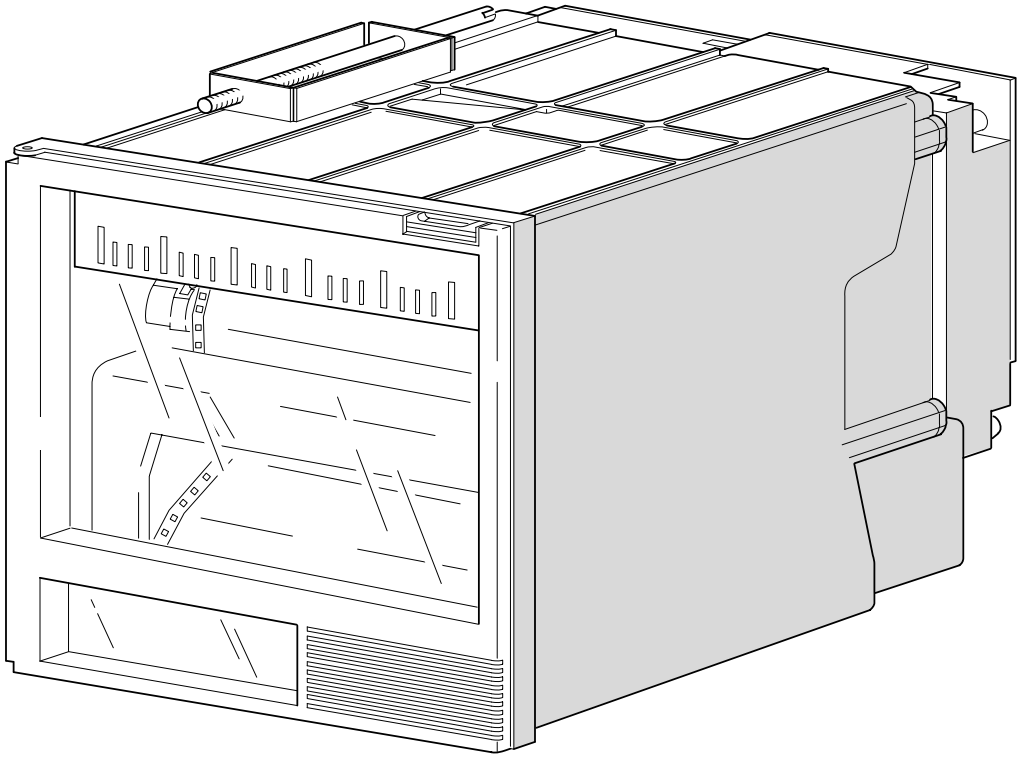
Instruction Manual

MICROJET RECORDER E

TYPE: PHE-2



Fuji Electric Co., Ltd.

INP-TN2PHEc-E

PREFACE

Congratulations on your purchase of Fuji Microjet Recorder (Type: PHE)

- Read this instruction manual carefully to ensure correct installation, operation and preparation. Incorrect handling may lead to accidnt or injury.
- Specifications of this unit is subject to change without prior notice for improvement.
- Modification of this unit without permission is strictly prohibited. Fuji will not bear any responsibility for a trouble caused by such a modification.
- This instruction manual should be kept by the person who is actually using the unit.
- After reading the manual, be sure to keep it at a place easy to access.
- This instruction manual should be delivered to the end user without fail.

Manufacturer	: Fuji Electric Co., Ltd.
Type	: Shown on nameplate of Microjet recorder
Date of manufacture	: Shown on nameplate of Microjet recorder
Product nationality	: Japan

Request

- It is prohibited to transfer part or all of the manual without Fuji's permission.
- Description in this manual will be changed without prior notice.

Issued in March, 2000
Rev. 1st edition May, 2005
Rev. 2nd edition Jan., 2008
Rev. 3rd edition Apr., 2011

CAUTION ON SAFETY

First of all, read this "Caution on safety" before using the unit.

- The cautionary descriptions listed here contain important information about safety, so they should always be observed. Those safety precautions are ranked 2 levels, DANGER and CAUTION.

DANGER	Wrong handling may cause a dangerous situation, in which there is a risk of death or heavy injury.
CAUTION	Wrong handling may invite a dangerous situation, in which there is a possibility of medium level trouble or slight injury or only physical damage is predictable.
PROHIBITION	Items which must not be done are noted.

Caution on Installation

DANGER

- This unit is not an explosion-proof type. Do not use it in a place with explosive gases to prevent explosion, fire or other serious accident.

CAUTION

- For installation, select a place observing the operating conditions noted in the instruction manual. Installation at an unsuited place may cause fall, trouble or malfunction.
- The unit must be installed correctly as shown in the instruction manual. Incorrect installation may cause fall, trouble or malfunction.
- During installation work, keep the inside of the unit free from entry of cable chips or other foreign objects as it may cause fire, trouble or malfunction.

CAUTION

This unit is a component device used for instrumentation. It is mounted on a panel or in a rack.

- The unit conforms to IEC1010-1 (1990) Safety Standards, and is designed for protection class I, overvoltage Category II and pollution degree 2, except the alarm output terminal (overvoltage category I).
- EMC conforms to EN50081-1 (1992) and EN50082-1 (1992), (both used for housing areas), except that the noise level of the power terminal is rated for Class A (used for commercial and industrial areas).
- Input signals and communication interface should be of SELV (safety separated from hazardous voltage).

Caution of Wiring

DANGER

- Wiring work must be performed as specified. If the unit is not earthed, it would result in electric shocks or malfunction.
- Be sure to connect power source that matches the rating. Connection of incorrect rating of power source may lead to fire.
- Before starting wiring work, be sure to turn OFF the main power to prevent electric shocks.
- Wiring materials to be used must meet the rating. Use of materials which do not withstand the rating may cause a fire accident.

Caution on Maintenance

DANGER

- When disposing of the recording head, put it in a vinyl bag and seal it to prevent the diffusion of ink. It should be handled as an imcombustible object when disposing of it.
- Ink is harmful to human body. Observe the following emergency treatments.
  - When ink gets in eyes, wash out for at least 5 minutes immediately with much clean water, and ask your doctor for treatment at once.
  - When ink gets on skin, wash out and clean skins with soap and water.
  - When ink is breathed in, move to a clean place immediately. If necessary, ask your doctor for treatment at once.
- Do not touch the connector at the rear of the carriage mounting the recording head to avoid the risk of electric shocks.

Caution on Use

DANGER

- If the fault or anomaly of the device may cause serious accident or troubles to other devices, externally install appropriate protective circuit to avoid accidents.
- The instrument has no power switch nor fuse. Install them if necessary.
- When fuse is blown out, check and remove the cause of it, and replace it with new one specified in the instruction manual. Do not use any other fuse or short it, as it may cause electric shocks or fire.

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CAUTION

Chapter 3,4 and chapter 8 should be observed for installation and maintenance of the unit. So, it must be performed by qualified engineers.

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1. INTRODUCTION

We thank you for purchasing Microjet Recorder PHE.

The instruction manual describes installation, operation, maintenance, etc. of Microjet Recorder. Read it carefully before use.

1.1 Microjet recorder

(1) This recorder (100mm wide) is used to record up to 6 points of input signals from a thermocouple, resistance bulb and DC voltage.
(2) Analog trend data and digital print data are color recorded clearly and quickly.
(3) Analog trend data can be recorded continuously or intermittently (see Item 1.3 “Check on type and specification”).
(4) Besides recording measured values, chart paper feed speed, measurement range, etc. can be printed as standard functions.

1.2 Product check

Upon receiving the unit, check the appearance and accessories to make sure that they are not damages. Also, check that the accessories are supplied correctly.

Check on accessories

The unit comes with the accessories shown in Fig. 1-1. Please check that they are all there.

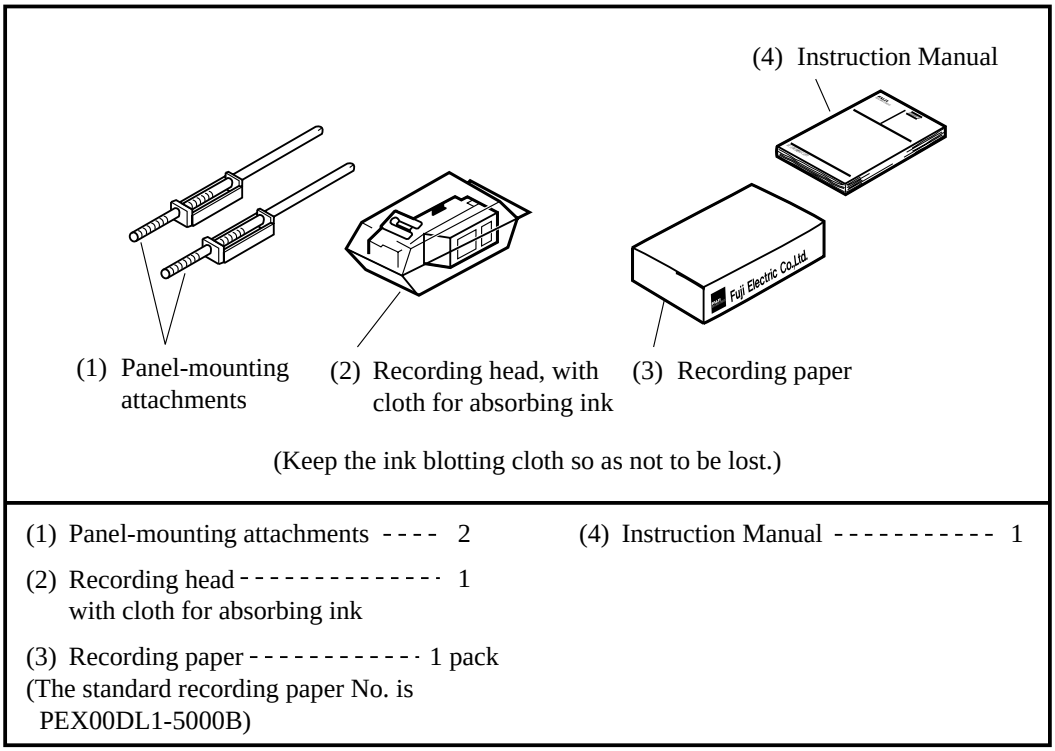
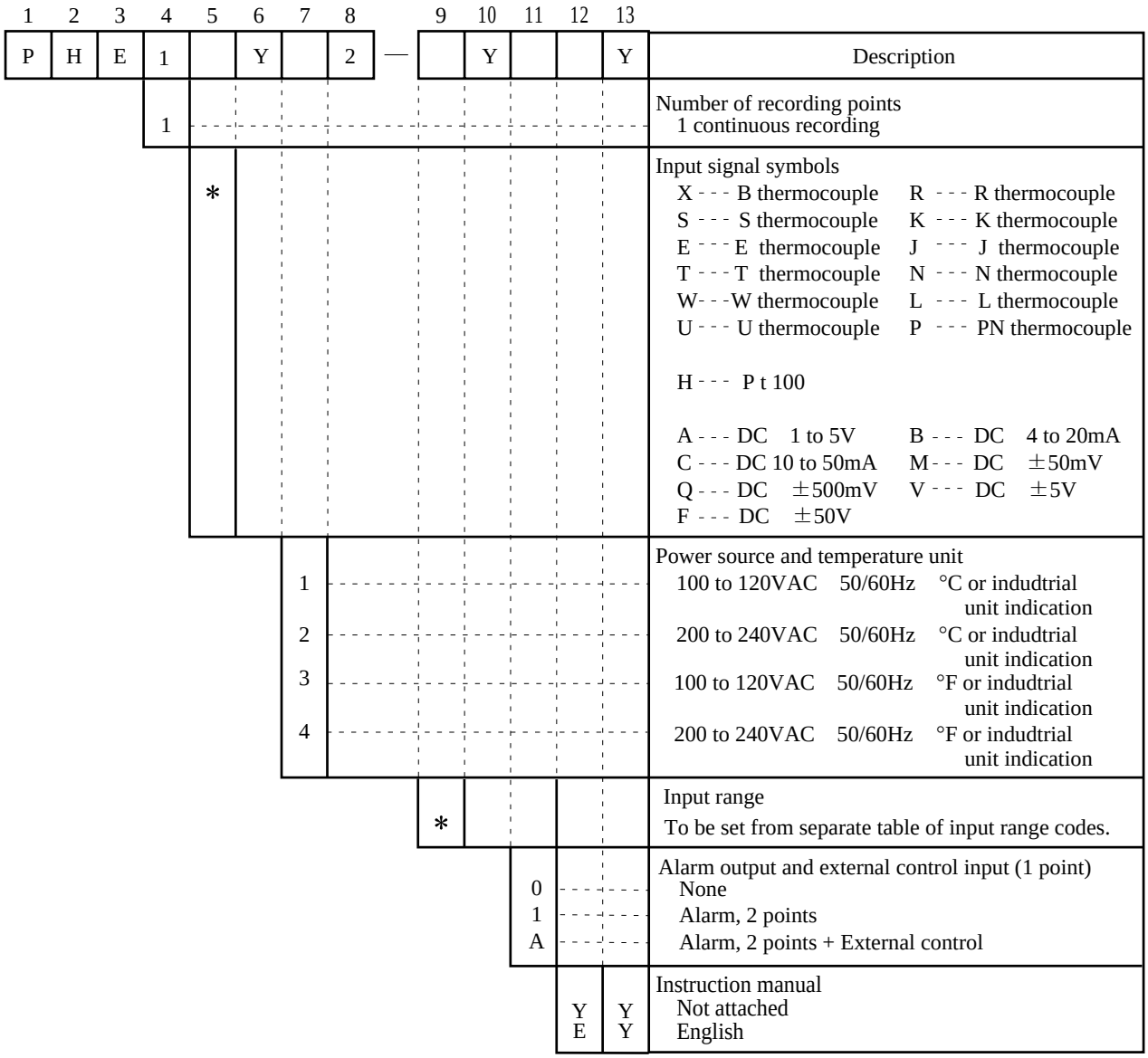


Fig. 1-1 Accessories

1.3 Check on type and specification

The data plates note the type name, etc. Please check to see that you have got a unit with the specification you ordered. (There are data plates on the top surface on the case and main unit.)

(1) 1 continuous recording type



1	2	3	4	5	6	7	8	—	9	10	11	12	13	Description
P	H	E	1		Y		2			Y			Y	
			1											Number of recording points 1 continuous recording
				*										Input signal symbols X - - - B thermocouple R - - - R thermocouple S - - - S thermocouple K - - - K thermocouple E - - - E thermocouple J - - - J thermocouple T - - - T thermocouple N - - - N thermocouple W- - -W thermocouple L - - - L thermocouple U - - - U thermocouple P - - - PN thermocouple H - - - P t 100 A - - - DC 1 to 5V B - - - DC 4 to 20mA C - - - DC 10 to 50mA M - - - DC ±50mV Q - - - DC ±500mV V - - - DC ±5V F - - - DC ±50V
						1								Power source and temperature unit 100 to 120VAC 50/60Hz °C or indudtrial unit indication
						2								200 to 240VAC 50/60Hz °C or indudtrial unit indication
						3								100 to 120VAC 50/60Hz °F or indudtrial unit indication
						4								200 to 240VAC 50/60Hz °F or indudtrial unit indication
									*					Input range To be set from separate table of input range codes.
											0			Alarm output and external control input (1 point) None
											1			Alarm, 2 points
											A			Alarm, 2 points + External control
												Y	Y	Instruction manual Not attached
												E	Y	English

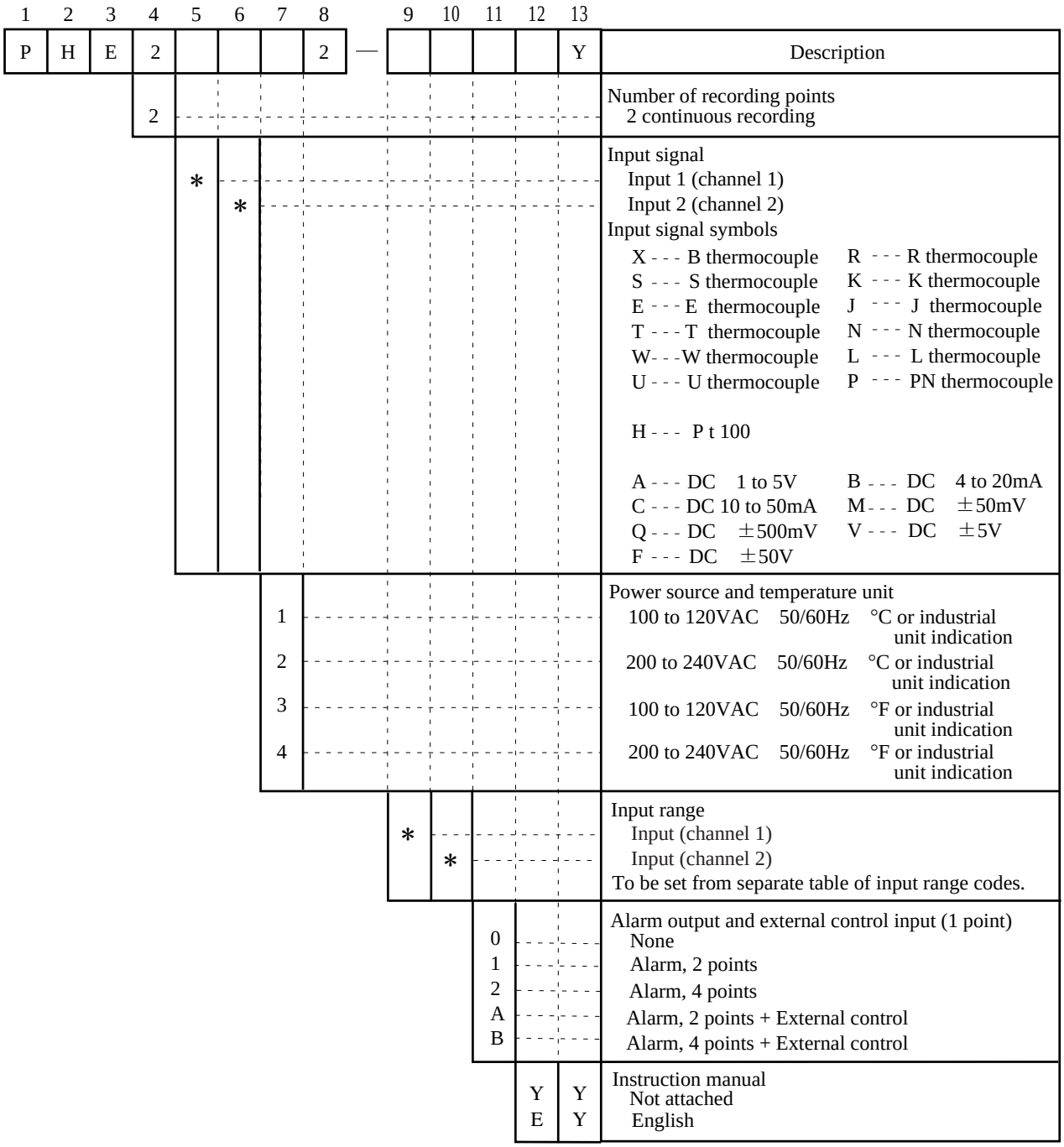
Note 1) The recorder is supplied with shunt resister for measurement of current input.

Note 2) The following items are designated from code descriptions.

(1) Industrial value, industrial unit

(2) Special chart paper
(other than time line print, scale value print and 50-division scale)

(2) 2 continuous recording type



Note 1) The recorder is supplied with shunt resister for measurement of current input.

Note 2) The following items are designated from code descriptions.

(1) Industrial value, industrial unit

(2) Special chart paper
(other than time line print, scale value print and 50-division scale)

(3) 6 dot recording type

1	2	3	4	5	6	7	8	—	9	10	11	12	13	Description
P	H	E					2	—					Y	
			7											Number of recording points 6 dot recording (single range) 6 dot recording (double range)
			8											
				*	*									Input signal 6 dot (single range) ＊Y 6 dot (dounle range) ＊＊(Note 1) Input signal symbols X - - - B thermocouple R - - - R thermocouple S - - - S thermocouple K - - - K thermocouple E - - - E thermocouple J - - - J thermocouple T - - - T thermocouple N - - - N thermocouple W- - -W thermocouple L - - - L thermocouple U - - - U thermocouple P - - - PN thermocouple H - - - P t 100 A - - - DC 1 to 5V B - - - DC 4 to 20mA C - - - DC 10 to 50mA M - - - DC ±50mV Q - - - DC ±500mV V - - - DC ±5V F - - - DC ±50V
						1								Power source and temperature unit 1 100 to 120VAC 50/60Hz °C or industrial unit indication 2 200 to 240VAC 50/60Hz °C or industrial unit indication 3 100 to 120VAC 50/60Hz °F or industrial unit indication 4 200 to 240VAC 50/60Hz °F or industrial unit indication
						2								
						3								
						4								
									*	*				Input range 6 dot (single trange) ＊Y 6 dot (double range) ＊＊(Note 1) To be set from separate table of input range codes.
											0			Alarm output and external control input (1 point) 0 None 1 Alarm, 2 points 2 Alarm, 4 points 3 Alarm, 6 points A Alarm, 2 points + External control B Alarm, 4 points + External control C Alarm, 6 points + External control
											1			
											2			
											3			
											A			
											B			
											C			
												Y	Y	Instruction manual Y Y Not attached E Y English

Note) 6 dot double range is classfied into the group of input 1, 2 and 3, and the group of input 4, 5 and 6.

＊ ＊

Input range of input 4, 5 and 6

Input range of input 1, 2 and 3

Note) The recorder is supplied with shunt resister for measurement of current input.

Note) The following items are designated from code descriptions.

