RM10C
HYBRID RECORDER
(PEN TYPE RECORDER)
INSTRUCTION MANUAL

Ohkura

HXPRM10mnC0002E

AUG. 2001 (2nd Edition)

For safety using

Thank you for purchasing our RM10C Hybrid Recorder.

In order to this instrument to exhibit all of its functions effectively and correctly, read and understand this instruction manual thoroughly before using the instrument.

The symbols below are used on this instrument for the cautioning information.

Symbols used on the instrument	
	This shows "Caution for handling". This symbol is used on the parts need to reference the instruction manual for saving human body and the instrument.
	This shows "Protective grounding". Be sure to provide protective grounding prior to operate this instrument.
	This shows "Risk of electric shock".This symbol is used on the parts, which has a risk of electric shock.

Be sure to observe the following warnings/cautions and those provided in the text in order to secure safety in handling the instrument.

⚠ WARNING

General	In order to prevent electric shock; be sure to disconnect this instrument from the main power source when wiring it.
Protective Grounding	(1) In order to prevent an electric shock; be sure to provide protective grounding prior to turning on this instrument. (2) Do not cut a protective grounding conductor or disconnect protective grounding.
Power Source	(1) Make sure that the supply voltage for this instrument conforms to the voltage of the supply source. (2) Attach a protective cover prior to turning on this instrument.
Working Environment	Do not operate this instrument in the environment where it is exposed to a combustible/explosive/corrosive gas or water/steam.
Input and Output Wiring	Provide input and output wiring after turning off the power.

⚠ CAUTION

Input and Output Wiring	Do not use empty terminals for other purposes such as relaying, etc.
Transportation	Do not touch the switches, etc. inside this instrument. Also, do not replace the main unit or printed circuit boards. When this is neglected, we cannot guarantee functioning of the instrument. Contact our dealer where you purchased the instrument, or our sales representative.
Inside of Instrument	When transporting this instrument or the equipment with this instrument incorporated in it, take measures to prevent opening the door and falling out the inner module.

[Note]

Instruction Manual	(1) Deliver this instruction manual to an end user. (2) Prior to handling this instrument, be sure to read this manual. (3) If you have any questions on this manual or find any errors or omissions in this manual, contact our sales representative. (4) After reading this manual, keep it carefully by the instrument. (5) When the manual is lost or stained, contact our sales representative. (6) It is prohibited to copy or reproduce this manual without our permission.
Installation	(1) When installing this instrument, put on a protective gear such as safety shoes, helmet, etc. for your safety. (2) Do not put your foot on the installed instrument or get on it, because it is dangerous.
Maintenance	Only our serviceman or persons authorized by OHKURA are allowed to remove and take the inner module, the main unit and printed circuit boards apart.
Disposal	(1) Dispose the replaced batteries in a correct way. (2) Do not incinerate plastics of maintenance parts and replacement parts. A harmful gas may be produced.
Cleaning	(1) Use dry cloth to clean the surface of this instrument. (2) Do not use any organic solvent. (3) Cleaning the instrument after turning off the power.
Revisions	This instruction manual is subject to change without prior notice.

Using procedure for this manual

1. Using procedure

This instruction manual consists of "For safety using", "Contents" and "Chapter 1 to Chapter 11" as bellow.
Read the applying sections for your purpose to use this instrument.

Chapter and TITLE	For purchase and install	For initial setting and change setting	For daily operation	For using communication	For maintenance and trouble-shooting
For safety using (page 1)	◎	◎	◎	◎	◎
1. INTRODUCTION	◎				
2. CONSTRUCTION	○	○	○		○
3. INSTALLATION	◎		○		
4. WIRING	◎	○	○	○	○
5.PREPARATIONS FOR OPERATION		○	◎		
6. OPERATION		○	◎		
7. DEVICE SETTING		◎		○	○
8.COMMUNICATIONS				◎	
9. MAINTENANCE					◎
10. TROUBLESHOOTING		○			◎
11. SPECIFICATIONS	○	○			○

◎ : Be absolutely certain to read this.

○ : Be certain to read this if you need.

The symbols below are used on the warning and cautioning information in this manual.

Symbols used on this manual	
⚠ **WARNING**	Failure to observe this information could result in death or injury. Be absolutely certain to read this.
⚠ **CAUTION**	Failure to observe this information could damage the instrument. Be certain to read it.
[Note]	This is cautionary information for correct use of the instrument. Be certain to read it.
[Reference]	This is information to help you use the functions of this instrument more effectively.

2. Guide of Instruction manual

The instruction manuals of this instrument are as the table below.

		Name	Part No.	Outline
This manual ⇨	1	RM10C Hybrid Recorder (Pen type) instruction manual	HXPRM10mnC0002E	Explanation for installing, wiring, standard operation. And setting or operation for using this instrument.
	2	RM10C Hybrid Recorder Communication Command instruction manual	HXPRM10mnC0005E	Explanation for reading and writing data of the recorder by communication function.

CONTENTS

1. INTRODUCTION

1.1 Checking the Accessories

Upon delivery of this instrument, unpack and check its accessories and appearance.

If there are any missing accessories or damages on the appearance, contact our dealer where you purchased the instrument, or our sales representative.

Following accessories should be attached.

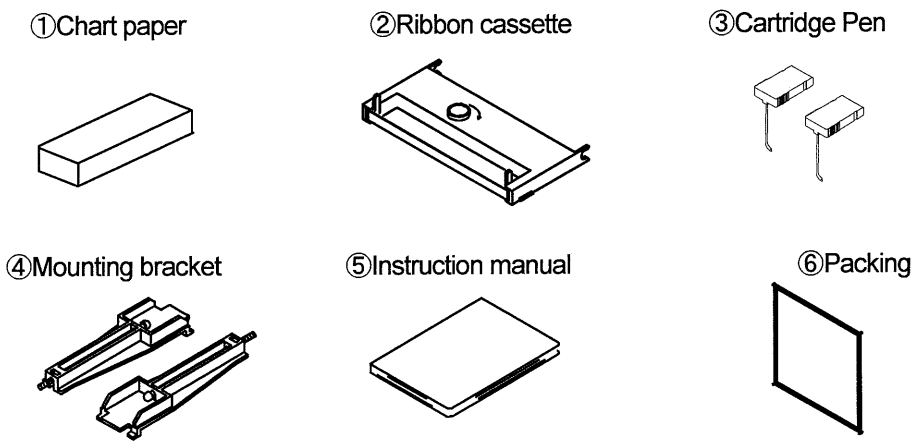


Fig. 1.1 Accessories

Table 1.1 List of Accessories

No.	Part Name	Type	Quantity		Remarks
			1 pen	2 pen	
1	Chart paper	HZCGA0105EL001	1	1	50 equal divisions
2	Ribbon Cassette	HPSR001H0002C	1	1	
3	Cartridge Pen	WPSR196A000001A	1	1	For 1 pen (Red)
		WPSR196A000002A	———	1	For 2 pen (Green)
4	Mounting bracket	H4A14175	2	2	Panel mounting bracket
5	Instruction manual	HXPRM10mnC0002E	1	1	This manual
6	Packing	H4H14900	1	1	For IP65

[Note]

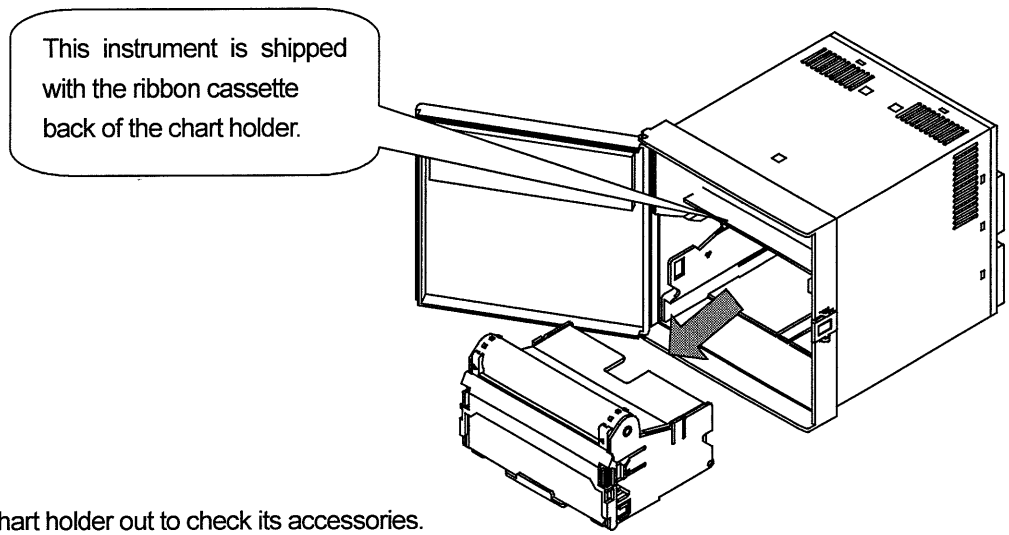
The ribbon cassette has been set in the instrument upon shipment.

[Note]

①This instrument is equipped with the ribbon cassette back of the chart holder. Open the door and take out the chart holder to check it. (See Section 5.1 about taking out the chart holder.)

②The chart paper and the cartridge pen are contained in the chart holder. Take the chart holder out and open the chart cover to check it.

③Maximum angle of the door in opened-state is 135 degree. Do not further open the door otherwise hinge will be broken.



Take the chart holder out to check its accessories.

See Section 5.1 "Setting the Chart Paper" for taking out the chart holder.

Fig. 1.2 Position of the Ribbon Cassette

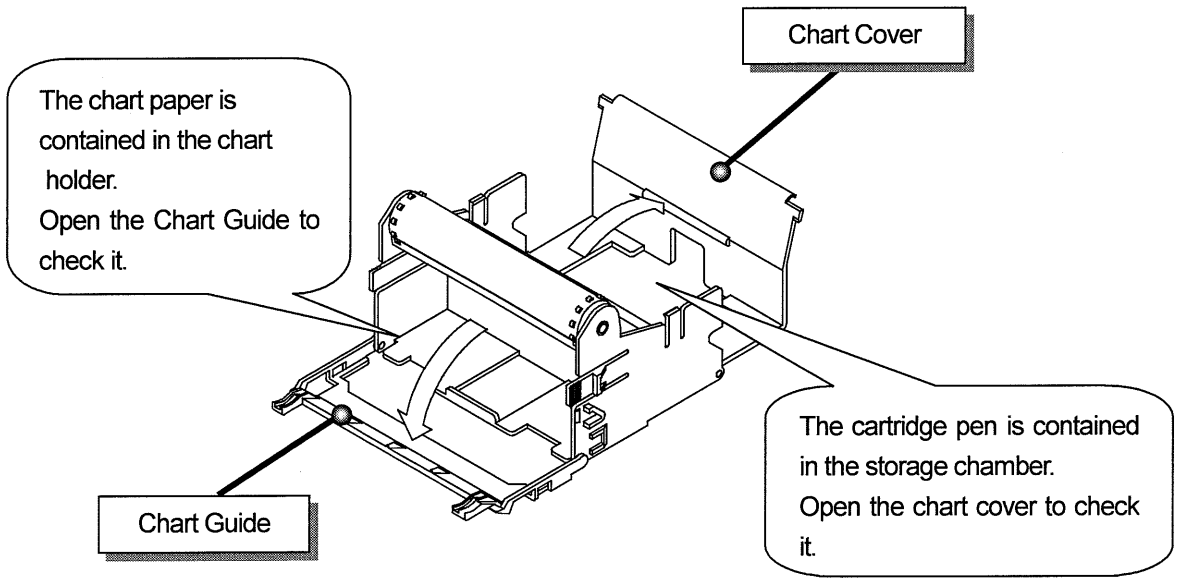


Fig. 1.3 Position of the Chart Paper and the Cartridge Pen

1.2 Checking the Type and Specifications

A nameplate is affixed to the inside of the instrument. Remove the chart holder and make sure that the nameplate is affixed to the middle far side of the instrument.

Make sure that this instrument meets your requested specification, seeing the following tables.

Table 1.2 Type

1	2	3	4	5	6	7	8	9	10	11
R	M	1	0			C				0
				①			②	③	④	

①Model

01	1 pen type
02	2 pen type

②Communication

0	RS-232C (Standard)
1	RS-485 (Option)

③DI/DO (Option)

0	None
1	3 Relay output
2	3 DI
3	3 DI + 3 Relay output

④Paper-empty Sensor (Option)

0	None
1	Yes

1.3 Temporary Storage

Store the instrument in the following environment.

When incorporated in the equipment, store it in the following environment as well.

⚠ CAUTION

Storage in a poor environment may damage the appearance, functions, and service life of the instrument.

Storage Environment

- A place with little dust.
- A place free from combustible, explosive, or corrosive gases (SO_2, H_2S, etc.).
- A place free from vibrations or shocks.
- A place free from water or steam or high humidity (95% RH max.).
- A place free from direct sunshine or high temperature (50°C max.).
- A place free from an extremely low temperature (-20°C min.).

1.4 Indication Card

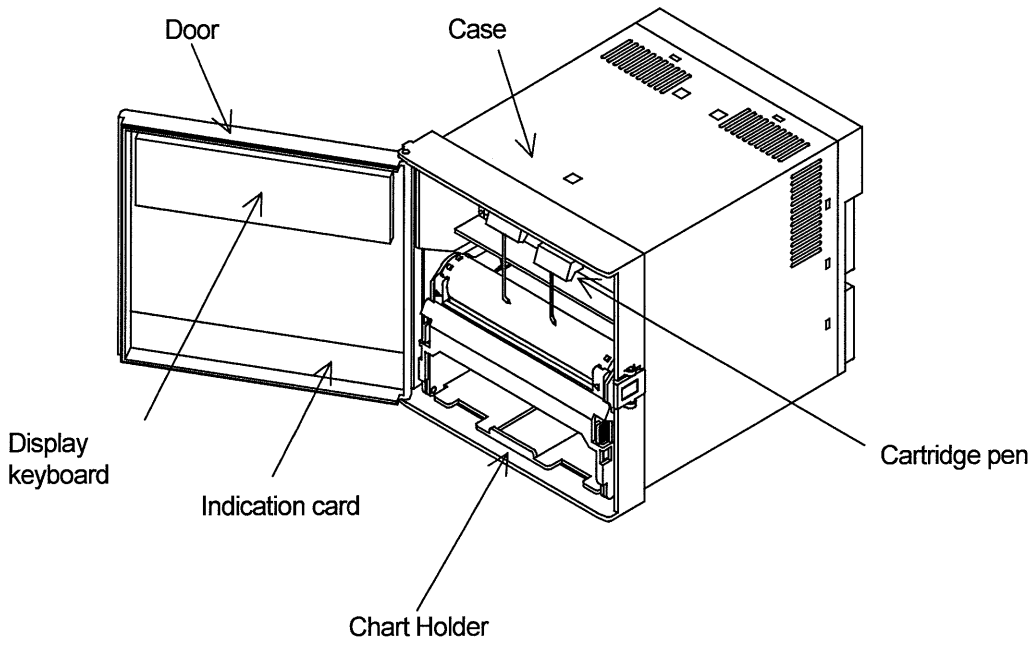
An indication card has been affixed to the door upon delivery. Enter a name as required.

⚠ CAUTION

Note that if a non-original nameplate is attached, it may damage the door or mounting part.

2. CONSTRUCTION

2.1 Appearance



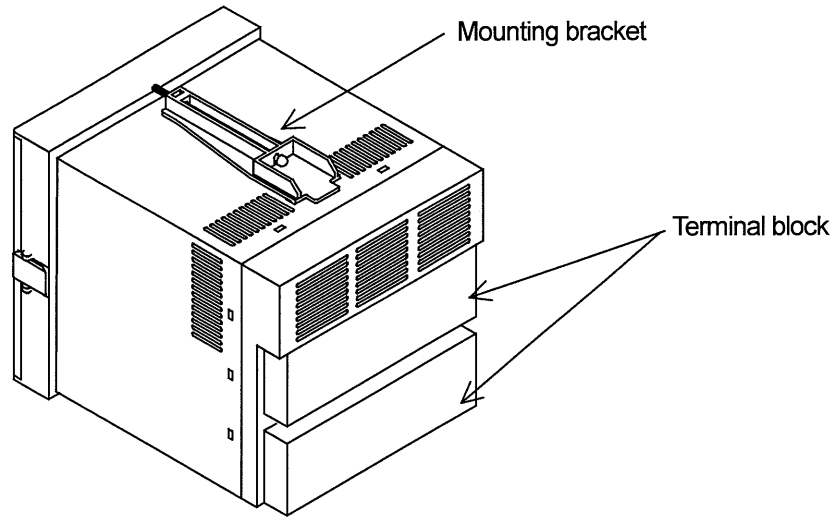


Fig. 2.1 Appearance

2.2 Display Screen and Operation Keys

2.2.1 Display Screen

The following describes the display screen. Since the channel numbers and data are indicated by a 7-segment LED, alphabets are symbolized to represent them.

For the LED display, see " Symbolized Alphabets for Display" at [Reference] below.

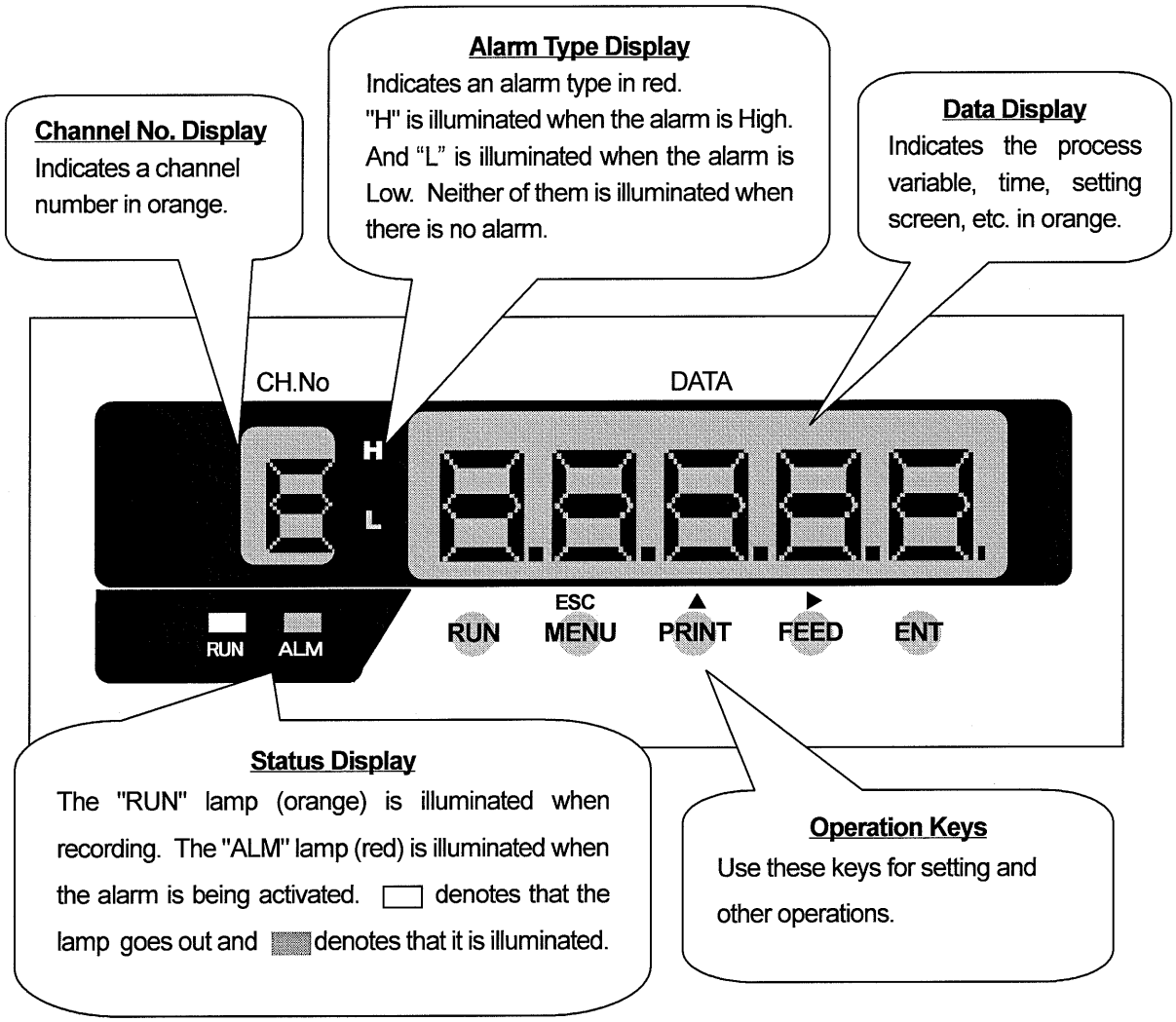


Fig. 2.2 Display

[Reference] Symbolized Alphabets for Display

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

2.2.2 Operation Keys

The following describes each operation key.

This manual represents the actual operation keys as shown in the figure below.

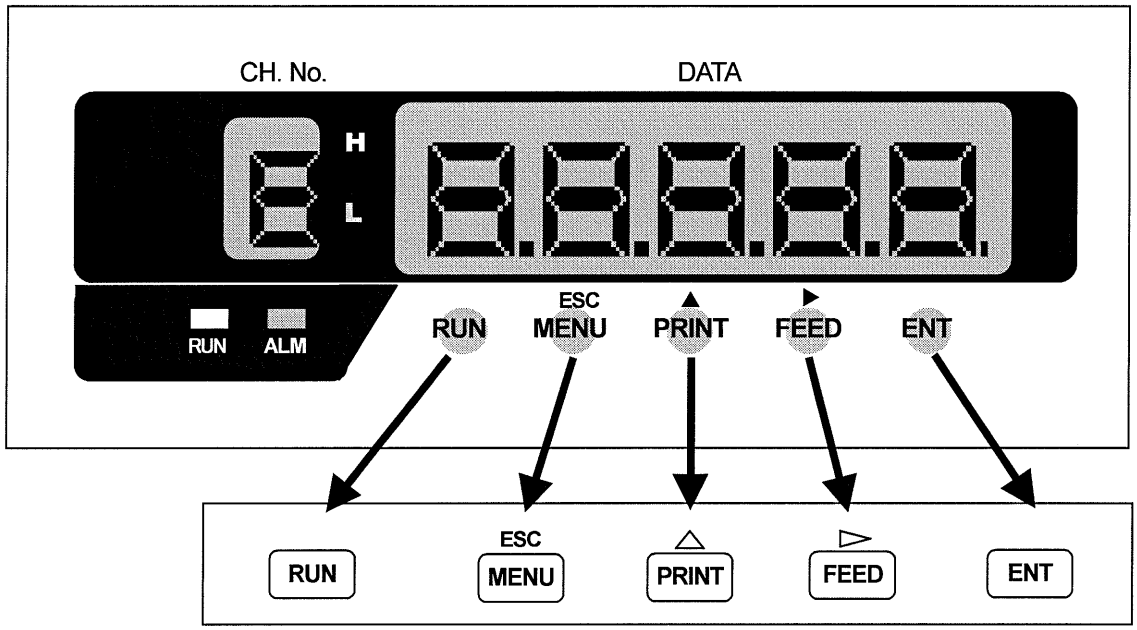


Fig. 2.3 Operation Keys in This Manual

Table 2.1 Names of Operation Keys and Their Functions

Key	Name	Function	
RUN	"RUN" key	Starts/stops recording. To stop, hold down the "RUN" key for 3 seconds or more. (Gone out the "RUN" lamp.) To start, press the "RUN" key. (Illuminates the "RUN" lamp.)	
ESC MENU	"MENU" key	MENU function	Selects engineering list print and change to the setting mode.
	"ESC" key	ESC function	Exits that menu halfway selecting a function.
△ PRINT	"PRINT" key	PRINT function	Used to perform manual print or list print.
	"△" key	△ function	Used to select a setting parameter (numeral or built-in command)(ascending direction).
▷ FEED	"FEED" key	FEED function	The chart paper is fed while the key is pressed, and stopped when released.
	"▷" key	▷ function	Used to shift a digit in setting a numeral.
ENT	"ENT" key	Used for registering a setting parameter (numeral or built-in command) after selecting it, or executing a function. Pressing this key executes the setting.	

3.1 Outside Dimensions Drawing and Panel Cutting Dimensions

Unit: mm

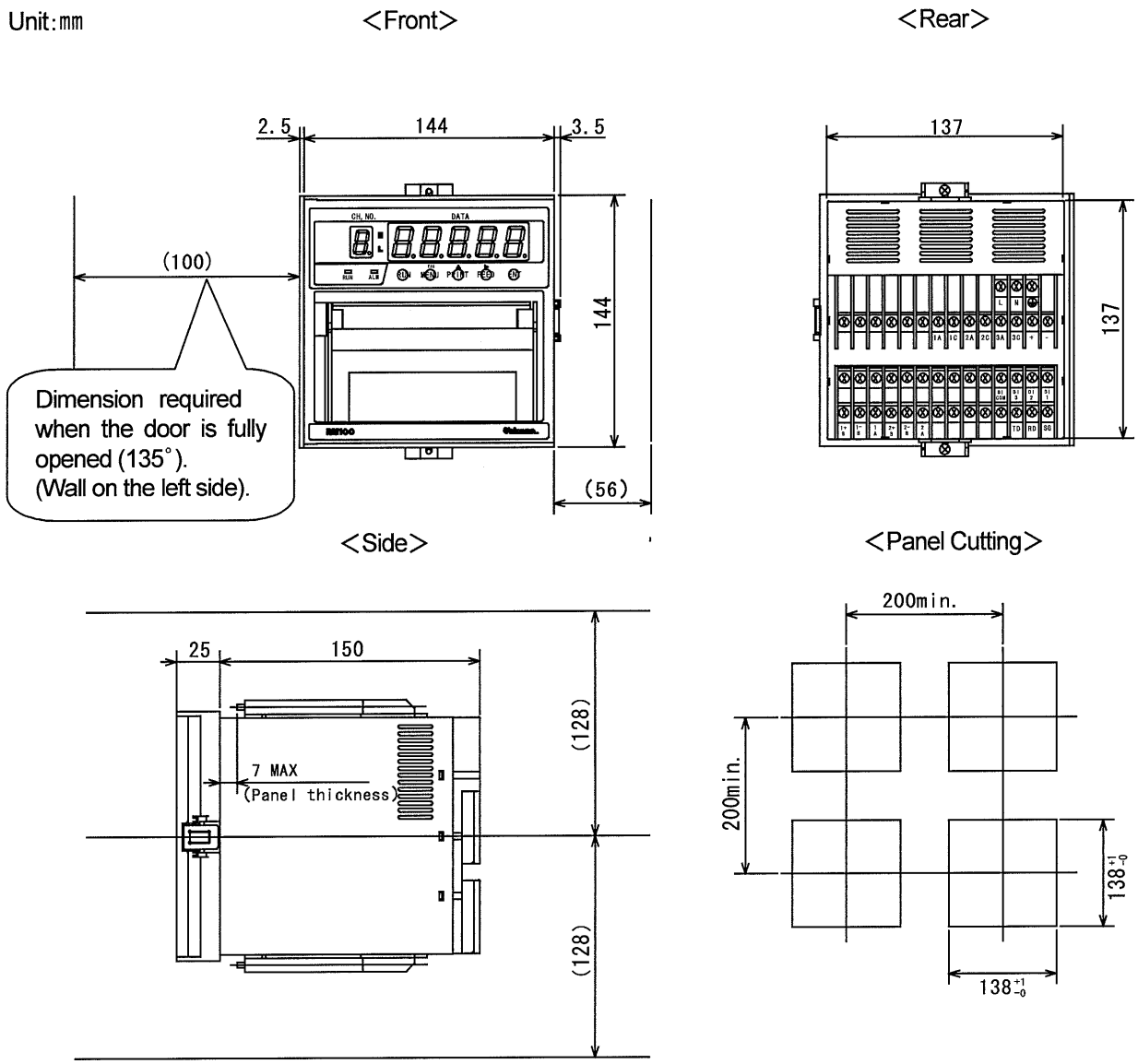


Fig. 3.1 Outside Dimensions and Panel Cutting Dimensions

> **⚠ CAUTION**
>
> For maintenance and safety of the instrument, it is recommended to secure the spacing larger than the parenthesized dimensions per unit.

3.2 Mounting to the Panel

⚠ WARNING

Do not install the instrument in a place exposed to a combustible, explosive, or corrosive gas (SO_2, H_2S, etc.).

⚠ CAUTION

Install the instrument in the following places

- A place free from where humidity often changes.
- A place of normal temperature (25°C or so).
- A place exposed to as little mechanical vibrations as possible.
- A place with as little dusts as possible.
- A place affected by the electromagnetic field as little as possible.
- A place not directly exposed to high radiant heat.
- A place where the altitude is up to 2000m.
- Humidity has an effect on the chart paper and ink. Use the instrument in a humidity range of 20 to 80%RH (60%RH is optimum).
- This instrument needs the inside installation.

Mounting to the Panel

- A steel plate not thinner than 1.2mm is recommended as a mounting panel.
- The maximum thickness of the mounting panel is 7mm.

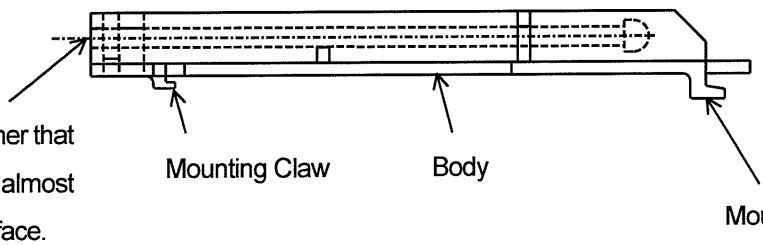
Inclination

- Install the instrument horizontally.

The instrument should be installed so that its inclination should be 0° at the front and within 30° at the rear.

3.2.1 Procedure for Mounting to the Panel

1) Assemble the mounting bracket refer to Fig.3.2.
2) Fit in this instrument through the front of the panel.
3) Fit the claws of the mounting bracket into the square holes in the top and bottom surfaces of the case.
4) Tighten the screw of the mounting bracket with a screwdriver to attach it to the panel. When the mounting unit does not move back and forth any more, tighten a screw by 180°.



Assemble in such a manner that the screw nose will be almost aligned with the plate surface.

Fig. 3.2 Mounting bracket

[Note]

If it is tightened with an excessive force, the case may be distorted and the mounting bracket may be deformed. An adequate tightening torque is about 0.2 to 0.3 N·m (2～3 kgf·cm).

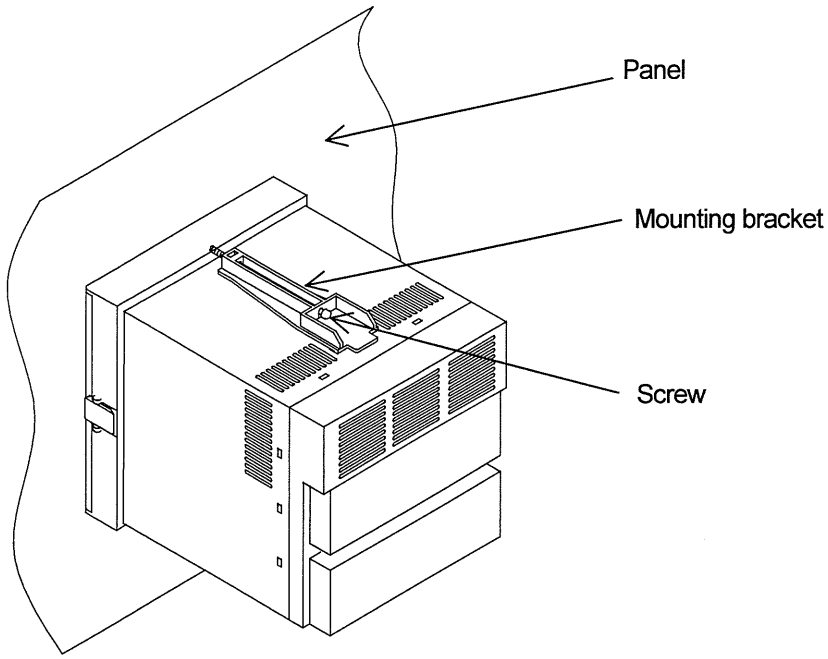


Fig. 3.3 Mounting to the Panel

3.2.2 Mounting to the Panel in compliance with the IP65

Prior to mounting the instrument to the panel, attach packing to the position shown in the figure.
The rest of the procedure is the same.

