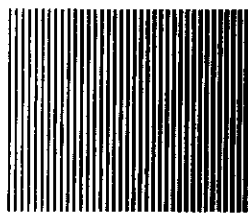


No. INE-159



ES600 Series

60mm CHART MINI-RECORDER



INSTRUCTIONS

CHINO

Thank you for your purchase of ES600 series Minirecorder.

Please read this instruction manual in advance so as to prevent troubles beforehand and fully utilize the functions of this instrument.

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Cautions

- (1) For the contents of this manual, alteration is reserved without notice.
- (2) This manual has been prepared while making assurance doubly sure about its contents. However, if any question has arisen or if an error or an omission was found, please contact your nearest CHINO's sales shop or agent.
- (3) CHINO CORP. will not be responsible for any effects of the operation results of this instrument, irrespective of the description in item (2).

1. INTRODUCTION

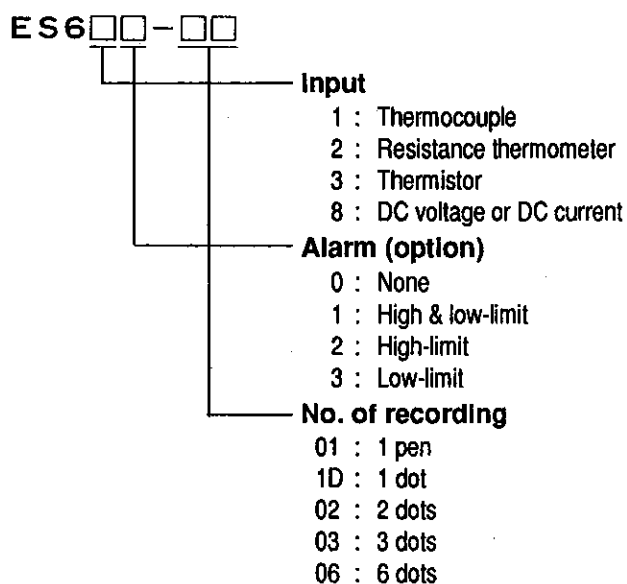
1-1 ES Series

This small recorder having a 60mm wide chart offers a highly reliable servo system, a fan-fold chart ensuring easy recording control, and other functions which are equivalent to those of large recorders.

- It comprises two types. One is a dot printing type of 1 ~ 6 dots, while the other is a 1-pen type using a cartridge pen.
- It can also offer an alarm function common to all points as an option.

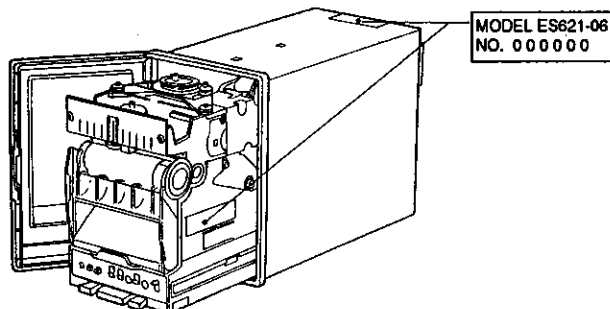
1-2 Model and Code Check

Certain operations differ according to the models (input signals). Check your ordering model and the model of the delivered product.



Reference 1 Model · Manufacturing nameplate

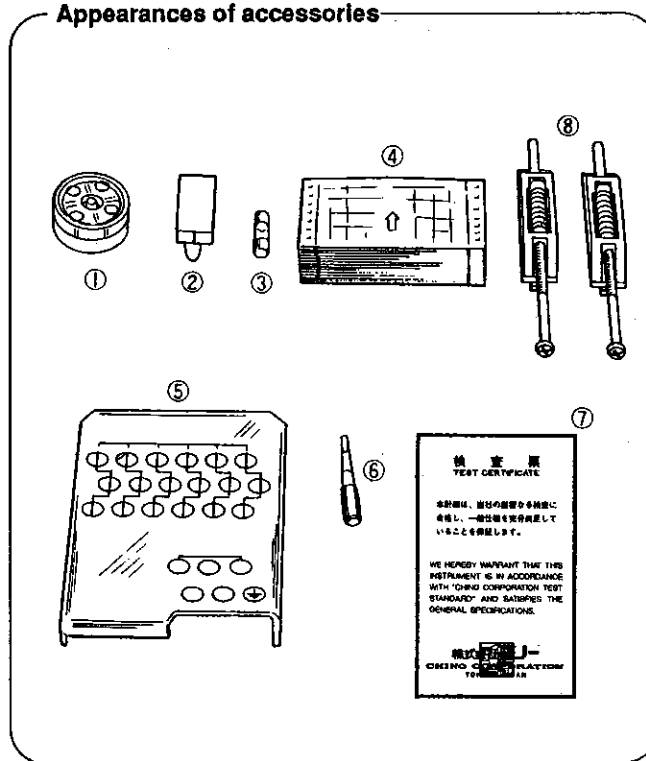
This nameplate is mounted on the upper face of the case and the right side panel of the chassis.



1-3 Accessories

Name	Q'ty	Remarks
① Ink pad case	1 pc.	For dot-printing type
② Cartridge pen	1 pc.	For pen-writing type
③ Fuse	1 pc.	1A
④ Chart paper	1 pad	
⑤ Terminal cover	1 pc.	
⑥ Setting tool	1 pc.	Resin (-) screwdriver
⑦ Test certificate	1 sheet	
⑧ Mounting bracket	2 pcs.	For panel-mounting
Instruction manual	1 copy	

Appearances of accessories



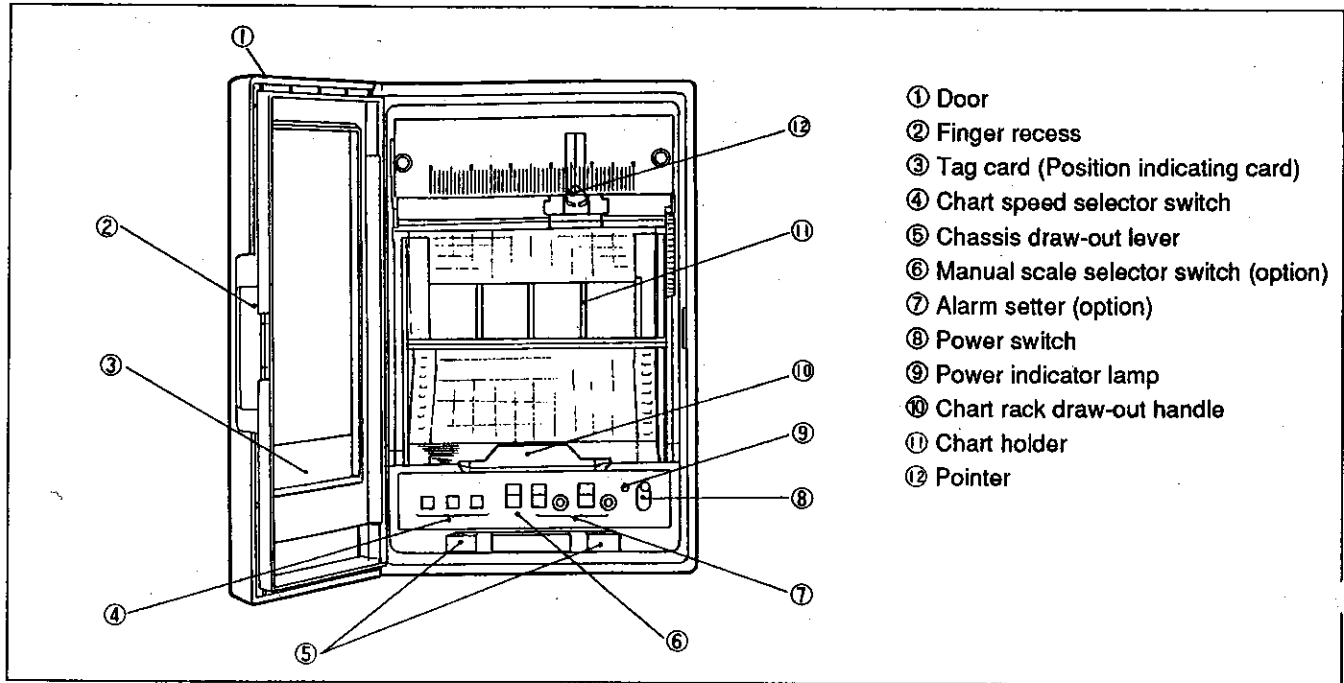
1-4 Consumables

You are requested to prepare the following consumables at all times.

