and channel B in the lower section.
If the display format is 2 zone or 4 zone, display/record channel A in the upper section of the top zone and channel B in the lower section of the bottom zone.

Bottom : Display/Record both channel A and B in the lower section of the bottom zone.

Equal : Display/Record each bit in equal intervals.
If the display format is 2 zone, display channel A in the upper zone and channel B in the lower zone.
If the display format is 4 zone, display/record each bit of channel A an B in order (bit 1, 2, 3, 4) from the top zone.

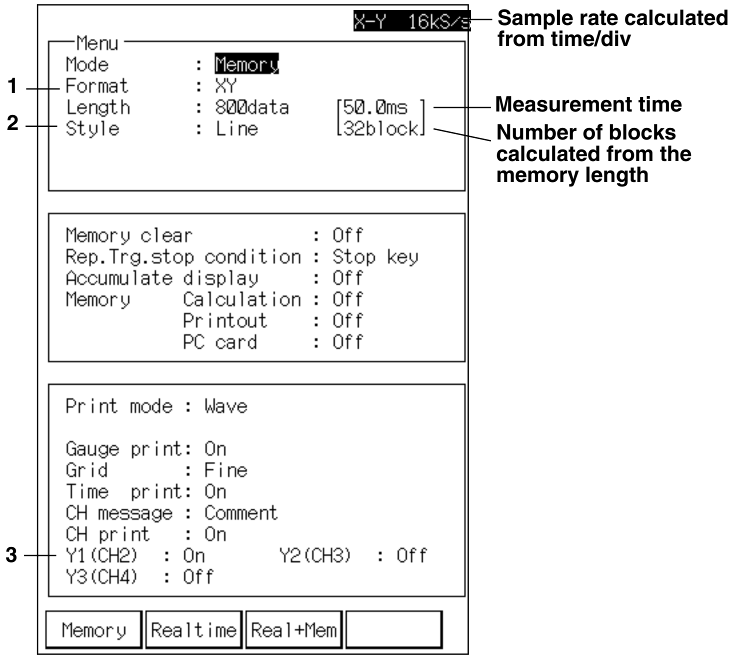
Note

When recording the captured data, you can continue to set the recording format on this setting screen. For details, see 6.6 “Displaying/Recording the Captured Data.”

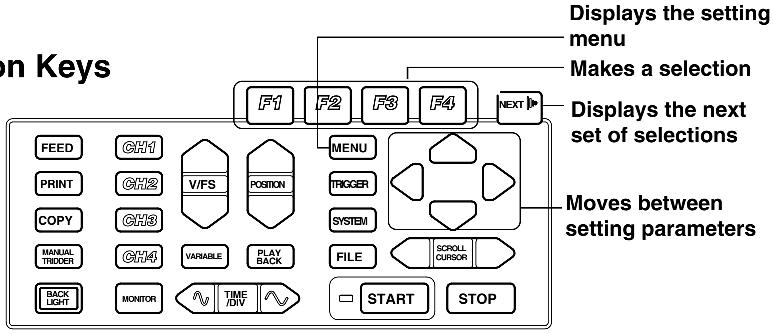
6.4 Setting the X-Y Display Format

Setting screen

MENU



Operation Keys



Operating Procedure

1. Setting the display format

Set the display format to “XY” with the “F4” (XY) key.

2. Setting the style

Select the display style from the following.

Line : Display by connecting the measurement points with a line.

Point : Display the measurement points as points.

3. Setting the Y-axis.

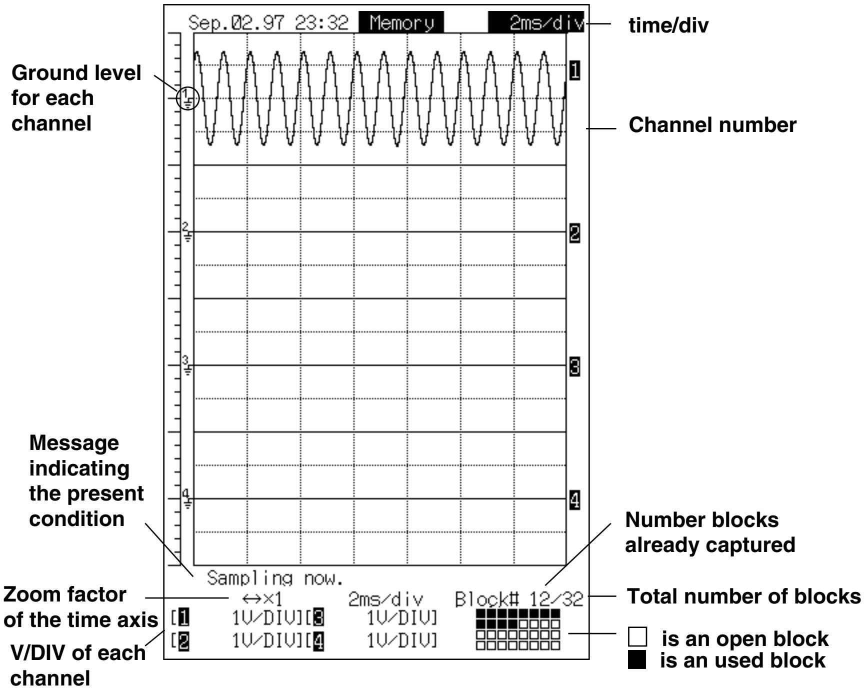
Select the channel to assign to the Y-axis. X-axis is fixed to channel 1.

6.5 Starting/Stopping

Operating procedure

1. Starting the measurement

Pressing the “START” key starts the measurement. The waveform is displayed on the screen according to the format set in sections 6.3 and 6.4. If the trigger mode is set to anything other than FREE, “Waiting for trigger” message is displayed on the lower left of the screen.



Note

- You cannot change any other settings besides the input coupling and the filter during a data capture. If the input coupling or the filter is changed, it is reflected in the next data capture (block).
- If you change the input type during data capturing, the NULL setting is cancelled.
- A message indicating the present condition is displayed at the lower left of the screen when the measurement is started.
- When the time axis setting is longer than 500 ms/div, the captured waveform is displayed at the same time that the measurement is started (trigger is activated).
- When the time axis setting is 200 ms/div, the captured analog waveform is displayed at the same time that the trigger is activated. This applies if the trigger is not set to free mode and the zoom factor of the time axis is less than or equal to ×1.
- When the time axis setting is shorter than 100 ms/div, the waveform is displayed after all data capture is completed.

2. Stopping the measurement.

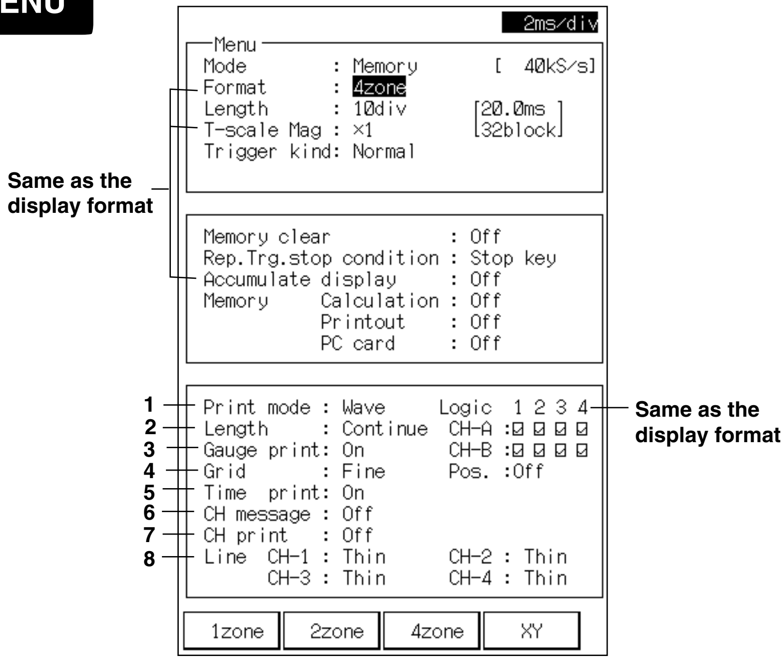
Pressing the “STOP” key stops the measurement.
The last captured data block is displayed on the screen.

6.6 Displaying/Recording the Captured Data as an Analog Waveform

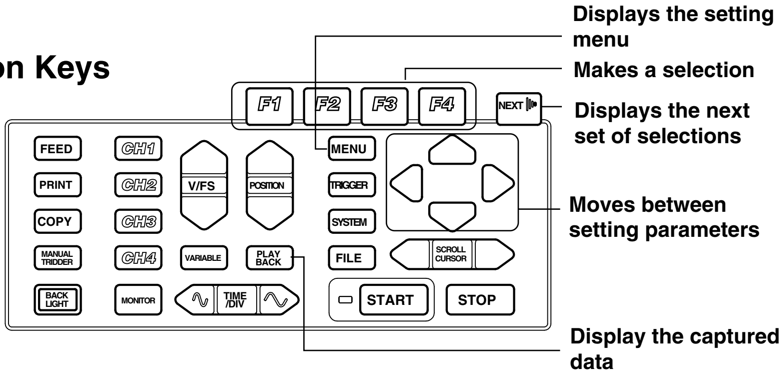
Setting the recording format

Setting screen

MENU



Operation Keys



Operating Procedure

Recording Format of the Analog Waveform

1. Setting the recording mode

Set the recording mode with “F1” (Wave) key or “F2” (Numeric) key. Here, press the “F1” key to select “Wave.”

2. Setting the record length

Set the record size with the “F1” to “F3” keys.

Continuous :	Record at 10 mm/div(the same time axis zoom factor as the displayed waveform)
A4 :	Record so that it fits in the length of an A4-size paper.
A5 :	Record so that it fits in the length of an A5-size paper.

“A4” and “A5” are valid when the recording range is “All.” If the recording range is “Cursor,” the record size is set to “continuous.”

See page 6-13 on the recording range.

3. Setting the gauge record

Select whether or not to record the scale at the end of the recording.

4. Setting the grid.

Set the grid type.

Off :	Do not record the grid.
Simple :	Record only the base line.
Fine :	Record thin lines.

5. Setting the time record

Set whether or not to record the date, time, and time of the data capture on the time axis.

6. Setting the channel message

Select the message to record at the start of the data recording from the following.

Off :	Do not record channel messages.
Comment :	Record the comment set at the screen that appears when the channel key is pressed.
CH info :	Record the measurement range.

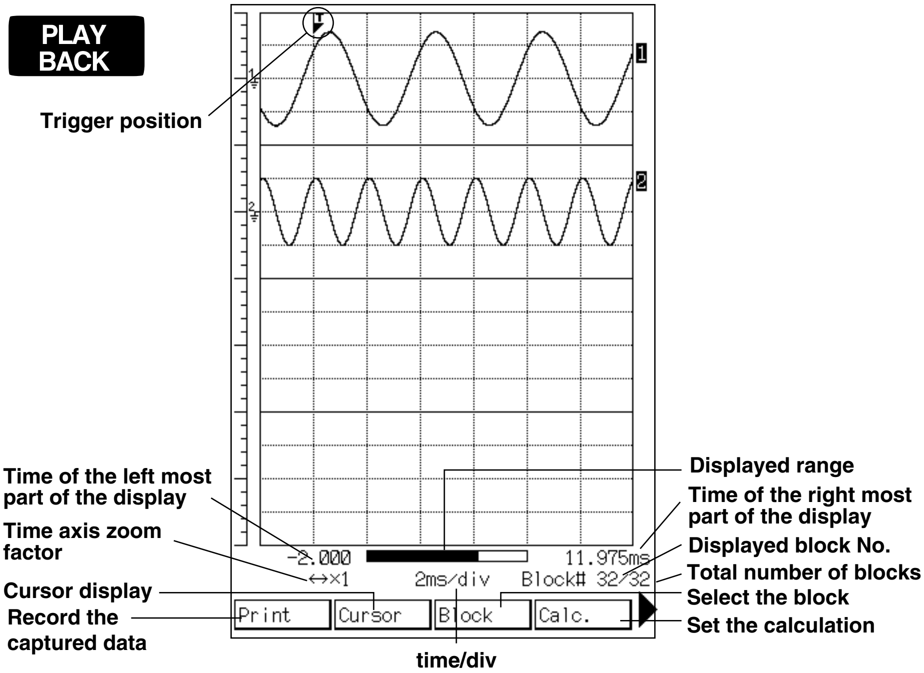
7. Setting the channel record

Select whether or not to record the channel numbers or tags. Tag is set at the screen that appears when the channel key is pressed. Switching between channel number and tag is done on the next page of the screen that appears when the “SYSTEM” key is pressed. For details, see 12.5 “Setting Tags,” or 12.6 “Setting Tags and Comments.”

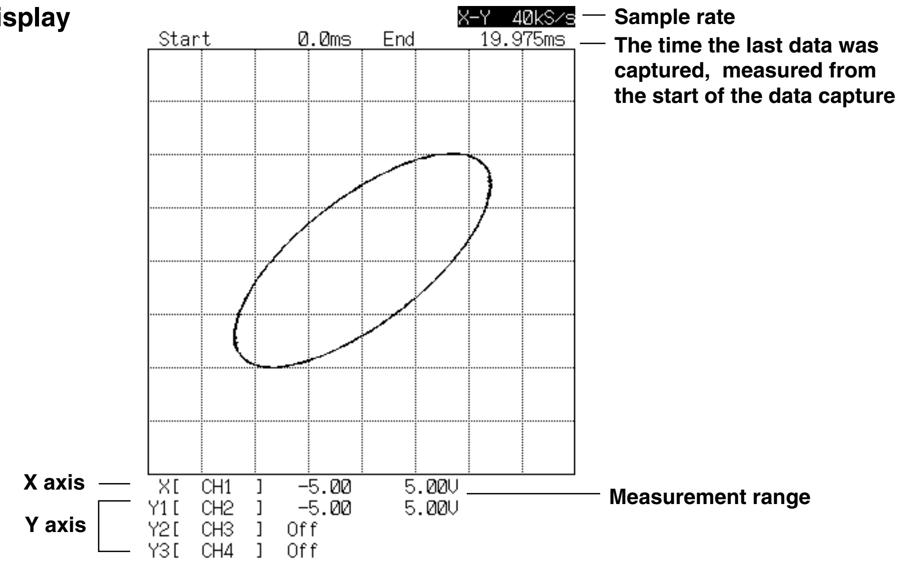
8. Setting the line for recording

Select thin, medium, or thick line for each channel.

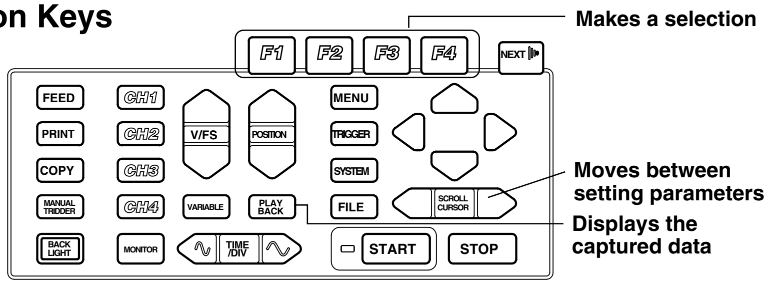
Setting Screen for Displaying Captured Data



X-Y Display



Operation Keys



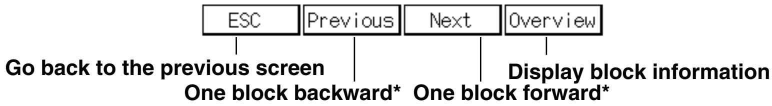
Operating Procedure

1. Displaying the captured data

Pressing the "Playback" key displays the last captured data block.

2. Selecting the block to display

Pressing the "F3" (Block) key displays the menu for selecting which block to display. Select the block to display with the "F2" and "F3" keys.



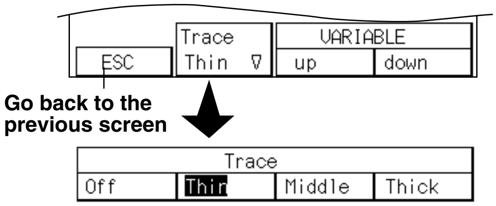
* When displaying the block information, the block of which the information is displayed is changed.

3. Scrolling the waveform

Pressing the "SCROLL/CURSOR" key changes the display range of waveform. The display range is displayed on the lower section of the screen.

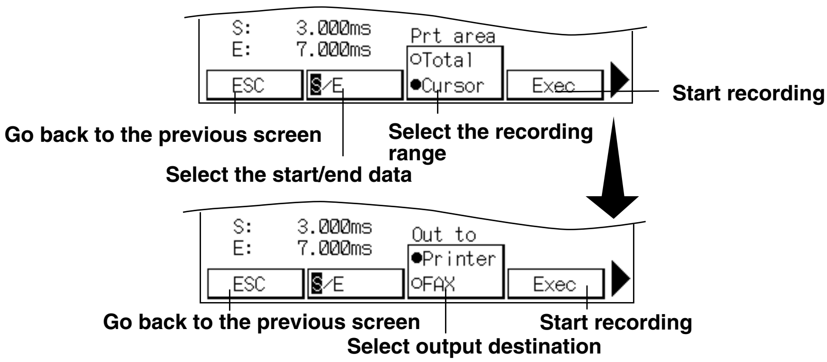
4. Not displaying the waveform

On the playback screen, press the channel key ("CH1" to "CH4" keys) that you do not want displayed.
Pressing the "F2" (Trace) key. If set to OFF, the waveform is not displayed.



Recording the Captured Data

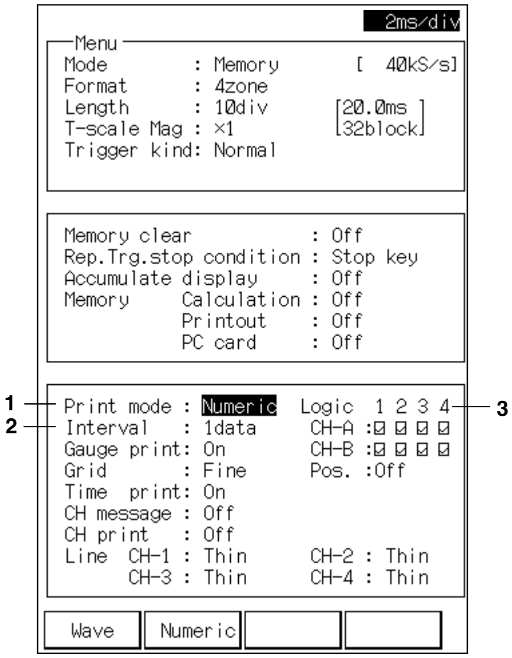
After selecting the block on the playback screen, pressing the "PRINT" key starts the recording. For selecting the block, see page 11.
To set the recording range, press the "F1" (Print) key to display the screen for setting the recording range. To specify the range with the cursor, use the "SCROLL/CURSOR" key. Pressing the "F4" (Exec) key starts the recording.



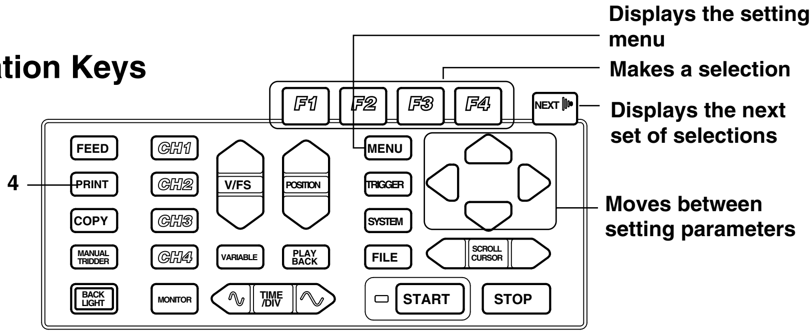
6.7 Recording the Captured Data as Digital Values

Setting screen

MENU



Operation Keys



Operation Procedure

1. Setting the recording mode

Set the recording mode with “F1” (Wave) key or “F2” (Numeric) key. Here, press the “F2” key to select “Numeric.”

2. Setting the record interval

Set the record interval from the following.

1 data :	Record all data points.
10 data :	Record every ten data points.
100 data :	Record every one handred data points.

3. Setting the logic channel

Setting whether or not to record the logic input.

Set the display/record to ON/OFF for each bit. When a check mark is in the check box it is ON. Otherwise, it is OFF.

“Position” sets whether or not to record the logic data.

Off :	Do not record.
Both/Bottom/Equal :	Record each bit of the measurement data using “0” and “1”.

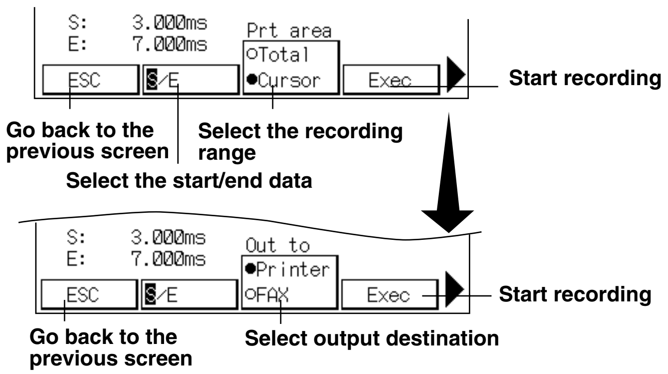
Note

All settings besides the ones shown above do not affect the digital value recording.

4. Recording the captured data.

After selecting the block on the playback screen, pressing the “PRINT” key starts the recording. For selecting the block, see page 11.

To set the recording range, press the “F1” (Print) key to display the screen for setting the recording range. To specify the range with the cursor, use the “SCROLL/CURSOR” key. Pressing the “F4” (Exec) key starts the recording.

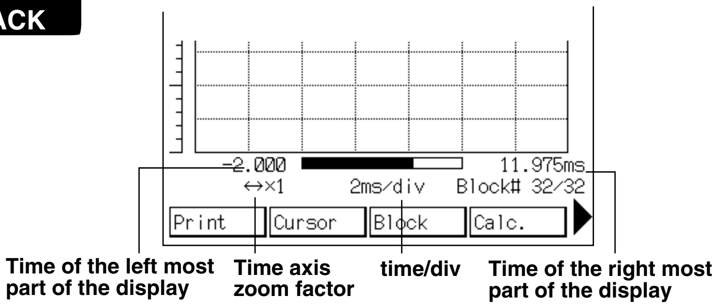


6.8 Zooming In or Out on the Displayed Waveform

Setting Screen

Screen for setting the time axis zoom

PLAY BACK



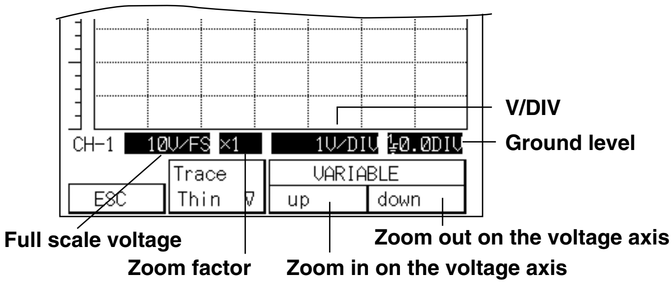
Screen for setting the voltage axis zoom

PLAY BACK

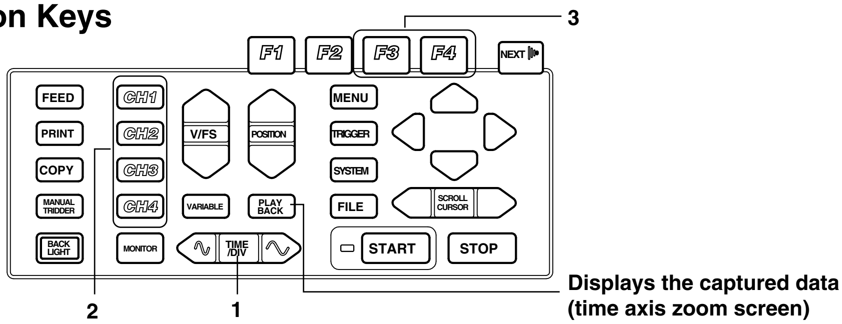
CH1

to

CH4



Operation Keys



Operating Procedure

1. Zooming in or out on the time axis

Pressing the “Time Axis” key on the playback screen zooms the waveform. Pressing the right side of the “Time/Div” key shortens time/div and the waveform is expanded. Pressing the left side of the “Time/Div” key lengthens time/div and the waveform is reduced.
The zoom factor that you can specify varies depending on the time/div setting.

time/div	Zoom factor
200 μs/div	1/1000, 1/500, 1/250, 1/100, 1/50, 1/25, 1/10, 1/5, 1/2, 2
500 μs/div	1/1000, 1/400, 1/200, 1/100, 1/40, 1/20, 1/10, 1/4, 1/2, 1, 2
1 ms/div	1/1000, 1/500, 1/200, 1/100, 1/50, 1/20, 1/10, 1/5, 1/2, 1, 2
2 ms/div	1/1000, 1/500, 1/250, 1/100, 1/50, 1/25, 1/10, 1/5, 1/2, 1, 2
5 ms/div	1/1000, 1/400, 1/200, 1/100, 1/40, 1/20, 1/10, 1/4, 1/2, 1, 2
10 ms/div	1/1000, 1/500, 1/200, 1/100, 1/50, 1/20, 1/10, 1/5, 1/2, 1, 2
20 ms/div	1/1000, 1/500, 1/250, 1/100, 1/50, 1/25, 1/10, 1/5, 1/2, 1, 2
50 ms/div	1/1200, 1/600, 1/200, 1/100, 1/40, 1/20, 1/10, 1/4, 1/2, 1, 2
100 ms/div	1/1200, 1/600, 1/300, 1/100, 1/50, 1/20, 1/10, 1/5, 1/2, 1, 2
200 ms/div	1/1500, 1/600, 1/300, 1/150, 1/50, 1/25, 1/10, 1/5, 1/2, 1, 2
500 ms/div	1/1200, 1/600, 1/240, 1/120, 1/60, 1/20, 1/10, 1/4, 1/2, 1, 2
1 s/div	1/1800, 1/600, 1/300, 1/120, 1/60, 1/30, 1/10, 1/5, 1/2, 1, 2
2 s/div	1/1800, 1/900, 1/300, 1/150, 1/60, 1/30, 1/15, 1/5, 1/2, 1, 2
5 s/div	1/1440, 1/720, 1/360, 1/120, 1/60, 1/24, 1/12, 1/6, 1/2, 1, 2
10 s/div	1/1800, 1/720, 1/360, 1/180, 1/60, 1/30, 1/12, 1/6, 1/3, 1, 2
30 s/div	1/1200, 1/600, 1/240, 1/120, 1/60, 1/20, 1/10, 1/4, 1/2, 1, 2
1 min/div	1/1200, 1/600, 1/300, 1/120, 1/60, 1/30, 1/10, 1/5, 1/2, 1, 2
2 min/div	1/1500, 1/600, 1/300, 1/150, 1/60, 1/30, 1/15, 1/5, 1/2, 1, 2
External samping clock	1/1000, 1/500, 1/200, 1/100, 1/50, 1/20, 1/10, 1/5, 1/2, 1, 2

2. Displaying the voltage axis zoom screen

Press the channel (“CH1” to “CH4”) key to select the channel to zoom on the vertical axis on the playback screen. Voltage zoom screen is displayed.

3. Setting the zoom factor

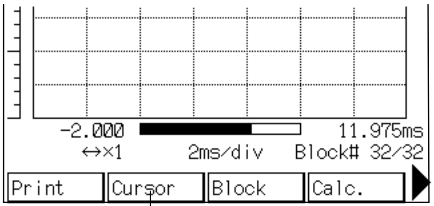
Set the zoom factor with the “F3” (up) or the “F4” (down) key. Select the zoom factor from 1/2, 2/3, 1, 2, or 5 times.

6.9 Displaying the Cursor

Setting Screen

Cursor display screen

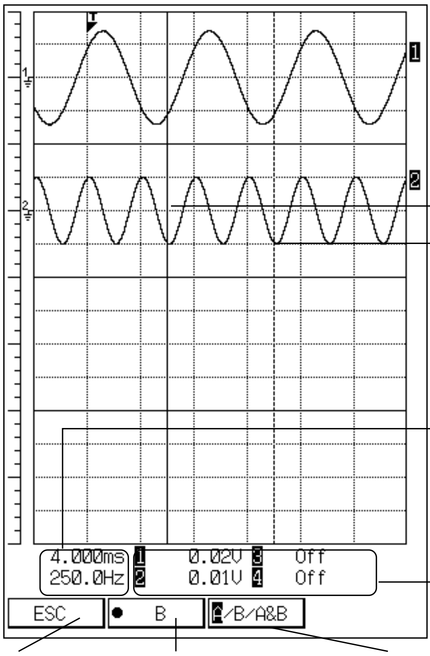
PLAY BACK



Cursor display

F2

Cursor display screen



Cursor A

Cursor B

If only cursor A is displayed, displays the time of the cursor A position. If both cursor A and B are displayed, displays the time difference between A and B and the frequency calculated from the time difference

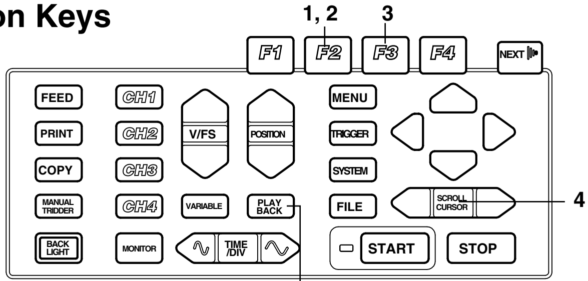
If only cursor A is displayed, displays the measured value of the cursor A position. If both cursor A and B are displayed, displays the difference between A and B

Go back to the previous screen

Display/Clear cursor B

Selects cursor to move

Operation Keys



Displays the captured data

Operating Procedure

1. Displaying the cursor

Press the "F2" (Cursor) key on the playback screen. It will display cursor A (solid line) or cursor A and cursor B (dotted line).

2. Displaying/Clearing cursor B

Pressing the "F2" (B) key toggles the display of cursor B.

3. Moving the cursor

Select the cursor to move by pressing the "F3" (A/B/A&B) key several times. This operation is not necessary if cursor B is not displayed.
Move the cursor with the "SCROLL/CURSOR" key.

A : Move cursor A only.
B : Move cursor B only.
A&B : Move cursors A and B.

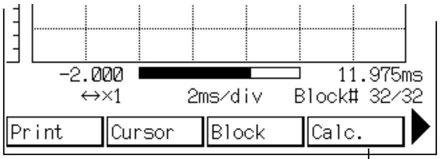
If cursor B is not displayed, the screen displays the measured value and the measured time at the cursor A position. If cursor B is displayed, the screen displays the difference between the measured values, the time difference between A and B, and the frequency calculated from the time difference. (Displays "*****Hz" when the frequency is below 0.001 Hz).

6.10 Calculating Statistics

Setting Screen

Cursor display screen

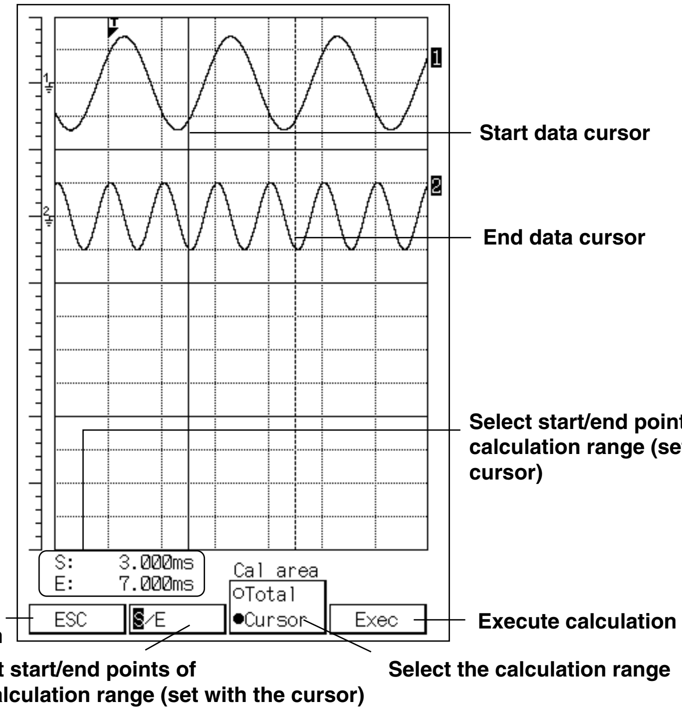
PLAY BACK



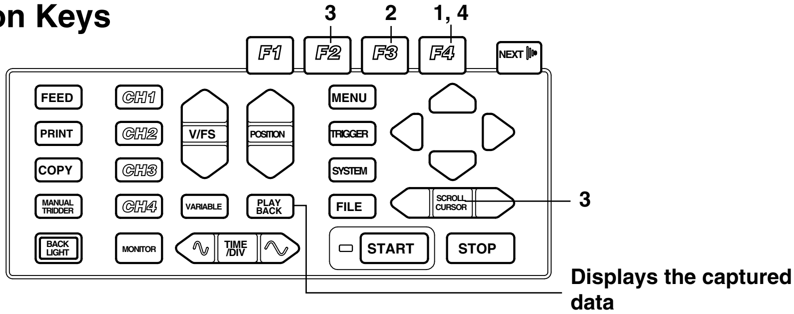
Calculation screen

Calculation screen

F 4



Operation Keys



Operating Procedure

1. Displaying the calculation setting screen

Press the "F4" (Calc.) key on the playback screen. Calculation setting screen is displayed.

2. Setting the calculation range

Set whether to calculate based on all data points in the block being displayed (Total) or the data points in the range specified by the cursors (Cursor). The one with "●" is selected. Pressing the "F3" key switches between the two.

3. Setting the calculation range with the cursors

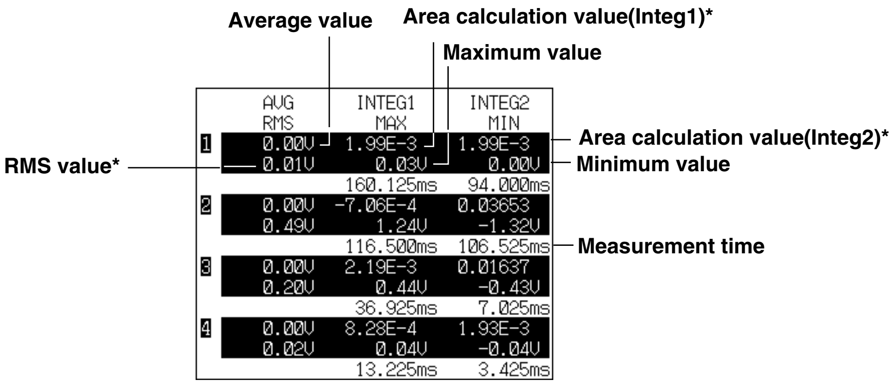
If "Cursor" was selected in step 2, the calculation range is specified by the cursors. Select whether to set the start point (S) of the calculation range or the end point (E) of the calculation range with the "F2" key. Pressing the "F2" key switches between the two.
Set the starting point and end point with the "SCROLL/CURSOR" key.

4. Executing the calculation

Pressing the "F4" key executes the calculation, and displays the calculation results.

Note

Setting "Expansion calc." to ON at the screen that appears when the "SYSTEM" key is pressed, calculates and displays the RMS value and the area (Integ1, Integ2).
Calculation takes more time when you have the "expansion calc." set to ON.



***: Shows the calculation value if expansion calculation is turned ON.**

About auto calculation

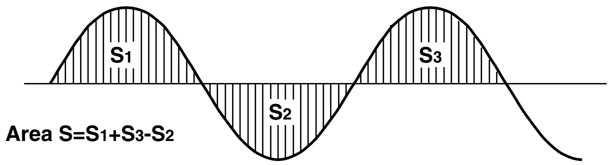
If the "interval calculation" of "operation after data capturing" in 6.2 "Setting the Conditions on Capturing the Measurement Data" is set to ON, interval statistical calculation on the entire range of the block is performed and displayed after capturing one block of data.
Also, if the "print output" of "operation after data capturing" is set to ON along with the "interval calculation," the result of the interval statistical calculation can be automatically printed.

6
Data Capturing

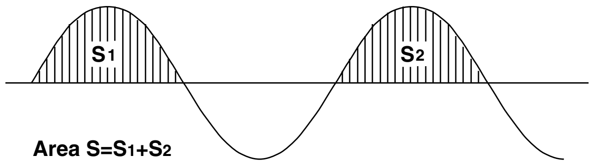
Area Calculation

If you set “Expansion calc.” to ON at the screen that appears when the “SYSTEM” key is pressed, the results of the following area calculations are displayed.

- Integ1
  Calculates the negative portion as a negative area.



- Integ2
  Ignores the negative portion.



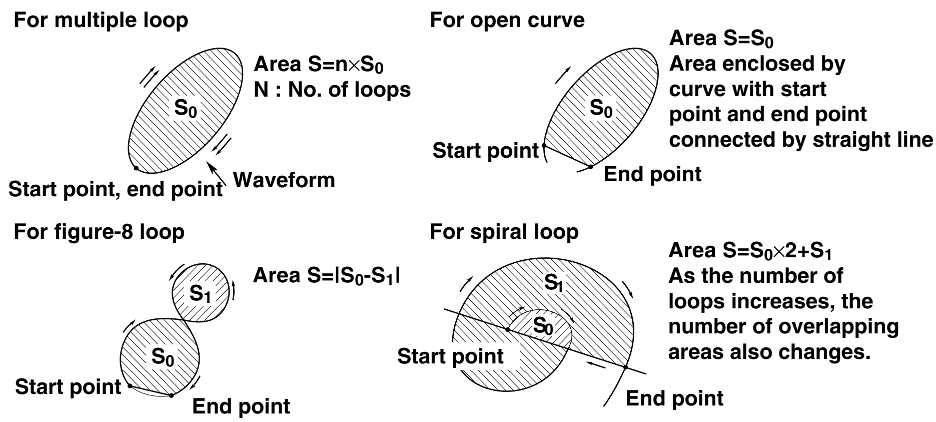
Calculation when displaying the captured data in X-Y format

When displaying the captured data in X-Y format, the area of the waveform is calculated in stead of calculating statistics. The operation procedure is the same as the statistic calculation. There are two calculation methods.

INTEG1 : The area of the enclosed area made by the line connecting the start and end points and the waveform.

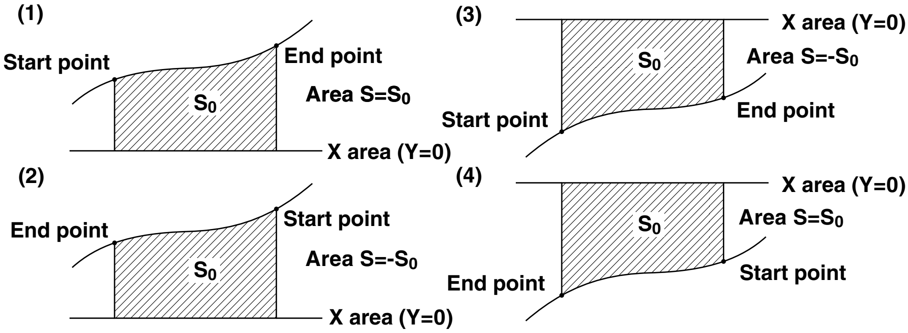
INTEG2 : The area of the enclosed area made by the vertical lines from the start and end points to the X-axis, the X-axis, and the waveform.

INTEG1

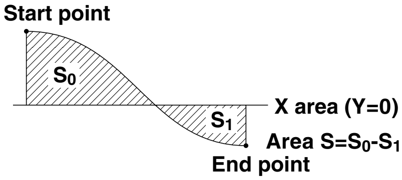


INTEG2

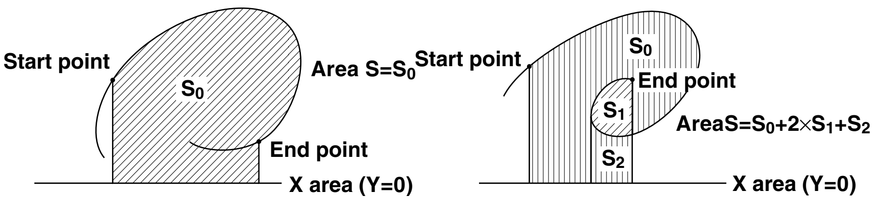
When there is only one Y data point for each X data point



For waveform with negative (minus) amplitude



When there are several Y data points for each X data point

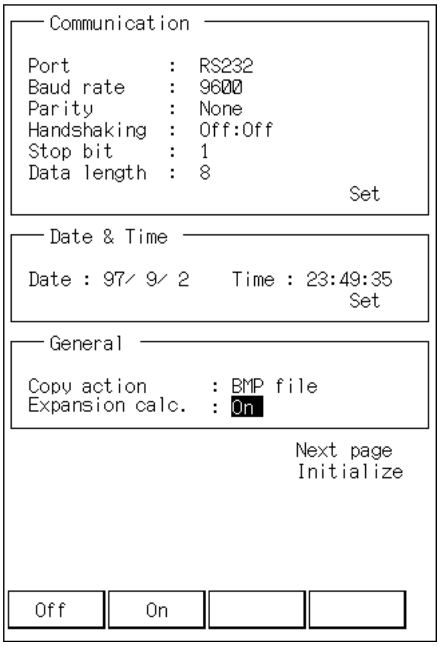


6.11 Turning Expansion Calculation ON and the results of the area calculation

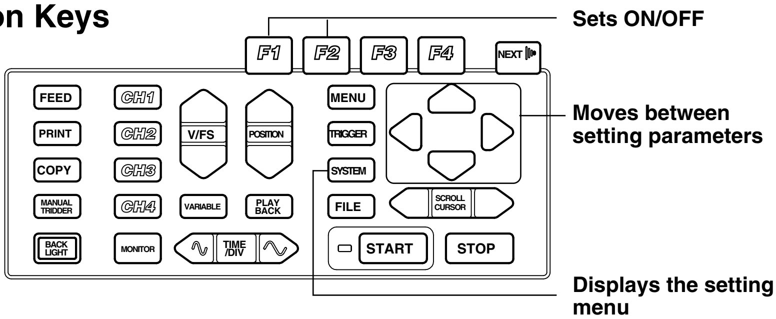
The RMS value can also be calculated and displayed when executing the calculation as described in 6.10 “Calculating Statistics.” Calculation takes more time when you have the “expansion calc.” set to ON.

Setting Screen

SYSTEM



Operation Keys



Operating procedure

Set the “Expansion calc” to “ON” at the screen that appears when the “SYSTEM” key is pressed.
Executing the calculation displays the RMS value with the other calculated results.

7.1 Setting Parameters

This chapter describes the methods to display or record the measurement data. The relevant parameters are listed below.
You will set these parameters using the screen that appears when the "MENU" key is pressed.

Recording format of the analog waveform

Setting parameters	Description
Operation mode	Select whether to save the measurement data to memory or realtime record with the built-in printer. Select "Realtime."
Format	Select the recording format from 1 zone, 2 zone, or 4 zone.
Record length	Set the record length. Select continuous, 20 div, 200 div or 800 div (for /L1 or /L2 model).
Record format	Sets whether or not to realtime record. Set to "Wave."
Gauge record	Select whether or not to record the scale value for each channel at the end of the recording.
Grid	Select the grid type.
Time record	Set whether or not to record the time record of the captured data.
Channel message	Select whether or not to record comments or measurement range information.
Channel record	Select whether or not to record the channel numbers or tags.
Line	Set the thickness of the line used to record the analog waveform.
Logic	Set the display of each bit to ON/OFF and the record position of the logic channel.

Recording format of digital values

Setting parameters	Description
Operation mode	Select whether to save the measurement data to memory or realtime record with the built-in printer. Select "Realtime."
Format	Select a recording format other than XY.
Record length	Set the record length. Select continuous, 20 div, 200 div or 800 div (for /L1 or /L2 model).
Record format	Sets whether or not to realtime record. Set to "Numeric."
Interval time	Set only when recording digital values. Sets the recording interval.
Playback	Set the recording interval when recording the captured data.
Logic	Set the display of each bit to ON/OFF and the recording of the logic channel to ON/OFF.

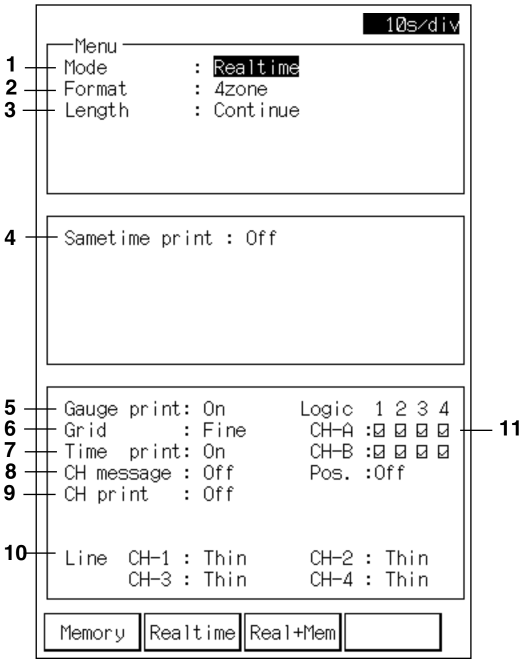
Recording format of X-Y

Setting parameters	Description
Operation mode	Select whether to save the measurement data to memory or realtime record with the built-in printer. Select "Realtime."
Format	Select the recording format. Select "XY."
Style	Set only when using X-Y format. Set the line style to record.
Record format	Sets whether or not to realtime record. Set to "ON."
Gauge record	Select whether or not to record the scale value for each channel at the end of the recording.
Grid	Select the grid type.
Time record	Set whether or not to record the time record of the captured data.
Channel message	Select whether or not to record comments or measurement range information.
Channel record	Select whether or not to record the channel numbers or tags.
Channel selection	Set only when using X-Y format. Set the Y-axis to channel 2, 3, or 4.

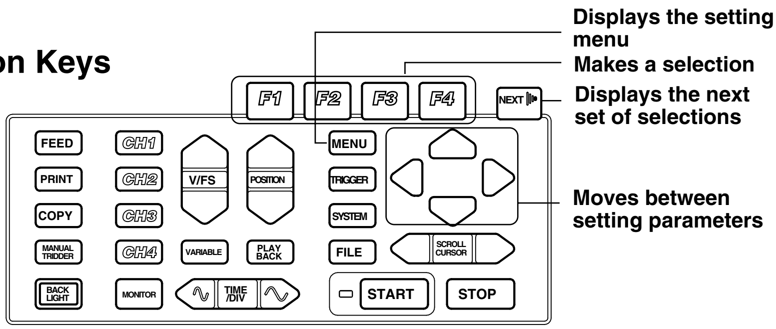
7.2 Setting the Recording Format of the Analog Waveform

Setting Screen

MENU



Operation Keys



Operating Procedure

1. Setting the operation mode

Set the operation mode to “Realtime” with the “F2” (Realtime) key.

2. Setting the display/recording format

Set the display/record format with the “F1” to “F4” keys.

1 zone : Display/Record every channel in one zone.
2 zone : Display/Record channels 1 and 2 to the upper zone and channels 3 and 4 to the lower zone.
4 zone : Display/Record channels 1, 2, 3, and 4 in order from the top zone.
XY : Display/Record X-Y (See 7.4 “Setting the X-Y Recording Format.”)

3. Setting the record length

Select the record length with the “F1” to “F3” keys.

Continuous : Record continuously.
20 div, 200 div : Record 20 div or 200 div worth of measurement data. (800 div is also available on the OR100E/L1, /L2 models or OR300E)

4. Setting record format

Select the recording method with the “F1” to “F3” keys.

Off: Display the waveform to the screen in realtime. No recording.
Wave : Record the waveform in realtime
Numeric : Record the digital values in realtime.

Here, set to “Wave.”

The setting of the recording format is also used for the recording of the captured data.

5. Setting the gage record

Select whether or not to record the scale value for each channel at the end of the recording.

6. Setting the grid

Set the grid type.

Off : Do not record the grid.
Simple : Record only the base line.
Fine : Record thin lines.

7. Setting the time record

Set whether or not to record the date, time, and time of the data capture on the time axis.

8. Setting the channel message

Select the message to record at the start of the data recording from the following.

- Off : Do not record channel messages.
- Comment : Record the comment set at the screen that appears when the channel key is pressed. For setting the comment, see 12.6 "Setting Tags and Comments."
- CH info : Record the measurement range.

9. Setting the channel record

Select whether or not to record the channel numbers or tags. Tag is set at the screen that appears when the channel key is pressed. For details, see 12.6 "Setting Tags and Comments." Switching between channel number and tag is done on the next page of the screen that appears when the "SYSTEM" key is pressed. For details, see 12.5 "Setting Tags," or 12.6 "Setting Tags and Comments."

10. Setting the line for recording

Select thin, medium, or thick line for each channel.

11. Setting the logic channel

Set whether or not to display/record the logic inputs. Also, set the display positions.

Set the display/record to ON/OFF for each bit. When a check mark is in the check box it is ON. Otherwise, it is OFF.

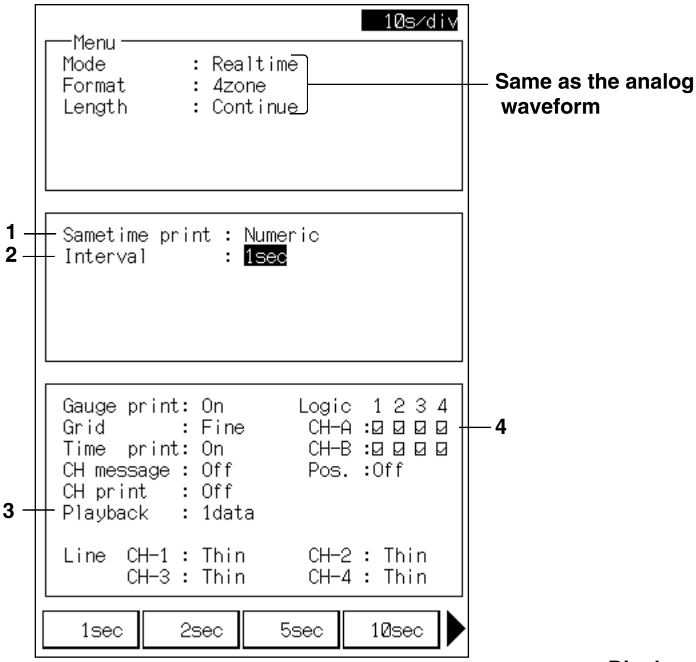
Select the position of the display/record from the following.

- Off : Do not display/record.
- Both : Display/Record channel A in the upper section and channel B in the lower section.
  If the display format is 2 zone or 4 zone, display/record channel A in the upper section of the top zone and channel B in the lower section of the bottom zone.
- Bottom : Display/Record both channel A and B in the lower section of the bottom zone.
- Equal : Display/Record each bit in equal intervals.
  If the display format is 2 zone, display channel A in the upper zone and channel B in the lower zone.
  If the display format is 4 zone, display/record each bit of channel A an B in order (bit 1, 2, 3, 4) from the top zone.

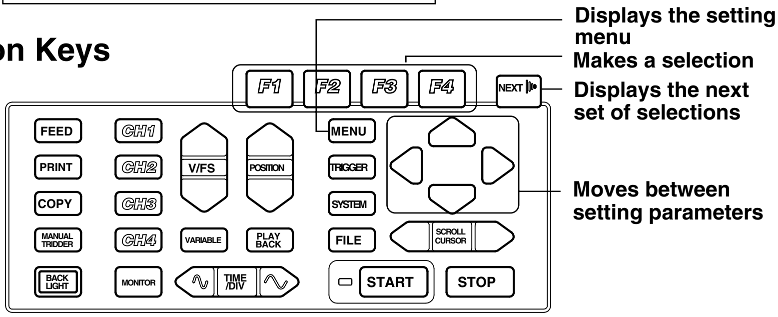
7.3 Setting the Recording Format of the Digital Values

Setting Screen

MENU



Operation Keys



Operating Procedure

1. Setting the simultaneous recording

Press the “F3” key to select “Numeric.”

2. Setting the recording interval

Select the time interval for recording.

3. Setting the playback

Sets the recording interval when recording the captured data with digital values.

4. Setting the logic channel

Setting whether or not to record the logic input.

Off :	Do not record.
Both/Bottom/Equal :	Record each bit of the measurement data using “0” and “1.”

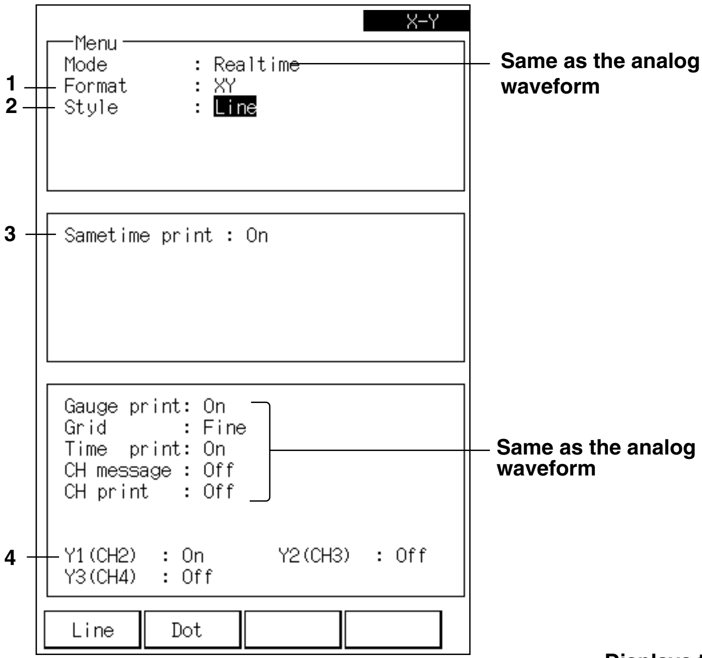
Note

All settings besides the ones shown above do not affect the digital value recording.

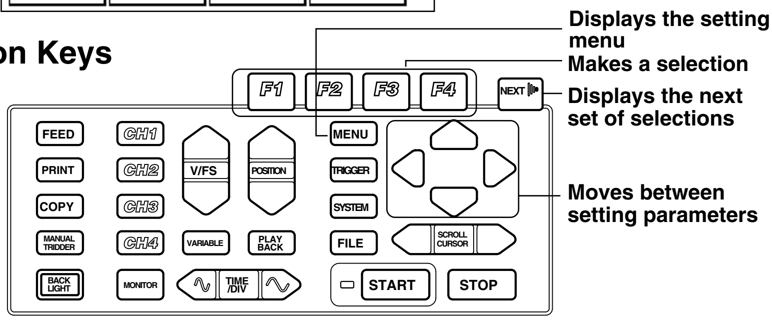
7.4 Setting the X-Y Recording Format

Setting Screen

MENU



Operation Keys



Operating Procedure

1. Setting the recording format

Press the “F4” (XY) key to set the recording format to “XY.”

2. Setting the style

Select the record style from the following.

Line : Record by connecting the measurement points with a line.

Point : Record the measurement points as points.

3. Setting the simultaneous recording

Set to ON when recording to the chart.

4. Setting the Y-axis

Select the channel to assign to the Y-axis. X-axis is fixed to channel 1.

7.5 Starting/Stopping

Operating Procedure

1. Starting the measurement

Pressing the "START" key starts the measurement and displays the measurement data on the screen in realtime. If the simultaneous recording is set to "Wave" or "Numeric," it will also start recording with the built-in printer. When using X-Y format, the screen displays the X-Y waveform. When the measurement is stopped with the "STOP" key, it is recorded with the built-in printer.

Note

You cannot change any other settings when using X-Y format.

2. Stopping the measurement.

Pressing the "STOP" key stops the measurement.

About the chart speed

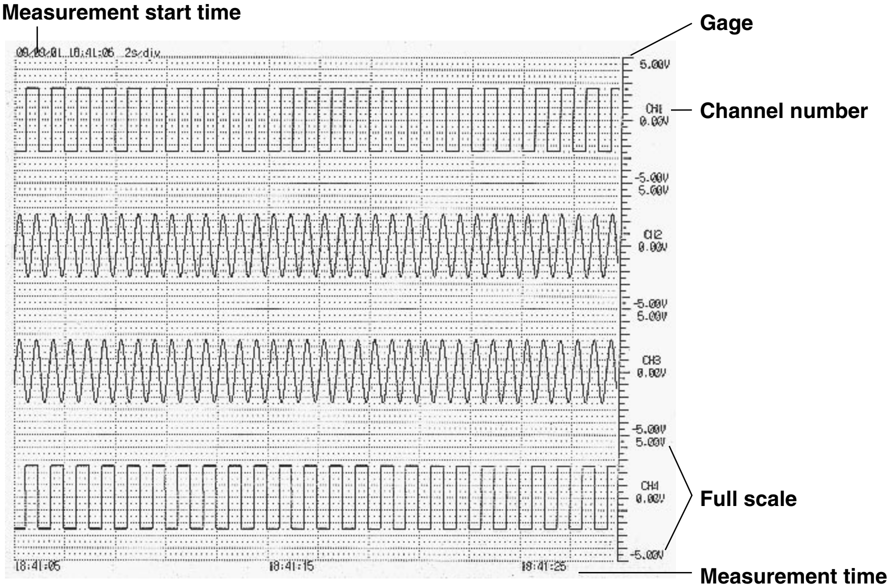
Chart speed is the time/div set in 4.3 "Setting the Time Axis." Since 1 div = 10 mm, converting to speed gives

Chart speed = 10 / (time/div)   The unit of time/div is seconds.

