CONTENTS

Chapter 1
Chapter 2
Chapter 3
Chapter 4
Chapter 5
Chapter 6
Chapter 7
Chapter 8
Chapter 9
APPENDIX
INDEX

Chapter 1 OVERVIEW OF VR100

1.1 Functional Overview

1.1.1 Functional Configuration

The functions of the VR100 recorder are illustrated below.
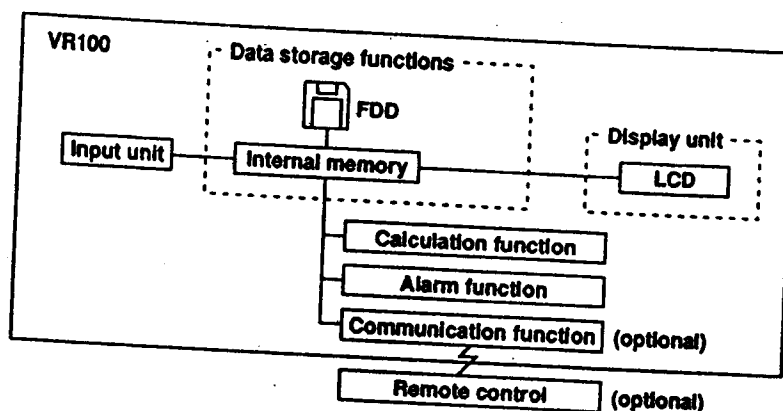
1.2 Input Unit

The following table outlines the possible input types for this recorder, measuring period, and measuring ranges. For details, see Section 9.1, "Input Specifications."

Item	Description	
Number of inputs	Up to four channels (can be set from one to four. *1)	
Input types	DCV:	DC voltage
	TC:	Thermocouple
	RTD:	Resistance temperature detector
	DI:	on/off (contact) input
	DCA:	DC current *2
Measuring period	125 ms	
Measuring range	DCV:	±20 mV to ±20 V
	TC, RTD:	Corresponding to the range specified for each element type
	DI:	For voltage input; detecting off when less than 2.4 V, and on when 2.4 V or greater
		For contact input; on/off of contact

*1: To be defined in the SETUP mode.
*2: A DC current input requires an external shunt resistor. For details of the shunt resistors, see "Checking the Package Contents" in the beginning part of this document.

In the measurement of each input channel, the following processing can be performed depending on your setup.

Function	Description
Burnout upscale/downscale	Forcibly clamps the measured value reading to zero or full scale when the thermocouple burns out.
Filter	Suppresses the fluctuations of the input signals.

5.5-inch Color LCD

This recorder has a 5.5-inch TFT color LCD on which it displays the measured results (320 (vertical) × 240 (horizontal) pixels).
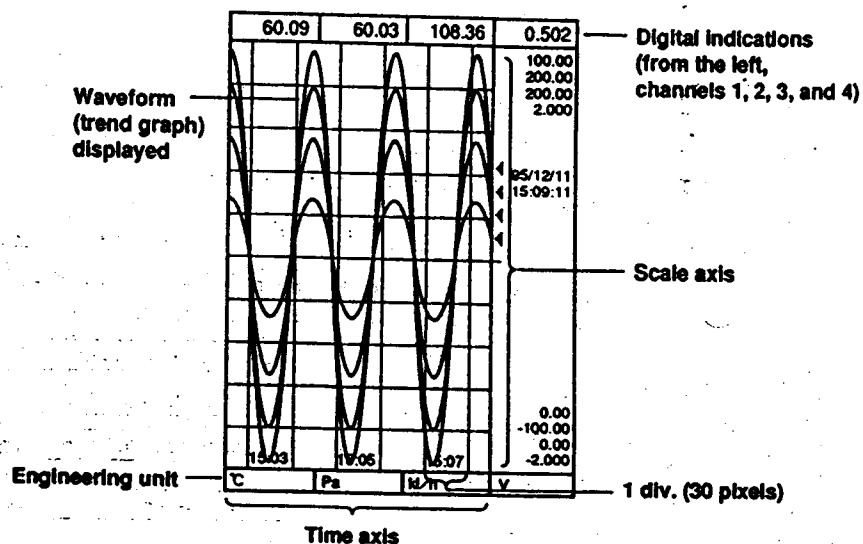
Waveform Span Rate

The waveform(s) moves from right to left along with the time axis at a speed determined by the *waveform span rate*. The waveform span rate, which is equivalent to the chart speed in a conventional pen recorder and which determines the time span in each division (grid interval) of the time scale, can be selected from six rates as shown in the following table. To trace the waveform on the screen, the maximum and minimum values of the measured values, which are sampled every 125 ms within the interval equivalent to one pixel of the time scale, are handled as the data to be traced on that time-axis pixel. The following table shows the relation between the waveform span rate and trend speed.

Waveform span rate (time span per division of time axis)	Time per pixel	Trend speed (approximate)
1 min	(2 s)	615.0 mm/h
5 min	(10 s)	123.0 mm/h
10 min	(20 s)	61.5 mm/h
20 min	(40 s)	30.5 mm/h
30 min	(60 s)	20.5 mm/h
60 min	(120 s)	10.2 mm/h

The updating period of the digital indications at the top of the screen is fixed to one second, regardless of the above.

Operation Functions on Screen

The following operation functions are provided on the screen.

Function	Description
Referencing past trend data	Past trends stored in the internal memory are displayed on the left half of the screen. All data stored in the internal memory can be viewed by scrolling the screen.
Magnifying/reducing the time axis	In addition to the normal trend screen determined by the waveform span rate, the display span (= 6 divisions) can be switched to 6, 18, or 30 minutes to magnify/reduce the time axis of the trend graphs.
Writing time-axis marks	Time-axis marks can be displayed on arbitrary points on the time axis. The information at the points of time thus marked is stored in the internal memory as time-axis mark information.

Referencing past trend data
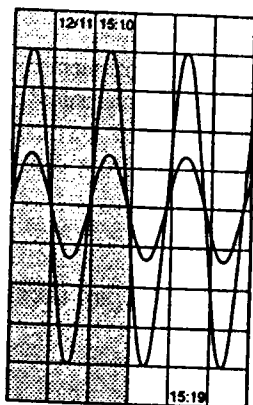
Magnifying/reducing the time axis
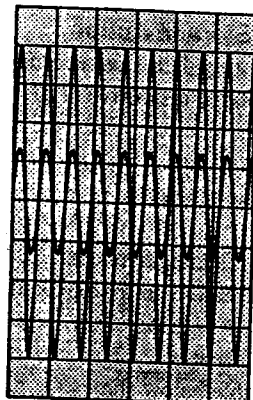
Writing time-axis marks
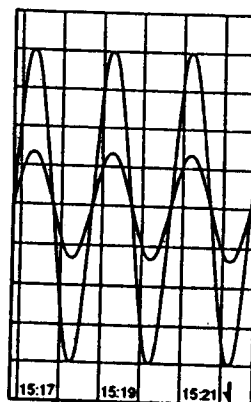
Time-axis mark

Various Screen Settings

In addition to the standard screen where the trends of all channels are displayed on a common scale axis, the following display settings are available.

Function	Description
Discrete display	Splits the display area into zones for individual channels for viewing the trends discretely.
Partial expansion	Zooms in on a portion you want to view in detail.
Trip level indications	Certain key levels can be drawn as horizontal lines on the graph.
Tag indications	Displays the tag numbers corresponding to channels.

Discrete display
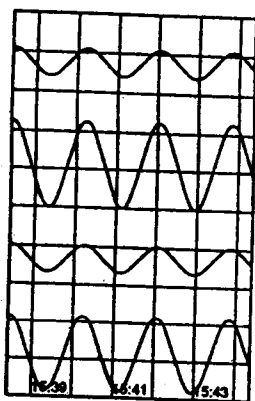
Partial expansion
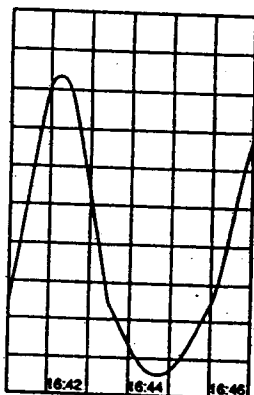
Trip level and tag indications
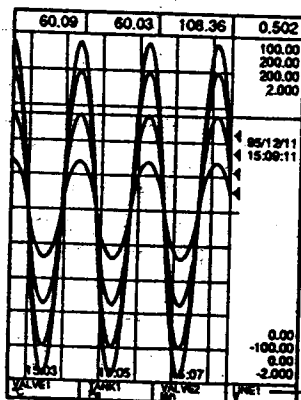
Trip level

Tag number

LCD Display Preferences

The following display preferences can be set.

Preference	Option
Display color	The color of each waveform (trend) trace can be set to red, green, blue, brown, or magenta.
Background color	The background color can be switched between white and black.
LCD brightness	The brightness can be selected from fifteen levels.
LCD saver	The backlight of the LCD automatically dims if no key is pressed for a certain preset time (can be set from 1 to 60 minutes). This increases the life of the backlight.

Data Storage Action

For storing data, this recorder has 1 MB of internal memory and is equipped with a 3.5-inch floppy disk drive (1.2/1.44 MB 2HD). The measured data are always stored in the internal memory. Once the floppy disk is inserted, the recorder starts copying the measured data from the internal memory to the floppy disk automatically, together with the following data.

• Major setup parameters
• Information on time-axis marks, power failures, and alarms

Data Types

The table below shows the data types and contents which are saved on FDC.

Data Type		Storage Contents and Action	File Format	File (Extension)	File Naming Method
Measured data	Display data	• These are the data used to display the traces on the LCD. • The data are stored up to the predefined memory length and overwritten when the memory becomes full.	Yokogawa standard format Note	Display data file (.DAT)	Automatic setting or user specified
	Event data	• Collected and stored at the specified sampling period. • The data writing action differs depending on the trigger setting. (For details, see Section 6.5.1.)	Yokogawa standard format Note	Event file (.DAT)	Automatic setting or user specified
Time-axis mark information		• Information at the points of time where the time-axis marks are drawn (for the latest 32 marks) is saved.	ASCII format	Information file (.INF)	The file name of the measured data is set automatically.
Power failure information		• Information at the times of (the latest ten) power failures is saved.			
Alarm information		• Information on (the latest fifty) alarms is saved.			
Setup parameter list		• These data are used to view the list of major parameters to set up in the SET and SETUP modes. • The file is automatically created when measured data starts to be saved, and is saved together with the measured data.	ASCII format	Parameter list file (.LST)	The file name of the measured data is set automatically.
Parameter settings		• These data are used to view the parameter settings made in the SET and SETUP modes. (The user can set up the recorder using these data.) • The contents can be saved, read, or modified in the SET or SETUP mode.	ASCII format	SET/SETUP configuration files (• Settings in the SET mode: .PNL) (• Settings in the SETUP mode: .PNS)	User specified

☞ For details of the SET and SETUP modes, see Section 1.3, "Run Mode."

Collection of Event Data

The processing which occurs when collecting the event data is determined by
• File definitions (types and number of files defined);
• Sampling period; and
• Trigger action type (in the sample mode).
The following table shows the selections available for these specifications.

Definition	Description

File definitions	The types and number of files to be created can be selected from the following three combinations.
	(a) Event file + display data file
	  One event file and display data file for each are created.
	(b) Event file x 16 + display data file
	  This combination can be selected only when the sample mode is set to *trigger-on* or *trigger-rotation* (see the second next row). Sixteen event files, in which the measured data are to be stored after the trigger is raised, are created together with one display data file.
	(c) Event file only
	  Only one event file is created.

Sampling period	The sample period at which to store the data can be selected from: 125 ms, 250 ms, 500 ms, or 1 s
Sample mode	The trigger action can be selected from the following three types. When "trigger-on" or "trigger-rotation" is selected, various other trigger settings can be made. Trigger-free: Data collection starts after power-on. When the file in the internal memory becomes full, the data are overwritten. Trigger-on: Data collection starts when a trigger is raised. When the file in the internal memory becomes full, the data collection stops. Trigger-rotation: Data collection starts when a trigger is raised. After the file in the internal memory becomes full, the data are overwritten.

Relation Between Measuring Period and Sampling Period

This recorder captures the input data into its A/D converter at the *measuring period* of 125 ms. The *sampling period* denotes the interval used to sample and store the measured data in memory. If the sampling period is set to 125 ms, all measured data values are stored in the memory.

Trigger

This recorder is usually used such that, upon power-on, it runs the self-diagnostics and then automatically starts data collection into the memory. However, this recording action can be set to be suspended upon power-on and started by a certain key. This key is called the *trigger*. There are three types of triggers that can be set for this recorder.

Key trigger: Pressing the key starts data storage.
External trigger: When the contact input signal is closed, data storage starts.
Alarm trigger: When a specified alarm occurs, data storage starts.

The *pre-trigger* function, which means that data is always collected in the leading part of the event file, is useful when data needs to be collected before the trigger occurs.

1.1.5 Alarm Function

Alarm Types

The following six alarm types can be set:
High limit (H), low limit (L), differential high limit (h), differential low limit (l), rate-of-change on increase (R), and rate-of-change on decrease (r) alarms

Alarm Preferences

The following preferences can be specified for alarms.

Preference	Description
Hysteresis	Activates/inactivates the hysteresis of 0.5% of span.
Alarm output relay (option)	Outputs the contact signal linking with an alarm status.
Re-annunciation of subsequent alarm (option)	Using a single alarm relay, re-alerts the occurrence of a subsequent alarm (re-flashing) during occurrence of an alarm.
Fail/memory end output (option)	The relay contact output on the rear panel alerts the occurrence of a system error and when the memory is almost full.

1.1.6 Calculation Functions

The following calculations can be specified.

Function	Description
Differential computation	Calculates the difference between the measured values of two channels.
Linear scaling	Used to convert an input value to fit a different unit system.
Square root	Extracts the square root of an input value.

1.1.7 Other Functions

Function	Description
Communication functions (option)	RS-422A interface added.
Remote control (option)	This option allows the event trigger (start of event data collection), wr of time-axis marks, and time adjustment functions to be controlled rem by contact input.

1.2 Component Names and Functions

1.2.1 Front Panel

When the operation panel cover is closed

Recess for pulling open the cover
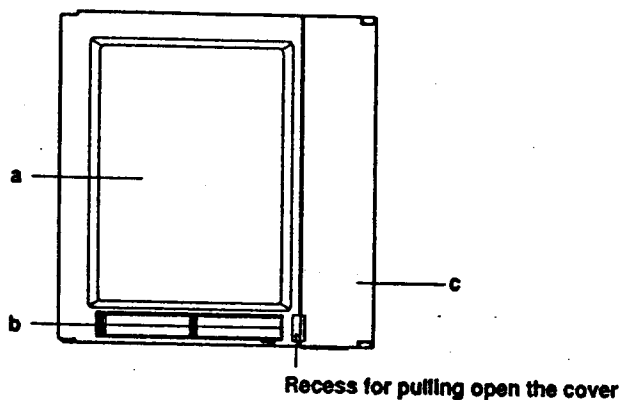
a. LCD Panel

Displays the trend graphs and the digital readouts of the measured data.

b. Label

Specified by the user to identify the signal corresponding to each channel.

c. Operation Panel Cover

To access the power switch or panel keys or to insert or eject the floppy disk, pull the cover open by placing a finger in the recess at the bottom of the cover. Always keep the cover closed other than when performing these operations.

When the operation panel cover is opened
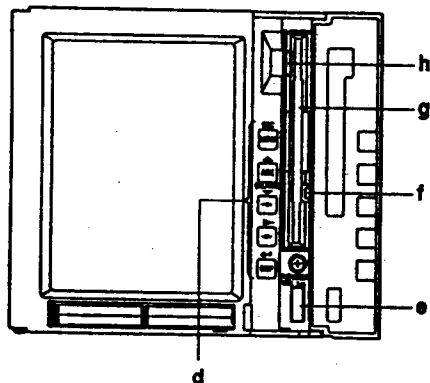
d. Panel Keys

Used to switch the screen and mode, select the menu, and enter data and characters.

e. Power Switch

Used to turn the power on and off.

f. Access Lamp

Indicates that the floppy disk is being accessed.

g. Floppy Disk Drive

Used to save the measured data, setup parameters, etc. to a floppy disk.

h. Eject Button

Used to eject the floppy disk.

VR104D   **VR104P**
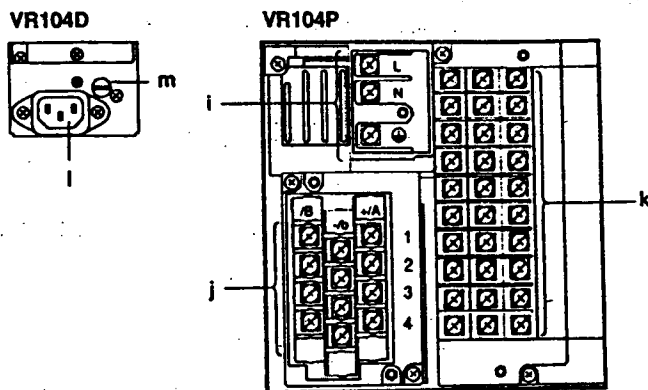
Terminal screw: ISO M4 screw, nominal length 6 mm

i. Power Terminals (for VR104P)

Connect the power and protection grounding cables.

j. Input Terminals

Connect the input signal cables.

k. Option Terminals

Connect the input/output signals for optional functions.

Alarms
1
2
3
4
5
6

Fail/memory end
7
8

Remote control signal
9
10
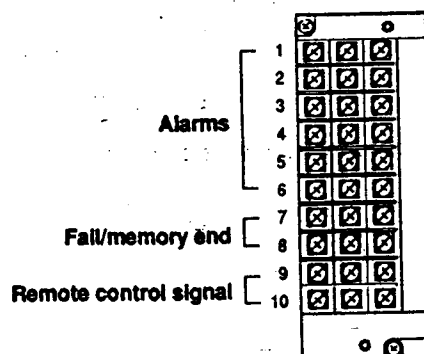
l. Power Connector (for VR104D)

Connect the power cable plug.

m. Function grounding terminal (for VR104D)

1.3 Run Mode

1.3.1 Modes

There are three modes of operation of this recorder, and the available screens and valid keys depend on the mode.

Mode	Description	Valid Operations
Operation mode	Normal run mode. Selected automatically when the power is turned on.	• Monitoring and operation • Storing and saving the measured data
SET mode	Used to set parameters such as input ranges and waveform span rate. Pressing the MENU key for three seconds in the operation mode switches the mode to SET.	• Basic setting • Operations on floppy disk and files • Measured data can be stored in memory, but not saved on a floppy disk.
SETUP mode	Used to set the operation environment for the recorder such as inputting method and data storage method. Turning on the power while pressing the [↵] key starts up the recorder in the SETUP mode.	• Settings of operation environment • Displaying, storing, or saving the measured data is not allowed.

Note

* If a password is set, the password must be entered when entering the SET mode.
* Modifying the input range or waveform span rate clears the measured data stored in the internal memory, as does modifying a setting in the SETUP mode.

1.3.2 Mode Transition

The figure below shows the transitions between the operation, SET, and SETUP modes.
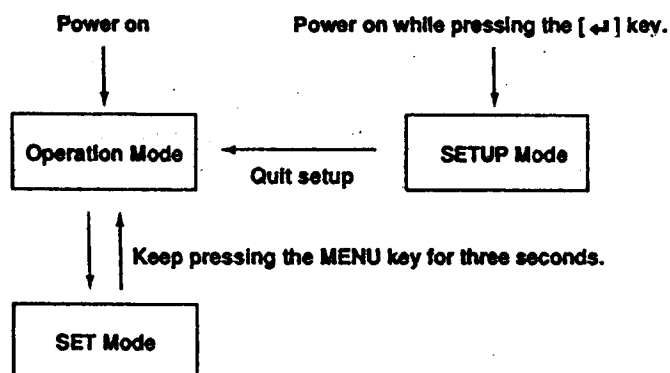
1.4 Display Format

1.4.1 Screen in Operation Mode

Standard Screen
Example: when four channels are used.
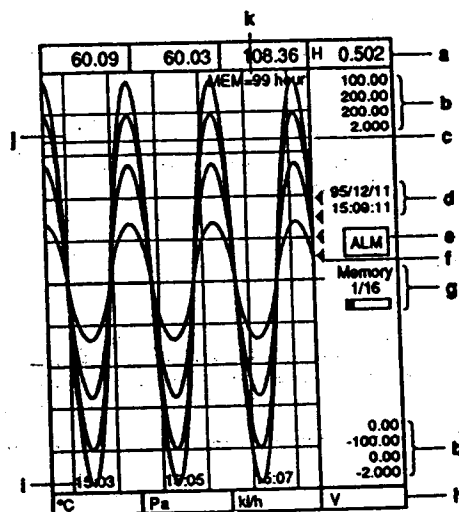
a. Digital Indications
Displays the current measured value of each channel at the update period of 1 second.
When 3 or 4 channels are used: Only the digital values are displayed. The engineering units are displayed in **h** at the bottor
When 1 or 2 channels are used: The digital values and engineering units are displayed together. When the display of tag numbers is set on, each column for the engineeri unit is split into two rows and the tag number an unit are displayed in the upper and lower rows, respectively. (See also Section 4.7.3.)

b. Scale Values
The upper and lower limits of recording scale for all channels are displayed. If scaling computation is used, the values displayed are the scale values after scali computation.

Note
In the trend graph, all measured values are displayed in 0-100% ranges corresponding to the (vertical) scales defined.

c. Trip Level
A horizontal line used to note a particular level

For details on how to draw this line, see Section 4.7.4, "Trip Level (TRIP) Setting.'

d. Time Indication
When 3 or 4 channels are used, the current time is displayed here. When 1 or channels are used, the current time is displayed in **h** at the bottom. The displa format is as follows:
Nov.10.95 15:20:00

e. Alarm (ALM) Indication
Displays the alarm when an alarm occurs. The behavior of the alarm indicati varies depending on the setting.

For details on the behavior of the alarm indication, see Section 3.3, "Resetting an Alarm Output."

f. Current Value Pointers

Indicates the current values of all channels at the update period of 125 ms.

g. Memory Status Indicator

Shows how much area of memory is occupied when the measured data are collected into the event file by the key trigger.

h. Engineering Unit (or Time Indication)

When 3 or 4 channels are used: The engineering unit for each current value indication (a) is displayed. When the display of tag numbers is set on, each column is split into two rows and the tag number and unit are displayed in the upper and lower rows, respectively. (See also Section 4.7.3.)

When 1 or 2 channels are used: The current time is displayed in the format described in e above.

i. Time-axis Values

The beginning time of the division is displayed for every other division in the format hh:mm.

Displays the time of this point.
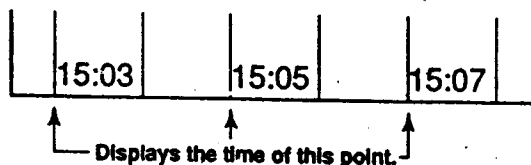
j. Grid

Grids are displayed at intervals of 10% for the scale axis and at the waveform span rate for the time axis. The grid moves together with the trend graph.

Note

The grid lines of the time axis are usually displayed at every interval of the selected waveform span rate. However, if the power is switched off and on during the measurement, the trends (waveforms) start to be traced again continuously from the point of time of the power-off and this causes the interval of the grid lines to be different from the waveform span rate in this case.

k. Display of Remaining Time Before Overwriting Display Data File

Displays the remaining time until the display data file starts being overwritten after saving data to an FDC. When the data are saved to an FDC, the displayed time is reset.

The remaining time is displayed as 'MEM=99hour,' which then shows the time in minutes when the remaining time is less than one hour.

When the display shows 'MEMORY FULL,' the display data is currently being overwritten.

When displaying the processing mode   When displaying the message
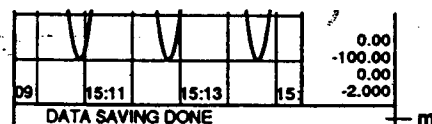
l. Processing Mode Display

Pressing the DISP key while the standard screen is displayed switches the processing mode and displays the processing mode at the bottom of the screen. The processing mode is switched in the sequence of standard, writing of time-axis marks, zooming of time-axis, activation of manual trigger (if the "key-trigger" is set), and then back to standard.

m.Message Display

Displays operation messages, alarm messages, and error messages for the user during operation.

1.4.2 Screen in SET Mode

60.09	60.03	108.36	0.502
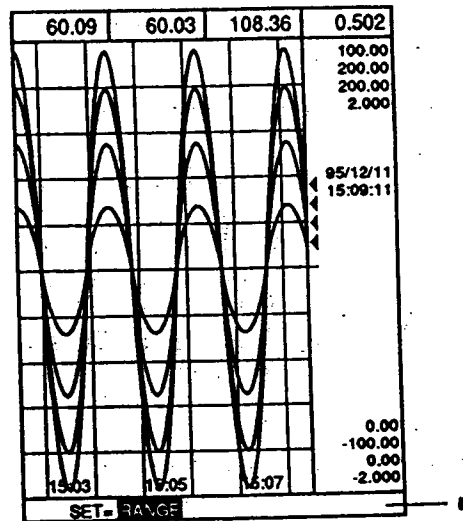
n. Menu Display

Displays the menus available in the set mode. Warning and error messages for parameter setting are also displayed here.

Note

All display contents other than the bottom field are the same as those in the operation mode.

1.4.3 Screen in the SETUP Mode
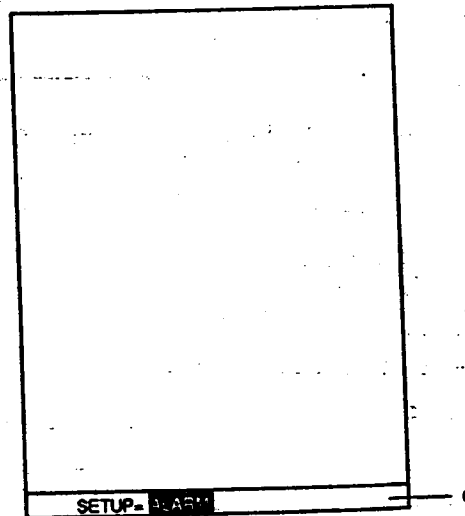
o. Menu Display

Displays the menus available in the setup mode. Warning and error messages parameter setting are also displayed here.

Note

Except for the bottom field, nothing is displayed on the LCD.

1.5 How to Use the Panel Keys

1.5.1 Keys Used in Operation Mode

The following five keys are used in the operation mode.

Key	Description in This Manual	Function
[ACK]	ACK key	Used to acknowledge the alarm currently displayed (when the alarm is not recovered: changes from blinking to lit; when already recovered: changes to off). Also resets the alarm output relay (option). This key is valid only when the hold type is selected for the alarm behavior (see Section 3.3).
[←]	[←] key	On the normal operation screen, used to switch the standard screen to the past-data reference screen. While displaying the processing mode or operation message, used to select or execute the processing.
[→]	[→] key	
[DISP]	DISP key	Each time this key is pressed while the standard screen is displayed, the processing mode switches in the sequence of standard, writing of time-axis marks, zooming of time-axis, activation of manual trigger (if the "key-trigger" is set), and then back to standard.
[MENU]	MENU key	Changes the mode to SET if this key is kept pressed for three seconds.

1.5.2 Keys Used In SET and SETUP Modes

SET Menu and Entry Value

The user interface in the SET and SETUP modes is interactive: a menu appears on the bottom of the screen and prompts entry of the necessary data. All data can be entered using the panel keys. If the set value you entered needs another associated parameter to be set, the screen automatically changes to prompt entry of that associated parameter. The display usually consists of two parts:

SET=RANGE

└─ Menu   └─ Set value: The entry field is highlighted.

In this manual, the shaded entry field as shown below denotes that the actual display shows the value you set previously.

01:MODE=▓▓▓▓▓

└─ ▓▓▓ Previously set value
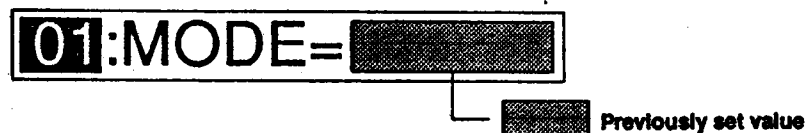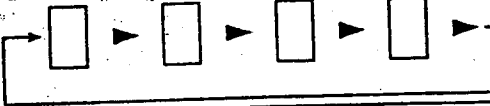
The display '*SET OK*' or '*XXX SET*' (XXX is the value you entered) appears when all the necessary parameters have been entered successfully for a menu item and means that settings for that menu item has been completed. The following five panel keys are used for data entry and, in the SET and SETUP mode, the functions pictured above (not "on") the individual keys are valid.

Entry of Alphanumeric Characters

To enter alphanumeric characters, use the UP/DOWN ([▲]/[▼]) keys. Pressing the [▲] key calls up the alphanumeric characters on the entry field in the sequence as shown below and the [▼] key reverses the sequence.

[▲]key →

[▼]key ←

A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z	a	b	c	d
e	f	g	h	i	j	k	l	m	n
o	p	q	r	s	t	u	v	w	x
y	z	0	1	2	3	4	5	6	7
8	9	#	%	(	)	+	-	*	/
.	°	μ	Ω	℧					

Panel Keys Used

Key	Description in This Manual	Functions
ESC	ESC key	Used to abandon the setting before the '*SET OK*' (or '' SET*') display appears. The display will return to the primar in the menu, 'SET=xxx' or 'SETUP=xxx.'
[▲] ACK / [▼]	[▲] key / [▼] key	Used to move through multiple selections. In the case of messages or units for example, these keys are used to select alphanumeric character in a digit where the entry cursor is l UP calls the next choice, DOWN calls the previous choice.
[►]	[►] key	Used to move the entry cursor to the next digit while ent value. Since there is no backspace key provided, this key wil to the first digit after the last digit.

□ ► □ ► □ ► □ ► ⟶

| [↵] | [↵] key | Used to confirm your highlighted entry. After pressing this I will be prompted to enter the next parameters. If there values to be set on one display, pressing this key to confirm set value then highlights and enables entry of the other par |
| MENU | MENU key | To change the mode back to the operation mode, keep pres key for three seconds. |

Note

When entering a numeric value, be sure to enter all digits including the decimal point. The entered number is placed digit.

	Value entered	Value identified	
Bad entry:	2.	0.02	(For a fixed decimal point)
Good entry:	2.00	2.00	(For a fixed decimal point)

1.6 Flow of Operation and Setting

1.6.1 Operation Mode

In the operation mode, the switching between the standard screen and past-data reference screen differs from the other operations. The following shows the flows of these two types of operation.

Screen Switching

Other Operations

* Displayed only when the "key trigger" is set.

1.6.2 Flow Chart of SET Mode

The figure below shows the flow of settings in the SET mode.

```
RANGE ─ CH.No. ─ VOLT ─── RANGE ─ SPAN-LOWER ─ SPAN-UPPER (Section 4.1.1, "Voltage Input
                                                            (VOLT) Setting")

                  TC ──── TYPE ─ SPAN-LOWER ─ SPAN-UPPER (Section 4.1.2, "TC/RTD Input
                                                          Setting")

                  RTD ─── TYPE ─ SPAN-LOWER ─ SPAN-UPPER (Section 4.1.2, "TC/RTD Input Sett

                  DI ──── DI TYPE (Section 4.1.3, "Digital Input (DI) Setting")

                  DELT ── REFERENCE CHANNEL ─ SPAN-LOWER ─ SPAN-UPPER (Section 4.1.
                  Difference   Specifying the reference channel              "Difference
                  computation                                               Computation
                  SCL ─── MODE ─ RANGE ─── SPAN-LOWER ─ SPAN-UPPER        (DELT) Setti
                  Scaling
                          SCALE-LOWER ─ SCALE-UPPER (Section 4.1.5, "Scaling Computation
                                                                     (SCL) Setting")

                  SQRT ── RANGE ─ SPAN-LOWER ─ SPAN-UPPER ─ SQRT SCALE-LOWER

                          SQRT SCALE-UPPER (Section 4.1.6, "Square Root Computation (SQRT)

                  SKIP ── (When measurement, recording, and display of a channel(s) are not to be mac
                          Section 4.1.7, "SKIP Setting")


ALARM ─ CH.No. ─ LEVEL(1-4) ─ ALARM ON/OFF ─ TYPE ─ VALUE ─ RELAY ON/OFF ─ RELAY No. (S
                 Alarm level   Switching the alarm        Alarm set                     Assigning the
                 number        on/off                     value                         relay number

UNIT ─ CH.No. ─ UNIT CHARACTERS (Section 4.3, "Unit Assignment")

TIME/DIV ─ TIME/DIV (Section 4.4, "Waveform Span Rate (TIME/DIV) Setting")
Setting the waveform span rate

CLOCK ─ DATE ─ TIME (Section 4.5, "Clock Setting")

COPY ─ FROM CH? ─ TO CH? (Section 4.6, "Copying the Channel Settings." Not displayed
                          when "one" is specified for the number of channels used.)
```

AUX — ZONE — CH.No. — ZONE (LOWER) — ZONE(UPPER) (Section 4.7.1, "Setting of Discrete Display (ZONE)")

PART — CH.No. — PARTIAL ON/OFF — EXPAND FROM — BOUNDARY (Section 4.7.2, "Setting of Partial-expanded Display (PART)")

TAG — CH.No. — TAG CHARACTERS (Section 4.7.3, "Tag Setting")

FD — FORMAT (Section 5.1, "Setting of Floppy Disk Format (FD)")

TRIP — LEVEL (1-2) — SET ON/OFF — POSITION (Section 4.7.4, "Trip Level (TRIP) Setting")

FILE — MESSAGE — FILE NAME SET/DATE — FILE E — FILE D (Section 5.2, "File Name (FILE) Setting")

LCD — LIGHT — SAVER ON/OFF — SAVER TIME (Sections 4.8, "Settings of LCD Brightness and LCD Saver (LCD)")

INIT MEMORY — YES/NO (Section 5.3, "Initializing the Data Memory (INIT_MEMORY)")

FD_SET — LOAD — FILE (Section 5.5.2, "Reading the SET Configuration File (LOAD)")

SAVE — FILE (Section 5.5.1, "Saving the SET Configuration File (SAVE)")

DEL — FILE (Section 5.5.3, "Deleting the SET Configuration File (DEL)")

INIT — VOLUME — YES/NO (Section 5.4, "Initializing the Floppy Disk (INIT)")

1.6.3 Flow Chart of SETUP Mode

The figure below shows the flow of settings in the SETUP mode.

