

HYBRID RECORDER
HR-700
(DOT PRINTING TYPE)
INSTRUCTION MANUAL

Shinbo

For safe use

Thank you for purchasing our HR-706 type Hybrid Recorder.

In order for this instrument to function effectively and correctly, please 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 indicates "Caution for handling". Please refer to the instruction manual when handling parts with this symbol on it for protecting human body and the instrument.
	This indicates "Protective grounding". Be sure to provide protective grounding prior to the operation of this instrument.
	This indicates "Risk of electric shock". This symbol is used on the parts which have a risk of electric shock.

Be sure to observe the following warnings/cautions and those written in this manual in order to secure safety when using this 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 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 protective covers 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 unused terminals for other purposes such as relaying.

Transportation

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.

Inside of Instrument

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.

[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 and helmet for safety.
- (2) Do not step on the installed instrument or get on it, because this is dangerous.

Maintenance

Only our servicemen or engineers authorized by Shinko 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) Clean the instrument after the power is turned off.

Revisions

This instruction manual is subject to change without prior notice.



SAFETY PRECAUTIONS

- To ensure safe and correct use, thoroughly read and understand this manual before using this instrument.
- This instrument is intended to be used for industrial machinery, machine tools and measuring equipment. Verify correct usage after consulting purpose of use with our agency or main office. (Never use this instrument for medical purposes with which human lives are involved.)
- External protection devices such as protection equipment against excessive temperature rise, etc. must be installed, as malfunction of this product could result in serious damage to the system or injury to personnel.
Also proper periodic maintenance is required.
- This instrument must be used under the conditions and environment described in this manual. Shinko Technos Co., Ltd. does not accept liability for any injury, loss of life or damage occurring due to the instrument being used under conditions not otherwise stated in this manual.

Caution with respect to Export Trade Control Ordinance

To avoid this instrument from being used as a component in, or as being utilized in the manufacture of weapons of mass destruction (i.e. military applications, military equipment, etc.), please investigate the end users and the final use of this instrument. In the case of resale, ensure that this instrument is not illegally exported.

Using this manual

1. Using this manual

This instruction manual consists of “For safe use”, “Contents” and “Chapter 1 to Chapter 11” as below. Please read the corresponding sections for your purpose to use this instrument.

Chapter and title	For purchase and installation	For initial setting and setting change	For daily operation	For communication	For maintenance and troubleshooting
For safe use (page 1)	⊙	⊙	⊙	⊙	⊙
1. INTRODUCTION	⊙				
2. CONSTRUCTION	○	○	○		○
3. INSTALLATION	⊙		○		
4. WIRING	⊙	○	○	○	○
5. PREPARATIONS FOR OPERATION		○	⊙		
6. OPERATION		○	⊙		
7. DEVICE SETTING		⊙		○	○
8.COMMUNICATION				⊙	
9. MAINTENANCE					⊙
10. TROUBLESHOOTING		○			⊙
11. SPECIFICATIONS	○	○			○

⊙: Be sure to read this.

○: Be sure to read this if required.

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

Symbols used in this manual	
 WARNING	Failure to observe this information could result in death or injury. Be sure to read this.
 CAUTION	Failure to observe this information could damage the instrument. Be sure to read this.
[Note]	This is cautionary information for correct use of the instrument. Be sure to read this.
[Reference]	This is an information about the functions of this instrument for effective use.

2. Guide of Instruction manual

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

	Name	Edition No.	Outline
This manual ⇒	1 HR-700 Hybrid Recorder (Multipoint type) instruction manual	No.HR71E	Explanation for installation, wiring, standard operation. Setting and operation for using this instrument.
	2 HR-700 Hybrid Recorder Communication Command instruction manual	No.HR7CE	Explanation for reading and writing data of the recorder by communication function.

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1. INTRODUCTION

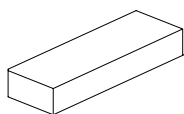
1.1 Checking the Accessories

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

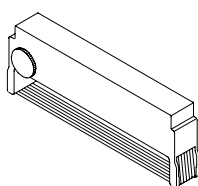
If there are any missing accessories or damage to the appearance of the instrument, please contact our dealer where you purchased the instrument, or our sales representative.

The following accessories are included with the recorder.

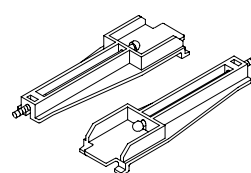
1. Chart paper



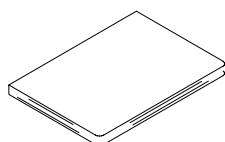
2. Ribbon cassette



3. Mounting bracket



4. Instruction manual



5. Packing

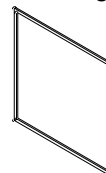


Fig. 1.1 Accessories

Table 1.1 List of Accessories

No.	Part Name	Type	Quantity	Remarks
1	Chart paper	H-10100	1	100 equal divisions
2	Ribbon Cassette	WPSR188A000001A	1	
3	Mounting bracket	H4A14175	2	Panel mounting bracket
4	Instruction manual	HR71E	1	This manual
5	Packing	H4H14900	1	For IP65

[Note]

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

1.2 Checking the Model Type and Specifications

A nameplate has been secured on the inside of the instrument. Remove the chart holder and make sure that the nameplate is put in the middle far side of the instrument.

Make sure that this instrument meets your requested specification, checking the following table.

Table 1.2 Model type

H R – 7 0 6, ☐ ☐ ☐		144(W) x 144 (H) x 150 (D)mm	
Measuring point	6		6 points
Options		C5	Communication function (RS-485)
		RE6	DI function
		FL	Paper-empty detection function
		LH6	Alarm output function

1.3 Temporary Storage

Store the instrument in the following environment.

When installed within another machine, ensure that the operating environment conforms to the following conditions.



CAUTION

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

Storage Environment

- A place free from excess dust
- A place free from combustible, explosive, or corrosive gases (SO₂, H₂S, 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 sunlight 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-approved nameplate is attached, it may damage the door or mounting part.

2. CONSTRUCTION

2.1 Appearance

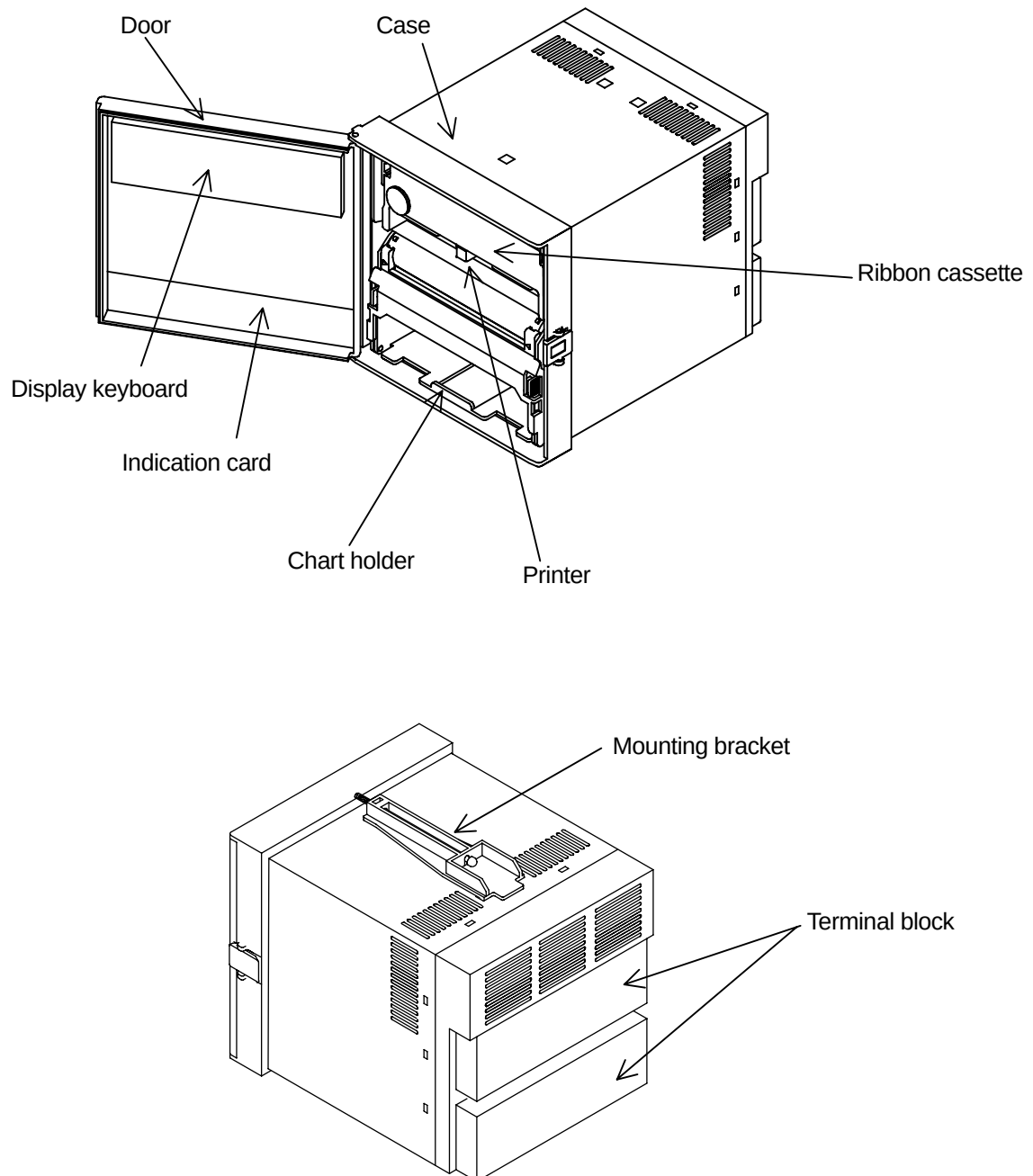


Fig. 2.1 Appearance

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.

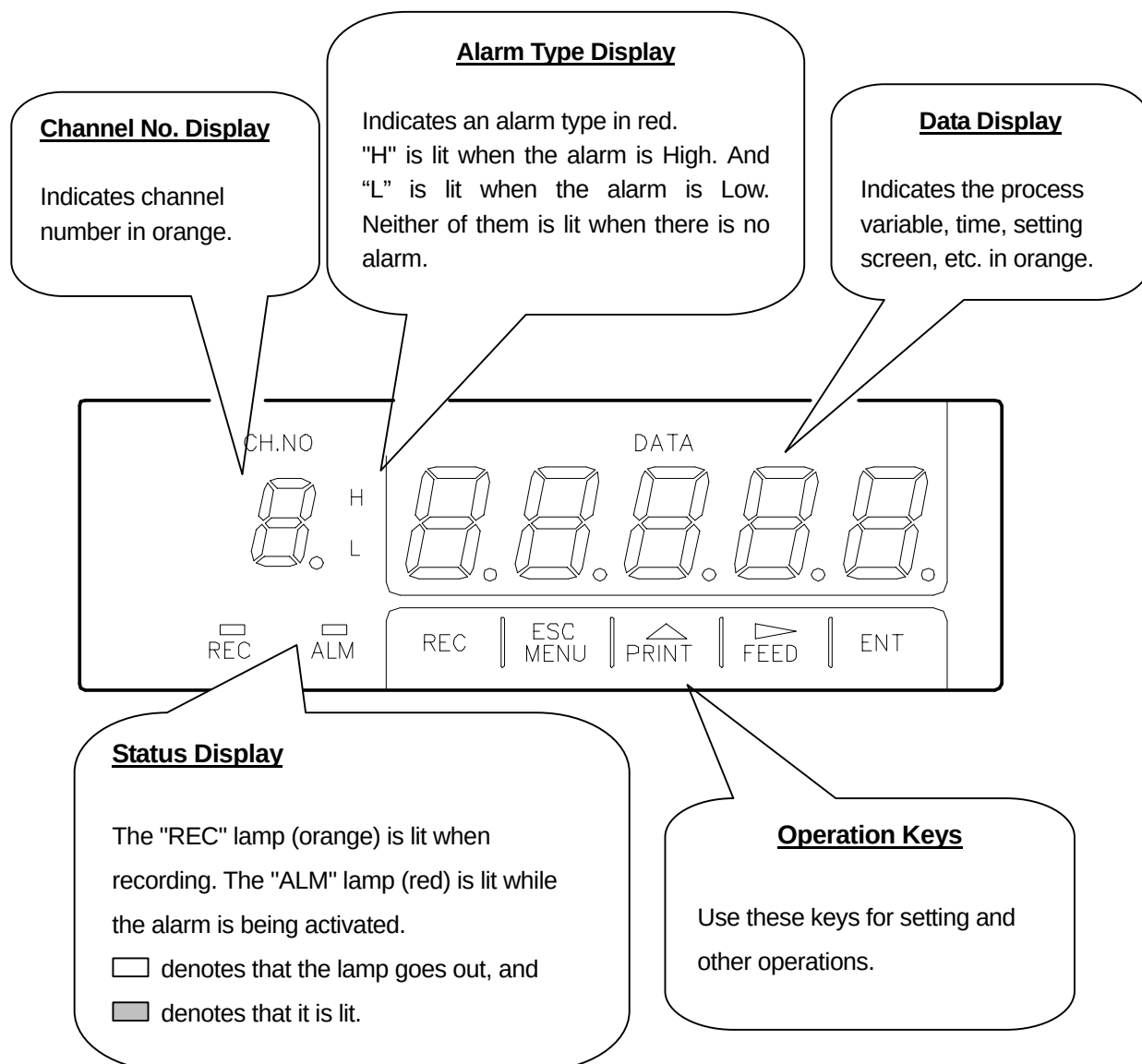


Fig. 2.2.1 Display

[Reference] Symbolized Alphabets for Display

Display	A	b	C	d	E	F	G	H	h	I	J	K	L	l
Alphabet	A	B	C	D	E	F	G	H	h	I	J	K	L	I
Display	m	n	o	P	q	r	S	t	U	V	W	X	Y	Z
Alphabet	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

2.2.2 Operation Keys

The following describes functions of each operation key.

The actual operation keys are described as shown below.

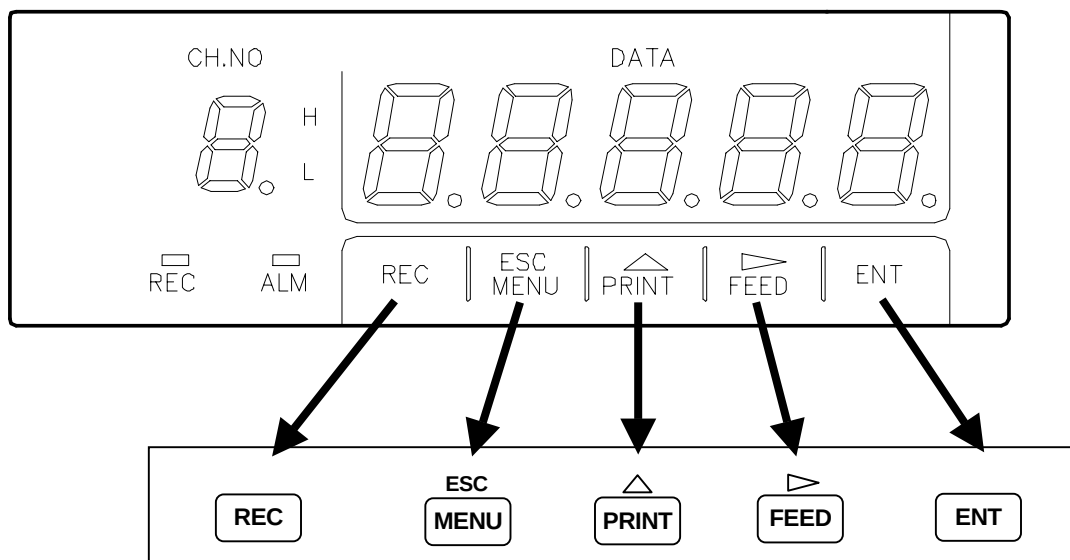


Fig. 2.2.2 Operation Keys in this manual

Table 2.2.2 Names of Operation Keys and Their Functions

Key	Name	Function	
	"REC" key	Starts/stops recording. To stop, press the "REC" key for 3 seconds or longer. (The "REC" lamp goes out.) To start, press the "REC" key. (The "REC" lamp lights.)	
	"MENU" key	MENU function	Selects engineering list print and changes the mode to the setting mode.
	"ESC" key	ESC function	While selecting a function, exits that menu without finishing.
	"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" 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" key	Used to register a setting parameter (numeral or built-in command) after selecting it, or executing a function. Pressing this key executes the setting.	

3. INSTALLATION

3.1 External dimensions and panel cutout

Unit: mm

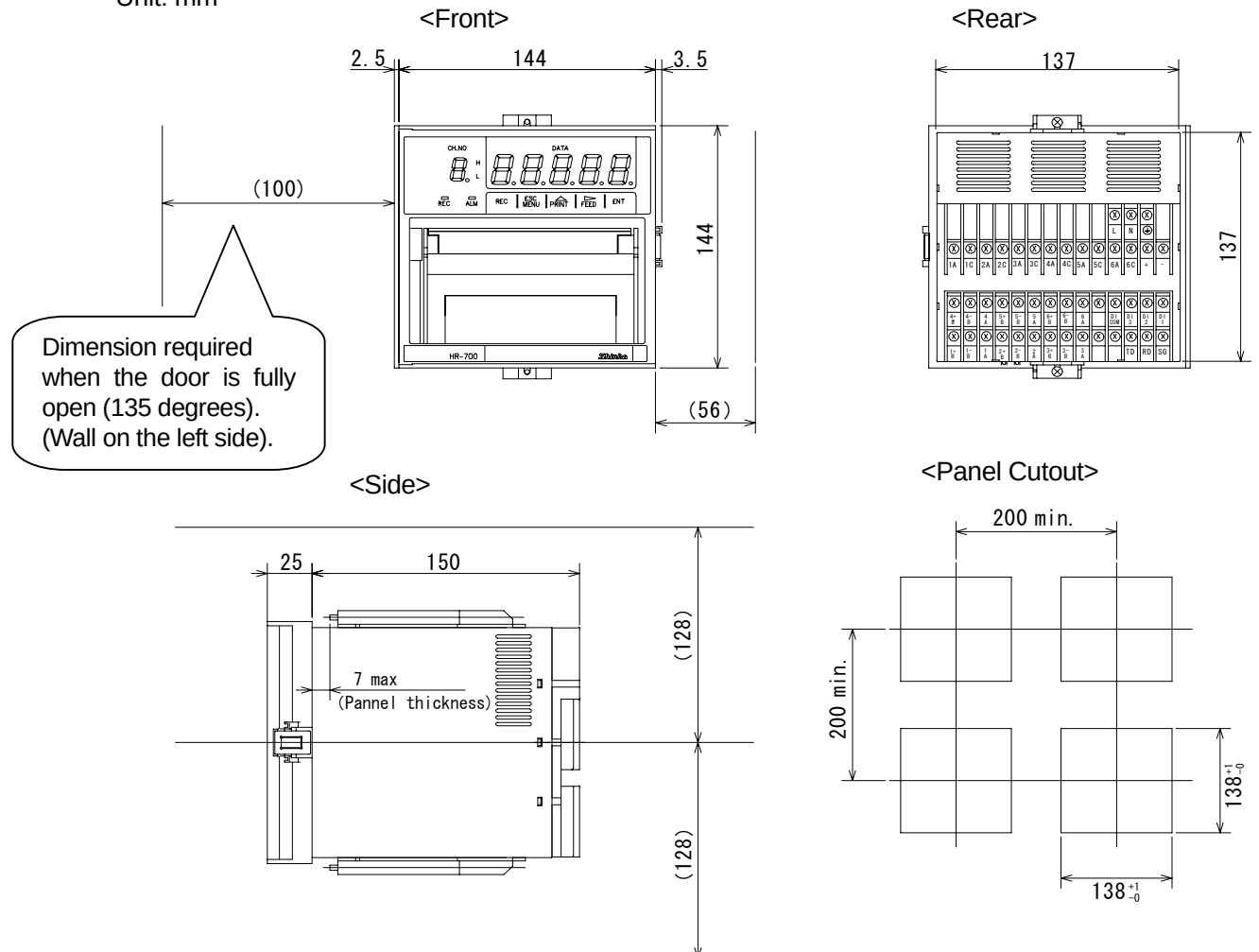


Fig. 3.1 External dimensions and panel cutout



CAUTION

For the maintenance and safety of the instrument, spaces larger than the size written in the bracket () should be secured to unit.

3.2 Mounting to the Panel



WARNING

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



CAUTION

Install the instrument in the following places

- A place without rapid humidity change.
- A place of normal temperature (around 25°C).
- 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 the 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, referring to Fig.3.2.1-1.
- 2) Insert this instrument through the front of the panel.
- 3) Hook the claws of the mounting bracket at the square holes on 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 the screw by 180° .

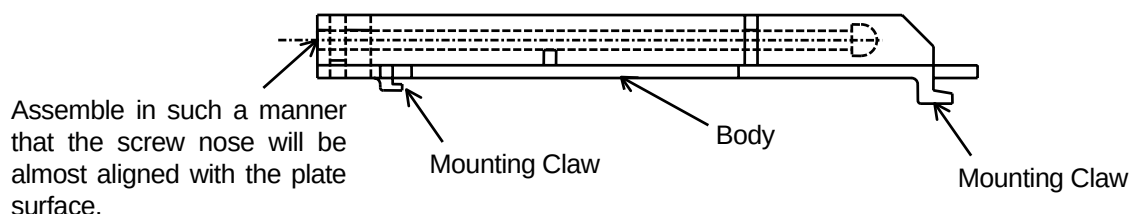


Fig. 3.2.1-1 Mounting bracket

[Note]

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

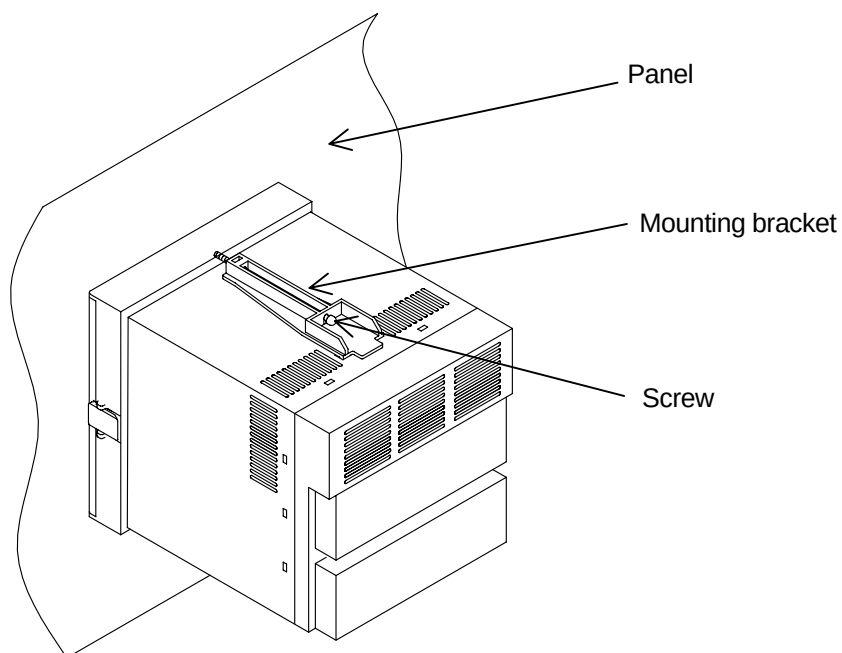


Fig. 3.2.1-2 Mounting to the Panel

3.2.2 Mounting to the Panel in compliance with the IP65

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

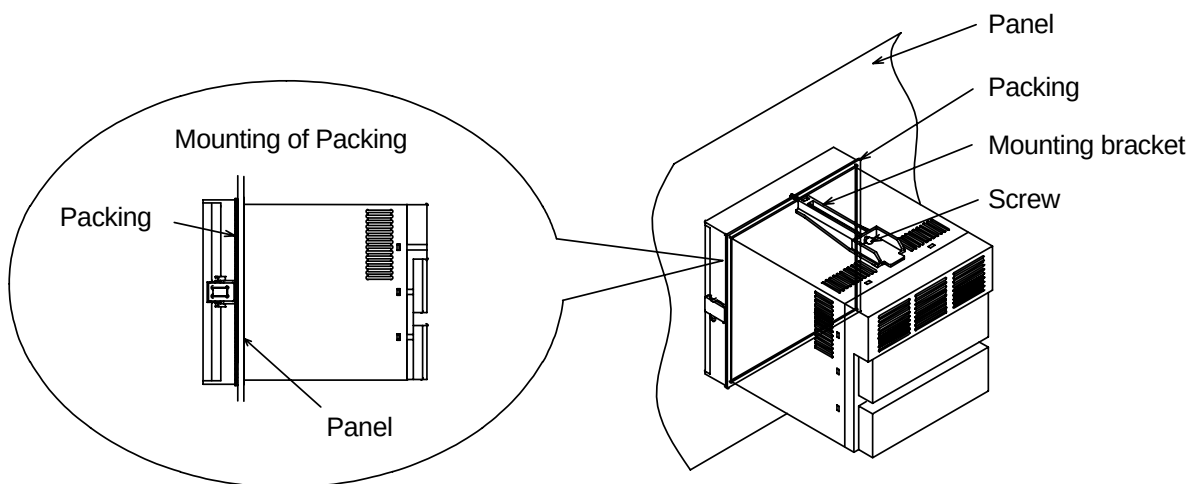


Fig. 3.2.2 Mounting to the Panel (in compliance with the IP65)

4.1 Terminal arrangement and power wiring

4.1.1 Terminal arrangement

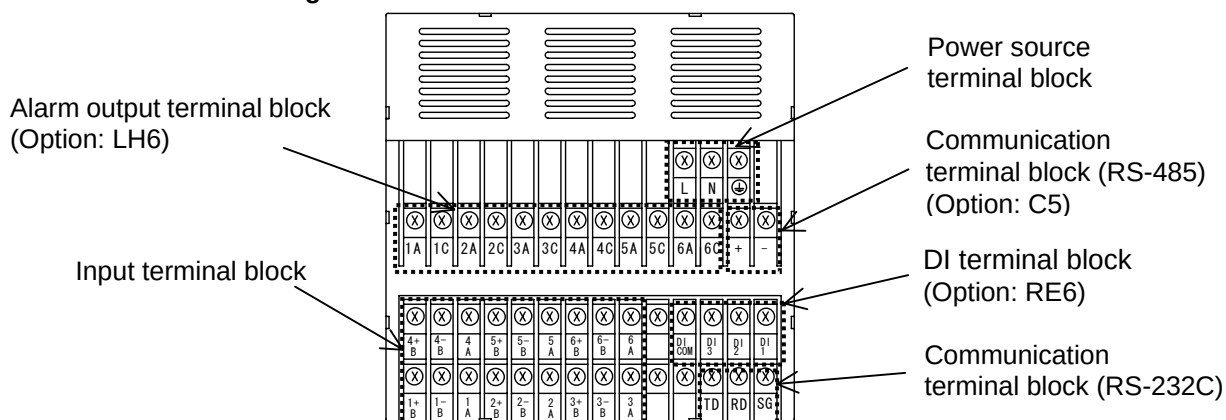


Fig. 4.1.1 Terminal arrangement (Rear view)

4.1.2 Power Wiring



WARNING

- (1) In order to prevent an electric shock, be sure to provide protective grounding prior to the power supply to the instrument.
- (2) Do not cut the 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 switching on power to the instrument.
- (5) Any interruption to the protective conductor inside or outside the instrument or disconnection of the protective grounding terminal is likely to make the instrument dangerous under fault conditions. Intentional interruption is prohibited.



