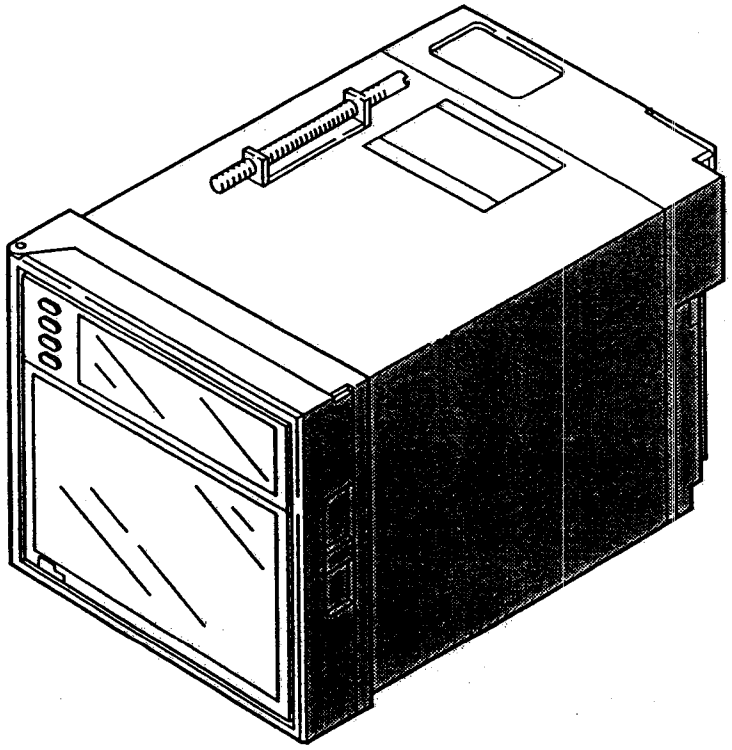
RD1603
3-Channel, 100mm Strip Chart Recorder

RD1606
6-Channel, 100mm Strip Chart Recorder



OMEGA®

An OMEGA Technologies Company

Operator's Manual

UNPACKING

Remove the Packing List and verify that you have received all equipment. If you have any questions about the shipment, please call the OMEGA Customer Service Department at 1-800-622-2378 or (203) 359-1660.

When you receive the shipment, inspect the container and equipment for any signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material in event reshipment is necessary.

CAUTION ON SAFETY

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

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

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

Caution on Installation	
⚠ DANGER	• This unit is not an explosion-proof type. Do not use it in a place with explosive gases to prevent explosion, fire or other serious accident.
⚠ CAUTION	• For installation, select a place observing the operating conditions noted in the instruction manual. Installation at an unsuited place may cause fall, trouble or malfunction. • The unit must be installed correctly as shown in the instruction manual. Incorrect installation may cause fall, trouble or malfunction. • During installation work, keep the inside of the unit free from entry of cable chips or other foreign objects as it may cause fire, trouble or malfunction.

⚠ CAUTION	This unit is a component device used for instrumentation. It is mounted on a panel or in a rack. • The unit conforms to IEC1010-1 (1990) Safety Standards, and is designed for protection class I, overvoltage Category II and pollution degree 2, except the alarm output terminal (overvoltage category I). • EMC conforms to EN50081-1 (1992) and EN50082-1 (1992), (both used for housing areas), except that the noise level of the power terminal is rated for Class A (used for commercial and industrial areas). • External power fuse required rating : T1A, 250V AC or equivalent protection • Input signals and communication interface should be of SELV (safety separated from hazardous voltage).

Caution of Wiring

DANGER

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

Caution on Maintenance

DANGER

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

CONTENTS

NOTES

1. INTRODUCTION

1.1 About the recorder

① This recorder is a multirange input recorder 100mm wide which can record up to a maximum of 6 points using thermocouple/resistance bulb and DC voltage input signals.

② It effects high-speed recording and gives clear analog trend records and digital print-outs in 6 colors.

③ The analog trend records can be given as continuous record type or as intermittent (dot) records.

④ As well as providing records of measurement values, the standard unit has a wide range of print-out functions comprising, e.g., the print-out of dates, chart speed, measurement ranges, Tag Nos., daily reports and integrated totals.

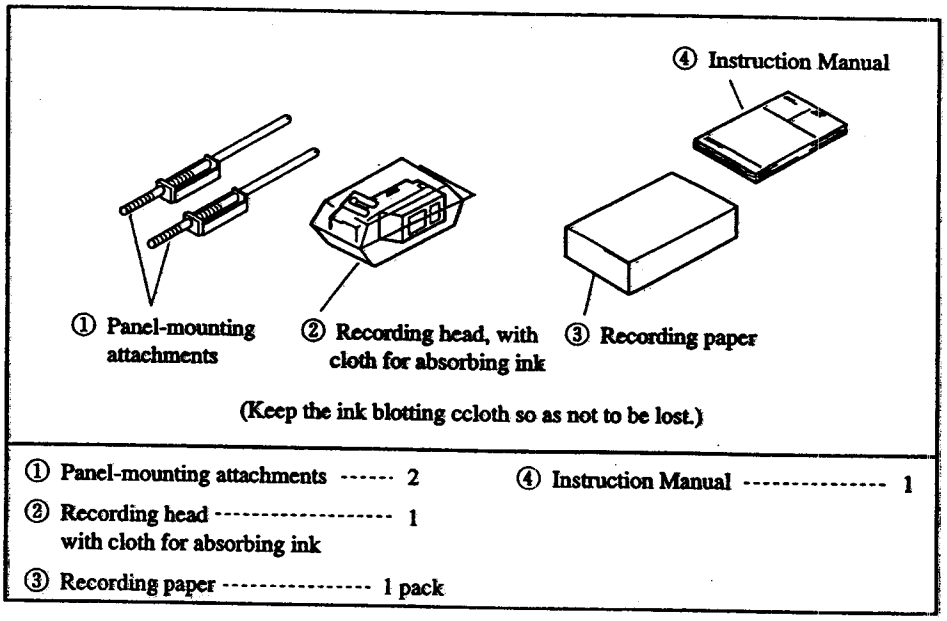
⑤ Operation of the equipment is simple thanks to an easy-view display section which permits key-in of various items of set data.

1.2 Product check

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

Check on accessories

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



① Panel-mounting attachments ------ 2	④ Instruction Manual ---------- 1
② Recording head ---------- 1 with cloth for absorbing ink	
③ Recording paper ---------- 1 pack	

Fig. 1-1 Accessories

1.3 Model numbers and accessories

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

PART NUMBER	DESCRIPTION
RD 1603	3 Channel, 100mm strip chart recorder
RD 1606	6 Channel, 100mm strip chart recorder

OPTIONS & ACCESSORIES*

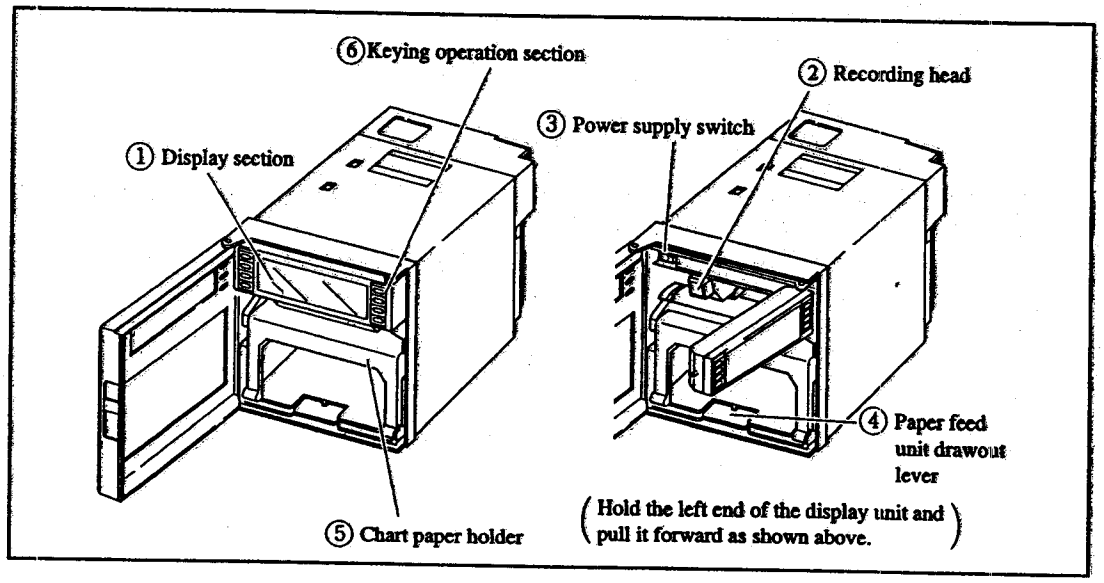
PART NUMBER	DESCRIPTION
RD 1600-RP	Chart paper (1 set of 6 packs)
RD 1600-RH	6-color recording head with ink
RD 1600-AL6	6-alarm point board
RD 1600-LITE	Chart illuminator - plug in
RD 1600-RS	RS-485 communication board

*All options are field installable.

SPARE PARTS

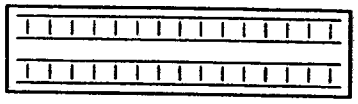
PART NUMBER	DESCRIPTION
TK7G8473P1	Replacement battery
PHZL1001	Replacement fluorescent lamp

2. NAMES AND FUNCTIONS OF PARTS



① Display section

For displays such as measurement data and displays of various parameters and comments



← Display of units and data for each channel

← Display of various parameters, comments

② Recording head

This is a recording head which serves for analog trend recording and digital print-outs. **As this is not installed in the main unit at the time of delivery, please install it referring to Section 5.2.**

③ Power supply switch

This is used to turn the power on and off.

④ Paper feed unit drawout lever

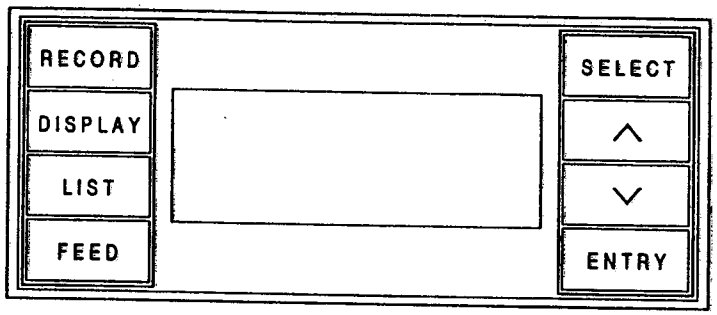
When setting (or replacing) chart paper, push down the drawout lever. The paper feed unit will come out. If it does not come out, pull it forward while holding the lever down.

⑤ Chart paper holder

The chart paper holder is used to feed paper smoothly.

⑥ Keying operation section

This is used for setting various parameters, making checks and running the equipment.



Name of key	Function
RECORD	Operation key for starting and stopping recording. Recording starts when the key is pressed once and stops when the key is pressed again. This key is ineffective during print-out of data or lists.
DISPLAY	1. This is used for changing the data display. The following 4 items are selected at each press. (1) Data of all channels are displayed in order, except for the skip channel. Data display is updated at intervals of I second and channels are selected every 3 seconds. (2) Display only of the data of specific channels. The data display is updated once every second. (3) No. 1 to 6 channels are displayed simultaneously, and data display is updated at 1 second intervals. (4) Display of the date and time. 2. This key is used for shifting from a set mode to the data display mode. This key is ineffective during print-out of data or lists.
LIST	This is used for effecting print-out of data (instantaneous values). If you wish to stop the print-out partway through, press the key again. This key is alwys effective.
FEED	Chart paper fast-feed key Feed speed is 3mm/s at the beginning of press, and about 8mm/s after 1 second. This key is always effective.
SELECT	1. This is used for shifting from the data display mode to a set mode. 2. This is used for effecting sequential read-out of parameters during operation in a set mode. This key is ineffective during print-out of data or lists.
[∧] [∨] (up) (down)	This is used to scroll numerical values up and down. The values are scrolled up or down 1 count each time the relevant key is pressed. Holding a key depressed for more than 0.5 seconds results in a fast up/down scroll at a rate of 5 counts/second and holding it depressed for a further 2 seconds results in an ultra-fast scroll of 55 counts/second.
ENTRY	This is used to register set data. This key is effective only during set mode operation.

3. MOUNTING METHOD

This unit is designed to be panel mounted.

3.1 Mounting location

Select the following location for mounting the unit.

(1) A place that is not subject to vibration or impact.

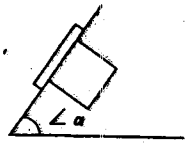
(2) A place where there is no corrosive gas.

(3) A place that is subject to little temperature variation and is close to normal temperature (23°C)

(4) A place that is not struck directly by strong radiant heat.

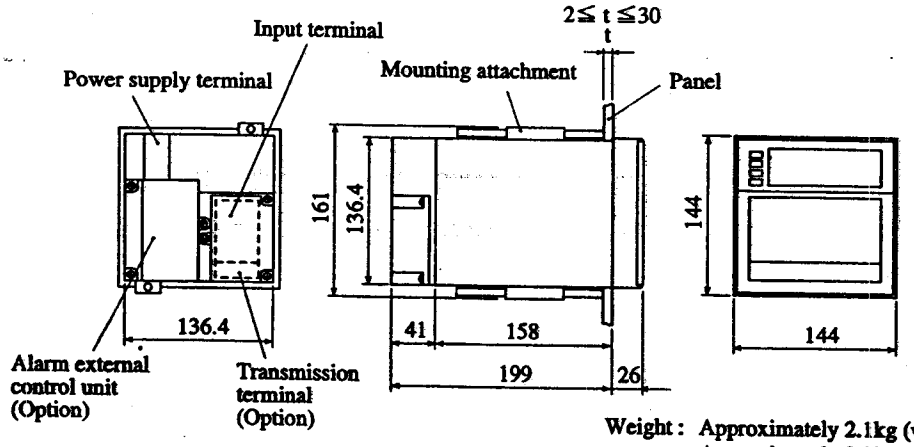
(5) As humidity affects the ink and recording paper, select a place that is in the range 45 to 80% RH.

(6) Mount the unit horizontally, with no tilt to the left or right.
(The forward tilt should be 0° but the unit may be inclined 0 to 30° rearwards.)



α =60 to 90°

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



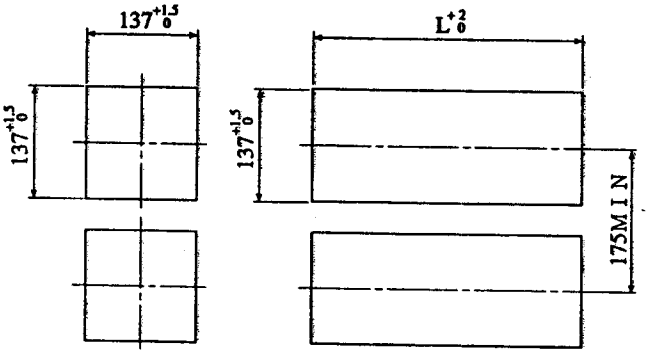
Weight : Approximately 2.1kg (without options)
Approximately 2.2kg (with all options)

Power consumption : Approximately 22VA (100V AC without options)
Approximately 26VA (100V AC with all options)

PANEL CUTOUT

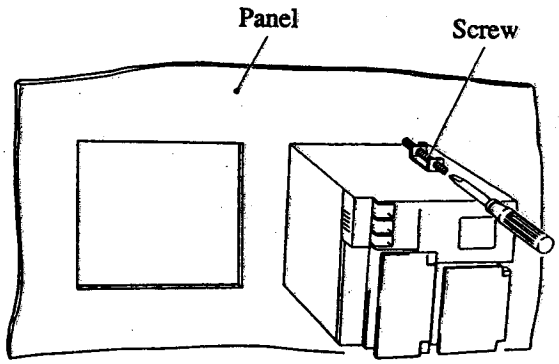
For single unit mounting

For left/right tight fit mounting



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

3.3 Method of mounting into panel



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

4. WIRING

4.1 Before wiring

To carry out wiring, remove the unit's rear cover (Notes)

(1) When wiring the power supply unit, use vinyl-insulated 600V cables or equivalent cables.

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

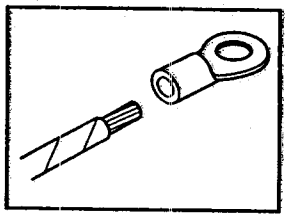
(3) Input signal cables should be wired separately as far as possible (30cm or more) from power lines and high-voltage lines to minimize the effect of inductive noise. Shielded cables should preferably be used. In this case, the shield braids should be earthed at one point.

(4) For wiring the terminals, use a maximum of 2 crimp style terminals.

Notes

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

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



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

4.2 Connection of wires to terminals

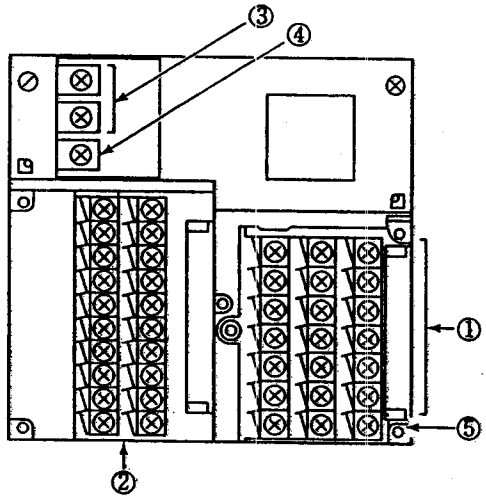
① Input terminals ⇨ Connect signal leads for each channel.

② Alarm, external control unit (option) ⇨ Connect the alarm signal outputs and external control signal inputs (for alarms 1 to 6, external controls 1 to 3).

③ Power terminal ⇨ Connect power cables to AC/DC terminals. Make sure that the power source to be connected is stable and noiseless. Power source : 100 to 120V AC or 200 to 240V AC (50/60Hz).

④ Ground terminal ⇨ Effect type 3 grounding (100Ω or less) of the G terminal.

⑤ Transmission terminal (option) ⇨ Connect the transmission signals.



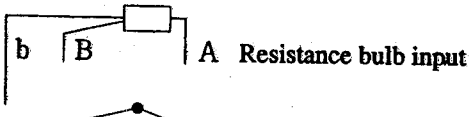
⚠ CAUTION
Alarm output terminals (⑭ to ⑲, ㉔ to ㉙) are of overvoltage category I. Other terminals (input signals, communication interface) are for SELV signals (safety separated from hazardous voltage).

(1) Wiring of Input terminals

(1) There are individual input terminal numbers for different channels.

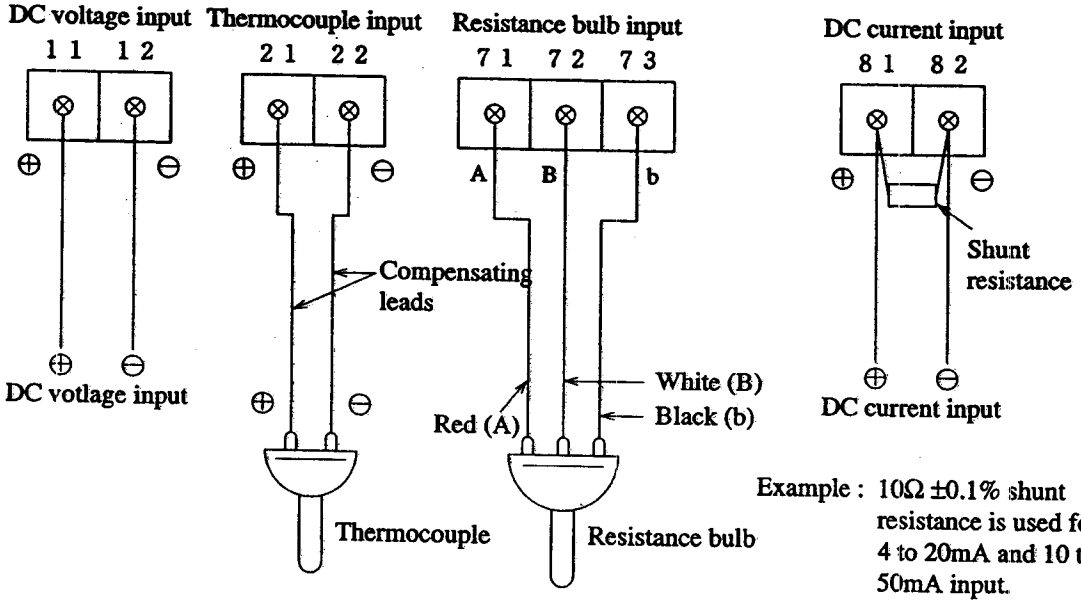
(2) All inputs are set as the thermocouple input at the time of shipment.

(3) If you decide to change the type of input signals after your purchase, be sure to remember to wire the channel accordingly.



13	12	11	←Input 1
23	22	21	←Input 2
33	32	31	←Input 3
43	42	41	←Input 4
53	52	51	←Input 5
63	62	61	←Input 6

Example | Input terminal wiring



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

In this case, ±500mV input range is available. See Item 5.3.

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

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

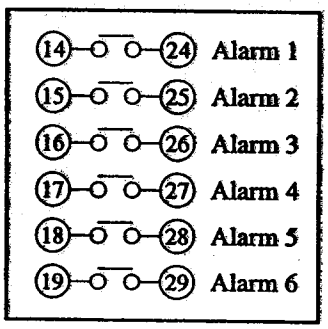
About alarm outputs :

(1) Alarms can be set at 6 points in each channel and alarm outputs are provided as an option for up to a maximum of 6 points.

(2) When an alarm is detected, the relevant terminals are shorted.

1a contact output: Relay contact capacity 240V AC/3A, 30V DC/3A (resistive load)

1b contact output: Relay contact capacity 125V AC/0.4A, 30V DC/2A (resistive load)

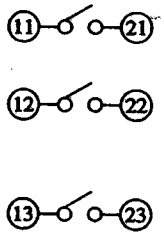


Note : If lamps are used on the outside, insert a resistor to prevent surge current.
Also, if relays or solenoids are used, insert elements for contact protection (diodes, surge killers, etc.).

About remote control inputs :

(1) This performs the functions 'Recording operation start/stop', 'Two-stage changeover of recording paper speed' and 'Data (instantaneous value) print-out' in response to contact signals from outside the instrument.

(2) There are separate wiring terminals for the different functions.



Note 1: As the external control unit is not insulated, use it with interposition of an external relay.

External contact capacity 12V DC/0.05A 1a contact

Note 2: Operation with the external control unit and the front panel switches are shown in the table on next page.

(The sign "—" in the table does not affect the operation of the unit)

Note 3: When using the message print function or alarm latch function, the meaning of control input is different. Refer to "7.10 Message print specification" and "9.3 Alarm latch specification".

	Remote control						Front panel swich	
	Recording start (across terminals ⑪—㉑)		Chart speed change (across terminals ⑫—㉒)		Data print-out (across terminals ⑬—㉓)		RECORD	LIST
	ON	OFF	ON	OFF	ON	OFF		
While recording is stopped	Recording starts	——	——	——	List print-out starts	——	Recording starts	List print-out starts
During recording	——	Recording stops	Remote mode chart speed	Normal operation chart speed	List print-out starts	——	Recording stops	List print-out starts
List print out	Recording starts	——	——	——	——	——	——	List print-out stops

(3) Caution on connection of input signal through barrier

A) Thermocouple input and resistance bulb input.

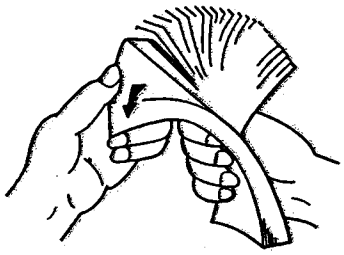
Perform "Calibration of measured value" with the input connected to the barrier recorder because the barrier internal resistance is added and causes an error in the measured value.

For the calibration method, refer to Item 9.4.

5. SET-UP

5.1 Loading Chart Paper

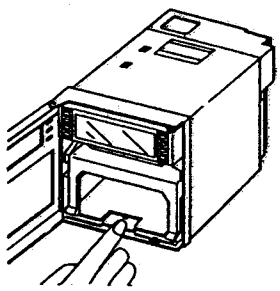
Step 1



Prepare chart paper.

Loosen chart paper to prevent some sheets of paper from being fed together.

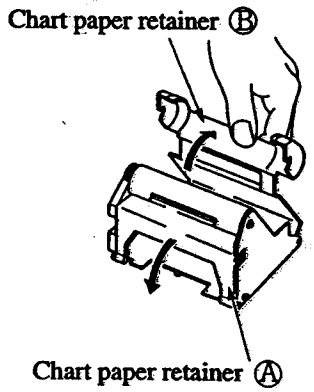
Step 2



Open the front door and press down the paper feed unit drawout lever.

The paper feed unit will be drawn out.

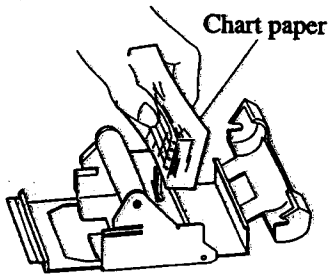
Step 3



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

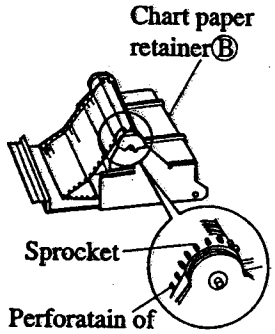
Also, hold and open the chart paper retainer (A).

Step 4



Set chart paper lengthwise in the paper holder.

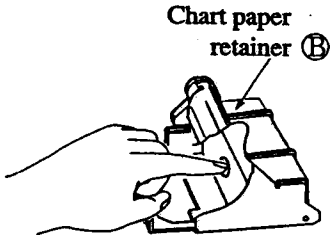
Step 5



Pull out the first or second fold of the chart paper, then close the compartment by holding the chart paper retainer Ⓑ.

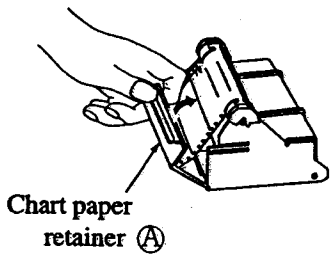
At this time, make sure that the sprocket is fitted correctly into the perforation of the chart paper.

Step 6



When some sheets of chart paper are caught by the chart paper retainer Ⓑ, push them with hand through the hole at the front of the chart paper case.

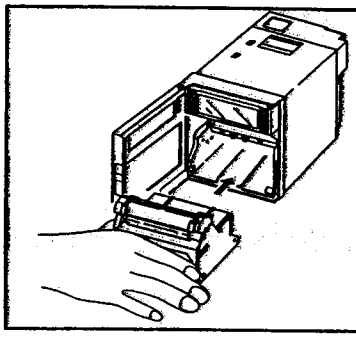
Step 7



Hold the chart paper retainer Ⓐ and close it.

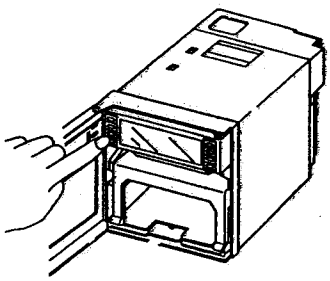
Make sure that the chart paper retainer Ⓐ is locked firmly at both ends.

Step 8



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

Step 9



Press the FEED key and check that the chart paper is fed out smoothly.

(Feed out about 2 folds of paper.)

<If the paper is not fed out smoothly, go through the procedure from Step 2 again.>

Note 1 Selection of chart paper

The chart paper greatly affects the quality of the printed recording and it is also related to problems such as paper jamming, etc.
Please be sure to use the pure-quality chart paper specified us.

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

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

Reference 1 Chart paper length

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

Reference 2 Chart paper end mark

The amount of chart paper remaining is indicated by digits (units : 10cm) on the right-hand side of the paper. When there is only a small amount left, red letters appear on the right-hand edge.
If the recording paper runs out completely, a recording paper end indicator displays 'Chart end' in the display section and recording automatically stops.

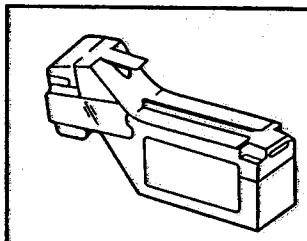
5.2 Recording head installation (replacement)

The recording head is a combination of a head and ink.

When ink is used out or trouble arises with the head, it can easily be replaced.

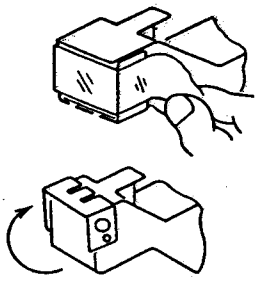
Use the recording head carefully observing the "Caution" noted in the later paragraph.

Step 1



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

Step 2



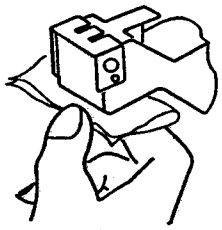
Tear the tape.

Open the cap by turning it in the direction indicated by the arrow.

(If the head is not going to be used for a long time, close the cap back in its original position.)

The cap is integral with the head unit. Turn it about 180° until it stops against the top of the head.

Step 3

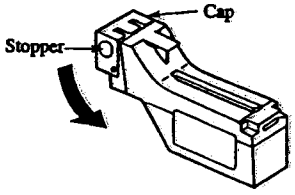


- **Lightly press** the nozzle surface (the surface from which ink is discharge). Make sure that the cloth is properly impregnated with the 4 colors blue, red, yellow and black.

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

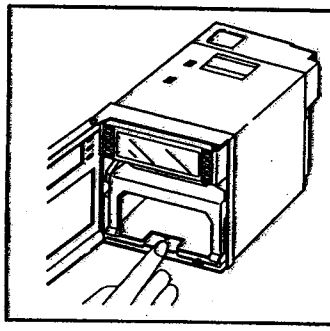
Note) Do not use any cloth other than the supplied one. Also, do not rub the nozzle with the cloth.

How to close the cap



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

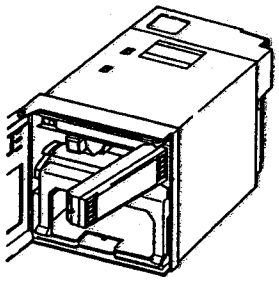
Step 4



- Press the RECORD key. Operate the recorder after it has been set in recording stop mode.
- Open the front door and press down the paper feed unit drawout lever.

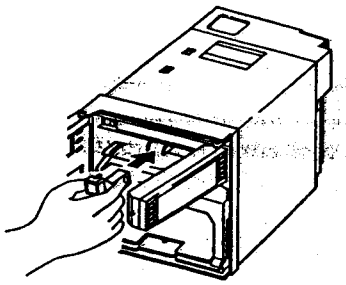
The paper feed unit will be drawn out.

Step 5



Hold the left end of the indicator and pull it forward.
The indicator will turn 90°.

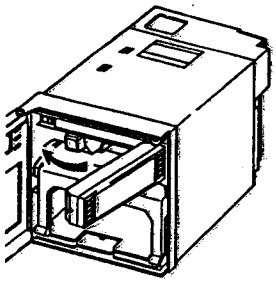
Step 6



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

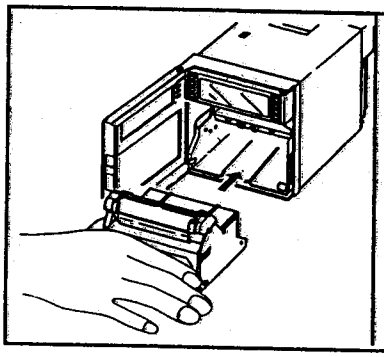
⚠ CAUTION Do not touch the connector at the rear of the carriage to avoid the risk of minor electric shocks.

Step 7



Set the indicator in its original position.

Step 8



· Set the paper feed unit in its original position.

The above completes installation of the recording head.

The recording head is a consumable part. Replace it with a new one when the ink it contains is used up.

Recording head replacement

Draw out the recording head in the manner that is opposite to what is described in (Step 6) of the recording head setting procedure, and replace it with a new recording head.

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

(1) Setting the ink monitor

Perform the following keying actions in order to get correct performance of the ink dry-up warning-detection function.