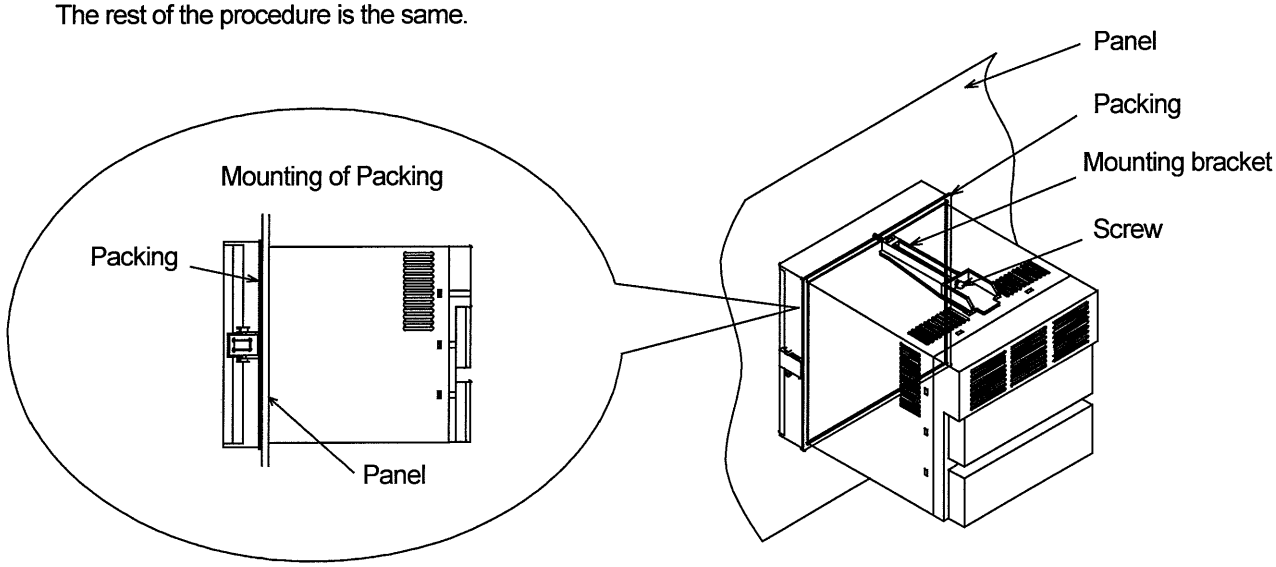


Fig. 3.4 Mounting to the Panel (in compliance with the IP65)

4.1 Terminal Layout and Power Wiring

4.1.1 Terminal Layout

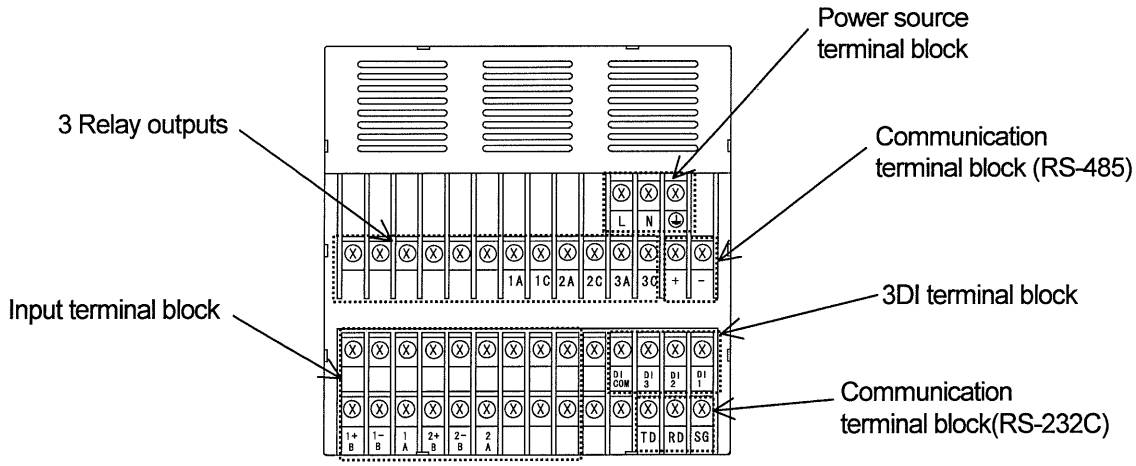


Fig. 4.1 Terminal Layout (Rear view)

4.1.2 Power Wiring

⚠ WARNING

① In order to prevent an electric shock, be sure to provide protective grounding prior to turning on the instrument.

② Do not cut a protective grounding conductor or disconnect protective grounding.

③ Make sure that the supply voltage for the instrument conforms to the voltage of the supply source.

④ Attach a transparent protective cover prior to turning on the POWER of the instrument.

⑤ Any interruption of the protective conductor inside or outside the apparatus or disconnection of the protective grounding terminal is likely to make the apparatus dangerous under some fault conditions. Intentional interruption is prohibited.

⚠ CAUTION

① As an electric wire for the power source, use a 600 V vinyl insulated wire (IEC 227-3) or its equivalent or above.

② Attach a round press-fitting terminal with insulated sleeve (for M3.5) to the end of the electric wire.

③ Connect a protective grounding (resistance:100 Ω or lower, a minimum diameter of a grounding conductor:1.6mm) to the protective grounding terminal.

④ If other instrument shares the protective grounding conductor, there may be an effect caused by noise coming from the grounding conductor. It is recommended not to share it with other instrument.

⑤ In order to comply with the requirements of safety standard EN61010, the recorder shall have one of the following as a disconnecting device, fitted within easy reach of the operator, and labeled as the disconnecting device.

a. A switch or circuit breaker which complies with the requirements of IEC60947-1, IEC60947-2 and IEC60947-3.

b. A separable coupler which can be disconnected without the use of a tool.

c. A separable plug, without a locking device, to mate with a socket outlet in the building.

⑥ This product has been designed to conform to IEC1010-1 installation category Ⅱ and pollution degree 2.

4.1.3 Wiring Procedure

⚠ CAUTION

The transparent protective cover should surely remove the left and right (both sides) hooks simultaneously. If it removes by turns, there is a possibility that it may damage.

1) Put your fingers on the left and right (both sides) hooks of the transparent protective cover on the power source terminal block. Pushing them inside, take out the cover to this side.
2) Connect the power source electric wire refer to Fig. 4.2. Connect the protective grounding to the ⏚ terminal. Connect the non-grounding side of the power source to "L" terminal. Connect the grounding side to the "N" terminal.
3) Put back the transparent protective cover.
4) Make sure that protective grounding is properly provided.

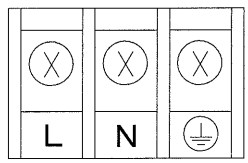


Fig. 4.2 Power source Terminal block

4.2 Input Wiring

⚠ CAUTION

①Precautions for the input electric wire

- See that no noise is mixed in input wiring. For input wiring, it is recommended to use a shielding wire or twisted wire effective for noise.
- In case of thermocouple input, connect a thermocouple wire directly or use a compensating lead wire. It is recommended to use a shielded input line.
- In case of resistance temperature detector input, dispersion of 3-wire line resistance should be less than the below mentioned values. It is recommended to use a shielded input line.

  For Pt 100, JPt 100 ; 50mΩ max.
- When it is likely to be affected by induction noise, particularly when wiring near the high-frequency power source, it is recommended to use a shielded twisted wire.
- Attach a round press-fitting terminal with insulated sleeve (for M3.5) to the end of the electric wire.

②Precautions for wiring

- The wiring between the instrument and measurement point should be kept away from the power circuit (25V or higher circuit or DO circuit).
- Short-circuit unused input terminals. (Short-circuit between "+" and "−" in case of mV, V, or thermocouple input, and short-circuit among A, B, and B in case of resistance temperature detector input.)
- Ground the shield of connecting wire.

4.2.1 Wiring Procedure

> **⚠ CAUTION**
>
> The transparent protective cover should surely remove the left and right (both sides) hooks simultaneously. If it removes by turns, there is a possibility that it may damage.

1) Put your fingers on the left and right (both sides) hooks of the transparent protective cover on the input terminal block. Pushing them inside, take out the cover to this side.
2) Wire the input lines refer to Fig. 4.3(Page 19), Fig. 4.4 and Fig. 4.5(Page 20).
3) Put back the transparent protective cover.

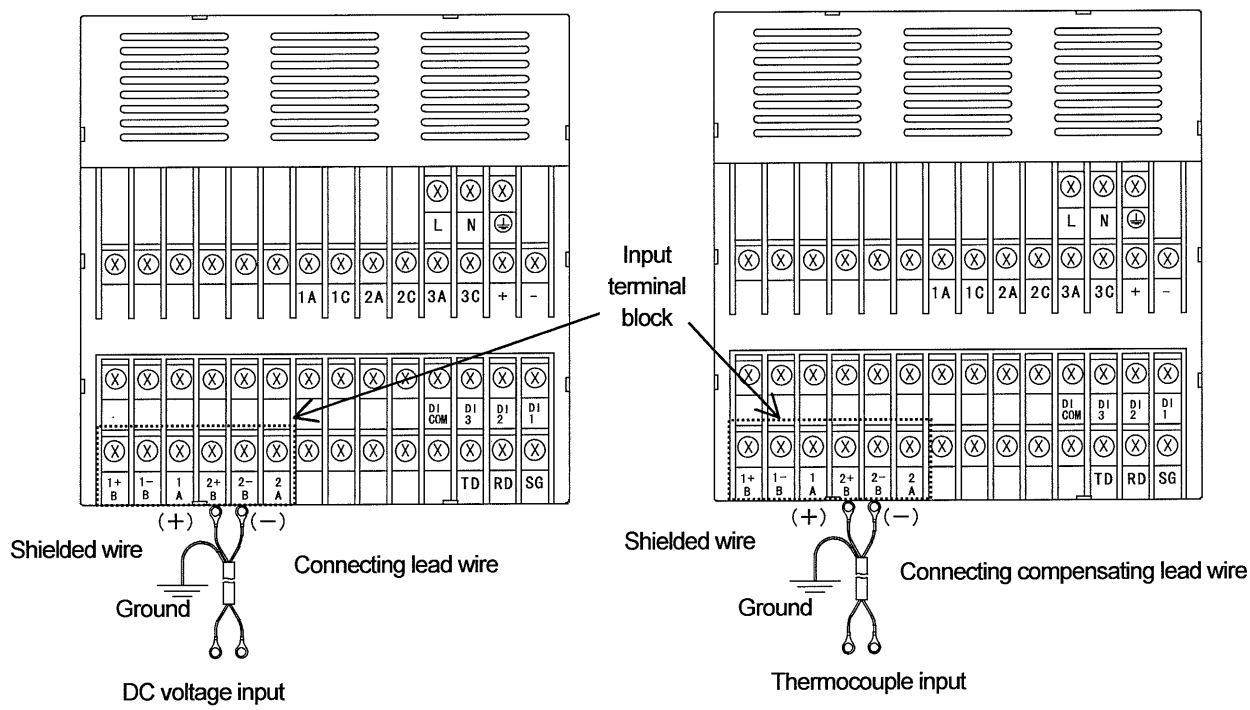


Fig. 4.3 Input Wiring (For mV, V and Thermocouple inputs)

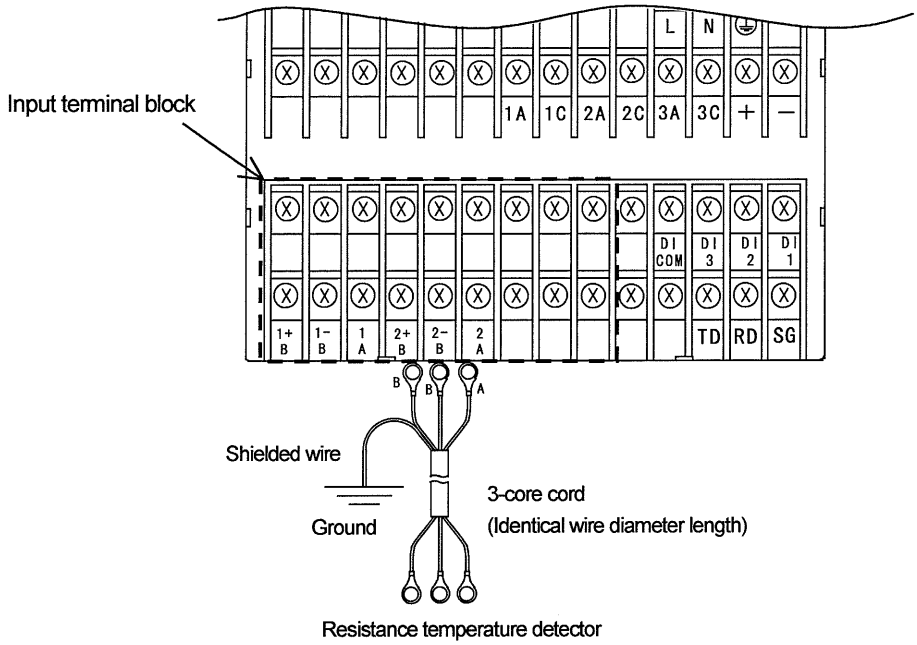


Fig. 4.4 Input Wiring (For Resistance temperature detector)

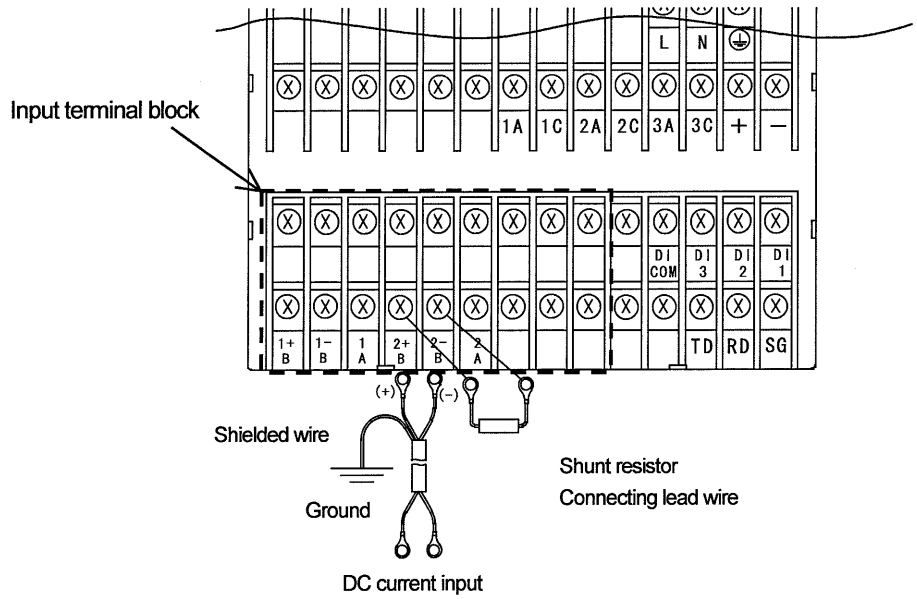


Fig. 4.5 Input Wiring (For mA input)

⚠ CAUTION

① Attach the shunt resistor to the input terminal block of the instrument.

② Input accuracy is effected with the shunt resistor. Use the following recommended resistor.

Resistance: 250Ω Rated power: 1/4W Tolerance: ±0.1% max.

Temperature coefficient: ±50ppm max.

4.3 DI/Alarm Output Wiring (Option)

⚠ WARNING

① Be sure to wire after turning off the POWER.

② When the power source has been connected to the Alarm output, turn off that power source.

③ When a hazardous voltage supplies to alarm terminal:

a) Never touch terminals preventing from electric shock.

b) Attach covers to terminals.

c) Wires should be double shielded.

d) Adept round pressure terminal connectors with insulation cover for wire, preventing from loses connection.

⚠ CAUTION

Precautions for Wiring the DI

① DI input has the built-in drive power source. Do not apply a voltage to a DI input terminal from the outside.

② A DI input contact capacity should be a withstand voltage of 50V DC, 16mA or more, ON resistance of 20 Ω max.(wiring resistance included).

③ Do not use unused terminals as relay terminals.

Precautions for Wiring the Alarm Output

① An alarm output contact capacity is as follows.

250VAC 3A at maximum (Resistive load)

30VDC 3A at maximum (Resistive load)

125VDC 0.5A at maximum (Resistive load)

0.1A at maximum L/R= 7ms at maximum (Inductive load)

② Attach an anti-surge protective circuit (surge absorbers, etc.) to an output terminal, as required.

③ Attach a round press-fitting terminal with insulated sleeve (for M3.5) to the end of an electric wire.

④ Keep alarm output wiring away from input wiring.

⑤ Do not use unused terminals as relay terminals.

4.3.1 DI/Alarm Output Wiring Example

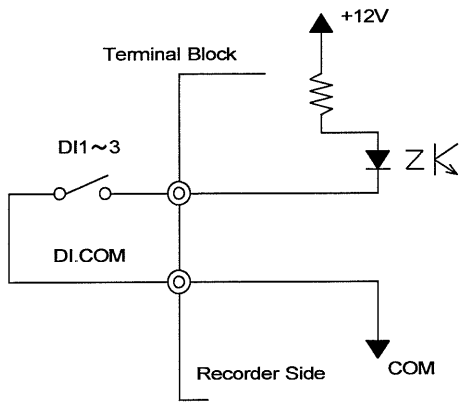


Fig. 4.6 DI Wring Example

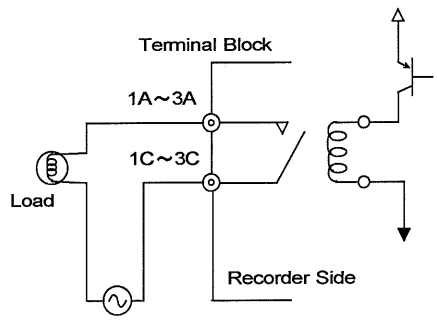


Fig. 4.7 Alarm Output Wiring Example

⚠ CAUTION

The DI (Option) consists of a combination of 3 Digital inputs. The alarm output consists of 3-Relay output (Normally open).

4.3.2 Alarm Output Wiring Procedure

Wire the Alarm output refer to Fig.4.8.

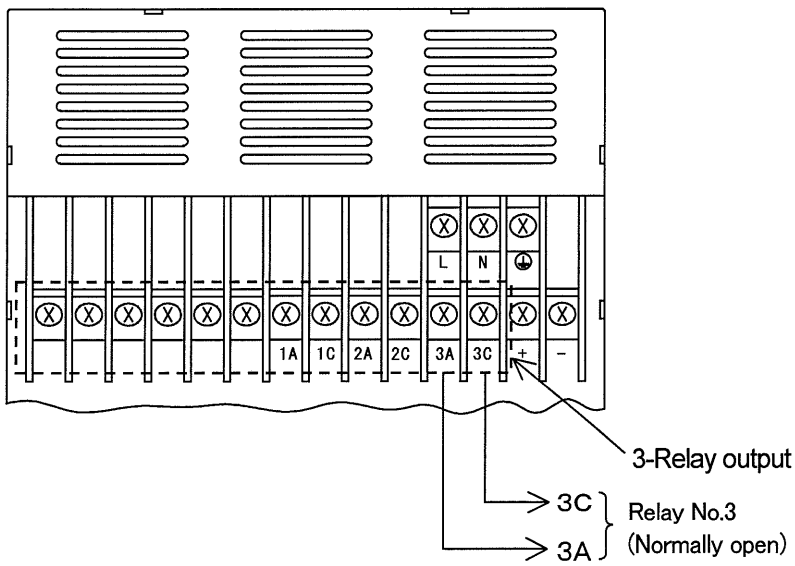


Fig. 4.8 Alarm Output Wiring

4.3.3 DI Wiring Procedure

Wire the DI refer to Fig.4.9.

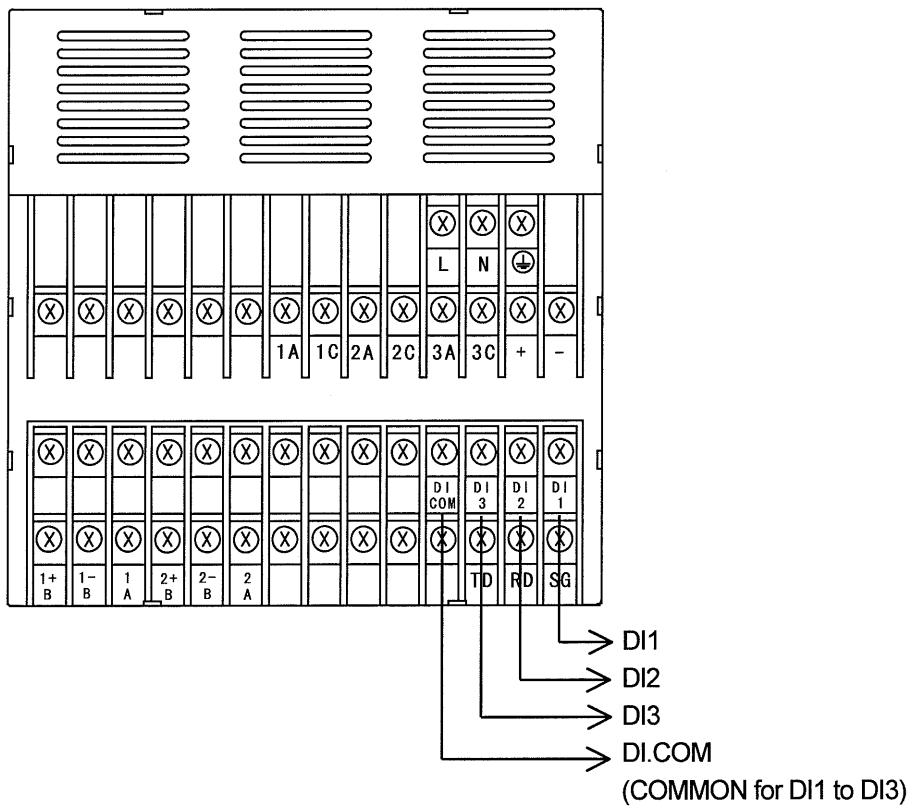


Fig. 4.9 DI Wiring

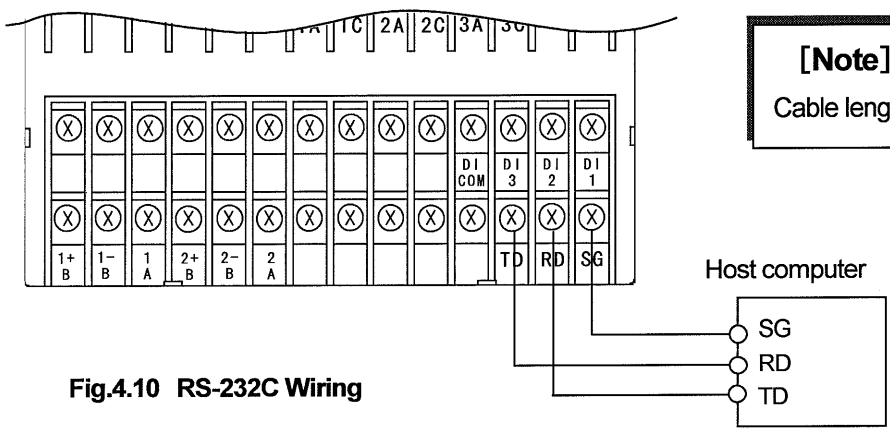
4.4 Communication Wiring

⚠ CAUTION

Precautions for the communication wiring

- See that no noise is mixed in communication wiring. For communication wiring, it is recommended to use a shielding wire effective for noise.
- When it is likely to be affected by induction noise, particularly when wiring near the high-frequency power source, it is recommended to use a shielded twisted wire.
- Attach a round press-fitting terminal with insulated sleeve (for M3.5) to the end of the electric wire.
- Ground the shield of a connecting wire.

4.4.1 RS-232C Wiring

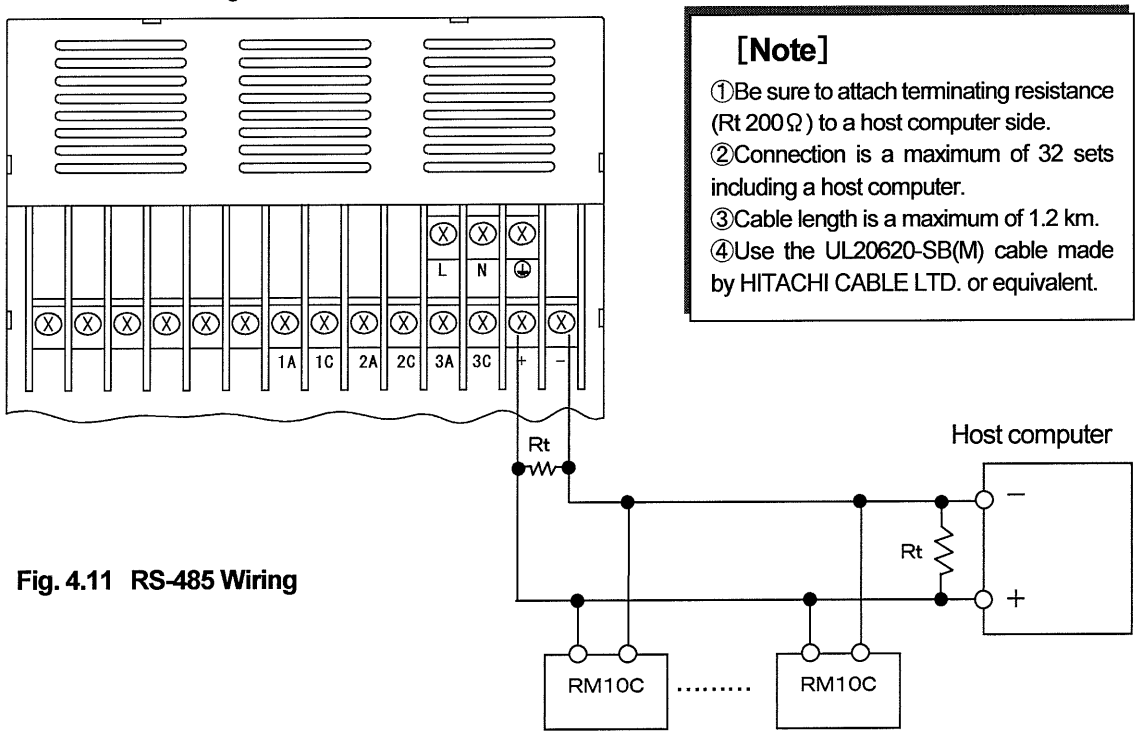


[Note]
Cable length is a maximum of 15m.

Fig.4.10 RS-232C Wiring

4.4.2 RS-485 Wiring

Wire RS-485 refer to Fig.4.11.



[Note]
①Be sure to attach terminating resistance (Rt 200Ω) to a host computer side.
②Connection is a maximum of 32 sets including a host computer.
③Cable length is a maximum of 1.2 km.
④Use the UL20620-SB(M) cable made by HITACHI CABLE LTD. or equivalent.

Fig. 4.11 RS-485 Wiring

5. PREPARATIONS FOR OPERATION

5.1 Setting the Chart Paper

> ⚠ **CAUTION**
>
> It is recommended to use our original chart paper to ensure proper recording.
> If the chart holder is taken out with recording operation being activated, the ink ribbon may be damaged. To replace the chart paper, be sure to press the "RUN" key to stop recording.
> Be sure to move up the cartridge pen. Otherwise, it will be damaged.

(1) Pressing the "RUN" key for 3 seconds or more

Stop recording operation. With the power turned on, press the RUN key for 3 seconds or more.

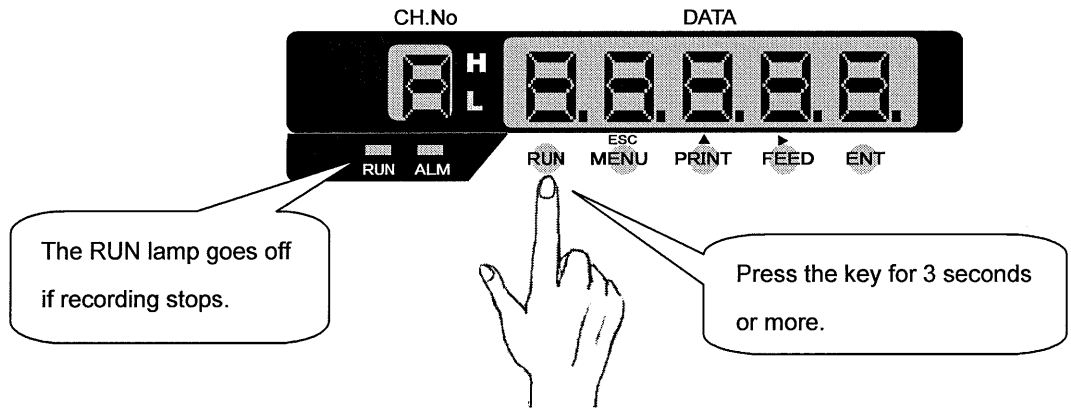


Fig. 5.1 Pressing the "RUN" key

If recording stops, the pen and printer will move automatically, discontinuing paper feed.
The No. 1 pen(red) records the left side(approx. 15 %) and No. 2 pen(green) records the right side(approx. 85 %), respectively.

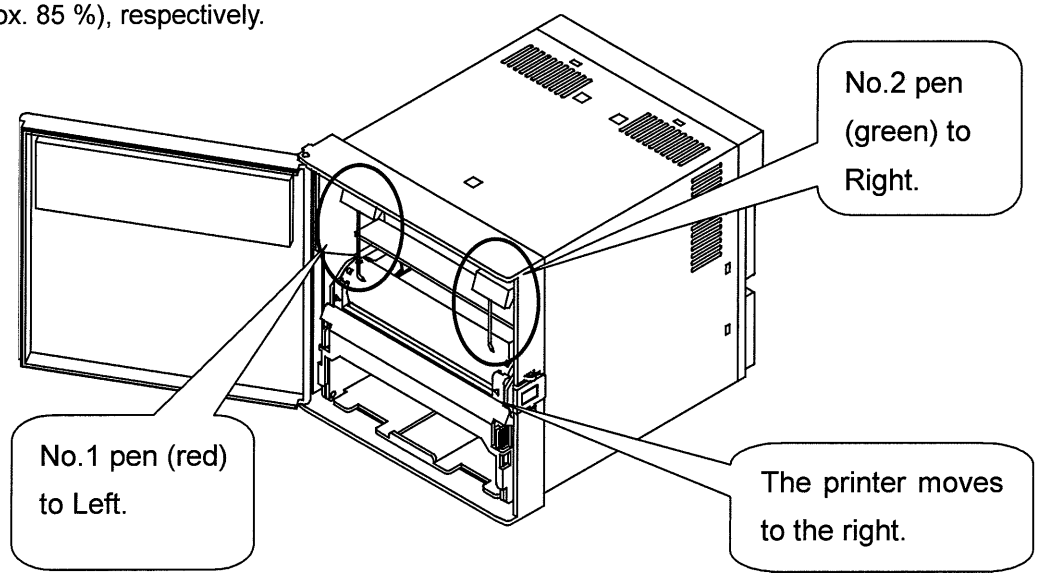


Fig. 5.2 Automatically Moving the 2 Pens and Printer

(2) Opening the Door

⚠ CAUTION

Maximum angle of the door in opened-state is 135 degree. Do not further open the door otherwise hinge will be broken.

Push the door hook to unlock the door. Pull the door to this side to open it.

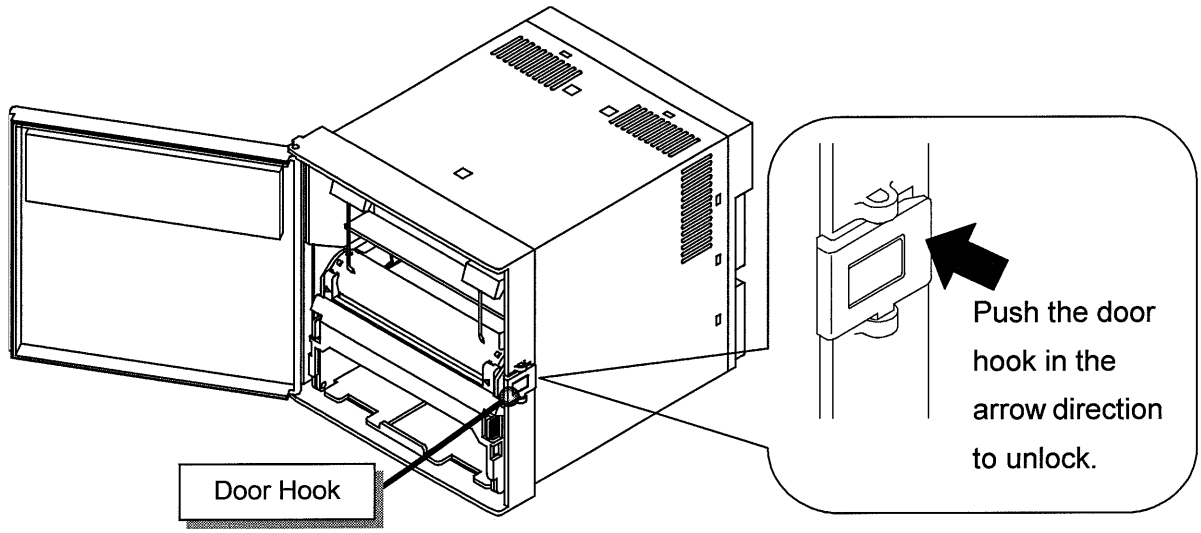


Fig. 5.3 Opening the Door

(3) Moving up the Pen

Push up the pen-up lever to move a pen tip away from the chart paper.(Move up the pen)

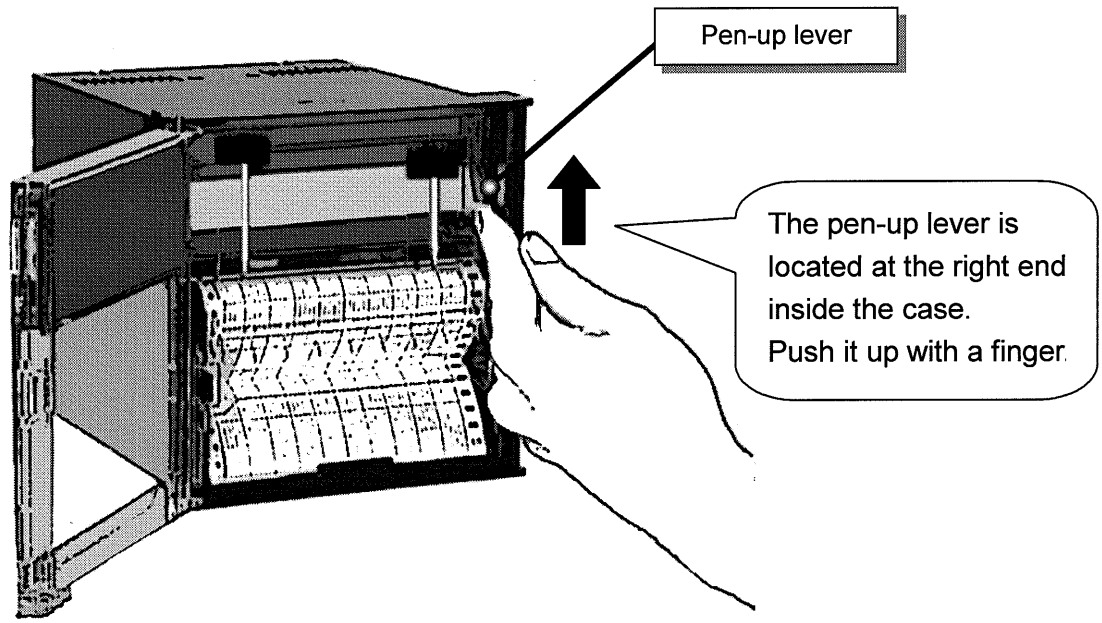


Fig. 5.4 Moving up the Pen

(4) Taking out the Chart Holder

Put your fingers onto the levers at both sides of the chart holder and pull it out to this side.

