
**Instruction
Manual**

**Model 4351, 4352,
4353 and 4354**

μR100F

100 mm Micro Pen Recorders

IM 4D4B1 - 01E

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1. HANDLING PRECAUTIONS

The Model μ R100F Recorders are thoroughly factory-tested before shipment. When the instrument is received, however, check visually if any external damage has occurred during shipment. Confirm that all standard accessories are supplied.

If you have any problems or questions, contact the nearest YOKOGAWA service center or the dealer from whom the recorder was purchased.

1.1 Accessories

The accessories shown in Figure 1.1 should be supplied with the instrument. Check that nothing is missing.

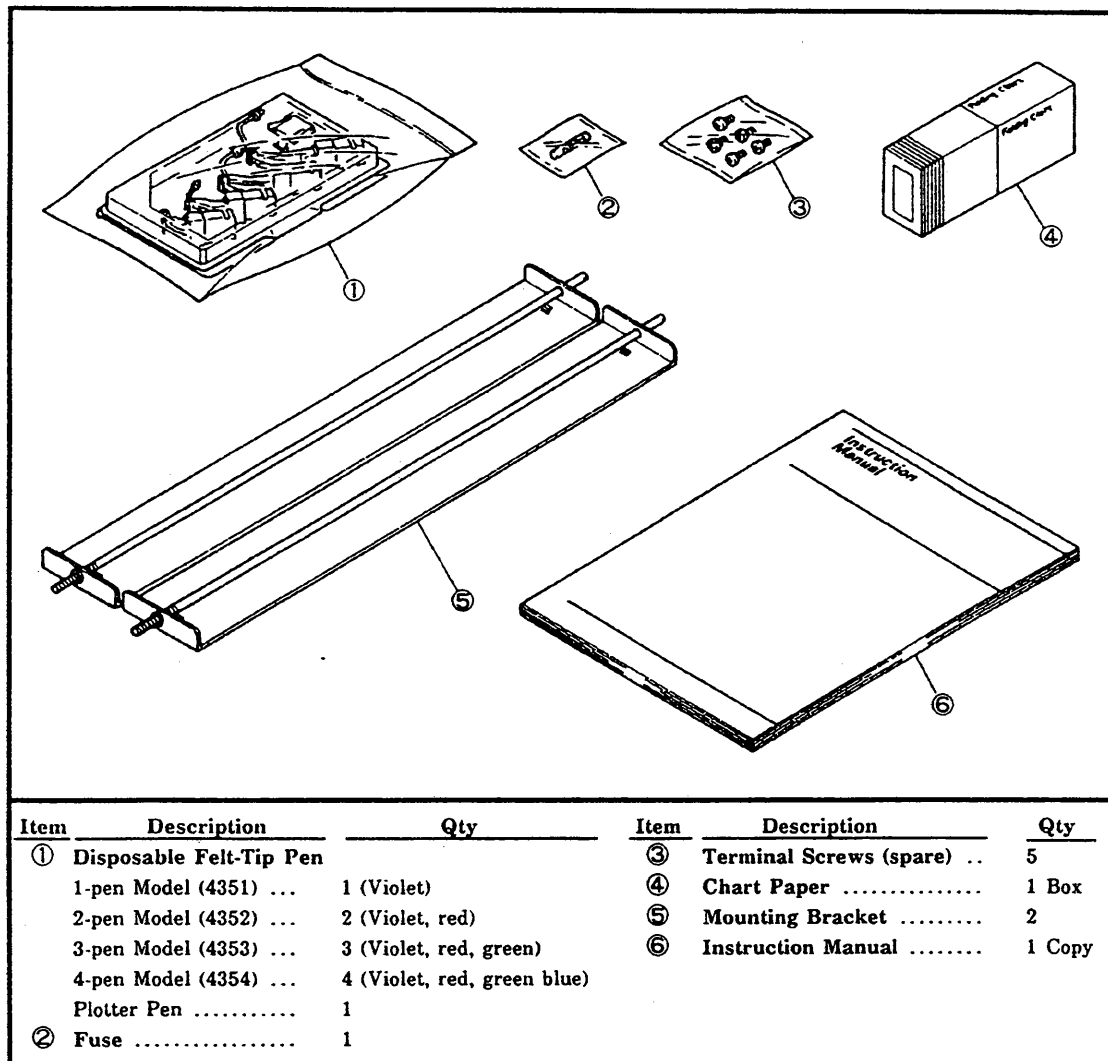


Figure 1.1 Accessories

1.2 Removing Packings and Shipping Lock Screw

The internal assembly is secured in position by protection brackets, packing and a lock screw to safeguard it against damage during transit.

- (1) Remove the protection brackets on both sides of the front door (as shown below), by unscrewing 4 pcs. of screws (See Figure 1.2).

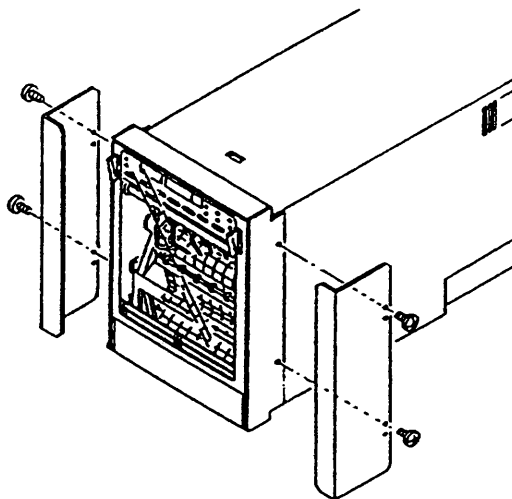


Figure 1.2

- (2) Remove all packing.
- (3) Remove a shipping lock screw on the bottom of the rear panel. The lock screw removed should be kept a safe place (See Figure 1.3).

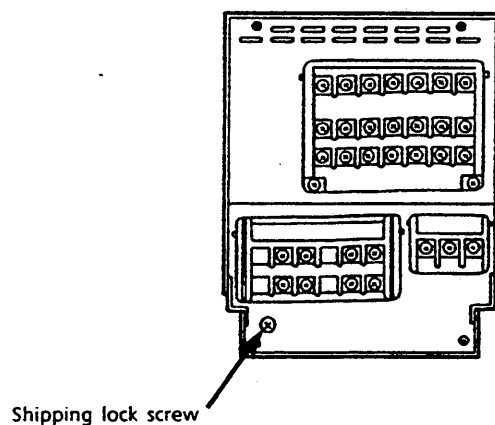


Figure 1.3

1.3 Data Plate Check

The recorder model number is indicated on the data plate. Verify that it is specified in the order.

Model and Suffix Codes

Model	Suffix Codes	Description																																																											
4351	μ R100F recorder (1-pen model)																																																											
4352	μ R100F recorder (2-pen model)																																																											
4353	μ R100F recorder (3-pen model)																																																											
4354	μ R100F recorder (4-pen model)																																																											
1-pen model, 1st pen of 2-pen, 3-pen or 4-pen model	-00 to -45	<table border="1"> <thead> <tr> <th>Input Type</th> <th>Range Code</th> <th>Measuring Range</th> </tr> </thead> <tbody> <tr> <td rowspan="5">DC V</td> <td>00</td> <td>-20.00 to 20.00 mV</td> </tr> <tr> <td>01</td> <td>-200.0 to 200.0 mV</td> </tr> <tr> <td>02</td> <td>-2.000 to 2.000 V</td> </tr> <tr> <td>03</td> <td>-6.000 to 6.000 V</td> </tr> <tr> <td>04</td> <td>-20.00 to 20.00 V</td> </tr> <tr> <td>05</td> <td>-50.00 to 50.00 V</td> </tr> <tr> <td rowspan="5">DC V (Linear scaling)</td> <td>30</td> <td>-20.00 to 20.00 mV</td> </tr> <tr> <td>31</td> <td>-200.0 to 200.0 mV</td> </tr> <tr> <td>32</td> <td>-2.000 to 2.000 V</td> </tr> <tr> <td>33</td> <td>-6.000 to 6.000 V</td> </tr> <tr> <td>34</td> <td>-20.00 to 20.00 V</td> </tr> <tr> <td>35</td> <td>-50.00 to 50.00 V</td> </tr> <tr> <td rowspan="5">DC V (Square root scaling)</td> <td>40</td> <td>-20.00 to 20.00 mV</td> </tr> <tr> <td>41</td> <td>-200.0 to 200.0 mV</td> </tr> <tr> <td>42</td> <td>-2.000 to 2.000 V</td> </tr> <tr> <td>43</td> <td>-6.000 to 6.000 V</td> </tr> <tr> <td>44</td> <td>-20.00 to 20.00 V</td> </tr> <tr> <td>45</td> <td>-50.00 to 50.00 V</td> </tr> <tr> <td rowspan="10">TC</td> <td rowspan="10">-00 to -45</td> <td>10 R (Pt13Rh-Pt) 0 to 1,760°C 32 to 3,200°F</td> </tr> <tr> <td>11 S (Pt10Rh-Pt) 0 to 1,760°C 32 to 3,200°F</td> </tr> <tr> <td>12 B (Pt30Rh-Pt6Rh) 400 to 1,820°C 752 to 3,308°F</td> </tr> <tr> <td>13 K (NiCr-Ni) -200 to 1,370°C -328 to 2,498°F</td> </tr> <tr> <td>14 E (NiCr-CuNi) -200 to 800°C -328 to 1,472°F</td> </tr> <tr> <td>15 J (Fe-CuNi) -200 to 1,100°C -328 to 2,012°F</td> </tr> <tr> <td>16 T (Cu-CuNi) -200 to 400°C -328 to 752°F</td> </tr> <tr> <td>17 N (Nicrosil-Nisil) 0 to 1,300°C 32 to 2,372°F</td> </tr> <tr> <td>18 W (W5%Re-W26%Re) 0 to 2,315°C 32 to 4,200°F</td> </tr> <tr> <td>19 L (Fe-CuNi) -200 to 900°C -328 to 1,652°F</td> </tr> <tr> <td>1A U (Cu-CuNi) -200 to 400°C -328 to 752°F</td> </tr> <tr> <td rowspan="2">RTD</td> <td rowspan="2">-00 to -45</td> <td>20 JPt 100 * -200 to 550°C -328 to 1,022°F</td> </tr> <tr> <td>21 Pt 100 ** -200 to 550°C -328 to 1,022°F</td> </tr> </tbody> </table>	Input Type	Range Code	Measuring Range	DC V	00	-20.00 to 20.00 mV	01	-200.0 to 200.0 mV	02	-2.000 to 2.000 V	03	-6.000 to 6.000 V	04	-20.00 to 20.00 V	05	-50.00 to 50.00 V	DC V (Linear scaling)	30	-20.00 to 20.00 mV	31	-200.0 to 200.0 mV	32	-2.000 to 2.000 V	33	-6.000 to 6.000 V	34	-20.00 to 20.00 V	35	-50.00 to 50.00 V	DC V (Square root scaling)	40	-20.00 to 20.00 mV	41	-200.0 to 200.0 mV	42	-2.000 to 2.000 V	43	-6.000 to 6.000 V	44	-20.00 to 20.00 V	45	-50.00 to 50.00 V	TC	-00 to -45	10 R (Pt13Rh-Pt) 0 to 1,760°C 32 to 3,200°F	11 S (Pt10Rh-Pt) 0 to 1,760°C 32 to 3,200°F	12 B (Pt30Rh-Pt6Rh) 400 to 1,820°C 752 to 3,308°F	13 K (NiCr-Ni) -200 to 1,370°C -328 to 2,498°F	14 E (NiCr-CuNi) -200 to 800°C -328 to 1,472°F	15 J (Fe-CuNi) -200 to 1,100°C -328 to 2,012°F	16 T (Cu-CuNi) -200 to 400°C -328 to 752°F	17 N (Nicrosil-Nisil) 0 to 1,300°C 32 to 2,372°F	18 W (W5%Re-W26%Re) 0 to 2,315°C 32 to 4,200°F	19 L (Fe-CuNi) -200 to 900°C -328 to 1,652°F	1A U (Cu-CuNi) -200 to 400°C -328 to 752°F	RTD	-00 to -45	20 JPt 100 * -200 to 550°C -328 to 1,022°F	21 Pt 100 ** -200 to 550°C -328 to 1,022°F
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2nd pen of 2-pen, 3-pen or 4-pen model	-00 to -45																																																												
3rd pen of 3-pen or 4-pen model	-00 to -45																																																												
4th pen of 4-pen model	-00 to -45																																																												
Power requirements	-1 -3 -5 -7	100V AC 115V AC 200V AC 230V AC																																																											
Frequency	1 2	50 Hz 60 Hz																																																											
Optional features ※	/□/□	Designate each specification code																																																											

※ See page 7-6 for optional specifications.

2. OUTLINE

The Model μ R100F Recorder is a microprocessor-based intelligent 100mm width 1- to 4-pen continuous writing recorder.

Any of the DC voltages, thermocouplers and RTDs can be selected as an input for each channel. In addition to distinct analog data traces, various data such as measured value and date can be printed out digitally.

The μ R100F is also provided with an analog scaled LED display to permit the measured value or industrial quantity to be read by means of digital data and recording traces.

There are four models for standard pen-writing models; 1-pen type (Model 4351), 2-pen type (Model 4352), 3-pen type (Model 4353), and 4-pen type (Model 4354).

2.1 Features

(1) Clear, Distinct Four-Color Continuous Traces:

- 1st pen : Violet
- 2nd pen : Red
- 3rd pen : Green
- 4th pen : Blue

Disposable felt-tip pens can be easily replaced while the recorder installed without staining hands.

(2) Versatile Digital Printout Functions

Fixed time printout, program list printout and alarm printout, in addition to the optional functions of the manual and message printouts, are available with all necessary data being printed out digitally.

(3) Measured Value Can Be Displayed, Recorded and Printed out as Industrial Quantity.

DC voltage input can be substituted for any numeric value by the scaling function and can be displayed, recorded and printed out.

(4) Programmable Functions

Range setting, record mode selection, unit setting fixed time and alarm printout ON/OFF can be performed arbitrarily.

2.2 Component Names

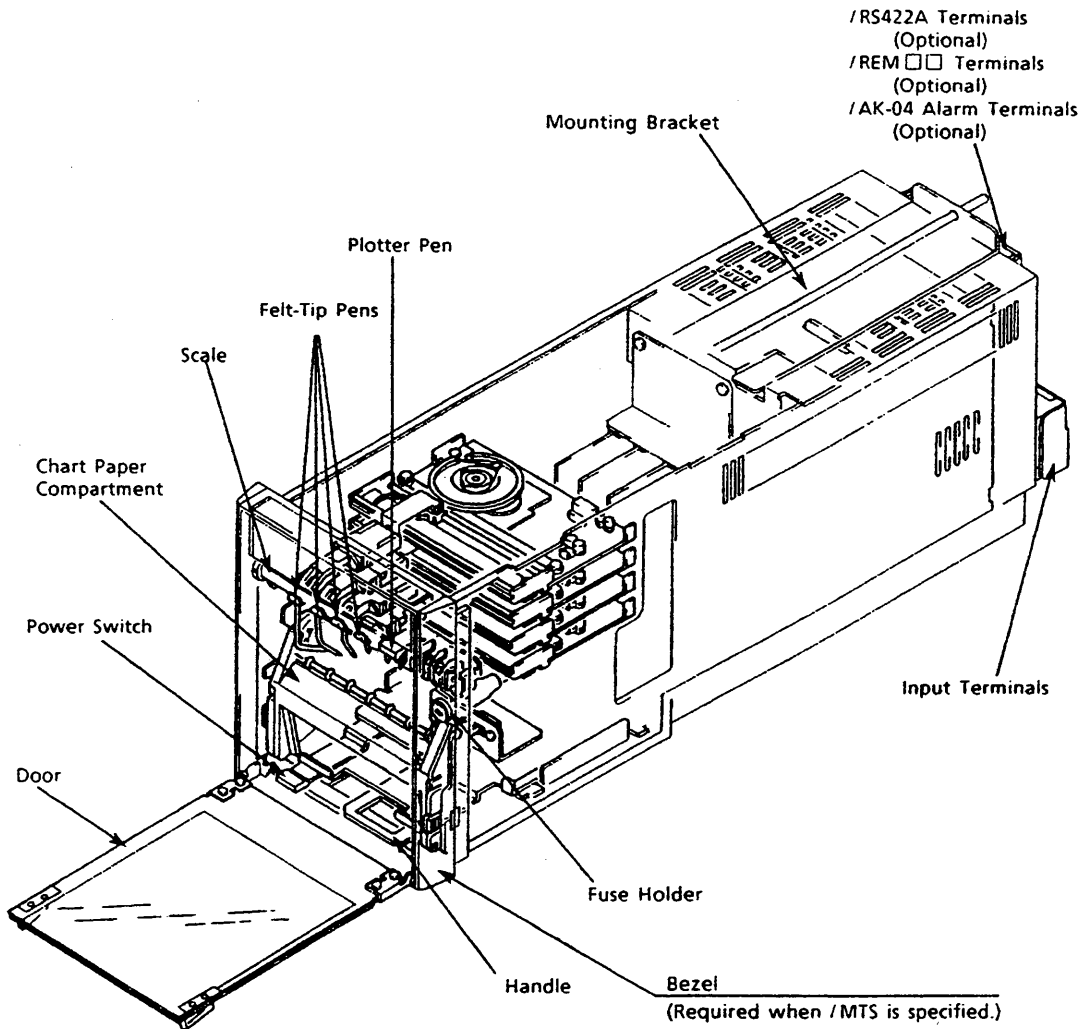


Figure 2.1 Names of μ R100F 100 mm Micro Recorder Components

3. INSTALLATION

3.1 Location

This recorder has been designed for flush panel mounting.

Select an installation location which:

- (1) is not subject to mechanical vibration.
- (2) is not subject to corrosive gases.
- (3) has a small temperature variation and is near normal room temperature (23°C).
- (4) is not subject to direct strong heat radiation.
- (5) is not affected by magnetic fields.

Note 1: The ink and chart are affected by humidity when it is too high or too low. Use the recorder in ambient humidity range of 20 to 80% R.H. (at 5 to 40°C).

2: Mount the recorder horizontally. (It is possible to mount the recorder at an angle of between 0 to 30° backward from the vertical.)

3.2 External Dimensions and Panel Cutout

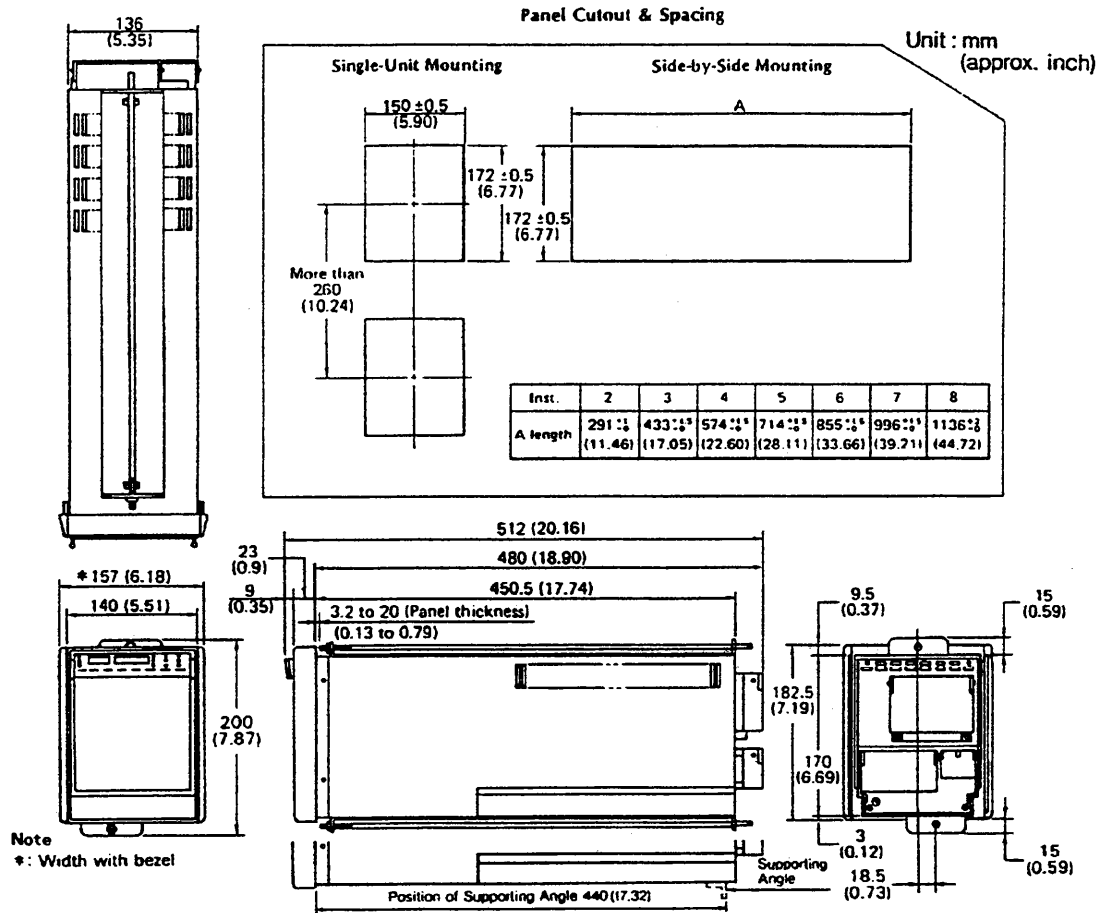


Figure 3.1 µR100F External and Panel Cutout Dimensions

3.3 Mounting

- (1) The recorder should be mounted on a 3.2 mm minimum thick steel panel.
- (2) Insert the recorder into the panel cutout from the front of the panel.
- (3) Hold the bottom of the recorder and mount it on the panel using the mounting bracket supplied with the recorder.

Note: Remove adhesive seal tapes attached to holes for fixing the mounting brackets.

4. WIRING

4.1 Wiring Instructions

Turn OFF the recorder power switch. Open the terminal rear cover.

- (1) Use wires or a cable for power wiring, which is equivalent to or better than 600 V vinyl insulated wires (JIS C 3307).
- (2) It is preferable to connect thermocouple wires directly to the recorder terminals. However, where the distance between thermocouples and the recorder is great, compensation lead wires can be used.*
 - * It is recommended that "crimp-on" lugs (for 4 mm screws) with insulation sleeves, be used for connecting wires to terminals (see Figure 4.1).
- (3) The ground terminal should be grounded with a low ground resistance.
- (4) To minimize noise pickup:
 - a) The measuring circuit wiring should be run as remote as possible from the power and ground lines.
 - b) It is recommended that shielded wires be used to minimize noise pickup from an electrostatic induction source. Shielding of the cable should be connected to the recorder ground terminal (two-point grounding must be strictly avoided).
 - c) To minimize noises due to electromagnetic induction, twist measuring line cables in short and equal intervals.

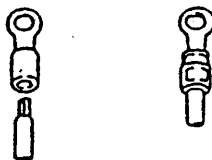


Figure 4.1 Crimp-On Lugs

4.2 Recorder Terminal Arrangement

Rear Terminal Arrangement

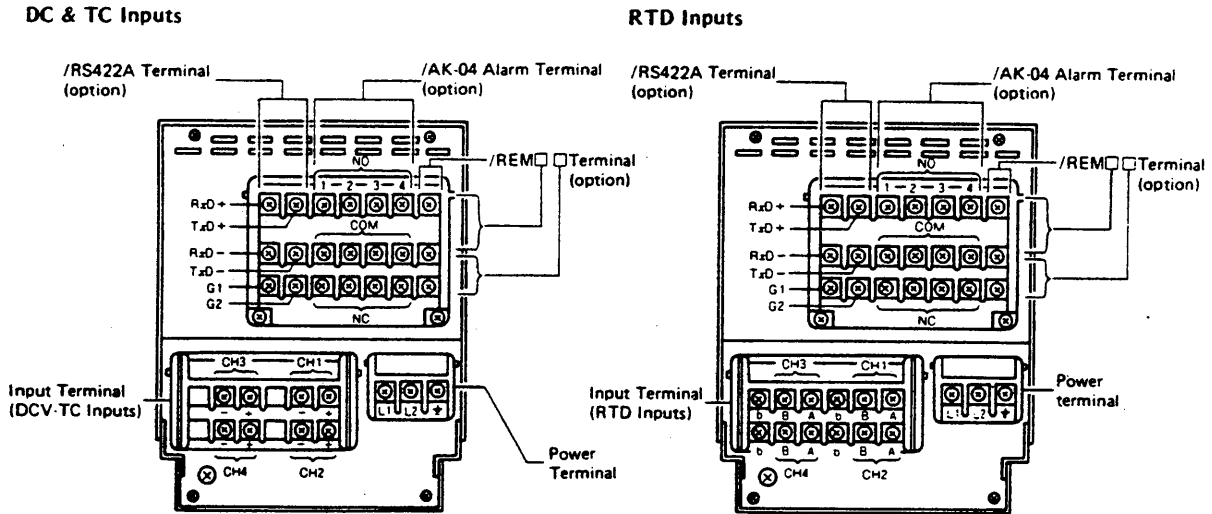
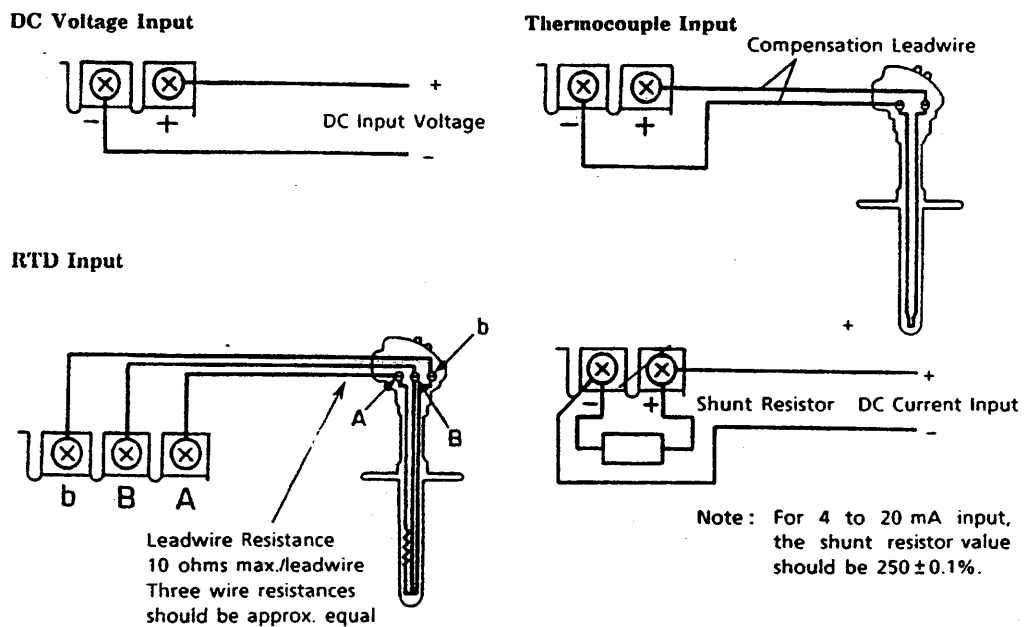


Figure 4.2 Example of Model 4354 Recorder

4.3 Wiring Input Terminals



Note: For 4 to 20 mA input, the shunt resistor value should be $250 \pm 0.1\%$.

Figure 4.3

5. OPERATION

5.1 Preparation

5.1.1 Loading (Replacing) Chart Paper

- (1) Thoroughly fan the chart paper from both sides before loading. (see Figure 5.1.)
(Chart Part No. : B9565AW).
- (2) Open the recorder front door and while gently pressing the chart paper compartment lock tab, remove the compartment by slightly raising and pulling it forward (see Figure 5.2). The POWER switch can remain "ON".

Note: Refer to Precautions for Chart Cassette Removal.

- (3) Press the sides of the chart guide plate at the top rear of the chart compartment and turn the guide plate. (see Figure 5.3.)
- (4) Pull down the front transparent chart guide. (See Figure 5.3.)
- (5) Remove the chart pressure roller. (See Figure 5.3.)

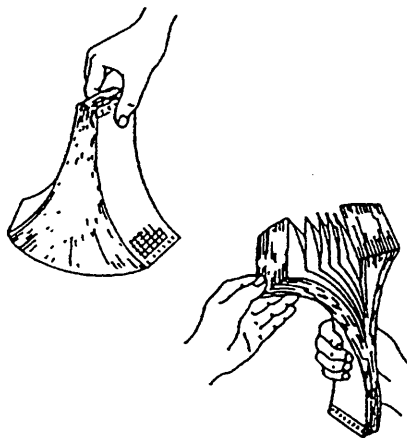


Figure 5.1 Fan Chart Paper

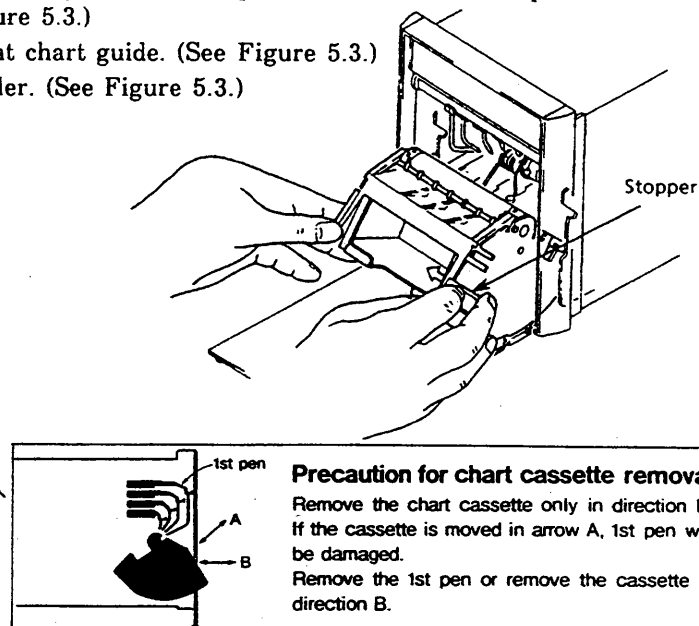


Figure 5.2 Remove the Compartment

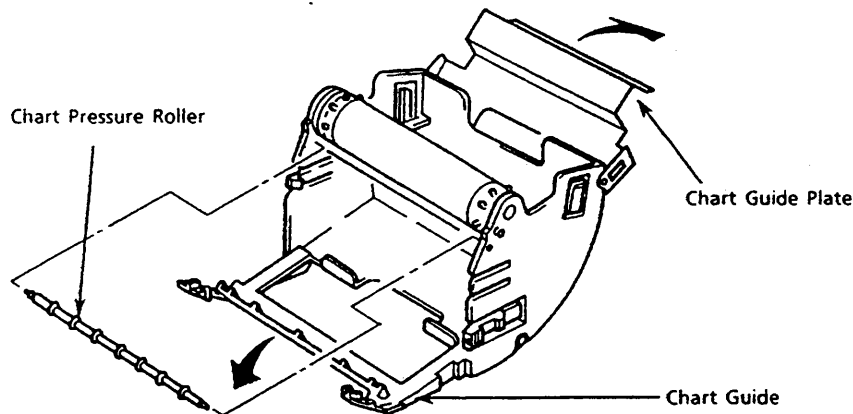



Figure 5.3 Pull Down the Chart Guide

Precaution for chart cassette removal
Remove the chart cassette only in direction B. If the cassette is moved in arrow A, 1st pen will be damaged. Remove the 1st pen or remove the cassette in direction B.

- (6) Load the chart paper into the top hopper of the compartment making sure that the sprocket teeth of the chart drive are correctly engaged in the chart paper perforation holes. (Take care not to invert the chart feeding direction.) (see Figure 5.4.)
- (7) Place the rear chart guide plate back into position. Holding both right and left ends of the chart in your hands, turn the rear chart guide plate down towards you to load the chart.
- (8) Set the chart pressure roller. (See Figure 5.5.)
- (9) Place the front transparent chart guide back into position. (see Figure 5.6.)
- (10) Replace the chart paper compartment back into the recorder. Slide the protruding bosses of the chart paper compartment into the cutout groves located on the support brackets. Push the compartment into the recorder until the lock tab clicks shut. (see Figure 5.7.)
- (11) Press the  key, and confirm that the chart is fed smoothly. (See Figure 5.8.)
 - * If the chart cannot be fed continuously and smoothly, reload the paper.