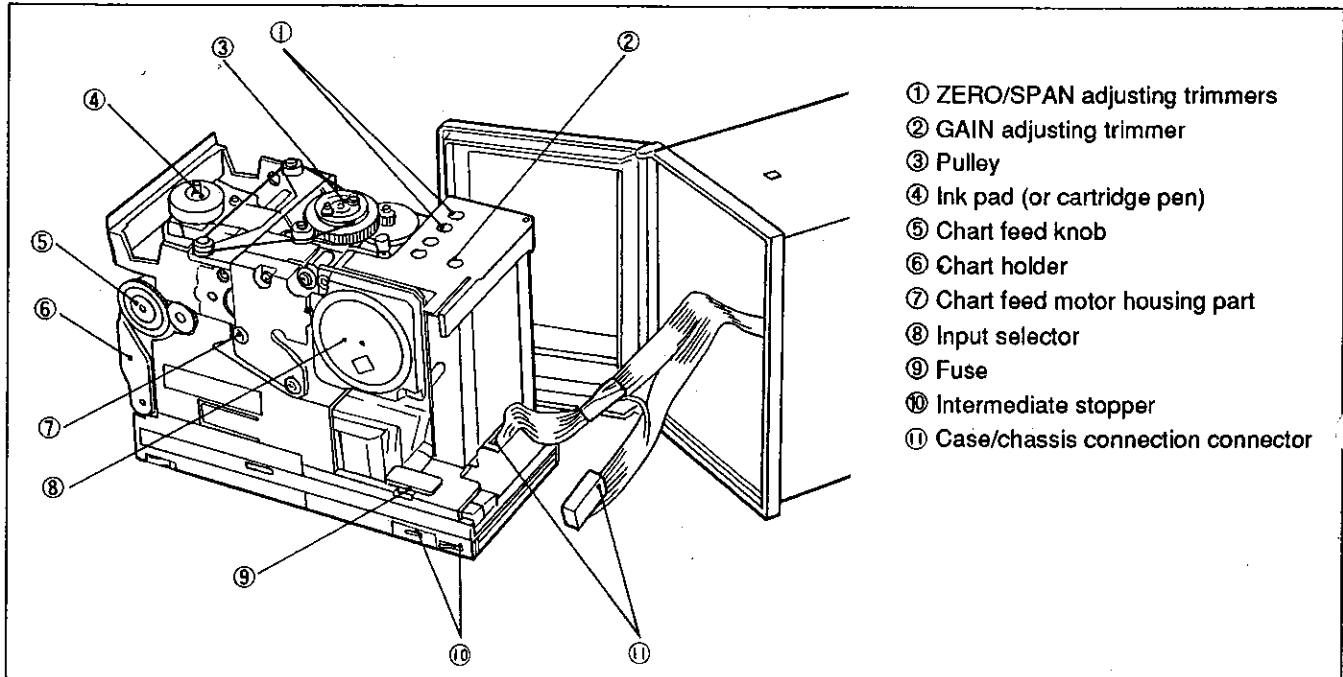
Name	Type	Handling unit	Article name for ordering
① Pad case	4 types for 1,2,3, and 6 dots	1 box containing 5 cases	ES600 PAD□P □ --- 1 : For 1 dot, 2 : For 2 dots, 3 : For 3 dots, 6 : For 6 dots
② Cartridge pen	For 1 pen	1 box containing 5 caess	ES600 PEN
③ Chart paper		1 box containing 15 pads	Specify chart No. entered on the right side of your chart employed.

2. NAMES OF COMPONENT PARTS

2-1 Front View



2-2 Chassis



(1) How to open the door

The door can be opened by drawing it toward you after hooking your finger to the finger recess.

(2) How to draw out the chassis

The chassis can be drawn out by pulling it toward you after gripping the chassis draw-out lever mounted at the lower part of the chassis.

(3) How to remove the cases out of the chassis

The chassis is not removed from the case usually. For drawing the chassis out of the case for maintenance or other purposes, draw it out of the case toward you while pressing the intermediate stopper at the lower part on the right side panel of the chassis by means of a finger. The chassis and case can be separated from each other by unlocking the connector locks of two case/chassis connection connectors (or the case/chassis connection connector in case of 1-pen type).

3. MOUNTING METHOD

For mounting this instrument onto an instrument panel, observe the following procedure.

3-1 Mounting Place

1 Ambient temperature and ambient humidity

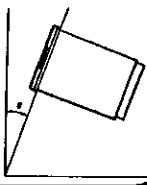
Temperature range : $-10^{\circ} \sim 50^{\circ}\text{C}$
 Humidity range : 30 ~ 90% RH
 A place where the temperature and humidity are stable within the above ranges.

2 Environment

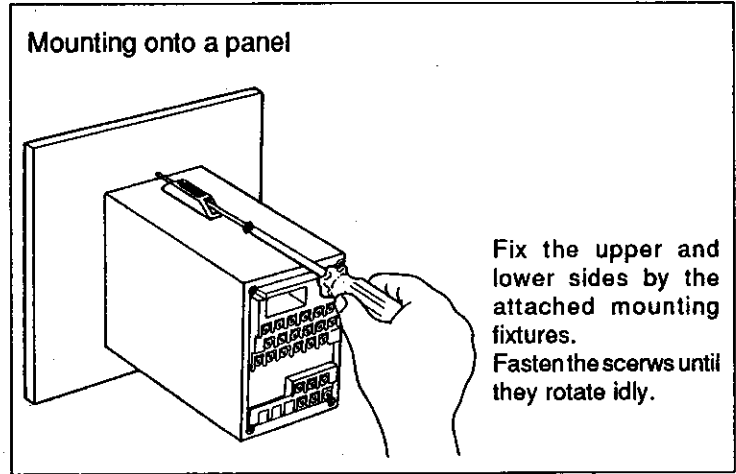
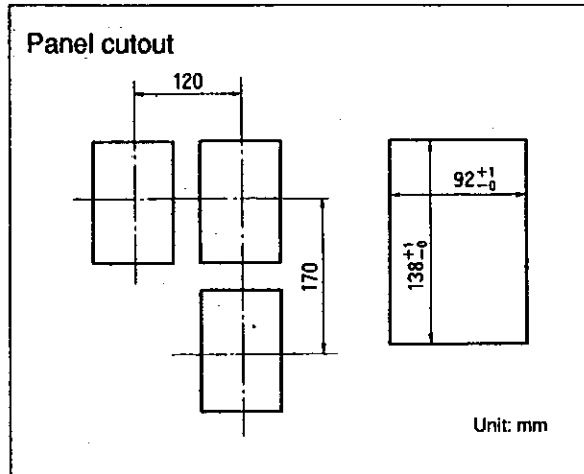
Don't mount the instrument in the following environments.
 1. A dusty place
 2. A corrosive gas atmosphere
 3. A place subjected to vibrations or shocks.