As in "Clearing the ink monitor" of Section 7.16, press the SELECT key to give an "INK MONITOR CLEAR" display

```
INK MONITOR CLEAR
                NO
```

↓ [^]

```
INK MONITOR CLEAR
                YES
```

Press the [^] key to change the flickering "NO" to "YES".
Next, press [ENTRY] key.
This completes the setting.
Press the [DISPLAY] key to return to a data display.

(2) Test pattern print-out

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

(3) Adjustment of analog trend recording positions

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

Precautions in handling recording heads

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

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

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

If the head is left installed in the recorder:

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

If it is not possible to keep the power switched on, make sure that the cap is closed.
Draw out the paper feed unit using the recording head setting method (Step 4) and (Step 5) .
Open the indicator and tighten the cap.

Note 2 At the start of use of a recording head

If you are starting to use a new recording head or if the recorder has been left unused for a long time, always wipe the head's nozzle surface lightly with the accessory cloth and check that the 4 colours black, blue, red and yellow ooze out properly into the cloth. (See Section 5.2.)
Also, after normal recording is possible. See Section 6.3 for the way of printing out a test pattern.
When the working environment is 15°C or less; perform print-out of "test pattern" after period of several minutes has elapsed since the recording head was mounted. (The recording head has a built-in heater.)

Note 3 Handling recording heads

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

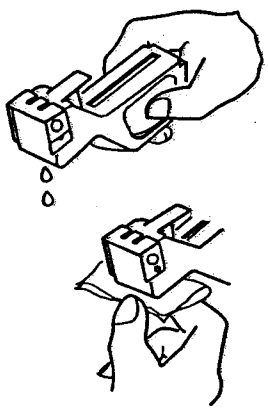
Note 4 Storage of recording heads

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

Note 5	Shipping of recording head

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

Note 6	If the ink is not sprayed.



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

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

Reference	Ink consumption

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

About 1 year --------- 1, 2, 3 continuous recording or 6 intermittent recording
About 6 months------- 6 continuous recording

Alarm of ink consumption is displayed and printed by ink consumption detecting function.
(See Section 11.12 for an example of print-out.)

5.3 Changing the type of input signals

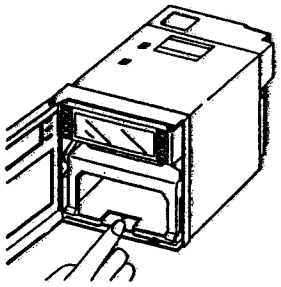
This recorder is a multi-input type which permits the input for any channel to be changed to thermo-couple, resistance bulb or DC voltage input.

Follow the procedure described below if you with to change the type of input signals subsequent to purchase.

Step 1 Turn off the power.

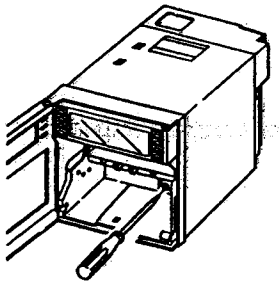
Step 2 Open the front flap and remove the main unit in the manner shown in the drawings below.

Step 2 - 1



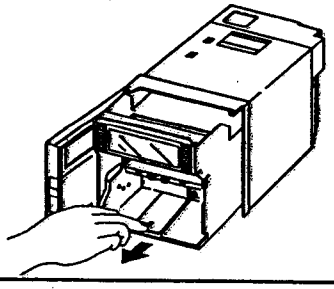
Open the front door and press down the paper feed unit drawout lever.
The paper feed unit will be drawn out.

Step 2 - 2



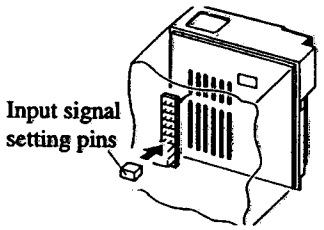
Loosen the lock screw (M4) in the unit with a phillips driver.

Step 2 - 3



Hold the side or bottom of the frame and pull the unit forcedly to remove it from the case. It can be removed easily when the door is opened by about 90°.

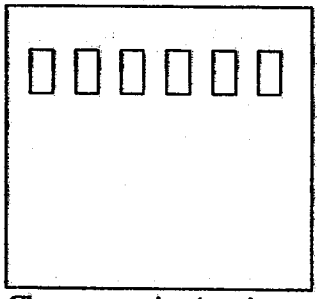
Step 2 - 4



Change the setting of each channel pin on the printed circuit board in the unit.
(See the next page for changing the position of pin.)
* To remove or attach the pins, use pincette or pliers.

Method of changing pin positions

Large printed circuit board at the back of the case

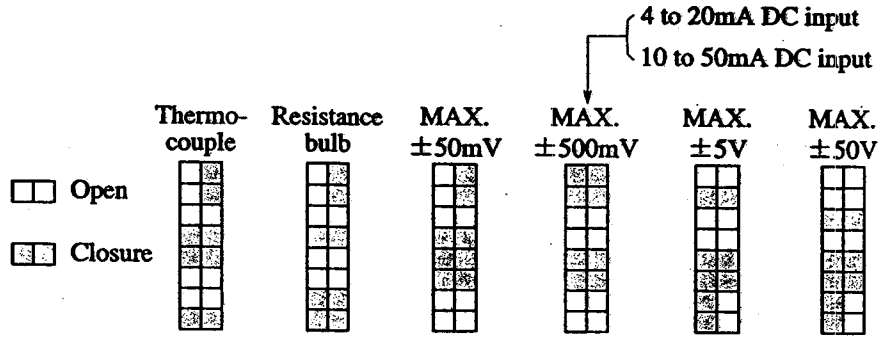


Changeover pins (maximum 6)

Correspondence between pin line-up and input channels

CH1 CH2 CH3 CH4 CH5 CH6

Pin positions for different types of inputs



(Insertion of input setting pins results in closure.)

Step 2 - 5

- After completing the change, push the main unit back into its original place and fix it with the left and right lock screws.
- Push in the paper feed until it is set as before.

Step 2 - 6

- Change the input terminal wiring to make it correspond to the new input signal type.
- For DC voltage input, provide the input terminals with shunt resistors.

  Example: In the case of 4 to 20mA DC input, fit the separately sold shunt resistors (10Ω and set to ±500mV range input pin positions.

Step 2 - 7

Refer to Section 7.8 and carry out front-panel keyboard operations in order to change setting in correspondence to changed types of input signals.

6. OPERATION AND ACTIONS

6.1 Before running the equipment:

Check the following points before starting operation.

1 Setting the chart paper and recording head

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

2 Wiring

① Input terminals .....
② Alarm terminals (option) ..... } See Section 4.2
③ Power and earth terminals .....

3 Conformity of input connection to recording channel

① Code symbols ..... See Section 1.3
② Change and settingo type of input signal ..... See Section 5.3

6.2 Power switch-on and states

(1) Open the front door. Then hold the left end of the indicator and turn it forward.

(2) The power supply switch is at the above left; switch it on.

1) Initial switch-on of power

↓

The recording head moves slowly toward the right end (100%).

↓

After detecting 100%, the recording head moves to the center and stops ant that position.

↓

1	100℃

The input data and Tag No. are displayed in the display section.
(No recording takes place.)

2) If the power is switched off while recording is stopped and switched on again.
(The state becomes "Recording stopped")

3) If the power is switched off during recording operation and switched on again.
(The state becomes "Recording in progress")

Recording in progress

↓

Power supply cut off

↓

Display disappears Recording stops

↓

Power turned on again

↓

The recording head moves slowly tooward the right end (100%).

↓

After detecting 100%, the recording head moves to the center and then the right end, and it stops at that position.

↓

1	100℃
Rec.	ON

The input data is displayed in the display section and recording restarts.

6.3 Test pattern print-out

(1) Open the front flap, switch the power supply switch on the press the [SELECT] key.

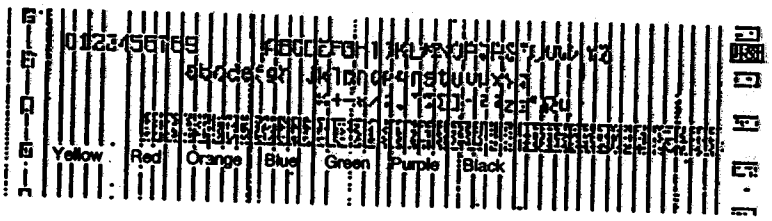
(2) Pressing the [SELECT] key several more times results in the following display.

```
LIST = 1
PARAMETER LIST
```

(3) Press the [∧] key twice; this gives the following display.

```
LIST = 1
TEST PATTERN
```

(4) When the [ENTRY] key is pressed, the following test pattern is printed out.



- Check that there is a complete recording in each colour.

  If the colours do not come out or are blurred, follow the procedure of Section 5.2 to clean the recording head nozzle surface.

6.4 Actions during operation

(1) Stopping and starting recording operation ([RECORD] key)

- Stopping the recording is possible at anytime during operation.
- Recording is alternately started and stopped each time the [RECORD] key is pressed.

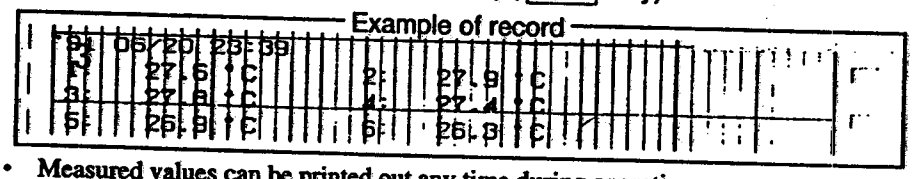
```
6        315℃
  Rec.    ON
```

During recording operation

```
6        315℃
```

When recording is stopped

(2) Digital print-out (instantaneous values) ([LIST] key)



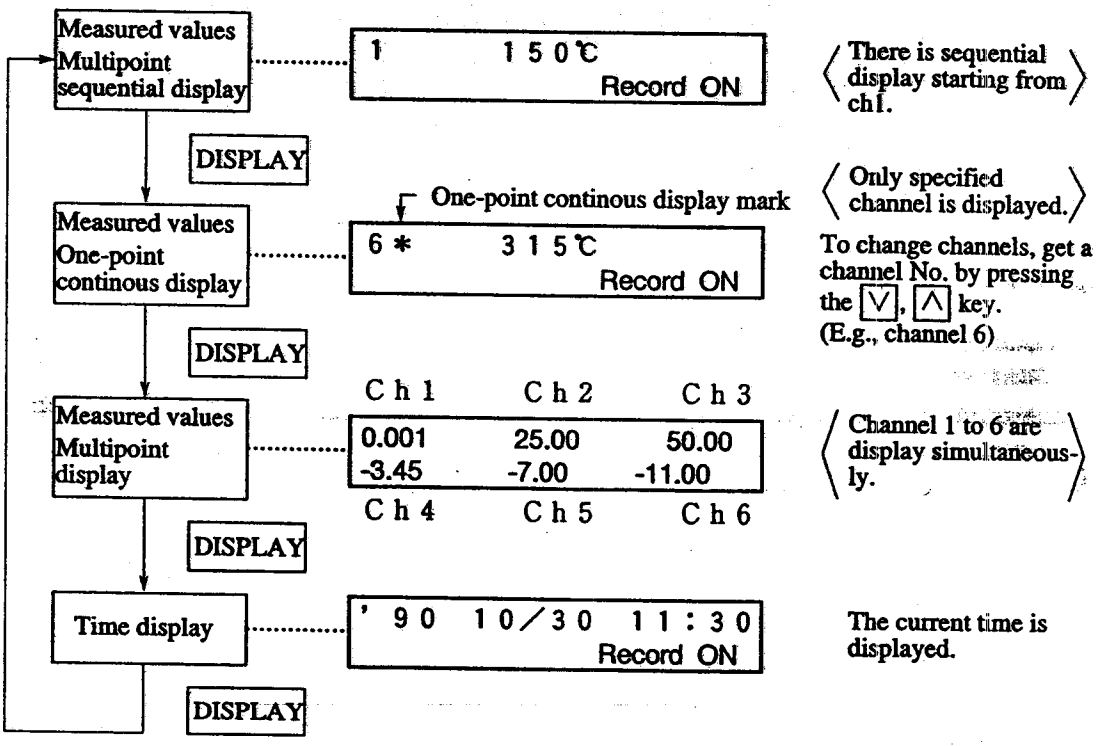
- Measured values can be printed out any time during operation.
- Pressing the [LIST] key results in a digital print of the time at which the key was pressed and the measured values and units of all the channels at that time.
- Analog trend recording is stopped during digital printing.
- Completion of digital print-out is followed by a return to analog recording.
- To stop printing during operation, press the [LIST] key. Analog trend recording is started again.
- Channels which are skipped are printed with the sign "–" (lateral line).

(3) Chart paper fast feed (FEED key)

- To effect fast feed regardless of recording, press the FEED key.
- The speed is 3mm/s during the first second that the key is held depressed and goes to 8mm/sec after the elapse of 1 second.
- When the FEED key is released, there is a return to the set speed.

(4) Changing the display mode (DISPLAY key)

- Display modes can be selected at any time pressing the DISPLAY key during operation.
- There are the following changes in the display mode each time the DISPLAY key is pressed.



Note) No Record ON is displayed when recording is stopped.

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

(1) If an alarm is detected the display section gives a display as follows.

Example of alarm display

2 123.5℃ Ch 6 ALARM H ALM1 (This display continues until it is cancelled.)	Example: Upper section Ch 2 measured value Lower section Alarm in Ch 6 H alarm, relay No. 1

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

On detection: The time of detection, channel No., type of alarm, relay No.
..... Print-out color: Red

On cancellation: The time of cancellation, channel No., relay No.
..... Print-out color: Black

Example of alarm print-out

② Channel 1 No. 1 H alarm release
Relay No. 1
Release time: 14:58

① Channel 1 No. 1 H alarm generation
Relay No. 1
Generating time: 14:57

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

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

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

(1) If a thermocouple or resistance bulb wire breaks, the relevant details are indicated in a display

Example of burn-out display

6 BURN-OUT Rec. ON	Example: Burn-out in Ch 6
0.1 0.01 0.001 Burnout –0.01 –0.001	Multipoint display

Note: The trend record is switched to the 100% side.

(2) When alarm is generated or released, its data is printed on the right side of chart paper. (print color: red)

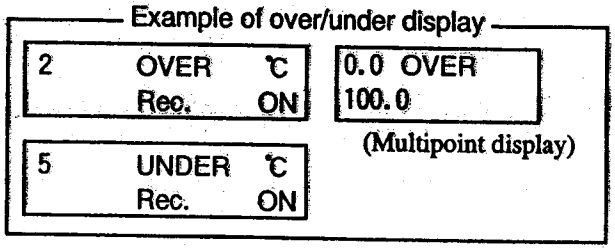
Example of burn-out print-out

1 BURN-OUT 11:52	Time of occurrence : 11.52 Channel No. : 1

6.7 Over-range, under-range display and abnormal input display

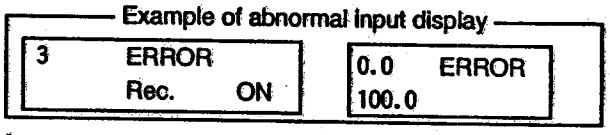
In all cases, for thermocouples, resistance bulbs and DC voltage input, there is a reference range for input signals. If input is outside preset range an 'Over' or 'Under' display is given.

Example of over/under display



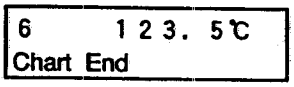
When voltage input is applied and the input signal cable breaks down or an over/under voltage is inputted, it is displayed as an abnormal input.

Example of abnormal input display



6.8 Display and record when chart paper runs out

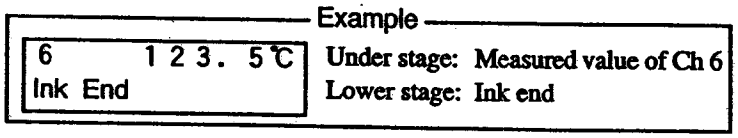
When chart paper is used out, the following is displayed and the recording stops automatically. But display of measured value and alarm monitoring are continued.



6.9 Display and record when the recording head ink is low

(1) A display as follows is given on the chart paper when the amount of remaining ink is low. 'Ink End' is displayed in the display section.

Example



(2) 'Ink Empty' is printed on the right-hand side of the chart paper.
< Print-out color : The color of the ink whose remaining quantity is low >

Note) The sign "Ink End" is displayed when the ink left in the recorder reaches less than 10%, but recording continues for a while after "Ink End" is displayed. Use a new recording head.
(When ink is used out, recording and printing operation is interrupted immediately)

6.10 Display when data backup batteries need to be replaced

When the voltage of back-up batteries becomes low, a display indicating that they need to be replaced is given.

'Battery End' is displayed in the display section.

Example

6 123. 5℃ Battery End	Under stage: Measured value of Ch 6 Lower stage: Battery end

Replace the batteries promptly when a 'Battery End' display appears page 8-3.

6.11 Display of fault in recording head carriage

If a fault in the recording head carriage occurs and the recording head can no longer function normally, a fault display is given and the recording operation stops.

Example

6 123. 5℃ Carriage Alarm	Under stage: Measured value of Ch 6 Lower stage: Carriage failure

When the sign "Carrier Failure" is displayed, turn OFF the power and check the following points.

(1) Is foreign matter adhering to the recording head carrier shaft ?

(2) Is the wire that drives the recording head broken or slack ?

(3) Has the recording paper lifted up and come into contact with the recording head ?

(4) Is the recording head set in place correctly ?

After eliminating the cause of the fault, switch on the power supply of the main unit.

6.12 Order of priority of state displays

If the items noted below occur simultaneously, the corresponding displays are given in the indicated order.

1. Chart end
2. Carriage alarm
3. Ink end
4. Battery end
5. Alarm

Note: When the state displays 1 and 2 above are given, the [SELECT] key is inoperative. However, the [DISPLAY] and [FEED] keys are operative.

7. SETTING AND CHECKING PARAMETERS

7.1 Setting and Checking

① The parameters at the time of shipment are as indicated in the table below. Recorder operations (displays, analog trend recording) can be effected simply by switching the power on without making any adjustments, but you can set the parameters you require.

② The record ranges are multirange and it is necessary to set the required ranges.

③ Alarms, Tag Nos., Message, scaling, square root extracting and subtract calculation, daily report and totalize functions are not set. Please set these if they are required. Input filters are set to 3 seconds.

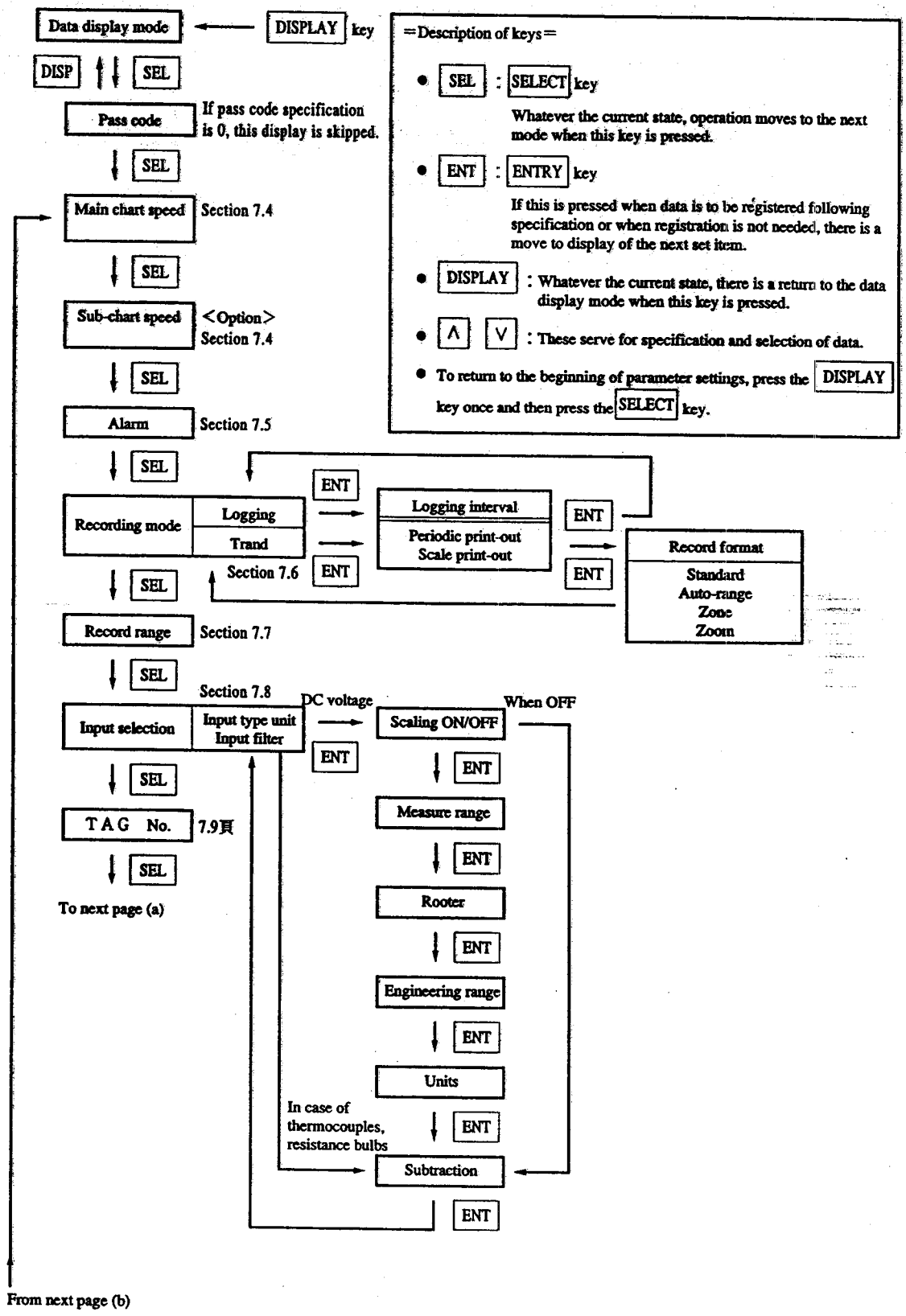
Note) If you set parameters, always do so after setting chart paper in place.
If chart paper is not installed, the SELECT key is inoperative.

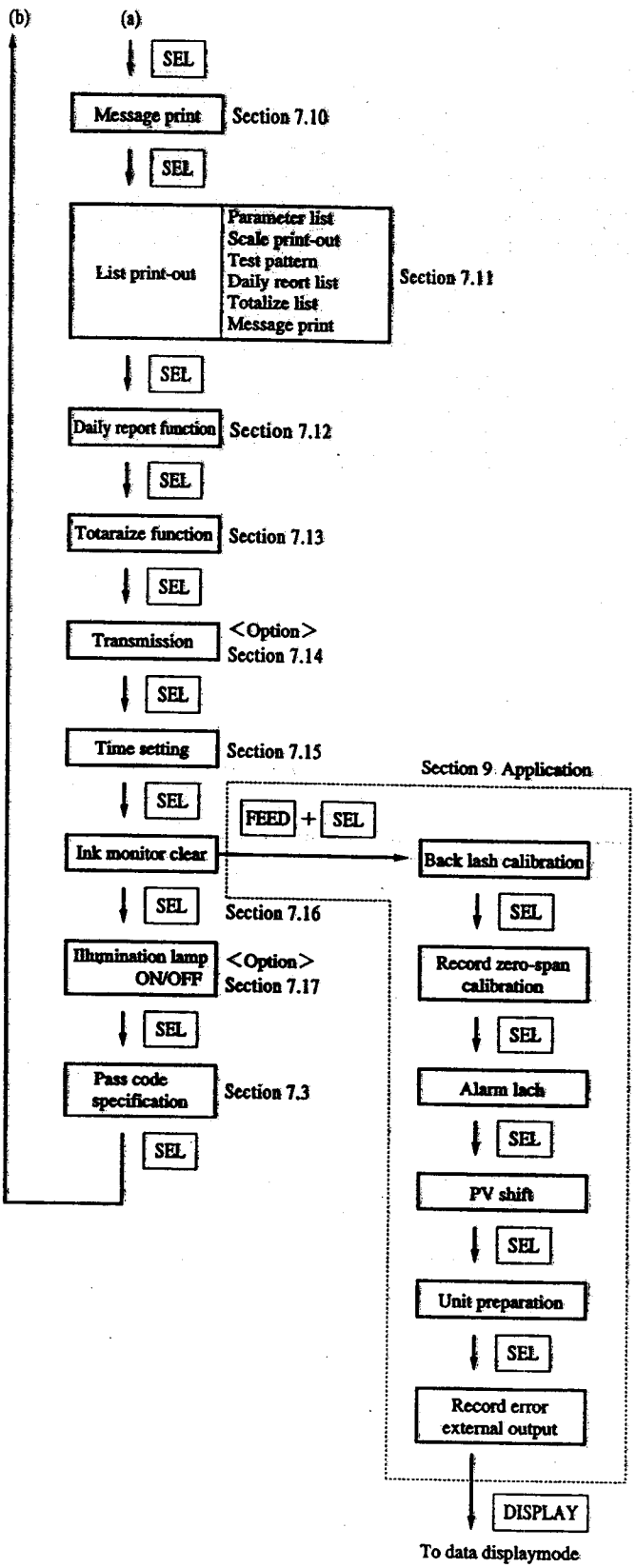
(1) Values of parameters at the time of shipment (initial values)

Parameter name	State at time of shipment (initial values)	Remarks		Method of setting, checking
Pass code	(Cancelled)	Setting range : 0 to 9999		Section 7.3
Main chart speed	20mm/h	Setting range : 5 to 1500mm/h		Section 7.4
Sub-chart speed (option)	20mm/h	Setting range : 5 to 1500mm/h Changed by external contact input		Section 7.4
Alarms	No. 1 to 4 : No Set value : 0 ALM : 0	4 kinds and 4 points, L, H, RH and RL, are available for each channel (relay output: option).		Section 7.5
Recording mode	Trend recording	Trend recording/logging recording selection		Section 7.6
	Periodic print-out : ON	Periodic digital print-out on/off selection		
	Scale print-out : ON	Fied interval scale lines, digital, units printout selection		
	Recording format : standard	Standard, auto-range recording, zoom records, zone recording selection		
Record range	Thermocouple system: 0 to 1200°C, K Resistance bulb system: 0 to 500°C, Pt DC voltage system: −5 to +5V DC	Specifiation of record range		Section 7.7
Input selection	Thermocouple: K thermocouples, °C Resistance bulb: Pt100, °C	Input type specification, °C, °F, specification	Skip/copy setting	Section 7.8
	DC voltage : V	mV, V specification		
	Input filter : 3 seconds	Setting range : 0 to 900 seconds		
	Scaling : OFF	DC voltage input scaling can be set (working values, units)		
	Rooter : OFF	DC voltage input rooter (square root extractor) can be specified		
	Subtract calculation : OFF Computation : OFF	Recording of differences between channels can be specified		
TAG No.	Blank	Up to 8 alphanumeric characters		Section 7.9
Message print	Blank Print position : 0.0mm Print timing : Manual	10-message, alphanumeric : Within 16 characters		Section 7.10
List print-out	————	Parameter list print-out, scale print-out, test pattern print-out, daily report, totaling list		Section 7.11

Parameter name	State at time of shipment (initial values)	Remarks	Method of setting, checking
Daily report	Function : OFF Automatic print-out : ON Start time : 00:00 End time : 00:00	Daily report function on/off selection, start time selection Daily report list automatic print-out on/off selection Daily report operation on/off setting for each channel	Section 7.12
Totalize	Function : OFF Automatic print-out : ON Start time : 00:00 End time : 00:00	Totalize function on/off selection, start time selection Totalize list automatic print-out on/off selection Totalize operation on/off setting for each channel	Section 7.13
RS-485 transmission (option)	Station No. : 1 Baud rate : 19200bps Stop bit : 1 Parity : odd	Specified if there is connection with parent CPU.	Section 7.14
Time setting	Current time setting	Display in the order — Year — Month — Day — Hours — Minutes	Section 7.16
Ink monitor clear	NO	Setting of ink end warning-detection function. Always set to clear (YES) after recording head replacement.	Section 7.16
Recoding paper illumination lamp (option)	ON	Set to "OFF" to turn out the recording paper illumination lamp.	Section 7.17

7.2 Outline of procedure for setting parameters




(b)
(a)
SEL
Message print
Section 7.10
SEL
List print-out
Parameter list
Scale print-out
Test pattern
Daily reort list
Totalize list
Message print
Section 7.11
SEL
Daily report function
Section 7.12
SEL
Totaraize function
Section 7.13
SEL
Transmission
<Option>
Section 7.14
SEL
Time setting
Section 7.15
SEL
Ink monitor clear
SEL
Section 7.16
Illumination lamp ON/OFF
<Option>
Section 7.17
SEL
Pass code specification
Section 7.3
SEL
Section 9 Application
FEED + SEL
Back lash calibration
SEL
Record zero-span calibration
SEL
Alarm lach
SEL
PV shift
SEL
Unit preparation
SEL
Record error external output
DISPLAY
To data displaymode

7.3 Pass code setting

Explanation

If the pass code is set to a value other than 0, it is necessary to enter the correct pass code before changing parameter setting pass code. A numerical value is specified on the screen by means of the [∧] and [∨] keys and is input by the [ENT] key. If this value is the same as the previously set pass code, there is a move to a display of the next parameter.
If the pass code is incorrectly specified, the keys are locked as follows.
Preset pass code < 5000
Only the list display is given and it is not possible to change parameter setting.
Preset pass code ≧ 5000
The list display is given, but list print-out is inhibited.
Furthermore, [RECORD], [LIST], and [FEED] keys on the front panel are locked.
At the time of shipment, the pass code is set to 0 and the key lock is released.
If the pass code is 0, the pass code display is skipped.

Example	Setting of the pass code	
Key actuation	Explanation	Display
[SEL]	Press the [SEL] key several times to bring up the pass code specification display.	PRESET PASS CODE □□□□
[∧] [∨]	Press the [∧] [∨] key to specify the value you want for the pass code (specification range: 1 to 9999).	PRESET PASS CODE □□□□
[ENT]	Press the [ENT] key to register the value. When it has been registered, there is a move to the next parameter.	MAIN CHART SPEED □□□□ mm/h
[DISP]	Press the [DISP] key to go to the data display mode.	ch1 123.4℃
[SEL]	Press the [SEL] key to bring up the pass code input screen.	PASS CODE =? □ 0
[∧]	Press the [∧] key to give the value of the pass code that has been specified.	PASS CODE =?
[ENT]	Press the [ENT] key to effect registration. Note: If the value input at this time is different from the pass code that has already been specified, the list screen comes up (key lock state). In this case, it is not possible to clear the pass code, so go through the process again from the beginning and input the correct value. If the value input is the same as the pass code value, there is a move to the next parameter.	LIST = 1 PARAMETER LIST MAIN CHART SPEED □□□□ mm/h

7.4 Setting the chart speed (main chart speed/sub-chart speed)

Explanation

- Main chart speed : This is the procedure fo rsetting the chart speed in normal operation.
  The setting range is 5 to 1500mm/h (Can be set in 1mm/h steps.)
- **If the case of a continuous recording type, if the chart speed is too fast, the result is dashed line recording instead of continuous recording. (As a general criterion, 400mm/h or more)**
- **Please note that the following digital print-outs are not possible** if the chart speed is 401mm/h or more for continous recording or 51mm/h or more for dot recording.
  "Periodic print-out", "Message print-out", "Scale print-out", "Alarm printout", "Parameter print-out", "Ink Out print-out", "Burn-out".
  However, a "Scale print-out", "Message print-out" can be made manually. See Section 7.11.
- On an intermittent recording type, if the chart paper feed speed is fast, it becomes difficult to read recording due to increase in the space between break points. It is recommended that the recorder be sued at a speed of 50mm/h or less.
- On a continuous recording type, the recording cycle varies with chart paper feed speed.

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

(But not faster than 2 seconds.)

Example)

Chart speed (mm/h)	10	20	25	50	100	200 or more
Sample time (sec.)	40	20	16	8	4	2

Example	Changing the normal chart speed of 25mm/h to 20mm/h.	
Key actuation	Explanation	Display
[SEL]	Press the [SEL] key twice to display the main chart speed.	MAIN CHART SPEED 25 mm/h
[V]	Press the [V] key to set to "20".	MAIN CHART SPEED 20 mm/h
[ENT]	Press the [ENT] key to effect registration. There is a move to display of the next parameter.	SUB CHART SPEED 25 mm/h

Explanation

• Sub-chart speed : This is the chart speed when its rate is controlled by a remote control signal.
The setting range is 5 to 1500mm/h. (can be set in 1mm/h steps.)
The optional external control unit is necessary.