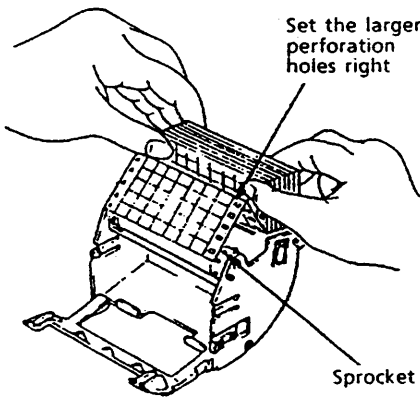


Figure 5.4 Load Chart Paper

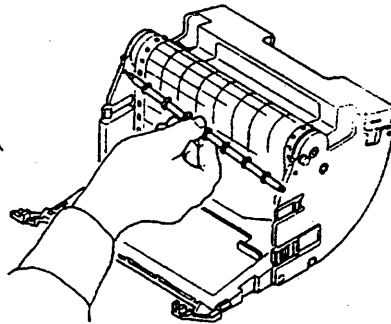


Figure 5.5 Set the Chart Pressure Roller

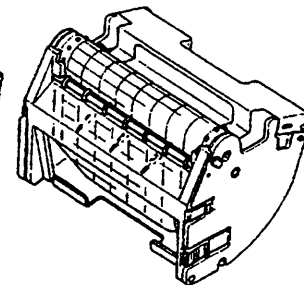


Figure 5.6 Chart Paper Loaded

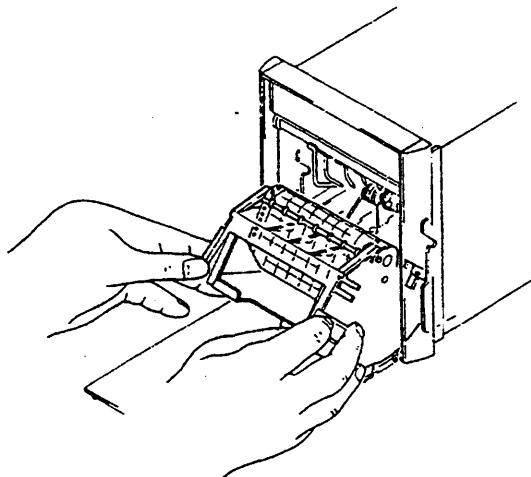


Figure 5.7 Replace the Chart Paper Compartment Back into the Recorder

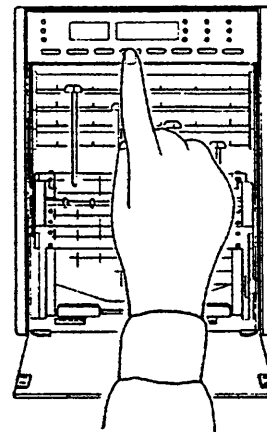


Figure 5.8 Press the Chart Feed Key

5.1.2 Felt-Tip Pen Replacement

- (1) Open the recorder front door to turn the POWER switch "OFF". (see Figure 5.9.)
- (2) Turn the scale, with mounting holder corresponding to the pen to be replaced, upward. (see Figure 5.9.)
- (3) Grasp the felt-tip pen and pull it out of the cartridge holder. (see Figure 5.10.)
- (4) Remove the pen cap of the new felt-tip pen.
- (5) Insert the new pen cartridge into the pen holder and fix it into place. (see Figure 5.11.)
- (6) Re-place the scale in position.

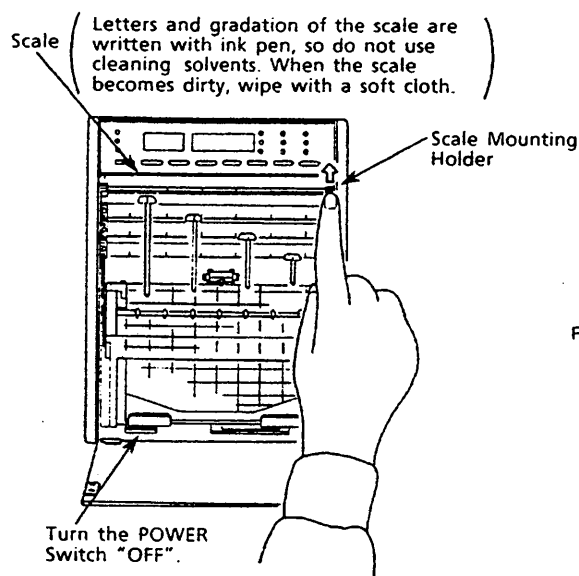


Figure 5.9 Turn the Scale

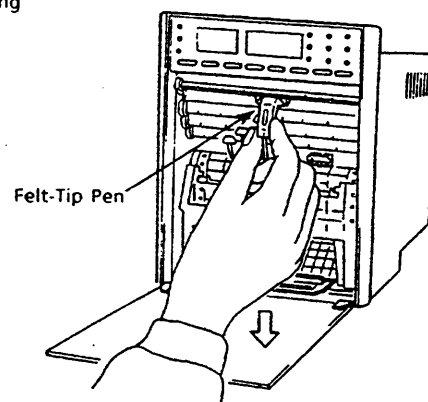


Figure 5.10 Replace the Felt-Tip Pen

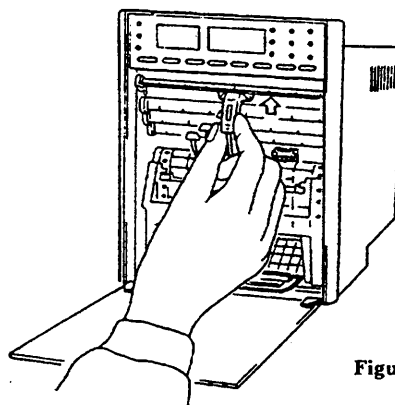


Figure 5.11

- Note 1: Remove the other pen cartridge from the holder before pulling off the objective pen cartridge if that pen cartridge disturbs the replacement of the objective pen cartridge. Do not apply excessive force to the left or right otherwise it may cause the pen to function incorrectly.
- Note 2: The part Nos. of the felt-tip pens are as follows:
- | | |
|------------------------|------------------------|
| 1st pen (violet) | B9625AY (3 in one box) |
| 2nd pen (red) | B9588KG (3 in one box) |
| 3rd pen (green) | B9688KH (3 in one box) |
| 4th pen (blue) | B9688KJ (3 in one box) |

5.1.3 Plotter Pen Replacement

- (1) Open the recorder front door and turn the POWER switch "OFF" (see Figure 5.12).
- (2) Grasp the plotter pen stopper and gently pull it out of the plotter pen holder.
- (3) Remove the cap of the new plotter pen.
- (4) Insert the new plotter pen into the plotter pen holder and secure it into place.

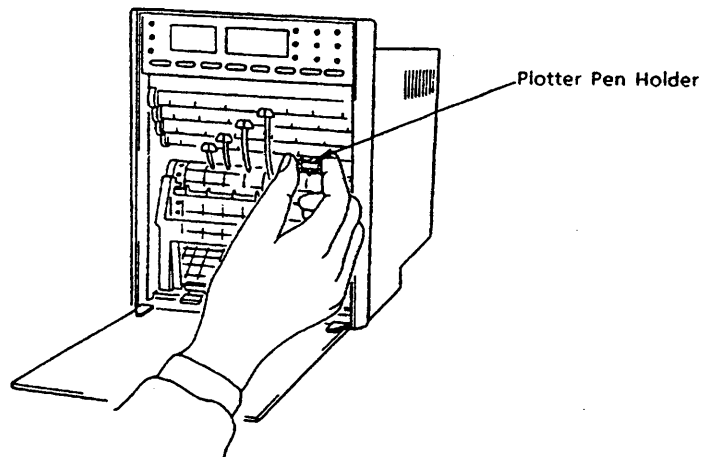
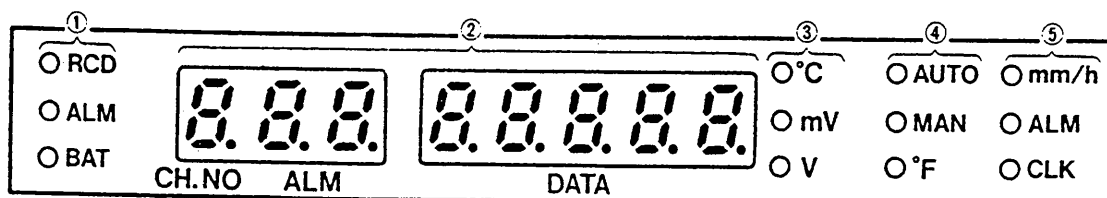

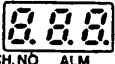






Figure 5.12 Plotter Pen Replacement

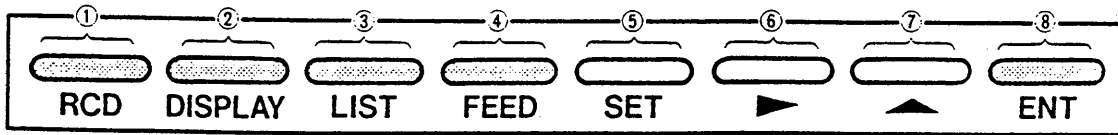
- Note
- 1: Remove the other pen cartridge from the holder before pulling off the plotter pen if that pen cartridge disturbs the replacement of the plotter pen. Do not apply excessive force to the plotter pen holder to the left or right, otherwise it may cause the pen to function incorrectly.
 - 2: The part No. of the plotter pen (purple) is B9565AS (3 in one box).










5.2 Description of Display





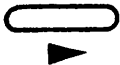







	Display	Description
	RCD (Green)	Indicates recording. When not recording, this is not lit (selected with the  key).
①	ALM (Red)	Indicates an alarm due to the measured data (lit when an alarm occurs in any channel).
	BAT (Red)	Indicates that the life of a battery for memory protection is over.
②	  CH.NO ALM DATA	Displays measured data and setpoints with alphanumerics and symbols. A 7-segment LED composes one character.
③	°C, °F, mV, V (Green)	Indicates measured data or unit in setting. (Unit display °F: Effective only when optional specification / DF is added)
④	AUTO (Green)	Display ② shows a measured data. It is selected with  key. The measured values in each channel are indicated in ② display, automatically (AUTO) selected at 3-second intervals in turn.
	MAN (Green)	The measured value of a special channel is displayed. Changing the channel is performed with  key operation (MAN).
⑤	mm/h (Green)	When setting is carried out, one out of three items, mm/h, ALM, and CLK is lit indicating what is to be set. Changes when  key is pressed.
	ALM (Green)	Chart speed can be set.
	CLK (Green)	Alarm can be set.
		Date and time can be set.

5.3 Keyboard



	Key and Name	Description of Key
①	 RCD Record Key	<p>Used when the measured data is to be recorded on the chart.</p> <p>Recording is performed in ON status and stopped in OFF status. Press  key to select ON and OFF status.</p>
②	 DISPLAY Display Key	<p>Used when the mode in which measured data is to be indicated in the display is selected.</p> <ul style="list-style-type: none"> • AUTO mode (automatic measured data display mode): Measured values in each channel are displayed at 3-second intervals in turn. • MAN mode (manual measured data display mode): Only the measured values in the specific channels are displayed. If  key is pressed, measured values are changed in turn in the ascending channel numbers. Thus, the desired channel data can be displayed. • No Display Nothing is indicated in the display (except RCD, ALM, and BAT LEDs).
③	 LIST List Key	<p>Used when setting information lists such as for range, unit, alarm, date and time, and chart speed in each channel are to be printed. (If it is to be aborted on the way, press the key again.)</p> <p>When /MP or /REM <input type="checkbox"/>5 is optionally available, set as follows:</p> <p>press  key once and press  key → Start of LIST printout</p> <p>press  key twice and press  key → Start of manual printout</p>

	Key and Name	Description of Key
④	 FEED Feed Key	Used for chart paper feeding. While  key is pressed, the chart paper is fed and stopped when a finger is set free from the key (used for, e.g., chart replacement).
⑤	 SET Set Key	Used when several values are to be set. Setting items are as follows: <ul style="list-style-type: none"> • mm / h : Chart speed setting • ALM : Alarm setting • CLK : Date and Time settings : Tag setting • No display : Message (Optional) Each display for the above settings are transferred in turn with every pressing of  key.
⑥	 Cursor Key	Used to move the flashing position of the display such as for changing set values.
⑦	 Up Key	Used for setting <ol style="list-style-type: none"> (1) Move the flashing position to the position to be changed and press the  key. Data in that position is displayed in turn (contents displayed varies with each setting and position. The display “ -1 ” represents -1). (2) Used for calling the display for specific channel when the measured data indicated in the display is in MAN mode. (3) Used for setting the chart speed.
⑧	 ENT Entry Key	Used for entering the setting data. When  key is pressed, the setting becomes valid.
		When /MP or /REM □5 is available press  key simultaneously to start manual printout.

5.4 DIP Switch

There are two types of DIP switches.

- ① DIP switch to change the frequency and other set modes.
- ② Pen offset compensation function ON/OFF (with/PS option) sets pen offset compensation ON/OFF.

5.4.1 DIP Switch

- 1 Pull out the internal instrument. Then the DIP switch appears on the top of the internal instrument (see Figure 5.15).
 - (1) Open the front door and turn the POWER switch "OFF".
 - (2) Remove the chart paper compartment (see Figure 5.13).
 - (3) Remove the lock screw (see Figure 5.14).

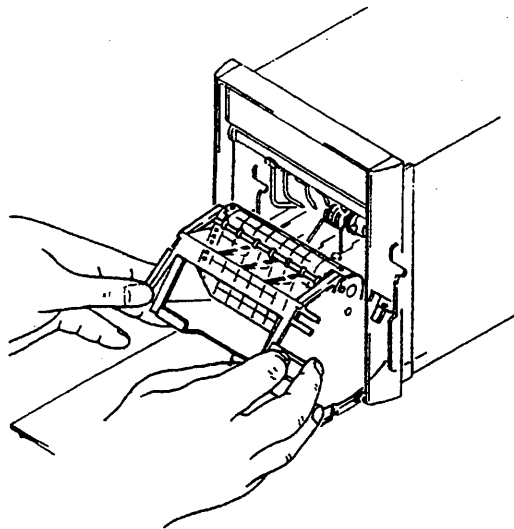


Figure 5.13 Remove the Compartment

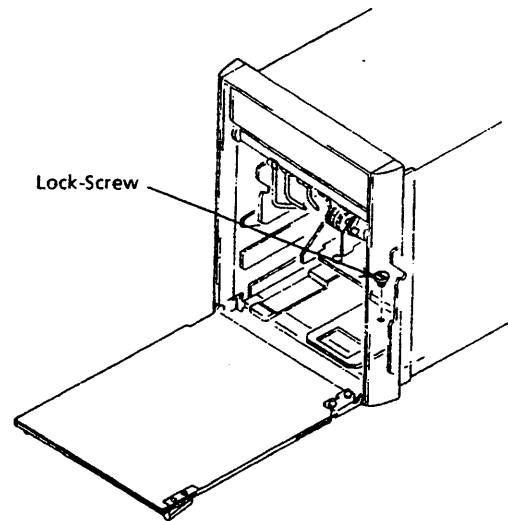


Figure 5.14

- (4) Pull out the internal instrument. Then the DIP switch appears on the top of the internal instrument (see Figure 5.15). (To pull out the internal assembly, be sure to use the internal assembly handle as shown in Figure 5.15)

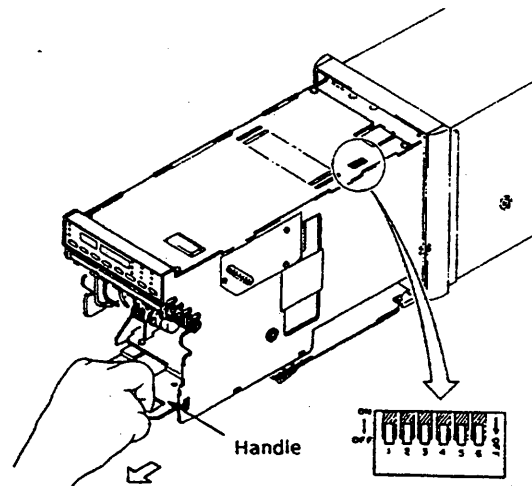


Figure 5.15

(5) Set the DIP switch with a thin flat-blade screwdriver or a pair of tweezers.

2 DIP Switch Functions

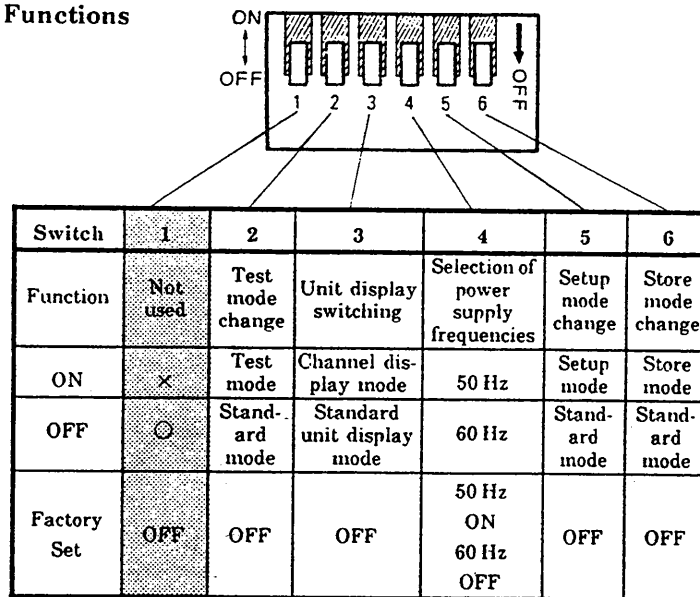


Figure 5.16

3 Units Display Transfer

This recorder includes the standard unit display mode and the channel display mode. Use DIP switches to select either one of the display modes.

Mode	Standard Unit Display Mode (Factory Set)	Channel Display Mode
Display		
Display Contents	<p>Displays units when data is recorded. (Specify /DF when °F is displayed.) Unit display is fixed by measuring range.</p> <p>When scaling range is set, units are not displayed.</p>	<p>LEDs corresponding to channels light up.</p> <p>In four channel mode, scaling ranges are specified to display engineering units.</p> <p>For example, when /UNT is specified, 180 engineering units can be used.</p>

5.4.2 Pen Offset Compensation ON / OFF Switch (Only when /PS is Specified)

Figure 5.17 shows the location of the pen offset compensation switch.

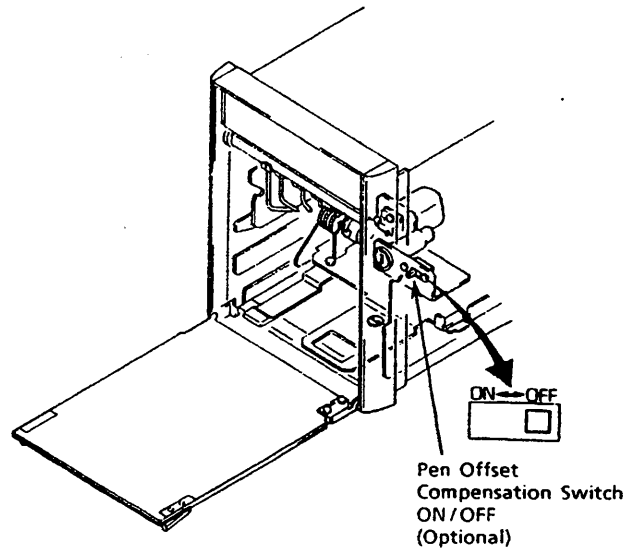


Figure 5.17 Pen Offset Compensation Switch

6. SETTING

μ R100F has four modes — (1) standard mode, (2) setup mode to change range and recording modes, (3) test mode to adjust recording position, and (4) store mode to save set data. Use DIP switches to change modes. Set data from the front panel.

6.1 Dip Switch Transfer

The μ R100F recorder can transfer between four modes using the dip switches on the recorder as shown in paragraph 5.4.1.

Measurement and Recording

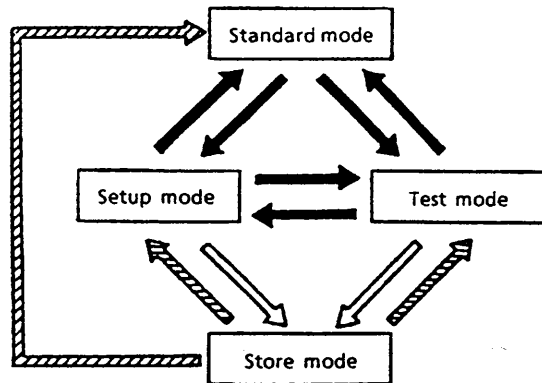
Mode	Measurement and Set Procedures	Set Items	DIP Switch Positions
Standard Mode	<p><u>Measure data.</u> All front panel functions can be used. "3" for engineering units display and change. "4" for frequency change. Set ON or OFF. (Set data are guarded for 10 years by built-in lithium battery.)</p>	<ul style="list-style-type: none"> Recorder chart feed speed Alarm set value Date and time TAG No. Messages (optional specifications) 	<p>ON ↑ OFF</p>

Range and Recording Mode Changes or Recorder Pen Position Adjustment

Mode	Measurement and Set Procedures	Set Items	DIP Switch Positions
Set-up Mode	<p><u>Measuring and recording mode changes</u></p> <p>① Set data does not need to be backed up by built-in batteries. ② As for range change, the models which specified at preparation DC V, TC input, and RTD input can change setting.</p>	<ul style="list-style-type: none"> Measuring range <ul style="list-style-type: none"> Range Recording span Scaling span Recording mode <ul style="list-style-type: none"> Normal recording Differential data recording Skip UNITS setting Periodical printout ON or OFF Alarm printout ON or OFF 	<p>ON ↑ OFF</p>
Test Mode	<p><u>Pen (zero and full scale) positions can be adjusted from the front panel.</u> (Adjustments can be done by the front key operation (need not tools).)</p>	Adjust recorder pen zero and full scale positions.	<p>ON ↑ OFF</p>
Store Mode	<p><u>Data set in setup mode and test mode can be stored in this mode.</u> To store data, set DIP switch 2 or 5. Then set DIP switch 6. Press the ENT key on the front panel.</p>	Store set data in the memory.	<p>ON ↑ OFF</p>

6.2 Procedure for Transferring to Each Mode

Transferring to each mode is carried out using the dip switches. To set store mode, turn ON the corresponding dip switch with power turned ON. To set an other mode, turn OFF the power, set the corresponding dip switch and then turn ON the power (see the instruction).



Transfer

- ① Turn the power OFF.
- ② Set the dip switches to the intended mode.
- ③ Turn the power ON.

Transfer

- ① Set dip switch No.6 ON with the power ON.

Transfer

- ① Turn dip switch No. 6 OFF.
- ② Set the dip switches to the intended mode.
- ③ Turn the power OFF.
- ④ Turn the power ON.

NOTE

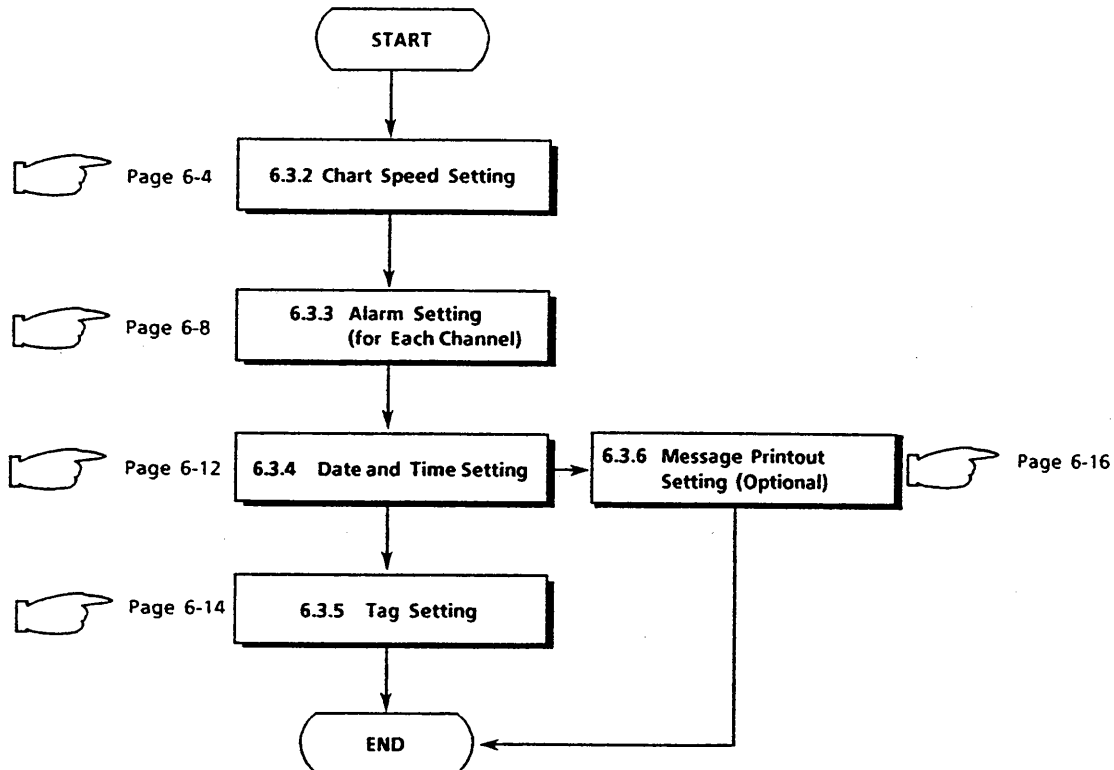
- Never turn the power ON or OFF while in Store mode, (dip switch 6 : ON). Internal data may not be stored properly and could lose data immediately or later.
- If you accidentally turn the power ON or OFF with No. 6 ON, you will to re-store the data.
- Always turn power ON or OFF after dip switch 6 is set to OFF.

6.3 Standard Mode

Measure and record data in this mode. All front panel function can be used.

Follow the flowchart below. Each step indicates the related page number where a detailed explanation for that step may be found.

6.3.1 Setting Procedure Flow Chart



Note : It is recommended that measurement be started after confirming setting contents by LIST printout when each setting is completed.

6.3.2 Chart Speed Setting

Although a chart speed can be set within a range of 5 to 12,000 mm/h, selecting one out of the speeds given in Table 6.1, fixed time printing (digital data printouts) is available only in the range of 10 to 1,500 mm/h shown in Table 6.2.

Note: Initial setting value is 20 mm/h.

Chart Speed Setting Table

Table 6.1 Chart Speed Setting Table

Unit: mm/h

5	30	80	240	600	1500	4320
6	32	90	250	675	1600	4500
8	36	96	270	720	1800	4800
9	40	100	300	750	2000	5400
10	45	120	320	800	2160	6000
12	48	125	360	900	2250	7200
15	50	135	375	960	2400	8000
16	54	150	400	1000	2700	9000
18	60	160	450	1080	2880	10800
20	64	180	480	1200	3000	12000
24	72	200	500	1350	3600	
25	75	225	540	1440	4000	

Note : With a fast chart speed (especially 600 to 1,500 mm/h), the time tick positional error is large.


Example : The error may reach about 2 cm at 1,500 mm/h.

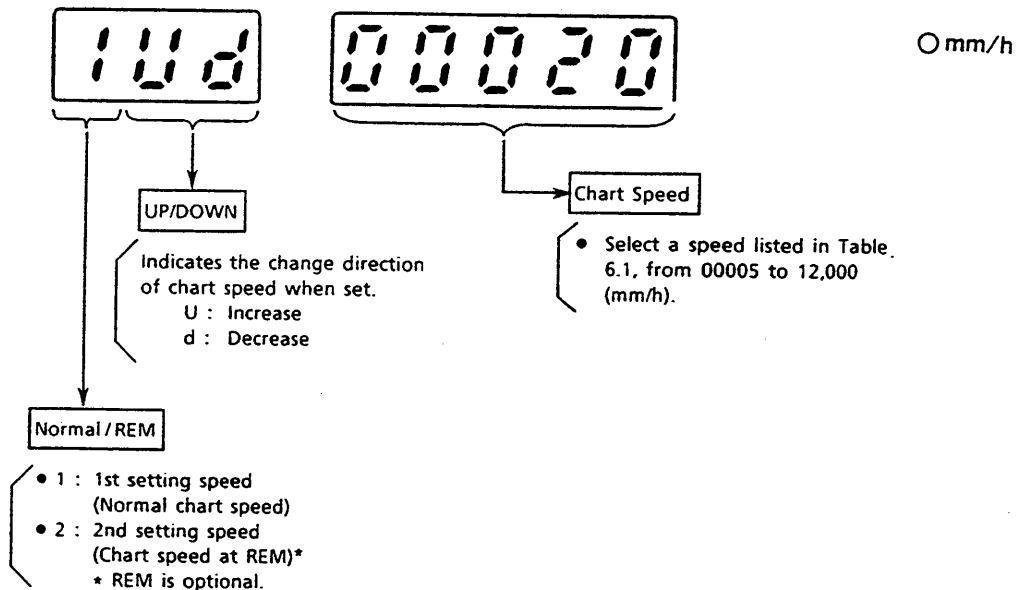
Table 6.2 Fixed Time Printing Range

Chart Speed (mm/h)	5 to 9	10 to 18	20 to 36	40 to 72	75 to 135	150 to 180	200 to 320	360 to 1,500	1,600 to 12,000
Fixed Time Printout Interval	Not printed out	8 Hours	4 Hours	2 Hours	1 Hour	30 Minutes	20 Minutes	10 Minutes	Not printed out
Printouts of Alarm and Chart Feed Speed Change*	Printed out at any time when generated (Alarm or REM contact signal)								
Message Printout	Not printed out	Printed out at any time when generated							



* Optional/REM specification is required.

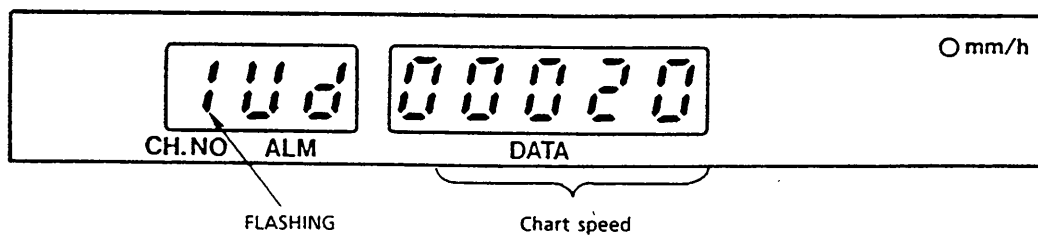
Chart Speed Setting Procedure

- 1 Press the  key as many times as necessary (varies with the time to be set at) until the required chart speed is displayed (initially set to 20 mm/h). Confirm that "mm/h" is displayed.





Normal Chart Speed Setting



- 2 Set normal chart speed. Press the  key to set '1' (If the  key is kept depressed, displays '1' and '2' alternately appear).



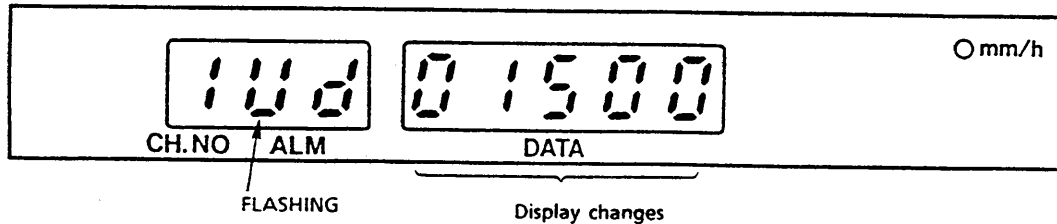
- 3 Set chart paper speed. (fixed to five digits, unit mm/h)

Example : When 1,500 mm/h is to be set

Press the  key to move the flashing position to "U". Keep pressing the  key until 1.500 mm/h is displayed.