3 Tilted mounting

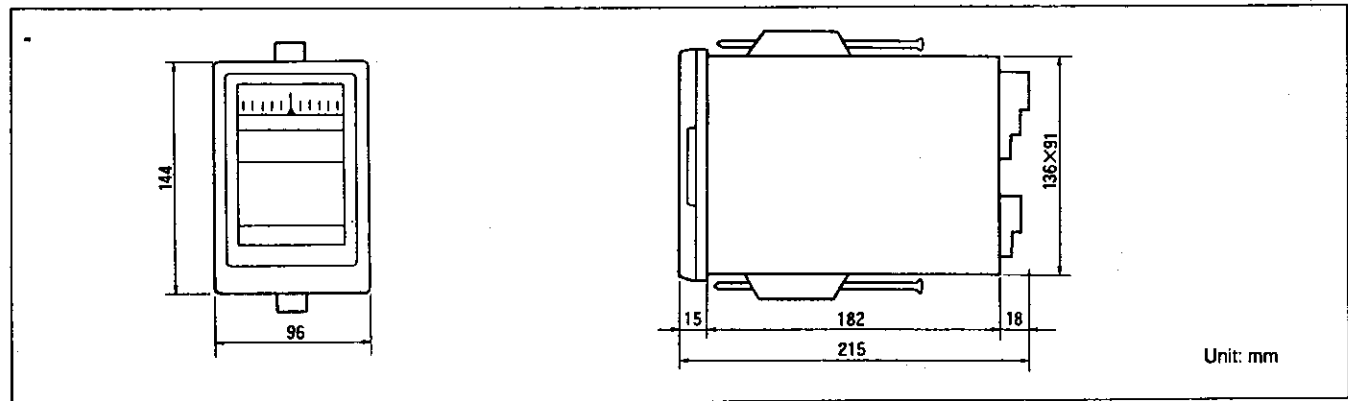
Forward tilting : 0°
 Backward tilting : $0^{\circ} \sim 20^{\circ}$
 A tilted mounting condition other than specified above will affect the recording operation unfavorably.
 $\theta = 20^{\circ}$ or less



3-2 Panel-mounting



3-3 External Dimensions



Reference 1 Weight

About 1.7kg

Reference 2 Power consumption

About 7VA

4. WIRING

4-1 Cautions on Connections

1 Strong power circuit

Don't connect the input signal cable near a strong power circuit or a powerful noise generating place. Separate the input signal cable at least 30cm from a strong power circuit when it is connected in parallel with the strong power circuit.

2 Power voltage fluctuation

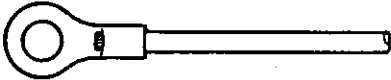
Obtain an instrument power supply from a power source which is free of voltage fluctuations and waveform distortions.

3 Soldering or fastening of terminals

Solder or fasten each terminal securely.

4 Wiring materials

① Terminate the wiring cable with a circular crimp style terminal (for M4), in principle.



② Utilize a compensating wire conforming to the type in case of thermocouple inputs.

③ Be careful since a dispersion of the resistance values of three cables between the instrument and the sensor causes a measuring error in case of resistance thermometer inputs. (same cable diameter and the same length)

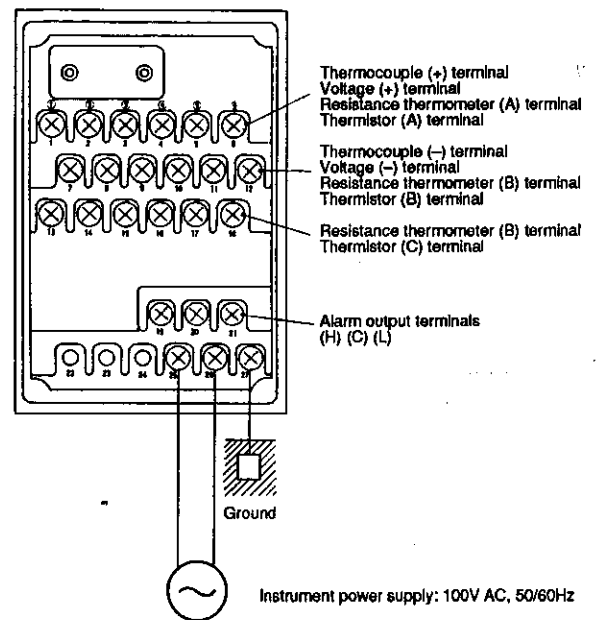
5 Resistance thermometer element

Use a resistance thermometer element of Pt100Ω 3-wire type having a specified current of 5mA.

4-2 Connections of Input Terminals

Input terminal connections differ according to the measuring systems. Connect the input terminals to meet the detection terminals.

Measuring system	Terminal name
Thermocouple input (ES610)	Thermocouple terminals (+)(-)
DC voltage input (ES680)	Voltage terminals (+)(-)
Resistance thermometer input (ES620)	Resistance thermometer terminals (A)(B)(B)
Thermistor input (ES630)	Thermistor terminals (A)(B)(C)



Instrument power supply: 100V AC, 50/60Hz

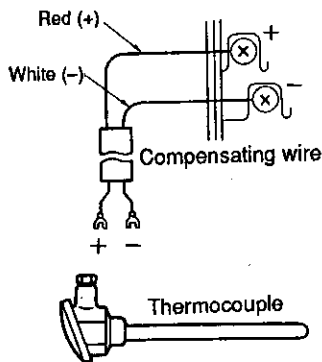
4-3 Connections of Power Terminals and Ground Terminal

Connect the power terminals and ground terminal as illustrated below.

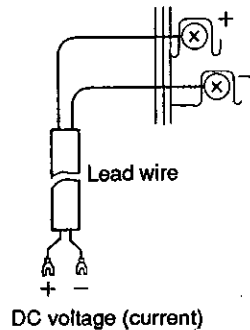
Connect the ground terminal to the ground securely.

An example of the connections of Input terminals

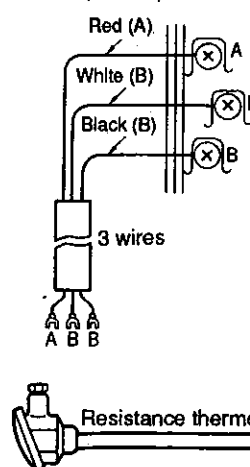
Thermocouple input (ES610)



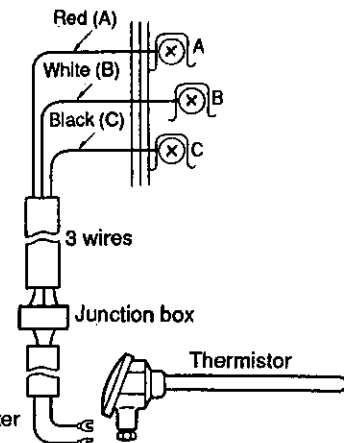
DC voltage (current) input (ES680)



Resistance thermometer Input (ES620)





Thermistor input (ES630)



4-4 Connections of Alarm Terminals (option)

An no-voltage on-off contact signal is output to alarm output terminals (H) (C) (L).
The following table shows the output conditions. Connect an alarm lamp or an alarm buzzer as required.

Output conditions under the measuring conditions of high-limit, low-limit, and high/low-limit alarms

Pointer conditions Alarm type	Low-limit setting	High-limit setting	Low-limit setting	High-limit setting	Low-limit setting	High-limit setting	When power supply OFF	● Operating conditions of internal relay  Relay OFF condition  Relay ON condition
	Measured value		Measured value		Measured value			
Low-limit alarm							A contact output appears L(21) and C(20) when a measured value is lower than a set value. A contact output appears across C and H when power is turned OFF.	
High-limit alarm							A contact output appears across C and H when a measured value is higher than a set value. A contact output appears across C and L when power is turned OFF.	
High & low-limit alarm							A contact output appears across C and H or across C and L when a measured value is higher than or lower than a set value. Terminals C-L and C-H are open when power is turned OFF.	

Reference 1 Alarm setting

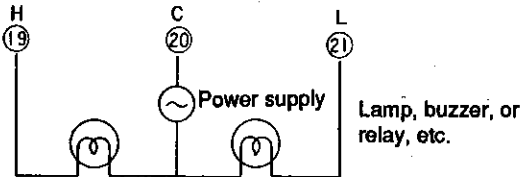
All alarm points are set and output in common. For details of the setting method and check, refer to page 8.

Reference 2 Alarm output

Since all alarm points are output in common, the internal relay turns on the output a contact signal when an alarm occurs at one of these alarm points. However, this signal is not held, but output during measurement.

Reference 3 Wiring example

Connect an alarm lamp or an alarm buzzer as shown below for operating it when an alarm occurs.



