

BH SERIES (DOT-PRINTINGTYPE) HYBRID RECORDER

(Including Operation Alarm and External Drive)

INSTRUCTIONS

CONTENTS

(Bef	ore u	ise)
P	refac	e [Requests and notices]
ÆF	or sa	fe use
<u> </u>	<i>l</i> arnir	ngsii
Intro	duct	ion
1.	Intro	oduction
	1.1	Confirmation
		Attachments
2.	Nan	nes of Component Parts 🛕
Ope	ratio	\overline{n}
3.	Ope	eration
	3.1	Basic operation
	3.2	Applied operation
	3.3	Selection of functions (DIP. SW1) 🛕
4.	Indi	cation and Display
	4.1	Analog indication
	4.2	Digital display
5.	Rec	ording Operation
	5.1	Recording operation
	5.2	Recording and fast feed
	5.3	Digital recording and printing contents
6.	Cor	tinuous Indicator Mode
	6.1	Operation procedure
	6.2	Flow drawing of operation14
Set	ting	
7.		ic Setting
	7.1	Setting keys and setting items
	7.2	Setting ranges
	7.3	Characters of display17
	7.4	Setting errors and remedial measures
8.	Set	ting Methods
	8.1	Chart speed and speed No
	8.2	Time (year/month, day/hour, minute)
		Data printing24
	8.4	Fixed time recording
	8.5	Skip function/(setting memory)

Optio	on)	
9.	Alarm (Option)	
	9.1 Before setting alarms	31
	9.2 Setting of alarm set values	33
	9.3 Clearing an alarm set point value (non-setting)	34
	9.4 Alarm value copy	35
10.	External Drive (option) and Terminal Connections 🛕	37
Prep	parations and Maintenance	
11.	Installation to Panel 🛕	38
12.	Connections	
	12.1 Terminal board diagram 🛕	39
	12.2 Caution on connections 🛕	40
	12.3 Connections of power & protective conductor terminals 🛕	41
	12.4 connections of measuring input terminals 🛕	42
	12.5 Connections of alarm output terminals (option)	43
13.	Unlocking and Draw-Out of Internal Unit 🛕	44
14.	Mounting and Exchange of Ribbon Cassette	45
15.	Loading of Chart A	47
Mair	ntenance	
16.	Maintenance	
	16.1 Daily inspection	49
	16.2 Cleaning and lubrication/storage methods 🛕	50
	16.3 Troubleshooting 🛕	51
	16.4 Consumables and reference exchange intervals 🛕	55

Note) Read the items marked with $extbf{A}$ in the title without fail. They comprise $extbf{A}$ Warning and $extbf{A}$ Caution .

17. Input type Codes and Unit Codes

18. Specifications Table

56

57

PREFACE Requests and notices

Thank you for your purchase of BH series hybrid recorder (dot-printing type) having a 180mm recording width. Please read this instruction manual without fail for using this instrument correctly and safely and also preventing troubles in advance.

Separate Instruction Manuals

This instruction manual describes options ① alarm, ② external drive, and ③ time-axis synchronization in addition to the standard specifications. When the instrument is provided with the communication interface (option), the [instruction manual for communication interface] is attached as a separate manual. For other options, their instruction manuals are attached, respectively.

Request to designers, instrument controllers, and sale agents

Deliver this instruction manual to the operator of this instrument without fail.

Request to the operator of this instrument -

This instruction manual is necessary for maintenance, too. Keep this manual with due care until the instrument is discarded.

Notices

- 1. No part of this manual can be reproduced in any form, without permission.
- 2. For the contents of this manual, alteration is reserved without notice in the future.
- 3. This manual has been prepared by making assurance doubly sure about its contents.

 However, if any question arises or if any error, an omission, or other deficiencies were found, please inform your nearest CHINO's sales agent of them.
- 4. You are requested to understand that CHINO is not responsible for any operation results.

♠ FOR SAFE USE

1 Installation of the Instrument and Environment

This instrument is designed for mounting on an indoor instrumentation panel for use. Don't mount it on a desk or the like. Never run or store this instrument in any inflammable gas or vapor atmosphere.

● This instrument conforms to IEC standard safety class I (with protective conductor terminal).

2 Indication Labels of This Instrument

The following indication labels are mounted for safe use of this instrument. Read the corresponding items in this manual without fail after understanding their contents.

Indication label	[Name] and place	Contents (meanings) - Corresponding items	
\triangle	[Alert symbol mark] Various terminals (rear panel)	Handle these places with due care, otherwise [electric shock accident] [injuries] may result. → 12. Connections	
	[Protective conductor terminal] Right side of power terminals (rear panel)	This terminal is connected to the ground for preventing an electric shock accident. 12.3 Connections of power terminals and protective conductor terminal	
90-120V AC 50/60Hz 45VA	[Power supply specifications] Power terminals ※	Specifications of the power supply (voltage range, frequency, power consumption) for this instrument. 12.3 Connections of power are protective conductor terminals	
SHIPPING LOCK	[Transportation lock] Right side panel of internal unit (inside)	Lock for preventing the internal unit for jumping out during transportation or when mounting the instrument onto a panel or dismounting it from the panel. 13. Unlock and drawing out of internal unit	

 $[\]divideontimes$ The 200V system (180 - 240V AC) and the free power supply (100 - 240V AC) are also available.

3 Symbols in This Manual

The cautions to be observed for preventing the damage of this instrument and unexpected accidents are sorted by the following symbols according to their importance degrees for enabling operators to use this instrument safely.

Symbols	Ranages of cautions
A	This symbol is described in the titles (items) where Warning or Caution is explained.
Warning	This symbol describes the cautions for avoiding the possibilities when the user is in danger of causing serious injuries or death due to an electric shock accident or other accidents.
(Caution	This symbol describes the cautions for avoiding the possibilities when the user is in a danger of causing slight injuries or this instrument or peripheral units may be damaged.
Remarks	This symbol shows a caution when this instrument does not function as specified or when such a possibility exists.
Reference	This reference serves as a supplement for handling and operation, and it may be convenient for users.

WARNINGS

This paragraph covers important warnings for safety to be observed before reading the instructions. Fully understand the following warnings before reading this manual. These warnings are important for preventing the danger to human bodies as well as accidents.

1 Switch and overcurrent protective device

Mount a switch and an overcurrent protective device (breaker, circuit protector or the like) for the power supply within 3m where the operator can reach them handily. This instrument is not provided with any replaceable overcurrent protective device.

Use these switch and overcurrent protective device conforming to IEC947-1 and IEC947-3.

2 Connect the instrument to the ground with out fail.

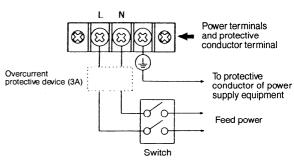
Connect the protective conductor terminal to the ground without fail before turning on the power supply. Don't disconnect it during use for preventing an electric shock accident.

3 Before turning on the power supply first

Make sure that the feed voltage is within the range indicated on the power label for safety before turning on the external power switch.

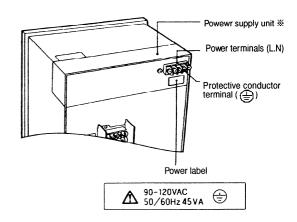
4 Don't repair or modify the instrument.

Don't repair or modify the instrument by replacing parts by any persons other than servicemen approved by our company, otherwise the instrument may be



Reference Non-replaceable overcurrent protective device The following fuse is mounted on the power supply unit of this instrument for safety.

Maker: LITTEL FUSE INC. Type: 215002P, 250V 2A



 Never remove the power supply unit case for preventing an electric shock accident.

damaged or the instrument does not function normally, and also, accidents like an electric shock accident may occur. The internal unit and case are provided with electric circuits and moving parts. Don't put your hands, etc. into them, otherwise an electric shock accident or injuries may result.

5 Use the instrument according to the instruction manual.

Use the instrument correctly and safely according to this instruction manual. You should understand that we are not responsible for any injuries, damage, lost profits, and any other demands which may be caused by wrong uses.

6 Stop feeding power supply, if an abnormal symptom occurs.

If abnormal odor, noises, or smoke occurs, or if the instrument is hot to such an extent as it cannot touch by hand, a dangerous trouble may occur. Turn off the power supply at once, and inform our representatives of it.

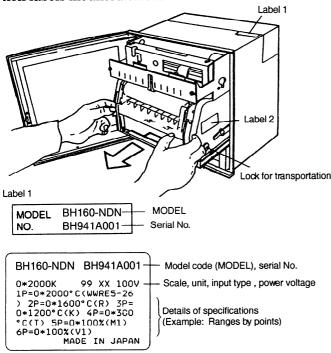


1. INTRODUCTION

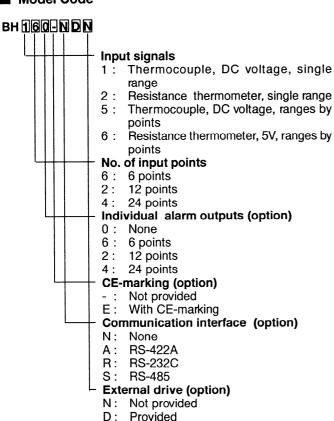
1.1 Confirmation

1 Confirmation of model code

Conform the mode code (MODEL), serial No., scale range, unit, input type, power supply, voltage, option specifications, etc. of your instrument by two indication labels mounted on the instrument.



■ Model Code



2 Items to be specified in advance (Caution and requests)

1) Attached chart (Recording chart)

A 0 to 100 divisions (equally graduated into 100 divisions) chart is mounted to the instrument having a scale other than the standard scale.

Standard scales and chart No.

Otalidara obalog and onare ito:					
Standard s (linear)		Chart No.	Standard scale Chart No.		
0 to 1 0 to 2 0 to 2	50°C 100°C 150°C 200°C	EH05045 EH05001 EH05044 EH05043 EH05042	0 to 1000°C EH05036 0 to 1200°C EH05035 0 to 1400°C EH05031 0 to 1600°C EH05034 0 to 1800°C EH05030 400 to 1600°C EH05048		
0 to 4 0 to 5 100 to 2 -20 to + -40 to + -50 to +1 -50 to + -100 to +2 -50 to 1 0 to 6	100°C -50°C -50°C	EH05041 EH05040 EH05039 EH05049 EH05056 EH05052 EH05053 EH05054 EH05051 EH05066 EH05064 EH05038 EH05037	0 to 5mV 0 to 10mV 0 to 20mV 0 to 50mV -5 to +5mV -10 to +10mV 1 to 5V 4 to 20mA 10 to 50mA Dual to sextet scale Non-standard scale		

* The chart is linearly graduated in the same way as in the standard scale and printed. Accordingly, it can be used in common, irrespective of input types (thermocouple, Pt resistance thermometer, etc.).

2) Restriction of digital printing function

The required data printing time depends upon the number of measuring input points. Be careful since analog recording is interrupted until printing ends when data are printed.

No. of input points	Required data printing time
6 points	About 1min 20sec
12 points	About 2min 20sec
24 points	About 5min

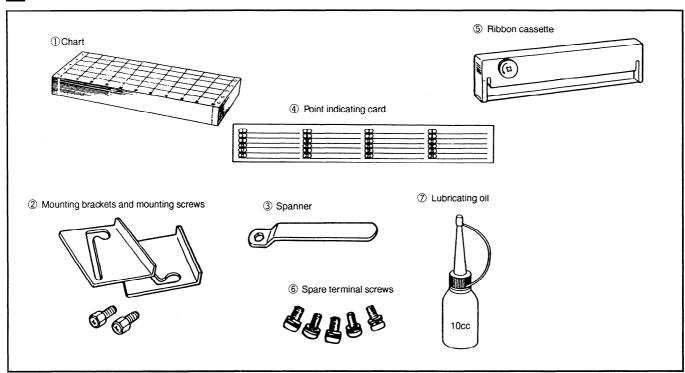
- ② If the chart speed is set to be higher than 251mm/H, no printing functions are possible. (Data cannot be printed.)
- ③ Analog recording is dot-printed at 5sec intervals. If time, etc. are printed during this recording, dot-printing intervals may be prolonged more or less due to the insertion of time printing, etc. Accordingly, this condition does not cause any problems.
- ④ Since digital characters are formed by one-pin dots, characters are not formed correctly, if the power supply is turned off during the formation of characters, and this condition does not cause any problem.

1.2 Attachments

1 Appearance check

- ① Check if the door on the front panel of the instrument is free of flaws and fissures.
- 2 Check if the door is opened and closed smoothly.
- 3 Check if the entire case is free of fissures and flaws.

2 Attachments check



3 Ordering of consumables

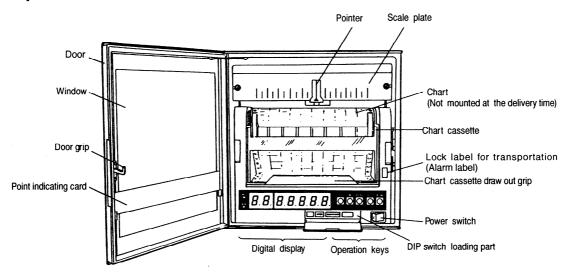
Chart and ribbon cassette are consumables. For ordering them, please specify them, referring to the following table.

Name	Article name and specifications for ordering	Handling unit
Chart	Chart No. (Example EH01001)	1 case (containing 15 pads)
Ribbon cassette	6 colors ribbon cassette for BH	1 piece

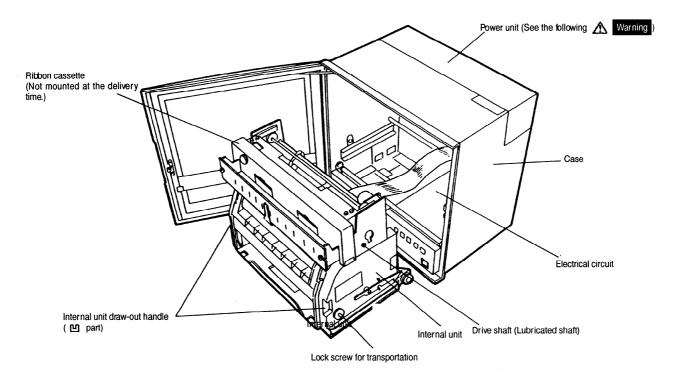
2. NAMES OF COMPONENT PARTS



Front panel



2 Internal unit drawing ass'y



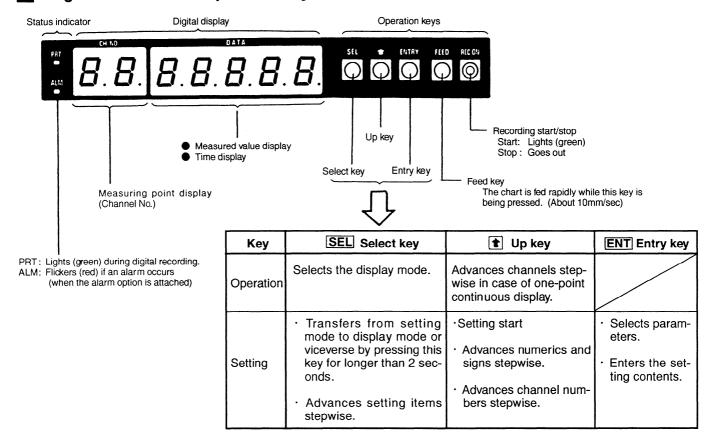
Warning Don't remove the case and cover of the power supply unit. -

Don't remove the case and cover of the power supply unit for preventing an electric shock accident, since the unit contains electric circuits.

