No. INE-151AL

NEW AH SERIES
HYBRID RECORDER
(DOT PRINTING TYPE)

AH-11E

INSTRUCTIONS

Index of Major Items

— Use the following index together with the contents.

CHINO

FOR SAFE USE OF THE PRODUCT

In order to use this instrument correctly and safely, be sure to observe caution as follows.

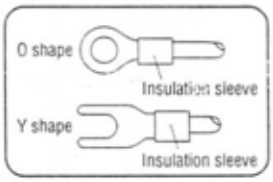
1. Installation place and terminal cover

① **Panel mounting type**
This instrument must be installed on the panel for operation. In order to avoid electric shock, provide means to prevent operators from touching any power supply section or the input/output terminals.

② **Mobile type**
Provide a cover to the terminals section in order to avoid electrical shock.

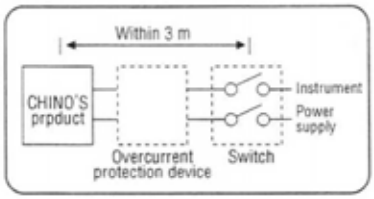
2. Terminal processes for connections

Crimp style terminals with insulation sleeve should be employed for the connections. O-shaped terminals should be used for the power supply and the protective grounding terminals.



3. Installation of a power supply circuit breaker

For the power supply, provide a switch which is suitable to the rated power supply for this instrument or an overcurrent protection device within a distance of 3 m from the unit and also within easy reach.



4. Provide separate safety measures for the output functions

When the instrument is to be used in a system which has output functions including controls, alarm, etc., apply separate safety measures against phenomena which would be caused by malfunction due to mis-operation, or failure of the instruments or sensors.

5. Symbol marks used for this instrument

⚠ This symbol is used on parts where there is an electric shock hazard. Be very careful against electric shock when wiring, maintaining or servicing these parts.

⏚ This symbol is used on parts which require protection by a ground terminal. Instruments with this symbol must to be grounded for power supply facilities before starting operation.

⚠ Warnings	
Confirm power supply voltage rates and grounding.	Before supplying power to the instrument, be sure to check that its rated voltage matches the supply voltage and that the power and protective grounding wiring has been connected correctly and securely.
Do not put your hands into the case.	Unless essential operational repairs are required, do not put your hands inside the rack or case. Electric shock or injury may occur.
Do not use in a gaseous atmosphere.	Do not operate or install the instrument in a place where there is a combustible or explosive gas or vapor.
Maintenance and modification.	When maintenance and modification become necessary, consult your nearest CHINO branch office, agent or your dealer. <Note> Only a service person designated by CHINO can perform maintenance and modification by replacing parts.

Thank you for purchasing an AH Series Hybrid Recorder. To prevent trouble and to make full use of the recorder's functions, please read these instructions carefully before use.

CONTENTS

1. INTRODUCTION

1.1 FEATURES

① This instrument is a microprocessor-controlled, multi-range input hybrid recorder using 180-mm chart paper which is capable of both dot-printing analog recording and plotter-type digital recording.

② Two models are available for printing values measured at either 6 or 12 points. In addition to 6-input or 12-input analog trend recording, digital recording of measured values is also possible at any desired time interval.

③ Many recording and printing functions are provided as standard including the constant-interval printing of the date, time, chart speed, scale, etc., alarm recording and difference recording.

④ A digital display is available in both the multiple-point sequential display and single-point continuous display modes. The chart speed and time of the day are displayed in both modes.

1.2 BEFORE OPERATING

Perform the following checks and preparations before starting to operate the recorder.

1.2.1 External check

Unpack and check the following points to ensure that there are no problems in external appearance.

① If the front glass is damaged.

② If the door can be opened and closed easily.

③ If the case is damaged, scratched or stained.

1.2.2 Accessory Check

The following accessories should be present. For their appearance, please refer to the next page.

1) Inside the accessory carton

Item Name	Quantity	Remark
① Fuse (250 V, 5 A)	1	Spare.
② Recording inks (same number as the number of inputs)	1set	For dot printing.
③ Pad case	1	For dot printing.
④ Ink pad	1bag	Spare.
⑤ Key	2	For key lock.
⑥ Terminal screw (4 mm)	5	Spare.
⑦ Plotter pen (Black)	2	For digital printing.
⑧ Lubricant (10 cc)	1	For maintenance

2) Inside package and recorder

Item Name	Quantity	Remark
⑨ Recording chart *	1 carton	Contains 3 packages (small carton).
⑪ Mounting hardware	1 set	For panel installation.
⑫ Position indication cards	2 sheets	Inside the door.
⑬ Instruction manual	1	
⑭ Test Certificate	1	

* The standard part name is Chart No. EH01001. Charts with various scales are available. The minimum ordering unit is a large carton (containing 15 charts).

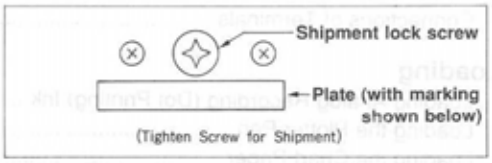
1.2.3 Preparations

1) Opening the door

A finger recess is provided on the right side of the door. Insert your finger into the recess and pull the door toward you to open it.

2) Sliding out the rack

Loosen the shipment lock screw on the rear panel of the recorder, open the door, and pull the handle on the rack to slide it out.



Ref. 1 How to use the shipment lock screw

The rack is secured into the case to prevent it from coming out during transportation.
Loosen the screw when the recorder is to be operated. For safety, re-tighten the screw before transporting the recorder.

Ref. 2 How to remove the rack

Remove the rack from the case by the following procedure for inspection or maintenance.

① Slide out the rack until it stops.

② A rack stopper is provided below the left corner of the rack (on the rail); lift the stopper with your finger to remove the rack from the case.

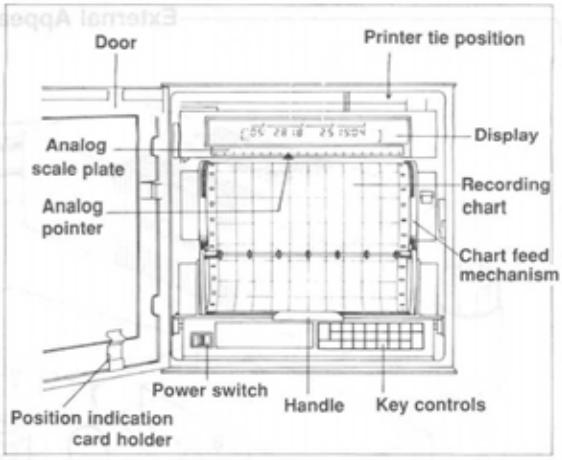
③ There are three cords from the back of the case (terminal case) connected to the rack; disconnect the three cords from the connectors.

3) Separating the printer and rack

When the door is opened and the rack is slid out, you will find that the printer is attached to the rack with a string behind the display on the right; untie the knot.

4) Before transporting or moving the recorder

Tighten the shipment lock screw and tie the string to attach the printer to the rack.



1.3 MODEL CHECK

Operations vary depending on the types of input signals. Before use, check the input signal type (model).

AH□□□-□N□

- Input signal
  - 5: Thermocouple, DC voltage multi-range
  - 6: Resistance thermometer multi-range
  - 7: Full multi-range *
- Inputs
  - 6: 6 points
  - 2: 12 points
- Alarm outputs
  - 0: 2 points
  - 1: 4 points *
  - 3: 14 points *
  - 4: 24 points *
- Communication interface *
  - N: None
  - A: RS-422A
  - R: RS-232C
  - G: GP-IB
- External drive *
  - N: None
  - D: Drive possible

Items marked * are optional.

Note) Only the 2-point alarm outputs are available with the full multi-range input model.

Note 1: In case of problems

This recorder is shipped after stringent in-company inspection. However, should any problem be found such as a failure due to an accident during transportation, a failure due to a product defect or a missing accessory, please contact your dealer.

Note 2: In case of trouble due to mishandling

This recorder is provided with many sophisticated functions. However, we cannot assume responsibility for trouble caused by the user's handling or mistakes in operation, such as wiring errors. Be sure to read these instructions carefully before use.

Ref. 1 Basic operating procedure

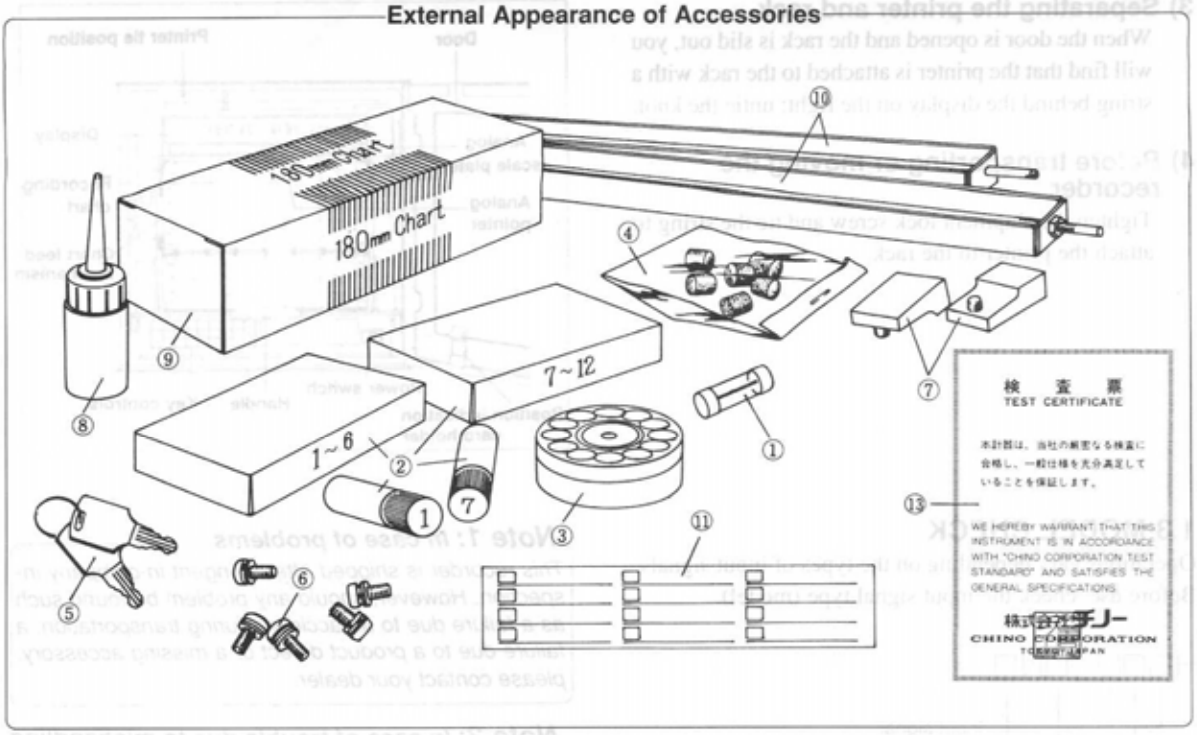
To help carry out the required operations correctly and quickly, the basic operation procedure for a first-time user is shown on page 7.

Ref. 2 Positions of model and serial No. plates

Two name plates are provided, inside the door (lower part) and on the right side of the rack.

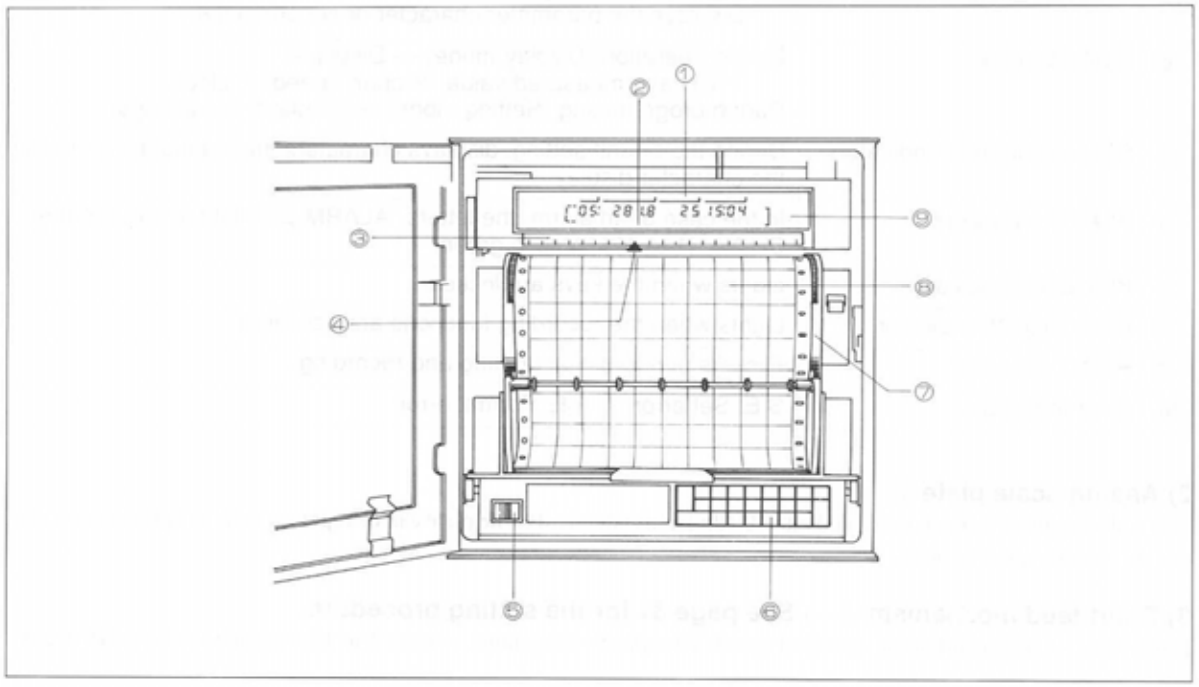
MODEL AH520-ONN ← Model No.
NO. AH95A001 ← Serial No.

External Appearance of Accessories



2. NAMES OF PARTS AND THEIR FUNCTIONS

2.1 FRONT



① Display (Digital display)

② Display (Status display ①)

③ Analog scale plate

④ Analog pointer

⑤ Power switch

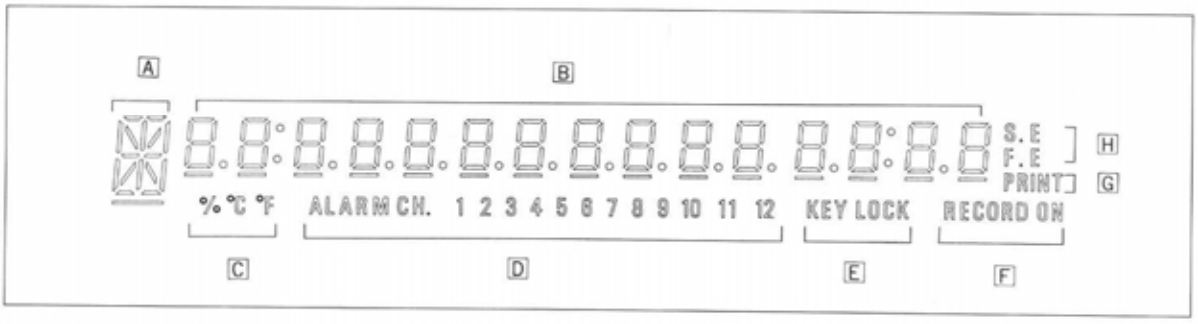
⑥ Key controls

⑦ Chart feed mechanism

⑧ Chart paper

⑨ Display (Status display ②)

1) Display ① ②



Item	Key Name	Function
A	Character display	During operation (Display mode) — A: Multi-point sequential display mode. C: Single-point continuous display mode. During setting (Setting mode) — Displays the parameter character or set character.
B	Digital display	During operation (Display mode) — Displays; ① CH and measured value; ② chart speed; ③ clock. During programming (Setting mode) — Displays the settings.
C	Special character indicators	During tag or unit setting, displays characters that cannot be shown in the character display.
D	ALARM indicators	In the case of an alarm, the letters "ALARM CH" light in red and the CH No. (1 to 12) lights in green.
E	KEY LOCK indicator	Lights when the keys are locked.
F	RECORD ON indicator	Lights when the recording functions are activated.
G	PRINT indicator	Flickers during digital printing and recording.
H	Error indicators	S.E: Set error F.E: Format error

2) Analog scale plate ③

The scale length of 180 mm is divided into 100 divisions (standard). The plate can be replaced with an optional scale that can be manufactured to order.

3) Chart feed mechanism ⑦ → See page 31 for the setting procedure.

Feeds the recording chart at the specified speed. The speed setting range is from 1 to 1500 mm/H (in 1-mm/H steps).

4) Recording chart ⑧ → See page 15 for the loading procedure.

Fanfold recording chart with an effective recording width of 180 mm (total width 200 m) and total length of 20 m, which is folded into 100 sections.

5) Key controls ⑥

Used in setting and other operations. See section 2.3 for the functions of the keys.

6) Power switch ⑤

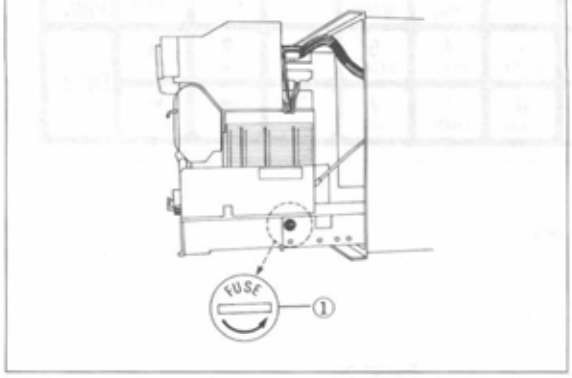
Toggle switch for turning the power ON and OFF.

7) Analog pointer ④

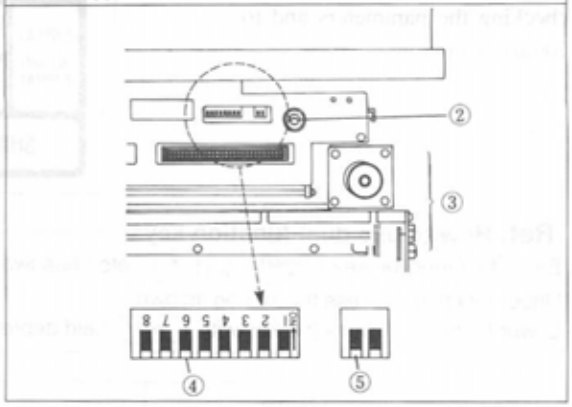
Indicates the analog measurement position of each CH. The analog recording position can be read from the analog scale plate ③.

2.2 RACK

Rack Right Side View



Rack Upper Side View



① Fuse

A 250 V, 5 A fuse is incorporated in the holder.

② Key Lock switch

Insert the supplied lock key and turn it to activate the Key Lock. When the Key Lock function is activated, the front panel keys are locked and their operations will not be accepted. However, the DISPLAY/RECORD FORMAT, ▲/7 and ▼/8 keys are accepted any time.

③ Recording mechanism

This performs analog recording by 6-point or 12-point ink pad dot printing with a different color for each input, as well as plotter-type digital printing using a black felt-tipped pen.

④ 8-element DIP switch → See page 21.

Set when additional functions such as Memory Clear (see page 46) and scale calibration are required.

⑤ 2-element DIP switch

Do not touch this DIP switch as it has been set at the factory before delivery.

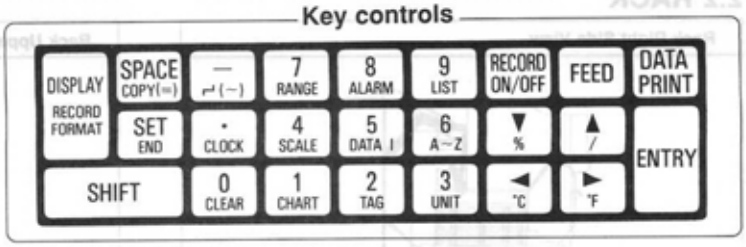
***Note:* In case an external fuse is used:**

Use a fuse with a capacity of 5 A or more.

2.3 KEY CONTROLS

These keys are used for setting or checking the parameters and to control operations.

Key controls



Ref. How to use dual-function keys

Each dual-function key (SPACE COPY(=) · CLOCK ◄ °C , etc.) has two functions.
Upper function ... Press the key on its own.
Lower function ... Press the key with SHIFT held depressed.

Key	Name	Function
DISPLAY RECORD FORMAT	DISPLAY key	① Switches the display mode — Each time it is pressed, the recorder alternates between the"multi-point sequential display" and "single-point continuous display" modes. ② When pressed during setting, suspends the setting and returns the display to the display mode.
SPACE COPY(=)	SPACE key	① Deletes unnecessary digits. ② Deletes the decimal point. ③ Inserts a blank character in unit or tag setting. (The digit becomes blank.)
SET END	SET key	Initiates the setting change mode. The underline lights, and the cursor lights under the leftmost digit of the item that can be changed.
SHIFT	SHIFT key	Used in combination with dual-function keys. When the lower function of a dual-function key is required, press the key with the SHIFT key held depressed.
— ↵(–) · CLOCK 0 CLEAR ~ 9 LIST	Minus Decimal point 0 ~ 9 (Numeric keys)	① Use when entering a parameter. ② To enter a decimal point, move the cursor to the next digit and press the "." key before entering a figure. ③ To delete the decimal point, move the cursor to the next digit and press the SPACE key.
RECORD ON/OFF	RECORD key	Turns the recording functions ON/OFF — Each time it is pressed, the recorder alternates between the activated condition (ON) and the deactivated condition (OFF). (Recording functions refer to analog recording, digital recording/printing and chart feed.)
FEED	FEED key	Fast feeds the chart while the key is held depressed. The set chart feed speed resumes when the key is released. (This function is valid while the recording functions are ON.)
▼ %	Down key	① During the setting operation, press to select the parameter above by the cursor (other than the numeric figures). Each time it is pressed, the parameter changes upward (Up key) or downward (Down key). ② When checking settings, press to change the CH No.
▲ /	Up key	
◄ °C ► °F	Cursor keys	Press to move the cursor to the left or right. (◄ °C : Press to move one digit to the left — movement stops at the leftmost digit) (► °F : Press to move one digit to the right — movement stops at the rightmost digit)
DATA PRINT	DATA PRINT key	Press to record the current data digitally. Do not press during digital printing or it will result in overwriting.

Key	Name	Function
ENTRY	ENTRY key	Press to enter (store) the settings in the ROM. When several parameters, such as the range, scale, unit, tag, alarm, etc. are to be stored in one setting operation, the data is first stored temporarily (preliminary storage) when the ENTRY key is pressed. The parameters are not stored finally until the SET/END key is pressed.
DISPLAY RECORD FORMAT	RECORD FORMAT key	Selects the recording format (analog recording) (optional).
SPACE COPY	COPY key	Press to copy the same set values to another channel. → See page 43. (This function cannot be used to copy alarm settings.)
SET END	END key	Press to store the temporarily-stored (preliminary-storage) setting contents in the ROM. This operation is not required with a setting which consists of only one parameter (e.g. chart speed, etc.).
—	From key	When setting the range or scale, press this key between the 0% entry (left end) and 100% entry (right end). (The display shows " ⌐ ", but it means "from".)
CLOCK	CLOCK key	Press to enter the clock mode display to check or set the time. See page 25 for the setting procedure.
0 CLEAR	CLEAR key	In the setting mode, press to clear (make blank) the parameter being displayed.
7 RANGE	RANGE key	Press to check or set the range. See page 26 for the checking and setting procedures.
4 SCALE	SCALE key	Press to check or set the scale. See page 28 for the checking and setting procedures.
1 CHART	CHART key	Press to check or set the chart speed. See page 31 for the checking and setting procedures. (3 speeds can be selected with the optional external drive.)
8 ALARM	ALARM key	Press to check or set alarm conditions. See page 32 for the checking and setting procedures.
5 DATA	DATA Interval key	Press to check or set the fixed-interval digital recording condition. See page 34 for the checking and setting procedures.
2 TAG	TAG key	Press to check or set the tag condition. See page 36 for the checking and setting procedures.
9 LIST	LIST key	Press to print the setting content list on the chart. To interrupt printing, press the RECORD key to OFF. → See page 19.
6 A–Z	Alphabet key	During tag setting or unit setting, press to change the numeric display to an alphabetic display. Then press the " ▲ " key to step through the characters forward (A → B → C ...) or the " ▼ " key to step through them backward (Z → Y → X ...).
3 UNIT	UNIT key	Press to check or set the unit. See page 38 for the checking and setting procedures.
%	Percent key	During tag or unit setting, press to use the % symbol (character). This has no relationship with the conversion of measured values. "%" is treated as 2 digits.
/	Slash key	During tag setting or unit setting, press to use the / symbol (character).
°C	°C key	During tag or unit setting, press to use the °C symbol (character). This has no relationship with the conversion of measured values. "°C" is treated as 2 digits.
°F	°F key	During tag or unit setting, press to use the °F symbol (character). This has no relationship with the conversion of measured values (→ See page 44). "°F" is treated as 2 digits.

3. OPERATING PROCEDURE

The following shows the quickest way to perform the necessary operations when the recorder is used for the first time.

3.1 BEFORE SWITCHING THE POWER ON

1 Check
- ① External check ..... See page 1.
- ② Model check ..... See page 2.
- ③ Accessory check ..... See page 1.
- ④ Preparations ..... See page 1.

2 Installation
- ① Limitations on installation position
- ② Panel installation
- ③ Weight
- ④ Power consumption

See page 10.

3 Connections
- ① Before connecting ..... See page 11.
- ② Input terminals ..... See page 12.
- ③ Alarm terminals ..... See page 12.
- ④ Power supply/grounding .... See page 13.

3.2 AFTER SWITCHING THE POWER ON

Parameter Setting ..... See page 22 for the factory settings of the parameters.

Be sure to set the following.

Chart speed setting	Preset to 25 mm/H. A new setting is required if a speed other than this is required.	→ Page 31
Range setting	This is a multi-range recorder, so the range must be set for each channel. The ranges vary depending on the model.	→ Page 26
Scale setting	Necessary except when directly measuring a voltage value from a voltage input. Usually not necessary with temperature inputs (thermocouples, resistance thermometers).	→ Page 28

Set the following as required.

Alarm setting	Up to 4 alarm points can be set per channel.	→ Page 32
Fixed-interval digital recording setting	Digital recording can be performed at a predetermined time interval.	→ Page 34
Unit setting	Units can be printed with digital recording data.	→ Page 38
Tag setting	An ID Tag can be set for each channel.	→ Page 36
Difference recording setting	The difference between channels or from a reference value can be recorded.	→ Page 40

Set the following after checking.

Time (clock) setting	The time has been pre-set at the factory. Adjust the time when it is wrong or when a different time is required.	→ Page 25

Control Operations

Display mode selection	Select the multi-point sequential display or single-point continuous display mode.	→ Page 18
On-demand digital recording	Prints/records the current data.	→ Page 19
Recording ON/OFF	Select whether the recording functions (chart feed, fixed-interval digital recording, on-demand digital recording, analog recording, digital printing) are to be activated (ON) or not (OFF).	→ Page 18
Other	Various other functions are available including; ① skip channels setting; ② °C/°F display switching; ③ chart fast feed; ④ specification check; ⑤ scale calibration.	→ Page 20 etc.

4. INSTALLATION

The recorder can be used standing on a table or can be installed in an instrument panel.

4.1 LIMITATIONS ON INSTALLATION POSITION

1 Ambient temperature and humidity ranges

Temperature range: 0 to 40°C
Humidity range: 20 to 80% Rh
Install the recorder in a stable place subject to the above environmental conditions.

2 Environmental conditions

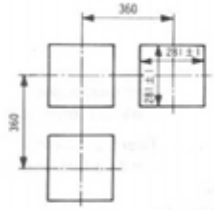
Avoid installing the recorder in the following places.
1. In a place which is dirty or dusty.
2. In a place filled with corrosive gas.
3. In a place subject to vibrations or shocks.

3 Tilted installation

Forward tilting: 0°
Backward tilting: 0 to 30°
Left/right tilting: 0 to 10°
Angles exceeding the above limits will affect recording operations.