Reference 4 Contact capacity

100V AC 0.5A (Resistive load)

200V AC 0.2A (")

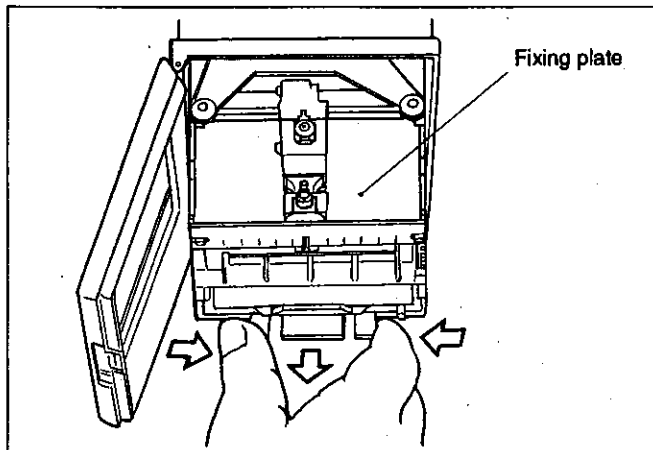
Use an auxiliary relay or the like, if the above contact capacity is not enough.

5. INSTALLATION OF CONSUMABLES

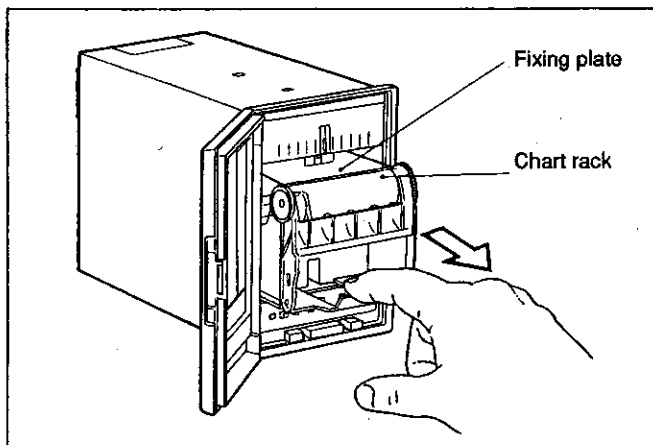
5-1 Preparation

How to remove the recording mechanism fixing plate during transportation

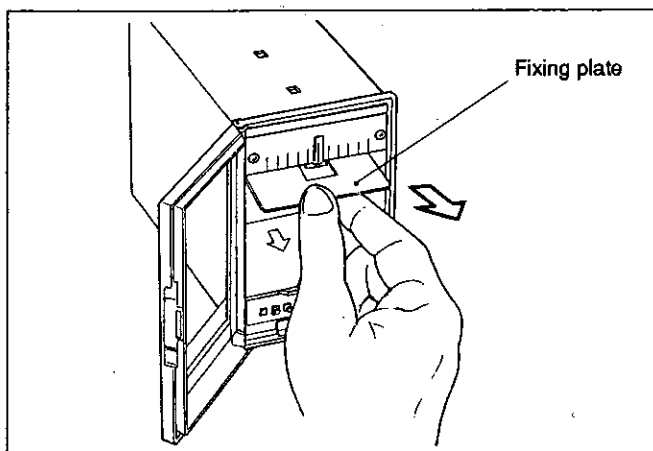
- ① After opening the front door, draw out the chassis, and the fixing plate is seen.



- ② Remove the chart rack.



- ③ Remove the fixing plate by drawing it out toward you. Reset the chart rack as before.



5-2 Mounting of Ink Pad Case

- ① Take the ink pad case out of the accessories box. The ink pad case is previously colored with the following ink.

Type	Recording dot No. and dotting color					
1-dot printing type	Red					
2-dot printing type	① Red	② Blue				
3-dot printing type	① Red	② Blue	③ Green			
6-dot printing type	① Red	② Blue	③ Green			
	④ Violet	⑤ Purple	⑥ Brown			

Caution The ink pad case is expendable.

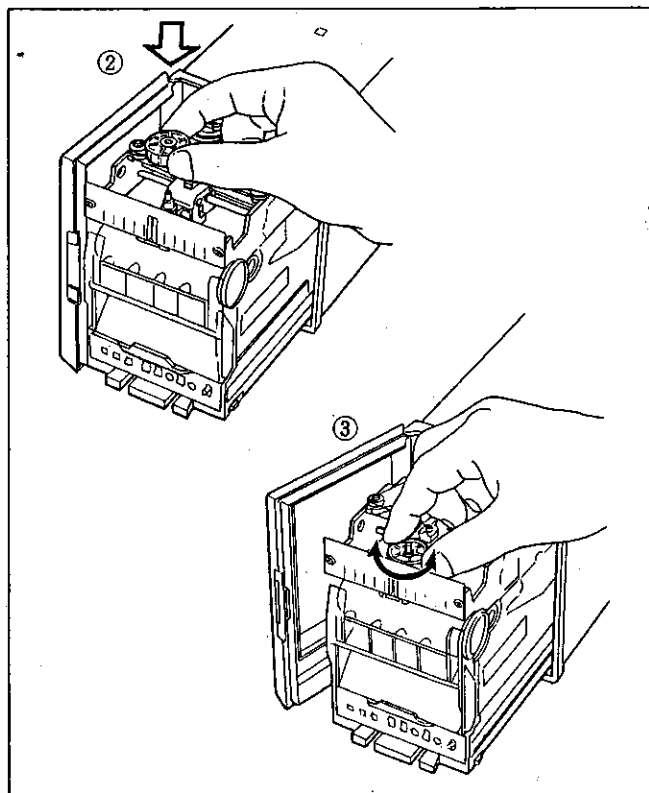
Don't supply any ink additionally, otherwise an ink drop will cause a trouble. Replace the pad case with new one when the ink color has become light.

The ink consumption degree depends upon the working conditions.

The pad case will be employable for about 1.5 months in continuous recording.

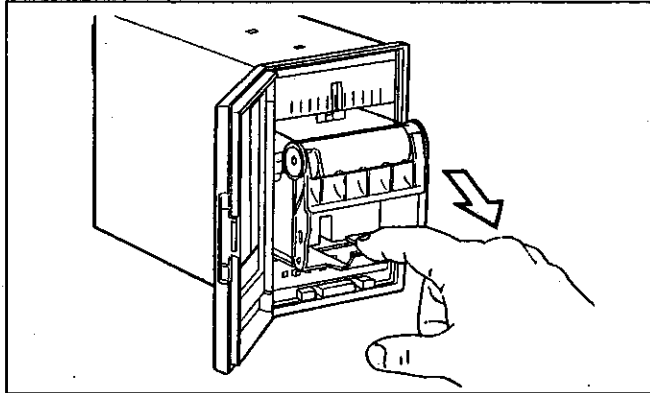
- ② Draw out the chassis about 10cm, and insert the pad case onto the pad shaft of the recording mechanism.

- ③ By turning the pad case by finger, the pad case drops at the position where the convexed part meets the convexed part. Now, the pad case has been mounted.

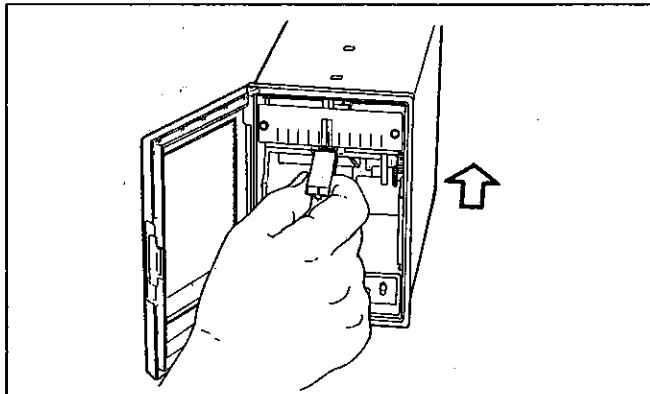


5-3 Mounting of Cartridge Pen

- ① Take the cartridge pen out of the accessory box.
- ② Draw the chart rack out of the main unit.

