User's Manual

Models SR10001/SR10002/SR10003/SR10004/
SR10006

SR10000 Recorder

vigilantplant.

YOKOGAWA ◆

Yokogawa Electric Corporation

Foreword

Thank you for purchasing the YOKOGAWA SR10000 Recorder.

This user's manual explains how to use the SR10000 recorder excluding the communication functions. To ensure correct use, please read this manual thoroughly before operation.

The following three manuals including this manual are available for the SR10000 Recorder.

- **Paper Manual**

Manual Title	Manual No.	Description
SR10000 Recorder Operation Guide	IM 04P03B01-02E	Explains concisely the operations of the SR10000 Recorder. It is also provided in the CD-ROM.

- **Electronic Manuals Provided on the Accompanying CD-ROM**

Manual Title	Manual No.	Description
SR10000 Recorder Operation Guide	IM 04P03B01-02E	Explains concisely the operations of the SR10000 Recorder. This is the electronic version of the paper manual.
SR10000 Recorder User's Manual	IM 04P03B01-01E	This manual.
SR10000 Communication Interface User's Manual	IM 04P03B01-17E	Explains the communication functions of the SR10000 Recorder using Ethernet interface and the RS-422A/485 communication interface.

Notes

- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functions.
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How to Use This Manual

Read the Operation Guide first to familiarize yourself with the basic operation, and then read this manual. For a description of the communication function, see the *SR10000 Communication Interface User's Manual (IM 04P03B01-17E)* .

This user's manual consists of the following sections.

Chapter	Title and Description
1	**Functional Description** Describes the functions of the SR10000 Recorder.
2	**Frequently Used Setup Operations (Setting Mode)** Describes how to change the input range, alarms, chart speed, etc.
3	**Setup Operations for Convenient Functions (Setting Mode)** Describes the setup operations for convenient functions such as how to assign tags to channels and how to set message strings that are to be printed.
4	**Setup Operations for Changing/Adding Functions (Basic Setting Mode)** Describes the setup operations for changing or adding functions such as setting the recorder to detect sensor burnouts and changing the contents that are printed on the chart paper.
5	**Troubleshooting** Describes error message and troubleshooting measures of the SR10000 Recorder.
6	**Maintenance** Describes periodic inspection, calibration, and pen adjustment/printer carriage adjustment.
7	**Specifications** Gives the specifications of the SR10000 Recorder.
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Note
- This user's manual covers information regarding the recorders with English as the printout font (suffix code "2").

1

Conventions Used in This Manual

Unit

K .... Denotes 1024. Example: 768 KB (file size)

k .... Denotes 1000.

2

Safety Markings

The following markings are used in this manual.

3

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

4

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

5

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

6

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

7

Subheadings

On pages that describe the operating procedures in Chapter 2 through 4 and 6, the following symbols are used to distinguish the procedures from their explanations.

Index

Procedure   Follow the numbered steps. All procedures are written with inexperienced users in mind; depending on the operation, not all steps need to be taken.

Explanation   This subsection describes the setting parameters and the limitations on the procedures. It does not give a detailed explanation of the function. For details on the function, see chapter 1.

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Chapter 5　Troubleshooting

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Chapter 7　Specifications

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1.1   Measuring Input Section

Input Section

Number of Measurement Channels and Scan Interval

The recorder samples the input signals on the measurement channels at the scan interval to obtain the measured values.

Model	Number of Channels	Scan Interval
1-pen model	1	125 ms
2-pen model	2	125 ms
3-pen model	3	125 ms
4-pen model	4	125 ms
Dot model	6	1 s
		(However, the scan interval is 2.5 s when the integration time of the A/D converter is 100 ms.)

Input Type, Measurable Range, and Computation

The recorder can measure the following types of inputs.

Input Type	Measurable Range
DC voltage	DC voltage in the range of ±20 mV to ± 50 V
1-5V	See "1-5V" below.
Thermocouple	Temperature range corresponding to each type: R, S, B, K, E, J, T, N, W, L, U, and WRe
RTD	Temperature range corresponding to each type: Pt100Ω and JPt100Ω
ON/OFF input	Contact input: Open contact is OFF (0). Closed contact is ON (1).
	Voltage input: Less than 2.4 V is OFF (0). Greater than or equal to 2.4 V is ON (1)

- **1-5V**

  1-5V is scaled to values in the appropriate unit to be used as measured values. Also, the low-cut function (input less than 0% is fixed to 0 (scale left value)) can be used.

- **Current Input**

  A shunt resistor is attached to the input terminal. The current signal is converted to a voltage signal and measured. The measurable range is the range equivalent to the "DC voltage" range indicated above after converting the current to the voltage signal.

Note

> Three types of shunt resistors (250 Ω, 100 Ω, and 10 Ω) are available for current input (See "Optional Accessories (Sold Separately)" in the *Operation Guide*.) For example, a 250-Ω shunt resistor is used to convert the signal to the range of 1 to 5 V for 4 to 20 mA input.

- **Range Type, Measurable Range, and Recording Span**

  Various "range type" are available for the different types of inputs (for example thermocouple R). Each range type has a preset measurable range (0.0 to 1760.0°C for thermocouple R). Measurement can be made by specifying an arbitrary range within the measurable range as the *input range*. The measured values in the input range are recorded on the chart paper. The range of measured values that are recorded is called the *recording span*.

**Measurable range
(Thermocouple R example)**   **Input range or
recording span**
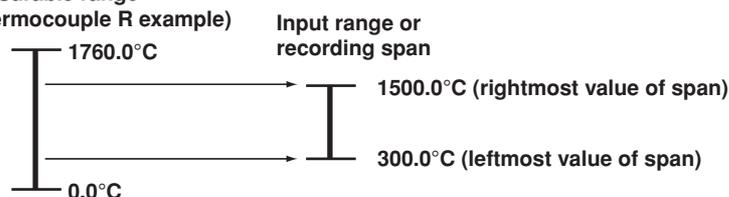
        ─ 1760.0°C

                        ─ 1500.0°C (rightmost value of span)

                        ─ 300.0°C (leftmost value of span)

        ─ 0.0°C

For the procedure to set the functions, see section 1.6, "Function Setup Guide."

- **Delta Computation**

  The value obtained by subtracting the measured value of another channel (called the *reference channel*) from the input value of the channel set to delta computation is used as the measured value of that channel. The reference channel must be assigned to a channel whose channel number is less than that of the channel on which delta computation is specified. The channel on which delta computation is specified is automatically set to the same range type as the reference channel.

  Channel set to delta computation

  Input value → + ⊖ → **Measured value**
                              −

  Measured value on the reference channel
  DC voltage
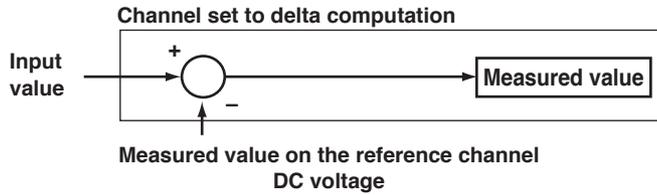
  Note

  > A channel whose input type is set to DC voltage, TC, or RTD can be designated as a reference channel. However, channels set to scaling or square root computation cannot be designated.

- **Scaling**

  The input values are scaled to values in the appropriate unit to be used as measured values.

  Input value   **Measured value**

  10 V ──────────→ 300.0°C

  0 V ──────────→ −100.0°C
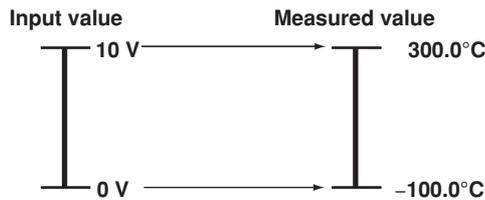
- **Square Root Computation**

  When the input type is DC voltage, the square root of the input value is calculated, the result is scaled to a value in the appropriate unit, and used as the measured value of the channel. Also, the low-cut function (input less than a given measured value is fixed to 0 (scale left value)) can be used.

  Channel set to square root computation

  Input value → √ → **Scaling** → **Measured value**

  Measured value   **Result of square root computation**

  Low-cut value
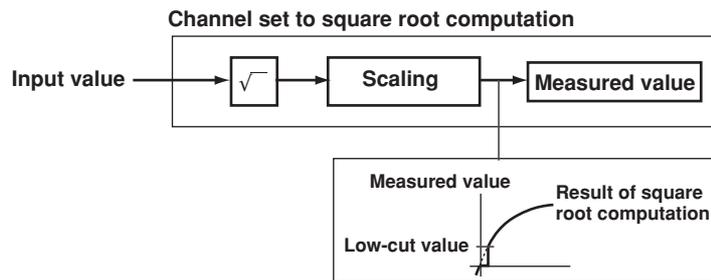
  Note

  The square root computation on the recorder uses the following formula.

  $$F_x = (F_{max} - F_{min}) \sqrt{\dfrac{V_x - V_{min}}{V_{max} - V_{min}}} + F_{min}$$

  where V_{min} (leftmost value of span) $<$ V_{max} (rightmost value of span)
  F_{min} (leftmost value of scale after scaling) $<$ F_{max} (rightmost value of scale after scaling)
  V_x is the input voltage and F_x is the scaled value

For the procedure to set the functions, see section 1.6, "Function Setup Guide."

· **Bias**

A given value (bias value) is added to the input value and used as the measured value of that channel.

Biased channel

Input value → ◯ → **Measured value**

+

Bias value
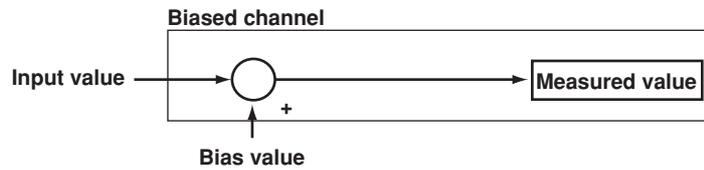
· **Calibration Correction (/CC1 Option)**

Corrects the measured value of each channel using segment linearizer approximation and makes the resultant value the measured value of the channel. You can set arbitrary correction values for 2 to 16 points of arbitrary measured values. Linear approximation is used between two segment points. Correction values can be assigned using revise values or absolute values.

Scale value

B5

Measured value

A5

A4

Correction value

B3 **B4**

B2

A3

B1

A2

A1

Calibration point

Correction using revise values
Measured value = A
Correction value = B – A

Correction using absolute values
Measured value = A
Correction value = B

A1 to A5: Measured value (measured value before correction)
B1 to B5: Correction value (measured value after correction)
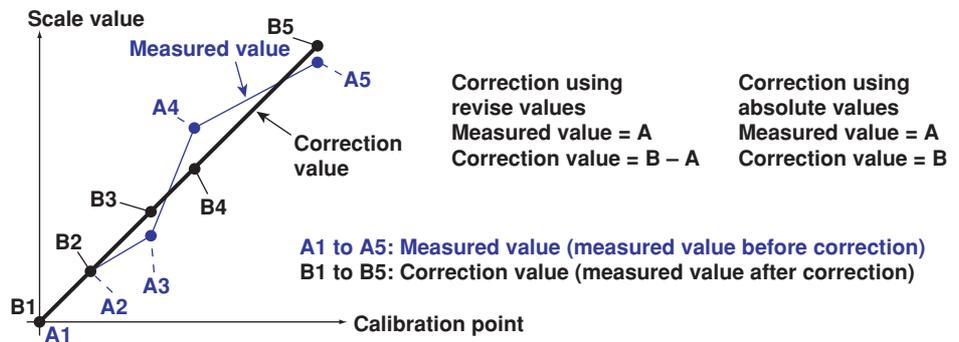
Reference Junction Compensation of Thermocouple Input

When measuring the temperature using a thermocouple, the reference junction compensation on the recorder can be used. When using external reference junction compensation, you can set the reference voltage. The reference junction compensation can be set for each channel.

By default, the recorder is configured to use the internal reference junction compensation function.

Note

When using external reference junction compensation, set an appropriate reference junction compensation voltage. For example, if the reference junction temperature of the external reference compensation is T_0 °C, set the reference compensation junction voltage to the thermoelectromotive force of the 0°C reference of T_0 °C.

Example when using external reference junction compensation

Recorder

External reference junction compensation
(Hold the contact point of the thermocouple and copper wire at T_0°C)

Copper wire
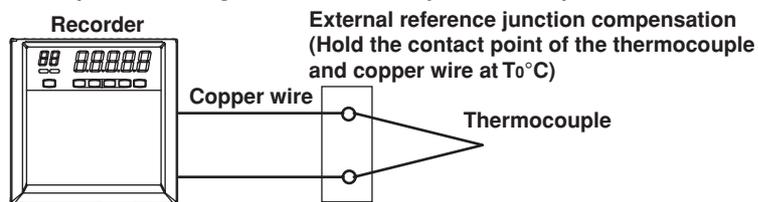
Thermocouple

For the procedure to set the functions, see section 1.6, "Function Setup Guide."

Burnout Detection of Thermocouples

This function makes the recording go off the scale to the right or left when the thermocouple burns out while measuring temperature with a thermocouple. This function can also be used on 1-5V. The burnout detection function can be set for each channel.

By default, this function is disabled.

Note

For 1-5V, a burnout occurs when the input value is less than or equal to 0.2 V.

Noise Elimination from Input Signals

Filter and Moving Average

This function used to suppress the effects of noise that is riding on the signal. The pen model and dot model are equipped with a filter function and a moving average function, respectively. The function can be set for each measurement channel. However, it does not operate on channels set to ON/OFF input.

- **Filter (Pen Model)**

  The filter is a low-pass filter. The time constant can be set to 2 s, 5 s, or 10 s.

Filter result (output for a step input)

Input signal

63.2% of the output value

Output response curve (when using the filter)

2, 5, 10 s (time constant, the time it takes to reach 63.2% of the output value)
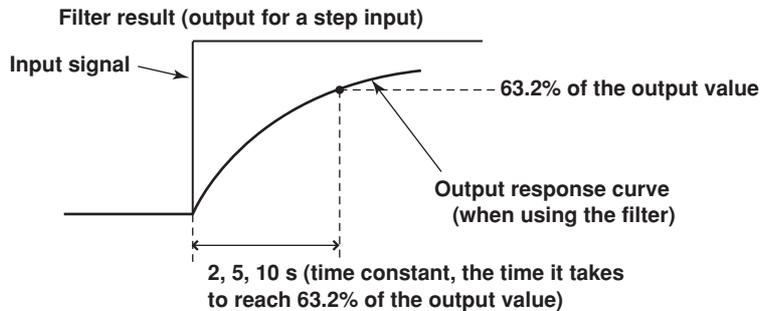
- **Moving Average (Dot Model)**

  The average value of the m most recent values acquired at the scan interval is used as the measured value of the channel. The number of moving-averaged data points (m) can be set in the range 2 to 16. The figure below shows an example indicating the operation of the buffer for the moving average computation when the number of moving averaged data points is set to 5.

	Buffer data for the nth sampling time	Buffer data for the n+1th sampling time Most recent data	Buffer data for the n+2th sampling time Most recent data
1	10.0 mV	15.0 mV	10.0 mV
2	5.0 mV	10.0 mV	15.0 mV
3	0.0 mV	5.0 mV	10.0 mV
4	–5.0 mV	0.0 mV	5.0 mV
5	–10.0 mV	–5.0 mV	0.0 mV
		Deleted	Deleted
Moving average	0.0 mV	5.0 mV	8.0 mV
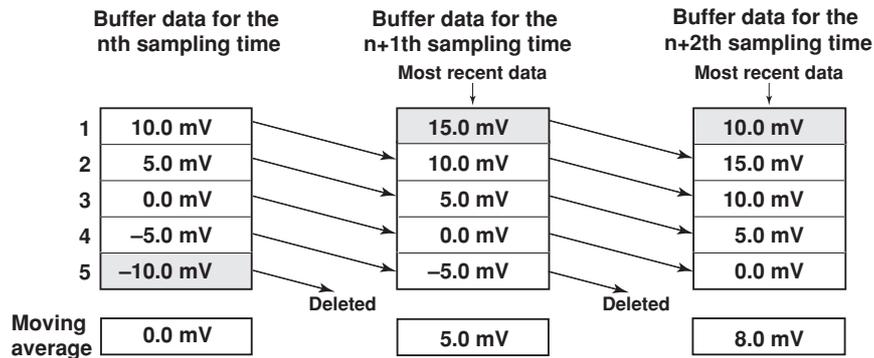
For the procedure to set the functions, see section 1.6, "Function Setup Guide."

Integration Time of the A/D Converter

The recorder uses an A/D converter to convert the sampled analog signal to a digital signal. By setting the integration time of the A/D converter to match the time period corresponding to one cycle of the power supply or an integer multiple of one cycle, the power supply frequency noise can be effectively suppressed.

The integration time of the A/D converter is selected according to the model from the table below.

Model	Integration Time of the A/D Converter
Pen model	Select 16.7 ms (60 Hz), 20 ms (50 Hz), or Auto
Dot model	Select 16.7 ms (60 Hz), 20 ms (50 Hz), 100 ms or Auto

·   If Auto is selected, the recorder detects the power supply frequency and automatically selects 16.7 ms or 20 ms. However, if the 24-VDC power supply is being used on a recorder with the 24-VDC/AC power supply (/P1 option), the integration time is fixed to 20 ms.

·   Because 100 ms is an integer multiple of 16.7 ms and 20 ms, this setting can be used to suppress the power frequency noise for either frequency, 50 Hz or 60 Hz.

·   The scan interval on the dot model is 1 s when the integration time is set to 16.7 ms or 20 ms and 2.5 s when the integration time is set to 100 ms.

For the procedure to set the functions, see section 1.6, "Function Setup Guide."

1.2 Alarms

This function generates an alarm when the measured data meets a certain condition. The alarm status is displayed on the screen while recording the alarm occurrence/release on the chart paper.

Also, alarm output relays can be used to output contact signals when alarms occur (/A1, /A2, and /A3 options).

Alarm Types

Number of Alarm Point Marks
Up to four alarms can be set for each channel.

Alarm Conditions
The following four conditions are available: The alphanumeric character or symbol inside the parentheses is used on the recorder to denote each alarm.

- **High Limit Alarm (H/⊣)**
  An alarm occurs when the input value exceeds the alarm value.
- **Low Limit Alarm (L/⌊)**
  An alarm occurs when the input value falls below the alarm value.
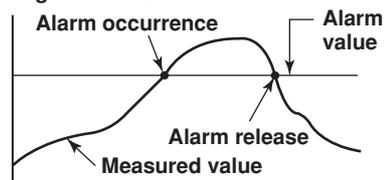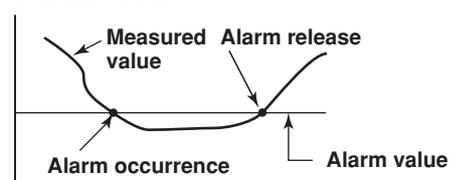
- **Difference High Limit Alarm (h/⊣)***
  An alarm occurs when the difference in the input values of two channels is greater than or equal to the specified value.
- **Difference Low Limit Alarm (l/⌊)***
  An alarm occurs when the difference in the input values of two channels is less than or equal to the specified value.
  * Can be specified on channels set to delta computation.

Alarm Hysteresis
Hysteresis can be specified to the values for activating and releasing the alarm. The hysteresis applies only to high limit alarm (H) and low limit alarm (L). The hysteresis width can be set in the range of 0.0% (OFF) to 1.0% of the recording span in 0.1 steps. The setting applies to all high limit alarms and low limit alarms. By default, the hysteresis width is set to 0.5%.
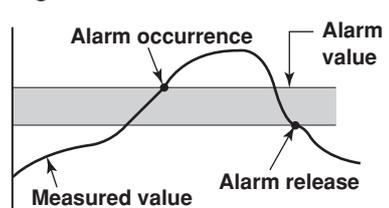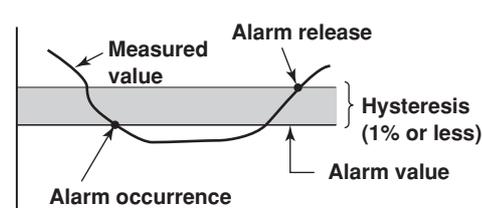
For the procedure to set the functions, see section 1.6, "Function Setup Guide."

Alarm Indication

When an alarm occurs, the ALM indicator in the status display section illuminates, and the 2nd digit of the LED shows the alarm status for each channel. When the alarm clears, the indicator and the LED turn OFF.

Alarm Recording

The alarm occurrence/release can be recorded on the chart paper. See section 1.3.

Alarm Output Relay (/A1, /A2, and /A3 Options)

Contact signals can be generated from alarm output relays when alarms occur. The number of output relays is 2 (/A1), 4 (/A2), or 6 (/A3). The alarm output relays are denoted as I01 to I06 on the recorder.
The following functions can be assigned to the alarm output relay.

Diagnosis Output

The diagnosis output can be assigned to alarm output relay I01.
The relay is activated when there is an error in the plotter operation on the pen model, when a burnout is detected, or when there is an error in the A/D converter. Output relay I01 is normally energized and de-energizes when an error is detected (de-energized operation).

Note

If diagnosis output is enabled, I01 becomes a relay dedicated to diagnosis output.

Energized/De-energized Operation of Alarm Output Relays

You can select whether the alarm output relay is energized or de-energized when an alarm occurs. If de-energized is selected, the status of the alarm output relay when an alarm occurs is the same as the status that results when the power is shut down. The setting applies to all alarm output relays.
The default setting is energized.
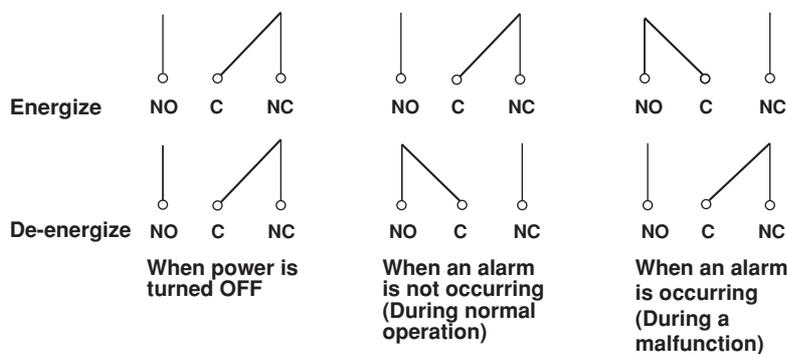
NO : Normally Opened, **C** : Common, **NC** : Normally Closed

Note

If diagnosis output is enabled, I01 is fixed to de-energized operation.

Alarm Output Relay Operation

When the output destination of multiple alarms is assigned to a single alarm output relay, the relay is activated when any of the assigned alarms is occurring (OR operation).

For the procedure to set the functions, see section 1.6, "Function Setup Guide."

1.3 Recording

The recorder is capable of recording the measured values with pens or dots (trend recording) as well as various other types of information.

Trend Recording

The measured values are printed within a width of 100 mm.

Recording Method (Pen Model)
- The measured value is updated every scan interval and continuously recorded.
- The recording colors in order from channel 1 are red, green, blue, and violet.

Recording Method (Dot Model)
- The most recent measured value is recorded with a dot every dot printing interval. The dot printing interval is in the range of 10 s to 90 s. There are two recording methods from which you can select. One method automatically adjusts the dot printing interval according to the chart speed so that the dots do not overlap. The other method records at the fastest dot printing interval at all times.
- The recording colors in order from channel 1 are purple, red, green, blue, brown, and black. The recording color of each channel can be changed among these six colors.
- For each channel, trend recording can be enabled or disabled.

Chart Speed
On the pen model, the chart speed can be selected from 40 settings in the range of 10 to 12000 mm/h.
On the dot model, the chart speed can be selected from 28 settings in the range of 10 to 1500 mm/h.
The default setting is 20 mm/h.

Zone Recording
A recording zone is assigned to each channel.
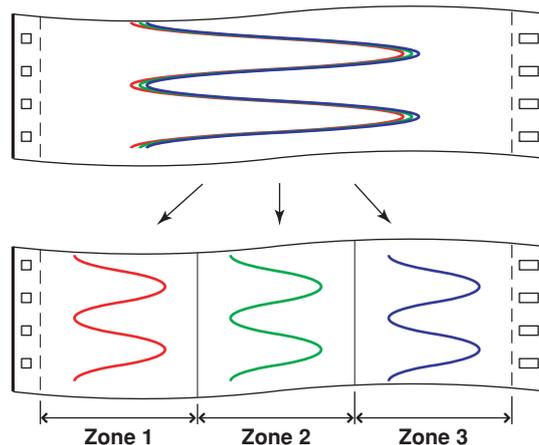
For the procedure to set the functions, see section 1.6, "Function Setup Guide."

Partial Expanded Recording

This function expands a section of the recording range. By default, partial expanded recording is disabled.

Compressed   Expanded
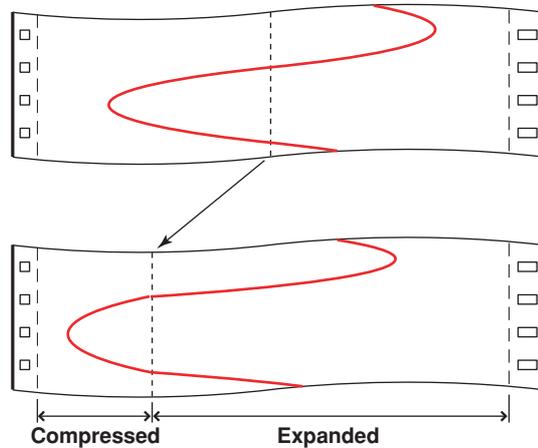
Pen Offset Compensation (Pen Model)

This function compensates for the pen offset (phase difference) along the time axis. On 2-pen, 3-pen, and 4-pen recorders, there are offsets along the time axis (phase difference) between the pens. This offset is corrected when pen offset compensation is used.

Same time
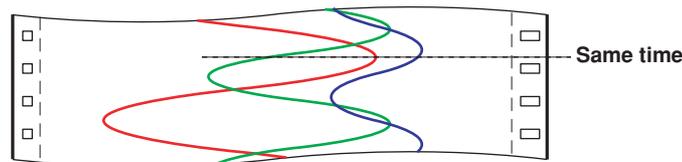
Below is an explanation for the 2-pen model.

The recording of these two pens are offset by an amount of phase P. If pen offset compensation is enabled, the measured values of pen 1 are stored in the memory, and recorded when the chart paper is fed by an amount corresponding to P.

Reference pen (pen 2)

Pen 1

Recorder front panel

Chart paper

P

Chart feeding direction
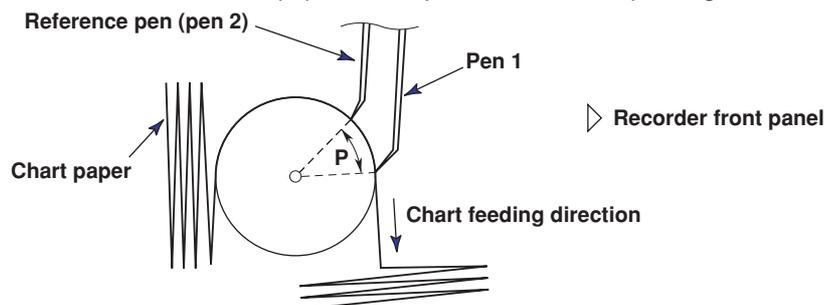
By default, this function is disabled.

For the procedure to set the functions, see section 1.6, "Function Setup Guide."

Printout

The figure below is used to explain the printout contents. The actual printout and font are different from those illustrated in the figure. The printout positions are also slightly different.

Printout Example on the Pen Model
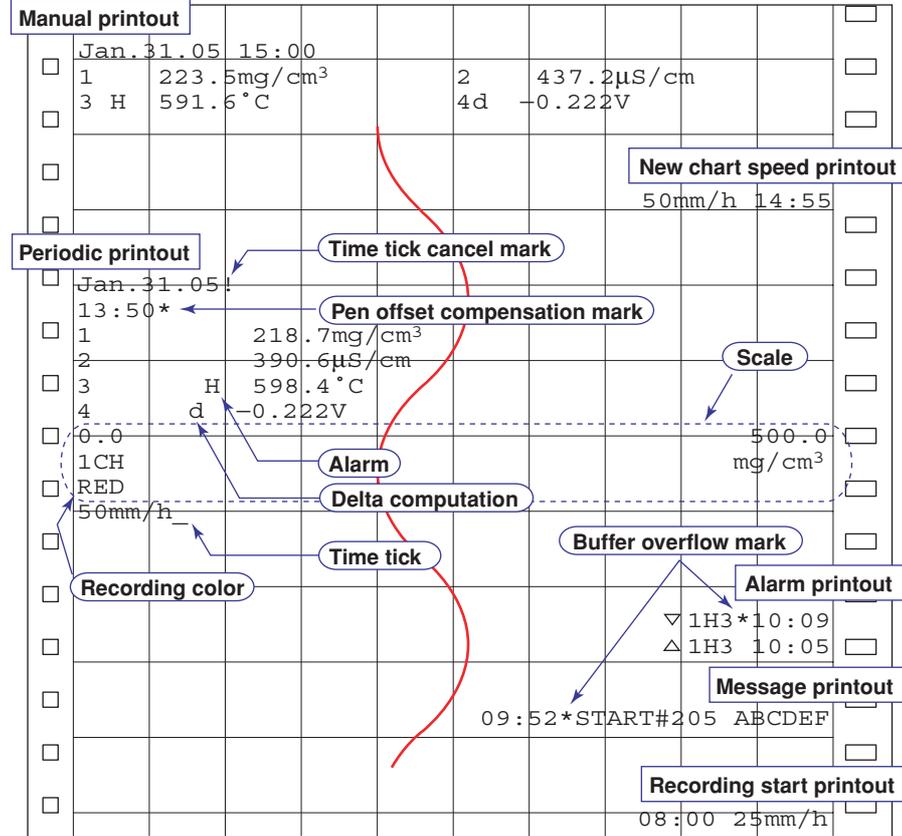
Time tick

The time ticks are marks that indicate the positions of the date/time on the chart paper.

Time tick cancel mark

An exclamation point (!) is printed when the periodic printout time tick was not printed at the correct position.

For the procedure to set the functions, see section 1.6, "Function Setup Guide."

Printout Example on the Dot Model

Manual printout

```
Jan.31.05 16:00
1     223.5mg/cm³          2      437.2µS/cm
3 H   591.6˚C              4d   -0.222V
5   -0.665V                6 L -0.448V
```

New chart speed printout

```
50mm/h 14:55
```

Time tick

Periodic printout

```
Jan.31.05
13:50
1            218.7mg/cm³
2            390.6µS/cm
3         H  598.4˚C
4       d  -0.222V
5         -0.995V
6       L -0.448V
0.0                          500.0
1CH                          mg/cm³
50mm/h
```

Scale

Delta computation

Alarm

Buffer overflow mark

Time tick

Alarm printout

```
∇1H3*10:09
△1H3 10:05
```

Message printout

```
09:52*START#205 ABCDEF
```

Recording start printout

```
08:00 25mm/h
```

Channel printout

Time tick

Channel Printout (Dot Model Only)

Prints the channel No. or tag by the trend recording. The channel No. or tag is printed every approximately 25 mm on the chart paper. The channel printout can be enabled or disabled. By default, the channel printout is enabled.

Printout/Display Format of the Date.

The printout/display format of the date can be selected from the list below.

Selectable Settings	Type	Printout Format Example	Display Format Example	Notes
Ynd	Year/Month/Day	2006/03/31	06 03 31	Default value
ndY_1	Month/Day/Year	03/31/2006	03 31 06	
dnY_1	Day/Month/Year	31/03/2006	31 03 06	
dnY_2	Day.Month.Year	31.03.2006	31 03 06	
ndY_2	Month.Day.Year	Mar.31.2006	03 31 06	

Printout Format of the Time

The printout format of the time can be selected from the list below.

Selectable Settings	Type	Printout Format Example	Notes
Hn	Hour:Minute	10:00	Default value
HnS	Hour:Minute:Second	10:00:00	
ndHn	Month/Day Hour:Minute	03/31 10:00	
ndHnS	Month/Day Hour:Minute:Second	03/31 10:00:00	
Y-S	Year/Month/Day Hour:Minute:Second	2006/03/31 10:00:00	

*1: The year/month/day format varies depending on the printout/display format of the date.

*2: Can be set to the alarm printout, message printout, recording start printout, and new chart speed printout.