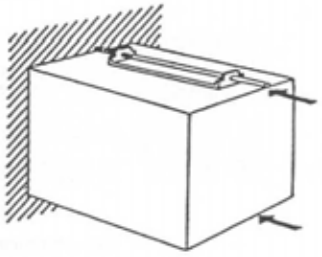
4.2 PANEL INSTALLATION

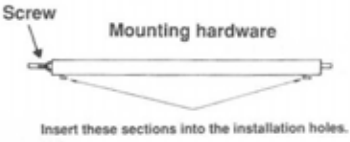
Panel Cutouts



Unit=mm

Installation Condition





Fix the upper panel side and lower panel side using the supplied fittings and secure with screws.

4.3 EXTERNAL DIMENSIONS

Unit=mm

Ref. 1 Weight

About 13 kg

Ref. 2 Power consumption

About 60 VA

Ref. 3 Treatment before transportation

Before transporting or moving the recorder, be sure to tighten the shipment lock screw to prevent the inner mechanism rack from coming out of the case. → See page 2.

5. CONNECTIONS

Four types of connections are used. All are done on the terminal board on the rear of the recorder.

5.1 BEFORE CONNECTING

1 High-voltage circuitry
The input signal cords should be located away from high-voltage circuitry and any strong source of noise. If a signal cord is parallel to a high-voltage circuit, there should be a distance of more than 30 cm between them.

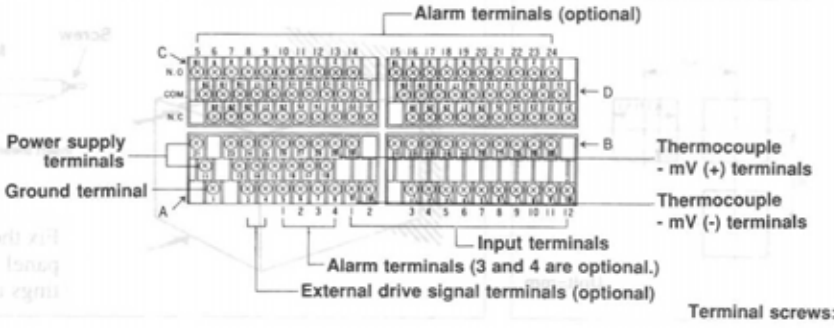
2 Supply voltage fluctuations
Do not use a power supply with significant voltage or waveform fluctuations.

3 Securing the terminals
The wires should be soldered and terminals tightened securely to prevent wires from becoming disconnected.

5.2 TERMINAL BOARD ..... "A" to "D" indicate blocks of the terminal board.

AH5□□

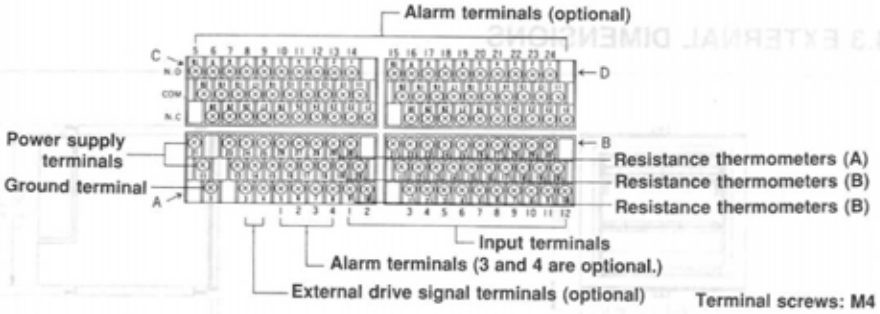
(DC Voltage or thermocouple inputs)



Terminal screws: M4

AH6□□

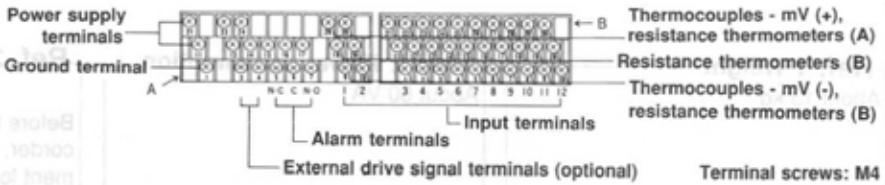
(Resistance thermometer inputs)



Terminal screws: M4

AH7□□

(① DC voltage or thermocouple, and ② resistance thermometer inputs)



Terminal screws: M4

5.3 CONNECTION OF TERMINALS

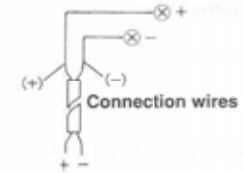
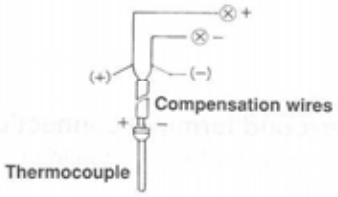
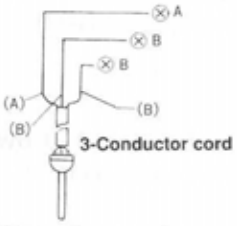
Connection 1	Input terminals	➡	Input terminals are provided for either 6 or 12 points. Connect DC voltage or thermocouple inputs to both the + and - terminals, and connect resistance thermometer inputs to the A, B and C terminals of each channel.
Connection 2	Alarm terminals (only when required)	➡	The standard model has 2 alarm outputs; 4, 14 or 24 alarm outputs are optionally available. Each output consists of a set of three terminals. (The AH7 □□ model has only 2 outputs.)
Connection 3	External drive signal terminals (optional)	➡	This connection is required only when this option is provided.
Connection 4	Power supply and ground terminals	➡	A free power supply (81 to 264 V AC) is used.

1) Connection 1 (Input terminal connections)

① The method varies depending on the input type of your recorder.

② The terminal numbers of CH 1 are shown below. The terminals of CH 2 and later are located to the right in sequence.

Signal Name	+, A	B	–, B
DC Voltage	29	—	9
Thermocouple	29	—	9
Resistance thermometer	29	19	9

Example of DC Voltage Input Connection	Example of Thermocouple Input Connection	Example of Resistance Thermometer Input Connection
		

2) Connection 2 (Alarm terminal connections)

① 4 alarm points can be set per input channel, but the standard model has only 2 alarm outputs.

② When an alarm condition occurs, N.O and COM are short-circuited, outputting a make-contact output (non-voltage contact output). The connection between N.C and COM is open.

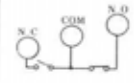
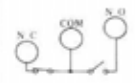
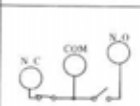
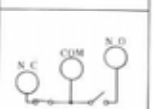
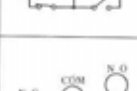
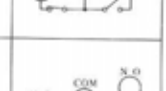
Ref. 1 Output in case lower-limit alarm is set.

If the lower-limit alarm output is selected for output 1 (ALARM 1), the output according to the relationship between the measured value and set value will be as shown in the diagram on the right.

Ref. 2 Output in case higher-limit alarm is set

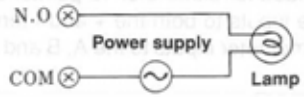
If the higher-limit alarm output is selected for output 2 (ALARM 2), the output according to the relationship between the measured value and set value will be as shown in the diagram on the right.

Higher-Limit and Lower-Limit Alarm Output Conditions

Relation Between Measured Value and Set Point	(ALARM 1) Lower-Limit Alarm Output	(ALARM 2) Higher-Limit Alarm Output
Lower-limit setting, Higher-limit setting, Indicated value		
		
		
When power is OFF		

Ref. 3 Connection example

- To light a lamp when an alarm occurs:



Ref. 4 Contact capacity

100 V AC: 0.5 A (resistance load)
200 V AC: 0.2 A (resistance load)
If the above is insufficient, use an auxiliary relay, etc.

Ref. 5 How to set an alarm

The alarm type (higher-limit or lower-limit), set value, alarm No. and output No. can be set as required for each alarm point.
See page 32 for the setting and checking procedures.

Ref. 6 Alarm outputs 3 to 24

Outputs 3, 4: For 4-point alarm outputs (optional)
Outputs 3-14: For 14-point alarm outputs (optional)
Outputs 3-24: For 24-point alarm outputs (optional)
The above are valid only when the required option is added.

Ref. 7 Alarm specifications

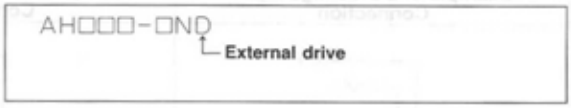
Alarm system : Individual setting, individual display, OR selection output system.
Alarm display : The CH No. where the alarm occurred flickers.
Setting system : Individual setting for each point (key operation).

Ref. 8 Terminal numbers of output 1

AH5□□, AH6□□	AH7□□
⑱N.O ⑲COM ⑳N.C	⑮ ⑯ ⑰ N.C I N.O COM

3) Connection 3 (External drive signal terminal connection)

These connections are valid only when the external drive option is added.



4) Connection 4 (Power supply/ground terminal connections)

① Power supply terminals. ..... The power source is a free power supply from 81 to 264 V AC, 50/60 Hz. Use a regulated power supply.
② Ground terminal ..... Use a sufficiently low grounding resistance.

6. LOADING

Ensure that the shipment lock screw ("Tighten screw for shipment") on the rear panel is loosened (see page 2).

6.1 LOADING ANALOG RECORDING (DOT PRINTING) INK

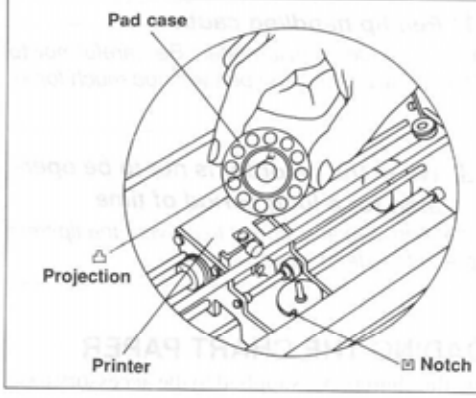
① Prepare the pad case supplied in the accessory case. The pad case is packed in a transparent package; be sure to take the pad case out of the package and remove the lid. The ink pads in the pad case have the colors on the right.

Number of Points	Recording Dot No./Color
6-point recorder	① Red; ② Black; ③ Light blue; ④ Green; ⑤ Brown; ⑥ Purple.
12-point recorder	① Red; ② Black; ③ Light blue; ④ Green; ⑤ Brown; ⑥ Purple; ⑦ Orange; ⑧ Gray; ⑨ Dark blue; ⑩ Olive; ⑪ Scarlet; ⑫ Violet.

② Using the handle on the front of the rack, slide the rack out of the case.

③ Attach the pad case to the printer mechanism. When attaching, insert the projection of the pad case into the notch in the pad fixing plate.

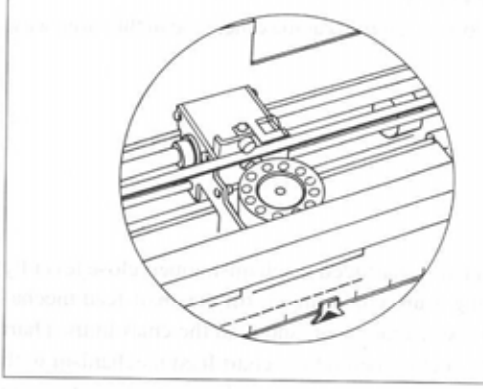
Attaching on the printer mechanism ③



④ Using the handle on the front of the rack, push the rack back to its original position. This completes the installation of the ink pad. The shipment lock screw does not have to be tightened unless the recorder is to be transported.

⑤ If the ink color fades during recording, top up with the ink provided.
Only one or two drops of ink is enough. Do not supply too much ink, as ink may flow into the printer mechanism and cause a malfunction.
Add ink to the ink pad through the cotton section on the bottom.

Ink pad installation condition ④



6.2 LOADING THE PLOTTER PEN (FOR DIGITAL RECORDING/PRINTING)

① Prepare the plotter pen supplied in the accessory case.
② Slide the rack out of the case, and push up the left of the display unit and turn it forward.
③ Tilt the chart feed mechanism toward the front (see the next page), and move the printer to approximately the center position.
④ Insert the plotter pen into the pen holder on the lower part of the printer, and push in until it is fixed.
⑤ Return the chart feed mechanism and display unit to their original positions.

Prepare a pen and insert it into the holder.

***Note 1:* Pen tip handling caution**

The pen tip is made of nylon fiber. Be careful not to damage the tip by pushing the pen with too much force, etc.

***Note 2:* When the pen is replaced**

The ink will not flow smoothly when the pen is new. Hold the pen and rub it lightly against the paper.

***Note 3:* When the recorder is not to be operated for a long period of time**

Remove the pen, cap and store it to prevent the tip from drying up and to extend its service life.

Ref. Ink life

The service life varies depending on the operating conditions, but the life is typically about 80,000 characters.

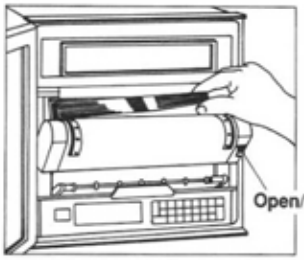
6.3 LOADING THE CHART PAPER

① Prepare the chart paper supplied in the accessory case.
② To prevent the chart from being fed without being unfolded, hold one side of the chart and loosen its folds by fanning it.
Also loosen the folds at the other side in the same way.

Loosen the chart folds. ②

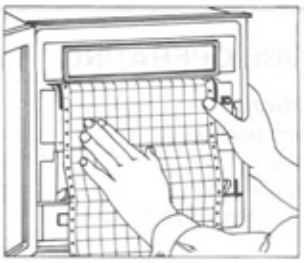
③ Unlock the chart feed mechanism open/close lever by pushing it up with a finger, tilt the chart feed mechanism toward the front, and load the chart in the chart holder section behind the chart feed mechanism with the top of the chart (the end where characters are printed) at the top (so that the circular sprocket holes are on the left when seen from the front, and the oval holes are on the right).

Tilt the chart feed mechanism toward the front. ③



④ Pull out about 30 cm of the chart (do not pass it below the chart guide).

Pull out the chart. ④

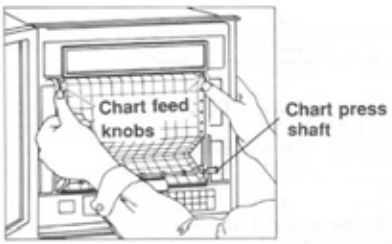


⑤ Align the left and right sprocket holes with the sprockets, and return the tilted chart feed mechanism to its original position.

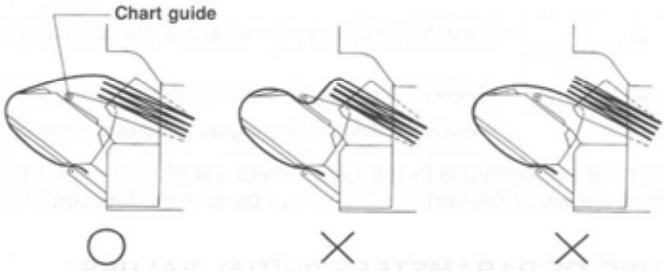
⑥ With the chart pressure rod tilted toward the front, fold the chart over the chart support.

⑦ Return the chart pressure rod to its original position. This completes the loading of the chart.

Align with the sprockets. ⑤



How to load the chart in the holder section



Ref. 1 Amount of chart

Charts are about 20 meters long, allowing continuous recording for about 30 days at a chart speed of 25 mm/H.

Ref. 2 Chart end mark

The amount of chart remaining is marked on the right in red figures. When the chart is nearly run out, the end mark (red letters) will appear on the right. When you see this, replace with a new chart.

7. Operations

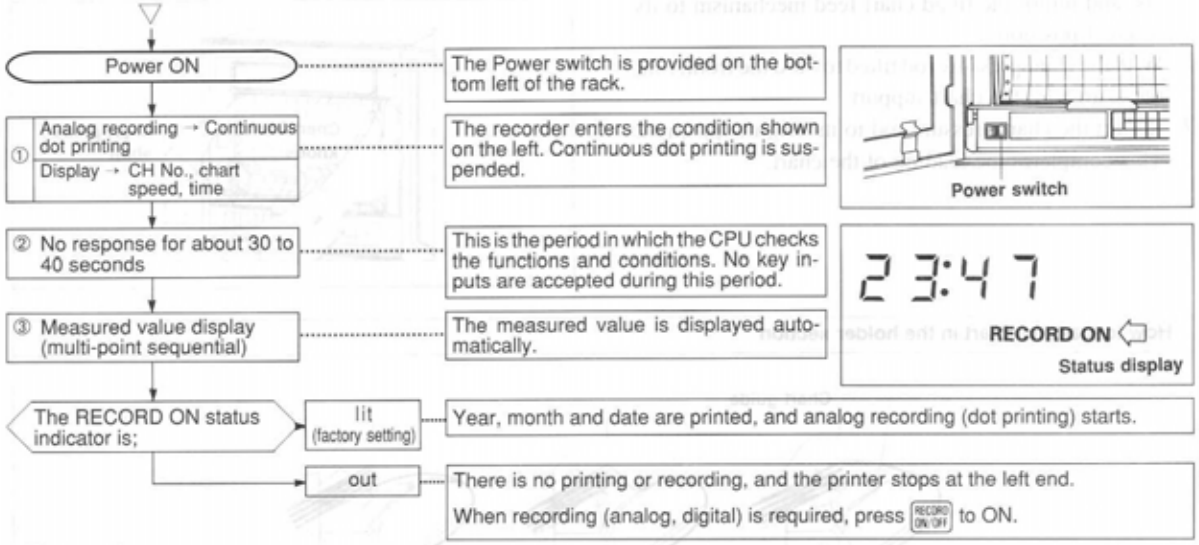
7.1 BEFORE OPERATING

1 Installation
① Installation position
② Environment
③ Tilted installation
→ See page 10.

2 Pen and chart loading
① Pad case loading
② Plotter pen loading
③ Chart loading
→ See pages 14 and 15.

3 Connections
① Input terminals
② Alarm terminals (only when required)
③ External drive signal terminals (optional)
④ Power supply and grounding terminals
→ See page 12.

7.2 CONDITION AFTER POWER ON



<Remark> Operation will be performed with the parameters set after ③. The factory setting of the parameters is shown in section 7.3. They can be changed as required.

7.3 FACTORY SETTING OF PARAMETERS (INITIAL VALUES)

Parameters		Factory/Initial		Setting Value	Setting/Check Method	
Number of Setting	Name				Section	Page
1	Clock (Time)	Present time		(Note)	8.2	22
	Chart speed	25 mm/H			8.5	27
	Constant-interval recording	Blank (Not set)			8.7	31
n	Range	Voltage input	K: 0 ~ 1200°C	Same as on left	8.3	23
		Resistance input	Pt100:–200 ~ 500°C			
	Scale	Voltage input	0 ~ 1200		8.4	25
		Resistance input	–200 ~ 500			
	Unit	°C			8.9	35
	Tag	Blank (Not set)			8.8	33
n x 4	Alarm	Blank (Not set)			8.6	29

(Note) 1989, 05 (May), 01, 00 (hours) 00 (minutes). **<Remark>** See page 22 for related items.

Resetting method
Read the description on Memory Clear. → See page 46.

Blank (Not set)
Blank means that it should be set according to requirements.

"n"
"n" is the number of input channels. It is 6 with a 6-point input model, and 12 with a 12-point input model.

Ref. 1 Range and scale of the AH7 □□ model

The voltage input or resistance input is assigned to each channel No.

→ See page 46.

Ref. 2 Blank parameters

The characters for setting mode identification and supplementary fixed display are displayed.

Ref. 3 External drive specifications

All three externally selectable chart speeds are preset to 25 mm/H when the recorder leaves the factory.

7.4 SWITCHING BETWEEN MULTI-POINT SEQUENTIAL DISPLAY AND SINGLE-POINT CONTINUOUS DISPLAY (DISPLAY RECORD FORMAT)

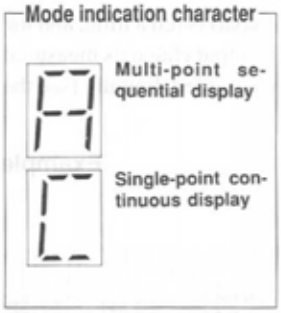
① The display mode can be selected at any time during operation.

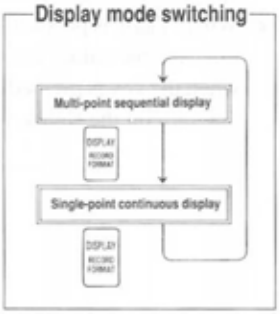
② Every time DISPLAY RECORD FORMAT is pressed, the recorder alternates between the "multi-point sequential display" and the "single-point continuous display".

③ The mode indication character is displayed to the left of the digital display.

④ The channel to be displayed by the single-point continuous display can be selected with ▲ and ▼.

⑤ To switch between the setting mode and display mode, press DISPLAY RECORD FORMAT.





Multi-point sequential display	Each point is switched at an interval of about 5 seconds, synchronized with analog recording (dot printing). However, in case the recording functions are activated (RECORD ON), fast recording occurs until the channel matches the CH No. of the digital display.
Single-point continuous display	The CH No. can be selected with ▲ and ▼. Analog recording (dot printing) is performed sequentially at a rate of about 5 seconds/dot.

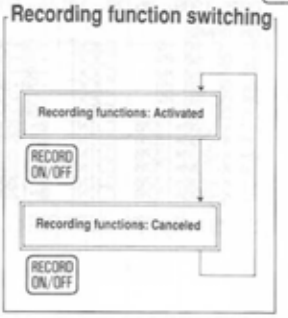
7.5 ACTIVATING/CANCELING THE RECORDING FUNCTIONS (RECORD ON/OFF)

① The RECORD functions can be activated (ON) or canceled (OFF) at any time during operation.

② Every time RECORD ON/OFF is pressed, the recorder alternates between ON and OFF.

③ The recording functions are activated while the status indicator (RECORD ON) is lit, and canceled when it is not lit.

④ The factory setting before shipment is ON.



Recording Functions	Activated (ON)	Canceled (OFF)
① Chart feed (incl. fast feed)	Performed	Stopped
② Constant-interval recording	Performed	Stopped
③ Instantaneous data recording	Possible	Impossible
④ Analog recording	Performed	Stopped
⑤ Digital printing * List printing	Performed	Stopped

* Data, time, chart speed, scale, unit, etc.

Note: *Fixed-interval recording during setting*

If the time for fixed-interval recording is reached while a parameter is being set, digital recording does not occur.

Ref. Digital printing and chart speed

The contents and timing of digital printing are determined depending on the chart speed. → See page 53.

7.6 ON-DEMAND DIGITAL RECORDING (DATA PRINT)

① The current data can be printed (digital recording) at any time during operation.

② When DATA PRINT is pressed, the chart is fed a little, and the time and the values from the input channels measured when the key is pressed are recorded digitally (see the diagram on the right).

③ Chart feed and analog recording (dot printing) are suspended during recording.

Example of Recording

7.7 LIST PRINTING (9 LIST)

① A list of current set parameters can be printed at any time during operation.

② When 9 LIST is pressed, a list of set parameters is printed on the chart.

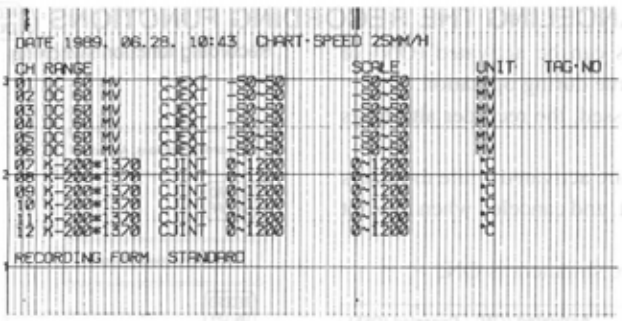
③ To suspend list printing, refer to "Notes" on the following page.

Listed Items

① Year, month, date, time
② Chart speed
③ Range setting of each channel
④ Scale setting and unit of each channel
⑤ Other items (tag, alarm, constant-interval recording) are printed only when they have been set.

Example of List Printing

(This list shows the AH52 □ model as shipped from the factory.)



7.8 CHART FAST FEED (FEED)

① The chart feed speed can increased regardless of the current setting by simple key operation.

② While FEED is held depressed, the chart is fast-fed at a speed of about 600 mm/H regardless of the current chart feed speed.

③ The chart speed returns to the set speed when FEED is released.

④ When it is required to feed the chart manually at high speed → Refer to "Ref." on the right below.

Ref. Manual fast feed of chart

Rotate the gears on both sides by hand.

***Notes:** If the RECORD O indicator is not lit, to suspend recording and printing:*

① *The DATA PRINT , 9 and FEED keys are not accepted when the recording functions are canceled (RECORD ON out).*

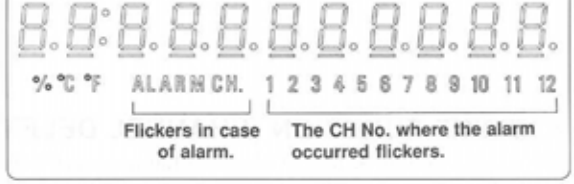
② *Press RECORD ON/OFF to suspend the recording and list printing. The printing stops as soon as the line being printed has been printed. In this case, the remaining data will not be printed even if RECORD ON/OFF is pressed again. However, with alarm printing, the remaining data is printed when the printing is resumed after having been suspended.*

7.9 DISPLAY AND PRINTING IN CASE OF ALARM OCCURRENCE (CANCELLATION)

① When an alarm condition occurs, the ALARM CH. indicator in the display and the alarm CH No. flicker.

② Every time an alarm occurs or is released, the details are printed on the right edge of the chart.

Display



1) Display in case of alarm occurrence

① Display meanings

1 Alarm occurrence indication

The ALARM CH. indicator (red) flickers on the status display while the alarm is occurring (until it is canceled).

2 Alarm channel indication

The channel number indicator (1 to 12, green) corresponding to the alarm flickers in the status display while the alarm is occurring (until it is canceled).

3 How to stop the flickering

Press ENTRY to stop the flickering of the ALARM CH. and CH No. indicators.

Ref. 1 Alarm status display

① The ALARM CH. indicator will not go out while an alarm condition continues at any of the alarm points.

② The CH No. indicator goes out when the alarm in that channel is canceled.

Ref. 2 When the flickering stops ...

① The alarm output is not released even after the flickering has stopped.

② The flickering of the ALARM CH. indicator cannot be restarted. The flickering will not restarted except when the next alarm occurs after an alarm has been canceled or when a different alarm No. occurs.

② Confirming the details of an alarm

The alarm details of each channel (alarm No., alarm type) can be displayed in sequence by the following procedure.

Example of Check Display

1 To start the alarm mode display:

8 ALARM (SHIFT + 8 ALARM)

The display is switched to the alarm mode.

2 Check

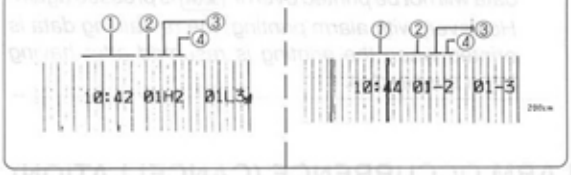
▲ ▼

When all of the alarm details have been displayed, the settings be displayed.

2) Printing in case of alarm

① When an alarm occurs or is canceled, the following alarm printing is printed on the right of the chart.

Example of Alarm Printing



Condition	Print Details	
Occurrence	① Occurrence time ③ Alarm type	② CH No. ④ Alarm No.
Cancellation	① Cancellation time ③ Hyphen	② CH No. ④ Alarm No.

***Notes:* Data storage capacity when alarms occur and are canceled**

① *Data for a maximum of 48 alarms can be stored. However, only a max. 10 can be printed per line when several should be printed simultaneously. If, during the period the chart advances by the amount (5 mm) necessary for the printing of the next line to be possible, alarm occurrences and cancellations occur frequently and there is data for more than 48 alarms, the 49th and later are not stored. If the 48th alarm is reached,* OVER FLOW *is printed after printing the alarm.*

② *When alarm data has been printed, it is erased from memory so new data can be stored in its place.*

7.10 SKIP FUNCTION (CHANNEL DELETION)

The display and recording of channels the ranges of which have not been set are skipped. Therefore, clearing the range has the same effect as deleting a channel.

