Instruction Manual

μRS1000

Models 4365□□
μRS1000 Recorder
/H8 with Digital Display

IM 4D6B1-51E

YOKOGAWA ◆
Yokogawa Electric Corporation

IM 4D6B1-51E
1st Edition

INTRODUCTION

Thank you for purchasing the YOKOGAWA industrial strip-chart μRS1000 recorder with /H8.
To take full advantage of numerous capabilities and to operate this instrument correctly and efficiently, please read this Instruction Manual before use.
This manual describes both pen and dot-printing models of the 100 mm chart recorder.
The following documents are provided separately:

Quick Reference Sheet IM 4D6B1-91E
Instruction Manual for RS-422-A Communication Function (Option) IM 4D6B1-10E

NOTE

- The contents of this manual is the subject to change without notice.
- All reasonable effort has been made to ensure the accuracy of the contents of this manual. However, if you find any ambiguous descriptions, please inform YOKOGAWA.
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REVISIONS

- April 1994 : First edition

Disk No. MR24
1st Edition : April 1994 (YG)

SAFETY PRECAUTIONS

This recorder is developed to satisfy and to be used under the following conditions:

- The recorder is a component type instrument to be installed on an instrumentation panel or rack.
- The recorder conforms to IEC348, Safety Class I (with protective earth terminal)
- The recorder is based on EN55011 (EMI) Group 1, Class A (for commercial and industrial use).

The following safety precautions must be observed during all phases of operation, maintenance, and repair of the recorder. Even when personal injury or product damage occurs in disregard of those precautions, YOKOGAWA assumes no responsibility.

General definitions of safety symbols used on the recorder and in this manual.

Monitory symbol; the elements marked with this symbol alert the user to refer to the instruction manual to avoid personal injury or recorder damage.

Protective grounding terminal; this terminal must be connected to the ground before turning the power switch on.

This manual uses the following signs for safety precautions:

WARNING

A **WARNING** sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in personal injury or death of personnel.

CAUTION

A **CAUTION** sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the recorder.

Power Supply

Ensure the source voltage matches the specified power supply voltage before turning on the power.

WARNING

Protective Grounding
Make sure to connect the protective grounding to prevent an electric shock before turning on the power.

Necessity of Protective Grounding
Never cut off the internal or external protective grounding wire or disconnect the wiring of protective grounding terminal. Doing so poses a potential shock.

Defects of Protective Grounding and Fuse
Do not operate the recorder when protective grounding or fuse might be defective.

Fuse
To prevent a fire, use the fuse with specified ratings. Before replacing the fuse, turn off the power and disconnect the power source. Do not use an off-specification fuse or short circuit the fuseholder.

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

Keep Away from Live Circuits
Inside this recorder there are areas of high voltage; therefore, never touch the interior when the power supply is connected. The recorder has replacable parts and subassemblies; however, the replacement must be carried out only by YOKOGAWA service personnel or properly trained personnel only.

External Connction
Before connecting to measurement and control unit, connect the protective grounding wire.

HOW TO USE THIS MANUAL

Relationship between chapters and their purposes or timing to read is broken down in the table below:
◉:Necessary to read
○:Optional to read

Chapters	Purchase & Installation	Daily Operation/ Maintenance	Setting Renewing	Trouble-shooting
Safety Precautions	◉	◉	◉	◉
1 Before Installation	◉			
2 Installation	◉			
3 Component Names & Functions		◉	○	
4 Daily Operation		◉		○
5 Data Entry Guides			◉	
6 Options	○	○		
7 Troubleshooting				◉

For the communication function (option), which is not described in this manual, refer to IM 4D6B1-10E. For the specifications of this recorder, refer to the General Specification Sheet (GS 4D6B1).

CONTENTS

Chapter 1 BEFORE INSTALLATION

This chapter describes the necessary preparations before handling the recorder; read them for safe handling.

1.1 Handling Precautions

The recorder contains many plastic parts; therefore, never use chemicals such as benzine or thinner to clean the recorder.

Do not bring any objects charged with static electricity near the signal terminals. This might cause malfunction.

Do not allow any volatile substances to the front glass or key panel. Do not allow rubber or vinyl to remain in contact with the recorder for long periods.

Whenever the recorder is not used, turn the power switch off.

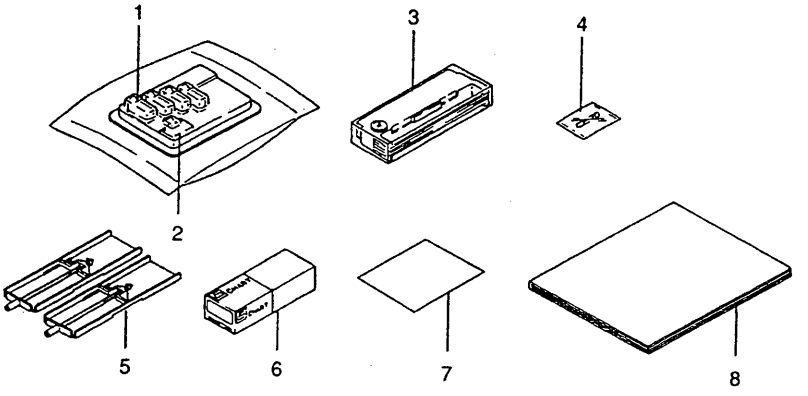
Turn the recorder power switch off as soon as any symptoms of malfunction such as unusual sound, smell, or smoke yield from the recorder. Also turn the main power switch off.
If a malfunction occurs, contact your sales representative or nearest service center.

1.2 Checking and Unpacking

This recorder has been thoroughly inspected before shipment; however, when you receive the recorder, check that all accessories are present and in the correct quantities. Also check the external appearance of the recorder to ascertain that no damage has occurred.

1.2.1 Checking Accessories and Appearance

The recorder should be accompanied by the accessories indicated in Figure 1.1. Check that all are present in the correct quantities. Also check the external appearance of the recorder to ascertain that no damage has occurred.



No.	Name	Qty	Remarks
1.	Disposable felt pen		
	1-pen mode	1	Red
	2-pen model	2	Red, green
	3-pen model	3	Red, green, blue
	4-pen model	4	Red, green, blue, violet
2.	Plotter pen	1	
3.	Ribbon cassette	1	Only for dot-printing model
4.	Fuse	1	250 V, 500 mA, time-lag type for others than /P1 and /P5 model
		1	250V, 5A, time-lag type for /P1 and /P5 model
5.	Mounting brackets	2	
6.	Z-fold chart paper	1	Approx. 16 m
7.	Seal	1	
8.	Instruction manual	1	
	Quick reference sheet	1	
	Instruction manual for communication function	1	Option

Figure 1.1 Accessories

Table 1.1 Spare Parts

Name	Part No.	Qty	Remarks
Disposable felt pen (red)	B9930BP	3	Only for pen model
Disposable felt pen (green)	B9930BP	3	
Disposable felt pen (blue)	B9930BP	3	
Disposable felt pen (violet)	B9930BP	3	
Plotter pen	B9902AR	3	
Ribbon cassette	B9901AX	1	Only for dot-printing model
Fuse	A1360EF	4	250 V, 500 mA, time-lag type for others than /P1 and /P5 model
	A1102EF	4	250V, 5A, time-lag type for /P1 and /P5 model
Mounting brackets	B9900CW	2	
Z-fold chart paper	B9565AW	6	Approx. 16 m
Seal	B9930JT	1	
Lubricating oil	B9901AZ	1	Only for dot-printing model

1.2.2 Removing Packings

The internal assembly is secured in position by packings to safeguard against damages during transit. When you unpack the recorder, remove the packings referring to Figure 1.2 and 1.3.

(1) Remove the lock screw securing the interior of the recorder during transit.
(2) Open the front door, and open the scale plate by pulling its left end after removing the adhesive tape. (For a dot-printing model, pull down the flag before opening the scale.)
(3) Remove all packings.

CAUTION

Before closing the scale of a dot-printing model, check to see that the flag is pulled down; if not, the flag may be damaged.

Pen model

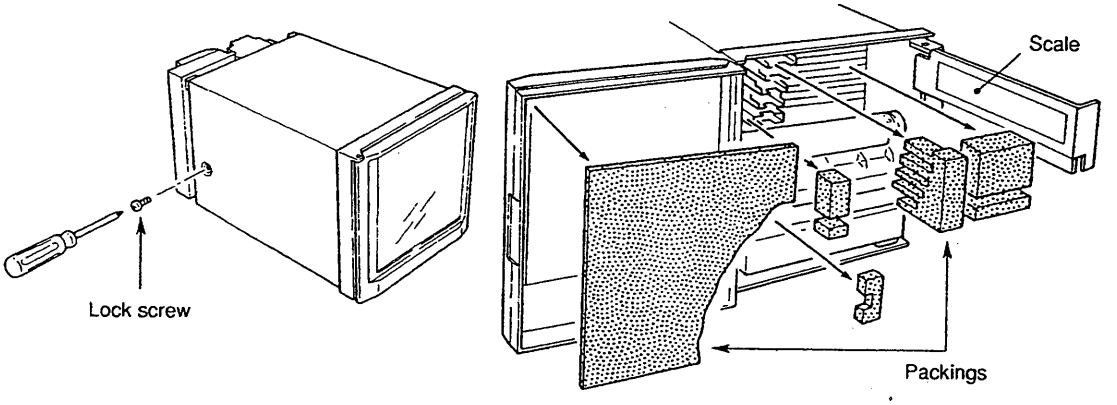


Figure 1.2 Removing Lock Screw and Packings for Transit (Pen Model)

Dot-printing model

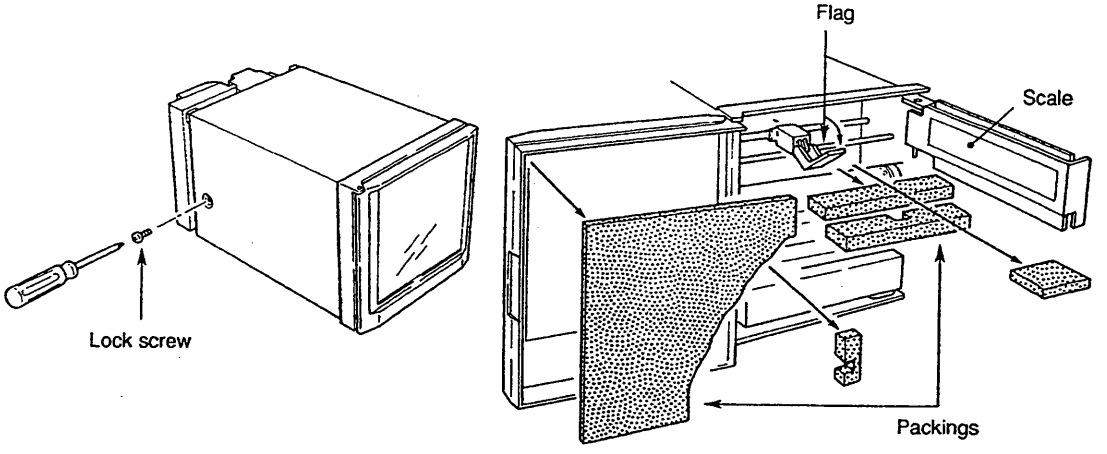


Figure 1.3 Removing Lock Screw and Packings for Transit (Dot-Printing Model)

CAUTION

Please take care not to apply any undue pressure in an upward or downward direction to the scale plate and keyboard. This might cause a strain on the hinges.

1.2.3 Checking Model Codes

Check the model codes on the nameplate to make sure they are as specified by your order.

The nameplate is visible after you removed the chart cassette and is as shown in the figure below. When you contact YOKOGAWA sales and service offices, inform the model code (MODEL) and the serial number (No.).

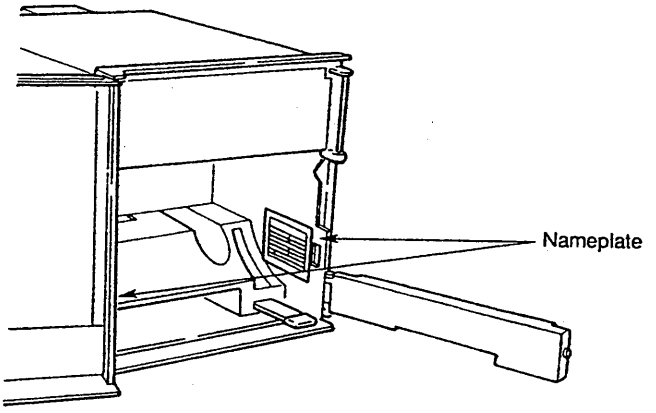


Figure 1.4 Checking Model Codes

Chapter 2 INSTALLATION

This chapter describes the installation method of the recorder: selecting the installation site, mounting and wiring methods. Read this chapter before installation.

2.1 Installation Site and Mounting Methods

2.1.1 Installation Site

The recorder should be installed according to the following conditions as close as possible.

Panel and rack mounting

The recorder is designed to be installed on an instrumentation panel or rack.

Well ventilated location

Install the recorder in a well ventilated site to prevent from internal temperature rise.

Avoid mechanical vibration

To install the recorder in a location susceptible to mechanical vibration will adversely affect the mechanical parts and the quality of recording. Please choose an installation site characterized by minimal mechanical vibration.

Horizontal installation

This recorder must be installed horizontally (however, mounting may be inclined up to 30°C backward from vertical).

Avoid direct sunshine or heater radiation.

The recorder will be adversely affected if the unit is exposed to direct sunlight or installed near a heater. Choose a location near room temperature (23°C) with minimal temperature fluctuation.

Keep out of soot, steam, moisture, dust, corrosive gases

To expose the recorder to soot, steam, moisture, dust, corrosive gases, etc., will adversely affect it.

Keep away from electro-magnetic fields

To use the recorder within strong electro-magnetic fields may cause malfunction. Please avoid installing near electro-magnetic objects.

2.1.2 Mounting Methods

(1) Mount the recorder on a steel panel whose thickness is at least 2 mm (and up to 26 mm).
(2) Insert the recorder into the panel-front face.
(3) Fix the recorder to the panel using the mounting brackets as shown in Figure 2.1. Adequate screw tightening torque is approximately 8 to 12 kg-cm. A pair of mounting brackets can be applied to the recorder's top and bottom, or to both side faces. Remove the seals covering the holes for the brackets before attaching them.

CAUTION

A tightening torque exceeding the above-mentioned adequate values may cause deformation of the recorder case or brackets.

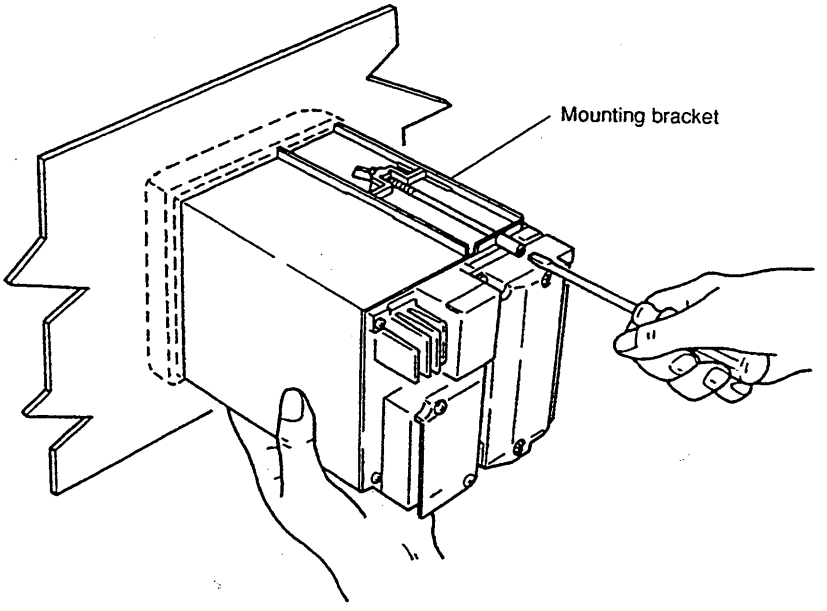
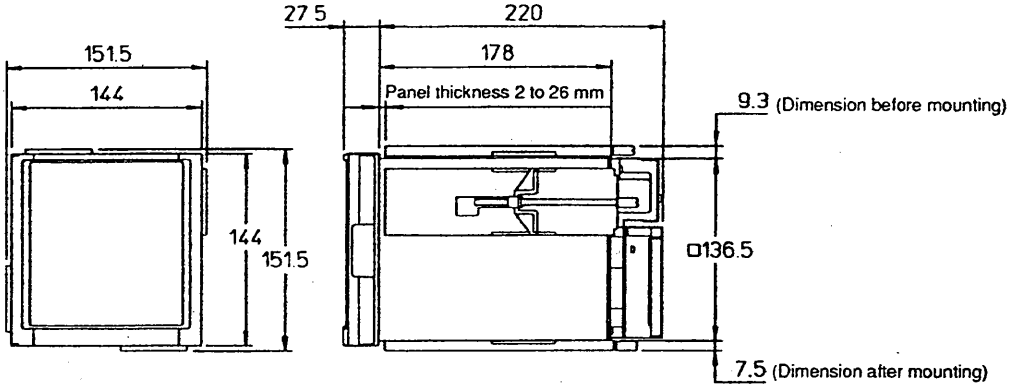


Figure 2.1 Mounting

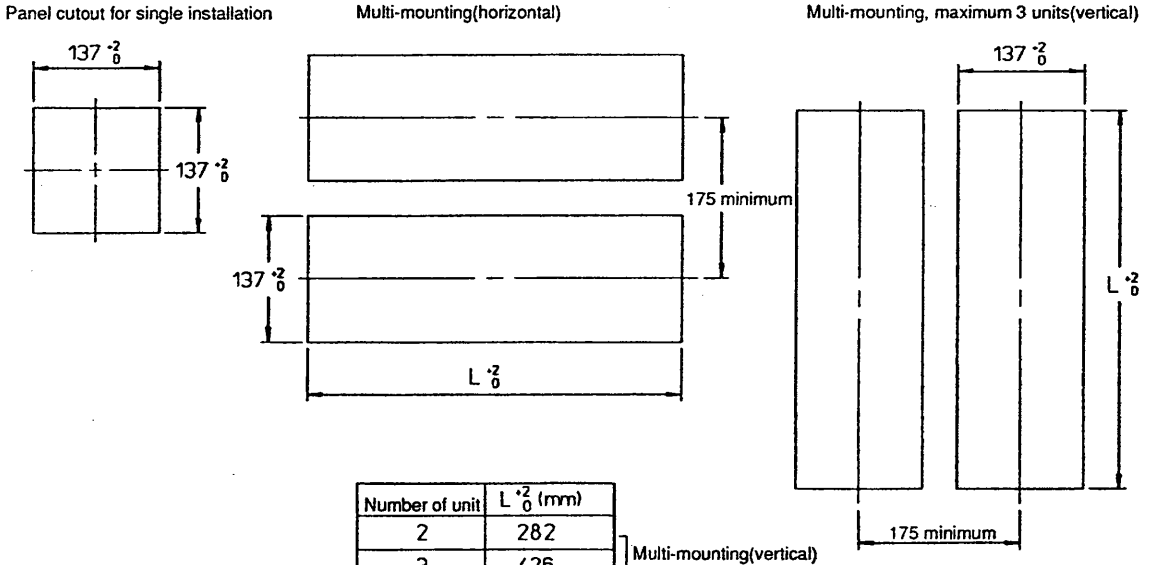
2.1.3 External Dimensions

Unit: mm

Unless otherwise specified, dimensional tolerance is ±3%; however, for less than 10 mm, it is ±0.3 mm.



Panel cutout



Number of unit	L +2 0 (mm)	
2	282	Multi-mounting(vertical)
3	426	
4	570	
5	714	
6	858	
7	1002	
8	1146	
9	1290	
10	1434	
n	(144xn)-6	

Figure 2.2 Panel Cutout and External Dimensions (Including Mounting Brackets)

NOTE A pair of mounting brackets should be used on the top and bottom, or on both sides of the recorder.

2.2 Wiring ⚠

Wiring should be done only after you have read this section. The section consists of the following subsections:

2.2.1 Rear Panel Terminal Arrangement
2.2.2 Power Supply Wiring
2.2.3 Input Signal Wiring
2.2.4 Alarm Output Wiring
2.2.5 FAIL/Chart-End Output Wiring
2.2.6 Remote Control Wiring

WARNING Make sure to fasten the wiring at the rear wall of the mounting panel and employ some kind of strain relief between the rear wall and the recorder.

