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)

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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.

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

**OR300E**

<table>
<thead>
<tr>
<th>Model</th>
<th>Suffix Code</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR322</td>
<td></td>
<td>2-channel isolated input model</td>
</tr>
<tr>
<td>OR342</td>
<td></td>
<td>4-channel isolated input model</td>
</tr>
<tr>
<td>Display language</td>
<td>-2</td>
<td>English</td>
</tr>
<tr>
<td>Options</td>
<td>/PM</td>
<td>Carring case package. UL/CSA standard power supply code.</td>
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</tr>
<tr>
<td></td>
<td>/PS</td>
<td>Carring case package. BS standard power supply code.</td>
</tr>
</tbody>
</table>

**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
  - OR122, OR322: 2
  - OR142, OR342: 4
- Belt
- AAA allaline dry cell: 6
- Users manual

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 probe  788031
4-ch high voltage logic probe  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 probe read
B9879PX
B9879KX

AC adapter  788011

UL/CSA Standard  -M
VDE Standard  -F
SAA Standard  -R
BS Standard  -S

Temperature input adapter  788041

Rechargeable battery pack (NiMH battery)  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.

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<th>Title</th>
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<tbody>
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<td>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.</td>
</tr>
<tr>
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<td>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.</td>
</tr>
<tr>
<td>3</td>
<td>First-time Users</td>
<td>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.</td>
</tr>
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<td>4</td>
<td>Setting the Measurement Range, Filter, Time Axis, and Linear Scaling</td>
<td>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.</td>
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<tr>
<td>5</td>
<td>Triggering</td>
<td>Describes how to set the normal trigger and the wave window trigger.</td>
</tr>
<tr>
<td>6</td>
<td>Data Capturing</td>
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<tr>
<td>7</td>
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<td>Describes how to display and record the measurement data in realtime.</td>
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<td>8</td>
<td>Data Capturing while Realtime Recording</td>
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<td>9</td>
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</tr>
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<td>10</td>
<td>Using External Media</td>
<td>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.</td>
</tr>
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<td>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.</td>
</tr>
<tr>
<td>12</td>
<td>Miscellaneous Functions</td>
<td>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.</td>
</tr>
<tr>
<td>13</td>
<td>Troubleshooting, Maintenance, and Testing</td>
<td>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.</td>
</tr>
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</tr>
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Conventions Used in this Manual

Unit

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

Used Characters
Alphanumeric 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.
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Chapter 1 Overview

1.1 Names of the Parts and Their Functions

- Chart paper exit section
- Chart paper cover
- LCD
- Measurement input terminal
- AC adapter connection jack
- Operation panel
- PC card eject button
- PC card insert
- Functional ground
- Power switch
- Recharge Monitor (LED)
- Battery (Alkaline dry cell/Nickel-Metal Hydride)

Upper
- Belt attachment
- RS-232 connector
- CH B
- CH A
- Logic input connector
- External input/output terminal
- Trigger output
- Trigger input/Sampling clock/Start and Stop
- Belt attachment
1.1 Names of the Parts and Their Functions

Operation Panel

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

Keys dealing with setup of each channel
These keys deal with the setup parameters that are individually set for each channel.

Execution keys
These keys execute various operations.

Monitor key
Keys for setting the time axis

Keys used to set parameters
These keys are used to set various parameters.

Start/Stop key of operation
Keys to display the setup screen
These keys display various setup screens.

Playback screen key

See next page for descriptions on the function of each
1.1 Names of the Parts and Their Functions

---

**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.

**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.

**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.

---

**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.

---

**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.
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.
1.2 System Configuration

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 stop 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.

Select one of the triggers beforehand

Normal Trigger

OR

CH 1 to CH 4

Trigger for the analog channels
Rise, fall, bi-slope, level (high, low), window in, window out
Trigger filter***
Trigger filter, timeout trigger

OR

CH 1 to CH 4

Condition 1 to Condition 4

Time

Set up to 4 types of harmonic distortion levels or relative harmonic content levels for the trigger conditions. The parameter for checking the levels (harmonic distortion or relative harmonic content) is common across all conditions.

Logic trigger
Rise, fall, level (high, low), don't care
Logic trigger filter***
Common filter for all bits

External
Time*

Harmonic Trigger

Wave Window Trigger**

* 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.
1.4 Trigger Function

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).
1.4 Trigger Function

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.
1.4 Trigger Function

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.
1.6 Input Method of Numerical Values and Characters

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.

- Selects the character (highlighted section moves to the left)
- Selects the character (highlighted section moves to the right)
- Moves the character input position
- Switches upper/lower case letters
- Deletes the previous character (Back space)
- Inserts a character before the character input position

1.6.1 Input Method of Numerical Values and Characters
Chapter 2  Before Operation

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.
2.1 Handling Precautions

**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.

![Diagram of belt attachment](image)

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.

![Image of input signal cable connection]

**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 mm².

**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 mm²
Usable wires: solid wire Ø0.4 to 1.0(AWG26 to 18), cross sectional area 0.3 to 0.75 mm²(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.
### 2.3 Connecting the Signal Cable

#### 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.

3. **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.
2.3 Connecting the Signal Cable

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:** $\pm 35$ VDC
- **Input impedance:** $10 \, \text{k}\Omega$ 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: $10 \, \text{M}\Omega$ 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 ($\pm 35$ 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).
2.3 Connecting the Signal Cable

Specifications 788035 (when connected to the OR100E/OR300E)

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

**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.

**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 separately.

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.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Operation Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigger wait condition without options</td>
<td>About 2 hours (OR100E)</td>
</tr>
<tr>
<td>Recording an 1-Hz cycle waveform with 2 s/div setting</td>
<td>About 30 minutes (OR100E)</td>
</tr>
<tr>
<td></td>
<td>About 110 minutes (OR300E)</td>
</tr>
<tr>
<td></td>
<td>About 20 minutes (OR300E)</td>
</tr>
</tbody>
</table>
2.4 Connecting the Power Supply and ON/OFF

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

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.
2.4 Connecting the Power Supply and ON/OFF

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).

![Clamp filter A1193MN](image)

**DC output side (Connects to the OR100E/OR300E)**

**AC input side (Connects to the power plug)**
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.
2.4 Connecting the Power Supply and ON/OFF

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.
2.4 Connecting the Power Supply and ON/OFF

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 “’elle” 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.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Operation Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigger wait condition without options</td>
<td>About 3 hours and 30 minutes</td>
</tr>
<tr>
<td>Recording an 1-Hz cycle waveform with 2 s/div setting</td>
<td>About 3 hours</td>
</tr>
</tbody>
</table>
2.4 Connecting the Power Supply and ON/OFF

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

**Specification**

- **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.
2.4 Connecting the Power Supply and ON/OFF

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.
2.4 Connecting the Power Supply and ON/OFF

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.
2.5 Loading the Chart

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

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

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.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Keys to display the setting screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set measurement conditions</td>
<td>CH1 to CH4</td>
</tr>
<tr>
<td>Measurement range</td>
<td></td>
</tr>
<tr>
<td>DC (V/div)</td>
<td></td>
</tr>
<tr>
<td>TC (200 °C/400 °C/600 °C)</td>
<td></td>
</tr>
<tr>
<td>Time/div</td>
<td></td>
</tr>
<tr>
<td>Set the trigger</td>
<td></td>
</tr>
<tr>
<td>Set the display format</td>
<td></td>
</tr>
<tr>
<td>Set the recording format</td>
<td></td>
</tr>
<tr>
<td>Start measurement</td>
<td></td>
</tr>
<tr>
<td>Stop measurement</td>
<td></td>
</tr>
<tr>
<td>Display captured data</td>
<td></td>
</tr>
<tr>
<td>Set the display format</td>
<td></td>
</tr>
<tr>
<td>Set the recording format</td>
<td></td>
</tr>
<tr>
<td>Set the display format</td>
<td></td>
</tr>
<tr>
<td>Select the block</td>
<td></td>
</tr>
<tr>
<td>Play Back</td>
<td></td>
</tr>
<tr>
<td>Start recording captured data</td>
<td></td>
</tr>
<tr>
<td>Waveform analysis</td>
<td></td>
</tr>
<tr>
<td>Automatic analysis</td>
<td></td>
</tr>
<tr>
<td>Start measurement</td>
<td></td>
</tr>
<tr>
<td>Display the result of analysis</td>
<td></td>
</tr>
<tr>
<td>Stop measurement</td>
<td></td>
</tr>
</tbody>
</table>

Only in "Realtime+Memory" mode
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.

![Setting Screen]

**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.

Display update rate

Automatically set the measurement range according to the input signal

Change the display update rate according to the input signal
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.

- Increase the measurement range (waveform amplitude becomes smaller)
- Decrease the measurement range (waveform amplitude becomes larger)
- Set the time axis (time/div)
3.4 Changing the Measurement Range and Sample Rate

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.

Sample rate

Menu
Mode: Memory
Format: 4 Zone
Length: 10 div
T-scale Mag: X1
Trigger kind: Normal
3.5 Setting the Trigger

### Trigger

- **Trigger mode**
  - Free: Capture the data regardless of the trigger
  - Single: Capture one block of data once after the trigger
  - Repeat: Capture one block of data after every trigger

- **Trigger delay**

- **Trigger condition for each channel**

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

2 V (10% of the measurement range)

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

**Trigger point**

Range captured to memory (Memory length)

When delay is 0

- Trigger level
  - When delay is -10%
    - \( x = 10\% \) of the memory length
  - When delay is +10%
    - \( x = 10\% \) of the memory length

**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”).

---

IM OR100E-01E
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.

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

Setting Screen

[Image of the setting screen with CH1 and CH4 selected, showing menu options and input options.

Operation Keys

[Image of the operation keys with P1, P2, P3, P4 buttons labeled, and other function keys with descriptions such as MENU, START, STOP, INPUT, FILTER, NULL, SCROLL, CURSOR, MANUAL, TRIGGER, TIME/DIV, MONITOR, V/FSPRINT, SYSTEM, TRIG, FEED, COPY, MONITOR, and Variable.

Displays the setting menu
Sets the measurement range
Makes a selection
Displays the monitor screen

Displays the monitor screen

Off DC RMS END
4.2 Setting the Input Coupling

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.

![Input circuit diagram](image)

**Frequency characteristics (without filter)**

- **Gain**: -3dB
- **Input circuit**: 1MΩ
- **Frequency**: 40kHz

---

**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

Full scale

Measurement range

Operation Keys

Displays the setting menu
Sets the measurement range
Makes a selection

Displays the monitor screen

Setting the Measurement Range Automatically (Auto range)
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.

<table>
<thead>
<tr>
<th>V/div</th>
<th>Measurement range</th>
<th>ACrual measurement DC</th>
<th>ACrual measurement RMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mV/DIV</td>
<td>100 mV</td>
<td>±100.0 mV</td>
<td>0 to 100.0 mVrms</td>
</tr>
<tr>
<td>20 mV/DIV</td>
<td>200 mV</td>
<td>±200.0 mV</td>
<td>0 to 200.0 mVrms</td>
</tr>
<tr>
<td>50 mV/DIV</td>
<td>500 mV</td>
<td>±500.0 mV</td>
<td>0 to 500.0 mVrms</td>
</tr>
<tr>
<td>0.1 V/DIV</td>
<td>1 V</td>
<td>±1.000 V</td>
<td>0 to 1.000 Vrms</td>
</tr>
<tr>
<td>0.2 V/DIV</td>
<td>2 V</td>
<td>±2.000 V</td>
<td>0 to 2.000 Vrms</td>
</tr>
<tr>
<td>0.5 V/DIV</td>
<td>5 V</td>
<td>±5.000 V</td>
<td>0 to 5.000 Vrms</td>
</tr>
<tr>
<td>1 V/DIV</td>
<td>10 V</td>
<td>±10.00 V</td>
<td>0 to 10.00 Vrms</td>
</tr>
<tr>
<td>2 V/DIV</td>
<td>20 V</td>
<td>±20.00 V</td>
<td>0 to 20.00 Vrms</td>
</tr>
<tr>
<td>5 V/DIV</td>
<td>50 V</td>
<td>±50.00 V</td>
<td>0 to 50.00 Vrms</td>
</tr>
<tr>
<td>10 V/DIV</td>
<td>100 V</td>
<td>±100.0 V</td>
<td>0 to 100.0 Vrms</td>
</tr>
<tr>
<td>20 V/DIV</td>
<td>200 V</td>
<td>±200.0 V</td>
<td>0 to 200.0 Vrms</td>
</tr>
<tr>
<td>50 V/DIV</td>
<td>500 V</td>
<td>±500.0 V</td>
<td>0 to 500.0 Vrms</td>
</tr>
<tr>
<td>100 V/DIV</td>
<td>1000 V</td>
<td>±500.0 V</td>
<td>0 to 500.0 Vrms</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>ACrual measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>200°C</td>
<td>-50 to 200°C</td>
</tr>
<tr>
<td>400°C</td>
<td>-50 to 400°C</td>
</tr>
<tr>
<td>600°C</td>
<td>-50 to 600°C</td>
</tr>
</tbody>
</table>

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

- **CH1** to **CH4**
- Displays the zoom factor setting screen
- Makes a selection
- Moves the waveform up
- Moves the waveform down
- Displays the zoom factor setting screen

Operation Keys

Variables:

- Off
- Hz
- 50Hz
- Off
- Execute
4.4 Setting the Filter, NULL, Position and Zoom Factor

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.

![Voltage vs. Actual input signal graph]

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.

![Adjusted waveform graph]

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

![Setting Screen Diagram]

**Operation Keys**

- **SCROLL**: Displays the setting menu
- **CURSOR**: Decreases the time/div
- **MANUAL**: Increases the time/div
- **TIME/DIV**: 
- **PLAY**: 
- **BACK**: 
- **LIGHT**: 
- **MONITOR**: 
- **VARIABLE**: 
- **START**: 
- **FILE**: 
- **FEED**: 
- **COPY**: 
- **V/FSPRINT**: 
- **MENU**: 
- **SYSTEM**: 
- **TRIGGER**: 
- **NEXT**: 
- **POSITION**: 
- **STOP**:
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.

\[
\text{Sample rate} = \frac{80}{\text{(time/div)}} \quad \text{The unit of time/div is seconds.}
\]

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.

<table>
<thead>
<tr>
<th>time/div</th>
<th>Chart speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 s/div</td>
<td>5 mm/s</td>
</tr>
<tr>
<td>5 s/div</td>
<td>2 mm/s</td>
</tr>
<tr>
<td>10 s/div</td>
<td>1 mm/s</td>
</tr>
<tr>
<td>30 s/div</td>
<td>20 mm/min</td>
</tr>
<tr>
<td>1 min/div</td>
<td>10 mm/min</td>
</tr>
<tr>
<td>2 min/div</td>
<td>5 mm/min</td>
</tr>
<tr>
<td>5 min/div</td>
<td>2 mm/min</td>
</tr>
<tr>
<td>10 min/div</td>
<td>1 mm/min</td>
</tr>
<tr>
<td>30 min/div</td>
<td>20 mm/hour</td>
</tr>
<tr>
<td>1 hour/div</td>
<td>10 mm/hour</td>
</tr>
</tbody>
</table>
4.6 Setting the Linear Scaling

Setting Screen

CH1

Go back to the previous screen

Operation Keys

Displays the setting menu

Makes a selection

Moves between setting parameters

Moves the input position when entering characters/numerical values

Selects the character or numerical value when entering characters/numerical values
4.6 Setting the Linear Scaling

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.

5. Setting Point2 (P2)
   Enter the values in the similar way as entering the values for Point1.

Note

- The ranges for setting the voltage value and the scaling value are as follows.
  \(-1.0 \times 10^9 < x < -1.0 \times 10^{-9}, 0, 1.0 \times 10^{-9} < x < 1.0 \times 10^9\)
- Set exponential representation using \( E \).
  \(1.0E + 8 = 1.0 \times 10^{8}\)
- Linear scaling is not possible when the input type is set to TC.
4.7 Monitor Display/Zero Adjust

Setting Screen

Operation Keys

Changes the display update rate

Displays the monitor screen

Zero adjust

Display update rate

V/DIV
(voltage value per 1 DIV)

Operation mode

Monitor

Operation Keys

FEED
PRINT
COPY
MEMORY
MONITOR
NEXT
STOP
START
FILE
SYSTEM
MENU
TRIGGER
V/FSPRINT
FILE
FILE
LIST
GRID
4.7 Monitor Display/Zero Adjust

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 display.

<table>
<thead>
<tr>
<th>Analog channel</th>
<th>Measurement value</th>
<th>When input is OFF</th>
<th>Bit No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.64V</td>
<td>Off</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>2</td>
<td>1.03V</td>
<td></td>
<td>A 1 1 1</td>
</tr>
<tr>
<td>3</td>
<td>0.00V</td>
<td></td>
<td>B 1 1 1</td>
</tr>
</tbody>
</table>

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**

<table>
<thead>
<tr>
<th>Setting parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| 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)**

<table>
<thead>
<tr>
<th>Setting parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| 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

Setting Screen

When the trigger conditions are consecutively satisfied the number of times of measurement indicated, trigger occurs

Time corresponding to the specified number of times of measurement

Voltage value corresponding to the specified trigger level

Triggers when the trigger conditions are not met within the specified number of times of measurement after the first trigger condition is met.