ALARM — REFLASH ON/OFF — AND/OR RELAY — ENERGIZE/DE-EN — RELAY HOLD/NONHOLD —
— INDICATOR HOLD/NONHOLD — SCAN R TIME — SCAN r TIME — ALARM HYSTERESIS
(Section 6.1, "Alarm Behavior (ALARM) Setting")

INTG — A/D FREQUENCY (Section 6.2.1, "A/D Integration Time (INTG) Setting")

B.OUT — UP/DOWN — CH.No. — BURNOUT ON/OFF (Section 6.2.2, "TC Burnout Upscale/Downscale (B.OUT) Setting")

RJC — CH.No. — RJC MODE — RJC VOLT(μV) (Section 6.2.3, "Setting of Reference Junction Compensation (RJC)")

FILTR — CH.No. — DIGITAL DAMPING TIME (Section 6.2.4, "Input Filter (FILTR) Setting")

COLOR — BACKGROUND WHT/BLK — CH.No. — RED, GREEN, BLUE, BROWN, PURPLE (Section 6.3, "Display Color (COLOR) Setting")

TEMP — TEMP UNIT (Section 6.4, "Setting the Temperature Unit")

INIT — YES/NO (Section 6.8, "Initializing the Settings in SET Mode (INIT)")

MEMORY — DATA — SAMPLE RATE — SAMPLE MODE — PRE-TRIG — TRIG KEY ON/OFF —
— TRIG EXT ON/OFF — TRIG ALM ON/OFF (Section 6.5, "Setting of Data Storage Method")

AUX — CH QTY — CH or TAG — MSG LANG JPN/ENG — PASSWORD ON/OFF — PASSWORD NO. (Section 6.6, "Auxiliary Function Setting")

OPT — COMM If optional communication function is equipped (See instruction manual IM 4N1A1-11E.)

FD_SET — LOAD — FILE (Section 6.7.2, "Reading the SETUP Configuration File (LOAD)")

SAVE — FILE (Section 6.7.1, "Saving the SETUP Configuration File (SAVE)")

DEL — FILE (Section 6.7.3, "Deleting the SETUP Configuration File (DEL)")

END — END&INIT.DATA ABORT/STORE (Exiting from the SETUP mode.)

IM 4N1A1-01E

Chapter 2 BEFORE OPERATION

2.1 Precautions

Read these precautions before using this recorder and the floppy disk.

2.1.1 Handling Precautions

Cleaning
This recorder contains many plastic parts. To clean it, moisten a cloth with a neutral detergent, then wring the cloth out before cleaning. Do not use chemicals such as benzene or thinner, since these may cause discoloration or damage.

Static electricity
Do not bring any object charged with static electricity near the signal terminals. This may cause malfunction.

Insecticide sprays, rubber, vinyl, etc.
Do not allow any volatile substances such as insecticides etc. to come in contact with the LCD panel, panel keys, etc. Do not allow rubber or vinyl to remain in contact with the recorder for long periods.

After use
Ensure that the power switch is turned to the OFF position.

In case of malfunction
Never continue to use the instrument if there are any symptoms of malfunction such as unusual sounds, smell, or smoke coming from the instrument. Immediately disconnect the power supply and stop using the instrument. If such abnormal symptoms persist, contact your sales representative or nearest service center (see the list on the rear cover).

2.1.2 Cautions When Handling the Floppy Disk

After saving
Be sure to eject the floppy disk after saving the measured data in the operation mode.

Powering on/off
Do not power on or off the recorder while a floppy disk is inserted.

Access lamp
Do not eject the floppy disk while the access lamp is lit, since this may destroy the data on the disk.

Write-protection
Files cannot be saved to or deleted from a write-protected floppy disk, nor can the disk be initialized.

General handling precaution
For other general precautions, follow the instructions given with the floppy disks you use.

2.2 Installation

This section describes how to install the recorder including the location and mounting it. Read this section before installing the recorder.

2.2.1 Installation Location

Install the recorder in a location which meets the following conditions. See also Secti 9.6, "General Specifications," which describes the required operating environment.

Instrument panel/rack (VR104P)
This recorder is designed for panel or rack mounting.

Ventilation
The recorder should be placed in a well ventilated area to prevent the internal temperature rising.

Minimum vibrations
Choose an installation location with minimal mechanical vibration.

Horizontal
The recorder should be installed horizontally (however, mounting may be inclined u 30° backwards and forwards from the vertical).

AVOID:

Direct sunlight, near a heater
The recorder will be adversely affected if exposed to direct sunlight or installed nea heater. Choose a location near room temperature (23°C) with minimal temperature fluctuations.

Soot, steam, moisture, dust, corrosive gases, etc.
Exposing the recorder to soot, steam, moisture, dust, corrosive gases etc. will adve affect it. Avoid such locations.

Near electromagnetic objects
Using the recorder in a strong electromagnetic field may cause errors in reading. / installing it near electromagnetic objects or bringing such objects near the recorde

Bad angle for viewing screen
The display unit of the recorder is a 5.5-inch TFT color LCD, which may not be c visible if viewed from a steep angle. Install the recorder in a location where the p can be viewed from directly in front of it.

2.2.2 Mounting

The recorder should be mounted on a steel panel from 2 to 26 mm thick.
1 Insert the recorder into the panel cutout.
2 Use the mounting brackets supplied with the recorder to mount it on the panel shown in the following figure.
   - Use the mounting brackets to support the top and bottom of the recorder or sides. (If still in place, remove the seals covering the holes for the mountir brackets.)
   - The proper tightening torque for the mounting screw is 0.8 to 1.2 Nm (8 tc kg•cm).

CAUTION

Tightening at a greater torque may deform the case or damage the brac

2.3 Input Signal Wiring ⚠

This section describes the wiring for the input signals. Read this section before wiring the input signals cables.

CAUTION

If a large tensile force is applied to the cable connected to the recorder, it may damage the terminal of the recorder and/or cable. Make sure to fasten the wiring cables at the rear wall of the mounting panel and use something to prevent excessive strain between the rear wall and the terminals of the recorder.

2.3.1 Input Signal Wiring ⚠

Wiring Precautions

Be sure to follow the instructions below when wiring the input signal cables.

It is recommended to use "crimp on" lugs (for 4 mm screws) with insulation sleeves : the leadwire ends.
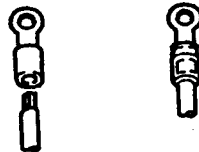
Crimp-on Lug

Since the input terminal is affected by changes in temperature (e.g. due to wind), al‹ replace the transparent cover after wiring.
Even after replacing the cover, take care not to expose the terminals to fans, etc.
Suggestions for minimizing noise pickup:
- The measuring circuit wiring should be run as far as possible away from the pov and ground wires.
- Shielded wires should be used to minimize noise pickup from electrostatic induc‹ sources. The shielding wire of the cable should be connected to the ground term of the recorder (only one ground line).
- To minimize noise from an electromagnetic induction source, twist the measurir line cables at short, equal intervals.
- The measured object should be free from noise. However, if it isn't, make sure the measuring circuit is isolated and that the measured object is grounded.

If TC and RJC are used, the temperature of the input terminals should be as stable possible. Therefore, always use the transparent cover. The thermal capacity of the wiring should be small (recommended dia. 0.3 mm).
Try not to wire the input parallel, but if you do wire it parallel, then
- do not use the burnout upscale/downscale function (see Section 6.2.2);
- ground the instruments at the same point;
- turning ON/OFF the power may cause malfunction; and
- RTD cannot be wired parallel.

WARNING

To prevent electric shock, ensure the main power supply is turned OFF a connect the ground terminal using a class 3 resistance of 100 or less .

CAUTION

If you have an input of DC 2 V or a TC, do not apply an input voltage exceeding ±10 VDC.
If you have an input of 6 to 20 VDC, do not apply an input voltage excee‹ ±30 VDC.
Do not apply a maximum common mode voltage of more than 250 Vrms (50/60 Hz), since the recorder and measured values will be adversely af‹

Mounting

Mounting bracket
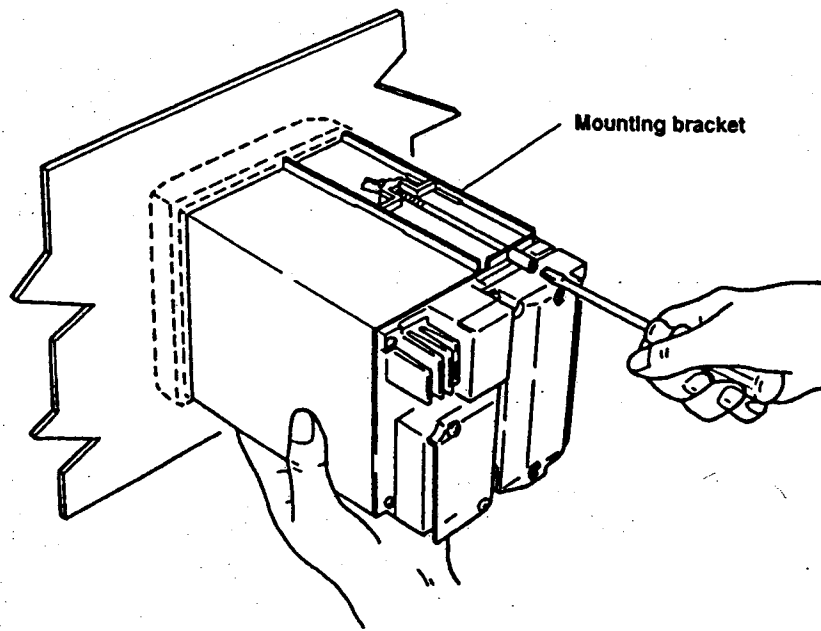
☞ For details of the panel cutout and external dimensions, see Section 9.7, "External Dimensions."

To prevent the generation of electromagnetic disturbances, separate the input wires from the other wires by at least 0.1 m, and preferably by more than 0.5 m.

Wiring Procedure

1 Make sure the power switch is turned OFF and remove the transparent cover of the input terminals.
2 Connect the input signal wires to the input terminal.

Terminal Arrangements

For DC Voltage, DC A (Current), TC, and DI inputs
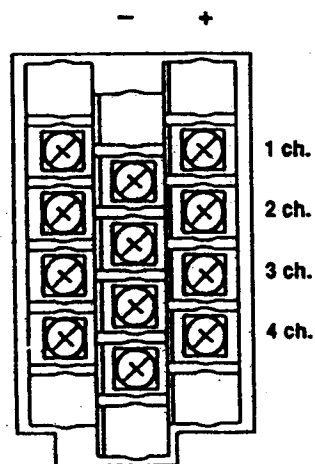
Standard Input Terminals

For RTD Input
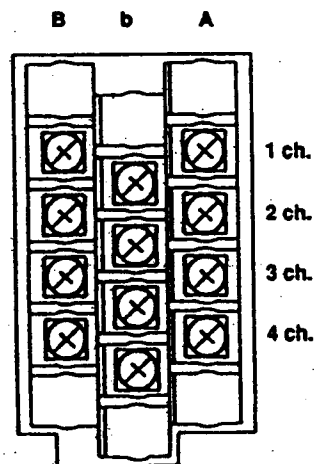
Standard Input Terminals

Wiring Diagram

DC Voltage and DI (Contact) Input
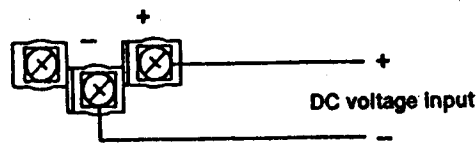
DC voltage input

Thermocouple Input
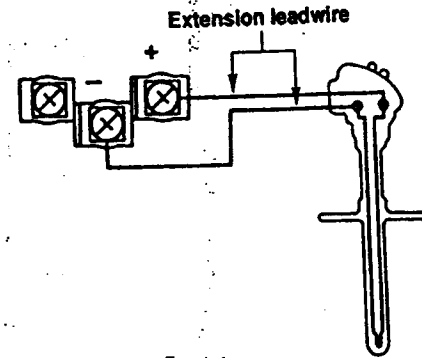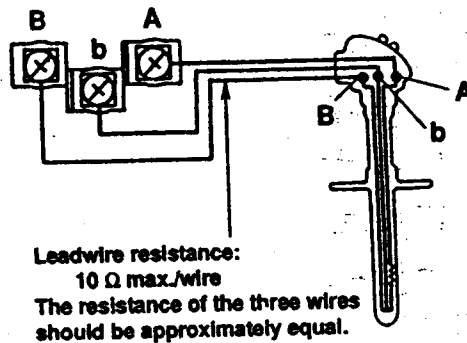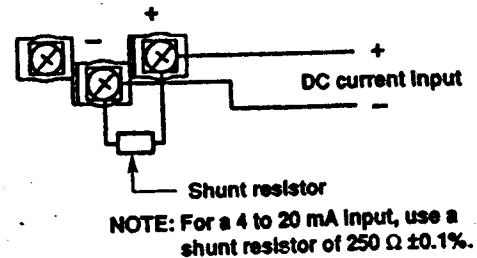
Extension leadwire

Resistance Temperature Detector Input

B   A

A
B   b

Leadwire resistance:
10 Ω max./wire
The resistance of the three wires
should be approximately equal.

DC Current Input

DC current input

Shunt resistor

NOTE: For a 4 to 20 mA input, use a
shunt resistor of 250 Ω ±0.1%.

3   Replace the transparent terminal cover.

Note

The terminal block itself can be removed by loosening the two screws at the top left and bottom right of the block. This makes the wiring work easier. To avoid a contact failure, make sure to tighten the terminal-block fixing screws after wiring.

Loosen
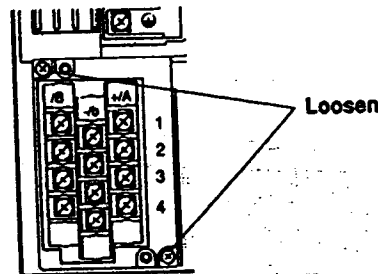
2.3.2 Alarm Output Wiring ⚠

WARNING

To prevent electric shock, ensure the main power supply is turned OFF during wiring and ensure the ground terminal is connected using a class 3 resistance of 100 or less.

Wiring Procedure

1   Make sure the power switch is turned OFF and remove the transparent cover of the option terminals.
2   Connect the alarm output wires to the option terminal. Do NOT change the location of the terminal block!
   Depending on your option, your alarm output terminal will be arranged like one of the following:

ALARM

| 1 | NO | C | NC |
| 2 | NO | C | NC |

Option /A1
(2-contact outputs)

ALARM

1	NO	C	NC
2	NO	C	NC
3	NO	C	NC
4	NO	C	NC
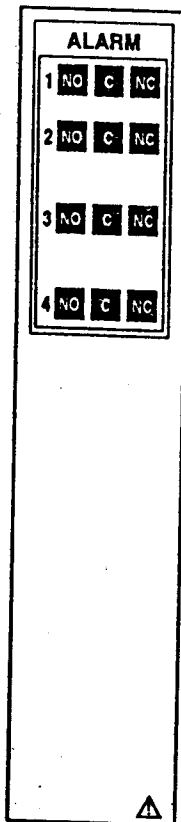
Option /A2
(4-contact outputs)

ALARM

1	NO	C	NC
2	NO	C	NC
3	NO	C	NC
4	NO	C	NC
5	NO	C	NC
6	NO	C	NC
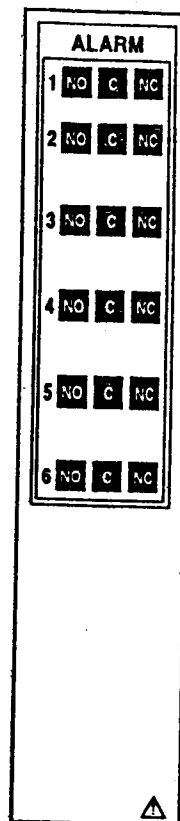
Option /A3
(6-contact outputs)

3 Replace the transparent terminal cover.

Note

* The terminal block itself can be removed by loosening the two screws at the top left and bottom right of the block. This makes the wiring work easier. To avoid a contact failure, make sure to tighten the terminal-block fixing screws after wiring.

Loosen
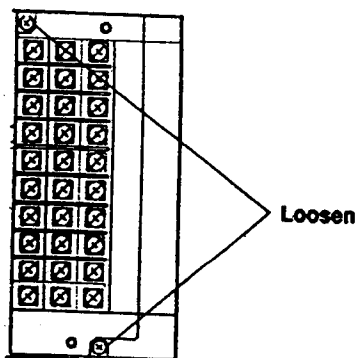
* To prevent the generation of electromagnetic disturbances, separate the alarm output wires from the power supply and input wires by at least 0.1m, and preferably by more than 0.5m.

Contact Specifications

Item	Specification
Output type	Relay transfer contact (energized/de-energized when alarm switchable)
Output capacity	250 VAC (50 or 60 Hz), 3A 250 VDC, 0.1 A (resistive load)
Dielectric strength	1500 VAC (50 or 60 Hz) for one minute between output terminals and ground terminal

For details of the alarm behavior settings such as switch-over between energized and de-energized when an alarm occurs, see Section 6.1, "Alarm Behavior (ALARM) Setting."

2.3.3 FAIL/Memory End Wiring ⚠

To prevent electric shock, ensure the main power supply is turned OFF during wiring and ensure the ground terminal is connected using a class 3 resistance of 100 or less.

Wiring Procedure

1 Make sure the power switch is turned OFF and remove the transparent cover of the option terminals.
2 Connect the FAIL/Memory End output wires to the option terminals.
The FAIL/Memory End terminals (option) are arranged as follows:
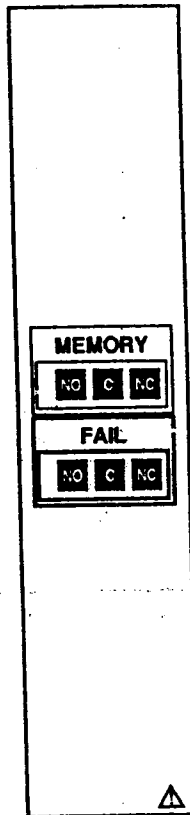
```
┌─────────────────────┐
│                     │
│                     │
│                     │
│                     │
│   ┌─────────────┐   │
│   │   MEMORY    │   │
│   │ ┌──┬─┬──┐   │   │
│   │ │NO│C│NC│   │   │
│   │ └──┴─┴──┘   │   │
│   │    FAIL     │   │
│   │ ┌──┬─┬──┐   │   │
│   │ │NO│C│NC│   │   │
│   │ └──┴─┴──┘   │   │
│   └─────────────┘   │
│                     │
│                     │
│          ⚠          │
└─────────────────────┘
```

3 Replace the transparent terminal cover.

Note
- The terminal block itself can be removed by loosening the two screws at the top left and bottom right of the block. This makes the wiring work easier. To avoid a contact failure, make sure to tighten the terminal-block fixing screws after wiring.
- To prevent the generation of electromagnetic disturbances, separate the FAIL/Memory end wires from the power supply and input wires by at least 0.1m, and preferably by more than 0.5m.
- The FAIL/Memory End output relay is of the de-energize type (de-energized at occurrence).

👉 For the FAIL/Memory End output, see also Section 3.7, "Confirming the Fail/Memory End."

2.3.4 Remote Control Wiring

To prevent electric shock, ensure the main power supply is turned OFF during wiring and ensure the ground terminal is connected using a class 3 resistance of 100 or less.

Wiring Procedure

1 Make sure the power switch is turned OFF and remove the transparent cover at the rear of the recorder.
2 Connect the REMOTE output wires to the REMOTE output terminal. Make sure to connect every signal with the common terminal. Use shielded wires to prevent electromagnetic interference.

The remote control terminal (option) is arranged as follows:

```
REMOTE
1  2  3
4  5  C
⚠
```
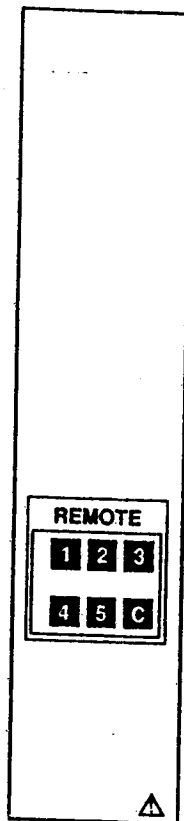
3 Replace the transparent cover.

Note

- The terminal block itself can be removed by loosening the two screws at the top left and bottom right of the block. This makes the wiring work easier. To avoid a contact failure, make sure to tighten the terminal-block fixing screws after wiring.
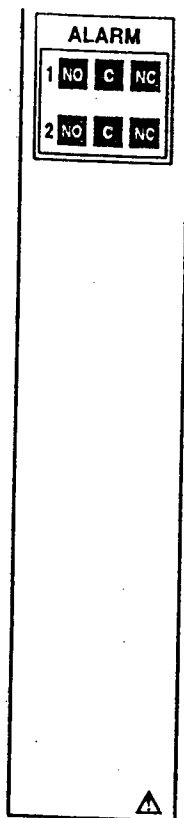- Use shielded wires to prevent electromagnetic interference. The outer conductor must be grounded at the ground terminal of the recorder.
- To prevent the generation of electromagnetic disturbances, separate the Remote Control wires from the power supply and input wires by at least 0.1m, and preferably by more than 0.5m.

Input Specifications

Item	Specification
Input signals	Voltage-free (dry) contact or open-collector (TTL or transistor)
Input conditions	ON voltage: 0.5 V maximum (30 mA DC) Leakage current in OFF state: 0.25mA maximum Signal duration: 250 ms minimum
Input type	Photocoupler isolation (one side common) Internal isolated power source (5V ±5%)
Dielectric strength	500 VDC for one minute between input terminals and ground terminal

Input Types for Individual Functions

Terminal No.	Function	Input Type
1	Writing of time-axis mark - writes a time-axis mark on the display and file.	Trigger (250 ms or longer duration): energized when on
2	External trigger - inputs the external trigger signal to start storing data in the event file.	
3	Time adjustment - depending on the time when the trigger is raised, corrects the internal clock as follows.	

Time of Trigger-on	Processing
hh:00:00 to hh:01:59	Cut off readings of less than one minute. E.g., 10:00:50 is corrected as 10:00:00.
hh:58:00 to hh:59:59	Round up readings of less than one minute. E.g., 10:59:50 is corrected as 11:00:00.
hh:02:00 to hh:57:59	No processing is to be performed.

2.4 Power Supply Wiring ⚠

This section describes how to connect the power supply cable. Read this section before wiring the power supply cables.

• For VR104P Panel Mounting Model

Precautions for Power Supply Wiring

To prevent electric shock and damage to the recorder, note the following warnings.

### WARNING

To prevent electric shock, ensure the main power supply is turned OFF and connect the ground terminal using a class 3 resistance of 100 or less.

For power and ground wiring termination, use "crimp on" lugs (for 4 mm screws) with insulation sleeves (see Section 2.3.1).

To prevent fire, use 600V PVC insulated wire (AWG18) for power and ground wiring (cross sectional area of 0.83 mm² or more, anti-galvanic corrosion finish, insulation thickness should be more than 0.8 mm, and insulation resistance should be more than 50 M Km at 20°C, approved EN60 320 (VDE0625)).

To prevent electric shock, attach the transparent terminal cover when the power is on.

Make sure to provide a power switch on the power supply line having the following specifications:

• Rated power current > 1A

• Rated rush current > 60A

Also provide fuse(s) of 2 to 15 A on the power supply line.

The power switch and fuse used on the power supply line should be

• CSA approved (for use in North America) or

• VDE approved (for use in Europe).

Wiring Procedures

1 Make sure the power switch is turned OFF and remove the transparent cover of the power supply terminals.

2 Connect the power supply wires and the protective ground wire to the power terminals and the ground terminals as shown in the figure below.
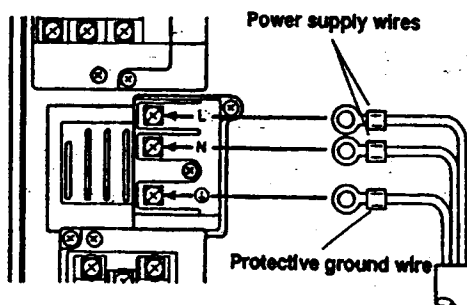
3 Replace the transparent terminal cover.

Note

• Avoid using a power supply of 132 to 180 VAC, since this may affect the measuring accuracy.
• To prevent the generation of electromagnetic disturbances, separate the power supply wires from the other wires by at least 0.1m, and preferably by more than 0.5m.

CAUTION

If a large tensile force is applied to the cable connected to the recorder, it may damage the terminal of the recorder and/or cable. Make sure to fasten the wiring cables at the rear wall of the mounting panel and use something to prevent excessive strain between the rear wall and the terminals of the recorder.

Chapter 3 DAILY OPERATIONS (OPERATIONS IN OPERATION MODE)

3.1 Turning On/Off the Power Switch

This section describes how to turn on and off the power. Read this section before turning the power on or off.

CAUTION

- Do not leave the floppy disk inserted when turning the power on or off.
- If the input signal is connected in parallel with another instrument, avoid turning on/off either the recorder or that instrument while one is being operating, since this may affect the reading.

Location of Power Switch
The power switch is located at the bottom behind the operation panel cover.

Turning On/Off the Power Switch
The power switch is an alternate pushbutton. Pressing it once turns on the power and pressing it again turns the power off (see the figure below).

Power switch

ON

OFF
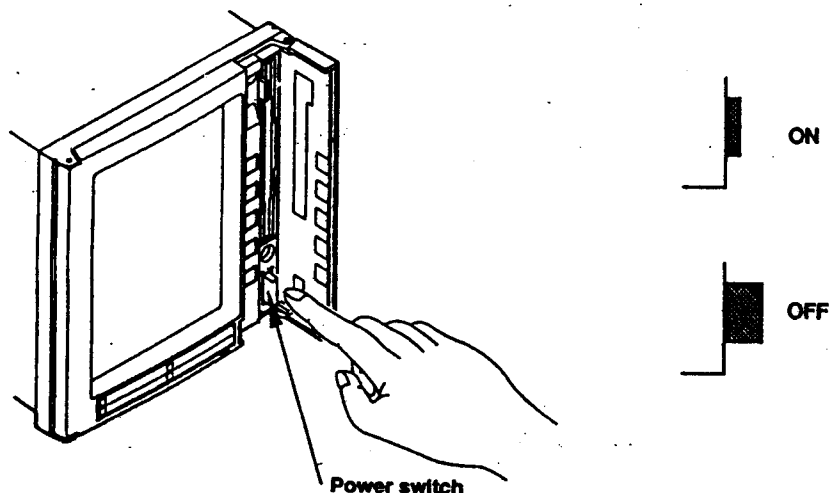
Turning on the power runs the self-diagnostic function, which runs for opproximately ten seconds. The standard screen in the operation mode then appears on the LCD.

Note
- The warm-up time of the recorder is thirty minutes; however, it may take longer the first time after wiring.
- If an error message appears at the bottom of the screen, take action according to Section 8.1, "Error Messages."

3.2 Saving the Measured Data on Floppy Disk

This section describes how to save the measured data on a floppy disk. Read this section before inserting or ejecting a floppy disk and saving the measured data.

CAUTION

- Always eject the floppy disk after saving the measured data on it. Leav the disk in the drive may damage the recorder.
- The measured data cannot be saved on a write-protected disk. Use ar disk or release the write-protection.

Automatic Saving

Simply inserting a floppy disk into the drive while the standard screen in the ope mode is displayed starts saving the internal memory data on the floppy disk automatically. While any other screen is displayed, this does not occur. In this saving start when the screen is switched to the standard screen.

Inserting the floppy disk (to save the measured data)

1 Open the operation panel cover.
2 Insert floppy disk into the drive until it clicks.
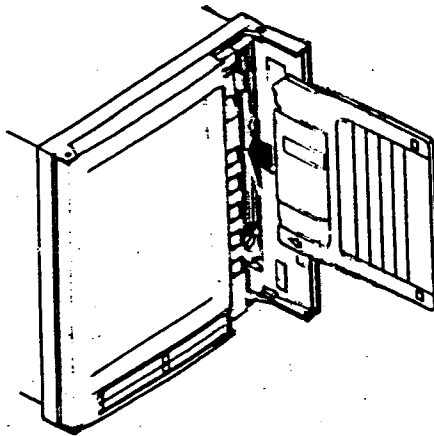
The access lamp then lights and the message 'SAVING DATA...' appears at of the screen. Saving the measured data takes approximately two minutes. W saving completes, the message 'DATA SAVING DONE' appears. If any oth appears, see "When a Message Appears" later on in this section.

CAUTION

Do not eject the floppy disk while the access lamp is lit. This may des data.

Ejecting the floppy disk (to complete the data saving)

1 Confirm that the message 'DATA SAVING DONE' is displayed at the b screen.
2 Press the eject button.

Eject button
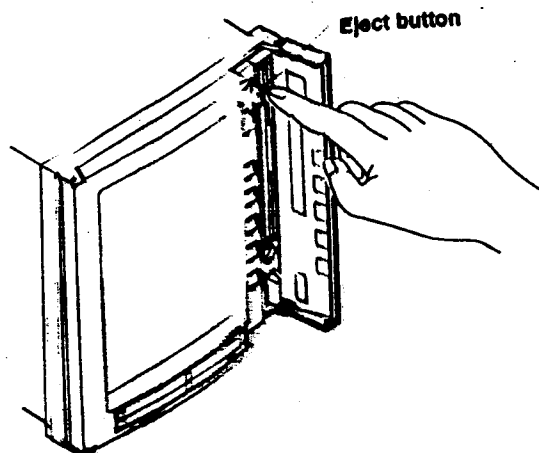
3.3 Resetting an Alarm Output

Alarm Behavior

Digital Indication

When an alarm occurs on a channel, the digital indication for that channel on the screen changes color from white to yellow, and a character which represents the alarm status (as shown below) is displayed at the head of the digital indication.

H: high limit alarm
h: differential high limit alarm
R: high rate-of-change limit alarm

L: low limit alarm
l: differential low limit alarm
r: low rate-of-change limit alarm

"ALM" Indications and Alarm Relays

When an alarm occurs, the alarm output relay (optional) and the ALM indication behaves as shown in the table below.

Alarm Type	Alarm Behavior *2	
Non-hold Type *1	Upon occurrence of alarm	Alarm output relay: on ALM indication: lit
	Recovery of alarm	Alarm output relay: off ALM indication: off
Hold type	Upon occurrence of alarm	Alarm output relay: on ALM indication: flashing (stopped and lit by pressing the ACK key.)
	Recovery of alarm	Alarm output relay: kept on (reset by pressing the ACK key.) ALM indication: kept flashing (stopped and light goes off by pressing the ACK key.)

*1 When the non-hold type is selected, the ACK key is not effective.
*2 The behavior of the alarm output relay shown in this table is for a normally-opened terminal. The behavior of a normally-closed terminal is the reverse.

> For details on selecting non-hold/hold type, see Section 6.1, "Alarm Behavior (ALARM) Setting."

The time chart below shows the relation between the behaviors of the alarm output relay and ALM indication.
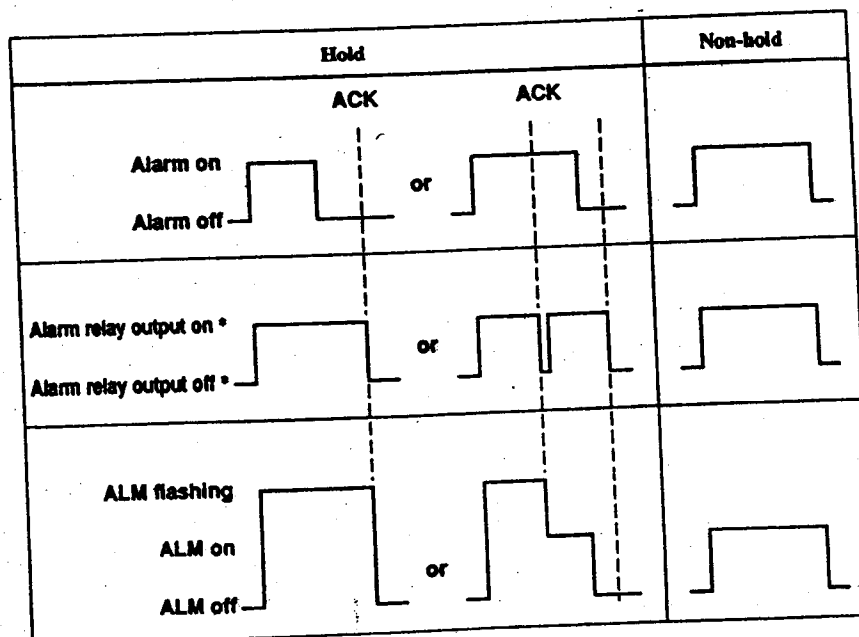
* For a normally-opened terminal. The behavior of a normally-closed terminal is the reverse.

This completes the saving of the measured data.

Note _____

- Regardless of the operation on the floppy disk, the measured data are continuously stored in the internal memory, and if a trigger is set, then storing of the measured data starts when the trigger is raised. The capacity of the data stored in the internal memory varies depending on the configuration of the memory. (For details of the capacity of the data storage, see Section 6.4, "Setting of Data Storage Method.")
- When the key trigger (trigger-on or trigger-rotation) is set, saving the data on floppy disk clears the event files in the internal memory.
- After the display data file becomes full, the data are overwritten. If the optional Memory End output is installed, the relay contact alerts the end of memory at the preset time before it becomes full.

When a Message Appears

The following messages may appear on the screen when you insert a floppy disk. In such cases, follow the guidance given by the message.

Operation Message

When inserting a floppy disk which is not formatted:

| PUSH [←] TO FORMAT FD |

1 To format the floppy disk, press the [←] key.
The floppy disk is then formatted and the data saving starts.
2 To avoid formatting the floppy disk, press a key other than the [←] key.
The message 'DATA SAVING ABORTED' appears. Eject the floppy disk.

When a file having the same file name already exists in the floppy disk:

| PUSH [←] TO OVERWRITE |

1 To overwrite the file, press the [←] key.
The file is then overwritten.
2 To avoid overwriting the file, press a key other than the [←] key.
The message 'DATA SAVING ABORTED' appears. Eject the floppy disk.

Error Message

If a wrong operation is performed, an error message appears such as the example message shown below.

| E202:FD WRITE PROTECTED |

1 Eject the floppy disk. The message then disappears.
2 Clear the cause of the error and perform the operation properly.

For details of troubleshooting for error messages, see Section 8.1, "Error Messages."

• For VR104D Desk-top Model

Precautions When Plugging in Power Cable
To prevent electric shock and damage to the recorder, note the following warnings.

WARNING

Confirm that the supply voltage meets the rated power supply voltage of the VR104D before connecting the cable.

To prevent electric shock, ensure the power switch of the VR104D is turned OFF and connect the ground terminal using a class 3 resistance of 100 or

For the power cable be sure to use ones provided *By Omega* to preven fire and electric shock.

To prevent electric shock, be sure to connect the protective grounding Connect the power cable, of the VR104D to a 3-pole power socket with protective grounding pole.

Do not use an extension cable without the protective grounding wire, sinc this invalidates the protection.

Connection Procedures

1 Make sure the power switch of the recorder is turned OFF.
2 Connect the power cable (supplied with the recorder) to the power connecto rear panel of the recorder.
3 Connect the other side of the power cable to a power socket which meets th following requirements. The socket should be a 3-pole power socket with a protective grounding pole.

• Rated power supply voltage: 100 to 120 VAC or 220 to
• Allowable fluctuation of power supply voltage: 90 to 132 VAC or 198 to 2
• Rated power supply frequency: 50/60 Hz
• Allowable frequency range: 48 to 63 Hz
• Maximum power consumption: 60 VA (100 VAC)
                                         70 VA (200 VAC)

3-pole socket

Power cable (accessory)
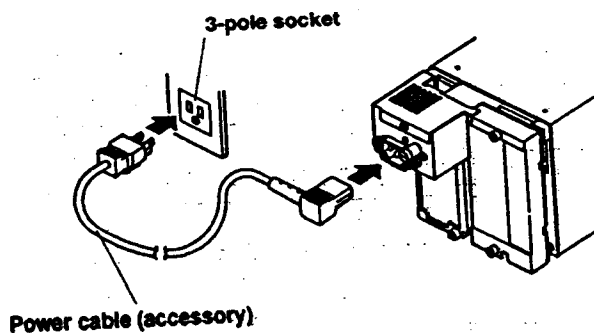
Scrolling the Referenced Waveform

On the past-data reference screen, the referenced waveform can be scrolled using the cursor keys.

Type of Scroll	Procedure
Scroll by one-pixel increment	Press the [←] or [→] key. The reference waveform is scrolled as follows: [←] key: moves the referenced waveform to the left (advances the time scale). [→] key: moves the referenced waveform to the right (turns back the time scale).
Scroll by 2-division increment	Keep pressing the [←] or [→] key. The referenced waveform is then scrolled by two divisions of the time axis.
Fast scroll	Keep pressing the [←] or [→] key and press the DISP key together.

3.5 Writing the Time-axis Mark

Marks can be drawn on the time axis on the screen. When writing a time-axis mar
information at the mark is written in the internal memory. Information for the thir
two most recent time-axis marks can be stored.

☞ For details of the information on the time-axis mark, see Appendix 2, "Data Form
Parameter List File and Information File."

1 Press the DISP key when the standard screen is displayed.
The message 'PUSH [←] TO MARK EVENT' appears at the bottom of the s⟨
2 Press the [←] key to write the mark. A light-blue ⟨ mark is then written at th⟨
current time on the time axis on the screen.

```
                                          -100.00
                                             0.00
   ┌────┬──────┬────┬──────┬──┐           -2.000
   │15:17│     │15:19│     │15:21│⟨│
   ├────┴──────┴────┴──────┴──┤
   │ PUSH ◁═▷ TO MARK EVENT    │
   └──────────────────────────┘
```

To avoid writing a mark, do not press the [←] key and proceed to step 3.
3 To return to the standard screen, press the DISP key twice (or three times w
key trigger is set).

3.6 Zooming/Reducing the Time Axis

The time axis can be zoomed and reduced in the standard screen.

1 Press the DISP key twice.

The message 'DISP WINDOW:NORMAL/6min' appears at the bottom of the screen. (The display span used last time is called first, i.e., it could be '. . . ./18min' or '. . . ./30min.')

2 Press the [→] key.

The characters '6min' are then highlighted and the display span (= 6 divisions) is changed to 6 minutes.

3 Each time the [▲]/[▼] key is pressed the display span changes to 18, 30, and then 6 minutes, to zoom and reduce the display time span.

4 To switch back to the standard display time span (based on the waveform span rate defined), press the [→] key.

5 Pressing the DISP key once (or twice when the key trigger is set) clears the guidance message at the bottom of the screen and returns the standard screen.

Standard Screen
(display time span based on the waveform span rate)
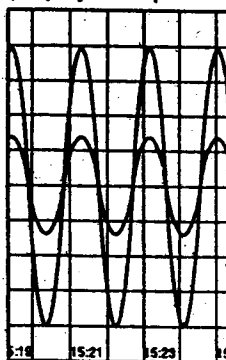
| | [→] key
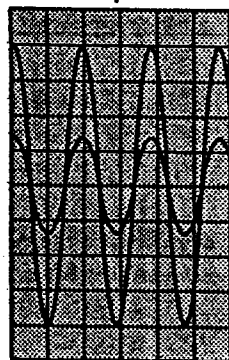
6-minute span   **18-minute span**   **30-minute span**
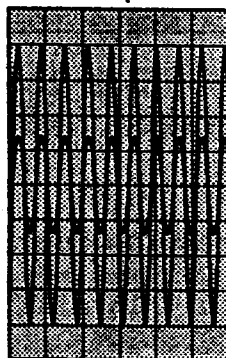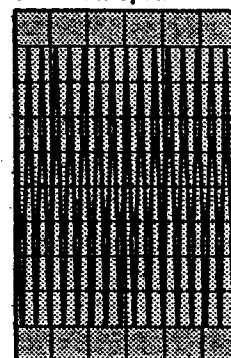
[▲]/[▼] key

Note

- When the time axis is zoomed or reduced, the background color changes: if the standard screen is displayed on a white background, it is switched to black, and if the standard background is black, it is switched to white.
- While zooming and reducing the time axis, past data cannot be referenced. Also, neither time indications, memory status indicator, nor time-axis marks are displayed.
- The screen that appears first after turning on the power is the standard screen, regardless of what was displayed before the power was turned off.
- If a power failure is recorded, both maximum and minimum data values during that power failure are set to 7F7FH.
- When the time axis is zoomed or reduced, the trends (waveforms) are displayed according to the current discrete display (ZONE) and partial expanded (PART) settings in the full display span, although on the standard screen, the time at which the discrete display (ZONE) or partial expanded (PART) setting was changed can be identified (each part of each waveform is displayed according to the settings at the time of data sampling). When switching back to the standard screen, the waveforms are now displayed according to the current discrete display (ZONE) and partial expanded (PART) settings in the full display span. Hence, the time at which the discrete display (ZONE) or partial expanded (PART) setting was changed cannot be identified in this case.

3.7 To Start Storing the Measured Data by Manual Trigger

This section describes how to use the panel key to start storing the measured data
manual trigger). To start storing the data by the manual trigger, select the "trigger
or "trigger-rotation" in the SETUP mode and set the key trigger to on, in advance

For details on how to set the key trigger, see Section 6.5.3, "Setting of Data Stora
Method as Trigger-on or Trigger-rotation."

Memory status indicator
When using the panel key to start storing the data, the memory status indicator a
in the figure below is displayed on the right of the screen. This is not displayed
"trigger-free" is selected.

Example:

Memory
1/16 ◄———————— Block number*1 of the memory in which the data are
currently written

Finish ◄———————— Finish: Writing completed
Stop: Writing stopped due to write-protected floppy disk

Ratio of the area where the data have already been writter
Blue: Waiting for trigger *2
Red: Written after trigger is raised
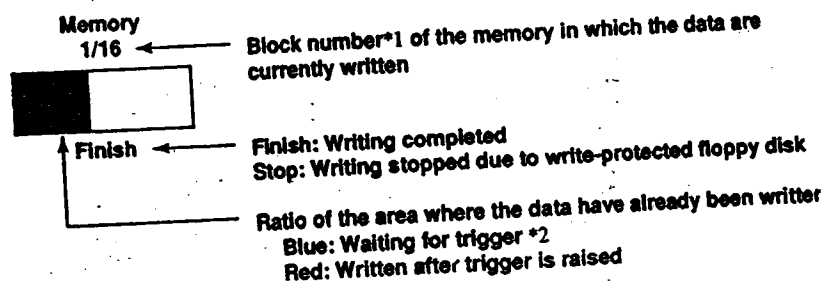
*1 Displayed when sixteen event files are created.
*2 When the pre-trigger is set, the measured data are always stored in part (specified by the ratio) c

To start storing data by manual trigger
1 Confirm that the memory status indicator is displayed on the screen.
2 Press the DISP key three times to call up the message 'PUSH [←] TO TR
3 Press the [←] key. The memory status indicator changes color from blue
the data start being stored in the internal memory.

Note
Once the event files are saved on floppy disk, the event files in the internal memory are all initialized.

3.8 Detecting the FAIL and Memory End (Option)

If the fail/memory end output option is equipped, contact outputs alert the occurrence of a system error (FAIL) and when the memory is almost full. An output relay is provided for each of the "memory end" and "FAIL" contacts.

☞ For the wiring, see Section 2.3.3, "FAIL/Memory End Wiring."

Operation at Memory End

The relay is energized when the time specified until end of memory before the display data file is full is reached. This relay action cannot be reversed to "de-energized on memory end." (The figure at the bottom of this page shows the relay contact actions.) When the memory end occurs, promptly save the data to a floppy disk.

Operation at System Failure

The relay is de-energized if the CPU fails. This relay action cannot be reversed to "energized on failure" and thus this relay is de-energized also upon power-off (including a power failure). If this relay contact is activated during power-on, it means that a system failure occurred. Please contact your nearest Sales & Service Office; addresses may be found on the back cover of this manual.

Relay Contact Actions

Memory End Relay Output (Energized on Memory End)

NO	C	NC	NO	C	NC	NO	C	NC
Normal			Memory end			Power-off		
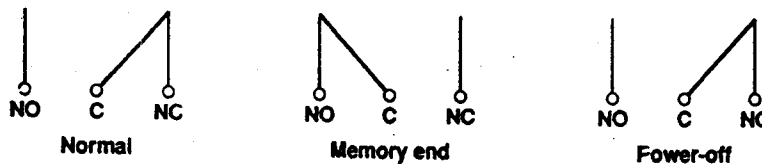
FAIL Relay Output (De-energized on Failure)

NO	C	NC	NO	C	NC	NO	C	NC
Normal			Failure			Power-off		
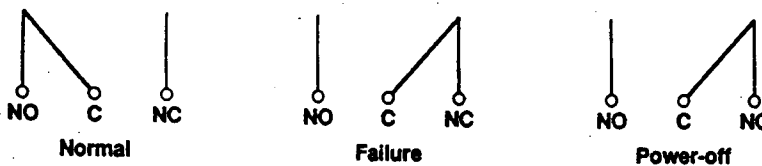
Note: NO, C, and NC denote normally-opened, common, and normally closed, respectively.

Chapter 4 BASIC SETTINGS
(OPERATIONS IN SET MODE)

4.1 Setting the Input Range and Display Span

MODE	Description	Section
VOLT	Measures and displays a DC voltage.	4.1.1
TC	Measures and displays a temperature using a thermocouple.	4.1.2
RTD	Measures and displays a temperature using a resistance temperature detector.	4.1.2
DI	Detects and displays the on/off status of a contact or voltage input.	4.1.3
DELT	Performs difference computation between two channels which have the same input range and displays the difference.	4.1.4
SCL	Performs scaling on the measured data of a voltage, TC, or RTD input and displays the scaled value. *	4.1.5
SQRT	Extracts the square root ( ) of the measured data of a DC voltage input and performs scaling for display. *	4.1.6
SKIP	Skips the scan of a specified channel, i.e., prevents that input channel from being measured and displayed.	4.1.7

* Scaling is typically used to convert an actual measured value to a value in the desired unit system (physical value) to be displayed.

Note

Setting these input specifications initializes the data memory (which can then not be restored) and the information file. If necessary, save the data in memory to a floppy disk before setting.

4.1.1 Voltage Input (VOLT) Setting

To measure and display a DC voltage signal, follow the procedure below to set the range.

MENU:
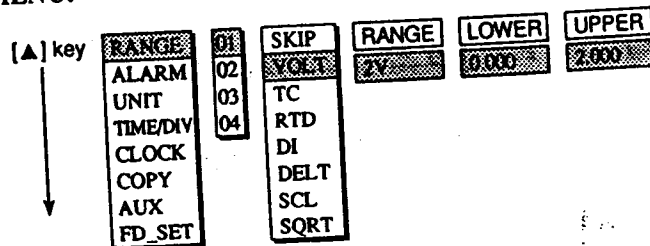
[▲] key

RANGE	01	SKIP	RANGE	LOWER	UPPER
ALARM	02	VOLT	2V	0.000	2.000
UNIT	03	TC
TIME/DIV	04	RTD
CLOCK		DI
COPY		DELT
AUX		SCL
FD_SET		SQRT

PROCEDURE:

	Key Sequence	Display	
1	ESC 3sec	SET=RANGE	Press the MENU key for three seconds to enter the S mode. Select the 'SET=RANGE' display using the [keys, then press the [↵] key.
2	ACK/	01:MODE=	Select the desired channel using the [▲]/[▼] keys, press the [↵] key.
3	ACK/	01:MODE=VOLT	Select 'VOLT' using the [▲]/[▼] keys, then press key.
4	ACK/	01:RANGE=2V	Select the desired range using the [▲]/[▼] keys, t the [↵] key.

Display	Range
20mV	−20.00~20.00mV
60mV	−60.00~60.00mV
200mV	−200.0~200.0mV
2V	−2.000~2.000V
6V	−6.000~6.000V
20V	−20.00~20.00V

	Key Sequence	Display	
5	ACK/	01:LOWER=0.000	Specify the low limit value of the display span (l limit). Use the [▲]/[▼] keys to increment/decr value of each digit and the [►] key to shift the d press the [↵] key.
6	ACK/	01:UPPER=2.000	In the display which then appears, enter the high of the display span (upper limit). Enter it the sa the low limit value, then press the [↵] key.

Note

The display span cannot exceed the input range, nor can the LOWER UPPER setting.

	Key Sequence	Display	
7	ACK/	INIT. DATA_MEMORY=YES	If the settings are changed, this message appea not mind initializing the data memory, select ' the [↵] key. Selecting 'NO' does not initialize memory, and the settings are not changed.
8	/ ESC 3 sec	*SET OK*	The setting is completed. To continue setting another channel, press th return to the '□:MODE=VOLT' display. To return to the 'SET=RANGE' display, pre To return to the operation mode, press the M three seconds.

4.1.2 TC/RTD Input Setting

To measure and display a TC (Thermocouple) or RTD (Resistance Temperature Detector) signal, the range can be set the same way as if it were a DC-voltage.

MENU:

PROCEDURE:

Key Sequence	Display	
1	SET=RANGE	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=RANGE' display using the [▲]/[▼] keys, then press the [↵] key.
2	01:MODE=	Select the desired channel using the [▲]/[▼] keys, then press the [↵] key.
3	01:MODE=TC	Select either 'TC' or 'RTD' using the [▲]/[▼] keys, then press the [↵] key.
4	01:TYPE=N	Select the desired element type using the [▲]/[▼] keys, then press the [↵] key.

TC Type			RTD Type	
Display	**Range**		**Display**	**Range**
R	0.0 to 1760.0°C		PT (Pt100Ω)	-200.0 to 600.0°C
S	0.0 to 1760.0°C		JPT (JPt100Ω - JIS 1989)	-200.0 to 550.0°C
B	0.0 to 1820.0°C		CU1 to 6(Cu10Ω) *1	-200.0 to 300.0°C
K	-200.0 to 1370.0°C		CU25(Cu25Ω) *1	-200.0 to 300.0°C
E	-200.0 to 800.0°C			
J	-200.0 to 1100.0°C			
T	-200.0 to 400.0°C			
N	0.0 to 1300.0°C			
W	0.0 to 2315.0°C			
L (Fe-CuNi)	-200.0 to 900.0°C			
U (Cu-CuNi)	-200.0 to 400.0°C			

*1 Can be specified when the /N1 option is equipped.
CU1: Cu 10Ω detector based on GE standard
CU2: Cu 10Ω detector based on L&N standard
CU3: Cu 10Ω detector based on WEED standard
CU4: Cu 10Ω detector based on BAILEY standard
CU5: Cu 10Ω, α = 0.0392 at 20°C
CU6: Cu 10Ω, α = 0.0393 at 20°C
CU25: Cu 25Ω, α = 0.00425 at 20°C

	Display	
5	01:LOWER=0.0	Specify the low limit value of the display span (lower span limit). Use the [▲]/[▼] keys to increment/decrement the value of each digit and the [►] key to shift the digit, then press the [↵] key.
6	01:UPPER=800.0	In the display which then appears, enter the high limit value of the display span (upper limit). Enter it the same way as for the low limit value, then press the [↵] key.

Note

The display span cannot exceed the input range, nor can the LOWER setting be equal to the UPPER setting.

	Display	
7	INIT. DATA_MEMORY=YES	If the settings are changed, this message appears. If you do not mind initializing the data memory, select 'YES' and press the [↵] key. Selecting 'NO' does not initialize the data memory, and the settings are not changed.
8	*SET OK*	The setting is completed. To continue setting another channel, press the [↵] key to return to the '□:MODE=TC' (or '□:MODE=RTD') display. To return to the 'SET=RANGE' display, press the ESC key. To return to the operation mode, press the MENU key for three seconds.

4.1.3 Digital Input (DI) Setting

To measure and display the status of a digital input signal (contact input/voltage level input), follow the procedure below to set the input specification.

MENU:
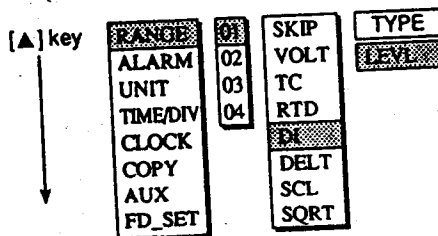
[▲] key

RANGE	01	SKIP	TYPE
ALARM	02	VOLT	LEVL
UNIT	03	TC	
TIME/DIV	04	RTD	
CLOCK		DI	
COPY		DELT	
AUX		SCL	
FD_SET		SQRT	

PROCEDURE:

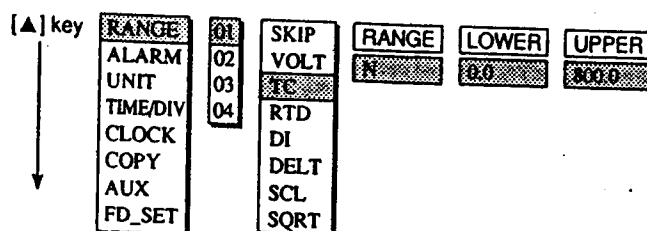| Key Sequence	Display	
1	SET=RANGE	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=RANGE' display using the [▲]/[▼] keys, then press the [↵] key.
2	01:MODE=	Select the desired channel using the [▲]/[▼] keys, then press the [↵] key.
3	01:MODE=DI	Select 'DI' using the [▲]/[▼] keys, then press the [↵] key.

4	01:TYPE=LEVL	There are two input types: (voltage) level and contact.
		LEVL: Voltage level signal
		  Less than 2.4 V: off (0)
		  2.4 V or greater: on (1)
		CONT: Contact signal
		  Opened: off (0)
		  Closed: on (1)
		
		Select the desired type using the [▲]/[▼] keys, then press the [↵] key.

5	INIT. DATA_MEMORY=YES	If the settings are changed, this message appears. If you do not mind initializing the data memory, select 'YES' and press the [↵] key. Selecting 'NO' does not initialize the data memory, and the settings are not changed.
6	*SET OK*	The setting is completed. To continue setting another channel, press the [↵] key to return to the '□:MODE=DI' display. To return to the 'SET=RANGE' display, press the ESC key. To return to the operation mode, press the MENU key for three seconds.

Note

The above settings will result in a recording trace from the top end to the bottom end of the graph between the contact statuses OFF and ON. If desired, a discrete display for an on/off status recording can be set so that the recording trace appears within the limited band of the graph. See Section 4.7.1.

4.1.4 Difference Computation (DELT) Setting

To display the difference between the measured values of two channels, follow the procedure below to set up the differential calculation. This setting can only be used if the reference channel is a VOLT, TC or RTD input.

MENU:

[▲] key

RANGE	01	SKIP	REFERENCE CH	LOWER	UPPER
ALARM	02	VOLT	1	-2.000	2.000
UNIT	03	TC			
TIME/DIV	04	RTD			
CLOCK		DI			
COPY		DELT			
AUX		SCL			
FD_SET		SQRT			

PROCEDURE:

Key Sequence — **Display**

1. [ESC MENU 3 sec] [ACK/◄] [▼] [↵] `SET=RANGE`
   Press the MENU key for three seconds to enter the SET mode. Select the 'SET=RANGE' display using the [▲]/[▼] keys, then press the [↵] key.

2. [ACK/◄] [▼] [↵] `02:MODE=`
   Select the desired channel using the [▲]/[▼] keys, then press the [↵] key.

   Note
   The channel number of the input to be compared to the reference channel must be greater than that of the reference channel. Thus, Channel 1 cannot be selected here.

3. [ACK/◄] [▼] [↵] `02:MODE=DELT`
   Select 'DELT' using the [▲]/[▼] keys, then press the [↵] key.

4. [ACK/◄] [▼] [↵] `02:REFERENCE CH=01`
   Select the reference channel number using the [▲]/[▼] keys, then press the [↵] key.
   The input range of the channel currently selected is automatically set to the same as that of the reference channel. The difference of the measured value from the reference channel becomes the value displayed in this channel.

5. [ACK/◄] [▼] [►] [↵] `02:LOWER=-2.000`
   The display which appears will show the same low limit value of the display span for the reference channel.
   Specify the low limit value of the desired display span (lower span limit). Use the [▲]/[▼] keys to increment/decrement the value of each digit and the [►] key to shift the digit, then press the [↵] key.

6. [ACK/◄] [▼] [►] [↵] `02:UPPER=2.000`
   The display which appears will show the same high limit value of the display span for the reference channel.
   Specify it the same way as for the low limit value, then press the [↵] key.

   Note
   For a TC and RTD input, the display span cannot exceed the +/– value of the input range width. E.g., if the input range of the TC type L is -200 to 900°C, then the maximum display span for DELT is ±1100°C.
   For a VOLT input, the display span cannot exceed the input range, and the UPPER setting cannot be equal to the LOWER setting.

7. [ACK/◄] [▼] [↵] `INIT. DATA_MEMORY=YES`
   If the settings are changed, this message appears. If you do not mind initializing the data memory, select 'YES' and press the [↵] key. Selecting 'NO' does not initialize the data memory, and the settings are not changed.

8 ⏎/ESC 3 sec | ✱SET OK✱ |
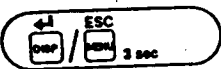
The setting is completed.
To continue setting another channel, press the [⏎] key to
return to the '☐:MODE=DELT' display.
To return to the 'SET=RANGE' display, press the ESC key.
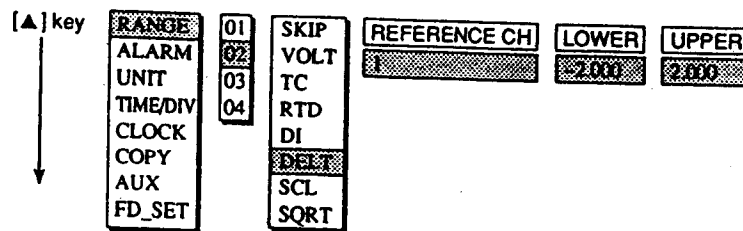To return to the operation mode, press the MENU key for
three seconds.

4.1.5 Scale (SCL) Setting

To assign a different scale to the measured data, the range can be set as described below. Note that the measured data for which a different scale can be set is the voltage (VOLT), thermocouple (TC) or resistance temperature detector (RTD) type. To assign a unit to this new scale, refer to Section 4.3, "UNIT Assignment."

MENU:

[▲] key

RANGE	01	SKIP		SCALING MODE	RANGE	LOWER	UPPER	SCL LOWER	SCL UPPER
ALARM	02	VOLT		VOLT	2V	0.000	2.000	-100.0	100.0
UNIT	03	TC							
TIME/DIV	04	RTD							
CLOCK		DI							
COPY		DELT							
AUX		SCL							
FD_SET		SQRT							

PROCEDURE:

|	Key Sequence	Display	
1	ESC 3 sec / ACK ▲ ▼ ↵	SET=RANGE	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=RANGE' display using the [▲]/[▼] keys, then press the [↵] key.
2	ACK ▲ / ▼ ↵	01:MODE=	Select the desired channel using the [▲]/[▼] keys, then press the [↵] key.
3	ACK ▲ / ▼ ↵	01:MODE=SCL	Select 'SCL' using the [▲]/[▼] keys, then press the [↵] key.
4	ACK ▲ / ▼ ↵	01:SCALING MODE=VOLT	Select the input type using the [▲]/[▼] keys, then press the [↵] key.
5	ACK ▲ / ▼ ↵	01:RANGE=2V	Select the desired input range using the [▲]/[▼] keys, then press the [↵] key.
6	ACK ▲ / ▼ ► ↵	01:LOWER=0.000	Set the low limit value of the desired display span (lower span limit). Use the [▲]/[▼] keys to increment/decrement the value of each digit and the [►] key to shift the digit, then press the [↵] key.
7	ACK ▲ / ▼ ► ↵	01:UPPER=2.000	Set the high limit value of the desired display span (upper span limit) the same way as for the low limit value, then press the [↵] key.

Note

The display span cannot exceed the input range, nor can the LOWER setting be equal to the UPPER setting.

	Key Sequence	Display	
8	ACK ▲ / ▼ ► ↵	01:SCL LOWER=-100.0	Set the lower scale limit (including the decimal point) corresponding to the low limit value of the display span using the [▲]/[▼] and [►] keys. Note that the allowable range is −20000 to 20000. Then press the [↵] key.
9	ACK ▲ / ▼ ► ↵	01:SCL UPPER=100.0	Set the upper scale limit corresponding to the high limit value of the display span. Select it the same way as the lower scale limit, then press the [↵] key. Note that the decimal point will be in the same position as for SCL LOWER. SCL UPPER cannot be equal to SCL LOWER. In this example, 0.000 V is to be converted to -100.0, and 2.000 V to 100.0.

4. BASIC SETTINGS (OPERATIONS IN SET MODE)

IM4HTA1-01E

4-7

10 INIT. DATA_MEMORY=YES

If the settings are changed, this message appears. If you do not mind initializing the data memory, select 'YES' and press the [↵] key. Selecting 'NO' does not initialize the data memory, and the settings are not changed.

11 *SET OK*

The setting is completed.
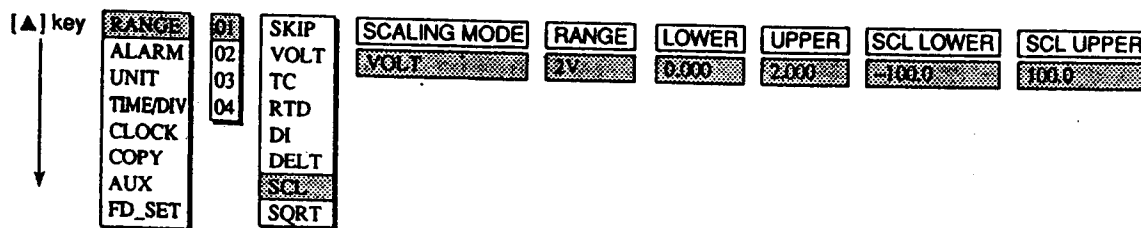To continue setting another channel, press the [↵] key to return to the '□:MODE=SCL' display.
To return to the 'SET=RANGE' display, press the ESC key.
To return to the operation mode, press the MENU key for three seconds.

4.1.6 Square Root Computation (SQRT) Setting

To compute the square root of a DC voltage input signal and display it as the measured value with your desired scale, follow the procedure below. To assign the unit, refer to Section 4.3, "UNIT Assignment."

MENU:

[▲] key

RANGE	01	SKIP
ALARM	02	VOLT
UNIT	03	TC
TIME/DIV	04	RTD
CLOCK		DI
COPY		DELT
AUX		SCL
FD_SET		SQRT

| RANGE | LOWER | UPPER | SCL LOWER | SCL UPPER |
| 2V | 0.000 | 2.000 | -2000.0 | 2000.0 |

PROCEDURE:

	Key Sequence	Display	
1	ESC 3 sec / ▲ ▼ ACK / ◄ ↵	SET=RANGE	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=RANGE' display using the [▲]/[▼] keys, then press the [↵] key.
2	▲ ▼ ACK / ◄ ↵	01:MODE=	Select the desired channel using the [▲]/[▼] keys, then press the [↵] key.
3	▲ ▼ ACK / ◄ ↵	01:MODE=SQRT	Select 'SQRT' using the [▲]/[▼] keys, then press the [↵] key.
4	▲ ▼ ACK / ◄ ↵	01:RANGE=2V	Select the desired input range using the [▲]/[▼] keys, then press the [↵] key.
5	▲ ▼ ► ACK / ◄ ↵	01:LOWER=0.000	Set the low limit value of the desired display span (lower span limit) using the [▲]/[▼] and [►] keys, then press the [↵] key.
6	▲ ▼ ► ACK / ◄ ↵	01:UPPER=2.000	Set the high limit value of the desired display span (upper span limit) the same way as for the low limit value, then press the [↵] key.