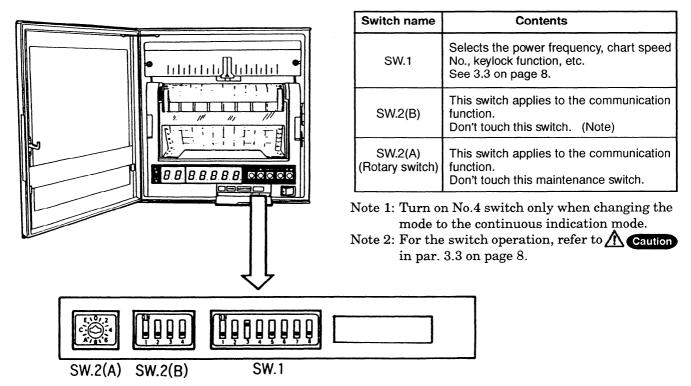
Caution Don't remove the internal unit as illustrated above.

Draw out the internal unit until it is stopped by the stopper for preventing if from falling or being damaged. Electric circuits are mounted at the innermost of the internal unit and the case interior.

3 Digital indicator and operation keys



4 DIP switches



Set conditions at the delivery time from factory.

If the communication (option) function is provided, No.3 of SW2(B) is turned on.

3. OPERATION

3.1 Basic Operation

This instrument can be operated at once simply by turning on the power supply. No troublesome setting is necessary, in particular.

1 Turn on the power supply

2 Initialisation sequence

It takes about 15 to 30 seconds to perform the initialisation operation. As the number of input points increases, the required initialisation operation time becomes longer.

3 Time setting

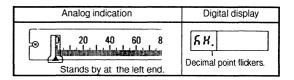
Year, month, and day can also be changed. For the setting method, see par. 8.2 on page 21.

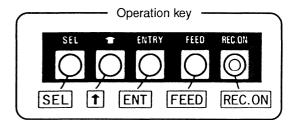
4 Chart mounting condition check

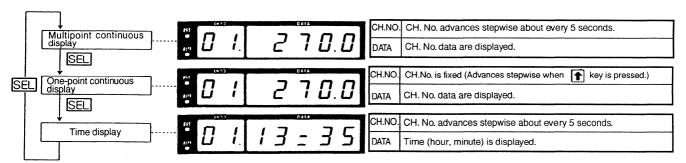
Try pressing FEED switch, and check if the chart is correctly fed fast while this key is being pressed. (About 10mm/sec)

5 Display selection

The display contents change each time SEL key is pressed.



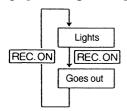




The decimal point of CH. No. flickers.

6 Recording start/stop

The lamp (green) lights or goes out repeatedly, each time REC. ON key is pressed.



		Lamp lights	Lamp goes out
Analog	Indication	Functions	Stand by at the left end.
Analog	Recording	Functions	Stops
Digital	Display	Fuctions	Functions
Digital	Recording	Functions	Stops
FEED key		Effective	Ineffective

Remarks 1 In case of external drive (option); -

Both REC. ON and FEED keys become inoperable, if a [stop] signal is applied to the external drive terminals.

Remarks 2 When the lamp goes out; -

Printing stops halfway when printing is in progress.

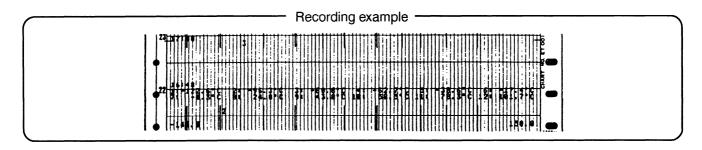
3.2 Applied Operation

1 Digital recording of present data → [Data print] (key operation)

- ① Current digital recording commences at once after interrupting the analog recording (dot printing).
- 2 The recording time depends upon the number of input points.

Starting method See par. 8.3 on page 24.

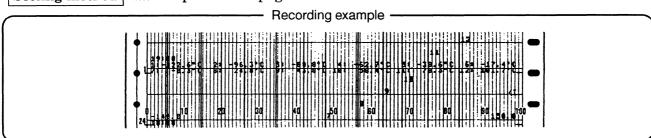
No. of input points	Required data printing time
6 points	About 1min 20sec
12 points	About 2min 20sec
24 points	About 5min



2 Digital recording at a fixed interval → [Fixed time recording] (key setting)

- ① Digital recording occurs at a preset interval together with analog recording (dot printing).
- 2 The start time and interval time must be set.

Setting method See par. 8.4 on page 25.



3 Chart speed change → [Chart speed] (key setting)
One of three speed numbers is selected.
The speed of each speed No. can be reset.

Setting range

1(mm/H) to 1500 (mm/H) for each speed
No.

Setting method | See par. 8.1 on page 19.

Deletion of unused channels → [Skip function] (key setting)
Indication, display and recording of unused channels can be skipped.

Setting method See par. 8.5 on page 28.

Continuous monitoring of one-point analog indication → [Continuous indication mode] (DIP. SW2 and key operation)

- ① Analog indication of a specified channel can be monitored continuously. Data are updated every about 1.5sec.
- 2 No recording occurs.

Mode change method See par. 6 on page 14.

6 Functioning of alarm (option) → [Alarm value setting] (key setting)

- 1 No alarm value is set at the delivery time.
- 2 For alarm operation, set alarm values.

Setting method See par. 9.2 on page 33.

7 Setting of the same alarm value to the other channels → [Alarm value copy] (key setting)
The same alarm value can easily be set to the other channels.

Setting method See par. 9.4 on page 35.

8 Reset lock → [Key lock] (DIP. SW1)

Set contents can be confirmed, but they cannot be changed if key lock is selected.

Locking method See par. 3.3 on page 8.

9 Deletion of time printing → [Time printing] (DIP. SW1)

Time printing occurs at certain intervals, and it depends upon the chart speed.

Time printing can be deleted.

Deletion method See par. 3.3 on page 8.

speed 4mm/H 5 to 91111/71 10mm/H	Time printing intervals ———				
			5 to 9mm/H	Higher than 10mm/H	
Interval	Printing interval	12 to 3H	2H	1H	

10 Deletion of fixed time printing function → [Fixed time printing] (DIP. SW1)

① Date (year, month, day), ② Scale (divisions), ③ Chart speed, ④ Time lines, ⑤ Channel No., and ⑥ Time to be printed at fixed time can be deleted.

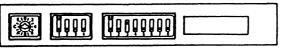
Deletion method See par. 3.3 on page 8.

3.3 Selection of Functions (DIP. SW1)



1 Mounting position and names of switches

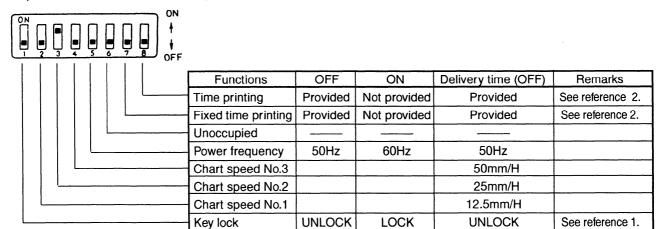
After taking out the chart cassette, the switches are accessible at the lower part of the internal unit.



SW 2(A) SW.2(B) SW.1

2 Functions and the status when switches are turned on or off

Set positions of SW1 at the delivery time



Caution Before operating switches -

- •Electronic parts may be broken by the static electricity of the body when touching switches SW.1 to SW.3.
- Discharge the static electricity from the body by touching a grounded metal (the side panel of the internal unit in case of this instrument, for example) by hand before operating SW1 to SW3.

Remarks SW.2 and SW.3

SW.2 are mainly used for communication (except for No.8), while SW.3 are mainly used for maintenance. Don't touch any switches other than SW.2 communication (option) switches.

Reference 1 What does the key lock mean?

- (1) Setting cannot be changed.
- 2 FEED and REC. ON keys become inoperable.
- 3 Set contents can be confirmed.

Reference 2 Selection of fixed time printing and time printing functions

- 1) These functions are selectable by turning on or off No.7 and No.8 of DIP. SW1.
- ② Turn the power switch ON→ OFF→ON without fail after

(The switch position is recognizable only when the power switch is turned on.)

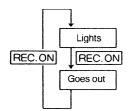
Functions	No.	OFF	ON
Fixed time printing	7	Provided	Not provided
Time printing	8	Provided	Not provided

4. INDICATION AND DISPLAY

4.1 Analog Indication

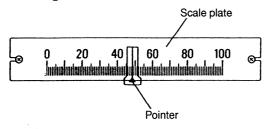
1 Indication start and stop

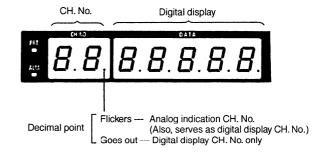
The lamp (green) lights or goes out alternately, each time REC.ON key is pressed once.



		Lamp lights	Lamp goes out
Analog	Indication	Functions	Stands by at the left end.
Analog	Recording	Functions	Stops
Digital	Display	Fuctions	Functions
Digital	Recording	Functions	Stops
FEED key	,	Effective	Ineffective

2 Analog indication and CH No.



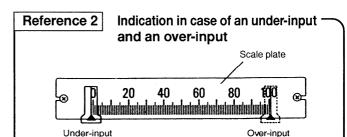


Reference 1 "Indication" or "display"

Indication ---- This is used for indicating analog values.

The values indicated by the indicating pointer are read on the scale plate.

Display ----- This is used for indicating digital values shown by DATA.



The indication is about 0.5 mm less than MIN. or more than MAX.

Reference 3 Analog indication interval

The analog indication interval is equal to the dotprinting interval, and it depends upon the chart speed.

Longer than 5sec when the chart speed is lower than 5mm/H.

5sec when the chart speed is higher than 6mm/H.

Reference 4 | Continuous indication mode -

A specified channel is indicated continuously, but no recording takes place.

See par. 6 on page 14.

4.2 Digital Display

1 Display start and stop

Display is started or stopped by turning the power switch on or off. (Analog indication is started or stopped by REC. ON key.)

OFF ON OF

2 Names and functions of digital indicator

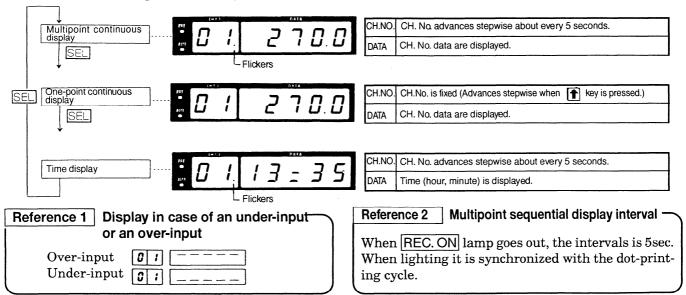


	PRT	(green)	Lights during digital recording & printing.		
Lamp	ALM (red) % 1 Flickers during the occurrence of an alarm (This alarm decision result does not alway with the output.)				
	REC.ON (green)		Lights during recording operation, and goes out when recording stops.		
Indicator	CH. NO.	•	Analog indication and data display point number (One-point continuous display only is exclusively used for data display) $\mbox{\%}2$		
	DATA				Data or time is displayed. ※ 2

- * 1: Flickers when an alarm function (option) is provided.
- * 2: Set contents are displayed in the setting mode.

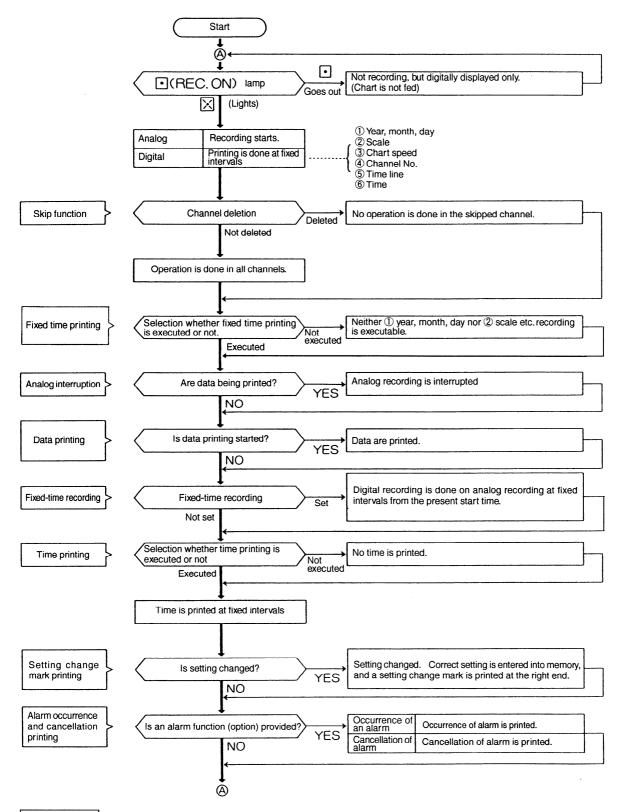
3 Selection of display modes

- The display contents change in the order of multipoint sequential display → one-point continuous display → time display, each time SEL key is pressed once.
- CH. No. advances stepwise, each time **1** key is pressed in the one-point continuous display mode.
- CH. No. decimal point flickering shows CH. No. of analog indication.



5. RECORDING OPERATION

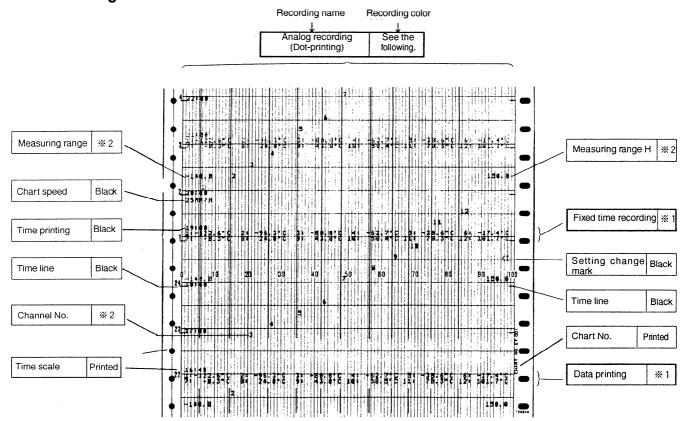
5.1 Recording Operation



Reference How to read the flow chart

- The thick lines show the recording operation flow being set at the delivery time.
- The thin lines show the execution of setting or switching of DIP. SW1.

5.2 Recording and Fast Feed



- ※1: Repetition in the order of dot-printing colors
- ※ 2: Same as the dot-printing colors

(Note) When fixed time recording is executed on the hour sharp, the time printing is common to the time printing of fixed time recording.

L	Referen	ce 1	Analog	j record	ing col	ors —			
Recording colors and channel No.									
		Red	Black	Blue	Green	Brown	Purple		
l		1	2	3	4	5	6		
l	CLING	7	8	- 9	10	11	12		
ı	CH.No.	13	14	15	16	17	18		
l		19	20	21	22	23	24		

Reference 2 Digital recording and digital printing-

Digital recording:

①Data printing

② Fixed time recording

Digital printing:

Those other than the above

digital recording

Reference 3 Setting change mark printing

A change mark is printed when set contents are changed and entered into memory without any setting miss.

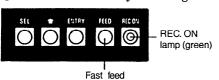
Setting item	Change mark
Chart speed	<h< td=""></h<>
Time	<0
Fixed time recording	<
Alarm (when it is added as an option)	<a< td=""></a<>
Skip	<k< td=""></k<>

The change mark is <H>, if setting is changed by means of communication.

Fast feed of chart

The chart can be fed fast, and this function is convenient for the following cases.

- ① Setting of the time scale to the present time
- ② Chart feed check after chart exchange
- 3 Chart feed for newly recording data



Condition: REC. ON lamp (green) is lit.

Method : The chart is fed at a speed of about 10mm/sec when FEED key is

pressed.

Remarks: Recording operation is interrupted during the fast feed of the chart.