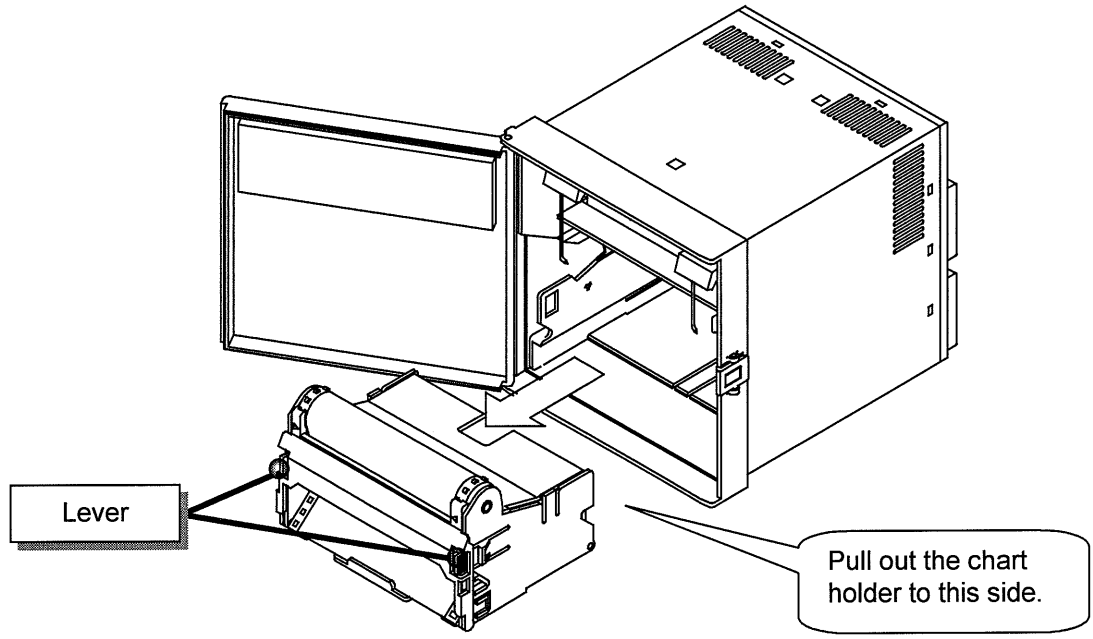


Fig. 5.5 Taking out the Chart Holder

(5) Opening the Chart Cover and Chart Guide

Open the chart guide and the chart cover outwardly.

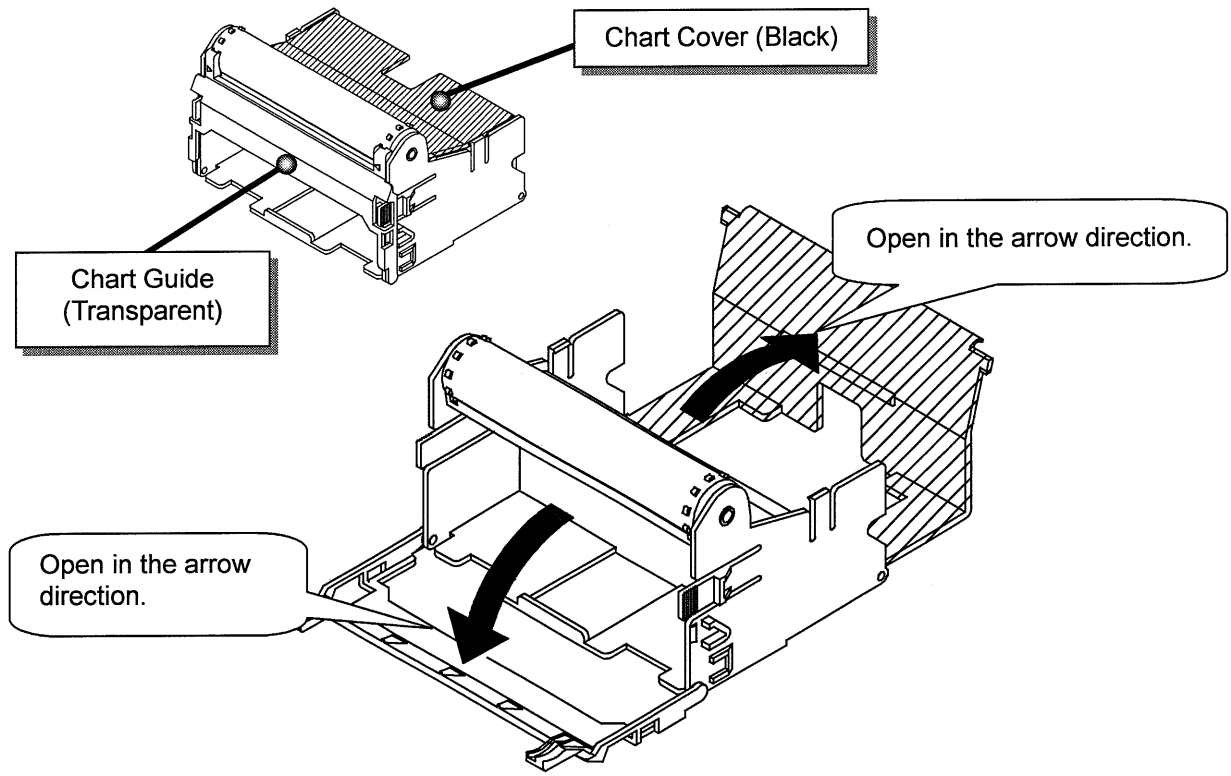


Fig. 5.6 Opening the Chart Cover and Chart Guide

(6) Loosening the chart paper

The chart paper may not be proper fed, if it is stuck at perforations. Be sure to loosen the paper.

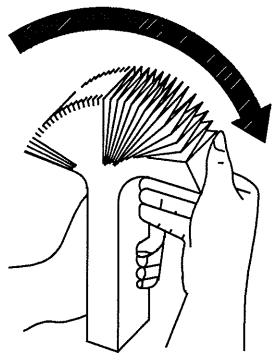


Fig. 5.7 Loosening the Chart Paper

(7) Setting the Chart Paper into the Storage Chamber

Unfold the chart paper by two plies. Holding the printing surface upward, set it in the storage chambe.

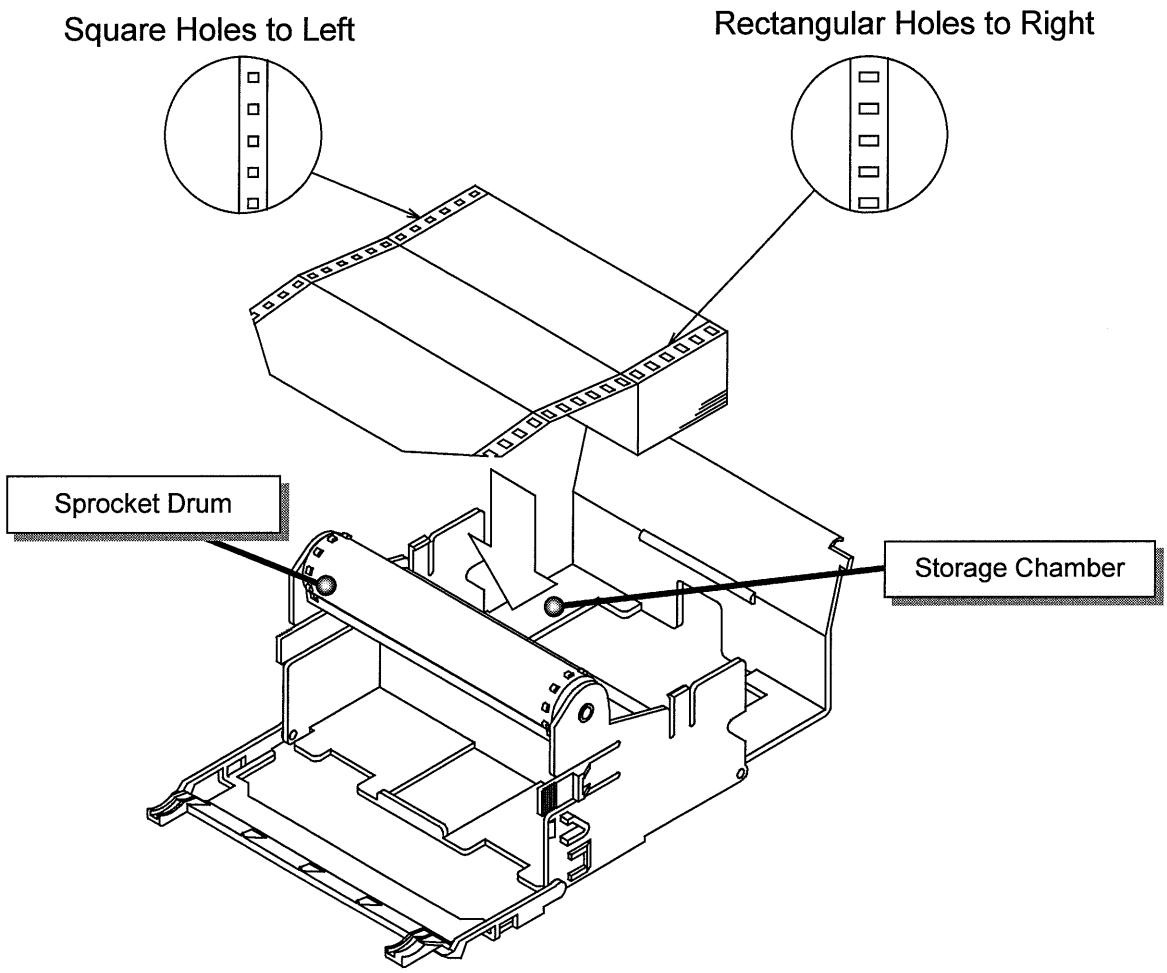


Fig. 5.8 Setting the Chart Paper

(8) Aligning the Chart Paper with the Sprocket Drum

Align the holes in the chart paper with the sprocket drum teeth. Set the chart paper along the sprocket drum. Put the first ply of the chart paper into the chart receiver.

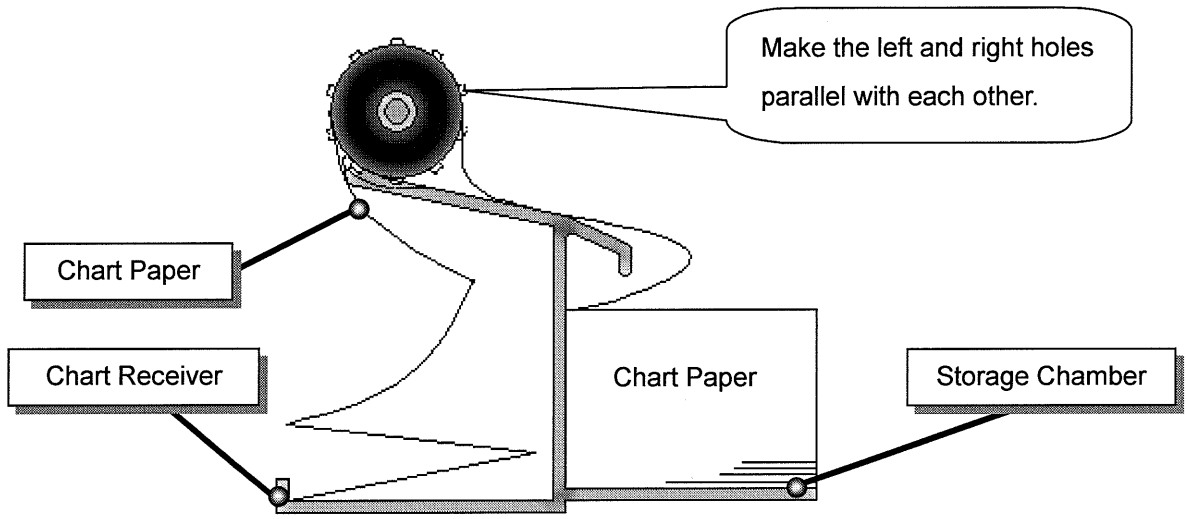


Fig. 5.9 Aligning the Chart Paper with Sprocket Drum (Chart Holder Sectional View)

(9) Closing the Chart Cover and the Chart Guide

Close the chart cover and the chart guide in the arrow directions.

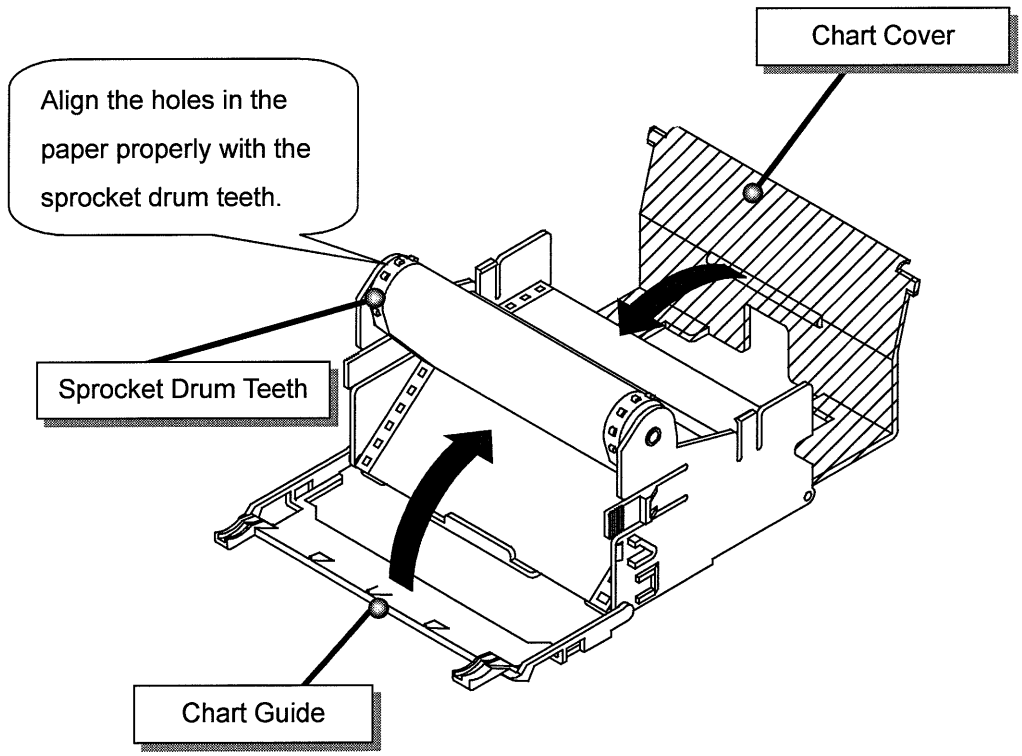


Fig. 5.10 Closing the Chart Cover and Chart Guide

(10)Turning the Sprocket Drum Gear

Check paper feed with your hand. Turn the sprocket drum gear to feed out the chart paper.

(It is recommended to feed the chart paper by 4 plies.)

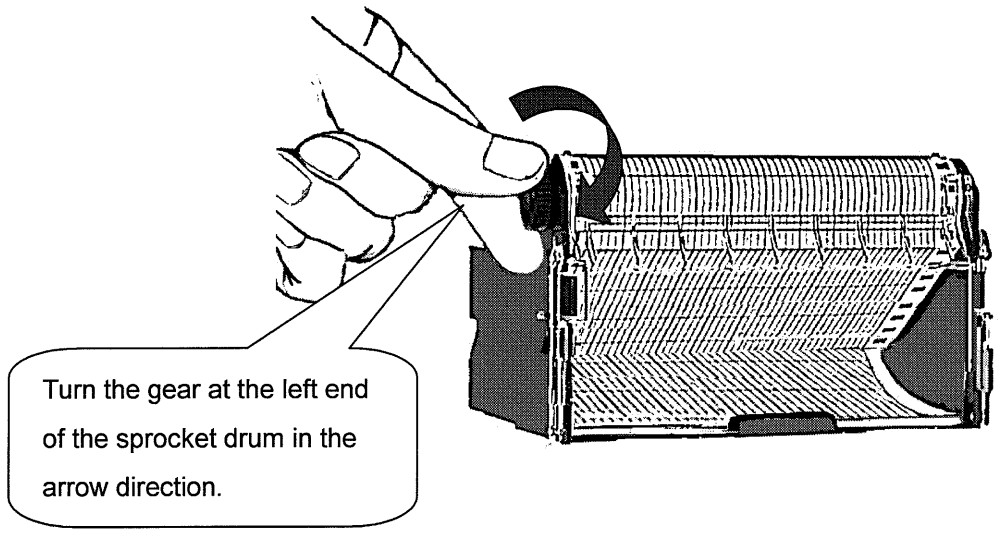


Fig. 5.11 Checking Paper Feed

(11)Putting Back the Chart Holder

Push in the chart holder horizontally into the case until it is locked.

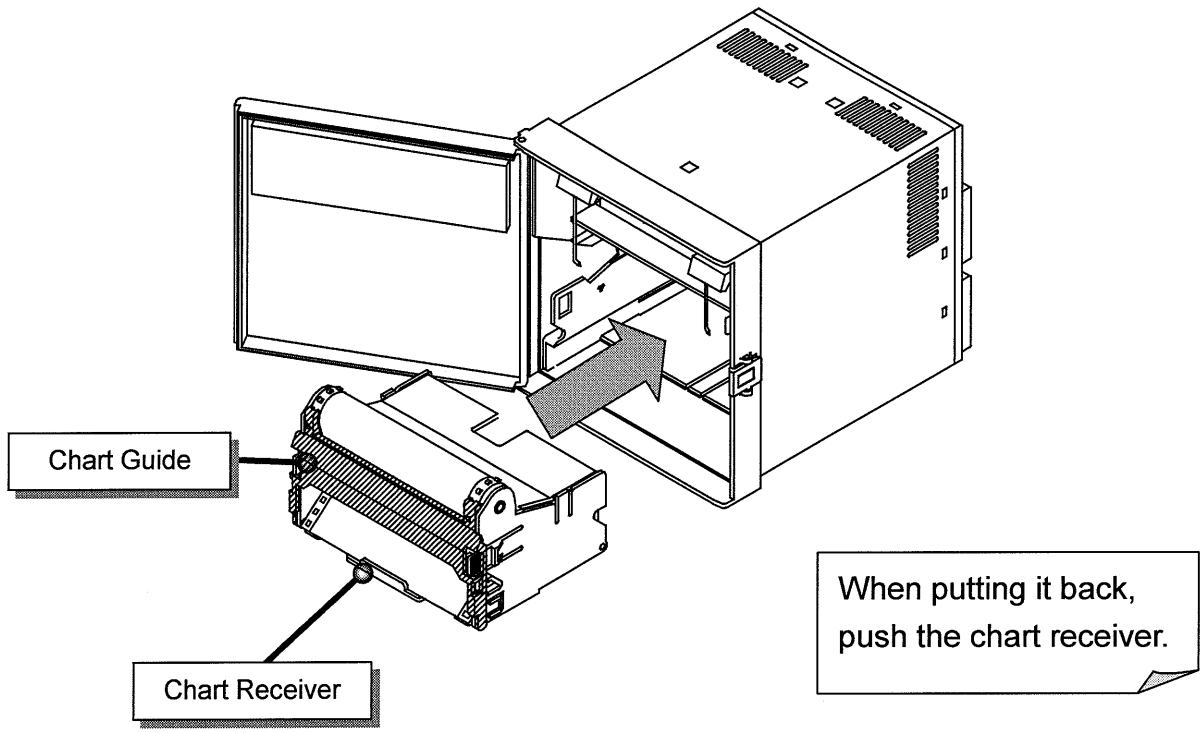


Fig. 5.12 Putting Back the Chart Holder

(12)Moving down the Pen to Close the Door

Move down the pen with the pen-up lever. Close the door and check a door lock.

The pen-up lever is located at the right end inside the case. Push it down with a finger.

(13)Pressing the "FEED" key to Check Paper Feed

Press the "FEED" key on the display keyboard to feed the chart paper.

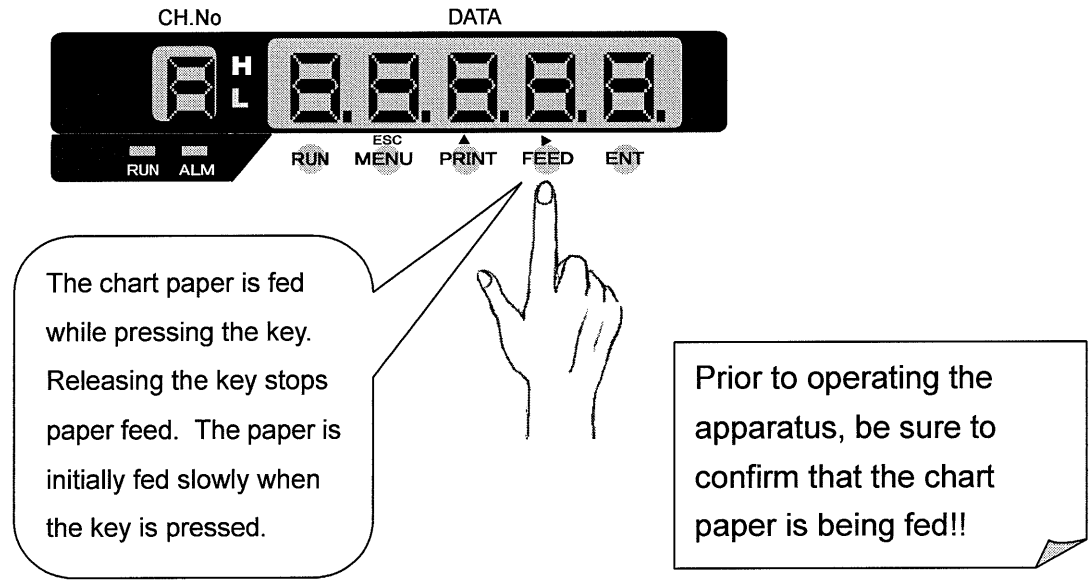


Fig. 5.13 Pressing the "FEED" key

(14)Pressing the "RUN" key to Restart Operation

5.2 Setting the Cartridge Pen

> ⚠ **CAUTION**
>
> To replace the cartridge pen, be sure to press the "RUN" key to stop recording.

(1) Pressing the "RUN" key for 3 seconds or more

Stop recording. With the power turned on, press the "RUN" key for 3 seconds or more.

Once recording stops, the RUN lamp goes off. (See Fig. 5.1 on Page 25)

The pen and printer automatically move, discontinuing paper feed. The No. 1 pen (red) records the left side (approx. 15 %) and No. 2 pen (green) records the right side (approx. 85 %), respectively. (See Fig. 5.2 on Page 25)

(2) Opening the Door

Push the door hook to unlock the door. Pull the door to this side to open it. (See Fig. 5.3 on Page 26)

> ⚠ **CAUTION**
>
> Maximum angle of the door in opened-state is 135 degree. Do not further open the door otherwise hinge will be broken.

(3) Detaching the Cartridge Pen

Pull out the cartridge pen to this side.

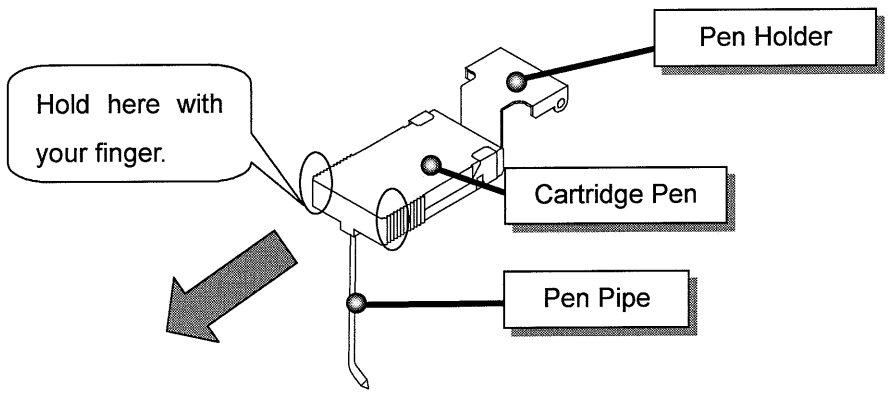


Fig. 5.14 Detaching the Cartridge Pen

> ⚠ **Note**
>
> When pulling out the cartridge pen, do not hold the pen pipe. It could be bent, resulting in improper recording.

Removing the Pen Cap

Remove the pen cap from the new cartridge pen.

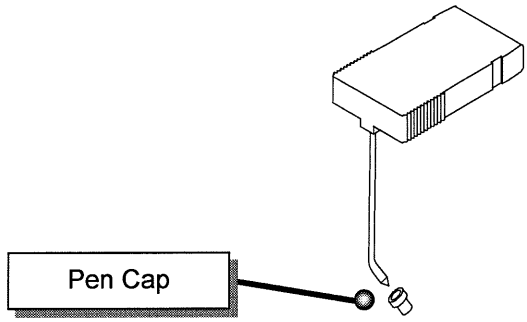


Fig. 5.15 Removing the Pen Cap

(5) Reattaching the Cartridge Pen

Reattach the cartridge pen to the pen holder. Push it in firmly until it clicks.

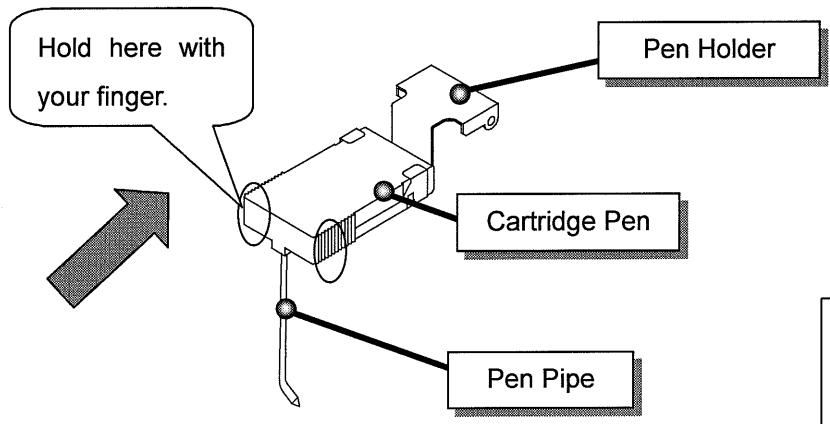


Fig. 5.16 Reattaching the Cartridge Pen

(6) Pressing the "RUN" Key to Restart Operation

5.3 Setting the Ribbon Cassette

⚠ CAUTION

If the chart holder is taken out with recording operation being activated, the ink ribbon may be damaged. To replace the ribbon cassette, be sure to press the "RUN" key to stop recording. Be sure to move up the cartridge pen. Otherwise, it will be damaged.

(1) Pressing the "RUN" key for 3 seconds or more

Stop recording. With the power turned on, press the "RUN" key for 3 seconds or more.

Once recording stops, the RUN lamp goes off. (See Fig. 5.1 on Page 25)

The pen and printer automatically move, discontinuing paper feed. The No. 1 pen (red) records the left side (approx. 15 %) and No. 2 pen (green) records the right side (approx. 85 %), respectively. (See Fig. 5.2 on Page 25)

(2) Opening the Door

Push the door hook to unlock the door. Pull the door to this side to open it. (See Fig.5.3 on Page 26)

⚠ CAUTION

Maximum angle of the door in opened-state is 135 degree. Do not further open the door otherwise hinge will be broken.

(3) Moving up the Pen

Push up the pen-up lever to move a pen tip away from the chart paper. (Move up the pen; see Fig.5.4 on Page 26)

(4) Taking out the Chart Holder

Put your fingers onto the levers at both sides of the chart holder and pull it out to this side. (See Fig.5.5 on Page 27) The guide shaft, printer, and the main shaft are laid out as shown in the figure below. (The main shaft is invisible if the ribbon cassette has been set.)

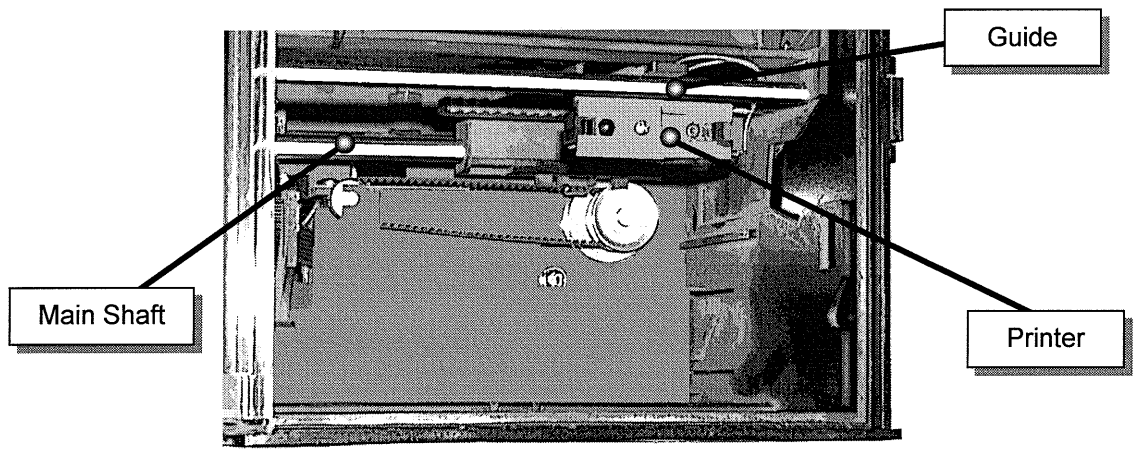


Fig. 5.17 Layout of Guide Shaft, Printer and Main Shaft

(5) Lowering the Ribbon Cassette

Detach both sides of the ribbon cassette from the guide shaft.

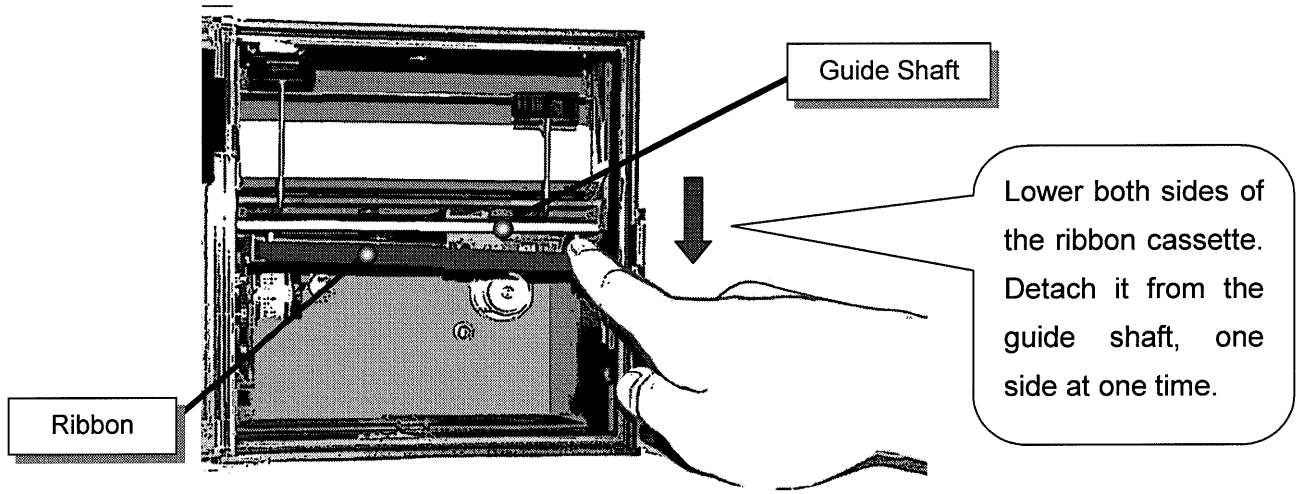


Fig. 5.18 Detaching from the Guide Shaft

(6) Pulling down the Ribbon Cassette Slantly

Detach the ribbon cassette from the main shaft.

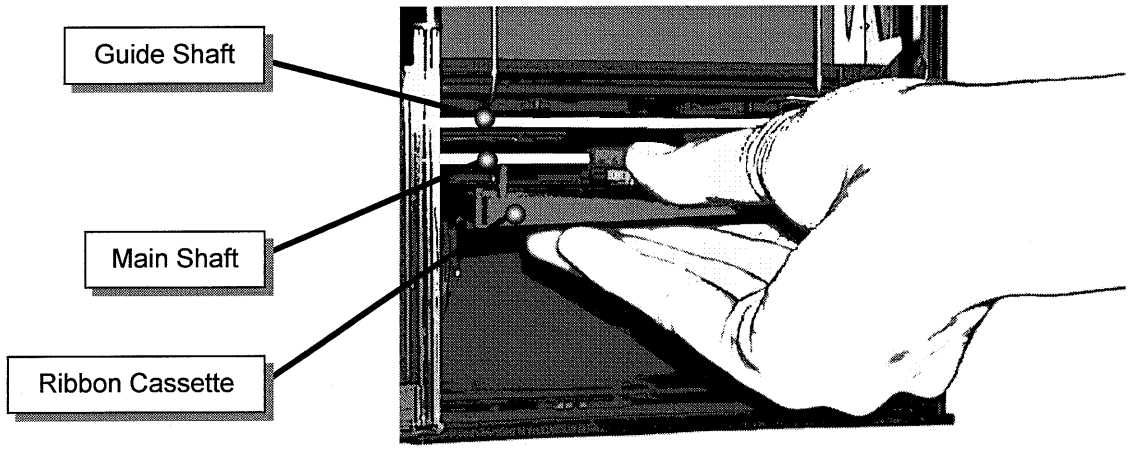


Fig. 5.19 Detaching from the Main Shaft

Viewing from the right side (section), the hook of the ribbon cassette has been engaged with the main shaft.