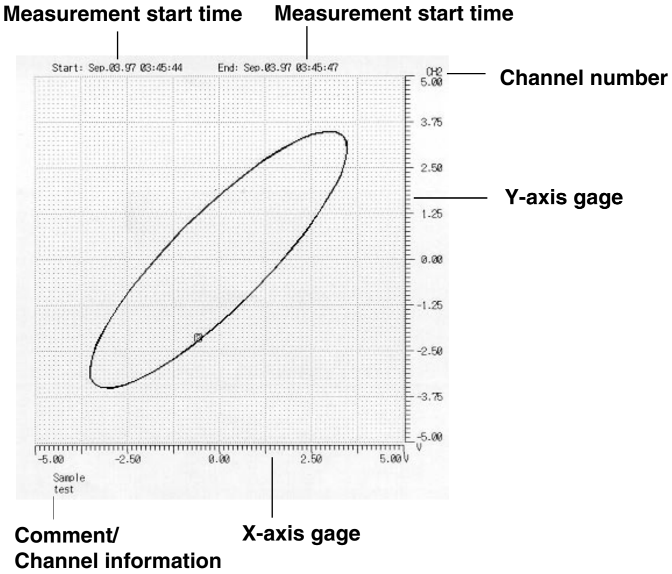
The following table shows the relationship between time/div and chart speed.

time/div	Chart speed
2 s/div	5 mm/s
5 s/div	2 mm/s
10 s/div	1 mm/s
30 s/div	20 mm/min
1 min/div	10 mm/min
2 min/div	5 mm/min
5 min/div	2 mm/min
10 min/div	1 mm/min
30 min/div	20 mm/hour
1 hour/div	10 mm/hour

Zone Recording

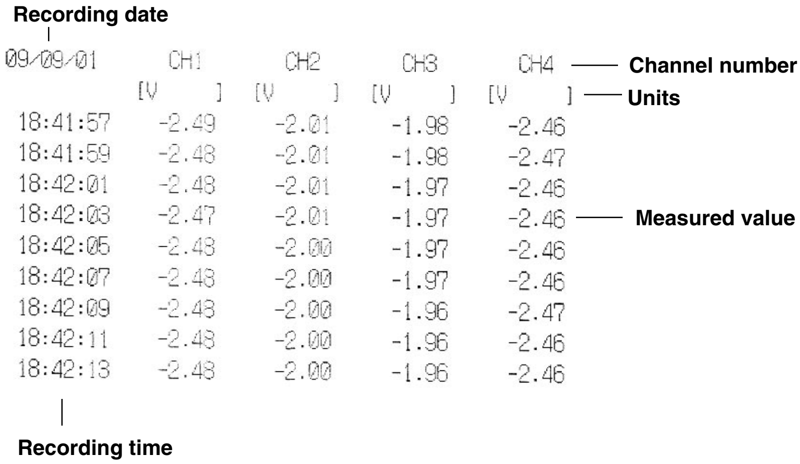


X-Y Recording



Digital Value Recording

This function records the measured value of each channel as numerical values in the specified interval.



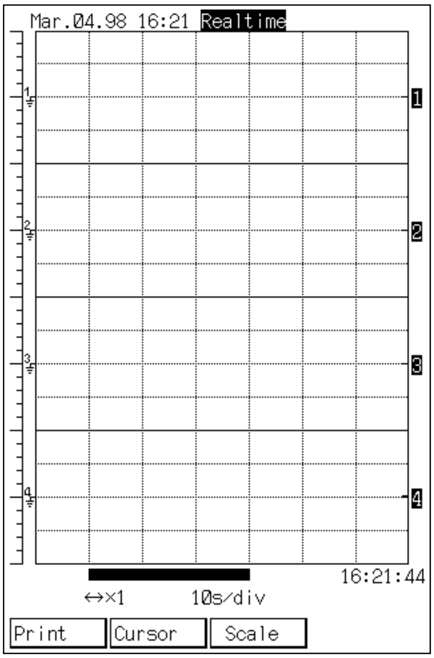
09/09/01	CH1	CH2	CH3	CH4
	[V]	[V]	[V]	[V]
18:41:57	-2.49	-2.01	-1.98	-2.46
18:41:59	-2.48	-2.01	-1.98	-2.47
18:42:01	-2.48	-2.01	-1.97	-2.46
18:42:03	-2.47	-2.01	-1.97	-2.46
18:42:05	-2.48	-2.00	-1.97	-2.46
18:42:07	-2.48	-2.00	-1.97	-2.46
18:42:09	-2.48	-2.00	-1.96	-2.47
18:42:11	-2.48	-2.00	-1.96	-2.46
18:42:13	-2.48	-2.00	-1.96	-2.46

7.6 Displaying/Recording the Captured Data

Since the measurement data is captured and held in the internal memory temporarily even in the realtime recording mode, you can display/record the captured data.

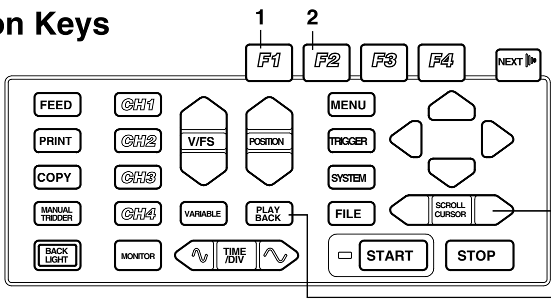
Setting Screen

PLAY BACK



Measurement start time

Operation Keys



Scrolls the waveform or moves the cursor

Displays the captured data

Operating Procedure

After capturing the data, pressing the “Playback” key displays seven divisions of the most current measurement data. Pressing the “Playback” key at a screen other than the screen displaying the captured data, displays the screen of the captured data that was displayed previously.

The amount of data points that can be saved to the memory is the number of divisions specified for the record length. If continuous was selected, up to 200 div of measurement data is saved (800 div for OR100E with option /L1 and /L2 or OR300E).

1. Recording the captured data

There are two methods. One is to press the “PRINT” key. The other is to press the “F1” (Print) key.

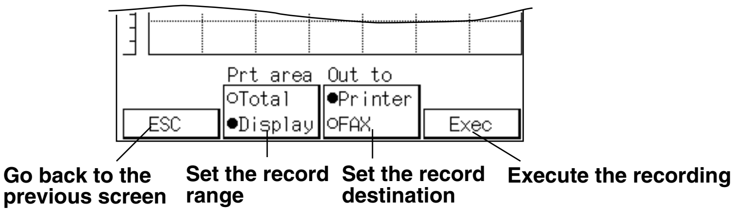
When Using the “PRINT” Key

Record all the captured data with the built-in printer.

When Using the “F1” Key

You can select the range and the destination of the recording.

Pressing the “F1” (Print) key displays the screen for setting the record range and the record destination.



Press the “F2” (Print area) key to select the record range.

- All : Record all the captured data.
- Display : Record the range currently displayed.

Press the “F3” (Destination) key to select the record destination.

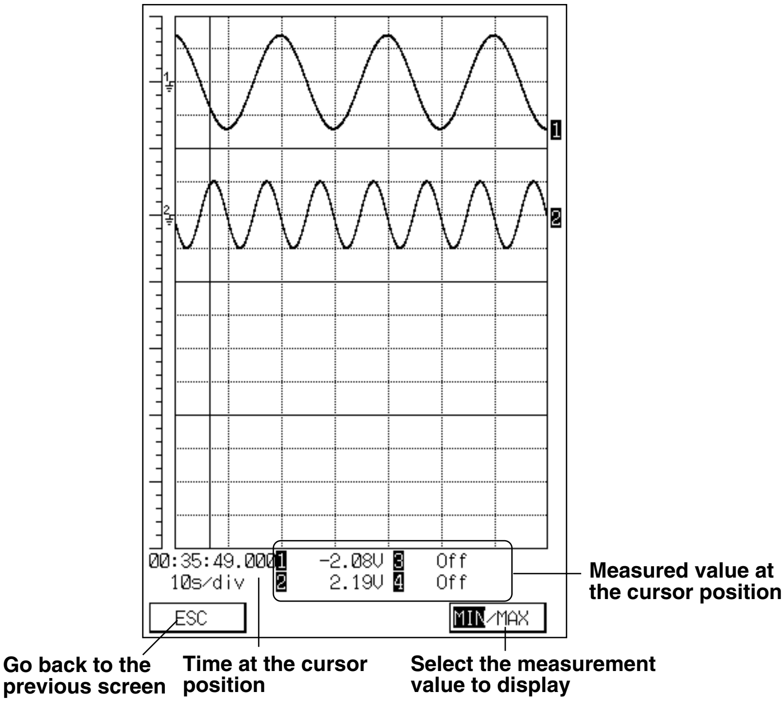
- Printer : Record with the built-in printer.
- FAX : Record over FAX modem.

If “FAX” is selected, the FAX modem need to be set at the screen that appears when the “SYSTEM” key is pressed. For details, see 11.8 “Sending the Measurement Data with the FAX Modem.”

Pressing the “F4” (Exec) key starts the recording.

2. Reading the measurement data with the cursor

Pressing the “F2” (Cursor) key displays the cursor display screen.



About MIN/MAX(Display of the captured data of realtime recording)

The OR100E/OR300E displays 40 points in 1 div in the time axis direction. On the other hand, the sample rate during realtime recording is 400 kS/s and the maximum chart speed is 2 s/div, which results in at least 800 k points of measured data in 1 div. This means that multiple points of measured data exist at the same time position. The maximum and minimum values of the measured data at the same time position are used for displaying and recording on this recorder. The “F4” (MIN/MAX) key switches which value, maximum or minimum, to display.

8.1 Setting Parameters

This chapter describes the methods to capture the data during the realtime recording. The relevant parameters are listed below. You will set these parameters using the screen that appears when the "MENU" key is pressed. The setting procedure is very similar to that of the memory mode. However, you can not perform X-Y recording or X-Y display.

Setting the Measurement Conditions

Setting parameters	Description
Operation mode	Select whether to save the measurement data to memory or realtime record with the built-in printer. Select "Realtime+Memory."
Format	Select the recording format from 1 zone, 2 zone, or 4 zone.
Memory length	The number of data points to capture in one data capture. Set in terms of div (80 data/div).
Kind of trigger	Select normal trigger or wave window trigger.
Clear memory at start	Select whether or not to clear the measurement data captured previously at the start of the measurement.
Condition to stop repeat trigger	When the trigger mode is repeat, select whether to stop the measurement by pressing the "STOP" key or stop the measurement after capturing enough data to fill the internal memory.
Operation after data capturing	Set the operation after capturing the data once.

Setting the display format

Setting parameters	Description
Format	Select the display format from 1 zone, 2 zone, or 4 zone.
T-axis zoom factor	Set the T-axis zoom factor for the display screen.
Logic	Set the display of each bit to ON/OFF and the display position of the logic channel.

Setting the recording format

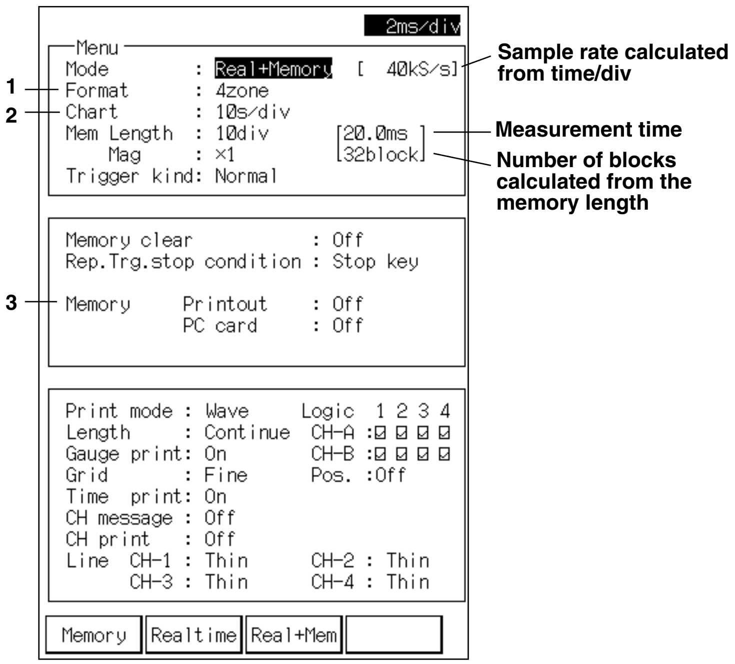
Setting parameters	Description
Format	Select 1 zone, 2 zone, or 4 zone.
Setting the Chart speed	Set the chart speed in time/div.
Record mode	Select whether to record the analog waveform or the digital values.
Record length	Select whether to record the captured data with the same zoom factor as the display zoom factor or expand/reduce to A4 or A5 size to record. This parameter is invalid when recording digital values.
Interval time	Set only when recording digital values. Set the recording interval.
Gague record	Select whether or not to record the scale value for each channel at the end of the recording.
Grid	Select the grid type.
Time record	Set whether or not to record the time record of the captured data.
Channel message	Select whether or not to record comments or measurement range information.
Channel record	Select whether or not to record the channel numbers or tags.
Line	Set the thickness of the line used to record the analog waveform.
Logic	Set the display of each bit to ON/OFF and the record position of the logic channel.

8.2 Setting the “Realtime+Memory” Mode

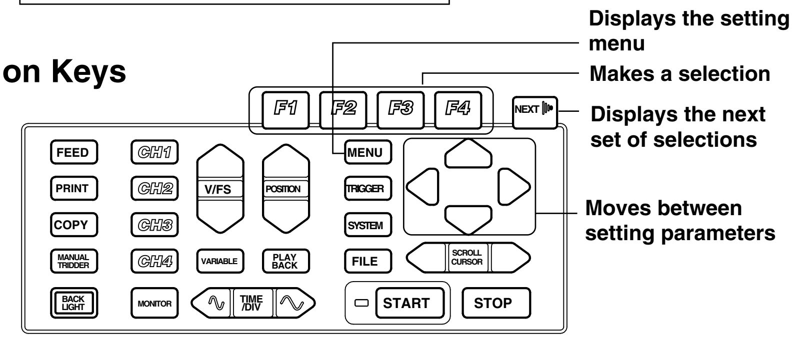
In this chapter, only the differences between the “Realtime+Memory” mode and the “Memory” mode are explained. For parameters that are not explained in this chapter, see the corresponding sections in chapter 6 on the “Memory” mode.

Setting screen

MENU



Operation Keys



Operating Procedure

1. Setting the display/recording format

Set the display/recording format with the "F1" to "F4" keys.

1 zone : Display/Record every channel in one zone.

2 zone : Display/Record channels 1 and 2 to the upper zone and channels 3 and 4 to the lower zone.

4 zone : Display/Record channels 1, 2, 3, and 4 in order from the top zone.

2. Setting the chart speed

Set the chart speed used during realtime recording in time/div.

The maximum chart speed that can be selected varies depending on the time/div setting.

time/div (Sample rate)	Maximum Chart Speed
2 s/div (40 S/s)	2 s/div
5 s/div (16 S/s)	5 s/div
10 s/div (8 S/s)	10 s/div
30 s/div (2.67 S/s)	30 s/div
1 min/div (1.33 S/s)	1 min/div
2 min/div (0.667 S/s)	2 min/div

3. Setting the operation after data capturing

Set the operation to perform after capturing one block of measurement data with the "F1" and "F2" keys. Set the print output to ON.

Print output : Record the captured data with the built-in printer.

PC card : Send the measurement data over FAX modem or save the data to the PC card. For details, see 10.3 "Saving the Measurement Data to the PC Memory Card", or 11.9 "Sending the Measurement Data over the FAX Modem card."

Note

The settings for recording the digital values are the same as in the memory mode.

8.3 Starting/Stopping

Operating Procedure

1. Starting the measurement.

Pressing the “START” key starts the measurement and records the waveform with the built-in printer in realtime. The measurement data is displayed on the screen, but the back lighting turns off and the screen darkens.

Note

- You cannot change any other settings.
- If the print output or fax transmission of the operation after the data capture is set to ON in the previous section, the realtime recording is aborted and the captured data is recorded or sent over the FAX modem every time a block of measurement data is saved. When the recording or the FAX transmission is complete, the recorder resumes the realtime recording.
- If the “PC card” of the operation after the data capture is set to “Data save” in the previous section, the measurement data is saved to the flash ATA memory card every time a block of measurement data is saved. Realtime recording is not aborted while it is saving the measurement data to the memory card, but the display screen is not updated during this time.

2. Stopping the measurement.

Pressing the “STOP” key stops the measurement.

About the chart speed

Chart speed is the time/div set in 4.3 “Setting the Time Axis.” Since 1 div = 10 mm, converting to speed gives

Chart speed = 10 / (time/div)   (The unit of time/div is seconds)

The following table shows the relationship between time/div and chart speed.

time/div	Chart speed
2 s/div	5 mm/s
5 s/div	2 mm/s
10 s/div	1 mm/s
30 s/div	20 mm/min
1 min/div	10 mm/min
2 min/div	5 mm/min
5 min/div	2 mm/min
10 min/div	1 mm/min
30 min/div	20 mm/hour
1 hour/div	10 mm/hour

About sample rate

The sample rate of the “realtime+memory” mode is determined by the time/div setting even during realtime recording as in the memory mode. It is not fixed to 400 kS/s.

8.4 Displaying the Captured Data

As in the memory mode, you can display the captured data, read the measurement value with the cursor, and make statistical calculations. See the sections listed below.

6.6 Displaying/Recording the Captured Data as an Analog Waveform
6.7 Recording the Captured Data as Digital Values
6.8 Zooming In or Out on the Displayed Waveform
6.9 Displaying the Cursor
6.10 Calculating Statistics

9.1 Setting Parameters

The parameters shown below will be set in this chapter.
The screen for setting parameters is the screen that appears when the “MENU” key is pressed.

Waveform Analysis (Harmonic Analysis from an arbitrary point)

Conditions on capturing the measurement data

Setting parameters	Description
Operation mode	Set to “Harmonic.”
Analysis method	Set to “Wave”
Frequency	Set the frequency of the power supply being measured.
Memory length	Set how many cycles of data to capture.
Kind of Trigger	Select normal trigger or wave window trigger.
Clear memory at start	Select whether or not to clear the measured data captured previously at the start of the measurement.
Condition to stop repeat trigger	When the trigger mode is repeat, select whether to press the “STOP” key to stop the measurement or stop the measurement after capturing enough data to fill the internal memory.
Operation after data capturing	Set the operation after capturing the data once.

Setting the display format

Setting parameters	Description
Format	Select 1 zone, 2 zone or 4 zone.
Accumulate display	Select whether or not to accumulate the waveform
Logic	Set the display of each bit to ON/OFF and the display position of the logic channel.
Channel selection	Set only when using X-Y format. Set the Y-axis to channel 2, 3, or 4.

Setting the recording format

Setting parameters	Description
Format	Select 1 zone, 2 zones or 4 zones.
Record mode	Select whether to record the analog waveform or the digital values.
Record length	Select whether to record the captured data in 10 mm/div or expand/reduce to A4 or A5 size to record. This parameter is invalid when recording digital values .
Interval time	Set only when recording digital values. Sets the recording interval.
Gauge record	Select whether or not to record the scale value for each channel at the end of the recording.
Grid	Select the grid type.
Time record	Set whether or not to record the time record of the captured data.
Channel message	Select whether or not to record comments or measurement range information.
Channel record	Select whether or not to record the channel numbers or tags.
Line	Set the thickness of the line used to record the analog waveform.
Logic	Set the display of each bit to ON/OFF and the record position of the logic channel.

Automatic analysis (Perform harmonic analysis automatically)

Conditions on capturing the measurement data

Setting parameters	Description
Operation mode	Set to "Harmonic."
Analysis method	Set to "Auto"
Frequency	Set the frequency of the power supply being measured. Selecting "Auto" will automatically estimate the frequency from the measured signal.
Display contents	Select what to display from the results of the automatic analysis
Wiring method	Select the wiring method.
Operation after data capturing	Set the operation after capturing the data once.
Saving results of analysis	Select whether or not to save the results of the analysis at certain intervals to the flash ATA memory card.
Start time/stop time	Select the start and stop times when saving the results of the analysis at certain intervals to the flash ATA memory card.
Parameters under analysis to save	Select what parameters to save when saving the results of the analysis at certain intervals to the flash ATA memory card.

Setting display format

Setting Recording format

The display and recording formats of the automatic analysis are the newer of the two settings, waveform analysis and memory mode setting.
Accumulate display is not available.

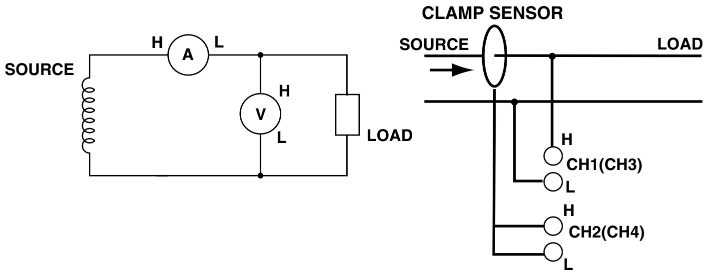
Note

When measuring power, scale the measured value of the channel that will connect the clamp probe to the current value.

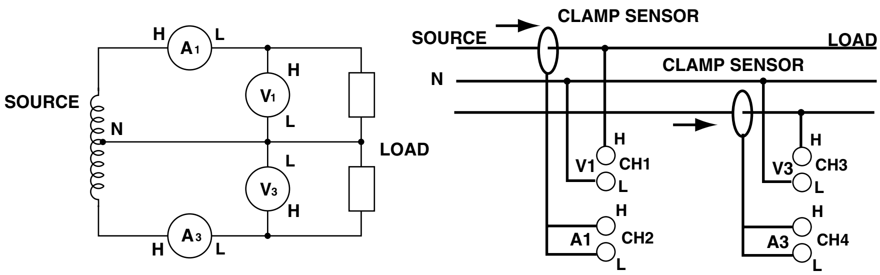
9.2 Connecting Cables for Power Measurement

When measuring the power (automatic analysis), connect the input signal cable as shown in the following figure. Follow the warnings described in section 2.3 “Connecting the Signal Cable,” when connecting the cable.

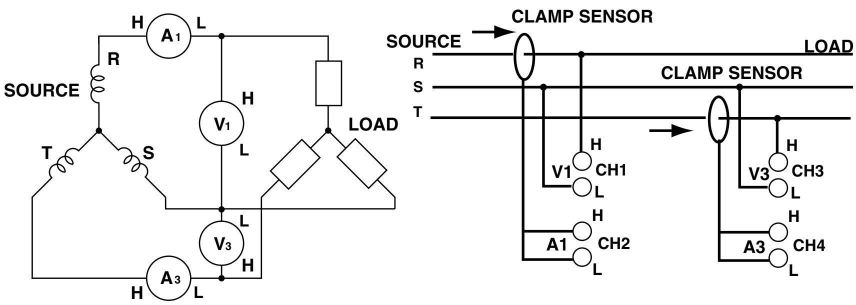
Single-phase Two-wire Configuration



Single-phase Three-wire Configuration



Three-phase Three-wire Configuration

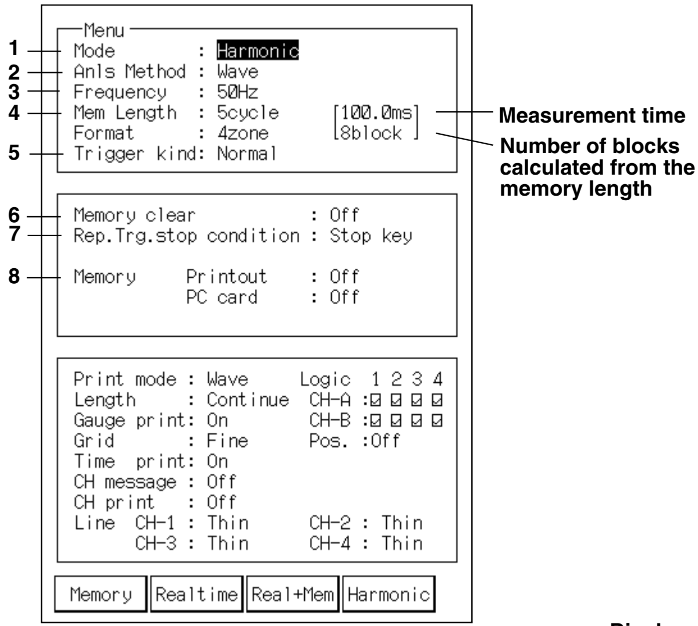


9.3 Setting Conditions to Capture Measured Data

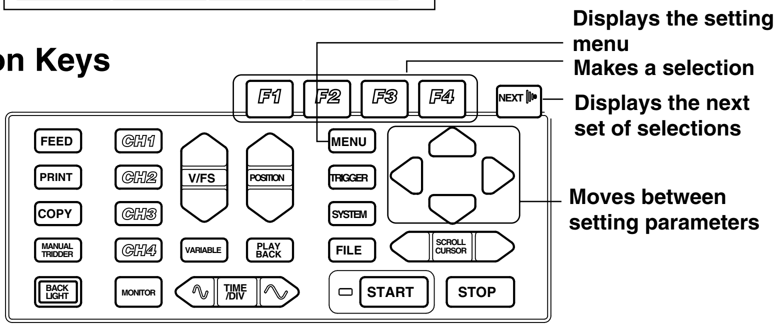
When specifying the range to analyze (waveform analysis)

Setting screen

MENU



Operation Keys



Operating Procedure

1. Setting the operation mode

Press the “F4” (Harmonic) key to set the operation mode to “Harmonic.”

2. Setting the analysis method

Press the “F1” (Wave) key to set the analysis method to “Wave.”

3. Setting the frequency

Press “F1” and “F2” keys to set the frequency of the signal under measurement.

Note

Sample rate is fixed according to the frequency.
50 Hz: 25600 S/s
60 Hz: 30720 S/s

4. Setting memory length

Set the memory length in units of cycles with “F1” to “F4” keys. Memory length is the amount of data that is saved in one data capturing operation.
Pressing “Next” will show the next set of selections.
The relationship between the memory length and number of blocks are as follows.

Memory Length (Number of Cycles)	5	10	25	50	100	250	500	1000
Number of blocks (Normal trigger)	32	16	8	4	2	1	1[*1]	1[*2]
Number of blocks (WW trigger)	16	8	4	2	1	--	--	--

[*1] Two channels are linked
[*2] Four channels are linked (OR342)

5. Setting the kind of trigger

Select the kind of trigger with “F1” and “F2” keys. See chapter 5 “Triggering.”

6. Setting how to handle the memory at the start of the data capture

Select ON or OFF with “F1” and “F2” keys.

On : Clear the measurement data captured previously
Off : Capture the data to the next block after the previous data.

7. Setting the condition to stop the repeat trigger

Set only when the trigger is set to repeat.
Set the stop condition with “F1” and “F2” keys.

Stop Key : Overwrite the data until the “STOP” key is pressed.
Memory Full : Stop the measurement after capturing enough data to fill the memory.
If you start the data capture in the middle of the internal memory, the data is captured up to the block immediately before the block you started on.

8. Setting the operation after data capturing

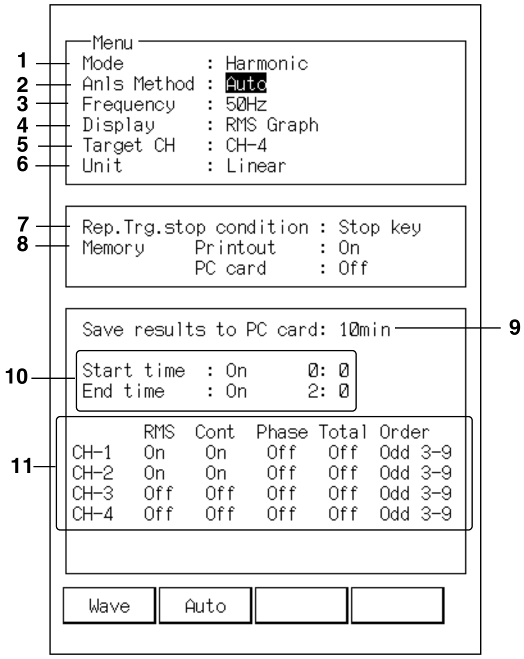
The following operation is performed automatically after capturing one block of measurement data. Use the “F1 ” (Off) and “F2” (On) keys to set the operation.

Print output : Record with the built-in printer. The recording format is the format specified in 6.6 “Displaying/Recording the Captured Data as an Analog Waveform.”

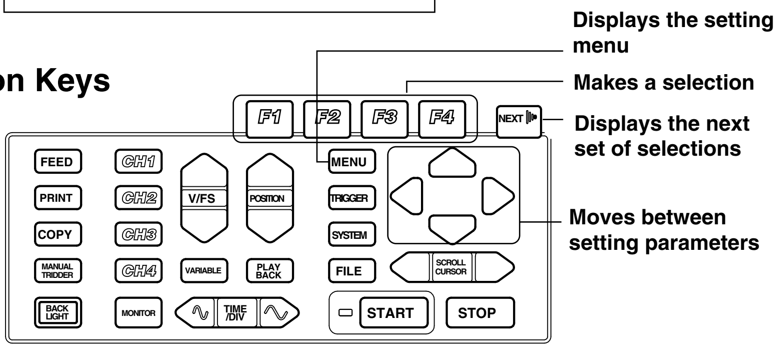
PC card : Send the measurement data over FAX modem or save the data to the flash ATA memory card. For details, see 10.3 “Saving the Measurement Data to the PC Memory Card,” or 11.8 “Sending the Measurement Data over the FAX Modem.”

When analyzing automatically (automatic analysis)

MENU



Operation Keys



Operating Procedure

1. Setting the operation mode

Press the “F4” (Harmonic) key to set the operation mode to “Harmonic.”

2. Setting the analysis method

Press the “F2” (Auto) key to set the analysis method to “Auto.”

3. Setting the frequency

Press “F1” to “F3” keys to set the frequency of the signal under measurement. If you select “F3” (Auto), the input signal is measured for a certain period, then the frequency is estimated in the range from 45 Hz to 65 Hz in 0.1 Hz steps.

Note

- If you select “Auto,” the frequency is estimated on the assumption that the measured signal is a sine wave. Therefore, correct estimation may not always be possible.
- Sample rate is set according to the frequency as follows.
  50 Hz: 25600 S/s
  60 Hz: 30720 S/s
  Auto: Set so that it becomes 512 data/cycle.

4. Display contents

Select which results of the analysis to display after capturing the data. Use "F1" to "F4" keys to make the selection.

RMS: Displays the RMS value of the specified channel on the bar graph, and displays the harmonic distortion and total RMS value with digital values.

Content: Displays the relative harmonic content of the specified channel on the bar graph, and displays the harmonic distortion and total RMS value with digital values.

Phase: Displays the phase angle of the specified channel on the bar graph, and displays the harmonic distortion and total RMS value with digital values.

Table1: Displays the RMS value, relative harmonic content, and phase angle for each harmonic order of the specified channel on the graph, and displays the harmonic distortion and total RMS value with digital values.

RMS(P): Displays the active power of the specified measurement data on the bar graph, and displays the active power, reactive power, apparent power, and power factor with digital values.

Cont(P): Displays the relative power content of the specified measurement data on the bar graph, and displays the active power, reactive power, apparent power, and power factor with digital values.

Phase(P): Displays the difference of voltage phase angle and current phase angle of the specified measurement data on the bar graph, and displays the active power, reactive power, apparent power, and power factor with digital values.

Table2: Displays the active power, relative power content, power phase angle for each harmonic order of the specified measurement data on the graph, and displays the active power, reactive power, apparent power, and power factor with digital values.

Off: Does not display the results of the analysis.

5. Setting the channel and wiring method

If you selected RMS, Content, Phase, or Table1 in step 4, select the channel. If you selected RMS(P), Cont(P), Phase(P), select the measurement data with the wiring method.

1Φ2W.1-2: Measurement data of channels 1 and 2 connected in single-phase two-wire.

1Φ2W.3-4: Measurement data of channels 3 and 4 connected in single-phase two-wire.

1Φ3W: Measurement data of channels 1 to 4 connected in single-phase three wire.

3Φ3W: Measurement data of channels 1 to 4 connected in three-phase three wire.

6. Setting the unit

If you selected RMS or RMS(P) in step 4, set the unit on the time axis. Select either "F1" (linear) or "F2" (log) key.

Linear: Display on linear scale.

Log: Display on logarithmic scale.

7. Setting the condition to stop the repeat trigger

Set only when the trigger is set to repeat.

Set the condition with the "F1" and "F2" keys.

Stop key: Overwrite the data until the "STOP" key is pressed.

Memory Full: Stop the measurement after capturing enough data to fill the memory.
If you start the data capture in the middle of the internal memory, the data is captured up to the block immediately before the block you started on.

8. Setting the operation after data capturing

The following operation is performed automatically after capturing one block of measurement data. Use the "F1 " (Off) and "F2" (On) keys to set the operation.

Print output : Record with the built-in printer. The recording format is the most-recent format specified in either memory mode, realtime+memory mode, or at the waveform analysis of the harmonic mode.

PC card : Send the measurement data over FAX modem or save the data to the flash ATA memory card. For details, see 10.3 "Saving the Measurement Data to the PC Memory Card," or l1.8 "Sending the Measurement Data over the FAX Modem."

9. Saving results to the flash ATA memory card

Set whether or not to automatically save the results of the analysis to the flash ATA memory card upon completing the analysis. Use "F1" to "F4" keys to make the selection.

Off: Does not save to the flash ATA memory card.

1 min/10 min/30 min/1 hour/24 hour: Save the results of the analysis over specified interval.

If you selected anything other than Off, then select which parameters under analysis to save to the flash ATA memory card.

10. Setting the start time/stop time

Set the start and stop times for the operation that was selected in step 9. If the start time is set to "OFF," the operation starts upon pressing the "START" button. If the stop time is set to "OFF," the operation selected in step 8 is performed repeatedly.

11. Setting the result of the analysis to save

Set whether or not to save the result of the analysis to the flash ATA memory card for each parameter that is analyzed.

9.4 Setting the Display Format

When specifying the range to analyze (waveform analysis)

Setting parameters are the same as the display format for the memory mode except for the following items.

- X-Y display is not available.
- Time axis scale is the most-recent scale specified either by the memory mode or by the latest display of the measurement data. The time axis scale can be changed using the "Time Axis" key on the display screen after capturing the measurement data as in the memory mode.
- Accumulation of display is not available.

For details, see section 6.3 "Setting the Display Format."

When analyzing automatically (automatic analysis)

If the display contents are set to Off or if displaying the captured data, the waveform is displayed with the most-recent format specified in either the memory mode setting, waveform analysis setting, or by the latest display of the measurement data. However, the following items are excluded.

- X-Y display is not available.
- Time axis scale is the most-recent scale specified either by the memory mode or by the latest display of the measurement data. The time axis scale can be changed using the "Time Axis" key on the display screen after capturing the measurement data as in the memory mode.
- Accumulation of display is not available.

9.5 Analyzing by Specifying the Range

Starting the measurement

Pressing the “START” key starts the measurement. Pressing the “STOP” key stops the measurement. For details, see 6.5 “Starting/Stopping.”

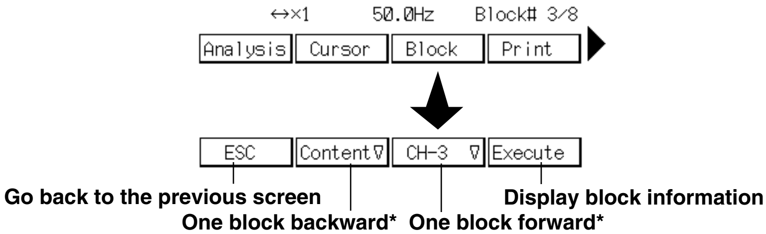
The measurement data are captured in the harmonic analysis mode in the same way as in the memory mode.

Selecting the block to display

Pressing the “PLAYBACK” key while the measurement is stopped, displays the waveform of the block containing the measurement data most-recently captured.

Pressing the “F3” (Block) key displays a menu for selecting the block to display.

Select the block using “F2” and “F3” keys. For details, see pages 6-12 and 6-13.



*** When displaying the block information, the block of which the information is displayed is changed.**

Note

If you change the block, the result of the previous analysis are cleared. Select the same block and perform the analysis again.

Specifying the start of the range to analyze

Using the cursor, specify the first data of the range in which to perform the harmonic analysis.

Press the “F1” (Analysis) key on the display screen. A cursor appear.

Set the first data of the range in which to perform the harmonic analysis using the “SCROLL/CURSOR” key.

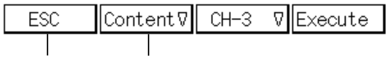
Note

Harmonic analysis is performed over one cycle of measurement data from the specified data.

Setting parameters to analyze and the channels

1. Displaying the menu

Pressing the “F1” (Analysis) key at the screen displaying the captured data, displays a menu for selecting the analysis condition.



Go back to the previous screen **Display parameters to analyze**

2. Setting parameters to analyze

Pressing the “F2” key displays a menu for selecting the parameters to be analyzed.

Select the parameter using “F1” to “F4” keys.

Table: Displays the RMS value, relative harmonic content, and phase angle for each harmonic order of the specified channel on the graph, and displays the harmonic distortion (IEC, CSA) and total RMS value with digital values.

RMS: Displays the RMS value of the specified channel on the bar graph, and displays the harmonic distortion (IEC, CSA) and total RMS value with digital values.

Content: Displays the relative harmonic content of the specified channel on the bar graph, and displays the harmonic distortion (IEC, CSA) and total RMS value with digital values.

Phase: Displays the phase angle of the specified channel on the bar graph, and displays the harmonic distortion (IEC, CSA) and total RMS value with digital values.

Note

If waveform analysis is selected on the menu screen after measurement data are captured under automatic analysis and the data are displayed without starting a new set of measurements, parameters that an be analyzed under automatic analysis are displayed and analysis can be carried out.

3. Setting the channel

Pressing the “F3” key opens a menu for selecting the channel to analyze. Select the channel number using “F1” to “F4” keys.

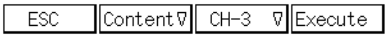
9

Harmonic Analysis

Executing the harmonic analysis

1. Displaying the menu

Pressing the “F1” (Analysis) key at the screen displaying the captured data, displays a menu for selecting the analysis condition.



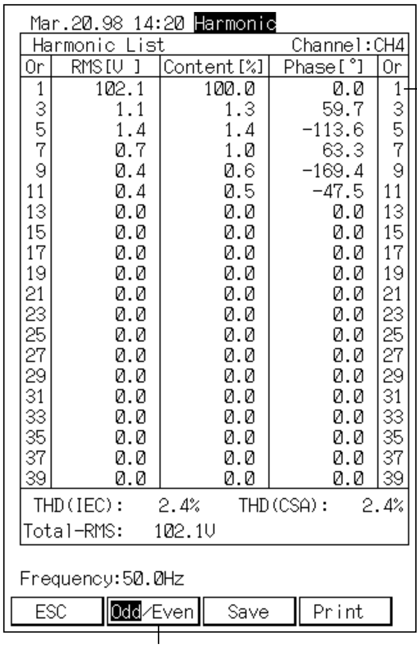
2. Executing

Pressing the “F4” (Execute) key starts the harmonic analysis.

Note

- If the measurement data are over the range, the results of the analysis will be displayed with asterisks (*).
- Waveform data outside the measurement range may not be measured accurately, making exact analysis impossible.

When the parameter to be analyzed is table

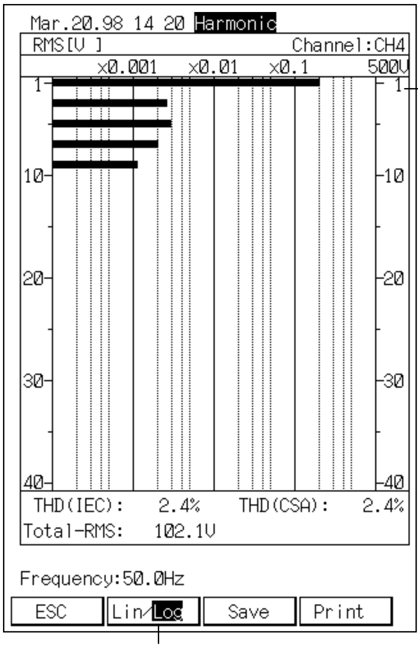


Or	RMS[V]	Content[%]	Phase[°]	Or
1	102.1	100.0	0.0	1
3	1.1	1.3	59.7	3
5	1.4	1.4	-113.6	5
7	0.7	1.0	63.3	7
9	0.4	0.6	-169.4	9
11	0.4	0.5	-47.5	11
13	0.0	0.0	0.0	13
15	0.0	0.0	0.0	15
17	0.0	0.0	0.0	17
19	0.0	0.0	0.0	19
21	0.0	0.0	0.0	21
23	0.0	0.0	0.0	23
25	0.0	0.0	0.0	25
27	0.0	0.0	0.0	27
29	0.0	0.0	0.0	29
31	0.0	0.0	0.0	31
33	0.0	0.0	0.0	33
35	0.0	0.0	0.0	35
37	0.0	0.0	0.0	37
39	0.0	0.0	0.0	39

Switching the harmonic order

You can switch the display of the even harmonics and odd harmonics.
Pressing the “F2” (Odd/Even) key at the screen displaying the results of the analysis, switches between the two.

When the parameter to be analyzed is RMS (same for Content/Phase)



Harmonic order

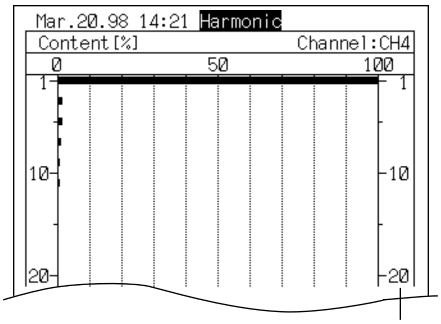
Switching the horizontal axis

Switching the time axis (RMS value)

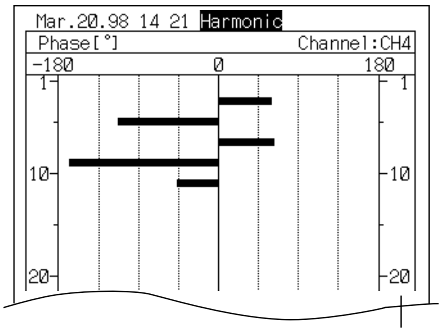
If the parameter to be analyzed is RMS, you can switch the horizontal axis between linear and logarithmic.

Pressing the "F2" (Lin/Log) key at the screen displaying the RMS values, switches the horizontal axis.

When the parameter to be analyzed is Content or Phase



Harmonic order



Harmonic order

9

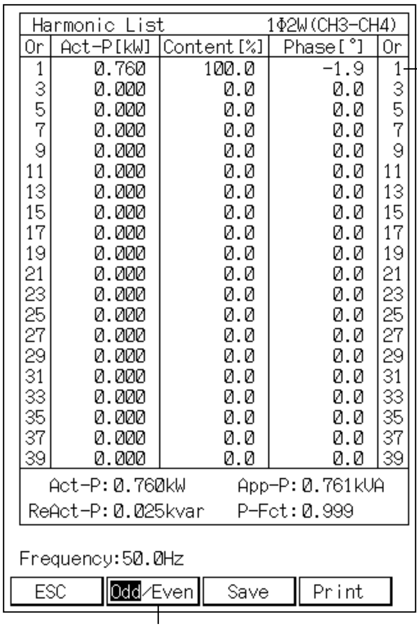
Harmonic Analysis

9.6 Analyzing Automatically

If you set the analysis method to “Auto” in 9.3 “Setting Conditions to Capture Measured Data” and measurement is started, harmonic analysis is performed automatically after capturing one cycle of data and the results are displayed. If you selected anything other than Off for saving the results to the PC card, then the specified results of the analysis are saved to the flash ATA memory card every time the analysis completes. The file is automatically assigned the name “trend***.csv.” “***” is automatically numbered from 000 to 999. The number returns to 000 after 999.

The measurement data are captured in the harmonic analysis mode in the same way as in the memory mode.

When the parameter to be analyzed is table2



Harmonic List 1Φ2W(CH3-CH4)

Or	Act-P[kW]	Content[%]	Phase[°]	Or
1	0.760	100.0	-1.9	1
3	0.000	0.0	0.0	3
5	0.000	0.0	0.0	5
7	0.000	0.0	0.0	7
9	0.000	0.0	0.0	9
11	0.000	0.0	0.0	11
13	0.000	0.0	0.0	13
15	0.000	0.0	0.0	15
17	0.000	0.0	0.0	17
19	0.000	0.0	0.0	19
21	0.000	0.0	0.0	21
23	0.000	0.0	0.0	23
25	0.000	0.0	0.0	25
27	0.000	0.0	0.0	27
29	0.000	0.0	0.0	29
31	0.000	0.0	0.0	31
33	0.000	0.0	0.0	33
35	0.000	0.0	0.0	35
37	0.000	0.0	0.0	37
39	0.000	0.0	0.0	39

Act-P:0.760kW App-P:0.761kVA
ReAct-P:0.025kvar P-Fct:0.999

Frequency:50.0Hz

ESC | Odd/Even | Save | Print

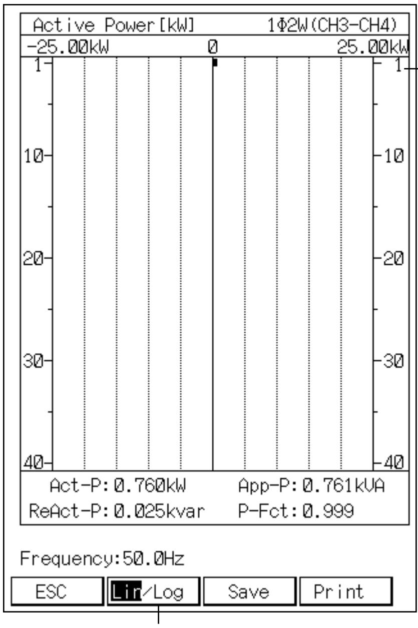
Note

- The information displayed for table1 is the same as when analyzing by specifying the range.
- Waveform data outside the measurement range may not be measured accurately, making exact analysis impossible.

Switching the harmonic order

You can switch the display of the even harmonics and odd harmonics. Pressing the “F2” (Odd/Even) key at the screen displaying the results of the analysis, switches between the two.

When the parameter to be analyzed is RMS(P)



Harmonic order

Switching the horizontal axis

Note

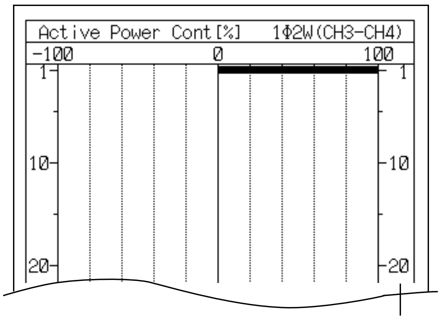
The displayed information of RMS, Content, and Phase are the same as when analyzing by specifying the range.

Switching the time axis (RMS value)

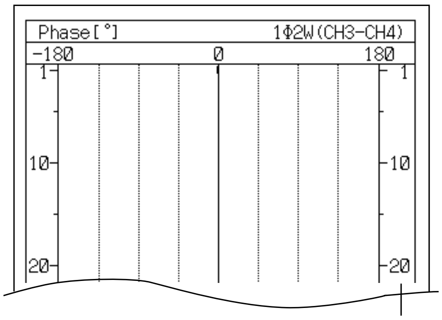
If the parameter to be analyzed is RMS, you can switch the horizontal axis between linear and logarithmic.

Pressing the “F2” (Lin/Log) key at the screen displaying the RMS values, switches the horizontal axis.

When the parameter to be analyzed is Cont(P) or Phase(P)



Harmonic order



Harmonic order

9

Harmonic Analysis

Changing the analysis condition

After capturing the measurement data, you can change the analysis condition and the channel to be analyzed before executing the analysis.

1. Displaying the menu

Press the “F1” (Back) key at the screen immediately after the automatic analysis.
If you press the “F1” (Analysis) key again, a menu for selecting the analysis condition appears.

ESC	Content∇	CH-3 ∇	Execute

2. Setting parameters to analyze

Pressing the “F2” key displays a menu for selecting the parameters to be analyzed.
Select the parameter using “F1” to “F4” keys.

3. Setting the channel

Pressing the “F3” key opens a menu for selecting the channel to analyze. Select the channel number using “F1“ to “F4” keys. However, if you selected RMS(P), Cont(P), Phase(P), and Table2, there is no channel selection.

4. Executing

Pressing the ”F4” (Execute) key starts the harmonic analysis.

9.7 Saving the Results of the Analysis

There are two methods to save the results of the analysis to flash ATA memory card in CSV format.

Saving on the screen displaying the results of the analysis

Pressing the “F3” (Save) key on the screen displaying the results of the analysis, saves the information to the flash ATA memory card. The file is automatically assigned the name “harmo***.csv.” “***” is automatically numbered from 000 to 999. The number returns to 000 after 999.

Frequency:50.0Hz

ESC	Lin/Log	Save	Print

Saving with the “FILE” key

Pressing this key saves the measurement data in binary format along with the most-recent results of the analysis. File name is “********.csv.” Asterisks contain the file name of the measurement data.

The data that are saved using the “FILE” key are as follows.

Save format / Analysis Method	Binary Format (Save (B))	ASCII Format (Save (A))	Save All Blocks
Waveform Analysis	Waveform data ********.dat Analyzed data ********.csv	Waveform data ********.csv	Waveform data blk*****.dat
Auto Analysis	Waveform data ********.csv Analyzed data ********.csv	Waveform data ********.csv	Waveform data blk*****.dat

For details, see 10.3 “Saving Measurement Data to the PC Memory Card.”

9.8 Recording the Results of the Analysis

Pressing the “F4” (Print) key or the “PRINT” key on the screen displaying the results of the analysis, records the information to the built-in printer.

For tables: Records the results for every harmonic order with digital values.

For bar graphs: Records the screen image (equivalent to a hard copy).

9.9 Other Functions

The following operations can be carried out on the measurement data in the same way as in the memory mode even when the operation mode is set to harmonic analysis.

- Displaying/Recording captured data
- Zooming in or out on the waveform
- Cursor display
- Statistical calculation
- Scale display

9.10 Computing Equations for Harmonic Analysis

OR300E uses the following computing equations for the various analysis.

Harmonic Voltage RMS value (RMS)

The harmonic voltage can be expressed with the following equation.

$$V=V_1\sin(\omega t) + V_2\sin(2\omega t+\theta_2) + V_2\sin(2\omega t+\theta_2) + \cdots\cdots$$
$$\cdots + V_{(n-1)}\sin((n-1)\omega t+\theta_{(n-1)}) + V_n\sin(n\omega t+\theta_n)$$

By taking the FFT (512) of this equation, the RMS value Vn of the nth order harmonic voltage is decomposed to its components as follows:

Vn=(Vnr, Vni)

Vnr is the real component and Vni is the imaginary component.

Therefore, the RMS value Vn of the nth order harmonic voltage can be found by the following equation.

$$V_n = \sqrt{\{(V_{nr})^2 + (V_{ni})^2\} /2}$$

Note

Since the computational result is linearly scaled in the harmonic mode, the result may become negative depending on the linear scale setting.

Harmonic Current RMS Value (RMS)

The harmonic current can also be found in the similar way with the following equation.

$$A_n = \sqrt{\{(A_{nr})^2 + (A_{ni})^2\} /2}$$

Note

Since the computational result is linearly scaled in the harmonic mode, the result may become negative depending on the linear scale setting.

Relative Harmonic Content

Taking the relative harmonic content of RMS value of the fundamental component to be 100%, the relative harmonic content of RMS value for each order is computed.

nth order relative harmonic content
= (RMS value of the nth order / RMS value of fundamental component) x 100%

Phase Angle

Computes the phase difference of the nth order harmonic component with respect to the fundamental component of the input signal.

For harmonic voltage

θ_n= (the phase of the nth order harmonic voltage) - (phase of the fundamental component) x n

$$= \tan^{-1}(V_{nr}/V_{ni}) - \{\tan^{-1}(V_{1r}/V_{1i})\} \times n$$

where Vnr: real component of the nth order, Vni: imaginary component of the nth order

For harmonic current

θ_n= (the phase of the nth order harmonic current) - (phase of the fundamental component) x n

$= \tan^{-1}(A_{nr}/A_{ni}) - \{\tan^{-1}(A_{1r}/A_{1i})\} \times n$

where Anr: real component of the nth order, Ani: imaginary component of the nth order

Active Power (Automatic Analysis)

Single-phase two-wire system

$W_n = V_n \times A_n \times \cos\Phi_n$ (n=1, 2, 3, ·····n-1, n)

W_n: nth order active power

V_n: nth order active voltage

A_n: nth order active current

Φ: Phase difference of the nth order current with respect to the nth order voltage

Φn>0: When the current phase is ahead of the voltage phase

Φn<0: When the current phase is behind the voltage phase

Single-phase three-wire system, three-phase three-wire system

$W_n = W_{n1} + W_{n2}$ (n=1, 2, 3, ·····n-1, n)

W_n: nth order active power

W_{n1}: nth order active power from CH1 and CH2

W_{n2}: nth order active power from CH3 and CH4

Relative Harmonic Content of Active Power

Taking the relative harmonic content of active power of the fundamental component to be 100%, the relative active power content for each order is computed.

nth order relative active power content = (active power of the nth order / active power of fundamental component) x 100%

Phase Angle (Power Measurement)

Computes the phase difference of the nth order harmonic current with respect to the nth order harmonic voltage.

$\Phi_n=\cos^{-1}$\{nth order active power / (RMS voltage value of the nth order x RMS current value of the nth order)\}

$\Phi_n>0$: When the current phase is ahead of the voltage phase

$\Phi_n<0$: When the current phase is behind the voltage phase

Harmonic Distortion (IEC)

Computes the ratio of the total RMS value of the 2nd to the 40th order harmonics with respect to the fundamental.

Harmonic Distortion (IEC)

$$= \sqrt{\frac{\sum_{n=2}^{40}(\text{RMS value of the nth order harmonic voltage (or current)})^2}{(\text{RMS value of the fundamental voltage (or current)})}}$$

Harmonic Distortion (CSA)

Computes the ratio of the total RMS value of the 2nd to the 40th order harmonics with respect to the total RMS value of the fundamental to the 40th order harmonics.

Harmonic Distortion (CSA)

$$= \sqrt{\frac{\sum_{n=2}^{40}(\text{RMS value of the nth order harmonic voltage (or current)})^2}{\sum_{n=1}^{40}(\text{RMS value of the fundamental voltage (or current)})^2}}$$

Total RMS Value

Computes the total RMS value of the fundamental to the 40th order harmonics.

Harmonic Distortion (CSA)

$$= \sqrt{\frac{\sum_{n=2}^{40}(\text{RMS value of the nth order harmonic voltage (or current)})^2}{\sum_{n=1}^{40}(\text{RMS value of the fundamental voltage (or current)})^2}}$$

Note

Since the computational result is linearly scaled in the harmonic mode, the result may become negative depending on the linear scale setting.

Active Power

Active power = (total RMS value of the voltage) x (total RMS value of current) x cosφ"

φ= Phase difference of the current with respect to the voltage

Apparent Power

Apparent power = total RMS value of the voltage X total RMS value of current

Reactive Power

Reactive power = total RMS value of the voltage x total RMS value of current x sinφ"

$$= \sqrt{(\text{apparent power})^2 - (\text{active power})^2}$$

φ= Phase difference of the current with respect to the voltage

Note

If the current is ahead of the voltage, a minus sign is displayed on the reactive power.

Power Factor

Computes the ratio of the active power with respect to the apparent power.

Power factor = active power / apparent power

10.1 External Media

External Media that can be Used with the OR100E/OR300E

External media described in this chapter indicate external memory devices that can connect to the OR100E.