Operation Keys

Displays the setting menu
Makes a selection
Displays the next set of selections
Moves between setting parameters
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

Operation Keys

Displays the setting menu
Makes a selection
Displays the next set of selections
Moves between setting parameters
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

![Diagram of the setting screen with various options and parameters]

Operation Keys:
- **Displays the setting menu**
- **Makes a selection**
- **Displays the next set of selections**
- **Moves between setting parameters**
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.
5.4 Setting the Wave Window Trigger

When Creating the Wave Window with the Input Signal Setting Screen

**MENU**

Menu:
- Mode: Memory [40kHz]
- Format: 4zone
- Length: 10 div [20.0 ms]
- T-scale: X1 [15 block]
- Trigger kind: Wave Window Trigger

**TRIGGER**

- Mode: Repeat, Sync. trigger
- Ref. wave: Auto, CH: CH-1
- Delay: 10%, Edge: Rise
- Freq.: 50 Hz, Level: 20%

**WaveWindow**

- CH Type: On, Tolerance: 10%
- Off, Tolerance: 20%

**Operation Keys**

- Displays the setting menu
- Makes a selection
- Displays the next set of selections
- Moves between setting parameters

Displays reference signal
5.4 Setting the Wave Window Trigger

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.
   - 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

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copy action</td>
<td>BMP file</td>
</tr>
<tr>
<td>Expansion calc.</td>
<td>Off</td>
</tr>
</tbody>
</table>

Next page
Initialize

To Next page

1. OK

Operation Keys

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEED</td>
<td>Displays the setting menu</td>
</tr>
<tr>
<td>PRINT</td>
<td>Makes a selection</td>
</tr>
<tr>
<td>COPY</td>
<td>Displays the next set of selections</td>
</tr>
<tr>
<td>V/FSPRINT</td>
<td>Moves between setting parameters</td>
</tr>
<tr>
<td>TRIGGER</td>
<td>Sets off the trigger</td>
</tr>
</tbody>
</table>

Go back to the previous screen
Self test

Display language : English
Tag : Off
Manual trigger key : Valid
Ext.term.start/stop : Invalid
Key lock : Off
Display grid : On
WM-trg level change : Off
Start time : 0: 0
End time : 0: 0
Change level CH1 : 0% CH2 : 0%
CH3 : 0% CH4 : 0%
5.5 Triggering with the Manual Trigger Key

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
Mode: Harmonic
Ampl. Method: Sinus
Frequency: 50Hz
Display: Content (Power)
Wiring: 1026 (CH1-CH2)

TRIGGER

1. Trigger
Mode: Repeat
Sync. CH: CH-1
Kind: THD (TEC) Level: 0%
2. CH
CH-1
CH-2
CH-3
Off
3. Level
30.0%
0.0%
4. Free
5. Single
6. Repeat

Operation Keys

Displays the setting menu
Makes a selection
Displays the next set of selections
Moves between setting parameters
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%.
### 5.6 Setting Trigger for Automatic Analysis of Harmonics

**Trigger for Automatic Analysis of Harmonics**

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

- **Start measurement**
  - **Did the measured value on the synchronized channel exceed the specified level?**
    - **NO**
      - **Store one cycle of the measured data in the block**
      - **Harmonic analysis**
      - **Did the result of the analysis of any channel exceed the specified level?**
        - **NO**
          - **Save the measured data and the result of the analysis**
          - **Go to the next block**
        - **YES**
          - **Clear the measured data and the result of the analysis**
          - **Same block**
      - **YES**
        - **Clear the measured data and the result of the analysis**
        - **Same block**

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

<table>
<thead>
<tr>
<th>Setting parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation mode</td>
<td>Select whether to save the measurement data to memory or realtime record with the built-in printer. Select “Memory.”</td>
</tr>
<tr>
<td>Memory length</td>
<td>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.</td>
</tr>
<tr>
<td>Kind of Trigger</td>
<td>Select normal trigger or wave window trigger. When using X-Y format, it is fixed to normal trigger.</td>
</tr>
<tr>
<td>Clear memory at start</td>
<td>Select whether or not to clear the measurement data captured previously at the start of the measurement.</td>
</tr>
<tr>
<td>Condition to stop repeat trigger</td>
<td>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.</td>
</tr>
<tr>
<td>Operation after data capturing</td>
<td>Set the operation after capturing the data once.</td>
</tr>
</tbody>
</table>

### Setting the display format

<table>
<thead>
<tr>
<th>Setting parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Format</td>
<td>Select 1 zone, 2 zone, 4 zone, or XY.</td>
</tr>
<tr>
<td>T-axis zoom</td>
<td>Set the T-axis zoom factor for the display screen.</td>
</tr>
<tr>
<td>Accumulate display</td>
<td>Select whether or not to accumulate the waveform.</td>
</tr>
<tr>
<td>Logic</td>
<td>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.</td>
</tr>
<tr>
<td>Channel selection</td>
<td>Set only when using X-Y format. Set the Y-axis to channel 2, 3, or 4.</td>
</tr>
</tbody>
</table>

### Setting the recording format

<table>
<thead>
<tr>
<th>Setting parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Format</td>
<td>Select 1 zone, 2 zones, 4 zones, or XY.</td>
</tr>
<tr>
<td>Record mode</td>
<td>Select whether to record the analog waveform or the digital values. This parameter is invalid when using X-Y format.</td>
</tr>
<tr>
<td>Record length</td>
<td>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.</td>
</tr>
<tr>
<td>Interval time</td>
<td>Set only when recording digital values. Sets the recording interval.</td>
</tr>
<tr>
<td>Gauge record</td>
<td>Select whether or not to record the scale value for each channel at the end of the recording.</td>
</tr>
<tr>
<td>Grid</td>
<td>Select the grid type.</td>
</tr>
<tr>
<td>Time record</td>
<td>Set whether or not to record the time record of the captured data.</td>
</tr>
<tr>
<td>Channel message</td>
<td>Select whether or not to record comments or measurement range information.</td>
</tr>
<tr>
<td>Channel record</td>
<td>Select whether or not to record the channel numbers or tags.</td>
</tr>
<tr>
<td>Line</td>
<td>Set the thickness of the line used to record the analog waveform.</td>
</tr>
<tr>
<td>Logic</td>
<td>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.</td>
</tr>
<tr>
<td>Style</td>
<td>Set only when using X-Y format. Set the line style to record.</td>
</tr>
<tr>
<td>Channel selection</td>
<td>Set only when using X-Y format. Set the Y-axis to channel 2, 3, or 4.</td>
</tr>
</tbody>
</table>
6.2 Setting the Conditions on Capturing the Measurement Data

Setting screen

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.

For logic channels, channel B cannot be used only when the maximum memory capacity is 512 K.
### 6.2 Setting the Conditions on Capturing the Measurement Data

**Memory length**

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

<table>
<thead>
<tr>
<th>Memory length</th>
<th>Number of data points captured in memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 div</td>
<td>800 data points</td>
</tr>
<tr>
<td>20 div</td>
<td>1600 data points</td>
</tr>
<tr>
<td>50 div</td>
<td>4000 data points</td>
</tr>
<tr>
<td>100 div</td>
<td>8000 data points</td>
</tr>
<tr>
<td>200 div</td>
<td>16000 data points</td>
</tr>
<tr>
<td>400 div</td>
<td>32000 data points</td>
</tr>
<tr>
<td>800 div</td>
<td>64000 data points</td>
</tr>
<tr>
<td>1600 div</td>
<td>128000 data points</td>
</tr>
<tr>
<td>3200 div(^1)</td>
<td>256000 data points</td>
</tr>
<tr>
<td>6400 div(^2)</td>
<td>512000 data points</td>
</tr>
</tbody>
</table>

\(^1\): 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

Operation Keys

1. Makes a selection
2. Displays the setting menu
3. Moves between setting parameters
4. Displays the next set of selections

Sample rate calculated from time/div
Measurement time
Number of blocks calculated from the memory length
6.3 Setting the Display Format

**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

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

![Image of the menu screen with settings]

- **Menu**:
  - Mode: Memory (40kS/s)
  - Format: 4 zone
  - Length: 100 div (200 μs)
  - T-scale Mag: x1
  - Trigger kind: Normal

- **Memory clear**: Off
- **Rep.Eng. stop condition**: Stop key
- **Accumulate display**: Off
- **Memory Calculation**: Off
- **Printout**: Off
- **PC card**: Off

### Operation Keys

- **FEED**: Displays the setting menu
- **PRINT**: Makes a selection
- **COPY**: Displays the next set of selections
- **MONITOR**: Moves between setting parameters
- **SYSTEM**: Display the captured data
6.6 Displaying/Recording the Captured Data as an Analog Waveform

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.
6.6 Displaying/Recording the Captured Data as an Analog Waveform

Setting Screen for Displaying Captured Data

PLAY BACK

Trigger position

Time of the left most part of the display
Time axis zoom factor
Cursor display
Record the captured data

Record the captured data

Cursor display
Select the block
Set the calculation

DISPLAYED block No.
Total number of blocks

Displayed range

X-Y Display

Start 0.3ms End 19.9ms

Sample rate
The time the last data was captured, measured from the start of the data capture

X axis
Y axis

Measurement range

Operation Keys

Makes a selection
Moves between setting parameters
Displays the captured data

Sample rate

Measurement range

Operation Keys

Makes a selection
Moves between setting parameters
Displays the captured data
6.6 Displaying/Recording the Captured Data as an Analog Waveform

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.

   Go back to the previous screen

   Display block information

   One block backward* One block forward*

   * 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.

   Go back to the previous screen

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
Mode : Memory [ 40kS/s ]
Rate  : 4zone
Length : 10Div
T-scale Mag : ×1 [ 32block ]
Trigger kind: Normal

Memory clear : Off
Rep.Trig.stop condition : Stop key
Accumulate display : Off
Memory Calculation : Off
Printout : Off
PC card : Off

Print mode : Numeric
Interval : 3data CH-1 : 0 0 0 0
Gauge print : On CH-2 : 0 0 0 0
Grid : Fine CH-3 : 0 0 0 0
Time print : On CH-4 : Thin
OH message : Off
OH print : Off
Line CH-1 : Thin CH-2 : Thin
CH-3 : Thin CH-4 : Thin