(If the intended value is exceeded, use the  key to move the flashing position to "d" and return to the desired value by pressing  key.)

When the **▶** key is kept depressed, the flashing position moves in the order of ... "1" → "U" → "d" → "1"



The set numeric value is displayed.

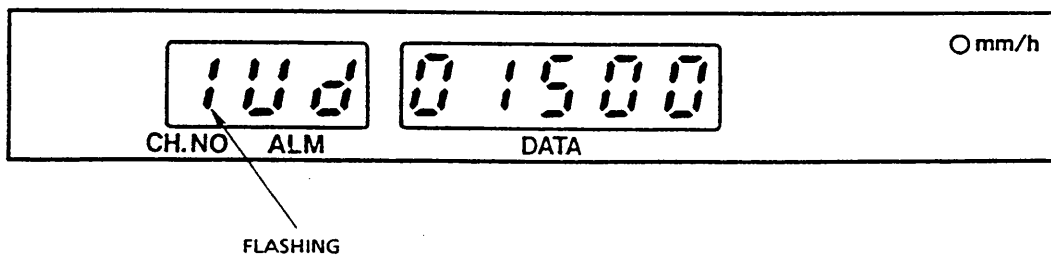
- 4 Press the **ENT** key to enter the value. When the flashing character disappears, setting is complete.
When resetting, press the **ENT** key once again and reset starting from the beginning.

Remove Chart Speed Setting

When the chart speed is to be changed by a REM (remote) contact signal, follow the 2nd setting speed (remote chart speed) setting procedure described in 5 to 8.

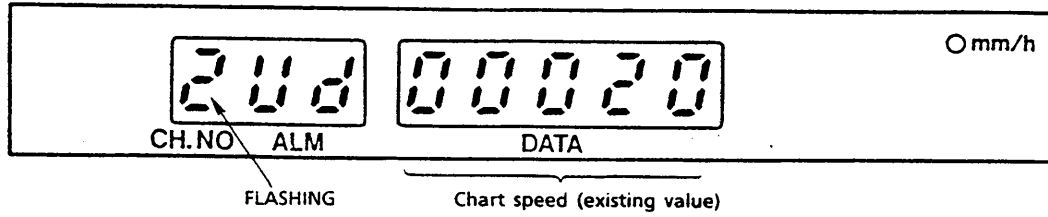
Note : /REM (remote) is an optional specification.

- 5 Press the **ENT** key once.



Flashing restarts.

- 6 Press the ▲ key once. Set 2 for remote chart speed setting.
Initial setting value for remote chart speed is displayed automatically.



- 7 Perform step 3 and set the chart speed for REM specification.
- 8 Perform step 4 and enter a chart speed for REM specification.

Setting for REM is Complete


6.3.3 Alarm Setting

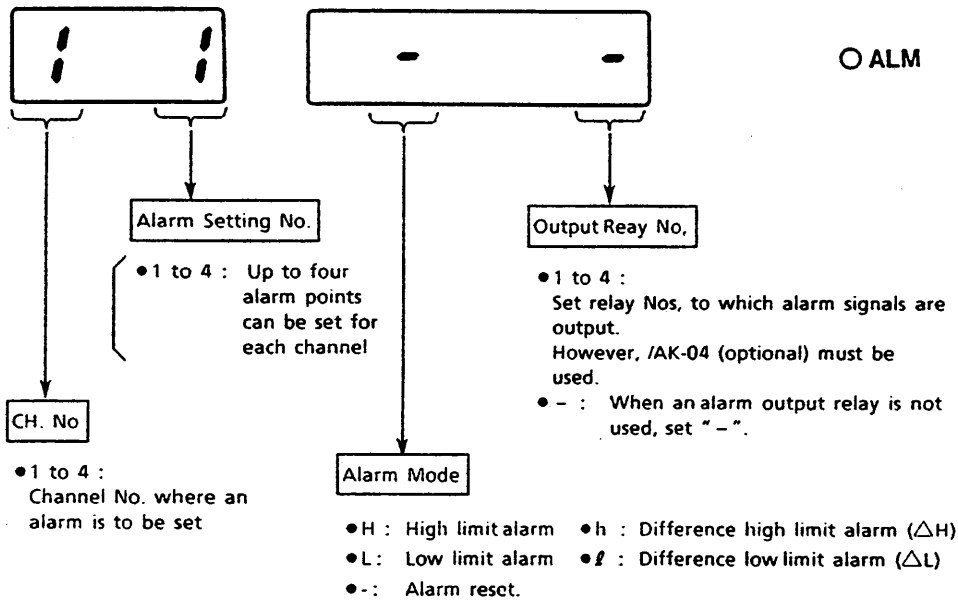
Together with the absolute value recording and difference recording, up to four alarm set point, the recorder displays "ALM" and simultaneously performs alarm printout on the chart.

Also when using the alarm output relay /AK-04 (optional), alarm signal output at alarm occurrence is available, and by combining the /AK-04 with the /REM specification (optional), the chart speed can be changed when the alarm is output.

Initial setting value is illustrated in 1.

Alarm Setting Procedure in Absolute Value Recording

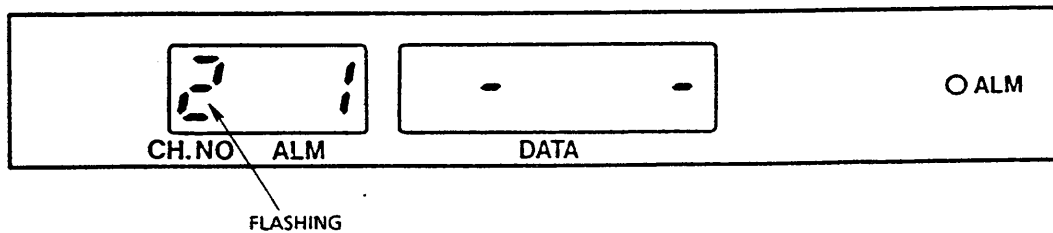
- 1 Press the  key as many times as necessary (varies with the time to be set at) until the alarm setting display appears. Confirm the display "ALM".



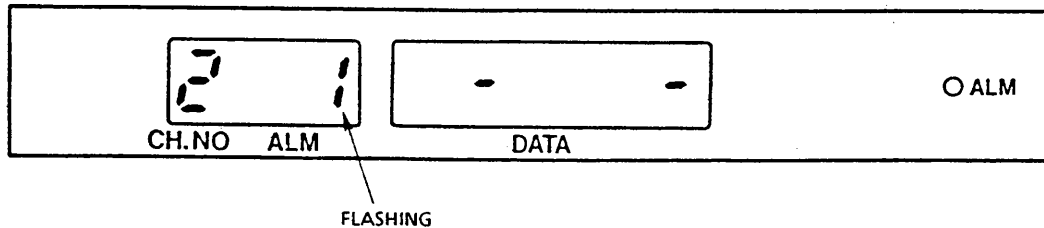
- 2 Set the numeral of a channel No. to which alarm is to be set.

Example : For setting to channel 2,

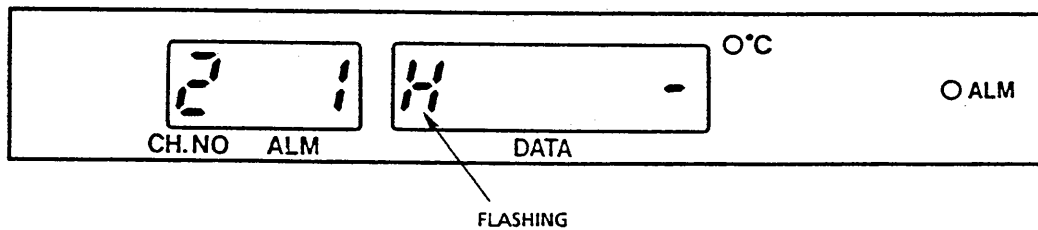
Press the \blacktriangle key until "2" appears. (If \blacktriangle key is kept pressed, this digit displays ... "4", "1", "2", "3" ... in this order).



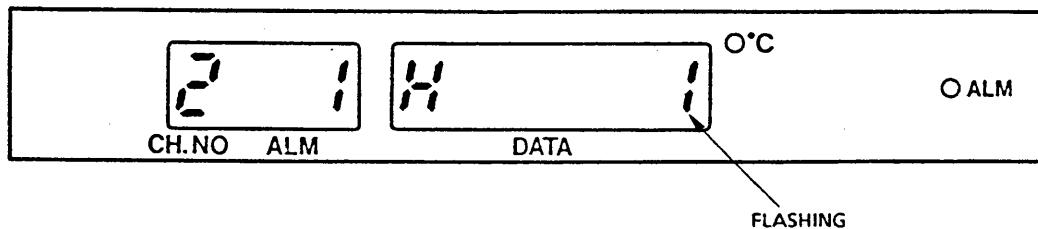
- ③ Set an alarm setting No. (up to four points can be set per channel).
 Press the \blacktriangleright key once to set the flashing position at the alarm setting No.
 Press the \blacktriangle key to set an alarm setting No. (If the \blacktriangle key is kept depressed, this digit displays ... "4", "1", "2", "3", "4" ... in this order).





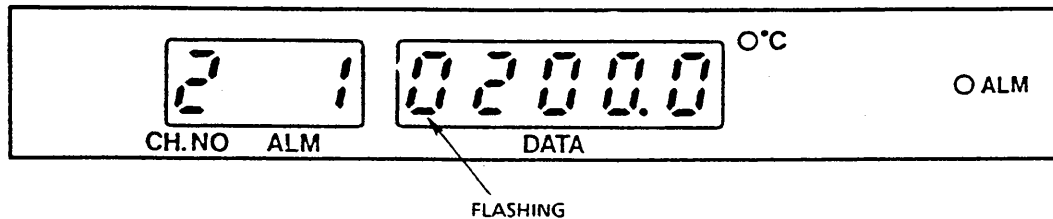
- ④ Set the alarm mode.
 Example : To set a high limit alarm.
 Press the \blacktriangleright key to set flashing at an alarm mode position.
 Press the \blacktriangle key to set "H". (If \blacktriangle key is kept depressed, this digit displays ... "-", "H", "L", "h", "l" ... in this order).



- ⑤ Set relay contact Nos. to which alarms are output. (When /AK-04 is not used, setting is possible, but output is not made.)
 Example : When a relay contact is set to No. 1
 Press the \blacktriangleright key once to move the flashing position right and press the \blacktriangle key to set "1". (If \blacktriangle key is kept depressed, this digit displays ... "4", "-", "1" ... in this order.)



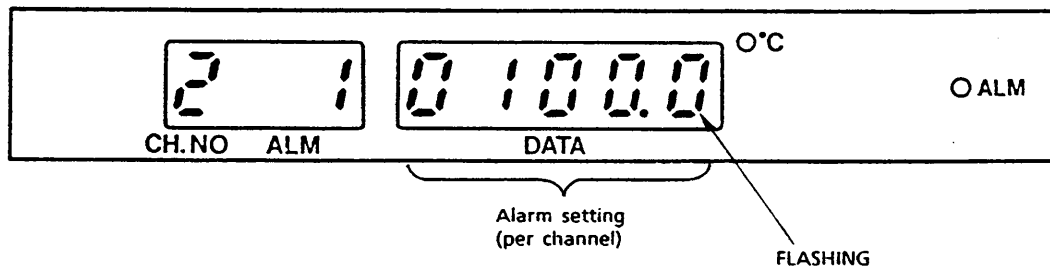
- 6 Press the  key to enter the data.
 Display of alarm value setting automatically appears.
 If setting is done erroneously, all LEDs flash. Press the  key and restart from the beginning.




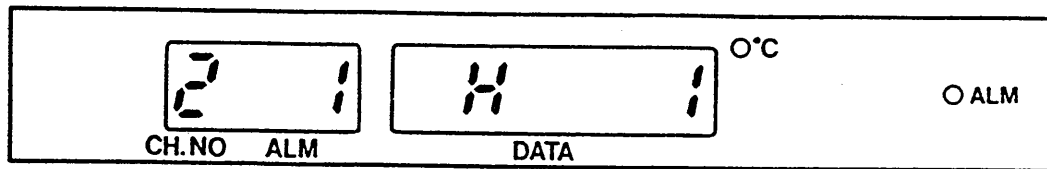
- 7 Set an alarm value.
 Example : Set 100 °C.


Press the ▲ key to set "0" (When the ▲ key is kept depressed, the left digit before the most significant digit of the alarm value changes in the order of ... "0", "1", "2", "3", "-", "-1", "0" ... -/ represents -1.)


Press the ► key to move the flashing position right and set "1" with the ▲ key. In the same way, move the flashing position with the ► key and set a numeric value with the ▲ key (when the flashing position is at the least significant digit, press the ► key once to move it to the most significant digit).



- 8 Press the  key to enter the data. No character flashes and the setting is completed with the initial alarm setting displayed.



If setting is done erroneously, all LEDs flash. Press  key once again and restart from the beginning.

For setting another alarm point, return to Step 2 (after pressing the  key once again subsequent to setp 8). Then, set a channel number.

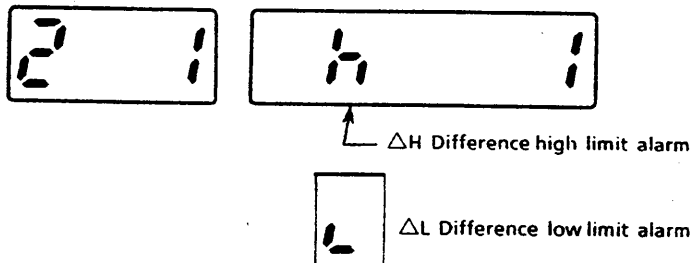
Repeat Setps 3 to 8 for setting the alarm point in a similar manner.

Alarm Setting Procedure in Difference Value Recording

The alarm setting procedure is the same as the alarm setting procedure in absolute value recording discribed above.

Note: However, in this case the difference value recording must be set previously to the channel No. to which alarm can be set. (see Page 6-30)

[Display Example]



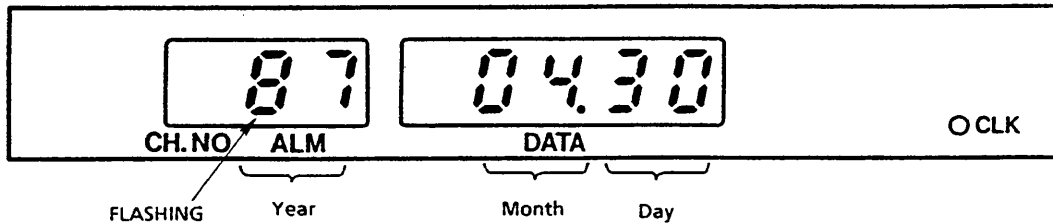
6.3.4 Date and Time Setting

For a leap year, the 29th day (February) is automatically provided.

The initial setting is entered according to Japan standard time.

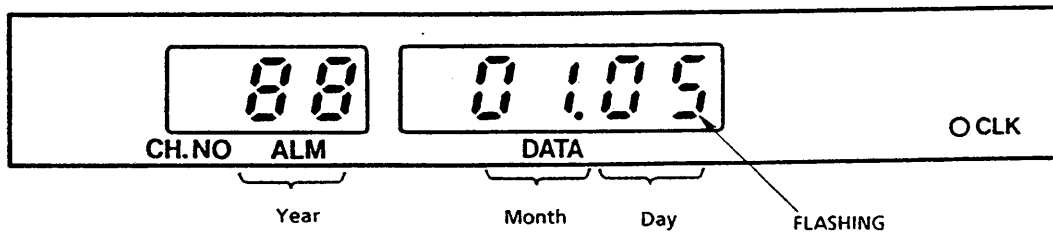
Date and Time Setting Procedure

- 1 Press the **SET** key as many times as necessary (varies with the time to be set) until the year, month, and day are displayed.
"CLK" is displayed and the display becomes as shown below, for example.




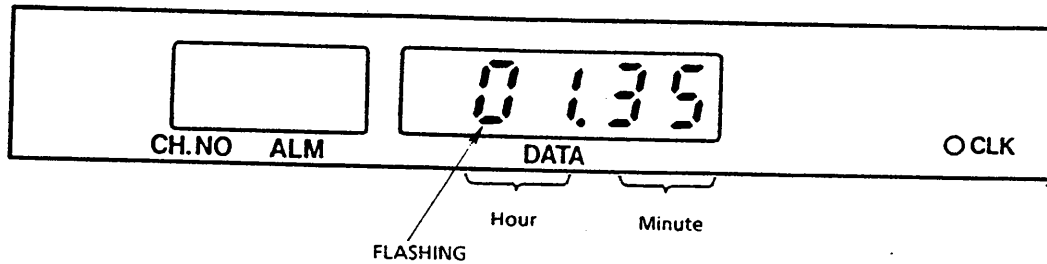
- 2 Enter year, month and day.
Example : To set January 5, 1988,
Press the **▲** key as many times as necessary until "8" appears.
Next, press the **▶** key once to move to flashing position right.
Set "8" by pressing the **▲** key as many times as necessary in a similar manner.

Repeat the operation above as necessary to set the date and time.

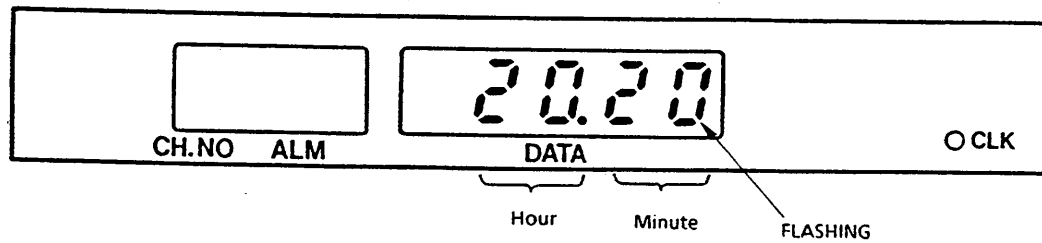


- 3 Press the **ENT** key to enter the data.
Now no character is flashing and the setting is completed. If the erroneous setting is made (example "87, 11, 31"), all LEDs flash. When resetting, press the **ENT** key once again and restart the setting at the first step.


- 4 Press the  key once.
The display changes to the present time.
Display is, for instance, as shown below.



- 5 Set hour and minute.
Example : To set p. m. 8:20
Press the ▲ key to display "2" and move the flashing position right by once digit with the ► key. Press the ► key again to enter "0." Repeat the operation above to complete the setting.



Note : time is represented in the 24-hour system.

- 6 Press the  key to enter the data. Now no character is flashing which indicates completion of hour and minute setting. If the setting is erroneous, reset in a similar manner starting from step 3.


Setting Completed

6.3.5 Tag Setting

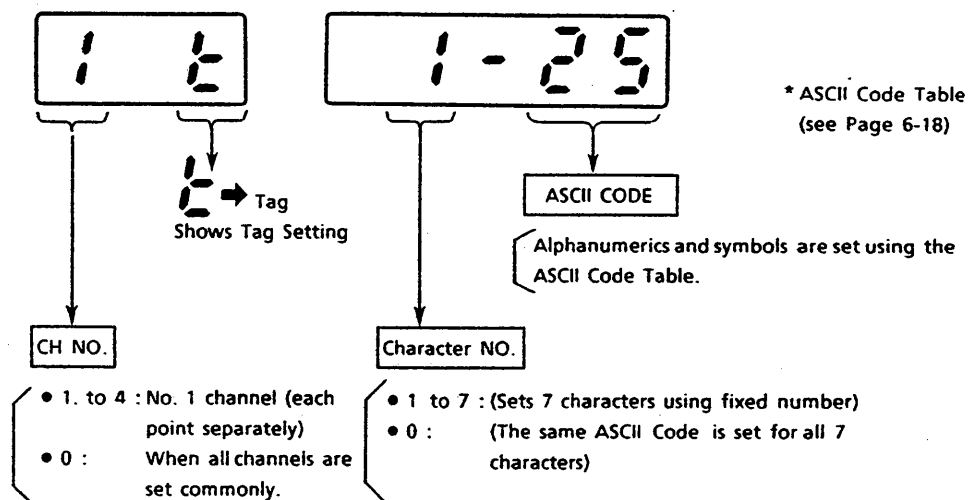
Tag setting allows the object being measured or recorded to be identified easily.

Tags can be set using seven characters (alphanumerics and symbols) for each channel.

TAG Setting Procedure

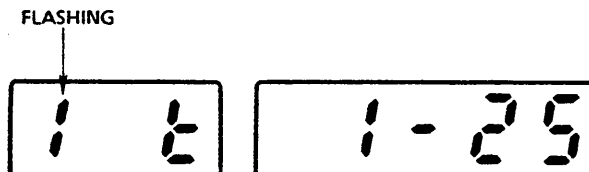
- 1 Press the  key as many times as necessary (varies with the time to be set) until the tag setting display appears. The default value is blank (ASCII Code 20) (see Page 6-18).

Tag Setting Display



- 2 Set the Tag setting channel No. with the ▲ Key. Next, move the flashing position to the right with the ► key.

Example : When the Tag is set to channel No.1
Press the ▲ key to display "1" (when the ▲ key is kept depressed channel number changes in the order of 2, 3, 4, 1)



3 Tag Setting

Setting Example: STN-1A

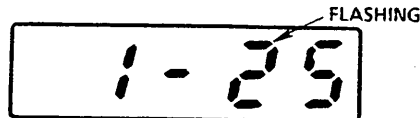
(1) Press the **▶** key and move the flashing position to the character No.

(2) Specify the first character.

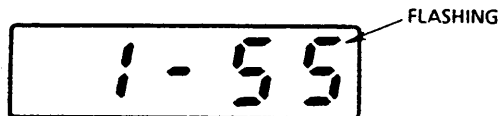
Press the **▲** key to set the character No. to "1".

(3) Setting "S"

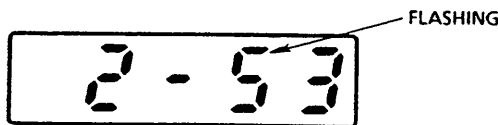
- Press the **▶** key to move the flashing position to ASCII Code
- Using the ASCII Code table select the codes corresponding to the "S" → 5, 3



- Press the **▲** key and set "5" (When the **▲** key is kept depressed, this digit displays ...5, 6, 7, 2, 3, 4, 5, ..., in this order).
- Press the **▶** key and move the flashing position to the right.



- Press the **▲** key and set "3" (When the **▲** key is kept pressed digit displays ... 1·2·3.... 4·A·B·C·D·E·F·0·1 ... in this order).
 - Press the **ENT** key to enter the characters. (here, "S" is set to the first character.)
- (4) When the entry is complete, the second character is displayed on the display character No.



(5) Using the ASCII Code table and in the same manner as for the first character, set the subsequent characters.

When a blank is to be specified, set **20** for each characters.(6) After the 6th character setting is completed, press the **ENT** key.**End fo Tag Setting**


At this time, whether the Tag is correctly set to the desired channel can be confirmed by performing a list printout.

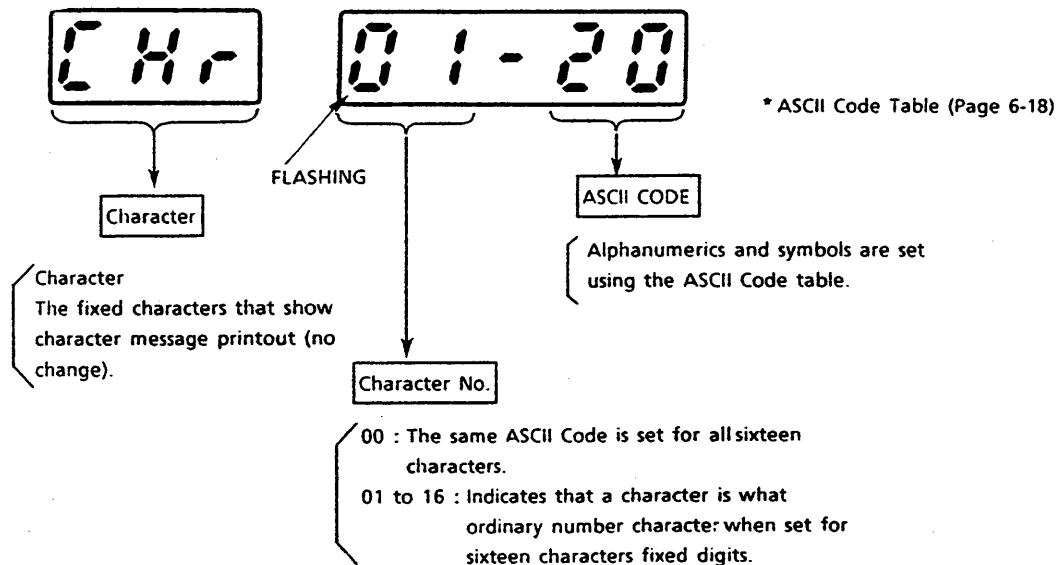
6.3.6 Message Printout Setting

This setting is used for the model to which an optional message printout function is added. A message entered when a contact input in ON (CLOSE) is printed out.

The initial setting value is blank (ASCII Code 20). (see Page 6-18)

Message Setting Procedure


- 1 Press the  key as many times as necessary (varies with the time to be set) until the message setting display appears.

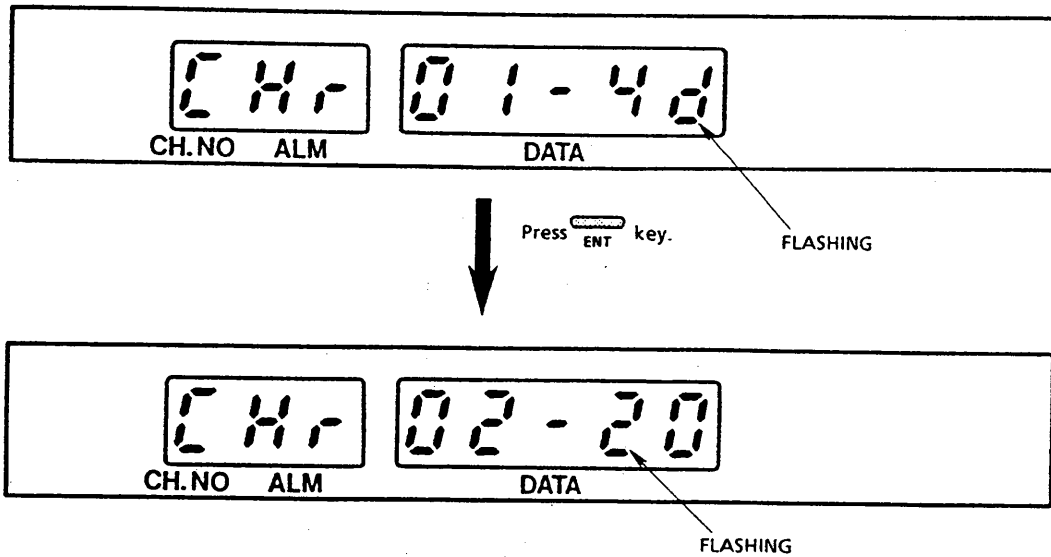



- 2 Sets a message

Set a message within sixteen characters (alphanumerics and symbols).

Example : Set MESSAGE

Set the digit of ten of character No. to "0" with the ▲ key. Next, move the flashing position to the right with the ► key. Set the number of units to "1" with the ▲ key. Move the flashing position to the ASCII CODE position with the cursor key. Select '4' and 'd' which correspond to "M" in the ASCII code table. Set '4' with the ▲ key (if ▲ key is kept depressed, this digit displays ... 5, 6, 7, 2, 3, ... in this order). Move the flashing position right with the ► key and set 'd' with the ▲ key (if the ▲ key is kept depressed, this digit displays ... , 1, 2, 3, ..., 9, A, b, c, d, E, F, 0, 1, ..., in this order). Press the  key to display the character No. "02" and set and enter the second character in a similar manner.



When setting of the second character is complete, press the  key to set the third character.

Repeat the above procedure until sixteen characters are entered.

For the 7th and subsequent characters, enter blanks by selecting "2" and "0" from the ASCII Code table.

* ASCII Code

An ASCII code table is given in next page. In the ASCII Codes, combination of two alphanumeric characters expresses a character. For example, "1" is expressed as 31 of the ASCII Code.

ASCII CODE Table

b \ a	2	3	4	5	6	7
0		0	@	P	'	p
1	!	1	A	Q	a	q
2	"	2	B	R	b	r
3	#	3	C	S	c	s
4	\$	4	D	T	d	t
5	%	5	E	U	e	u
6	&	6	F	V	f	v
7	'	7	G	W	g	w
8	(	8	H	X	h	x
9	)	9	I	Y	i	y
A	*	:	J	Z	j	z
B	+	;	K	I	k	°
C	,	<	L	△	l	Ω
D	-	=	M	l	m	μ
E	.	>	N	▽	n	—
F	/	?	O	-	o	Ω

"1" represented with ASCII code is "31".

6.4 Setup Mode

In this mode, the record mode and measuring ranges can be set.

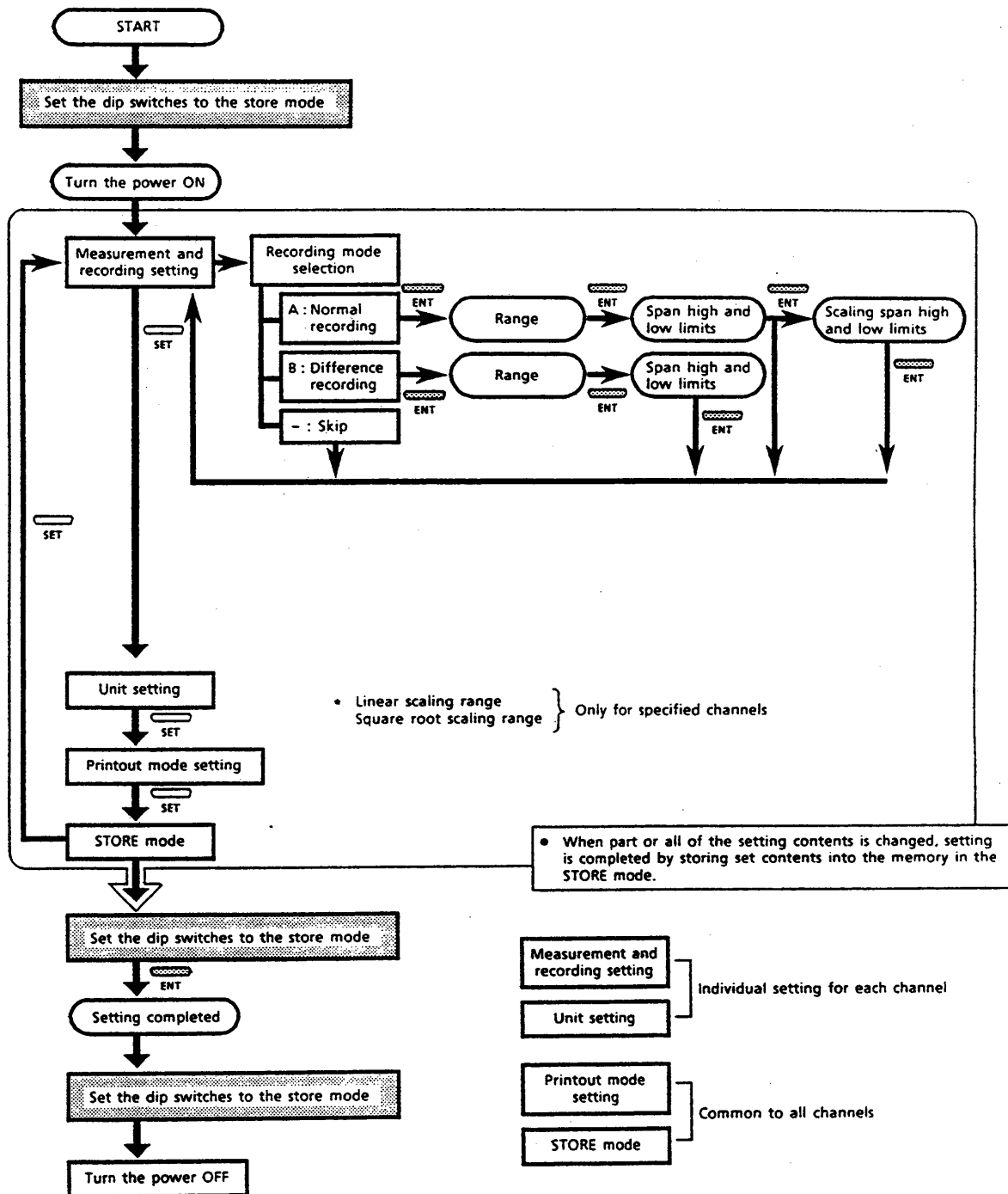
6.4.1 Setup Mode Setting Function Table

Classification and Setting Items		Contents
Measurement and recording setting	Recording mode selection (The recording mode can be selected from among three modes per channel)	Normal recording mode ... Records absolute or scaled measured values. <ul style="list-style-type: none"> ◦ Differential recording mode ... When the ranges are the same, the difference between the reference channel and each channel are recorded. ◦ Skip mode ... The set channel is not measured or recorded.
	Range setting	Measurement range can be set for each channel in the DCV / RTD System <ul style="list-style-type: none"> ◦ DCV : 00 to 15 (DC voltage) 10 to 1A (TC) 30 to 35 (Linear scaling) 40 to 45 (Square root scaling) ◦ RTD : 20 to 21 (RTD)
	Arbitrarily set recording span	Measurement and recording span can be set for each channel. Linear scaling and square root scaling values can be set arbitrarily.
	Scaling span	Linear or square scaling values can be set. Setting ranges are : 5mV to 50V ranges Voltage range : Up to 75% of measuring range Scaling value : -19999 to 20000 Maximum span : 30000
Unit setting		Units suitable for actual recording can be set for each channel. (Only for channels in which linear or square root scaling is specified.) <ul style="list-style-type: none"> ◦ Number of characters per unit : Up to six ◦ Number of units : Four ◦ Specification : ASCII Code
Printout mode setting	Alarm printout	Each recording can be set ON or OFF
	Periodic printout	



6.4.2 Setup Mode Setting Procedure











This chapter explains setup mode setting in order of measured record setting, unit setting, printout mode setting and store mode.