Example	Changing the recording paper feed of speed 100mm/h to 150mm/h by an external control signal (DI)	
Key actuation	Explanation	Display
[SEL]	Press the [SEL] key 3 times to display the sub-chart speed.	SUB CHART SPEED 100 mm/h
[V]	Press the [∧] key to set to "150".	SUB CHART SPEED 150 mm/h
[ENT]	Press the [ENT] key to effect registration. There is a move to display of the next parameter.	ALARM Ch 1 HH=OFF 0

7.5 Setting alarms

Explanation

- Channel : Setting of channel No. for object alarm.
- Alarm No. : Up to 4 points of alarm can be set per channel.
- Kind of alarm : 4 kinds, H, L, RL, RH (setting freely for each channel).
  Alarm operation stoops at selection of No. (alarm display, print and alarm output operations are not available).
- Alarm setting value: Setting in industrial values (absolute alarm value)
- ALM : Setting of option alarm unit relay No. (no output at 1 to 6, 0)

Example	Chang of alarm No. 1 of channel 1 L → H 30°C → 80°C ALM → 6	
Key actuation	Explanation	Display
SEL	Press the SEL key several times to give the alarm display. (In cases where pass code = 0)	ALARM Ch 1 NO. 1=L 30℃ ALM
ENT	Select channel to be changed, and press the ∧ key.	ALARM Ch 1 NO. 1=L 30℃ ALM1
∧	Press the ∧ key to change "L" to "H".	ALARM Ch 1 NO. 1=H 30℃ ALM1
ENT	Press the ENT key.	
∧	Press the ∧ key to change the set value from "30°C" to "80°C" and press the ENT key.	ALARM Ch 1 NO. 1=H 80℃ ALM1
ENT		
∧	Press the ∧ key to change the ALM No. from "1" to "6" and press the ENT key to effect registration.	ALARM Ch 1 NO. 1=H 80℃ ALM1
ENT		
	(When the ENT key is pressed, the channel No. flashes and the setting is completed. Follow the same procedure for setting in other channels.)	

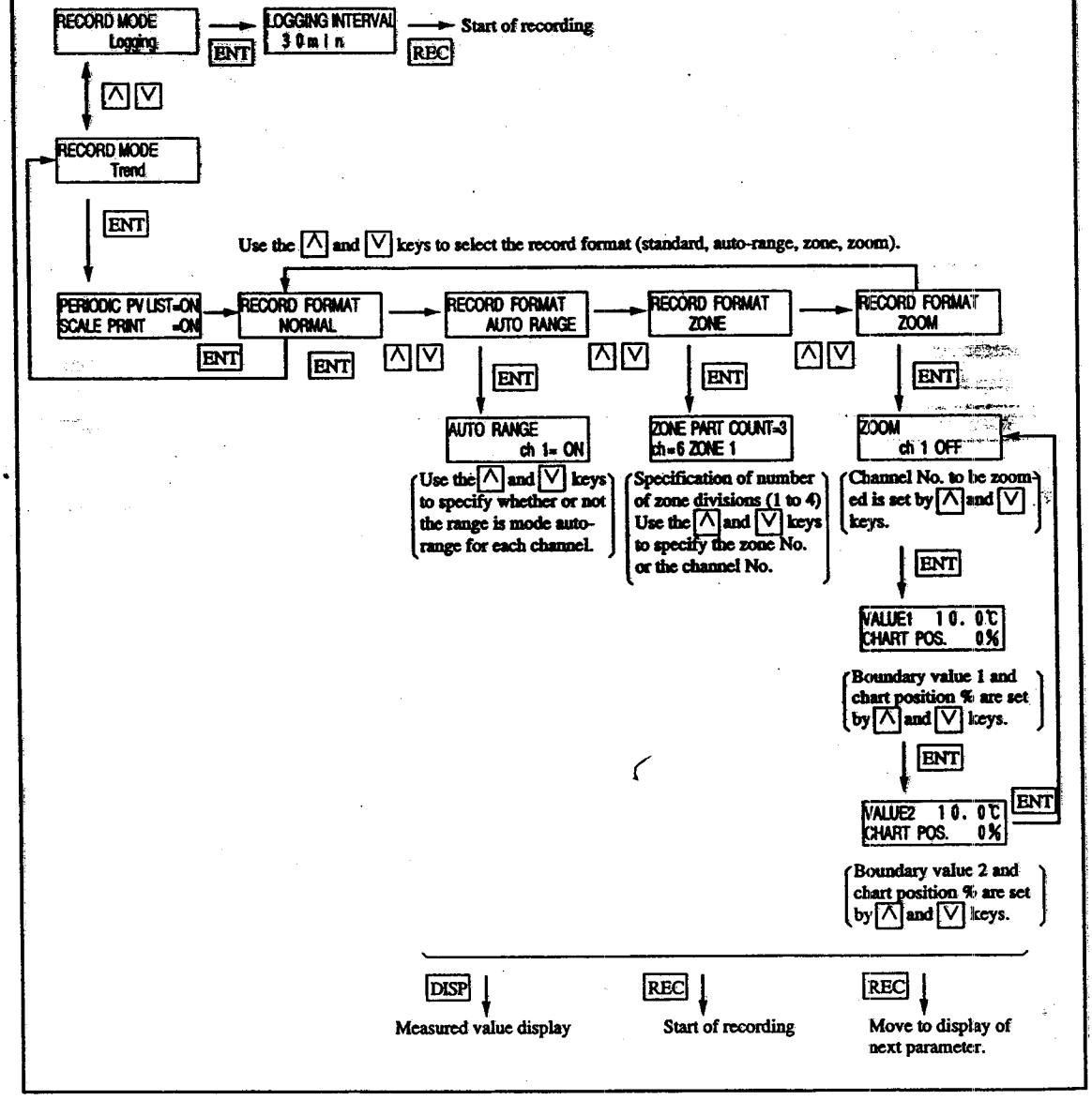
Note : RH, RL ····· High/low limit alarm for variation rate.
Alarm is emmitted when variation rate per input exceeds the set value of each alarm.

7.6 Setting the recording mode

The following recording modes can be set in this section.

① Logging recording (logging)
② Periodic print-out
③ Scale print-out
④ Auto-range recording (auto-range)
⑤ Enlarged/reduced recording (zoom)
⑥ Zone recording (zone)

Setting procedure



① Logging recording (logging)

- In this case, there is no analog trend recording but a record of data (the time channel Nos., measured values, units) is produced at specified intervals of time (10 - 60 minutes can be specified.)
- If there is detection or clearing of an alarm during logging print-out, this is printed on the right-hand side of the recording paper. (Example of print-out: Section 11.9)

② Periodic print-out

- The following items are printed out at set intervals in depending on chart speed.
  [Time line, time, chart speed, channel Nos., measured values, engineering units.]
- This print-out is effected alternately with scale print-outs.
- It is not effected if the periodic print-out is set to "OFF".

③ Scale print-out

- Scale lines, digits, unit and Tag Nos. are printed out at set intervals.
- This print-out is effected alternately with periodic print-outs.
- It is not effected if the scale print-out is set to "OFF".
- If both scale print-out and periodic print-out are set to "ON", the print-outs are effected alternately at set intervals.

Periodic print-out and scale print-out time intervals sub heading

The time intervals of print-outs vary depending on the chart speed.

(1) In the case of continuous recording

Chart speed (mm/h)	5 to 9	10 to 19	20 to 39	40 to 79	80 to 159	160 to 239	240 to 300
Print-out time interval	12 hrs	8 hrs	4 hrs	2 hrs	1 hr	30 min	20 min

When the chart speed exceeds 401mm/h, only the time line is recorded. Periodic print-out and scale print-out are not effected.

(2) In the case of intermittent recording

Chart speed (mm/h)	5 to 9	10 to 19	20 to 39	40 to 50
Print-out time interval	12 hrs	8 hrs	4 hrs	2 hrs

When the chart speed exceeds 51mm/h, only the time line is recorded. Periodic print-out and scale print-out are not effected.

Note: If the time for a periodic print-out or scale print-out arrives while data printing or other list printing is in progress, the periodic print-out or scale print-out is not made.
If data print-out is started while a periodic print-out or scale print-out is in progress, the periodic print-out or scale print-out is halted partway through.

④ Auto-range recording (auto-range)

- If input outside the record range occurs, recording is effected with the record range automatically changed.
- The record range after a change goes 50% of the span to the plus side or the minus side. Note that the recording span does not change. (Made effective with an ON setting.)

Example : With a 0 to 100°C record range (recording span 100°C)

- If input goes beyond the range in the positive direction, there is a change to 50 to 150°C.
- If input goes outside the range in the negative direction, there is a change to –50 to +50°C.

Note 1: A change in the range is only effected once in a given direction.
Once a range has changed in the positive direction, it does not change again even if the record range is exceeded again.

Note 2: If the record range changes because it has been exceeded in the positive direction and then input below the new range in the negative direction there is a return to the original range. (The reverse also applies.)

Note 3: A mark is printed in black at the right-hand edge of the recording paper when the range changes.

Note 4: There is a record range MAX. value and MIN. value for each type of input.
Consequently, if a change means that a range is going to go beyond the MAX. value or MIN. value for the record range of the type of input in question, the MAX. value or MIN. value imposes a limit.

Example : For a K thermocouple 0 to 1000°C record range
If over-range occurs: change to 400 to 1400°C
If under-range occurs: change to -230 to 770°C

Note 5: Auto-range recording cannot be specified simultaneously with zoom recording or zone recording.

⑤ Enlarged/reduced recording (zoom)

- Within the record range (record range) for each channel, there are three recording scales. This makes it possible to have an enlarged record in one portion and a reduced record in the other portion.

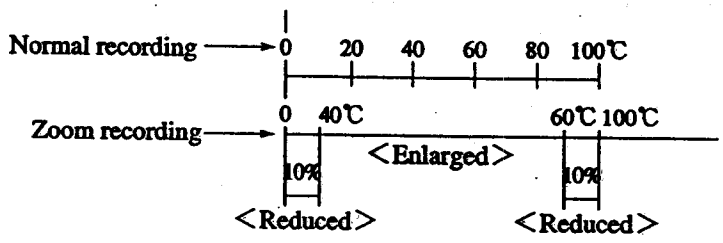
Example: With a 0 to 100°C record range:

Suppose you want to enlarge 40 to 60°C record in a 10 to 90% range.

(The 0 t 10% range becomes a reduced record of 0 to 60°C, and the 90 to 100% range becomes a reduced record of 60 to 100°C)

Boundary value 1 = 40°C Boundary value 2 = 60°C

Chart position = 10% Chart position = 90%



Note 1: Do not set the normal recording 0% value at the 100% recording position or the normal recording 100% value at the 0% recording position.
If you do, proper operation becomes impossible.

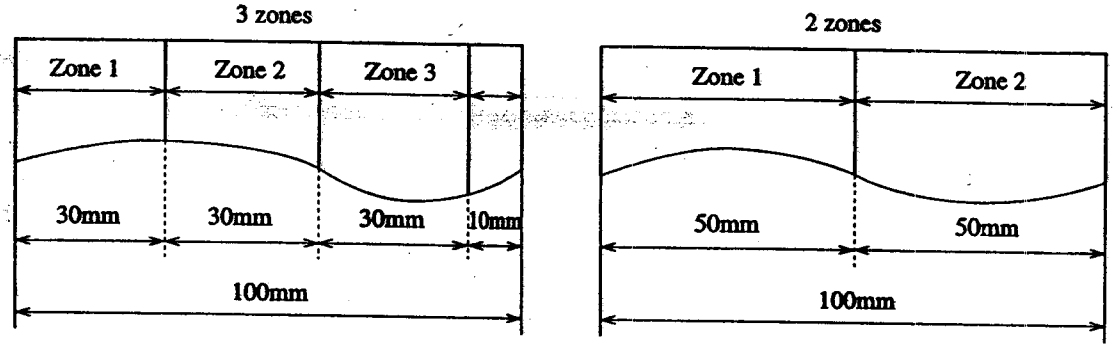
Note 2: If zoom recording is specified, scale print-out digits are printed only for the 4 points 0% and 100% of the record range, and the boundary value 1 and the boundary value 2. (Boundary value scale digits are printed only if the record position is 15 to 85% and when the difference between boundary value 1 and boundary value 2 is less than 7%, only the small chart position is printed.)

Example: With a record range 0 to 500°C, the boundary value 1 of 200°C, chart position of 30%, and the boundary value 2 of 300°C, chart position of 70%.

Note 3: Zoom recording cannot be specified simultaneously with auto-range recording or zone recording.

⑥ Zone recording (zone)

- The recording width is 100mm and overlap of the records of different channels is prevented by the provision of recording zones for the various channels.
- Any zone can carry the record of any channel.
- The number of divisions is up to a maximum of 3 zones.



10mm at the right-hand edge is blank

Note 1: For scale print-outs when zone recording is specified, there is a print-out only of scale digits for the 2 points record range 0% and 100%.

Note 2: During zone recording, alarm print-outs and burn-out print-outs are produced at the right-hand edge whatever the zone.

Note 3: Zone recording cannot be specified simultaneously with auto-range recording or zoom recording.

7.7 Setting record ranges

Explanation

An individual record range is set for each channel.
'Record range' means the 0% and 100% position scale on recording paper.
When the recorder is used with DC voltage input scaling, the recording range should be specified after setting the scaling.
When the scaling has been set, the decimal point position of the recording range is the same as the decimal point position specified by engineering values.

Example	The record range of channel 1 is changed from 0 to 100°C to –50 to 50°C.	
Key actuation	Explanation	Display
SEL	Press the SEL key several times to give the recording range display.	Ch 1 RANGE °C 0.0 ~ 1000.0
ENT	Since channel No. 1 is selected, press the ENT key.	Ch 1 RANGE °C 0.0 ~ 1000.0
V ENT	Press the V key to change the range lower limit from "0" to "–50" and press the ENT key.	Ch 1 RANGE °C −50.0 ~ 1000.0
V ENT	Press the V key to change "100" to "50" and press the ENT key.	Ch 1 RANGE °C −50.0 ~ 50.0
	When the ENT key is pressed, the channel No. flashes and the setting is completed. Follow the same procedure for setting in other channels.	

Table 1 Specifiable ranges record ranges

Type		Reference range	Reference range	Specifiable ranges for record range	
Thermo-couples	B	400 to 1760℃	752 to 3200°F	370.0 to 1790.0℃	698.0 to 3254.0°F
	R	0 to 1760℃	32 to 3200°F	- 30.0 to 1790.0℃	- 22.0 to 3254.0°F
	S	0 to 1760℃	32 to 3200°F	- 30.0 to 1790.0℃	- 22.0 to 3254.0°F
	K	-200 to 1370℃	-328 to 2498°F	- 230.0 to 1400.0℃	- 382.0 to 2552.0°F
	E	-200 to 800℃	-328 to 1472°F	- 230.0 to 830.0℃	- 382.0 to 1526.0°F
	J	-200 to 1100℃	-328 to 2012°F	- 230.0 to 1130.0℃	- 382.0 to 2066.0°F
	T	-200 to 400℃	-328 to 752°F	- 230.0 to 430.0℃	- 382.0 to 806.0°F
	N	0 to 1300℃	32 to 2372°F	- 30.0 to 1330.0℃	- 22.0 to 2426.0°F
	W	0 to 1760℃	32 to 3200°F	- 30.0 to 1790.0℃	- 22.0 to 3254.0°F
	L	-200 to 900℃	-328 to 1652°F	- 230.0 to 930.0℃	- 382.0 to 1706.0°F
	U	-200 to 400℃	-328 to 752°F	- 230.0 to 430.0℃	- 382.0 to 806.0°F
	P N	0 to 1300℃	32 to 2372°F	- 30.0 to 1330.0℃	- 22.0 to 2426.0°F
Resist-ance bulbs	JPt100	-200 to 600℃	-328 to 1112°F	- 230.0 to 630.0℃	- 382.0 to 1166.0°F
	Pt100	-200 to 600℃	-328 to 1112°F	- 230.0 to 630.0℃	- 382.0 to 1166.0°F
DC voltage		- 50 to +50mV		- 55.00 to +55.00mV	
		-500 to +500mV		- 550.0 to +550.0mV	
		- 5 to +5V		- 5.500 to +5.500V	
		- 50 to +50V		- 55.00 to +55.00V	

* JPt100 : Pt100Ω for JIS CI604 1981. (α =0.003916Ω/Ω/℃)
Pt100 : (α =0.00385Ω/Ω/℃)
WCCS, L (JDIN), U(TDIN)

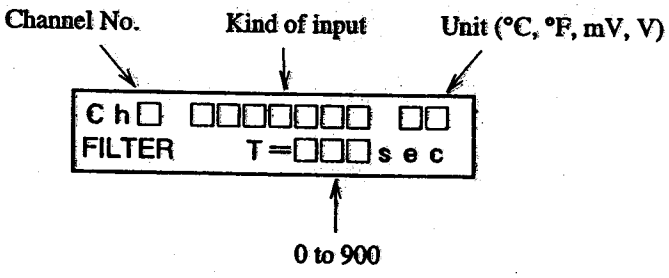
The range -32767 to 32767 (decimal points can be located wherever required) can be specified for the record range in scaling or difference calculation specifications.

7.8 Setting kind of input, skip, unit, filter, scaling and subtraction

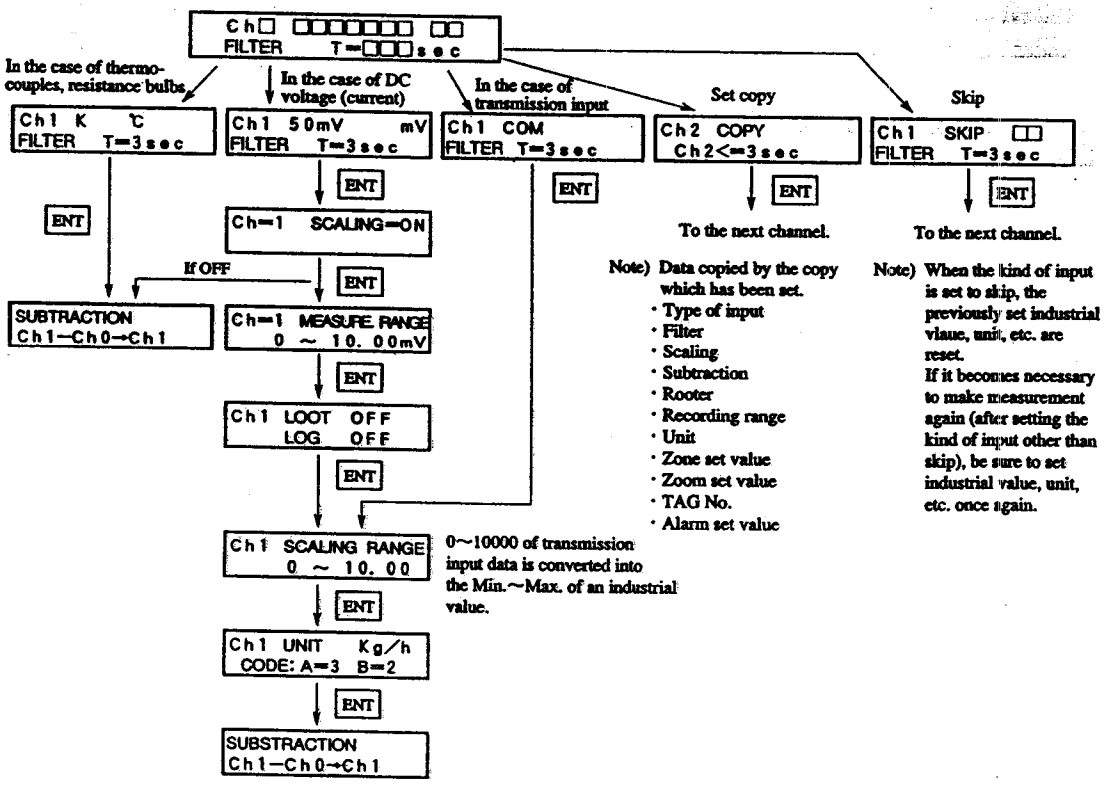
Explanation

Kind of input (B, R, S, K, E, J, T, N, W, L, U, PH thermocouples, JPt, Pt, voltage, com, copy skip), units (°C, °F, mV, V), filters (time constant) and scaling, input range, industrial value (scaling value), unit, rooter (square extraction) and logarithmic calculation for DC voltage input can be set for each channel. This parameter is also used for setting subtraction.

– Explanations of display –



Note: When the kind of input is set to skip, indication, recording and alarm operations are not performed.

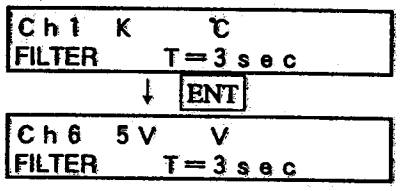


① Setting and changing input signal type

Thermocouple ⟷ Resistance bulb ⟷ DC voltage

To effect the changes refer to Section 5.3 to change the positions of the setting pins. Then, use the following parameter specification to specify the correct input signal type.

Example: Changing 5V input signal type of channel 6 to thermocouple input

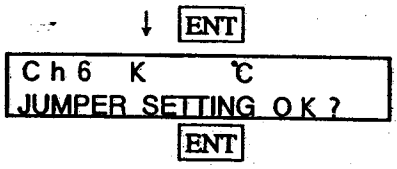


Use the [∧] [∨] keys to select channel 6 and press the [ENT] key.

The cuurent "5V" value is flashing; press the [∧] [∨] keys to select the "K" input type and press the [ENT] key. (Note)

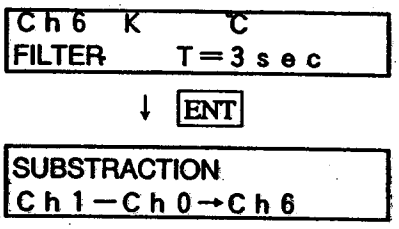
(Note)
The type of input is displayed in the following order by pressing the [∧] key (in reverse order with [∨] key).

→K→E→J→T→R→S→B→N→W→L→U→P N→P t→J P t→50mV
↓
Skip←Copy←C O M←50 V←5 V←500mV



There is output of a display asking you to check the change in setting pins and the type of input after the change. Please check that the work of changing the setting pins has been completed.
If everything is OK, press the [ENT] key.

② Setting and changing the input filter



If there is no change in the filter, press the [ENT] key.
Input filter setting range: 0 to 900 sec. (in 1 sec. Units)

There is a move to the next parameter.

③ Scaling , scaling ranges, units

- For DC voltage input, scaling is set to "ON" or "OFF".
- The [∧] and [∨] keys are used to set the measurement range.
  (The left-hand side is the lower limit and the right-hand side the upper limit.)
- The [∧] and [∨] keys are used to specify scaling range for the corresponding measurement range.
  (Range of − 32767 to 32767; decimal point can be located anywhere)
- The decimal point positioning
  When the [ENT] key is pressed following setting of the upper limit value, the lower limit value and the upper limit value both flash. The positions of the decimal points can now be changed by pressing the [∧] and [∨] keys.
  Example: 0.00 to 10.00
- Referring to the 'Units code table' on page 7-21, press the [∧], [∨] keys to specify the units.
  Example: Code A = 3, B = 2 → kg/h

Note: Relation between measuring range, industrial value, recording range and indicated value.
Example:

		Example 1	Example 2	Example 3	Example 4
Specifi-cations	Input range	5V	5V	5V	5V
	Mesurement range	1 to 5V	1 to 5V	1 to 5V	1 to 5V
	Engineering value	0 to 1000	0 to 1000	0 to 1000	0 to 1000
	Record range	0 to 1000	0 to 500	0 to 2000	−1000 to 1000
	(Enginnering units)	(t/h)	(t/h)	(t/h)	(t/h)
If input is 1V	Indicated value	0 (t/h)	0 (t/h)	0 (t/h)	0 (t/h)
	Record	0% point	0% point	0% point	50% point
If input is 3V	Indicated value	500 (t/h)	500 (t/h)	500 (t/h)	500 (t/h)
	Record	50% point	100% point	25% point	75% point
If input is 5V	Indicated value	1000 (t/h)	1000 (t/h)	1000 (t/h)	1000 (t/h)
	Record	100% point	Over 100.5% point	50% point	100% point

Note: When setting scaling "ON", the recording range is cleared to zero. Set it again referring to Item 7.7 "Setting of recording range".

④ Square root extraction

- This sets a rooter (square root extraction) function for each channel.
  ON: Operative
  OFF: Inoperative

This calculates square root of input values converted to % taking the specified measurement range to be 0 to 100%. Negative input is regarded as 0%. Data (0 to 100%) after square root extraction are converted to scaling ranges.

Example: With Input range 5V
Measurement range 1 to 5V
Working value 0 to 1000 (t/h)

	Scaling range	Record
If the input is 1V (0%)	$(1000-0) \times \sqrt{0} = 0$ (t/h)	0% point
If the input is 3V (50%)	$(1000-0) \times \sqrt{0.5} = 707$ (t/h)	70.7% point
If the input is 5V (100%)	$(1000-0) \times \sqrt{1} = 1000$ (t/h)	100% point

⑤ Logarithmic calculation

- Setting of logarithmic calculation function of each channel.
  ON: Valid OFF: Invalid

① Instruction and print format: 9.9E ±9 Indication: –9 to 9
Numeric unit: 1 digit below decimal point
Data range: 1.0×10^{-9} to 1.0×10^{9}
(When the index value is negative for simultaneous display of 6 channnels, 1.0^{-9} is displayed.)

② Setting of industrial value and recording range

Setting of industrial value
To be set by index only

C h 1 Industrial value
0 ~ 9

(this means 10^0 to 10^9)

Setting of threshold of recording range and zoom recording
To be set by index only

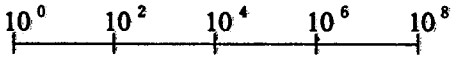
C h 1 Recording range V
0 ~ 8

(this means 10^0 to 10^8)

Example of setting:
Input 1 to 5V is converted into 10^0 to 10^8 at setting of measurement range 1 to 5V and industrial value 0 to 9

	Industrial value
Input 10 (0%)	1.0E0
Input 30 (50%)	1.0E4
Input 50 (100%)	1.0E8

Example of scale print: (only 10^n is printed)



③ During logarithmic operation setting, substract calculation and integration are not available, and average value is not printed on the daily report list.

⑥ Subtraction

- This is a specification for recording the result of calculation of the difference between 2 channels.

  Example: The result of Ch1 to Ch3 is recorded in Ch1.
- Subtract calculations are only possible between channels for which the units and decimal point position are the same. (If they are different, results cannot be guaranteed.)
- If Ch0 is specified, no subtract calculation is performed.
- When the channel requiring subtract calculation is skipped, the subtract calculation is skipped, the subtract calculation is not performed.

Cautions on setting/change of input signal, scaling and subtract calculation

When setting or changing input signal, scaling or subtract calculation, the parameter of the corresponding channel is initialized as shown below. In this case, be sure to set the parameter once again.

Initializing timing / Parameter	Change of input signal and setting of scalling OFF	Setting of scaling ON	Setting of subtract calculation CH = 0 〈Subtract calculation OFF〉
Recording range	Initial value corresponding to the type of input is obtained	Cleared to 0, 0 to 0	Initial value corresponding to the type of input is obtained
Alarm	All alarms (H, L, RL, RH) turn OFF. Alarm set value and output relay No. are cleard to 0.		
Auto range	Auto range setting for the channel to be changed turns OFF	———	———
Zoom	Zoom setting for the channel to be changed turns OFF, and threshold value and chart position are cleard to 0.	———	Threshold value for the channel to be changed is cleare to 0.
Scaling	Scaling turns OFF and measuring range, industrial value and unit are initialized.	———	———
Router	OFF	———	———
Subtract calculation	Subtract calculation channel = 0 (Subtract calculation OFF)	———	———
PV shift	Initial value Shift = 0, inclination = 100%	Ditto	———

Table of unit codes

Classification	Code A \ Code B	1	2	3	4	5	6	7	8	9	10
Temperature, humidity	1	℃	°F					%RH	Vol%		
Flow rate	2	t/day	kg/day	g/day	Nm^3/day	m^3/day	Nl/day	l/day	cc/day		
	3	t/h	kg/h	g/h	Nm^3/h	m^3/h	Nl/h	l/h	cc/h		
	4	t/min	kg/min	g/min	Nm^3/min	m^3/min	Nl/min	l/min	cc/min		
	5	t/sec	kg/sec	g/sec	Nm^3/sec	m^3/sec	Nl/sec	l/sec	cc/sec		
Pressure	6	mmH_2O	mH_2O	mmHg	cmHg	mHg	mmAq		mbar	bar	
	7	mg/cm^2	g/cm^2	kg/cm^2		N/mm^2	N/m^2		psi	Torr	
	8	mPa	Pa	kPa	MPa						
Level, height	9	mm	cm	m					in	ft	
Capscity, weight, area	10	ml	l	kl		mm^3	cm^3	m^3		cc	
	11	mm^2	cm^2	m^2			g	kg	t		
Density	12	g/cm^3	kg/cm^3	g/m^3	kg/m^3	t/m^3	g/l	kg/l	g/ml		
Analysis	13	ppm	$ppmNH_3$	$ppmSO_2$	ppmH2S	ppmCO	$ppmO_2$	ppmNOx	ppb	pH	mol
	14	%	$\%H_2$	$\%CO_2$	%He	%Ar	$\%O_2$	%NaCl	%CO	CP	PO_2
Force - energy	15	mN	N	Nm	gcm	kgcm	kgm		J	KJ	HP
Speed, acceleration	16	mm/sec	mm/min	mm/h	m/sec	m/min	m/h	km/h			
	17	rps	rpm	rph		m/sec^2	rad/sec				
Time	18	μsec	msec	sec	min	h					
Electro-magnetism	19	mV	V	kV	μA	mA	A		A/T	Hz	dB
	20	W	kW	VA	kVA	Var	kVar	Ωcm	kΩcm	MΩcm	μS/cm
	21	μF	F	mH	H	C	mΩ	Ω	kΩ	MΩ	μ
Heat, light	22	kcal	cal	$kcak/m^3$		lx	cd	lm	cd/m^2		
Radiation	23	cps	cpm	μSv/h	mSv/h	nGy/h	μGy/h	μm	g/m^2		
Others	24	Pa·s	mPa·s								

Note: Empty boxes are spaces.
Any units prepared by users can be registered in 12 places of the Code A=1-12 and B=10.
(See Section 9.4)

Example of specification:kg/h is specified.
Code A : 3Code B : 2 specified

Ch 1 UNIT
A=3 B=2

7.9 Setting TAG Nos.

Explanation

A Tag No. for each channel is specified by up to 8 alphanumeric characters.
Specified Nos. are printed on the recording paper, so as to identify the channel to which measurement record applies.