Waves Numeric
```

Operation Keys

- Displays the setting menu
- Makes a selection
- Displays the next set of selections
- Moves between setting parameters
### 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 hundred 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

![Time axis zoom factor diagram]

Screen for setting the voltage axis zoom

![Voltage axis zoom factor diagram]

Operation Keys

![Operation keys diagram]
### 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.

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

#### 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

![Cursor display screen](image)

**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**

- **1, 2, 3, 4**
- **PLAY BACK**
- **F2**
- **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

Calculation screen

Operation Keys

Displays the captured data
6.10 Calculating Statistics

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.

<table>
<thead>
<tr>
<th>Average value</th>
<th>Area calculation value(Integ1)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMS value*</td>
<td></td>
</tr>
<tr>
<td>Area calculation value(Integ2)*</td>
<td>Minimum value</td>
</tr>
<tr>
<td>Measurement time</td>
<td></td>
</tr>
<tr>
<td>Area calculation value(Integ2)*</td>
<td>Maximum value</td>
</tr>
</tbody>
</table>

*: 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.
Area Calculation

If you set “Expansion cale.” 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.

  ![Area S=S₁+S₃−S₂](image)

- **Integ2**
  Ignores the negative portion.

  ![Area S=S₁+S₂](image)

**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**

- **For multiple loop**
  \[ \text{Area } S = n \times S_0 \]
  
  \( n \) : No. of loops

- **For figure-8 loop**
  \[ \text{Area } S = |S_0 - S_1| \]

- **For open curve**
  Area enclosed by curve with start point and end point connected by straight line

- **For spiral loop**
  Area \( S = S_0 + 2S_1 \)

As the number of loops increases, the number of overlapping areas also changes.
INTEG2

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

(1) Start point 

Area \( S = S_0 \)

End point

X area \( (Y=0) \)

(2) End point 

Start point 

Area \( S = -S_0 \)

X area \( (Y=0) \)

For waveform with negative (minus) amplitude

Start point 

\( S_0 \)

Area \( S = S_0 \cdot S_1 \)

End point

(3) X area \( (Y=0) \)

(4) X area \( (Y=0) \)

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

Start point 

Area \( S = S_0 \)

End point

X area \( (Y=0) \)

\( S_1 \)

Area \( S = S_0 + 2 \times S_1 + S_2 \)

Start point 

End point

X area \( (Y=0) \)
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

### Communication

- **Port**: RS232
- **Baud rate**: 9600
- **Parity**: None
- **Handshaking**: Off:Off
- **Stop bit**: 1
- **Data length**: 8

### Date & Time

- **Date**: 97/9/2
- **Time**: 23:43:35

### General

- **Copy action**: BMP file
- **Expansion calc.**: On

Next page
Initialize

### Operation Keys

- **Sets ON/OFF**
- **Moves between setting parameters**
- **Displays the setting menu**

#### 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

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

### Recording format of digital values

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

### Recording format of X-Y

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

#### Setting Screen

<table>
<thead>
<tr>
<th>Menu</th>
<th>Mode</th>
<th>Format</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Realtime</td>
<td>42one</td>
<td>Continue</td>
</tr>
</tbody>
</table>

- **Scroll**: Makes a selection
- **Cursormanual**: Displays the setting menu
- **Back**: Moves between setting parameters
- **Light**: Displays the next set of selections
- **Time/Div**: Displays the next set of selections
- **Play**
- **Feed**
- **Copy**
- **F/vspr**: Displays the setting menu
- **Menu**: Makes a selection
- **System**: Displays the next set of selections
- **Trigger**: Moves between setting parameters
- **Next**: Moves between setting parameters
- **Position**: Moves between setting parameters
- **Stop**: Moves between setting parameters

- **Gauge print**: On
- **Logic**: 1 2 3 4
- **Grid**: Fine
- **Time print**: On
- **CH message**: Off
- **CH print**: Off

### Operation Keys

- **Feed**
- **Print**
- **Copy**
- **V/fsp**
- **Menu**
- **System**
- **Trigger**
- **Next**
- **Position**
- **Stop**
7.2 Setting the Recording Format of the Analog Waveform

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/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.
   - 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 and B in order (bit 1, 2, 3, 4) from the top zone.
7.3 Setting the Recording Format of the Digital Values

Setting Screen

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**

![Setting Screen Diagram]

- **1. Menu**
  - **Mode**: Realtime
  - **Format**: XY
  - **Style**: Off

- **2. Sometime print**: On

- **3. Gauge print**: On
  - **Grid**: Fine
  - **Time print**: On
  - **CH message**: Off
  - **CH print**: Off

- **4. Y1(CH2)**: On
  - **Y2(CH3)**: Off
  - **Y3(CH4)**: Off

**Operation Keys**

- **FEED**: Displays the setting menu
- **SCROLL**: Makes a selection
- **CURSOR**: Displays the next set of selections
- **MANUAL**: Moves between setting parameters
- **TRIGGER**: Next
- **BACK**: Position
- **LIGHT**: Stop
- **TIME/DIV**: Displays the next set of selections
- **PLAY**: Moves between setting parameters
- **MONITOR**: Stop
- **VARIABLE**: Starts
- **FILE**: Copy
- **V/FSPRINT**: V/F Print
- **SYSTEM**: Stop
- **MENU**: System

**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.

<table>
<thead>
<tr>
<th>time/div</th>
<th>Chart speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 s/div</td>
<td>5 mm/s</td>
</tr>
<tr>
<td>5 s/div</td>
<td>2 mm/s</td>
</tr>
<tr>
<td>10 s/div</td>
<td>1 mm/s</td>
</tr>
<tr>
<td>30 s/div</td>
<td>20 mm/min</td>
</tr>
<tr>
<td>1 min/div</td>
<td>10 mm/min</td>
</tr>
<tr>
<td>2 min/div</td>
<td>5 mm/min</td>
</tr>
<tr>
<td>5 min/div</td>
<td>2 mm/min</td>
</tr>
<tr>
<td>10 min/div</td>
<td>1 mm/min</td>
</tr>
<tr>
<td>30 min/div</td>
<td>20 mm/hour</td>
</tr>
<tr>
<td>1 hour/div</td>
<td>10 mm/hour</td>
</tr>
</tbody>
</table>
7.5 Starting/Stopping

Zone Recording

Measurement start time

Channel number

Gage

Full scale

Measurement time

X-Y Recording

Measurement start time

Channel number

Y-axis gage

Comment/
Channel information

X-axis gage
### Digital Value Recording
This function records the measured value of each channel as numerical values in the specified interval.

<table>
<thead>
<tr>
<th>Recording date</th>
<th>CH1</th>
<th>CH2</th>
<th>CH3</th>
<th>CH4</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/09/01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18:41:57</td>
<td>-2.49</td>
<td>-2.01</td>
<td>-1.98</td>
<td>-2.46</td>
</tr>
<tr>
<td>18:41:59</td>
<td>-2.49</td>
<td>-2.01</td>
<td>-1.96</td>
<td>-2.47</td>
</tr>
<tr>
<td>18:42:01</td>
<td>-2.49</td>
<td>-2.01</td>
<td>-1.97</td>
<td>-2.46</td>
</tr>
<tr>
<td>18:42:03</td>
<td>-2.47</td>
<td>-2.01</td>
<td>-1.97</td>
<td>-2.46</td>
</tr>
<tr>
<td>18:42:05</td>
<td>-2.43</td>
<td>-2.00</td>
<td>-1.97</td>
<td>-2.46</td>
</tr>
<tr>
<td>18:42:07</td>
<td>-2.43</td>
<td>-2.00</td>
<td>-1.97</td>
<td>-2.46</td>
</tr>
<tr>
<td>18:42:09</td>
<td>-2.43</td>
<td>-2.00</td>
<td>-1.96</td>
<td>-2.47</td>
</tr>
<tr>
<td>18:42:11</td>
<td>-2.43</td>
<td>-2.00</td>
<td>-1.96</td>
<td>-2.46</td>
</tr>
<tr>
<td>18:42:13</td>
<td>-2.49</td>
<td>-2.00</td>
<td>-1.96</td>
<td>-2.46</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recording time</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>
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

Operation Keys

Scrolls the waveform or moves the cursor
Displays the captured data
7.6 Displaying/Recording 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.

<table>
<thead>
<tr>
<th>Prt area Out to</th>
<th>Set the record range</th>
<th>Set the record destination</th>
<th>Execute the recording</th>
</tr>
</thead>
</table>

Go back to the previous screen

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**

<table>
<thead>
<tr>
<th>Setting parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation mode</td>
<td>Select whether to save the measurement data to memory or realtime record with the built-in printer. Select “Realtime+Memory.”</td>
</tr>
<tr>
<td>Format</td>
<td>Select the recording format from 1 zone, 2 zone, or 4 zone.</td>
</tr>
<tr>
<td>Memory length</td>
<td>The number of data points to capture in one data capture. Set in terms of div (80 data/div).</td>
</tr>
<tr>
<td>Kind of trigger</td>
<td>Select normal trigger or wave window trigger.</td>
</tr>
<tr>
<td>Clear memory at start</td>
<td>Select whether or not to clear the measurement data captured previously at the start of the measurement.</td>
</tr>
<tr>
<td>Condition to stop repeat trigger</td>
<td>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.</td>
</tr>
<tr>
<td>Operation after data capturing</td>
<td>Set the operation after capturing the data once.</td>
</tr>
</tbody>
</table>

**Setting the display format**

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

**Setting the recording format**

<table>
<thead>
<tr>
<th>Setting parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Format</td>
<td>Select 1 zone, 2 zone, or 4 zone.</td>
</tr>
<tr>
<td>Setting the Chart speed</td>
<td>Set the chart speed in time/div.</td>
</tr>
<tr>
<td>Record mode</td>
<td>Select whether to record the analog waveform or the digital values.</td>
</tr>
<tr>
<td>Record length</td>
<td>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.</td>
</tr>
<tr>
<td>Interval time</td>
<td>Set only when recording digital values. Set the recording interval.</td>
</tr>
<tr>
<td>Gauge record</td>
<td>Select whether or not to record the scale value for each channel at the end of the recording.</td>
</tr>
<tr>
<td>Grid</td>
<td>Select the grid type.</td>
</tr>
<tr>
<td>Time record</td>
<td>Set whether or not to record the time record of the captured data.</td>
</tr>
<tr>
<td>Channel message</td>
<td>Select whether or not to record comments or measurement range information.</td>
</tr>
<tr>
<td>Channel record</td>
<td>Select whether or not to record the channel numbers or tags.</td>
</tr>
<tr>
<td>Line</td>
<td>Set the thickness of the line used to record the analog waveform.</td>
</tr>
<tr>
<td>Logic</td>
<td>Set the display of each bit to ON/OFF and the record position of the logic channel.</td>
</tr>
</tbody>
</table>
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.
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.

<table>
<thead>
<tr>
<th>time/div (Sample rate)</th>
<th>Maximum Chart Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 s/div (40 S/s)</td>
<td>2 s/div</td>
</tr>
<tr>
<td>5 s/div (16 S/s)</td>
<td>5 s/div</td>
</tr>
<tr>
<td>10 s/div (8 S/s)</td>
<td>10 s/div</td>
</tr>
<tr>
<td>30 s/div (2.67 S/s)</td>
<td>30 s/div</td>
</tr>
<tr>
<td>1 min/div (1.33 S/s)</td>
<td>1 min/div</td>
</tr>
<tr>
<td>2 min/div (0.667 S/s)</td>
<td>2 min/div</td>
</tr>
</tbody>
</table>

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 real-time. The measurement data is displayed on the screen, but the backlighting 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:

$$\text{Chart speed} = 10 \div \text{(time/div)}$$  \hspace{1cm} (The unit of time/div is seconds)

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

<table>
<thead>
<tr>
<th>time/div</th>
<th>Chart speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 s/div</td>
<td>5 mm/s</td>
</tr>
<tr>
<td>5 s/div</td>
<td>2 mm/s</td>
</tr>
<tr>
<td>10 s/div</td>
<td>1 mm/s</td>
</tr>
<tr>
<td>30 s/div</td>
<td>20 mm/min</td>
</tr>
<tr>
<td>1 min/div</td>
<td>10 mm/min</td>
</tr>
<tr>
<td>2 min/div</td>
<td>5 mm/min</td>
</tr>
<tr>
<td>5 min/div</td>
<td>2 mm/min</td>
</tr>
<tr>
<td>10 min/div</td>
<td>1 mm/min</td>
</tr>
<tr>
<td>30 min/div</td>
<td>20 mm/hour</td>
</tr>
<tr>
<td>1 hour/div</td>
<td>10 mm/hour</td>
</tr>
</tbody>
</table>

**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**

<table>
<thead>
<tr>
<th>Setting parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation mode</td>
<td>Set to “Harmonic.”</td>
</tr>
<tr>
<td>Analysis method</td>
<td>Set to “Wave”</td>
</tr>
<tr>
<td>Frequency</td>
<td>Set the frequency of the power supply being measured.</td>
</tr>
<tr>
<td>Memory length</td>
<td>Set how many cycles of data to capture.</td>
</tr>
<tr>
<td>Kind of Trigger</td>
<td>Select normal trigger or wave window trigger.</td>
</tr>
<tr>
<td>Clear memory at start</td>
<td>Select whether or not to clear the measured data captured previously at the start of the measurement.</td>
</tr>
<tr>
<td>Condition to stop</td>
<td>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.</td>
</tr>
<tr>
<td>repeat trigger</td>
<td></td>
</tr>
<tr>
<td>Operation after data capturing</td>
<td>Set the operation after capturing the data once.</td>
</tr>
</tbody>
</table>

**Setting the display format**

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

**Setting the recording format**

<table>
<thead>
<tr>
<th>Setting parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Format</td>
<td>Select 1 zone, 2 zones or 4 zones.</td>
</tr>
<tr>
<td>Record mode</td>
<td>Select whether to record the analog waveform or the digital values.</td>
</tr>
<tr>
<td>Record length</td>
<td>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.</td>
</tr>
<tr>
<td>Interval time</td>
<td>Set only when recording digital values. Sets the recording interval.</td>
</tr>
<tr>
<td>Gauge record</td>
<td>Select whether or not to record the scale value for each channel at the end of the recording.</td>
</tr>
<tr>
<td>Grid</td>
<td>Select the grid type.</td>
</tr>
<tr>
<td>Time record</td>
<td>Set whether or not to record the time record of the captured data.</td>
</tr>
<tr>
<td>Channel message</td>
<td>Select whether or not to record comments or measurement range information.</td>
</tr>
<tr>
<td>Channel record</td>
<td>Select whether or not to record the channel numbers or tags.</td>
</tr>
<tr>
<td>Line</td>
<td>Set the thickness of the line used to record the analog waveform.</td>
</tr>
<tr>
<td>Logic</td>
<td>Set the display of each bit to ON/OFF and the record position of the logic channel.</td>
</tr>
</tbody>
</table>
9.1 Setting Parameters

**Automatic analysis (Perform harmonic analysis automatically)**
Conditions on capturing the measurement data

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

**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)

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.

<table>
<thead>
<tr>
<th>Memory Length (Number of Cycles)</th>
<th>5</th>
<th>10</th>
<th>25</th>
<th>50</th>
<th>100</th>
<th>250</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of blocks (Normal trigger)</td>
<td>32</td>
<td>16</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1*1</td>
</tr>
<tr>
<td>Number of blocks (WW trigger)</td>
<td>16</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

*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)

**Operation Keys**
- **SCROLL**
- **CURSOR**
- **MANUAL TRIGGER**
- **BACK LIGHT**
- **TIME / DIV**
- **PLAY**
- **BACK**
- **MONITOR**
- **VARIABLE**
- **START**
- **FILE**
- **FEED**
- **COPY**
- **V/F PRINT**
- **MENU**
- **SYSTEM**
- **TRIGGER**
- **NEXT POSITION**
- **STOP**

**Operational 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 11.8 “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.

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.

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 can 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.
9.5 Analyzing by Specifying the Range

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

<table>
<thead>
<tr>
<th>Harmonic Order</th>
<th>Content</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>102.1</td>
<td>100.0</td>
</tr>
<tr>
<td>3</td>
<td>1.1</td>
<td>1.3</td>
</tr>
<tr>
<td>5</td>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>7</td>
<td>0.7</td>
<td>1.0</td>
</tr>
<tr>
<td>9</td>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>11</td>
<td>0.4</td>
<td>0.5</td>
</tr>
<tr>
<td>13</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>15</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>17</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>19</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>21</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>23</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>25</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>27</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>29</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>31</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>33</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>35</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>37</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>39</td>
<td>0.2</td>
<td>0.0</td>
</tr>
</tbody>
</table>

- THD(IEC): 4.2%  THD(IEC): 2.4%
- Total-RMS: 102.7V

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.
9.5 Analyzing by Specifying the Range

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

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
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

<table>
<thead>
<tr>
<th>Harmonic List</th>
<th>140kW(CH8-CH4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Or</td>
<td>Act-P</td>
</tr>
<tr>
<td>1</td>
<td>0.000</td>
</tr>
<tr>
<td>3</td>
<td>0.000</td>
</tr>
<tr>
<td>5</td>
<td>0.000</td>
</tr>
<tr>
<td>7</td>
<td>0.000</td>
</tr>
<tr>
<td>9</td>
<td>0.000</td>
</tr>
<tr>
<td>11</td>
<td>0.000</td>
</tr>
<tr>
<td>13</td>
<td>0.000</td>
</tr>
<tr>
<td>15</td>
<td>0.000</td>
</tr>
<tr>
<td>17</td>
<td>0.000</td>
</tr>
<tr>
<td>19</td>
<td>0.000</td>
</tr>
<tr>
<td>21</td>
<td>0.000</td>
</tr>
<tr>
<td>23</td>
<td>0.000</td>
</tr>
<tr>
<td>25</td>
<td>0.000</td>
</tr>
<tr>
<td>27</td>
<td>0.000</td>
</tr>
<tr>
<td>29</td>
<td>0.000</td>
</tr>
<tr>
<td>31</td>
<td>0.000</td>
</tr>
<tr>
<td>33</td>
<td>0.000</td>
</tr>
<tr>
<td>35</td>
<td>0.000</td>
</tr>
<tr>
<td>37</td>
<td>0.000</td>
</tr>
<tr>
<td>39</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Harmonic order

Switching the harmonic order

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.
9.6 Analyzing Automatically

When the parameter to be analyzed is RMS(P)

![Graph showing Harmonic Analysis for 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)

![Graph showing Harmonic Analysis for Cont(P) and Phase(P)]

Harmonic order  
Harmonic order
9.6 Analyzing Automatically

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.

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.

**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.

<table>
<thead>
<tr>
<th>Analysis Method</th>
<th>Save format</th>
<th>Binary Format (Save (B))</th>
<th>ASCII Format (Save (A))</th>
<th>Save All Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waveform Analysis</td>
<td>Waveform data ********.dat</td>
<td>Waveform data ********.csv</td>
<td>Waveform data blk*****.dat</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analyzed data ********.csv</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auto Analysis</td>
<td>Waveform data ********.csv</td>
<td>Waveform data ********.csv</td>
<td>Waveform data blk*****.dat</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analyzed data ********.csv</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

\[ V = V_1 \sin(\omega t) + V_2 \sin(2\omega t + \theta) + V_2 \sin(2\omega t + \theta) + \cdots + V_{(n-1)} \sin((n-1)\omega t + \theta) + V_n \sin(n\omega t + \theta) \]

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

\[ V_n = (V_{nr}, V_{ni}) \]

\( V_{nr} \) is the real component and \( V_{ni} \) is the imaginary component.

Therefore, the RMS value \( V_n \) of the nth order harmonic voltage can be found by the following equation.

\[ V_n = \sqrt{\left(\frac{(V_{nr})^2 + (V_{ni})^2}{2}\right)} \]

**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.

\[ A_n = \sqrt{\left(\frac{(A_{nr})^2 + (A_{ni})^2}{2}\right)} \]

**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.

\[ \text{nth order relative harmonic content} = \left(\frac{\text{RMS value of the nth order}}{\text{RMS value of fundamental component}}\right) \times 100\% \]

#### 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

\[ \theta_n = (\text{the phase of the nth order harmonic voltage}) - (\text{phase of the fundamental component}) \times n \]

\[ = \frac{\tan^{-1}(V_{nr} / V_{ni}) - \{\tan^{-1}(V_{nr} / V_{ni})\} \times n}{n} \]

where \( V_{nr} \): real component of the nth order, \( V_{ni} \): imaginary component of the nth order.
For harmonic current
\[ \theta_n = (\text{the phase of the nth order harmonic current}) - (\text{phase of the fundamental component}) \times n \]
\[ = \tan^{-1}\left(\frac{A_{nr}}{A_{ni}}\right) - \left(\tan^{-1}\left(\frac{A_{1r}}{A_{1i}}\right)\right) \times n \]
where \( A_{nr} \): real component of the nth order, \( A_{ni} \): imaginary component of the nth order

**Active Power (Automatic Analysis)**

Single-phase two-wire system
\[ W_n = V_n \times A_n \times \cos \phi_n \quad (n=1, 2, 3, \ldots, n-1, n) \]
\( W_n \): nth order active power
\( V_n \): nth order active voltage
\( A_n \): nth order active current
\( \phi_n \): Phase difference of the nth order current with respect to the nth order voltage

- \( \phi_n > 0 \): When the current phase is ahead of the voltage phase
- \( \phi_n < 0 \): When the current phase is behind the voltage phase

Single-phase three-wire system, three-phase three-wire system
\[ W_n = W_{n1} + W_{n2} \quad (n=1, 2, 3, \ldots, n-1, n) \]
\( W_n \): 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.

\[ \text{nth order relative active power content} = \left( \frac{\text{active power of the nth order}}{\text{active power of fundamental component}} \right) \times 100\% \]

**Phase Angle (Power Measurement)**

Computes the phase difference of the nth order harmonic current with respect to the nth order harmonic voltage.
\[ \phi_n = \cos^{-1}\left\{ \text{(nth order active power)} \div (\text{RMS voltage value of the nth order} \times \text{RMS current value of the nth order}) \right\} \]

- \( \phi_n > 0 \): 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.

\[ \text{Harmonic Distortion (IEC)} = \sqrt[40]{\sum_{n=2}^{40} \left( \frac{\text{RMS value of the nth order harmonic voltage (or current)}}{\text{RMS value of the fundamental voltage (or current)}} \right)^2} \]
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.

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

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

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

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
\[
\text{Active power} = (\text{total RMS value of the voltage}) \times (\text{total RMS value of current}) \times \cos \phi
\]
\[
\phi = \text{Phase difference of the current with respect to the voltage}
\]

Apparent Power
\[
\text{Apparent power} = \text{total RMS value of the voltage} \times \text{total RMS value of current}
\]

Reactive Power
\[
\text{Reactive power} = \sqrt{(\text{apparent power})^2 - (\text{active power})^2}
\]
\[
\phi = \text{Phase difference of the current with respect to the voltage}
\]

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.
\[
\text{Power factor} = \frac{\text{active power}}{\text{apparent power}}
\]
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)
10.1 External Media

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.

<table>
<thead>
<tr>
<th>Setting Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode</td>
<td>Select the data to save or load. Select “Data” (measurement data) or “Panel” (setup data).</td>
</tr>
<tr>
<td>Function</td>
<td>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).</td>
</tr>
<tr>
<td>Filename</td>
<td>Set the filename.</td>
</tr>
<tr>
<td>Save Option</td>
<td>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.</td>
</tr>
</tbody>
</table>
## 10.3 Saving the Measurement Data to the PC Memory Card

### Setting Screen

![Setting Screen](image)

### Operation Keys

![Operation Keys](image)

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEED</td>
<td>Displays the setting menu</td>
</tr>
<tr>
<td>PRINT</td>
<td>Makes a selection</td>
</tr>
<tr>
<td>COPY</td>
<td>Displays the next set of selections</td>
</tr>
<tr>
<td>MAKE</td>
<td>Moves between setting parameters</td>
</tr>
<tr>
<td>VAR</td>
<td>select input characters</td>
</tr>
<tr>
<td>TRIG</td>
<td></td>
</tr>
<tr>
<td>SYSTEM</td>
<td></td>
</tr>
<tr>
<td>FILE</td>
<td></td>
</tr>
<tr>
<td>FILE</td>
<td></td>
</tr>
<tr>
<td>NEXT</td>
<td></td>
</tr>
</tbody>
</table>

**Save/Load**

- **PC Card [9MByte]**

### Setting Parameters

1. **Node**: Data
2. **Function**: Save (Binary)
3. **File name**: [ ]
4. **Comment**: [ ]
5. **Save option**
   - **Node**: Off
   - **Save CH**: CH1: Yes, CH2: Yes, CH3: Yes, CH4: Yes
   - **Limit**: 0% ~ 100%

### File Types

- **Data**
- **Panel**
10.3 Saving the Measurement Date to the PC Memory Card

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.
- BLKAAABBB.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.
10.3 Saving the Measurement Date to the PC Memory Card

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.
10.3 Saving the Measurement Date to the PC Memory Card

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.