When part or all of the setting is set or changed, all of the setting is completed by transferring it to the store mode and storing it into the internal memory.



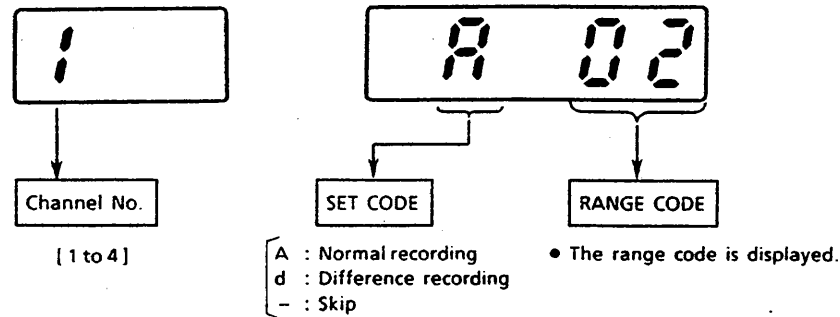
6.4.3 Operation Key Description

To set data, press the SET, , , and ENT keys: Other keys cannot be used in the set up mode.

Key to be Used	Function Description in the Test Mode
 SET Set key	Measuring and recording setting, → unit setting, → printout mode setting, → store mode → measured recording setting Used to transfer setting contents. (Note) The specifications inside the brackets are optional.
 Cursor key	Shifts the flashing position cursor on a display.
 Up key	Used for setting. (1) Use the  key to shift the cursor to the intended position, then press the  key again so that data to be entered there is displayed in turn. (2) This key is used to set the decimal point in the scaling range. (3) When data setting is completed (panel stops) and setting is to be continued, press the  key and then restart the cursor (the  key functions in the same way).
 ENT Entry key	(1) Used to register set data. (2) When data setting is completed and data setting is to be continued, press the  key or the  key to restart the cursor.

6.4.4 Measurement and Recording Setting


- ① When dip switches are set to the setup mode and the power is turned ON, the following measurement recording setting panel is displayed. The displayed panel is set as specified.



[1] Channel No. Setting

Set the No. of the intended channel with the \blacktriangle key.


(When the \blacktriangle key is kept depressed, the numeric value changes 1, 2, 3, 4, ... 1, 2 ... in this order)

Press the  key to enter channel No.

[2] Recording Mode Selection



Set the recording mode for each channel.

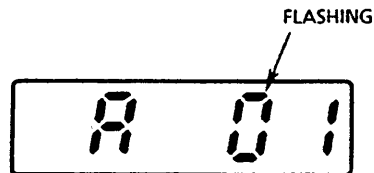
(1) Press the \blacktriangleright key to move the flashing position to the SET CODE position.

(2) Select the SET CODE and press the  key to enter the SET CODE.

(When the \blacktriangle key is kept depressed, the display changes in the order of A, d, -, A)

② When A (Normal Recording) Mode is Selected

Set A to the SET CODE display and enter by pressing the  key. When the  key is pressed, the RANGE CODE flashes.



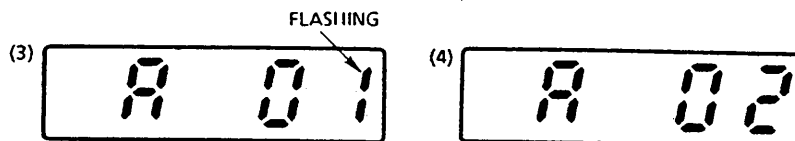
[1] DC Voltage Measurement/Absolute Value Recording

Setting Measuring Range Code

(Example : Set to channel No. 1)

Set the channel No. as per item 6.4.4 [1] [1] (see Page 6-22)

- (1) Select the measuring range from the measuring range code table.
Example : To select the range -2.000V to 2.000V , set range code "02".
- (2) Press the \blacktriangle key to set the numeric value "0" (when the \blacktriangle key is kept depressed ... the numeric value changes ... 0, 1, 2, 3, 4, 0, 1 ..., in this order)
- (3) Press the \blacktriangle key and move the flashing position to the right.
- (4) Press the \blacktriangle key and set numeric value "2".
- (5) Press the ENT key to enter the measuring range code.



Measuring Range

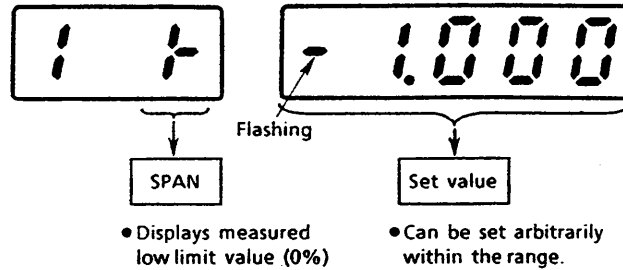
Input Type	Range Code	Measuring Range
DC V	00	-20.00 to 20.00 mV
	01	-200.0 to 200.0 mV
	02	-2.000 to 2.000 V
	03	-6.000 to 6.000 V
	04	-20.00 to 20.00 V
	05	-50.00 to 50.00 V
DC V (Linear scaling)	30	-20.00 to 20.00 mV
	31	-200.0 to 200.0 mV
	32	-2.000 to 2.000 V
	33	-6.000 to 6.000 V
	34	-20.00 to 20.00 V
	35	-50.00 to 50.00 V
DC V (Square root scaling)	40	-20.00 to 20.00 mV
	41	-200.0 to 200.0 mV
	42	-2.000 to 2.000 V
	43	-6.000 to 6.000 V
	44	-20.00 to 20.00 V
	45	-50.00 to 50.00 V
TC	10	R 0 to $1,760^\circ\text{C}$ 32 to $3,200^\circ\text{F}$
	11	S 0 to $1,760^\circ\text{C}$ 32 to $3,200^\circ\text{F}$
	12	B 400 to $1,820^\circ\text{C}$ 752 to $3,308^\circ\text{F}$
	13	K -200 to $1,370^\circ\text{C}$ -328 to $2,498^\circ\text{F}$
	14	E -200 to 800°C -328 to $1,472^\circ\text{F}$
	15	J -200 to $1,100^\circ\text{C}$ -328 to $2,012^\circ\text{F}$
	16	T -200 to 400°C -328 to 752°F
	17	N 0 to $1,300^\circ\text{C}$ 32 to $2,372^\circ\text{F}$
	18	W 0 to $2,315^\circ\text{C}$ 32 to $4,200^\circ\text{F}$
	19	L -200 to 900°C -328 to $1,652^\circ\text{F}$
	1A	U -200 to 400°C -328 to 752°F
RTD	20	JPt100 -200 to 550°C -328 to 1022°F
	21	Pt100 -200 to 550°C -328 to 1022°F

* JPt100 : JIS C1604-1989, JIS C1606-1989

** Pt100 : JIS C1604-1989, JIS C1606-1989
DIN IEC751, IEC751

Setting Recording Span Low Limit Value

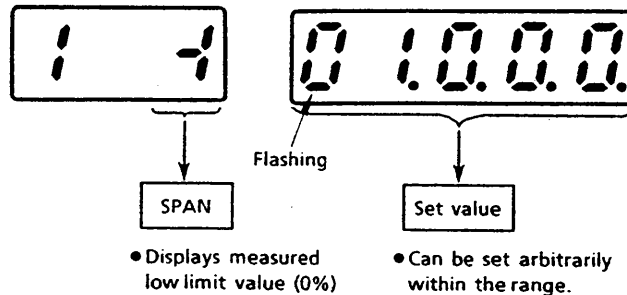
(The example shows a low limit value of $-1,000$ V).



- (1) Press the \blacktriangle key to set numerics (when the \blacktriangle key is kept depressed, the most significant digit changes in the order of ...0, 1, 2, 3, -, -1, 0, ...(-1 means -1). Other digits changes 1, 1, 2, ... 8, 9, 0).
- (2) Press the \blacktriangleright key to move the cursor to the right.
- (3) Set a numeric in each digit in the same manner as when the cursor is in the least significant digit by pressing the \blacktriangleright key, which moves the cursor to the most significant digit.
- (4) Press the $\overline{\text{ENT}}$ key to store the setting when completed.
- (5) If a set value exceeds the measuring range and is set erroneously, the panel flashes. Press the $\overline{\text{ENT}}$ key and reset with the correct value. (If an incorrect value is set in the following section, reset with the correct value in the same way.)

High Limit Value Setting Recording Span

(The example shows a high limit value of 1,000V).



- (1) Press the ▲ key to set numeric.
Press the ► key to move the cursor to the right and set a numeric for each digit in the same manner.
- (2) Press the ENT key to store the setting when completed.

Recording Span Setting Finished

The example given in to [2][1] means the following.

DC voltage absolute value recording

Measuring channel: No. 1

Measuring range (fixed): -2,000V to 2,000V

(range code No. 02)

Recording span: -1,000V to 1,000V

Carry out thermocouples and RTD setting in the same manner.

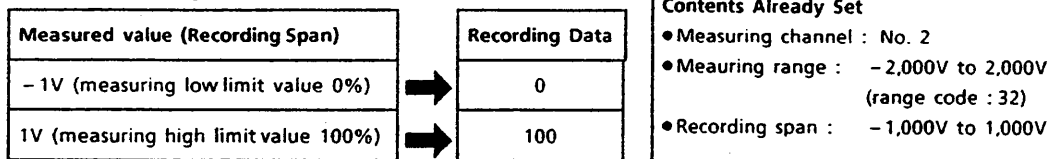
- [2] **Thermocouple Measurement/Absolute Value Recording**
Refer to [2][1] DC voltage measurement/Absolute Value Recording items for setting the measuring range code and recording span.
- [3] **RTD Measurement/Absolute Value Recording**
Refer to [2][1] DC Voltage Measurement/Absolute Value Recording items for setting the measuring range code and recording span.

[4] DC Voltage Measurement / Linear Scaling Recording

Refer to [2][1] DC Voltage Measurement / Absolute Value Recording items for setting the measuring range code and recording span.

Here, the scaling numeric value is set so that the measured value is converted to the numeric value in a system of units matched to the actual work (scaling value can be set within the -19999 to 20000 range and the span up to 30000).


Scaling Example

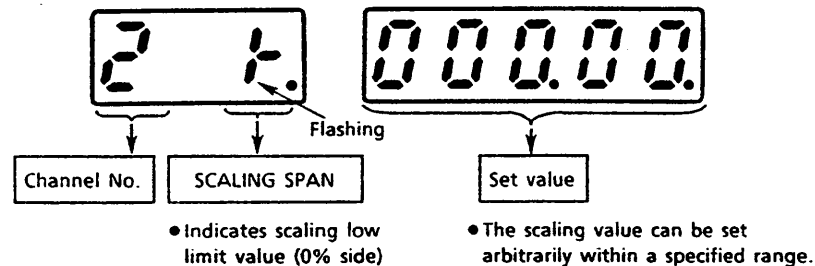


Scaling Value and Low Limit Value Setting


(The example shows a low limit value of 000,00)

(The example shows a low limit value of 000,00)


When the  key is pressed after recording span is set, the following panel is displayed. The displayed panel is set as specified.



- (1) Press the ▲ key to set the decimal point position.

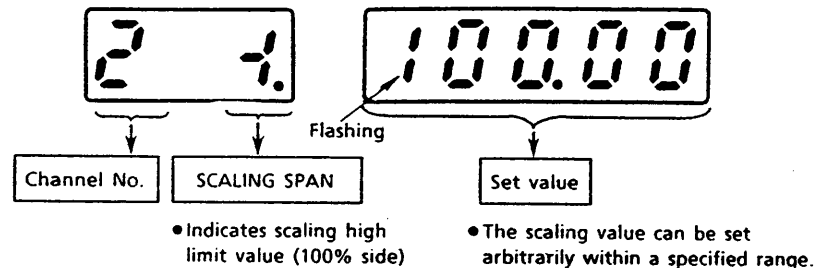
While  is flashing, the decimal point position of the scaling value can be set arbitrarily with the ▲ key.

- (2) Move the flashing figure with the ► key and set the scaling value with the ▲ key.

- (3) When setting is completed, press the  key for registration.


Scaling Value High Limit Setting

(The example shows a high limit value of 100.00)



Set numerics with the ▲ key.

Move the flashing character to the right with the ► key and set a numeric for each digit in the same way.

When setting is finished, press the  key for registration.

Note: The decimal point position is set with a low limit value.

Linear Scaling Value Setting Completed

The example in [2][4] uses the following.

DC voltage linear scaling recording

- Measuring channel: No. 2
- Measuring range: -2,000V to +2,000V
- Recording span: -1,000V to +1,000V
- Scaling span: 000,00 to 100,00

When setting of the scaling data is complete, see paragraph 6.4.5 Unit Setting (page 6-33)

Scaling Range Setting Precautions

- (1) In scaling recording (common to linear scaling recording and square root scaling), up to 75% of the measuring range shown by each range code can be measured (measuring span).

For example, when the range code 32 is set as in procedure 2 [4] the measuring range is -2 to $2V$ with $4V$.

However, the actual measuring range is

$$4(V) \times 0.75 = 3(V)$$

That is, maximum span is $3V$ (when $0V$ is center, maximum span is $-1.5V$ to $1.5V$). Measurable range (span) for the measuring range area is drawn with an oblique line as shown in Figure 6.1.

- (2) The number of displayed scaling value digits varies with the decimal point position setting.

For example, for scaling value 1, the digits displayed can be set arbitrarily as 1, 10, 100, 1,000, 1.0000.

- (3) The unit of a channel for which a scaling range is specified is not displayed or printed.

If necessary, specify a unit display when ordering.

When printing units, follow section 6.4.5 Unit Setting (Page 6-33).

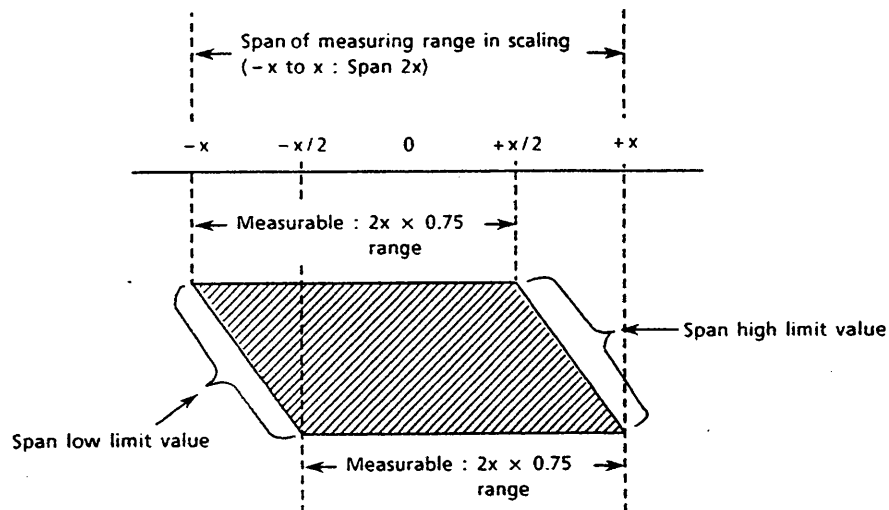


Figure 6.1

[5] DC Voltage Measurement/Square Root Computation Recording

Refer to [2][1] DC Voltage Measurement/Absolute Value Recording for measuring range code and recording span setting. (Page 6-23).

Square Root Computation Scaling Numeric Value Setting

See [2][4] DC voltage Measurement/Linear Scaling Recording (Page 6-26).

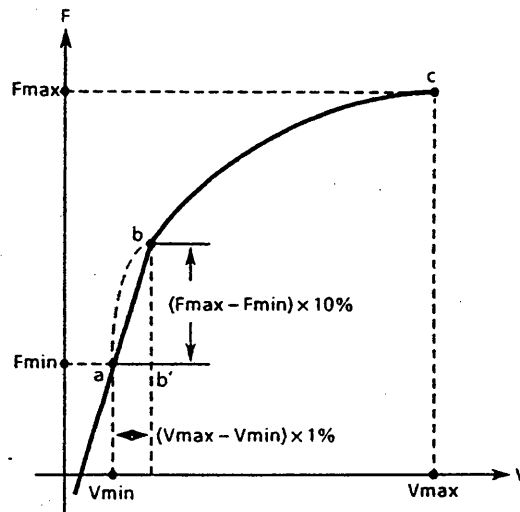
Square Root Computation

Square root computation in $\mu R100F$ Recorder is done in the following way.

Each item is defined as follows.

- V min : recording span low limit value
- V max : recording span high limit value
- F min : low limit scaling value
- F max : high limit scaling value
- Vx : input voltage
- Fx : scaling value

Relation between Vx (input voltage) and Fx (scaling value) is shown in the following graph (approximate curve).



The following relationship for Fx and Vx exists between b and c on the graph.

$$F_x = (F_{\max} - F_{\min}) \sqrt{\frac{V_x - V_{\min}}{V_{\max} - V_{\min}}} + F_{\min}$$

And, the following relationship exists between a and b,

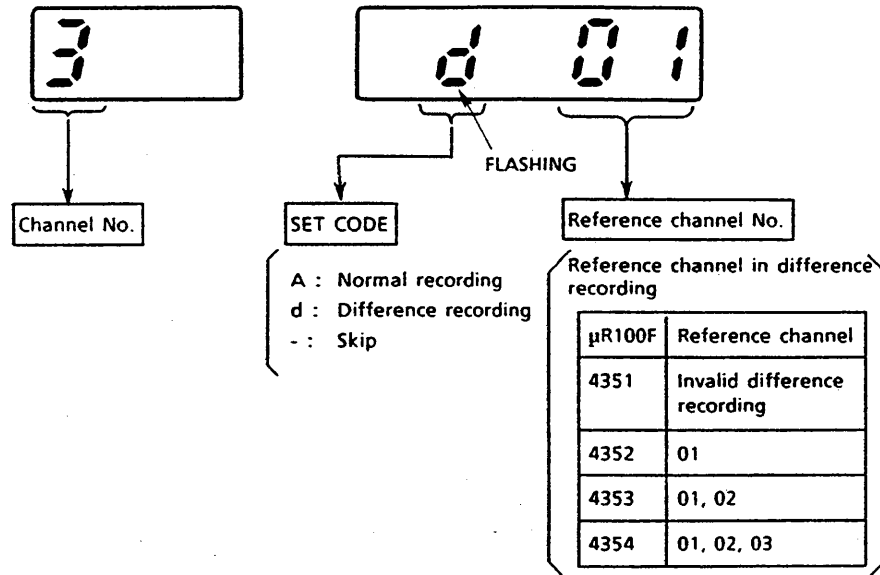
$$F_x = \frac{10 (F_{\max} - F_{\min})}{V_{\max} - V_{\min}} (V_x - V_{\min}) + F_{\min}$$

See available span setting range on page 6-28 for **Scaling Range Setting**
Precautions.

3 d : (Difference recording mode) Selection

Set a channel No. to record the difference } refer to 1 [1], [2] (Page 6-22)
 SET CODE Display

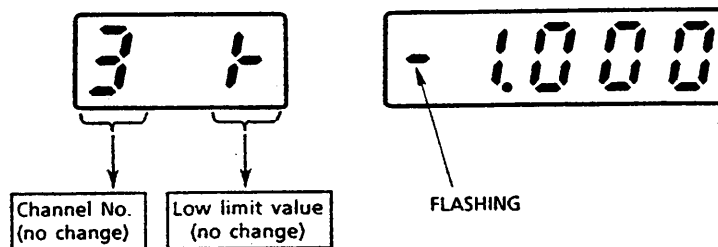
As shown in the figure, the two right digits transfer from range code to the reference channel No. of the difference recording. At this time, 01 is displayed as an initial reference channel value.



[1] Reference Channel Setting

Press the \blacktriangleright key to move the flashing character to the right and set a reference channel. When setting is finished, press the ENT key for registration. The display then transfers to the difference recording span panel. The example is set so that channel 1 is the reference channel and the difference is recorded on channel 3.

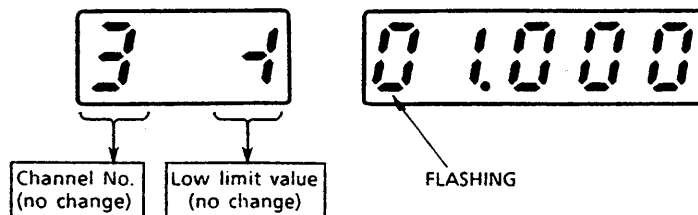
[2] Difference Recording Span Setting (the example shows a low limit value of -1,000V)



Set in the same way as in 2 [1]. (Page 6-23)

Difference Recording Span High Limit Value Setting

(the example shows a high limit value of 1,000V)

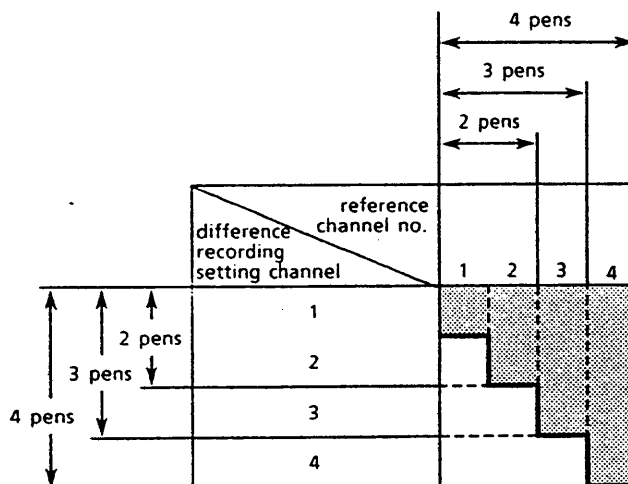


Set in the same way as shown in "Setting Recording Span $\boxed{2}$ [1]" (Page 6-23).
When setting is finished, press the ENT key for registration.

Difference Recording Setting Completed

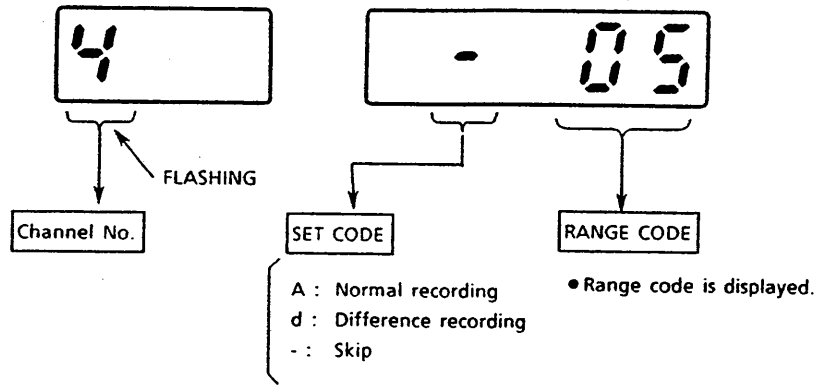
[3] Difference Recording Setting Conditions and Precautions.

- (1) Difference recording cannot be done in 1-pen model (Model 4351)
- (2) When difference recording is to be done, reference measurement of another channel is necessary. Channel No. for difference recording must be larger than a reference channel. Reference channel Nos. and channels which can set difference recording are shown on Table 5.1.
- (3) A reference channel and a channel for difference recording must have the same range code.
- (4) Difference between TC input and RTD input cannot be recorded.
- (5) Difference between channels for linear scaling and square root scaling cannot be recorded.



4 - : (Skip mode) Selection

Skip setting should be done for channels which do not measure or record (if skip setting is not carried out for the channel, an unnecessary line may be drawn).
 Remove the pen from the channel for which skip setting is carried out.



- [1] Set channel No. that does not measure or record.
 - [2] Set - for the SET CODE and press the ENT key for registration.
- } refer to [1] [1], [2] (page 6-22)

Skip Setting Completed

6.4.5 Unit Setting

(1) When linear scaling range or square root scaling range is specified, a setting unit for the corresponding channel No. is useful. The units suitable for actual operation can be recorded on a sheet.

However, printing is not carried out unless a unit is set.

Unit setting is valid only for printout. When special units other than standard units ($^{\circ}\text{C}$ or $^{\circ}\text{F}$, mV, V) are required. Switch the Unit display transfer switch (DIP switch) to channel display mode, and put the special unit seal on the display section.

Even if units are set for channels other than linear scaling and square root scaling channels, setting becomes invalid and a unit suitable for each range is printed and displayed.

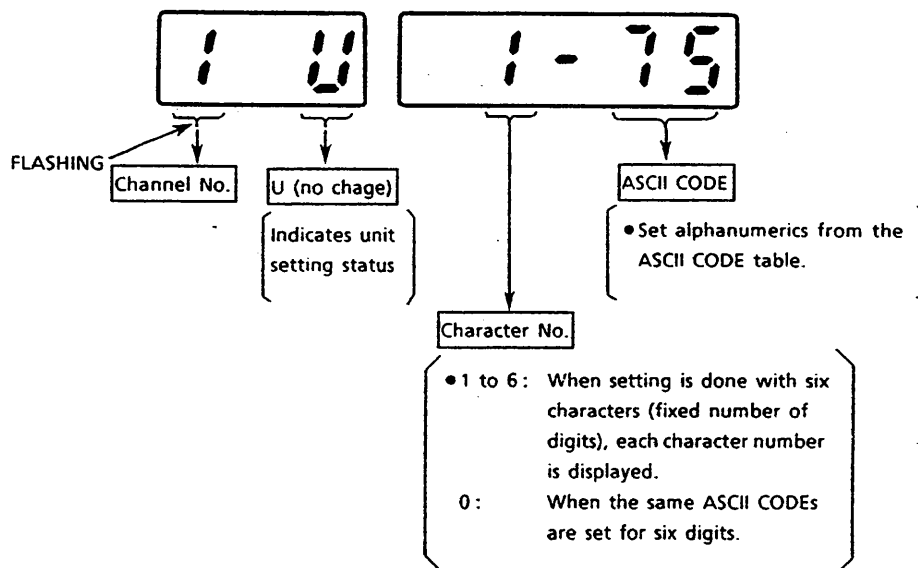
(2) Unit setting conditions are as follows:


- ① Number of setting units : Up to four
- ② Number of setting characters: Up to six characters per unit (alphanumerics)
Assign characters to Nos. 1 to 6 from the keyboard.
- ③ Setting method : Enter ASCII CODE from the key board
- ④ Three types of units can be set per channel arbitrarily.

1 When dip switches are set to the setup mode and power is turned on, the measured record setting panel is displayed.

2 Press the SET key and display the unit setting panel. When a unit is set after measured record setting, press the SET key and also display the unit setting panel.

Display the Unit Setting Panel



- ③ Set the channel No. with the ▲ key (move the flashing character with the ► key).
At this time, the first character is displayed automatically.
- ④ Press the ► key and set the characters to move the flashing character to ASCII CODE. Setting should be done in ASCII CODE with the ▲ key. Move the flashing character to the right with the ► key.
- ⑤ After the first character has been set, press the  key.
At this time, the second character No. is displayed automatically.
Set characters in the ASCII code in the same way as for the first character.
Repeat the above operation until the sixth character is set.
When specifying blanks for all characters, set 20 per character.
When setting is finished, press the ENT key.

Unit Setting Completed

(Other units should be set in the same way.)

- ⑥ When setting the print mode, press the SET key.
- ⑦ When storing set contents into the built-in memory, press the SET key twice and proceed to 6.4.7 Store Mode (Page 6-36).

ASCII CODE Table

b \ a	2	3	4	5	6	7
0		0	@	P	'	p
1	!	1	A	Q	a	q
2	"	2	B	R	b	r
3	#	3	C	S	c	s
4	\$	4	D	T	d	t
5	%	5	E	U	e	u
6	&	6	F	V	f	v
7	'	7	G	W	g	w
8	(	8	H	X	h	x
9	)	9	I	Y	i	y
A	*	:	J	Z	j	z
B	+	;	K	I	k	°
C	,	<	L	△	l	Ω
D	-	=	M	l	m	μ
E	.	>	N	▽	n	—
F	/	?	O	-	o	Ω

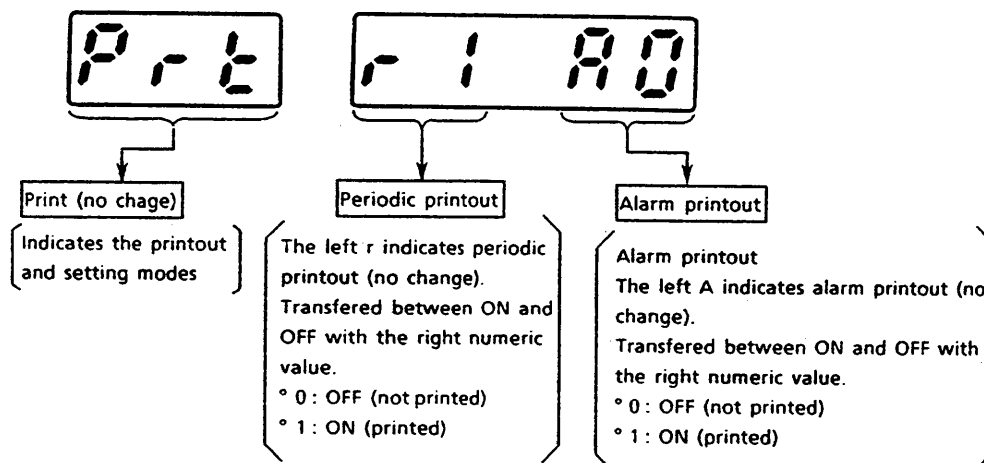
Panel display
example in ②
(Page 6-33)

6.4.6 Printout Mode Setting

The μ R100F recorder has versatile digital printout functions including periodic printouts and alarm printouts that can be transferred between ON (printout) and OFF (not printed).