Example	The Tag No. "TR1-1234" of Ch1 is changed to "RR1-ABCD".	
Key actuation	Explanation	Display
[SEL]	ress the [SEL] key several times to give the Tag No. mode display.	Ch 1 TAG NO. TR1−1234
[ENT]	Since channel No. 1 is selected, press the [ENT] key.	Ch 1 TAG NO. TR1−1234
[∧] [∨]	The 1st place of the Tag No. flashes. Press the [∧] or [∨] key to indicated the character you want.	Ch 1 TAG NO. RR1−1234
[ENT]	Press the [ENT] key. When the [ENT] key is pressed, the 2nd position of the Tag No. flashes. Specify this and subsequent place in the same way. If 8 places are not needed, press the [ENT] key to make each position flash in turn. When the channel No. flashes, the specification is complete. Follow the same procedure to specify Tag Nos. for other channels	Ch 1 TAG NO. RR1−1234 Ch 1 TAG NO. RR1−A234 ⋮ Ch 1 TAG NO. RR1−ABCD

TAG No. Table : The following characters and symbols can be specified. Select with the [∧], [∨] keys.
(Total of 67 characters/symbols)

```
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z
0 1 2 3 4 5 6 7 8 9 . + − * / % Space
```

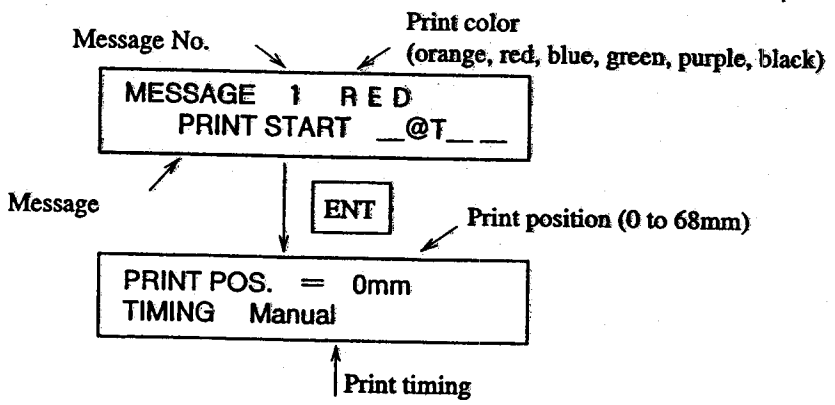
Tag No. is printed on scale and displayed together with industrial value of corresponding channel as shown below.

```
1        100        ℃
RR1−ABCD  Record on
```

7.10 Message print specification

Explanation

- Message print is possible at the occurrence of any events.
- Up to 10 messages, each containing a maximum of 16 characters, can be registered by the user.
- Messages can be specified in numerals, alphabets and other special symbols. Print colors (orange, red, blue, green, purple, black) and print positions (0 to 68mm) can also be specified.
- Message print timing can be specified for fixed time at the time of alarm, DI input and recording start.



(1) Print color specification

①Message print color is selected by [∧], [∨] keys. Press the [ENT] key after selection.
②Print color comes in 6 kinds (orange, red, blue, green, purple, black).
③When OFF is set in print color, no message is printed.

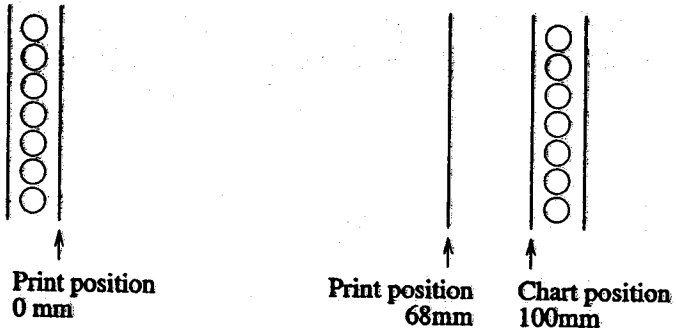
(2) Message specification

①At the completion of print color specification, the first digit of message flashes. Press the [∧], [∨] keys to display desired characters, then press the [ENT] key.
At this time, the second digit flashes. Specify the next desired characters in the same manner.
②When '@Y', '@D' and '@T' are specified in message, "year", "month", "day" and "time" are printed (year is expressed in 3 characters, while month, day and time are expressed in 5 characters).
Example: Specification: @Y__ @D__/__ @T__:__
Print: '93 06/09 12:00
③When @1 to 6' are specified in message, measured values (7 characters, without unit) corresponding to Ch1 to 6 are printed.
Example: Specification: ch__1__ @1_____mV___
Print: ch 1 −0.005mV
④When message contains more than 16 characters, up to 16 characters are printed.

(3) Print position specification

①Message print position can be selected by the [∧], [∨] keys. Press the [ENT] key after selection.
②The print range is 0 to 68mm. The size of each print character is 2mm.

Example : Print position for chart



(4) Print timing specification

①Select message print timing with [∧], [∨] keys and press [ENT] key.

(a) Manual

- When "manual" is selected, messages cannot be printed except for list print.

(b) Recording start

- When "Record start" is selected, message are printed at the start of recording (record reset after power ON, and record start with [REC] key).

(c) DI1 ON, DI1 OFF

- When DI1 is selected, messages are printed at ON or OFF of DI1 (terminals; ⑪to㉑). (When DI2 is selected by message print timing, DI1 record start/stop function is not operating)

(d) DI2 ON, DI2 OFF

- When DI2 is selected, message are printed at ON or OFF of DI2 (terminals; ⑫ to ㉒). (When DI2 is selected by message print timing, DI2 chart paper feed speed select function is not operating)

(e) DI3 ON, DI3 OFF

- When DI3 is selected, message are printed at ON or OFF of DI3 (terminals; ⑬ to ㉓). (When DI3 is selected by message print timing, DI3 data print function is not operating)

(f) 00:00 to 24H

- When time is selected, messages are printed at set time, then printing is made at intervals of designated print time ("minute" not settable).

Example : Messages are printed at intervals of 2 hours starting from 8 o'clock.

PRINT POS. = 0 mm
TIMING 8 : 0 0 ~ 2 H

Set 8:00 with [∧] and [∨] keys and press [ENT] key, then set 2H with [∧] and [∨] keys and press [ENT] key.

(g) ALM1 1 OFF

- When alarm is selected, message are printed at ON or OFF of alarm of the set channel.
  Example : Message are printed at ON of channel 2 No. 1 alarm.

Set channel 2 with [∧] and [∨] keys and press [ENT] key. Then set alarm No. with [∧] and [∨] keys and press [ENT] key. Next, set ON with [∧] and [∨] keys and press [ENT] key.

(h) Record end

Messages are printed at stop of recording.

7.11 List print-out specification

Explanation

- This is used for any of the parameter list print-outs, scale print-outs, test pattern print-outs, daily report lists, totalize lists, message print-out and list print is used for printing parameter list, scaling, test pattern, daily report list, integration list and messages.
- The data display mode during printing of a list is the normal measurement display mode.
- If a list is printed during recording operation, analog trend recording is halted but it automatically re-starts when print-out of the list ends. Message print is possible without suspending analog trend recording.

Example	Print-out of a test pattern is mode.	
Key actuation	Explanation	Display
SEL	Press the SEL key several times to give the list selecting display.	LIST = 1 PARAMETER LIST
∧	Press the ∧ key to change to "List = 3" TEST PATTERN.	LIST = 3 TEST PATTERN
ENT	When the ENT key is pressed, printing starts.	
	(To stop the print-out partway through, press the LIST key.)	

LIST = 1 PARAMETER ..... Example of print-out: See Section 11.3
2 SCALE PRINT (Print-out for each channel is possible.)
..... Example of print-out: See Section 11.5
3 TEST PATTERN ..... Example of print-out: See Section 11.4
4 DAILY REPORT ..... Example of print-out: See Section 11.6
5 SUM DATA LIST ..... Example of print-out: See Section 11.7
6 MESSAGE PRINT (Print-out for each No. is possible.)
..... Example of print-out: See Section 11.8

Note 1: In the case of continuous recording, when a list print-out ends and analog trend recording restarts, the input value of immediately before the list print-out and the input value of immediately after the list print-out are recorded as a continuous line.

7.12 Daily report specification

Explanation

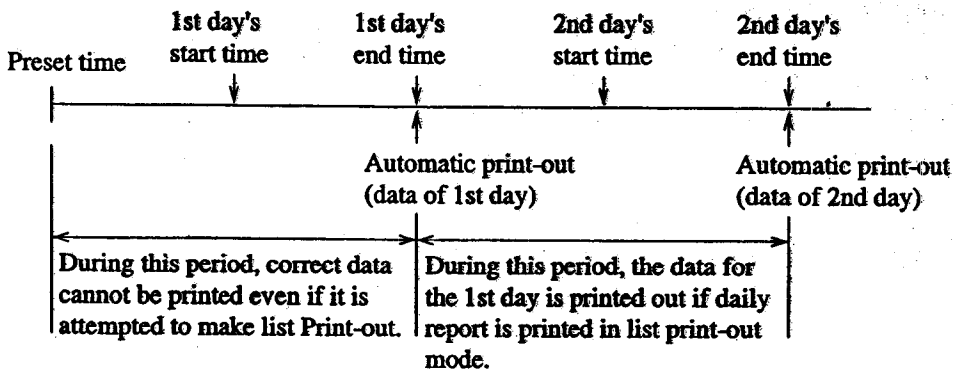
- Instantaneous value data for each hour in each channel over a 24-hour period (up to 24 data items) and the average values, maximum values and minimum values of these lots of data items are printed out. (Printing time: about 24 minutes/6 channels for 24-hour setting) (Analog trend recording cannot be performed during print-out.)
- The specification consists of specifying operation start time and operation end time on/off for automatic print-out and on/off for operation in each channel.
  (Daily report operation is not performed for the channel set to OFF.)
- For execution, automatic print-out is set to ON. Print-out is executed at the operation end time.

Example	Print-out of a test pattern is mode.	
Key actuation	Explanation	Display
SEL	Press the SEL key several times to display "DAILY REPORT"	DAILY REPORT OFF
∧ ENT	Press the ∧ key to display "ON" and press the ENT key.	DAILY REPORT OFF
∧ ∨ ENT	Next, use the ∧, ∨ keys to display "ON" for causing automatic print-out and press the ENT key.	AUTO PRINT ON
	Use the ∧, ∨ keys to set the operation start time to "09" and press the ENT key.	START TIME 09:00 STOP TIME 16:00
	Press the ∧, ∨ keys to set operation end time to "16", then press the ENT key.	
∧ ∨ ENT	Use the ∧, ∨ keys to select channel No. 1 and press the ENT key.	PRINT CHANNEL Ch□=ON
	Next, use the ∧, ∨ keys to select ON and press the ENT key.	
	Follow the same procedure to make setting for channel Nos. 2 to 6.	

Note: Relations between operation start times and printing time

When the setting of the start time and end time of daily report is changed, the print list thereafter is not compensated.

After changing the time setting, set the daily report or integration to OFF (buffer clear), then set it to ON and wait for 1 day (until the end time of the following day).



When printing 24-hour daily report, set the start time and end time.

7.13 Specifying totalize function

Explanation

- A maximum 24-hour lots of wholly totalizing value data in each channel (up to 24 data items) and the value of the sum totals of these lots of 24 data items are printed out (Printing time: about 24 minutes/6 channels). (Analog trend recording cannot be performed during print-out.)
- The specification consists of specifying on/off for automatic print-out and on/off for operation in each channel.
  (Totalize function is not available for the channel set to OFF.)
- For execution, automatic print-out is set to ON. The print-out is effected at the operation end time.

Example	Integration operation is performed from 9 to 16 o'clock and automatic print-out is effected for channel 1 to 6.	
Key actuation	Explanation	Display
SEL	Press the SEL key several times to display "DATA SUM FUNCTION"	DATA SUM FUNCTION OFF
∧ ENT	Press the ∧ key to display "ON" and press the ENT key.	DATA SUM FUNCTION ON
∧ ∨ ENT	Next, use the ∧, ∨ keys to display "ON" for causing automatic print-out and press the ENT key.	AUTO PRINT ON
	Use the ∧, ∨ keys to set the operation start time to "09" and press the ENT key.	START TIME 09:00 STOP TIME 16:00
	Press the ∧, ∨ keys to set operation end time to "16", then press the ENT key.	
∧ ∨ ENT	Use the ∧, ∨ keys to select channel No. 1 and press the ENT key.	PRINT CHANNEL Ch□=ON
	Next, use the ∧, ∨ keys to select ON and press the ENT key.	
	Follow the same procedure to make setting for channel Nos. 2 to 6.	

Note: The relations between integration operation start times and print-out times are the same as for the daily report function. See Section 7.12.

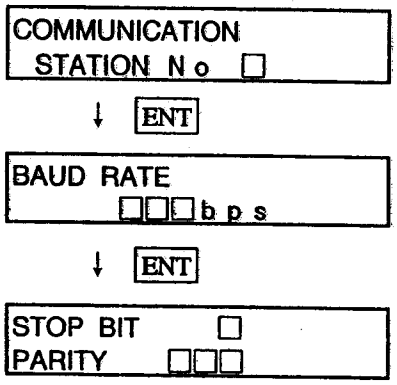
The input to the channel of integrating action ON is integrated in one second period, and it becomes 100% in an hour.
(Example) When the input 0 to 100 ℓ per hour:
The integrated value becomes 100 ℓ after integration of 100 ℓ per hour for one hour.

7.14 Transmission specification (option)

Explanation

The transmission function (option) of this unit serves for transmission of measured values and reception of specified condition, etc. through an RS-485 interface.
For details, please see Appendix 3.

Items for specification in this unit are as follows.



The station No. can be set to 1 to 31 for RS-485. (It is set by means of the [∧], [∨] keys.)

The 4 rates 2400, 4800, 9600 and 19200 bps can be set for the baud rate (transmittion rate).
(It is set by means of the [∧], [∨] keys.)

- The stop bit can be made 1 bit or 2 bits.
- Parity: Can be set to EVEn (even parity), ODD (odd parity), or NONE (no parity).

Items accessible by transmission are as follows.

	Item	READ	WRITE
Operation	Recording start/stop	×	×
	Extra value list print	×	×
	Chart fast-forward feed	×	×
Display	Measured value	○	○
	Time	○	×
	Alarm	○	×
	Chart end	○	×
	Carriage abnormal	○	×
	Battery end	○	×
	Burnout	○	×
	Over/under range	○	×
Manual print	Set value list print	×	×
	Test pattern print	×	×
	Scale print	×	×
	Daily report integration print	×	×
Setting	Main chart speed	○	○
	Sub chart speed	○	○
	Time setting	×	○
	Ink alarm clear	×	×
	Chart illumination lamp ON/OFF	○	○
Alarm	Alarm ON/OFF	○	○
	Alarm set value	○	○
	Output relay No.	○	○
Recording mode	Recording mode	○	○
	Fixed time print ON/OFF	○	○
	Scale print ON/OFF	○	○
	Logging interval	○	○
	Recording format	○	○
	Auto range channel ON/OFF	○	○
	Zoom record channel ON/OFF	○	○
	Zoom record position	○	○
	Zoom boundary value	○	○
	Zone record division number	○	○
	Zone record channel zone No.	○	○
Range	Record range	○	○
	Input unit	○	○
	Input filter value	○	○
	Scaling ON/OFF	○	○
	Rooter ON/OFF	○	○
	Measurement range	○	○
	Engineering value	○	○
	Decimal point position	○	○
	Engineering unit	○	○
	Subtraction channel No.	○	○
	TAG. No.	○	○
Daily report	Daily report ON/OFF	○	○
	Auto print ON/OFF	○	○
	Operation start time	○	○
	Channel ON/OFF	○	○
Integration	Integration ON/OFF	○	○
	Auto print ON/OFF	○	○
	Operation start time	○	○
	Channel ON/OFF	○	○
Transmission	Station No.	○	○
	Transmission speed	○	○
	Stop bit	○	○
	Parity	○	○

(Note 1)
○ : Possible
× : Not possible
(Note 2)
READ: Send data from recorder to personal computer
WRITE: Receive data from personal computer to recorder

7.15 Setting the time

Explanation

Year, Month, Day, Hours, Minutes are displayed in that order going from the left.
Initial value is set in Japan's time.

Example	Clock is 1 minute slow, (Correction of 35 minutes to 36 minutes)	
Key actuation	Explanation	Display
SEL	Press the SEL key several times to display "DATE CLOCK".	DATA CLOCK ' 90 12/20 11:35
ENT	Since there is no change in the year, month, day or hours, press the ENT key to get the "minutes" section flashing.	DATA CLOCK ' 90 12/20 11:35
∧	Press the ∧ key to set to "36".	DATA CLOCK ' 90 12/20 11:36
ENT	Mach the time to the recorded time on the telephone, etc, and press the ENT key.	DATA CLOCK ' 90 12/20 11:36

Reference 1: The clock is set to the current time in JAPAN at the time of shipment.
It is backed up by a lithium battery and so continues counting even if there is a power failure or the power is cut off.

Reference 2: The time is indicated on a 24-hour clock basis. The setting is 00 hours 00 minutes e.g.-23 hours 59 minutes.

Reference 3: Seconds are not displayed.
When the minutes are set and the ENT key is pressed, a seconds counter is cleared to 0 and starts to count.

7.16 Clearing the ink monitor

Explanation

This is a function or warning and detection of ink dry-up.
Normally, this operation is not required but **always set to "Clear" when you replace the recording head with a new one.** If you forget to make the setting "Clear", operation continues from the previous count value, and so the ink dry-up warning-detection count is actuated and there is a constant ink dry-up warning-detection print-out.

Note: If you set to "Clear" other than times of replacement with new parts, there will be no "Ink empty" display when low level is reached.

Example	Clock is 1 minute slow, (Correction of 35 minutes to 36 minutes)	
Key actuation	Explanation	Display
[SEL]	Press the [SEL] key several times to display "INK MONITOR CLEAR".	INK MONITOR CLEAR? NO
[^]	Press the [^] key and change to "YES".	INK MONITOR CLEAR? YES
[ENT]	When the [ENT] key is pressed the counter value is cleared. Display moves to the next parameter. Press the [DISP] key to return to the measurement display.	ILLUMINATION ON

7.17 Turning the chart illumination lamp on/off (option)

Explanation

If the unit is provided with recording paper illumination (option), the lamp can be turned on and off by keyboard operation.

Example	Turning off chart illumination lamp	
Key actuation	Explanation	Display
SEL	Press the SEL key several times to display "ILLUMINATION".	ILLUMINATION ON
∧	Use the ∧ key to make it "OFF".	ILLUMINATION OFF
ENT	When the ENT key is pressed, the lamp is turned off. Display moves to the next parameter.	MAIN CHART SPEED 20mm/h

8. MAINTENANCE - INSPECTION

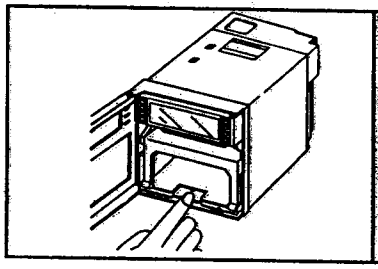
Carry out periodic maintenance and inspection to keep the equipment in good condition.
Pay particular attention to the items noted below and make replacement with spares when necessary.

Inspection, Maintenance Items	Procedure
Recording head replacement:	The recording head is a consumable part. If there is no more ink, replace the head with a new one. Ink consumption varies depending on the contents of records, but writing for about 6 months is possible for 6 points continuous recording at a recording paper speed of 20mm/h. If the ink dry-up warning display "Ink end" appears in the display section, refer to '5.2 Recording head installation' and replace the recording head with a new head. Recording is possible for a little while after the warning display "Ink end" appears.(There is about 10% of the total amount of ink remaining)
Inspection of the recording head	In normal conditions, there is no need for preventive maintenance of the recording head. However, in a high-temperature or very dusty environment, periodically wiping the nozzle surface prevents accumulation of dust and ink and so prevents nozzle blockage that is liable to be caused by such accumulation. To absorb ink, use the supplied "Ink blotting cloth" **If the recording head is left unused for a long time without using the cap, ink may not be absorbed when the blotting cloth is attached to the nozzle of the recording head. In such a case, wet the blotting cloth with water end attach it to the nozzle for several 10 seconds until the 4 colors (red, blue, yellow, black) are absorbed sufficiently.**
Recording paper replacement	In continuous operation at a paper feed speed of 20mm/h, the recording paper lasts about 31 days. When there is only a small amount of recording paper left, red characters are printed on the right-hand edge of the paper. When this happens, refer to Section 5.1 and replace the recording paper. When there is no more recording paper, recording operations stop and 'Chart end' is displayed in the display section.

Replacing the battery

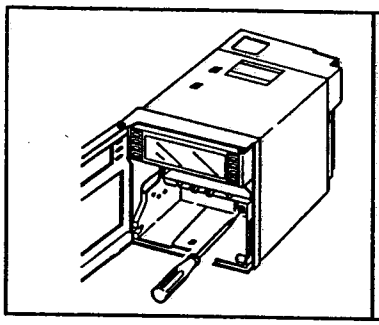
- When the sign "Battery End" appears on the indicator, be sure to replace the battery as soon as possible. [It should be noted that the set data may be erased if the power is turned OFF after the sign "Battery End" has been displayed for a long time.
  In such a case, print the parameter list before replacing the battery for printing and storage of the set data so that the same data can be set once again.]
- Turn OFF the power.
- Open the front door and replace the battery using the following procedures.

Step 1



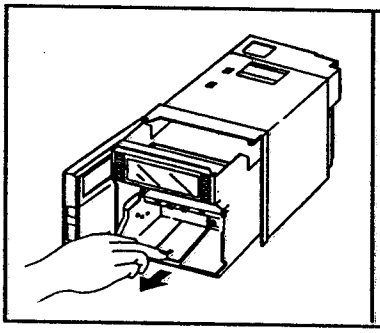
Open the front door and press down the paper feed unit drawout lever.
The paper feed unit will be drawn out.

Step 2



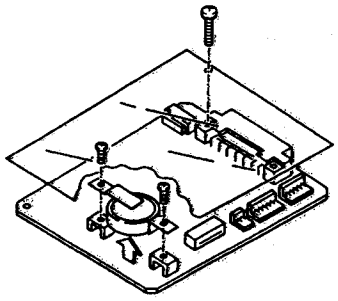
Loosen lock screw (M4), by using a (+) driver.

Step 3



Hold the side or bottom of the main unit and pull it forcedly until it is removed.

Step 4



① Remove the protection sheet attached to the top of the unit.

② The CPU board is located under the protection sheet, and the battery unit is mounted on the board with screws.
Remove these screws (2 places) and then remove the battery unit.

③ Mount a new battery unit with screws (2 places).
Make sure that the battery polarity is correct.

Step 5

- After replacing the battery, set the recorder as it was.
  Be sure that the lock screw inside the recorder is firmly tightened.
- Set the paper feed unit as it was.
- Make sure that the sign "Battery End" on the indicator has disappeared.

Reference | Battery life

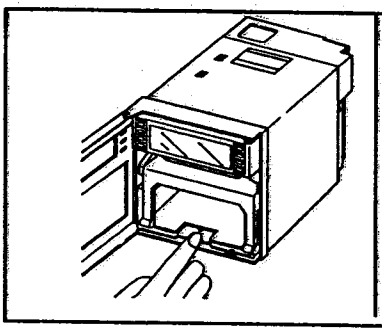
- The battery life is about 10 years at normal temperature.

Flourescent lamp replacement

When the lamp fails to light or it is too dark or flickers, it should be replaced with a new one.

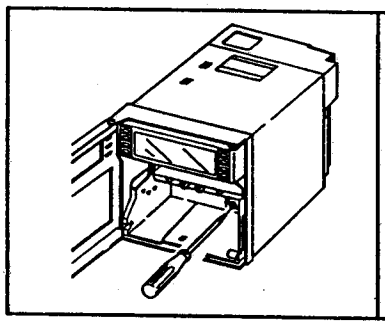
- Turn OFF the power.
- Open the front door and replace the lamp using the following procedures.

Step 1



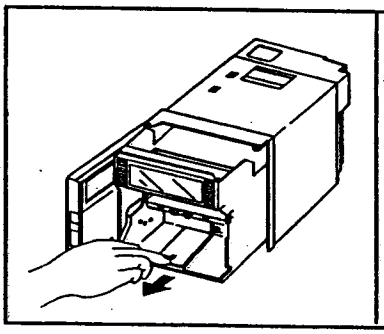
Open the front door and press down the paper feed unit drawout lever.
The paper feed unit will be drawn out.

Step 2



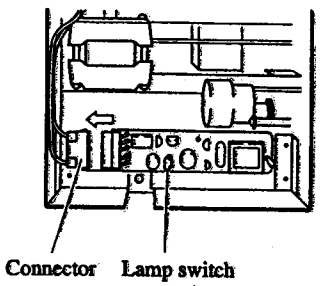
Loosen (counterclockwise turn) the lock screw and remove the unit.

Step 3



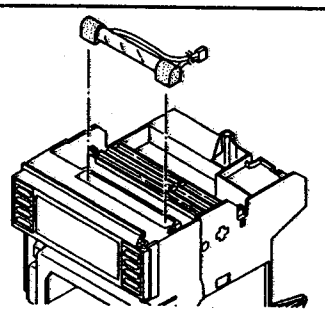
Remove the display unit from the main unit.

Step 4



Remove the connectors(2 places) connecting the display unit to the main unit.

Step 5



Remove the fluorescent lamp from the rear of the display unit.

Step 6

• Set a new lamp (with cable and connector).
It should be set in the order of
Step 5 → Step 4 → Step 3 → Step2 → Step 1

Step 7

• Turn ON the power and check that the lamp lights up.

Reference	Life of lamp

• About 1 year (continuous)

9. APPLICATION FUNCTIONS

The following operations are available by the application functions in this Chapter.

① Print/record adjustment
② Adjustment of zero/span of analog trend record position
③ Setting of alarm latch function and print of integrated total value
④ Shift of measured value
⑤ Preparation of unit
⑥ Record error external output

Any adjustment can be processed on software for easy operation.

9.1 Adjustment of backlash

Explanation

Make adjustment when character kink and/or disturbance of record (round trip difference) occur. Connection of calibration equipment is not required for this adjustment.

Operation

① Stop the recording operation by pressing the [REC] key.
② Have parameter "INK ALARM CLEAR" displayed by pressing the [SEL] key.
③ Press the [SEL] key while the [FEED] key is kept pressed. The parameter for calibration will be displayed.

ADJUST HEAD
BACKLASH=5

Adjustment of print/record is displayed. Normally, 4, 5 or 6 is displayed.

<Example>

Have BACKLASH=6 displayed by pressing the [^] key.
Press the [ENT] key.
Return to the display mode by pressing the [DISPLAY] key.
(See section 6.3 for the test pattern printing method.)
If improvement of character kink is insufficient, repeat the operation of step ② and subsequent and increase the value of BACKLASH=□.
If character kink has become worse, repeat the operation of step ② and subsequent and decrease the value of BACKLASH=□.
Obtain the best condition of repeating

Note:

The value of BACKLASH can be changed from 0 to 9, but the maximum value changes with setting of zero/span of head. The standard value is 5. In general, normal print and record are made between 4 and 6.

9.2 Zero/span adjustment of analog trend recording position

Explanation

The zero point (0% point) and span point (100% point) for analog trend records on the recording paper and adjusted. There is no need to connect a calibration instrument for this adjustment.

Procedure

① Press the [REC] key to stop recording operation.

② Press the [SEL] key to bring up a display of the parameter 'Ink alarm clear'.

③ Press the SEL key while holding the [FEED] key depressed. This effects a shift to a display of parameters for calibration. The first display shows manufacture's test parameters, ignore this and press the [SEL] key.

ADJUST HEAD BACKLASH=3	An analog trend record zero span calibration display appears.

↓ [SEL]

HEAD ZERO/SPAN? NO	Use the [∧], [∨] keys to indicate whether calibration is required or not.

Calibration not required (NO) → [SEL] key

Calibration required (YES) →

To alarm latch ON/OFF	[ENT] Press the ENT key.

The recording head moves and records a black straight line at the zero point (0% point). If the place where this line is recorded is not at the 0% point of the recording paper, make an adjustment.
Pressing the [∧] key moves the recording point to the right.
Pressing the [∨] key moves the recording point to the left.

↓

After bringing the recording point to the zero point, press the [ENT] key. ...This completes zero point calibration.

↓

The recording head moves to the 100% side and records a black straight line at the span point (100% point).
If the place where this line is recorded is not at the 100% point of the recording paper, make an adjustment.
Pressing the [∧] key moves the recording point to the right.
Pressing the [∨] key moves the recording point to the left.

↓

After bringing the recording point to the span point, press the [ENT] key. The recording head moves and recording stops. ... End of span point calibration

* You can switch to the display mode by pressing the [DISPLAY] key.

Note: When list print is requested during calibration of zero/span of head, "message print" or "list print" is displayed. During zero/span calibration, do not request list print.

9.3 Setting of alarm latch and integrated total value print-out

(1) Setting of alarm latch

Explanation

- Alarm display output is retained even when alarm is released.
- Latch release and alarm release are performed when the alarm latch function is set to OFF or DI3 (terminal 13 - 33) is inputted.
- When alarm latch function is ON, a list of instantaneous values is not printed at ON of DI3

(2) Setting of integrated total value

Explanation

- When integrated total value is ON, only the total value is printed during printing an integrated list.
- Example of print

Integrated list '95-04-03

	ch1	ch2	ch3	ch4	ch5	ch6
Total	5.000	5.000	5.000	5.000	5.000	5.000

Operation

Example: Procedure to turn ON alarm latch function and integrated total value print.

① Press [SEL] key to display parameter "Ink Alarm Clear".
② Press the [SEL] key while pressing the [FEED] key.
③ Press the [SEL] key to display "Alarm latch" on screen.

```
ALARM LATCH OFF
TOTAL PRINT  OFF
```

④ Press [∧] key to set alarm latch from OFF to ON.
⑤ Press [ENT] key for setting.
⑥ Press [∧] key to set total print from OFF to ON.
⑦ Press [ENT] key to complete setting.

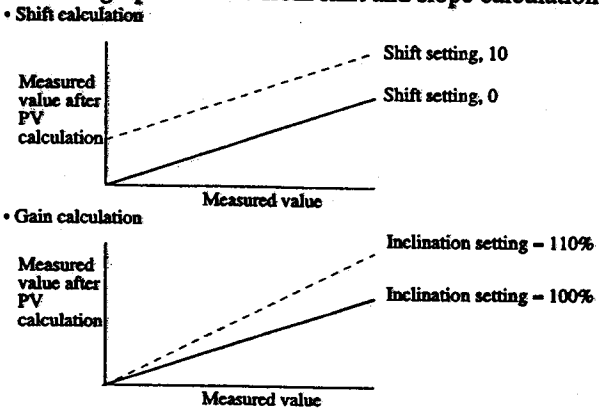
* By pressing [DISPLAY] key, the unit is set in display mode.

9.4 Setting of PV shift

(1) PV shift function

- Measured value can be calculated by PV shift constant for record and display.
- PV shift calculation is used for setting slope and shift values.

  A conversion graph obtained from shift and slope calculation is shown below.



- Details of PV shift calculation is as follows.

  $P' = AP + B$

  P' : Measured value after PV calculation
  P : Measured value
  A : Gain (0.01 to 327.67%)
  B : Shift value (-32767 to 32767 industrial value, decimal point depending on type of input)

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

- When the type of input is changed or scaling function is set to ON/OFF, the PV shift set value of that channel is cleared.
- PV shift set value cannot be copied even when the set value is copied using the copy function being set.

<Set panel>

Measured value (varies with change in PV shift set value)

Panel 1

```
ch1 SHIFT   -10.000
  0.00  V
```

⇧
Shift value (initial value, 0)

Panel 2

```
 ch1 GAIN   -10.000
100.00  %
```

⇧
Gain value (initial value, 100.00%)

- Do not use PV shift during logarithmic value operation setting.

9.5 User definable unit

Explanation

It is possible to create arbitrary units with numerals, alphabets, etc., which can be defined up to 7 digits for registration of 12 different units.

Operation

Example) Creation of unit kgf/cm² to Code A=2, B=10

① Press the [SEL] key to display parameter "Ink Alarm Clear".

② Press the [SEL] key while pressing the [FEED] key to display calibration parameter.

③ Press the [SEL] key to display "Unit" image.

```
Unit : A=1   B=10
       ________
```

④ Using the [∧] and [∨] keys, specify the unit register code A=2 and press the [ENT] key. (A=1 to 12 can be specified. B=10 is fixed.)

⑤ The first digit of unit flashes. Specify "K" with the [∧] and [∨] keys and press the [ENT] key.

⑥ Next, the second digit flashes. Specify the unit in the same manner.

```
Unit : A=2   B=10
       kgf /cm²
```

⑦ All the digits flash one by one in order, and the numeral of A=[2] flashes to indicate that the unit has been specified.

* By pressing the [DISPLAY] key, the recorder is changed over to display mode.

9.6 Setting of record error external output

Explanation

- Relay output is given to external device at occurrence of chart end, battery end, carriage failure of ink end.
- When output is set to the same relay as the relay No. designated by "Alarm Setting", output is given at occurrence of alarm or record error.

Explanation

① Output is given to relay 6 at ink end.

Chart end	
OFF	ALM0

② Press [∧] and [∨] keys to display ink end.

Ink end	
OFF	ALM0

③ Press [∧] key to set alarm from OFF to ON.