```
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory clear</td>
<td>Off</td>
</tr>
<tr>
<td>Rep.Trig,stop condition</td>
<td>Stop key</td>
</tr>
<tr>
<td>Accumulate display</td>
<td>Off</td>
</tr>
<tr>
<td>Memory Calculation</td>
<td>Off</td>
</tr>
<tr>
<td>Printout</td>
<td>Off</td>
</tr>
<tr>
<td>PC card</td>
<td>Data Save</td>
</tr>
</tbody>
</table>
```

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 overwritten.
- 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.
10.3 Saving the Measurement Date to the PC Memory Card

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

![Setting Screen Image]

Operation Keys

![Operation Keys Image]

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**

<table>
<thead>
<tr>
<th>Analysis Method</th>
<th>Save format</th>
<th>Binary Format (Save (B))</th>
<th>ASCII Format (Save (A))</th>
<th>Save All Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory Mode</td>
<td>Waveform data</td>
<td>Waveform data</td>
<td>Waveform data</td>
<td>Waveform data blk*****.dat</td>
</tr>
<tr>
<td></td>
<td>******.dat</td>
<td>******.csv</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harmonic Waveform Analysis</td>
<td>Waveform data</td>
<td>Analyzed data</td>
<td>Waveform data</td>
<td>Waveform data blk*****.dat</td>
</tr>
<tr>
<td></td>
<td>******.dat</td>
<td>******.csv</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harmonic Auto Analysis</td>
<td>Waveform data</td>
<td>Analyzed data</td>
<td>Waveform data</td>
<td>Waveform data blk*****.dat</td>
</tr>
<tr>
<td></td>
<td>******.dat</td>
<td>******.csv</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analysis Method</th>
<th>Save format</th>
<th>Auto save after data capturing</th>
<th>Save on the analyzed data display</th>
<th>Trend save</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory Mode</td>
<td>Waveform data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>auto***.dat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harmonic Waveform Analysis</td>
<td>Waveform data</td>
<td>Analyzed data</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>auto***.dat</td>
<td>harmo***.csv</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harmonic Auto Analysis</td>
<td>Waveform data</td>
<td>Analyzed data</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>auto***.dat</td>
<td>harmo***.csv</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analysis Method</th>
<th>Save format</th>
<th>Save on the waveform display screen</th>
<th>Save data to the flash ATA memory card while capturing data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory Mode</td>
<td>Waveform data</td>
<td>Binary format</td>
<td>memd****.dat</td>
</tr>
<tr>
<td></td>
<td>disp***.dat</td>
<td>ASCII format</td>
<td></td>
</tr>
<tr>
<td>Harmonic Mode</td>
<td>Analyzed data</td>
<td>disp***.dat</td>
<td></td>
</tr>
</tbody>
</table>
10.4 Writing Data Simultaneously to the Flash ATA Memory Card

Setting Screen

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.”
10.4 Writing Data Simultaneously to the Flash ATA Memory Card

**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

Operation Keys

Makes a selection
Moves between setting parameters
Displays the setting menu
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 | 03:01:01 00:01:04 |
| Sample rate  | 150kHz/s (50us/div) |
| Data length  | 8000 |
| File size    | 76Kbyte |
| 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

- **PLAY BACK**
- Trigger position
- Time of the left most part of the display
- Time axis zoom factor
- Cursor display
- Record the captured data

### Operation Keys

- **FEED**
- **PRINT**
- **COPY**
- **PLAY**
- **BACK**
- **LIGHT**
- **TIME/DIV**
- **PLAY**
- **BACK**
- **MONITOR**
- **VARIABLE**
- **START**
- **FILE**
- **FEED**
- **COPY**
- **V/FPRINT**
- **MENU**
- **SYSTEM**
- **TRIGGER**

**NEXT**
- Makes a selection
- Moves between setting parameters
- Displays the captured data

### 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.
10.6 Displaying the Loaded Measurement 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

Operation Keys

Makes a selection
Moves between setting parameters
Displays the setting menu
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

![Setting Screen Diagram]

Operation Keys

![Operation Keys Diagram]
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

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RD (Received Data)</td>
<td>Data received from the personal computer. Signal direction: Input</td>
</tr>
<tr>
<td>2</td>
<td>SD (Send Data)</td>
<td>Data transmitted to a personal computer. Signal direction: Output</td>
</tr>
<tr>
<td>3</td>
<td>SG (Signal Ground)</td>
<td>Ground for signals.</td>
</tr>
<tr>
<td>4</td>
<td>RS (Request to Send)</td>
<td>Signal used for handshaking when receiving data from a personal computer. Signal direction: Output</td>
</tr>
<tr>
<td>5</td>
<td>CS (Clear to Send)</td>
<td>Signal used for handshaking when transmitting data to a personal computer. Signal direction: Input</td>
</tr>
</tbody>
</table>

Pins 1, 4, 6, and 9 are not used.
11.2 Connecting the RS-232 Interface Cable

Signal Direction

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

![Diagram of Signal Directions]

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

<table>
<thead>
<tr>
<th>Signal Table</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pin No.</strong></td>
</tr>
<tr>
<td>(9-pin connector)</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
</tbody>
</table>

Connection Example of Signal Lines

Pin numbers are that of 9-pin connectors.

In general, use a cross cable.

- **OFF-OFF / XON-XON**

  PC OR100E
  
  SD 3 3 SD
  RD 2 2 RD
  RS 7 7 RS
  CS 8 8 CS
  SG 5 5 SG

- **XON-RS(XON-RS)**

  PC OR100E
  
  SD 3 3 SD
  RD 2 2 RD
  RS 7 7 RS
  CS 8 8 CS
  SG 5 5 SG

- **CTS-RS(CS-RS)**

  PC OR100E
  
  SD 3 3 SD
  RD 2 2 RD
  RS 7 7 RS
  CS 8 8 CS
  SG 5 5 SG
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.

<table>
<thead>
<tr>
<th>Handshaking method</th>
<th>Data Sending Control (Control for sending data to a computer)</th>
<th>Data Receiving Control (Control for receiving data from a computer)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Software Handshake</td>
<td>Hardware Handshake</td>
</tr>
<tr>
<td>OFF-OFF</td>
<td>No handshaking</td>
<td>No handshaking</td>
</tr>
<tr>
<td>XON-XON</td>
<td>XON-XON</td>
<td></td>
</tr>
<tr>
<td>XON-RS</td>
<td>XON-RTS</td>
<td></td>
</tr>
<tr>
<td>CS-RS</td>
<td>CTS-RTS</td>
<td></td>
</tr>
</tbody>
</table>

**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.
11.3 Handshaking

**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

Operation Keys

Displays the setting menu
Makes a selection
Displays the next set of selections
Moves between setting parameters
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 : 1200, 2400, 4800, 9600, and 19200 bps.
and the FAX modem

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.

<table>
<thead>
<tr>
<th>OR100E - FAX Modem (OR100E setting)</th>
<th>FAX Modem - FAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200 to 4800 bps</td>
<td>2400 bps</td>
</tr>
<tr>
<td>9600 bps</td>
<td>4800 bps</td>
</tr>
<tr>
<td>19200 bps</td>
<td>9600 bps</td>
</tr>
</tbody>
</table>
11.6 FAX Modem

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**

<table>
<thead>
<tr>
<th>Communication</th>
<th>Operation Keys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port: Fax/Modem card</td>
<td>Makes a selection</td>
</tr>
<tr>
<td>Baud rate: 3200</td>
<td>Displays the setting menu</td>
</tr>
<tr>
<td>Tel. number 1:</td>
<td>Makes a selection</td>
</tr>
<tr>
<td>Tel. number 2:</td>
<td>Displays the next set of selections</td>
</tr>
<tr>
<td>Tel. line: Tone</td>
<td>Moves between setting parameters</td>
</tr>
<tr>
<td>Header:</td>
<td></td>
</tr>
<tr>
<td>[init.command1:</td>
<td></td>
</tr>
<tr>
<td>[init.command2:</td>
<td></td>
</tr>
<tr>
<td>Set</td>
<td></td>
</tr>
</tbody>
</table>

Date & Time

- Date: 9/9/19
- Time: 17:34:13

General

- Copy action: BMP file
- Expansion calc.: Off

Operation Keys

- FEED
- PRINT
- COPY
- FEED
- MONITOR
- NEXT
- PLAY
- BACK
- LIGHT
- TIME/DIV
- TRIGGER
- FILE
- STOP
- START

Next page

Initialize
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

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

**Operation Keys**
- Displays the setting menu
- Makes a selection
- Displays the next set of selections
- Moves between setting parameters
- Displays the captured data
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

```
+5V
100Ω
4.7kΩ
100pF
74LS07 or equivalent

Maximum input voltage range: −0.5 to 5.5V

+5V
1kΩ
74LS07 or equivalent
```

Input circuit(TRIG IN)  Output circuit(TRIG OUT)
12.1 Running Multiple OR Series in Synchronized Operation

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.
12.1 Running Multiple OR Series in Synchronized Operation

Setting Screen

<table>
<thead>
<tr>
<th>TRIGGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ext. trig. : Rise</td>
</tr>
<tr>
<td>Start time : Off</td>
</tr>
<tr>
<td>Off</td>
</tr>
</tbody>
</table>

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

--- Communication ---
Port : RS232
Baud rate : 9600
Parity : None
Handshaking : Off:Off
Stop bit : 1
Data length : 8

--- Date & Time ---
Date : 97/9/3  Time : 1:4:45

--- General ---
Copy action : BMP file
Expansion calc. : On

Record to the built-in printer  Output to FAX  Save the data in BMP format to the flash ATA card
12.2 Taking a Hard Copy

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**

![Input circuit configuration diagram]

- Maximum input voltage range: –0.5 to 5.5V

---

**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, Italian, German, English or Japanese.

Setting Screen

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” (Italian) 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.”

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**

![Setting Screen Diagram]

**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

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

```
Copy action : BMP file
RMS Stat. calc : On

Initialize

To Next page

OK

Display language : English
Tag : Off
Manual trigger key : Valid
Ext. term. start/stop : Invalid
Key lock : Off
Display grid : On
Wave trig. level change : Off
Start time : 0; 0
End time : 0; 0
Change level CH1: 0% CH2: 0%
CH3: 0% CH4: 0%