- 1 When dip switches are set to the setup mode and the power is turned on, the measured record setting panel is displayed.
- 2 Press the SET key twice and display the printout mode setting panel.
(When the printout mode is set after unit setting, press the SET key and display the printout mode setting panel).

Printout Mode Setting Panel



- 3 **Periodic printout ON/OFF**
Set the flashing character to 0 or 1 with the ▲ key.
- 4 **ON/OFF of alarm printout**
Move the flashing character to the alarm printout with the ► key and set 0 or 1.
When setting is finished, press the ENT key.

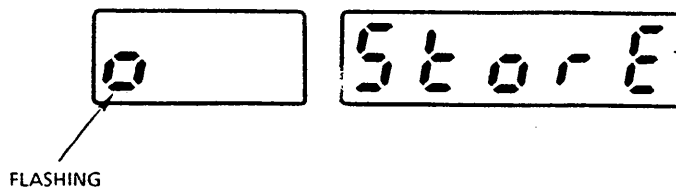
Printout Mode Setting Completed

- 5 When storing set contents into the built-in memory, press the SET key and proceed to 6.4.7 Store Mode (page 6-36).

6.4.7 Store Mode

The contents of measurement/recording setting, unit setting and printout mode setting can be stored into the built-in memory.

- 1 Press the SET key until the store mode panel is displayed.
(Pressing times vary with the setting mode.)



- 2 Turn ON dip switch No. 6 (No. 5 remains ON.).
- 3 When the ENT key is pressed and flashing stops, the set contents are stored into the memory.

Note: When dip switches are set erroneously, the whole panel flashes. In such a case, press the ENT key again to return to the initial store mode panel (only 0 is flashing), set the dip switches correctly and press the ENT key again.

Memory Storing Completed → All set values are stored into the built-in memory.

- 4 Set the dip switches to the required mode and turn the power OFF.

6.5 Test Mode

In test mode, zero and full-scale positions can be set for each pen.
Before adjusting the instrument, allow the instrument to warm up sufficiently.

6.5.1 Test Mode

Zero adjustment	Adjusts the 0% recording position
Full scale adjustment	Adjusts the 100% recording position

6.5.2 Test Mode Setting and Adjustment Procedure

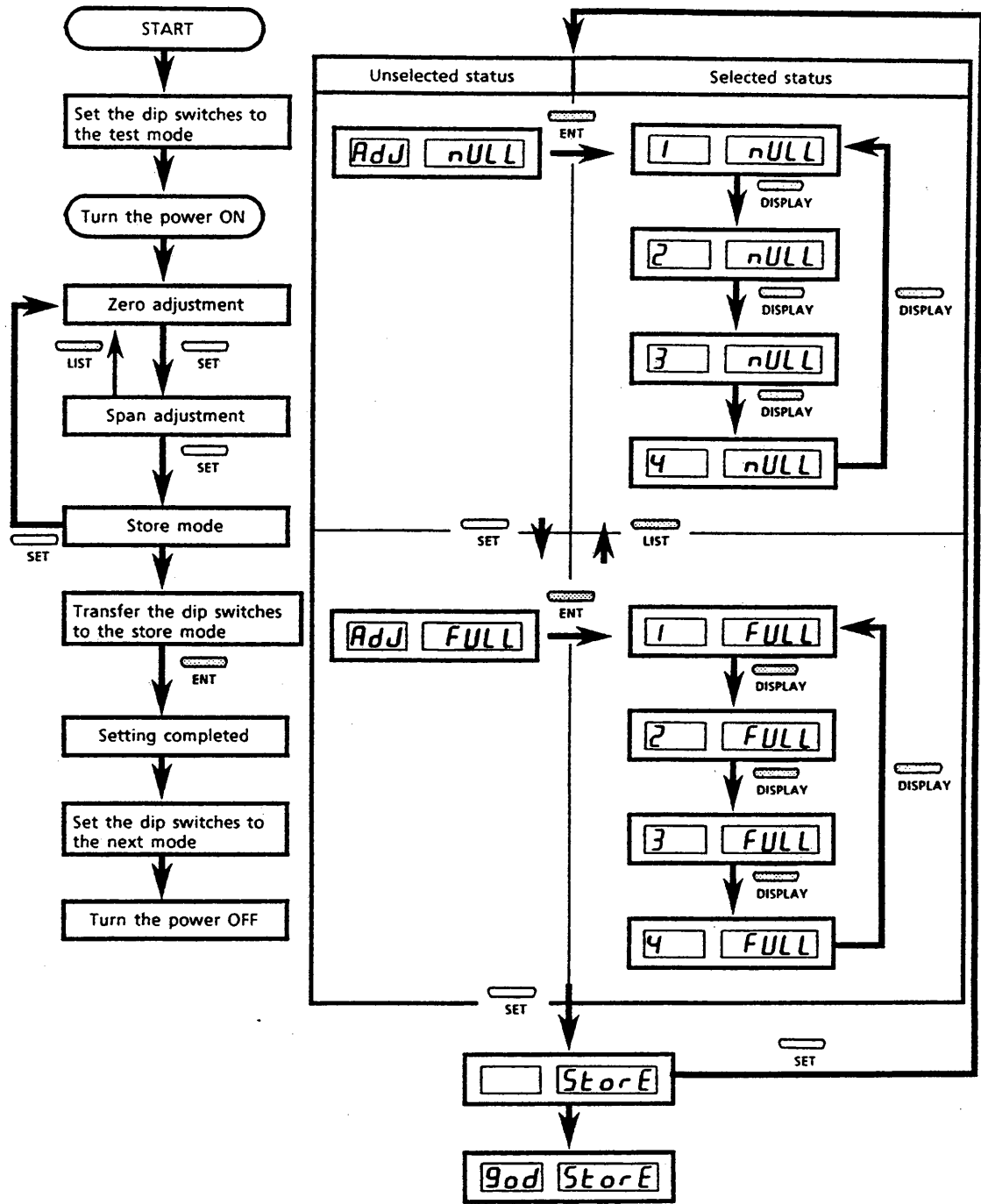
In the test mode, zero adjustment or full scale adjustment is selected.

When the power is turned on, zero adjustment is selected.

When another adjustment is to be carried out, press the SET key, move to the title panel and press the ENT key; then select the adjustment.



In store mode, store data and press the SET key. By doing this, you can set 0% recording position in the same manner as the power is turned ON.

As in the setup mode, when part or all of each adjustment is changed, the mode is transferred to the store mode and the setting is stored into the internal memory to complete the setting.










6.5.3 Operation Key

The keys used for setting are as shown below.

Seven keys: DISPLAY, FEED, SET,  ,  , ENT, LIST

Note: In the test mode, do not use keys that are not listed in the table.

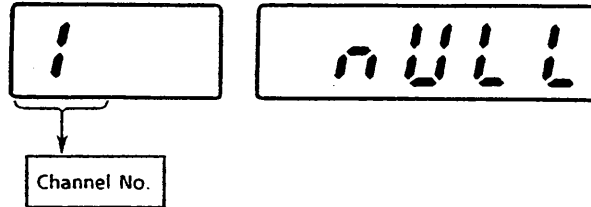
If other keys are pressed or a recorder does not operate normally, turn the power OFF and reset the keys again.

Key to be Used	Function Description in the Test Mode
 DISPLAY Display key	All adjustments shall be done for every channel (open). This key is used to change channels in each adjustment execution panel.
 FEED Feed key	Zero adjustment and full scale adjustment are performed and recorded. This key is used to sheet feed.
 SET Set key	This key is used to transfer the adjustment mode display in the order of zero adjustment, → full scale adjustment → store mode, → and zero adjustment.
 Cursor key	The recording position shifts to the left when this key is pressed in zero adjustment and full scale adjustment.
 Up key	The recording position shifts to the right when this key is pressed in zero adjustment and full scale adjustment.
 ENT Entry key	(1) This key is used to transfer a panel to an adjustment panel when adjustment is done in each adjustment mode. (2) This key is used to register (store) adjusted contents to the memory in the store mode.
 LIST LIST key	(1) This key is used to return a panel from full scale adjustment to zero adjustment.

6.5.4 Zero Adjustment



Press the ENT key to display the zero adjustment execution panel and perform zero adjustment.



At this time the first pen shifts to the left (In the 2-, 3- or 4- pen models, move the second, third and fourth pens to the center so as not to disturb the adjustment). Adjust the zero position with the \blacktriangleright or \blacktriangle keys.

When the \blacktriangleright key is pressed, the pen shifts to the left and when the \blacktriangle key is pressed, the pen shifts to the right.
 When these keys are pressed simultaneously, the pen shifts by 1/7000th of the sheet width (100 mm) and when pressed for more than one second, the pen shifts by 1/700th of sheet width. Pens do not move when the \blacktriangleright and \blacktriangle keys are pressed simultaneously.

Adjustment of the first pen is finished.

When adjustment of the second, third and the fourth pens are carried out in succession, press the DISPLAY key, set a channel No. and perform zero adjustment in the same way.

When adjustment is finished, press the SET key and proceed to full scale adjustment ; at which time the full scale adjustment title panel is displayed.

Zero Adjustment Completed

6.5.5 Full Scale Adjustment

Press the ENT key and display the full scale adjustment execution panel.

The channel No. is that when zero adjustment is finished. The channel pen shifts to the right (at the same time, the other pens move the center in the 2-, 3- or 4-pen models).

Set the channel No. for which full scale adjustment is to be done.

Press the \blacktriangleright or \blacktriangle keys to adjust full position.

The direction and amount shifted by the \blacktriangleright and \blacktriangle keys are the same as that for the zero position.

When full position adjustment of other pens is necessary in the 2-, 3- or 4- pen models, perform the same operation.

When adjustment is finished, press the SET key and set the store mode.

Span Adjustment Completed

Go to 6.5.6 Store Mode

6.5.6 Store Mode

The set contents in zero adjustment and full scale adjustment can be stored into the built-in memory.



Set dip switch No. 6 to ON (No. 2 remains ON).
Press the ENT key.



Store end display

- The store end display (abbreviation of good) is lit for about one second.

Note: If the store error display (abbreviation of Error) is lit for about one second, the dip switches are set erroneously. Set the dip switches correctly, press the ENT key again and confirm that the store end display appears.



Store error display

Storing into Memory Completed

Set the dip switch to the intended mode and turn the power OFF.

Test Mode Completed

6.5.7 Precautions for Operation in the Test Mode

Since the test mode includes inspection items performed before shipment, do not use keys that are not listed in section 6.5.3 Operation key. (Page 6-39)

If a wrong key is pressed, or the recorder does not operate normally, turn the power OFF and re-execute the test mode and, especially since an alarm output relay ON / OFF test is included, remove the wire to the output terminals from the recorder with an alarm output relay or turn OFF the power for connected equipment.

7. SPECIFICATIONS

7.1 Specifications

Item	Description
Input	Number of Inputs 1 (for 1-pen model 4351), 2 (for 2-pen model 4352), 3 (for 3-pen model 4353), or 4 (for 4-pen model 4354)
	Type of Input Circuit Floating, channels are isolated from each other
	Scan Cycle Time 125 ms / input channel
	Input Signal Levels DC Voltages 20 mV to 50 V ranges Thermocouples 100°C span and 3 mV or more RTDs 50°C span (Pt100Ω) or more * Specify range codes when ordering.
	Max. Permissible Input voltage (Continuous) ±10V DC for DC voltage with a measuring range of 2V DC or less, thermocouples and RTDs ±100V DC for DC voltage with a measuring range of 6 to 50V DC
Recording	Writing System Disposable felt-tip pen cartridges (analog data)
	Recording Colors First pen (violet), Second pen (red), Third pen (green), Fourth pen (blue)
	Effective Recording Width 100mm
	Recording Chart Z folding type : total length 16m
	Step Response Time 1 second or less (90% step)* * Conforms to IEC TC65 method
	Chart Speed 5 to 12,000 mm/h, Keyboard setting selecting one out of 82 speeds
Display	Digital Display LEDs (red)
	Display Items At measuring : Measured value (DC voltage ... 3-1/2 digits, temperature ... down to the first decimal place) and CH No. At alarm occurrence : H or L At setting : Chart speed, alarm value, date and time
	Analog Scale Background : White, Letters / lines / symbols : Black
	Status Display Displays each mode status. Operation mode (RCD, ALM, BAT), Digital display mode (AUTO, MAN), Setting mode (mm/h, ALM, CLK)
	Unit Display Displays units of each measured value (Standard ... °C or °F, mV and V)

Item		Description
Construction	Material	Case ... Steel plate, Front door ... Acrylic resin
	External Dimensions	Common to 1- to 4-pen models 140W×182.5H×480D mm (D is referred to the length from the panel front face and does not include door thickness 23mm. See Figure 3.1.)
	Coating Finish	Case ... Black, Front door frame ... Black
	Weight	1-pen model (4351) approx. 8.3kg, 2-pen model (4352) approx. 8.5kg, 3-pen model (4353) approx. 8.8kg, 4-pen model (4354) approx. 9.0kg.
	Mounting	Flush mounting on a vertical panel; Tilting; possible up to 30° back from vertical, but must be level on the horizontal plane.
Power	Supply Voltage	100, 115, 200, or 230V AC ±10% (designation required)
	Supply Frequency	50 or 60Hz (designation required, otherwise selectable)
	Power Consumption	1-pen model (4351) approx. 26 V A, 2-pen model (4352) approx. 28 V A, 3-pen model (4353) approx. 31 V A, 4-pen model (4354) approx. 35 V A.
Normal Operating Conditions	Ambient Temperature	0 to 50°C
	Ambient Humidity	20 to 80% RH (at 5 to 40°C)
	Vibration	10 to 60Hz, 0.02G or less
	Magnetic Field	400 AT/m or less
	Noises Induced from Outside	i) Permissible Normal Mode Voltage (50/60Hz) DC voltage input: Peak value containing signal component must be 1.2 times or less the measuring range. Thermocouple input: Peak value containing signal component must be 1.2 times or less the measured thermo-emf value. RTD input: 50mV or less ii) Permissible Common Mode Voltage (50/60Hz) 100V AC or less in all ranges
	Warm-up Time	30 minutes or more from turning power ON
Operating Condition Effect	Supply Voltage and Frequency Effect	1. For ±10% voltage variation: Indication... ± (0.1% of reading + 1 digit) or less Recording... ±0.2% of span or less 2. For ±2Hz frequency variation: Indication... ± (0.1% of reading + 1 digit) or less Recording... ±0.1% of span or less

Item	Description
Operating Condition Effect	Ambient Temperature Effect For 10°C variation: Indication... \pm (0.1% of reading + 1 digit) or less Recording... \pm 0.3% of span or less (excluding the effect of reference junction compensation on TC input)
	External Magnetic Field Effect For an AC or DC magnetic field of 400 AT/m. Indication... \pm (0.1% of reading + 10 digits) or less Recording... \pm 0.5% or less of span
	Input Signal Source Resistance Effect 1. For signal source resistance of 1k Ω : i) Voltage range: \pm 10 μ V or less for 20, 200mV, and 2V range, -0.1% or less (span change) for 6, 20 and 50V range ii) TC range: \pm 10 μ V or less (100 μ V or less in models with burn-out function) 2. For 10 Ω /wire change in RTD input: Indication... \pm (0.1% of reading + 1 digit) or less Recording... \pm 0.1% of span or less (resistance values of all three wires must be identical).
	External Noise Effect For noises shown in the normal operating conditions (frequency 50 or 60 \pm 0.1Hz): <ul style="list-style-type: none"> • Normal mode rejection ratio... 40dB or more • Common mode rejection ratio... 120dB or more
	Tilted Mounting Effect For tilting angles up to 30° back from vertical Indication... \pm (0.1% of reading + 1 digit) or less Recording... \pm 0.1% of span or less
	Vibration Effect For application of linear vibration of frequency 10 to 60Hz and acceleration of 0.02G to three axes of the recorder: Indication... \pm (0.1% of reading + 1 digit) or less Recording... \pm 0.1% of span or less
Standard Performance	Thermocouple Reference Junction Compensating Accuracy* \pm 1°C for types R, S, B, and W \pm 0.5°C for types K, E, J, T, N, L, and U * When input terminal temperature is in the ambient temperature range 0 to 50°C.
	Input Resistance 10M Ω or more for DC voltages of 20, 200mV, and 2V ranges and thermocouples Approx. 1M Ω for DC voltages of 6, 20, or 50V ranges
	Input Bias Current 10nA or less (though approx. 100nA when /BU or /BD is optionally specified for thermocouple input)
	Chart Speed Accuracy \pm 0.1% or less (when running 1000 mm or more continuously and not including paper expansion or contraction)
	Clock Accuracy \pm 100ppm or less (not including delay at power ON/OFF of 1 second or less at a time)

Item	Description																																																												
<p>Standard Performance</p> <p>Accuracy and Deadband</p>	<p>Performance in the reference operating condition ($23 \pm 2^\circ\text{C}$, $55 \pm 10\%$ R.H., rated supply voltage $\pm 1\%$, rated frequency $\pm 1\%$, warm up 30 minutes or more, and having no adverse effect on recorder operation)</p> <table border="1" data-bbox="761 485 1384 1091"> <thead> <tr> <th rowspan="2">Input</th> <th rowspan="2">Range</th> <th colspan="2">Measurement (digital)</th> <th colspan="2">Recording (analog)</th> </tr> <tr> <th>Accuracy</th> <th>Resolution</th> <th>Accuracy</th> <th>Dead-band</th> </tr> </thead> <tbody> <tr> <td rowspan="4">DC V 0 □ 3 □ 4 □</td> <td>20mV</td> <td>$\pm(0.2\% \text{ of rdg} + 3 \text{ digits})$</td> <td>10$\mu\text{V}$</td> <td rowspan="4">Measurement accuracy $\pm(0.3\% \text{ of span})$</td> <td rowspan="4">0.2% of span</td> </tr> <tr> <td>200mV</td> <td>$\pm(0.2\% \text{ of rdg} + 2 \text{ digits})$</td> <td>100$\mu\text{V}$</td> </tr> <tr> <td>2V</td> <td>$\pm(0.1\% \text{ of rdg} + 2 \text{ digits})$</td> <td>1mV</td> </tr> <tr> <td>6V</td> <td>$\pm(0.3\% \text{ of rdg} + 2 \text{ digits})$</td> <td>10mV</td> </tr> <tr> <td rowspan="10">TC (Not including reference junction compensating accuracy.) 1 □</td> <td>R</td> <td>$\pm(0.15\% \text{ of rdg} + 1^\circ\text{C})$</td> <td rowspan="3">0.2$^\circ\text{C}$</td> <td rowspan="10">When recording span is selected as shown below.</td> <td rowspan="10"></td> </tr> <tr> <td>S</td> <td>However, with R and S: $\pm 3.7^\circ\text{C}$ for 0 to 100°C $\pm 1.5^\circ\text{C}$ for 100 to 300°C $\pm 2^\circ\text{C}$ with D for 400 to 600°C</td> </tr> <tr> <td>B</td> <td></td> </tr> <tr> <td>K</td> <td>$\pm(0.15\% \text{ of rdg} + 0.7^\circ\text{C})$ However, for -200 to -100°C $\pm(0.15\% \text{ of rdg} + 1^\circ\text{C})$</td> <td rowspan="4">0.1$^\circ\text{C}$</td> </tr> <tr> <td>E</td> <td>$\pm(0.15\% \text{ of rdg} + 0.5^\circ\text{C})$</td> </tr> <tr> <td>J</td> <td>However, with J: -200 to 100°C</td> </tr> <tr> <td>T</td> <td>$\pm(0.15\% \text{ of rdg} + 0.7^\circ\text{C})$</td> </tr> <tr> <td>N</td> <td>$\pm(0.15\% \text{ OF RDG} + 0.7^\circ\text{C})$</td> <td rowspan="2">0.2$^\circ\text{C}$</td> </tr> <tr> <td>W</td> <td>$\pm(0.15\% \text{ OF RDG} + 1^\circ\text{C})$</td> </tr> <tr> <td>L</td> <td>$\pm(0.15\% \text{ OF RDG} + 0.5^\circ\text{C})$ However, with L: -200 to 100°C</td> <td rowspan="2">0.1$^\circ\text{C}$</td> </tr> <tr> <td>U</td> <td>$\pm(0.15\% \text{ of rdg} + 0.7^\circ\text{C})$</td> </tr> <tr> <td>RTD</td> <td>Pt100 (JPt)[*] Pt100^{**}</td> <td>$\pm(0.15\% \text{ of rdg} + 0.3^\circ\text{C})$</td> <td>0.1$^\circ\text{C}$</td> <td></td> <td></td> </tr> </tbody> </table> <p>Note: * Pt 100Ω (JPt): JIS C1604-1981, JIS C1606-1986 ** Pt 100Ω: JIS C1604-1989, JIS C1606-1989 DIN IEC751, IEC751</p>	Input	Range	Measurement (digital)		Recording (analog)		Accuracy	Resolution	Accuracy	Dead-band	DC V 0 □ 3 □ 4 □	20mV	$\pm(0.2\% \text{ of rdg} + 3 \text{ digits})$	10 μV	Measurement accuracy $\pm(0.3\% \text{ of span})$	0.2% of span	200mV	$\pm(0.2\% \text{ of rdg} + 2 \text{ digits})$	100 μV	2V	$\pm(0.1\% \text{ of rdg} + 2 \text{ digits})$	1mV	6V	$\pm(0.3\% \text{ of rdg} + 2 \text{ digits})$	10mV	TC (Not including reference junction compensating accuracy.) 1 □	R	$\pm(0.15\% \text{ of rdg} + 1^\circ\text{C})$	0.2 $^\circ\text{C}$	When recording span is selected as shown below.		S	However, with R and S: $\pm 3.7^\circ\text{C}$ for 0 to 100°C $\pm 1.5^\circ\text{C}$ for 100 to 300°C $\pm 2^\circ\text{C}$ with D for 400 to 600°C	B		K	$\pm(0.15\% \text{ of rdg} + 0.7^\circ\text{C})$ However, for -200 to -100°C $\pm(0.15\% \text{ of rdg} + 1^\circ\text{C})$	0.1 $^\circ\text{C}$	E	$\pm(0.15\% \text{ of rdg} + 0.5^\circ\text{C})$	J	However, with J: -200 to 100°C	T	$\pm(0.15\% \text{ of rdg} + 0.7^\circ\text{C})$	N	$\pm(0.15\% \text{ OF RDG} + 0.7^\circ\text{C})$	0.2 $^\circ\text{C}$	W	$\pm(0.15\% \text{ OF RDG} + 1^\circ\text{C})$	L	$\pm(0.15\% \text{ OF RDG} + 0.5^\circ\text{C})$ However, with L: -200 to 100°C	0.1 $^\circ\text{C}$	U	$\pm(0.15\% \text{ of rdg} + 0.7^\circ\text{C})$	RTD	Pt100 (JPt) [*] Pt100 ^{**}	$\pm(0.15\% \text{ of rdg} + 0.3^\circ\text{C})$	0.1 $^\circ\text{C}$		
Input	Range			Measurement (digital)		Recording (analog)																																																							
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RTD	Pt100 (JPt) [*] Pt100 ^{**}	$\pm(0.15\% \text{ of rdg} + 0.3^\circ\text{C})$	0.1 $^\circ\text{C}$																																																										
<p>Insulation Resistance</p>	<p>20MΩ or more (between each terminal and ground at 500V DC)</p>																																																												
<p>Withstand Voltage (50/60Hz)</p>	<ul style="list-style-type: none"> • 1,000V AC for 1 min.: between input terminals (except for RTD input model) • 1,500V AC for 1 min.: between power terminal and ground • 1,000V AC for 1 min.: between input terminal and ground 																																																												
<p>Printing</p>	<p>Fixed Time Printing Measured value, time tick (printed with "-"), date, time, tag, unit, scale letters (both 0 and 100% sides), and chart speed</p> <p>List Printing Date, time, CH No., tag, input range, recording span, unit, alarm, chart speed, scaling span (when scaling range is specified) and pen offset compensation (POC) ON, digital printing, alarm printout OFF and alarm messages</p> <p>Alarm Printing CH No., H·L·h·l, ON and OFF times, and marking</p> <p>Printing When Chart Speed is Changed <ul style="list-style-type: none"> • Chart speed changing (remote signal generation) time and resetting time • Speed 1 or 2 (Optional) Note: The chart speed changes in two steps by the remote signal. In this case, printing to show speed change implementation is performed. However, optional specification is needed. </p> <p>Message Printing A message within 16 characters is printed, though it needs optional specification.</p> <p>Manual Print Date, time, measured, value, unit, tag, alarm status (optional)</p>																																																												

Item		Description
Alarms	Setting	Set from the keyboard.
	Number of Setting Points	Up to four levels in each channel (high, low limits difference high, low limits and any other item levels)
	Output	Common 4 outputs, printed on the chart as standard (relay output is optional)
	Display	ALM display (red) when generated
	Maximum Hysteresis Error	Approx. 0.5% of recording span

Standard Functions

Function	Description
Fixed Time Printout	Prints out measured value, date and time, units, scale letters (on 0% and 100% sides), CH No., and chart speed on the recording chart at a fixed interval.
List Printout	Prints out measuring ranges, recording spans, units, alarms (output relays are optional), associated sensors, date and time, chart speeds, etc. in each channel.
Alarm Printout	Prints out CH NO., H/L ON and OFF time and the mark when an alarm is generated.
Digital Display	At measuring: Displays measured values in each channel (or turns off all the LEDs) At setting: Displays the set contents.
Status Display	Displays statuses in each mode of operation, digital display and setting.
Unit Display	Displays each unit for measurements ($^{\circ}\text{C}$ or $^{\circ}\text{F}$, mV, V)
Analog Indication	Normally equipped with scales and pointers similar to analog indicating recorders.
Scaling	Free scaling is available for any voltage range from 5mV span up to 50V span. (Scaling should be within span 30,000 in the range -19999 to 20000 when linear scaling input is specified.)*
Square Root Extraction	Square root extraction is available (scaling is within span 30,000 in the range -19999 to 20000) when square root extraction input is specified.*
Arbitrary Setting Functions	Operator mode: Chart speed, alarm values, date, time and TAG No. can be simply set by key operation. Set up mode: Recording mode, range, recording span, scaling span and unit setting etc. can be changed. Range changes can be done in DCV, TC or RTD.
Memory Backup	Set memory contents are protected by a built-in lithium battery (battery life is about 10 years at ambient temperature of 23°C).
Recorder Interior Lighting	Allows measured data to be read even when the recorder is placed in a dark location.

* Voltage span at linear scaling or square root extraction is 75% or less of the measuring range.

Optional Features

Name		Optional Code
Thermocouple burnout protection	Up scale action	/BU
	Down scale action	/BD
Remote signal terminal		/REM□□
Alarm output relay unit		/AK-04
Pen offset compensation		/PS
Communicating function : RS-422A interface		/RS422A
Manual printing function		/MP
With mounting kit		/MTS
Bezel color change		/SCF-G2M
With Foxboro mounting kit		/MTF
Unit display °F		/DF
Engineering unit seal		/UNT

Can not specify both for same recorder.

(1) Thermocouple Burnout Protection (/BU /BD)

When the input is disconnected, the pen travels beyond the 100% or 0% point. (Burnout current is approx. 100nA and burnout condition is 10MΩ or more.)

- Upscale burnout action (/BU): Common to all points.
- Downscale burnout action (/BD): Common to all points.

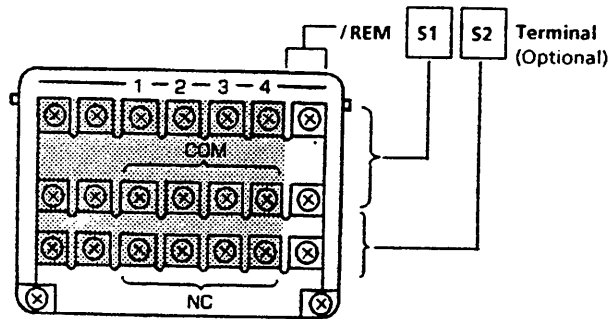
(2) Remote Controls (/REM□□)

Recording start/stop (chart drive START/STOP), chart speed changing, list printout, message printout and manual printout are performed. Two of the following four specified functions are set as illustrated in Figure 7.1.

- ① Recording can be started or stopped by an external contact signal. The same function as the $\overline{\text{RCD}}$ key on the keyboard. However, the remote contact signal overrides the key operation.
- ② The chart feed speed is changed from the 1st set speed (normal chart speed) to the 2nd set speed (chart speed in remote control mode) by an external contact signal. When signals are cancelled, the chart speed returns to the 1st set speed.
- ③ List printing is performed by a contact signal.
- ④ Message printing is performed by a contact signal. Up to 16 characters are permitted for a message.
- ⑤ Manual printing is performed by a contact signal. Manual printing using the LIST key is also possible.

In remote terminals, the upper rows are for S₁ terminals while the lower rows are for S₂ terminals.

Optional Specifications	Terminal Arrangement	
	S ₁ Terminal	S ₂ Terminal
/REM12	1	2
/REM13	1	3
/REM14	1	4
/REM15	1	5
/REM23	2	3
/REM24	2	4
/REM25	2	5
/REM34	3	4
/REM35	3	5
/REM45	4	5



(For example, when /REM23 is specified, the righthand REM terminal is for [2] function and the lefthand terminal is for [3] function.)

Figure 7.1 REM Terminals

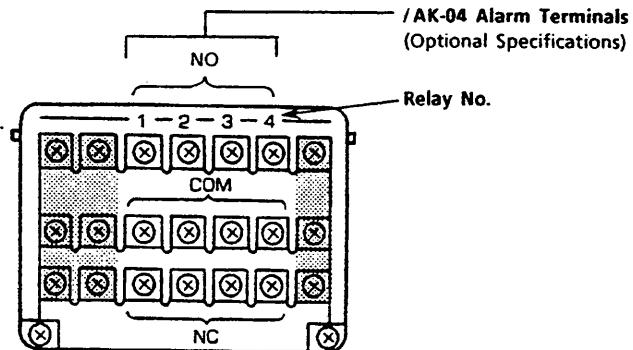
(3) Alarm Four Outputs (Relay) (/AK-04)

(incorporated in the recorder if specified)

Number of Output Points : 4

Relay Contact Rating : 240V AC, 3A or less
30V DC, 3A (resistive load) or less.

Terminal layout of the /AK-04 is shown in Figure 7.2.



NC: Normally closed, NO: Normally open, COM: Common

Figure 7.2 Alarm Terminals

Relay contact conditions depend on the instrument ($\mu R100F$) conditions as shown below.

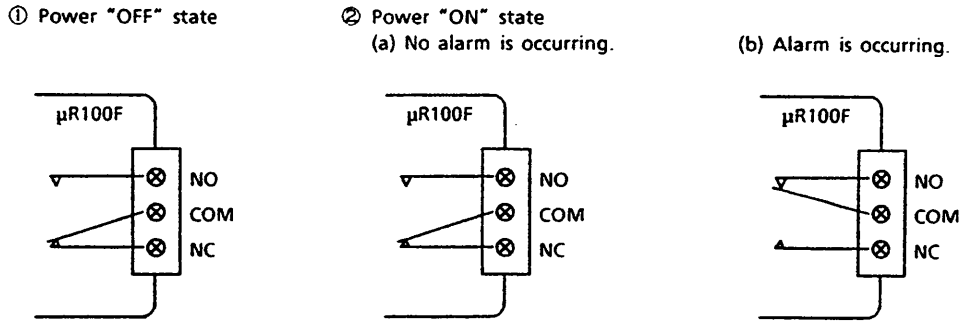


Figure 7.3

The relay for (/AK-04) operates when the measured value reaches the recorder alarm set point. The operation of the 3-pen model is explained below as an example.

AL_{mn} indicates a setting No. of an alarm point. For example, AL₃₂ is an alarm point of setting No. 2 of channel 3. Moreover, it is set to alarm output No. 4 as illustrated in the figure (up to four setting No. can be set per channel).

For alarm output No. 4, when an alarm occurs in AL₁₄, AL₂₃, AL₃₂ or AL₄₁, a relay operates and the status becomes that of the Figure 7.3 (b) (No. 4 relay *2).