The external medium that can be used with the OR100E/OR300E is as follows.

Flash ATA card

Functions of the Flash ATA Card

Save measurement data in binary format.

Save measurement data in ASCII format.

Load measurement data saved in binary format.

Save/Load setup data such as the measurement range.

Save screen data in BMP format. (See 12.2 “Taking Hard Copies.”)

Formatting the flash ATA card

The recorder can use flash ATA cards that are formatted to MS-DOS.

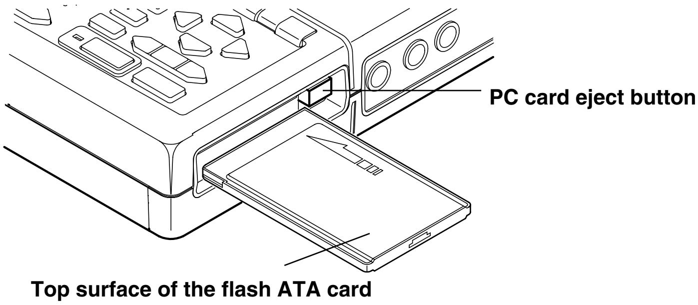
The recorder cannot format the flash ATA card. Use a personal computer to format the card.

Useable flash ATA memory cards

- SanDisk Corporation
  SDP3B
- EPSON
  FLASH-PACKER Series
  (FLASH-PACKER-2, FLASH-PACKER-6, FLASH-PACKER-10, FLASH-PACKER-20, FLASH-PACKER-40)
- I-O DATA DEVICEE
  PCFCA Series
  (PCFCA-10MS, PCFCA-20MS, PCFCA-40MS)
  ATA Card (110 MB or less)
- FUJISOKU Corporation
  FUJISOKU Card (160 MB or less)

Inserting the Flash ATA Card

While the recorder is turned ON, insert the Flash ATA card into the PC card slot with the top surface facing up. A message, “PC card detected,” is displayed at the upper left corner of the screen.



Removing the Flash ATA Card

Check that the flash ATA card is not being accessed, and press the PC card eject button on the side of the PC card slot.

CAUTION

Do not remove the flash ATA card while it is being accessed as this may damage the files saved on the card or the flash ATA card itself. For general handling precautions, refer to the instructions supplied with the flash ATA card.

10.2 Setting Parameters

The parameters shown below will be set in this chapter.

Saving/Loading Measurement or Setup Data

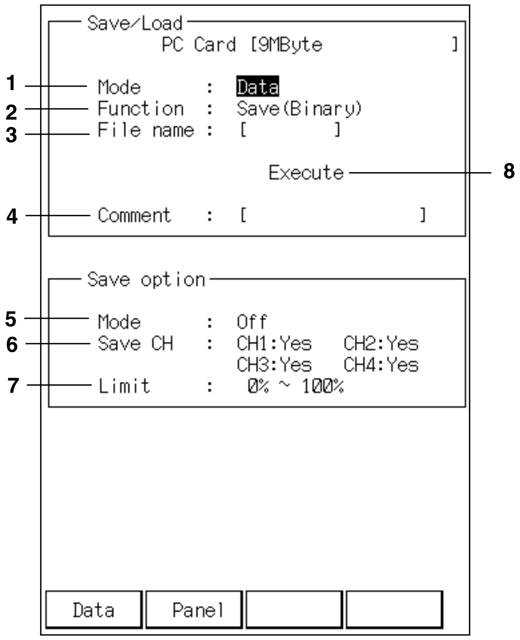
You will set the parameters using the screen that appears when the “FILE” key is pressed.

Setting parameter	Description
Mode	Select the data to save or load. Select “Data” (measurement data) or “Panel” (setup data).
Function	Set the function. Select “Save(B)” (save in binary format), “save(A)” (save in ASCII format), “Load” (load), or “Delete” (delete) “All blocks” (Save measured data of all blocks in binary format).
Filename	Set the filename.
Save Option	Valid when the function is “Save(B)” or “Save(A).” Set whether to save all of the internal memory or to specify the channel and range of the channel to save.

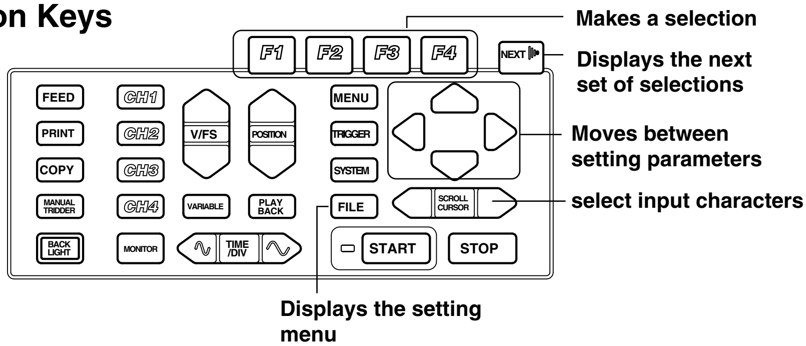
10.3 Saving the Measurement Data to the PC Memory Card

Setting Screen

FILE



Operation Keys



Operating Procedure

1. Selecting the data

Select the data type with the "F1" (Data) or "F2" (Panel) key. Select "F1" (Data) key to select measurement data.

2. Setting the function

Select the operation. Select either "F1" (Save(B)) or "F2" (Save(A)) , or "Next" key followed by the "F1" (All blocks) key.

Save(B): Save measurement data in binary format (extension : .dat)
Save(A): Save measurement data in ASCII format (extension : .csv)
All blocks: Save measured data of all blocks in binary format (extension: .dat)

Steps 3 to 7 are not necessary when selecting all blocks.

Note

The OR100E/OR300E cannot load files that are saved in ASCII format.

3. Setting the filename

Set the filename with eight characters or less. You can use alphanumeric characters and special characters ($&#%'()-^_~{}!).If lower case characters are used for the file name, they are converted to upper case characters.
If you perform harmonic analysis on the OR300E, the results of the analysis are saved automatically when you save the measured data in binary format. The file name containing the results is "(file name of measured data).csv."
If you save all blocks, the file names are assigned as follows.
BLKAAABB.dat
AAA: With one save operation, the files are numbered automatically from 000 to 999. The number returns to 000 after 999.
BB: Block number.

4. Setting comments

Set comments with 16 characters or less as necessary.

5. Setting the range to save

You can save the measurement data by specifying the channel and the range, if the mode is set to ON. If set to OFF, the specified channel and range are invalid.

6. Setting the channel to save

Set whether or not to save the channel by specifying "Yes" or "No" for each channel. If "Yes" is specified, the measurement data for that channel is saved.

7. Setting the range to save

Set the range of the block to save as a percentage of the data length.

8. Executing the save

Highlighting "Execute" and pressing the "F1" (Execute) key saves the measurement data. A message, "Accessing file," is displayed while it is saving.

Data that is saved is the measurement data of the current block. Current block is the last block displayed on the screen. Immediately after data capturing, current block is the last block that was captured. If the captured data was displayed, it is the last block that was displayed.
To change the current block, display the block that you wish to save on the screen. For details, see pages 6-12 and 6-13.

File Size

File size varies depending on the data format being saved.

Binary format

The file size can be determined from the following equation.

File size = file header+data

File header = 192+64×(number of analog channels+number of logical bits)+64×(number of analog channels)

Data = 2×number of data points to save×(number of analog channels + number of logical channels)

Example)

Memory length	: 10 div (800 data points)
Number of analog channels	: 4 channels
Number of logic channels	: 2 channels (A, B)
Number of logic bits	: 4 bits (2 bits from A and B)

If there is no range specified for saving the data, file size becomes:

File header = 192+64×(4+4)+64×4

= 960

Data = 2×800×(4+2) = 9600

File size = 960+9600 = 10560 bytes

ASCII format

The file size of an ASCII file cannot be determined by an equation as in the binary format. Refer to the following example.

Memory length: 10 div (800 data points)

Number of analog channels : 4 channels

File size is about 35K bytes for the above case.

Memory length: 10 div (800 data points)

Number of analog channels	: 4 channels
Number of logic channels	: 2 channels (A, B)
Number of logic bits	: 8 bits (4 bits from A and B)

File size is about 54K bytes for the above case.

Saving the measurement data automatically

You can automatically have the data saved to the flash ATA card after capturing the data in the “Memory”, “Realtime + Memory”, or “Harmonic” mode.
Set “Data save” at the “PC card” parameter under “Memory” in the setting screen that appears when the “MENU” key is pressed.

```
Memory clear           : Off
Rep.Trg.stop condition : Stop key
Accumulate display     : Off
Memory     Calculation : Off
           Printout    : Off
           PC card     : Data Save
```

Set to data save

Filename

The filenames automatically become “AUTO****.DAT.” The part indicated with “****” is automatically numbered from 0000 to 9999. The number after 9999 is 0000.
If the “File No. is selected at the “Initialize parameter at the screen that appears when the “SYSTEM” key is pressed, the filename is reset to 0000.

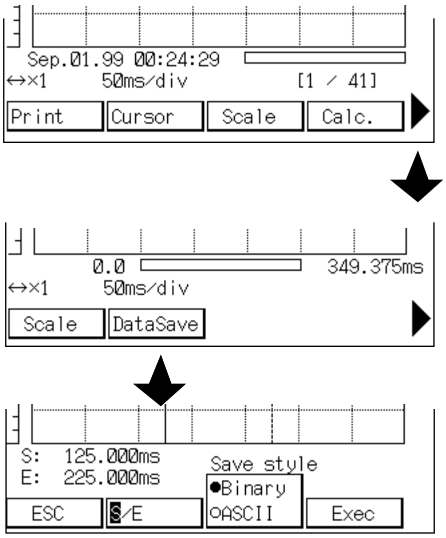
Note

- If the same file name already exists, these will overwiritten.
- If the flash ATA card runs out of memory, the recorder displays a message and aborts the save. Data capturing continues as before.
- When saving the measurement data automatically, settings made on pages 10-4 and 10-5 are invalid. The measurement data that is saved includes all analog channels that are not turned OFF and logic channels that are being displayed.

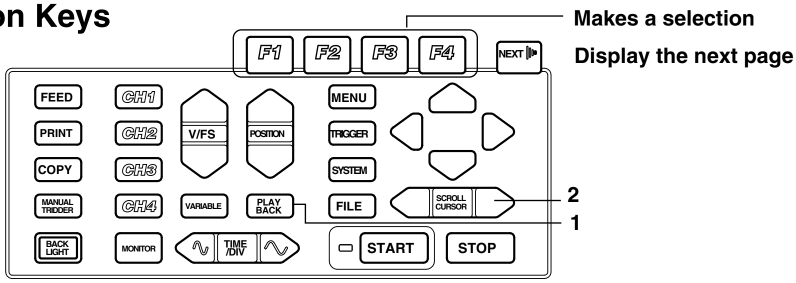
Saving Data from the Screen Displaying the Waveform

Waveform data can be saved by specifying a range while viewing the waveform. This is possible from the waveform display screen in the “Memory” mode and the waveform display screen of the OR300E’s “Harmonic” mode.

Setting Screen



Operation Keys



Operating Procedure

1. **Displaying the setting screen**

   At the waveform display screen, that is displayed by pressing the “Playback” key, press the “Next” key and then the “F2” (Save) key. In the harmonics mode, press the “F3” (Save) key. A screen used to set the range of data to be saved and the data format will appear.

2. **Setting the range of data to be saved using the cursor**

   Set the range of data to be saved using the cursor. Use the “F2” key to select whether to specify the start point or the end point of the range to be saved. “S” and “E” toggles each time the “F2”" key is pressed.
   Use the “Scroll/Cursor” key to set the start and end points.

3. Selecting the data format

Use the "F3" key to select whether to save the data in binary format or in ASCII format. The selected format is indicated with the "●" mark. The format will toggle each time the "F3" key is pressed.

4. Executing the save

Pressing the "F3" (Execute) key saves the measurement data in the specified range.

File name

The file name is as follows:

Binary format: dispxxxx.dat

where xxxx is a sequence number from 0000 to 9999.

ASCII format: dispxxxx.csv

where xxxx is a sequence number from 0000 to 9999.

Saving method and file format

Analysis Method \ Save format	Binary Format (Save (B))	ASCII Format (Save (A))	Save All Blocks
Memory Mode	Waveform data ********.dat	Waveform data ********.csv	Waveform data blk*****.dat
Harmonic Waveform Analysis	Waveform data ********.dat Analyzed data ********.csv	Waveform data ********.csv	Waveform data blk*****.dat
Harmonic Auto Analysis	Waveform data ********.dat Analyzed data ********.csv	Waveform data ********.csv	Waveform data blk*****.dat

Analysis Method \ Save format	Auto save after data capturing	Save on the analyzed data display	Trend save
Memory Mode	Waveform data auto***.dat	———	———
Harmonic Waveform Analysis	Waveform data auto***.dat	Analyzed data harmo***.csv	———
Harmonic Auto Analysis	Waveform data auto***.dat	Analyzed data harmo***.csv	Analyzed data trend***.csv

Analysis Method \ Save format	Save on the waveform display screen		Save data to the flash ATA memory card while capturing data
	Binary format	ASCII format	
Memory Mode	Waveform data disp***.dat	Waveform data disp***.csv	memd****.dat
Harmonic Mode	Analyzed data disp***.dat	Analyzed data disp***.csv	———

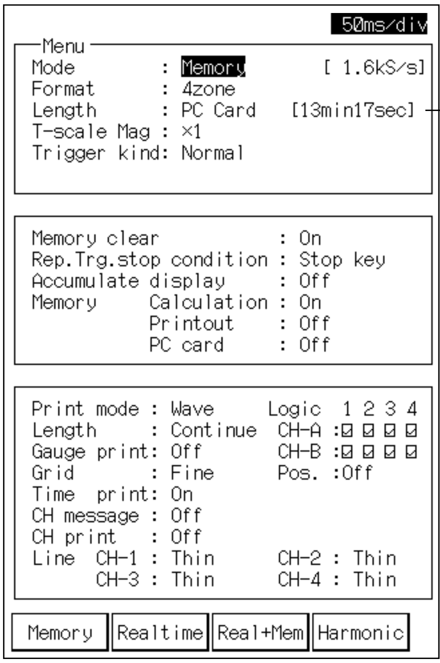
10

Using External Media

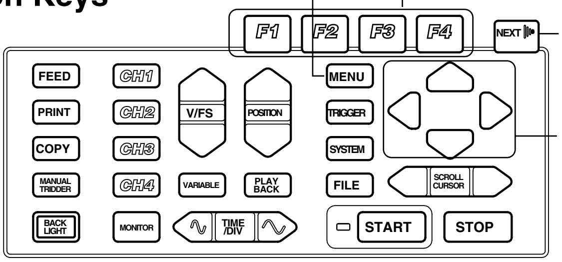
10.4 Writing Data Simultaneously to the Flash ATA Memory Card

Setting Screen

MENU



Operation Keys



Operating Procedure

1. **Setting the operation mode**

   Set the operation mode to “Memory” with the “F1” (Memory) key.

2. **Setting the memory length**

   Press the “Next” key twice and the “F3” (PC card) key to set the memory length to “PC card.”

3. **For other settings, see section 6.2, “Setting the Conditions on Capturing the Measurement Data.”**

CAUTION

Never remove the flash ATA memory card while data are being saved to it. This can destroy the data on the memory card or damage the card or the OR.
Even when data capturing is stopped with the "STOP" key, it may take 10 to 100 seconds before the operation actually stops. Do not remove the flash ATA memory card during this time period.

Simultaneous Writing Operation

When data capture is started, data in the internal memory is automatically saved to the flash ATA memory card while continuing the capturing process to the internal memory. The measurement data that are captured up to the point when the operation is stopped are saved as a single file to the flash ATA memory card. The file name is MDxxx.dat where xxx is a sequence number starting with 000 that is automatically assigned. When data capture is stopped, the most recent 128 k of data are saved to the internal memory (if the number of data points is less than 128 k, then all the data are saved).

Displaying and Recording the Data Capture Time

Normally, the data capture time that is saved is a relative time with respect to the trigger point. However, if the number of data points captured exceeds 128 k, the time is an absolute value. The absolute time is expressed as "hour:minute:second.XXX (where XXX is a value between 000 and 999)."

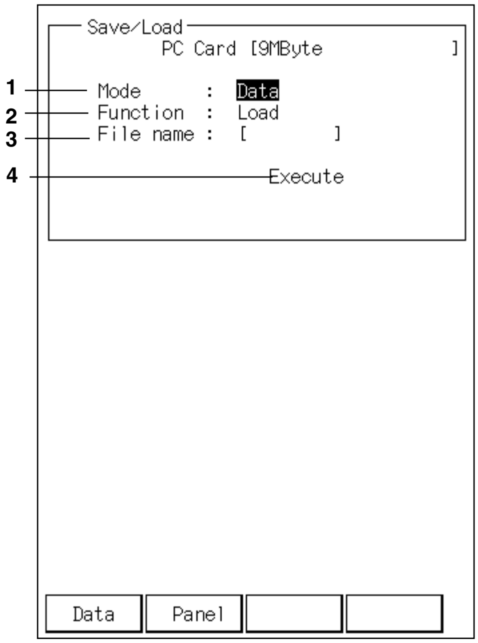
Note

- Set the operation mode to "Memory" and the kind of trigger to "Normal."
  Otherwise, "PC card" cannot be specified for the memory length.
- Set the trigger to "Free" or "Single."
- Set the time axis to 50 ms/div (16000 S/s) or less. An external sampling clock cannot be used.
  If the memory length is set to "PC card" when the time axis setting exceeds 50 ms/div, the time axis setting is automatically changed to 50 ms/div. In addition, if the memory length is set to "PC card" when the time axis setting is "External," the time axis is automatically changed to 2 min/div.
- When the sampling rate is greater than or equal to 400 S/s, time and channel number (tag) are not displayed.
- Trigger delay is void.
- In some cases, the actual data capture starts a few seconds (10 to 100 seconds) after the "START" key is pressed. If you wish to keep a record of the time at which the data capture is started, use a manual trigger to start the operation.
- In some cases, even when data capturing is stopped with the "STOP" key, it may take 10 to 100 seconds before the operation actually stops.

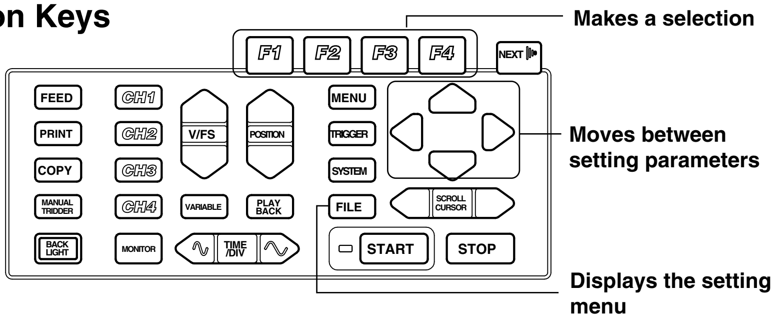
10.5 Loading the Measurement Data

Setting Screen

FILE



Operation Keys



Operating Procedure

1. Selecting the data

Select the data type with the “F1” (Data) or “F2” (Panel) key. Select “F1” (Data) key to select measurement data.

2. Setting the function

Select the operation. Select “F3” (Load).

Note

The OR100E/OR300E cannot load files that were saved in ASCII format.

3. Selecting the filename

A list of files that can be loaded is displayed. Select the file with the “F1” (↑) or “F2” (↓) key. Pressing the “F4” (Info) key displays information about the selected file.

```
File name      TEST1-6B
Trigger time   09/01/01 00:01:04
Sample rate    160kS/s (500us/div)
Data length    800
File size      7KByte
Comment       [                ]
```

Pressing the “F4” (Back) key returns to the screen with the list of files.

4. Executing the load

Highlighting “Execute” and pressing the “F1” (Yes) key loads the measurement data.

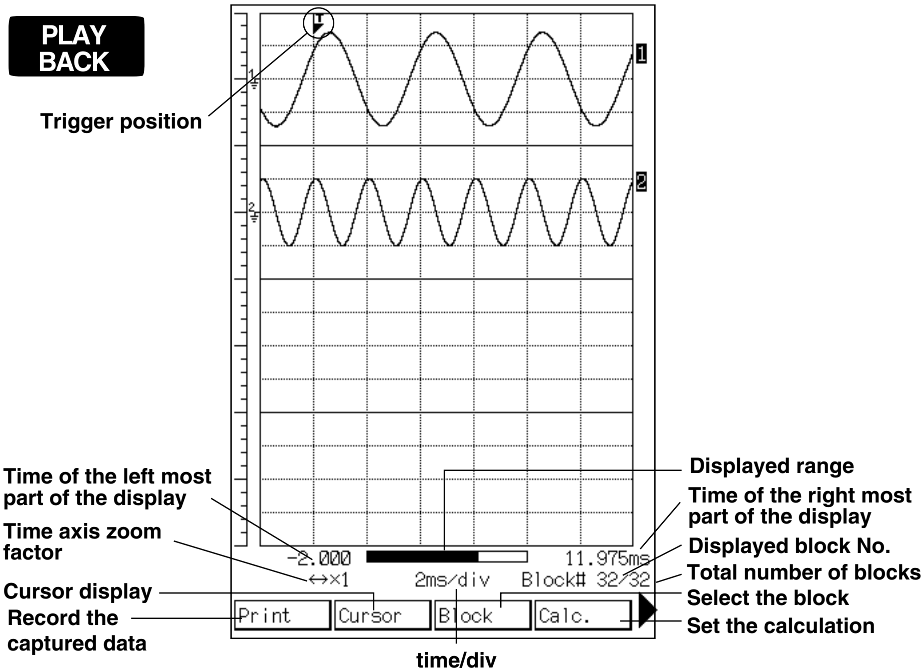
Note

- Loading the measurement data clears all previous measurement data in the internal memory.
- Loading the measurement data sets the number of blocks to 1. If you start the measurement, the loaded data will be cleared.
- Data that is loaded can be saved to the flash ATA card again.
  However, if measurement data that had been saved to the flash ATA memory card while capturing data are loaded and the file exceeds 128 K, then the data cannot be saved to the flash ATA memory card again.

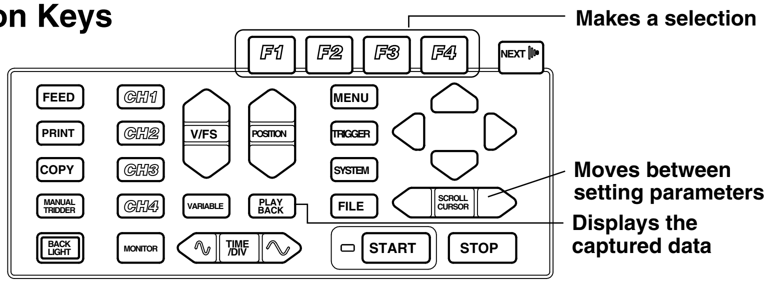
10.6 Displaying the Loaded Measurement Data

You can display the measurement data that are loaded from an external storage media.

Setting Screen



Operation Keys



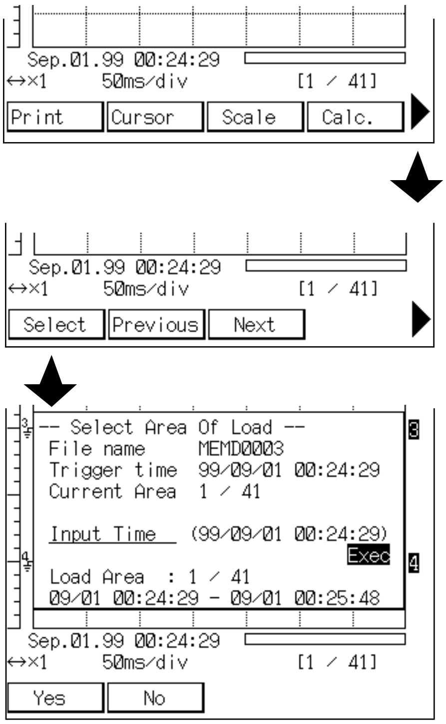
Operating Procedure

Press the “Playback” key to display the loaded measurement data.

For measurement data that were saved to the flash ATA memory card while capturing data

Measurement data that were saved to the flash ATA memory card while capturing data are displayed in units of 128 k. The data that are displayed when the “Playback” key is pressed the first time are the most recent 128 k of data. The following two methods are available to display other sections of the data.

- **Displaying 128 k of data before or after the data currently displayed**
  With the flash ATA memory card inserted, press the “Next” key at the waveform display screen. This will open a screen used to select the data to be displayed.
  Press either the “F2” (Previous) or “F3” (Next) key to load and display 128 k of data before or after the current data.
- **Displaying 128 k of data that includes the measured data captured at a specified time**
  With the flash ATA memory card inserted, press the “Next” key at the waveform display screen. This will open a screen used to select the data to be displayed.
  Pressing the “F1” (Select) key displays a screen used to specify the data capture time.
  Move the cursor to the appropriate position by pressing the right and left select keys.
  Press the “F2” key to toggle + (increase) and - (decrease). Press the “F3” or “F4” key to set the time.
  Press the down select key to move the cursor to “Execute.” The information regarding the 128 k of data that includes the measured data captured at a specified time is displayed.
  Press the “F1” (Yes) key to load and display the specified data.

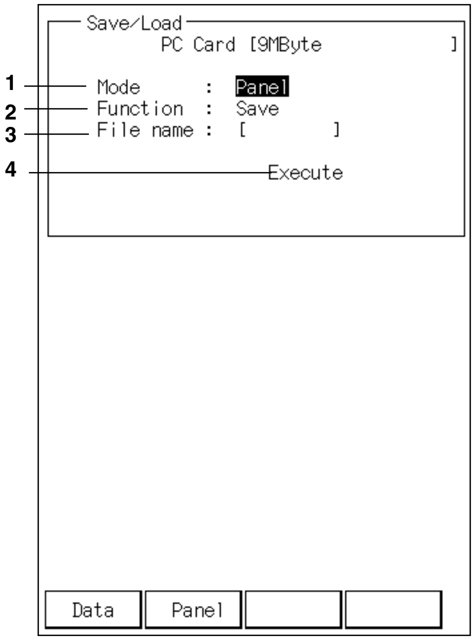


When the loaded measurement data are displayed, the same operations that you can perform on the displayed data captured in the memory described in chapter 6 can be performed. These operations include printing, displaying cursors, scaling, zooming in or out, and calculating statistics. For the operating procedures, see section 6.6 to 6.10.

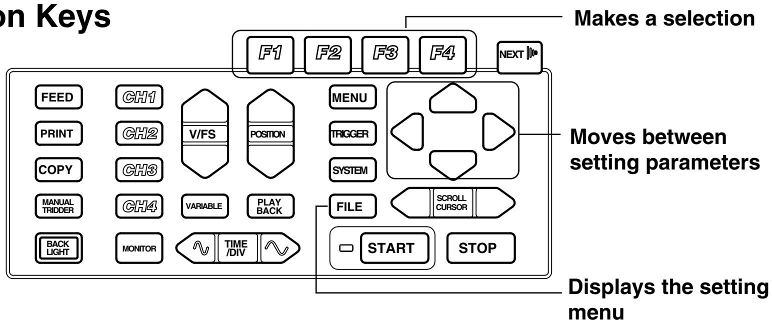
10.7 Loading the Setup Data

Setting Screen

FILE



Operation Keys



Operating Procedure

1. Selecting the data

Select the data type with the "F1" (Data) or "F2" (Panel) key. Select "F2" (Panel) key to select setup data.

2. Setting the function

Select the operation. Select the "F1" (Save) or "F2" (Load) key to save or load.

3. Setting/Selecting the filename

If you are saving the data, set the filename with eight characters or less. You can use alphanumeric characters and special characters ($&#%'()-^_~{}!).
If you are loading the data, a list of files that can be loaded is displayed. Select the file with the "F1" (↑) or "F2" (↓) key.

4. Executing the load

Highlighting "Execute" and pressing the "F1" (Execute) key executes the operation.

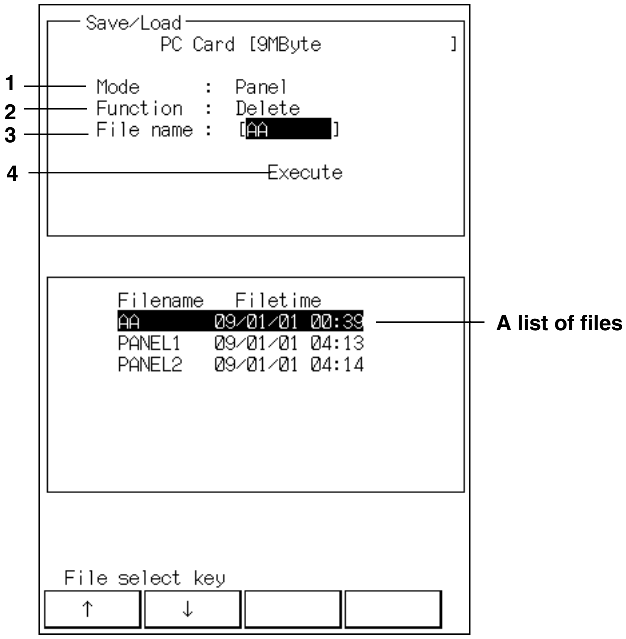
Note

- The following setup data cannot be saved.
  - Communication settings.
  - Current date and time.
  - Display language.
  - Parameters dealing with saving and loading
- Settings relating to saving or loading except for the save options for the measurement data.
- Loading the setup data changes the current settings.
- ".pnl" is the extension of the setup data file.
- If the setup data are loaded using a memory length that is different from what it was at the time the setup data were saved, then the following setup parameters will not change.
  - Memory length (during memory mode)
  - Record length (during realtime mode)

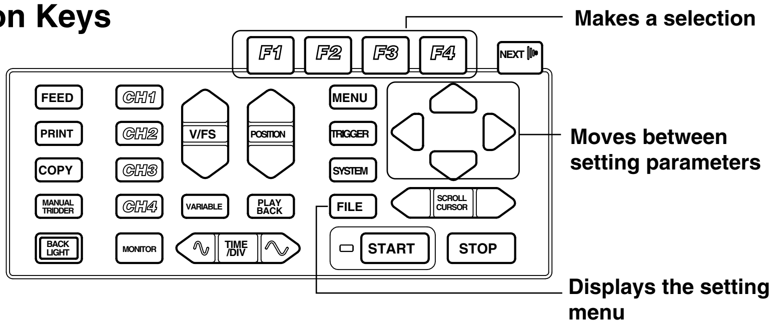
10.8 Deleting Files

Setting Screen

FILE



Operation Keys



Operating Procedure

1. Selecting the data

Select the data type with the “F1” (Data) or “F2” (Panel) key.

2. Setting the function

Select the operation. Select the “F4” (Delete) key to delete the measurement data. Select the “F3” (Delete) key to delete the setup data.
To delete all the files on the PC card, press the “Next” key and select “F2” (All del). Then, go to step 4.

3. Selecting the filename

A list of files that can be deleted is displayed. Select the file with the “F1” (↑) or “F2” (↓) key.

4. Executing the load

Highlighting “Execute” and pressing the “F1” (Execute) key deletes the file.

Note

The OR100E/OR300E cannot delete files that were saved in ASCII format.

11.1 RS-232 Interface Specifications

Receiving Function

All of the parameters you set with the panel keys can be set through the RS232 interface except for the following:

- Turning the recorder ON/OFF.
- Setting the communication parameters.
- Performing operations dealing with the scrolling of the waveform or the cursor

Sending Function

You can output setup data/measurement data/status data/error code.

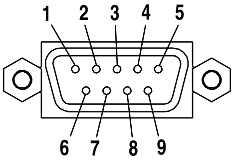
RS-232 Interface Specifications

Electrical, mechanical characteristics :	Conforms to EIA RS-232-C
Connection :	Point-to-point
Communication :	Full-duplex
Synchronization :	Start-stop synchronization
Baud rate :	1200, 2400, 4800, 9600, 19200 bps
Start bit :	1 bit (fixed)
Data length :	7 or 8 bits
Parity :	Even, odd, none
Stop bit :	1 or 2 bits
Connector :	DEL-J9PAF-13L6 (JAE or equivalent)
Hardware handshaking :	Flow control using CA and CB signals
Software handshaking:	Flow control using XON and XOFF signals
Receive buffer size :	256 bytes

11.2 Connecting the RS-232 Interface Cable

When connecting this recorder to a computer, make sure the handshaking methods, data transmission rates, and data formats match on both sides.
For details, see the following pages. Also, make sure to use interface cables that match the specifications of the recorder.

Connector and Signal Names



DELC-J9PAF-13L6 or equivalent

RD (Received Data) :	Data received from the personal computer. Signal direction :Input
SD (Send Data) :	Data transmitted to a personal computer. Signal direction :Output
SG (Signal Ground) :	Ground for signals.
RS (Request to Send) :	Signal used for handshaking when receiving data from a personal computer. Signal direction :Output
CS (Clear to Send) :	Signal used for handshaking when transmitting data to a personal computer Signal direction :Input

Pins 1, 4, 6, and 9 are not used.

Signal Direction

The figure below shows the directions of the signals used by the RS-232 interface of the OR100E/OR300E.

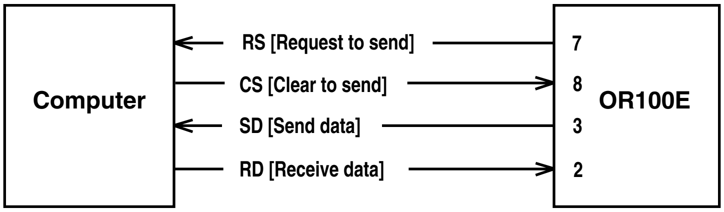


Table of RS-232-C Standard Signal and their JIS and CCITT abbreviations

Signal Table

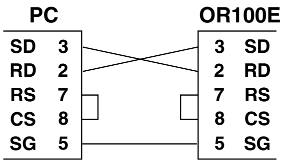
Pin No. (9-pin connector)	Abbreviation			Description
	RS-232	CCITT	JIS	
5	AB (GND)	102	SG	Signal ground
3	BA (TXD)	103	SD	Transmitted data
2	BB (RXD)	104	RD	Received data
7	CA (RTS)	105	RS	Request to send
8	CB (CTS)	106	CS	Clear to send

Connection Example of Signal Lines

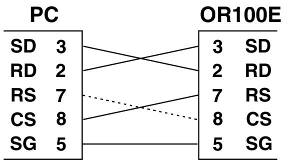
Pin numbers are that of 9-pin connectors.

In general, use a cross cable.

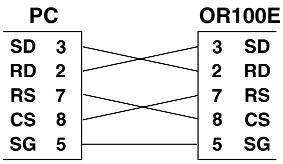
• OFF-OFF / XON-XON



• XON-RTS(XON-RS)



• CTS-RTS(CS-RS)



11.3 Handshaking

When using the RS-232 interface for transferring data, it is necessary for equipment on both sides to agree on a set of rules to ensure the proper transfer of data. The set of rules is called handshaking. Because there are many handshaking methods that can be used in combination with the computer, the same method must be chosen for the recorder and the computer.

You can choose any of the four methods shown in the following table.

Handshaking Methods (means it is a valid selection)

Handshaking method		Data Sending Control (Control for sending data to a computer)			Data Receiving Control (Control for receiving data from a computer)		
		Software Handshake	Hardware Handshake		Software Handshake	Hardware Handshake	
	OR100E menu	Stops sending when X-OFF is received. Resume when X-ON is received.	Stops sending when CB(CTS) is false. Resume when it is true.	No hand shaking	Send X-OFF when receive data buffer is 3/4th filled. Send X-ON when receive data buffer becomes 1/4th filled.	Set CA(RTS) to False when receive data buffer is 3/4th filled. Set to True when receive data buffer becomes 1/4th filled.	No hand shaking
OFF-OFF	NO-NO			○			○
XON-XON	XON-XON	○			○		
XON-RS	XON-RTS	○				○	
CS-RS	CTS-RTS		○			○	

OFF-OFF

Send data control

There is no handshaking between the recorder and the computer. The “X-OFF” and “X-ON” signals are treated as data, and CS is ignored.

Receive data control

There is no handshaking between the recorder and the computer. When the receive buffer becomes full, all extra data are discarded.

RS is fixed to True.

XON-XON

Send data control

Software handshaking is performed between the recorder and the computer. When "X-OFF" code is received while sending data to the computer, the recorder stops the data sending. When it receives the next "X-ON" code, it resumes the data sending. CS signal from the computer is ignored.

Receive data control

Software handshaking is performed between the recorder and the computer. When the free area of the receive buffer reaches 64 bytes, the recorder sends an "X-OFF" code. When the free area increases to 192 bytes, it sends an "X-ON" code. RS is fixed to True.

XON-RS

Send data control

Software handshaking is performed between the recorder and the computer. When "X-OFF" code is received while sending data to the computer, the recorder stops the data sending. When it receives the next "X-ON" code, it resumes the data sending. CS signal from the computer is ignored.

Receive data control

Hardware handshaking is performed between the recorder and the computer. When the free area of the receive buffer reaches 64 bytes, the recorder sets "RS=False." When the free area increases to 192 bytes, it sets "RS=True."

CS-RS

Send data control

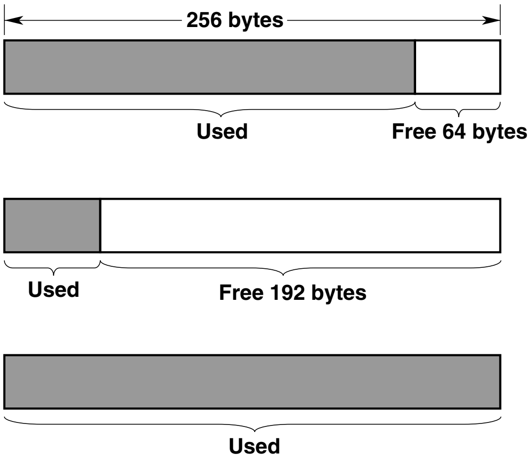
Hardware handshaking is performed between the recorder and the computer. When CS becomes False while sending data to the computer, the recorder stops the data sending. When CS becomes True, it resumes the data sending. "X-OFF" is treated as data.

Receive data control

Hardware handshaking is performed between the recorder and the computer. When the free area of the receive buffer reaches 64 bytes, the recorder sets "RS=False." When the free area increases to 192 bytes, it sets "RS=True."

Precautions on Data Receive Control

When handshaking is used to control the receive data, additional data may be received even if the free area drops below 64 bytes. If the receive buffer becomes full, all extra data are discarded regardless of the handshaking. When free area becomes available again, data will be stored.



When handshaking is used, the recorder signals the computer to stop when the data in the buffer cannot be processed fast enough and the free area drops to 64 bytes.

After stopping the reception of the data, data in the buffer continues to be passed to the internal program. When the free area increases to 192 bytes, it starts receiving the data again.

Regardless of the handshaking, if the buffer becomes full, all additional data are not stored and are lost.

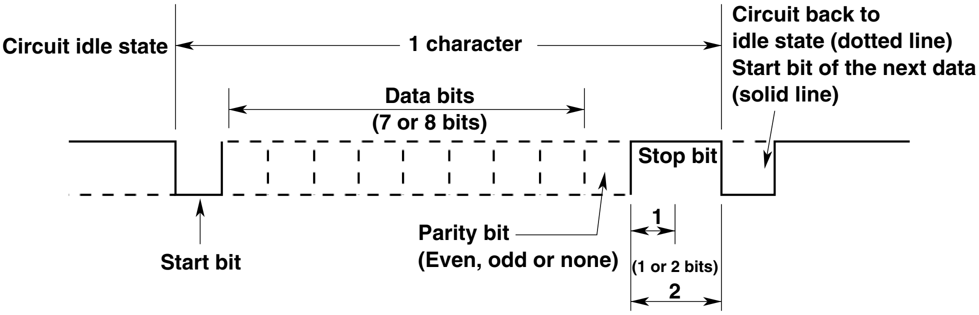
Data Receive Control using Handshaking

Note

The program on the personal computer must be designed so that the receive buffers on the recorder and the personal computer do not become FULL.

11.4 Matching the Data Format

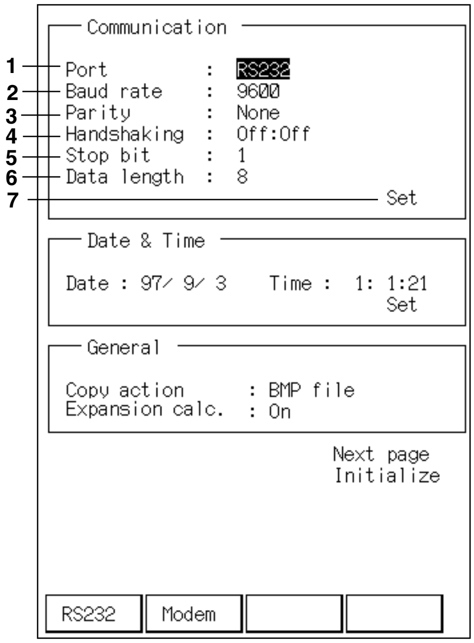
The RS-232 interface on the recorder communicates using start-stop synchronization. With the start-stop synchronization, a start bit is added every time a character is transmitted. Then, the data bits, parity bit, and stop bit follows. See the figure below.



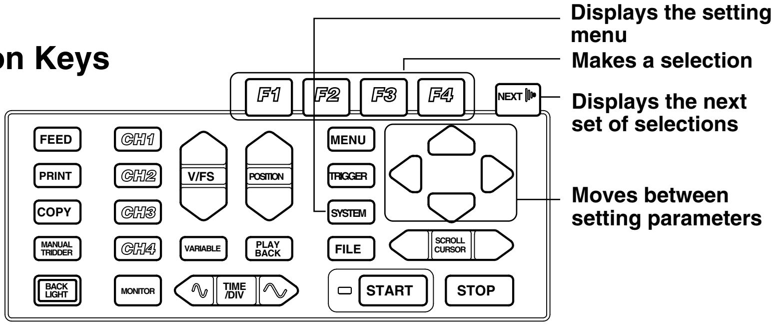
11.5 Setting the RS-232

Setting Screen

SYSTEM



Operation Keys



Operating Procedure

1. Setting the communication port

Select the communication port with the “F1” (RS232) or “F2” (Modem) key.
Here, select “F1”(RS232) key.

2. Setting the baud rate

Set the baud rate with the “F1” to “F4” keys. Pressing “NEXT” displays the next set of selections. Select the baud rate from 1200/2400/4800/9600/19200.

3. Setting the parity

Select the parity with the “F1” (Odd), “F2” (Even), or “F3” (None) key.

4. Setting the handshake

Select the handshaking method with the “F1” (Off:Off), “F2” (XON,XON), “F3” (XON:RS), or “F4” (CS:RS) key.

5. Setting the stop bit

Select the stop bit with the “F1” (1) or “F2” (2) key.

6. Setting the data length

Select the data length with the “F1” (7) or “F2” (8) key.

7. Confirming the setting

Highlighting “Set” and pressing the “F1” (Yes) key confirms the setting.
Pressing the “F2” (No) key cancels the setting.

11.6 FAX Modem

You can use the FAX modem to fax the captured data. This is possible in memory mode and realtime+memory mode.
You can record the continuous analog waveform, digital values, and X-Y waveform. You can also record the screen image with the FAX (see 12.2 Taking a Hard Copy).

Specification

Modem control command :	Conforms to Hayes AT command
FAX control command :	Conforms to EIA-592 Class. 2
Dialing method :	Pulse dialing, tone dialing
Data speed between the recorder : and the FAX modem	1200, 2400, 4800, 9600, and 19200 bps.

Note

- The communication parameters besides the data speed (parity, handshake, stop bit, data length) between the recorder and the FAX modem can be set automatically.
- If the phone line is unstable, set the data speed to 9600 bps or less.

FAX Modem Card

For information on the modem cards that can be used with this recorder, contact your nearest YOKOGAWA dealer listed on the back cover of this manual.

Useable FAX modem cards

- US-Robotics (Magahertz)
  XJ-4336
- 3 Com
  XJ1560J

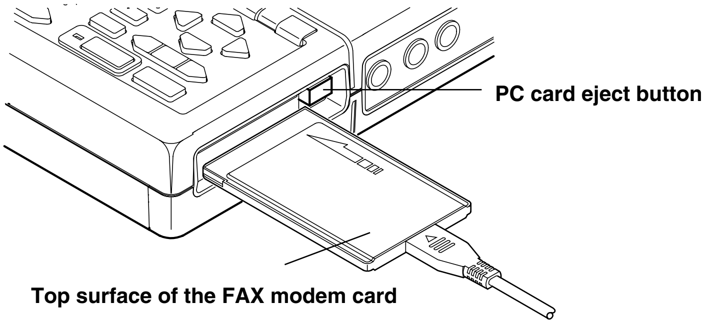
Communication Speed

The communication speed between the recorder and the FAX modem and the speed between the FAX modem and the FAX are different. See the following table.

OR100E - FAX Modem (OR100E setting)	FAX Modem - FAX
1200 to 4800 bps	2400 bps
9600 bps	4800 bps
19200 bps	9600 bps

Inserting the FAX modem card

While the recorder is turned ON, insert the FAX modem card into the PC card slot with the top surface facing up. A message, “PC card detected” is displayed at the upper left corner of the screen.



Removing the FAX modem card

Check that the FAX modem card is not being accessed, and press the PC card eject button on the side of the PC card slot.

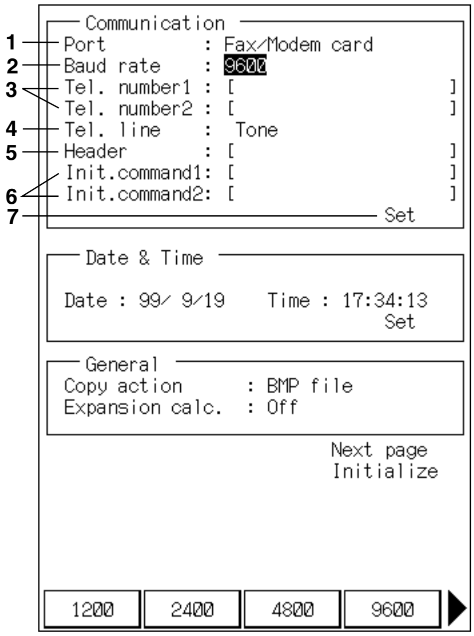
CAUTION

- Do not remove the FAX modem card while it is being accessed as this may damage the PC card.
- For general handling precautions, refer to the instructions supplied with the FAX modem card.

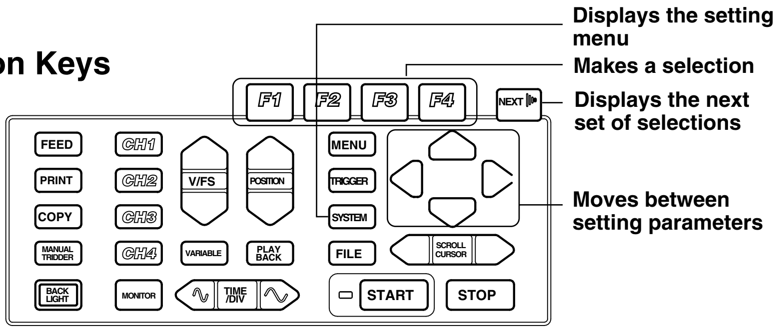
11.7 Setting the FAX Modem

Setting Screen

SYSTEM



Operation Keys



Operating Procedure

1. Setting the communication port

Select the communication port with the “F1” (RS232) or “F2” (Modem) key.
Here, select “F2” (Modem) key to select the FAX modem.

2. Setting the baud rate

Set the baud rate with the “F1” to “F4” keys. Pressing “NEXT” displays the next set of selections. Select the baud rate from 1200/2400/4800/9600/19200.

3. Setting the FAX number

Set the destination telephone number.
Set the destination telephone number in telephone number 1.
For telephone number 2, set a backup destination telephone number that is used when a connection cannot be established to telephone number 1 (the line is busy, for example).

Note

If your phone system requires you to dial additional numbers (prefix) to access an outside line, place a comma between these and the actual phone number. If it takes a long time to connect to the outside number, place several “,” (commas).

4. Setting the telephone line

Select the telephone line to use with the “F1” (Pulse) or “F2” (Tone).
Pulse : Pulse dialing.
Tone : Tone dialing.

5. Setting the header

Set the header using 20 characters or less. The characters are recorded at the head of the FAX message.

6. Entering AT commands

You can enter up to two AT commands at once. Enter the command using the alphabet and symbols. For information on the AT commands, see the instruction manual for the FAX modem.

Note

AT commands are commands for the modem developed by Hayes Corporation.

7. Confirming the setting

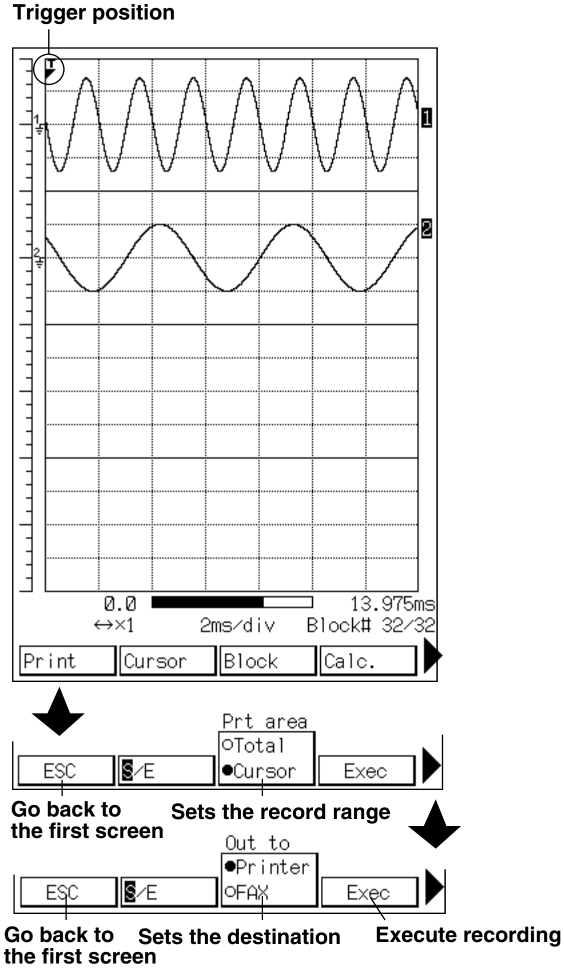
Highlighting “Set” and pressing the “F1” (Yes) key confirms the setting.
Pressing the “F2” (No) key cancels the setting.

11.8 Sending the Measurement Data over the FAX Modem

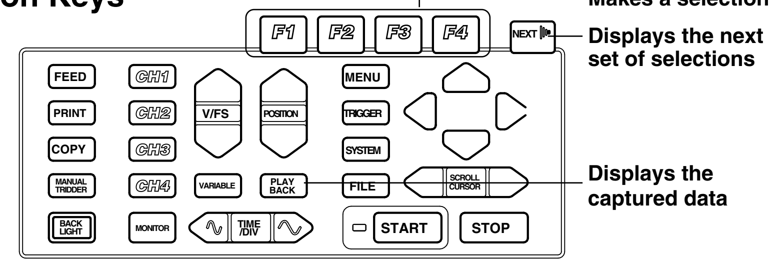
There are two ways to send the measurement data over the FAX modem.
Specify the block and the range on the screen displaying the captured data and send.
Automatically send the data after capturing one block of data.

Specifying the Block and the Range and Sending.
Setting Screen

PLAY BACK



Operation Keys



Operating Procedure

Set the block and the range before sending the FAX. See 6.6 "Displaying/Recording the Captured Data as an Analog Waveform" or 6.7 "Recording the Captured Data as Digital Values" on how to set these parameters.

1. Setting the destination

Press the "F1"(Print) key in the playback screen. A screen for setting the record range appears.
Pressing the "NEXT" key displays the screen for setting the destination.
Press the "F3" (Destination) key and select "FAX." The destination is marked with a "●".
Press the "F4" (Execute) key to start sending the FAX.

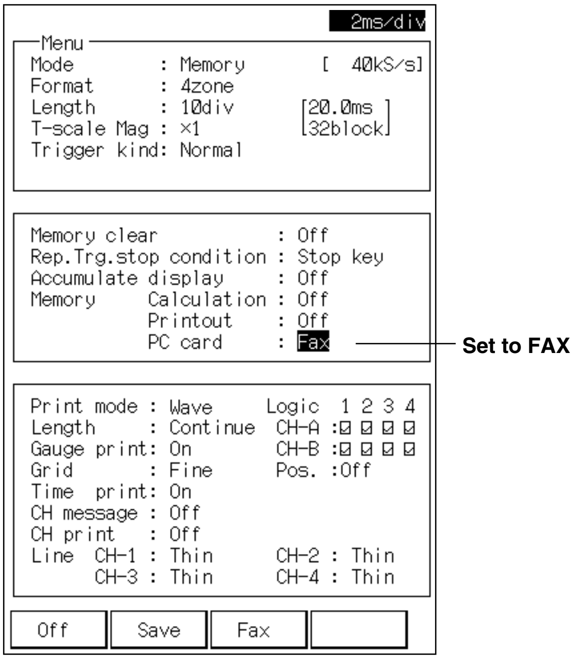
Note

- If the destination was set to "FAX" beforehand, you can simply press the "PRINT" panel key to send the FAX.
- The recording format is the same as the recording format used to record with the built-in printer.
- If a connection cannot be established such as when the FAX at telephone number 1 is busy, the following procedures are taken.
  When telephone number 2 is not specified
  The OR redials after approximately 90 seconds. If a connection cannot be established after 9 redial attempts, FAX transmission is canceled and the measurement data are printed using the built-in printer.
  When telephone number 2 is specified
  The OR immediately dials the second telephone number. If a connection cannot be established to telephone number 2, the OR redials the first number after approximately 90 seconds. If a connection cannot be established after 9 redial attempts, FAX transmission is canceled and the measurement data are printed using the built-in printer.
- If the destination is busy, it will redial after about 90 seconds. If it is still busy after 4 redials then the data is recorded with the built-in printer.
- If the FAX modem could not be recognized by the recorder such as when the FAX modem is not connected, the data is recorded with the built-in printer.
- If the destination FAX is using a cut paper, then the data is divided into several pages if it exceeds one page. If the destination FAX is using continuous paper, then the data is recorded continuously.
- During the communication, the following messages are displayed.
  Dialing: "Connecting line."
  Sending: "Sending FAX."
  Sending complete: "Sending complete."

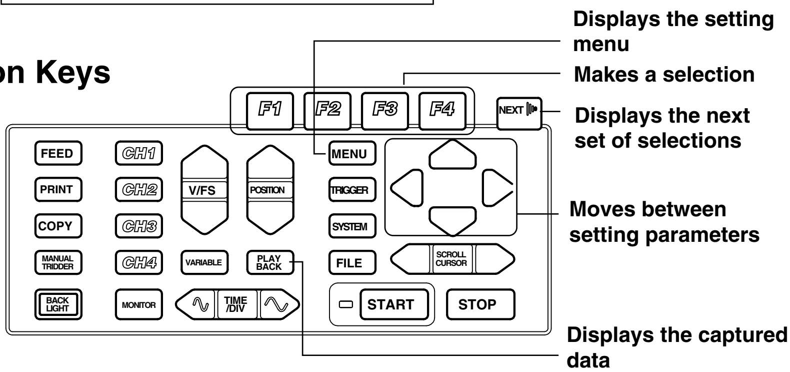
Automatically Sending the Data after Capturing One Block of Data.

Setting Screen

MENU



Operation Keys



Operating Procedure

1. Setting the operation after data capturing

At the screen that appears when the “MENU” key is pressed, set the PC card parameter under the “operation after memory” to “FAX.”
Pressing the “START” key will capture the data under the specified measurement conditions and after capturing one block of data, the recorder automatically sends the data to the FAX.

Note

- The recording format is the same as the recording format used to record with the built-in printer.
- If the destination is busy, it will redial after about 90 seconds. If it is still busy after 4 redials then the data is recorded with the built-in printer.
- If the FAX modem could not be recognized such as when the FAX modem is not connected, the data is recorded with the built-in printer.
- If the destination FAX is using a cut paper, then the data is divided into several pages if it exceeds one page. If the destination FAX is using continuous paper, then the data is recorded continuously.
- During the communication, the following messages are displayed.
  Dialing: “Connecting line.”
  Sending: “Sending FAX.”
  Sending complete: “Sending complete.”

11.9 Other Fax Modem Functions

Connecting the OR100E/OR300E to a personal computer with the FAX modem allows you to communicate with the OR100E/OR300E just as you would with the RS-232 interface. For details on the RS-232 commands, see the appendix.