CAUTION

- (1) As an electric wire for the power source, use a 600V vinyl insulated wire (IEC 227-3) or its equivalent or above.
- (2) Attach a round solderless terminal with an insulation sleeve (for M3.5) to the end of the electric wire.
- (3) Connect a protective grounding (resistance: 100Ω or lower, a minimum diameter of a grounding conductor: 1.6mm) to the protective grounding terminal.
- (4) If another instrument shares the protective grounding conductor, there may be an effect caused by noise coming from the grounding conductor. Do not share the grounding conductor with other instruments.
- (5) In order to comply with the requirements of safety standard EN61010, the recorder should 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 plug in 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

For the transparent protective cover, remove the left and right (both sides) hooks simultaneously. If they are removed in turn, the cover may be damaged.

- (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, pull out the cover toward you.
- (2) Connect the power source electric wire, referring to Fig. 4.1.3. 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) Attach the transparent protective cover.
- (4) Make sure that protective grounding is properly done.

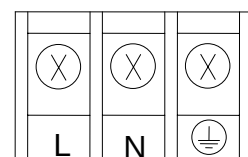


Fig. 4.1.3 Power source Terminal block

4.2 Input Wiring



CAUTION

(1) Precautions for the input electric wire

- Make sure that no noise is mixed in input wiring. For input wiring, a shielded wire or twisted wire effective for noise should be used.
- In the case of thermocouple input, connect a thermocouple wire directly or use a compensating lead wire. A shielded input line should be used.
- In the case of RTD (resistance temperature detector) input, dispersion of 3-wire line resistance should be lower than the values mentioned below. A shielded input line should be used.

For Pt 100, JPt 100; 50m Ω max.

- When it is likely to be affected by induction noise, particularly when wiring near the high-frequency power source, a shielded twisted wire should be used.
- Attach a round solderless terminal with an insulated sleeve (for M3.5) to the end of the electric wire.

(2) Precautions 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 the case of mV, V, or thermocouple input, and short-circuit among A, B, and B in the case of RTD input.)
- Be sure to ground the connecting wire shield.

4.2.1 Wiring Procedure



CAUTION

For the transparent protective cover, remove the left and right (both sides) hooks simultaneously. If they are removed in turn, the cover may be damaged.

- (1) Put your fingers on the left and right hooks of the transparent protective cover on the input terminal block. Pushing them inside, pull out the cover toward you.
- (2) Wire the input lines, referring to Fig. 4.2.1-1 (P.18), Fig. 4.2.1-2 and Fig. 4.2.1-3. (P.19)
- (3) Attach transparent protective covers.

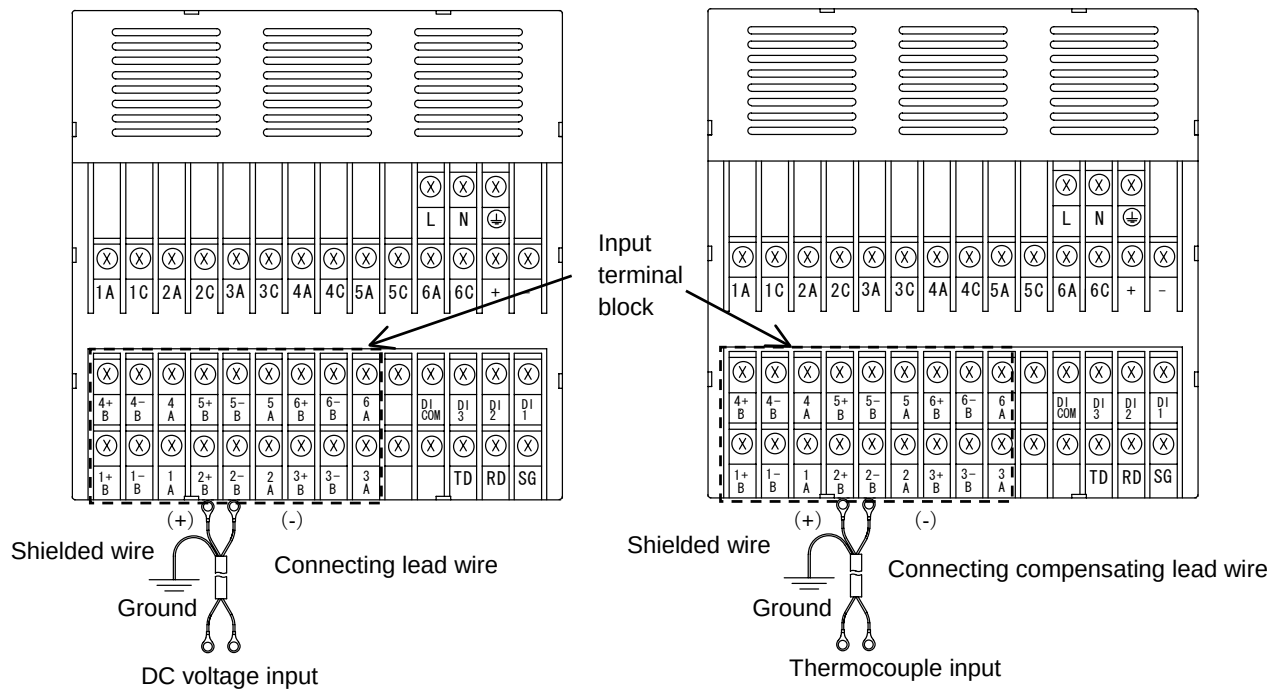


Fig. 4.2.1-1 Input Wiring (For mV, V and Thermocouple inputs)

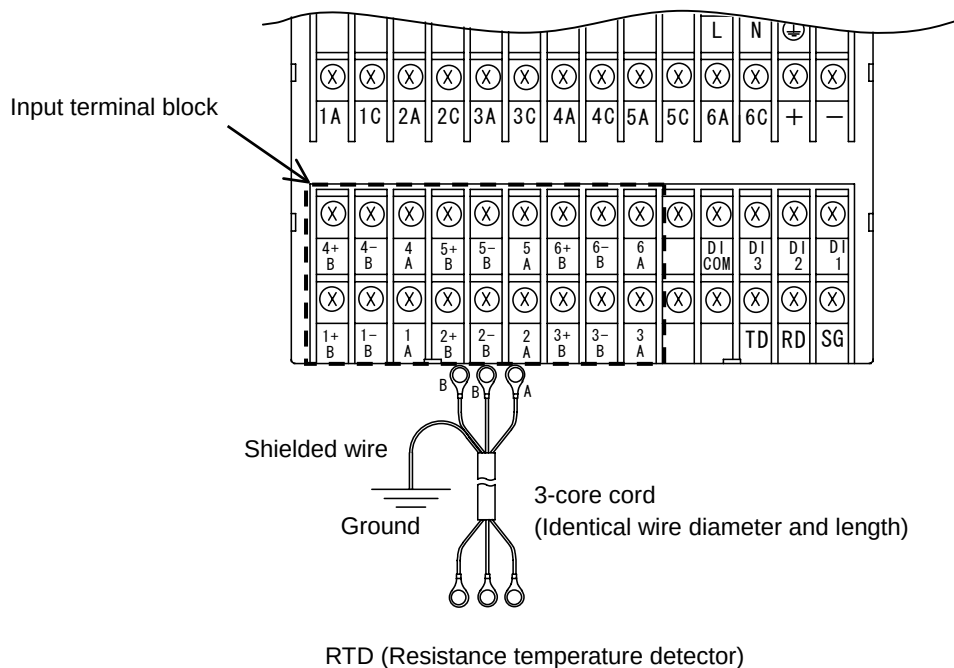


Fig. 4.2.1-2 Input Wiring (For RTD)

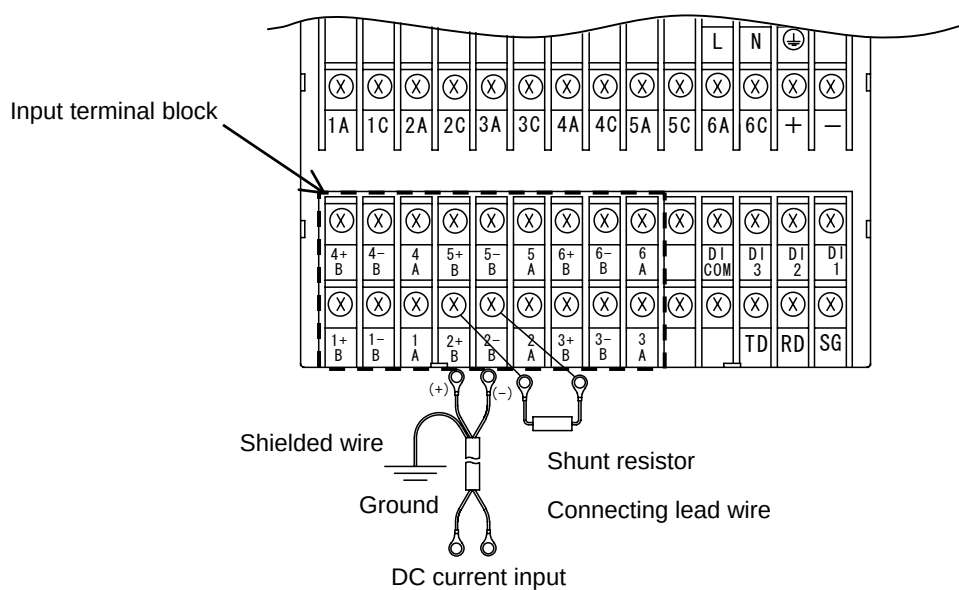


Fig. 4.2.1-3 Input Wiring (For mA input)



CAUTION

- (1) Attach a shunt resistor to the input terminal block of the instrument.
- (2) A shunt resistor affects input accuracy. Use the following resistor.
Resistance: 250Ω , Rated power: $1/4W$, Tolerance: $\pm 0.1\%$ max.
Temperature coefficient: $\pm 50\text{ppm}$ max.

4.3 DI function/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 is supplied to the alarm terminal:
 - a) Never touch terminals.
 - b) Attach covers to terminals.
 - c) Wires should be double shielded.
 - d) Use round pressure terminal connectors with an insulation cover for wire, whereby preventing a loose connection.



CAUTION

Precautions for Wiring the DI function

- (1) DI function input has the built-in drive power source. Do not apply a voltage to a DI function input terminal from the outside.
- (2) A DI function input contact capacity should be a withstanding voltage of 50V DC, 16mA or more, ON resistance of 20Ω 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 :
 - 250V AC : 3A at maximum (Resistive load)
 - 30V DC : 3A at maximum (Resistive load)
 - 125V DC : 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, when required.
- (3) Attach a round solderless terminal with an insulation sleeve (for M3.5) to the end of an electric wire.
- (4) Keep alarm output wiring away from the input wiring.
- (5) Do not use unused terminals as relay terminals.

4.3.1 DI function/Alarm Output Wiring Example

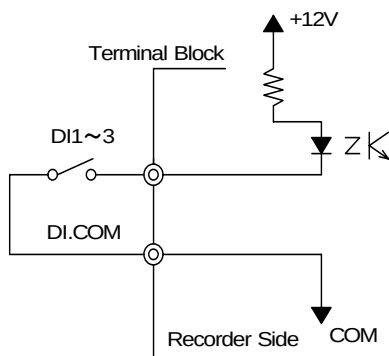


Fig. 4.3.1-1 DI function Wiring Example

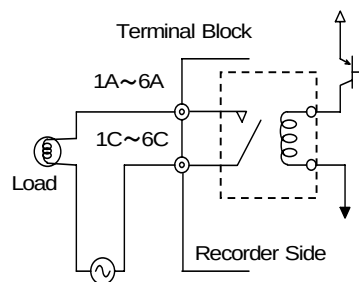


Fig. 4.3.1-2 Alarm Output Wiring Example



CAUTION

The DI function (Option) consists of 3 Digital inputs.
The alarm output consists of 6-Relay output (Normally open).

4.3.2 Alarm Output Wiring Procedure

Wire the Alarm output (option: LH6), referring to Fig.4.3.2.

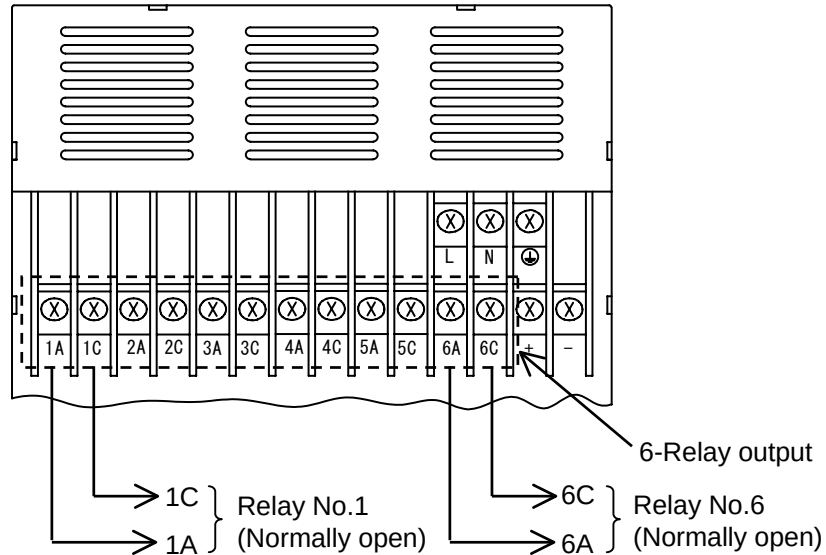


Fig. 4.3.2 Alarm Output Wiring

4.3.3 DI function Wiring Procedure

Wire the DI function (option: RE6), referring to Fig.4.3.3.

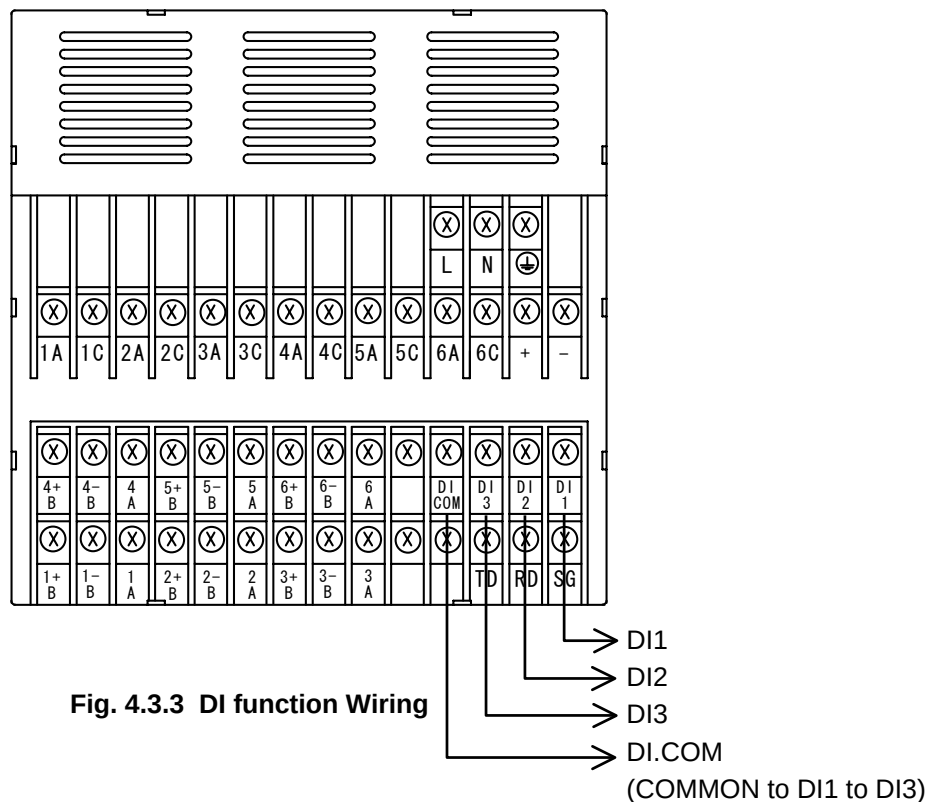


Fig. 4.3.3 DI function Wiring

4.4 Communication Wiring



CAUTION

Precautions for the communication wiring

- (1) Make sure that no noise is mixed in communication wiring. For communication wiring, a shielded wire effective for noise should be used.
- (2) When it is likely to be affected by induction noise, particularly when wiring near the high frequency power source, a shielded twisted wire should be used.
- (3) Attach a round solderless terminal with an insulation sleeve (for M3.5) to the end of the electric wire.
- (4) Be sure to ground the shield of a connecting wire.

4.4.1 RS-232C Wiring

Wire RS-232C, referring to Fig.4.4.1.

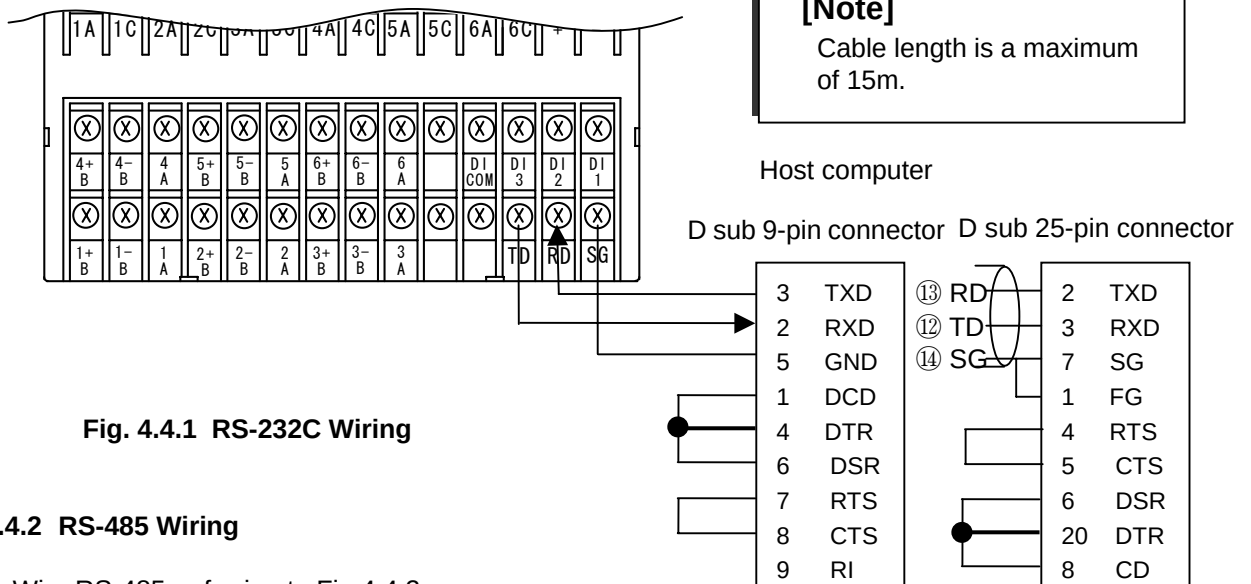


Fig. 4.4.1 RS-232C Wiring

4.4.2 RS-485 Wiring

Wire RS-485, referring to Fig.4.4.2.

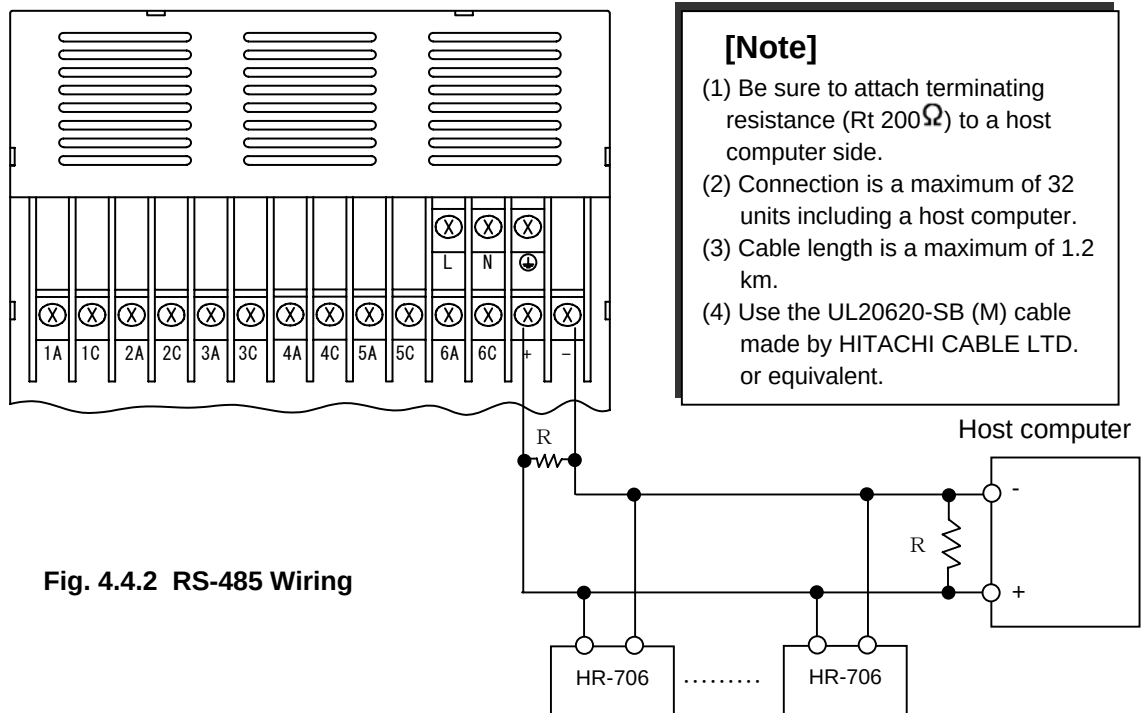


Fig. 4.4.2 RS-485 Wiring

5. PREPARATIONS FOR OPERATION

5.1 Setting the Chart Paper



CAUTION

Our original chart paper should be used to ensure proper recording.
If the chart paper 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 "REC" key to stop recording.

- (1) Press the "REC" key for 3 seconds or longer

Stop recording operation. With the power turned on, press the "REC" key for 3 seconds or longer.

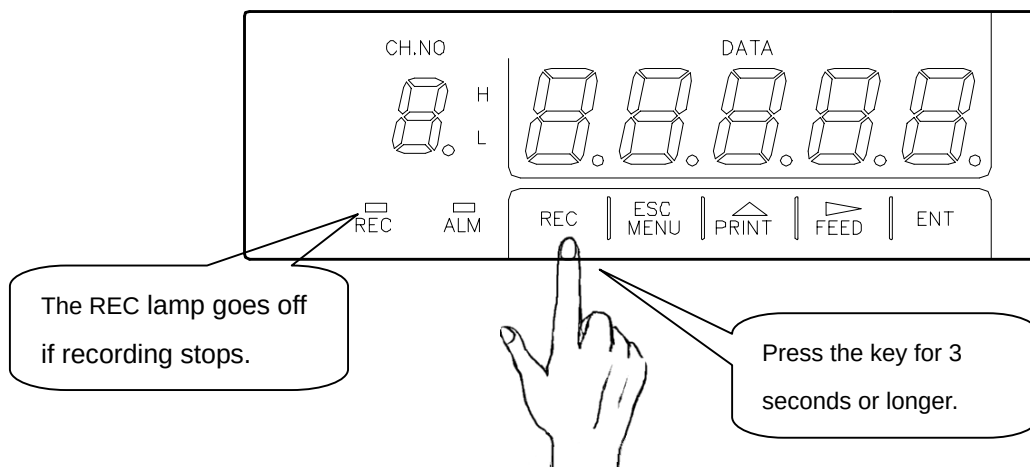


Fig. 5.1-1 Pressing the "REC" key

- (2) Open the Door



CAUTION

Maximum angle of the fully opened door is 135 degrees. Do not open the door any further, as the hinge will break.

Push the door hook to unlock the door. Pull out the door to open it.

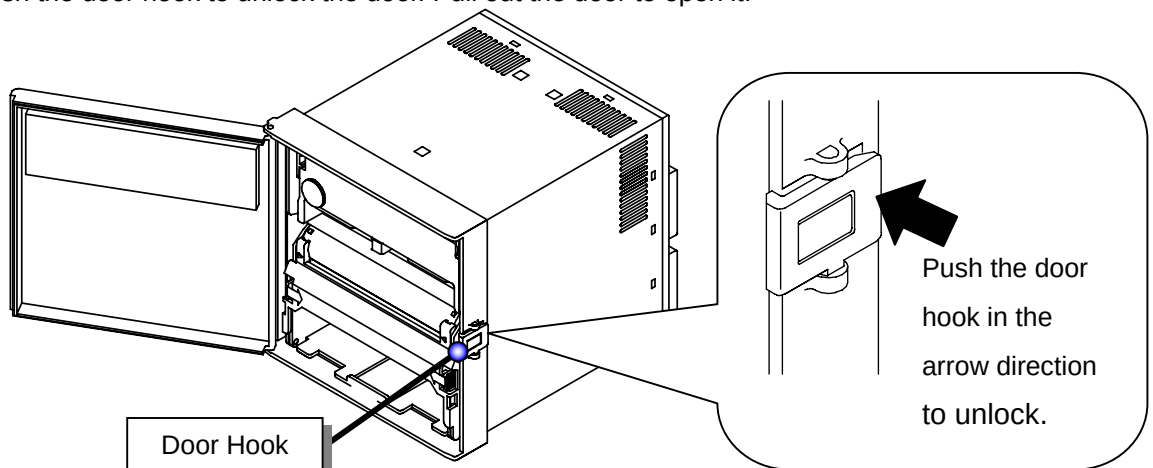


Fig. 5.1-2 Opening the Door

(3) Pull out the Chart Holder

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

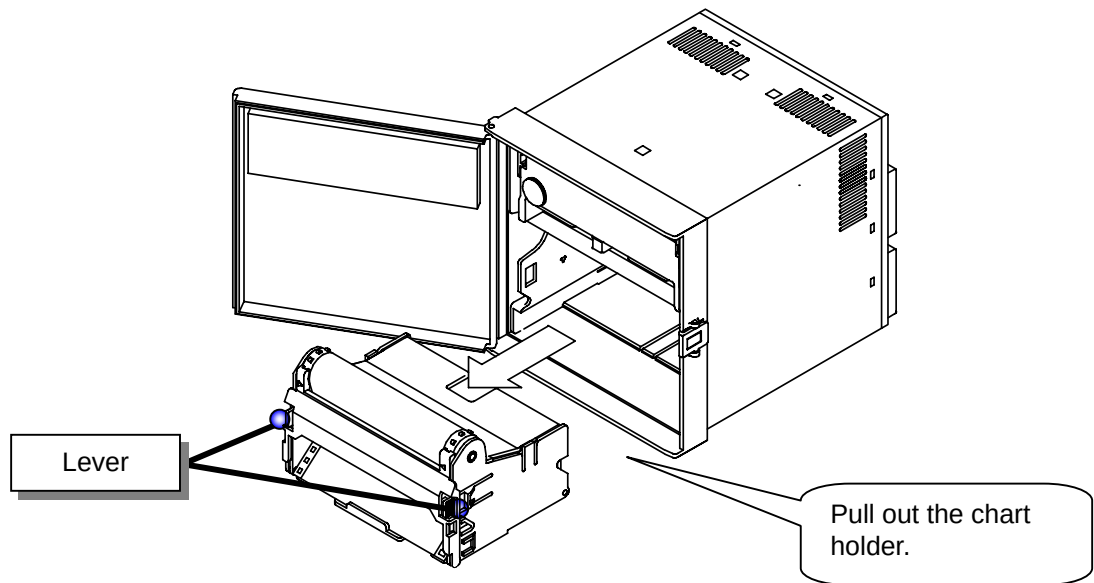


Fig. 5.1-3 Pulling out the Chart Holder

(4) Open the Chart Cover and Chart Guide

Open the chart guide and the chart cover outward.

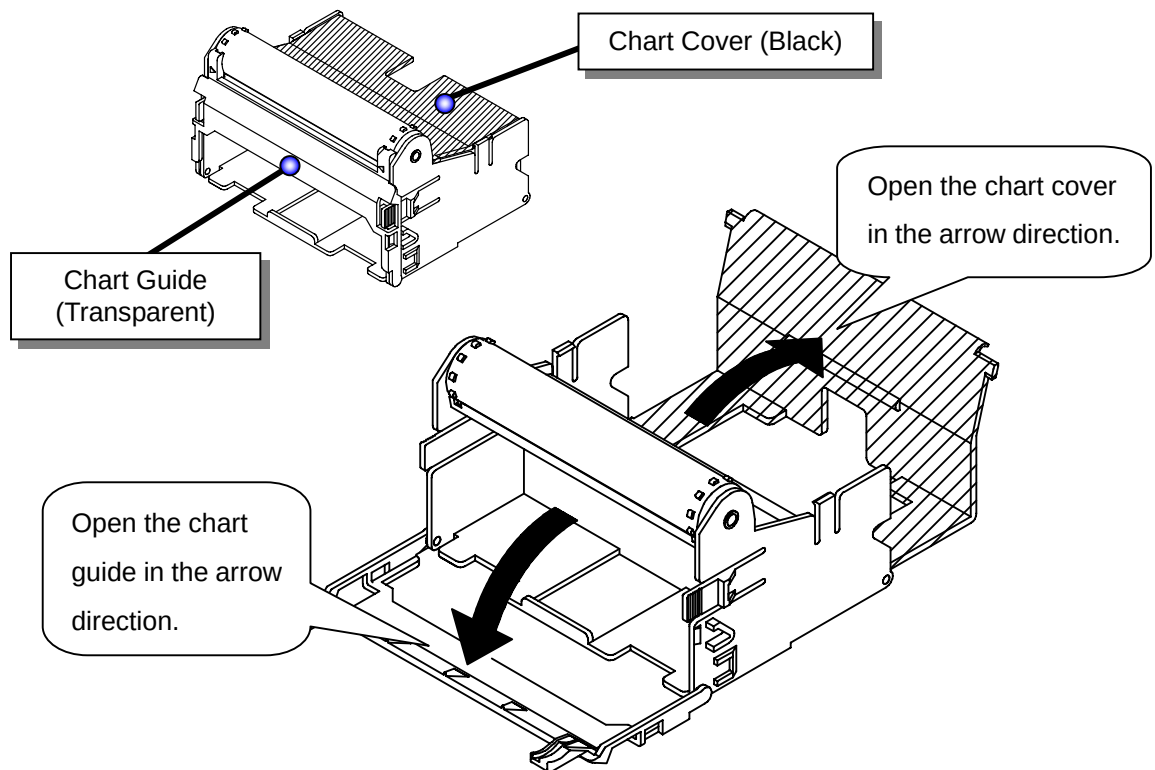


Fig. 5.1-4 Opening the Chart Cover and Chart Guide

(5) Loosen the chart paper

The chart paper may not be properly fed, if stuck. Be sure to loosen the paper.



Fig. 5.1-5 Loosening the Chart Paper

(6) Set the Chart Paper into the Storage Chamber

Unfold 2 sections of chart paper. Holding the printing surface upward, set it in the storage chamber.

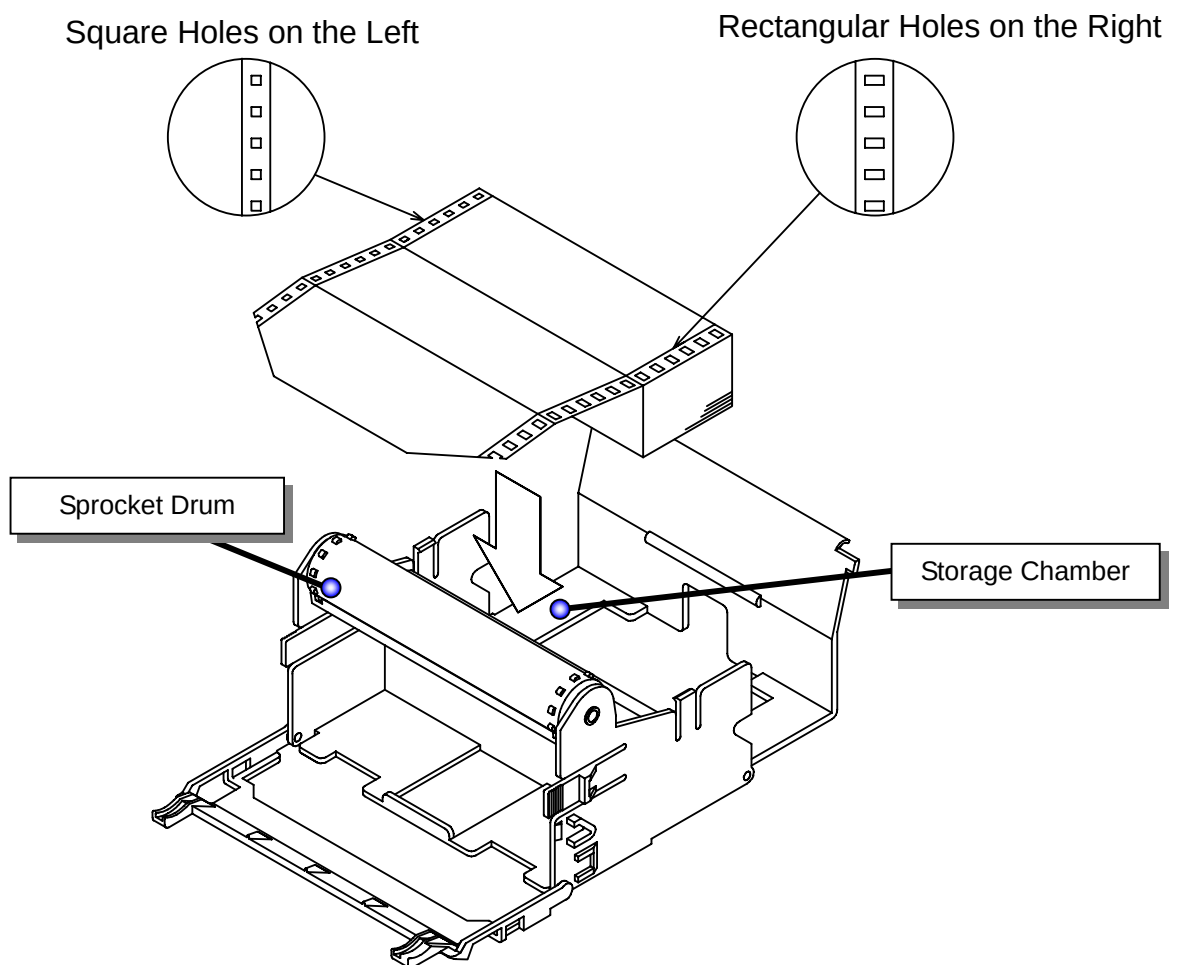


Fig. 5.1-6 Setting the Chart Paper

(7) Align the Chart Paper with the Sprocket Drum

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

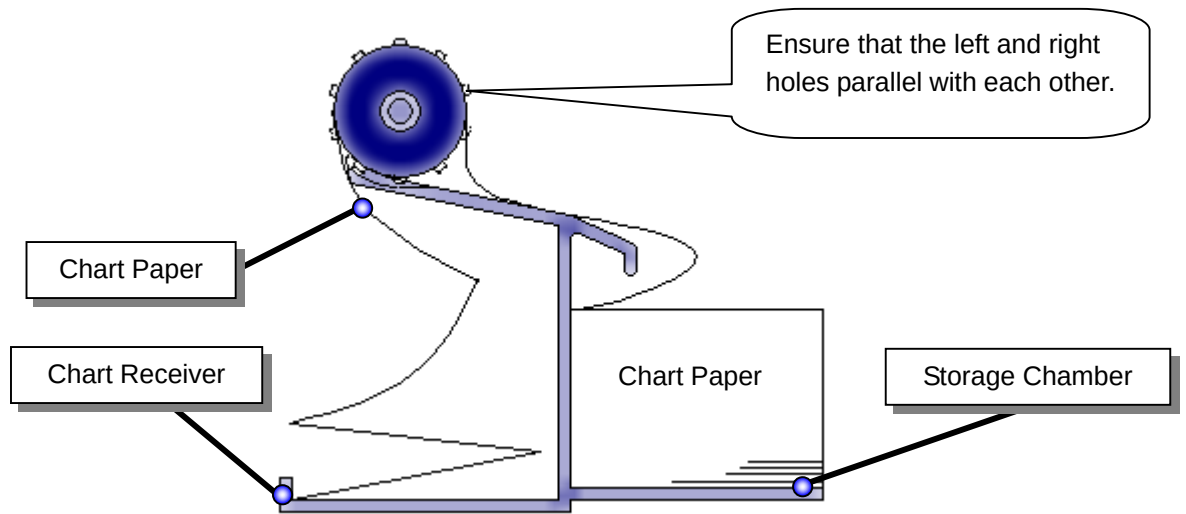


Fig. 5.1-7 Aligning the Chart Paper with Sprocket Drum (Chart Holder Sectional View)

(8) Close the Chart Cover and Chart Guide

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

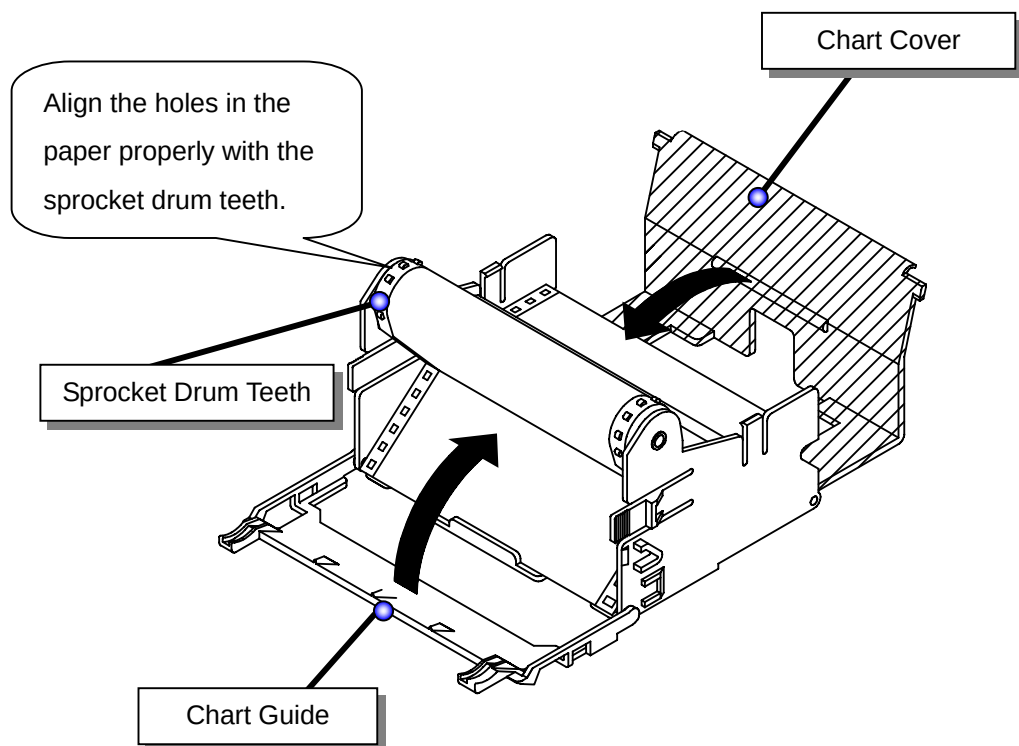


Fig. 5.1-8 Closing the Chart Cover and Chart Guide

(9) Turn the Sprocket Drum Gear

Check paper feed using your hand. Turn the sprocket drum gear to feed out the chart paper.
(4 sections of chart paper should be fed out.)

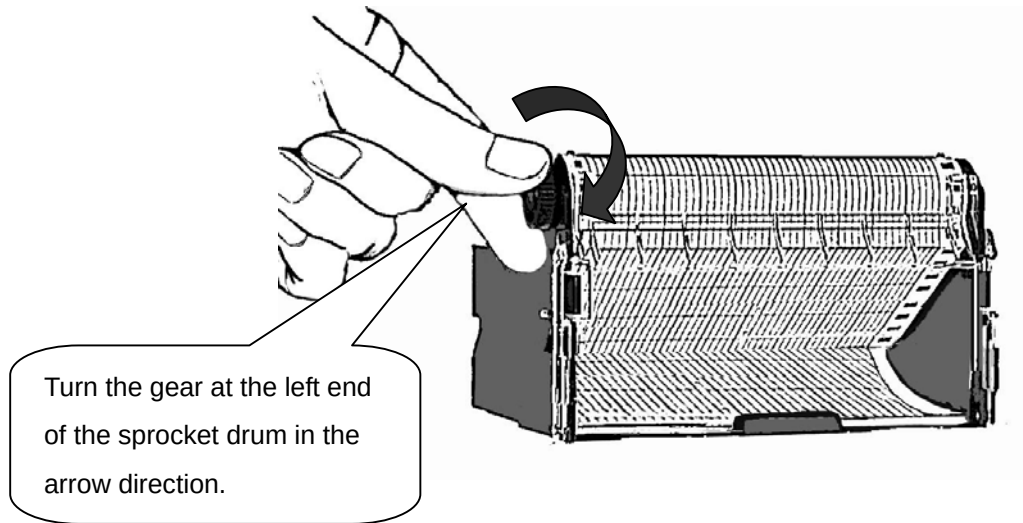


Fig. 5.1-9 Checking Paper Feed

(10) Put the Chart Paper Holder back

Insert the chart holder horizontally into the case until it is locked.

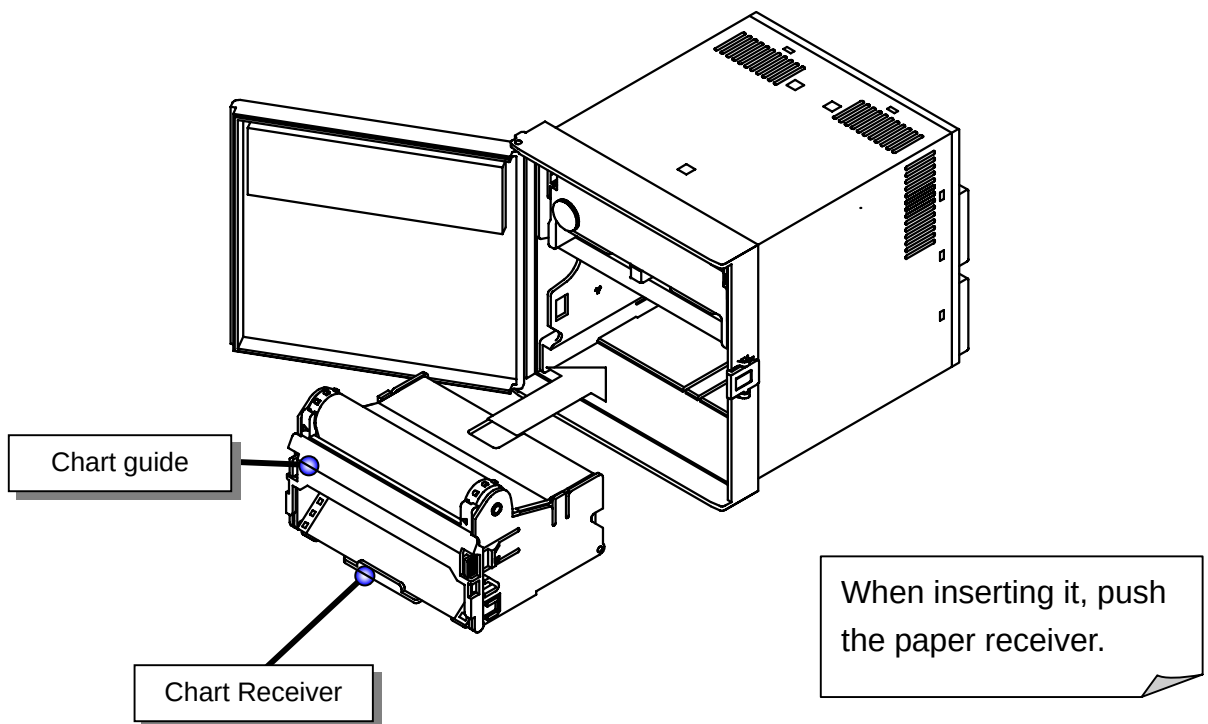


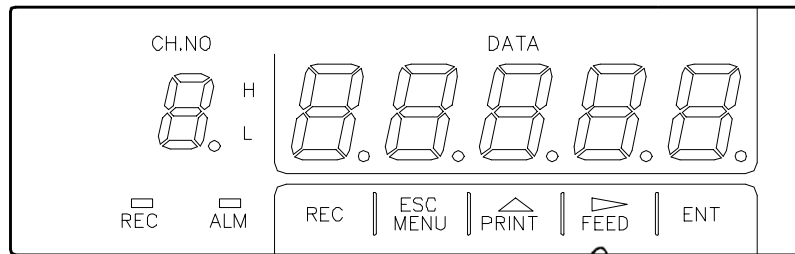
Fig. 5.1-10 Putting Back the Chart Holder

(11) Close the Door

Close the door and check a door lock.

(12) Press the “FEED” key to check Paper Feed

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



The chart paper is fed while pressing the key. Releasing the key stops paper feed. The paper begins a slow feed when the key is pressed.

Prior to the operation of the instrument, be sure to confirm that the chart paper is being fed!!

Fig. 5.1-11 Pressing the “FEED” key

(13) Press the “REC” Key to restart Operation

5.2 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 “REC” key to stop recording. If the ribbon cassette is not set properly, the recording color may change or the ribbon may be damaged.

- (1) Press the “REC” key for 3 seconds or longer

Recording stops. With the power turned on, press the “REC” key for 3 seconds or longer.

Once recording stops, the REC lamp goes off.(See Fig. 5.1-1 on page 23.)

- (2) Open the Door

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

(See Fig.5.1-2 on page 23.)



CAUTION

Maximum angle of the fully opened door is 135 degrees. Do not open the door any further, as the hinge will break.

- (3) Pull out the Ribbon Cassette

Grab the left side of the ribbon cassette. Holding down the ribbon holder, pull out the ribbon cassette toward you.

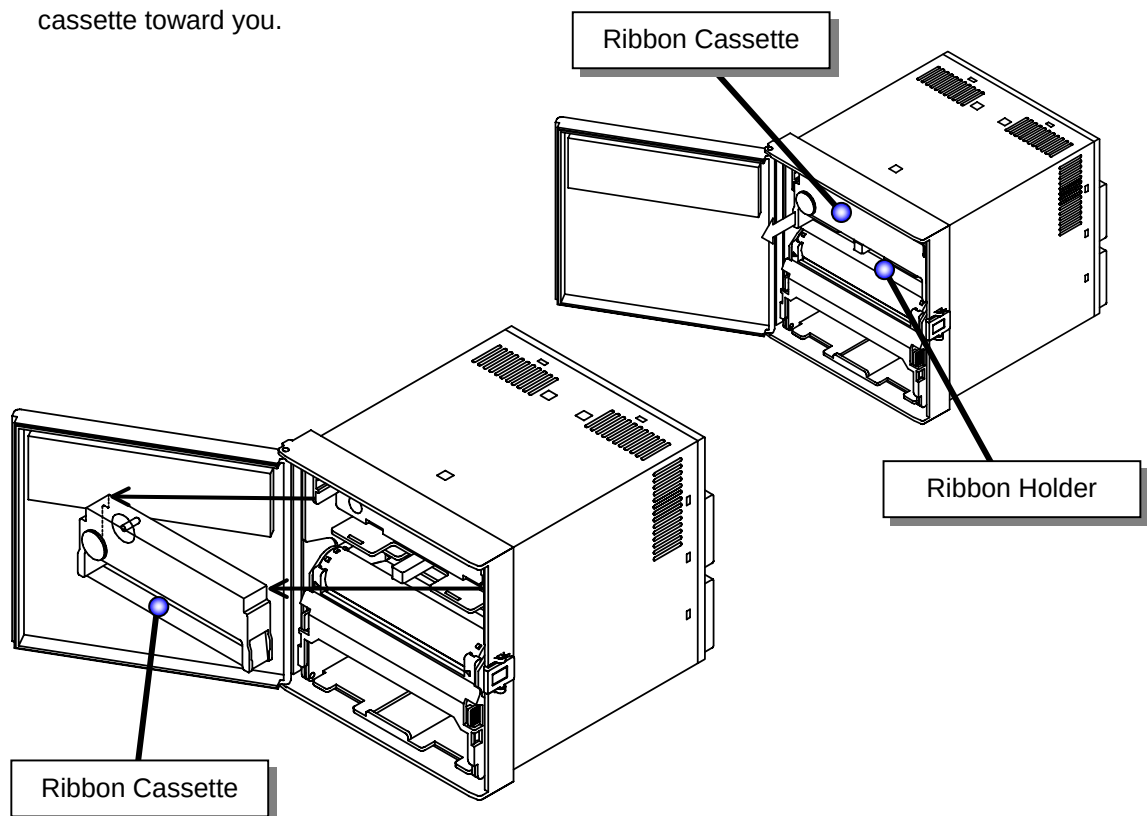


Fig. 5.2-1 Taking Out the Ribbon Cassette

(4) Unslack the Ink Ribbon

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

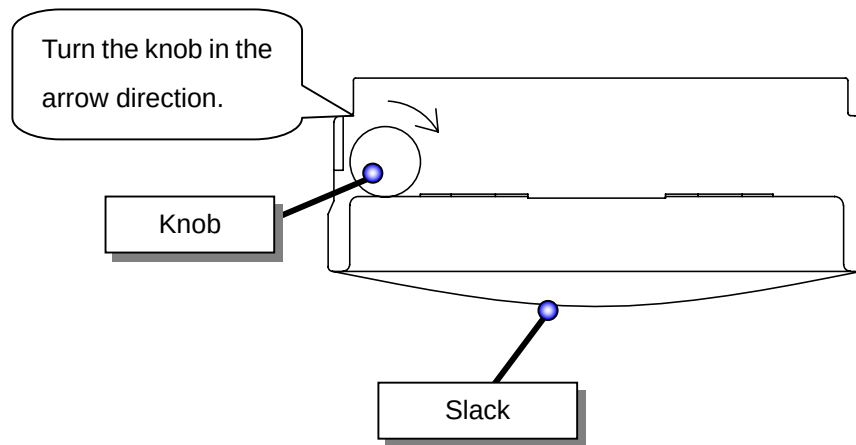


Fig. 5.2-2 Unslacking the Ink Ribbon

(5) Set the Ribbon Cassette

Push the ribbon cassette into the ribbon holder until the latch clicks.

When the ribbon feeding shaft does not easily fit in, turn the gear in the direction of an arrow to adjust the position. When this is done, push the ribbon cassette until the latch clicks.

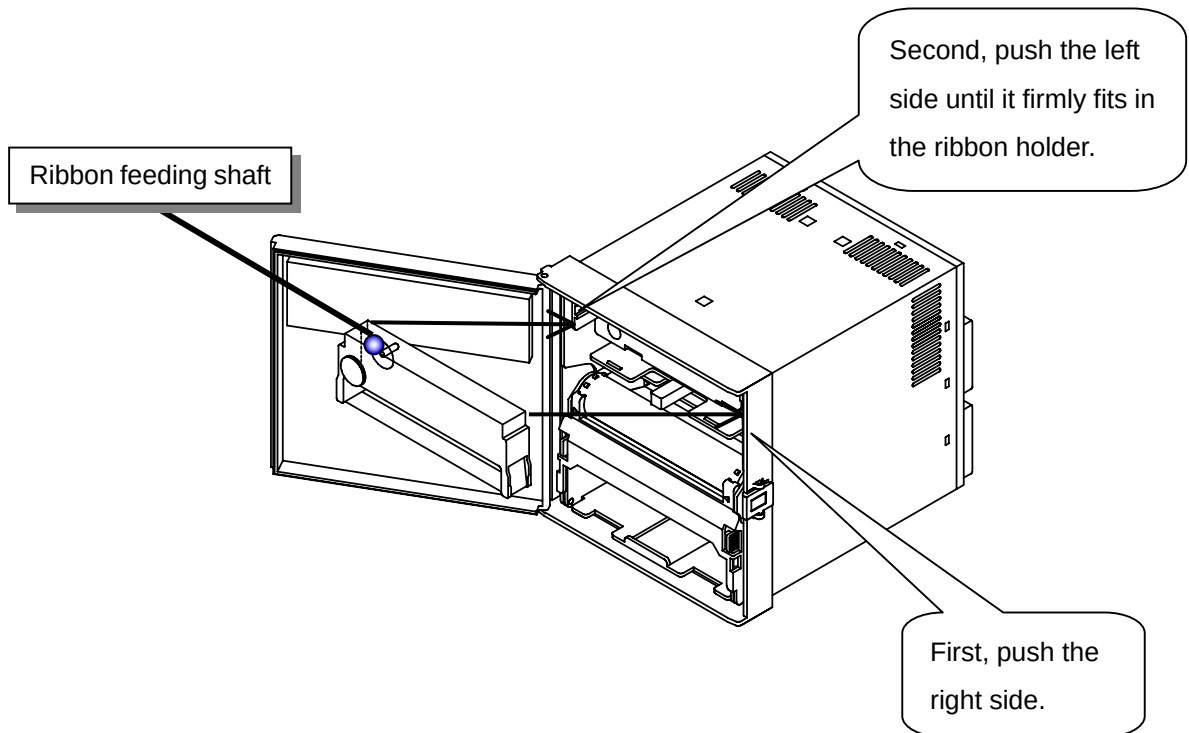


Fig. 5.2-3 Setting the Ribbon Cassette

6.1 Running



WARNING

Prior to switching the power on, make sure that the supply voltage meets the specifications for the instrument, and the instrument is properly grounded.



CAUTION

This recorder has no power switch.

Prior to switching the power on, 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.



WARNING

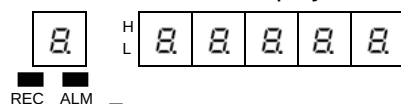
When calibrating data, connect the equipment according to Section 9.5 of the instruction manual. Data calibration must be performed correctly.

Therefore, operators possessing knowledge of electricity and control related matters should perform the calibration after careful reading of Sections 7.2 and 9.5 of the instruction manual. (Shinko Technos Co., Ltd. is not liable for damages incurred if calibration is performed other than prescribed in the instruction manual.)

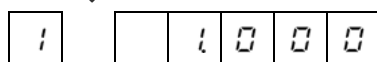
Once the power is turned on, the display on the front of the door lights. The instrument will be ready to run (user mode) in about 5 seconds, including the initial screen. If the REC lamp is unlit, press the "REC" key to start recording operation.

6.1.1 Status after Initial Screen

- (1) Display screen : The "REC" lamp keeps the status 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 output information are not recoverable after the power has been switched off.
- (4) Data and Channel number are displayed as the following Fig. 6.1.1.



REC ALM



Returns to the mode before power-OFF.

Fig. 6.1.1 Screen at Power-on

[Note]

- (1) If electric power failed, the initialization is performed after power recovery. And the recorder reverts to the initial status above.
- (2) The printout data is eliminated in initialization. Printout operation does not continue 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.6.1.1. The number of indicated digits differs depending on the setting.

6.2 Recording



CAUTION

- (1) The instrument checks zero point for every recording. If the printer block is manually moved during recording, the recording position may be dislocated.
- (2) In order to protect the chart paper, dot printing is not performed when the distance between the previous dot printing position and the current one for an identical channel is less than 0.3mm in the chart paper feed direction or less than 0.5mm in the scale direction.

6.2.1 Recording Colors

Table 6.2.1 lists the recording colors for each channel in analog recording.

The recording color can be selected from 6 colors for every channel.

Table 6.2.1 Recording Colors (standard)

Channel No.	Color
1	Purple
2	Red
3	Green
4	Blue
5	Brown
6	Black

6.3 How to Record

6.3.1 Starting/Stopping Recording

To start/stop recording, press the “REC” key.

To stop, press the “REC” key for 3 seconds or longer.

“REC” lamp is unlit when recording stops.

[Note]

- (1) When the power is turned on, the recorder continues from the state in which it was turned off.
- (2) When controlling a start/stop of recording through Digital Input DI function (option: RE6), start/stop cannot be switched by the “REC” key.

6.3.2 Feeding 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 and Alarm on print example

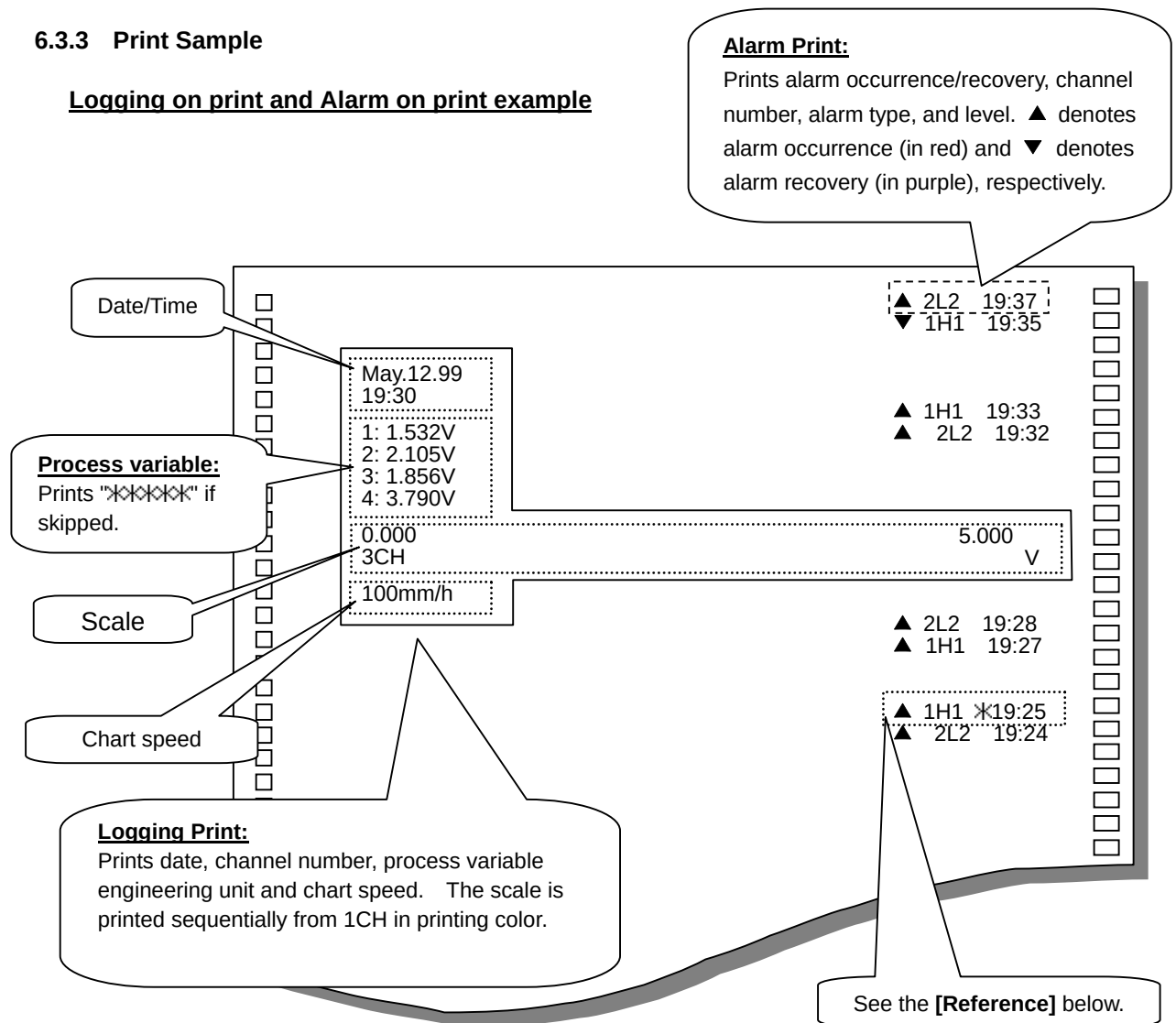


Fig. 6.3.3 Print Sample

[Reference]

When other printing is active with current job, Alarm print, Comment print and Date-and-Time print will queue.

HR-706 stores up to six items of Alarm Occurrence/Recovery print and up to five items of Comment/Date-and-Time print. If printing commands exceed those numbers, HR-706 prints "*" on the last printing.

This mark means that the item with a "*" mark and following items could not be printed. For priority of respective printings, see "Priority" in Reference on the next page.

[Note]

Logging print will not be in the printing queue. At the start time as Logging print, if prior Logging print is printing, the next log will not print. In this case, to prolong the printing interval of the Logging print is recommended.

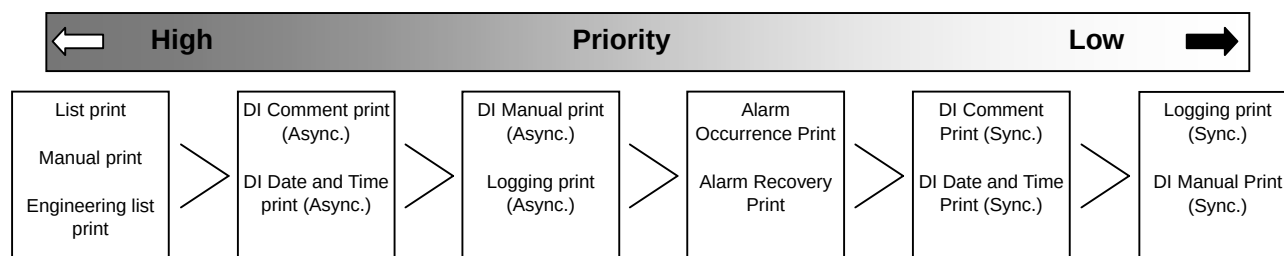
6.4 Digital Print

Digital prints listed below are performed by key operation.

- Manual print
- List print
- Engineering list print

[Reference]

Printing is activated in the following priority order. When multiple types of printing are activated simultaneously, higher-priority printing takes effect first by following the priority order. However, while alarm printing is performed, lower category (Logging, DI Manual) is activated at the same time. (See Fig. 6.3.3. Alarm Time printing and Logging print are performed at the same time).



The Synchronous printout synchronizes with the analog recording, and executes digital printout. In the case of asynchronous printout, an analog recording stops and a digital printout is executed. After the digital printout is completed, the analog recording resumes.

6.4.1 Manual Print

Prints the following data on the chart paper:

- Time/date (year, month, day)
- Channel number/Tag setting character
- Activated alarm type/latest process variable/engineering unit (all channels)

(1) Manual print operating procedure

- 1) Press the "PRINT" key.
- 2) Use the "PRINT" key to display "nAn", and press the "ENT" key.
- 3) Use the "PRINT" key to select "Set A-R-t". Pressing the "ENT" key executes manual print.

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

When manual print is finished, the display returns to the status prior to starting manual print.

[Note]

- (1) Analog recording is interrupted while manual print is running. However, measurement/alarm detection remains effective.
- (2) If an alarm is activated while manual print is running, alarm print starts from the time when manual print finished.

(2) Manual print stopping procedure

- 1) Press the "PRINT" key.
- 2) Use the "PRINT" key to display "MAN", and press the "ENT" key.
- 3) Use the "PRINT" key to select "STOP". Pressing the "ENT" key stops manual print.

However, printing will continue until the line is completely printed. Then manual print will stop, and the display will return to the status prior to starting manual print.

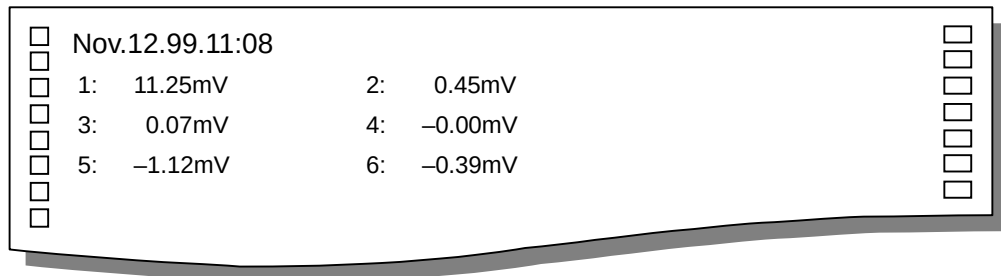


Fig. 6.4.1 Manual Print

6.4.2 List Print

Prints the following setting data of the instrument on the chart paper:

- Date/time/Chart feed speed/2nd chart feed speed/Printing cycle.
- Channel number/range/scaling value/engineering unit
- Setting alarm type

(1) List print operating procedure

- 1) Press the "PRINT" key.
- 2) Use the "PRINT" key to display "LIST", and press the "ENT" key.
- 3) Use the "PRINT" key to select "Start". Pressing the "ENT" key executes the list print.

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

Upon termination of the list print, the display returns to the status prior to starting list print.

[Note]

- (1) Analog recording is interrupted while list print is running. However, measurement/alarm detection remains effective.
- (2) If an alarm is activated while list print is running, alarm print starts when recording restarts.

(2) List print stopping procedure

- 1) Press the "PRINT" key.
- 2) Use the "PRINT" key to display "*LI St*", and press the "ENT" key.
- 3) Use the "PRINT" key to select "*Stop*". Pressing the "ENT" key stops list print.

However, printing continues until the line is completely printed. Then list print is stopped, and the display returns to the status prior to starting list print.

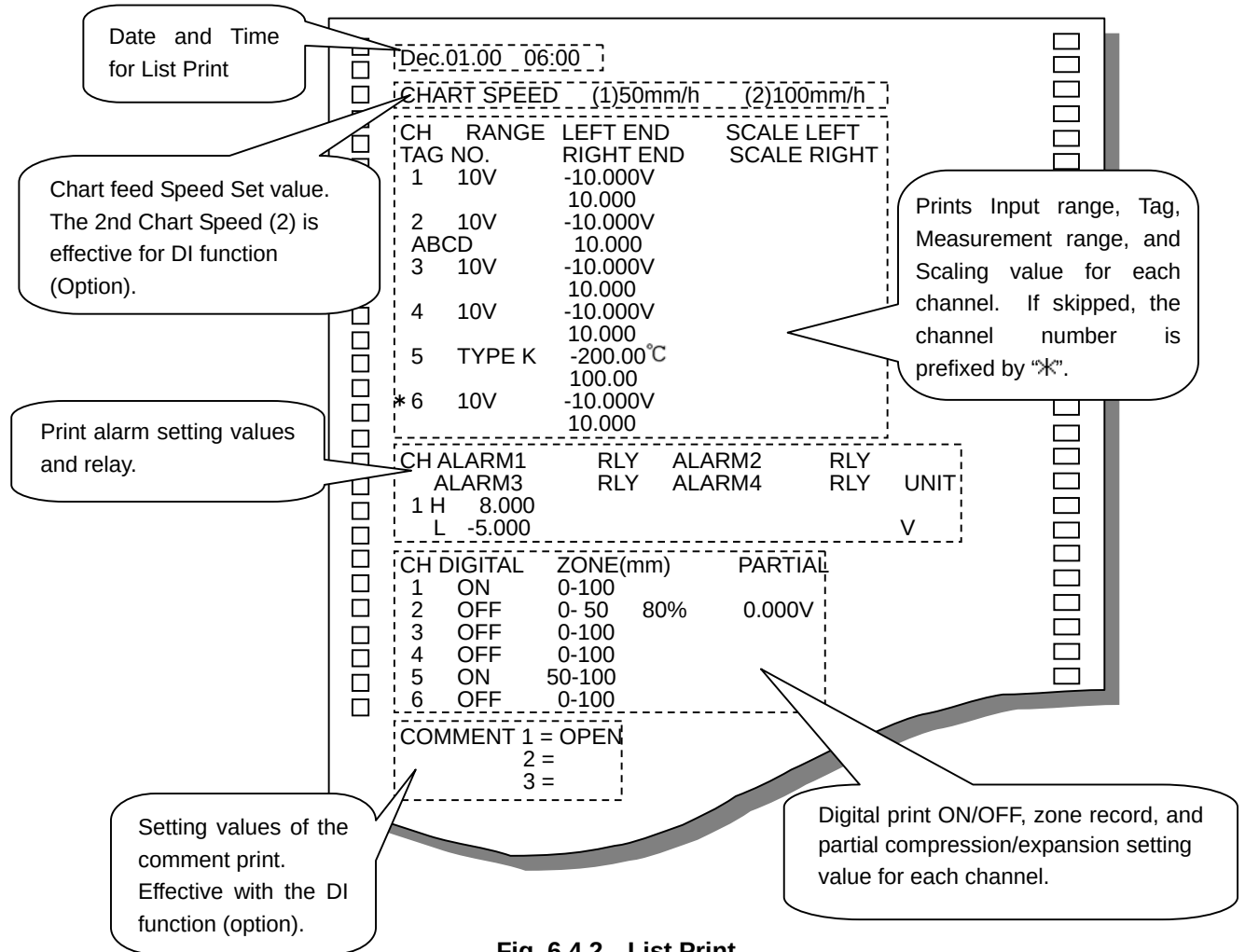


Fig. 6.4.2 List Print

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

- 1) Press the “MENU” key.
- 2) Use the “PRINT” key to display “*ELI St*”, and press the “ENT” key.
- 3) Use the “PRINT” key to select “*St Rr-t*”. Pressing the “ENT” key executes engineering list print.

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

Upon termination of the engineering list print, the display returns to the status prior to starting engineering list print.

[Note]

(1) Analog recording is interrupted while engineering list print is running.

However, measurement/alarm detection remains effective.

(2) If an alarm is activated while engineering list print is running, alarm print is performed when recording restarts.

(2) Engineering list print stopping procedure

- 1) Press the "MENU" key.
- 2) Use the "PRINT" key to display "*ELI St*", and press the "ENT" key.
- 3) Use the "PRINT" key to select "*St oP*". Pressing the "ENT" key stops engineering list print.

However, the printing continues until the line is completely printed.

Then Engineering list print stops. And the display returns to the status prior to starting engineering list print.

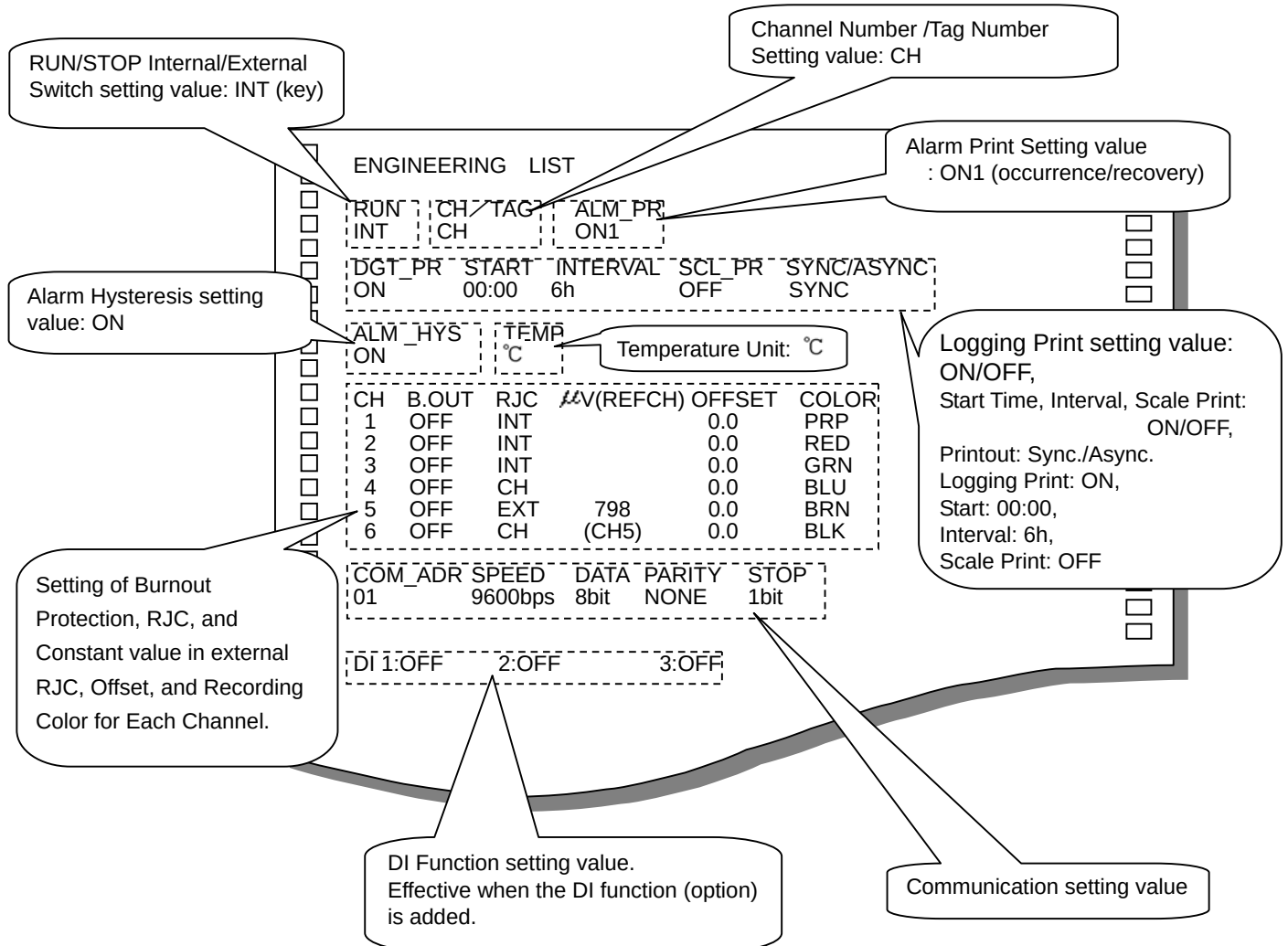


Fig. 6.4.3 Engineering List Print

6.5 Changing the Display

Display selection procedure

- (1) Press the "MENU" key to display "*di SP*", and press the "ENT" key.
- (2) Use the "PRINT" key to select a required screen from the menu below.

Press the "ENT" key.

- (3) "*CH*" is displayed in the 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

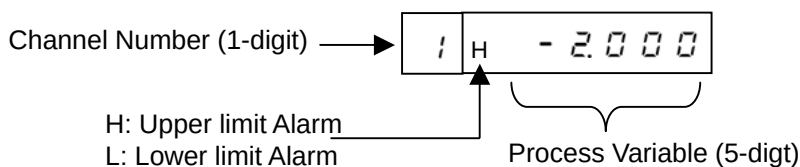
"*DATE*"(DATE) : Date display

"*TIME*"(TIME) : Time display

"*OFF*"(OFF) : Display off

6.5.1 *AUTO* <Auto Display>

Displays the process variable of each channel sequentially at intervals of 2.5 seconds.



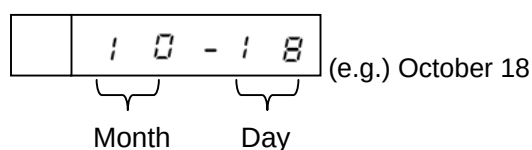
6.5.2 *MAN* <Manual Display>

Displays the process variable of the specific channel, and updates it every measurement cycle.

The data is the same as that of Auto display. Pressing the "ENT" key changes the displayed channel number (it increments).

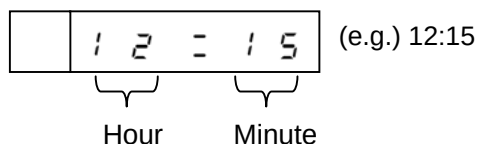
6.5.3 *DATE* <Date Display>

Displays the month and day. Leap year is adjusted automatically.



6.5.4 *TIME* <Time Display>

Displays the hour and minute.



6.5.5 *OFF* <Display Off>

Turns off the process variable display. Key operation is the same as usual.

To switch to other displays, repeat steps (1) through (3) mentioned above.

7. DEVICE SETTING

7.1 Setting the Setup Mode



WARNING

When calibrating data, connect equipment according to Section 9.5 of the instruction manual.

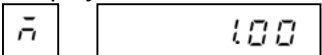
Data calibration must be performed correctly.

Therefore, operators possessing knowledge of electricity and control related matters should perform the calibration after careful reading of Sections 7.2 and 9.5 of the instruction manual. (Shinko Technos Co., Ltd. is not liable for damages incurred if calibration is performed other than prescribed in the instruction manual.)

Key Operation for Entering the Setup Mode

Press the “MENU” key for 3 seconds or longer to enter the setup mode.

The software version is displayed approximately 1 second as below. After that, the setting screen of the range is displayed.



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

The following describes how to set the following items.

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

● 7.1.1 Setting the Range

Setting	Channel	Mode	
rANGE	Ch1	Volte	Current/ Voltage input
	.	tC	Thermocouple input
	.	rtD	Resistance temperature detector input
	.	SCALE	Scaling
	.	SqrT	Square Root
	.	dECAd	Decade
	.	dELt	Difference
	.	SiGn	Sum
	.	nEAr	Average
	Ch6	SKI P	Skip

● 7.1.2 Setting the Alarm

Setting	Channel	Level	ON/OFF	Type	Setting value	Option	
						Relay ON/OFF	Relay No.
ALARm	Ch1	L1	on	H	-2000	on	1
	.	L2	oFF	L		oFF	.
	.	L3					.
	.	L4					.
	Ch6						6

● 7.1.3 Setting the Unit

Setting	Channel	Char. No.	Code No.	
Unit	Ch1	1	Cd 6F	(°)
	.	2	Cd 43	(C)
	.	3	Cd 00	End
	.	4		
	Ch6	5		
		6		

● 7.1.4 Setting the Chart feed 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	MO 1-01	606:00

● 7.1.6 Copying the Setting Data

Setting	Channel to copy from	Channel to copy to
Copy	F Ch1	t Ch2
	F Ch2	t Ch3
	.	.
	.	.
	F Ch5	t Ch6

● 7.1.7 Setting Other Functions (Printing Cycle, Zone Recording, Partial Compression/Expansion, Digital Print, Tag, Comment Words)

Setting	Mode
Func	trEnd Zone Part Print TAG Cant
	Printing Cycle Zone Recording Partial Compression/Expansion Digital Print Tag Comment Words

● Shift to the engineering mode

Setting	Password
Eng	P 0000

Input the password to enter the engineering mode.
See the key operation on page 67.

Table 7.1 Default value of the setup mode

Setting items	Default value	Remarks
Range (all channels)	±10mV Scaling 0 to 100.0 (°C)	
Alarm (all channels)	All levels are alarm OFF, relay OFF	
Engineering unit (all channels)	°C (BF 43 00)	
Chart feed speed	(1) 20mm/h (2) 20mm/h	
Time	2000/01/01, 00:00	The present time has been set. (Japan standard time) GMT + 09:00
Dot point interval	10 (s)	
Zone setting (all channels)	0 to 100 (%)	
Partial compression/expansion (all channels)	OFF	
Digital print (all channels)	ON	
Tag print character (all channels)	"Blank up to the 7th character"	
Comment print word (1 to 3)	"Blank up to the 16th character"	

7.1.1 Setting the Range

(1) Setting method

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

Use the Δ key to shift the mode ① to ③ shown in the Table below.

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

DC voltage	: $\pm 10, 0$ to $20, 0$ to $50, \pm 200$ mV DC, $\pm 1, 0$ to $5, \pm 10$ 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, PL-II, U, L
RTD	: Pt100, JPt100

Sets 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	① <i>volt</i> (Voltage, Current)	Δ key
		② <i>tC</i> (Thermocouple)	
		③ <i>rtd</i> (Resistance temperature detector)	
	Ch 2	④ <i>SCALE</i> (Scaling)	
	Ch 3	⑤ <i>Sqr</i> (Square root)	
	Ch 4	⑥ <i>decad</i> (Decade)	
	Ch 5	⑦ <i>diff</i> (Difference)	
	Ch 6	⑧ <i>sum</i> (Sum)	
	Setting for all channels	⑨ <i>ave</i> (Average)	
		⑩ <i>skip</i> (Skip)	

[Note]

A decimal point arbitrary position can be set only in the "scaling" and "square root" modes. When altering the decimal point position in Voltage/Current/Thermocouple/RTD input, set it in the "scaling" mode. To fix the decimal point position, set it as follows.

Input	Decimal point place	Input	Decimal point place
mV	2nd place * * *.00	Thermocouple	1st place * * * *.0
$\pm 1, 0$ to $5V$	3rd place * *.000	RTD	1st place * * * *.0
$\pm 10V$	2nd place * * *.00	$\pm 200mV$ DC	1st place * * * *.0
mA	2nd place * * *.00		

(2) *Volts* (Current/Voltage), *tC* (Thermocouple), *rtD* (Resistance Temperature Detector)

[Note]: When changing a decimal point position, change it during (3) Scaling (pages 46, 47)

Measures Current, Voltage, Thermocouple and RTD.

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

Display	Operation keys	Description
	ESC MENU 3sec ENT	Press the "MENU" key for 3 seconds or longer to enter the setup mode. Displays " <i>rANGE</i> ", then, press the "ENT" key.
	△ PRINT ENT	Use the △ key to select the desired channel. Press the "ENT" key.
	△ PRINT ENT	Use the △ key to select the mode. Press the "ENT" key.
	△ PRINT ENT	Use the △ key to select the type. Press the "ENT" key.
 (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.
 (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.
	ENT	Press the "ENT" key. Setting is completed. To return to the user mode, press the "MENU" key for 3 seconds or longer.

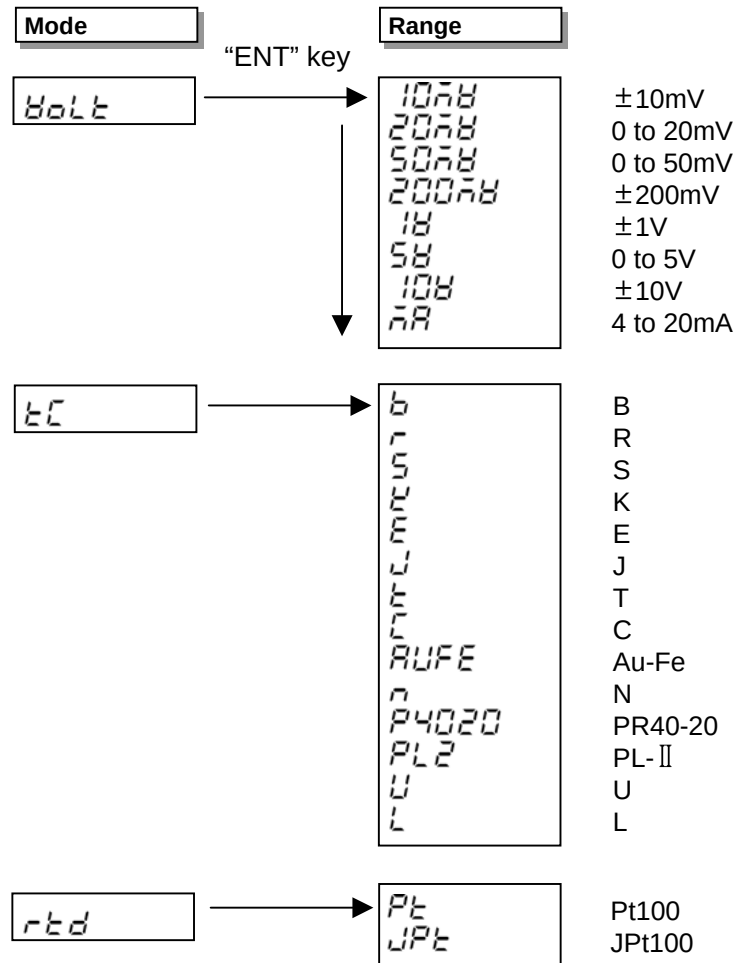
[Note]

- When an incorrect numeral is entered, or is displayed.
Press the "ENT" key and re-enter a correct numeral.
- Perform range settings which do not need the scaling at this step (2) *Volts*, *tC*, *rtD* (Especially the range setting of thermocouple and RTD for which decimal point position change is not necessary). (One digit after the decimal point is standard.)
Do not perform scaling here.

[Note]

In the *volt*, *tc*, or *rtd* mode, press the “ENT” key to select the range.

Use the Δ key to select a range type.

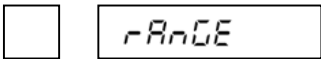
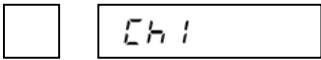
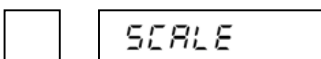
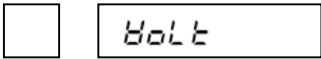
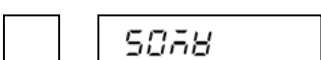
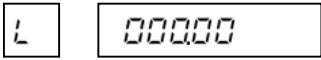


(3) *SCALE* (Scaling)

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

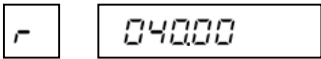
Setting the unit is possible. (See 7.1.3 on page 56)

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
	 3sec  	Press the "MENU" key for 3 seconds or longer to enter the setup mode. Use the  key to display "rANGE". Press the "ENT" key.
	  	Use the  key to select the desired channel. Press the "ENT" key.
	  	Use the  key to select "SCALE". Press the "ENT" key.
	  	Use the  key to select "Volt". Press the "ENT" key. If <i>tC</i> or <i>rtD</i> is selected here, temperature input scaling is possible.
	  	Use the  key to select a range (50mV). Press the "ENT" key.
 (Zero input value)	   	Use the  key to select a numeral. Use the  key to shift a digit. Press the "ENT" key.

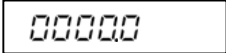
[Note]

In the case of TC and RTD inputs, set the Zero input value equal to the Zero-side scale value.
See *1 on the next page.

 (Span input value)	   	Use the  key to select a numeral. Use the  key to shift a digit. Press the "ENT" key.
---	--	--

[Note]

In the case TC and RTD inputs, set the Span input value equal to the Span-side scale value.
See *2 on the next page.

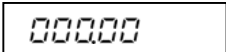





 (Zero-side scale value) (*1)

Use the  key to select a numeral.

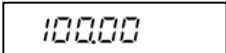
Use the  key to shift a digit.



 (Decimal point)
 

Press the  key again in the lowest digit (right end) to flash a decimal point. Use the  key to select a decimal point position. Press the “ENT” key.

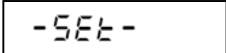





 (Span-side scale value) (*2)
 

Use the  key to select a numeral.

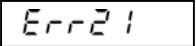
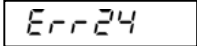
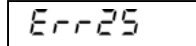
Use the  key to shift a digit. Press the “ENT” key.


Press the “ENT” key. Setting is completed.

To return to the user mode, press the “MENU” key for 3 seconds or longer.

[Note]

When an incorrect numeral is entered,  ,   or   is displayed.

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

(4) *Sqr* (Square Root)

Calculates the square root of Volt input, and scales the value.

The unit can be set. (See 7.1.3 on page 56.)

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

Display	Operation keys	Description
	3sec 	Press the "MENU" key for 3 seconds or longer to enter the setup mode. Use the key to display "rANGE". Press the "ENT" key.
		Use the key to select the desired channel. Press the "ENT" key.
		Use the key to select "Sqr". Press the "ENT" key.
		Use the key to select a range (50mV). Press the "ENT" key.
 (Zero input value)		Use the key to select a numeral. Use the key to shift a digit. Press the "ENT" key.
 (Span input value)		Use the key to select a numeral. Use the key to shift a digit. Press the "ENT" key.
 (Zero-side scale value)		Use the key to select a numeral. Use the key to shift a digit.
 (Decimal point)		Press the key again at the lowest digit (right end) to flash a decimal point. Use the key to select a decimal point position. Press the "ENT" key.
 (Span-side scale value)		Use the key to select a numeral. Use the key to shift a digit. Press the "ENT" key.
		Press the "ENT" key. Setting is completed. To return to the user mode, press the "MENU" key for 3 seconds or longer.

[Note]

If an incorrect numeral is entered, , or is displayed.
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 setting on the previous page is performed, the display is shown as below.

Input voltage (mV)	0	10	20	30	40
Display (%)	0.00	50.00	70.71	86.63	100.00

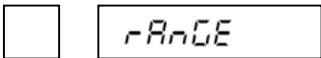
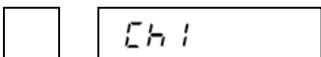
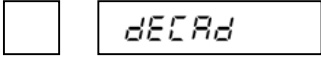
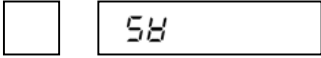
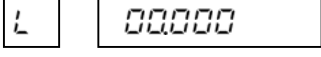
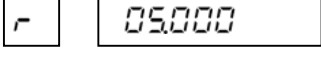
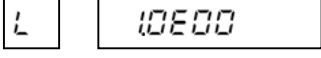
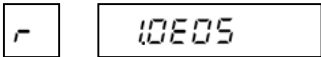
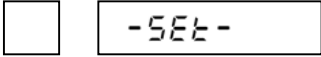
[Note]

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

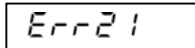
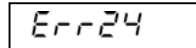
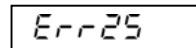
(5) *decAd* (Decade)

Scaling the VOLT input and displays the index number. Setting the unit is possible. (See 7.1.3 on page 56)

Example) When setting the voltage of 0 to 5V and decade of 1.0×10^0 to 1.0×10^5 for Channel 1.

Display	Operation keys	Description
	 3sec  	Press the "MENU" key for 3 seconds or longer to enter the setup mode. Use the  key to display "rAnGE". Press the "ENT" key.
	  	Use the  key to select the desired channel. Press the "ENT" key.
	  	Use the  key to select "decAd". Press the "ENT" key.
	  	Use the  key to select a range (5V). Press the "ENT" key.
 (Zero input value)	   	Use the  key to select a numeral. Use the  key to shift a digit. Press the "ENT" key.
 (Span input value)	   	Use the  key to select a numeral. Use the  key to shift a digit. Press the "ENT" key.
 (Zero-side scale value)	   	Use the  key to select a numeral. Use the  key to shift a digit. Press the "ENT" key.
 (Span-side scale value)	   	Use the  key to select a numeral. Use the  key to shift a digit. Press the "ENT" key.
		Press the "ENT" key. Setting is completed. To return to the user mode, press the "MENU" key for 3 seconds or longer.

[Note]

When an incorrect numeral is entered,   ,  
or   is displayed.

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)

IN : Input voltage

OUT : Output (Scaling value)

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.

- Decade display adheres to 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 : Log₁₀(SCAL_L)

LGSCAL_R : Log₁₀(SCAL_R)

[Note]

Decade output is used for display and print. It is not reflected in a printing position.

Example) When setting on the previous page is performed, the display is shown as below.

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) *delE* (Difference), *SiCn* (Sum), *AEAn* (Average)

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

Example) Subtracting Ch1 input data from Ch6 input data to set the difference value to Ch6.

(0 to 40mV). "Ch6 (input) - Ch1 (input)" is recorded and displayed on Ch6.

Display	Operation keys	Description
	3sec 	Press the "MENU" key for 3 seconds or longer to enter the setup mode. Use the key to display "RANGE". Press the "ENT" key.
 (Setting channel)		Use the key to select the desired channel. Press the "ENT" key.
		Use the key to select "delE". Press the "ENT" key.
 (Reference channel)		Use the key to select the desired channel subtract." Press the "ENT" key.
 (Zero input value after difference operation)		Use the key to select a numeral. Use the key to shift a digit. Press the "ENT" key.
 (Span input value after difference operation)		Use the key to select a numeral. Use the key to shift a digit. Press the "ENT" key.
		Press the "ENT" key. Setting is completed. To return to the user mode, press the "MENU" key for 3 seconds or longer.

[Note]

If an incorrect numeral is entered,

or is displayed.

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 which computes the "difference, sum or average" value.
(e.g.) When setting to Ch6, a value of from Ch1 to Ch5 can be subtracted from Ch6.
- The range and scale of the setting channel is the same as those of the reference channel which computes the "difference, sum or average" value.
- The range value after computation cannot exceed the maximum range of the instrument.
- For the reference channel, only the voltage, current, thermocouple, RTD, and their scaling ranges can be set.

(7) SKIP (Skip)

Set SKIP to the channel for which display and recording are not required.

Example) When skipping Channel 6.

Display	Operation keys	Description
—Range	ESC MENU 3sec △ PRINT ENT	Press the “MENU” key for 3 seconds or longer to enter the setup mode. Use the △ key to display “—Range”. Press the “ENT” key.
Ch6	△ PRINT ENT	Use the △ key to select the desired channel. Press the “ENT” key.
SKIP	△ PRINT ENT	Use the △ key to select “SKIP”. Press the “ENT” key.
-Set-	ENT	Press the “ENT” key. Setting is completed. To return to the user mode, press the “MENU” key for 3 seconds or longer.

[Note]

If all channels are set to Skip,

E

Err28

 is displayed.
At least, one channel should be set to Measurement.

About Skip

Measurement can be conducted on a skipped channel, however, display, print or alarm assessment cannot be performed.

If input is not connected, be sure to short-circuit the measurement terminal.

7.1.2 Setting the Alarm

Setting items

The following 2 alarm types can be set to each channel.

Up to 4 alarm points (4 levels) can be set per channel.

Once alarm point is set, the "ALM" lights when PV (process variable) reaches alarm point, and simultaneously, the alarm is printed on the chart paper, indicating an alarm occurrence.

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

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

Operation

Setting	Channel	Level	ON/OFF	Type	Setting value	Option	
						Relay ON/OFF	Relay No.
ALARM	Ch1	L1	on	H	-2.000	on	1
	.	L2	off	L		off	.
	.	L3					.
	.	L4					.
	Ch6						6

Example) When setting Channel 1 alarm point (Level 1) to the following:

Upper limit alarm, set value of -2.000, Alarm output relay No. 1

Display	Operation keys	Description
 ALARM	 3sec	Press the "MENU" key for 3 seconds or longer to enter the setup mode. Use the  key to display "ALARM". Press the "ENT" key.
 Ch1	  	Use the  key to select the desired channel. Press the "ENT" key.
 L1	  	Use the  key to select an alarm level. Press the "ENT" key. Up to 4 levels can be set.
 on	  	Use the  key to select alarm setting ON. Press the "ENT" key. Setting to "off" displays "ALARM" and completes setting.
 H	  	Use the  key to select an alarm type. Press the "ENT" key.
 -2.000	   	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 during the alarm point setting process, display will switch to the next setting display.

Setting hereinafter is valid only for the model to which an alarm output (option: LH6) has been added.
 If the option has not been added, press the “ENT” key until “-SEt-” is displayed.
 Then, press the “ENT” key again. Setting is completed.

Display	Operation keys	Description
/ on	△ PRINT ENT	When an alarm occurs, the alarm output is issued 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.
/ /	△ PRINT ENT	If the alarm output is set to ON, set the relay number. Use the △ key to select a relay number out of 1 to 6, and press the “ENT” key.
-SEt-	ENT	Press the “ENT” key. Setting is completed. To continue to set other channels, press the △ key to select a channel, and start setting. To return to the user mode, press the “MENU” key for 3 seconds or longer.

[Note]
 With Alarm print setting, the channel number is printed even if the tag print has been set.

7.1.3 Setting the Unit

Setting Items

Sets the temperature unit for each channel.

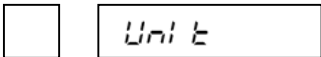
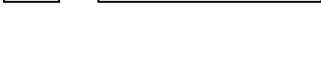
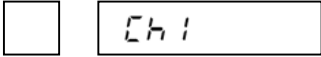
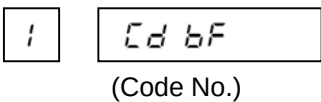
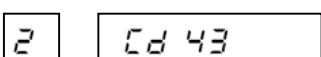
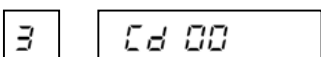
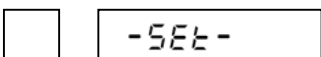
[Note]

To change the unit in the range of *bol*, *tc* or *red*, set the range to *SCALE*.

Operation

Setting	Channel	Char. No.	Code No.
Unit	Ch1	1	Cd bF (°)
	.	2	Cd 43 (C)
	.	3	Cd 00 End
	Ch6	4	
		5	
		6	

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

Display	Operation keys	Description
	 3sec	Press the "MENU" key for 3 seconds or longer to enter the setup mode. Use the  key to display "Unit".
	 	Then, press the "ENT" key.
	 	Use the  key to select the desired channel. Then, press the "ENT" key.
	  	Use the  or  key to select the 1st character of the code number, and press the "ENT" key.
		See Character code table on the next page.
	  	Set the 2nd character in the same manner.
	  	When the number of unit characters is less than 6, enter the code (00) to finish. Press the "ENT" key.
		Press the "ENT" key. Setting is completed.
		To return to the user mode, press the "MENU" key for 3 seconds or longer.

[Note]

The unit setting is effective only when the range setting is *SCALE*, *99rt*, *decad*, *del*, *Si Gā* and *REARn* (including the range setting of *del*, *Si Gā* and *REARn* only when *SCALE* is selected as a range setting of the reference channel).

For other range settings, the unit is automatically determined according to the range.

(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	△	Υ	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	
✖ F	/	?	O	—	o		◦	◦	O	▲	o	

Setting example) The code number for "C" is "43".

7.1.4 Setting the Chart feed speed

Setting Items

Sets the chart feed speed. Select it from the table below.

Table 7.1.4 Chart Speed (Unit: mm/h)

0	1	2	3	4	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						

Operation

Setting	1st/2nd Chart feed speed	Chart feed speed
CHART	SPd-1	1500
	SPd-2	

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

Display	Operation keys	Description
	ESC MENU 3sec △ PRINT ENT	Press the "MENU" key for 3 seconds or longer to enter the setup mode. Use the △ key to display "CHART", and press the "ENT" key.
	△ PRINT ENT	Use the △ key to select the 1st chart feed speed, and press the "ENT" key.

[Note]

When changing the chart feed speed using the DI function (option: RE6), set the 2nd chart feed speed.

If the DI function (option: RE6) is not added, setting of the 2nd chart feed speed becomes invalid.

Display	Operation keys	Description
	△ PRINT FEED	Use the △ key to set the 1st chart feed speed, and press the "ENT" key.
	ENT	Press the "ENT" key. To return to the user mode, press the "MENU" key for 3 seconds or longer.

[Note]

Restriction of printing
by chart feed 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)	1 to 100 (mm/h)
Logging print (Synchronous)	10 to 100 (mm/h)

When the chart speed is 0mm/h, it's printed with forcible chart feed. (When the chart feed speed is higher than 120mm/h, the table shown above is not printed.) 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) are printed regardless of the chart feed speed.

7.1.5 Setting the Date and Time

Operation

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

Setting	Year	Month, Day	Time
CLOCK	Y 2000	M 01-01	t 06:00

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

Display	Operation keys	Description
	ESC MENU 3sec	Press the "MENU" key for 3 seconds or longer to enter the setup mode. Use the key to display "CLOCK", and press the "ENT" key.
	PRINT ENT 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.
	PRINT FEED ENT	Set the month and day. Operate in the same manner as setting the year.
	PRINT FEED ENT	Set the time (Hour:Minute). Operate in the same manner as setting the year.
	ENT	Press the "ENT" key. To return to the user mode, press the "MENU" key for 3 seconds or longer.

[Note]

If a non-existent date or time is entered, is displayed. 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 any channel to another channel.

The number of the channel to be copied must be bigger than the channel to copy from.

Operation

Setting	Channel to copy from	Channel to copy to
COPY	F CH1	t CH2
	F CH2	t CH3
	⋮	⋮
	F CH5	t CH6
	⋮	⋮

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

Display	Operation keys	Description
COPY	ESC MENU 3sec	Press the "MENU" key for 3 seconds or longer to enter the setup mode.
F CH1	△ PRINT ENT	Use the △ key to display "COPY", and press the "ENT" key.
t CH2	△ PRINT ENT	Use the △ key to select the channel to copy from, and press the "ENT" key.
-Set-	ENT	Use the △ key to select the channel to copy to, and press the "ENT" key.
		Press the "ENT" key. To return to the user mode, press the "MENU" key for 3 seconds or longer.

7.1.7 Setting other functions

Other functions can be set as the following.

Setting Items

(1) *trEnd* (Printing cycle)

Selects a printing cycle from 10, 20, 30, and 60 seconds.

(2) *Zone* (Zone recording)

The data for each channel can be recorded separately in another area so as not to be overlapped.

(3) *Part* (Partial compression/expansion)

Records the measured data of the channel, partially compressed or expanded.

(4) *Print* (Digital print)

Specify ON or OFF whether the measured data for each channel is printed or not.

(5) *Tag* (Tag)

Sets the tag, which is to be printed instead of a channel number, for logging print or manual print.

For tag setting, up to 7 characters can be used (select from character code table on page 57) for each channel.

(6) *Comment* (Comment words)

Sets the comment words to be printed by DI function (Option: RE6).

There are 3 kinds of comment words and setting up to 16 characters (select from Character code table on page 57) for each DI is possible.

Operation

Setting	Mode	
<i>Run</i>	<i>trEnd</i> <i>Zone</i> <i>Part</i> <i>Print</i> <i>Tag</i> <i>Comment</i>	Printing Cycle Zone Recording Partial Compression/Expansion Digital Print Tag Comment Words

(1) *trEnd* (Printing Cycle)

Example) Setting the printing cycle to 60 seconds.

Display	Operation keys	Description
	3sec 	Press the "MENU" key for 3 seconds or longer to enter the setup mode. Use the key to display " <i>RUN</i> ", and press the "ENT" key.
		Use the key to display " <i>trEnd</i> ", and press the "ENT" key.
		Use the key to select the printing cycle " <i>60</i> ", and press the "ENT" key.
		Press the "ENT" key. Setting is completed. To return to the user mode, press the "MENU" key for 3 seconds or longer.

(2) *Zone* (Zone Recording)

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

Display	Operation keys	Description
	3sec 	Press the "MENU" key for 3 seconds or longer to enter the setup mode. Use the key to display " <i>RUN</i> ", and press the "ENT" key.
		Use the key to display " <i>Zone</i> ", and press the "ENT" key.
		Use the key to select the desired channel, and press the "ENT" key.
 (Setting of Left-end position)		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.
 (Setting of Right-end position)		Set a span printing position in percentage (%). Operate in the same manner as setting the zero point printing position.
		Press the "ENT" key. Setting is completed. To return to the user mode, hold down the "MENU" key for 3 seconds or longer.

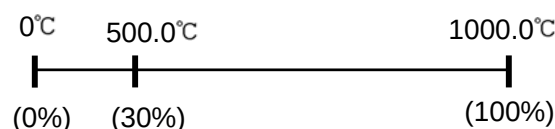
[Note]

If an incorrect numeral is entered, or is displayed.

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

(3) *Part* (Partial Compression/Expansion)

Example) Setting Channel 1 scale of 0 to 1,000.0°C to 500.0°C at a boundary point of 30 %.



Display	Operation keys	Description
☐ RUN	ESC MENU 3sec △ PRINT ENT	Press the "MENU" key for 3 seconds or longer to enter the setup mode. Use the △ key to display "RUN", and press the "ENT" key.
☐ Part	△ PRINT ENT	Use the △ key to select "Part", and press the "ENT" key.
☐ Ch1	△ PRINT ENT	Use the △ key to select the desired channel, 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.
☐ 05000	△ 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, press the "MENU" key for 3 seconds or longer.

[Note]

If an incorrect numeral is entered, E Err21 is displayed.
Press the "ENT" key and re-enter a correct numeral.

(4) *Print* (Digital Print)

Example) Setting logging channel data print to "ON" (print enabled) for all channels.

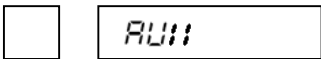
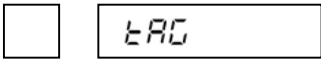
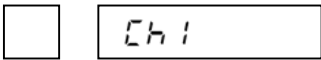
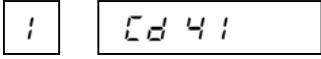
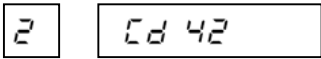
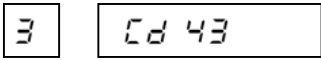
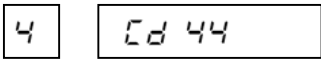
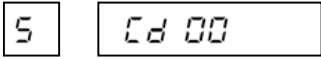
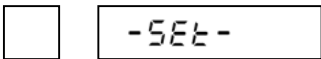
Display	Operation keys	Description
<i>Run</i>	ESC MENU 3sec PRINT ENT	Press the "MENU" key for 3 seconds or longer to enter the setup mode. Use the Δ key to display " <i>Run</i> ", and press the "ENT" key.
<i>Print</i>	Δ PRINT ENT	Use the Δ key to display " <i>Print</i> ", and press the "ENT" key.
<i>Ch 1</i>	Δ PRINT ENT	Use the Δ key to select the desired channel, and press the "ENT" key.
<i>on</i>	Δ PRINT ENT	Use the Δ key to switch from " <i>off</i> " to " <i>on</i> ", and press the "ENT" key.
<i>-Set-</i>	ENT	Press the "ENT" key. Setting is completed.
<i>Ch2</i> ⋮ <i>Ch6</i>	Δ PRINT ENT Δ PRINT ENT ENT	Repeat the setting for other channels.

[Note]

When the channel for which skip is selected during the range setting is set to ON, "*" is printed.

(5) *LRG* (Tag)

Example) Setting "ABCD" for Channel 1.

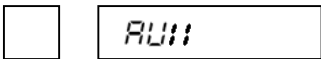
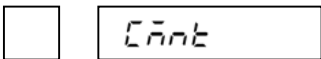
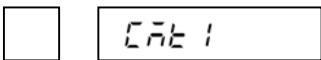
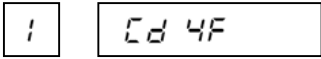
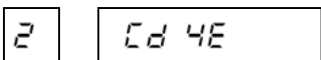
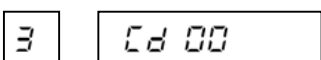
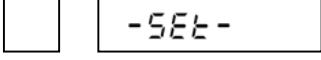
Display	Operation keys	Description
	 3sec   	Press the "MENU" key for 3 seconds or longer to enter the setup mode. Use the  key to display " <i>Run</i> ", and press the "ENT" key.
	  	Use the  key to display " <i>LRG</i> ", and press the "ENT" key.
	  	Use the  key to select the desired channel, and press the "ENT" key.
 (Setting of 1st Character)	   	Set " <i>4 1</i> " as the 1st character. Use the  key to select a code, and use the  key to shift a digit. Press the "ENT" key.
 (Setting of 2nd Character)	   	Set the 2nd to the 4th characters in the same manner.
 (Setting of 3rd Character)	   	
 (Setting of 4th Character)	   	
 (Setting of 5th Character)	   	Set " <i>00</i> " as the 5th character and press the "ENT" key.
		Press the "ENT" key. Setting is completed. To return to the user mode, press the "MENU" key for 3 seconds or longer.

[Note]

When the number of tag characters is less than 7, following the last character, set the "*00*" code. See page 57 for Character code table.

(6) コメント (Comment Words)

Example) Setting "ON" for Comment 1 (コメント 1).

Display	Operation keys	Description
	ESC MENU 3sec PRINT ENT	Press the "MENU" key for 3 seconds or longer to enter the setup mode. Use the Δ key to display "RUN", and press the "ENT" key.
	Δ PRINT ENT	Use the Δ key to display "コメント", and press the "ENT" key.
	Δ PRINT ENT	Use the Δ key to select a comment number. Display "コメント 1" and press the "ENT" key.
 (Setting of the 1st Character)	Δ PRINT FEED ENT	Set "4F" as the 1st character. Use the Δ key to select a code, and use the $\triangleright$ key to shift a digit. Press the "ENT" key.
 (Setting of the 2nd Character)	Δ PRINT FEED ENT	Set "4E" as the 2nd character. Operate in the same manner as setting the 1st character.
 (Setting of the 3rd Character)	Δ PRINT FEED ENT	Set "00" as the 3rd character. Operate in the same manner as setting the 1st character.
 (Setting of the 9th Character)	}	Repeat the setting up to 16th characters.
 (Setting of the 10th Character)		
 (Setting of the 11th Character)		
 (Setting of the 16th Character)		
 ENT		Press the "ENT" key. Setting is completed. To return to the user mode, press the "MENU" key for 3 seconds or longer.

[Note]

- When the number of tag characters is less than 16, following the last character, set the "00" code. See page 57 for Character code table.
- When DI (option: RE6) is not designated, comment print does not function.
Do not set the comment setting.

7.2 Setting the Engineering Mode



WARNING

When calibrating data, connect the equipment written in Section 9.5 of the instruction manual. Data calibration must be performed correctly.

Operators possessing knowledge of electricity and control related matters should perform the calibration after careful reading the Sections 7.2 and 9.5 of the instruction manual (Shinko Technos Co., Ltd. is not liable for any damages incurred if calibration is performed other than described in the instruction manual.)

Key Operation to Enter the Engineering Mode

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

Use the Δ key to select "ENC", and press the "ENT" key to display "0000".

Use the Δ key to alter a numeral, and the $\triangleright$ key to shift a digit. Enter the password "2222", then press the "ENT" key. "RESET" will be flashing.

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

The following shows a display map of the Engineering mode. Use the Δ key to operate.

• 7.2.1 Alarm Hysteresis

Setting	ON/OFF	
ALHYS	on off	Sets the hysteresis width Cancels the hysteresis width

• 7.2.2 Burnout ON/OFF

Setting	Channel	ON/OFF	
burnt	Ch1 Ch2 Ch3 Ch4 Ch5 Ch6	on off	Sets burnout Cancels burnout

• 7.2.3 Channel Offset

Setting	Channel	OFFSET	
offset	Ch1 Ch2 Ch3 Ch4 Ch5 Ch6	00000	Enters an offset value

• 7.2.4 Reference Junction Compensation

Setting	Channel	Function	
rjc	Ch1 Ch2 Ch3 Ch4 Ch5 Ch6	Int Ext Ch	Internal Compensation External Compensation External Channel Input Compensation

• 7.2.5 Changing the Printing Color

Setting	Channel	COLOR	
Color	Ch1	P_rP	Purple
	Ch2	rEd	Red
	Ch3	Grn	Green
	Ch4	blU	Blue
	Ch5	brn	Brown
	Ch6	blK	Black

• 7.2.6 Settings Related to Recording

Setting	Function	
rUn	rUntG	Recording start/stop INT/EXT selection
	tAG	Tag/channel print selection
	ALARn	Alarm print ON/OFF
	dGtPr	Logging print ON/OFF
	SCALE	Scale print ON/OFF
	dSYnG	Logging print Synchronous/Asynchronous print selection

• 7.2.7 Setting the Communication Function

Setting	Setting the Communication Function
Coñ	Local Address Communication speed 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	oFF	No function
	di 2	rCd	Recording start/stop
	di 3	SPEED	Chart feed speed selection
		Comnt1	Comment 1 print (Synchronous)
		Comnt2	Comment 2 print (Synchronous)
		Comnt3	Comment 3 print (Synchronous)
		MAN-P	Manual print (Synchronous)
		ti n-P	Date and time print (Synchronous)
		ACnt1	Comment 1 print (Asynchronous)
		ACnt2	Comment 2 print (Asynchronous)
		ACnt3	Comment 3 print (Asynchronous)
		MAN-P	Manual print (Asynchronous)
		ti n-P	Date and time print (Asynchronous)

• 7.2.10 Temperature Unit selection

Setting	Temp Unit	
tEñP	C	Centigrade Unit
	F	Fahrenheit Unit

• 7.2.11 Point Calibration

Setting	Function	
P ADJ	Zero FULL HYS Color	Zero point calibration Span point calibration Hysteresis at left/right move (Factory adjustment item) Ribbon select calibration (Factory adjustment item)

• 7.2.12 Data Calibration

Setting	Function	
d ADJ	Volt rtd rjc	Voltage calibration RTD (Resistance temperature detector) calibration Internal reference junction compensation calibration

• 7.3 Terminating the Engineering Mode

Setting	Function	
End	Store Abort	Saves the setting value Cancels the setting value

[Note]

Upon termination the Engineering mode, if "End" is selected and the power was turned off without selecting "Store", the setting will become invalid.
For "End" operation, see Page 81.

Table 7.2 Default value of the engineering mode

Setting items	Default value	Remarks
Alarm hysteresis	ON (0.5%)	
Burnout (all channels)	OFF	
Channel offset (all channels)	0.0	
RJC (all channels)	Internal compensation INT	
Dot print color (Ch1 to Ch6)	Purple(1), Red(2), Green(3), Blue(4), Brown(5), Black(6)	
REC record RUN/STOP trigger Channel/Tag print Alarm print Logging print Logging printing interval Logging print reference time Logging print scale print Logging print Sync/Async	INT Ch OFF ON 6H 00:00 OFF Sync (Synchronous)	Use the "REC" key
COM (communication) Address Communication speed Data length Parity bit Stop bit	01 9600 8bit None 1bit	
DI function (Ch1 to Ch3)	OFF	
Temperature unit	℃ (centigrade unit)	

7.2.1 Alarm Hysteresis

0.5% hysteresis can be set as a value upon alarm activation and alarm recovery. (Common to all alarms)

Example) Turning alarm hysteresis OFF.

Display	Operation keys	Description
 ALHYS	   	Enter the engineering mode (See the key operation on page 67). Use the  key to display "ALHYS", and press the "ENT" key.
 OFF	  	Use the  key to display "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) Setting Burnout High for Channel 4.

Display	Operation keys	Description
 bout	   	Enter the engineering mode (See the key operation on page 67). Use the  key to display "bout", and press the "ENT" key.
 CH4	  	Use the  key to display "CH4", and press the "ENT" key.
 on	  	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.

Input value can be set from -19999 to 99999.

Example) Setting the value (3.0) to be added to Channel 3.

Display	Operation keys	Description
 offset	   	Enter the engineering mode (See the key operation on page 67). Use the  key to display "offset", and press the "ENT" key.
 CH3	  	Use the  key to select "CH3", and press the "ENT" key.
 30000	   	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 determined, press the "ENT" key.

7.2.4 Reference Junction Compensation

The following describes how to compensate an electromotive force generated between a thermocouple wire or compensation lead wire and a terminal. There are 3 compensating methods as follows:

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

For this recorder, Internal compensation (INT) default value has been set.

Example) Setting the external compensator's temperature constant voltage for Ch6 to 391~~μ~~V.

(Thermocouple T input, external compensator's compensating temperature 10°C,
Electromotive force input 391~~μ~~V)

Display	Operation keys	Description
		Enter the engineering mode (See the key operation on page 67). Use the key to display "rJC", and press the "ENT" key
		Use the key to select "Ch6", and press the "ENT" key.
		Use the key to select "EXT", and press the "ENT" key.
		Use the key to alter a numerical value, and the key to shift a digit. Once the numerical value is determined, press the "ENT" key.
		Once setting is completed, the recorder will return to the Channel setting mode.

Example) When Channel 1 input compensates Channel 6 reference junction.

Display	Operation keys	Description
ruC		Enter the engineering mode (See the key operation on page 67). Use the key to display "ruC", and press the "ENT" key.
Ch6		Use the key to select "Ch6", and press the "ENT" key.
Ch		Use the key to select "Ch", and press the "ENT" key.
Ch1		Use the key to select "Ch1", and press the "ENT" key.
Ch6		Once setting is completed, the recorder will return to Channel setting screen.

7.2.5 Changing the Printing Color

Set a printing color for each channel.

Example) Setting the black color as a printing color.

Display	Operation keys	Description
Color		Enter the engineering mode (See the key operation on page 67). Use the key to display "Color", and press the "ENT" key.
Ch1		Use the key to select "Ch1", and press the "ENT" key.
blE		Use the key to display "blE", and press the "ENT" key.
Color		Once setting is completed, the recorder will return to Printing Color Setting screen.

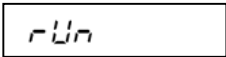
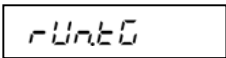
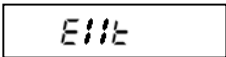
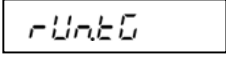
7.2.6 Settings Related to Recording

Recording start/stop trigger, tag/channel print, alarm print, logging print, and scale print ON/OFF can be set.

(1) Trigger setting for recording start/stop

Sets whether the recording start/stop trigger should be performed by the "REC" key or by the DI.

Example) Setting DI as a recording start/stop trigger.

Display	Operation keys	Description
 	   	Enter the engineering mode (See the key operation on page 67). Use the  key to display "rUn", and press the "ENT" key.
 	  	Use the  key to select "rUnStG", and press the "ENT" key.
 	  	Use the  key to display "E!!!", and press the "ENT" key.
 	   	Once setting is completed, the recorder will return to Recording Start/Stop Setting screen.

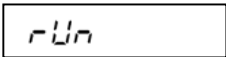
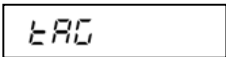
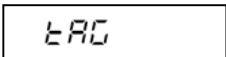
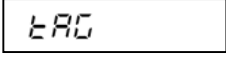
[Note]

When "E!!!" is displayed, the "RUN/STOP" key does not function. Set DI to "rCd". See DI functions on page 77.

(2) Tag/channel print selection

In the case of logging print or manual print, this sets either a tag print or a channel print.

Example) Setting the tag print.

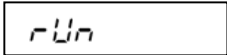
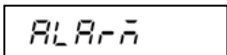
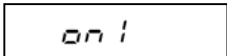
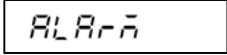
Display	Operation keys	Description
 	   	Enter the engineering mode (See the key operation on page 67). Use the  key to display "rUn", and press the "ENT" key.
 	  	Use the  key to select "tAG", and press the "ENT" key.
 	  	Use the  key to display "tAG", and press the "ENT" key.
 		Once setting is completed, the recorder will return to Tag/Channel Setting screen.

(3) Alarm print ON/OFF

Sets the alarm print ON/OFF.

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

Example) When setting both the alarm occurring and the alarm recovering.

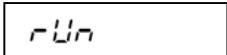
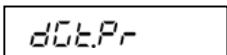
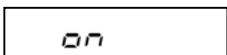
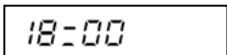
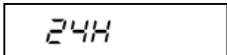
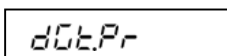
Display	Operation keys	Description
 	   	Enter the engineering mode (See the key operation on page 67). Use the  key to display "rUn", and press the "ENT" key.
 	  	Use the  key to select "ALArñ", and press the "ENT" key.
 	  	Use the  key to display "on1", and press the "ENT" key.
 		Once setting is completed, the recorder will return to the Alarm Print Setting screen.

(4) Logging print ON/OFF

Sets the logging print ON/OFF.

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

Example) When setting the logging print to start at 18:00 every day.

Display	Operation keys	Description
 	   	Enter the engineering mode (See the key operation on page 67). Use the  key to display "rUn", and press the "ENT" key.
 	  	Use the  key to select "dGt.Pr", and press the "ENT" key.
 	  	Use the  key to display "on", and press the "ENT" key.
  (Print Start Time)	   	Use the  key to alter a numeral, and  key to shift a digit. Then, set the time and press the "ENT" key.
  (Interval)	  	Use the  key to display "24H", and press the "ENT" key. (Select from 10min, 15min, 20min, 30min, 1H, 2H, 3H, 4H, 6H, 8H, 12H and 24H)
 		Once setting is completed, the recorder will return to the Logging print Setting screen.

(5) Scale print ON/OFF

Set scale print to ON/OFF.

Example) Setting the Scale print to OFF.

Display	Operation keys	Description
rUn		Enter the engineering mode (See the key operation on page 67). Use the key to display "rUn", and press the "ENT" key.
SCALE		Use the key to select "SCALE", and press the "ENT" key.
oFF		Use the key to display "oFF", and press the "ENT" key.
SCALE		Once setting is completed, the recorder will return to the Scale Print Setting screen.

(6) Logging print Synchronous/Asynchronous

Sets logging print to synchronous print/asynchronous.

Example) Setting logging print to synchronous.

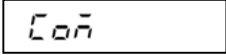
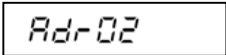
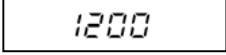
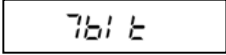
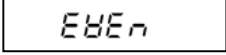
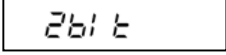
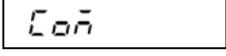
Display	Operation keys	Description
rUn		Enter the engineering mode (See the key operation on page 67). Use the key to display "rUn", and press the "ENT" key.
d5ync		Use the key to select "d5ync", and press the "ENT" key.
sync		Use the key to display "sync", and press the "ENT" key.
d5ync		Once setting is completed, the recorder will return to the Logging print Sync/Async Setting screen.

7.2.7 Setting the Communication Function

Sets Local Address, Communication speed, Data Length, Parity Bit, and Stop Bit.

Example) Local Address: 02, Communication speed: 1200bps, Data Length: 7 bits,

Parity Bit: even, Stop Bit: 2 bits.

Display	Operation keys	Description
 	   	Enter the engineering mode (See the key operation on page 67). Use the  key to display "C o n", and press the "ENT" key.
 	  	Use the  key to display "A d r 0 2", and press the "ENT" key. (Select from <i>A d r 0 1</i> to <i>A d r 3 2</i>)
 	  	Use the  key to display " 1 2 0 0", and press the "ENT" key. (Select from 1200, 2400, 4800, 9600)
 	  	Use the  key to display " 7 b i t", and press the "ENT" key. (Select 7 bits or 8 bits)
 	  	Use the  key to display "E V E n", and press the "ENT" key. (Select from EVEN, ODD and NONE)
 	  	Use the  key to display " 2 b i t", and press the "ENT" key. (Select 1 bit or 2 bits)
 		Once setting is completed, the recorder will return to Communication Function Setting screen.

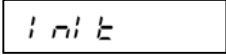
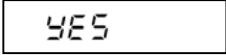
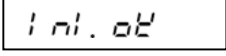
7.2.8 Initializing the Setup Data

The setup data reverts to the default value.

Since this function initializes all setup data, take care when executing this function.

Calibration data is not initialized.

Example) Initializing the Setup Data.

Display	Operation keys	Description
 	   	Enter the engineering mode (See the key operation on page 67). Use the  key to display "i n i t", and press the "ENT" key.
 	  	Use the  key to select "Y E S", and press the "ENT" key.
 		Initialization is completed.

7.2.9 DI Functions

Allocates functions to 3 DIs. There are 12 DI functions as follows.

No function	: <i>oFF</i>	
Manual print (Sync.)	: <i>MAN-P</i>	(Positive edge: running start)
Manual Print (Async.)	: <i>MANP</i>	(Positive edge: running start)
RUN/STOP trigger function	: <i>CLd</i>	(ON: RUN, OFF: STOP)
Date/Time Print (Sync.)	: <i>CLT-P</i>	(Positive edge: running start)
Date/Time Print (Async.)	: <i>CLTP</i>	(Positive edge: running start)
Chart feed speed selection	: <i>SPEED</i>	(ON: Spd-1, OFF: Spd-2)
Comment print 1 to 3 (Sync.)	: <i>CLnt1, CLnt2, CLnt3</i>	(Positive edge: running start)
Comment print 1 to 3 (Async.)	: <i>CLnt1, CLnt2, CLnt3</i>	(Positive edge: running start)

Example) Setting comment print 3 for DI3

Display	Operation keys	Description
 <i>di</i>	  	Enter the engineering mode (See the key operation on page 67). Use the Δ key to display " <i>di</i> ", and press the "ENT" key.
 <i>di 3</i>	 	Use the Δ key to select " <i>di 3</i> ", and press the "ENT" key.
 <i>CLnt3</i>	 	Use the Δ key to display " <i>CLnt3</i> ", and press the "ENT" key.
 <i>di 3</i>		Once setting is completed, the recorder will return to the DI3 Function Setting screen.

[Note]

- Although DI synchronous does not print in STOP status, DI asynchronous prints in STOP status.
- Be sure to set to OFF when DI function (Option: RE6) is not designated.
Do not set any setting except for OFF.

7.2.10 Temperature Unit selection

Sets the temperature unit.

Example) Setting the temperature unit to Fahrenheit.

Display	Operation keys	Description
 <i>TEMP</i>	  	Enter the engineering mode (See the key operation on page 67). Use the Δ key to indicate " <i>TEMP</i> ", and press the "ENT" key.
 <i>F</i>	 	Use the Δ key to select " <i>F</i> ", and press the "ENT" key.
 <i>TEMP</i>		Once setting is completed, the recorder will return to the Temperature Unit Setting screen.

[Note]

If the temperature unit is changed, all setup data will revert to default values.

7.2.11 Point Calibration

Calibrates a dot printing position.

Zero : Calibration of the zero point position

FULL : Calibration of the span point position

[Note]

Point calibration "*HYS*" and "*Color*" are setup item before shipment. Do not change the setup value.

Example) Calibrating the zero point.

Display	Operation keys	Description
<i>P Adj</i>		Enter the engineering mode (See the key operation on page 67). Use the key to display " <i>P Adj</i> ", and press the "ENT" key.
<i>Zero</i>		Use the key to select " <i>Zero</i> ", and press the "ENT" key.
00003		The instrument starts to feed and print the chart paper. With the (left move) and (right move), adjust the 0mm position of the chart paper and the recording position. Press the "ENT" key. Display indicates the set counter value.
<i>Zero</i>		Once setting is completed, the recorder will return to the Zero Point Calibration screen.

Example) Calibrating the span point.

Display	Operation keys	Description
<i>P Adj</i>		Enter the engineering mode (See the key operation on page 67). Use the key to display " <i>P Adj</i> ", and press the "ENT" key.
<i>FULL</i>		Use the key to select " <i>FULL</i> ", and press the "ENT" key.
0 1003		The instrument starts to feed and print the chart paper. With the (left move) and (right move), adjust the 100mm position of the chart paper and the recording position. Press the "ENT" key. Display indicates the set counter value.
<i>FULL</i>		Once setting is completed, the recorder will return to the Span Point Calibration screen.

7.2.12 Data Calibration

Calibrates the voltage, RTD(resistance temperature detector), and reference junction compensation.

volt : Calibration of the voltage

rtd : RTD (Calibration of the resistance temperature detector)

rjc : Calibration of reference junction compensation

Example) alibrating the voltage at Channel 1.

Display	Operation keys	Description
<i>d Adj</i>	 	Enter the engineering mode (See the key operation on page 67). Use the key to display " <i>d Adj</i> ", and press the "ENT" key.
<i>volt</i>		Use the key to select " <i>volt</i> ", and press the "ENT" key. Selects the channel where an instrument for calibration such as an mV generator is connected, and then, press the "ENT" key.
<i>ch1</i>		
<i>00mV</i>		Enter 0mV. After 30 seconds, make sure that the ALM lamp is unlit and press the "ENT" key.
<i>15mV</i>		Enter 15mV. After 10 seconds, make sure that the ALM lamp is unlit and press the "ENT" key.
<i>25mV</i>		Enter 25mV. After 10 seconds, make sure that the ALM lamp is unlit and press the "ENT" key.
<i>35mV</i>		Enter 35mV. After 10 seconds, make sure that the ALM lamp is unlit and press the "ENT" key.
<i>55mV</i>		Enter 55mV. After 10 seconds, make sure that the ALM lamp is unlit and press the "ENT" key.
<i>200mV</i>		Enter 200mV. After 10 seconds, make sure that the ALM lamp is unlit and press the "ENT" key.
<i>001V</i>		Enter 1V. After 10 seconds, make sure that the ALM lamp is unlit and press the "ENT" key.
<i>005V</i>		Enter 5V. After 10 seconds, make sure that the ALM lamp is unlit and press the "ENT" key.
<i>010V</i>		Enter 10V. After 10 seconds, make sure that the ALM lamp is unlit and press the "ENT" key.
<i>Store</i>		If the calibration is correct, select " <i>Store</i> " with the key, and if incorrect, select " <i>Abort</i> " with the key. Then, press the "ENT" key.

[Note]

For calibration of voltage input, calibrate only one channel.

Example) When calibrating the RTD at Channel 2.

Display	Operation keys	Description
d Rdu	ENT △ PRINT ENT	Enter the engineering mode (See the key operation on page 67). Use the △ key to display "d Rdu", and press the "ENT" key.
rtd	△ PRINT ENT	Use the △ key to select "rtd", and press the "ENT" key. Select the channel where the instrument for calibration such as dial resistor is connected and then, press the "ENT" key.
ch2	△ PRINT ENT	
r r 100	ENT	Enter 100Ω. After 10 seconds, make sure that the ALM lamp is unlit and press the "ENT" key.
r r 150	ENT	Enter 150Ω. After 10 seconds, make sure that the ALM lamp is unlit and press the "ENT" key.
r r 300	ENT	Enter 300Ω. After 10 seconds, make sure that the ALM lamp is unlit and press the "ENT" key.
Store	△ PRINT ENT	If the calibration is correct, select "Store" with the △ key, and if incorrect, select "Abort" with the △ key. Then, press the "ENT" key.

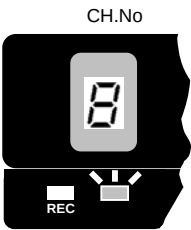
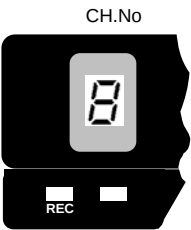
[Note]

When calibrating RTD for a channel, short-circuit the other channels except the calibrating channel. RTD calibration is required for every channel.

[Note]

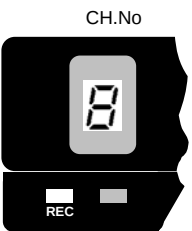
During calibration, the ALM lamp displays the following conditions.

- (1) When the ALM lamp is unlit:
 The calibration is within range.
- (2) When the ALM lamp is flashing:
 Assessing the input value.



	: The lamp is unlit.
	: The lamp is lit.

- (3) When the ALM lamp is lit:
 The calibration is not within range.
 Make sure that the connection is proper and input is correct.



Example) Setting the terminal temperature for Channel 1.

Display	Operation keys	Description
d Adj	 	Enter the engineering mode (See the key operation on page 67). Use the key to display "d Adj", and press the "ENT" key.
r JC	 	Use the key to select "r JC", and press the "ENT" key.
r Ch1	 	Select the Channel to set, and press the "ENT" key.
245		Measures and displays the current terminal temperature. Press the "ENT" key, and the display turns to temperature setting.
250	 	Use the key to alter a numeral, and key to shift a digit. Then, press the "ENT" key. See 9.5 (3) Calibration of Reference Junction Compensation.
Store	 	If the calibration is correct, select "Store" with the key, and if incorrect, select "Abort" with the key. Then, press the "ENT" key.

[Note]

When calibrating the terminal temperature, select a channel to calibrate from channel 1 to channel 3, and select another channel from channel 4 to channel 6. Calibrate these channels separately.

7.3 Terminating the Engineering Mode

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

Display	Operation keys	Description
End	 	Use the key to display "End", and press the "ENT" key.
Store		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]

When terminating the Engineering mode, if "End" is selected and the power was turned off without selecting "Store", the settings will become invalid. Selecting "Abort" invalidates the settings, and starts recording under the previous settings.

8.1 General Description

8.1.1 General Description of Functions

This Recorder has the following communication functions:

(1) Process variable output

Process variable, alarm status, etc.

(2) Setting value output

Reading the setup data such as a range and chart feed speed.

(3) Setting value input

Writing the setup data such as a range and chart feed speed.

(4) Recorder control (Partial)

Switching to print, recording start/stop and changing display.

For functions (2) to (4), see the separate volume "Communication Command Manual".

The engineering mode cannot be set by communication function.

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 structure

(1) Character structure

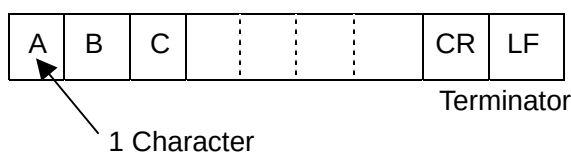
In order to send 1 data (byte) in start-stop synchronous communication, the following data format is assumed.

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 data as a result of a signal error such as parity error and framing error due to noise or hardware problems, this data will be ignored. Consequently, a data format error will result, as the data was not sent in the normal data format. That command will not be executed in the receiving function, and no response will be resulted in the transmitting function. 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.

This code cannot be treated as a 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 a part of the text data.

LF: 0A HEX (hexadecimal)

This data is added to the end of the text data together with the CR data.

This code cannot be treated as a part of the text data.

8.2 Opening/Closing the Link

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

8.2.1 Open Command

(ESC)O 01 (CR)(LF)

Address (01 to 32)

Space (20 Hex.)

To communicate with the recorder, the host computer must issue this command and must memorize that it has issued this command.

8.2.2 Close Command

(ESC)C 01 (CR)(LF)

Address (01 to 32)

Space (20 Hex.)

When sending data to the recorder to which the open command has not been issued, the host computer must issue this command to the recorder to which the open command has been issued.

8.3 Outputting the Process Variable

8.3.1 Specifying the Process Variable Output

`TS0(CR)(LF)`

Once this command is received, the recorder transfers the process variable to the transmission 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 updated process variable to the transmission buffer.

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

`BO0(CR)(LF)` Outputs start from the upper byte.

`BO1(CR)(LF)` Outputs start from the lower byte.

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

8.3.4 Outputting the Data

`FM0, S_CH, E_CH` Specifies the ASCII mode output.

`FM1, S_CH, E_CH` Specifies the BINARY mode output.

S_CH: Output start channel 01 to 06

E_CH: Output end channel 01 to 06

When the number of channel is 1, specify (S_CH) = (E_CH).

“_” means Space.

8.3.5 Process Variable 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) (UNIT 1 to 6) (CHNo.), (DATA) (CR) (LF)

(1) DS1: 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

S: Skip (All data: Space)

(2) DS2: 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 to 6: UNIT (6 bytes)

Returns the setting unit with codes. (When sending the 7-bit data, 1 bit information is omitted.)

(5) CHNo.: Channel number (2 bytes)

01 to 06

(6) DATA: Process variable

Sign (1 byte) : "+" or "-"

Data mantissa section (6 bytes): 00000 to 99999

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

<Example> +99999E - 02

8.3.6 Process Variable Transmission Format (BINARY)

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

Output bytes (2 bytes): $5 \times n$ (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. (1 byte): Channel number 01H to 06H

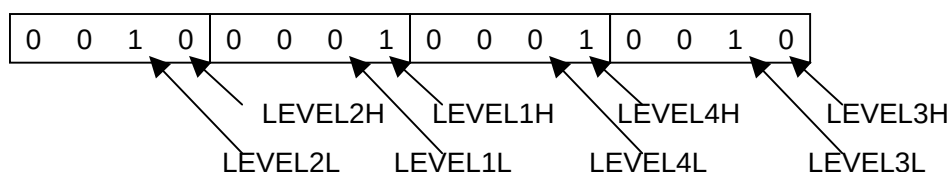
A1 to A4 (2 bytes): Alarm type activated at each alarm level

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

DATA1, DATA2 (2 bytes): Process variable

-32000 to + 32000 (2-byte hexadecimal data)

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

If Skip is specified, 8080H will be outputted.

[Note]

(1) Output data over -32000 to +32000 constitutes overflow. The overflow 7E7E is output on the plus side, and 8181 is output on the minus side (Excluding the Decade channel).

(2) Irrespective of the BO command, data output of the Decade channel is as follows.

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 the 1st 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 transmission 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 updated unit and decimal point position data to the transmission buffer

8.4.3 Outputting the Data

`LF, S_CH, E_CH`

S_CH: Output start channel 01 to 06

E_CH: Output end channel 01 to 06

When the number of channel is 1, specify (S_CH) = (E_CH). “_” means Space.

8.4.4 Data Format

`(DS1)(DS2)(CHNo.) (UNIT1 to 6)(DP)`

- (1) DS1 : 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
 - S : Skip (All data: Space)
- (2) DS2 : Data information 2 (1 byte)
 - E : Final data
 - _(Space): Other data
- (3) CHNo.: Channel number (2 bytes); 01 to 06
- (4) UNIT 1 to 6: UNIT
 - Returns the set unit with codes.
 - (When sending the 7-bit data, 1 bit information is omitted.)
- (5) DP: Decimal point information (1 byte); 0 to 4

[Note]

Depending on the range setting, a decimal point position may differ from that of the 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 the command clears the on-going error.

8.5.1 Status Output Command

```
ESC S(CR) (LF)
```

Upon receiving this command, outputs will be the status of commands received so far.

8.5.2 Status Output

```
E R X X CR LF
```

XX: 00 to 19

Table 8.5.2 Status output list

Status factor Status output	Status factor		
	A/D END	Syntax error	Chart paper-empty
ER 00 C _R L _F			
ER 01 C _R L _F	O		
ER 02 C _R L _F		O	
ER 03 C _R L _F	O	O	
ER 04 C _R L _F			
ER 05 C _R L _F	O		
ER 16 C _R L _F			O
ER 17 C _R L _F	O		O
ER 18 C _R L _F		O	O
ER 19 C _R L _F	O	O	O

O: Factor by which the status is ENABLED.

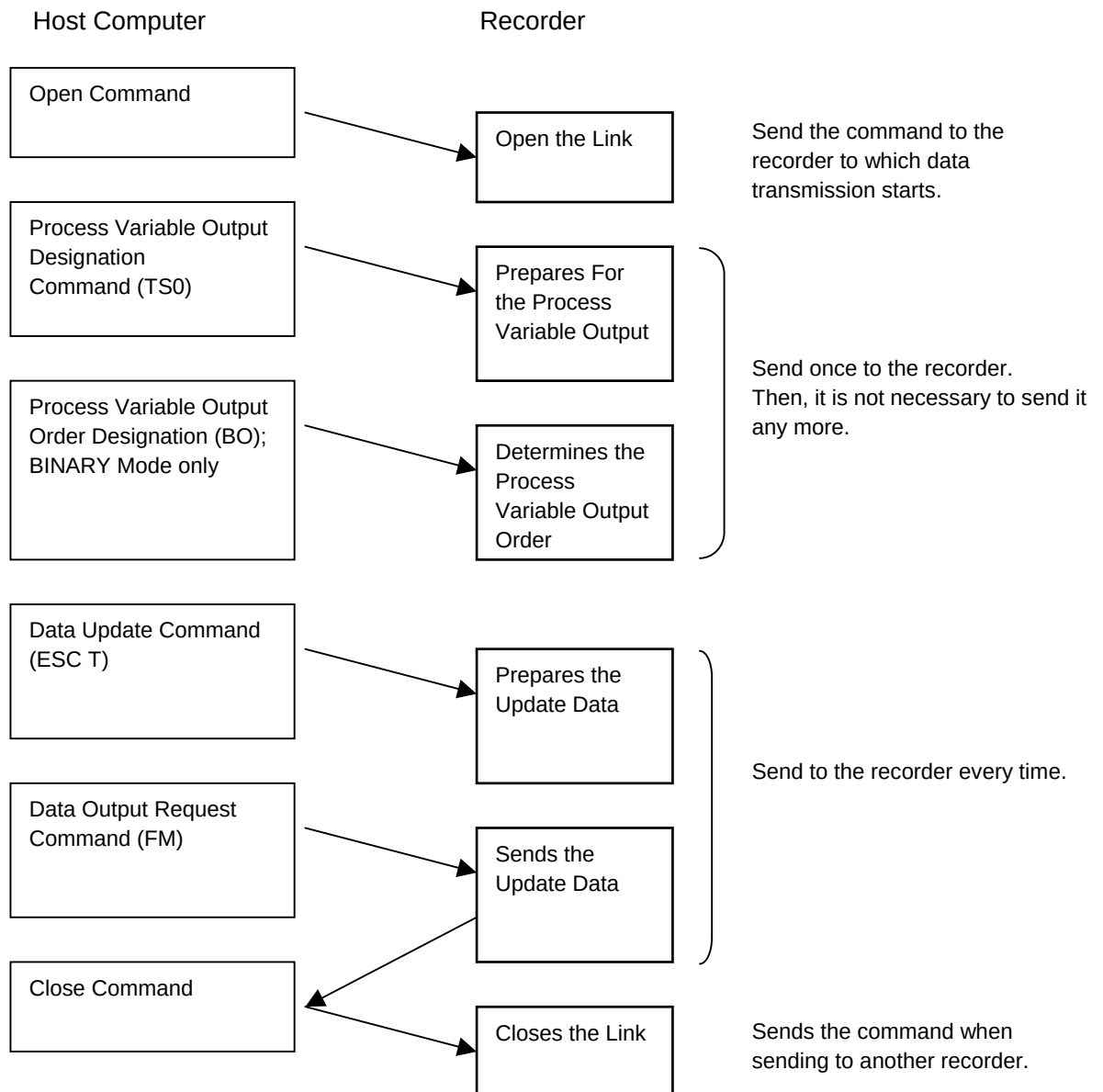
A/D END : This occurs when AD conversion is completed.

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

Chart paper-empty: This occurs when chart paper-empty is detected.

(When chart paper-empty option has been added.)

8.6 Data Reception Example



9. MAINTENANCE

Check the following items in order to use this instrument effectively.

- Inspection
- Cleaning
- Replacing Consumables
- Adjustment of the Dot Printing Position
- Calibration

9.1 Inspection

Inspect the condition of operation periodically for effective use.

When any defect is found, see Chapter “10. Troubleshooting”.

- Check whether trend recording is deflected.
- Check whether the recording indication is proper.
 - Check whether there are any large errors in indicated values or dot printing position.
 - Check whether there is improper dot printing.
 - Check whether there are any blurred dot printing or printout.
 - Check whether printout is proper.
- Check whether the chart paper is fed properly.
 - Check whether the chart paper is folded properly.
 - Check whether the feed holes in the chart paper are torn off or broken.
 - Check whether the chart speed is normal.
- Check whether there are any abnormal sound.

9.2 Cleaning

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

[Note]

Do not use any organic solvents.

9.3 Replacing Consumables

Replace consumables according to the following list.

No.	Name	Type	Period	Remarks	Quantity
1	Chart paper	H-10100	33 days	When chart feed speed is 20mm/h	1
2	Ribbon cassette	WPSR188A000001A	3 months	When chart feed speed is 20mm/h	1

[Note]

- (1) When recording with a ribbon, a dot printing color phases out. To ensure clear recording, replace the ribbon cassette as soon as possible.
- (2) Use the ribbon cassette within one year after its purchase. Due to evaporation of ink, printing color phases out over time.

9.4 Adjusting Dot Printing Position (Point Calibration)

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

It is advised to adjust recording position annually for accurate recording.

How to Adjust

It is unnecessary to enter the reference. Leave the recorder as it is, and adjust it according to the instructions in 7.2.11 Point Calibration. (See page 78)

9.5 Calibration (Data Calibration)

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

[Note]

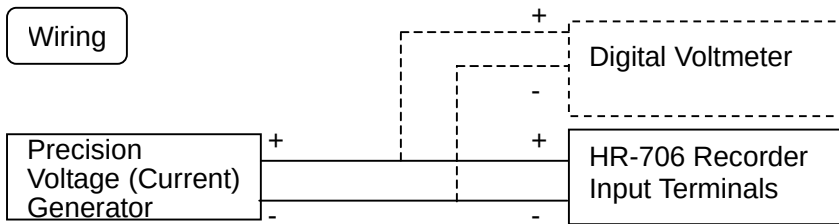
Prior to calibration, allow for at least 30 minutes warm-up after switching the power on.

Devices required for calibration

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

(1) Calibration of Voltage

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

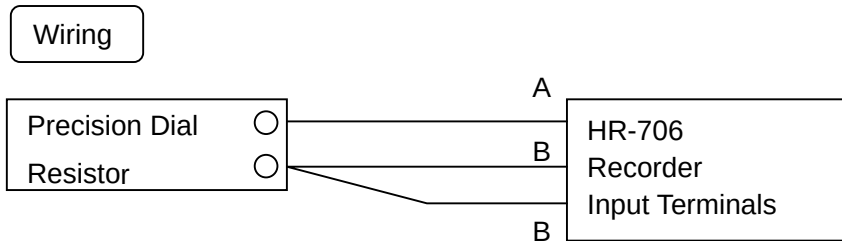


Calibrate the voltage according to the instructions in Section “7.2.12 Data Calibration” (Calibration of the voltage). (See page 79)

[Note]

- (1) Calibrate at any one channel.
- (2) When a shunt resistor is attached to the input terminal block in the case of current input, detach it prior to calibration.

(2) Calibration of RTD (Resistance temperature detector)



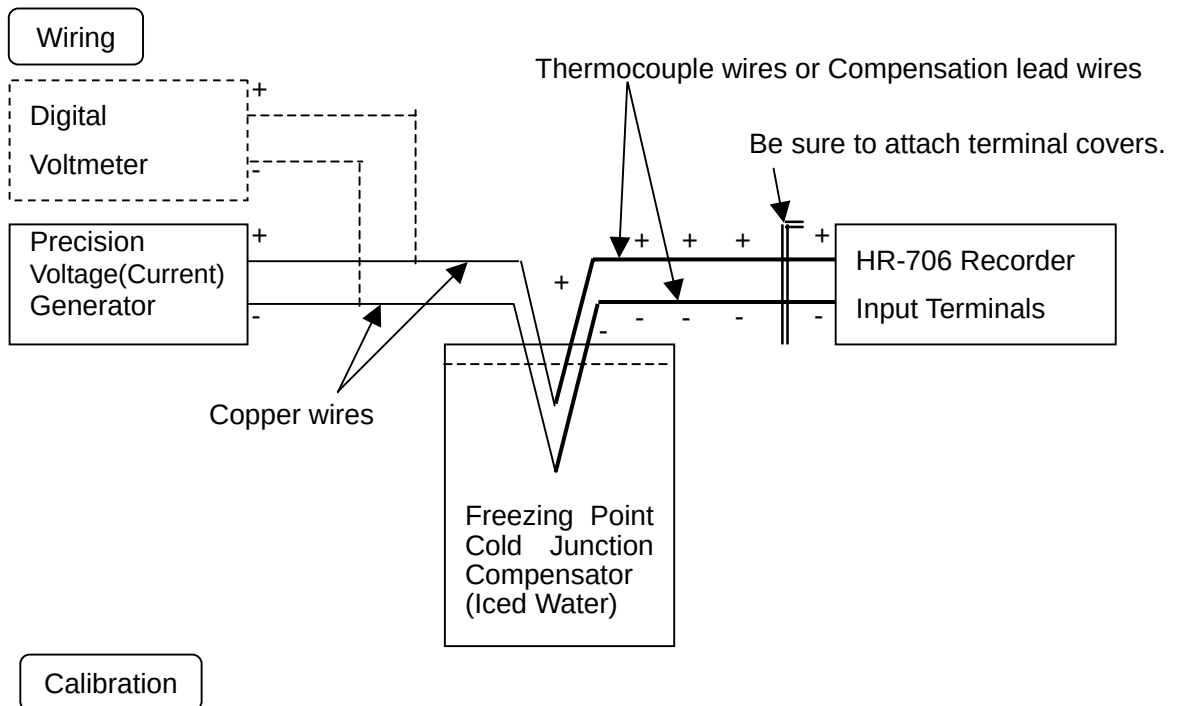
Calibrate RTD according to the instructions in Section “7.2.12 Data Calibration” (Calibration of the RTD). (See page 80)

[Note]

- The dispersion of resistance for each wire must be $6\text{ m}\Omega$ or less.
- Calibrate RTD at every channel.
- Short-circuit the input terminals except calibrating channels.

(3) Calibration of Reference Junction Compensation

Calibrate the reference junction compensation in the case of thermocouple input.



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

- 1) Check the Process variable when impressing $0.000\text{mV} \pm 2\mu\text{V}$ to Channel 1 by the voltage generator beforehand. (In this example, it is -0.5°C .)
- 2) Check the terminal temperature of Channel 1 at the data calibration in the engineering mode (Reference junction compensation). (In this example, it is 24.5°C .)
- 3) Set the value which is added the difference (0.5°C) to the true value as a correct RJC temperature.

$$[24.5 - (-0.5) = 25.0^{\circ}\text{C}]$$

Calibrate RJC according to the instructions in 7.2.12 Data Calibration (Calibration of reference junction compensation). (See page 81)

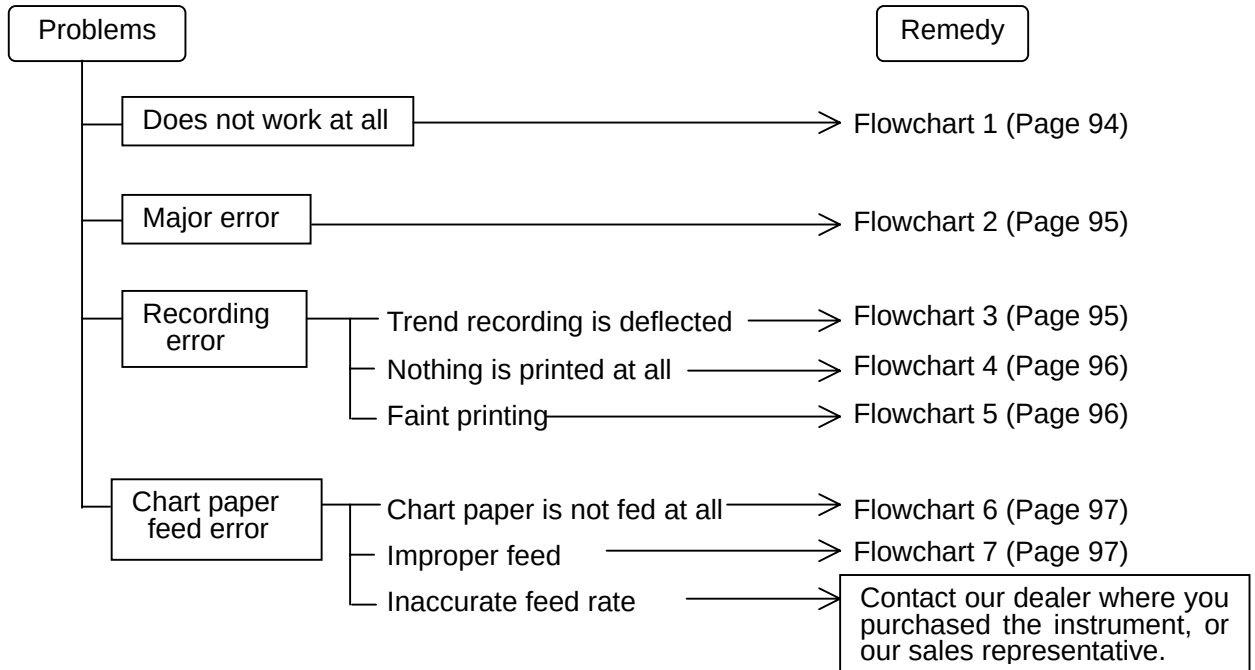
[Note]

- (1) This calibration is conducted when compensation by the recorder's built-in temperature sensing element (INT: internal compensation) is selected as a reference junction compensation method.
- (2) Wire Channel 1 and Channel 4 to calibrate.
- (3) After wiring, attach the terminal covers and wait for 5 minutes or longer, then calibrate it.

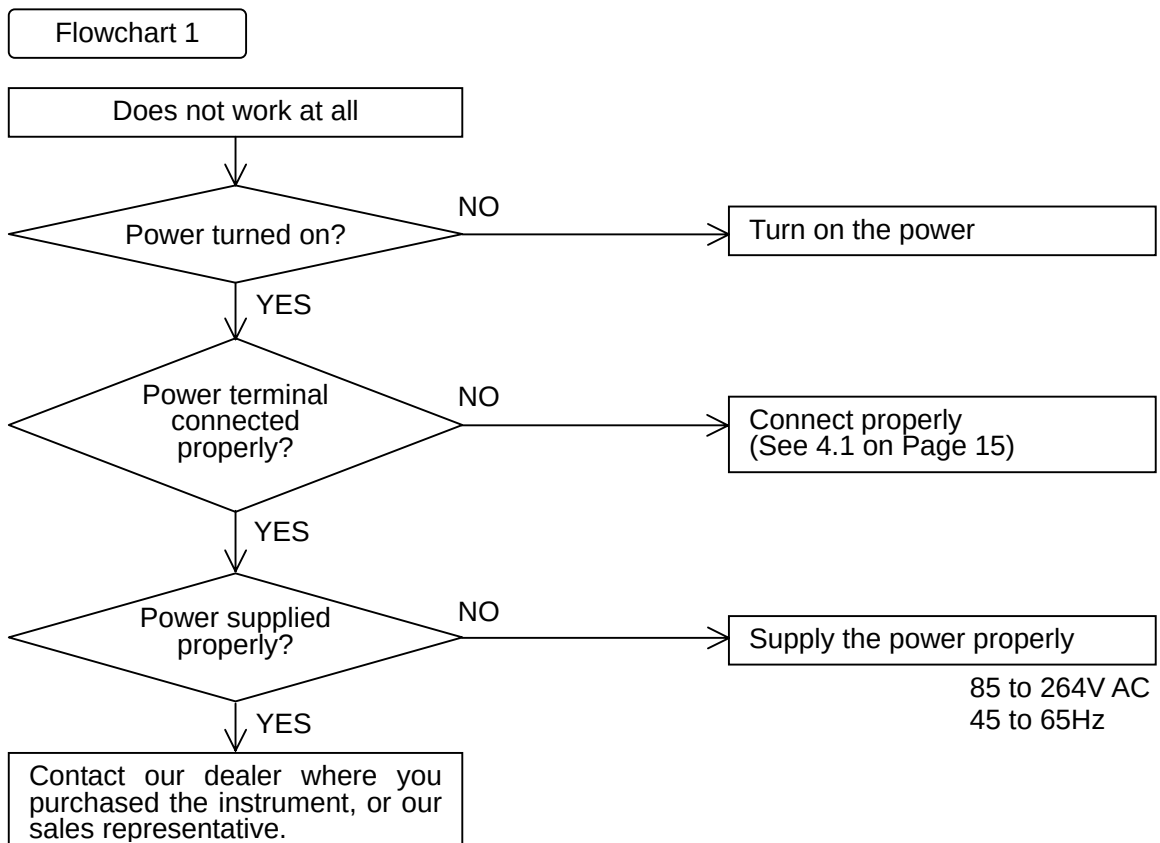
10. TROUBLESHOOTING

10.1 Troubleshooting

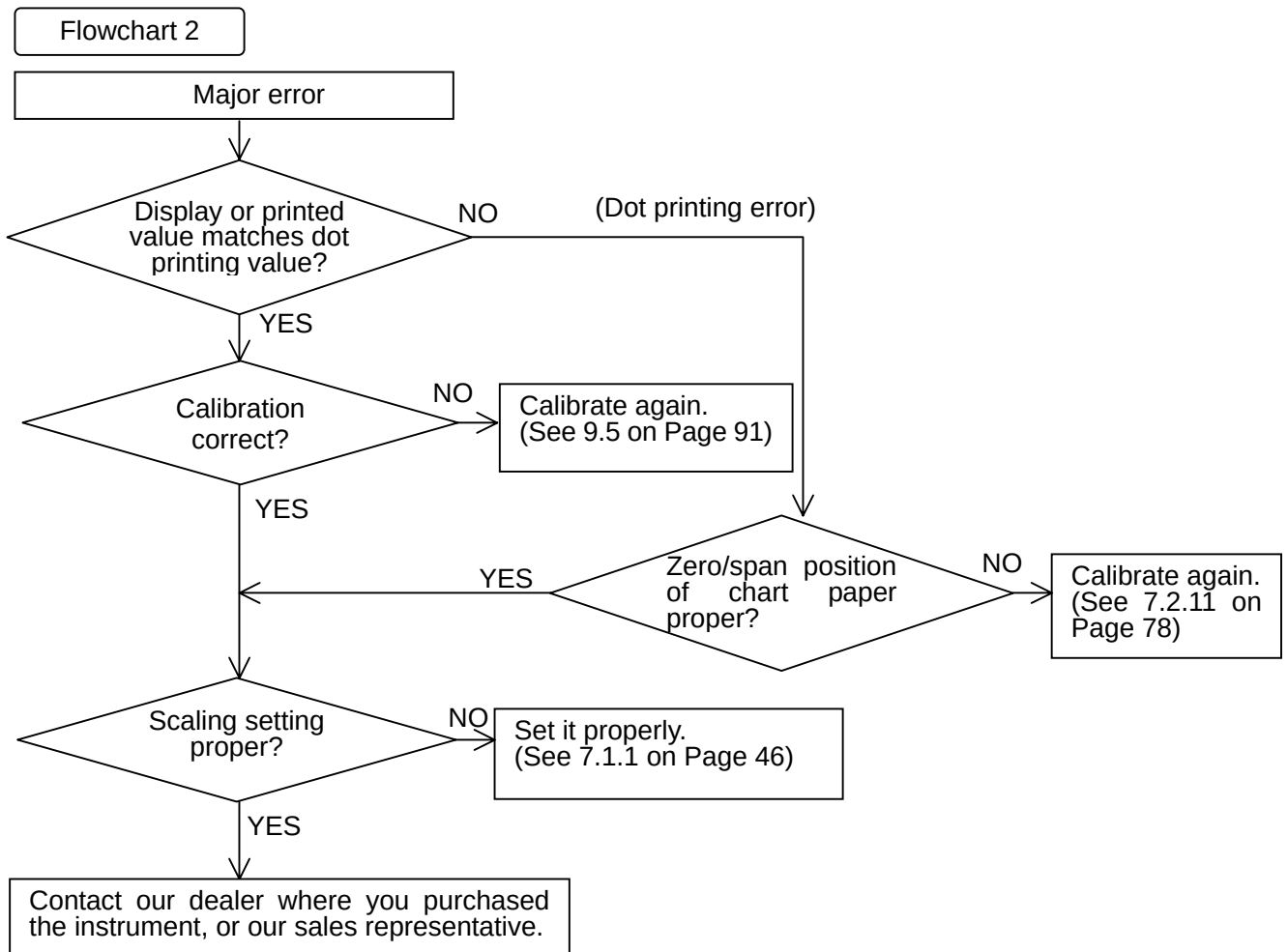
10.1.1 Problems



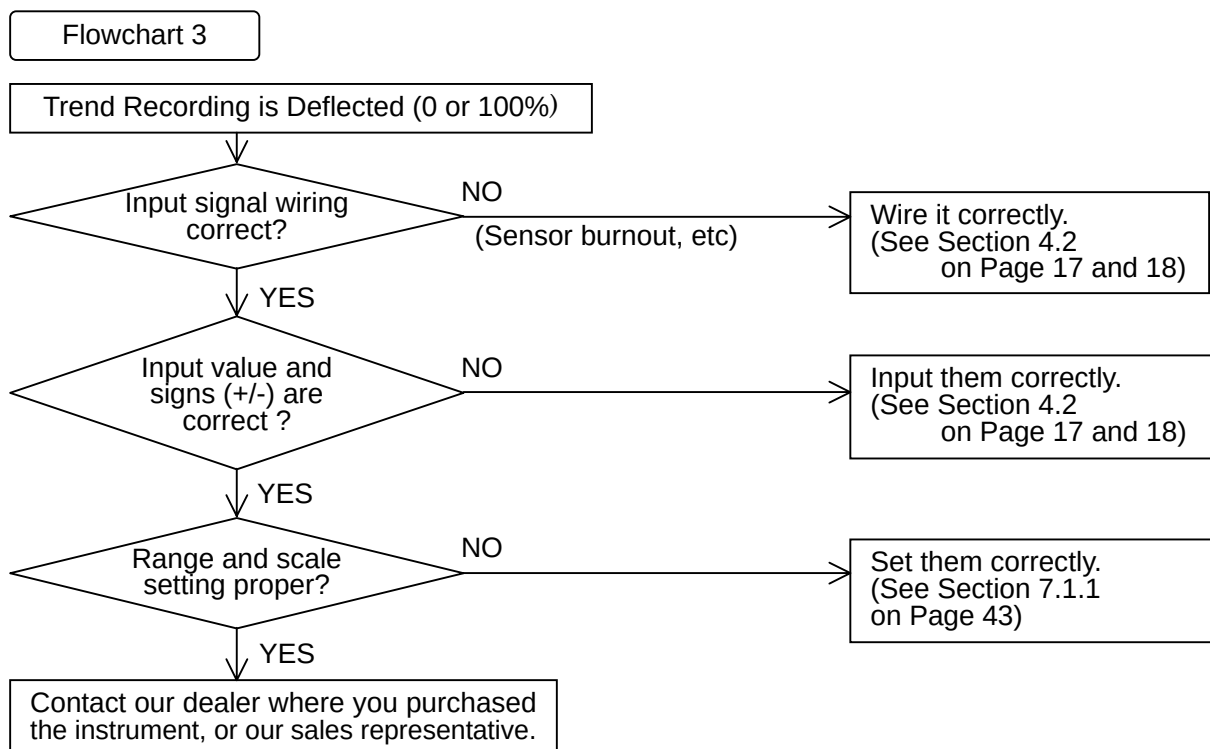
10.1.2 When the Recorder does not Work at all



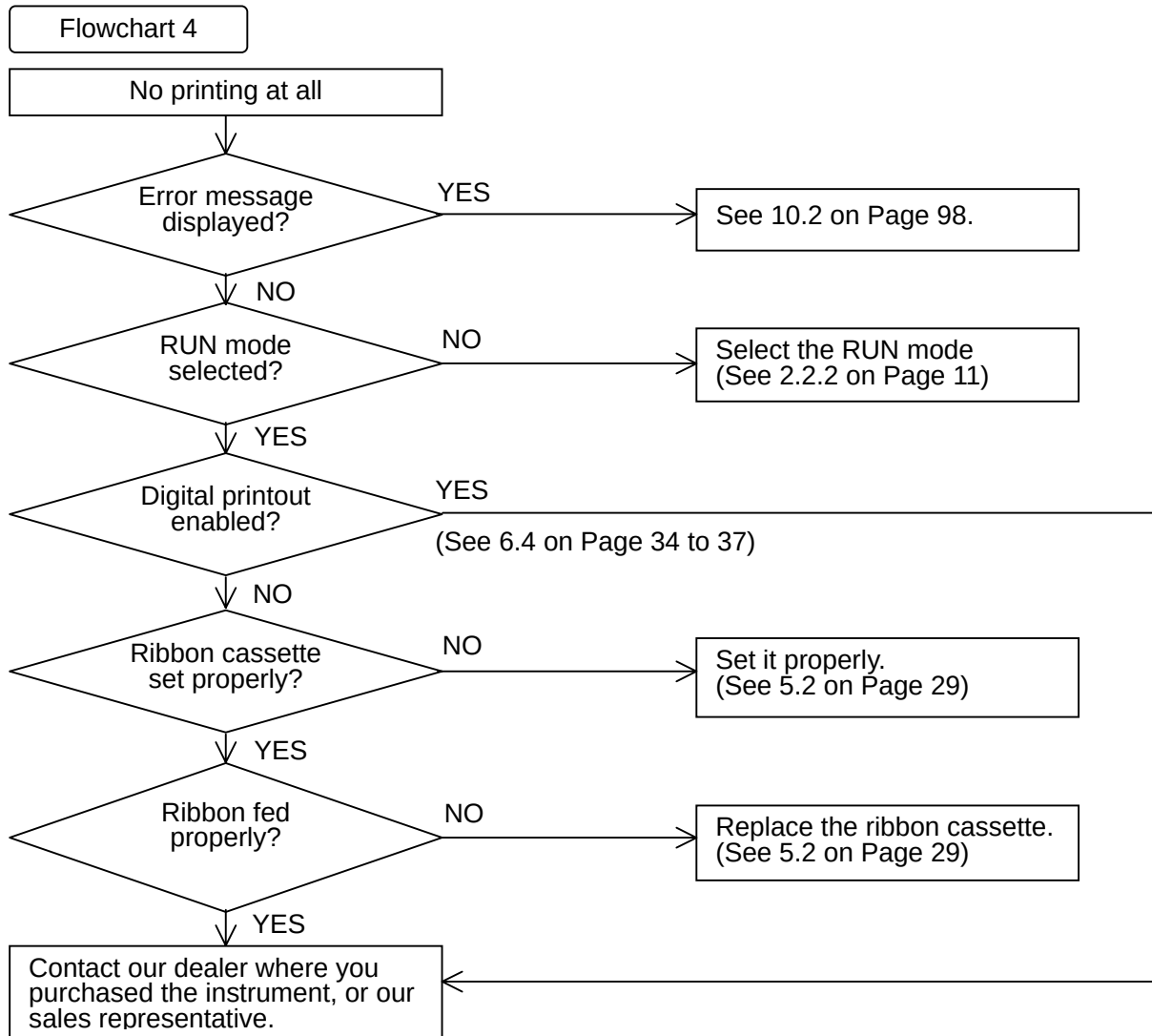
10.1.3 When there is a Major Error



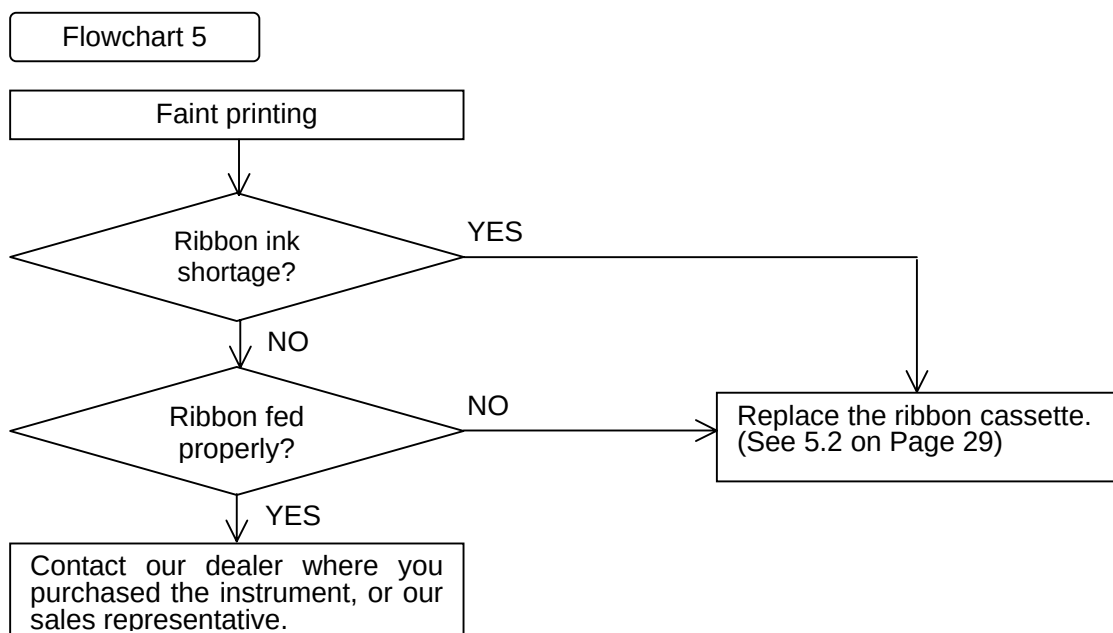
10.1.4 When the Trend Recording is deflected



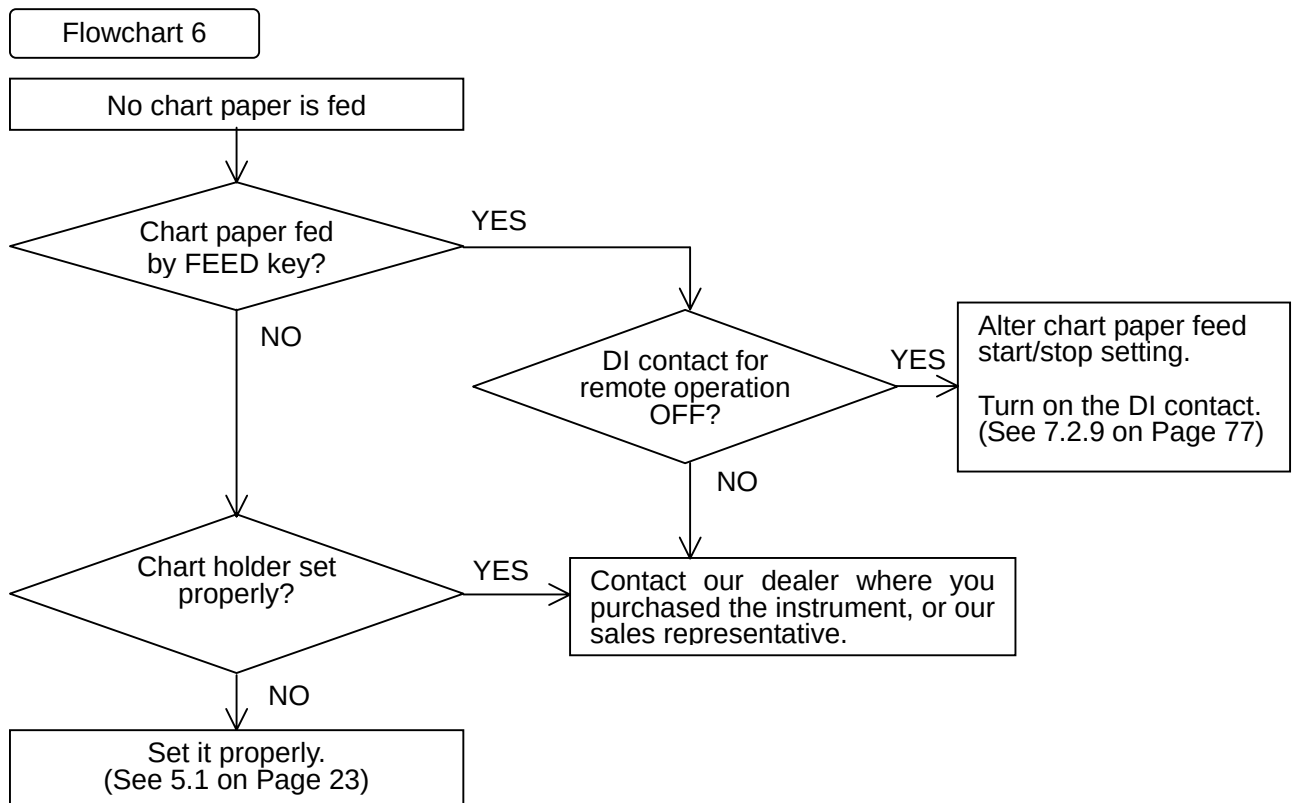
10.1.5 When nothing is recorded



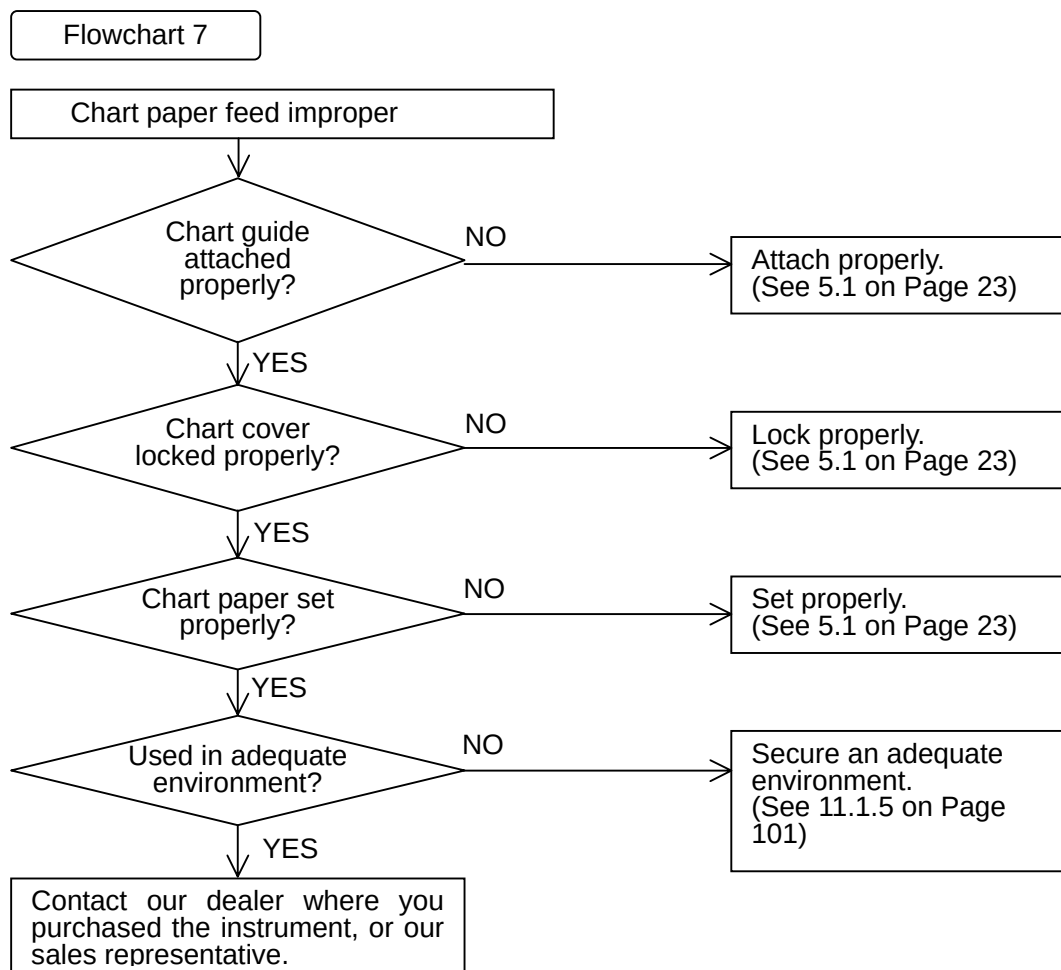
10.1.6 When Printing is Faint



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 Diagnosis Function (ERROR)

This instrument always diagnoses itself on the items listed in the Table 10.2.1 below. When an error is found after self diagnosis, a relevant error number is displayed.

10.2.1 Self diagnosis Items

Table 10.2.1 List of Diagnosis Items

Type	Error message	Part	Diagnosis	Remedy
Hard ware error	EErr01	Zero point sensor	Zero point position of servomotor cannot be detected.	Contact our dealer where you purchased the instrument or our sales representative.
	EErr02	ADC	AD conversion end error, Initialization error	
	EErr03	IC for clock	The clock battery is used up [Note 1]	
	EErr04	WDT	Watchdog timer error	
	EErr05	EEP WRITE	Non-volatile memory Writing error	
	EErr06	EEP READ1	Non-volatile memory Reading error (Setup data)	
	EErr07	EEP READ2	Non-volatile memory Reading error (Engineering data)	
	EErr08	EEP READ3	Non-volatile memory Reading error (ADC Calibration data)	
Operation error	EErr21	Area error	Input value is outside of the setting range.	Set properly
	EErr22	Time error	Clock time setting error	
	EErr23	Setting range error	Setting the channel (CH1) to which sum/difference/average operation cannot be set.	
	EErr24	Area error	Span L $\geq$ Span R	
	EErr25	Area error	Scale L $\geq$ Scale R	
	EErr26	Area error	Zone L $\geq$ Zone R or Zone R–Zone L is less than 5mm.	
	EErr27	Reference channel setting error	The reference channel range of the sum/difference/average operation is not for Volt, TC, RTD and SCALE.	
	EErr28	All channels skip error	Setting all channels to Skip	
Other	EErr41	Calibration value input error	Not calibrated with the specified input.	Calibrate it with a correct input.

[Note 1] The battery life lasts approx.10 years, however, this is subject to the type of environment in which it is used.

10.2.2 Error Display

- When multiple errors occur, their serial error numbers are automatically displayed.
- When an error is recovered, the error display can be canceled by pressing the “REC” key.



CAUTION

While an error is indicated, Auto, Manual and Data/Time are not indicated.

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, PL-II, U, L

RTD : Pt100, JPt100

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

11.1.2 Performance and Characteristics

Digital indication accuracy rating: See 11.2.1

Input impedance: $10M\Omega$ min. in mV, TC input (without burnout)

$200k\Omega$ min. in mV, TC input (with burnout)

$1M\Omega$ min. in voltage input

250Ω in mA input (shunt resistance: external <sold separately: HMSU3081A11>)

Allowable signal source resistance:

$10k\Omega$ max. in mV, TC input (without burnout)

100Ω max. in mV, TC input (with burnout)

$1k\Omega$ max. in Voltage input

10Ω max.(per line) in RTD input

Normal mode reduction ratio : 60dB min.(50/60 $\pm$ 0.1Hz)

Common mode reduction ratio: 140dB min.(50/60 $\pm$ 0.1Hz)

Insulation resistance: 0.5kV DC $20M\Omega$ min. between 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: 200V AC at 50/60 Hz

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

Shock resistance : $2m/s^2$ max.

Clock precision : ± 50 ppm max.

Chart feed accuracy: $\pm 0.1\%$ max.

11.1.3 Structure

Mounting : Panel mounting (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 (Based on IEC529-IP65)

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 11.1.4 Power consumption

	100V AC	Max. power consumption
6-dot recorder	About 25VA	About 30VA

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/s² 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

11.1.6 Alarm Output (Option: LH6)

Number of output : 6 points (Built-in option, normally open)

Alarm type : 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 : 0.5%

Setting accuracy : The same as Digital indication 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: RE6)

A maximum of 3 points can be set.

11.1.9 Paper-empty Detection Function (Option: FL)

Detects the chart paper-empty to output an alarm.

11.2 Standard Specifications

11.2.1 Measurement Range

An arbitrary setup is possible by the front key.

Digital indication accuracy rating is described in Table 11.2.1 below under the Reference operating conditions.

Reference operating conditions: Ambient temperature ; $23 \pm 2^{\circ}\text{C}$

Ambient humidity ; $55 \pm 10\%\text{RH}$

Power source voltage ; 85 to 264Vac

Electric wave frequency ; $50/60\text{Hz} \pm 1\%$

Warming up time ; 30 minutes min.

(The performance in the state where there is no vibration and shock)

Terminal block reference junction compensation accuracy is not included in the digital indication accuracy rating.

Terminal block reference junction compensation accuracy:

B, R, S, Au-Fe, PR40-20 : $\pm 1^{\circ}\text{C}$

K, E, J, T, C, N, PL-II, U, L : $\pm 0.5^{\circ}\text{C}$

Table 11.2.1 Measurement Range

Type	Range	Measurement range	Measurement		
			Indication (Digital)		Recording (Analog)
			Accuracy	Max. resolution	Accuracy
DC voltage DC current Input		-10 to 10mV	$\pm (0.2\% \text{ of rdg} + 3\text{digits})$	10 0 μV	
		0 to 20mV	$\pm (0.2\% \text{ of rdg} + 3\text{digits})$	10 0 μV	
		0 to 50mV	$\pm (0.2\% \text{ of rdg} + 2\text{digits})$	10 0 μV	
		-200 to 200mV	$\pm (0.2\% \text{ of rdg} + 3\text{digits})$	100 0 μV	
		-1 to 1V	$\pm (0.1\% \text{ of rdg} + 3\text{digits})$	1mV	
		0 to 5V	$\pm (0.2\% \text{ of rdg} + 2\text{digits})$	1mV	
		-10 to 10V	$\pm (0.3\% \text{ of rdg} + 3\text{digits})$	10mV	
		4 to 20mA	$\pm (0.2\% \text{ of rdg} + 2\text{digits})$	0.01mA	
Thermocouple	B	0.0 to 1820.0 $^{\circ}\text{C}$	$\pm (0.15\% \text{ of rdg} + 1^{\circ}\text{C})$ 400 to 600 $^{\circ}\text{C}$, $\pm 2^{\circ}\text{C}$ Accuracy is not guaranteed within a range of 0 to less than 400 $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}/0.18^{\circ}\text{F}$	Digital indication accuracy $\pm (0.3\% \text{ of span})$
		32.0 to 3308.0 $^{\circ}\text{F}$	$\pm (0.15\% \text{ of rdg} + 1.8^{\circ}\text{F})$ 752 to 1112 $^{\circ}\text{F}$, $\pm 3.6^{\circ}\text{F}$ Accuracy is not guaranteed within a range of 32 to less than 752 $^{\circ}\text{F}$		
	R1	0.0 to 1760.0 $^{\circ}\text{C}$	$\pm (0.15\% \text{ of rdg} + 1^{\circ}\text{C})$ However, 0 to 100 $^{\circ}\text{C}$, $\pm 3.7^{\circ}\text{C}$ 100 to 300 $^{\circ}\text{C}$, $\pm 1.5^{\circ}\text{C}$		
		32.0 to 3200.0 $^{\circ}\text{F}$	$\pm (0.15\% \text{ of rdg} + 1.8^{\circ}\text{F})$ However, 32 to 212 $^{\circ}\text{F}$, $\pm 6.7^{\circ}\text{F}$ 212 to 572 $^{\circ}\text{F}$, $\pm 2.7^{\circ}\text{F}$		

Type	Range	Measurement range	Measurement		
			Indication (Digital)		Recording (Analog)
			Accuracy	Max. resolution	Accuracy
Thermocouple	R2	0.0 to 1200.0°C	±(0.15% of rdg + 0.8°C) However, 0 to 100°C, ±3.7°C 100 to 300°C, ±1.5°C	0.1°C/0.18°F	Digital indication accuracy ±(0.3% of span)
		32.0 to 2192.0°F	±(0.15% of rdg + 1.44°F) However, 32 to 212°F, ±6.7°F 212 to 572°F, ±2.7°F		
	S	0.0 to 1760.0°C	±(0.15% of rdg + 1°C) However, 0 to 100°C, ±3.7°C 100 to 300°C, ±1.5°C		
		32.0 to 3200.0°F	±(0.15% of rdg + 1.8°F) However, 32 to 212°F, ±6.7°F 212 to 572°F, ±2.7°F		
	K1	-200.0 to 1370.0°C	±(0.15% of rdg + 0.7°C) However, -200 to -100°C, ±(0.15% of rdg + 1°C)		
		-328.0 to 2498.0°F	±(0.15% of rdg + 1.3°F) However, -328 to -148°F, ±(0.15% of rdg + 1.8°F)		
	K2	-200.0 to 600.0°C	±(0.15% of rdg + 0.4°C) However, -200 to -100°C, ±(0.15% of rdg + 1°C)		
		-328.0 to 1112.0°F	±(0.15% of rdg + 0.7°F) However, -328 to -148°F, ±(0.15% of rdg + 1.8°F)		
	K3	-200.0 to 300.0°C	±(0.15% of rdg + 0.3°C) However, -200 to -100°C, ±(0.15% of rdg + 1°C)		
		-328.0 to 572.0°F	±(0.15% of rdg + 0.5°F) However, -328 to -148°F, ±(0.15% of rdg + 1.8°F)		
	E1	-200.0 to 800.0°C	±(0.15% of rdg + 0.5°C)		
		-328.0 to 1472.0°F	±(0.15% of rdg + 0.9°F)		
	E2	-200.0 to 300.0°C	±(0.15% of rdg + 0.4°C)		
		-328.0 to 572.0°F	±(0.15% of rdg + 0.7°F)		
	E3	-200.0 to 150.0°C	±(0.15% of rdg + 0.3°C)		
		-328.0 to 302.0°F	±(0.15% of rdg + 0.5°F)		
	J1	-200.0 to 1100.0°C	±(0.15% of rdg + 0.5°C) However, -200 to -100°C, ±(0.15% of rdg + 0.7°C)		
		-328.0 to 2012.0°F	±(0.15% of rdg + 0.9°F) However, -328 to -148°F, ±(0.15% of rdg + 1.3°F)		
	J2	-200.0 to 400.0°C	±(0.15% of rdg + 0.4°C) However, -200 to -100°C, ±(0.15% of rdg + 0.7°C)		
		-328.0 to 752.0°F	±(0.15% of rdg + 0.7°F) However, -328 to -148°F, ±(0.15% of rdg + 1.3°F)		
	J3	-200.0 to 200.0°C	±(0.15% of rdg + 0.3°C) However, -200 to -100°C, ±(0.15% of rdg + 0.7°C)		
		-328.0 to 392.0°F	±(0.15% of rdg + 0.5°F) However, -328 to -148°F, ±(0.15% of rdg + 1.3°F)		

Type	Range	Measurement range	Measurement		
			Indication (Digital)		Recording (Analog)
			Accuracy	Max. resolution	Accuracy
Thermocouple	T1	-200.0 to 400.0°C	±(0.15% of rdg + 0.5°C) However, -200 to -100°C, ±(0.15% of rdg + 0.7°C)	0.1°C/0.18°F	Digital indication accuracy ± (0.3% of span)
		-328.0 to 752.0°F	±(0.15% of rdg + 0.9°F) However, -328 to -148°F, ±(0.15% of rdg + 1.3°F)		
	T2	-200.0 to 200.0°C	±(0.15% of rdg + 0.4°C) However, -200 to -100°C, ±(0.15% of rdg + 0.7°C)		
		-328.0 to 392.0°F	±(0.15% of rdg + 0.7°F) However, -328 to -148°F, ±(0.15% of rdg + 1.3°F)		
	C	0.0 to 2320.0°C	±(0.15% of rdg + 1°C)		
		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) However, 1 to 20 K, ±2.4 K	0.1K	
	N	0.0 to 1300.0°C	±(0.15% of rdg + 0.7°C)	0.1°C/0.18°F	
		32.0 to 2372.0°F	±(0.15% of rdg + 1.3°F)		
	PR40-20	0.0 to 1880.0°C	±(0.15% of rdg + 1°C) However, 0 to 300°C, ±37.6°C 300 to 800°C, ±18.8°C		
		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°C	±(0.15% of rdg + 0.7°C)		
		32.0 to 2534.0°F	±(0.15% of rdg + 1.3°F)		
	U	-200.0 to 400.0°C	±(0.15% of rdg + 0.5°C) However, -200 to -100°C, ±(0.15% of rdg + 0.7°C)		
		-328.0 to 752.0°F	±(0.15% of rdg + 0.9°F) However, -328 to -148°F, ±(0.15% of rdg + 1.3°F)		
	L	-200.0 to 900.0°C	±(0.15% of rdg + 0.5°C) However, -200 to -100°C, ±(0.15% of rdg + 0.7°C)		
		-328.0 to 1652.0°F	±(0.15% of rdg + 0.9°F) However, -328 to -148°F, ±(0.15% of rdg + 1.3°F)		
Resistance temperature detector	Pt100-1	-200.0 to 650.0°C	±(0.15% of rdg + 0.3°C)		
		-328.0 to 1202.0°F	±(0.15% of rdg + 0.6°F)		
	Pt100-2	-200.0 to 200.0°C	±(0.15% of rdg + 0.2°C)		
		-328.0 to 392.0°F	±(0.15% of rdg + 0.4°F)		
	JPt100-1	-200.0 to 630.0°C	±(0.15% of rdg + 0.3°C)		
		-328.0 to 1166.0°F	±(0.15% of rdg + 0.6°F)		
JPt100-2	-200.0 to 200.0°C	±(0.15% of rdg + 0.2°C)			
	-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 shown as the following formula.

Scaling accuracy (digits) = $\pm$ (Range accuracy rating (digits) x Scaling factor + 2 digits)

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

Example 1) When VOLT range is -1.000 to 1.000V and Scaling range is 0.00 to 100.00 .

Range accuracy rating = $0.1\% \times 1.000\text{V} + 3$ digits

(Input $+1.000\text{V}$) = 4 digits

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

Therefore, Scaling accuracy = $\pm(4 \times 5 + 2)$
= ± 22 digits

Analog recording accuracy = $\pm \left[4 + \{1000 - (-1000)\} \times \frac{0.3}{100} \right]$
= ± 10 digits
= $\pm 0.01\text{V}$

Example 2) When Type K is 0.0 to 200.0°C and Scaling is 0.00 to 200.00 .

Range accuracy rating = $0.15\% \times 200.0 + 0.3^\circ\text{C}$

(Input 200°C) = 0.6°C

= 6 digits

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

Therefore, Scaling accuracy = $\pm(6 \times 10 + 2)$
= ± 62 digits
= $\pm 0.62^\circ\text{C}$

(2) Square root computation

The square root computation is shown as the following formula.

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

Display value accuracy rating: $\mathcal{E}$

Process variable accuracy: e

Process variable: x (convert into %)

Display value = $10 \sqrt{x \pm e} \approx \sqrt{10} \times \pm \frac{10e}{2\sqrt{x}}$

Therefore, Display value accuracy $\mathcal{E} = \frac{5e}{\sqrt{x}}$

For input 4 to 20mA, the square root computation accuracy $\mathcal{E}$ is as the following formula.

$$\begin{aligned} \text{Measuring 100\% } \mathcal{E}_{100} &= \frac{5e}{\sqrt{100}} = \frac{5(0.2+0.125)}{10} = 0.16\% \text{ rdg} \\ \text{Measuring 50\% } \mathcal{E}_{50} &= \frac{5e}{\sqrt{50}} = \frac{5(0.1+0.167)}{7.07} = 0.19\% \text{ rdg} \\ \text{Measuring 9\% } \mathcal{E}_9 &= \frac{5e}{\sqrt{9}} = \frac{5(0.018+1.39)}{3} = 2.3\% \text{ rdg} \\ \text{Measuring 1\% } \mathcal{E}_1 &= \frac{5e}{\sqrt{1}} = 5(0.002 + 12.5) = 62.5\% \text{ rdg} \end{aligned}$$

If the process variable is low, as above, its accuracy rating is not valid.

(3) Decade

The accuracy rating at the decade computation is defined as the logarithm of display value. Under normal operating conditions, the accuracy rating is less than 1 digit, and it cannot be read.

(4) Difference, Sum and Average

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

Difference and Sum : Reference channel accuracy rating $\times 2$

Average : Reference channel accuracy rating

Example) When Reference channel VOLT is 00.00 to 10.00V and Difference is -10.00 to 10.00.

$$\begin{aligned} \text{Reference channel accuracy rating} &= \pm(0.3\% \times 10.00\text{V} + 3 \text{ digits}) \\ &= \pm(1000 \times 0.003 + 3) \\ &= \pm 6 \text{ digits} \end{aligned}$$

$$\text{Difference accuracy rating} = \pm 6 \times 2 = \pm 12 \text{ digits}$$

11.2.3 Individual Specifications

Table 11.2.3 Specification Items

Block	Item	Specification
Input	Measuring Point	6
	Input Sampling	10s/6CH
	Display Interval	2.5s
Record & Printer	Recording Form	Wire dot (6-color ink ribbon)
	Printing Form	
	Recording Width	100mm
	Print Period	10s/6CH [Note 1]
	Chart paper	Length: 16m, Width: 114mm, Folding width: 40mm The length of the Clean Chart is 12m.
	Chart feed speed	0, 1, 2, 3, 4, 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, 1500mm/h (Analog recording will not be performed when the chart feed speed is set to 0mm/h.)
	Recording color	No.1(Purple), No.2(Red), No.3(Green), No.4(Blue), No.5(Brown), No.6(Black) [Note 2]
	Printing color	Purple, Red, Green, Blue, Brown, Black
Weight		1.5kg max.
Power consumption		25VA max. (at 100V AC)

[Note 1] Select the Dot Point Interval from 10, 20, 30 and 60 seconds depending on the setting.

[Note 2] Changeable to the arbitrary color.

11.2.4 Standard Functions

Table 11.2.4 Standard Functions

Item	Description
Analog indication	None
Analog recording	Analog recording with 6-color dot.
Engineering unit indication	None
Digital indication	Indicates Channel No., Process variable, Chart feed speed, Alarm setting value on the display.
Logging print	Prints Date, Time, Scaling, Chart feed speed, Process variable and Engineering unit at a programmed interval. Synchronous print/Asynchronous print can be selected depending on the setting.
List print	Prints Chart feed 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, Alarm function, Logging print ON/OFF, Reference time, Interval, Scaling print ON/OFF, Logging print Sync./Async., Alarm hysteresis, Burnout, DI function(Optional)
Affix print	Prints Channel number near the analog record.
Manual print	Prints Measurement result by key input. Analog recording pauses.
Dot print skip	Skips recording of an unused channel.
Programming	Programs Chart feed speed, Alarm setting value, Logging, Dot point skip, Date and Time by key operation.
Memory backup	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 levels.
Chart feed speed	Selects Chart feed speed from 34 types.
Clock indication	Indicates Year, Month, Day, Hour and Minute. Sets the year in A.D, and adjusts leap year automatically.
Self diagnosis	When malfunctions occur, "E Err * *" is indicated. (* *: Type of error)
Scaling	Indicates and records the input of a signal 4 to 20mA, etc. by converting it into the engineering scales.

11.3 Standard Setting Functions

11.3.1 Standard Setting Functions

Table 11.3.1 Standard Setting Functions

Function	Description
Burnout	To deflect over toward 100% with disconnecting input. Every channel's burnout can be specified. (DC voltage of $\pm 50\text{mV}$ max., TC input)
Tag Number	Sets a tag number by up to 7 figures per channel. (Prints at a logging print)
Reference Junction Compensation	Specifies an inside/outside of the Reference Junction Compensation.
Copy Function	Copies a channel setting.
Input offset	Sets the input offset per channel.
Zone Recording (Track Recording)	Specifies a recording area per channel to separate the record into Tracks.
Partial compression/expansion	Records Partial Compression/Expansion to 1-crease line per channel.
Decade Recording Indication	Records and indicates by up to 5 decades. 2 digits are effective for indication and print.
Alarm Print	Prints Occurrence time, Occurrence channel, Alarm setting No. and Alarm type in red when an alarm occurs.
Alarm Recovery Print	Prints Recovery time, Recovery channel, Setting No. and Alarm type in purple when alarm recovers.
Computation	Computes Square root.
Interchannel Computation	Computes Sum, Difference and Average values between channels.
Alarm Hysteresis Width	Sets an alarm hysteresis width to 0% FS or 0.5% FS.

11.4 Optional Functions

11.4.1 Remote Function of DI

Function	Description
Chart Feed Start/Stop	ON: Start, OFF: Stop
Changing Chart feed Speed	ON: 1st, OFF: 2nd
Comment Print (Sync./Async.)	ON: Comment Print
Manual Print (Sync./Async.)	ON: Manual Print
Date and Time Print (Sync./Async.)	ON: Date and Time Print

11.4.2 Alarm Output function

6 relays

11.4.3 Communication unit

RS-232C (Standard)

RS-485 (Optional)

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