ESC
Self test

Invalid Valid

Go back to the previous screen
```
12.9 Starting/Stopping Measurement with External Signal

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.

High or Open

Low or Close

START STOP

Note

For connecting the input signal, see page 2-5.

Input circuit

Maximum input voltage range: –0.5 to 5.5V
12.10 Locking the Keys

Setting screen

SYSTEM

Copy action : BMP file
RMS Status calc : On

Next page
Initialize

To Next page

OK

Display language : English
Tag : Off
Manual trigger key : Valid
Ext. term., start/stop : Invalid
Key lock : Off
Display grid : On
Wtthtl level change : Off
Start time : 0: 0
End time : 0: 0
Change level CH1 : 0% CH2 : 0%
CH3 : 0% CH4 : 0%

ESC
Self test

Self test

Off StartKey All Keys
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

SYSTEM

Copy action: BMP file
RMS Stat calc: On

To Next page

Display language: English
Tag: Off
Manual trigger key: Invalid
Ext. term. start/stop: Invalid
Key lock: Off
Display grid: Off
WM-trig level change: Off
Start time: 0: 0
End time: 0: 0
Change level CH1: 0% CH2: 0%
CH3: 0% CH4: 0%

Go back to the previous screen

ESC
Self test

Off On

Next page
Initialize
12.11 Turning ON/OFF the Grid

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 Screen

| Copy action : BMP file |
| RMS Status calc : On |

Next page
Initialize

To Next page

OK

Display language : English
Tag : Off
Manual trigger key : Valid
Ext.term. start/stop : Invalid
Key lock : Off
Display grid : On
WM-trig level change : Off
Start time : 0: 0
End time : 0: 0
Change level CH1 : 0% CH2 : 0%
CH3 : 0% CH4 : 0%

ESC
Self test

Go back to the previous screen
12.12 Temporarily Changing the Width of the Wave Window Trigger

**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.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Things to Check</th>
<th>Reference Page</th>
</tr>
</thead>
</table>
| The recorder does not turn ON. | • Check that the power switch located on the left side of the recorder is turned ON.  
• Check that the power cord is firmly plugged into the power outlet.  
• Check that the batteries are properly installed.  
• If you are using the NiMH battery pack, check that the battery is recharged.  
• Check that you are not using power outside the allowable power supply voltage. | 1-10, 2-17 |
| 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. | — |
| 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.  
• Check whether the linear scaling function is being used.  
• Allow 30 minutes for the recorder to warm up after turning ON the power to make accurate measurements. | 4-4, 4-5, 4-8, 4-9 |
| The printout is faint. | • Check that you are using the proper type of thermal paper.  
• Check the printer head as described in section 13.4.  
If it is not working properly, the recorder needs servicing.  
• 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, 2-3, 13-14, — |
## 13.1 Troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Things to Check</th>
<th>Reference Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>The recorder does not print.</td>
<td>· Check that the thermal paper is installed in the right direction.</td>
<td>2-19, 2-20</td>
</tr>
<tr>
<td>Waveforms cannot be recorded.</td>
<td>· Check that the input coupling is set to DC.</td>
<td>4-3</td>
</tr>
<tr>
<td></td>
<td>· Check that the trace is turned ON.</td>
<td>6-11</td>
</tr>
<tr>
<td>The trace intensity is faint.</td>
<td>· 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.</td>
<td></td>
</tr>
<tr>
<td>Data cannot be saved to the flash ATA memory card.</td>
<td>· If you are using a new card, make sure that it is formatted.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>· Check that the card is inserted properly.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>· Check that there is enough space available to record the data.</td>
<td>10-2</td>
</tr>
<tr>
<td></td>
<td>· Check if the card is supported by the recorder by contacting your nearest YOKOGAWA dealer.</td>
<td></td>
</tr>
<tr>
<td>Data cannot be loaded from the flash ATA memory card.</td>
<td>· Check that the card is inserted properly.</td>
<td>11-11</td>
</tr>
<tr>
<td></td>
<td>· Some of the data files saved by other models can not be loaded.</td>
<td></td>
</tr>
<tr>
<td>The recorder cannot be controlled through the RS-232 interface.</td>
<td>· Check that the communication parameters are set correctly on the computer side and the recorder side.</td>
<td>11-8</td>
</tr>
<tr>
<td></td>
<td>· Communication parameters are not changed until after highlighting “Set” and pressing the “F1” (Confirm) key.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>· Check that you are using the correct type of cable for the intended application.</td>
<td>11-3</td>
</tr>
<tr>
<td>Data cannot be sent over the FAX</td>
<td>· Check that the card is inserted properly.</td>
<td>11-11</td>
</tr>
<tr>
<td></td>
<td>· Check that the settings are correct for the telephone line that you are using.</td>
<td>11-12</td>
</tr>
<tr>
<td></td>
<td>· 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.</td>
<td>11-12</td>
</tr>
<tr>
<td></td>
<td>· Check that the destination is set to FAX.</td>
<td>11-14</td>
</tr>
<tr>
<td>The chart has jammed.</td>
<td>· Remove the jammed paper as follows.</td>
<td>2-19, 2-20</td>
</tr>
<tr>
<td></td>
<td>Turn OFF the power switch.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lift the release lever.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Remove the paper.</td>
<td></td>
</tr>
<tr>
<td>The chart does not feed.</td>
<td>· Check if the recorder has run out of paper.</td>
<td>2-19, 2-20</td>
</tr>
<tr>
<td></td>
<td>· Check that the release lever is down.</td>
<td>2-19, 2-20</td>
</tr>
<tr>
<td>Screen display is dark.</td>
<td>· Pressing the “back light” key darkens the screen display.</td>
<td>1-3</td>
</tr>
<tr>
<td></td>
<td>· Screen display automatically darkens while recording with the built-in printer. This is not a malfunction.</td>
<td></td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Error Message</th>
<th>Description and Corrective Measures</th>
<th>Reference Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>600</td>
<td>Out of chart paper</td>
<td>Out of chart paper Load new roll chart.</td>
<td>2-19, 2-20</td>
</tr>
<tr>
<td>601</td>
<td>Printhead raised</td>
<td>Lower the release lever.</td>
<td>2-19, 2-20</td>
</tr>
<tr>
<td>603</td>
<td>Low battery</td>
<td>Not enough battery voltage to drive the recorder. Replace the AAA batteries or recharge the rechargeable battery.</td>
<td>2-11, 2-15, 2-16</td>
</tr>
<tr>
<td>630</td>
<td>Modem card not ready</td>
<td>There is no modem card for sending the FAX. Insert the modem card firmly in the slot.</td>
<td>11-10, 11-11</td>
</tr>
<tr>
<td>632</td>
<td>Can’t use this modem card</td>
<td>This modem card cannot be used with this recorder. Use a modem card supported by this recorder.</td>
<td>11-10, 11-11</td>
</tr>
<tr>
<td>633</td>
<td>Can’t initialize modem</td>
<td>Reinsert the modem card. If it still does not work, change to another modem card.</td>
<td>11-11</td>
</tr>
<tr>
<td>634</td>
<td>Can’t send fax</td>
<td>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.</td>
<td>11-10 to 11-13</td>
</tr>
<tr>
<td>635</td>
<td>Connection failure</td>
<td>Failed to connect due to the following reason. Phone number is not specified. Destination Busy after four redials.</td>
<td>11-10 to 11-13</td>
</tr>
<tr>
<td>650</td>
<td>PC card not ready</td>
<td>Flash ATA card is not inserted. Insert the card firmly in the slot.</td>
<td>10-2</td>
</tr>
<tr>
<td>651</td>
<td>Card unformatted</td>
<td>Flash ATA card is not formatted to MS-DOS. Format the card with a personal computer.</td>
<td>—</td>
</tr>
</tbody>
</table>
### 13.2 Messages and Corrective Measures

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Error Message</th>
<th>Description and Corrective Measures</th>
<th>Reference Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>653</td>
<td>Specified file unavailable</td>
<td>Cannot find the specified file. Check the file name.</td>
<td>10-8 to 10-13</td>
</tr>
<tr>
<td>654</td>
<td>Invalid file name</td>
<td>Tried to use a file name that cannot be used or tried to use invalid characters or symbols.</td>
<td>Chapter 10</td>
</tr>
<tr>
<td>655</td>
<td>No data to save</td>
<td>or no measurement data in the specified range. Save after capturing data or change the range to save.</td>
<td>10-5</td>
</tr>
<tr>
<td>656</td>
<td>No data to load</td>
<td>There is no data in the specified file.</td>
<td>10-8 to 10-11</td>
</tr>
<tr>
<td>657</td>
<td>Not enough space to save</td>
<td>There is not enough free space on the flash ATA card. Delete unnecessary files or save to another card.</td>
<td>10-12, 10-13</td>
</tr>
<tr>
<td>658</td>
<td>Directory full</td>
<td>Maximum number of files allowed in the root directory has been exceeded. Delete unnecessary files or save to another card.</td>
<td>10-12, 10-13</td>
</tr>
<tr>
<td>659</td>
<td>Invalid file format</td>
<td>OR100E does not support this file format.</td>
<td>—</td>
</tr>
<tr>
<td>660</td>
<td>Invalid format version</td>
<td>OR100E does not support this file format version.</td>
<td>—</td>
</tr>
<tr>
<td>662</td>
<td>Write protected file</td>
<td>The file is write protected. Cannot overwrite or delete the file. Clear the write protection with a personal computer.</td>
<td>—</td>
</tr>
<tr>
<td>663</td>
<td>Access error</td>
<td>Card was removed during loading or saving, or the card is physically damaged. Insert a proper card.</td>
<td>10-1, 10-2</td>
</tr>
<tr>
<td>664</td>
<td>File system error</td>
<td>Other file system error. Insert another flash ATA card or format the card with a personal computer.</td>
<td>10-2</td>
</tr>
<tr>
<td>665</td>
<td>File exists</td>
<td>A file with a same file name already exists. Delete the file or save with another file name.</td>
<td>10-5, 10-12</td>
</tr>
<tr>
<td>667</td>
<td>File is corrupt</td>
<td>Cannot load the specified file because it is corrupt.</td>
<td>—</td>
</tr>
<tr>
<td>668</td>
<td>No harmonic data</td>
<td>There are no data that have been analyzed. Perform harmonic analysis first.</td>
<td>—</td>
</tr>
<tr>
<td>669</td>
<td>No previous load data</td>
<td>No data to be displayed.</td>
<td>—</td>
</tr>
<tr>
<td>670</td>
<td>No next load data</td>
<td>No data to be displayed.</td>
<td>—</td>
</tr>
<tr>
<td>700</td>
<td>Execution error</td>
<td>Cannot execute the specified operation.</td>
<td>—</td>
</tr>
</tbody>
</table>
## 13.2 Messages and Corrective Measures

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Error Message</th>
<th>Description and Corrective Measures</th>
<th>Reference Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>702</td>
<td>No such channel</td>
<td>The specified channel does not exist.</td>
<td>—</td>
</tr>
<tr>
<td>703</td>
<td>No captured data</td>
<td>Cannot execute the specified operation because there is no captured data.</td>
<td>—</td>
</tr>
<tr>
<td>704</td>
<td>Invalid data number</td>
<td>In the save option of the captured data, the specified range for saving the data is incorrect.</td>
<td>10-5</td>
</tr>
<tr>
<td>705</td>
<td>Channel is off</td>
<td>Cannot execute because the input of the specified channel is turned OFF. Set the input to DC or change the channel number.</td>
<td>4-3</td>
</tr>
<tr>
<td>710</td>
<td>Invalid model</td>
<td>Cannot load the specified file because the file was saved on different equipment.</td>
<td>—</td>
</tr>
<tr>
<td>711</td>
<td>Invalid version</td>
<td>Cannot load the specified file because the file was saved on equipment with a different version or a different configuration.</td>
<td>—</td>
</tr>
<tr>
<td>712</td>
<td>No data on X-axis</td>
<td>Cannot execute because the input of the channel set to the X-axis is turned OFF. Change to another channel.</td>
<td>6-6, 7-6</td>
</tr>
<tr>
<td>713</td>
<td>Remote</td>
<td>You can release the remote operation, carrying out the followings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Push NEXT to local.)</td>
<td>Return to local operation with the communication command. Push the NEXT key. Turn off the power switch.</td>
<td></td>
</tr>
<tr>
<td>714</td>
<td>Local lockout</td>
<td>You can release the local lockout, carrying out the followings. Push the NEXT key. Turn off the power switch.</td>
<td></td>
</tr>
<tr>
<td>715</td>
<td>Key has been locked</td>
<td>Keys are locked. To operate the keys, release the key lock.</td>
<td>—</td>
</tr>
<tr>
<td>802</td>
<td>Setting out of range</td>
<td>The specified value exceeds the allowable range.</td>
<td>—</td>
</tr>
<tr>
<td>803</td>
<td>Cannot set data</td>
<td>The specified value exceeds the allowable range.</td>
<td>—</td>
</tr>
<tr>
<td>805</td>
<td>Illegal data exists</td>
<td>The computation was aborted because there was data outside the range. Change the computation range.</td>
<td>6-19</td>
</tr>
<tr>
<td>806</td>
<td>Parameter error</td>
<td>Incorrect parameter in the communication command or cannot execute in the present condition. Change the parameter setting.</td>
<td>App-1 to App-57</td>
</tr>
<tr>
<td>807</td>
<td>Mode error</td>
<td>Issued a communication command that is not allowed in the current mode.</td>
<td>App-1 to App-57</td>
</tr>
<tr>
<td>808</td>
<td>Cannot set it while running</td>
<td>Issued a communication command that is not allowed in the current mode.</td>
<td>App-1 to App-57</td>
</tr>
<tr>
<td>809</td>
<td>CH2 memory unavailable</td>
<td>Linking two channels of memory (2-channel model)</td>
<td>6-3</td>
</tr>
<tr>
<td>810</td>
<td>CH2,4 memory unavailable</td>
<td>Linking two channels of memory (4-channel model)</td>
<td>6-3</td>
</tr>
<tr>
<td>811</td>
<td>CH2,3,4, memory unavailable</td>
<td>Linking four channels of memory (4-channel model)</td>
<td>6-3</td>
</tr>
</tbody>
</table>
### Status Messages

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Settings complete</td>
<td>Parameters have been set correctly.</td>
</tr>
<tr>
<td>5</td>
<td>Waiting for connection</td>
<td>Waiting to reconnect because the destination was busy.</td>
</tr>
<tr>
<td>6</td>
<td>Connecting to line</td>
<td>Connecting to the line to send FAX.</td>
</tr>
<tr>
<td>7</td>
<td>Sending FAX</td>
<td>Sending FAX.</td>
</tr>
<tr>
<td>8</td>
<td>FAX complete</td>
<td>FAX transmission completed successfully.</td>
</tr>
<tr>
<td>9</td>
<td>Aborted sending FAX</td>
<td>Aborted sending FAX.</td>
</tr>
<tr>
<td>10</td>
<td>Waiting for error retry</td>
<td>An error occurred while sending fax. Reestablishing connection.</td>
</tr>
<tr>
<td>20</td>
<td>Execution complete</td>
<td>A successful completion.</td>
</tr>
<tr>
<td>21</td>
<td>Acq. memory initialized</td>
<td>Initialized (cleared) the captured data in the acquisition memory.</td>
</tr>
<tr>
<td>23</td>
<td>Calculating</td>
<td>Calculation is being performed.</td>
</tr>
<tr>
<td>24</td>
<td>Calc. aborted</td>
<td>Calculation was aborted.</td>
</tr>
<tr>
<td>25</td>
<td>PC card has been detected</td>
<td>PC card has been properly inserted.</td>
</tr>
<tr>
<td>28</td>
<td>Accessing file</td>
<td>OR100E is accessing the flash ATA card.</td>
</tr>
<tr>
<td>29</td>
<td>Aborted file access</td>
<td>Aborted the access to the flash ATA card.</td>
</tr>
<tr>
<td>30</td>
<td>In measuring</td>
<td>OR100E is making a measurement.</td>
</tr>
<tr>
<td>33</td>
<td>Save completed</td>
<td>File saving has been completed.</td>
</tr>
<tr>
<td>40</td>
<td>Panel keys are locked</td>
<td>Panel keys have been locked.</td>
</tr>
<tr>
<td>41</td>
<td>Start key is locked</td>
<td>Start key has been locked.</td>
</tr>
<tr>
<td>42</td>
<td>Key lock is released</td>
<td>Key lock has been released.</td>
</tr>
<tr>
<td>43</td>
<td>Panel save completed</td>
<td>Parameters have been saved.</td>
</tr>
<tr>
<td>44</td>
<td>Panel load completed</td>
<td>Parameters have been loaded.</td>
</tr>
</tbody>
</table>
### Warning Messages

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Description</th>
<th>Reference Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>52</td>
<td>Backup battery flat</td>
<td>The battery for backing up the setting parameters and measured data is flat.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact your nearest YOKOGAWA dealer.</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Battery flat</td>
<td>The battery (AAA batteries or rechargeable battery) voltage for the power supply is low.</td>
<td>2-12, 2-16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Replace the AAA batteries or recharge the rechargeable battery.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>This message is displayed when it detects the low voltage. Afterwards, a battery warning mark is displayed in the upper left of the screen.</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Data &amp; Settings initialized</td>
<td>Setting parameters have been initialized to the default values.</td>
<td>12-11</td>
</tr>
</tbody>
</table>

### Communication Syntax Error Messages (100 to 199)

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Description</th>
<th>Reference Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>102</td>
<td>Syntax error</td>
<td>Syntax error other than the ones listed below.</td>
<td>App-1 to App-57</td>
</tr>
<tr>
<td>103</td>
<td>Invalid separator</td>
<td>Separate each data with a “,” (comma).</td>
<td>App-1</td>
</tr>
<tr>
<td>104</td>
<td>Data type error</td>
<td>See pages A-5 to A-7. Use the correct data type.</td>
<td>App-5 to App-7</td>
</tr>
<tr>
<td>108</td>
<td>Parameters not allowed</td>
<td>Check the number of parameters.</td>
<td>App-5 to App-7</td>
</tr>
<tr>
<td>109</td>
<td>Missing parameter</td>
<td>Specify the necessary parameter.</td>
<td>App-5 to App-7</td>
</tr>
<tr>
<td>111</td>
<td>Header separator error</td>
<td>Separate the header and the data with a space.</td>
<td>App-2</td>
</tr>
<tr>
<td>112</td>
<td>Program mnemonic too long</td>
<td>Check the mnemonic (character string consisting of letters and numbers).</td>
<td>App-9 to App-57</td>
</tr>
<tr>
<td>113</td>
<td>Undefined header</td>
<td>Check the header.</td>
<td>App-9 to App-57</td>
</tr>
<tr>
<td>114</td>
<td>Header suffix out of range.</td>
<td>Check the header.</td>
<td>App-9 to App-57</td>
</tr>
<tr>
<td>120</td>
<td>Numeric data error</td>
<td>Mantissa must be entered before the numeric value in &lt;NR3&gt; format.</td>
<td>App-5, App-6</td>
</tr>
<tr>
<td>123</td>
<td>Exponent too large</td>
<td>Use a smaller exponent in &lt;NR3&gt; format.</td>
<td>App-5 to App-57</td>
</tr>
<tr>
<td>124</td>
<td>Too many digits</td>
<td>Limit the number of digits to 255 or less.</td>
<td>App-5, App-57</td>
</tr>
<tr>
<td>128</td>
<td>Numeric data not allowed</td>
<td>Use a format other than &lt;NRf&gt; format.</td>
<td>App-5, App-57</td>
</tr>
</tbody>
</table>
## 13.2 Messages and Corrective Measures

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Description</th>
<th>Reference Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>131</td>
<td>Invalid suffix</td>
<td>Check the units for &lt;Voltage&gt;, &lt;Time&gt;, and &lt;Frequency&gt;.</td>
<td>App-6</td>
</tr>
<tr>
<td>134</td>
<td>Suffix too long</td>
<td>Check the units for &lt;Voltage&gt;, &lt;Time&gt;, and &lt;Frequency&gt;.</td>
<td>App-6</td>
</tr>
<tr>
<td>138</td>
<td>Suffix not allowed</td>
<td>Units are not allowed other than for &lt;Voltage&gt;, &lt;Time&gt;, and &lt;Frequency&gt;.</td>
<td>App-6</td>
</tr>
<tr>
<td>141</td>
<td>Invalid character data</td>
<td>Enter one of the character strings in {...}.</td>
<td>App-9 to App-57</td>
</tr>
<tr>
<td>144</td>
<td>Character data too long</td>
<td>Check the character strings in {...}.</td>
<td>App-9 to App-57</td>
</tr>
<tr>
<td>148</td>
<td>Character data not allowed</td>
<td>Enter in a format other than the one in {...}.</td>
<td>App-9 to App-57</td>
</tr>
<tr>
<td>150</td>
<td>String data error</td>
<td>&lt;Character string&gt; must be enclosed by double quotation marks or single quotation marks.</td>
<td>App-6</td>
</tr>
<tr>
<td>151</td>
<td>Invalid string data</td>
<td>&lt;Character string&gt; is too long or contains characters that cannot be used.</td>
<td>App-9 to App-57</td>
</tr>
<tr>
<td>158</td>
<td>String data not allowed</td>
<td>Enter in a data format other than &lt;character string&gt;.</td>
<td>App-9 to App-57</td>
</tr>
<tr>
<td>161</td>
<td>Invalid block data</td>
<td>Cannot use &lt;Block data&gt;.</td>
<td>App-6 to App-57</td>
</tr>
<tr>
<td>168</td>
<td>Block data not allowed</td>
<td>Cannot use &lt;Block data&gt;.</td>
<td>App-6 to App-57</td>
</tr>
<tr>
<td>181</td>
<td>Invalid outside macro definition</td>
<td>OR100E does not support the macro functions specified in IEEE488.2.</td>
<td>—</td>
</tr>
</tbody>
</table>
## Communication Execution Errors (200 to 299)

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Description</th>
<th>Reference Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>221</td>
<td>Setting conflict</td>
<td>Check the relevant setting parameters.</td>
<td>App-9 to App-57</td>
</tr>
<tr>
<td>222</td>
<td>Data out of range</td>
<td>Check the setting range.</td>
<td>App-9 to App-57</td>
</tr>
<tr>
<td>223</td>
<td>Too much data</td>
<td>Check the data byte length.</td>
<td>App-9 to App-57</td>
</tr>
<tr>
<td>224</td>
<td>Illegal parameter value</td>
<td>Check the setting range.</td>
<td>App-9 to App-57</td>
</tr>
<tr>
<td>241</td>
<td>Hardware missing</td>
<td>Check the availability of options.</td>
<td>—</td>
</tr>
<tr>
<td>260</td>
<td>Expression error</td>
<td>Cannot use an equation.</td>
<td>—</td>
</tr>
<tr>
<td>270</td>
<td>Macro error</td>
<td>OR100E does not support the macro functions specified in IEEE488.2.</td>
<td>—</td>
</tr>
<tr>
<td>272</td>
<td>Macro execution error</td>
<td>OR100E does not support the macro functions specified in IEEE488.2.</td>
<td>—</td>
</tr>
<tr>
<td>273</td>
<td>Illegal macro label</td>
<td>OR100E does not support the macro functions specified in IEEE488.2.</td>
<td>—</td>
</tr>
<tr>
<td>275</td>
<td>Macro definition too long</td>
<td>OR100E does not support the macro functions specified in IEEE488.2.</td>
<td>—</td>
</tr>
<tr>
<td>276</td>
<td>Macro recursion error</td>
<td>OR100E does not support the macro functions specified in IEEE488.2.</td>
<td>—</td>
</tr>
<tr>
<td>277</td>
<td>Macro redefinition not allowed.</td>
<td>OR100E does not support the macro functions specified in IEEE488.2.</td>
<td>—</td>
</tr>
<tr>
<td>278</td>
<td>Macro header not found</td>
<td>OR100E does not support the macro functions specified in IEEE488.2.</td>
<td>—</td>
</tr>
<tr>
<td>280</td>
<td>The password cannot change</td>
<td>The previous password is incorrect.</td>
<td>—</td>
</tr>
<tr>
<td>281</td>
<td>Invalid password</td>
<td>Enter the correct password.</td>
<td>—</td>
</tr>
<tr>
<td>282</td>
<td>The password is not input</td>
<td>Enter the password.</td>
<td>—</td>
</tr>
</tbody>
</table>
### Communication Query Error Messages (400 to 499)

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>410</td>
<td>Query INTERRUPTED</td>
<td>Check the transmission and reception order.</td>
<td>App-2</td>
</tr>
<tr>
<td>420</td>
<td>Query UNTERMINATED</td>
<td>Check the transmission and reception order.</td>
<td>App-2</td>
</tr>
<tr>
<td>430</td>
<td>Query DEADLOCKED</td>
<td>Limit the length of the program message including the &lt;PMT&gt; to 1024 bytes or less.</td>
<td>—</td>
</tr>
<tr>
<td>440</td>
<td>Query TERMINATED after indefinite response</td>
<td>Do not enter queries after *IDN? or *OPT?.</td>
<td>—</td>
</tr>
</tbody>
</table>

### System Error (Communication) (912 to 915)

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>912</td>
<td>Fatal error in Communication-driver</td>
<td>Needs servicing.</td>
<td>—</td>
</tr>
<tr>
<td>914</td>
<td>Time out error in communication</td>
<td>Set the time out so that data can be received before the time out. Or, there may be a problem with the phone line.</td>
<td>—</td>
</tr>
</tbody>
</table>

### Other (350, 390)

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
<td>Queue error</td>
<td>Read the error queue.</td>
<td>App-57</td>
</tr>
<tr>
<td>390</td>
<td>Overrun error (for RS-232 only)</td>
<td>Use a lower baud rate.</td>
<td>—</td>
</tr>
</tbody>
</table>

**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

Copy action : BMP file
Expansion calcs. : On

Next page
Initialize

To Next page

OK

To Self test

OK

Self test

#1 : Key test
#2 : Memory test
#3 : Printer test

ESC

4ch Model
Ver0.28

ESC  #1  #2  #3
```

Testing the Keys  Testing the printer

Go back to the first screen  Testing the memory
13.3 Testing the Recorder

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.
13.3 Testing the Recorder

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.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ROM</td>
<td>OK</td>
</tr>
<tr>
<td>RAM</td>
<td>OK</td>
</tr>
<tr>
<td>Aqd. mem</td>
<td>OK</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Overvoltage category*¹</th>
<th>Maximum Input Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAT II environment</td>
<td>500 Vrms</td>
</tr>
<tr>
<td>CAT III environment</td>
<td>300 Vrms</td>
</tr>
</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>Overvoltage category*¹</th>
<th>Maximum Input Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAT II environment</td>
<td>500 Vrms</td>
</tr>
<tr>
<td>CAT III environment</td>
<td>300 Vrms</td>
</tr>
</tbody>
</table>

*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)

<table>
<thead>
<tr>
<th>measuring range (time/div)</th>
<th>actual measuring range</th>
<th>accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mV FS(10 mV/div)</td>
<td>±100.0 mV</td>
<td>±(1 % of FS+1 mV)</td>
</tr>
<tr>
<td>200 mV FS(20 mV/div)</td>
<td>±200.0 mV</td>
<td>±(1 % of FS+1 mV)</td>
</tr>
<tr>
<td>500 mV FS(50 mV/div)</td>
<td>±500.0 mV</td>
<td>±(1 % of FS+1 mV)</td>
</tr>
<tr>
<td>1 V FS(100 mV/div)</td>
<td>±1.000 V</td>
<td>±(1 % of FS+1 mV)</td>
</tr>
<tr>
<td>2 V FS(200 mV/div)</td>
<td>±2.000 V</td>
<td>±(1 % of FS+1 mV)</td>
</tr>
<tr>
<td>5 V FS(500 mV/div)</td>
<td>±5.000 V</td>
<td>±(1 % of FS+1 mV)</td>
</tr>
<tr>
<td>10 V FS(1 V/div)</td>
<td>±10.00 V</td>
<td>±(1 % of FS+1 mV)</td>
</tr>
<tr>
<td>20 V FS(2 V/div)</td>
<td>±20.00 V</td>
<td>±(1 % of FS+1 mV)</td>
</tr>
<tr>
<td>50 V FS(5 V/div)</td>
<td>±50.00 V</td>
<td>±(1 % of FS+1 mV)</td>
</tr>
<tr>
<td>100 V FS(10 V/div)</td>
<td>±100.0 V</td>
<td>±(1 % of FS+1 mV)</td>
</tr>
<tr>
<td>200 V FS(20 V/div)</td>
<td>±200.0 V</td>
<td>±(1 % of FS+1 mV)</td>
</tr>
<tr>
<td>500 V FS(50 V/div)</td>
<td>±500.0 V</td>
<td>±(1 % of FS+1 mV)</td>
</tr>
<tr>
<td>1000 V FS(100 V/div)</td>
<td>±500.0 V</td>
<td>±(1 % of FS+1 mV)</td>
</tr>
</tbody>
</table>