When a channel is skipped:

① Channel display ..... Not displayed.
② Measured value display ..... Not displayed.
③ Digital recording ..... Not recorded.
④ Analog recording ..... Not recorded.

Ref. Skip operation procedure

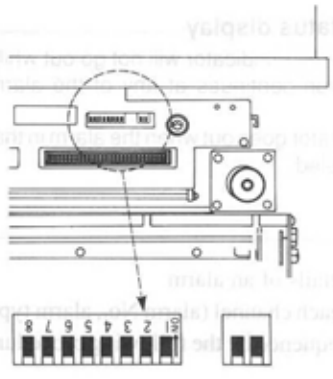
The absence of range setting means that Clear is assigned to the range of that channel. To clear the range, press 0 CLEAR, ENTRY and SET INC.

For a related description, see "Note 3" on page 27.

7.11 FUNCTION CHANGE ... SEE PAGE 48 FOR A RELATED DESCRIPTION.

A DIP switch provided on the upper side of the rack allows some functions that can be changed as shown on the right.

No.	Function		Ref. Page	Normal	OFF (Front)
1	—		—	OFF	Operating
2	—		—	OFF	Operating
3	—		—	OFF	Operating
4	°C/°F switching		44	OFF	°C
5	—		—	OFF	Operating
6	Operating Mode Definition	Memory Clear	46	OFF	Operating
7		Check Mode	48		
8		Scale Calibration	55		



8. SETTING AND CHECKING PARAMETERS

8.1 NOTES ON SETTING/CHECKING PARAMETERS

① The settings of the parameters when the recorder is shipped from the factory are as shown in the table below. Operation can be started in this condition immediately after switching the power ON. If other parameters are required, set as desired.

② The ranges have been set for multi-range operation. Set the ranges as required.

③ Constant-interval digital recording, alarm, tag and difference recording have not been set. Set them if required.

1) Parameters and their factory settings (except for optional parameters).

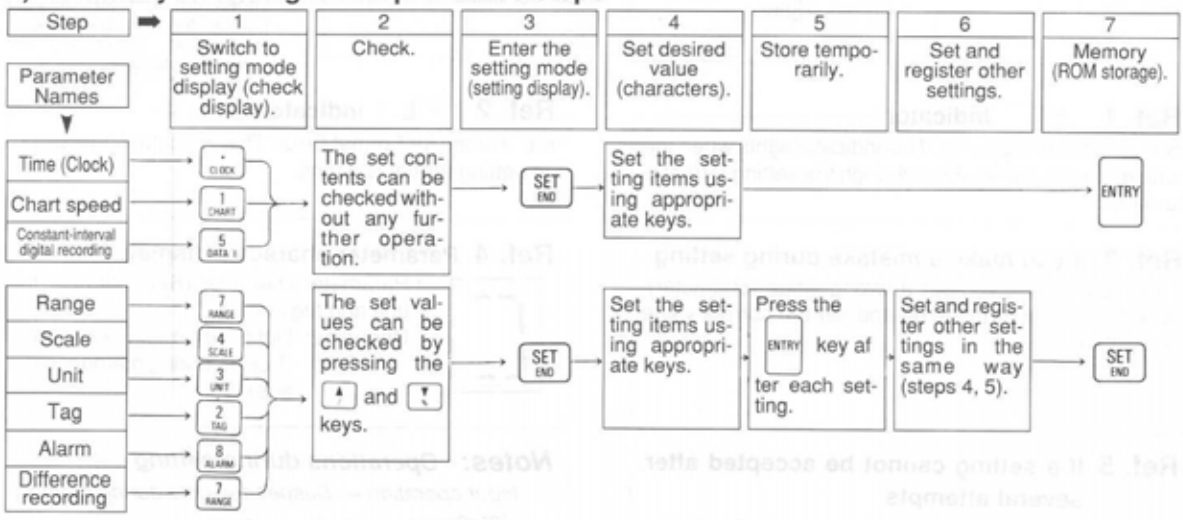
Parameters		Factory Setting			Remark		Setting/ Check Method	
Number of Setting	Name						Section	Page
1 (Common)	Clock (Time)	Present time			Initial value: 01 May 1989, 00:00		8.2	25
	Chart speed	25 mm/H			Setting range: 1 ~ 1500 mm/H		8.5	31
	Constant-interval recording	Blank (Not set)			Start time and interval can be set.		8.7	34
Number of Channels	Range *1	Voltage	DC: –50 ~ 50 mV		8 range types	Three range systems are assigned depending on the model. Select the appropriate range type and analog recording range.	8.3	26
		Thermocouple	K: 0 ~ 1200°C		29 range types			
		Resistance thermometer	Pt100: –200 ~ 500°C		8 range types			
	Scale *2	Voltage	–50 ~ 50		Setting range: –9999 ~ 99999		8.4	28
		Thermocouple	0 ~ 1200		Normally, this need not be set.			
		Resistance thermometer	–200 ~ 500					
	Unit *3	Voltage		mV	No °F conversion, even when set. → See page 44.		8.9	38
		Thermocouple, resistance thermometer		°C				
	Tag *3	Blank (Not set)			9 digits or less.		8.8	36
	Difference recording	Blank (Not set)			The difference between channels or from a reference value can be selected.		8.10	40
Individual	Alarm	Blank (Not set)			Up to 4 points can be set per channel.		8.6	32

*1: This varies depending on the model (input types and number of input points). Ranges have been set for all channels except for the resistance thermometer inputs. → See page 46.

*2: When the analog recording range is set in the range setting, that value will be entered automatically.

*3: These are characters printed in digital recording/printing; they do not appear in the recorder's display.

2) Summary of setting/check procedure steps



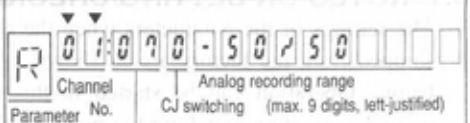
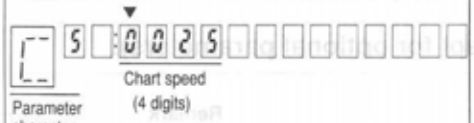
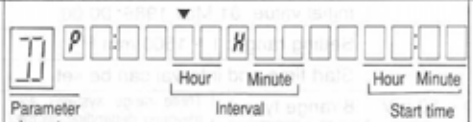
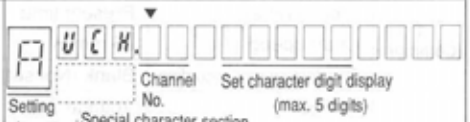
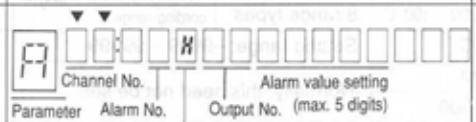
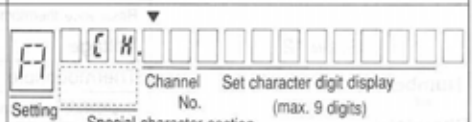
<Remark 1> The CLOCK and 1 CHART to SET END are pressed while holding the SHIFT key depressed.

<Remark 2> To return to the display mode in the middle of setting or after checking (steps 1 to 6), press the DISPLAY RECORD FORMAT key.

<Remark 3> Each of the unit and tag characters can be set and checked by operating the ▶ and ◀ keys.

3) Setting mode display format ... The following shows the initial settings (except for options).

▼: Initial cursor position

Mode Name	Display Format	Mode Name	Display Format
Time (Clock)		**Range**	
Chart speed		**Scale**	
Constant-interval digital recording		**Unit**	
Alarm		**Tag**	

The difference recording mode can be entered from the range mode.

4) Setting errors and countermeasures

ENTRY is pressed after one setting.

- Correct setting → Short beep sound is generated indicating that the setting has been accepted.
- Wrong setting → Long beep sound is generated indicating an error.
  - ① The digital display flickers,
  - ② The error indicator (S.E or F.E) lights. Perform correct setting by the following procedure.

Stop flickering.
Press any key other than SHIFT .

→ **Check details of error.**
Errors can be roughly classified by whether S.E or F.E lights.

→ **Re-set the incorrect entry.**
Move the cursor to the position of the error and set the correct value.

→ **Temporary (or memory) storage**
Press a key other than ENTRY . The error indicator goes out and the acceptance tone is generated, indicating temporary or memory storage.

Ref. 1 S.E indicator

"S.E" stands for Set Error. This indicator lights when the setting value is impossible although the setting format is correct.

Ref. 2 F.E indicator

"F.E" stands for Format Error. This indicator lights when the setting format is wrong.

Ref. 3 If you make a mistake during setting

If you realize that you set a wrong value (character), move the cursor to that digit and set the correct value (character).

Ref. 4 Parameter character display

→ Parameter character (Set character for unit and tag setting)

Underline: Lights when SET is pressed (flickers during memory storage).

Ref. 5 If a setting cannot be accepted after several attempts

Press SET (SHIFT + SET) to return to the display mode. The settings of parameters which have been accepted before ENTRY was pressed cannot be changed.

Notes: Operations during setting

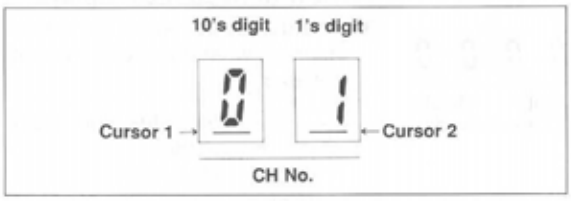
① *Input operation — Suspended only during memory storage.*

② *Recording functions — Performed normally, but the RECORD ON/OFF , FEED , DATA PRINT and 9 LIST keys are not accepted.*

5) Key operations

① Channel No. setting: In case of range, scale, alarm or difference recording setting

a. The two digits of a CH No. are set individually, but two cursors are displayed simultaneously.



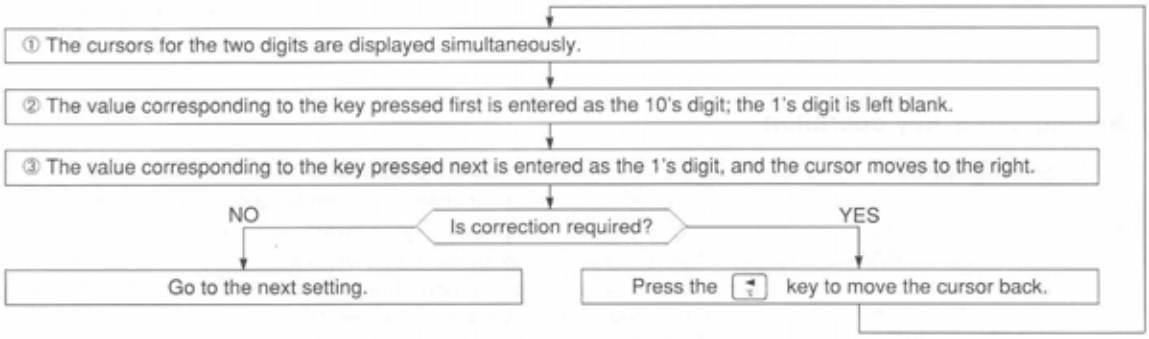
b. Refer to the flowchart on the right for the setting method.

c. When it is required to correct or modify a CH No., both the digits must be set again.

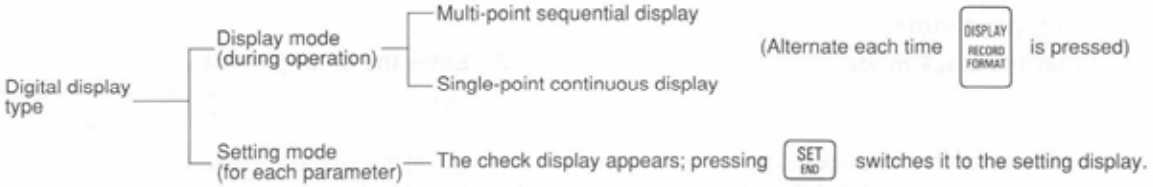
Ref. When the [SPACE] key is pressed

① If cursors are present below the Ch No. digits, both the digits become blank.

② The cursor will not move to the next digit.



② Types of digital display



Ref. 1 In the check display .....

In the check display of the setting mode, the check display of another parameter can be recalled without returning to the display mode.

([CLOCK] → [7 RANGE] → [1 CHART] .....)

Ref. 2 In the setting display .....

When it is required to recall the setting mode of another parameter, [DISPLAY RECORD FORMAT] must be pressed to first return to the display mode.

③ If you have forgotten an operation step in the middle of setting, press [DISPLAY RECORD FORMAT] to return to the display mode, and re-start setting from the beginning.

④ If it is required to clear the screen (make it blank);

a. To clear the whole of the setting screen display, press [0 CLEAR] ([SHIFT] + [0 CLEAR]) in the setting mode. Note that this will return the chart speed to its initial value.

b. Pressing [SET END] in the above condition has a different function for each parameter (apart from time, chart speed and constant-interval recording). For details, read the description of setting the parameters.

8.2 CLOCK (TIME)

This setting covers the year, month, date and time of the day. Although they have been set before the recorder left the factory, please set them again if an error is found when checking.

1) Clock mode display format ... The following is the display of the initial values.

How to Read the Display

▼: The digit under which the cursor appears when the clock mode is initiated

: Indicates the clock mode.
← Underline

: (Colon):
Flickering .... Check
Lit ..... Setting

2) Setting items, key operation

Setting Items

① Year : 4 digits
② Month & date : 4 digits
③ Time : 4 digits
(hours & minutes)

<Remark> The time is shown in the 24-hour system.

Key Operations

① To obtain the lower function of a dual-function key such as [CLOCK] or [0 CLEAR], press the key with [SHIFT] held depressed.
② The cursor moves to the next digit when a numeric key is pressed.
③ Two cursors are displayed when the minutes are to be entered. The cursors do not move in this case, and the set value is entered in the 10's and 1's digits alternately.

3) Setting procedure

1 Enter the clock mode

[CLOCK] ([SHIFT] + [CLOCK])

The display changes to the clock mode.
The time continues counting, but the displayed time is not updated.
For the check procedure, see 4) below.

2 Enter the setting mode

[SET END] (The colon stops flickering, and underline lights.)

The lighting of the cursor indicates the value which can be set (changed).
([▷] : cursor moves to right)
([◁] : cursor moves to left)

3 Set the clock

[0 CLEAR] ~ [9 LIST]

Set the correct time.
Two cursor appears under the minute's digits. The cursors do not move. → See "Key operations" above.

4 Registration, memory storage

[ENTRY] (The underline flickers, and setting change mark is printed.)

After storage in the ROM, the display mode returns to that before the start of setting. Measurement is suspended during memory storage.

4) Check procedure

① Year, month, date — Can be checked using step 1) in procedure 3) above. Press [DISPLAY RECORD FORMAT] to return to the previous display mode.

② Time — Can be checked in the display mode during operation. In condition ①, the time remains the same and is not counted up.

Ref. 1 Note on clock

The clock has been pre-set in the factory. It is backed up by a lithium battery so counting continues even in the case of a power failure or when the power is switched off. The battery life is over 5 years (total of times the power is off).

Ref. 2 How to start the clock

When [ENTRY] is pressed in step (4 of 3), the counting of seconds starts at 00 second.

Ref. 3 Year/month/date and time setting ranges

Year, month, date : 1980 to 2079.
Time : 00:00 to 23:59

Ref. 4 Initial value and resetting

Initial value: 01 May 1989 (1989, 05, 01), 00:00
For resetting operation, see page 46.
The initial value can be displayed by pressing [0 CLEAR] .

Ref. 5 How to return to the display mode

To return to the previous display mode in the middle of setting or checking, press [DISPLAY RECORD FORMAT] .

Ref. 6 Setting of 60 minutes

It is not possible to set 60 minutes. This should be set as 1 hour.
<Example> 13:60 →14:00

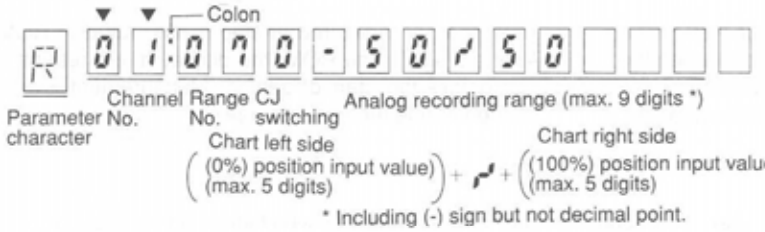
8.3 RANGE

① This is a multi-range recorder and the type of range and analog recording range can be set independently for each channel (CH).
② Three multi-range systems are available depending on the model. Please check the system in your recorder.

Multi-Range Systems of Different Models

AH5□□: DC voltages (8 types) and thermocouples (29 types)
AH6□□: Resistance thermometers (8 types)
AH7□□: DC voltages (8 types), thermocouples (29 types) and resistance thermometers (8 types)

1) Range mode display format .. The following shows the initial values (CH1 to CH3) of the AH56_ model.



* Including (-) sign but not decimal point.

How to Read the Display

▼▼: The digits where the cursors appear when the range mode setting display is initiated

: "R" indicates the Range mode.
← Underline

2) Setting items, key operations

Setting Items

For each channel...
① Range No. (Range type): 2 digits
② CJ switching (Internal/External): 4 digits
③ Analog recording range: Max. 9 digits *
* Max. 5 digits + ↵ + Max. 5 digits

Key Operations

① To obtain the lower function of a dual-function key such as [7 RANGE] , [ ] [SET IND] or [0 CLEAR] , press the key while holding [SHIFT] depressed.
② The cursor moves to the next digit when a numeric key is pressed.
③ Two cursors are displayed when a CH No. is entered. When the 10's digit is set, the 1's digit becomes blank. When the 1's digit is set, the cursor moves to the next digit.

3) Setting procedure

1 Enter the range mode

[7 RANGE] ([SHIFT] + [7 RANGE])

The display changes to the range mode display.

2 Check

[▲] [▼]

The ranges of other channels can be checked.
(For the first setting, go to next step 3)

3 Enter the setting mode

[SET IND] (The underline lights, and the cursor lights.)

The cursor indicates the position which can be set (changed).
([►] : cursor moves to right)
([◄] : cursor moves to left)

4 Select the channel No.

[0 CLEAR] ~ [9 LIST]

Select the desired CH No.
For cursor operations, refer to "Key operations" above.

5 Select the range No.

[0 CLEAR] ~ [9 LIST]

For the range No., refer to the table on page 28.

6 Switch the CJ

[0 CLEAR] [1 CHART]

When the CJ (reference contact temperature compensation) is;
- used (necessary, internal) →1.
- not used (unnecessary, external) →0.

Set to "0" except when thermocouple inputs are used.

7 Set the analog recording range

[0 CLEAR] ~ [9 LIST] [. CLOCK] [(-)] [(-)]

① Set the input for the left (0%) position of chart as 5 digits max. .
② [(-)] .
③ Set the input for the right (100%) position of chart as 5 digits max. .

8 Temporary registration

[ENTRY] (The next CH No. is displayed.)

Every time the data for one channel has been set, be sure to temporarily register that data.
(Otherwise, the set contents cannot be stored in the ROM.)

9 Set and register other channels

[0 CLEAR] ~ [9 LIST] [. CLOCK] [(-)] [(-)] [ENTRY]

Set the data for other channels in the same way (steps 4 to 8). The copy function is recommended when the same data is used for more than one channel.
→See page 43.

10 Store temporarily-registered data in memory

[SET END] (The underline flickers and setting change mark is printed.)

The contents registered in step 8 are stored in ROM. After storage in the ROM, the display mode returns to that before the start of setting. Measurement is suspended during memory storage.

4) Check procedure .... Use steps 1 and 2 of 3) above to check the settings of each channel. Press [DISPLAY RECORD FORMAT] to return to the previous display mode.

Note 1: Range No. not listed in the table

A Set Error occurs if a range No. that is not present in the range list is set. *→See "Ref. 7".*

Note 2: Number of digits of analog recording ranges

If 6 or more digits are set as the input value of the left (0%) position, [(-)] will not be accepted.

Note 3 In case Clear is assigned

If clear is assigned ([0 CLEAR] + [ENT]) during range setting, all the functions of the channel (display, dot printing, digital recording/printing) are stopped and the channel is skipped. The scale, alarm, unit and tag setting contents for that channel are also cleared. *→See page 21.*

Ref. 1 How to delete the decimal point and excessive digits

Decimal point: Move the cursor to the next digit and press [SPACE] .
Excessive digit: Move the cursor to the digit and press [SPACE] .

Ref. 2 How to clear the whole of the display

Press [0 CLEAR] to clear the whole of the setting screen display. Pressing [ENT] in the above condition performs a different operation.
→See "Note 3".

Ref. 3 Note on "Unit" and "Decimal Point" in the table

Unit : The unit of digital printing/recording when the unit has not been set.
Decimal Point : The number of digits below the decimal point when the scale has not been set.

Ref. 4 In case the range is changed

If the range of a channel for which the scale and unit have been set is changed, the type and unit of the new range are copied. If [ENT] is pressed without making any changes, they are not copied.

Ref. 5 Minimum analog recording ranges

The range can be set arbitrarily; be careful that resolution and accuracy are appropriate. → See page 77.

Input		Minimum Range
DC voltage	Approx.	1/5 of full scale
Thermocouple		2/5 (converted into electromotive force) of full scale
Resistance thermometer	100°C width (Pt100, JPt100)	

Ref. 6 Resetting the initial value

There are three types as follows, although they may vary depending on the model and channel. → See page 46.

Input	Range No.	CJ	Analog Recording Range
DC voltage	07	Unnecessary	–50 ~ 50 mV
Thermocouple	20	Necessary	0 ~ 1200 °C
Resistance thermometer	52	Unnecessary	–200 ~ 500°C

Ref. 7 Setting error

If the display flickers when [ENTRY] is pressed, a setting error has been made; press any key (except [SHIFT]) to stop the flickering, and set the item again. →See page 23 (Setting Error).

5) Settings ... with the AH7□□ model

Example	CH No.	Range Type	Analog Recording Range	Set Value (Display Format)
①	1	DC: –12.5 ~ 12.5 mV	–5 ~ 12mV	R01:050 – 5 ↵ 12
②	2	K: –200 ~ 600°C	–100 ~ 500°C	R02:191 – 1 ↵ 500
③	3	Pt100: –200 ~ 300°C	50 ~ 250°C	R03:54050 ↵ 250

Table: Range No. List

Range Type		Unit	Decimal Places	Range Type		Unit	Decimal Places	Range Type		Unit	Decimal Places
No.	Measuring Range			No.	Measuring Range			No.	Measuring Range		
05	DC: –12.5 ~ 12.5 mV	MV	2	18	K: –200 ~ 300°C	°C	1	33	W5: 0 ~ 2320°C	°C	0
06	DC: –25 ~ 25mV	MV	2	19	K: –200 ~ 600°C	°C	1	34	W0: 0 ~ 2320°C	°C	0
07	DC: –60 ~ 60mV	MV	2	20	K: –200 ~ 1370°C	°C	0	35	PR20: 0 ~ 1880°C	°C	0
08	DC: –120 ~ 120mV	MV	1	21	E: –200 ~ 350°C	°C	1	36	PR5: 0 ~ 1800°C	°C	0
09	DC: –200 ~ 200mV	MV	1	22	E: –200 ~ 900°C	°C	0	37	NiMo: 0 ~ 1310°C	°C	0
10	DC: –500 ~ 500mV	MV	1	23	J: –200 ~ 400°C	°C	1	38	AuFe: 0 ~ 300K	K	1
11	DC: –2 ~ 2V	V	3	24	J: –200 ~ 1100°C	°C	0	39	Platinel: –100 ~ 300°C	°C	1
12	DC: –5 ~ 5V	V	3	25	T: –200 ~ 250°C	°C	1	40	Platinel: –100 ~ 600°C	°C	1
				26	T: –200 ~ 400°C	°C	1	41	Platinel: –100 ~ 1390°C	°C	0
50	Pt100: –100 ~ 100°C	°C	1	27	R: 0 ~ 1760°C	°C	0	42	U: –200 ~ 250°C	°C	1
51	Pt100: –200 ~ 300°C	°C	1	28	S: 0 ~ 1760°C	°C	0	43	U: –200 ~ 450°C	°C	1
52	Pt100: –200 ~ 649°C	°C	1	29	B: 400 ~ 1820°C	°C	0	44	U: –200 ~ 600°C	°C	0
53	JPt100: –100 ~ 100°C	°C	1	30	NiCr: 0 ~ 350°C	°C	1	45	L: –200 ~ 450°C	°C	1
54	JPt100: –200 ~ 300°C	°C	1	31	NiCr: 0 ~ 700°C	°C	1	46	L: –200 ~ 900°C	°C	0
55	JPt100: –200 ~ 649 °C	°C	1	32	NiCr: 0 ~ 1300°C	°C	0				
56	JPt50: –200 ~ 649°C	°C	1								
57	PtCo: 4 ~ 374K	K	1								

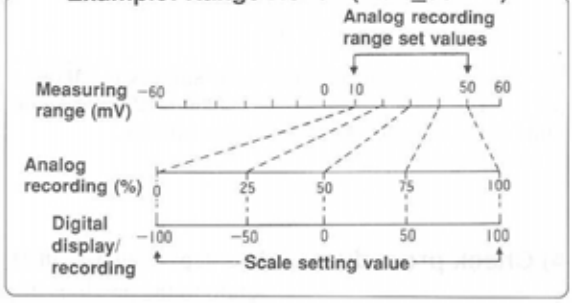
8.4 SCALE

This operation sets the scale for the analog recording range. This is also used as the digital display and digital recording scale.

In the example on the right, the relationship between the analog recording position and digital display/recording and the input signal values are as shown in the following table.

Input Signal (mV)	-60	0	10	30	50	60	100
Analog Recording (%)	Below lower limit		0	50	100	Above higher limit	
Digital Display/Recording	-450	-150	-100	0	100	150	·····

Example: Range No. 07 (DC: ±60 mV)



1) Scale mode display format .... The following shows the initial values (CH1 to CH3) of the AH56_* model.

(0%) position scale value (max. 5 digits) + ⌐ + (100%) position scale value (max. 5 digits)

* Including (–) sign but not decimal point.

How to Read the Display

▼▼: The digits where the cursors appear when the scale mode setting display is initiated

:"S" indicates the Scale mode.
←Underline

2) Setting items, key operation

Setting Items

For each channel...
① Analog recording range 0% input: Scale value in max. 5 digits *
② Analog recording range 100% input: Scale value in max. 5 digits *

Key Operations

① To obtain the lower function of a dual-function key such as [4 SCALE], [⌐], [SET END] or [0 CLEAR], press the key with [SHIFT] held depressed.
② The cursor moves to the next digit when a numeric key is pressed.
③ Two cursors are displayed for the entry of a CH No. When the 10's digit is set, the 1's digit becomes blank. When the 1's digit is set, the cursor moves to the next digit.

3) Setting (checking) procedure

1 Enter the scale mode

[4 SCALE] ([SHIFT] + [4 SCALE])

The display changes to the scale mode display.

2 Check

[▲] [▼]

The scales of other channels can be checked.
(For the first setting, go to step 3)

3 Enter the setting mode

[SET END] (The underline lights, and the cursor lights.)

The lighting of the cursor indicates the position which can be set (changed).
([▶] : Cursor moves to right)
([◀] : Cursor move to left)

4 Select the channel No.

[0 CLEAR] ~ [9 LIST]

Select the desired CH No.
For cursor operations, refer to "Key operations" above.

5 Set the scale

[0 CLEAR] ~ [9 LIST] [. CLOCK] [⌐] [⌐]

Set the scale values corresponding to the analog recording range.
To set the decimal point
→See item 5).

6 Temporary registration

[ENTRY] (The next CH No. is displayed.)

Every time the data for one channel has been set, be sure to temporarily register the data.
(Otherwise, the set contents cannot be stored in the ROM.)