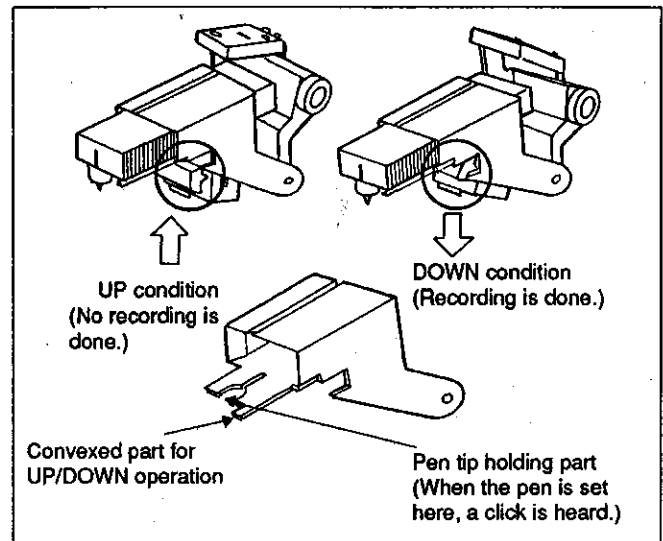


- ③ Remove the pen cap, and fully insert the cartridge pen until it is fixed to the pen holder at the lower part of the recording mechanism. (A click is heard.)



④ Pen UP/DOWN operation

After mounting the pen, set DOWN the pen for recording. The pen can be set UP or DOWN by moving UP or DOWN the convexed part at the right corner of the pen holder by finger.



Caution 1 Handling of pen tip

The pen tip is made of nylon fiber. Don't press it strongly, otherwise it may be crushed.

Caution 2 Handling of recording mechanism

Never move the recording mechanism right or left forcedly. For moving it, rotate the pulley after drawing out the chassis.

Caution 3 Pen exchange

Ink will not come out of a new pen smoothly first. In such a case, try writing lightly on a paper by holding the pen before mounting it.

Caution 4 Consumption degree of Ink

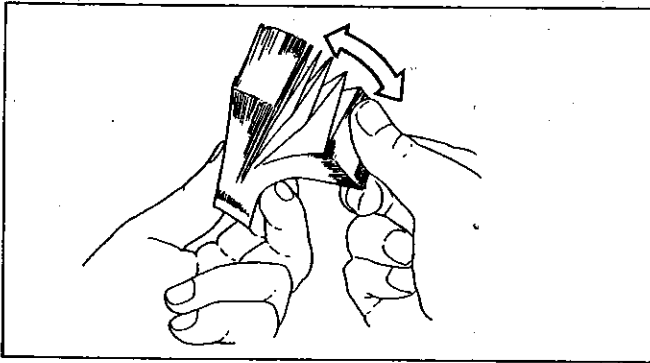
The consumption degree of ink differs according to the working conditions. The pad case can be used for about 1.5 months in continuous recording.

Caution 5 Stop of recording for a long time

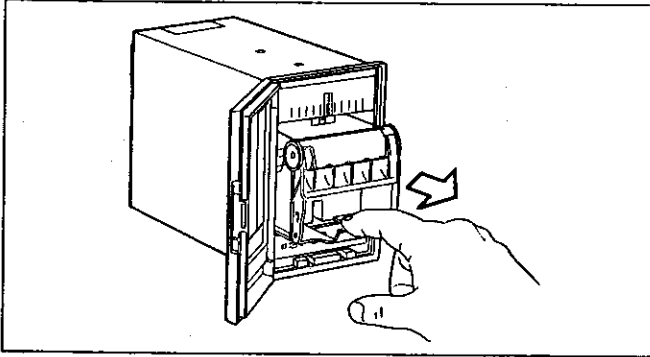
Remove the pen and store it after putting the pen cap to the pen for the purpose of preventing the pen tip from being dried up and prolonging the pen life when the instrument is not used for a long time or when the instrument is used for indications only without recording.

5-4 How to Mount the Chart Paper

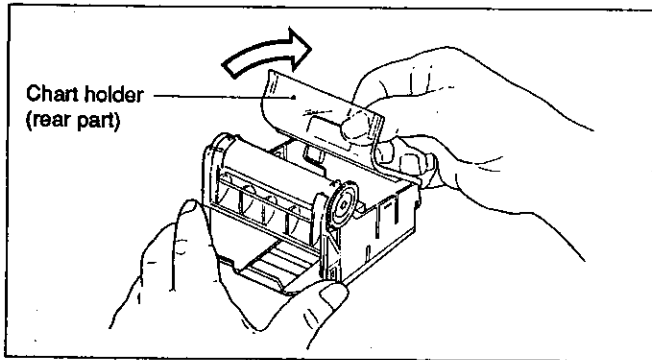
- ① Prepare the chart paper, and shuffle it sufficiently.



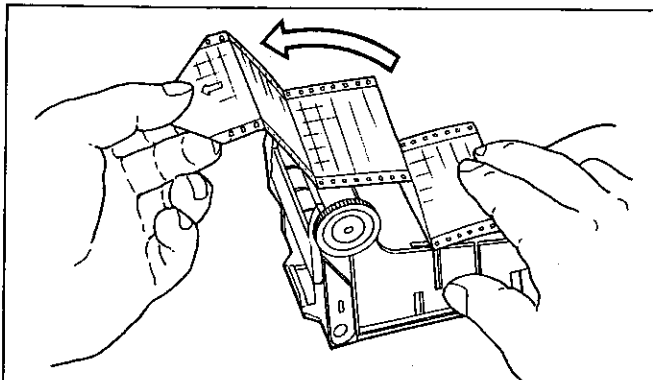
- ② Take the chart rack out of the chassis.



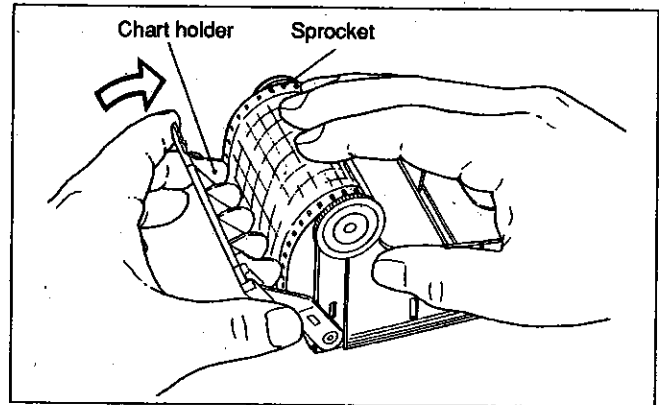
- ③ Open the chart holder (rear part), and mount the chassis.



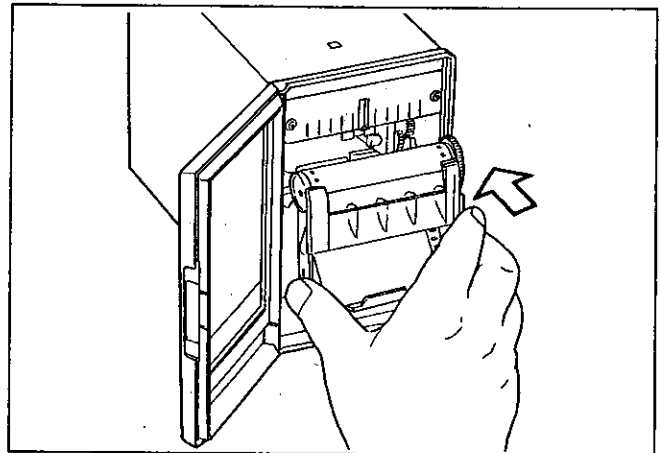
- ④ Put the chart paper into the housing part with its leading tip facing upward, draw it out about 10cm, and reset the holder.



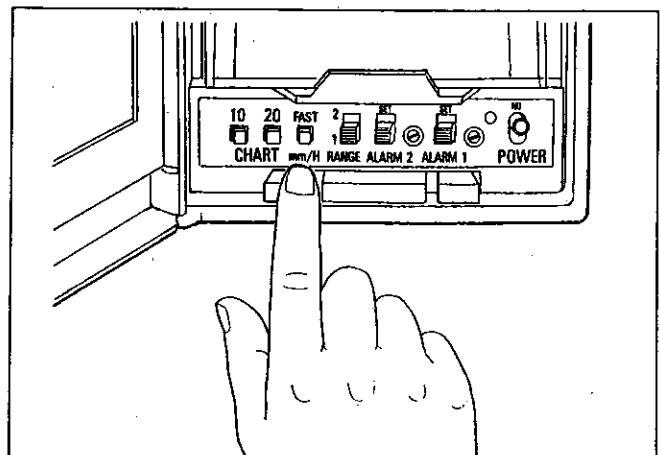
- ⑤ Tilt the chart holder forward to set the sprocket to the chart feed holes, (Set the square holes to the left and rectangular holes to the right), fold the chart 2 ~ 3 folds on the chart receiving base, and reset the chart holder. (Be careful not to double the chart paper.)