#### 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)

<table>
<thead>
<tr>
<th>measuring range (time/div)</th>
<th>actual measuring range</th>
<th>accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mV FS(10 mV/div)</td>
<td>100.0 mV rms</td>
<td>±(2 % of FS+1 mV)</td>
</tr>
<tr>
<td>200 mV FS(20 mV/div)</td>
<td>200.0 mV rms</td>
<td>±(2 % of FS+1 mV)</td>
</tr>
<tr>
<td>500 mV FS(50 mV/div)</td>
<td>500.0 mV rms</td>
<td>±(2 % of FS+1 mV)</td>
</tr>
<tr>
<td>1 V FS(100 mV/div)</td>
<td>1.000 V rms</td>
<td>±(2 % of FS+1 mV)</td>
</tr>
<tr>
<td>2 V FS(200 mV/div)</td>
<td>2.000 V rms</td>
<td>±(2 % of FS+1 mV)</td>
</tr>
<tr>
<td>5 V FS(500 mV/div)</td>
<td>5.000 V rms</td>
<td>±(2 % of FS+50 mV)</td>
</tr>
<tr>
<td>10 V FS(1 V/div)</td>
<td>10.00 V rms</td>
<td>±(2 % of FS+50 mV)</td>
</tr>
<tr>
<td>20 V FS(2 V/div)</td>
<td>20.00 V rms</td>
<td>±(2 % of FS+50 mV)</td>
</tr>
<tr>
<td>50 V FS(5 V/div)</td>
<td>50.00 V rms</td>
<td>±(2 % of FS+50 mV)</td>
</tr>
<tr>
<td>100 V FS(10 V/div)</td>
<td>100.0 V rms</td>
<td>±(2 % of FS+0.1 V)</td>
</tr>
<tr>
<td>200 V FS(20 V/div)</td>
<td>200.0 V rms</td>
<td>±(2 % of FS+0.1 V)</td>
</tr>
<tr>
<td>500 V FS(50 V/div)</td>
<td>500.0 V rms</td>
<td>±(2 % of FS+0.1 V)</td>
</tr>
<tr>
<td>1000 V FS(100 V/div)</td>
<td>500 V rms</td>
<td>±(2 % of FS+0.1 V)</td>
</tr>
</tbody>
</table>

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
## 14.1 Measurement Input

### 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)

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Actual Measurement Range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 °C</td>
<td>-50 °C to 200 °C</td>
<td>±2 °C</td>
</tr>
<tr>
<td>400 °C</td>
<td>-50 °C to 400 °C</td>
<td>±3 °C</td>
</tr>
<tr>
<td>600 °C</td>
<td>-50 °C to 600 °C</td>
<td>±5 °C</td>
</tr>
</tbody>
</table>

#### 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 μs/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
14.3 Recording

**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 order)
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)
14.9 General Specifications

**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>

Response Messages
Response messages are returned by the recorder to the controller. The format of a response message is shown below.

<PMT>
PMT is a terminator used to terminate each program message. For the OR100E, CR (ODH) LF (0AH) will be the terminator.
<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>

<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> Space <Response data>

<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>

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

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
Commands

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
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.

<table>
<thead>
<tr>
<th>Data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;Decimal&gt;</td>
<td>Value expressed as a decimal number</td>
</tr>
<tr>
<td></td>
<td>(Example: Trigger delay value →TRIGger:DElay 20)</td>
</tr>
<tr>
<td>&lt;Voltage&gt;&lt;Time&gt;&lt;Frequency&gt;</td>
<td>Physical value (Example: Measurement range of CH2</td>
</tr>
<tr>
<td></td>
<td>→CHANnel12:RANGE:100MV)</td>
</tr>
<tr>
<td>&lt;Register&gt;</td>
<td>Register value expressed in binary, octal, decimal, or hexadecimal (Example: Extended event register value →STATus:ESSe #HFE)</td>
</tr>
<tr>
<td>&lt;Character data&gt;</td>
<td>Specified character string (mnemonic). Select from {} (Example: CH1 input selection</td>
</tr>
<tr>
<td></td>
<td>→CHANnel1:INPut [OFF</td>
</tr>
<tr>
<td>&lt;Boolean&gt;</td>
<td>Indicates ON/OFF. Specify with [ON], [OFF], or a value. (Example: Turn ON CH3 scaling</td>
</tr>
<tr>
<td></td>
<td>→CHANnel3:SCALing:MODE ON)</td>
</tr>
<tr>
<td>&lt;Character string data&gt;</td>
<td>Arbitrary character string (Example: CH4 Tag string</td>
</tr>
<tr>
<td></td>
<td>→CHANnel4:TAG &quot;ABCDEF&quot;)</td>
</tr>
<tr>
<td>&lt;Block data&gt;</td>
<td>Arbitrary 8-bit data (Example: Response containing captured waveform data</td>
</tr>
<tr>
<td></td>
<td>→#80000010ABCDEFGHIJ)</td>
</tr>
</tbody>
</table>

<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.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;NR1&gt;</td>
<td>Integer</td>
<td>125 -1/+1000</td>
</tr>
<tr>
<td>&lt;NR2&gt;</td>
<td>Fixed point number</td>
<td>125.0 -90 +001</td>
</tr>
<tr>
<td>&lt;NR3&gt;</td>
<td>Floating point number</td>
<td>125.0E+0 -9E-1 +.1E4</td>
</tr>
<tr>
<td>&lt;NRf&gt;</td>
<td>Any of the forms &lt;NR1&gt; to &lt;NR3&gt; is allowed.</td>
<td></td>
</tr>
</tbody>
</table>

<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.

<table>
<thead>
<tr>
<th>Form</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;NRf&gt;&lt;Multiplier&gt;&lt;Unit&gt;</td>
<td>5MV</td>
</tr>
<tr>
<td>&lt;NRf&gt;&lt;Unit&gt;</td>
<td>5E-3V</td>
</tr>
<tr>
<td>&lt;NRf&gt;&lt;Multiplier&gt;</td>
<td>5M</td>
</tr>
<tr>
<td>&lt;NRf&gt;</td>
<td>5E-3</td>
</tr>
</tbody>
</table>

<Multiplier>
The following multipliers are available.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Word</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EX</td>
<td>Exa</td>
<td>$10^{15}$</td>
</tr>
<tr>
<td>PE</td>
<td>PEPeta</td>
<td>$10^{12}$</td>
</tr>
<tr>
<td>T</td>
<td>Tera</td>
<td>$10^{12}$</td>
</tr>
<tr>
<td>G</td>
<td>Giga</td>
<td>$10^{9}$</td>
</tr>
<tr>
<td>MA</td>
<td>Mega</td>
<td>$10^{6}$</td>
</tr>
<tr>
<td>K</td>
<td>Kilo</td>
<td>$10^{3}$</td>
</tr>
<tr>
<td>M</td>
<td>Milli</td>
<td>$10^{-3}$</td>
</tr>
<tr>
<td>U</td>
<td>Micro</td>
<td>$10^{-6}$</td>
</tr>
<tr>
<td>N</td>
<td>Nano</td>
<td>$10^{-9}$</td>
</tr>
<tr>
<td>P</td>
<td>Pico</td>
<td>$10^{-12}$</td>
</tr>
<tr>
<td>F</td>
<td>Femto</td>
<td>$10^{-15}$</td>
</tr>
<tr>
<td>A</td>
<td>Atto</td>
<td>$10^{-18}$</td>
</tr>
</tbody>
</table>

<Unit>
The following units are available.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Word</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>Volt</td>
<td>Voltage</td>
</tr>
<tr>
<td>S</td>
<td>Second</td>
<td>Time</td>
</tr>
<tr>
<td>HZ</td>
<td>Hertz</td>
<td>Frequency</td>
</tr>
<tr>
<td>MHZ</td>
<td>Megahertz</td>
<td>Frequency</td>
</tr>
</tbody>
</table>

<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.

<table>
<thead>
<tr>
<th>Form</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;NRf&gt;</td>
<td>#H07</td>
</tr>
<tr>
<td>#O&lt;Octal value made up of digits 0 to 7&gt;</td>
<td>#777</td>
</tr>
<tr>
<td>#B&lt;Binary value made up of digits 0 and 1&gt;</td>
<td>#B001100</td>
</tr>
</tbody>
</table>

<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.

<table>
<thead>
<tr>
<th>Form</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>{AC</td>
<td>DC</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Form</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ON</td>
<td>OFF</td>
</tr>
</tbody>
</table>

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 (“).</Character String Data>

<table>
<thead>
<tr>
<th>Form</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;Character string data&gt;</td>
<td>‘ABC’ “IEEE488.2-1987”</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Form</th>
<th>Example</th>
</tr>
</thead>
</table>
| #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.  
Data/Controller
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 SINGle;: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>
## Appendix 1.2 Commands

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<td>Executes zero adjust.</td>
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<tr>
<td>:ACTion:AUTOrange</td>
<td>Executes auto range</td>
<td>App-16</td>
</tr>
<tr>
<td>:ACTion:LCDLight</td>
<td>Sets/queries the ON/OFF condition of the LCD back lighting</td>
<td>App-16</td>
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<tr>
<td>:ACTion:PRINT&lt;x&gt;</td>
<td>Starts printer-related operation</td>
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</tr>
<tr>
<td>:ACTion:START&lt;x&gt;</td>
<td>Starts a memory operation such as measurement, display, and recording</td>
<td>App-16</td>
</tr>
<tr>
<td>:ACTion:STOP</td>
<td>Stops/aborts operations such as measurement, display, and recording</td>
<td>App-16</td>
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<tr>
<td>:ACTion:TDIV</td>
<td>Sets/queries the time axis rate of the monitor screen</td>
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<td><strong>BLOCK Group</strong></td>
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<td>Queries all the memory block settings</td>
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<td>:BLOCK:ACTual?</td>
<td>Queries the number of blocks already sampled</td>
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<tr>
<td>:BLOCK:CURRENT</td>
<td>Sets/queries the current block number</td>
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<tr>
<td><strong>CHANnel Group</strong></td>
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<td>:CHANnel&lt;x&gt;?:</td>
<td>Queries the settings for the specified channel</td>
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<tr>
<td>:CHANnel&lt;x&gt;:COMMENT</td>
<td>Sets/queries the annotation message for the specified channel</td>
<td>App-18</td>
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<tr>
<td>:CHANnel&lt;x&gt;:FILTER</td>
<td>Sets/queries the filter for the specified channel</td>
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<tr>
<td>:CHANnel&lt;x&gt;:INPUT</td>
<td>Sets/queries the input to the specified analog channel</td>
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<td>:CHANnel&lt;x&gt;:LOWScale</td>
<td>Sets/queries the lower limit scale for temperature measurements</td>
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<tr>
<td>:CHANnel&lt;x&gt;:MAGNi</td>
<td>Sets/queries the Y-axis zoom factor for the specified channel</td>
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<tr>
<td>:CHANnel&lt;x&gt;:NULL</td>
<td>Sets/queries the NULL for the specified channel</td>
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<tr>
<td>:CHANnel&lt;x&gt;:POSITION</td>
<td>Sets/queries the zero point for the specified channel</td>
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<tr>
<td>:CHANnel&lt;x&gt;:RANGE</td>
<td>Sets/queries the measurement range for the specified channel</td>
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<tr>
<td>:CHANnel&lt;x&gt;:SCALing?</td>
<td>Queries all setting values relating to scaling</td>
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<tr>
<td>:CHANnel&lt;x&gt;:SCALing:MODE</td>
<td>Sets/queries the ON/OFF condition of the scaling for the specified channel</td>
<td>App-20</td>
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<tr>
<td>:CHANnel&lt;x1&gt;:SCALing:POS&lt;x2&gt;?</td>
<td>Queries all setting values relating to POS1 and POS2 for the specified channel</td>
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<tr>
<td>:CHANnel&lt;x1&gt;:SCALing:POS&lt;x2&gt;:SCALE</td>
<td>Sets/queries the scaling value of POS1 and POS2 for the specified channel</td>
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<tr>
<td>:CHANnel&lt;x1&gt;:SCALing:POS&lt;x2&gt;:VOLT</td>
<td>Sets/queries the measured value of scaling POS1 and POS2 for the specified channel</td>
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<tr>
<td>:CHANnel&lt;x1&gt;:SCALing:UNIT</td>
<td>Sets/queries the scaling unit for the specified channel</td>
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<tr>
<td>:CHANnel&lt;x1&gt;:TAG</td>
<td>Sets/queries the tag character string for the specified channel</td>
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<td>:CHANnel&lt;x1&gt;:UPPScale</td>
<td>Sets/queries the upper limit scale for temperature measurements</td>
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<td><strong>COMMunicate Group</strong></td>
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<td></td>
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<td>:COMMunicate?</td>
<td>Queries all the communication settings</td>
<td>App-21</td>
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<td>:COMMunicate:HEADer</td>
<td>Sets/queries whether or not the header is returned in response to a query</td>
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<td>:COMMunicate:LOCKout</td>
<td>Sets/releases local lockout</td>
<td>App-22</td>
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<tr>
<td>:COMMunicate:REMOTE</td>
<td>Sets remote/local. ON is remote</td>
<td>App-22</td>
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<tr>
<td>:COMMunicate:STATUS?</td>
<td>Queries status specific to the line</td>
<td>App-22</td>
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<tr>
<td>:COMMunicate:VERBOSE</td>
<td>Sets/queries whether the response to a query is returned in full or abbreviated form</td>
<td>App-22</td>
</tr>
<tr>
<td>:COMMunicate:WAIT</td>
<td>Waits for any of the specified extended events to occur</td>
<td>App-22</td>
</tr>
<tr>
<td>:COMMunicate:WAIT?</td>
<td>Generate a response when any of the specified extended events occur</td>
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</table>
## Appendix 1.2 Commands

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<td>:DATA?</td>
<td>Queries all settings relating to the output of the memory data</td>
<td>App-23</td>
</tr>
<tr>
<td>:DATA:BLOCk</td>
<td>Sets/queries the block number of the waveform to be sent</td>
<td>App-23</td>
</tr>
<tr>
<td>:DATA:BYTeorder</td>
<td>Sets/queries the byte order when sending data in word format</td>
<td>App-24</td>
</tr>
<tr>
<td>:DATA:CHANnel&lt;x&gt;:RANGe?</td>
<td>Queries the measurement range and full scale value of the specified analog channel</td>
<td>App-24</td>
</tr>
<tr>
<td>:DATA:CHANnel&lt;x&gt;:SCALing:COEFFicient?</td>
<td>Queries the scaling coefficient of the specified analog channel</td>
<td>App-24</td>
</tr>
<tr>
<td>:DATA:CHANnel&lt;x&gt;:SCALing:MODE?</td>
<td>Queries the ON/OFF condition of the scaling of the specified analog channel</td>
<td>App-24</td>
</tr>
<tr>
<td>:DATA:CHANnel&lt;x&gt;:SCALing:OFFSet?</td>
<td>Queries the scaling offset value of the specified analog channel</td>
<td>App-24</td>
</tr>
<tr>
<td>:DATA:CHANnel&lt;x&gt;:SCALing:UNIT</td>
<td>Queries the scaling unit of the specified analog channel</td>
<td>App-24</td>
</tr>
<tr>
<td>:DATA:SEND?</td>
<td>Sends the data of the specified analog channel.</td>
<td>App-24</td>
</tr>
<tr>
<td>:DATA:END</td>
<td>Sets/queries which point of the specified waveform is to be the last data</td>
<td>App-24</td>
</tr>
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<td>:DATA:FORMat</td>
<td>Sets/queries the format of the data to send</td>
<td>App-25</td>
</tr>
<tr>
<td>:DATA:INTERval?</td>
<td>Queries the time between the data (in units of seconds) of the specified waveform</td>
<td>App-25</td>
</tr>
<tr>
<td>:DATA:length?</td>
<td>Queries the total number of data points of the specified waveform</td>
<td>App-25</td>
</tr>
<tr>
<td>:DATA:{LOA</td>
<td>LOB}:INPUT?</td>
<td>Queries the ON/OFF condition of each bit of the specified logic channel</td>
</tr>
<tr>
<td>:DATA:{LOA</td>
<td>LOB}:SEND?</td>
<td>Sends the data of the specified logic channel of the specified waveform</td>
</tr>
<tr>
<td>:DATA:START</td>
<td>Sets/queries which point of the specified waveform is to be the first data</td>
<td>App-25</td>
</tr>
<tr>
<td>:DATA:TRIGger?</td>
<td>Queries the trigger point of the specified waveform</td>
<td>App-25</td>
</tr>
<tr>
<td>:DATA:TIMe?</td>
<td>Queries the trigger time of the specified waveform</td>
<td>App-25</td>
</tr>
<tr>
<td><strong>FILE Group</strong></td>
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<tr>
<td>:FILE?</td>
<td>Queries all the setting values relating to saving and loading</td>
<td>App-26</td>
</tr>
<tr>
<td>:FILE:LOAD:PA nel</td>
<td>Loads the setup data</td>
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<tr>
<td>:FILE:SAVE?</td>
<td>Queries all the setting values relating to saving</td>
<td>App-26</td>
</tr>
<tr>
<td>:FILE:SAVE:ALL</td>
<td>Saves all blocks measured data in binary format</td>
<td>App-26</td>
</tr>
<tr>
<td>:FILE:SAVE:ASCii</td>
<td>Saves the measured data in ASCII format</td>
<td>App-26</td>
</tr>
<tr>
<td>:FILE:SAVE:BINary</td>
<td>Saves the measured data in binary format</td>
<td>App-26</td>
</tr>
<tr>
<td>:FILE:SAVE:CHANnel&lt;x&gt;</td>
<td>Sets/queries the channel to save</td>
<td>App-27</td>
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<tr>
<td>:FILE:SAVE:COMm ent</td>
<td>Sets/queries the save comments</td>
<td>App-27</td>
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<tr>
<td>:FILE:SAVE:END</td>
<td>Sets/queries the end data number to save</td>
<td>App-27</td>
</tr>
<tr>
<td>:FILE:SAVE:OPTion</td>
<td>Sets/queries whether or not to set the option used in saving</td>
<td>App-27</td>
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<tr>
<td>:FILE:SAVE:PA nel</td>
<td>Saves the setup data</td>
<td>App-27</td>
</tr>
<tr>
<td>:FILE:SAVE:STARt</td>
<td>Sets/queries the start data number for saving</td>
<td>App-27</td>
</tr>
<tr>
<td><strong>INITialize Group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>:INITialize:ACQuire</td>
<td>Initializes acquisition memory</td>
<td>App-27</td>
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<tr>
<td>:INITialize:ALL</td>
<td>Initializes all memory</td>
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<tr>
<td><strong>MENU Group</strong></td>
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<td>:MENU?</td>
<td>Queries all menu screen settings.</td>
<td>App-33</td>
</tr>
<tr>
<td>:MENU:ACCumulate</td>
<td>Sets/queries the accumulate display</td>
<td>App-33</td>
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<tr>
<td>:MENU:CHART</td>
<td>Sets/queries the chart speed when the mode is in realtime+memory mode</td>
<td>App-33</td>
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<tr>
<td>:MENU:CPRint</td>
<td>Sets/queries contents of the channel print</td>
<td>App-33</td>
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<tr>
<td>:MENU:FORMat</td>
<td>Sets/queries the display format</td>
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<td>:MENU:GAUGE</td>
<td>Sets/queries contents of the gage print</td>
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<td>:MENU:GRID</td>
<td>Sets/queries the grid setting</td>
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<td>:MENU:</td>
<td>HARMonic?</td>
<td>Queries all the setting values relating to harmonic mode</td>
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<tr>
<td>:MENU:</td>
<td>HARMonic:CHANnel</td>
<td>Sets/queries the channel to analyze automatically</td>
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<tr>
<td>:MENU:</td>
<td>HARMonic:CYCLE</td>
<td>Sets/queries the memory length for waveform analysis</td>
</tr>
<tr>
<td>:MENU:</td>
<td>HARMonic:DISPLAY</td>
<td>Sets/queries the contents to display for the automatic analysis</td>
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<tr>
<td>:MENU:</td>
<td>HARMonic:FREQuency</td>
<td>Sets/queries the frequency of the harmonic mode</td>
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<td>:MENU:</td>
<td>HARMonic:METHOD</td>
<td>Sets/queries the analysis method of the harmonic mode</td>
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<td>:MENU:</td>
<td>HARMonic:TRENd?</td>
<td>Queries all the setting values relating to the trend save of the automatic analysis</td>
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<td>:MENU:</td>
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<td>POWer&lt;X2&gt;}:CONTent</td>
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<td>HARMonic:TRENd:ENTime</td>
<td>Sets/queries the end time during trend save of automatic analysis</td>
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<tr>
<td>:MENU:</td>
<td>HARMonic:TRENd:START</td>
<td>Sets/queries whether or not to use the start time during trend save of automatic analysis</td>
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<tr>
<td>:MENU:</td>
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<td>Sets/queries the start time during trend save of automatic analysis</td>
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<td>:MENU:</td>
<td>HARMonic:UNI</td>
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<td>:MENU:</td>
<td>HARMonic:WIRing</td>
<td>Sets/queries the wiring method of the automatic analysis</td>
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<td>:MENU:</td>
<td>LINE&lt;X&gt;</td>
<td>Sets/queries the line type used to record the analog CH</td>
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<td>[LOA</td>
<td>LOB]:BIT&lt;X&gt;</td>
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<td>:MENU:</td>
<td>LOPrint</td>
<td>Sets/queries record position of the logic waveform</td>
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<td>:MENU:</td>
<td>MBLength</td>
<td>Sets/queries the memory length</td>
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<td>:MENU:</td>
<td>MCLear</td>
<td>Sets/queries whether or not to clear the previous memory at memory start</td>
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<td>:MENU:</td>
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<td>Sets/queries contents of the message print</td>
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<td>MINTerval</td>
<td>Sets/queries the digital recording interval after capturing the data in the memory</td>
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<td>Sets/queries the operating mode</td>
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<td>:MENU:</td>
<td>MPRint</td>
<td>Sets/queries record setting after capturing the data in the memory</td>
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<tr>
<td>:MENU:</td>
<td>MSTAtis</td>
<td>Sets/queries parameter calculation after capturing the data in the memory</td>
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<td>Sets/queries the memory stop condition during repeat triggering</td>
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<td>Sets/queries the digital recording interval during playback</td>
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<tr>
<td>:MENU:PLENgt</td>
<td>Sets/queries record length</td>
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<tr>
<td>:MENU:PMODE</td>
<td>Sets/queries record mode</td>
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<tr>
<td>:MENU:RDINterval</td>
<td>Sets/queries the digital printing interval during realtime recording</td>
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<tr>
<td>:MENU:RLENgt</td>
<td>Sets/queries the length of the realtime recording</td>
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<td>:MENU:RPRint</td>
<td>Sets/queries the simultaneous recording</td>
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### MONitor Group