For the procedure to set the functions, see section 1.6, "Function Setup Guide."

Periodic Printout

The contents of the periodic printout vary between the pen model and dot model. Values such as the measured values are printed at the specified interval.

The figure below illustrates the printout contents. The font used in the figure differs from that of the actual printout. The printout positions may also differ from those of the actual printout.
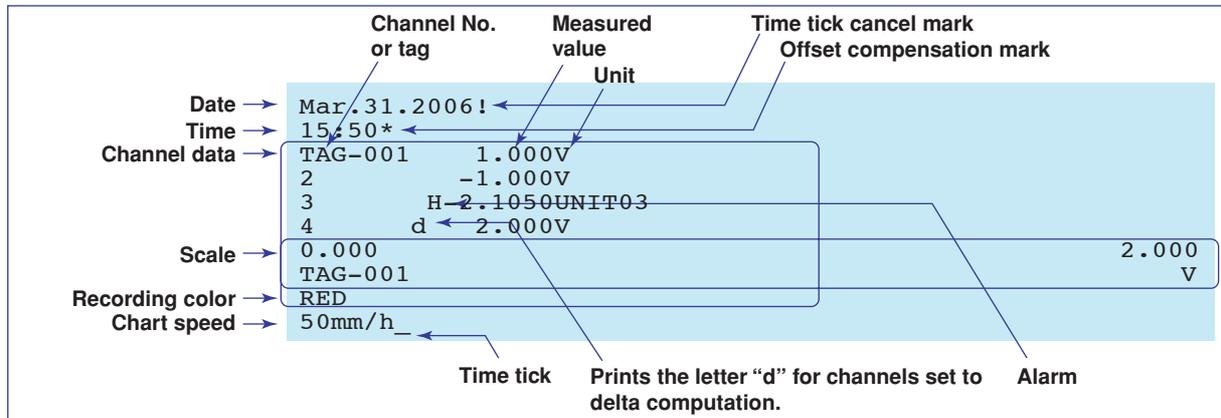
- **Printout Contents**
    - Date/Time: The date/time when the periodic printout was executed.
    - Time ticks: Marks that indicate the first pen position of the date/time on the chart paper. If the time tick is not printed in the correct position, the pen model prints a time tick cancel mark (!), and the dot model does not print the time tick.
    - Offset compensation mark: When pen offset is being executed on the pen model, asterisks (∗) are printed.
    - Channel data: Prints the channel numbers or tags, measured values (instantaneous values), and units.
    - Alarm status: Prints the alarm that is occurring. Prints the letter "d" on channels set to delta computation. If multiple alarms are occurring, the alarm with the highest precedence is printed.
      Alarm printout precedence: (Higher) H, L, h, and l (lower)
    - Scale: Prints the leftmost and rightmost values of the recording span and the channel number or tag for channels that have scale printout specified. The scale is printed for one channel at each periodic printout. The channel whose scale is printed changes in ascending order. The scale of channels that are being zone recorded is printed within the recording range of the zone for 40 mm or greater.
    - Recording color (pen model): Prints the recording colors of channels that have scale printout and recording color printout specified.
    - Chart speed: The chart speed can be printed.
    - For the measured values and alarm status, you can select whether to print them for each channel. For the scale and recording color (pen model), you can select whether to print them.

- **Interval**

  The printout interval can be set by specifying the value or set automatically in sync with the chart speed. Printout is not carried out at the following chart speeds.
  Pen model: 1800 mm/h or higher
  Dot model: 120 mm/h or higher

- **Turning ON/OFF the Periodic Printout**

  Periodic printout can be turn ON/OFF. By default, periodic printout is enabled with the interval synchronized to the chart speed.

For the procedure to set the functions, see section 1.6, "Function Setup Guide."

Alarm Printout

Alarm information is printed when an alarm occurs or releases.

△ 1 H 2 ∗ 1 0 : 0 0

            └── **Time of alarm occurrence/release**

          └── **Indicates that there are alarms that are not printed because the alarm printout buffer is full.**

        └── **Level number**

      └── **Alarm type (H: high limit, L: low limit, h: difference high limit, and l: difference low limit)**

    └── **Channel No. or tag**

  └── **△ : Alarm occurrence, ▽ : Alarm release**
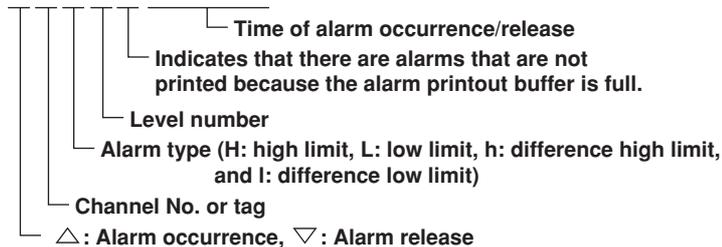
- The print condition can be set to (1) print when alarms occur and release, (2) print only when alarms occur, or (3) do not print.
- Alarms that occur while an alarm printout is in progress are temporarily saved to the buffer memory in a printout-wait condition. Alarms are cleared from the buffer memory when they are printed.
- The number alarms that can be stored in the buffer is 8 and 12 on the pen model and dot model, respectively. Alarms that occur while the buffer is full are not printed. A buffer overflow mark is printed when there are alarms that cannot be printed because the buffer is full.
- The time printout format can be selected.

Manual Printout

Measured values and alarm status can be printed manually using the keys. When manual printout is executed, trend recording stops and restarts when manual printout is complete.

<For the operation procedure, see the *Operation Guide* .>

Message Printout

Preset messages can be printed on the chart paper using the keys. Five messages, each within 16 characters, can be registered in advance.

- If message printout is executed while another message is being printed, the most recent message is temporarily stored to the buffer memory in a printout-wait condition. Messages are cleared from the buffer memory when they are printed.
- The number of messages that can be stored in the buffer is 5. If message printout is executed when the buffer is full, the message is not printed. A buffer overflow mark is printed when there are messages that cannot be printed because the buffer is full.
- The time printout format can be selected.

New Chart Speed Printout

- When the chart speed is changed, the time tick (dot model), the date/time of change, and the new chart speed are printed. An asterisk (∗) shows there are messages that cannot be printed.
- The time printout format can be selected.

Recording Start Printout

When recording is started, the time tick (dot model), the time, and the chart speed can be printed. An asterisk (∗) shows there are messages that cannot be printed.

- The recording start printout can be enabled or disabled. By default, the recording start printout is disabled.
- The time printout format can be selected.

For the procedure to set the functions, see section 1.6, "Function Setup Guide."

Setting Printout

List or setup list can be printed. When setting printout is executed, trend recording stops and restarts when the printout is complete.

List printout contains settings such as the input range and alarm for each channel.

Setup list printout contains settings of basic specifications such as the alarm output relay operation and printout method.

· **Printout Example of List on the Pen Model**
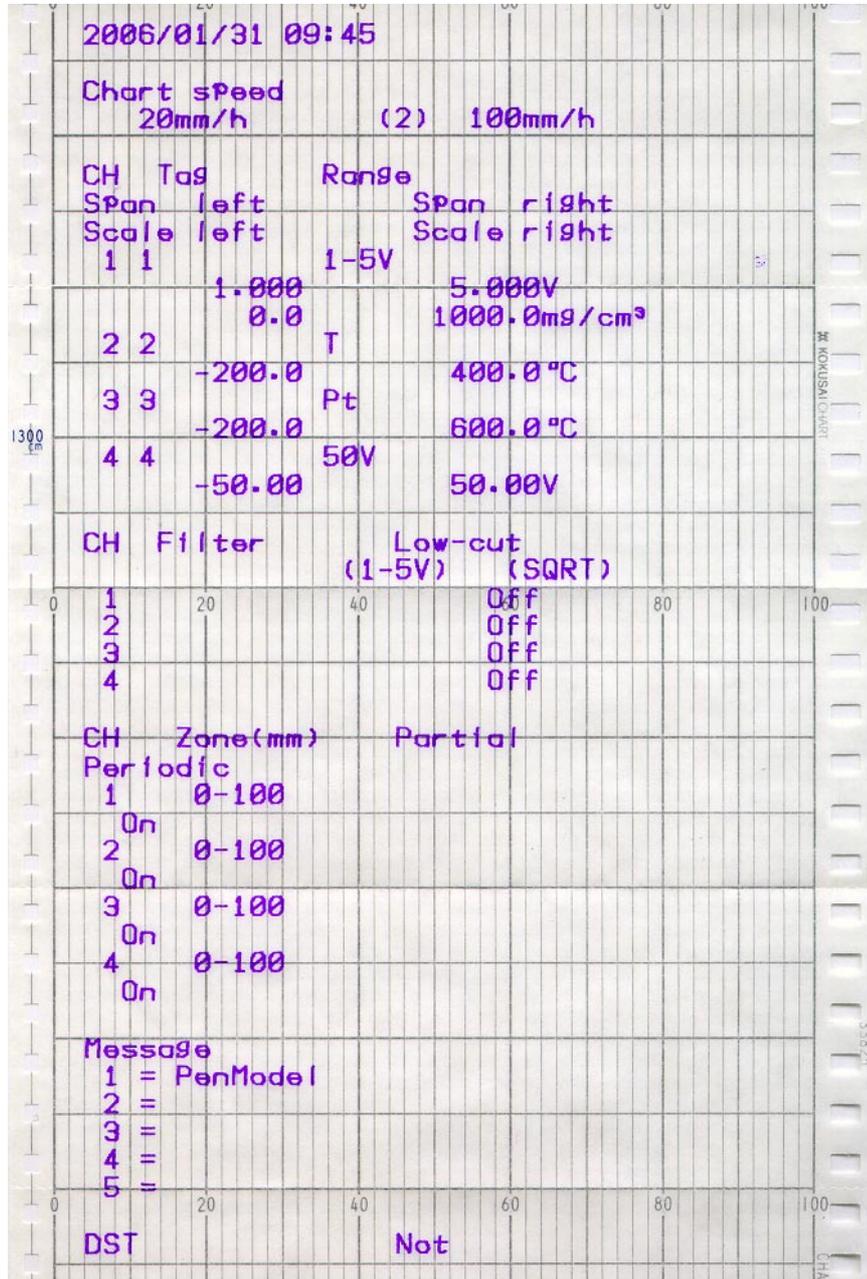
The printout examples may appear differently from the actual printout as a result of functional improvements made on the recorder after this manual was written.

For the procedure to set the functions, see section 1.6, "Function Setup Guide."

- **Printout Example of List on the Dot Model**
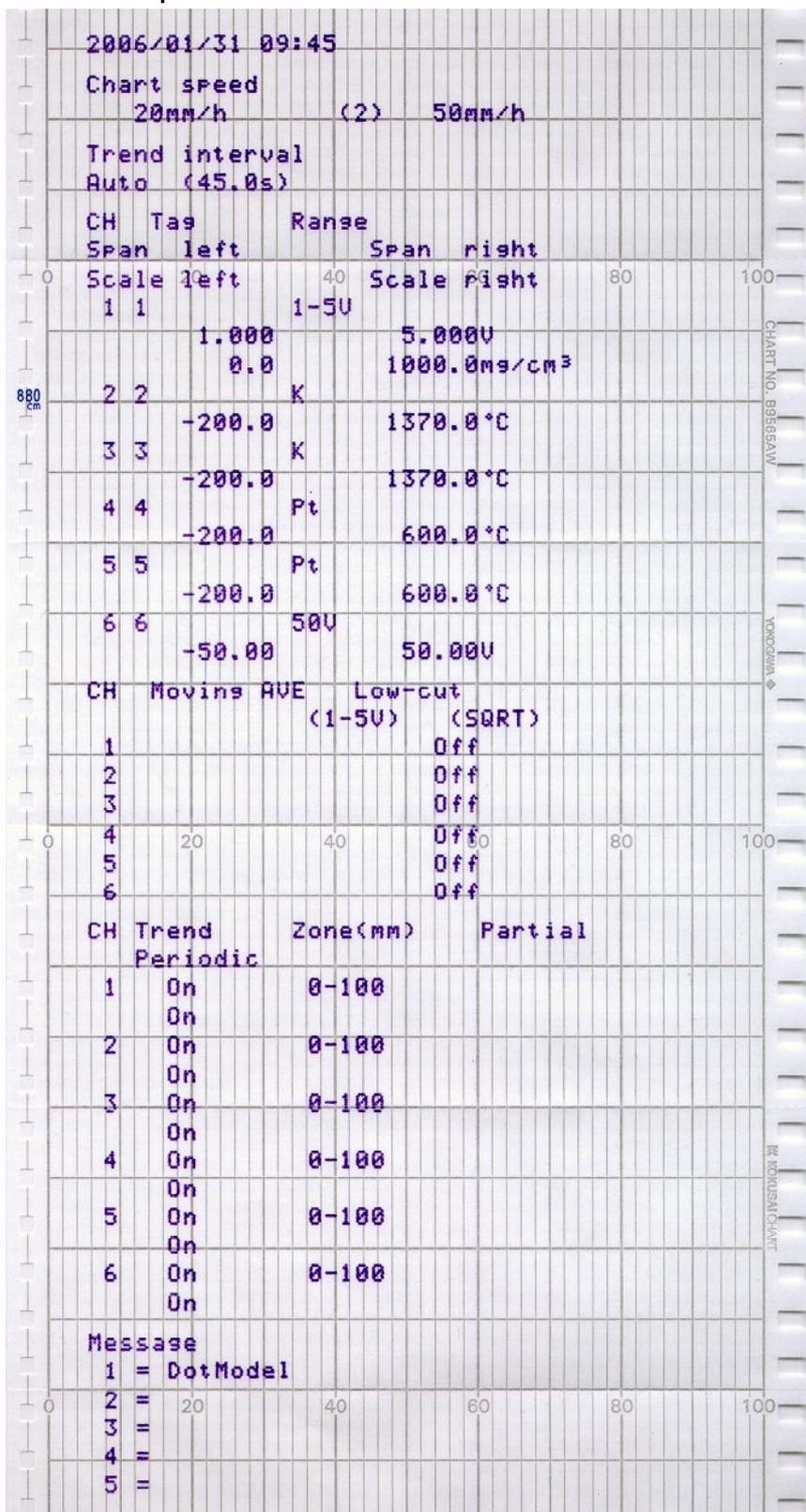
```
2006/01/31 09:45

Chart speed
    20mm/h        (2)    50mm/h

Trend interval
Auto  (45.0s)

CH  Tag         Range
Span  left          Span  right
Scale left       40  Scale right    80    100
 1  1              1-5V
              1.000          5.000V
              0.0          1000.0mg/cm³
 2  2             K
            -200.0          1370.0°C
 3  3             K
            -200.0          1370.0°C
 4  4             Pt
            -200.0           600.0°C
 5  5             Pt
            -200.0           600.0°C
 6  6             50V
            -50.00           50.00V

CH  Moving AVE    Low-cut
              (1-5V)    (SQRT)
 1                        Off
 2                        Off
 3                        Off
 4                        Off
 5                        Off
 6                        Off

CH Trend       Zone(mm)    Partial
   Periodic
 1    On       0-100
      On
 2    On       0-100
      On
 3    On       0-100
      On
 4    On       0-100
      On
 5    On       0-100
      On
 6    On       0-100
      On

Message
 1 = DotModel
 2 =
 3 =
 4 =
 5 =
```

The printout examples may appear differently from the actual printout as a result of functional improvements made on the recorder after this manual was written.

For the procedure to set the functions, see section 1.6, "Function Setup Guide."

1.4 Remote Control Function (/R1 Option)

Specified operations can be carried out by applying remote signals (contact or open collector signals) to the remote control input terminals.

There are five remote control input terminals. An action can be assigned to each terminal.

Assignable Functions

- **Recording start/stop**
  - Remote input signal: Rising edge signifies start; falling edge signifies stop
  - Starts/stops recording.
  - Applying a rising edge signal when recording is already in progress produces no effect. Applying a falling edge signal when recording is stopped produces no effect.

- **Chart Speed Switch**
  - Remote input signal: Level
  - The chart paper is fed at the secondary chart speed while a level signal is applied to the terminal. The secondary chart speed is set in advance.

- **Internal Clock Adjustment**
  - Remote input signal: Trigger
  - The internal clock of the recorder is adjusted to the nearest hour depending on the time when the remote signal is applied.

Time When Signal Is Input	Adjustment
00 min 00 s to 01 min 59 s	Truncates the minutes and seconds. Example: 10 hours 01 min 50 s becomes 10 hours 00 min 00 s.
02 min 00 s to 57 min 59 s	The time is not changed.
58 min 00 s to 59 min 59 s	Rounds up the minutes and seconds. Example: 10 hours 59 min 50 s becomes 11 hours 00 min 00 s.

- **Message 1 Printout to Message 5 Printout**
  - Remote input signal: Trigger

- **Manual Printout**
  - Remote input signal: Trigger

Remote Signal (Edge, Trigger, and Level)

The above actions are carried out on the rising or falling edge of the remote signal (edge), the ON signal lasting at least 250 ms (trigger), or the ON/OFF signal (level).

Rising/Falling edge | Trigger | Level
Rising   Falling
250 ms or more | 250 ms or more | Operates at the secondary chart speed
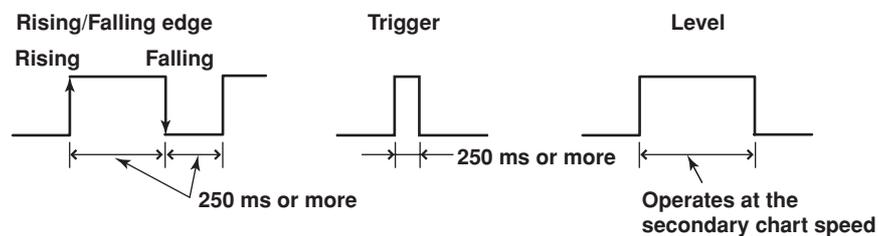
For contact inputs, the remote signal rises when the contact switches from open to closed and falls when the contact switches from closed to open. For open collector signals, the remote signal rises when the collector signal (voltage level of the remote control terminal) goes from high to low and falls when the collector signal goes low to high.

For the procedure to set the functions, see section 1.6, "Function Setup Guide."

1.5   Other Functions

Key Lock

Key lock is a function that prohibits key operations. When key lock is enabled, pressing keys produces no effect. To release the key lock, a password is entered.

Key Lock Items

Each of the following keys can be included or excluded from the key lock function.

Keys that can be locked
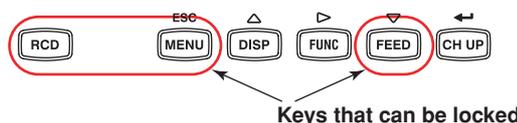
In the case of the FUNC key, each function of the FUNC key can be included or excluded from the key lock function.

FUNC key functions: Manual printout, list printout, setup list printout, message printout, printout buffer clear, pen exchange (pen model), and ribbon cassette exchange (dot model)

Customize Menu

The menu can be customized to display only the menus that you use.
- Display only the items that you use on the FUNC key menu.
- Display only the items that you use on the Setting mode menu.
- Lock Basic Setting mode (use a password to enter the mode).
  The pen position adjustment (pen model) and dot printing position adjustment (dot model) can be set so that they can be used without the password.
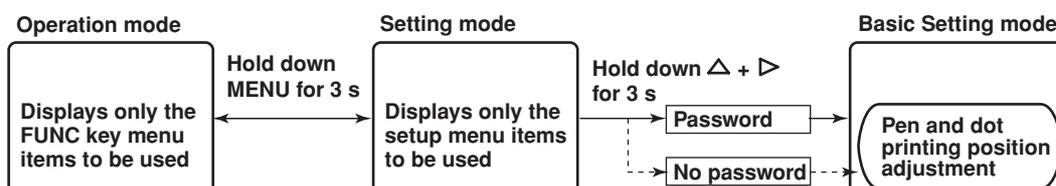
Font

The characters used in the printout can be set to English, Japanese, German, or French. The characters that are available vary depending on the selected font.

English: Alphabet, numbers, and symbols
Japanese: Alphabet, numbers, Katakana, and symbols
German: Alphabet (German), numbers, and symbols
French: Alphabet (French), numbers, and symbols

DST

If the recorder is used in a region that has DST, time can be switched automatically between DST and standard time by setting the date/time when switching from the standard time to DST and the date/time when switching back from DST to standard time. When switching from standard time to DST, the clock is set ahead by 1 hour. When switching back from DST to standard time, the clock is set back by 1 hour.

Temperature Unit

The temperature unit can be set to Celsius or Fahrenheit. The setting applies to all channels.

For the procedure to set the functions, see section 1.6, "Function Setup Guide."

1.6   Function Setup Guide

This section explains the settings necessary to use various functions of the recorder. Read the section corresponding to the function you wish to use.

Note
This section contains all the settings related to each item. If the desired setting is the same as the default value, you do not have to set it.

Item	Description	Reference Section
Date/Time setting	Use **CLOCK** in Setting mode	2.5
DST	Sets the date/time for switching between DST and standard time using **AUX > DST** in Setting mode.	3.12
Setting initialization	Use **INIT** in Basic Setting mode to initialize the settings of Setting mode and Basic Setting mode to their default values.	4.17

Measuring input functions

Item	Description	Reference Section
Input range of each channel	Set **RANGE** in Setting mode.	2.1
1-5V	• Unit Use **UNIT** in setting mode to set the unit after scaling. • Low-cut Use **PERS. > 1-5V** low-cut in Basic Setting mode and select Use or Not. If Use is selected, turn ON/OFF the low-cut function using **RANGE** in Setting mode. If Not is selected, the Low-cut item does not appear in the **RANGE** setting.	2.3 4.15 2.1
Scaling	• Unit Use **UNIT** in setting mode to set the unit after scaling.	2.3
Square Root Computation	• Unit Use **UNIT** in setting mode to set the unit after scaling. • Low-cut Use **PERS. > SQRT** low-cut in Basic Setting mode and select Use or Not. If Use is selected, set the low-cut value using **RANGE** in Setting mode. If Not is selected, the Low-cut item does not appear in the **RANGE** setting.	2.3 4.15 2.1
Bias	Use **PERS. > BIAS** in Basic Setting mode and select Use or Not. If Use is selected, set the bias value that is added to the input using **BIAS** in Setting mode. If Not is selected, the **BIAS** item does not appear.	4.15 3.10
Calibration Correction (/CC1 option)	Use **PERS. > CALIB** in Basic Setting mode to select whether to use the calibration correction function. If Use is selected, use **CALIB** in Basic Setting mode to select revise value or absolute value and set the number of correction points. Use **CALIB** in Setting mode to set the measured values and correction values. If Not is selected, the **CALIB** item of Basic Setting and Setting modes does not appear.	4.15 4.19 3.11
RJC of TC input	Use **RJC** in Basic Setting mode to select whether to use the recorder's RJC function or an external RJC function.	4.4
Burnout detection function of TC input and 1-5V input	Use **B_OUT** in Basic Setting mode to set the burnout detection function for each channel.	4.3
Filter (pen model)	Use **FILTR** in Basic Setting mode and select Use or Not. If Use is selected, set the filter time constant using **AUX > FILTR** in Setting mode. If Not is selected, the **AUX > FILTR** item does not appear.	4.11 3.2
Moving average (dot model)	Use **M_AVE** in Basic Setting mode and select Use or Not. If Use is selected, set the number of samples of moving average using **AUX > M_AVE** in Setting mode. If Not is selected, the **AUX > M_AVE** item does not appear.	4.10 3.3

Item	Description	Reference Section
Integration time of the A/D converter		4.2
	Use **INTG** in Basic Setting mode to set the integration time of the A/D converter.	
Temperature Unit	Select the temperature unit using **TEMP** in Basic Setting mode.	4.23

Alarm functions

Item	Description	Reference Section
Alarms for each channel	Use **ALARM** in Setting mode.	2.2
Set a hysteresis on the alarm occurrence/release value of high limit alarm and low limit alarm		
	Use **ALARM > HYS** in Basic Setting mode to set the hysteresis to be applied to the high limit alarm and low limit alarm of measurement channels.	4.1
Diagnosis output	Use **ALARM > DIAG** in Basic Setting mode to set the function.	4.1
Change the alarm output relay operation		
	If **ALARM > RELAY** in Basic Setting mode set to **"DE_EN"**, alarm output relay is energized during normal operation and de-energized when an alarm occurs.	4.1

Recording functions

Item	Description	Reference Section
Recording interval (dot model)		
	Use **AUX > TREND** in Setting mode to set the recording interval to AUTO or FIX.	3.1
Change the recording color of measurement channels (dot model).		
	Use **COLOR** in Basic Setting mode to set the recording color of measurement channels.	4.5
Turn trend recording ON/OFF (dot model)		
	Use **AUX > PRINT** in Setting mode to turn ON/OFF the trend recording for each measurement channel.	3.6
Chart speed	Use **CHART** in Setting mode to set the chart speed.	2.4
Record by setting recording zone for each channel		
	Use **AUX > ZONE** in Setting mode to set the recording zone for each channel.	3.4
Partial expanded recording	Use **PART** in Basic Setting mode and select Use or Not.	4.12
	If Use is selected, set the display mode using **AUX > PART** in Setting mode.	3.5
	If Not is selected, the **AUX > PART** item does not appear.	
Record by compensating for the pen offset along the time axis (pen model)		
	Use **POC** in Setting mode to turn ON/OFF offset compensation.	4.6
Date format	Use **DATE** in Basic Setting mode to set the printout/display format of the date.	4.14
Periodic printout		

```
Mar.31.2006!
15:50*
 1        1.000V
 2       -1.000V
0.000              2.000
1                      V
RED
50mm/h_
```

Channel number or tag
Measured value
Scale
Recording color (pen model)
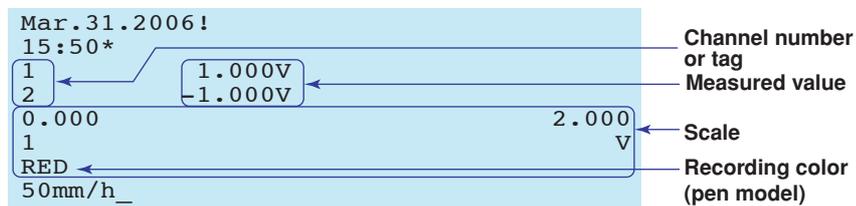
- Printout interval — 4.8
  Use **PER.** in Basic Setting mode to set the periodic printout interval.
- Enable/Disable the periodic printout — 4.8
  Use **PER.** in Basic Setting mode to turn ON/OFF the periodic printout.
- Scale printout and recording color printout (pen model) — 4.7
  Use **PRINT > SCALE** in Basic Setting mode to turn scale printout ON/OFF.
  Use **PRINT > PEN** color in Basic Setting mode to turn pen color printout ON/OFF (pen model).
- Turn ON/OFF periodic printout for each channel — 3.6
  Use **AUX > PRINT** in Setting mode to turn ON/OFF the periodic printout for each measurement channel.

Item	Description	Reference Section
Alarm occurrence/release printout		
	• Turn printout ON/OFF Use **PRINT > ALARM** in Basic Setting mode to select whether to print the alarm occurrence and release, print only the alarm occurrence, or not print.	4.7
	• Time printout format Use **T_PRN > ALARM** in Basic Setting mode to set the time printout format when printing alarm occurrence/release.	4.16
Message printout	• Set the message string Use **AUX > MSG** to set the message string to be printed.	3.8
	• Time printout format Use **T_PRN > MSG** in Basic Setting mode to set the time printout format.	4.16
	• Execute the message printout Use **FUNC** key **> MSG** in Operation mode to execute the message printout.	Operation Guide Printing a Message
New chart speed printout	• Turn printout ON/OFF Use **PRINT > SPEED** in Basic Setting mode to set whether to print the new chart speed when the chart speed is changed.	4.7
	• Time printout format Use **T_PRN > SPEED** in Basic Setting mode to set the time printout format.	4.16
Recording Start Printout	• Turn printout ON/OFF Use **PRINT > RCD** in Basic Setting mode to enable/disable the recording start printout.	4.7
	• Time printout format Use **T_PRN > RCD** in Basic Setting mode to set the time printout format.	4.16
Channel/tag selection	• Use **PRINT > TAG. CH** in Basic Setting mode to select whether to use channel numbers or tags in printouts.	4.7
	• Use **AUX > TAG** in Setting mode to set the tag name.	3.7

Display functions

Item	Description	Reference Section
Date format	Same as the Date format in "Recording functions."	4.14

Other functions

Item	Description	Reference Section
Key lock	• Target keys and password Use **LOCK** in Basic Setting mode to set the keys to be key-locked and the password.	4.9
	• Enable the key lock Use **FUNC** key > **LOCK** in Operation mode to turn key lock ON/OFF.	Operation Guide Activating/Releasing the Key Lock
Customize menu	• FUNC key target menu selection Use **S.MENU > FUNC** in Basic Setting mode to set the menus you wish to hide to OFF.	4.21
	• Setting mode target menu selection Use **S.MENU > SET** in Basic Setting mode to set the menus you wish to hide to OFF.	4.20
	• Customize menu execution Use **CUST.M** in Basic Setting mode to select whether to use the customized menu.	4.22
Font	Use **FONT** in Basic Setting mode to set the characters used in the recording.	4.13

Remote control function (/R1 option)

Item	Description	Reference Section
Remote control function	• Assign functions to the remote control input terminals Use **REM** in Basic Setting mode to set the function to be assigned to the remote control input terminal.	4.18
	• Secondary chart speed If "chart speed switching" is assigned, use **AUX > SPD_2** in Setting mode to set the secondary chart speed.	3.9

2.1   Setting the Input Range

Input range can be set for each measurement channel. Set unused channels to Skip.
If you change the input range, set the bias, measured and correction values (/CC1 option), alarm, and partial expanded recording again.

Procedure

TC, RTD, and DC Voltage

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
   To change the polarity, press the △ or ▽ key when the leftmost digit of the value is blinking.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

3. Press the ↵ key to set other channels.
   If you are done, press the **ESC** key.
4. Hold down the MENU key for 3 seconds to return to Operation mode.

Description

- **Selectable Range of Input Range, Span Left, and Span Right**
  The input range, span left, and span right can be set in the range shown below. Span left and span right cannot be set to the same value.

  DC voltage (ᗡoᒪᤓ)

Range Type	Selectable Span Range
20 mV(2ᗡᗠᗠ)	–20.00 to 20.00 mV
60 mV(6ᗡᗠᗠ)	–60.00 to 60.00 mV
200 mV(2ᗡᗡᗠᗠ)	–200.0 to 200.0 mV
2 V(2ᗠ)	–2.000 to 2.000 V
6 V(6ᗠ)	–6.000 to 6.000 V
20 V(2ᗡᗠ)	–20.00 to 20.00 V
50 V(5ᗡᗠ)	–50.00 to 50.00 V

  Thermocouple (ᒼC)

Range Type	Selectable Span Range (°C)	Selectable Span Range (°F)
R (ᖇ)	0.0 to 1760.0°C	32 to 3200°F
S (ᔡ)	0.0 to 1760.0°C	32 to 3200°F
B (ᖯ)	0.0 to 1820.0°C	32 to 3308°F
K (ᖽ)	–200.0 to 1370.0°C	–328 to 2498°F
E (ᗱ)	–200.0 to 800.0°C	–328.0 to 1472.0°F
J (ᒍ)	–200.0 to 1100.0°C	–328.0 to 2012.0°F
T (ᒼ)	–200.0 to 400.0°C	–328.0 to 752.0°F
N (ᐢ)	0.0 to 1300.0°C	32 to 2372°F
W (ᖴ)	0.0 to 2315.0°C	32 to 4199°F
L (ᒪ)	–200.0 to 900.0°C	–328.0 to 1652.0°F
U (ᒎ)	–200.0 to 400.0°C	–328.0 to 752.0°F
WRe (ᖴᖇᗱ)	0.0 to 2400.0°C	32 to 4352°F

  RTD (ᖇᒼᖑ)

Range Type	Selectable Span Range (°C)	Selectable Span Range (°F)
PT (Pt100) (Pᒼ)	–200.0 to 600.0°C	–328.0 to 1112.0°F
JPT(JPt100) (ᒍPᒼ)	–200.0 to 550.0°C	–328.0 to 1022.0°F

  /N1 option

Selectable Settings		Input Type
Cu1	ᗞᒎᎱ	Cu10 (GE)
Cu2	ᗞᒎᖰ	Cu10 (L&N)
Cu3	ᗞᒎᖰ	Cu10 (WEED)
Cu4	ᗞᒎᖰ	Cu10 (BAILEY)
Cu5	ᗞᒎᔡ	Cu10: a = 0.00392 at 20°C
Cu6	ᗞᒎᖲ	Cu10: a = 0.00393 at 20°C
Cu25	ᗞᒎᖰᔡ	Cu25*: a = 0.00425 at 0°C

  /N3 option

Selectable Setting		Input Type	Notes
PR	Pᖇ	PR40-20	Thermocouple
PLATI	PᒪᖰᒼᎱ	PLATINEL	
NiMo	ᐢᎱᐢo	NiNiMo	
W/WRe	ᖴ ᖴᖇᗱ	W/WRe26	
N2	ᐢᖰ	Type N (AWG14)	
Kp	ᖽP	Kp vs Au7Fe	
Pt4	Pᒼᖰ	Pt25	RTD
Pt3	Pᒼᖰ	Pt50	
Ni1	ᐢᎱᎱ	Ni100 (SAMA)	
Ni2	ᐢᎱᖰ	Ni100 (DIN)	
Ni3	ᐢᎱᖰ	Ni120	
J263	ᒍᖰᖲᖰ	J263*B	
Cu8	ᗞᒎᖰ	Cu53	
Cu9	ᗞᒎᖰ	Cu100: a = 0.00425 at 0°C	

1-5V Input

r A n G E (RANGE)   Select "RANGE."