④ Press [∧] key to set ALM 6.

Ink end	
ON	ALM6

⑤ Press [ENT] key to complete setting.

9.7 Calibration of measured value

Explanation

Normally, no adjustment is required, except when measurement display value exceeds the guaranteed accuracy.
Use of calibration input signal performs adjustment automatically by software.
Input a correct calibration signal to object channel.
Note: Use of incorrect calibration input signal will result in malfunction.

Operation

① Press [REC] key to stop record operation.
② Press [SEL] key to display parameter "Ink Alarm Clear".
③ Press [SEL] key while pressing [FEED] key. The unit will shift to calibration parameter display.

```
ADJUST HEAD
 BACKLASH=3
```
Print/record adjustment display

↓ Press [SEL] key

```
HEAD ZERO/SPAN?
    NO
```
Analog trend record zero/span calibration display

↓ Press [SEL] key

```
ALARM LATCH OFF
TOTAL PRINT OFF
```
Press [SEL] key key while pressing [FEED] key.

↓

```
ADJUST Ch□
 ZERO   SPAN
```
Measured value zero/span calibration display

NOTE) To stop measured value zero/span calibration for a brief time, press [DISPLAY] key. Do not press [ENT] key (Unit is set in display mode).

④ Press [∧], [∨] keys to select channels to be calibrated.
Ch 1 ~ Ch 6 = DC voltage, input, resistance bulb input, thermocouple input
Ch 7 ~ Ch 8 = Used for maker's test. Do not use for operation

↓ Press [ENT] key

⑤ * 1 Apply 0% input

↓

Press [ENT] key.

↓

Zero calibration end...

↓

⑥ * 2 Apply 100% input

↓

Press [ENT] key.

↓

Span calibration end...

↓

⑦ Press [DISPLAY] key.

* 1
0% Calibration input signal is as follows.
Voltage input : 0 mV or 0V
Thermocouple input: 0 mV
Resistance bulb input (Pt, JPt): 100 Ω

Zero calibration is automatically started.
(Press ENT key after applying 0% input in *1)
OK is displayed. The unit is set in span calibration mode.

* 2
100% calibration input signal is as follows.
±50 mV :50 mV
±500 mV :500 mV
±5V :5V
±50V :50V
±Thermocouple: 50 mV (room temperature compensation is not required) Resistance bulb (Pt, JPt: 324.26Ω)

Span calibration is automatically started.
(Press ENT key after applying 100% input in *2)
OK is displayed. When adjusting other channels, press [∧] and [∨] keys for setting channels.

The unit is set in display mode and calibration is completed.

Note: When list print or message print is requested during input adjustment, function keys other than [FEED] key may not become effective. Input adjustment should be made when list or message print is not requested.

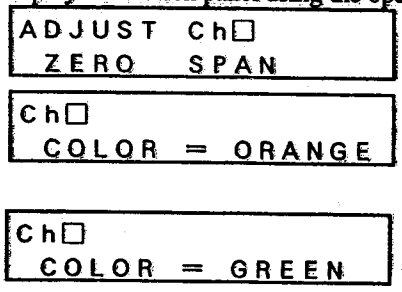
9.8 Change of record color

Explanation

• Record color for each channel can be changed.

Operation

① Display calibration panel using the operation in Item 9.5.



Press [SEL] key to display record color change panel.

Press [∧] and [∨] keys to select channel to be changed, then press [ENT] key. Once again, press [∧] and [∨] keys to select record color, then press [ENT] key to complete the setting operation.

9.9 Language selection

Explanation

The characters for display and print-out with this machine may be selected out of the following three languages.

English German French

Operation

The display is switched when the [∧] key or the [∨] key is pressed while the message shown on the left is display. Select a display language and then press [ENT] key. display and print-out in the selected language will be made.

10. TROUBLESHOOTING

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

State	Points to check	Action to take
Does not work at all	(1) Is the power supply terminal connection correct?	Connect correctly
	(2) Is power being supplied properly?	Effect proper supply
Keys do not work	(1) Have you caused data print-out by pressing the [LIST] key?	Wait until the end of print-out. Press the [LIST] key to stop the print-out
	(2) Is a parameter list, scale print-out, test pattern, daily report list or integration list print-out in progress? "The following keys are inoperative during data print-out and list print-out. See section 2) [RECORD] [DISPLAY] [SELECT]	
	(3) Is Chart end, Carriage alarm being displayed? * The [SELECT] key is inoperative when the above state displays are produced.	Eliminate the displayed state. (Put recording paper in, Check the carrier fault.
The record swings over to the 0% side or the 100% side	(1) Is the input signal wiring correct?	Correct the wiring
	(2) Is the record range correct (⊖, ⊕ sides)?	Set a correct range
	(3) Has a thermocouple or resistance bulb wire broken? (If wire breakage occurs, there is a burn-out display and a swing over to the 100% side.) Refer to Section 9.2 and adjust.	Replace the thermocouple or resistance bulb.
The record zero/span point is out of position	Refer to Section 9.2 and adjust. Always make the adjustment of Section 9.2 after replacing the recording head.	
There are large errors	Do the input signals match the specification? (Signal source resistance, etc.)	Bring them to the proper specification.
The data display goes to 'Over', 'Under' or 'Error'	(1) The specification of the input signal setting pins and the input signal type specification made using the front panel do not agree	Adjust so that they agree
	Is there supply of excessively large or excessively small input?	Effect supply of correct input
The display goes to 'Carriage Alarm'.	Refer to section 6.11	

State	Points to check	Action to take
Ink does not come out even though there is no 'Ink out' display or the ink colours are blurred.	Carefully note the points described on page 5-8 in relation to the recording head (i.e., the notes on storage and avoiding imposition of vibration or impact). If ink does not flow properly, take the action described on the right. If this has no effect, the recording head must be replaced.	Refer to "Note 6: If the ink is not sprayed" on page 5-8. When the working environment is 15℃ or less, perform print-out of "record" or "test pattern" after a period of several minutes has elapsed since the recording head was mounted. (The recording head has a built-in heater.)
Characters are deformed.		
The record colours are wrong.		
Ink does not flow.	Is the head inserted into the carrier sufficiently?	Push the head on properly. (Refer to Step 6 of section 5.2.)
Trend record or characters turn to double-line (round trip difference appears) or characters are disordered.	1) Wire the carriage drive shaft with dry, clean cloth. 2) When this procedure 1) is not effective, follow Section 9.1 Adjustment of backlash	

11. EXAMPLES OF RECORDS AND PRINT-OUTS

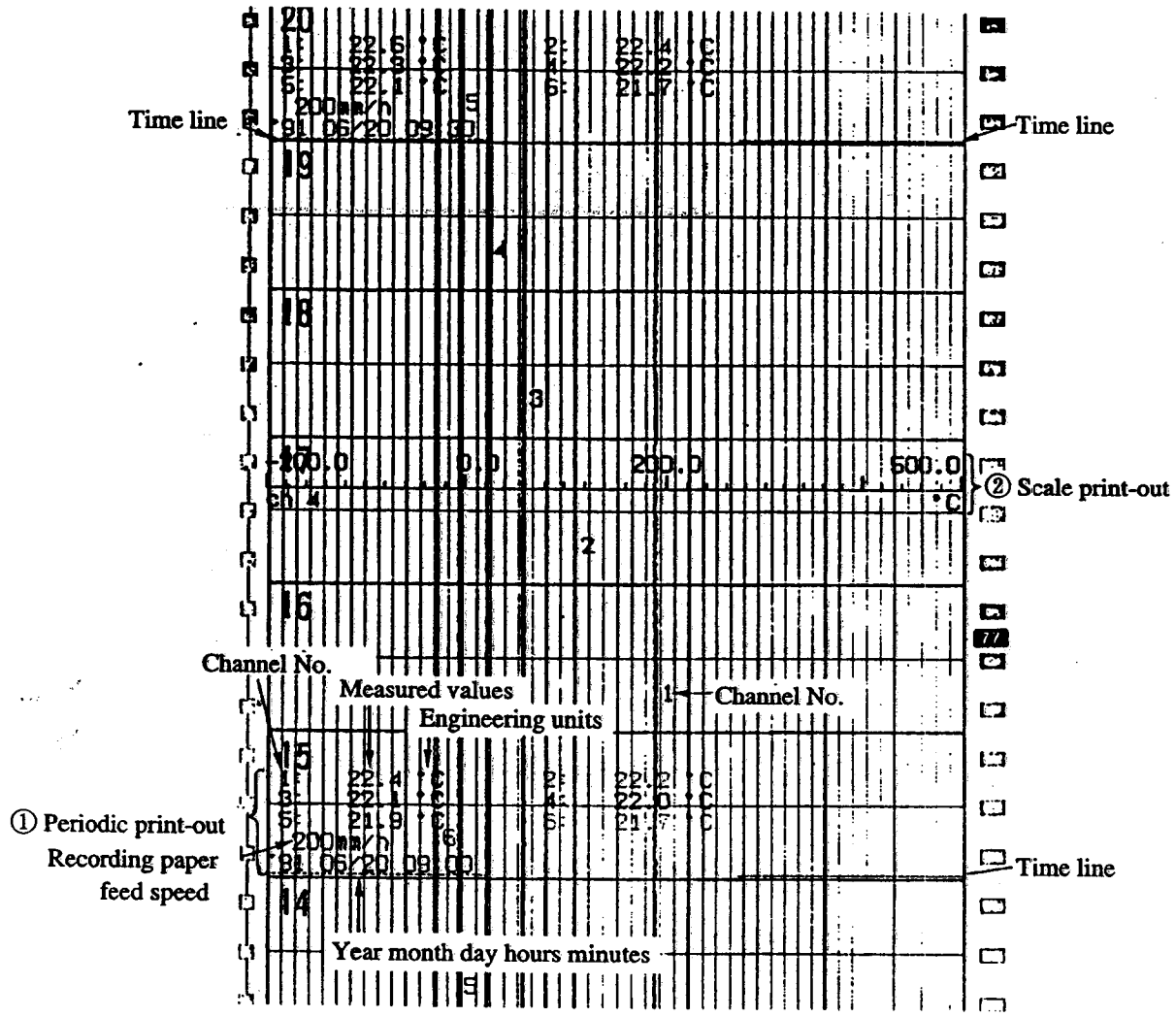
Note: If the chart speed is ≧ 401 mm/h for continuous recording or ≧ 51 mm/h for dot recording, there are no periodic print-outs, scale print-outs (but print-out can be made manually; see Section 7.11) message print-out, alarm print-out, burn-out print-outs or ink end print-outs.

11.1 Periodic print-outs, scale print-outs

① Periodic print-outs: Time lines, dates, times, the chart speed and the measured values for each channel are automatically printed out at set intervals in correspondence to the chart speed.
(There is print-out only if periodic print-out is set to "ON", See Section 7.6.)

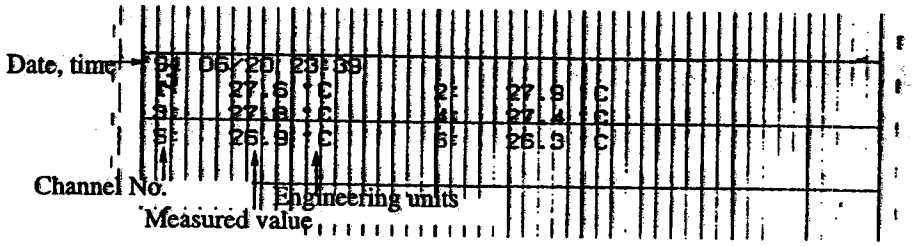
② Scale print-outs: Scale lines, figures and units are automatically printed out at set intervals in correspondence to the chart speed.(There is print-out only if scale print-out is set to "ON". See Section 7.6.)

Example of 6 continuous records



11.2 Digital print-out (Instantaneous value)

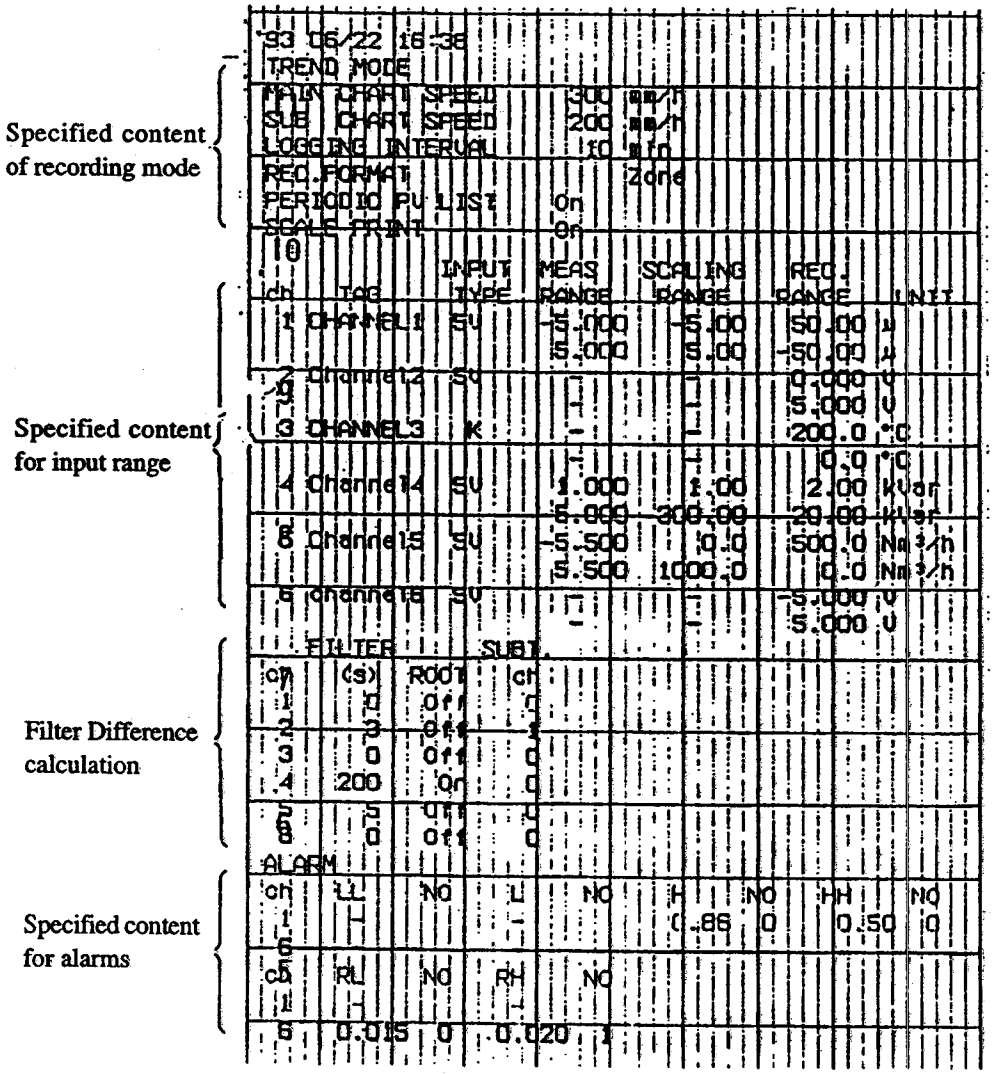
Pressing the LIST key effects immediate print-out of current values. (See Section 6.4.)



Note) On a channel in which skip has been set, the measured value is printed with a mark " — " (horizontal line) and industrial unit is not printed.

11.3 Parameter list print-out

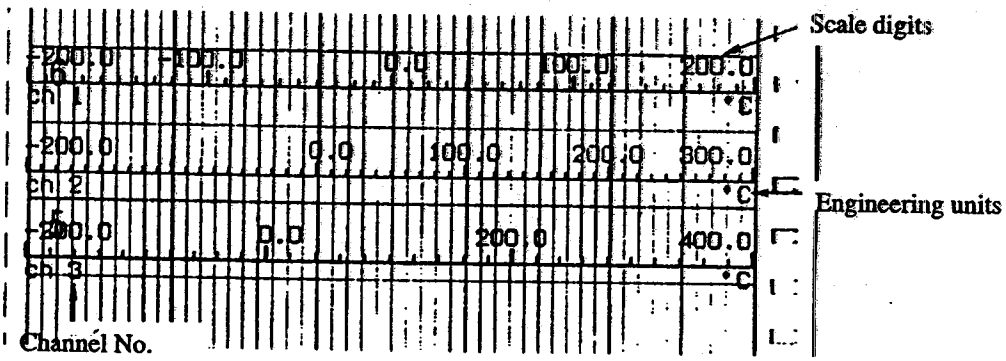
The specified contents of parameters are all printed out together on the recording paper. (See Section 7.11.)



11.4 Test pattern

11.5 Scale print-outs

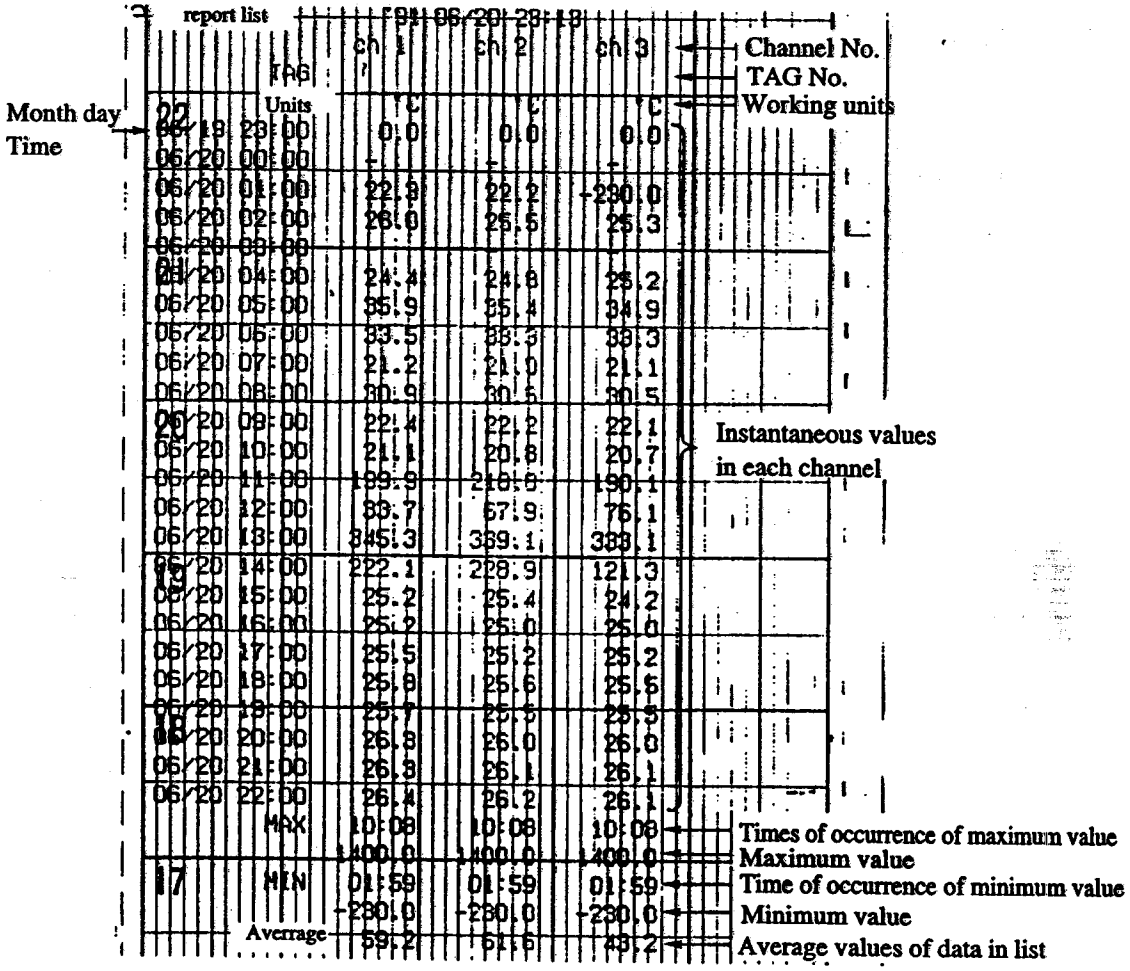
The scales of specified channels are printed. (See Section 7.11.)



11.6 Daily report print-out

This consists of print-out of the data for a max. 24-hour period (max. 24 data items in hourly units) for specified channels.

The maximum, minimum and average values of the instantaneous values on the every full hour from the daily report start time to the daily report end time and printed out. (For setting, refer to Section 7.12.)



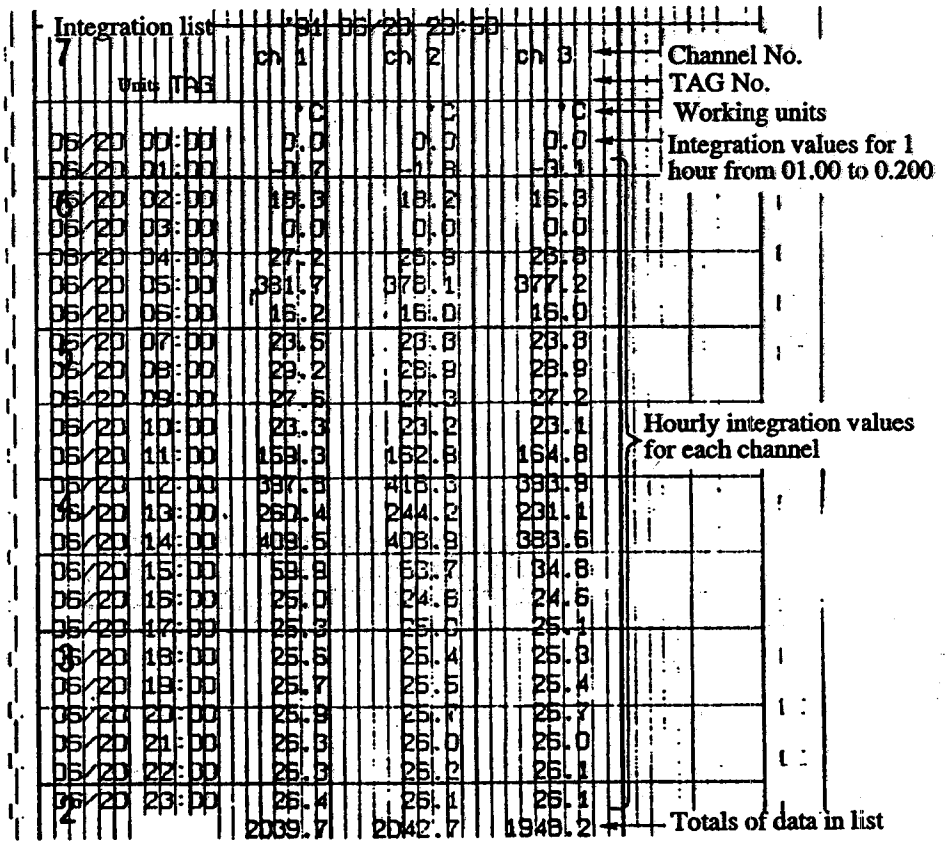
Note 1) In the event of input error, the following items are printed.

* Under-range: Minimum value of recording range
* Over-range: Maximum value of recording range
* Error: Maximum value of recording range
* Burnout: "—" (horizontal bar)

11.7 DATA SUM LIST PRINT-OUT

This consists of print-out of the data for a max. 24-hour period (max. 24 data items in hourly units) for specified channels.

The integrated values for each hour and the totals of the integrated values from the integration start time to end time are printed out. (For setting, refer to Section 7.13.)

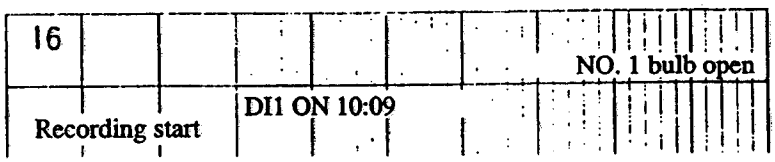


Note 1) In the event of input error, the following items are printed.

* Under-range: Minimum value of recording range
* Over-range: Maximum value of recording range
* Error: Maximum value of recording range
* Burnout: 0

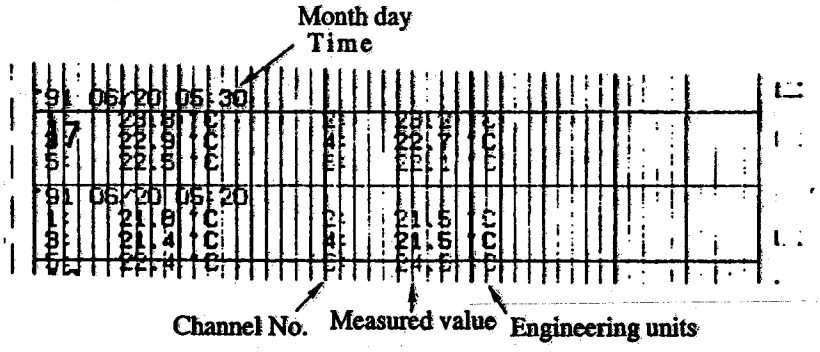
11.8 Message print (manual print)

Specified message is printed. (Refer to Section 7.10)



11.9 Logging

The instantaneous values of the various channels are printed out at set intervals of time. (See Section 7.6 ①.)

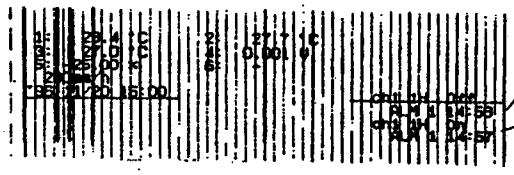


11.10 Alarm print-outs

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

On detection: print-out colour red, on cancellation: print-out colour: black

Example of alarm print-out

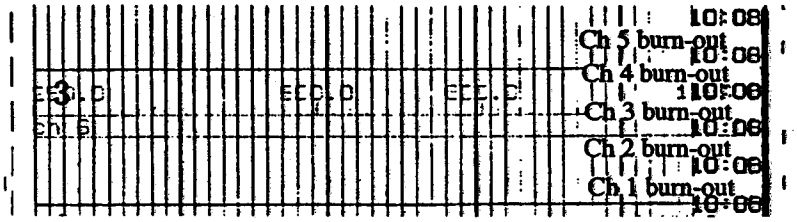


② Channel 1 No.1 H alarm release Relay No.1 Release time 14:58

① Channel 1 No.1 H alarm generation Relay No.2 Generation time 14:57

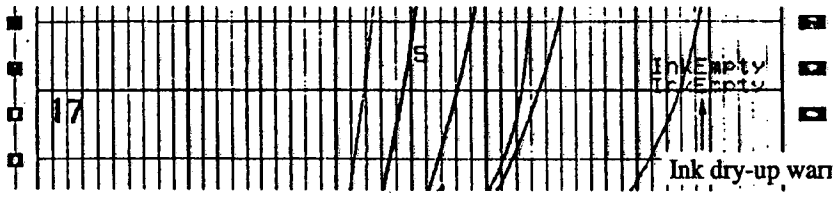
11.11 Burn-out print-out

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



11.12 Ink dry-up warning print-out

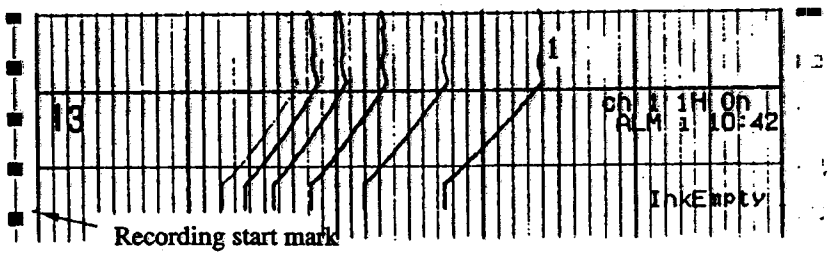
When only about 10% or less of an ink remains, 'Ink Empty' is printed out in the colour of this ink on the right-hand side of the recording paper.



Ink dry-up warning

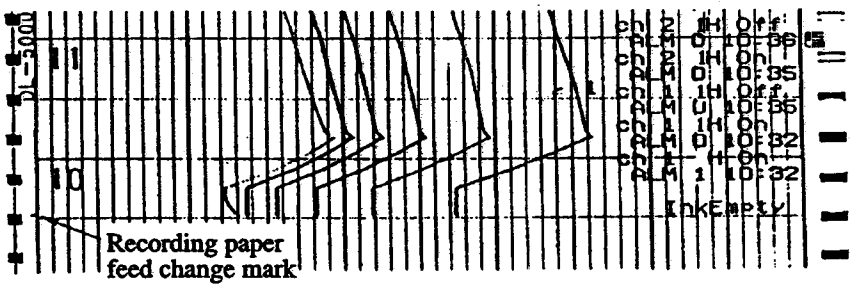
11.13 Record start mark

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



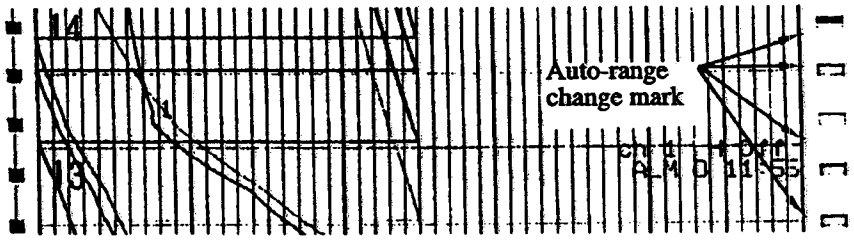
11.14 Chart speed change mark

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



11.15 Auto-range change mark

If the auto-range function changes the range during recording, a change mark is printed at the right-hand edge of the recording paper.



12. SPECIFICATIONS

Input Section

Number of input points: 5 classes: 1, 2, 3 or 6 continuous records and 6 dot record

Input signals:
Thermocouple input: B, R, S, K, E, J, T, N, W, L, U, PN
Resistance bulb input: Pt100, JPt100 (JPt means special input in Japanese)
DC voltage input: 50 mV range, 500 mV range, 5V range, 50V range
Direct current input: 4 to 20 mA DC. 10 to 50 mA DC
(Note: Terminal section to be fitted with separately sold 10Ω shunt resistor and range to be made 500 mV.)
Maximum allowable input voltage:
Thermocouples, resistance bulbs, DC voltage (50 mV, 500 mV range): ±10V
Direct current input (5V, 50V range): ±100V

Setting and changing of input signals: For each channel, any combination of thermocouples, resistance bulbs and DC voltage (50 mV, 500 mV, 5V, 50V ranges) can be made or altered by changing the setting pins inside the instrument.

Record range specification: Can be made any range within the input range from the keyboard.

Burn-out function: If a thermocouple of resistance bulb input lead breaks, the record will go to full scale.

Reference ranges

Type		Input range	Input range
Thermocouple	B	400 to 1760℃	752 to3200°F
	R	0 to 1760℃	32 to3200°F
	S	0 to 1760℃	32 to3200°F
	K	-200 to 1370℃	-328 to2498°F
	E	-200 to 800℃	-328 to1472°F
	J	-200 to 1100℃	-328 to2012°F
	T	-200 to 400℃	-328 to 752°F
	N	0 to 1300℃	32 to2372°F
	W (C)	0 to 1760℃	32 to3200°F
	L (JDIN)	-200 to 900℃	-328 to1652°F
	U (TDIN)	-200 to 400℃	-328 to 752°F
	P N	0 to 1300℃	32 to2372°F
Resistance bulb	JPt100	-200 to 600℃	-328 to1112°F
	Pt100	-200 to 600℃	-328 to1112°F
DC voltage		- 50 to + 50mV -500 to +500mV -5 to +5V - 50 to +50V	Scaling in the range -30000 to 30000 is possible. (Decimal point may located where required.)

Note: N : NICOSIL-NISIL (IEC584)
W : +Foot 5% Re, -Foot 26% Re.W (Hoskins Mgf. Co., U.S.A) Also known as C
L : +Foot Fe, -Foot Cu. Ni alloy (DIN43710) Also known as JDIN
U : +Foot Cu, -Foot Cu. Ni alloy (DIN43710) Also known as TDIN
PN : Platinum
JPt100 : JIS C 1604, 1606 (old JIS Pt100) (α =0.003916Ω/Ω/℃)
Pt100 : JIS C 1604, 1606, DIN IEC 751 (α =0.00385Ω/Ω/℃)

Accuracy resolution: Performance at standard conditions (23±2°C, 55±10% RH, power supply voltage and frequency fluctuation within ±1%, warm-up time ≧ 30 minutes, vertical mounting, environment with no adverse effects of external noise, etc.)