Setting the OR100E

You can configure the OR100E/OR300E using the communication commands for the RS-232 interface. However, you cannot do the following:

Turning the recorder ON/OFF.
Setting the communication parameters.
Scrolling the waveform.
Performing operations dealing with the cursor.

Outputting data

OR100E outputs setup data, measurement data, status data, and error codes. If the phone line is disconnected while outputting the data, the OR100E/OR300E will be busy until it outputs all of the data. Reconnect after all of the data has been output.

Note

In the initial OR100E/OR300E setting, OR100E/OR300E will answer an incoming call automatically when it detects two alert signals. To change the number of alert signals before answering an incoming call, set the following initial command.
To answer after 5 alert signals: ATS0=5

Setting the parameters

To set the communication parameters, see 11.7 “Setting the FAX Modem.”

Passwords

If you set a password using the communication command, only the command for entering the password (:PASSword:INPut) and the command to output the status data are accepted until you enter the password.
The default is set to “0” (password not used).
If you do a complete initialization, the password is also initialized. See 12.8 “Initializing” on complete initialization.

12.1 Running Multiple OR Series in Synchronized Operation

This chapter describes the methods to synchronously operate multiple OR Series Recorders (OR100E/OR300E, ORP, PRM, OR1400) by utilizing the external trigger function.

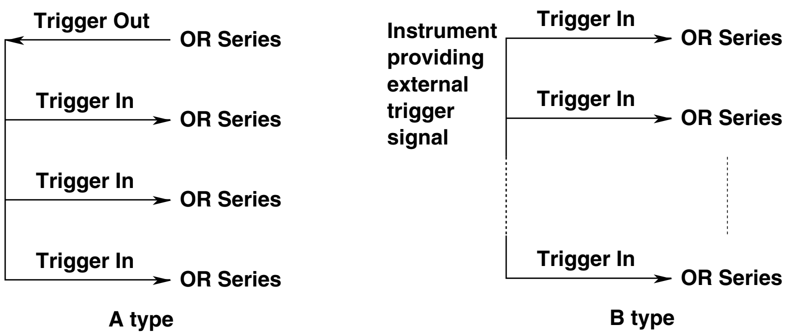
Overview

Types of synchronous operation

There are two types of synchronous operation.

A : Synchronous operation with OR Series' external trigger output as the source.

B : Synchronous operation with external trigger output other than OR Series' as the source.



Maximum number of recorders operating synchronously

A type : Four recorders including the one providing the external trigger.

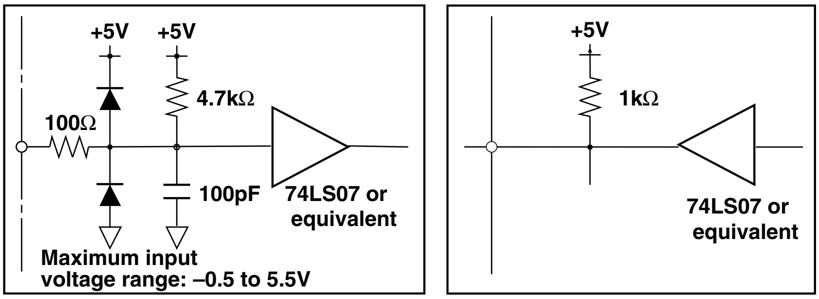
B type : Supports as many recorders as the output impedance of the external trigger source will allow.

Signal and operation

TRIG OUT : Leading edge of a TTL-level signal (pulse width approx. 2 ms).

TRIG IN : Leading edge or trailing edge of a TTL-level signal (pulse width 2 µs or more).

Input Circuit Configuration and Output Circuit Configuration



Input circuit(TRIG IN)   Output circuit(TRIG OUT)

Condition in which synchronous operation does not work

If an external trigger signal is applied to this recorder while it is recording or capturing data, the external signal is discarded (cannot operate synchronously). Therefore, to ensure that the Type A synchronous operation works properly, set the mode to "single" on the OR Series recorder providing the trigger signal and the ones receiving the signal.

CAUTION

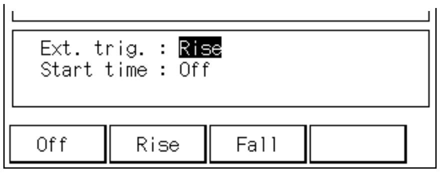
Applying voltages outside the maximum input voltage to the input terminals may damage the input circuit.
When operating multiple OR Series Recorders, use a power supply with a large enough capacity to handle the increased power consumption. For information regarding the maximum power consumption, see 14.8 "General Specifications."

Note

To avoid erroneous operation due to noise, use connection cables that are 3 m or less.

Setting Screen

TRIGGER



Setting the external trigger

At the screen that appears when the “TRIGGER” key is pressed, set “Ext. Trig.” to “Rise.”

Note

Because the trigger output is a TTL-level signal, set the trigger type to “Rise” when operating synchronously.

12.2 Taking a Hard Copy

There are three ways to save the screen image.

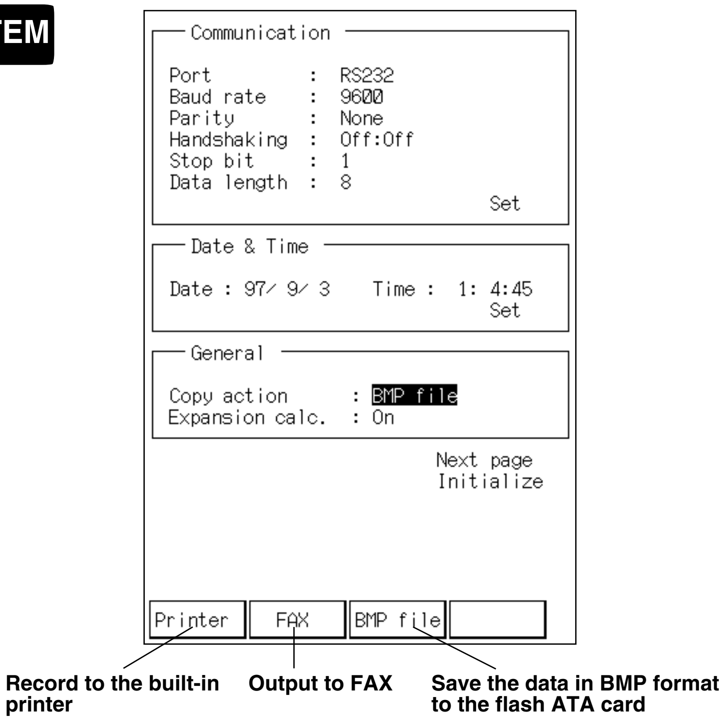
Record with the built-in printer.

Save the data in BMP format to the flash ATA card.

Output over the FAX modem.

Setting Screen

SYSTEM



Operating Procedure

1. Selecting the output method

At the screen that appears when the “SYSTEM” key is pressed, select the “Copy action” from Printer, FAX, or BMP file.

2. Taking the hard copy

Pressing the “COPY” key will output the current screen image.

CAUTION

When outputting to FAX or saving in BMP format, do not remove the flash ATA card or the FAX modem card until a message is displayed indicating the completion of the hard copy. Doing so may damage the PC card.

Note

- You cannot hard copy under the following conditions:
  While capturing measurement data.
  While realtime recording.
  While waiting for a trigger.
  While accessing the flash ATA card or the FAX modem.

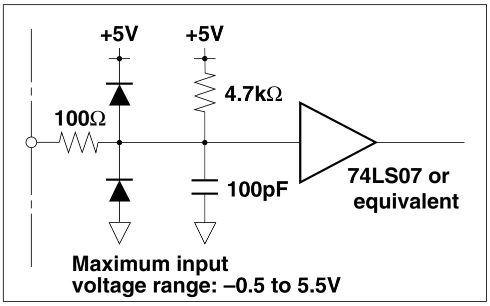
12.3 Capturing Data using the External Sampling Clock

You can use a TTL-level signal with a maximum frequency of 100 kHz as a sampling clock to capture the measurement data.

Input/Output terminal

Input the signal in the TRIG IN/EXT. SAMPLE terminal

Input circuit configuration



CAUTION

Applying voltages outside the maximum input voltage to the input terminals may damage the input circuit.

Time/div

Press the “Time Axis” key and set the “Time/div” displayed on the upper right of the screen to “External.”

For details, see section 4.4 “Setting the Time Axis (Sample Rate/Chart Speed).”

Note

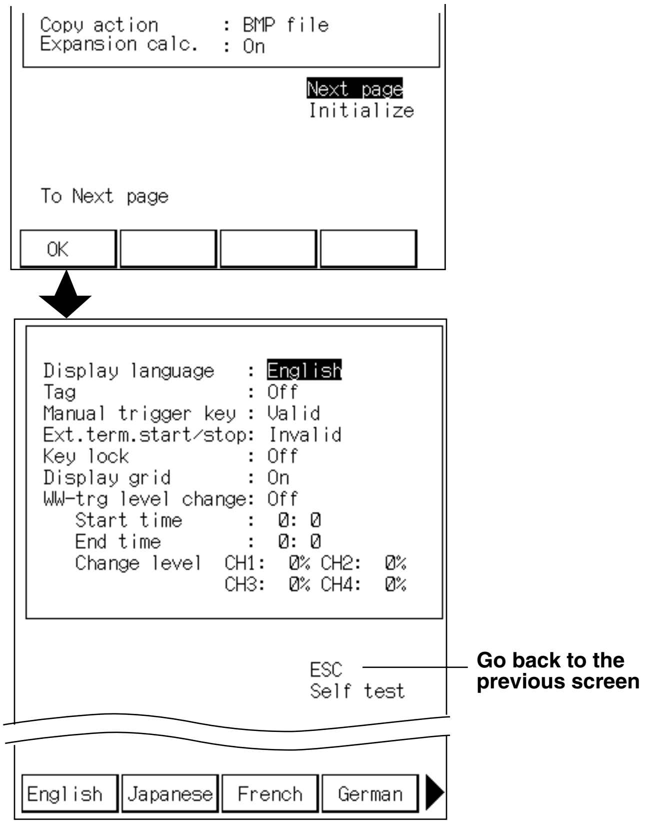
- To avoid erroneous operation due to noise, use connection cables that are 3 m or less.
- When using an external sampling clock to capture the data, the A/D conversion of the realtime data is also performed using the external sampling clock. Therefore, depending on the frequency, the resolution of the display and the recording of the realtime data may go down.
- If the data captured using the external sampling clock is displayed (or recorded) as an analog waveform, the data No. are displayed (or recorded) on the time axis instead of the time of the data capture.

12.4 Changing the Language of the Display

You can select French, Itarian, German, English or Japanese.

Setting Screen

SYSTEM



Operating Procedure

Selecting the language of the display

At the screen that appears when the "SYSTEM" key is pressed, highlight "Next page." Press the "F1" (OK) key to display the next page.

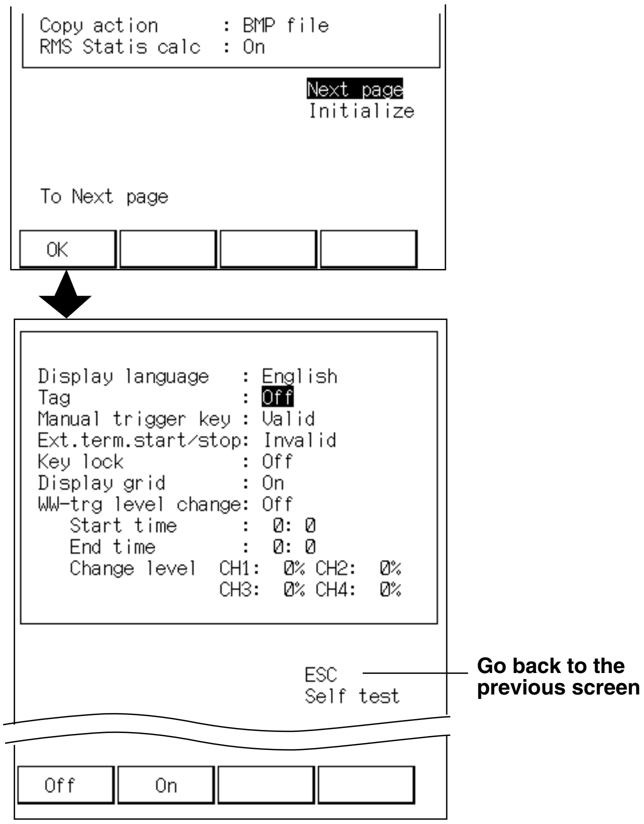
Select the "Display language" with the "F1" (English), "F2" (Japanese), "F3" (French), "F4" (German), or "Next" and "F1" (Itarian) key.

12.5 Setting Tags

When recording with the built-in printer or by FAX, you can record a tag instead of the channel number. For setting the tag, see 12.6 "Setting Tags and Comments."

Setting Screen

SYSTEM



Operating Procedure

Turning ON the tag

At the screen that appears when the "SYSTEM" key is pressed, highlight "Next page."

Press the "F1" (OK) key to display the next page.

Set the "Tag" to "On" with the "F2" (On) key.

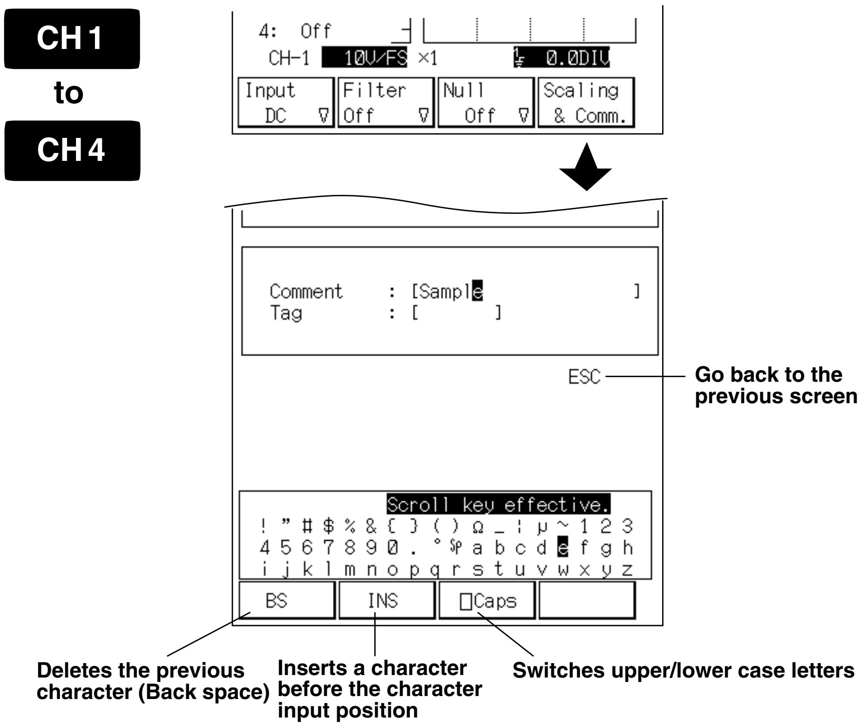
Note

The toggling of the "Tag" affects all channels.

12.6 Setting Tags and Comments

You can set tags and comments for each channel. To record the tags and comments, set the “CH message” or “CH record” to ON at the screen that appears when the “MENU” key is pressed. For details, see 6.6 “Displaying/Recording the Captured Data as an Analog Waveform.” Also, to validate the tags, Turn ON the tag as described in 12.5 “Recording Tags.”

Setting Screen



Operating Procedure

Setting tags and comments

At the screen that appears when the channel key (“CH1” to “CH4”) is pressed, press the “F4” (scaling & comm.) key to display the screen for setting the tags and comments.

Set the tags and comments individually. Move the input position with the “Selection” key and select the character with the “SCROLL/CURSOR” key.

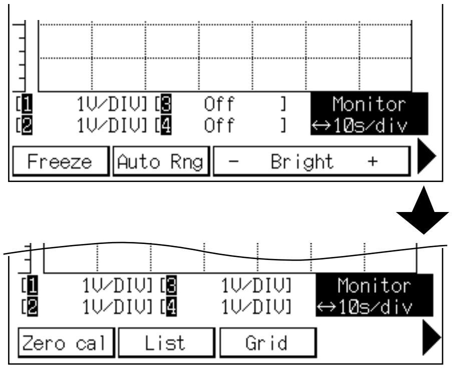
Set the tag with seven characters or less and the comment with 20 characters or less.

12.7 Printing the List of Settings

You can record the list of the current settings with the built-in printer.

Setting Screen

MONITOR



Operating Procedure

Printing the list of settings

At the screen that appears when the “MONITOR” key is pressed, press the “NEXT” key. A screen for executing the list print appears.

Pressing the “F2” (List) key records the list of settings with the built-in printer.

Note

- Setting parameters on the screen that appears when the “FILE” key is pressed, is not recorded.
- You cannot abort a list print.
- You cannot list print under the following conditions.
  While capturing measurement data.
  While waiting for a trigger.
  While the built-in printer is operating.
  While accessing the flash ATA card or the FAX modem.

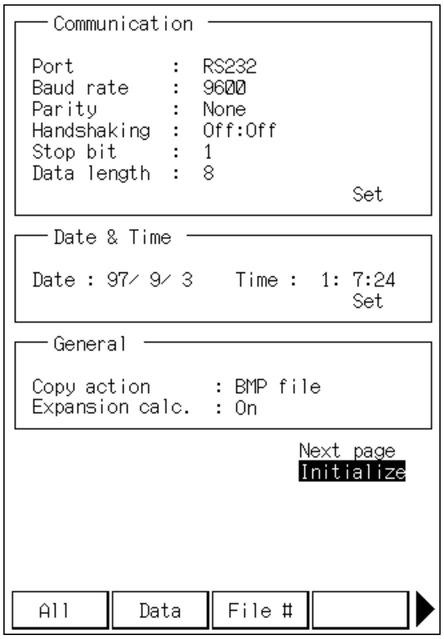
12.8 Initializing

Select the parameters to initialize and execute.

All :	Initialize setting parameters and internal memory.
Wave :	Initialize internal memory.
Filename :	Numbers for the following file names
	memd****
	auto****
	disp****

Setting Screen

SYSTEM



Operating Procedure

At the screen that appears when the “SYSTEM” key is pressed, highlight “Initialize”

Pressing the “F1” (All), “F2” (Wave), or “F3” (File) key executes the initialization.

Note

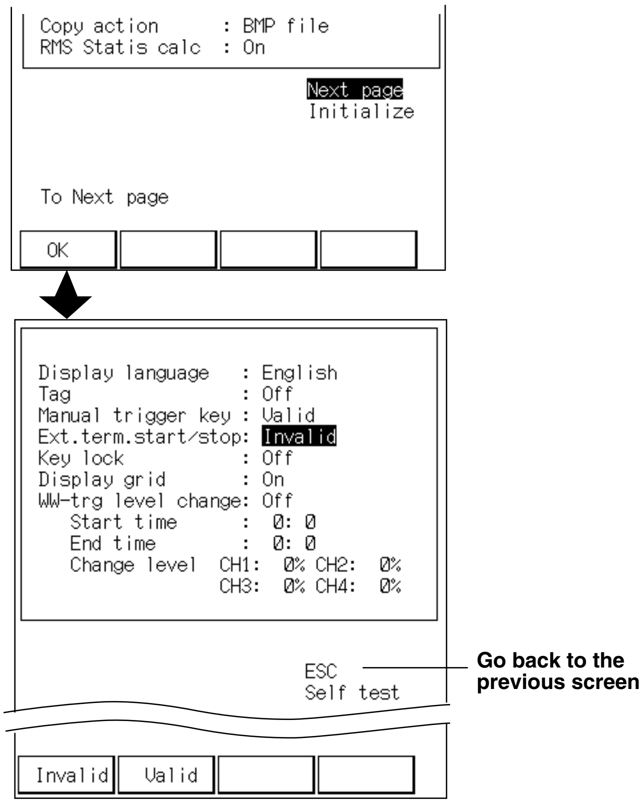
When performing a complete initialization (All), the setting parameters and measurement data in the internal memory are initialized. Save important setup data and measurement data to the flash ATA card beforehand. For instructions on saving, see 10.3 “Saving the Measurement Data to the PC Memory Card” or 10.5 “Saving/Loading the Setup Data.”

12.9 Starting/Stopping Measurement with External Signal

You can start/stop the operation set in the memory mode, realtime+memory mode, or each of the harmonic modes by applying a TTL-level signal or a contact signal to the trigger-in terminal.

Setting screen

SYSTEM



Operating Procedure

On the screen that appears when the “SYSTEM” key is pressed, highlight “Next Page” and press the “F1” (OK) key. The next page is displayed.

Set the “Ext. term. start/stop” with the “F1” (Invalid) or “F2” (Valid) key.

Invalid: Measurement is not started/stopped even if a signal enters the trigger-in terminal.

Valid: Measurement is started/stopped when a signal enters the trigger-in terminal.

Input signal

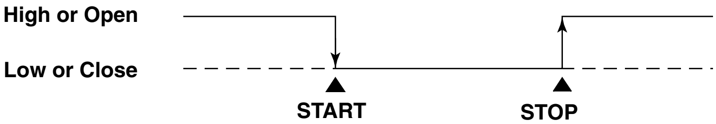
Two types of signals can be input.

TTL Level signal (High/Low)

High: 2.7 V or more, Low: 0.8 V or less

Contact signal (Open/Close)

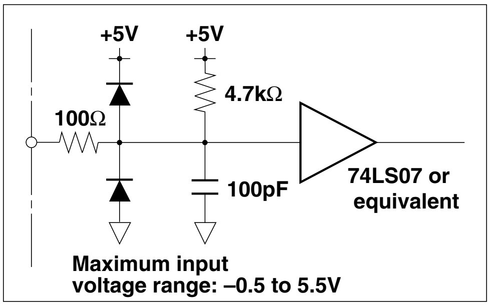
About 5 mA of current flows when the contact is Close.



Note

For connecting the input signal, see page 2-5.

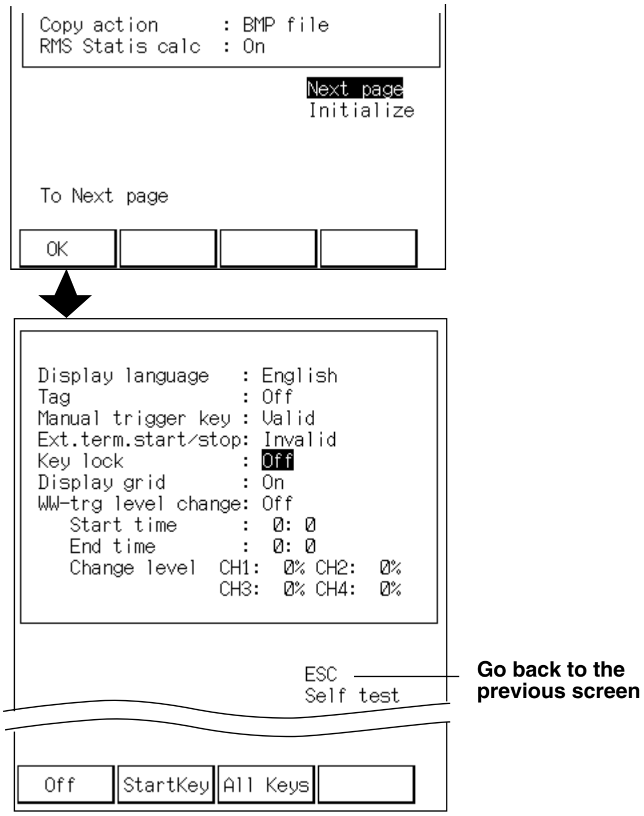
Input circuit



12.10 Locking the Keys

Setting screen

SYSTEM



Operating Procedure

1. Enabling/Disabling key lock

On the screen that appears when the "SYSTEM" key is pressed, highlight "Next Page" and press the "F1" (OK) key. The next page is displayed.

Select "Key lock" with the "F2" (Start Key) or "F3" (All Key).

Start Key: Enables the lock on only the "START" key.

All Key: Enables the lock all panel keys except for "BACK LIGHT" key.

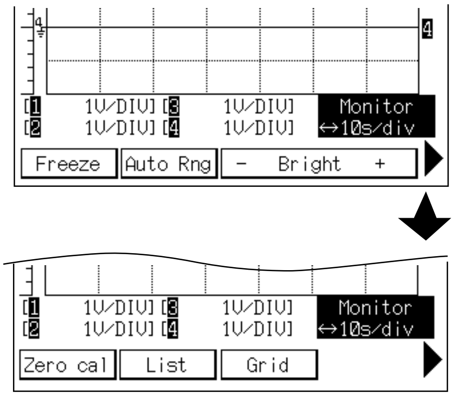
2. Locking the key

Pressing the "BACK LIGHT" key for three seconds locks the keys. To unlock the keys, press the " BACK LIGHT" key for three seconds again.

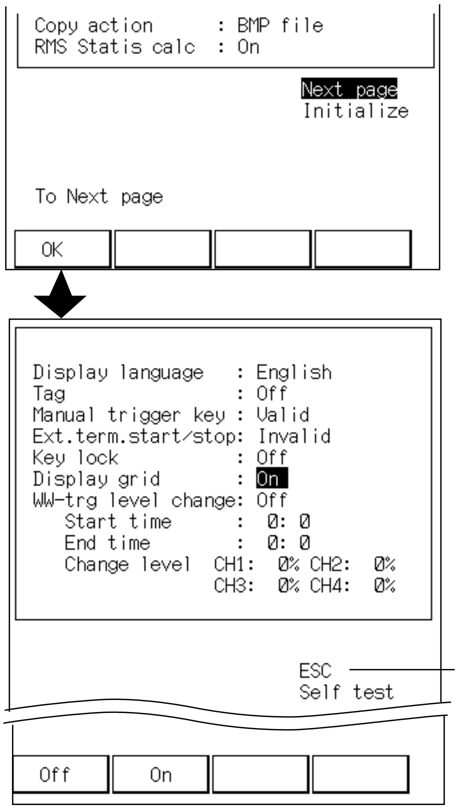
12.11 Turning ON/OFF the Grid

Setting Screen

MONITOR



SYSTEM



Go back to the previous screen

Operating Procedure

Operation of the monitor screen

At the screen that is displayed when the “Monitor” key is pressed, press the “Next” key.
Pressing the “F3” (Grid) key turns ON/OFF the grid display.

Operation on the system menu

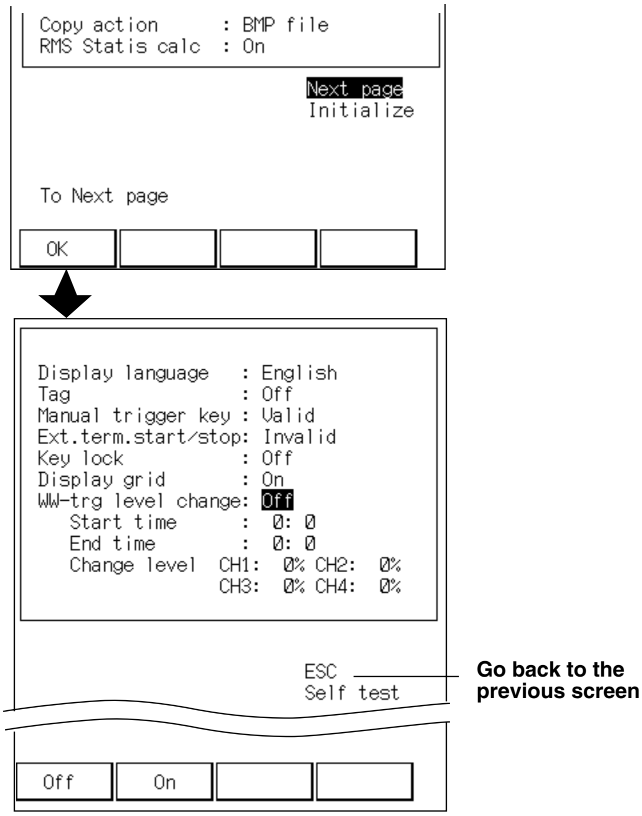
At the screen that is displayed when the “System” key is pressed, highlight “Next” and press the “F1” (OK) key. The next page is displayed.
Turn ON/OFF the “Display grid” with the “F1” (Off) or “F2” (On) key.

12.12 Temporarily Changing the Width of the Wave Window Trigger

The width of the wave window trigger can be changed during a specified period of time. This is useful when changing the width of the wave window trigger according to the different power conditions that may exist between night and day.

Setting Scrren

SYSTEM



Operating Procedure

At the screen that is displayed when the “System” key is pressed, highlight “Next” and press the “F1” (OK) key. The next page is displayed.
Turn ON/OFF the “WW-trg level change” with the “F1” (Off) or “F2” (On) key.
Set the time during which the width of the wave window trigger is to be changed in the “Start time” box.
Set the time at which the width of the wave window trigger is to be changed.
Set the hour in the range from 00 to 23 and the minute in the range from 00 to 59.
Set the time at which the width of the wave window trigger is to be changed back in the “End time” box.
Set the width of the wave window trigger.
Set the width of the wave window trigger for each channel with the “Change level” box.

Note

When the width changes, the measurement is temporarily suspended. The time period during which the measurement is suspended is normally 10 s. It is approximately 30 s during realtime + memory mode. (Recording to the chart paper is also suspended for approximately 30 s.)

13.1 Troubleshooting

This chapter describes the methods to correct problems that might occur with your recorder. If a message is displayed on the screen, check 13.2 "Messages and Corrective Measures". If the recorder needs servicing or the condition does not improve after taking the corrective measures, contact your nearest YOKOGAWA dealer listed on the back cover of this manual.

Problem	Things to Check	Reference Page
The recorder does not turn ON.	• Check that the power switch located on the left side of the recorder is turned ON.	1-10, 2-17
	• Check that the power cord is firmly plugged into the power outlet.	2-13
	• Check that the batteries are properly installed.	2-11, 2-15
	• If you are using the NiMH battery pack, check that the battery is recharged.	2-16
	• Check that you are not using power outside the allowable power supply voltage.	2-13
The setup data are initialized when the power is turned OFF.	• Change the backup battery if the "Battery flat" message appears on the screen. The life of the backup battery is about 10 years.	—
The panel keys do not operate	• Wait for the operation to complete or abort the operation with the "STOP" key. Then, operate the keys. During data capturing. While waiting for trigger. While PC card is being accessed.	—
	• Test the keys as described in section 13.4. If it is not working properly, the recorder needs servicing.	13-12
Measurement values are erroneous.	• Noise may be picked up. Check the installation environment. Also, check if the following measures are taken to reduce the noise. The recorder is grounded. The functional ground of the equipment under measurement is connected to that of the recorder.	
	• Check the input filter settings.	4-4, 4-5
	• Check whether the linear scaling function is being used.	4-8, 4-9
	• Allow 30 minutes for the recorder to warm up after turning ON the power to make accurate measurements.	—
The printout is faint.	• Check that you are using the proper type of thermal paper.	2
	• Check the printer head as described in section 13.4. If it is not working properly, the recorder needs servicing.	13-14
	• The life of the printer head is about 50 km (about 5000 chart rolls). Operation beyond this point may cause the print quality to go down. To replace the printer head, contact your nearest YOKOGAWA dealer listed on the back cover of this manual.	—
	• If the recorder is not installed in an environment as described in section 2.2, dust may get trapped between the printer head and paper and damage the head. In this case, the recorder needs servicing.	2-3

Problem	Things to Check	Reference Page
The recorder does not print.	· Check that the thermal paper is installed in the right direction.	2-19, 2-20
Waveforms cannot be recorded.	· Check that the input coupling is set to DC. · Check that the trace is turned ON.	4-3 6-11
The trace intensity is faint.	· When the printing density is high, the recorder may lower the intensity to avoid overheating the print head. This is normal. For all other cases, the recorder needs servicing.	— —
Data cannot be saved to the flash ATA memory card.	· If you are using a new card, make sure that it is formatted. · Check that the card is inserted properly. · Check that there is enough space available to record the data. · Check if the card is supported by the recorder by contacting your nearest YOKOGAWA dealer.	— 10-2 10-4 —
Data cannot be loaded from the flash ATA memory card.	· Check that the card is inserted properly. · Some of the data files saved by other models can not be loaded.	11-11 —
The recorder cannot be controlled through the RS-232 interface.	· Check that the communication parameters are set correctly on the computer side and the recorder side. · Communication parameters are not changed until after highlighting “Set” and pressing the “F1” (Confirm) key. · Check that you are using the correct type of cable for the intended application.	11-8 11-8 11-3
Data cannot be sent over the FAX	· Check that the card is inserted properly. · Check that the settings are correct for the telephone line that you are using. · If your phone system requires you to dial additional numbers to access an outside line, place a “,” (comma) between these and the actual phone number. · Check that the destination is set to FAX.	11-11 11-12 11-12 11-14
The chart has jammed.	· Remove the jammed paper as follows. Turn OFF the power switch. Lift the release lever. Remove the paper.	2-19, 2-20
The chart does not feed.	· Check if the recorder has run out of paper. · Check that the release lever is down.	2-19, 2-20 2-19, 2-20
Screen display is dark.	· Pressing the “back light” key darkens the screen display. · Screen display automatically darkens while recording with the built-in printer. This is not a malfunction.	1-3 —

13.2 Messages and Corrective Measures

This section describes error messages, warning messages, and status messages displayed by the recorder. It also describes corrective measures to deal with the problems indicated by the messages. If the recorder needs servicing or the condition does not improve after taking the corrective measures, contact your nearest YOKOGAWA dealer listed on the back cover of this manual.

Error Messages

Error Code	Error Message	Description and Corrective Measures	Reference Page
600	Out of chart paper	Out of chart paper Load new roll chart.	2-19, 2-20
601	Printhead raised	Lower the release lever.	2-19, 2-20
603	Low battery	Not enough battery voltage to drive the recorder. Replace the AAA batteries or recharge the rechargeable battery.	2-11, 2-15, 2-16
630	Modem card not ready	There is no modem card for sending the FAX. Insert the modem card firmly in the slot.	11-10, 11-11
632	Can't use this modem card	This modem card cannot be used with this recorder. Use a modem card supported by this recorder.	11-10, 11-11
633	Can't initialize modem	Reinsert the modem card. If it still does not work, change to another modem card.	11-11
634	Can't send fax	You cannot send fax under the following conditions: Not properly connected to the phone line. Incorrect telephone number. Not enough wait for dialing to the outside line. Add commas "," between the prefix and the phone number. Unstable phone line.	11-10 to 11-13
635	Connection failure	Failed to connect due to the following reason. Phone number is not specified. Destination Busy after four redials.	11-10 to 11-13
650	PC card not ready	Flash ATA card is not inserted. Insert the card firmly in the slot.	10-2
651	Card unformatted	Flash ATA card is not formatted to MS-DOS. Format the card with a personal computer.	—

Error Code	Error Message	Description and Corrective Measures	Reference Page
653	Specified file unavailable	Cannot find the specified file. Check the file name.	10-8 to 10-13
654	Invalid file name	Tried to use a file name that cannot be used or tried to use invalid characters or symbols.	Chapter 10
655	No data to save	or no measurement data in the specified range. Save after capturing data or change the range to save.	10-5
656	No data to load	There is no data in the specified file.	10-8 to 10-11
657	Not enough space to save	There is not enough free space on the flash ATA card. Delete unnecessary files or save to another card.	10-12, 10-13
658	Directory full	Maximum number of files allowed in the root directory has been exceeded. Delete unnecessary files or save to another card.	10-12, 10-13
659	Invalid file format	OR100E does not support this file format.	—
660	Invalid format version	OR100E does not support this file format version.	—
662	Write protected file	The file is write protected. Cannot overwrite or delete the file. Clear the write protection with a personal computer.	—
663	Access error	Card was removed during loading or saving, or the card is physically damaged. Insert a proper card.	10-1, 10-2
664	File system error	Other file system error. Insert another flash ATA card or format the card with a personal computer.	10-2
665	File exists	A file with a same file name already exists. Delete the file or save with another file name.	10-5, 10-12
667	File is corrupt	Cannot load the specified file because it is corrupt.	—
668	No harmonic data	There are no data that have been analyzed. Perform harmonic analysis first.	—
669	No previous load data	No data to be displayed.	—
670	No next load data	No data to be displayed.	—
700	Execution error	Cannot execute the specified operation.	—

Error Code	Error Message	Description and Corrective Measures	Reference Page
702	No such channel	The specified channel does not exist.	—
703	No captured data	Cannot execute the specified operation because there is no captured data.	—
704	Invalid data number	In the save option of the captured data, the specified range for saving the data is incorrect.	10-5
705	Channel is off	Cannot execute because the input of the specified channel is turned OFF. Set the input to DC or change the channel number.	4-3
710	Invalid model	Cannot load the specified file because the file was saved on different equipment.	—
711	Invalid version	Cannot load the specified file because the file was saved on equipment with a different version or a different configuration.	—
712	No data on X-axis	Cannot execute because the input of the channel set to the X-axis is turned OFF. Change to another channel.	6-6, 7-6
713	Remote (Push NEXT to local.)	You can release the remote operation, carrying out the followings. Return to local operation with the communication command. Push the NEXT key. Turn off the power switch.	
714	Local lockout	You can release the local lockout, carrying out the followings. Push the NEXT key. Turn off the power switch.	
715	Key has been locked	Keys are locked. To operate the keys, release the key lock.	—
802	Setting out of range	The specified value exceeds the allowable range.	—
803	Cannot set data	The specified value exceeds the allowable range.	—
805	Illegal data exists	The computation was aborted because there was data outside the range. Change the computation range.	6-19
806	Parameter error	Incorrect parameter in the communication command or cannot execute in the present condition. Change the parameter setting.	App-1 to App-57
807	Mode error	Issued a communication command that is not allowed in the current mode.	App-1 to App-56
808	Cannot set it while running	Issued a communication command that is not allowed in the current mode.	App-1 to App-56
809	CH2 memory unavailable	Linking two channels of memory (2-channel model)	6-3
810	CH2,4 memory unavailable	Linking two channels of memory (4-channel model)	6-3
811	CH2,3,4, memory unavailable	Linking four channels of memory (4-channel model)	6-3

Status Messages

Code	Message	Description
4	Settings complete	Parameters have been set correctly.
5	Waiting for connection	Waiting to reconnect because the destination was busy.
6	Connecting to line	Connecting to the line to send FAX.
7	Sending FAX	Sending FAX.
8	FAX complete	FAX transmission completed successfully.
9	Aborted sending FAX	Aborted sending FAX.
10	Waiting for error retry	An error occurred while sending fax. Reestablishing connection.
20	Execution complete	A successful completion.
21	Acq. memory initialized	Initialized (cleared) the captured data in the acquisition memory.
23	Calculating	Calculation is being performed.
24	Calc. aborted	Calculation was aborted.
25	PC card has been detected	PC card has been properly inserted.
28	Accessing file	OR100E is accessing the flash ATA card.
29	Aborted file access	Aborted the access to the flash ATA card.
30	In measuring	OR100E is making a measurement.
33	Save completed	File saving has been completed.
40	Panel keys are locked	Panel keys have been locked.
41	Start key is locked	Start key has been locked.
42	Key lock is released	Key lock has been released.
43	Panel save completed	Parameters have been saved.
44	Panel load cpmpleted	Parameters have been loaded.

Warning Messages

Code	Message	Description	Reference Page
52	Backup battery flat	The battery for backing up the setting parameters and measured data is flat. Contact you nearest YOKOGAWA dealer.	
53	Battery flat	The battery (AAA batteries or rechargeable battery) voltage for the power supply is low. Replace the AAA batteries or recharge the rechargeable battery. This message is displayed when it detects the low voltage. Afterwards, a battery warning mark is displayed in the upper left of the screen.	2-12 2-16
54	Data & Settings initialized	Setting parameters have been initialized to the default values.	12-11

Communication Syntax Error Messages (100 to 199)

Code	Message	Description	Reference Page
102	Syntax error	Syntax error other than the ones listed below.	App-1 to App-57
103	Invalid separator	Separate each data with a “,” (comma).	App-1
104	Data type error	See pages A-5 to A-7. Use the correct the data type.	App-5 to App-7
108	Parameters not allowed	Check the number of parameters.	App-5 to App-7
109	Missing parameter	Specify the necessary parameter.	App-5 to App-7
111	Header separator error	Separate the header and the data with a space.	App-2
112	Program mnemonic too long	Check the mnemonic (character string consisting of letters and numbers).	App-9 to App-57
113	Undefined header	Check the header.	App-9 to App-57
114	Header suffix out of range.	Check the header.	App-9 to App-57
120	Numeric data error	Mantissa must be entered before the numeric value in <NR3> format.	App-5, App-6
123	Exponent too large	Use a smaller exponent in <NR3> format.	App-5 to App-57
124	Too many digits	Limit the number of digits to 255 or less.	App-5, App-57
128	Numeric data not allowed	Use a format other than <NRf> format.	App-5, App-57

Code	Message	Description	Reference Page
131	Invalid suffix	Check the units for <Voltage>, <Time>, and <Frequency>.	App-6
134	Suffix too long	Check the units for <Voltage>, <Time>, and <Frequency>.	App-6
138	Suffix not allowed	Units are not allowed other than for <Voltage>, <Time>, and <Frequency>.	App-6
141	Invalid character data	Enter one of the character strings in {..|..|..}.	App-9 to App-57
144	Character data too long	Check the character strings in {..|..|..}.	App-9 to App-57
148	Character data not allowed	Enter in a format other than the one in {..|..|..}.	App-9 to App-57
150	String data error	<Character string> must be enclosed by double quotation marks or single quotation marks.	App-6
151	Invalid string data	<Character string> is too long or contains characters that cannot be used.	App-9 to App-57
158	String data not allowed	Enter in a data format other than <character string>.	App-9 to App-57
161	Invalid block data	Cannot use <Block data>.	App-6 to App-57
168	Block data not allowed	Cannot use <Block data>.	App-6 to App-57
181	Invalid outside macro definition	OR100E does not support the macro functions specified in IEEE488.2.	—

Communication Execution Errors (200 to 299)

Code	Message	Description	Reference Page
221	Setting conflict	Check the relevant setting parameters.	App-9 to App-57
222	Data out of range	Check the setting range.	App-9 to App-57
223	Too much data	Check the data byte length.	App-9 to App-57
224	Illegal parameter value	Check the setting range.	App-9 to App-57
241	Hardware missing	Check the availability of options.	—
260	Expression error	Cannot use an equation.	—
270	Macro error	OR100E does not support the macro functions specified in IEEE488.2.	—
272	Macro execution error	OR100E does not support the macro functions specified in IEEE488.2.	—
273	Illegal macro label	OR100E does not support the macro functions specified in IEEE488.2.	—
275	Macro definition too long	OR100E does not support the macro functions specified in IEEE488.2.	—
276	Macro recursion error	OR100E does not support the macro functions specified in IEEE488.2.	—
277	Macro redefinition not allowed.	OR100E does not support the macro functions specified in IEEE488.2.	—
278	Macro header not found	OR100E does not support the macro functions specified in IEEE488.2.	—
280	The password cannot change	The previous password is incorrect. Enter the correct password.	—
281	Invalid password	Enter the correct password.	—
282	The password is not input	Enter the password.	—

Communication Query Error Messages (400 to 499)

Code	Message	Description	Reference
410	Query INTERRUPTED	Check the transmission and reception order.	App-2
420	Query UNTERMINATED	Check the transmission and reception order.	App-2
430	Query DEADLOCKED	Limit the length of the program message including the <PMT> to 1024 bytes or less.	—
440	Query TERMINATED after indefinite response	Do not enter queries after *IDN? or *OPT?.	—

System Error (Communication) (912 to 915)

Code	Message	Description	Reference
912	Fatal error in Communication-driver	Needs servicing.	—
914	Time out error in communication	Set the time out so that data can be received before the time out. Or, there may be a problem with the phone line.	—

Other (350, 390)

Code	Message	Description	Reference
350	Queue error	Read the error queue.	App-57
390	Overrun error (for RS-232 only)	Use a lower baud rate.	—

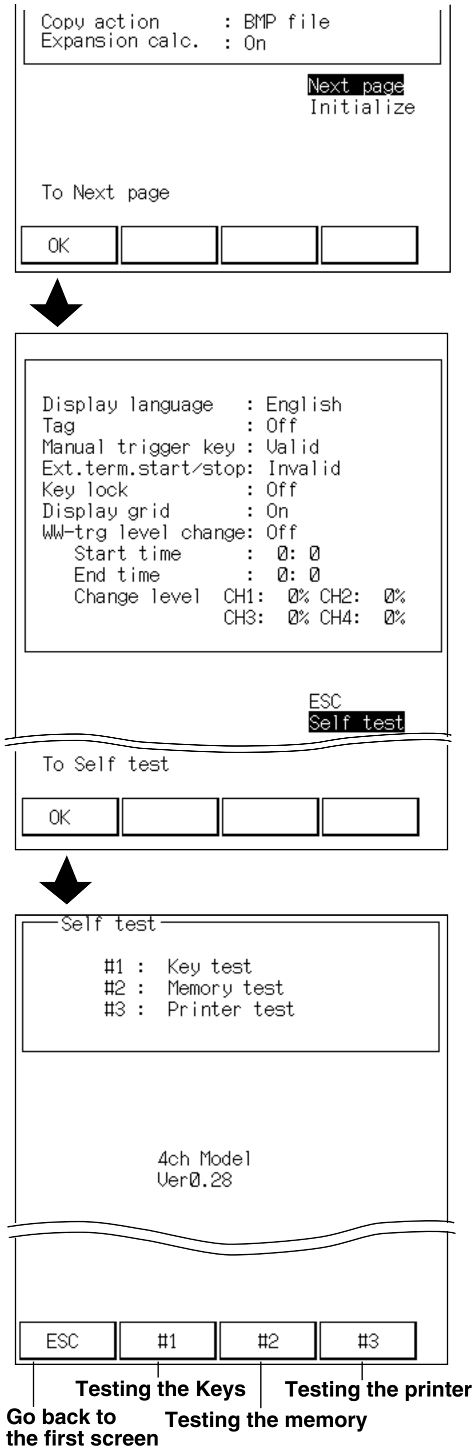
Note

Code (350) occurs when the error queue overflows. This error is notified only during the STATus:ERRor? query, and is not displayed on the screen.

13.3 Testing the Recorder

Setting screen

SYSTEM



Operating Procedure

1. Displaying the self-test screen

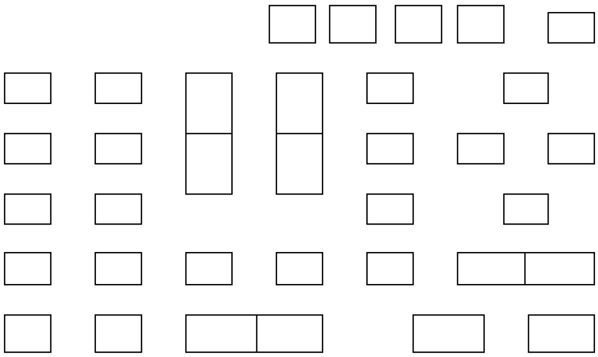
At the screen that appears when the “SYSTEM” key is pressed, highlight “Next page” and press the “F1” (OK) key.
Highlight “Self Test” and press the “F1” (OK) key. A screen for selecting the test items appears.

2. Selecting the self-test item.

Select the self-test item with the “F2” to “F4” keys.

Testing the Keys

This test checks whether the panel keys are operating properly.
Pressing the “F2” key at step 2 displays a representation of the panel keys on the screen. Pressing a key should highlight the corresponding key on the screen. If it does not, the keys may be malfunctioning. Contact your nearest YOKOGAWA dealer listed on the back cover of this manual.



To go back to the selection screen for the self-test, press the “FEED” key twice.

Testing the memory

CAUTION

If an "Aqd. memory" (Acquisition memory) error occurs, all measurement data will be deleted. You should therefore save necessary data to a Flash ATA memory card or other media before performing the selftest.

This test checks the memory function.
Pressing the "F3" key at step 2 will display the results of the memory test with a "OK" or "NG." If "NG" is displayed, the memory may be malfunctioning.

```
ROM         : OK
RAM         : OK
Aqd. memory : OK
```

Testing the printer

This test checks the printer.
Pressing the "F4" key at step 2 will record test patterns with the built-in printer. If white lines do not appear, the printer is okay. If it does, clean the printer head as described in 13.4 "Cleaning the Printer Head." If white lines still appear after cleaning, it may be malfunctioning.

13.4 Cleaning the Printer Head

The printer head will become dirty after long use. If the printouts are unclear and difficult to read, clean the printer head as described below.

1. Cut a section of the chart paper (20 to 30 cm) and apply rubbing alcohol on the backside of the paper. Then, load the paper with the backside facing down. (See 2.5 “Loading the Chart.”)
2. With the release lever down, move the chart paper back and forth by hand to clean the printer head.

14.1 Measurement Input

Input type

Floating, unbalanced input, isolated channels

Input coupling

DC/GND

A/D resolution

12 bit (internal processing resolution equivalent to 11 bit)

Maximum sampling rate

400 Ks/s (all channels simultaneously, 80 kS/s for wave window mode)

Input impedance

1 MΩ±1 %, 5 pF(At 40 kHz, Typical*)

* : Typical values represent typical or average values. It is not strictly guaranteed.

Scaling function

Available

Input terminal

Safety terminal type (for banana plug)

Maximum input voltage

Between input terminal HI and LO

Overvoltage category*1	Maximum Input Voltage
CAT II environment	500 Vrms
CAT III environment	300 Vrms

*1 : CAT II environment
Environment represented by research laboratories and offices. Local level, equipment, transportable equipment (Primary side of an equipment having a power cord that connects to the power outlet)
CAT III environment
Power distribution level of a building or a factory. Primary power supply system level (Primary side of an equipment receiving electricity directly from the distribution board or from the branch section to the power outlet)

Maximum floating voltage

Between input terminals HI, LO and the ground

Overvoltage category*1	Maximum Input Voltage
CAT II environment	500 Vrms
CAT III environment	300 Vrms

*1 : CAT II environment
Environment represented by research laboratories and offices. Local level, equipment, transportable equipment (Primary side of an equipment having a power cord that connects to the power outlet)
CAT III environment
Power distribution level of a building or a factory. Primary power supply system level (Primary side of an equipment receiving electricity directly from the distribution board or from the branch section to the power outlet)

DC coupling

Measurement range and accuracy

As shown below (23±5 ˚C, after zero calibration after 30-minute warm-up, DC coupling)

measuring range(time/div)	actual measuring range	accuracy
100 mV FS(10 mV/div)	±100.0 mV	±(1 % of FS+1 mV)
200 mV FS(20 mV/div)	±200.0 mV	±(1 % of FS+1 mV)
500 mV FS(50 mV/div)	±500.0 mV	±(1 % of FS+1 mV)
1 V FS(100 mV/div)	±1.000 V	±(1 % of FS+1 mV)
2 V FS(200 mV/div)	±2.000 V	±(1 % of FS+1 mV)
5 V FS(500 mV/div)	±5.000 V	±(1 % of FS+1 mV)
10 V FS(1 V/div)	±10.00 V	±(1 % of FS+1 mV)
20 V FS(2 V/div)	±20.00 V	±(1 % of FS+1 mV)
50 V FS(5 V/div)	±50.00 V	±(1 % of FS+1 mV)
100 V FS(10 V/div)	±100.0 V	±(1 % of FS+1 mV)
200 V FS(20 V/div)	±200.0 V	±(1 % of FS+1 mV)
500 V FS(50 V/div)	±500.0 V	±(1 % of FS+1 mV)
1000 V FS(100 V/div)	±500 V	±(1 % of FS+1 mV)

Zero position

Variable within measurement range, with NULL function (10 % of measurement range or less)

Temperature coefficients

Zero point ±(0.04 % of FS)/ ˚C

Gain ±(0.02 % of FS)/ ˚C

Frequency characteristics (filter off)

DC to 40 kHz (+1/-3 dB, Typical*)

* : Typical values represent typical or average values. It is not strictly guaranteed.

Common mode rejection ratio

85 dB or more (50/60 Hz, signal source resistance less than 500 Ω)

Low pass filter

Filter can be turned ON/OFF (except for harmonic analysis mode)

Cutoff frequency : 5 Hz, 500 Hz

Filter characteristics : -6 dB/octave

Noise (filter off, input shorted at 10 mV/div)

2.0 mVp-p (Typical*)

* : Typical values represent typical or average values. It is not strictly guaranteed.

RMS (OR300E)

Measurement range and accuracy

As shown below (23±5 ˚C, after zero calibration after 30-minute warm-up, RMS)

measuring range(time/div)	actual measuring range	accuracy
100 mV FS(10 mV/div)	100.0 mV rms	±(2 % of FS+1 mV)
200 mV FS(20 mV/div)	200.0 mV rms	±(2 % of FS+1 mV)
500 mV FS(50 mV/div)	500.0 mV rms	±(2 % of FS+1 mV)
1 V FS(100 mV/div)	1.000 V rms	±(2 % of FS+1 mV)
2 V FS(200 mV/div)	2.000 V rms	±(2 % of FS+1 mV)
5 V FS(500 mV/div)	5.000 V rms	±(2 % of FS+50 mV)
10 V FS(1 V/div)	10.00 V rms	±(2 % of FS+50 mV)
20 V FS(2 V/div)	20.00 V rms	±(2 % of FS+50 mV)
50 V FS(5 V/div)	50.00 V rms	±(2 % of FS+50 mV)
100 V FS(10 V/div)	100.0 V rms	±(2 % of FS+0.1 V)
200 V FS(20 V/div)	200.0 V rms	±(2 % of FS+0.1 V)
500 V FS(50 V/div)	500.0 V rms	±(2 % of FS+0.1 V)
1000 V FS(100 V/div)	500 V rms	±(2 % of FS+0.1 V)

Temperature coefficients

Zero point ±(0.04 % of FS)/ ˚C

Gain ±(0.02 % of FS)/ ˚C

Frequency characteristics

DC, 40 Hz to 1 kHz

Response Time (against the step input of 0 to 100%)

Rising (from 0% of FS to 90% of FS) : 200 msec (Typical)

Falling (from 100% of FS to 10% of FS) : 310 msec (Typical)

* : Typical values represent typical or average values. It is not strictly guaranteed.

Crest Factor

2 (Measurement range RMS value within 90% of the f.s. at CF2)

Harmonic Analysis (OR300E)

Anti-aliasing filter

5th order LPF (fc=7.5 kHz, -30 dB/oct)

Influence to the bandwidth under analysis due to the aliasing -40 db or more *1*3

Amplitude accuracy (voltage, current)*1

Fundamental to the 20th order harmonics: ±(1.5% of rdg + 1.5 % of FS)

The 21st to the 40th order harmonics: ±(1.5% of rdg + 2 % of FS)

Phase accuracy (voltage, current - phase difference with respect to the fundamental waveform)*1*2

The 2nd to the 10th order harmonics: ±5 deg

Then 11th to the 40th order harmonics: ±15 deg

*1: at 50, 60 Hz fixed mode, excluding the current clamp accuracy

*2: Harmonic amplitude: at FS/100 or higher

*3: Automatic setting for harmonic mode only

Temperature Measurement

When using the temperature input adapter 788041-1

Measurement range and accuracy

As shown below (23±5 °C, after a 30-minute warm-up and zero calibration, sensor accuracy excluded)

Measurement range	Actual Measurement Range	Accuracy
200 °C	-50 °C to 200 °C	±2 °C
400 °C	-50 °C to 400 °C	±3 °C
600 °C	-50 °C to 600 °C	±5 °C

Input type

Unbalanced input

Linear type

Linear approximation using analog circuits

Thermocouple type

Type K

Input terminal

Clamp terminal

Measuring temperature range

-50 °C to 600 °C

Linear output voltage

5 mV/°C

Maximum input voltage

42 V (DC+AC peak)

Maximum common mode voltage

42 V (DC+AC peak)

Environment in which the temperature measurement adapter 788041 is to be used

Operating temperature : 5 °C to 40 °C
Operating humidity : 35% to 80%
Storage temperature : -20 °C to 60 °C
Storage humidity : 90% or less

Response characteristics

Rising and falling : Within 2 s (sensor response excluded)

Power consumption of the temperature measurement adapter 788041

Power supply : Supplied by the OR100E/300E
Power consumption : 100 mΩ or less

14.2 Memory Function

Time axis

200, 500 μ s/div

1, 2, 5, 10, 20, 50, 100, 200, 500 ms/div

1, 2, 5, 10, 30 s/div

1, 2 min/div

Time axis resolution

80 point/div

Measurement period

1/80 of the time axis

Memory length

OR100E, standard 10, 20, 50, 100, 200, 400, 800[*1], 1600[*2] div

OR100E, long memory option and OR300E

10, 20, 50, 100, 200, 400, 800, 1600, 3200[*1], 6400[*2] div

*1 : Two channels are linked. Only odd channels can be used

*2 : Four channels are linked. Only one channel can be used

Number of memory blocks

Maximum 32 blocks. Depends on installed memory, memory length setting, whether or not wave window trigger is used.