Reference Fast feed condition and recording operation

FEED is effective when the key is not locked and REC.ON lamp (green) lights. Recording operation is interrupted during fast feed.

5.3 Digital Recording and Printing Contents

Division	Recording name	Recording contents	Remarks			
cording	Fixed time recording	 Time Channel No. Measured value Unit 	Data are recorded in the order of red → black → blue → green → brown → purple repeatedly on analog recording at an optional preset time interval.			
Digital recording	Data printing	 Time Channel No. Measured value Unit 	 Data are recorded at the started point when data printing begins. Analog recording is interrupted. Recording colors are the same as those in time recording. 			
	Fixed time printing	 Time line Time Chart speed Measuring range (L) Measuring range (H) Channel No. (Identification of analog recording points) 	 Data are printed at fixed intervals according to the chart speed. The printing interval depends upon the printing contents and chart speed. 			
Digital printing	Alarm printing (only when the alarm function is provided as an option) 1. Time of occurrence 2. Channel No. 3. Type of alarm 4. Alarm No. 1. Time of occurrence 2. Channel No. 3. Type of alarm 4. Alarm No. 1. Time of cancellation 2. Channel No. 3. Alarm No. 3. Alarm No.		These data are printed on the right side of the chart when an alarm occurred or when the alarm has been cancelled. $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			
	Setting change mark printing	1. Setting change mark A setting change mark is printed on the right side of the chart when a setting change is completed. If not printed, if shows that the setting change is not completed, and the operation continues with the last set contents.	Setting item Change mark Chart speed <h (when="" <i="" <o="" alarm="" digital="" fixed="" function="" is="" or="" or<="" recording="" td="" this="" time=""></h>			

Remarks

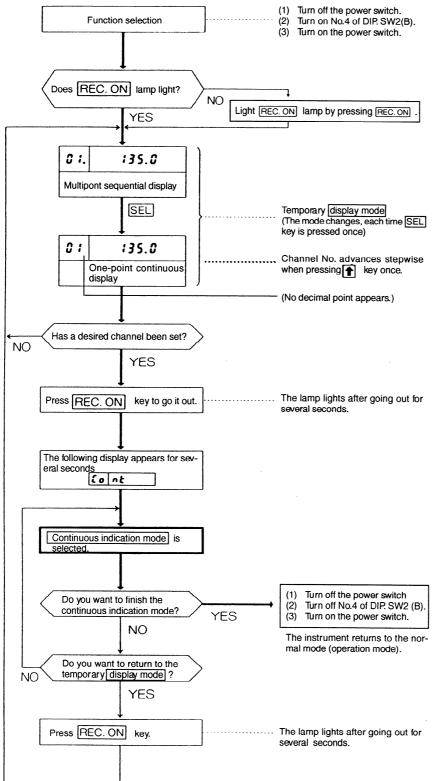
Be careful since neither digital recording nor printing is executed if the chart speed is higher than 251mm/H.

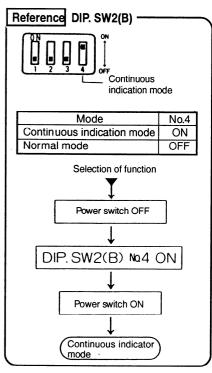
6. CONTINUOUS INDICATION MODE

6.1 Operation Procedure

- ① Analog indication and digital display of a selected channel No. can be monitored continuously.
- 2 Data are updated at intervals of about 1.5sec.
- ③ Neither analog recording (dot printing) nor digital recording (printing) takes place.
- 4 The chart is not fed.

6.2 Flow Drawing of Operation

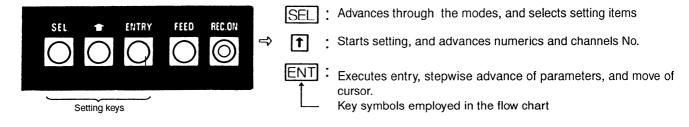




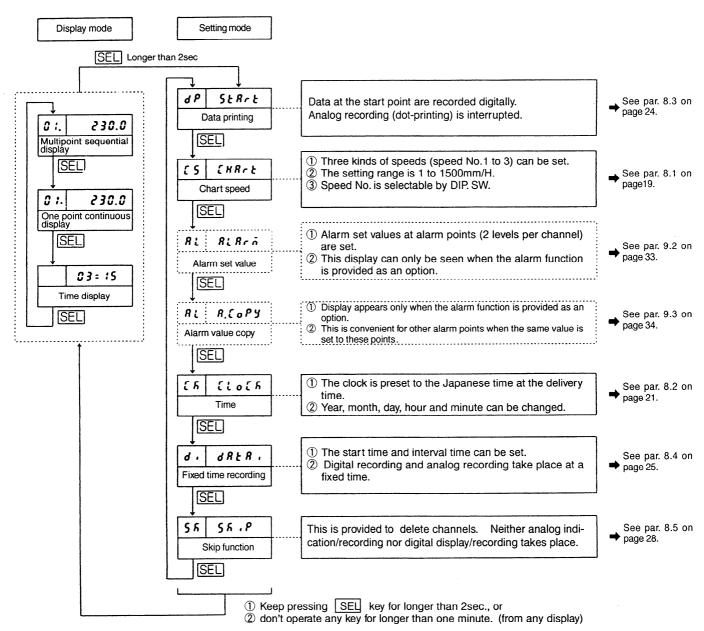
7. BASIC SETTING

7.1 Setting Keys and Setting Items

1 Setting keys



2 Setting items



7.2 Setting Ranges

Setting items	Parameters	Delivery time	Setting ranges			
	Speed No.1	12.5(mm/H)	1 to 1500 (mm/H), 1 (mm/H) step except for 12.5mm/H			
Chart speed	Speed No.2	25(mm/H)				
	Speed No.3	50(mm/H)	(Common each speed)			
	Hour, minute		00:00 to 23:59			
Time	Year	Preset to the Japanese time.	1993 to 2092			
	Month, day		01/01 to 12/31			
Fixed time	Interval time	Not set	00:02 to 24:00 **			
recording	Start time	Not set	00:00 to 23:59			
Chin function	Channel 1	No skip				
Skip function	Channel 2	No skip	M/hathautha alia function is mustisful (4) accest (0)			
(Channel	:		Whether the skip function is provided (1) or not (0) can			
deletion)	Channel n	No skip	be set every channel.			

^{*} The shortest interval time is restricted according to the chart speed. For details, refer to Remarks on page 13.

Reference 1 Chart speed No. selection -

Chart speed No. can be selected by DIP. SW1. See page 19.

Reference 2 | Month/day error decision

This instrument judges the leap year and whether the month is a 31-day month or a month with thirty or less days, and issues a set error (5.f.), if Feb. 30 is set, for example.

Reference 3 Digits in display

The number of display digits are already designated depending on the scale range.

For instance 0.1 digit is not displayed in a range of 0 to 2000° C .

Reference 4 "Not set" on fixed time recording

Means "clear" status, no fixed time recording is carried out.

Reference | Setting change mark

- ① A setting change mark is printed on the right side of the chart when ENT (entry) is done after changing various set values.
- ② The change mark depends upon the kinds of setting.
- 3 If no change mark is printed after a change, it is caused by no entry due to a setting error.

Setting item	Setting change mark
Chart speed	<h< td=""></h<>
Time	<0
Fixed time recording	<
Alarm (when the alarm functions provided as an option)	<a< td=""></a<>
Skip	<k< td=""></k<>

7.3 Characters of Display

This instruments uses a 7-segment indicator. Alphabetic characters are displayed as shown in the following table, since part of them cannot be reasonably represented.

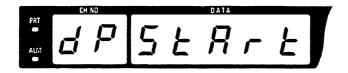


7-segment LED

1 Alphabetic characters

А	В	С	D	Е	F	G	Н	l	J	K		М
A	b		ď	E	F	ũ	H	•	ű	F	1	ñ
N	1		•	1		1	1		ł	•	1	
n	Q	P		,-	5	£	u	Ħ	-		y	-

2 Major characters employed



Display			Characters	
CH.NO.	DATA	CH.NO.	DATA	Meanings
d P	5 <i>t Ar t</i>	DP	START	Data printing execution (start)
[5	[XRrt	CS	CHART	Chart speed setting item
R:	RLArā	AL	ALARM	Alarm value setting item (Option)
A!	A.CoPY	AL	A.COPY	Alarm value copy setting item (Option)
[F	[Lo[h	СК	CLOCK	Time setting item
d ·	dRFR.	DI	DATAI	Fixed time recording setting item
55	5 <i>5 .P</i>	SK	SKIP	Skip function setting item

3 Numerical value/sign

1	2	3	4	5	6	7	8	9	0	Space	Minus	Hyphen	Colon	\
1	3	3	4	5	5	7	8	1.0			-	-	-	اسو

7.4 Setting Errors and Remedial Measures

Kinds of setting errors

Two kinds of setting errors are present; 5.f. and f.f. .

1 [5.£.] (Abbreviation of SET ERROR)

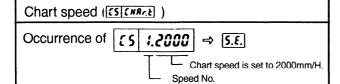
A set value is out of the setting range, but the setting format is correct.

2 F.E. (Abbreviation of FORMAT ERROR)

A setting format is in error. **5.**£. is displayed preferentially, if **F.**£. occurs concurrently.

An example of 5.E.

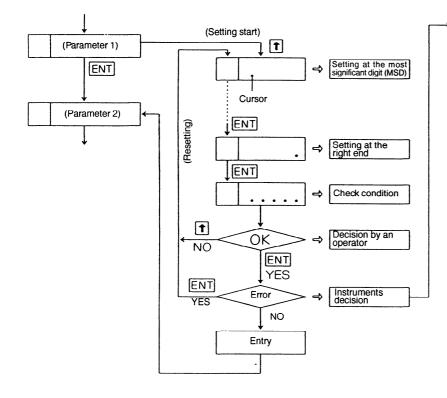
An example of F.E.



Set value 2000 is out of the setting range of 1 to 1500 (mm/H).

At the delivery time or setting is done after clearing, all digits are spaced (—). If ENT key is pressed and "minute" is set without setting any "hour" digit for setting 10:00 hours, for example.

2 Decision of errors and remedial measures



Judgement

The instrument judges whether setting is in error or not when pressing ENT key under the check condition after setting a parameter.

Display of the occurrence of an error

Error display
(every about 1sec) Setting
display
(isplay)

Remedial measures

By pressing ENT key, the error display disappears, and the setting display only remains unerased. The cursor is displayed. Repeat setting again.

Reference -

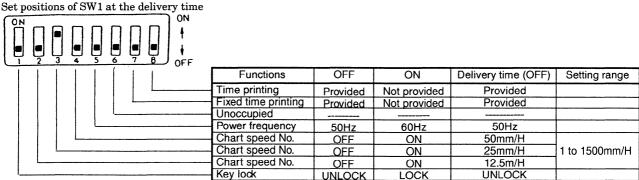
The instrument returns to $\boxed{\text{Display mode}}$, if no key is operated for longer than 1 minute under an optional display condition.

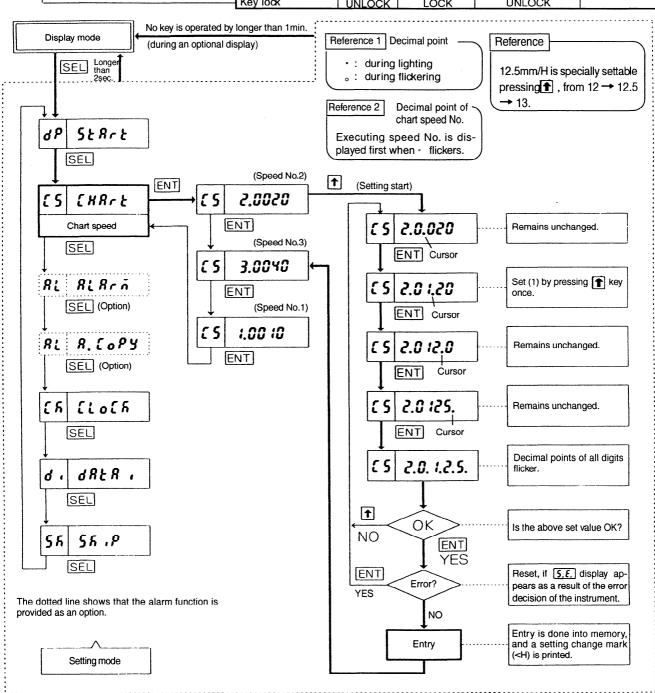
8. SETTING METHODS

8.1 Chart Speed and Speed No.

Setting flow chart

<Example> Change of the speed of chart speed No. (2) from 25 to 125(mm/H)





2 Clearing value

The instrument returns to the initial value easily at every speed No.

- ① Select a speed No. by parameter selection
- ② Set the instrument to be ready for setting by pressing [key.
- 3 Press ENT key to shift the cursor to the right end.
- 4 Press **†** key several times to select a space.
- (5) An initial value is selected and the speed No. transfers to the next one when pressing ENT key twice.

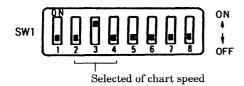
- 1.0 125
- 1.0. 125
- 1.0 125.
- 1.0 12

Reference How to return to display mode

For returning the instrument to display mode when it is desired to stop or finish setting, continue pressing SEL key for longer than 2 seconds.

3 Chart speed No. selection

- ① DIP. switches are accessible by opening the cover below the operation keys after opening the door.
- 2 Set No.2 to 4 of DIP. SW1 to desired speed No. *



The chart speed is set as shown below, and speed No.2 is selected, if the chart speed is not specified in particular at the time of ordering.

		ğoqq	40000000	
•	SW.2(A)	SW.2(B)	SW.1	

Switch to either upper or lower notch by using a thin minus screwdriver or the like.

Speed No.	No.2	No.3	No.4	At the delivery time from factory
1	ON	OFF	OFF	12.5mm/H
2	OFF	ON	OFF	25mm/H
3	OFF	OFF	ON	50mm/H

Reference 1 In case of wrong selection,						
	SW 2	SW 3	SW 4	Speed No.		
	OFF	OFF	OFF	1 Reference		
	OFF	ON	ON	2		
	ON	ON	ON/OFF	1		
	ON	OFF	ON	1		
· '						

Reference 2 | Selection by an external contact signal

- ① When the [external drive] function (option) is provided, speed numbers can be switched by an external contact signal.
- ② For switching with [external drive], turn off No.2 to No.4 of DIP. SW. **

Reference 3 If DIP. switches were changed over during setting;

If speed No. is changed by DIP. SW or external contacts during setting, the actual speed changes, but its change is not displayed. The above change is displayed by pressing **ENT** key.

* For the switch operation, refer to ! Caution in par. 3.3 on page 8.