Type of input		Indication (digital display)		Record	
		Accuracy	Resolution	Accuracy	Resolution
Thermocouple	B	± (0.15% + 1 digit) (Does not include reference junction compensation error.)	0.1℃	Indication precision ± (0.25% record span)	0.1mm
	R		0.1℃		
	S		0.1℃		
	K		0.1℃		
	E		0.1℃		
	J		0.1℃		
	T		0.1℃		
	N		0.1℃		
	W(C)		0.1℃		
	L (JDIN)		0.1℃		
	U (TDIN)		0.1℃		
	P N		0.1℃		
Resistance bulb	JPt100 Pt100	± (0.15% + 1 digit)	0.1℃		
DC voltage	- 50 to + 50mV	± (0.15% + 1 digit)	10μV		
	-500 to +500mV		100μV		
	-5 to +5V		1mV		
	- 50 to +50V		10mV		

Note 1) The rating of indication accuracy is shown in % within the input span.

Note 2) Indication accuracy at 400 to 600°C of B-thermocouple is ±(0.25% + 1 digit).

Recording section

Recording system: Ink jet system, 6 colours

Effective recording width: 100 mm

Recording colours: 1st, (orange), 2nd, (green), 3rd, (purple), 4th, (red), 5th, (black), 6th, (blue)

Chart paper: folding, total length 15.08m

Chart speed: 5 to 400 mm/h continuous record (400 mm/h is the general standard) 401 to 1500 mm/h discontinuous records
Dot record type: 5 to 1500 mm/h
All settable in 1 mm/h steps.

Speed setting method: Set from keyboard.

Sample time: Dot records ... 30 seconds/for all channels.
Continuous records ... Depends on chart speed.
Calculation formula ... Recording cycle (seconds) = 400/[chart speed (mm/h)]
But is not faster than 2 seconds.

Measurement period: 1 to 3 input points: 160 ms
6 input points: 320 ms

Ink life (depends on conditions): approximately 6 months for 6 point continuous records at a recording paper feed speed of 20 mm/h

Display section

Display system:	Fluorescent display (blue-green), 20 characters × 2 lines
Display characters:	5 × 7 dots, character height 4.16 mm, width 2.25 mm
Display contents:	(1) Measured values: Temperature ... to 1st decimal place Voltage ... 6 places (including symbols decimal point) (2) Channel Nos.: 2 places (1 - 6) (3) Engineering units: Maximum 7 places (°C, °F, %. kg/cm², mmH_2O, ppm, m³/h, etc.) (4) Time: Year, month, day, hours, minutes (5) Status display: Under recording, under digital data printing, under list printing, chart end, battery alarm, alarm, ink run-out alarm, burn-out, carriage failure (6) Commands for setting parameters: Displayed as alphanumeric characters

Printing section

Printing system:	Ink jet system, 6 colours
Periodic printing:	Instantaneous values, units, date, time, time lines, chart speed
Scale print:	Scale value, scale line, Channel No., TAG No., unit
Message printing:	Any message with 10 kinds of 16 characters
List printing:	(1) Instantaneous value lists (date, time, channel Nos., instantaneous values, units) (2) Set value lists (date, time channel Nos., record range, scaling, units, alarm set values, chart speed, Tag Nos.) (3) Test pattern (all characters and colour patterns)
Alarm print-outs:	Channel No., type of alarm (H, L, RH., RL), output relay No., time of detection/ cancellation
Burn-out print-out:	Channel where burn-out occurred and time
Others:	Ink low warning print-out, auto-range change mark, recording start mark, recording paper feed speed change

Performance, characteristics

Input resistance:	≧ 10 MΩ (50 mV range, thermocouples) Approximately 100 kΩ (500 mV range) Approximately 1 MΩ (5V, 50V range)
Chart speed accuracy:	±0.1% (For continuous feed of 1m or more. Does not include paper elongation/shrinkage.)
Clock precision:	≦ ±50 ppm (monthly variation about 2 minutes)

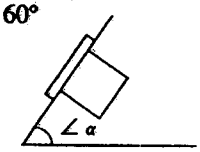
Insulation resistance: 100 MΩ (across each terminal and ground at DC 500V)

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

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

Construction

Mounting method: Mounted in panel (vertical panel)
Tilt angle α = 90 to 60°



α = 60 to 90°

Material: Case: steel plate
Front flap frame: glass-containing polycarbonate

Mass: Approximately 2.1 kg (without options)
Approximately 2.2 kg (with all options)

External dimensions: 144 × 144 × 199 mm

Painted colour: Case black; front flap frame black

External terminals: Screw terminals (M4 thread)

Power supply section

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

Range of operating power voltage: 85 to 150VAC or 150 to 300VAC

Supply frequency: 50/60 Hz both employable

Power consumption: 100VAC without options approximately 20 VA
100VAC with all options approximately 26 VA

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

Ambient temperature: 0 to 50°C

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

Vibration: 10 to 60 Hz, 0.02G or less

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

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

Warm-up time: ≧ 30 minutes

Impact: none

Effects of operating conditions

Effects of operating conditions: With 85 to 150 VAC or 150 to 300VAC fluctuation (frequency 50 or 60 Hz)
100VAC base
Indication variation: ±(0.1% of reference range + 1 digit)
Recording variation: ±0.2% of record span
With 47 to 63 Hz fluctuation (power supply voltage: 100VAC) 50 Hz base
Indication variation: ±(0.1% of reference range + 1 digit)
Recording variation: ±0.2% of record span

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

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

Effect of mounting attitude: With rearward tilt within 30°
Indication variation: ±(0.1% of reference range + 1 digit)
Recording variation: ±0.2% of record span

Effect of vibration: On 2 hours imposition of frequency 10 to 60 Hz, acceleration 0.02G linear vibration in each of 3 axes
Indication variation: ±(0.1% of reference range + 1 digit)
Recording variation: ±0.2% of record span

Effect of external noise: Normal mode noise: (50, 60 Hz ±0.1 Hz): ≧ 30 dB
Common mode noise: (50, 60 Hz ±0.1 Hz): ≧ 120 dB

Recording paper:	On 20°C, 65% RH base Elongation at 85% RH: ≦ 0.4% Shrinkage at 35% RH: ≦ 0.5%

Alarms

Setting method:	Set from keyboard.
Number of settings:	Optional setting of Max. 4 points, 4 kinds (H, L, RH, RL) for each channel.
Display:	On detection, display section indication of alarm types, and output relay Nos. for each channel
Print-out:	Print-out of Channel Nos., alarm types, output relay Nos. and detection/cancellation times on recording paper
Output:	As in supplementary specification
Hysteresis amplitude:	About 0.5% of record span

Transport, storage conditions

Temperature:	-10 to +60°C
Humidity:	5 to 90% RH (but to be no dew condensation)
Vibration:	10 to 60 Hz, 0.25G
Impact:	≦ 30G

Reference standards

Safety Standards:	IEC1010-1 (1990) reinforce insulation overvoltage category II except alarm output terminals (overvoltege category I) pollution degree 2
EMC Standards:	EN50081-1 (1992), EN50082-1 (1992)
Dust/drip-proofing:	IP50

Supplementary specification

1. Recording paper illumination: cold cathode fluorescent lamp
2. Alarm output/external control: Special-purpose unit needed.
   Unit can be mounted in rear of instrument as extra equipment at a later date.

(1)	Alarm output (DO):	6 point of relay contact output, each being used for individual channel or OR operation.
	Relay contact capacity:	1a contact, 240VAC, 3A (resistive load), 30VDC, 3A (resistive load) 1b contact, 125VAC, 0.4A (resistive load), 30VDC, 2A (resistive load)

(2) External control (DI): The following functions can be performed in response to external contact signals:

Recording operation start/stop (DI1): Contact signals can start/stop recording operations. Recording starts when contact is closed and stops when contact is open.
Message print is started when DI1 is specified. It is also started during recording when the contact is closed.

2-stage change of chart speed (DI2): Contact signals can effect a change from normal recording paper feed speed to remote mode chart speed. Closing the contact gives remote mode chart speed.
Opening the contact gives normal chart speed.
Message print is started when DI2 is specified. It is also started during recording when the contact is closed.

Instantaneous value print-out (DI3): Instantaneous value lists (dates, times, channel Nos., measured values, units) are printed out in response to contact signals.
Print-out starts when the contact is closed and stops when the contact is opened.
But, latch is OFF when alarm latch function is ON.

Note: As the external control unit is not insulated, use it with insertion of an external relay.
Contact capacity: 12VDC 0.05A 1a contact

3. Transmission function: RS-485 interface
Serves to transmit measured values and receive specified conditions.

RS-485

Transmission system	Half duplex bit-serial
Synchronization type	Start-stop synchronization
Coding type	Binary Date length 8 bits Parity odd/even/none Stop bits 1 or 2
Transmission rate	2400, 4800, 9600, 19200 bps
Number of units connected	Maximum 31 units
Transmission distance	Total length maximum 1 km

Standard functions

Function		Contents
Arbitrary range setting		Any record range can be set for each individual channel.
Arbitrary specification of input signals		Any type of input can be specified for each individual channel.
Skip function		Function for skipping the records, indication sand alarms at any measurement point.
List print-out function	Instantaneous values list	Dates, times and the measured values and units for each channel are printed out.
	Set value list	Dates, times, recording ranges, scaling, units, input types, alarm set values, recording paper feed speed and Tag Nos. are printed out.
	Test pattern	All the types of characters and color patterns are printed out.
Periodic print-out function		Time lines, dates, times, recording paper feed speed and measured values for each channel are printed out at set intervals of time. The keyboard can be used to allow or to prohibit print-outs.
Message print function		Messages of up to 10 kinds and 16 characters which have arbitrarily specified are printed. Message print is started when the contact is closed.
Alarm print-out function		The times of detection of alarms and clearing of alarms, the channel Nos. alarm types and output relay Nos. are printed out.
Units display		°C, °F, %, mV, mA, kg/cm² and other working units are displayed. (Units can be specified from the keyboard.)
Scaling function		In the case of DC voltage input, any scaling is possible. Any specification in the range -32767 to 32767, with the decimal point anywhere, is possible.
Difference records		The difference between any specified channels are recorded. (Channels are specified from the keyboard.)
Auto-range change function		Function whereby if input goes above or below the current range the range is automatically changed and the change is recorded (specified from the keyboard). However, this function cannot be used if zone recording or zoom recording used.
Zone recording function		Function for effecting recording with the recording area divided into a maximum of 3 zones. However, this function cannot be used if auto-range recording or zoom recording is used.
Zoom function		Function for effecting recording with one part of the recording area for each channel enlarged and another reduced. However, this function cannot be used if auto-range recording or zone recording is used.
Square root extraction function		DC voltage input $\sqrt{\ }$ calculations can be performed.
Logarithmic calculation function		10^n input with DC input is possible. Display, 1.0E − 9 to 1.0E + 9
PV shift function		Setting of zero shift and gain shift of measured value.
Record color change function		Function for changing record print color for each channel.

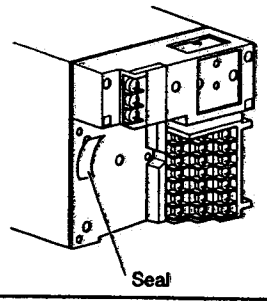
Function	Contents
Daily report function	Max. 1-day lots (lots of max. 24 data items) of the instantaneous values at each full hour for each channel each day are stored and printed out. At the same time, maximum values, minimum values and average values are printed out too. The operation is turned on/off for individual channels and the operation start time is specified from the keyboard.
Data sum function	Max. 1-day lots (lots of max. 24 data items) of the integration values for 1-hour periods in each channel each day are stored and printed out. At the same time, maximum values, minimum values and average values are printed out too. The operation is turned on/off for individual channels and the operation start time is specified from the keyboard.
Memory backup function	Set data and clock functions are protected by a lithium battery incorporated in the recorder. (Battery life is about 10 years at normal temperature.)
Input filter	Filter function for delaying the response of each channel to counter sharp changes in input. (Primary delay filters) Time constant setting range : 0 to 900 seconds (set from the keyboard)
Burn-out function	If thermocouple or resistance bulb wire breakage occurs, there is a swing to the maximum value of recording range and at the same time a display is given and a printed record is made.
Alarm latch function	Used to hold alarm display and alarm output even after alarm is recovered. ON/OFF operation is made from the keyboard. Alarm in hold mode is released by external control (DI).
Set value copying function	Used to copy the value, which has been set in any channel, to another channel.

APPENDIX 1. MOUNTING THE 6-ALARM POINT BOARD (RD1600-AL6)

Step 1

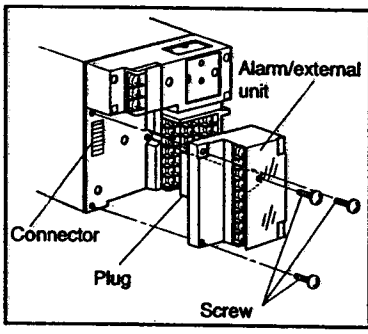
Be sure to turn OFF the power before mounting board.

Step 2



Tear the blind seal from the main unit's rear panel, so the connector is exposed.

Step 3



Insert the alarm/external control unit plug into the connector on the main unit.
Fasten them together with three lock screws.

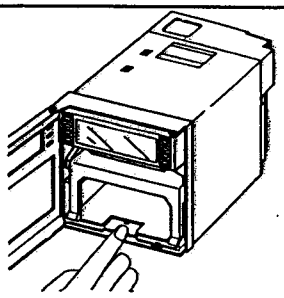
APPENDIX 2. MOUNTING (OR REPLACING) THE FLOURESCENT LAMP UNIT

When the lamp fails to light or it is too dark or flickers, it should be replaced with a new one.
Go through the following steps:

Step 1

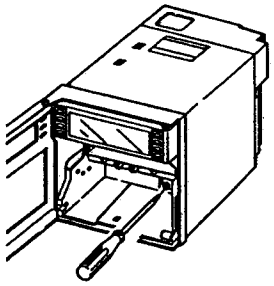
Turn OFF the power.

Step 2



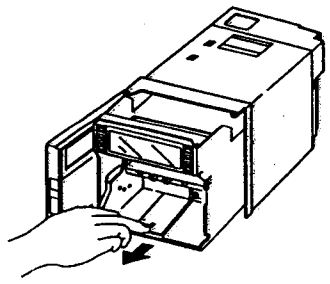
Open the front door and press down the paper feed unit drawout lever.
The paper feed unit will be drawn out.

Step 3



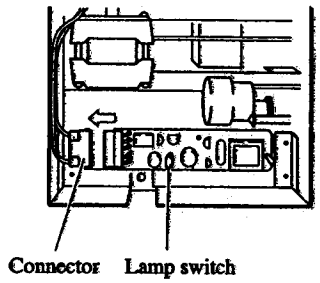
Loosen (counterclockwise turn) the lock screw and remove the unit.

Step 4



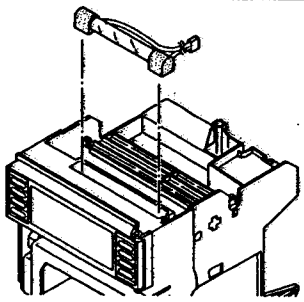
Remove the display unit from the main unit.

Step 5



Remove the connectors(2 places) connecting the display unit to the main unit.

Step 6



Remove the fluorescent lamp from the rear of the display unit.

Step 7

• Set a new lamp (with cable and connector).
It should be set in the order of
Step 6 → Step 5 → Step 4 → Step 3 → Step 2 → Step 1

Step 8

• Turn ON the power and check that the lamp lights up.

Reference	Life of lamp

• About 1 year (continuous)

APPENDIX 3. RS-485 INTERFACE

TABLE OF CONTENTS

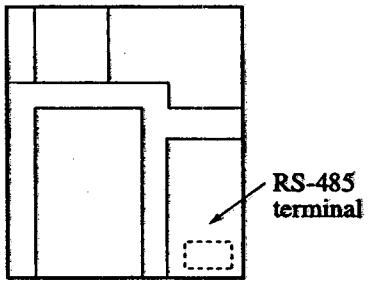
1. PREFACE

This appendix describes the RS-485 interface used as an optional function for the RD1600 series recorder.

Before using the RS-485 interface, be sure to read through this appendix to ensure its maximum performance.

The RS-485 interface is self-contained in the recorder or may be installed by the user.

Upon receiving the recorder, check to make sure that there is a terminal for RS-485 on the rear panel, if the board is installed by the factory.



Type:RD1603/1606

2. INSTALLATION PROCEDURE

This section includes the installation procedure for the RD1603/1606 recorder RS-485 communications board (RD1600-RS).

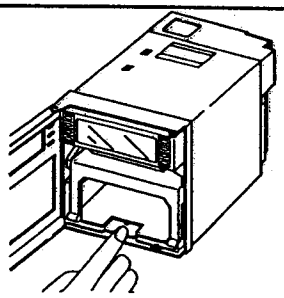
INSTALLING THE RS-485 COMMUNICATION BOARD (RD1600-RS)

When using the RS-485 transmission function, mount the communication board (RS-485) in the following procedure.

Step 1 Turn OFF the power.

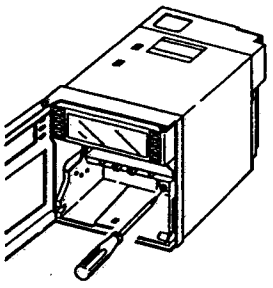
Step 2 Open the front flap and remove the main unit in the manner shown in the drawing below.

Step 2-1



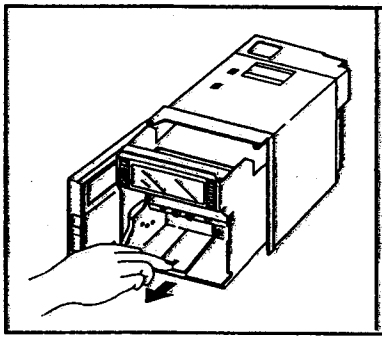
Open the front door and press down the paper feed unit drawout lever.
The paper feed unit will be drawn out.

Step 2-2



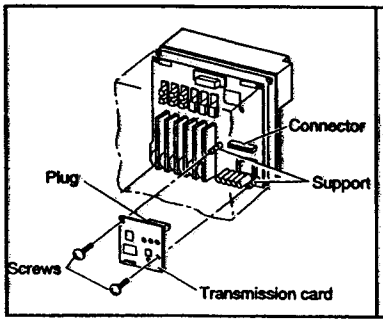
Loosen (counterclockwise turn) the lock screw and remove the unit.

Step 2-3



Remove the display unit from the main unit.

Step 3



Insert the RS-485 transmission card plug into the connector of the internal printed circuit board.
Affix them with two lock screws (M2×5).

Step 4

- After work has been completed, return the main unit to the case and affix with lock screws.
- Reinstall the paper feed unit.

3. TRANSMISSION FUNCITONS

A maximum of 31 recorders can be connected to the personal computer serial port.

Various data can be exchanged by connecting personal computer and recorder.

(The recorder can be connected to a personal computer equipped with RS-485 serial port.
For a personal computer equipped with RS-232C port alone, a line converter is required for connection.)

Transmission Access Table

	Item	READ	WRITE
Operation	Record start/stop	×	×
	Instantaneous value list print	×	×
	Chart high-speed feed	×	×
Display	Measured value	○	○
	Time	○	×
	Alarm	○	×
	Chart end	○	×
	Carriage error	○	×
	Battery end	○	×
	Burnout	○	×
	Over/under range	○	×
Manual print	Set value list print	×	×
	Test pattern print	×	×
	Scale print	×	×
	Daily report cumulative print	×	×
	Message print	×	○
Setting	Main chart speed	○	○
	Sub-chart speed	○	○
	Time setting	○	○
	Ink alarm clear	×	×
	Chart illumination lamp ON/OFF	○	○
Alarm	Alarm ON/OFF	○	○
	Alarm set value	○	○
	Output relay No.	○	○
Recording mode	Record mode	○	○
	Fixed time print ON/OFF	○	○
	Scale print ON/OFF	○	○
	Logging interval	○	○
	Record format	○	○
	Auto range channel ON/OFF	○	○
	Zoom record channel ON/OFF	○	○
	Zoom record position	○	○
	Zoom boundary value	○	○
	Zone record division number	○	○
	Zone record channel zone No.	○	○

	Item	READ	WRITE
Range	Record range	○	○
	Kinds and units of input	○	○
	Input filter value	○	○
	Scaling ON/OFF	○	○
	Router ON/OFF	○	○
	Measuring range	○	○
	Industrial values	○	○
	Decimal point position	○	○
	Industrial units	○	○
	Differential operation channel No.	○	○
	Tag No.	○	○
Daily report	Daily report ON/OFF	○	○
	Auto print ON/OFF	○	○
	Operation start/end time	○	○
	Channel ON/OFF	○	○
	Daily report data	○	×
	Average value data	○	×
	Maximum value data	○	×
	Minimum value data	○	×
Integration	Integration ON/OFF	○	○
	Auto print ON/OFF	○	○
	Operation start/end time	○	○
	Channel ON/OFF	○	○
	Integrated data	○	×
	Integration total data	○	×
Transmission	Station No.	○	○
	Transmission speed	○	○
	Stop bit	○	○
	Parity	○	○
	Data type	○	○
Message	Message character data	○	○
	Print start position	○	○
	Print color	○	○
	Print start time	○	○
	Print timing	○	○
	Print interval	○	○
	Print timing alarm channel	○	○
	Print timing alarm ON/OFF	○	○
	Print timing alarm types	○	○

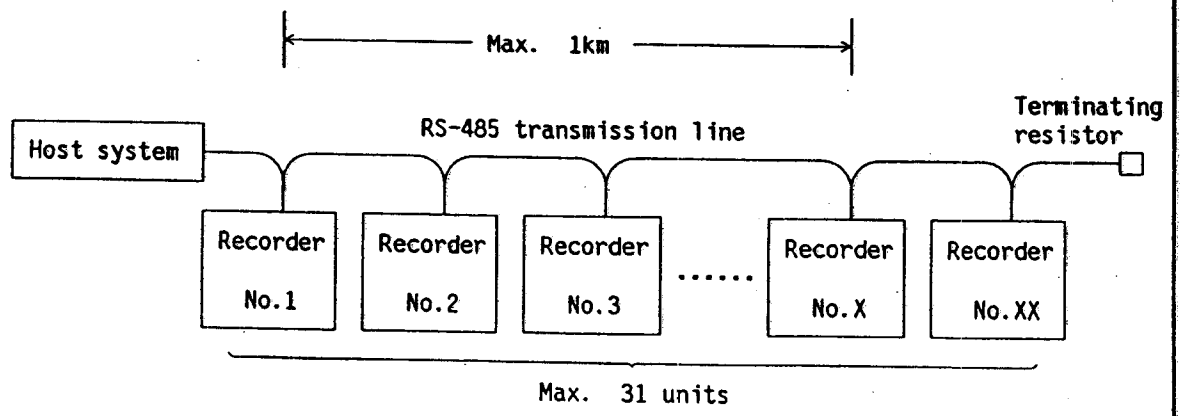
(Note 1) ○: Possible
×: Not possible

(Note 2) READ: Data from recorder to personal computer
WRITE: Data from personal computer to recorder

4. TRANSMISSION SPECIFICATIONS

Item	Specification	Remarks
Physical interface	RS-485	
Communication system	Half-duplex communication system	
Synchronizing system	Start-stop synchronizing	
Data length	8 bits	
Parity	Odd or even number parity (or without parity)	Setting by front panel key
Stop bit	1 or 2 bits	Setting by front panel key
Response	ACK, NACK system	
Error control system	Parity and BCC (*1)	
Connection control system	Polling/selecting system	
Transmission rate	9600 or 19200 bps	Setting by front panel key
Transmission block length	Max. 18 words (36 bytes), without BCC	
Transmission distance	Total length; max. 1km	
Transmission cable	Twisted paired cable with shield	
Number of connectable units	Max. 31 units	

Connection



(*1) BCC: Block check character (horizontal parity)

5. WIRING

5.1 RS-485 transmission cable wiring

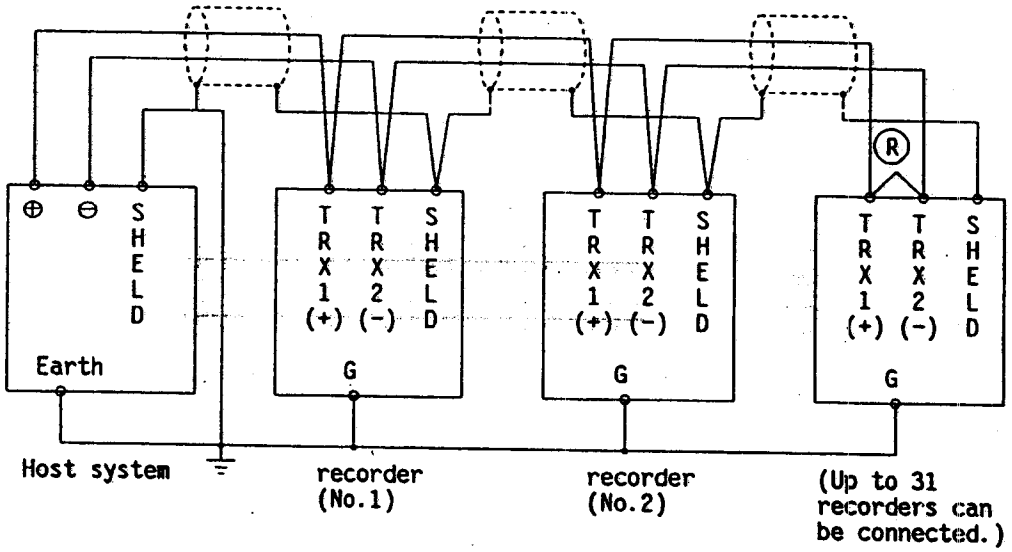
Connect the recorder to the host system.

① Each device, with the exception of the host system, has its own station No. to perform 1:1 transmission with the device designated to the host system. Make sure that the station No. is not the same as the station No. of other instruments connected to the RS-485 transmission line.

② The transmission cable must be separated from the power cable and other cables which are deemed to generate noise, in order to eliminate the effect of inductive noise. Avoid parallel wiring.

③ The transmission cable should be a twisted-pair shield cable (characteristic impedance: 100Ω, capacitance: 250pF/m).

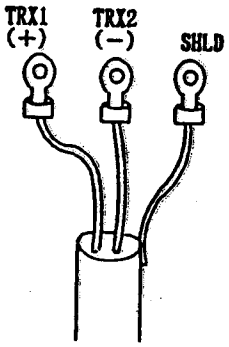
④ The shield of the transmission cable should be grounded at the ground point of the host system.



(Note) Terminating resistor (R) should be 100Ω, 1/2W.

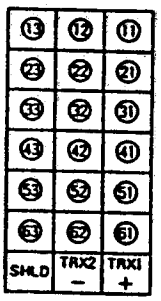
⑤ Do not short the transmission terminals ⊕ and ⊖, since it damages the transmission circuit.

5.2 Treatment of transmission cable



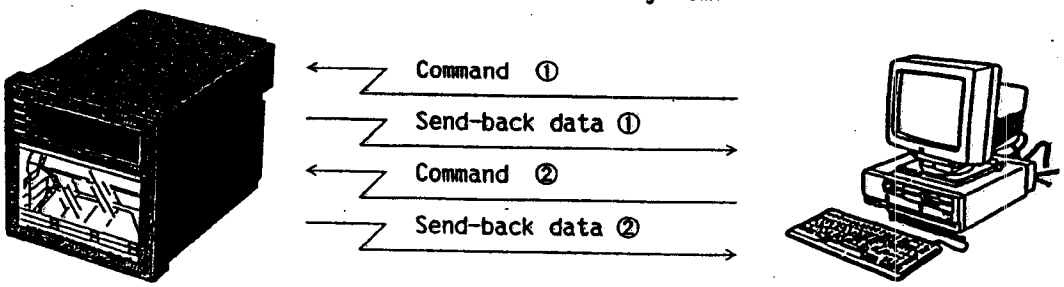
As shown in the diagram at left, the cable end should be treated. Then, the cable should be connected to the personal computer through each recorder.

5.3 Terminal diagram



6. TRANSMISSION PROCEDURES

Transmission data 1 message (Within 38 bytes) is sent back when 1 message (within 38 bytes) of command is received from the host system.



Hand-shake operation in the order of command ①⟷send-back data ①, command ② ⟷send-back data ②. Receive the send-back data.

(Note) For communication, turn ON the power switch of the recorder. Communication is started when the measured data appears on the display section.

7. SETTING OF TRANSMISSION PARAMETERS

Transmission parameters can be set by using the recorder keys or from the host system.

Setting items

Set the following items required for transmission.

① Station No. • • • 1-31 can be set (initial set value: 1).
② Baud rate (transmission rate) • • • 2400, 4800, 9600 or 19200bps can be set (initial set value: 19200)
③ Stop bit • • • 1 or 2 bit can be set (initial set value: 1).
④ Parity • • • EVEN, ODD, NONE (initial set value: ODD)
⑤ Data type • • • Parameter for T-link transmission. Factory use only-nothing to set or change.

Setting procedures (setting by recorder keys)

① Turn ON the power switch of the recorder.

② Press the [SELECT] key several times to give the transmission display.
Then, set it using the following procedures.

[SELECT]	
COMMUNICATION STATION NO□	Press the [∧] and/or [∨] keys for setting the station No. (1-31 can be set).
[ENTRY]	Press the [ENTRY] key for registration.
BAUD RATE □□□□□bps	Press the [∧] and/or [∨] keys for setting the baud rate (transmission rate). (2400, 4800, 9600 or 19200bps can be set.)
[ENTRY]	Press the [ENTRY] key for registration.
STOP BIT □ PARITY□□□□	• Press the [∧] and/or [∨] keys for setting stop bit (1 or 2 bit). • Press the [∧] and/or [∨] keys for setting parity. (EVEN, ODD or NONE can be set.)
[ENTRY]	Press the [ENTRY] key for registration.
DATA TYPE	
[ENTRY]	
[DISPLAY]	Press the [DISPLAY] key for measurement display.
Ch□□□□	

- Setting operation has been completed. -

NOTE: When transmission data have been re-written, turn OFF the power for the recorder temporarily to obtain effective data.

8. TRANSMISSION DATA AND FORMAT

8.1 Kinds of messages

Messages used for transmission between control station (host system) and controlled station (recorder) are classified into the following 5 messages.

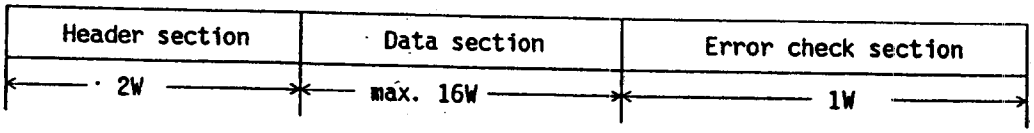
Table 8-1 Kinds of messages

Message	Transmission direction	Description
Polling message	Ⓜ → Ⓢ	Message for reading file of recorder
Selecting message	Ⓜ → Ⓢ *	Message for writing in file of recorder
ACK 1 message	Ⓢ → Ⓜ *	ACK message for polling message
ACK 2 message	Ⓢ → Ⓜ	ACK message for selecting message/ control message
NACK message	Ⓢ → Ⓜ	NACK message for selecting message/ control message

Ⓜ : Master (host system)
Ⓢ : Slave (RD1603/1606)
ACK : Acknowledge
NACK: Negative Acknowledge

Asterisked (*) item shows message with data
(Note) There is no NACK message for polling message.

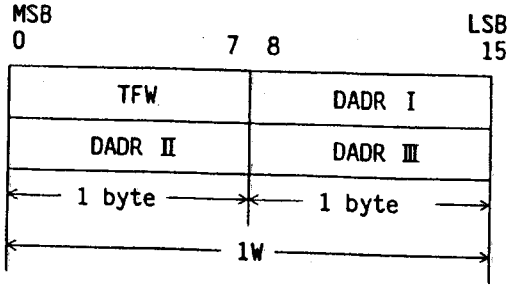
8.2 Formats of messages



The selecting message and ACK 1 message containing data are each composed of 2W header, 16W (or less) data and 1W error check sections as shown in the above format. Other messages without data are composed of a fixed length of 2W header section only

(1) Header section

The header section is composed of 1 byte Transmission Function Word (TFW) and 3 bytes of data address word, a total of 2W.