7 Set and register other channels

[0 CLEAR] ~ [9 LIST] [. CLOCK] [⌐] [⌐] [ENTRY]

Set the data of other channels in the same way (steps 4 to 6). The copy function is recommended if the same data is to be set for more than one channel.
→See page 43.

8 Store temporarily-registered data in memory

[SET END] (The underline flickers, and setting change mark is printed.)

The contents registered in step 6 are stored in the ROM. After storage in the ROM, the display mode returns to that before the start of setting. Measurement is suspended during memory storage.

4) Check procedure ..... Use steps 1 and 2 in 3) above to check the setting of each channel. Press [DISPLAY RECORD FORMAT] to return to the previous display mode.

5) Setting the decimal point

① In case of DC voltage and current inputs

In step 5 on page 29, set the scale with value to which the position of the decimal point is assigned.

<Example> Measured value with range No. 6, analog recording range of 0 to 20 mV and at an input of 5 mV:

Scale Setting	Measured Value
None	5.00
–10 ↵ 10	–5
–10.0 ↵ 10.0	–5.0
–10.00 ↵ 10.00	–5.00

② In case of temperature input

In step 5 on page 29, set the scale with the value to which the position of the decimal point is assigned.

• When it is required to increase the number of digits :

<Example>

Range Setting	Scale Setting	Measured Value
K : 0 ~ 1200	0.0 ↵ 1200.0	850.3

• When it is required to decrease the number of digits :

<Example>

Range Setting	Scale Setting	Measured Value	Remark
T : 0 ~ 200	None	120.3	→ "Ref. 2"
	0 ↵ 200	120.3	Note)
	0 ↵ 200.0	120	→ "Note 1"

Note) Because the scale setting has not been changed, the number of decimal places will be the standard for the range. → See "Note 1".

Note 1: Decimal point position setting rules

If the decimal point positions of the 0% input and the 100% input are different, the setting with less digits below the decimal point is adopted. This rule is also applied in the opposite way, when it is required to reduce the number of digits below the decimal point of a temperature input.

<Example>

Scale Setting	Measured Value
0.000 ↵ 100.00	60.00
50.0 ↵ 150.00	60.0
0.00 ↵ 100	60

Note 2: In case Clear is assigned

① *If clear is assigned (0 CLEAR + ENTRY) during scale setting, the values become the values set at the time of range setting (same condition as in "Ref. 1"). A similar thing occurs with the unit, while the alarm and tag settings are cleared (initial values: Blank).*

② *If Clear is assigned after changing only the channel, the channel before the change is processed in the same way as above, while the display shows the setting of the channel after change.*

Note 3: Scale setting and alarm points

The alarm point values must be set within the scale. Therefore, the alarm points must be set again once the scale is changed.

Note 4: Correspondence of decimal point in range setting

The analog recording range is copied to the scale, but the decimal point is determined based on the range type (see the table on page 28) without corresponding to the scale.

To change the setting of the decimal point, use the operation shown in the example on the right.

<Example> Range R010500.0 ↵ 10.0
The scale (copy) is a display of 0.0 ↵ 10.0, but it is actually handled as 0.00 to 10.00. Change the scale setting to 0.00 ↵ 10 once (*), then set to 0.0 ↵ 10.0 again. * See "Note 1".

Ref. 1 Range setting and scale

When the range is set, the values are copied to the scale. As the voltage (mV, V) range is scaled by the preset values, usually it is required to set the scale again.

<Example> When the range setting is No.06 with 0 to 20 mV, the values from 0 mV to 20 mV are preset as the scale.

Ref. 2 Temperature input scale

Scale setting is not required because the values of the range setting are copied. If it is required to change the positions of the decimal point shown in the table on page 28, use the scale setting function. →See paragraph 5).

Ref. 3 0% input and 100% input

0% input: The setting value input for the left end of the analog recording range (left side of chart).

100% input: The setting value input for the right end of the analog recording range (right side of chart).

Ref. 4 How to delete the decimal point and excessive digits

Decimal point: Move the cursor to the next digit and press SPACE COPY(-1) .

Excessive digit: Move the cursor to the digit and press SPACE COPY(-1) .

Ref. 5 How to clear the whole display

Press 0 CLEAR to clear the whole of the setting screen display. Pressing ENT in the above condition has a different significance. → See "Note 2".

Ref. 6 Initial values and resetting

① The initial values vary depending on the model and CH No. → See page 46.

② For the resetting operation, see page 47.

Ref. 7 Limitations of setting values

① Use only the numeric keys (0 to 9), · and − The max. number of digits is 5 for each value. Note)
② Spaces must not be entered in the middle of a value.
Note) The symbol (-) is counted as 1 digit, but the decimal point is not.

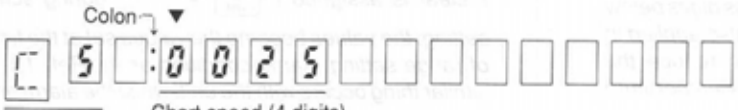
8.5 CHART SPEED

This setting operation sets the recording chart speed. The setting range is as shown in the diagram on the right. The speed can be set in 1 mm/H steps.

Setting Range (▼ : Initial value ... 25 mm/H)

(Unit: mm/H)

1) Chart speed mode display format .... The following shows the display of initial values.



How to Read the Display

▼: The digit where the cursor appears when the chart speed mode is initiated

: Indicates the Chart speed mode.
← Underline

2) Setting items, key operation

Setting Items

① Chart speed: 4 digits

Key Operations

① To obtain the lower function of a dual-function key such as 1 CHART or 0 CLEAR, press the key with SHIFT held depressed.
② The cursor moves to the next digit when a numeric key is pressed. (This does not apply to the lowest digit; move with ◄ .)

3) Setting (checking) procedure

1 Enter the chart speed mode

1 CHART (SHIFT + 1 CHART)

The display changes to the chart speed mode display.

2 Enter the setting mode

SET END (The underline lights, and the cursor lights.)

The lighting of the cursor indicates the position which can be set (changed).
(► : Cursor moves to right)
(◄ : Cursor moves to left)

3 Set the chart speed

0 CLEAR ~ 9 LIST

Set the distance per hour (mm/H) as 4 digits. Entering a space will cause an error.
(If 25 mm/H is required, set 0025 .)
To set the decimal point → See item 5).

4 Store data in memory

ENTRY (The underline flickers, and setting change mark is printed.)

After storage in ROM, the display mode returns to that before the start of setting. Measurement is suspended during memory storage.

Note: Influence on fixed-interval recording

Changing the chart speed causes the fixed-interval recording setting to be cleared (blank). The fixed-interval recording should be set again when it is required.

Ref. 1 Clear

Press 0 CLEAR to return to the initial value display (25 mm/H).

Ref. 2 Initial value, resetting

Initial value: 25 mm/H

Related information →See page 46.

Ref. 3 How to return to the display mode

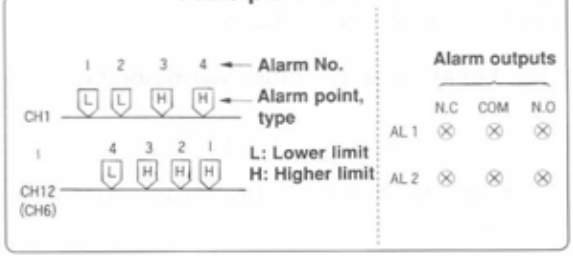
To return to the previous display mode in the middle of setting or checking, press [DISPLAY RECORD FORMAT].

8.6 ALARMS

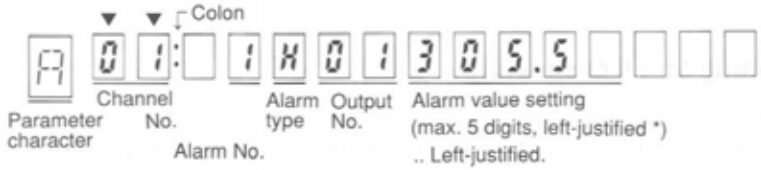
① Four alarm points can be used per input channel, and any alarm type (higher limit, lower limit) can be assigned to each of them. The maximum number of alarm points is 4 x 6 (CH) = 24 points with 6-point input, and 4 x 12 (CH) = 48 with 12-point input.

② Two alarm outputs can be used. Each of the alarm input points can be assigned to either of the outputs (No. 1, 2). It is possible to assign several alarm points to a single alarm output, but the alarm output outputs an alarm whenever an alarm condition is generated at any of the alarm points.

Principle of Alarm



1) Alarm mode display format ... The initial display consists only of "H".



* Including (–) sign but not decimal point.

How to Read the Display

▼▼: The digits where cursors appear when the alarm mode setting display is initiated

: "A" stands for Alarm mode.

← Underline

2) Setting items, key operation

Setting Items

For each alarm point ...

① CH No. : 2 digits
② Alarm No. : 1 digit
③ Alarm type : 1 digit
④ Output No. : 2 digits
⑤ Alarm value : Max. 5 digits

Key Operations

① To obtain the lower function of a dual-function key such as [8 ALARM], [0 CLEAR] or [SET END], press the key with [SHIFT] held depressed.

② The cursor moves to the next digit when a numeric key is pressed.

③ Two cursors are displayed when a CH No. is entered. When the 10's digit is set, the 1's digit becomes blank. When the 1's digit is set, the cursor moves to the next digit.

3) Setting procedure

1 Enter the alarm mode

[8 ALARM] ([SHIFT] + [8 ALARM])

The display changes to the alarm mode display.

2 Check

[▲ /] [▼ %]

Other alarm points can be checked. All of the set alarm points are displayed in order. →See page 20.
For the first setting, go to step 3.

3 Enter the setting mode

[SET END] (The underline lights, and the cursor lights.)

The cursor lights at the left end.
The lighting of the cursor indicates the position which can be set (changed).
([→] : Cursor moves to right)
([←] : Cursor moves to left)

4 Select the channel No.

[0 CLEAR] ~ [9 LIST]

Select the desired CH No.

5 Select the alarm No.

[1 CHART] ~ [4 SCALE]

A max. of 4 alarm points can be set per channel. This step is used to assign an alarm No. to each alarm for identification.

6 Select the alarm type

[▲ /] [▼ %] (H and L are displayed alternately.)

Select whether a higher-limit (H) alarm or lower-limit (L) alarm is engaged.
H: Higher-limit alarm
L: Lower-limit alarm

7 Select the output No.

1 CHART 2 TAG (For 0, see "Ref. 10".)

Select the output No. through which the alarm signal is to be output. When "0" is set, the alarm signal is not output and only the alarm indication appears. Alarm occurrence and cancellation are printed even in this case.

8 Set the alarm value

0 CLEAR ~ 9 LIST . CLOCK (−)

Set a max. of 5 digits. If the scale has been set, the alarm value should be set based on the scale values.

9 Temporary registration

ENTRY (The next alarm point display is displayed.)

Every time the data for one alarm point has been set, be sure to temporary register the data. (Otherwise, the set contents cannot be stored in the ROM.)

10 Set and register other alarm points

0 CLEAR ~ 9 LIST . CLOCK (−) ▲ ▼ ENTRY

Set the data for other required alarm points in the same way (steps 4 to 9).

11 Store temporarily-registered data in memory

SET END (The memory colon flickers, and setting change mark is printed.)

The contents registered in step 9 are stored in the ROM. After storage in the ROM, the display mode returns to that before the start of setting. Measurement is suspended during memory storage.

4) Check procedure ..... Use steps 1 and 2 of 3) above to check the setting of each alarm point. Press DISPLAY RECORD FORMAT to return to the previous display mode.

5) How to set the same alarm setting for all channels

The copy function (with the SPACE COPY(→) key) cannot be used when setting alarms.

The setting operation is much easier if all channels use the same alarm conditions (alarm No., alarm type, output No., alarm value).

<Example> To copy the set contents of CH1 to another channel:

1 Set the alarm conditions for CH01

Set CH No. 01 using steps 1 to 9 on the previous page.

2 Set CH02

Press ▼ to return to the CH01 display, change the CH No. to 02, and press ENT .

3 Set other channels

Set the remaining channels by the same operation as in step 2 above.

4 Store temporarily-registered data in memory

Press SET END . The data for all channels registered in steps 2 and 3 is stored in the ROM.

6) Setting examples

Example	CH No.	Range Setting		Scale Setting	Alarm No.	Alarm Type	Output No.	Alarm Value	Alarm Setting
		No.	Analog Recording Range						
①	1	06	−10 ↵ 10	0 ↵ 1000	2	Higher	1	5mV*	A01 2H01750
②	2	06	0 ↵ 20	0 ↵ 1000	3	Lower	1	250	A02 3L01250
③	2	06	−5 ↵ 25	0 ↵ 1000	1	Higher	1	10mV*	A02 1H01500

* Alarms values must be within the set scale range rather than the analog range, otherwise the alarms will not operate.

→See "Note 3" on page 30.

Note 1:In case Clear is assigned

① *If Clear is assigned (0 CLEAR + ENTRY) during alarm setting, alarms at that alarm point will not function.*

② *If Clear is assigned after changing only the channel and alarm, the alarm point before the change is cleared (see above), and the display shows the setting value of the changed channel and alarm No.*

Note 2:In case Clear is assigned during scale setting

If Clear is assigned (0 CLEAR + ENTRY) during scale setting, all of the alarm points of that channel will be cleared (blank). If alarms are required, they should be set again.

Related information

→See "Note 2" and "Note 3" on page 30.

Ref. 1 Alarm No.

A max. of 4 alarm points can be set per channel. An alarm No. is assigned to each for identification. Alarm Nos. can be assigned in any order, without any restriction.

Ref. 2 Alarm type

An alarm can either be a higher-limit alarm or lower-limit alarm. The alarm type can be set as required for each alarm point.

Ref. 3 OR output

The outputs of several alarm points can be assigned to one output No. In this case, the output outputs a signal when an alarm condition occurs at any of the alarm points.

Ref. 4 Display order

Press [▲] to display the alarm Nos. and alarm types in channel order, then the contents of each alarm point will be displayed in sequence.
Press [▼] to display them in reverse order.

Ref. 5 Initial value, resetting

Initial value:	Only "H" is displayed. *

For the resetting operation, see page 47.
* Only "H" (higher-limit) is displayed as the alarm type, and all other digits are blank.

Ref. 6 How to return to the display mode

To return to the display mode during setting or checking, press [DISPLAY RECORD FORMAT].

Ref. 7 Alarm printing

The alarm information is printed on the left of the chart whenever an alarm occurs or is canceled (reset to normal condition).

Occurrence	08:45 1L2
Cancellation	13:20 3-1

Related information →See page 20.

Ref. 8 Output specifications

Contact capacity: 0.5 A ~ 100 V AC
0.2 A ~ 200 V AC

Ref. 9 Alarm indication

One of the CH No. indicators on the left of the status display ALARM CH indicator lights.
→ See page 20.

Ref. 10 Indication-only output

When the alarm output signal is not required but the alarm indication is necessary, set "0" as the output No. Alarm printing is also performed in this case. → See step [7].

Ref. 11 Alarm cancellation

The alarm is not canceled until the measured value enters the normal range or the alarm point setting is changed.

Ref. 12 How to delete the decimal point and clear excess digits from the display

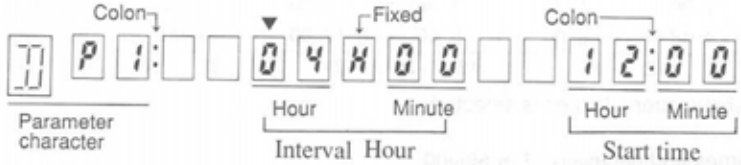
Decimal point: Move the cursor to the next digit and press the [SPACE] key.
Excess digit : Move the cursor to the excess digit and press the [SPACE] key.

8.7 FIXED-INTERVAL DIGITAL RECORDING

This function allows digital recording at a set time interval. The start time can be specified (in the 24-hour system) so that digital printing can be performed starting at the required time, at the required interval. In digital recording, ① time, ② CH No., ③ measured values and ④ unit (first 2 digits) are printed out in this order.

Example of Recording

1) Fixed-interval digital recording mode display format ... The initial display is blank.



How to Read the Display

▼: The digit where the cursor appears when the fixed-interval digital recording mode is initiated.

: Indicates the fixed-interval digital recording mode.
Underline

2) Setting items, key operation

Setting Items

① Interval period : 4 digits
② Start time : 4 digits
(24-hour system)

Key Operations

① To obtain the lower function of a dual-function keys such as [5 DATA ↓] or [0 CLEAR], press the key with [SHIFT] held depressed.
② The cursor moves to the next digit when a numeric key is pressed.

3) Setting procedure

1 Enter the constant-interval digital recording mode

(5 DATA ↕) (SHIFT + 5 DATA ↕)

The display changes to the constant-interval digital recording mode display.

2 Enter the setting mode

SET END (The underline lights, and the cursor lights.)

The cursor lights at the left end.
The lighting of the cursor indicates the position which can be set (changed).
(▶ : Cursor moves to right)
(◀ : Cursor moves to left)

3 Set the interval

0 CLEAR ~ 9 LIST

The minimum interval is 5 minutes and maximum interval is 24 hours. However, it should be noted that the minimum interval may be restricted by the chart speed. → See "Note 1".

4 Set the start time

0 CLEAR ~ 9 LIST

Set the time in the 24-hour system. The setting range is from 00:00 to 23:59.

5 Store data in memory

ENTRY (The underline flickers, and setting change mark is printed.)

After storage in the ROM, the display mode returns to that before the start of setting. Measurement is suspended during memory storage.

4) Check procedure

.... Use step 1 of 3) above to check the setting. Press DISPLAY RECORD FORMAT to return to the previous display mode.

Note 1: Interval setting condition

The minimum interval is restricted by the following conditions based on the chart speed.

$T \geq \frac{14}{CS}$ *(H)*

(T: Interval Time CS: Chart Speed (mm/H))

Note that 5 minutes (1/12 H) has priority as the minimum interval.

Example 1: CS = 20 mm/H	Example 2: CS = 200 mm/H
$\frac{14}{20}$ = 0.7 H (42 minutes), so the interval must be set at 42 minutes or more.	$\frac{14}{200}$ = 0.07 H (4.2 minutes), but the minimum interval is limited at 5 minutes so the interval must be set to 5 minutes or more.

Note 2: In case Clear is assigned

If Clear is assigned (0 CLEAR + ENTRY) during fixed-interval digital recording setting, fixed-interval digital recording is impossible.

Note 3: In case the chart speed is changed

The fixed-interval digital recording setting is cleared from memory when the chart speed is changed. The setting should be set again if required.

Note 4: Whether the fixed-interval digital recording time is altered after a power failure

① The time will not be altered if the power supply is recovered before the end of the next day. → re-setting not required.

② The time will be altered if the power supply is recovered following the next day and the division of "24/Interval" is not an integer. → re-setting required.

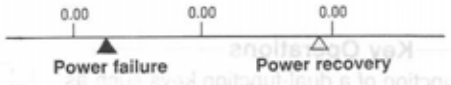
<Reference 1> "24/Interval" = Integer in the following cases.

Hour:Minute	1: 00		1: 12		1: 20		1: 30		1: 36		2: 00		2: 20		2: 40	
	3: 00		4: 00		4: 48		6: 00		8: 00		12: 00		24: 00			48
Minute	5	6	8	9	10	12	15	16	18	20	24	30	32	36	41	45

The time will not be altered if one of the above interval times is selected.

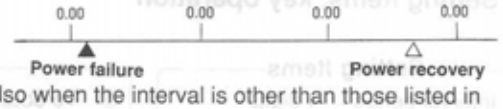
<Reference 2> Power failure/recovery times and necessity of re-setting

Re-setting not required



Not dependent on the interval.

Re-setting required



Also when the interval is other than those listed in <Reference 1>.

Ref. 1 Interval

The interval refers to the time between each digital recording. It can be set in 1-minute steps.
It is not possible to set 60 minutes. (This should be regarded as 1 hour.)
For the condition, see "Note 1".

Ref. 2 Start time

This refers to the time when digital recording is to be performed for the first time. It can be set in the range from 00:00 to 23:59 in 1-minute steps.
If a time before the present time is set, recording will start from that time the next day.

Ref. 3 Initial value, resetting

Initial value	25 mm/H

For the resetting procedure, see page 47.

Ref. 4 How to return to the display mode

To return to the previous display mode in the middle of setting, press [DISPLAY RECORD FORMAT].

Ref. 5 How to clear the whole of the display

Press [0 CLEAR] to clear the whole of the setting display.

8.8 TAGS

A tag can be set for each channel. The tag characters are printed on the chart when digital printing and list printing take place, and are used to identify the object of measurement and recording.

Example of Printing

(Digital printing)

(List printing)

1) Tag mode display format

The initial display is blank.

How to Read the Display

▼: The digit where the cursor appears when the tag mode setting display is initiated

: The character to be set in the digit indicated by the cursor.

← Underline

2) Setting items, key operation

Setting Items

For each channel to be tagged ...
① Tag set characters: Max. 9 digits

Key Operations

① To obtain the lower function of a dual-function key such as [2 TAG], [0 CLEAR] or [SET END], press the key with [SHIFT] held depressed.
② The cursor keys ([◄], [►]) are used to assign positions in the display. The position of the cursor is the character which can be set.

3) Characters that can be set

Numerals	0 ~ 9, —	⓪~⑨⊟
Letters	A ~ Z	[▲] (A → B → C·····) [▼] (A → Z → Y·····) [8 A-Z] to change from numerals to letters.
Other	␣, %, /, °C, °F	␣ (Space): [SPACE COPY], %, /, °C, and °F should be pressed with [SHIFT] held depressed.

°C and °F are regarded as 2 digits. Therefore, they cannot be used as the ninth digit.

4) Setting procedure

1 Enter the tag mode

2 TAG (SHIFT + 2 TAG)

The display changes to the tag mode display.

2 Check

▲ / ▼ % / ► Y / ◄ °C

Select the CH No. with ▲ and ▼, move the digit (with decimal point) with ► and ◄, and check the characters in the set character display.
(For the first setting, go to step 3.)

3 Enter the setting mode

SET END

The cursor lights at the CH No. display.
The lighting of the cursor indicates the position which can be set (changed).
(◄ Y : Cursor moves to right)
(► % : Cursor moves to left)

4 Select the channel No.

0 CLEAR ~ 9 LIST

Select the desired CH No.

5 Set the unit character

See "Characters that can be set".

① Move the cursor to the first digit of the set character digit display, and press the key for the desired character (check it in the set character display).
② Set the second digit and later in the same way.

6 Temporary registration

ENTRY (Changes to the next channel No.)

Every time the data for one channel has been set, be sure to register that data temporarily.

(Otherwise, the set contents cannot be stored in ROM.)

7 Set and register other channels

Same as steps 4 to 6.

Set the tag data of other channels in the same way (steps 4 to 6).
If the same tag setting is to be used with other channels, the use of the Copy function is recommended. → See page 43.

8 Store temporarily-registered data in memory

SET END (The underline flickers, and setting change mark is printed.)

The contents registered in step 6 are stored in the ROM. After storage in the ROM, the display mode returns to that before the start of setting. (Page 34)

5) Check procedure ..... Use steps 1 and 2 of 4) above to check the setting of each tag. Press DISPLAY RECORD FORMAT to return to the previous display mode.

6) Setting examples (Cursor key operations are omitted from the key operation examples below.)

①	Before setting : MV Set characters : TIC-10	▲ (7 times) T + ▲ (12 times) I + ▲ (3 times) C + − + 1 + 0
②	Before setting : TIC-10□A Set characters : XY-2	CLEAR All digits blank + ▼ (3 times) X + ▼ (2 times) Y + − + 2
③	Before setting : T5C-10AB Set characters : AB-15/20	CLEAR All digits blank + (►only) A + ▲ (2 times) B + − + 1 + 5 + / + 2 + 0

Note 1: In case Clear is assigned

① *If Clear is assigned (0 CLEAR + ENTRY) during tag setting, the tag will not be printed for that channel.*
② *If Clear is assigned after changing the channel, the channel before the change is cleared as described above, and the display shows the setting value of the changed channel.*

Note 2 : In case Clear is assigned during scale setting

If Clear is assigned (0 CLEAR + ENTRY) during scale setting, the tag setting will also be cleared (blank). The tag should be set again if it is required.
→See "Note 2" on page 30.

Ref. 1 How to clear all digits

Press [0 CLEAR] to clear (blank) the display of all digits. Use this function when it is required to reduce the number of digits, etc.

Ref. 2 How to reduce the number of digits

① If excessive characters are deleted by [SPACE], they are regarded as space ( ) characters. The digit will be displayed when the tag is checked.

② If [0 CLEAR] is pressed then the tag is set again from the first digit, excessive digits are made blank.

Ref. 3 TAG

A tag is a name assigned to a channel for identification.

Ref. 4 Initial value, resetting

Initial value: Blank

For the resetting procedure, see page 47.

Ref. 5 How to return to the display mode

To return to the previous display mode in the middle of checking or setting, press [DISPLAY RECORD FORMAT].

Ref. 6 [°C], [°F] and [%] setting display

When °C, °F or % is set, it is not displayed as a set character, but the corresponding symbol is displayed in the special display.

Ref. 7 Digital recording

This is the generic name of the fixed-interval digital recording and on-demand digital recording.

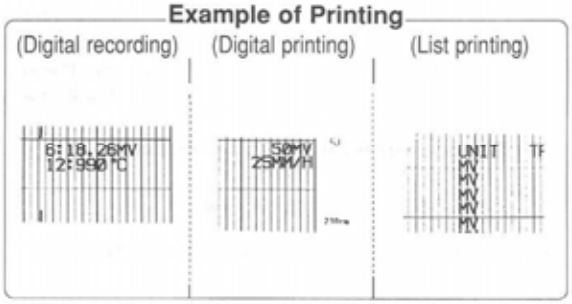
Ref. 8 Digital printing

This refers to the data contents printed out at fixed intervals, including the year/month/date, time, clock line, chart speed, range (scale), unit, CH No. and tag.

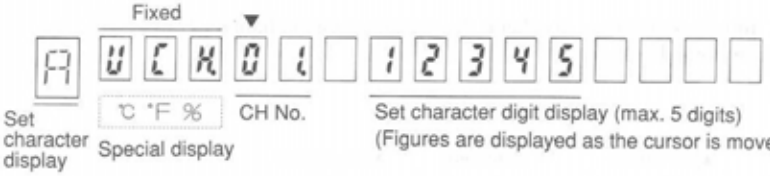
8.9 UNITS

The unit can be set independently for each channel. When the unit is set, it is printed on the chart at the time of digital recording, digital printing and list printing. However, in the case of digital recording, only the first two digits of the unit are printed out.

Example of Printing



1) Unit mode display format .. The initial display is blank.



How to Read the Display

▼: The digit where the cursor appears when the unit mode setting display is initiated

: The character that can be inserted into the digit indicated by the cursor.
Underline

2) Setting items, key operation

Setting Items

For each desired channel ...

① Unit set characters: Max. 5 digits

Key Operations

① To obtain the lower function of a dual-function key such as [3 UNIT], [0 CLEAR] or [SET IND], press the key with [SHIFT] held depressed.

② The cursor keys ([▶], [◀]) are used to assign positions in the display. The position of the cursor is the character which can be set.

3) Characters that can be set

Numerals	0 ~ 9, —	0 ~ 9, −	
Letters	A ~ Z	▲ (A → B → C·····) ▼ (A → Z → Y·····)	.@ to change from numerals to letters.
Other	␣, %, /, °C, °F	␣ (Space): SPACE , %, /, °C, and °F should be pressed with SHIFT held depressed.	

°C and °F are regarded as 2 digits. Therefore, they cannot be used as the fifth digit.

4) Setting procedure

1 Enter the unit mode

3 UNIT (SHIFT + 3 UNIT)

The display changes to the unit mode display.

2 Check

▲ / ▼ % ► °F ◄ °C

Select the CH No. with ▲ and ▼, move the digit (displayed with a decimal point) with ► and ◄, and check the character in the set character display.
(For the first setting, go to step 3.)

3 Enter the setting mode

SET END (The set character display goes out.)

The cursor lights under the CH No. display.
The cursor indicates the position which can be set (changed).
(◄ : Cursor moves to the right)
(► : Cursor moves to the left)

4 Select the channel No.

0 CLEAR ~ 9 LIST

Select the desired CH No.

5 Set the unit character

See "Characters that can be set".

① Move the cursor to the first digit of the set character digit display, and press the key for the desired character (check it in the set character display).
② Set the second and later digits in the same way.

6 Temporary registration

ENTRY (Changes to the next channel No.)

Every time the data for one channel has been set, be sure to register it temporarily.

(Otherwise, the set contents cannot be stored in ROM.)

7 Set and register other channels

Same as steps 4 to 6.

Set the units of other channels in the same way (steps 4 to 6).
If the same tag setting is to be used with other channels, the use of the Copy function is recommended.
→ See page 43.

8 Store temporarily-registered data in memory

SET END (The underline flickers, and setting change mark is printed.)

The contents registered in step 6 are stored in the ROM. After storage in ROM, the display mode returns to that before the start of setting.

5) Check procedure

Use steps 1 and 2 of 4) above to check the setting of each channel. Press DISPLAY RECORD FORMAT to return to the previous display mode.

6) Setting examples

① ppm	Before setting : MV Set characters: PPM	▲ (3 times) / P + ▼ (6 times) / P + ▲ (12 times) / M
② kg/cm²	Before setting : G/CM2 Set characters: K/CM2	▲ (4 times) / K + (After this, operations are not required.)

Example ② shows a case in which the desired unit consists of 6 characters (digits) exceeding the limit. Therefore, "g" is omitted in this example.

Note 1: In case Clear is assigned

① *If Clear is assigned ([0 CLEAR] + [ENTRY]) during tag setting, the unit will not be printed for that channel.*

② *If Clear is assigned after changing only the channel, the channel before the change is cleared as described above, and the display shows the setting value of the changed channel.*

Note 2: In case the range is changed

The set unit is cleared and the same unit as that used with the set range is copied. → *See table on page 28*

Note 3: In case Clear is assigned during scale setting

If Clear is assigned ([0 CLEAR] + [ENTRY]) during scale setting, the unit setting will also be cleared (blank) and the same unit as the unit used with the set range is copied.
→ *See table on page 28.*

Note 4 Unit printing conditions

The following conditions apply when the unit is printed.

① *Digital recording : First 2 digits*
② *Digital printing : Right-justified*
③ *List printing : Left-justified*

Unit Setting Characters	Digital Recording	Digital Printing	List Printing
P P M	○○○ PP	PPM	PPM
P P M ␣ ␣	○○○ PP	PPM	PPM
␣ ␣ P P M	○○○	PPM	PPM
␣ : Set a space.			

Ref. 1 How to clear all digits

Press [0 CLEAR] to clear (blank) the display of all digits. Use this function when it is required to reduce the number of digits, etc.

Ref. 2 How to reduce the number of digits

① If the characters assigned to excessive digits are deleted by [SPACE COPY] , they will be printed as spaces but will still be shown in the display.

② If [0 CLEAR] is pressed then the unit is set again from the first digit, excessive digits are made blank.

Ref. 3 Initial value, resetting

Initial value	°C

For the resetting procedure, see page 47.

Ref. 4 How to return to the display mode

To return to the previous display mode in the middle of setting, press [DISPLAY RECORD FORMAT] .

Ref. 5 [°C] and [°F] keys

These are regarded as unit characters. No conversion is performed.
Related information → See page 44.

Ref. 6 [°C], [°F] and [%] setting display

When °C, °F or % is set, it is not displayed as a set character, but the corresponding symbol is displayed in the special display.

Ref. 7 Digital recording

This is the generic name of fixed-interval digital recording and on-demand digital recording.

Ref. 8 Digital printing

This refers to the data contents printed out at fixed intervals, and include the year/month/date, time, clock line, chart speed, range (scale):unit, CH No. and tag.

8.10 DIFFERENCE RECORDING

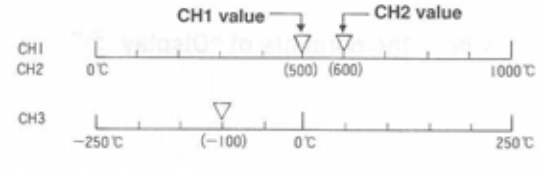
8.10.1 Inter-Channel Difference

① The following setting operation allows the measurement of the difference between the values of two channels and records it in the specified channel.

② The specified recording channel is used to display and record the difference (both as analog and digital values).

③ The analog recording range has to be set for the specified channel. For the minimum analog recording range, see "Ref. 5" on page 27.

<Example> When the difference between CH1 and CH2 is displayed/recorded on CH3



Notes) CH: Channel →: Analog recording position and range

1) Difference recording mode display format ... In case of the above <Example>.

Display ①

Parameter character — Difference recording CH No. — Reference CH No. — No. of CH to be subtracted — Clear (Space)

(This display can be obtained from the range setting display.)

Display ②

(Display ① chages to display ② after step 8* of the setting procedure.)

Analog recording range (max. 11 digits * , left-justified.) * Including (–) sign but not decimal point.

(Chart left side (0%) position input value) (max. 5 digits) + ⌐ + (Chart right end (100%) position input value) (max. 5 digits)

2) Setting procedure .. In case of the above <Example>. Also see item 3) on page 26.

1 Enter the range mode

7 RANGE (SHIFT + 7 RANGE)

2 Enter the setting mode

SET END

3 Select the CH No. to be used to record the difference

0 CLEAR 3 UNIT

4 Set -

SHIFT + ▲ /

5 Select the reference CH No.

0 CLEAR 1 CHART

→ See "Note" on next page.

6 Select the No. of the CH to be subtracted from the reference CH No.

— ⌐(-) and 0 CLEAR 2 TAG

→ See "Note" on next page.

7 Enter spaces in excessive digits

SPACE COPY(→) ► F .....

8 Go to the format of "Display ②" above

ENTRY

9 Set the contents of "Display ②"

— ⌐(-) 2 TAG 5 DATA ↕ 0 CLEAR — ⌐(-) 2 TAG 5 DATA ↕ 0 CLEAR

10 Temporary registration

ENTRY

(If this operation is omitted, the set contents cannot be stored in the ROM.)

11 Set and register other channels

If another inter-channel difference recording is required, set the data in the same way (steps 3 to 10).

12 Store the temporarily-registered data in memory

SET END (The setting change mark is printed.)

After storage in the ROM, the display mode returns to that before the start of setting.

3) Checking procedure

1 Enter the range mode

7 RANGE (SHIFT + 7 RANGE)

The display changes to the range mode display.

2 Check the contents of "Display ①"

▲ / ▼ %

Every time ▲ / is pressed, the range of the next channel is displayed; finally the display returns to the format shown in "Display" ① above.
Pressing ▼ % steps through channels in the reverse order.

3 Check the contents of "Display ②"

ENTRY

When "Display ①" is displayed in step 2 press ENT to change the display to the format shown in "Display ②".

4 Check other channels

ENTRY ▲ /

When ENT is pressed in step 3 the display returns to "Display ①". Now press ▲ / to display "Display ①" of another channel. Check other channels in the same way.

Ref. How to return to the display mode

After checking, press [DISPLAY RECORD FORMAT] to return to the display mode before checking.

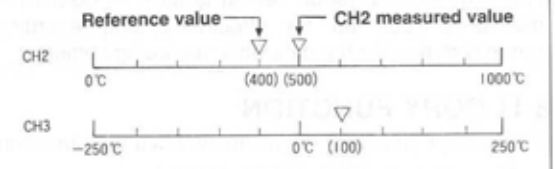
8.10.2 Difference from Reference Value

① The following setting operation allows the measurement of the difference of the measured value of a channel from a specified reference value, and records it on a specified channel.

② The specified recording channel is used to display and record the difference (both analog and digital).

③ The analog recording range has to be set for the specified recording channel. For the minimum analog recording range, see "Ref. 5" on page 27.

<Example> When the difference between CH2 and a reference value is displayed/recorded on CH3



Notes) CH: Channel →: Analog recording position and range

1) Difference recording mode display format ... In case of <Example> above.

① Display ① → This is not the same as Display ① of the difference between channels. The reference value is set in place of the Ch NO. to be subtracted.

(This display can be obtained from the range setting display.)

Parameter character — Difference recording CH No. — Reference CH No. — Reference value (Value to be subtracted) (max. 5 digits *, left-justified) — Clear (Space)

* Including (–) sign but not decimal point.

② Display ② → Same as Display ② of the inter-channel difference. See previous page.

2) Setting procedure .. In case of the above <Example>. Also see item 3) on page 26.

1 Enter the range mode

[7 RANGE] ([SHIFT] + [7 RANGE])

2 Enter the setting mode

[SET END]

3 Set the CH No. to be used to record the difference

[0 CLEAR] [3 UNIT]

4 Set [=]

[SHIFT] + [▲ /]

5 Select the reference CH No.

[0 CLEAR] [2 TAG]

→ See "Note" below.

6 Select the reference value

[(–)] and [4 SCALE] [0 CLEAR] [0 CLEAR]

7 Enter spaces in excessive digits

[SPACE COPY(→)] [► Y] .....

8 Go to the format of "Display ②"

[ENTRY]

9 Set the contents of "Display ②"

[(–)] [2 TAG] [5 DATA ↑] [0 CLEAR] [(–)]
[2 TAG] [5 DATA ↑] [0 CLEAR]

10 Temporary registration

[ENTRY]

(If this operation is omitted, the set contents cannot be stored in the ROM.)

11 Set and register other channels.

If another difference recording is required, set the data in the same way (steps 3 to 10).

12 Store temporarily-registered data in memory.

[SET END] (The setting change mark is printed.)

After storage in the ROM, the display mode returns to that before the start of setting.

3) Checking procedure..... Same as inter-channel difference recording (previous page). After checking, press [DISPLAY RECORD FORMAT] to return to the display mode before checking.

Note: Range settings of reference CH and CH to be subtracted

The ranges of the reference CH and the CH to be subtracted must be set prior to difference recording setting.

Ref. 1 Inter-channel difference recording:

Note on the CH used for difference recording

(When CH1 or CH2 is specified for the recording of the difference between CH1 and CH2)

The function of the CH specified for recording is to record the difference, so the CH will therefore display and record (both analog and digital) the calculated difference. In this case, the original range setting is used to obtain the measured value, but the effective analog recording range is that set in the difference recording setting.

Ref. 2 Difference from reference value recording:

Note on the difference recording CH setting

(When the reference CH is specified as the reference recording CH)

Same as "Ref. 1".

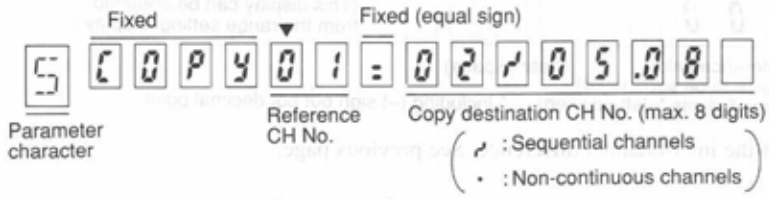
8.11 COPY FUNCTION

① The copy function is convenient when the same contents are to be set in several channels.

② The copy function can be used with the four parameters that can be set for each channel; a) range; b) scale; c) tag; and d) unit. It cannot be used for copying alarm settings, but a simplified setting operation is available for this. → See page 33.

1) Copy mode display format

(Example: When, in the scale setting, the contents of CH1 are copied to CH2 to CH5 and CH8)



How to Read the Display

▼: The digit where the cursor appears when the copy mode is initiated.

: Parameter character (R: Range, S: Scale, T: Tag, U: Unit)

2) Setting procedure

Step	Range	Scale	Tag	Unit
1	Perform steps 1 to 8 on pages 26 ~ 27 to set and temporarily register data for the reference CH.	Perform steps 1 to 6 on page 29 to set and temporarily register data for the reference CH.	Perform steps 1 to 6 on page 37 to set and temporarily register data of the reference CH.	Perform steps 1 to 6 on page 39 to set and temporarily register data of the reference CH.
2	Press SPACE COPY(=) to change the display to the copy function display. The parameter character remains the same as in the previous setting mode, but the tag and unit are displayed as T (Tag) and U (Unit).			
3	Set the reference CH No. to the left of the equals sign (=), and the copy destination CH No. to the right. If there are several copy destination CHs, ➡ insert ↗ between CH Nos. if the CHs are continuous. Insert · (decimal point) if the CHs are not continuous.			
4	Press ENTRY to temporary register the data. The display returns to the display of the CH No. before the copy display was initiated. (If this operation is omitted, the set contents cannot be stored in the ROM.)			
5	Press SET END. (The underline flickers, and setting change mark is printed.)	The contents registered in steps 1 to 4 are stored in the ROM. After storage in the ROM, the display mode returns to that before the start of setting.		

Note 1: Copying a channel the range of which has not been set

During settings with which the copy function can be used, such as setting the scale, tag or unit, setting a CH for which the range has not been set results in a Set Error. For channels the range of which has not been set, see section 7.10 (page 21).

Note 2: When the unit or tag setting is copied

The parameter character display becomes "U" or "T".

8.12 °C/°F SWITCHING

① The unit used initially for the measured values of thermocouple and resistance thermometer inputs is °C. Use the procedure described here when it is required to measure these inputs with the values converted into °F.

② °C/°F conversion formulae

$$°C = \frac{5}{9} \times (°F - 32) \qquad °F = \frac{9}{5} \times °C + 32$$

1) Switching method

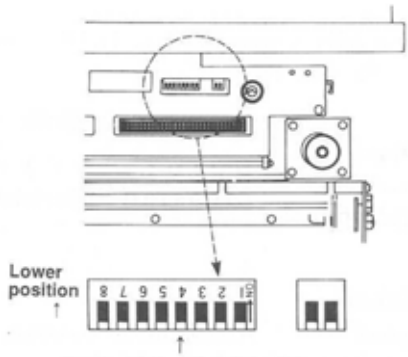
Use the DIP switch on the upper part of the rack.

① Set the Power switch to OFF.

② Set DIP switch No. 4 to ON (lower position).

③ Set the Power switch to ON.

DIP Switch Position



***Note 1:* Settings of the range, scale, unit and alarms**

① *Measured values will be displayed as ˚C or ˚F depending on the switch setting, however their meanings will not be changed.*

② *Range and alarm values will be set according to ˚C or ˚F, whichever is set. The analog recording range will be copied to the scale, so the scale does not have to be set again. For units, refer to Note 2.*

***Note 2:* Unit setting when ˚C is changed to ˚F**

① *[˚F] must be set for printing, otherwise ˚C will be printed.*

② *When the range setting is changed, ˚C is used as the unit, so ˚F will have to be set when necessary.*

③ *When the parameters are initialized, the initial values for range and scale will be set as ˚C; when required, set to ˚F.*

***Note 3* Ranges in the unit of K**

Ranges No. 38 (AuFe) and No. 57 (Pt-Co) use absolute temperature (K) as their unit, so this function is not applicable to them.

***Note 4* Relation to unit setting**

Even when °F is set in the unit setting described on page 38, the measured value is not converted. Only the printed unit is covered by this setting.

***Ref. 1* To return to ˚C**

As in the "Switching method" above, set DIP switch No.4 to OFF. Be careful to change the unit back to ˚C.
No. 4 to OFF

***Ref. 2* Confirmation of setting of DIP switch**

This can only be done when the power is initially switched on and cannot be done during operation.

2) °F unit measuring range list

For the measuring range list of °C unit, see page 28.

Range Type No.	Measuring Range	Unit	Decimal Point
18	K : –300 ~ 550	˚F	1
19	K : –300 ~ 1100	˚F	1
20	K : –300 ~ 2450	˚F	0
21	E : –300 ~ 650	˚F	1
22	E : –300 ~ 1650	˚F	0
23	J : –300 ~ 750	˚F	1
24	J : –300 ~ 2000	˚F	0
25	T : –300 ~ 450	˚F	1
26	T : –300 ~ 750	˚F	1
27	R : 32 ~ 3200	˚F	0
28	S : 32 ~ 3200	˚F	0
29	B : 800 ~ 3300	˚F	0
30	NiCr : 32 ~ 650	˚F	1
31	NiCr : 32 ~ 1250	˚F	1
32	NiCr : 32 ~ 2350	˚F	0

Range Type No.	Measuring Range	Unit	Decimal Point
33	W_5 : 32 ~ 4200	˚F	0
34	W_6 : 32 ~ 4200	˚F	0
35	PR_{20} : 32 ~ 3400	˚F	0
36	PR_5 : 32 ~ 3250	˚F	0
37	NiMo : 32 ~ 2350	˚F	0
38	AuFe : 0 ~ 300	K	1
39	Platinel : –100 ~ 550	˚F	1
40	Platinel : –100 ~ 1100	˚F	1
41	Platinel : –100 ~ 2500	˚F	0
42	U : –300 ~ 450	˚F	1
43	U : –300 ~ 800	˚F	1
44	U : –300 ~ 1100	˚F	0
45	L : –300 ~ 800	˚F	1
46	L : –300 ~ 1650	˚F	0

Range Type No.	Measuring Range	Unit	Decimal Point
50	Pt100 : –100 ~ 200	˚F	1
51	Pt100 : –300 ~ 550	˚F	1
52	Pt100 : –300 ~ 1200	˚F	1
53	JPt100 : –100 ~ 200	˚F	1
54	JPt100 : –300 ~ 550	˚F	1
55	JPt100 : –300 ~ 1200	˚F	1
56	JPt50 : –300 ~ 1200	˚F	1
57	Pt-Co : 4 ~ 374	K	1

<Remark> The "Decimal Point" refers to the number of digits below the decimal point when scale setting has not been performed.

9. Correction of Incorrect Settings

If a mistake is made in setting parameters, the correction method varies depending on the parameter and on the stage at which you noticed the error.

Parameter Name (Setting Mode)	Parameters stored with ENT		Parameters stored with SET END			
	Before pressing ENT	After pressing ENT	Before pressing ENT	After pressing ENT	After pressing SET END	After pressing 0 CLEAR + ENT
Clock (Time)	Procedure 1	Procedure 2				
Chart speed						
Constant-interval						
Digital recording			Procedure 3	Procedure 4	Procedure 5	Procedure 6
Range						
Scale						
Unit						
Tag						
Alarm						
Difference recording						
Copy						

Correction Methods

Procedure 1	1 Set the correct value. Move the cursor to the position of the incorrect digit and set the correct value. 2 Go to the next step. The subsequent operations are the same as in the normal setting procedure.	**Procedure 4**	1 Return to the display. Press ↑ to return to the display in which the incorrect setting was made. 2 Set the correct value. Move the cursor to the position of the incorrect digit and set the correct value. 3 Go to the next step. The subsequent operations are the same as in the normal setting procedure.
Procedure 2	1 Wait until the recorder returns to the display mode after ROM storage. 2 Set data again. Re-enter the setting mode and set the correct value by performing the entire setting procedure.	**Procedure 5**	1 Wait for the display mode. 2 Set the data again.
Procedure 3	1 Set the correct value. Move the cursor to the position of the incorrect digit and set the correct value. 2 Go to the next step. The subsequent operations are the same as in the normal setting procedure.	**Procedure 6**	1 Return to the display. Press ↑ to return to the display of the setting which was cleared (made blank). 2 Set the correct value. 3 Go to the next step. The subsequent operations are the same as in the normal setting procedure.

Ref. When you are not sure which step of the setting procedure you have reached

Press DISP/RECORD FORMAT to return to the display before the start of setting, and start setting again.

10. Memory Clear (Resetting the Set Data)

This recorder is provided with three memory clear functions.
Settings are stored in an EEPROM so that they are retained even when the power is switched off.

Memory Clear Types

① Resetting the set parameters
② Resetting the clock
③ Resetting the scale calibration compensation data

10.1 RESETTING THE SET PARAMETERS

① The set parameters are reset to the initial values set when the recorder was shipped from the factory.
② The initial values of the parameters are as shown in the table on the right.
③ Use this function to change (set) all parameters, etc.

Parameter Name	Initial Value
Range	Variable depending on the model and CH. → See "Ref.".
Scale	
Unit	
Alarm	All clear (blank).
Difference recording	All clear (blank).
Recording format	Standard. All other formats are cleared (optional).
Fixed-interval digital recording	Cleared (blank).
Chart speed	25 mm/H
Tag	All clear (blank).
Recording functions	Activated (ON).
Display mode	Multi-point sequential.

Ref. Initial values of range, scale and unit

Model	CH No.	Range	Scale	Unit	Model	CH No.	Range	Scale	Unit
AH56□	1~3	DC: –50 ~ 50mV	–50 ~ 50	mV	AH76□	1, 2	DC: –50 ~ 50mV	–50 ~ 50	mV
	4~6	K: 0 ~ 1200°C	0 ~ 1200	°C		3, 4	K: 0 ~ 1200°C	0 ~ 1200	°C
AH52□	1~6	DC: –50 ~ 50mV	–50 ~ 50	mV		5, 6	Pt100: –200 ~ 50°C	–200 ~ 500	°C
	7~12	K: 0 ~ 1200°C	0 ~ 1200	°C	AH72□	1~4	DC: –50 ~ 50mV	0 ~ 1200	mV
AH66□	1~6	Pt100: –200 ~ 500°C	–200 ~ 500	°C		5~8	K: 0 ~ 1200°C	0 ~ 1200°C	°C
AH62□	1~12	Pt100: –200 ~ 500°C	–200 ~ 500	°C		9~12	Pt100: –200 ~ 500°C	–200 ~ 500	°C

10.2 RESETTING THE SCALE COMPENSATION DATA

All of the data compensated by performing scale calibration (see page 56) is reset and returns to the same scale calibration values as when the recorder was shipped from the factory.
However, the zero and span adjustments for analog recording sometimes have different values when the recorder is shipped from the factory.

Deleted Compensation Data (Adjusted Values)

① Zero and span adjustments of range
② Ship set value of shift
③ Zero and span adjustments of analog recording
④ Time axis adjustment of plotter pen.

10.3 RESETTING THE CLOCK

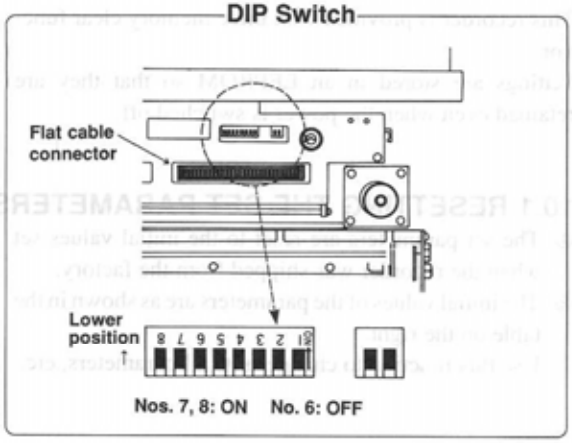
When the clock is reset, the date/time become as shown on the right. The clock has been set before the recorder is shipped from the factory.

Initial value	1 May 1989 (1989 05 01) 00:00

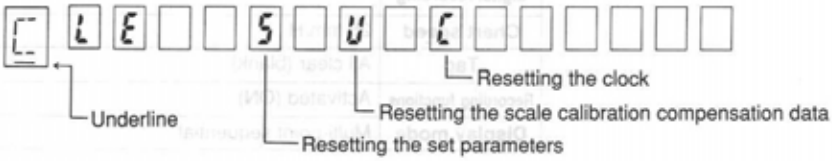
10.4 MEMORY CLEAR OPERATION

1) Preparation

① Set the Power switch to OFF.
② Slide out the rack and disconnect the flat cable from the inside of the upper surface from its connector.
③ An 8-element DIP switch will be seen. Set switches No. 7 and No. 8 to ON, and No.6 to OFF.
④ Connect the flat cable again, and set the Power switch to ON.
⑤ The memory clear mode display will appear.



2) Memory clear mode display format



3) Setting procedure

1 Move the cursor

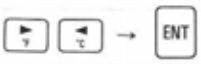
Move the cursor to the position of the item to be reset (S, U or C).

2 Select item and store it in memory

(The underline flickers, and setting change mark is printed.)

The selected item is reset. After memory storage is completed, the underline stops flickering and lights steadily.

3 Reset other items



When it is required to reset another item, reset it in the same way (steps 1 and 2).

4 Return to the operating mode

Set the Power switch to OFF, set the DIP switch to the original position (No.6 to No. 8 to OFF), and set the Power switch to ON again.

Ref. DIP switch setting check

The recorder checks the settings only when the power is switched ON. Therefore, there will be no response when switch settings are changed in the middle of operation.

11. Specification Check Function

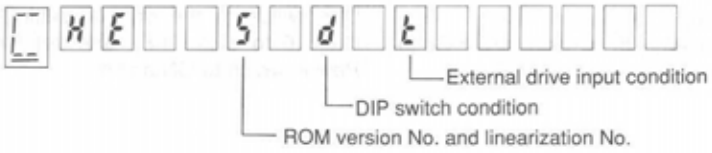
Three items in the specifications of the recorder can be checked by DIP switch and key operations, as shown on the right.

Specification Check Items

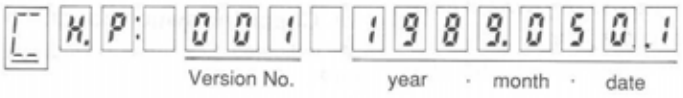
① ROM version No. and linearization No.
② DIP switch condition
③ External drive (optional) input condition

11.1 DISPLAY FORMATS

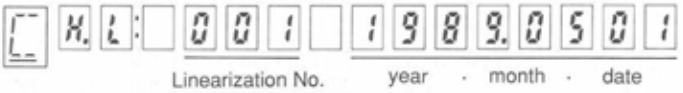
1) Check mode



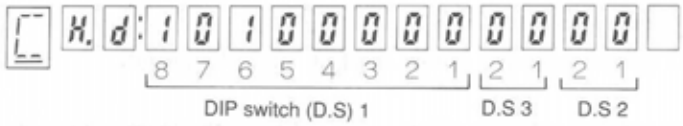
2) ROM version No.



3) Linearization No.

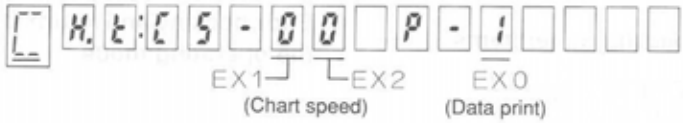


4) DIP switch condition

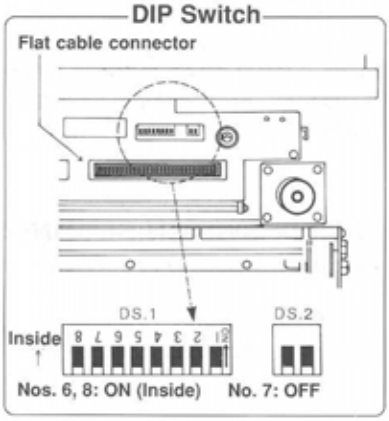


Note) DS2 and DS3 are preset in the factory; do not touch.

5) External drive input condition



DIP Switch



External Drive Display

① EX1 and EX2 (terminals)

Chart Speed	EX1	EX2
CS1	0	0
CS2	0	1
CS3	1	0
Stop	1	1

0: Open, 1: Shorted

② EX0 (terminals)

Digital recording external drive	EX0
Stop	0
Operating	1

0: Open, 1: Shorted
<Remark> External drive is optional.

③ Relation between symbols and terminals

Symbol	Terminal Nos.
EX0	③ · ④
EX1	⑬ · ⑭
EX2	㉓ · ㉔

11.2 PREPARATION FOR OPERATION

① Set the Power switch to OFF.
② Slide out the rack and disconnect the flat cable (harness) at the inside of the upper surface from the connector.
③ An 8-element DIP switch will be seen. Set switches No. 6 and No. 8 to ON, and No. 7 to OFF.
④ Connect the flat cable again and set the Power switch to ON.
⑤ The check mode display appears.
⑥ Hereafter, follow the operating procedure of each check item.

11.3 ROM VERSION NO. AND LINEARIZATION NO.

1 Preparation

Prepare as described in section 11.2.

2 Initiate the version No. display

Move the cursor to [5] and press [ENT].

3 Initiate the linearization No. display

[▲], [▼]. (The version No. and linearization No. are displayed alternately.)

4 Initiate the check mode display

[SET (END)] ([SHIFT] + [SET (END)])

This returns the display to the check mode display. When checking other items is not required, skip steps 4 and 5 and go to step 6.

5 Check other items

[→] [←] → [ENTRY]

① DIP switch condition → Go to step 2 of section 11.4.
② External drive condition → Go to step 2 of section 11.5.

6 End checking and return to the operating mode

Set the Power switch to OFF, set the DIP switch to the original settings (Nos. 6 to 8 to OFF), and set the Power switch to ON again.

11.4 DIP SWITCH SETTINGS

The ON/OFF statuses of three DIP switches (D.S 1 to 3) can be checked. [1] indicates ON, and [0] indicates OFF.

1 Preparation

Prepare as described in section 11.2.

2 Initiate the DIP switch condition display

Move the cursor to [d] and press [ENTRY].

3 Check the switch condition

"1" indicates ON, and "0" indicates OFF.

4 Initiate the check mode display

[ENTRY]

This returns the display to the check mode display. When checking other items is not required, skip this step and go to step 6.

5 Check other items

[→] [←] → [ENTRY]

① ROM version No. and linearization No. → Go to step 2 of section 11.3.
② External drive condition → Go to step 2 of section 11.5.

6 Stop checking and return to the operating mode

Set the Power switch to OFF, set the DIP switch to its original settings (Nos. 6 to 8 to OFF), and set the Power switch to ON again.

11.5 EXTERNAL DRIVE INPUT CONDITIONS

The terminal input statuses of the external drive signals (optional) can be checked. [1] indicates ON (shorted), and [0] indicates OFF (open).

1 Preparation

Prepare as described in section 11.2.

2 Initiate the external drive input condition display

Move the cursor to [E] and press [ENT].

3 Check the terminal condition

"0" indicates OFF (open), and "1" indicates ON (shorted).

4 Initiate the check mode display

[ENTRY]

This returns the display to the check mode display. When checking other items is not required, skip steps 4 and 5 and go to step 6.

5 Checking other items

[→] [←] → [ENTRY]

① ROM version No. and linearization No. → Go to step 2 of section 11.3.
② DIP switch condition → Go to step 2 of section 11.4.

6 End checking and return to the operating mode

Set the Power switch to OFF, set the DIP switch to the original settings (Nos. 6 to 8 to OFF), and set the Power switch to ON again.

12. Digital Recording/Printing Formats

Fixed-interval digital recording

Data can be recorded in black ink on the analog recording chart at any specified interval. (This function is not performed unless the fixed-interval recording has been set.) Setting and check procedures → See page 34.

① Time
② CH No.
③ Data
④ Unit (first 2 digits)

On-demand digital recording

When DATA PRINT is pressed, the current data is recorded instantaneously.
Related information → See page 19.

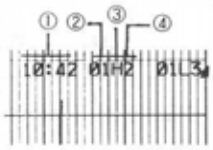
① Time
② CH No.
③ Data
④ Unit (first 2 digits)

Alarm printing

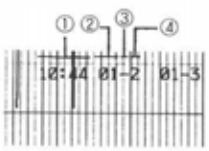
Whenever an alarm occurs or is canceled, alarm printing is performed on the right of the chart.
Related information → See page 20.

Alarm printing has priority over digital printing. If they overlap on the same line, the right side of the digital printing is omitted.

In case of occurrence



In case of cancellation

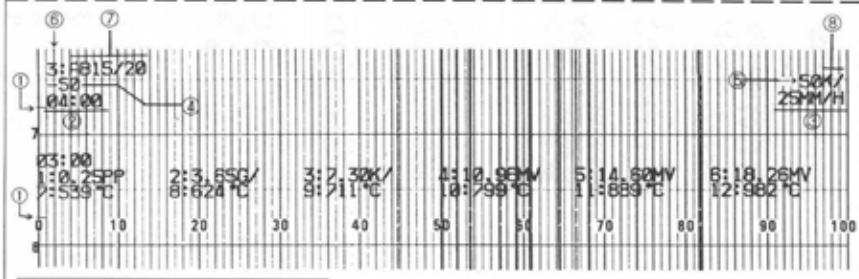


In case of occurrence
① Occurrence time
② CH No.
③ Alarm type (H: Higher-limit, L: Lower-limit)
④ Alarm No.

In case of cancellation
① Cancellation time
② CH No.
③ Hyphen
④ Alarm No.

Digital printing (fixed-interval printing)

The items listed on the right are printed at specific intervals, depending on the chart speed.
There are four types of fixed-interval printing, and the items printed vary depending on the type. For details, see page 53.



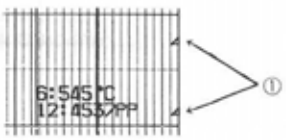
Example of group printing

① Time line
② Time
③ Chart speed
④ Scale (0% input equivalent)
⑤ Scale (100% input equivalent)
⑥ CH No.
⑦ Tag
⑧ Unit

Ref. Group Printing
If the tag has not been set and the scale and unit have the same setting, the CH Nos. are printed together as a group.

Setting change mark

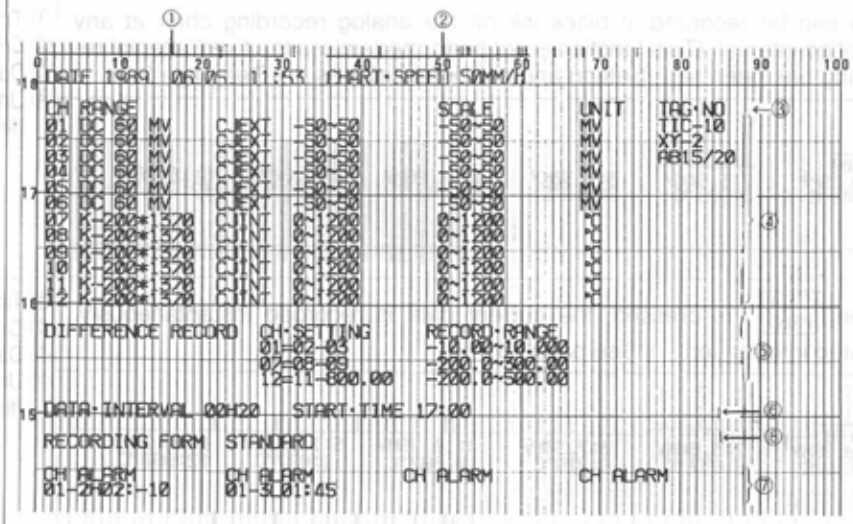
① Whenever a parameter setting is changed (new setting is stored in memory), the setting change mark (△) is printed on the right of the chart.
② If the setting change mark is not printed, it means that the new setting is not stored in the ROM; in this case, measurement/recording continues with the previous settings.



① Setting change mark

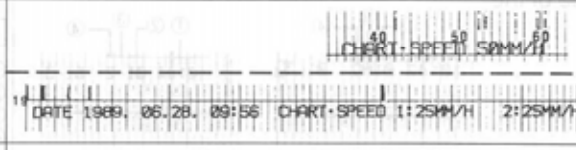
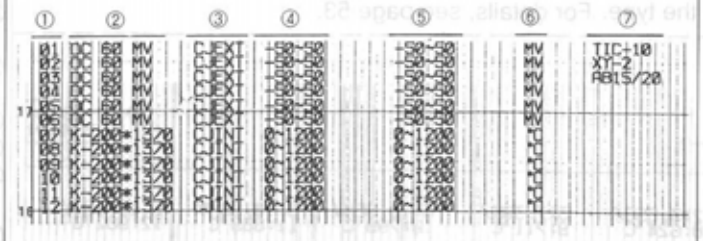
List printing

Press [9 LIST] to perform list printing; the parameters are printed on the chart.



① Clock
② Chart speed
③ Titles
④ Setting contents of each CH (range, scale, unit, tag)
⑤ Difference recording setting
⑥ Fixed-interval digital recording setting
⑦ Alarm setting
⑧ Recording format (optional)

Ref. Details of list printing ①

① Clock		25 May 1989, 17:35 (example shows 5 June)
② Chart speed		Standard specification External drive specification (Optional)
③ Titles		Titles of channel, range, scale, unit and tag
④ Setting contents of each CH		① CH No. ② Range type ③ CJ internal/external switching (This is not displayed for resistance thermometer inputs.) ④ Analog recording range ⑤ Scale range ⑥ Unit ⑦ Tag
⑤ Difference recording setting		① Difference recording set ② CH setting conditions ③ Analog recording range of difference recording CH
⑥ Constant-interval digital recording range		① Fixed-interval digital recording set ② Interval time ③ Start time

Ref. Details of list printing ②

⑦ Alarm	① CH ALARM 01-2H02:-10 CH ALARM 01-3L01:45 CH ALARM CH ALARM ② ④ ③ ⑤ Even when less than 4 alarm points have been set, details are printed for four points.	① Alarm set ② CH No. ③ Alarm No. ④ Alarm type ⑤ Output No. ⑥ Alarm value
⑧ Difference recording formats	Standard recording ① RECORDING FORM STANDARD	① Standard recording selected
	Automatic range switching ① ② ③ ④ ⑤ ⑥ ⑦ RECORDING FORM AUTO-RANGE CH ZERO (R1) (R2) (R3) (R4) SPAN 01 -1000 10000 20000 25000 30000 40000 02 -200 0 400 800 1200 03 -100 0 0 0 200 21 0 500 1000 1000 1000 2000	① Auto range switching selected ② Selected CH No. ③ Min./Max. values of 1st step ④ Max. value of 2nd step ⑤ Max. value of 3rd step ⑥ Max. value of 4th step
	Partially compressed/expanded recording ① ② ③ ④ ⑤ ⑥ RECORDING FORM SPREAD CH ZERO 1ST 2ND SPAN 01 -1000 10% 10000 50% 20000 50000 02 -200 20% 0 50% 1000 1200 03 -100 25% 0 200 06 5 10% 50 600 11 0 50% 500 80% 1000 2000 12 -150 25% 0 150	① Partially compressed/expanded recording selected ② Selected CH No. ③ Zero (0%) set value ④ First change point set value ⑤ Second change point set value ⑥ Span (100%) set value
	Zone recording ① ② RECORDING FORM PARALLEL 4 AREA ③→ 1ST 01~03 2ND 04.08 ←④ 3RD 05~07.09~10 4TH 12 ⑤ ⑥	① Zone recording selected ② Number of divisions (zones) ③ CH Nos. of 1st zone ④ CH Nos. of 2nd zone ⑤ CH Nos. of 3rd zone ⑥ CH Nos. of 4th zone

13. Relationship Between Chart Speed and Digital Printing

The items printed depend on the chart speed.

Printing Type / Chart Speed (mm/H)	1	2	3	4	5
	① CH No., ② Tag, ③ Scale, ④ Unit, ⑤ Time, ⑥ Time line, ⑦ Chart speed	① Chart speed, ② Time, ③ Time line	Time line only	Year/month/date printing	Same as Printing Type "1" except for ⑤ Time
1 ~ 9	—	Only 12:00	Every 6 hrs.	At power ON, at 00:00	—
10 ~ 15	Every 4 hrs.	—	Every 2 hrs.	At power ON, at 00:00	At 00:00
16 ~ 30	Every 4 hrs.	Every 2 hrs.	Every hour	At power ON, at 00:00	At 00:00
31 ~ 60	Every 2 hrs.	Every hour	—	At power ON, at 00:00	At 00:00
60 ~ 119	Every hour	—	Every 30 min.	At power ON, at 00:00	At 00:00
120 or more	Every 30 min.	—	—	At power ON, at 00:00	At 00:00

① The printing interval is determined based on the time schedule.

② Year/month/date printing is performed at 00:00 regardless of the chart speed.

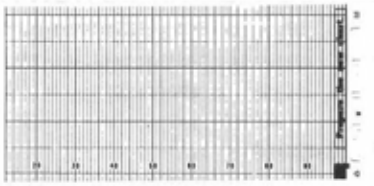
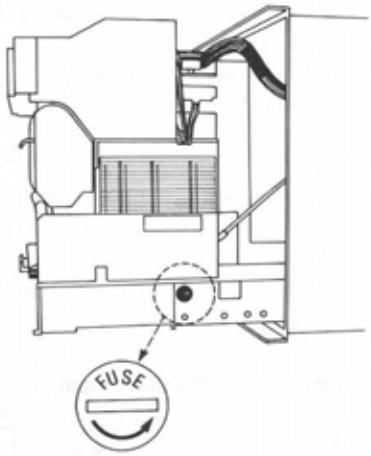
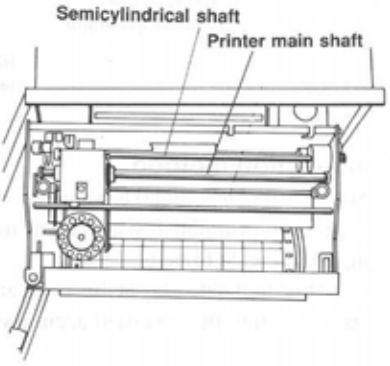
③ When the scale and unit are different or when tag setting has been performed, the CH Nos. are printed one channel at a time, at the intervals shown in the table above (in order from the smallest CH No.).

Ref. Digital printing time and printing types for different chart speeds

Printing Type / Time	Chart Speed (mm/H)						
	1 ~ 9	10 ~ 15	16 ~ 30	31 ~ 60	61 ~ 119	120 ~	Memo
00 : 00	3,4	4,5	4,5	4,5	4,5	4,5	
00 : 30	—	—	—	—	3	1	
01 : 00	—	—	3	2	1	1	
01 : 30	—	—	—	—	3	1	
02 : 00	—	3	2	1	1	1	
02 : 30	—	—	—	—	3	1	
03 : 00	—	—	3	2	1	1	
03 : 30	—	—	—	—	3	1	
04 : 00	—	1	1	1	1	1	
04 : 30	—	—	—	—	3	1	
05 : 00	—	—	3	2	1	1	
05 : 30	—	—	—	—	3	1	
06 : 00	3	3	2	1	1	1	
06 : 30	—	—	—	—	3	1	
07 : 00	—	—	3	2	1	1	
07 : 30	—	—	—	—	3	1	
08 : 00	—	1	1	1	1	1	
08 : 30	—	—	—	—	3	1	
09 : 00	—	—	3	2	1	1	
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
12 : 00	2	1	1	1	1	1	
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
18 : 00	3	3	3	1	1	1	
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
00 : 00	3,4	4,5	4,5	4,5	4,5	4,5	

14. Maintenance and Checking

① Periodical maintenance and checking are recommended if the recorder is to operate in the optimum condition.
② Perform maintenance by checking the following items, and supply and consumables and lubricate parts as required.

Maintenance/Check Items	Treatment
Topping up analog recording ink	The consumption of recording ink varies depending on the operating conditions, but the usual life of the ink is about 1.5 months of continuous recording. When the ink color fades, refer to section 6.1 on page 14, and top up the ink pad with one or two drops of the ink provided.
Plotter pen replacement	Although the life of the recording pen varies depending on the frequency of digital printing, the standard pen life is about 80,000 characters. When the ink color fades, refer to section 6.2 on page 15, and replace with the provided plotter pen.
Chart replacement	When the chart has nearly run out, the end mark appears on the right of the chart. When this happens, refer to section 6.3 on page 15 and replace with a spare chart. 
Fuse replacement	If the fuse blows, first set the Power switch to OFF, then identify the cause and replace the fuse. ① Slide out the inner rack, and remove the fuse cover on the right by turning the cover counterclockwise. ② Replace the blown fuse with the supplied 250 V, 5 A fuse. ③ To replace the fuse cover, push it in while turning it clockwise. ***Note:*** ***Turn the power OFF before replacement.*** *Be sure to set the Power switch to OFF before replacement.* 
Lubrication	To prevent wear and to maintain the recorder in its optimum operating condition, lubricate the mechanism periodically, at 6-month intervals. ① Wipe dirt or dust from the points to be lubricated before lubrication. Be particularly careful to clean the main shaft of the printer and the semicylindrical shaft at the rear of the printer. ② To lubricate, punch a hole in the provided lubricant container. ③ Supply one or two drops of lubricant; take care that lubricant does not flow away from the points being lubricated, and wipe off excessive lubricant. ④ Lubricating points • Printer main shaft, semicylindrical shaft, bearings • Clutch shaft and bearings • Other sliding parts 

15. Scale Inspection and Calibration

① With this recorder, different ranges can be set for each channel. Scale inspection must therefore be performed for each channel.
② For the scale, four types of adjustment (compensation) functions are provided as shown on the right. Use the appropriate function according to the phenomenon, etc.
③ All of these adjustments (compensations) are processed at a software level. There are no mechanical adjustments with trimmers, etc.

Adjustment (Compensation) Types

① Scale calibration (measured value zero/span adjustments) *
② Shift setting (shift setting of displayed value) *
③ Analog recording zero/span adjustments
④ Plotter pen time-axis adjustment
* Possible for each channel

15.1 SCALE INSPECTION AND CORRECTION

Inspection is performed separately for each channel. Even if the same range has been set, it is possible that there are errors in different channels.

Accuracy of inspection tools

The standard accuracy of the recorder is 0.1%. (See page 79 for details.)
Therefore, inspection tools must have an equal or higher accuracy. If not, the inspection will be meaningless.

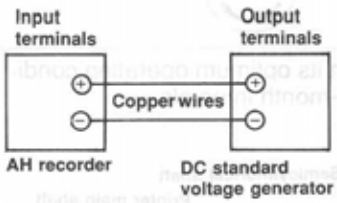
1) Preparation

① Set the Power switch to OFF, and connect wires according to the input signals (see diagram below). Connect the wire to the input terminals corresponding to the CH No. to be inspected.
② Attach the terminal cover.
③ Set the Power switch to ON, and press [DISPLAY] to select the single-point continuous display mode.
④ Display the CH No. to be inspected by operating [▲] or [▼] .
⑤ Start inspection more than 30 minutes after switching the power ON.

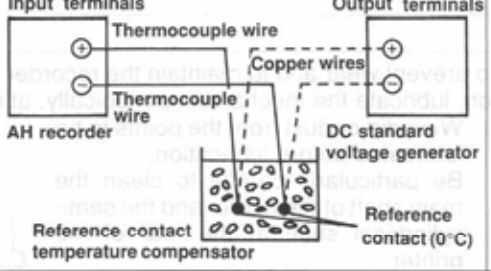
In case a reference contact temperature compensator (CJ) is not available

When the CJ switching for a thermocouple input is set to "1" (Internal) and if a reference contact temperature compensator is not available, use connection 1 below. In this case, set the CJ switching of the range setting to "0" only during inspection. However, the reference contact temperature compensation error cannot be compensated in this case.

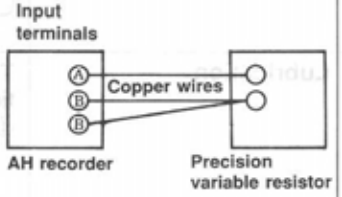
Connection 1 (DC voltage input)



Connection 2 (Thermocouple input)



Connection 3 (Resistance thermometer



Use three copper wires with the same length and thickness.

2) Inspection method

① Set the inspecting tool (DC standard voltage generator or precision variable resistor) to the input corresponding to the scale to be inspected.
② Read the digital display at this time, and check that the error is within the specified accuracy.
③ At least three points on the scale must be inspected; the minimum, maximum and center values. Ideally, checking should be performed at five or more points distributed at equal intervals.
④ Next, change the connection to the CH No. to be inspected, and inspect in the same way.
⑤ Also check the analog indication and dot printing positions.

Note 1: Caution in reading digital display values

Note that the digital display is shifted if shift setting has been performed (see section 15.3).

Note 2 : When a reference contact temperature compensator is used

Check that the reference contact temperature is 0°C. If an electronic reference contact temperature compensator is used, refer to its instruction manual for information on connection, etc.

15.2 SCALE CALIBRATION

15.2.1 Scale calibration per channel

① The following operation consists of the zero and span adjustments of the digital display and digital recording for the range setting of each channel.

② The calibration operations will not alter the analog recording position. Check the analog recording and calibrate it in case an error is found.

③ If the error found as a result of scale inspection is out of the accuracy tolerance, calibrate it as described below.

1) Preparation

① Connect the inspection tool to the CH No. to be calibrated. → See "Preparation" in section 14.1 "Scale calibration".

② Be sure to attach the terminal cover. → See "Ref. 1".

③ Set the 8-element DIP switch to the following settings. (Nos. 6 and 7 to OFF, No. 8 to ON, Nos. 1 to 5 not changed)

④ Set the Power switch to ON. The scale calibration-select mode display is initiated.

⑤ Start calibration more than 30 minutes after switching the power ON.

Ref. 1 Attaching the terminal cover

The temperatures of the terminals drop when they are exposed to an external air flow. Therefore, be sure to attach the terminal cover, especially in the case of thermocouple inputs.

Ref. 2 8-element DIP switch

2) Scale calibration/select mode display format

① Scale calibration per channel
② Shift setting per channel
③ Analog recording zero/span adjustments
④ Plotter pen time-axis adjustment

3) Calibration method

1 Obtain the scale calibration-working mode display

Move the cursor to the position of 0 and press ENT to obtain the scale calibration-working mode display.

2 Select the CH No.

Set the CH No. to which the inspection tool is connected, and press ENT to initiate the zero adjustment display.

3 Zero adjustment (acquisition of compensation data)

Apply zero input → ENTRY

The 0% input of the analog recording range (left end input) is displayed. Apply that value from the inspection tool and press ENT to initiate the span adjustment display.

4 Span adjustment (acquisition of compensation data)

Apply span input → ENTRY

The 100% input of analog recording range (right end input) is displayed. Apply that value from the inspection tool, and press ENT to return to the zero adjustment display.

5 Calibrate other channels

Steps 2 to 4

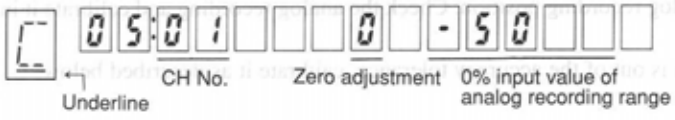
① Connect the inspection tool to the next CH No. to be calibrated, switch the power ON and leave the recorder for more than 15 minutes, then start calibration.
② Calibrate other channels in the same way (steps 2 to 4).

6 Store compensation data in memory and end

SET END (The underline flickers, and setting change mark is printed.)

① Press SET END to store the acquired compensation in the ROM.
② To end the operation, set the Power switch to OFF, return the DIP switch to its original settings (Nos. 6 to 8 to OFF), and set the Power switch to ON again.

Zero adjustment display format



Span adjustment display format

Note 1: Selection of a CH without range setting

An error occurs if a CH for which the range has not been set is selected in step 2 of the above procedure.

Note 2: When SET END is pressed with the display of step 2 or 3 above

The scale calibration of the selected channel will not be performed.

Note 3: When Clear is assigned with the display of step 2 or 3 above

If Clear is assigned (0 CLEAR + ENT), the compensation data for the channel is reset, and the display returns to that in step 1.

15.2.2 Shift setting per channel

① The following operation consists of the adjustment of the shift amount of the digital display and digital recording for the scale setting of each channel.
② The shift setting operation will not affect analog recording.
③ This operation is used to shift the displayed or recorded value slightly even when the measured value (digital display, recording) is correct.
④ When the shift setting has been done, the values are shifted by the set amount. Do not forget this when you inspect the scale.

Example of Shift Setting

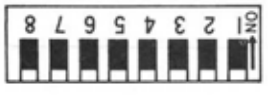
Scale setting : 0 - 1200
Measured value : 1035
When it is required to read the measured value as 1040 although the scale inspection is normal, press ▲/7 to display 1040. (The shift amount is "5".)

1) Preparation

① Connect the inspection tool to the CH No. to be shifted. →See "Preparation" in section 15.1 "Scale inspection and correction".
② Attach the terminal cover and set the 8-element DIP switch to the following settings.
(Nos. 6 and 7 to OFF, No. 8 to ON, Nos. 1 to 5 not changed)
③ Set the Power switch to ON. The scale calibration-select mode display is initiated.
④ Start setting more than 30 minutes after switching the power ON.

Ref. 1 8-element DIP switch

No.6·7 : OFF
No.8 : ON



2) Scale calibration-select mode display format

① Scale calibration per channel
② Shift setting per channel
③ Analog recording zero/span adjustment
④ Plotter pen time-axis adjustment

3) Setting method

1 Obtain the scale calibration-shift mode display.

Move the cursor to the position of 5 and press ENT to obtain the scale calibration-shift mode display.

2 Select the CH No.

Set to the CH No. to which the inspection tool is connected, and press ENT to obtain the shift setting display with which the measured value is displayed.

3 Perform shift setting.

The cursor appears at the lowest digit of the measured value. Set the desired shift value with ▲ or ▼ and press ENT to return to the display in step 1.

4 Perform the shift setting of other channels.

Steps 2, 3

① Connect the inspection tool to the next CH No. to be shifted, switch the power ON, leave the recorder for more than 15 minutes, then start setting.
② Perform the shift setting of other channels in the same way (steps 2 and 3).

5 Store shift setting data in memory and end.

SET END (The underline flickers, and setting change mark is printed.)

① Press SET END to store the set shift amount in the ROM.
② To end the operation, set the Power switch to OFF, return the DIP switch to its original settings (Nos. 6 to 8 to OFF), and set the Power switch to ON again.

Shift setting display format

***Note 1:** Selection of a CH without range setting*

An error occurs if a CH for which the range has not been set is selected in step 2 of the above procedure.

***Note 2:** When SET END is pressed with the display of step 2 or 3 above*

The shift setting of the selected channel will not be performed.

***Note 3:** When Clear is assigned with the display of step 2 or 3 above*

If Clear is assigned (0 CLEAR + ENT), the shift value for the channel is reset (to zero).

15.2.3 Analog recording zero/span adjustments

① The following operation consists of the zero and span adjustments of analog dot printing on the chart.
② These adjustments do not affect the measured values (digital display and recording).

1) Preparation

① Set the 8-element DIP switch to the following settings. (Nos. 6 and 7 to OFF, No. 8 to ON, Nos. 1 to 5 not changed)
② Set the Power switch to ON. The scale calibration-select mode display is initiated.
③ Start adjustment more than 30 minutes after switching the power ON.

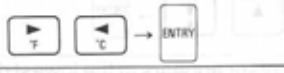
Ref. 1 8-element DIP switch

2) Scale calibration-select mode display format

① Scale calibration per channel
② Shift setting per channel
③ Analog recording zero/span adjustments
④ Plotter pen time-axis adjustment

3) Calibration method

1 Obtain the scale calibration-analog calibration mode display

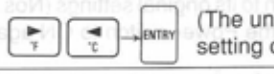


Move the cursor to the position of " A ", and press ENT to obtain the scale calibration-analog calibration mode display. The pointer will move to the left end (zero position) of the chart, dot printing is performed and the chart is fed.

2 Zero adjustment

① Every time ▶ is pressed, the dot printing position moves slightly to the right. Every time ◀ is pressed, it moves slightly to the left.
② When the pointer comes to the desired position (which is normally the 0% position of the chart), press ENT.
③ The pointer moves to the right end of the chart and dot-printing recording starts.

3 Perform span adjustment and store the compensation data in memory



(The underline flickers, and setting change mark is printed.)

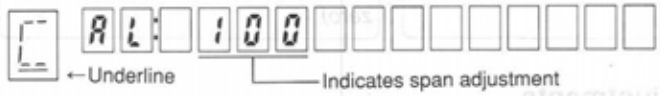
① Move the pointer to the desired position (which is normally the 100% position of the chart) by operating ▶ or ◀, and press ENT.
② The compensation data is stored in the ROM, and the display changes to the select mode display.

4 End the operation

Set the Power switch to OFF, return the DIP switch to its original settings (Nos. 6 to 8 to OFF), and set the Power switch to ON again.

Zero adjustment display format

Span adjustment display format



15.2.4 Plotter pen time-axis adjustment

① The following operation consists of the adjustment of the plotter pen (for use in digital printing and recording) in the time-axis direction.
② This adjustment is necessary when there is a discrepancy between the time line and the timing of the dot printing position.

Time Line

The time line is printed at a certain interval which varies with the chart speed. → See pagr 50

1) Preparation

① Set the Power switch to OFF, and set the 8-element DIP switch to the following settings.
(Nos. 6 and 7 to OFF, No. 8 to ON, Nos. 1 to 5 not changed)

② Set the Power switch to ON. The scale calibration-select mode display is obtained.

Ref. 1 8-element DIP switch

No.6·7 : OFF
No.8 : ON

2) Scale calibration-select mode display format

① Scale calibration per channel
② Shift setting per channel
③ Analog recording zero/span adjustment
④ Plotter pen time-axis adjustment

3) Setting method

1 Obtain the scale calibration-time axis mode

Move the cursor to the position of " P ", and press ENT to obtain the scale calibration-time axis mode display.
The plotter pen draws a straight line from the zero position of the time axis (Y axis) to the span position, the chart is fed by only 4 mm, and recording (dot printing) is performed in the section between the 40% and 60% positions of the chart at intervals of 1 mm.

2 Open the display section

Slide out the rack, lift the left side of the display section, and open it by pulling it towards the front taking care not to hit the analog pointer (cursor pointer).

3 Perform time axis adjustment

▲/7

Every time ▲/7 is pressed, the chart is fed by 0.05 mm. Press ▲/7 until the dot printing recording is aligned with the line drawn by the plotter pen.

4 Store compensation data in memory

ENTRY (The underline flickers, and the setting change mark is printed.)

Press ENT when the line drawn by the plotter pen is aligned with the dot printing recording.
The data is stored in the ROM and the display returns to the scale calibration-select mode display.

5 End operation

Set the Power switch to OFF, return the DIP switch to its original settings (Nos. 6 to 8 to OFF), and set the Power switch to ON again.

Time axis setting display format

Note 1: When Clear is assigned

If Clear is assigned (0/CLEAR + ENT), the compensation data is cleared and step 1 is performed again.

Note 2: Is the plotter pen inserted properly?

Ensure that the plotter pen is inserted completely into the pen holder of the printer.

16. OPTIONS

16.1 EXTERNAL DRIVE SIGNAL

① By applying a (short-circuit or open) contact signal to the external drive terminals, recording can be started and stopped, the chart feed speed can be selected or instantaneous digital recording can be commanded, without operating front panel keys.

② Any of three chart feed speeds which have been preset with the front panel keys can be selected.

External Drive Functions

① Start/stop of recording
② Selection of chart feed speed, among three preset speeds
③ Execution of instantaneous digital recording

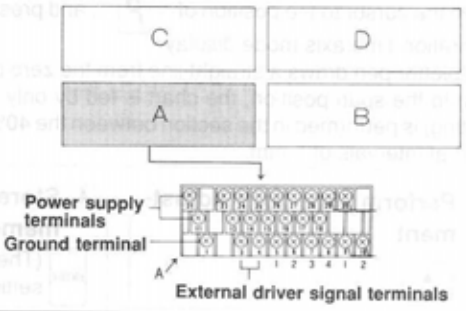
1) Relation between external drive function and terminals

The external drive terminals are located in block A on the rear panel terminal board (on the right side of the power supply/ground terminals).

Function			Terminal No. and signal			
Recording function*	Operation (chart feed speed)	CS1	Between terminals ⑬ and ⑭	Open	Between pin ㉓ and ㉔	Open
		CS2		Open		Short-circuit
		CS3		Short-circuit		Open
	Stop			Short-circuit		Short-circuit
Execution of instantaneous digital recording			Short-circuit between terminals ③ and ④ (for more than 0.5 seconds)			

* The external drive does not function when the RECORD ON indicator on the front panel is not lit (when recording is inhibited). Press RECORD ON/OFF key to enable the recording function.

Terminal board and external drive terminals



Note 1:When chart feed speed is switched

Even when the chart feed speed is switched, the settings for fixed-interval digital recording will not be cleared.
The setting will be cleared when the value of any of the three chart feed speeds is changed. Reset as required.

***Note 2:* Chart feed speed and interval for fixed-interval digital recording**

If the interval time setting is not possible at the chart feed speed selected (refer to Note 1 on page 35), constant-interval digital recording will be performed at the time interval which is as close as possible to the registered interval time(*).
** An integer multiple of the registered interval time.*

***Note 3:* Judgment condition of the interval time for fixed-interval digital recording**

The judgment condition for fixed-interval recording is related to the current chart feed speed. If the interval time is changed when the recording function is stopped, the chart feed speed immediately before it was stopped will be used for judgment.

Ref. 1: Recording function stop condition

The same operation as when the RECORD ON/OFF key on the front panel is pressed will be performed. For details, refer to page 18.
Note:When performed during list printing, printing will be interrupted.

Ref. 2: Instantaneous digital recording

The same operation as when the DATA PRINT key on the front panel is pressed will be performed. For details, refer to page 19.
Note:This will not be accepted during setting the parameters.

Ref. 3: RECORD ON indicator

For the external driver functions to operate, the RECORD ON indicator in the status display on the front panel should be lit. When recording is stopped by the external drive, the RECORD ON indicator will go off.

Ref. 4: Setting of CS1 - 3

These are set by the same procedure as the chart feed speed (see page 31), however, the method of storing into ROM is different. For details. refer to item 2) (on the next page).

Ref. 5: In the key lock condition

When the KEY LOCK indicator in the status display is lit, no front panel key inputs will be accepted.
→See page 6.

Ref. 6: If short-circuit is released mid-way

① The recording operation also affects the selection of the chart feed speed. If the two lines between terminals ⑬ and ⑭, ㉓ and ㉔ are open, CS1 will be selected.
② When instantaneous digital recording has been commanded, if the short-circuit is released after 0.5 seconds has elapsed, the function will be executed.

2) Chart feed speed setting (3 speeds)

This procedure is for setting the three chart feed speeds. The setting range is as shown on the right, and is variable in 1-mm steps.

Setting range (▽Initial value ... 25 mm/H)

Unit: mm/H

① Chart feed speed mode display ..... Initial values are shown.

How to check the display

▼: Position of the digit where the cursor (_) appears when the chart feed setting value appears in the display.

S : Represents the chart feed speed mode
← Underline

② Setting items and key operations

Setting items:

① CS1 : 4 digits
② CS2 : 4 digits
③ CS3 : 4 digits

Key operations:

① For the lower function of a dual-function key such as 1 CHART 0 CLEAR, press the key with the SHIFT key depressed.
② When a numeric key is pressed, the cursor moves to the next digit. (When the cursor is under the bottom digit, it is moved using the ◄ key.)

③ Setting (confirmation) procedure

1 Set to the chart feed speed mode

1 CHART (SHIFT + 1 CHART)

The display is changed to the chart feed speed mode.

2 Confirmation

▲ / ▼ %

Setting conditions of other CS (chart speed) number can be checked using these keys.
When setting, proceed to step 3.

3 Set to the setup mode

SET END (Underline and cursor appear)

The digit over the cursor can be set (or modified).
►: Moves the cursor to the right.
◄: Moves the cursor to the left.

4 Designate the CS No.

▲ / ▼ %

Numbers from 1 to 3 can be used.

5 Enter the chart feed speed

0 CLEAR ~ 9 LIST

Enter the chart feed speed (mm/H) as four digits. Leaving a space will cause an error.
(To set 25 mm/H, enter 0025.)

6 Temporary registration

ENTRY (The display is changed to the next CS No.)

After completing the setting for one CS No., be sure to store it temporarily. (If this operation is not performed, the set contents will not be stored in memory.)

7 Setting and registration of other CS No

0 CLEAR ~ 9 LIST ENTRY

Perform in the same way (steps 4 - 6) for other CS numbers.

8 Memorization

SET END (Underline blinks and setting change mark will be printed.)

The contents registered in step 6 are stored in memory (ROM), and when the operation is completed, the display before entering the setup mode will resume.

④ Confirmation procedure ..... Confirmation is possible in step [1], [2] in the above item [3].

When the [DISPLAY RECORD FORMAT] key is pressed, the display mode before entering the setup mode will resume.

Ref. 7: How to clear

When the [0 CLEAR] key is pressed, the initial values are displayed.
(25 mm/H for all three speeds.)

Ref. 8: Initial value and initialization

Initial	25 mm/H (for all 3 speeds)

Related items →See page 46

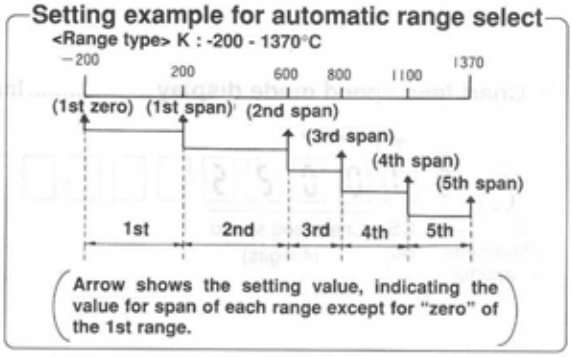
Ref. 9: To return to the display mode

To return to the display mode during setting or checking, press the [DISPLAY RECORD FORMAT] key.

16.2 AUTOMATIC RANGE SELECT RECORDING

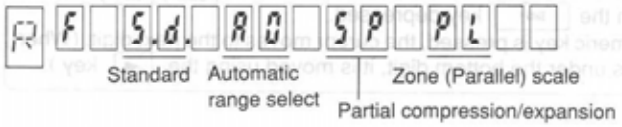
① This can be set for each channel separately.
② Recording ranges can be set for up to 5 steps.
③ For range selection, when the measured value exceeds zero or the span selected for each step by 0.5 mm, the range is changed automatically to the next step.
④ The relationship between the range step number and each span setting value should be as follows:
1st span < 2nd span < 3rd span ....
⑤ The zero point of the 1st step can be set arbitrary. Also the span for the final step can be set arbitrary.
⑥ Value setting is done by setting the scale value.

Setting example for automatic range select



1) Display format ..... ▼ shows the initial position (digit).

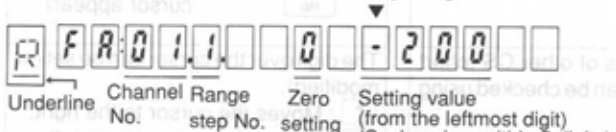
① Analog recording format select mode



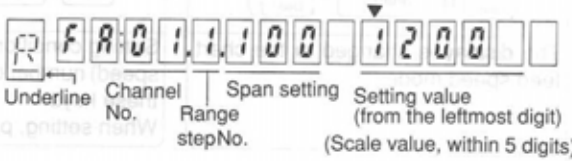
Decimal point is shown in the selected format. When the setup mode is entered, the decimal point will go out and the cursor appears.

② Automatic range select display

③ Zero setting display for the 1st range step



④ Span setting display for 1st to 5th range step



2) Setting procedure

[1] Set to the select mode

[DISPLAY RECORD FORMAT] (SHIFT + [DISPLAY RECORD FORMAT])

The display is changed to the analog recording format select mode.
→Display format ①

[2] Set to the setup mode

[SET END] (Underline appears)

The decimal point goes out in the selected format and the cursor appears.
→Display format ①

[3] Selection of automatic range select mode

Move the cursor to [A] and press [ENTRY]

The display is changed to the automatic range select mode.
→Display format ②

4 Channel No. setting

0 CLEAR ~ 9 LIST → ENTRY

Set the channel No. in which automatic range select recording is required, and press the ENTRY key. The display is changed to format ③.

5 Zero setting for the 1st range

0 CLEAR ~ 9 LIST . CLOCK — → ENTRY

Set the zero point for the 1st range step and press the ENTRY key. The display is changed to the span setting display ④ for the 1st step.

6 Span setting for the 1st range

0 CLEAR ~ 9 LIST . CLOCK — → ENTRY

Set the span for the 1st range step and press the ENTRY key. The display is changed to the span setting display for the 2nd step.

7 Span setting for the 2nd to 5th ranges

0 CLEAR ~ 9 LIST . CLOCK — → ENTRY

Set the span for the 2nd range step and press the ENTRY key. Then, in the same way, set the span for the 3rd to 5th range steps.

8 Memorizing setting contents

SET END (Underline blinks and the setting change mark is printed)

When the display format is returned to ③ and the SET END key (SHIFT + SET END) is pressed, the setting contents are stored in ROM, and when the operation is completed, the display mode before entering the setup mode will resume.

Ref. 1: When setting another channel

After setting step 8 , repeat the operations from step 1 .

3) Confirmation procedure ..... After the operation in step 1 in the above item 2), press the ENTRY key to enter the confirmation mode.

Then, each time the ENTRY key is pressed, the setting contents for the selected channel will be checked in sequence. Press the ▲ or ▼ key to change to another channel.

When the DISPLAY RECORD FORMAT key is pressed, the display before entering the confirmation mode will resume.

4) Setting example

Setting condition

Range type No.: 20 (K : –200 –1370°C)
Channel No. : 07 (Channel 7)
Range step : 3 (division), see below
1st range step : 500 - 700°C
2nd range step : 700 - 900°C
3rd range step : 900 - 1100°C

Step 1 : Set to the selection mode. (→ Refer to Setting Procedure 1 .)
Step 2 : Set to the setup mode. (→ Refer to Setting Procedure 2 .)
Step 3 : Select the automatic range select mode. (→ Refer to Setting Procedure 3 .)
Step 4 : Set the channel No. "07". → ①
Step 5 : Set the zero point for the 1st range step to "500" and press the [ENTRY] key. →①
Step 6 : Set the span for the 1st range step to "700" and press the [ENTRY] key. →②
Step 7 : Set the span for the 1st range step to "900" and press the [ENTRY] key. →③
Step 8 : Set the span for the 1st range step to "1100" and press the [ENTRY] key. →④
Step 9 : Press the [ENTRY] key twice to resume the zero setting display for the 1st range step. →①
Step 10 : Press the [END] key to store the setting contents in memory. (→ Refer to Setting Procedure 8 .)

The above operation performs setting for the automatic range select recording of channel 07. Perform the same for other channels.

Note 1: Display format to store in memory

Perform storage after returning the display to the 1st range step zero setting mode. If the memory store operation is performed in the span setting mode (the [SET END] key is pressed), the settings of the selected channel will not be stored in memory.

Note 2: When [0 CLEAR] key is pressed

The display is cleared and the display format ② resumes. And when the [SET END] key is pressed after pressing the [ENT] key, the settings for the selected channel will be cleared.

Ref. 2: When there are range steps for which no setting is required

When storing in memory, the display should be returned to the zero setting mode for the 1st range step. Since the range step number is advanced one at a time, skip unnecessary numbers by pressing the [ENT] key repeatedly.

Ref. 3: To return to standard recording

Set the analog recording format select mode and enter the setup mode, then move the cursor to "S" of the "Sd" display and press the [ENT] key.

To return to the automatic range select recording, perform the operations in steps [1] - [3], and press the [SET END] key.

Ref. 4: Digital printing for only one range step

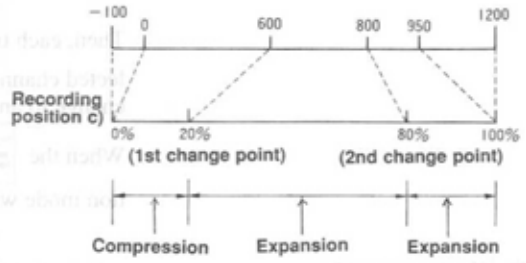
Fixed-interval digital printing prints the scales in channel number order, as well as the range step number. If there is only one range step, "R1" will not be printed.

16.3 PARTIAL COMPRESSION/EXPANSION RECORDING

① This can be set for each channel separately.
② This function is used to compress and expand a specific area of the analog recording range.
③ Since up to 2 change points can be set, compression/expansion can be different in up to three areas.
④ To set up, first set the recording position (%) at a change point then set the scale value for analog recording at the change point (%).
⑤ In the example on the right, temperatures between -100 and 0°C are recorded at the 0% position and temperatures between 950 and 1200°C are recorded at the 100% position.

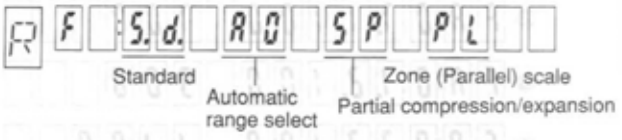
Setting example for partial compression/expansion

<Analog recording range> –100 ~ 1200°C



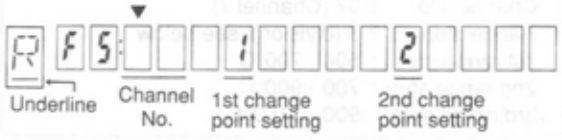
1) Display format ..... ▼ shows the initial position (digit).

① Analog recording format select mode



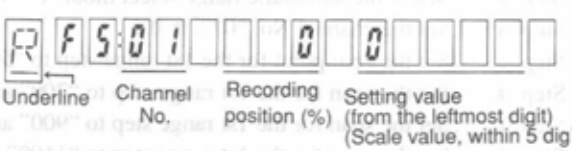
(Decimal point is shown in the selected format. When the setup mode is entered, the decimal point will go out and the cursor will appear.)

② Partial compression/expansion display



③ Setting display for the 1st and 2nd change points

④ Input value setting display for each recording position



2) Setting procedure

1 Set to the select mode

DISPLAY RECORD FORMAT (SHIFT + DISPLAY RECORD FORMAT)

The display is changed to the analog recording format mode display.
→Display format ①

2 Set to the setup mode

SET END (Underline appears)

The decimal point goes out in the selected format and the cursor appears.
→Display format ①

3 Selection of partial compression/expansion

Move the cursor to the [S] of " S P " and press ENTRY

The display is changed to the partial compression/expansion display mode.
→Display format ②

4 Channel No. setting

0 CLEAR ~ 9 LIST

Set the channel No. for which partial compression/expansion is required.

5 Setting of 1st and 2nd change points

0 CLEAR ~ 9 LIST → ENTRY

Set each change point at the recording position (%) as 2 digits (enter "0.5" for 5%), and press the ENT key. The display is changed to the display ④ for the 1st step.

6 Setting for each recording position

0 CLEAR ~ 9 LIST . CLOCK — → ENTRY

① Set the scale value at the 0% position and press the ENT key.
② In the same way, enter the scale value for each change point and the scale value at the 100% position.

7 Setting of other channels

0 CLEAR ~ 9 LIST . CLOCK — → ENTRY

When setting other channels is also required, perform in the same way (steps 4 - 6).

8 Memorizing setting contents

SET END (Underline blinks and the setting change mark is printed)

With the display format ③ appeared, press the SET END key (SHIFT + SET END), the setting contents are stored in ROM, and when the operation is completed, the display mode before entering to the setup mode will resume.

3) Confirmation procedure .....

After the operation in step 1 in the above item 2), press the ENTRY key to enter the confirmation mode. Then, each time the ENTRY key is pressed, the setting contents for the selected channel will be displayed in sequence. Press the ▲ or ▼ key to change to another channel. When the confirmation DISPLAY RECORD FORMAT key is pressed, the display before entering the confirmation mode will be resumed.

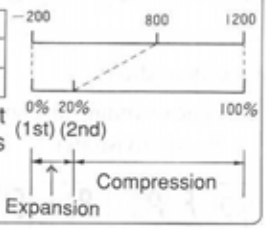
4) Setting example

Setting condition

Analog recording range : –200 –1200°C
Channel No. : 03 (Channel 3)

Recording position	Recording range
0~ 20 %	–200%~ 800°C
20~ 100%	800~ 1200°C

Only one change point is set here. The 1st change point is set at the 20 (%) position.



① FR F S:0 3 1 2
② F S:0 3 1 2 0 2
③ F S:0 3 0 -2 0 0
④ F S:0 3 2 0 8 0 0
⑤ F S:0 3 1 0 0 1 2 0 0

Step 1 : Set to the selection mode. (→ Refer to Setting Procedure 1.)
Step 2 : Set to the setup mode. (→ Refer to Setting Procedure 2.)
Step 3 : Select the partial compression/expansion mode. (→ Refer to Setting Procedure 3.)
Step 4 : Set the channel No. "03". →①
Step 5 : Set the 1st change point to 20% and press the [ENTRY] key. →②
Step 6 : Set the scale value at the recording position 0% to "-200" and press the [ENTRY] key. →③
Step 7 : Set the scale value at the recording position 20% to "800" and press the [ENTRY] key.→④
Step 8 : Set the scale value at the recording position 100% to "1200" and press the [ENTRY] key. →⑤
Step 9 : After the display ② appears, press the [END] key to store the setting contents in ROM. (Refer to "Setting Procedure" step 8 to store the Setting contents.)
With the above operation, the setting for the partial compression/expansion of channel 03 is completed. Set other channels in the same way.

***Note 1:* Display format when storing in memory**

Perform after returning the display to the setting mode for the 1st and 2nd change points. If the memory operation is performed in another mode (scale value setting mode for each recording position) by pressing the [SET] key ([SHIFT] + [SET]), the settings for the selected channel will be cleared.

***Note 2:* Range setting of the selected channel**

If a channel for which no range setting has been performed (skip channel) is selected, setting will not be accepted, and this will cause a setting error (S.E).

Ref 1: When only one change point is required

Set the value for the 1st change point in step 5, then press the [ENTRY] key.

Ref. 2: To return to the standard recording mode

Set to the analog recording format select mode and enter the setup mode, then move the cursor to the "S" of "Sd" and press the [ENTRY] key.

To return the partial compression/expansion recording mode again, perform the operations in steps 1 - 3, and press the [SET] key.

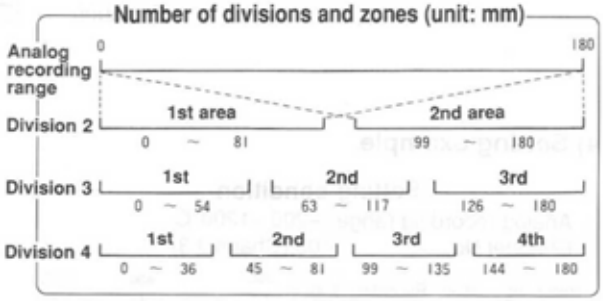
Ref 3: Conditions for change point setting

The values for each point should satisfy the following conditions:
0 ≦ 1st change point < 2nd change point < 100
If the above conditions are not followed, it will cause a set error (S.E).

16.4 ZONE (PARALLEL) RECORDING

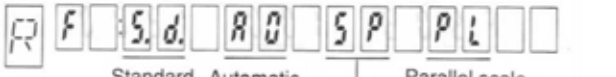
① With the zone recording function, the recording range can be divided into up to four zones and different channels can be assigned to each zone.
② The number of divisions and the recording areas are shown in the figure on the right. Each of these smaller recording areas is used as an analog recording zone for each range setting.
③ To set up, first set the number of divisions and then assign the input channel Nos. to be used for recording.

Number of divisions and zones (unit: mm)



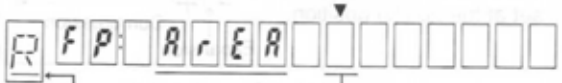
1) Display format ..... ▼ shows the initial position (digit).

① Analog recording format select mode



The decimal point is shown in the selected format. When the setup mode is entered, the decimal point will go out and the cursor appears.

② Zone recording display (Display designating the number of divisions)



③ Channel No. select for 1st zone

(⌐ : when continuous channels are selected
. : when non-continuous channels are selected)

④ Channel No. select for 2nd - 4th zone

(⌐ : when continuous channels are selected
. : when non-continuous channels are selected)

2) Setting procedure

1 Set to the select mode

[DISPLAY RECORD FORMAT] ([SHIFT] + [DISPLAY RECORD FORMAT])

The display is changed to the analog recording format mode display.
→ Display format ①

2 Set to the setup mode

[SET END] (Underline appears)

The decimal point goes out in the selected format and the cursor appears.
→ Display format ①

3 Selection of zone recording

Move the cursor to the [P] of " P L " and press [ENTRY]

The display changes to the zone recording display mode.
→ Display format ②

4 Designation of number of zones

[2 TAG] ~ [4 SCALE] → [ENTRY]

Set the number of zones to 2 - 4 as required, then press the [ENTRY] key.
→ Display format ③

5 Selection of channel Nos. for 1st zone

[0 CLEAR] ~ [9 LIST] ([—] [.]) → [ENTRY]

Select the channel Nos. that are to be recorded in the 1st zone, and press the [ENTRY] key.
→ Display format ③

(When continuous channels are selected, insert [⌐] ([SHIFT] + [SET END]) between the first and last channels. When non-continuous channels are selected, insert [.] (decimal point) between channels.)

6 Selection of channels Nos. for 2nd - 4th zones

[0 CLEAR] ~ [9 LIST] ([—] [.]) → [ENTRY]

Perform the same to select each channel.
→ Display format ④

7 Memorization of setting contents

[SET END] (Underline blinks and the setting change mark is printed)

With the display format ② appears, press the [SET END] key ([S [SHIFT] + [SET END]); the setting contents are stored in ROM, and when the operation is completed, the display mode before entering the setup mode will resume.

3) Confirmation procedure ..... After the operations in step 1 in the above item 2), press the [ENTRY] key to enter the confirmation mode. Then, each time the [ENTRY] key is pressed, the setting contents for the selected channel will be checked in sequence. When the [DISPLAY RECORD FORMAT] key is pressed, the display before entering the confirmation mode will resume.

4) Setting example

Setting condition

No. of divisions : 3 (3 zones)
1st zone : Channels 01 - 06, 08
2nd zone : Channels 07, 09
3rd zone : Channels 10 - 12

Step 1 : Set to the selection mode. (→ Refer to Setting Procedure 1.)
Step 2 : Set to the setup mode. (→ Refer to Setting Procedure 2.)
Step 3 : Select the zone recording mode. (→ Refer to Setting Procedure 3.)
Step 4 : Set the No. of zones to "3" and press the [ENTRY] key. →①
Step 5 : Set channels 01 - 06 and 08 for the 1st zone. →②
Step 6 : Set channels 07 and 09 for the 2nd zone, and press the [ENTRY] key. →③
Step 7 : Set channels 10 - 12 for the 3rd zone, and press the [ENTRY] key.→④
Step 8 : Set the display to the division number select mode. →①
Step 9 : Press the [END] key to store the setting contents into ROM. (Refer to "Setting Procedure" step 7 to store the Setting contents.)

The above operation completes the settings for zone recording.

***Note 1:* Display format when storing in memory**

After setting for all zones is completed, the setting contents can be stored in memory in any display format (② -④). Although the display format ② is shown in step 7, this does not imply any limitation.

***Note 2:* Selection of all channels and duplication**

Be sure to designate all channels for which ranges have been set. If a channel is not designated, the pointer may swing beyond the scale. Also, if the same channel is designated repeatedly, it will causes a setting error (S.E).

Ref.: To return to the standard recording mode

Set to the analog recording format select mode and enter the setup mode, then move the cursor to the "S" of the "Sd" display and press the ENTRY key.

To return to the zone format select mode, perform the operations in steps 1 - 3, and press the SET/END key.

16.5 VARIATION RATE ALARM

① With this function, when the variation of the input (measurement value) in a fixed time exceeds a preset value, an alarm is generated.

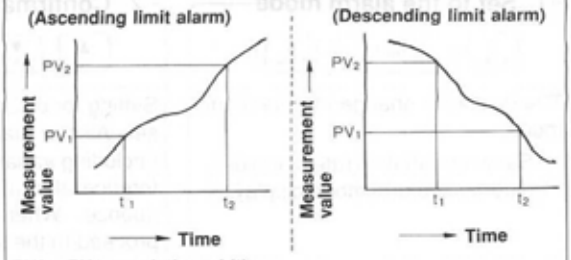
② A fixed time is represented by the following equation:
Measurement period x No. of sampling times for input
(where,
Measurement period : 5 seconds for 6-point input, 10 seconds for 12-point input,
No. of sampling times for input : 1 - 9 (arbitrary setting)

③ There are two types of variation rate alarm; ascending limit and descending limit. The ascending limit results in an alarm being output when the variation of the rate of increase of the input exceeds the preset value in a fixed time. The descending limit results in alarm being output when the variation of the rate of decrease of the input exceeds the preset value in a fixed time.

④ Up to four alarm points are available for each channel, and any required type can be selected (refer to *1 on page 72) arbitrarily.

⑤ There are two alarm outputs, and the combination of the alarm points and the alarm output points can be made arbitrarily.

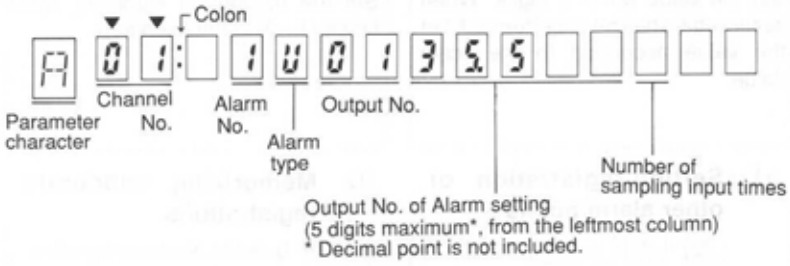
Variation rate alarm:



PV2 – PV1 = variation width
t2 – t1 = measurement period x No. of input sampling times (n)
(Descending limit alarm)

<Remark> The setting of the variation rate alarm is performed in a similar way as the normal alarm described in item 8.6 (page 32).

1) Variation rate alarm display format ..... The initial value is only for "H".



How to check display section

▼▼: Column where cursor appears when the display is changed to the alarm setting mode.

: Represents the alarm mode (same as variation rate alarm or difference alarm mode)
Underline

2) Setting items and key operation

Setting items

The following items can be set for each alarm point:

①	Channel No.	: 2 digits
②	Alarm No.	: 1 digit
③	Alarm type	: 1 digit
④	Output No.	: 2 digits
⑤	Alarm value	: Within 5 digits
⑥	No. of sampling input times	: 1 digit

Key operation

① For the lower function of dual-function keys such as [8 ALARM], [0 CLEAR] or [SET END], press with the [SHIFT] key held depressed.

② When a numeric key is pressed, the cursor shifts to the next column.

③ Only the channel No. is displayed by a two-digit cursor, and when the 10's digit is entered, a "blank" will be entered as the 1's digit and when the 1's digit is entered, the cursor moves to the next column.

3) Setting procedure

1 Set to the alarm mode

[8 ALARM] ([SHIFT] + [8 ALARM])

The display is changed to the alarm mode.

(Same as variation rate alarm or difference alarm mode display.)

2 Confirmation

[▲ /] [▼ %]

Setting for other alarm points can be set. All the alarm points registered (including variation rate alarm or difference alarm) are displayed in sequence. When setting the alarm, proceed to the subsequent step 3 .

3 Set to the setup mode

[SET END] (Underline lights, cursor appears)

The cursor lights at the left end. Setting (or modification) of the digit indicated by the cursor is possible.

([▶ Y] : Moves the cursor to the right,
[◀ C] : Moves the cursor to the left)

4 Designation of channel No.

[0 CLEAR] ~ [9 LIST]

Select the channel No.

5 Designation of alarm No.

[1 CHART] ~ [4 SCALE]

Since up to four alarm points can be set, designate the alarm No. to be set.

6 Selection of alarm type

[▲ /] [▼ %] (Display is changed in the order "H", "L", "b", "S", "U" and "d".)

Select the alarm type between an ascending limit alarm (U) and descending limit alarm (d).

H : Upper limit alarm
U : Ascending limit alarm
L : Lower limit alarm
d : Descending limit alarm
(b: Difference upper limit alarm
S: Difference lower limit alarm)

7 Designation of output No.

[1 CHART] [2 TAG] (for "O", refer to "Reference 10".)

Designate the output No. to which the alarm signal is to be output.
If "0" is entered, no signal is output and only the alarm display appears. But printing of alarm occurrence and cancellation will be performed.

8 Setting of alarm value

[0 CLEAR] ~ [9 LIST] [• CLOCK] [(−) ⌐(−)]

Set the value within 5 digits. When scale setting has been performed, set the value according to the scale value.

9 Setting of the number of sampling input times

[0 CLEAR] ~ [9 LIST]

Set the number of sampling input times (1 - 9) in the fixed time.

10 Temporary registration

[ENTRY] (Display is changed to the next alarm point mode)

After the settings for an alarm point are complete, be sure to register them temporarily.
(If this operation is not done, the setting contents will not be stored in memory.)

11 Setting/registration of other alarm points

[0 CLEAR] ~ [9 LIST] [• CLOCK] [(−) ⌐(−)]
[▲ /] [▼ %] [ENTRY]

In the same way, perform setting for other alarm points required (as in the steps 4 - 10).

12 Memorizing temporary registrations

[SET END] (Underline blinks and the setting change mark is printed)

The contents registered in step 10 will be stored in memory (ROM), and when the operation is completed, the display before entering the setup mode will resume.

4) Confirmation procedure .....

When the operation in steps 1 and 2 in the above item 3 are performed, the details of each alarm point can be checked. Press the [DISPLAY RECORD FORMAT] key to resume the previous mode.

5) How to set the same setting for all channels

The [SPACE COPY(→)] key cannot be used for alarm setting.

When the same alarm setting (alarm No., alarm type, output No., alarm value) is used for all channels, perform in the following way to simplify setting up.

<Example> To copy the setting contents of Channel 1 to another channel:

1 Setting for Channel 01

Perform setting for channel No. 01 as described in steps 1 - 10 on the previous page.

2 Setting for Channel 02

Press the [↑] key to return the display to CH01, then set the channel No. to "02" and press the [ENT] key.

3 Setting for other channels

Set other channels in the same way as in step 2.

4 Memorizing temporary registrations

When the [SET (NO)] ([SHIFT] + [SET (NO)]) key is pressed, the contents for all channels registered in steps 2 and 3 will be stored in memory (ROM).

6) Setting example

Example	CH No.	Range setting	Scale setting	Alarm No.	Alarm type	Output No.	Alarm value	No. of sampling input times	Alarm setting
①	1	No.06 −10 ⌐ 10	0 ⌐ 1000	1	Upper limit	1	800	—	A01 1H01800
②				2	Ascending limit	2	25.5	3	A01 2U0225.5 3
③				2	Descending limit	2	25.5	5	A01 3d0225.5 5
④				2	Lower limit	1	600	—	A01 4L01600

7) Alarm type and alarm points

Up to four alarm points can be set for each channel. The alarm types for each of the four alarm points can be selected arbitrarily among upper limit (H), lower limit (L), ascending limit (U), and descending limit (d). Since a difference alarm can also be set (refer to page 67), any of six alarm types can be selected including the difference upper limit (b) and difference lower limit (S).

Note 1: When "clear" is registered

[Reference 1] Alarm No.
[Reference 2] Alarm type *1
[Reference 3] OR output
[Reference 4] Display order
[Reference 5] Initial value and initialization
[Reference 6] To resume the display mode

Refer to page 33 and 34.

Note 2: When "clear" is registered during scale setting

[Reference 7] Alarm printing *2
[Reference 8] Output format 3
[Reference 9] Alarm display
[Reference 10] Display output only
[Reference 11] Releasing the alarm
[Reference 12] To cancel the decimal point\,
To cancel the whole display

Refer to page 33 and 34.

*1: Alarm type ____In addition to standard upper and lower limit alarms, there are ascending and descending limits for variation rate and difference upper and lower limits and a total of six types of alarms are available. Among these, any required alarm type can be selected arbitrarily for each alarm point. However, the maximum number is four for each channel.

*2: Alarm printing _the character representing the alarm type, such as the "L" in '1L2' is changed to "U" for ascending limit and "d" for descending limit alarms.

16.6 DIFFERENCE ALARM

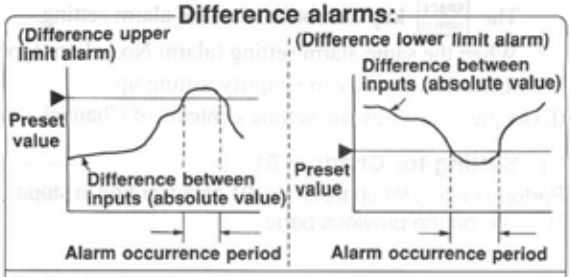
① With this function, when the difference between two channel inputs (absolute value) exceeds the alarm set value, an alarm is generated.

② There are two types of difference alarms; difference upper limit and difference lower limit alarms. The difference upper limit alarm outputs an alarm when the difference between the inputs (absolute value) increases and exceeds a preset value.
The difference lower limit alarm outputs an alarm when the difference between the inputs (absolute value) decreases and exceeds a preset value.

③ Up to four alarm points can be set for each channel, and any required type can be selected (refer to *1 on page 75) arbitrarily.

④ There are two alarm outputs, and the combination of alarm points and alarm output points can be made arbitrarily.

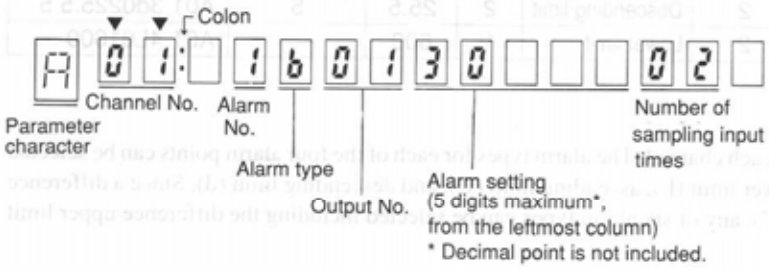
Difference alarms:



When the difference between the inputs (absolute value) is lower than the alarm preset value, a difference upper limit alarm is output.
When the difference between the inputs (absolute value) is higher than the alarm preset value, a difference lower limit alarm is output.

<Remark> A difference alarm is set similarly to a normal alarm, as described in item 8.6 (page 32).

1) Difference alarm display format ..... The initial value is only for "H".



How to check the display section

▼▼: Columns where cursors appear when the display is changed to the alarm setting mode.

: Represents the alarm mode (same as difference alarm or variation rate alarm mode)
Underline

2) Setting items and key operations

Setting items

The following items can be set for each alarm point:
① Channel No. : 2 digits
② Alarm No. : 1 digit
③ Alarm type : 1 digit
④ Output No. : 2 digits
⑤ Alarm value : Within 5 digits
⑥ No. of sampling input times : 1 digit

Key operation

① For the lower function of a dual-function key such as [8 ALARM], [0 CLEAR] or [SET END], press the key while holding the [SHIFT] key depressed.
② When a numeric key is pressed, the cursor is shifted to the next column.
③ Only the channel No. is displayed with two-digit cursors, and when the 10's digit is entered, the 1's digit will be filled with a "blank"; when the 1's digit is entered, the cursor moves to the next column.

3) Setting procedure

1 Set to the alarm mode

[8 ALARM] ([SHIFT] + [8 ALARM])

The display is changed to the alarm mode.
(Same as difference alarm or variation rate alarm mode display.)

2 Confirmation

[▲ /] [▼ %]

Settings for other alarm points can be set. All the alarm points registered (including difference or variation rate alarm) are displayed in sequence. When setting the alarm, proceed to the subsequent step 3.

3 Set to the setup mode

SET END (Underline lights, cursor appears)

The cursor lights at the left end. Setting (or modification) of the digit under which the cursor lights is possible.
(→ : Moves the cursor to the right,
← : Moves the cursor to the left)

4 Designation of 1st channel No.

0 CLEAR ~ 9 LIST

Select the first channel No.

5 Designation of alarm No.

1 CHART ~ 4 SCALE

As up to four alarm points can be set, designate the alarm No. to be set.

6 Selection of alarm type

▲ ▼ (The display changed in the order "H", "L", "b", "S", "U" and "d".)

Select the alarm type between the difference upper limit alarm (b) and the difference lower limit alarm (S).
H: Upper limit alarm L: Lower limit alarm
b: Difference upper limit alarm
S: Difference lower limit alarm
(U: Ascending limit alarm d: Descending limit alarm)

7 Designation of output No.

1 CHART 2 TAG (for "0", refer to "Reference 10")

Designate the output No. to which the alarm signal is to be output.
If "0" is entered, no signal is output and the only alarm display appears. But the printing of occurrence or cancellation will be performed.

8 Setting of alarm value

0 CLEAR ~ 9 LIST . CLOCK — (−)

Set the value within 5 digits. When the scale setting has been performed, set it for the scaled value.

9 Designation of 2nd channel No.

0 CLEAR ~ 9 LIST

Select the second channel No.

10 Temporary registration

ENTRY (Display is changed to the next alarm point mode)

After settings for an alarm point are completed, be sure to register them temporarily.
(If this operation is not done, the setting contents will not be stored in memory.)

11 Setting/registration of other alarm points

0 CLEAR ~ 9 LIST . CLOCK — (−)
▲ ▼ ENT

Perform setting for the other alarm points in the same way (as in steps 4 - 10).

12 Memorizing temporary registrations

SET END (Underline blinks and the setting change mark is printed)

The contents registered in step 10 will be stored in memory (ROM), and when the operation is completed, the display before entering the setup mode will resume.

4) Confirmation procedure ..... When the operations in steps 1 and 2 in the above item 3 are performed, the settings of each alarm point can be checked. Press the DISPLAY RECORD FORMAT key to resume the previous mode.

5) How to set the same setting for all channels ..... The SPACE COPY(→) key cannot be used in alarm setting. When the same alarm setting (alarm No., alarm type, output No., alarm value) is used for all channels, perform the following to simplify setup.

<Example> To copy the setting contents of Channel 1 to another channel:

1 Setting for Channel 01

Perform setting for channel No. 01 in the same way as in steps 1 - 9 in the previous item.

2 Setting for Channel 02

Press the ← key to return the display to CH01, then set the channel No. to "02" and press the ENT key.

3 Setting for all channels

In the same way as in step 2, perform setting for all channels (other than the channel registered in the 2nd channel).

4 Memorizing temporary registrations

When the SET (END) (SHIFT + SET (INS)) key is pressed, the contents for all channels registered in steps 2 and 3 will be stored in memory (ROM).

6) Setting example

Example	CH No.	Range setting	Scale setting	Alarm No.	Alarm type	Output No.	Alarm value	2nd channel No.	Alarm setting
①	1	No.06 −10 ⌐ 10	0 ⌐ 1000	1	Upper limit	1	800	—	A01 1H01800
②	1			2	Difference upper limit	2	25.5	3	A01 2b0225.5 03
③	1			3	Difference upper limit	2	15.5	10	A01 3S0215.5 10
④	1			4	Lower limit	1	600	—	A01 4L01600

7) Alarm type and alarm points

Up to four alarm points can be set for each channel. The alarm types for each of the four alarm points can be selected arbitrarily among the upper limit (H), lower limit (L), difference upper limit (b), and difference lower limit (S). Since variation rate alarms are also available (refer to page 70), the alarm type can be selected among six types including ascending limit (U) and descending limit (d).

Note 1: When "clear" is registered

[Reference 1] Alarm No.
[Reference 2] Alarm type *1
[Reference 3] OR output
[Reference 4] Display order
[Reference 5] Initial value and initialization
[Reference 6] To resume the display mode

Refer to page 33 and 34.

Note 2: When "clear" is registered during scale setting

[Reference 7] Alarm printing *2
[Reference 8] Output format 3 [Reference 9] Alarm display
[Reference 10] Display output only
[Reference 11] Releasing the alarm
[Reference 12] To cancel the decimal point\,
To cancel all the display

Refer to page 33 and 34.

*1: Alarm type ..... Other than the standard upper and lower limit alarms, there are ascending and descending limits for variation rate and upper and lower difference limits — a total of six types alarms are available. Among these, any required alarm type can be selected arbitrarily for each alarm point. However, the maximum number is four for each channel.

*2: Alarm printing ..... The character representing the alarm type, such as "L" for '1L2' is "b" for the difference upper limit and "S" for the difference lower limit.

16.7 HIGH-SPEED PRINTING

① This allows a shorter printing interval. The printing interval differs depending on the distance the analog pointer (needle) has to move, but is about 2.5 seconds as an average. (The printing interval is about 5 seconds at the standard speed.)

② The time the analog pointer (needle) is stopped is about 1 second. (It is about 3 seconds at the standard speed.)

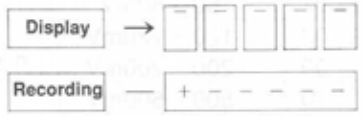
16.8 BURNOUT

When any of the input lines is short-circuited, the analog recording (indication) is shifted to the upper limit (right end) and the display and digital recording will change as shown in the figure on the right.

Note: Difference from over-range

There is no difference between burnout and over-range. The same phenomenon will occur.

Display and digital recording when burnout occurs



16.9 DC CURRENT INPUT

With this, the externally connected input resistance (see the table on the right) is used to use a DC current input as the signal. With DC current input, the scale setting (page 28), unit (page 38) and tag (page 36) settings are possible.

Measurement current I (mA)	Input resistance
20<1≦ 50	20Ω ±0.1%
1≦ 20	250Ω ±0.1%

16.10 DIVIDED VOLTAGE INPUT

With this, an externally connected voltage divider is used for DC voltage input and the measurement of high DC voltage inputs exceeding DC 5 V and below DC 60 V is made possible.

16.11 4-POINT, 14-POINT, 24-POINT ALARM OUTPUT

① This uses an additional 2-, 12- or 22-point alarm outputs. Together with the standard 2 points, a total of 4, 14 or 24 alarm points are available.

② Alarm output No. can be designated among 1 - 4, 1 - 14 or 1 - 24 arbitrarily.

③ For the alarm setting method, refer to page 32. For optional variation rate and difference alarms, refer to pages 70 and 73.

④ For alarm connections, refer to page 11.

17. GENERAL SPECIFICATIONS

1) Input specifications

Number of measurement inputs : 6 or 12

Measuring range : Set from table below for each channel.

Type of input		Range No.	Measuring range	Indication resolution
DC voltage		05	-12.5 ~ 12.5mV	0.01
		06	-25 ~ 25mV	
		07	-60 ~ 60mV	
		08	-120 ~ 120mV	0.1
		09	-200 ~ 200mV	
		10	-500 ~ 500mV	
		11	-2 ~ 2V	0.001
		12	-5 ~ 5V	
Thermocouple	K	18	-200 ~ 300°C	0.1
		19	-200 ~ 600°C	
		20	-200 ~ 1350°C	1
	E	21	-200 ~ 350°C	0.1
		22	-200 ~ 900°C	1
	J	23	-200 ~ 400°C	0.1
		24	-200 ~ 1100°C	1
	T	25	-200 ~ 250°C	0.1
		26	-200 ~ 400°C	
	R	27	0 ~ 1760°C	1
	S	28	0 ~ 1760°C	
	B	29	400 ~ 1820°C	
	Nicrosil -Nicil	30	0 ~ 350°C	0.1
		31	0 ~ 700°C	
		32	0 ~ 1300°C	
	WWRe5-26	33	0 ~ 2320°C	1
	WWRe0-26	34	0 ~ 2320°C	
	PR20-40	35	0 ~ 1880°C	
	NiNiMo	36	0 ~ 1800°C	
	AuFeCr	37	0 ~ 1310°C	
		38	0 ~ 300K	0.1
	PLATINEL	39	-100 ~ 300°C	
		40	-100 ~ 600°C	
		41	-100 ~ 1390°C	1
	U (DIN T)	42	-200 ~ 250°C	0.1
		43	-200 ~ 450°C	
		44	-200 ~ 600°C	1
	L (DIN J)	45	-200 ~ 450°C	0.1
		46	-200 ~ 900°C	1
Resistance thermometer	Pt100Ω	50	-100 ~ 100°C	0.1
		51	-200 ~ 300°C	
		52	-200 ~ 649°C	
	JPt100Ω	53	-100 ~ 100°C	
		54	-200 ~ 300°C	
		55	-200 ~ 649°C	
	JPt50Ω	56	-200 ~ 649°C	
	Pt–Co	57	4 ~ 374K	

Minimum analog recording setting ranges: Refer to the table below for the relationship of ranges and resolutions

DC voltage	More than 1/5 of the measurement range
Thermocouple	Approx. more than 2/5 of the measurement range when it is calculated as an electromotive force. (Any negative measurement range must be over 0°C.)
Resistance thermometer	Pt100 ohm, JPt100 ohm ..... more than 100°C JPt55 ohm ..... more than 200°C

Input resistance : Higher than approx. 8 Mohm. When a built-in voltage divider is provided (over 50 V DC), it should be higher than 1 Mohm.

2) Recording Specification

Dot interval : Approx. 5 sec./dot

Chart speed : 1 ~ 1,500 mm/hour (any setting is possible)

Chart paper : Fan-fold type,
Effective recording width, 180 mm
Overall width 200 mm,
Total length 20 m,

Number of recording points : 6, 12 (analog recording, digital recording)

Recording mechanism :

Analog recording : Inkpad dot type

Digital recording : Felt-tip pen plotter type

Color of pens:

Inkpad colors : ① Red, ② Black, ③ Light blue, ④ Green, ⑤ Brown, ⑥ Purple, ⑦ Orange, ⑧ Gray, ⑨ Dark blue, ⑩ Olive, ⑪ Scarlet, ⑫ Violet

Plotter type : Black

Fixed-interval printing : The following are printed at the specified interval (depending on the chart speed); date, time, time line, chart speed, range, scale, unit, channel No. and tag.
(Note) Whenever the power is switched on, the year, month and day are printed at 00:00 hours.

Fixed-interval digital-recording : Time and data are recorded digitally on the analog recording chart (the interval can be specified).

On-demand digital recording : When required, analog recording is interrupted and the time and data are recorded digitally in responses to front panel operation.

List printing : When required, analog recording is interrupted and the setting values of each parameter are printed in response to front panel key operation.

Setting change mark : When a setting is changed, a mark is printed on the right of the chart.

Alarm printout:

When an alarm occurs : occurrence time, channel No., H.L, and alarm No. are printed out on the right of the chart.

When an alarm is canceled : cancellation time, channel No., and alarm No. are printed out on the right of the chart.

Recording functions:

① Difference recording : The difference between two channels or from a reference value are recorded.

② Partial compression/expansion recording: The ratio of compression/ expansion can be set as required.

• Expanded recording : Max. 2 dots, 3 areas

③ Zone scale : Max. 4 zones
Recording: (Refer to the following table.)

④ Auto-ranging — Max. 5 recording ranges
Selection recording: can be set

(Items ② - ④ are options. Select one item from ① - ④.)

Number of areas and positions of zone recording

Unit: mm

Number of areas	Area 1	Area 2	Area 3	Area 4
2 zones	0 ~ 81	99 ~ 180	—	—
3 zones	0 ~ 54	63 ~ 117	126 ~ 180	—
4 zones	0 ~ 36	45 ~ 81	99 ~ 135	144 ~ 180

3) Display specification

Digital display:

FL display : 16-segment 1-digit, character height 11 mm
: 7-segment 15-digit, character height 7 mm

Display items : Channel No., data, chart speed, time
(For analog data, multi-point sequential indication or single-point continuous indication can be selected.)

Status indication : The following items are displayed in the FL display.

Alarm : Occurrence channel No. display

PRINT : Flickers during digital recording and printing.

RECORD ON : Flickers during recording function. (during analog recording, digital recording, printing and chart feeding)

KEY LOCK : Flickers in KEY LOCK mode.

SE, FE : Flickers to indicate setting error.

Analog indication : 180 mm (with scale divided into 100 equal divisions), red pointer.

Chart illumination : LED

Data display range : -9999 to +99999 (decimal point can be set as required)

4) Alarm specification

No. of setting points : 4 points/CH (individual setting)

Setting system : Individual setting of each point (high-limit/low-limit can be set as required.)

Alarm output : 3 terminals (N.C, COM, N.O) x 2 (OR selection output possible) 4, 14 and 24 points are optionally available.

Contact Capacity : 100 V AC/0.5 A, 200 V AC/0.2 A (with resistive load)

Alarm deadband : 0.1% of analog recording range

5) Power supply specification

Power source : Free power supply. 81 V to 264 V AC, 50/60 Hz

Countermeasures against power failures : Details of settings are retained in an EEPROM. The clock is backed up for approx. 5 years by a lithium battery.

Power consumption : approx. 60 VA (fuse: 5 A)

6) Performance

Accuracy : ±0.1% ±0.1 digit of the measuring range (at room temperature 23°C ±2°C)
(Thermocouple inputs do not include reference junction compensation accuracy.) Please refer to the table for details of accuracy rating.

Reference point compensation accuracy:
K, E, J, T, Nicrosil-Nisil, Platinel ... ±0.5°C or less
Thermocouple inputs other than above. ... ±1°C or less.

Temperature coefficient: ±0.01%/°C ±1 digit of the measuring range

Measuring period : approx. 5 sec. for 6 points, approx. 10 sec. for 12 points.

Allowable signal source resistance:

Thermocouple input/ DC voltage : 1 kilohm or less

Resistance thermometers : 10 ohm or less per lead

Chart feed accuracy : ±0.1% or less (stretching of the chart is not taken into consideration.)

Recording deadband : ±0.1% or less of analog recording range

Series-mode rejection ratio : 50 dB or more

Common-mode rejection ratio : 130 dB or more

Maximum input voltage : Under 5 V range: 10 V

Insulation resistance:

Between measuring terminals and ground terminal:
500 V DC, 20 Megohm or more

Between power terminals and ground terminal:
500 V DC, 20 Megohm or more

Between measuring terminals and ground terminal:
500 V DC, 20 Megohm or more

Withstand voltages:

Between measuring terminals and ground terminal:
500 V AC, for 1 minute

Between power terminals and ground terminal:
1500 V AC, for 1 minute.

Between measuring terminals and power terminals:
1500 V AC, for 1 minute.

7) Construction

Material : Door .....Diecast aluminum
Case .....Plain steel plate

Color : Door .....Munsell N1.5 (Black)
Case .....Munsell N7.0 (Gray)

Weight : approx. 13 kg

8) Conditions for normal operation

Ambient temperature/humidity : 0 - 40°C, 20 - 80% Rh

Power supply voltage : 81 - 264 V AC

Normal mode noise :

DC voltage input : less than 1.2 times the measurement range*

Thermocouple input : less than 1.2 times the measurement range*

Resistance thermometer: less than 50 mV

* Peak value including input signal component.

Common mode noise : less than 200 V AC

Mounting position : Forward tilting: 0°
Backward tilting :0 ~ 30°
Lateral tilting :0 ~ 10°

Warming up time : more than 30 min.

9) Transportation and storage conditions*

Ambient temperature : –20 ~ +60°C

Ambient humidity : 5 ~ 95% Rh (Non-condensing)

Vibrations : less than 10 ~ 60 Hz 0.5 G

Impact : less than 40 G

* The above conditions are specified when in packaged condition.

Details of accuracy range (☐ % ±1: abbreviation of ±1 digit)

	Input			Accuracy
Basic	DC voltage			±0.1%±1
	Thermocouple	AuFe, PR5, PR20		±0.2%±1
		Other than the above	–200 ~ 0°C	±0.15%±1
			0°C ~	±0.1%±1
	Resistance thermometer	Pt-Co		±0.15%±1
		Other than the above		±0.1%±1

	Input		Accuracy	
Exceptions	Thermocouple	B	400~800°C : ±0.15%±1	
		R,S	0~200°C : ±0.15%±1	
		W0	0~100°C : ±0.15%±1	
	Resistance thermometer	AuFe	20 K or less: ±0.5%±1	20~50K:±0.3%±1
		PR5	0~100°C:±4%	100~200°C:±0.5%±1
		PR20	0~300°C:±1.5%±1	300~500°C:±0.8%±1
		Pt-Co	20 K or less: ±0.5%±1	20~50K:±0.3%±1
		Other than above	–100 ~ +100°C: ±0.15%±1 (excluding JPt50)	

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