C H 1 (CH1)   Select the channel number.

1   1 - 5 H (1–5V)   Select "1-5V."

Channel number

1 ⊢   0 1.0 0 0   Set the left span value.

Span left

1 ⊣   0 5.0 0 0   Set the right span value.

Span right

1 ⊢   -0 0.0 0   Select the left scale value and the decimal place.

Scale left   Decimal point

1 ⊐   1 0 0.0 0   Select the right scale value.

Scale right

L C   o n (ON)   **(When low-cut is enabled)**
Select whether to use low-cut.

Low-cut

ESC

o H (OK)   The settings are activated.

Description

· **Span Left and Span Right**

Selectable span left range: 0.8 to 1.2 V

Selectable span right range: 4.8 to 5.2 V

· **Scale Left and Scale Right**

Selectable range (mantissa): –19999 to 30000

Decimal place: XXXXX, XXXX.X, XXX.XX, XX.XXX, X.XXXX

To set the decimal place, press the △ or ▽ key while the ⊢ of the setup item of scale left is blinking.

Make sure that scale left is less than scale right.

· **Low-Cut**

ON (o n):   Cuts values less than or equal to 0% of the recording span (sets such values to 0% (scale left value)).

OFF (o F F):   Does not apply the low-cut function.

<Related Topics>

Enabling the low-cut function: Section 4.15

Linear Scaling

	r	A	n	G E	Select "RANGE."

(RANGE)

Select the channel number.

(CH1)

Select "SCALE."

(SCALE)
Channel number

Select the input type.

(VOLT)

Select the range.

(2V)

Set the left span value.

Span left

Set the right span value.

Span right

Select the left scale value and the decimal place.

Scale left   Decimal point

Select the right scale value.

Scale right

ESC

The settings are activated.

(OK)
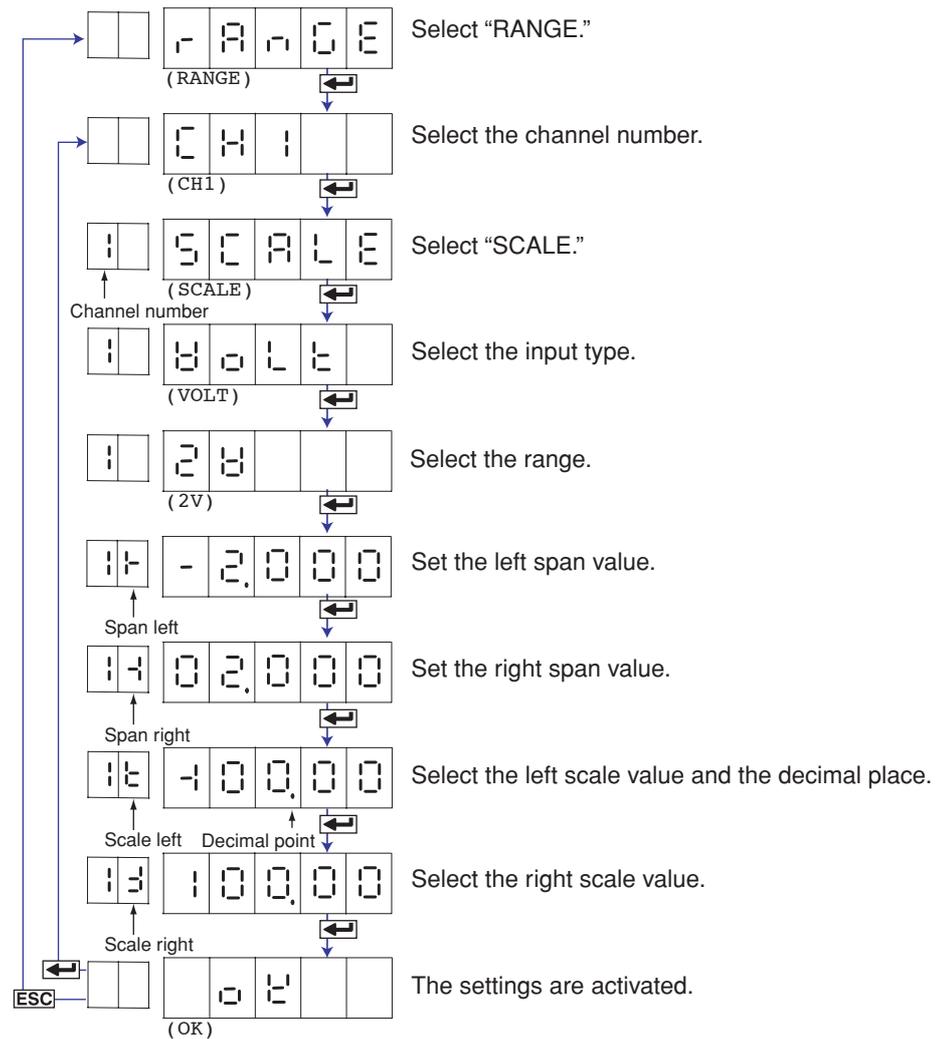
Description

· **Scale Left and Scale Right**

Selectable range (mantissa):   −19999 to 30000

Decimal place: XXXXX, XXXX.X, XXX.XX, XX.XXX, X.XXXX

To set the decimal place, press the △ or ▽ key while the ᴸᵗ of the setup item of scale left is blinking.

2

Delta Computation

Display	Instruction
r A n G E (RANGE) ⏎	Select "RANGE."
C H 2 (CH2) ⏎	Select the channel number.
2 d E L t A (DELTA) ⏎ *Channel number*	Select "DELTA."
2 C H 1 (CH1) ⏎	Select the reference channel.
2L − 2.000 ⏎ *Span left*	Set the left span value.
2⅃ 02.000 ⏎ *Span right*	Set the right span value.
⏎ ESC o t (OK)	The settings are activated.

Description

· **Reference Channel**

The reference channel must be a channel that is smaller in channel number than the channel being set.

· **Span Left and Span Right**

The range type is the same as the reference channel. The span left and span right can be set in the range shown below. Span left and span right cannot be set to the same value.

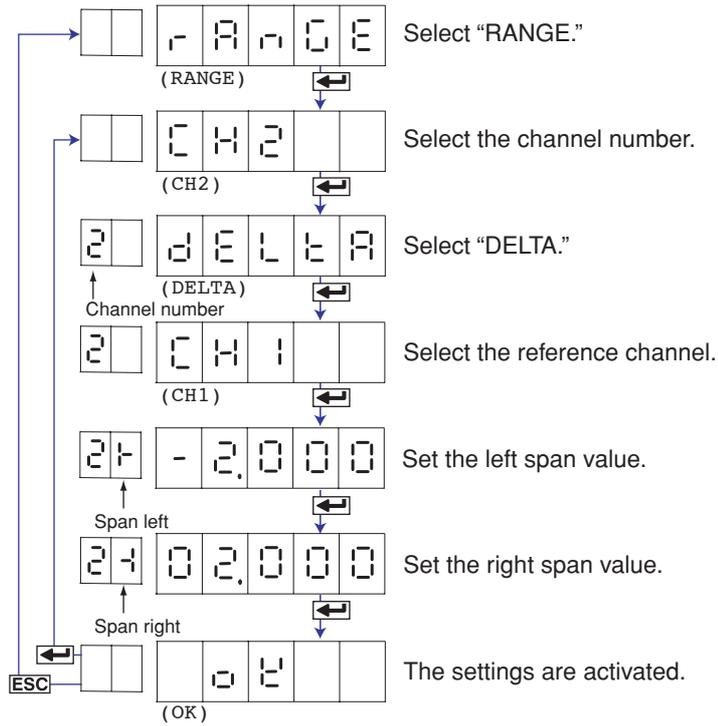| Input Type	Range Type	Selectable Span Range (°C)	Selectable Span Range (°F)
DC voltage (Volt)	20 mV (20mV)	−20.00 to 20.00 mV	
	60 mV (60mV)	−60.00 to 60.00 mV	
	200 mV (200mV)	−200.0 to 200.0 mV	
	2 V (2V)	−2.000 to 2.000 V	
	6 V (6V)	−6.000 to 6.000 V	
	20 V (20V)	−20.00 to 20.00 V	
	50 V (50V)	−50.00 to 50.00 V	
Thermocouple (tC)	R (r)	−1760.0 to 1760.0°C	−3168 to 3168°F
	S (S)	−1760.0 to 1760.0°C	−3168 to 3168°F
	B (b)	−1820.0 to 1820.0°C	−3276 to 3276°F
	K (K)	−1570.0 to 1570.0°C	−2826 to 2826°F
	E (E)	−1000.0 to 1000.0°C	−1800 to 1800°F
	J (J)	−1300.0 to 1300.0°C	−1999.9 to 2340.0°F
	T (t)	−600.0 to 600.0°C	−1080.0 to 1080.0°F
	N (n)	−1300.0 to 1300.0°C	−2340 to 2340°F
	W (W)	−1999.9 to 2315.0°C	−4167 to 4167°F
	L (L)	−1100.0 to 1100.0°C	−1980 to 1980°F
	U (U)	−600.0 to 600.0°C	−1080.0 to 1080.0°F
	WRe (Wre)	−1999.9 to 2400.0°C	−4320 to 4320°F
RTD (rtd)	PT(Pt100) (Pt)	−800.0 to 800.0°C	−1440.0 to 1440.0°F
	JPT(JPt100) (JPt)	−750.0 to 750.0°C	−1350.0 to 1350.0°F
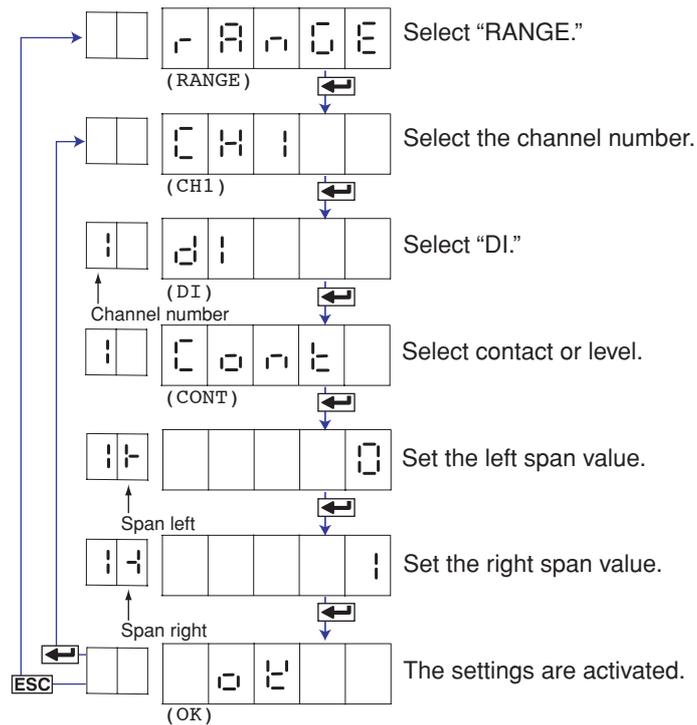
ON/OFF Input

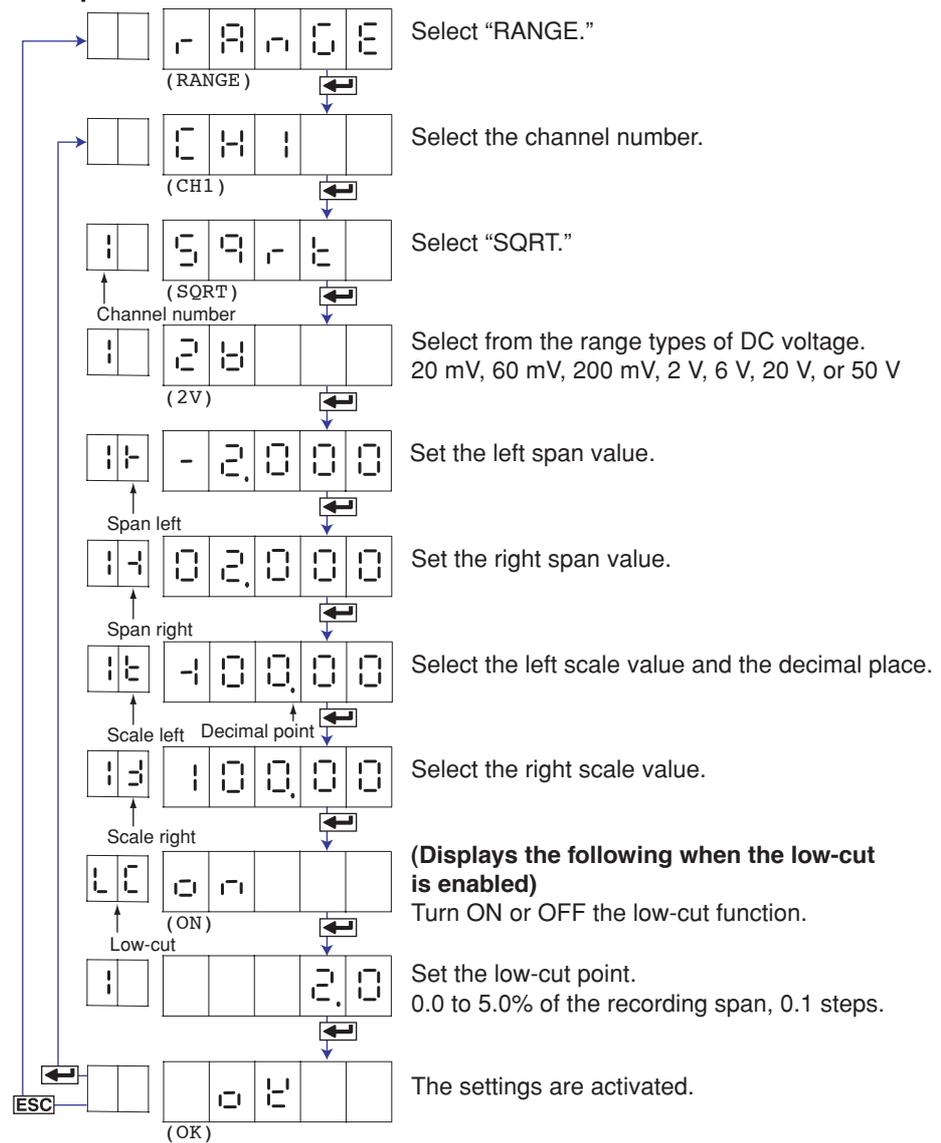|		
⌐ A ⌐ ☐ E (RANGE) ↵	Select "RANGE."
C H 1 (CH1) ↵	Select the channel number.
d 1 (DI) ↵ Channel number	Select "DI."
C o ⌐ t (CONT) ↵	Select contact or level.
☐ Span left ↵	Set the left span value.
1 Span right ↵	Set the right span value.
o U (OK) ESC ↵	The settings are activated.

Description

- **Selectable Range of Input Range, Span Left, and Span Right**
  The input range, span left, and span right can be set in the range shown below. Span left and span right cannot be set to the same value.

Range Type	Selectable Span Values
Level (LEVEL)	0: Less than 2.4 V, 1: 2.4 V or higher, within ±6 V
Contact (Cont)	0: Open, 1: Closed

Square Root Computation

Display	Description
r A n G E (RANGE)	Select "RANGE."
C H 1 (CH1)	Select the channel number.
1 S q r t (SQRT) — Channel number	Select "SQRT."
1 2 U (2V)	Select from the range types of DC voltage. 20 mV, 60 mV, 200 mV, 2 V, 6 V, 20 V, or 50 V
1 L – 2.000 — Span left	Set the left span value.
1 H 02.000 — Span right	Set the right span value.
1 L –100.00 — Scale left, Decimal point	Select the left scale value and the decimal place.
1 J 100.00 — Scale right	Select the right scale value.
L C on (ON) — Low-cut	**(Displays the following when the low-cut is enabled)** Turn ON or OFF the low-cut function.
1 2.0	Set the low-cut point. 0.0 to 5.0% of the recording span, 0.1 steps.
ESC — o k (OK)	The settings are activated.

Description

- **Input Type on Which Square Root Computation Can Be Performed**
  Square root computation can be performed when set to DC voltage input.
- **Span Left and Span Right**
  Same as the selectable span range of the DC voltage range.
  Make sure that span left is less than span right.
- **Scale Left and Scale Right**
  Selectable range (mantissa): –19999 to 30000
  Decimal place: XXXXX, XXXX.X, XXX.XX, XX.XXX, X.XXXX
  To set the decimal place, press the △ or ▽ key while the ⌐ of the setup item of scale left is blinking.
  Make sure that scale left is less than scale right.
- **Low-Cut and Low-Cut Point**
  If low-cut is set to ON, set the low-cut point.
  Selectable range of the low-cut point: 0.0 to 5.0% of the recording span
  Values below the low-cut point is set to 0% of the recording span (scale left value).

<Related Topics>

Enabling the low-cut function: Section 4.15

Skip (Unused Channels)

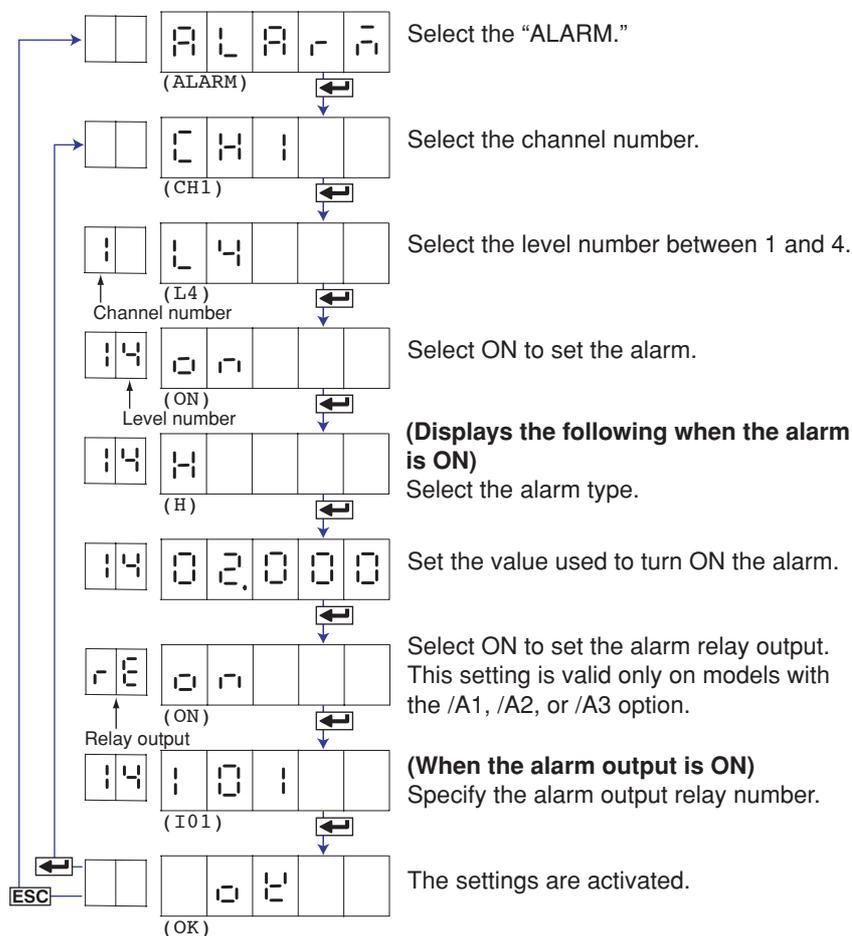|		
r A n G E		Select "RANGE."
(RANGE)	⏎	
C H 1		Select the channel number.
(CH1)	⏎	
1 S k I P		Select "SKIP."
(SKIP)	⏎	
Channel number		
⏎ o k		The settings are activated.
ESC (OK)		
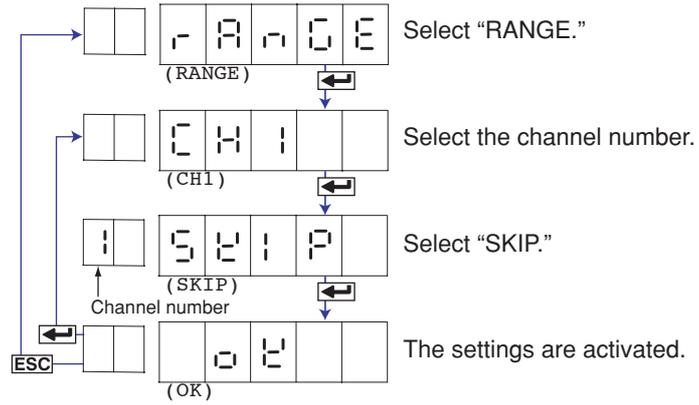
Note

Do not use channels set to skip as a reference channel of delta computations.

2.2   Setting the Alarm

An alarm can be set for each channel.
If you change the input range, set the alarm again.

Procedure

1.   Hold down the MENU key for 3 seconds to enter Setting mode.
2.   Carry out the procedure shown in the figure below.
      Press the △ or ▽ key to select the value.
      For the procedure on how to enter values or characters, see page 18 in the
      Operation Guide.
      To change the polarity, press the △ or ▽ key when the leftmost digit of the
      value is blinking.
      If you press the **ESC** key, the operation is cancelled, and the display returns to a
      higher level menu.

(ALARM)	Select the "ALARM."
(CH1)	Select the channel number.
(L4) Channel number	Select the level number between 1 and 4.
(ON) Level number	Select ON to set the alarm.
(H)	**(Displays the following when the alarm is ON)** Select the alarm type.
02.000	Set the value used to turn ON the alarm.
(ON) Relay output	Select ON to set the alarm relay output. This setting is valid only on models with the /A1, /A2, or /A3 option.
(I01)	**(When the alarm output is ON)** Specify the alarm output relay number.
(OK) ESC	The settings are activated.

3.   Press the ↵ key to set other channels.
      If you are done, press the **ESC** key.
4.   Hold down the MENU key for 3 seconds to return to Operation mode.

Explanation

Alarm Type

Symbol	Name	Notes
H (⌐¦)	High limit alarm	
L (⌐╵)	Low limit alarm	
h (⌐╷)	Difference high limit alarm	Can be specified on channels set to delta computation.
l (⌐╷)	Difference low limit alarm	Can be specified on channels set to delta computation.

Note

On channels set to delta computation, alarms can be detected on the values illustrated in the figure below.

Alarm on a channel set to delta computation
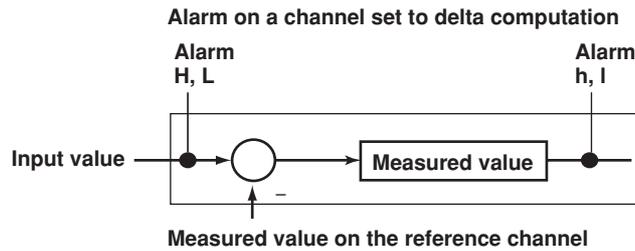
Alarm Value

- **High Limit Alarm/Low Limit Alarm**

  The following values can be specified.
  - For DC voltage, thermocouple, or RTD:

    Values within the measurable range in the input range (example: –2.000 to 2.000 V for the 2 V input range).
  - For ON/OFF input (DI): 0 or 1.
  - For linear scaling (1-5V, scaling, and square root):

    A value within –5 to 105% of the scaling span and within the range of –19999 to 30000 (excluding the decimal point).

- **Difference High Limit Alarm/Difference Low Limit Alarm**

  Values in the measurable range can be specified.Measurable range refers to "Selectable Span Range" in the table on page 2-5.

Relay No.

The selectable relay numbers are listed below.

I01 and I02 on the /A1 option

I01, I02, I03, and I04 on the /A2 option

I01, I02, I03, I04, I05, and I06 on the /A3 option

<Related Topics>

Setting the auxiliary alarm function: Section 4.1

2.3   Setting the Unit on Linearly Scaled Channels

Units can be assigned on channels whose input range is set to Scale, 1-5V, or SQRT.The assigned unit is added when printing to the chart paper or during data transmission.

Procedure

1. Hold down the [MENU] key for 3 seconds to enter Setting mode.
2. Carry out the procedure shown in the figure below.
    Press the △ or ▽ key to select the value.
    For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
    If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.
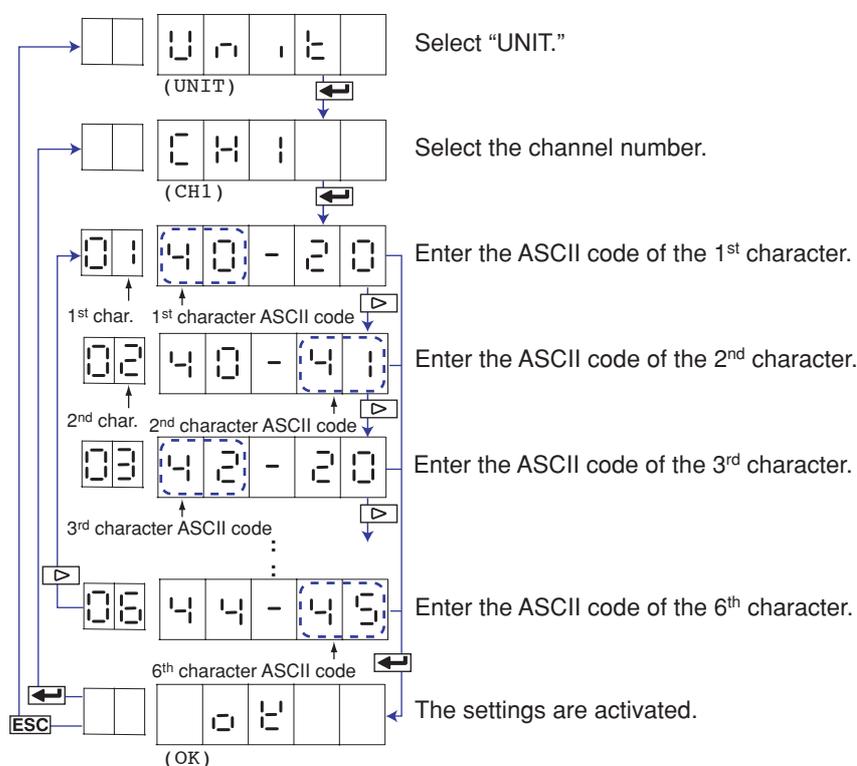
3. Press the ← key to set other channels.
    If you are done, press the **ESC** key.
4. Hold down the [MENU] key for 3 seconds to return to Operation mode.

Explanation

Characters That Can Be Used for Units
A unit is set using up to six characters.
The available characters are as follows:
   Alphabet, numbers, symbols (%, #, °, @, +, −, ∗, /, (,), μ, Ω, ^{2}, ^{3}, .), and space

2.4 Changing the Chart Speed

The chart speed can be changed.

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

	CHArt	Select the "CHART."
	(CHART) ⏎	
	1500	Select the chart speed.
	⏎	
ESC	oy	The settings are activated.
	(OK)	
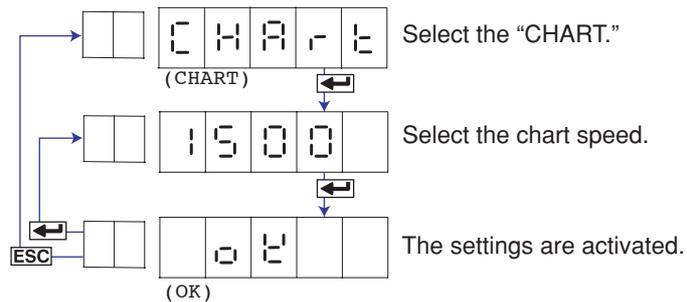
3. If you are done, press the **ESC** key.
4. Hold down the MENU key for 3 seconds to return to Operation mode.

Chart Speed
- Pen model: Select from the 40 settings shown below.
- Dot model: Select from the 28 settings in the thick frame shown below.

Chart speed (the chart speed of the dot model is inside the thick frame)   (Unit: mm/h)

10	15	20	25	30	40	50	60	75	80
90	100	120	150	160	180	200	240	300	360
375	450	600	720	750	900	1200	1500	1800	2400
3000	3600	4500	4800	5400	6000	7200	9000	10800	12000

<Related Topics>
Disabling the new chart speed printout: Section 4.7

2.5   Setting the Date/Time

The date/time can be set.

Procedure

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Carry out the procedure shown in the figure below.
    Press the △ or ▽ key to select the value.
    For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
    If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

3. If you are done, press the **ESC** key.
4. Hold down the MENU key for 3 seconds to return to Operation mode.

Explanation

Date/Time
Set the lower two digits of the year.
Values in the range 80 and 99 correspond to 1980 to 1999.

Note

When setting the date/time, the year, month, day, hour, minute, and second are displayed in the order shown above regardless of the printout/display format of the date (see section 4.14).

<Related Topics>
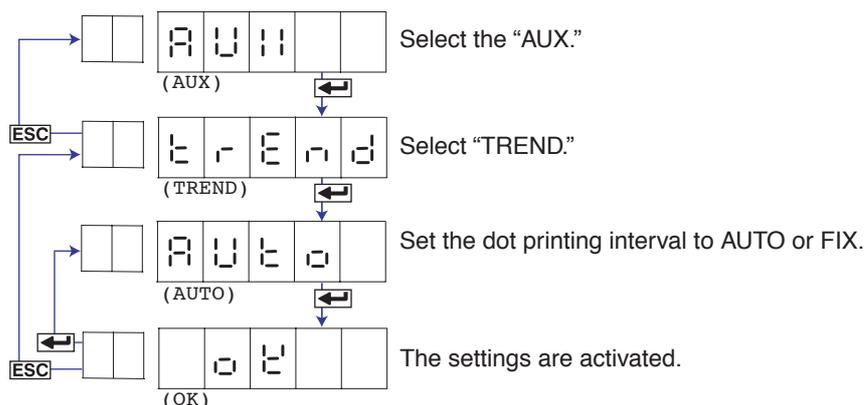Changing the printout/display format of the date: Section 4.14
Changing the printout format of the time: Section 4.16

3.1   Setting the Trend Recording Interval (Dot Model)

The trend recording interval (dot printing interval) on the dot model can be set.

Procedure

1.   Hold down the [MENU] key for 3 seconds to enter Setting mode.
2.   Carry out the procedure shown in the figure below.
      Press the △ or ▽ key to select the value.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

(AUX)   Select the "AUX."

(TREND)   Select "TREND."

(AUTO)   Set the dot printing interval to AUTO or FIX.

(OK)   The settings are activated.

3.   If you are done, press the **ESC** key.
4.   Hold down the [MENU] key for 3 seconds to return to Operation mode.

Explanation

Trend Recording Interval

AUTO (ﾁﾘﾄﾛ):   The trend recording interval is set according to the chart speed so that the dots do not overlap.

FIX (ﾌﾞﾊ):   The trend recording interval is fixed to 10 s/6 dots.