For alarm output No. 1, since only AL₁₁ is set, the relay operates when this alarm occurs (No. 2 relay).

Alarm Output No. / CH. No.	1	2	3	4
CH. 1	AL ₁₁	AL ₁₂	AL ₁₃	AL ₁₄
CH. 2		AL ₂₁	AL ₂₂	AL ₂₃
CH. 3			AL ₃₁	(AL ₃₂)
CH. 4				AL ₄₁

CH. X				
Setting No.	1	2	3	4
Alarm point	AL _{X1}	AL _{X2}	AL _{X3}	AL _{X4}

Any alarm output No. can be set. /AK-04 Alarm Terminals (Optional Specifications)

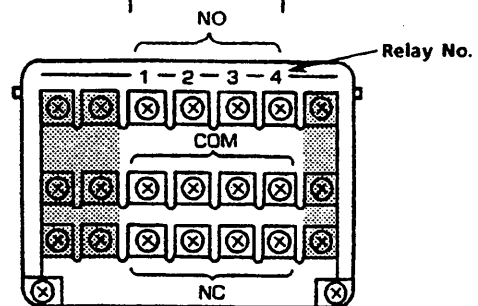


Figure 7.4

*1: Two alarm points or more cannot be set with the same setting No. in one channel.

*2: Alarm output No. = Relay No.

An alarm expressed as AL_{mn} can be set matching one to one to any alarm output No. (though limited within four alarms).

(4) Pen Offset Compensation (/PS)

Pen offset compensation function eliminates the time axis offset between pens.

(Pen offset compensation error $\pm 1\text{mm}$ max)

Let us take a 2-pen recorder 4352 as an example (3- and 4-pen recorder is similar).

Figure 7.5 shows a chart recording side view.

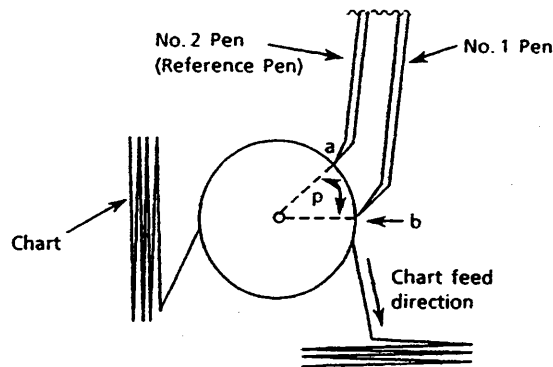


Figure 7.5 Pen Recording on the Chart

Figure 7.5 shows that, in any pen recorder (to prevent collision between pens), the pens (Nos. 1 and 2) must be offset by a distance p on the chart. Therefore, recordings at the instant also offset relative to the time axis.

(Time offset $\Delta T = P/V$)

Where V : chart speed)

Therefore, the measurement data taken during pen offset (time) is stored.

After the chart is fed by the time offset p , the stored (delayed) data is recorded to compensate the offset to the time axis on the chart.

Note 1: The reference pen is: Pen 2 for mode 4352
Pen 3 for model 4353
Pen 4 for model 4354

The pen offset compensation switch is set ON at the factory.

- 2: Pens other than the reference pen do not perform recording until the time corresponding to the phase difference elapses and, therefore, the pens may seem not to move accurately.

Measured values are still stored by the memory, so the recording pens do not move until the time corresponding to the time offset elapses.

The reference pen operates conveniently, immediately after turning on power. The other pens do not work until the time corresponding to the time offset has elapsed but this does not mean failure.

- 3: The pen offset compensation function is available with only 2-, 3- or 4-pen recorders. When provided, the pen offset compensation can be switched ON and OFF. The switch is located on the front panel. (see 5.4.2 Page 5-10) Be sure to perform switching with the power switch turned "OFF".
Switching cannot be done with the power switch turned "ON".

(5) Communication Function RS-422A (/RS422A)

Signal level: Conforms to EIA RS-422A

Communication system: Four wire half duplex multi-drop connecting system

Communication rate: 150, 300, 600, 1200, 2400, 4800, 9600 BPS selectable

Data: ASCII code

Others: Input/output signals non-isolated

For details, refer to a separate μ R100F RS-422A Instruction Manual, IM 4D4B1-10E.

(6) Manual Printing (/MP)

Each channel date, time, channel No., alarm status, measured value and TAG No. can be printed out as required.

(7) With Mounting Kit (/MTS)

Specify for each single mounted unit, or for one side-by-side mounted unit.

Mounting kit consists of a bezel to be attached to the instrument and a vise to prevent the instrument rolling.

Bezels are:

Material : Aluminum die-cast

Coating : Black

Weight : 0.4kg

(8) Bezel Color Change (/SCF-G2M)

Muncel 7.5BG 4/1.5

(when /SCF-G2M is added, /MTS must be specified)

(9) With Foxboro Mounting Kit (/MTF)

Must be specified when the instrument is mounted on a Foxboro specified 200 shelf.

(10) Unit Display °F (/DF)

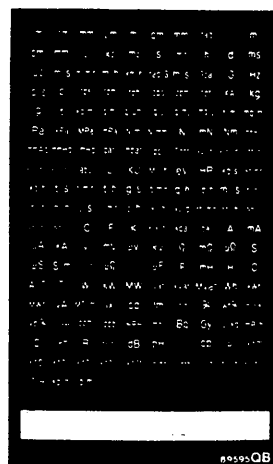
Display measurement unit is °F.

(11) Engineering Unit Seal (/UNT)

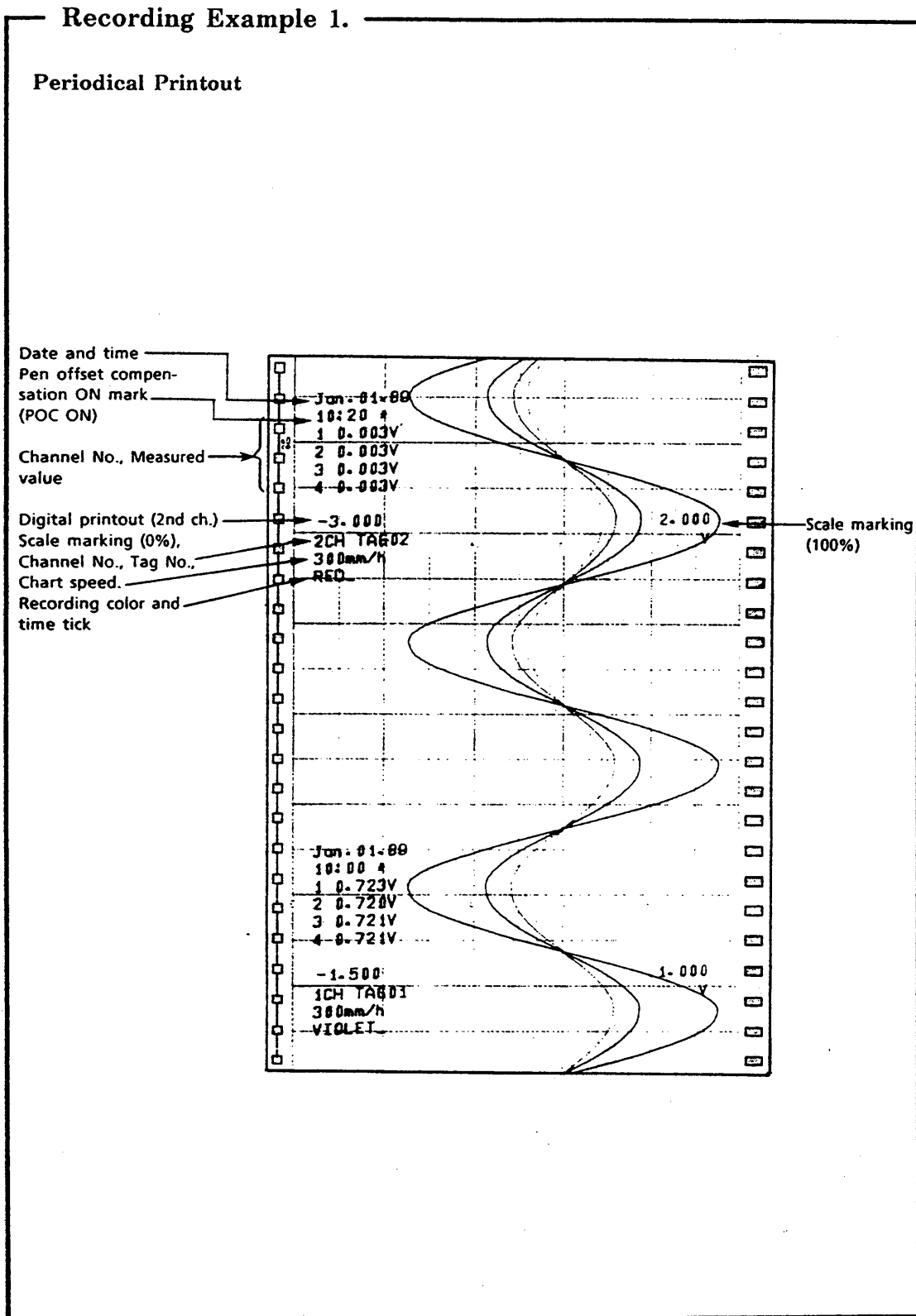
4 sheets of unit seals for non standard are attached.

(1 sheet consists of 180 kinds of unit seals.)

(The number of seals depends on the number of pens.)

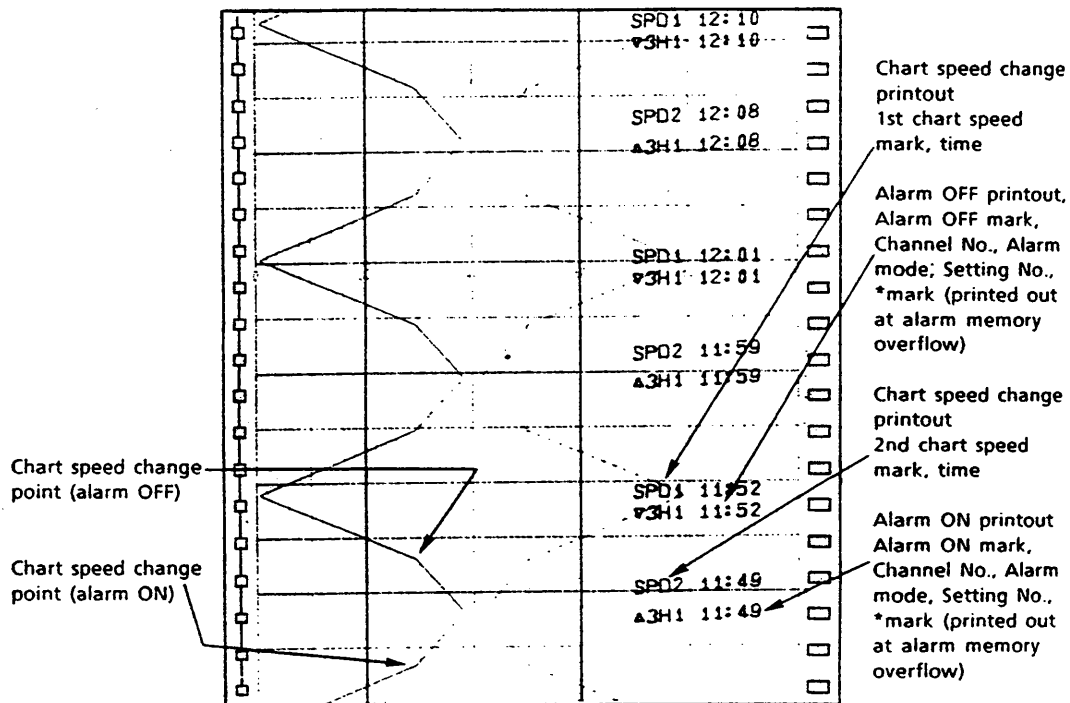


7.2 Examples of Recording and Printing



Recording Example 2.

Alarm Printout/Seleciton of Two Chart Speeds Alarm output, selection of two chart speeds (optional)



Note 1: Since the alarm printout occurs prior to the fixed time printout, printing of the scale value (fixed time printout).

Note 2: When * mark is printed out, some other alarms are not printed out. the alarm ON/OFF data are stored in a 30 data memory, and the data are output sequentially as alarm printouts. However, if the alarm occurs or resets frequently, the alarm printout (output from memory) speed is slower than the alarm generation speed. So memory overflow eventually occurs. Data generated at that time cannot be stored or printed out (data to printout chart speed change in REM mode are included in the 30 data that can be stored).

Recording Example 3.

Program List Printout/Manual Printout/Message Printout
 (Manual printout and Message printout: Optional)

Manual printout

Date and time	Jan. 01-89 13:18
Channel No.	1 300t/h TAG01
	2 340cm TAG02
Alarm mode	3H 80k _a /cm ² TAG03
Measured value, Tag No.	4 *OVER °C TAG04

Program list printout

Date and time, Pen offset compensation ON (POC ON): Jan. 01-89 13:18 POC ON

CHART SP1 20mm/h PERIOD PRINT OFF
 SP2 120mm/h ALARM PRINT OFF

CH. NO. TAG. NO.	RANGE	RECORD SPAN	SCALE SPAN	UNIT
CH1 TAG01	8V	1.000 5.000	1200	0 t/h
CH2 TAG02	8V	1.000 5.000	1400	0 cm
CH3 TAG03	20V	0.00 10.00	300	0 k _a /cm ²
CH4 TAG04	Type E	200.0 800.0		°C

Alarm setting

CH	ALARM1	ALARM2	ALARM3	ALARM4
1	H 04 1000	-	-	-
2	-	L 03 1250	-	-
3	-	-	H 0	-
4	-	-	-	L 02 350.0

Message printout

MESSAGE= MR100F message

8. MAINTENANCE

8.1 Periodic Maintenance

Check the recorder operation periodically to keep the recorder in good operating condition.

Especially, check the following items and replace as required parts such as the chart, disposable felt-tip pens, fuse and batteries, etc.

- (1) Are display and recording functioning properly?
- (2) Are there no blurred or incomplete printout characters? *1
- (3) Is the chart paper feeding correctly?
- (4) Is there sufficient chart left? *2
- (5) Is "BAT" displaying? (Memory backup batteries must be replaced). *3

*1: If any blurred or incomplete printouts are found, replace the relevant felt-tip pen or plotter pen. Refer to "paragraph 5.1.2 Felt-tip Pen Replacement" or paragraph 5.1.3 Plotter Pen Replacement" for replacing pens.

*2: Refer to "paragraph 5.1.1 Loading (Replacing) Chart Paper" for replacement method.

*3: If "BAT" is displayed, contact the nearest YOKOGAWA service center or the dealer from whom the recorder was purchased.

8.2 Fuse Replacement

Before replacing the fuse, turn OFF the POWER switch.

- (1) Remove the chart paper compartment (refer to "5.1.1 Loading (Replacing) Chart Paper"). Then it is found that the fuse is mounted (see Figure 8.1).
- (2) Turn the carrier of the fuse holder counterclockwise with a flat-bladed screwdriver, and the holder will slide out with the fuse (see Figure 8.1). Make sure that the rating of the new fuse is correct, and mount the fuse by turning the carrier clockwise.

* When replacing the fuse, turn "OFF" the POWER switch.

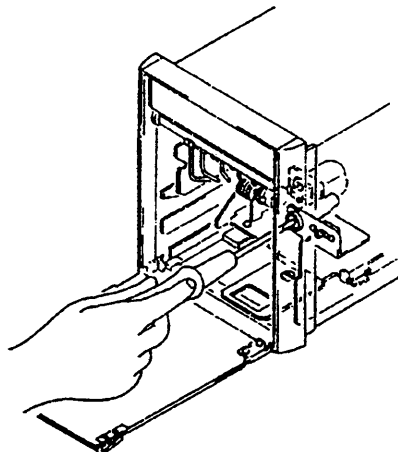


Figure 8.1 Fuse Replacement

9. TROUBLESHOOTING

The recorder block diagram is shown in Figure 9.1.

When the recorder fails to operate correctly observe the fault conditions carefully, follow the troubleshooting flow sequence given in Section 9.2, and find a suitable remedy for the problem.

However, if a complicated problem does occur, please contact the dealer from whom the recorder was purchased or the nearest YOKOGAWA service center.

9.1 Block Diagram

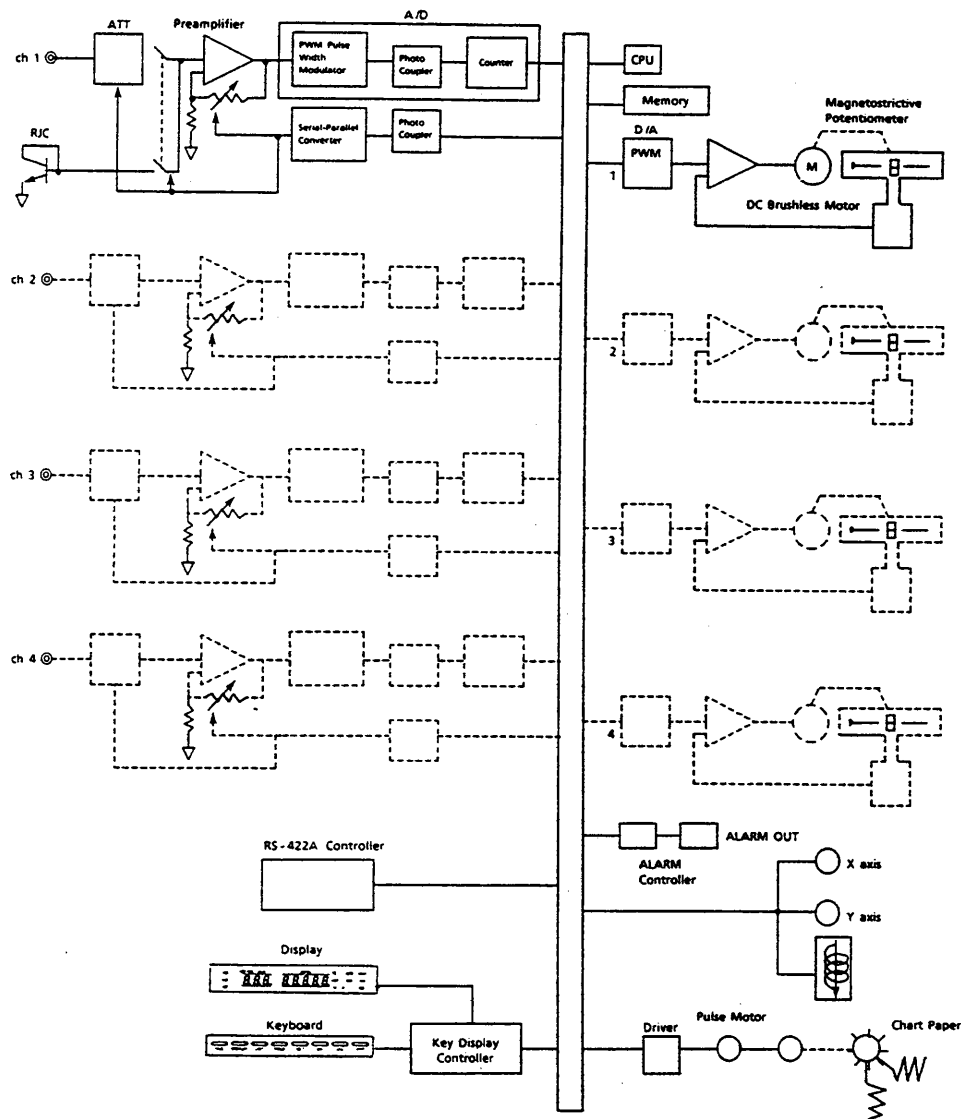
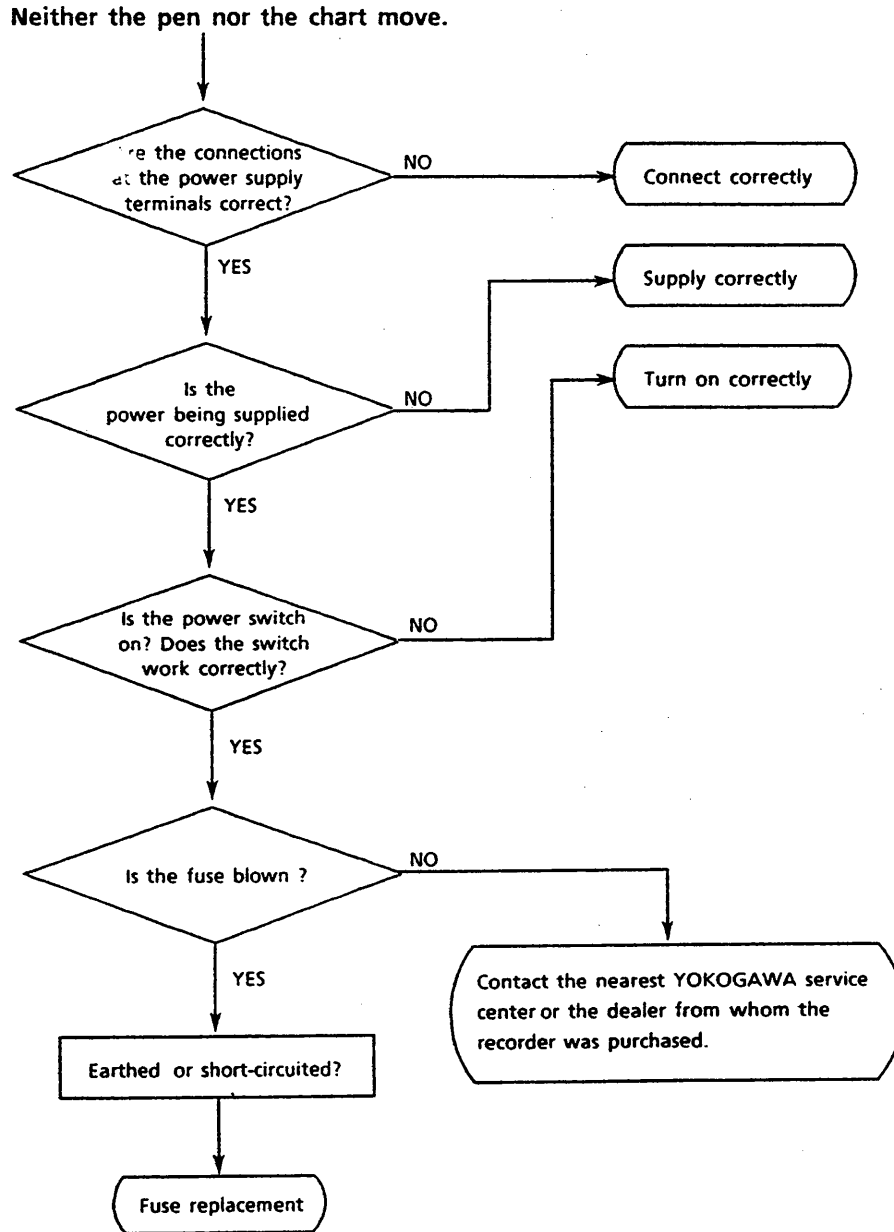
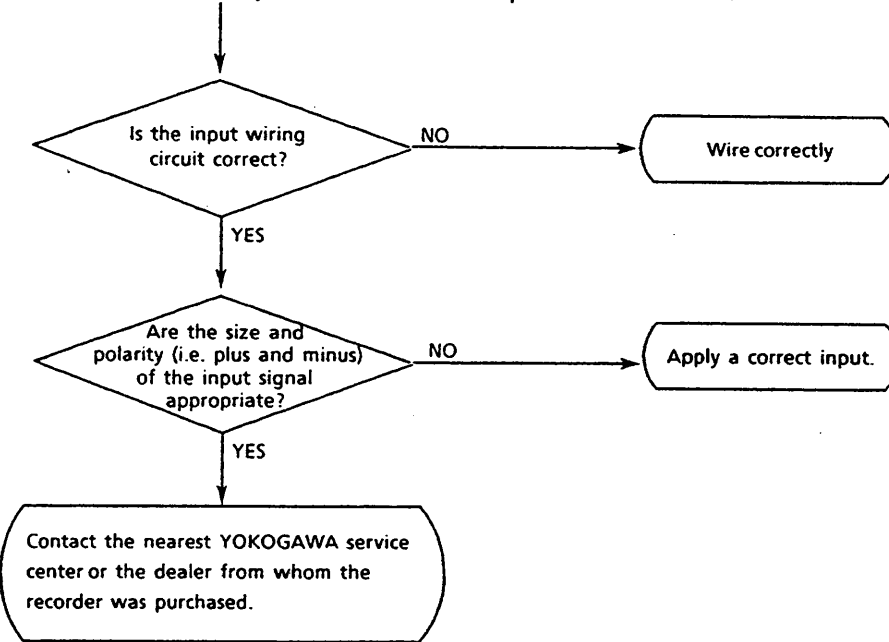


Figure 9.1 Block Diagram for $\mu R100F$ Recorder

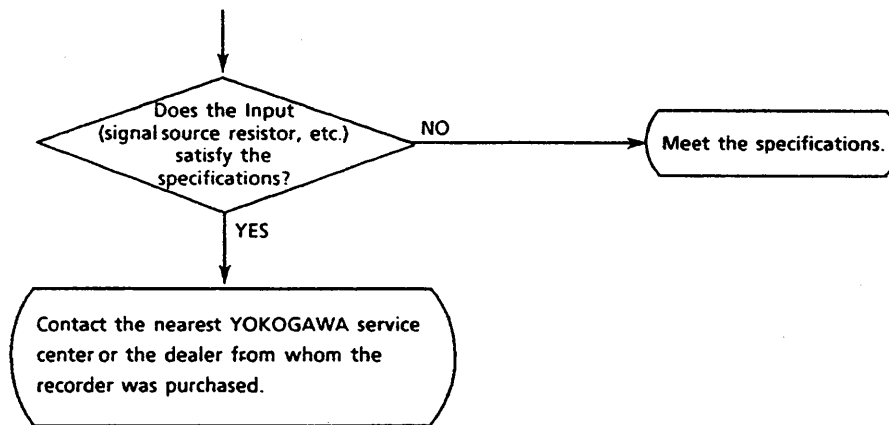
9.2 Troubleshooting Flow Sequence



The pen travels beyond the 0 or 100% point on the chart.



The error is large.



10. SCHEMATIC DIAGRAM

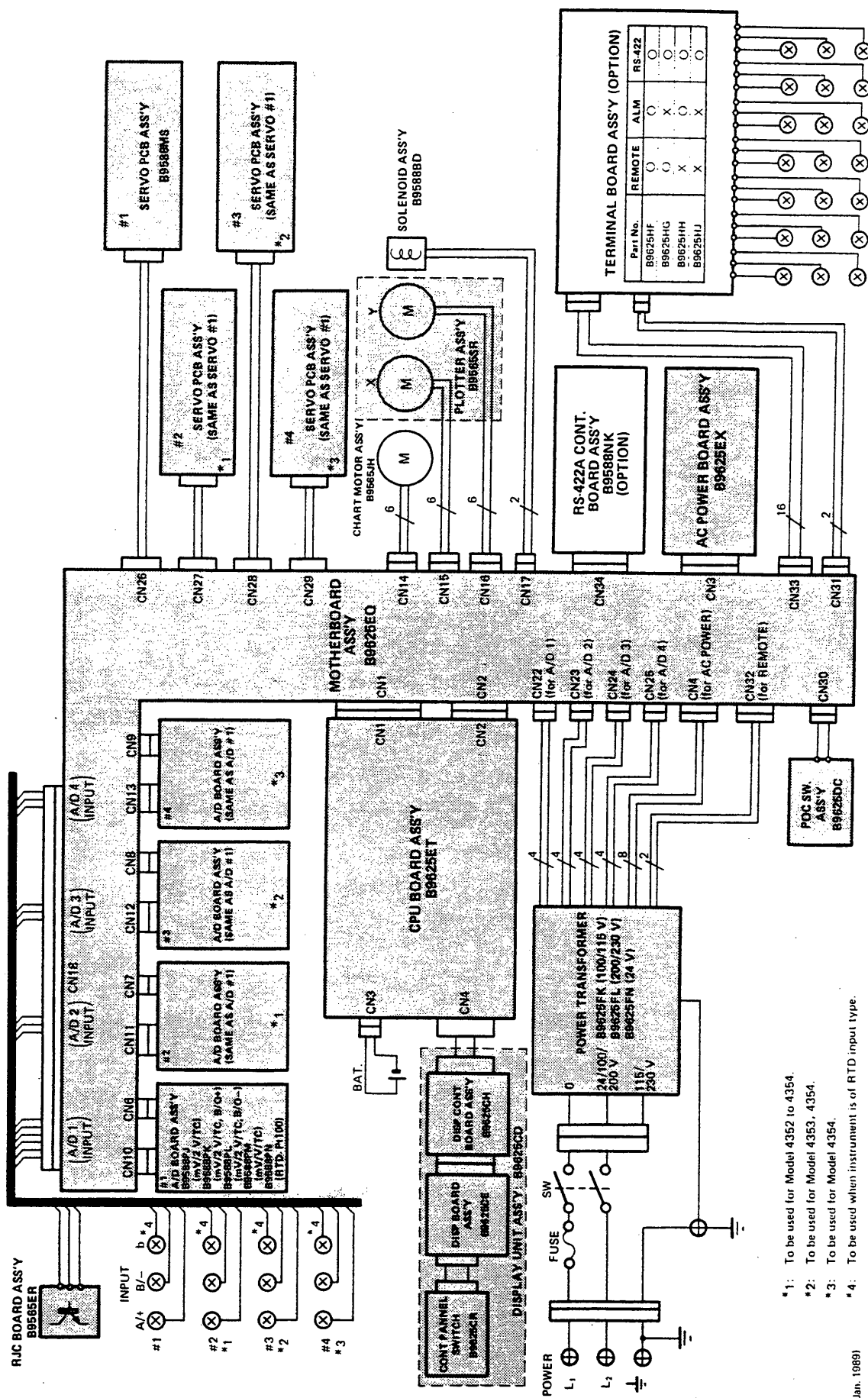


Figure 10.1. μ R100F Micro Pen Recorders Overall Wiring.

APPENDIX INSTALLATION

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2.1 Power Supply and Grounding	Appendix - 2
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1. GENERAL

To ensure performance integrity over an extended period when configuring a measuring system using the μ R100F Recorders, you are requested to give due consideration to installation conditions including location, environmental requirements, and installation method, as detailed below.

For the configuration, outline and functions of the μ R100F Recorders, refer to the relevant manuals.

2. NOISE COUNTERMEASURES

Noise should be minimized as it affects the instruments and may cause malfunctions. Installation should be such that wiring is not affected by noise. Noise countermeasures should be taken in accordance with the following precautions.

2.1 Power Supply and Grounding

The power supply should be free from noise. If the power line generates a high level of high-frequency noise, an isolation transformer should always be installed and a power supply filter inserted as necessary.

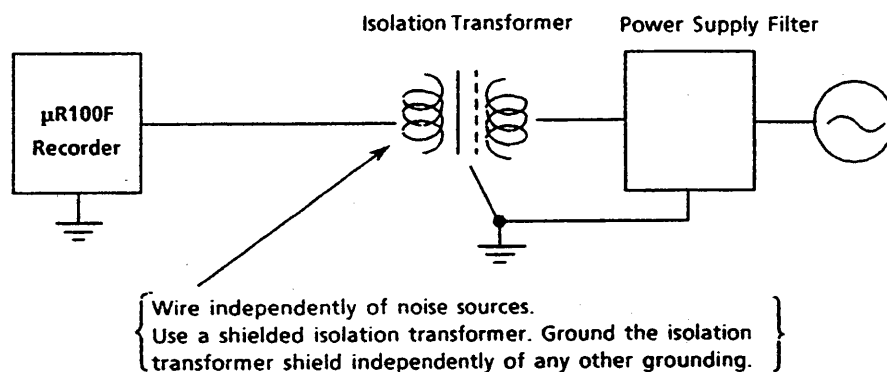


Figure 2.1 Power Supply and Grounding

The quality of the grounding work has a great bearing on noise suppression. The equipment, cable shields, and enclosures should be grounded completely as instructed in Section 3.2 "Grounding." Noise suppression can also be improved substantially if the signal cables are arranged correctly. For details, refer to Section 3.5 "Cabling Requirements."