Time-axis accuracy

±0.02 %

Memory data output

Display, recording, RS232 communication, external memory through the PCMCIA I/F, Modem communication

Auto functions

Auto print, auto display, auto statistical calculation, auto save (external memory), auto dial (FAX modem)

Cursor functions

1 cursor : Simultaneous display of measurement values on all channels

2 cursors : Difference in time or measurement values on any channel, or frequency

Zoom in/out function

Time axis : ×2, ×1, ×1/2 to 1/1000 (Zoom out factor varies according to the memory length)

Y-axis : ×5, ×2, ×1, ×2/3, ×1/2

Cursor calculation function

T-Y mode : Max, Min, Ave, RMS, area values in the range specified by the cursors

X-Y mode : Area of the range specified by the cursors

14.3 Recording

Recording Section

Printer type
Thermal printer

Chart paper
Roll paper (width 111 mm × 10 m)

Valid recording width
104 mm (832 dots)

Paper feed Accuracy
±3 %

Chart speed
2, 5, 10, 30 s/div
1, 2, 5, 10, 30 min/div
1 hour/div

Recording Format

T-Y recording
Analog 4 ch + logic 8 bit   1, 2, 4 zone recording
(Recording of each bit can be turned ON/OFF individually on logic channel)

Digital recording
Analog 4 ch + logic Records measurement data in digital values

X-Y recording
X-axis fixed to channel 1
Recording style 8 div × 8 div (80 mm × 80 mm)
Recording style Dot/Line selectable

Printing Function

Print items
List (setting), scale (unit), time marker, chart speed, chart speed change position marker, trigger detection position, trigger time, trigger detection channel, grid, channel No., TAG, and so on

List
List of setting parameters

Grid
Fine/Simple/off selectable

Scale (gage)
Prints the scale value and unit for each channel

Time, time print position

Prints the time at the start of the recording and the time in 50 mm intervals

Comments

Prints character strings (20 characters/ch) or channel information every 100 mm intervals

Chart speed

Chart speed at the start of the recording, chart speed change marker, and the chart speed after the change

Chart speed change position

Prints the new chart speed

Channel No.

Prints channel numbers or TAG name (7 characters/ch) on the waveform

Record length

20 div, 200 div, 800 div*, continuous

* : for /L1 or /L2 model.

Record line type

Thin, medium, thick (analog waveform)

14.4 Realtime Recorder & Memory

Overview of operation

Normally, realtime record and start data capturing when trigger is detected.

Operation mode

Single, repeat

Single : After data capturing, return to realtime recording.

Repeat : After data capturing, return to realtime recording and wait for trigger.

If the operation after data capturing is set to print output or FAX transmission, the realtime recording is aborted after capturing the measurement data, the data is displayed, printed, or sent over the FAX modem, and the realtime recording is resumed.

14.5 Trigger

Normal Trigger

Trigger source

Analog channels 1 to 4, logic AB, external trigger input, manual, timer

Trigger mode

Free, single, repeat

Trigger combination (condition)

AND or OR of each trigger condition

Trigger type

Analog channel: Rise, Fall, High, Low, Bi-slope

Level window: in, out

Logic channel

AND or OR of the edge or level of each bit

Trigger level setting

1 %FS increment

Trigger filter

Filter or timeout (except for bi-slope)

Trigger delay

-100 % to 100 % (1 % increment)

Wave Window Trigger

Trigger mode

Wave window single, Wave window repeat

Target frequency

50, 60 Hz

Trigger combination (condition)

OR of each analog channel

Method to create reference signal

By specifying parameters, or from the current input

Reference signal parameter

Amplitude, width, offset (1 % increment), phase (1 degree increment)

Trigger delay

-100 % to 100 % (1 % increment)

Sample rate

80 kS/s (1 ms/div), 40 kS/s (2 ms/div), 16 kS/s (5 ms/div), 8 kS/s (10 ms/div)

Memory length

Memory cannot be linked, maximum memory length of each channel is 200 div (800 div for OR300E or /L1, /L2 models of OR100E)

14.6 Display

Screen

5.7 inch LCD

Dot

480 × 320 dots

Contrast adjustment

Available

Back lighting

FL tube ON/OFF manually

Display language

English/Japanese

Display format

T-Y display

Overlap analog input waveforms and logic input waveforms

Set each bit to ON/OFF on logic input waveform

X-Y display

X-axis : channel 1, Y-axis : channel 2 to 4

Digital value display

Display measurement values as numerical values

14.7 Harmonic Analysis (OR300E)

Waveform Analysis Mode Section

Description of operation

1 CH of harmonic analysis function added to the operation conforming to the memory mode

Target frequency

50 Hz, 60 Hz

Sample rate

25600 S/s (50 Hz), 30720 S/s (60 Hz)

Memory recording length

5, 10, 25, 50, 100, 250, 500, 1000 cycle

Analysis Operation

After taking the measurement, analyze the waveform after specifying the target position using the key operation.

Analyzed parameters

RMS value of harmonics, relative harmonic content, phase angle for each order of each channel; and the total RMS value, total harmonic distortion (IEC, CSA)

Display

Bar graph display (all harmonics displayed at once, switching Lin/Log available for RMS values only) or chart format (switch the display of the even and odd order)

Automatic Analysis Mode Section

Description of operation

Display the result of the analysis after measure one wavelength
Function to save the result of the analysis to the PC card available

Target frequency

50 Hz, 60 Hz, automatic estimation (45.0 Hz to 65.0 Hz)

Trigger

Operation: Free, repeat, single
Parameters: Harmonic distortion or relative harmonic content

Analysis Operation

After making the measurement, automatically display the result of the analysis

Analyzed parameters

RMS value of harmonics, relative harmonic content, phase angle for each order of each channel, and the total RMS value, total harmonic distortion (IEC, CSA)
Harmonic power, relative harmonic content, harmonic phase angle for single-phase two-wire system, single-phase three-wire system, and three-phase three-wire system; and the active power, apparent power, reactive power, power factor

Display

Bar graph display (all harmonics displayed at once, switching Lin/Log available for RMS values only) or chart format (switch the display of the even and odd harmonics)

14.8 Other Specifications

External I/O Interface

Terminal

Screw-less terminal

External trigger input

TTL-level or contact point (pulse width 2 μs or more)

External sampling clock input (up to 100 kHz) selectable

External trigger output

TTL-level (pulse width 2 ms, for synchronous operation)

RS-232 Interface

Connector

9 pin DSUB connector (male)

Electrical characteristics

Conforms to EIA RS-232

Baud rate

1200, 2400, 4800, 9600, 19200 bps

Synchronization

Start-stop synchronization

Functional specification

Input/Output setup data, output measurement data

External OR100E control except POWER ON/OFF

PC Card Interface

External memory

Supported cards :	Flash ATA memory card
Supported card capacity :	Maximum 40 MB
Functional specification :	Save setup data, measurement data, screen image
Save format :	ASCII, Binary, BMP

Modem communication

Supported cards :	FAX/Modem card
Baud rate :	Maximum 19200 bps
FAX control :	Class 2 card
Functional specification :	Sending measurement data, receiving setting commands, automatic sending of measurement data (FAX only)

14.9 General Specifications

Measurement mode

Memory mode, realtime mode, realtime & memory mode, harmonic analysis mode

Number of channels

Analog : 2 or 4 channels

Logic : 8 bits (connects up to two 4-bit probes)

Internal memory capacity

OR100E standard: 32 kdata/ch (64 kdata/2 ch linking, 128 kdata/4 ch linking)

OR100E with long memory option and OR300E: 128 kdata/ch (256 kdata/2 ch linking, 512 kdata/4 ch linking)

Internal memory type

SRAM (with battery backup)

Power supply

Commercially sold AAA Alkaline dry cells, dedicated AC adapter, dedicated DC/DC converter, dedicated NiMH battery pack

Recharging the dedicated NiMH battery pack can be done inside the recorder only

AC adapter or DC/DC converter has priority over battery when both are used simultaneously

External power supply input by the AC adapter: 12 V±10 %

Dedicated AC adapter (sold separately)

Rated power supply voltage :	100 to 240 VAC
Permissible supply voltage range :	90 to 264 VAC
Rated supply voltage frequency :	50/60 Hz
Permissible supply voltage frequency range :	48 to 62 Hz
Maximum power consumption :	70 to 90 VAC
AC adapter rated output voltage :	12 VDC
AC adapter maximum rated output current :	2.6 A

DC/DC converter (sold separately)

Permissible power supply voltage :	788025-1	9 VDC to 18 VDC
	788025-2	18 VDC to 36 VDC
Output voltage range :	12 VDC ±5 % 20 VA MAX	

Dedicated NiMH battery pack (sold separately)

2100 mAh, 7.2 V

Number of recharges (cycle life) : About 300 times (depends on environment)

AAA dry cell batteries

AAA Alkaline dry cells (JIS, IEC model No.: LR6) 6 batteries

Recharge function of the dedicated NiMH battery pack

Use dedicated battery pack, connect dedicated AC adapter, turn OFF power switch for recharge mode. Recharge time about 1.5 hours.

Power consumption

When using AC adapter : 25 VA Max.

When using batteries : 20 VA max.

Warm-up time

30 minutes

Withstand voltage

Between OR100E/OR300E and power line of dedicated AC adapter :
2 kVAC for 1 min.

Between OR100E/OR300E and analog input terminal : 2 kVAC for 1 min.

Between input terminals : 2 kVAC for 1 min.

Insulation resistance

Between OR100E/OR300E and power line of dedicated AC adapter :
10 MΩ or more at 500 VDC.

Between OR100E/OR300E and analog input terminal : 100 MΩ or more at 500 VDC.

Between input terminals : 100 MΩ or more at 500 VDC

Permissible signal source resistance

500 Ω or less

Environment

Operating temperature and humidity :	(except wet-bulb temperature 29 ˚C or less, no condensation. NiMH battery excluded)
Storage temperature and humidity :	(except wet-bulb temperature 29 ˚C or less, no condensation. NiMH battery, Alkaline dry cells excluded)
Operating altitude :	2000 m or less
Acoustic noise :	65 dB or less
Positioning :	horizontal ±5 ˚

Time accuracy

±100 ppm (typical*)

* : Typical values represent typical or average values.
It is not strictly guaranteed

Battery backup

Setting values, measurement data, backup lithium battery for clock

Backup lithium battery life

About five years (at room temperature)

External dimensions

About 256 (H) × 190 (W) × 46 (D) mm

Weight

OR122/OR322 (2-channel model) Approx 1.3 kg (batteries, chart excluded)

OR142/OR342 (4-channel model) Approx 1.5 kg (batteries, chart excluded)

Accessories

Chart paper (Roll paper 111 mm × 10 m, part No. B9988AE) 1 roll

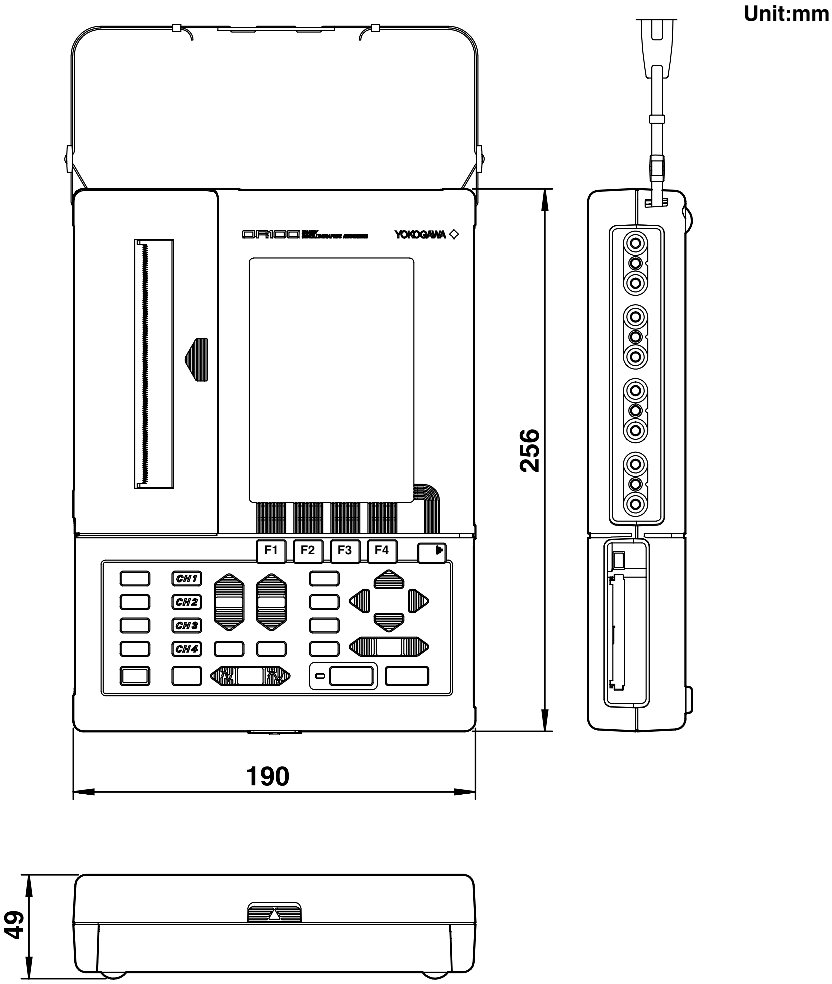
Measurement lead (Model No. 366963) 1 lead per channel

AAA Alkaline Dry Cells (Part No. A1070EB) 6 batteries

Belt (Part No. B9988CK) 1 set

Instruction manual 1 copy

14.10 External Dimensions



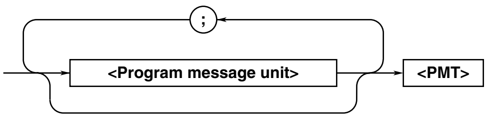
If not specified, the tolerance is ±3%.
However, in cases of less than 10mm, the tolerance is ±0.3mm.

Appendix 1 Communication Commands

Appendix 1.1 Before programming Messages

Messages

The communication between the controller and the recorder is done in blocks of data called messages. Messages sent from the controller to this recorder are called program messages, and messages received by the controller from this recorder are called response messages.
If a program message contains a query command (a command which requests a response), the recorder returns a response message. A single response message is always returned in response to a program message.



Program Messages

As explained above, program messages are sent from the controller to this recorder. The format of a program message is shown below.

<Program message unit>

A program message consists of zero or more program message units; each unit corresponds to one command. This recorder executes the commands in the order that they are received.
Each program unit is separated by a ";" (semicolon).
For a description of the format of the program message unit, see the explanation given in the next section.
Example

```
:CHANNEL1:INPUT DC;RANGE 100MV<PMT>
```

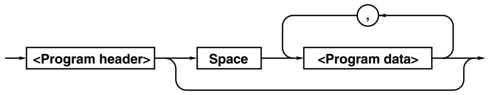
Unit Unit

<PMT>

PMT is a terminator used to terminate each program message. For the OR100E, CR (ODH) LF (0AH) will be the terminator.

Program message unit format

The format of a program message unit is shown below.



<Program header>

The program header contains the command type. For details, see page App-3.

<Program data>

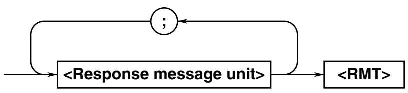
If there are certain conditions for executing a command, they are placed in the program data. The program data follows the program header and is separated from the program header by a space (ASCII code 20H). If there are multiple data, they are separated by a "," (comma). For details, see page App-5.

Example `:MENU:MODE MEMORY<PMT>`

Unit Data

Response Messages

Response messages are returned by the recorder to the controller. The format of a response message is shown below.



<Response message unit>

A response message consists of one or more response message units; each response message unit corresponds to one response.
Each response unit is separated by a ";" (semicolon).
For a description of the format of the response message unit, see the next page.
Example

```
:CHANNEL1:INPUT DC;RANGE 2.000E+00<PMT>
```

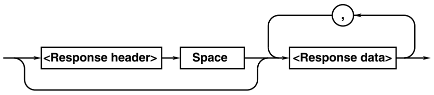
Unit **Unit**

<RMT>

RMT is a terminator used to terminate each response message.
CR (ODH) LF (0AH) will be the terminator.

Response message unit format

The format of a response message unit is shown below.



<Response header>

A response header sometimes precedes the response data. Response data is separated from the header by a space. For details, see App-3.

<Response data>

Response data contains the contents of the response. If there are multiple data, they are separated by a "," (comma). For details, see page App-5.

Example

```
2.000E+00<PMT>
```

Data

```
:CHANNEL:SCALing:MODE OFF
```

Header **Data**

If a program message contains multiple queries, the responses are made in the same order as the queries. Most queries return only one response message unit, but there are exceptions. This means that the 'n'th response unit does not necessary correspond to the 'n'th query.

To be certain that the response message unit corresponds to the correct program message unit, place one query in a program message.

<Notes when transmitting messages>

- You can send the next message at any time, if the previously sent message did not contain any queries.
- If the previous message contained a query, you cannot send the next message until the entire response message is received. If you do send a message, an error will occur and the response message that was not received will be discarded.
- If the controller tries to receive a response message when there is none, an error will occur. This also applies, if the controller tries to receive a response message before it is done sending the program message.
- If a program message contains multiple units and some of the units are incomplete, this recorder will attempt to pick up the complete units and execute them. However, these attempts may not always be successful, and some responses may not be returned even if the program message contained queries.

Dead lock

This recorder has buffer memories for program and response messages. Each buffer has at least 1024 bytes of area. (The number of bytes available will vary depending on the operating condition of the recorder.) If both memories become full at the same time, the recorder becomes inoperative. This condition is called a dead lock. To resume the operation, discard the response message.
Dead lock will not occur, if the size of the program message including the PMT is kept below 1024 bytes. Dead lock never occurs if the program message does not contain a query.

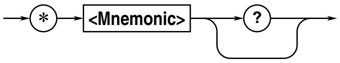
Commands

Commands

There are two types of commands (program headers) that can be sent from the controller to the recorder. They differ in the format of their program headers.

Common Command Header

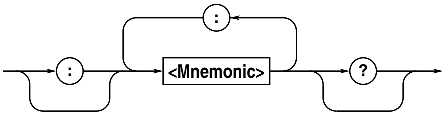
Commands defined in IEEE 488.2-1987 are called common commands. The header format of a common command is shown below. An “*” (asterisk) always precedes a common command.



An example of a common command : `*CLS`

Compound Header

Dedicated commands designed to be used only with this recorder are classified and arranged in a hierarchy according to their functions. The format of a compound header is shown below. A “:” (colon) is used to specify a lower level header.



An example of a compound header
`:CHANNEL1:NULL OFF`

Note

A mnemonic is a character string made up of alphanumeric characters.

When Concatenating Commands

Command Group

A command group is a group of commands which have the same compound header. A command group may contain sub-groups.

Example Commands relating to system

```
SYSTEM?              SYSTEM:CLOCK?
SYSTEM:CACTion       SYSTEM:CLOCK:DATE
SYSTEM:EXTernal?     SYSTEM:CLOCK:TIME
```

When Concatenating Commands of the Same Group

This recorder stores the hierarchical level of the command which is currently being executed, and performs analysis on the assumption that the next command will also belong to the same level. Therefore, you may omit the header if the commands belong to the same group.

Example
```
:CHANNEL1:INPUT DC;
RANGE 100V<PMT>
```

When Concatenating Commands of Different Groups

Include a “:” (colon) before the header, if the following command does not belong to the same group as the preceding command.

Example
```
:CHANNEL1:INPUT DC;:
MENU:MODE MEMORY
```

When Concatenating Common Commands

Common commands defined in IEEE 488.2-1987 are independent of hierarchy. “:” (colon) is not necessary before a common command.

Example
```
:CHANNEL1:INPUT DC;*CLS;
TRIGGER:MODE FREE
```

App

Appendix

When Separating Commands with <PMT>

If a terminator is used to separate two commands, each command is a separate message. Specify the command header for each command even when the commands from the same command group are being concatenated.

Example :

```
CHANNEL1:INPUT DC<PMT>CHANNEL1:
RANGE 20V<PMT>
```

Upper-level Query

A query with a "?" (question mark) on the top-most-level command in a group is called an upper-level query. Executing an upper-level query allows all the setting parameters in the group to be received at once. Some query groups comprising more than three hierarchical levels output all their lower level settings.

Example : `CHANNEL1?<PMT>→:`
`CHANNEL1:INPUT DC;`
`RANGE 10.000E+00;NULL OFF`

A response to an upper-level query can be sent exactly as it was received, as a program message to the recorder. This allows the settings that existed at the time of the query to be restored. However, Some upper-level queries will not return setting information that is not currently in use. Please be aware that not all the group's information is output as a response.

Header Interpretation Rules

This recorder interprets a received header according to the following rules.

Mnemonics are not case sensitive.
Example `TRIGger` can also be written as `trigger` or `Trigger`

The lower-case portion of a header can be omitted.
Example `TRIGger` can also be written as `TRIGGE` or `TRIG`

The "?" (question mark) at the end of the header denotes a query. You can not omit the "?" (question mark).
Example `TRIGger?` cannot be abbreviated to anything shorter than `TRIG?`.

If the "x" (numeric value) at the end of the header is omitted, it is assumed to be "1."
Example If `CHANnel<X>` is written as `CHAN` , this represents `CHANnel1`.

Response

Response

On receiving a query from the controller, this recorder returns a response message to the controller. A response message is sent in one of the following two forms.

Response consisting of a header and data
If the response can be used as a program message as it is, the response message will include the header.

Response consisting of data only
If the response cannot be used as a program message as it is (it is a query-only command), the response message will include only the data. However, some query-only commands will include a header.

Example : STATUS:ERROR?<PMT>→
0,"NO ERROR"<RMT>

When you want a response without a header

You can have the header removed from a response that has a header and data by using the COMMunicate:HEADer command.

Abbreviated form

Usually, the lower-case letter portion of a response header is abbreviated when it is returned. You can have it not abbreviate the lower-case letters by using the COMMunicate:VERBose command.

Data

Data

The data section comes after the header. A space must be included between the header and the data. The data contains conditions and values. It is classified as follows.

Data	Description
<Decimal>	Value expressed as a decimal number (Example: Trigger delay value →TRIGger:DELay 20)
<Voltage><Time><Frequency>	Physical value (Example: Measurement range of CH2 →CHANnel2:RANGe 100MV)
<Register>	Register value expressed in binary, octal, decimal, or hexadecimal (Example: Extended event register value →STATus:EESE #HFE)
<Character data>	Specified character string (mnemonic). Select from { } (Example: CH1 input selection →CHANnel1:INPut {OFF|DC|GND}
<Boolean>	Indicates ON/OFF. Specify with [ON], [OFF], or a value. (Example: Turn ON CH3 scaling →CHANnel3:SCALing:MODE ON)
<Character string data>	Arbitrary character string (Example: CH4 Tag string →CHANnel4:TAG "ABCDEF")
<Block data>	Arbitrary 8-bit data (Example: Response containing captured waveform data →#800000010ABCDEFGHIJ)

<Decimal>

<Decimal> indicates a value expressed as a decimal number, as shown in the table below. Decimal values are given in NR form specified in ANSI X3.42-1975.

Symbol	Description	Example
<NR1>	Integer	125 -1 +1000
<NR2>	Fixed point number	125.0 -.90 +001
<NR3>	Floating point number	125.0E+0 -9E-1 +.1E4
<NRf>	Any of the forms <NR1> to is allowed.	

<NRf> represents the case when any of the forms <NR1> to <NR3> can be used.
The recorder accepts decimal values from the controller in any form <NRf>.

The form, <NR1> to <NR3>, used for the response message is determined for each query. The same form is used irrespective of whether the value is large or small.

When using <NR3>, the "+" after the "E" can be omitted, but the "-" cannot be.
If a value outside the setting range is specified, the closest valid value will be used.
If the value specified is beyond the precision of the recorder, the value will be rounded.

<Voltage>, <Time>, <Frequency>

<Voltage>, <Time>, and <Frequency> indicate decimal values which have physical significance. <Multiplier> or <Unit> can be attached to the <NRf> form. The values are specified in any of the following forms.

Form	Example
<NRf><Multiplier><Unit>	5MV
<NRf><Unit>	5E-3V
<NRf><Multiplier>	5M
<NRf>	5E-3

<Multiplier>

The following multipliers are available.

Symbol	Word	Description
EX	Exa	10^{18}
PE	PEPeta	10^{15}
T	Tera	10^{12}
G	Giga	10^{9}
MA	Mega	10^{6}
K	Kilo	10^{3}
M	Mili	10^{-3}
U	Micro	10^{-6}
N	Nano	10^{-9}
P	Pico	10^{-12}
F	Femto	10^{-15}
A	Atto	10^{-18}

<Unit>

The following units are available.

Symbol	Word	Description
V	Volt	Voltage
S	Second	Time
HZ	Hertz	Frequency
MHZ	Megahertz	Frequency

<Multiplier> and <Unit> are not case sensitive.
"U" is used to indicate "µ."
"MA" is used for Mega (M) to distinguish it from Mili, except for Megahertz, which is expressed as "MHZ." Hence, "M" (Mili) cannot be used for Hertz.
If both <Multiplier> and <Unit> are omitted, the default unit will be used.
Response messages are always expressed in the <NR3> form. The default unit is used without the <Multiplier> or the <Unit>.

<Register>

<Register> is an integer, and can be expressed in hexadecimal, octal, or binary besides decimal. <Register> is used when each bit of a value has a particular meaning. It is expressed in one of the following forms.

Form	Example
<NRf>	1
#H<Hexadecimal value made up of digits 0 to 9 and A to F>	#H07
#O<Octal value made up of digits 0 to 7>	#q777
#B<Binary value made up of digits 0 and 1>	#B001100

<Register> is not case sensitive.
Response messages are always expressed in the <NR1> form.

<Character Data>

<Character data> is a data of specific characters (mnemonic). It is mainly used to indicate options and is chosen from character strings given in { }.
For interpretation rules, see "Header Interpretation Rules" on page App-4.

Form	Example
`{AC|DC|GND}`	`AC`

As with the header, the "`COMMunicate:VERBose`"command can be used to select a full response or an abbreviated response.
The "`COMMunicate:HEADer`" command has no effect on <character data>.

<Boolean>

<Boolean> is a type of data that indicates ON or OFF, and is expressed in one of the following forms.

Form	Example
{ON|OFF|<NRf>}	ON OFF 1 0

When expressing <Boolean> in <NRf> form, OFF is selected if the rounded integer value is “0” and ON is selected if the rounded integer is “non 0.”
A response message is always “1” if the value is ON and “0” if it is OFF.

<Character String Data>

<Character string data> is an arbitrary character string unlike the <character data>, which uses only specific characters. The character string must be enclosed in single quotation marks (‘) or double quotation marks (“).

Form	Example
<Character string data>	‘ABC’ “IEEE488.2-1987”

If a character string contains a double quotation mark (”), use two double quotation marks (””) to indicate it. This rule also applies to a single quotation mark within a character string.
Response messages always use double quotation marks (”) around the character string.
Since <Character string data> is an arbitrary character string, leaving the end quotation mark (’) or double quotation mark (”) will cause the recorder to interpret the program message unit as part of the <character string data>. As a result, errors may not be detected properly.

<Block Data>

<Block data> is an arbitrary 8-bit data. <Block data> is used only in response messages. It is expressed in the following form.

Form	Example
<N-digit decimal value><Data byte string>	#6000010ABCDEFGHIJ

#N
Indicates that the data is <Block data>.
<N-digit decimal value>
Indicates the number of bytes of data. (000010 = 10 bytes)
<Data byte string>
Indicates the actual data. (ABCDEFGHIJ)
Data is comprised of 8-bit values (0 to 255). This means that ASCII code “CR” which is “0DH” and “LF” which is “0AH” can also be included as part of the data. Be sure the controller can distinguish between the data and the message terminators.

Synchronization with the Controller

Synchronization methods

There are cases when events other than communication events such as trigger occurrence that cause a command sent later to be executed before the completion of a command sent earlier. For example, if you want to query measurement data captured using single trigger mode, sending the following command would not suffice. The command "DATA:CHANnel1:SEND?" is executed whether or not the capturing has completed and may result in command execution error.

```
TRIGger:MODE SSINgle;:STARt;:
DATA:CHANnel1:SEND?<PMT>
```

To overcome this problem, following methods can be used to synchronize to the end of the data capturing.

Using STATus:CONDition? query

"STATus:CONDition?" is a command for querying the contents of the condition register. Whether the data capturing is in progress or not can be determined by reading bit 0 of the condition register. If bit 0 is "1," data capturing is in progress. If it is "0," data capturing is stopped.

Example
```
TRIGger:MODE
SINGLe;:ACTion:STARt1<PMT>
STATus:CONDition?<PMT>
```
(Read the response. If bit 0 is "1", go back one line.)
DATA:CHANnel1:SEND? will not be executed until bit 0 of the condition register becomes "0."

Using COMMunicate:WAIT command

"COMMunicate:WAIT" is a command used to wait for certain events to occur.

Example
```
STATus:FILTer1
FALL;:STATus:EESR?;:TRIGger:MODE
SINGle;:ACTion:STARt1<PMT>
```
(Read the response to STATus:EESR?)
```
COMMunication:WAIT 1;:DATA:
CHANnel1:SEND?<PMT>
```

"STATus:FILTer1 FALL" indicates that the transit filter is set so that bit 0 (FILTer) of the extended event register is set to "1" when bit 0 of the condition register changes from "1" to "0."
"STATus:EESR?" is used to clear the extended event register.
"COMMunicate:WAIT 1" indicates to wait for bit 0 of the extended event register to change to "1."
"DATA:CHANnel:SEND?" will not be executed until bit 0 of the extended event register changes to "1."

Appendix 1.2 Commands

Command	Description	Page
ACTion Group		
:ACTion:ADJust	Executes zero adjust.	App-16
:ACTion:AUTorange	Executes auto range	App-16
:ACTion:LCDLight	Sets/queries the ON/OFF condition of the LCD back lighting	App-16
:ACTion:PRINt<X>	Starts printer-related operation	App-16
:ACTion:STARt<X>	Starts a memory operation such as measurement, display, and recording	App-16
:ACTion:STOP	Stops/aborts operations such as measurement, display, and recording	App-16
:ACTion:TDIV	Set/queries the time axis rate of the monitor screen	App-16
BLOCK Group		
:BLOCk?	Queries all the memory block settings	App-17
:BLOCk:ACTual?	Queries the number of blocks already sampled	App-17
:BLOCk:CURRent	Sets/queries the current block number	App-17
CHANnel Group		
:CHANnel<X>?	Queries the settings for the specified channel	App-18
:CHANnel<X>:COMMent	Sets/queries the annotation message for the specified channel	App-18
:CHANnel<X>:FILTer	Sets/queries the filter for the specified channel	App-18
:CHANnel<X>:INPut	Sets/queries the input to the specified analog channel	App-18
:CHANnel<X>:LOWScale	Sets/queries the lower limit scale for temperature measurements	App-19
:CHANnel<X>:MAGNi	Sets/queries the Y-axis zoom factor for the specified channel	App-19
:CHANnel<X>:NULL	Sets/queries the NULL for the specified channel	App-19
:CHANnel<X>:POSition	Sets/queries the zero point for the specified channel	App-19
:CHANnel<X>:RANGe	Sets/queries the measurement range for the specified channel	App-19
:CHANnel<X>:SCALing?	Queries all setting values relating to scaling	App-20
:CHANnel<X>:SCALing:MODE	Sets/queries the ON/OFF condition of the scaling for the specified channel	App-20
:CHANnel<X1>:SCALing:POS<X2>?	Queries all setting values relating to POS1 and POS2 for the specified channel	App-20
:CHANnel<X1>:SCALing:POS<X2>:SCALe	Sets/queries the scaling value of POS1 and POS2 for the specified channel	App-20
:CHANnel<X1>:SCALing:POS<X2>:VOLT	Sets/queries the measured value of scaling POS1 and POS2 for the specified channel	App-20
:CHANnel<X>:SCALing:UNIT	Sets/queries the scaling unit for the specified channel	App-20
:CHANnel<X>:TAG	Sets/queries the tag character string for the specified channel	App-20
:CHANnel<X>:UPPScale	Sets/queries the upper limit scale for temperature measurements	App-21
COMMunicate Group		
:COMMunicate?	Queries all the communication settings	App-21
:COMMunicate:HEADer	Sets/queries whether or not the header is returned in response to a query	App-21
:COMMunicate:LOCKout	Set/releases local lockout	App-22
:COMMunicate:REMote	Sets remote/local. ON is remote	App-22
:COMMunicate:STATus?	Queries status specific to the line	App-22
:COMMunicate:VERBose	Sets/queries whether the response to a query is returned in full or abbreviated form	App-22
:COMMunicate:WAIT	Waits for any of the specified extended events to occur	App-22
:COMMunicate:WAIT?	Generate a response when any of the specified extended events occur	App-22

Command	Description	Page
DATA Group		
:DATA?	Queries all settings relating to the output of the memory data	App-23
:DATA:BLOCk	Sets/queries the block number of the waveform to be sent	App-23
:DATA:BYTeorder	Sets/queries the byte order when sending data in word format	App-24
:DATA:CHANnel<x>:RANge?	Queries the measurement range and full scale value of the specified analog channel	App-24
:DATA:CHANnel<X>:SCALing:COEFficient?	Queries the scaling coefficient of the specified analog channel	App-24
:DATA:CHANnel<X>:SCALing:MODE?	Queries the ON/OFF condition of the scaling of the specified analog channel	App-24
:DATA:CHANnel<X>:SCALing:OFFSet?	Queries the scaling offset value of the specified analog channel	App-24
:DATA:CHANnel<X>:SCALing:UNIT	Queries the scaling unit of the specified analog ch	App-24
:DATA:CHANnel<X>:SEND?	Sends the data of the specified analog channel.	App-24
:DATA:END	Sets/queries which point of the specified waveform is to be the last data	App-24
:DATA:FORMat	Sets/queries the format of the data to send	App-25
:DATA:INTerval?	Queries the time between the data (in units of seconds) of the specified waveform	App-25
:DATA:LENGth?	Queries the total number of data points of the specified waveform	App-25
:DATA:{LOA|LOB}:INPut?	Queries the ON/OFF condition of each bit of the specified logic channel	App-25
:DATA:{LOA|LOB}:SEND?	Sends the data of the specified logic channel of the specified waveform	App-25
:DATA:STARt	Sets/queries which point of the specified waveform is to be the first data	App-25
:DATA:TRIGger?	Queries the trigger point of the specified waveform	App-25
:DATA:TTIMe?	Queries the trigger time of the specified waveform	App-25
FILE Group		
:FILE?	Queries all the setting values relating to saving and loading	App-26
:FILE:LOAD:PANel	Loads the setup data	App-26
:FILE:SAVE?	Queries all the setting values relating to saving	App-26
:FILE:SAVE:ALL	Saves all blocks measured data in binary format	App-26
:FILE:SAVE:ASCii	Saves the measured data in ASCII format	App-26
:FILE:SAVE:BINary	Saves the measured data in binary format	App-26
:FILE:SAVE:CHANnel<X>	Sets/queries the channel to save	App-27
:FILE:SAVE:COMMent	Sets/queries the save comments	App-27
:FILE:SAVE:END	Sets/queries the end data number to save	App-27
:FILE:SAVE:OPTion	Sets/queries whether or not to set the option used in saving	App-27
:FILE:SAVE:PANel	Saves the setup data	App-27
:FILE:SAVE:STARt	Sets/queries the start data number for saving	App-27
INITialize Group		
:INITialize:ACQuire	Initializes acquisition memory	App-27
:INITialize:ALL	Initializes all memory	App-27
MENU Group		
:MENU?	Queries all menu screen settings.	App-33
:MENU:ACCumulate	Sets/queries the accumulate display	App-33
:MENU:CHARt	Sets/queries the chart speed when the mode is in realtime+memory mode	App-33
:MENU:CPRint	Sets/queries contents of the channel print	App-33
:MENU:FORMat	Sets/queries the display format	App-33
:MENU:GAUGe	Sets/queries contents of the gage print	App-33
:MENU:GRID	Sets/queries the grid setting	App-33

Command	Description	Page
:MENU:HARMonic?	Queries all the setting values relating to harmonic mode	App-33
:MENU:HARMonic:CHANnel	Sets/queries the channel to analyze automatically	App-34
:MENU:HARMonic:CYCLe	Sets/queries the memory length for waveform analysis	App-34
:MENU:HARMonic:DISPlay	Sets/queries the contents to display for the automatic analysis	App-34
:MENU:HARMonic:FREQuency	Sets/queries the frequency of the harmonic mode	App-34
:MENU:HARMonic:METHod	Sets/queries the analysis method of the harmonic mode	App-34
:MENU:HARMonic:TRENd?	Queries all the setting values relating to the trend save of the automatic analysis	App-34
:MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}?	Queries all the setting values relating to the channel or power of the trend save of the automatic analysis	App-35
:MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}:CONTent	Sets/queries whether or not to save the relative harmonic content during trend save of automatic analysis	App-35
:MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}:ORDer	Sets/queries which harmonic order to save during trend save of automatic analysis	App-35
:MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}:PHASe	Sets/queries whether or not to save the phase during trend save of automatic analysis	App-35
:MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}:RMS	Sets/queries whether or not to save the RMS value during trend save of automatic analysis	App-36
:MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}:TOTal	Sets/queries whether or not to save the overall results during trend save of automatic analysis	App-36
:MENU:HARMonic:TRENd:END	Sets/queries whether or not to use the end time during trend save of automatic analysis	App-36
:MENU:HARMonic:TRENd:ENTime	Sets/queries the end time during trend save of automatic analysis	App-36
:MENU:HARMonic:TRENd:STARt	Sets/queries whether or not to use the start time during trend save of automatic analysis	App-36
:MENU:HARMonic:TRENd:STTime	Sets/queries the start time during trend save of automatic analysis	App-36
:MENU:HARMonic:TRENd:SAVE	Sets/queries the trend save interval of automatic analysis	App-37
:MENU:HARMonic:UNI	Sets/queries the vertical scale of the RMS value graph of the automatic analysis	App-37
:MENU:HARMonic:WIRing	Sets/queries the wiring method of the automatic analysis	App-37
:MENU:LINE<X>	Sets/queries the line type used to record the analog CH	App-37
:MENU:{LOA|LOB}:BIT<X>	Sets/queries the input of each bit of the logic channel	App-37
:MENU:LOPRint	Sets/queries record position of the logic waveform	App-37
:MENU:MBLength	Sets/queries the memory length	App-37
:MENU:MCLear	Sets/queries whether or not to clear the previous memory at memory start	App-37
:MENU:MESSage	Sets/queries contents of the message print	App-38
:MENU:MINTerval	Sets/queries the digital recording interval after capturing the data in the memory	App-38
:MENU:MODE	Sets/queries the operating mode	App-38
:MENU:MPCCard	Sets/queries PC card operation after capturing the data in the memory	App-38
:MENU:MPRint	Sets/queries record setting after capturing the data in the memory	App-38
:MENU:MSTAtis	Sets/queries parameter calculation after capturing the data in the memory	App-38
:MENU:MSTOp	Sets/queries the memory stop condition during repeat triggering	App-38

Command	Description	Page
:MENU:MTDiv	Sets/queries the time-axis rate during the data capture	App-38
:MENU:PLAYback	Sets/queries the digital recording interval during playback	App-39
:MENU:PLENgth	Sets/queries record length	App-39
:MENU:PMODe	Sets/queries record mode	App-39
:MENU:RDINterval	Sets/queries the digital printing interval during realtime recording	App-39
:MENU:RLENgth	Sets/queries the length of the realtime recording	App-39
:MENU:RPRint	Sets/queries the simultaneous recording	App-39
:MENU:RTDiv	Sets/queries the time-axis rate of the realtime recording	App-39
:MENU:STYLe	Sets/queries the recording method when the recording format is X-Y	App-39
:MENU:TPRint	Sets/queries the time printing	App-40
:MENU:TRIGger	Sets/queries the kind of trigger	App-40
:MENU:TSMag	Sets/queries the T-axis zoom factor for memory display and recording	App-40
:MENU:XY<X>	Sets/queries the Y-axis input (Y1 to Y3) of the X-Y recording <X>=1 to 3 (corresponds to Y1 to Y3)	App-40
MONitor Group		
:MONitor?	Queries all setting values relating to the current measured data output	App-41
:MONitor:BYTeorder	Sets/queries the byte order when sending data in word format	App-41
:MONItor:CHANnel<X>:DPOint?	Queries the decimal point position of the current measured data of the specified analog channel	App-41
:MONItor:CHANnel<X>:UNIT?	Queries the unit of the current measured data of the specified analog channel	App-41
:MONItor:FORMat	Sets/queries format of the data to send	App-41
:MONItor:PINTerval	Sets/queries the interval for sampling at a constant period	App-42
:MONItor:PSENd?	Sends the measured data sampled at a constant period	App-42
:MONItor:SEND?	Sends the current measured data	App-42
PASSword Group		
:PASSword:CHANge	Changes the password	App-43
:PASSword:INPut	Enters the password	App-43
SELFtest Group		
:SELFtest:MEMory?	Performs memory test and query the result	App-43
:SELFtest:PCCard?	Performs PC card test and query the result	App-43
:SELFtest:PRINter	Performs printer test	App-43
STATIs Group		
:STATIs?	Queries all setting values relating to statistical calculation	App-45
:STATIs:CHANnel<X>:AVG?	Queries the average value of the calculation result of the specified analog CH	App-45
:STATIs:CHANnel<X>:INTEG1?	Queries the INTEG1 value of calculation result of the specified analog CH	App-45
:STATIs:CHANnel<X>:INTEG2	Queries the INTEG2 value of calculation result of the specified analog CH	App-45
:STATIs:CHANnel<X>:MAX?	Queries the maximum value of the calculation result of the specified analog CH and the time the value was measured	App-45
:STATIs:CHANnel<X>:MIN?	Queries the minimum value of the calculation result of the specified analog CH and the time the value was measured	App-45
:STATIs:CHANnel<X>:RMS?	Queries the RMS value of the calculation result of the specified analog CH	App-45
:STATIs:END	Sets/Queries the data number of the end of the calculation	App-46

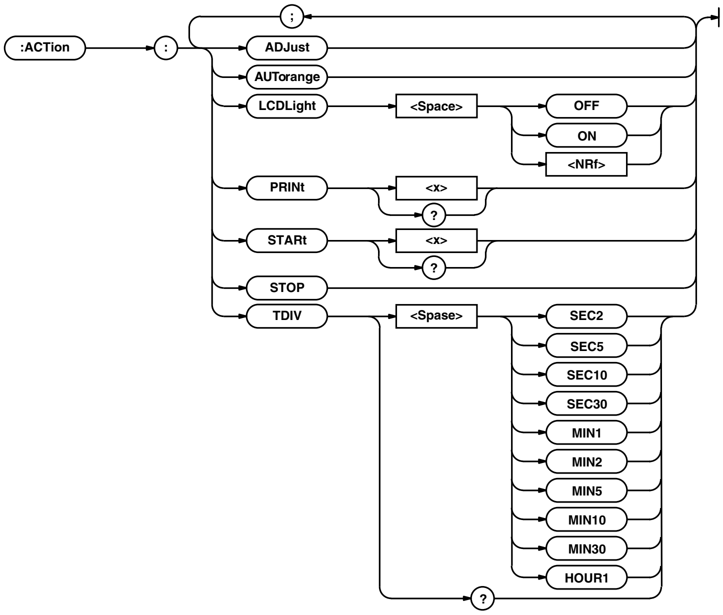
Command	Description	Page
:STATIs:EXECute	Executes calculation	App-46
:STATIs:HARMonic:CHANnel<X1>:ORDer<X2>:CONTent?	Queries the relative harmonic content of each harmonic order of each analog channel from the results of the harmonic analysis	App-46
:STATIs:HARMonic:CHANnel<X1>:ORDer<X2>:PHASe?	Queries the phase of each harmonic order of each analog channel from the results of the harmonic analysis	App-46
:STATIs:HARMonic:CHANnel<X1>:ORDer<X2>:RMS?	Queries the RMS value of each harmonic order of each analog channel from the results of the harmonic analysis	App-46
:STATIs:HARMonic:CHANnel<X>:THD1?	Queries the harmonic distortion (IEC) of each analog channel from the results of the harmonic analysis	App-46
:STATIs:HARMonic:CHANnel<X>:THD2?	Queries the harmonic distortion (CSA) of each analog channel from the results of the harmonic analysis	App-46
:STATIs:HARMonic:CHANnel<X>:TRMS?	Queries the total RMS value of each analog channel from the results of the harmonic analysis	App-47
:STATIs:HARMonic:EXECute	Executes the harmonic analysis	App-47
:STATIs:HARMonic:POWer<X>:ACTPower?	Queries the total active power from the results of the harmonic analysis	App-47
:STATIs:HARMonic:POWer<X>:APPPower?	Queries the apparent power from the results of the harmonic analysis	App-47
:STATIs:HARMonic:POWer<X1>:ORDer<X2>:CONTent?	Queries the relative power content of each harmonic order from the results of the harmonic analysis	App-47
:STATIs:HARMonic:POWer<X1>:ORDer<X2>:PHASe?	Queries the power phase of each harmonic order from the results of the harmonic analysis	App-47
:STATIs:HARMonic:POWer<X1>:ORDer<X2>:RMS?	Queries the active power of each harmonic order from the results of the harmonic analysis	App-48
:STATIs:HARMonic:POWer<X>:PFACtor?	Queries the power factor from the results of the harmonic analysis	App-48
:STATIs:HARMonic:POWer<X>:REACtpower?	Queries the reactive power from the results of the harmonic analysis	App-48
:STATIs:HARMonic:STARt	Sets/queries the first data number of the harmonic analysis	App-48
:STATIs:STARt	Sets/Queries the data number of the start of the calculation	App-48
:STATIs:XY<X>:INTEG1?	Queries the calculated area of the X-Y recording	App-48
:STATIs:XY<X>:INTEG2	Queries the calculated area during X-Y	App-48
STATus Group		
:STATus?	Queries all the settings relating to the status of the communication function	App-49
:STATus:CONDition?	Queries the contents of the condition register	App-49
:STATus:EESE	Sets/Queries the extended event enable register	App-49
:STATus:EESR?	Queries the contents of the extended event register and clears the register	App-49
:STATus:ERRor?	Queries the error code and message (head of the error queue)	App-50
:STATus:FILTer<X>	Sets/Queries the specified transition filter	App-50
:STATus:QENable	Sets/Queries whether or not to store messages other than error messages in the error queue	App-50
:STATus:QMESsage	Sets/Queries whether or not to add the message contents to the STATus:ERR? response	App-50
:STATus:SPOLl?	Executes a serial poll	App-50

Command	Description	Page
SYSTem Group		
:SYSTem?	Queries all the system settings	App-52
:SYSTem:CACTion	Sets/Queries the destination of the hard copy	App-52
:SYSTem:CLEVel<x>	Sets/queries the allowed with of the wave window trigger for each channel	App-52
:SYSTem:CLOCk?	Sets/Queries all the settings relating to date and time	App-52
:SYSTem:CLOCk:DATE	Sets/Queries the date	App-52
:SYSTem:CLOCk:TIME	Sets/Queries the time	App-52
:SYSTem:ETime	Sets/queries the time at which the width of the wave window trigger is reset to the original value	App-52
:SYSTem:GRID	Sets/queries whether or not to display the grid	App-52
:SYSTem:HEADer	Sets/Queries the header to the FAX message	App-52
:SYSTem:LANGuage	Sets/Queries the display language	App-52
:SYSTem:MTKey	Sets/Queries the manual trigger key	App-53
:SYSTem:RMSStatis	Sets/Queries whether or not to calculate the eapansion calculation	App-53
:SYSTem:STTime	Sets/queries the time at which the width of the wave window trigger is changed	App-53
:SYSTem:TAG	Sets/Queries whether or not to use the tag	App-53
:SYSTem:TLINe	Sets/Queries the type of telephone line used for FAX/MODEM	App-53
:SYSTem:TNUM2	Sets/Queries the destination telephone number 2 for FAX/MODEM	App-53
:SYSTem:TNUMber	Sets/Queries the destination telephone number for FAX/MODEM	App-53
:SYSTem:WTWC	Sets/queries the function used to change the width of the wave window trigger	App-53
TRIGger Group		
:TRIGger?	Queries all trigger settings	App-57
:TRIGger:CHANnel<x>?	Queries all setting values relating to the specified analog CH for triggering	App-57
:TRIGger:CHANnel<x>:FCOunt	Sets/Queries the trigger filter amount of the specified analog CH for the normal trigger	App-57
:TRIGger:CHANnel<x>:FILTer	Sets/Queries the trigger filter of the specified analog CH for the normal trigger	App-57
:TRIGger:CHANnel<x>:LEVel<x>	Sets/Queries the trigger levels of the specified analog CH for the normal trigger	App-57
:TRIGger:CHANnel<x>:OFFSet	Sets/Queries the ideal waveform offset for the wave window trigger	App-57
:TRIGger:CHANnel<x>:PEAK	Sets/Queries the ideal waveform peak for the wave window trigger	App-57
:TRIGger:CHANnel<x>:PHASe	Sets/Queries the ideal waveform phase for the wave window trigger	App-58
:TRIGger:CHANnel<x>:TOLerance	Sets/Queries the width of the wave window trigger	App-58
:TRIGger:CHANnel<x>:TYPE	Sets/Queries the trigger type of the specified analog CH	App-58
:TRIGger:COMBination	Sets/Queries the AND/OR logic for the normal trigger	App-58
:TRIGger:DELay	Sets/Queries the trigger delay	App-58
:TRIGger:EXTernal	Sets/Queries the contents of the external trigger for the normal trigger	App-58
:TRIGger:FREQuency	Sets/Queries the frequency for the wave window trigger	App-58
:TRIGger:INTerval	Sets/Queries the time trigger interval after the start time	App-58
:TRIGger:HARMonic?	Queries all the setting values of the trigger for automatic analysis	App-59
:TRIGger:HARMonic:MODE	Sets/queries the trigger mode for automatic analysis	App-59
:TRIGger:HARMonic:CONDition<X>:CHANnel	Sets/queries the trigger channel for the automatic analysis	App-59
:TRIGger:HARMonic:CONDition<X>:LEVel	Sets/queries the trigger level for the automatic analysis	App-59

Command	Description	Page
:TRIGger:HARMonic:CONDition<X>:ORDer	Sets/queries the harmonic order used in triggering during the automatic analysis	App-59
:TRIGger:HARMonic:KIND	Sets/queries the kind of trigger for the automatic analysis	App-59
:TRIGger:HARMonic:SYNChronize:CHANnel	Sets/queries the synchronous trigger channel for the automatic analysis	App-60
:TRIGger:HRAMonic:SYNChronize:LEVel	Set/queries the synchronize trigger level for the automatic analysis	App-60
:TRIGger:{LOA|LOB}?	Queries all setting values relating to the specified logic CH for the normal trigger	App-60
:TRIGger:{LOA|LOB}:PATTern<x>	Sets/Queries the logic trigger bit pattern of the specified logic CH for the normal trigger	App-60
:TRIGger:{LOA|LOB}:TYPE	Sets/Queries the trigger type of the specified logic CH for the normal trigger	App-60
:TRIGger:LOGic?	Queries all setting values relating to the logic input for the normal trigger	App-60
:TRIGger:LOGic:FCOunt	Sets/Queries the trigger filter amount of the logic CH for the normal trigger	App-60
:TRIGger:LOGic:FILTer	Sets/Queries the trigger filter of the logic CH for the normal trigger	App-60
:TRIGger:MODE	Sets/Queries the trigger mode	App-61
:TRIGger:RWAVe	Sets/Queries the reference waveform of the wave window trigger	App-61
:TRIGger:STTime	Sets/Queries start time of the time trigger function	App-61
:TRIGger:SYNChronize?	Queries all setting values relating to the synchronization trigger of the wave window trigger	App-61
:TRIGger:SYNChronize:CHANnel	Sets/Queries the synchronization trigger channel of the wave window trigger	App-61
:TRIGger:SYNChronize:EDGE	Sets/Queries the synchronization trigger edge of the wave window trigger	App-61
:TRIGger:SYNChronize:LEVel	Sets/Queries the synchronization trigger level of the wave window trigger	App-61
:TRIGger:TIME	Sets/Queries whether or not to use the time trigger function	App-61
Common Command Group		
:*CLS	Clears the standard and extended event registers and the error queue	App-62
:*ESE	Sets/Queries the value of the standard	App-62
:*ESR?	Queries the standard event register value	App-62
:*IDN?	Queries the recorder mode	App-62
:*OPT?	Queries installed options	App-63
:*PSC	Sets/Queries whether or not clear the following registers when the power is turned ON	App-63
:*RST	Resets the current setting	App-63
:*SRE	Sets/Queries the value of the service request enable register	App-63
:*STB?	Queries the value of the status byte register	App-63
:*TST?	Executes a self-test and queries the result	App-63

ACTion Group

The commands in the ACTion group are used to adjust the zero position, execute auto range, start playback recording, start and stop measurement/display/recording, and set the LCD back lighting ON/OFF. It is also used to make inquires about them.



:ACTion:ADJust

Function Executes zero adjust.
Syntax ACTion:ADJust
Example ACTION:ADJUST

:ACTion:AUTorange

Function Executes auto range.
Syntax ACTion:AUTorange
Example ACTION:AUTORANGE

:ACTion:LCDLight

Function Controls LCD back lighting.
Turn the LCD back lighting ON.
Syntax ACTion:LCDLight {<Boolean>}
Example ACTION:LCDLIGHT ON

:ACTion:PRINt<X>

Function Starts printer-related operation.
Syntax ACTion:PRINt<X>
<x> indicates the operation.
1 Start list printing
2 Start screen copy (corresponds to the COPY key).
Example ACTION:PRINT1

:ACTion:STARt<X>

Function Starts a memory operation such as measurement, display, and recording.
Syntax ACTion:STARt<X>
<x> indicates the operation.
1 Start measurement (corresponds to the START key).
2 Start PLAYBACK (corresponds to the PLAYBACK key).
3 Start recording (corresponds to PRINT key).
4 Start manual trigger (corresponds to MANUALTRIGGER key).
5 Start analog waveform monitor.
6 Start digital value monitor.
Example ACTION:START1

:ACTion:STOP

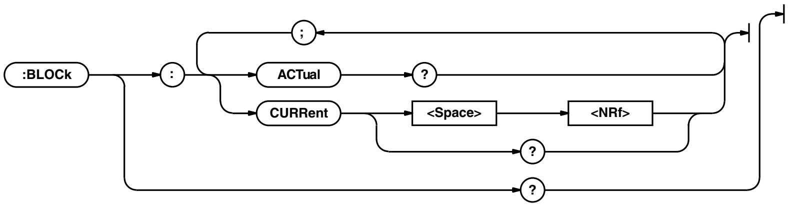
Function Stops/Aborts operations such as sampling, display, and recording.
Syntax ACTion:STOP
Example ACTION:STOP

:ACTion:TDIV

Function Set/queries the time axis rate of the monitor screen
Syntax ACTion:TDIV {SEC2|SEC5|SEC30|MIN1|MIN2|MIN5|MIN10|MIN30|HOUR1}
ACTion:TDIV?
Example ACTION:TDIV SEC2
ACTION:TDIV?→:ACTION:TDIV SEC2

BLOCk Group

The BLOCK command is used to set or query block parameters.



:BLOCk?

Function **Queries all the memory block settings.**
Syntax `BLOCk?`
Example `BLOCK?→:BLOCK:CURRENT 1`

:BLOCk:ACTual?