(1) Industrial value, industrial unit

(2) Special chart paper

(other than time line print, scale value print and 50-division scale)

Input range code table

In the case of temparature input, the input range (= recording range) is indicated to 1 digit below decimal point.

Example: 150.0

150 or 150.00 is not indicated.

<Thermocouple/resistance bulb input ˚C range> Ranges marked ○, ●, ◎ and △ can be set.

Input range code	Input range (˚C) (Recording range)	B	R	S	K	E	J	T	N	W	L	U	PN	Pt
0	0 to 100					●	●				●			○
1	0 to 200				○	○	○	○	●		○	○	●	○
2	0 to 300				○	○	○	○	○		○	○	○	○
3	0 to 400				○	○	○	○	○	●	○	○	○	○
4	0 to 500				○	○	○		○	○	○		○	○
5	0 to 600		●	●	○	○	○		○	○	○		○	○
6	0 to 800		●	●	○	○	○		○	○	○		○	
7	0 to 1000		△	△	○		○		○	○			○	
8	0 to 1200		△	△	○				○	○			○	
9	0 to 1400		△	△						○				
A	0 to 1600		△	△						○				
B	0 to 150				●	○	○	●			○	●		○
C	400 to 1400	○	○	○						○				
D	600 to 1600	○	○	○						○				
E	100 to 300				○	○	○	○	●		○	○	●	○
F	200 to 400				○	○	○	○	●		○	○	○	○
G	300 to 600				○	○	○		○	●	○		○	○
H	400 to 800				○	○	○		○	●	○		○	
J	500 to 1000		●	●	○		○		○	○			○	
K	600 to 1200		●	●	○				○	○			○	
L	800 to 1600	○	○	○						○				
M	-50 to 50					●	●				●			○
N	-50 to 150				○	○	○	○			○	○		○
P	-200 to 100				◎	◎	◎	◎			◎	◎		○
Q	-200 to 500				◎	◎	◎				◎			○
Y	Maximum range of each input signal	○	△	△	◎	◎	◎	◎	○	○	◎	◎	○	○

[Additional information]

1. Marked ○ above means ± (0.3% of measuring range +1 digit) indication accuracy.
2. Marked ● above means ± (1% of measuring range +1 digit) indication accuracy.
3. Marked ◎ above means ± (0.3% of measuring range +1 digit) indication accuracy, but ± (0.5% of measuring range +1 digit) indication between -200 to -100˚C range.
4. Marked △ above means ± (0.3% of measuring range +1 digit) indication accuracy, but ± (0.5% of measuring range + 1 digit) indication between 0 to 300˚C range.
5. In case of thermocouple and resistance bulb input, measuring table is equal to recording range and indicated value is 1 digit below decimal point.

Note)

The indication accuracy of thermocouple does not include reference junction compensation error.

<Thermocouple/resistance bulb input ˚F range> Range marked ○, ●, ◎ and △ can be set.

Input range code	Input range (˚F) (Recording range)	B	R	S	K	E	J	T	N	W	L	U	PN	Pt
0	32 to 200					●								○
1	32 to 400				○	○	○	○	●		○	○	●	○
2	32 to 600				○	○	○	○	○	●	○	○	○	○
3	32 to 800				○	○	○		○	●	○		○	○
4	32 to 1000				○	○	○		○	○	○		○	○
5	32 to 1200		●	●	○	○	○		○	○	○		○	
6	32 to 1500		△	●	○		○		○	○	○		○	
7	32 to 2000		△	△	○		○		○	○			○	
8	32 to 2400		△	△	○					○				
9	32 to 2500		△	△	○					○				
A	32 to 3000		△	△						○				
B	32 to 300				●	○	●	●			○	●		○
C	500 to 2500		○	○	○					○				
D	1000 to 3000	○	○	○						○				
E	200 to 600				○	○	○	○	●		○	○	○	○
F	400 to 800				○	○	○		●		○		○	○
G	600 to 1200				○	○	○		○	●	○		○	
H	1000 to 1500				○		○		○	●	○		○	
J	1000 to 2000		●	●	○		○		○	○			○	
K	1000 to 2500	●	○	○	○					○				
L	1500 to 3000	○	○	○						○				
M	-100 to 100					●	●				●			○
N	-100 to 300				○	○	○	○			○	○		○
P	-300 to 200				◎	◎	◎	◎			◎	◎		○
Q	-300 to 1000				◎	◎	◎				◎			○
Y	Maximum range of each input signal	○	△	△	◎	◎	◎	◎	○	○	◎	◎	○	○

[Additional information]

1. Marked ○ above means ± (0.3% of measuring range +1 digit) indication accuracy.
2. Marked ● above means ± (1% of measuring range +1 digit) indication accuracy.
3. Marked ◎ above means ± (0.3% of measuring range +1 digit) indication accuracy, but ± (0.5% of measuring range +1 digit) indication between -300 to -148˚F range.
4. Marked △ above means ± (0.3% of measuring range +1 digit) indication accuracy, but ± (0.5% of measuring range + 1 digit) indication between 32 to 600˚F range.
5. In case of thermocouple and resistance bulb input, measuring table is equal to recording range and indicated value is 1 digit below decimal point.

Note)

The indication accuracy of thermocouple does not include reference junction compensation error.

<DC voltage input>

Input range code	± 50mV	± 500m V	± 5V	± 50 V
0	0 to 10	0 to 100	0 to 1	0 to 10
1	0 to 15	0 to 150	0 to 1.5	0 to 15
2	0 to 20	0 to 200	0 to 2	0 to 20
3	0 to 30	0 to 300	0 to 3	0 to 30
4	0 to 50	0 to 500	0 to 5	0 to 50
5	10 to 50	100 to 500	1 to 5	10 to 50
6	4 to 20	40 to 200	0.4 to 2	4 to 20
7	-50 to 0	-500 to 0	-5 to 0	-50 to 0
Y	-50 to 50	-500 to 500	-5 to 5	-50 to 50

Note) DC current input is converted into voltage input with shunt resistor prior to delivery (shunt resistor :10 Ω).

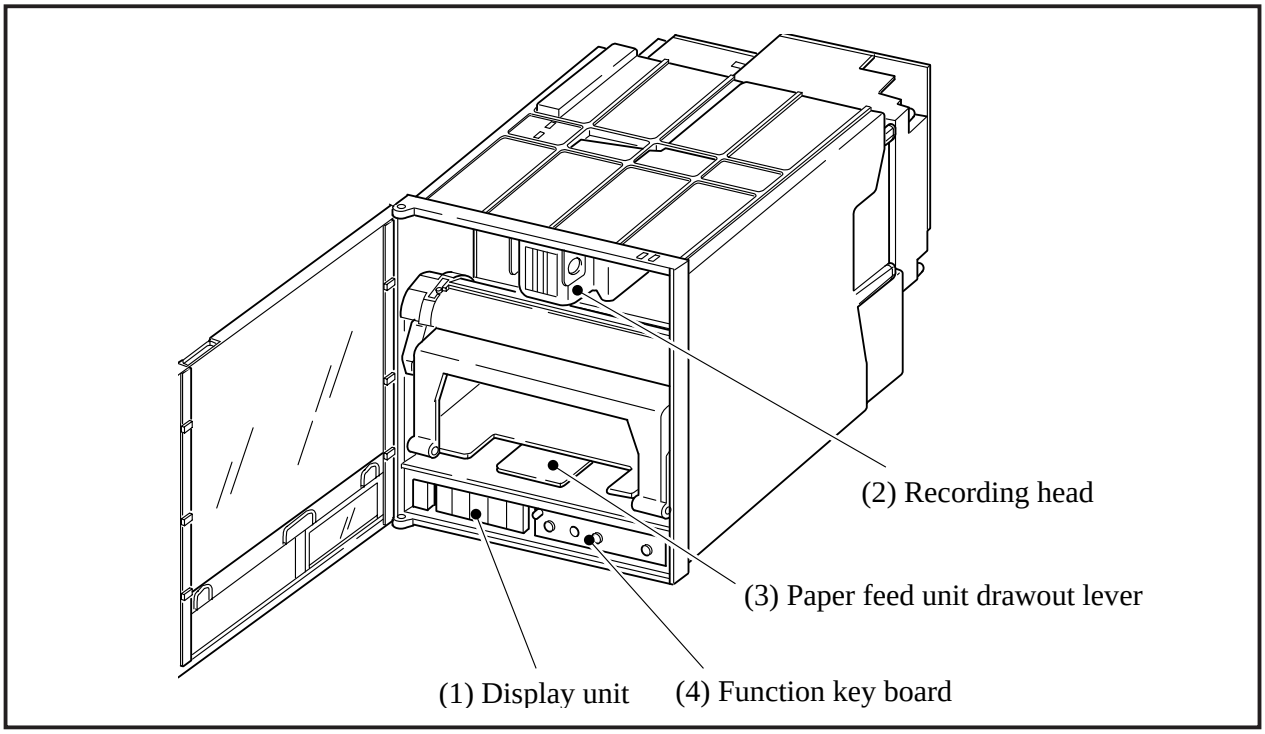
4 to 20mA DC : 40 to 200mV DC input

10 to 50mA DC : 100 to 500mV DC input

<Table of maximum range of input signals>

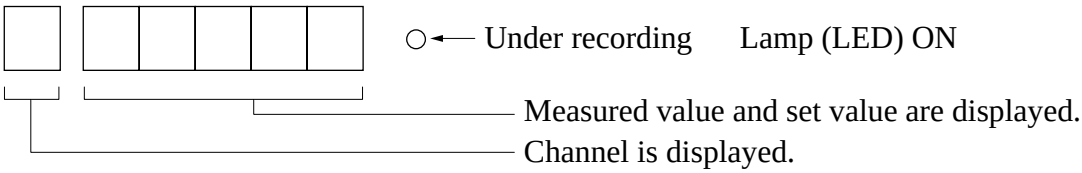
Input signal		Input range	Input range
Thermocouple	B	400 to 1760°C	752 to 3200°F
	R	0 to 1760°C	32 to 3200°F
	S	0 to 1760°C	32 to 3200°F
	K	-200 to 1370°C	-328 to 2498°F
	E	-200 to 800°C	-328 to 1472°F
	J	-200 to 1100°C	-328 to 2012°F
	T	-200 to 400°C	-328 to 752°F
	N	0 to 1300°C	32 to 2372°F
	W	0 to 1760°C	32 to 3200°F
	L	-200 to 900°C	-328 to 1652°F
	U	-200 to 400°C	-328 to 752°F
	P N	0 to 1300°C	32 to 2372°F
Resistance bulb	Pt100	-200 to 600°C	-328 to 1112°F
DC voltage	± 50mV	-50 to 50mV	
	± 500mV	-500 to 500mV	
	± 5V	-5 to 5V	
	± 50V	-50 to 50V	

2. NAMES AND FUNCTIONS OF PARTS



(1) Display unit

Time, measurement data, set values and comments are displayed.



(2) Recording head

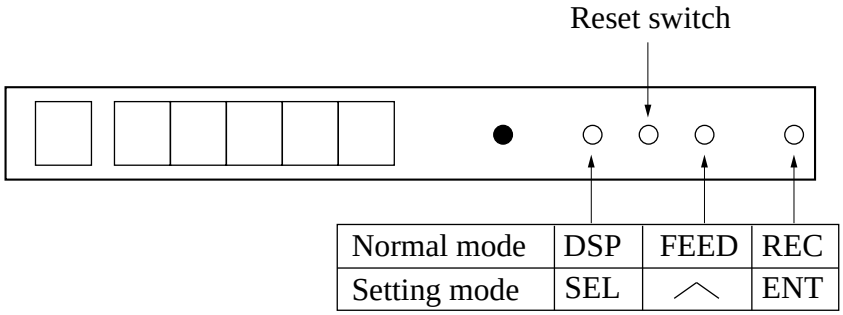
Used for analog trend recording and digital printing. **(Recording head is not mounted in the recorder prior delivery. It should be mounted referring to Item 5.2)**

(3) Paper feed unit drawout lever

When setting (replacing) chart papaer, press down the drawout lever and the paper feed unit will be drawn out. If it is not drawn out automatically, pull out the paper feed unit by hand while pressing down the lever.

(4) Function key board

Used for setting or confirming parameters and for operating the recorder.



・Normal mode : Measured value or the states of alarm of each channel is displayed. This mode is started at power ON.

・Setting mode : This mode is used for setting chart speed or alarm.

	Name of key	Function
Normal mode	REC (record)	Recording start/stop function key. Recording is started at the first press of the key and stops at the second press.
	FEED (feed)	Chart paper fast feed key Feed speed becomes fast by pressing the key for more than 3 seconds.
	DSP (display)	1. Used for changing display data . The following 2 functions are selected at each press of the key. (1) Data of all channels are displayed in order, except for the skip channel. (2) Display only of the data of specific channels. 2. Used when shifting from normal mode to setting mode (press the key for more than 3 seconds)
Setting mode	ENT (entry)	Used to register set data and to start or stop list printing.
	∧ (up)	Used to change set data. Chart paper fast feed is effected during list printing.
	SEL (select)	1. Used to read parameters in order in setting mode. **This key can not be used during list printing.** 2. Used when shifting from setting mode to normal mode (press the key for more than 3 seconds)
	Reset switch	Used to reset the recorder (The operation is the same as that at power ON/OFF.)

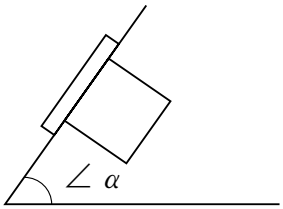
3. MOUNTING METHOD

This unit is designed to be panel mounted.

3.1 Mounting location

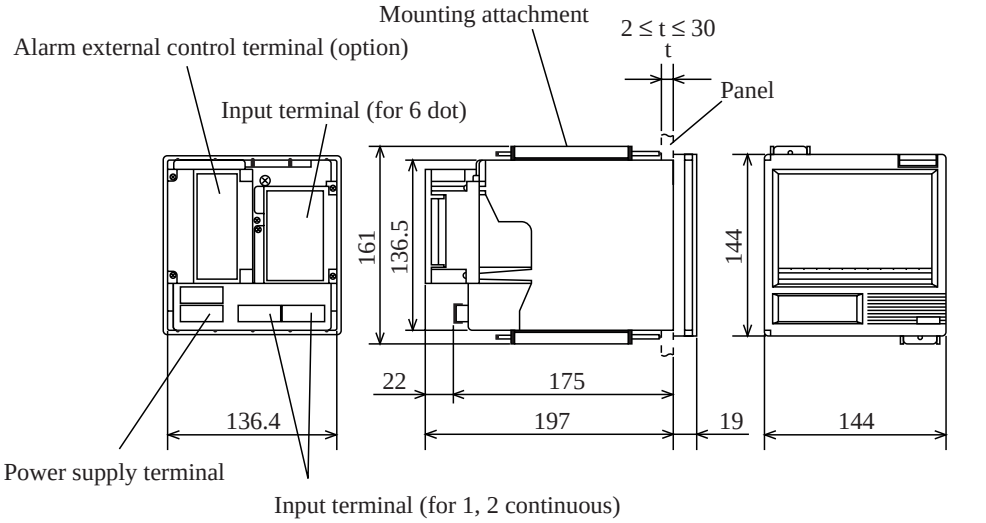
Select the following location for mounting the unit.

(1) A place that is not subject to vibration or shock.
(2) A place where there is no corrosive gas.
(3) A place that is subject to little temperature variation and is close to normal temperature (23°C)
(4) A place that is not struck directly by strong radiant heat.
(5) As humidity affects the ink and recording paper, select a place that is in the range 45 to 80% RH.
(6) Mount the unit horizontally, with no tilt to the left or right. (The forward tilt should be 0° but the unit may be inclined 0 to 30° rearwards.)



α =60 to 90°

3.2 External dimensions and panel cut out dimensions (unit: mm)

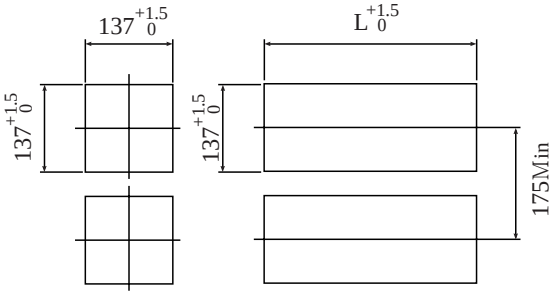


Number of units	$L^{+1.5}_{0}$ (mm)
2	282
3	426
4	570
5	714
6	858
7	1002
8	1146
9	1290
10	1434
n	(144×n) −6

Mass : Continuous type Approx. 1.3kg
(without alarm terminal)
Approx. 1.5kg
(with alarm terminal)
Intermittent type Approx. 1.5kg
(without alarm terminal)
Approx. 1.7kg
(with alarm terminal)

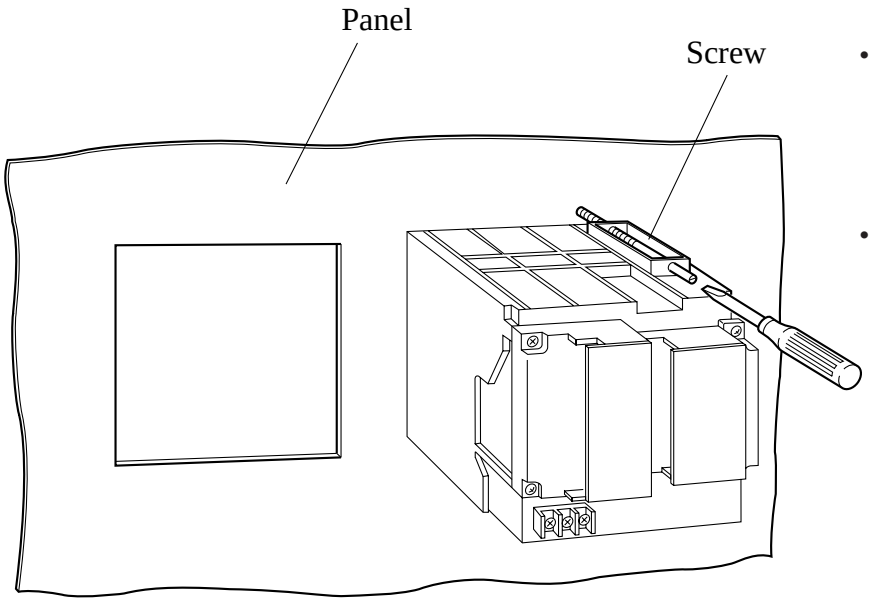
PANEL CUTOUT

Single unit mounting Left/right tight fit mounting



Power consumption :
Approx. 13VA (100V AC, without option)
Approx. 15VA (100V AC, with all options)

3.3 Method of mounting onto panel



- Using the supplied mounting fixture, tighten the upper and lower screws until the panel is fixed.
- The panel to be used should be more than 2mm thick.

4. WIRING

4.1 Before wiring

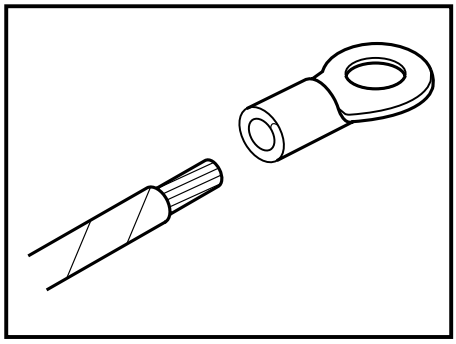
(1) For thermocouple input, be sure to use a compensated lead wire.

(2) Input signal cables should be wired separately as far as possible (30cm or more) from power lines and high-voltage lines to minimize the effect of inductive noise. Shielded cables should preferably be used. In this case, the shield braids should be earthed at one point.

Notes)

(1) At the completion of wiring of the input terminals, be sure to close the rear cover to ensure the compensation of reference contact when thermocouple input is used.

(2) For connection of lead wires to terminals, use of sleeve-insulated clamping terminals (for M4 screws) is recommended.



4.2 Caution on power source wiring

(1) This recorder has no power fuse. Mount a power fuse outside the recorder as necessary.
Recommend fuse rating : 250V AC, 1A

(2) When connecting power cable and earth cable to terminals, be sure to use crimp style terminals with insulated sleeves (M4 screw).

(3) For power cable connection, be sure to use 600V vinyl insulated cable or equivalent.

DANGER

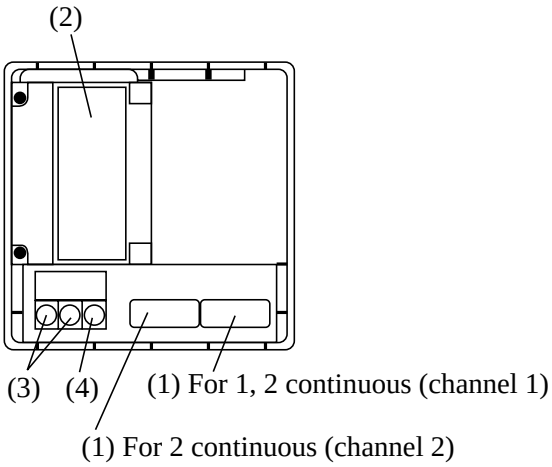
- Before making a wiring work, be sure to turn OFF the main power to prevent the risk of electric shocks. After wiring, be sure to close the cover.
- Wiring materials to be used must meet the rating. Use of materials which do not withstand the rating may cause a fire accident.
- Wring work must be performed as specified. If the unit is not earthed, it would result in electric shocks or malfunction.