2.2.1 Rear Panel Terminal Arrangement

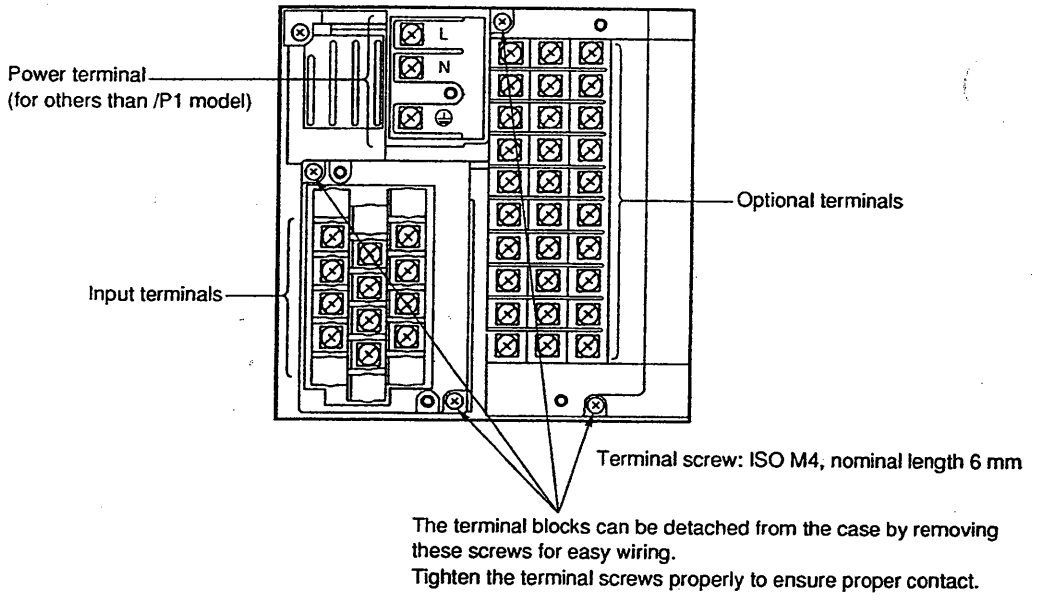


Figure 2.3 Pen Model

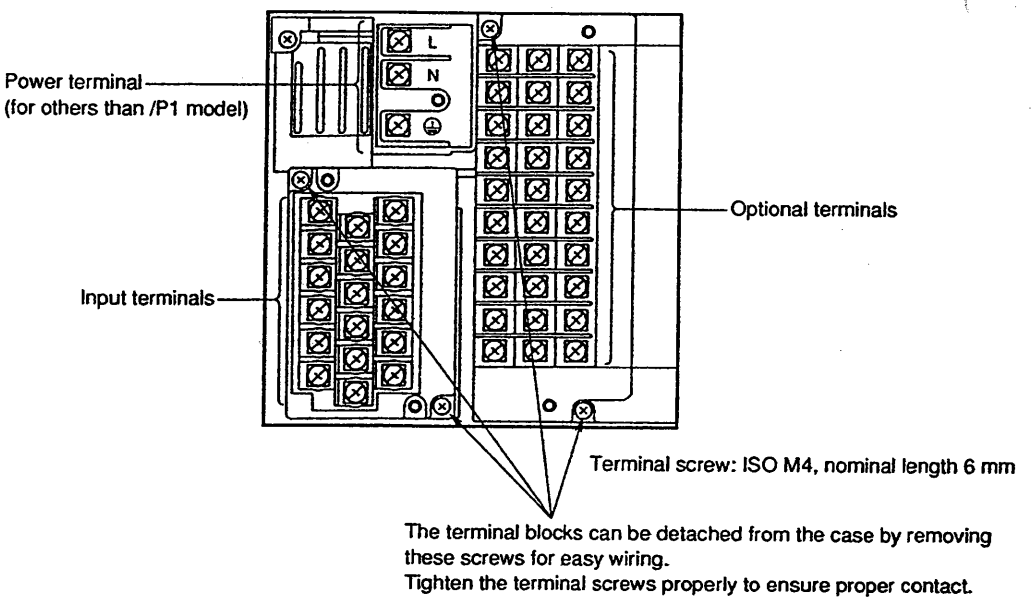


Figure 2.4 Dot-Printing Model

2.2.2 Power Supply Wiring ⚠

(1) The rated power supply voltage for the recorder is follows.
- 100 to 240 V AC (Standard model)
- 24 V DC (for /P1 model)
- 24 V AC (for /P5 model)

(2) Turn the recorder's power switch off.
(3) Open the transparent cover of the power terminal after releasing the cover screw.
(4) Connect the power supply wires and the protective ground wire to the terminal.
(5) Cover the terminals with the transparent cover, and secure the screw.

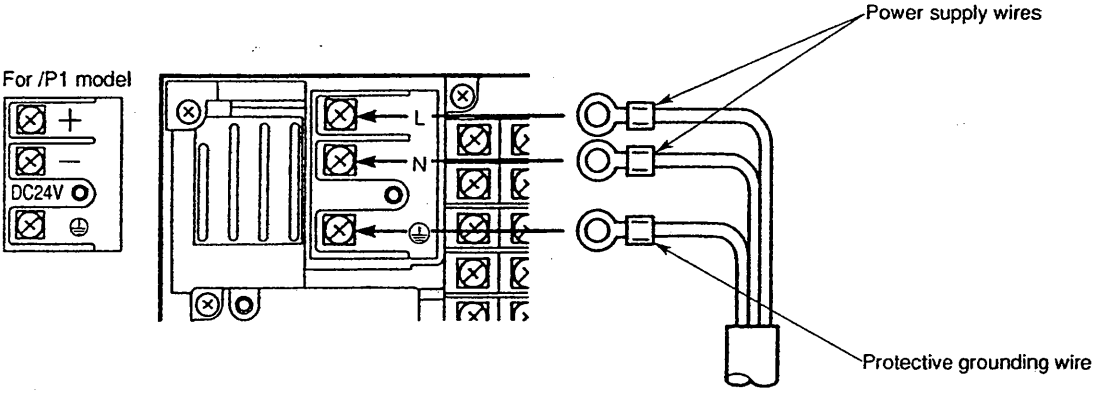


Figure 2.5 Power Supply Wiring

WARNING

- To prevent an electric shock, ensure the main power supply is turned off before wiring.
- To prevent fire, use 600 V PVC insulated wire (AWG18) for power and ground wiring (cross sectional area of 0.83 mm² or thicker, anti-galvanic corrosion finish, insulation thickness should be more than 0.8 mm, insulation resistance ahould be more than 50 MΩ Km at 20°C, approved EN60 320 (VDE0625)), or equivalent cables.
- Connect the protective grounding wire to the earth through grounding resistance less than 100 Ω before turning on the power.
- Use crimp on lugs (for 4 mm screws) with insulation sleeves (refer to Figure 2.6.).
- To prevent an electric shock, cover the power terminals certainly with the transparent cover.
- Make sure to apply a power switch in the power supply cord with the following characteristic:
  rated power current > 1A (> 3A for /P1 and /P5 model)
  rated rush current > 60A (> 70A for /P1 and /P5 model)
  fuse (s) of 2A to 15A (5A to 15A for /P1 and /P5 model) is (are) necessary.

NOTE

- Do not apply a power supply in the range from 132 V to 180 V AC. Doing so might affect the measuring accuracy.

2.2.3 Input Signal Wiring ⚠

(1) Turn off the recorder power switch.
(2) Remove the transparent cover for the input signal terminals.
(3) Connect the input signal wires to the terminals.
(4) Attach the cover on the terminals, and secure the screws.

It is recommended to use the crimp-on lugs (for 4 mm screws) with insulation sleeves for lead wire ends, but they are not required for thermocouples (TC) and the clamped input terminals (option).

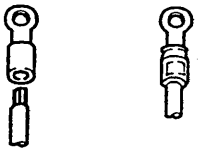


Figure 2.6 Crimp-On Lugs

Suggestions to minimize noise pickup:
- Separate the measuring-signal wires from power lines and grounding lines
- It is desirable that the measuring object is not a noise source; if not, insulate it from the measuring signal wires and ground the object.
- It is recommended to use shielded wires to minimize noise pickup from an electrostatic induction source. The shields are connected to the recorder's grounding terminal, if necessary. In that case, avoid two-point grounding.
- To minimize the noize from an electrostatic induction noise, twist the measuring wires (a pair of wires) in short and equal intervals.
- The grounding line must have low resistance.

A thermocouple (TC) recorder is equipped with a reference junction compensator, so the ambient temperature around the recorder's terminal board should be kept as stable as possible.
- Cover the input terminals with the transparent cover.
- Do not use a large-diameter wire (cross sectional area of more than 0.5 mm^2) because it has a large radiation rate.
- Keep the ambient temperature as stable as possible; start/stop of a nearby fan affects the temperature.

If input signal wires are connected to two or more receivers with parallel connection, measured values sometimes affect each other. The following notes should be observed for parallel connection:
- Ground each receiver at the same point.
- Do not turn on/off the power of a receiver while other receivers are in measuring operation.
- A resistance temperature sensor (RTD) cannot be used essentially in parallel connection.

WARNING To prevent an electric shock, ensure the main power switch is turned off when wiring.

CAUTION Do not apply inputs exceeding the rated range as follows to prevent the recorder from damage:
- Maximum input voltage
  ±10 V DC for TC, and for the voltage range of 2 V DC or less
  ±30 V DC for the voltage range of 6 to 20 V DC
- Maximum common mode voltage
  250 V AC rms (50/60 Hz)

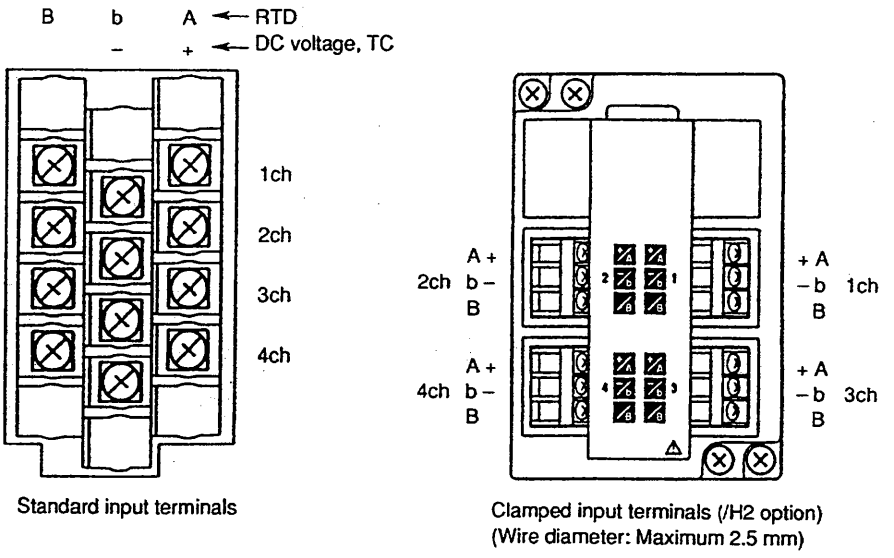


Figure 2.7 Terminal Board (Pen Model)

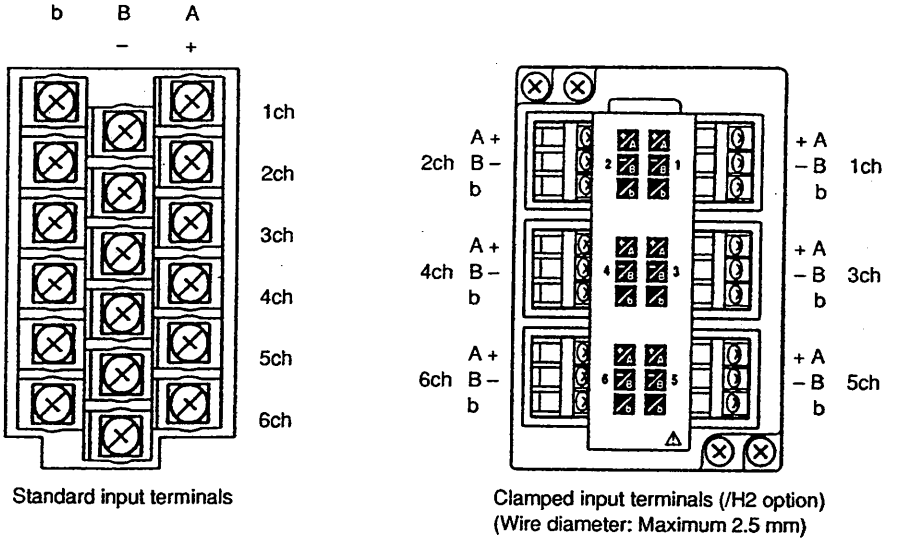


Figure 2.8 Terminal Board (Dot-Printing Model)

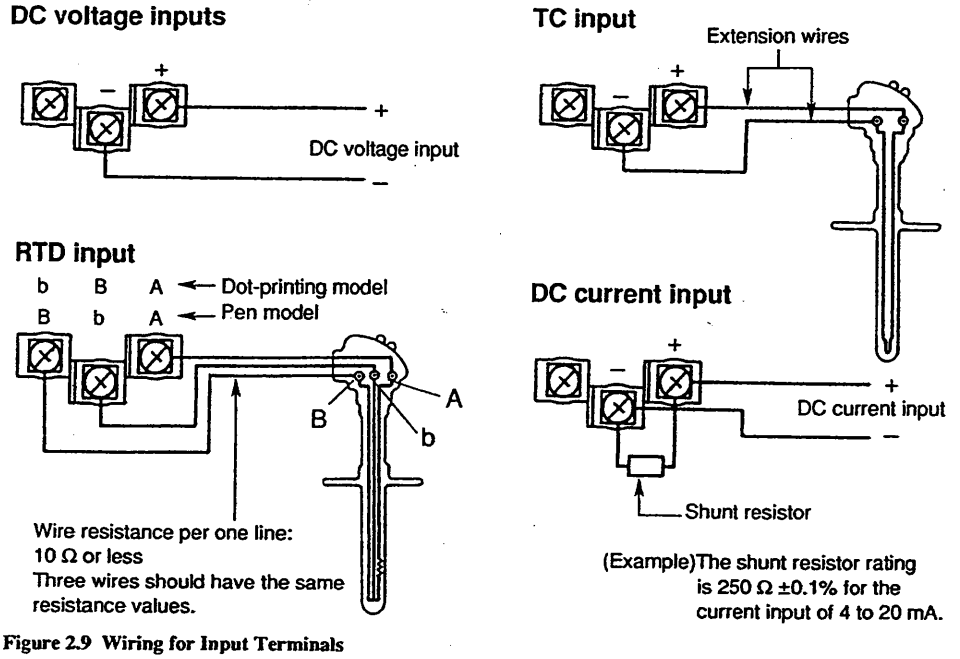


Figure 2.9 Wiring for Input Terminals

2.2.4 Alarm Output Wiring ⚠

(1) Turn the power switch off.
(2) Remove the transparent cover of the optional terminals.
(3) Connect the alarm output wires to the optional terminals.
(4) Cover the terminals with the transparent cover and secure the screws.

Depending on the type (the number of outputs) of alarm relay options, the terminal arrangement changes as shown in Figure 2.10:

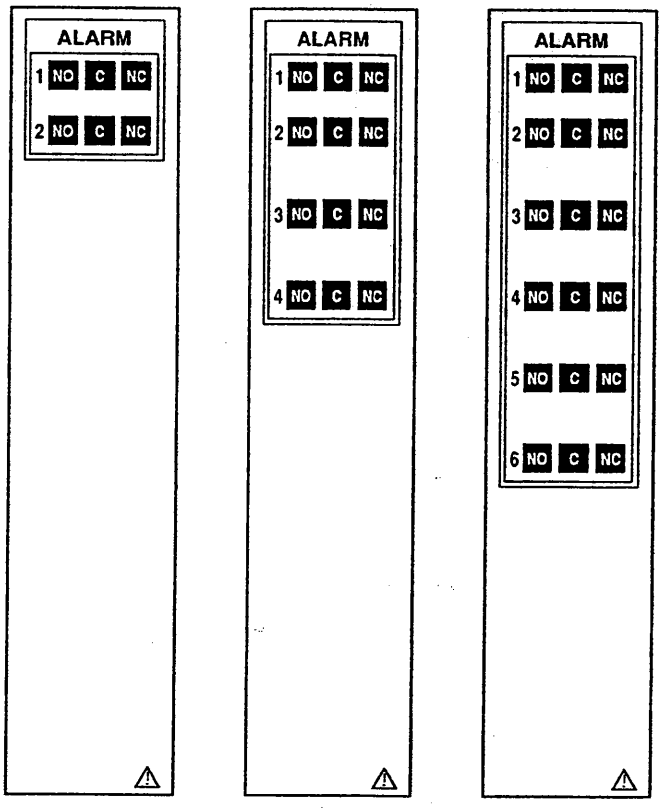


Figure 2.10 Alarm Output Terminal Arrangements

Contact characteristics:

Output type : Relay transfer contacts

Output capacity : 250 V AC (50/60 Hz), 3 A
250 V DC, 0.1 A (resistive load)

Dielectric strength : 1500 V AC (50/60 Hz) for one minute between output terminals and grounding terminals

WARNING To prevent an electric shock, ensure the main power switch is turned off before wiring.

2.2.5 FAIL/Chart End Wiring ⚠

(1) Turn the power switch off.
(2) Remove the transparent cover of the optional terminals.
(3) Connect the FAIL/Chart end output wires to the optional terminals.
(4) Cover the terminals with the transparent cover and secure the screws.

Terminal arrangements for FAIL/Chart end output signals are as follows:

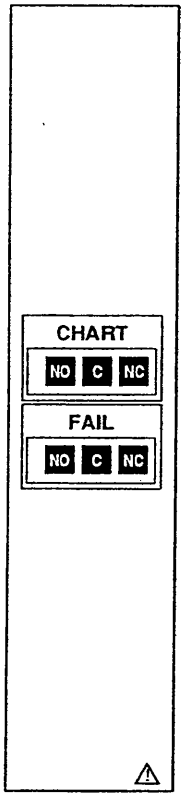


Figure 2.11 FAIL/Chart End Output Terminal Arrangements

WARNING To prevent an electric shock, ensure the main power switch is turned off before wiring.

NOTE The FAIL output is of the de-energize type.
Refer to 6.2 for details.

2.2.6 Remote Control Wiring ⚠

(1) Turn the power switch off.
(2) Remove the transparent cover of the optional terminals.
(3) Connect the wires for remote control to the optional terminals. The C is the terminal common to other 1 to 5.
(4) Cover the terminals with the transparent cover and secure the screws.

Remote control terminals are arranged as follows:

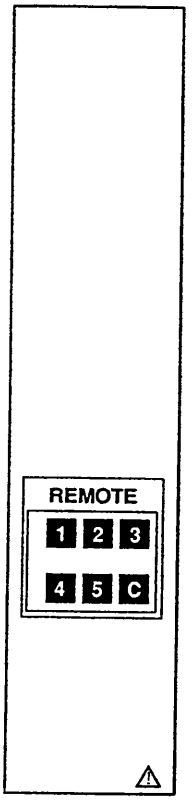


Figure 2.12 Remote Control Terminal Arrangements

Input characteristics:

Input signal : Dry contact, open-collector (TTL or transistor) signal

Control functions and signal types:

	(1) Recording start/stop	level
	(2) Chart speed change	level
	(3) Manual printing	trigger more than 250 msec
	(4) Printout message 1	trigger more than 250 msec
	(5) Printout message 2	trigger more than 250 msec
Signal characteristics :	ON voltage	0.5 V or less (30 mA DC)
	Leakage current in OFF state	0.25 mA or less
	Signal duration	250 msec or more
Input types :	Photocoupler isolation (one line common)	
	Internal isolated power source (5 V±5%)	
Dielectric strength :	500 V DC for one minute between input terminals and grounding terminal.	

WARNING To prevent an electric shock, ensure the main power switch is turned off before wiring.

NOTE
- Use shielded cables for remote control signals to prevent noise pickup. The shield should be grounded at the recorder's terminal.
- No. 4 and No. 5 terminals cannot be used.

Chapter 3 COMPONENT NAMES AND FUNCTIONS

This chapter describes the names of components, and outlines their functions.

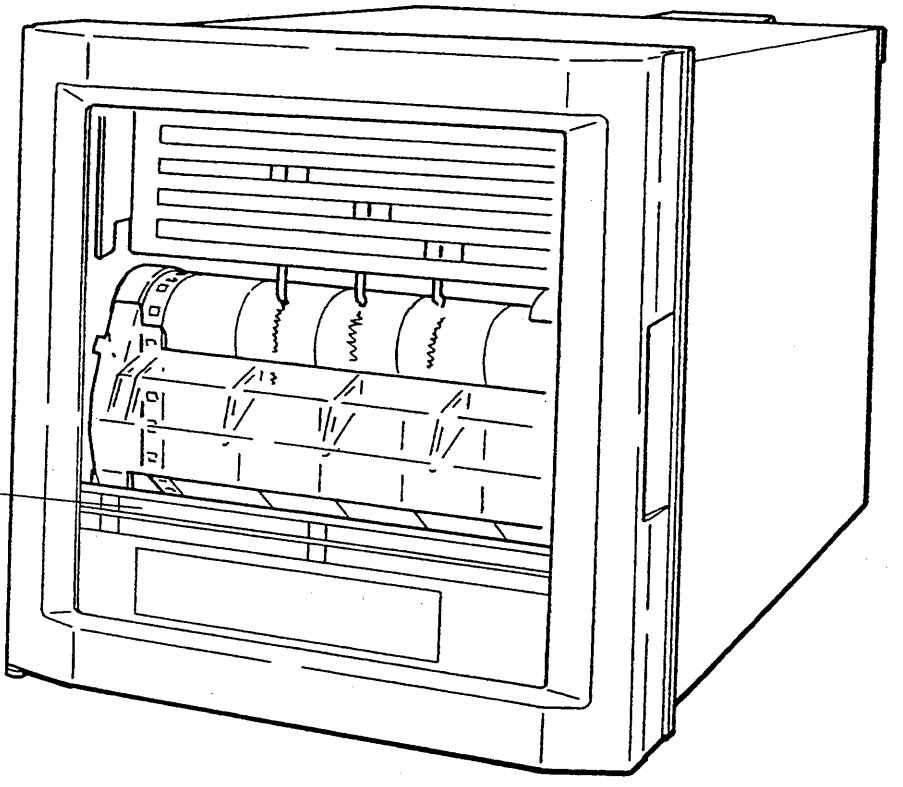


Figure 3.1 External View

3.1 Front Panel

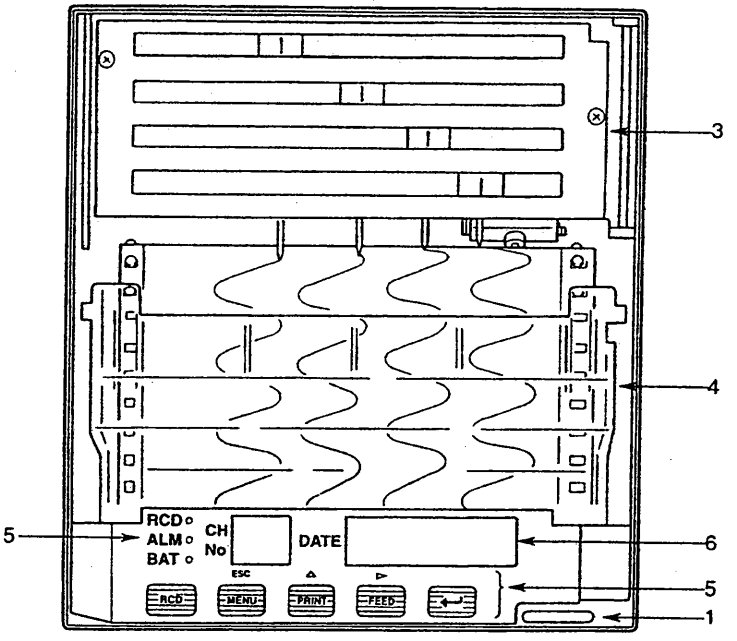


Figure 3.2 Front Panel (Pen Model)

1. Power switch (push-button type)

Pressing the switch turns the power ON and OFF.