Note

The display span cannot exceed the input range, nor can the LOWER setting be equal to the UPPER setting.

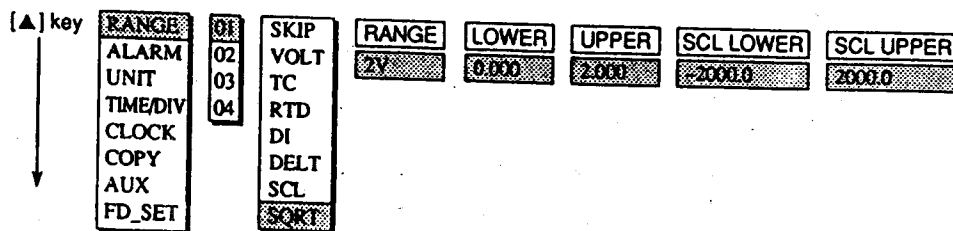|	Key Sequence	Display	
7	▲ ▼ ACK / ◄ ↵	01:SCL LOWER=-2000.0	Set the lower scale limit (including the decimal point) corresponding to the low limit value of the display span using the [▲]/[▼] and [►] keys. Note that the allowable range is –20000 to 20000. Then press the [↵] key.
8	▲ ▼ ► ACK / ◄ ↵	01 : SCL UPPER=2000.0	Set the upper scale limit corresponding to the high limit value of the display span. Select it the same way as the lower scale limit, then press the [↵] key. Note that the decimal point will be in the same position as for SCL LOWER. SCL UPPER cannot be equal to SCL LOWER.
9	▲ ▼ ACK / ◄ ↵	INIT. DATA_MEMORY=YES	If the settings are changed, this message appears. If you do not mind initializing the data memory, select 'YES' and press the [↵] key. Selecting 'NO' does not initialize the data memory, and the settings are not changed.
10	↵ / ESC 3 sec	*SET OK*	The setting is completed. To continue setting another channel, press the [↵] key to return to the '□:MODE=SQRT' display.

To return to the 'SET=RANGE' display, press the ESC key.
To return to the operation mode, press the MENU key for
three seconds.

EXPLANATION OF SQUARE ROOT:

The VR100 uses the following square-root computation:
Using the following expressions:

V_{min} = minimum value of display span (LOWER)
V_{max} = maximum value of display span (UPPER)
F_{min} = minimum value of scale (SCL LOWER)
F_{max} = maximum value of scale (SCL UPPER)
V_x = input voltage
F_x = scaled value

then the relationship between V_x (input voltage) and F_x (scaled value) is as shown in the
graph below (the graph is approximate).
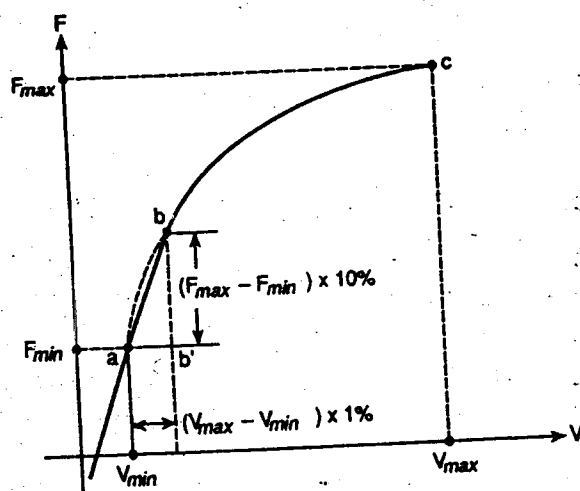
Between b and c in the graph, the following relation exists between F_x and V_x:

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

and the relation between a and b can be expressed as:

$$F_x = \frac{10(F_{max} - F_{min})}{V_{max} - V_{min}}(V_x - V_{min}) + F_{min}$$

IM 4N1A1-01E

4.1.7 SKIP Setting

Unused channels can be skipped, which means that these channels will not be measured or displayed. Follow the procedure below to skip a channel.

MENU:

[▲] key
RANGE	01	SKIP
ALARM	02	VOLT
UNIT	03	TC
TIME/DIV	04	RTD
CLOCK		DI
COPY		DELT
AUX		SCL
FD_SET		SQRT

PROCEDURE:

|	Key Sequence	Display	
1	ESC 3 sec / [ACK]/[◄] [DISP]	SET=RANGE	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=RANGE' display using the [▲]/[▼] keys, then press the [↵] key.
2	[ACK]/[◄] [DISP]	01:MODE=	Select the desired channel using the [▲/▼] keys, then press the [↵] key.
3	[ACK]/[◄] [DISP]	01:MODE=SKIP	Select 'SKIP' using the [▲]/[▼] keys, then press the [↵] key.
4	[ACK]/[◄] [DISP]	INIT. DATA_MEMORY=YES	If the settings are changed, this message appears. If you do not mind initializing the data memory, select 'YES' and press the [↵] key. Selecting 'NO' does not initialize the data memory, and the settings are not changed.
5	[↵]/ESC 3 sec	*SET OK*	The setting is completed. To continue setting another channel, press the [↵] key to return to the '☐:MODE=SKIP' display. To return to the 'SET=RANGE' display, press the ESC key. To return to the operation mode, press the MENU key for three seconds.

4.2 Alarm Setting

Alarms can be set for the measured data of any channel.
If an alarm is set and an alarm occurs, the ALM indication will appear on the screen. If the optional alarm output relays are equipped, these will be activated by the occurrence of an alarm (see Section 6.1). Up to four alarm levels from among the following six types of alarms can be set per channel.

H   High limit alarm: generated when the measured value is higher than, or equal to, the alarm setting.

L   Low limit alarm: generated when the measured value is lower than, or equal to, the alarm setting.

R   Rate-of-change limit on increase: generated when the measured value variation in the ascending direction during a selected interval is greater than, or equal to, the alarm setting.

r   Rate-of-change limit on decrease: generated when the measured value variation in the descending direction during a selected interval is greater than, or equal to, the alarm setting.
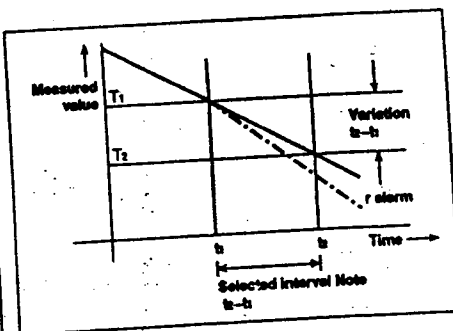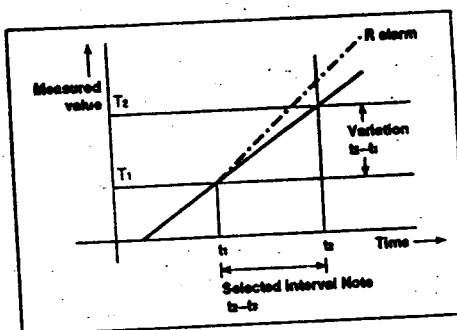
h   Difference high-limit alarm: generated when the [measured value of the channel – measured value of a specified reference channel] is equal to or greater than the alarm setting. (This type of alarm can only be set when the corresponding channel is set as the differential value display (DELT).)

l   Difference low-limit alarm: generated when the [measured value of a specified reference channel – measured value of the channel] is equal to or greater than the alarm setting. (This type of alarm can only be set when the corresponding channel is set as the differential value display (DELT).)

Note _____
Alarm settings are automatically canceled on the affected channel when any of the following changes occurs:
• input type (VOLT, TC, etc.) or input range (2V, etc.) is changed.
• decimal point for linear scaling and square root is changed.
• high or low limit value of the display span is changed (in case of linear scaling and square root).
• upper or lower scale limit is changed (in case of linear scaling and square root).
For a channel displaying a differential value, alarm settings are canceled when any of the following changes occur:
• reference channel is changed.
• input type or range of the reference channel is changed.
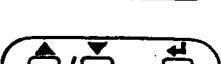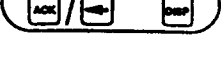
The initial value is 'OFF' for all channels and all levels. To set an alarm, follow the procedure on the next page.

MENU:

[▲] key	RANGE	01		LEVEL	ALARM ON/OFF	TYPE	VALUE	RELAY ON/OFF	RELAY No.
	ALARM	02		1	ON	H	2.000	ON	I01
	UNIT	03							
	TIME/DIV	04							
	CLOCK								
	COPY								
	AUX								
	FD_SET								

PROCEDURE:

	Key Sequence	Display	
1	ESC MENU 3 sec / ▲ACK ▼ ↵DISP	SET=ALARM	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=ALARM' display using the [▲]/[▼] keys, then press the [↵] key.
2	▲ACK / ▼ ↵DISP	01:ALARM LEVEL=	Select the desired channel using the [▲]/[▼] keys, then press the [↵] key.
3	▲ACK / ▼ ↵DISP	01:ALARM LEVEL=1	Select the desired level of alarm using the [▲]/[▼] keys (up to four levels can be set), then press the [↵] key.
4	▲ACK / ▼ ↵DISP	01/1:ALARM=ON	Check the channel and alarm level numbers displayed and select the status of the alarm (ON or OFF) using the [▲]/[▼] keys. Initially all are set to OFF. Then press the [↵] key. When OFF is entered, the message '*SET OK*' appears to show the end of setting. Alarms cannot be set for a SKIPped or DI channel.
5	▲ACK / ▼ ↵DISP	01/1:TYPE=H	Enter the type of alarm using the [▲]/[▼] keys (one of six types), then press the [↵] key. Types h and l will appear only if the corresponding channel is the DELT type.
6	▲ACK / ▼ ▶ ↵DISP	01/1:VALUE=2.000	Enter the alarm value using the [▲]/[▼] and [▶] keys, then press the [↵] key.
7	▲ACK / ▼ ↵DISP	01/1:RELAY=ON	Specify whether an output relay should be activated (ON) or not (OFF) using the [▲]/[▼] keys. Note that output relays are optional (/A1, 2 or 3). If the option is not installed, data entry will be ignored. Then press the [↵] key.
8	▲ACK / ▼ ↵DISP	01/1:RELAY No.=I01	Use the [▲]/[▼] keys to specify the output relay number (depending on the option) from I01 to I06.

Note
If you specify a relay number which your recorder does not have, no alarm will be output.

After selection, press the [↵] key.

| 9 | ↵DISP / ESC MENU 3 sec | *SET OK* | The setting is completed. To continue setting another channel, press the [↵] key to return to the ' □:ALARM LEVEL=□ ' display. To return to the 'SET=ALARM' display, press the ESC key. To return to the operation mode, press the MENU key for three seconds. |

Note
• The alarm output behavior can be selected as either hold or non-hold (see Section 6.1.4).
• Multiple alarms can be assigned to an alarm output relay, representing the AND or OR logic status of those alarms. For details on selecting the logic, see Section 6.1.2.

4. BASIC SETTINGS (OPERATIONS IN SET MODE)

IM 1A1-01E

4.3 Unit Assignment

When you are using the scaling (SCL) or square root (SQRT) setting, you can assign an engineering unit to the scale of that channel, using up to six characters.
To set the engineering unit, follow the procedure below.

MENU:

[▲] key
```
          RANGE    01   CHARACTERS
          ALARM    02   ▓▓▓▓▓▓
          UNIT     03
          TIME/DIV 04
          CLOCK
          COPY
          AUX
          FD_SET
```

PROCEDURE:

Key Sequence — **Display**

1. [ESC / 3 sec]
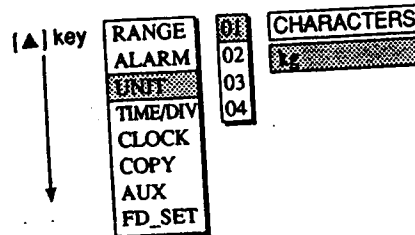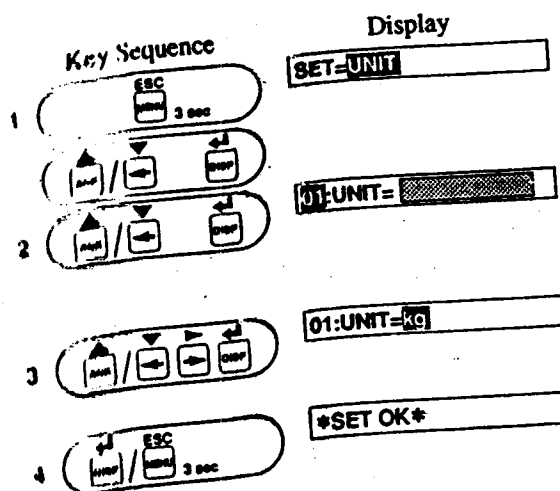
   Display: `SET=UNIT`

   Press the MENU key for three seconds to enter the SET mode. Select the 'SET=UNIT' display using the [▲]/[▼] keys, then press the [↵] key.

2. [▲ / ▼] / [↵]

   Display: `01:UNIT=▓▓▓▓▓`

   Select the desired channel using the [▲]/[▼] keys, then press the [↵] key. If the selected channel is not the SCL or SQRT type, data entry will be ignored.

3. [▲ / ▼] [►] [↵]

   Display: `01:UNIT=kg`

   Enter the desired unit (up to six characters) using the [▲]/[▼] and [►] keys, then press the [↵] key.

4. [↵] / [ESC 3 sec]

   Display: `*SET OK*`

   The setting is completed.
   To continue setting another channel, press the [↵] key to return to the '□:UNIT=□ □ □ □' display.
   To return to the 'SET=UNIT' display, press the ESC key.
   To return to the operation mode, press the MENU key for three seconds.

4.4 Setting of Waveform Span Rate (TIME/DIV)

The waveform span rate, which corresponds to the "chart speed" for a conventional strip chart recorder and indicates the span for each division of the time axis on the screen, can be selected from the following six speeds. The table below shows the relationship between the waveform span rate, time per pixel, and trend speed.

Waveform span rate (time span per division of time axis)	Time per pixel	Trend speed (approximate)
1 min	2 s	615.0 mm/h
5 min	10 s	123.0 mm/h
10 min	20 s	61.5 mm/h
20 min	40 s	30.5 mm/h
30 min	60 s	20.5 mm/h
60 min	120 s	10.2 mm/h

CAUTION

Changing the waveform span rate initializes the following databases:
- the data memory, which can then not be restored;
- the time-axis mark information in the information file; and
- the power failure information records related to the display data file.
If necessary, save the data in memory to a floppy disk before setting.

Note

• When tracing the waveform (trend graph), the range of the measured values—from the maximum value to the minimum—sampled within the interval for each pixel at the scanning period of 125 ms is traced for each pixel on the screen.
Example: When the waveform span rate is 1 minute.

2 s (per pixel)

1 min (30 pixels)
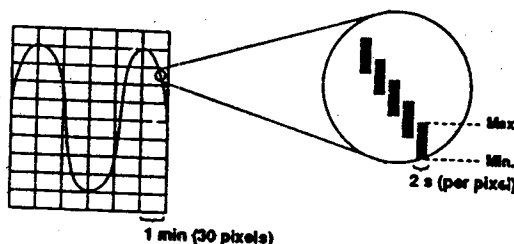
• When the display data file has been created, the maximum and minimum values for each pixel are then also recorded in the file.

MENU:

[▲] key   RANGE   Time per Division
           ALARM
           UNIT
           TIME/DIV
           CLOCK
           COPY
           AUX
           FD_SET

PROCEDURE:

Key Sequence	Display	
ESC MENU 3 sec	SET=TIME/DIV	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=TIME/DIV' display using the [▲]/[▼] keys, then press the [↵] key.
▲ ACK / ▼ DISP ↵ DISP	TIME/DIV=5 min	Select the desired rate from 1, 5, 10, 20, 30, and 60 minutes using the [▲]/[▼] keys, then press the [↵] key.
▲ ACK / ▼ DISP ↵ DISP	INIT. DISP_DATA=YES	If you do not mind initializing the display data file, use the [▲]/[▼] key to select 'YES', then press the [↵] key.
↵ DISP / ESC MENU 3 sec	*SET OK*	The setting is completed. To modify the setting, press the [↵] key to return to the 'TIME/DIV=□ min' display. To return to the 'SET=TIME/DIV' display, press the ESC key. To return to the operation mode, press the MENU key for three seconds.

4.5 Clock Setting

To set the date and time of the internal clock, follow the procedure below:

MENU:

[▲] key | RANGE | DATE | TIME
ALARM
UNIT
TIME/DIV
CLOCK
COPY
AUX
FD_SET

DATE: 96/01/30 TIME: 13:30:00
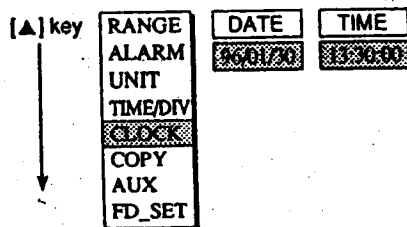
PROCEDURE:

Key Sequence	Display	
1	SET=CLOCK	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=CLOCK' display using the [▲]/[▼] keys, then press the [↵] key.
2	DATA=96/02/30	Enter the correct date, which is written as year/month/day (YY/MM/DD) using the [▲]/[▼] and [►] keys, then press the [↵] key. (The date will be automatically updated, regardless of whether the power is turned on or off. Leap years are automatically included.)
3	TIME=13:30:00	Enter the correct time, which is written as hour:minute:second (HH:MM:SS) using the [▲]/[▼] and [►] keys, then press the [↵] key. Upon pressing the [↵] key, the clock starts.
4	*SET OK*	The setting is completed. To modify the setting, press the [↵] key to return to the 'DATE=□ □/□ □/□ □' display. To return to the 'SET=CLOCK' display, press the ESC key. To return to the operation mode, press the MENU key for three seconds.

4.6 Copying the Channel Settings

It is possible to copy settings from one channel to another. All settings concerning range, alarm, unit, zone display, partial expanded display, and tag number are copied. For details of the settings concerning zone display, partial expanded display, and tags, see Section 4.7. These settings are all copied, and it is impossible to copy certain settings only, such as alarm settings.

Exactly the same values as these settings are copied to the specified channel. To copy the settings, follow the procedure below.

MENU:

[▲] key | RANGE | FROM CH | TO CH
| ALARM | 01 | 01
| UNIT
| TIME/DIV
| CLOCK
| COPY
| AUX
| FD_SET

PROCEDURE:

Key Sequence	Display	
1	SET=COPY	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=COPY' display using the [▲]/[▼] keys, then press the [↵] key.
2	COPY FROM 01 TO	Enter the channel number from which you want to copy using the [▲]/[▼] keys.

Note

You can only copy from a lower channel number to a higher channel number.

Then press the [↵] key.

3	COPY FROM 01 TO 03	Enter the channel number to which you want to copy using the [▲]/[▼] keys, then press the [↵] key.
4	INIT. DATA_MEMORY=YES	This message then appears to announce that copying the channel settings initializes the data memory. If you do not mind initializing the data memory, select 'YES' and press the [↵] key. Selecting 'NO' does not initialize the data memory, and the settings are not copied.
5	*SET OK*	The setting is completed.

To continue copying the channel settings to another channel, press the [↵] key to return to the 'COPY FROM ☐ TO ☐' display.

To return to the 'SET=COPY' display, press the ESC key.

To return to the operation mode, press the MENU key for three seconds.

4. BASIC SETTINGS (OPERATIONS IN SET MODE)

4.7 Settings of Discrete Display (ZONE), Partial Expanded Display (PART), Trip Level (TRIP) and Tags

The following sections describe the procedures for the settings listed below.

MODE	Description	Section
ZONE	Enables the trend trace (waveform) of each channel to be displayed in discrete zones on the screen.	4.7.1
PART	Enables part of the display range to be compressed in order to examine another part of the range in more detail.	4.7.2
TAG	Defines the tag numbers for identifying channels.	4.7.3
TRIP	Draws a horizontal line on the trend graph (waveform) on the screen in order to represent a specific signal level to be noted.	4.7.4

4.7.1 Setting of Discrete Display (ZONE)

Discrete (zone) display enables you to define different bands for each channel on the screen. The traces of the trend graph will then not overlap, making it easier to see each trend (waveform).

MENU:

[▲] key

RANGE	ZONE	01	ZONE LOWER	ZONE UPPER
ALARM	PART	02	25 %	50 %
UNIT	TAG	03		
TIME/DIV	FD	04		
CLOCK	TRIP			
COPY	FILE			
AUX	LCD			
FD_SET	INIT_MEMORY			

PROCEDURE:

	Key Sequence	Display	
1	ESC MENU 3 sec / ▲ ACK / ▼ ↩	SET=AUX	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=AUX' display using the [▲]/[▼] keys, then press the [↵] key.
2	▲ ACK / ▼ ↩	MODE=ZONE	Select the 'MODE=ZONE' display using the [▲]/[▼] keys. Then press the [↵] key.
3	▲ ACK / ▼ ↩	02:ZONE LOWER= %	Select the desired channel using the [▲]/[▼] keys, then press the [↵] key.
4	▲ ACK / ▼ ► ↩	02:ZONE LOWER=25%	Specify the lower boundary on the graph using the [▲]/[▼] and [►] keys. On the trend graph screen, this lower boundary value corresponds to the lower span limit. (For example, if channel 2 has a display span of –2V to 2V, and if you specify the zone to start from 25%, then the display at 25% of the full span on the graph will correspond to the value of –2V.) Then press the [↵] key.
5	▲ ACK / ▼ ► ↩	02:ZONE UPPER=50%	Specify the upper boundary value using the [▲]/[▼] and [►] keys, then press the [↵] key.

Note

The upper boundary must be greater than the lower boundary by at least 5%.

	Key Sequence	Display	
6	↩ / ESC 3 sec	*SET OK*	The setting is completed. To continue setting another channel, press the [↵] key to return to the ' □:ZONE LOWER=□ □ □%' display. To return to the 'SET=AUX' display, press the ESC key. To return to the operation mode, press the MENU key for three seconds.

EXPLANATION:
The following figure shows an example of the display after discrete display has been set.
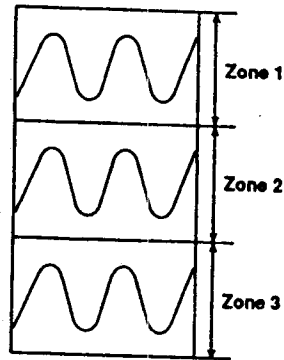
4.7.2 Setting of Partial Expanded Display (PART)

Partial expanded display enables you to compress part of the display span in order to examine the expanded (other) part of the range in more detail. The initial value is 'OFF'. To set partial expanded display, follow the procedure below.

MENU:

[▲] key

RANGE	ZONE
ALARM	PART
UNIT	TAG
TIME/DIV	FD
CLOCK	TRIP
COPY	FILE
AUX	LCD
FD_SET	INIT_MEMORY

| 01 |
| 02 |
| 03 |
| 04 |

partial expanded recording	expand from	boundary value
ON	25 %	0.000

PROCEDURE:

	Key Sequence	Display	
1	ESC 3 sec / ACK ▲ ▼ ← ↵	SET=AUX	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=AUX' display using the [▲]/[▼] keys, then press the [↵] key.
2	ACK ▲ ▼ ← ↵	MODE=PART	Select the 'MODE=PART' display using the [▲]/[▼] keys, then press the [↵] key.
3	ACK ▲ ▼ ← ↵	01:PARTIAL=	Select the desired channel using the [▲]/[▼] keys, then press the [↵] key.
4	ACK ▲ ▼ ← ↵	01:PARTIAL=ON	Select ON (or OFF if you set partial expanded display before and want to reset it now) using the [▲]/[▼] keys, then press the [↵] key. If you selected OFF, the setting is now completed.
5	ACK ▲ ▼ ← ► ↵	01:EXPAND FROM=25%	Specify the percentage (1 to 99%) of the full display span which is to be compressed, using the [▲]/[▼] and [►] keys, then press the [↵] key.
6	ACK ▲ ▼ ← ► ↵	01:BOUNDARY=0.000	The display which then appears prompts you to set the boundary value. The boundary value corresponds to the compressed part which was previously set. See also the figure on the next page. Set this value using the [▲]/[▼] and [►] keys.

Note

This boundary value must be within the display span. (If scaling is ON, this value must be within the scaling range.)

Then press the [↵] key.

		Display	
7	↵ / ESC 3 sec	*SET OK*	The setting is completed. To continue setting another channel, press the [↵] key to return to the '□:PARTIAL=□ □' display. To return to the 'SET=AUX' display, press the ESC key. To return to the operation mode, press the MENU key for three seconds.

Note

The settings of the partial expanded display are automatically canceled when any of the following changes occur:
- input type (VOLT, TC, etc.) or input range (2V, etc.) is changed.
- decimal point for linear scaling and square root is changed.
- high or low limit value of the display span is changed (in case of linear scaling and square root).
- upper or lower scale limit is changed (in case of linear scaling and square root).
- For the differential value display: the reference channel, or the input type or range of the reference channel is changed.

EXPLANATION:

The following figures show the displays before and after the above settings have been completed:

Normal Display

Partial Expanded Display
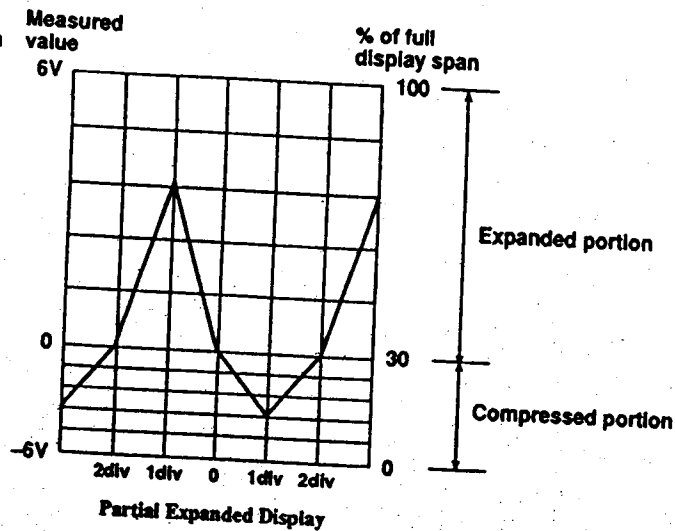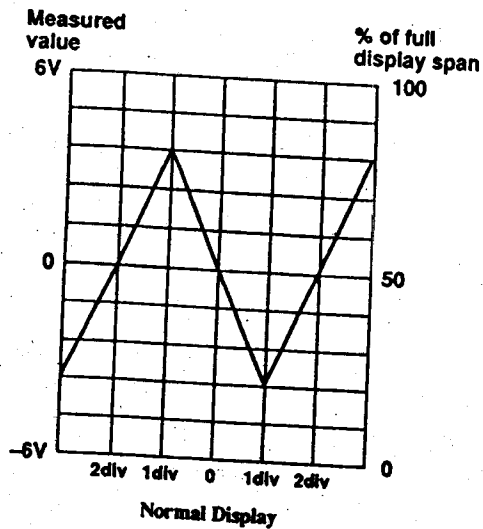
As can be seen from these figures, the lower side of the boundary (0 V) shows at 30% of the full span of the screen the data in the range –6V to 0V. On the upper side of the boundary, the range 0V to 6V is shown at 70% of the full span of the screen. Thus the scales differ on the upper and lower sides of the boundary.

4.7.3 Tag Setting

Depending on the setting in the SETUP mode, the tag numbers can be used instead of the channel numbers for identifying the channels. The tag numbers which are set are displayed in the upper row of the unit display area on the screen and stored in files together when the data is saved. The maximum length of a tag number that can be specified for each channel is seven characters.

Note

To make the tag numbers take effect, you must switch from the channel numbers to tag numbers. (For details of the procedure, see Section 6.6.)

Follow the procedure below to set a tag number.

MENU:
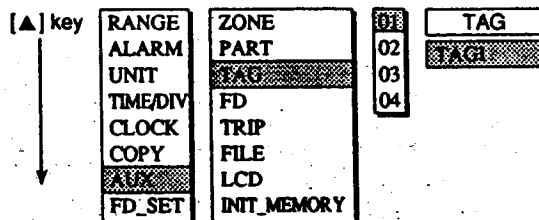
[▲] key

RANGE	ZONE	01	TAG
ALARM	PART	02	TAG1
UNIT	TAG	03	
TIME/DIV	FD	04	
CLOCK	TRIP		
COPY	FILE		
AUX	LCD		
FD_SET	INIT_MEMORY		

PROCEDURE:

Key Sequence / **Display**

1. ESC 3sec / ▲ACK / ▼◄ / ↵DISP — **SET=AUX**

   Press the MENU key for three seconds to enter the SET mode. Select the 'SET=AUX' display using the [▲]/[▼] keys, then press the [↵] key.

2. ▲ACK / ▼◄ / ↵DISP — **MODE=TAG**

   Select the 'MODE=TAG' display using the [▲]/[▼] keys, then press the [↵] key.

3. ▲ACK / ▼◄ / ↵DISP — **01:TAG=**

   Select the desired channel using the [▲]/[▼] keys, then press the [↵] key.

4. ▲ACK / ▼◄ / ↵DISP — **01:TAG=TAG1**

   Enter the desired characters (up to seven) using the [▲]/[▼] and [►] keys, then press the [↵] key.

5. ↵DISP / ESC 3sec — **＊SET OK＊**

   The setting is completed.
   To continue setting another channel, press the [↵] key to return to the '☐:TAG=☐ ☐ ☐ ☐' display.
   To return to the 'SET=AUX' display, press the ESC key.
   To return to the operation mode, press the MENU key for three seconds.

4.7.4 Trip Level (TRIP) Setting

This setting allows you to draw up to two horizontal lines on the trend graph (waveform) display to represent particular or critical levels. The two lines are displayed in different colors as follows:

Level 1: red
Level 2: yellow

MENU:

[▲] key

RANGE	ZONE
ALARM	PART
UNIT	TAG
TIME/DIV	FD
CLOCK	TRIP
COPY	FILE
AUX	LCD
FD_SET	INIT_MEMORY

| LEVEL | SET ON/OFF | POSITION |
| 1 | ON | 70% |

PROCEDURE:

	Key Sequence	Display	
1	ESC 3 sec / ▲ ACK / ▼ ← / ↵ DISP	SET=AUX	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=AUX' display using the [▲]/[▼] keys, then press the [↵] key.
2	▲ ACK / ▼ ← / ↵ DISP	MODE=TRIP	Select the 'MODE=TRIP' display using the [▲]/[▼] keys, then press the [↵] key.
3	▲ ACK / ▼ ← / ↵ DISP	TRIP LEVEL=1	Select the trip level using the [▲]/[▼] keys, then press the [↵] key.
4	▲ ACK / ▼ ← / ↵ DISP	TRIP SET=ON	Select ON or OFF using the [▲]/[▼] keys, then press the [↵] key.
5	▲ ACK / ▼ ← / ↵ DISP	TRIP POS=70%	Specify the position of the line to be drawn as a percentage (0 to 100%) of the full display span, using the [▲]/[▼] and [►] keys, then press the [↵] key.
6	↵ DISP / ESC 3 sec	*SET OK*	The setting is completed. To continue setting the other trip level, press the [↵] key to return to the 'TRIP LEVEL=□' display. To return to the 'SET=AUX' display, press the ESC key. To return to the operation mode, press the MENU key for three seconds.

4.8 Settings of LCD Brightness and LCD Saver (LCD)

Follow the procedure below to set the brightness and saver for the LCD.
Brightness (LIGHT): Select from levels 1 to 15. The initial setting is 8.
LCD saver (SAVER): This function dims the backlight automatically when there have
been no key operations for a certain time, in order to prolong the
life of the backlight. The initial setting is off.

Note

When the sever is set to on, the backlight is automatically dimmed after a certain time. Pressing any key or inserting a floppy disk when the backlight is dimmed returns the brightness to the original level set in 'LIGHT.'

MENU:

[▲] key

RANGE	ZONE
ALARM	PART
UNIT	TAG
TIME/DIV	FD
CLOCK	TRIP
COPY	FILE
AUX	LCD
FD_SET	INIT_MEMORY

LIGHT	SAVER	SAVER TIME
15	ON	60 min

PROCEDURE:

Key Sequence | Display

1   SET=AUX

Press the MENU key for three seconds to enter the SET mode. Select the 'SET=AUX' display using the [▲]/[▼] keys, then press the [◄┘] key.