CAUTION

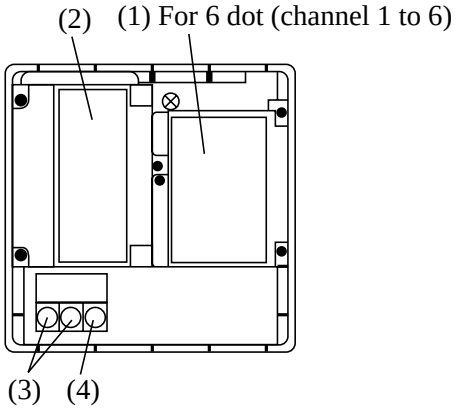
The recorder is not provided with a power fuse.
Use an external power fuse.
Rating : T1A, 250V AC or equivalent protection.

4.3 Connection to terminals

1, 2 continuous recording



6 dot recording



(1) Input terminal ⇨ Connect signal cable for each channel.

(2) Alarm/external control unit (option) ⇨ Connect the alarm signal output and external control signal input (for alarms 1 to 6, external control).

(3) Power terminal ⇨ Connect power cable to L N terminal. Power source to be connected should be free from noise .
(Code symbol : 100 to 120V AC or 200 to 240 V AC, 50/60 Hz)

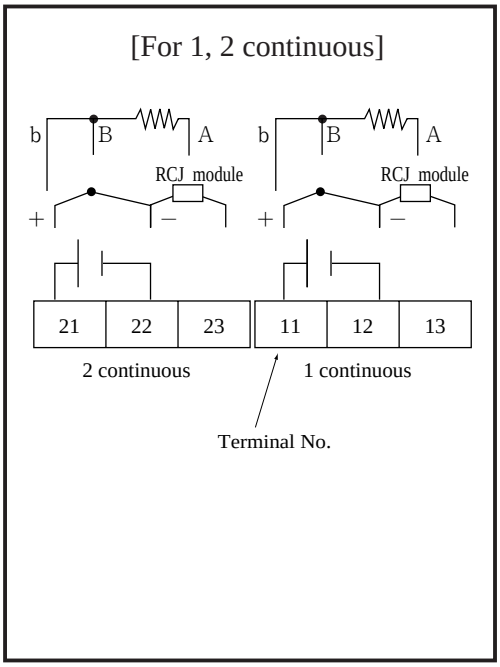
(4) Earth terminal ⇨ Connect to PE terminal (Class-3, less than 10 Ω).

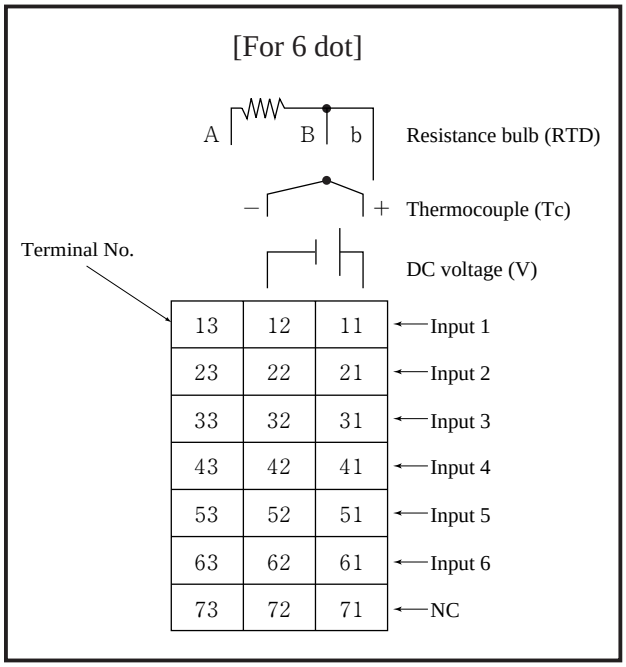
CAUTION Alarm output terminals (⑪ to ⑯, ㉑ to ㉖) are of overvoltage category I. Other terminals (input signals, communication interface) are for SELV signals (safety separated from hazardous voltage).

(1) Connection of input terminals

(1) Input terminal No. is determined for each channel.

(2) Connect input terminals according to the relation between the number of points of input signal and channel shown in Code Symbols (see Item 1.3).

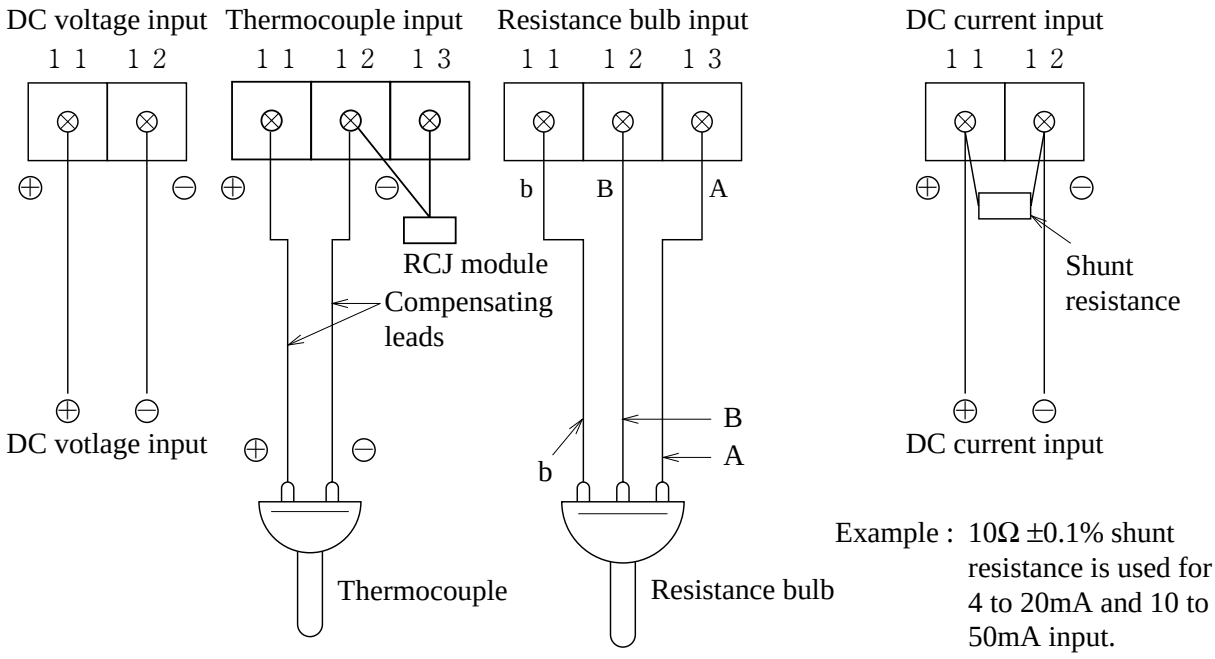




DANGER

- Before starting wiring work, be sure to turn OFF the main power to prevent the risk of electric shocks.

Example | Input terminal wiring **<1, 2 continuous>**

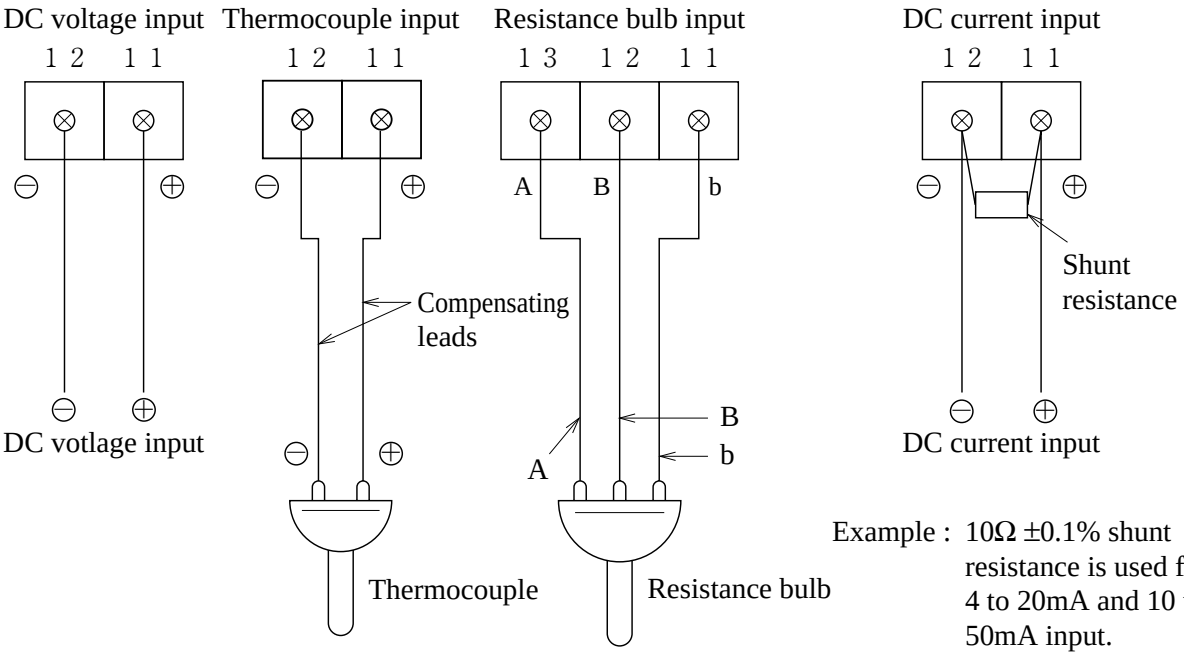


Example : 10Ω ±0.1% shunt resistance is used for 4 to 20mA and 10 to 50mA input.

In this case, ±500mV input range is available.

Note) Avoid using thermocouple input with wiring parallel to other instruments.

Example	Input terminal wiring	**<6 dot>**



Example : 10Ω ±0.1% shunt resistance is used for 4 to 20mA and 10 to 50mA input.

Note) Avoid using thermocouple input with wiring parallel to other instruments.

Note) The line between channels is not insulated only at input from resistance bulb. Be sure to use an insulated type resistance bulb input unit.

In this case, ±500mV input range is available.

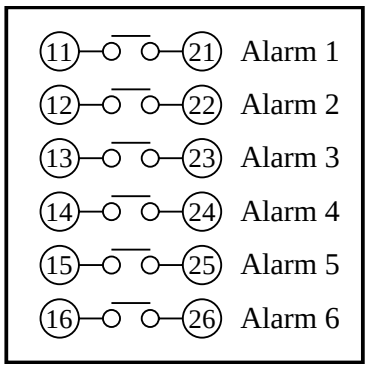
(2) Alarm output/remote control unit (option)

About alarm outputs :

(1) Alarm setting (2 points) is provided for each input channel. Alarm output is option and selected from among 2 points, 4 points and 6 points.

(2) When an alarm is generated, the relevant terminals are shorted.
1a contact output : Relay contact capacity 240V AC/3A, 30V DC/3A (resistive load)

(3) Alarm 1 to 6 corresponds to DO output No. 1 to 6 on the alarm setting panel. For details, refer to the alarm setting method under Item 7.10.

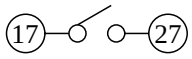


Note : If lamps are used on the outside, insert a resistor to prevent surge current.
Also, if relays or solenoids are used, insert elements for contact protection (diodes, surge killers, etc.).

External control unit

(1) This unit has a function “Chart speed selection” using contact signals from the outside of the recorder.

(2) Wiring



(DI) Chart speed selection ····· Sub-chart speed at short, and main chart speed at open

Note 1) The external control unit is not insulated and should be used with a relay connected to the outside.
External contact capacity : 12V DC/0.05A, 1a contact

Note 2) Recording start/stop operation is selected by setting sub-chart speed to 0 mm/h.
For details, refer to the sub-chart speed under Item 9.4.

DANGER

- Before starting wiring work, be sure to turn OFF the main power to prevent the risk of electric shocks.

(3) Caution on connection of input signal through barrier

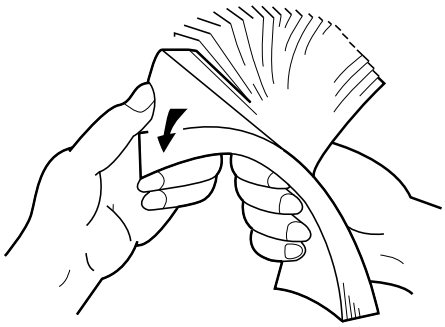
A) Thermocouple input and resistance bulb input.
Perform "Calibration of measured value" with the input connected to the barrier recorder because the barrier internal resistance is added and causes an error in the measured value.
For the calibration method, refer to Item 9.7.

B) When using Fuji Zener Barrier (PWZ), a power source 100V AC line (100 to 120V AC) should be used to ensure safe operation of the unit.

5. SET-UP

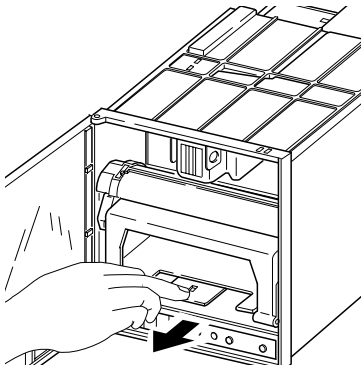
5.1 Loading chart paper

Step 1



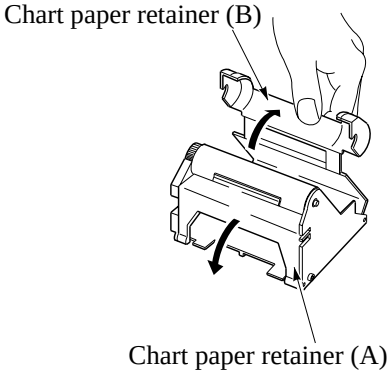
Prepare chart paper.
Loosen both ends of the chart paper thoroughly to prevent sheets from being fed together.

Step 2



Open the front door and press down the paper feed unit drawout lever.
The paper feed unit will be drawn out.

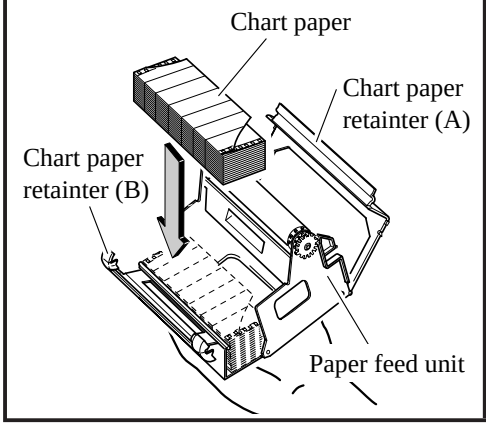
Step 3



Hold the chart paper retainer (B) and open it backward.

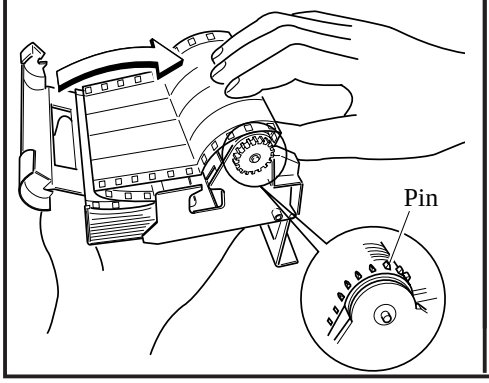
Also, hold and open the chart paper retainer (A).

Step 4



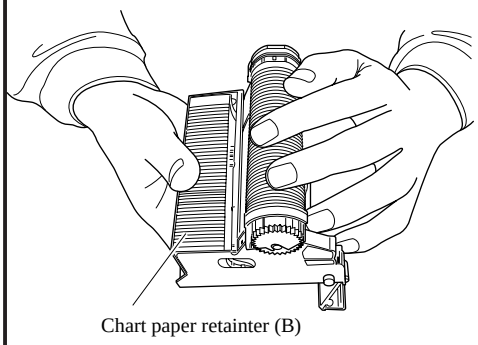
Set chart paper in the chart paper retainer (B) as illustrated.

Step 5



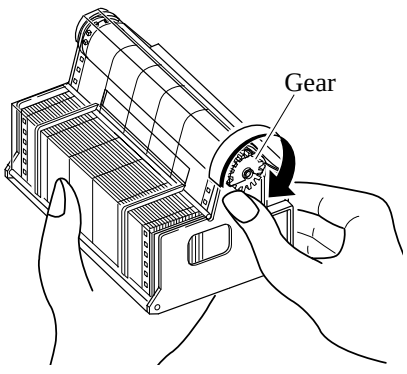
Align the perforations of the chart paper with the pins.

Step 6



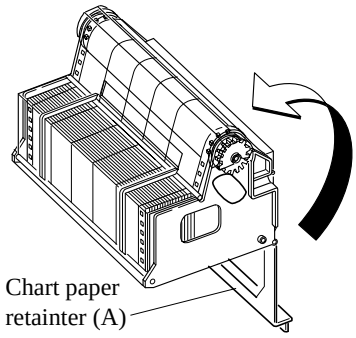
Close the chart paper retainer (B). (The chart paper is set vertically).

Step 7



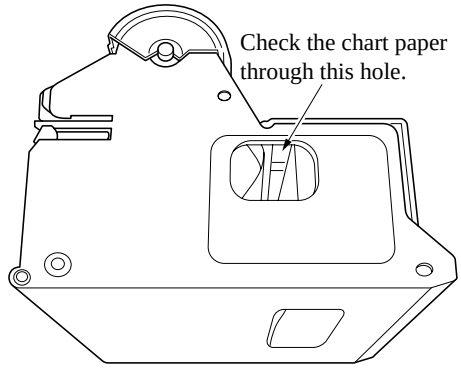
Turn clockwise the gear of the roller unit with hand and check that the chart paper shifts forward.

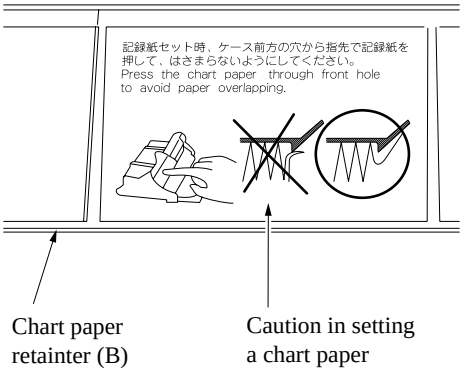
Step 8



Transfer the chart paper that has been forwarded into the storage of the paper feed unit. Then close the chart paper retainer (A).

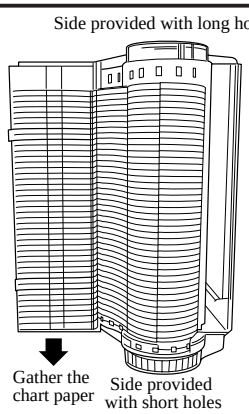
Step 9





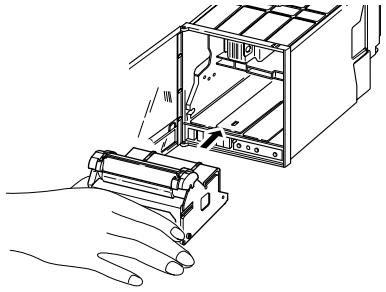
As shown by the caution display on the chart paper retainer (B), if paper is caught in the chart paper retainer (B), paper jam may result.
As shown by the figure at left, check through the holes on the left and the right side of the paper feed unit that the chart paper is not caught in the retainer.

Step 10



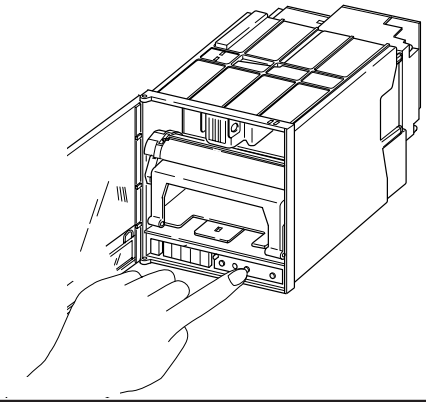
The chart paper is provided with long holes and short holes. Gather the chart paper in the storage to the side provided with short holes as illustrated on the left.

Step 11



Mount the paper feed unit in the recorder. At this time, check that it is properly locked in position.

Step 12



Press the FEED key and check that the chart paper is fed out smoothly.
(Feed out about 2 folds of paper.)
<If the paper is not fed out smoothly, go through the procedure from Step 2 again.>

Note 1 Selection of chart paper

The chart paper greatly affects the quality of the printed recording and it is also related to problems such as paper jamming, etc.
Please be sure to use the pure-quality chart paper specified us.
Chart paper type: PEX00DL1-5000B (50 equal divisions, no time lines).

Note 2 Use of the recorder after it has been left unused for a long time

If the recorder is left unused for a long time with chart paper still in the main unit, the paper 'packs down' and if the recorder is used straightway there can be problems of paper jamming, etc.
If you use the equipment after it has been left unused for a long time, first press the FEED key to feed out 2 to 3 folds of the paper.

Reference 1 Chart paper length

The chart paper is approximately 15m long. This permits about 31 days continuous print-out at a chart speed of 20mm/h.

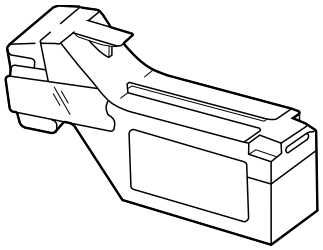
Reference 2 Chart paper end mark

The remainder of chart paper is indicated by numerals on the right of paper (unit : 10cm). When it becomes small, a red band will appear on the right to indicate that the chart paper needs to be replaced with new one.
(Note) The recorder is not provided with a chart paper end sensor. When chart paper is used out, stop recording or replace the chart paper with new one.

5.2 Recording head installation (replacement)

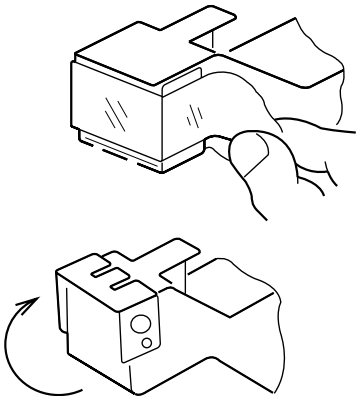
The recording head is a combination of a head and ink.
When ink is used out or trouble arises with the head, it can easily be replaced.
Use the recording head carefully observing the “Caution” noted in the later paragraph.