2.2 Transceiver

When transceivers are used in the control room, observe the following precautions.

- (1) Never use the transceivers in the proximity of any instrument or within any panel.
- (2) The use of the transceiver is limited as follows:
(Recommendations by the Working Group for Radio Frequency Interference of the Japan Electric Measuring Instruments Manufacturers' Association, 1975)
 - The antenna of the transceiver should be set at least 1 m away from the instrument or the wiring of the instrument.
 - Use the transceiver in front of the instrument panel, and not at the back of or within the panel.
 - Do not use the transceiver with the chassis or door of the instrument open.
 - The output of the transceiver should be limited to 1 W or less.
 - The transceiver frequency should be in the 27 MHz band.

2.3 Noise from Relays

To prevent noise and protect contacts, be sure to attach a surge absorber across every relay coil, solenoid, or the like. (Refer to Section 3.4 (2) "Precautions on the Use of Relays.")

2.4 Other Noise Sources

If μ R100F Recorders are installed near motors, SCRs for phase control, or welding machines, attach C-R filters or varistors to suppress noise. (If varistors are faulty, their circuits are short-circuited. So take special considerations about varistor circuits.)

3. WIRING

3.1 Power Wiring

- (1) The power circuit from the power supply unit should be arranged so as not to induce noise in nearby signal cables and also not to be affected by other high-current circuits. It is, therefore, important to provide ample clearances between these circuits and to lay the power circuits and other high-current circuits in respective metal conduits. Where metal conduit work is difficult, use shielded cables.
- (2) Where the signal cables run parallel to or cross over the power cables, both the signal and power cables should be shielded, and should be installed with a minimum clearance of 15 cm, or separated electrostatically and electromagnetically with a grounded metal partition.
- (3) If a 3-phase power supply is used, connect a load to each phase so that the three-phase circuit is almost balanced under load. When one of the three-phase power cables is grounded, use the grounded cable.

3.2 Grounding

The purpose of grounding is to keep the potential of the equipment at the same level as the ground not only to protect the human body from electric shocks, but also to stabilize the circuit potential for stable system operations. Any noise that has invaded the system is drained through a low impedance grounding circuit into the ground, and is prevented from affecting the system's control and signal circuits. To eliminate mutual interference, it is desirable to install an independent grounding circuit for each system component. There are the following exceptions, however, and the best practical grounding methods should be used.

- (1) When circumstances do not permit grounding at more than one point or by more than one grounding wire, a system illustrated in Figure 3.1 may be recommended. In this case, the grounding resistance must be sufficiently reduced (about 10 ohms), and a low-resistance conductor (about 22 mm²) must be used, to minimize common impedance.
- (2) With reference to the standard grounding system, if the distance between the grounding electrodes is great and if the ground current is large, the resultant potential difference between the grounding electrodes may cause problems. If such is the case, it is recommended that the grounding method specified in item (1) above be used.

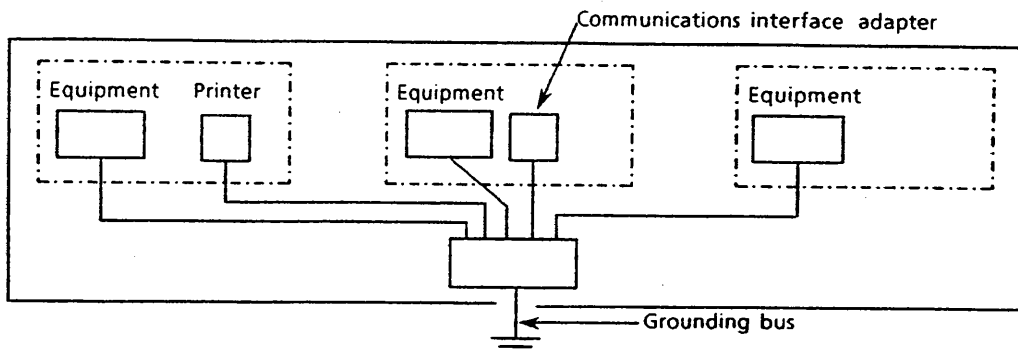


Figure 3.1 Simplified Method of System Grounding
(Where a number of panels are installed within the same room)

- (3) The grounding wires of instruments which require independent grounding should not be interconnected.
- (4) The panel grounding should not be used in common by noise-producing and noiseless instruments to protect the noiseless instruments from noise Interference.
- (5) The grounding of the shields of the signal cables extended from the field equipment should be made in accordance with the following principles :
 - a) Where the signal source is grounded, that end of the cable shield which is closer to the signal source should be grounded.

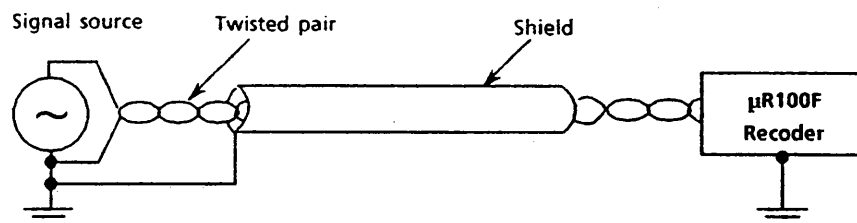


Figure 3.2

- b) Where the signal source is not grounded, that end of the cable shield which is closer to the connected equipment should be grounded.

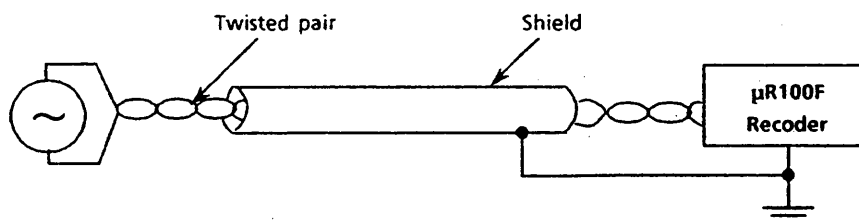


Figure 3.3

In this case, observe the following precaution.

Ground the field signal cable shields in one group independent of other grounding circuits.

3.3 Input Signal

- (1) Use individual cables for analog and digital signals.
- (2) Separate the power signal cables. Do not run those cables in parallel.
- (3) Use a twisted pair of wires for the analog signal whenever possible. It is recommended that twisting pitch be 50 mm or less. For shield grounding, follow the instructions in Section 3.2 (5).

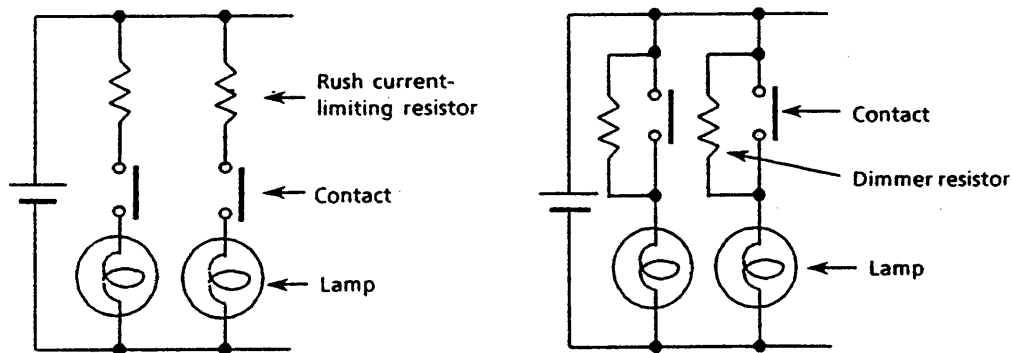
3.4 Alarm Wiring

(1) Precautions on the Use of Lamps

The lamp rating should be determined in accordance with the following points when the lamps are lit by using system equipment contacts.

(see Figure 3.4)

- The rated voltage of the lamp must not exceed the rated voltage of the contact used.
- Usually, the rush current of the incandescent lamp is 10 to 15 times as much as its rated current.
- In case the rush current exceeds the rated current of the contact, use a dimmer resistor or a rush current-limiting resistor in series with the contact circuits. Be sure that the rush current does not exceed the contact rated current, even when these resistors are installed.
- The dimmer resistor should be selected so that it will limit the lamp current to 40 to 50% of the rated lamp current. When the dimmer resistor is used, it may also be used for checking lamp failure.
- An appropriate rush current-limiting resistor should be selected to limit the lamp rush current to 80 to 90% of the rated lamp current.
- The instructions above are given only for reference. For (determination of the lamps) and resistors, conduct a verification test to see whether the lamp circuit fulfills the above requirements.



Note : Observe the lamps are lit.

Note : Observe that lamps are lit with the dimmer resistor connected in series.

Figure 3.4 Precautions on the Use of Lamps

(2) Precautions on the Use of Relays

When driving the relays and solenoids by making use of the contacts of the system instruments, observe the following: (see Figure 3.5)

<For DC Relay>

To suppress noise and to protect the contacts, be sure to connect a diode directly to the relay coil or solenoid coil.

- Use a relay or solenoid circuit rated at as low a voltage as possible for the purpose of increasing the operating reliability.
- The diode rating should match the relay or solenoid rating.

It is common practice to select a diode whose rated rectified current is three times or more the current flowing the relay coil or solenoid coil.

Its withstand reverse voltage should be three times or more the rated voltage of the coil.

Note: The relay and solenoid coils are inductive loads which generate the counter-electromotive force across them. This phenomenon damages contacts and generates noise, causing malfunctions of equipment and of the entire system.

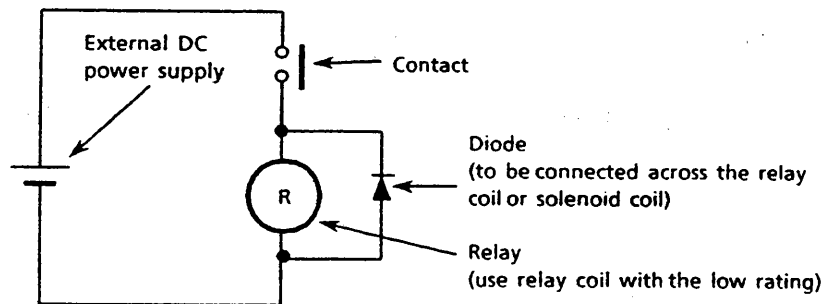


Figure 3.5 Precautions on the Use of DC Relays and Solenoids

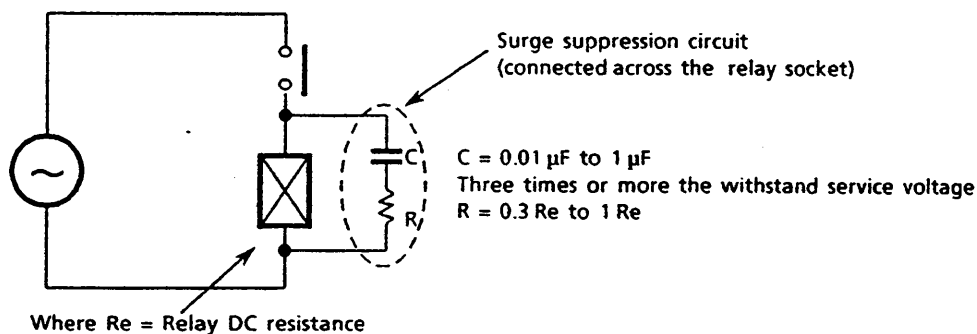
<For AC Relay>

Figure 3.6 Precautions on the Use of AC Relays

When the relay contact signals are supplied to the instrument, connect the same surge suppression circuits on the relays as shown above. Otherwise, the counter-electromotive force generated in the relay coil will interface with the contact circuits, causing erroneous operation in the instrument to which the contact signal is supplied.

3.5 Cabling Requirements

The installation of signal cables and equipment power cables should satisfy the following conditions.

- (1) Condition 1: Install a separator as illustrated in Figure 3.7.
- (2) Condition 2: Provide a clearance between signal and power cables by making use of a cable rack as illustrated in Figure 3.8.

Note: If power cables operating at a voltage of up to 220V and a current of 10A or more are not shielded, their clearance between the power and signal cables should be at least 60 cm.

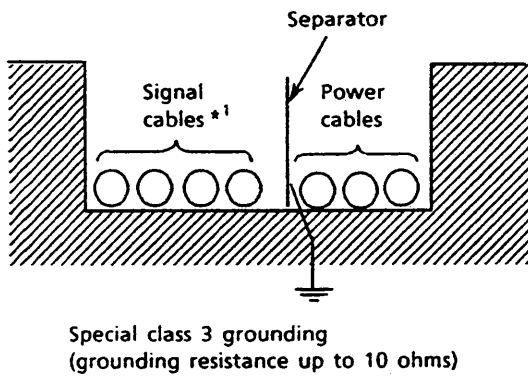


Figure 3.7 Separator in Duct and Pit

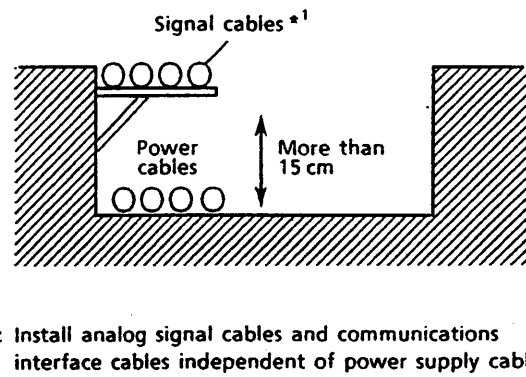


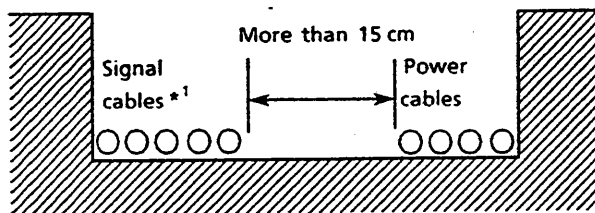
Figure 3.8 Cable Rack and Pit

- (3) Condition 3: Provide a clearance of at least 15 cm between signal and power cables as illustrated in Figure 3.9.

Note: If power cables operating at a voltage of up to 220V and a current of 10A or more are not shielded, their clearance between the power and signal cables should be at least 60 cm.

- (4) Condition 4: Cross the signal and power cables as illustrated in Figure 3.10.

Note: If unshielded cables are used, it is desirable to set an iron sheet of at least 1.6 mm thickness between the power and signal cables as indicated by the dotted line in Figure 3.10.



*1: Install the analog signal cables and communications interface cables independent of the power cables.

Figure 3.9 Clearance between Signal and Power Cables

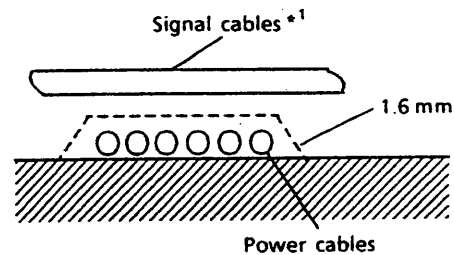


Figure 3.10 Right-angled Intersection between Power and Signal

3.6 Others

- (1) Avoid parallel connection with controllers. If a voltage or thermocouple input is applied to a μ R100F Recorder that is connected parallel to a controller, operation of the controller is affected when:

Power switch is turned ON and OFF.

- (2) Do not connect a μ R100F recorder, with a burnout features, parallel with other measuring instrument with burnout features. Otherwise, erroneous operations occur in burnout conditions.

- (3) Line frequency

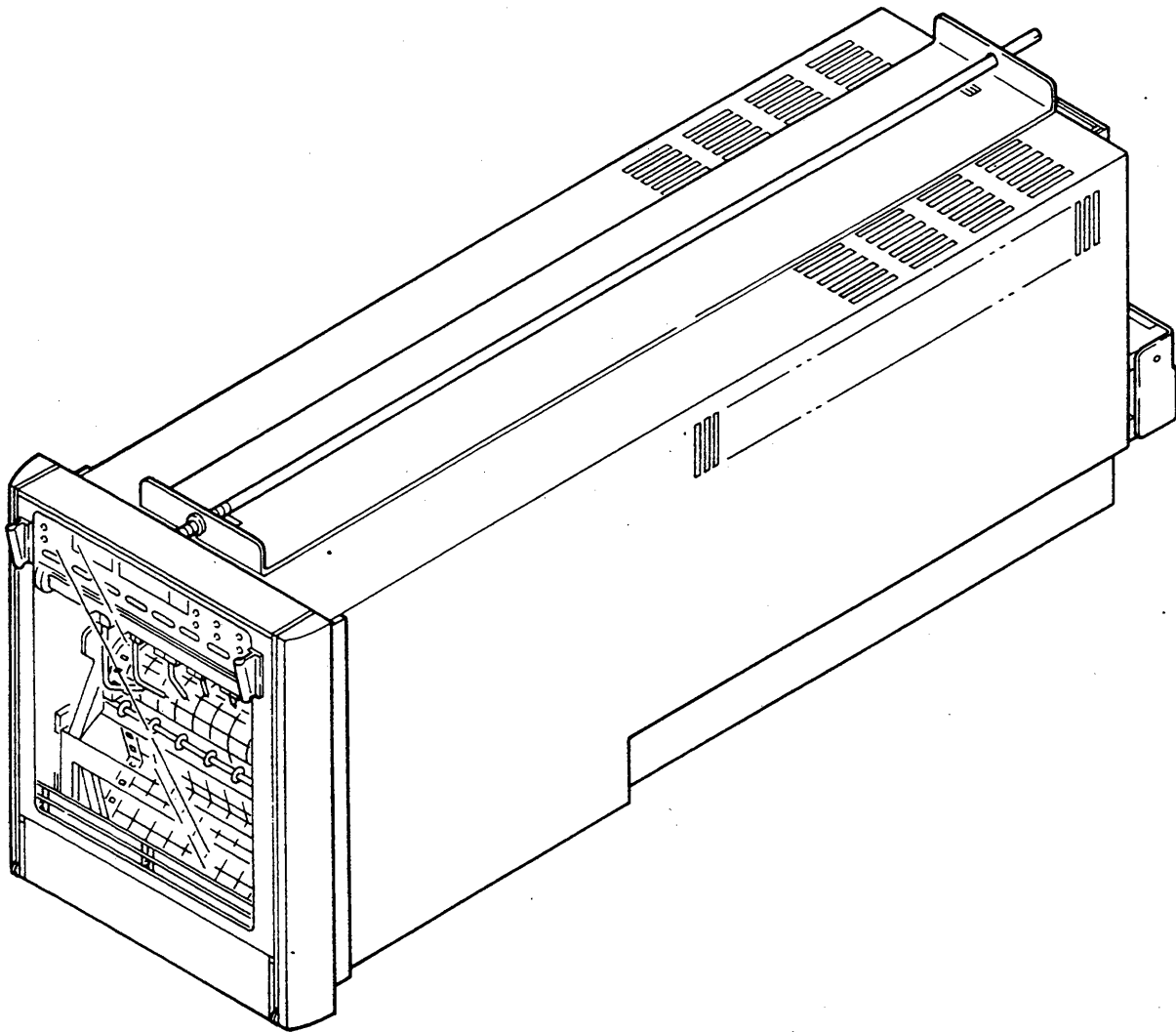
Set the line frequency in the installation location for the μ R100F recorder. See an appropriate μ R100F Recorder Instruction Manual for more detailed instructions.

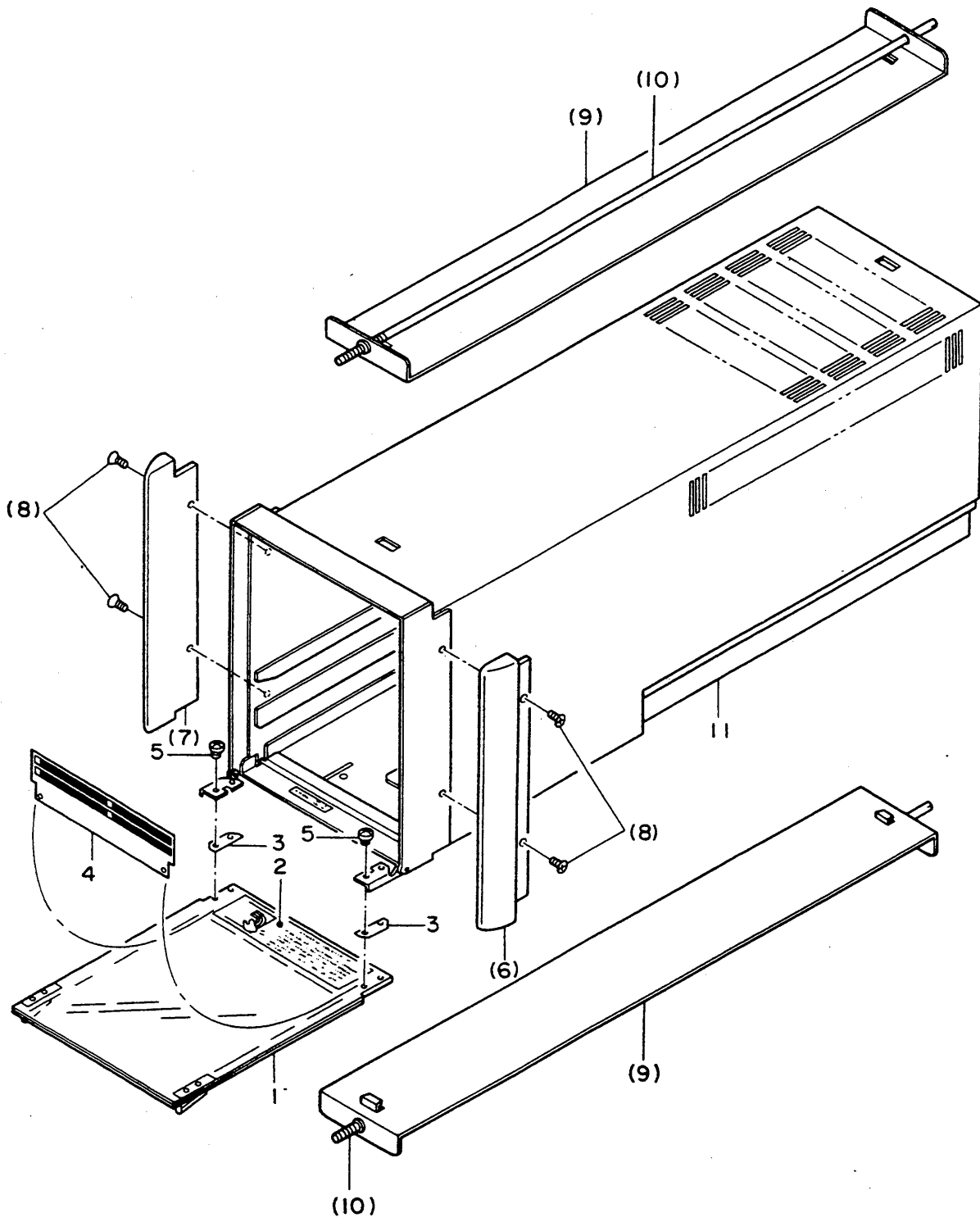
Line frequencies for μ R100F Recorders are adjusted at the factory before shipment. Recorder data items are printed on the instrument nameplate. When you change the line frequency, change the instrument nameplate.

**Customer
Maintenance
Parts List**

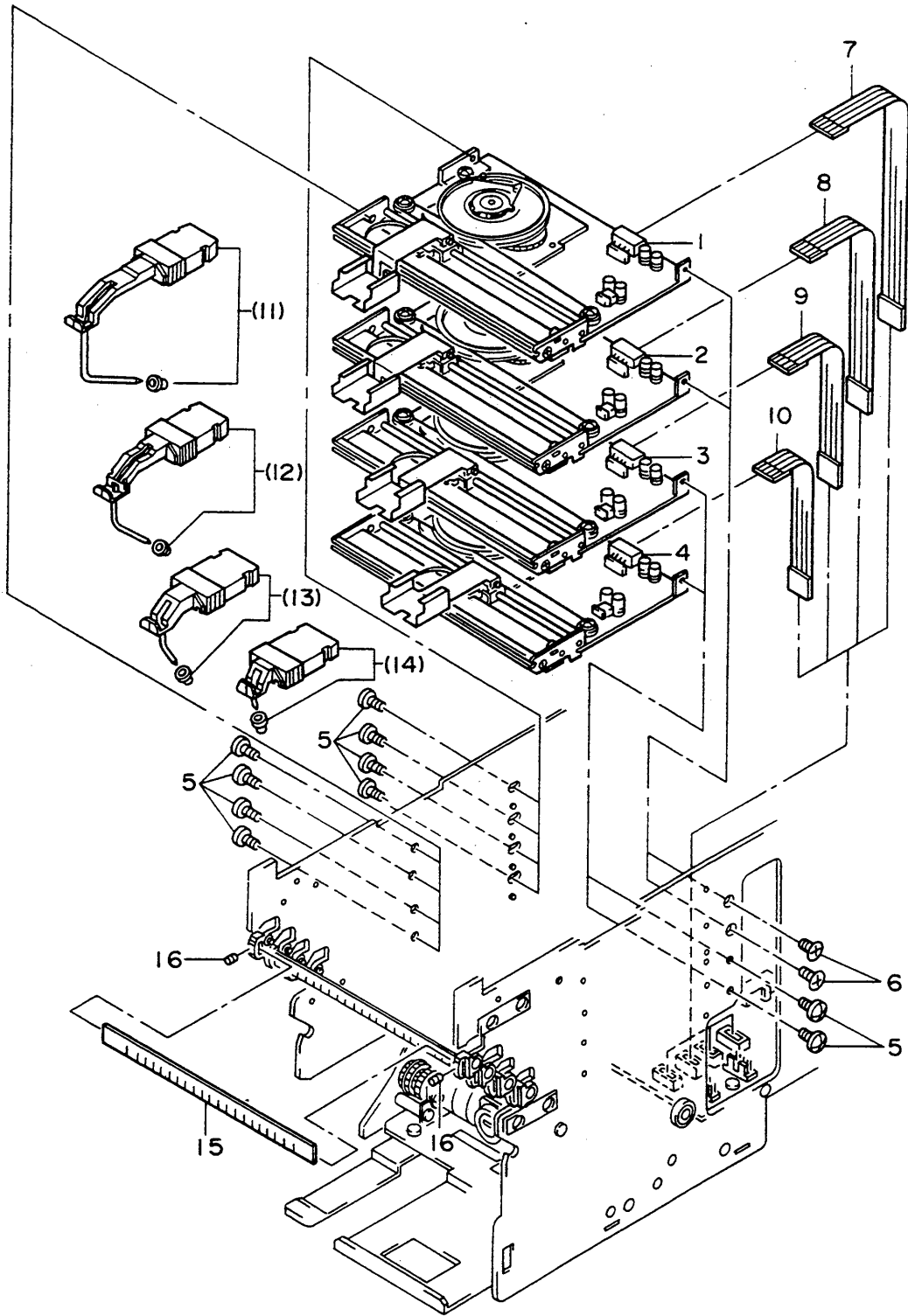
Model 4351
Model 4352
Model 4353
Model 4354
 μ R100F Recorders

μ R100F



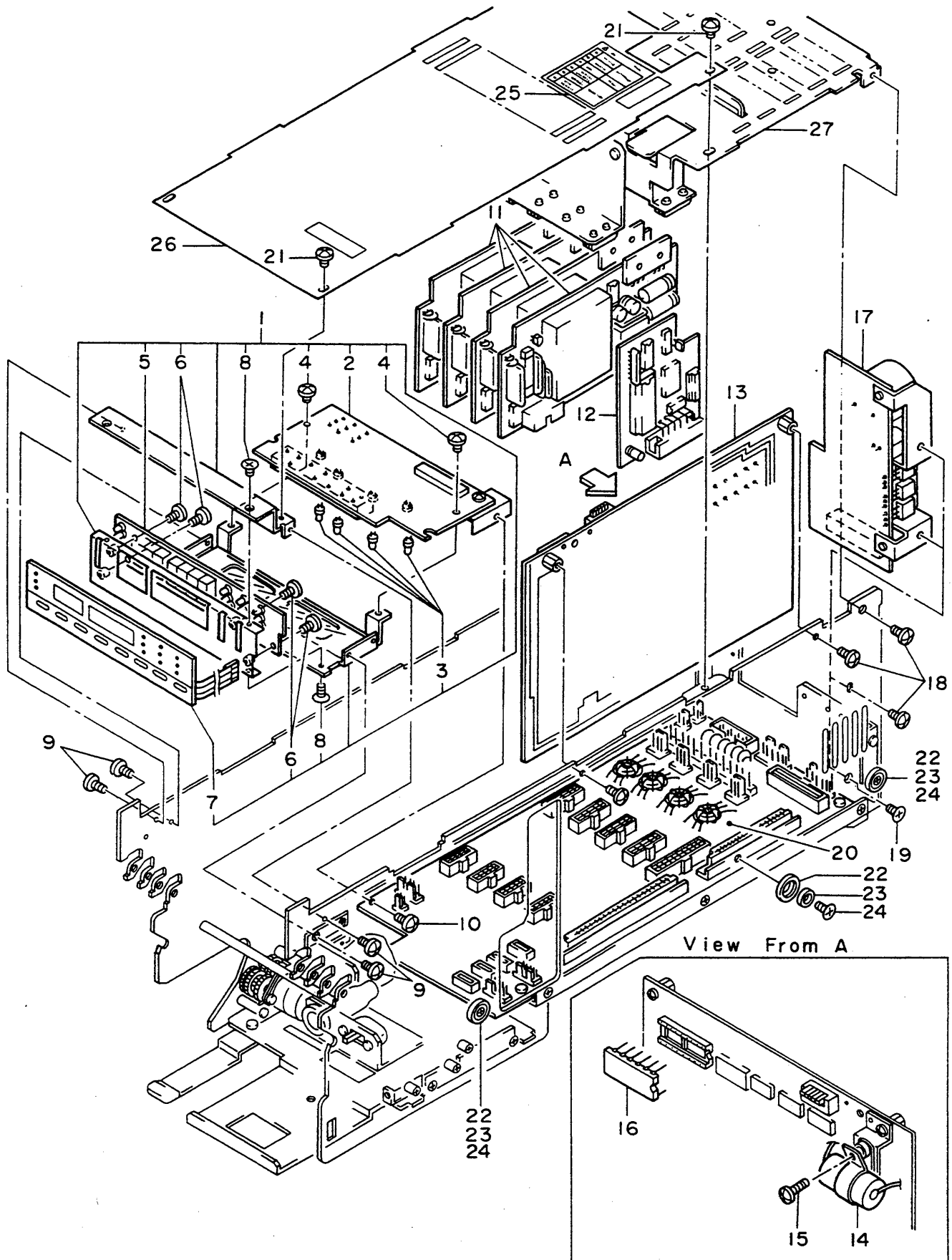


Item	Part No.	Model	Qty				Description
			4351	4352	4353	4354	
1	B9625AF		1	1	1	1	Door Assembly
2	B9625AE		1	1	1	1	Nameplate (for japanese)
	B9625AJ		1	1	1	1	Nameplate (for english) } (Select either one)
3	-		2	2	2	2	Sheet
4	B9625LF		1				Tag No. Sheet
	B9625LG			1			Tag No. Sheet
	B9625LH				1		Tag No. Sheet
	B9625AC					1	Tag No. Sheet
5	Y9204KE		4	4	4	4	B.H. Screw, M2.3x4
(6)	B9625KB		1	1	1	1	Frame (right side)
(7)	B9625KA		1	1	1	1	Frame (left side)
(8)	Y9306ES		4	4	4	4	F.H. Screw, M3x6
(9)	E9710CN		2	2	2	2	Bracket } (accessory)
(10)	E9710CP		2	2	2	2	Shaft
11	-		1	1	1	1	Case Assembly