2. Key panel (push-key type)

The panel contains five keys, and turns (opens) around the hinge which is attached at its right end. Open the panel when taking out the recorded chart from the retainer.

RCD — [RCD] key
Pressing the key starts or stops the recording.

ESC / MENU — [MENU] key, [ESC] key

(MENU function)	Changes to the setting modes, executes SET UP list printout (refer to 4.6.3) and others.
(ESC function)	Exits from the menu in the middle of setting or selecting procedures.

△ / PRINT — [PRINT] key, [△] key

(PRINT function)	Conducts manual printout (refer to 4.6.1) and the list printout (4.6.2).
(△ function)	Selects setting parameters (numerics or command codes). Selecting step is upward circulation.

[FEED] key, [▷] key

(FEED function) The chart is fed as long as this key is being pressed (refer to 4.5.2.).

(▷ function) Changes the number of digits for setting numeric values. The digit moves from high to low.

[ENT] key

Conducts parameter entry or executes functions after selecting parameters (numerics or command codes). Pressing the key executes the settings.

3. Scale

The scale plate can be turned (opened) by pulling its left end. Open the scale plate when replacing pens or ribbon cassette.

4. Chart cassette

Contains a Z-fold chart (width: 100 mm, length: 16 m).

5. Status Display

RCD indicator : illuminated when recording of measurement values is in progress. Or, in case your instrument is equipped with the chart end option (/F1), the indicator will be flashing when out of chart.

ALM indicator : will illuminate when an alarm occurs.

BAT indicator : illuminated when the battery for setting data backup needs to be replaced.

6. Data Display

This display shows the measurement values digitally. During entering settings, the display will show these settings.

3.2 Characters on the Display

The display consists of seven segmetns, and therefore characters exist which are difficult to display.
Characters are presented on the display as shown in the following table.

Display														
Alphabet	A	B	C	D	E	F	G	H	h	I	J	K	L	l
Display														
Alphabet	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Chapter 4 DAILY OPERATION/ MAINTENANCE

This chapter describes the daily operation and maintenance of the μRS1000 Recorder. Read this chapter before operation.

4.1 How to Switch the Power ON/OFF

The power switch is located at the lower right-hand corner of the front face behind the door.
The switch is a push-button type. Press the switch to turn 'ON' the recorder and press again to turn 'OFF' (refer to Fig. 4.1).
After the power turns on, the recorder executes a self-diagnostic check for several seconds before starting measurement and recording.

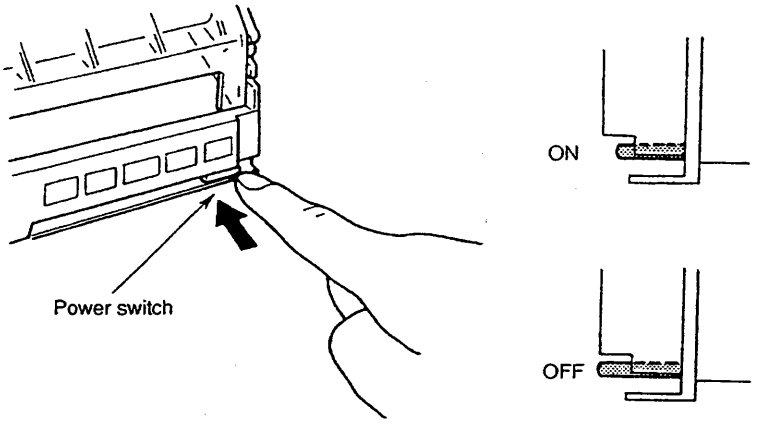


Figure 4.1

NOTE

- The warm-up time is approximately 30 minutes; however, after the initial start-up, the recorder might need more time.
- If the input wiring is connected parallel with other equipment, do not turn the power switch on/off to prevent fluctuations in measuring values.

4.2 How to Install (or Replace) Chart Paper

(1) Open the front door of the recorder.
(2) Check the recorder is not in recording state; but the power ON is allowed.
(3) Riffle the chart thoroughly before loading.
(4) Pull the key panel to open it around the hinge. While gently pressing the chart-cassette stoppers, located at both front ends of the cassette, lift and draw the cassette out of the recorder case.

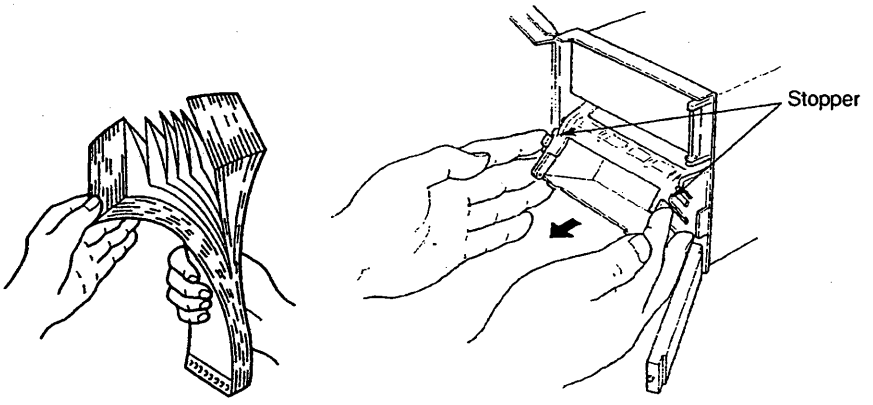


Figure 4.2

(5) Open the chart retainer backward on the cassette.
(6) Pull and open the front transparent chart guide.

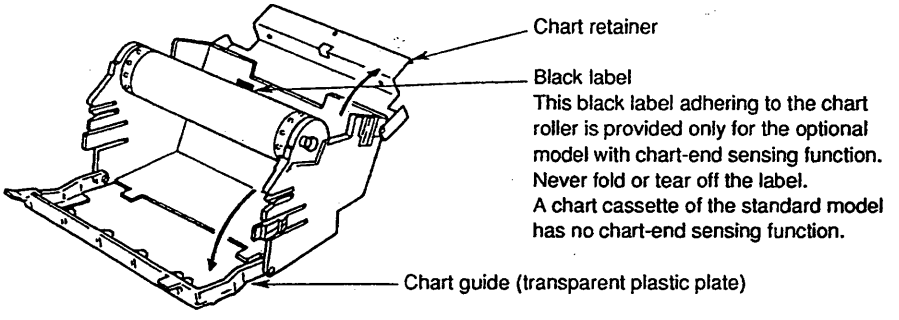


Figure 4.3

(7) Load the chart paper into the chart compartment; the small perforations should be at the left-hand. Make sure that the sprocket teeth of the chart drives are properly engaged in the chart paper perforations. Take care not to load the chart paper backwards.

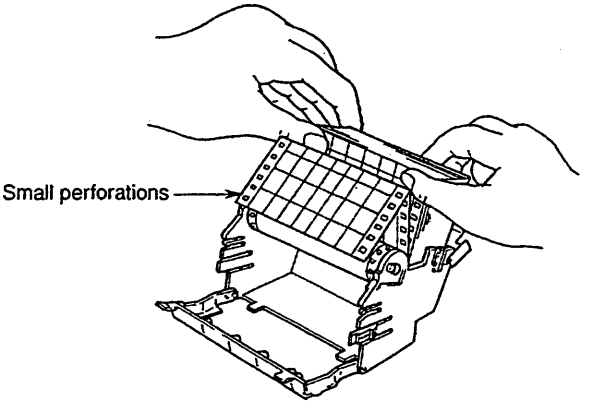


Figure 4.4

(8) Close the chart retainer.
(9) Close the chart guide (transparent plastic plate).

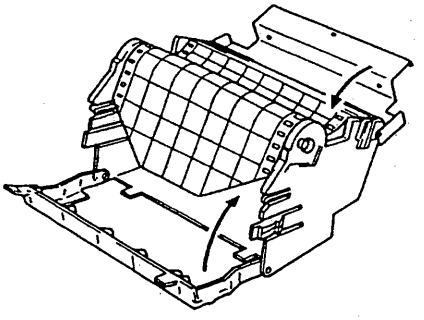


Figure 4.5

(10) Replace the chart cassette back into the recorder case; hang the knurls of the cassette to the grooves of the case, and move the cassette to trap the stopper.

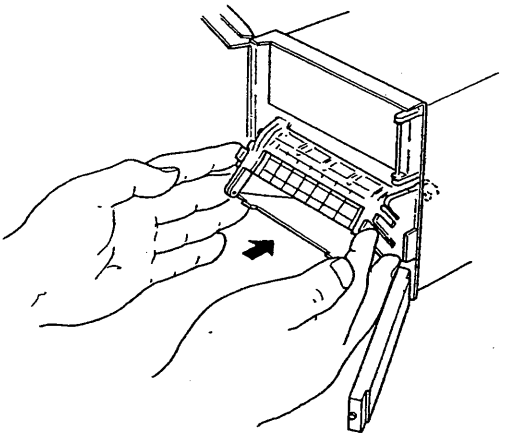


Figure 4.6

(11) Press the **[FEED]** key on the key panel to assure that the chart moves two or more folds smoothly into the chart receiver. If it moves unsteadily, do the installing procedure again from step (4).

NOTE A red band with a 'RENEW CHART' notice appears when the chart nears to its end (length of remaining chart is approximately 40 cm) to suggest you to prepare a new chart.

4.3 How to Install (or Replace) Pens (Pen Model)

Felt-tip pen

Simple replacement

(1) Open the front door, and check to see that the recording is OFF, but the power ON is allowed.
(2) Pull and open the scale plate around the hinge.
(3) Pull out the pen-cartridge by pulling the protruding part of the cartridge from the pen holder.

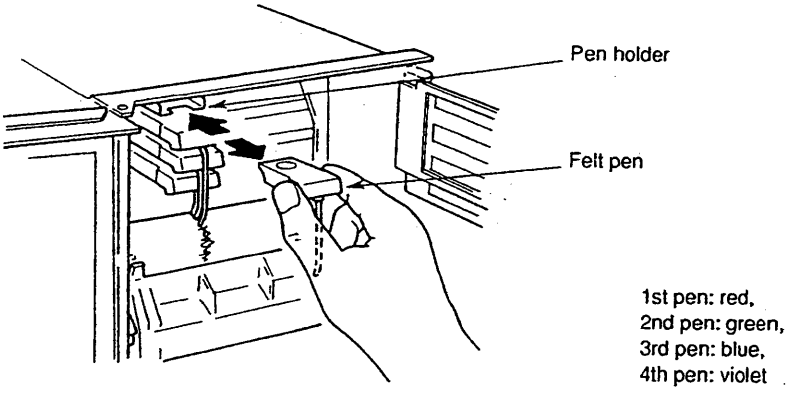


Figure 4.7

(4) Remove the cap from a new felt-tip pen, and insert the pen firmly to the pen holder.
(5) Press the **[RCD]** key to restart the recording.

CAUTION

- Do not press or pinch the felt tip to prevent deformation. Do not move the pen holder up- or down-scale to protect the driving mechanism.
- Always make sure to remove the pen cap before installation.

Replacement under pen-replacement mode

When a pen is located at a place where its replacement is difficult to do, relocate the pen by the following procedures:

(1) Check to see that the recording is OFF, but the power ON is necessary.
(2) Press the **[MENU]** key, then press the [△] key to display [C_PEn], and press the **[ENT]** key.
(3) Press the [△] key to display [YES], and press the **[ENT]** key. The pens will move near to the center of the scale where the pens can be easily replaced.

NOTE When the pens move, a line is drawn on the chart.

(4) Replace the pen according to the 'simple replacement' (2), (3), and (4) described above.
(5) After pen replacement the indicator shows [End], then press the **[ENT]** key.
(6) To restart recording, press the **[RCD]** key.

Plotter pen

(1) Open the front door, and check to see that the recording is OFF, but the power ON is allowed.
(2) Pull and open the scale plate around the hinge.
(3) Pull out the pen-cartridge by pulling the protruding part of the cartridge from the pen holder.

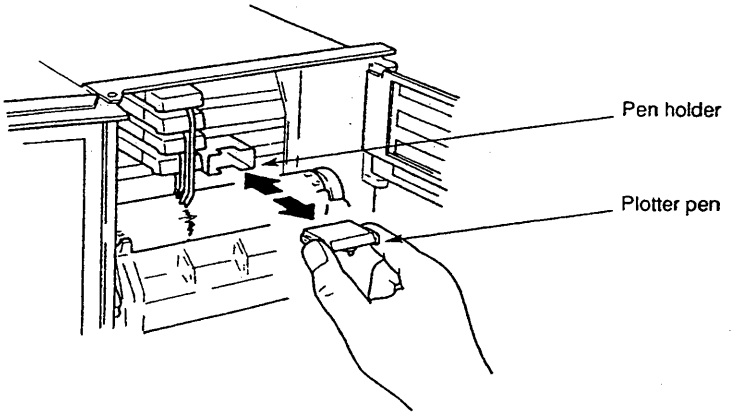


Figure 4.8

(4) Remove the cap from a new pen, and insert the pen firmly to the pen holder.

CAUTION Always make sure to remove the pen cap before installation.

4.4 How to Install (or Replace) Ribbon Cassette (Dot-Printing Model)

(1) Open the front door, and check that the power is switched **OFF**.
(2) Pull the flag downward.
(3) Open the scale plate by pulling its left end.
(4) Hold the printer carriage, and move it to the right.
(5) Hold the left-hand part of the ribbon cassette, and pull it out from the recorder case.

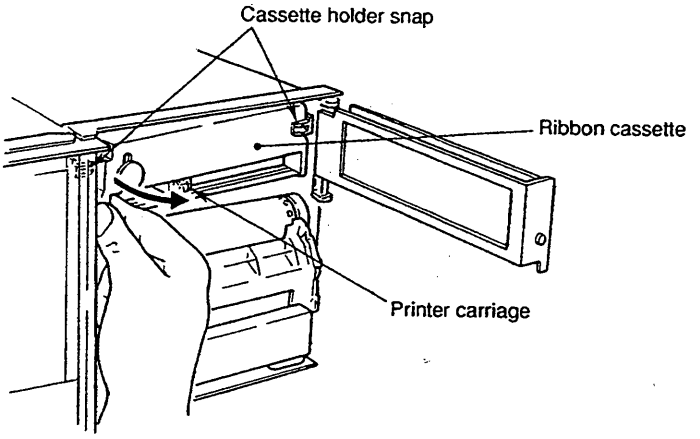


Figure 4.9

(6) Insert a new ribbon cassette into the cassette holder; first, insert the right-hand part, next the left-hand part. Check that the cassette is properly engaged with the cassette holder snap.
If the cassette is not engaged with the holder properly, turn the ribbon feeding knob in the direction of the arrow to fit the peg to the driving hole of the holder.
(7) To check that the cassette is properly inserted, turn the left-hand knob in the direction of the arrow a half or more turning.
(8) If the ribbon loosens, turn the knob in the direction of the arrow to tighten it.
(9) Turn the scale plate back to the normal position.
(10) Lift the flag upward.

CAUTION

- Improper insertion of the cassette may cause illegal-print color or damage to the cassette.
- Do not turn the scale plate back whenever the flag is lifted.

4.5 How to Get the Recording

4.5.1 How to Start/Stop the Recording

Press the [RCD] key to start or stop the recording.

NOTE When the remote control (option) is used for the start/stop of recording, the [RCD] key cannot be used.

4.5.2 How to Feed the Chart

The chart paper is fed by pressing the [FEED] key as long as the key is pressed.

4.5.3 Printing Samples

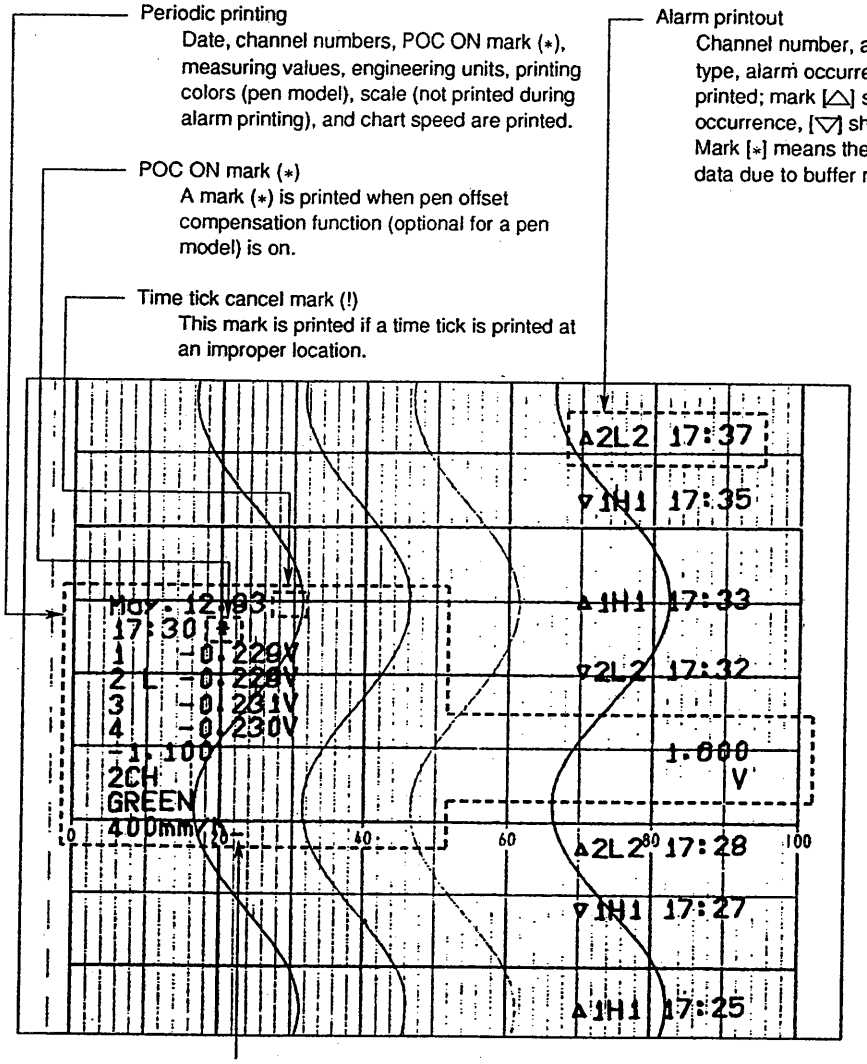


Figure 4.10 Printing Samples

4.6 How to Get a Digital Printout

A digital printout can be any one of the following:
- Manual printout
- List printout
- Set-up list printout

4.6.1 How to Get a Manual Printout

A manual printout includes:
- Date and time
- Channel number, type of alarm occurred, latest measured values with engineering units (for all channels)

Manual printing is executed by the following procedure:
(1) Press the **[PRINT]** key.
(2) Press the [△] **(PRINT)** key to call [MAN] on the indicator, then press the **[ENT]** key.
(3) Press the [△] key to call [START] on the indicator, then press the **[ENT]** key, and manual printing will start.

When manual printing starts, the indicator returns to recording mode automatically. After the printing finishes, the recorder returns to the state before starting the manual printing.

NOTE
- While a manual printing is executed, analog recording is interrupted; however, measuring and alarm detecting activities continue.
- If an alarm occurs during manual printout, the alarm printout starts just after the analog recording restarts.

If you require to interrupt a manual printing, execute the following procedure:
(1) Press the **[PRINT]** key.
(2) Press the [△] **(PRINT)** key to call [MAN] on the indicator, then press the **[ENT]** key.
(3) Press the [△] key to call [STOP] on the indicator, then press the **[ENT]** key. Then the manual printing will stop and the recorder will return to the state before starting the manual printing.

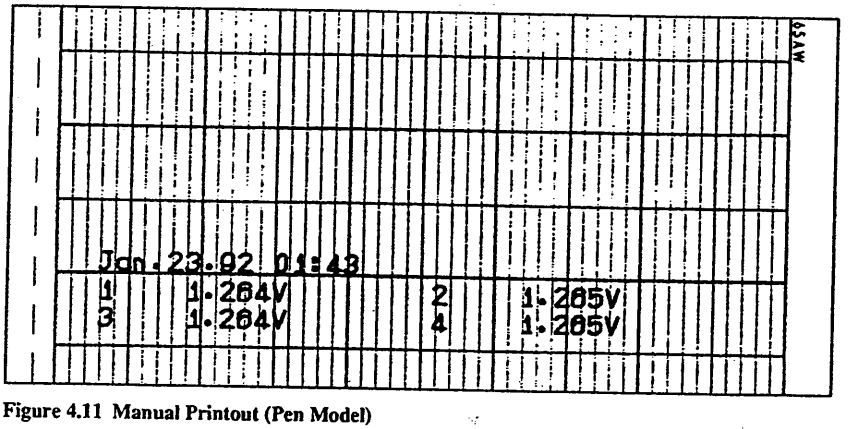


Figure 4.11 Manual Printout (Pen Model)

4.6.2 How to Get a List Printout

A list printout includes the following setting values:

- Date/time/chart speed/2nd-chart speed/trend record interval
- Channel number/range/span/scaling value/engineering unit
- Types of set alarms
- ON/OFF setting for periodic printing/zone recording/partial expanded recording
- Message printout setting

List printing is executed by the following procedure:

(1) Press the[PRINT] key.
(2) Press the [△] (PRINT) key to call [LIST] on the indicator, then press the [ENT] key.
(3) Press the [△] key to call [START] on the indicator, press the [ENT] key, and list printing will start.

When the list printing starts, the indicator returns to recording mode automatically. After the printing finishes, the recorder returns to the state before starting the list printing.

NOTE

- While list printing is executed, analog recording is interrupted; however, measuring and alarm detecting activities continue.
- If an alarm occurs during list printout, the alarm printout starts just after the analog recording restarts.