Step 1



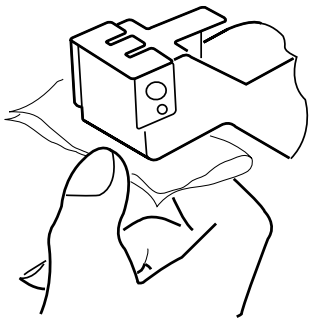
Get the recording head ready by taking it out of its aluminium pack.

Step 2



Tear the tape.
Open the cap by turning it in the direction indicated by the arrow.
(If the head is not going to be used for a long time, close the cap back in its original position.)
The cap is integral with the head unit. Turn it about 180° until it stops against the top of the head.

Step 3

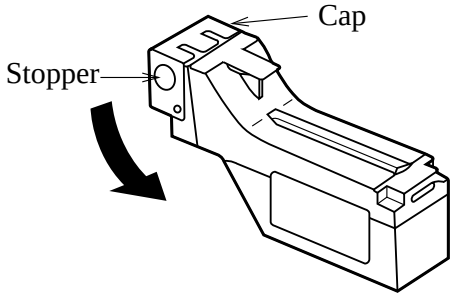


- **Lightly attach the supplied cloth to the nozzle** (ink ejecting side) to such up the ink. For the standard head, check to make sure that 4-color ink, blue, red, yellow and black, are soaked into the cloth (for the 2-color head, 2 colors of ink are soaked).

(First press the cloth against the surface for 2 to 3 second; if the 4 colors ooze out, it is OK.)

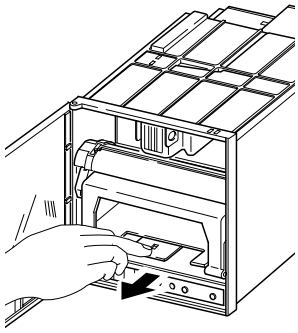
Note) Do not use any cloth other than the supplied one. Also, do not rub the nozzle with the cloth.

How to close the cap



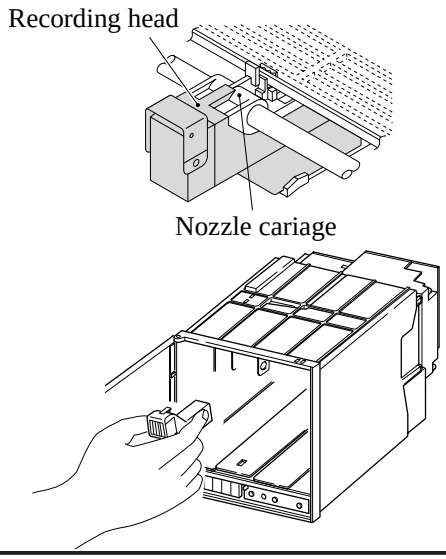
- Turn the cap in the direction indicated by the arrow and press it firmly until it is retained by the stopper.
- Ink may leak out if the cap is not properly in place.

Step 4



- Press the REC key. Operate the recorder after it has been set in recording stop mode.
- Open the front door and press down the paper feed unit drawout lever.
  The paper feed unit will be drawn out.

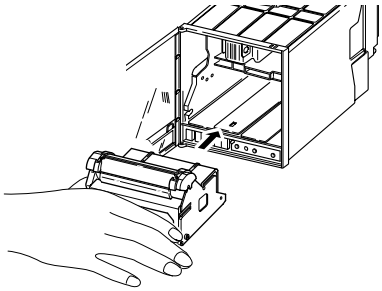
Step 5



- Hold the recording head horizontally, **line it up with the carriage in the main unit, slide it** in slowly and press it firmly until it does not go in any further.
- Take care not to bang the nozzle surface of the head. Also, avoid touching the nozzle surface with your hand.

CAUTION Do not touch the connector at the rear of the carriage to avoid the risk of minor electric shocks.

Step 6



- Set the paper feed unit in its original position.

The above completes installation of the recording head.

The recording head is a consumable part. When the built-in ink is used out, replace the head with new one.

It comes in 2 types, one is for the 1, 2 continuous recording (PHZH2002) and another for the 6 dot recording (PHZH1002). Choose the type of the head according to the recording mode of the recorder.

Recording head replacement

Draw out the recording head in the manner that is opposite to what is described in (Step 5) of the recording head setting procedure, and replace it with a new recording head.

Always carry out the following procedure after replacing a recording head.

(1) Test pattern print-out

Print out a test pattern to check that normal recording is possible. See Section 6.3 for the way of printing out a test pattern.

(2) Adjustment of analog trend recording positions

Referring to Section 9.2, readjust the zero and span on the recording paper.

Precautions in handling recording heads

Handling recording heads

DANGER

- Do not knock or shake recording heads as this can cause faults.
- The inks are not harmful but they are very difficult to remove if they adhere to the skin or to clothes, so handle heads carefully in order to avoid staining. Also, do not disassemble them.
- If, by accident, it happens that ink gets into your eyes, wash thoroughly with water as an emergency measure and then immediately consult a specialist doctor.
- When the recording head is empty of ink, it should be disposed of as a incombustible object or returned to our office for reuse (recycling).

Note 1 | If recording is halted and the recorder is not used for a long time

Carry out the following in order to prevent jamming and drying-up of the ink.

> Remove the recording head from the main unit, make absolutely sure the cap is closed properly and store the head in a cool, dark place (average temperature 5 to 30°C).

If the head is left installed in the recorder:

> Do not switch off the power to the recorder and do not close the cap.
> * Periodically, there is an automatic discharge of ink to prevent drying-up.
> Leave the recording paper in place in the recorder.

If it is not possible to keep the power switched on, make sure that the cap is closed.
Draw out the paper feed unit using the recording head setting method (Step 4) **.**
Open the indicator and tighten the cap.

Note 2 | At the start of use of a recording head

If you are starting to use a new recording head or if the recorder has been left unused for a long time, always wipe the head's nozzle surface lightly with the accessory cloth and check that the ink oozes out properly into the cloth. (See (Step 3) **.**)
Also, after normal recording is possible. See Section 6.3 for the way of printing out a test pattern.
When the working environment is 15°C or less, perform print-out of "test pattern" after period of several minutes has elapsed since the recording head was mounted. (The recording head has a built-in heater.)

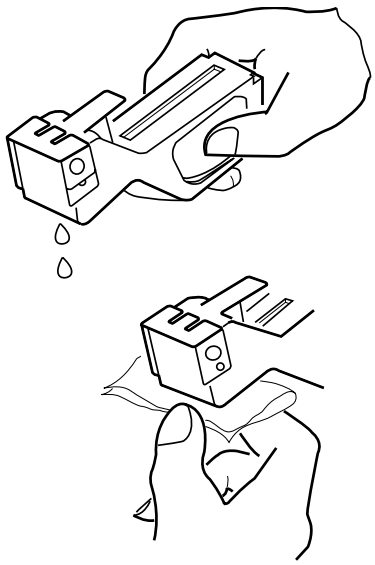
Note 3 | Storage of recording heads

When they are delivered, recording heads are in aluminium packs.
If you are not going to use a head straight-away, leave it sealed and store it in a cool, dark place with an average temperature of 5 to 30°C.

Note 4	Shipping of recording head

- Do not ship the unit recording head after the aluminum pack was opened up. If it is necessary to ship the unit recording head under avoidable circumstances, **be sure to close the cap**, and ship it as contained in a boxboard in the state where vibration and impack are eased using cushioning materials.
- **Always close the cap if you are transporting** a head while it is still installed in the recorder main unit.

Note 5	If the ink is not sprayed.



(1)Hold the recording head with turning the nozzle surface downward and push the side strong till spilling two drops.
(2)Absorb the standing ink on the nozzle surface with the cloth attached.
(3)Hold the cloth to the nozzle surface again to find the ink flowed onto cloth.
When ink does not come out, repeat the above operation ((1) through (3)).

* When working environment is 15°C or less, perform print-out of "record" or "test pattern" after a period or several minutes has elapsed since the recording head was mounted. (The recording head has a built-in heater.)

Reference	Ink consumption

When recording at 20mm/h of chart speed and a given input, the consumption of ink is as shown below, though it depends on operating conditions.

1, 2 continuous recording, 6 dot recording ------- about 12 months

6. OPERATION AND ACTIONS

6.1 Before running the equipment:

Check the following points before starting operation.

1 Setting the chart paper and recording head

(1) Setting the chart paper ..... See Section 5.1
(2) Setting the recording head ..... See Section 5.2

2 Wiring

(1) Input terminals .....
(2) Alarm terminals (option) ..... } See Section 4.3
(3) Power and earth terminals .....

3 Conformity of input connection to recording channel

(1) Code symbols ..... See Section 1.3

6.2 Turning on power and status

The instrument has no power switch. Engaging the power cord with power source turns it on.

1) Turning on power for the first time

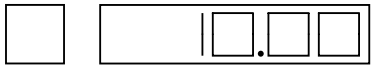
↓

The recording head slowly moves toward the left end (0% side).

↓

After detecting the 0% position, the recording head moves to the approximate central position.

↓



The current time appears on the display section, approximately 30 seconds later in case of 6 dot type.

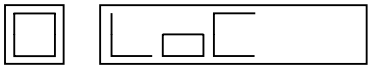
2) Whether to start recording when turning on is as in "7.11 /Selecting whether to start recording when turning on".

CAUTION

- Prior to delivery of the unit, the recording condition at power ON is set in "Record Stop" mode. When starting the recording operation at the time of recovery of power failure during operation, turn ON the power and set the unit in "Record Start" mode referring to Item 7-11.

6.3 Printing the test pattern

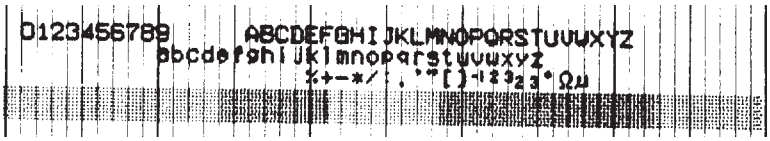
① Open the front door and press the DSP key for 3 seconds to display the following.



② Press the SEL key two times to display the following.

③ Press the ∧ key until "0" turns "2".

④ Press the ENT key to print the test pattern below.



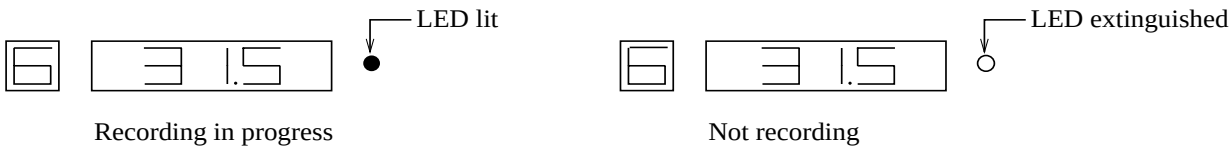
Note 1) Make sure all colours are recorded. If any colour is not developed or is unclear, apply the furnished cloth carefully on the nozzle end to wipe it. (See 5.2, (Step 3).)

Note 2) To quit print-out, press the ENT key again.

6.4 Operation in normal mode

(1) Stopping and starting the recording operation (REC key)

- Only in the normal mode, recording can be started or stopped.
- Each press of REC key alternately selects recording operation or recording stop.



Recording in progress

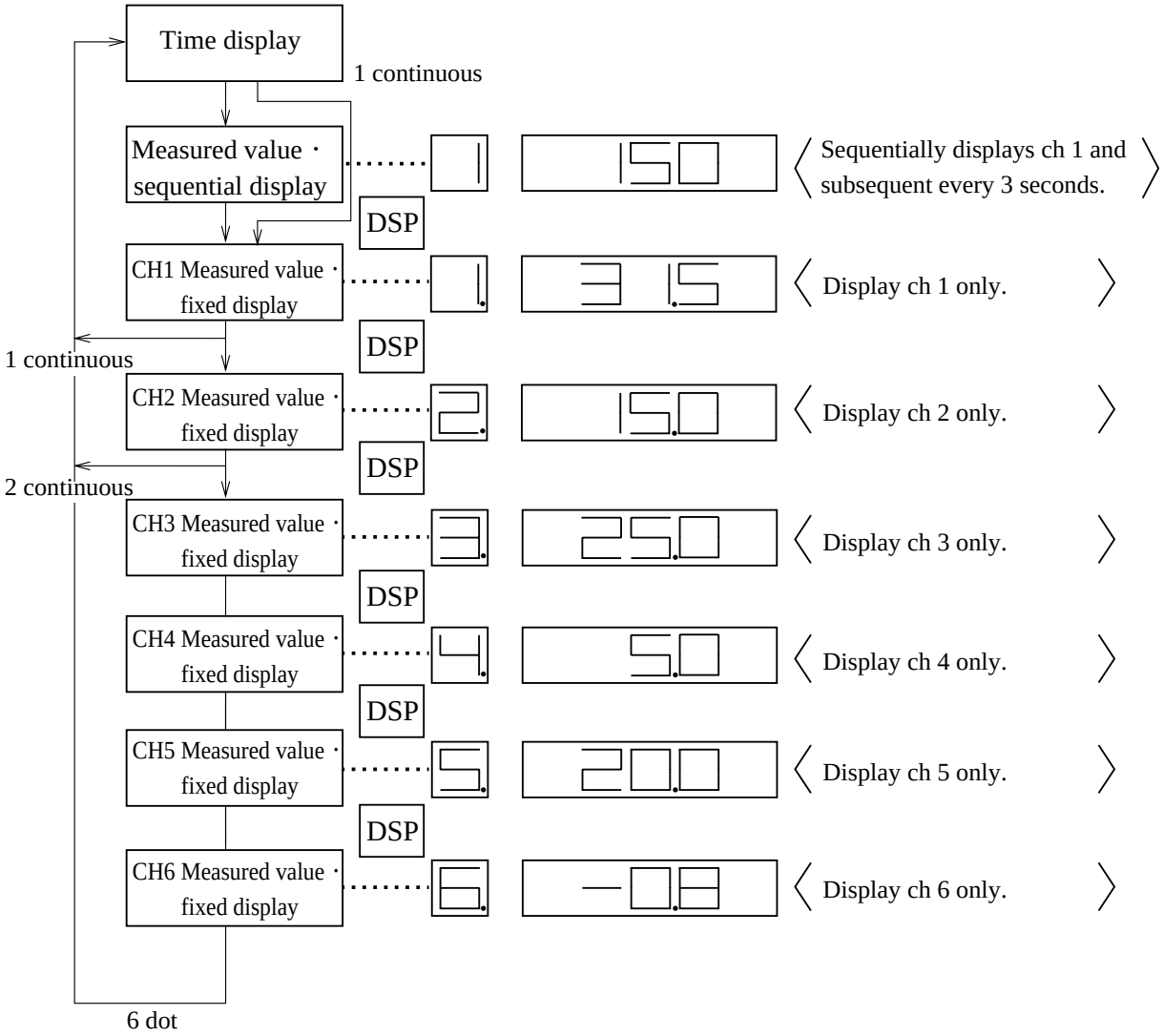
Not recording

(2) Quick feed of recording chart (FEED key)

- Hold down the FEED key to quickly feed the recording chart, overriding the normal chart speed.

(3) Changing the display mode (DSP key)

- Pressing the DSP key changes the display mode.
- Each press of DSP key selects the next display mode.
  (The number of screens depends on 1 continuous, 2 continuous or 6 dot recording.)



6.5 Displays and print-outs on detection (cancellation) of alarms

(1) When an alarm has occurred, its contents appear on the display section. They appear for 1 second every 3 seconds while displaying a measured value.

Note) In case of fixed display of measured value, the alarm status for the fixed channel only appears.

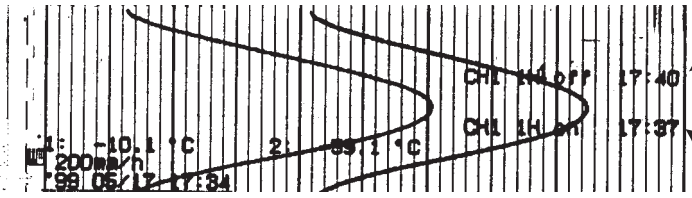
Example of alarm display

Example: Alarm No.1 and No.2 of ch 1 has occurred.

(2) When an alarm detected and cancelled, the relevant details are printed on the right-hand side of the chart paper.

On detection: The time of detection, channel No., type of alarm,
---- Print-out color: Red (6 dot), Red (1,2-continuous)

On cancellation: The time of cancellation, channel No., type of alarm
---- Print-out color: Black (6 dot), Blue (1,2-continuous)



(2) Channel 1 No. 1 H alarm release
Release time: 17 : 40

(1) Channel 1 No. 1 H alarm generation
Generating time: 17 : 37

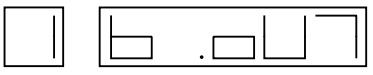
(3) If an alarm is detected or a cancellation is made during data print-out or list print-out, the alarm print-out takes place after completion of the data or list print-out.

(4) Up to a maximum of 30 alarm detection cancellation information can be stored and sequentially printed out, but if the storage capacity is exceeded because of a large number of detections/cancellations in a short time, information in the overflow portion is discarded and cannot be printed out.

6.6 Displays and print-outs on occurrent of burnt-out

(1) If a thermocouple or resistance bulb has burnt our, its contents appear.

Example of alarm display



Example: Ch 1 burnt out.

Note: Trend recording overswings toward the maximum side of the recording range.

(2) If a burn-out occurs, its contents are printed on the right of recording chart (in red).

Example of burn-out print-out

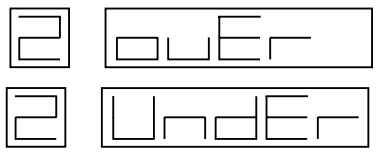
1	BUNOUT	11 : 52

Occurrence time : 11 : 52
Channel No. : 1

6.7 Indication of over-range, under-range display and abnormal input display

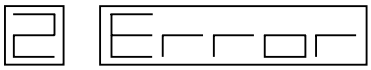
For any of thermocouple, resistance bulb and voltage inputs, the measurable input signal range is fixed. If the input is beyond the specified range, “over” or “under” appears.

Example of over/under display



An input error indication appears if the voltage input signal line has been open-circuited or if the voltage input signal is further beyond over/under.

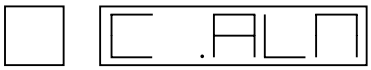
Example of abnormal input display



6.8 Display of fault in recording head carriage

If the recording head does not operate properly any more because the recording head running section is erroneous, an error appears and the recording operation stops.

Example



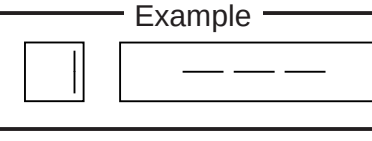
If "C. ALM " has appeared, turn OFF power and check the following points.

(1) Check whether the recording head running shaft is clogged with foreign matters? (If contaminated, wipe off by dry rag.)
(2) Check whether the recording head drive belt is cut or loose?
(3) Check whether the recording chart floats, thereby touching the recording head?
(4) Check whether the recording head is correctly installed?
After eliminating the cause of error, turn on the instrument again.

6.9 Display of skipped parameter

The channel for which the parameter setting is skipped appears as “ ——— ” on the display section. In the case, recording alarm and operations are not carried out at all.

Example



7. SETTING AND CHECKING PARAMETERS

7.1 Setting and Checking

(1) Parameters are factory set as given in the table below. Turning on power as they are initiates operation (indication, analog trend recording). As required, change the parameter setting.