Header section

Elements of the header section in the unit of byte are explained in the following.

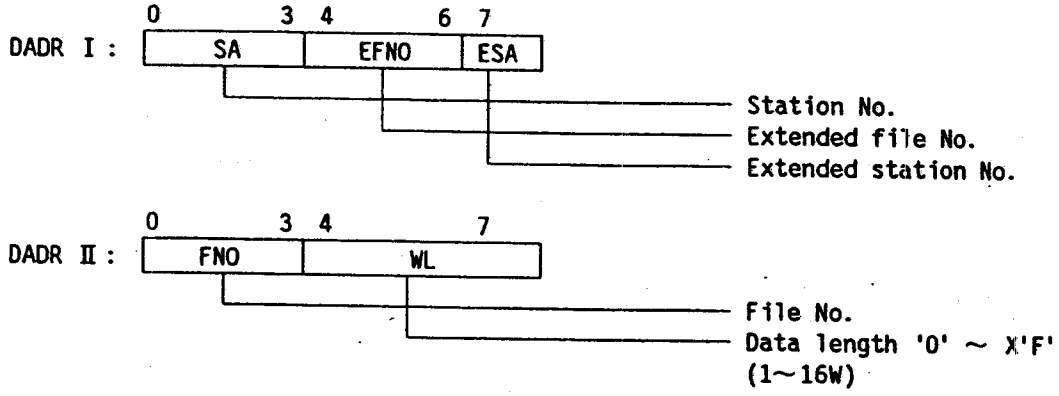
(a) Transmission function word (TFW)
Transmission function word is classified as shown in the following table.

Table 8.2 Tramsmission function word

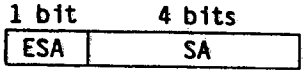
Function word	Symbol	Code	Meaning of function word
Polling	POL	(Note 1) X'D4'	Code of polling message
Selecting	SEL	X'69'	Code of selecting message
Acknowledge 1	ACK1	X'AC'	Code of ACK 1 message
Acknowledge 2	ACK2	X'C5'	Code of ACK 2 message
Negative Acknowledge	NACK	X'1B'	Code of NACK message

Note 1) X'**' is a hexadecimal expression.

(b) Data zone designation

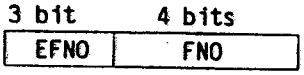


• The station No. of the controlled station connected to the line is designated by 5 bits with ESA and SA as shown in the following.



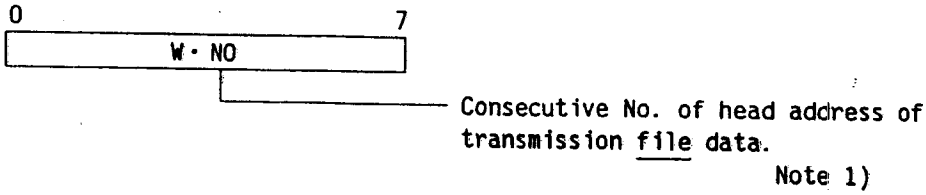
X'01'~X'1F'
(Station 1 ~ 31)

• Transmission destination file No. is also designated by 7 bits with EFNO and FNO.



X'00'~X'7F'
(File No.0 ~ 127)

DADR III : In case where function word is POL, SEL or ACK1, or ACK2 for selecting



In case where function word is NACK

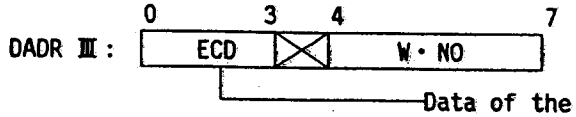
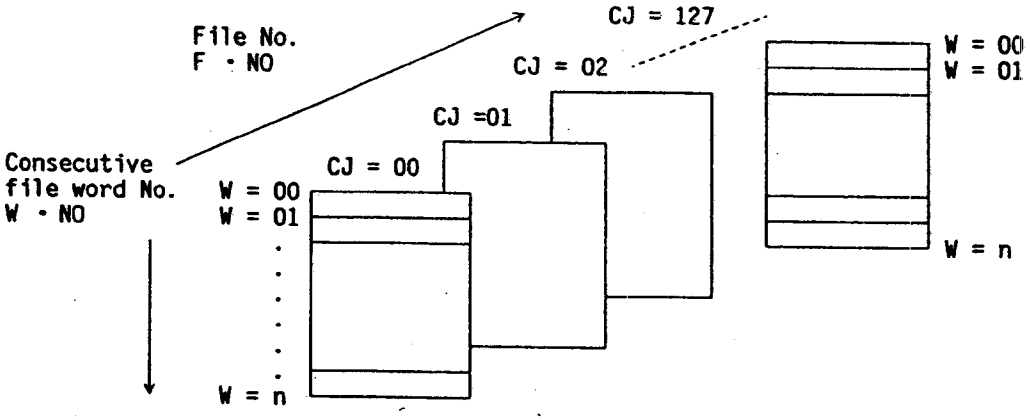


Table 8.3 Error code

Error code	Cause of NACK
X'1'	Receive buffer full
X'2'	Occurrence of parity or flaming error
X'3'	Occurrence of BCC error
X'4'	Occurrence of file protect error

Note 1) The controlled station file is composed as shown below.

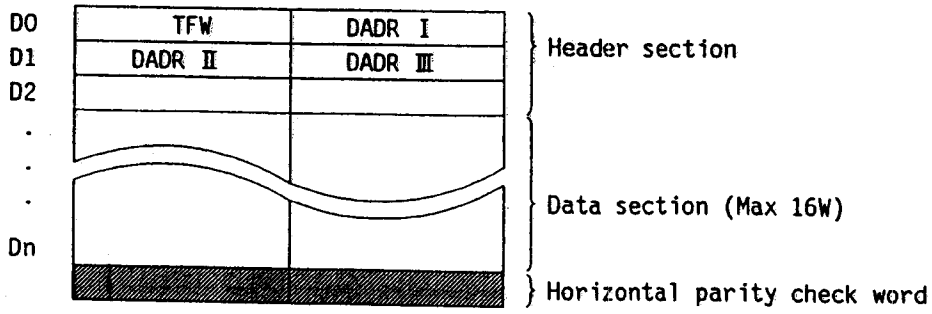


(2) Data section

This is composed of data with word length designated by DADR Ⅱ W.L of headersection. The 1W data on transmission line is transmitted in the order of upper byte to lower byte.

(3) Error check section (BCC)

This is composed of horizontal parity check word, 1W up to the final word of data section from the header section.



Calculation of horizontal parity check word

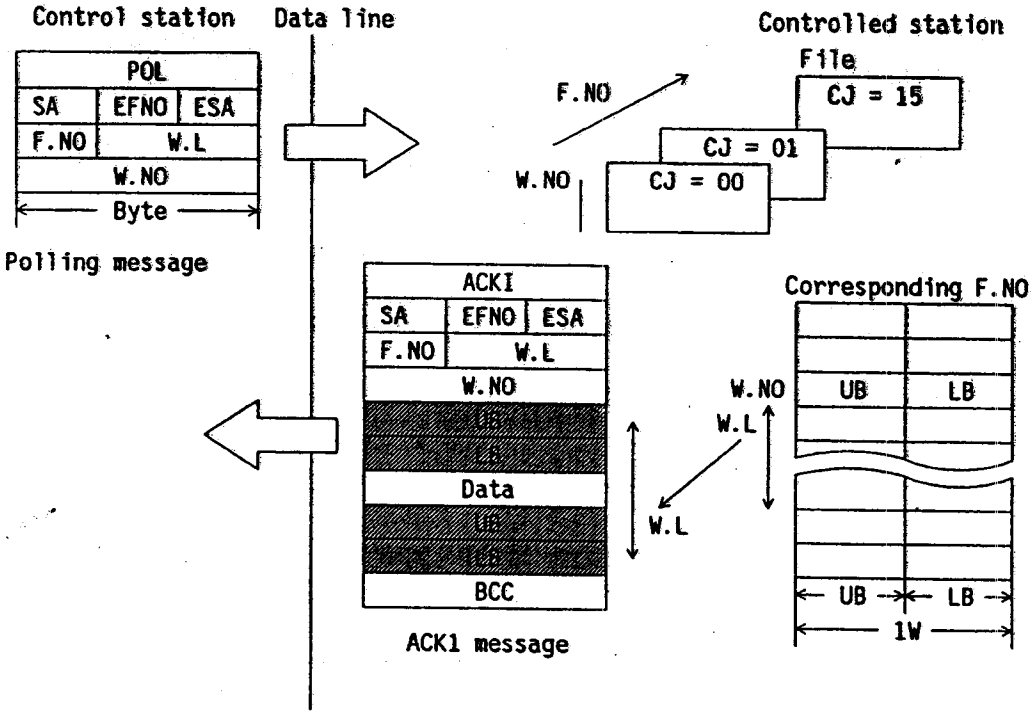
Horizontal parity check word = X' FFFF' ∀D0∀D1∀D2∀....∀Dn

∀ shows the calculation of exclusive-OR.

8.3 Examples of message communication

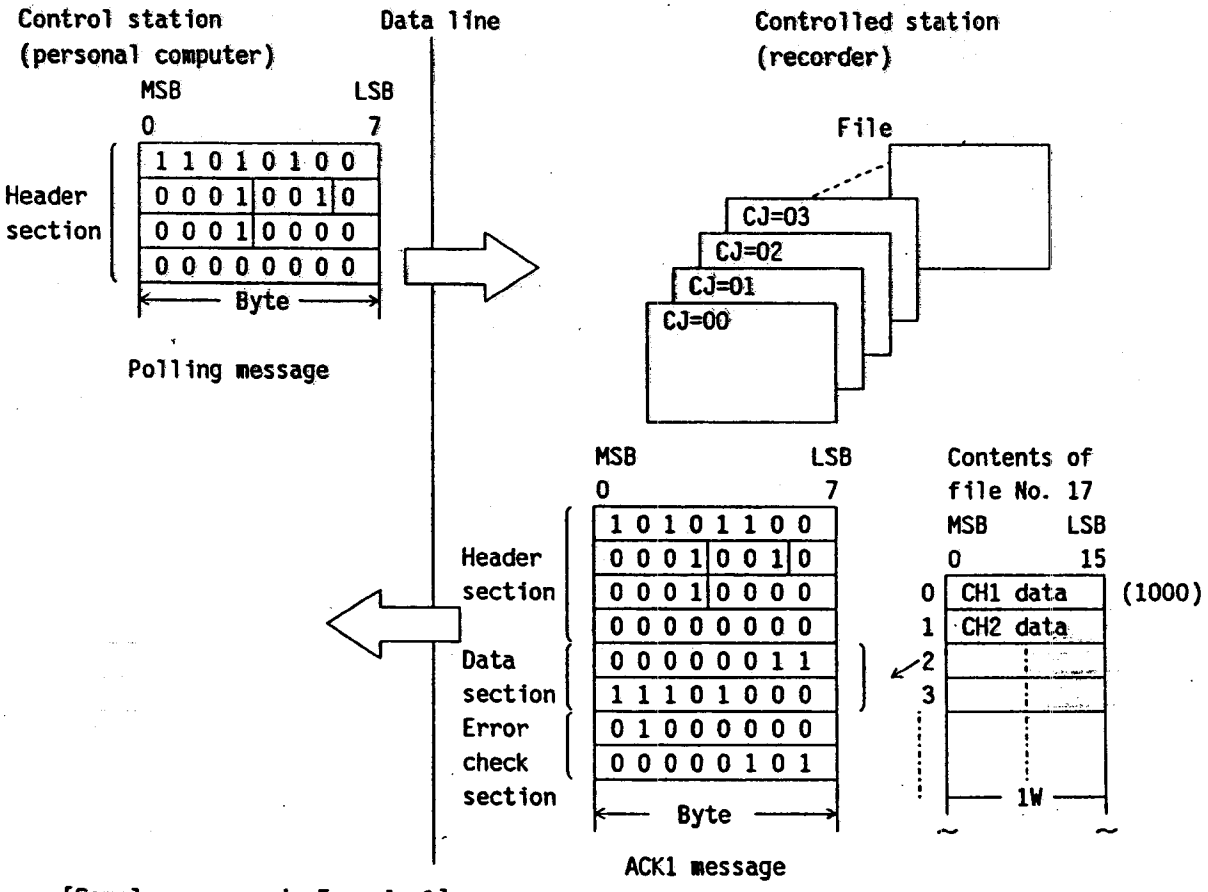
Communication message is described in the unit of characters (bytes) according to transmission format.

(1) Polling message



Example 1

Request (READ) for CH1 measured value from personal computer to the station No. 1 recorder

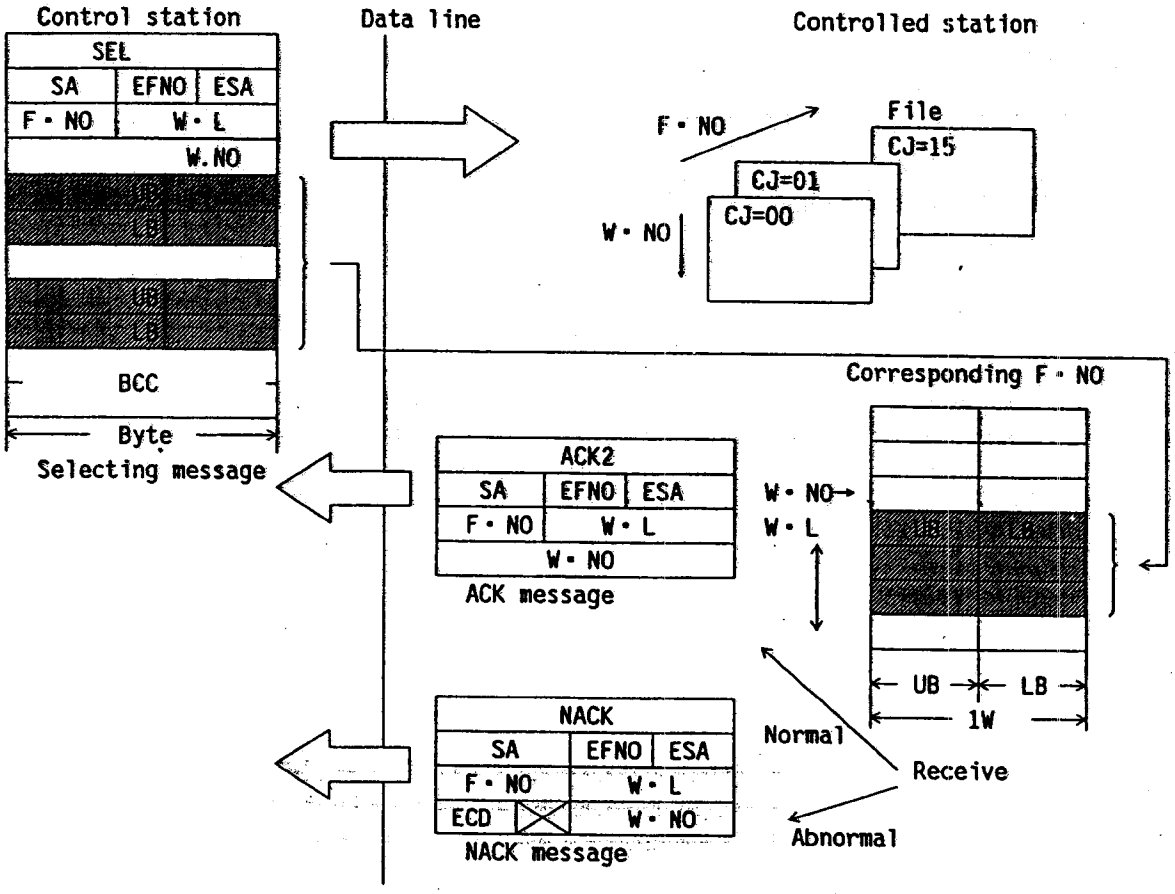


[Sample program in Example 1]

Using BASIC language of personal computer, poling message program in Example 1 is shown in the following.

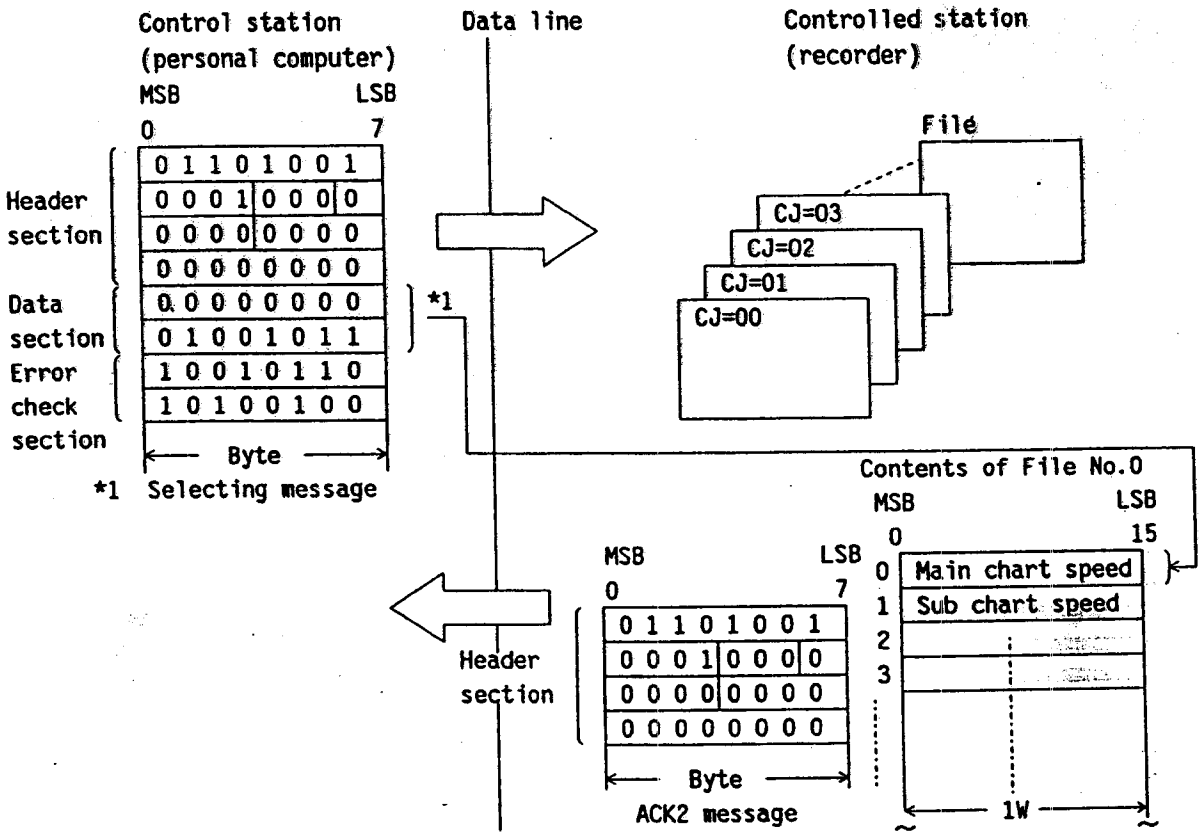
```
10  OPEN "COM1:N83NN" AS "#1
20  PRINT #1, CHR$(&HD4)+CHR$(&H12)+CHR$(&H10)+CHR$(&H0):
30  X$=INPUT$(1,#1)
40  PRINT HEX$(ASC(X$))
50  GOTO 30
60  END

[After execution]
RUN
AC
10
30
02
03
E8   } Data section (CH1 input data)
60
05
```

(2) Selecting message



Example 2

Setting (WRITE) of main chart speed from personal computer to the station No. 1 recorder (setting: 75mm/h).



[Sample program in Example 2]

Using BASIC language of personal computer, selecting messaage program in Example 2 is shown in the following.

```
10  OPEN "COM1:N83NN" AS "#1
20  PRINT #1, CHR$(&H69)+CHR$(&H10)+CHR$(&H00)+CHR$(&H00)+CHR$(&H00)+
    CHR$(&H4B)+CHR$(&H96)+CHR$(&HA4);
30  X$=INPUT$(1,#1)
40  PRINT HEX$(ASC(X$))
50  GOTO 30
60  END
```

[After execution]

```
RUN
C5
10
00
03
```

9. TRANSMISSION CONTROL PROCEDURES

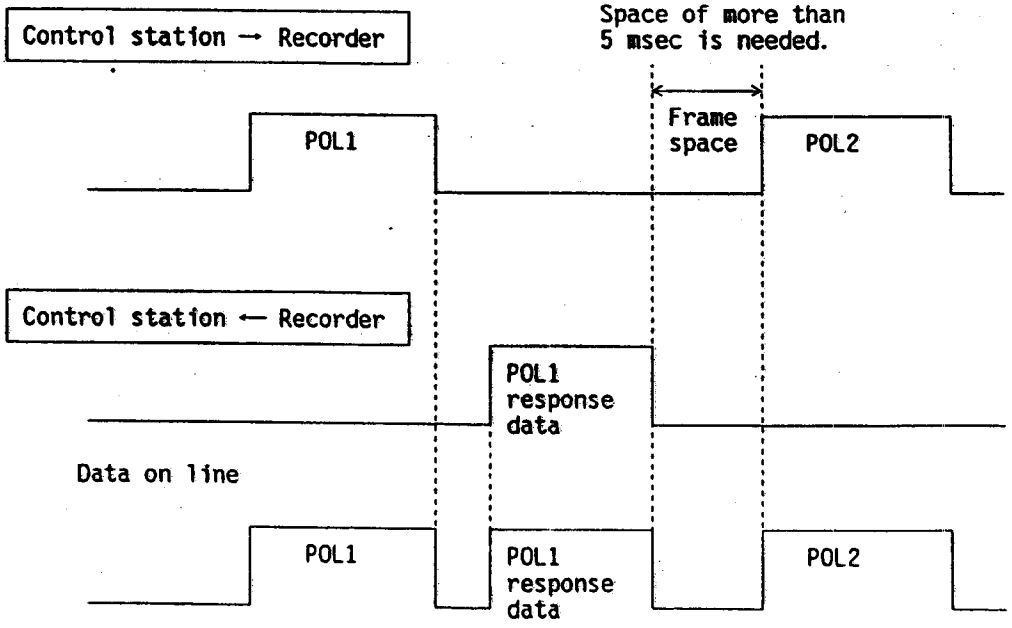
In general, transmission control procedure is divided into the following 3 phases.

(1) Data link setup
(2) Data transfer
(3) Data link release

In this transmission system, the data link setup (1) serves for the data link release (3) of the previous frame, so the space between frames must be secured correctly. The time required for spacing the frames is more than 5 msec.

Polling message or selecting message from the control station and corresponding response message from the controlled station are called the polling frame and the selecting frame, respectively.

In other words, when the controlled station has not received one character data for more than 5 msec on the line, the data link initializes receptions based on the judgement that a new frame is started.
During reception (during transmission from control station), when the character space is 2.5 msec, or more, the controlled station is automatically initialized and the data which have been received are completely cleared. Under the condition of initialized reception, the first character is limited to transmission functions words (POL, SEL), so a series of messages starting with other charactrers are all disregarded.
In the controlled station, when the function words are "POL", the header section, that is, only 2 words are taken, and in the case of "SEL", the data (data section) of the data length shown in the header section are taken, while others are all disregarded.



NOTE:
Data response time of RD1603/1606 is 1 second (Max).
For time-out detection with personal computer, the time required for time-out detection should be more than 1 second.

10. INTERNAL FILE SPECIFICATIONS

10.1 Parameter file

File No.	Name	Access	File size
0	Parameter file	READ/WRITE	16 words

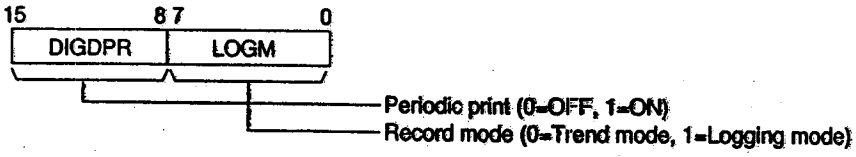
General

This file is used for setting the chart speed, recording mode, etc.

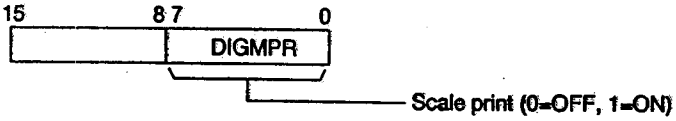
Configuration

WNo.	Abbreviations		Name	Unit	Range of values (setting range)
0	CHART1		Main chart speed	mm/h	5 to 1500
1	CHART2		Sub-chart speed	mm/h	5 to 1500
2	DIGDPR	LOGM	Periodic print/record print		See the following description in (1).
3		DIGMPR	/scale print		See the following description in (2).
4	LOGINT		Logging interval	min.	10 to 60
5	RECTYP		Record format		0=Standard, 1=Auto range recording, 2=Zone recording, 3=Zoom recording
6	ZCNT		Zone divisions		2 to 4
7	LAMPM		Chart illumination		0=Goes out, 1=Lights
8	ROUT	DAYREP	Daily report auto print/ daily report function		See the following description in (3).
9	RSTOP	RSTART	Daily report function stop time/start time		See the following description in (4).
10	SOUT	DATSUM	Data sum list auto print/ data sum function		See the following description in (5).
11	SSTOP	SSTART	Data sum function stop time/ start time		See the following description in (6).
12	SPO	STNO	Transmission baud rate/ station No.		See the following description in (7).
13	PRT	STP	Parity/stop bit		See the following description in (8).
14		TIOD	Construction of T-link I/O transmission		See the following description in (9).
15		TOTAL	Printing of only integrated value Printing function ON/OFF		See the following description in (10).

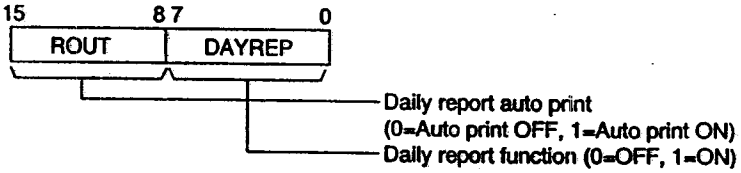
(1) DIGDPR/LOGM



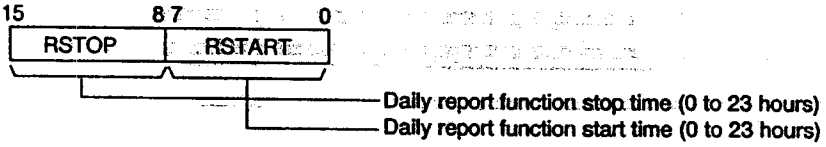
(2) DIGMPR



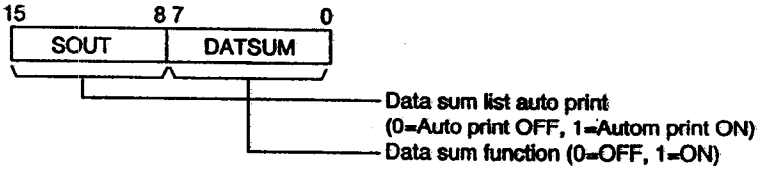
(3) ROUT/DAYREP



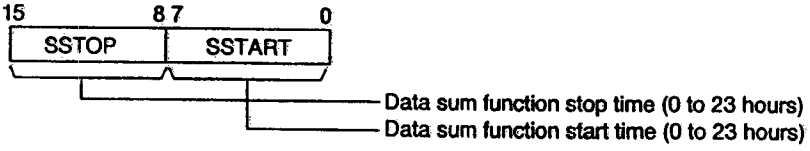
(4) RSTOP/RSTART



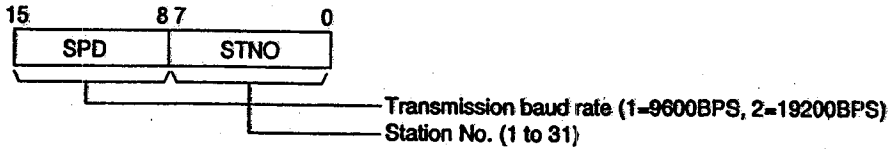
(5) SOUT/DATSUM



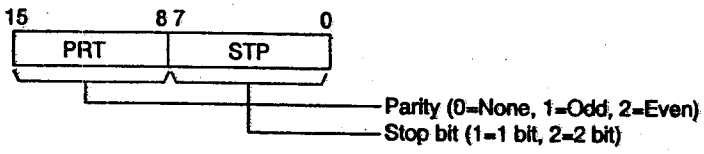
(6) SSTOP/SSTART



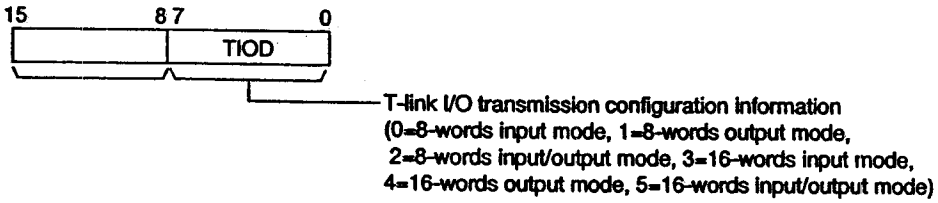
(7) SPD/STNO



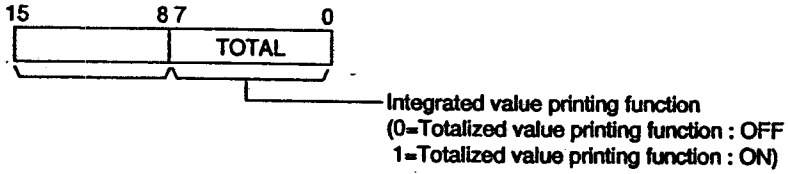
(8) PRT/STP



(9) TIOD



(10) TOTAL



Note) When transmission data is rewritten, turn OFF the power source of the recorder once or else the data can not be rewritten.

10.2 Range file

File No.	Name	Access	File size
1 to 12	Range file	READ/WRITE	32 words each

General

This file is used for setting the input type, record range, tag No. and other data of each input channel. File No. 1 to 12 correspond to CH1 to 12. (CH1 to CH6 for PHC)

Configuration

WNo.	Abbreviations		Name	Unit	Range of values (setting range)
0	TAG(1)	TAG(0)	TAG No.		Set tag No. (8 digits) by ASCII codes. See the following description in (1).
1	TAG(3)	TAG(2)			
2	TAG(5)	TAG(4)			
3	TAG(7)	TAG(6)			
4	DFIST		Input filter	sec.	0 to 900 (No input filter is provided at 0.)
5	UNIT	TYPE	Unit/input type		See the following description in (2).
6	POINT		Position of industrial value decimal point		0 to 5
7	RMIN		Record range (0% side)		Depends upon the input types. See the following description in (2).
8	RMAX		Record range (100% side)		
9	MMIN		Measurement range (base scale)		DC voltage input only -5500 to 5500.
10	MMAX		Measurement range (full scale)		
11	SMIN		Industrial value (base scale)		DC voltage input only -32767 to 32767.
12	SMAX		Industrial value (full scale)		
13	ROOT	SCAL	Square-root extraction/scaling		See the following description in (3).
14	SUB		Subtract operation channel No.		0 to 12 (No subtract operation at 0.)
15	SEK	NIP	Summation/daily report		See the following description in (4).
16	ZONE		Specified zone for zone record		1 to 4
17	ZOOM	ARNG	Zoom record/auto range record		See the following description in (5).
18	ZMBDY1		Zoom recording boundary value ①	Industrial value	Depends upon the input types.
19	ZMBDY2		Zoom recording boundary value ②		
20	ZMPCT1		Zoom recording chart position ①	%	0 to 100
21	ZMPCT2		Zoom recording chart position ②		
22	TAI	COLOR	Logarithm operation/ Printing color		See the following description in (6).
23	PVSIFT		PV shift value	Industrial value	-32767 to 32767
24	PVGAIN		PV gain	%	0.01 to 327.67
28			(Spare)		
29			(Spare)		
30			(Spare)		
31			(Spare)		

(1) TAG No. (TAG (0) to TAG (7))

Set tag No. (max. 8 digits) by ASCII codes as follows.