8.2 Time (year/month, day/hour, minute)

1 Status at the delivery time and setting range

Parameters	Delivery time	Setting example	Setting range
① Hour, minute	Set to the	14:27	00:00 to 23:59
② Year	Japanese	1994	1993 to 2092
③ Month, day	time.	Feb. 15	01/01 to 12/31

Reference In case of setting out of the setting range

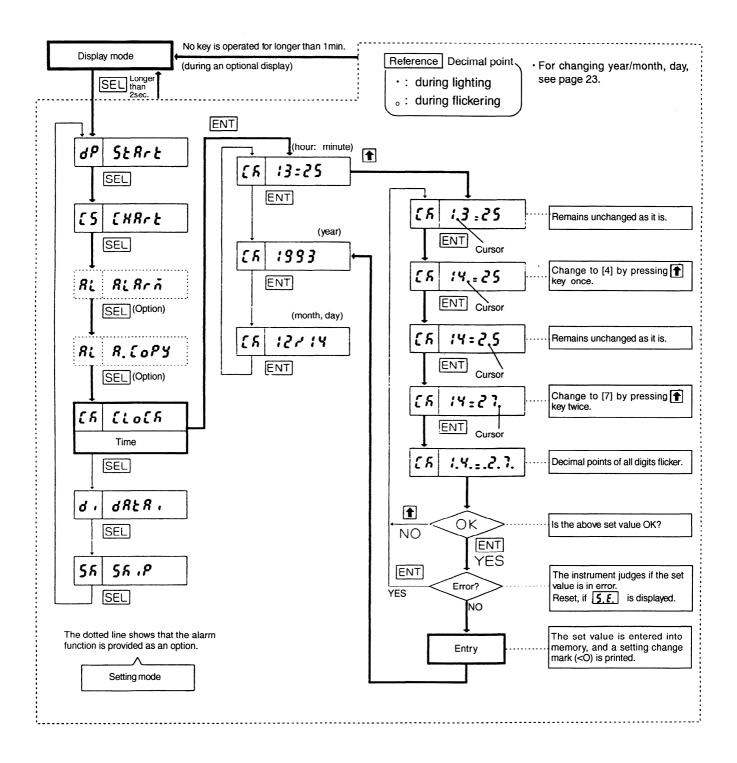
If the instrument judges it as an error, it displays [5.f.] and the set value alternately. Reset parameters within the range by pressing ENT key.

2 Caution on setting

Time consists of three parameters ① hour, minute ② year ③ month, day, and set (or changed) by corresponding parameters. Set value are entered when ① hour & minute have been set. Set ① hour and minute without fail when ② year or ③ month & day have been changed.

3 Setting flow chart

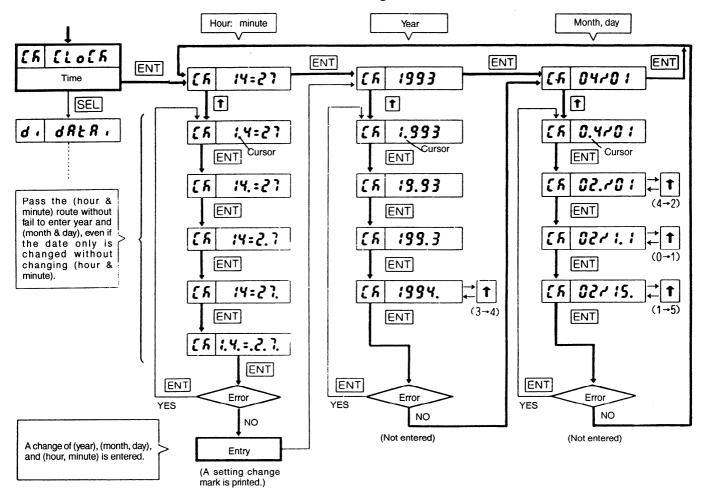
<Example> A change of hour : minute from 13:25 to 14:27



4 For changing the year/month, day

<Example> A change from April 1, 1993 to Feb. 15, 1994 (without changing hour & minute)

If the (hour & minute) route is skipped after changing the year, month, and day, the date is not entered. Pass the (hour & minute) route without fail for entering the date.



Reference 1 For resetting to the display mode

For resetting the instrument to display mode when you want to stop or finish setting, continue pressing SEL key for longer than 2 seconds.

Reference 2 Backup of clock -

- The clock is backed up with a lithium battery even after the power supply has been turned off.
- It is backed up for longer than 10 years, assuming that it is operated for 8 hours every day.

Reference 3 Time start-

- Time is started when (hour & minute) have been entered.
- Time display is stopped during setting, but time is counted continuously.

Reference 4 Time clearing

Time cannot be cleared.
 Set time to a desired time (including year/month & day).

Reference 5 A 31 day month and a month - with thirty days or less

• The instrument judges the leap year (whether February consists of 28 days or 29 days) and whether the month consists of 31 days or 30 or less days, referring to the built-in calendar at the

Reference 6 Clock accuracy

Monthly difference $\pm 2min$

Reference 7 Setting interruption -

The instrument is reset to display mode from optional display when SEL key is pressed for longer than 2 seconds.

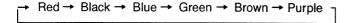
8.3 Data Printing

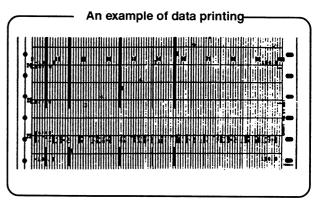
1 Data printing

- ① Data are held and recorded digitally when (ENT key is pressed.)
- ② Analog indication/recording and digital display are interrupted.
- 3 For executable conditions, refer to Remarks.
- 4 The recording time depends upon the number of input points.

No. of input points	Required data printing time		
6 points	About 1min 20sec		
12 points	About 2min 20sec		
24 points	About 5min		

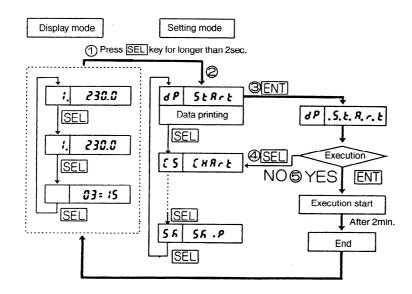
5 The recording color changes each time.





Recording contents: Time, CH No., measured values, & unit (4 items)

2 Execution method



Remarks Non executable conditions -

- 1. REC. ON goes out.
- 2. Data printing is being executed.
- 3. Key lock condition
- 4. Chart speed is higher than 251mm/H.

Reference 2 Functions of keys during execution

All keys are functionable, except for data printing execution.

Reference 1 Execution operation

- ① Analog indication and recording are interrupted, and the chart is fed slightly.
- ② Digital recording (hour, minute, channel, data, unit) is performed.
- 3 The chart is fed to start analog indication and recording, and then, the instrument is reset to display mode.
- 4 Digital display is [[S [[HA-E] during the above operation.

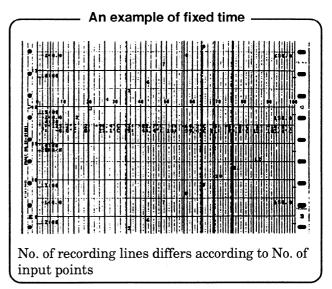
Reference 3

For interrupting data printing, press REC. ON key to turn off its built-in lamp.

8.4 Fixed Time Recording

Fixed time recording

- ① Data are recorded on analog recording at a preset interval time.
- ② The recording contents consist of time, channel No., measured values (data), and units.
- 3 This setting is entered when setting the start time.
 - Set the start time, too, only when the interval time is changed.
- 4 This recording can only be done, depending upon the chart speed.
 - See Remark 2 on page 27.



Recording contents: Time, CH No., PV values, & units (4 items)

2 Status at the delivery time and setting range

These parameters are not set at the delivery time (clear status). Therefore, the fixed time recording is not available under these conditions.

Parameter	Delivery time	Setting example	Setting range	
Interval time	Not set	02.00	0.01 to 24.00 %	
Start time	Not set	10:00	0:00 to 23:59	

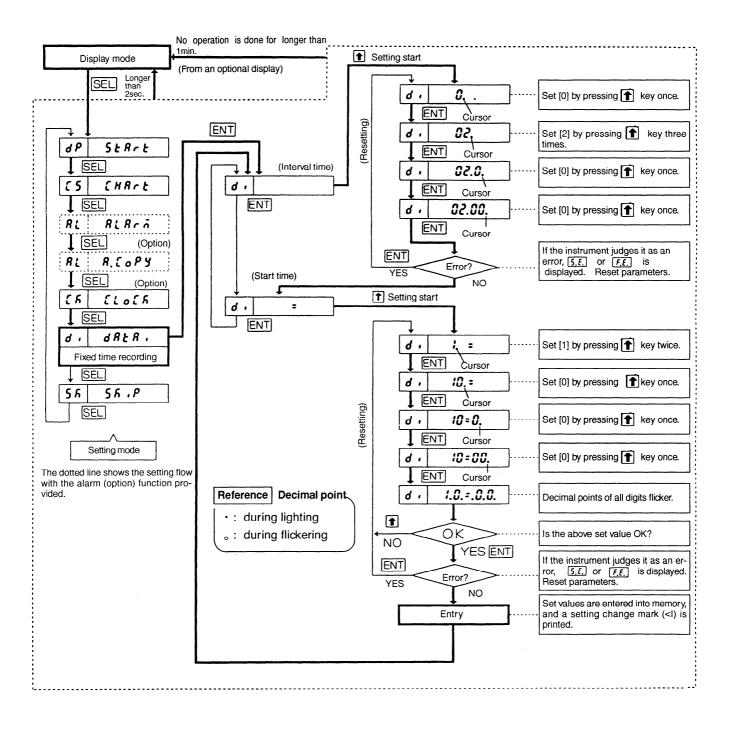
% This setting is limited by the chart speed. If impossible, $\boxed{5.\mathcal{E}.}$ is displayed.

Reference In case of setting out of the setting range -

If the instrument judges it as an error, it displays 5.f. and the set value alternately. Reset parameters within the range by pressing ENT key.

3 Setting flow chart

<Example> Interval time → 02.00, Start time → 10:00



4 Clearing a set value (Stop of fixed time recording)

If the start time is cleared, neither interval time nor start time is set, so that the fixed time recording is not performed. (Status at the delivery time)

1	Select [start time] parameter.	d .	10 = 00	Start time
2	Press key to be settable. A cursor appears on the left side	d .	1,0 = 00 Cursor	Setting start Press ENT key three times.
3	Shift the cursor to the right end by pressing $\begin{tabular}{ l l l l l l l l l l l l l l l l l l l$	d ·	10 = 00 ₁	Bring the cursor to the right end.
4	Select a space (□: blank) by pressing ★ key several times	d ı	Cursor	Set a space.
(5)	When pressing $\[\overline{\text{ENT}} \]$ key, the decimal points of all digits flicker	d ·	1.0.=.0.	Clear
6	For clearing, press ENT key. The [start time] is cleared to shift to the [interval time] parameter	d .	•	YES
7	For stopping clearing, continue pressing SEL key for longer than 2 seconds, and the processing returns to display model.	0:	:32.9	SEL for longer than 2sec

Remarks 1 Change of interval time only -

Even if the interval time only is changed, it is not entered, and returned to the last time.

After changing to the [start time], bring the cursor to the right end, and press ENT key twice.

After this entry, a setting change mark (<I) is printed on the right side of the chart.

Remarks 2 Limitation in interval time setting -

- ① The interval time cannot be set unconditionally when the chart speed is higher than 251mm/H.
- ② The interval time may be restricted when the chart speed is 1mm/H to 250mm/H, and if the condition is not satisfied, 5.ξ. is displayed because of overlapped recording.

Reference of interval time

Time		(): Set value	
Chart speed *	For a 6-point instrument	For a 12-point instrument	For a 24-point instrument
5mm/H	One hour & 15 minutes orlonger (01.15)	Two hour or longer (02.00)	Three hour or longer (03.00)
12.5mm/H	30 minutes or longer than (00.30)	45 minutes or longer (00.45)	One hour & 30 minutes or longer (01.30)
25mm/H	15 minutes or longer (00.15)	30 minutes or longer (00.30)	One hour or longer (01.00)
50mm/H	10 minutes or longer (00.10)	15 minutes or longer (00.15)	30 minutes or longer (00.30)
100mm/H	5 minutes or longer (00.05)	10 minutes or longer (00.10)	15 minutes or longer (00.15)

^{*}Set the interval time based on the lowest chart speed being preset by speed No.1, 2, or 3 as a reference, irrespective of the chart speed to be executed.

(Example) Assume that speed No.1: 12.5mm/H, 2: 25mm/H, and 3: 50mm/H are set and the operation is executed at 25mm/H.

In this case, set the interval time at 12.5mm/H which is the lowest of three speeds.

③ If the condition is not satisfied in interval time setting, an **5.**£. display appears.

If the chart speed was changed to be lower halfway, the required recording time may become multiple times of the preset interval time.

8.5 Skip Function/(setting memory)

Reference How to obtain the shortest interval time

Interval time (min) = $\frac{180 \times \text{No. of printing lines}}{\text{Chart speed (mm/H)} \times 1}$

No. of printing channels 2 1 to 6 7 to 12 13 to 24 No. of printing lines 2 3 4

* 1: Use the lowest speed value out of 3 speeds.

* 2: No skipped channel is counted.

[Example] Assume that 3 chart speeds are 12.5, 25, and 50(mm/H), and skipped channel is 24.

 $180 \times 4/12.5 = 57.6 \le 58$ (min). This value shows the shortest interval time. An $\boxed{\text{S.E}}$ appears if a time shorter than 58 (min) is set.

When the skip function is used in channels where no recording is required, indications, display, and records can be read easily.

1 Skip function

- ① Corresponding channels are deleted.
- ② No indication, display, or recording takes place in skipped channels.
- 3 Setting is required every channel.
- 4 The dot-printing interval may be delayed.

Reference In case of a skipped channel;

Channel No.

- ① Analog indication None
- ② Analog recording None
- 3 Digital display None
- 4 Digital recording None

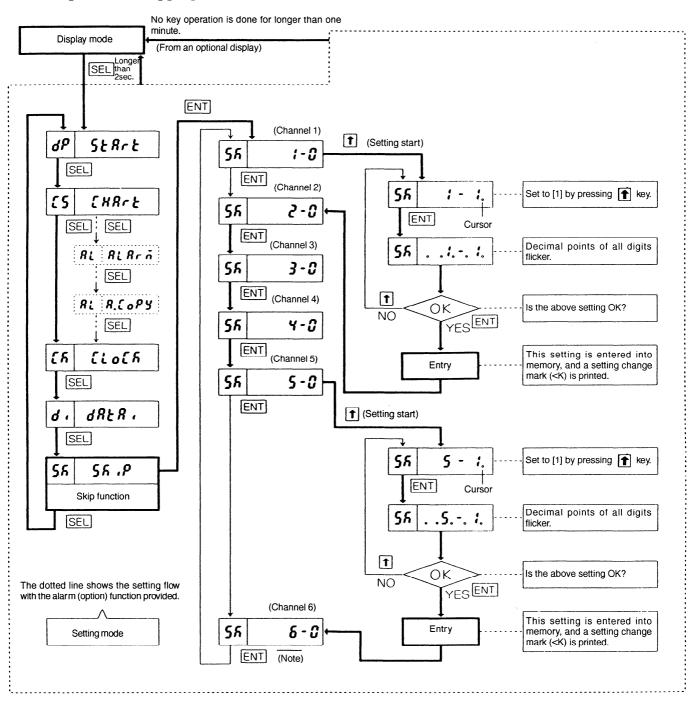
2 Status at the delivery time and setting range

- 1 All channels are not set to be skipped at the delivery time.
- ② Set either skipped (1) or not (0) every channel.

Setting whether a channel is skipped or not Skipped/Not skipped { 0: Not skipped 1: Skipped 1: Skipped

3 Setting flow chart

<Example> For skipping channel No.1 and No.5



(Note) This shows that No. of input points is 6 points.

Channels advance stepwise up to 12 for 12 input points or up to 24 for 24 input points.

4 Clearing the setting (Return to the delivery parameters)

Skip setting cannot be cleared. Check the skip condition in each channel by parameter selection, and change skipped channels, if any, to non-skipped channels.

Remarks If all channels are skipped;-

- ① [5.E.] is displayed, and no operation is done. Accordingly, the recording does not function at all.
- ② For resetting to setting mode, continue pressing SEL key for longer than 2 seconds, and resetting can be done.

Reference For resetting to display mode;

The instrument is reset to display mode when SEL key is pressed for longer than 2 seconds or when no operation is done for longer than one minute during optional setting display.