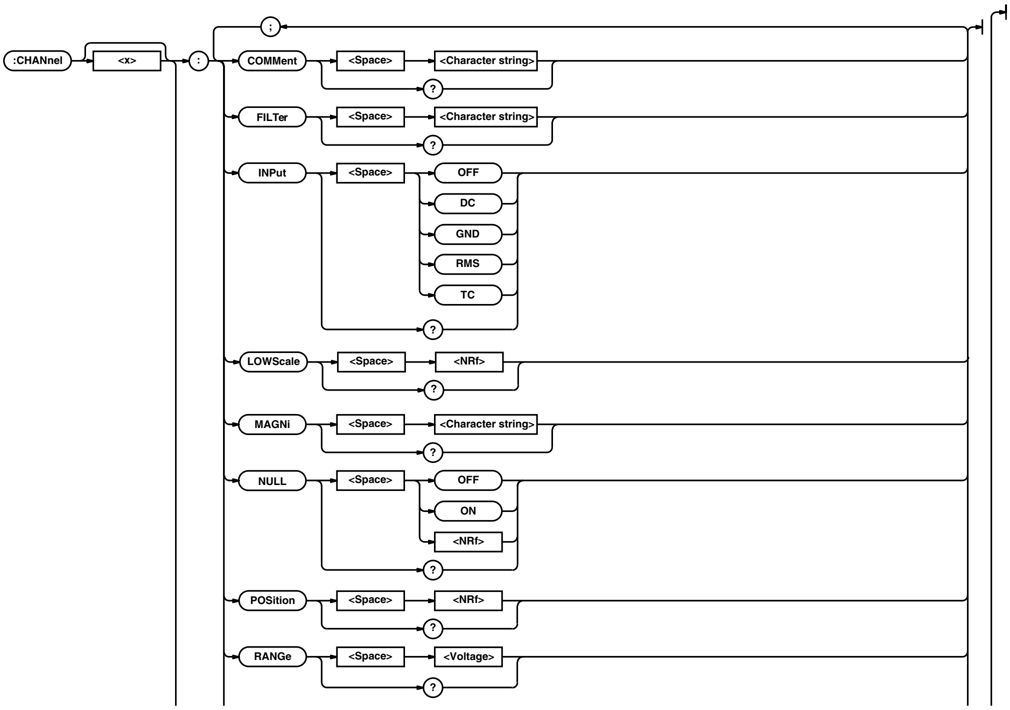
Function **Queries the number of blocks already sampled.**
Syntax `BLOCk:ACTual?`
Example `BLOCK:ACTUAL?→12`
Description Cannot query during memory measurement. "0" is returned if there are no samples.

:BLOCk:CURRent

Function **Sets/queries the current block number.**
Syntax `BLOCk:CURRent {<NRf>}`
`BLOCk:CURRent?`
`{<NRf>}=BLOCK No.=1 to 32`
Example `BLOCK:CUREENT 3`
`BLOCK:CURRENT?→:BLOCK:CURRENT 3`
Description Cannot set or query during memory measurement.

CHANnel Group

The commands in the CHANnel group are used to set or query CHANnel parameters. These commands correspond to [CH1] to [CH4] keys.



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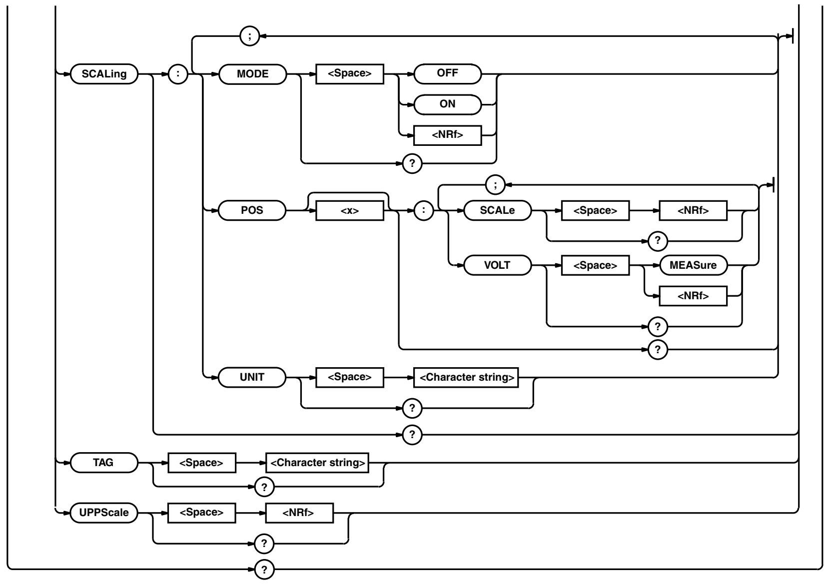


:CHANnel<X>?

Function Queries the settings for the specified channel.

Syntax CHANnel<X>?
<X>=1 to 4

Example CHANNEL1?→:CHANNEL1:COMMENT "OR100E   ";FILTER "Off";INPUT DC;MAGNI "*1";NULL 0;POSITION0.0;RANGE 10.000E+00;SCALING:MODE 0;POS1:SCALE -5.0000E+0;VOLT -5.0000E+0;:CHANNEL1:SCALING:POS2:SCALE 5.0000E+0;VOLT 5.0000E+0;:CHANNEL1:SCALING:UNIT "mV ";:CHANNEL1:TAG "OR100E   "

:CHANnel<X>:COMMent

Function Sets/queries the annotation message for the specified channel.

Syntax CHANnel<X>:COMMent {<character string>}
<X>=1 to 4
CHANnel<X>:COMMent?
{<character string>}=20 characters or less

Example CHANNEL1:COMMENT "OR100E"
CHANNEL1:COMMENT?→:CHANNEL1:COMMENT "OR100E"

:CHANnel<X>:FILTer

Function Sets/queries the filter for the specified channel.

Syntax CHANnel<X>:FILTer {<character string>}
<X>=1 to 4
CHANnel<X>:FILTer?
{<character string>}="Off", "5Hz", "500Hz"

Example CHANNEL1:FILTER "5Hz"
CHANNEL1:FILTER?→:CHANNEL1:FILTER "5Hz"

:CHANnel<X>:INPut

Function Sets/queries the input to the specified analog channel.

Syntax CHANnel<X>:INPut {OFF|DC|RMS|TC|GND}
<X>=1 to 4
CHANnel<X>:INPut?

Example CHANNEL1:INPUT DC
CHANNEL1:INPUT?→:CHANNEL1:INPUT DC

Description RMS is only available on the OR300E.

:CHANnel<X>:LOWScale

Function Sets/queries the lower limit scale for temperature measurements.

Syntax CHANnel<X>:LOWScale {<NRf>}
<X>=1 to 4
CHANnel<X>:LOWScale?
{<NRf>}=-50 to 580 (10 steps)

Example CHANNEL1:LOWScale -20
CHANNEL1:LOWSclae?
→:CHANNEL1:LOWScale -20

:CHANnel<X>:MAGNi

Function Sets/queries the Y-axis zoom factor for the specified channel.

Syntax CHANnel<X>:
MAGNi {<Character string>}
<X>=1 to 4
CHANnel<X>:MAGNi?
{<Character string>}="*1/2","
*2/3","*1","*5/4","*5/3","*2",
*5/2","*5"

Example CHANNEL1:MAGNI "*1/2"
CHANNEL1:MAGNI?→:CHANNEL1:
MAGNI "*1/2"

Description "*1", "*2" and "*5" can be set on OR300E.

:CHANnel<X>:NULL

Function Sets/queries the NULL for the specified channel.

Syntax CHANnel<X>:NULL {<Boolean>}
<X>=1 to 4
CHANnel<X>:NULL?

Example CHANNEL1:NULL ON
CHANNEL1:NULL?→:CHANNEL1:
NULL 1

Description If you set the input to RMS on OR300E, you cannot set NULL.

:CHANnel<X>:POSition

Function Sets/queries the zero point for the specified channel.

Syntax CHANnel<X>:POSition {<NRf>}
<X>=1 to 4
CHANnel<X>:POSition?
{<NRf>}=POSition
(0.1Pos Step)

magnification	×10	105.0	to	-105.0
magnification	×5	55.0	to	-55.0
magnification	×2	25.0	to	-25.0
magnification	×1	15.0	to	-15.0
magnification	×2/3	11.6	to	-11.6
magnification	×1/2	10.0	to	-10.0

when you set input to RMS on DR300

magnification	×5	0.0	to	-40.0
magnification	×2	0.0	to	-10.0
magnification	×1		-	

Example CHANNEL1:POSITION 10.4
CHANNEL1:POSITION?→:CHANNEL1:
POSITION 10.4

:CHANnel<X>:RANGe

Function Sets/queries the measurement range for the specified channel.

Syntax CHANnel<X>:RANGe {<Voltage>}
<X>=1 to 4
CHANnel<X>:RANGe?
{<voltage>} measurement
range=1000 V, 500 V, 200 V,
100 V, 50 V, 20 V, 10 V, 5 V,
2 V, 1 V, 500 MV, 200 MV,
100 MV

Example CHANNEL1:RANGE 20V
CHANNEL1:RANGE?→:CHANNEL1:
RANGE 2.000E+00

Discription Since the measurment range is set in terms of V/FS (V/full scale) or mV/FS, it is 10 times V/DIV or mV/FS.

:CHANnel<X>:SCALing?

Function Queries all setting values relating to scaling for the specified channel.

Syntax CHANnel<X>:SCALing?
<X>=1 to 4

Example CHANNEL1:SCAILNG?→:CHANNEL1:SCALING:MODE 0;POS1:SCALE -5.0000E+0;VOLT -5.0000E+0;:CHANNEL1:SCALING:POS2:SCALE 5.0000E+0;VOLT 5.0000E+0;:CHANNEL1:SCALING:UNIT "mV "

:CHANnel<X>:SCALing:MODE

Function Sets/queries the ON/OFF condition of the scaling for the specified channel.

Syntax CHANnel<X>:SCALing:MODE {<Boolean>}
<X>=1 to 4
CHANnel<X>:SCALing:MODE?

Example CHANNEL1:SCAILNG:MODE OFF
CHANNEL1:SCALING:MODE?
→:CHANNEL1:SCALING:MODE 0

:CHANnel<X1>:SCALing:POS<X2>?

Function Queries all setting values relating to POS1 and POS2 for the specified channel.

Syntax CHANnel<X1>:SCALing:POS<X2>?

Example CHANNEL1:SCALING:POS1?
→:CHANNEL1:SCALE -5.0000E+0;VOLT -5.0000E+0

:CHANnel<X1>:SCALing:POS<X2>:SCALe

Function Sets/queries the scaling value of POS1 and POS2 for the specified channel.

Syntax CHANnel<X1>:SCALing:POS<X2>:SCALe {<NRf>}
CHANnel<X1>:SCALing:POS<X2>:SCALe?
<X1>=1 to 4, <X2>=1 to 2
{<NRf>}Measurement range that can be specified
1e9to1e-9,0, -1e-9to-1e9

Example CHANNEL1:SCALING:POS1:SCALE 1.234
CHANNEL1:SCALING:POS1:SCALE?→:CHANNEL1:SCALING:POS1:SCALE 1.234

:CHANnel<X1>:SCALing:POS<X2>:VOLT

Function Sets/queries the measured value of scaling POS1 and POS2 for the specified channel.

Syntax CHANnel<X1>:SCALing:POS<X2>:VOLT {MEASure|<NRf>}
CHANnel<X1>:SCALing:POS<X2>:VOLT?
<X1>=1 to 4, <X2>=1 to 2
{<NRf>} Measurement range that can be specified
1e9to1e-9,0.0, -1e-9to-1e9
When {MEASURE} is specified, current measured value is used.

Example CHANNEL1:SCALING:POS1:VOLT MEASURE
CHANNEL1:SCALING:POS1:VOLT?→:CHANNEL1:SCALING:POS1:VOLT 1.234

:CHANnel<X>:SCALing:UNIT

Function Sets/queries the scaling unit for the specified channel.

Syntax CHANnel<X>:SCALing:UNIT {<character string>}
<X>=1 to 4
CHANnel<X>:SCALing:UNIT?

Example CHANNEL1:SCALING:UNIT "OR100E"
CHANNEL1:SCALING:UNIT?
→:CHANNEL1:SCALING:UNIT "OR100E"

:CHANnel<X>:TAG

Function Sets/queries the tag character string for the specified channel.

Syntax CHANnel<X>:TAG {<character string>}
<X>=1 to 4
CHANnel<X>:TAG?
{<character string>}=7 characters or less

Example CHANNEL1:TAG "OR100E"
CHANNEL1:TAG?→:CHANNEL1:TAG "OR100E"

:CHANnel<X>:UPPScale

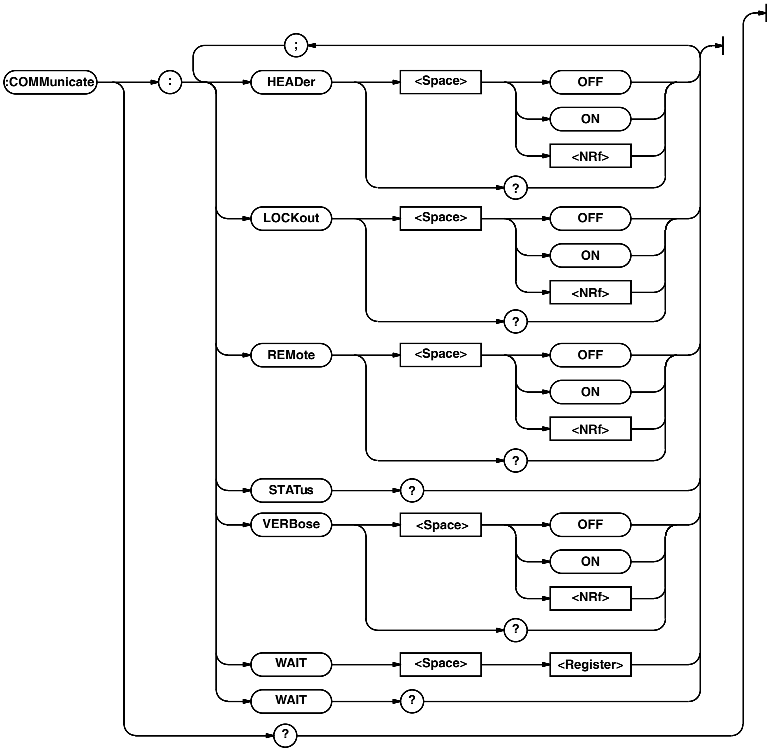
Function Sets/queries the upper limit scale for temperature measurements.

Syntax
```
CHANnel<X>:UPPScale {<NRf>}
<X>=1 to 4
CHANnel<X>:UPPScale?
{<NRf>}=-30 to 600 (10 steps)
```

Example
```
CHANNEL1:UPPScale 500
CHANNEL1:UPPScale?
→:CHANNEL1:UPPScale 500
```

COMMunicate Group

The commands in the COMMunicate Group are used to set or query communication parameters.



:COMMunicate?

Function Queries all the communication settings.

Syntax
```
COMMunicate?
```

Example
```
COMMUNICATE?
→:COMMUNICATE:HEADER1;
VERBOSE 1
```

:COMMunicate:HEADer

Function Sets/queries whether or not the header is returned in response to a query.

Syntax
```
COMMunicate:HEADer {<Boolean>}
COMMunicate:HEADer?
```

Example
```
COMMUNICATE:HEADER ON
COMMUNICATE:HEADER?
→:COMMUNICATE:HEADER 1
```

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:COMMunicate:LOCKout

Function Sets/releases local lockout.

Syntax COMMunicate:
LOCKout {<Boolean>}
COMMunicate:LOCKout?

Example COMMUNICATE:LOCKOUT ON
COMMUNICATE:LOCKOUT?
→:COMMUNICATE:LOCKOUT 1

Description The recorder is always in the local state at power up.

:COMMunicate:REMote

Function Sets remote/local. ON is remote.

Syntax COMMunicate:REMote
{<Boolean>}
COMMunicate:REMote?

Example COMMUNICATE:REMOTE ON
COMMUNICATE:REMOTE?
→:COMMUNICATE:REMOTE 1

Description To switch back from the remote state to the local state, initiate the communication command (:COMMunicate:REMote OFF) or press the "NEXT" key.
You cannot use any of the keys except the "NEXT" key during the remote state. If you have set the local lockout, the "NEXT" keys is also ineffective (you cannot use any of the keys).

:COMMunicate:STATus?

Function Queries status specific to the line.

Syntax COMMunicate:STATus?

Example COMMUNICATE:STATUS?→0

Description Description of the status bits

Bit 0	Parity error
1	Framing error
2	BREAK character detected
3 to	Always 0

When one the event above occurs, the corresponding status bit is set. The bits are cleared when the status is read.

:COMMunicate:VERBose

Function Sets/queries whether the response to a query is returned in full or abbreviated form.

Syntax COMMunicate:
VERBose {<Boolean>}
COMMunicate:VERBose?

Example COMMUNICATE:VERBOSE ON
COMMUNICATE:VERBOSE?
→:COMMUNICATE:VERBOSE 1

:COMMunicate:WAIT

Function Waits for any of the specified extended events to occur.

Syntax COMMunicate:
WAIT {<Register>}
{<Register>}=0 to 65535
See extended event register (page App-57)

Example COMMUNICATE:WAIT 65535

:COMMunicate:WAIT?

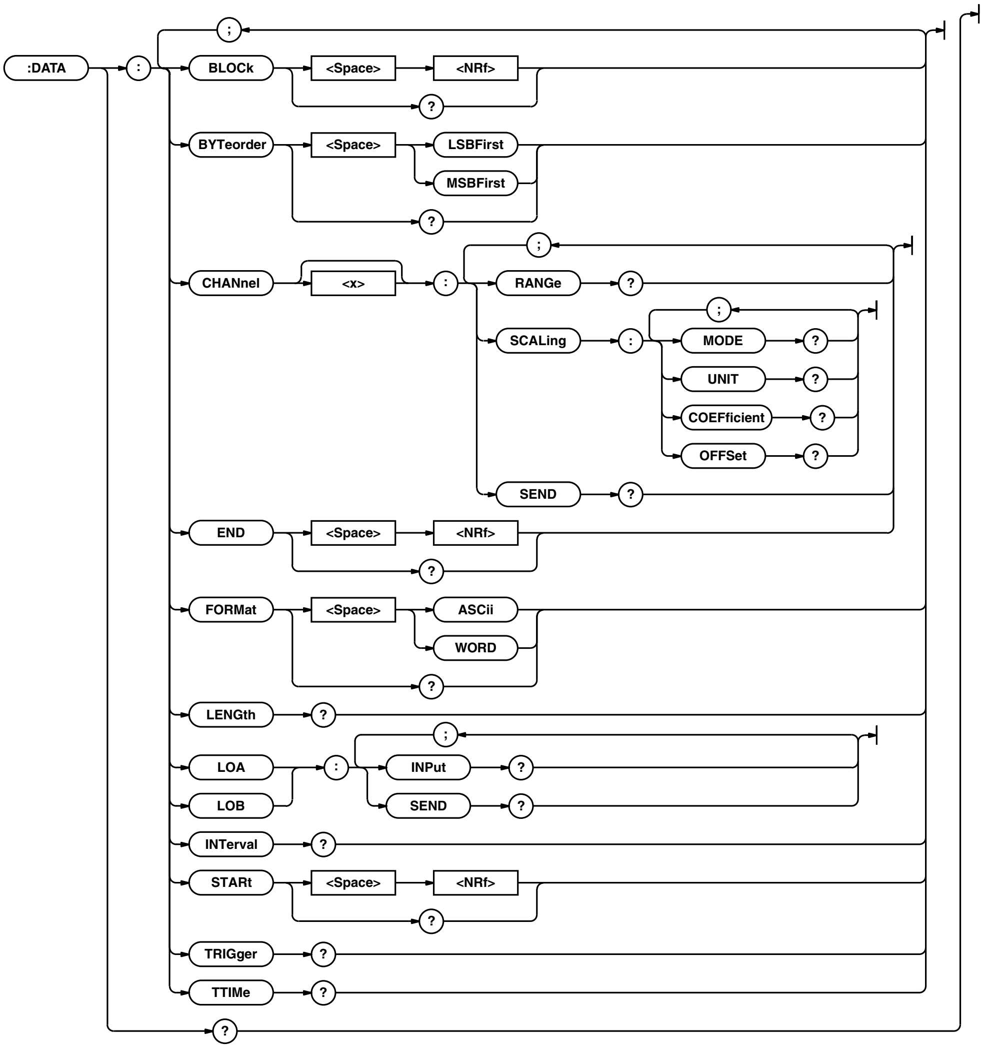
Function Generates a response when any of the specified extended events occur.

Syntax COMMunicate:WAIT?
{<Register>}
{<Register>}=0 to 65535
See extended event register (page App-57)

Example COMMUNICATE:WAIT?65535→1

DATA Group

The commands in the DATA group deal with the setting parameters and the measured data.



:DATA?

Function Queries all settings relating to the output of the memory data.

Syntax DATA?

Example DATA?→:DATA:BLOCK 1;
BYTEORDER LSBFIRST;
END 127999;FORMAT WORD;
START 0

:DATA:BLOCk

Function Sets/queries the block number of the waveform to be sent.

Syntax DATA:BLOCk {<NRf>}
DATA:BLOCk?
{<NRf>}=Block number=1 to 32

Example DATA:BLOCK 2
DATA:BLOCK?→:DATA:BLOCK 2

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:DATA:BYTeorder

Function Sets/queries the byte order when sending data in word format.

Syntax DATA:BYTeorder {LSBFirst|MSBFirst}
DATA:BYTeorder?

Example DATA:BYTEORDER LSBFIRST
DATA:BYTEORDER?→:DATA:BYTEORDER LSBFIRST

:DATA:CHANnel<X>:RANGe?

Function Queries the measurement range and full scale value of the specified analog channel.

Syntax DATA:CHANnel<X>:RANGe?
<X>=1 to 4

Example DATA:CHANNEL1:RANGE?
→500,MV,1400

Description Outputs <range value>, <range unit character string>, <full scale value> in that order.

:DATA:CHANnel<X>:SCALing:COEFficient?

Function Queries the scaling coefficient of the specified analog channel.

Syntax DATA:CHANnel<X>:SCALing:COEFficient?
<X>=1 to 4

Example DATA:CHANNEL1:SCALING:COEFFICIENT?→1.234

:DATA:CHANnel<X>:SCALing:MODE?

Function Queries the ON/OFF condition of the scaling of the specified analog channel.

Syntax DATA:CHANnel<X>:SCALing:MODE?
<X>=1 to 4

Example DATA:CHANNEL1:SCALING:MODE?→1

:DATA:CHANnel<X>:SCALing:OFFSet?

Function Queries the scaling offset value of the specified analog channel.

Syntax DATA:CHANnel<X>:SCALing:OFFSet?
<X>=1 to 4

Example DATA:CHANNEL1:SCALING:OFFSET?→1.234

:DATA:CHANnel<X>:SCALing:UNIT?

Function Queries the scaling unit of the specified analog ch.

Syntax DATA:CHANnel<X>:SCALing:UNIT?
<X>=1 to 4

Example DATA:CHANNEL1:SCALING:UNIT?→"mV"

:DATA:CHANnel<X>:SEND?

Function Sends the data of the specified analog channel.

Syntax DATA:CHANnel<X>:SEND?
<X>=1 to 4

Description ASCII Format

−	2	.	0	2	7	,	−	2	.	2	3	1	,	···

···	1	3	4	,	3	.	2	1	3	cr	lf

The measured values are separated by "," (0X2C) and output for each data No.
The unit character string can be queried using "DATA:CHANnel<x>:RANGE?"

WORD format
The output format is #8<8-digit decimal number><data byte string><CRC><crlf>.

- #8
  Indicates that it is <block data>.
  The number indicates the number of digits in the byte number field of the following data.
- <8-digit decimal number>
  Indicates the number of bytes of data
- <data byte string>
  Indicates the measured value. The WORD-size measurement values are listed for each data No.
- <CRC>
  2-byte CRC value.
  CRC is a way to check the data by considering all the data to be an array of bit values and determining the remainder by dividing with a specific value.
  CRC-CCITT (CRC-ITU-T): It is calculated by using the divisor, $0x11021=X^{16}+X^{12}+X^{5}+1$.

:DATA:END

Function Sets/queries which point of the specified waveform is to be the last data.

Syntax DATA:END {<NRf>}
DATA:END?
{<NRf>}
Data number=0 to 127999
(128kW/CHModel 0 to 511999)

Example DATA:END 100
DATA:END?→:DATA:END 100

:DATA:FORMat

Function Sets/queries the format of the data to send.

Syntax `DATA:FORMat {ASCii|WORD}`
`DATA:FORMat?`

Example `DATA:FORMAT ASCII`
`DATA:FORMAT?→:DATA:FORMAT ASCII`

:DATA:INTerval?

Function Queries the time between the data (in units of seconds) of the specified waveform.

Syntax `DATA:INTerval?`

Example `DATA:INTERVAL?→1.25E-5`

Description Cannot query during measurement.

:DATA:LENGth?

Function Queries the total number of data points of the specified waveform.

Syntax `DATA:LENGth?`

Example `DATA:LENGTH?→1000`

:DATA:{LOA|LOB}:INPut?

Function Queries the ON/OFF condition of each bit of the specified logic channel.

Syntax `DATA:{LOA|LOB}:INPut?`
`LOA=Logic Ach,LOB=Logic Bch`

Example `DATA:LOA:INPUT?→3`

Description The sum of the following bits is output in 1-byte integer (decimal).

7	6	5	4	3	2	1	0
0	0	0	0	1	0	1	1

Bits 0 to 3 correspond to bit 1 to bit 4 of the logic input.
Indicates the ON/OFF setting of the display/recording of each bit.
0 : OFF
1 : ON

:DATA:{LOA|LOB}:SEND?

Function Sends the data of the specified logic channel of the specified waveform.

Syntax `DATA:{LOA|LOB}:SEND?`
`LOA=LogicAch,LOB=LogicBch`

Description ASCII Fomat

0	0	0	1	,	1	0	0	1	,	···

···	,	0	0	0	0	,	1	1	1	1	cr	lf

The measured values are separated by "," (0X2C) and output for each data No.

WORD format

The output format is #8<8-digit decimal number><data byte string><CRC><crlf>.

- #8
  Indicates that it is <block data>. The number indicates the number of digits in the byte number field of the following data.
- <8-digit decimal number>
  Indicates the number of bytes of data
- <data byte string>
  Indicates the measured value. The WORD-size measurement values are listed for each data No.
- <CRC>
  2-byte CRC value.
  CRC is a way to check the data by considering all the data to be an array of bit values and determining the remainder by dividing with a specific value.
  CRC-CCITT (CRC-ITU-T): It is calculated by using the divisor, $0x11021=X^{16}+X^{12}+X^{5}+1$.

:DATA:STARt

Function Sets/queries which point of the specified waveform is to be the first data.

Syntax `DATA:STARt {<NRf>}`
`DATA:STARt?`
`{<NRf>} Data number=0 to 127999`
`(128kW/CHModel 0 to 511999)`

Example `DATA:START 100`
`DATA:START?→:DATA:START 100`

:DATA:TRIGger?

Function Queries the trigger point of the specified waveform.

Syntax `DATA:TRIGger?`

Example `DATA:TRIGGER?→100`

Description Cannot query during memory measurement.

:DATA:TTIMe? (Trigger Time)

Function Queries the trigger time of the specified waveform.

Syntax `DATA:TTIMe?`

Example `DATA:TTIME?`
`→"1997-04-12 23:46:12"`
`(YYYY-MM-DD HH:MM:SS)`

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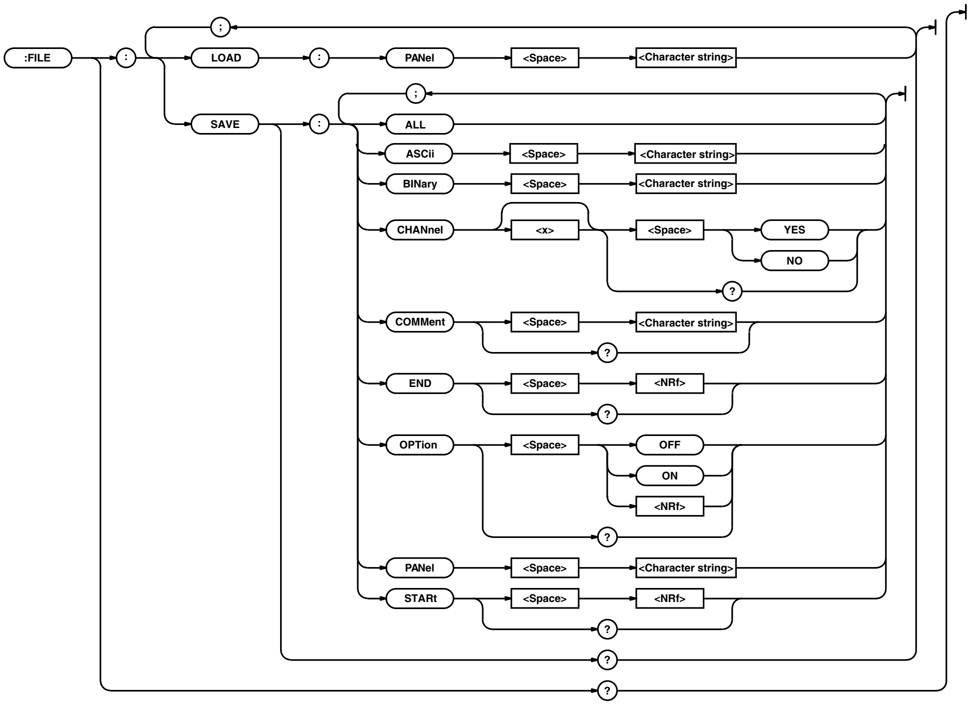
FILE Group

The commands in the FILE group are used load or save the setup data and the measured data.



:FILE?

Function Queries all the setting values relating to saving and loading.

Syntax `FILE?`

Example `FILE?→:FILE:SAVE:`
`CHANNEL1 YES;CHANNEL2 YES;`
`CHANNEL3 YES;CHANNEL4 YES;`
`COMMENT "OR100E        ";`
`END 100;OPTTION 0;START 0`

:FILE:LOAD:PANel

Function Loads the setup data.

Syntax `FILE:LOAD:PANel {<Character>}`
`{<Character string data>}=`
`filename (8 characters or less)`

Example `FILE:LOAD:PANEL "DATA1"`

:FILE:SAVE?

Function Queries all the setting values relating to saving.

Syntax `FILE:SAVE?`

Example `FILE:SAVE?→:FILE:SAVE:`
`CHANNEL1 YES;CHANNEL2 YES;`
`CHANNEL3 YES;CHANNEL4 YES;`
`COMMENT "OR100E        ";`
`END 100;OPTTION 0;START 0`

:FILE:SAVE:ALL

Function Saves all blocks measured data in binary format.

Syntax `FILE:SAVE:ALL`

Example `FILE:SAVE:ALL`

:FILE:SAVE:ASCii

Function Saves the measured data in ASCII format.

Syntax `FILE:SAVE:`
`ASCii {<Character string>}`
`{<Character string>}=`
`File name (Within 8 Character)`

Example `FILE:SAVE:ASCII "DATA1"`

:FILE:SAVE:BINary

Function Saves the measured data in binary format.

Syntax `FILE:SAVE:`
`BINary {<Character string>}`
`{<Character string>}=`
`file name (8 characters or less)`

Example `FILE:SAVE:BINARY "DATA1"`

:FILE:SAVE:CHANnel<X>

Function Sets/queries the channel to save.

Syntax FILE:SAVE:
CHANnel<X> {YES|NO}
FILE:SAVE:CHANnel<x>?

Example FILE:SAVE:CHANNEL1 YES
FILE:SAVE:CHANNEL1?→:FILE:
SAVE:CHANNEL1 YES

:FILE:SAVE:COMMent

Function Sets/queries the save comments.

Syntax FILE:SAVE:
COMMent {<Character string>}
FILE:SAVE:COMMent?
{<Character string>}
=filename (16 characters or less)

Example FILE:SAVE:COMMENT "OR100E"
FILE:SAVE:COMMENT?→:FILE:
SAVE:COMMENT "OR100E"

:FILE:SAVE:END

Function Sets/queries the end data number to save.

Syntax FILE:SAVE:END {<NRf>}
FILE:SAVE:END?
{<NRf>}=1 to 100 (%)

Example FILE:SAVE:END 100
FILE:SAVE:END?→:FILE:
SAVE:END 100

Discription Set the end position as a percentage of the data length.

:FILE:SAVE:OPTion

Function Sets/queries whether or not to set the option used in saving.

Syntax FILE:SAVE:OPTion {<Boolean>}
FILE:SAVE:OPTion?

Example FILE:SAVE:OPTION ON
FILE:SAVE:OPTION?→:FILE:
SAVE:OPTION 1

:FILE:SAVE:PANel

Function Saves the setup data.

Syntax FILE:SAVE:
PANel {<Character string>}
{<Character string>}
=filename (8 characters or less)

Example FILE:SAVE:PANEL "DATA1"

:FILE:SAVE:STARt

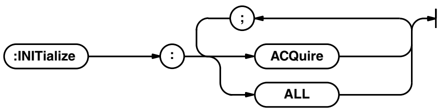
Function Sets/queries the start data number for saving.

Syntax FILE:SAVE:STARt {<NRf>}
FILE:SAVE:STARt?
{<NRf>}=0 to 99 (%)

Example FILE:SAVE:START 0
FILE:SAVE:START?→:FILE:
SAVE:START 0

Discription Set the start position as a percentage of the data length.

INITialize Group



:INITialize:ACQuire

Function Initializes acquisition memory.

Syntax INITialize:ACQuire

Example INITIALIZE:ACQUIRE

:INITialize:ALL

Function Initializes setup data and the acquisition memory.

Syntax INITialize:ALL

Example INITIALIZE:ALL

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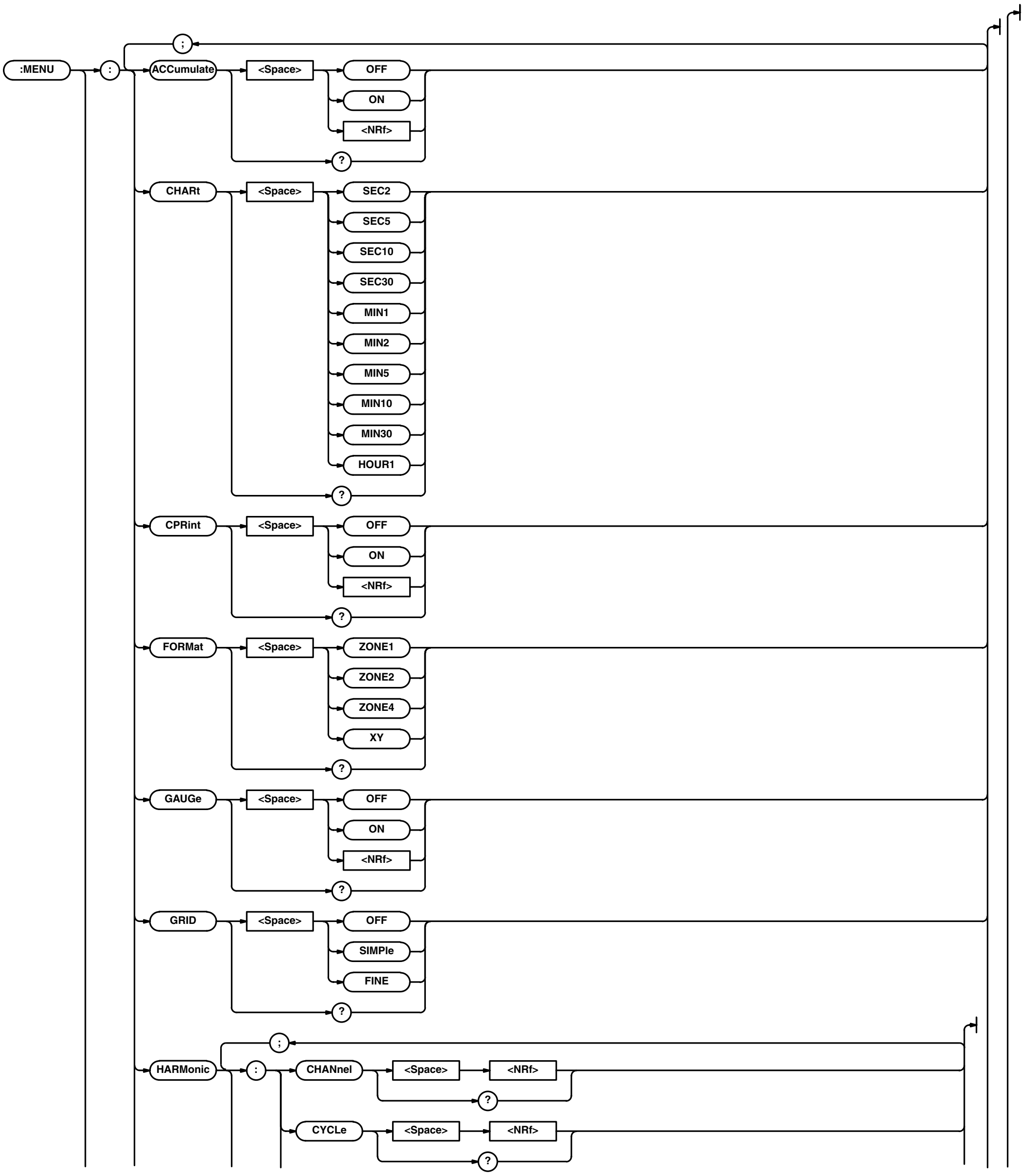
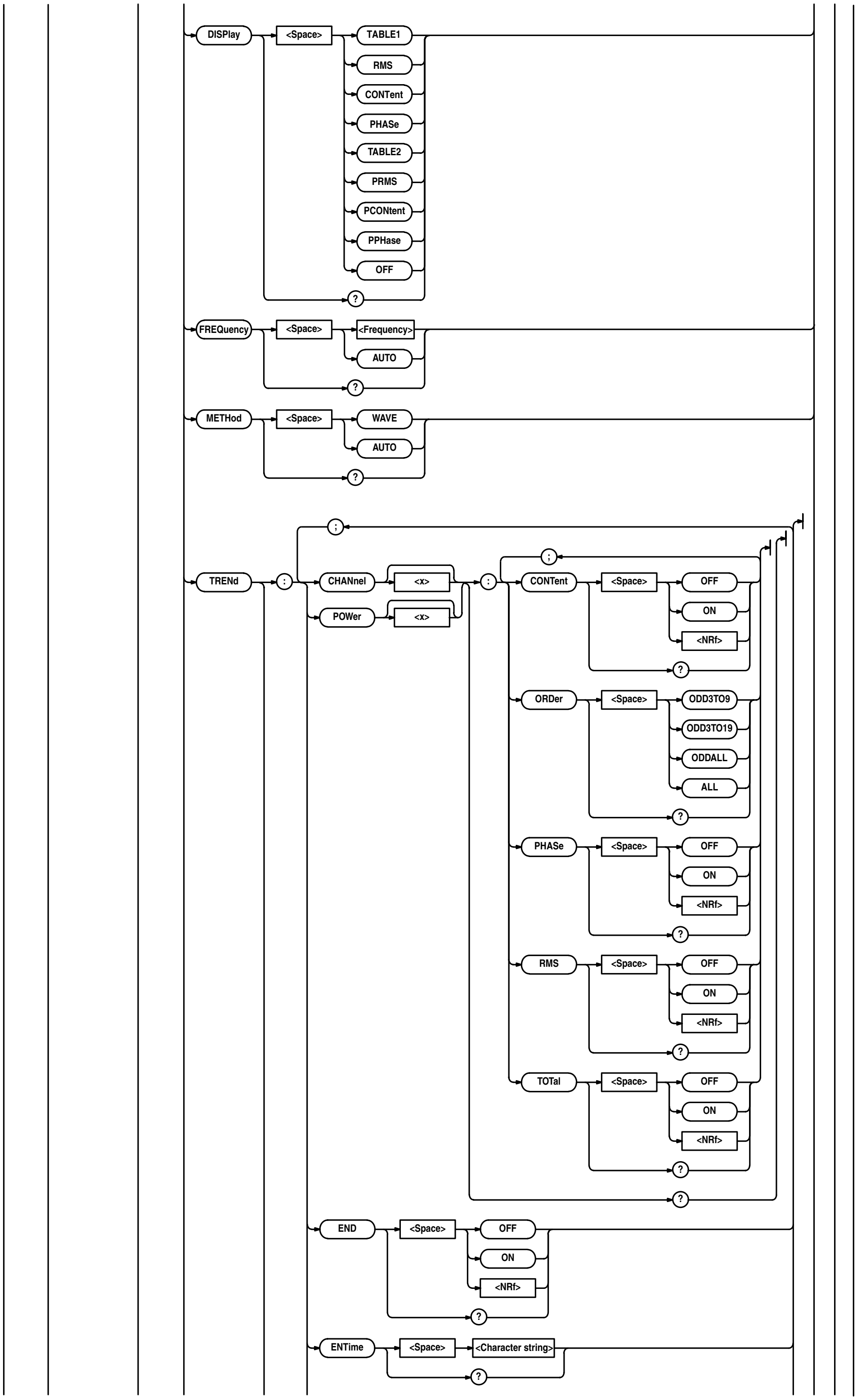
MENU Group

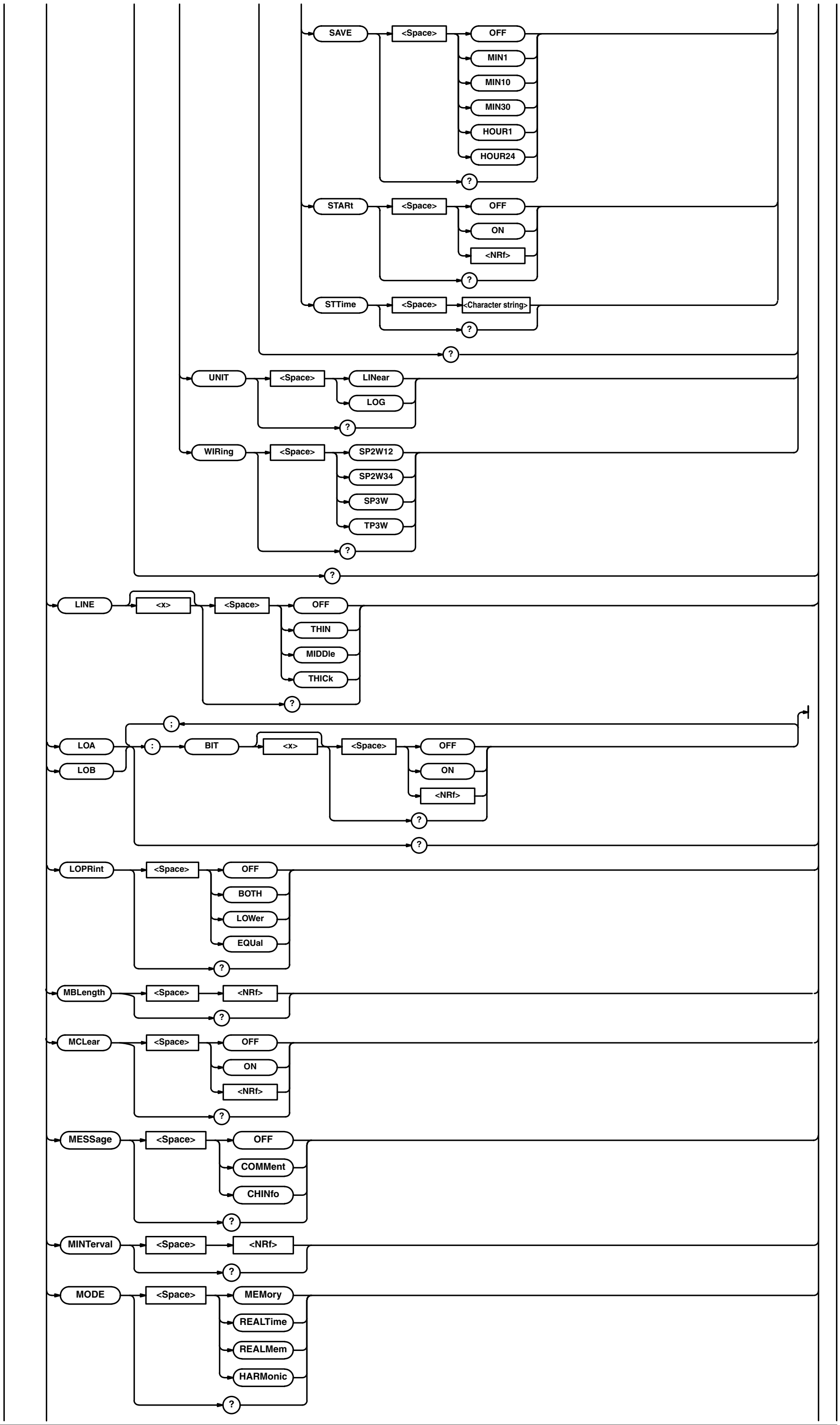
The commands in the MENU group set or query data capturing conditions, display format, and recording format. This command corresponds to the MENU key.

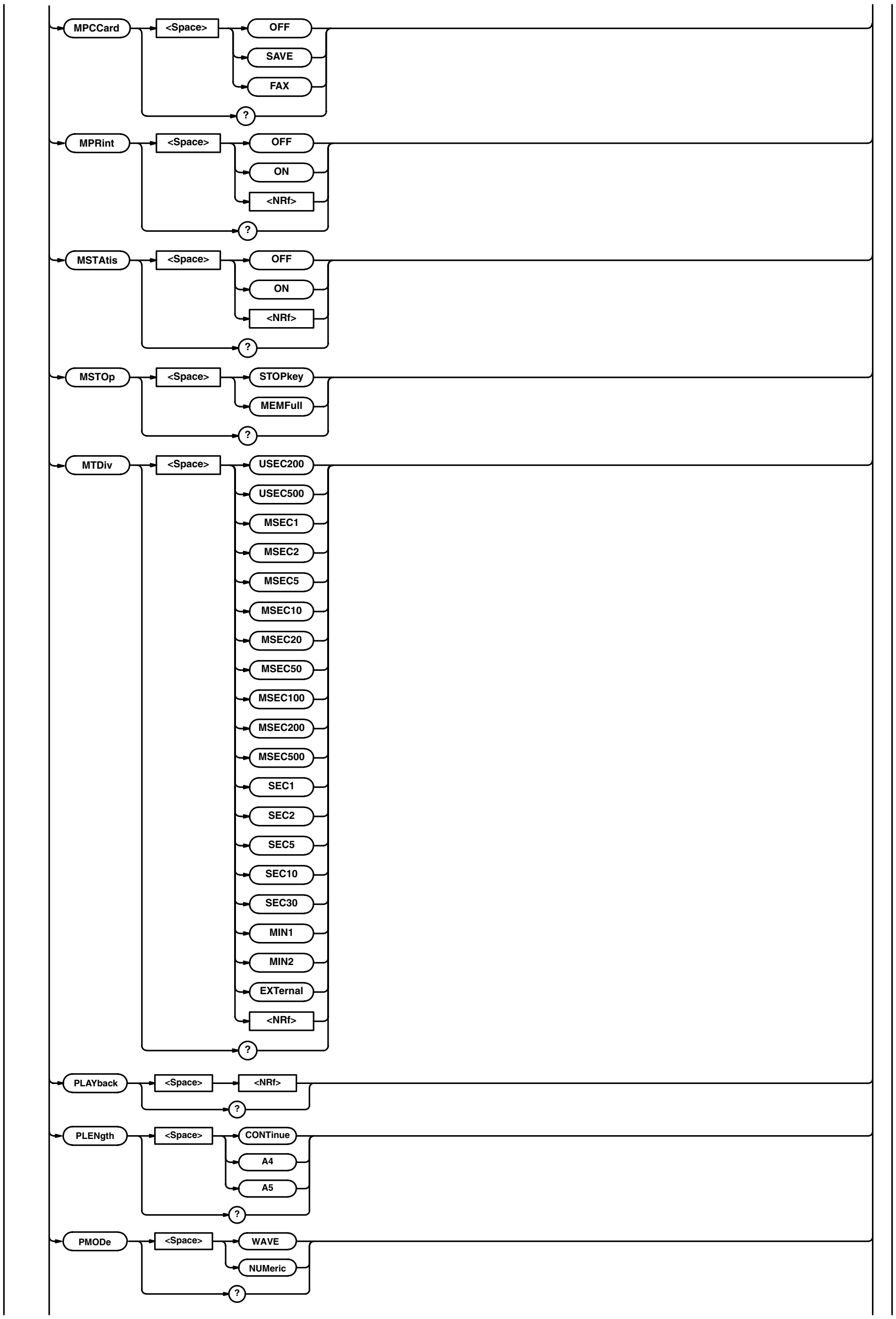


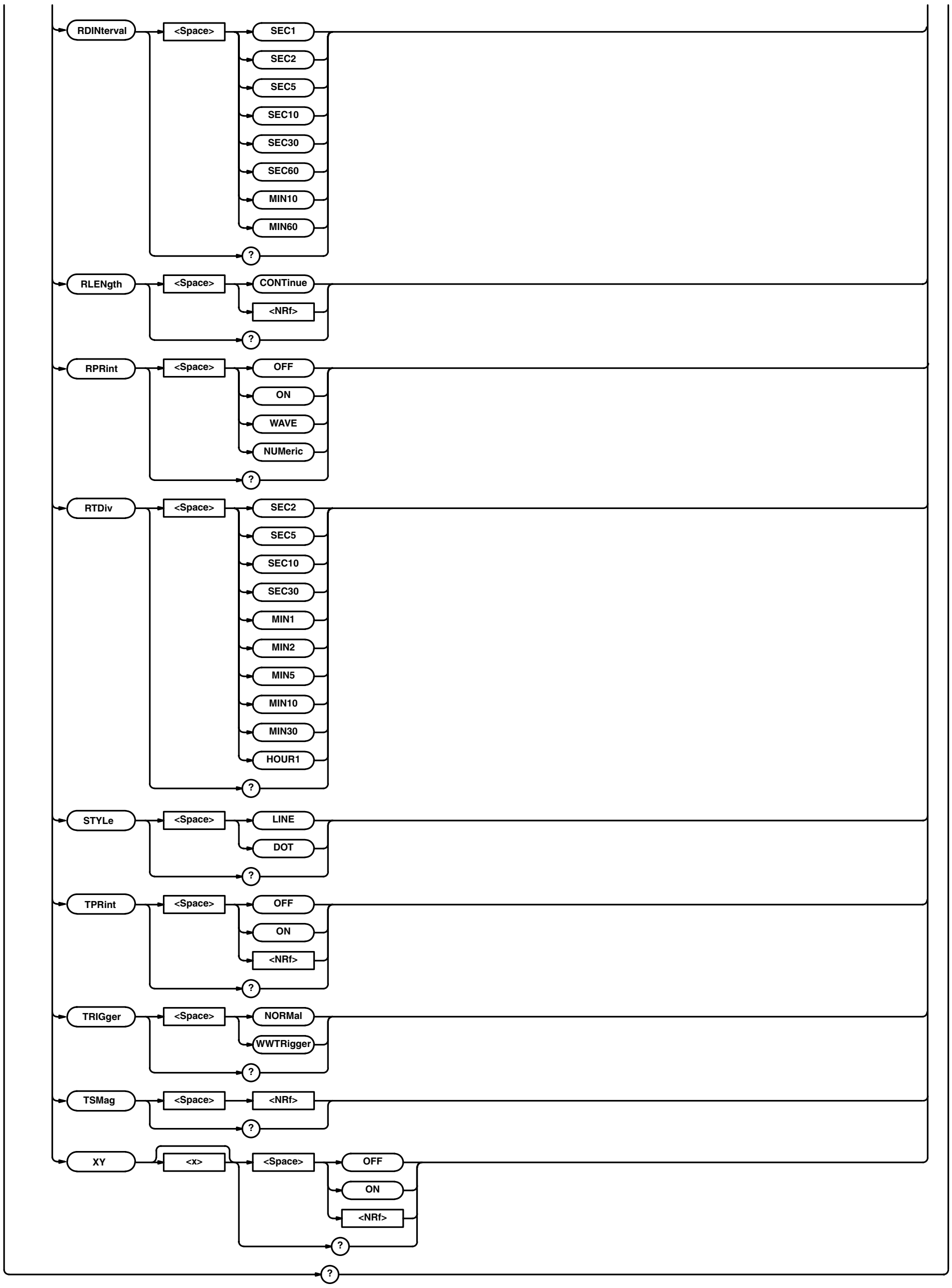


App

Appendix


SAVE
<Space>
OFF
MIN1
MIN10
MIN30
HOUR1
HOUR24
?
STARt
<Space>
OFF
ON
<NRf>
?
STTime
<Space>
<Character string>
?
?
UNIT
<Space>
LINear
LOG
?
WIRing
<Space>
SP2W12
SP2W34
SP3W
TP3W
?
?
LINE
<x>
<Space>
OFF
THIN
MIDDle
THICk
?
;
LOA
LOB
:
BIT
<x>
<Space>
OFF
ON
<NRf>
?
?
LOPRint
<Space>
OFF
BOTH
LOWer
EQUal
?
MBLength
<Space>
<NRf>
?
MCLear
<Space>
OFF
ON
<NRf>
?
MESSage
<Space>
OFF
COMMent
CHINfo
?
MINTerval
<Space>
<NRf>
?
MODE
<Space>
MEMory
REALTime
REALMem
HARMonic
?


MPCCard
<Space>
OFF
SAVE
FAX
?
MPRint
<Space>
OFF
ON
<NRf>
?
MSTAtis
<Space>
OFF
ON
<NRf>
?
MSTOp
<Space>
STOPkey
MEMFull
?
MTDiv
<Space>
USEC200
USEC500
MSEC1
MSEC2
MSEC5
MSEC10
MSEC20
MSEC50
MSEC100
MSEC200
MSEC500
SEC1
SEC2
SEC5
SEC10
SEC30
MIN1
MIN2
EXTernal
<NRf>
?
PLAYback
<Space>
<NRf>
?
PLENgth
<Space>
CONTinue
A4
A5
?
PMODe
<Space>
WAVE
NUMeric
?


RDINterval
<Space>
SEC1
SEC2
SEC5
SEC10
SEC30
SEC60
MIN10
MIN60
?
RLENgth
<Space>
CONTinue
<NRf>
?
RPRint
<Space>
OFF
ON
WAVE
NUMeric
?
RTDiv
<Space>
SEC2
SEC5
SEC10
SEC30
MIN1
MIN2
MIN5
MIN10
MIN30
HOUR1
?
STYLe
<Space>
LINE
DOT
?
TPRint
<Space>
OFF
ON
<NRf>
?
TRIGger
<Space>
NORMal
WWTRigger
?
TSMag
<Space>
<NRf>
?
XY
<x>
<Space>
OFF
ON
<NRf>
?
?

:MENU?

Function Queries all menu screen settings.

Syntax MENU?

Example MENU?→:MENU:MODE MEMORY;FORMAT ZONE4;ACCUMULATE 0;CPRINT 0;GAUGE 1;GRID FINE;LINE1 THIN;LINE2 THIN;LINE3 THIN;LINE4 THIN;LOA:BIT1 1;BIT2 1;BIT3 1;BIT4 1;:MENU:LOB:BIT1 1;BIT2 1;BIT3 1;BIT4 1;:MENU:LOPRINT OFF;MBLENGTH 1600;MCLEAR 0;MESSAGE OFF;MPCCARD OFF;MPRINT 0;MSTOP STOPKEY;MTDIV SEC5;PMODE ANALOG;TPRINT 1;TRIGGER NORMAL;TSMAG 3;MSTATIS 0;PLENGTH A5

:MENU:ACCumulate (Valid only when the mode is memory)

Function Sets/queries the accumulate display.

Syntax MENU:ACCumulate {<Boolean>}
MENU:ACCumulate?

Example MENU:ACCUMULATE ON
MENU:ACCUMULATE?→:MENU:ACCUMULATE 1

:MENU:CHARt

Function Sets/queries the chart speed when the mode is in realtime+memory mode.

Syntax MENU:CHARt {<Character data>}
MENU:CHARt?
{<Character data>}={SEC2|SEC5|SEC10|SEC30|MIN1|MIN2|MIN5|MIN10|MIN30|HOUR1}

Example MENU:CHART SEC2
MENU:CHART?→:MENU:CHART SEC2

:MENU:CPRint (Channel Print)

Function Sets/queries contents of the channel print.

Syntax MENU:CPRint {<Boolean>}
MENU:CPRint?

Example MENU:CPRINT OFF
MENU:CPRINT?→:MENU:CPRINT 0

:MENU:FORMat

Function Sets/queries the display format.

Syntax MENU:FORMat {ZONE1|ZONE2|ZONE4|XY}
MENU:FORMat?

Example MENU:FORMAT ZONE1
MENU:FORMAT?→:MENU:FORMAT ZONE1

:MENU:GAUGe

Function Sets/queries contents of the gage print.

Syntax MENU:GAUGe {<Boolean>}
MENU:GAUGe?

Example MENU:GAUGE ON
MENU:GAUGE?→:MENU:GAUGE 1

:MENU:GRID

Function Sets/queries the grid setting.

Syntax MENU:GRID {OFF|SIMPle|FINE}
MENU:GRID?

Example MENU:GRID OFF
MENU:GRID?→:MENU:GRID OFF

:MENU:HARMonic? (Valid only when the operation mode is set to harmonic)

Function Queries all the setting values relating to harmonic mode.

Syntax MENU:HARMonic?