When set to AUTO   **When set to FIX**

Dot
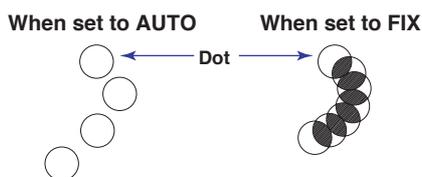
Recording Intervals When AUTO Is Selected

Chart speed	Integration Time Set to 50Hz/60Hz/AUTO	Integration Time Set to 100 ms
10 mm/h	90 s	90 s
15 mm/h	60 s	60 s
20 mm/h	45 s	45 s
25 mm/h	36 s	35 s
30 mm/h	30 s	30 s
40 mm/h	22 s	22.5 s
50 mm/h	18 s	17.5 s
60 mm/h	15 s	15 s
75 mm/h	12 s	10 s
80 mm/h	11 s	10 s
90 mm/h or faster	10 s	10 s

3.2 Setting the Filter (Pen Model)

A filter can be set on the measurement channels on the pen model.

1. Hold down the [MENU] key for 3 seconds to enter Setting mode.
2. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.
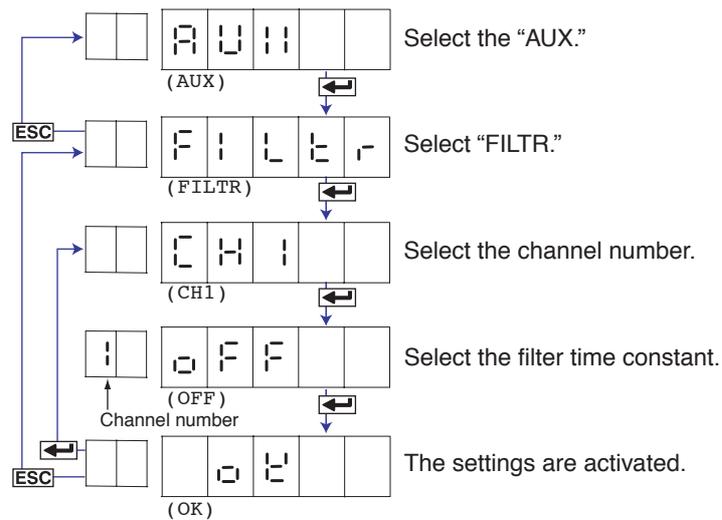
3. Press the ↵ key to set other channels.
   If you are done, press the **ESC** key.
4. Hold down the [MENU] key for 3 seconds to return to Operation mode.

Explanation

Filter Time Constant
The time constant is selectable from 2 s, 5 s, and 10 s. Select OFF when not using the filter.

<Related Topics>
Enabling the filter function: Section 4.11

3.3　Setting the Moving Average (Dot Model)

The moving average function can be set on the measurement channels on the dot model.

Procedure

1. Hold down the [MENU] key for 3 seconds to enter Setting mode.
2. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.
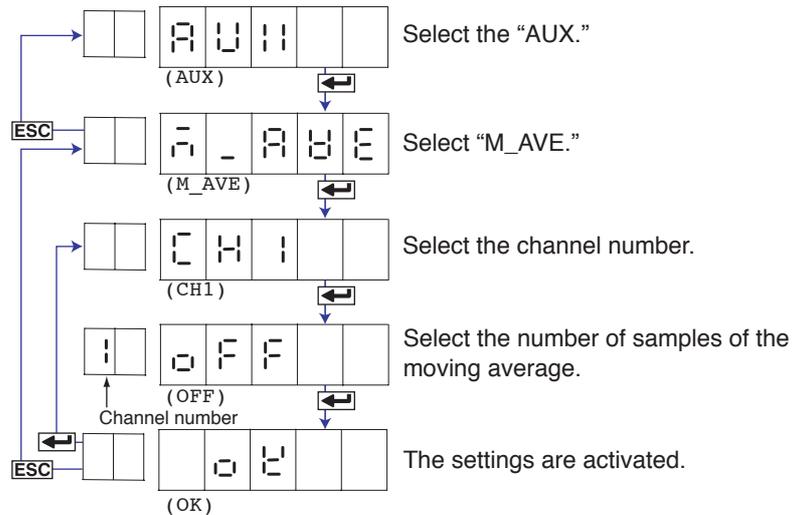
3. Press the ← key to set other channels.
   If you are done, press the **ESC** key.
4. Hold down the [MENU] key for 3 seconds to return to Operation mode.

Explanation

Number of Samples of Moving Average
The number of samples can be set to an integer between 2 and 16. Select OFF when not using the moving average function.

<Related Topics>
Enabling the moving average: Section 4.10

3.4 Setting Recording Zones for Each Channel (Zone Recording)

A recording zone can be set for each measurement channel.

1. Hold down the [MENU] key for 3 seconds to enter Setting mode.
2. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.
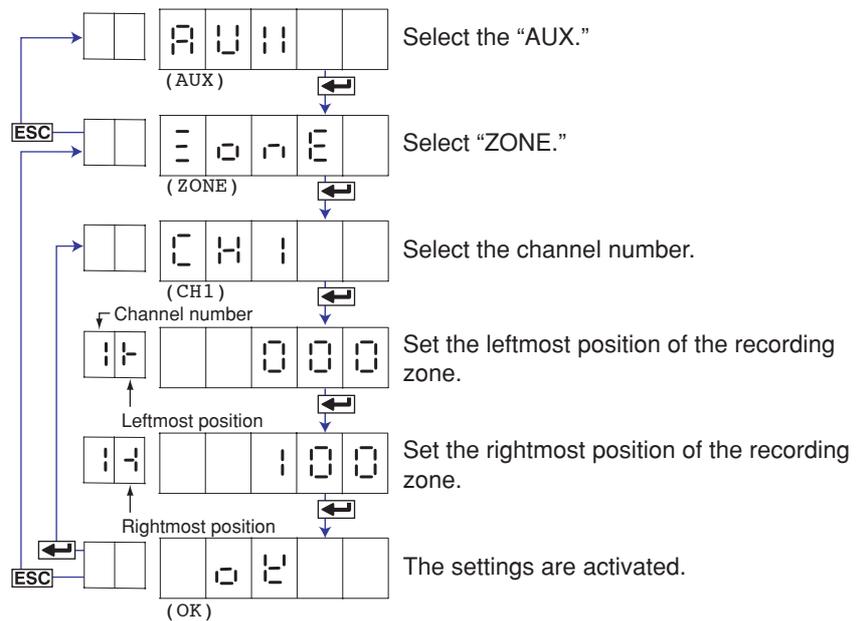
3. Press the ↵ key to set other channels.
   If you are done, press the **ESC** key.
4. Hold down the [MENU] key for 3 seconds to return to Operation mode.

Recording Zone
The recording zone can be set in the following range.
Leftmost position: 0 mm to 95 mm
Rightmost position: 5 mm to 100 mm
Set a larger value for the rightmost position than the leftmost position.
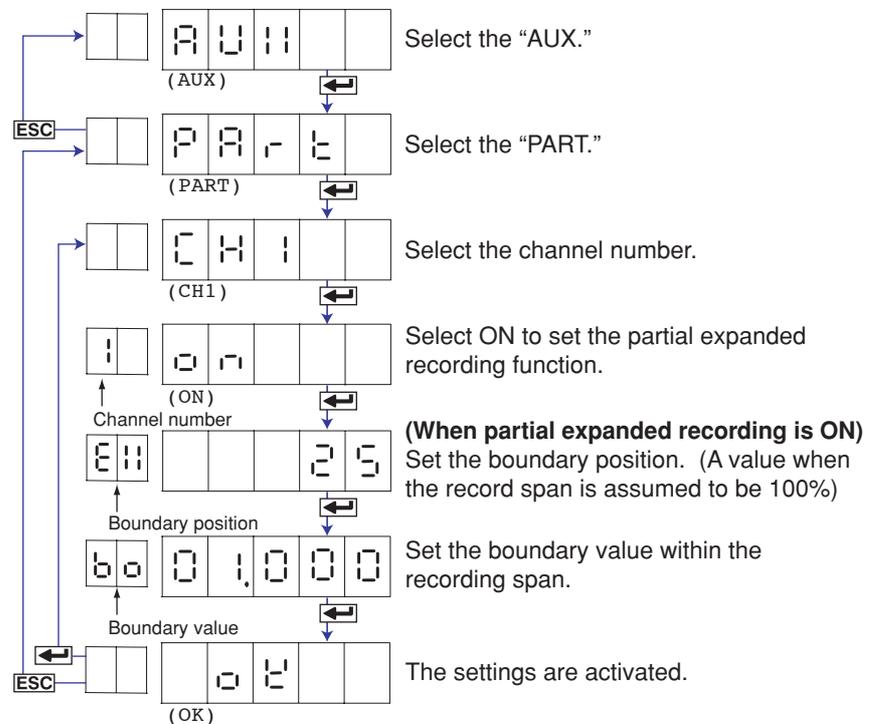Set at least 5 mm for the recording zone width.

Note
> If the recording zone is set to a value less than 40 mm, scale printout of periodic printout cannot be executed.

3.5   Setting the Partial Expanded Recording

A section of the recording range can be expanded.
If you change the input range, set the partial expanded recording again.

Procedure

1.   Hold down the [MENU] key for 3 seconds to enter Setting mode.
2.   Carry out the procedure shown in the figure below.
     Press the △ or ▽ key to select the value.
     For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
     To change the polarity, press the △ or ▽ key when the leftmost digit of the value is blinking.
     If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

Select the "AUX."

Select the "PART."

Select the channel number.

Select ON to set the partial expanded recording function.

(When partial expanded recording is ON)
Set the boundary position. (A value when the record span is assumed to be 100%)

Set the boundary value within the recording span.

The settings are activated.

3.   Press the ↵ key to set other channels.
     If you are done, press the **ESC** key.
4.   Hold down the [MENU] key for 3 seconds to return to Operation mode.

Explanation

Boundary Position
Set a value between 1 and 99%.
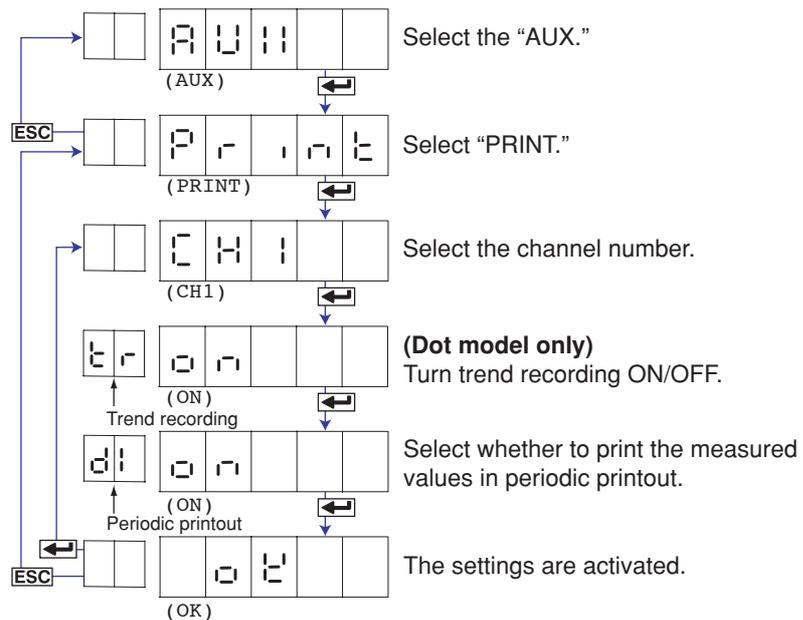
<Related Topics>
Enabling the partial expanded recording function: Section 4.12

3.6 Turning Trend Recording (Dot Model) and Periodic Printout ON/OFF for Each Channel

This section explains the details of setting the trend recording and periodic printout for each measurement channel.

Procedure

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.

Display	Description
(AUX)	Select the "AUX."
(PRINT)	Select "PRINT."
(CH1)	Select the channel number.
tr (ON) Trend recording	**(Dot model only)** Turn trend recording ON/OFF.
di (ON) Periodic printout	Select whether to print the measured values in periodic printout.
(OK)	The settings are activated.

3. Press the ← key to set other channels.
   If you are done, press the ESC key.
4. Hold down the MENU key for 3 seconds to return to Operation mode.

Explanation

The following settings can be entered for each channel on the dot model.
· Turn trend recording ON/OFF.
· Turn the printing of measured values ON/OFF during periodic printout.
The following settings can be entered for each channel on the pen model.
· Turn the printing of measured values ON/OFF during periodic printout.

<Related Topics>
Setting the periodic printout: Section 4.8

3.7   Setting Tags on Channels

Tags can be assigned to measurement channels.

Procedure

1. Hold down the [MENU] key for 3 seconds to enter Setting mode.
2. Carry out the procedure shown in the figure below.
    Press the △ or ▽ key to select the value.
    For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
    If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.
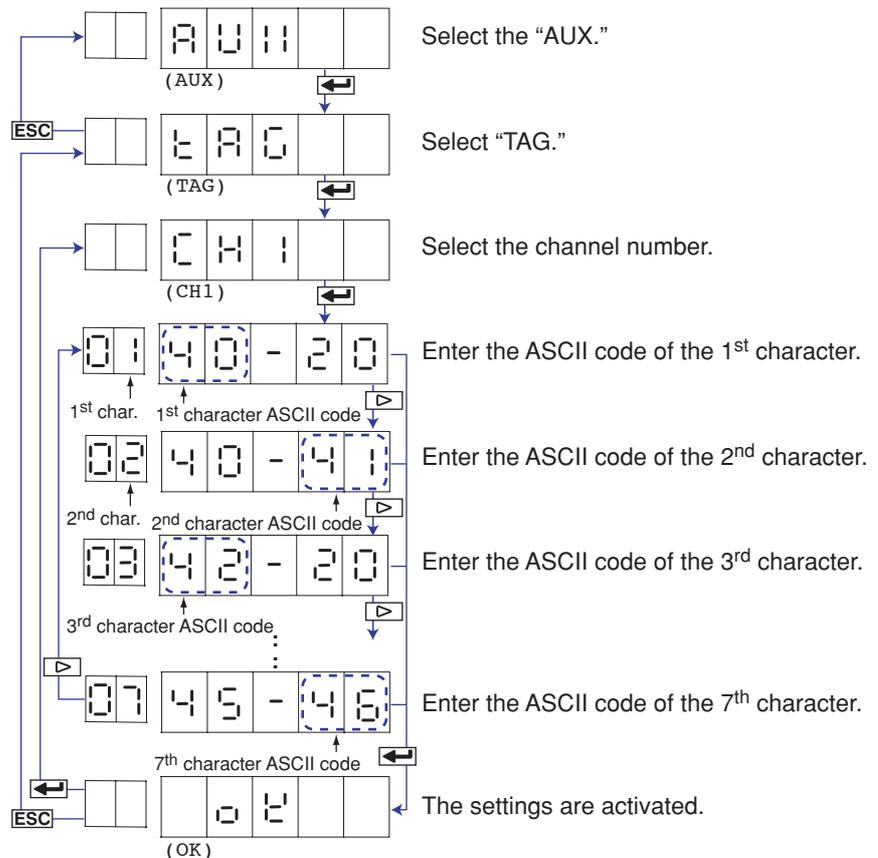
3. Press the ↵ key to set other channels.
    If you are done, press the **ESC** key.
4. Hold down the [MENU] key for 3 seconds to return to Operation mode.

Explanation

Characters That Can Be Used for Tags
Set a tag using up to seven characters.
The available characters are as follows:
    Alphabet, numbers, symbols (%, #, °, @, +, −, *, /, (,), μ, Ω, ^{2}, ^{3}, .), and space

<Related Topics>
Printing tags in place of channel numbers: Section 4.7

3.8   Setting the Message String

Message strings to be printed on the chart paper can be set. Up to five message strings can be registered.

1.   Hold down the [MENU] key for 3 seconds to enter Setting mode.
2.   Carry out the procedure shown in the figure below.
Press the △ or ▽ key to select the value.
For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.
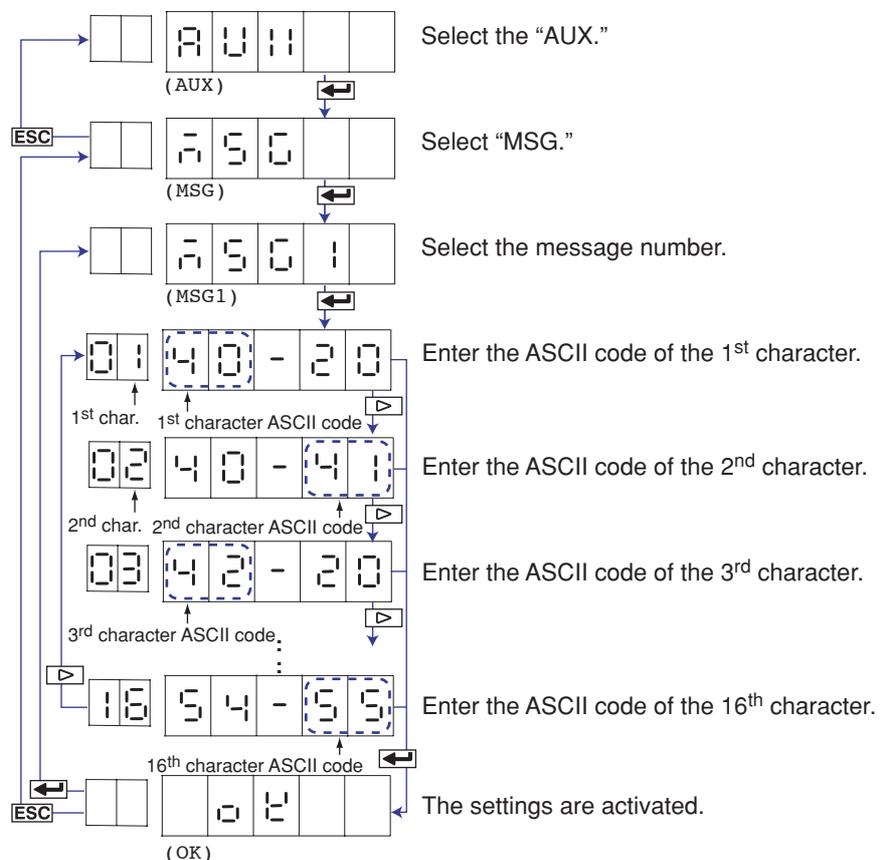
3.   Press the ⏎ key to set other message numbers.
If you are done, press the **ESC** key.
4.   Hold down the [MENU] key for 3 seconds to return to Operation mode.

Characters That Can Be Used for Messages
Set a message using up to 16 characters.
The available characters are as follows:
Alphabet, numbers, symbols (%, #, °, @, +, −, ∗, /, (,), μ, Ω, ^{2}, ^{3}, .), and space
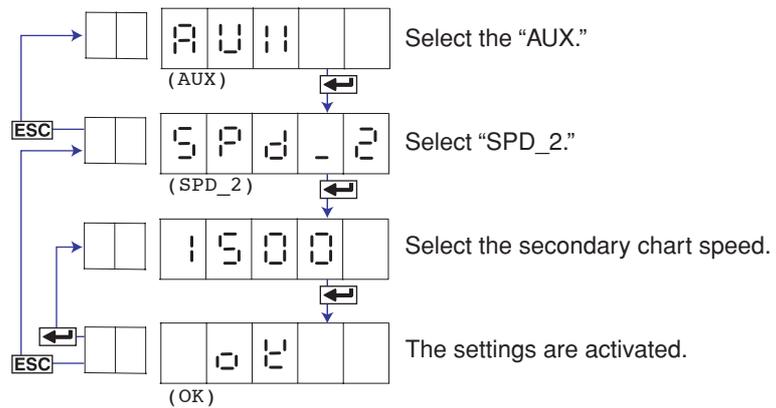
<Related Topics>
Printing a message: "Printing a Message" in the *Operation Guide*

3.9 Setting the Secondary Chart Speed (Remote Control Function, /R1)

The secondary chart speed when the chart speed is to be switched using the remote control function (/R1 option) can be set.

Procedure

1. Hold down the [MENU] key for 3 seconds to enter Setting mode.
2. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

Display	Description
ＲＵＩＩ (AUX)	Select the "AUX."
ＳＰｄ＿２ (SPD_2)	Select "SPD_2."
１５００	Select the secondary chart speed.
ｏｔ (OK)	The settings are activated.

3. If you are done, press the **ESC** key.
4. Hold down the [MENU] key for 3 seconds to return to Operation mode.

Explanation

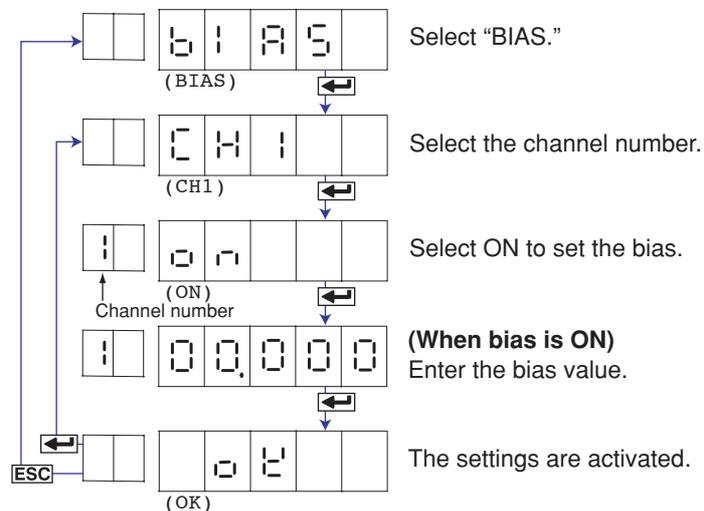**Chart Speed**
See section 2.4.

<Related Topics>
Setting the remote control function: Section 4.18

3.10 Applying a Bias on the Measuring Input Signal

A bias can be applied to the scaled value of the measuring input signal.
If you change the input range, set the bias again.

Procedure

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
   To change the polarity, press the △ or ▽ key when the leftmost digit of the value is blinking.
   If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.

b I A S (BIAS) ⏎	Select "BIAS."
C H I (CH1) ⏎	Select the channel number.
I o n (ON) ⏎ ↑ Channel number	Select ON to set the bias.
I 0 0.0 0 0 ⏎	**(When bias is ON)** Enter the bias value.
⏎ o L (OK) ESC	The settings are activated.

3. Press the ⏎ key to set other channels.
   If you are done, press the ESC key.
4. Hold down the MENU key for 3 seconds to return to Operation mode.

Explanation

Bias

The range of bias that can be specified is approximately ±10% of the measurable range of the input range. For example, the range is –0.4 V to 0.4 V for the 2 V input range. For channels on which scaling is set, the range is approximately ±10% of the scaling width.

Note

A bias cannot be set on channels set to ON/OFF input (DI). In addition, the bias function cannot be used on all channels if calibration correction (/CC1 option) is used.

<Related Topics>
Enabling the bias function: Section 4.15

3.11 Performing Calibration Correction (/CC1 Option)

The scaled values of the measuring input signal are corrected using specified segments, and the results are used as measured values.
If you change the input range, set the measured and correction values again.
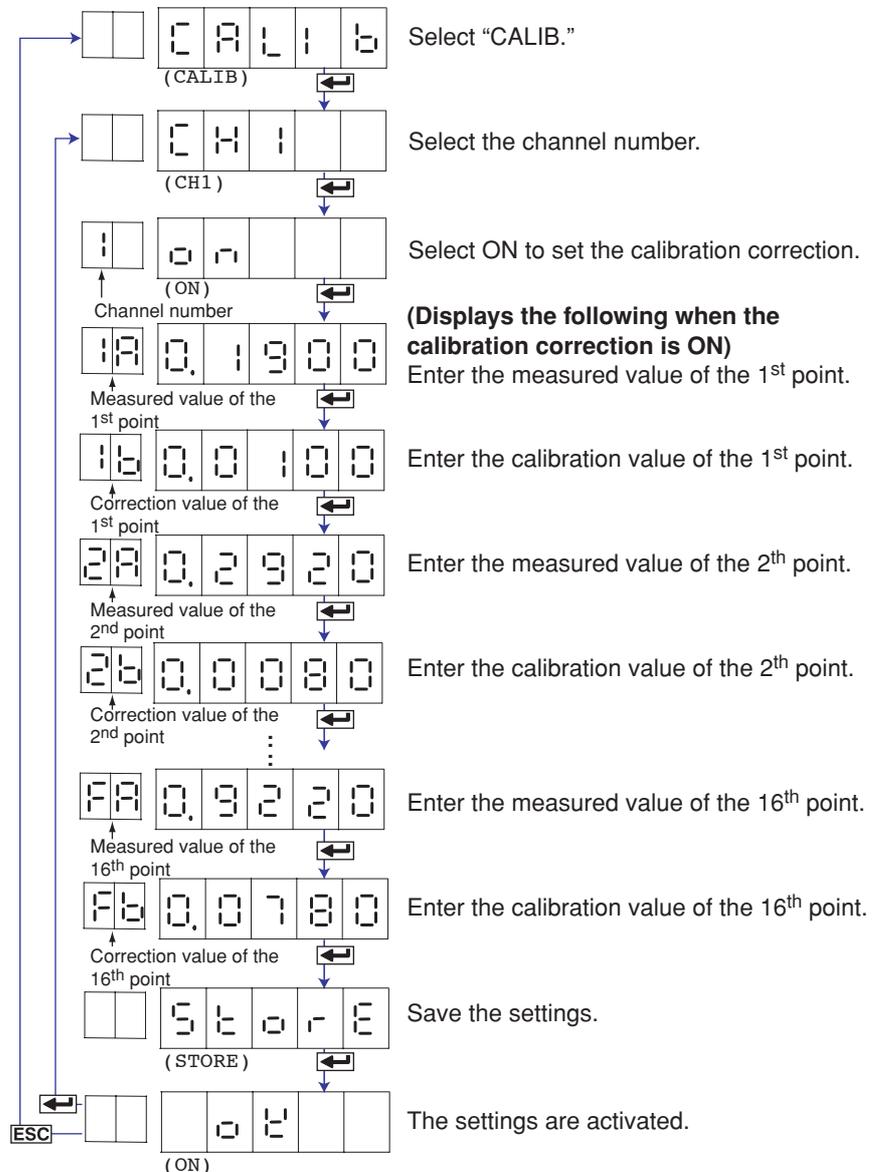
Procedure

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
   To change the polarity, press the △ or ▽ key when the leftmost digit of the value is blinking.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

Select "CALIB."
(CALIB)

Select the channel number.
(CH1)

Select ON to set the calibration correction.
(ON)
Channel number

(Displays the following when the calibration correction is ON)
Enter the measured value of the 1st point.
Measured value of the 1st point

Enter the calibration value of the 1st point.
Correction value of the 1st point

Enter the measured value of the 2th point.
Measured value of the 2nd point

Enter the calibration value of the 2th point.
Correction value of the 2nd point

Enter the measured value of the 16th point.
Measured value of the 16th point

Enter the calibration value of the 16th point.
Correction value of the 16th point

Save the settings.
(STORE)

The settings are activated.
(ON)

Setting example when the calibration correction method is set to revise value and the number of calibration correction points is set to 16
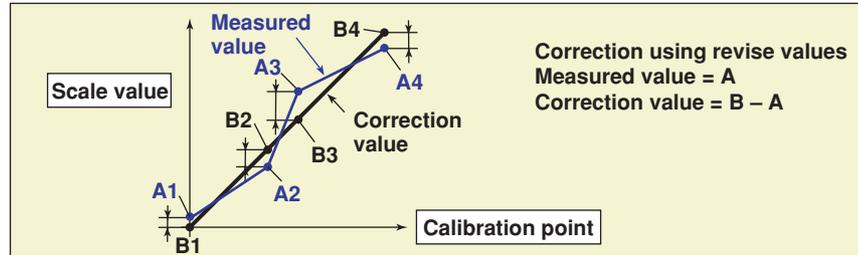
3. Press the ⬅ key to set other channels.

   If you are done, press the **ESC** key.

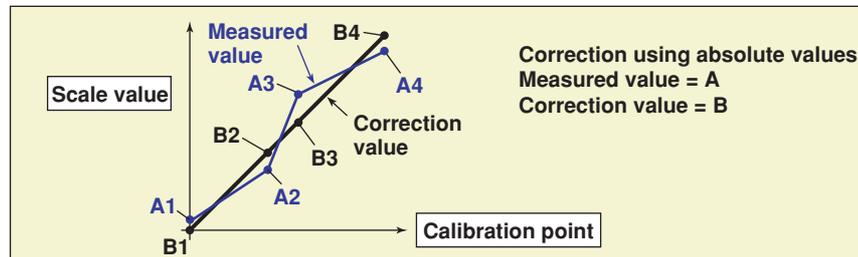4. Hold down the MENU key for 3 seconds to return to Operation mode.

Explanation

Setting Measured and Corrected Values
- Using revise values

- Using absolute values

Example of a two-point correction

Calibration Correction Point	Corrected Value	Measured value (A)	Correction Value	
			Revise Value (B − A)	Absolute Value (B)
1	10.0°C	9.8°C	0.2°C	10.0°C
2	90.0°C	90.5°C	− 0.5°C	90.0°C

Setup Conditions of Measured and Corrected Values
- Setting range of measured and correction values when using revise values

  A1 < A2 ≤ A3 ≤ ... ≤ A16

  (A1 + B1) < (A2 + B2) < (A3 + B3) < ... < (A16 + B16)

  A and B are within the measurable range or scaling range of the range type*

  * Within the scaling range: −5% to 105% of the scale value or −19999 to 30000 (the decimal place is the same as the setting for the scale value)

- Setting range of measured and correction values when using absolute values

  A1 < A2 ≤ A3 ≤ ... ≤ A16

  B1 < B2 < B3 < ... < B16

  A and B are within the measurable range or scaling range of the range type*

  * Within the scaling range: −5% to 105% of the scale value or −19999 to 30000 (the decimal place is the same as the setting for the scale value)

Note

- Make sure that the leftmost value is less than the rightmost value for span and scale.
- Calibration correction cannot be set on ON/OFF input (DI), delta computation, and square root computation channels. In addition, calibration correction cannot be used on all channels if the bias function is enabled.

<Related Topics>

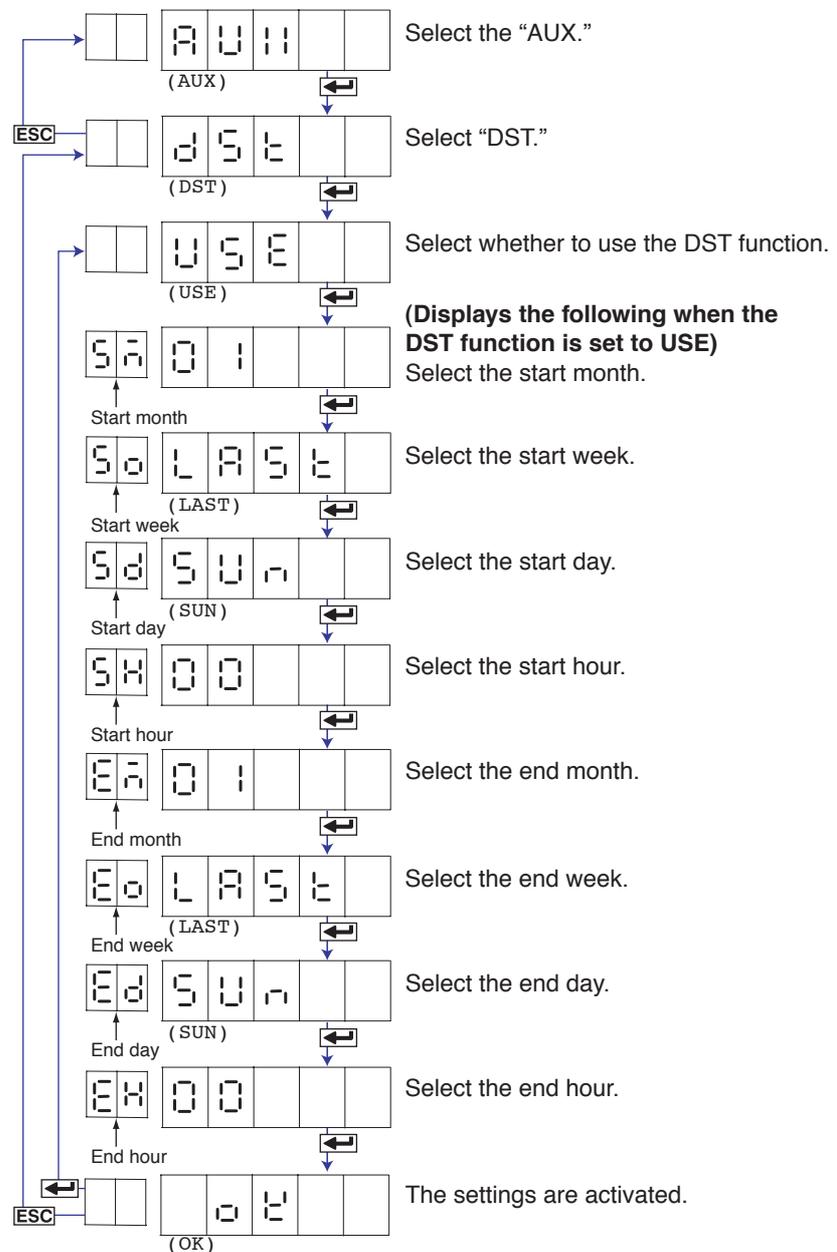Enabling the calibration correction function: Section 4.15

Setting the calibration correction function: Section 4.19

3.12 Setting the Date/Time for Switching between Standard Time and DST

The date/time for switching from the standard time to DST and the date/time for switching back from DST to standard time can be set, if the recorder is used in a region that has DST. When the preset date/time arrives, the recorder internal clock automatically switches.