- [Setting MEMO] -

Chart speed		beens	Speed No.1 S		Speed No.2		Speed No.3		Speed No. selection	
L	Chart speed		mm/H		mm/H		mm/H			
Five	time	recording	Interva	ıl time		Start time				
I IXCO	ı tırınc	recording	Hour Mi				Hour		Minute	
			Channel No.	1	2	3	4	5	6	
		6 points	Present/Absent							
	points		Channel No.	7	8	9	10	11	12	
Skip	nt po	12 points	Present/Absent							
Chip	. i c		Channel No.	13	14	15	16	17	18	
No. of	o		Present/Absent							
	24 points	Channel No.	19	20	21	23	23	24		
			Present/Absent							

[Remarks]

9. ALARM (option)

9.1 Before Setting Alarms

1 Alarm specifications at the delivery time

The [alarm type], [output number], and [output processing = AND connection or OR connection] are set every alarm point (No. of channels × 2 levels) at the delivery time of this instrument according to the order specifications.

However, alarm set point values are not set yet. Set them to the desired values.

An example of alarm order specifications

Alarm po	Alarm point		Output	Output	Alarm
Channel	Level	type	No.	processing	value
	1	н	1	OR	Not set
1	2	Ĺ	1	OR	Not set
	1	ະ	2	OR	Not set
2	2	đ	2	OR	Not set
	:	:	:	:	•••
	1	ь	n	OR	Not set
n	2	5	n	OR	Not set

- n: No. of input points (6, 12, or 24 points)
- If alarm specifications are not specified at the time of ordering, the instrument is delivered with the following alarm specifications.

However, alarm set point values are not set. Set them to the desired values.

Alarm specifications when they are not specified by the client

Alarm p	oint	Alarm	Output No.	Output	Alarm
Channel	Level	type	,	processing	value
Every	1	н	Same as	OR	Not set
channel	2	i	channel No.	OR	Not set

Remarks Items settable by the instrument

Alarm set point values can only be set by the instrument itself.

Other alarm specifications are fixed by the specifications when ordering.

2 Levels and No. of alarm points

Two setting levels No. of input points are provided every channel.

The total alarm points amount to (No. of input points \times 2).

3 Alarm types and display

		Alarm st	andby
Alar	m type	Not provided	Provided
Abaaluta valva	Higher-limit	н	איי
Absolute value	Lower-limit	٤	ر. برد
Change setie	Lifting limit	Ü	ن د .
Change ratio	Lowering limit	đ	٥.
Differential	Higher-limit	ь	٩.
Differential	Lower-limit	5	ي ج

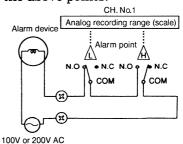
4 No. of alarm output points and output processing

- No. of output points
 No. of output points (No. of terminals) is 6, 12,
 or 24 points, which correspond to output No.1
 to 24.
- 2) Output processing
 Since the total alarm points provided are more
 than the output points, they don't correspond
 to each other at a ratio of 1:1.

AND or OR processing is necessary for a common use of output points.

Remarks 1 AND output

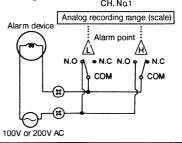
If alarm occurs at all the higher-limit or lower-limit alarm points of individual channels, an alarm signal is output. This alarm is cancelled if it is reset at one of the above points.



Remarks 2 OR output

If alarm occurs at one of the higher-limit or lower-limit alarm points of individual channels, an alarm signal is output.

If an alarm occurs at two points concurrently, the alarm signal is also output.

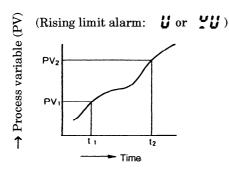


Remarks 3 Change ratio alarm

An alarm is triggered, if a variable (maximum value — minimum value) per measuring interval is larger than a set value.

The variable comprises two kinds; rising limit and lowering limit.

* 5sec. usually



(Lowering limit alarm: **d** or **d**)

PV₂

PV₁

Time

 $PV_2 ---- PV_1 = Change width$

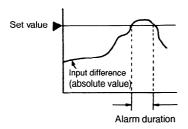
 t_2 ——— t_1 = Measuring interval (About 5sec) \times n, n: 1 to 9 (specified)

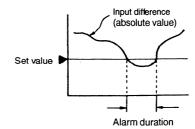
Remarks 4 Differential alarm _

An alarm occurs, if a difference between one channel and another channel is larger than a set value (higher-limit) or smaller than the set value (lower-limit).

(Differential higher-limit alarm: $\,$ **b** or $\,$ $\,$ $\,$ $\,$ $\,$ $\,$)

(Differential lower-limit alarm: 5 or 5)





A differential higher-limit alarm occurs, if the input difference (absolute value) > alarm set value, or a differential lower-limit alarm occurs if input difference (absolute value) < alarm set value.

Remarks 5 Alarm standby

This function is provided so as not to trigger any alarm until a PV value enters the setting range when power has been turned on. On setting change, this function is executed by resetting after clearing once.

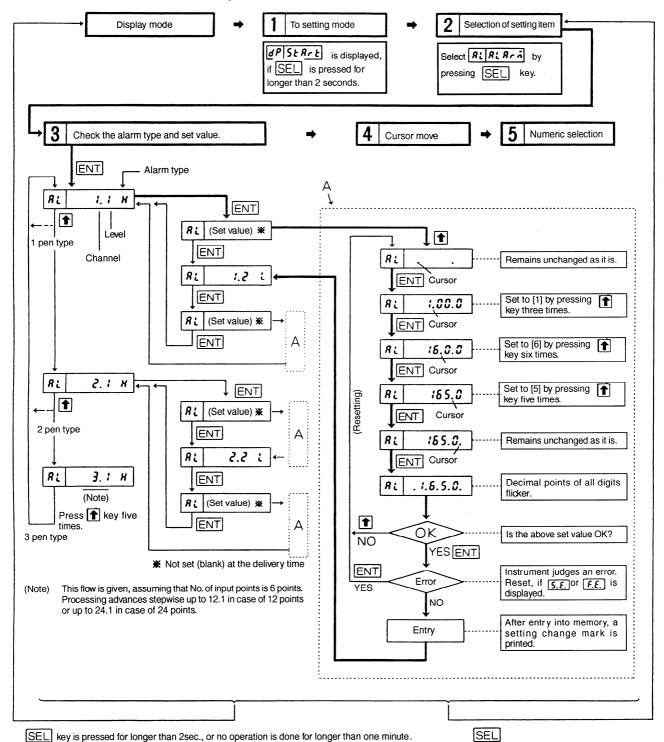
9.2 Setting of Alarm Set Values

Caution Alarm setting (Alarm action execution)

- ① Two-level alarm points are provided every channel. Set the alarm values at these alarm points.
- The two-level alarm types of each channel become as shown in the right table, if they are not specified.
- ③ If no alarm set value (alarm value) is set, the alarm cannot be judged and the alarm action does not function.

Re	terence	Alarm	specific	cations (when no	ot specified) -
	Channel	Level	Туре	Output processing	Setting value
	4	1	Н	OR	Not set
	•	2	لد	OR	Not set
	:	:	•••	:	:
	•	1	Н	OR	Not set
	6	2	L	OR	Not set

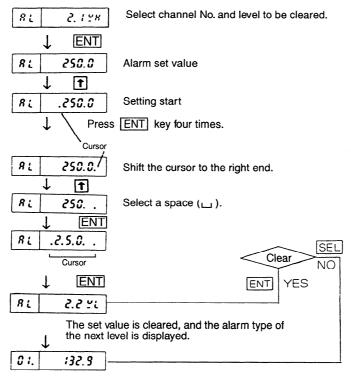
Example> Setting of the set value of level 1 (absolute value higher-limit alarm) of channel 1 to 165.0 (from the value at the delivery time)



9.3 Clearing an Alarm Set Point Value (non-setting)

A set point value can be cleared every alarm point. The cleared alarm point is not set in the same way as in the delivery condition. The instrument does not judge any alarm when the alarm point is not set.

<Example> Clearing a set value of 250.0 of level 1 of channel 2 (Select channel No. and level to be cleared.)

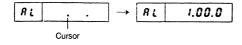


To exit clearing, continue pressing SEL key for longer than 2 seconds. The instrument returns to the multipoint display.

Reference 1 Setting from non-setting display

Only when the first digit is set, 0 is inserted to the digits lower than the set digit.

<Example> Assume that 1 is set during the course of setting 150.0.



Reference 2 Clearing all alarm points

Collective clearing of all alarm points cannot be done.

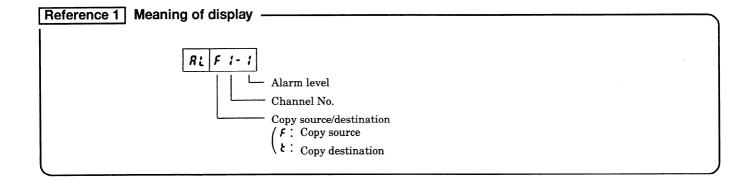
Clearing has to be done every alarm point.

9.4 Alarm Value Copy

1 What does the alarm value copy function mean?

- 1) This function is provided to copy an alarm value of a certain channel level to other channel levels.
- 2 By using this function, the same alarm value can be set to several points easily.

Remarks If channels are selected more than No. of input points; For setting copy designation, if channels are selected more than the number of input points (6, 12, or 24 points), are selected, [5.8.] appears. Reset channels by pressing ENT key.



2 Copy flow chart

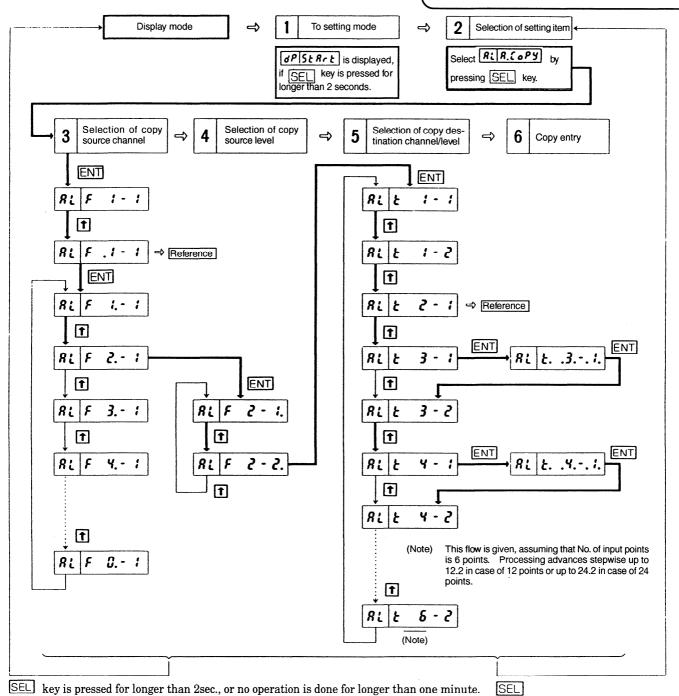
<Example>

	Copy source	Coppy destination		
Channel	2	3	4	
Alarm level	2	1	1	

Reference 2 Alarm value check

No alarm value can be confirmed by copy display.

Confirm it, referring to the flow chart in par. 9.2 on page 33.



Reference 3 Copy source channel/level -

The copy destination channel/level advances stepwise when pressing key except for the copy source channel/level.

Reference 4 Channel selection of [10] place

Each time 1 key is pressed, the channel advances stepwise in the order of $1 \rightarrow 2 \rightarrow$ space.

The channel is set to a space when No. of input points is 6 points.

10. EXTERNAL DRIVE (option) AND TERMINAL CONNECTIONS



1 External drive

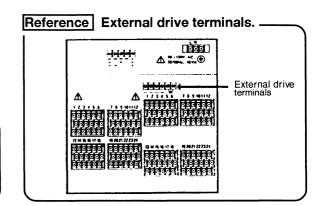
The following operation is executable by a contact signal from the terminals.

- (1) Recording start and stop
- ② Chart speed (3 speeds (speed No.)) selection
- 3 Data printing



Warning Turn off the feed source power supply before starting connections.

Turn off the feed source power supply before starting the connections of external drive terminals for the purpose of preventing an electric shock accident.



2 External drive function and relation with external drive terminals

Exter	External drive functions			Across COM and EX□ terminals			terminals	Pomerke [ON : Shorted]
LATE				EX1	EX2	EX3	EX4	Remarks LOFF: Open _
	F	0	1	OFF	OFF			REC. ON and FEED keys are effective.
Record-	Execu-	Speed No.	2	ON	OFF			Note: DIP. SW1 takes precedence of others. See Remarks
ing			3	OFF	ON			Enthancements believe
		Stop		ON	ON			REC. ON and FEED keys are invalid.
				*	*	ON		Continue the ON time for
Data pr	Data printing start		* *				ON	longer than 1sec. For longer than 1sec.

* Data printing cannot be executed unless recording is being executed.

Remarks | Selection of speed No. by external drive

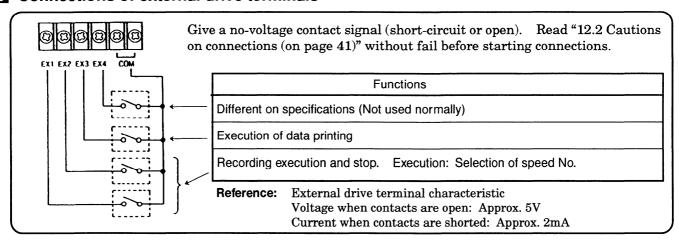
The selection by DIP. SW takes precedence of the selection by external drive. For selection by external drive, turn off No.2 to No.4 of DIP. SW1. Setting can be done irrespective of the key lock condition.



Warning No-voltage contacts

For the contacts to be connected to exernal drive terminals, use the contacts of a switch, a relay, or the like which is driven at a voltage level of lower than 30V AC or 60V DC or manual contacts.

Connections of external drive terminals





Warning Treat connected cords properly -

Treat connected cords securely so as not to allow them to be caught by a person or an article. If cords are broken or cut due to catching, an electric shock accident or other failures may occur.

11. INSTALLATION TO PANEL **A**





Warning Mount this instrument on a panel for use.

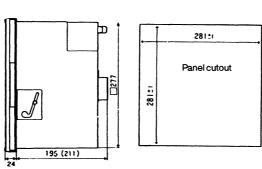
Mount the instrument on a panel without fail for preventing its falling down, drop, and other failures, except for portable type. Use a steel panel having a thickness of 2mm to 6mm. Don't mount the instrument at a place directly exposed to the sunlight. Separate the instrument from a place subjected to an electric field and a magnetic field.

1 Requirements of mounting place

Ambient temperature and humidity	Surrounding environment	Others	
The ambient temperature and humidity shall be stable within the following ranges. Temperature range: 0 to 50°C Humidity range: 20 to 80%RH Don't mount the instrument at a place where is subjected to a hot blast (70°C).	Overvoltage category II Contamination degree (Contamination class) 2 Altitude Lower than 2,000m	Mounting angle: Forward tilting : 0° Backward tilting: 0 to 30° Lateral tilting : 0° A place free of vibrations and shocks	

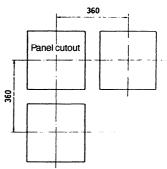
2 External dimensions and panel cutout

288 297



Parenthesized values show the sizes when options (external drive, alarm, and communication functions options) are provided. The terminal profiles are different in this case.

Minimum space when plural instruments are mounted

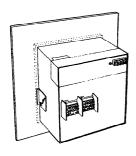


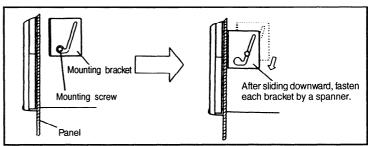
Use the mounting panel having a thickness of more than 2mm but less than 6mm.