Example MENU:HARMONIC?→:MENU:HARMONIC:METHOD AUTO;DISPLAY PPHASE;FREQUENCY 0.050E+03;TREND:SAVE STOPKEY;CHANNEL1:CONTENT 0;ORDER ODD3TO9;PHASE 0;RMS 1;TOTAL 0;:MENU:HARMONIC:TREND:CHANNEL2:CONTENT 0;ORDER ODD3TO9;PHASE 0;RMS 0;TOTAL 0;:MENU:HARMONIC:TREND:CHANNEL3:CONTENT 0;ORDER ODD3TO9;PHASE 0;RMS 0;TOTAL 0;:MENU:HARMONIC:TREND:CHANNEL4:CONTENT 0;ORDER ODD3TO9;PHASE 0;RMS 0;TOTAL 0;:MENU:HARMONIC:TREND:POWER1:CONTENT 0;ORDER ODDALL;PHASE 1;RMS 0;TOTAL 1;:MENU:HARMONIC:TREND:POWER2:CONTENT 0;ORDER ODD3TO9;PHASE 0;RMS 0;TOTAL 0;:MENU:HARMONIC:WIRING SP2W12:MENU:HARMONIC:CHANNEL 1

:MENU:HARMonic:CHANnel (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries the channel to analyze automatically.

Syntax
```
MENU:HARMonic:
CHANnel {<NRf>}
MENU:HARMonic:CHANnel?
{<NRf>} = 1 to 4
```

Example
```
MENU:HARMONIC:CHANNEL 1
MENU:HARMONIC:CHANNEL?
→:MENU:HARMONIC:CHANNEL 1
```

:MENU:HARMonic:CYCLe (Valid only when the operation mode is set to harmonic and the analysis method is set to waveform analysis.)

Function Sets/queries the memory length for waveform analysis.

Syntax
```
MENU:HARMonic:CYCLe {<NRf>}
MENU:HARMonic:CYCLe?
{<NRf>} = 5,10,25,50,100,
250,500,1000
```

Example
```
MENU:HARMONIC:CYCLE 5
MENU:HARMONIC:CYCLE?→:MENU:
HARMONIC:CYCLE 1
```

:MENU:HARMonic:DISPlay (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries the contents to display for the automatic analysis.

Syntax
```
MENU:HARMonic:DISPlay {TABLE1|
RMS|CONTent|PHASe|TABLE2|PRMS|
PCONtent|PPHase|OFF}
MENU:HARMonic:DISPlay?
```

Example
```
MENU:HARMONIC:DISPLAY RMS
MENU:HARMONIC:
DISPLAY?→:MENU:HARMONIC:
DISPLAY RMS
```

:MENU:HARMonic:FREQuency (Valid only when the operation mode is set to harmonic)

Function Sets/queries the frequency of the harmonic mode.

Syntax
```
MENU:HARMonic:
FREQuency {<Frequency>|AUTO}
MENU:HARMonic:FREQuency?
{<Frequency>}=50, 60  "AUTO"
:Valid only when the analysis
method is set to automatic
analysis.
```

Example
```
MENU:HARMONIC:FREQUENCY 50
MENU:HARMONIC:FREQUENCY?
→:MENU:HARMONIC:
FREQUENCY 0.050E+03
```

:MENU:HARMonic:METHod (Valid only when the operation mode is set to harmonic)

Function Sets/queries the analysis method of the harmonic mode.

Syntax
```
MENU:HARMonic:METHod {WAVE|
AUTO}
MENU:HARMonic:METHod?
```

Example
```
MENU:HARMONIC:METHOD WAVE
MENU:HARMONIC:MEHTOD?
→:MENU:HARMONIC:METHOD WAVE
```

:MENU:HARMonic:TRENd? (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Queries all the setting values relating to the trend save of the automatic analysis.

Syntax
```
MENU:HARMonic:TRENd?
```

Example
```
MENU:HARMONIC:TREND?
→:MENU:HARMONIC:TREND:
SAVE MIN1;END 1;
ENTIME "23:49";START 1;
STTIME "18:50";CHANNEL1:
CONTENT 0;ORDER ODDALL;
PHASE 0;RMS 1;TOTAL 0;:
MENU:HARMONIC:TREND:CHANNEL2:
CONTENT 0;ORDER ODD3TO9;
PHASE 0;RMS 0;TOTAL 0;:
MENU:HARMONIC:TREND:CHANNEL3:
CONTENT 1;ORDER ODD3TO9;
PHASE 0;RMS 0;TOTAL 0;:MENU:
HARMONIC:TREND:CHANNEL4:
CONTENT 0;ORDER ODD3TO9;
PHASE 0;RMS 0;TOTAL 0;:MENU:
HARMONIC:TREND:POWER1:
CONTENT 0;ORDER ODD3TO9;
PHASE 1;RMS 0;TOTAL 0;:MENU:
HARMONIC:TREND:POWER2:
CONTENT 0;ORDER ODD3TO9;
PHASE 0;RMS 0;TOTAL 0
```

:MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}? (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Queries all the setting values relating to the channel or power of the trend save of the automatic analysis.

Syntax
```
MENU:HARMonic:TRENd:
{CHANnel<X1>|POWer<X2>}?
<X1>=1 to 4, <X2>=1,2
```

Example
```
MENU:HARMONIC:TREND:
CHANNEL1?→:MENU:HARMONIC:
TREND:CHANNEL1:CONTENT 0;
ORDER ODD3TO9;PHASE 0;RMS 1;
TOTAL 0:MENU:HARMONIC:
METHOD WAVE
```

Description Valid only when the trend save is effective.

:MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}:CONTent (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries whether or not to save the relative harmonic content during trend save of automatic analysis.

Syntax
```
MENU:HARMonic:TRENd:
{CHANnel<X1>|POWer<X2>}:
CONTent {<Boolean>}
MENU:HARMonic:TRENd:
{CHANnel<X1>|POWer<X2>}:CONTent?
<X1>=1 to 4, <X2>=1,2
```

Example
```
MENU:HARMONIC:TREND:
CHANNEL1:CONTENT OFF
MENU:HARMONIC:TREND:CHANNEL1:
CONTENT?→:MENU:HARMONIC:
TREND:CHANNEL1:CONTENT 0
```

Description Valid only when the trend save is effective.

:MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}:ORDer (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries which harmonic order to save during trend save of automatic analysis.

Syntax
```
MENU:HARMonic:TRENd:
{CHANnel<X1>|POWer<X2>}:
ORDer{ODD3TO9|ODD3TO19|ODDALL|
ALL}
MENU:HARMonic:TRENd:
{CHANnel<X1>|POWer<X2>}:ORDer?
<X1>=1 to 4, <X2>=1,2
```

Example
```
MENU:HARMONIC:TREND:
CHANNEL1:ORDER ODD3TO9
MENU:HARMONIC:TREND:
CHANNEL1:ORDER?→:MENU:
HARMONIC:TREND:CHANNEL1:
ORDER ODD3TO9
```

Description Valid only when the trend save is effective.

:MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}:PHASe (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries whether or not to save the phase during trend save of automatic analysis.

Syntax
```
MENU:HARMonic:TRENd:
{CHANnel<X1>|POWer<X2>}:
PHASe {<Boolean>}
MENU:HARMonic:TRENd:
{CHANnel<X1>|POWer<X2>}:PHASe?
<X1>=1 to 4, <X2>=1,2
```

Example
```
MENU:HARMONIC:TREND:
CHANNEL1:PHASE ON
MENU:HARMONIC:TREND:CHANNEL1:
PHASE?→:MENU:HARMONIC:TREND:
CHANNEL1:PHASE 1
```

Description Valid only when the trend save is effective.

:MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}:RMS (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries whether or not to save the RMS value during trend save of automatic analysis.

Syntax MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}:RMS {<Boolean>}
MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}:RMS?
<X1>=1 to 4, <X2>=1,2

Example MENU:HARMONIC:TREND:CHANNEL1:RMS ON
MENU:HARMONIC:TREND:CHANNEL1:RMS?→:MENU:HARMONIC:TREND:CHANNEL1:RMS 1

Description Valid only when the trend save is effective.

:MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}:TOTal (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries whether or not to save the overall results during trend save of automatic analysis.

Syntax MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}:TOTal {<Boolean>}
MENU:HARMonic:TRENd:{CHANnel<X1>|POWer<X2>}:TOTal?
<X1>=1 to 4, <X2>=1,2

Example MENU:HARMONIC:TREND:CHANNEL1:TOTAL ON
MENU:HARMONIC:TREND:CHANNEL1:TOTAL?→:MENU:HARMONIC:TREND:CHANNEL1:TOTAL 1

Description Valid only when the trend save is effective.

:MENU:HARMonic:TRENd:END (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries whether or not to use the end time during trend save of automatic analysis.

Syntax MENU:HARMonic:TRENd:END {<Boolean>}
MENU:HARMonic:TRENd:END?

Example MENU:HARMONIC:TREND:END OFF
MENU:HARMONIC:TREND:END?
→:MENU:HARMONIC:TREND:END 0

:MENU:HARMonic:TRENd:ENTime (End Time) (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries the end time during trend save of automatic analysis.

Syntax MENU:HARMonic:TRENd:ENTime {<character string>}
MENU:HARMonic:TRENd:ENTime?
{<character string>}="HH:MM"
HH (hour)=00 to 23,
MM (minute)=00 to 59

Example MENU:HARMONIC:TREND:ENTIME "01:45"
MENU:HARMONIC:TREND:ENTIME?
→:MENU:HARMONIC:TREND:ENTIME "01:45"

:MENU:HARMonic:TRENd:STARt (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries whether or not to use the start time during trend save of automatic analysis.

Syntax MENU:HARMonic:TRENd:STARt {<Boolean>}
MENU:HARMonic:TRENd:STARt?

Example MENU:HARMONIC:TREND:START OFF
MENU:HARMONIC:TREND:START?
→:MENU:HARMONIC:TREND:START 0

:MENU:HARMonic:TRENd:STTime (Start Time) (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries the start time during trend save of automatic analysis.

Syntax MENU:HARMonic:TRENd:STTime {<character string>}
MENU:HARMonic:TRENd:STTime?
{<character string>}="HH:MM"
HH (hour)=00 to 23,
MM (minute)=00 to 59

Example MENU:HARMONIC:TREND:STTIME "01:45"
MENU:HARMONIC:TREND:STTIME?
→:MENU:HARMONIC:TREND:STTIME "01:45"

:MENU:HARMonic:TRENd:SAVE (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries the trend save interval of automatic analysis.

Syntax MENU:HARMonic:TRENd:
SAVE {OFF|MIN1|MIN10|MIN30|
HOUR1|HOUR24}
MENU:HARMonic:TRENd:SAVE?

Example MENU:HARMONIC:TREND:SAVE OFF
MENU:HARMONIC:TREND:SAVE?
→:MENU:HARMONIC:TREND:
SAVE OFF

:MENU:HARMonic:UNIT (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries the vertical scale of the RMS value graph of the automatic analysis.

Syntax MENU:HARMonic:UNIT {LINear|
LOG}
MENU:HARMonic:UNIT?

Example MENU:HARMONIC:UNIT LINEAR
MENU:HARMONIC:UNIT?
→:MENU:HARMONIC:UNIT LINEAR

Description Valid only when display content is RMS value or effective power.

:MENU:HARMonic:WIRing (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries the wiring method of the automatic analysis.

Syntax MENU:HARMonic:WIRing {SP2W12|
SP2W34|SP3W|TP3W}
MENU:HARMonic:WIRing?

Example MENU:HARMONIC:WIRING SP2W12
MENU:HARMONIC:WIRING?
→:MENU:HARMONIC:WIRING SP2W12

:MENU:LINE<X>

Function Sets/queries the line type used to record the analog ch.

Syntax MENU:LINE<X> {OFF|THIN|
MIDDle|THICk}
MENU:LINE<X>?
<x>=1 to 4 (corresponds to
CH1 to CH4)

Example MENU:LINE1 THIN
MENU:LINE1?→:MENU:LINE1 THIN

:MENU:{LOA|LOB}:BIT<X>

Function Sets/queries whether or not to display/record each bit of the logic channel.

Syntax MENU:{LOA|LOB}:
BIT<X> {<Boolean>}
MENU:{LOA|LOB}:BIT<X>?
LOA=Logic Ach, LOB=Logic Bch
<x>=1 to 4 (corresponds to
CH1 to CH4)

Example MENU:LOA:BIT1 ON
MENU:LOA:BIT1?→:MENU:LOA:
BIT1 1

:MENU:LOPRint

Function Sets/queries record position of the logic waveform.

Syntax MENU:LOPRint {OFF|BOTH|LOWer|
EQUal}
MENU:LOPRint?

Example MENU:LOPRINT UPPRE
MENU:LOPRINT?→:MENU:
LOPRINT UPPER

:MENU:MBLength (valid only when the mode is memory or real&memory)

Function Sets/queries the memory length.

Syntax MENU:MBLength {<NRf>}
MENU:MBLength?
When the format is "T-Y"
{<NRf>}=10,20,50,100,200,400,
800,1600,3200,6400
(The unit is div. 3200 and
6400 div are available on
long memory model only)
When the format is "X-Y"
{<NRf>}=800,1600,4000,8000,
16000,32000,64000,128000,256000,
512000
(The unit is data. 256000
and 512000 data are available
on long memory model only)

Example MENU:MBLENGTH 20
MENU:MBLENGTH?→:MENU:
MBLENGTH 20

:MENU:MCLear (valid only when the mode is memory or real&memory)

Function Sets/queries whether or not to clear the previous memory at memory start.

Syntax MENU:MCLear {<Boolean>}
MENU:MCLear?

Example MENU:MCLEAR OFF
MENU:MCLEAR?→:MENU:MCLEAR 0

:MENU:MESSage

Function Sets/queries contents of the message print.

Syntax MENU:MESSage {OFF|COMMent|CHINfo}
MENU:MESSage?

Example MENU:MESSAGE COMMENT
MENU:MESSAGE?→:MENU:MESSAGE COMMENT

:MENU:MINTerval (valid only when the mode is memory or real&memory and the recording mode is numeric)

Function Sets/queries the digital recording interval after capturing the data in the memory.

Syntax MENU:MINTerval {<NRf>}
MENU:MINTerval?
{<NRf>}=1,10,100

Example MENU:MINTERVAL 1
MENU:MINTERVAL?→:MENU:INTERVAL 1

:MENU:MODE

Function Sets/queries the operating mode.

Syntax MENU:MODE {MEMory|REALTime|REALMem|HARMonic}
MENU:MODE?

Example MENU:MODE MEMORY
MENU:MODE?→:MENU:MODE MEMORY

Description HARMonic is only available on the OR300E.

:MENU:MPCCard (valid only when the mode is memory or real&memory)

Function Sets/queries PC card operation after capturing the data in the memory.

Syntax MENU:MPCCard {OFF|SAVE|FAX}
MENU:MPCCard?

Example MENU:MPCCARD SAVE
MENU:MPCCARD?→:MENU:MPCCARD SAVE

:MENU:MPRint (valid only when the mode is memory or real&memory)

Function Sets/queries record setting after capturing the data in the memory.

Syntax MENU:MPRint {<Boolean>}
MENU:MPRint?

Example MENU:MPRINT OFF
MENU:MPRINT?→:MENU:MPRINT 0

:MENU:MSTAtis (valid only when the mode is memory or real&memory)

Function Sets/queries parameter calculation after capturing the data in the memory.

Syntax MENU:MSTAtis {<Boolean>}
MENU:MSTAtis?

Example MENU:MSTATIS ON
MENU:MSTATIS?→:MENU:MSTATIS 1

:MENU:MSTOp (valid only when the mode is memory or real&memory)

Function Sets/queries the memory stop condition during repeat triggering.

Syntax MENU:MSTOp {STOPkey|MEMFull}
MENU:MSTOp?

Example MENU:MSTOP STOPKEY
MENU:MSTOP?→:MENU:MSTOP STOPKEY

:MENU:MTDiv (valid only when the mode is memory or real&memory)

Function Sets/queries the time-axis rate during the data capture.

Syntax MENU:MTDiv {<character data>|<NRf>}
MENU:MTDiv?
When the format is "T-Y"
{<Character data>}={USEC200|USEC500|MSEC1|MSEC2|MSEC5|MSEC10|MSEC20|MSEC50|MSEC100|MSEC200|MSEC500|SEC1|SEC2|SEC5|SEC10|SEC30|MIN1|MIN2|EXTernal}
When the format is "X-Y"
{<NRf>}=400000 to 0.667
(The unit is S/s)
{<Character data>}={EXTernal}

Example MENU:MTDIV USEC200
MENU:MTDIV?→:MENU:MTDIV USEC200
MENU:MTDIV 400000
MENU:MTDIV?→:MENU:MTDIV 400000

:MENU:PLAYback (valid only when the mode is realtime and the simultaneous recording is numerical values and the format is T-Y)

Function Sets/queries the digital recording interval during playback.

Syntax
```
MENU:PLAYback {<NRf>}
MENU:PLAYback?
{<NRf>}=1,10,100
```

Example
```
MENU:PLAYBACK 1
MENU:PLAYBACK?→:MENU:
PLAYBACK 1
```

:MENU:PLENgth (valid only when the mode is memory or real&memory and the recording mode is wave)

Function Sets/queries record length.

Syntax
```
MENU:PLENgth {CONTinue|A4|
A5}
MENU:PLENgth?
```

Example
```
MENU:PLENGTH CONTINUE
MENU:PLENGTH?→:MENU:
PLENGTH CONTINUE
```

:MENU:PMODe (valid only when the mode is memory or real&memory)

Function Sets/queries record mode.

Syntax
```
MENU:PMODe {WAVE|NUMeric}
MENU:PMODe?
```

Example
```
MENU:PMODE WAVE
MENU:PMODE?→:MENU:PMODE WAVE
```

:MENU:RDINterval (valid only when the mode is realtime and the simultaneous recording is numerical values and the format is T-Y)

Function Sets/queries the digital printing interval during realtime recording.

Syntax
```
MENU:RDINterval {<Character
data>}
MENU:RDINterval?
{<Character data>}={SEC1|
SEC2|SEC5|SEC10|SEC30|SEC60|
MIN10|MIN60}
```

Example
```
MENU:RDINTERVAL SEC1
MENU:RDINTERVAL?→:MENU:
RDINTERVAL SEC1
```

:MENU:RLENgth (valid only when the mode is realtime and the format is T-Y)

Function Sets/queries the length of the realtime recording.

Syntax
```
MENU:RLENgth {CONTinue|
<NRf>}
MENU:RLENgth?
{<NRf>}=Memory length=20,200,
800
```

Example
```
MENU:RLENGTH CONTINUE
MENU:RLENGTH?→:MENU:
RLENGTH CONTINUE
```

Description 800 is for long memory model only

:MENU:RPRint (valid only when the mode is realtime)

Function Sets/queries the simultaneous recording.

Syntax
```
MENU:RPRint {<Character data>}
MENU:RPRint?
When the format is "T-Y"
{<Character data>}={OFF|
WAVE|NUMeric}
When the format is "X-Y"
{<Character data>}={OFF|ON}
```

Example
```
MENU:RPRINT OFF
MENU:RPRINT?→:MENU:
RPRINT OFF
```

:MENU:RTDiv (valid only when the mode is realtime and the format is T-Y)

Function Sets/queries the time-axis rate of the realtime recording.

Syntax
```
MENU:RTDiv {<Character data>}
MENU:RTDiv?
{<Character data>}={SEC2|
SEC5|SEC10|SEC30|MIN1|MIN2|
MIN5|MIN10|MIN30|HOUR1}
```

Example
```
MENU:RTDIV SEC2
MENU:RTDIV?→:MENU:RTDIV SEC2
```

:MENU:STYLe (valid only when the format is X-Y)

Function Sets/queries the recording method when the recording format is X-Y.

Syntax
```
MENU:STYLe {LINE|DOT}
MENU:STYLe?
```

Example
```
MENU:STYLE LINE
MENU:STYLE?→:MENU:STYLE LINE
```

:MENU:TPRint (Time print)

Function Sets/queries the time printing.

Syntax `MENU:TPRint {<Boolean>}`
`MENU:TPRint?`

Example `MENU:TPRINT ON`
`MENU:TPRINT?→:MENU:TPRINT 1`

:MENU:TRIGger (valid only when the mode is memory or real&memory and the format is T-Y)

Function Sets/queries the kind of trigger.

Syntax `MENU:TRIGger {NORMal|WWTRigger}`
`MENU:TRIGger?`

Example `MENU:TRIGGER NORMAL`
`MENU:TRIGGER?→:MENU:TRIGGER NORMAL`

:MENU:TSMag (valid only when the mode is memory or real&memory and the format is T-Y)

Function Sets/queries the T-axis zoom factor for memory display and recording.

Syntax `MENU:TSMag {<NRf>}`
`MENU:TSMag?`
`{<NRf>}=11 factors from 2 to 12`

Example `MENU:TSMAG 2`
`MENU:TSMAG?→:MENU:TSMAG 2`

:MENU:XY<X>

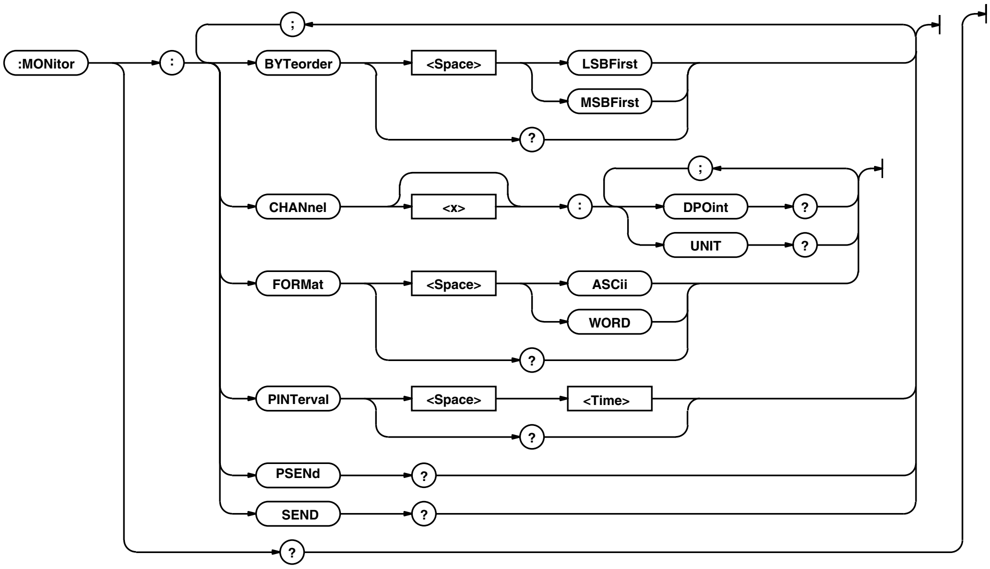
Function Sets/queries the Y-axis input (Y1 to Y3) of the X-Y recording.

Syntax `MENU:XY<X> {<Boolean>}`
`MENU:XY<X>?`
`<X>=1 to 3 (corresponds to Y1 to Y3)`

Example `MENU:XY1 ON`
`MENU:XY1?→:MENU:XY1 1`

MONitor Group

The commands in the MONitor group are used to set or query parameters corresponding to the MONOTOR key.



:MONitor?

Function Queries all setting values relating to the current measured data output.

Syntax `MONitor?`

Example `MONITOR?→:MONITOR:BYTEORDER LSBFIRST;FORMAT ASCII;PINTERVAL 1.000E+00`

:MONitor:BYTeorder

Function Sets/queries the byte order when sending data in word format.

Syntax `MONitor:BYTeorder {LSBFirst|MSBFirst}`
`MONitor:BYTeorder?`

Example `MONITOR:BYTEORDER MSBFIRST`
`MONITOR:BYTEORDER?→:MONITOR:BYTEORDER MSBFIRST`

:MONitor:CHANnel<X>:DPOint?

(decimal point)

Function Queries the decimal point position of the current measured data of the specified analog channel.

Syntax `MONitor:CHANnel<x>:DPOint?`
`<x>=1 to 4`

Example `MONITOR:CHANNEL1:DPOINT?→2`

:MONitor:CHANnel<X>:UNIT?

Function Queries the unit of the current measured data of the specified analog channel.

Syntax `MONitor:CHAnnel<x>:UNIT?`
`<x>=1 to 4`

Example `MONITOR:CHANNEL1:UNIT?`
`→MV (All Caps)`

:MONitor:FORMat

Function Sets/queries format of the data to send.

Syntax `MONitor:FORMat {ASCii|WORD}`
`MONitor:FORMat?`

Example `MONITOR:FORMAT ASCII`
`MONITOR:FORMAT?→:MONITOR:FORMAT ASCII`

Description WORD data can be converted to physical values with the following expression.
WORD data × E-(decimal point position) (unit)
(Decimal point position) can be determined by `MONitor:CHANnel<x>:DPOint?`
(Unit) can be determined by `MONITor:CHANnel<x>:UNIT?`

:MONitor:PINTerval (periodic interval)

Function Sets/queries the interval for sampling at a constant period.

Syntax `MONitor:PINTerval {<Time>}`
`MONitor:PINTerval?`
`{<Time>}=0.1S,0.2S,0.5S,1S`

Example `MONITOR:PINTERVAL 0.1S`
`MONITOR:PINTERVAL?→:MONITOR:PINTERVAL 0.100E+00`

:MONitor:PSENd? (periodic send)

Function Sends the measured data sampled at a constant period.

Syntax `MONitor:PSENd?`

Description **Output format**

#3<3-digit decimal number><data byte string><crlf>.

- #3
  Indicates that the number of characters will be output in a 3-digit decimal ASCII character string.
- <3-digit decimal number>
  Indicates the total number of bytes where the total is the sum of the data number and the data bytes. It is fixed to 014 in this case.
- <data number>
  Outputs the data number as 2-byte data
- <data byte string>
  Outputs the data of 4 ch+ logic 2 ch, regardless of the number of channels.
  When analog input is OFF, it outputs 0x7f7f.

Logic data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	1	1	1	1	0	0	0	0	1	0	0	1
				B								A			

A: Indicates the measurment data of each bit.
Bits 0 to 3 correspond to bit 1 to bit 4 of the logic input.

B: Indicates the ON/OFF setting of the display/recording of each bit.
Bits 8 to 11 correspond to bit 1 to bit 4 of the logic input.
0 : OFF
1 : ON

:MONitor:SEND?

Function Sends the current measured data.

Syntax `MONitor:SEND?`

Description ASCII format

		–	2	.	0	0	0	m	v						,	···

Measured value (eight characters, alignment right) unit (six characters)

···	1	0	1	1	,	1	0	1	1	cr	lf

Analog 4 ch + logic 2 ch are output. The measured values are separated by ","=0x2c. "Off" is output as the measured value for a channel whose input is turned OFF.

WORD format

The output format is #3<3-digit decimal number><data byte string><crlf>.

- #3
  Indicates that it is <block data>. The number indicates the number of digits in the byte number field of the following data.
- <3-digit decimal number>
  Indicates the number of bytes of data. 012 = 12 bytes.
- <data byte string>
  Indicates the measured value. Outputs the data of 4 ch+ logic 2 ch, regardless of the number of channels.
  When analog input is OFF, it outputs 0x7f7f.

Logic data

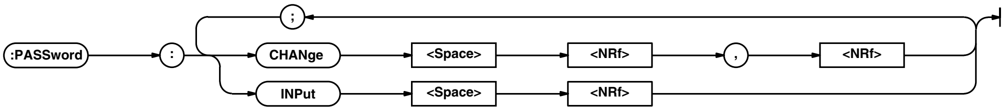
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	1	1	1	1	0	0	0	0	1	0	0	1
				B								A			

A: Indicates the measurment data of each bit.
Bits 0 to 3 correspond to bit 1 to bit 4 of the logic input.

B: Indicates the ON/OFF setting of the display/recording of each bit.
Bits 8 to 11 correspond to bit 1 to bit 4 of the logic input.
0 : OFF
1 : ON

PASSword Group

The commands in the PASSWord group set or query password parameters.
They are valid only during modem communication.



:PASSword:CHANge

Function Changes the password.

Syntax `PASSword:CHANge {<NRf>},{<NRf>}`
`{<NRf>},{<NRf>}={<OLD password},{<NEW password>}`
`{<NRf>}=0 to 9999`
`However, "0" is considered no password.`
`Password can be changed only if the OLD password is correct.`

Example `PASSWORD:CHANGE 0,1234`

Discription The default value is “0” (password not used)

:PASSword:INPut

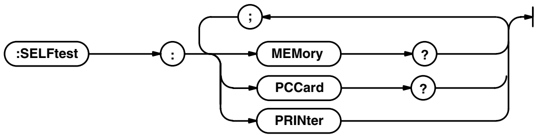
Function Enters the password.

Syntax `PASSword:INPut{<NRf>}`
`{<NRf>}=0 to 9999`

Example `PASSWORD:INPUT 100`

SELFtest Gorup

The commands in the SELFtest group are used to perform testing.



:SELFtest:MEMory?

Function Performs memory test and query the result.

Syntax `SELFtest:MEMory?`

Example `SELFTEST:MEMORY?`→`2`

Description
- If it passes the test, “0” is returned.
- If it fails the test, a value other than “0” is returned.

The sum of the following bits is output as an integer (decimal).

Bit	Description
0	ROM Test Result 0: Pass 1: Fail
1	RAM Test Result 0: Pass 1: Fail
2	Acquisition RAM Test Resutl 0: Pass 1: Fail

Bit3 to bit7 are empty (always 0).

:SELFtest:PCCard?

Function Performs PC card test and query the result.

Syntax `SELFtest:PCCard?`

Example `SELFTEST:PCCARD?`→`0`

Description
- If it passes the test, “0” is returned.
- If it fails the test, a value other than “0” is returned.

:SELFtest:PRINter

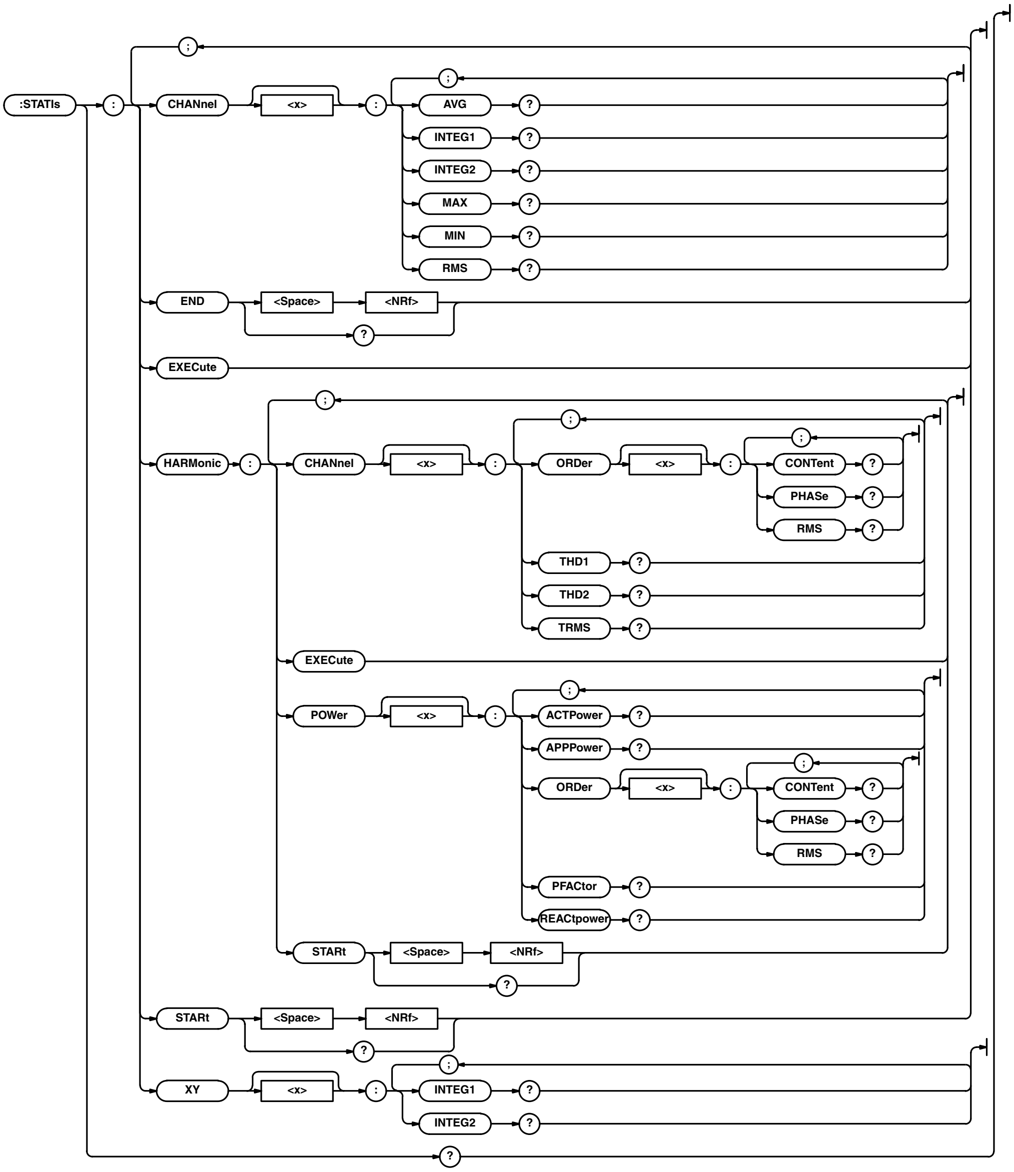
Function Performs printer test.

Syntax `SELFtest:PRINter`

Example `SELFTEST:PRINTER`

STATIs Group

The commands in the STATIs group deals with statistical calculation.



:STATIs?

Function Queries all setting values relating to statistical calculation.

Syntax `STATIs?`

Example `STATIS?→:STATIS:END 2000;START 0`

:STATIs:CHANnel<X>:AVG?

Function Queries the average value of the calculation result of the specified analog CH.

Syntax `STATIs:CHANnel<X>:AVG?`
`<X>=1 to 4`

Example `STATIS:CHANNEL1:AVG?→"1.23mV"`

Description
- If calculation is not performed, "`"Off"`" is returned.
- If the result is abnormal, "`"*****"`" is returned.

:STATIs:CHANnel<X>:INTEG1?

Function Queries the INTEG1 value of calculation result of the specified analog ch.

Syntax `STATIs:CHANnel<X>:INTEG1?`
`<X>=1 to 4`

Example `STATIS:CHANNEL1:INTEG1?→"1.23"`

Description If calculation is not performed, "`"Off"`" is returned.
If calculation is abnormal, "`"*****"`" is returned.

:STATIs:CHANnel<X>:INTEG2

Function Queries the INTEG2 value of calculation result of the specified analog ch.

Syntax `STATIs:CHANnel<X>:INTEG2?`
`<X>=1 to 4`

Example `STATIS:CHANNEL1:INTEG2?→"1.234"`

Description If calculation is not performed, "`"off"`" is returned.
If calculation is abnormal, "`"*****"`" is returned.

:STATIs:CHANnel<X>:MAX?

Function Queries the maximum value of the calculation result of the specified analog CH and the time the value was measured.

Syntax `STATIs:CHANnel<X>:MAX?`
`<X>=1 to 4`

Example `STATIS:CHANNEL1:MAX?→"1.23V,2.3ms"`

Description {<maximum value>, <time of measurement>}
- If calculation is not performed, "`"Off"`" is returned.
- If the result is abnormal, "`"*****"`" is returned.

:STATIs:CHANnel<X>:MIN?

Function Queries the minimum value of the calculation result of the specified analog CH and the time the value was measured.

Syntax `STATIs:CHANnel<X>:MIN?`
`<X>=1 to 4`

Example `STATIS:CHANNEL1:MIN?→"1.23V,2.3ms"`

Description {<minimum value>, <time of measurement>}
- If calculation is not performed, "`"Off"`" is returned.
- If the result is abnormal, "`"*****"`" is returned.

:STATIs:CHANnel<X>:RMS?

Function Queries the RMS value of the calculation result of the specified analog ch.

Syntax `STATIs:CHANnel<X>:RMS?`
`<X>=1 to 4`

Example `STATIS:CHANNEL1:RMS?→"1.23mV"`

Description
- If calculation is not performed, "`"Off"`" is returned.
- If the result is abnormal, "`"*****"`" is returned.

:STATIs:END

Function Sets/Queries the data number of the end of the calculation.

Syntax `STATIs:STARt {<NRf>}`
`STATIs:STARt?`
`{<NRf>} Data No.=0 to 127999 (128kW/CH Model No.0 to 511999)`

Example `STATIS:END 1000`
`STATIS:END?→:STATIS:END 1000`

:STATIs:EXECute

Function Executes calculation.

Syntax `STATIs:EXECute`

Example `STATIS:EXECUTE`

:STATIs:HARMonic:CHANnel<X1>:ORDer<X2>:CONTent?

Function Queries the relative harmonic content of each harmonic order of each analog channel from the results of the harmonic analysis.

Syntax `STATIs:HARMonic:CHANnel<X1>:ORDer<X2>:CONTent?`
`<X1>=1 to 4 Channel,`
`<X2>=1 to 40 Harmonic order`

Example `STATIS:HARMONIC:CHANNEL1:ORDER3:CONTENT?→"3.33%"`

Description If calculation is not performed, "`off`" is returned.
If calculation is abnormal, "`"*****"`" is returned.

:STATIs:HARMonic:CHANnel<X1>:ORDer<X2>:PHASe?

Function Queries the phase of each harmonic order of each analog channel from the results of the harmonic analysis.

Syntax `STATIs:HARMonic:CHANnel<X1>:ORDer<X2>:PHASe?`
`<X1>=1 to 4 Channel,`
`<X2>=1 to 40 Harmonic order`

Example `STATIS:HARMONIC:CHANNEL1:ORDER3:PHASE?→"3.5deg"`

Description If calculation is not performed, "`off`" is returned.
If calculation is abnormal, "`"*****"`" is returned.

:STATIs:HARMonic:CHANnel<X1>:ORDer<X2>:RMS?

Function Queries the RMS value of each harmonic order of each analog channel from the results of the harmonic analysis.

Syntax `STATIs:HARMonic:CHANnel<X1>:ORDer<X2>:RMS?`
`<X1>=1 to 4 Channel,`
`<X2>=1 to 40 Harmonic order`

Example `STATIS:HARMONIC:CHANNEL1:ORDER3:RMS?→"3.33V"`

Description If calculation is not performed, "`off`" is returned.
If calculation is abnormal, "`"*****"`" is returned.

:STATIs:HARMonic:CHANnel<X>:THD1?

Function Queries the harmonic distortion (IEC) of each analog channel from the results of the harmonic analysis.

Syntax `STATIs:HARMonic:CHANnel<X>:THD1?`
`<X>=1 to 4 Channel`

Example `STATIS:HARMONIC:CHANNEL1:THD1?→"3.33%"`

Description If calculation is not performed, "`off`" is returned.
If calculation is abnormal, "`"*****"`" is returned.

:STATIs:HARMonic:CHANnel<X>:THD2?

Function Queries the harmonic distortion (CSA) of each analog channel from the results of the harmonic analysis.

Syntax `STATIs:HARMonic:CHANnel<X>:THD2?`
`<X>=1  to  4 Channel`

Example `STATIS:HARMONIC:CHANNEL1:THD2?→"3.33%"`

Description If calculation is not performed, "`off`" is returned.
If calculation is abnormal, "`"*****"`" is returned.

:STATIs:HARMonic:CHANnel<X>: TRMS? (Total RMS)

Function Queries the total RMS value of each analog channel from the results of the harmonic analysis.

Syntax `STATIs:HARMonic:CHANnel<X>: TRMS?`
`<X>=1 to 4 Channel`

Example `STATIS:HARMONIC:CHANNEL1: TRMS?→"3.5V"`

Description If calculation is not performed, "`off`" is returned.
If calculation is abnormal, "`"*****"`" is returned.

:STATIs:HARMonic:EXECute (Valid only when the operation mode is set to harmonic)

Function Executes the harmonic analysis.

Syntax `STATIs:HARMonic:EXECute`

Example `STATIS:HARMONIC:EXECUTE`

Description Valid only when the screen is at the harmonic analysis screen.

:STATIs:HARMonic:POWer<X>: ACTPower?

Function Queries the total effective power from the results of the harmonic analysis.

Syntax `STATIs:HARMonic:POWer<X>: ACTPower?`
`<X>=1 to 2 (2 is valid only for single-phase two-wire (CH3-CH4))`

Example `STATIS:HARMONIC:POWER1: ACTPOWER?→"3.33W"`

Description If calculation is not performed, "`off`" is returned.
If calculation is abnormal, "`"*****"`" is returned.

:STATIs:HARMonic:POWer<X>: APPPower?

Function Queries the apparent power from the results of the harmonic analysis.

Syntax `STATIs:HARMonic:POWer<X>: APPPower?`
`<X>=1 to 2 (2 is valid only for single-phase two-wire (CH3-CH4))`

Example `STATIS:HARMONIC:POWER1: APPPOWER?→"3.33var"`

Description If calculation is not performed, "`off`" is returned.
If calculation is abnormal, "`"*****"`" is returned.

:STATIs:HARMonic:POWer<X1>: ORDer<X2>:CONTent?

Function Queries the relative power content of each harmonic order from the results of the harmonic analysis.

Syntax `STATIs:HARMonic:POWer<X1>: ORDer<X2>:CONTent?`
`<X1>=1 to 2 (2 is valid only for single-phase two-wire (CH3-CH4)), <X2>=1 to 40 Harmonic order`

Example `STATIS:HARMONIC:POWER1: ORDER3:CONTENT?→"3.33%"`

Description If calculation is not performed, "`off`" is returned.
If calculation is abnormal, "`"*****"`" is returned.

:STATIs:HARMonic:POWer<X1>: ORDer<X2>:PHASe?

Function Queries the power phase of each harmonic order from the results of the harmonic analysis.

Syntax `STATIs:HARMonic:POWer<X1>: ORDer<X2>:PHASe?`
`<X1>=1 to 2 (2 is valid only for single-phase two-wire (CH3-CH4)), <X2>=1 to 40 Harmonic order`

Example `STATIS:HARMONIC:POWER1: ORDER3:PHASE?→"3.33deg"`

Description If calculation is not performed, "`off`" is returned.
If calculation is abnormal, "`"*****"`" is returned.

:STATIs:HARMonic:POWer<X1>:ORDer<X2>:RMS?

Function Queries the effective power of each harmonic order from the results of the harmonic analysis.

Syntax STATIs:HARMonic:POWer<X1>:ORDer<X2>:RMS?
<X1>=1 to 2 (2 is valid only for single-phase two-wire (CH3-CH4)), <X2>=1 to 40 Harmonic order

Example STATIS:HARMONIC:POWER1:ORDER3:RMS?→"3.5V"

Description If calculation is not performed, "off" is returned.
If calculation is abnormal, ""*****"" is returned.

:STATIs:HARMonic:POWer<X>:PFACtor?

Function Queries the power factor from the results of the harmonic analysis.

Syntax STATIs:HARMonic:POWer<X>:PFACtor?
<X>=1 to 2 (2 is valid only for single-phase two-wire (CH3-CH4))

Example STATIS:HARMONIC:POWER1:PFACTOR?→"3.33"

Description If calculation is not performed, "off" is returned.
If calculation is abnormal, ""*****"" is returned.

:STATIs:HARMonic:POWer<X>:REACtpower?

Function Queries the reactive power from the results of the harmonic analysis.

Syntax STATIs:HARMonic:POWer<X>:REACtpower?
<X>=1 to 2 (2 is valid only for single-phase two-wire (CH3-CH4))

Example STATIS:HARMONIC:POWER1:REACTPOWER?→"3.33VA"

Description If calculation is not performed, "off" is returned.
If calculation is abnormal, ""*****"" is returned.

:STATIs:HARMonic:STARt

Function Sets/queries the first data number of the harmonic analysis.
(511999 for 128 kW/CH model)

Syntax STATIs:HARMonic:STARt {<NRf>}
STATIs:HARMonic:STARt?
{<NRf>} data number =0 to 127999 (0 to (511999 for 128 kW/CH model)

Example STATIS:HARMONIC:START 0
STATIS:HARMONIC:START?
→:STATIS:HARMONIC:START 0

Description Valid only when the screen is at the harmonic analysis screen.

:STATIs:STARt

Function Sets/Queries the data number of the start of the calculation.

Syntax STATIs:STARt {<NRf>}
STATIs:STARt?
{<NRf>} Data No.=0 to 127999 (128kW/CHModelNo.0 to 511999)

Example STATIS:START 0
STATIS:START?→:STATIS:START 0

:STATIs:XY<X>:INTEG1?

Function Queries the calculated area of the X-Y recording.

Syntax STATIs:XY<X>:INTEG1?
<X>=1 to 3 (Y1 to Y3)

Example STATIS:XY1:INTEG1?→"1.23"

Description
- If calculation is not performed, ""Off"" is returned.
- If the result is abnormal, ""*****"" is returned.

:STATIs:XY<X>:INTEG2

Function Queries the calculated area during X-Y.

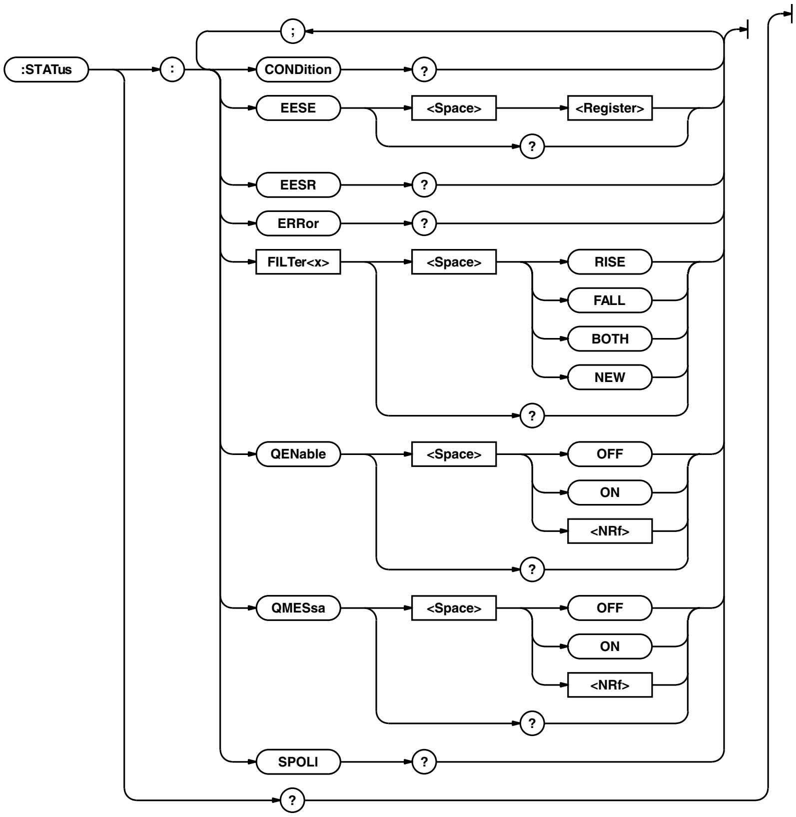
Syntax STATIs:XY<X>:INTEG2?
<X>=1 to 3 (Y1 to Y3)

Example STATIS:XY1:INTEG2?→"1.234"

Description
- If calculation is not performed, ""Off"" is returned.
- If the result is abnormal, ""*****"" is returned.

STATus Group

The commands in the STATus group deal with the status report. For information on the status report, see appendix 1.3.



:STATus?

Function Queries all the settings relating to the status of the communication function.

Syntax `STATus?`

Example `STATUS?→:STATUS:EESE 0;FILTER1 RISE;FILTER2 RISE;FILTER3 RISE;FILTER4 RISE;FILTER5 RISE;FILTER6 RISE;FILTER7 RISE;FILTER8 RISE;FILTER9 RISE;FILTER10 RISE;FILTER11 RISE;FILTER12 RISE;FILTER13 RISE;FILTER14 RISE;FILTER15 RISE;FILTER16 RISE;QENABLE 1;QMESSAGE 1`

:STATus:CONDition?

Function Queries the contents of the condition register.

Syntax `STATus:CONDition?`

Example `STATUS:CONDITION?→16`

:STATus:EESE

Function Sets/Queries the extended event enable register.

Syntax `STATus:EESE {<Register>}`
`STATus:EESE?`
`<Register>=0 to 65535`

Example `STATUS:EESE 0`
`STATUS:EESE?→:STATUS:EESE 0`

:STATus:EESR?

Function Queries the contents of the extended event register and clears the register.

Syntax `STATus:EESR?`

Example `STATUS:EESR?→0`

App

Appendix

:STATus:ERRor?

Function Queries the error code and message (head of the error queue).

Syntax `STATus:ERRor?`

Example `STATUS:ERREOR?`
`→201, "Syntax error"`

Description If there is no error, "`0, "No error"`" is returned.
You can set whether or not to add the message contents using the "`STATus:QMESsage`" command.

:STATus:FILTer<X>

Function Sets/Queries the specified transition filter.

Syntax `STATus:FILTer<x> {RISE|FALL|BOTH|NEVer}`
`STATus:FILTer<x> ?`
`<x>=1 to 16`

Example `STATUS:FILTER2 RISE`
`STATUS:FILTER2?→:STATUS:FILTER2 RISE`

Description Specify how each bit of the condition register must change to set the event.
"`Rise`" sets the event when 0 changes to 1.

:STATus:QENable

Function Sets/Queries whether or not to store messages other than error messages in the error queue.

Syntax `STATus:QENable {<Boolean>}`
`STATus:QENnable?`

Example `STATUS:QENABLE ON`
`STATUS:QENABLE?→:STATUS:QENABLE 1`

:STATus:QMESsage

Function Sets/Queries whether or not to add the message contents to the "`STATus:ERRor?`" response.

Syntax `STATus:QMESsage {<Boolean>}`
`STATus:QMESsage?`

Example `STATUS:QMESSAGE OFF`
`STATUS:QMESSAGE?→:STATUS:QMESSAGE 0`

:STATus:SPOLl? (Serial Poll)

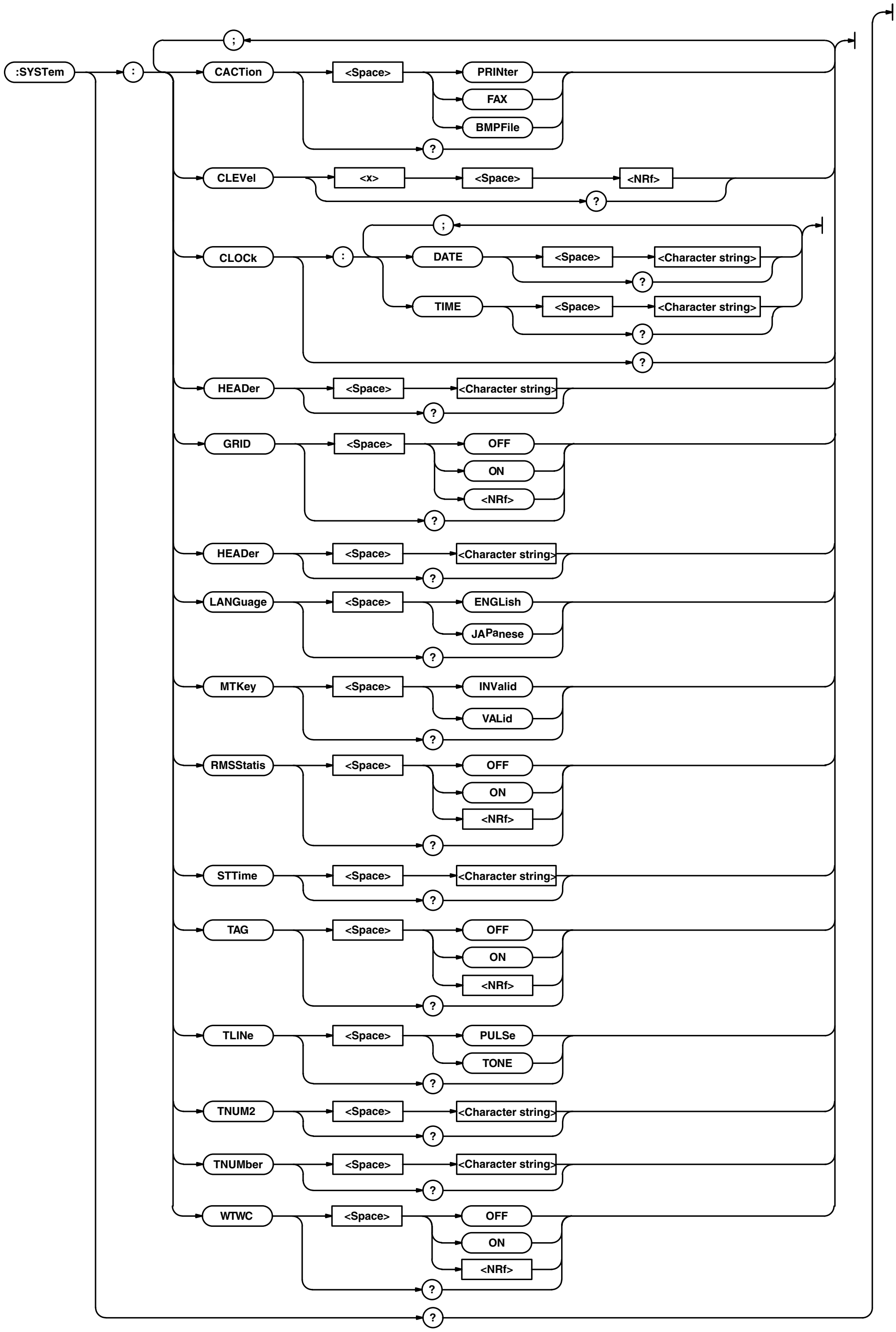
Function Executes a serial poll.

Syntax `STATus:SPOLl?`

Example `STATUS:SPOLL?→4`

SYSTem Group

The commands in the SYSTem group set or query system parameters. These commands correspond to the SYSTEM key.



App

Appendix

:SYSTem?

Function Queries all the system settings.

Syntax `SYSTem?`

Example `SYSTEM?→:SYSTEM:CACTION PRINTER;CLOCK: DATE "97/07/12"; TIME "03:50:12";:SYSTEM: EXT TRIGGER;HEADER "OR100E "; LANGUAGE ENGLISH; MTKEY VALID;RMSSTATIS 0; TAG 0;TLINE TONE; TNUMBER "0123456789        "`

:SYSTem:CACTion

Function Sets/Queries the destination of the hard copy.

Syntax `SYSTem:CACTion {PRINter|FAX|BMPFile}`
`SYSTem:CACTion?`

Example `SYSTEM:CACTION PRINTER`
`SYSTEM:CACTION?→:SYSTEM:CACTION PRINTER`

:SYSTem:CLEVel<x>

Function Sets/queries the allowed with of the wave window trigger for each channel.

Syntax `SYSTem:CLEVel<x> {<NRf>}`
`SYSTem:CLEVel<x>?`

Example `SYSTEM:CLEVel1 20`
`SYSTEM:CLEVel1?→:SYSTEM:CLEVel1 20`

:SYSTem:CLOCk?

Function Sets/Queries all the settings relating to date and time.

Syntax `SYSTem:CLOCk?`

Example `SYSTEM:CLOCK?→:SYSTEM:CLOCK:DATE "97/07/12"; TIME "03:52:58"`

:SYSTem:CLOCk:DATE

Function Sets/Queries the date.

Syntax `SYSTem:CLOCk:DATE {<character string>}`
`SYSTem:CLOCk:DATE?`
`<character string>="YY/MM/DD"`
`YY (2 A.D)=00 to 99,`
`MM (Month)=01 to12,`
`DD (Day)=01 to 31`

Example `SYSTEM:CLOCK:DATE "97/04/01"`
`SYSTEM:CLOCK:DATE?→:SYSTEM:CLOCK:DATE "97/04/01"`

:SYSTem:CLOCk:TIME

Function Sets/Queries the time.

Syntax `SYSTem:CLOCk:TIME {<character string>}`
`SYSTem:CLOCk:TIME?`
`<character string>="HH:MM:SS"`
`HH (Hour)=00 to 23,`
`MM (Min)=00 to 59,`
`SS (Sec)=00 to 59`

Example `SYSTEM:CLOCK:TIME "02:08:56"`
`SYSTEM:CLOCK:TIME?→:SYSTEM:CLOCK:TIME "02:08:56"`

:SYSTem:ETime

Function Sets/queries the time at which the width of the wave window trigger is reset to the original value.

Syntax `SYSTem:ETime {<character string>}`
`SYSTem:ETime?`

Example `SYSTEM:ETIME "06:00:00"`
`SYSTEM:ETIME?→:SYSTEM:ETIME "06:00:00"`

:SYSTem:GRID

Function Sets/queries whether or not to display the grid.