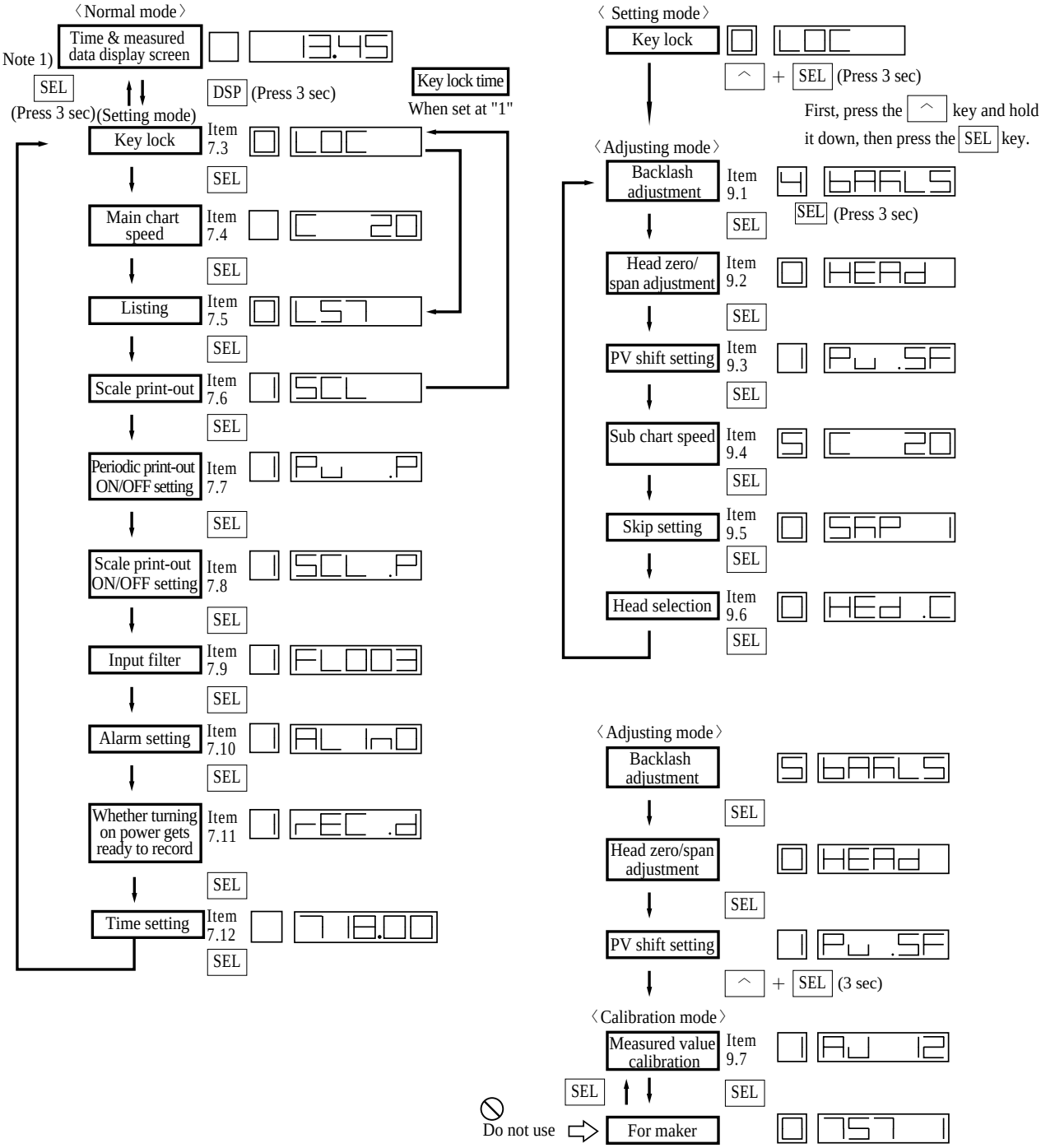
(2) Alarm and PV shift are not set. Set them as necessary. Note that the input filter is set at 3 seconds.

> Note) Before setting any parameter, install the recording chart.

(1) Parameters as set by factory (initial values)

Prameter name	Factory setting (initial values)		Remarks	How to check setting
Key lock	OFF (0)		Set to "1" for key lock	Item 7.3
Main chart speed	20mm/h		Settable range : 10,20,24,30,50,120,200 300,400,1000,1200,1500	Item 7.4
Periodic print-out	ON (1)		Set to "1" for periodic print-out	Item 7.7
Scale print-out	ON (1)		Set to "1" for scale print-out	Item 7.8
Input filter	3 seconds		Settable range:0 to 255 for each channel	Item 7.9
Alarm	————		Alarm No.1 and 2	Item 7.10
	Alarm type : N		No alarm : N H alarm : H L alarm : L	
	at H, L	DO output No.: 0	Settable range 0 to 6 0 : No DO output	
		Alarm set value : 0	To alarm setting range of each kind of input.	
Whether to start recording when turning on	Recording stop (0)		Set to "1" for getting ready to record when turning on . Set to "0" for record stop when turning on .	Item 7.11

7.2 Outline of procedure for setting parameters



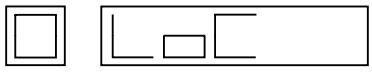
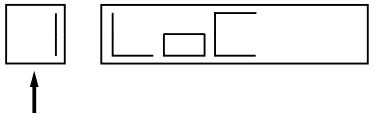
Note) By pressing the "SEL" key for 3 seconds on any mode (setting mode, adjustment mode and calibration mode), the screen returns to the normal mode.

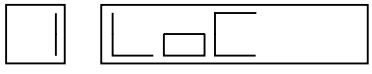
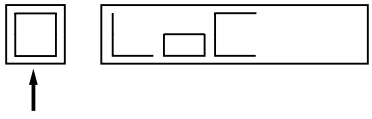
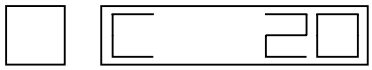
7.3 Key lock setting/release

Explanation

When parameters need not be changed after setting, you are advised to lock the key to prevent them from being changed accidentally. When the key is locked, the SEL key is used only for display of list printing and scale printing.

Key lock ON	1
Key lock OFF	0

Operation contents (ex.)	Lock the key.	
Keying	Explanation	Display
DSP	Press the DSP key for 3 seconds to select the setting mode. (key lock display appears.)	
∧	Press the ∧ key until "1" is selected.	
ENT	Press the ENT key to register and transfer to display of the next parameter.	
SEL	Press the SEL key for 3 seconds to select the normal mode.	

Operation contents (ex.)	Unlock the keys.	
Keying	Explanation	Display
DSP	Press the DSP key for 3 seconds to select the setting mode. (key lock display appears.)	
∧	Press the ∧ key until "0" is selected.	
ENT	Press the ENT key to register and transfer to the next parameter display.	
SEL	Press the SEL key for 3 seconds for setting in normal mode.	

7.4 Setting the Chart Speed (main chart speed)

Explanation

- Main chart speed : Set the recording chart speed in normal operation to one of 10, 20, 24, 30, 50, 120, 200, 300, 400, 1000, 1200 and 1500.
- **If the case of a continuous recording type, if the chart speed is too fast, the result is dashed line recording instead of continuous recording. (As a general criterion, 1000mm/h or more)**
- On a dot recording type, if the chart speed is fast, it becomes difficult to read recording due to increase in the space between break points. It is recommended that the recorder be sued at a speed of 50mm/h or less.
- On a continuous recording type, the recording cycle varies with chart speed.

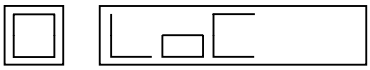
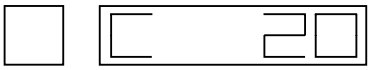
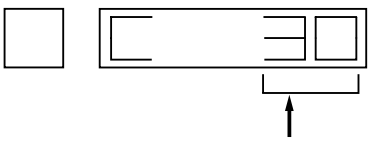
$$\text{Recording cycle(sec.)} = \frac{400}{\text{Chart speed (mm/h)}}$$

(But not faster than 2 seconds.)

Example)

Chart speed (mm/h)	10	20	30	50	120	200
Recording cycle (sec.)	40	20	13 or 14	8	3 or 4	2

- The recording cycle for dot recording type is 30 seconds fixed.

Operation contents (ex.)	Changing the normal recording chart speed from 20 to 30mm/h.	
Keying	Explanation	Display
DSP	Press the DSP key for 3 seconds to display the setting mode. (key lock display appears.)	
SEL	Press the SEL key to display the main chart speed.	
∧	Press the ∧ key for selecting "30".	
ENT	Press the ENT key to register and transfer display of next parameter.	
SEL	Press the SEL key for 3 seconds for setting in normal mode.	

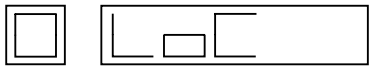
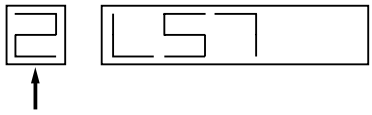
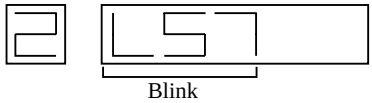
7.5 How to list

Explanation

• Use for arbitrarily printing the prameter list, instantaneous value list, test pattern or scale.

Listing	Print-out contents	Set value
Instantaneous value listing	Each channel measured value (instantaneous value) and engineering unit, time, channel number	0
Parameter listing	Input signal, input range, recording range, unit, alarm, input filter, chart speed, etc.	1
Test pattern print-out	Colour patterns and test characters	2
Scale print-out	Scale of desired channel (Refer to 7.6)	Next screen

• Analog trend recording is stopped by listing but is automatically resumed after end of listing.

Operation contents (ex.)	Print a test pattern.	
Keying	Explanation	Display
DSP	Press the DSP key for 3 seconds to display the setting mode. (key lock display appears.)	
SEL	Press the SEL key twice for displaying the listing.	
∧	Press the ∧ key for selecting "2" Test pattern.	
ENT	Press the ENT key to start printing.	 Blink
	[To stop printing, press the ENT key again. Pressing the ∧ key while listing rapidly feeds the chart paper.]	
SEL	After completion of printing, press the SEL key for 3 seconds for setting in normal mode.	

•Instantaneous value list ---------- For print-out example, refer to 11.2.

•Parameter list ---------- For print-out example, refer to 11.3.

•Test pattern ---------- For print-out example, refer to 11.4.

Note) When resuming the analog trend recording after the end of listing in case of continuous recording type, the input values preceding and following the listing are recorded as continuous line.

7.6 How to print the scale (manually)

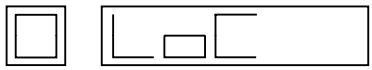
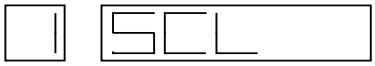
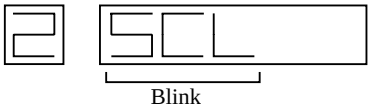
Explanation

• Use for arbitrary scale print-out.

Number of recording point	Settable range
1 continuous	1
2 continuous	1 to 2
6 dot	1 to 6

• Scale can be printed even while recording.

• Analog trend recording is stopped by scale print-out but is automatically resumed after the end of listing.

Operation contents (ex.)	Print 2 continuous type 2 ch scale.	
Keying	Explanation	Display
DSP	Press the DSP key for 3 seconds to display the setting mode. (key lock display appears.)	
SEL	Press the SEL key three times for displaying the scale print-out.	
∧	Press the ∧ key for selecting "2" (2 ch).	
ENT	Press the ENT key to start printing. [To stop printing, press the ENT key again. Pressing the ∧ key while listing rapidly feeds the chart paper.]	
SEL	After completion of printing, press the SEL key for 3 seconds for setting in normal mode.	

∗ Scale print-out ---------- For print-out example, refer to 11.5.

7.7 How to set ON/OFF of periodic print-out

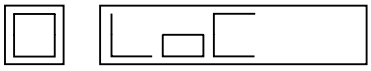
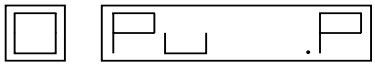
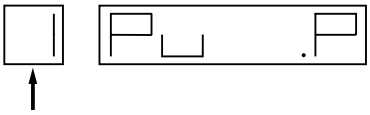
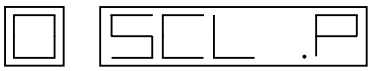
Explanation

- Selects whether or not to print the instantaneous values at fixed intervals while recording.
- Prints the following items at fixed intervals according to the chart speed.

  [Printing start line, channel No., measured value, unit, chart speed, current time]
- Alternately selects periodic print-out and scale print-out.

Periodic print-out ON	1
Periodic print-out OFF	0

- For details, refer to "Relation between chart speed and printing" on Page 7-9.

Operation contents (ex.)	Periodic print-out (ON).	
Keying	Explanation	Display
DSP	Press the DSP key for 3 seconds to display the setting mode. (key lock display appears.)	
SEL	Press the SEL key four times for displaying ON/OFF of periodic print-out.	
∧	Press the ∧ key for selecting "1".	
ENT	Press the ENT key to register and transfer to the next parameter display.	
SEL	Press the SEL key for 3 seconds for setting in normal mode.	

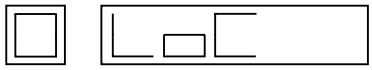
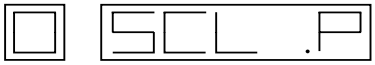
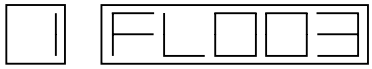
7.8 How to set ON/OFF of scale print-out

Explanation

- Selects whether or not to print the scale while recording.
- The scale print-out for each channel sequentially is effected alternately with periodic print-out.
- The printing interval is automatically determined by chart feed speed.

Scale print-out ON	1
Scale print-out OFF	0

- For details, refer to "Relation between chart speed and printing" on Page 7-9.

Operation contents (ex.)	Scale print-out (ON).	
Keying	Explanation	Display
DSP	Press the DSP key for 3 seconds to display the setting mode. (key lock display appears.)	
SEL	Press the SEL key five times for displaying the scale print-out.	
∧	Press the ∧ key for selecting "1".	
ENT	Press the ENT key to register and transfer to the next parameter display.	
SEL	Press the SEL key for 3 seconds for setting in normal mode.	

Relationship between chart speed and printing

• The following items depend on the recording chart speed.

(1) Printing action : Provided that the printing is available, periodic print-out, scale, alarm, burn-out or channel No. digital print-out is available while recording.

(2) Periodic print-out, scale print-out cycle : Print-out interval is determined by the chart speed. Periodic print-outs and scale print-out are effected alternately.

(3) Recording cycle : 1 continuous or 2 continuous recording cycles are determined by the chart speed. 6 dot recording cycle is 30 seconds fixed regardless of the chart speed.

Chart speed	1, 2 continuous recording			6 dot recording		
	(1) Printing action	(2) Periodic print-out cycle	(3) Recording cycle	(1) Printing action	(2) Periodic print-out cycle	(3) Recording cycle
10mm/h	Printable	8 h	40 sec.	Printable	8 h	30 sec. fixed
20mm/h		4 h	20 sec.		4 h	
24mm/h		4 h	16 or 17 sec.		4 h	
30mm/h		4 h	13 or 14 sec.		4 h	
50mm/h		2 h	8 sec.		2 h	
120mm/h		1 h	3 or 4 sec.	Unprintable	1 h	
200mm/h		30 min	2 sec.		30 min	
300mm/h		20 min	2 or 3 sec.		20 min	
400mm/h		20 min	2 sec.		20 min	
1000mm/h	Unprintable	6 min	2 sec.		6 min	
1200mm/h		6 min	2 sec.		6 min	
1500mm/h		4 min	2 or 3 sec.		4 min	

Note 1) Digital print-out is not made if 1, 2 continuous version has 1000 mm/h or higher chart speed. **Only printing start line is recorded.**

Note 2) Digital print-out is not made if 6 dot version has 120 mm/h or higher chart speed. **Only printing start line is recorded.**

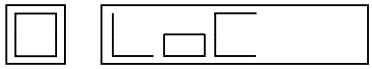
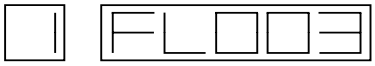
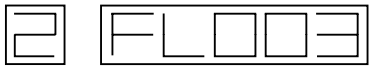
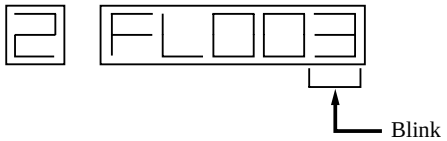
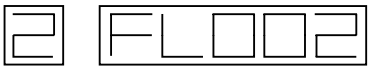
Note 3) Periodic print-out or scale print-out is not executed even if their time has come if listing is being executed then. Similarly, the periodic print-out or scale print-out being executed is stopped if listing is activated then, and the print-out is not recovered even after the end of listing.

Note 4) When time is changed during recording, periodic print-out and scale print-out may not be executed. In this case, stop recording and then start it again to return to the normal status.

7.9 How to set the input filter

Explanation

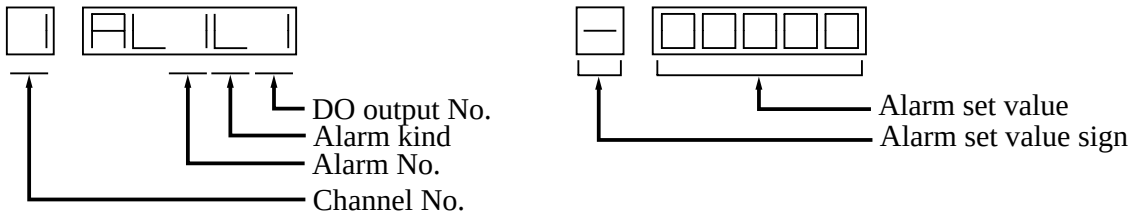
- Sets the input filter (time constant) for each channel.
- Settable in 1 second steps within the range of 0 to 255 seconds.

Operation contents (ex.)	Change the time constant of channel 2 from 3 to 2.	
Keying	Explanation	Display
DSP	Press the DSP key for 3 seconds to display the setting mode. (key lock display appears.)	
SEL	Press the SEL key six times for displaying the input filter setting.	
∧	Press the ∧ key to change the channel 1 to channel 2.	
ENT	Press the ENT key 3 times to blink 1-place.	
∧	Press the ∧ key several times for changing 3 to 2.	
ENT	Press the ENT key to register.	
SEL	Press the SEL key for 3 seconds for setting in normal mode.	

7.10 How to set the alarm

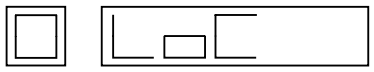
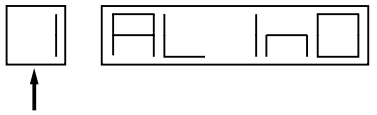
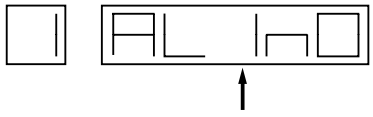
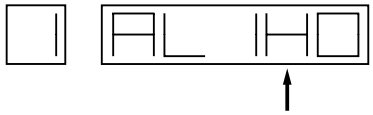
Explanation

- Channel : Setting of channel No. for object alarm.
- Alarm No. : Up to 2 alarms can be set per channel.
- Kind of alarm : 2 kinds, H and L (settable freely for each alarm).
  N selected delivers no alarm (gives no alarm display nor alarm output).
- Alarm set value : Setting in engineering values (see Table 1 Alarm settable range).
- DO output No. : Setting of option alarm unit relay No. (0 to 6, no output at 0).
  DO output can also be used for common setting (OR output).



Note 1) Set the sign concurrently with digit 5. (Refer to the next page)

Note 2) Blank for plus or " − " for minus.

Operation contents (ex.)	Change the alarm No. 1 for channel 1. N→H 0.0℃→80.0℃ DO0→2	
Keying	Explanation	Display
DSP	Press the DSP key for 3 seconds to display the setting mode. (key lock display appears.)	
SEL	Press the SEL key seven times for displaying the alarm setting.	
(∧) ENT	Press the ∧ key until a channel to change is selected and press the ENT key.	
(∧) ENT	Press the ∧ key until an alarm No. to change is selected and press the ENT key.	
(∧) ENT	Press the ∧ key until "N" turns "H" and press the ENT key.	

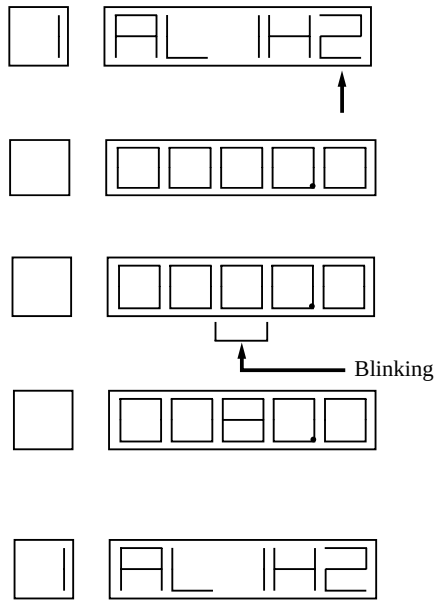
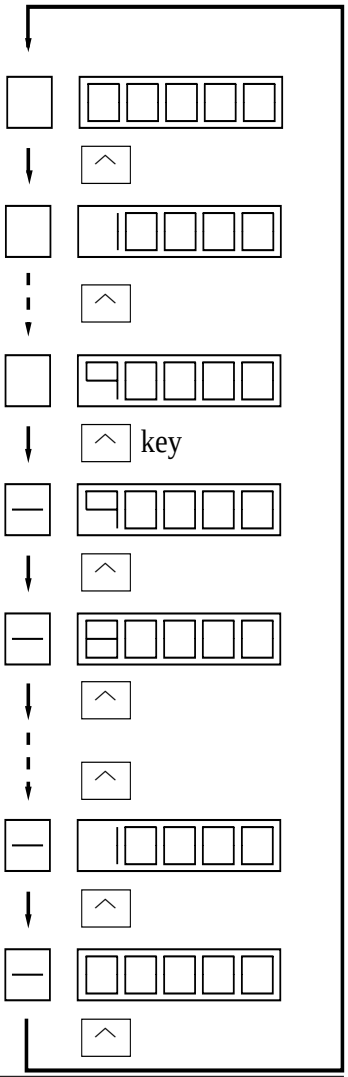
Keying	Explanation	Display
∧	Press the ∧ key until "0" turns "2".	
ENT	Press the ENT key to display the alarm set value.	
ENT	Press the ENT key twice for blinking the 10-places.	
∧	Press the ∧ key for turning "0" to "8".	
ENT	Press the ENT key three times for displaying the alarm setting. The set value is registered.	
SEL	Press the SEL key for 3 seconds for setting in normal mode.	