3 Mounting method

Lock the instrument before mounting the instrument for preventing a danger. (See page 45)

- ① Prepare the attached mounting brackets (right and left brackets, one each) two mounting screws and a spanner.
- ② Insert this instrument into the panel cutout from the front.
- 3 Screw the mounting screws lightly onto the right and left side panels of the case, slide the mounting brackets downward until they are closely attached to the panel, and then, fasten the mounting screws with the spanner.





• Two mounting brackets are provided for right side and left side.

Caution Fastening torque is within 15kg-cm.

The case is made of plastics. Don't fasten it excessively, otherwise it may be deformed or cracked. Keep the fastening torque within 15kg-cm.

Caution Transportation lock

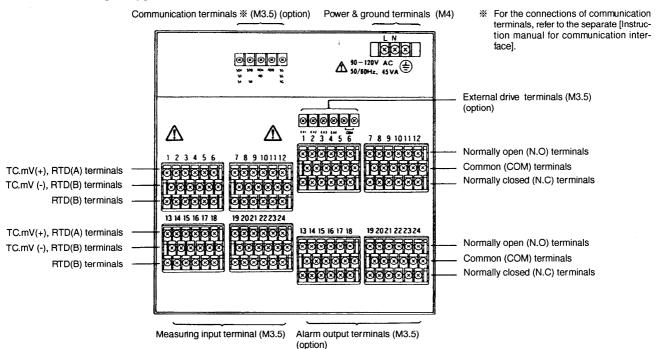
Lock the instrument without fail when mounting it onto or dismounting it from the panel or when transporting or relocating the instrument.

12. CONNECTIONS

12.1 Terminal Board Diagram



The terminal board shown in the following figure is provided when the full option (model BH144ADD) is mounted with 3-pen type resistance thermometer inputs.





Alert symbol marks (1) and places Warning

The alert symbol mark (\bigwedge) is mounted at a place where one may receive an electric shock if one should touch. (See the following table) Read paragraphs describing the connections of individual terminals.

Name of terminals	Power terminals	Measuring input terminals	Alarm output terminals
Mounting place of label	Lower left of power terminals	Upper left of terminal cover	Upper left of terminal cover

Reference Input terminal board and alarm terminal board are removable.

The input terminal board and alarm terminal board * are removable for easy connections.

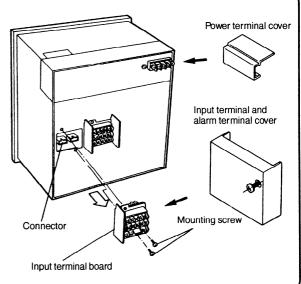
- * If external drive is provided, external drive terminal board is also removable.
- 1 Each terminal board can be removed by removing two mounting screws.
- 2 Each terminal board is connected to the instrument by a connector

Caution Turn off the power supply in advance. -

For mounting or dismounting the terminal board, turn off the external power switch for the purpose of preventing the electric circuits from being damaged.

Remarks Exchange of terminal board

The thermocouple input terminal board only cannot be replaced with that of other instruments, otherwise the calibration becomes incorrect.



12.2 Cautions on Connections



Observe the following cautions during connections for securing safety and reliability.

Feed source power supply

Use a single-phase power supply having a stable voltage without any waveform distortion for the purpose of preventing wrong operations.



Warning Addition of a switch and an overcurrent protective device

Add a switch and an overcurrent protective device (3A) to the feed source power supply for preventing an electric shock accident during connection work.

This instrument is not provided with any replaceable overcurrent protective device.



Warning Turn off the feed source power supply before starting connections.

Turn off the feed source power supply in advance without fail for preventing an electric shock accident when the power supply and input/output terminals are connected.

2 Separate input/output connections from a strong power circuit

Don't place the input/output cables to be close to or in parallel with any drive power line or other strong power circuits. Separate them more than 50cm from strong power circuits when they are placed to be close to or in parallel with strong power circuits.

3 Separate the thermocouple input terminals from a heat source

Separate the thermocouple input terminals from a heat source (a heating body) for the purpose of reducing a reference junction compensation error. Don't expose these terminals to the radiation of direct sunlight, etc.

4 Separate all connection cables from noise sources

Separate all connection cables to the instrument from a noise source as far as possible, otherwise an unexpected trouble may occur. Take a remedial measure if the cables cannot be separated from a noise source due to unavoidable circumstances.

Majopr noise sources	Remedial measures
	Insert noise filters
power line having waveform	between power terminals
distortion, inverter, thyristor	and input/output termi-
regulator	nals.
	A CR filter is often used.

5 Use crimp style terminals

- ① Mount crimp style terminals as connection cables' termination for preventing the looseness or disconnection of terminals and a short-circuit failure between
- 2 For crimp style terminals, use an insulation sleeve for preventing an electric shock accident.

6 Unused terminals

Don't use any unused terminals for relaying, otherwise electric circuits may be damaged.

Warning Treat connected cables properly

Treat connected cables securely so as not to allow them to be hooked by a person or a substance, otherwise the connections may be disconnected or cut to cause an electric shock accident or other accidents.

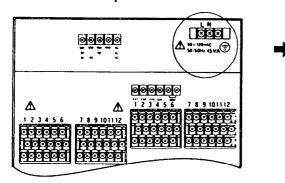
Reference | Kinds of terminals and termination

Terminal name	Screw diameter	Termination (unit: mm)
Power and protective conductor terminals	M4	Less than 8.5 More than 4.3 (Use an insulation sleeve)
Terminals other than specified above	M3.5	Less than 8 More than 3.7 t: 0.8 Less than 8 More than 3.7

12.3 Connections of Power and Protective conductor Terminals



1 Power terminals and protective conductor terminal



Warning Turn off the feed source power supply

Turn off the feed source power supply without fail before connecting the power terminals and protective conductor terminal for the purpose of preventing an electric shock accident.

2 Connection of power terminals

Use a 600V vinyl insulated cable (IEC 227-3), with the crimp style terminals and an insulation sleeve.

Caution Be careful with the power voltage and noises.

The power voltage of this instrument is indicated on the power terminals assembly. Don't apply any voltage other than indicated, otherwise a trouble occurs or malfunction results.

If noises are mixed into the power supply, take a remedial measure, such as the installation of a noise cut transformer, etc.

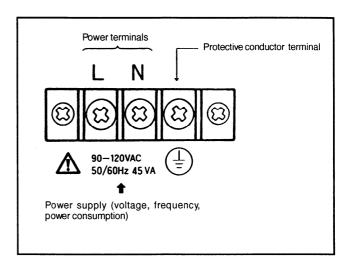
3 Connection of protective conductor terminal

Connect this terminal to the protective conductor of the power supply equipment without fail. For this connection, use a cable with a crimp style terminal and an insulation sleeve.

· Grounding wire: A copper wire having a wire diameter of larger than 2mm²

Marning mark at power terminals

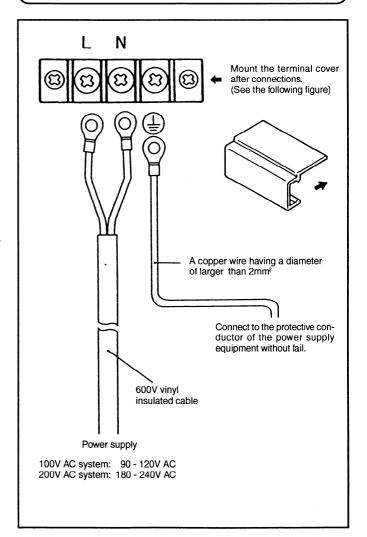
A voltage exceeding 90V AC or 180V AC is applied to the power terminals after connections. Mount the power terminal cover (transparent) without fail after connections for the purpose of preventing an electric shock accident.



Remarks L.N indication of power terminals

This indication conforms to the CSA standard, Canada. The live side of the single-phase AC power supply is indicated as L, and the neutral side is indicated as N.

Observe the L.N connections for obtaining satisfactory performance.



12.4 Connections of Measuring Input Terminals



1 Measuring input terminals

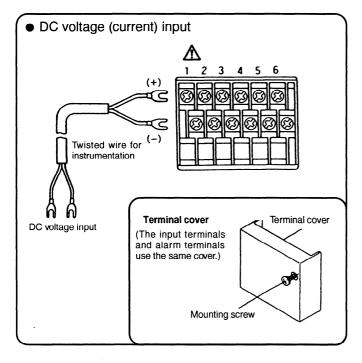
- ① Never touch the power terminals after connections, otherwise an electric shock accident occurs. Turn off the feed source power supply for safety.
- ② Input signals (par. 19) are decided according to the models (par. 1.1). Be careful not to apply any inputs other than specified, otherwise this instrument may be damaged. See (caution).
- 3 For the connections, use cables with crimp style terminals and an insulation sleeve.
- The measuring input terminals are provided at the lower left of the terminal board.

Caution Allowable input voltage

Input type	Allowable input voltage
Voltage, thermocouple input	± 10V DC
Resistance thermometer input	Don't apply any voltage

2 Connections of DC voltage (current) input

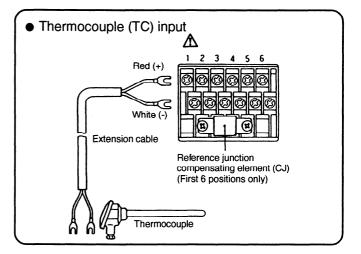
- Be careful not to apply any voltage exceeding ± 10V to the input terminals, except for nonstandard inputs.
- ② Use a twisted cable for instrumentation as the input cable for the purpose of suppressing noises.



3 Connections of thermocouple (TC) inputs

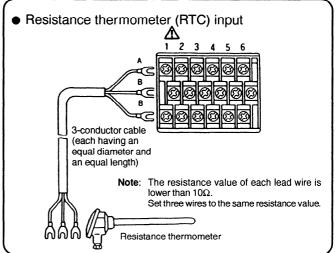
Use a thermocouple cable (or extension cable) to the input terminals of this instrument without fail. If a copper wire is used halfway, a noticeable measuring error occurs.

Don't use a pair of thermocouple wires in parallel with other instruments (controller, etc.).



4 Connections of resistance thermometer (RTD) inputs

For the input wire, use a 3-conductor cable where each conductor has an equal resistance value. Don't use one resistance thermometer in parallel with other instruments (controller, etc.).



Marning () mark of measuring input terminals

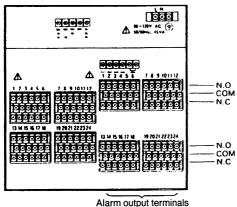
A high voltage may be applied to the measuring input terminals due to common mode noises. The allowable noise value is lower than 30V AC or 60V DC. Make sure that the noises are lower than the allowable values. Mount the terminal cover after connections for the purpose of preventing an electric shock accident and protecting the input wires. In case of thermocouple inputs, an error of the reference junction compensation can be reduced by the terminal cover.

12.5 Connections of Alarm Output Terminals (option)



1 Alarm output terminals

cident.



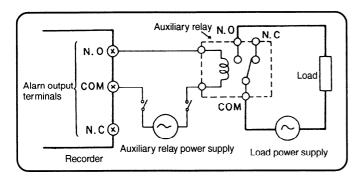
Connections of alarm output terminals

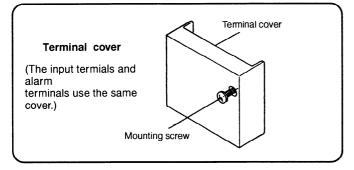
Turn off the feed source power supply and auxiliary relay power supply before starting connections for the purpose of preventing an electric shock ac-

- ① Connect the load via an auxiliary relay conforming to the load specifications.
- ② Connect the output cables with crimp style terminals

minals. Caution Connection via an auxiliary relay -

Don't connect any load directly to the alarm terminals of this instrument, but connect the load via an auxiliary relay without fail.





The alarm outputs of this instrument may become out of order due to wrong operation, troubles, abnormal inputs, or other causes.

Caution Take safety measures.

Take safety measures on the load side against output failures as occasion demands.

3 Contact conditions between terminals

When an alarm has occurred;	When an alarm has been canceled; When the power is OFF;
N. O ⊗	N. 0 🛇
COM 🗙	Closed Open
N. C ⊗	N. C ⊗

Remarks Rated contact capacity

Reference 1 Alarm points and output No.

Two alarm points are provided every channel (CH). Output No. of each alarm point is designated. Its standard is as shown in $\fbox{Reference 2}$, if not designated.

Reference 2 Standard alarm points and - output No.

Alous soists	CH. No.		1	2	2	n	*
Alarm points	Level	1	2	1	2	1	2
Output No.			1		2	n	*

* n: Individual alarm output points (6, 12, or 24).

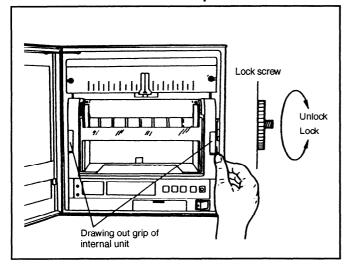
Warning (1) mark at alarm output terminals

Connect a load lower than specified to the alarm output terminals. The auxiliary relay power supply is applied to the alarm output terminals after connections and the operator receives an electric shock by touching these terminals. Mount the terminal cover without fail after connections.

13. UNLOCKING AND DRAW-OUT OF INTERNAL UNIT



1 How to remove the transportation lock screw



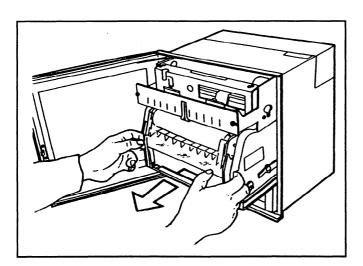
Remarks For re-transportation

Lock the internal unit without fail before transporting the instrument.

2 Drawing out the internal unit

The internal unit can be drawn out of the case by pulling it this side while pressing the stopper level downward.

Hold the internal unit securely by both hands so as not to drop it.



Caution Don't put your hands into the interior.-

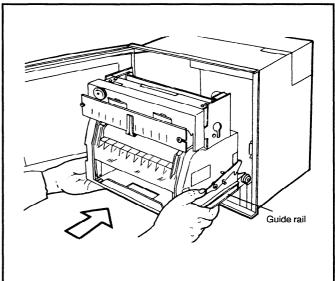
The internal unit contains electric circuits and moving parts. If you should touch these components, you may be injured. Never put your hands into the internal unit.

Caution Don't draw out the internal unit.-

It is not necessary for running and operation to draw out the internal unit.

Don't draw out the internal unit, otherwise it may drop or its electric circuits may be broken. Particularly be careful if the internal unit is drawn out for operating the maintenance power switch due to unavoidable circumstances.

3 Reinserting the internal unit

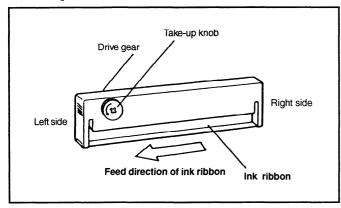


14. MOUNTING AND EXCHANGE OF RIBBON CASSETTE

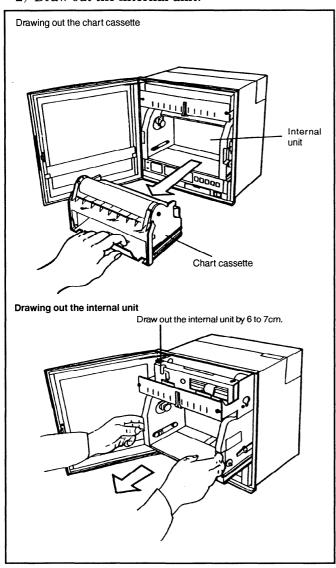
1 Mounting method

The ribbon cassette is constructed by encasing sixcolor ink ribbons into a case for analog recording and digital recording.