Syntax `SYSTem:GRID {<Boolean>}`
`SYSTem:GRID?`

Example `SYSTEM:GRID ON`
`SYSTEM:GRID?→:SYSTEM:GRID 1`

:SYSTem:HEADer

Function Sets/Queries the header to the FAX message.

Syntax `SYSTem:HEADer {<character string data>}`
`SYSTem:HEADer?`

Example `SYSTEM:HEADER "OR100E"`
`SYSTEM:HEADER?→:SYSTEM:HEADER? "OR100E"`

:SYSTem:LANGuage

Function Sets/Queries the display language.

Syntax `SYSTem:LANGuage {ENGLish|JAPanese}`
`SYSTem:LANGuage?`

Example `SYSTEM:LANGUAGE ENGLISH`
`SYSTEM:LANGUAGE?→:SYSTEM:LANGUAGE ENGLISH`

:SYSTem:MTKey (Manual Trigger Key)

Function Sets/Queries the manual trigger key.

Syntax SYSTem:MTKey {INValid|VALid}
SYSTem:MTKey?

Example SYSTEM:MTKEY INVALID
SYSTEM:MTKEY→:SYSTEM:
MTKEY INVALID

:SYSTem:RMSStatis

Function Sets/Queries whether or not to calculate the expansion.

Syntax SYSTem:RMSStatis {<Boolean>}
SYSTem:RMSStatis?

Example SYSTEM:RMSSTATIS ON
SYSTEM:RMSSTATIS?→:SYSTEM:
RMSSTATIS 1

:SYSTem:STTime

Function Sets/queries the time at which the width of the wave window trigger is changed.

Syntax SYSTem:STTime {<Character string>}
SYSTem:STTime?

Example SYSTEM:STTIME "20:00:00"
SYSTEM:STTIME?→:SYSTEM:
STTIME "06:00:00"

:SYSTem:TAG

Function Sets/Queries whether or not to use the tag.

Syntax SYSTem:TAG {<Boolean>}
SYSTem:TAG?

Example SYSTEM:TAG ON
SYSTEM:TAG?→:SYSTEM:TAG 1

:SYSTem:TLINe (Tel Line)

Function Sets/Queries the type of telephone line used for FAX/MODEM.

Syntax SYSTem:TLINe {PULSe|TONE}
SYSTem:TLINe?

Example SYSTEM:TLINE PULSE
SYSTEM:TLINE?→:SYSTEM:TLINE
PULSE

:SYSTem:TNUM2 (Tel Number)

Function Sets/Queries the destination telephone number 2 for FAX/MODEM.

Syntax SYSTem:TNUM2 {<Character string data>}
SYSTem:TNUM2?

Example SYSTEM:TNUM2 "0123456789"
SYSTEM:TNUM2?→:SYSTEM:
TNUM2 "0123456789"

:SYSTem:TNUMber (Tel Number)

Function Sets/Queries the destination telephone number for FAX/MODEM.

Syntax SYSTem:TNUMber {<character string data>}
SYSTem:TNUMber?

Example SYSTEM:TNUMBER "0123456789"
SYSTEM:TNUMBER?→:SYSTEM:
TNUMBER "0123456789"

:SYSTem:WTWC

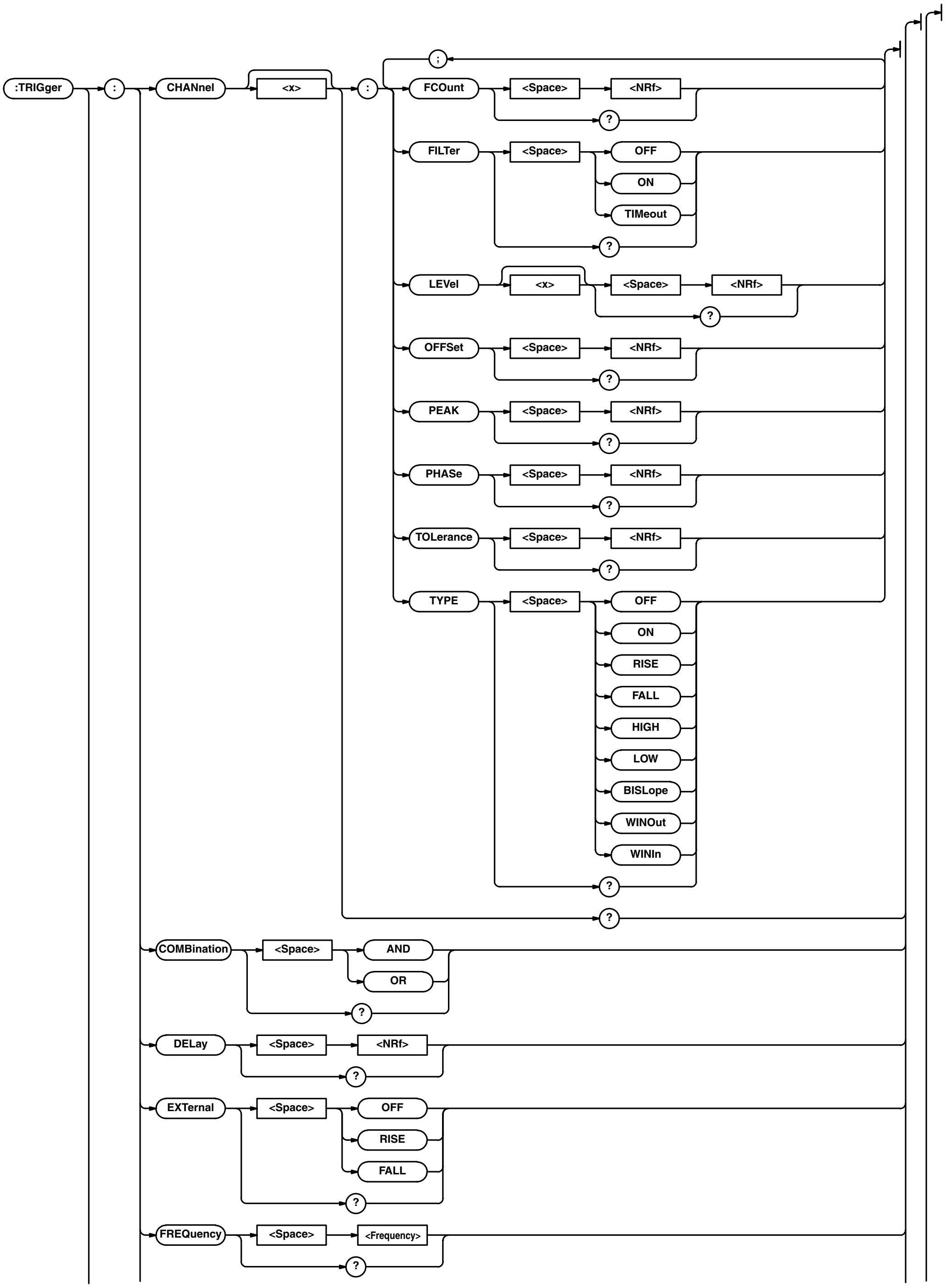
Function Sets/queries the function used to change the width of the wave window trigger.

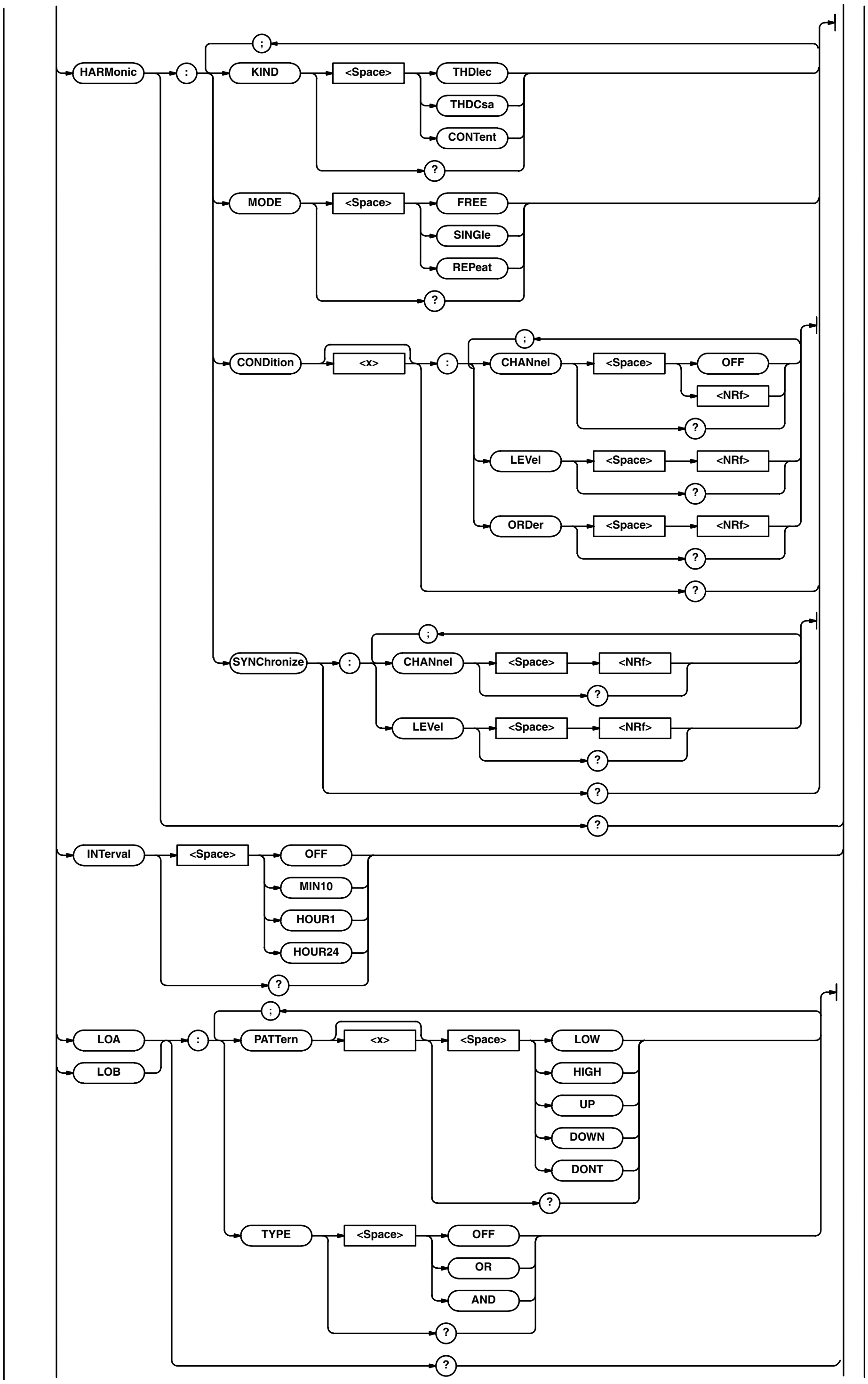
Syntax SYSTem:WTWC {<Boolean>}
SYSTem:WTWC?

Example SYSTEM:WTWC ON
SYSTEM:WTWC→:SYSTEM:WTWC ON

TRIGger Group

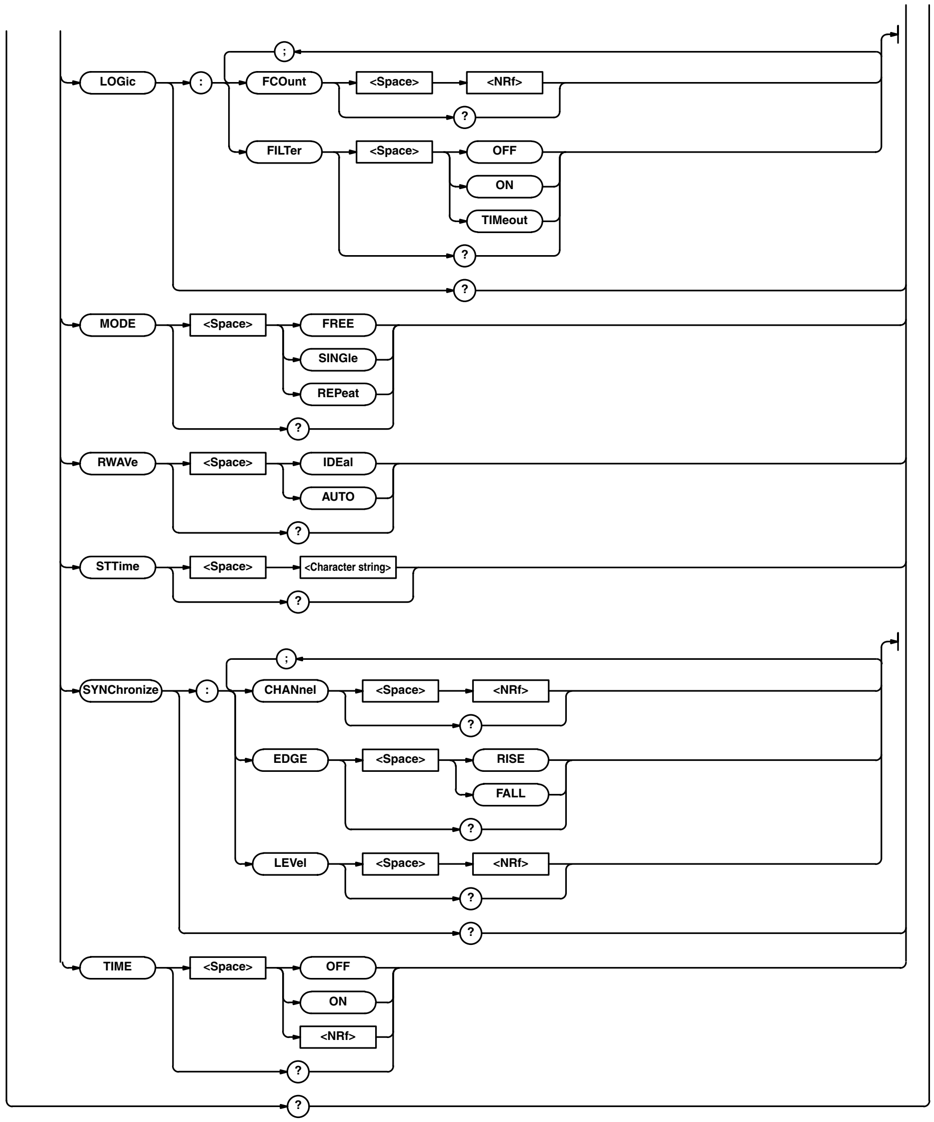
The commands in the TRIGger group set or query system parameters. These commands correspond to the TRIGGER key.





App

Appendix



LOGic
:
;
FCOunt
<Space>
<NRf>
?
FILTer
<Space>
OFF
ON
TIMeout
?
?
MODE
<Space>
FREE
SINGle
REPeat
?
RWAVe
<Space>
IDEal
AUTO
?
STTime
<Space>
<Character string>
?
SYNChronize
:
;
CHANnel
<Space>
<NRf>
?
EDGE
<Space>
RISE
FALL
?
LEVel
<Space>
<NRf>
?
?
TIME
<Space>
OFF
ON
<NRf>
?
?

:TRIGger?

Function Queries all trigger settings.

Syntax `TRIGger?`

Example
```
TRIGGER?→:TRIGGER:MODE FREE;
CHANNEL1:TYPE RISE;FILTER ON;
LEVEL1 0;FCOUNT 1;:TRIGGER:
CHANNEL2:TYPE WINOUT;
FILTER ON;LEVEL1 0;LEVEL2 0;
FCOUNT 1;:TRIGGER:CHANNEL3:
TYPE FALL;FILTER ON;LEVEL1 0;
FCOUNT 1;:TRIGGER:CHANNEL4:
TYPE BISLOPE;LEVEL1 0;:
TRIGGER:COMBINATION OR;
DELAY 0;EXTERNAL OFF;
INTERVAL OFF;LOA:TYPE AND;
PATTERN1 DONT;PATTERN2 DONT;
PATTERN3 DONT;PATTERN4 DONT;:
TRIGGER:LOB:TYPE OR;
PATTERN1 DONT;PATTERN2 DONT;
PATTERN3 DONT;PATTERN4 DONT;:
TRIGGER:LOGIC:FILTER ON;
FCOUNT 1;:TRIGGER:TIME 0
```

:TRIGger:CHANnel<X>?

Function Queries all setting values relating to the specified analog ch for triggering.

Syntax
```
TRIGger:CHANnel<X>?
<X>=1 to 4
```

Example
```
TRIGGER:CHANNEL1?→:TRIGGER:
CHANNEL1:TYPE WINOUT;FILTER
ON;LEVEL1 0;LEVEL2 0;
FCOUNT 1
```

:TRIGger:CHANnel<X>:FCOunt (Filter Count)

Function Sets/Queries the trigger filter amount of the specified analog ch for the normal trigger.

Syntax
```
TRIGger:CHANnel<X>:FCOunt
{<NRf>} <X>=1 to 4
TRIGger:CHANnel<X>:FCOunt?
{<NRf>}=1 to 255
```

Example
```
TRIGGER:CHANNEL1:FCOUNT 1
TRIGGER:CHANNEL1:FCOUNT?
→:TRIGGER:CHANNEL1:FCOUNT 1
```

:TRIGger:CHANnel<X>:FILTer

Function Sets/Queries the trigger filter of the specified analog ch for the normal trigger.

Syntax
```
TRIGger:CHANnel<X>:
FILTer {OFF|ON|TIMeout}
<X>=1 to 4
TRIGger:CHANnel<X>:FILTer?
```

Example
```
TRIGGER:CHANNEL1:FILTER OFF
TRIGGER:CHANNEL1:FILTER?
→:TRIGGER:CHANNEL1:
FILTER OFF
```

:TRIGger:CHANnel<X1>:LEVel<X2>

Function Sets/Queries the trigger filter levels of the specified analog ch for the normal trigger.

Syntax
```
TRIGger:CHANnel<X1>:
LEVel<X2> {<NRf>}
TRIGger:CHANnel<X1>:LEVel<X2>?
<X1>=1 to 4, <X2>=1 to 2
{<NRf>}=-100 to 100
```

Example
```
TRIGGER:CHANNEL1:LEVEL1 -10
TRIGGER:CHANNEL1:LEVEL1?
→:TRIGGER:CHANNEL1:
LEVEL1 -10
```

:TRIGger:CHANnel<X>:OFFSet

Function Sets/Queries the ideal waveform offset for the wave window trigger.

Syntax
```
TRIGger:OFFSet{<NRf>}
TRIGger:OFFSet?
{<NRf>}=-100 to 100
```

Example
```
TRIGGER:OFFSET -100
TRIGGER:OFFSET?→:TRIGGER:
OFFSET -100
```

:TRIGger:CHANnel<X>:PEAK

Function Sets/Queries the ideal waveform peak for the wave window trigger.

Syntax
```
TRIGger:PEAK{<NRf>}
TRIGger:PEAK?
{<NRf>}=-100 to 100
```

Example
```
TRIGGER:PEAK 50
TRIGGER:PEAK?→:TRIGGER:
PEAK 50
```

:TRIGger:CHANnel<X>:PHASe

Function Sets/Queries the ideal waveform phase for the wave window trigger.

Syntax TRIGger:CHANnel<x>:PHASe{<NRf>}
TRIGger:CHANnel<x>:PHASe?
{<NRf>}=-180 to 180

Example TRIGGER:CHANNEL<x>:PHASE 30
TRIGGER:CHANNEL<x>:PHASE?
→:TRIGGER:PHASE 30

:TRIGger:CHANnel<X>:TOLerance

Function Sets/Queries the width of the wave window trigger.

Syntax TRIGger:CHANnel<x>:TOLerance{<NRf>}
TRIGger:CHANnel<x>:TOLerance?
{<NRf>}=1 to 50

Example TRIGGER:CHANNEL<x>:TOLERANCE 50
TRIGGER:CHANNEL<x>:TOLERANCE?
→:TRIGGER:TOLERANCE 50

:TRIGger:CHANnel<X>:TYPE

Function Sets/Queries the trigger type of the specified analog ch.

Syntax TRIGger:CHANnel<X>:TYPE {<Character data>}
TRIGger:CHANnel<X>:TYPE?
<X>=1 to 4
For the normal trigger:
{<Character data>}={OFF|RISE|FALL|HIGH|LOW|BISLope|WINOut|WINIn}
For the wave window trigger:
{<Character data>}={OFF|ON}

Example TRIGGER:CHANNEL1:TYPE OFF
TRIGGER:CHANNEL1:TYPE?
→:TRIGGER:CHANNEL1:TYPE OFF

:TRIGger:COMBination

Function Sets/Queries the AND/OR logic for the normal trigger.

Syntax TRIGger:COMBination {AND|OR}
TRIGger:COMBinatiion?

Example TRIGGER:COMBINATION AND
TRIGGER:COMBINATION?
→:TRIGGER:COMBINATION AND

:TRIGger:DELay

Function Sets/Queries the trigger delay.

Syntax TRIGger:DELay {<NRf>}
TRIGger:DELay?
{<NRf>}=-100 to 100
This command is not available in realtime mode.

Example TRIGGER:DELAY 20
TRIGGER:DELAY?→:TRIGGER:DELAY 20

:TRIGger:EXTernal

Function Sets/Queries the contents of the external trigger for the normal trigger.

Syntax TRIGger:EXTernal {OFF|RISE|FALL}
TRIGger:EXTernal?

Example TRIGGER:EXTERNAL FALL
TRIGGER:EXTERNAL?→:TRIGGER:EXTERNAL FALL

:TRIGger:FREQuency

Function Sets/Queries the frequency for the wave window trigger.

Syntax TRIGger:FREQuency {<Frequency>}
TRIGger:FREQuency?
{<Frequency>}=50HZ,60HZ

Example TRIGGER:FREQUENCY 50HZ
TRIGGER:FREQUENCY?→:TRIGGER:FREQUENCY 50

:TRIGger:INTerval

Function Sets/Queries the time trigger interval after the start time.

Syntax TRIGger:INTerval {OFF|MIN10|HOUR1|HOUR24}
TRIGger:INTerval?

Example TRIGGER:INTERVAL MIN1
TRIGGER:INTERVAL?→:TRIGGER:INTERVAL MIN1

:TRIGger:HARMonic? (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Queries all the setting values of the trigger for automatic analysis.

Syntax
```
TRIGger:HARMonic? (Valid only
when the operation mode is
set to harmonic and the
analysis method is set to
automatic analysis.)
```

Example
```
TRIGGER:HARMONIC?→:TRIGGER:
HARMONIC:MODE SINGLE;KIND
CONTENT;CONDITION1:CHANNEL 3;
LEVEL 4.0;ORDER3;:TRIGGER:
HARMONIC:CONDITION2:
CHANNEL 1;LEVEL 3.0;ORDER5;:
TRIGGER:HARMONIC:CONDITION3:
CHANNEL 3;LEVEL 2.0;ORDER7;:
TRIGGER:HARMONIC:CONDITION4:
CHANNELOFF;:TRIGGER:HARMONIC:
SYNCHRONIZE:CHANNEL 1;LEVEL 3
```

:TRIGger:HARMonic:MODE (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries the trigger mode for automatic analysis.

Syntax
```
TRIGger:HARMonic:MODE {FREE|
SINGle|REPeat}
TRIGger:HARMonic:MODE?
```

Example
```
TRIGGER:HARMONIC:MODE SINGLE
TRIGGER:HARMONIC:MODE?
→:TRIGGER:HARMONIC:
MODE SINGLE
```

:TRIGger:HARMonic:CONDition<X>:CHANnel (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries the trigger channel for the automatic analysis.

Syntax
```
TRIGger:HARMonic:
CONDition<X>:CHANnel {OFF|
<NRf>}
TRIGger:HARMonic:
CONDition<X>:CHANnel?
<X>=1 to 4
{<NRf>}=1 to 4
```

Example
```
TRIGGER:HARMONIC:CONDITION1:
CHANNEL 1
TRIGGER:HARMONIC:CONDITION1:
CHANNEL?→:TRIGGER:HARMONIC:
CONDITION1:CHANNEL 1
```

:TRIGger:HARMonic:CONDition<X>:LEVel (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries the trigger level for the automatic analysis.

Syntax
```
TRIGger:HARMonic:
CONDition<X>:LEVel {<NRf>}
TRIGger:HARMonic:
CONDition<X>:LEVel?
<X>=1 to 4
{<NRf>}=0.0 to 1000.0
```

Example
```
TRIGGER:HARMONIC:
CONDITION1:LEVEL 123.4
TRIGGER:HARMONIC:CONDITION1:
LEVEL?→:TRIGGER:HARMONIC:
CONDITION1:LEVEL 123.4
```

:TRIGger:HARMonic:CONDition<X>:ORDer (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries the harmonic order used in triggering during the automatic analysis.

Syntax
```
TRIGger:HARMonic:
CONDition<X>:ORDer {<NRf>}
TRIGger:HARMonic:
CONDition<X>:ORDer?
<X>=1 to 4
{<NRf>}=1 to 40
```

Example
```
TRIGGER:HARMONIC:
CONDITION1:ORDER 5
TRIGGER:HARMONIC:CONDITION1:
ORDER?→:TRIGGER:HARMONIC:
CONDITION1:ORDER 5
```

Description Valid only when the kind of trigger is “Content.”

:TRIGger:HARMonic:KIND (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries the kind of trigger for the automatic analysis.

Syntax
```
TRIGger:HARMonic:KIND {THDIec|
THDCsa|CONTent}
TRIGger:HARMonic:KIND?
```

Example
```
TRIGGER:HARMONIC:KIND THDIEC
TRIGGER:HARMONIC:KIND?
→:TRIGGER:HARMONIC:
KIND THDIEC
```

:TRIGger:HARMonic:SYNChronize:CHANnel (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries the synchronous trigger channel for the automatic analysis.

Syntax TRIGger:HARMonic:SYNChronize:CHANnel {<NRf>}
TRIGger:HARMonic:SYNChronize:CHANnel?
{<NRf>}=1 to 4

Example TRIGGER:HARMONIC:SYNCHRONIZE:CHANNEL 1
TRIGGER:HARMONIC:SYNCHRONIZE:CHANNEL?
→:TRIGGER:HARMONIC:SYNCHRONIZE:CHANNEL 1

:TRIGger:HARMonic:SYNChronize:LEVel (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

Function Sets/queries the synchronous trigger level for the automatic analysis.

Syntax TRIGger:HARMonic:SYNChronize:LEVel {<NRf>}
TRIGger:HARMonic:SYNChronize:LEVel?
{<NRf>}=-100 to 100

Example TRIGGER:HARMONIC:SYNCHRONIZE:LEVEL 10
TRIGGRE:HRAMONIC:SYNCHRONIZE:LEVEL?→:TRIGGER:HARMONIC:SYNCHRONIZE:LEVEL 10

:TRIGger:{LOA|LOB}?

Function Queries all setting values relating to the specified logic ch for the normal trigger.

Syntax TRIGger:{LOA|LOB}?
LOA=Logic Ach,LOB=Logic Bch

Example TRIGGER:LOA?→:TRIGGER:LOA:TYPE AND;PATTERN1 DONT;PATTERN2 HIGH;PATTERN3 UP;PATTERN4 DOWN

:TRIGger:{LOA|LOB}:PATTern<X>

Function Sets/Queries the logic trigger bit pattern of the specified logic ch for the normal trigger.

Syntax TRIGger:{LOA|LOB}:PATTern<X> {LOW|HIGH|UP|DOWN|DONT}
TRIGger:{LOA|LOB}:PATTern<X>?
LOA=Logic Ach,LOB=Logic Bch
<X>=1 to 4 (correspond to Bit1 to 4)

Example TRIGGER:LOB:PATTERN1 LOW
TRIGGER:LOB:PATTERN1?
→:TRIGGER:PATTERN1 LOW

:TRIGger:{LOA|LOB}:TYPE

Function Sets/Queries the trigger type of the specified logic ch for the normal trigger.

Syntax TRIGger:{LOA|LOB}:TYPE {OFF|OR|AND}
TRIGger:{LOA|LOB}:TYPE?
LOA=Logic Ach,LOB=Logic Bch

Example TRIGGER:LOA:TYPE OR
TRIGGER:LOA:TYPE?→:TRIGGER:LOA:TYPE OR

:TRIGger:LOGic?

Function Queries all setting values relating to the specified logic input for the normal trigger.

Syntax TRIGger:LOGic?

Example TRIGGER:LOGIC?→:TRIGGER:LOGIC:FILTER ON;FCOUNT 1

:TRIGger:LOGic:FCOunt (Filter Count)

Function Sets/Queries the trigger filter amount of the logic ch for the normal trigger.

Syntax TRIGger:LOGic:FCOunt {<NRf>}
TRIGger:LOGic:FCOunt?
{<NRf>}=1 to 255

Example TRIGGER:LOGIC:FCOUNT 1
TRIGGER:LOGIC:FCOUNT?
→:TRIGGER:LOGIC:FCOUNT 1

:TRIGger:LOGic:FILTer

Function Sets/Queries the trigger filter of the logic ch for the normal trigger.

Syntax TRIGger:LOGic:FILTer {OFF|ON|TIMeout}
TRIGger:LOGic:FILTer?

Example TRIGGER:LOGIC:FILTER TIMEOUT
TRIGGER:LOGIC:FILTER?
→:TRIGGER:LOGIC:FILTER TIMEOUT

:TRIGger:MODE

Function Sets/Queries the trigger mode.

Syntax
```
TRIGger:
MODE {<Character data>}
TRIGger:MODE?
```

Example
```
TRIGGER:MODE SINGLE
TRIGGER:MODE?→:TRIGGER:
MODE SINGLE
```

:TRIGger:RWAVe (Reference Wave)

Function Sets/Queries the reference waveform of the wave window trigger.

Syntax
```
TRIGger:RWAVe{IDEal|AUTO}
TRIGger:RWAVe?
```

Example
```
TRIGGER:RWAVE IDEAL
TRIGGER:RWAVE?→:TRIGGER:
RWAVE IDEAL
```

:TRIGger:STTime (Start Time)

Function Sets/Queries start time of the time trigger function.

Syntax
```
TRIGger:STTime {<character
string>}
TRIGger:STTime?
{<character string>}="HH:MM"
HH (Hour)=00 to 23,
MM (Min)=00 to 59
```

Example
```
TRIGGER:STTIME "03:09"
TRIGGER:STTIME?→:TRIGGER:
STTIME "03:09"
```

:TRIGger:SYNChronize?

Function Queries all setting values relating to the synchronization trigger of the wave window trigger.

Syntax
```
TRIGger:SYNChronize?
```

Example
```
TRIGGER:SYNCHRONIZE?
→:TRIGGER:SYNCHRONIZE:
CHANNEL 1;EDGE HIGH;LEVEL 21
```

:TRIGger:SYNChronize:CHANnel

Function Sets/Queries the synchronization trigger channel of the wave window trigger.

Syntax
```
TRIGger:SYNChronize:
CHANnel{<NRf>}
TRIGger:SYNChronize:CHANnel?
{<NRf>}=1 to 4
```

Example
```
TRIGGER:SYNCHRONIZE:CHANNEL 1
TRIGGER:SYNCHRONIZE:CHANNEL?
→:TRIGGER:SYNCHRONIZE:
CHANNEL 1
```

:TRIGger:SYNChronize:EDGE

Function Sets/Queries the synchronization trigger edge of the wave window trigger.

Syntax
```
TRIGger:SYNChronize:
EDGE{RISE|FALL}
TRIGger:SYNChronize:EDGE?
```

Example
```
TRIGGER:SYNCHRONIZE:
EDGE RISE
TRIGGER:SYNCHRONIZE:EDGE?
→:TRIGGER:SYNCHRONIZE:
EDGE RISE
```

:TRIGger:SYNChronize:LEVel

Function Sets/Queries the synchronization trigger level of the wave window trigger.

Syntax
```
TRIGger:SYNChronize:
LEVel{<NRf>}
TRIGger:SYNChronize:LEVel?
{<NRf>}=-100to100
```

Example
```
TRIGGER:SYNCHRONIZE:
LEVEL 100
TRIGGER:SYNCHRONIZE:LEVEL?
→:TRIGGER:SYNCHRONIZE
:LEVEL 100
```

:TRIGger:TIME

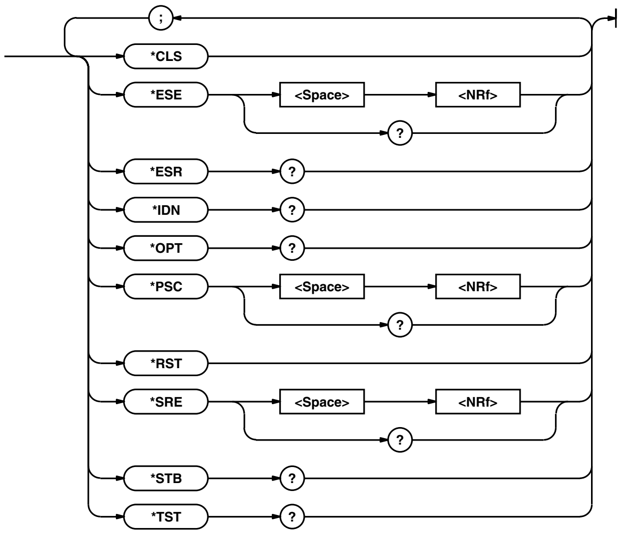
Function Sets/Queries whether or not to use the time trigger function.

Syntax
```
TRIGger:TIME {<Boolean>}
TRIGger:TIME?
```

Example
```
TRIGGER:TIME OFF
TRIGGER:TIME?→:TRIGGER:
TIME 0
```

Common Group

The commands in the common command group are specified in IEEE488.2-1987. These commands are independent of the dedicated commands used only with this recorder.



*CLS

Function Clears the standard and extended event registers and the error queue.

Syntax `*CLS`

Example `*CLS`

Description
- The output queue will also be cleared if the `*CLS` command is appended after the program message terminator.

*ESE

Function Sets/Queries the value of the standard event enable register.

Syntax `*ESE {<NRf>}`
`*ESE?`
`{<NRf>}=0 to 255`

Example `*ESE 253`
`*ESE?→253`

Description
- <NRf> is the sum of the bits expressed as a decimal number.
- The default value is "`*ESE 0`" (all bits disabled).
- The standard event enable register is not cleared by inquiring with `*ESE?`.

*ESR?

Function Queries the standard event register value and clear the register.

Syntax `*ESR?`

Example `*ESR?→32`

Description
- <NRf> is the sum of the bits expressed as a decimal number.
- This query allows you to determine what type of event occurred when a SRQ is in effect.
- The standard event enable register is cleared by inquiring with `*ESR?`.

*IDN?

Function Queries the recorder model.

Syntax `*IDN?`

Example
`*IDN?→YOKOGAWA,OR100E,0,F1.01`

Description
- A reply sequence is returned as follows:<Manufacturer><Model><Serial No.><Firmware version>.
- <Model> will be "OR100E".
- <Serial No.> is always 0.

*OPT?

Function Queries installed options.

Syntax `*OPT?`

Example `*OPT?→2CHANNELS,32K`

Description
- A reply sequence is returned as follows: <Number of channels><Memory length per channel>
- "`*OPT?`" must always be the last query in a program message. If there is another query after this one, an error will occur.

*PSC

Function Sets/Queries whether or not to clear the following registers when the power is turned ON. They are cleared if a nonzero value is specified.
- Standard event enable register
- Extended event enable register
- Transition filter

Syntax
```
*PSC {<NRf>}
*PSC?
{<NRf>}=0 (Do not clear),
non-0 (Clear) besides(cleare)
```

Example
```
*PSC 1
*PSC?→1
```

*RST

Function Resets the current settings.

Syntax `*RST`

Example `*RST`

Description
- This command is equivalent to the "`INITialize:EXECute`" command.

*SRE

Function Sets/Queries the value of the service request enable register.

Syntax
```
*SRE {<NRf>}
*SRE?
{<NRf>}=0to255
```

Example
```
*SRE 239
*SRE?→239
```

Description
- <NRf> is the sum of the bits expressed as a decimal number
- Since bit 6 (MSS) of the status byte register is the MSS bit, it will be ignored.
- The default value is "`*SRE 0`" (all bits disabled).
- The service request enable register is not cleared by inquiring with `*SRE?`.

*STB?

Function Queries the value of the status byte register.

Syntax `*STB?`

Example `*STB?→4`

Description
- <NRf> is the sum of the bits expressed as a decimal number
- Since the register is read without serial polling, bit 6 is MSS not RQS.
- The status byte register is not cleared by inquiring with `*STB?`.

*TST?

Function Executes a self-test and queries the result.

Syntax `*TST?`

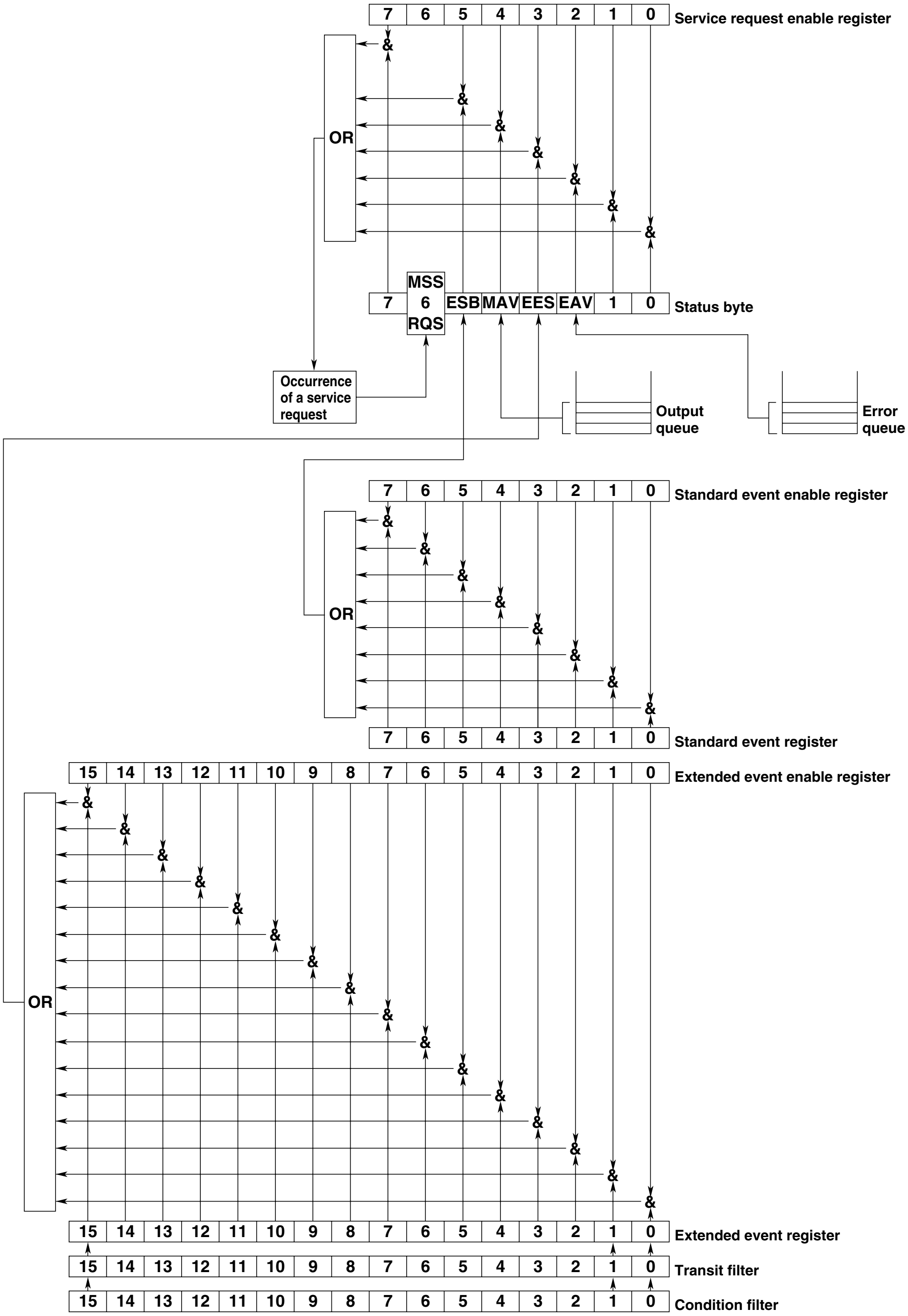
Example `*TST?→0`

Description
- If it passes the self-test, "`0`" is returned. If not, a non-"`0`" value is returned.
- This command is equivalent to the "`SELFtest:MEMory`" command.

Appendix 1.3 Status Response

Overview of the Status Report

The figure below shows the status report which is read by a serial poll. This is an extended version of the one specified in IEEE 488.2-1987.



Overview of Registers and Queues

Status byte
Function —
Writing Serial poll (RQS),
Reading (RQS), *STB?(MSS)

Service request enable registerπ
Function Masks status byte.
Writing *SRE
Reading *SRE?

Standard event register
Function Standard event
Writing —
Reading *ESR?

Standard event enable register
Function Masks standard
Writing *ESE
Reading *ESE?

Extended event register
Function Change in device
Writing —
Reading STATus:EESR?

Extended event enable register
Function Masks extended
Writing STATus:EESE
Reading STATus:EESE?

Condition register
Function Current instrument status
Writing —
Reading STATus:CONDition?

Transit filter
Function Extended event
Writing STATus:FILTer<x> occurrence conditions
Reading STATus:FILTer<x>?

Output queue
Function Stores response message
Writing All executable queues to a queues
Reading —

Error queue
Function Stores error Nos.
Writing —
Reading STATus:ERRor?

Registers and Queues which Affect the Status Byte

Registers which affect each bit of the status byte are shown below.

Standard event register : Sets bit 5 (ESB) of status byte to "1" or "0".
Output queue : Sets bit 4 (MAV) of status byte to "1" or "0".
Extended event register : Sets bit 3 (EES) of status byte to "1" or "0".
Error queue : Sets bit 2 (EAV) of status byte to "1" or "0".

Enable Registers

Registers which mask a bit so that the bit does not affect the status byte, even if the bit is set to "1", are shown below.

Status byte : Masks bits using the service request enable register.
Standard event register : Masks bits using the standard event enable register.
Extended event register : Masks bits using the extended event enable register.

Writing/Reading from Registers

The *ESE command is used to set bits in the standard event enable register to "1" or "0", and the *ESR? query is used to check whether bits in that register are set to "1" or "0".

Status Byte

Overview of Status Byte

	RQS						
7	6	ESB	MAV	EES	EAV	1	0
	MSS						

Bits 0, 1 and 7

Not used (always “0”)

Bit 2 EAV (Error Available)

Set to “1” when the error queue is not empty, i.e. when an error occurs. For details, refer to page App-58.

Bit 3 EES (Extended Event Summary Bit)

Set to “1” when a logical AND of the extended event register and the corresponding enable register is “1”, i.e. when an event takes place in the instrument. Refer to page App-57.

Bit 4 MAV (Message Available)

Set to “1” when the output queue is not empty, i.e. when there is data which is to be output when an inquiry is made. Refer to page App-58.

Bit 5 ESB (Event Summary Bit)

Set to “1” when a logical AND of the standard event register and the corresponding enable register is “1”, i.e. when an event takes place in the instrument. Refer to page App-55 and App-56.

Bit 6 RQS (Request Status)/MSS (Master Summary Status)

MSS is set to “1” when a logical AND of the status byte (except for bit 6) and the service request enable register is not “0”, i.e. when the instrument is requesting service from the controller.
RQS is set to “1” when MSS changes from “0” to “1”, and is cleared when a serial poll is performed or when MSS changes to “0”.

Bit Masking

To mask a bit in the status byte so that it does not cause an SRQ, set the corresponding bit of the service request enable register to “0”.
For example, to mask bit 2 (EAV) so that no service will be requested, even if an error occurs, set bit 2 of the service request enable register to “0”. This can be done using the *SRE command. To query whether each bit of the service request enable register is “1” or “0”, use `*SRE?`.

Operation of the Status Byte

A service request is issued when bit 6 of the status byte becomes “1”. Bit 6 becomes “1” when any of the other bits becomes “1” (or when the corresponding bit in the service request enable register becomes “1”).
For example, if an event takes place and the logical OR of each bit of the standard event register and the corresponding bit in the enable register is “1”, bit 5 (ESB) will be set to “1”. In this case, if bit 5 of the service request enable register is “1”, bit 6 (MSS) will be set to “1”, thus requesting service from the controller.
It is also possible to check what type of event has occurred by reading the contents of the status byte.

Reading from the Status Byte

The following two methods are provided for reading the status byte.

Inquiry using the *STB? query

Making an inquiry using the *STB? query sets bit 6 to MSS. This causes the MSS to be read. After completion of the read-out, none of the bits in the status byte will be cleared.

Serial poll

Execution of a serial poll changes bit 6 to RQS. This causes RQS to be read. After completion of the read-out, only RQS is cleared. Using a serial poll, it is not possible to read MSS.

Clearing the Status Byte

No method is provided for forcibly clearing all the bits in the status byte. Bits which are cleared are shown below.

When an inquiry is made using the *STB? query

No bit is cleared.

When a serial poll is performed

Only the RQS bit is cleared.

When the *CLS command is received

When the *CLS command is received, the status byte itself is not cleared, but the contents of the standard event register (which affects the bits in the status byte) are cleared. As a result, the corresponding bits in the status byte are cleared, except bit 4 (MAV), since the output queue cannot be emptied by the *CLS command. However, the output queue will also be cleared if the *CLS command is received just after a program message terminator.

Standard Event Register

Overview of the Standard Event Register

7	6	5	4	3	2	1	0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Bit 7 PON (Power ON)

Bit 7 PON (Power ON) Set to 1 when power is turned ON

Bit 6 URQ (User Request)

Not used (always “0”)

Bit 5 CME (Command Error)

Set to 1 when the command syntax is incorrect.
Examples: Incorrectly spelled command name; 9 used in octal data.

Bit 4 EXE (Execution Error)

Set to 1 when the command syntax is correct but the command cannot be executed in the current state.
Examples: Parameters are outside the setting range: an attempt is made to make a hard copy during acquisition.

Bit 3 DDE (Device Dependent Error)

Set to 1 when execution of the command is not possible due to an internal problem in the instrument that is not a command error or an execution error.
Example: The circuit breaker is reset.

Bit 2 QYE (Query Error)

Set to 1 if the output queue is empty or if the data is missing even after a query has been sent.
Examples: No response data; data is lost due to an overflow in the output queue.

Bit 1 RQC (Request Control)

Not used (always 0)

Bit 0 OPC (Operation Complete)

Not used (always 0)

Bit Masking

To mask a bit in the standard event register so that it does not cause bit 5 (ESB) of the status byte to change, set the corresponding bit in the standard event enable register to “0”.
For example, to mask bit 2 (QYE) so that ESB will not be set to 1, even if a query error occurs, set bit 2 of the standard event enable register to 0. This can be done using the `*ESE` command. To inquire whether each bit of the standard event enable register is 1 or 0, use the `*ESE?`.

Operation of the Standard Event Register

The standard event register is provided for eight different kinds of event which can occur inside the instrument. Bit 5 (ESB) of the status byte is set to “1” when any of the bits in this register becomes “1” (or when the corresponding bit of the standard event enable register becomes “1”).
Examples
1. A query error occurs.
2. Bit 2 (QYE) is set to 1.
3. Bit 5 (ESB) of the status byte is set to 1 if bit 2 of the standard event enable register is 1.

It is also possible to check what type of event has occurred inside the instrument by reading the contents of the standard event register.

Reading from the Standard Event Register

The contents of the standard event register can be read by the *ESR command. After completion of the read-out, the register will be cleared.

Clearing the Standard Event Register

The standard event register is cleared in the following three cases.
When the contents of the standard event register are read using `*ESR?`
When the `*CLS` command is received
When power is turned ON again

Extended Event Register

Reading the extended event register tells you whether changes in the condition register (reflecting internal conditions) have occurred. A filter can be applied which allows you to decide which events are reported to the extended event register.

FILTer<x>→	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Condition register :STATus:CONDition?	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	CHA	0	0	0	0	RNG	DSP	CLC	ACS	PRN	TST	CAL	TRG	0	RUN
Transition filter :STATus:FILTer<x> {RISE | FALL | BOTH | NEVer}	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Extended event register :STATus:EESR?	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

The meaning of each bit of the condition register is as follows.

Bit 0	RUN (Running)	Set to 1 during acquisition.
Bit 2	TRG (Awaiting trigger)	Set to “1” when the unit is awaiting a trigger.
Bit 3	CAL (Calibrating)	Set to 1 during calibration.
Bit 4	TST (Testing)	Set to 1 during self-test.
Bit 5	PRN (Printing)	Set to 1 while the built-in printer is in operation.
Bit 6	ACS (Accessing)	Set to 1 during access of the floppy disk, hard disk, or MO disk.
Bit 7	CLC (Caliculation)	Set to 1 during Caliculation.
Bit 9	DSP (Display)	Set to 1 during auto set-up.
Bit 10	RNG (Range)	Set to 1 during auto range setting.
Bit 14	CHA (Chart erro)	Set to 1 when chart empty.

The filter is applied to each bit of the condition register seperately, and can be selected from the following. Note that the numbering of the bits used in the filter setting differs from the actual bit number (1 to 16 vs. 0 to 15).

Rise	The bit of the extended event register becomes “1” when the bit of the condition register changes from “0” to “1”.
Fall	The bit of the extended event register becomes “1” when the bit of the condition register changes from “1” to “0”.
Both	The bit of the extended event register becomes “1” when the bit of the condition register changes from “0” to “1”, or from “1” to “0”.
Never	The bit of the extended event register is disabled and always “0”.

Output Queue and Error Queue

Overview of the Output Queue

The output queue is provided to store response messages to queries. For example, when the `WAVeform:SEND?` query is sent to request output of the acquired waveform, the response data will be stored in the output queue until it is read out.

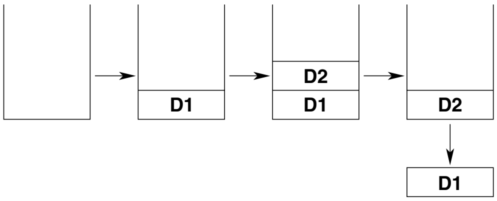
The example below shows that data is stored record by record in the output queue, and is read out oldest item first, newest item last. The output queue is emptied in the following cases (in addition to when read-out is performed).

When a new message is received from the controller

When dead lock occurs

When power is turned ON again

The output queue cannot be emptied using the `*CLS` command. To see whether the output queue is empty or not, check bit 4 (MAV) of the status byte.



Overview of the Error Queue

The error queue stores the error No. and message when an error occurs. For example, when the built-in battery has run out, an error occurs and its error No. (113) and message "Undefined header" will be stored in the error queue.

The contents of the error queue can be read using the `STATus:ERRor?` query. As with the output queue, messages are read oldest first, newest last (refer to the previous page).

If the error queue becomes full, the final message will be replaced by message 350, "Queue overflow".

The error queue is emptied in the following cases (in addition to when read-out is performed).

When the `*CLS` command is received

When power is turned ON again

To see whether the error queue is empty or not, check bit 2 (EAV) of the status byte.

Appendix 1.4 Sample Program

Output measured data in ASCII format

```
100 /**********************************************
110 /*   Output measured data in ASCII format      *
120 /*                                             *
130 /*     Communication protocol                  *
140 /*       Data length: 8 bits   Parity: none    *
150 /*       Stop bit: 1 bit                       *
160 /**********************************************
170 /
180 OPEN “COM1:N81NN” AS #1                    /Open RS-232 interface
190 OPEN “MEMASC.DAT” FOR OUTPUT AS #2         /Open file to save measurement data
200 /
210 / Clear the extended event and set an event to occur at the end of the
data sample.
220 PRINT #1,”STATUS:FILTER1 FALL;:STATUS:EESR?”
230 LINE INPUT #1,S$
240 PRINT #1,”TRIGGER:MODE SINGLE”             /Set trigger mode to SINGLE
250 PRINT #1,”ACT:START1"                      /Start sample
260 PRINT #1,”COMMUNICATE:WAIT 1"              /Wait for sample to end
270 /
280 / Get current block number
290 PRINT #1,”COMMUNICATE:HEADER OFF”          /No header on queries
300 PRINT #1,”BLOCK:CURRENT?”                  /Request to output current
block number
310 LINE INPUT #1,BLOCK$
320 PRINT #1,”COMMUNICATE:HEADER ON”           /Set header on queries
330 /
340 / Set block number
350 PRINT #1,”DATA:BLOCK “+BLOCK$
360 /
370 / Set send condition for data
380 PRINT #1,”DATA:FORMAT ASCII”               /Specify ASCII format
390 PRINT #1,”DATA:START 0"                    /Send start point 0
400 PRINT #1,”DATA:END 20"                     /Send end point 20
410 PRINT #1,”DATA:CHAN1:SEND?”                /Request to send CH1 data
420 /
430 LINE INPUT #1,D$                           /Read measurement values
440 PRINT D$                                   /Display the measurement value
on the screen
450 PRINT #2,D$
460 CLOSE
470 END
```

Output measured data in WORD format

```
100 /***********************************************
110 /*   Output measured data in WORD format        *
120 /*                                              *
130 /*     Communication protocol                   *
140 /*       Data length: 8 bits   Parity: none      *
150 /*       Stop bit: 1 bit                        *
160 /***********************************************
170 /
180 OPEN "COM1:N81NN" AS #1                   /Open RS-232 interface
190 OPEN "MEMWORD.DAT" FOR OUTPUT AS #2       /Open file to save
measurement data
200 /
210 / Get range information for measurement
220 GOSUB *GET.RANGE
230 /
240 / Set send condition for data
250 PRINT #1,"DATA:FORMAT WORD"               /Specify WORD format
260 PRINT #1,"DATA:BYTEORDER LSBFIRST"        /Send lower byte first
270 PRINT #1,"DATA:START 0"                   /Send start point 0
280 PRINT #1,"DATA:END 10"                    /Send end point 10
290 PRINT #1,"DATA:CHAN1:SEND?"               /Request send CH1 data
300 /
310 D$=INPUT$(1,#1)                           /Read "#"
320 N$=INPUT$(1,#1)                           /Read header length
330 A=VAL(N$)
340 /
350 / Determine number of output data points
360 BT=0
370 FOR I=1 TO A
380   N$=INPUT$(1,#1)
390   N=VAL(N$)
400   BT=BT+(N*10^(A-I))                      /Convert the number of bytes
to a numerical value
410 NEXT I
420 BT=BT/2
430 /
440 / Read the data.  Display and save the data to file
450 FOR I=1 TO BT
460   D$=INPUT$(2,#1)                         /Read measurement values
470   D=ASC(MID$(D$,1,1))+ASC(MID$(D$,2,1))*256
480   IF D>=32768! THEN D=D-65536!
490   DAT=D*RANGE/FULL                        /Convert A/D values to
physical values
500   PRINT DAT                               /Display the physical values
on the screen
510   PRINT #2,DAT
520 NEXT I
530 /
540 D$=INPUT$(4,#1)                           /Skip over CRC and CR+LF
550 CLOSE
560 END
```

```
570 /
580 *GET.RANGE
590   PRINT #1,"DATA:CHANNEL1:RANGE?"         /Specify to read the range
information
600   LINE INPUT #1,A$
610   K=INSTR(1,A$,",")
620   RANGE=VAL(MID$(A$,1,K))                 /Read the range
630   PRINT "RANGE = ";RANGE
640   K1=INSTR(K+1,A$,",")
650   UNIT$=MID$(A$,K+1,K1-K-1)               /Read the unit
660   PRINT "UNIT = ";UNIT$
670   K2=INSTR(K1+1,A$,",")
680   FULL=VAL(MID$(A$,K1+1))                 /Read the FULL value
690   PRINT "FULL = ";FULL
700   RETURN
```

Program to calculate CRC-CCITT

```
/****************************************************/
/*                                                  */
/*    Program to calculate CRC-CCITT                */
/*                                                  */
/****************************************************/

unsigned short int CalcCRC(
char *data,                 /* Area for storing the data on which the
CRC is calculated */
int  length                 /* Number of data points for calculating
the CRC       */
)
{
    int                 cnt;            /* Loop counter for the data
points */
    int                 bit;            /* Loop counter for the bits
*/
    unsigned short int  crc;            /* CRC value              */

    crc = 0;                            /* Initialize CRC value */
    for( cnt=0; cnt<length; cnt++ ){    /* Loop for the amount of
data points */
        crc ^= ((unsigned short int)*data++ << 8);  /* Take XOR with
the upper 8 bits */
        for( bit=0; bit<8; bit++ ){
            if( crc & 0x8000 )                      /* If MSB is 1 */
              crc = (crc << 1) ^ 0x1021;            /* take the XOR
*/
            else
              crc = crc << 1;                       /* Shift the
digit */
        }
    }
    return crc;                         /* return CRC value */
}
```

Index

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