- ⑥ Reset the chart rack to the main unit by pushing it inward until a click is heard. Now, the chart paper has been loaded.



- ⑦ Push the FAST button to check the fast feed condition of the chart during operation. (If the chart paper is not set properly, it may be fed doubly under the initial loaded condition.)



6. OPERATION

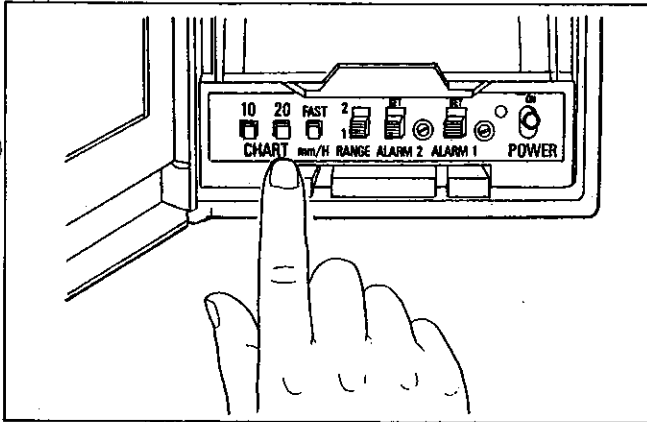
After connecting and confirming the input terminals, power terminals, and ground terminal, start operating the instrument.

6-1 Turning on the Power Supply

Turn ON the POWER switch, and the POWER indicator lamp lights on the left side of the switch. This switch also serves as an indicating/recording switch. By turning it ON, indications and recording are started.

6-2 Chart Speed Selection

Select a chart speed of 10mm/h or 20mm/h by pushing either pushbutton switch.

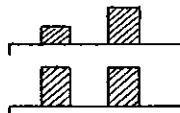


Reference 1 Chart feed stop

These switches are alternate. Make sure that either one is pushed down without fail. If either one is not pressed securely, it may be reset and neither 10mm/h nor 20mm/h is selected to cause the chart feed to stop. (Set these switches to this condition if it is desired to stop the chart feed only.)

Either chart speed is selected.

No chart speed is selected.



Reference 2 Fast feed of chart paper

By pressing FAST button, the chart is fed fast at a speed of about 340mm/min while this FAST button is being pushed. Use this FAST button for chart time axis setting or chart speed check at the operation start time, or cutting of the chart during operation, etc.

Caution 1: It is possible that the chart feed is delayed by a backlash of the mechanism when the time axis is set by the chart feed knob.

Reference 3 The chart paper cannot be fed reversely.

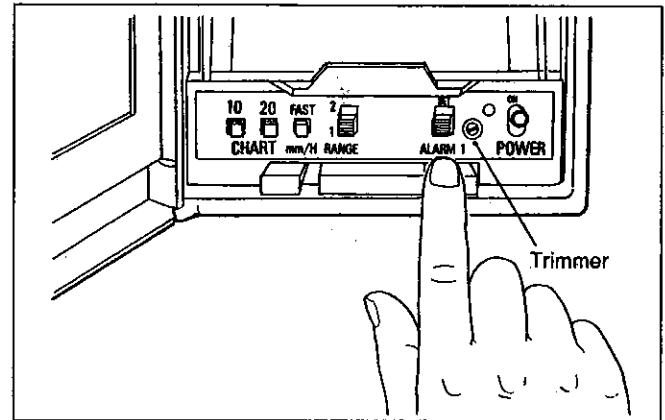
For resetting the chart paper for the purpose of time line setting, set the chart paper again from the beginning.

6-3 Alarm Setting (option)

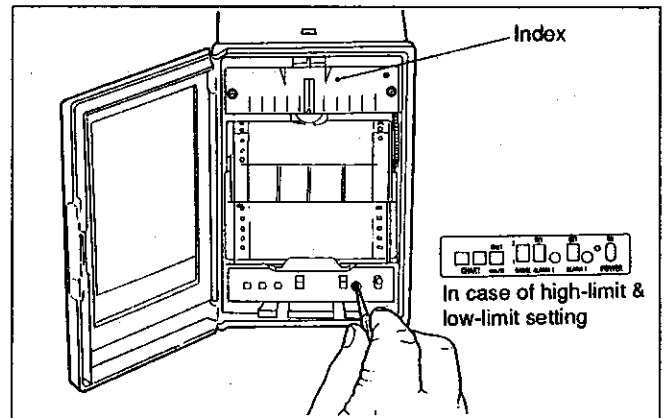
Set the alarm setting index to a desired alarm set value on the scale plate.

1) High-limit or low-limit

① By setting the ALARM/SET selector switch mounted beside the POWER switch to SET, the pointer indicates an alarm set value by the trimmer.



② Set the pointer to the previously mounted index position by turning the setting tool or a minus screwdriver in the accessory box to bring pointer to a set value, and set the slide switch to ALARM.



2) High & low-limit alarm specification

ALARM1 shows high-limit setting, while ALARM2 shows low-limit setting. Set ALARM1 and 2 in the same way as described above.

Caution

The dot printing mechanism functions to record dots even during the alarm setting by setting the slide switch to SET in the dot printing type.

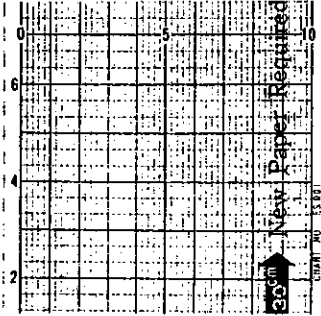
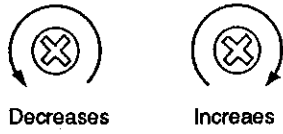
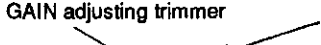
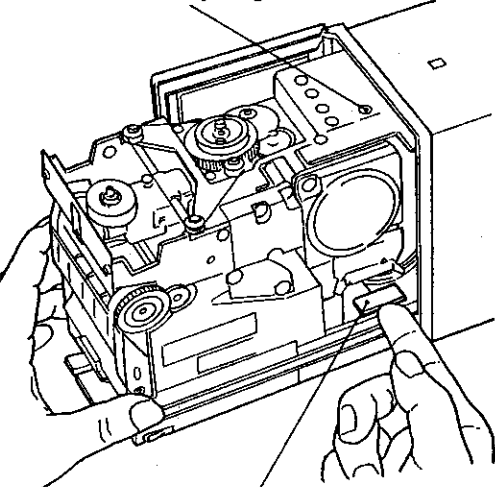
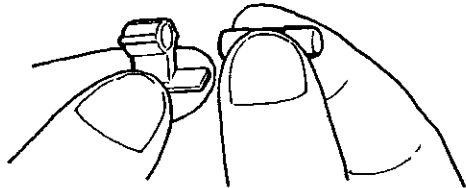
6-4 Manual Scale Switching (option)

Select range 1 or 2 by RANGE selector switch. (The range 1, 2 scales are fixed as designated at the purchase time.)