If you want to interrupt a list printing, proceed as follows:

(1) Press the [PRINT] key.
(2) Press the [△] (PRINT) key to call [LIST] on the indicator, then press the [ENT] key.
(3) Press the [△] key to call [STOP] on the indicator, and press the [ENT] key. The list printing will stop and the recorder will return to the state before starting the list printing.

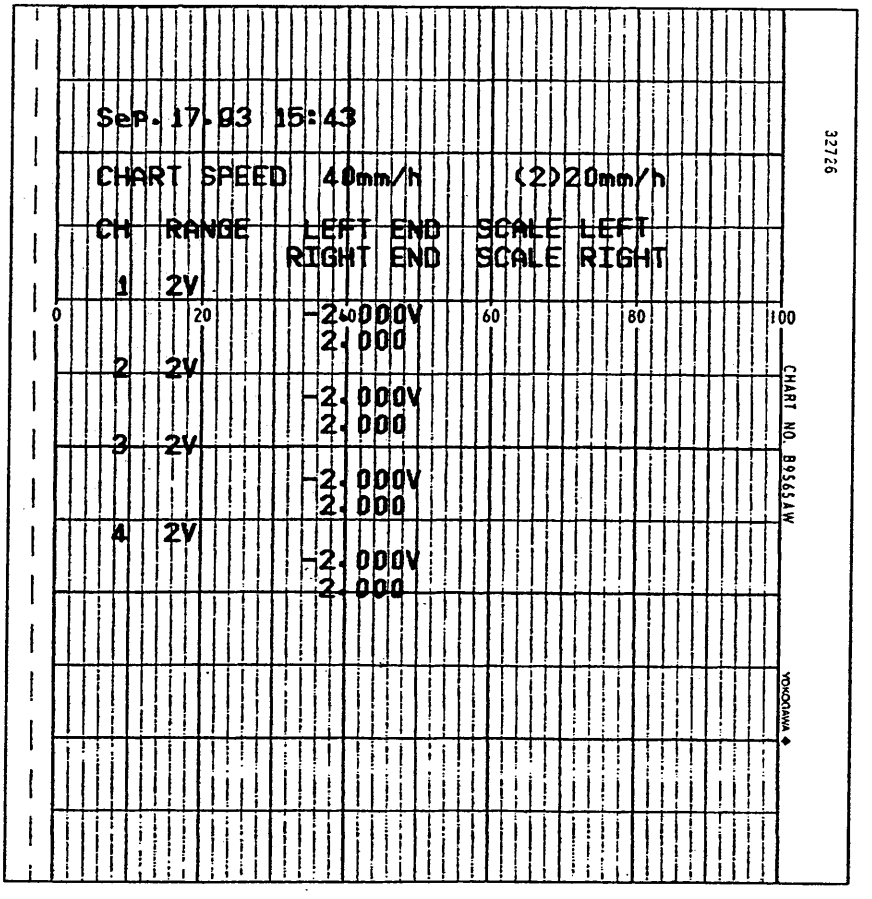


Figure 4.12 List Printout (Pen Model)

4.6.3 How to Get a SET UP List Printout

A SET UP list printout includes the setting values of the following printing functions:

- Analog recording
- Digital printing
- Burnout function, reference junction compensation (RJC) and others

SET UP list printing is executed by the following procedure:

(1) Press the [MENU] key.
(2) Press the [△] key to call [SLIST] on the indicator, and press the [ENT] key. (For a dot-printing model, do not press the [ENT] key.)
(3) Indicate [START] using the [△] key, press the [ENT] key, and the SET UP list printing will start.

When the list printing starts, the indicator returns to recording mode automatically. After the printing finishes, the recorder returns to the state before starting the list printing procedure.

NOTE

- While list printing is executed, analog recording is interrupted; however, measuring and alarm detecting activities continue.
- If an alarm occurs during list printing, the alarm printout starts just after the analog recording restarts.

If you require to interrupt a SET UP list printing, execute the following procedure:

(1) Press the [MENU] key.
(2) Press the [△] key to call [SLIST] on the indicator, and press the [ENT] key.
(3) Press the [△] key to call [STOP] on the indicator, and press the [ENT] key. The list printing will stop and the recorder will return to the state before starting the list printing.

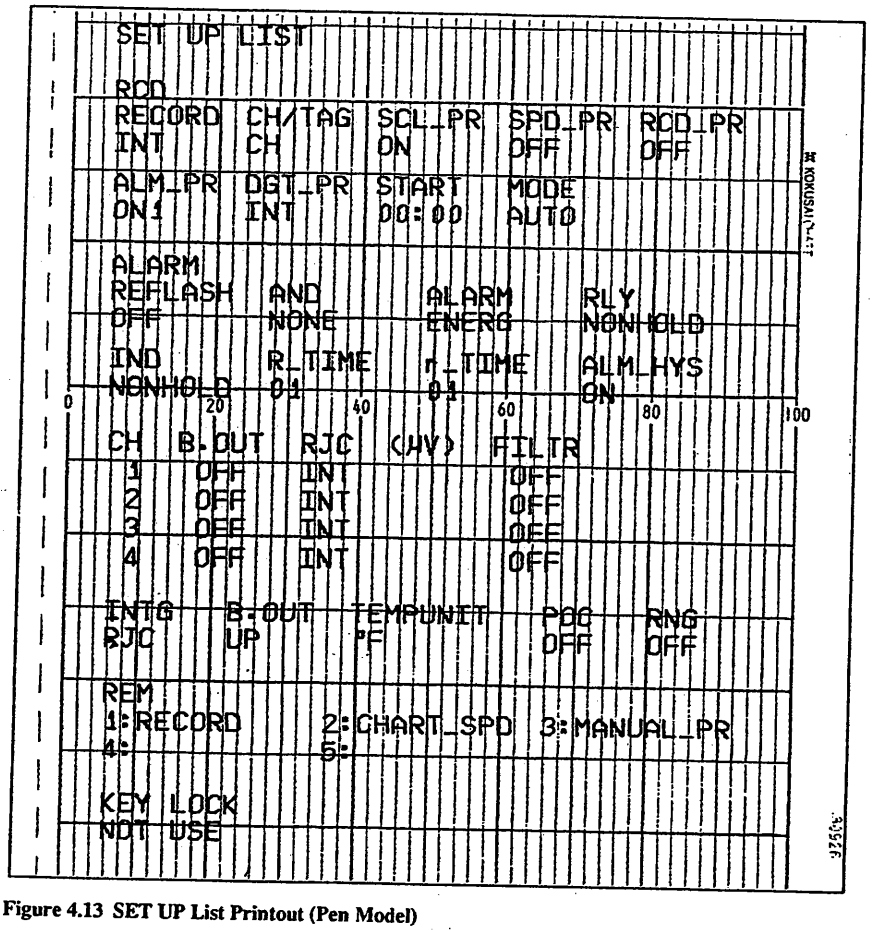


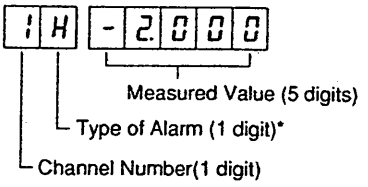
Figure 4.13 SET UP List Printout (Pen Model)

4.7 How to Select the Display

Five different displays can be selected. These are:

DISPLAY AUTO (AUTo)

Channel number and measured values will appear on the display.
Every channel will be shown for approximately 2 sec. If the input is greater than the upper limit of the recording span, ---- will appear.
If the input is less than the lower limit of the recording span, ----- will appear.



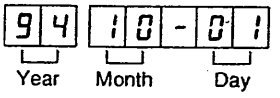
*Type of alarm
H : high limit
L : low limit
h : high difference limit
L : low difference limit

DISPLAY MAN (MAn)

Channel number and measured values will appear on the display for a specific channel only. This display looks the same as the AUTO display. Using the [ENT] key, the displayed channel number will go up.

DISPLAY DATE (dATE)

Date, including the year will appear on the display. Leap years are provided.



DISPLAY TIME (TIME)

Time will appear on the display.

DISPLAY OFF (oFF)

Nothing will appear on the display except for status LED.

How to select the display

Press the [MENU] key and select the display [dI SP] using the [△] key. Then press the [ENT] key. You have now entered the following flow:

AUto	AUTO
mAn	MAN -- CH
dAtE	DATE
tImE	TIME
oFF	OFF

Moving between the different displays cen be done by using the [△] keys.
Once you selected the desired display, press the [ENT] key (In case of the manual display, select the channel number by using the [△] key. Then press the [ENT] key again).
After having pressed the [ENT] key, the selected display will appear.

4.8 Maintenance

The activities necessary to maintain the recorder in good operating condition are shown below:

- Periodic maintenance (Refer to 4.8.1)
- Battery replacement (Refer to 4.8.2)
- Fuse replacement (Refer to 4.8.3)
- Cleaning plotter carriage shaft (Refer to 4.8.4)
- Calibration (Refer to 4.8.5)
- Pen adjustment (Refer to 4.8.6)
- Printer carriage adjustment (Refer to 4.8.7)
- Parts replacement (Refer to 4.8.8)

4.8.1 Periodic Maintenance

Check the following items periodically, and replace consumable parts, if necessary:

Are indication and recording normal?
If not, refer to Chapter 8 Troubleshooting.

Are recorded lines or printed characters clear, not blurred?
To replace a felt-tip pen or a plotter pen of a pen recorder, refer to 4.3 How to Install (or Replace) Pens; also, refer to 4.4 How to Install (or Replace) Ribbon Cassette to replace the ribbon cassette of a dot-printing model.

Is chart-paper feeding smooth, not jammed?
If not, refer to Chapter 8 Troubleshooting.

Is there enough chart paper left in the chart compartment?
Remaining chart length (cm) is printed on the left margin of the chart at intervals of 20 cm (See Fig. 4.14).
Refer to 4.2 How to Install (or Replace) Chart Paper.

Is 'BAT' illuminated?
If it is, refer to 4.8.2 Battery Replacement as the lithium battery for memory backup needs to be replaced.

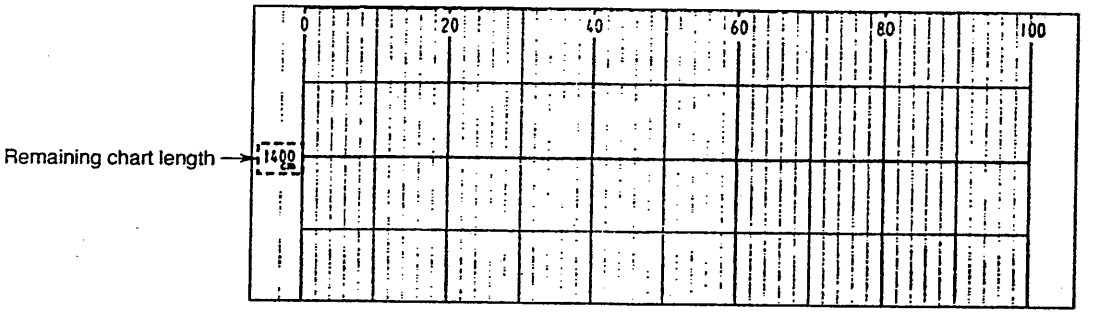


Figure 4.14 Indication of Remaining Chart Length

4.8.2 Battery Replacement

The 'BAT' illumination indication shows lithium battery deterioration, which is used for memory backup. The battery has a lifetime of approximately 10 years under normal operation.
When 'BAT' is illuminated, contact your dealer or the YOKOGAWA Sales & Service Offices printed on the back cover.

WARNING

Replacing the lithium battery can be dangerous. Do not attempt to replace the battery; never disassemble the recorder for replacing the battery.

4.8.3 Fuse Replacement ⚠

Replacing the fuse every two years is recommended as preventive maintenance.
Replacing procedure is as follows:

(1) Turn the power switch OFF.
(2) Take out the chart cassette; the fuse holder is found in the main unit.
Turn the fuse carrier counterclockwise to release it with the fuse.
(3) Change the fuse with a new one, and insert the carrier to the fuse holder turning it clockwise for fixing.

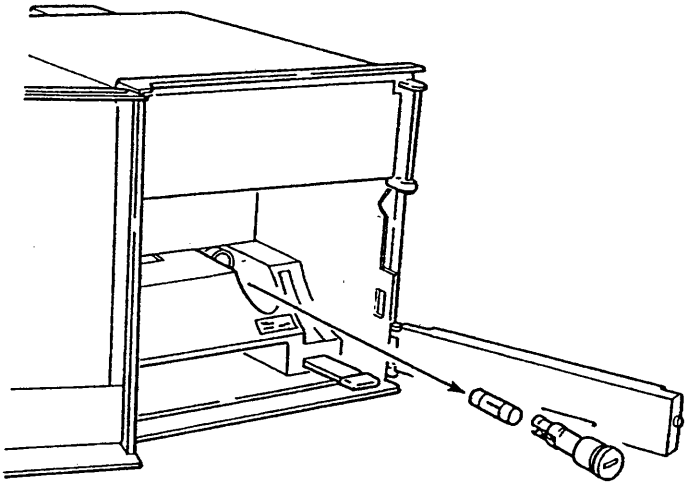


Figure 4.15 Fuse Replacement

WARNING

- To protect personal injury, turn the power switch OFF and disconnect the recorder from the main power line before replacing the fuse.
- To protect an accident such as a fire, use only the specified fuse purchased from YOKOGAWA.

4.8.4 Cleaning the Carriage Shafts

Pen model

To maintain proper recording functions, it is recommended to clean the plotter-carriage shaft once a year.
Cleaning procedure is shown below (refer to Figure 4.16):

Wipe the two shafts, the upside and downside ones for the plotter carriage, with a piece of soft cloth or paper without fluffing.
If stains are persistent, use several drops of ethyl alcohol with the cloth or paper.

CAUTION

- Do not damage the plotter's flexible-printed circuit when cleaning the shafts.
- The shafts do not require lubricating oil.

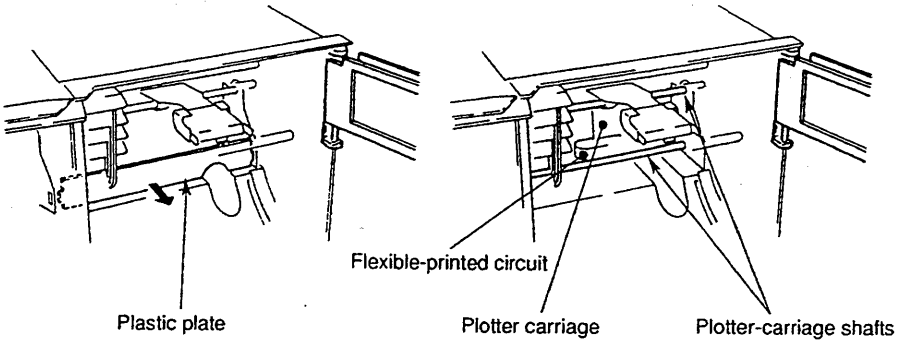


Figure 4.16 Pen Model

Dot-printing model

To maintain proper recording functions, it is recommended to lubricate the printer-carriage shaft once a year.
Lubricating procedure is shown below (refer to Figure 4.17):

(1) Wipe up dust or oil from the shaft of the printer carriage with a piece of soft cloth or paper without fluffing.
(2) Take out the tube of lubricating oil from among the spare parts.
(3) Coat the shaft with a few small drops of lubricating oil, but remove excess oil with a piece of soft cloth or paper without fluffing.

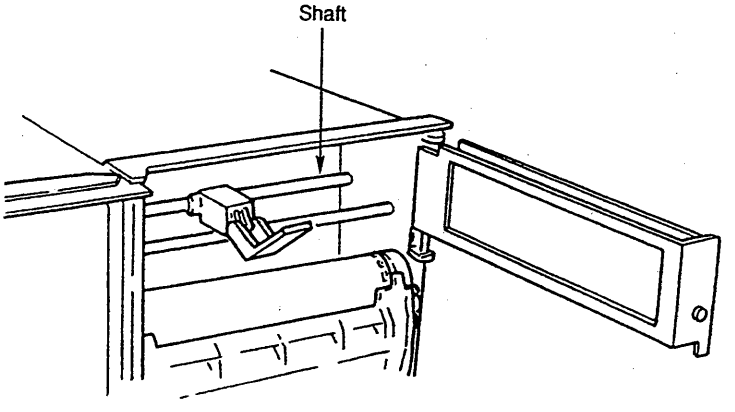


Figure 4.17 Dot-Printing Model

4.8.5 Calibration

Calibration is a comparing operation between standard inputs and measured values. It is recommended to carry out a calibration once a year to assure the measuring accuracy.

Required instruments for calibration

The instruments for calibration should have the required resolution. If necessary, ask the sales office from whom you purchased the recorder about those instruments.

Recommended instruments

DC voltage standard (YOKOGAWA Model 2552 or equivalent)
Decade resistance box (YOKOGAWA Model 2793/01 or equivalent)

Calibration procedure

(1) Connect the instruments to the recorder; connecting the terminals is shown in Figure 4.18 to 4.20. Give enough warm-up time to the instruments (more than 30 minutes for the recorder).

(2) Check that the ambient temperature and humidity are within the standard operating conditions.

Standard operating conditions

Ambient temperature	:	23±2°C
Humidity	:	55±10% RH
Power supply	:	90 to 132 V AC, or 180 to 250 V AC 21.6 to 26.4V DC (for /P1 model) 21.6 to 26.4V AC (for /P5 model)
Power frequency	:	50/60 Hz±0.1%
Warm-up time	:	30 minutes or more
Mechanical vibration	:	Within the range not affecting recorder operation

However, when the calibration is conducted under normal operating conditions (referring to 4.8.7), check the accuracy influenced by the conditions.

Chart paper yields thermal expansion or shrinkage, sometimes resulting in differences from the calibrated values.

Examples of expansion are shown below assuming the reference temperature 20°C and humidity 65% RH:

Expansion at 85% RH ..... 0.4% or less
Expansion at 35% RH ..... 0.45% or less

(3) Input the standard signals equivalent to 0, 50, and 100% of the setting range of the recorder, then check the difference error between input signals and measured values.

If the error is not within the specified accuracy, contact your dealer or YOKOGAWA Sales & Service Offices shown on the back cover.

NOTE A reference input for a thermocouple (TC) signal needs temperature compensation; the temperature at the recorder input terminal should be measured to make voltage compensation (adding) due to the reference junction temperature compensation.

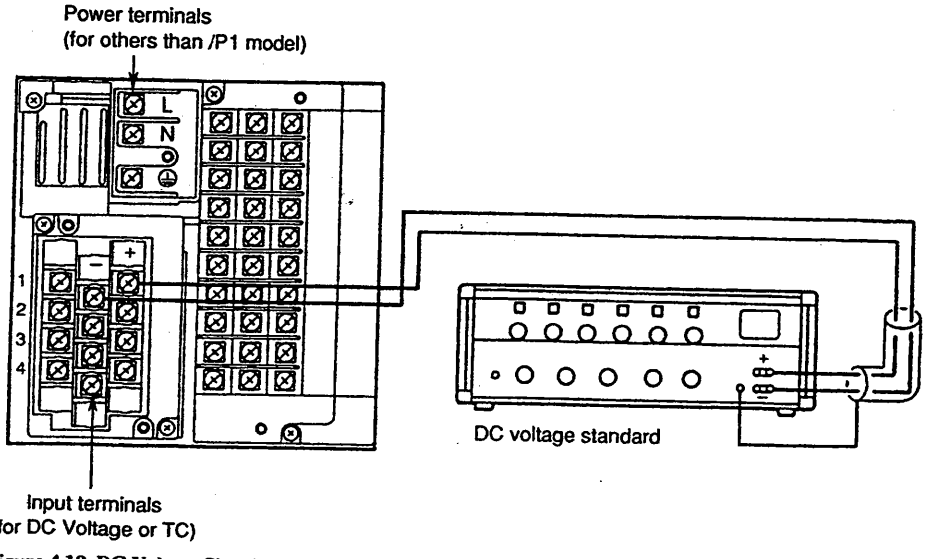


Figure 4.18 DC Voltage Signal for Pen Model (same as Dot-Printing Model)

Temperature Measurement for Resistance Temperature Detector (RTD)

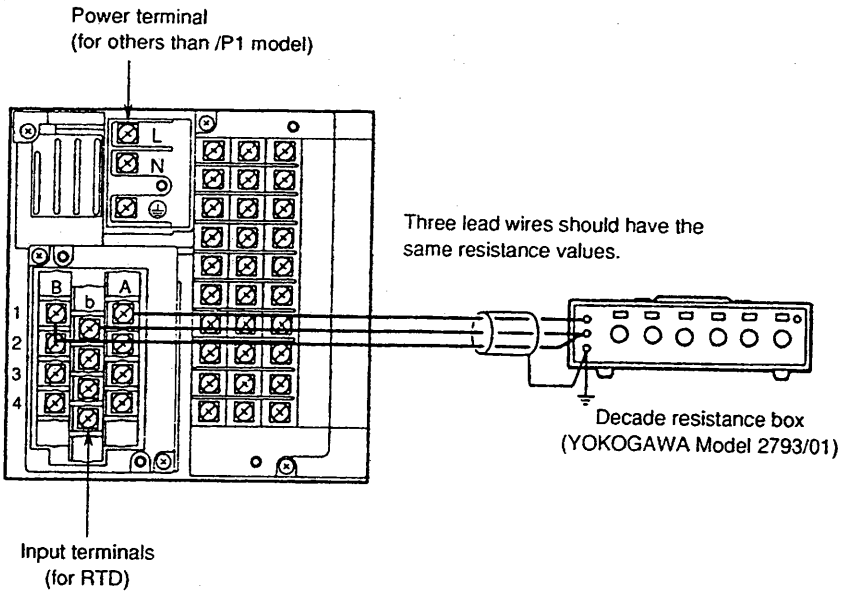
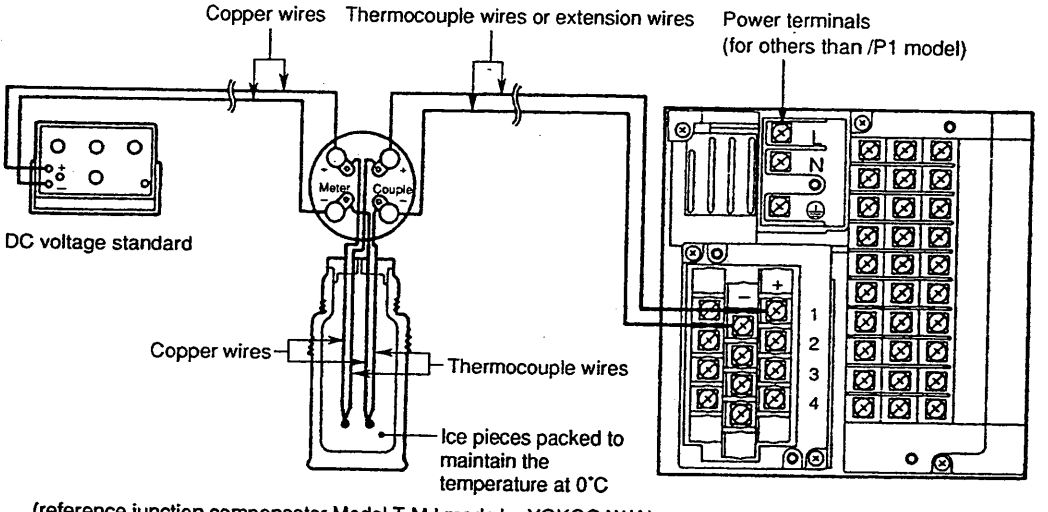


Figure 4.19 Temperature Signal as RTD for Pen Model
(for dot-printing model, the wire connection exchanges between the terminal B and b.)