Table 1 : Alarm settable range

Kind		Alarm settable range	
Thermocouple	B	370.0 to 1790.0℃	698.0 to 3254.0˚F
	R	- 30.0 to 1790.0℃	- 22.0 to 3254.0˚F
	S	- 30.0 to 1790.0℃	- 22.0 to 3254.0˚F
	K	-230.0 to 1400.0℃	-382.0 to 2552.0˚F
	E	-230.0 to 830.0℃	-382.0 to 1526.0˚F
	J	-230.0 to 1130.0℃	-382.0 to 2066.0˚F
	T	-230.0 to 430.0℃	-382.0 to 806.0˚F
	N	- 30.0 to 1330.0℃	- 22.0 to 2426.0˚F
	W	- 30.0 to 1790.0℃	- 22.0 to 3254.0˚F
	L	-230.0 to 930.0℃	-382.0 to 1706.0˚F
	U	-230.0 to 430.0℃	-382.0 to 806.0˚F
	P N	- 30.0 to 1330.0℃	- 22.0 to 2426.0˚F
Resistance bulb	JPt100	-230.0 to 630.0℃	-382.0 to 1166.0˚F
	Pt100	-230.0 to 630.0℃	-382.0 to 1166.0˚F
DC voltage scalling OFF		-55.00 to 55.00mV -550.0 to 550.0mV -5.500 to 5.500V -55.00 to 55.00V	
DC voltage scalling ON		-32767 to 32767 [decimal point anywhere]	

· Change of symbol digit and 5th digit

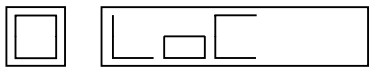
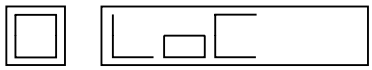


7.11 Selecting whether to start recording when turning on

Explanation

• Selects whether turning on power gets ready to record or not.

Not ready to record	0
Ready to record	1

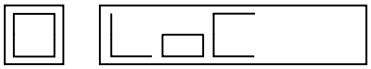
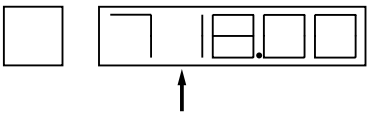
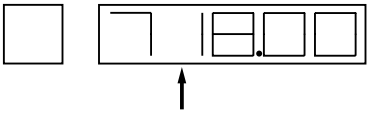
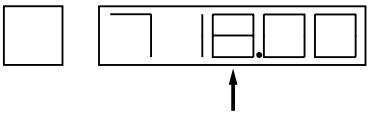
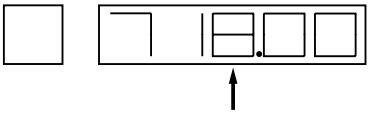
Operation contents (ex.)	Turning on power does not get ready to print (OFF).	
Keying	Explanation	Display
DSP	Press the DSP key for 3 seconds to display the setting mode. (key lock display appears.)	
SEL	Press the SEL key eight times for displaying whether turning on power gets ready to record or not.	
∧	Press the ∧ key for turning "1" to "0".	
ENT	Press the ENT key to register and transfer to the next parameter display.	
SEL	Press the SEL key for 3 seconds for setting in normal mode.	

7.12 Setting of date and time

Explanation

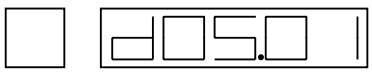
• Built-in clock is properly set before product shipment. However, if the clock does not keep good time or when the battery is replaced, reset the time.

Note) Stop recording to set the time.

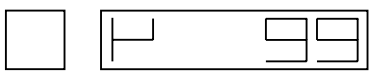
Operation contents (ex.)	Explanation	Display
DSP	Press the DSP key for 3 seconds to display the setting mode (key-lock display).	
SEL	Press the SEL key 9 times to display the "Time Setting" screen. When nothing is displayed in the left-most digit and T is displayed in the 2nd digit from left, the "Time Setting" screen is displayed.	
∧	Press the ∧ key to change the digit of 10'clock. **Note) For setting, use a 24H system.**	
ENT	Press the ENT key to register and shift to the digit of 1 o'clock.	
∧	Press the ∧ key to change the digit of 1 o'clock.	
ENT	Press the ENT key to register and shift to the digit of 10 min.	
∧	Press the ∧ key to change the digit of 10 min.	
ENT	Press the ENT key to register and shift to the digit of 1 min.	
∧	Press the ∧ key to change the digit of 1 min.	

Similarly, date and year are set.

Date Setting screen



Year Setting screen



8. MAINTENANCE - INSPECTION

8.1 Maintenance/inspection items

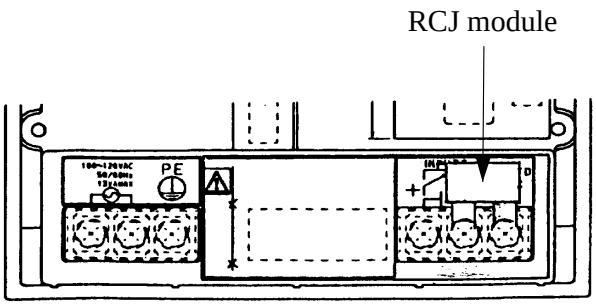
Carry out periodic maintenance and inspection to keep the equipment in good condition.
Pay particular attention to the items noted below and make replacement with spares when necessary.

Inspection, Maintenance Items	Procedure
Recording head replacement:	The recording head is a consumable part. If there is no more ink, replace the head with a new one. Ink consumption varies depending on the contents of records, but writing for about one year is possible at a chart speed of 20mm/h. To get spares, quote the following type. Recording head type: PHZH2002/1, 2 continuous recording type PHZH1002/6 dot recording type
Inspection of the recording head	In normal conditions, there is no need for preventive maintenance of the recording head. However, in a high-temperature or very dusty environment, periodically wiping the nozzle surface prevents accumulation of dust and ink and so prevents nozzle blockage that is liable to be caused by such accumulation. To absorb ink, use the supplied "Ink blotting cloth" **If the recording head is left unused for a long time without using the cap, ink may not be absorbed when the blotting cloth is attached to the nozzle of the recording head. In such a case, wet the blotting cloth with water end attach it to the nozzle for several 10 seconds until the ink is absorbed sufficiently.**
Recording paper replacement	In continuous operation at a chart speed of 20mm/h, the recording paper lasts about 31 days. When there is only a small amount of recording paper left, a red band is printed on the right-hand edge of the paper. When this happens, refer to section 5.1 and replace the recording paper. To get supplementary paper, quote the following type. Recording paper type: PEX00DL1-5000B
Battery replacement	Replace the battery every 5 years. Type of battery unit: TK7J1145C2
Cleaning of traveling shaft	Wipe off dust, if found, on the shaft for traveling the record head horizontally with clean cloth. Otherwise accurate recording may not be made. **Do not lubricate the traveling shaft. Lubricating can cause inaccurate recording.**
Transfer of record head	• Do not transfer the record head taken out of the aluminum bag alone. If the transfer is unavoidable, **make sure to tighten the cap** and place the record head in a cardboard box with sufficient cushioning materials to reduce vibration and impact. • **Make sure to tighten the cap** when transferring the record head in a state installed in a recorder main unit.

8.2 Battery replacement procedure

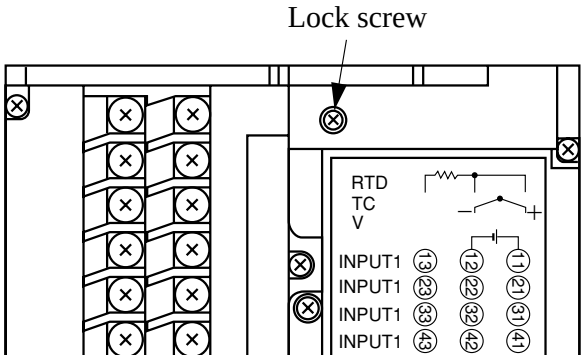
* The battery should be replaced every 5 years. If the battery power is lost, time and date cannot be registered when the AC power is not supplied.
* Turn OFF the power source.
* Open the front door and replace the battery, using the following procedure.

Step 1



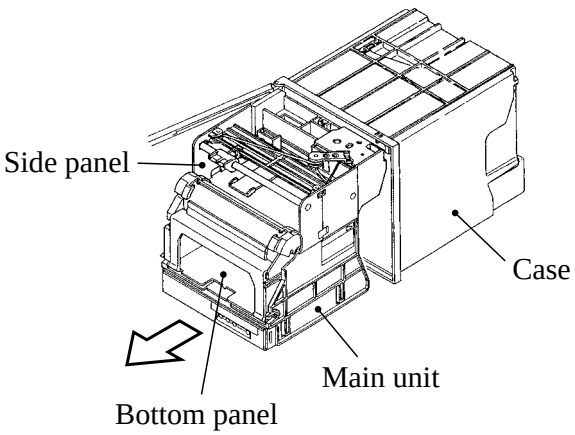
When an RCJ module is attached, it should be removed.

Step 2



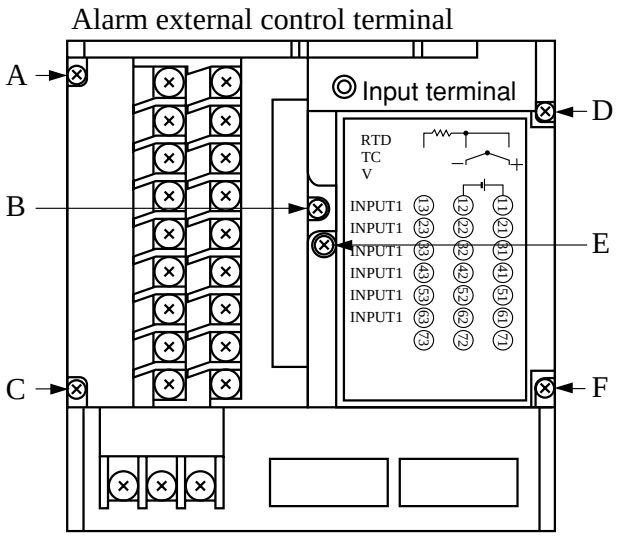
Loosen the lock screw (M4) of the main unit, using a screwdriver ⊕.

Step 3



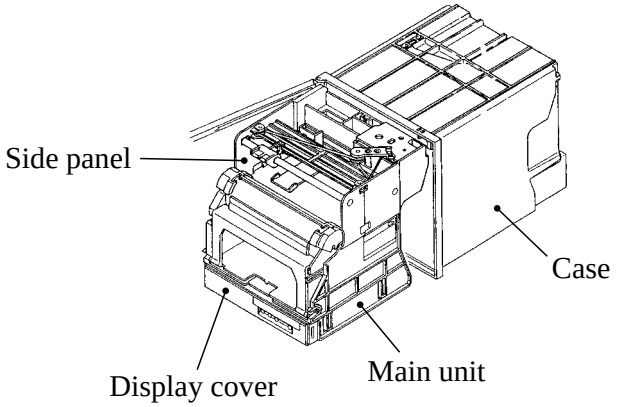
Hold the slide panel or the bottom panel with your fingers, and pull it with force toward you. The main unit will be removed from the case.

Step 4



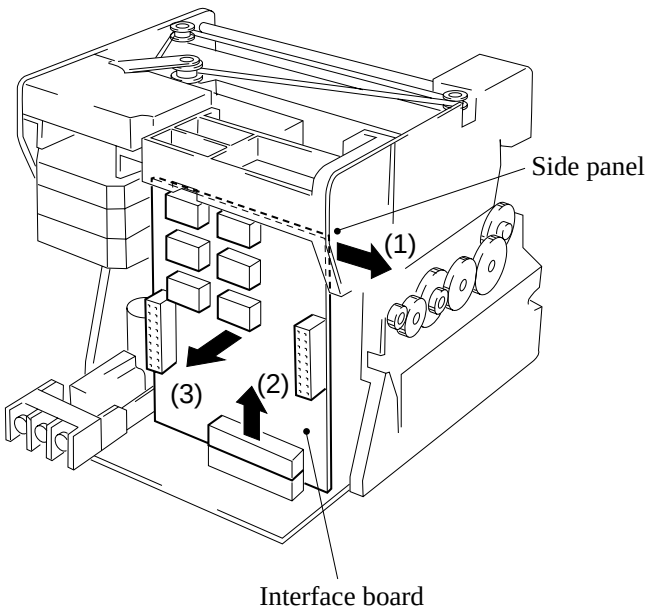
When an alarm is provided, remove the screws, A, B and C (M2.5), then remove the alarm external control terminal.
In the case of 6 dot points, remove the screws, D, E and F (M2.5), and then remove the input terminal.

Step 5



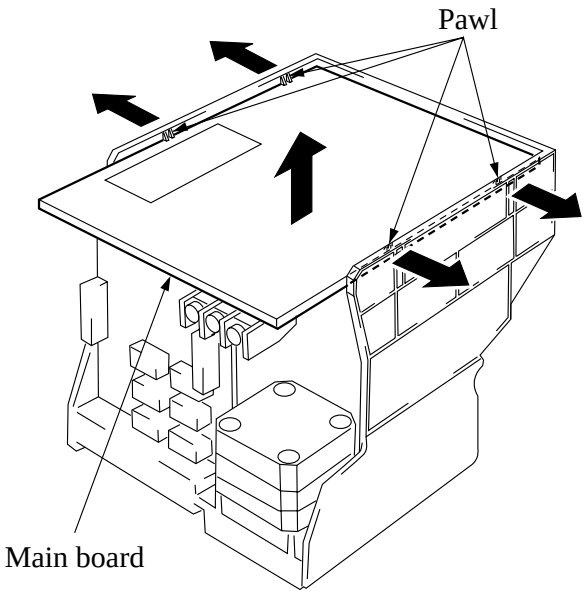
Pull out and remove the main unit from the case.
Pull out and remove the display cover from the main unit.

Step 6 Removal of interface board



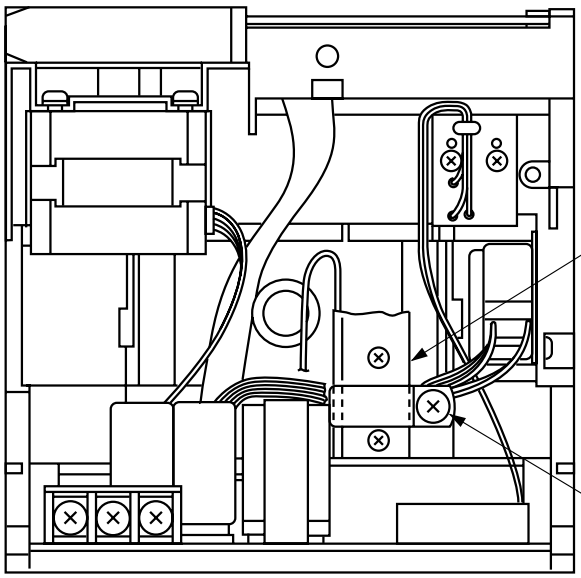
Full the interface board toward you while pressing the side panel outward. The interface board will be removed.

Step 7 Removal of main board



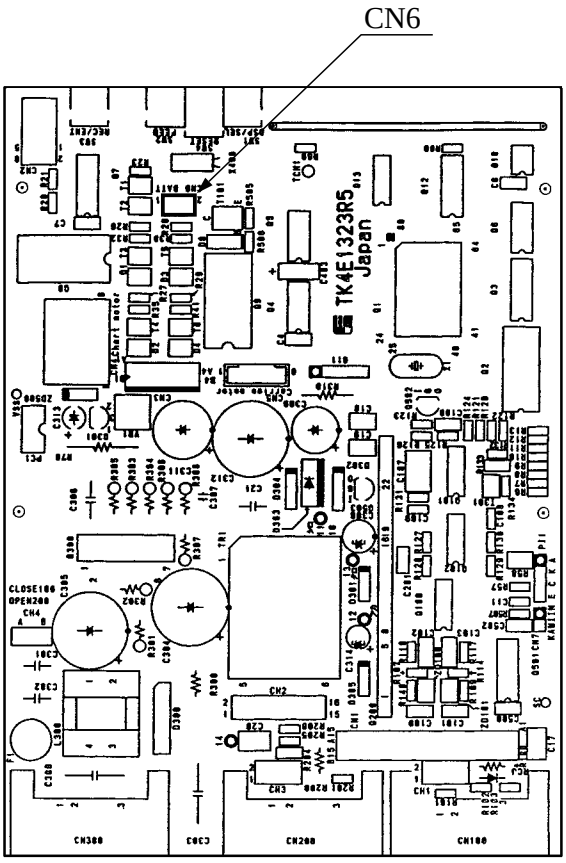
Put the main unit upside down and lift up the main board while pressing the side panel outward, and the main board will be removed.

Step 8 Removal of battery



Remove the battery fixing screw (M3), and the battery will be removed.

Step 9 Removal of CN6



Remove the tip (CN6) of the battery from the main board.

Step 10

Attach CN6, new battery, main board and interface board in reverse order of the procedures for removal.

Step 11

After replacing the battery, set the main unit as it was. Be sure to tighten the lock screw of the main unit.

Reference

Battery life is about 10 years when the battery is used under normal temperature.

9. ADJUSTMENT MODE

Applied operations in this chapter allows:

(1) Adjusting the print-out or record
(2) Adjusting zero and span of analog trend recording position
(3) PV shift
(4) Setting the sub chart speed
(5) Skip setting
(6) Selecting the recording head

Any adjustment is easily processed by software.

9.1 How to adjust the printing and recording (adjust the backlash)

Explanation

Proceed to adjustment if characters are off-positioned or recording is disorderly (different between go and return). For the adjustment, calibrating devices need not be connected.

Operation

(1) Press the DSP key for 3 seconds to display the setting mode. (Key lock display appears.)

(2) Holding down the ∧ key, press the SEL key for 3 seconds to transfer to the adjusting mode.


is the display for printing/recording adjustment.

(3) At the completion of adjustment, press the SEL key for 3 seconds for setting in normal mode.

<Example>

Press the ∧ key for displaying  .

Press the ENT key.

Press the SEL key for 3 seconds to resume the display mode.

Print a test pattern and check whether characters are off-positioned or not.

(For test pattern printing method, see 7.5.)

If the character off-position has not sufficiently been remedied, repeat the step ② and subsequent for increasing the backlash value.

If the character off-position has gone for the worse, repeat the step ② and subsequent for decreasing the backlash value.

Repeat the above operation until the status is optimum.

Note)

The backlash value is changeable between 0 and 15. Numerals from 10 to 15 are displayed in characters A through F. The standard value is 5. Normal printing and recording will usually been obtained between 4 and 6.

9.2 How to position the analog trend recording (position the head zero/span)

Explanation

Align the zero (0%) and span (100%) for analog trend recording with chart. In this operation, calibrating davices need not be connected.

Note) This operation is not allowed while recording.

Operation

(1) Press the [REC] key to stop recording.

(2) Press the [DSP] key for 3 seconds to display the setting mode. (Key lock display appears.)

(3) Holding down the [∧] key, press the [SEL] key for 3 seconds to transfer to the adjusting mode.


is the display for ptinting/recording adjustment.

↓ [SEL]


is a calibrating display for zero and span of analog trend recording.

Press the [∧] key for selecting whether to calibrate or not.

Do not calibrate (0) → [SEL] key → Set PV shift

calibrate (1) → [ENT] key

The recording head moves and draws a line at the zero point (0%) in blue for 1 or 2 continuous print-out or in black for 6 dot print-out.
Adjust if recording position is off 0% of recording chart.
Pressing the [∧] key moves the recording points to the right.
Pressing the [SEL] key moves the recording points to the left.

↓

After adjusting zero , press the [ENT] key ...Zero calibration ended.

↓

The recording head moves to the 100% point and draws a line at the 100% (span) in blue for 1 or 2 continuous print-out or in different colours for 6 dot print-out.
Adjust if recording position is off 100% of recording chart.
Pressing the [∧] key moves the recording points to the right.
Pressing the [SEL] key moves the recording points to the left.

↓

After adjusting the span, press the [ENT] key.
The recording head moves to the center and recording stops. ... Span calibration ended.

↓

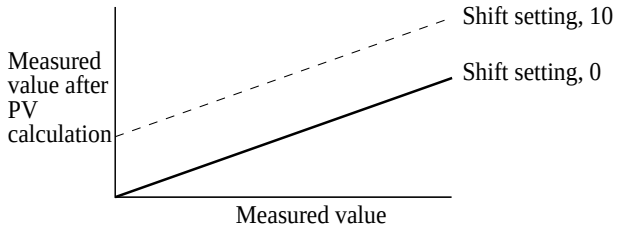
Press the [SEL] key for 3 seconds for setting in normal mode.

9.3 How to set the PV shift

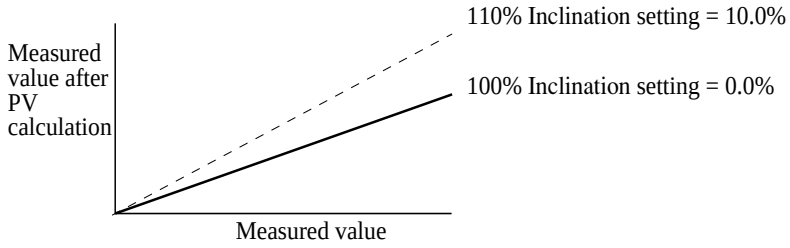
Explanation

- Measured value can be calculated by PV shift constant for record and display.
- PV shift calculation is used for setting slope and shift values.
  A conversion graph obtained from shift and slope calculation is shown below.

• Shift calculation



• Gain calculation



• Details of PV shift calculation is as follows.

$P' = GP + S$

P' : Measured value after PV calculation
P : Measured value
G : Gain (87.3 to 112.7%)
(Note) Inclination calculation value is within the range of 87.3 to 112.7% and inclination setting is within the range of -12.7 to 12.7%. Inclination value is calculated by the following equation.
Inclination calculation value =
100% + Inclination setting value
S : Shift value (-127 to 127 industrial value, decimal point depending on type of input)

* Measured value after PV shift calculation, is limited to be set within the record setting range of the type of input set in each channel.

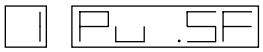
Operation

① Press the DSP key for 3 seconds to display the setting mode. (Key lock display appears.)

② Holding down the ∧ key, press the SEL key for 3 seconds to transfer to the adjusting mode.


is the display for printing/recording adjustment.

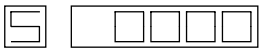
↓ SEL Press the SEL key twice to display PV shift setting.