Item	Part No.	Model	Qty				Description
			4351	4352	4353	4354	
1	B9625EL	1	1	1	1	1	Servo Assembly (for 1st pen)
2	B9588JA	1	1	1	1	1	Servo Assembly (for 2nd pen)
3	B9588JB	1	1	1	1	1	Servo Assembly (for 3rd pen)
4	B9588JC	1	1	1	1	1	Servo Assembly (for 4th pen)
5	B9565AY	2	4	7	10		Screw
6	Y9304EE	1	2	2	2		F.H. Screw, M3x4
7	B9625ZC	1	1	1	1		Wire (1st pen servo → mother board)
8	B9625ZD	1	1	1	1		Wire (2nd pen servo → mother board)
9	B9588DZ	1	1	1	1		Wire (3rd pen servo → mother board)
10	B9588DZ	1	1	1	1		Wire (4th pen servo → mother board)
(11)	-	1	1	1	1		Pen Assembly (1st pen)
(12)	-	1	1	1	1		Pen Assembly (2nd pen)
(13)	-	1	1	1	1		Pen Assembly (3rd pen)
(14)	-	1	1	1	1		Pen Assembly (4th pen)
15	B9588DC	1	2	3	4		Scale Assembly
16	B9588DH	2	4	6	8		Setscrew

} (accessory)



Item	Part No.	Qty				Description
		Model	4351	4352	4353		4354
1	B9625CD	1	1	1	1	Display Unit Assembly
2	B9625CH	1	1	1	1	Display Cont. Board Assembly
3	B9625CM	4	4	4	4	Lamp
4	Y9304LB	2	2	2	2	B.H. Screw, M3x4
5	B9625CE	1	1	1	1	Display Board Assembly
6	Y9203KB	4	4	4	4	B.H. Screw, M2.3x3
7	B9625CR	1	1	1	1	Cont. Panel Switch
8	B9625GV	4	4	4	4	F.H. Screw, M1.7x3
9	Y9204KE	6	6	6	6	B.H. Screw, M2.3x4
10	B9565AY	1	1	1	1	Screw
11	B9588PM	1	2	3	4	A/D Board Assembly *1
	B9588PN	1	2	3	4	A/D Board Assembly *2
	B9625JL	1	2	3	4	A/D Board Assembly *1-3
	B9625JM	1	1	1	1	A/D Board Assembly *1-4
12	B9588NK	1	1	1	1	RS422A Board Assembly *5
13	B9625ET	1	1	1	1	CPU Board Assembly
14	B9588ZB	1	1	1	1	Battery
15	Y9308LB	1	1	1	1	B.H. Screw, M3x8
16	B9625YA	1	1	1	1	ROM Assembly
17	B9625EX	1	1	1	1	Power Board Assembly
18	B9565AY	5	5	5	5	Screw
19	Y9304EE	1	1	1	1	F.H. Screw, M3x4
20	B9625EQ	1	1	1	1	Mother Board
21	B9565AY	4	4	4	4	Screw
22	B9625GJ	6	6	6	6	Roller
23	B9625GH	6	6	6	6	Shaft
24	Y9306ES	6	6	6	6	F.H. Screw, M3x6
25	-	1	1	1	1	Nameplate (for Japanese)
	-	1	1	1	1	Nameplate (for English)
26	-	1	1	1	1	Plate
27	-	1	1	1	1	Bracket Assembly

(select)

(left side 3
right side 3)

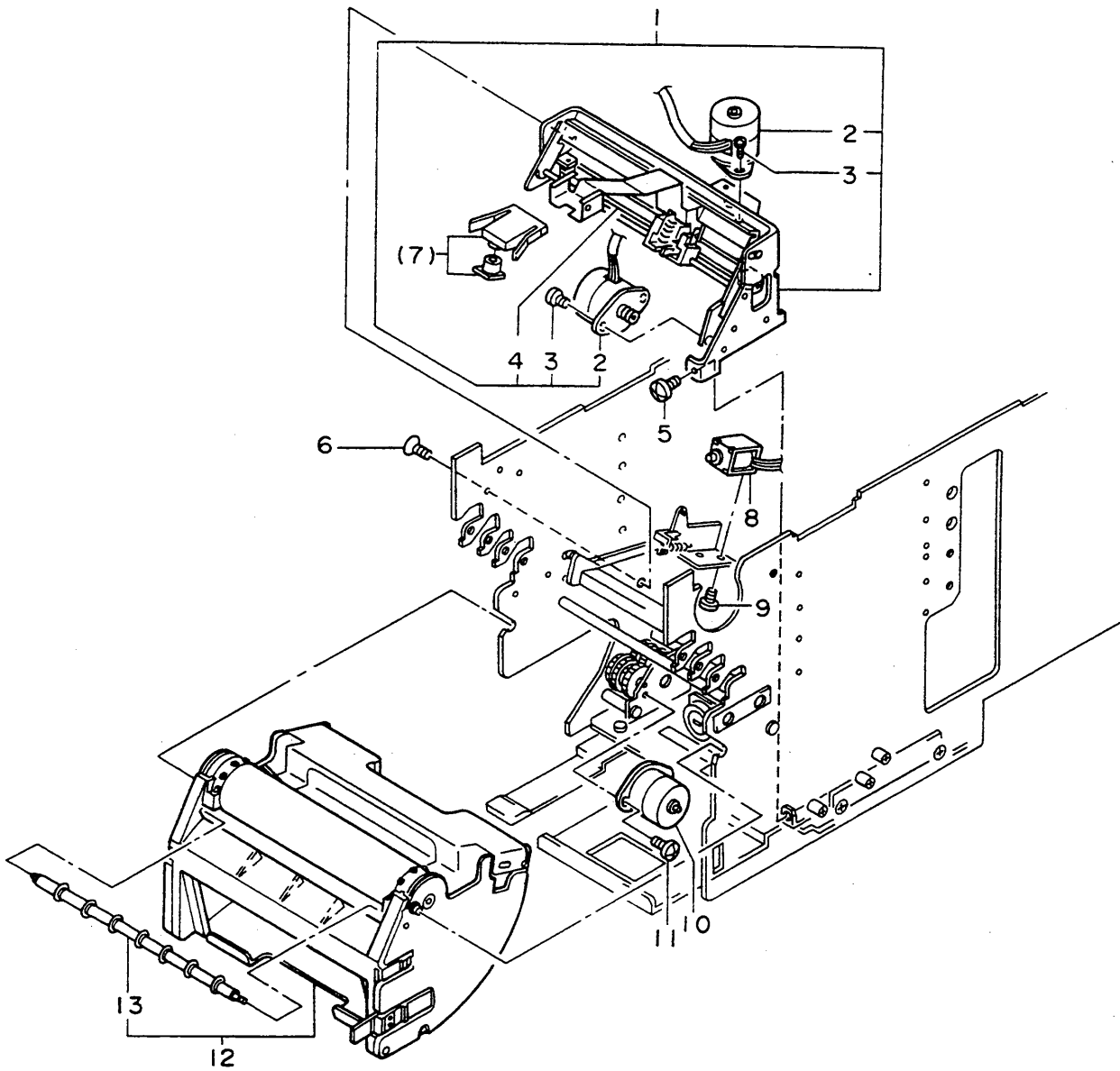
Note 1:

Input Type	Range Code	Measuring Range	
DC V	00	-20.00 to 20.00 mV	
	01	-200.0 to 200.0 mV	
	02	-2.000 to 2.000V	
	03	-6.000 to 6.000 V	
	04	-20.00 to 20.00 V	
	05	-50.00 to 50.00 V	
DC V (Linear scaling)	30	-20.00 to 20.00 mV	
	31	-200.0 to 200.0 mV	
	32	-2.000 to 2.000 V	
	33	-6.000 to 6.000 V	
	34	-20.00 to 20.00 V	
	35	-50.00 to 50.00 V	
DC V (Square root scaling)	40	-20.00 to 20.00 mV	
	41	-200.0 to 200.0 mV	
	42	-2.000 to 2.000 V	
	43	-6.000 to 6.000 V	
	44	-20.00 to 20.00 V	
	45	-50.00 to 50.00 V	
TC	10	R (Pt13Rh-Pt)	0 to 1,760°C 32 to 3,200°F
	11	S (Pt10Rh-Pt)	0 to 1,760°C 32 to 3,200°F
	12	B (Pt30Rh-Pt6Rh)	400 to 1,820°C 752 to 3,308°F
	13	K (NiCr-Ni)	-200 to 1,370°C -328 to 2,498°F
	14	E (NiCr-CuNi)	-200 to 800°C -328 to 1,472°F
	15	J (Fe-CuNi)	-200 to 1,100°C -328 to 2,012°F
	16	T (Cu-CuNi)	-200 to 400°C -328 to 752°F
	17	N (Nicrosil-Nisil)	0 to 1,300°C 32 to 2,372°F
	18	W (W5%Re-W26%Re)	0 to 2,315°C 32 to 4,200°F
	19	L (Fe-CuNi)	-200 to 900°C -328 to 1,652°F
1A	U (Cu-CuNi)	-200 to 400°C -328 to 752°F	
RTD	20	JPt 100-6	-200 to 550°C -328 to 1,022°F
	21	Pt 100-7	-200 to 550°C -328 to 1,022°F

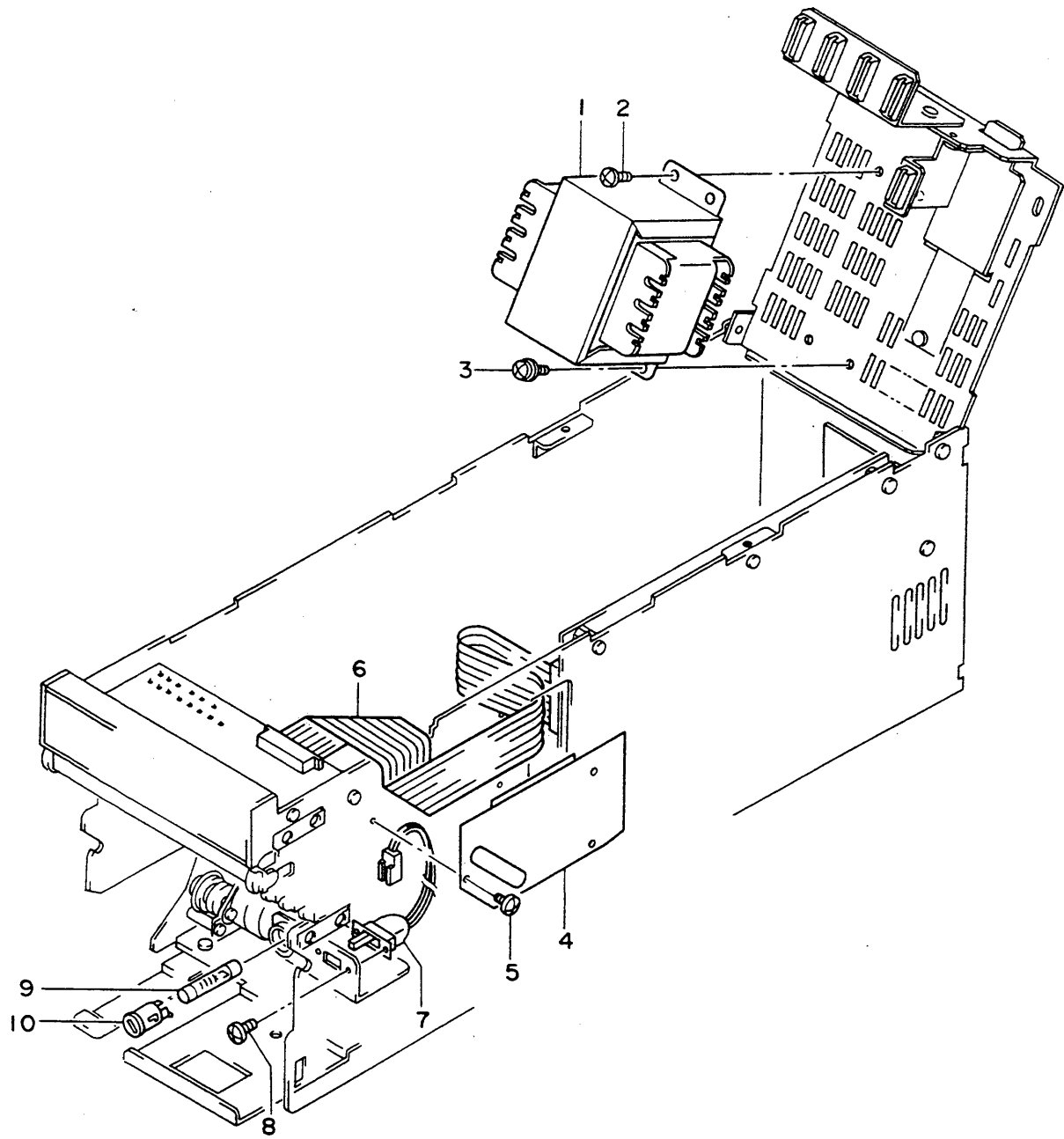
*6: JPt 100: JIS C 1604-1989, JIS C 1606-1989
 *7: Pt 100: JIS C 1604-1989, JIS C 1606-1989
 DIN IEC 751, IEC 751

Note 2:

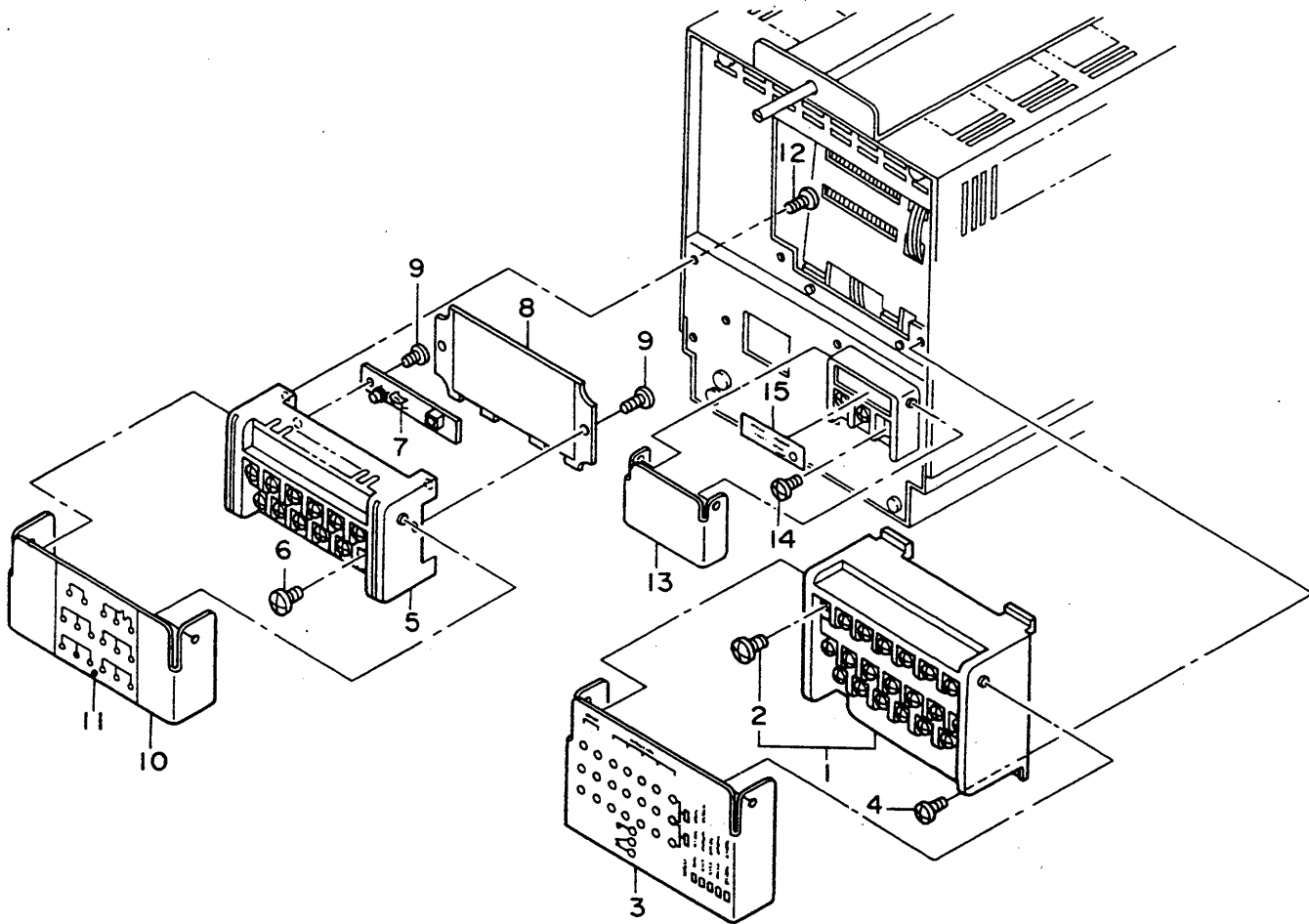
Model Code	Suffix Code (options)	
435□	/BU	*3
	/BD	*4
	/RS422A	*5



Item	Part No.	Qty	Description
1	B9565SR	1	Plotter Assebmly
2	B9565JH	2	Motor Assembly
3	Y9203JB	4	Pan H. Screw, M2.3 x 3
4	B9565TR	1	String Assembly
5	Y9305LE	1	B.H. Screw, M3 x 5
6	Y9304EE	1	F.H. Screw, M3 x 4
(7)	-	1	Pen Assembly (accessory)
8	B9588ZJ	1	Solenoid
9	Y9203JB	2	Pan H. Screw, M2 x 3
10	B9565JH	1	Motor Assembly
11	Y9203JS	2	Pan H. Screw, M2.3 x 3
12	B9625AM	1	Chart Cassette Assembly
13	B9625JC	1	Shat Assembly



Item	Part No.	Qty	Description
1	B9625FK	1	Transformer (100V AC, series)
	B9625FL	1	Transformer (200V AC, series)
			(select either one)
2	Y9406LS	2	B.H. Screw, M4 x 6
3	Y9406LK	2	B.H. Screw, M4 x 6 (with tootheq lockwasher)
4	-	1	Cover
5	Y9203KE	3	B.H. Screw, M2.3 x 3
6	B9590NA	1	Cable (display unit ↔ CPU board)
7	B9625DC	1	POC. Switch Assembly
8	Y9203JS	2	Pan H. Screw, M2 x 3
9	A9049KF	1	Fuse (100V AC, series) (0.5A timelag)
	A9078KF	1	Fuse (200V AC, series) (0.315A timelag)
			(select either one)
10	-	1	Fuse Holder

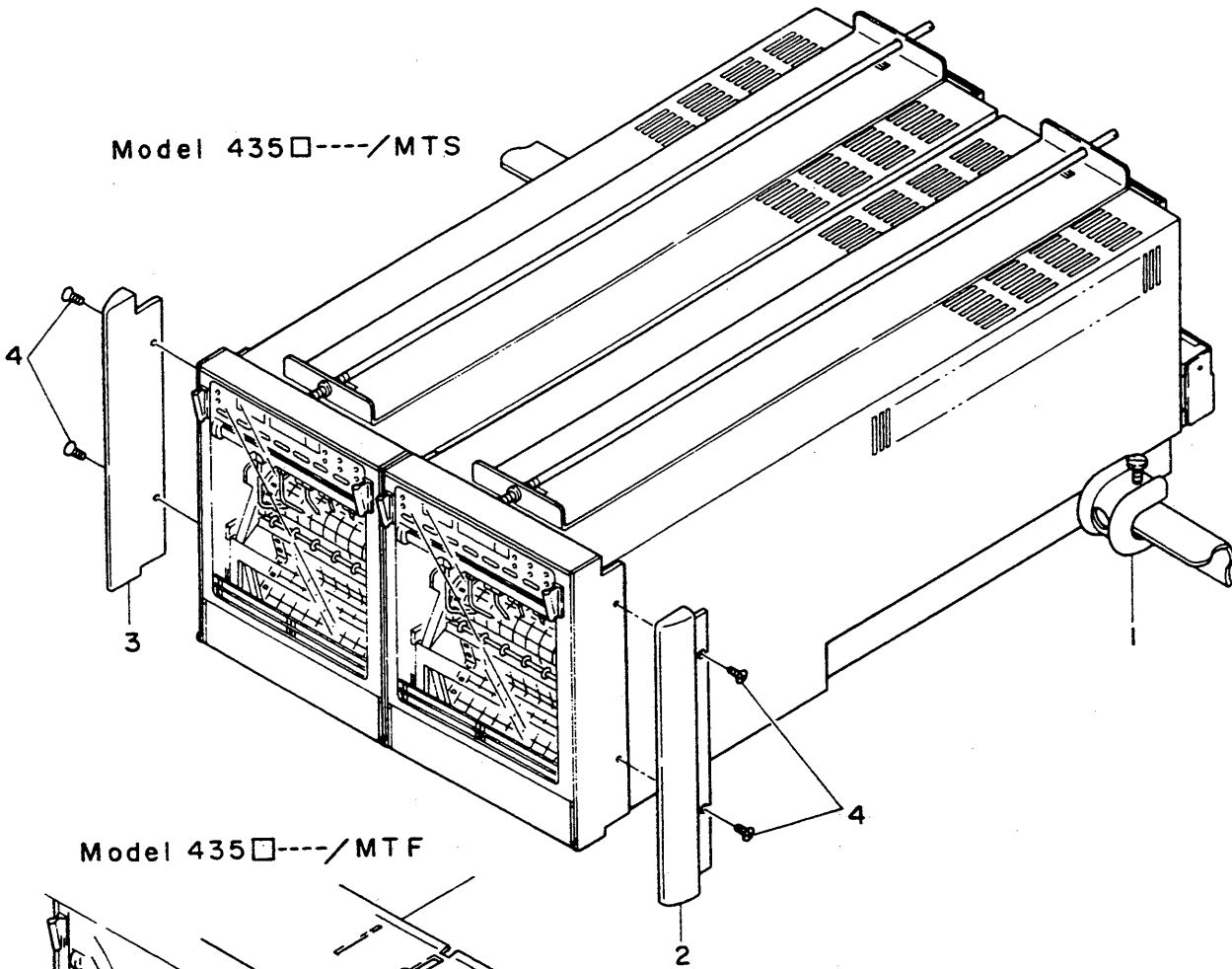


Item	Part No.	Qty	Description
1	B9625HA	1	Terminal Assembly *1
	B9625HB	1	Terminal Assembly *2
	B9625HC	1	Terminal Assembly *3
	B9625HD	1	Terminal Assembly *4
	B9625HW	1	Terminal Assembly *5
	B9625HX	1	Terminal Assembly *6
	B9625HY	1	Terminal Assembly *7
2	B9565AZ	3 to 21	Screw
3	B9625FH	1	Terminal Cover
4	Y9306LE	2	B.H. Screw, M3 x 6
5	-	1	Terminal (for input)
6	B9565AZ	12	Screw
7	B9565ER	1	RJC Board Assembly
8	-	1	Plate
9	Y9310TS	3	Tapping Screw, M3 x 10
10	B9565FP	1	Terminal Cover
11	B9625AX	1	Nameplate
12	Y9310TS	4	Tapping Screw, M3 x 10
13	B9565FK	1	Terminal Cover
14	B9565AZ	3	Screw
15	Below	-	Nameplate
	B9588BP	1	100V AC, 50Hz
	B9588BQ	1	115V AC, 50Hz
	B9588BR	1	200V AC, 50Hz
	B9588BS	1	230V AC, 50Hz
	B9588BP	1	100V AC, 60Hz
	B9588BQ	1	115V AC, 60Hz
	B9588BR	1	200V AC, 60Hz
	B9588BS	1	230V AC, 60Hz

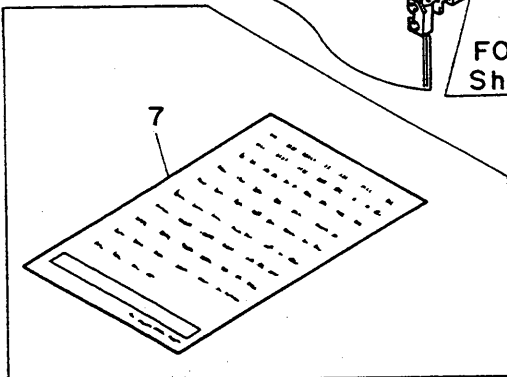
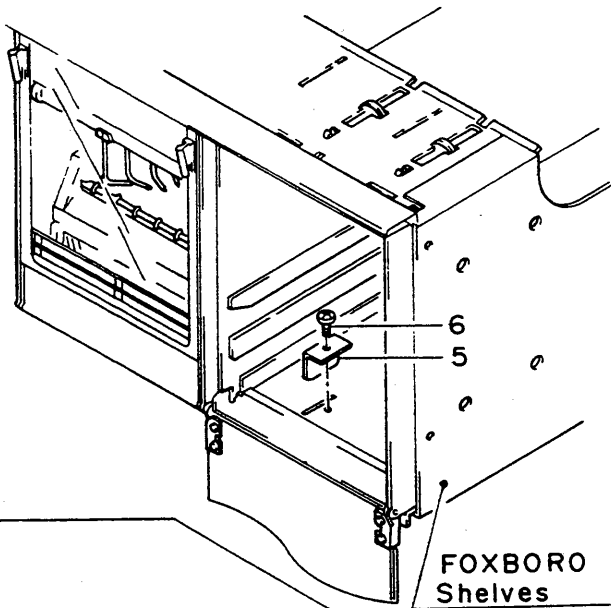
Note:

Model Code	Suffix Code (options)
435□	/AK-04 /REM /RS422A *1
	/REM /RS422A *2
	/AK-04 /RS422A *3
	/RS422A *4
	/AK-04 *5
	/REM *6
	/AK-04 /REM *7

Model 435□----/MTS



Model 435□----/MTF



Item	Part No.	Qty				Description
		Model 4351	4352	4353	4354	
1	E9310DT	1	1	1	1	Vise (2pcs/set)
2	B9625SB	1	1	1	1	Frame •1 } (right side) Frame •2 }
	B9625KE	1	1	1	1	
3	B9625SA	1	1	1	1	Frame •1 } (left side) Frame •2 }
	B9625KD	1	1	1	1	
4	Y9306ES	4	4	4	4	F.H. Screw, M3x6 •1•2
5	B9625KC	1	1	1	1	Stopper Bracket •3
6	Y9304LS	1	1	1	1	B.H. Screw, M3x4•3
7	B9595QB	1	2	3	4	Unit Identification Label •4

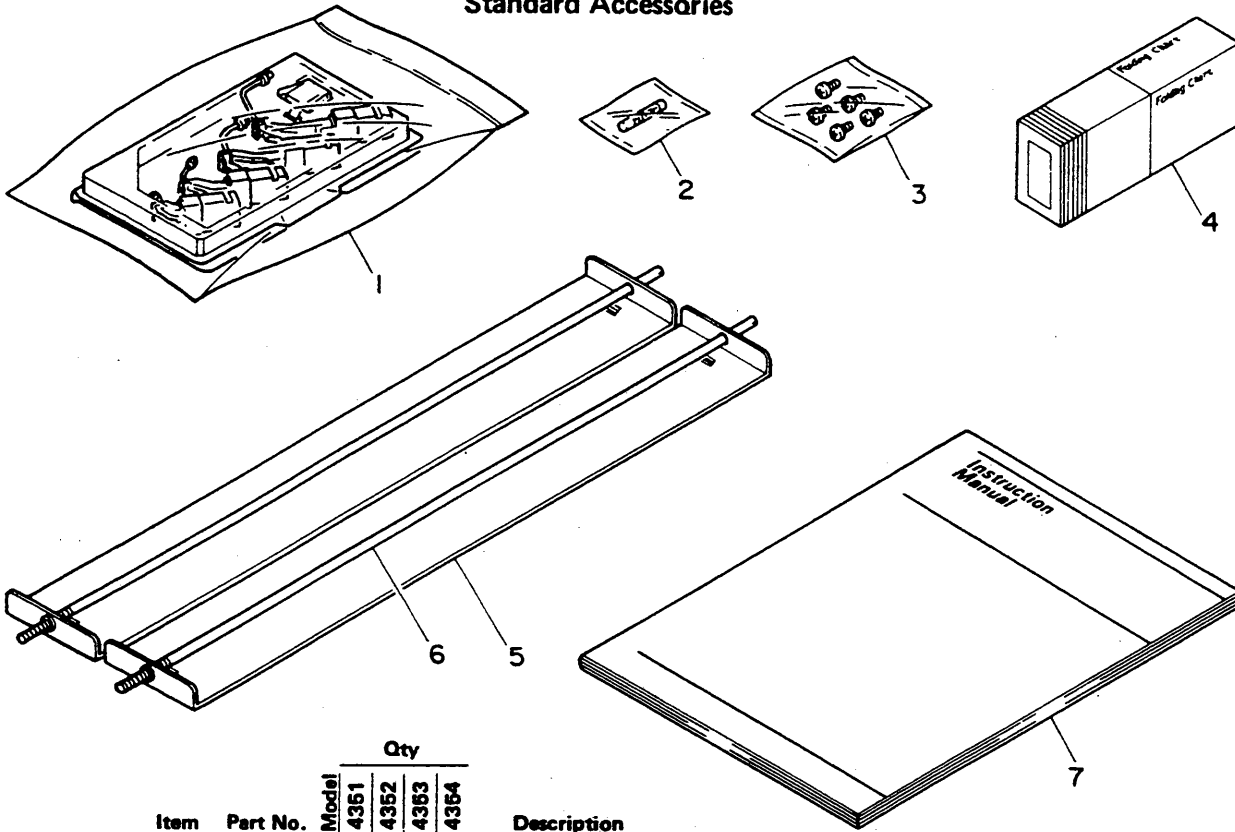
Note 1:

Model Code	Suffix Code (options)	
435□	/MTS	•1
	/MTS /SCF-G2M	•2
	/MTF	•3
	/UNT	•4

Note 2:

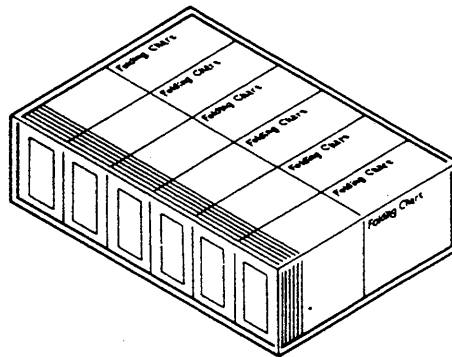
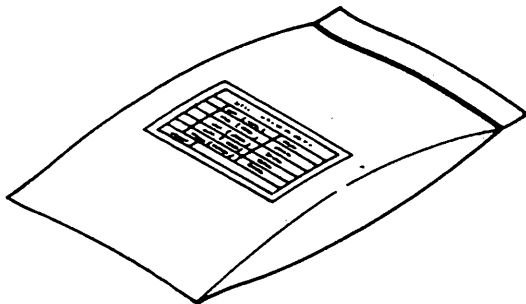
•2: Specify the frame color in color code when ordering.

Standard Accessories



Item	Part No.	Qty				Description
		Model 4361	4362	4363	4364	
1	-	1				Pen Assembly (1st pen and plotter pen) Pen Assembly (1st, 2nd pens and plotter pen) Pen Assembly (1st, 2nd, 3rd pens and plotter pen) Pen Assembly (1st, 2nd, 3rd, 4th pens and plotter pen)
	-		1			
	-			1		
	-				1	
2	A9049KF	1	1	1	1	Fuse (100 V series 0.5A, timelag) Fuse (200 V series 0.315A timelag) } (select either one)
	A9078KF	1	1	1	1	
3	B9565AZ	5	5	5	5	Screw (for input or alarm terminal)
4	-	1	1	1	1	Chart Paper *2
5	E9710CN	2	2	2	2	Bracket
6	E9710CP	2	2	2	2	Shaft
7	-	1	1	1	1	Instruction Manual

Spares



Note
 *1: Pen package is supplied in packs of 3 pcs order part number see below. One pack is the minimum order quantity.

Part No.	Qty	Description
B9625AY	3	1st Pen (violet)
B9588KG	3	2nd Pen (red)
B9588KH	3	3rd Pen (green)
B9588KJ	3	4th Pen (blue)
B9565AS	3	Plotter Pen (purple)

*2: Part number: B9565AW
 Minimum order quantity: 6 units (1 chart/unit)