Temperature Compensation for Thermocouple Signal



(reference junction compensator Model T-MJ made by YOKOGAWA)

Reference Junction Compensation for Thermocouple Input

A DC voltage generated by a thermocouple differs from a value calculated from the table of thermo-electromotive force (EMF) because the table is based on the 0°C reference temperature but the temperature at the recorder input terminal is generally equal to the room temperature.

The recorder measures the temperature at the input terminal for compensation; when the input terminals are shorted (equivalent to 0°C of the thermocouple in the EMF table), the recorder indicates the temperature at the input terminal.

For calibrating a recorder, an input voltage after the compensation (after subtraction of the compensating voltage) should be applied to the recorder; an example is shown in Figure 4.20 (the YOKOGAWA Model T-MJ reference junction compensator is used).

Figure 4.20 Reference Temperature Compensating Connection for Pen Model
(same as Dot-Printing Model)

4.8.6 Pen-Position Adjustment (Pen Model)

It is recommended to adjust pen positions on the chart at least once a year.

Adjusting procedure

(1) Turn the recorder power on and allow a warm-up time of more than 30 minutes.

(2) Check that the environmental conditions are within normal operating conditions.

Normal operating conditions

Power supply : 90 to 132 V AC, or 180 to 250 V AC
21.6 to 26.4 V DC (for /P1 model)
21.6 to 26.4 V AC (for /P5 model)
Power frequency : 50/60 Hz±2%
Ambient temperature : 0 to 50°C
Ambient humidity : 20 to 80% RH (under 5 to 40°C)
Mechanical vibration : 10 to 60 Hz, 0.2 m/s^2 or less
Mechanical shock : Not permitted
Magnetic field : 400 AT/m or less (DC and 50/60 Hz)
External noise : Normal mode (50/60 Hz)
DC voltage ..... Noise peak value with signal is limited to 1.2 times larger value than the measuring range.
TC signal ..... Noise peak value with signal is limited to 1.2 times larger value than the measuring thermoelectromotive force.
RTD signal ..... 50 mV or less
Common mode noise (50/60 Hz): 250 V AC rms or less for any range
Maximum noise voltage between channels (50/60 Hz):
Pen model, dot-printing model (6, 12-point) ..... 250 V AC rms or less
Dot-printing model (18, 12-point) ..... 200 V AC rms or less
Mounting inclination : Backward 0 to 30°

Chart paper yields thermal expansion or shrinkage, sometimes resulting in differences from the calibrated values. Adjust the pen position, if necessary.
Examples of expansion are shown below assuming the reference temperature 20°C and humidity 65% RH:
Expansion at 85% RH ..... 0.4% or less
Expansion at 35% RH ..... 0.45% or less

(3) To enter the SET UP mode, turn the power switch off, and turn on again while pressing the [ENT] key.

(4) Select [P_AdJ] using the [△] key, and press the [ENT] key.

(5) Select [nULL] (leftward movement) or [FULL] (rightward movement) using the [△] key, and press the [ENT] key.

(6) Select the number of the channel to be adjusted using the [△] key, and press the [ENT] key.

(7) The selected pen moves leftward (for NULL) or rightward (for FULL). Increase or decrease the setpoint value to make the pen accurately overlap the graduated line of the chart.
The setting consists of a number of five digits.
Select the digit by pressing the [▷] key, and select a numeral by the [△] key.
Setting range is 7950 to 11350 for NULL, 14500 to 19500 for FULL. Finally press the [ENT] key after all codes are entered.
The pen will move after pressing the [ENT] key. The pen movement corresponding to [1] is 0.0057 mm. Decreasing the numeral moves the pen leftward, and increasing moves the pen rightward.

NOTE If the [ENT] key is pressed while setting the numeric codes, the indicator returns to [nULL] or [FULL], and the numeric codes already set stay valid. However, they become invalid when pressing the [ESC] key.

(8) The indicator displays [- SEt -], and the pen will move to the adjusted position.
Confirm the pen position and press the [ENT] key.

(9) The indicator returns to [nULL] or [FULL]. When you want to carry out the position adjustment again, press the [ENT] key and carry out step (6) again. When another adjustmens are required, select [nULL] or [FULL] again by pressing the [△] key. In order to finish the adjustment, press the [ESC] key to return to the [P_Adj] indication.

(10) Before leaving the SET UP mode, its contents should be stored.
Select [End] by pressing the [△] key, and press the [ENT] key.

(11) Select [StorE] to keep setting values valid, or select [Abort] to abort them by pressing the [△] key, and press the [ENT] key.
The SET UP mode finishes, and several seconds after, the mode returns to the operation mode.

4.8.7 Dot-Position Adjustment (Dot-Printing Model)

It is recommended to adjust the position of dots at least once a year.

Adjusting procedure

(1) Turn the recorder power on and allow a warm-up time of more than 30 minutes.

(2) Check that the environmental conditions are within normal operating ranges (refer to 4.8.6).

(3) To enter the SET UP mode, turn the power switch off, and turn on again while pressing the [ENT] key.

(4) Select [P_Adj] by pressing the [△] key, and press the [ENT] key.

(5) Select [nULL] (leftward movement) or [FULL] (rightward movement) or [HYS] (movement toward the center of dotted line) by pressing the [△] key, and press the [ENT] key.
Selection and adjustment should be made in the order of HYS→NULL→FULL.

(6) First, the HYS should be adjusted. A zigzag line will be drawn in the center area of the chart. When the line is as Figure a, increase the set value, but in case of Figure b, decrease it.

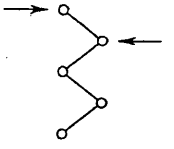


Figure a

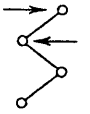


Figure b

The arrows show the moving direction of the printer head.

The setting consists of a number of five digits.
Select the digit by pressing the [▷] key, and select a numeral by the [△] key; the setting range is –7 to 7. Finally press the [ENT] key after all codes are entered.
The dot position movement corresponding to [1] is 0.1 mm.

NOTE If the [ENT] key is pressed while setting the numeric codes, the indication returns to [HYS], and the numeric codes already set stay valid. However, pressing the [ESC] key turns them invalid.

(7) The indicator displays [-SET-], and the dot carriage will move to the adjusted position.
Confirm the dot carriage position and press the [ENT] key.

(8) The indication returns to [HYS] and recording stops. If the recording position is illegal, press the [ENT] key and repeat step (6); if correct, press the [△] key and select [nULL] or [FULL].

(9) Next, the NULL and FULL should be adjusted. Increase or decrease the setpoint value to make the dot position accurately overlap the graduated line of the chart.
The setting consists of is a number of five digits.
The setting range is 1 to 15 for NULL, and 970 to 1030 for FULL. Finally press the [ENT] key after all codes are entered.
The dot position movement corresponding to [1] is 0.1 mm. Decreasing the numeral moves the dot position leftward, and increasing moves it rightward.

NOTE If the [ENT] key is pressed while setting the numeric codes, the indication returns to [nULL] or [FULL], and the numeric codes already set stay valid. However, pressing the [ESC] key turns them invalid.

(10) The indicator displays [-SET-], and the dot carriage will move to the adjusted position.
Confirm the dot carriage position and press the [ENT] key.

(11) The indication returns to [nULL] or [FULL]. When you want to carry out the position adjustment again, press the [ENT]key and carry out step (9) again. When another adjustments are required, select [nULL], [FULL] or [HYS] again by pressing the [△] key. In order to finish the adjustment, press the [ESC] key to return to the [P_Adj] indication.

(12) Before leaving the SET UP mode, its contents should be stored.
Select [End] by pressing the [△] key, and press the [ENT] key.

(13) Select [StorE] to keep setting values valid, or select [Abort] to abort them by pressing the [△] key, and press the [ENT] key.
The SET UP mode finishes, and several seconds after, the mode returns to the operation mode.

Chapter 5 DATA SETTING GUIDES

This chapter describes the setting modes listed below and how to enter setting data to the recorder. Values shown in parentheses are default values.
Read this chapter before you enter settings for the first time.

5.1 Various Modes

The recorder has three modes which are described below:

Operation mode

This is the mode for daily operation; when the power turns on, the recorder automatically enters this mode. For details, refer to "Chapter 4 DAILY OPERATION AND MAINTENANCE".

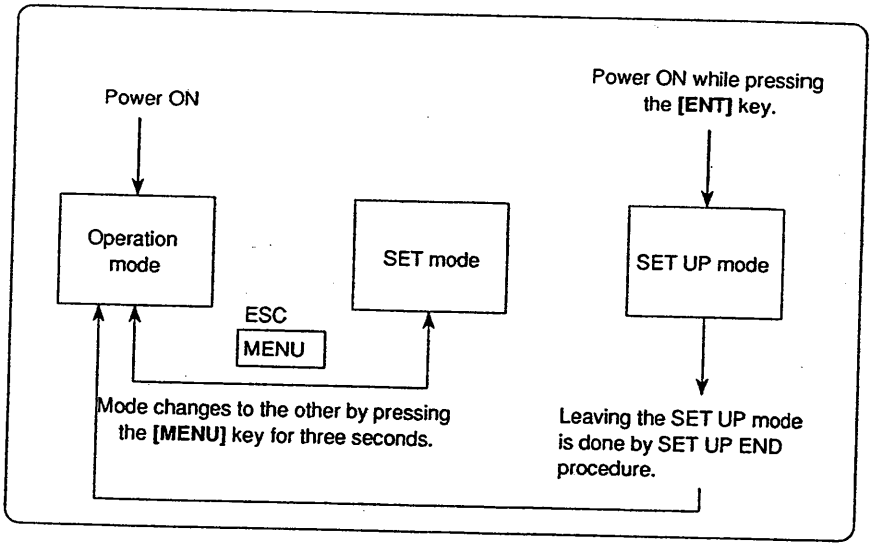
SET mode

In this mode, daily-used data such as alarm setpoints, date, and time are set. Pressing the [MENU] key three seconds in the operation mode changes the mode to the SET mode.

SET UP mode

In this mode, interface functions for communication are set, and pen or dot-printing position are adjusted. You can enter this mode by turning the power on while pressing the [ENT] key.

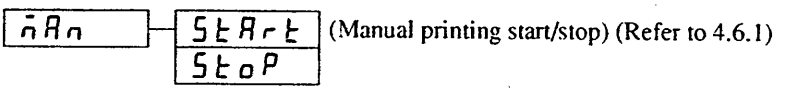
NOTE While in the SET mode, measurement, recording, and alarm detection are not carried out.



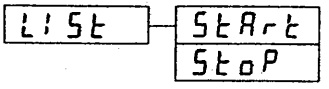
5.1.1 Operation Mode

Select the following functions by pressing the keys on the key panel.

[PRINT] key

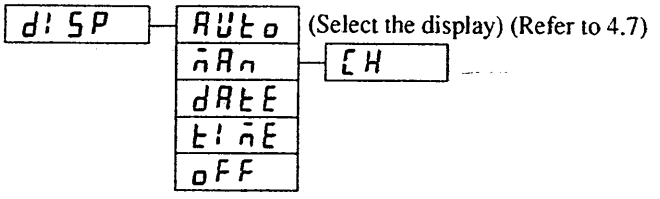


(Manual printing start/stop) (Refer to 4.6.1)

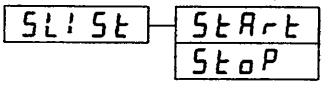


(List printing start/stop) (Refer to 4.6.2)

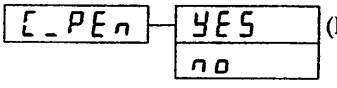
[MENU] key



(Select the display) (Refer to 4.7)



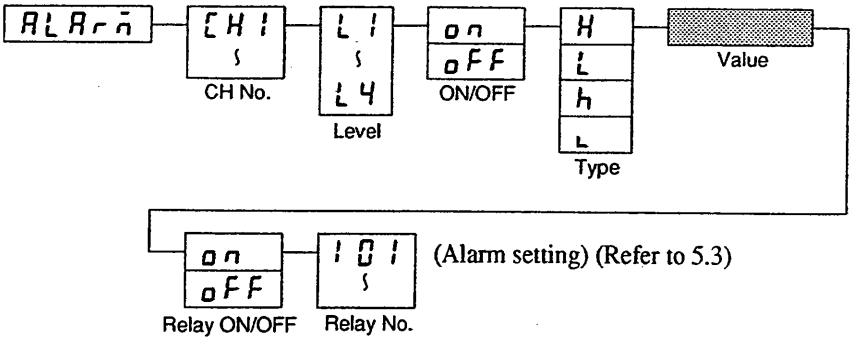
(SET UP list printing start/stop) (Refer to 4.6.3)



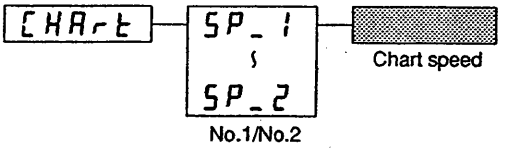
(Pen replacement, only for pen model) (Refer to 4.3)

5.1.2 SET Mode

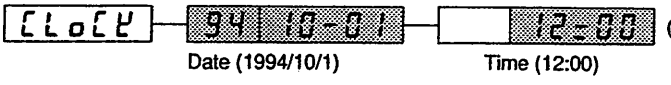
This flow can be entered by pressing the [MENU] key for three seconds.



(Alarm setting) (Refer to 5.3)



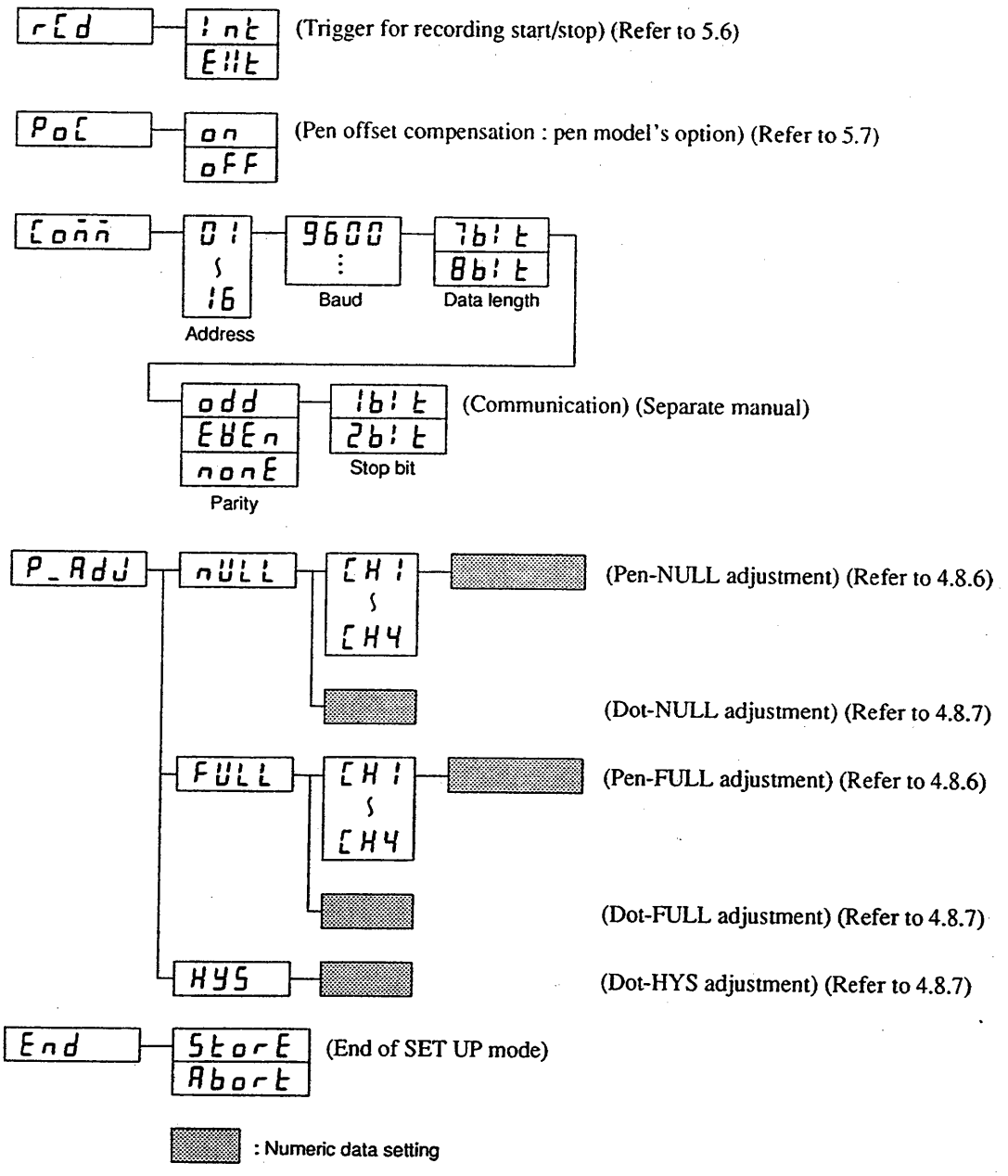
(Chart speed) (Refer to 5.4)



(Date, time setting) (Refer to 5.5)

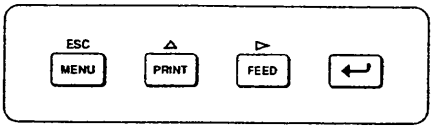
: Numeric data setting

5.1.3 SET UP Mode



5.2 Procedures to Enter Setting Data

Data setting is done by the four keys on the key panel which are referred to by the marks on the keys.



ESC MENU [ESC] key : Cancels the already set data in the middle of a setting; after canceling, the previous indication will be shown on the indicator.

PRINT [△] key : Selects parameters of any setting, or selects any numeric characters in case of alarms or date/time.

FEED [▷] key : Moves the cursor to the next digit while entering parameters. Since there is no backspace key provided, this key will move to the first digit after the last digit.

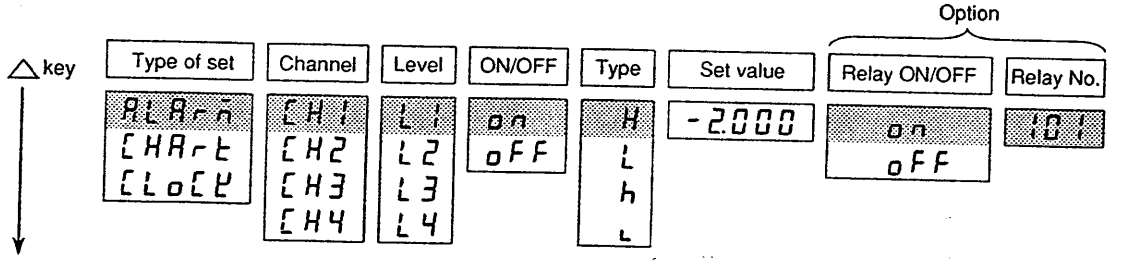
[ENT] key : Confirms a set value for entry. Pressing the key moves the indication to the next setting display.

5.3 Setting Alarms

Alarms can be set on the measured data of any channel.
Up to four alarms (i.e. four levels) can be set on one channel.
After setting an alarm, and the measured value reaches the setpoint, the ALM LED will be illuminated and an alarm printout will be made on the chart. (Refer to 1.2.)

H : High alarm	Occurs when a measuring value is over the alarm setpoint.
L : Low alarm	Occurs when a measuring value is under the alarm setpoint.
h : Difference high-limit alarm	Alarm is geneated when the difference between the measured values of two channels is more than the alarm setting. (This type of arlam can only be set when the corresponding channel is of the DELT-type.)
l : Difference low-limit alarm	Alarm is generated when the difference between the measured values of two channels is less than the alarm setting. (This type of alarm can only be set when the corresponding channel is of the DELT-type.)

Menu



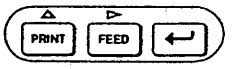
Key operation	Indication	Description
ESC MENU 3 sec, PRINT, ↵	ALArn	Enter the set mode by pressing the [MENU] key for three seconds. Select [ALArn] by pressing the [△] key, and press the [ENT] key.
PRINT, ↵	CH1	Select a channel by the [△] key, and press the [ENT] key.
PRINT, ↵	1 L1	Select an alarm level by the [△] key, and press the [ENT] key. Up to four levels can be set.
PRINT, ↵	11 on	Select ON/OFF of the alarm settings by the [△] key, and press the [ENT] key. Setting [oFF] shows [ALArn] and ends this setting.
PRINT, ↵	11 H	Select a type of alarms by the [△] key, and press the [ENT] key.

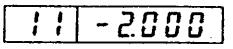
NOTE Alarm settings are automatically canceled on the affected channel, when any of the following changes occur:

- the input type (VOLT, TC, etc.) or input range (2 V, etc.) is changed.
- decimal point for linear scalling and square root is changed.
- minimum or maximum value of the recording span is changed (in case of linear scaling and square root).
- minimum or maximum value of the scale is changed (in case of linear scaling and square root).