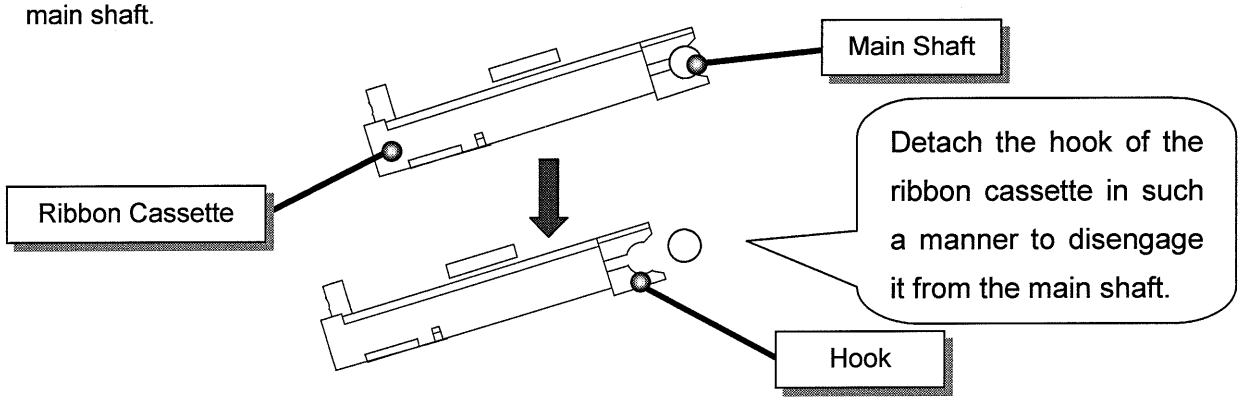


Fig. 5.20 Ribbon Cassette Sectional View

(7) Leveling the Ribbon Cassette

Prior to the pulling out the ribbon cassette, level it.

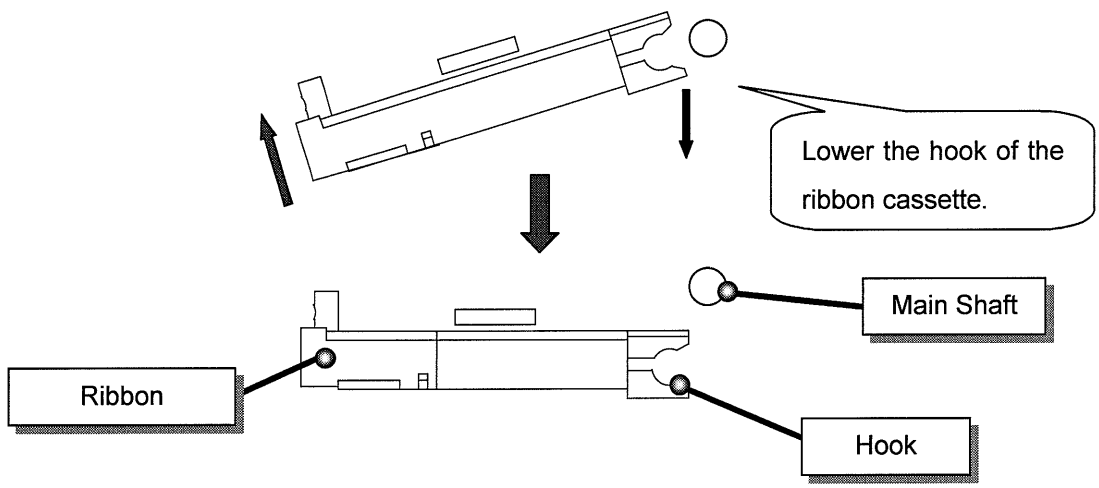


Fig. 5.21 Leveling the Ribbon Cassette (Ribbon Cassette Sectional View)

(8) Pulling out the Ribbon Cassette

Pull out the ribbon cassette horizontally. If the gear of the ribbon cassette touches the printer, move the printer further to the right.

(9) Unslacking the Ink Ribbon

Set the new ink ribbon. Turn the gear in the arrow direction to unslack the ink ribbon.

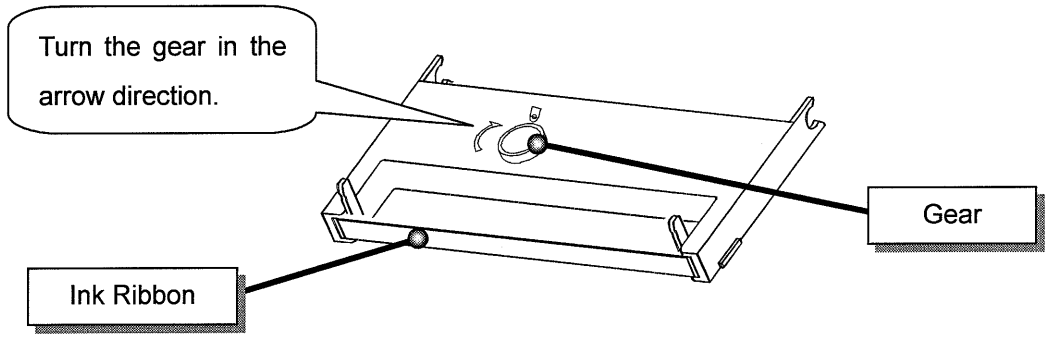


Fig. 5.22 Unslacking the Ribbon

(10) Inserting the Ribbon Cassette Horizontally

Insert the ribbon cassette horizontally.

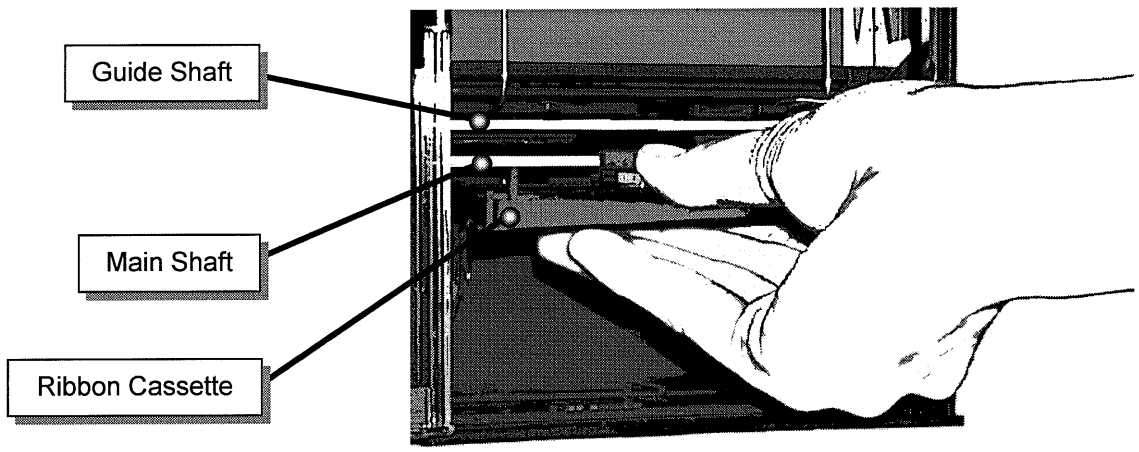


Fig. 5.23 Inserting the Ribbon Cassette

[Note]

Your hands may be stained by ink when replacing the cartridge pen or ribbon cassette.
Use soap to clean them.

(11) Reattaching the Ribbon Cassette to the Main Shaft

Holding the ribbon cassette slantly, reattach it to the main shaft in such a manner that the hook of the ribbon cassette will be engaged with the main shaft

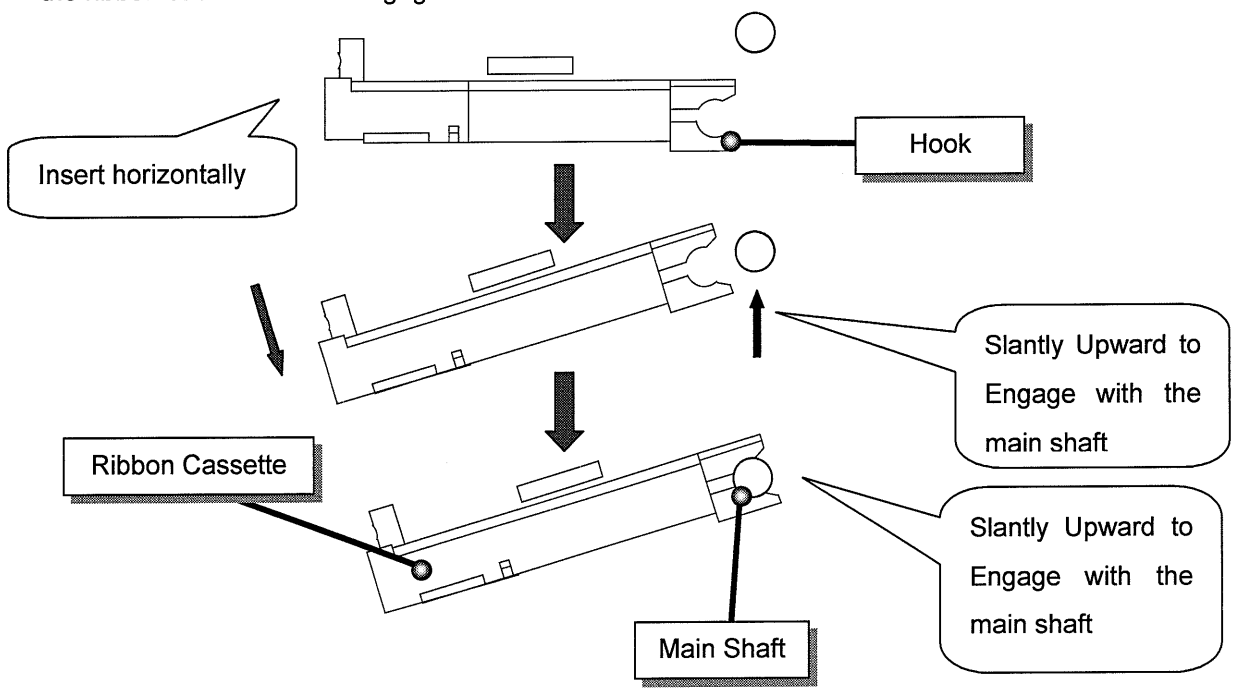


Fig. 5.24 Reattaching to the Main Shaft (Ribbon Cassette Sectional View)

(12) Pushing up the Ribbon Cassette

Attach both sides of the ribbon cassette to the guide shaft. If the gear of the ribbon cassette is not properly engaged with the printer, slide the printer slightly.

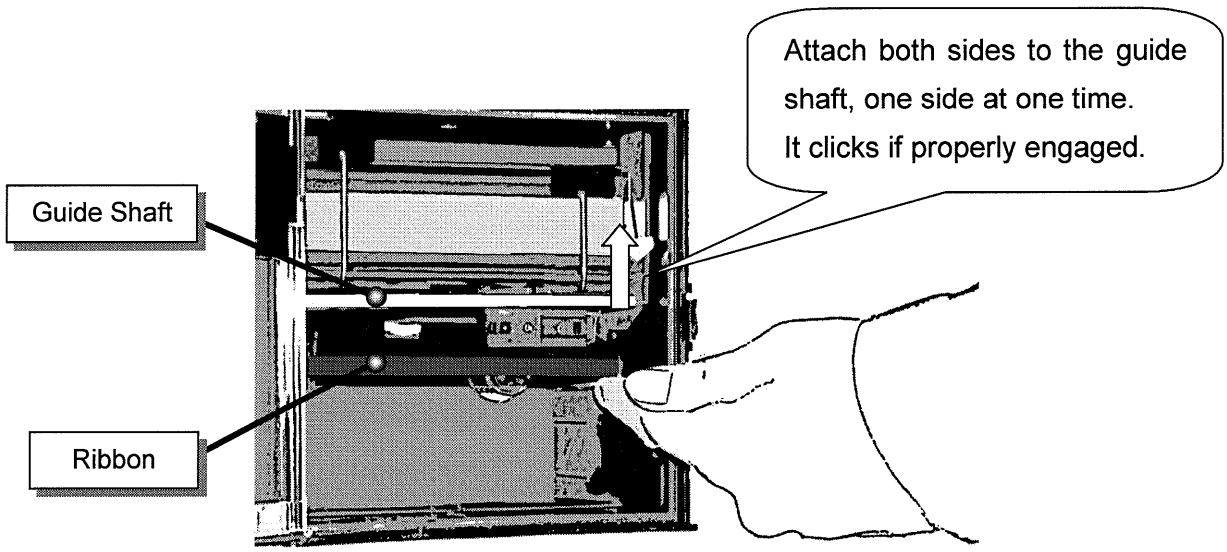


Fig. 5.25 Attaching to the Guide Shaft

(13) Putting back the Chart Holder

Put back the chart holder horizontally into the case until it is locked. (See Fig. 5.12 on Page 30)

(14) Moving down the Pen to Close the Door

Use the pen-up lever to move down the pen. Close the door and make sure that it is locked.

(15) Pressing the "RUN" key to Reset Operation

6. OPERATION

6.1 Operation

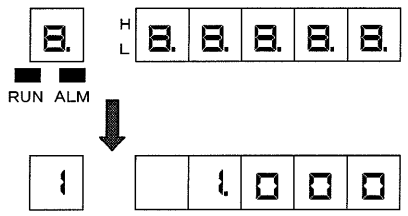
> **⚠ WARNING**
>
> Prior to turning on the power, make sure that the supply voltage meets the specifications for the instrument and the instrument is properly grounded.

> **⚠ CAUTION**
>
> Prior to turning on the power, make sure that the chart paper is set in the chart holder.
> If the printer is activated with no chart paper set, the sprocket drum (cylindrical part) of the chart holder may be damaged.

Once the power is turned on, the display on the front of the door is illuminated. The instrument will be ready to run (user mode) in about 5 seconds, including the initial screen. If the RUN lamp is unilluminated, press the "RUN" key to start recording operation.

6.1.1 Status after Initial Screen

(1)Display screen : The "RUN" lamp keeps the condition of before power-off.
(2)Printout data : All printing data and analog recording data of before power-off are cleared.
(3)Alarm and Diagnosis : Alarm indications and outputs of before power-off are not recovered.
(4)Data display and Channel number are indicated refer to Fig.6.1.



※ Returning to the mode before the power OFF.

Fig. 6.1 Display Screen at Power-on

> **[Note]**
>
> ① When electric power failure occurs, the initialization is performed after power recovery. And it becomes the above initial state.
> ② The printout data are eliminated in initialization. Printout operation is not continued after power recovery when the power is turned off during printout.
> ③ When the power is turned on, the display indicates "0" while reading data in Fig.6.1. The numeral of the indicated digit depends on the setting.

6.2 Recording

6.2.1 Recording Colors

Table 6.1 shows the recording colors for each channel in analog recording.

Table 6.1 Recording Colors

Channel No.	Color
1	Red
2	Green

6.2.2 Printing Color

Various digital prints are recorded in purple.

6.2.3 Pen Gap

Fig.6.2 shows the gap between No.1 and No.2 pens.

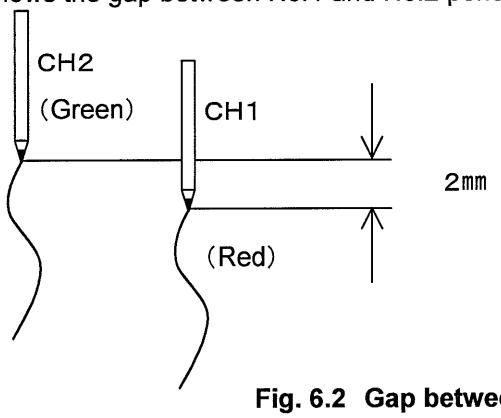


Fig. 6.2 Gap between Pens

6.2.4 Gaps between Pens and Printer

Fig. 6.3 shows the gaps between the No.1/No.2 pen and print.

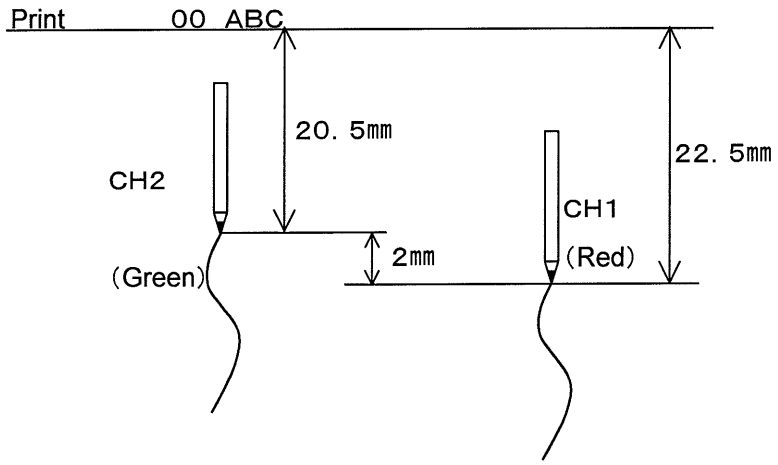


Fig. 6.3 Gaps between Pens and Printer

6.2.5 Print gap correction

It is function to correct a gap between the print head and pen record.

When setting this function ON, it send record paper automatically for the whole printout contents to come to the position in front of 1 pen ofer the asynchronous print out completes. (Fig.6.4)

The printout contents can be immediately confirmed by this .

As for this function, only DI asynchronous print, on asynchromous lo gprint are applerd.

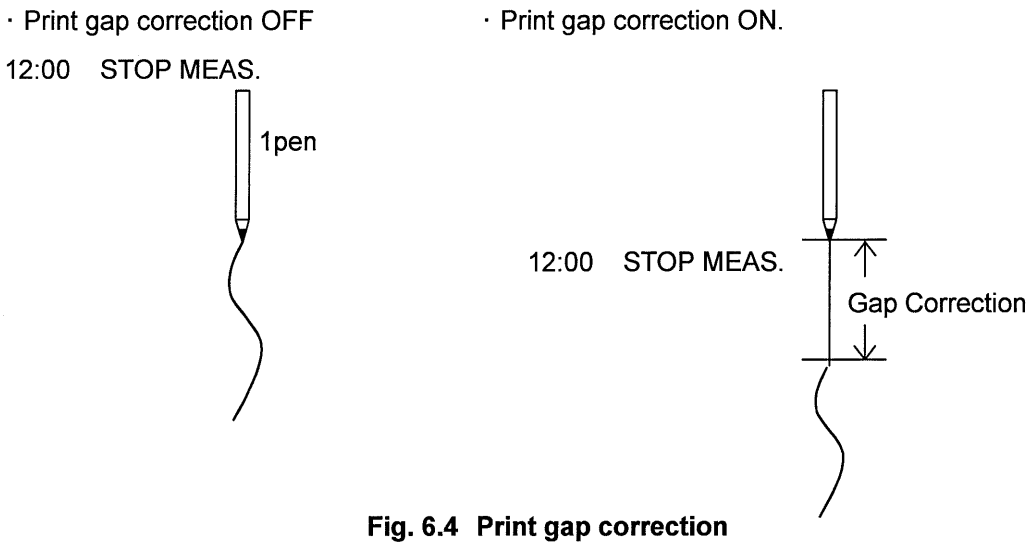


Fig. 6.4 Print gap correction

6.3 How to Record

6.3.1 Starting/Stopping Recording Operation

Starting/Stopping Recording Operation

To start/stop recording, press the "RUN" key.

To stop, hold down the "RUN" key for 3 seconds or more.

"RUN" lamp is unilluminated when stop recording.

[Note]

① When the power is turned on, the previous state where you turned off is continued.

② When controlling a start/stop of recording through Digital Input(DI, option), you cannot switch start/stop with the "RUN" key.

③ When stopping, the No.1 pen (red) holds a left-side position (approx. 15%) and No.2 pen (green) a right-side one (approx. 85%), respectively. Paper feed is suspended, but a feed key movement is enabled.

6.3.2 Feed the Chart Paper

The chart paper is fed while the "FEED" key is pressed, and stops when released.

6.3.3 Print Sample

Logging on print example and Alarm on print example

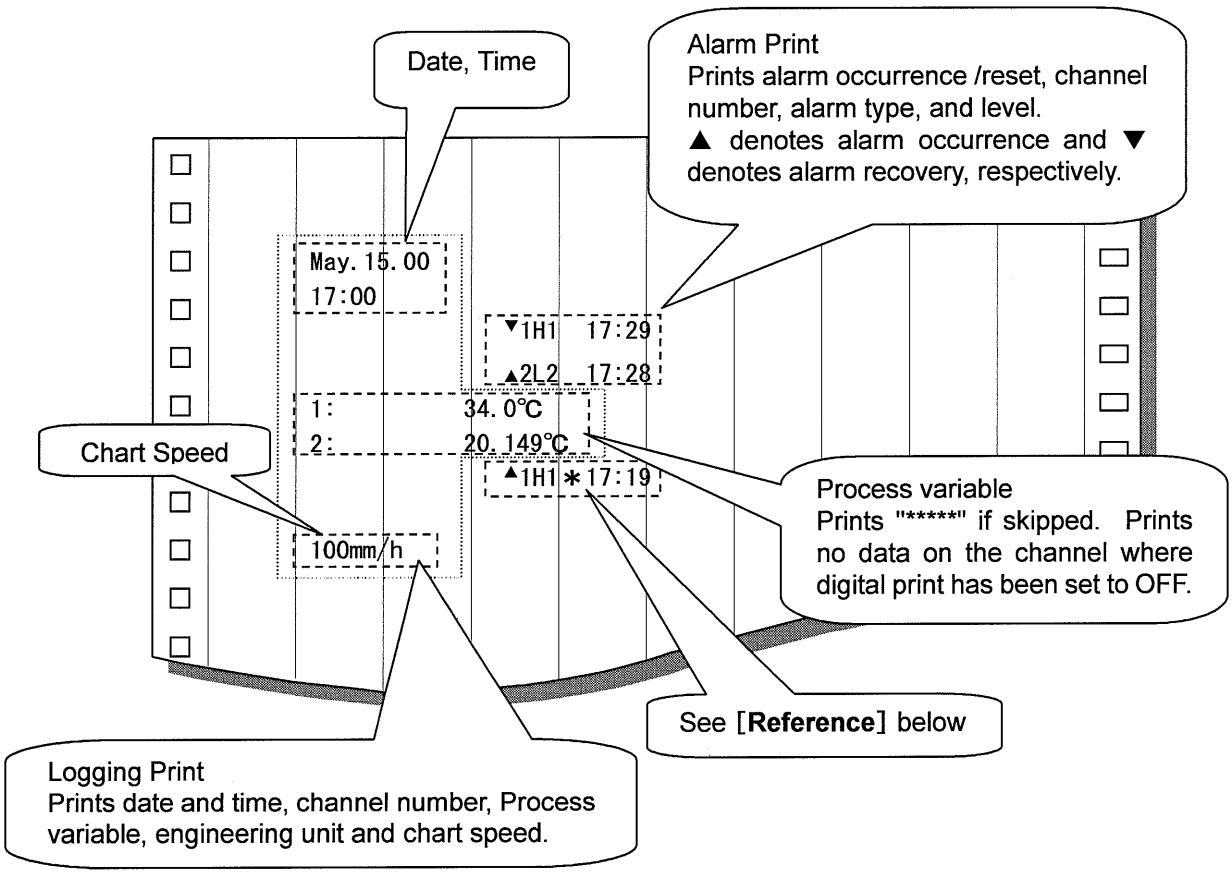


Fig. 6.5 Print Sample

[Reference]

Alarm print, Comment print and Date-and-Time print becomes waited-state if the other printing is actuated.

RM10C stores up to six items of Alarm Occurrence/Recovery print and five items of Comment/Date-and-Time print. If printing commands are over, RM10C prints a marking " * " on the end of the last printing. This mark is meaning of that over items would not be printed.

For priority of respective printing, see next page ; Priority in Reference.

[Note]

Logging print will not be the wait printing state. At the start time of Logging print, if the prior Logging print is printing, the next one cannot print. Prolong the printing interval of Logging print in this case.

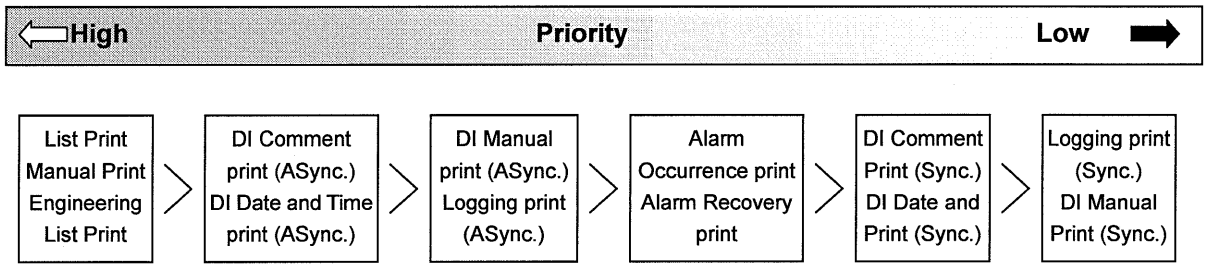
6.4 Digital Print

Print the digital print as follows

- Manual print
- List print
- Engineering list print

[Reference]

Printing is actuated in following priority. See following Priority Order. When multiple types of printing are activated simultaneously, higher-priority printing takes effect first according as following order.



The Synchronous printout synchronizes with analog record and dose a digital printout.
In case of the asynchronous printout, it stops an analog record and it executes a digital printout. It resumes an analog record after the digital printout completes.

6.4.1 Manual Print

Print the following data on the chart paper:

- Time/date (year, month, day)
- Channel number or setting tag characters
- Activated alarm type, latest Process variable, engineering unit

(1) Manual print operating procedure

①Press the "PRINT" key.

②Use the "PRINT" key to display "MAN", and press the "ENT" key.

③Use the "PRINT" key to select "START". Pressing the "ENT" key executes manual print.

Once manual print starts, the display is automatically returned to the Data Display screen.

Upon termination of manual print, it is returned to it was prior to starting manual print.

[Note]

① Analog recording is continued while manual print is running. Chart paper is fed forcibly.

② If an alarm is activated while manual print is running, alarm print will be performed when manual print ended.

(2) Manual print stopping procedure

①Press the "PRINT" key.

②Use the "PRINT" key to display "MAn", and press the "ENT" key.

③Use the "PRINT" key to select "StoP". Pressing the "ENT" key stops manual print.

However, print operation continues until the line is completed. Manual print is stopped. And the display returned it was prior to starting manual print.

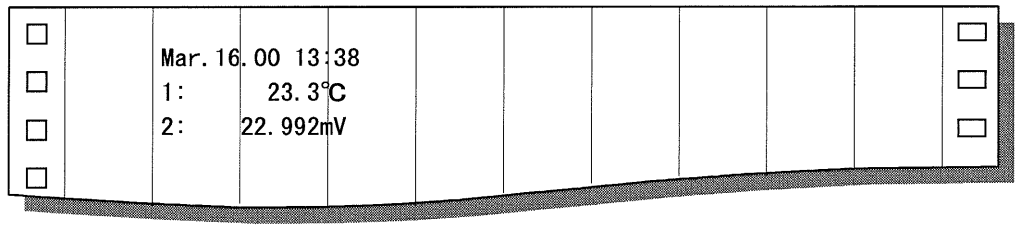


Fig. 6.6 Manual Print

[Note]

No print as to the channel where digital print has been set to OFF.

6.4.2 List Print

Print the following set up data of the instrument on the paper:

- Date/time/Chart speed/2nd chart speed
- Channel number/range/tag/scaling value/engineering unit.
- Setting alarm type
- Comment/Others

(1) List print operating procedure

①Press the "PRINT" key.

②Use the "PRINT" key to display "LI St", and press the "ENT" key.

③Use the "PRINT" key to select "StArt". Pressing the "ENT" key executes list print.

Once list print starts, the display is automatically returned to the Data Display screen.

Upon termination of list print, it is returned to it was prior to starting list print.

[Note]

① Analog recording is continued while list print is running. Chart paper is fed forcibly.

② If an alarm is activated while list print is running, alarm print will be performed when list print ended.

(2) List print stopping procedure

①Press the "PRINT" key.

②Use the "PRINT" key to display "LI St", and press the "ENT" key.

③Use the "PRINT" key to select "StoP". Pressing the "ENT" key stops list print.

However, print operation continues until the line is completed. List print is stopped. And the display returned it was prior to starting list print.

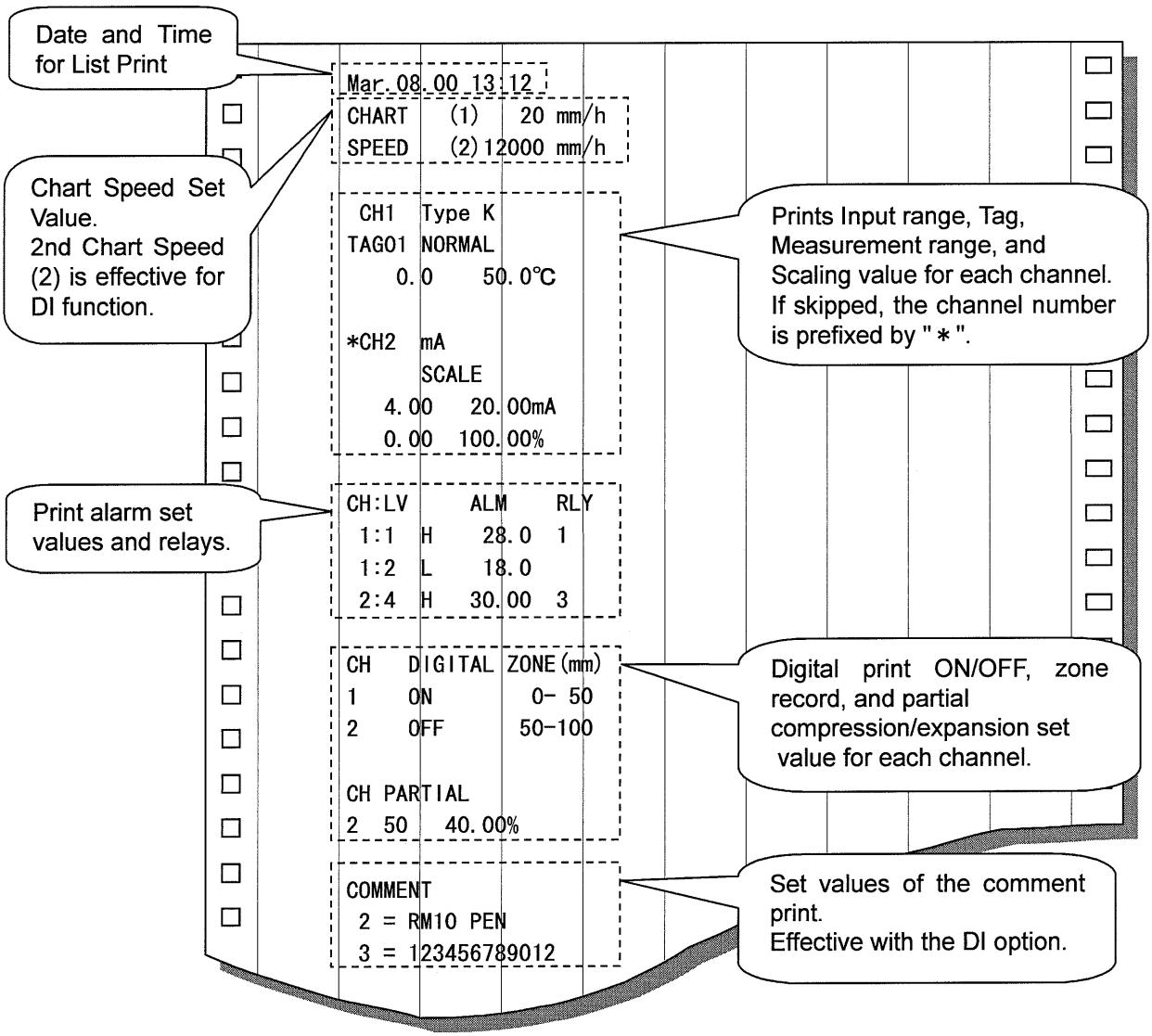


Fig. 6.7 List Print

6.4.3 Engineering List Print

Engineering list print provides the following setting data of the instrument on the chart paper.

- Analog recording
- Digital printing
- Burnout/RJC etc.

(1) Engineering list print operating procedure

①Press the "PRINT" key.

②Use the "PRINT" key to display "ELI SE". Then, press the "ENT" key.

③Use the "PRINT" key to select "StArt". Pressing the "ENT" key executes engineering list print.

Once engineering list print starts, the display is automatically returned to the Data Display screen.

Upon termination of engineering list print, it is returned to it was prior to starting engineering list print.

[Note]

① Analog recording is continued while engineering list print is running. Chart paper is fed forcibly.

② If an alarm is activated while engineering list print is running, alarm print will be performed when engineering list print ended.

(2) Engineering list print stopping procedure

①Press the "PRINT" key.

②Use the "PRINT" key to display "ELI St". Then, press the "ENT" key.

③Use the "PRINT" key to select "StoP". Pressing the "ENT" key stops engineering list print. Engineering list print is stopped. And the display returned to it was prior to starting engineering list print.