- :MONitor?
  - Queries all setting values relating to the current measured data output
- :MONitor:BYTEorder
  - Sets/queries the byte order when sending data in word format
- :MONitor:CHANnel<X>:DPOint?
  - Queries the decimal point position of the current measured data of the specified analog channel
- :MONitor:CHANnel<X>:UNIT?
  - Queries the unit of the current measured data of the specified analog channel
- :MONitor:FORMAT
  - Sets/queries format of the data to send
- :MONitor:FINterval
  - Sets/queries the interval for sampling at a constant period
- :MONitor:SPEnd?
  - Sends the measured data sampled at a constant period
- :MONitor:SEND?
  - Sends the current measured data

### PASSword Group

- :PASSword:CHANge
  - Changes the password
- :PASSword:INPut
  - Enters the password

### SELFtest Group

- :SELFtest:MEMory?
  - Performs memory test and query the result
- :SELFtest:PCCard?
  - Performs PC card test and query the result
- :SELFtest:PRINTER
  - Performs printer test

### STATIs Group

- :STATIs?
  - Queries all setting values relating to statistical calculation
- :STATIs:CHANnel<X>:AVG?
  - Queries the average value of the calculation result of the specified analog CH
- :STATIs:CHANnel<X>:INTEG1?
  - Queries the INTEG1 value of calculation result of the specified analog CH
- :STATIs:CHANnel<X>:INTEG2
  - Queries the INTEG2 value of calculation result of the specified analog CH
- :STATIs:CHANnel<X>:MAX?
  - Queries the maximum value of the calculation result of the specified analog CH and the time the value was measured
- :STATIs:CHANnel<X>:MIN?
  - Queries the minimum value of the calculation result of the specified analog CH and the time the value was measured
- :STATIs:CHANnel<X>:RMS?
  - Queries the RMS value of the calculation result of the specified analog CH
- :STATIs:END
  - Sets/Queries the data number of the end of the calculation
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### STATus Group

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**Common Command Group**

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**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.
- **Example**: `ACTION:START1`

### :ACTion:STOP
- **Function**: Stops/Aborts operations such as sampling, display, and recording.
- **Syntax**: `ACTion:STOP`
- **Example**: `ACTION:STOP`

### :ACTion:TDIV
- **Function**: Sets/queries the time axis rate of the monitor screen.
- **Syntax**: `ACTion:TDIV {SEC2|SEC5|SEC10|SEC30|MIN1|MIN2|MIN5|MIN10|MIN30|HOUR1}`
- **Example**: `ACTION:TDIV SEC2`
**BLO CK 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

:BLO CK: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.

**CH ANnel 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 Group**

### :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;  
POSITION 0.0;  
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>:FILTer
**Function** Sets/queries the filter for the specified channel.
**Syntax** `CHANnel<X>:FILTer`  
<X>=1 to 4
**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`  
<X>=1 to 4
**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:LOWScale?
→: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  x10 105.0 to -105.0
magnification  x5 55.0 to -55.0
magnification  x2 25.0 to -25.0
magnification  x1 15.0 to -15.0
magnification  x2/3 11.6 to -11.6
magnification  x1/2 10.0 to -10.0
when you set input to RMS on DR300
magnification  x5 0.0 to -40.0
magnification  x2 0.0 to -10.0
magnification  x1 -
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
Description  Since the measurement range is set in terms of V/FS (V/full scale) or mV/FS, it is 10 times V/DIV or mV/FS.
### CHANnel Group

#### :CHANnel<X>:SCALing?

**Function**
Queries all setting values relating to scaling for the specified channel.

**Syntax**
CHANnel<X>:SCALing?

**Example**
```
CHANNEL1:SCALING? →
: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>}

**Example**
```
CHANNEL1:SCALING:MODE OFF
CHANNEL1:SCALING:MODE?
```

#### :CHANnel<X>: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?
```

#### :CHANnel<X1>:SCALing:POS<X2>:

**Function**
Sets/queries the scaling value of POS1 and POS2 for the specified channel.

**Syntax**
CHANnel<X1>:SCALing:POS<X2>: SCALE {<NRf>}

**Example**
```
CHANNEL1:SCALING:POS1: SCALE 1.234
```

#### :CHANnel<X1>:SCALing:POS<X2>:

**Function**
Sets/queries the measured value of scaling POS1 and POS2 for the specified channel.

**Syntax**
CHANnel<X1>:SCALing:POS<X2>: VOLT {MEASure|<NRf>}

**Example**
```
CHANNEL1:SCALING:POS1: VOLT MEASURE
```

#### :CHANnel<X>:SCALing:UNIT

**Function**
Sets/queries the scaling unit for the specified channel.

**Syntax**
CHANnel<X>:SCALing:UNIT {<character string>}

**Example**
```
CHANNEL1:SCALING:UNIT "OR100E"
```

#### :CHANnel<X>:TAG

**Function**
Sets/queries the tag character string for the specified channel.

**Syntax**
CHANnel<X>:TAG {<character string>}

**Example**
```
CHANNEL1:TAG "OR100E"
```

---

**App-20**

IM OR100E-01E
**: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
COMMunicate Group

:COMMunicate:LOCKOut
Function Sets/releases local lockout.
Syntax COMMunicate:LOCKOut {<Boolean>}
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>}
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>}
Example 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>}
Example DATA:BLOCk 2

DATA Group
## DATA Group

### :DATA:BYTeorder

**Function**
Sets/queries the byte order when sending data in word format.

**Syntax**
```
DATA:BYTeorder {LSBFirst | MSBFirst}
```

**Example**
```
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?
```

**Example**
```
DATA:CHANNEL1:RANGE?
```

**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?
```

**Example**
```
DATA:CHANNEL1:SCALING:COEFFICIENT?
```

### :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?
```

**Example**
```
DATA:CHANNEL1:SCALING:MODE?
```

### :DATA:CHAnnel<X>:SCALing:OFFSet?

**Function**
Queries the scaling offset value of the specified analog channel.

**Syntax**
```
DATA:CHANnel<X>:SCALing:OFFSet?
```

**Example**
```
DATA:CHANNEL1:SCALING:OFFSET?
```

### :DATA:CHAnnel<X>:SCALing:UNIT?

**Function**
Queries the scaling unit of the specified analog ch.

**Syntax**
```
DATA:CHANnel<X>:SCALing:UNIT?
```

**Example**
```
DATA:CHANNEL1:SCALING:UNIT?
```

### :DATA:CHAnnel<X>:SENDe?

**Function**
Sends the data of the specified analog channel.

**Syntax**
```
DATA:CHANnel<X>:SENDe?
```

**Example**
```
DATA:CHANNEL1:SEND?
```

**Description**
- **ASCII Format**
  - 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>.
  - 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=X16+X12+X5+1.

### :DATA:END

**Function**
Sets/queries which point of the specified waveform is to be the last data.

**Syntax**
```
DATA:END {<NRf>}
```

**Example**
```
DATA:END 100
```
DATA Group

:DATA:FORMat
Function Sets/queries the format of the data to send.
Syntax DATA:FORMat {ASCII|WORD}
Example DATA:FORMat?
Example DATA:FORMat ASCII
Example DATA:FORMat?→:DATA:
Example 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

: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?
Example DATA:LOA:INPut?
Example DATA:LOB:INPut?
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?
Example DATA:LOA:SEND?
Example DATA:LOB:SEND?
Description ASCII Format
0 0 0 1 . . .
... 0 0 0 1 1 1 1 1
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><CR>
• #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>}
Example DATA:STARt?→100
Description Cannot query during measurement.

: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)
The commands in the FILE group are used load or save the setup data and the measured data.

### FILE Group

- **FILE?**
  - **Function:** Queries all the setting values relating to saving and loading.
  - **Syntax:** `FILE?`
  - **Example:**
    ```
    FILE? → :FILE:SAVE:
    CHANNEL1 YES; CHANNEL2 YES;
    END 100; OPTION 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;
    END 100; OPTION 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 Group

#### :FILE:SAVE:CHANnel<X>
**Function**
Sets/queries the channel to save.

**Syntax**
```
FILE:SAVE:CHANnel<X> {YES,NO}
```

**Example**
```
FILE:SAVE:CHANnel1 YES
```

#### :FILE:SAVE:COMmment
**Function**
Sets/queries the save comments.

**Syntax**
```
FILE:SAVE:COMmment {<Character string>}
```

**Example**
```
FILE:SAVE:COMmment "OR100E"
```

#### :FILE:SAVE:END
**Function**
Sets/queries the end data number to save.

**Syntax**
```
FILE:SAVE:END {<NRf>}
```

**Example**
```
FILE:SAVE:END 100
```

#### :FILE:SAVE:OPTion
**Function**
Sets/queries whether or not to set the option used in saving.

**Syntax**
```
FILE:SAVE:OPTion {<Boolean>}
```

**Example**
```
FILE:SAVE:OPTion ON
```

#### :FILE:SAVE:PANel
**Function**
Saves the setup data.

**Syntax**
```
FILE:SAVE:PANel {<Character string>}
```

**Example**
```
FILE:SAVE:PANel "DATA1"
```

#### :FILE:SAVE:STARt
**Function**
Sets/queries the start data number for saving.

**Syntax**
```
FILE:SAVE:STARt {<NRf>}
```

**Example**
```
FILE:SAVE:STARt 0
```

**Description**
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
```
The commands in the MENU group set or query data capturing conditions, display format, and recording format. This command corresponds to the MENU key.
**MENU Group**

---

**:MENU?**

**Function**  Queries all menu screen settings.

**Syntax**  MENU?

**Example**  

```plaintext
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;MLENGTH 1600;
MCLEAR 0;MESSAGE OFF;
MPCCARD OFF;MPRINT 0;
MSTOP STOPKEY;MTDIV SECS;
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>}

**Example**  

```plaintext
MENU:ACCUMULATE ON
```

---

**:MENU:CHART**

**Function**  Sets/queries the chart speed when the mode is in realtime+memory mode.

**Syntax**  MENU:CHART {<Character data>}

**Example**  

```plaintext
MENU:CHART SEC2
```

---

**:MENU:CPRint (Channel Print)**

**Function**  Sets/queries contents of the channel print.

**Syntax**  MENU:CPRint {<Boolean>}

**Example**  

```plaintext
MENU:CPRINT OFF
```

---

**:MENU:FORMat**

**Function**  Sets/queries the display format.

**Syntax**  MENU:FORMat {ZONE1|ZONE2|ZONE4|XY}

**Example**  

```plaintext
MENU:FORMat ZONE1
```

---

**:MENU:GAUGe**

**Function**  Sets/queries contents of the gage print.

**Syntax**  MENU:GAUGe {<Boolean>}

**Example**  

```plaintext
MENU:GAUGE ON
```

---

**:MENU:GRID**

**Function**  Sets/queries the grid setting.

**Syntax**  MENU:GRID {OFF|SIMPlE|FINE}

**Example**  

```plaintext
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**  

```plaintext
MENU:HARMONIC?
```

---

---
### MENU Group

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
<th>Syntax</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>:MENU:HARMOnic:CHANnel</td>
<td>Sets/queries the channel to analyze automatically.</td>
<td>MENU:HARMOnic:CHANnel {&lt;NRf&gt;}</td>
<td>→:MENU:HARMOnic:CHANnel 1</td>
</tr>
<tr>
<td>:MENU:HARMOnic:CYCLE</td>
<td>Sets/queries the memory length for waveform analysis.</td>
<td>MENU:HARMOnic:CYCLE {&lt;NRf&gt;} = 5,10,25,50,100,250,500,1000</td>
<td>→:MENU:HARMOnic:CYCLE 1</td>
</tr>
<tr>
<td>:MENU:HARMOnic:DISPlay</td>
<td>Sets/queries the contents to display for the automatic analysis.</td>
<td>MENU:HARMOnic:DISPlay {TABLE1</td>
<td>RMS</td>
</tr>
<tr>
<td>:MENU:HARMOnic:FREQuency</td>
<td>Sets/queries the frequency of the harmonic mode.</td>
<td>MENU:HARMOnic:FREQuency {&lt;Frequency&gt;</td>
<td>AUTO}</td>
</tr>
</tbody>
</table>

### :MENU:HARMOnic:METHOD (Valid only when the operation mode is set to harmonic)

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
<th>Syntax</th>
<th>Example</th>
</tr>
</thead>
</table>

### :MENU:HARMOnic:TRENd? (Valid only when the operation mode is set to harmonic and the analysis method is set to automatic analysis.)

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
<th>Syntax</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>:MENU:HARMOnic:TRENd?</td>
<td>Queries all the setting values relating to the trend save of the automatic analysis.</td>
<td>MENU:HARMOnic:TRENd?</td>
<td>→:MENU:HARMOnic:TRENd:SAVE MIN1;END 1;ENTIME &quot;23:49&quot;;START 1;STTIME &quot;18:50&quot;;CHANNEL1:CONTENT 0;ORDER ODDALL;PHASE 0;RMS 0;TOTAL 0;CHANNEL2:CONTENT 0;ORDER ODD3TO9;PHASE 0;RMS 0;TOTAL 0;CHANNEL3:CONTENT 1;ORDER ODD3TO9;PHASE 0;RMS 0;TOTAL 0;POWER1:CONTENT 0;ORDER ODD3TO9;PHASE 1;RMS 0;TOTAL 0;POWER2:CONTENT 0;ORDER ODD3TO9;PHASE 0;RMS 0;TOTAL 0</td>
</tr>
</tbody>
</table>
**MENU Group**

`: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>}
```

**Example**
```
:MENU:HARMonic:TRENd:
CHANNEL1:CONTent OFF
```

**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}
```

**Example**
```
: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>}
```

**Example**
```
:MENU:HARMonic:TRENd:
CHANNEL1:PHAse ON
```

**Description**
Valid only when the trend save is effective.
### 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?
```