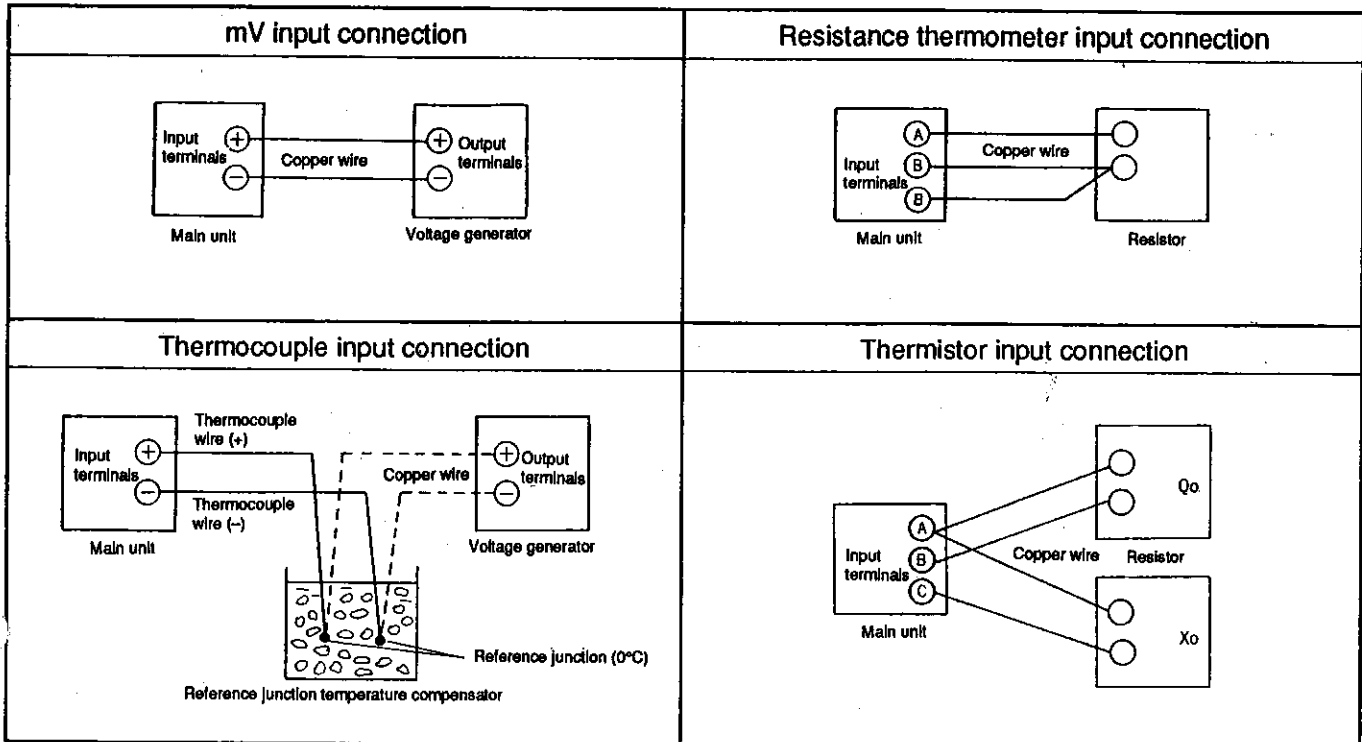
Reference: Two kinds of ranges are optionally selectable by points (option).

7. MAINTENANCE AND CHECK

Perform the following maintenance and check for operating this instrument under the best conditions at all times.

Maintenance and check items	Processing methods
Exchange of cartridge pen (pad case)	<p>The consumption degree of recording ink differs according to the working conditions of the instrument. The cartridge pen can be used for about one month (or the pad case can be used for about 1.5 months) at a chart speed of 10mm/h in continuous recording. Replace the cartridge pen (or pad case) with new one, referring to the [Mounting of Pen] in 5 when the ink color has become light.</p>
Exchange of chart paper	<p>The chart can be used for about 40 days at a chart speed of 10mm/h in continuous recording. When the chart paper comes to an end, the end information (☞ New Paper Required) appears at the right end of the chart paper. Replace the chart paper with new one. For checking the residual quantity of the chart halfway, lift the recorded chart by hand, and a non-recorded chart quantity can be confirmed by the inner window.</p> 
Gain adjustment	<p>Adjust the gain by turning the GAIN adjusting trimmer mounted at the innermost on the upper face of the chassis by means of a minus screwdriver after drawing out the chassis, if the pointer moves dull due to a drop of the amplifier gain (sensitivity) or the pointer is not stable due to hunting. The gain increases when turning the trimmer clockwise.</p>  
Exchange of fuse	<p>For replacing the fuse, draw the chassis out of the case, remove the fuse holder from the inner lower part of the chassis, and replace the fuse with new one. If the fuse is blown out again soon after replacing it, it may be caused by an internal trouble. In such a case, please contact your nearest CHINO's sales agent.</p>  <p>Fuse (Remove the fuse by pushing it upward by the finger nail.)</p> 

8. SCALE TEST



8-1 Preparation

The scale testing method differs according to the kinds of input signals. Refer to the corresponding item.

① Preparation of devices

• In case of mV inputs

Prepare a DC standard voltage generator.

• In case of thermocouple inputs

Prepare a DC standard voltage generator, a reference junction temperature compensator, and a thermocouple for testing.

• In case of resistance thermometer inputs

Prepare a precise variable resistor (Variable up to 3 digits above decimal point and down to 2 digits below decimal point Unit: Ω).

• In case of thermistor inputs

Prepare 2 precise variable resistors (For Q_0 — Variable up to 4 digits above decimal point and down to 2 digits below decimal point, For X_0 — Variable up to 4 digits above decimal point and down to 1 digit below decimal point Unit: Ω).

② After turning OFF the POWER switch, connect the instrument as illustrated above. (In case of the dot-printing type instrument, turn OFF the POWER switch when the selected point meets the point where reference inputs are connected.)

③ For the dot-printing type instrument, draw out the chassis, and set the slide switch inside the rectangular hole (having no nameplate) at the lower part on the right side panel backward by the tip of the accessory tool (insulated minus screwdriver). (See page 12)

④ Turn ON the POWER switch.

8-2 Testing Method

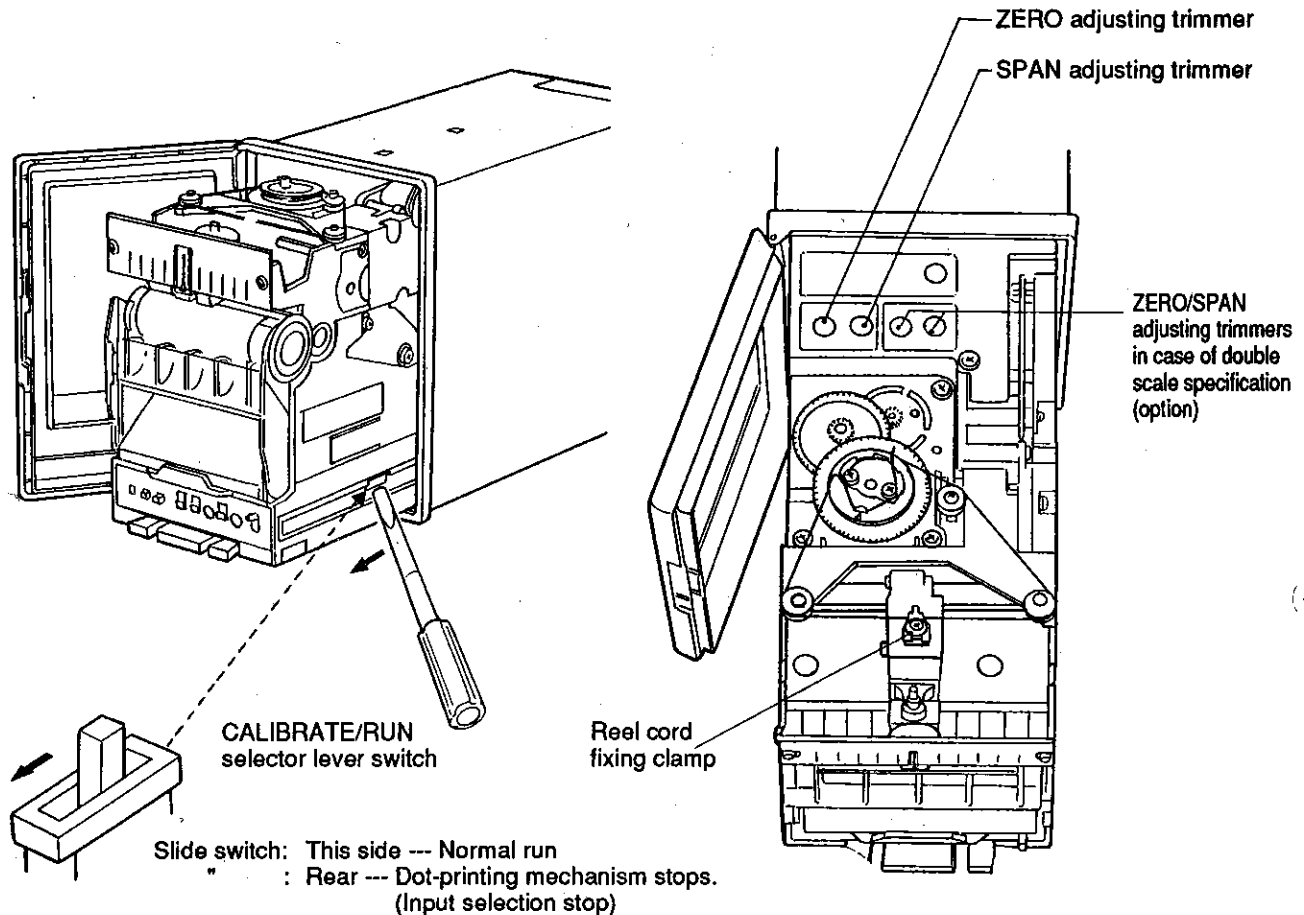
Wait for longer than 20 minutes after turning ON the indicate switch before starting the scale test.