Procedure

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.

Display	Description
AU11 (AUX)	Select the "AUX."
dSt (DST)	Select "DST."
USE (USE)	Select whether to use the DST function.
Sn 01 — Start month	**(Displays the following when the DST function is set to USE)** Select the start month.
So LASt (LAST) — Start week	Select the start week.
Sd SUn (SUN) — Start day	Select the start day.
SH 00 — Start hour	Select the start hour.
En 01 — End month	Select the end month.
Eo LASt (LAST) — End week	Select the end week.
Ed SUn (SUN) — End day	Select the end day.
EH 00 — End hour	Select the end hour.
oY (OK)	The settings are activated.

3. If you are done, press the **ESC** key.
4. Hold down the MENU key for 3 seconds to return to Operation mode.

Explanation

Start Month, Start Day, and Start Time

Set the date/time for switching from standard time to DST. Specify the day as the nth day of the week of the month.

End Month, End Day, and End Time

Set the date/time for switching from DST to standard time. Specify the day as the nth day of the week of the month.

Start Month and End Month

01 to 12: January to December

Start Week and End Week

1: 1st week
2: 2nd week
3: 3rd week
4: 4th week
LASt : Last week

Start Day and End Day

SUn : Sunday
non : Monday
tUE : Tuesday
YEd : Wednesday
tHU : Thursday
Fri : Friday
SAt : Saturday

Start Time and End Time

00 to 23: Hour 00 to hour 23

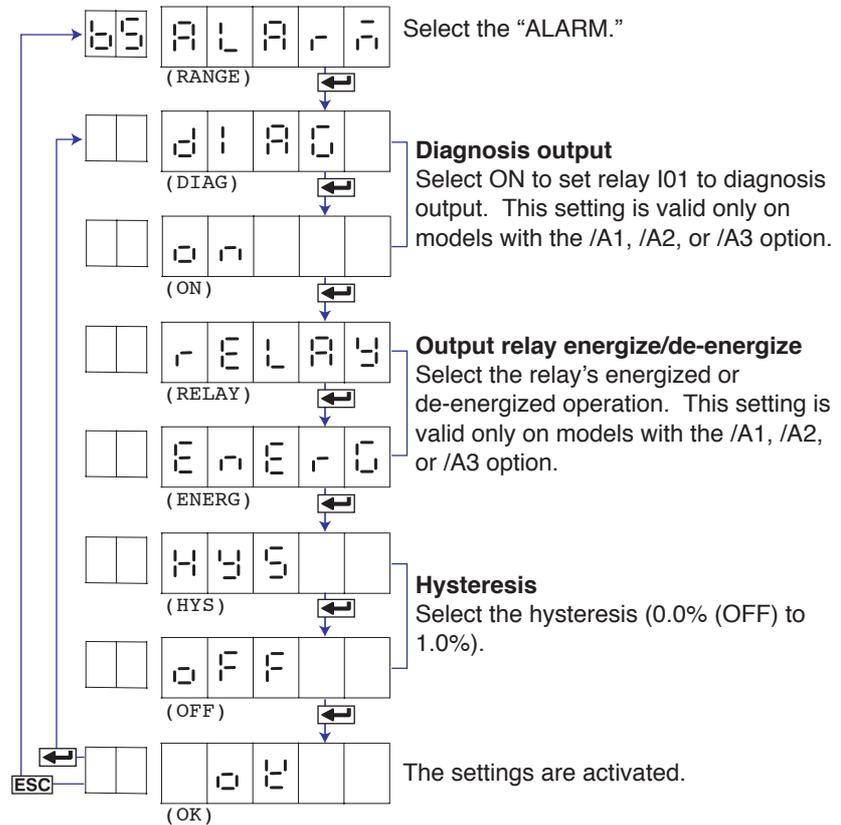# 4.1   Changing the Auxiliary Alarm Function

This section explains the details of setting the alarm system items listed below.
- Diagnosis output using the alarm output relay (I01)
- Energized/De-energized operation of alarm output relays when alarms occur
- Alarm hysteresis

Basic Setting mode cannot be entered when recording is in progress

Procedure

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

Select the "ALARM."

Diagnosis output
Select ON to set relay I01 to diagnosis output. This setting is valid only on models with the /A1, /A2, or /A3 option.

Output relay energize/de-energize
Select the relay's energized or de-energized operation. This setting is valid only on models with the /A1, /A2, or /A3 option.

Hysteresis
Select the hysteresis (0.0% (OFF) to 1.0%).

The settings are activated.

4. If you are done, press the **ESC** key.
5. To return to the Operation mode,
   1. Press the **ESC** key, use the △ or ▽ key to select End, and press the ↵ key.
   2. Press the △ or ▽ key to select StorE or Abort, and press the ↵ key.

Explanation

Diagnosis Output

When set to ON, alarm output relay I01 becomes a dedicated diagnosis output relay, and the operation is fixed to de-energized. Diagnosis output is a function which outputs a relay signal when an error is detected in the recording section, burnout detection function, or the A/D converter.

Output Relay Energize/De-Energize Operation

Sets whether the output relay is energized or de-energized when an alarm occurs.

Energize (EnErG):   Energizes the relay when an alarm occurs. The relay is de-energized during normal operation.

De-energize (dE_En):De-energizes the relay when an alarm occurs. The relay is energized during normal operation.

Hysteresis

Sets the alarm hysteresis of the measurement channels.

The hysteresis width can be set in the range of 0.0% (OFF) to 1.0% of the recording span in 0.1 steps.

The hysteresis applies to all high limit and low limit alarms of measurement channels.
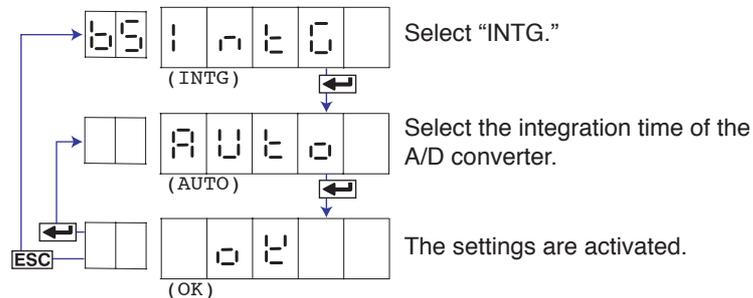
<Related Topics>

Setting the alarm: Section 2.2

4.2 Changing the Integration Time of the A/D Converter

The integration time of the A/D converter can be set. Basic Setting mode cannot be entered when recording is in progress

Procedure

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

Select "INTG."

Select the integration time of the A/D converter.

The settings are activated.

4. If you are done, press the **ESC** key.
5. To return to the Operation mode,
   1. Press the **ESC** key, use the △ or ▽ key to select End, and press the ↵ key.
   2. Press the △ or ▽ key to select Store or Abort, and press the ↵ key.

Explanation

Integration Time

Selects the integration time of the A/D converter.

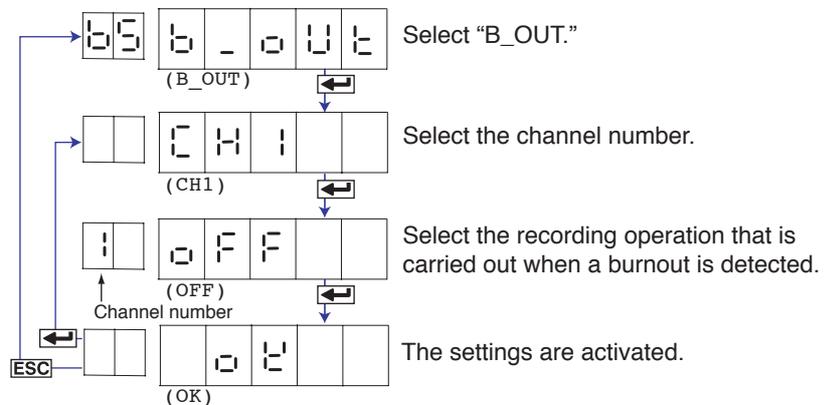| Selectable Settings	Integration Time	Scan Interval (Pen Model)	Recording Interval (Dot Model)
50 Hz (50HZ)	20 ms	125 ms	1 s
60 Hz (60HZ)	16.7 ms	125 ms	1 s
Auto (Auto)	20 ms or 16.6 ms[2]	125 ms	1 s
100 ms (100mS)[1]	100 ms	–	2.5 s

*1 Selectable only on the dot model.
*2 Automatically switch by detecting the power supply frequency.

4.3 Setting the Burnout Detection Function

The burnout detection function of thermocouples can be set on 1-5V or TC input channels. Basic Setting mode cannot be entered when recording is in progress

1. Hold down the [MENU] key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.

	(B_OUT)	Select "B_OUT."
	(CH1)	Select the channel number.
	(OFF)	Select the recording operation that is carried out when a burnout is detected.
	(OK)	The settings are activated.

Channel number

4. Press the ⏎ key to set other channels.
   If you are done, press the ESC key.
5. To return to the Operation mode,
   1. Press the ESC key, use the △ or ▽ key to select End, and press the ⏎ key.
   2. Press the △ or ▽ key to select Store or Abort, and press the ⏎ key.

Burnout

Selects the action taken when a burnout is detected at the 1-5V input or the thermocouple input.

Upscale (UP):   Records off the scale on the 100% side.

Downscale (doUn): Records off the scale on the 0% side.

OFF (oFF):   Disables the burnout detection function.

4.4 Setting the RJC Function on TC Input Channels

The RJC mode can be set on TC input channels. Basic Setting mode cannot be entered when recording is in progress
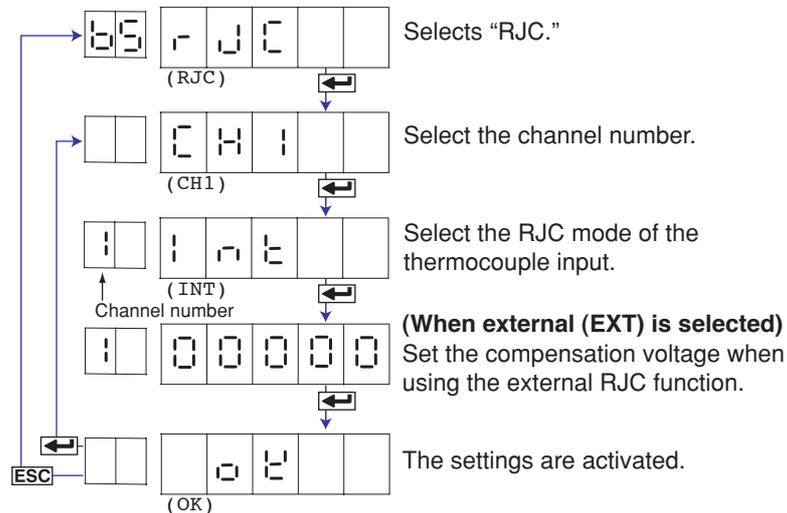
1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
   To change the polarity, press the △ or ▽ key when the leftmost digit of the value is blinking.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

	Selects "RJC."
bS r J C (RJC)	
C H 1 (CH1)	Select the channel number.
1 I n t (INT) Channel number	Select the RJC mode of the thermocouple input.
1 0 0 0 0 0	**(When external (EXT) is selected)** Set the compensation voltage when using the external RJC function.
o k (OK)	The settings are activated.

4. Press the ⏎ key to set other channels.
   If you are done, press the **ESC** key.
5. To return to the Operation mode,
   1. Press the **ESC** key, use the △ or ▽ key to select E n d, and press the ⏎ key.
   2. Press the △ or ▽ key to select S t o r E or A b o r t, and press the ⏎ key.

RJC

Sets the RJC mode.

Internal (I n t):   Uses the RJC function of the recorder.

External (E I t):   Uses an external RJC function. If external is selected, set the compensation voltage.

Compensation Voltage

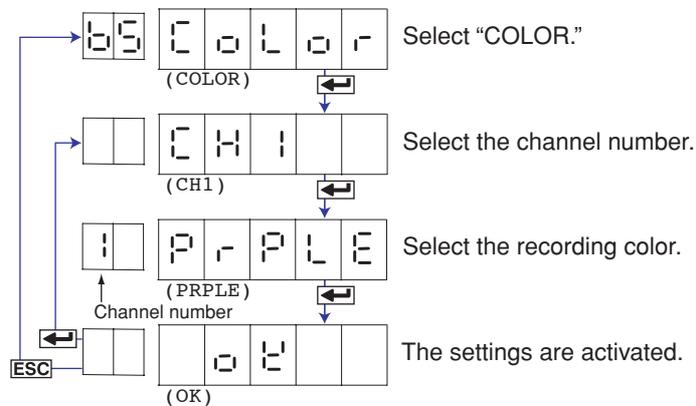Sets the compensation voltage when using an external RJC function.

The compensation voltage can be set in the range of –19999 µV to 20000 µV.

4

Setup Operations for Changing/Adding Functions (Basic Setting Mode)

4.5 Changing the Channel Recording Color (Dot Model)

The trend recording color on the dot model can be changed. Basic Setting mode cannot be entered when recording is in progress

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.

4. Press the ↵ key to set other channels.
   If you are done, press the ESC key.
5. To return to the Operation mode,
   1. Press the ESC key, use the △ or ▽ key to select End, and press the ↵ key.
   2. Press the △ or ▽ key to select Store or Abort, and press the ↵ key.

Color
Sets the recording color of measurement channels.
By default, the recording colors are set as follows:
Channel 1: Purple (PrPLE)
Channel 2: Red (rEd)
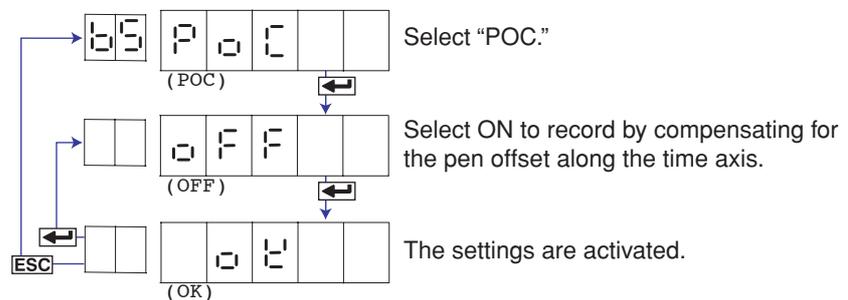Channel 3: Green (GrEEn)
Channel 4: Blue (bLUE)
Channel 5: Brown (broЧn)
Channel 6: Black (bLACЧ)

4.6 Recording by Compensating for the Pen Offset along the Time Axis (Pen Model)

The pen offset along the time axis (pen model) can be compensated. Basic Setting mode cannot be entered when recording is in progress

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.

bS	P o C		Select "POC."
	(POC)	⏎	
	o F F		Select ON to record by compensating for the pen offset along the time axis.
	(OFF)	⏎	
ESC ⏎	o H		The settings are activated.
	(OK)		

4. If you are done, press the ESC key.
5. To return to the Operation mode,
   1. Press the ESC key, use the △ or ▽ key to select End, and press the ⏎ key.
   2. Press the △ or ▽ key to select Store or Abort, and press the ⏎ key.

Explanation

When pen offset compensation is turned ON, an asterisk is printed by the time on the periodic printout.
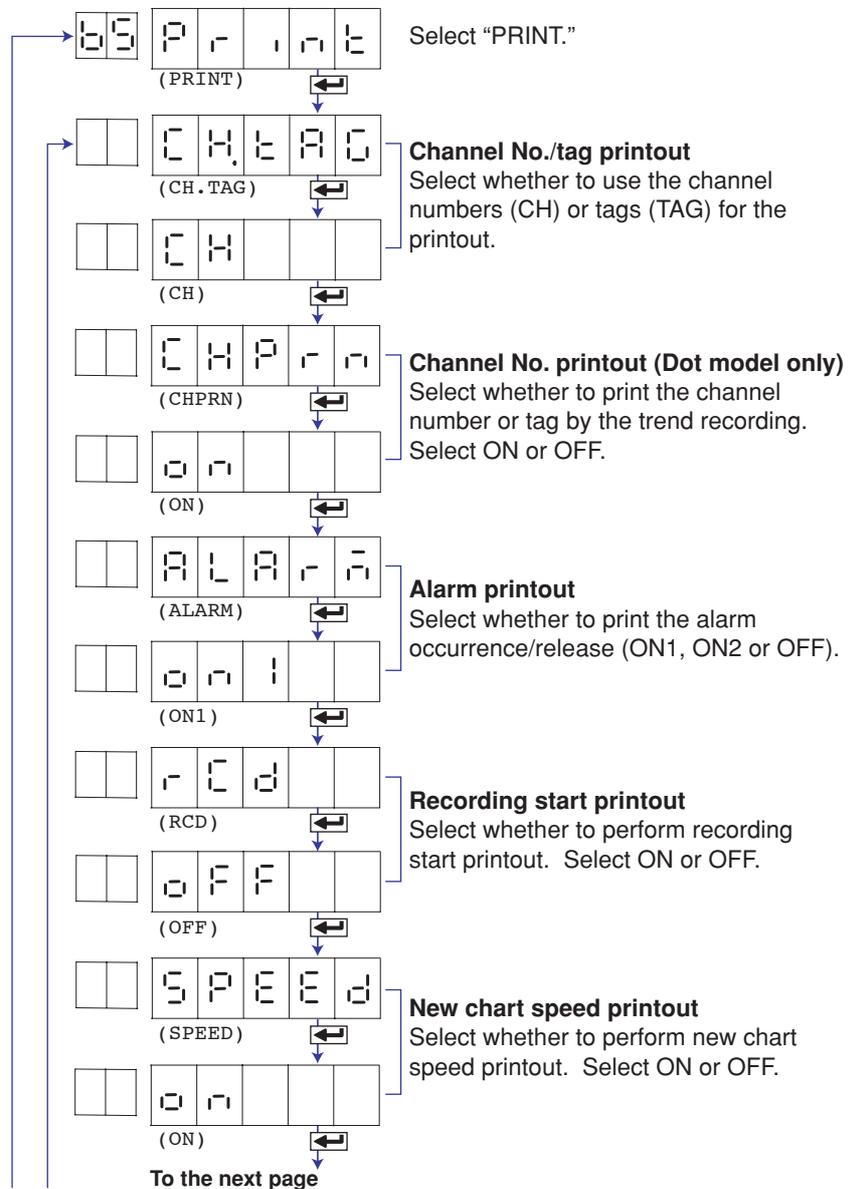
Note

When pen offset compensation is enabled, all pens are aligned with the reference pen (pen that is furthest to the back: pen 2 on the 2-pen model, pen 3 on the 3-pen model, and pen 4 on the 4-pen model) for recording. When recording is started, only the reference pen moves until the offset is compensated. This is not a malfunction.
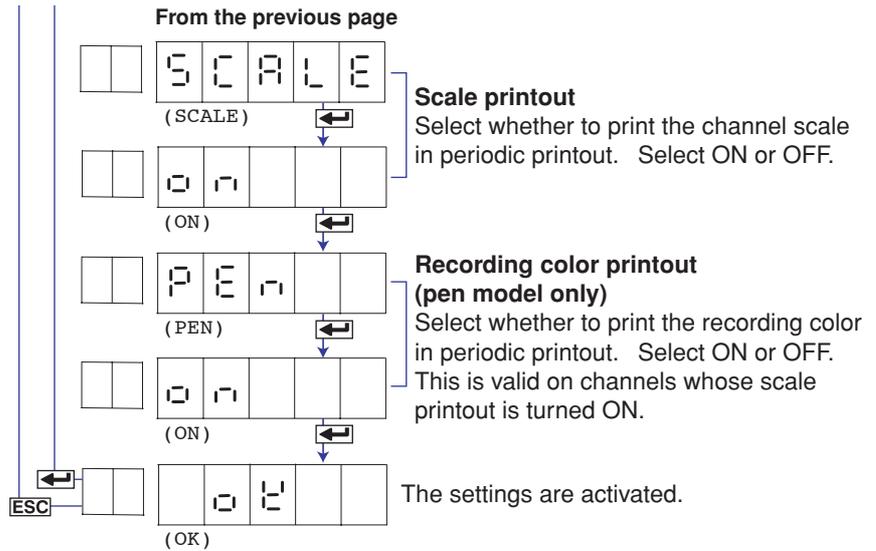
4.7 Turning Printouts ON/OFF

Select whether to print using channel numbers or tags and set whether to print the various printout items. Basic Setting mode cannot be entered when recording is in progress.

Procedure

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.

bS (PRINT) ⏎	Select "PRINT."
CH.tAG (CH.TAG) ⏎	**Channel No./tag printout** Select whether to use the channel numbers (CH) or tags (TAG) for the printout.
CH (CH) ⏎	
CHPrn (CHPRN) ⏎	**Channel No. printout (Dot model only)** Select whether to print the channel number or tag by the trend recording. Select ON or OFF.
on (ON) ⏎	
ALArM (ALARM) ⏎	**Alarm printout** Select whether to print the alarm occurrence/release (ON1, ON2 or OFF).
on1 (ON1) ⏎	
rCd (RCD) ⏎	**Recording start printout** Select whether to perform recording start printout. Select ON or OFF.
oFF (OFF) ⏎	
SPEEd (SPEED) ⏎	**New chart speed printout** Select whether to perform new chart speed printout. Select ON or OFF.
on (ON) ⏎	

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SCALE

(SCALE)

Scale printout
Select whether to print the channel scale in periodic printout. Select ON or OFF.

On

(ON)

PEn

(PEN)

Recording color printout (pen model only)
Select whether to print the recording color in periodic printout. Select ON or OFF. This is valid on channels whose scale printout is turned ON.

On

(ON)

ESC

oy

(OK)

The settings are activated.

4. If you are done, press the **ESC** key.
5. To return to the Operation mode,
    1. Press the **ESC** key, use the △ or ▽ key to select End, and press the ← key.
    2. Press the △ or ▽ key to select StorE or Abort, and press the ← key.

Explanation

Channel Number/Tag Printout

Channel (CH): Prints the channel number.
Tag (tAG):   Prints the tag.

Alarm Printout

ON1 (on 1): Prints the alarm information when an alarm occurs or releases.
ON2 (on2): Prints the alarm information only when an alarm occurs.
OFF (oFF): Does not print alarm information.

4

Setup Operations for Changing/Adding Functions (Basic Setting Mode)
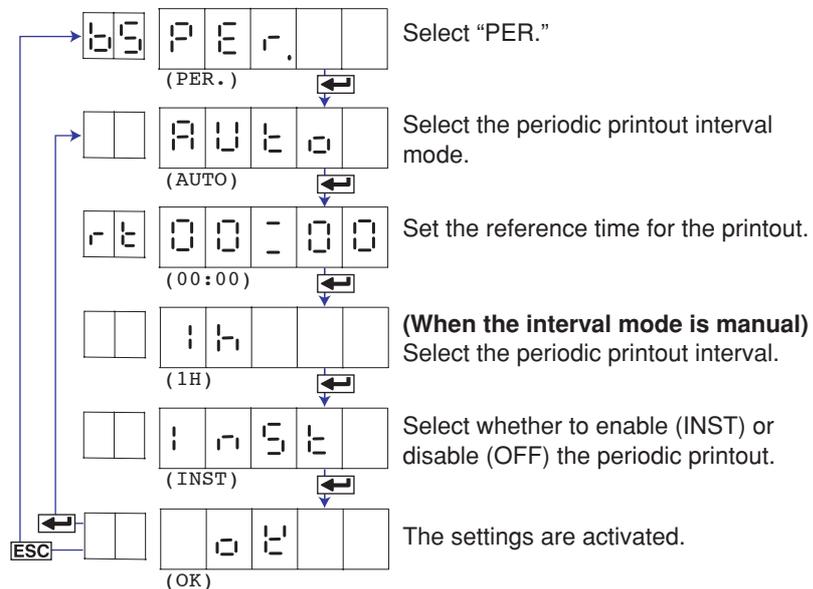
4.8 Setting the Periodic Printout

The periodic printout settings can be specified. Basic Setting mode cannot be entered when recording is in progress

Procedure

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
   If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.

bS PEr. (PER.) ⏎	Select "PER."
AUto (AUTO) ⏎	Select the periodic printout interval mode.
rt 00:00 (00:00) ⏎	Set the reference time for the printout.
1h (1H) ⏎	**(When the interval mode is manual)** Select the periodic printout interval.
InSt (INST) ⏎	Select whether to enable (INST) or disable (OFF) the periodic printout.
ESC ⏎ oƷ (OK)	The settings are activated.

4. If you are done, press the ESC key.
5. To return to the Operation mode,
   1. Press the ESC key, use the △ or ▽ key to select End, and press the ⏎ key.
   2. Press the △ or ▽ key to select StorE or Abort, and press the ⏎ key.

Explanation

Periodic Printout
Selects the periodic printout interval mode.
Auto (AUto): Automatically sets the printout interval in sync with the chart speed.
Manual (mAn): Set the printout interval manually.

Reference Time
Sets the reference time for determining the times for executing the periodic printout.
The reference time is set in the range of 00 to 23 in 1 hour steps. Minutes cannot be specified.

Interval
Select the interval from 10, 12, 15, 20, 30 minutes, 1, 2, 3, 4, 6, 8, 12, and 24 hours
(10min to 24h).

Turning ON/OFF the Periodic Printout
ON (instantaneous value) (InSt): Prints the measured value at that point.
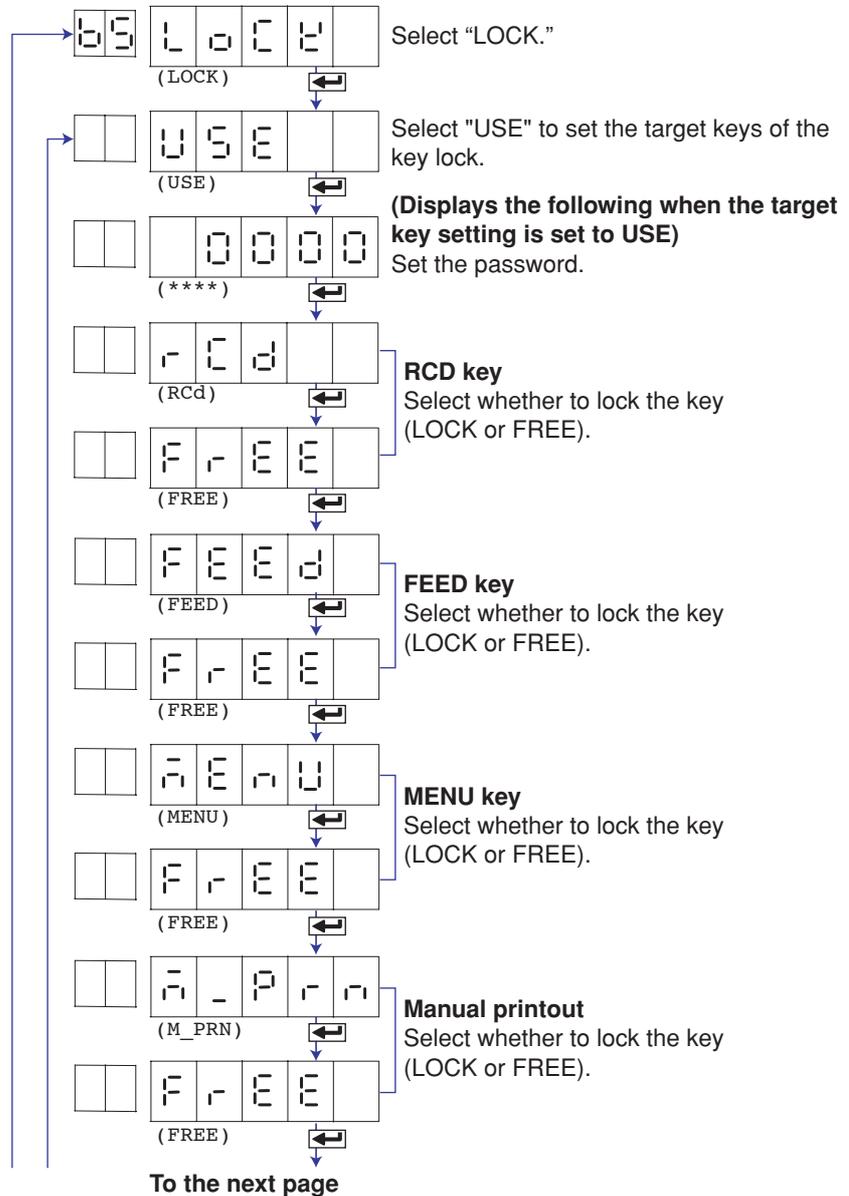OFF (oFF): Disables periodic printout.
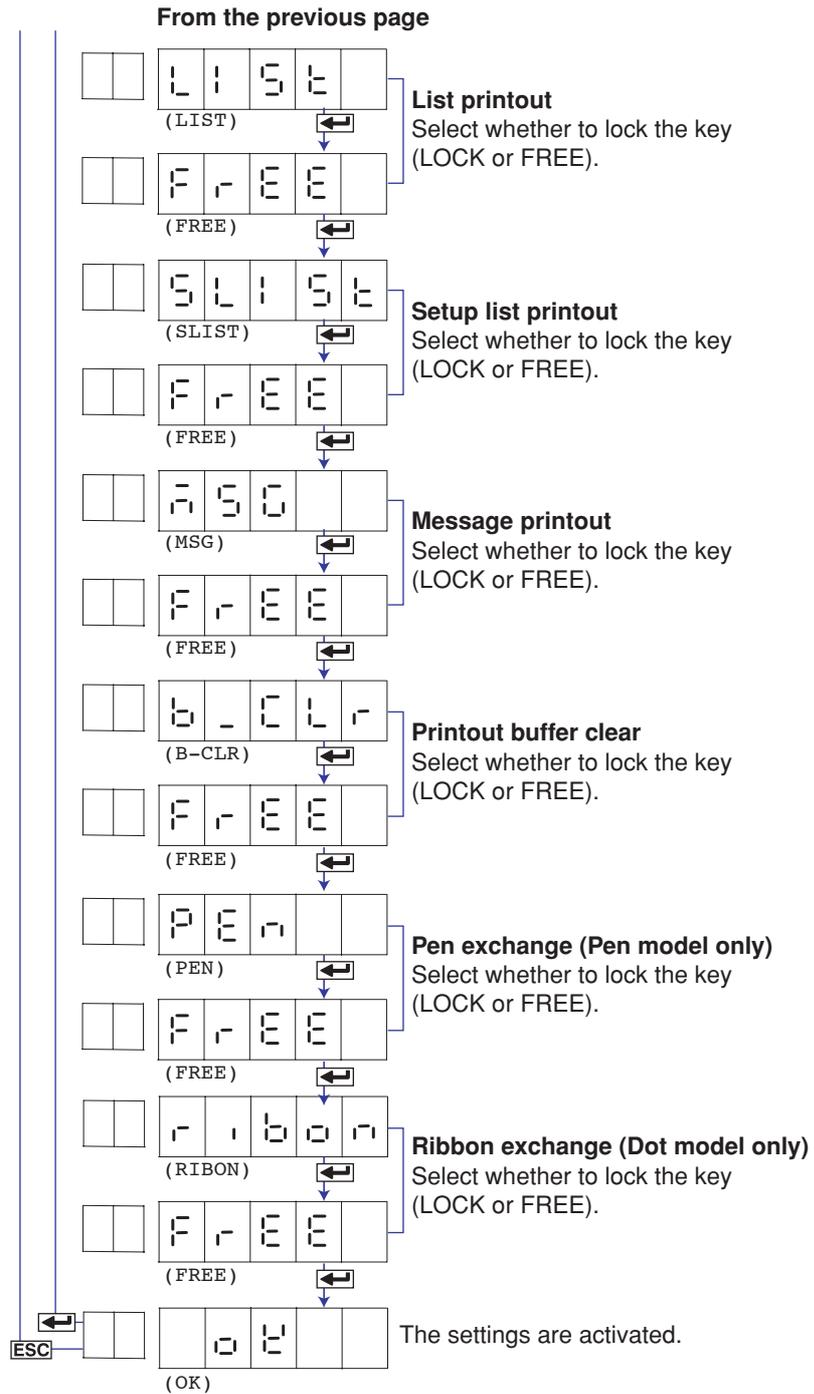
4.9   Setting the Key Lock

The keys that can be locked and the password for releasing the key lock can be set.
Basic Setting mode cannot be entered when recording is in progress

Procedure

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
    Press the △ or ▽ key to select the value.
    For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
    If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.

bS | LoCK (LOCK)   Select "LOCK."