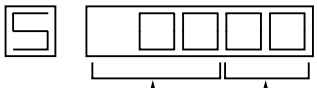

is the display for PV shift setting.

↓ ENT

Press the ∧ key for selecting PV shift setting channel.

↓ ENT

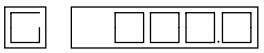

is the input screen for PV shift setting.

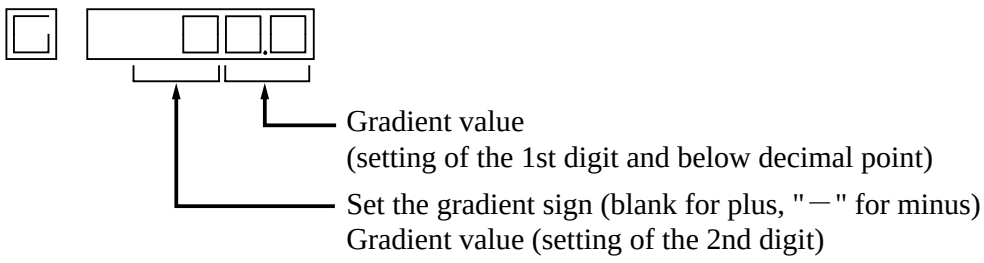


Press the ∧ key for selecting the set value at each place.

After setting all digits, press the ENT key.

↓ ENT


is the display for inputting PV shift gradient.



Press the ∧ key for selecting the set value at each place.

After setting all digits, press the ENT key.

↓

Press the SEL key for 3 seconds for setting in normal mode.

9.4 How to set the sub chart speed

Explanation

- Chart speed selected by external control input.
- Selects the chart speed out of:
  0, 10, 20, 24, 30, 50, 120, 200, 300, 400, 1000, 1200, 1500
  Note) 0 mm/h performs no recording.

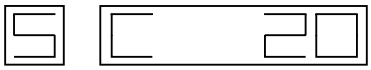
Operation

(1) Press the [DSP] key for 3 seconds to display the setting mode. (Key lock display appears.)

(2) Holding down the [∧] key, press the [SEL] key to transfer to the adjusting mode.


is the display for printing/recording adjustment.

↓ [SEL] Press the [SEL] key three times for display PV shift setting.


is the display for sub chart speed setting.

Press the [∧] key for selecting the sub chart speed set value.

↓ [ENT]

The display appears for the next adjustment setting.

↓

Press the [SEL] key for 3 seconds for setting in normal mode.

9.5 How to set the skip

Explanation

• Skips unused channels.

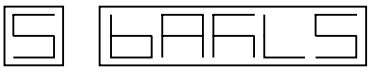
• For skipped channels, display, recording alarm and other operations are not performed.

Skip ON	1
Skip OFF	0

Operation

(1) Press the DSP key for 3 seconds to display the setting mode. (Key lock display appears.)

(2) Holding down the ∧ key, press the SEL key for 3 seconds to transfer to the adjusting mode.


is the display for printing/recording adjustment.

↓ SEL Press the SEL key four times for displaying the skip setting.


is the display for skip setting.

Channel No.

Press the ∧ key for selecting the channel No. to skip.

↓ ENT


Select whether to skip or not

Select “1” to skip or “0” not to skip.

↓

Press the SEL key for 3 seconds for setting in normal mode.

9.6 Head selection

Explanation

- Selects a recording head to use.
- There are recording heads for 1 and 2 continuous and 6 dot recording.

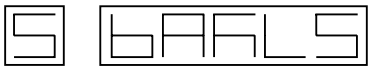
6 dot	0
1, 2 continuos	1

- At the time of delivery, it is set to “1” for 1, 2 continuous recording and “0” for 6 dot recording.

Operation

(1) Press the [DSP] key for 3 seconds to display the setting mode. (Key lock display appears.)

(2) Holding down the [∧] key, press the [SEL] key for 3 seconds to transfer to the adjusting mode.



is the display for printing/recording adjustment.

↓ [SEL] Press the [SEL] key five times for displaying the head selection.

is the display for head selection.

Select the head

Select “0” for 6 dot recording or “1” for 1 or 2 continuous recording.

↓ [ENT]

The display for the next adjustment setting appears.

↓

Press the [SEL] key for 3 seconds for setting in normal mode.

9.7 How to calibrate measured value (ADJUST) ⚠ CAUTION

Explanation

No adjustment is required normally but only when the measured reading exceeds the guaranteed accuracy.

Applying a calibrating input signal automatically calibrates the value via software. Apply a correct calibrating input signal to a relevant channel.

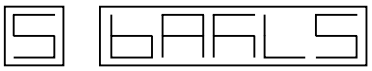
Note: Applying incorrect input signal causes wrong operation.

Operation

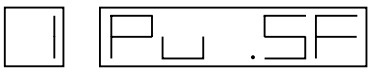
(1) Press the [REC] key to stop recording.

(2) Press the [DSP] key for 3 seconds to display the setting mode. (Key lock display appears.)

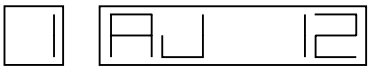
(3) Holding down the [∧] key, press the [SEL] key for 3 seconds to transfer to the adjustment mode.


is the display for printing/recording adjustment.

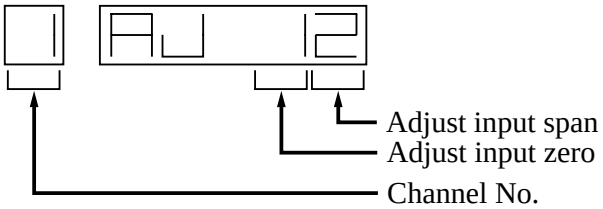
↓ [SEL] Press the [SEL] key twice to display PV shift setting.


is the display for PV shift setting.

(4) Holding down the [∧] key, press the [SEL] key for 3 seconds to transfer to the calibrating mode.


is the display for calibrating zero and span of measured value (Adjust display).

Note) To quit the zero and span calibration for measured value, do not press the [ENT] key but hold down the [SEL] key for 3 seconds. (The display mode is selected.)



(5) Press [∧] key for selecting the channel No. to calibrate.
Ch 1 to Ch 6 = DC voltage input, resistance bulb input, thermocouple input
Ch 7 to Ch 8 = For factory test. Never operate them.

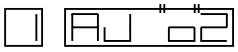
↓ Press the [ENT] key

(6) [＊1 Apply 0% input] ＊1

0% Calibrating input signal is :
Voltage input : 0 mV or 0V
Thermocouple input: 0 mV
Resistance bulb input (Pt, JPt): 100 Ω

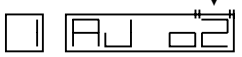
[ENT] Press the [ENT] key. Zero calibration automatically starts.
"1" turns "0", which blinks
(After applying 0% input marked *1, press the [ENT] key.)

Blink



End of zero calibration……"0" stops blinking and "2" starts blinking, whereby standing by for span calibration.

Blink



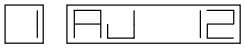
(7) [＊2 Apply 100% input] ＊2

100% calibrating input signal is:
±50 mV : 50 mV
±500 mV : 500 mV
±5V : 5V
±50V : 50V
Thermocouple : 50 mV
(correction for room termperature is unnecessary)
Resistance bulb (Pt, JPt) : 324.26 Ω

[ENT] Press the [ENT] key (after applying 100% input in *2) to start automatically the span calibration.
"2" turns "0", which blinks.

Blink

End of span calibration……The initial screen appears. For adjusting other channels, press the [∧] key for selecting them.



(8) Press the [SEL] key for 3 seconds to exit from the calibration and resume the display mode.

Note) After selecting a channel No., calibration can not be interrupted with [SEL] key until it is completed.
To interrupt calibration, turn ON the power again or press the reset button.

10. TROUBLESHOOTING

If the unit fails to operate properly, check the operating conditions and take necessary steps referring to the following.

If any uncontrollable problem arises, contact your dealer or your nearest Fuji service station.

State	Points to check	Action to take
Does not work at all	(1) Is the power supply terminal connection correct?	Connect correctly
	(2) Is power being supplied properly?	Effect proper supply
Keys do not work	(1) Is a parameter list, instantaneous value list, scale print-out or test pattern print-out in progress? The SEL key is inoperative during data print-out and list print-out. (See section 2 (4))	Wait until the end of print-out.
	(2) Is Carriage alarm being displayed? * The FEED REC keys are inoperative when the above state display is produced.	Check the carrier fault.
The record swings over to the 0% side or the 100% side	(1) Is the input signal wiring correct?	Correct the wiring
	(2) Has a thermocouple or resistance bulb wire broken? (If wire breakage occurs, there is a burn-out display and a swing over to the 100% side.)	Replace the thermocouple or resistance bulb.
The record zero/span point is out of position	Refer to Section 9.2 and adjust. Be sure to make the adjustment of Section 9.2 after replacing the recording head.	
There are large errors	Do the input signals match the specification? (Signal source resistance, etc.)	Bring them to the proper specification.
The data display goes to 'Over', 'Under' or 'Error'	Is there supply of excessively large or excessively small input?	Effect supply of correct input
The display goes to 'Carriage Alarm'.	Refer to section 6.8	
Ink does not come out even though there is no 'Ink out' display or the ink colours are blurred.	Carefully note the points described on page 5-7 in relation to the recording head (i.e., the notes on storage and avoiding imposition of vibration or impact). If ink does not flow properly, take the action described on the right. If this has no effect, the recording head must be replaced.	Refer to "Note 5: If the ink is not sprayed" on page 5-8. When the working environment is 15℃ or less, perform print-out of "record" or "test pattern" after a period of several minutes has elapsed since the recording head was mounted. (The recording head has a built-in heater.)
Characters are deformed.		
The record colours are wrong.		
Ink does not flow.	Is the head inserted into the carrier sufficiently?	Push the head on properly. (Refer to Step 6 of section 5.2.)
Trend record or characters turn to double-line (round trip difference appears) or characters are disordered.	1) Wire the carriage drive shaft with dry, clean cloth. 2) When this procedure 1) is not effective, follow Section 9.1 Adjustment of backlash	

State	Points to check	Action to take
Time changes at OFF of AC power source	If the time display is in normal operation when the AC power source is left ON, it is an indication that the battery power is lost.	Replace the battery referring to Item 8.2.

11. EXAMPLES OF RECORDING AND PRINTING

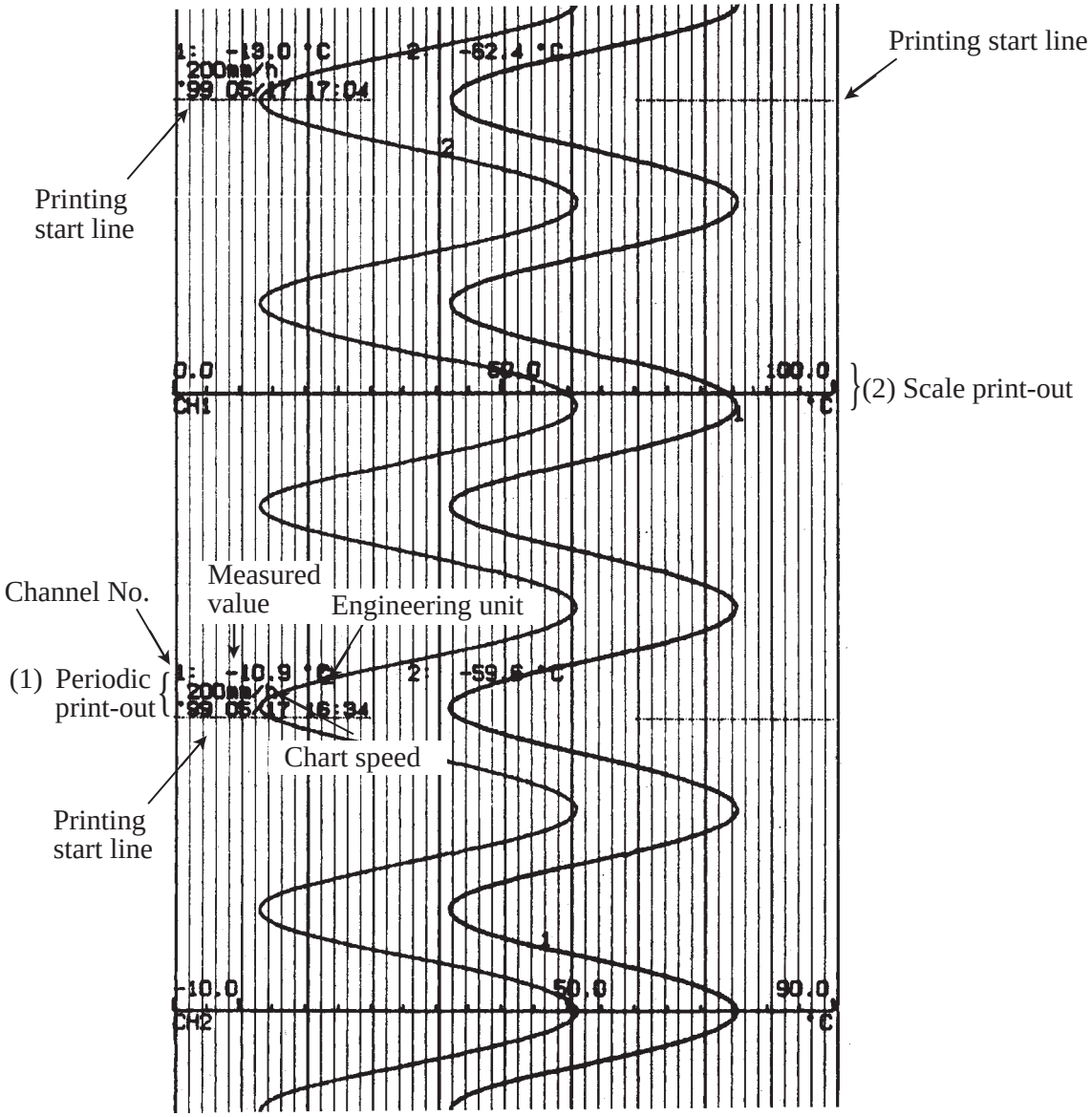
Note: If the chart speed is 1000mm/h or higher for continuous recording type or 120 mm/h or higher for dot recording type, periodic print-out, scale print-out (execept manual print-out ⋯see 7.6), alarm print-out and burn-out print-out are not effected.

11.1 Periodic print-out and scale print-out

(1) Periodic print-out: According to the chart speed, printing start line, chart speed and measured values of each channel are automatically printed at fixed intervals. (provided that periodic print-out is turned on. See 7.7.)

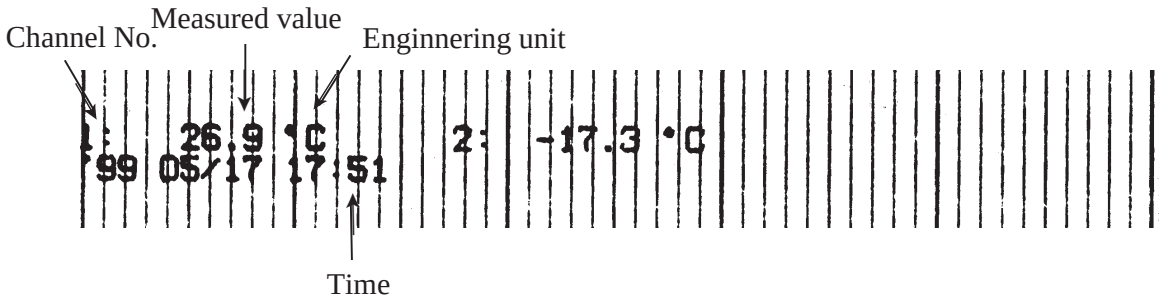
(2) Scale print-out: According to the chart speed, scale line, scale digits, units and channel No. are automatically printed at fixed intervals. (provided that scale print-out is turned on. See 7.8.)

Example of 2 continuous records



11.2 Digital print-out (Instantaneous values)

Measured values (instantaneous values) for each channel, engineering units, lapse of time and channel numbers are printed. (See 7.5.)



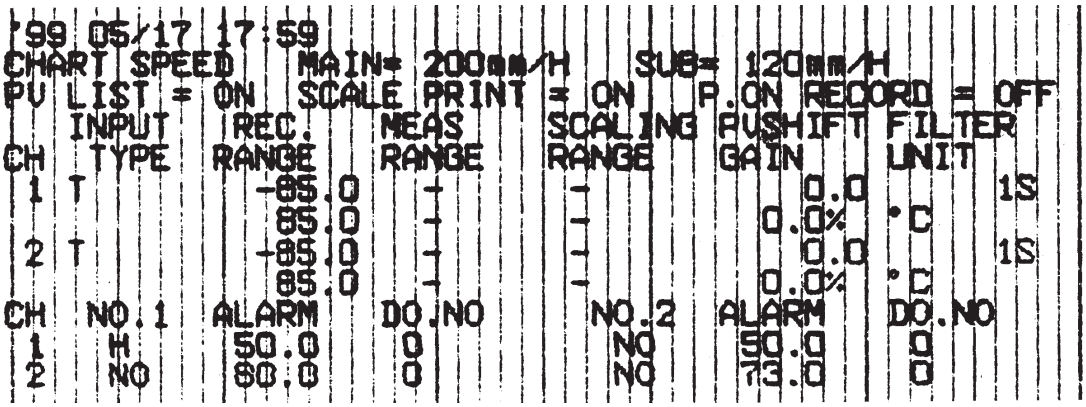
Note) " — " (dash) is printed instead of measured value of channel which is skipped.

11.3 Parameter listing

Setting contents of parameters are printed in batch on recording chart. (See 7.5.)

The parameter listing is made in the following order of setting.

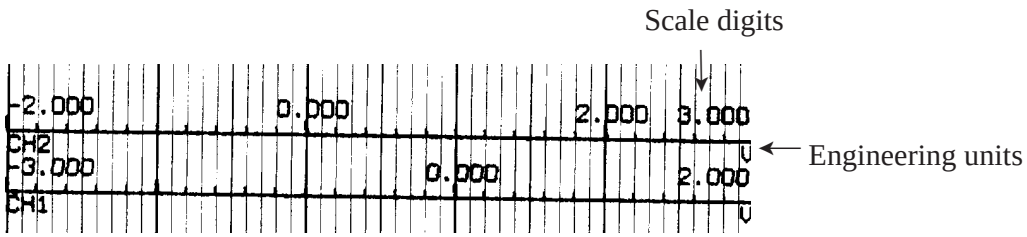
- Current time
- Main chart speed, sub chart speed
- Periodic print-out ON/OFF, scale print-out ON/OFF, recording ON/OFF when turning on power.
- Channel No., input signal, recording range, measuring range, engineering value, PV shift/gradient, input filter/unit
- Channel No., alarm No. 1 kind/set value/DO relay No., alarm No. 2 kind/set value/DO relay No.



11.4 Test pattern

11.5 Scale print-outs (manual print-outs)

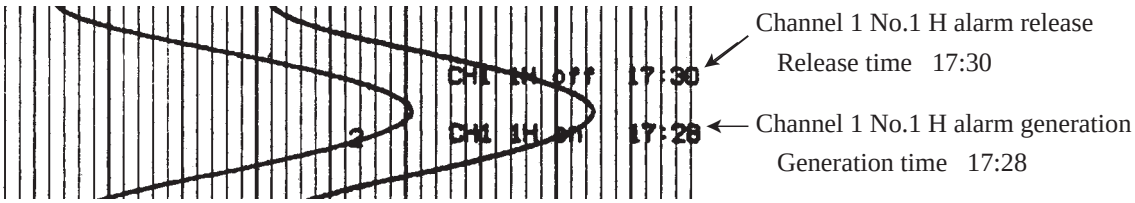
The scales of specified channels are printed (See section 7.6)



11.6 Alarm print-outs

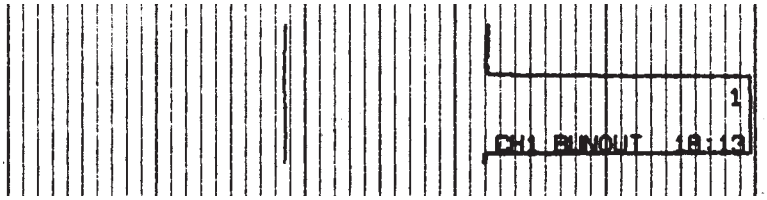
When an alarm is detected and canceled, the time of detection and cancellation and the channel No. are printed on the right-hand side of the recording paper.

On detection: print-out colour red, on cancellation: print-out colour: blue(1,2 continuous recording)
black (6 dot recording)



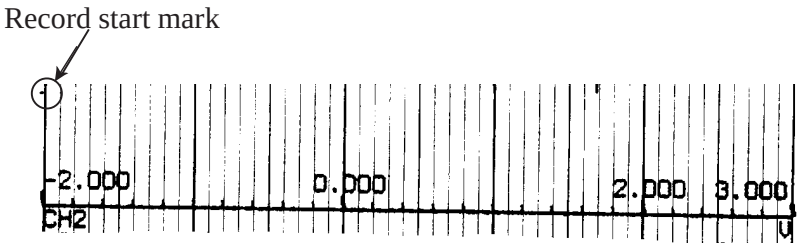
11.7 Burn-out print-out

If a burn-out occurs, the channel No. burn-out and time of occurrence are printed in red at the right-hand edge of the recording paper.



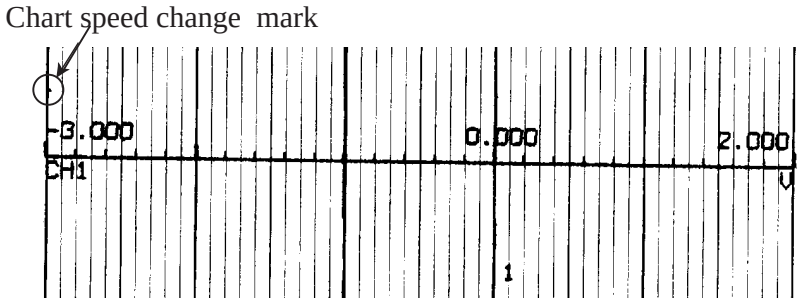
11.8 Record start mark

When recording starts, a record start mark is printed at the left-hand edge of the recording paper (outside the 0% scale line).