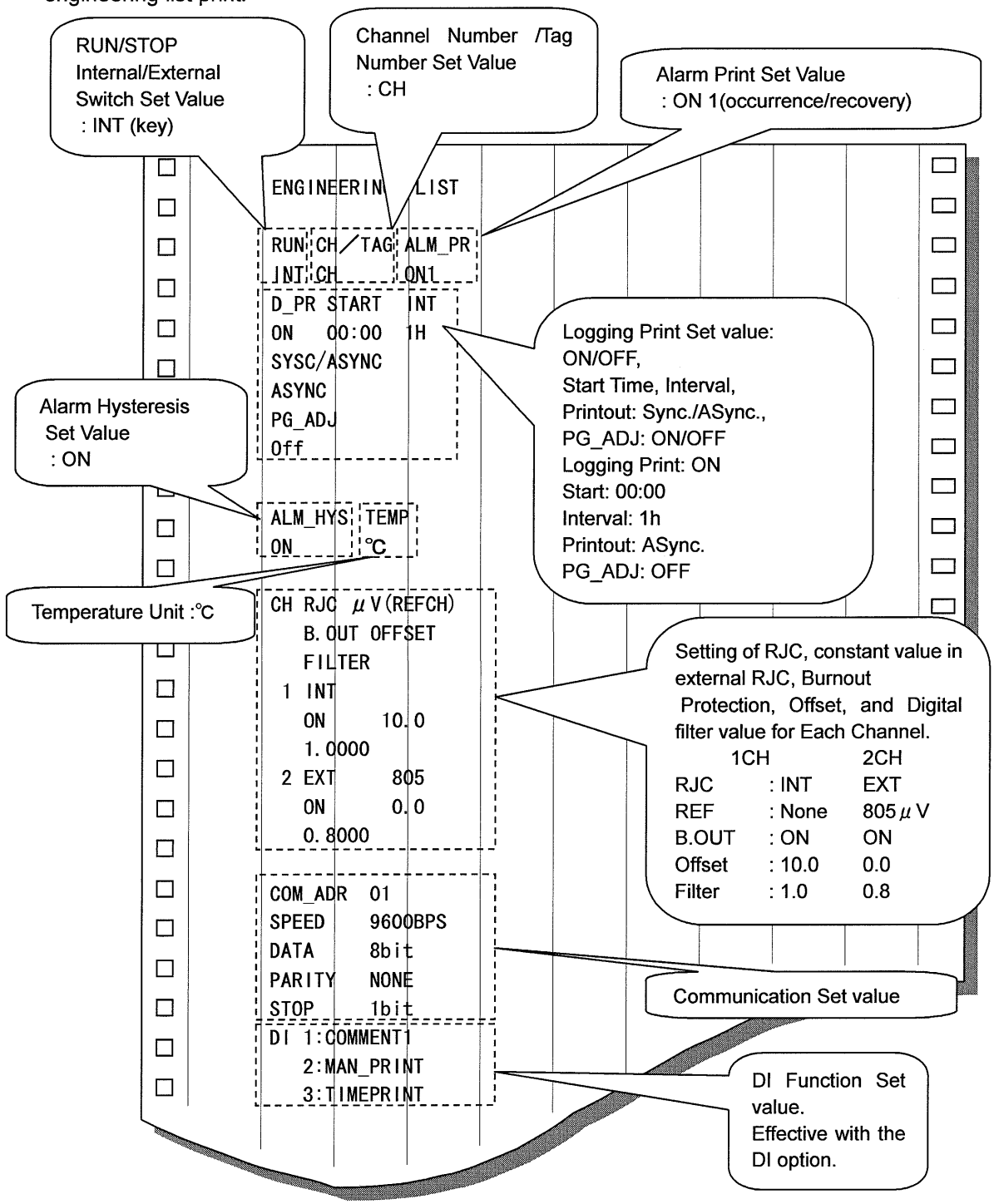


Fig. 6.8 Engineering List Print

6.5 Changing the Display

Display selection procedure

①Press the "MENU" key to indicate "dI SP" , and press the "ENT" key.

②Use the "PRINT" key to select a required display screen from the menu below. Press the "ENT" key.

③"CH□" is indicated in case of manual display. Use the "PRINT" key to select the channel number. Press the "ENT" key.

"AUto"(AUTO) : Auto display

"MAn"(MAN) : Manual display

"dAtE"(DATE) : Date display

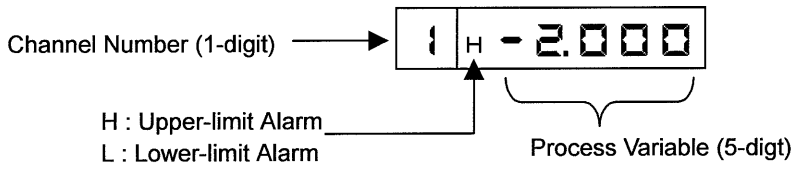
"tI ME"(TIME) : Time display

"oFF"(OFF) : Display off

6.5.1 Auto Display <AUto>

Indicates the process variable of each channel sequentially at intervals of 2.4 seconds.

(Data renewal period 120ms.)



6.5.2 Manual Display <MAn>

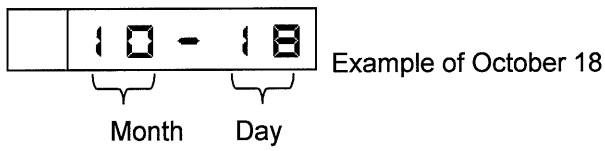
Indicates the Process variable of specific channel, it updates every measurement cycle(120ms).

The data is the same as Auto display.

Pressing the "ENT" key changes the indicated channel number (it increments).

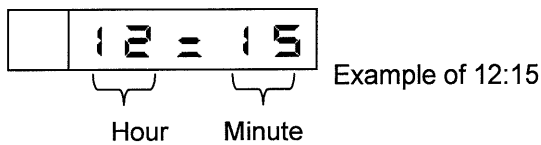
6.5.3 Date Display <dAtE>

Indicates the month and day. Leap year adjustment is automatic.



6.5.4 Time Display <tI ME>

Indicates hour and minute.



6.5.5 Display Off <oFF>

Turns off the process variable display. Key operation is the same as usual. To switch to other display, take steps ① through ③ mentioned above.

7. DEVICE SETTING

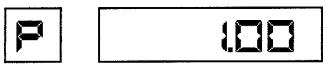
7.1 Setting the Setup Mode

"**Key Operation for Entering the Setup Mode**

Press the "MENU" key for 3 seconds or more to enter the setup mode.

At the time, indicates the version of the software approximately 1.0 seconds as below.

After, indicates the setting screen of the range.

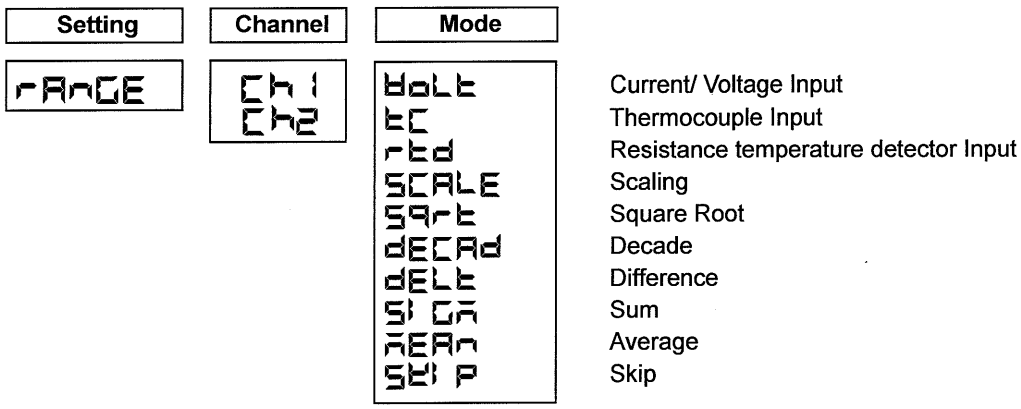


To return from the setup mode to the recording mode (user mode), press the "MENU" key for 3 seconds or more again.

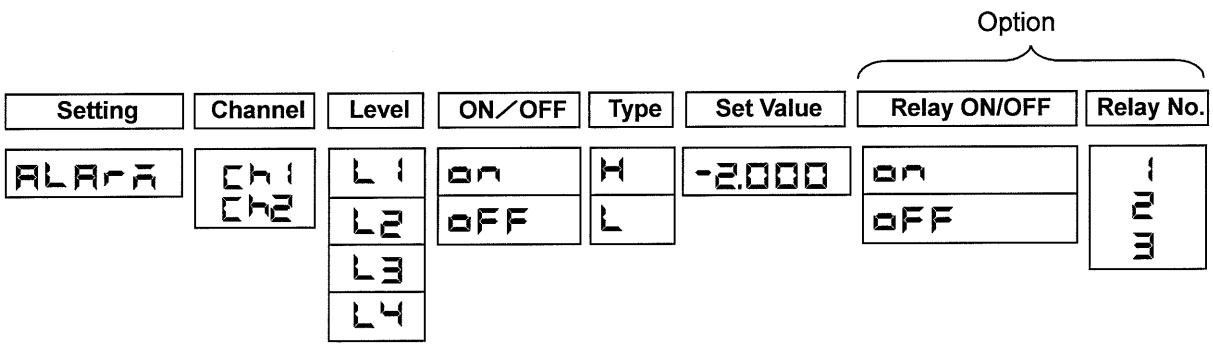
The following describes how to set the following items.

The following shows a display map of the setup mode. Use the △key to operate.

- 7.1.1 Setting the Range



- 7.1.2 Setting the Alarm



- 7.1.3 Setting the Unit

Setting	Channel	Char. No.	Code No.	
Unit	Ch1 Ch2	1	Cd bF	(°)
		2	Cd 43	(C)
		3	Cd 00	End
		4		
		5		
		6		

- 7.1.4 Setting the Chart Speed

Setting	1st/2nd Chart speed	Chart speed
CHArt	SPd-1	1500
	SPd-2	

- 7.1.5 Setting the Date and Time

Setting	Year	Month, Day	Time
CLoCK	Y 2000	A 01-01	t 06:00

- 7.1.6 Copying the Setting Data

Setting	Copy-from Channel	Copy-to Channel
CoPY	F Ch1	t Ch2

- 7.1.7 Setting Other Functions (Zone recording, Partial compression/expansion, Digital print, Tag, Comment words)

Setting	Mode	
AUt1	ZonE	Zone Recording
	PArt	Partial Compression/Expansion
	Print	Digital Print
	tAG	Tag
	CMnt	Comment Words

- Setting the password

Setting	Password	
EnG	P 0000	See the key operation in page 77.

Table 7.1 Initial setting value of the setup mode

Setting items	Initial set	Remarks
★Range (all channels)	±10mV DC Scaling 0～100.0 (℃)	
★Alarm (all channels)	All levels are alarm OFF, relay OFF	
★Engineering unit (all channels)	「℃」(BF 43 00)	
★Chart speed	(1) 20mm/h (2) 20mm/h	
★Time	2000/01/01 00:00	Sets up the present time.(Japan standard time)GMT＋09:00
★Zone setting (all channels)	0～100(%)	
★Partial compression/expansion (all channels)	OFF	
★Digital print (all channels)	ON	
★Tag print character (all channels)	"Blank until the 5th character"	
★Comment print word (1～3)	"Blank until the 12th character"	

7.1.1 Setting the Range

(1) Setting method

With a multirange system, setting the range for each channel is possible.

Use the △ key to shift the mode ① to ⑩ shown in the Table below.

Set the range from the following input signals. (mode ① to ③)

DC voltage : ±10, 0 to 20, 0 to 50, ±200 mV DC, ±1, 0 to 5, ±10 V DC
DC current : 4 to 20 mA DC (External shunt resistor: 250Ω)
Thermocouple : B, R, S, K, E, J, T, C, Au-Fe, N, PR40-20, PLⅡ, U, L
Resistance temperature detector : Pt100, JPt100

Set scaling, decade, square root, interchannel sum/difference/average. (mode ④ to ⑨)

Unnecessary channels can be skipped. (mode ⑩)

Setting	Channel	Mode		Key
rAnGE	Ch 1 Ch 2 Setting for all channels	①	bOLt (Current/ Voltage Input)	△Key
		②	tC (Thermocouple Input)	↓
		③	rtd (Resistance temperature detector Input)	↓
		④	SCALE (Scaling)	↓
		⑤	Sqrt (Square Root)	↓
		⑥	dECAd (Decade)	↓
		⑦	dELt (Difference)	↓
		⑧	SUM (Sum)	↓
		⑨	AVAn (Average)	↓
		⑩	SKIP (Skip)	

[Note]

A decimal point position can be arbitrary setup only in the "scaling" and "square root" modes.When you want to alter the decimal point position in Voltage/Current/Thermocouple/Resistance temperature detector input set it in the "scaling" mode. To fix the decimal point position, set as follows.

Input	Decimal Places		Input	Decimal Places	
mV	2nd place	***.**	Thermocouple	1st place	****.*
±1, 0~5V	3rd place	**.***	RTD	1st place	****.*
±10V	2nd place	***.**	±200mV DC	1st place	****.*
mA	2nd place	***.**			

(2) volt (Current/Voltage), tc (Thermocouple), rtd (Resistance Temperature Detector)

Measurs Current, Voltage, Thermocouple and RTD.

Example) When setting Thermocouple T for Channel 1(T : -100 to 300 ℃)

Display	Operation Keys	Description
rAnGE	ESC MENU 3 sec, ENT	Hold down the MENU key for 3 seconds or more to enter the setup mode. Indicates "rAnGE", then, press the "ENT" key.
Ch 1	△ PRINT, ENT	Use the △ key to select the channel you want to set. Press the "ENT" key.
tC	△ PRINT, ENT	Use the △ key to select the mode. Press the "ENT" key.
t	△ PRINT, ENT	Use the △ key to select the type. Press the "ENT" key.
L - 100.0 (Zero setting)	△ PRINT, ▷ FEED, ENT	Use the △ key to select a sign and numeral. Use the ▷ key to shift a digit. Press the "ENT" key.
r 300.0 (Span setting)	△ PRINT, ▷ FEED, ENT	Use the △ key to select a sign and numeral. Use the key to shift a digit. Press the "ENT" key.
-SEt-	ENT	Press the "ENT" key. Setting is completed. To return to the user mode, hold down the "MENU" key for 3 seconds or more.

[Note]

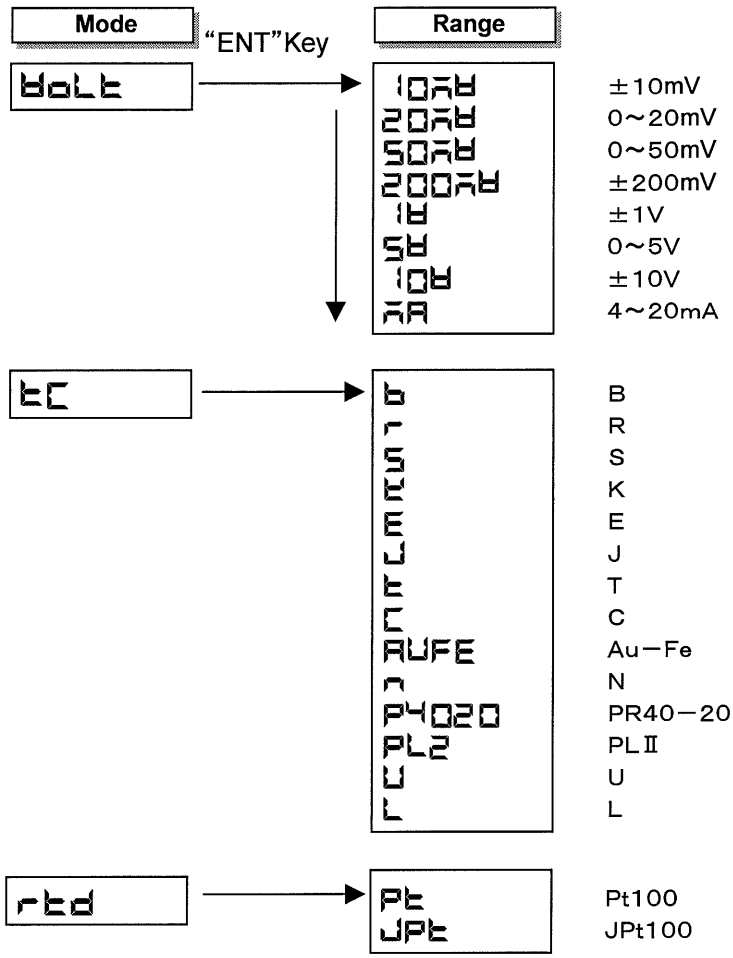
① An entry of an incorrect numeral indicates an error, E Err21 or E Err24. Press the "ENT" key and re-enter a correct numeral.

② For the range setting (When especially, don't change a decimal point position at the thermocouple or in RTD) which doesn't have the necessity of the scaling, don't set a scaling.

[Note]

In the volt, tc, or rtd mode, press the "ENT" key to select the range.

Use the △ key, you can select the type out of the range.



(3) SCALE (Scaling)

Changes the input of VOLT, TC and RTD into a quantity.

Setting the unit is possible.(See 7.1.3 on page 66.)

Example) When setting the voltage of 0 to 40 mV and scale of 000.00 to 100.00 for Channel 1

Display	Operation Keys	Description
rAnGE	ESC MENU 3 sec △ PRINT ENT	Hold down the MENU key for 3 seconds or more to enter the setup mode. Use the △ key to indicate "rAnGE". Press the "ENT" key.
Ch 1	△ PRINT ENT	Use the △ key to select the channel you want to set. Press the "ENT" key.
SCALE	△ PRINT ENT	Use the △ key to select "SCALE". Press the "ENT" key.
VoLt	△ PRINT ENT	Use the △ key to select "VoLt". Press the "ENT" key.
50mV	△ PRINT ENT	Use the △ key to select a range(50 mV). Press the "ENT" key.
L 000.00 (Zero input value)	△ PRINT ▷ FEED ENT	Use the △ key to select a numeral. Use the ▷ key to shift a digit. Press the "ENT" key.

[Note]

When input TC and RTD, set the Zero input value equal to the Zero-side scale value.
But, set a decimal point position to the standard position. (* 1:next page)

r 040.00 (Span input value)	△ PRINT ▷ FEED ENT	Use the △ key to select a numeral. Use the ▷ key to shift a digit. Press the "ENT" key.

[Note]

When input TC and RTD, set the Span input value equal to the Span-side scale value.
But, set a decimal point position to the standard position. (* 2:next page)

(Zero-side scale value) (* 1)

PRINT FEED

Use the △ key to select a numeral.
Use the ▷ key to shift a digit.

(Decimal point)

FEED PRINT

ENT

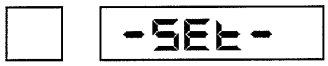
Press the ▷ key again in the lowest digit(right end) to blink a decimal point. Use the △ key to select a decimal point position. Press the "ENT" key.

(Span-side scale value) (* 2)

PRINT FEED

ENT

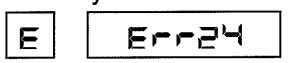
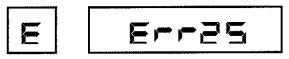
Use the △ key to select a numeral.
Use the ▷ key to shift a digit. Press the "ENT" key.



ENT

Press the "ENT" key. Setting is completed.
To return to the user mode, hold down the "MENU" key for 3 seconds or more.

[Note]

An entry of an incorrect numeral indicates an error,  or  or  .

Press the "ENT" key and re-enter a correct numeral.

(4) SQRT (Square Root)

Caluclates the square root of Volt input, and scaling that value.

Setting the unit is possible. (See 7.1.3 on page 66.)

Example) When setting the voltage of 0 to 40 mV and scale of 000.00 to 100.00 for Channel 1

Display	Operation Keys	Description
RANGE	ESC MENU 3 sec; △ PRINT; ENT	Hold down the "MENU" key for 3 seconds or more to enter the setup mode. Use the △ key to indicate "RANGE". Press the "ENT" key.
CH 1	△ PRINT; ENT	Use the △ key to select the channel you want to set. Press the "ENT" key.
SQRT	△ PRINT; ENT	Use the △ key to select "SQRT". Press the "ENT" key.
SOAV	△ PRINT; ENT	Use the △ key to select a range(50 mV). Press the "ENT" key.
L 000.00 (Zero input value)	△ PRINT; ▷ FEED; ENT	Use the △ key to select a numeral. Use the ▷ key to shift a digit. Press the "ENT" key.
F 040.00 (Span input value)	△ PRINT; ▷ FEED; ENT	Use the △ key to select a numeral. Use the ▷ key to shift a digit. Press the "ENT" key.
L 0000.0 (Zero-side scale value)	△ PRINT; ▷ FEED	Use the △ key to select a numeral. Use the ▷ key to shift a digit.
L 000.00 (Decimal point)		Press the ▷ key again in the lowest digit(right end) to blink a decimal point. Use the △ key to select a decimal point position. Press the "ENT" key.
F 100.00 (Span-side scale value)	△ PRINT; ▷ FEED; ENT	Use the △ key to select a numeral. Use the ▷ key to shift a digit. Press the "ENT" key.
-SET-	ENT	Press the "ENT" key. Setting is completed. To return to the user mode, hold down the "MENU" key for 3 seconds or more.

[Note]

An entry of an incorrect numeral indicates an error, E Err21 or E Err24 or E Err25.

Press the "ENT" key and re-enter a correct numeral.

About Square Root Computation

The square root computation is as follows:

- Each item is defined as follows:

  $SPAN_L$: Span lower-limit value (Span L)

  $SPAN_R$: Span upper-limit value (Span R)

  $SCAL_L$: Scaling lower-limit value (Scale L)

  $SCAL_R$: Scaling upper-limit value (Scale R)

  IN : Input voltage

  OUT : Output (Scaling value)

- When an input value is 1 % or more (1 to 100 %)

$$OUT = (SCAL_R - SCAL_L) \times \sqrt{\frac{IN - SPAN_L}{SPAN_R - SPAN_L}} + SCAL_L$$

- When an input value is less than 1 %

$$OUT = \frac{10 \times (SCAL_R - SCAL_L)}{SPAN_R - SPAN_L} \times (IN - SPAN_L) + SCAL_L$$

Example) When makes setting in previous page, the display is as follow table

Input voltage (mV)	0	10	20	30	40
Display (%)	0. 00	50. 00	70. 71	86. 63	100. 00

[Note]

The relation between scaling factor and displaying digit may stagger the accuracy rating.

(5) dECAd (Decade)

Scaling the VOLT input and displays the index number. Setting the unit is possible. (See 7.1.3 on page 66.)

Example) When setting the voltage of 0 to 5 V and decade of 1.0×10^0 to 1.0×10^5 for Channel1

Display	Operation Keys	Description
rAnGE	ESC MENU 3 sec △ PRINT ENT	Hold down the "MENU" key for 3 seconds or more to enter the setup mode. Use the △ key to indicate "rAnGE". Press the "ENT" key.
Ch 1	△ PRINT ENT	Use the △ key to select the channel you want to set. Press the "ENT" key.
dECAd	△ PRINT ENT	Use the △ key to select "dECAd". Press the "ENT" key.
5V	△ PRINT ENT	Use the △ key to select a range(5V). Press the "ENT" key.
L 00.000 (Zero input value)	△ PRINT ▷ FEED ENT	Use the △ key to select a numeral. Use the ▷ key to shift a digit. Press the "ENT" key.
r 05.000 (Span input value)	△ PRINT ▷ FEED ENT	Use the △ key to select a numeral. Use the ▷ key to shift a digit. Press the "ENT" key.
L 1.0E00 (Zero-side scale value)	△ PRINT ▷ FEED ENT	Use the △ key to select a numeral. Use the ▷ key to shift a digit. Press the "ENT" key.
r 1.0E05 (Span-side scale value)	△ PRINT ▷ FEED ENT	Use the △ key to select a numeral. Use the ▷ key to shift a digit. Press the "ENT" key.
-SEt-	ENT	Press the "ENT" key. Setting is completed. To return to the user mode, hold down the "MENU" key for 3 seconds or more.

[Note]

An entry of an incorrect numeral indicates an error, E Err21 , E Err24 or E Err25 .
Press the "ENT" key and re-enter a correct numeral.

About Decade Display

- Each item is defined as follows:

  $SPAN_L$: Span lower-limit value (Span L)

  $SPAN_R$: Span upper-limit value (Span R)

  $SCAL_L$: Scaling lower-limit value (Scale L)

  $SCAL_R$: Scaling upper-limit value (Scale R)

  } XXEYY
  XX: Mantissa section (1.0 to 9.9)
  YY: Exponent section (-19 to 19)
  Up to 5 decades.
  (Scaling upper limit)
  −(Scaling lower limit) is 1.0E5 or less.

  IN : Input voltage

  OUT : Output (Scaling value)

- Decade display abides by the following relational expression.

$$OUT1 = IN \times \frac{LGSCAL_R - LGSCAL_L}{SPAN_R - SPAN_L} + \frac{SPAN_R \times LGSCAL_L - SPAN_L \times LGSCAL_R}{SPAN_R - SPAN_L}$$

$$OUT = 10^{OUT1}$$

$LGSCAL_L$: $Log_{10}(SCAL_L)$

$LGSCAL_R$: $Log_{10}(SCAL_R)$

[Note]

Decade output is used for display and print. It is not reflected on pen recording.

Example) When makes setting in previous page, the display is as follow table

Input voltage (V)	0. 0	1. 0	2. 5	3. 0	5. 0
Display	1. 0E0	1. 0E1	3. 2E2	1. 0E3	1. 0E5

(6) dELt (Difference), SUM (Sum), AVRG (Average)

Caluclates the input of VOLT, TC, RTD or SCALE, and output.

Example) When subtracting the Channel 1 input data from the Channel 2 input data to set the difference (0 to 40 mV)

Records and indicates "Channel 2 (input value) minus Channel 1" to Channel 2

Display	Operation Keys	Description
rANGE	ESC MENU 3 sec; △ PRINT; ENT	Hold down the "MENU" key for 3 seconds or more to enter the setup mode. Use the △ key to indicate "rANGE". Press the "ENT" key.
Ch2 (Setting channel)	△ PRINT; ENT	Use the △ key to select the channel you want to set. Press the "ENT" key.
dELt	△ PRINT; ENT	Use the △ key to select "dELt". Press the "ENT" key.
Ch 1 (Reference channel)	△ PRINT; ENT	Use the △ key to select the "channel you want to subtract." Press the "ENT" key.
L 000.00 (Zero input value after difference operation)	△ PRINT; ▷ FEED; ENT	Use the △ key to select a numeral. Use the ▷ key to shift a digit. Press the "ENT" key.
r 040.00 (Span input value after difference operation)	△ PRINT; ▷ FEED; ENT	Use the △ key to select a numeral. Use the ▷ key to shift a digit. Press the "ENT" key.
-SEt-	ENT	Press the "ENT" key. Setting is completed. To return to the user mode, hold down the "MENU" key for 3 seconds or more.

[Note]

An entry of an incorrect numeral indicates an error, E Err21, E Err23 or E Err24.

Press the "ENT" key and re-enter a correct numeral.

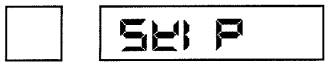
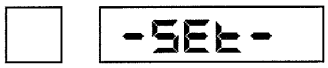
About Difference, Sum, and Average

- The channel to be set must be larger than the one on which computes the "difference, sum, or average". Set up only Channel 2.
- The range and scale of the set channel is the same as the channel on which computes the "difference, sum, and average".
- A range value after the computation cannot exceed the maximum range of the instrument.
- Set for the reference channel only the voltage, current, thermocouple, resistance temperature detector, and their scaling ranges.

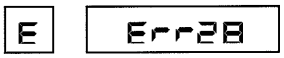
(7) SKIP (Skip)

Setting SKIP on the Channel does not display and recording.

Example) When skipping Channel 2

Display	Operation Keys	Description
	ESC MENU 3 sec △ PRINT ENT	Hold down the "MENU" key for 3 seconds or more to enter the setup mode. Use the △ key to indicate "rANGE". Press the "ENT" key.
	△ PRINT ENT	Use the △ key to select the channel you want to set. Press the "ENT" key.
	△ PRINT ENT	Use the △ key to select "SKIP". Press the "ENT" key.
	ENT	Press the "ENT" key. Setting is completed. To return to the user mode, hold down the MENU key for 3 seconds or more.

[Note]

Setting all the channels to Skip indicates an error,  .

At least, one channel should be set to measurement.

About Skip

The skip channel conducts measurement, but does not provide display, print, or alarm judgment. If input is not connected, short-circuit a measurement terminal.

The pen keeps zero point position. Remove the cartridge pen.

7.1.2 Setting the Alarm

Setting items

Alarm setting to the following two types for each channel is possible.

Alarm point can set up 4 levels for each channel.

Once sets up the alarm point, illuminated "ALM" when a process variable reaches alarm point, and simultaneously, outputs the alarm print indicating an alarm occurrence to the chart paper.

H : Upper-limit alarm — When the process variable is higher than the alarm set point, issues an alarm.

L : Lower-limit alarm — When the process variable is lower than the alarm set point, issues an alarm.

Operation

Option

Setting	Channel	Level	ON/OFF	Type	Set Value	Relay ON/OFF	Relay No.
ALArA	Ch 1	L 1	on	H	-2.000	on	1
	Ch2	L2	oFF	L		oFF	2
		L3					3
		L4					

Example) When setting for the Channel 1 alarm point (Level 1) the upper-limit alarm, set value of -2.000, and alarm output relay No. 1

Display	Operation Keys	Description
ALArA	ESC MENU 3 sec / △ PRINT / ENT	Hold down the "MENU" key for 3 seconds or more to enter the setup mode. Use the △ key to indicate "ALArA". Press the "ENT" key.
Ch 1	△ PRINT / ENT	Use the △ key to select the channel you want to set. Press the "ENT" key.
L 1	△ PRINT / ENT	Use the △ key to select an alarm level. Press the "ENT" key. Up to 4 levels can be set.
on	△ PRINT / ENT	Use the △ key to select alarm setting ON. Press the "ENT" key. Setting "oFF" indicates "ALArA" and completes setting.
H	△ PRINT / ENT	Use the △ key to select an alarm type. Press the "ENT" key.
-2.000	△ PRINT / ▷ FEED / ENT	Set an alarm point. Use the ▷ key to shift a digit, and use the △ key to select a numeral. Once setting is completed, press the "ENT" key. A decimal point position is fixed depending on the range.

[Note]

When the "ENT" key is pressed in setting the alarm point. Display will be switched to the next setting display.

Setting hereinafter is valid only for the model to which an alarm output relay option has been attached. If the option has not been set, press the "ENT" key until "-SEt-" is indicated.

Then, press the "ENT" key once more. Setting is completed.

Display	Operation Keys	Description
1 on	△ PRINT ENT	When an alarm occurs, issues the alarm output from the alarm output relay. Use the △ key to select alarm output ON and press the "ENT" key. If the alarm output is not used, select OFF and press the "ENT" key.
1 1	△ PRINT ENT	If the alarm output is set to ON, set the relay number. Use the △ key to select the relay number out of 1 to 3, and press the "ENT" key.
-SEt-	ENT	Press the "ENT" key. Setting is completed. When you want to continue to set for other channel, press the △ key to select the channel, and start setting. To return to the user mode, hold down the "MENU" key for 3 seconds or more.

[Note]

The tag setting does not effect on Alarm print setting. Prints channel numbers every time.

7.1.3 Setting the Unit

Setting Items

Set the unit for each channel.

> **[Note]**
> If you change the unit in the range of Volt, TC or rtd, setting the range to SCALE.

Operation

Setting	Channel	Char. No.	Code No.	
Unit	Ch1	1	Cd bF	(°)
	Ch2	2	Cd 43	(C)
		3	Cd 00	End
		4		
		5		
		6		

Example) Setting the unit (°C) for Channel 1

Display	Operation Keys	Description
Unit	ESC MENU 3 sec; △ PRINT; ENT	Hold down the "MENU" key for 3 seconds or more to enter the setup mode. Use the △ key to indicate "Unit". Then, press the "ENT" key.
Ch1	△ PRINT; ENT	Use the △ key to select the channel you want to set. Then, press the "ENT" key.
1 Cd bF (Code No.)	△ PRINT; ▷ FEED; ENT	Use the △ or ▷ key to select the 1st character of the code number, and press the "ENT" key. See Characters Code Table on the next page.
2 Cd 43	△ PRINT; ▷ FEED; ENT	Set the 2nd character in the same manner.
3 Cd 00	△ PRINT; ▷ FEED; ENT	When the number of unit characters is less than 6, enter a code(00) to end. Press the "ENT" key.
-SEt-	ENT	Press the "ENT" key. Setting is completed. To return to the user mode, hold down the "MENU" key for 3 seconds or more.

> **[Note]**
> The unit setting effects only when the range setting is SCALE, Sqrt or dECAd (including dELt, SI GA and AEAn selected SCALE as the reference channel).
> When the range setting is others, the unit sets appropriate unit for the range automatically.

(1)Character Code Table

	2*	3*	4*	5*	6*	7*	A*	B*	C*	D*	E*	F*
*0	SP	0	@	P		p	$_0$	^{0}		Π		π
*1	!	1	A	Q	a	q	$_1$	^{1}	A	P	α	ρ
*2	″	2	B	R	b	r	$_2$	^{2}	B	Σ	β	σ
*3	#	3	C	S	c	s	$_3$	^{3}	Γ	T	γ	τ
*4	$	4	D	T	d	t	$_4$	^{4}	Δ	Y	δ	υ
*5	%	5	E	U	e	u	$_5$	^{5}	E	Φ	ε	φ
*6	&	6	F	V	f	v	$_6$	^{6}	Z	X	ζ	χ
*7	′	7	G	W	g	w	$_7$	^{7}	H	Ψ	η	ψ
*8	(	8	H	X	h	x	$_8$	^{8}	Θ	Ω	θ	ω
*9	)	9	I	Y	i	y	$_9$	^{9}	I		ι	
*A	*	:	J	Z	j	z			K		κ	
*B	+	;	K	[	k	{	$_+$	$^+$	Λ		λ	
*C	,	<	L	¥	l	|	±	∓	M	◿	μ	
*D	−	=	M	]	m	}			N	◢	ν	
*E	.	>	N	^	n	¯	$_-$	$^-$	Ξ	◺	ξ	
*F	／	?	O	_	o		$_\circ$	$^\circ$	O	◣	ο	

Example) The code number for "C" is "43"

7.1.4 Setting the Chart Speed

Setting Items

Set the chart speed. Select it from the table below.

Table 7.2 Chart Speed (Unit: mm/h)

5	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									

Operation

Setting	1st/2nd Chart speed	Chart speed
CHArt	SPd- 1	1500
	SPd-2	

Example) When setting the 1st chart speed to 1500 mm/h

Display	Operation Keys	Description
CHArt	ESC MENU 3 sec; △ PRINT ENT	Press the "MENU" key for 3 seconds or more to enter the setup mode. Use the △ key to indicate "CHArt", and press the "ENT" key.
SPd- 1	△ PRINT ENT	Use the △ key to select the 1st chart speed, and press the "ENT" key.

[Note]

When altering the chart speed with the DI option, set the 2nd chart speed.
If the DI option is not attached, setting of the 2nd chart speed becomes invalid.

Display	Operation Keys	Description
1500	△ PRINT ▷ FEED	Use the △ key to set the 1st chart speed, and press the "ENT" key.
-SEt-	ENT	Press the "ENT" key. To return to the user mode, hold down the "MENU" key for 3 seconds or more.