2   MODE=LCD

Select the display 'MODE=LCD' using the [▲]/[▼] keys. Press the [◄┘] key.

3   LIGHT=15

Use the [▲]/[▼] keys to select the brightness level from '01' to '15' ('01' is the darkest and '15' is the brightest), then press the [◄┘] key.

4   SAVER=ON

Select 'ON' or 'OFF' using the [▲]/[▼] keys, then press the [◄┘] key.

5   SAVER TIME=60min

If you selected 'ON,' select the time after which to dim the backlight. Select 1, 2, 5, 10, 30, or 60 minutes using the [▲]/[▼] keys, then press the [◄┘] key.

6   *SET OK*

The setting is completed.
Pressing the [◄┘] key in this step returns to the display 'LIGHT=□'
Pressing the ESC key in this step returns to the display
To return to the 'SET=AUX' display, press the ESC key.
To return to the operation mode, press the MENU key for three seconds.

# Chapter 5 FLOPPY DISK AND FILES (OPERATIONS IN SET MODE)

5.1 Setting the Floppy Disk Format (AUX–FD)
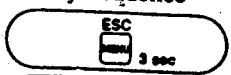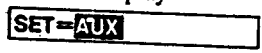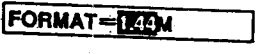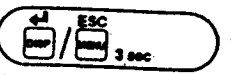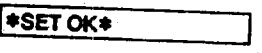
Follow the procedure below to set the formatting type for floppy disks—be sure to select 1.44 MB when using the English version software even though 1.2 MB can be selected in the following procedure. The type set by this procedure will automatically be selected when formatting a floppy disk.

For details on how to format a floppy disk, see Section 5.4, "Formatting a Floppy Disk."

MENU:

[▲] key

RANGE	ZONE	FORMAT
ALARM	PART	1.44MB
UNIT	TAG	
TIME/DIV	FD	
CLOCK	TRIP	
COPY	FILE	
AUX	LCD	
FD_SET	INIT_MEMORY	

PROCEDURE:

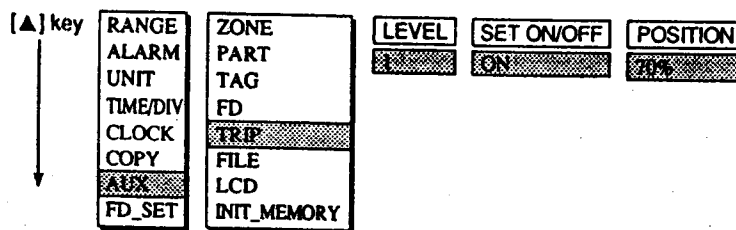| Key Sequence	Display	
1	SET=AUX	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=AUX' display using the [▲]/[▼] keys, then press the [↵] key.
2	MODE=FD	Select the 'MODE=FD' display using the [▲]/[▼] keys, then press the [↵] key.
3	FORMAT=1.44M	Select '1.44M' (or '1.2M' only if you are using the Japanese version software and NEC PC-9801 series computer) using the [▲]/[▼] keys, then press the [↵] key.
4	*SET OK*	The setting is completed. To change the setting, press the [↵] key to return to the 'FORMAT=□ □ □' display. To return to the 'SET=AUX' display, press the ESC key. To return to the operation mode, press the MENU key for three seconds.

5.2 Setting the Data File Name (AUX–FILE)

Select the method of setting the names of event files and display data files from the following two:

    Automatic setting (DATE)
    User-defined (SET)

If you select the user-defined system, enter the file names individually for event and display data files. The default names are blanks if you select the user-defined system. Even when there is no display data file to be saved, enter the file names for both event and display data files. A comment can also be attached to the event and display data files.

Note

Once user-defined names have been set, they will remain the same until changed. Note that if there is already a file with the same file name in the floppy disk when saving the measured data to that floppy disk, the file will be overwritten.

File Names

- When specifying the file names, follow the rules below.
  - The maximum length is seven characters.
  - The following system-reserved names cannot be used:
    CON, PRN, AUX, AUX1, AUX2, NUL, CLOCK, blanks.
  - The following characters cannot be used:
    * (asterisk), . (period), + (plus sign), / (slash).
- For a user-defined file name, the suffix code as shown below is appended automatically (when saving data to a floppy disk).

File	Suffix Code
Event file	.DAT
Display data file	.DAT
Parameter list file	.LST
Information file	.INF

When the file name is set automatically, the file names are set (when saving data to a floppy disk) as follows.

File	Format of File Name (Automatic Setting)
Event file	

```
S 1 0 1 3 1 5 1 . D A T
              └─ Block number of the file (1-9, A-G) *1
            └─── Time triggered (hour) *2
          └───── Time triggered (day) *2
        └─────── Time triggered (month) *2
    └─────────── File identifier (fixed to 'S')
```

Display data file

```
D 1 0 1 3 1 5   . D A T
            └─ Time when saved to floppy disk (hour)
          └─── Time when saved to floppy disk (day)
        └───── Time when saved to floppy disk (month)
    └───────── File identifier (fixed to 'D')
```

Parameter list file

```
D 1 0 1 3 1 5   . L S T
          └───── Same name as the display data file *3
```

Information file

```
D 1 0 1 3 1 5   . I N F
          └───── Same name as the display data file *3
```

*1 If multiple event files are created, the event file number is appended. (This also occurs when user-defined names are used.)
*2 When the trigger is set as trigger-free, these are the times when the data are saved to the floppy disk.
*3 When there is no display data file to be saved, these names are the same as the file name of the event file.

MENU:

[▲] key

RANGE	ZONE
ALARM	PART
UNIT	TAG
TIME/DIV	FD
CLOCK	TRIP
COPY	FILE
AUX	LCD
FD_SET	INIT_MEMORY

MESSAGE	FILE_NAME	FILE_E	FILE_D
SAMPLING	SET	AAA	BBB
	DATE		
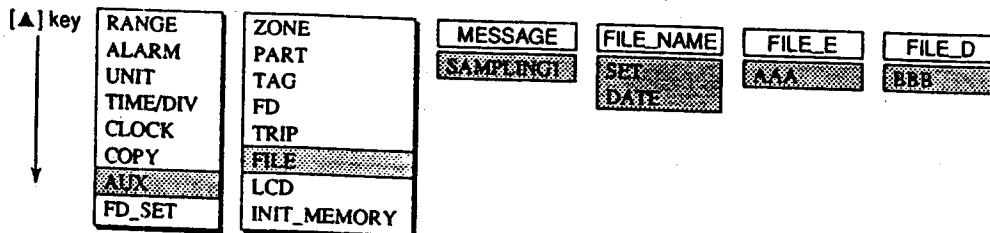
PROCEDURE:

(1) When setting user-defined file names

	Key Sequence	Display	
1	[ESC/MENU 3 sec] [ACK/◄] [◄┘/DISP]	SET=AUX	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=AUX' display using the [▲]/[▼] keys, then press the [◄┘] key.
2	[ACK/◄] [◄┘/DISP]	MODE=FILE	Select the 'MODE=FILE' display using the [▲]/[▼] keys, then press the [◄┘] key.
3	[ACK/◄] [►] [◄┘/DISP]	MSG=SAMPLING	Enter a comment for the files using up to thirty-two characters if necessary. Use the [▲]/[▼] keys to select the character in each digit on the entry cursor and the [►] key to move the entry cursor. After the entry, press the [◄┘] key.
4	[ACK/◄] [◄┘/DISP]	FILE_NAME=SET	Select 'SET' using the [▲]/[▼] keys, then press the [◄┘] key.
5	[ACK/◄] [►] [◄┘/DISP]	FILE_E=AAA	Enter the file name for the event file using up to seven characters. Use the [▲]/[▼] keys to select the character in each digit on the entry cursor and the [►] key to move the entry cursor. After the entry, press the [◄┘] key.

Note

If no file name is entered or if the entered name is illegal, the message 'E217: INVALID FILE NAME' appears. In this case, press any key. The message then disappears and the display is returned to the status before the file name was entered.
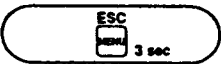
	Key Sequence	Display	
6	[ACK/◄] [►] [◄┘/DISP]	FILE_D=BBB	Enter the file name for the display data file using up to seven characters. Use the [▲]/[▼] keys to select the character in each digit on the entry cursor and the [►] key to move the entry cursor. After the entry, press the [◄┘] key.

Note

* If no file name is entered or if the entered name is illegal, the message 'E217: INVALID FILE NAME' appears. In this case, press any key. The message then disappears and the display is returned to the status before the file name was entered.
* The same name as the one for the event file cannot be specified for the display data file.

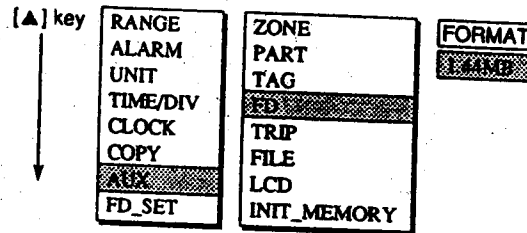|	Key Sequence	Display	
7	[◄┘/DISP] [ESC/MENU 3 sec]	*SET OK*	The setting is completed. To modify the settings, press the [◄┘] key to return to the 'MSG=□ □ □ □' display. To return to the 'SET=AUX' display, press the ESC key. To return to the operation mode, press the MENU key for three seconds.

IM 4H4A1-01E.

(2) When using automatically assigned file names

Key Sequence	Display	

1 [ESC/MENU 3 sec] [ACK/◄ DISP] `SET=AUX`

Press the MENU key for three seconds to enter the SET mode. Select the 'SET=AUX' display using the [▲]/[▼] keys, then press the [↵] key.

2 [ACK/◄ DISP] `MODE=FILE`

Select the 'MODE=FILE' display using the [▲]/[▼] keys, then press the [↵] key.

3 [ACK/◄ ► DISP] `MSG=SAMPLING▯`

Enter a comment for the files using up to thirty-two characters if necessary. Use the [▲]/[▼] keys to select the character in each digit on the entry cursor and the [►] key to move the entry cursor. After the entry, press the [↵] key.

4 [ACK/◄ DISP] `FILE_NAME=DATE`

Select 'DATE' using the [▲]/[▼] keys, then press the [↵] key.

5 [DISP/ESC 3 sec] `*SET OK*`

The setting is completed.
To continue setting another channel, press the [↵] key to return to the 'MSG=□ □ □ □' display.
To return to the 'SET=AUX' display, press the ESC key.
To return to the operation mode, press the MENU key for three seconds.

5.3 Initializing the Data Memory (AUX–INIT_MEMORY)

Follow the procedure below to initialize the contents of the event files, display data file, and information file in the internal memory. After initialization, all contents are cleared and the files are returned to the status before measurement.

Note

Once initialized, the data memory can not be restored. Save the data in memory to a floppy disk before initializing, if necessary.

MENU:

[▲] key

RANGE		ZONE		INIT OK
ALARM		PART		YES
UNIT		TAG		
TIME/DIV		FD		
CLOCK		TRIP		
COPY		FILE		
AUX		LCD		
FD_SET		INIT_MEMORY		

PROCEDURE:

	Key Sequence	Display	
1	ESC MENU 3 sec / ▲ACK/►/⏎ENT	SET=AUX	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=AUX' display using the [▲]/[▼] keys, then press the [⏎] key.
2	▲ACK/►/⏎ENT	MODE=INIT_MEMORY	Select the 'MODE=INIT_MEMORY' display using the [▲]/[▼] keys, then press the [⏎] key.
3	▲ACK/►/⏎ENT	INIT OK=YES	Select 'YES' to execute initialization or 'NO' to cancel initialization using the [▲]/[▼] keys, then press the [⏎] key. If 'YES' is selected, the data memory is initialized.
4	⏎ENT/ESC MENU 3 sec	*SET OK*	Initialization is completed (when 'YES' was entered) or canceled (when 'NO' was entered). To return to the 'INIT OK=☐ ☐' display, press the [⏎] key. To return to the 'SET=AUX' display, press the ESC key. To return to the operation mode, press the MENU key for three seconds.

5. FLOPPY DISK AND FILES (OPERATIONS IN SET MODE)

5.4 Formatting a Floppy Disk (FD_SET–INIT)

Follow the procedure below to format a floppy disk. The format type set in Sec "Setting the Floppy Disk Format (FD)" is used. When formatting a floppy disk, can also set the volume name (can be omitted).

Note _____

Formatting a floppy disk clears all the data on it.

_____

Volume Name
When specifying the volume name, follow the rules below.
- The maximum length is eleven characters.
- The following characters cannot be used:
  * (asterisk), . (period), + (plus sign), / (slash).

MENU:

[▲] key
RANGE	LOAD	INIT OK
ALARM	SAVE	YES
UNIT	DEL	
TIME/DIV	INIT	
CLOCK		
COPY		
AUX		
FD SET		

PROCEDURE:

Key Sequence	Display	
1	SET=FD SET	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=FD_SET' display using the [▲]/[▼] keys, then press the [↵] key.
2	SET=INIT	Select the 'SET=INIT' display using the [▲]/[▼] keys, then press the [↵] key.
3	VOLUME=VR100	Enter the volume name using up to eleven characters (can be omitted). Use the [▲]/[▼] keys to select a character in each digit on the entry cursor and the [►] key to move the entry cursor. After entering all characters, press the [↵] key. If you omit the volume name, simply press the [↵] key without entering any character.
4	INIT OK=YES	Use the [▲]/[▼] keys to select 'YES' to execute formatting or 'NO' to cancel, then press the [↵] key.
5	*SET OK*	If 'YES' is selected, the floppy disk is formatted. The floppy disk has been formatted (when 'YES' was entered) or formatting has been canceled (when 'NO' was entered). To format another floppy disk, press the [↵] key to return to the 'SET=INIT' display. To return to the 'SET=FD_SET' display, press the ESC key. To return to the operation mode, press the MENU key for three seconds.

IM 4N1A1-01E

5.5 Operations on SET Configuration File

The following sections describe how to save, read, and delete the file which contains the settings made in SET mode.

5.5.1 Saving the SET Configuration File (FD_SET-SAVE)

Follow the procedure below to save to a floppy disk the settings made in SET mode.

File Names
- When specifying the file name, follow the rules below.
  - The maximum length is eight characters.
  - The following system-reserved names cannot be used:
    CON, PRN, AUX, AUX1, AUX2, NUL, CLOCK.
  - The following characters cannot be used:
    * (asterisk), . (period), + (plus sign), / (slash).
- The suffix code ".PNL" is appended to the file name automatically.

Space in FDC
If the space remaining in the FDC is less than 4 K bytes, the SET configuration file cannot be saved to it. In this case, the message 'E201: INSUFFICIENT DISK SPACE' appears.

MENU:

[▲] key

| RANGE |
| ALARM |
| UNIT |
| TIME/DIV |
| CLOCK |
| COPY |
| AUX |
| FD_SET |

| LOAD |
| SAVE |
| DEL |
| INIT |

| FILE |
| SET02 |

PROCEDURE:

Key Sequence	Display	
1	SET=FD_SET	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=FD_SET' display using the [▲]/[▼] keys, then press the [↵] key.
2		Insert a floppy disk into the drive.
3	SET=SAVE	Select the 'SET=SAVE' display using the [▲]/[▼] keys, then press the [↵] key.
4	file=▮ FILE=SET02	• To overwrite an existing file: Pressing the [▲]/[▼] keys calls up the names of the configuration files stored on the floppy disk. Call up the desired file name and press the [↵] key. The display then changes to 'FILE=<file name>.' Pressing the [↵] key again overwrites the file. • To save as a new file: Press the [↵] key. The display then changes to 'FILE=' to allow the file name to be entered. Enter the file name (using up to eight characters) and press the [↵] key. If no file name is entered or if the entered name is illegal, the message 'E217: INVALID FILE NAME' is displayed. In this case, press any key to return to the preceding state, then enter a proper name.
	Saving....*	The file is saved.

5   `[↵/DISP] / [ESC/MENU] 3 sec` | *SET OK* |

Saving is completed.
To return to the 'SET=SAVE' display, press the [↵] key.
To return to the 'SET=FD_SET' display, press the ESC key.
To return to the operation mode, press the MENU key for three seconds.

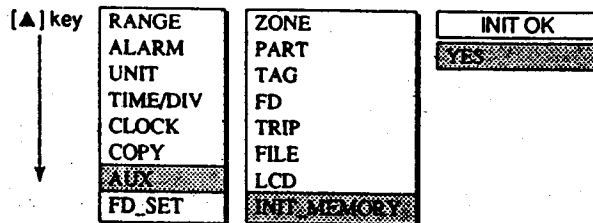## 5.5.2 Reading the SET Configuration File (FD_SET–LOAD)

Follow the procedure below to load a file (suffix .PNL) which contains the settings made in SET mode, from a floppy disk to the internal memory.

MENU:

[▲] key

| RANGE |
| ALARM |
| UNIT |
| TIME/DIV |
| CLOCK |
| COPY |
| AUX |
| FD_SET |

| LOAD |
| SAVE |
| DEL |
| INIT |

| FILE |
| SET02 |

PROCEDURE:

Key Sequence	Display	
1	SET=FD_SET	Press the MENU key for three seconds to enter the SET mode. Select the 'SET=FD_SET' display using the [▲]/[▼] keys, then press the [↲] key.
2		Insert a floppy disk into the drive.
3	SET=LOAD	Select the 'SET=LOAD' display using the [▲]/[▼] keys, then press the [↲] key.
4	FILE=SET02	Select which of the files is to be loaded using the [▲]/[▼] keys, then press the [↲] key.
	Loading....*	The file is loaded. When loading is completed, the mode is automatically switched back to the operation mode.

5.5.3 Deleting the SET Configuration File (FD_SET–DEL)

Follow the procedure below to delete from a floppy disk a file (suffix .PNL) which contains the settings made in SET mode.

MENU:

[▲] key

RANGE
ALARM
UNIT
TIME/DIV
CLOCK
COPY
AUX
FD_SET

LOAD
SAVE
DEL
INIT

FILE
SET02

PROCEDURE:

Key Sequence   Display

1. `SET=FD_SET` — Press the MENU key for three seconds to enter the SET mode. Select the 'SET=FD_SET' display using the [▲]/[▼] keys, then press the [↵] key.

2. Insert a floppy disk into the drive.

3. `SET=DEL` — Select the 'SET=DEL' display using the [▲]/[▼] keys, then press the [↵] key. If an error message appears, see Section 8.1, "Error Messages."

4. `FILE=SET02` — Select which of the files is to be deleted using the [▲]/[▼] keys, then press the [↵] key.

5. `*SET OK*` — The file is deleted.
To delete another file, press the [↵] key to return to the 'SET=DEL' display.
To return to the 'SET=FD_SET' display, press the ESC key.
To return to the operation mode, press the MENU key for three seconds.

Chapter 6 OPERATIONAL PREFERENCES SETUP (OPERATIONS IN SETUP MODE)

Note _____

The measurements, display, and alarm detection are suspended while the recorder is in SETUP mode.

CAUTION	• Selecting the 'SETUP=END' and then 'END&INIT. DATA=STORE' display and pressing the [↵] key at the end of each procedure (described in this chapter) initializes the data memory and information file. If necessary, save the data memory contents (e.g., measured data) to a floppy disk before setting.

• Do not turn off the power before switching back to the operation mode after executing 'SETUP=END' and 'END&INIT.DATA=STORE,' otherwise the calibration data in the recorder may be destroyed.

6.1 Changing the Initial Settings for the Alarm Function (ALARM)

The following sections describe how to change the initial settings for the alarm function.

6.1.1 Setting the reflash function on/off (initial value = 'OFF')

6.1.2 Setting the logic of representative alarm output relay, AND or OR (initial value = 'NONE')

6.1.3 Setting the output relay to be energized/de-energized when an alarm occurs (initial value = 'ENERG')

6.1.4 Setting the alarm output behavior, hold or non-hold (initial value = 'NONHOLD')

6.1.5 Setting the ALM indication behavior, hold or non-hold (initial value = 'NONHOLD')

6.1.6 Setting the sampling interval for rate-of-change alarms (initial value = '01')

6.1.7 Setting the alarm hysteresis on/off (initial value = 'ON')

6.1.1 Setting the Reflash Function On/Off

The reflash function indicates repeating alarms occurring among a group of alarms sharing the same output relay. When the optional alarm output relays are not installed, data entry will be ignored. Note that only I01 to I03 (which should be assigned in the alarm setting also) can be used for the reflash function.
The initial value is 'OFF'.

PROCEDURE:

Key Sequence	Display	
1		While pressing the [↵] key, turn on the power to enter the SETUP mode.
2	SETUP=ALARM	Select the display 'SETUP=ALARM' using the [▲]/[▼] keys, then press the [↵] key.
3	REFLASH=ON	Select ON or OFF using the [▲]/[▼] keys, then press the [↵] key.
		The display is switched to the procedure in Section 6.1.2. Pressing the ESC key in this step makes this new setting invalid.
		Before leaving the SETUP mode, you must store the new setting in the internal memory.
4	*ALARM SET*	Press the [↵] key several times, or proceed to and finish other alarm settings, until the display '*ALARM SET*' appears.
5	SETUP=END	Press the ESC key to return to the 'SETUP=ALARM' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [↵] key.
6	END&INIT.DATA=STORE	Finally, • to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [↵] key; or • to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [↵] key. The mode is then released from SETUP to operation.

6.1.2 Setting the Logic of Representative Alarm Output Relay, AND or OR

When a group of alarms is assigned to (optional) output relays, the logic of the relay action to represent these alarms can be set to either AND or OR. The default is 'NONE,' which means that all the relays are set to use OR logic.

AND: True (1) when all the alarms assigned occur

OR: True (1) when any one of the alarms assigned occurs

If the optional alarm output relays are not installed, data entry will be ignored.

Note

When you set the I01 to I03 relays to reflash, only I04 to I06 can be specified for the AND/OR representative alarms.

Alarm status — Channel 1 / Channel 2

Alarm relay status — AND / OR

PROCEDURE:

Key Sequence	Display	
1		While pressing the [↵] key, turn on the power to enter the SETUP mode.
2	SETUP=ALARM	Select the display 'SETUP=ALARM' using the [▲]/[▼] keys, then press the [↵] key.
3	AND=I01-I02	Press the [↵] key repeatedly until the display 'AND=□ □' appears.
4	AND=I01-I06	Use the [▲]/[▼] keys to select which relays are to use AND logic. If you specify 'I01-I06' for example, all six relays (I01 to I06) will use AND logic. (Note that 'I01' is always displayed on the left side of the entry field, i.e., the beginning number of the relays.) Selecting 'NONE' means that all relays will use OR output. After making a selection, press the [↵] key.
		The display is switched to the procedure in Section 6.1.3. Pressing the ESC key in this step makes this new setting invalid.
5	*ALARM SET*	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the [↵] key several times, or proceed to and finish other alarm settings, until the display '*ALARM SET*' appears.
6	SETUP=END	Press the ESC key to return to the 'SETUP=ALARM' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [↵] key.
7	END&INIT.DATA=STORE	Finally, • to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [↵] key; or • to discard the new settings, select the

Note

- When I01 to I03 are used for the reflash function, they cannot be used to represent the AND logic of multiple alarms (see Section 6.1.2).
- Once this reflash function is set on, I01 to I03 will be exclusively used for the reflash function regardless of the number of alarm output relays.

'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [↵] key.
The mode is then released from SETUP to operation.

6.1.3 Setting the Output Relay to Be Energized/De-energized When an Alarm Occurs

The action of the alarm output relays can be selected between "energized on alarm" or "de-energized on alarm." Setting the "de-energized on alarm" action allows the contact to output the same signal when a power failure occurs as when an alarm occurs. (This setting applies to all the alarm output relays).

The default is "energized on alarm" (set as 'ENERG').

Energized   NO   C   NC   NO   C   NC   NO   C   NC

De-energized   NO   C   NC   NO   C   NC   NO   C   NC

Power failure   **Alarm off**   **Alarm on**

NO = Normally opened; C = common; and NC = normally closed

PROCEDURE:

Key Sequence	Display	
1		While pressing the [↵] key, turn on the power to enter the SETUP mode.
2	SETUP=ALARM	Select the display 'SETUP=ALARM' using the [▲]/[▼] keys, then press the [↵] key.
3	ALARM=ENERG	Press the [↵] key repeatedly until the display 'ALARM=□ □' appears.
4	ALARM=ENERG	Use the [▲]/[▼] keys to select • 'ENERG' for "energized on alarm" or • 'DE_EN' for "de-energized on alarm" and press the [↵] key. The display is switched to the procedure in Section 6.1.4. Pressing the ESC key in this step makes this new setting invalid.
5	*ALARM SET*	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the [↵] key several times, or proceed to and finish other alarm settings, until the display '*ALARM SET*' appears.
6	SETUP=END	Press the ESC key to return to the 'SETUP=ALARM' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [↵] key.
7	END&INIT.DATA=STORE	Finally, • to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [↵] key; or • to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [↵] key. The mode is then released from SETUP to operation.

6.1.4 Setting the Alarm Output Behavior, Hold or Non-hold

You can set the behavior of the alarm output relays to either hold or non-hold. The default is non-hold (set as 'NONHOLD') This setting applies to all the alarm output relays.

If you have set the I01 to I03 relays to reflash, the non-hold type must be set.

Non-hold Type ('NONHOLD'):

The alarm contact is set and reset in synchronization with the alarm status.

Alarm on

Alarm off

Relay output on

Relay output off

* Shows the status of the normally-opened (NO) contact of the relay. The status is the reverse for the normally-closed contact.

Hold Type ('HOLD'):

Set when an alarm occurs, the alarm contact is not reset even if the alarm recovers until the ACK key is pressed.

Alarm on

Alarm off

Press ACK key

Relay output on

Relay output off

PROCEDURE:

Key Sequence	Display	
1		While pressing the [↵] key, turn on the power to enter the SETUP mode.
2	SETUP=ALARM	Select the display 'SETUP=ALARM' using the [▲]/[▼] keys, then press the [↵] key.
3	RLY=NONHOLD	Press the [↵] key repeatedly until the display 'RLY=□ □' appears.
4	RLY=NONHOLD	Use the [▲]/[▼] keys to select • 'HOLD' for the hold type or • 'NONHOLD' for the non-hold type then press the [↵] key. The display is switched to the procedure in Section 6.1.5. Pressing the ESC key in this step makes this new setting invalid.
5	*ALARM SET*	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the [↵] key several times, or proceed to and finish other alarm settings, until the display '*ALARM SET*' appears.
6	SETUP=END	Press the ESC key to return to the 'SETUP=ALARM' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [↵] key.

6. OPERATIONAL PREFERENCES SETUP (OPERATIONS IN SETUP MODE)

7 ▲/▼ ⏎ `END&INIT.DATA=STORE`   Finally,
- to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [⏎] key; or
- to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [⏎] key.
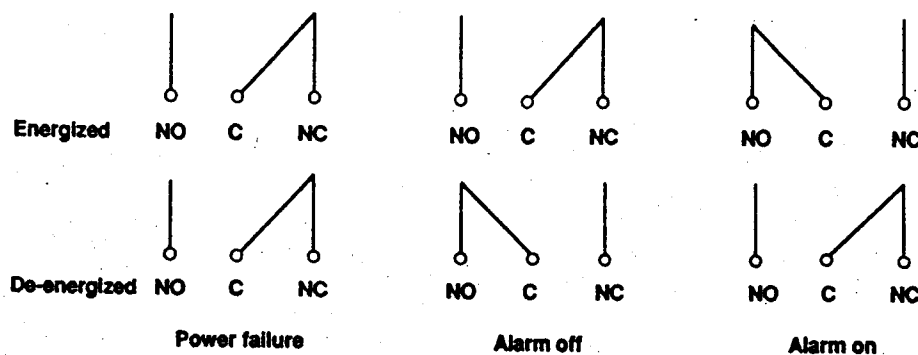
The mode is then released from SETUP to operation.

6.1.5 Setting the ALM Indication Behavior, Hold or Non-hold

You can set the behavior of the ALM indication to either hold or non-hold. The default is non-hold (set as 'NONHOLD') This setting applies to all the alarms.

Non-hold Type ('NONHOLD'):

The ALM indication is displayed in synchronization with the alarm status.
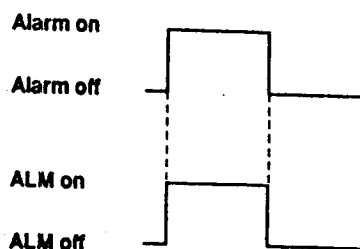
Hold Type ('HOLD'):

The ALM indication starts flashing when an alarm occurs, and it remains flashing even if the alarm is recovered until the ACK key is pressed. When the ACK key is pressed, the ALM indication stops flashing, or it disappears if the alarm has already recovered.

PROCEDURE:

Key Sequence	Display	
1		While pressing the [↵] key, turn on the power to enter the SETUP mode.
2	SETUP=ALARM	Select the display 'SETUP=ALARM' using the [▲]/[▼] keys, then press the [↵] key.
3	IND=NONHOLD	Press the [↵] key repeatedly until the display 'IND=☐ ☐' appears.
4	IND=NONHOLD	Use the [▲]/[▼] keys to select • 'HOLD' for the hold type or • 'NONHOLD' for the non-hold type and press the [↵] key. The display is switched to the procedure in Section 6.1.6. Pressing the ESC key in this step makes this new setting invalid.
5	*ALARM SET*	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the [↵] key several times, or proceed to and finish other alarm settings, until the display '*ALARM SET*' appears.

6 (ESC △ ▽ ↵) `SETUP=END`

Press the ESC key to return to the 'SETUP=ALARM' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [↵] key.

7 (△/▽ ↵) `END&INIT.DATA=STORE`

Finally,
- to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [↵] key; or
- to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [↵] key.
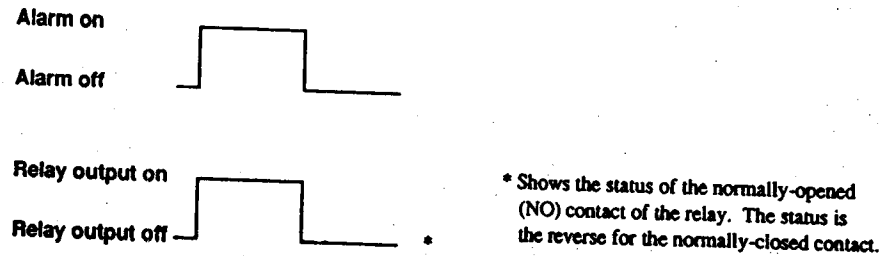
The mode is then released from SETUP to operation.

6.1.6 Setting the Sampling Interval for Rate-of-change Alarms

Follow the procedure below to set the sampling interval for rate-of-change alarms (effective for all channels).

The initial value is 125 ms (one sample).

PROCEDURE:

Key Sequence	Display	
1		While pressing the [⏎] key, turn on the power to enter the SETUP mode.
2	SETUP=ALARM	Select the display 'SETUP=ALARM' using the [▲]/[▼] keys, then press the [⏎] key.
3	R_TIME=01	Press the [⏎] key repeatedly until the display 'R_TIME=□ □' (prompting you to enter the interval for monitoring the rate-of-change alarm on increase) appears.
4	R_TIME=01	Select the number of sampling times using the [▲]/[▼] keys, then press the [⏎] key. The measuring period is fixed to 125 ms and thus the interval to be set is expressed using the number of sampling times on increase, R_TIME, as: interval to be set = 125 ms × number of sampling times
5	r_TIME=01	The display 'r_TIME=□ □' then appears, prompting you to enter the interval for monitoring the rate-of-change alarm on decrease. In the same manner as above, select the number of sampling times using the [▲]/[▼] keys, then press the [⏎] key. The display is switched to the procedure in Section 6.1.7. Pressing the ESC key in this step makes this new setting invalid.
6	*ALARM SET*	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the [⏎] key several times, or proceed to and finish other alarm settings, until the display '*ALARM SET*' appears.
7	SETUP=END	Press the ESC key to return to the 'SETUP=ALARM' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [⏎] key.
8	END&INIT.DATA=STORE	Finally, • to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [⏎] key; or • to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [⏎] key.

6. OPERATIONAL PREFERENCES SETUP (OPERATIONS IN SETUP MODE)

6.1.7 Setting the Alarm Hysteresis On/Off

The alarm hysteresis is the gap between the levels of alarm occurrence and recovery (applies to all alarms). You can choose between two levels of hysteresis: 0% (= off) and approximately 0.5% of recording span (= on).
The initial value is 'ON.'