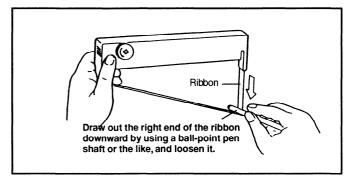
1) Prepare the ribbon cassette



2) Draw out the internal unit.

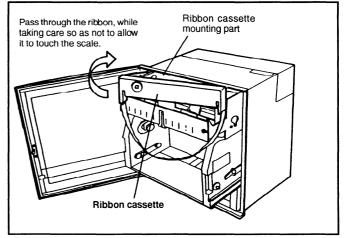


3) Loosen the ribbon



4) Pass through the ribbon to the innermost of the scale plate.

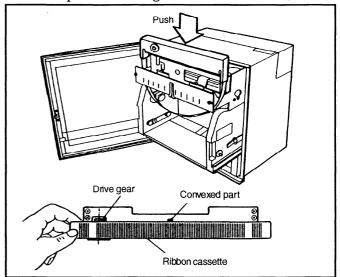
Be careful not to allow the ribbon to touch the scale plate, otherwise the scale may be contaminated.



5) Set the ribbon cassette to the ribbon cassette mounting part.

Fit the center convex of the ribbon cassette into the cut portion of the mounting part securely, and set the ribbon cassette so that the drive gear is engaged with the mounting part.

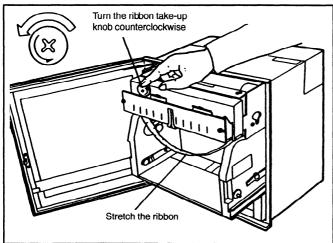
(Incomplete mounting will cause a trouble.)



6) Stretch the ribbon

The ribbon can be stretched in two ways.

When the power switch is turned off;
 Turn the ribbon take-up knob counterclockwise.



② When the power switch is turned on;
Press REC.ON key several times. Take up
the ribbon by several cm during lamp lighting.

Remarks Confirmation of the stretched condition of ribbon

Make sure that ribbon is parallel without any distortion or other defects. If it is distorted, correct color recording becomes impossible. In such a case, take up the ribbon again, referring to [Reference] given below.

7) Encase the chart cassette

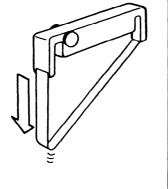
Remarks Turning direction of take-up knob

Don't touch the take-up knob clockwise, otherwise the ribbon take-up failure may occur.



Reference

If a take-up failure occurred, draw out the left side of the ribbon once, and try taking it up by turning the knob.

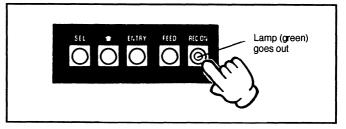


2 Exchange method

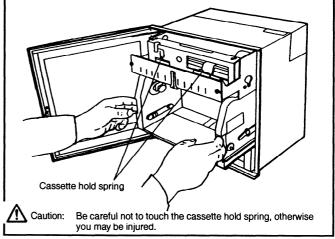
The ribbon cassette can be used for about 3 months usually.

Replace it with new one, if recorded data have becomes faint.

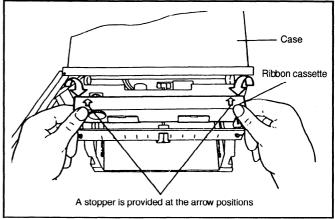
1) Go out the lamp (green) by pressing REC. ON key.



Draw out the internal unit.
 Take out the chart cassette, and draw out the internal unit about 6 to 7cm.



- 3) How to take out the ribbon cassette
 - ① Hold the ribbon cassette by both hands, remove the stopper by twisting it towards you, and lift up the ribbon cassette as it is to remove it from its mounting part.
 - ② Take out the ribbon cassette by passing it through the scale plate.



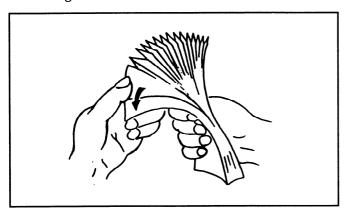
4) Mounting of new ribbon cassette

Mount new ribbon cassette according to par. 1
on page 45.

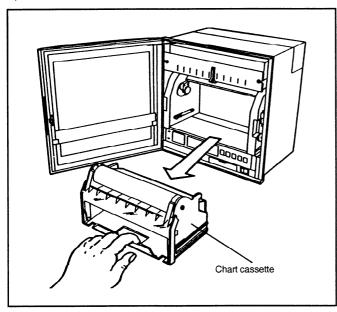
15. LOADING OF CHART



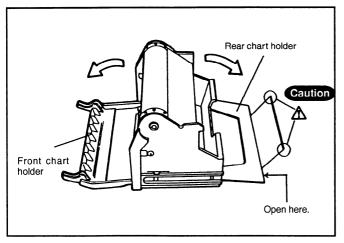
1) Prepare the chart Shuffle it both ends sufficiently to prevent it double feeding.



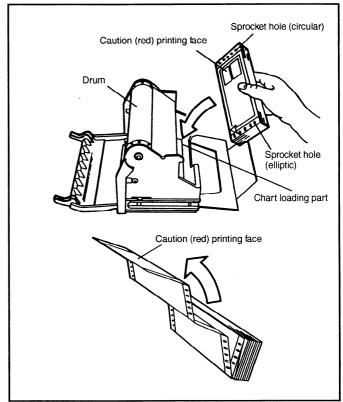
2) Take out the chart cassette



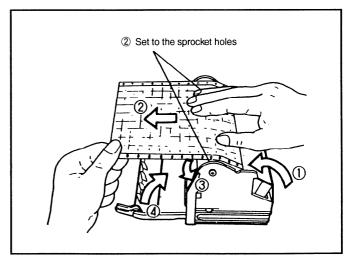
3) Open the chart holders



4) Put the chart into the loading part
Be careful not to set the sprocket holes (circular and elliptic holes) wrongly.



- 5) Set the chart
 - ① Draw out the chart about 30cm, and close the rear chart holder.
 - ② Set the chart to the drum sprocket.
 - 3 Insert the chart into the chart fold part by folding it 2 to 3 folds.
 - Make sure that the chart is set to the sprocket holes, and close the front chart holder. (Hold the chart securely by your right hand until the chart is set properly so as not to dislocate it.)

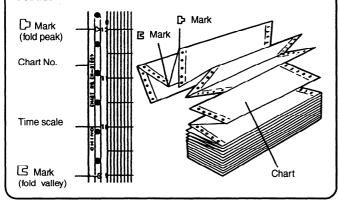


Remarks C

Chart folds -

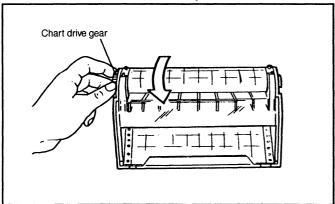
Chart folds are marked with \bigcirc at both ends of peaks, and \bigcirc at both ends of valleys.

Don't reverse these folds when inserting the chart into the fold-up part, otherwise a folding failure may occur.



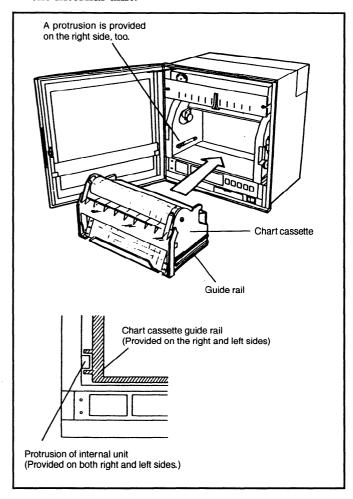
6) Chart feed check

Turn the chart drive gear this side, and make sure that the chart is fed smoothly.



7) Replace the chart cassette into the internal unit The chart cassette is provided with guide rails at the right and left bottoms.

Insert the chart cassette after fitting the convexed portions of the rails into the protruded portions of the internal unit.



Remarks Turning direction of chart drive gear -

Don't turn the chart drive gear inward, otherwise the chart cannot be returned, and it causes a chart feed failure.

If the chart cannot be fed normally, set it again from the beginning.

8) Press [FEED] key.

Chart will not move for a while just after starting running. Eliminate the backlash of gears by pressing [FEED] key in advance.

16. MAINTENANCE

16.1 Daily Inspection

Caution Overcurrent protective device -

This instrument is not provided with any overcurrent protective device. Mount a overcurrent protective device externally. Turn off the power switch in advance when removing the internal unit.

Check and maintenance items	Remedial measures
Chart	The chart can be recorded for about 32 days when it is continuously used at a chart speed of 25mm/H. When the chart comes to an end, a red mark appears at the right end of the chart over about 80cm residual part. Prepare a new chart For ordering, specify chart No. and handling unit. 1 Chart No. is printed on the right side of the chart. <ex.> EL-01001 2 Handling unit: 1 case (containing 15 charts)</ex.>
Ribbon cassette	The ribbon cassette can be used for about 3 months usually. When recorded data becomes faint, replace it with a new one. Prepare a new chart For ordering, specify the article name and handling unit. 1 Article name: BH ribbon cassette 2 Handling unit: 1 pc.
Chart feed condition	Check if the chart is fed normally without any double feed, deviation from the sprocket, and other failures. Mount the chart again from the beginning, if an abnormal condition was detected. The chart cannot always be fed normally if the working humidity range is out of the specified range (20 to 80%RH).
General function conditions	 Are the analog indications and digital display normal? Are the analog recording and digital recording normal? Are the instrument is free of abnormal noises, abnormal odor, abnormal heating, or other defects? If an abnormal condition was detected, take proper remedial measures, referring to par. 16.3 on page 51.

16.2 Cleaning and Lubrication/Storage Methods



Cleaning of door and other components

The door and front indicator are molded with plastic (ABS-94HB). For cleaning them, wipe them off with a dry soft cloth or a cloth moistened with lukewarm water or a neutral detergent.

Caution Don't use any solvent chemicals.

Don't use tinner, benzine, and other solvent chemicals, otherwise the surfaces will melt. The door window and front chart holder are made of acryl. Don't use any solvent chemicals, otherwise they may be broken.

2 Cleaning and lubrication of main shafts of pens.

Clean and lubricate the main shafts of pens once every 6 months. Two main shafts are mounted for one-pen type, three main shafts are mounted for 2-pen type, and four main shafts are mounted for 3-pen type.

Remarks 1 Turn off the record switch first-

Turn off the record switch to go out the green lamp before starting cleaning and lubrication.

Remarks 2 Clean the main shafts before lubrication

Clean the main shafts with a soft cloth before lubricating them.

Remarks 3 Don't lubricate any resin gears

Don't lubricate any resin gears. No lubrication is necessary for them.

Remarks 4 Lubricating oil -

Don't use any other lubricating oil, but the attached lubricating oil. Don't use the lubricating oil, if its color has turned to dark yellow or brown.

Remarks 5 Handling of pen holder -

Don't move any pen holder rightward or leftward by hand.

3 Storage method of this instrument

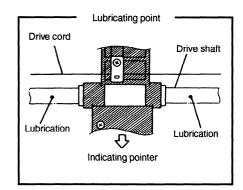
Be careful with the following items when storing the instrument for a long time (longer than one month)

1) Preparation before storage

- 1 Remove the cartridge pens and plotter pen and store them after mounting their caps.
- 2 Remove the chart and store it. Apply the transportation lock to it.
- 3 Fasten the terminals of the terminal board so as not to remove them.
- 4 Keep the instrument free of being contaminated with dust by covering it with a vinyl bag or the like.

2) Storage place

- ① Store the instrument at a well-ventilated place free of being exposed to the direct sunlight.
- 2 Store the instrument at a place free of corrosive gases, vibrations, shocks, the possibilities of crumbling or drop.
- 3 Store the instrument at a place where the ambient temperature is comparatively stable within a range of 0 to 50°C without any moisture, steam, or the like.



16.3 Troubleshooting



This paragraph shows the symptoms, causes, and remedial measures to be observed when the operation or functions of this instrument are abnornal.

The following table summarizes the classification of abnormal symptoms. Read the corresponding item.

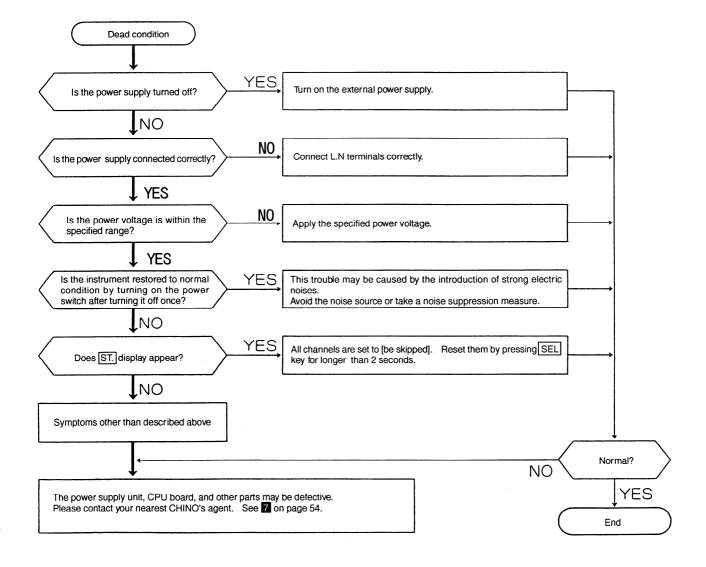
1 Dead condition	4 Abnormal analog recording
2 Abnormal analog indications	5 Abnormal digital recording and printing
3 Abnormal digital display	6 Abnormal setting

Remedial measures cannot be taken easily for abnormal symptoms other than described above.

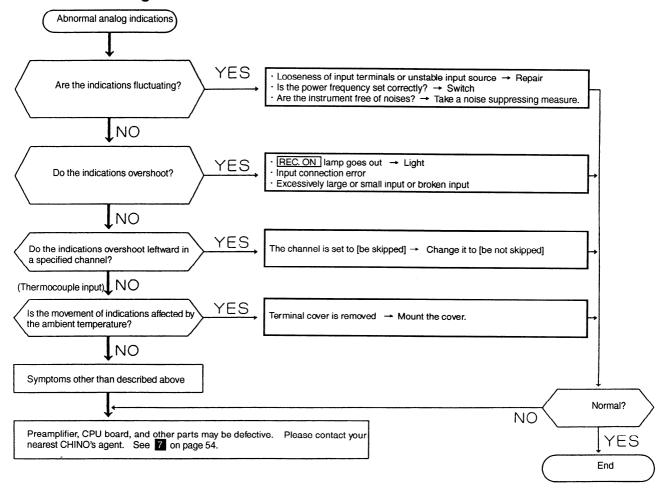
Warning Repair and modifications -

Don't repair or modify the instrument by replacing its units and parts, otherwise the instrument cannot be recovered or repaired correctly, and an electric shock accident may occur or the instrument may be broken.