Difference alarm setting (h, l)are canceled when any of the following changes occur:

- the reference channel is changed.
- the input type or range of the reference channel is changed.



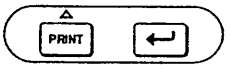


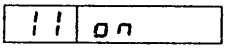
The display which appears will allow you to enter the alarm value.
Set the alarm value using the [△] and [▷] keys. After setting, press the [ENT] key.
The decimal point is predetermined by the input range.

Table 5.1 Relationship between Input Range and Decimal Points

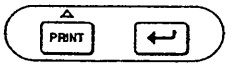
Type of Input		Standard Range Codes	Position of Decimal Point
DC Voltage	-20.00 to 20.00 mV	-00/-30/-40	XXX. XX
	-200.0 to 200.0 mV	-01/-31/-41	XXXX. X
	-2.000 to 2.000 V	-02/-32/-42	XX. XXX
	-6.000 to 6.000 V	-03/-33/-43	XX. XXX
	-20.00 to 20.00 V	-04/-34/-44	XXX. XX
Thermocouple/RTD		-10 to -21	XXXX. X

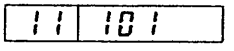
The following settings are available only for the model with relay options (A1/A2/A3). For models without these options, the alarm setting ends by pressing the [ENT] key until [ALArn] appears.





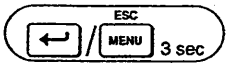
Determines whether the relay outputs a signal or not when an alarm occurs.
Select ON/OFF by the [△] key, and press the [ENT] key.





Sets the number of the relay after the alarm output ON is selected. A numeric to be set is selected from I01 to I12 by the [△] key. Then press the [ENT] key.

NOTE If a number larger than the available number of output relays is selected, the alarm output will not implemented.



The setting ends with the [ALArn] indication.
When you want to set alarm settings for other channels continuously, press the [ENT] key to return to thechannel setting.
In order to return to the operation mode, press the [MENU] key for three seconds.

NOTE

- As a merged function, a combination of remote control option (/R1) and alarm output relay option is available to change the chart speed when an alarm occurs.
- If you press the [ESC] key in the middle of setting, the indication returns to the [ALArn] and already set data will be aborted.

5.4 Setting Chart Speed

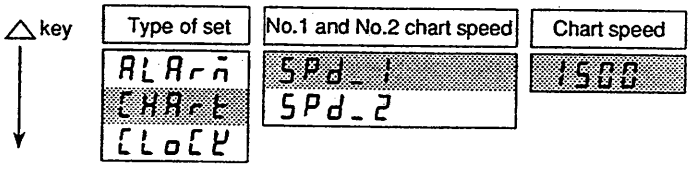
Relationships between chart speeds and their code numbers are shown in Table 5.2.

Table 5.2 Chart Speed (unit: mm/h)

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

The data for a dot-printing model (10 mm/h to 1500 mm/h) are shown within the thick lined area.

Menu



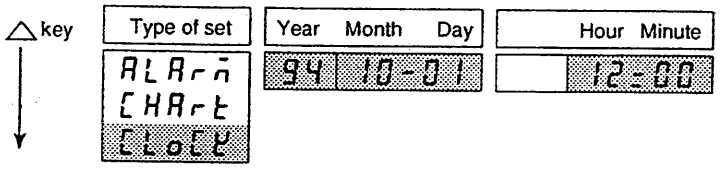
Key operation	Indication	Description
ESC MENU 3 sec △ PRINT ↵	CHArt	Press the [MENU] key for three seconds to enter the SET mode, and select [CHArt] using the [△] key. Then press the [ENT] key.
△ PRINT ↵	SPd_1	Using the [△] key, select one of the two kinds of chart speed, the No.1 and No.2 chart speeds. Then press the [ENT] key. **NOTE** The No.2 chart speed identifies the chart speed which takes effect in case the speed is changed by remote control (optional function). For models without the remote control function, the setting of the No.2 chart speed is invalid.
△ PRINT ↵	1500	Select a numeric code referring to Table 5.2 using the [△] key and press the [ENT] key. **NOTE** Digital printing will not be carried out when the chart speeds are: 1800 mm/h or more for a pen model 120 mm/h or more for a dot-printing model When a pen model uses a fast chart speed such as 600 mm/h to 1500 mm/h, the position error of the time tick of a periodic printout may become as large as 2 cm for 1500 mm/h.
ESC ↵/MENU 3 sec	CHArt	The setting ends with the [CHArt] indication. When you want to set another chart speed continuously, press the [ENT] key. In order to return to the operation mode, press the [MENU] key for three seconds.

NOTE If you press the **[ESC]** key in the middle of setting, the indication returns to the [CHArt] and already set data will be aborted.

5.5 Setting Date/Time (Clock)

Menu

An example of the date and time setting procedure is shown below:



Key operation	Indication	Description
ESC MENU 3 sec / PRINT ↵	CLoCK	Press the [MENU] key for three seconds to enter the SET mode, and select [CLoCK] by pressing the [△] key. Then press the [ENT] key.
PRINT FEED ↵	94 10-01	First, set the year, month and day. The two digits on the left side of the display (three in case of dot model) indicate the year. The five digits on the right side of the display indicate the month and day. After finishing the setting, press the [ENT] key.
PRINT FEED ↵	12:00	Set the hour and minutes. After finishing, press the [ENT] key. The seconds will be automatically set to 0.
↵ / ESC MENU 3 sec	CLoCK	The setting ends with the [CLoCK] indication. In order to return to the operation mode, press the [MENU] key for three seconds.

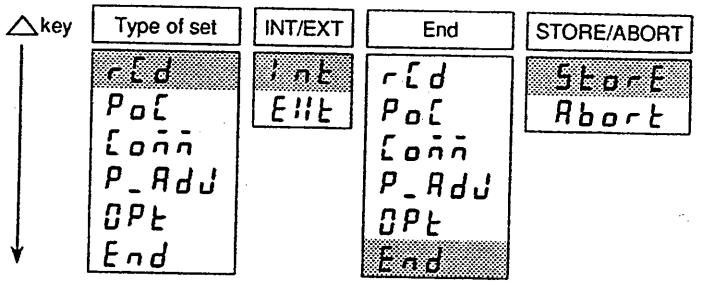
NOTE If you press the [ESC] key in the middle of setting, the indication returns to the [CLoCK] and already set data will be aborted.

5.6 Setting Triggers for Recording Start/Stop

The start/stop of recording can be triggered by the [RCD] key on the key panel (as internal trigger: INT) as well as by a remote control signal (as external trigger: EXT).
The default value is 'INT' (trigger by the [RCD] key).

NOTE If 'EXT' is not selected, triggers from the remote control (option) will not be implemented to start/stop the recording.

Menu

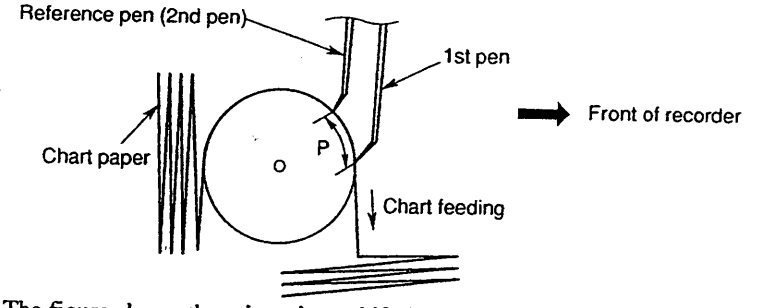


Key operation	Indication	Description
Power ON	rCd	Turn the power ON while pressing the [ENT] key to enter the SET UP mode, and select [rCd] using the [△] key. Then press the [ENT] key.
PRINT	Int	Select [Int] (INT) or [Ext] (EXT), and press the [ENT] key.
PRINT	End	The indicator shows [rCd] of the SET UP mode menu. In order to finish the setting, select [End] using the [△] key, and then press the [ENT] key.
PRINT	StorE	Select [StorE] (STORE) for set data valid or [Abort] (ABORT) for invalid using the [△] key, then press the [ENT] key. The setting process returns to the operation mode to begin normal recording.

NOTE If you press the **[ESC]** key in the middle of setting, the indication returns to the [rCd] and already set data abort.

5.7 Setting Pen Offset Compensation (Only for Pen Model)

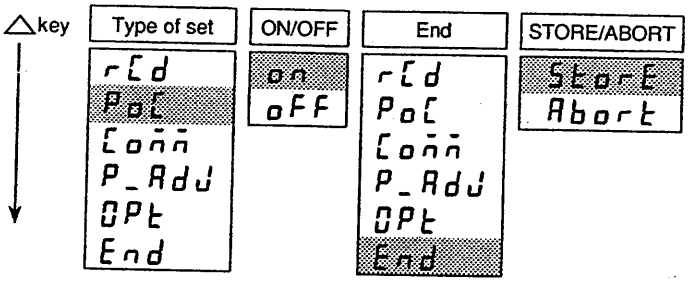
Pen offsets are phase deviations (phase shifts) on the time axis, which are produced on a two-, three-, or four-pen model.
The pen offset compensation function is used to eliminate those deviations between the pens referring to the time axis.
The compensation function is described below; the figure shows an example between two pens, but the description is similar for three- or four-pen model.



The figure shows there is a phase shift (P) between two pens, so the recording of both pens are not aligned horizontally even when recordings are made at the same time.
The recorder with the pen offset compensation function has a memory. The data of the channels other than that of the reference pen are temporarily stored in the memory, and written on the chart after the chart is fed length corresponding to the phase shift (P).

NOTE
- When the recording is stopped, chart feeding also stops, and data stored in the memory will not be recorded.
- The compensation applies to the pens other than the reference one, so those pens sometimes appear to be malfunctioning. Immediately after the recording starts, only the reference oen operates but the other pens do not start; this is not a recorder defect.

Menu



Key opreration	Display	Description
[↵] Power ON	PoC	Turn the power ON while pressing the [ENT] key to enter the SET UP mode, and select [PoC] using the [△] key. Then press the [ENT] key.
[PRINT] [↵]	on	Select ON or OFF. Then press the [ENT] key. The display [PoC] will appear. You can now adjust other settings in the SET UP Mode, by using the [△] key.
[PRINT] [↵]	End	Before leaving the SET UP Mode, you have to store your new settings. Press the [△] key until the display [End] will appear.
[PRINT] [↵]	StorE	Press the [ENT] key. Select [StorE] to keep your new settings or [Abort] and press the [ENT] key. After a few seconds, the Operation Mode will appear.

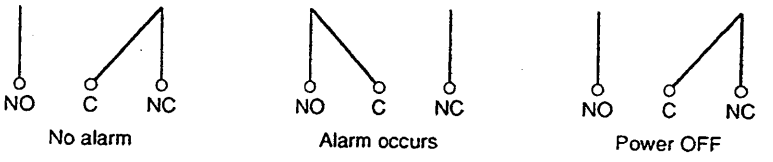
NOTE If you press the **[ESC]** key in the middle of setting, the indication returns to the [PoC] and already set data will be aborted.

Chapter 6 OTHER OPTIONS

This chapter outlines the following optional functions. Operating procedures are not shown; therefore, you may skip paragraphs if not applicable.

6.1 Alarm Outputs

The recorder outputs contact signals when an alarm occurs. The output relays adopt the energizing system.



6.2 FAIL/Chart End Detection

If an error of the CPU (central processing unit) or the end mark of the chart is detected, the recorder outputs contact signals.
Respective relay contact outputs are provided for each FAIL and chart end detection.
Refer to 2.2.5 for the wiring.

FAIL

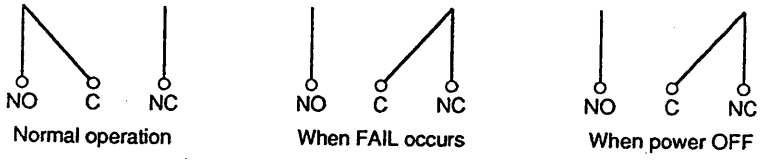
If an error occurs in the CPU, a relay contact signal is output; however, the error will not be shown on the indicator.
This relay is of the de-energize type; so the signal is also output when the power turns off (such as in case of power failure). Relay terminal connection is shown in figures below.
If a relay signal is output even when the power turns on, contact your sales representative or YOKOGAWA Sales and Service Offices listed on the back cover.

Chart end detection

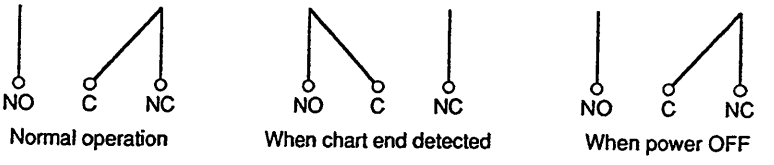
When the remaining chart reduces to approximately 2 cm, the recording stops automatically with an indication of [CHArt], and a relay contact signal is output.
This relay output is an energize type (refer to the figures below).
For the replacement of chart, refer to 4.2.

Relay terminal connection

Relay output for FAIL (de-energize type)



Relay output for chart end (energize type)



6.3 Remote Control Functions

The following functions are carried out by remote-controlled input signals (contact signals):

Remote-input terminal	Functions
No.1	Recording start/stop
No.2	Change of chart speed
No.3	Manual printing
No.4	Printout message 1
No.5	Printout message 2

NOTE In order to implement the remote control for recording start/stop, select 'EXT' as described in '5.6 Setting Triggers for Recording Start/Stop.'

6.4 Burnout Functions

If a wire disconnection (burnout) occurs in a thermocouple circuit, this function moves the measuring value upward or downward on the scale. The moving direction is the same for every channel.

Chapter 7 SPECIAL FUNCTION

7.1 SET UP Mode

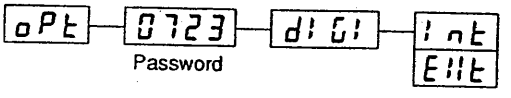
When entering the password in the SET UP Mode, the following settings can be done.

- Setting the Periodic Printout trigger
  Selecting the periodical printout by internal time (INT) or by optional remote control (EXT).

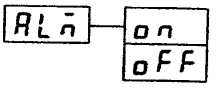
- Selecting the alarm printout ON/OFF
  Select whether to print the alarm printout on occurrence and recovery of an alarm.

- Selecting to change the range
  When this setting is ON, changing the range becomes possible. Futhermore, the settings described on the following pages become valid.

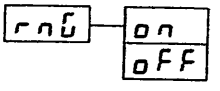
When entering the password, the [oPt] menu of the SET UP Mode will be as follows.



(Select the periodic printout trigger) (Refer to 7.1.1)



(Setting alarm printout ON/OFF) (Refer to 7.1.2)



(ON/OFF) (Refer to 7.1.3)

7.1.1 Select to Trigger the Periodic Printout

The periodic printout should be triggered internally or externally.
If you select EXTernal, you need the REMOTE option.

NOTE The periodic printout will not be printed out when the chart speed is set as follows.
PEN MODEL: 5 to 9mm/h and exceeding 1500mm/h
DOT MODEL: 5 to 9mm/h and exceeding 100mm/h

SETTING PROCEDURE:
Enter the SET UP Mode by turning 'ON' the power while pressing and holding the [ENT] key until the [rEd] display appears.

Use the [△] key to select the display [oPt]. Press the [ENT] key.

Input the password, which is '0723'. Press the [ENT] key.

Use the [△] key to select the display [dI SI]. Press the [ENT] key.

Select [I nt] (in the case of internal triggering) or [Ext] (in the case of external triggering). Press the [ENT] key.
Note that in case of [I nt], the relation between the chart speed and the printing intervals of periodic printouts will be as shown in the table below.

Pen Model

Chart Speed	Printing Interval of Periodic Printout
5 to 9 mm/h	no printout
10 to 18 mm/h	every 8 hours
20 to 36 mm/h	every 4 hours
40 to 72 mm/h	every 2 hours
75 to 135 mm/h	every hour
150 to 180 mm/h	every 30 minutes
200 to 320 mm/h	every 20 minutes
360 to 1500 mm/h	every 10 minutes
more than 1500 mm/h	no printout

Dot Model

Chart Speed	Printing Interval of Periodic Printout
1 to 9 mm/h	no printout
10 to 19 mm/h	every 8 hours
20 to 39 mm/h	every 4 hours
40 to 79 mm/h	every 2 hours
80 to 100 mm/h	every hour
101 to 1500 mm/h	no printout

The display [oPt] will appear. You can now adjust other settings in the SET UP Mode, by using the [△] key.

Before leaving the SET UP Mode, you have to store your new settings. Press the [△] key until the display [End] will appear.

Press the [ENT] key. Select [Stor E] to keep your new settings or [Abort] and press the [ENT] key. After a few seconds, the Operation Mode will appear.

NOTE If you press the **[ESC]** key in the middle of a setting, the indication returns to the [oPt] and already set data will be aborted.

7.1.2 Select the Alarm Printout ON/OFF

When alarms occur, the channel number, type of alarm and ON/OFF time can be printed on the right side of the chart. It is selectable to get the ON/OFF time of alarms (ON1), the ON time only (ON2) or to get no printout (OFF). Note that alarms will not be printed when the chart speed is as shown below.

Pen Model: more than 1599mm/h
Dot Model: more than 100mm/h

SETTING PROCEDURE:

Enter the SET UP Mode by turning 'ON' the power while pressing and holding the [ENT] key until the [rCd] display appears.

Use the [△] key to select the display [oPt]. Press the [ENT] key.

Input the password, which is '0723'. Press the [ENT] key.

Use the [△] key to select the display [Arn]. Press the [ENT] key.

Select [on1], [on2] or [oFF]. Press the [ENT] key.

The display [oPt] will appear. You can now adjust other settings in the SET UP Mode, by using the [△] key.

Before leaving the SET UP Mode, you have to store your new settings. Press the [△] key until the display [End] appears.

Press the [ENT] key. Select [Stor E] to keep your new settings or [Abort] and press the [ENT] key. After a few seconds, the Operation Mode will appear.

NOTE If you press the [ESC] key in the middle of a setting, the indication returns to the [oPt] and already set data will be aborted.

7.1.3 Setting to Change the Range to ON

This allows you to change the range, and also to enter zone settings, etc.

SETTING PROCEDURE:

Enter the SET UP Mode by turning 'ON' the power while pressing and holding the [ENT] key until the [rEd] display appears.

Use the [△] key to select the display [oPt]. Press the [ENT] key.

Input the password, which is '0723'. Press the [ENT] key.

Use the [△] key to select the display [rnG]. Press the [ENT] key.

Select [on]. Press the [ENT] key.

The display [oPt] will appear. You can now adjust other settings in the SET UP Mode, by using the [△] key.

Before leaving the SET UP Mode, you have to store your new settings. Press the [△] key until the display [End] will appear.

Press the [ENT] key. Select [Stor E] to keep your new settings or [Abort] and press the [ENT] key. After a few seconds, the Operation Mode will appear.

NOTE If you press the **[ESC]** key in the middle of a setting, the indication returns to the [oPt] and already set data will be aborted.

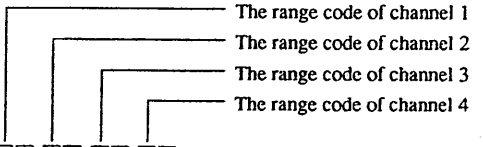
7.2 SET Mode

By setting to change the range to ON in the SET UP Mode, the following settings become valid.

- Range/Span Setting
  The following setting can be made for each channel

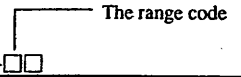
SKIP	Measurement and recording will not be done.
VOLT	Measurement and recording of the DC voltage will be done.
TC	Measurement and recording of the temperature due to thermocouple will be done.
RTD	Measurement and recording of the temperature due to RTD will be done.
Contact input	Recording of ON/OFF due to contact input/voltage change will be done.
Difference recording	Recording of the difference between 2 channels set to the same range is made.
Scaling	In case of measuring VOLT, TC or RTD, recording is done while changing the system of units (a physical amount) to match the purpose of measuement.
Square-root extraction	Calculates the square root of the DC voltage input for the scaling recording of the results.

NOTE The input types which can be measured are limited according to the type of recorder.
Confirm your type of recorder by its nameplate (refer to 1.2.2)



Pen Model 43650□-□□-□□-□□-□□-□□

Range code	Input type which can be measured
0□	Voltage
1□	Voltage, thermocouple, RTD, contact input
2□	Voltage, thermocouple, RTD, contact input
3□	Voltage
4□	Voltage



Dot Model 4365□□-□□

Range code	Input type which can be measured
0□	Voltage
1□	Thermocouple, Contact input
20, 21	Voltage, Thermocouple, RTD (JPt100, Pt100) Contact input
22	Voltage, Thermocouple, RTD (JPt50), Contact input
23 to 29	Voltage, Thermocouple, RTD (Cu10, Cu25) Contact input
3□	Voltage
4□	Voltage
6□	Voltage
7□	Voltage, Thermocouple, Contact input
8□	Voltage, Thermocouple, RTD, Contact input

- Alarm Setting

- Units Setting
  It is possible to set any unit for the channels set to the scaling and square-root extraction.

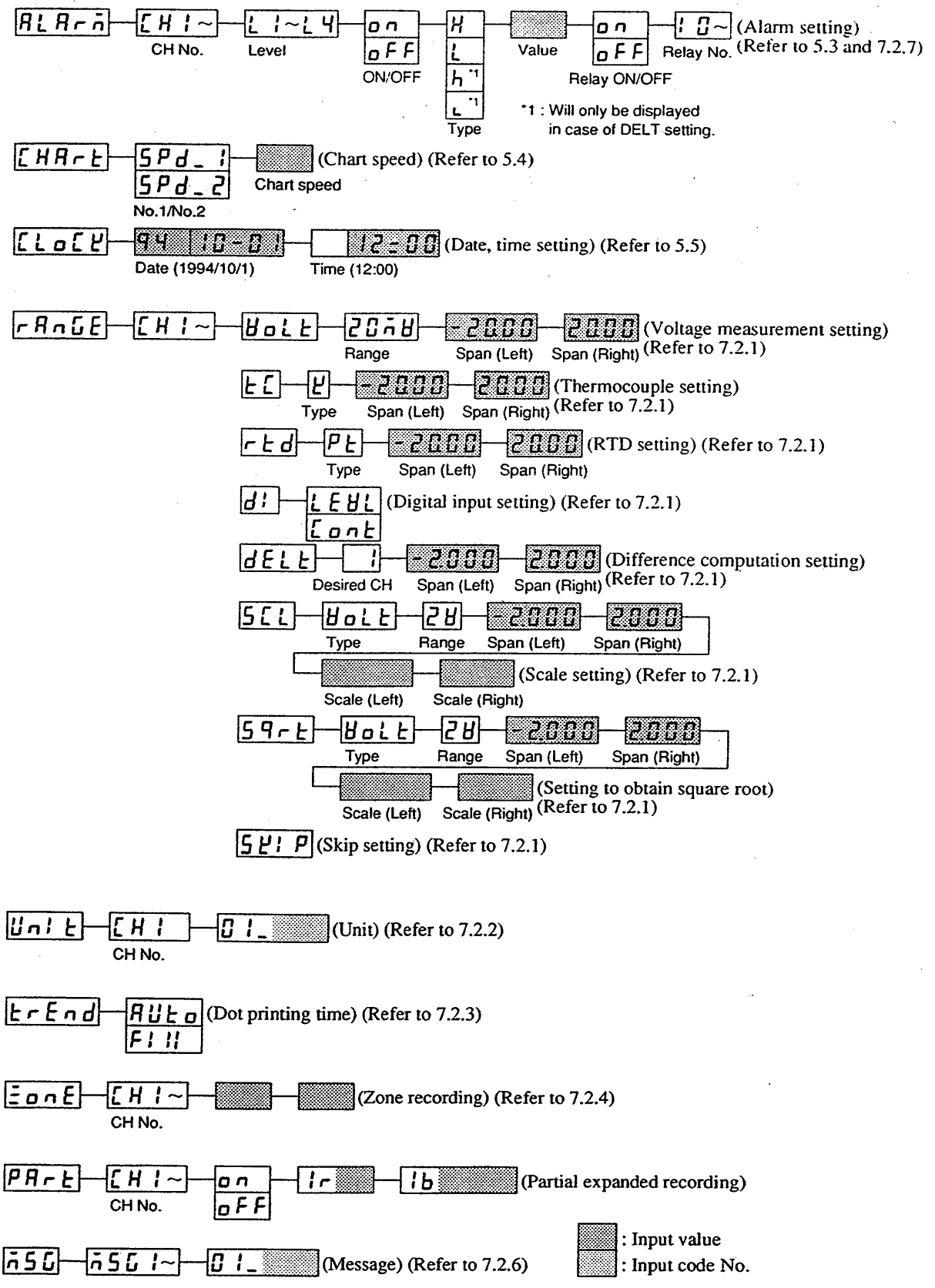
- Dot Printing Time
  The dot printing time for analog recording is selected from AUTO and FIX.
  AUTO : The dot printing time is automatically adjusted according to the chart speed so as not to overlap the dot printings on each other (10 to 90 seconds).
  FIX : Regardless of the chart speed, it is possible to perform dot printing at the highest speed.

- Zone Recording
  Zone recording allows you to get recording results which are easy to read since there is no overlapping of analog recordings.

- Partial Expanded Recording
  Partial expanded recording enables you to compress a part of the recording span.

- Message
  Up to five messages can be set.
  Messages can be printed onto the chart by remote control which is optional.

By setting to change the range to ON in the SET UP Mode, the SET Mode will become as follows.



7.2.1 How to Set Input Range and Recording Span

One of the following parameters can be set for every channel:

SKIP	Prevents the specified channel from being measured, recorded and displayed.
VOLT	Measures and records DC-voltage.
TC	Measures and records temperatures using Thermocouple.
RTD	Measures and records temperatures using Resistance Temperature Detector.
DI	Accepts Digital Input (contact/voltage level) and performs ON/OFF recording.
DELT	Performs difference computation between two channels which have same input range.
SCL	Performs scaling on voltage, TC and RTD measurements. Scaling results in appending a different scale to the measured values.
SQRT	Takes the square root ($\sqrt{\ }$) of DC-voltage measured data.

SKIP Setting

Unused channels can be skipped, which means that these channels will not be measured, recorded or displayed.

Key operation	Indication	Description
ESC MENU 3 sec PRINT ↵	rAnGE	Press the [MENU] key for three seconds to enter the SET mode. Select the [rAnGE] display by using the [△] key. Then press the [ENT] key.
PRINT ↵	CH1	Use the [△] key to select the desired channel. Press the [ENT] key.
PRINT ↵	1 SKIP	Use the [△] key to select [SKIP]. Press the [ENT] key.
ESC ↵/MENU 3 sec	rAnGE	[rAnGE] is displayed and the setting is completed. Press the [ENT] key to set another channel; or press the [MENU] key for three seconds to return to the Operation mode.

Voltage Measurement Setting (VOLT Setting)

In the case that the measured signal is a DC-voltage, the range can be set as follows:

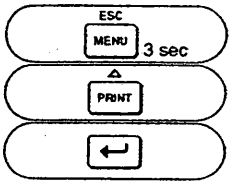
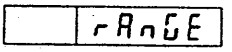
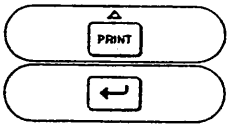
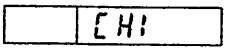
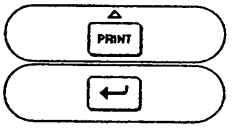
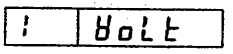
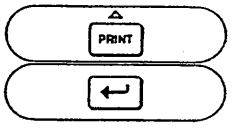
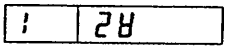
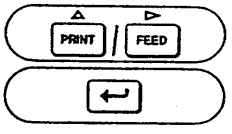
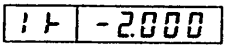
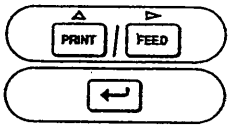
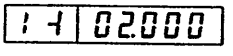
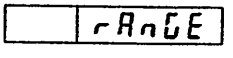
Key operation	Indication	Description
		Press the [MENU] key for three seconds to enter the SET mode. Select the [rAnGE] display by using the [△] key. Then press the [ENT] key.
		Use the [△] key to select the desired channel. Press the [ENT] key.
		Use the [△] key to select [Volt]. Press the [ENT] key.
		Select the desired range using the [△] keys and press the [ENT] key.

Table 7.1 VOLT Input Ranges

Display	Range
20mV	-20.00 to 20.00mV
60mV	-60.00 to 60.00mV
200mV	-200.0 to 200.0mV
2V	-2.000 to 2.000V
6V	-6.000 to 6.000V
20V	-20.00 to 20.00V

		Select the minimum value of the recording span (SPAN L) using the [△] and [▷] keys. Then press the [ENT] key.
		The display which appears will allow you to enter the maximum value of the recording span (SPAN R). Select it the same way as for the minimum value and press the [ENT] key. Note that the recording span cannot be beyond the input range, nor can SPAN L be equal to SPAN R.
		[rAnGE] is displayed and the setting is completed. Press the [ENT] key to set another channel; or press the [MENU] key for three seconds to return to the Operation mode.

Thermocouple and Resistance Temperature Detector Setting (TC, RTD Setting)

In the case that the measured signal is a TC (Thermocouple) or RTD (Resistance Temperature Detector) the range can be set the same way as if it were a DC-voltage.

Key operation	Indication	Description
ESC MENU 3 sec PRINT ↵	rAnGE	Press the [MENU] key for three seconds to enter the SET mode. Select the [rAnGE] display by using the [△] key. Then press the [ENT] key.
PRINT ↵	CH1	Use the [△] key to select the desired channel. Press the [ENT] key.
PRINT ↵	1 tC	Use the [△] key to select [tC], or [rtd]. Press the [ENT] key.
PRINT ↵	1 r	Select the desired type (R, S, B, K, E, J, T, N, W, L, U in case of TC, or PT, JPT in case of RTD) using the [△] key and press the [ENT] key.

Table 7.2 TC Type Description and RTD Type Description

TC Type Description		
	Range	
r	0.0 to 1760.0°C	32 to 3200°F
S	0.0 to 1760.0°C	32 to 3200°F
b	0.0 to 1820.0°C	32 to 3308°F
H	-200.0 to 1370.0°C	-328 to 2498.0°F
E	-200.0 to 800.0°C	-328.0 to 1472.0°F
J	-200.0 to 1100.0°C	-328.0 to 2012.0°F
t	-200.0 to 400.0°C	-328.0 to 752.0°F
n	0.0 to 1300.0°C	32 to 2372°F
U	0.0 to 2315.0°C	32 to 4199°F
L (Fe-CuNi)	-200.0 to 900.0°C	-328.0 to 1652.0°F
U (Cu-CuNi)	-200.0 to 400.0°C	-328.0 to 752.0°F
PLt (Platinel)*1	0.0 to 1900.0°C	32 to 3452°F
Pr (Pr 40-20)*1	0.0 to 1400.0°C	32 to 3552°F

*1 : for /N1 model

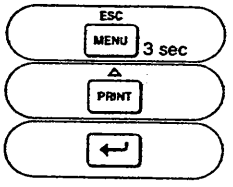
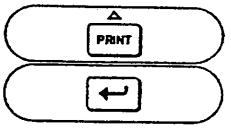
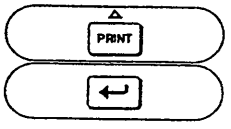
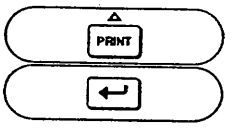
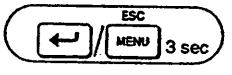
RTD Type Description			
		Range	
Pt	(pt100Ω)	-200.0 to 600.0°C	-328.0 to 1112.0°F
JPt	(Jpt100Ω)	-200.0 to 550.0°C	-328.0 to 1022.0°F
JP50	(JPt50)*1	-200.0 to 600.0°C	-328.0 to 1112.0°F
CU1 to 5	(Cu10Ω)*2	-200.0 to 300.0°C	-328.0 to 572.0°F
CU25	(Cu25Ω)*2	-200.0 to 300.0°C	-328.0 to 572.0°F

*1 : for /N3 model
*2 : for /N1 model
– : The Pt and JPt type can't be set together with the Cu type.
Cu1 : Cu 10Ω GE
Cu2 : Cu 10Ω L & N
Cu3 : Cu 10Ω WEED
Cu4 : Cu 10Ω BAILAY
Cu5 : Cu 10Ω α=0.00392 at 20°C
Cu6 : Cu 10Ω α=0.00393 at 20°C
Cu25 : Cu 25Ω α=0.00425 at 0°C

PRINT / FEED ↵	1L 00000 1H 17600	Select the desired minimum value (SPAN L) and maximum value of the recording span (SPAN R) in the same way as described under **'VOLT setting'**. Note that the recording span cannot be beyond the input range, nor can SPAN L be equal to SPAN R.
ESC ↵ / MENU 3 sec	rAnGE	[rAnGE] is displayed and the setting is completed. Press the [ENT] key to set another channel; or press the [MENU] key for three seconds to return to the Operation mode.

Digital Input Setting (DI Setting)

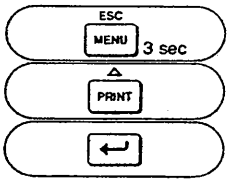
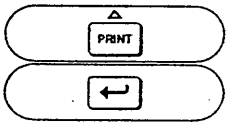
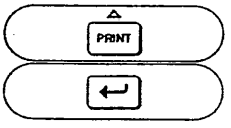
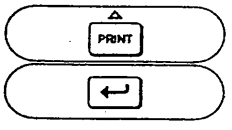
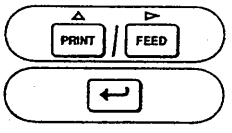
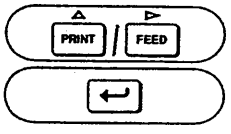
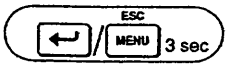
If a Digital Input (contact input/voltage level input) is being used, the setting can be done as follows:

Key operation	Indication	Discription
	rAnGE	Press the [MENU] key for three seconds to enter the SET mode. Select the [rAnGE] display by using the [△] key. Then press the [ENT] key.
	CH1	Use the [△] key to select the desired channel. Press the [ENT] key.
	1 dI	Use the [△] key to select [dI]. Press the [ENT] key.
	1 LEVL	There are two types, namely LEVEL and CONTACT. **LEVL**: (VOLT) Records ON/OFF status of a voltage input (0 to 2.4V is OFF (0), 2.4V and higher is ON (1)). **CONT**: (Contact) Records ON/OFF status of a contact (close is ON (1), open is OFF (0)). Select the desired type using the [△] key and press the [ENT] key.
	rAnGE	[rAnGE] is displayed and the setting is completed. Press the [ENT] key to set another channel; or press the [MENU] key for three seconds to return to the Operation mode.

NOTE The above mentioned selections will result in a recording trace from 0mm to 100mm between the contact statuses OFF and ON, which is from the extreme left side of the chart to the extreme right side. If desired, a zone for the ON/OFF recording can be set. See 7.2.4.

Difference Computation Setting (DELT Setting)

To obtain the difference between the measured values of two channels, proceed as follows. Note that this setting can only be applied if the reference channel is of the VOLT, TC or RTD type.

Key Operation	Indication	Discription
	rAnGE	Press the [MENU] key for three seconds to enter the SET mode. Select the [rAnGE] display by using the [△] key. Then press the [ENT] key.
	CH2	Use the [△] key to select the desired channel. Note that channel No.1 cannot be of the 'DELT' type. Press the [ENT] key.
	2 dELt	Use the [△] key to select [dELt]. Press the [ENT] key.
	2 1	The display which appears will allow you to enter a reference channel number. Note that the reference channel number must be lower than that of the channel being set. Therefore channel No.1 cannot be of the [dELt] type. Use the [△] key to select the desired reference channel number. Press the [ENT] key.
	2H -2.000	The display which appears will show the same minimum value of the recording span as of the reference channel. Use the [△] and [▷] keys to select the minimum value. Press the [ENT] key. Note that in case of VOLT, the input range of the DELT-channel must be within the range of the reference channel. The difference in measured value from the reference channel will be recorded on the DELT-channel.
	2H 02.000	The display which appears will show the same maximum value of the recording span as of the reference channel. Use the [△] and [▷] keys to select the maximum value. Note that SPAN L cannot be equal to SPAN R. Press the [ENT] key. Note that in case of TC, RTD, the maximum span values can be found by taking the ±value of the input range width. E.g. input range of TC type L = –200 to 900°C: maximum span values will be at ±1100°C.
	rAnGE	[rAnGE] is displayed and the setting is completed. Press the [ENT] key to set another channel; or press the [MENU] key for three seconds to return to the Operation mode.

Scale Setting (SCL Setting)

To assign a different scale to the measured data, the range can be set as described below. Note that the measured data which can get a different scale must be of the voltage (VOLT), Thermocouple (TC) or Resistance Temperature Detector (RTD) type. To assign a unit to this new scale, refer to UNIT setting (7.2.2).

Key operation	Indication	Discription
ESC MENU 3 sec / PRINT ↵	rANGE	Press the [MENU] key for three seconds to enter the SET mode. Select the [rANGE] display by using the [△] key. Then press the [ENT] key.
PRINT / ↵	CH1	Use the [△] key to select the desired channel. Press the [ENT] key.
PRINT / ↵	1 SCL	Use the [△] key to select [SCL]. Press the [ENT] key.
PRINT / ↵	1 VOLT	Select the input type using the [△] key and press the [ENT] key.
PRINT / ↵	1 2V	Select the desired range (using the [△] key) and press the [ENT] key.
PRINT / FEED / ↵	1 L 00000	The display which appears will allow you to enter the minimum value of the recording span. Select the desired minimum value using the [△] and [▷] keys. Then press the [ENT] key.
PRINT / FEED / ↵	1 1 02.000	The display which appears will allow you to enter the maximum value of the recording span. Select it the same way as the minimum value and press the [ENT] key. Note that the decimal point will be in the same position as for SPAN L. SPAN L and SPAN R cannot be same.
PRINT / FEED / ↵	1 L -0000	This display allows you to enter the minimum value of the scale corresponding to the minimum value of the recording span. Select it using the [△] and the [▷] keys. The position of the decimal point can be moved using the [△] key in case [L] is flashing. Note that the allowable range is –20000 to 20000. Then press the [ENT] key.
PRINT / FEED / ↵	1 H 10000	This display allows you to enter the desired maximum value of the scale corresponding to the maximum value of the recording span. Select it the same way as the minimum value. Then press the [ENT] key. Note that the decimal point will be in the same position as for SCL L. SCL L and SCL R cannot be same.
↵ / ESC MENU 3 sec	rANGE	[rANGE] is displayed and the setting is completed. Press the [ENT] key to set another channel; or press the [MENU] key for three seconds to return to the Operation mode.

NOTE In this example, 0.000V input will be scaled to –100.0. 2.000V input will be scaled to 100.0.

Setting to Obtain Square Root (SQRT Setting)

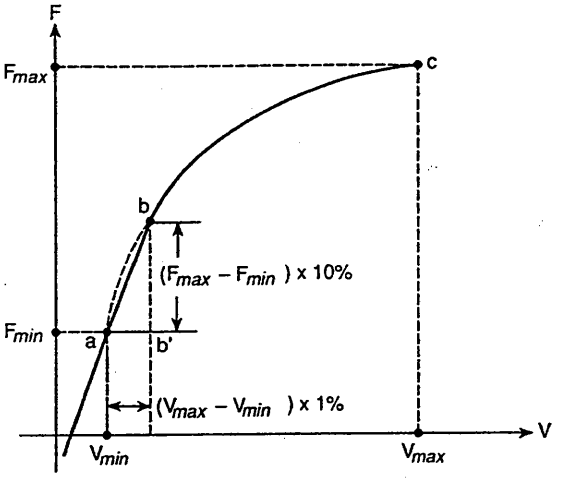
To obtain the square root of the measured value, proceed as follows:
Note that the measured data of which the square root can be taken, can only be of the voltage type. To assign a unit, refer to UNIT setting (7.2.2).

Key operation	Indication	Discription
ESC MENU 3 sec / PRINT / ↵	rAnGE	Press the [MENU] key for three seconds to enter the SET mode. Select the [rAnGE] display by using the [△] key. Then press the [ENT] key.
PRINT / ↵	CH1	Use the [△] key to select the desired channel. Press the [ENT] key.
PRINT / ↵	1 SQrt	Use the [△] key to select [SQrt]. Press the [ENT] key.
PRINT / ↵	1 2U	Select the desired range (using the [△] key) and press the [ENT] key.
PRINT / FEED / ↵	1L -2.000	The display which appears will allow you to enter the minimum value of the recording span. Select the desired minimum value using the [△] and [▷] keys. Then press the [ENT] key.
PRINT / FEED / ↵	1H 02.000	The display which appears will allow you to enter the maximum value of the recording span. Select it the same way as for the minimum value and press the [ENT] key. Note that the decimal point will be in the same position as for SPAN L. SPAN L and SPAN R cannot be same.
PRINT / FEED / ↵	1E 40000	This display allows you to enter the minimum value of the scale corresponding to the minimum value of the recording span. Select it using the [△] and the [▷] keys. The position of the decimal point can be moved using the [△] key in case [E] is flashing. Note that the allowable range is –20000 to 20000. Then press the [ENT] key.
PRINT / FEED / ↵	1J 10000	This display allows you to enter the maximum value of the scale corresponding to the maximum value of the recording range. Select it the same way as for the minimum value. Then press the [ENT] key. Note that the decimal point will be in the same position as for SCL l. SCL l and SCL r cannot be same.
↵ / ESC MENU 3 sec	rAnGE	[rAnGE] is displayed and the setting is completed. Press the [ENT] key to set another channel; or press the [MENU] key for three seconds to return to the Operation mode.

EXPLANATION OF SQUARE ROOT:

The μRS1000 uses the following square rooting-method:
Let us define the items as follows:
V_{min} = minimum value of recording span (SPAN L)
V_{max} = maximum value of recording span (SPAN R)
F_{min} = minimum value of scale (SQRT SCL l)
F_{max} = maximum value of scale (SQRT SCL r)
V_x = input voltage
F_x = scaling value

The relationship between V_x (input voltage) and F_x (scaling value) is as shown in the graph below (the graph configuration 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 between a and b, the relation is:

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

7.2.2 How to Assign Units

When you are using scaling (SCL) or the square root setting (SQRT), it is possible to assign a different unit to the scales. Up to six characters can be set.
The initial value is all spaces. To set, proceed as follows:

Key operation	Indication	Discription
ESC MENU 3 sec △ PRINT ↵	Unit	Press the [MENU] key for three seconds to enter the SET mode. Select the [Unit] display by using the [△] key. Then press the [ENT] key.
△ PRINT ↵	CH1	Specify the desired channel using the [△] key, and press the [ENT] key. If the selected channel is not of the SCL or SQRT-type, data entry will be ignored.
△ PRINT / ▷ FEED ↵	1 02_42	The maximum six characters of the unit can be set by the described code (Example is given in parentheses).
		The code number can be selected using the [△] key. After setting both numbers of a code, press the [▷] key and the sequential number of the to be set character will go up one.
↵ / ESC MENU 3 sec	Unit	[Unit] is displayed and the setting is completed. Press the [ENT] key to set another channel; or press the [MENU] key for three seconds to return to the Operation mode.

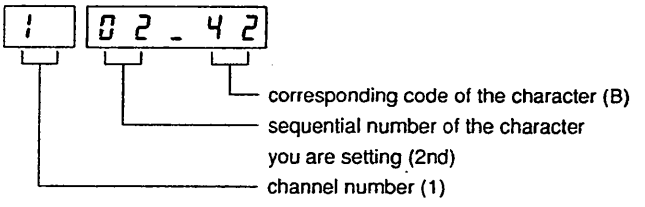
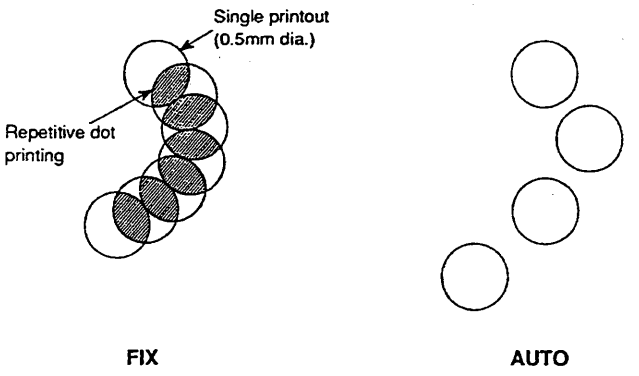


Table of characters code.

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

7.2.3 How to Adjust the Trend Recording Format (only for Dot Model)

The μRS1000 prints in FIX or AUTO mode.
In FIX mode, dot printing is performed with a constant interval regardless of the chart speed (approx. 10 sec).
AUTO mode is provided to prevent the chart from being damaged during repetitive dot printing. This mode is useful for low chart speeds. The chart is protected from damage because the printout timing changes with the chart speed (approx. 10 to 90 sec).



The initial value is 'AUTO'. To set the trend recording mode, proceed as follows:

Key Operation	Indication	Discription
ESC MENU 3 sec PRINT ↵	trEnd	Press the [MENU] key for three seconds to enter the SET mode. Select the [trEnd] display using the [△] key, and press the [ENT] key.
PRINT ↵	AUto	Specify AUTO or FIX using the [△] key. Then press the [ENT] key.
↵/ESC MENU 3 sec	trEnd	[trEnd] is displayed and the setting is completed. Press the [MENU] key for three seconds to return to the Operation mode.

7.2.4 How to Set Zone Recording

Zone recording enables you to define different bands (zones) for each channel, so the recording traces will not overlap during analog recording.
The initial value is '0 to 100mm'.
To set the zones, proceed as follows:

Key operation	Indication	Discription
ESC MENU 3 sec PRINT ENT	ZonE	Press the [MENU] key for three seconds to enter the SET mode. Select the [ZonE] display using the [△] key, and press the [ENT] key.
PRINT ENT	CH1	The display which appears will prompt you to specify the desired channel. Use the [△] key to do so and press the [ENT] key.
PRINT / FEED ENT	1L 030	Then specify the left boundary value (three digits) using the [△] key (three digits). On the chart paper this left boundary value will correspond with the left span value. (For example, if your channel 2 has a recording span of –2V to 2V, and you specify the zone to start from 30mm, then the recording at 30mm will correspond with the value of –2V.) Then press the [ENT] key. Note that the minimum width of a zone is 5mm. The left boundary must be less than the right boundary.
PRINT / FEED ENT	1H 050	The next display will prompt you to specify the right span value. Use the [△] key to do this and then press the [ENT] key. Note that scales will only be printed for 40mm and bigger zones.
ENT / ESC MENU 3 sec	ZonE	[ZonE] is displayed and the setting is completed. Press the [ENT] key to set another channel; or press the [MENU] key for three seconds to return to the Operation mode.

EXPLANATION:
The next figure shows the chart after zone recording has been set (example).

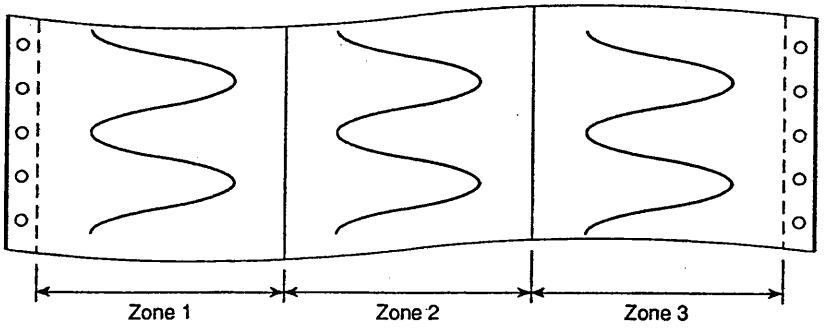
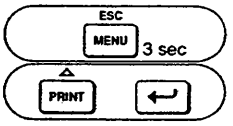
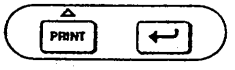
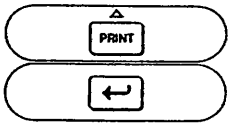
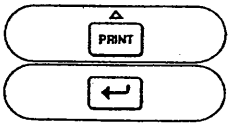
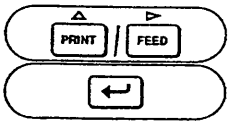


Figure 7.1 Zone Recording Example

7.2.5 How to Set Partial Expanded Recording

Partial expanded recording enables you to compress a part of the recording span, in order to examine the expanded (other) part of the range in more detail. The initial value is 'OFF'. To set partial expanded recording, proceed as follows:

Key operation	Indication	Discription
	PArt	Press the [MENU] key for three seconds to enter the SET mode. Select the [PArt] display using the [△] key, and press the [ENT] key.
	CH1	The display which appears prompts you to specify the desired channel. Use the [△] key to do so and press the [ENT] key.
	1 on	Then select ON (or OFF in case you had set partial expanded recording before and want to stop it now) using the [△] key. Then press the [ENT] key. In the case you selected OFF, the setting is completed.
	1 25	Specify the percentage (1 to 99%) of the full recording span which has to be compressed, using the [△] key. Press the [ENT] key.
	1 00000	The display which appears prompts you to set the boundary value. The boundary value corresponds to the previous set compressed part. See also figure 7.3. Set this value by using the [△] and the [▷] keys. Note that this boundary value must be within the recording span. (If scaling is ON, this value must be within the scaling range.) Then press the [ENT] key.
	PArt	[PArt] is displayed and the setting is completed. Press the [ENT] key to set another channel; or press the [MENU] key for three seconds to return to the Operation mode.

NOTE Partial Expanded settings are automatically canceled, when any of the following changes occur:

- the input type (VOLT, TC, etc.) or input range (2V, etc.) is changed.
- decimal point for linear scaling and square root is changed.
- minimum or maximum value of the recording span is changed (in case of linear scaling and square root).
- minimum or maximum value of the scale is changed (in case of linear scaling and square root).
- the reference channel is changed.
- the input type or range of the reference channel is changed.

EXPLANATION:

The next figures show the recordings before and after the above settings have been completed:

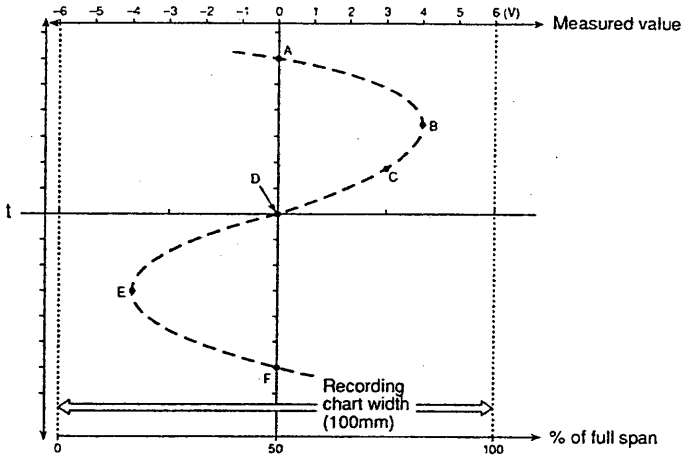


Figure 7.2 Normal Recording Example

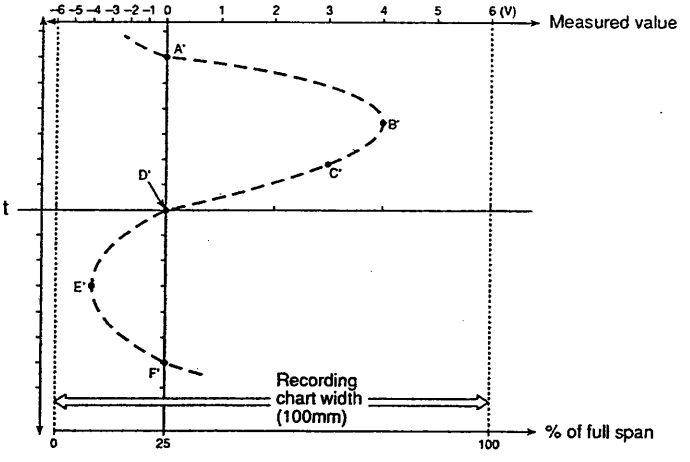
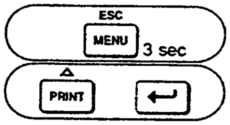
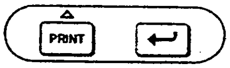
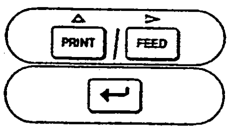
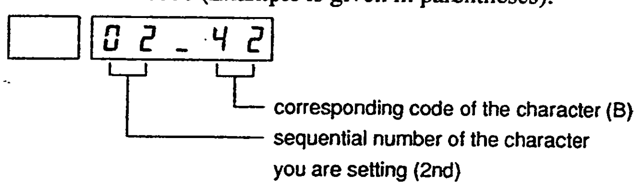
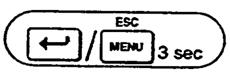


Figure 7.3 Partial Recording Example

As can be seen from these figures, the left side of the boundary (D') shows on 25% of the chart the data in the range –6V to 0V. On the right side of the boundary you can see the range 0V to 6V on 75% of the chart. Thus the scales differ on the left and right sides of the boundary.

7.2.6 How to Set Messages

The following setting enables you to set the messages. Up to five messages can be set, each of up to 16 characters. Printing out messages can only be done with the use of the remote control option (/R1), with which your recorder must be equipped. Messages can not be printed out without this option.
Note that the printing of the messages will not be done when the chart speed is faster than 1500 mm/h (Pen model) or 100 mm/h (Dot model) or when recording is OFF.
To set a message, proceed as follows:

Key operation	Indication	Discription
	n5G	Press the [MENU] key for three seconds to enter the SET mode. Select the [n5G] display using the [△] key, and press the [ENT] key.
	n5G 1	The display which appears will prompt you to specify which message you want to set. Up to five messages can be set. Use the [△] key to specify message number and press the [ENT] key. **NOTE** Only message 1 and 2 can be printed out by remote control. If you want to print out other messages, you must change the assignment of the remote terminals using the accessory setting display (437904).
	02_42	The maximum sixteen characters of the message can be set by the described code (Example is given in parentheses).  The code number can be selected using the [△] key. After setting both numbers of a code, press the [▷] key and the sequential number of the to be set character will fo go up one.
	n5G	[n5G] is diplayed and the setting is completed. Press the [ENT] key. Press the [MENU] key for three seconds to return to the Operation mode.

NOTE If your µRS1000 is equipped with the /R1 option, and you want them to be triggered by remote control, the messages must be assigned to the /R1 terminals.

Table of characters codes.

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

Chapter 8 TROUBLESHOOTING

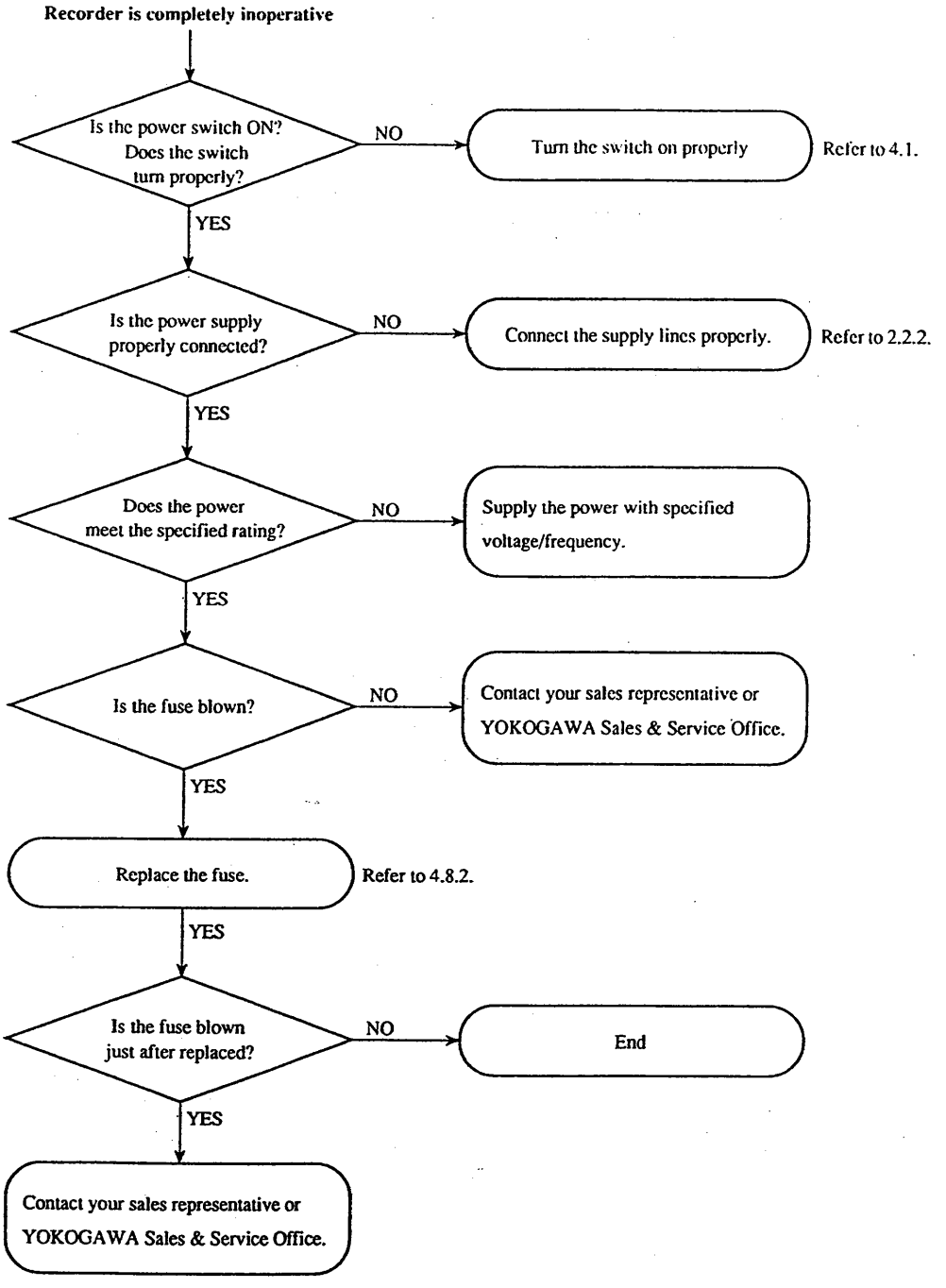
This chapter describes the causes and recovering methods of recorder errors.

8.1 Error Code List

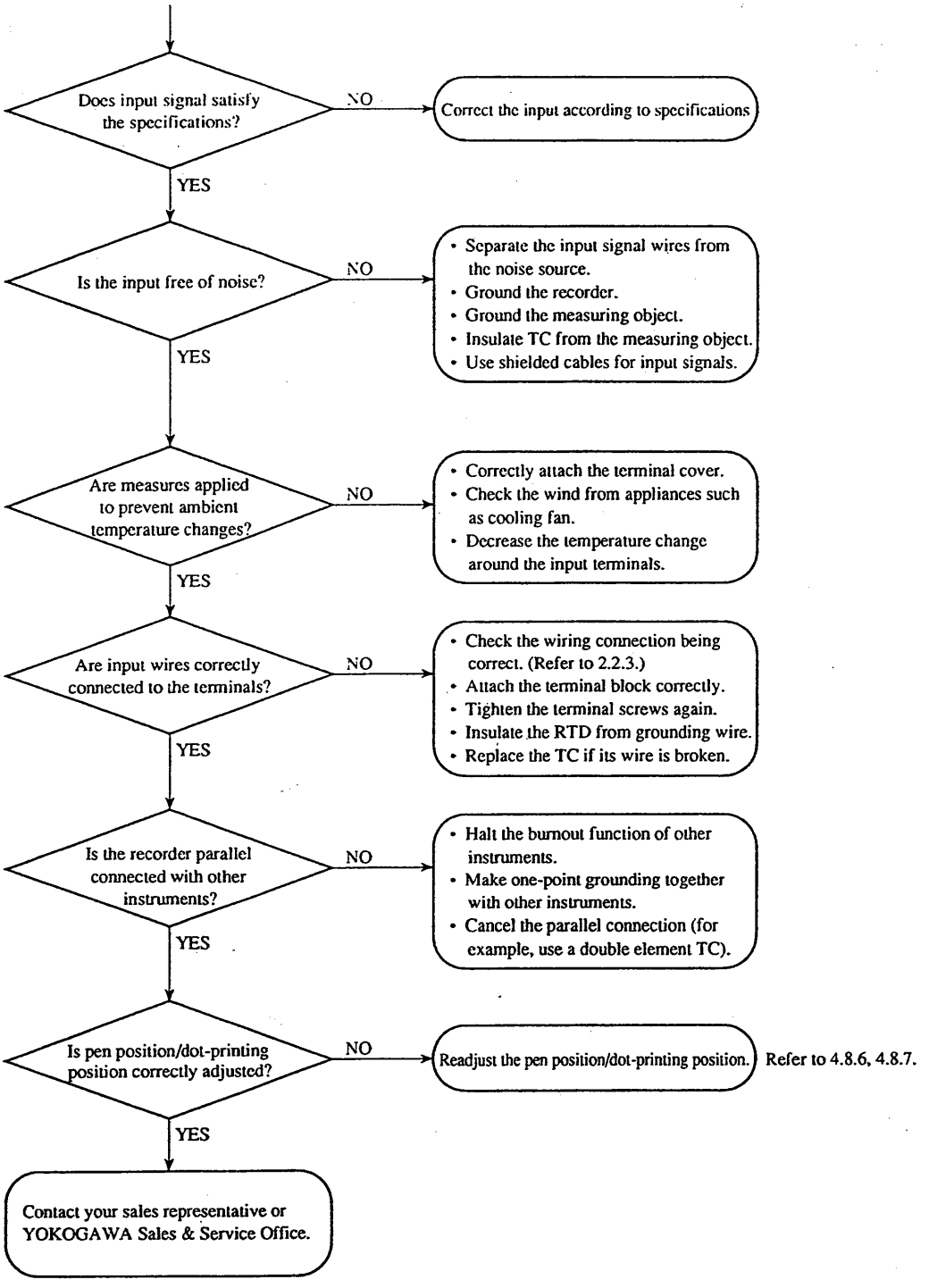
Error Codes	Meaning	Recovery
Er nH0	Memory error of input A/D converter (dot model)	Contact your nearest Sales and Service center.
Er nH□	Memory error of Xchannel input A/D converter (pen model) [No Xchannel recording (skipped)]	
Er AdJ0	Calibration data error of input A/D converter (dot model)	
Er AdJ□	Calibration data error of Xchannel input A/D converter (pen model) [No Xchannel recording (skipped)]	
Er M_nH1	Main memory reading error	
Er M_nH2	Main memory writing error	
Er A_nH1	A/D converter memory reading error	
Er A_nH2	A/D converter memory writing error	
Er r_nH1	Range memory reading error	
Er roM	System ROM failure	
Er rAM	Main memory failure	
Er PLot	Plotter card failure (pen model)	
Er r1bbn	Ribbon shift, ribbon feed failure (dot-printing model)	
Er Prn	Printer failure (dot-printing model)	
Er CoMM	Communication card failure (separating communication function)	
Er001	System failure	
Er002	Entered value exceeds allowable setting range	Enter correct data.
Er003	Time setting error	Enter correct time.
Er011	Attempt to print manual, list, SET UP list when out of chart	Install new chart (refer to 4.2.).
Er012	Attempt to replace pen (C_PEn) while recording	Stop recording (refer to 4.3.).
Er060	Attempt to set alarm to SKIPped channel	Select OFF for setting (refer to 5.3).
Er061	Attempt to set alarm to DI (contact input) channel	Select OFF for setting (refer to 5.3).
Er160	Error about communication	Refer to IM 4D6B1-10E.

Self-diagnostic Message Printout	Meanings
STORE SET UP SETTINGS AGAIIN	Check the settings to maintain the reliability of the internal data. • Enter the SET UP mode, and select [End]. • Select [StorE], and press the [ENT] key.
CONTACT YOUR NEAREST SALES OR SERVICE CENTER	Failure occurs in nonvolatile storage. Contact YOKOGAWA sales and service office.

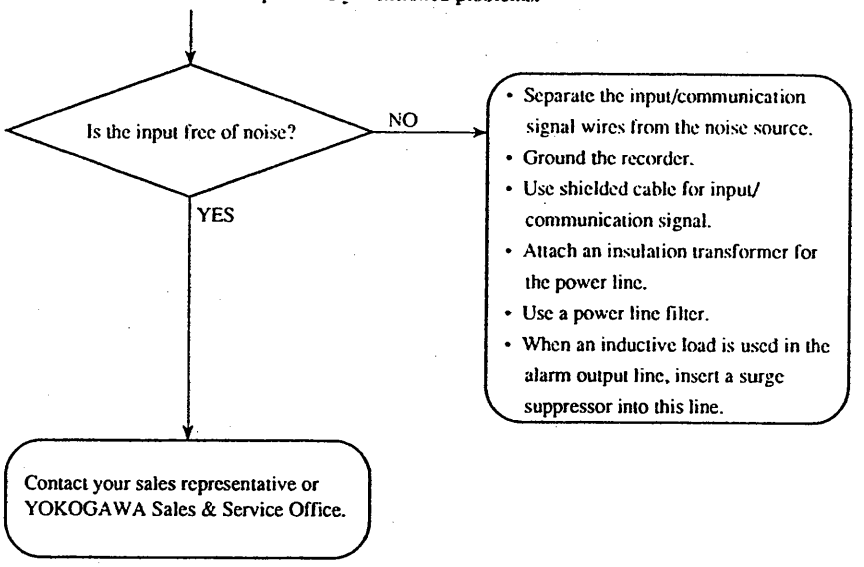
8.2 Troubleshooting



- **Errors exceed specified limits**
- **Measuring value indications fluctuate**
- **Pen/printer carriage goes off-scale at 0% or 100%.**



Glitch is found other than the previously mentioned ploblems.



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