USE (USE)   Select "USE" to set the target keys of the key lock.

0000 (****)   **(Displays the following when the target key setting is set to USE)** Set the password.

rCd (RCd)   **RCD key** Select whether to lock the key (LOCK or FREE).

FrEE (FREE)

FEEd (FEED)   **FEED key** Select whether to lock the key (LOCK or FREE).

FrEE (FREE)

MEnU (MENU)   **MENU key** Select whether to lock the key (LOCK or FREE).

FrEE (FREE)

M_Prn (M_PRN)   **Manual printout** Select whether to lock the key (LOCK or FREE).

FrEE (FREE)

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	List printout
(LIST)	Select whether to lock the key (LOCK or FREE).
(FREE)	

	Setup list printout
(SLIST)	Select whether to lock the key (LOCK or FREE).
(FREE)	

	Message printout
(MSG)	Select whether to lock the key (LOCK or FREE).
(FREE)	

	Printout buffer clear
(B-CLR)	Select whether to lock the key (LOCK or FREE).
(FREE)	

	Pen exchange (Pen model only)
(PEN)	Select whether to lock the key (LOCK or FREE).
(FREE)	

	Ribbon exchange (Dot model only)
(RIBON)	Select whether to lock the key (LOCK or FREE).
(FREE)	

ESC

	The settings are activated.
(OK)	

4. If you are done, press the **ESC** key.
5. To return to the Operation mode,
   1. Press the **ESC** key, use the △ or ▽ key to select End, and press the ↵ key.
   2. Press the △ or ▽ key to select Store or Abort, and press the ↵ key.

Explanation

Key Lock

Select the target keys (USE)

Not use the key lock (not)

Password

Sets the password for releasing the key lock. Set the password using a four-digit number.

Operation of Keys to Be Key-Locked

Sets the operation of the keys to be key-locked. Select Lock ($LoCt$) or Free ($Free$) for each key operation.

RCD: [RCD] key
FEED: [FEED] key
MENU: [MENU] key
M_PRN: [FUNC] key + manual printout operation
LIST: [FUNC] key + list printout operation
SLIST: [FUNC] key + setup list printout operation
MSG: [FUNC] key + message printout operation
B_CLR: [FUNC] key + clear operation of the printout buffer memory
PEN: [FUNC] key + the operation of moving the pen to an easily accessible position of replacement (pen model)
RIBON: [FUNC] key + the operation carried out when replacing the ribbon cassette with the power turned ON (dot model)

<Related Topics>

Activating/Releasing the Key Lock: "Activating/Releasing the Key Lock" in the *Operation Guide*

4.10 Enabling the Moving Average Function (Dot Model)

The moving average function can be enabled/disabled on the dot model. Basic Setting mode cannot be entered when recording is in progress

1. Hold down the [MENU] key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.

Display	Description
bS M_AVE (M_AVE) ⏎	Select "M_AVE."
not (NOT) ⏎	Select whether to use moving average function.
ESC OK (OK)	The settings are activated.

4. If you are done, press the ESC key.
5. To return to the Operation mode,
   1. Press the ESC key, use the △ or ▽ key to select End, and press the ⏎ key.
   2. Press the △ or ▽ key to select Store or Abort, and press the ⏎ key.

Moving Average

Enable (USE): Enables the setting of the number of samples of the moving average in Setting mode.

Disable (not): The "M_AVE" item does not appear in Setting mode.

<Related Topics>

Setting the moving average: section 3.3

4.11 Enabling the Filter Function (Pen Model)

The input filter function on the pen model can be enabled/disabled. Basic Setting mode cannot be entered when recording is in progress

Procedure

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

bS FILtr (FILTR)	Select "FILTR."
not (NOT)	Select whether to use the filter function.
oⱯ (OK)	The settings are activated.

4. If you are done, press the **ESC** key.
5. To return to the Operation mode,
   1. Press the **ESC** key, use the △ or ▽ key to select End, and press the ⏎ key.
   2. Press the △ or ▽ key to select StorE or Abort, and press the ⏎ key.

Explanation

Filter

Enable (USE): Enables the setting of the filter and the time constant in Setting mode.
Disable (not): The "FILTR" item does not appear in Setting mode.

<Related Topics>
Setting the filter: Section 3.2

4.12 Enabling the Partial Expanded Recording Function

The partial expanded recording function can be enabled/disabled. Basic Setting mode cannot be entered when recording is in progress

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.

Select the "PART."

Select whether to use the partial expanded recording function.

The settings are activated.

4. If you are done, press the ESC key.
5. To return to the Operation mode,
   1. Press the ESC key, use the △ or ▽ key to select End, and press the ◄┘ key.
   2. Press the △ or ▽ key to select Store or Abort, and press the ◄┘ key.

Explanation

Partial Expanded Recording
Enable (USE): Enables the setting of the boundary position and boundary value of the partial expanded recording function in Setting mode.
Disable (not): The "PART" item does not appear in Setting mode.

<Related Topics>
Setting the partial expanded recording: Section 3.5

4.13   Changing the Printout Font

The printout font can be changed. Basic Setting mode cannot be entered when recording is in progress

1.   Hold down the MENU key for 3 seconds to enter Setting mode.
2.   Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3.   Carry out the procedure shown in the figure below.
     Press the △ or ▽ key to select the value.
     If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

Select "FONT."

Select the printout font.

The settings are activated.

4.   If you are done, press the **ESC** key.
5.   To return to the Operation mode,
     1. Press the **ESC** key, use the △ or ▽ key to select E n d, and press the ⏎ key.
     2. Press the △ or ▽ key to select S t o r E or A b o r t, and press the ⏎ key.

Explanation

Font

English (E n G.):   Uses the alphabet, numbers, and symbols for printout.
Japanese (J P n.): Uses the alphabet, Katakana, numbers, and symbols for printout.
German (G E r.):   Uses the German alphabet, numbers, and symbols for printout.
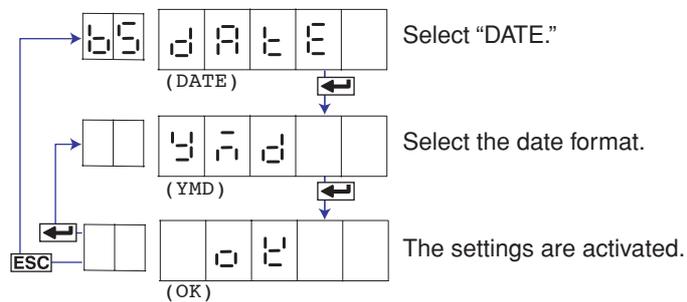French (F r E.):   Uses the French alphabet, numbers, and symbols for printout.
   * Katakana (Japanese), German, and French can be used in the message printout and tag printout when the respective font is selected.

4

Setup Operations for Changing/Adding Functions (Basic Setting Mode)

4.14 Changing the Print/Display Format of the Date

The format of the printout and display of the year, month, and day can be changed.
Basic Setting mode cannot be entered when recording is in progress

Procedure

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.

Select "DATE."

Select the date format.

The settings are activated.

4. If you are done, press the ESC key.
5. To return to the Operation mode,
   1. Press the ESC key, use the △ or ▽ key to select End, and press the ↵ key.
   2. Press the △ or ▽ key to select Store or Abort, and press the ↵ key.

Explanation

Type

Selectable Settings	Type	Printout Format Example	Display Format Example	Notes
Ymd	Y/M/D	2006/03/31	06 03 31	Default value
mdy_1	M/D/Y	03/31/2006	03 31 06	
dmy_1	D/M/Y	31/03/2006	31 03 06	
dmy_2	D.M.Y	31.03.2006	31 03 06	
mdy_2	M.D.Y	Mar.31.2006	03 31 06	

4.15 Enabling the Bias, Low-Cut, and Calibration Correction Functions

The bias, low-cut, and calibration correction functions can be enabled/disabled. Basic Setting mode cannot be entered when recording is in progress

Procedure

1. Hold down the [MENU] key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
    Press the △ or ▽ key to select the value.
    If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

bS PErS. (PERS.) ⏎	Select "PERS."
bIAS (BIAS) ⏎	**Bias function**
not (NOT) ⏎	Select enable (USE) or disable (NOT).
SQrt (SQRT) ⏎	**Low-cut function of the channel on which square root computation is assigned**
USE (USE) ⏎	Select enable (USE) or disable (NOT).
1-5U (1–5V) ⏎	**Low-cut function of the channel on which 1-5V signal is assigned**
not (NOT) ⏎	Select enable (USE) or disable (NOT).
CALIb (CALIB) ⏎	**Calibration correction function (Models with the /CC1 option)**
not (NOT) ⏎	Select enable (USE) or disable (NOT).
⏎ ESC oY (OK)	The settings are activated.

4. If you are done, press the **ESC** key.
5. To return to the Operation mode,
    1. Press the **ESC** key, use the △ or ▽ key to select End, and press the ⏎ key.
    2. Press the △ or ▽ key to select StorE or Abort, and press the ⏎ key.

Explanation

Bias

Enable (⎕⎕⎕): Enables the setting of the bias value in Setting mode.

Disable (⎕⎕⎕): The "BIAS" item does not appear in Setting mode.

SQRT Low-Cut

Sets the low-cut function for the square root computation.

Enable (⎕⎕⎕): Enables the setting of the low-cut function when a channel is set to square root computation in Setting mode.

Disable (⎕⎕⎕): The "SQRT" item does not appear in Setting mode.

1-5V Low-Cut

Sets the low-cut function for the 1-5V input.

Enable (⎕⎕⎕): Enables the setting of the low-cut function when a channel is set to 1-5V in Setting mode.

Disable (⎕⎕⎕): The "1-5V" item does not appear in Setting mode.

Calibration Correction (/CC1 Option)

Enable (⎕⎕⎕): Enables the setting of the calibration correction function in Basic Setting and Setting modes.

Disable (⎕⎕⎕): The "CALIB" item does not appear in Basic Setting or Setting mode.

Note

The bias and calibration correction functions (/CC1 option) cannot be enabled simultaneously.

<Related Topics>

Setting the bias value: Section 3.10

Setting the low-cut function: Section 2.1

Setting the calibration correction function: Section 4.19

Performing calibration correction: Section 3.11

4.16 Changing the Time Printout Format

The time printout format can be changed on the alarm printout, message printout, recording start printout, and new chart speed printout. Basic Setting mode cannot be entered when recording is in progress

Procedure

1. Hold down the [MENU] key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

Select "T_PRN."

(T_PRN)

(ALARM) **Alarm printout**
Select the time printout format.

(HM)

(MSG) **Message printout**
Select the time printout format.

(HM)

(RCD) **Recording start printout**
Select the time printout format.

(HM)

(SPEED) **New chart speed printout**
Select the time printout format.

(HM)

(OK) The settings are activated.

4. If you are done, press the **ESC** key.
5. To return to the Operation mode,
   1. Press the **ESC** key, use the △ or ▽ key to select End, and press the ↵ key.
   2. Press the △ or ▽ key to select StorE or AborT, and press the ↵ key.

Explanation

Selecting the Printout Format

Select the time format of the alarm printout, message printout, recording start printout, and new chart speed printout.

- **Alarm Printout, Recording Start Printout, and New Chart Speed Printout**

H:M (H̄m̄):	Hour:Minute
H:M:S (H̄m̄S̄):	Hour:Minute:Second
M/D H:M (m̄d H̄m̄):	Month/Day Hour:Minute
M/D H:M:S (m̄d H̄m̄S̄):	Month/Day Hour:Minute:Second
Y/M/D H:M:S (ȳ - S̄):	Year/Month/Day Hour:Minute:Second

- **Message Printout**

H:M (H̄m̄):	Hour:Minute
H:M:S (H̄m̄S̄):	Hour:Minute:Second
M/D H:M (m̄d H̄m̄):	Month/Day Hour:Minute
M/D H:M:S (m̄d H̄m̄S̄):	Month/Day Hour:Minute:Second
Y/M/D H:M:S (ȳ - S̄):	Year/Month/Day Hour:Minute:Second
NONE (nonE):	Does not print the date/time.

Note

The printout format of the year, month, and day varies depending on the print/display format of the date (see section 4.14).

4.17 Initializing the Settings

The recorder settings can be initialized to their factory default.
Be careful, because all settings except the date/time setting in the recorder will be initialized. Basic Setting mode cannot be entered when recording is in progress

Procedure

1. Hold down the [MENU] key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

| bS | I | n | I | t | | Select "INIT." |
| (INIT) | | ⏎ | | | | |

| | S | E | t | U | P | Select the range to be initialized. |
| | (SETUP) | | | ⏎ | | |

| **ESC** | | n | o | | | Select "YES" and press ⏎ to execute the initialization and return to Operation mode. |
| | | (NO) | | | | |
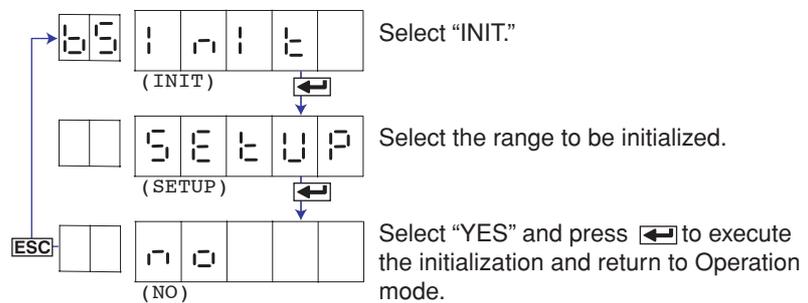
Explanation

Initialization

Set (SEt):   Initializes the settings in Setting mode.
Setup (SEtUP): Initializes the settings in Basic Setting mode and Setting mode.

Items That Are Not Initialized

The following items are not initialized.
· Adjustment value of the pen position and the adjustment value of the printer carriage position (Basic Setting mode)
· Date/Time (Setting mode)

4.18 Assigning Functions to the Remote Control Input Terminals (/R1 Option)

Functions can be assigned to the remote control input terminals. Basic Setting mode cannot be entered when recording is in progress

Procedure

1. Hold down the [MENU] key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

b5 rEn (REM)		Select "REM."
rEn1 (REM1)		Select the remote control terminal number.
r1 rCd (RCD) — Remote control terminal number		Select the function to be assigned.
ESC oH (OK)		The settings are activated.
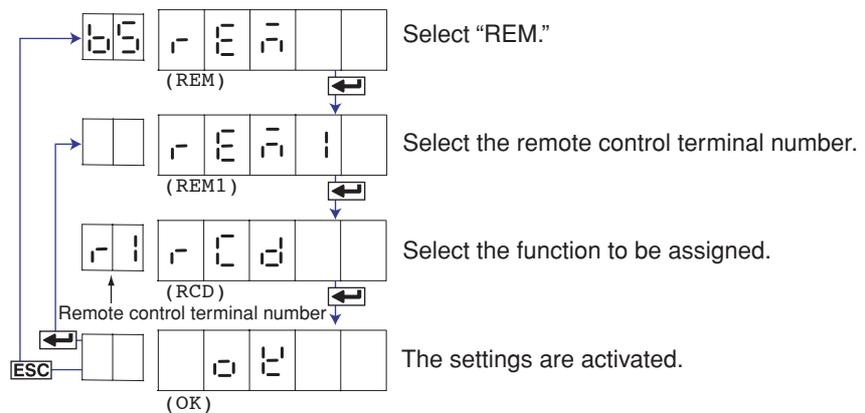
4. Press the ↵ key to set other remote numbers.
   If you are done, press the **ESC** key.
5. To return to the Operation mode,
   1. Press the **ESC** key, use the △ or ▽ key to select End, and press the ↵ key.
   2. Press the △ or ▽ key to select StorE or Abort, and press the ↵ key.

Explanation

Remote Numbers
The remote control input terminal numbers are from 1 to 5.

Functions to Be Assigned

RCD (rCd): Starts/stops recording.
C_SPD (C_SPd): Changes the chart speed.
T_ADJ (t_Adj): Adjusts the internal clock to the nearest hour.
M_PRN (m_Prn): Executes a manual printout.
MSG1 (mSG1): Prints message 1.
MSG2 (mSG2): Prints message 2.
MSG3 (mSG3): Prints message 3.
MSG4 (mSG4): Prints message 4.
MSG5 (mSG5): Prints message 5.
NONE (nonE): No function is assigned.
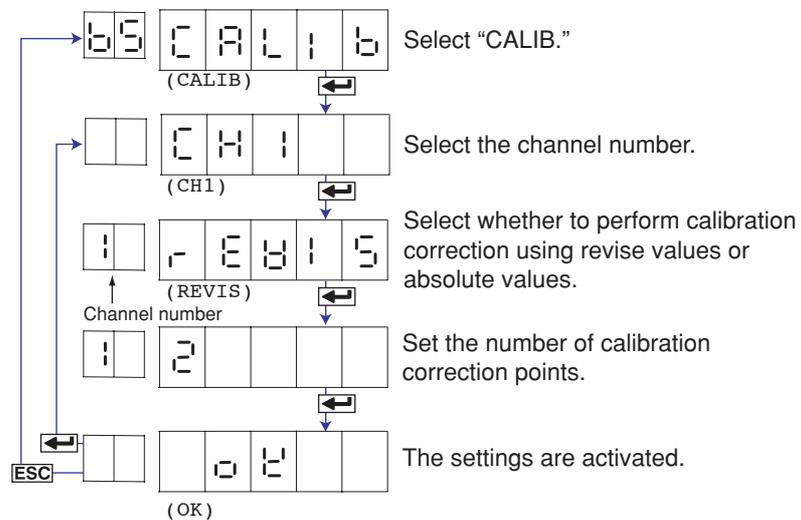
<Related Topics>
Setting the secondary chart speed: Section 3.9

4.19 Setting the Calibration Correction Function (/CC1 Option)

The calibration correction method and the number of correction points can be set. Basic Setting mode cannot be entered when recording is in progress

Procedure

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

bS | CALIb | Select "CALIB."
(CALIB)

CH1 | Select the channel number.
(CH1)

rEHIS | Select whether to perform calibration correction using revise values or absolute values.
(REVIS)

Channel number

2 | Set the number of calibration correction points.

oY | The settings are activated.
(OK)

4. Press the ← key to set other channels.
   If you are done, press the **ESC** key.
5. To return to the Operation mode,
   1. Press the **ESC** key, use the △ or ▽ key to select End, and press the ← key.
   2. Press the △ or ▽ key to select StorE or Abort, and press the ← key.

Explanation

Calibration Correction Method
Revise value (rEHIS): Specifies the difference between the correction values and input values.
Absolute value (AbSoL): Specifies the correction values.

Number of Correction Points
Selects the number of points that make up the segments (including the start and end points) in the range of 2 to 16.

<Related Topics>
Enabling the calibration correction function: Section 4.15
Performing calibration correction: Section 3.11

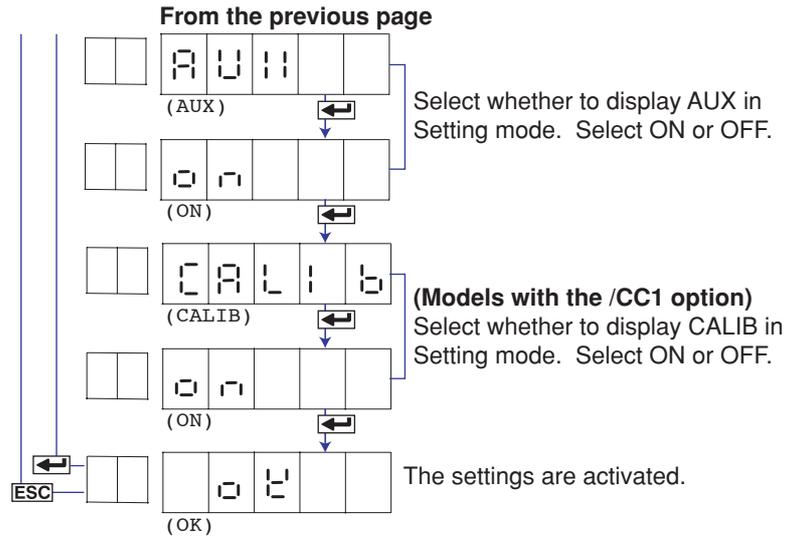# 4.20 Selecting the Menus to Be Hidden in Setting Mode

You can select the menu items to be hidden in Setting mode. Basic Setting mode cannot be entered when recording is in progress

Procedure

1. Hold down the [MENU] key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the [ESC] key, the operation is cancelled, and the display returns to a higher level menu.

b5 S.MEn U (S.MENU) ⏎	Select "S.MENU."
[ESC] → SEt (SET) ⏎	Select "SET."
rAnGE (RANGE) ⏎	Select whether to display RANGE in Setting mode. Select ON or OFF.
On (ON) ⏎	
bIAS (BIAS) ⏎	Select whether to display BIAS in Setting mode. Select ON or OFF.
On (ON) ⏎	
ALArM (ALARM) ⏎	Select whether to display ALARM in Setting mode. Select ON or OFF.
On (ON) ⏎	
Unit (UNIT) ⏎	Select whether to display UNIT in Setting mode. Select ON or OFF.
On (ON) ⏎	
CHArt (CHART) ⏎	Select whether to display CHART in Setting mode. Select ON or OFF.
On (ON) ⏎	

To the next page

From the previous page

```
A U 1 1
(AUX)
```
Select whether to display AUX in Setting mode. Select ON or OFF.

```
o n
(ON)
```

```
C A L I b
(CALIB)
```
(Models with the /CC1 option)
Select whether to display CALIB in Setting mode. Select ON or OFF.

```
o n
(ON)
```

ESC

```
o E
(OK)
```
The settings are activated.

4.   If you are done, press the **ESC** key.
5.   To return to the Operation mode,
     1. Press the **ESC** key, use the △ or ▽ key to select E n d, and press the
        ↵ key.
     2. Press the △ or ▽ key to select S t o r E or A b o r t , and press the
        ↵ key.

Explanation

ON (o n):   Shows the menu in Setting mode.
OFF (o F F): Hides the menu in Setting mode when customized menu is enabled.

<Related Topics>
Enabling the customized menu: Section 4.22

4

Setup Operations for Changing/Adding Functions (Basic Setting Mode)

4.21 Selecting the FUNC Key Menus to Be Hidden

You can select the FUNC key menu items to be hidden. Basic Setting mode cannot be entered when recording is in progress

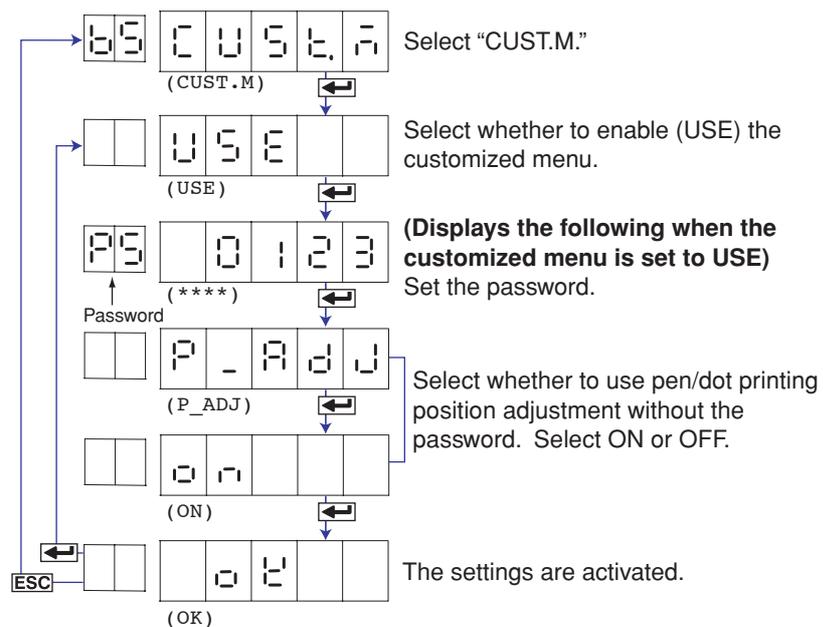**Procedure**

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.

Select "S.MENU."

Select "FUNC."

Select whether to display the manual printout FUNC key. Select ON or OFF.

Select whether to display the setup list FUNC key. Select ON or OFF.

Select whether to display the message FUNC key. Select ON or OFF.

Select whether to display the buffer clear FUNC key. Select ON or OFF.

The settings are activated.

4. If you are done, press the ESC key.
5. To return to the Operation mode,
   1. Press the ESC key, use the △ or ▽ key to select End, and press the ↵ key.
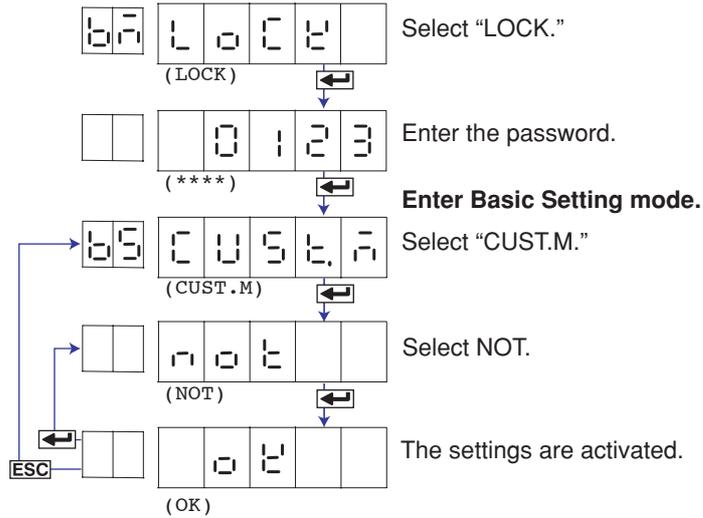   2. Press the △ or ▽ key to select Store or Abort, and press the ↵ key.

Explanation

ON(⊡⊓): Shows the FUNC key menu.

OFF(⊡⊏⊏): Hides the FUNC key menu when customized menu is enabled.

<Related Topics>

Enabling the customized menu: Section 4.22

4

Setup Operations for Changing/Adding Functions (Basic Setting Mode)

4.22 Enabling/Disabling the Customized Menu

The following operations are carried out when the customized menu is enabled.
- Locks Basic setting mode.
- Hides specified FUNC key menu items.
- Hides specified menu items in Setting mode.

Basic Setting mode cannot be entered when recording is in progress

Procedure

Enabling the Customized Menu

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
   If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.

Select "CUST.M."

Select whether to enable (USE) the customized menu.

(Displays the following when the customized menu is set to USE)
Set the password.

Select whether to use pen/dot printing position adjustment without the password. Select ON or OFF.

The settings are activated.

4. If you are done, press the ESC key.
5. To return to the Operation mode,
   1. Press the ESC key, use the △ or ▽ key to select End, and press the ⏎ key.
   2. Press the △ or ▽ key to select Store or Abort, and press the ⏎ key.

Disabling the Customized Menu

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

4. If you are done, press the **ESC** key.
5. To return to the Operation mode,
   1. Press the **ESC** key, use the △ or ▽ key to select E nd, and press the ← key.
   2. Press the △ or ▽ key to select St or E or Abor t, and press the ← key.

Explanation

Enable (U 5 E): Locks Basic Setting mode and hides the specified menu items in Setting mode and FUNC key menu items.

Disable (n o t): Releases Basic Setting mode and shows the all menu items in Setting mode and all FUNC key menu items.

Password

This is the password used to release the customized menu or to enter Basic Setting mode. Set the password using a four-digit number.

Note

Changing the Settings without Releasing the Basic Setting Mode Lock

The settings in Basic Setting mode can be changed without releasing the customized menu.

Procedure

1. Enter the password in the same manner as described in "Releasing the Customized Menu," and press the ⏎ key.
2. Enter Basic Setting mode.
3. Change the settings in the same manner as the normal procedure.
4. Return to Operation mode with the customized menu enabled.

<Related Topics>

Selecting the FUNC key menus to be hidden: Section 4.21

Selecting the menus to be hidden in Setting mode: Section 4.20

Adjusting the pen/dot position: Sections 6.4 and 6.5

4.23 Changing the Temperature Unit

The unit of the temperature measured using the TC or RTD can be changed. Basic Setting mode cannot be entered when recording is in progress

Procedure

1. Hold down the MENU key for 3 seconds to enter Setting mode.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

Select "TEMP."

Selects the temperature unit.

The settings are activated.

4. If you are done, press the **ESC** key.
5. To return to the Operation mode,
   1. Press the **ESC** key, use the △ or ▽ key to select End, and press the ↵ key.
   2. Press the △ or ▽ key to select Store or Abort, and press the ↵ key.

Explanation

Temperature Unit
°C (dEG_C): Uses Celsius.
°F (dEG_F): Uses Fahrenheit.

5.1   A List of Error Messages

There are cases in which the LED displays an error code during operation. The error messages and their description are listed below.

Setting Errors

Code	Message Sent via Communication	Explanation/Countermeasures
001	System error.	Contact your nearest YOKOGAWA dealer.
002	Incorrect date or time setting.	Check the setting.
003	A disabled channel is selected.	The channel does not exist.
004	Incorrect function parameter.	Incorrect communication parameter.
005	The input numerical value exceeds the set range.	–
006	Incorrect input character string.	The entered character cannot be used.
007	Too many characters.	–
008	Incorrect input mode.	Incorrect range mode (Volt, TC, Scale, etc.) setting.
009	Incorrect input range code.	Incorrect range type (2 V, R, PT100, etc.) setting.
010	Format error.	Incorrect character string format.
011	Range settings are not same within the selected channels.	Channels whose range differs cannot be set simultaneously.
012	An invalid characters.	Contains an invalid character.
013	Ref. CH error.	Specify a channel whose range is set to voltage, TC, or RTD for the reference channel.
021	Cannot set an alarm for a SKIPPED channel.	–
022	The upper and lower span limits are equal.	This is not allowed.
023	The upper and lower scale limits are equal.	This is not allowed.
024	The lower span limit is greater than the upper span limit.	–
025	The lower scale limit is greater than the upper scale limit.	–
026	Bias cannot be set to the SKIPPED channel.	–
027	Bias cannot be set to the DI channel.	–
030	The partial boundary value exceeds the range of the span.	–
031	Partial is invalid on the SKIPPED channel.	–
035	The upper and lower limits of the printing zone are equal.	Set the rightmost value of the zone – the leftmost value ≥ 5 mm.
036	The lower limit of the printing zone is greater than the upper limit.	Set the rightmost value of the zone – the leftmost value ≥ 5 mm.
037	The printing zone is narrower than the minimum width (5 mm).	Set the rightmost value of the zone – the leftmost value ≥ 5 mm.
038	Partial is invalid on the DI channel.	–
039	The bias and the calibration cannot be used simultaneously.	–
040	Datume value (1 >= 2)	Set the measured value of the first point less than that of the second point in the calibration correction.
041	Datume value (n-1 > n)	Set the measured value of the $n-1^{th}$ point less than or equal to that of the nth point in the calibration correction.
042	Revise value (n-1 >= n)	Set the correction value of the $n-1^{th}$ point less than that of the nth point in the calibration correction.
048	Start = Finish.	The DST start time and end time cannot be set to the same time.
049	Invalid or missing DST time settings.	Since the time gains one hour when the DST starts, the set-up time does not exist.

Code	Message Sent via Communication	Explanation/Countermeasures
081	All space or 'quit' string cannot be specified.	–
086	The key-lock release password is incorrect.	Enter the correct password.
087	This key is locked.	–
091	Password is incorrect.	Enter the correct password.
100	IP address doesn't belong to class A, B, or C.	–
101	The result of the masked IP address is all 0s or 1s.	–
102	SUBNET mask is incorrect.	Set a correct subnet mask.
103	The net part of default gateway is not equal to that of IP address.	Set the correct default gateway.
161	This action is invalid during pen hold.	–
163	This action is invalid during record.	–
164	This action is invalid during manual printing.	–
165	This action is invalid during list printing.	–
166	This action is invalid during setup list printing.	–
167	This action is invalid during chart feed.	–
169	This action is invalid during ribbon hold.	–

Operation Errors

Code	Message Sent via Communication	Explanation/Countermeasures
232	There is no available data.	There is no data for periodic printout or data for calculating TLOG when the timer expired.

Communication Errors

Code	Message Sent via Communication	Explanation/Countermeasures
300	Command is too long.	–
301	Too many number of commands delimited with ';'.	Keep the number of commands separated by sub delimiters under 10.
302	This command has not been defined.	–
303	Data request command can not be enumerated with sub-delimiter.	–
350	Command is not permitted to the current user level.	–
351	This command cannot be specified in the current mode.	–
352	The option is not installed.	–
353	This command cannot be specified in the current setting.	–
390	Command error.	–
391	Delimiter error.	–
392	Parameter error.	–
393	No permission.	–
394	No such connection.	–
395	Use "quit" to close this connection.	Attempted to disconnect its own connection.
396	Failed to disconnect.	–
397	No TCP control block.	The control block of the specified connection cannot be found.

Code	Message Sent via Communication	Explanation/Countermeasures
400	Input username.	–
401	Input password.	–
402	Select username from 'admin' or 'user'.	If the recorder is configured not to use the user name and password, use user names 'admin' or 'user'.
403	Login incorrect, try again!	–
404	No more login at the specified level is acceptable.	–
420	Connection has been lost.	–
421	The number of simultaneous connection has been exceeded.	–
422	Communication has timed-out.	–

Warning Messages

Code	Message Sent via Communication	Explanation/Countermeasures
600	Initialized.	Settings and measured data have been initialized.

System Errors

Code	Message Sent via Communication	Explanation/Countermeasures
902	RAM failure.	Contact your nearest YOKOGAWA dealer.
910	A/D error.	Contact your nearest YOKOGAWA dealer.
921	A/D calibration value error.	Contact your nearest YOKOGAWA dealer.
922	A/D calibration is in the wrong order.	Contact your nearest YOKOGAWA dealer.
930	Memory acquisition failure.	Contact your nearest YOKOGAWA dealer.
940	The ethernet module is down.	Contact your nearest YOKOGAWA dealer.
950	A/D number error.	Contact your nearest YOKOGAWA dealer.
951	EEPROM write error.	Contact your nearest YOKOGAWA dealer.
960	Ribbon error	Contact your nearest YOKOGAWA dealer.
961	Printer error	Contact your nearest YOKOGAWA dealer.
962	Plotter error	Contact your nearest YOKOGAWA dealer.
963	Pen 1 error	Contact your nearest YOKOGAWA dealer.
964	Pen 2 error	Contact your nearest YOKOGAWA dealer.
965	Pen 3 error	Contact your nearest YOKOGAWA dealer.
966	Pen 4 error	Contact your nearest YOKOGAWA dealer.

5

Troubleshooting

5.2 Troubleshooting Flow Charts

Follow the flow charts to correct the problem.
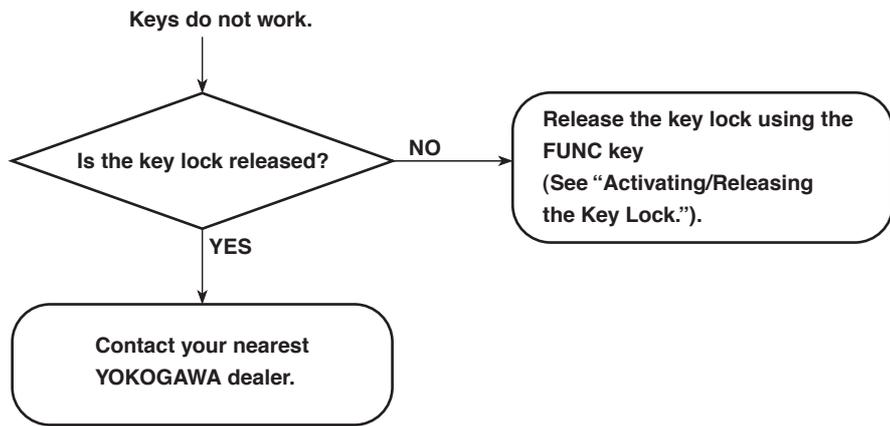
Nothing works (pen and chart paper do not move).

Is the power switch turned ON? Does the switch work properly? — NO → **Turn ON the power properly.**

See "Power Supply Wiring" in the *Operation Guide*.

YES

Is the power supply connected properly? — NO → **Connect properly.**

See "Power Supply Wiring" in the *Operation Guide*.

YES

Is the power supplied properly? — NO → **Supply the power at the specified voltage and frequency.**

YES

Contact your nearest YOKOGAWA dealer.

· **The reading error is large.**
· **The indication is unstable.**
· **The pen is off the scale on either the 0% or 100% side.**

Does the input meet the specifications? — NO → **Change the input to meet the specifications.**

YES

Are the span and range settings correct? — NO → **Adjust the span and range.**

YES

To the next page

From the previous page

YES

↓

Is the input free of noise? —NO→ · **Separate the input wiring from the noise source.**
· **Ground the recorder properly.**
· **Ground the measured object properly.**
· **Insulate the TC from the measured object.**
· **Use shielded cables for input.**
  Select the integration time of the A/D converter (See section 4.2).
· **Use input filter (pen model: see sections 4.11 and 3.2), moving average (dot model: see sections 4.10 and section 3.3).**

YES

↓

Is the environmental temperature kept constant? —NO→ · **Attach the input terminal cover properly.**
· **Protect the input terminal from wind or fans.**
· **Keep the temperature fluctuation near the input terminal to a minimum.**

YES

↓

Is the input wiring correct? —NO→ · **Wire correctly (See "Input Signal Wiring" in the *Operation Guide*.).**
· **Install the terminal block correctly.**
· **Fasten the terminal screws correctly.**
· **Insulate the RTD from ground.**
· **If burnt, replace the TC.**

YES

↓

Is the input wiring parallel with other equipment? —NO→ · **Stop the TC burnout upscale/ downscale function of other equipment.**
· **Ground the recorder and other equipment at the same grounding pole.**
· **Disconnect parallel wiring. (Use a double-element TC, for instance.)**

YES

↓

Is the RJC setting correct (TC input)? —NO→ **Set correctly.**

Section 4.4

YES

↓

Is the pen position and dot printing position adjustment correct? —NO→ **Adjust the pen position or dot printing position**

Section 6.4
Section 6.5

YES

↓

Contact your nearest YOKOGAWA dealer.

5

Troubleshooting

Display and other functions do not work properly.

```
                    ┌──────────────────────────┐
                    │  Is the input free of     │── NO ──▶
                    │  noise?                   │
                    └──────────────────────────┘
                            │ YES
                            ▼
                    ┌──────────────────────────┐
                    │ Contact your nearest     │
                    │ YOKOGAWA dealer.         │
                    └──────────────────────────┘
```

- Separate the input and communication wiring from the noise source.
- Ground the recorder properly.
- Use shielded cables for input and communication wiring.
- Insert an isolation transformer into the power line.
- Insert a power line filter into the power line.
- If an inductive load is connected to an alarm contact output, use a surge suppresser on that line.

Keys do not work.

```
                    ┌──────────────────────────┐
                    │ Is the key lock          │── NO ──▶
                    │ released?                 │
                    └──────────────────────────┘
                            │ YES
                            ▼
                    ┌──────────────────────────┐
                    │ Contact your nearest     │
                    │ YOKOGAWA dealer.         │
                    └──────────────────────────┘
```

Release the key lock using the FUNC key
(See "Activating/Releasing the Key Lock.").

- Some of the menus are not displayed.
- Unable enter Basic Setting mode.

```
                    ┌──────────────────────────┐
                    │ Is the customize         │── NO ──▶
                    │ menu released?            │
                    └──────────────────────────┘
                            │ YES
                            ▼
                    ┌──────────────────────────┐
                    │ Contact your nearest     │
                    │ YOKOGAWA dealer.         │
                    └──────────────────────────┘
```

Release the hiding of the menu items using keys.

Section 4.22

6.1   Periodic Inspection

Check the operation periodically to keep the recorder in good working order.
Perform the following checks and replace worn parts as needed.

*   Is the indication and recording functioning properly? If not, see chapter 5.
*   Are recorded lines or printed characters clear (not blurred)?
    On the pen model, replace the felt pens and plotter pens. On the dot model, replace the ribbon cassette. For the procedure, see "Preparing to Record" in the *Operation Guide.*
*   Is the chart paper feeding properly (no paper jams)? If not, see chapter 5.
*   Is there enough chart paper remaining?
    Remaining chart length is printed on the left margin of the chart at intervals of 20 cm.
    For the replacement procedure of the chart paper, see "Preparing to Record" in the *Operation Guide*.

Remaining amount of chart paper
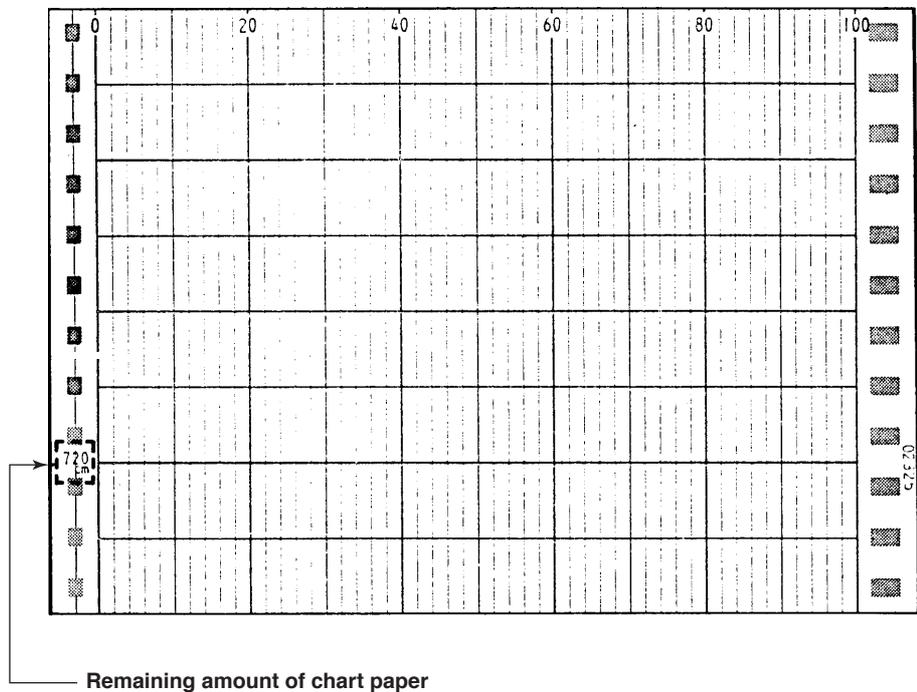
6.2 Cleaning the Recorder

CAUTION

- When cleaning, be sure not to scratch the flexible printed circuit board of the plotter carriage.
- Do not apply lubricating oil to the shaft.

Pen Model

To maintain smooth operation, it is recommended that the plotter carriage shaft be cleaned once a year.

Cleaning Procedure
Wipe the dust off the plotter carriage shaft using a soft lint-free cloth or paper.
If the dirt does not come off easily, apply ethyl alcohol to the cloth or paper.
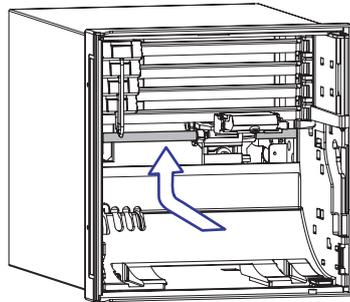
Dot Model

To maintain smooth operation, wipe the dust off the two shafts of the printer carriage using a soft lint-free cloth or paper. It is recommended that these shafts be cleaned once a year.
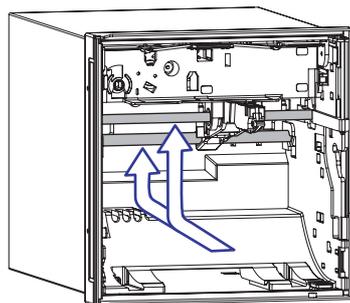
6.3   Calibrating the Recorder

Calibrate the measured value against the input.
It is recommended that the recorder be calibrated once a year to assure its
measurement accuracy.
For details regarding calibration, contact your nearest YOKOGAWA dealer.

Required Instruments

A calibration instrument with appropriate resolution is required for calibrating the
recorder.
Recommended Instrument
- DC voltage standard: Model 5520A by FLUKE or equivalent
  Main Specifications
  Output accuracy: $\pm(0.005\% + 1\ \mu V)$
- Decade resistance box: Yokogawa Meters & Intruments Model 2793-01 or equivalent
  Main Specifications
  Accuracy of output range 0.1 to 500 Ω: $\pm(0.01\% + 2\ m\Omega)$
  Resolution: 0.001 Ω
- 0°C standard temperature device: ZC-114/ZA-10 by Coper Electronics or equivalent
  Main Specifications
  Standard temperature stability accuracy: $\pm0.05°C$

For information on purchasing the calibration instruments, contact your nearest
YOKOGAWA dealer.

Calibration Procedure

1. Wire the recorder and the calibration instrument as shown in the following figure,
   and adequately warm up the instruments (the warm-up time of the recorder is at
   least 30 minutes).
2. Check that the operating environment such as ambient temperature and
   humidity is within the normal operating conditions (see section 7.6).
3. Apply appropriate input signals corresponding to 0%, 50%, and 100% of the
   input range and calculate the errors from the readings.
   If the error is outside the accuracy specifications, contact your nearest
   YOKOGAWA dealer.

Note _____

For thermocouple inputs, you must measure the temperature of the input terminal and apply a
voltage taking into account the reference junction temperature.

_____

DC Voltage Measurement

DC voltage standard

Input terminals
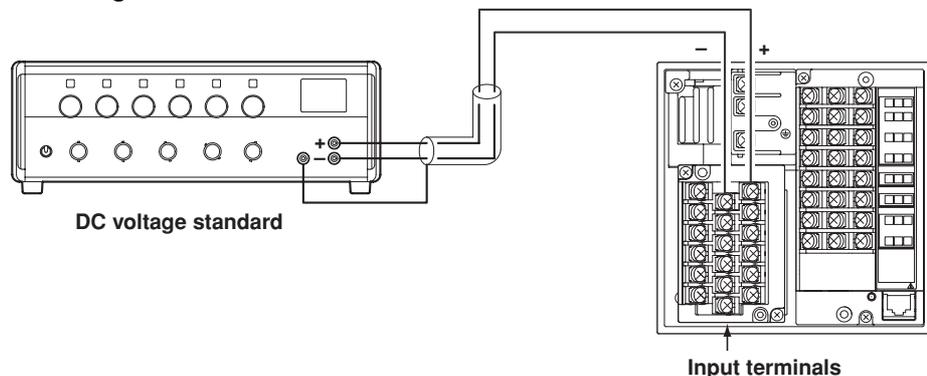
Temperature Measurement When Using an RTD

The resistance of three lead wires must be equal.

Decade resistance box

**(Model 2793-01 from
Yokogawa Meters & Instruments)**
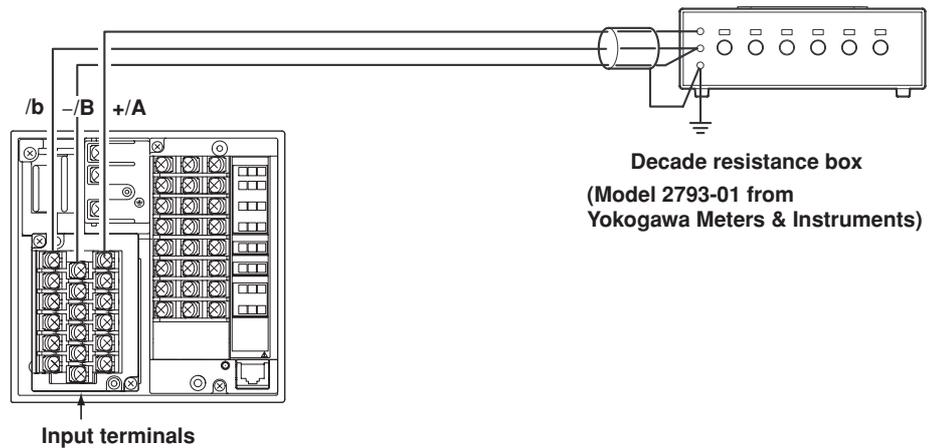
Input terminals

Temperature Measurement When Using a Thermocouple
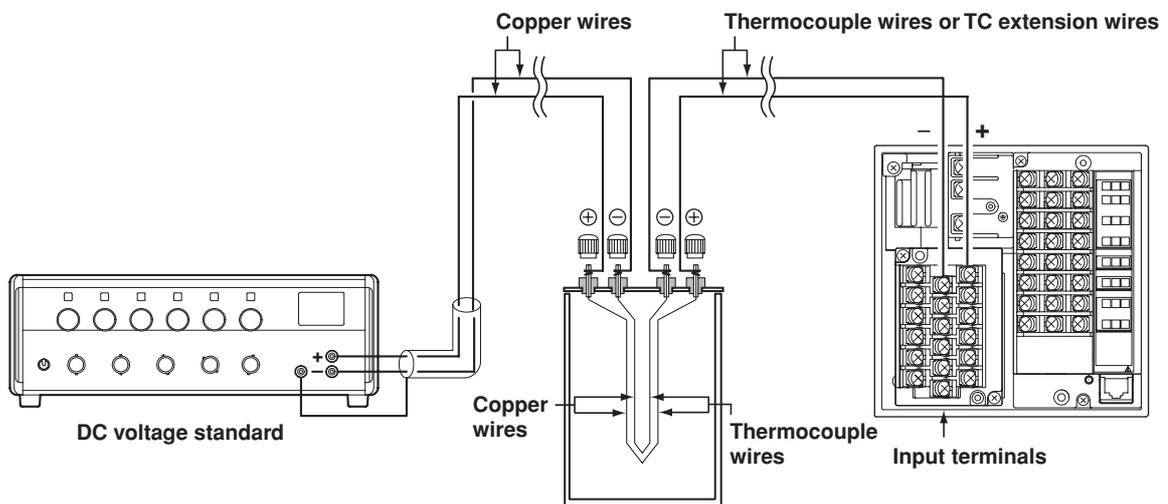
(0°C standard temperature device ZC-114/ZA-10 by Coper Electronics)

RJC of TC input

As the measurement terminal of the recorder is generally at room temperature, the actual output of the thermocouple is different from the values given on the thermoelectromotive force table based on 0°C. The recorder performs compensation by measuring the temperature at the input terminal and adding the corresponding thermoelectromotive force to the actual output of the thermocouple. Therefore, when the measurement terminal is shorted (equivalent to the case when the detector tip is 0°C), the measured value indicates the temperature of the input terminal.

When calibrating the recorder, this compensation voltage (thermoelectromotive force of 0°C reference corresponding to the input terminal temperature) must be subtracted from the output of the DC voltage standard before application. As shown in the figure, by using the 0°C standard temperature device to compensate the reference junction at 0 °C, you can input the thermoelectromotive force of 0 °C reference from the DC voltage standard and perform the calibration.

6.4 Adjusting the Pen Position (Pen Model)

The pen position on the chart paper can be adjusted.
It is recommended that the position be adjusted once a year to assure its recording accuracy.

Note

Pen position is adjusted under standard operating conditions when the recorder is shipped from the factory. Because the chart paper may expand or contract depending on the environment in which the recorder is used, it is recommended that the position be readjusted before use.

Procedure

1. Warm up the recorder for at least 30 minutes.
2. Check that the operating environment such as ambient temperature and humidity is within the standard operating conditions (see section 7.6).
3. Hold down the MENU key for 3 seconds to enter Setting mode.
4. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
5. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
   To change the polarity, press the △ or ▽ key when the leftmost digit of the value is blinking.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.
6. Adjust the zero position first and then the full position.
   Increase or decrease the setting to align pen position with the scale line on the chart paper.

Select "P_ADJ."
(P_ADJ)

Select the zero position (ZERO) or full position (FULL).
(ZERO)

Select the pen number.
(PEN1)

Enter the adjustment value.

The adjustment value is activated.
(OK)
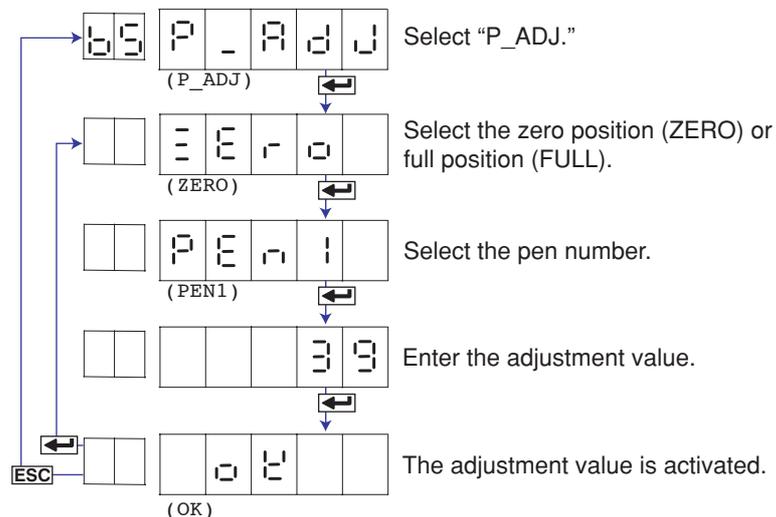
7. To repeat the setup, press the ↵ key.
   If you are done, press the **ESC** key.
8. To return to the Operation mode,
   1. Press the **ESC** key, use the △ or ▽ key to select End, and press the ↵ key.
   2. Press the △ or ▽ key to select StorE or Abort, and press the ↵ key.

Explanation

Zero position ($\exists E \sqcap \Box$): Left edge of the chart paper
Full position ($F \sqcup L L$): Right edge of the chart paper

$PE \sqcap 1$ to $PE \sqcap 4$:   Pen number 1 to 4

Adjustment

Zero position: 00 to 70, full position: –45 to 15

A value change of 1 corresponds to 0.033 mm change in the pen position. Decreasing the value moves the pen to the left and increasing the value moves the pen to the right.

Note

The procedure is different when the customized menu is enabled.
- **When "P-ADJ" of the customized menu is ON**
    Carry out steps 1 to 4 in "Adjusting the Pen Position."
    Select "FREE" and press the ← key to display "P-ADJ."
    Carry out the steps beginning with 5 in "Adjusting the Pen Position."
- **When "P-ADJ" of the customized menu is OFF**
    See "Releasing the Customized Menu" or "Changing the Settings without Releasing the
      Basic Setting Mode Lock."

<Related Topics>

Releasing the customized menu: Section 4.22

Changing the settings without releasing the basic setting mode lock: Section 4.22

6.5 Adjusting the Dot Printing Position (Dot Model)

The dot printing position on the chart paper can be adjusted. Adjust the hysteresis, the zero position, and then the full position.

It is recommended that the position be adjusted once a year to assure its recording accuracy.

Note

Dot printing position is adjusted under standard operating conditions when the recorder is shipped from the factory. Because the chart paper may expand or contract depending on the environment in which the recorder is used, it is recommended that the position be readjusted before use.

Procedure

1. Warm up the recorder for at least 30 minutes.
2. Check that the operating environment such as ambient temperature and humidity is within the standard operating conditions (see section 7.6).
3. Hold down the MENU key for 3 seconds to enter Setting mode.
4. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
5. Carry out the procedure shown in the figure below.
   Press the △ or ▽ key to select the value.
   For the procedure on how to enter values or characters, see page 18 in the *Operation Guide*.
   To change the polarity, press the △ or ▽ key when the leftmost digit of the value is blinking.
   If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.
6. Hysteresis: Increase or decrease the setting so that the center line on the chart paper becomes a single straight line.
   Zero and full positions: Increase or decrease the setting to align the line with the scale line on the chart paper.
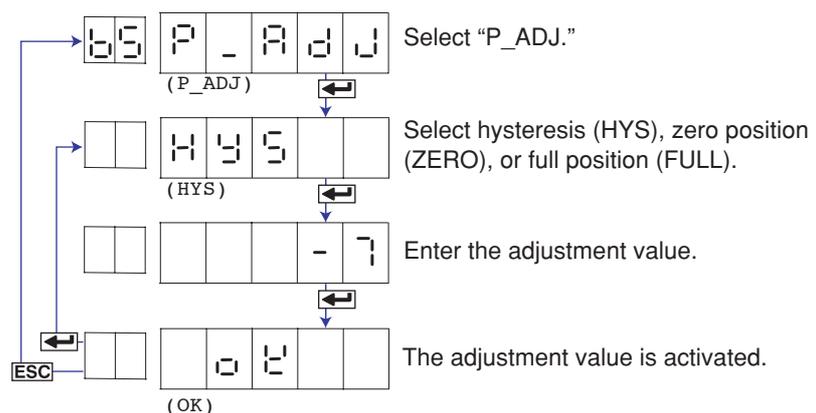
Select "P_ADJ."

Select hysteresis (HYS), zero position (ZERO), or full position (FULL).

Enter the adjustment value.

The adjustment value is activated.

7. If you are done, press the **ESC** key.
8. To return to the Operation mode,
   1. Press the **ESC** key, use the △ or ▽ key to select End, and press the ↵ key.
   2. Press the △ or ▽ key to select Store or Abort, and press the ↵ key.

Explanation

Hysteresis (HYS):   Center of the chart paper
Zero position (ZEro): Left edge of the chart paper
Full position (FULL): Right edge of the chart paper

Hysteresis Adjustment

Adjustment: –7 to 7

A line is drawn at the center of the chart paper. If the line appears as shown in Figure a, increase the displayed setting. If the line appears as shown in Figure b, decrease the displayed setting.

Repeat this procedure until the line becomes straight.

A value change of 1 corresponds to 0.1 mm change in the dot printing position.
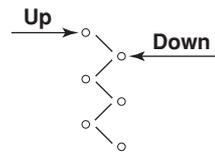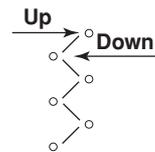
Figure a   **Figure b**

Zero Position and Span Adjustment

Adjustment

   Zero position: 00 to 15, full position: –45 to 15

A value change of 1 corresponds to 0.1mm change in the dot printing position.

Decreasing the value moves the line to the left and increasing the value moves the line to the right.

Note

The procedure is different when the customized menu is enabled.

· **When "P-ADJ" of the customized menu is ON**

      Carry out steps 1 to 4 in "Adjusting the Dot Printing Position."

      Select "FREE" and press the ⏎ key to display "P-ADJ."

      Carry out the steps beginning with 5 in "Adjusting the Dot Printing Position."

· **When "P-ADJ" of the customized menu is OFF**

      See "Releasing the Customized Menu" or "Changing the Settings without Releasing the
         Basic Setting Mode Lock."

<Related Topics>

Releasing the customized menu: Section 4.22

Changing the settings without releasing the basic setting mode lock: Section 4.22

7.1   Input Specifications

Number of Inputs and Scan Interval on the Pen Model

Item	Specifications
Number of inputs	1, 2, 3, or 4
Scan interval	125 ms

Number of Inputs and Scan Interval on the Dot Model

Item	Specifications
Number of inputs	6
Scan interval	1 s (when the integration time of the A/D converter is 20 ms or 16.7 ms)
	2.5 s (when the integration time of the A/D converter is 100 ms)

Input Type

Item	Specifications
Input type	DC voltage, 1-5V, TC, RTD, DI (ON/OFF input), DC current (by adding an external shunt resistor)

Input Range and Measurable Range

Input	Range Type	Measurable Range	
Volt	20 mV	−20.00 to 20.00 mV	
	60 mV	−60.00 to 60.00 mV	
	200 mV	−200.0 to 200.0 mV	
	2 V	−2.000 to 2.000 V	
	6 V	−6.000 to 6.000 V	
	20 V	−20.00 to 20.00 V	
	50 V	−50.00 to 50.00 V	
	1-5V	(0.800 to 1.200 V range) to (4.800 to 5.200 V range)	
TC	R[1]	0.0 to 1760.0°C	32 to 3200°F
	S[1]	0.0 to 1760.0°C	32 to 3200°F
	B[1]	0.0 to 1820.0°C	32 to 3308°F
	K[1]	−200.0 to 1370.0°C	−328 to 2498°F
	E[1]	−200.0 to 800.0°C	−328.0 to 1472.0°F
	J[1]	−200.0 to 1100.0°C	−328.0 to 2012.0°F
	T[1]	−200.0 to 400.0°C	−328.0 to 752.0°F
	N[1]	0.0 to 1300.0°C	32 to 2372°F
	W[2]	0.0 to 2315.0°C	32 to 4199°F
	L[3]	−200.0 to 900.0°C	−328.0 to 1652.0°F
	U[3]	−200.0 to 400.0°C	−328.0 to 752.0°F
	WRe[4]	0.0 to 2400.0°C	32 to 4352°F
RTD	PT (Pt100)[5]	−200.0 to 600.0°C	−328.0 to 1112.0°F
	JPT (JPt100)[5]	−200.0 to 550.0°C	−328.0 to 1022.0°F
DI	Level	0: Less than 2.4 V, 1: Greater than or equal to 2.4 V	
	Contact	0: Open, 1: Closed	

1   R, S, B, K, E, J, T, N: IEC584-1 (1995), DIN IEC584, JIS C1602-1995
2   W: W-5% Rd/W-26% Rd (Hoskins Mfg. Co.), ASTM E988
3   L: Fe-CuNi, DIN43710, U: Cu-CuNi, DIN43710
4   WRe: W-3%Re/W-25%Re (Hoskins Mfg Co.)
5   Pt100: JIS C1604-1997, IEC751-1995, DIN IEC751-1996
     JPt100: JIS C1604-1989, JIS C1606-1989
     Measurement current: i = 1 mA (Pt100, JPt100)

7

Specifications

Item	Specifications
Input type	Floating unbalanced input. Isolation between channels (except, b terminal is shared for RTD input).
Burnout Detection of TC	Can be set for each channel. Upscale/Downscale switchable.

Input Type	Operating Conditions
TC input	2 kΩ or less: normal, 10 MΩ or more: burnout, detection current: approx. 10 μA
1-5V input	0.2 V or less: burnout

Item	Specifications
RJC of TC input	Set whether to use the recorder RJC function or an external RJC function for each channel. Set the compensation voltage when using an external RJC function. Compensation voltage range: −19999 μV to 20000 μV.
A/D converter Resolution Integration time	16 bits Pen model: Selectable from 20 ms (50 Hz), 16.7 ms (60 Hz), and Auto (auto switch between 20 ms and 16.7 ms according to the power supply frequency). Dot model: Selectable from 20 ms (50 Hz), 16.7 ms (60 Hz), 100 ms and Auto (auto switch between 20 ms and 16.7 ms according to the power supply frequency).
Filter function (pen model)	Filter ON/OFF switchable for each channel. Time constant selectable from 2, 5, and 10 s.
Moving average function (dot model)	Moving average ON/OFF switchable for each channel. The number of samples of the moving average is selectable between 2 and 16.

Input Computation

Item	Specifications
Delta computation	Calculates the difference between two channel inputs using the following equation. Delta = (the input value of the channel set to delta computation) − (the input value of the reference channel) where (reference channel NO.) < (channel No. set to delta computation). Computable input type: DC voltage, TC, and RTD. The channel set to delta computation and the reference channel is set to the same range type.
Linear scaling	Scales the input value to a value with a unit suitable for the application. Computable input type: DC voltage, TC, RTD, DI Value after scaling Mantissa: −19999 to 30000 Decimal position: Can be set arbitrarily Unit: Can be set arbitrarily (up to 6 characters) Displayable and printable range −19999 to 31500
Computation on the 1-5V input Linear scaling	Linearly scales the 1-5V signal. Value after scaling: Same as linear scaling. Displayable and printable range: Same as linear scaling.
Low-cut function	Sets values below 0% of the recording span to the leftmost value of the scale. The leftmost value of scale must be less than the rightmost value of scale.
Square root computation	Takes the square root of the input value and linearly scales the result. Computable input type: DC voltage
Linear scaling	Value after scaling: Same as linear scaling. Displayable and printable range: Same as linear scaling.
Low-cut function	Sets values below the low-cut point to the leftmost value of scale. The leftmost value of scale must be less than the rightmost value of scale. Low-cut point range: 0.0 to 5.0% of the recording span (0.1% steps)
Bias	Adds a bias to the measuring input value. Bias value range: ±10% of the span of the measurable range at the specified range type. ±10% of the scaling span if linear scaling is used.

7.2 Alarm Function Specifications

Item	Specifications
Number of alarms	Up to four alarms (level) for each measurement channels.
Alarm type	High limit (H), low limit (L), difference high limit (h), and difference low limit (l). The symbol indicating the alarm is given in parentheses.
Hysteresis	Set a width to the value for detecting alarm occurrence/release (common to all channels and all levels) Applied to high limit alarm and low limit alarm. Hysteresis range: Approx. 0.0% to 1.0% of the recording span (0.1% steps)
Display	Indicates the alarm occurrence status on the display. Display for each channel: Displays the alarm type (display precedence: H , L , h , and ⌊). Alarm summary display: The ALM indicator illuminates.
Alarm relay contact output (optional specifications) See section 7.5	

7.3 Recording Function Specifications

Trend Recording (Pen Model)

Item	Specifications
Recording pen	Disposable felt pen
Step response time	Approx. 1 s (using the IEC61143 measurement method)
Number of pens	Up to 4
Recording color	Pen 1: Red, pen 2: Green, pen 3: Blue, pen 4: Violet
Trend recording	Updates the data at the scan interval. Continuous recording.
Pen offset compensation	Records by compensating for the offset of each pen along the time axis.
Chart speed	10 to 12000 mm/h (40 steps).
Zone recording	Recording zone can be specified for each channel. Recording width: 5 mm or more (1 mm steps)
Partial expanded recording	Records by expanding the right or left side of the boundary position (the other section is reduced). Boundary position: 1 to 99% Boundary value: Within the recording span range

Trend Recording (Dot Model)

Item	Specifications
Recording method	Trend recording by a 6-color wire dot printer
Recording color	Channel 1: Purple, channel 2: Red, channel 3: Green, channel 4: Blue, channel 5: Brown, channel 6: Black
Trend recording interval	Records at the following interval through a raster scan system. AUTO: Synchronizes to the chart speed and automatically sets to the interval FIX: 10 s/6 channels
Chart speed	10 to 1500 mm/h (28 steps)
Recording ON/OFF	Recording can be turned ON/OFF for each channel.
Zone recording	Same as the pen model.
Partial expanded recording	Same as the pen model.

Chart Paper

Item	Specifications
Printing width	100 mm
Type/Length	Z-fold type. Approx. 16 m.
Chart paper feeding accuracy	Within ±0.1% After feeding 1000 mm and with respect to the print scale on the chart paper.

Printouts (Pen Model)

Item	Specifications
Recording pen (color)	Plotter pen (purple)
Alarm printout	Prints alarm occurrence/release.
Printout contents	Occurrence (△)/release (▽) marks, channel No. or tag, alarm type, alarm level, time, printout buffer overflow mark.
Time printout format	Selectable from hour:minute, hour:minute:second, month:day:hour:minute, month:day:hour:minute:second, and year:month:day:hour:minute:second.
Alarm printout buffer	Stores 8 occurrences of alarm information waiting to be printed.
Periodic printout	Prints at specified time intervals from the reference time.
Interval	Reference time: 00 hour 00 minute to 23 hour 00 minute (1 hour steps, minute fixed) Auto: Automatically determined from the chart speed. Manual: Select 10 min, 12 min, 15 min, 20 min, 30 min, 1 hour, 2 hours, 3 hours, 4 hours, 6 hours, 8 hours, 12 hours, or 24 hours.
Mode	Select no periodic printout or print instantaneous values.
Printout contents	Date/Time, offset compensation ON/OFF, channel information (measured value, alarm status, unit, delta computation ON/OFF, scale, channel number or tag, recording color), chart speed (with time ticks)
Message printout	Prints preset message strings.
Number of messages	5
Printout contents	Time, message (up to 16 characters), printout buffer overflow mark.
Time printout format	Selectable from hour:minute, hour:minute:second, month:day:hour:minute, month:day:hour:minute:second, year:month:day:hour:minute:second, and not print.
Message printout buffer	Stores 5 messages waiting to be printed.
Recording start printout	Prints at the start of recording.
Printout contents	Time and chart speed, printout buffer overflow mark.
Time printout format	Selectable from hour:minute, hour:minute:second, month:day:hour:minute, month:day:hour:minute:second, and year:month:day:hour:minute:second.
New chart speed printout	Prints when the chart speed is changed.
Printout contents	Chart speed and time, printout buffer overflow mark.
Time printout format	Selectable from hour:minute, hour:minute:second, month:day:hour:minute, month:day:hour:minute:second, and year:month:day:hour:minute:second.
Manual printout	Prints the measured values of all channels.
Printout contents	Measured values of all channels at that point. Trend recording is temporarily suspended.
Setting printout (List)	Prints the settings of items in Setting mode.
Printout contents	Range setting, alarm setting, etc. Trend recording is temporarily suspended.
Setting printout (setup list)	Prints the settings of items in Basic Setting mode.
Printout contents	Basic alarm specifications, basic recording specifications, etc. Trend recording is temporarily suspended.

Items dependent on the chart speed

Chart speed	Periodic printout Alarm printout Message printout Recording start printout New chart speed printout
10 to 1500 mm/h	Printed
1800 mm/h or higher	Not printed

Chart speed	Periodic printout interval
10 to 15 mm/h	8 hours
20 to 30 mm/h	4 hours
40 to 60 mm/h	2 hours
75 to 120 mm/h	1 hour
150 to 180 mm/h	30 minutes
200 to 300 mm/h	20 minutes
360 to 1500 mm/h	10 minutes

Date printout format	Select the printout format of the date from Y/M/D, M/D/Y, D/M/Y, D.M.Y, and M.D.Y. The format applies to the date printout of all printout items .

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Specifications

Printout (Dot Model)

Item	Specifications
Recording	Dot printing.
Channel printout	Prints the channel number beside the trend recording every approx. 25 mm of chart paper. Channel printout ON/OFF selectable.
Alarm printout	Prints alarm occurrence/release.
Printout contents	Occurrence ($\triangle$, red)/release ($\triangledown$, blue) marks, channel No. or tag, alarm type, alarm level, time, printout buffer overflow mark.
Time printout format	Selectable from hour:minute, hour:minute:second, month day hour:minute, month day hour:minute:second, and month day year hour:minute:second.
Alarm printout buffer	Stores 12 occurrences of alarm information waiting to be printed.
Periodic printout	Prints at specified time intervals from the reference time.
Interval	Same as the pen model.
Measured value	Same as the pen model.
Printout contents	Same as the pen model except offset compensation ON/OFF and recording color are not printed.
Message printout	Same as the pen model.
Recording start printout	Same as the pen model. With time ticks.
New chart speed printout	Same as the pen model. With time ticks.
Manual printout	Same as the pen model.
Setting printout (List)	Same as the pen model.
Setting printout (Setup)	Same as the pen model.

Items dependent on the chart speed

Chart speed	Channel printout	Periodic printout Alarm printout Message printout Recording start printout New chart speed printout
10 to 100 mm/h	Printed	Printed
120 mm/h or higher	Not printed	Not printed

Chart speed	Periodic printout interval
10 to 15 mm/h	8 hours
20 to 30 mm/h	4 hours
40 to 75 mm/h	2 hours
80 to 100 mm/h	1 hour

Date printout format	Same as the pen model.

Values for Special Measured Values
Same as "Special values" for the digital display on page 7-7.

7.4 Display Function Specifications

Display and Displayed Contents

This section explains the specifications of the display functions of measurement channels. Display examples are illustrations used to explain the displayed contents and differ in appearance from the actual displays.

Item	Specifications
Display	7-segment LED (orange)
Number of screens	5 (switched using keys)
Displayed contents Display type	Digital display and channel ID alarm status display (automatically/manually switch the displayed channel) Date display Time display OFF
Display update of measured values / computed values When displayed channels are fixed	
	Dot model: Updated at the scan interval
	Pen model: Updated every 1 s
When displayed channels are automatically switched	
	Switches the channel/alarm status and measured value at 2-s intervals.

Status display
  RCD
  ALM
	
	This indicator turns ON when recording is started and turns OFF when stopped.
	The indicator turns ON when an alarm occurs and turns OFF when the alarm is released.

Display type specifications	
Digital display Channel number (1st digit)	 Displayed with 1 character as follows: Measurement channels: 1, 2, 3, 4, 5, 6
Alarm (2nd digit)	Displayed with the symbols below. If multiple alarms are occurring simultaneously, the alarm with higher precedence is shown. (Higher order of precedence) H , L , h , ∟ (lower order of precedence)
Measured value (3rd to 7th digits)	
	• DC voltage input: Displays values between "the min. measurable value – 5% of the span of the measurable range" and "the max. measurable value + 5% of the span of the measurable range" of the range (example: –2.200 to 2.200 V for the 2 V range).
	• TC and RTD input: Displays values for input values between "the min. measurable value – 10°C" and "the max. measurable value + 10°C" (example: –10.0°C to 1770.0°C for TC R)
	• ON/OFF input (DI): Displays the input value 0 or 1.
	• Linear scaling (1-5V, scaling, and square root): Displays value for input values between "the leftmost value of scale – 5% of scaling span" and "the rightmost value of scale + 5% of scaling span" (example: –5.0 to 105.0 when scaled to 0.000 to 100.0). However, the displayable range during scaling is from –19999 to 31500 (excluding the decimal). Values below –19999 and values above 31500 are displayed as –Over and +Over, respectively.

7.4 Display Function Specifications

Item	Specifications
Special values	Measurement channel

Status	Display	Description
+Over	OVER	See below.
–Over	–OVER	See below.
Skip	SKIP	A value for channels set to skip.
Error	ERROR	Values such as when both the reference channel and measurement channel are +Over or –Over in delta computation.
+Burnout	B.OUT	A value displayed when a burnout is detected on a channel set to burnout up scale.
–Burnout	B.OUT	A value displayed when a burnout is detected on a channel set to burnout down scale.

+Over and –Over of measurement channels
A condition in which the value is outside the display range indicated in "Measured value or computed value" above. For example,
- For 2 V range, values below –2.200 V are –Over and values over 2.200 V are +Over.
- For TC R, values below –10.0°C are –Over and values over 1770.0°C are +Over.
- If scaled to 0.0 to 100.0, values below –5.0 are –Over and values above 105.0 are +Over. However, the displayable range during scaling is from –19999 to 31500 (excluding the decimal). Values below –19999 and values above 31500 are displayed as –Over and +Over, respectively.

Item	Specifications
Date/Time display	Displays the date or the time. The date display format can be selected. The format is common with the date printout format.
Lights off	Displays nothing.

Name	Display Example	Description
Digital Display	(display: 1H 1.0000) Channel number — Alarm information — Measured value	Channel number. (1 digit), alarm (1 digit), and measured value (5 digits)
Date display	**Year/Month/Day** (06 03 31) Year — Month — Day **Month/Day/Year** (03 31 06) Month — Day — Year **Day/Month/Year** (31 03 06) Day — Month — Year	Displays the lower two digits for the year.
Time display	(16 45 50) Hour — Minute — Second	

7.5 Specifications of Optional Functions

Alarm Output Relay (/A1, /A2, and /A3)

Item	Specifications
Operation	Outputs relay contact signals from the dedicated terminals on the rear panel when alarms occur.
Number of outputs	2 outputs (/A1), 4 outputs (/A2), 6 outputs (/A3)
Relay contact rating	250 VDC/0.1 A (for resistance load)
	250 VAC (50/60 Hz)/3 A
Output format	NO-C-NC
Auxiliary functions	Energized/De-energized operation selectable (common to all relays)
	Reflash operation (Fixed to relay I01, I02, and I03. Relay release time is approx. 500 ms.)
Diagnosis output	Relay I01 can be used for diagnosis output.
	Diagnosis output: Outputs a relay signal when an error in the recording section (plotter on the pen model), a burnout, or an error in the A/D converter is detected. Relay operation is fixed to de-energized.

RS-422A/485 Communication Interface (/C3)

Item	Specifications
Connection	Complies with EIA RS-422A/485
Connection type	Multi-drop connection 1:32 (four-wire system), 1:31 (two-wire system)
Transmission mode	Half-duplex
Synchronization	Start-stop synchronization
Baud rate	1200, 2400, 4800, 9600, 19200, or 38400 bps
Start bit	Fixed to 1 bit
Data length	7 bits or 8 bits
Stop bit	Fixed to 1 bit
Parity	Odd, even, or none (no parity)
Received buffer length	2047 bytes
Escape sequence	Open and close
Protocol	Dedicated protocol, Modbus slave protocol
Communication mode	ASCII for input/output for control and setting
	ASCII or binary for input/output of measured data
Communication distance	1.2 km

Ethernet Communication Interface (/C7)

Item	Specifications
Function	
Setting/Measurement server	Uses a dedicated protocol
	Measured/computed data, setup data, status byte
Maintenance/Test server	Connection information, network statistics, etc.
Instrument information server	Model, serial number, etc.
Electrical and mechanical specifications	
	Conforms to IEEE 802.3.
Interface	Basic specifications
	Connection Ethernet (10BASE-T)
	Protocol TCP, IP, UDP, ICMP, and ARP
	The maximum number of simultaneous connections and the number of simultaneous use

Function Administrators	Maximum Number of Connections Users	Number of Simultaneous Users		Port Number
Setting/Measurement server	3	1	2	34260/tcp
Maintenance/Test server	1	1	1	34261/tcp
Instrument information server	-	-	-	34264/udp

Item	Specifications
Miscellaneous	
User authentication	Administrator: 1, users: 6 (limitations placed on users)
Keepalive	Drops the connection if there is no response to an inspection packet. Use or not use is selectable.

Green Display (/D6)

Item	Specifications
Color	1st digit (channel display) and 3rd to 7th digits (data display) of the 7- segment LED: Green 2nd digit (alarm display): Orange

Calibration Correction (/CC1)

Item	Specifications
Calibration Correction Method	
	Converts the measured values of the measurement channels to correction values.
	Specify using revise values or absolute values.
	Number of correction points: 2 to 16 (including the start and end points)
Selectable input ranges	DC voltage, TC, RTD, and 1-5V

Cu10, Cu25 RTD Input (/N1)

Item	Specifications
Cu10, Cu25 RTD	This option allows Cu10 and Cu25 inputs to be added to the standard input types.
Input type and measurable range	

Input Type		Measurable Range
RTD (Measurement current i: 2 mA)	Cu10 (GE) Cu10 (L&N) Cu10 (WEED) Cu10 (BAILEY) Cu10: α = 0.00392 at 20°C Cu10: α = 0.00393 at 20°C Cu25*: α = 0.00425 at 0°C	−200 to 300°C −328.0 to 572.0°F

* Measurement current i = 1 mA

Measurement and recording accuracy

Input Type	Measurement Accuracy	Recording Accuracy
Cu10 (GE) Cu10 (L&N) Cu10 (WEED) Cu10 (BAILEY) Cu10: α = 0.00392 at 20°C Cu10: α = 0.00393 at 20°C	±(0.4% of rdg + 1.0°C)	Measurement accuracy ± (0.3% of recording span)
Cu25: α = 0.00425 at 0°C	±(0.3% of rdg + 0.8°C)	

Expansion Inputs (/N3)

Item	Specifications
Input type	Adds the input types shown in the table below.

Input Type		Measurement Range	
Thermocouple	PR40-20	0.0 to 1900.0°C	32 to 3452°F
	PLATINEL	0.0 to 1400.0°C	32 to 2552°F
	NiNiMo	0.0 to 1310.0°C	32 to 2390°F
	W/WRe26	0.0 to 2400.0°C	32 to 4352°F
	Type N (AWG14)	0.0 to 1300.0°C	32 to 2372°F
	Kp vs Au7Fe	0.0 to 300.0 K	
RTD (Measuring current i = 1 mA)	Pt25	−200.0 to 550.0°C	−328.0 to 1022.0°F
	Pt50	−200.0 to 600.0°C	−328.0 to 1112.0°F
	Ni100 (SAMA)	−200.0 to 250.0°C	−328.0 to 482.0°F
	Ni100 (DIN)	−60.0 to 180.0°C	−76.0 to 356.0°F
	Ni120	−70.0 to 200.0°C	−94.0 to 392.0°F
	J263*B	0.0 to 300.0 K	
	Cu53	−50.0 to 150.0°C	−58.0 to 302.0°F
	Cu100: α = 0.00425 at 0°C	−50.0 to 150.0°C	−58.0 to 302.0°F

Item	Specifications

Measurement and recording accuracy

Input Type		Measurement Accuracy	Recording Accuracy
PR40-20	0 to 450°C	Not warranted	Measurement accuracy ±(0.3% of recording span)
	450 to 750°C	±(0.9% of rdg + 3.2°C)	
	750 to 1100°C	±(0.9% of rdg + 1.3°C)	
	1100 to 1900°C	±(0.9% of rdg + 0.4°C)	
PLATINEL		±(0.25% of rdg + 2.3°C)	
NiNiMo		±(0.25% of rdg + 0.7°C)	
W/WRe26	0 to 400°C	±15.0°C or less	
	400 to 2400°C	±(0.2% of rdg + 2.0°C)	
Type N(AWG14)		±(0.2% of rdg + 1.3°C)	
Kp vs Au7Fe	0 to 20 K	±4.5 K	
	20 to 300 K	±2.5 K	
Pt25		±(0.15% of rdg + 0.6°C)	
Pt50		±(0.3% of rdg + 0.6°C)	
Ni100(SAMA)		±(0.15% of rdg + 0.4°C)	
Ni100(DIN)			
Ni120			
J263*B	0 to 40 K	±3.0 K	
	40 to 300 K	±1.0 K	
Cu53		±(0.15% of rdg + 0.8°C)	
Cu100		±(0.2% of rdg + 1.0°C)	

Note) No RJC for PR40-20 (fixed to 0°C)

Remote Control 5 Points (/R1)

Item	Specifications
Number of input terminals	5
Input type	Isolated from the main circuitry through a photocoupler, built-in isolated power supply for the input terminals, and shared common
Input type and signal level	
Voltage-free contact	Contact closed at 200 Ω or less and contact open at 100 kΩ or greater
Open collector	ON voltage: 0.5 V or less (sink current 30 mA or more), leakage current when OFF: 0.25 A or less
Signal type	Edge, level, or trigger (250 ms or more)
Operation	Perform the following control operations by applying a given signal to the remote signal input terminal.

- Start/stop recording (edge)
- Set the clock (adjust the clock to the nearest hour with the contact input, trigger)

Time When Signal Is Input	Procedure
00 min 00 s to 01 min 59 s	Truncates the minutes and seconds. Example: 10:00:50 → 10:00:00
58 min 00 s to 59 min 59 s	Rounds up the minutes and seconds. Example: 10:59:50 → 11:00:00
02 min 00 s to 57 min to 59 s	No operation

- Manual printout (trigger)
- Message 1 to 5 printout (trigger)
- Switch the chart speed (level)

7

Specifications

24-VDC/AC Power Supply Operation (/P1)

Item	Specifications			
Rated supply voltage	24 VDC/AC			
Allowable power supply voltage range				
	21.6 to 26.4 VDC/AC			
Withstand voltage	1000 VAC at 50/60 Hz for one minute (between the power terminal and the ground terminal)			
Rated power supply frequency				
	50/60 Hz (for AC operation)			
Allowable power supply frequency range				
	50 Hz ± 2% or 60 Hz ± 2% (for AC operation)			
Effects of power supply voltage fluctuation				
	The fluctuation in the measured values is within ±1 digit and that in the recording is within ±0.1% in the recording span for the 21.6 to 26.4 VAC/DC range.			
Effects of power supply frequency fluctuation				
	The fluctuation in the measured values and recording is ±(0.1% of rdg + 1 digit) at the rated frequency ±2 Hz.			
Rated power	25 VA (for DC operation) or 35 VA (for AC operation)			
Power consumption	**Model**	**24 VDC**	**24 VAC**	**Maximum**
	1 to 4 pen models	Approx. 7 VA*	Approx. 13 VA*	Approx. 35 VA
	6 dot model	Approx. 8 VA*	Approx. 13 VA*	Approx. 35 VA
	* When balanced			

7.6   General Specifications

Construction

Item	Specifications
Mounting	Flush panel mounting (on a vertical plane)
Mounting angle	Inclined backward up to 30 degrees from a horizontal plane.
Allowable panel thickness	2 to 26 mm
Material	Case: drawn steel
	Front door: Aluminum die-cast
Color	Case: Charcoal gray light (Munsell 10B3.6/0.3 or equivalent)
	Front door: Charcoal gray light (Munsell 10B3.6/0.3 or equivalent)
Front panel	Water and dust-proof (complies with DIN40050-IP54)
Dimensions	144(W) × 144(H) × 220(D) mm (D: depth from the panel mounting plane)
Weight	1-pen: approx. 2.1 kg, 2-pen: approx. 2.2 kg, 3-pen: approx. 2.3 kg, 4-pen: approx. 2.4 kg
	6-dot: approx. 2.5 kg

Normal Operating Conditions

Item	Specifications
Ambient temperature	0 to 50°C
Ambient humidity	20 to 80%RH (at 5 to 40°C)
Allowable power supply voltage range	
	90 to 132, 180 to 264 VAC
Power supply frequency	50 Hz±2%, 60 Hz±2%
Vibration	10 to 60 Hz 0.2 m/s^2 or less
Shock	Not acceptable.
Magnetic field	400 A/m or less (DC and 50/60 Hz)
Noise	Normal mode (50/60 Hz)
	Volt: The peak value including the signal must be less than 1.2 times the rated value of the range (Example: 2 V for 2 V range).
	TC: The peak value including the signal must be less than 1.2 times the rated value of the range.
	RTD: 50 mV or less
	Common mode noise (50/60 Hz): 250 VACrms or less for all ranges
	Maximum noise voltage between channels (50/60 Hz): 250 VACrms or less.
Mounting position	Up to 30° of backward tilt angle allowed, no tilt to the left or right
Warm-up time	At least 30 minutes after power on
Altitude	2000 m or less above sea level

Power Supply

Item	Specifications
Rated supply voltage	100 to 240 VAC
Allowable power supply voltage range	
	90 to 132, 180 to 264 VAC
Rated power supply frequency	
	50 Hz, 60 Hz
Rated power	40 VA
Power consumption	

Model	100 VAC	240 VAC	Maximum
1- to 4-pen model	Approx. 12 VA*	Approx. 17 VA*	Approx. 40 VA
6-dot model	Approx. 13 VA*	Approx. 18 VA*	Approx. 40 VA

*   When balanced

Isolation

Item	Specifications
Insulation resistance	Each terminal to ground terminal: 20 MΩ or more (at 500 VDC)
Dielectric strength	Power supply to ground terminal: 1500 VAC (50/60 Hz), 1 minute
	Contact output terminal to ground terminal: 1500 VAC (50/60 Hz), 1 minute
	Measuring input terminal to ground terminal: 1000 VAC (50/60 Hz), 1 minute
	Between measuring input terminals: 1000 VAC (50/60 Hz), 1 minute (except for RTD input terminal)
	Remote input terminal to ground terminal: 500 VDC, 1 minute
Grounding	Grounding resistance: 100 Ω or less

Transport and Storage Conditions

Item	Specifications
Ambient temperature	–25 to 60°C
Ambient humidity	5 to 95%RH (no condensation)
Vibration	10 to 60 Hz, 4.9 m/s^2 maximum
Shock	392 m/s^2 maximum (in packaged condition)

Supported Standards

Item	Specifications
CSA	Certified by CSA22.2 No. 61010-1, Installation category II[1], Measurement category II[2], Pollution degree 2[3]
UL	Certified by UL61010B-1 (CSA NRTL/C)
CE	
EMC	EN61326(Emission: Class A, Immunity: Annex A)
	EN61000-3-2
	EN61000-3-3
	EN55011 Class A Group 1
Low voltage directive	EN61010-1, Installation category II, Measurement category II, Pollution degree 2
C-Tick	AS/NZS CISPR 11 Class A Group 1
Noise	Machine Noise Information Ordinance 3.GSGV, Jan 18, 1991
	Maximum noise level: 60 dB (A) or less (complies with ISO7779)

1 Installation category (overvoltage category) describes a number which defines a transient overvoltage condition. It implies the regulation for impulse withstand voltage. "II" applies to electrical equipment which is supplied from the fixed installation like a distribution board.

2 Applies to measuring circuits connected to low voltage installation, and electrical instruments supplied with power from fixed equipment such as electric switchboards.

3 "Pollution degree" describes the degree to which a solid, liquid, or gas which deteriorates dielectric strength or surface resistivity is adhering. "2" applies to normal indoor atmosphere. Normally, only non-conductive pollution occurs.

Standard Performance

Item	Specifications
Measurement and recording accuracy	

The following specifications apply to operation of the recorder under standard operation conditions:
Temperature: 23 ± 2°C
Humidity: 55% ± 10%RH
Power supply voltage: 90 to 132 or 180 to 264 VAC
Power supply frequency: 50/60 Hz ± 1%
Warm-up time: At least 30 minutes.
Other ambient conditions such as vibration should not adversely affect the operation

Input Type	Range Type	Measurement (Digital Display)		Recording (Trend)	
		Measurement Accuracy	Highest Res.	Recording Accuracy	Resolution
DC voltage	20 mV	±(0.1% of rdg + 2 digits)	10 μV	Measurement accuracy ± (0.3% of recording span)	Pen model: Dead band 0.2% of recording span Dot model: Resolution 0.1 mm
	60 mV		10 μV		
	200 mV		100 μV		
	2 V		1 mV		
	6 V		1 mV		
	20 V		10 mV		
	50 V	±(0.1% of rdg + 3 digits)	10 mV		
DC voltage	1-5 V	±(0.1% of rdg + 2 digits)	1 mV		
TC **(excludes RJC accuracy)**	R S B	±(0.15% of rdg + 1°C) except R,S: 0 to 100°C, ±3.7°C 100 to 300°C, ±1.5°C B: 400 to 600°C, ±2°C Accuracy not warranted for values less than 400°C	0.1°C		
	K	±(0.15% of rdg + 0.7°C) except ±(0.15% of rdg + 1°C) for −200 to −100°C			
	E J T	±(0.15% of rdg + 0.5°C) except ±(0.15% of rdg + 0.7°C) for: −200 to −100°C			
	N	±(0.15% of rdg + 0.7°C)			
	W	±(0.15% of rdg + 1°C)			
	L U	±(0.15% of rdg + 0.5°C) except ±(0.15% of rdg + 0.7°C) for: −200 to −100°C			
	WRe	±(0.2% of rdg + 1°C)			
RTD	Pt100 JPt100	±(0.15% of rdg + 0.3°C)			
ON/OFF input	Level Contact	Threshold level (2.4 V) accuracy ± 0.1 V ≤ 1 KΩ: ON, ≥ 100 kΩ: OFF (Parallel capacitance 0.01 μF or less)	–	–	

Measuring accuracy in case of linear scaling	

Accuracy during scaling (digits) = measuring accuracy (digits) × multiplier + 2 digits (rounded up)
where the multiplier = scaling span (digits)/measuring span (digits).
Example: Assuming that
• range type: 1-5 V
• measuring span: 1.000 to 5.000 V
• scaling span: 0.000 to 2.000 Then,
Measuring accuracy = ±(0.1% × 5 V + 2 digits)
                            = ±(0.005 V [5 digits] + 2 digits)
                            = ±7 digits
Multiplier = {2000 digits (0.000 to 2.000)}/{4000 digits (1.000 to 5.000)} = 0.5
Accuracy during scaling = ±(7 × 0.5 + 2) digits = 6 digits (rounded up)

Reference junction compensation	

Internal/External selectable for each channel

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Specifications

7.6 General Specifications

Item	Specifications
Reference junction compensation accuracy	
	Above 0°C with input terminal temperature balanced (60 minutes after power on)
	Type R, S, B, W, WRe: ±1.0°C
	Type K, J, E, T, N, L, U: ±0.5°C
Maximum input voltage	±10 VDC (continuous) for ranges of 200 mV or less, TC, RTD, and DI ranges
	±60 VDC (continuous) for 2 VDC or higher ranges
Input resistance	Approximately 10 MΩ or more for ranges of 200 mV or less and TC
	Approximately 1 MΩ for 2 VDC or higher ranges
Input source resistance	Volt, TC: 2 kΩ or less
	RTD input: 10 Ω or less per wire (The resistance of all three wires must be equal).
Bias current	10 nA or less (except when burnout detection function is enabled)
Common mode rejection ratio	120 dB (50/60 Hz ± 0.1%, 500 Ω unbalanced, between the minus terminal and ground)
Normal mode rejection ratio	40 dB or more (50/60 Hz ± 0.1%)
Noise rejection	By the integrating A/D converter: The integration time is 16.7 ms, 20 ms, or 100 ms (dot model)
	Low-pass filtering (pen model): Filter time constant is 2 s, 5 s, or 10 s
	Moving average (dot model): The number of samples is 2 to 16.

Effects of Operating Conditions

Item	Specifications
Ambient temperature	With temperature variation of 10°C:
	Measurement: ±(0.1% of rdg + 1 digit) or less
	Recording: Measurement fluctuation + ±0.2% of the recording span or less
	* Excluding the error of reference junction compensation
Power supply fluctuation	With variation within 90 to 132 V and 180 to 264 VAC (50/60 Hz):
	Measurement: ±1 digit or less
	Recording: ±0.1% of the recording span or less
	With variation of ±2 Hz from rated power frequency (power supply voltage 90 to 132, 180 to 264 VAC):
	Measurement: ±(0.1% of rdg + 1 digit) or less
	Recording: Same as the measurement fluctuation
Magnetic field	AC (50/60 Hz) and DC 400 A/m fields:
	Measurement: ±(0.1% of rdg 10 digits) or less
	Recording: ±0.5% of the recording span or less
Input source resistance	
DC voltage range	With variation of +1 kΩ:
	Ranges of 200 mV or less: Within ±10 μV
	Ranges of 2V or more: ±0.1% of rdg
TC range	With variation of +1 kΩ: ±10 μV or less
RTD range	With variation of 10 Ω per wire (resistance of all three wires must be equal):
	Measurement: ±(0.1% of rdg + 1 digit) or less
	Recording: Measurement fluctuation + ±0.1% of the recording span or less
	With maximum difference of 40 mΩ between wires: Approx. 0.1°C (for Pt100)
Mounting position	With a backward tilt of 30° or less
	Measurement: ±(0.1% of rdg + 1 digit) or less
	Recording: Indication fluctuation + ±0.1% of the recording span or less
Vibration	When a sinusoidal vibration along all three axis at a frequency between 10 to 60 Hz and an acceleration of 0.2 m/s^2 is applied for 2 hours
	Measurement: ±(0.1% of rdg + 1 digit) or less
	Recording: Indication fluctuation + ±0.1% of the recording span or less

Other Specifications

Item	Specifications
Clock	With a calendar function
Accuracy of clock	±100 ppm, excluding a delay (of 1 second, maximum) caused each time the power is turned on.
DST	The date/time for switching between standard time and DST can be specified.
Memory backup	A built-in lithium battery backs up the setup parameters and runs the clock (battery life: approximately ten years at room temperature).
Key Lock Function	Password for releasing the key lock can be set.
Key Lock Items	RCD key, MENU key, FEED key, and function under the FUNC key (manual printout, list printout, setup list printout, message printout, printout buffer clear, and pen/ribbon cassette exchange)

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