[Note]

Restriction of printing by chart speed

Print type	Chart speed(mm/h)
Alarm occurrence print, Alarm recovery print, Affix print, DI Comment print (Synchronous), DI Date and Time print (Synchronous), DI Manual print (Synchronous)	5～100(mm/h)
Logging print (Synchronous)	10～100(mm/h)

When the chart speed is 0 mm/h, it's printed with forcible chart feed. (When the chart speed is more than 120 mm/h, not printing as shown the Table above.) List Print, Engineering List Print , Manual Print (key), DI Comment print (Asynchronous) , DI Date and Time print (Asynchronous) , DI Manual print (Asynchronous) and Logging print (Asynchronous) is printed regardless of the chart speed.

7.1.5 Setting the Date and Time

Setting Items

The following describes how to set the date/time of the internal clock.

Setting	Year	Month, Day	Time
CLoCK	Y 2000	A 01-01	t 06:00

Example) When setting the date and time to January 1st, 2000, 6:00.

Display	Operation Keys	Description
CLoCK	ESC MENU 3 sec / △ PRINT ENT	Hold down the "MENU" key for 3 seconds or more to enter the setup mode. Use the △ key to indicate "CLoCK", and press the "ENT" key.
Y 2000	△ PRINT ▷ FEED ENT	Set the year. Use the △ key to select a numeral, and use the ▷ key to shift a digit. Press the "ENT" key.
A 01-01	△ PRINT ▷ FEED ENT	Set the month and day. Operate in the same manner as setting the year.
t 06:00	△ PRINT ▷ FEED ENT	Set the time (hours and minutes). Operate in the same manner as setting the year.
-SEt-	ENT	Press the "ENT" key. To return to the user mode, hold down the "MENU" key for 3 seconds or more.

[Note]

If you enter a non-existent dates or time, indicates an error E Err22 .
Press the ENT key and re-enter a correct numeral.

7.1.6 Copying the Setting Data

Setting Items

The following describes how to copy the setting data of 1 channel to 2 channel.

Operation

Setting	Copy-from Channel	Copy-to Channel
CoPy	F Ch 1	t Ch2

Example) When copying the setting data of Channel 1 to Channel 2.

Display	Operation Keys	Description
CoPy	ESC MENU 3 sec / △ PRINT ENT	Hold down the MENU key for 3 seconds or more to enter the setup mode. Use the △ key to indicate "CoPy," and press the "ENT" key.
F Ch 1	△ PRINT ENT	Use the △ key to select the copy-from channel.
t Ch2	△ PRINT ENT	Use the △ key to select the copy-to channel, and press the "ENT" key.
-SEt-	ENT	Press the "ENT" key. To return to the user mode, hold down the "MENU" key for 3 seconds or more.

[Note]

Copy the setting data of Channel 1 to Channel 2. The contrary is not made.

7.1.7 Setting Other Functions

Setting other functions as follows is possible.

Setting Items

①ZonE (Zone recording)

The data for each channel can be recorded separately in another area so that they will not overlap.

②PArt (Partial compression/expansion)

Record the measured data of the channel, partially compressed/expanded.

③Pri nt (Digital print)

Specify with ON/OFF whether the measured data for each channel is to be printed or not.

④tAG (Tag)

Set the tag, which is to be printed instead of a channel number, for logging print or manual print. Setting up to 5 characters (See Page 67 for Character Code Table), as the tag for each channel is possible.

⑥Cmnt (Comment words)

Set the comment words to be printed by DI. There are three kinds of comment words and setting up to 12 characters (See Page 67 for Character Code Table) for each channel is possible.

Operation

Setting	Mode	
AUt	ZonE	Zone Recording
	PArt	Partial Compression/Expansion
	Pri nt	Digital Print
	tAG	Tag
	Cmnt	Comment Words

(1) ZonE (Zone Recording)

Example) When setting the instrument so that Channel 1 zero/span will be recorded at the position of 20 to 50 %

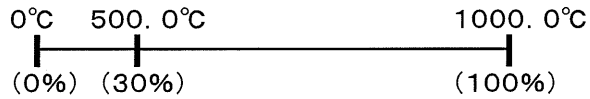
Display	Operation Keys	Description
AUt 1	ESC MENU 3 sec	Hold down the "MENU" key for 3 seconds or more to enter the setup mode. Use the △ key to indicate "AUt 1", and press the "ENT" key.
ZonE	△ PRINT ENT	Use the △ key to indicate "ZonE", and press the "ENT" key.
Ch 1	△ PRINT ENT	Use the △ key to select the channel you want to set, and press the "ENT" key.
L 020 (Setting of Left-end Position)	△ PRINT ▷ FEED ENT	Set a zero point printing position in percentage (%). Use the △ key to select a numeral, and use the ▷ key to shift a digit. Press the "ENT" key.
r 050 (Setting of Right-end Position)		Set a span printing position in percentage (%). Operate in the same manner as setting the zero point printing position.
-SEt-	ENT	Press the "ENT" key. Setting is completed. To return to the user mode, hold down the "MENU" key for 3 seconds or more.

[Note]

If you enter an incorrect numeral, indicates errors E Err2 1, E Err26. Press the "ENT" key and re-enter a correct numeral.

(2) PArt (Partial Compression/Expansion)

Example) When setting Channel 1 scale of 0 to 1,000.0 ℃ to 500.0 ℃ at a boundary point of 30 %



Display	Operation Keys	Description
AUt1	ESC MENU 3 sec △ PRINT ENT	Hold down the "MENU" key for 3 seconds or more to enter the setup mode. Use the △ key to indicate "AUt1", and press the "ENT" key.
PArt	△ PRINT ENT	Use the △ key to select "PArt", and press the "ENT" key.
Ch 1	△ PRINT ENT	Use the △ key to select the channel you want to set, and press the "ENT" key.
on	△ PRINT ENT	Use the △ key to select "on", and press the "ENT" key.
030	△ PRINT ▷ FEED ENT	Set a boundary point position in percentage (%). Use the △ key to select a numeral, and use the ▷ key to shift a digit. Press the "ENT" key.
0500.0	△ PRINT ▷ FEED ENT	Set a boundary point position to "0500.0". Use the △ key to select a numeral, and use the ▷ key to shift a digit. Press the "ENT" key.
-SEt-	ENT	Press the "ENT" key. Setting is completed. To return to the user mode, hold down the "MENU" key for 3 seconds or more.

[Note]

If you enter an incorrect numeral, indicates an error E Err21 .
Press the "ENT" key and re-enter a correct numeral.

(3) Print (Digital Print)

Example) When setting logging channel data print to "ON"(print enabled) for all the channels

Display	Operation Keys	Description
AUX	ESC MENU 3 sec △ PRINT ENT	Hold down the "MENU" key for 3 seconds or more to enter the setup mode. Use the △ key to indicate "AUX", and press the "ENT" key.
Print	△ PRINT ENT	Use the △ key to indicate "Print", and press the "ENT" key.
Ch1	△ PRINT ENT	Use the △ key to select the channel you want to set, and press the "ENT" key.
on	△ PRINT ENT	Use the △ key to switch from "oFF" to "on", and press the "ENT" key.
-SEt-	ENT	Press the "ENT" key. Setting is completed. To return to the user mode, hold down the "MENU" key for 3 seconds or more.
Ch2	△ PRINT ENT	Repeat setting for each channel.
-SEt-	ENT	

[Note]

The data for the channel to be skipped is printed "∗".

(4) tAG (Tag)

Example) When setting "AB" for Channel 1

Display	Operation Keys	Description
AUH	ESC MENU 3 sec △ PRINT ENT	Hold down the "MENU" key for 3 seconds or more to enter the setup mode. Use the △ key to indicate "AUH", and press the "ENT" key.
tAG	△ PRINT ENT	Use the △ key to indicate "tAG", and press the "ENT" key.
Ch 1	△ PRINT ENT	Use the △ key to select the channel you want to set, and press the "ENT" key.
1 Cd 41 (Setting of 1st Character)	△ PRINT ▷ FEED ENT	Set "41" as the 1st character to end. Use the △ key to select a code, and use the ▷ key to shift a digit. Press the "ENT" key.
2 Cd 42 (Setting of 2nd Character)	△ PRINT ▷ FEED ENT	Set the 2nd character to end in the same manner.
3 Cd 00 (Setting of 3rd Character)	△ PRINT ▷ FEED ENT	Set "00" as the 3rd character to end and press the "ENT" key.
-SEt-	ENT	Press the "ENT" key. Setting is completed. To return to the user mode, hold down the "MENU" key for 3 seconds or more.

[Note]

When the number of tag characters is less than 5, set the "00" code next to the last characters.
See Page 67 for Character Code Table.

(5) CMNT (Comment Words)

Example) When setting "ON" for Comment 1(CMT 1)

Display	Operation Keys	Description
AUX1	ESC MENU 3 sec △ PRINT ENT	Hold down the "MENU" key for 3 seconds or more to enter the setup mode. Use the △ key to indicate "AUX1", and press the "ENT" key.
CMNT	△ PRINT ENT	Use the △ key to indicate "CMNT", and press the "ENT" key.
CMT 1	△ PRINT ENT	Use the △ key to select a comment number. Indicate "CMT 1" and press the "ENT" key.
1 Cd 4F (Setting of 1st Character)	△ PRINT ▷ FEED ENT	Set "4F" as the 1st character to end. Use the △ key to select a code, and use the ▷ key to shift a digit. Press the "ENT" key.
2 Cd 4E (Setting of 2nd Character)	△ PRINT ▷ FEED ENT	Set "4E" as the 2nd character to end. Operate in the same manner as setting the 1st character to end.
3 Cd 00 (Setting of 3rd Character)	△ PRINT ▷ FEED ENT	Set "00" as the 3rd character to end. Operate in the same manner as setting the 1st character to end.
9 (Setting of 9th Character) 0 (Setting of 10th Character) 1 (Setting of 11th Character) 2 (Setting of 12th Character)		Repeat setting for each channel.
-SET-	ENT	Press the "ENT" key. Setting is completed. To return to the user mode, hold down the "MENU" key for 3 seconds or more.

[Note]

- When the number of comment characters is less than 12, set the "00" code next to the last characters. See Page 67 for Character Code Table.
- The digit is not indicate after setting the "00".
- The comment setting is not effective without the DI option. Do not set the comment setting.

7.2 Setting the Engineering Mode

Key Operation to Enter the Engineering Mode

Hold down the "MENU" key for 3 seconds or more to enter the setup mode.

Use the △ key to select "EnG", and press the "ENT" key then to display "0000".

Use the △ key to alter a numeral, and the ▷ key to shift a digit, enter the password "2222".

Press the "ENT" key then to display blinking "rESEt".

Press the "ENT" key. After reset, enter the engineering mode.

The following describes how to set the following items.

The following shows a display map of the Enginneering mode. Use the △key to operate.

- 7.2.1 Alarm Hysteresis

Setting	ON/OFF	
ALAHS	on	Set the hysteresis width
	oFF	Reset the hysteresis width

- 7.2.2 Burnout ON/OFF

Setting	Channel	ON/OFF	
b.oUt	Ch 1	on	Set burnout
	Ch2	oFF	Reset burnout

- 7.2.3 Channel Offset

Setting	Channel	OFFSET	
oFSEt	Ch 1	0.0000	Enter an offset value
	Ch2		

- 7.2.4 Reference Junction Compensation

Setting	Channel	Function	
rJC	Ch 1	Int	Internal Compensation
	Ch2	Ext	External Compensation
		Ch	Channel Input Compensation

- 7.2.5 Digital Filter

Setting	Channel	Function	
FILtr	Ch 1 Ch2	10000	Digital Filter value

- 7.2.6 Settings Related to Recording

Setting	Function	
run	run.tG	Recording start/stop INT/EXT selection
	tAG	Tag/channel print selection
	ALArm	Alarm print ON/OFF
	dGt.Pr	Logging print ON/OFF
	d.SYnC	Logging print Synchronous/Asynchronous print
	PG.Adj	Print gap correction ON/OFF

- 7.2.7 Setting the Communication Function

Setting	
Com	Setting the Communication Function Local Address Baud Rate Data Length Parity Bit Stop Bit

- 7.2.8 Initializing the Setup Data

Setting	YES/NO
Init	YES no

- 7.2.9 DI Functions

Setting	DI No.	Function	
di	di 1 di 2 di 3	oFF	No function
		rCd	Recording start/stop
		SPEEd	Chart speed selection
		Cmnt 1	Comment 1 print(Synchronous)
		Cmnt2	Comment 2 print(Synchronous)
		Cmnt3	Comment 3 print(Synchronous)
		mAn-P	Manual print(Synchronous)
		dt n-P	Date and time print(Synchronous)
		ACmt 1	Comment 1 print(Asynchronous)
		ACmt2	Comment 2 print(Asynchronous)
		ACmt3	Comment 3 print(Asynchronous)
		AmAn.P	Manual print(Asynchronous)
		Adt n.P	Date and time print(Asynchronous)

- 7.2.10 Temperature Unit

Setting	Temp Unit	
tEmP	C	Centigrade Unit
	F	Fahrenheit Unit

- 7.2.11 Point Calibration

Setting	Function	
P AdJ	ZEro	Zero point calibration
	FULL	Span point calibration

- 7.2.12 Data Calibration

Setting	Function	
d AdJ	VoLt	Voltage calibration
	rtd	Resistance temperature detector calibration
	rJC	Internal reference junction compensation calibration

- 7.3 Terminating the Engineering Mode

Setting	Function	
End	StorE	Save a set value
	AborT	Cancel a set value

[Note]

Upon termination if you select "End" and turn off the power without executing "StorE", the setting will become invalid. For "End" operation, see Page 91.

Table 7.3 Initial setting value of the engineering mode

Setting items	Initial set	Remarks
★Alarm hysteresis	ON(0.5%)	
★Burnout (all channels)	OFF	
★Channel offset (all channels)	0.0	
★RJC (all channels)	Internal compensation INT	
★Digital Filter Value	K=1.0000	
★RUN record		Use the RUN key
RUN/STOP trigger	INT	
Channel/Tag print	Ch	
Alarm print	OFF	
Logging Print	ON	
Logging Printing interval	6H	
Logging Print reference time	00:00	
Logging Print Sync./ASync.	Sync print	
Print gap correction	OFF	
★COM(communication)		
Address	01	
Baud rate	9600	
Data length	8bit	
Parity bit	None	
Stop bit	1bit	
★DI(1~3 channel)	OFF	
★Temperature unit	Centigrade Unit	

7.2.1 Alarm Hysteresis

Setting 0.5 % hysteresis to the values at alarm activation and alarm recovery is possible. (Common to all the alarms)

Example) When turning off alarm hysteresis

Display	Operation Keys	Description
☐ ALAHS	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △key to indicate "ALAHS", and press the "ENT" key.
☐ oFF	△ PRINT ENT	Use the △ key to indicate "oFF", and press the "ENT" key.

7.2.2 Burnout ON/OFF

Setting Burnout High (to deflect the recording over the span) for each channel is possible.

Example) When setting Burnout High for Channel 2

Display	Operation Keys	Description
☐ b.oUt	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to indicate "b.oUt", and press the "ENT" key.
☐ Ch2	△ PRINT ENT	Use the △ key to indicate "Ch2", and press the "ENT" key.
☐ on	△ PRINT ENT	Use the △ key to select "on", and press the "ENT" key.

7.2.3 Channel Offset

For channel offset setting, set the value to be added to an actual process variable.

The input possible value is -19999 to 99999.

Example) When setting the value (3.0) to be added to Channel 2

Display	Operation Keys	Description
	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to indicate "oFSEt", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to select "Ch2", and press the "ENT" key.
	△ PRINT ▷ FEED ENT	Use the △ key to alter a sign/numerical value or shift a decimal point. Use the ▷ key to shift a digit. Once the numerical value is decided, press the "ENT" key.

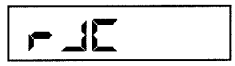
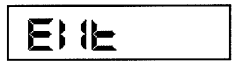
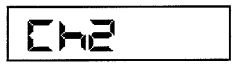
7.2.4 Reference Junction Compensation

The following describes how to set the method for compensating an electromotive force generated between a thermocouple wire or compensation lead wire and a terminal. There are the following three compensating methods:

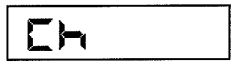
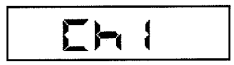
- A method to compensate through the built-in temperature sensing element (INT: Internal compensation)
- A method to compensate by keeping an external compensator's temperature constant (EXT: External compensation)
- A method to compensate by one input for the recorder temperature which gets external junction box. (CH: Channel input compensation)

Internal compensation (INT) has been initially set.

Example) When setting the external compensator's temperature constant voltage for Channel 2 to 391 μV. Input the thermocouple T, compensate the external compensator's temperature 10℃ and Input the electromotive force 391 μV.

Display	Operation Keys	Description
	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to indicate "rJC", and press the "ENT" key
	△ PRINT ENT	Use the △ key to select "Ch2", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to select "EHt", and press the "ENT" key.
	△ PRINT ▷ FEED ENT	Use the △ key to alter a numerical value, or the ▷ key to shift a digit. Once the numerical value is decided, press the "ENT" key.
		Setting is completed. Returned to the channel setting.

Example) When Channel 1 input compensates Channel 2 reference junction

Display	Operation Keys	Description
	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to indicate "rJC", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to select "Ch2", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to select "Ch", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to select "Ch 1", and press the "ENT" key.
		Setting is completed. Returned to the channel setting.

7.2.5 Digital Filter

Apply a digital filter to a process valuable to record the first order lag. From 99.5% response time (T_I), the filter constant (K) is obtained by the following formula.

$$K = \frac{0.64}{T_I}$$

Example) When 99.5% response time is 50 second; $K = \frac{0.64}{50} = 0.0128$

Set up the digital filter constant for Channel 2 to "K = 0.0128".

Display	Operation Keys	Description
FILtr	ENT	Enter the engineering mode (See the key operation in page 77).
Ch2	△ PRINT ENT	Use the △ key to select "Ch2" and press the "ENT" key.
0.0128	△ PRINT ▷ FEED	Use the △ key to alter a numerical value, or the key to shift a digit. Press the "ENT" key.
	ENT	
Ch2	△ PRINT ENT	Setting is completed. Returned to the channel setting.

7.2.6 Settings Related to Recording

Sets a recording start/stop trigger, select tag/channel print, or set alarm print and logging print.

(1) Recording start/stop trigger setting

Set whether the trigger of recording start/stop should be by the "RUN" key or DI.

Example) When setting DI as the recording start/stop trigger

Display	Operation Keys	Description
rUn	ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to indicate "rUn", and press the "ENT" key.
rUntG	△ PRINT ENT	Use the △ key to select "rUntG", and press the "ENT" key.
EIIt	△ PRINT ENT	Use the △ key to indicate "EIIt", and press the "ENT" key.
rUntG		Setting is completed. Returned to the Recording Start/Stop Setting screen.

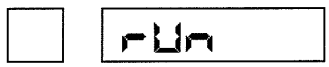
[Note]

When indicates "EIIt", RUN/STOP key does not operate. Set "rCd" to DI. See DI functions in page 88.

(2) Tag/channel print selection

In case of logging print or manual print, set whether a tag or channel should be printed.

Example) When setting the tag

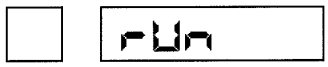
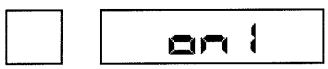
Display	Operation Keys	Description
	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to indicate "rUn", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to select "tAG", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to indicate "tAG", and press the "ENT" key.
		Setting is completed.Returned to the Tag/Channel Setting screen.

(3) Alarm print ON/OFF

Setting the alarm print ON/OFF.

When ON1, prints the alarm occurring and the alarm recovering. When ON2, prints only the alarm occurring.

Example) When sets both the alarm occurring and the alarm recovering

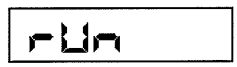
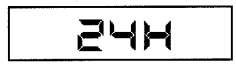
Display	Operation Keys	Description
	ENT △ PRINT ENT	Enter to the engineering mode (See the key operation in page 77). Use the △ key to indicate "rUn", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to select "ALArA", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to indicate "on 1", and press the "ENT" key.
		Setting is completed. Returned to the Alarm Print Setting screen.

(4) Logging print ON/OFF

Set logging print to ON/OFF.

In case of logging print ON, set the print start time and print interval.

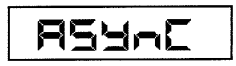
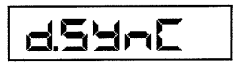
Example) When you want logging print to start at 18:00 every day

Display	Operation Keys	Description
	ENT / △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to indicate "rUn", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to select "dCt.Pr", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to indicate "on", and press the "ENT" key.
 (Print Start Time)	△ PRINT ▷ FEED / ENT	Use the △ key to alter a numeral, and ▷ key to shift a digit. Then, set the time and press the "ENT" key.
 (Interval)	△ PRINT ENT	Use the △ key to indicate "24H", and press the "ENT" key. (Choose from the inside of 10min, 15min, 20min, 30min, 1H, 2H, 3H, 4H, 6H, 12H, 24H)
		Setting is completed. Returned to the Logging Print Setting screen.

(5) Logging print Synchronous/Asynchronous

Set logging print to synchronous print/asynchronous print.

Example) When setting logging print to asynchronous print.

Display	Operation keys	Description
	ENT / △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to display "rUn", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to select "d.SYnC", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to display "ASYnC", and press the "ENT" key.
		Setting is completed. Returned to the logging print Sync/Async Setting screen.

(6) Print gap correction ON/OFF

Set print gap correction. As for this function, only DI asynchronous print, an asynchronous log print are applied.

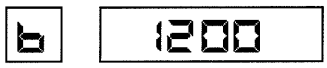
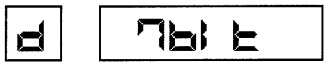
Example) When setting print gap correction to ON.

Display	Operation keys	Description
	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to display "rUn", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to select " PG.AdJ", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to display "on", and press the "ENT" key.
		Setting is completed. Returned to the print gap correction Setting screen.

7.2.7 Setting the Communication Function

Set Local Address, Baud Rate (communication speed), Data Length, Parity Bit, and Stop Bit.

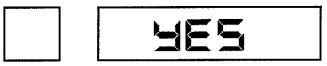
Example) Local Address: 02, Baud Rate: 1200bps, Data Length: 7 bit, Parity Bit: even, Stop Bit: 2 bit

Display	Operation Keys	Description
	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77).Use the △ key to indicate "CoM", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to indicate "Adr02", and press the "ENT" key. (Select from Adr01~Adr32)
	△ PRINT ENT	Use the △ key to indicate " 1200", and press the "ENT" key. (Select from 1200, 2400, 4800, 9600)
	△ PRINT ENT	Use the △ key to indicate "7bit", and press the "ENT" key. (Select from 7 bit, 8 bit)
	△ PRINT ENT	Use the △ key to indicate "EVEn", and press the "ENT" key. (Select from EVEN, ODD and NONE)
	△ PRINT ENT	Use the △ key to indicate "2bit", and press the "ENT" key. (Select from 1 bit, 2 bit)
		Setting is completed. Returned to the Communication Function Setting screen.

7.2.8 Initializing the Setup Data

Put back the setup data to what they were at shipment from the factory.Initialized all the setup data, please be careful. Calibration data is not initialized.

Example) When you initialize the Setup Data.

Display	Operation Keys	Description
	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to indicate "Init", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to select "YES", and press the "ENT" key.
	△ PRINT ENT	Initialization is completed.

7.2.9 DI Functions

Allocate the functions to three DIs. There are the following 12 DI functions.

No function	: oFF
Manual print (Sync.)	: MAn-P (Positive edge: running start)
Manual print (ASync.)	: AMAnP (Positive edge: running start)
RUN/STOP trigger function	: rCd (ON:RUN, OFF:STOP)
Date/time print (Sync.)	: tI M-P (Positive edge: running start)
Date/time print (ASync.)	: AtI MPC (Positive edge: running start)
Chart speed selection	: SPEEd (ON:Spd-1, OFF:Spd-2)
Comment print 1-3 (Sync.)	: CMnt 1、CMnt2、CMnt3 (Positive edge: running start)
Comment print 1-3 (ASync.)	: ACMt 1、ACMt2、ACMt3 (Positive edge: running start)

Example) When setting comment prints 3 for DI3

Display	Operation Keys	Description
dI	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to indicate "dI ", and press the "ENT" key.
dI 3	△ PRINT ENT	Use the △ key to select "dI 3", and press the "ENT" key.
CMnt3	△ PRINT ENT	Use the △ key to indicate "CMnt3", and press the "ENT" key.
dI 3		Setting is completed. Returned to the DI3 Function Setting screen.

[Note]

① Although "DI synchronous print" is not printed in RUN OFF, "DI asynchronous print" prints also in RUN OFF.

② The setting is OFF without the DI option. Do not set any setting except for OFF.

7.2.10 Temperature Unit

It changes the setting of a temperature unit.

Example) When setting a temperature unit to being Fahrenheit.

Display	Operation keys	Description
tEMP	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to indicate "tEMP", and press the "ENT" key.
F	△ PRINT ENT	Use the △ key to select "F", and press the "ENT" key.
tEMP		Setting is completed. Returned to the Temperature Unit Setting screen.

[Note]

When changes temperature unit, all set up data (configuration) becomes initial.

7.2.11 Point Calibration

Calibrate a pen recording position.

ZEro : Calibration of the zero point position

FULL : Calibration of the span point position

Example) When calibrate the zero point of 1 channel pen recording

Display	Operation Keys	Description
P AdJ	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to indicate "P AdJ", and press the "ENT" key.
ZEro	△ PRINT ENT	Use the △ key to select "ZEro", and press the "ENT" key.
Ch 1	△ PRINT ENT	Use the △ key to select "Ch 1", and press the "ENT" key.
27853	△ PRINT ▷ FEED ENT	The instrument starts to feed and trace the chart paper. With the △(left move) and ▷ (right move), adjust the 0 mm position of the chart paper and the recording position. Press the "ENT" key. Display indicates the set counter value.
ZEro		Setting is completed. Returned to the Zero Point Calibration screen.

Example) When calibrate the span point of 1 channel pen recording

Display	Operation Keys	Description
P AdJ	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to indicate "P AdJ", and press the ENT key.
FULL	△ PRINT ENT	Use the △ key to select "FULL", and press the "ENT" key.
Ch 1	△ PRINT ENT	Use the △ key to select "Ch 1", and press the "ENT" key.
04992	△ PRINT ▷ FEED ENT	The instrument starts to feed and trace the chart paper. With the △(left move) and ▷ (right move), adjust the 100 mm position of the chart paper and the recording position. Press the "ENT" key. Display indicates the set counter value.
FULL		Setting is completed. Returned to the Span Point Calibration screen.

7.2.12 Data Calibration

Calibrate the voltage, resistance temperature detector, and reference junction compensation.

bALt : Calibration of the voltage

rtd : Calibration of the resistance temperature detector

rJC : Calibration of reference junction compensation

[Note]
Calibrations require every channel.

Example) When calibrating the voltage at Channel 1

Display	Operation Keys	Description
dAdJ	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to indicate "dAdJ", and press the "ENT" key.
bALt	△ PRINT ENT	Use the △ key to select "bALt", and press the "ENT" key. Select the channel where a instrument for calibration such as a mV generator is connected, and press the "ENT" key.
Ch 1	△ PRINT ENT	
00AV	ENT	Enter 0 mV. After 30 seconds, make sure that the ALM lamp unilluminates and press the "ENT" key.
15AV	ENT	Enter 15 mV. After 10 seconds, make sure that the ALM lamp unilluminates and press the "ENT" key.
25AV	ENT	Enter 25 mV. After 10 seconds, make sure that the ALM lamp unilluminates and press the "ENT" key.
35AV	ENT	Enter 35 mV. After 10 seconds, make sure that the ALM lamp unilluminates and press the "ENT" key.
55AV	ENT	Enter 55 mV. After 10 seconds, make sure that the ALM lamp unilluminates and press the "ENT" key.
200AV	ENT	Enter 200 mV. After 10 seconds, make sure that the ALM lamp unilluminates and press the "ENT" key.
00 1V	ENT	Enter 1 V. After 10 seconds, make sure that the ALM lamp unilluminates and press the "ENT" key.
005V	ENT	Enter 5 V. After 10 seconds, make sure that the ALM lamp unilluminates and press the "ENT" key.
0 10V	ENT	Enter 10 V. After 10 seconds, make sure that the ALM lamp unilluminates and press the "ENT" key.
StorE	△ PRINT ENT	If the calibration is correct, select "StorE" with the △ key, and if incorrect, select "Abort", respectively. Then, press the "ENT" key.

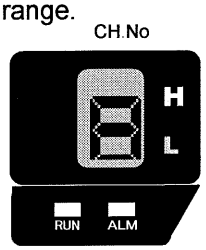
Example) When calibrating the resistance temperature detector at Channel 2

Display	Operation Keys	Description
d AdJ	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to indicate "d AdJ", and press the "ENT" key.
rtd	△ PRINT ENT	Use the △ key to select "rtd", and press the "ENT" key.
Ch2	△ PRINT ENT	Select the channel where a instrument for calibration such as a dial resistor is connected, and press the "ENT" key.
r 100	ENT	Enter 100Ω. After 10 seconds, make sure that the ALM lamp unilluminates and press the "ENT" key.
r 150	ENT	Enter 150Ω. After 10 seconds, make sure that the ALM lamp unilluminates and press the "ENT" key.
r300	ENT	Enter 300Ω. After 10 seconds, make sure that the ALM lamp unilluminates and press the "ENT" key.
StorE	△ PRINT ENT	If the calibration is correct, select "StorE" with the △ key, and if incorrect, select "Abort", respectively. Then, press the "ENT" key.

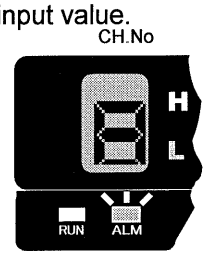
[Note]

During calibration, ALM lamp indicates following conditions below.

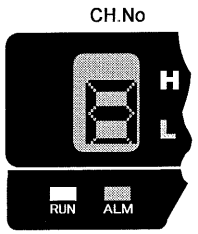
①Unilluminating the ALM lamp
The calibration is within the range.



②Blinking the ALM lamp
Judges the input value.

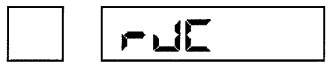
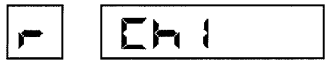
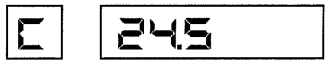


③Illuminating the ALM lamp
Make sure that the connection is properly or input is correctly.



□ Indicates unilluminating the lamp.
▒ Indicates illuminating the lamp.

Example) When setting the terminal temperature for Channel 1

Display	Operation Keys	Description
	ENT △ PRINT ENT	Enter the engineering mode (See the key operation in page 77). Use the △ key to indicate "d AdJ", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to select "rJC", and press the "ENT" key.
	△ PRINT ENT	Select the Channel to set, and press the "ENT" key.
	ENT	Measuring and indicating the real time terminal temperature. When pressing the "ENT" key, turn to the setting temperature display.
	△ PRINT ▷ FEED ENT	Use the △ key to alter a numeral, and ▷ key to shift a digit. Then, press the "ENT" key. See the section 9.5 "Calibration of Reference Junction Compensation" in page 99.
	△ PRINT ENT	If the calibration is correct, select "StorE" with the △ key, and if incorrect, select "Abort", respectively. Then, press the ENT key.

7.3 Terminating the Engineering Mode

Example) The following describes how to save the setting data.

Display	Operation Keys	Description
	△ PRINT ENT	Use the △ key to display "End", and press the "ENT" key.
	ENT	Use the △ key to select "StorE", and press the "ENT" key. The settings of the engineering mode have been saved. Recording starts under the new settings.

[Note]

Upon termination, if you select "End" and turn off the power without selecting "StorE", the settings will become invalid. Selecting "Abort" invalidates the settings and starts recording under the previous settings.

8. COMMUNICATIONS

8.1 General Description

8.1.1 General Description of Functions

This Recorder has the following communication functions

① Outputting the Process variable

Process variable, alarms status, etc.

②Outputting the set value

Reading the setup data such as a range, chart speed, etc.

③Inputting the set value

Writing the setup data such as a range, chart speed, etc.

④Controlling of the recorder (Partially)

Selection to print, recording start/stop and changing display etc.

For the functions ② to ④, see the separate Communication Command Reference Manual (charged). Setting the engineering mode is not capable with communication.

8.1.2 Transmission Specifications

(1)	Communication system	: Start-stop synchronous, half-duplex communications
(2)	Connection	: One-to-one(RS-232C), One-to-N(RS-485); N = 1 to 32
(3)	Communication speed	: 1200, 2400, 4800, or 9600 bps
(4)	Start bit	: 1 bit
(5)	Stop bit	: 1 or 2 bits
(6)	Parity	: Even, Odd, or None
(7)	Data length	: 7 or 8 bits

8.1.3 Data Construction

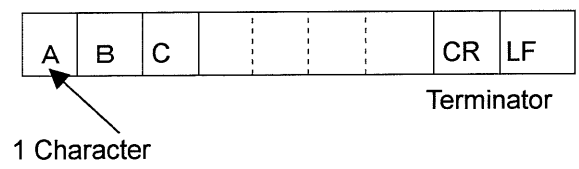
(1) Character construction

In order to send one data (byte) in start-stop synchronous communications, the following character construction is assumed:

Start Bit (1) + Data Bit (7 or 8) + Parity Bit (1) + Stop Bit (1 or 2)

(2) Data format

The communication data is sent with data terminators added to multiple characters. Upon receiving these terminators, the recorder starts analyzing the communication data.



(3) Error Detection

If the recorder receives the data that has resulted in a signal error such as a parity error, framing error, etc. due to the noise or hardware troubles, it will ignore that data. Consequently, a data format error results, determining that the data is not sent in the normal data format. The received function does not execute that command and the transmitted function does not reply. The data format error status can be confirmed by the ESC S command (described later).

(4) Control codes

ESC :1B HEX(hexadecimal)

This code is used for an escape sequence such as opening/closing the link. It cannot be treated as part of the text data.

CR :0D HEX(hexadecimal)

This data is added to the end of the text data together with the LF data. This code cannot be treated as part of the text data.

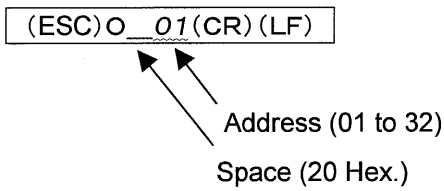
LF :0A HEX(hexadecimal)

This data is added to the end of the text data together with the LF data. This code cannot be treated as part of the text data.

8.2 Opening/Closing the Link

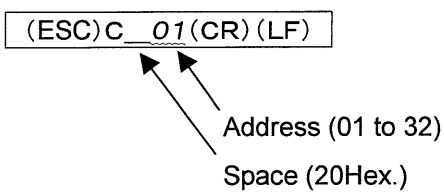
To communicate with the recorder, you must establish a connection between the host computer and the recorder. In case of one-to-N communications, it is necessary to inform each recorder which recorder the text is being sent. If a link open command is sent to multiple recorders through their send function, all the recorders, which have received the command, will send and cannot receive the normal data.

8.2.1 Open Command



For the host computer to communicate the recorder, it must issue this command and memorize that it has been issued.

8.2.2 Close Command



For the host computer to communicate with the recorder, this command must be issued to the open-link recorder, if you want to send the data to the recorders, which have not issued the open command.

8.3 Outputting the Process Variable Data

8.3.1 Specifying the Process Variable Data Output

TS*0*(CR)(LF)

Once this command is received, the recorder transfers the process variable data to the transmit buffer, when the (ESC) T command is received.

8.3.2 Updating the Data

(ESC)T(CR)(LF)

Once this command is received, the recorder transfers the update process variable data to the transmit buffer.

8.3.3 Specifying the Process Variable Data Output Order (At BINARY Mode Output)

BO*0*(CR)(LF) Outputs starting from the upper byte.

BO*1*(CR)(LF) Outputs starting from the lower byte.

The recorder outputs starting from the lower byte, unless otherwise specified.

8.3.4 Outputting the Data

FM*0*, S__CH, E__CH Specifies the ASCII mode output.

FM*1*, S__CH, E__CH Specifies the BINARY mode output.

S__CH : Output start channel *01 to 02*

E__CH : Output end channel *01 to 02*

※ When the number of channels is one, specify (S_CH) = (E_CH).

8.3.5 Process Variable Data Transmission Format (ASCII)

DATE (YY) (MM) (DD) (CR) (LF)	Date

Year Month Day

TIME (HH) (MM) (SS) (CR) (LF)	Time

Hour Minute Second

(DS1)(DS2)(ALM1)(ALM2)(ALM3)(ALM4)(UNIT1～6)(CHNo.), (DATA)(CR)(LF)

(1)DS*1* : Data information 1 (1 byte)

N: Normal, D: Difference computation data, S: Sum computation data,

M: Average computation data, R: Square root computation data, C: Decade computation data,

O: Over range (Data = ±99999), S: Skip (All the data are spaces)

(2)DS*2* : Data information 2 (1 byte)

E : Final data

_(Space) : Other data

(3)ALM*1 to 4* : Alarm information (1 byte each, 4 bytes in total)

H: Upper-limit alarm, L: Lower-limit alarm,

_(Space): Alarm OFF or alarm setting OFF.

(4)UNIT*1～6* : UNIT (6 bytes)

Returns the set unit in terms of code. (When sending the 7-bit data, the higher 1 bit is missing.)

(5)CHNo. : Returns the set unit in terms of code. (2bites)

01～02

(6)DATA : Process variable data

Sign(1 byte) : "+" or "−"

Data mantissa section (6 bytes) : *00000～99999*

Data exponent section (4 bytes) : E (Sign: 1 byte) (Multiplier: 2 bytes)

<Example> +*99999*E−*02*

8.3.6 Process Variable Data Transmission Format (BINARY)

Output bytes	Date and time	Process variable 1	...	Process variable 6

Output bytes (2 bytes) :5 × n (specified number of channels+6)

(1) Date and time (6 bytes):

①	②	③	④	⑤	⑥

① Year :00H to 63H (00H for the year 2000)

② Mouth :01H to 0CH

③ Day :01H to 1FH

④ Hour :00H to 17H (24-hour system)

⑤ Minute :00H to 3BH

⑥ Second :00H to 3BH

(2) Process variable (5 bytes)

CHNo.	A2	A1	A4	A3	DATA1	DATA2

CHNo. (1BYTE) : Channel number

01H～02H

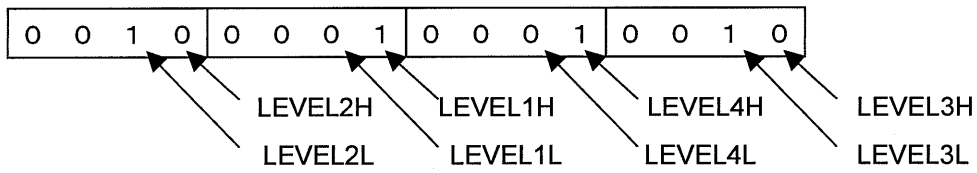
A1～*A4* (2BYTE) : Alarm type activated at each alarm level.

1 : Upper-limit alarm

2 : Lower-limit alarm

0 : Alarm OFF or alarm setting OFF

(Example) Bit Sequence



LEVELxH : Upper-limit alarm bit at the alarm level x

LEVELxL : Lower-limit alarm bit at the alarm level x

DATA*1*、*2* (2BYTE) : Process variable data

－*32000*～＋*32000* (2-byte hexadecimal data)

The higher and lower bytes can be reversed by the BO command.

If Skip is specified, 8080H will be output.

[Note]

- Outputs a data over -32000 to +32000 as the overflow. An overflow 7E7E is output on plus side, and 8181 is output on minus side. Excluding the Decade channel.
- It outputs data output by the Decade channel as follows regardless of the BO command. The upper byte outputs a mantissa (10 to 99). The lower byte outputs an exponent (-19 to 19). A decimal point position is fixed on 1 digit.

8.4 Outputting the Unit and Decimal Point Position Data

8.4.1 Specifying the Unit and Decimal Point Position Data Output

TS2(CR)(LF)

Once this command is received, the recorder transfers the unit and decimal point position data to the transmit buffer, when the (ESC) T command is received.

8.4.2 Updating the Data

(ESC)T(CR)(LF)

Once this command is received, the recorder transfers the update unit and decimal point position data to the transmit buffer.

8.4.3 Outputting the Data

LF, S__CH, E__CH

S__CH :Output start channel *01 to 02*

E__CH :Output end channel *01 to 02*

※ When the number of channels is one, specify (S_CH) = (E_CH). __(Space)

8.4.4 Data Format

(DS*1*)(DS*2*)(CHNo.)(UNIT*1*～*6*)(DP)

(1) DS*1* :Data information 1 (1 byte)

N	: Normal
D	: Difference computation data
S	: Sum computation data
M	: Average computation data
R	: Square root computation data
C	: Decade computation data,
O	: Over range (Data = ±99999)
S	: Skip (All the data are spaces)

(2) DS*2* :Data information 2 (1 byte)

E	:Final data,
__(Space)	:Other data

(3) CHNo. :Channel number (2bytes);01～02

(4) UNIT*1*～*6*:UNIT

Returns the set unit in terms of code. (When sending the 7-bit data, the higher 1 bit is missing.)

(5) DP: Decimal point information (1 byte); *0～4*

[Note]
By the range setting, a decimal point position may differ from a display screen.

8.5 Outputting the Status

If the open-link recorder has a data error on its link, it will save the error as a communication error in the internal status area. The (ESC S) command reads this status. Issuing this command clears the on-going error.

8.5.1 Status Output Command

ESC S(CR)(LF)

Receiving this command outputs the status for the command received so far.

8.5.2 Status Output

E	R	X	X	CR	LF

XX :00～19

Table 8.1 Status output list

Status output \ Status factor	Status factor		
	A/D END	Syntax error	Paper-empty
ER 00 C_RL_F			
ER 01 C_RL_F	○		
ER 02 C_RL_F		○	
ER 03 C_RL_F	○	○	
ER 04 C_RL_F			
ER 05 C_RL_F	○		
ER 16 C_RL_F			○
ER 17 C_RL_F	○		○
ER 18 C_RL_F		○	○
ER 19 C_RL_F	○	○	○

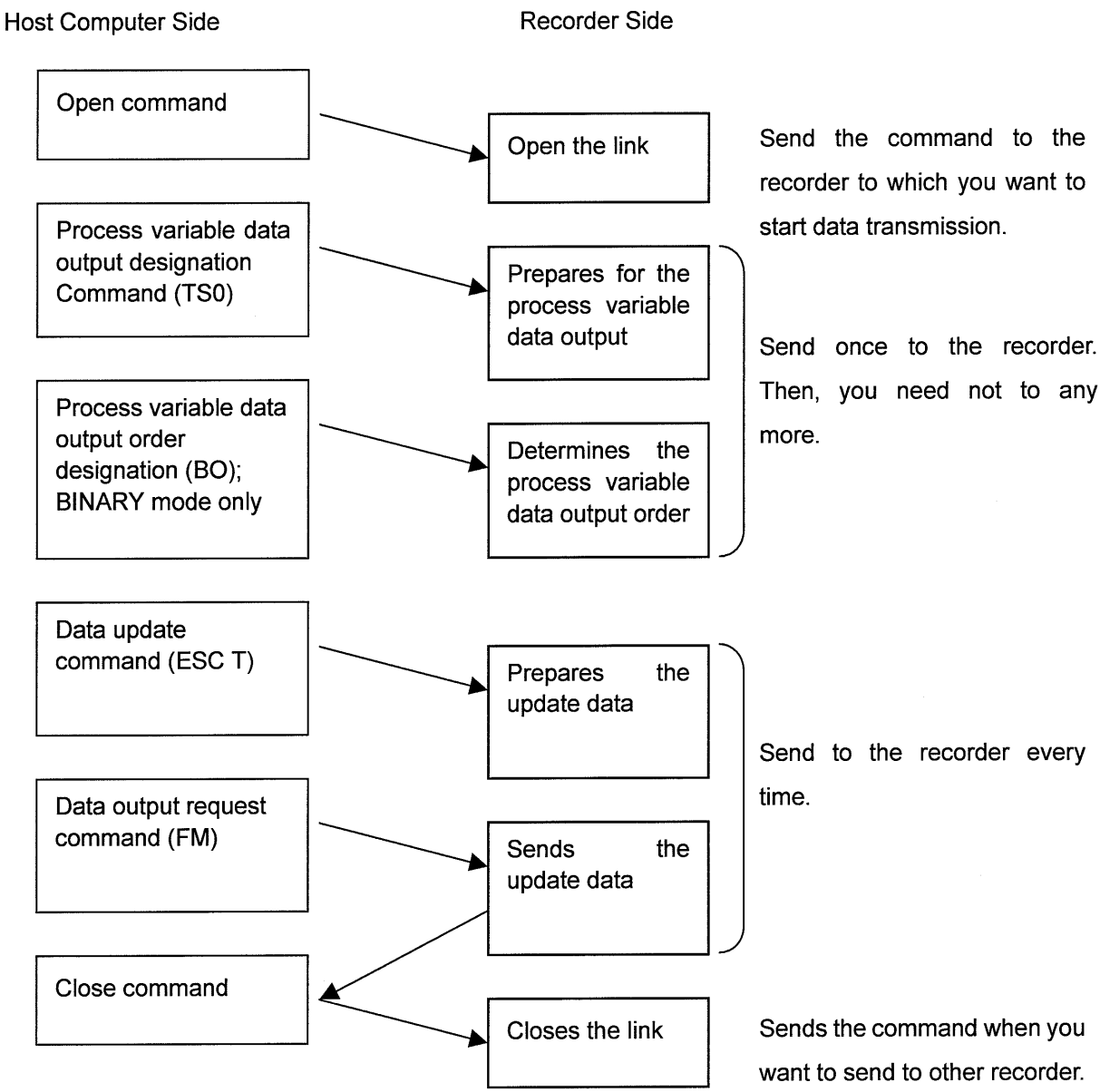
○ : The factor from which status is ENABLE.

A/D END : When carring out AD conversion end, it occurs.

Syntax error : It occurs during a communication error or a command error occurs.

Paper-empty : When Paper-empty is found, it occurs.
(The Paper-empty option has been attached)

8.6 Data Reception Example



9. MAINTENANCE

Inspect the following maintenance items in order to use this instrument effectively.

- Inspection
- Cleaning
- Replace Consumables
- Adjust Pen Recording Position
- Calibration

9.1 Inspection

Inspect the condition of operation to use effectively.

When a defect is found, see Chapter 10 "Trouble Shooting".

◆Pen recording deflected?

◆Are recording indication done properly?

- Any big error in indicated values or pen recording position?
- Any improper pen recording?
- Any blurred pen recording or printout?
- Proper printout?

◆Is the chart paper feed properly?

- Is the chart paper folded properly?
- Aren't the feed holes in the chart paper torn off or broken?
- Is the chart speed correct?

◆Is there any abnormal sound?

9.2 Cleaning

Many parts of this instrument are plastic. Use a dry cloth to wipe the parts should be clean.

[Note]

Do not use any organic solvent.

9.3 Replacing Consumables

Replace consumables according to the following list.

No.	Name	Type	Period	Remarks	Quantity
1	Chart paper	HZCGA0105EL001	33 days	Chart speed is 20 mm/h	1
2	Ribbon cassette	HPSR001H0002C	6 months	Chart speed is 20 mm/h	1
3	Cartridge pen	WPSR196A000001A	2 months	1 pen, about 2km on beeline	1
4	Cartridge pen	WPSR196A000002A	2 months	2 pen, about 2km on beeline	1

[Note]

① When recording with a ribbon, a dot printing color phases out. To ensure clear recording, replace the ribbon cassette as possible.

② Use the ribbon cassette within one year after its purchase. Due to evaporation of ink, a printing color phases out as time goes on.

③ When tracing faint before the changing period, change the cartridge pen ahead of the period.

9.4 Adjusting the Pen Recording Position (Point Calibration)

The following describes how to adjust a pen position on the chart paper.

You are well advised to adjust it annually in order to maintain recording accuracy.

How to Adjust

It is unnecessary to enter the reference. With the apparatus left in the working conditions, make adjustment according to the instructions in 7.2.11 Point calibration. (See Page 89)

9.5 Calibration (Data Calibration)

Calibrate a process variable input every year in order to keep measurement accuracy.

[Note]

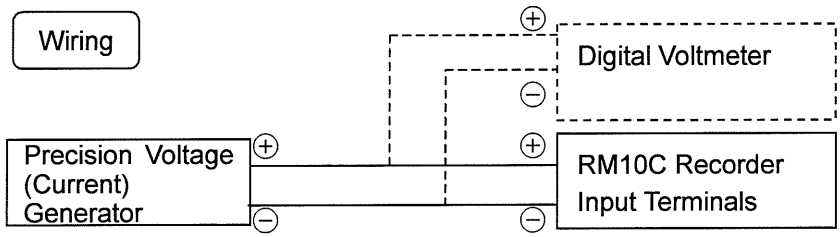
Prior to calibration, warm up for 30 minutes or more after power-on.

Devices required to calibrate

- Precision voltage(current) generator (Jointly use a digital voltmeter with accuracy of ±0.02 % or less as required)
- Precision dial resistor

(1) Calibration of Voltage

Conduct calibration in case of voltage, current or thermocouple input. For thermocouple input, calibrate reference junction compensation together.



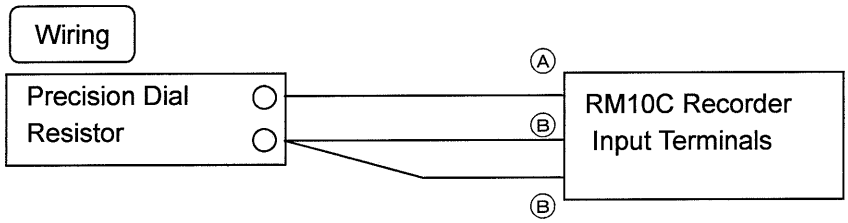
Conduct calibration according to the instructions in 7.2.12 Data Calibration (Calibration of the voltage). (See Page 90)

[Note]

① Calibrate at every channel.

② When a shunt resistor is attached to the input terminal block in case of current input, detach it prior to calibration.

(2) Calibration of Resistance Temperature Detector



Conduct calibration according to the instructions in 7.2.12 Data Calibration (Calibration of the resistance temperature detector). (See Page 91)

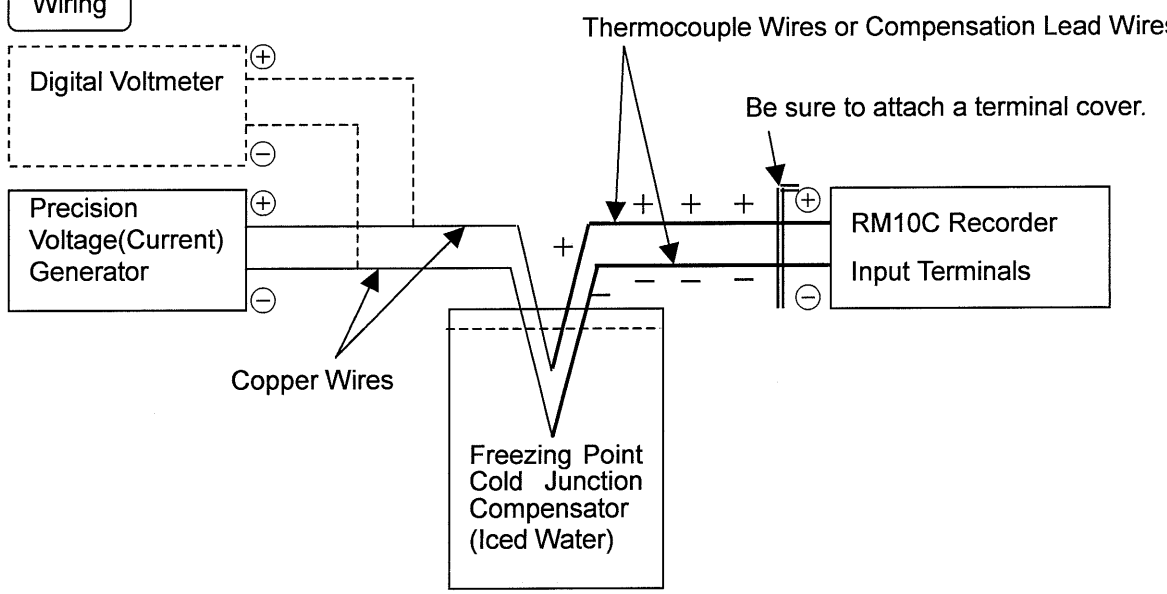
[Note]

A resistance value should not disperse greater than 6 mΩ from one wire to another.

(3) Calibration of Reference Junction Compensation

Conduct this calibration in case of thermocouple input.

Wiring



Calibration

Example) Connect the input to Channel 1 and setting the calibration when the thermocouple input value (RMC measurement) is -0.5 (input 0℃), the measured RJC temperature is 24.5℃.

1) Check the Process variable when impressing 0.000mV±2 μ V to Channel 1 by the voltage generator beforehand. (In this example, it is -0.5℃.)
2) Check the terminal temperature of Channel 1 at the data calibration in the enginnering mode (Reference junction compensation). (In this example, it is 24.5℃.)
3) Setup the value which added a part for the difference with true value (0.5℃) as the right RJC temperature.

   [24.5-(-0.5)=25.0℃]

Conduct calibration according to the instructions in 7.2.12 Data Calibration (Calibration of reference junction compensation). (See Page 92)

[Note]

① This calibration is conducted when compensation by the recorder's built-in temperature sensing element (INT: internal compensation) is selected as the reference junction compensation method.

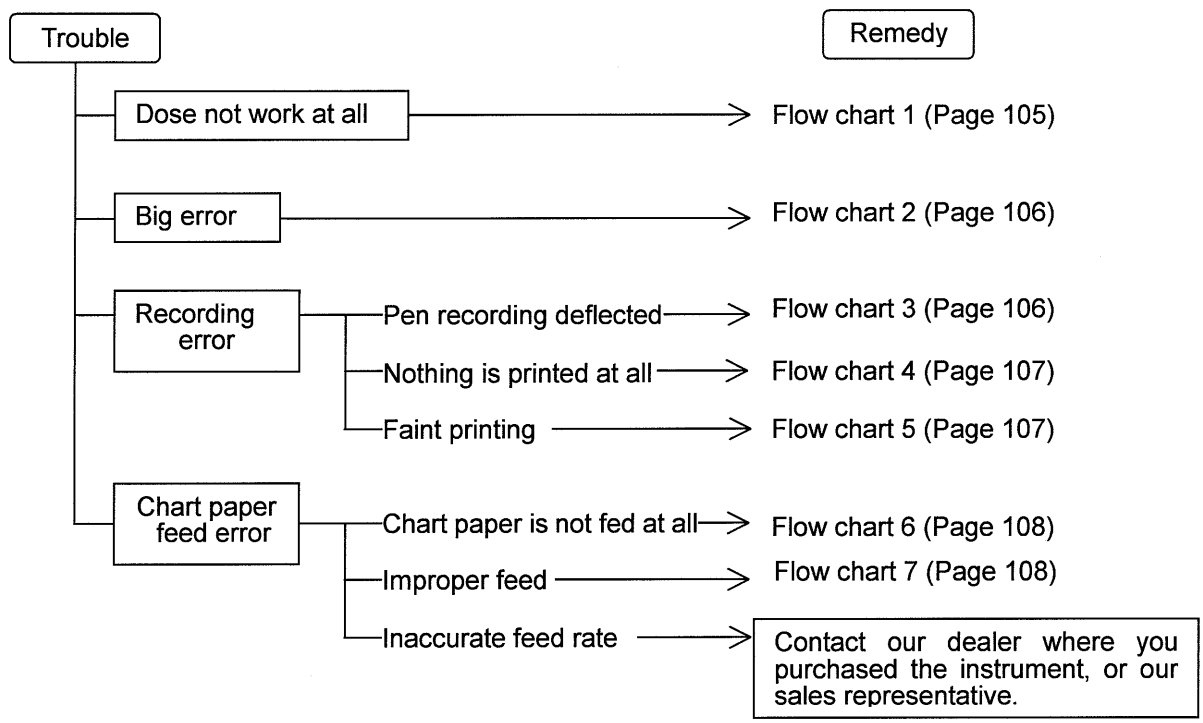
② Wire to Channels 1 and 2 to conduct calibration.

③ After wiring, attach the terminal covers and wait for 5 minutes or more. Then, conduct calibration.

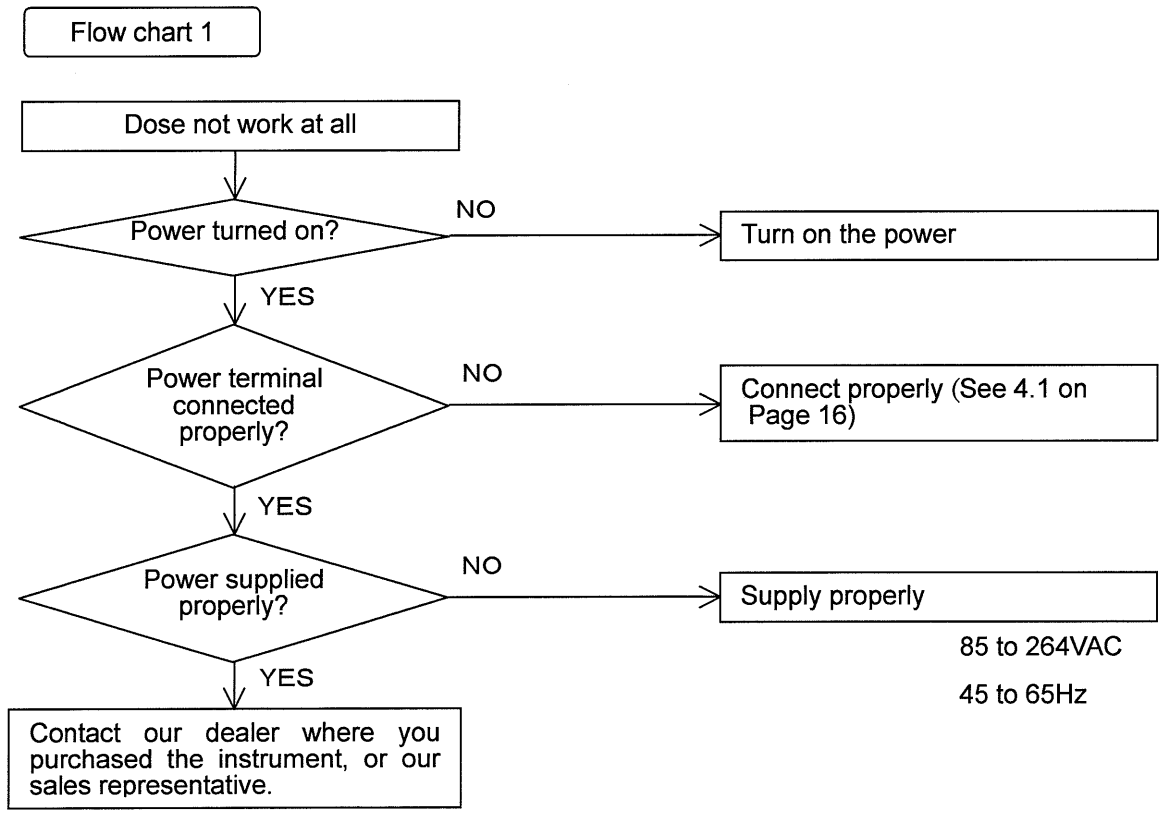
10. TROUBLESHOOTING

10.1 Troubleshooting

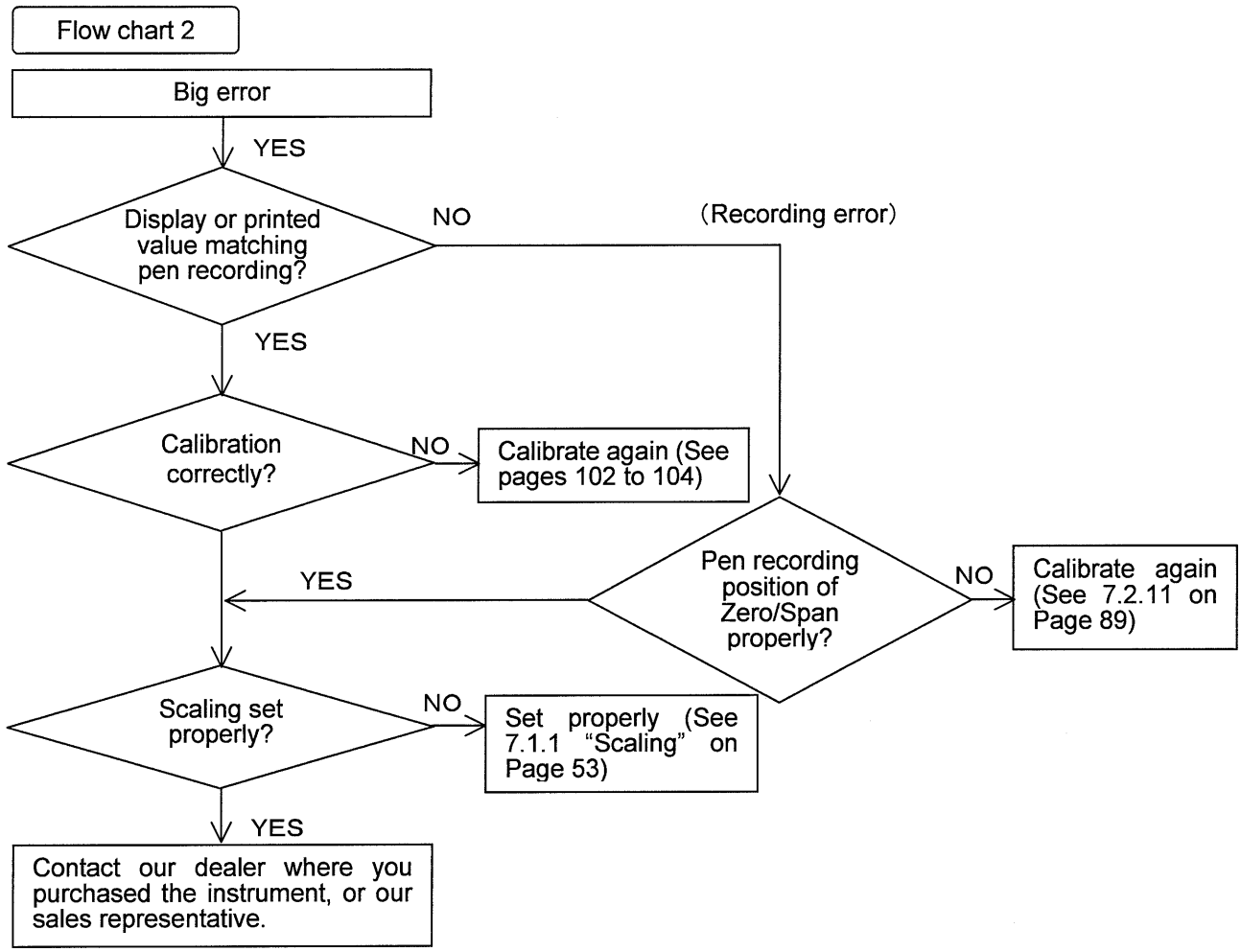
10.1.1 Trouble Items



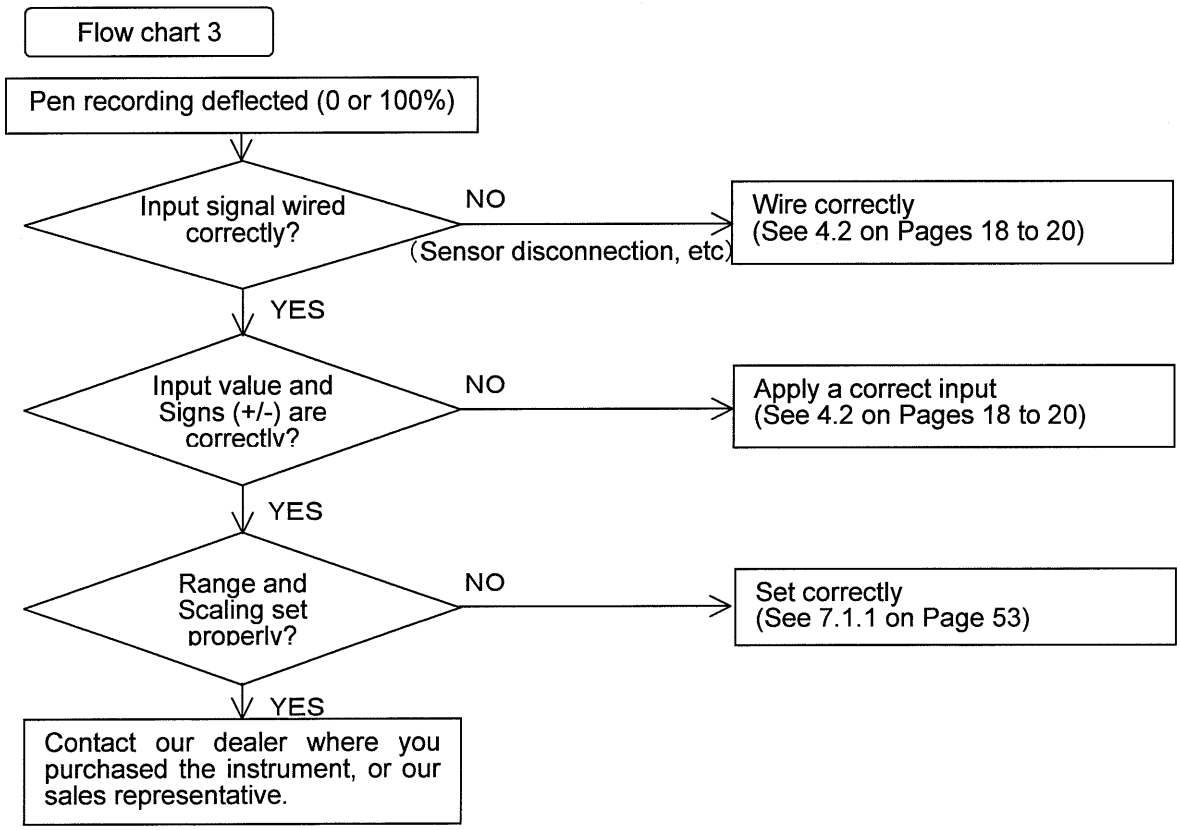
10.1.2 When the Recorder Dose not Work at All



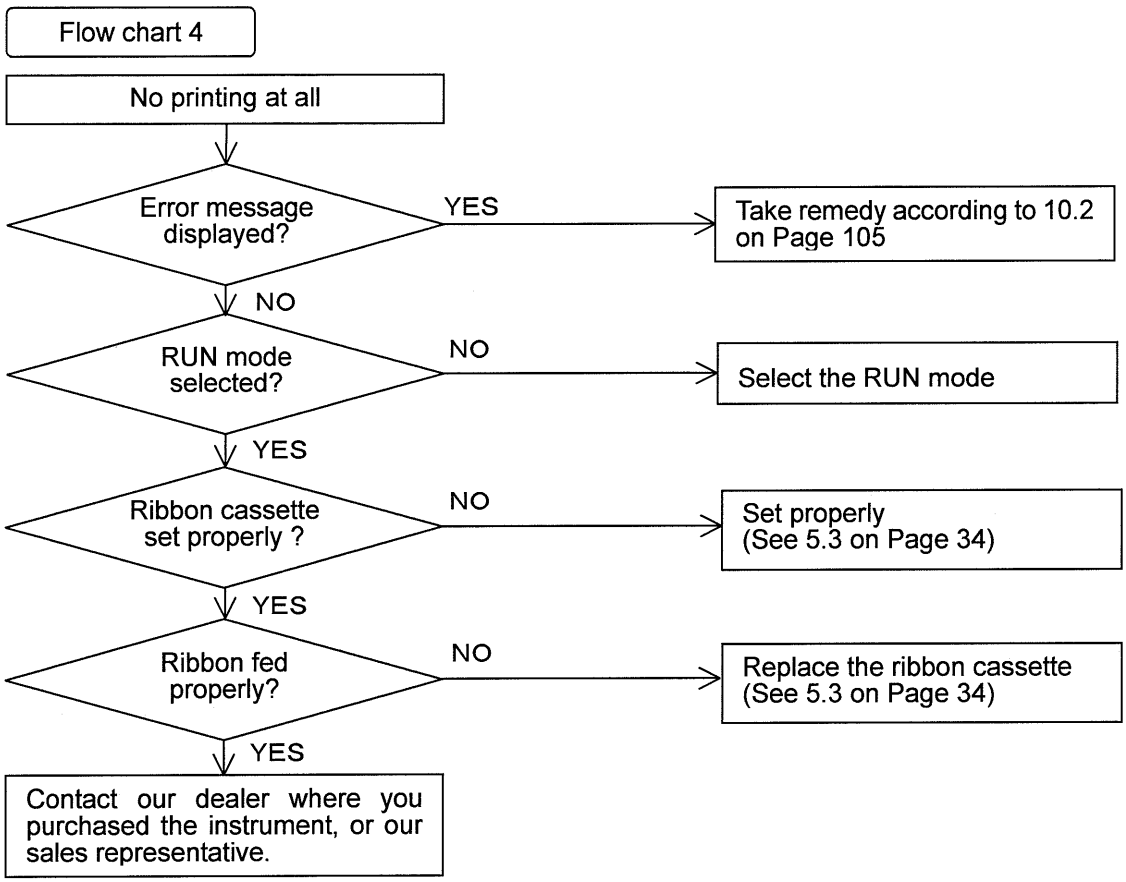
10.1.3 When There is a Big Error



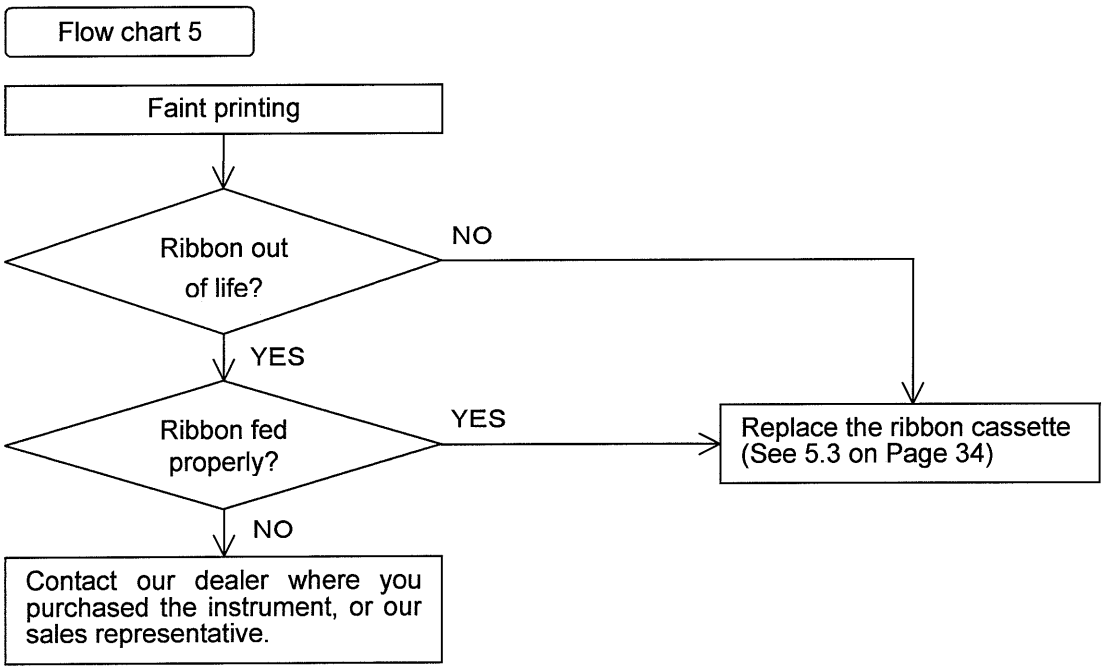
10.1.4 When the Pen Recording Deflected



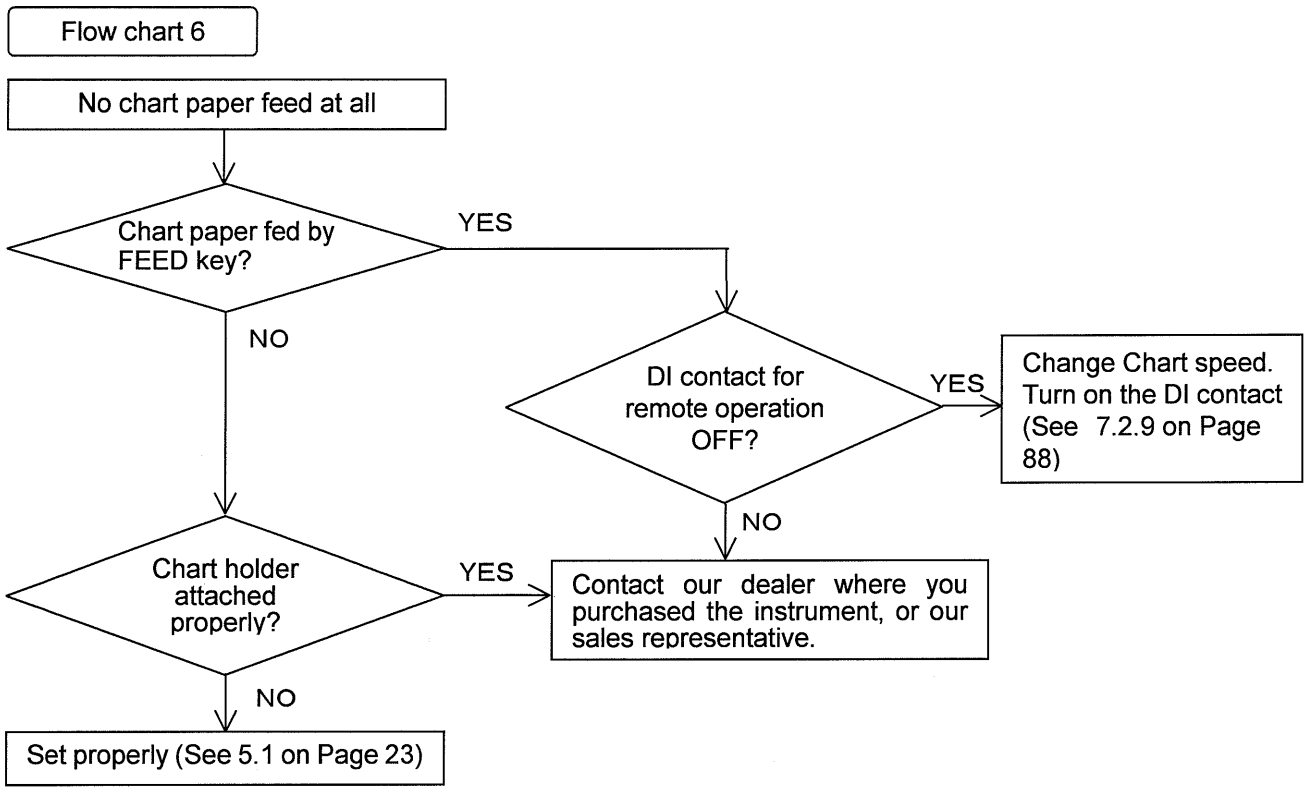
10.1.5 When Prints Nothing



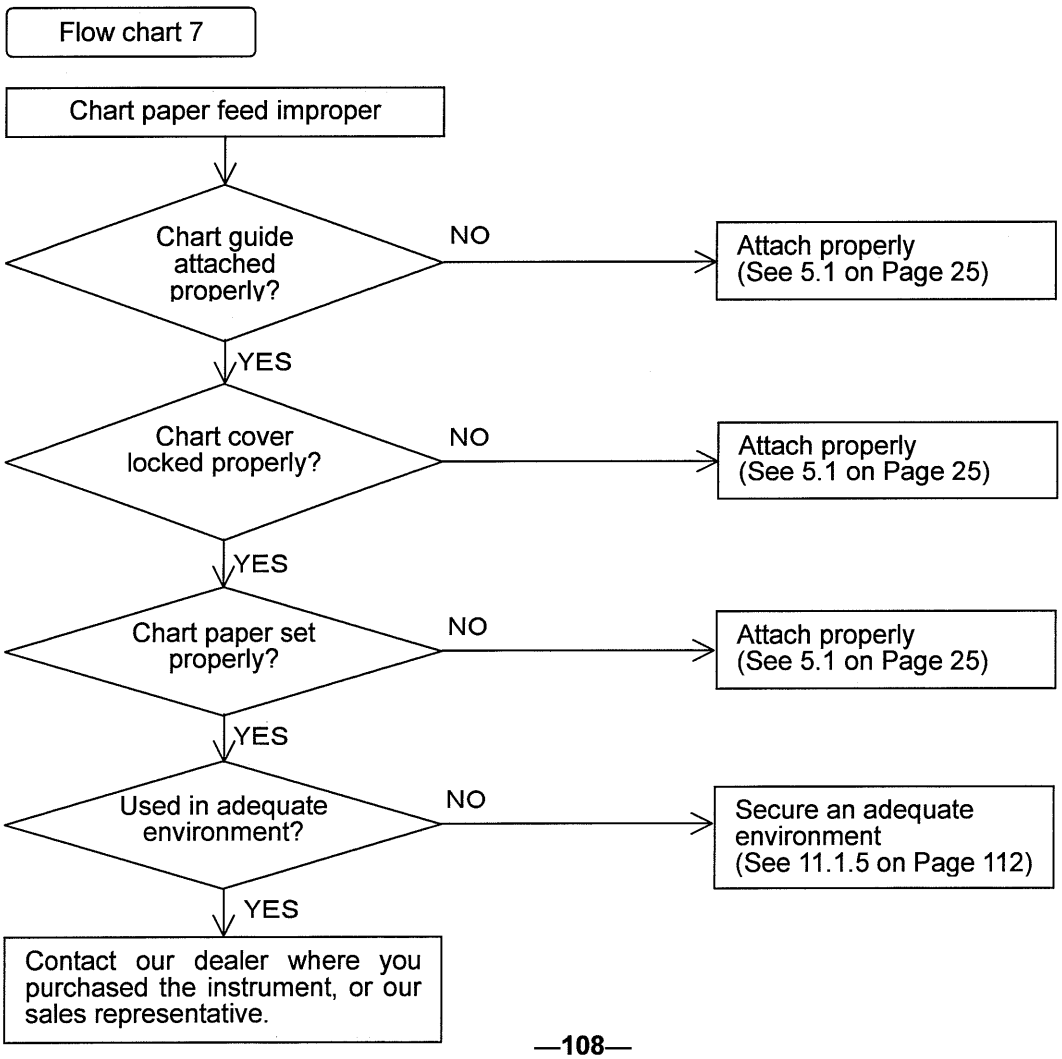
10.1.6 When Printing is Faint



10.1.7 When the Chart Paper is not Fed at All



10.1.8 When the Chart Paper is not Fed Properly



10.2 Self Diagnostics Function (ERROR)

This instrument always makes a self diagnostics on the items listed in Table 10.1 below. When an error is found in the self diagnostics results, a relevant error number is displayed.

10.2.1 Self Diagnostic Items

Table 10.1 List of Diagnostic Items

Type	Error message	Parts	Diagnostic	Remedy
Hard ware error	E Err01	Zero point sensor	Zero point position of servomotor cannot be detected.	Contact our dealer where you purchased the instrument or our sales representative.
	E Err02	ADC	conversion end error, Initializing error	
	E Err03	IC for clock	The clock battery runs down[Note1]	
	E Err04	WDT	Watchdog timer error	
	E Err05	EEP WRITE	Non-volatile memory Writing error	
	E Err06	EEP READ1	Non-volatile memory Reading error (Setup data)	
	E Err07	EEP READ2	Non-volatile memory Reading error (Engineering data)	
	E Err08	EEP READ3	Non-volatile memory Reading error (ADC Calibration data)	
Operation error	E Err21	Area error	Input value is over the setting range.	Set properly
	E Err22	Time error	Clock time setting error	
	E Err23	Setting range error	Setting the channel (CH1) which cannot set up the sum/difference/average operation.	
	E Err24	Area error	Span L ≧ Span R	
	E Err25	Area error	Scale L ≧ Scale R	
	E Err26	Area error	Zone L ≧ Zone R or Zone R−Zone L is less than 5mm.	
	E Err27	Setting channel error	The reference channel range of the sum/difference/average operation is except Volt, TC, RTD and SCALE.	
	E Err28	All channels skip error	Setting the Skip all channels.	
Other	E Err41	Other	It is not calibrating to the specified input.	Calibrate a correct input.

[Note1]The lifetime of the cell assumes about 10 years but sometimes depends of the use environment.

10.2.2 Error Display

- When multiple errors are encountered, their error numbers are displayed with automatic scrolling.
- When an error restores, an error display can be reset to the input of "RUN" key.

> ⚠ **CAUTION**
>
> While indicates an error, dose not indicate Auto, Manual and Date/Time.

11. SPECIFICATIONS

11.1 Common Specifications

11.1.1 Input signal

DC voltage :±10, 0 to 20, 0 to 50, ±200 mV DC, ±1, 0 to 5, ±10 V DC

Thermocouple :B、R、S、K、E、J、T、C、Au-Fe、N、PR40-20、PLⅡ、U、L
(Thermocouples not to be connected to hazardous voltage or equipment.)

Resistance temperature detector :Pt100,JPt100

DC current :4 to 20mA DC(External shunt resistor: 250Ω <charged:HMSU3081A11>)

11.1.2 Performance and Characteristics

Digital accuracy rating :See 11.2.1

Dead band :Within 0.2%

Input impedance :10MΩ min. in mV, TC input (without burnout)
200kΩ min. in mV, TC input (with burnout)
1MΩ min. in voltage input
250Ω (shunt resistance : external <charged:HMSU3081A11>)
in mA input

Allowable signal source resistance
:10kΩ max. in mV, TC input (without burnout)
100Ω max. in mV, TC input (with burnout)
1kΩ max. in Voltage input
10Ω max.(per line) in Resistance temperature detector input

Normal mode rejection ratio :60dB min.(50/60±0.1Hz)

Common mode rejection ratio :140dB min.(50/60±0.1Hz)

Isolation resistance :0.5kV DC 20MΩ min. between the each terminal and grounding terminal

Withstand Voltage :1.5kV AC for 1 minute between the power terminal and grounding terminal
:0.5kV AC for 1 minute between the input terminal and grounding terminal
:0.2kV AC for 1 minute between the input terminals
Interchannel maximum noise voltage: 200 V AC at 50/60 Hz

Vibration resistance :10 to 60Hz 1m/s^2 max.

Shock resistance :2m/s^2 max.

Clock precision :±50ppm max.

Chart feed accuracy :±0.1% max.

11.1.3 Structure

Mounting : Panel mount(vertical panel)
Allowable backward inclination : Within 30°

Material(Color) : Case ; Polycarbonate(Black), Glass 10% UL94-V2
Door ; Polycarbonate UL94-V2(Clear)
; Dust-proof, drip-proof (Complies with the IEC529-IP65) not evaluated as part of Underwriters Laboratories Listing certification.

11.1.4 Power Source

Rated supply voltage range : 100 to 240V AC
Working supply voltage range : 85 to 264V AC
Rated power frequency : 50/60Hz
Working frequency range : 45 to 65Hz

Table 11.1 Power consumption

	100VAC	Max. power consumption
1 pen	About 20VA	About 30VA
2 pen	About 25VA	About 35VA

11.1.5 Normal Operating Conditions

Ambient temperature :0 to 50°C
Ambient humidity :20 to 80%RH
Supply voltage :85 to 264V AC
Supply frequency :45 to 65Hz
Vibration :10 to 60Hz 0.2m/s^2 max.
Shock :Unacceptable
Magnetic field :400A/m max. (DC and AC: 50/60Hz)
Noise :Normal mode(50/60Hz)
DC current, Thermocouple; Peak value lower than the span width of the measurement range
Resistance temperature detector ; 50mV max.
Common mode (50/60Hz) ; 250V AC max.
Interchannel maximum noise voltage: 200 V AC at 50/60 Hz
Posture :Allowable backward inclination : within 30°, Right-and-left level
Warming up time :30 minutes min. from the time of a power-on injection

11.1.6 Alarm (Relay Output is Optional)

Outputs	:3 point(Built-in option, normally open)
Alarm types	:2 types(H, L), total 4 levels/channel
Contact point capacity	:250V AC, 3A max. (Resistive load)
	30V DC, 3A max. (Resistive load)
	125V DC, 0.5A max. (Resistive load)
Hysteresis width	:0.5%
Setting accuracy	:Setting accuracy

11.1.7 Safety Standard and EMI Standard

Electrical safety	:IEC1010-1,UL3101-1 Installation category Ⅱ and pollution degree 2.
Emissions	:EN55011 Group1 Class A
Immunity	:EN50082-2

11.1.8 DI Function (Option)

Set up point is a maximum of 3.

11.1.9 Paper-empty Detecting Function (Option)

Detects the Paper-empty to output an alarm.

11.2 Standard Setting Specifications

11.2.1 Measurement Range

The arbitrary setup is possible by the operation key.

A digital accuracy rating is as Table11.2 at Reference operating conditions. It is shown below.

Reference operating conditions : Temperature ; 23 ±2℃
Humidity ; 55 ±10%RH
Power source voltage ; 85 to 264V AC
Electric wave frequency ; 50/60%Hz ±1%
Warming up time ; 30 minutes min.

The performance in the state where nothing is vibration and a shock.

Terminal block reference junction compensation accuracy is not included in the digital accuracy rating. It is shown below.

Terminal block reference junction compensation accuracy.

- ◆ B、R、S、PR40-20、Au-Fe :±1℃
- ◆ K、E、J、T、C、N、PLⅡ、U、L :±0.5℃

Table 11.2 Measurement Range

Type	RANGE	Measurement range	Measurement		
			Digital		Analog
			Accuracy	Max. resolution	Accuracy
DC voltage DC contact Input		-10 to 10mV	±(0.2% of rdg + 3digits)	10μV	Digital accuracy ±(0.3% of span)
		0 to 20mV	±(0.2% of rdg + 3digits)	10μV	
		0 to 50mV	±(0.2% of rdg + 2digits)	10μV	
		-200 to 200mV	±(0.2% of rdg + 3digits)	100μV	
		-1 to 1V	±(0.1% of rdg + 3digits)	1mV	
		0 to 5V	±(0.2% of rdg + 2digits)	1mV	
		-10 to 10V	±(0.3% of rdg + 3digits)	10mV	
		4 to 20mA	±(0.2% of rdg + 2digits)	0.01mA	
Thermocouple	B	0.0 to 1820.0℃	±(0.15% of rdg + 1℃) 400 to 600℃, ±2℃ An accuracy is not compensated within a range of 0 to less than 400℃	0.1℃/0.18℉	
		32.0 to 3308.0℉	±(0.15% of rdg + 1.8℉) 752 to 1112℃, ±3.6℉ An accuracy is not compensated within a range of 32 to less than 752℉		
	R1	0.0 to 1760.0℃	±(0.15% of rdg + 1℃) ※0 to 100℃, ±3.7℃ 100 to 300℃, ±1.5℃		
		32.0 to 3200.0℉	±(0.15% of rdg + 1.8℉) ※32 to 212℃, ±6.7℉ 212 to 572℉, ±2.7℉		

Type	RANGE	Measurement range	Measurement		
			Digital		Analog
			Accuracy	Max. resolution	Accuracy
Thermocouple	R2	0.0 to 1200.0℃	±(0.15% of rdg + 0.8℃) ※0 to 100℃, ±3.7℃ 100 to 300℃, ±1.5℃	0.1℃/0.18˚F	Digital accuracy ±(0.3% of span)
		32.0 to 2192.0˚F	±(0.15% of rdg + 1.44˚F) ※32 to 212˚F, ±6.7˚F 212 to 572˚F, ±2.7˚F		
	S	0.0 to 1760.0℃	±(0.15% of rdg + 1℃) ※0 to 100℃, ±3.7℃ 100 to 300℃, ±1.5℃		
		32.0 to 3200.0˚F	±(0.15% of rdg + 1.8˚F) ※32 to 212˚F, ±6.7˚F 212 to 572˚F, ±2.7˚F		
	K1	-200.0 to 1370.0℃	±(0.15% of rdg + 0.7℃) ※-200 to -100℃, ±(0.15% of rdg + 1℃)		
		-328.0 to 2498.0˚F	±(0.15% of rdg + 1.3˚F) ※-328 to -148˚F, ±(0.15% of rdg + 1.8˚F)		
	K2	-200.0 to 600.0℃	±(0.15% of rdg + 0.4℃) ※-200 to -100℃, ±(0.15% of rdg + 1℃)		
		-328.0 to 1112.0˚F	±(0.15% of rdg + 0.7˚F) ※-328 to -148˚F, ±(0.15% of rdg + 1.8˚F)		
	K3	-200.0 to 300.0℃	±(0.15% of rdg + 0.3℃) ※-200 to -100℃, ±(0.15% of rdg + 1℃)		
		-328.0 to 572.0˚F	±(0.15% of rdg + 0.5˚F) ※-328 to -148˚F, ±(0.15% of rdg + 1.8˚F)		
	E1	-200.0 to 800.0℃	±(0.15% of rdg + 0.5℃)		
		-328.0 to 1472.0˚F	±(0.15% of rdg + 0.9˚F)		
	E2	-200.0 to 300.0℃	±(0.15% of rdg + 0.4℃)		
		-328.0 to 572.0˚F	±(0.15% of rdg + 0.7˚F)		
	E3	-200.0 to 150.0℃	±(0.15% of rdg + 0.3℃)		
		-328.0 to 302.0˚F	±(0.15% of rdg +0.5˚F)		
	J1	-200.0 to 1100.0℃	±(0.15% of rdg + 0.5℃) ※-200 to -100℃, ±(0.15% of rdg + 0.7℃)		
		-328.0 to 2012.0˚F	±(0.15% of rdg + 0.9˚F) ※-328 to -1480˚F, ±(0.15% of rdg + 1.3˚F)		
	J2	-200.0 to 400.0℃	±(0.15% of rdg + 0.4℃) ※-200 to -100℃, ±(0.15% of rdg + 0.7℃)		
		-328.0 to 752.0˚F	±(0.15% of rdg + 0.7˚F) ※-328 to -1480˚F, ±(0.15% of rdg + 1.3˚F)		
	J3	-200.0 to 200.0℃	±(0.15% of rdg + 0.3℃) ※-200 to -100℃, ±(0.15% of rdg + 0.7℃)		
		-328.0 to 360.0˚F	±(0.15% of rdg + 0.5˚F) ※-328 to -1480˚F, ±(0.15% of rdg + 1.3˚F)		

Type	RANGE	Measurement range	Measurement		
			Digital		Analog
			Accuracy	Max. resolution	Accuracy
Thermocouple	T1	-200.0 to 400.0℃	±(0.15% of rdg + 0.5℃) ※-200 to -100℃, ±(0.15% of rdg + 0.7℃)	0.1℃/0.18˚F	Digital accuracy ±(0.3% of span)
		-328.0 to 752.0˚F	±(0.15% of rdg + 0.9˚F) ※-328 to -1480˚F, ±(0.15% of rdg + 1.3˚F)		
	T2	-200.0 to 200.0℃	±(0.15% of rdg + 0.4℃) ※-200 to -100℃, ±(0.15% of rdg + 0.7℃)		
		-328.0 to 392.0˚F	±(0.15% of rdg + 0.7˚F) ※-328 to -148˚F, ±(0.15% of rdg + 1.3˚F)		
	C	0.0 to 2320.0℃	±(0.15% of rdg + 1℃)		
		32.0 to 4208.0˚F	±(0.15% of rdg + 1.8˚F)		
	Au-Fe	1.0 to 300.0K	±(0.15% of rdg + 1K) ※1 to 20 K, ±2.4 K	0.1K	
	N	0.0 to 1300.0℃	±(0.15% of rdg + 0.7℃)	0.1℃/0.18˚F	
		32.0 to 2372.0˚F	±(0.15% of rdg + 1.3˚F)		
	PR40-20	0.0 to 1880.0℃	±(0.15% of rdg + 1℃) ※0 to 300℃, ±37.6℃ 300 to 800℃, ±18.8℃		
		32.0 to 3416.0˚F	±(0.15% of rdg + 1.8˚F) ※32 to 572˚F, ±67.7˚F 572 to 1472˚F, ±33.8˚F		
	PL Ⅱ	0.0 to 1390.0℃	±(0.15% of rdg + 0.7℃)		
		32.0 to 2534.0˚F	±(0.15% of rdg + 1.3˚F)		
	U	-200.0 to 400.0℃	±(0.15% of rdg + 0.5℃) ※-200 to -100℃, ±(0.15% of rdg + 0.7℃)		
		-328.0 to 752.0˚F	±(0.15% of rdg + 0.9˚F) ※-328 to -148˚F, ±(0.15% of rdg + 1.3˚F)		
	L	-200.0 to 900.0℃	±(0.15% of rdg + 0.5℃) ※-200 to -100℃, ±(0.15% of rdg + 0.7℃)		
		-328.0 to 1652.0˚F	±(0.15% of rdg + 0.9˚F) ※-328 to -148˚F, ±(0.15% of rdg + 1.3˚F)		
Resistance temperature detector	Pt100-1	-200.0 to 650.0℃	±(0.15% of rdg + 0.3℃)		
		-328.0 to 1202.0˚F	±(0.15% of rdg + 0.6˚F)		
	Pt100-2	-200.0 to 200.0℃	±(0.15% of rdg + 0.2℃)		
		-328.0 to 392.0˚F	±(0.15% of rdg + 0.4˚F)		
	JPt100-1	-200.0 to 630.0℃	±(0.15% of rdg + 0.3℃)		
		-328.0 to 1166.0˚F	±(0.15% of rdg + 0.6˚F)		
	JPt100-2	-200.0 to 200.0℃	±(0.15% of rdg + 0.2℃)		
		-328.0 to 392.0˚F	±(0.15% of rdg + 0.4˚F)		

B,R,S,K,E,J,T,N : JIS C 1602-1995(IEC584-1)
C : Made by "Hoskins" (WRe5-26)
Au-Fe : ASTM COMMITTEE-20 ON TEMPERATURE MEASUREMENT
PR40-20 : ASTM E1751-1995
PL Ⅱ : ASTM E1751-1995
U : DIN43710 : 1985(Cu-CuNi)
L : DIN43710 : 1985(Fe-CuNi)
Pt100 : JIS C 1604-1997(IEC751)
JPt100 : (JIS C 1604-1981)

11.2.2 The Accuracy at the Computation

(1) Scaling

The accuracy rating at the scaling is as following formula.

Scaling accuracy (digits) = Range accuracy rating (digits) × Scaling factor +2 digits

But, Scaling factor= $\dfrac{\text{Scaling span (digits)}}{\text{Measurement range span (digits)}}$

Example 1) When VOLT range is −1.000～1.000V and Scaling range is 0.00～100.00.

Range accuracy rating =0.1%×1.000V+3 digits

(Input +1.000V) =4 digits

Scaling factor $= \dfrac{10000-0}{1000-(-1000)} = 5$

Therefore, Scaling accuracy $= \pm(4\times5+2)$

$= \pm 22$ digits

Analog recording accuracy $= \pm\left\{4+\{1000-(-1000)\}\times\dfrac{0.3}{100}\right\}$

$= \pm 10$ digits

$= \pm 0.01$V

Example 2) When Type K is 0.0～200.0℃ and Scaling is 0.00～200.00.

Range accuracy rating $= 0.15\%\times200.0+0.3$℃

(Input 200℃) $= 0.6$℃

$= 6$ digits

Scaling factor $= \dfrac{20000-0}{2000-0} = 10$

Therefore, Scaling accuracy $= \pm(6\times10+2)$

$= \pm 62$ digits

$= \pm 0.62$℃

(2) Square root computation

The square root computation is as following formula.

Display value $= 10\sqrt{\text{Process variable}}$

Display value accuracy rating: ε , Process variable accuracy: e, and

Process variable: x (convert into %).

Display value $= 10\sqrt{x\pm e} \fallingdotseq 10\sqrt{x} \pm \dfrac{10e}{2\sqrt{x}}$

Therefore, Display value accuracy ε $\varepsilon = \dfrac{5e}{\sqrt{x}}$

When input 4～20mA, the square root computation accuracy: ε is as following formula.

Measuring 100% $\varepsilon_{100} = \frac{5e}{\sqrt{100}} = \frac{5(0.2+0.125)}{10}$ =0.16% rdg

Measuring 50% $\varepsilon_{50} = \frac{5e}{\sqrt{50}} = \frac{5(0.1+0.167)}{7.07}$ =0.19% rdg

Measuring 9% $\varepsilon_{9} = \frac{5e}{\sqrt{9}} = \frac{5(0.018+1.39)}{3}$ =2.3% rdg

Measuring 1% $\varepsilon_{1} = \frac{5e}{\sqrt{1}} = 5(0.002+12.5)$ =62.5% rdg

If the process variable is low as above, its accuracy rating is incorrect.

(3) Decade

The accuracy rating at the decade computation is defined the logarithm of display value.

Normally, the accuracy rating is less than 1 digit and you cannot read by significant digit.

(4) Difference, Sum, and Average

The accuracy rating of Difference, Sum, and Average is as following formula.

Difference and Sum : Reference channel accuracy rating ×2

Average : Reference channel accuracy rating

Example) When Reference channel VOLT is 00.00～10.00V and Difference is −10.00～10.00.

Reference channel accuracy rating =±(0.3%×10.00V+3 digits)
=±(1000×0.003+3)
=±6digits

Difference accuracy rating =±6×2
=±12 digits

11.2.3 Individual Specifications

Table 11.3 Specification Items

Block	Item	Specification
Input Unit	Measuring Point	1,2
	Input Sampling	120ms
	Display Interval	2.4 s (Data renewal period 120ms)
Record & Printer	Recording Form	Disposable felt pen
	Printing Form	Wire dot (one color ink ribbon)
	Recording Width	100 mm
	Step Response Time	1.0 s max. (95% response to IEC 1143)
	Chart Paper	Length : 16m, Width : 114 mm, Folding width : 40 mm The length of the Clean Chart is 12 m.
	Chart Speed	5, 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 mm/h
	Recording Color	1 pen (Red), 2 pen (Green)
	Printing Color	Purple
Weight		2.5 kg max.
Power Consumption		35VA max.

11.2.4 Standard Functions

Table 11.4 Standard Functions

Item	Description
Analog indication	None
Analog recording	Analog recording by the pen.
Engineering unit indication	None
Digital display	Indicates Channel No., Process variable data, Chart speed, Alarm setting value on the display.
Logging print	Prints Date, Time, Chart speed, Process variable and Engineering unit at a programmed interval. With the setting, it is possible for the synchronous print/Asynchronous print to choose.
List print	Prints Chart speed, Sensor type, Measurement range, Engineering unit, Alarm setting value, Comment, Printing description, Logging print ON/OFF, Zone, Partial Compression/Expansion
Engineering list print	Prints Channel or Tag print, Alarm function, Logging print ON/OFF, Reference time, Interval, Logging print Sync./ASync., Print gap correction ON/OFF, Alarm hysteresis, Burn out, DI function (Option)
Manual print	Prints Measurement result by the key input.
Programming	Programs Chart speed, Alarm setting value, Logging, Date and Time.
Memory Back Up	A built-in lithium battery protects the clock function. The battery life is 10 years. (total power off period of the instrument : 5 years)A non-volatile memory stores setting data and calibration data.
Alarm	Sets 2 types (H, L) of alarms per channel. Sets a total of 4 level.
Chart Speed	Selects Chart speed from 41 types.
Clock Indication	Indicates Year, Month, Day, Hour and Minute. Sets the year in A.D, and adjusts leap year automatically.
Self Diagnostics	Occurring some type of the defect to indicate "E Err＊＊". (＊＊: type of the defect).
Scaling	Indicates and record the input of a unification signal etc. is changed into the engineering scales.

11.3 Standard Setting Functions

11.3.1 Standard Setting Functions

Table 11.5 Standard Setting Functions

Function	Description
Burnout	To deflect over toward 100% with disconnecting input. Specifies the every channel's burnout. (DC voltage of ±50mV max., TC input)
Tag Number	Sets a tag number by 5 figures every channel. (Prints at a logging print)
Reference Junction Compensation	Specifies an inside/outside of the reference junction compensation.
Copy Function	Copies a channel setting up.
Input Offset	Sets the input offset every channel.
Zone Recording (Track Recording)	Specifies a recording area every channel to separate into Tracks.
Partial Compression/Expansion	Records Partial Compression/Expansion to 1-crease line every channel.
Decade Recording Indication	Records and indicates by 5 decades. It is 2 figures that the effective number to indicate and print.
Alarm Print	Prints Occurrence time, Occurrence channel, Setting No. and Alarm type in purple at occurring an alarm.
Alarm Recovery Print	Prints Recovery time, Recovery channel, Setting No. and Alarm type in purple at recovering an alarm.
Computation	Computes Square root.
Interchannel Computation	Computes Sum, Difference and Average computation.
Alarm Hysteresis Width	Sets an alarm hysteresis width 0% FS or 0.5% FS.
Digital Filter	Records the first order lag with the filtering Process variable.

11.4 Optional Functions

11.4.1 Remote Function of DI

Function	Description
Chart Feed Start/Stop	Starts with tuning to ON. Stops with tuning to OFF.
Changing Chart Speed	Changes 1st with turning to ON and 2nd with OFF.
Comment Print(Sync./Async.)	Prints Comment with turning to ON.
Manual Print(Sync./Async.)	Prints Manual Print with turning to ON.
Date and Time Print(Sync./Async.)	Prints Date and Time with turning to ON.

11.4.2 Alarm Board

3 relays

11.4.3 Communication Unit

RS-232C(Standard)
RS-485(Option)