High Limit Alarm (H)

Low Limit Alarm (L)
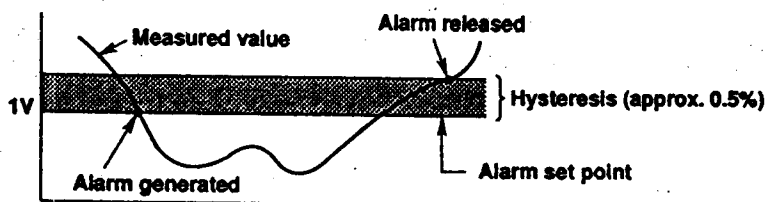
Note

This hysteresis setting applies to all alarms on all channels. You can not activate or inactivate the hysteresis for a particular channel or alarm.

PROCEDURE:

| Key Sequence	Display	
1		While pressing the [⏎] key, turn on the power to enter the SETUP mode.
2	SETUP=**ALARM**	Select the display 'SETUP=ALARM' using the [▲]/[▼] keys, then press the [⏎] key.
3	ALM_HYS=**ON**	Press the [⏎] key repeatedly until the display 'ALM_HYS=☐ ☐' appears.
4	ALM_HYS=**ON**	Select ON or OFF using the [▲]/[▼] keys, then press the [⏎] key.
	ALARM SET	The settings for alarm behavior are completed. Pressing the ESC key in this step enables you to proceed to other settings in the SETUP mode.
5	SETUP=**END**	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the ESC key to return to the 'SETUP=ALARM' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [⏎] key.
6	END&INIT.DATA=**STORE**	Finally, • to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [⏎] key; or • to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [⏎] key. The mode is then released from SETUP to operation.

6.2 Changing the Initial Settings for Input Processing

The following sections describe how to change initial settings for the input processing.
6.2.1 A/D Integration Frequency (INTG) Setting
6.2.2 TC Burnout Upscale/Downscale (B.OUT) Setting
6.2.3 Setting of Reference Junction Compensation (RJC)
6.2.4 Input Filter (FILTR) Setting

6.2.1 A/D Integration Frequency (INTG) Setting

This setting specifies which A/D integration frequency, 50 or 60 Hz, will be used. Depending on the power supply, the integration frequency affects the effectiveness of noise rejection and therefore the recording.

If the power supplies of the recorder and the measuring object are the same and if the integration frequency is set as 'AUTO' (initial setting), the integration frequency is automatically switched and the effect of noise is automatically minimized. 'AUTO' is therefore the recommended setting in this case.

If the power supplies are different, select the integration frequency as either 50 Hz or 60 Hz depending on the power supply of the instrument with the highest noise level. The initial setting is 'AUTO.'

PROCEDURE:

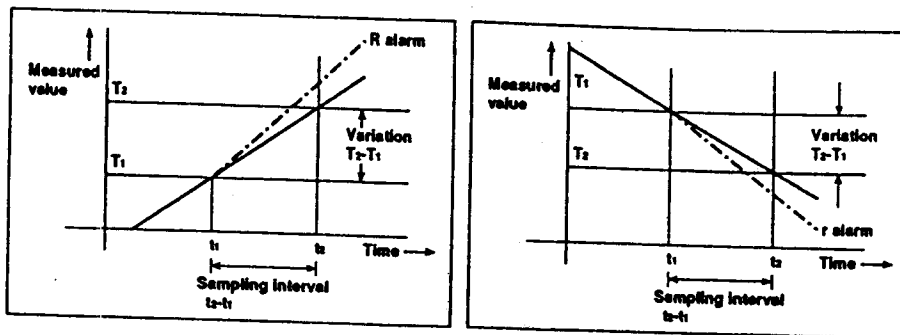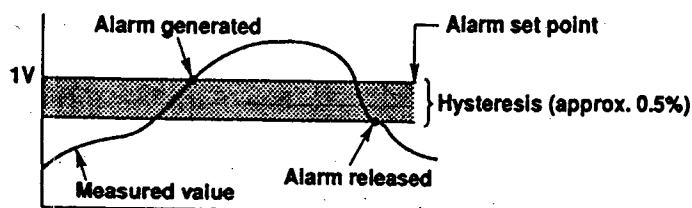| Key Sequence	Display	
1		While pressing the [↵] key, turn on the power to enter the SETUP mode.
2	SETUP=INTG	Select the display 'SETUP=INTG' using the [▲]/[▼] keys, then press the [↵] key.
3	INTG=AUTO	Select either 50 Hz, 60 Hz, or AUTO using the [▲]/[▼] keys, then press the [↵] key. The measuring period is fixed to 125 ms regardless of this integration frequency setting.
	INTG SET	The setting for the integration frequency is completed. Pressing the ESC key in this step enables you to proceed to other settings in the SETUP mode.
4	SETUP=END	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the ESC key to return to the 'SETUP=INTG' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [↵] key.
5	END&INIT.DATA=STORE	Finally, • to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [↵] key; or • to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [↵] key. The mode is then released from SETUP to operation.

6.2.2 TC Burnout Upscale/Downscale (B.OUT) Setting

This setting specifies where the reading should be placed if a thermocouple input burns out: upscale ('UP,' clamped to 100%) or downscale ('DOWN,' clamped to 0%, and on/off of this burnout function itself.

The selection of upscale or downscale applies to all channels; however, the function can be set on or off for each channel.

The initial settings are 'UP' and 'OFF' for all channels.

PROCEDURE:

Key Sequence	Display	
1		While pressing the [↵] key, turn on the power to enter the SETUP mode.
2	SETUP=B.OUT	Select the display 'SETUP=B.OUT' using the [▲]/[▼] keys, then press the [↵] key.
3	B.OUT=UP	Select 'UP' (burnout upscale) or 'DOWN' (downscale) using the [▲]/[▼] keys, then press the [↵] key.

Note
This setting applies to all channels.

|		
4	01:B.OUT=	Select the channel to which the burnout upscale/downscale function is to be set using the [▲]/[▼] keys, then press the [↵] key.
5	01:B.OUT=OFF	Select 'ON' or 'OFF' as required using the [▲]/[▼] keys, then press the [↵] key.
	B.OUT SET	The setting for the TC burnout upscale/downscale function is completed for the selected channel. To set the function on or off for another channel, press the [↵] key. Pressing the ESC key in this step enables you to proceed to other settings in the SETUP mode.
6	SETUP=END	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the ESC key to return to the 'SETUP=B.OUT' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [↵] key.
7	END&INIT.DATA=STORE	Finally, • to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [↵] key; or • to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [↵] key. The mode is then released from SETUP to operation.

6.2.3 Setting of Reference Junction Compensation (RJC)

This setting specifies whether internal or external reference junction compensation values are used, for each channel when inputting a thermocouple.

If set to 'INT,' the reference junction compensation is performed by the internal RJC circuit.

If set to 'EXT,' the reference junction compensation is based on the voltage set.

The initial value is 'INT.'

PROCEDURE:

Key Sequence	Display	
1		While pressing the [⏎] key, turn on the power to enter the SETUP mode.
2	SETUP=RJC	Select the display 'SETUP=RJC' using the [▲]/[▼] keys, then press the [⏎] key.
3	01:RJC=	Select the channel using the [▲]/[▼] keys, then press the [⏎] key.
4	01:RJC=INT	Select 'INT' or 'EXT' as required using the [▲]/[▼] keys, then press the [⏎] key. If you selected 'EXT,' enter the RJC voltage to be added to the input (from -20,000 to 20,000 μV, default 0 μV), then press the [⏎] key.
	RJC SET	The setting is completed. To continue setting another channel, press the [⏎] key. Pressing the ESC key in this step enables you to proceed to other settings in the SETUP mode.
5	SETUP=END	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the ESC key to return to the 'SETUP=RJC' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [⏎] key.
6	END&INIT.DATA=STORE	Finally, • to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [⏎] key; or • to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [⏎] key. The mode is then released from SETUP to operation.

6.2.4 Input Filter (FILTR) Setting

Noise in the measured signal can be suppressed in the final reading using an input damping filter. This setting specifies for each channel the time constant of damping as zero (off), 2, 5, or 10 seconds. The initial setting is off.

A filter works as follows:
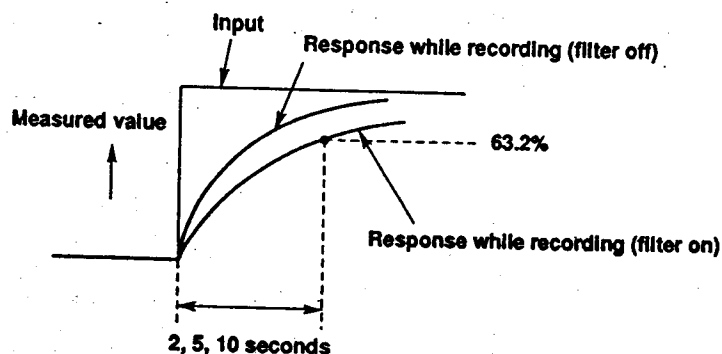
Note

Use of the input filter degrades the response to fast input changes, so the filter should be turned off if a precise record of the original trend is required. The filter is useful when a smooth recording trend is preferred, for example, when recording a flow rate. The time constant depends on the application; try varying from the shortest time constant and increasing it to find the most suitable one.

PROCEDURE:

Key Sequence	Display	
1		While pressing the [↵] key, turn on the power to enter the SETUP mode.
2	SETUP=FILTR	Select the display 'SETUP=FILTR' using the [▲]/[▼] keys, then press the [↵] key.
3	01:FILTR=	Select the channel using the [▲]/[▼] keys, then press the [↵] key.
4	01:FILTR=OFF	Select 2 seconds, 5 seconds, 10 seconds, or off as required using the [▲]/[▼] keys, then press the [↵] key.
	FILT SET	The setting is completed. To continue setting another channel, press the [↵] key. Pressing the ESC key in this step enables you to proceed to other settings in the SETUP mode.
5	SETUP=END	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the ESC key to return to the 'SETUP=FILTR' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [↵] key.
6	END&INIT.DATA=STORE	Finally,

Finally,
* to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [↵] key; or
* to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [↵] key.

The mode is then released from SETUP to operation.

6.3 Display Color (COLOR) Setting

Follow the procedure below to set the colors of the background and recording traces on the screen. The available colors are as follows.

Background: White (WHT) or black (BLK). The initial setting is white.

Recording trace colors: Select for each channel from red (RED), green (GRN), blue (BLU), brown (BRN), or red-purple (PRP). The initial settings are:

Channel 1: red
Channel 2: green
Channel 3: blue
Channel 4: red-purple

MENU:

| SETUP=COLOR | → | BACKGROUND=WHT BLK | → | 01:COLOR=RED S GRN 04 BLU BRN PRP |

PROCEDURE:

	Key Sequence	Display	
1	[⏎]		While pressing the [⏎] key, turn on the power to enter the SETUP mode.
2	[▲]/[▼] [⏎]	SETUP=COLOR	Select the display 'SETUP=COLOR' using the [▲]/[▼] keys, then press the [⏎] key.
3	[▲]/[▼] [⏎]	BACKGROUND=WHT	Select 'WHT' or 'BLK' using the [▲]/[▼] keys, then press the [⏎] key.
4	[▲]/[▼] [⏎]	02:COLOR=RED	Select the channel for which you want to set the trace color using the [▲]/[▼] keys, then press the [⏎] key.
5	[▲]/[▼] [⏎]	02:COLOR=PRP	The entry cursor then moves to the color entry field. Use the [▲]/[▼] keys to select the trace color from among 'RED,' 'GRN,' 'BLU,' 'BRN,' or 'PRP', then press the [⏎] key.
		COLOR SET	The setting is completed. To continue setting the color for another channel, press the [⏎] key to return to the display 'BACKGROUND:□.' Pressing the ESC key in this step enables you to proceed to other settings in the SETUP mode.
6	[ESC][▲]/[▼][⏎]	SETUP=END	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the ESC key to return to the 'SETUP=COLOR' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [⏎] key.
7	[▲]/[▼] [⏎]	END&INIT.DATA=STORE	Finally, • to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [⏎] key; or • to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [⏎] key. The mode is then released from SETUP to operation.

6.4 Setting the Temperature Unit (TEMP)

For the TC or RTD type, the VR100 will automatically append the temperature unit (°C or °F).
The initial setting is '°C', and common for all channels.

MENU:

| SETUP=TEMP | → | TEMPUNIT=°C |
| | | °F |

PROCEDURE:

	Key Sequence	Display	
1	[↵ DISP]		While pressing the [↵] key, turn on the power to enter the SETUP mode.
2	[▲ACK]/[▼◄] [↵DISP]	SETUP=**TEMP**	Select the display 'SETUP=TEMP' using the [▲]/[▼] keys, then press the [↵] key.
3	[▲ACK]/[▼◄] [↵DISP]	TEMPUNIT=**C**	Select "°C" or "°F" using the [▲]/[▼] keys, then press the [↵] key.
		TEMP SET	The setting is completed. Pressing the [↵] key in this step returns to the display 'TEMPUNIT=☐' Pressing the ESC key in this step enables you to proceed to other settings in the SETUP mode.
4	[ESC] [▲ACK]/[▼◄] [↵DISP]	SETUP=**END**	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the ESC key to return to the 'SETUP=TEMP' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, and then press the [↵] key.
5	[▲ACK]/[▼◄] [↵DISP]	END&INIT.DATA=**STORE**	Finally, • to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, and then press the [↵] key; or • to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [↵] key. The mode is then released from SETUP to operation.

CAUTION

When you change this setting, all settigs in the SET mode will return to their initial values. In the SETUP mode, the RJC setting (6.2.3) and the input filter setting (6.2.4) will return to their initial values. Other settings in the SETUP mode will not be affected. For details of the initial settings, see Appendix 1.

6.5 Setting of Data Storage Method (MEMORY)

There are two types of files where measured data is stored.

Display data file: Stores the data required to display the trends (waveforms) at the specified waveform span rate.

Event file: Stores the data sampled at the specified sampling period. Settings associated with the event file(s) other than the sampling period include the division of memory and trigger.

The following sections describe the items to be set for the event file(s) and display data file, then describe how to set the data storage method for the two cases where the trigger is set (trigger-on or trigger-rotation) and where the trigger is not set (trigger-free).

6.5.1 Precautions Before Setting

(1) Event File

Data Format

The measured values sampled at the specified period are stored according to the scanning sequence shown below.

```
        Scan 1              Scan 2                        Scan n
      ┌───┬───┬───┬───┬───┬───┬───┬───┐          ┌───┬───┬───┬───┐
      │Ch1│Ch2│Ch3│Ch4│Ch1│Ch2│Ch3│Ch4│ - - - - -│Ch1│Ch2│Ch3│Ch4│
      └───┴───┴───┴───┴───┴───┴───┴───┘          └───┴───┴───┴───┘
      └─┬─┘
   2 bytes (binary data)
```
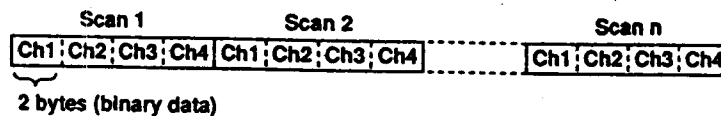
Memory Length

The memory length of an event file is determined by how the memory is divided (file definitions). The relationship between the memory length and file definitions is as follows.

File Definitions	Memory Length	Description
a. Event file + display data file (1E + 1D)	Display data file (768K) / Event file (256K) / 0	• One event file and display data file for each are created.
b. Event file × 16 + display data file (16E + 1D)	Display data file (768K) / 0 / Event file (16K)	• Sixteen event files and one display data file are created. • This combination can be selected only when the sample mode is set to trigger-on or trigger-rotation.
c. Event file only (1E)	Event file (960K) / 0	• Only an event file is created.

The number of data values that can be stored in an event file depends on not only the memory length but also the number of channels used. The table below shows the number of data values that can be stored for each channel and storage time span for each case.

File Definitions	Number of Channels Used	Number of Data Values (approx.)	Storage Time Span (approx.)	
			Sampling Speed: 1 s	Sampling Speed: 125 ms
a. 1E + 1D	1	120,000	33.2 hours	2 hours
	2	60,000	16.6 hours	2 hours
	3	40,000	11 hours	1 hours
	4	30,000	8.3 hours	hour
b. E16 + D	1	8,000	132 minutes	16.4 minutes
	2	4,000	66 minutes	8.2 minutes
	3	2,667	44 minutes	5.5 minutes
	4	2,000	33 minutes	4.1 minutes
c. E1	1	480,000	133.2 hours	16.4 hours
	2	240,000	66.6 hours	8.2 hours
	3	160,000	44.4 hours	5.5 hours
	4	120,000	33.3 hours	4.3 hours

Sampling Period

The sampling period can be selected from the following four:
   125 ms, 250 ms, 500 ms, or 1 s.

Trigger Mode (Sampling Mode)

The trigger mode, which determines how to start and stop storing the measured data, can be selected from the following three.

Sampling Mode	Action
Trigger-free (FREE)	Data collection starts after power-on. The data are stored after the previously stored data. When the file in the internal memory becomes full, the data are overwritten.
Trigger-on (TRIG)	Data collection starts when a trigger is raised, and the subsequent action is as follows.

• When there is only one event file:
When the specified data values are collected (the event file becomes full), the collection stops. After this, data collection cannot be started again until the data are saved to a floppy disk or the data memory is initialized.
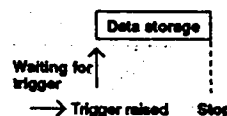
• When there are multiple event files:
When the specified data values are collected (the event file becomes full), the collection stops and the recorder waits for the next trigger. When the next trigger is raised, data collection starts in the next event file. When all event files become full, the data collection sequence stops. This data collection sequence will start storing the data in the first event file again after the data are saved to a floppy disk or the data memory is initialized.
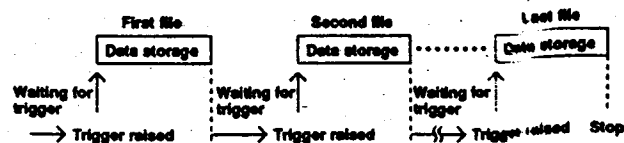
Trigger-rotation (ROTATE)	Data collection starts when a trigger is raised, and the subsequent action is as follows.

• When there is only one event file:

When the specified data values are collected (the event file becomes full), the collection stops and waits for the next trigger. When the next trigger is raised, the file is overwritten.
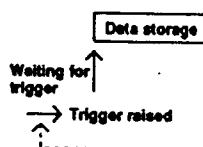
• When there are multiple event files:

When the specified data values are collected (the event file becomes full), the collection stops and the recorder waits for the next trigger. When the next trigger is raised, data collection starts in the next event file. When all event files become full, the first event file is overwritten and this data collection sequence is repeated until the data are saved to a floppy disk. This data collection sequence will begin again with the first event file after the data are saved to a floppy disk or the data memory is initialized.
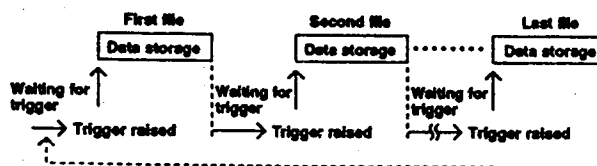
Note

If an error occurs while saving the data to a floppy in the trigger-on or trigger-rotation mode:
• The process of storing data in the internal memory is suspended until the data are successfully saved to the floppy disk.
• In the above case, the action of storing data into memory can be restarted forcibly by initializing the data memory; however, this deletes the display data at the same time.
• If a floppy disk is inserted while waiting for the trigger, the data stored in the file(s) until that time are saved to the floppy disk.

Pre-trigger (PRE.TRIG)

The pre-trigger function always stores the measured data in part of the memory, to allow a specified amount of data to be stored before the trigger (referred to as the pre-trigger data). The size of the area used for storing the pre-trigger data can be specified in increments of ten percent (from 0 to 100%). Setting the pre-trigger to 0% means that the entire file is used to store the data after the trigger, and setting it to 100% means that the entire file is used to store the data before the trigger.

Setting the Trigger Type

When you set the trigger mode to trigger-on or trigger-rotation, the following trigger types can be set on/off. The settings for these trigger types work as OR logic, so the recorder regards that a trigger is raised if any of the conditions corresponding to the trigger types which are set on is met.

Trigger Type	Condition to Raise a Trigger
Key trigger (TRIG KEY)	The trigger is raised manually on request. Pressing the [←] key when the message 'PUSH [←] TO TRIGGER' is displayed (called up using the DISP key in the operation mode) raises the trigger.
External trigger (TRIG EXT)	The trigger is raised when an external contact (Remote Control input) is set on.
Alarm trigger (TRIG ALM)	The trigger is raised when any alarm occurs.

(2) Display Data File

Data Format

The display data file stores the maximum and minimum data values within the time interval corresponding to each pixel of the trend graph (waveform) on the LCD from among the values measured every 125 ms.

Scan 1

Ch1 Min	Ch2 Min	Ch3 Min	Ch4 Min	Ch1 Max	Ch2 Max	Ch3 Max	Ch4 Max

Scan 2

Ch1 Min	Ch2 Min	Ch3 Min	Ch4 Min	Ch1 Max	Ch2 Max	Ch3 Max	Ch4 Max

⋮

Scan n

Ch1 Min	Ch2 Min	Ch3 Min	Ch4 Min	Ch1 Max	Ch2 Max	Ch3 Max	Ch4 Max

2 bytes (binary data)

Max: Maximum value
Min: Minimum value

☞ For the time interval corresponding to each pixel, see Section 1.1.3, "Display Unit."

Note

By storing the data in the display data file, you can then retrieve trend graphs (waveforms) on a PC, etc.

Memory Length

When defining the file configuration as "one event file + one display file" (1E + 1D) or "sixteen event files + one display data file" (16E + 1D), the display file is created. The table below shows the number of data values that can be stored and the data storage span.

Number of Channels Used	Number of Data Values	Data Storage Span *
1	192,000	133 days
2	96,000	66 days
3	64,000	44 days
4	48,000	33 days

* When the waveform span rate (TIME/DIV) is set as 30 minutes.

Note

The display data are also stored in a separate area from the display data file. Therefore, even if only an event file is created (file configuration: 1E), the data stored in this separate area can be retrieved on the past-data reference display (file capacity: twenty times the display area). If the display data file is also used, data are retrieved to the past-data reference display from the display data file, not from this separate area.

6.5.2 Setting of Data Storage Method as Trigger-free

Follow the procedure below to store the data in the event file in the trigger-free mode.

MENU:

SETUP=MEMORY	→	DATA=E1+D E1	→	SAMPLE RATE=125ms 250ms 500ms 1s	→	SAMPLE MODE=FREE

PROCEDURE:

	Key Sequence	Display	
1	⏎		While pressing the [⏎] key, turn on the power to enter the SETUP mode.
2	▲/▼ ⏎	SETUP=MEMORY	Select the display 'SETUP=MEMORY' using the [▲]/[▼] keys, then press the [⏎] key.
3	▲/▼ ⏎	DATA=E1+D	Select 'E1+D' (= 1E + 1D, one event file and one display data file) or 'E1' (= 1E, one event file only) using the [▲]/[▼] keys, then press the [⏎] key.
4	▲/▼ ⏎	SAMPLE RATE=125ms	Select '125ms,' '250ms,' '500ms,' or '1s' using the [▲]/[▼] keys, then press the [⏎] key.
5	▲/▼ ⏎	SAMPLE MODE=FREE	5 SAMPLE MODE=FREE Select 'FREE' using the [▲]/[▼] keys, then press the [⏎] key.
		SETUP MEMORY SET	The setup is completed. To proceed to another setting in the SETUP mode, press the ESC key.
6	ESC ▲/▼ ⏎	SETUP=END	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the ESC key to return to the 'SETUP=MEMORY' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [⏎] key.
7	▲/▼ ⏎	END&INIT.DATA=STORE	Finally, • to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [⏎] key; or • to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [⏎] key. The mode is then released from SETUP to operation.

MENU:

```
SETUP=MEMORY → DATA=E1+D      → SAMPLE RATE=125ms → SAMPLE MODE=TRIG
                    E16+D           250ms                          ROTATE
                    E1              500ms
                                    1s
```

```
→ PRE.TRIG=0 → TRIG KEY=ON → TRIG EXT=ON → TRIG ALM=ON
         ≀           OFF           OFF          OFF
        100
```

PROCEDURE:

Key Sequence	Display	
1		While pressing the [⏎] key, turn on the power to enter the SETUP mode.
2	SETUP=MEMORY	Select the display 'SETUP=MEMORY' using the [▲]/[▼] keys, then press the [⏎] key.
3	DATA=E16+D	Select 'E1+D' (= 1E + 1D, one event file and one display data file), 'E16+D' (= 16E + 1D, sixteen event files and one display data file), or 'E1' (one event file only) using the [▲]/[▼] keys, then press the [⏎] key.
4	SAMPLE RATE=1S	Select '125ms,' '250ms,' '500ms,' or '1s' using the [▲]/[▼] keys, then press the [⏎] key.
5	SAMPLE MODE=TRIG	Select 'TRIG' (trigger-on) or 'ROTATE' (trigger-rotation) using the [▲]/[▼] keys, then press the [⏎] key.
6	PRE.TRIG=40%	Use the [▲]/[▼] keys to select the percentage of the file size to be used for storing the pre-trigger data, then press the [⏎] key.
7	TRIG KEY=ON	Use the [▲]/[▼] keys to select 'ON' or 'OFF' to determine whether to use the key trigger, then press the [⏎] key.
8	TRIG KEY=OFF	Use the [▲]/[▼] keys to select 'ON' or 'OFF' to determine whether to use the external trigger, then press the [⏎] key.
9	TRIG ALM=ON	Use the [▲]/[▼] keys to select 'ON' or 'OFF' to determine whether to use the alarm trigger, then press the [⏎] key.
	SETUP MEMORY SET	The setup is completed. To proceed to another setting in the SETUP mode, press the ESC key.
10	SETUP=END	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the ESC key to return to the 'SETUP=MEMORY' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [⏎] key.

Finally,

- to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [↵] key; or
- to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [↵] key.

The mode is then released from SETUP to operation.

6.6 Auxiliary Function (AUX) Setting

The following are the settings in the AUX menu.

Number of channels to be used: Define the number of channels to be used. Set this to the minimum required number for effective use of memory. The default setting is four.

Tag number display: Define whether to display the tag number on the screen or not (simply displaying the traces and digital indications in different colors). When switching on the tag number display, tag numbers are also used to identify the data in files. The default setting is 'CH' (tag number display disabled).

Message language: Define whether the messages appearing in the operation mode or when using a floppy disk are to be shown in English ('ENG') or Japanese ('JPN'). The default setting is 'ENG.'

Memory End timer (option): Define the remaining time at which the Memory End contact output is to be set before the display data file becomes full. The remaining time means the time interval after which the data not yet saved on floppy disk start to be overwritten. The default setting is one hour.

Password: If a password is set, entry to the SET mode is not allowed without entering the password. Once this is set, when entering the SET mode (by pressing the MENU key for three seconds), password entry is requested. The password is a four-digit number. The default is 'OFF' (no password). The password is useful to allow only particular staff to access the SET mode for modifying the input range, display span, alarm settings, etc.

Note
- Regardless of the setting of the Memory End timer, the memory status indicator reduces the reading from 99 hours.
- Do not forget the password once it has been set, otherwise it may not be possible to perform any operations in the SET mode.

MENU:

SETUP=AUX → CH_QTY=4 → CH/TAG=CH TAG → MSG LANG=JPN ENG

MEMORY ALM=h → PASSWORD=ON OFF → PASS NO.=

Key Sequence	Display	
1		While pressing the [↵] key, turn on the power to enter the SETUP mode.
2	SETUP=AUX	Select the display 'SETUP=AUX' using the [▲]/[▼] keys, then press the [↵] key.
3	CH_QTY=4	Select the number of channels to be used using the [▲]/[▼] keys, then press the [↵] key.
4	CH/TAG=CH	Select 'CH' (tag number display inactive) or 'TAG' (tag number display active) using the [▲]/[▼] keys, then press the [↵] key.
5	MSG LANG=JPN	Select 'ENG' (message language: English) or 'JPN' (Japanese) using the [▲]/[▼] keys, then press the [↵] key.
6	MEMORY ALM=2h	Select the remaining time when the Memory End contact output is to be set from among 1, 2, 5, 10, 20, 50, or 100 hours using the [▲]/[▼] keys, then press the [↵] key.
7	PASSWORD=ON	Use the [▲]/[▼] keys to select 'ON' or 'OFF' to determine whether to set the password, then press the [↵] key.
8	PASS NO.=0	If you set password 'ON' (password is used), enter a four-digit number as the password. Use the [▲]/[▼] key to increment/decrement the number in each digit on the entry cursor and the [►] key to move the cursor. After setting the number, press the [↵] key.
	SETUP AUX SET	The setup is completed. To return to the display 'CH_QTY=□,' press the [↵] key. To proceed to another setting in the SETUP mode, press the ESC key. The display then returns to 'SETUP=AUX.'
9	SETUP=END	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the ESC key to return to the 'SETUP=AUX' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [↵] key.
10	END&INIT.DATA=STORE	Finally,

Finally,
• to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [↵] key; or
• to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [↵] key.
The mode is then released from SETUP to operation.

6.7 Operations on SETUP Configuration File

The following sections describe how to save, read, and delete the file which contains the settings made in the SETUP mode.

6.7.1 Saving the SETUP Configuration File (FD_SET–SAVE)

Follow the procedure below to save to a floppy disk the settings made in the SETUP mode.

Note

- If you have made any modification in the SETUP mode, the data you modified will be saved to the floppy disk, and not those stored in the internal memory. This means that the data on the floppy disk may not always be the same as the data in the internal memory. To equalize the two sets of data, store the new settings also to the internal memory after saving them to the floppy disk.
- The configuration file is saved in the ASCII file format.

File Names

- When specifying the file names, follow the rules below.
  - The maximum length is eight characters.
  - The following system-reserved names cannot be used:

    CON, PRN, AUX, AUX1, AUX2, NUL, CLOCK.
  - The following characters cannot be used:
    * (asterisk), . (period), + (plus sign), / (slash).
- The suffix code ".PNS" is appended to the file name automatically.

Space in FDC

If the space remaining in the FDC is less than 4 K bytes, the SET configuration file cannot be saved to it. In this case, the message 'E201: INSUFFICIENT DISK SPACE' appears.

MENU:

| SETUP=FD_SET | → | SET=SAVE | → | FILE=SETUP02 |

PROCEDURE:

	Key Sequence	Display	
1	⏎		While pressing the [↵] key, turn on the power to enter the SETUP mode.
2			Insert a floppy disk into the drive.
3	▲/▼ ⏎	SETUP=FD_SET	Select the 'SETUP=FD_SET' display using the [▲]/[▼] keys, then press the [↵] key.
4	▲/▼ ⏎	SET=SAVE	Select the 'SET=SAVE' display using the [▲]/[▼] keys, then press the [↵] key.
5	▲/▼ ⏎	file= FILE=SETUP02	• To overwrite an existing file: Pressing the [▲]/[▼] keys calls up the names of the configuration files stored on the floppy disk. Call up the desired file name and press the [↵] key. The display then changes to 'FILE=<file name>.' Pressing the [↵] key again overwrites the file. • To save as a new file: Press the [↵] key. The display then changes to 'FILE=' to allow the file name to be entered. Enter the file name (using up to eight characters) and press the [↵] key. If no file name is entered or if the entered name is illegal, the message 'E217: INVALID FILE NAME' is displayed. In this case, press any key to return to the preceding state, then enter a proper name.

| Saving.....* | The file is saved. |

| *SAVE COMPLETED* | Saving is completed. |

To return to the 'SET=SAVE' display, press the [⌐] key.
To proceed to another setting in the SETUP mode, press the ESC key. The display then returns to 'SETUP=FD_SET.'

Before leaving the SETUP mode, you must store the new setting in the internal memory if needed.
Press the ESC key to return to the 'SETUP=FD_SET' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [⌐] key.

6. SETUP=**END**

7. END&INIT.DATA=**STORE**

Finally,
• to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [⌐] key; or
• to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [⌐] key.
The mode is then released from SETUP to operation.

6.7.2 Reading the SETUP Configuration File (FD_SET-LOAD)

Follow the procedure below to load a file (suffix .PNS) which contains the settings made in the SETUP mode, from floppy disk to the internal memory.

MENU:

SETUP=FD_SET → SET=LOAD → FILE=SETUP02

PROCEDURE:

Key Sequence	Display	
1		While pressing the [↵] key, turn on the power to enter the SETUP mode.
2		Insert a floppy disk into the drive.
3	SETUP=FD_SET	Select the 'SETUP=FD_SET' display using the [▲]/[▼] keys, then press the [↵] key.
4	SET=LOAD	Select the 'SET=LOAD' display using the [▲]/[▼] keys, then press the [↵] key.
5	FILE=SETUP02	Select which files are to be loaded using the [▲]/[▼] keys, then press the [↵] key.
	Loading....*	The file is loaded.
	LOAD COMPLETED	Loading is completed. To return to the 'SET=LOAD' display, press the [↵] key. To proceed to another setting in the SETUP mode, press the ESC key. The display then returns to 'SETUP=FD_SET.'
6	SETUP=END	Before leaving the SETUP mode, you must store the new setting in the internal memory if needed. Press the ESC key to return to the 'SETUP=FD_SET' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [↵] key.
7	END&INIT.DATA=STORE	Finally, • to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [↵] key; or • to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [↵] key. The mode is then released from the SETUP to operation.

6.7.3 Deleting the SETUP Configuration File (FD_SET-DEL)

Follow the procedure below to delete from floppy disk a file (suffix .PNS) which contains the settings made in the SETUP mode.

MENU:

SETUP=FD_SET → SET=DEL → FILE=SETUP02

PROCEDURE:

Key Sequence | Display

1 ↵
While pressing the [↵] key, turn on the power to enter the SETUP mode.

2
Insert a floppy disk into the drive.

3 ▲/▼ ↵   `SETUP=FD_SET`
Select the 'SETUP=FD_SET' display using the [▲]/[▼] keys, then press the [↵] key.

4 ▲/▼ ↵   `SET=DEL`
Select the 'SET=DEL' display using the [▲]/[▼] keys, then press the [↵] key. If an error message appears, see Section 8.1, "Error Messages."

5 ▲/▼ ↵   `FILE=SETUP02`
Select which files are to be deleted using the [▲]/[▼] keys, then press the [↵] key.

`*DELETE COMPLETED*`
The file is deleted.
To return to the 'SET=DEL' display, press the [↵] key.
To proceed to another setting in the SETUP mode, press the ESC key. The display then returns to 'SETUP=FD_SET.'

6 ESC ▲/▼ ↵   `SETUP=END`
Before leaving the SETUP mode, you must store the new setting in the internal memory if needed.
Press the ESC key to return to the 'SETUP=FD_SET' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [↵] key.

7 ▲/▼ ↵   `END&INIT.DATA=STORE`
Finally,
* to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [↵] key; or
* to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [↵] key.
The mode is then released from the SETUP to operation.

The following procedure initializes all the settings made in the SET mode other than the ranges and engineering units. This does not affect the settings made in the SETUP mode.

✎ For details of the initial settings of the parameters to be set in the SET mode, see Appendix 1, "Setting Parameters and Initial Settings."

PROCEDURE:

Key Sequence	Display	
1		While pressing the [↵] key, turn on the power to enter the SETUP mode.
2	SETUP=INIT	Select the 'SETUP=INIT' display using the [▲]/[▼] keys, then press the [↵] key.
3	INIT OK=YES	Select 'YES' (to initialize) or 'NO' (to cancel) using the [▲]/[▼] keys, then press the [↵] key.
	INIT SET	Initialization is set. To proceed to another setting in the SETUP mode, press the ESC key.
4	SETUP=END	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the ESC key to return to the 'SETUP=INIT' display, then select the 'SETUP=END' display using the [▲]/[▼] keys, then press the [↵] key.
5	END&INIT.DATA=STORE	Finally,

- to actually initialize the settings which have been made in the SET mode and stored in the internal memory, select the 'END&INIT.DATA=STORE' display using the [▲]/[▼] keys, then press the [↵] key; or
- to cancel the initialization of the settings in the internal memory, select the 'END&INIT.DATA=ABORT' display using the [▲]/[▼] keys, then press the [↵] key.

The mode is then released from the SETUP to operation.

Chapter 7 MAINTENANCE

7.1 Periodic Maintenance

Check the recorder operation periodically to keep the recorder in good working order condition.

Perform the following checks and replace consumable parts as needed.

- Is the display functioning properly?
  If not, see Chapter 8, "Troubleshooting."

- Is the message 'LOW BATTERY' displayed at the bottom on the screen? This message warns that the lithium battery needs to be replaced. For replacement, contact your nearest Sales & Service Office; addresses may be found on the back cover of this manual. (See also Section 7.3.)

- Has the brightness of the LCD deteriorated? For replacement of the LCD unit, see Section 7.5.

| CAUTION | To avoid injury, do not replace the lithium battery yourself.

Replace the fuse at least once every two years for preventive maintenance.

WARNING

Before replacing the fuse, turn off the power supply and disconnect the power source. Use only the specified fuses, which should be obtained from your nearest Sales & Service Office. Using any other fuses could cause fire.

Follow the procedure below to replace the fuse.

1 Turn off the power.
2 Disconnect the power source.
3 Remove the screw above the power switch and swing open the front panel.
4 The fuse carrier is visible in the right lower side of the internal hardware. Turn the knob of the fuse carrier counterclockwise, and the carrier will slide out together with the fuse.

Fuse

Carrier
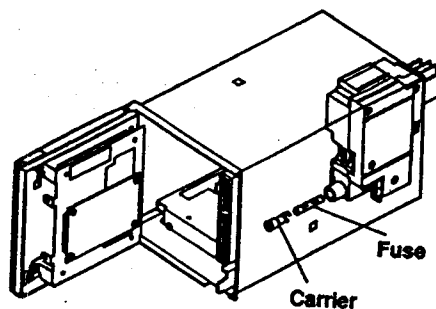
5 Make sure that the new fuse rating is correct and mount the new fuse by turning the knob clockwise.
6 Close the front panel and fix it with the screw.

7.3 Replacing the Battery

The message 'LOW BATTERY' displayed at the bottom on the screen warns that the lithium backup battery needs to be replaced.

This battery will last for ten years under normal operating conditions. For replacement, please contact your nearest Sales & Service Office; addresses may be found on the back cover of this manual.

WARNING

To avoid injury, do not replace the lithium battery yourself nor disassemble this recorder to attempt the replacement.

7.4 Checking the Accuracy

Check the accuracy of the readings once a year to ensure the measuring accuracy.

Required Instruments

DC Voltage Standard

Major specifications:
* Accuracy for output of 20 mV to 20 V: ±0.005%

Decade Resistance Box:

Major specifications:
* Accuracy in range of 0.1 to 500 Ω: ±0.001%
* Resolution: 0.001 Ω

Procedure

1 Connect the aforementioned calibration instruments to the input terminals of the recorder as shown in the following figures and allow the recorder to warm up for at least 30 minutes.
Allow the calibration instruments to warm up according to their respective specifications.
2 Check that the ambient temperature and humidity are within the normal operating conditions (see Chapter 9, "General Specifications").
3 Apply an input corresponding to 0, 50 and 100 percentage of the entered setting range, and calculate the errors from the readings on the display.
4 If the error at any point is outside the accuracy limits (for details of the accuracy, see Chapter 9, "General Specifications"), contact your nearest Sales & Service Office.

Note

For a TC input, the temperature of the input terminals must be measured, and a voltage corresponding to the temperature at the reference junction must be added.

DC Voltage Measurement

Power supply terminals

DC voltage standard

Input terminals]
(DC V and TC Inputs)

Temperature Measurement Using RTD

Power supply terminals

The resistance of three lead wires must be equal.

Decade resistance box

Input terminals (RTD inputs)

Temperature Measurement Using TC

Copper wires

Thermocouple wires or TC extension wires

DC voltage standard

Copper wires
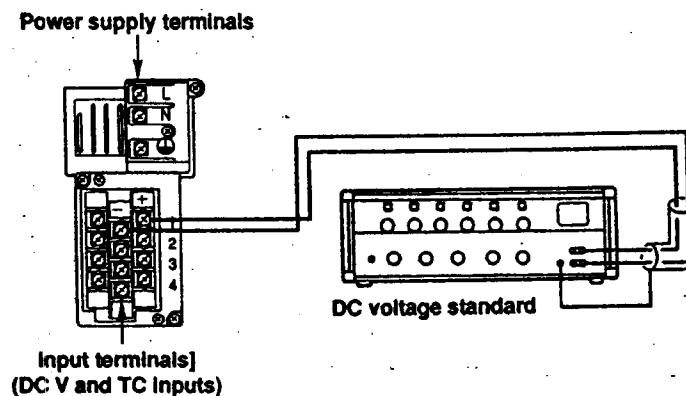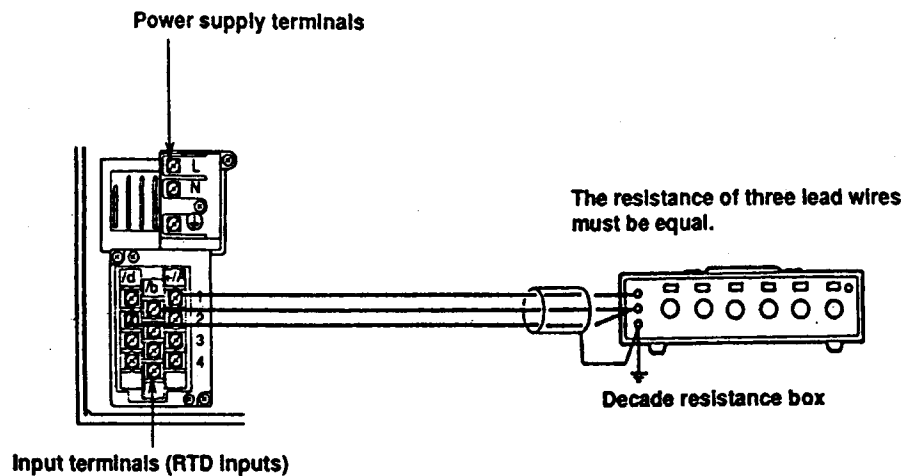
Thermocouple wires

Bathe in crushed ice to keep at 0°C.
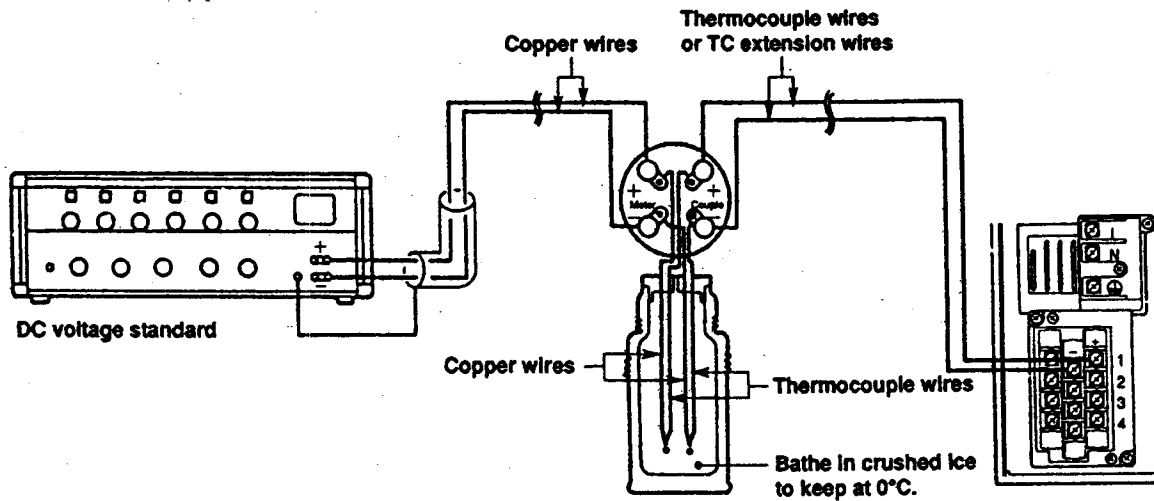
Reference Junction Compensation for Thermocouple Input
As the temperature at the measurement terminal of the recorder is generally equal to room temperature, a voltage is applied to the inside circuit to obtain the equivalent of 0°C. Therefore, when the measurement terminals are shorted (equivalent to 0°C at detector tip in the reference table) the room temperature (equals the temperature at the measurement terminal) is displayed. As a result, the recorder is measuring the temperature of the input terminal and compensates this value. When calibrating the recorder, the input voltage without subtracting the compensation voltage should be applied.(

7.5 Recommended Replacement Periods for Consumable Parts

To maintain the reliability of this recorder and to allow this recorder to deliver outstanding performance for a long time, periodic replacement of consumable parts is recommended.

The recommended replacement periods for consumable parts are shown in the following table. The periods shown in this table assume that the recorder is operating at the reference operating conditions. The periods to be applied to your recorder should be determined in consideration of the actual operating conditions.

Replacement of the LCD must be conducted by qualified *OMEGA* staff. When required, contact your nearest Sales & Service Office; addresses may be found on the back cover of this manual.

Item	Replacement Period	Part Name	Part Number	Remarks	Quantity Used
Fuse	2 years	Fuse	A1360EF	250 V/500 mA time lag	1
LCD unit	5 years	LCD module	A1049VA		1

Note

The recommended replacement period for the LCD unit is the period when the brightness falls to half (after approximately 20,000 hours of continuous use). The speed of degradation of the brightness varies depending on the operating conditions and the judgment is subjective. The period recommended in this table should thus be used as a guideline when determining the actual replacement period.

Chapter 8 TROUBLESHOOTING

8.1 Error Messages

8.1.1 Error Messages at Boot-up (Power-on)

Contact customer service

Error Message	Description	Countermeasure
E001: MAIN ROM ERROR	Main ROM failure	~~Contact your nearest Service Center.~~
E101: MAIN RAM ERROR	Main RAM failure	~~Contact your nearest Service Center.~~
E102: A/D ROM ERROR	A/D ROM failure	~~Contact your nearest Service Center.~~
E103: A/D RAM ERROR	A/D RAM failure	~~Contact your nearest Service Center.~~
E104: NV ERROR1	Failure of main non-volatile memory.	~~Contact your nearest Service Center.~~
E105: NV ERROR2	Failure of all input A/D converter memories.	~~Contact your nearest Service Center.~~
E11x: A/D NV ERRx	Failure of A/D converter memory for channel x.	~~Contact your nearest Service Center.~~
E12x: A/D ADJ ERRx	Failure of calibration data for A/D for channel x.	~~Contact your nearest Service Center.~~
E130: MEMORY ERROR	Acquisition memory failure.	~~Contact your nearest Service Center.~~
LOW BATTERY	Low voltage of back-up battery.	~~Contact your nearest Service Center.~~

Error Message*	Description	Countermeasure
E200: FD ERROR	An error was detected on the floppy disk. Saving is aborted.	Attempt saving on another floppy disk. If the same message still appears, contact ~~your nearest Service Center.~~ _Customer Service_
E201: INSUFFICIENT DISK SPACE	Insufficient space on the floppy disk.	Delete unnecessary files or use another floppy disk.
E202: FD WRITE PROTECTED	Floppy disk is write-protected.	Release the write-protection or use another floppy disk.
E203: NO DATA TO SAVE	There are no data to be saved on the floppy disk.	If use of the trigger is set to ON, attempt saving after the trigger is raised.
E210: FD REMOVED	·Floppy disk is ejected while being accessed.	·Clear the error and attempt the same operation. Do not eject the floppy disk while it is being accessed.
E211: FORMATTING FAILED	·Operation on a file or formatting of the floppy disk was attempted with no floppy disk inserted.	·Insert a floppy disk and attempt the same operation.
	·Failure in formatting the floppy disk	·Insert another floppy disk and attempt to format it. If the same message still appears, contact your nearest Service Center.
	·Operation on a file was attempted with a floppy disk which has not yet been formatted or formatted in a different format.	·Insert a properly formatted floppy disk and attempt the same operation.
E212: WRITE PROTECTED FILE NAME	There is a write-protected file on the floppy disk which has the same name as the one designated.	Change the attribute of the file to write-enabled.
E214: NO FILE	There are no files to be processed on the floppy disk.	Insert a floppy disk which contains files to be processed and attempt the same operation.
E216: NO. OF FILES EXCEED LIMIT	The number of files exceeds the limit that can be created on a floppy disk.	Delete unnecessary files or use another floppy disk. Then attempt the same operation.
E217: INVALID FILE NAME	File name was not entered or the name entered is illegal.	Enter a proper file name.
E218: INVALID FILE FORMAT	The file attempted to be loaded is not a SET/SETUP configuration file.	Specify a SET/SETUP configuration file (suffix: .PNL or .PNS).

* This table shows the messages that are displayed when the message language is set as English (ENG). The corresponding messages in Japanese are not covered in this manual. For details on how to select the message language, see Section 6.6.

8.1.3 Error Messages During Parameter Setting Operations

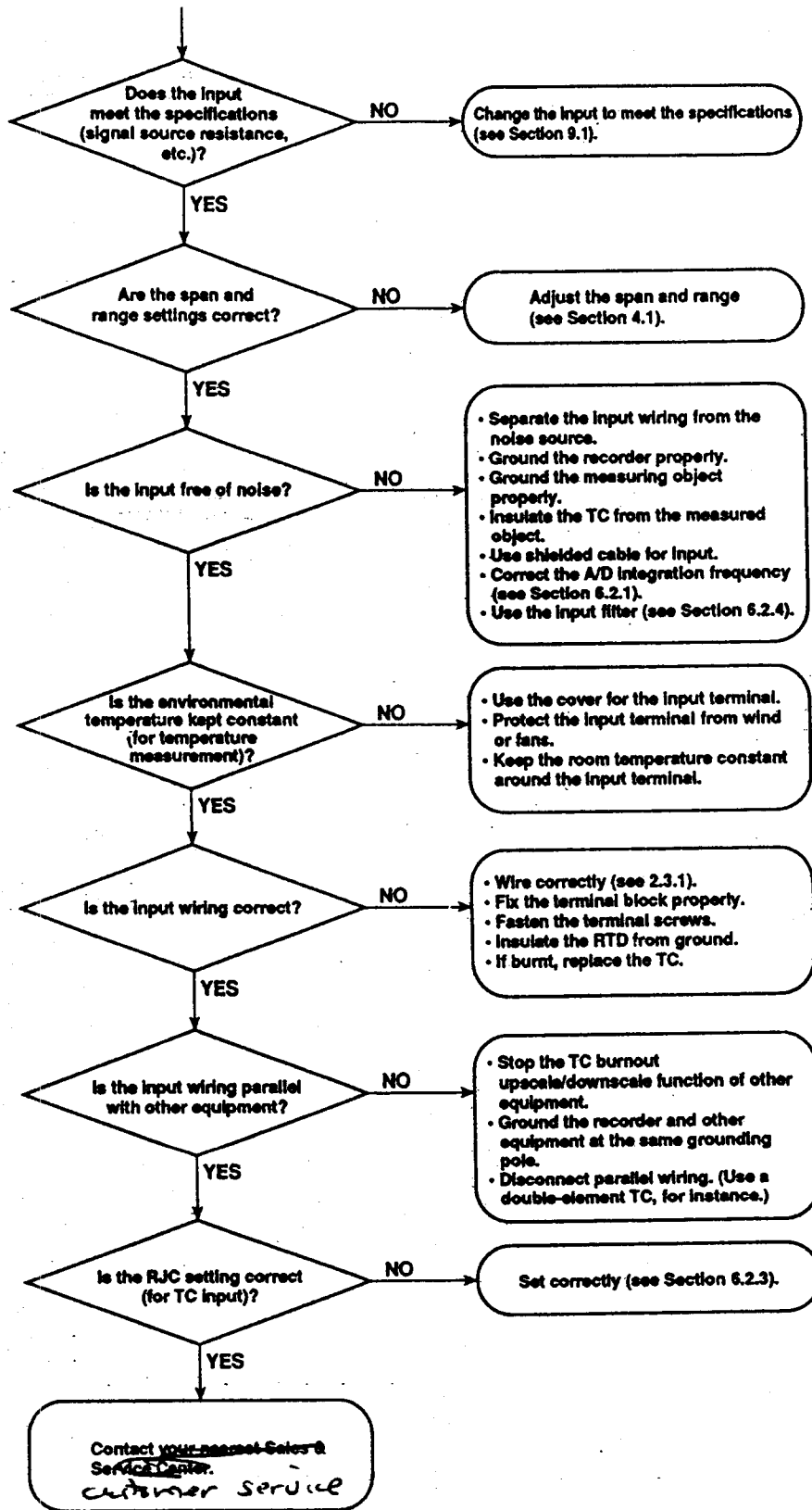| Error Message	Description	Countermeasure
E001: SYNTAX ERROR	There is an error in the recorder hardware other than the errors listed below.	Contact your nearest Service Center. ~~customer service~~
E002: VALUE OUT OF RANGE	Value entered is out of range.	Enter a proper value.
E003: INCORRECT TIME SETTING	Date or time is set incorrectly.	Enter a proper date and time.
E004: INVALID CHANNEL NUMBER	A disabled channel is selected.	Select an enabled channel.
E005: INVALID PARAMETER	A wrong parameter is set via communication or when loading a SET/SETUP configuration file.	Enter the correct parameter.
E020: INVALID SAMPLE MODE	Trigger-free cannot be selected if the file configuration is set so that multiple event files are created.	Change the file configuration setting to create a single event file or set the mode to trigger-on or trigger-rotation.
E021: NO EFFECTIVE TRIGGERS	Even though trigger-on or trigger-rotation is selected, all trigger types are set to OFF.	Set a trigger to ON.
E040: (DELTA CH) <= (REF CH)	The channel number assigned as the reference channel is equal to or greater than that of the channel to be compared for difference measurement ('DELT').	Change the reference channel number.
E041: REF CH = SKIP	The reference channel number assigned in difference measurement is set to be skipped.	Release the SKIP setting or assign another channel as the reference channel.
E042: REF CH = DI	The reference channel number assigned in difference measurement is a DI input channel.	Change the input type from DI or assign another channel as the reference channel.
E043: REF CH = SCALE, SQRT	Scaling or square root computation is specified for the reference channel number assigned in difference measurement.	Release the setting of scaling or square root computation or assign another channel as the reference channel.
E045: SPAN LOWER = UPPER	The maximum and minimum limits of the span are equal.	Correct the span setting so that the maximum limit is greater than the minimum.
E046: SCALE LOWER = UPPER	The upper and lower scale limits are equal.	Correct the scale setting so that the upper scale limit is greater than the lower limit.
E060: ALARM CH = SKIP	Alarm is set ON for a channel which is set to be skipped.	Release the SKIP setting or set the alarm on another channel.
E061: ALARM CH = DI	Alarm is set ON for a channel whose input is DI.	Change the input type from DI or set the alarm on another channel.
E083: PARTIAL CH = SKIP	Partial-extended display is set ON for a channel which is set to be skipped.	Release the SKIP setting or set the partial-extended display on another channel.
E084: PARTIAL CH = DI	Partial-extended display is set ON for a channel whose input is DI.	Change the input type from DI or set the partial-extended display on another channel.
E086: ZONE LOWER = UPPER	The upper and lower limits of the display band are equal.	Correct the setting so that the lower limit is less than the upper limit.
E087: ZONE LOWER > UPPER	The lower limit of the display band is greater than the upper limit.	Correct the setting so that the lower limit is less than the upper limit.
E088: ZONE TOO NARROW	The display band set is narrower than 5% of the entire display.	Correct the setting of the upper or lower limit to increase the band to 5% or greater.

8.2 Troubleshooting Flow Chart

Nothing is displayed.

Is the power switch on?
Does the switch work properly? — NO → Turn on the power properly (see Section 3.1).

YES

Is the power supply connected properly? — NO → Connect properly (see Section 2.4).

YES

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

YES

Is the fuse blown? — NO → Contact your nearest Sales & Service Center. Customer Service

YES

Replace the fuse (see Section 7.2).

YES

Does the fuse stay intact when the power is turned on again? — NO → Contact your nearest Sales & Service Center. customer service

YES

END

- The reading error is large.
- The digital indication or trend trace (waveform) is unstable.
- The trend trace (waveform) stays at 0 or 100%.

Does the input meet the specifications (signal source resistance, etc.)? — **NO** → Change the input to meet the specifications (see Section 9.1).

YES ↓

Are the span and range settings correct? — **NO** → Adjust the span and range (see Section 4.1).

YES ↓

Is the input free of noise? — **NO** →
- Separate the input wiring from the noise source.
- Ground the recorder property.
- Ground the measuring object property.
- Insulate the TC from the measured object.
- Use shielded cable for input.
- Correct the A/D integration frequency (see Section 6.2.1).
- Use the input filter (see Section 6.2.4).

YES ↓

Is the environmental temperature kept constant (for temperature measurement)? — **NO** →
- Use the cover for the input terminal.
- Protect the input terminal from wind or fans.
- Keep the room temperature constant around the input terminal.

YES ↓

Is the input wiring correct? — **NO** →
- Wire correctly (see 2.3.1).
- Fix the terminal block properly.
- Fasten the terminal screws.
- 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 (for TC input)? — **NO** → Set correctly (see Section 6.2.3).

YES ↓

Contact your nearest Sales & Service Center. *customer service*

Display and other functions do not work properly.

Is the input free of noise?

NO →
- 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.

YES

Contact your nearest Sales & Service Center.
customor service

Chapter 9 GENERAL SPECIFICATIONS

9.1 Input Specifications

Number of Inputs: Up to four channels (can be set up from one to four.)

Measurement Period: 125 ms

Input Types

DCV: Direct Voltage input, ±20 mV to ±20 V range
TC: Thermocouple
RTD: Resistance Temperature Detector
DI: Digital Input (contact or DC Voltage, TTL level)
DCA: Direct Current Input (using external shunt resistor (10 Ω, 100 Ω, 250 Ω))

Measuring Range: selectable for each channel

Input type	Range	Measuring Range
DC voltage (DCV)	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 V to 20.00 V

Input type	Range	Measuring Range °C	Measuring Range °F
Thermocouple (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° to 1472°F
	J*1	-200.0° to 1100.0°C	-328° to 2012°F
	T*1	-200.0° to 400.0°C	-328° to 752°F
	N*2	0.0° to 1300.0°C	32° to 2372°F
	W*3	0.0° to 2315.0°C	32° to 4199°F
	L*4	-200.0° to 900.0°C	-328° to 1652°F
	U*4	-200.0° to 400.0°C	-328° to 752°F

Input type	Range	Measuring Range °C	Measuring Range °F
Resistance temperature detector (RTD)	Pt100*5	-200.0° to 600.0°C	-328 to 1112°F
	JPt100*5	-200.0° to 550.0°C	-328° to 1022°F
	CU1 to CU6 (Cu10)	-200.0° to 300.0°C	-328° to 572°F
	CU25 (Cu25)	-200.0° to 300.0°C	-328° to 572°F

Input type	Range	Measuring Range
Event recording (DI)	DCV input	Less than 2.4 V: off; 2.4 V or greater: on
	Contact input	Contact on/off

*1 R, S, B, K, E, J, T: ANSI, IEC 584, DIN IEC 584, JIS C 1602-1981
*2 N: Nicrosil-Nisil, IEC 584, DIN IEC 584
*3 W: W-5% Re/W-26% Re (Hoskins Mfg. Co.) — also known as C thermocouple
*4 L: Fe-CuNi, DIN43710   also known as J DIN
   U: Cu-CuNi, DIN43710   also known as T DIN
*5 Pt100: JIS C 1604-1989, JIS C 1606-1989, IEC 751, DIN IEC 751
   JPt100: JIS C 1604-1981, JIS C 1606-1989

Calculation Function Specifications

Scaling (Linear):
Available for DCV, TC and RTD range
Scaling limits: –20000 to 20000
Decimal point: user selectable (should be specified when entering scale value)
Engineering unit: user settable, up to 6 characters (alphanumeric and special characters)

Differential Computation: Between any two channels, however reference channel number must be less than measuring channel number.
Available for DCV, TC, and RTD range; however, both channels must have the same range.

Square Root:
Available for DCV range
Scaling limits: –20000 to 20000
Decimal point: user selectable
Engineering unit: user settable, up to 6 characters (alphanumeric and special characters)

Measuring 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 according to the specifications, power supply frequency 50/60 Hz ±1%, warm-up time of at least 30 minutes, other ambient conditions should not adversely affect the recording operation.)

Input	Range	Measurement Accuracy (Digital Display)	Max. Resolution of Digital Display
DCV	20 mV	±(0.2% of rdg + 3 digits)	10 µV
	60 mV	±(0.2% of rdg + 2 digits)	10 µV
	200 mV	±(0.2% of rdg + 2 digits)	100 µV
	2 V	±(0.1% of rdg + 2 digits)	1 mV
	6 V	±(0.3% of rdg + 3 digits)	1 mV
	20 V	±(0.3% of rdg + 2 digits)	10 mV
TC (excluding the reference junction compensation accuracy)	R S B	±(0.15% of rdg + 1°C) However, R, S: ±3.7°C at 0° to 100°C ±1.5°C at 100° to 300°C B: ±2°C at 400° to 600°C accuracy at less than 400°C is not guaranteed.	0.1°C
	K	±(0.15% of rdg + 0.7°C) However, ±(0.15% of rdg + 1°C) at -200° to -100°C	
	E	±(0.15% of rdg + 0.5°C)	
	J T	±(0.15% of rdg + 0.5°C) However, ±(0.15% of rdg + 0.7°C) at -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) However, ±(0.15% of rdg + 0.7°C) at -200° to -100°C	
RTD	Pt100 JPt100	±(0.15% of rdg + 0.3°C)	
	Cu10 (CU1 to CU6)	±(0.4% of rdg + 1.0°C)	
	Cu25	±(0.3% of rdg + 0.8°C)	

Accuracy in Case of 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: DCV 6 V
- measuring span: 1.000 to 5.000 V
- scaling span: 0.000 to 2.000

Then,

Measuring accuracy $= \pm (0.3\% \times 5 \text{ V} + 2 \text{ digits})$

$= \pm (0.015 \text{ V } [15 \text{ digits}] + 2)$

$= \pm (17 \text{ digits})$

Multiplier = 2000 digits (0.000 to 2.000) / 4000 digits (1.000 to 5.000 V)

$= 0.5$

Accuracy during scaling = 17 digits × 0.5 + 2 = 11 digits (rounded up)

Maximum Allowable Input Voltage:

Less than 2 VDC ranges and TC ranges: ±10 VDC (cont.)

6 V to 20 VDC: ±30 VDC (cont.)

Reference Junction Compensation:

INT (internal compensation)/EXT (adding external voltage) selectable

Reference Junction Compensation Accuracy (above 0°C):

Types R, S, B, W: ±1°C

Types K, J, E, T, N, L, U: ±0.5°C (when measured 0°C)

A/D Integration Time:

AUTO: 20 ms (50 Hz) or 16.7 ms (60 Hz), selected automatically

50 Hz: 20 ms

60 Hz: 16.7 ms

TC Burnout:

On/off selectable

Burnout upscale/downscale selectable (common for all channels)

Normal: less than 2 kΩ, burnout: 10 MΩ or greater

Detection current: approx. 100 nA

Filter:

Signal damping (on/off selectable for each channel, in case of on: time constant selectable from 2, 5, or 10 seconds for each channel).

9.3 Display Specifications

Display Unit: 5.5-inch TFT color LCD (320 × 240 pixels)

Maximum Resolution of Analog Display:
Waveform (trend graph) display:
Amplitude (vertical) axis: 280 pixels (97 mm)
Time axis (horizontal) axis: 180 pixels (62 mm)
Pixel pitch: 0.348 (vertical) mm × 0.348 (horizontal) mm

Analog Display Color: Default: red for channel 1, green for channel 2, blue for channel 3, red-purple for channel 4
(The above colors as well as brown can be selected for each channel.)

Waveform Span Rate: User-selectable from 1, 5, 10, 20, 30, and 60 min/div (6 divisions on full screen)

Digital Indication: Measured values (updated every second), engineering units (up to 6 characters), and tag numbers (up to 7 characters)

Memory Status Indicator:
The memory status is displayed when sampling the event input signals and storing them in an event file in the trigger mode.

Other Display Contents: Scale values (0 and 100%), hour:minute on grid, current time (year/month/date, hour:minute:second), trip level, time-axis mark, alarm (ALM)

Data Referencing Function:
By horizontally splitting the waveform display area into two, current waveforms and reference waveforms can be compared on both halves of the display.

Display Magnification/Reduction Function:
The time scale of the analog display can be magnified and reduced by selecting a time scale of 6, 18, or 30 minutes for the display area.

LCD Saver Function: The LCD backlight automatically dims if no key is touched for a certain preset time (can be set from 1 to 60 minutes).

Discrete Display: Span bandwidth: 5% or greater, set in increments of 1%.

Partial Expanded Display:
Boundary of portion to be expanded/compressed: 1 to 99%
Boundary value: within the display span

9.4 Data Saving Specifications

Storage Medium:
3.5-inch floppy disk (2HD)
(1.2 or 1.44 MB format)

Saving Method:
Copying of data from internal memory (1 MB) to floppy disk

Data Saving Period:
Depends on the specified sampling rate (for the event file) or the waveform span rate (for a display data file).

Event File Sampling Rate:
Selectable from 125 ms, 250 ms, 500 ms, and 1 s.

File Configuration:
Files can be created in the internal memory in the following combinations:
(a) 1 Event file + 1 display data file
(b) 16 Event files + 1 display data file
(c) 1 Event file only

Data Storage Time Span: In cases (a) and (b) above,
Display data file (when using all four channels)

Waveform Span Rate (min/div)	Storage Time Span
1 min	Approx. 26 hours
5 min	Approx. 5 days
10 min	Approx. 11 days
20 min	Approx. 22 days
30 min	Approx. 33 days
60 min	Approx. 66 days

Event file (when using all four channels)

Sampling period	Sampling time
125 ms	Approx. 1 hour
250 ms	Approx. 2.1 hours
500 ms	Approx. 4.2 hours
1 s	Approx. 8.3 hours

Note: In case (b), each value in this table shows the total of sixteen event files.

In case (c) above,
Event file (when using all four channels)

Sampling period	Sampling time
125 ms	Approx. 4.1 min
250 ms	Approx. 8.3 min
500 ms	Approx. 16.6 min
1 s	Approx. 33.3 min

Other Files:
Configuration files (data set in the SET and SETUP modes), information file (event, power failure, and alarm information)

Event Recording:
An external contact, key on the recorder panel, or an alarm can be assigned as the trigger to start saving data in an event file.
A pre-trigger function is available. (The trigger point is set in increments of 10% of the memory size.)

9.5 Alarm Function Specifications

Number of Alarm Levels:

Up to four levels for each channel (high and low limits, differential high and low limits, and rate-of-change limits on increase and decrease)

Interval time of rate-of-change alarms: measurement interval times 1 to 15 (common to both increase and decrease)

Display:

Alarm status (type) displayed in the digital value display area when an alarm occurs for each channel, and common ALM indication

Output Contacts:

2, 4, or 6 points (optional)

Memory:

The times of alarm occurrence/recovery, alarm types, etc. are stored in the memory. (Up to fifty alarm events for all channels are stored.)
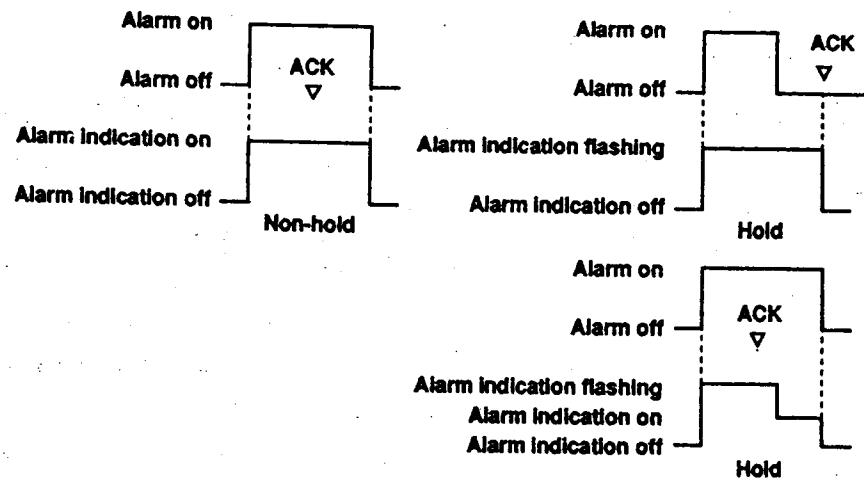
Hysteresis:

On (0.5% of span, effective for high and low limit alarms)/off switchable, common for all channels

Alarm Behavior (Relation with ACK Key):

Non-hold type: Not affected by the ACK key.

Hold type: The alarm indication starts flashing when an alarm occurs. After the ACK key is pressed, it stops flashing and the current alarm status is displayed.

9.6 General Specifications

Performance and Characteristics

Input Resistance: Approximately 10 MΩ or more for DCV ranges of 2V or less and TC
Approximately 1 MΩ for 6V and 20VDCV ranges

Input Source Resistance: DCV, TC: 2 kΩ or less
RTD: 10 Ω or less for each wire (The resistance of all three wires must be equal.)

Input Bias Current: 10 nA or less (however, when burnout is specified for TC: 100 nA)

Maximum Common Mode Voltage:
250 Vrms AC (50/60 Hz)

Maximum Differential Noise Between Channels (50, 60 Hz):
250 Vrms AC

Interference Between Channels:
120 dB (Rg = 500 Ω, the deviation when 30V is applied to another channel)

Common Mode Rejection Ratio:
120 dB (50/60 Hz ±0.1%, 500 Ω imbalance between terminal and ground)

Normal Mode Rejection Ratio:
40 dB (50/60 Hz ±0.1%)

Insulation Resistance: Each terminal to ground terminal: 20 MΩ or greater (at 500 VDC).

Dielectric Strength: Power supply to ground terminal: 1500 VAC (50/60 Hz), 1 minute
Contact output terminal to ground: 1500 VAC (50/60 Hz), 1 minute
Measuring input terminal to ground: 1000 VAC (50/60 Hz), 1 minute
Between measuring input terminals: 1000 VAC (50/60 Hz), 1 minute
Remote Control terminal to ground: 500 VDC, 1 minute

Conformance with EMC Standards (for VR104P standard panel-mounted model)

EMI   EN55011: Class A
EMS   EN50082-2

IEC1000-4-2:	Electrostatic Discharge	8 kV (Air) 4 kV (Contact)	Performance Criteria B
IEC1000-4-3:	80M-1000MHz 10 V/m		Performance Criteria A
IEC1000-4-4:	AC power line 2 kV, others 1 kV		Performance Criteria B
IEC1000-4-6:	0.15M-80MHz 10V		Performance Criteria A (±5% of range)
IEC1000-4-8:	50Hz 30A/m		Performance Criteria A

Construction

Mounting (Model VR104P):
Flush panel mounting (on a vertical plane), or horizontal side-by-side mounting
Mounting may be inclined up to ±30°, rear below front (with horizontal base).

Allowable Panel Thickness (Model VR104P):
2 to 26 mm

Material: Case: drawn steel, bezel: polycarbonate

Case Color: Model VR104P: Lamp black (Munsell 0.8Y2.5/0.4 or equivalent)
Model VR104D: Ice white (Munsell 6.6Y7.9/0.5 or equivalent)

Model VR104D: 144 (W) × 191.5 (H) × 326 (D) mm

Weight: Approximately 2.7 kgf

Power Supply

Rated Power Voltage: 100 to 240 VAC, automatically selected depending on the power supply voltage.

Usable Power Voltage Ranges: 90 to 132, 180 to 250 VAC

Rated Power Frequency: 50/60 Hz, switches need not be changed

Power Consumption:

Power Supply Voltage	When LCD Saver On	Consumption During Normal Operation	Maximum Consumption
100 V AC	Approx. 25 VA	Approx. 30 VA	Approx. 60 VA
240 V AC	Approx. 35 VA	Approx. 40 VA	Approx. 70 VA

Normal Operating Conditions

Power Voltage: 90 to 132, 180 to 250 VAC

Power Frequency: 50 Hz ±2%, 60 Hz ±2%

Ambient Temperature: 0 to 50°C (5 to 40°C when using floppy disk)

Ambient Humidity: 20 to 80% RH (at 5 to 40°C)

Vibration: 10 to 60 Hz, 0.2 m/s² or less

Shock: Not permissible

Magnetic Field: 400 A/m or less (DC and 50, 60 Hz)

Noise: Normal mode (50, 60 Hz):
  DCV Peak value including signal must not be greater than 1.2 times the measured range.
  TC   Peak value including signal must not be greater than 1.2 times the measured mV.
  RTD 50 mV or less
  Common Mode (50, 60 Hz): 250 Vrms AC or less for all ranges
  Maximum Differential Noise Between Channels (50, 60 Hz): 250 Vrms AC or less

Operating Position: Can be inclined up to 30° forward or backward.

Warm-up Time: At least 30 minutes after power on

Effect of Operating Conditions

Effect of Ambient Temperature:
  Within ±(0.1% of rdg + 1 digit) for ambient temperature variation of 10°C (excluding RJC-error)

Effect of Power Supply:
  Effect of variation in power supply voltage within 90 to 132 and 180 to 250 VAC: within ±1 digit
  Effect of rated power frequency variation of ±10%: within ±(0.1% of rdg + 1 digit)

Effect of Magnetic Field: Effect of AC (50/60 Hz) or DC 400 A/m field: within ±(0.1% of rdg + 10 digit)

9 - 8

Effect of Input Source Resistance:

Effect of input source resistance variation of +1 kΩ:

(1) DCV range:

Ranges less than 2 V: within ±10 μV

Ranges more than 6 V: within −0.1% of rdg

(2) TC range: within ±10 μV (±100 μV when TC burnout upscale/downscale function is set)

(3) RTD range:

• Effect of variation of 10 Ω for each wire (resistance of three wires must be equal): within ± (0.1% of rdg + 1 digit)

• Effect of difference between three wires: approx. 0.1°C of rdg for each 40 mΩ

Effect of Operating Position:

Within ±(0.1% of rdg + 1 digit) within 30° forward/backward

Vibration:

Effect when sine-wave motion of frequency 10 to 60 Hz and acceleration of 0.02G is applied to the instrument in the direction of each of the three axes for two hours: Within ±(0.1% of rdg + 1 digit)

Transport and Storage Conditions

The transportation and storage conditions are specified below, including during shipment, start of service, storage, and when this instrument is temporarily taken out of service.

Temperature:

−25 to 60°C

Humidity:

5 to 95% RH (no condensation)

Vibration:

10 to 60 Hz, 4.9 m/s² or less

Shock:

392 m/s² (40G) or less (inside package as shipped from factory)

Other Specifications

Clock:

With calendar function (Western calendar)

Accuracy:

±100 PPM, not including error due to turning on/off power

Memory Backup:

Built-in lithium battery preserves parameters set. Life is approximately ten years at room temperature. A "low voltage" alarm is displayed at the bottom of the screen prompting the user to replace the battery.

The measured values are stored in the flash memory, and thus the backup time is not limited.

Safety and EMI Standards

Safety standards:

Based on CSA1010, IEC1010

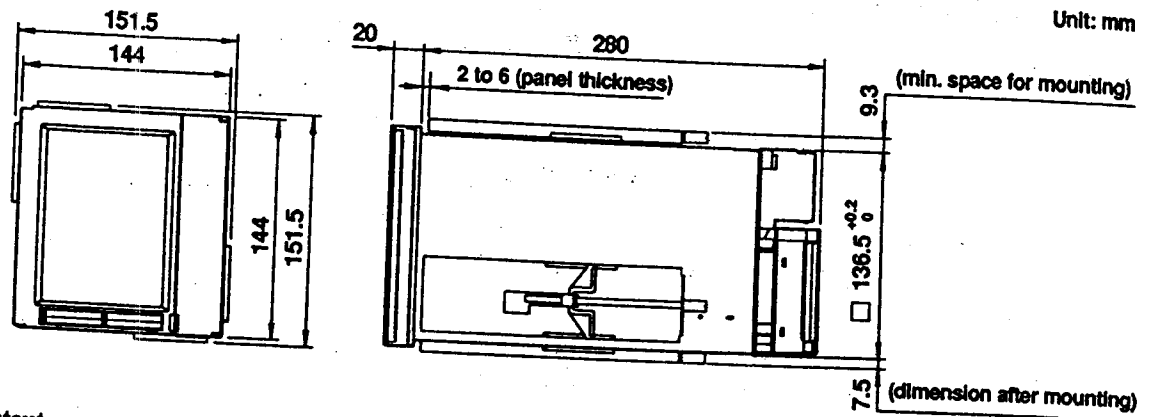Approved by CSA 142 and conforming to IEC 348

EMI standards: Based on EN55011 Group 1 Class A
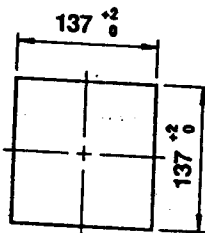
EMS standards: Based on EN50082-2
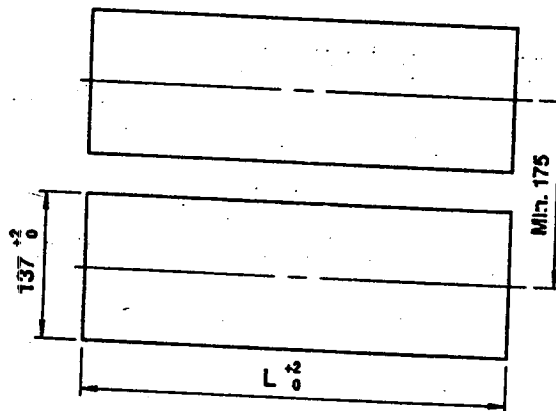
VR104P (Panel-mounting Model)

Unit: mm

151.5
144
144
151.5

20
280
2 to 6 (panel thickness)
9.3 (min. space for mounting)
$136.5^{+0.2}_{0}$
□
7.5 (dimension after mounting)

Panel Cutout

Single-unit Mounting

137^{+2}_{0}
137^{+2}_{0}

Side-by-side Mounting

Min. 175
137^{+2}_{0}
L^{+2}_{0}

Stacked Mounting (up to three)

137^{+2}_{0}
L^{+2}_{0}
Min. 175
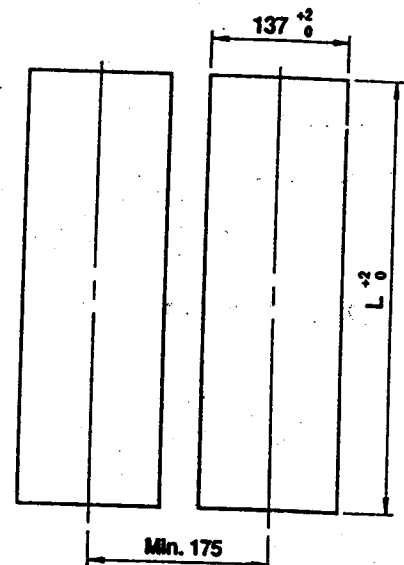
No. of recorders	L^{+2}_{0} (mm)
2	282
3	426
4	570
5	714
6	858
7	1002
8	1146
9	1290
10	1434
n	$(144 \times n) - 6$

Note

* When mounting to a panel, use two brackets, one on each of the top and bottom of the recorder, or on the left and right sides.
* The dimensional tolerance is ±3% unless otherwise specified. (However, the tolerance for dimensions less than 10 mm is ±0.3 mm.)

VR104D (Desk-top Model)

Unit: mm

144   20   237   89   40

144   136.5

8.8°   15
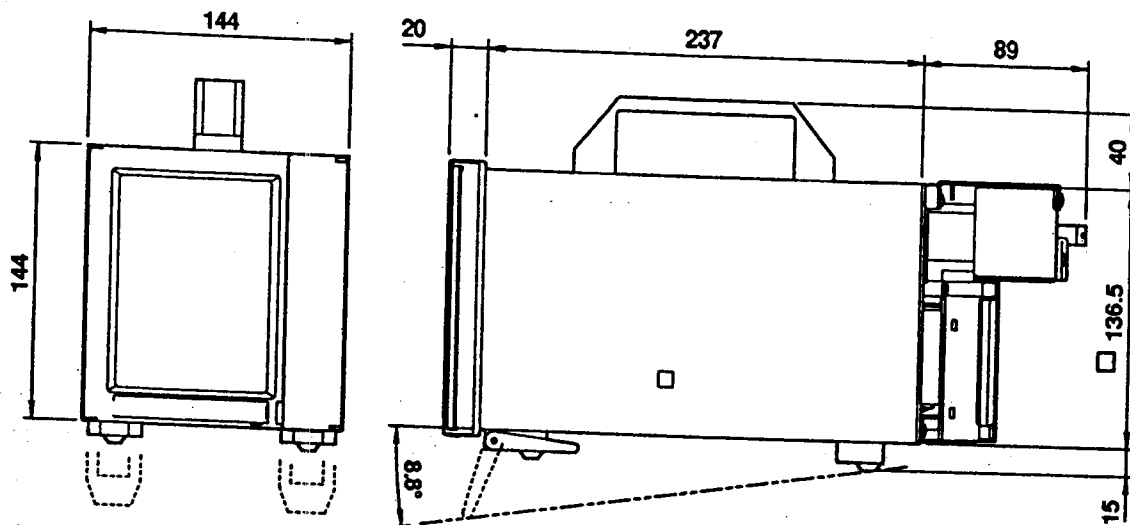
Note

The dimensional tolerance is ±3% unless otherwise specified. (However, the tolerance for dimensions less than 10 mm is ±0.3 mm.)

APPENDIX

Appendix 1 Parameters and Initial Settings

Parameters in SET Mode

Setting Parameters			Available Settings				Remarks
RANGE	MODE	VOLT	20mV	60mV	200mV	2V	DC voltage input
			6V	20V			
		TC	R	S	B	K	Thermocouple input
			E	J	T	N	
			W	L	U		
		RTD	PT	JPT			Resistance temperature detector input
		DI	LEVL	CONT			LEVL: voltage input; CONT: contact input
		DELT					Differential computation
		SCL	VOLT	TC	RTD		Scaling
		SQRT	20mV	60mV	200mV	2V	Computing the square root of measured data
			6V	20V			
		SKIP					Skips a channel
ALARM	LEVEL		1	2	3	4	Alarm level
	ALARM		ON	OFF			Alarm detection on/off
	TYPE		H	L	h	I	Types h and I can only be selected for a
			R	r			differential computation channel.
	VALUE						Alarm setpoint
	RELAY		ON	OFF			Output relay on/off
	RELAY No.		I01-I06				Relay number to be assigned for output
UNIT							Engineering unit
TIME/DIV			1	5	10	20	Waveform span rate
			30	60			
CLOCK							Date and time
COPY							Copies the settings of a channel
AUX	ZONE						Discrete (zone) display
	PART	PART	ON	OFF			Partial extended display
		EXPANDED FROM					%
		BOUNDARY					Boundary value
	TAG						Tag number (up to seven characters)
	FD	Format	1.2M	1.44M			Formatting type
	TRIP	LEVEL	1	2			Trip level number (1 or 2)
		SET	ON	OFF			To be drawn/not to be drawn
		POS	0-100				Trip level (%)
	FILE	MSG					Comment (up to thirty-two characters)
		FILE_NAME	DATE	SET			Date (automatic setting) or user-specified
		FILE_E					Event file
		FILE_D					Display data file

Setting Parameters			Available Settings				Remarks
AUX	LCD	LIGHT	01 to 15				LCD brightness
		SAVER	OFF	ON			On/off of saver
		SAVER TIME	01	02	05	10	Timer setting for saver
			30	60			
	INIT_ MEMORY	INIT OK	YES	NO			Initializes the data memory
FD_SET	LOAD						Loads (reads) a SET configuration fi
	SAVE						Saves the SET configuration file
	DEL						Deletes a SET configuration file
	INIT						Formats a floppy disk

Parameters in SETUP Mode

Setting Parameters		Available Settings				Remarks
ALARM	REFLASH	ON	OFF			Reflashing alarm
	AND	NONE	I01	I01-I02	I01-I03	Logic of alarms by output relay: AND or OR
		I01-I04	I01-I05	I01-I06		
	ALARM	ENERG	DE_EN			Relay action: energized or de-energized when alarm occurs
	RLY	NONHOLD	HOLD			Alarm action of relay: hold or non-hold
	IND	NONHOLD	HOLD			Alarm action of ALM indication: hold or non-hold
	R_TIME	01 to 15				Sampling interval for rate-of-change alarms on increase
	r_TIME	01 to 15				Sampling interval for rate-of-change alarms on decrease
	ALM_HYS	ON	OFF			Alarm hysteresis
INTG		50Hz	60Hz	AUTO		Integration frequency of input A/D converter
B. OUT	B. OUT	UP	DOWN			Burnout upscale/downscale
	B. OUT	ON	OFF			On/off (to be set for each channel)
RJC	RJC	INT	EXT			Reference junction compensation (to be set for each channel)
	(EXT voltage)					Compensation voltage
FILTR	FILT	OFF	2s	5s	10s	Input filter (to be set for each channel)
COLOR	BACKGROUND	WHT	BLK			Background color
	COLOR	RED	GRN	BLU	BRN	Display color for each channel
		PRP				
TEMP	TEMPUNIT	°C	°F			Temperature unit
INIT	INIT	NO	YES			Initializes the settings
MEMORY	DATA	E1 + D	E16 + D	E1		File configuration
	RATE	125ms	250ms	500ms	1s	Sampling period
	MODE	FREE	TRIG	ROTATE		Sample mode
	PRE.TRIG	0	10	20	30	Pre-trigger data area
		40	50	60	70	
		80	90	100		
	TRIG KEY	ON	OFF			Enables/disables manual trigger
	TRIG EXT	ON	OFF			Enables/disables external trigger
	TRIG.ALM	ON	OFF			Enables/disables alarm trigger
AUX	CH_QTY	1	2	3	4	Number of channels to be used
	CH/TAG	CH	TAG			Activate/inactivate tag number display
	MSG LANG	JPN	ENG			Message language selection: Japanese or English
	MEMORY ALM	1h	2h	5h	10h	Timer for remaining time until memory full
		20h	50h	100h		
	PASSWORD	OFF	ON			Determines whether to set the password
	PASS NO.	0 to 9999				Password number

Setting Parameters			Available Settings				Remarks
FD_SET	LOAD						
	SAVE						Loads (reads) a SETUP configuration file
	DEL						Saves the SETUP configuration file
OPT*	COMM	ADDRESS	01 to 16				Deletes a SETUP configuration file
							Specifies the address
		B. RATE	1200	2400	4800	9600	Baud rate
			19200				
		D. LEN	7bit	8bit			Data length
		PARITY	ODD	EVEN	NONE		Parity bit
		STOP BIT	1	2			Stop bit length
END	END&INIT. DATA		ABORT	STORE			End of setup

* The OPT parameters are displayed when the optional communication function is installed.

Initial Setting Values

SET Mode

Range	RANGE	VOLT (-2.000 to 2.000 V)
Alarm	ALARM	OFF
Engineering unit	UNIT	Blanks
Waveform span rate	TIME/DIV	30 min
Discrete display	ZONE	0 to 100%
Partial extended display	PART	OFF
Tag number	TAG	Blanks
Floppy disk format	FORMAT	1.44M
Trip level	TRIP SET	OFF
File name (automatic or user-specified)	FILE_NAME	DATE
LCD brightness	LIGHT	8
LCD saver	SAVER	OFF

SETUP Mode

Reflashing alarm	REFLASH=	OFF
Alarm output relay logic: AND/OR	AND=	NONE (OR)
Alarm output relay: energized/de-energized when alarm occurs	ALARM=	ENERG (energized on alarm)
Alarm output relay behavior: hold/non-hold	RLY=	NONHOLD
ALM indication behavior: hold/non-hold	IND=	NONHOLD
Sampling interval for rate-of-change alarms on increase	R TIME=	01
Sampling interval for rate-of-change alarms on decrease	r TIME=	01
Alarm hysteresis	ALM HYS=	ON (approx. 0.5% of span)
Input A/D converter integration frequency	INTG=	AUTO
TC burnout upscale/downscale	B.OUT=	UP
On/off of TC burnout upscale/downscale	B.OUT=	OFF (all channels)
Reference junction compensation	RJC=	INT (all channels)
Input filter	FILT=	OFF (all channels)
Background color	BACKGROUND=	WHT (white)
Display color	COLOR=	1 = red; 2 = green; 3 = blue; 4 = magenta
Temperature unit	TEMPUNIT=	°C
File configuration	DATA=	E1+D (one event file and display data file each)
Sampling period	SAMPLE RATE=	1s
Sample mode	SAMPLE MODE=	FREE
Number of channels	CH_QTY=	4
Tag number display	CH/TAG=	CH (tag number display: inactive)
Message language	MSG LANG=	ENG (English)
Memory end (relay contact output) timer	MEMORY ALM=	1h
Use of password	PASSWORD=	OFF

Data Format of Parameter List File

The parameter list file is an ASCII text file which lists the parameters in the format as shown below and can be viewed and edited on the CRT screen of a PC.

Example of Parameter List File (ASCII Text File)

```
*** List ***            Mar.01.96 01:27:23

TIME/DIV :  1min

CH   RANGE                     LOWER     UPPER    SCALE LOWER    UPPER  UNIT
 1   Type R(SCALE)               0.0   1760.0 C         30.00   100.00  J
 2   2V                        - 2.000    2.000V
 3   2V(DELTA 2 CH)            - 2.000    2.000V
 4   20V(SQRT)                 - 20.00    20.00V          50.00   100.00 Ws

CH   ALARM1      RLY   ALARM2      RLY    ALARM3      RLY   ALARM4     RLY
 1   r  700.0    03                                                     
 2   H  2.000          R   2.000   04
 3   H  2.000                             H   2.000   05
 4                                                         L  60.00   01

CH     TAG No.     ZONE(%)     PARTIAL
 1     AA          10-100      50%     350.0J
 2     BB          0-80        70%     1.500V
 3     CC          0-100       20%   - 1.500V
 4     DD          0-60

TRIP LEVEL       SET      POS
     1           ON       70%
     2           ON       100%

MESSAGE   : YOKOGAWA
FILE_NAME : DATE
FD_FORMAT : 1.44MB

LCD
LIGHT        SAVER       SAVER TIME
 08          OFF         60min


*** Setup List ***

ALARM
REFLASH   AND        ALARM     RLY       IND      R_TIME    r_TIME   ALM_HYS
OFF       NONE       ENERG     NONHOLD   HOLD     01        01       ON

CH        B.OUT      RJC                 FILTR    COLOR
 1        OFF        INT                 OFF      RED
 2        OFF        INT                 OFF      GRN
 3        OFF        INT                 OFF      BLU
 4        OFF        INT                 OFF      PRP

INTG         B.OUT        BACKGROUND      TEMPUNIT
AUTO         UP           WHT             C

MEMORY
DATA       RATE       MODE      PRE-TRIG    TRIG KEY    TRIG EXT    TRIG ALM
E16+D      125ms      TRIG      90%         ON          OFF         OFF

CH/TAG       MSG LANG     MEMORY ALM      PASSWORD
CH           ENG          1h              OFF

COMM
ADDRESS      B.RATE       D.LEN      PARITY       STOP BIT
01           9600         8bit       EVEN         1
```

Time-axis Mark Information

Header line

```
 1  2  3  4  5  6  7  8
[*][E][V][E][N][T][cr][lf]
```

Information lines

The following format is repeated as many times as the number of time-axis marks written, for up to the thirty-two most recent marks.

```
 1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
[(][E][0][1][)][ ][1][0][0][0][ ][ ][ ][ ][ ][ ][,][9][5][/][0][7][/][2][8][ ][1][1][:][5][5][:][0][0][cr][lf]
```

Time-axis mark number *1   Data number at the time on the mark (left adjusted)   Date at the mark (when the mark was written)   Time at the mark (when the mark was written)

*1 Time-axis mark number: E01 to E32

Example of stored data

```
*EVENT
(E01) 5140      ,95/11/24 16:25:10
(E02) 5176      ,95/11/24 16:25:45
(E03) 5348      ,95/11/24 16:28:38
(E04) 5700      ,95/11/24 16:34:29
```

Power Failure Information

Header line

```
 1  2  3  4  5  6  7  8  9 10
[*][R][E][C][O][V][E][R][cr][lf]
```

Information lines

The following format is repeated as many times as the number of power failures that occurred, for up to the ten most recent power failures.

```
 1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34
[(][D][0][1][)][ ][2][0][0][1][ ][ ][ ][ ][ ][ ][,][9][5][/][0][7][/][2][8][ ][1][1][:][5][5][:][0][0][,]
```

Power failure number *2   Display-data number when power failure occurred (left adjusted)   Date when power failure occurred   Time when power failure occurred

```
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
[9][5][/][0][7][/][2][8][ ][1][2][:][0][0][:][0][0][cr][lf]
```

Date of recovery from power failure   Time of recovery from power failure

*2 Power failure number: D01 to D10 for display data file
    E01 to E10 for event file (not stored when there are multiple event files)
    D** or E** when the stored data are lost

Example of stored data

```
*RECOVER
(D01) 2001      ,95/11/24 11:55:00,95/11/24 12:00:00
(D02) 3001      ,95/11/24 12:55:00,95/11/24 13:00:00
(E01) 4000      ,95/11/24 11:55:10,95/11/24 11:59:58
(E02) 6002      ,95/11/24 12:55:10,95/11/24 12:59:58
```

APPENDIX

Header line

```
 1  2  3  4  5  6  7  8
┌──┬──┬──┬──┬──┬──┬──┬──┐
│ *│ A│ L│ A│ R│ M│cr│lf│
└──┴──┴──┴──┴──┴──┴──┴──┘
```

Information lines

The following format is repeated as many times as the alarm occurred, for up to the fifty most recent alarms.

```
 1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
┌──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┐
│( │A │0 │1 │) │  │C │H │1 │  │  │  │  │, │H │2 │, │9 │5 │/ │0 │8 │/ │0 │7 │  │1 │0 │: │0 │0 │: │0 │0 │, │
└──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┘
 └── Alarm number *3    Channel number   Alarm type    Date when alarm      Time when alarm
                        on which alarm      and          occurred             occurred
                         occurred *4    level number *5
```

```
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54
┌──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┐
│9 │5 │/ │0 │8 │/ │0 │7 │  │1 │0 │: │0 │5 │: │1 │0 │cr│lf│
└──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┘
 └── Date of recovery from     Time of recovery from
          alarm                     alarm
```

*2 Alarm number: A01 to A50

*3 Tag number used instead of the channel number if the tag number display is active.

*4 Alarm types: H, L, h, l, R, r

Example of stored data

```
*ALARM
(A01) CH3      ,H1,95/12/20 16:57:50,95/12/20 16:57:54
(A02) CH4      ,L2,95/12/20 16:58:10,95/12/20 16:58:29
(A03) CH1      ,R2,95/12/20 17:03:09,95/12/20 17:03:37
(A04) CH3      ,H1,95/12/20 17:03:29,95/12/20 17:03:33
```

allowable input voltage	The maximum input voltage that can be applied to the input terminals
burnout	Failure of a device due to excessive heat
common-mode rejection ratio	The ability of an amplifier to cancel a common-mode voltage
common-mode voltage	A voltage that appears equally and in phase from each signal conductor with respect to ground. Also known as common-mode noise. The power noise induced from a power transformer is a typical example of this noise (voltage).
dead band	In static characteristics, the range through which an input signal can be varied without initiating an observable change in the output signal
DI	Digital Input (contact & voltage level)
dielectric strength	The potential gradient at which electric failure or breakdown occurs
EMI	An abbreviation for Electromagnetic Interference. Impairment of a wanted electromagnetic signal due to an electromagnetic disturbance.
error	Any discrepancy between a measured quantity, set-point, or rated value and the ideal value of the measured signal
hysteresis	An effect wherein a given value of a parameter may result in multiple values
input resistance	Resistance measured at the input terminals of an instrument under operating conditions
input source resistance	Resistance of the measuring circuit outside the instrument
ISO	An abbreviation for International Organization for Standardization
LCD	An abbreviation for Liquid Crystal Display
noise	An unwanted disturbance superimposed upon an indicated or supplied value, which obscures its information content
normal mode rejection ratio	The ability of certain amplifiers to cancel normal mode noise, usually expressed in decibels
normal mode voltage	An unwanted input (noise) voltage superimposed on the measurement voltage
reference junction	That thermocouple junction which is at a known or reference temperature
reference junction compensation	A means of counteracting the effect of temperature variations of the reference junction when allowed to vary within specified limits, by measuring the temperature at the terminal
flash	Function to indicate repeating alarm occurrences among a group of alarms sharing the same output relay
resistance temperature detector	A detector for measuring temperatures with a change in electrical resistance that is a known function of temperature
resolution	The minimum detectable change of some variables in a measurement system, or a minimum change in a supplied quantity that can be set

RS-422-A	The EIA (Electronics Industries Association) approved standard, which established the requirements for serial communications between computers
scaling	Recording of an input in terms of the engineering variable
shunt resistor	Resistor used at the input terminal to convert a current into a voltage
step response	The behavior of a system when its input signal is zero before a certain time and is equal to a non-zero value after this time
TFT	An abbreviation for Thin Film Transistor
thermocouple	A pair of dissimilar conductors joined at two points so that an electromotive force is developed by the thermoelectric effect when the junctions are at different temperatures
TTL	An abbreviation for Transistor/Transistor Logic
warm-up time	The time (after power turn-on) required before its rated performance characteristics apply

INDEX

INDEX