- ① Set the DC standard voltage generator or precise variable resistor to an input value corresponding to the scale to be tested.
- ② Read the indicating value. When the error is within the specified accuracy, the instrument is normal.
The indicating accuracy of this instrument is $\pm 1.0\%$ of the input span.
- ③ Test the scale at both ends and center of the scale (3 points in total) at least. It is desirable to test the scale at 5 points at equal intervals in practice.
- ④ If the accuracy exceeds the specified range as a result of testing the scale, calibrate the scale, referring to the calibration on page 12.

Caution

- In case of thermocouple inputs, make sure that the reference junction temperature is 0°C by using a mercury thermometer.
Refer to the instruction manual for the reference junction temperature compensator, if an electronic reference junction temperature compensator is used without using any ice.
- In case of resistance thermometer inputs, use 3 connection wires, each having the same length and same size.

9. CALIBRATION



If the indicating accuracy exceeds the specified range as a result of testing the scale, calibrate the scale according to the following adjusting procedures.

9-1 Triangle Mark (▼) Check

- ① Turn OFF the POWER switch.
- ② Shift the pointer toward the minimum scale line by turning the pulley counterclockwise by hand after drawing out the chassis.
- ③ Make sure that the pointer indicates the mark ▼ on the scale plate when turning pulley until it is stopped by the stopper.



- ④ If the pointer does not indicate mark ▼, loosen the reel cord fixing clamp, and set the pointer to mark ▼ correctly.
- ⑤ Fasten the fixing clamp, reset the chassis as before. Now, this triangle mark ▼ check is completed. Wait for longer than 20 minutes after turning ON the INDICATE switch, and then, start adjusting the zero and span by the ZERO adjusting trimmer and SPAN adjusting trimmer mounted at the innermost on the upper face of the chassis.

9-2 Zero Adjustment

- ① Set the DC standard voltage generator or precise variable resistor to an input value corresponding to the minimum scale.
- ② Adjust the ZERO adjusting trimmer by turning it with a minus screwdriver until the pointer meets the minimum scale on the scale plate.

9-3 Span Adjustment

- ① Set the DC standard voltage generator or precise variable resistor to an input value corresponding to the maximum scale.
- ② Adjust the SPAN adjusting trimmer by turning it with a minus screwdriver until the pointer meets the maximum scale on the scale plate. Calibrate the scale correctly by repeating the zero and span adjustment several times.

Caution

Test and calibrate the scale under the following standard conditions as much as possible.

Room temperature	: 23 \pm 2 $^{\circ}$ C
Humidity	: 55 \pm 10% RH
Power supply	: Rated voltage \pm 2%

10. SPECIFICATIONS

10-1 General Specifications

Input signal : mV — More than 10mV DC width, but less than 50V width
 Thermocouple —
 K, T ---- More than 250°C width
 E, J ---- More than 200°C width
 R ----- More than 1000°C width
 Resistance thermometer —
 More than 50°C width (Pt100, JPt100)
 Thermistor — More than 50°C width (at about room temperature)

Scale length : 60mm
Indicating accuracy rating : ±1.0% of input span
Dead band : 0.4% of input span
Balancing time : Input span shift About 2.0sec (50Hz)
 About 1.6sec (60Hz)

Chart paper : Fan-fold chart
 Effective recording width 60mm
 (Total width 73mm) Total length 10m

No. of recording points :
 Pen writing type — 1 pen
 Dot-printing type — 1 dot, 2 dots, 3 dots, 6 dots (4 kinds)

Recording system : Pen-writing type — Continuous recording with a cartridge pen (red)
 Dot-printing type — Dot recording with each pad in the following dot-printing colors

Dot-printing color
 1 dot ---- Red
 2 dots --- 1:Red, 2:Blue
 3 dots ---- 1:Red, 2:Blue, 3:Green
 6 dots ---- 1:Red, 2:Blue, 3:Green
 4:Violet, 5:Purple, 6:Brown

Chart speed : 10, 20mm/h (2 speeds) and fast feed
Dot printing interval : About 10sec
Pen lift (pen-writing type) : Manual

Power supply : 100V AC, 50/60Hz
Allowable voltage fluctuation :
 (+)10 ~ (-)10% of the rated value
Working temperature range : (-)10° ~ 50°C
Working humidity range : 30 ~ 90% RH
Allowable signal source resistance :

mV input, thermocouple input —
 Lower than 1kΩ
 Resistance thermometer input —
 Lower than 10Ω per wire

Input resistance : About 8MΩ
Maximum common mode voltage : 200V AC
Common mode rejection ratio : More than 100dB
Series mode rejection ratio : More than 50dB
Insulation resistance :

500V DC, higher than 20MΩ between measuring terminals and ground terminal
 500V DC, higher than 20MΩ between power terminals and ground terminal
 500V DC, higher than 20MΩ between measuring terminals and power terminals

Dielectric strength: 500V AC, 1min between measuring terminals and ground terminal
 1000V AC, 1min between power terminals and ground terminal
 1000V AC, 1min between measuring terminals and power terminals

Power consumption : About 7VA

Casing : Front door — ABS resin
 Flange, rear case — ABS resin

Color : Gray
Mounting : Panel mount
Weight : About 1.7kg

10-2 Standard Scale

Input	Contents		
Thermocouple	R	0~1400(50)	0~1600(50)
	K	0~250(5) 0~800(20)	0~300(10) 0~1200(20)
	E	0~200(5)	0~300(10)
	J	0~300(10)	0~400(10)
	T	0~250(5)	0~300(10)
mV		0~10(0.2) -5~5(0.2) 0~1V(0.02V)	0~20(0.5) -10~10(0.5) -1~1V(0.05V)
	mA	4~20mA(0.5mA)	
	Resistance thermometer	0~50(1)	0~100(2)
Pt100		0~200(5)	0~300(10)
	JPt100	-20~80(2)	-30~70(2)
		-50~100(5)	-100~50(2)
Thermistor	0~100(5)	0~200(5)	

Unit: °C, Unit of mV input only: mV, (): 1 division

10-3 Options

Option name	Contents
Chart speed	5mm/h ~ 400mm/h, various kinds
Dot-printing interval	About 5sec
Alarm contacts	Alarm system : High-limit (low-limit) or high & low-limit type Setting accuracy: ±1% of input span Dead band : 0.6% of input span Contact capacity: Resistive load 100V 0.5A, 200V 0.2A Alarm signal : On-off contact signal
Double scale	① Manual switching double scale ② Double scale switchable by points
Burnout	The indicating pointer overshoots the high-limit (or low-limit), if an input is interrupted. (Allowable signal source resistance 100Ω)
Portable type	Grips and legs are provided.

The allowable signal source resistance value and input resistance value are different from their standard values in case of the burnout and non-standard scale specifications.

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