### Description
Valid only when the trend save is effective.

### :MENU:HARMonic:TRENd: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?
```

### 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: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?

HH (hour)=00 to 23,
MM (minute)=00 to 59
```

### Example
```
:MENU:HARMonic:TRENd: STTime "01:45"
```

### :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?

HH (hour)=00 to 23,
MM (minute)=00 to 59
```

### Example
```
:MENU:HARMonic:TRENd: ENTime "01:45"
```
**MENU Group**

**: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}
```

**Example**
```
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 {LIlinear|LOG}
```

**Example**
```
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 automatic analysis.

**Syntax**
```
MENU:HARMonic:WIRing {SP2W12|SP2W34|SP3W|TP3W}
```

**Example**
```
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}
```

**Example**
```
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>}
```

**Example**
```
MENU:LOA:BIT1 ON
```

**:MENU:LOPrint**

**Function**
Sets/queries record position of the logic waveform.

**Syntax**
```
MENU:LOPrint {OFF|BOTH|LOWer|EQUal}
```

**Example**
```
MENU:LOPRINT UPPE
```

**:MENU:MBLength** (valid only when the mode is memory or real&memory)

**Function**
Sets/queries the memory length.

**Syntax**
```
MENU:MBLength {<NRf>}
```

**Example**
```
MENU:MCLEAR OFF
```

**Description**
Valid only when display content is RMS value or effective power.
<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MENU:MESSAGE</strong></td>
<td>Sets/queries contents of the message print.</td>
</tr>
<tr>
<td><strong>Syntax</strong></td>
<td>`MENU:MESSAGE {OFF</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td><code>MENU:MESSAGE COMMENT</code></td>
</tr>
<tr>
<td><strong>MENU:MINTERVAL</strong></td>
<td>Sets/queries the digital recording interval after capturing the data in the memory.</td>
</tr>
<tr>
<td><strong>Syntax</strong></td>
<td><code>MENU:MINTERVAL {&lt;NRf&gt;}</code></td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td><code>MENU:MINTERVAL 1</code></td>
</tr>
<tr>
<td><strong>MENU:MODE</strong></td>
<td>Sets/queries the operating mode.</td>
</tr>
<tr>
<td><strong>Syntax</strong></td>
<td>`MENU:MODE {MEMORY</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td><code>MENU:MODE MEMORY</code></td>
</tr>
<tr>
<td><strong>MENU:MPCCard</strong></td>
<td>Sets/queries PC card operation after capturing the data in the memory.</td>
</tr>
<tr>
<td><strong>Syntax</strong></td>
<td>`MENU:MPCard {OFF</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td><code>MENU:MPCard SAVE</code></td>
</tr>
<tr>
<td><strong>MENU:MPrint</strong></td>
<td>Sets/queries record setting after capturing the data in the memory.</td>
</tr>
<tr>
<td><strong>Syntax</strong></td>
<td><code>MENU:MPrint {&lt;Boolean&gt;}</code></td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td><code>MENU:MPrint OFF</code></td>
</tr>
<tr>
<td><strong>MENU:MTStatis</strong></td>
<td>Sets/queries parameter calculation after capturing the data in the memory.</td>
</tr>
<tr>
<td><strong>Syntax</strong></td>
<td><code>MENU:MTStatis {&lt;Boolean&gt;}</code></td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td><code>MENU:MTStatis ON</code></td>
</tr>
<tr>
<td><strong>MENU:MTStop</strong></td>
<td>Sets/queries the memory stop condition during repeat triggering.</td>
</tr>
<tr>
<td><strong>Syntax</strong></td>
<td>`MENU:MTStop {STOPkey</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td><code>MENU:MTStop STOPKEY</code></td>
</tr>
<tr>
<td><strong>MENU:MTDiv</strong></td>
<td>Sets/queries the time-axis rate during the data capture.</td>
</tr>
<tr>
<td><strong>Syntax</strong></td>
<td>`MENU:MTDiv {&lt;character data&gt;</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td><code>MENU:MTDiv USEC200</code></td>
</tr>
</tbody>
</table>
### MENU Group

**: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?` (valid only when the mode is realtime and the simultaneous recording is numerical values and the format is T-Y)

**Example**
- `MENU:PLAYBACK 1`
- `MENU:PLAYBACK?`: `MENU:PLAYBACK 1`

**:MENU:PLENghth** (valid only when the mode is memory or real&memory and the recording mode is wave)

**Function** Sets/queries record length.

**Syntax**
- `MENU:PLENghth {CONTinue|A4|A5}`
- `MENU:PLENghth?`

**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?` (valid only when the mode is realtime and the simultaneous recording is numerical values and the format is T-Y)

**Example**
- `MENU:RDINTERVAL SEC1`
- `MENU:RDINTERVAL?`: `MENU:RDINTERVAL SEC1`

**:MENU:RLENghth** (valid only when the mode is realtime and the format is T-Y)

**Function** Sets/queries the length of the realtime recording.

**Syntax**
- `MENU:RLENghth {CONTinue|<NRf>}`
- `MENU:RLENghth?` (valid only when the mode is realtime and the format is T-Y)

**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?` (valid only when the mode is realtime and the format is T-Y)

**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?` (valid only when the mode is realtime and the format is T-Y)

**Example**
- `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?` (valid only when the format is X-Y)

**Example**
- `MENU:STYLE LINE`
- `MENU:STYLE?`: `MENU:STYLE LINE`
**MENU Group**

### :MENU:TPRint (Time print)
**Function**
Sets/queries the time printing.

**Syntax**
```
MENU:TPRint {<Boolean>}
```

**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}
```

**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>}
```

```
{<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>}
```

```
<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 MONITOR 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 LSBFIRST
MONITOR:BYTEORDER?→:MONITOR:BYTEORDER MSBFirst

:MONitor:CHANnel<X>:DPOint?
(function point)
Function Queries the decimal point position of the current measured data of the specified analog channel.
Syntax MONitor:CHANnel<x>:DPOint?
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?
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 Group

: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: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**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Measured value (eight characters, alignment right)**
- 1101111011, 11011001

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**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**A**  
Indicates the measurement data of each bit.

**B**  
Indicates the ON/OFF setting of the display/recording of each bit.

:MONitor:SEND?

**Function**
Sends the current measured data.

**Syntax**
- `MONitor:SEND?`

**Description**
**ASCII format**
- `-2.0 0 0 m v . . .`

**Measured value**
(8 characters, alignment right)
- `1101111011 crlf`

**Analog format**
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**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**A**  
Indicates the measurement data of each bit.

**B**  
Indicates the ON/OFF setting of the display/recording of each bit.

**App-42**
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>}
Example PASSword:CHANge 0,1234

PASSword:INPut

Function Enters the password.
Syntax PASSword:INPut {<NRf>}
Example PASSword:INPut 100

SELFtest Group

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).

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>ROM Test Result 0: Pass 1: Fail</td>
</tr>
<tr>
<td>1</td>
<td>RAM Test Result 0: Pass 1: Fail</td>
</tr>
<tr>
<td>2</td>
<td>Acquisition RAM Test Result 0: Pass 1: Fail</td>
</tr>
</tbody>
</table>

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 Group

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STATIs:END</strong></td>
<td>Sets/Queries the data number of the end of the calculation.</td>
</tr>
</tbody>
</table>
| 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 |

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STATIs:EXECute</strong></td>
<td>Executes calculation.</td>
</tr>
<tr>
<td>Syntax</td>
<td>STATIs:EXECute</td>
</tr>
<tr>
<td>Example</td>
<td>STATIS:EXECUTE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STATIs:HARMonic:CHANnel&lt;X1&gt;:ORDer&lt;X2&gt;:CONTent?</strong></td>
<td>Queries the relative harmonic content of each harmonic order of each analog channel from the results of the harmonic analysis.</td>
</tr>
</tbody>
</table>
| 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. |

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STATIs:HARMonic:CHANnel&lt;X1&gt;:ORDer&lt;X2&gt;:PHASE?</strong></td>
<td>Queries the phase of each harmonic order of each analog channel from the results of the harmonic analysis.</td>
</tr>
</tbody>
</table>
| 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. |

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STATIs:HARMonic:CHANnel&lt;X1&gt;:ORDer&lt;X2&gt;:RMS?</strong></td>
<td>Queries the RMS value of each harmonic order of each analog channel from the results of the harmonic analysis.</td>
</tr>
</tbody>
</table>
| 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. |

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STATIs:HARMonic:CHANnel&lt;X&gt;:THD1?</strong></td>
<td>Queries the harmonic distortion (IEC) of each analog channel from the results of the harmonic analysis.</td>
</tr>
</tbody>
</table>
| 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. |

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STATIs:HARMonic:CHANnel&lt;X&gt;:THD2?</strong></td>
<td>Queries the harmonic distortion (CSA) of each analog channel from the results of the harmonic analysis.</td>
</tr>
</tbody>
</table>
| 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 Group

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
<th>Syntax</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STATIs:HARMonic:CHANnel&lt;X&gt;: TRMS</strong>? (Total RMS)</td>
<td>Queries the total RMS value of each analog channel from the results of the harmonic analysis.</td>
<td>STATIs:HARMonic:CHANnel&lt;X&gt;: TRMS? &lt;X&gt;=1 to 4 Channel</td>
<td>STATIs:HARMonic:CHANNEL1: TRMS? → &quot;3.5V&quot;</td>
</tr>
<tr>
<td><strong>STATIs:HARMonic:EXECute (Valid only when the operation mode is set to harmonic)</strong></td>
<td>Executes the harmonic analysis.</td>
<td>STATIs:HARMonic:EXECute</td>
<td>STATIs:HARMonic:EXECUTE</td>
</tr>
<tr>
<td><strong>STATIs:HARMonic:POWer&lt;X&gt;: ACTPower</strong>?</td>
<td>Queries the total effective power from the results of the harmonic analysis.</td>
<td>STATIs:HARMonic:POWer&lt;X&gt;: ACTPower? &lt;X&gt;=1 to 2 (2 is valid only for single-phase two-wire (CH3-CH4))</td>
<td>STATIs:HARMonic:POWER1: ACTPOWER? → &quot;3.33W&quot;</td>
</tr>
<tr>
<td><strong>STATIs:HARMonic:POWer&lt;X&gt;: APPPower</strong>?</td>
<td>Queries the apparent power from the results of the harmonic analysis.</td>
<td>STATIs:HARMonic:POWer&lt;X&gt;: APPPower? &lt;X&gt;=1 to 2 (2 is valid only for single-phase two-wire (CH3-CH4))</td>
<td>STATIs:HARMonic:POWER1: APPPOWER? → &quot;3.33var&quot;</td>
</tr>
<tr>
<td><strong>STATIs:HARMonic:POWer&lt;X&gt;: ORDER&lt;X2&gt;:CONTen?</strong></td>
<td>Queries the relative power content of each harmonic order from the results of the harmonic analysis.</td>
<td>STATIs:HARMonic:POWer&lt;X&gt;: ORDER&lt;X2&gt;:CONTen? &lt;X1&gt;=1 to 40 Harmonic order</td>
<td>STATIs:HARMonic:POWER1: ORDER3:CONTENT? → &quot;3.33%&quot;</td>
</tr>
<tr>
<td><strong>STATIs:HARMonic:POWer&lt;X&gt;: ORDER&lt;X2&gt;:PHASe?</strong></td>
<td>Queries the power phase of each harmonic order from the results of the harmonic analysis.</td>
<td>STATIs:HARMonic:POWer&lt;X&gt;: ORDER&lt;X2&gt;:PHASe? &lt;X1&gt;=1 to 40 Harmonic order</td>
<td>STATIs:HARMonic:POWER1: ORDER3:PHASE? → &quot;3.33deg&quot;</td>
</tr>
</tbody>
</table>

**Description**

- If calculation is not performed, "off" is returned.
- If calculation is abnormal, "*****" is returned.

Note: The syntax and examples provided are for illustrative purposes and may vary depending on the specific device and software interface.
**STATIs Group**

**: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 \(40\)

**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 \(<NRf>\)

**Example**
STATIs:HARMOnic:STARt 0

→ :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 \(<NRf>\)

**Example**
STATIs:STARt 0

→ :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:EESE
Function Sets/Queries the extended event enable register.
Syntax STATus:EESE {<Register>}
Example

:STATus:EESR?
Function Queries the contents of the extended event register and clears the register.
Syntax STATus:EESR?
Example

:STATus:CONDition?
Function Queries the contents of the condition register.
Syntax STATus:CONDition?
Example

;
:**STATus:ERRor?**

**Function**  Queries the error code and message (head of the error queue).

**Syntax**  STATus:ERRor?

**Example**  STATus:ERRor?

→ 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.
**: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 width 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?

**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?

**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
```

**App-52**

IM OR100E-01E
### :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:RMSStatis
**Function**: Sets/Queries whether or not to calculate the expansion.
**Syntax**: `SYSTem:RMSStatis {<Boolean>}`  
`SYSTem:RMSStatis?`

**Example**:  
`SYSTEM:RMSSTATIS ON`  
`SYSTEM:RMSSTATIS?`  

### :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:TAG
**Function**: Sets/Queries whether or not to use the tag.
**Syntax**: `SYSTem:TAG {<Boolean>}`  
`SYSTem:TAG?`

**Example**:  
`SYSTEM:TAG ON`  
`SYSTEM:TAG?`  

### :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: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: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: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 Group

"IM OR100E-01E"  
"App-53"
TRIGger Group

The commands in the TRIGger group set or query system parameters. These commands correspond to the TRIGGER key.
Appendix

: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>?

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

Example TRIGGER:CHANNEL1:FCOUNT 1
TRIGGER:CHANNEL1:FCOUNT?
→ :TRIGGER:CHANNEL1:FCOUNT 1

:TRIGger:CHANnel<X>:FIIter

Function Sets/Queries the trigger filter of the specified analog ch for the normal trigger.

Syntax TRIGger:CHANnel<X>:FIIter {OFF|ON|TIMeout}

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>} <X1>=1 to 4, <X2>=1 to 2

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>}

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>}

Example TRIGGER:PEAK 50
TRIGGER:PEAK?
→ :TRIGGER:
PEAK 50
TRIgger Group

: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|RISER|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:COMBination?
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 Group

### 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: CHANNEL OFF; 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}

**Example**  
TRIGGER:HARMONIC:MODE SINGLE → 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>}

**Example**  
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>}

**Example**  
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>}

**Example**  
TRIGGER:HARMONIC:CONDition1: ORDER 5

### :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}

**Example**  
TRIGGER:HARMONIC:KIND THDIEC
TRIGGER Group

: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?

Example
TRIGGER:HARMONIC:SYNCHRONIZE:CHANNEL 1
TRIGGER:HARMONIC:SYNCHRONIZE:CHANNEL?

: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?

Example
TRIGGER:HARMONIC:SYNCHRONIZE:LEVEL 10
TRIGGER:HARMONIC:SYNCHRONIZE:LEVEL?

:TRIGGER:{LOA|LOB}?
Function
Queries all setting values relating to the specified logic ch for the normal trigger.

Syntax
TRIGGER:{LOA|LOB}?

Example
TRIGGER:LOA?

: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>?

Example
TRIGGER:LOB:PATTERN1 LOW
TRIGGER:LOB:PATTERN1?

: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?

Example
TRIGGER:LOA:TYPE OR
TRIGGER:LOA:TYPE?

: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: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?

Example
TRIGGER:LOGIC:FCOUNT 1
TRIGGER:LOGIC:FCOUNT?

: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?

**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:

### :TRIGGER:Synchronize:Channel
**Function**: Sets/Queries the synchronization trigger channel of the wave window trigger.

**Syntax**: TRIGGER:Synchronize:
  CHANNEL{<NRf>}
  TRIGGER:Synchronize:CHANNEL?

**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?

**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 OFF
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(clear)
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 register
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:ESR?

Extended event enable register
Function Masks extended
Writing STATUS:ESE
Reading STATUS:ESE?

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 queue
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

<table>
<thead>
<tr>
<th>Bit</th>
<th>Mask</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td></td>
<td>RQS (Request Status)/MSS (Master Summary Status)</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Bit 6 RQS (Request Status)/MSS (Master Summary Status)</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Bit 5 ESB (Event Summary Bit)</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Bit 4 MAV (Message Available)</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Bit 3 EES (Extended Event Summary Bit)</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Bit 2 EAV (Error Available)</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Bits 0, 1 and 7</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>Not used (always “0”)</td>
</tr>
</tbody>
</table>

#### 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

<table>
<thead>
<tr>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>PON</td>
<td>URQ</td>
<td>CME</td>
<td>EXE</td>
<td>DDE</td>
<td>QYE</td>
<td>RQC</td>
<td>OPC</td>
</tr>
</tbody>
</table>

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)
Appendix 1.3  Status Response

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.

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 (Calculation) | Set to 1 during Calculation. |
| 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 \texttt{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 \texttt{*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 \texttt{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 \texttt{*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$                              /Get current block number
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$                          /Set send condition for data
320 PRINT #1,"COMMUNICATE:HEADER ON"              /Set header on queries
330 /
340 / Set block number
350 PRINT #1,"DATA:BLOCK "+BLOCK$                /Specify ASCII format
360 /
370 / Set send condition for data
380 PRINT #1,"DATA:FORMAT ASCII"                  /Send start point 0
390 PRINT #1,"DATA:START 0"                       /Send end point 20
400 PRINT #1,"DATA:END 20"                        /Request to send CH1 data
410 PRINT #1,"DATA:CHAN1:SEND?"                   /Read measurement values on the screen
420 /
430 LINE INPUT #1,D$                              /Display the measurement value
440 PRINT D$                                      /Display the measurement value
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
Appendix 1.4  Sample Program

Program to calculate CRC-CCITT

/******************************************************/
/*                                                    */
/*    Program to calculate CRC-CCITT                  */
/*                                                    */
/******************************************************/
unsigned short int CalcCRC(
    char *data,                 /* Area for storing the data on which the
    int  length                 /* Number of data points for calculating
    the CRC */
)
{
    int                 cnt;            /* Loop counter for the data
    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
        crc ^= ((unsigned short int)*data++ << 8);  /* Take XOR with
        for( bit=0; bit<8; bit++ ){          /* the upper 8 bits */
            if( crc & 0x8000 )                      /* If MSB is 1 */
                crc = (crc << 1) ^ 0x1021;            /* take the XOR
            else
                crc = crc << 1;                       /* Shift the
digit */
        }                                          /* return CRC value */
    }
    return crc;
}
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