11.9 Chart speed change mark

If a change in the speed of the recording paper is ordered, a chart speed change mark is printed at the left-hand edge of the recording paper (inside the 0% scale line).



12. SPECIFICATION

Input Section

Number of input points: 3 classes: 1, 2 continuous recording and 6 dot recording

Input signals: Thermocouple input: B, R, S, K, E, J, T, N, W, L, U, PN

Resistance bulb input: Pt100

DC voltage input: 50 mV range, 500 mV range, 5V range, 50V range

Direct current input: 4 to 20 mA DC. 10 to 50 mA DC

(Note: Terminal section to be fitted with separately sold 10Ω shunt resistor and range to be made 500 mV.)

Maximum allowable input voltage:

Thermocouples, resistance bulbs, DC voltage (50 mV, 500 mV range): ±10V DC

DC voltage (5V, 50V range): ±100V DC

Input signal		Max. input range	
Thermo-couple	B	400 to 1760℃	752 to 3200°F
	R	0 to 1760℃	32 to 3200°F
	S	0 to 1760℃	32 to 3200°F
	K	-200 to 1370℃	-328 to 2498°F
	E	-200 to 800℃	-328 to 1472°F
	J	-200 to 1100℃	-328 to 2012°F
	T	-200 to 400℃	-328 to 752°F
	N	0 to 1300℃	32 to 2372°F
	W	0 to 1760℃	32 to 3200°F
	L	-200 to 900℃	-328 to 1652°F
	U	-200 to 400℃	-328 to 752°F
	PN	0 to 1300℃	32 to 2372°F
Resistance bulb	Pt100	-200 to 600℃	-328 to 1112°F
DC voltage	50mV	-50 to +50mV	
	500mV	-500 to +500mV	
	5V	-5 to +5V	
	50V	-50 to +50V	

Recording range setting : Type assignment

Burn-out function : In case of thermocouple or resistance bulb input open-circuiting, overswings the recording to 100% side.

Input range : 1 continuous: 1 kind
2 continuous: 2 kinds
6 dot : 1 or 2 kinds

Note) During input of 6 dot signals from a resistance bulb, the line between channels is not insulated.

Display accuracy and resolution : Under measuring and recording conditions
(temperature: 23±5°C, relative humidity:65±10%, source voltage and frequency fluctuation:within ±1%, vertical mounting, no external noise, signal source resistance or wiring resistance: 1% max. of specified value, warm-up: 30 min or more)

In the case of temparature input, the input range (= recording range) is indicated to 1 digit below decimal point.

Example: 150.0
150 or 150.00 is not indicated.

<Thermocouple/resistance bulb input ˚C range> Ranges marked ○, ●, ◎ and △ can be set.

Input range code	Input range (˚C) (Recording range)	B	R	S	K	E	J	T	N	W	L	U	PN	Pt	Indication resolution
0	0 to 100					●	●				●			○	0.1˚C
1	0 to 200				○	○	○	○	●		○	○	●	○	
2	0 to 300				○	○	○	○	○		○	○	○	○	
3	0 to 400				○	○	○	○	○	●	○	○	○	○	
4	0 to 500				○	○	○		○	○	○		○	○	
5	0 to 600		●	●	○	○	○		○	○	○		○	○	
6	0 to 800		●	●	○	○	○		○	○	○		○		
7	0 to 1000		△	△	○		○		○	○			○		
8	0 to 1200		△	△	○				○	○			○		
9	0 to 1400		△	△						○					
A	0 to 1600		△	△						○					
B	0 to 150				●	○	○	●			○	●		○	
C	400 to 1400	○	○	○						○					
D	600 to 1600	○	○	○						○					
E	100 to 300				○	○	○	○	●		○	○	●	○	
F	200 to 400				○	○	○	○	●		○	○	○	○	
G	300 to 600				○	○	○		○	●	○		○	○	
H	400 to 800				○	○	○		○	●	○		○		
J	500 to 1000		●	●	○		○		○	○			○		
K	600 to 1200		●	●	○				○	○			○		
L	800 to 1600	○	○	○						○					
M	-50 to 50					●	●				●			○	
N	-50 to 150				○	○	○	○			○	○		○	
P	-200 to 100				◎	◎	◎	◎			◎	◎		○	
Q	-200 to 500				◎	◎	◎				◎			○	
Y	Maximum range of each input signal	○	△	△	◎	◎	◎	◎	○	○	◎	◎	○	○	

<Thermocouple/resistance bulb input ˚F range> Ranges marked ○, ●, ◎ and △ can be set.

Input range code	Input range (˚F) (Recording range)	B	R	S	K	E	J	T	N	W	L	U	PN	Pt	Indication resolution
0	32 to 200					●								○	0.1˚F
1	32 to 400				○	○	○	○	●		○	○	●	○	
2	32 to 600				○	○	○	○	○	●	○	○	○	○	
3	32 to 800				○	○	○		○	●	○		○	○	
4	32 to 1000				○	○	○		○	○	○		○	○	
5	32 to 1200		●	●	○	○	○		○	○	○		○		
6	32 to 1500		△	●	○		○		○	○	○		○		
7	32 to 2000		△	△	○		○		○	○			○		
8	32 to 2400		△	△	○					○					
9	32 to 2500		△	△	○					○					
A	32 to 3000		△	△						○					
B	32 to 300				●	○	●	●			○	●		○	
C	500 to 2500		○	○	○					○					
D	1000 to 3000	○	○	○						○					
E	200 to 600				○	○	○	○	●		○	○	○	○	
F	400 to 800				○	○	○		●		○		○	○	
G	600 to 1200				○	○	○		○	●	○		○		
H	1000 to 1500				○		○		○	●	○		○		
J	1000 to 2000		●	●	○		○		○	○			○		
K	1000 to 2500	●	○	○	○					○					
L	1500 to 3000	○	○	○						○					
M	-100 to 100					●	●				●			○	
N	-100 to 300				○	○	○	○			○	○		○	
P	-300 to 200				◎	◎	◎	◎			◎	◎		○	
Q	-300 to 1000				◎	◎	◎				◎			○	
Y	Maximum range of each input signal	○	△	△	◎	◎	◎	◎	○	○	◎	◎	○	○	

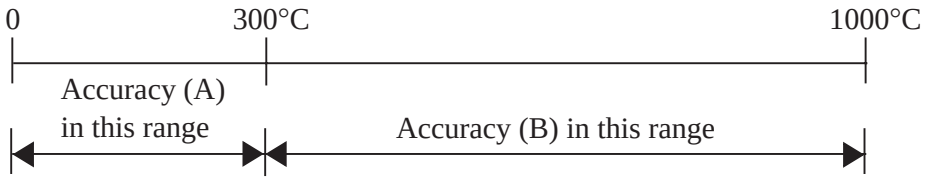
[Additional information]

1. Marked ○ above means ± (0.3% of measuring range +1 digit) indication accuracy.
2. Marked ● above means ± (1% of measuring range +1 digit) indication accuracy.
3. Marked ◎ above means ± (0.3% of measuring range +1 digit) indication accuracy, but ± (0.5% of measuring range +1 digit) indication between -200 to -100˚C [-300 to -148˚F] range.
4. Marked △ above means ± (0.3% of measuring range +1 digit) indication accuracy, but ± (0.5% of measuring range + 1 digit) indication between 0 to 300˚C [32 to 600˚F] range.
5. In case of thermocouple and resistance bulb input, measuring table is equal to recording range and indicated value is 1 digit below decimal point.

Note)

The indication accuracy of thermocouple does not include reference junction compensation error.

Example) R-thermocouple input range code 7 (0 to 1000°C)



$A = \pm (1000℃ \times \frac{0.5\%}{100} + 1 \text{ digit}) = \pm (5℃ + 0.1℃) = \pm 5.1℃$

$B = \pm (1000℃ \times \frac{0.3\%}{100} + 1 \text{ digit}) = \pm (3℃ + 0.1℃) = \pm 3.1℃$

(Reference) Indication accuracy

- Thermocouple……Indication accuracy expressed by electromotive force is as follows.
  1) Recording span (input span) width 8mV or more; ± (0.3% of recording span + 1 digit)
  2) Recording span (input span) width 4 to 8mV; ± (1.0% of recording span + 1 digit)
- Resistance bulb……Indication accuracy expressed by resistance value is as follows.
  1) Recording span width 36Ω or more: ± (0.3% of recording span + 1 digit)
  2) Recording span width 18 to 36Ω: ± (1.0% of recording span + 1 digit)

<DC voltage input>

Input range code	± 50mV	± 500mV (4 to 20mA DC / 10 to 50mA DC)	± 5V (1 to 5V)	±50V	Indication accuracy
0	0to 10	0 to 100	0 to 1	0 to 10	± 0.3 % +1 digit in all range (1digit refers to the change in the indication of least significant digit).
1	0 to 15	0 to 150	0 to 1.5	0 to 15	
2	0 to 20	0 to 200	0 to 2	0 to 20	
3	0 to 30	0 to 300	0 to 3	0 to 30	
4	0 to 50	0 to 500	0 to 5	0 to 50	
5	10 to 50	100 to 500	1 to 5	10 to 50	
6	4 to 20	40 to 200	0.4 to 2	4 to 20	
7	-50 to 0	-500 to 0	-5 to 0	-50 to 0	
Y	-50 to 50	-500 to 500	-5 to5	-50 to 50	
Indicating resolution	10μV	100μV	1mV	10mV	—

<Reference>

Input signal	Max. range	Indication accuracy
50mV	-50 to + 50mV	(1) Recording span width 8mV or more : ± (0.3% of recording span + 1 digit)
		(2) Recording span width 4 to 8mV : ± (1.0% of recording span + 1 digit)
500mV	-500 to+500mV	(1) Recording span width 80mV or more : ± (0.3% of recording span + 1 digit)
		(2) Recording span width 40 to 80mV : ± (1.0% of recording span + 1 digit)
5V	-5 to + 5 mV	(1) Recording span width 0.8V or more : ± (0.3% of recording span + 1 digit)
		(2) Recording span width 0.4 to 0.8V : ± (1.0% of recording span + 1 digit)
50V	-50 to + 50V	(1) Recording span width 8V or more : ± (0.3% of recording span + 1 digit)
		(2) Recording span width 4 to 8V : ± (1.0% of recording span + 1 digit)
1 to 5V	1 to 5V	± (0.3% + 1 digit)
4 to 20mA	4 to 20mA (40 to 20 mV DC)	± (0.3% + 1 digit)
10 to 50mA	10 to 50mA (100 to 500mV DC)	± (0.3% + 1 digit)

Recording section

Recording method:	Ink jet type, 6 or 3 colours		
Effective recording width:	100 mm		
Recording colours:	1 continuous type	:	Recording ------- Violet
			Printing ---------- Violet
	2 continuous type	:	Recording ------- Channel 1 in red
			Channel 2 in blue
			Printing ---------- Violet
	6 dot type	:	Recording ------- Channel 1 in orange
			Channel 2 in green
			Channel 3 in violet
			Channel 4 in red
			Channel 5 in black
			Channel 6 in blue
			Printing ---------- Black
Recording chart:	Z-folding.....15.08m long		
Recroding accuracy:	Indicating accuracy +0.2%		
Recording solution:	0.1mm		
Chart speed:	10, 20, 24, 30, 50, 120, 200, 300, 400, 1000, 1200, 1500mm/h [Note]Above 400mm/h, continuous recording is made on intermittent type.		
Speed setting method:	On keyboard.		
Recording cycle:	Dot records ... 30 seconds/for all points. Continuous recording... Depends on chart speed <Calculation expression> Recording cycle (seconds) = 400 / [chart speed (mm/h)] or 2 seconds, whichever greater		
Measuring cycle:	1, 2 continuous : 200 msec/point 6 dot : 30 sec/all points		
Ink life (depending on operating conditions) :	1 continuous ----- approx. 20 months 2 continuous ----- approx. 12 months 6 dot ---------- approx. 8 months		

Display section and keying section

Display method: LED (7 segments), 6 digits, green

Display characters: 7-segment alphanumerics, 10 mm high, 5 mm wide

Display contents:
(1) Time : hour & min
(2) Channel number : 1 digit (1 to 6)
(3) Measured value : 5 digit (including sign if below 0)
Temperature... 1 digit below decimal point
Voltage, current... As per scaling.
-9999 for -10000 or beyond
(4) Status display : Code indicating alarm, burn-out
Code indicating carriage error
(5) Measured value display cycle :
Channel change over... 3 sec.
Updating data within channel... 1 sec.

Operating keys: 3
Key lock : Soft key lock available by key operation.

Printing section

Printing method: Ink jet type

Ink colors: 1, 2 continuous type : Blue, blue, red, red, 2 colors (4 bags)
6 dot : Black, blue, red, yellow, 4 colors

Recording colors: 6 or 3
Mixed colors : (Orange, green, violet). 2 different colors put on same point.

Channel No.	1	2	3	4	5	6	Character
1 continuous recording	Violet	–	–	–	–	–	Violet
2 continuous recording	Red	Blue	–	–	–	–	Violet
6 dot recording	Orange	Green	Violet	Red	Black	Blue	Black

Automatically printed at following print-out analog recording.

Periodic print-out: Instantaneous value, unit, date, time, time line and paper feed speed
[Note] Printing intervals are automatically determined by recording chart speed.

Scale print-out: Scale line print-out for sequential channels is effected alternately with periodic print-outs.
[Note] Printing intervals are automatically determined by chart speed.

Alarm print-out: Channel No., alarm kind, occurrence/reset time at occurrence/reset of the input alarm

Burn-out print-out: Channel and time at burn-out occurrence

Others: Recording start mark print-out. Recording paper feed speed change mark print-out.

Following print-out activated by keying suspends analog recording. After the end of print-out, the analog recording is resumed.

Instantaneous value list: Print-out of each channel measured value (instantaneous value) and engineering unit, lapse of time, channel number

Parameter list: (set value list) Print-out of input signal, input range, recording range, unit, alarm, input filter, chart speed.

Scale print-out: (manual) Print-out of scale line of desired channel

Test pattern: Print-out of color pattern and test characters

Performance, characteristics

Input resistance: 10 MΩ or more(50 mV range, thermocouples)
Approximately 100 kΩ (500 mV range)
Approximately 1 MΩ (5V, 50V range)

Chart speed accuracy: ±0.1% (For continuous feed of 1m or more. Does not include paper elongation/shrinkage.)

Accuracy of clock: Better than ± 50ppm (lunar equation: about 2 min)

Insulation resistance: 100 MΩ (across each terminal and ground at 500V DC)

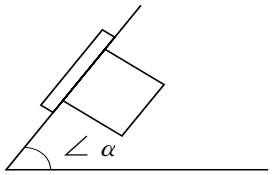
Withstand voltage:

Input terminal - input terminal	:	500VAC 1 minute
Power supply terminal - ground	:	2000VAC 1 minute
Input terminal - ground	:	500V AC 1 minute
Power terminal - input terminal	:	2000VAC, 1 minute
Between alarm terminals	:	750VAC, 1 minute
		(Leakage current 5 mA or less)

Reference junction compensation precision: K, E, J, T, N, L, U, PN .... ±0.5°C
R, S, B, W ..... ±1°C

Construction

Mounting method: Mounted in panel (vertical panel)
Inclination (angle) = 90 to 60° horizontal (left to right)



∠ α =60 to 90

Material: Case: mould (Black)
Front flap frame: mould (Black)

Mass:

Continuous type	Approx. 1.3 kg (without alarm terminal)
	Approx. 1.5 kg (with alarm terminal)
Dot type	Approx. 1.5 kg (without alarm terminal)
	Approx. 1.7 kg (with alarm terminal)

External dimensions: 144 × 144 × 175 mm (continuous recording type)
144 × 144 × 197 mm (dot recording type)

External terminals: Screw terminals (M4 thread)

Power supply section

Rated power voltage: 100 to 120VAC or 200 to 240VAC (designation)

Range of operating power voltage: 85 to 132VAC or 180 to 264VAC

Supply frequency: 50/60 Hz both employable

Power consumption: 100 to 120VAC, 200 to 240VAC without options approximately 13 VA
100 to 120VAC, 200 to 240VAC with all options approximately 15 VA

Normal operating condition (Condition of device designed for normal continuous operation)

Ambient temperature: 0 to 50°C

Ambient humidity: 20 to 80% RH, but temperature × humidity < 3200

Vibration: 10 to 60 Hz, 0.2m/s^2 [0.02G] or less

Mounting attitude: Forward tilt 0°, rearward tilt within 30°, left/right 0°

Signal source resistance: Thermocouple input ....1kΩ or less
Voltage input .... 0.1% or less of input resistance
Resistance bulb input .... 10Ω / wire or less (resistance of each wire of 3-wire system should be balanced.

Warm-up time: 30 minutes or more

Impact: none

Effects of operating conditions

Effects of power source fluctuation: 100 VAC base With 85 to 132 VAC fluctuation (frequency 50 or 60 Hz)
200 VAC base With 180 to 264 VAC fluctuation (frequency 50 or 60 Hz)
Indication variation: ±(0.1% of reference range + 1 digit)
Recording variation: ±0.2% of record span
With 47 to 63 Hz fluctuation (power supply voltage: 100VAC)
50 Hz base
Indication variation: ±(0.1% of reference range + 1 digit)
Recording variation: ±0.2% of record span

Effect of input source resistance and wiring resistance:
Thermocouples ..... 10μV per 100Ω
Variation with resistance value equivalent to 0.1% of the input value in the case of voltage
Indication variation: ±(0.1% of reference range + 1 digit)
Recording variation: ±0.2% of record span
Variation with fluctuation of 10Ω per line in the case of resistance bulbs
Indication variation: ±(0.1% of reference range + 1 digit)
Recording variation: ±0.2% of record span (if all 3 lines have the same resistance)

Effect of ambient temperature : Indication variation: ±(0.3% of reference range + 1 digit) / 10°C
Recording variation: ±0.5% of record span / 10°C

Effect of mounting attitude:	With rearward tilt within 30° Indication variation: ±(0.1% of reference range + 1 digit) Recording variation: ±0.2% of record span
Effect of vibration:	On 2 hours imposition of frequency 10 to 60 Hz, acceleration 0.2m/s^2 [0.02G] linear vibration in each of 3 axes Indication variation: ±(0.1% of reference range + 1 digit) Recording variation: ±0.2% of record span
Effect of external noise:	Normal mode noise reduction ratio (50, 60 Hz)....30 dB or more Common mode noise reduction ratio (50, 60 Hz)....120 dB or more
Recording paper:	On 20°C, 60% RH base Elongation at 85% RH: 0.4% or less Shrinkage at 35% RH: 0.5% or less

Alarms

Setting method:	Set from keyboard.
Number of settings:	Setting of Max. 2 points for each channel. (high limit 2 points, low limit 2 points or high / low limit)
Display:	On detection, display section indication of output relay Nos. for each channel
Print-out:	Channel number, alarm kind, output relay number, occurrence/reset time on chart paper
Output:	As in supplementary specification
Hysteresis amplitude:	About 0.2% of record span

Transport, storage conditions

(For transport or storage, be sure to remove the recording head from the unit and fully tighten the cap.)

Temperature:	-20 to +70°C
Humidity:	95% RH or less (but to be no dew condensation)
Vibration:	5 to 60 Hz, 2.45m/s^2 {0.25G} or less
Impact:	294m/s^2 [30G] or less

Reference standards

Safety Standards:	IEC1010-1 (1990) reinforce insulation overvoltage category II except alarm output terminals (overvoltege category I) pollution degree 2
EMC Standards:	EN50081-1 (1992), EN50082-1 (1992)

Dust/drip-proofing: IP50

Additional specification

(1) Alarm relay output (DO)

・1a contact output for two, four, six-points

・output of channels is available individually or commonly (OR operation)

・Contact capacity : 240 V AC, 3A. 30 V DC, 3A (resistive load).

・Alarm relay output unit is necessary

(2) External control (DI):

By external contact input, following operation is made.

・2-stage chageover of chart speed (which is set by keyboard)

・Setting the sub chart feed speed to 0mm/h allows recording start/stop changeover

・External control unit is necessary (where alarm relay is the same as output)

Note) The external control unit is not insulated, so an external relay should be used.
External contact capacity : DC12V/0.05A, 1a contact

Standard functions

Function		Contents
Skip function		Skips recording, indication or alarm of desired channel.
Listing function	Instantaneous values list	Prints date, time and measure value, unit and channel number of each channel.
	Parameter list	Prints input signal, input range, recording range, unit, alarm, input filter, chart speed, etc.
	Test pattern	Prints test characters and colour patterns.
	Scale print-out	Prints scale of desired channel.
Periodic print-out function		Prints periodic printing start line, date, time and paper feed speed and measured value of each channel at fixed intervals.
Scale print-out function		Prints scale of channels in their order alternately with periodic print-out.
Alarm print-out function		Prints time, channel number, alarm kind and output relay number at occurrence/reset of alarm.
PV shift function		Subjects measured value to summation and subtraction to shift the values to display or record in order to offset the difference in measured value by other instrument.
Input filter		Retards the response to abrupt change of input for each channel (first order lag filter). Time constant settable range : 0 to 255 sec.
Burn-out function		In case of thermocouple or resistance bulb open circuiting, overswings to the maximum value side of recording range and simultaneously displays and prints the input.

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