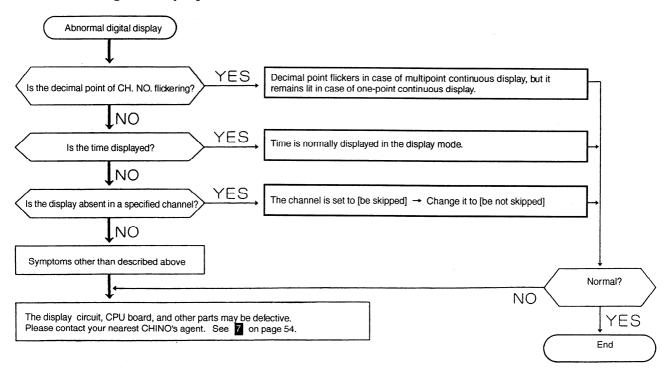
1 Dead condition



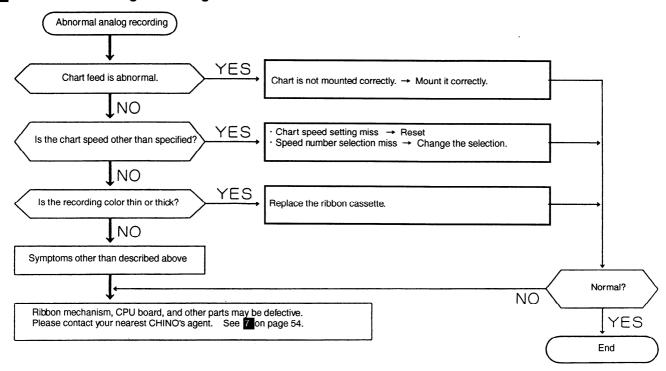
2 Abnormal analog indications



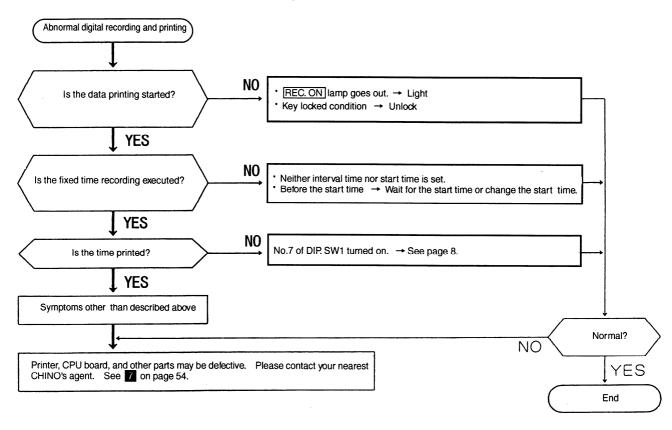
3 Abnormal digital display



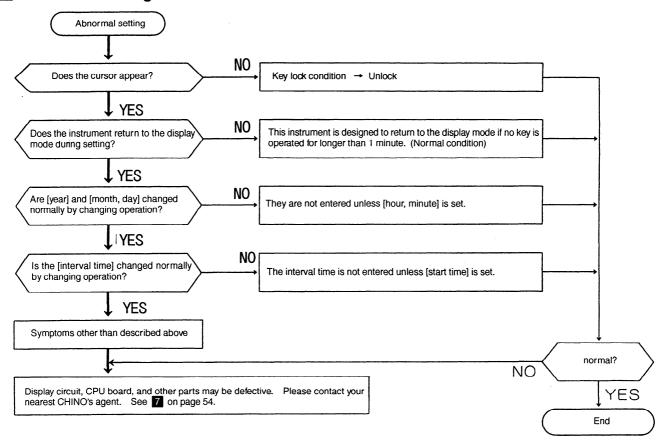
4 Abnormal analog recording



5 Abnormal digital recording and printing



6 Abnormal setting



7 Method of contacting the CHINO's agent

If you instrument has become abnormal and the trouble seems to be not caused by an operation failure or a handling failure, but it seems to be caused by defective parts, please contact the sales agent from which you purchased your instrument or CHINO's agent at once by specifying the following items.

Survey items	Examples	Remarks			
Sales agent from which you purchased your instrument	CHINO's agent	Sales agent from which you purchased your instrument, or the like			
② Instrument model	BH160-NDN	Label 2 (mounted on the left side panel of			
③ Serial No. of instrument	BH941A001	Label 2 (mounted on the left side panel of internal unit) → See page 56.			
4 Scale, etc. of instrument	K, 0 to 1200℃ , 100V AC				
⑤ Abnormal contents	No.1 pen remains stopped abruptly.	Occurrence time, occurrence frequency, and other data			
⑥ Notes	Special mounting environments (high temperature, high humidity), etc. and other items related to detected abnormal symptoms				

16.4 Consumables and Reference Exchange Intervals



This instrument comprises several consumables. You are recommended to check and replace them periodically for using the instrument under a good condition for a long time.

Warning Parts exchange —

Don't replace any parts other than the chart and pen mounting parts, otherwise the instrument cannot be repaired correctly or a dangerous accident may occur. For replacing consumables and other parts. please contact CHINO's agent.

1 Consumables and reference exchange intervals

	Names of consumables		Reference exchange intervals	Working	conditions and other remarks	
	Printer		4 to 6 years	Assume that the instandard condition	nstrument is used under the following	
ts	Main shaft of printer, auxiliary shaft, bearing		4 to 6 years	· Temperature: 25°C , Humidity: Lower than 80%F		
l par	Drive cord		4 to 6 years	· A place free of corrosive		
anica	Chart drive	mechanism	4 to 6 years	· A place free of dust, moisture, and soot		
Mechanical parts	Chart holde	er (front, rear)	4 to 6 years	•	vibrations and shocks	
	Ribbon selection mechanism		4 to 6 years	A place where the functions of instrument are not affected unfavorably		
	Various mo	tors	4 to 6 years			
	Power supply unit		5 years	Ambient temperature: at 25°C		
	Dalau	DC voltage, ther- mocouple input	5 years			
	Relay (For input)	Resistance ther- mometer input	2 years	Multiplexer, in preamplifier		
arts			100,000 times	Resistive load	Switching count	
Electrical parts	Relay (For alarm)		30,000 times	Inductive load	Switching Count	
Electr	EEPROM		10 years holding	Rewriting count: 10,000 times		
	Lithium battery		10 years	8-hours operation per day (Ambient temperature: Lower than 40°C)		
	DIP. SW		2,000 times	Switching count		
	Key		3 to 8 years	Depends largely ι atmospheres.	upon the working conditions and	

17. INPUT TYPE CODES AND UNIT CODES

Label 2 indicates details of input specifications, etc.

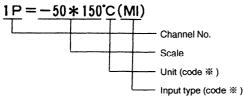
- The unit is indicated by the code. ① 1-pen type
- 2 Multi-pen type: Input specifications of each channel are indicated on the specifica-

tions column.

The unit and input type are indi-

cated by the codes.

(Example)



* If the input type and unit are not coded yet, they are indicated by actual input type and unit.

A sample of single-range label 2 -Model code SerialNo. BH160-NDN BH 941A001 Input type ※ T -50*100 • C 100V Power Unit (code) Scale voltage Specifications column MADE IN JAPAN

When the input type is not coded yet or when the input types are plural for multi-pen types, (SEE BELOW) is indicated, and these input types are specified in the specifications column.

Input Type Codes

Sort	Input type	Code	Sort	Input type	Code	Sort	Input type	Code
	B (Old PR6-30%)	В		WWRe5-26	W		0 to 10mV DC	M1
	R (Old PR13%)	R		WWRe0-26	0		0 to 5mV DC	M5
	S (Old PR10%)	S	Thermo- couples	Cu-CuCo	U		-5 to +5mV DC	M6
	K (Old CA)	K		AuFe-Cr	Α	mV	-10 to +10mV DC	M7
Thermo-	E (Old CRC)	E		Platinel **			0 to 20mV DC *	
couples	J (Old IC)	J		U(DIN J) ※			0 to 50mV DC *	
	T (Old CC)	Т		L(DINT) ※			1 to 5V DC	V6
	N(Old Nicrosil-Nisil)	N		Pt100Ω	13			
	Ni-NiMo *		Resistance	JPt100Ω	10		4 to 20mA DC	A4
	PR5-20 **		thermometers	Pt-Co (Old Pt50Ω)	PC	mΑ	10 to 50mA DC *	
	PR20-40	Р		·				

^{*} No code is provided.

Unit Codes

	Unit ※	Code	Unit ※	Code	Unit ※	Code	Unit ※	Code
Ĉ		Ç	рН	PH	mmH ₂ O	33	mol	61
°F		°F			mmHg	34	ppm	62
K		K	m/s	11	kg/cm ²	35	ppm SO ₂	63
Hz		HZ	m/min	12	Torr	36	ppm CO	64
g		G	m³/s	14	kcal	42	ppm CO ₂	65
kg		KG	m³/min	15	cal	43	%	91
Α	(DC)	Α	m³/h	16	cal	44	%RH	92
mA	(DC)	MA	kg/h	17	A (AC)	51	Others	99
٧	(DC)	V	t/h	18	mA (AC)	52		
mV	(DC)	MV	rpm	21	μV (DC)	54		
kW	(AC)	KW	ton	31	V (AC)	55		

^{*} Each unit is indicated by characters on the scale plate. (DC) is identified by " __"below characters, while (AC) is identified by " \sim " below characters.

[※] Each unit is printed in 2 digits. Printed characters are restricted (large 3 in case of m³, for example).

18. SPECIFICATIONS TABLE

	Items	Contents
	Input signals	Specify input signals out of the following scales every input point. (They can be combined within the range of thermocouples and DC voltage or within the range of resistance thermometers and 5V range only. Max. sextuple scales are available.) DC voltage± 7mV, ±14mV, ±25mV, ±70mV, ±5V ThermocoupleB, R, S, K, E, J, T, N, Ni-NiMo, PR5-20, PR20-40, WWRe5-26, WWRe0-26, U, L, platinel AuFe-Cr Resistance thermometer Pt100Ω, JPt100Ω, old Pt50Ω, Pt-Co
	Accuracy rating (under the reference condition)	Digital display and recording Thermocouple input, resistance thermometer input : \pm 0.3% of scale range \pm 1 digit or \pm 1°C , whichever is larger DC voltage: \pm 0.1% \pm 1 digit Analog indication \pm 0.5% of the scale range
ions	Temperature drift	\pm 0.01%FS/°C (Thermocouple input is calculated by electromotive force conversion)
specifications	Reference function compensation accuracy	K, E, J, T, N platinel Lower than \pm 0.5°C (at 0°C) R, S, Ni-NiMo, AuFe-Cr, WWRe5-26, WWRe0-26, U, L Lower than \pm 1.0°C (at 0°C)
Input s	Allowable signal source resistance	Thermocouple input, DC voltage input Lower than $1k\Omega$ (without burnout) Resistance thermometer input Lower than 10Ω per wire (Pt100, JPt100)
	Input resistance	Thermocouple input, DC voltage input Higher than $8M\Omega$, higher than $1M\Omega$ when a voltage divider is used.
	Common mode voltage	Lower than 30V AC or 60V DC
	Common mode rejection ratio	More than 130dB
	Series mode rejection ratio	More than 50dB
	No. of measuring points	6 points, 12 points, 24 points
	Measuring cycle	Approx. 5sec/6 points, Approx. 10sec/12 points, Approx. 20sec/24 points
	Terminal board	Detachable type (Removable for connections) Input terminals and alarm terminal
	Dotting cycle	About 5sec. 6 points when the chart speed is higher than 6mm/H inclusive, 12 points when the chart speed is higher than 3mm/H inclusive, 24 points when the chart speed is higher than 2mm/H inclusive. The dotting interval depends upon the chart speeds, if individual chart speeds are lower than specified above.)
	Recording system	Wire dot system 6-color ribbon (both analog recording and digital recording, printing)
Recording specifications	Recording color	Analog recording Repetition of 6 colors ① Red, ② Black, ③ Blue, ④ Green, ⑤ Brown, ⑥ Purple Digital recording ① Fixed time recording : Repetition of 6 colors (red, black, blue, green, brown, purple) ② Data printing: Same as specified above Digital printing ① Year, month, day, and time: Black ② Scale, point No: Same as specified in analog recording ③ Chart speed: Black ④ Occurrence and cancellation of alarm: Red ⑤ Setting change mark: Black ⑥ Time line: Black
	Recording chart	Fan-fold type: Total width 200mm, Total length 20m, Effective recording width 180mm
	Chart speed	Standard: 3 speeds (12.5, 25, 50mm/H) are selectable by DIP switches. Combinations of 3 speeds can be specified. 3 speeds can be set optionally. X Setting range: 1 to 1500mm/H
	Fixed time recording	Time, point No., measured values, and unit are recorded and printed on analog recording every setting interval.
	Data printing	Digital recording and printing are executed on analog recording at an optional time. The digital recording and printing contents are the same as those in fixed time recording.

	Items	Contents
	Date and time printing	Time line and time are printed every hour sharp, and the date (year, month, day) is printed at 00:00 hour. Printing intervals depend upon the chart speed.
	Point number printing	Point numbers are printed at fixed intervals on analog recording chart.
specifications	Scale printing	The scale zero is printed on the left side and the scale span is printed on the right side at a fixed interval.
cific	Chart speed printing	The executing chart speed is printed at a fixed interval on the right side.
Recording spe	Alarm occurrence/cancellation printing (when alarm option is added)	When an alarm occurs: Time, point No., alarm type, and level are printed on the right side. When an alarm has been canceled: Time, point No., and level are printed on the right side.
Œ	Setting change mark printing	When setting change ends, characters showing the change items are printed on the right side. (when communication option is added)
	Skip function	Analog indication/recording and digital display/recording can be skipped by setting this function every channel.
ons	Analog indication	Scale plate and pointer
specifications	Scale plate	Max. sextuple scales 150 equal divisions
spec		7-segment LED, character height 15mm
	Digital display	2-digits Channel (point) No. 5 digits Data (measured values) display
Indication and display	Display items	Measured value display % or time display % Measured value display is done by multi-point sequential display or one-point continuous display. (display selection)
Indic	Setting display	Digital display part is shared by key operation.
	Power supply voltage	Specify 100V AC line (90 to 120V AC) or 200V AC line (180 to 240V AC), 50/60Hz
	Power consumption	Approx. 45VA max.
	Working temperature range	0 to 50℃
	Humidity range	20 to 80%RH
	Countermeasure against power interruption	Set contents are held by EEPROM. Clock is baked up for longer than 10 years by a lithium battery (when the instrument runs for 8 hours every day)
General specifications	Insulation resistance	Higher than 20M Ω at 500V DC across measuring terminals and protective conductor terminal Higher than 20M Ω at 500V DC across power terminals and protective conductor terminal Higher than 20M Ω at 500V DC across measuring terminals and power terminals
General sp	Dielectric strength	500V AC, 1min. Across measuring terminals and protective conductor terminal 1500V AC, 1min. Across power terminals and protective conductor terminal 1500V AC, 1min. Across measuring terminals and power terminals
	Case	Door
	Painting color	Door Black (equivalent to Munsell code N3.0) Case Grey (equivalent to Munsell code N7.0)
	Mounting method	Panel flush-mount type
	Weight	Approx. 7.0kg
		

Option specifications

Option names	Specifications					
External drive %	No-voltage contact 4 inputs Chart speed: 3-speed selection (2 inputs), Data printing (1 input), Spare (1 input)					
Communication ※	One of RS-232C, RS-422A, and RS-485 ① Main parameters setting and check ② Transmission of measured values and status information					
Alarm output (6P) ※	No. of output points Alarm types Absolute values (higher-limit, lower-limit), Difference (higher-limit, lower-limit), Change ratio (increase limit, decrease limit) Standby alarm Whether the standby alarm is provided or not can be specified every alarm type. Output processing OR or AND output can be specified every alarm point. Setting level Compared to points, 24 points Absolute values (higher-limit, lower-limit), Difference (higher-					
High speed dotting	Approx. 2.5sec/point					
Non-standard input	Voltage-dividing input: Higher than 5V DC to lower than 60V DC (A voltage divider is built in) Power supply input: Lower than 50mA (A resistor can be mounted outside or it can be mounted as a built-in part)					
Burnout	If an input signal is interrupted, its indication overshoots the higher-limit. (excluding the voltage-dividing input and current input)					

^{*} The depth is extended by 16mm as compared with the standard instrument (Depth 195mm).

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