(Example)

(TAG No.)
Setting of TAG 12345 ⟶

TAG (1)	A	T	TAG (0)
TAG (3)	1	G	TAG (2)
TAG (5)	3	2	TAG (4)
TAG (7)	5	4	TAG (6)

(2) Setting of input types and record range

Table 10-1

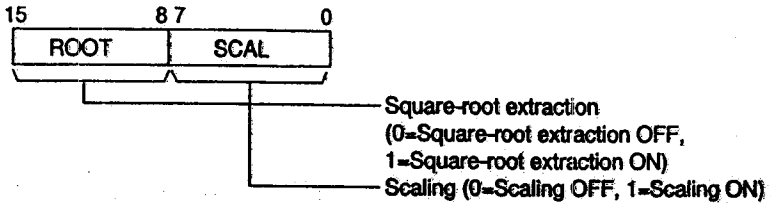
	Input type	Input type code	Record range setting	Remarks
Thermo-couple	K	1	-2300 to 14000	Corresponds to 230.0 to 1400.0℃
	E	2	-2300 to 8300	Corresponds to -230.0 to 830.0℃
	J	3	-2300 to 11300	Corresponds to -230.0 to 1130.0℃
	T	4	-2300 to 4300	Corresponds to -230.0 to 430.0℃
	R	5	-300 to 17900	Corresponds to -30.0 to 1790.0℃
	S	6	-300 to 17900	Corresponds to -30.0 to 1790.0℃
	B	7	3700 to 17900	Corresponds to -30.0 to 1790.0℃
	N	8	-300 to 13300	Corresponds to -30.0 to 1330.0℃
	W	9	-300 to 9300	Corresponds to -30.0 to 1790.0℃
	L	10	-2300 to 9300	Corresponds to -230.0 to 930.0℃
	U	11	-2300 to 4300	Corresponds to -230.0 to 430.0℃
	PN	12	-300 to 13300	Corresponds to -30.0 to 1330.0℃
Resistance thermometer	Pt100Ω	13	-2300 to 6300	Corresponds to -230.0 to 630.0℃
	JPt100Ω	14	-2300 to 6300	Corresponds to -230.0 to 630.0℃
DC voltage	±50mV	15	-5500 to 5500	Corresponds to -55.00 to 55.00℃
	±500mV	16	-5500 to 5500	Corresponds to -550.0 to 550.0℃
	±5V	17	-5500 to 5500	Corresponds to -5.500 to 5.500℃
	±50V	18	-5500 to 5500	Corresponds to -55.00 to 55.00℃
Transmission	COM	19	-32767 to 32767	
Logarithm operation ON			-9 × 2048 to 9 × 2048	Corresponds to 10^{-9} to 10^{9}

- When scaling is used at DC voltage input, record range from -32767 to 32767 can be set.
- When the unit is 02 (°F) at thermocouple or resistance bulb input, record range should be set within (above-mentioned record range × 1.8+32).
- With logarithm operation ON, record range, industrial value and zoom recording boundary value should be set by a magnification of 2048 within the range from -9 × 2048 to 9 × 2048.

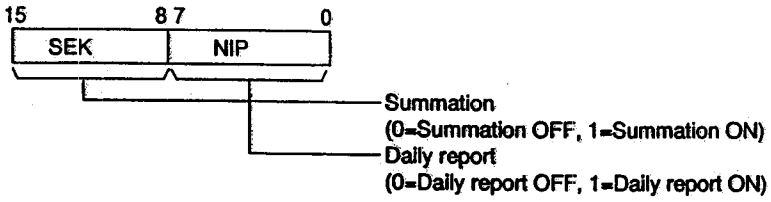
  (Example)

  When setting a record range of 10^{-3} to 10^{5}, set -6144 (-3 × 2048) in the 0% record range and 10240 (5 × 2048) in 100% record range.

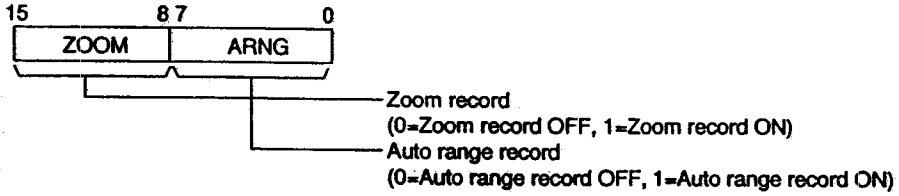
(3) ROOT/SCAL (at DC voltage input only)



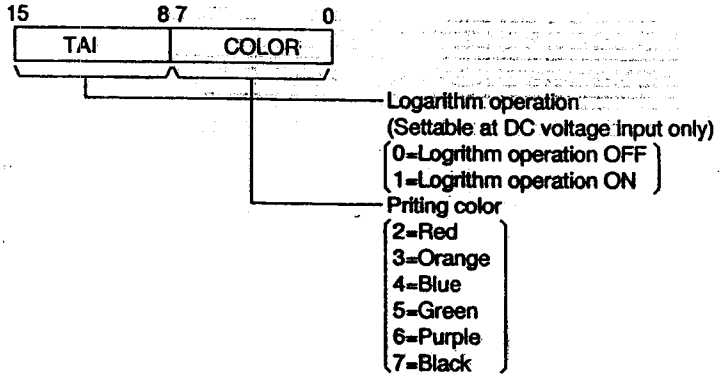
(4) SEK/NIP



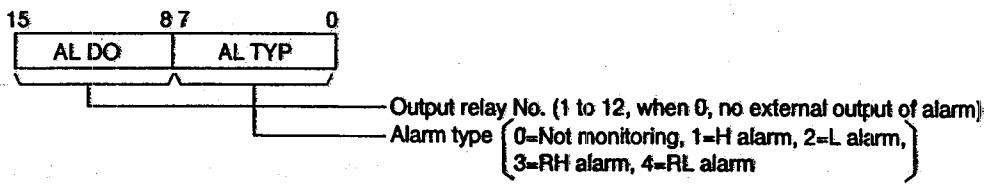
(5) ZOOM/ARNG



(6) TAI/COLOR



(1) Output relay No., alarm type



Each alarm of alarm No. 1 to 4 should be set in the same format.
When an output relay No. is specified from the plural printer at the same time, the output relay is ON when any alarm occurs.

Alarm setting value

Set an alarm setting value in terms with an industrial value. The setting range is the same as in the "record range setting" given in Table 10-1 (Item 10.2).

With logarithm operation ON, avoid setting RH alarm and RL alarm for the alarm type.
With logarithm operation ON, calculate the H and L alarm setting values from the following expression.
Alarm setting value=Log_{10} (real number) $\times$ 2048 + index $\times$ 2048

(Example)

When setting "3.1 $\times$ 10^{-2}" for the alarm setting value, set "-3090" from the following expression.
Alarm setting value =$Log_{10}3.1 \times 2048 + (-2) \times 2048 = -3090$

10.4 System file

File No.	Name	Access	File size
14	System file	READ/WRITE	32 words

General

Data required for internal operation of PHA and PHC are stored in system file to read RAS data such as present time (date, time), ink empty, etc., in the recorder.

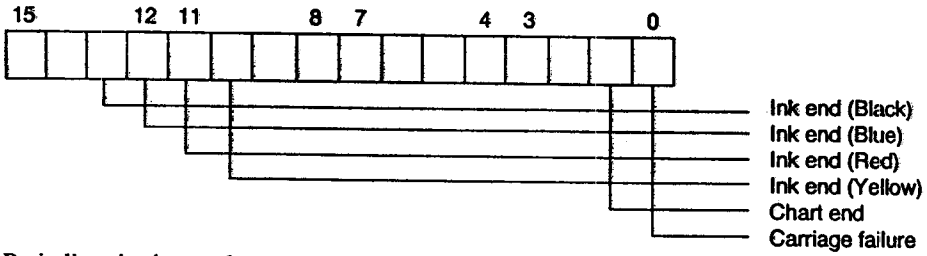
Configuration

WNo.	Abbreviations		Name	Unit	Range of values (setting range)	
0						
8	MONTH	YEAR	Present time (date, time)		YEAR : (lower significant 2 ditits) MONTH : (1 to 12) DAY : (1 to 31) HOUR : (0 to 23) MINUT : (0 to 59)	
9	HOUR	DAY				
10		MINUT				
24	RAS		RAS data		See the following description in (1).	
			(spare)			
30	MSTA	HSTA	Periodic print start time.	min. hours	0 to 59	0 to 23
31	MKAN	HKAN	Periodic print interval.	min. hours	0 to 59	0 to 24

MINUT : minute

(1) RAS data

Bit data are stored as shown below.



(2) Periodic print interval

- Periodic print is not done, if the periodic print interval is 0.
- The periodic print interval can not be set to any interval exceeding 24 hours.

10.5 Command file

File No.	Name	Access	File size
15	Command file	READ/WRITE	8 words

General

The command file is used for setting data required for internal operation of PHA and PHC. It is able to change the date, time in the recorder and to print message.

Configuration

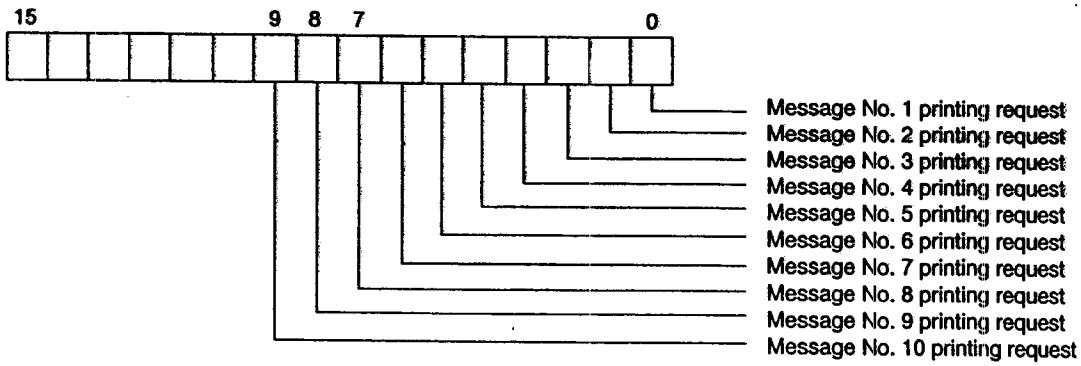
WNo.	Abbreviations		Name	Unit	Range of values (setting range)
0	YEAR	SET	SET : Set command		YEAR : (lower significant 2 ditits) MONTH : (1 to 12) DAY : (1 to 31) HOUR : (0 to 23) MINUT : (0 to 59)
1	DAY	MONTH			
2	MINUT	HOUR			
⋮					
⋮			(Spare)		
7	MESRE		Message printing		See the following description in (2).

(1) Date, time setting

After setting YEAR, MONTH, DAY, HOUR and MINUT of this file, the date, time in the recorder can be set by writing "1" in SET (set command).
(Set command and time can be set at the same time.)
After the time in the recorder has been set, the set command is automatically cleared to "0".

(2) Message printing

Each message is stored by the bit information as shown below.
The printing request is held, if a message is being printed.
The message printing request bit is cleared automatically after the printing request has been held.



10.6 Input failure information file

File No.	Name	Access	File size
16	Input failure information file	READ only	6 words

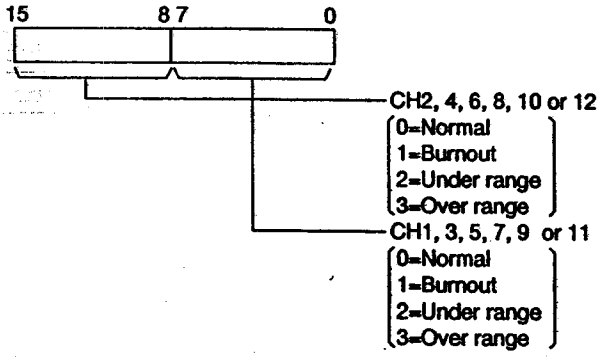
General

This file is used to store abnormal data on inputs, CH1 to CH12 for PHA and CH1 to CH6 for PHC. It is able to read burnout and over/under range.

Configuration

WNo.	Abbreviations		Name	Unit	Range of values (setting range)
0	CH2	CH1	Failure information of each input		See the following description in (1).
1	CH4	CH3			
2	CH6	CH5			
3	CH8	CH7			
4	CH10	CH9			
5	CH12	CH11			

(1) Input failure information



10.7 Input data file

File No.	Name	Access	File size
17	Input data file	READ only	12words

General

This file is used to store input data of the recorder.

It is able to read input data CH1 to CH12 for PHA and CH1 to CH6 for PHC in industrial value.

Configuration

WNo.	Abbreviations	Name	Unit	Range of values (setting range)
0	PV1	CH1 measuring data	IV*	Depends upon the input types.
1	PV2	CH2 measuring data	IV	Depends upon the input types.
2	PV3	CH3 measuring data	IV	Depends upon the input types.
3	PV4	CH4 measuring data	IV	Depends upon the input types.
4	PV5	CH5 measuring data	IV	Depends upon the input types.
5	PV6	CH6 measuring data	IV	Depends upon the input types.
6	PV7	CH7 measuring data	IV	Depends upon the input types.
7	PV8	CH8 measuring data	IV	Depends upon the input types.
8	PV9	CH9 measuring data	IV	Depends upon the input types.
9	PV10	CH10 measuring data	IV	Depends upon the input types.
10	PV11	CH11 measuring data	IV	Depends upon the input types.
11	PV12	CH12 measuring data	IV	Depends upon the input types.

IV: Industrial value

① All the measured data are stored in industrial value (without decimal point). The values are the same as shown in Table 10-1 (Item 10.2).

② When the input is "burnout" or "over/under range", the data becomes maximum or minimum in the range of the above value.

10.8 Alarm output file

File No.	Name	Access	File size
19	Alarm output file	READ only	36 words

General

This file is used to store the alarm data in the unit of byte.

It is able to read the alarm data being detected.

Configuration

WNo.	Abbreviations		Name	Unit	Range of values (setting range)
0	ALM2	ALM1	CH1 alarm occurrence information	____	0=No alarm occurrence 1=Alarm occurrence
1	ALM4	ALM3			
2	(Auxiliary)				
3	ALM2	ALM1	CH2 alarm occurrence information	____	0=No alarm occurrence 1=Alarm occurrence
4	ALM4	ALM3			
5	(Auxiliary)				
6	ALM2	ALM1	CH3 alarm occurrence information	____	0=No alarm occurrence 1=Alarm occurrence
7	ALM4	ALM3			
8	(Auxiliary)				
9	ALM2	ALM1	CH4 alarm occurrence information	____	0=No alarm occurrence 1=Alarm occurrence
10	ALM4	ALM3			
11	(Auxiliary)				
12	ALM2	ALM1	CH5 alarm occurrence information	____	0=No alarm occurrence 1=Alarm occurrence
13	ALM4	ALM3			
14	(Auxiliary)				
15	ALM2	ALM1	CH6 alarm occurrence information	____	0=No alarm occurrence 1=Alarm occurrence
16	ALM4	ALM3			
17	(Auxiliary)				
18	ALM2	ALM1	CH7 alarm occurrence information	____	0=No alarm occurrence 1=Alarm occurrence
19	ALM4	ALM3			
20	(Auxiliary)				
21	ALM2	ALM1	CH8 alarm occurrence information	____	0=No alarm occurrence 1=Alarm occurrence
22	ALM4	ALM3			
23	(Auxiliary)				
24	ALM2	ALM1	CH9 alarm occurrence information	____	0=No alarm occurrence 1=Alarm occurrence
25	ALM4	ALM3			
26	(Auxiliary)				
27	ALM2	ALM1	CH10 alarm occurrence information	____	0=No alarm occurrence 1=Alarm occurrence
28	ALM4	ALM3			
29	(Auxiliary)				
30	ALM2	ALM1	CH11 alarm occurrence information	____	0=No alarm occurrence 1=Alarm occurrence
31	ALM4	ALM3			
32	(Auxiliary)				
33	ALM2	ALM1	CH12 alarm occurrence information	____	0=No alarm occurrence 1=Alarm occurrence
34	ALM4	ALM3			
35	(Auxiliary)				

10.9 Transmission input data file

File No.	Name	Access	File size
21	Transmission input data file	WRITE only	12 words

General

This file is used to store transmission data to PH series recorder.

Transmission data (CH1 to 12 for PHA, CH1 to 6 for PHC) can be written in each channel with industrial values

Configuration

WNo.	Abbreviations	Name	Unit	Range of values (setting range)
0	CV1	CH1 transmission input data	IV*	Depends upon the input types.
1	CV2	CH2 transmission input data	IV	Depends upon the input types.
2	CV3	CH3 transmission input data	IV	Depends upon the input types.
3	CV4	CH4 transmission input data	IV	Depends upon the input types.
4	CV5	CH5 transmission input data	IV	Depends upon the input types.
5	CV6	CH6 transmission input data	IV	Depends upon the input types.
6	CV7	CH7 transmission input data	IV	Depends upon the input types.
7	CV8	CH8 transmission input data	IV	Depends upon the input types.
8	CV9	CH9 transmission input data	IV	Depends upon the input types.
9	CV10	CH10 transmission input data	IV	Depends upon the input types.
10	CV11	CH11 transmission input data	IV	Depends upon the input types.
11	CV12	CH12 transmission input data	IV	Depends upon the input types.

IV: Industrial value

① Input data can be recorded, printed and displayed, after the input data "0 to 10000" are converted to the base scale to full scale of the industrial value.

10.10 Message file

File No.	Name	Access	File size
22	Message file	READ/WRITE	120 words

General

This file is used to store message character data, printing colors, printing positions, printing timing, etc. in message printing.
Message data can be changed.

Configuration

WNo.	Abbreviations		Name	Unit	Range of values (setting range)
0	MES(1)	MES(0)	Message character data		Set message character data (16 digits) by ASCII codes. See the following description in (1).
1	MES(3)	MES(2)			
2	MES(5)	MES(4)			
3	MES(7)	MES(6)			
4	MES(9)	MES(8)			
5	MES(11)	MES(10)			
6	MES(13)	MES(12)			
7	MES(15)	MES(14)			
8	MPOS	MCOL	Printing start position/ printing color		See the following description in (2).
9	MSTR	MTIM	Printing start time/ printing timing		See the following description in (3).
10	MACH	MINT	Alarm CH/printing interval		See the following description in (4).
11	MAON	MAHL	Alarm ON/OFF /Alarm No.		See the following description in (5).
118					
119					

Message No. 1 setting
Message No. 2 setting
Message No. 10 setting

(1) Message character data (MES(0) to MES(15))

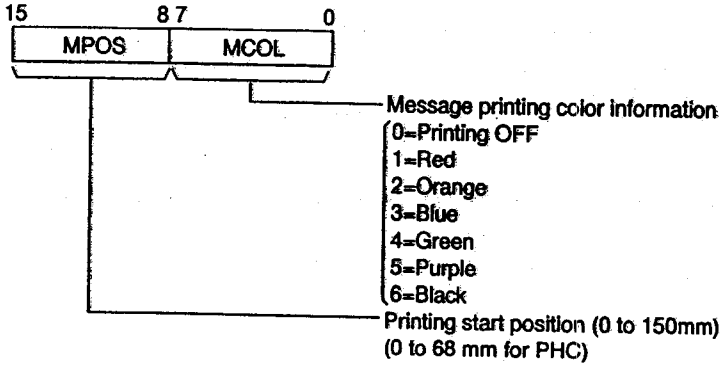
Set message character data (max. 16 digits) by ASCII codes as follows.

(Example)

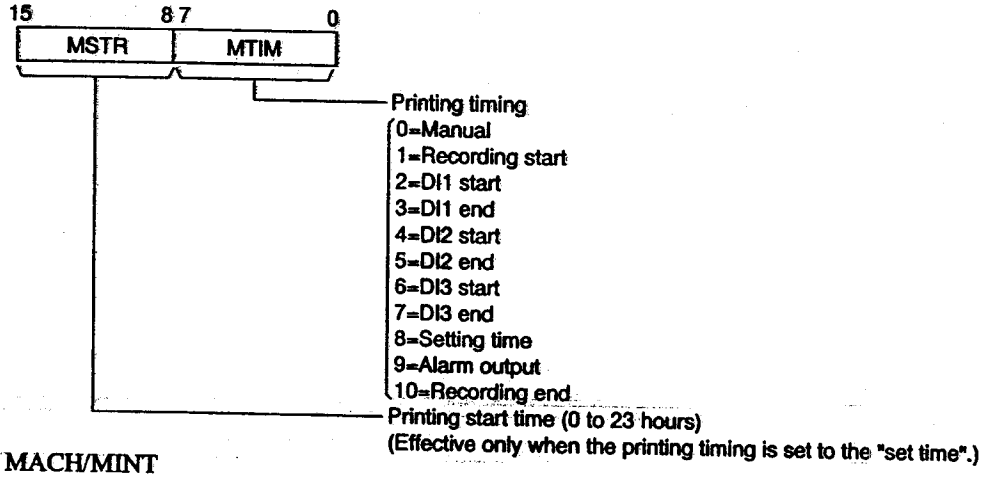
(Message character data)
Setting of MESSAGE123456789 →

MES (1)	E	M	MES (0)
MES (3)	S	S	MES (2)
MES (5)	G	A	MES (4)
MES (7)	1	E	MES (6)
MES (9)	3	2	MES (9)
MES (11)	5	4	MES (10)
MES (13)	7	6	MES (12)
MES (15)	9	8	MES (14)

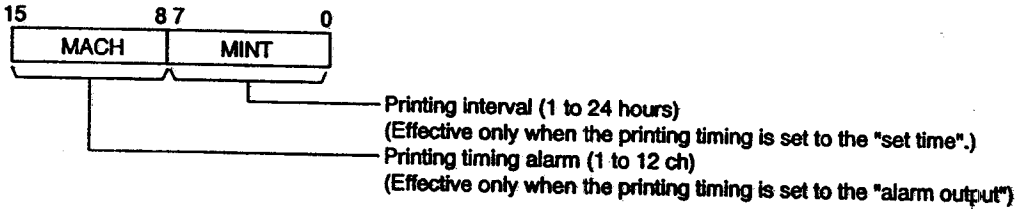
(2) MPOS/MCOL



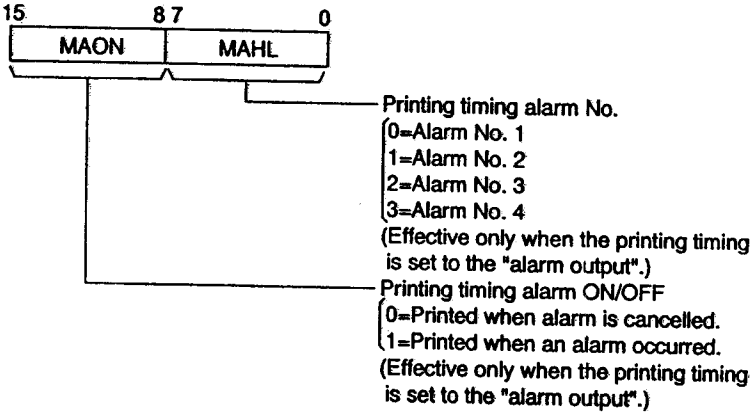
(3) MSTR/MTIM



(4) MACH/MINT



(5) MAON/MAHL



10.11 Daily report file

File No.	Name	Access	File size
33 to 35	Daily report file	READ only	256 words each

General

This daily report file is used to store instantaneous values every hour within the start and end time, generated time of these instantaneous values, average value of instantaneous values, the maximum value and its generated time, and minimum value and its generated time.
These daily report data can be read, and the daily report file is rewritten at the end time of the daily report.

Configuration

WNo.	Abbreviations	Name	Unit	Range of values (setting range)	
0 to 144		(Spare)			
145	DAY / MONTH	Instantaneous value data set time	Day/Month	1 to 31/ 1 to 21	Instantaneous value data at start time
146	MINUT / HOUR		Minute/Hour	0 to 59/0 to 23	
147	NV1	CH1 instantaneous value data	Industrial value	Depends upon the input types.	
148	NV2	CH2 instantaneous value data	Industrial value	Depends upon the input types.	
149	NV3	CH3 instantaneous value data	Industrial value	Depends upon the input types.	
150	NV4	CH4 instantaneous value data	Industrial value	Depends upon the input types.	
151	NV5	CH5 instantaneous value data	Industrial value	Depends upon the input types.	
152	NV6	CH6 instantaneous value data	Industrial value	Depends upon the input types.	
153	NV7	CH7 instantaneous value data	Industrial value	Depends upon the input types.	
154	NV8	CH8 instantaneous value data	Industrial value	Depends upon the input types.	
155	NV9	CH9 instantaneous value data	Industrial value	Depends upon the input types.	
156	NV10	CH10 instantaneous value data	Industrial value	Depends upon the input types.	
157	NV11	CH11 instantaneous value data	Industrial value	Depends upon the input types.	
158	NV12	CH12 instantaneous value data	Industrial value	Depends upon the input types.	
159	DAY / MONTH				Instantaneous value data after 1 hour
File 33					
251	NV7				Instantaneous value data after 7 hours
252	NV8				
253	NV9				
254	NV10				
255	NV11				
0	NV12				
1	DAY / MONTH				Instantaneous value data after 8 hours
File 34					
220	NV8				Instantaneous value data after 23 hours
221	NV9				
222	NV10				
223	NV11				
224	NV12				

WNo.	Abbreviations	Name	Unit	Range of values (setting range)
225	ANV1	CH1 average value	Industrial value	Depends upon the input types.
226	ANV2	CH2 average value	Industrial value	Depends upon the input types.
227	ANV3	CH3 average value	Industrial value	Depends upon the input types.
234	ANV10			
235	ANV11			
236	ANV12			
237	MINUT / HOUR	CH1 maximum value time	Minute/Hour	0 to 59/0 to 23
238	MAX1	CH1 maximum value	Industrial value	Depends upon the input types.
239	MINUT / HOUR	CH2 maximum value time	Minute/Hour	0 to 59/0 to 23
240	MAX2	CH2 maximum value	Industrial value	Depends upon the input types.
241	MINUT / HOUR	CH3 maximum value time	Minute/Hour	0 to 59/0 to 23
242	MAX3	CH3 maximum value	Industrial value	Depends upon the input types.
254	MAX9	CH9		
255	MINUT / HOUR	CH10		
0	MAX10	CH10		
1	MINUT / HOUR	CH11		
2	MAX11	CH11		
3	MINUT / HOUR	CH12		
4	MAX12	CH12		
5	MINUT / HOUR	CH1 minumum value time	Minute/Hour	0 to 59/0 to 23
6	MIN1	CH1 minumum value	Industrial value	Depends upon the input types.
7	MINUT / HOUR	CH2 minumum value time	Minute/Hour	0 to 59/0 to 23
27	MINUT / HOUR	CH12		
28	MIN2	CH12		
29 • • • 255		(Spare)		

File 34

File 35

① Instantaneous value data, average value data, maximum value data, and minimum value data are stored as industrial values (without decimal point), and the range of these values meets the "record range setting" in Table 10-1 (Item 10.2).

② If an input is a burnout or over/under range value, instantaneous value data is either maximum or minimum value within the above range of values.

10.12 Totalization file

File No.	Name	Access	File size
37, 38	Totalization file	READ only	256 words each

General

This totalization file is used to store the integrated values every hour within the integration start and end time, integration end time, and the total of integrated values.
The totalization file is rewritten at the integration end time.
These integrated data can be read.

Configuration

WNo.	Abbreviations	Name	Unit	Range of values (setting range)	
0 to 124		(Spare)			
125	DAY / MONTH	Integrated end time	Day/Month	1 to 31/ 1 to 12	
126	MINUT / HOUR		Minute/Hour	0 to 59/0 to 23	
127	SV1	CH1 integrated data	Industrial value	Depends upon the input types.	Integrated data at 1 hour after the integration start time
128	SV2	CH2 integrated data	Industrial value	Depends upon the input types.	
129	SV3	CH3 integrated data	Industrial value	Depends upon the input types.	
130	SV4	CH4 integrated data	Industrial value	Depends upon the input types.	
131	SV5	CH5 integrated data	Industrial value	Depends upon the input types.	
132	SV6	CH6 integrated data	Industrial value	Depends upon the input types.	
133	SV7	CH7 integrated data	Industrial value	Depends upon the input types.	
134	SV8	CH8 integrated data	Industrial value	Depends upon the input types.	
135	SV9	CH9 integrated data	Industrial value	Depends upon the input types.	
136	SV10	CH10 integrated data	Industrial value	Depends upon the input types.	Integrated data at 1 hour after (integration start+1) hours
137	SV11	CH11 integrated data	Industrial value	Depends upon the input types.	
138	SV12	CH12 integrated data	Industrial value	Depends upon the input types.	
139	DAY / MONTH				
File 37 ...					
253	SV1				Integrated data at 1 hour after (integration start+9) hours
254	SV2				
255	SV3				
0	SV4				
1	SV5				
2	SV6				
File 38 ...					
201	NV9				Integrated data at 1 hour after (integration start +23) hours
202	NV10				
203	NV11				
204	NV12				

WNo.	Abbreviations	Name	Unit	Range of values (setting range)
205	SVT01	CH1 integration total data	Industrial value	-999999 to 999999
206				
207	SVT02	CH2 integration total data	Industrial value	-999999 to 999999
208	SVT03	CH3 integration total data	Industrial value	-999999 to 999999
209				
210	SVT04	CH4 integration total data	Industrial value	-999999 to 999999
211	SVT05	CH5 integration total data	Industrial value	-999999 to 999999
212				
213	SVT06	CH6 integration total data	Industrial value	-999999 to 999999
214	SVT07	CH7 integration total data	Industrial value	-999999 to 999999
215				
216	SVT08	CH8 integration total data	Industrial value	-999999 to 999999
217	SVT09	CH9 integration total data	Industrial value	-999999 to 999999
218				
219	SVT010	CH10integration total data	Industrial value	-999999 to 999999
220	SVT011	CH11 integration total data	Industrial value	-999999 to 999999
221				
222	SVT012	CH12 integration total data	Industrial value	-999999 to 999999
223 • • • 225		(Spare)		

① All integrated data and integration total data are stored as industrial values (without decimal point) and the range of integrated data values meets the "record range setting" in Table 10-1 (Item 10.2).

② If an input is a burnout or over/under range value, the integrated data is either maximum or minimum value within the above range of values.

WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that our customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. Our Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

We are glad to offer suggestions on the use of our various products. Nevertheless, OMEGA only warrants that the parts manufactured by it will be as specified and free of defects.

OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

LIMITATION OF LIABILITY: The remedies of buyer set forth herein are exclusive and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

Every precaution for accuracy has been taken in the preparation of this manual; however, OMEGA ENGINEERING, INC. neither assumes responsibility for any omissions or errors that may appear nor assumes liability for any damages that result from the use of the products in accordance with the information contained in the manual.

SPECIAL CONDITION: Should this equipment be used in or with any nuclear installation or activity, buyer will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the equipment in such a manner.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA ENGINEERING Customer Service Department. Call toll free in the USA and Canada: 1-800-622-2378, FAX: 203-359-7811; International: 203-359-1660, FAX: 203-359-7807.

BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, YOU MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OUR CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems you are having with the product.

FOR **NON-WARRANTY** REPAIRS OR **CALIBRATION**, consult OMEGA for current repair/calibration charges. Have the following information available BEFORE contacting OMEGA:

1. Your P.O. number to cover the COST of the repair/calibration,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems you are having with the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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OMEGA... Your Source for Process Measurement and Control

TEMPERATURE
- Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- Wire: Thermocouple, RTD & Thermistor
- Calibrators & Ice Point References
- Recorders, Controllers & Process Monitors
- Infrared Pyrometers

PRESSURE/STRAIN FORCE
- Transducers & Strain Gages
- Load Cells & Pressure Gauges
- Displacement Transducers
- Instrumentation & Accessories

FLOW/LEVEL
- Rotameters, Gas Mass Flowmeters & Flow Computers
- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

pH/CONDUCTIVITY
- pH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

DATA ACQUISITION
- Data Acquisition and Engineering Software
- Communications-Based Acquisition Systems
- Plug-in Cards for Apple, IBM & Compatibles
- Datalogging Systems
- Recorders, Printers & Plotters

HEATERS
- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL
- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments