OM501, OM502 and OM503

Multi-trend and Data Logger

OMEGA®

An OMEGA Technologies Company

Operator's Manual
M454/0689

WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **25 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **two (2) year product warranty** to cover handling and shipping time. This ensures that our customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. Our Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

There are no warranties except as stated herein. There are no other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and of fitness for a particular purpose. OMEGA ENGINEERING, INC. is not responsible for any damages or losses caused to other equipment, whether direct, indirect, incidental, special or consequential, which the purchaser may experience as a result of the installation or use of the product. The buyer's sole remedy for any breach of this agreement by OMEGA ENGINEERING, INC. or any breach of any Warranty by OMEGA ENGINEERING, INC. shall not exceed the purchase price paid by the purchaser to OMEGA ENGINEERING, INC. for the unit or units or equipment directly affected by such breach.

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

RETURN REQUESTS / INQUIRIES

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

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

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

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

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

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

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

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CONTENTS

1. HANDLING CAUTIONS.

The OMEGA® OM-500 Portable Recorder is thoroughly factory-tested before shipment. When the recorder is delivered, check its appearance and operation to confirm that no damage occurred to it during transit. Immediately report any damage to the shipping agent. If there are any questions about the shipment, please call OMEGA Customer Service Department at (203) 359-1660.

(1) Take off the sealing tape from the front door.

(2) Remove the gasket.

(3) Remove Shipping Lock Screws.

Before using the recorder, use a screw driver to remove shipping lock screws which safeguard the internal assembly from damage during transit. Be sure to replace these screws again before shipping.

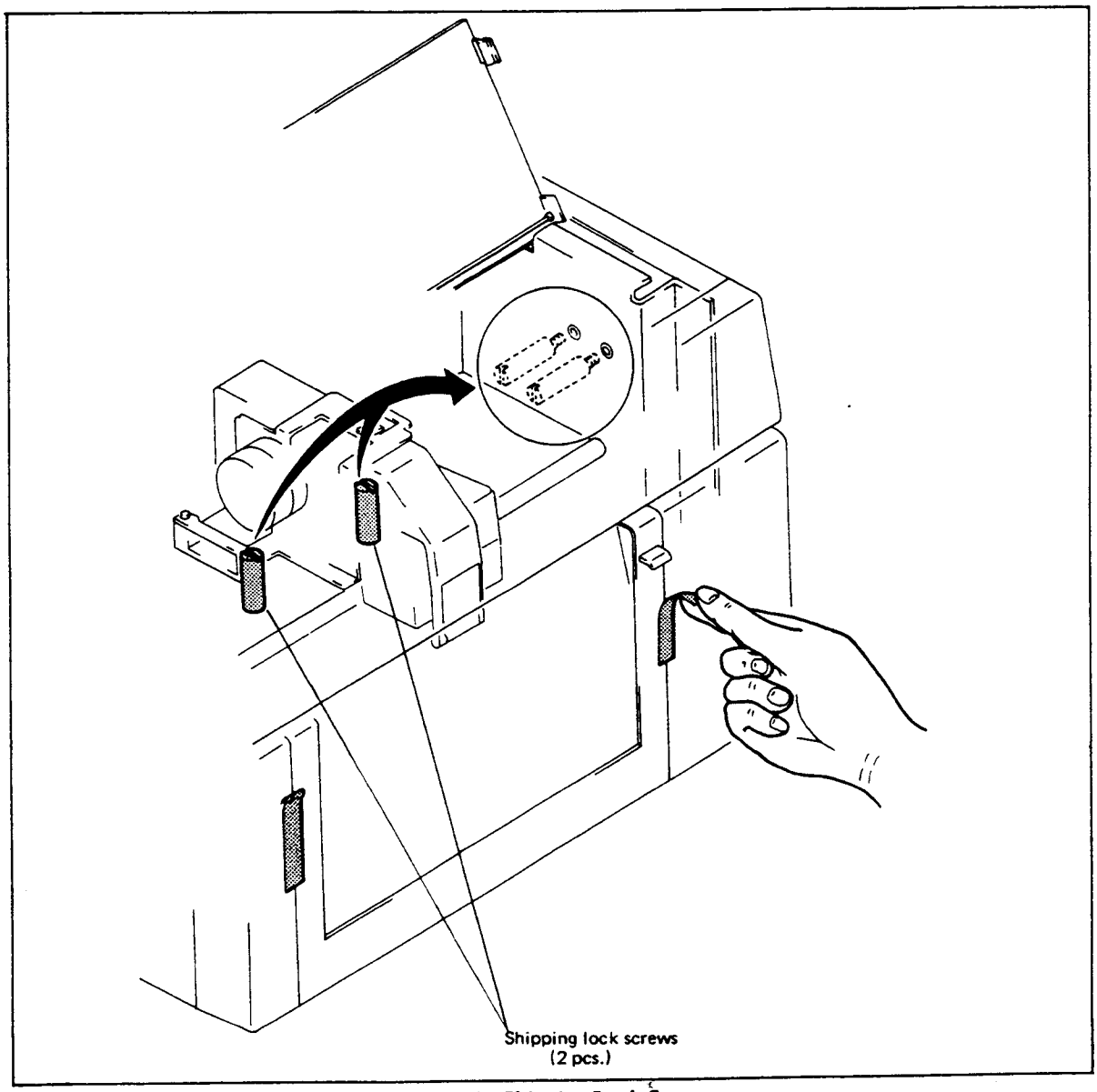


Figure 1-1. Shipping Lock Screws.

(4) Data Plate Check.

The recorder model name is indicated on the data plate located on the case rear panel. Verify that it is as specified in the order. When inquiring about the recorder, provide the model name, and serial number.

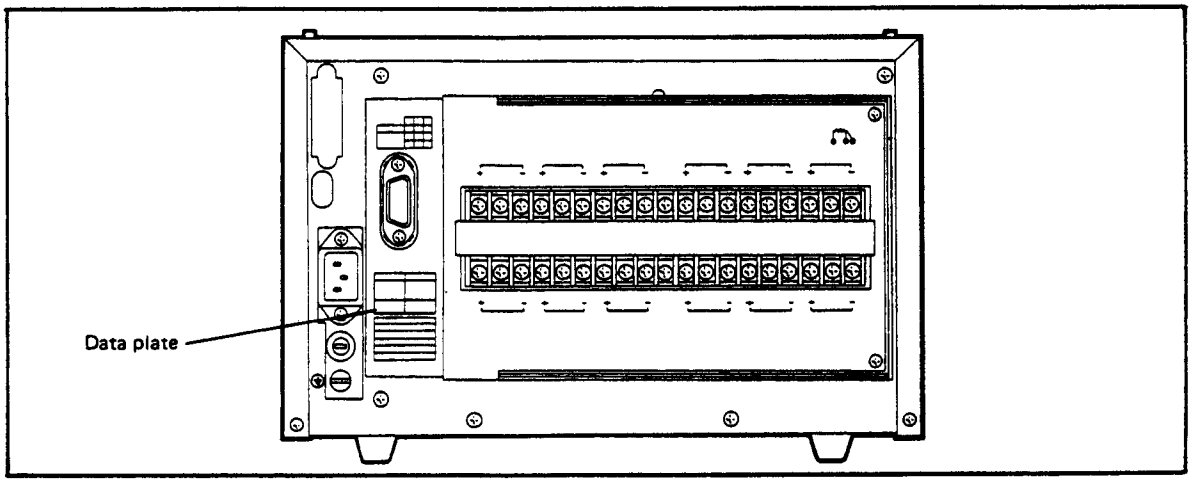


Figure 1-2. Data Plate.

2. GENERAL.

2-1. Description.

The Model OM-500 is a 12-channel compact portable hybrid recorder with expanded measuring and high-speed dot printing functions. Besides its variety of measuring inputs – DC voltage (DCV) thermocouples (TC) and resistance temperature detectors (RTD) – the inputs of DC voltage (DCV), AC voltage (ACV), resistance (Ω) for DMM (Digital Multimeter) functions are available for display and printing (only for channel No. 13).

Measurement data can be distinctly printed – the printer uses an endless six-color ribbon.

Switch-selectable analog, analog/digital and digital printing modes are provided, so the optimum printing mode can be selected to meet user requirements.

2-2. Features.

(1) Number of channel inputs: 12 plus 1 (for DMM).
(2) Analog/digital hybrid printing.

Three printing modes: analog, analog and digital and digital (logging function). Data analysis is facilitated by the choice of printing modes.

(3) Multiple measuring functions.

Multiple inputs . . . . . TC, RTD, DCV (rear panel)
DCV, ACV, Ω (front panel)

(4) Distinct multi-color printing facilitates channel identification.
(5) "Difference" (ΔT etc.) recording function is provided as a standard feature.

The difference between an arbitrary measurement channel and the reference channel can be automatically computed and printed.

(6) Scaling function is provided.

For voltage input, the actual scale corresponding to the input signal can be specified (0 to 10 mV, 1 to 5 V and 0 to 10 V).

(7) Easy-to-operate keys

Using the keys on the recorder front panel, measuring input ranges, intervals and chart speeds can be set with ease.

(8) Compact and lightweight .
(9) IEEE-488 interface bus (optional)

OM-501

Reads up to 12 thermocouple inputs of nine different calibrations. Also reads AC/DC voltage and resistance.

	Input Type	Measuring Range
Vdc	Voltage	±20mV, ±200mV, ±2V, ±20V, ±50V, 0 to 10 mV, 1 to 5 V and 0 to 10 V
J	Iron-Constantan	-328 to 1,652°F
K	Chromel-Alumel	-328 to 2,462°F
T	Copper-Constantan	-328 to 752°F
E	Chromel-Constantan	-328 to 1,472°F
R	Pt-Pt/13% Rh	32 to 2,912°F
S	Pt-Pt/10% Rh	32 to 2,912°F
B	Pt/6% Rh-Pt/30% Rh	752 to 3,092°F
N	Omegalloy™	-328 to 2,372°F
C	W/5% Re-W/26% Re	32 to 2,912°F

OM502

Reads up to 12 RTD (DIN) inputs as well as AC/DC voltage and resistance on DMM channel.

RTD	-328 to 1,022°F

OM503

Reads up to six thermocouple and six RTD inputs. AC/DC voltage and resistance can be read as well.

Vdc	Voltage	±20mV, ±200mV, ±2V, ±20V, ±50V, 0 to 10 mV, 1 to 5 V and 0 to 10 V
J	Iron-Constantan	-328 to 1,652°F
K	Chromel-Alumel	-328 to 2,462°F
T	Copper-Constantan	-328 to 752°F
E	Chromel-Constantan	-328 to 1,472°F
R	Pt-Pt/13% Rh	32 to 2,912°F
S	Pt-Pt/10% Rh	32 to 2,912°F
B	Pt/6% Rh-Pt/30% Rh	752 to 3,092°F
N	Omegalloy™	-328 to 2,372°F
C	W/5% Re-W/26% Re	32 to 2,912°F
RTD	100Ω Pt	-328 to 1,022°F

Front-panel (DMM) input for all models

Input Type	Measuring Range	Max. Sensitivity
Vdc	20 mV, 200 mV, 2 V, 20 V, 50 V,	5 μ V
Vac	2 V, 20 V, 200 V, 250 V	200 μ V
Ohms	200Ω, 2kΩ, 20kΩ, 200kΩ, 2MΩ	50mΩ

Omegalloy™, Type N, is generically known as Nicrosil-Nisil

3. NAMES AND FUNCTIONS OF COMPONENTS.

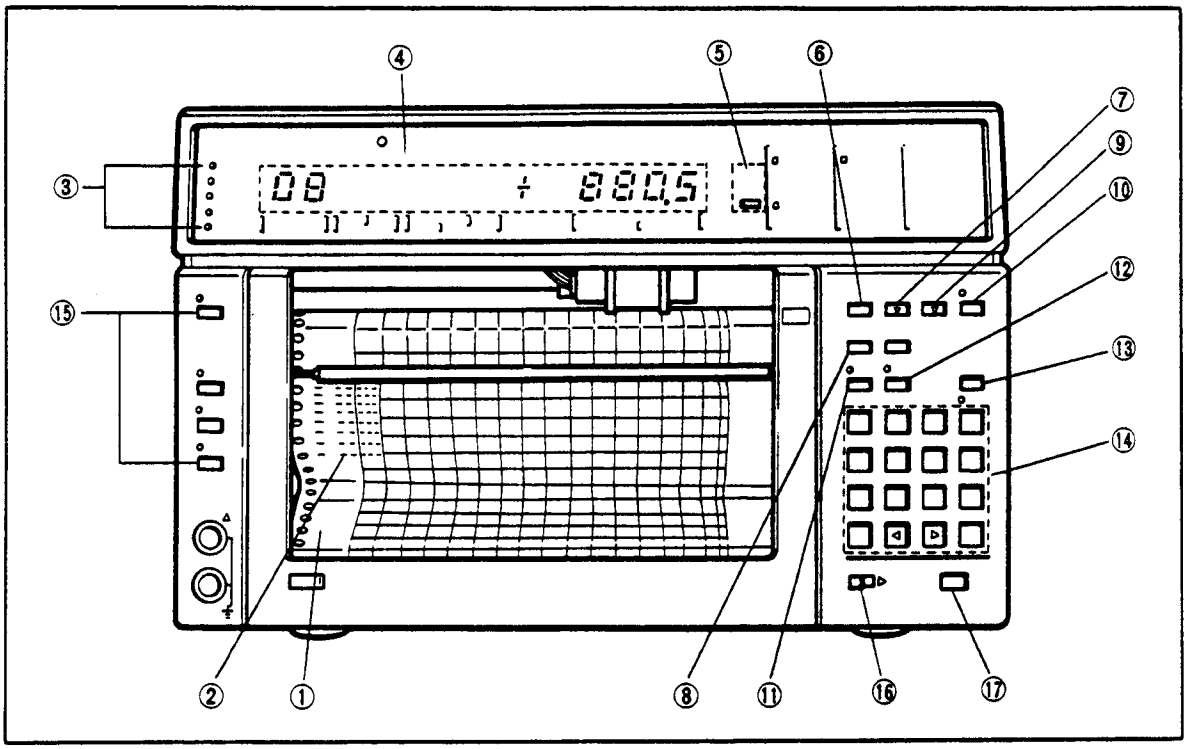


Figure 3-1. Names and Functions of Components (1).

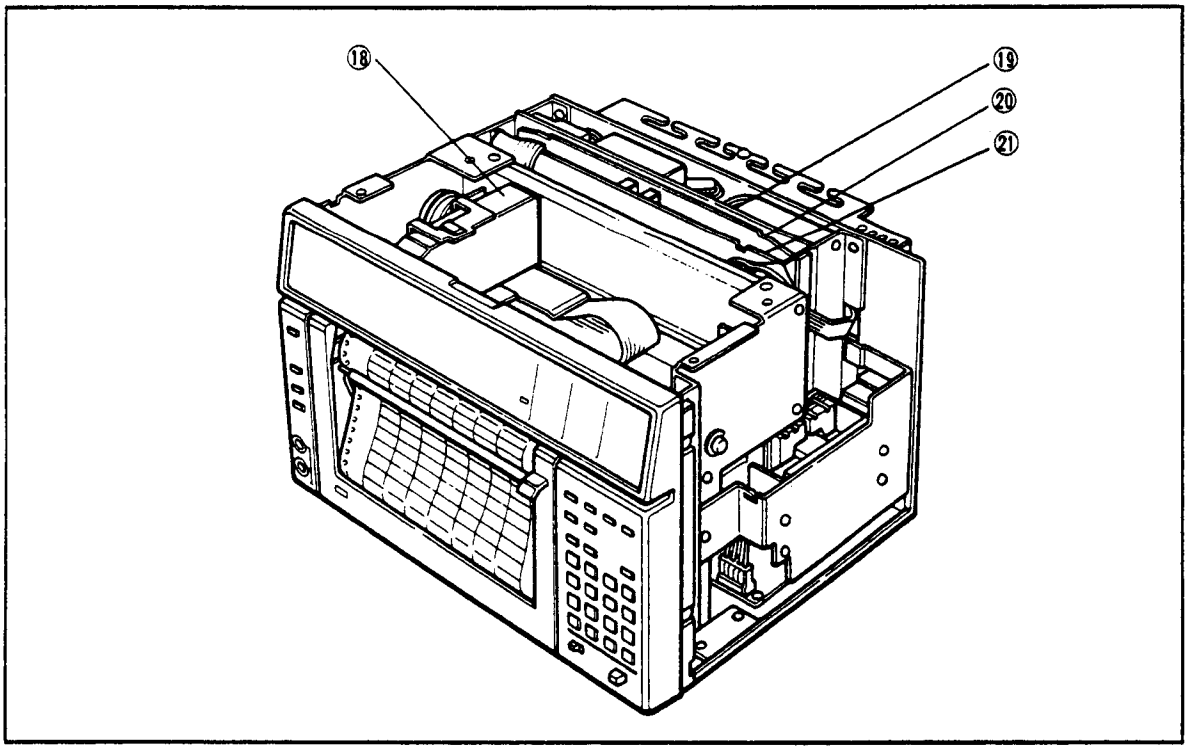


Figure 3-2. Names and Functions of Components (2).

① **Chart**

Z-fold chart (total width 210 mm, analog recording width 150 mm, digital printing approx. 20 mm in the left margin of the chart, total chart length 16 m) 100 uniform divisions.

② **Digital measurement data printout**

Measurement data are also digitally printed in the left margin of the chart. Such digital printing is executed automatically at fixed time intervals e.g. hourly (depends on the selected chart speed).

Relationships between Chart Speeds and Printouts.

Chart speed (mm/h)	CH No.	Date, Chart speed, Measurement data	Alarm Setpoint
1 to 9	printable	unprintable	printable
10 to 500	printable	printable	printable
501 to 1200	unprintable	unprintable	unprintable

Digital Measurement Data Printing Interval

Chart speed (mm/h)	Digital measurement data printing interval (h)
10 to 24	12
25 to 49	4
50 to 99	2
100 to 500	1

③ **LED indicators**

(1) ALARM: When any of the preset alarm conditions occurs, the red "ALARM" LED indicator lights.

(2) FAIL: The red "FAIL" LED indicator lights if the recorder function is abnormality.

(3) BATTERY: When the batteries for memory back-up are exhausted, the red "BATTERY" LED indicator flashes (batteries back up the memory for approx. three months).

(4) CHART: The red "CHART" LED indicator lights when chart end is sensed. Recording stops when the chart is fed 60 mm after this indicator lights.
When the CHART FEED key is pressed after this indicator lights, recording stops immediately. However, after the RENEW CHART mark on the chart paper, the LED becomes possible to operate occasionally ON/OFF.

(5) REMOTE: The green "REMOTE" LED indicator lights when remote control is executed via the interface bus (optional).

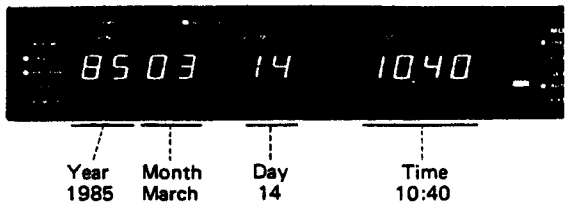
④ **Displays**

Year/month/day, time, measured data, chart speeds and various settings are displayed (LED 13 digits).

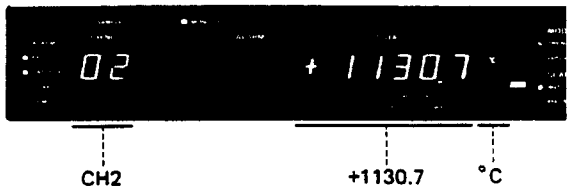
Examples:

(1) Year/month/day and time display

10:40 AM. March 14, 1985



(2) Data display Channel No. 2, 1130.7°C



⑤ **Engineering Unit Display**

Any one of the following engineering units lights according to the measuring range. However, when time, chart speed or scanning interval is displayed, engineering unit does not light.

mV	V
°C	°F
Ω	kΩ
MΩ	■ ← Lights when "scaling" set in performed.

Figure 3-3. Engineering Unit Display.

⑥ **Mode Selector Key (MODE)**

(1) TREND:
When MODE key is pressed and "TREND" LED indicator lights, the TREND mode is set.
When the TREND mode is set, analog printing and analog/digital printing can be executed.

(2) LOGGING:
When MODE key is pressed and "LOGGING" LED indicator lights, the LOGGING mode is set.
When the LOGGING mode is set, digital printing can be executed at fixed intervals.

⑦ **Display Selector Key (DISPLAY)**

Pressing DISPLAY key, you can select display any of DATA (AUTO), DATA (MAN) and CLOCK.

(1) DATA (AUTO): Displays CH No. and measurement data in order at 3 second intervals.

(2) DATA (MAN): Displays data only for the CH currently designated by the CH key. Pressing the CH key allows CH Nos. to be processively incremented, and the desired CH is called.

(3) CLOCK: Displays the year, month, day and time.

⑧ **Scanning Interval Selector Key (SCAN)**

By pressing SCAN key, either AUTO or FIX (5S) mode can be selected.

(1) AUTO: In TREND mode, the scanning period varies with the chart speed. Recording chart is fed 0.25 mm each scan. In LOGGING mode, input scanning is performed every scanning interval.

(2) FIX (5S): Keeps the scanning period constant (5 seconds) regardless of the chart speed selected.

⑨ Data Set Selector Key (SET)

By pressing SET key, any of RANGE, ALARM CLOCK, CHART SP/INTVL and PRINT TIME setting can be selected.

(1) RANGE: Measuring input range can be selected.

(2) ALARM: Alarm setting can be performed.

(3) CLOCK: Year, month, day and time may be set.

(4) CHART SP/INTVL: In TREND mode, chart speeds (at any point between 1 and 1200 mm/h) can be selected.
In LOGGING mode, intervals to print out measurement data (digital) on the chart can be set (for 1 min to 24h: in min unit).

(5) PRINT TIME: In TREND mode, the digital printout time can be set in minutes at any time. The digital printout interval complies with Item (2) on page 3-2.

⑩ LIST Key (LIST)

The LIST key permits measuring range, alarm setting of each channel, chart speed, date and time, to be printed out on the chart paper.

⑪ PRINT Key (PRINT)

The PRINT key permits, analog/digital or digital printing. Printing operation (both in TREND and LOGGING modes) is possible only when the LED indicator lights. By pressing this key, input scanning is performed once.

⑫ MAN PRINT Key (MAN PRINT)

Digitally prints measurement data of all channel (except for SKIP CH.).

⑬ CHART FEED Key (CHART FEED)

The CHART FEED key permits chart feeding.

⑭ Data Set Keys

(1) SHIFT Key (SHIFT): When the LED above the SHIFT key lights, the characters and mark above the numeral keys are effective.

(2) Numeral Keys (0 to 9): Numeric characters (0 to 9) can be set. In addition, these keys allow alphabetic characters A to F, H, L, and P to be set with the SHIFT key pressed.

(3) Sign Key (+/−): Sign key to change sign + or −.

(4) Brightly Lit Position Shift Keys (◀, ▶): When the set data currently displayed are to be changed, these keys are used to shift brightly lit positions so that characters or numerals to be changed are brightly lit.

(5) Entry Key (ENT): Enters RANGE, ALARM, CLOCK, CHART SP/INTVL and PRINT TIME settings when pressed at the end of the entry.

(6) OFF Key (OFF/(−)): Designates channel skip (in RANGE setting) and alarm OFF.

(7) ⊢ /⊣ Key: When the RANGE set data are displayed, this key is used to switch the LEFT END value to the RIGHT END value or vice versa. Pressing this key highlights the LEFT END value mark (⊢) or RIGHT END value mark (⊣) displayed and switching is completed by pressing SHIFT key and 0 (zero) key to display the other end value.

⑮ DMM Operation Keys

(1) DMM Operation Keys (DMM): Displays measured data of DCV, ACV or OHM (Ω) applied to terminals H and L on the recorder front panel.

(2) DCV, ACV and Ω Keys (DC, AC, Ω): When the DMM key is turned on, these keys are operated to select the type of input to be measured.

(3) Terminals H and L: Input terminals on the front panel. (Use the measurement lead supplied with the recorder).

⑯ Key Lock Switch: When this switch is slid to KEY LOCK position, the keys other than DISPLAY key will be disabled.

⑰ POWER Switch: Turns the instrument ON/OFF.

⑱ Ink Ribbon Cassette

⑲ A/D Card

⑳ MAIN CPU Card

㉑ SUB CPU Card

Changing °C to °F

Look through the grating at the top of the unit and locate the eight dip switches (refer to Figure 3-4). With a small pointed object, push dip switch 1 closed (up) for °C operation and open (down) for °F operation.

Bank of 8 DIP Switches on Main CPU Board:

Temperature °C/°F Conversion	DIP Switch #1	Closed (Up): °C Open (Down): °F
Vertical Printing option (see page 7-24)	DIP Switch #3	Closed (up): Horizontal Open (Down): Vertical

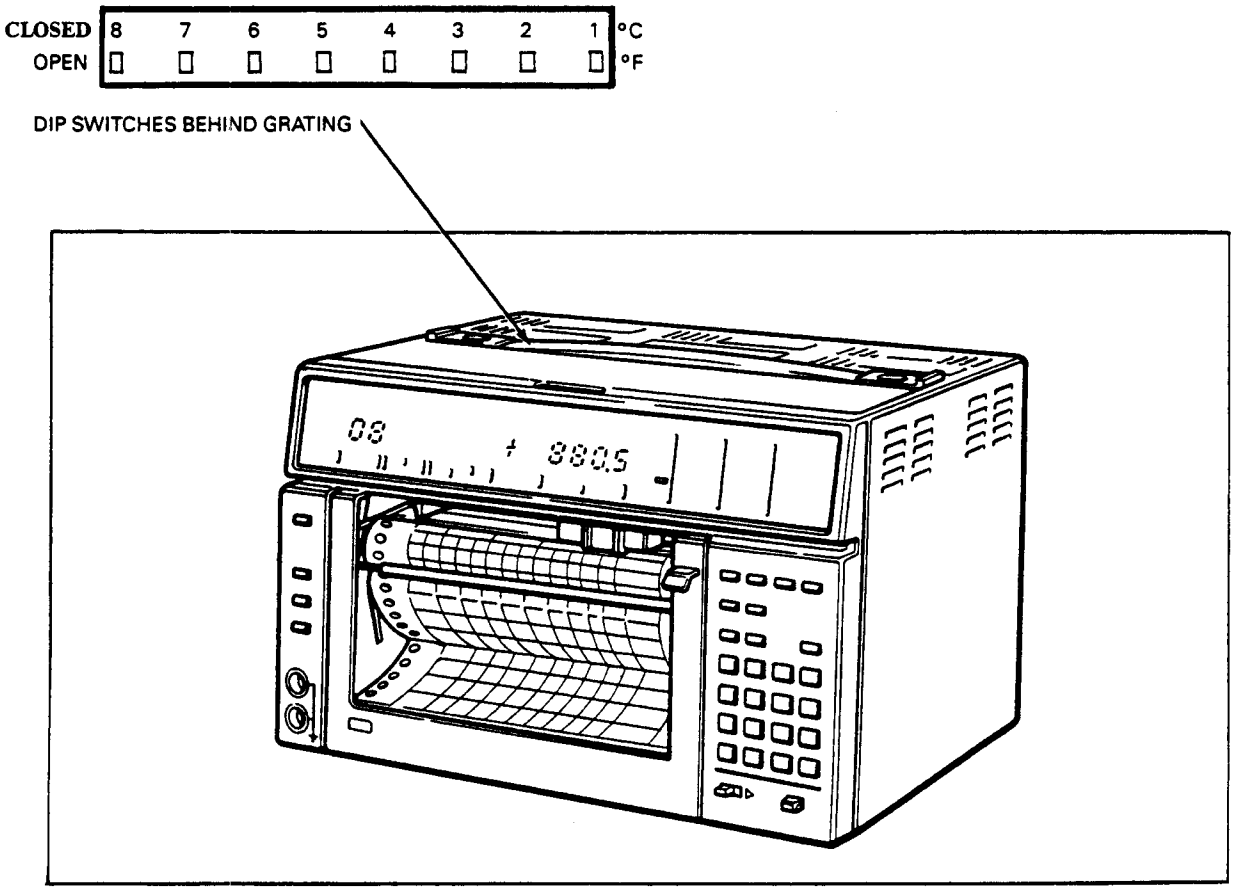
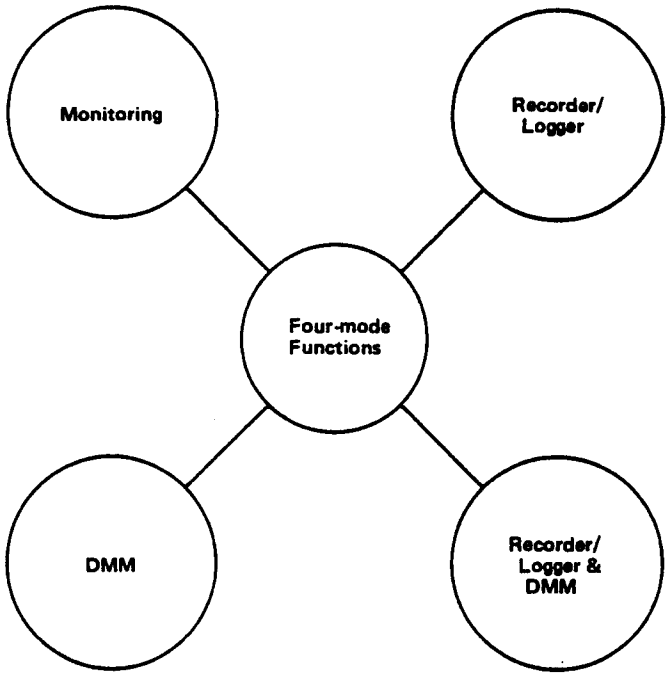


Figure 3-4. External View.

4. FUNCTIONS.

4-1. Four Modes.



MODE	PRINT KEY	DMM KEY	FUNCTION
Monitoring	• PRINT	• DMM	Monitor Function . . . . . CH1 to 12 (rear panel) CH13 (front panel) measurement and display Alarm Monitor . . . . . Display, relay output IEEE-488 interface (optional)
Recorder/Logger	✿ PRINT	• DMM	Recorder Function . . . . . CH1 to 12 and CH13 measurement, display, printout (analog trend or analog trend + digital printing) Logger Function . . . . . CH1 to 12 and CH13 measurement, display, printout (digital logging) Alarm Monitor . . . . . Display, print, relay output IEEE-488 interface (optional)
DMM	• PRINT	✿ DMM	DMM Function . . . . . CH13 (front panel) measurement, display IEEE-488 interface (optional)
Recorder/Logger & DMM	✿ PRINT	✿ DMM	Recorder/Logger + DMM function CH13 is sampled in DMM mode except when the instrument is scanning for CH1 to 12. IEEE-488 interface (optional)

✿ . . . . KEY ON. • . . . . KEY OFF.

4-2. Specifications.

Measuring range, number of display digits

Rear-panel inputs (CH1 to CH12):

Input type	Range code	Measuring range	Engineering unit	Number of digits	Description
DC V	00	−20 to +20 mV	mV	□□.□□□	
	01	−200 to +200 mV		□□□.□□	
	02	−2 to +2 V	V	□.□□□□	
	03	−20 to +20 V		□□.□□□	
	04	−50 to +50 V		□□.□□	
	05	1 to 5 V	Blank	□□□□.□	Scaling Refer to Note 1
	06	0 to 10 mV			
	07	0 to 10 V			
Thermocouple	10	Type R 0 to 1600°C 32 to 2912°F	°C °F	□□□□.□ □□□□	
	11	Type S 0 to 1600°C 32 to 2912°F	°C °F	□□□□.□ □□□□	
	12	Type B 400 to 1700°C 752 to 3092°F	°C °F	□□□□.□ □□□□	
	13	Type K −200 to 1350°C −328 to 2462°F	°C °F	□□□□.□ □□□□	
	14	Type E −200 to 800°C −328 to 1472°F	°C °F	□□□.□ □□□□.□	
	15	Type J −200 to 900°C −328 to 1652°F	°C °F	□□□.□ □□□□.□	
	16	Type T −200 to 400°C −328 to 752°F	°C °F	□□□.□ □□□.□	
	17	Type N −200 to 1300°C −328 to 2372°F	°C °F	□□□□.□ □□□□	
	18	Type W 0 to 1600°C 32 to 2912°F	°C °F	□□□□.□ □□□□	
Resistance temperature sensor	20	Pt 100Ω −200 to 550°C −328 to 1022°F	°C °F	□□□.□ □□□□.□	Measured current 1 mA
	21	Pt 100Ω −200 to 250°C −328 to 482°F	°C °F	□□□.□ □□□.□	Measured current 2 mA
	22	Pt 50Ω −200 to 550°C −328 to 1022°F	°C °F	□□□.□ □□□□.□	Measured current 2 mA

Notes 1. Range codes 05 to 07 are fixed ranges, which can be arbitrarily set on conditions that range is within −2000.0 to +2000.0 and that the span is ≦ 2000.0.

2. Only negative signs are displayed in the table (positive signs are omitted).

Front-panel inputs (CH13 or DMM):

Input type	Range code	Measuring range	Engineering unit	Number of digits	Description
DC V	00	–20 to +20 mV	mV	□□.□□□	
	01	–200 to +200 mV		□□□.□□	
	02	–2 to +2 V	V	□.□□□□	
	03	–20 to +20 V		□□.□□□	
	04	–50 to +50 V		□□□.□□	
AC V (Average value-rectified, effective value-calibrated)	30	0 to 2 V	V	□.□□□□	Frequency is 40 Hz to 1 kHz.
	31	0 to 20 V		□□.□□□	
	32	0 to 200 V		□□□.□□	
	33	0 to 250 V		□□□.□	
Resistance	40	0 to 200Ω	Ω	□□□.□□	Measured current 1 mA
	41	0 to 2kΩ	kΩ	□.□□□□	Measured current 1 mA
	42	0 to 20kΩ		□□.□□□	Measured current 10μA
	43	0 to 200kΩ		□□□.□□	Measured current 10μA
	44	0 to 2MΩ	MΩ	□.□□□□	Measured current 1μA

Notes 1. For DMM mode, the range is automatically set, and for TREND/LOGGING mode (CH13 is used), the range is manually set using the key board.
2. Only negative signs are displayed in the table (positive signs are omitted.)
3. On the OM-503 model, the first six channels are for RTD's only; channels 7-12 are for T/C's or Voltage inputs.

Standard Performances

Accuracy, resolving power

Input	Range	Measuring (Digital display, recording)		Recording (Analog trend)*	
		Accuracy	Resolution	Accuracy	Resolution
DC V	±20 mV	± (0.2% of rdg + 10 digits)	5 μV	±0.2% of span (excluding measuring accuracy)	0.1% of span
	±200 mV	± (0.2% of rdg + 5 digits)	20 μV		
	±2 V	± (0.1% of rdg + 5 digits)	200 μV		
	±20 V	± (0.3% of rdg + 5 digits)	2 mV		
	±50 V	± (0.3% of rdg + 5 digits)	20 mV		
	1 to 5 V	± (0.3% of rdg + 5 digits)	400 μV		
	0 to 10 mV	± (0.2% of rdg + 10 digits)	5 μV		
	0 to 10 V	± (0.3% of rdg + 5 digits)	2 mV		
Thermo-couple	R, S, B	± (0.05% of rdg + 0.5°C)	0.2°C		
	K, E, J T, N, W	R, S; 0 to 100°C: ±3.7°C 100 to 300°C: ±1.5°C B; 400 to 600°C: ±1°C	0.1°C		
Resistance temperature detector	Pt 100Ω Pt 50Ω	± (0.1% of rdg + 0.3°C)	0.1°C		
AC V	2 V	± (0.4% of rdg + 0.2% of range)	200 μV		
	20 V		2 mV		
	200 V		20 mV		
	250 V		200 mV		
Resistance	200 Ω	± (0.2% of rdg + 5 digits) When 200 Ω range is used, 10 digits equivalent to the measuring leadwire are added.	20 mΩ		
	2 kΩ		200 mΩ		
	20 kΩ		2 Ω		
	200 kΩ		20 Ω		
	2MΩ		200 Ω		

(*) The accuracy and resolution are measured when the setting span of each input is more than the below and the range nearest to the setting span is used.
DC V : 3 mV
Thermocouple : 100°C and 3 mV
Resistance temperature detector: 20°C (40°C for Pt 50 Ω)
AC V : 200 mV
Resistance : 20 Ω

Thermocouple Reference Junction Compensation Error: When the temperature at the input terminals is in equilibrium at the ambient temperature 5 to 40°C: Types R, S, B . . . ±1°C
Types K, J, E, T, N, W . . . ±0.5°C

Input Terminal Temperature Characteristic: When the temperature is in equilibrium, the temperature distribution at input terminal is within 0.3°C.

Scanning Interval: TREND mode,
FIX (5S); 5 seconds/13CH
AUTO; Scanning interval is automatically changed according to the programmed chart speed. Chart is fed 0.25 mm each scan. When the chart feed speed is faster than 180 mm/h, the period is 5 seconds.
(Example) When the chart feed speed is 50 mm/h,

$$60 \text{ minutes} \times 60 \text{ seconds} / \frac{50 \text{ mm}}{0.25 \text{ mm}}$$

= 18 seconds

LOGGING mode,

	Scanning interval for measuring	Scanning interval for recording
FIX (5S)	5 seconds	1 minute to 24 hours (set by one minute)
AUTO	1 minute to 24 hours (set by one minute)	

Scanning Speed (Carriage Speed): Approx. 3 seconds/150 mm.

Chart Speed: 1 to 1200 mm/h. Set by 1 mm/h.

Input Resistance:
Rear-panel input
DC V input (mV range), Thermocouple input: 10 MΩ or more
DC V input (V range) Approx. 1 MΩ
Front-panel input
DC V input: 20/200 mV/2 V range: 10 MΩ or more; 20/50 V range: Approx. 5 MΩ
AC V input: 2 V range: 10 MΩ or more; 20/200/250 V range: Approx. 1 MΩ

Input Bias Current: 10 nA or less
Approx. 10 nA (for 8 ms/one point) flows during checking burnout.

Insulation Resistance: At least 20 MΩ at 500 V DC between each terminal and case.

Dielectric Strength:
1500 V (50/60 Hz) for one minute between power terminals and case (leak current; 5 mA or less)
1000 V (50/60 Hz) for one minute between input terminals and case
1000 V (50/60 Hz) for one minute between input terminals

Power Consumption: 40 VA or less

Memory Backup: Three months or longer (red "BATTERY" LED flashes if the battery is worn out).

System Alarm: "FAIL" (red LED) lights if CPU fails.

Clock Accuracy: ±20 ppm (one second error might be caused whenever the power is ON and OFF).

Chart Feed Accuracy: ±0.1%

Chart End Detector: The red "CHART" LED lights when chart end is sensed. Recording stops when the chart is fed 60 mm after this indicators lights,

Burnout Protection: If a thermocouple is burnt (disconnected), the instrument detects a greater signal source resistance than 10 MΩ (burnout status).

Recorder

Printout Method: Raster scan, six-color wire dot printer.

Chart: Z-fold chart, whose total width is 210 mm, total length is 16 m, and analog recording width is 150 mm.

Recording Colors: Analog data

Channel Number	1, 7	2, 8	3, 9	4, 10	5, 11	6, 12
Color	Purple	Red	Green	Blue	Brown	Black

Digital data LOGGING mode and program list (purple), alarm (red), channel identification numbering (the same colors as those of analog data), digital data in analog trend plus digital logging (black), analog and digital DMM data (purple).

Display: 7-segment red LED, character size is approx. 10 mm.

Normal Operating Conditions

Power Voltage: 100 V, 115 V, 200 V or 230 V AC ±10%.

Power Frequency: 50, 60 Hz ±2%.

Ambient Temperature: 5 to 40°C.

Ambient Humidity: 20 to 80% RH.

Vibration: 10 to 60 Hz, 0.02 G

Magnetic Field: 400 A/m or less (DC; 50/60 Hz).

Noise: Normal mode noise (50, 60 Hz)
DC V, thermocouple . . . One and half times the range or less (peak value including signal).
Resistance temperature detector. . . 50 mV or less (peak value)
Common mode noise (50, 60 Hz)
DC V, thermocouple . . . 100 V or less
Resistance temperature detector . . 100 V or less

Input Signal Source Resistance:
DC V, thermocouple . . . 2 kΩ or less
Resistance temperature detector . . . .
10 Ω or less/wire (Pt 100 Ω)
5 Ω or less/wire (Pt 50 Ω)

Mounting: Horizontal at both sides. The front panel may be tilted upward a maximum of 30°. Panel tilt forward cannot be allowed.

Effect of Operating Conditions

Effect of Power Source Variation: When the variation is 10% of the rated voltage, the effects are as follows:

- Display (measured value) ... ±(0.1% of rdg + 0.02% of range) or less
- Record ... ±0.1% or less of span (excluding the measured value variation)

When the variation is 2% of the rated frequency, there is no effect in both display and record.

Effect of Ambient Temperature: When the ambient temperature changes ±10°C, the effects are as follows:

- Display (measured value) ... ±(0.1% of rdg + 0.03% of range) or less
- Record ... ±0.1% or less of span (excluding measured value variation)

Thermocouple reference junction compensation errors are not included in the above values.

Effect of External Magnetic Field:

The effects against 400 A/m at both DC and AC (50/60 Hz) are:

- Display (measured value) ... ±(0.5% of rdg + 0.1% of range) or less
- Record ... ±0.2% or less of span (excluding measured value variation)

Effect of External Noise:

Normal mode noise

The effects on the normal operating conditions are:

- Display (measured value) ... NMRR 40 dB or more
- Record ... ±0.5% or less of the variation span

Common mode noise (signal resistance of DC V and thermocouple inputs are 500 Ω or less, and wire resistance of resistance temperature detector input is 2 Ω/wire or less).

The effects on the normal operating conditions are:

- Display (measured value) ... CMRR 120 dB or more
- Record ... ±0.5% or less of the variation span

Effect of External Resistance: When the signal resistance changes ±1 kΩ, the effects for both display and record are:

DC V input (excluding mV range code) and thermocouple input ..... ±10 μV or less

DC V input (mV range code) ... 0.7% of the input decreases

When the resistance temperature detector changes 10 Ω/wire (5 Ω for Pt 50 Ω), the effects are as follows:

- Display (measured value) ... ±(0.1% of rdg + 0.05% of range) or less
- Record ... ±0.1% or less of span (excluding the measured variation)

Effect of Mounting Inclination: When the Model OM500 is inclined 30° upward, the effects are:

- Display (measured value) ... 0
- Record ... ±0.1% or less of span

There is no bad influenced on the recorder operation. However, the recorder must be placed horizontally at both sides.

Built-in Alarms

Setting Mode: One high and low limits of each channel can be set.

Setting Accuracy: Within ±1 digit of display.

Hysteresis:

TREND mode... Approx. 0.5% of recording span

LOGGING mode... 0

Display: H (high limit) or L (low limit) at the head of the data (H is lit if both the alarms are on) and the red "ALARM" LED (common to all channels) light.

Record:

TREND mode

- Channel no., H/L and times when the H/L alarm is on are printed in red in the right margin (overlapping the analog recording area approx. 5%).
- H/L alarm is printed at the head of the digital data in the left margin (overlapping the analog recording area approx. 5%).

LOGGING mode

- H/L alarm is printed at the head of the data.

Output: Two relay transfer contact outputs.

- 14-pin connector is used to connect with the outside.
- Contact rating 100 V AC 0.3 A (resistive load)
  24 V DC 0.5 A (resistive load)

Insulation Resistance: 20 MΩ or more (at 500 V DC).

Dielectric Strength: 1200 V AC at 50/60 Hz for one minute.

(Note) Alarm functions do not operate during DMM mode.

Construction

Case: Steel. Front bezel is aluminum die cast
338(W) x 210(H) x 315.5(D) mm (excluding rubber feet and door knob)

Finish: Light pale green (Munsell 2.0GY7.5/0.9 or equivalent)

Weight: Approx. 12 kg

Accessories Supplied at No Extra Cost

Power cord . . . . . 1 set
Test cord . . . . . 1 set
Ink ribbon . . . . . 1 pc.
Battery (SUM-2) . . . . . 3 pc.
Fuse . . . . . 2 pcs.

Hex wrench . . . . . 2 pcs.

Lubricating oil . . . . . 1 bottle
Measuring leadwire . . . . . 1 set
Connector (for alarm output) . . . . . 1 pc.

Option: IEEE-488 Communications Bus

DC 12 V drive
Vertical printing function

Standard Function List

Function	Description
Full-scale range setting	Programmable via keyboard for each channel, 6 or 12 channels as a group.
Skip	Printout skips for the group programmed (each channel, group of 6 or 12 channels)
Selectable Chart Speed	Selectable via keyboard from 1 to 1,200 mm/h
TREND/LOGGING modes (analog and digital data printout)	• TREND . . . . . analog or analog plus digital printout (channel numbers and measured data are printed out in digital in the left margin of the chart at a chart speed of 10 to 500 mm/h) • LOGGING . . . . . digital (measured and computed data) printout (channels 1 to 12)
Program list printout	Contents of entire program memory such as each channel range, alarm, sensor type and chart speed can be listed on the chart.
Difference (ΔT) measurement	Digital printout of difference between valued of the reference channel No. 1 or group head channel (either channel No. 1 or No. 7) and each channel.
Digital printout of alarm	At the time of out-of-limit occurrence, alarm conditions are printed out digitally (in red) in the right margin of the chart.
Scaling	Scaling for data display on input ranges of 0 to 10 mV, 1 to 5 V, and 0 to 10 V (±2000.0, however, span is 2000.0 or less.)
Channel identification numbering	Channel identification number is marked along the right of each trace (at a chart speed of 1 to 500 mm/h).
DMM input and printout	A single DMM input channel (front panel) can be displayed and printed.
Manual printout mode	Digital data of 1st to 12th channels are printed out at a push of MAN PRINT key.
Digital display	Clock, measured data, range or setting values are displayed.
Chart END alarm	LED indicator (red) comes on before out-of-chart conditions.
Battery-backup memory	Three built-in 1.5 V batteries backup all programs when power is removed (the battery lifetime is approx. three months).
FAIL alarm	LED (red) on the front panel comes on when the CPU is in fail condition.

Available Models

Basic Code	Input Type	Temperature Range
OM501	DC V & TC	°F or °C
OM502	RTD(DIN)	
OM503	DC V, TC(ANSI) & RTD (6 points, DIN)	

Optional Features

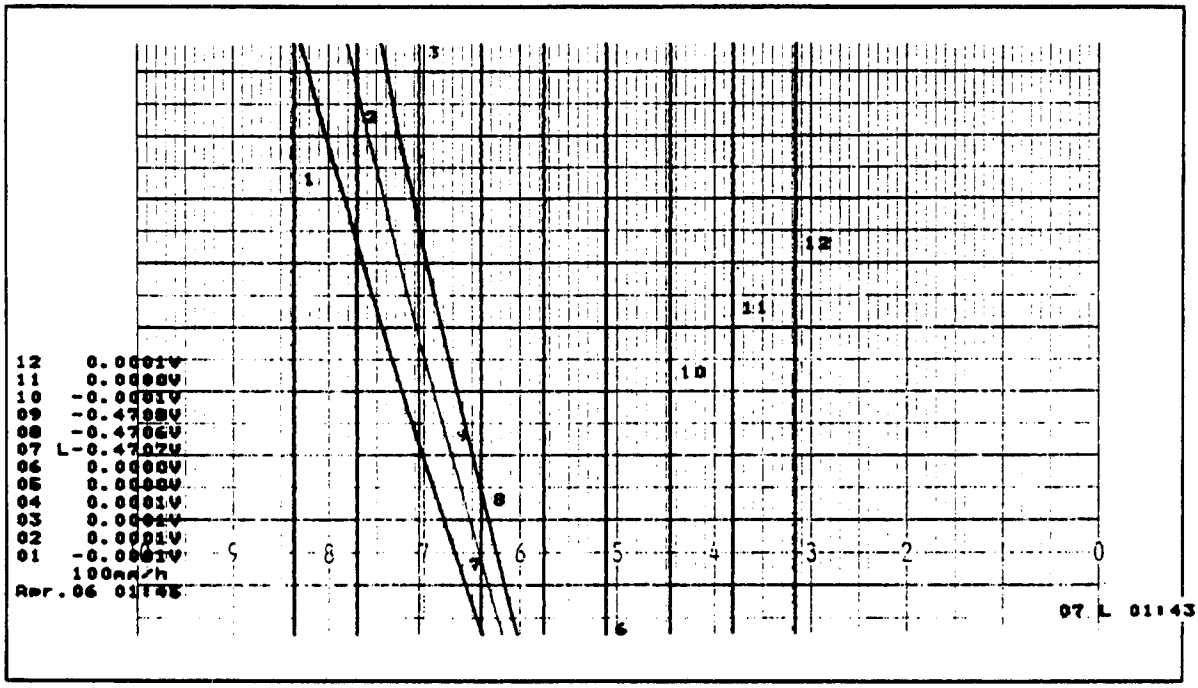
Option Code	Description
IEEE-488	General purpose interface bus
/DC	AC line & external 12 V DC operation
/VPT	Specialized printing from (prints across chart in LOGGING mode)

Spares

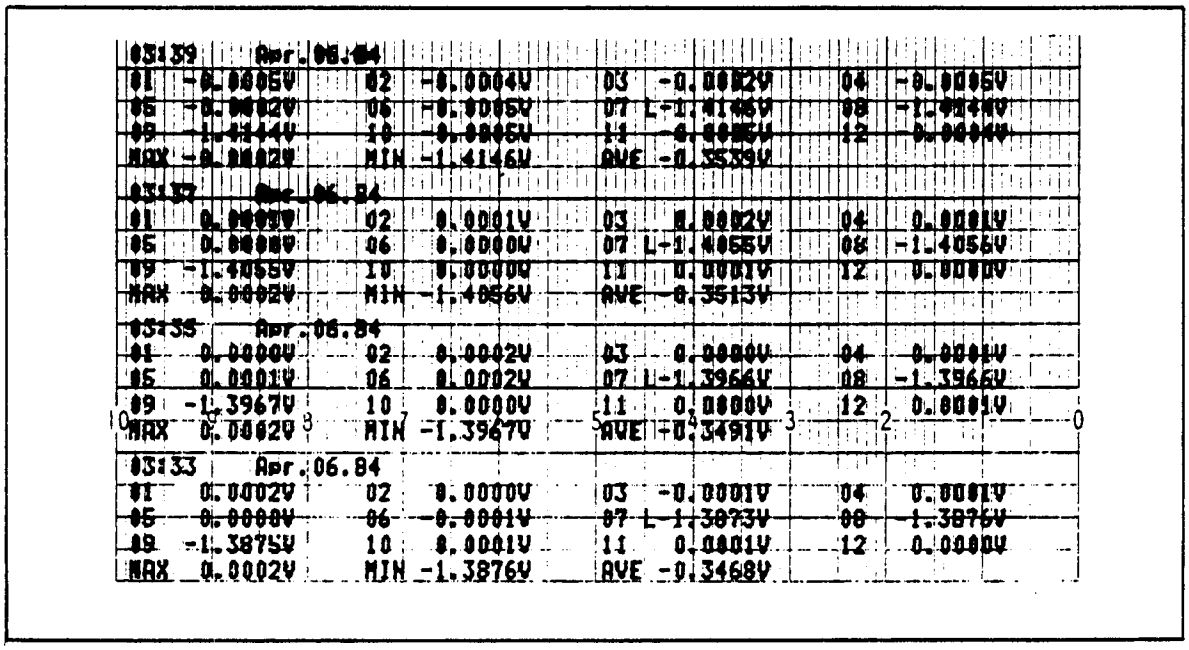
Name	Part No.	Description
Six-color ribbon	B9541AT	1 pc.
Z-fold chart	B9541AR	6 charts (100 uniform divisions)

4-3. Printout Examples.

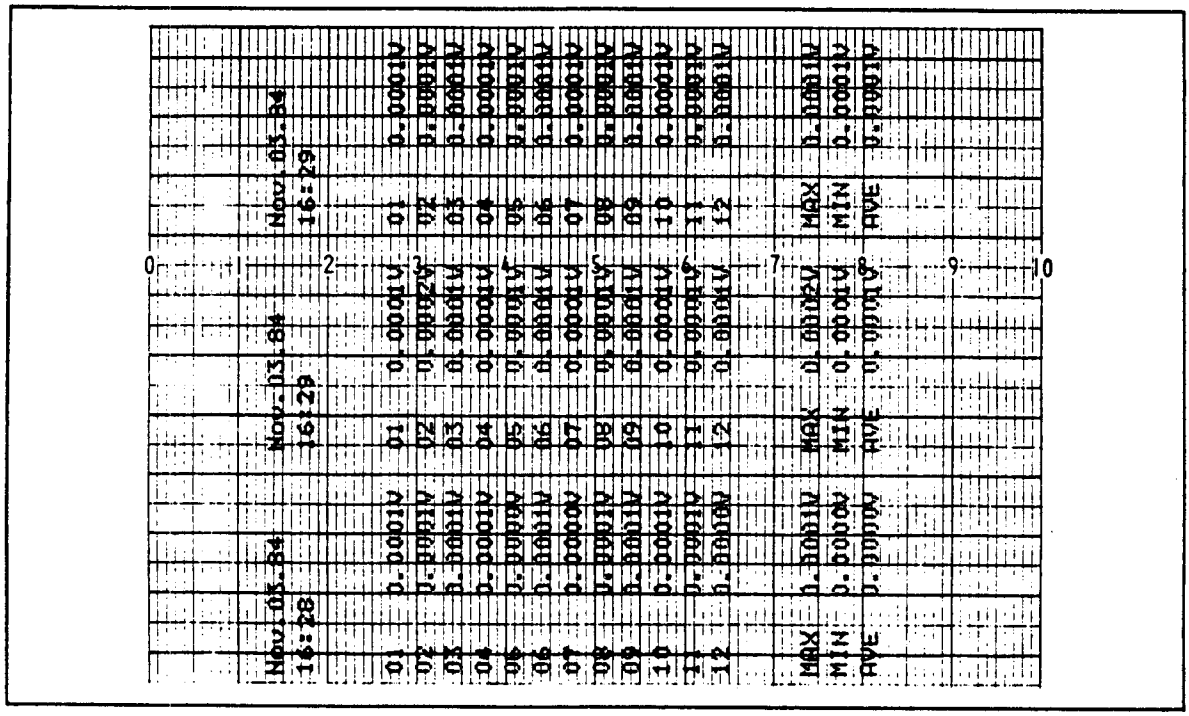
4-3-1. Analog/Digital Printout Example.



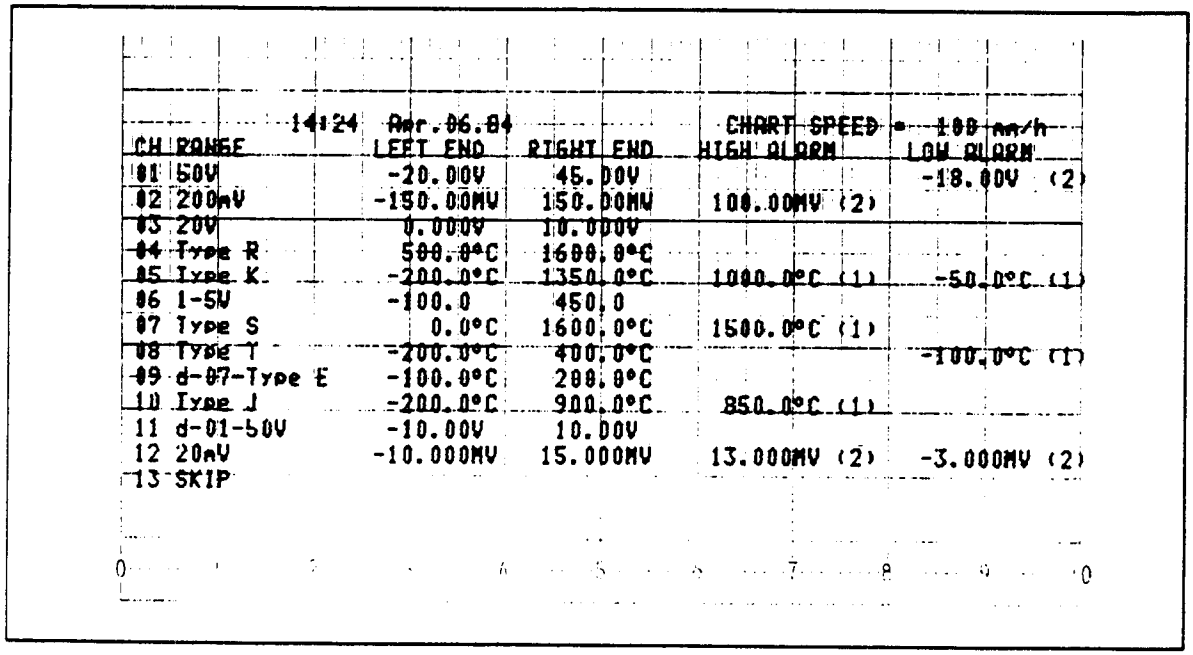
4-3-2. Digital Printout Example.



Specialized Printout Form (Optional)



4-3-3. List Printout Example.



14:24 Apr.06.84 CHART SPEED = 100 mm/h

CH	RANGE	LEFT END	RIGHT END	HIGH ALARM	LOW ALARM
01	50V	-20.00V	45.00V		-18.00V (2)
02	200mV	-150.00MV	150.00MV	100.00MV (2)	
03	20V	0.000V	10.000V		
04	Type R	500.0°C	1600.0°C		
05	Type K	-200.0°C	1350.0°C	1000.0°C (1)	-50.0°C (1)
06	1-5V	-100.0	450.0		
07	Type S	0.0°C	1600.0°C	1500.0°C (1)	
08	Type T	-200.0°C	400.0°C		-100.0°C (1)
09	d-07-Type E	-100.0°C	200.0°C		
10	Type J	-200.0°C	900.0°C	850.0°C (1)	
11	d-01-50V	-10.00V	10.00V		
12	20mV	-10.000MV	15.000MV	13.000MV (2)	-3.000MV (2)
13	SKIP				

5. INSTALLATION.

5-1. Installation Area.

Select an installation area which:

(1) is free from mechanical vibration.
(2) is free from corrosive gases.
(3) has minimum temperature variation (area near normal temperature . . 23°C . . is preferable).
(4) is not subject to strong heat radiation.
(5) has minimum influence from magnetic fields
(6) Has a relative humidity of approximately 40-60% (optimum relative humidity for trouble-free operation is 55%).

5-2. External Dimensions.

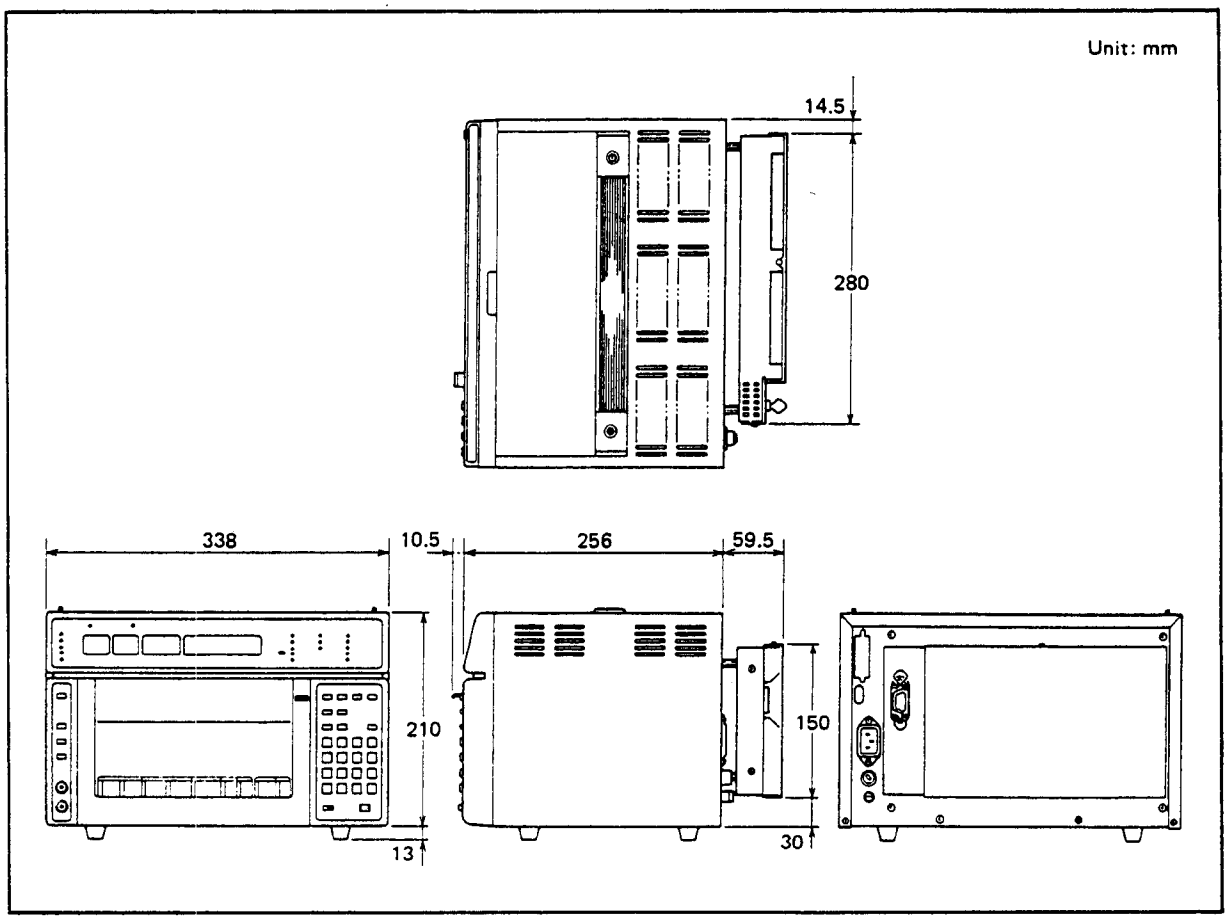


Figure 5-1. External Dimensions.

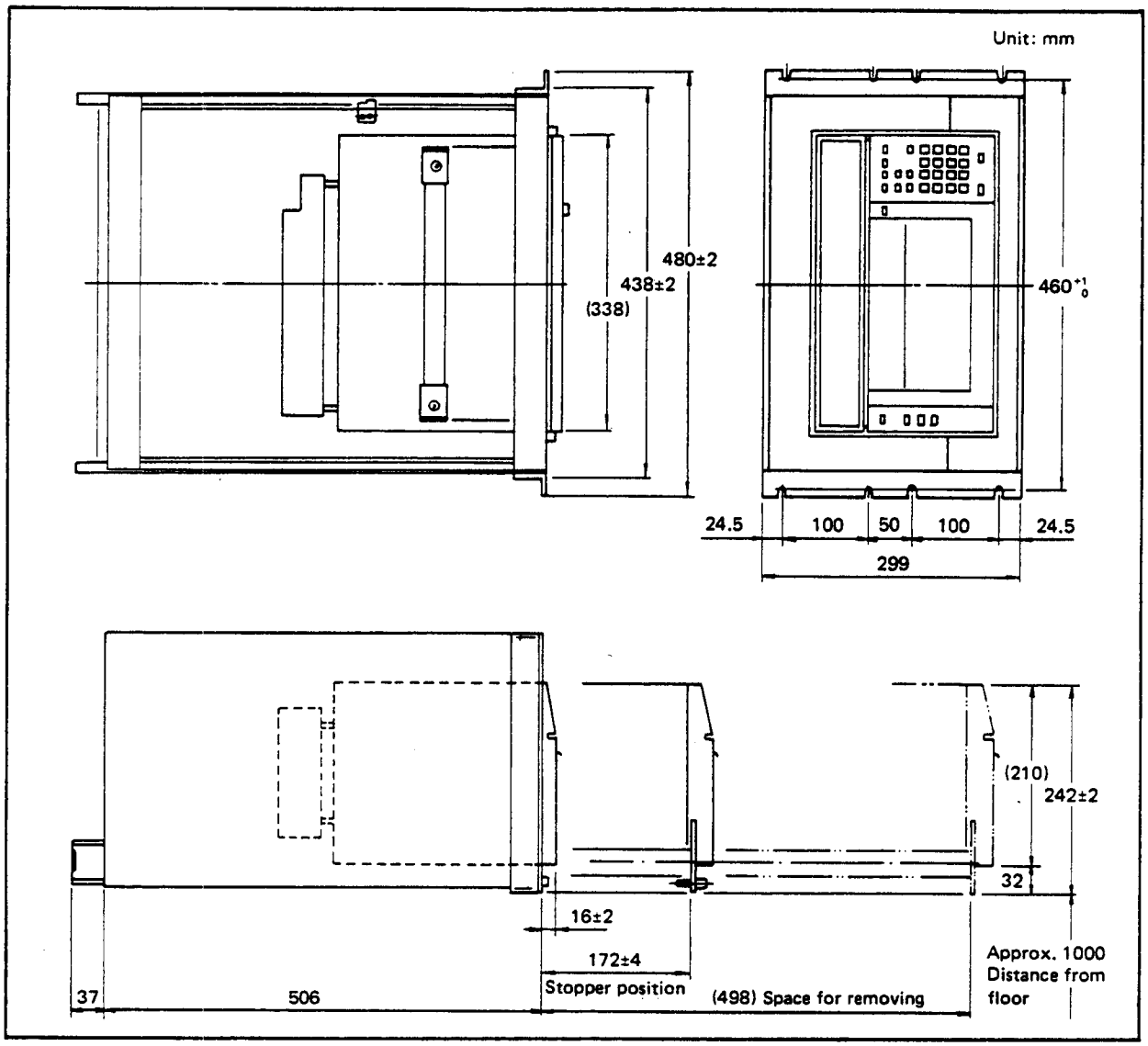


Figure 5-2. External Dimensions of Rack Mounted Instrument (Special Order).

6. WIRING.

6-1. Wiring.

(1) Turn the recorder POWER switch OFF, and remove the recorder rear cover.
(2) Use the power cord supplied with the recorder for power supply wiring.
(3) It is recommended that you use thermocouple wires to connect thermocouple inputs directly to recorder terminals. However, where the distance between thermocouples and the recorder is long, compensation leadwires are typically used.
(4) It is recommended that solderless crimp-on lugs (for 4 mm screws) with insulation sleeves be used for leadwire ends (see Figure 6-1).

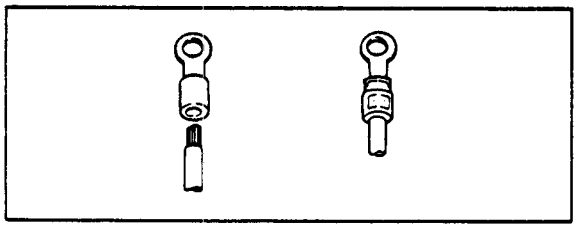


Figure 6-1. Solderless Lugs.

(5) To minimize noise pickup:
(a) The measuring circuit wiring should be spaced as possible from power circuit and ground circuit wiring.
(b) Use of shielded wires will be effective in suppressing noise pickup due to electrostatic induction. The shield of the cable should be connected to the recorder ground terminal. (always carry out one-point grounding).
(c) To minimize noise due to electromagnetic induction, it is recommended that the measuring circuit wires should be twisted at short, equal intervals.
(6) Ground the ground terminal to a low resistance ground.
(7) A measurement lead as shown in Figure 6-2 is supplied with the recorder. For measurement in DMM mode using CH13 (TREND/LOGGING Mode), use this measurement lead. For the safety of user and the object to be measured, the supplied measurement lead uses safety terminals – metal parts of terminals are not exposed.

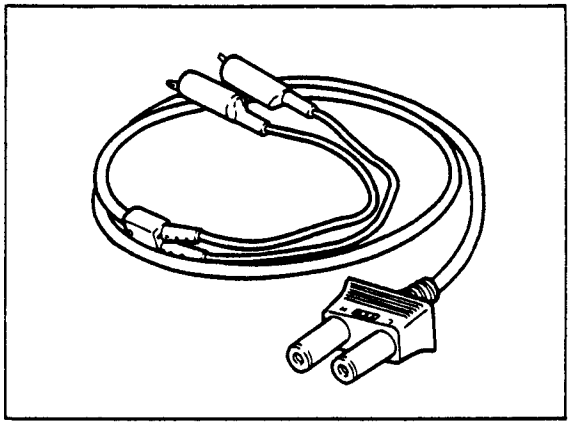


Figure 6-2. Measurement Lead.

6-2. Terminal Board.

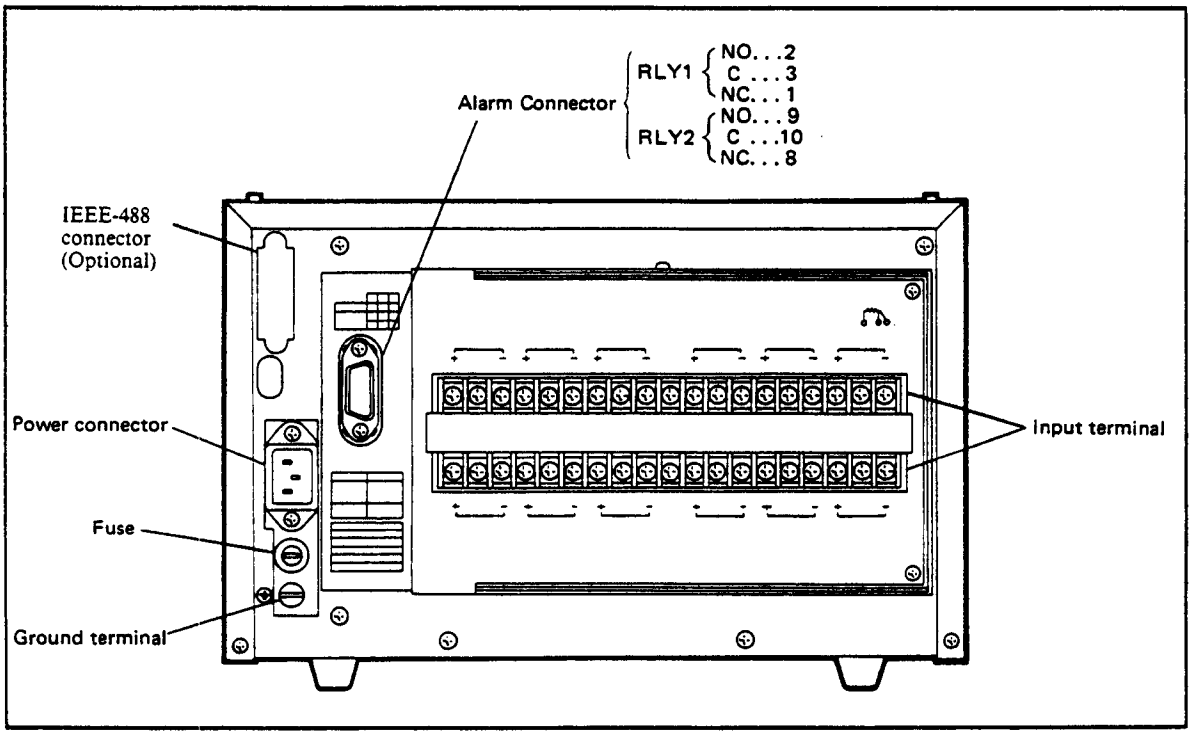


Figure 6-3. Terminal Board.

6-3. Input Terminal Connection.

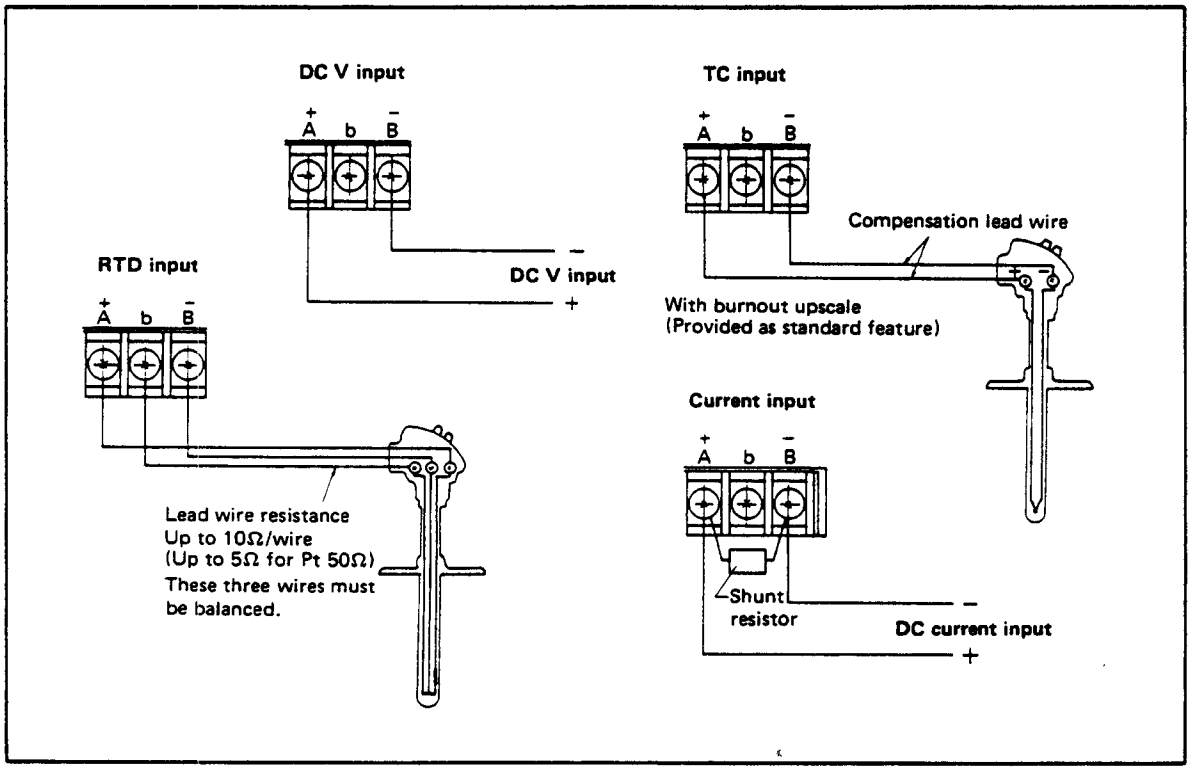


Figure 6-4. Input Terminal Connection.

7. OPERATION.

7-1. Preparation.

7-1-1. Chart Loading.

(1) Fan chart thoroughly at both ends before loading.

(2) Turn the POWER switch OFF and open the door.

(3) Remove the chart guide roller shaft while pushing it to the left (see Figure 7-1).

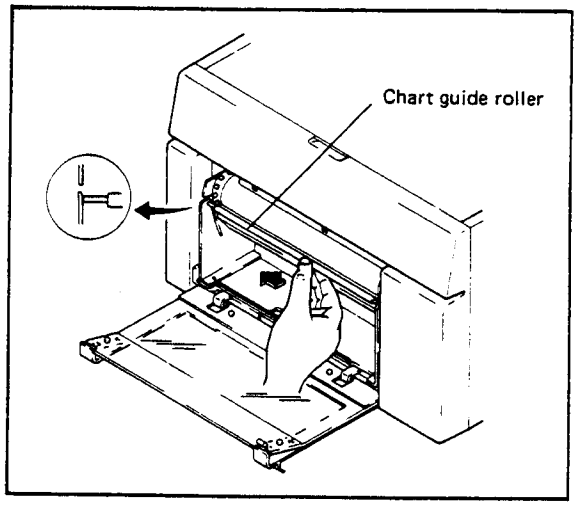


Figure 7-1.

(4) A stopper for drawing out the chart drive mechanism is provided under the chart rest tray. (The stopper projects through the square hole of the chart rest.)

(5) While pressing down the stopper, pull the chart drive mechanism toward you slowly to limit of travel (see Figure 7-2).

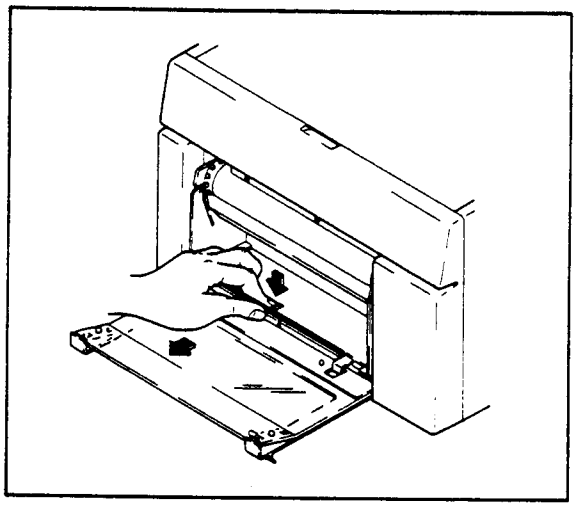


Figure 7-2.

(6) There is a chart guide plate on the top of the chart drive mechanism. Swing open the chart guide plate upward and you can see the chart compartment in it (see Figure 7-3).

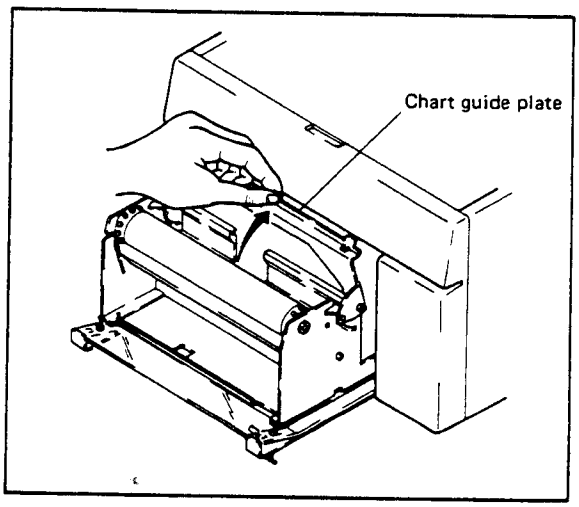


Figure 7-3.

(7) Load chart into the chart compartment (so that the pointed end of the chart is forward with the round chart perforations to the left).
Chart loading should be carefully made to avoid wrong insertion into the compartment, especially wrong folding at the end of the chart paper.

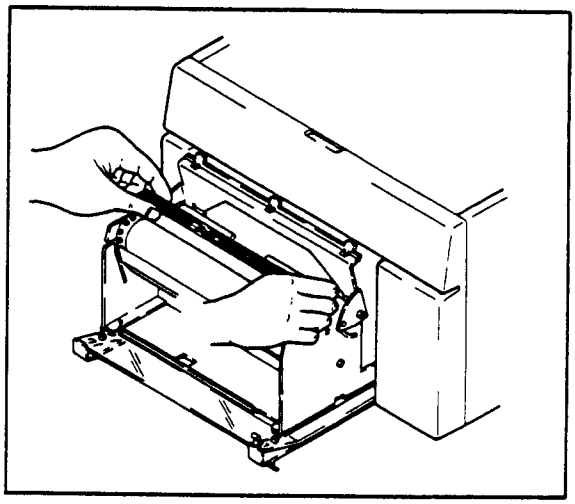


Figure 7-4.

(8) Pull out about seven folds of chart, engage the chart drive sprocket teeth in chart perforations and replace the chart guide plate in position.
(9) Push the chart drive mechanism slowly into the case and – observing the sprocket teeth, replace the chart guide roller shaft in position.
(10) Advance the chart manually until five folds of the chart drop into chart tray (Ensure that the chart is centered in the tray).
(11) The door should remain closed during recording.
(12) The "CHART" LED indicator on the recorder front panel will light when the recorder has run out of chart (remember that recording stops when the chart is fed 60 mm after the "CHART" LED is illuminated).

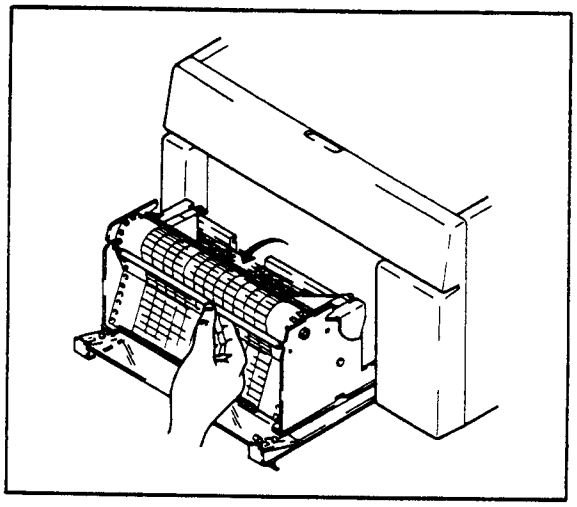


Figure 7-5.

7-1-2. Ink Ribbon Cassette Replacement.
(1) Turn the recorder POWER switch OFF.
(2) Open the cover on the recorder top.
(3) You can see the ink ribbon cassette attached to the printer carriage assembly (to replace the ink ribbon cassette, shift the printer carriage to 0% side).
(4) An ink ribbon cassette retainer plate is attached to the carriage assembly. While holding the retainer plate slightly upward, separate the ink ribbon cassette to 100% side (be careful not to damage the flexible printed circuit board).

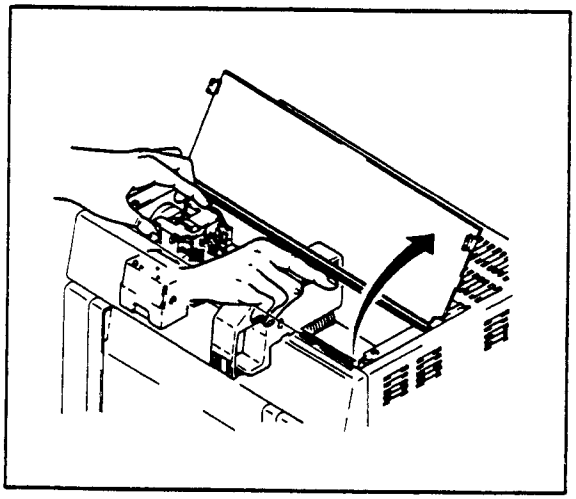


Figure 7-6.

(5) With the ink ribbon cassette slightly inclined, take it out of the carriage.
(6) To install an ink ribbon cassette, carry it near to the printer carriage assembly, with the ink ribbon cassette slightly inclined.
(7) The ink ribbon drive gear (a white Derlin gear) shaft of the carriage is provided with a guide hole for inserting the ink ribbon cassette shaft. Insert the cassette shaft into this hole. In doing this, obtain secure engagement of the cassette shaft with the ribbon drive gear shaft by turning the ribbon drive gear knob right and left.

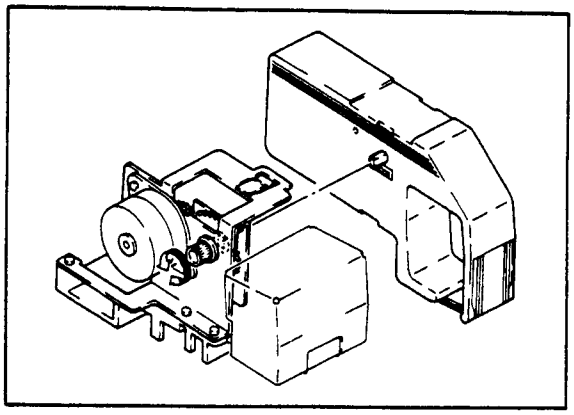


Figure 7-7.

(8) When the ink ribbon cassette is held firmly by the ink ribbon cassette retainer plate, now the replacement is finished.

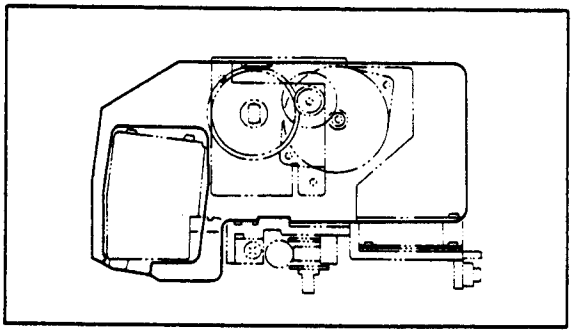


Figure 7-8.

7-1-3. Battery Replacement.

(1) Turn the recorder POWER switch ON. When replacing the batteries, turn ON this power switch to protect the contents of the memory.
(2) Open the door to gain access to a stopper for drawing out the chart drive mechanism under the chart rest tray. (The stopper projects through the square hole of the chart rest.)
(3) While pressing down the stopper, pull the chart drive mechanism toward you to remove.
(4) Three batteries (SUM-2) are installed in the chart drive mechanism.
(5) Replace the batteries with new batteries (replacement period is approximately three months.)

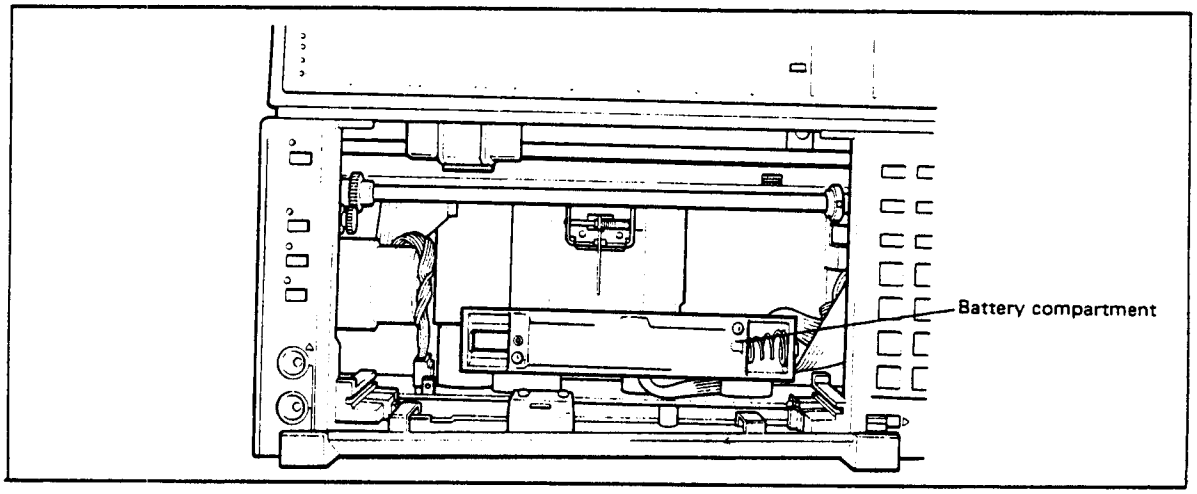


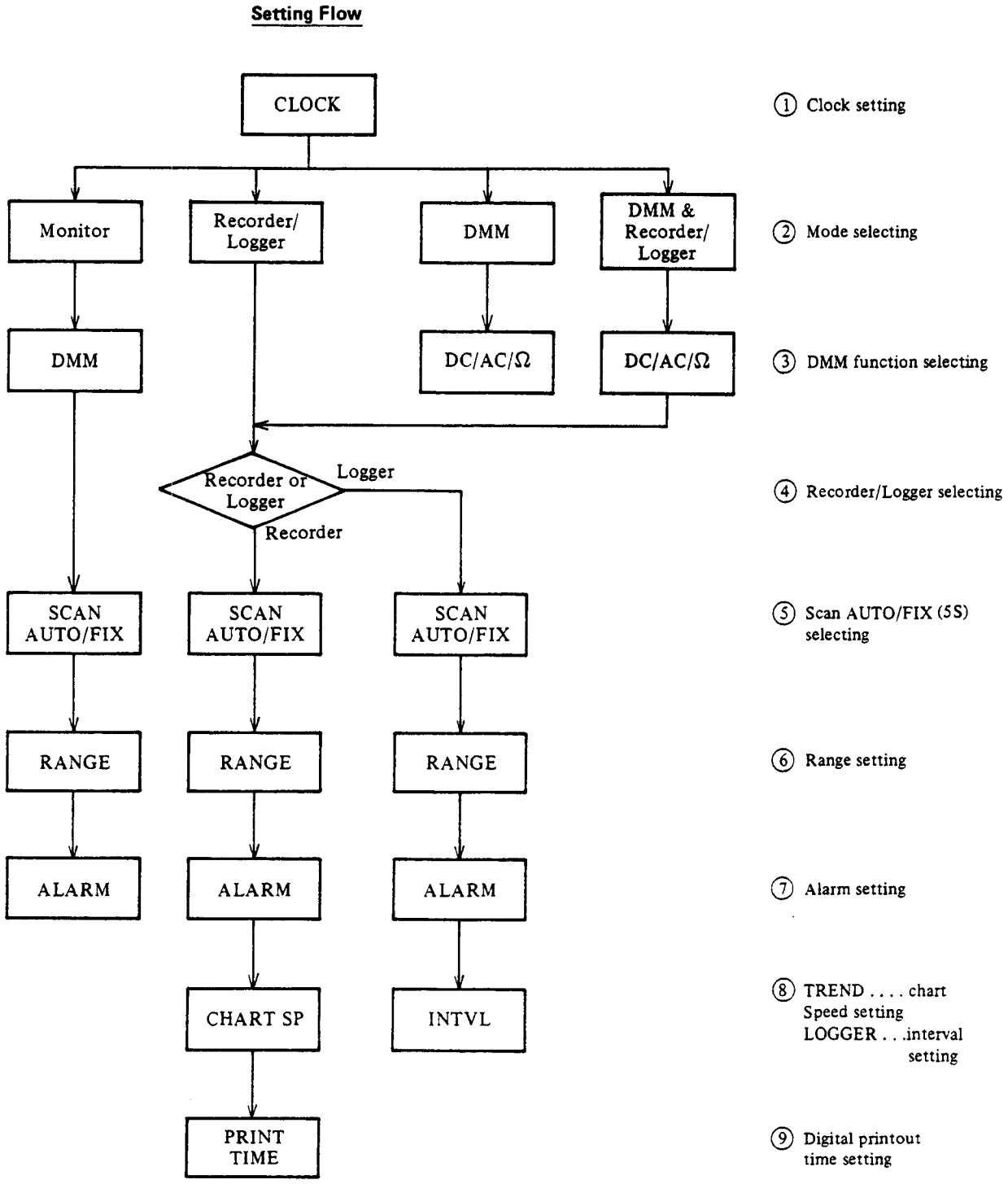
Figure 7-9.

7-2. Setting Status at Power Switch ON. (When the recorder is not backed up by batteries.)

CLOCK; 84 01 01 00.00
MODE: TREND
DISPLAY: CLOCK
SCAN: AUTO
MONITOR: ON
RANGE: CH1 to CH12, Normal, Analog/digital ±2
CH13; Skip
ALARM: All channels OFF
CHART SP: 100 mm/h
INTVL: 1 minute
PRINT TIME: 00 minute
"BATTERY" LED: Flashes.

Note: When the recorder is backed up by batteries, the setting status is the same as just before the power supply was turned OFF.

7-3. Setting Flowchart.



★ **Notes on Changing RANGE or Mode.**

(1) RANGE Changing.

When an alarm is set on the channel whose RANGE is to be changed, the set alarm turns OFF at the same time, the RANGE is changed.

(2) Mode Changing.

Even when the mode is changed, the other setting information such as range, alarm, clock, etc. is effective.

- Trend to Logging: Even when the mode returns to trend after interruption, digital printout does not continue.
- Logging to Trend: When the mode is changed while recording in logging mode, trend recording begins after all channels have been recorded.

7-4. DISPLAY Selection.

7-4-1. DATA (AUTO).

(1) Press the DISPLAY key to illuminate the "DATA (AUTO)" LED indicator.
(2) The measurement data for channels 1 to 12 appear sequentially on the display at 3 second intervals (however, if the DMM function is used, the measurement data for channel 13 is displayed in addition to the above).

7-4-2. DATA (MAN).

(1) Press the DISPLAY key to illuminate the "DATA (MAN)" LED indicator.
(2) Press the CH key (green) to increment the channel number until the desired channel is called.
(3) The measurement data for designated channel number is displayed.

7-4-3. CLOCK (Year, Month, Day, Hour and Minute).

(1) Press the DISPLAY key to illuminate the "CLOCK" LED indicator.
(2) The year, month, day, hour and minute appear on the display.
(3) Refer to par. 7-10 for setting year, month, day, hour and clock.

7-5. Printout Mode Selection.

7-5-1. TREND Mode.

(1) Press the MODE key to illuminate the "TREND" LED indicator.
(2) The recorder performs analog or analog/digital data printout.

7-5-2. LOGGING Mode.

(1) Press the MODE key to illuminate the "LOGGING" LED indicator.
(2) The recorder performs digital data printout at fixed intervals.

7-6. SCAN Selection.

7-6-1. SCAN AUTO.

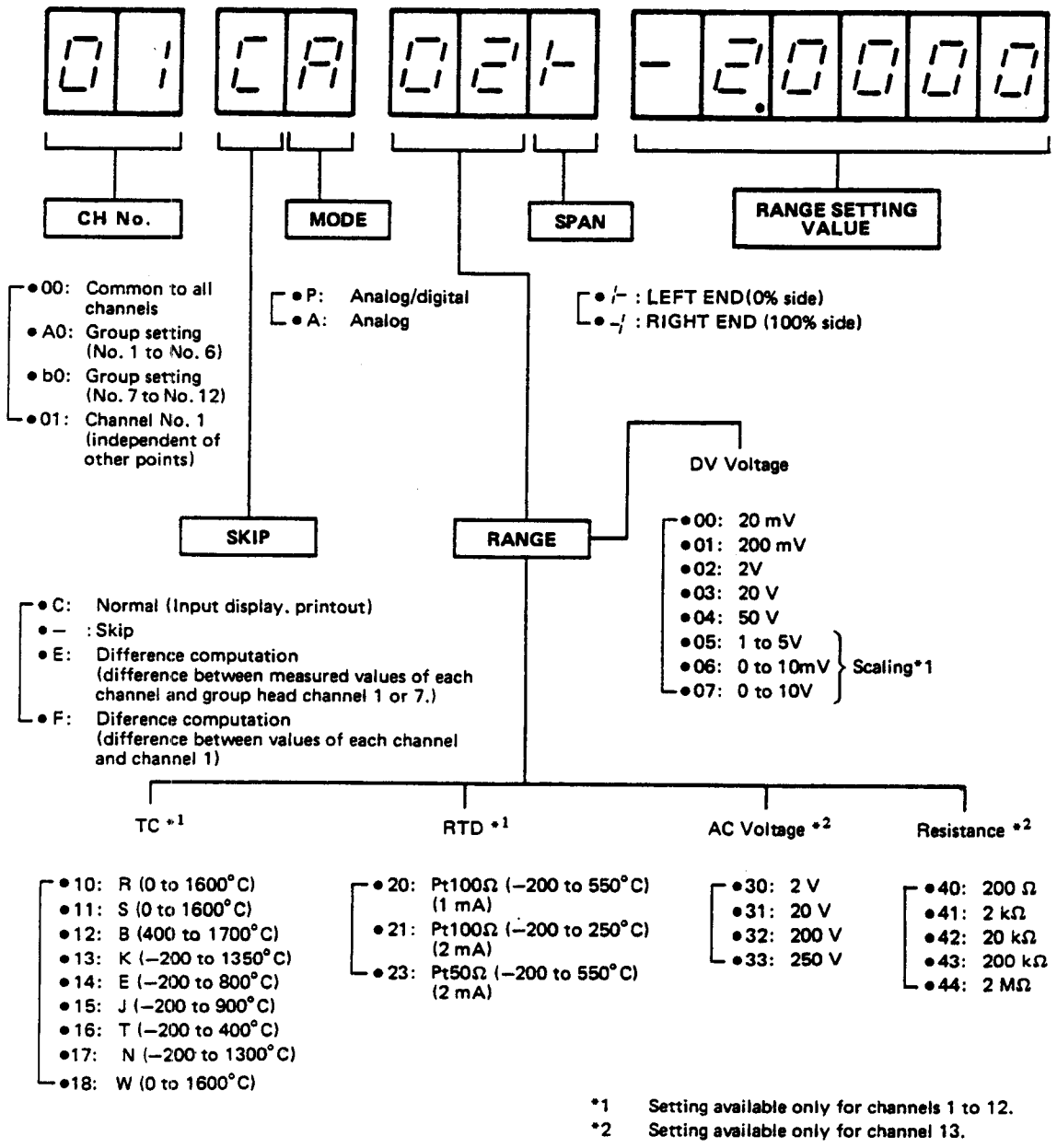
(1) Press the SCAN key to illuminate the "AUTO" LED indicator.
(2) In TREND mode, the scanning period varies in conjunction with the selected chart speed. Recording chart is fed 0.25 mm on each scan.
(3) In LOGGING mode, input scanning is performed every interval period.

7-6-2. SCAN FIX (5S).

(1) Press the SCAN key to illuminate the "FIX (5S)" LED indicator.
(2) Scanning period (5 seconds) is constant regardless of the chart speed (TREND mode) and interval (LOGGING mode).

7-7. Range Setting (TREND Mode).

◎ **Range Setting Table for TREND Mode.**



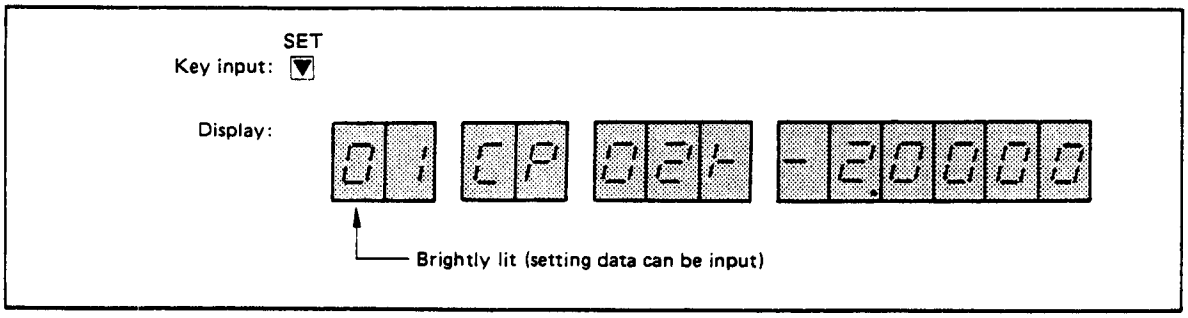
*1 Setting available only for channels 1 to 12.
*2 Setting available only for channel 13.

○ Minimum recording span
- DC Voltage: minumum 3 mV
- TC: minimum 100 °C and 3 mV
- RTD: minimum 20 °C (Pt 100Ω), minimum 40°C (Pt 50Ω)

7-7-1. Common Setting for All Channels.

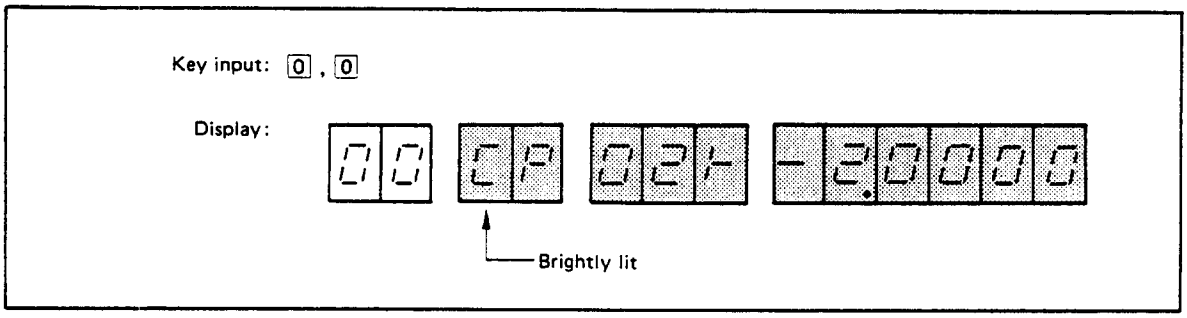
(Setting example) Common to all channels, normal input, analog recording, range 2 V (−1.5 to +1.4 V)

(1) RANGE Setting (Select RANGE using SET key)



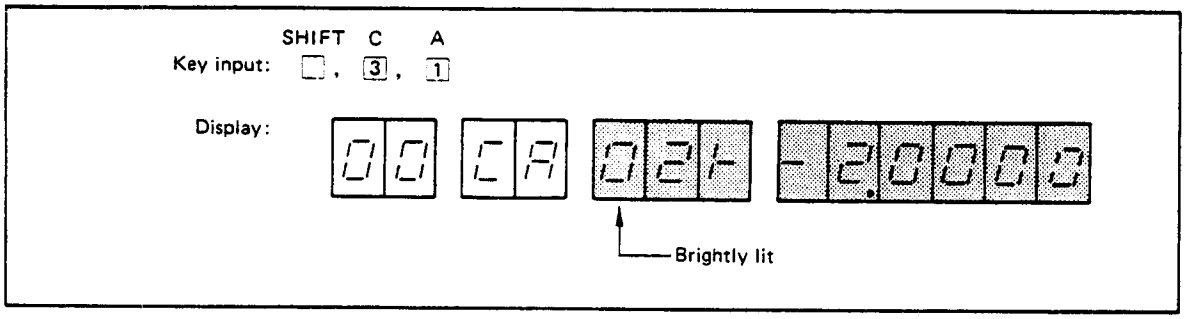
Note: 1: The following toned-screen displays show old data set, and untoned-screen displays show updated data.
2: + or − is brightly lit.

(2) Channel No. Setting (common to all channels)

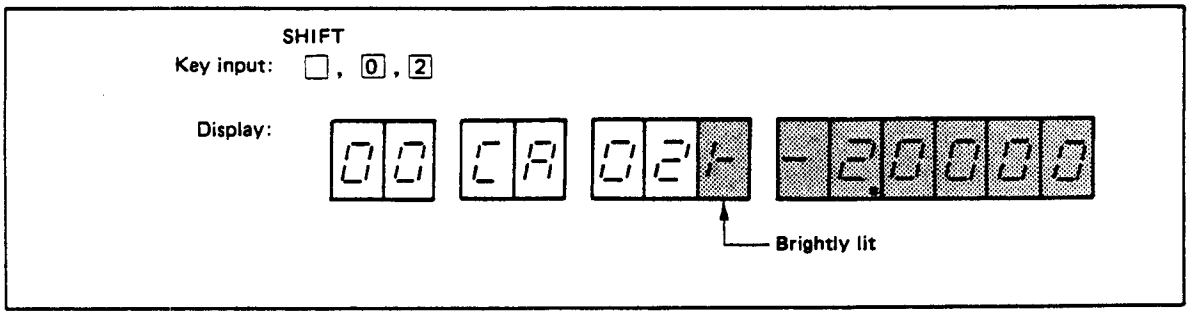


- When the first digit is entered, the brightly lit digit automatically shifts to the right.

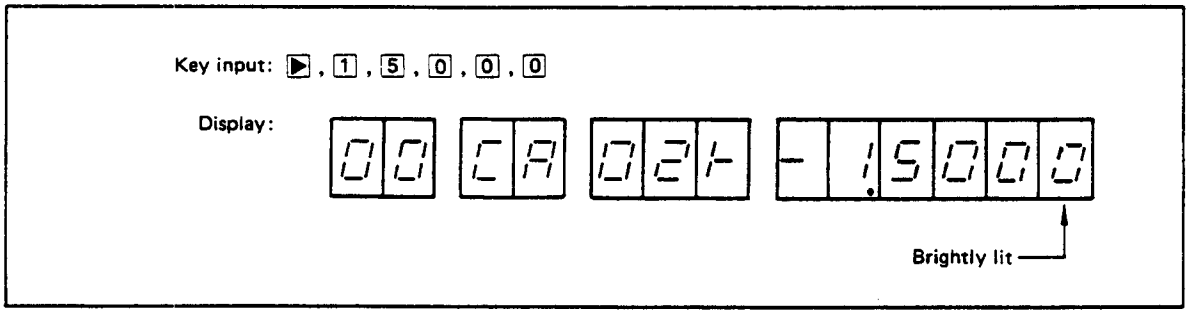
(3) Normal, Analog Setting



(4) RANGE Code Setting (2 V range)

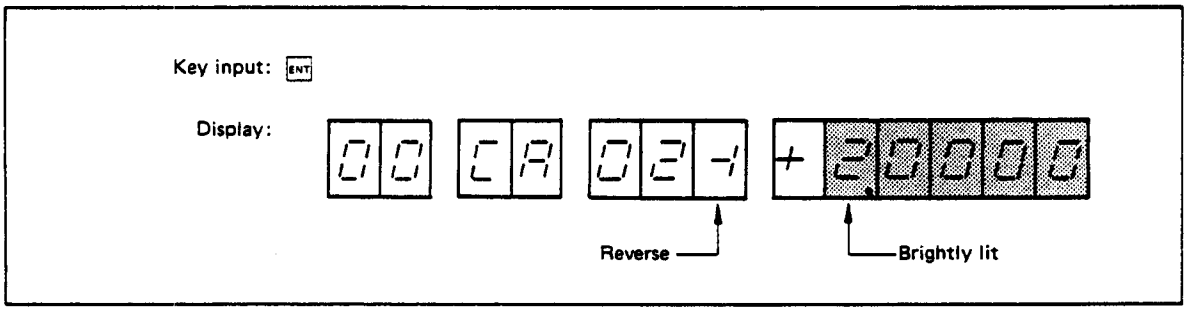


(5) LEFT END Value: −1.5000 V Setting

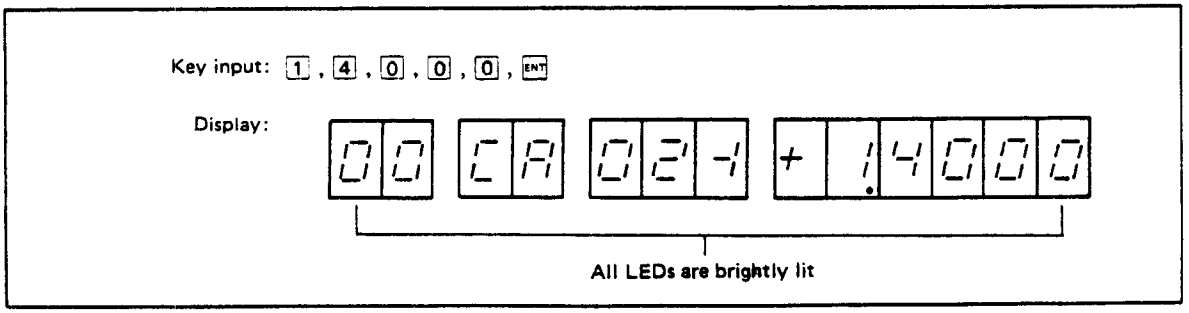


- Confirm that the setting value is correct; if it is not, use (◀,▶) keys to shift indicator value and input correct value using numeric keys.

(6) Setting Input



(7) RIGHT END Value: +1,4000 V Setting



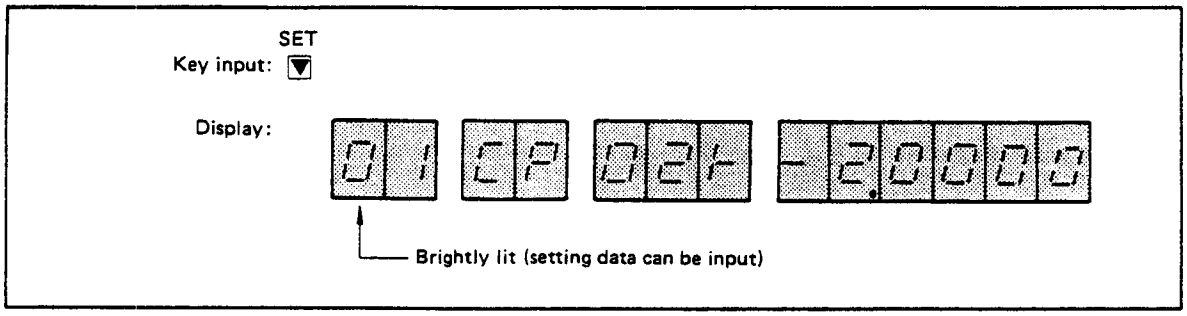
- Now setting is finished.

- Attempt to enter an erroneous setting (e.g. range is set to outside the specifications) causes all display LEDs to flash.
  In this case, press an appropriate numeric key to stop flashing. Confirm correct setting and re-enter.

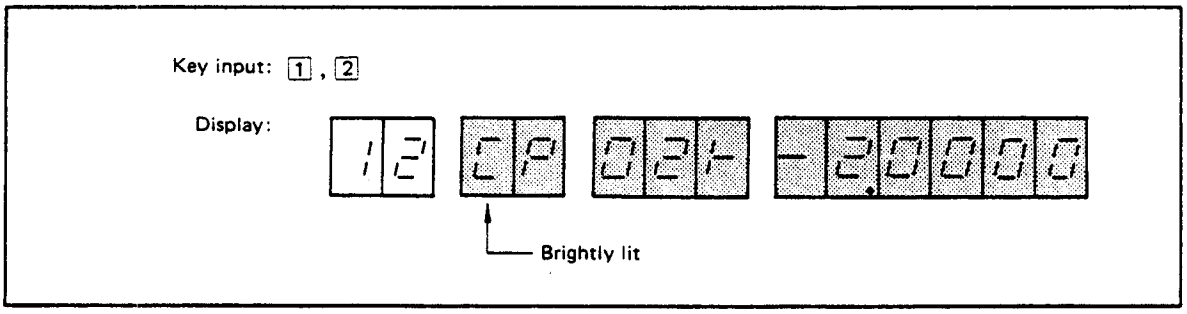
7-7-2. Scaling Setting.

(Setting example) Channel No. 12, normal input, analog/digital recording,
1 to 5 V (Scaling input) to −100 to +500 scaling.

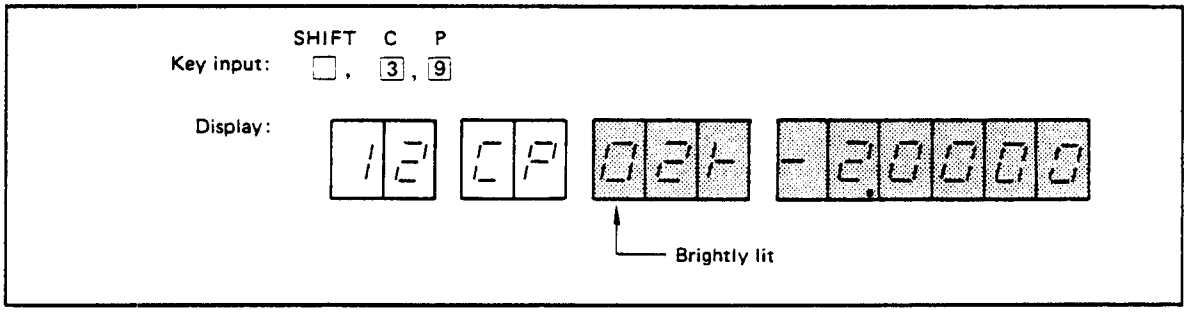
(1) RANGE Setting (Select RANGE using SET key)



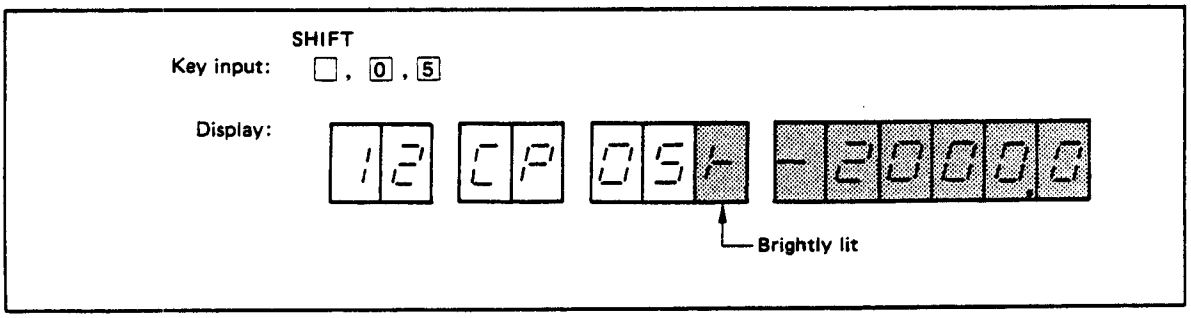
(2) Channel No. Setting (Channel 12)



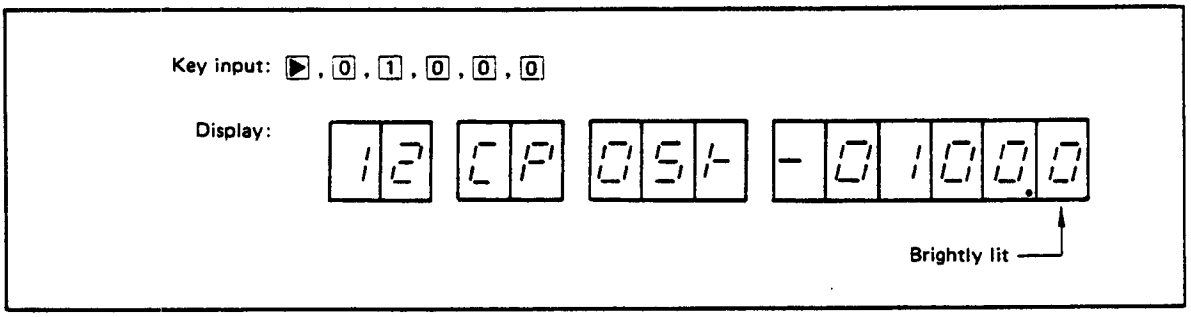
(3) Normal, Analog/Digital Setting



(4) RANGE Code Setting (1 to 5 V range)

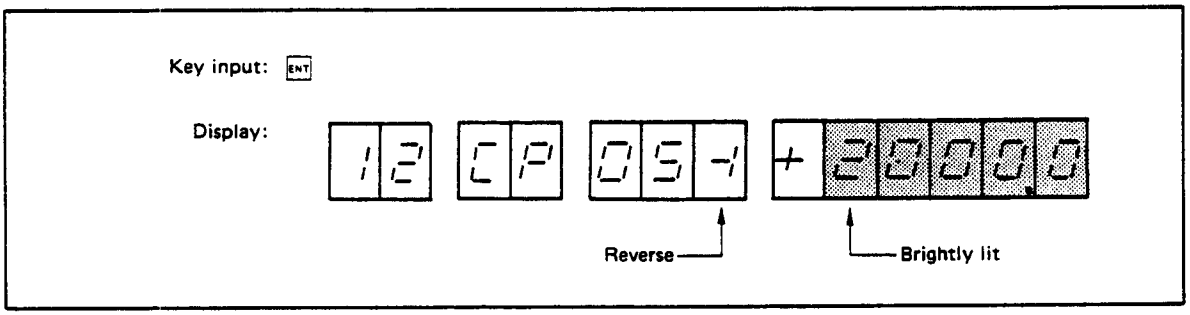


(5) LEFT END Value: −100 setting

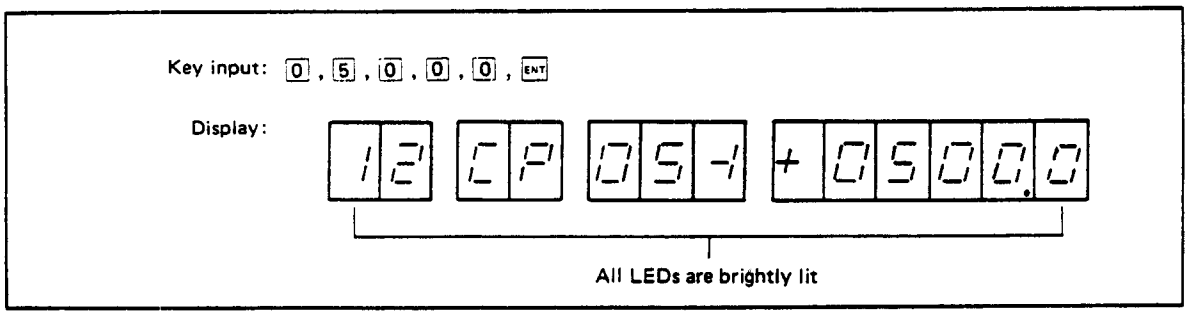


- For scaling setting, a span of 2000 or less can freely be set within the range ±2000.0.
- Confirm that the setting value is correct.

(6) Setting Input



(7) RIGHT END Value: +500 Setting



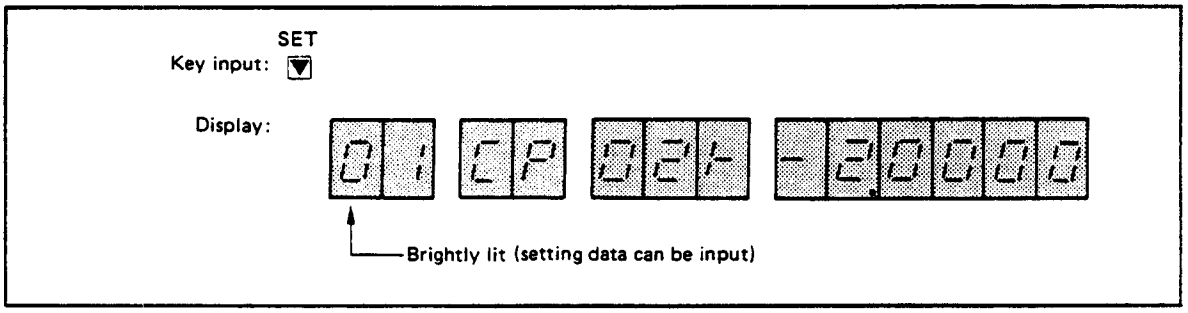
- Now setting is finished.

7-7-3. Difference Computation Setting.

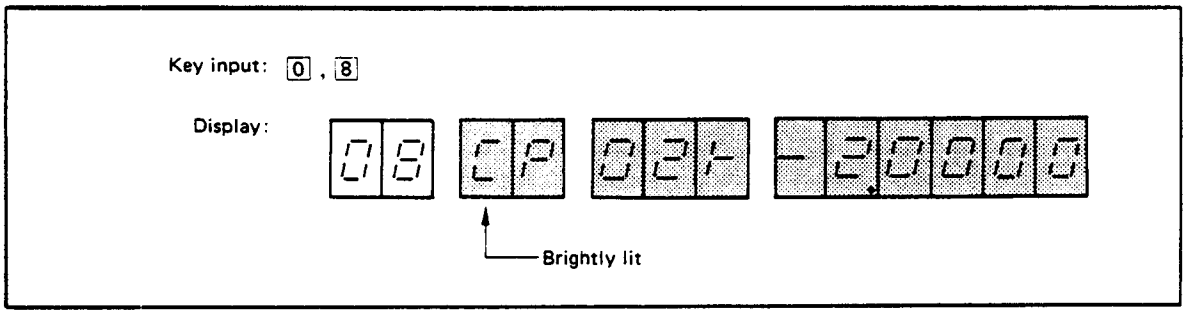
Note:
1: Difference computation cannot be set in the scaling ranges (1 to 5 V, 0 to 10 mV, and 0 to 10 V).
2: Difference computation cannot be set unless the difference has the same dimension as the reference channel or the first channel of a group.

(Setting example) Channel No. 8, difference computation (E), analog/digital recording, TC Type K −50 to +250°C

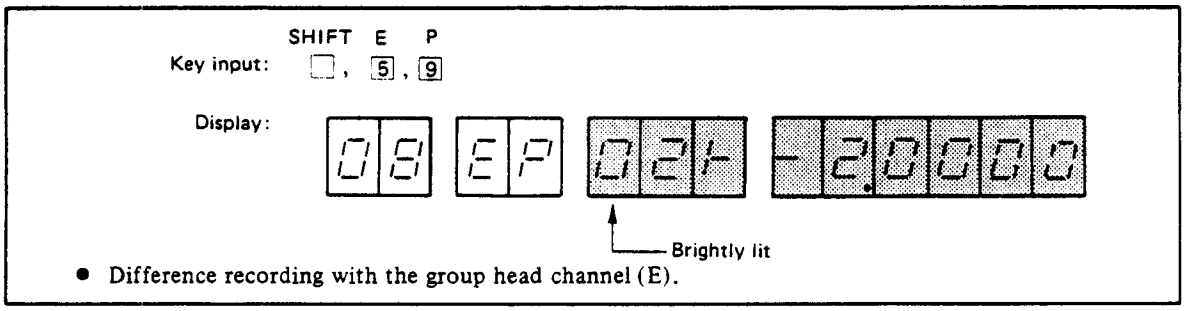
(1) RANGE Setting (Select RANGE using SET key)



(2) Channel No. Setting (Channel 8)

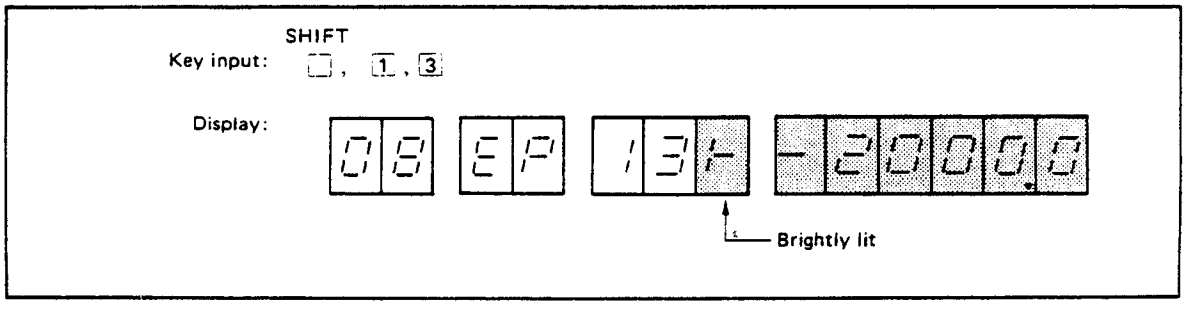


(3) Difference Computation (E), Analog/Digital Recording

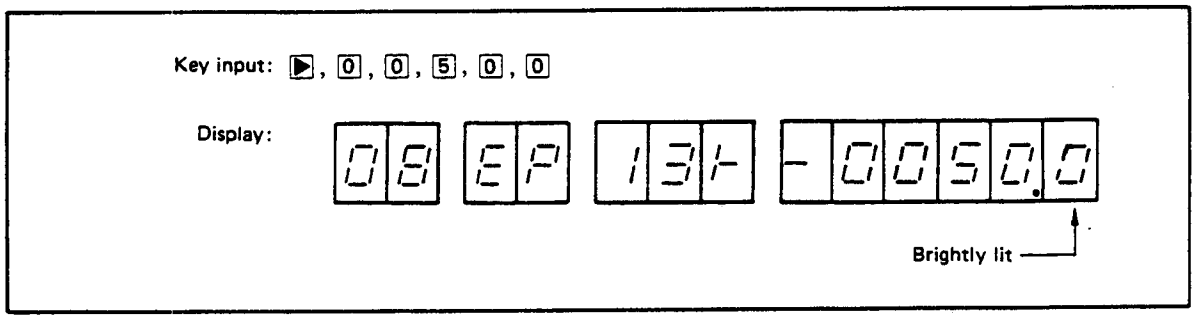


- Difference recording with the group head channel (E).

(4) RANGE Code Setting (TC Type K, −50 to 250°C)

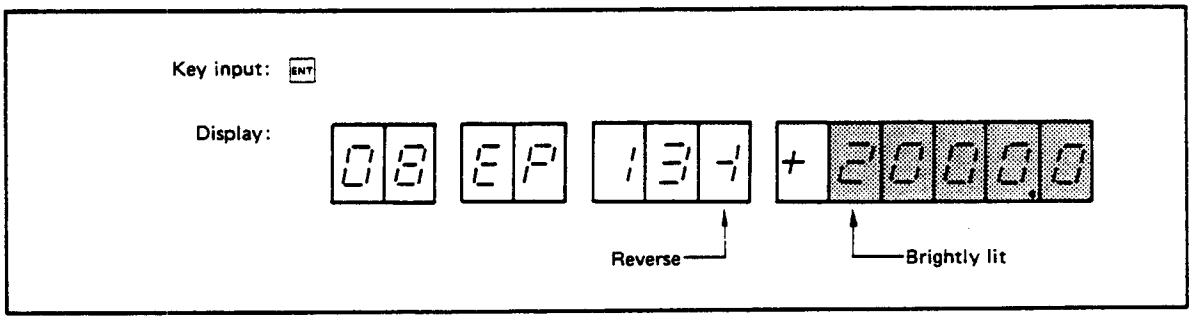


(5) LEFT END Value: −50°C Setting



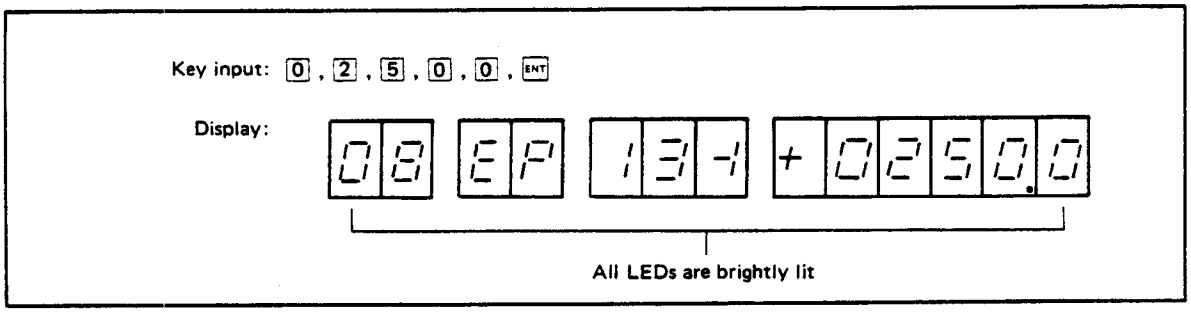
- Confirm that the setting value is correct.

(6) Setting Input



Note: If the input cannot be entered, confirm the dimension of the reference channel.

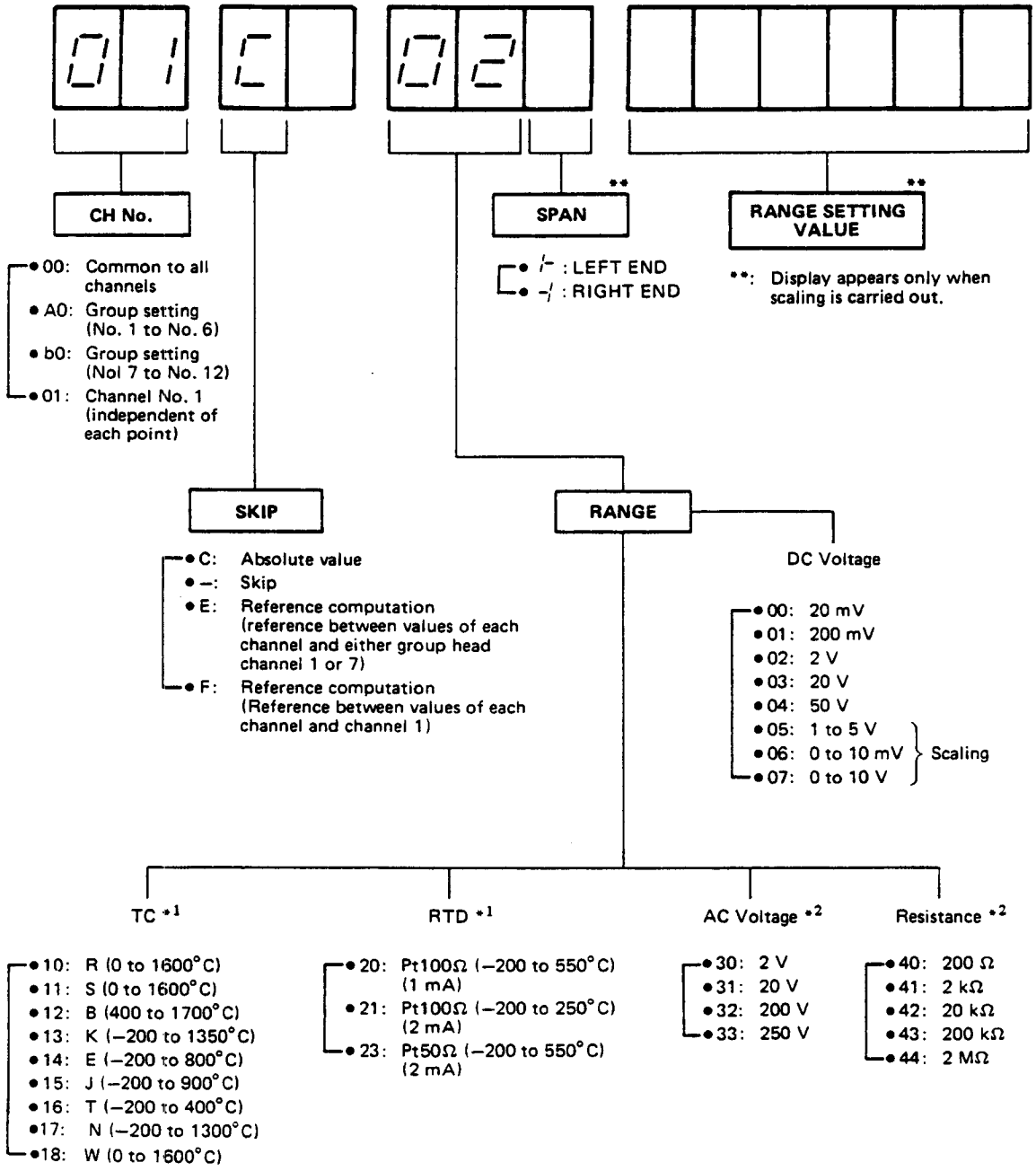
(7) RIGHT END Value: +250°C Setting



- Now setting is finished.

7-8. Range Setting (LOGGING Mode).

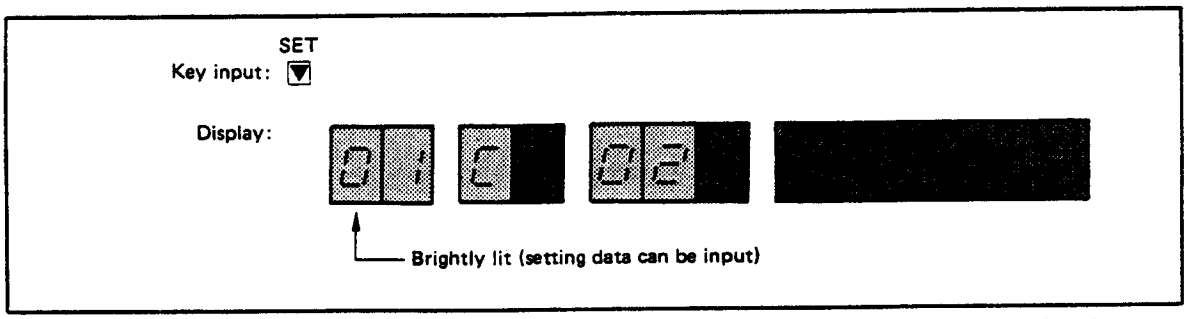
○ **Setting Table for LOGGING Mode (only for LOGGING mode)**



*1 Setting available only for channels 1 to 12.
*2 Setting available only for channel 13.

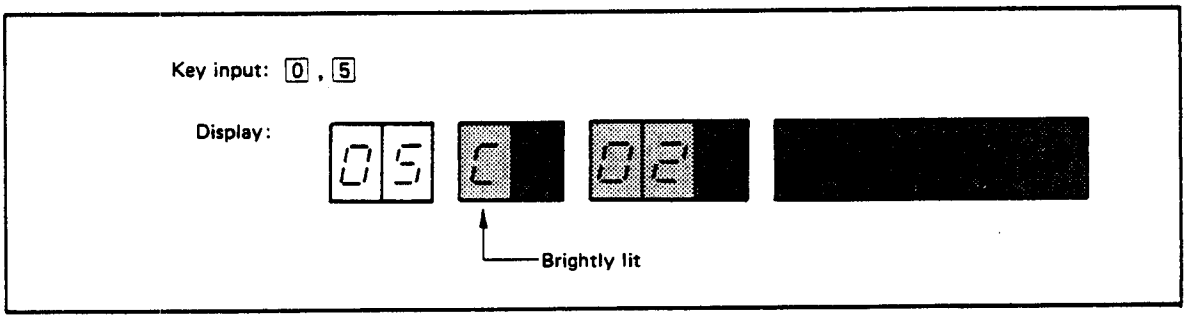
(Setting example) Channel No. 5, normal, TC Type E

(1) RANGE Setting (Select RANGE using SET key)

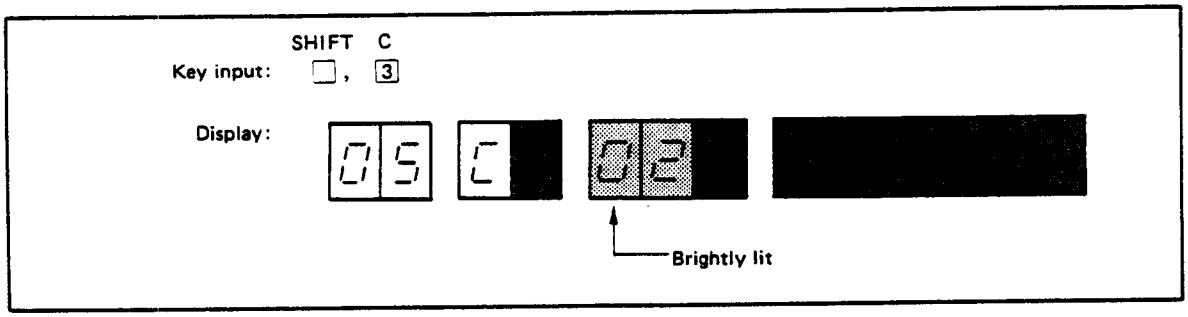


Note: The following toned-screen (brighter) displays show old data set, and darkly toned-screen displays show that LEDs are completely turned OFF.

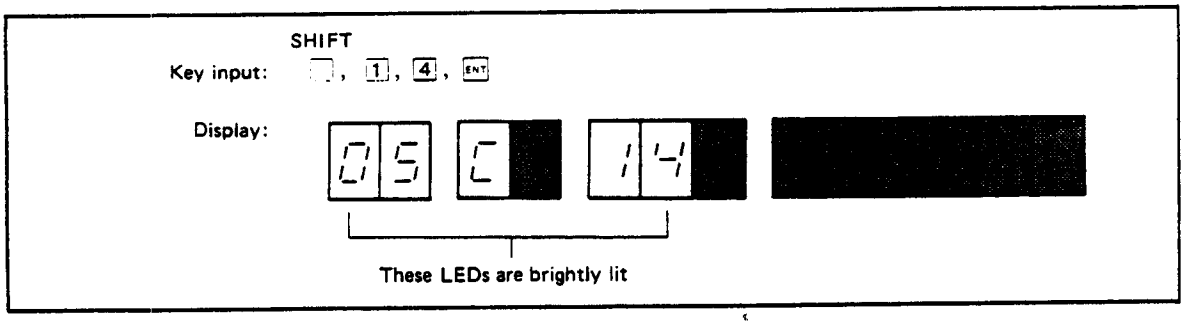
(2) Channel No. Setting (Chanenl 5)



(3) Normal Setting

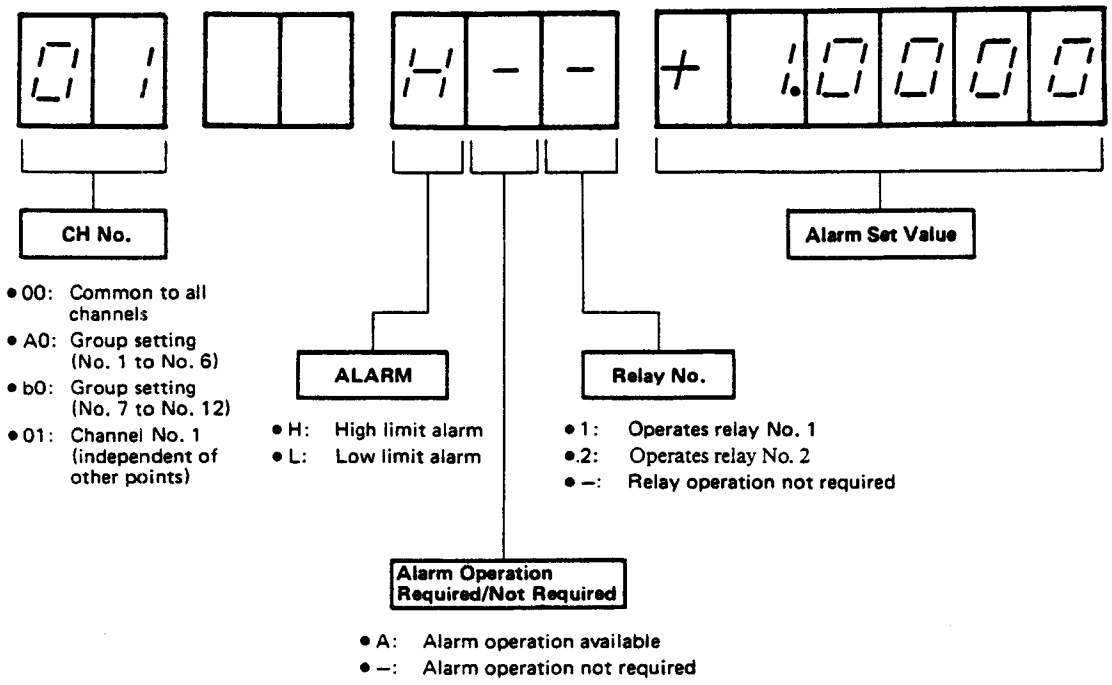


(4) RANGE Code Setting (TC Type E)



- Attempt to enter an erroneous setting (e.g. range is set to outside the specifications) causes all display digits to flash.
  In this case, press an appropriate numeric key to stop flashing. Confirm correct setting and re-enter.

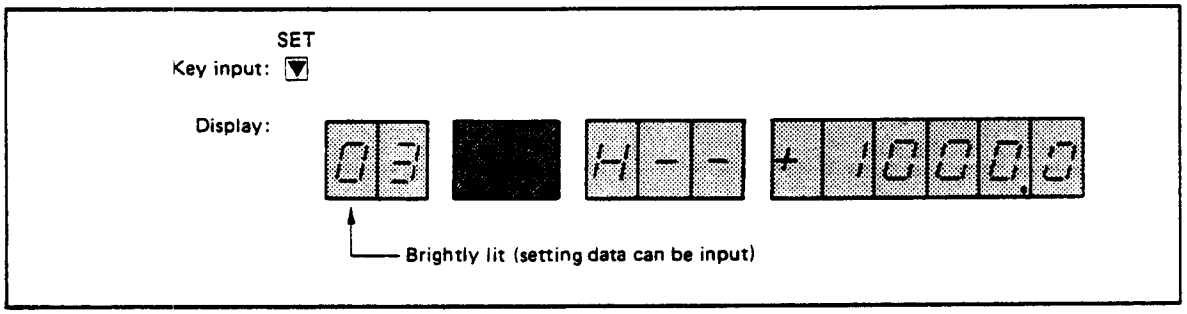
7-9. ALARM Setting.



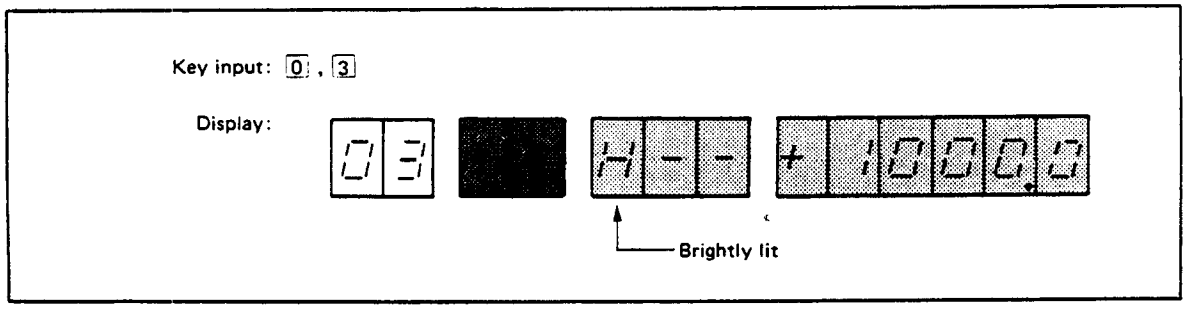
(Setting example)

After setting RANGE for the thermocouple type T into the channel No. 3, implement the following alarm setting. Channel No. 3, high (H) limit alarm, alarm ON Relay No. 1, Set value 300°C.

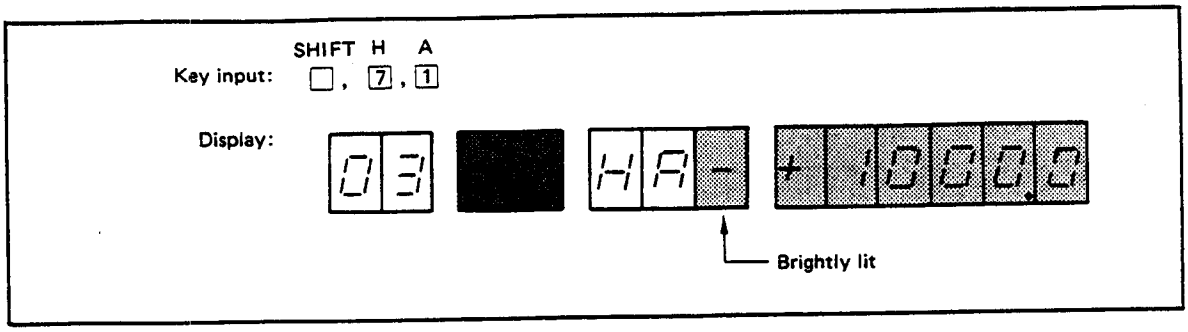
(1) Alarm Setting (Select ALARM using SET key)



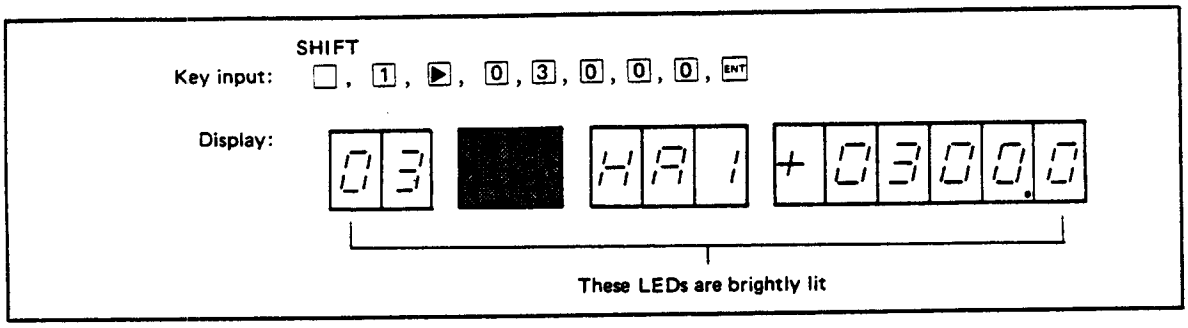
(2) Channel No. Setting (Channel 3)



(3) High Limit (H)/Low Limit (L) Setting, Relay ON (A)/OFF (–) Setting



(4) Relay No. and Setting Values

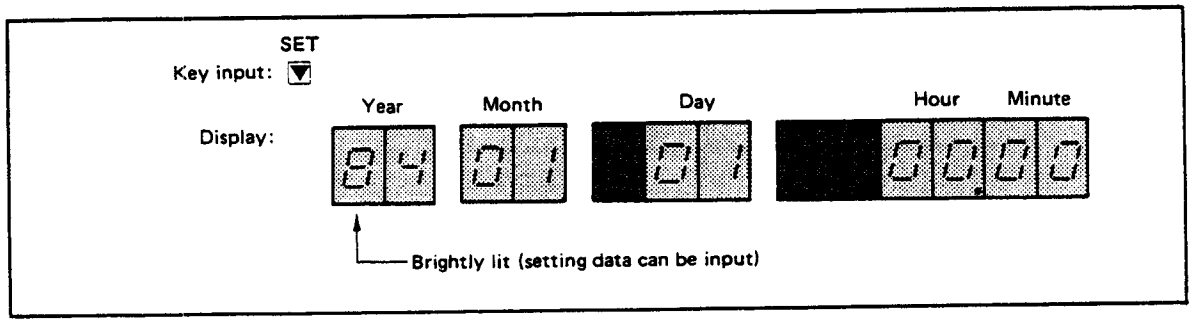


- Attempt to enter an erroneous setting (e.g. range is set to outside the specifications) causes all display digits to flash.
  In this case, press an appropriate numeric key to stop flashing. Confirm correct setting and re-enter.

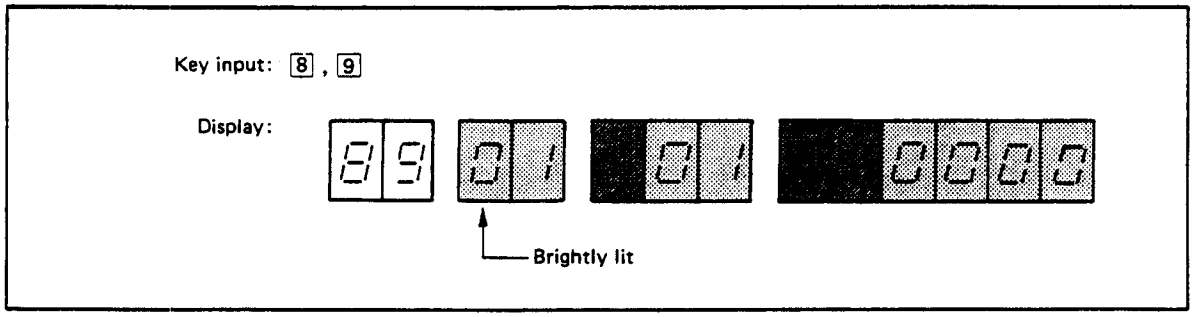
7-10. CLOCK (Year, Month, Day, Time) Setting.

(Setting example) 1:35 P.M. June 14, 1989

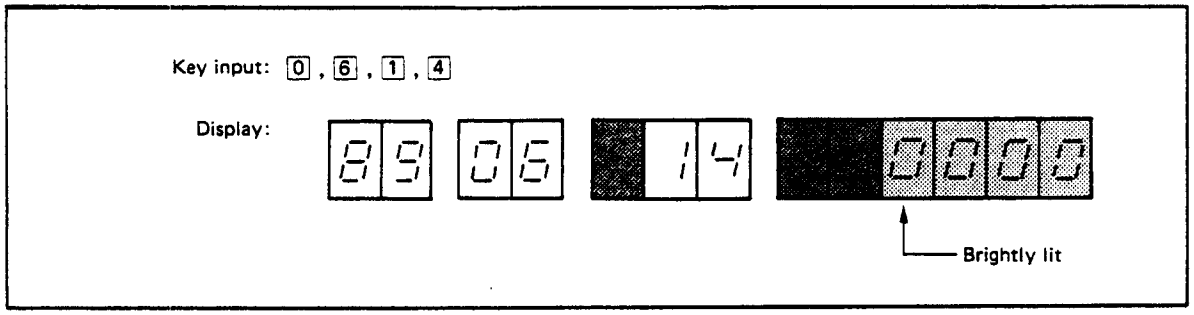
(1) CLOCK Setting (Select CLOCK using SET and DISPLAY keys)



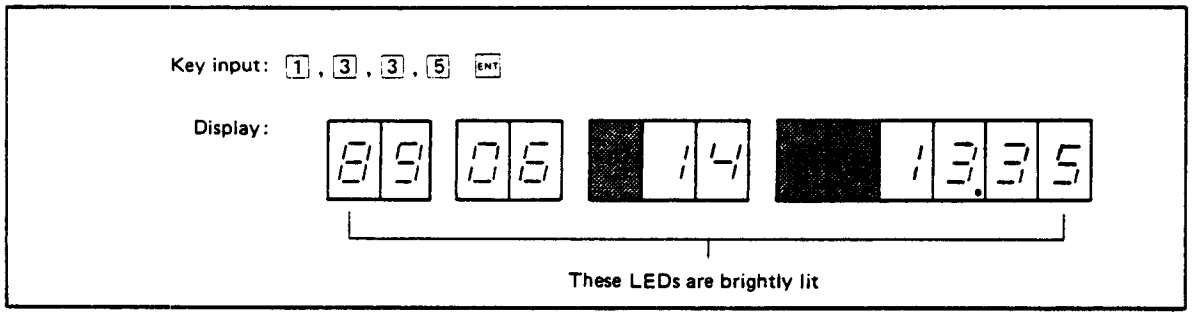
(2) Year Setting



(3) Month, Day Setting



(4) Hour, Minute Setting

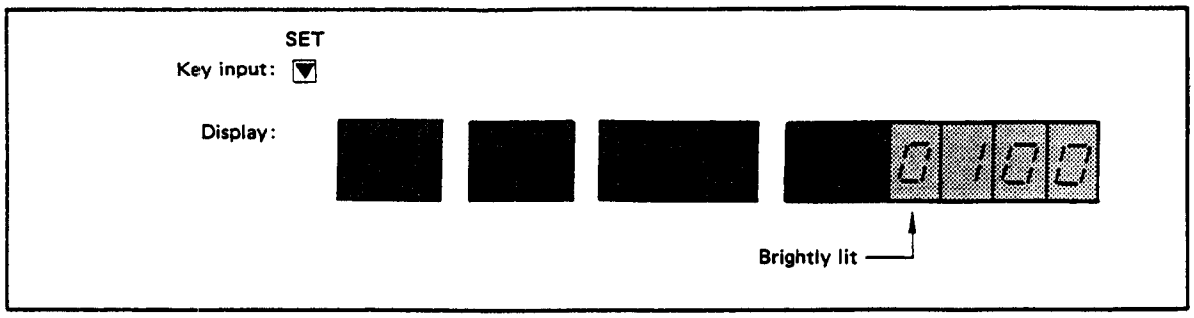


- Attempt to enter an erroneous setting (e.g. range is set to outside the specifications) causes all display LEDs to flash.
  In this case, press an appropriate numeric key to stop flashing. Conform correct setting and re-enter.

7-11. Chart Speed Setting (in TREND Mode).

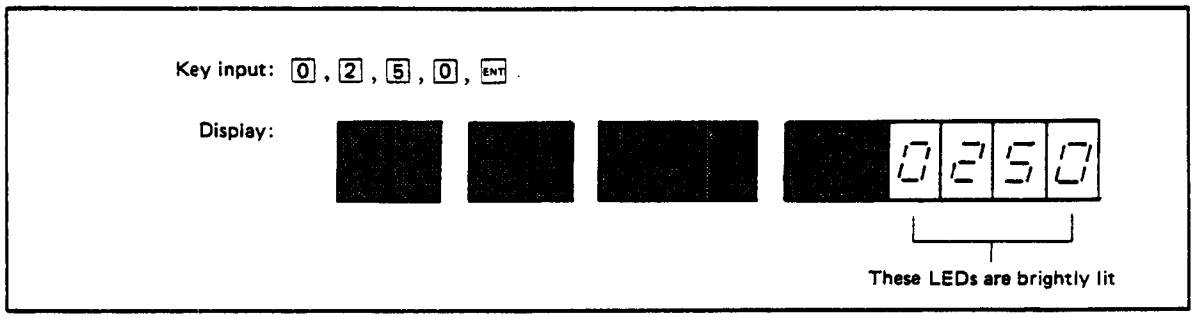
(Setting example) 250 mm/h

(1) Select CHART SP/INTVL Using SET Key.



- Chart speed can be set within the range 1 and 1200 mm/h.

(2) Chart Speed Setting.

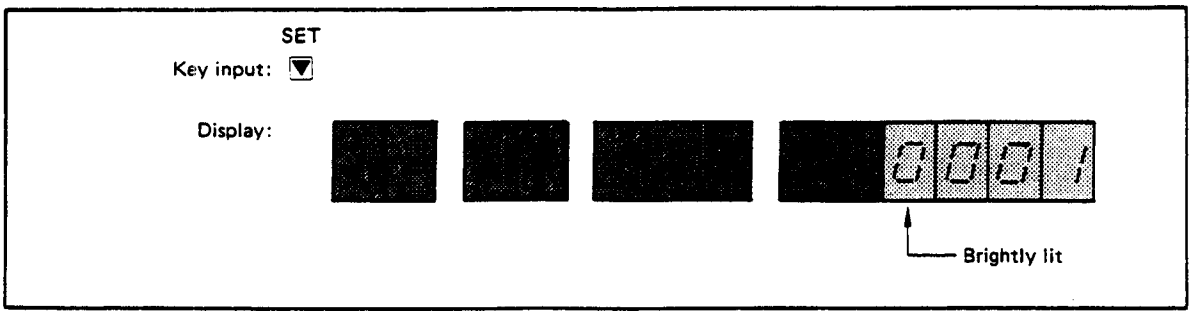


7-12. Digital Printing Interval Setting (in LOGGING Mode).

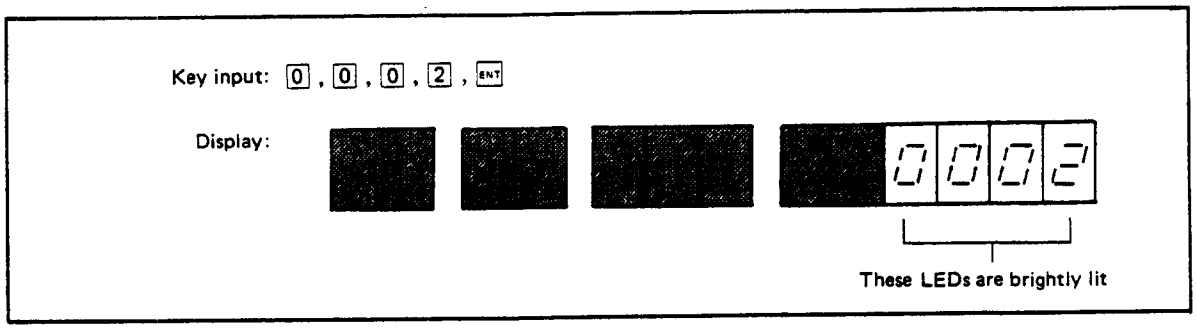
In LOGGING mode, sets time interval to print out digital measurement data on the chart. Time interval can be set from 1 minute to 24 hours.

(Setting example) 2 minute interval

(1) Select CHART SP/INTVL Using SET Key



(2) Interval Setting



7-13. PRINT TIME Setting (in TREND Mode).

In TREND mode, channel numbers and measured data are printed out digitally in the left margin of the chart. Print time can be set in minute units, i.e. the time in minutes after the hour at which printing is required. However, print interval is fixed by CHART SPEED.

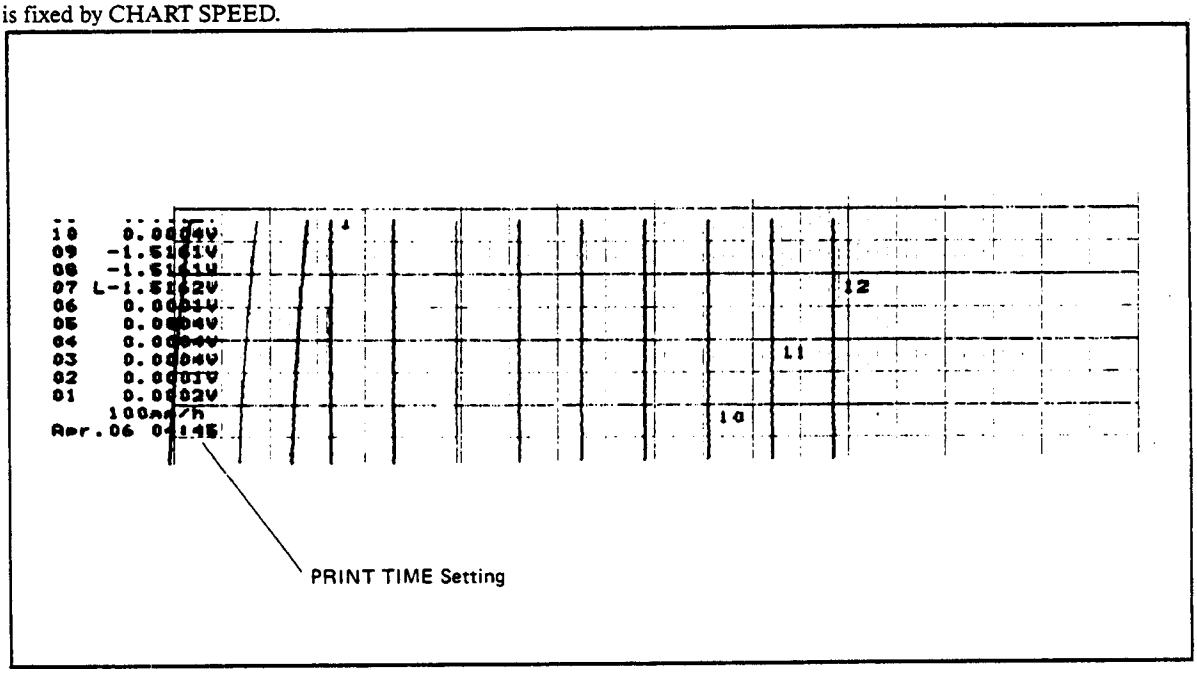
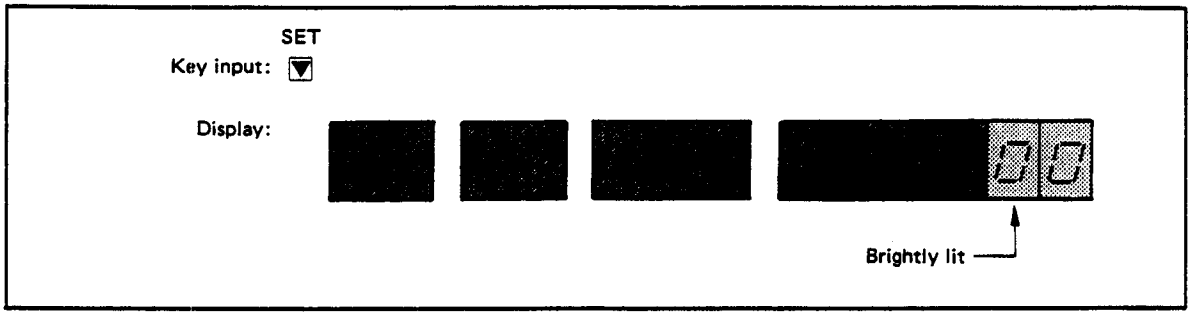
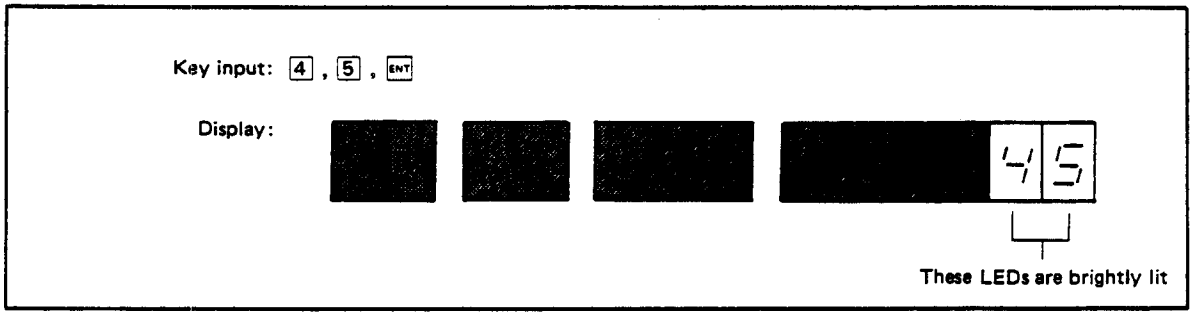


Chart speed mm/h	Digital measured data print interval in hours
10 to 24	12
25 to 49	4
55 to 99	2
100 to 500	1

(Setting value) 45 minutes
(1) Select PRINT TIME Using SET Key

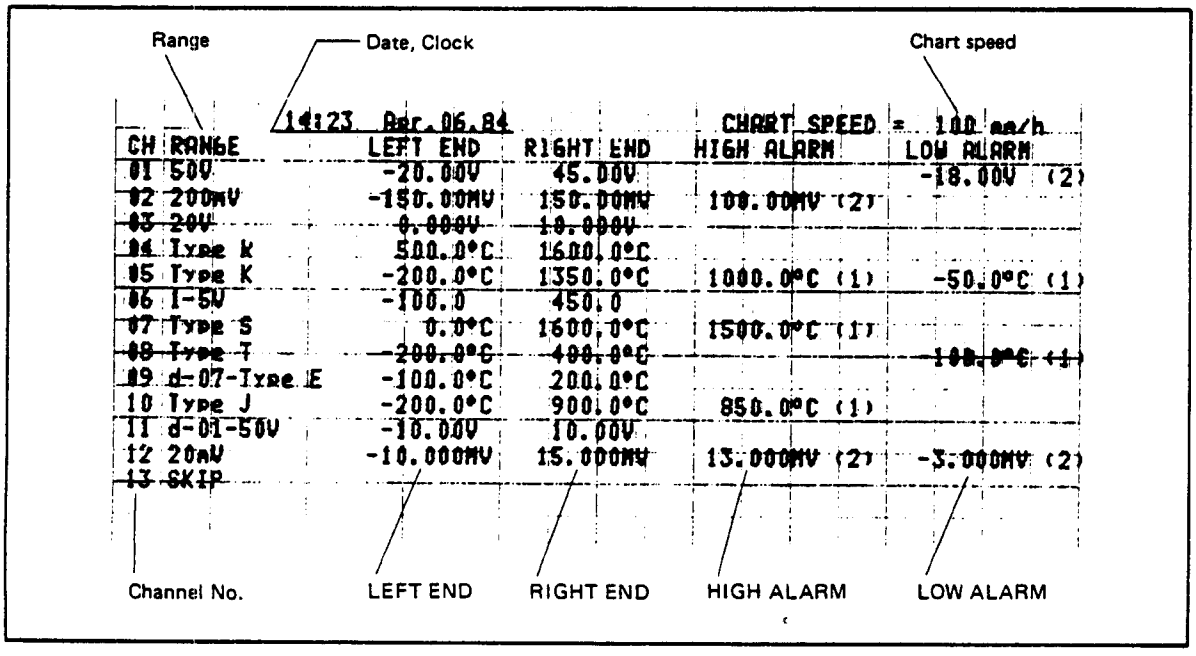


(2) Interval Setting



7-14. LIST Function.

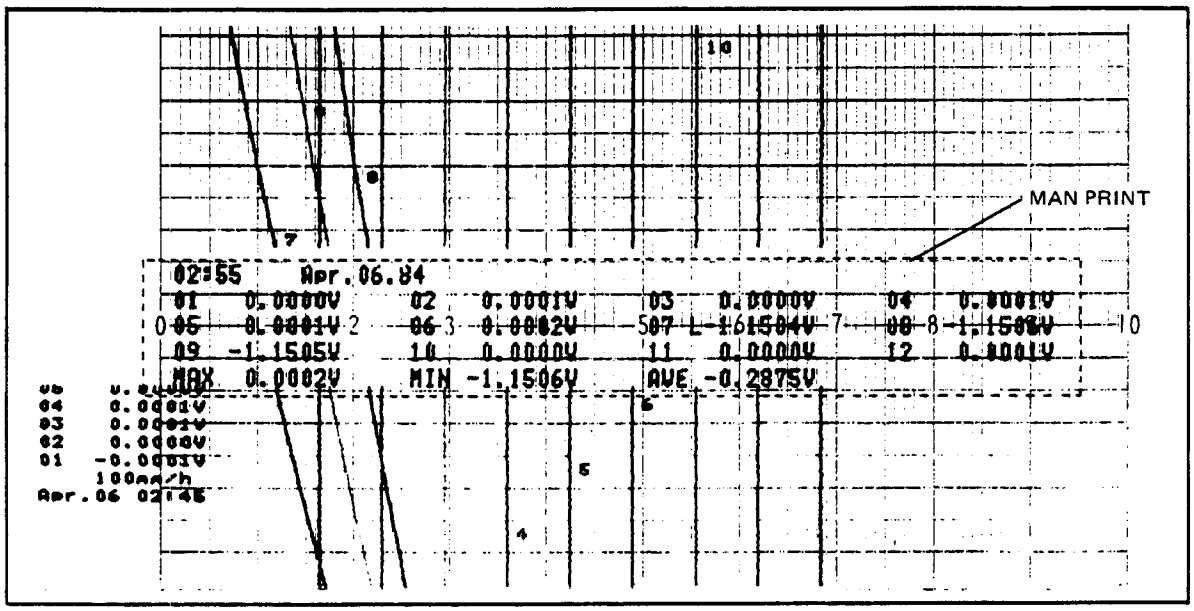
The set data – CH No., RANGE, LEFT END, RIGHT END, DATE, CHART SPEED, and high and low alarm setpoints – are printed out by pressing the LIST key (see below).



7-15. MAN PRINT Function.

Pressing MAN PRINT key causes one scan, and the digital data is printed out.

(1) In TREND Mode

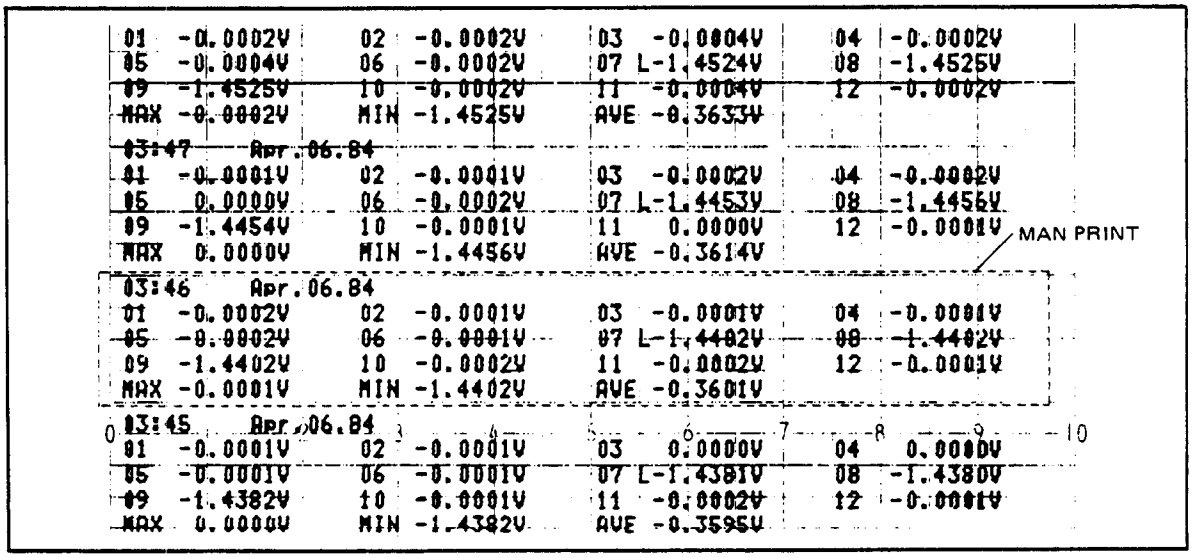


Pressing MAN PRINT key interrupts trend recording and prints out digital data on the chart as shown in the figure. When the digital recording is finished, trend recording restarts.

(Note)

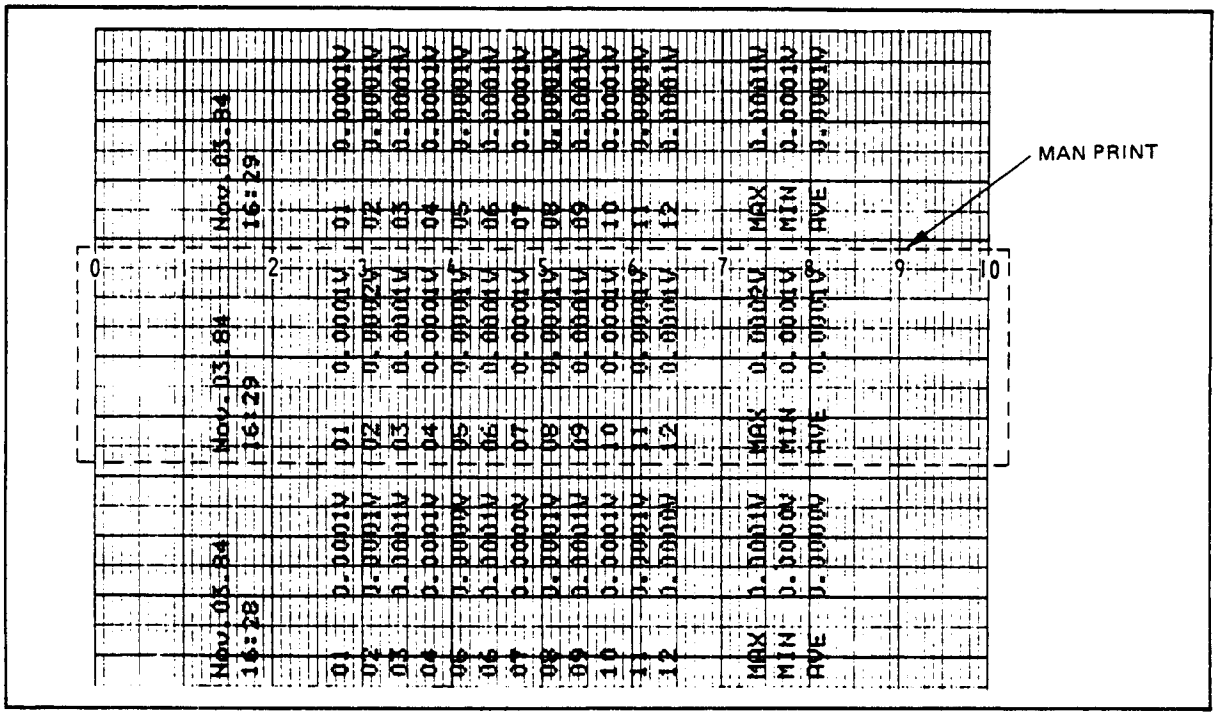
- Note that if MAN PRINT key is pressed during digital printing in the left margin of the chart, the digital printout is aborted.
- If MAN PRINT key is pressed during alarm printing in the right margin of the chart, printing is not aborted.

(2) In LOGGING Mode.

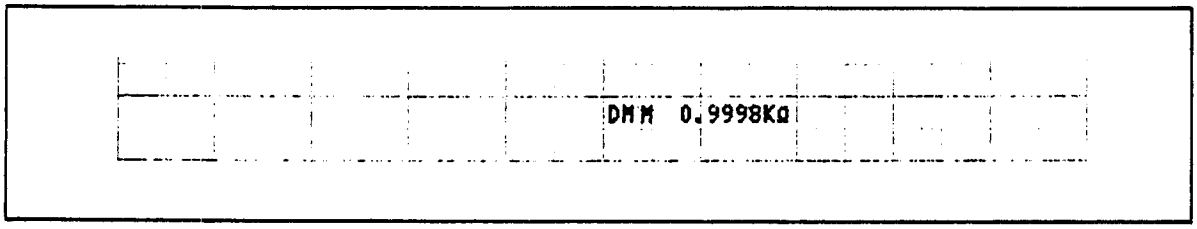


In LOGGING mode, if MAN PRINT key is pressed during an interval, one set of digital data is printed out.

Specialized Printout Form (Optional)



(3) IN DMM Mode.



When the recorder is used in DMM mode, if MAN PRINT key is pressed the data is printed out on the chart as shown in the figure.
DMM acts as Channel 13 and when in use, should always be programmed as shown in Section 7-7. There are no default settings for DMM channel.

7-16. DMM Measurement.

7-16-1. DC Voltage Measurement.

CAUTION

Maximum allowable input voltage (instantaneous) is 350 V (DC + AC peak). The withstand voltage from AC line input to ground is 350 V (DC + AC peak). If a voltage exceeding any of above voltages is applied to the recorder, the recorder may be damaged.

(1) Turn ON the recorder POWER switch.
(2) Press the DMM and DC keys.
(3) Connect the measurement leads to terminals H and L and the other ends of the leads to the DC voltage source to be measured as shown in Figure 7-10. The terminal L should be connected to low potential terminal.
(4) The measured value is displayed together with a polarity (polarity of the terminal H against that of the terminal L) and an engineering unit.
If the printout of the front panel input is required, carry out par. 7-7 RANGE Setting (TREND Mode).
(5) AUTO ranging may be used for measurement.

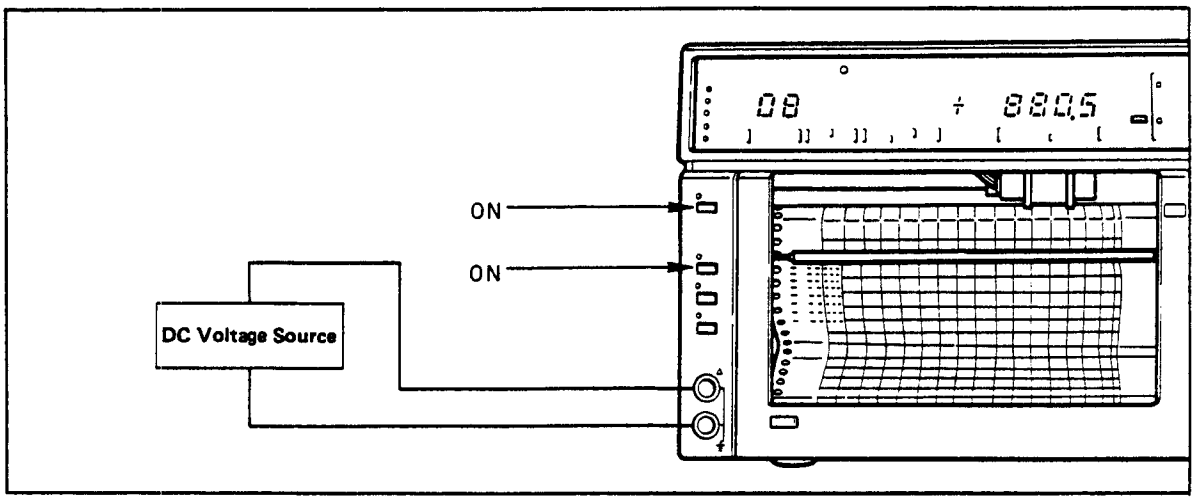


Figure 7-10. DC Voltage Measurement.

7-16-2. AC Voltage Measurement.

CAUTION

The maximum allowable input voltage is 250 Vrms (sinusoidal waveform) or 350 V (DC + AC peak). The withstand voltage from AC line input to ground is 350 V (DC + AC peak).

If a voltage exceeding any of above voltages is applied to the recorder, the recorder may be damaged.

(1) Turn ON the recorder POWER switch.
(2) Press the DMM and AC keys.
(3) Connect the measurement leads to terminals H and L and the other ends of the leads to the AC voltage source to be measured as shown in Figure 7-11. The terminal L should be connected to the low potential terminal.
(4) The measured value is displayed together with an engineering unit.
(5) The recorder displays calibration value of mean.
(6) If the printout of the front panel input is required, carry out par. 7-7 RANGE Setting (TREND Mode).

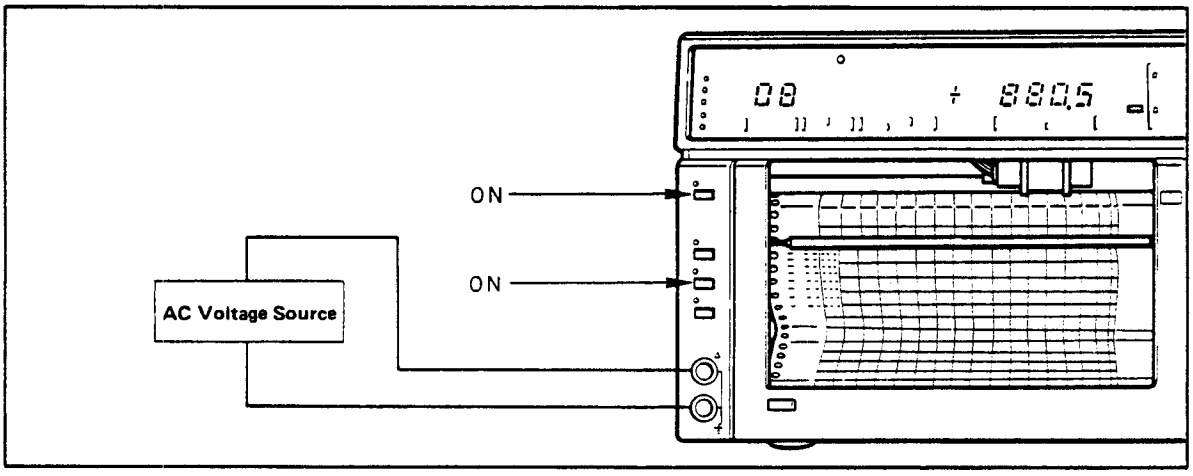


Figure 7-11. AC Voltage Measurement.

7-16-3. Resistance Measurement.

CAUTION

The maximum allowable input voltage is 200 V (DC + AC peak). The withstand voltage to the ground is 350 V (DC + AC peak). If a voltage exceeding any of above voltages is applied to the recorder, the recorder may be damaged.

(1) Turn ON the recorder POWER switch.
(2) Press the DMM and Ω keys.
(3) Connect the measurement leads to the terminals H and L and the other ends of the leads to the object to be measured (the measured voltage should be connected across the measurement terminals H and L so that the potential of the terminal H should be higher than that of the terminal L).
(5) The measured value is displayed together with engineering units.
(6) If a printout of the front panel input is required, carry out par. 7-7 RANGE Setting (TREND mode).

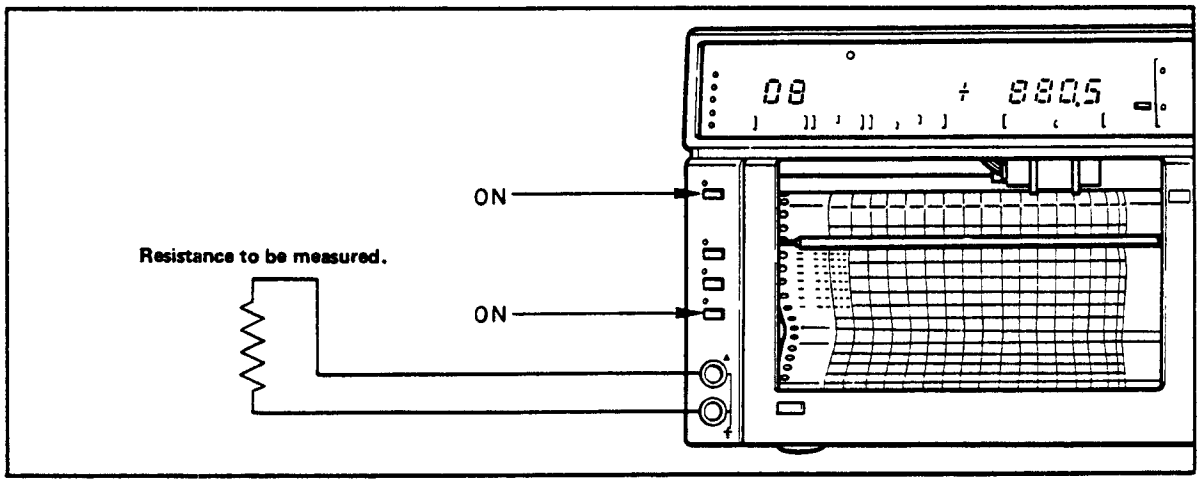


Figure 7-12. Resistance Measurement.

8. MAINTENANCE.

8-1. Lubrication.

To maintain the recorder in good operating condition, check lubricating points periodically and lubricate when necessary.

Lubrication once every 3 months is recommended.

(1) Wipe off dust and oil from lubricating points, especially from pointer assembly shaft before lubricating.
(2) The supplied lubricating oil is in full consideration of its lubricating function and vaporization. Always use the supplied lubricating oil.
(3) Make a hole in oil bottle nozzle with a thumbtack.
(4) Apply sufficient oil. Wipe off excess oil with blotting paper.
(5) Lubricating parts.
- Gears and bearings located from the ribbon drive motor to cassette.
- Chart drive gears and bearings.
- Printer carriage.
  · Main shaft periphery in contact with bearings (large and small).
  · Carriage guide plate surface in contact with bearings.

8-2. Parts Replacement.

8-2-1. Fuse Replacement.

It is recommended that fuses be renewed once every two years for preventive maintenance.

(1) Turn the recorder POWER switch OFF.
(2) The fuse is mounted on the recorder rear panel.
(3) Turn the carrier of the fuseholder counterclockwise, and the carrier will loosen out with fuse.
(4) Screw carrier into position after checking to see the new fuse has the indicated rating.

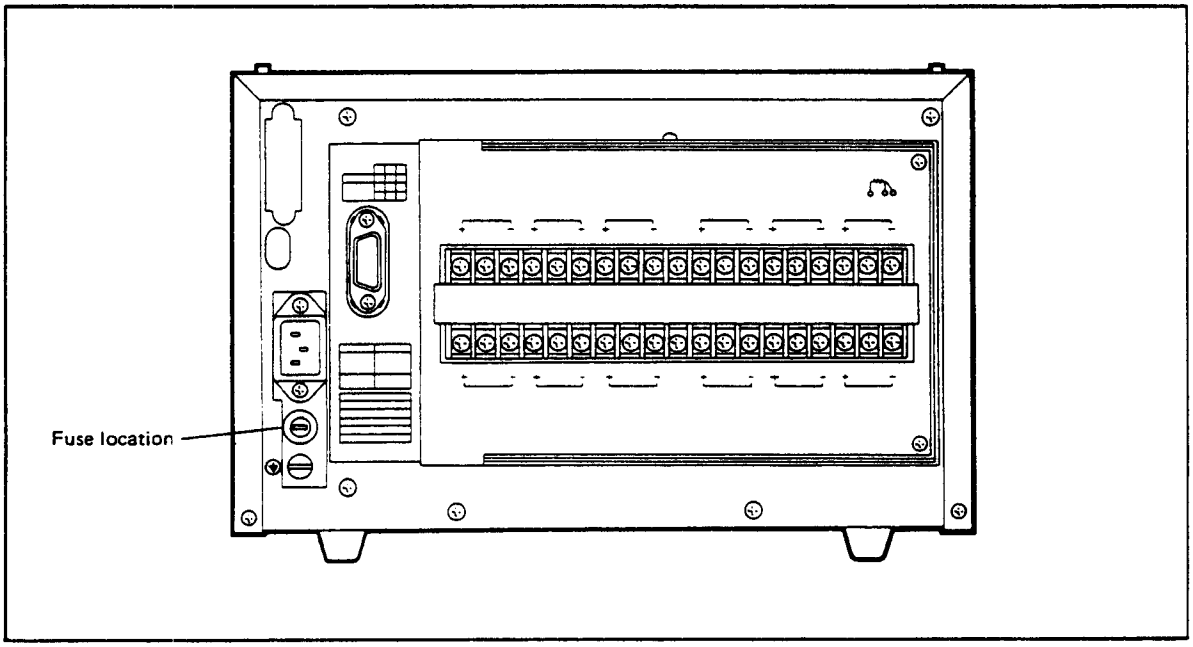


Figure 8-1. Fuse Location.

9. DC 12 V DRIVE (OPTIONAL).

The OM500 can be driven by DC 12 V as well as AC power.

Specifications

Normal Operating Voltage (DC): +11 to +14 V
Maximum Current (DC): 3A
Operating Limiting Voltage (DC): +10 to +15 V
Accessories (only for DC drive):
Power connector (female)
Fuse (3A, time lag)

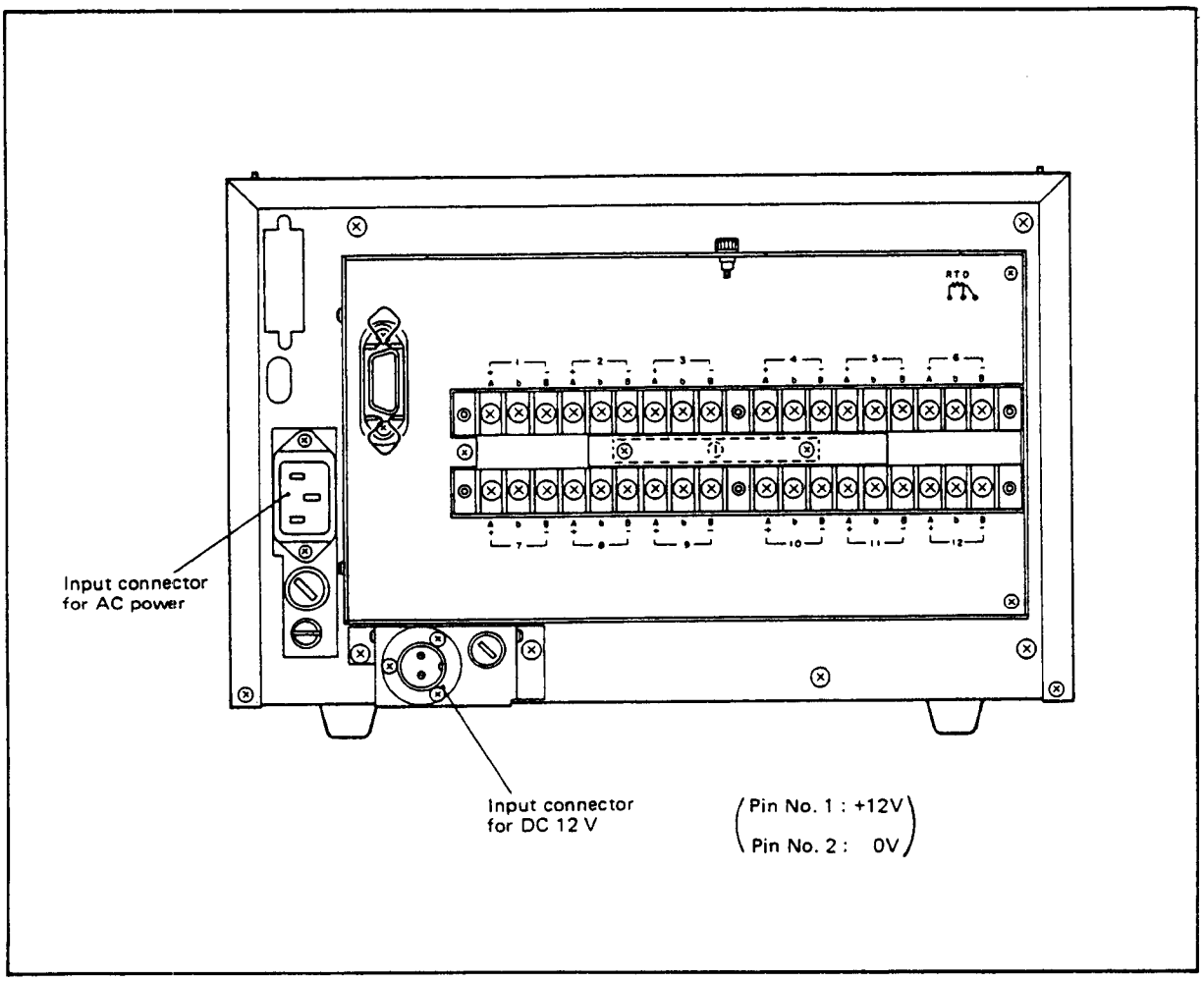


Figure 9-1. Rear View of DC-Driven Recorder.

10. OVERALL INSPECTION.

10-1. Standard Environmental Conditions for Overall Inspection.

- **Temperature:** 23 ± 2°C
- **Humidity:** 45 to 65% R.H.
- **Power Supply Voltage:** Rated power supply voltage ±1%
- **Power Supply Frequency:** Rated power supply frequency ±1%
- **Warmup:** At least 30 minutes
- **Other Conditions:** Environmental conditions such as vibration, shock, external magnetic field and electric noise should not be so bad as to affect instrument operation.

10-2. Overall Inspection.

The tests described below are to inspect whether the functions of the instrument in use are normal or not.

Hence, when maintaining or servicing the instrument, it is not always required to test all items described below.

(1) If you adjust items in the internal assembly, after adjustment be sure to check item 10-2-1 "Measurement Accuracy Test" and item 10-2-2 "Recording Accuracy Test".

(2) If any problem has occurred with any function corresponding to any of items 10-2-3 "Burnout Operation Test" through 10-2-11 "FAIL Display Function Test", it is sufficient to test only the corresponding item.

(3) The testing method covers instruments conforming to ANSI standards. For instruments conforming to DIN standards, for thermocouple and RTD inputs, use DIN standard tables to substitute values and carry out the tests.

10-2-1. Measurement Accuracy Test.

(1) Instruments to be Used

- DC Voltage Standard: Accuracy ±0.01% or better
- AC Voltage Standard: Accuracy ±0.1% or better
- Decade Resistance Boxes: Accuracy ±0.01% or better
- Digital Multimeter: Accuracy ±0.01% or better

(2) Measurement Accuracy Test in DMM Mode

(2-1) DC Voltage (DC V)

1) Set the instrument to DC voltage measurement mode.
2) Using a DC voltage standard, apply an input voltage corresponding to each range shown in Table 10-1 between the DMM H and L input terminals on the instrument front panel. To apply an input voltage, use the measurement leads supplied with the instrument.
3) Confirm that the values displayed on the instrument are within the tolerances listed in the table below.

Table 10-1.

Range	Input*	Accuracy	Measured Value Tolerance
20 mV	0020.000 mV	± (0.2% of rdg + 10 digits)	20.000 ± 0.050 mV
	0010.000 mV		10.000 ± 0.030 mV
	0000.000 mV		00.000 ± 0.010 mV
	−0010.000 mV		−10.000 ± 0.030 mV
	−0020.000 mV		−20.000 ± 0.050 mV
200 mV	0200.000 mV	± (0.2% of rdg + 5 digits)	200.00 ± 0.45 mV
2 V	02.00000 V	± (0.1% of rdg + 5 digits)	2.0000 ± 0.0025 V
20 V	020.0000 V	± (0.3% of rdg + 5 digits)	20.000 ± 0.065 V
50 V	050.0000 V	± (0.3% of rdg + 5 digits)	50.00 ± 0.20 V

* DC Voltage Standard Output Voltage.

(2-2) AC Voltage (AC V)

1) Set the instrument to AC voltage measurement mode.
2) Using an AC voltage standard, apply a 100 Hz sinusoidal input voltage, as prescribed for each range shown in Table 10-2, between the DMM H and L input terminals (use the measurement leads supplied with the instrument).
3) Confirm that the values displayed on the instrument are within the tolerances listed in the table below.

(2-3) Resistance (Ω)

1) Set the instrument to resistance measurement mode.
2) Using the measurement lead supplied with the instrument, connect a decade resistance box between the DMM H and L terminals on the instrument front panel.
3) While calibrating the resistance value with a digital multimeter, adjust the decade resistance box to set the resistance values listed corresponding to each range.
4) Confirm that the values displayed on the instrument are within the tolerances listed in the table below.

(2-4) AUTO Ranging Performance Check

While testing the measurement accuracy described above, –items (2-1) to (2-3)–sequentially increase or decrease the input in the vicinity of each range full scale value, and confirm that UP/DOWN auto ranging is performed correctly.

(3) Measurement Accuracy Test in TREND/LOGGING Mode.

(3-1) DC Voltage (mV) and Thermocouple (TC) Input Version

1) Set the instrument to TREND or LOGGING mode, then set the range code corresponding to each range listed in Table 10-4.
2) Using the DC voltage standard, apply an input voltage corresponding to each range listed in the table between the input terminals + (A) and – (B) on the instrument rear panel.
3) Confirm that the values displayed on the instrument are within the tolerances listed in the table below.

Table 10-2.

Range	Input*	Accuracy	Measured Value Tolerance
2 V	00.000 V	± (0.4 % of rdg +0.2 % of range)	0.0000 ± 0.0040 V
	02.000 V		2.0000 ± 0.0120 V
20 V	020.00V		20.000 ± 0.120 V
200 V	0200.0 V		200.00 ± 1.20 V
250 V	0250.0 V		250.0 ± 1.5 V

* AC Voltage Standard Output Voltage.

Table 10-3.

Range	Input*	Accuracy	Measured Value Tolerance
200 Ω	0000.00 Ω	± (0.2 % of rdg + 5 digits) However, on the 200 Ω range, add 10 digits to the measured value for the resistance of the measurement leads.	000.00 ± 0.15 Ω
200 Ω	0200.00 Ω		200.00 ± 0.55 Ω
2 kΩ	02.0000 kΩ		2.0000 ± 0.0045 kΩ
20 kΩ	020.000 kΩ		20.000 ± 0.045 kΩ
200 kΩ	0200.00 kΩ		200.00 ± 0.45 kΩ
2 MΩ	02.0000 MΩ		2.0000 ± 0.0045 MΩ

* If the accuracy of the resistor is ±0.05 % or worse, calibration using a digital multimeter is required.

Table 10-4.

Range	Code	Input*	Accuracy	Measured Value Tolerance
20 mV	00	0020.000 mV	± (0.2 % of rdg + 10 digits)	20.000 ± 0.050 mV
		0010.000 mV		10.000 ± 0.030 mV
		0000.000 mV		00.000 ± 0.010 mV
		-0010.000 mV		-10.000 ± 0.030 mV
		-0020.000 mV		-20.000 ± 0.050 mV
200 mV	01	0200.000 mV	± (0.2 % of rdg + 5 digits)	200.00 ± 0.45 mV
20 V	03	020.0000 V	± (0.3 % of rdg + 5 digits)	20.000 ± 0.065 V

* DC Voltage Standard Output Voltage.

(3-2) Resistance Temperature Detector (RTD) Input Version

1) Set the instrument to TREND or LOGGING mode, then set the range code corresponding to each range listed in Table 10-5.
2) Connect the decade resistance box between the input terminals + (A) and – (B) on the instrument rear panel. Set the decade resistance box to the resistance value corresponding to each testing temperature listed in the table.
3) Confirm that the values displayed on the instrument are within the tolerance listed in the table below.
4) For the °F measurement version, operate as per procedure 1) to 3) and confirm that the measured value displayed is within the tolerance listed in Table 10-6.

Table 10-5.

Range	Code	Test point	Input*	Accuracy	Measured Value Tolerance
Pt 100 Ω 1 mA	20	-200.0°C	017.140 Ω	± (0.1 % of rdg + 0.3°C)	-200.0 ± 0.5°C
		-25.0°C	090.020 Ω		-25.0 ± 0.3°C
		150.0°C	158.290 Ω		150.0 ± 0.4°C
		325.0°C	222.940 Ω		325.0 ± 0.6°C
		500.0°C	284.020 Ω		500.0 ± 0.8°C

* If the accuracy of the resistor is ±0.03 % or worse, calibration using a digital multimeter is required.

Table 10-6.

Range	Code	Test point	Input*	Accuracy	Measured Value Tolerance
Pt 100 Ω 1 mA	20	-328.0°F	017.140 Ω	± (0.1 % of rdg + 0.6°F)	-328.0 ± 0.9°F
		-13.0°F	090.020 Ω		-13.0 ± 0.6°F
		302.0°F	158.290 Ω		302.0 ± 0.9°F
		617.0°F	222.940 Ω		617.0 ± 1.2°F
		932.0°F	284.020 Ω		932.0 ± 1.5°F

* If the accuracy of the resistor is ±0.03 % or worse, calibration using a digital multimeter is required.

10-2-2. Recording Accuracy Test.

(1) Instruments and Other Items Required for Test

- DC Voltage Standard: Accuracy ±0.01 % or better
- Decade Resistance Box: Accuracy ±0.01 % or so
- Scale: Should be accurate over environmental range of temperature and humidity.

(2) Testing Method

(2-1) DC Voltage (mV) and Thermocouple (TC) Input Version

1) Set the instrument to TREND mode, and using a DC voltage standard, apply input voltages corresponding to the five test points (listed in Table 10-4) on 20 mV range decreasingly then increasingly between the input terminals on the instrument rear panel and carry out recording.
2) Measure each recorded point with the scale, confirm that recording error at each test point is within ±0.2 % of span (150 mm) or within ±0.3 mm.

(2-2) Resistance Temperature Detector (RTD) Input Version

1) Set the instrument to TREND mode, and Pt 100 Ω (1 mA) range and connect a decade resistance box between the input terminals on the instrument rear panel. Adjust the decade resistance box to set resistances corresponding to five test points in the range (see Table 10-5 or 10-6) increasingly then decreasingly and carry out recording.
2) Measure each recorded point with the scale, confirm that recording error at each test point is within ±0.2 % of span (150 mm) or within ±0.3 mm.

NOTE

Chart paper expands or contracts as ambient humidity varies. The degree of expansion or contraction depends on chart manufacturer and chart material. Generally, for ambient humidity variations in the range 60 ±20 %, the range of expansion or contraction of the chart is ±0.3 to ±0.4 %.

Hence, when extremely accurate measurements —like this test, non-defective or non-conformance is determined by measuring the dimensions of the chart recording—are required, avoid using the graduation printed on the chart paper; instead use a scale that is accurate over the environmental range of temperature and humidity.

10-2-3. Burnout Operation Test.

This test applies to the thermocouple (TC) input version.

(1) Items Required for Test

- 10 MΩ fixed resistor.

(2) Testing Method

1) This test applies to the thermocouple input version (range code: 10 to 18).
2) Connect a 10 MΩ resistor between the input terminals + (A) and – (B) on the instrument rear panel, and confirm that display and logging printout (manual print) are as follows:
   Display : – – – – – °C
   Printout : * * * * * °C

10-2-4. Reference Junction Compensation Accuracy Test.

(1) Tools to be Used

- 0°C Reference Temperature Equipment
- Thermocouple: Type K (calibrated)
- Thermometer: Calibrated

(2) Testing Method

1) Turn on the 0°C reference temperature equipment power supply and allow the equipment temperature to stabilize.
2) Meanwhile, connect a calibrated Type K thermocouple between the instrument's channel 7 input terminals as shown in Figure 10-1, and set the range code corresponding to that channel to 13. Insert the junction of the thermocouple into the 0°C reference temperature equipment. At this time, avoid contact of the junction with the reference temperature equipment wall—insert the junction so that it is at least 10 mm from the wall.

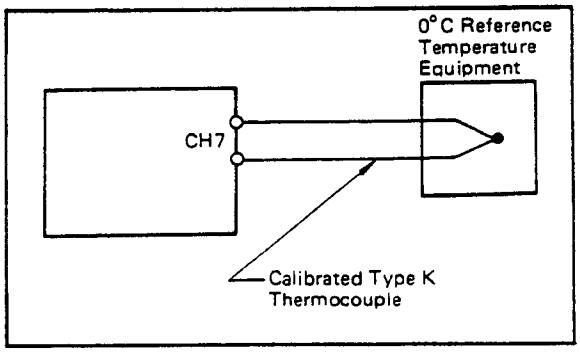


Figure 10-1.

3) When the instrument display stabilizes, read the value and confirm that measurement error is within ±0.5°C of the calibrated value*.

*: **When calibrating temperature, it is always necessary to monitor temperature in the 0°C reference temperature equipment using a calibrated thermometer.**

REFERENCE

1) According to the specifications, the measurement accuracy for 0°C measurement is ±0.5°C and the reference junction compensation accuracy is ±0.5°C, so overall measurement tolerance is within ±1.0°C.
   However, before shipment the instrument is adjusted so that when 0°C is measured, the measurement accuracy is within ±0.5°C including the reference junction compensation accuracy. If the measurement error is outside the tolerance described in the abovementioned specification standard, even when a calibrated thermocouple and calibrated temperature equipment are used, the failure may be due to "adjustment shift" in the reference junction compensation circuit.
2) A special jig is required for adjusting the reference junction compensation circuit, so on-site readjustment is difficult. Therefore, if the reference junction compensation circuit fails, replace the reference junction compensation PCB (RJC BOARD ASSY: B9541WZ-0) shown in Figure 10-2 with new one.

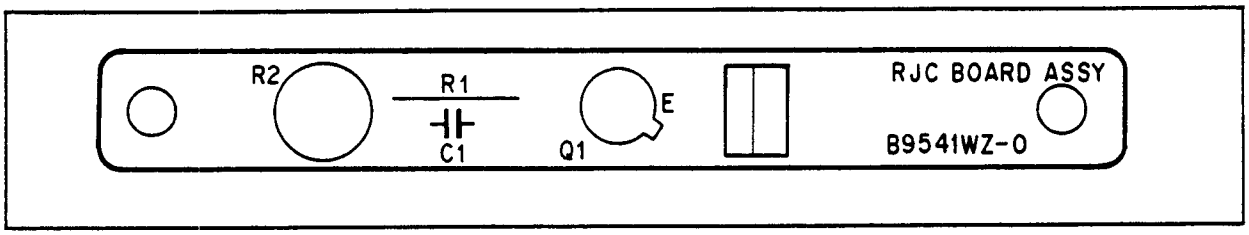


Figure 10-2.

10-2-5. Recording Format Test.

(1) DC Voltage (mV) and Thermocouple (TC) Input Version

[Preparation]

1) Confirm that the instrument power switch is turned OFF.
2) Remove the cover assembly from the instrument and put the instrument in the state as shown in Figure 3-2.
3) Set switch SW2-⑦ on the MAIN CPU CARD ASSY shown in Figure 3-2 ⑳ to ON.
4) Remove the input terminal cover on the instrument rear panel, and connect input terminals + (A) and – (B) of all channels CH1 through CH12 in parallel.
5) Using the measurement leads supplied with the instrument, connect the DMM input terminals H and L on the instrument front panel and short circuit the other end clips.
6) Open the front panel door, remove the chart drive assembly from the mainframe and remove the internal memory backup batteries from the holder.

[Operating procedure]

1) Reassemble the chart drive assembly which was removed in step 6) above. Turn the power switch ON.
2) Use the front panel keys to enter the following data:

   CLOCK: 85 01 01 00 05
   (Year Month Day Hour Min.)
   CHART SP : 100 mm/h
   PRINT TIME : 05
   SCAN : FIX (5S)

3) Press LIST key then press PRINT key and confirm that the record shown in Figure 10-3 is printed out.

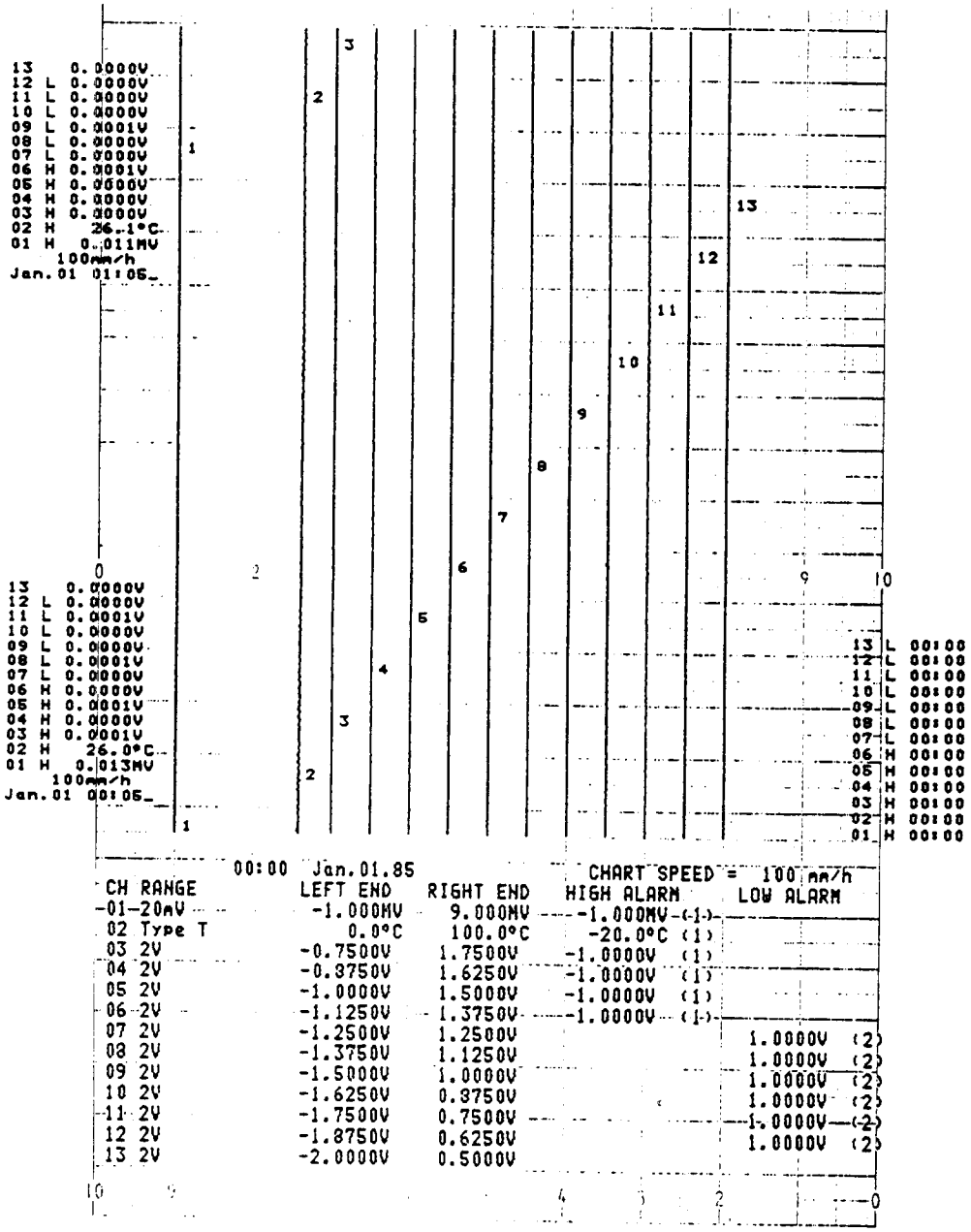


Figure 10-3.

4) Next, press MAN PRINT key and confirm that the instrument print out is as shown in Figure 10-4.

5) When the test is completed, turn off the instrument power switch and set SW2-⑦ to OFF to return the instrument to normal operation mode.

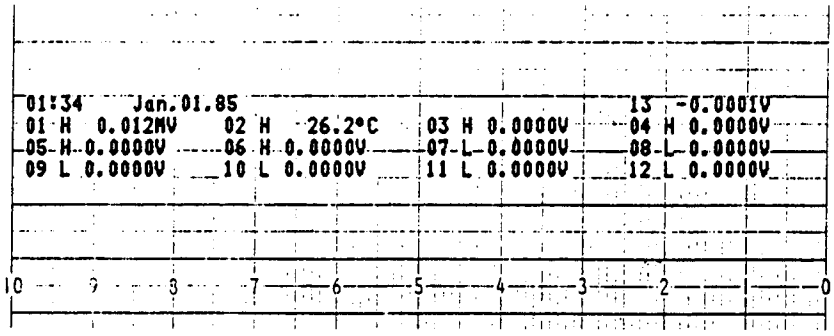


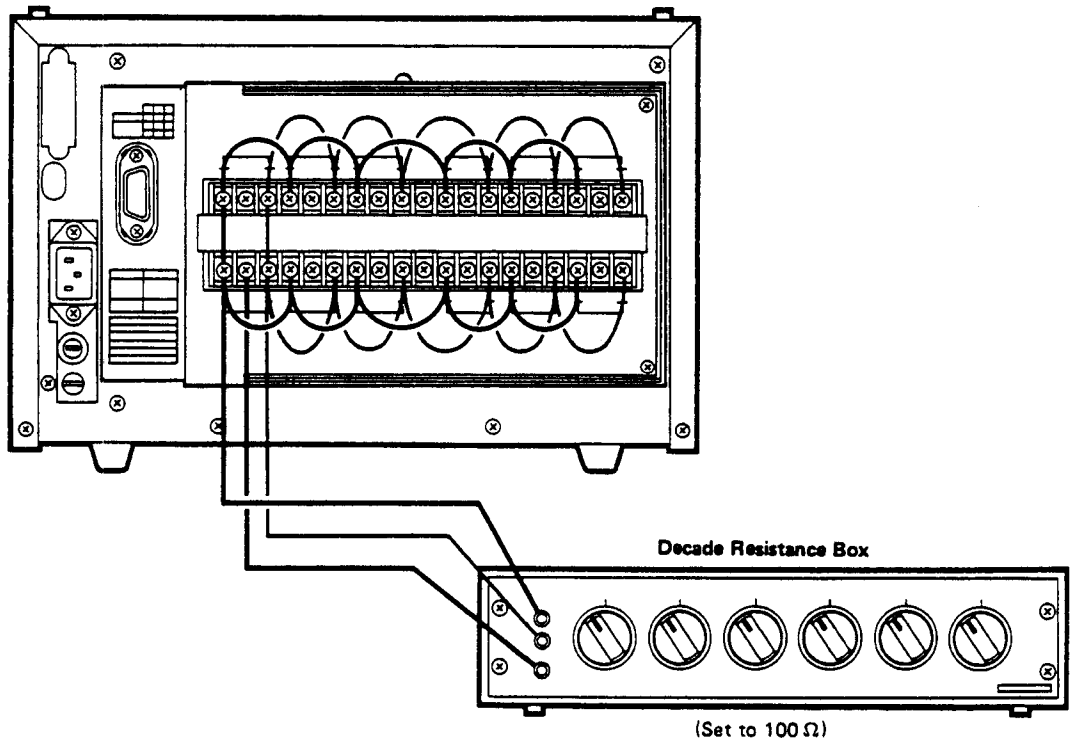
Figure 10-4.

(2) Resistance Temperature Detector (RTD) Input Version

[Preparation]

1) Confirm that the instrument power switch is turned OFF.

2) Remove the input terminal cover on the instrument rear panel, and connect a decade resistance box whose resistance is set to 100 Ω to input terminals + (A), – (B) and b (all channels CH1 through CH12 connected in parallel) as shown in Figure 10-5.



Terminals + (A) and – (B) of all channels are connected in parallel and connected to the terminals of decade resistance box as shown.
Connect either of the b terminals to the ground terminal (⏚) of the decade resistance box.

Figure 10-5.

3) Using the measurement leads supplied with the instrument, connect the DMM input terminals H and L on the instrument front panel and short circuit the other end clips.
4) Open the front panel door, remove the chart drive assembly from the mainframe and remove the internal memory backup batteries from the holder.

[Operating procedure]
1) The same as [operating procedure] 1) and 2) in (1) above.
2) Press the front panel keys to set the ranges as shown in Figure 10-6.
3) Press LIST key then press PRINT key and confirm that a record like Figure 10-3 is printed out.
4) Next, press MAN PRINT key and confirm that a record like Figure 10-4 is printed out.

(3) Resistance Temperature Detector (RTD)/DC Voltage (mV) and Thermocouple (TC) Input Version

[Preparation]
1) Confirm that the instrument power switch is turned OFF.
2) Remove the input terminal cover on the instrument rear panel, connect a decade resistance box whose resistance is set to 100 Ω to input terminals of CH1 to CH6 in the same manner as for the RTD input version (see (2) above and Figure 10-5).
3) Short circuit together input terminals + (A) and – (B) of all channels CH7 through CH12.
4) The operating procedure described below is the same as [preparation] 3) and 4) in (2) above.

[Operating procedure]
1) Same as [operating procedure] 1) and 2) in (1) above.
2) Press the front panel keys to set the ranges as shown in Figure 10-7.
3) Press LIST key then press PRINT key and confirm that a record like Figure 10-3 is printed out.
4) Next, press MAN PRINT key and confirm that a record like Figure 10-4 is printed out.

CH	RANGE	LEFT END	RIGHT END	HIGH ALARM	LOW ALARM
01					
02					
03	Pt100Ω	-20.0°C	80.0°C		
04	(1mA)				
05					
06					
07		-30.0°C	70.0°C	-10.0°C(1)	
08		-40.0°C	60.0°C		+10.0°C(2)
09	Pt100Ω	-50.0°C	50.0°C		
10	(1mA)	-60.0°C	40.0°C		
11		-70.0°C	30.0°C		
12		-80.0°C	20.0°C		
13	20mV	-9.000mV	1.000mV		

Figure 10-6.

CH	RANGE	LEFT END	RIGHT END	HIGH ALARM	LOW ALARM
01		-30.0°C	70.0°C	-10.0°C	
02		-40.0°C	60.0°C		+10.0°C
03	Pt100Ω	-50.0°C	50.0°C		
04	(1mA)	-60.0°C	40.0°C		
05		-70.0°C	30.0°C		
06		-80.0°C	20.0°C		
07	20mV	-1.000mV	9.000mV		
08	Type T	0.0°C	100.0°C		
09					
10	20mV	-1.000mV	9.000mV		
11					
12					
13	20mV	-9.000mV	1.000mV		

Figure 10-7.

10-2-6. Printout Quality Test.

Using the record printed out by paragraph 10-2-5 "Recording Format Test", check the following items.

1) Dot size: ϕ0.3 to ϕ0.5 mm
2) Color and Channel number:
   TREND ; Purple (1, 7, 13), Red (2, 8)
   Green (3, 9), Blue (4, 10)
   Brown (5, 11), Black (6, 12)
   LOGGING ; Purple (all channels)
3) Channel number should be printed out in the same color as trend recording.
4) No color shading and no color mixture.
5) No blurred or broken sections of printout.
6) No distortion in printout characters.
7) Scattering (range of random fluctuation) of printed positions may be up to 0.2 mm as shown in Figure 10-8, and when input is constant, printed position should not fluctuate cyclically.

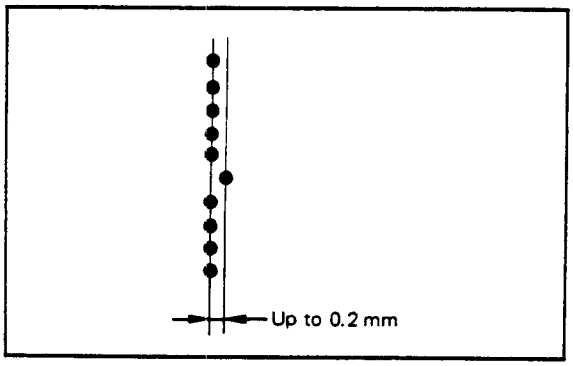


Figure 10-8.

10-2-7. Key/Display Function Test.

(1) Initial Conditions After the Power Supply is Turned On

NOTE

When carrying out this test, channel input terminals may be either short-circuited or left unconnected.

(1-1) When memory backup batteries are not installed.

1) With memory backup batteries removed from the instrument, turn on the instrument power supply.
2) Confirm that the instrument display is in CLOCK mode as shown in Figure 10-9 and the instrument initial display is
   85 01 01 00 00
   (january 1st 1985 00 hour 00 minute)
   and the LEDs are lit as shown in the figure.
3) Confirm that the carriage moves to the left 0% side to access the zero point detector then stops, ready for plotting.

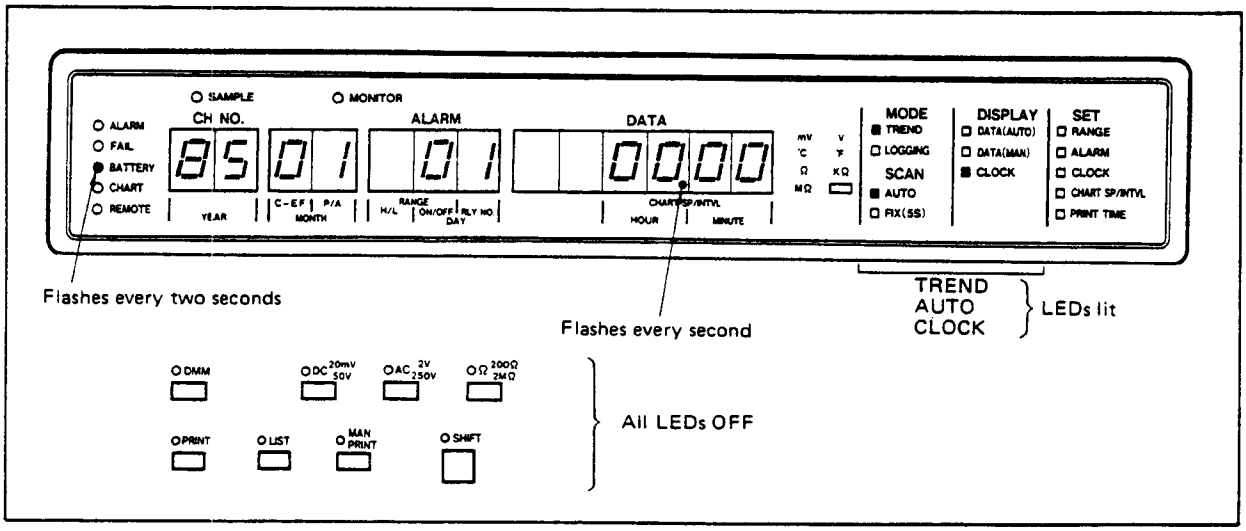


Figure 10-9.

(1-2) When memory backup batteries are installed.

1) With memory backup batteries installed, turn on the instrument power supply.
2) Press the front panel keys to enter the following data:
   CLOCK: 85 01 01 00 00
   (january 1st 1985 00 hour 00 minute)
   CHART SP : 100 mm/h
   PRINT TIME : 05
   SCAN : FIX (5S)
   PRINT : ON
3) With the instrument set as above, turn off the instrument power supply and after at least 10s has elapsed, check that the instrument display is as shown in Figure 10-10.
4) Confirm that the carriage moves to the left 0% side to access the zero point detector once, then continues scanning at 5-second intervals.

(2) Key/Display Function Test

1) Confirm that when each function key or switch shown in Table 10-7 is pressed, the corresponding LED shown in the table is lit.
2) Confirm that while pressing CHART FEED key, chart is fed with a chart speed of 10 mm/s.
3) For the programming keys listed in Table 10-7, in the SET mode, press each key to confirm that the character corresponding to each key is displayed on the 7-segment LED.
4) Set the instrument in RANGE SET mode, press the programming key [8] several times until all digits of the 7-segment LED are 8. Also confirm that H/L display LED displays H or L and sign display LED display + or −.
5) Set KEY LOCK switch to ▶ mark position to set the instrument in KEY LOCK state. In this state, confirm that all keys except for DISPLAY key are disabled. It's sufficient to perform this test for only one key apart from DISPLAY key.

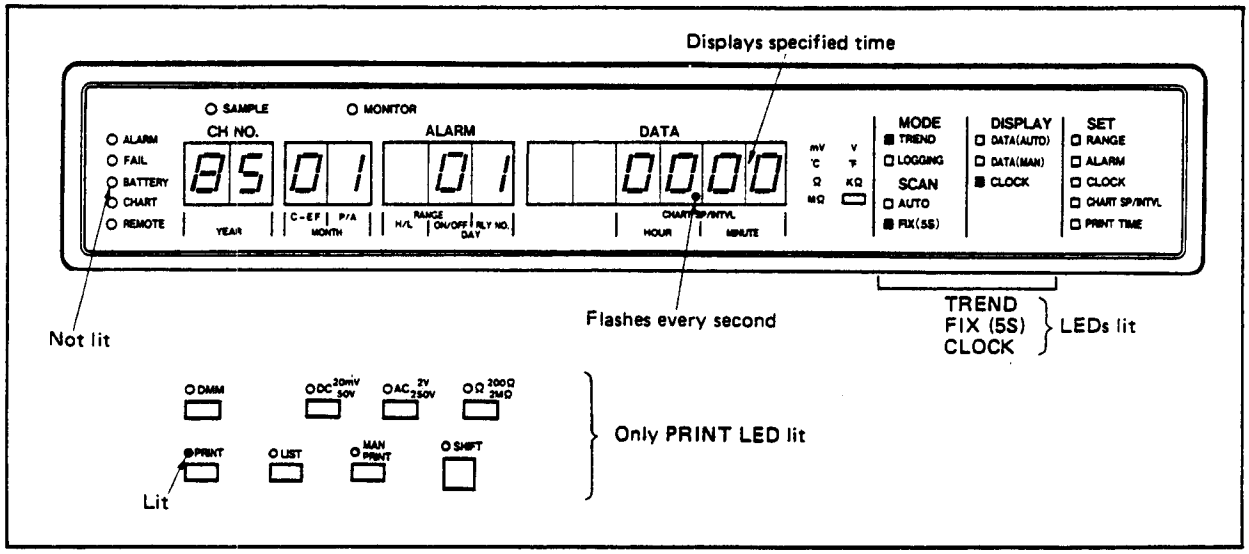


Figure 10-10.

Table 10-7 (1/2).

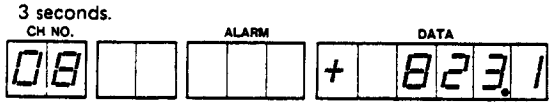
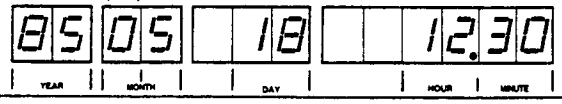
	Key or Switch	LED	Function	Description
Function Key	MODE	■ TREND ↕ ■ LOGGING	TREND mode (Analog recording or Analog recording plus digital printout) is selected. LOGGING mode (Digital Logging printout) is selected.	
	SCAN	■ AUTO ↕ ■ FIX (5S)	Scanning interval varies corresponding to chart speed. (TREND). Scanning interval = INTVL setting (Logging) Scanning interval 5 seconds fixed.	
	DISPLAY	■ DATA (AUTO) ↓ ■ DATA (MAN) ↓ ■ CLOCK	Measured data is displayed. CH No. updated every 3 seconds.  Measured data is displayed. Select CH by CH key. Clock display. 	
	CH	—	In DATA (MAN) mode, increments CH No. each time CH key is pressed. If this key is held pressed it auto repeats, incrementing CH No. continuously.	
	SET	■ RANGE ↓ ■ ALARM ↓ ■ CLOCK ↓ ■ CHART SP /INTVL ↓ ■ PRINT TIME	RANGE setting mode, only MSD is lit brightly, other digits are lit dimly. ALARM setting mode, only MSD is lit brightly, other digits are lit dimly. CLOCK setting mode, only MSD is lit brightly, other digits are lit dimly. CHART SPEED (in TREND mode) or INTERVAL (in LOGGING mode) setting mode, only MSD is lit brightly, other digits are lit dimly. PRINT TIME setting mode (only in TREND mode), only MSD is lit brightly, other digits are lit dimly.	
	PRINT	ON/OFF	When this key is turned ON, recording (TREND/ LOGGING) is performed.	
	MAN PRINT	ON/OFF	Each time this key is pressed, carries out one measurement scan and digital logging.	
	LIST	ON/OFF	Prints out setting data.	
	CHART FEED	—	Chart can be fed by pressing this key.	
	DMM	ON/OFF	DMM function is activated when this key is turned ON.	
	DC AC Ω		DC function is selected AC function is selected Ω function is selected } DMM function	

Table 10-7 (2/2).

	Key or Switch	LED	Function	Description
Programming Key	0 to 9	7 segments	Pressing numeric key displays corresponding numeral 0 to 9 on the display.	
	A to F, H, L, P	7 segments	Pressing alphabetic key (when SHIFT LED is lit) displays corresponding alphabetic character A to F, H, L or P	
	SHIFT	ON/OFF	When this key is turned on, characters such as A to F, H, L, P or ⊢/⊣ can be input. When this key is turned off, 0 to 9, +/–, OFF(–), can be set.	*1
	+/–	7 segments	Sets sign.	
	OFF (–)	7 segments	Sets skip, alarm operation OFF, alarm relay operation OFF.	
	◀ ▶	7 segments	Brightly lit digit shifts left and right.	
	⊢/⊣	7 segments	Designates range left end and right end.	
	ENT	7 segments	Setting data is read; when data is correct, all digits are brightly lit, if data is invalid then all digits flash.	
	KEY LOCK	—	Keys other than DISPLAY key are disabled.	*2

*1: If SET key is released with the SHIFT key set to ON, the SHIFT key cannot be set to OFF by pressing the SHIFT key.

*2: Slide switch.

10-2-8. Battery Alarm Function Test.

(1) Instrument and Tool to be Used

- DC Voltage Standard: Use the instrument which was used for measurement accuracy test in par. 10-2-1.
  Stabilized DC power source and DC voltmeter may be used.

(2) Testing Method

1) Remove the memory backup batteries. Using the DC voltage standard, apply a DC voltage of 4 V between both terminal of the battery case, observing the correct polarity for the applied voltage.
2) Gradually decrease the applied voltage from 4 V, and confirm that when the voltage is within 3±0.1 V, the red LED for "BATTERY" alarm on the front panel flashes approx. every 2 seconds.
3) When the test is completed, the instrument should be reassembled.

10-2-9. Chart End Detection Mechanism Test.

1) Confirm that the instrument power supply is turned OFF and pull chart stock out of the mainframe.
2) As shown in Figure 10-11 load new chart so that the length from the printout position to chart end is 2000±100 mm (Approx 32 to 35 folds) and the direction of chart end agrees with the direction shown in the figure.

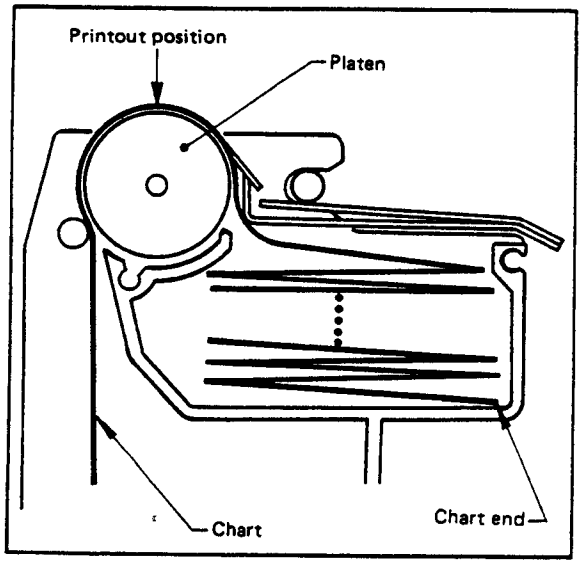


Figure 10-11.

NOTE

- When new chart is used, to prevent chart from duplicate feeding and jamming, fan chart thoroughly at both ends as shown in Figure 10-12 before installing chart in the chart stock.

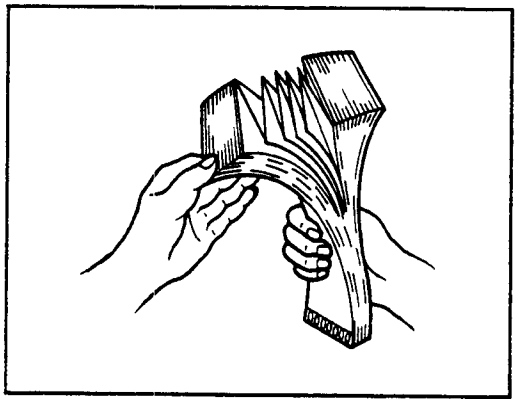


Figure 10-12.

- When chart is installed in the chart stock, be careful not to double over the end of chart paper.
- Chart paper—which should be neither wrinkled or folded—of an appropriate length may be used.

3) Reinstall the chart stock in the instrument. Turn on the instrument power supply.
4) Press CHART FEED key to feed chart.
5) When new chart is used, confirm that red "CHART" indication LED on the front panel lights after red RENEW CHART mark printed on the right of the chart is passed.
   If chart cut to an appropriate length is used, after the length between the printout position and chart end shown in Figure 10-11 reaches approximately 855 mm, confirm that the "CHART" indicator LED lights.
6) After the "CHART" indicator LED lights, confirm that the instrument feeds chart 60 mm and stops feeding, at the same time confirm that the chart remaining between printout position and chart end is approximately 795 mm or less.
7) When the test described above is completed and chart is removed from the chart stock section, confirm that the "CHART" indicator LED remains lit.

NOTE

In 5) and 6) steps described above, the "CHART" indicator LED may flash for a while after passing RENEW CHART mark or after the length of chart remaining between the printout position and chart end falls to approximately 855 mm. This is not due to unstable instrument operation.

10-2-10. Alarm Function Test.

1) Press SET key to set the instrument in ALARM setting mode. For each of the following settings, refer to chapter 7-9 ALARM setting.
2) Carry out high alarm (H) or low alarm (L) settings.
3) For "alarm operation available or not required" specify available (A).
4) The two relays RLY1: No. 1 and RLY2: No. 2 should be specified as high limit alarm relay and low limit alarm relays.
5) Next, set high and low limit alarm value.
6) Apply input voltage of higher than high limit alarm setting value or lower than low limit alarm setting value to the instrument and confirm that the status of relay output terminals between C and N.O. is "Closed", or confirm that the status of alarm connector—mounted on the instrument rear panel—pins (for RLY1: between pins 3 and 2, for RLY2: between pins 10 and 9) is "Closed".
7) At the same time, confirm that red "ALARM" indicator LED lights, and the 6th 7 segment LED from the left of the display displays "H" in high limit alarm operation or "L" in low limit alarm operation.

NOTE

When alarm function operates, in TREND mode, note that hysteresis of approximately 0.5 % occurs as shown in Figure 10-13.
In LOGGING mode no hysteresis occurs.

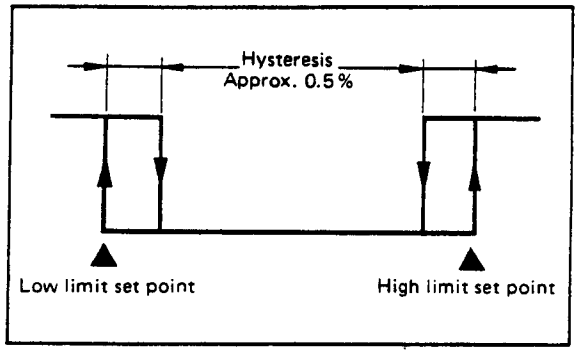


Figure 10-13.

10-2-11. Fail Display Function Test.

(1) Confirm that when the instrument operates normally, the red "FAIL" indicator LED on the front panel does not light.

(2) Confirm that "FAIL" indicator LED lights when adjusting each of recording zero, recording span, recording hysteresis and A/D converter span described later.

10-2-12. DC Driven Version Test.

This test applies to the DC driven version.

For the test items which are not included in this paragraph, the tests are the same as those for the AC driven standard model described above. The following tests should be carried out after the tests for AC power supply version are carried out.

(1) Instruments and Tool to be Used

- DC Voltage Standard: Accuracy ±0.01 % or better
- Decade Resistance Box: Accuracy ±0.01 % or better
- Stabilized DC Power Supply: with capacity 10 V, 3 A or more

(2) Testing Method (mV, TC input version)

1) Disconnect power supply cord from AC power supply connector on the instrument rear panel.
2) Connect a stabilized DC power supply adjusted to 10.0 V (Low limit operation voltage) to the DC connector and turn the instrument power switch ON. When connecting the DC power supply observe correct polarity.
3) With the DC power supply ON, carry out the measurement accuracy test described in paragraph 10-2-1 for only the DC 20 mV range in both DMM and TREND/LOGGING modes, and confirm that specifications shown in Tables 10-1 and 10-4 are satisfied.
4) Carry out the test in the same way as item (1) of paragraph 10-2-5 recording format test and confirm recording results.

(3) Testing Method (RTD Input Version)

1) The same as step 1) in (2) described above.
2) The same as step 2) in (2) described above.
3) With the DC power supply ON, carry out the measurement accuracy test described in paragraph 10-2-1 for only the DC 20 mV range in DMM mode, and confirm that specifications shown in Table 10-1 are satisfied.
4) Set the instrument in TREND/LOGGING mode, and carry out the measurement accuracy test for pt 100 Ω (1 mA) described in paragraph 10-2-1 item (3-2) and confirm that the specifications shown in Table 10-5 or 10-6 are satisfied.
5) Carry out the test as in paragraph 10-2-5 Recording Format Test item (2) and confirm the recording results.

11. ADJUSTMENT

11-1. Overall Adjustment (Electical Circuit).

11-1-1. Standard Environmental Conditions for Adjustment.

Same as section 10-1 "Standard Environmental Conditions for Overall Inspection".

11-1-2. Instruments to be Used.

- DC Voltage Standard: Accuracy ±0.01 % or better
- Digital Multimeter: Accuracy ±0.01% or better

11-1-3. Switching to Adjustment Mode.

Switch SW2 on Main CPU Card Ass'y: B9544WL is used to switch between the normal operating mode and the adjustment modes shown in Table 11-1.

Before switching from the normal operating mode to an adjustment mode, be sure to turn OFF the instrument power supply and not original SW2 settings. However, for switching between adjustment modes, the instrument power supply may be left ON.

Table 11-1 shows, from left to right; adjustment mode names, SW2 setting statuses, PCBs on which corresponding potentiometers to be adjusted are mounted, displays on the display section and the instrument operating conditions.

NOTE

- Before switching to adjustment mode, make a note of SW2 settings in normal operating mode.
- When adjustment is completed, return SW2 settings to those of normal operating mode.

Table 11-1. Adjustment Mode.

Adjustment Mode	MAIN CPU CARD B9541WL SW2	Adjustment Item Potentiometer, Switch	Display	Operation
A/D Converter Span	Bit 8 7 6 5 4 3 2 1 SW2 ON OFF OFF OFF OFF OFF OFF OFF	A/D CARD B9541WE/WG R51	☼ FAIL ← Lit 2u AdJ +2.0000 V	A/D operation only, no recording
Recording Hysteresis	Bit 8 7 6 5 4 3 2 1 SW2 ON OFF OFF OFF OFF OFF ON ON	MAIN CPU CARD B9541WL SW5-③, ④	☼ FAIL ← Lit H 95 AdJ	Dot printing back and forth near to approx. 80% point (amplitude approx. 20%, color: purple)
Recording Zero	Bit 8 7 6 5 4 3 2 1 SW2 ON OFF OFF OFF OFF OFF OFF ON	MAIN CPU CARD B9541WL SW3	☼ FAIL ← Lit n u 1 1 AdJ	Continuous dot printing at 0% point (color: purple)
Recording Span	Bit 8 7 6 5 4 3 2 1 SW2 ON OFF OFF OFF OFF OFF ON OFF	MAIN CPU CARD B9541WL SW4 SW5-①, ②	☼ FAIL ← Lit 5 PAn AdJ	Continuous dot printing at 100% point (color: purple)

11-1-4. Adjustment Procedure.

(1) A/D Converter Span Adjustment (mV·TC, mV·TC/RTD Input Versions)

1) With the instrument power supply turned OFF, set switch SW2 on the Main CPU Card ASS'y: B9544WL as per Table 11-1 "A/D Converter Span" adjustment mode.
2) with the A/D Card Ass'y: B9541WE/WG installed in the mainframe, turn on the power supply and allow the instrument to warm up for at least 15 minutes.
3) Using a DC voltage standard, apply a voltage of +2.0000 V DC between CH7 input terminals on the instrument rear panel.
4) Next, adjust the GAIN adjustment potentiometer R51 on the A/D Card Ass'y: B9541WE/WG shown in Figure 11-2 so that the display is within the range +2.0000 ± 0.0002 V.

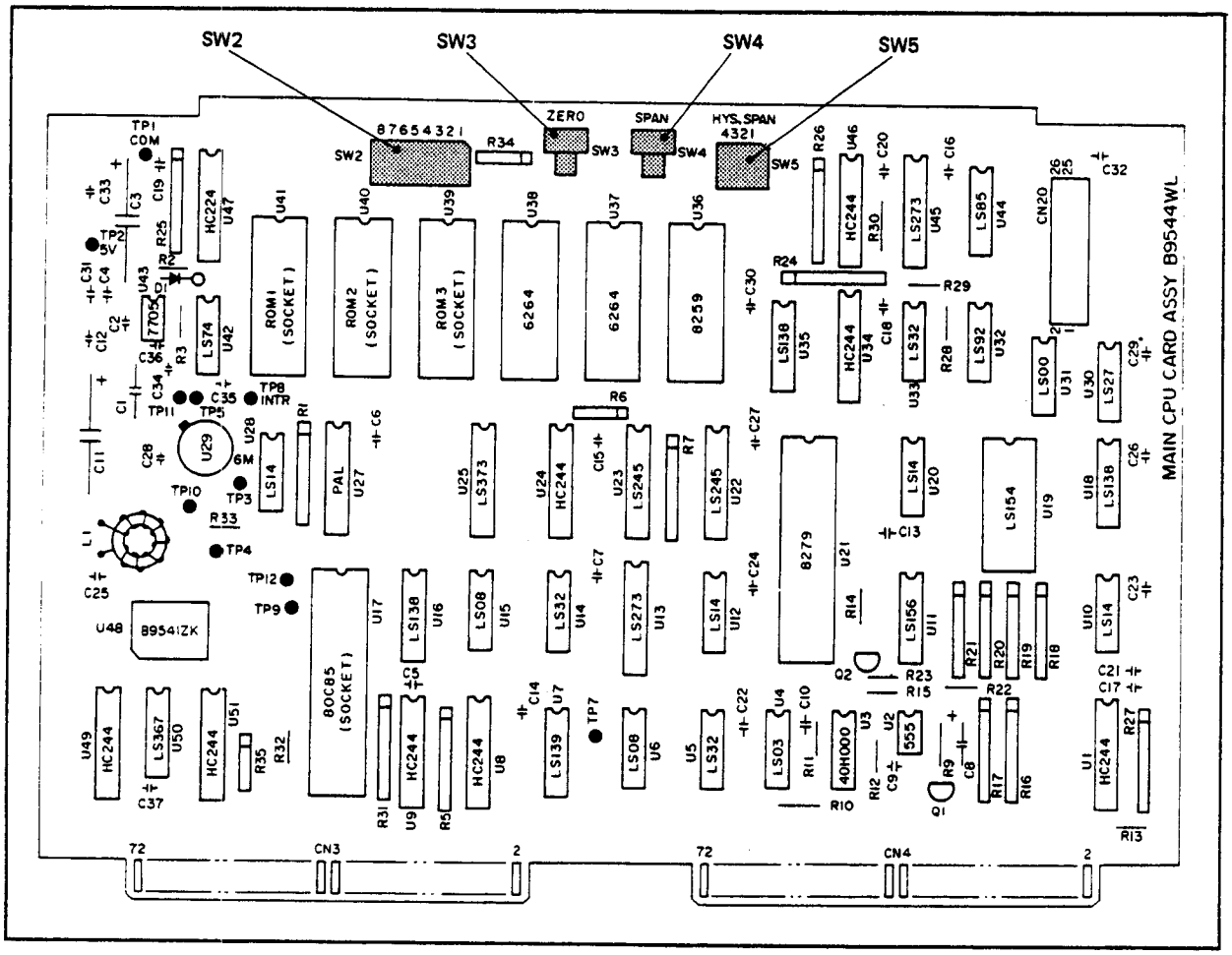


Figure 11-1. Main CPU Card Ass'y: B9544WL.

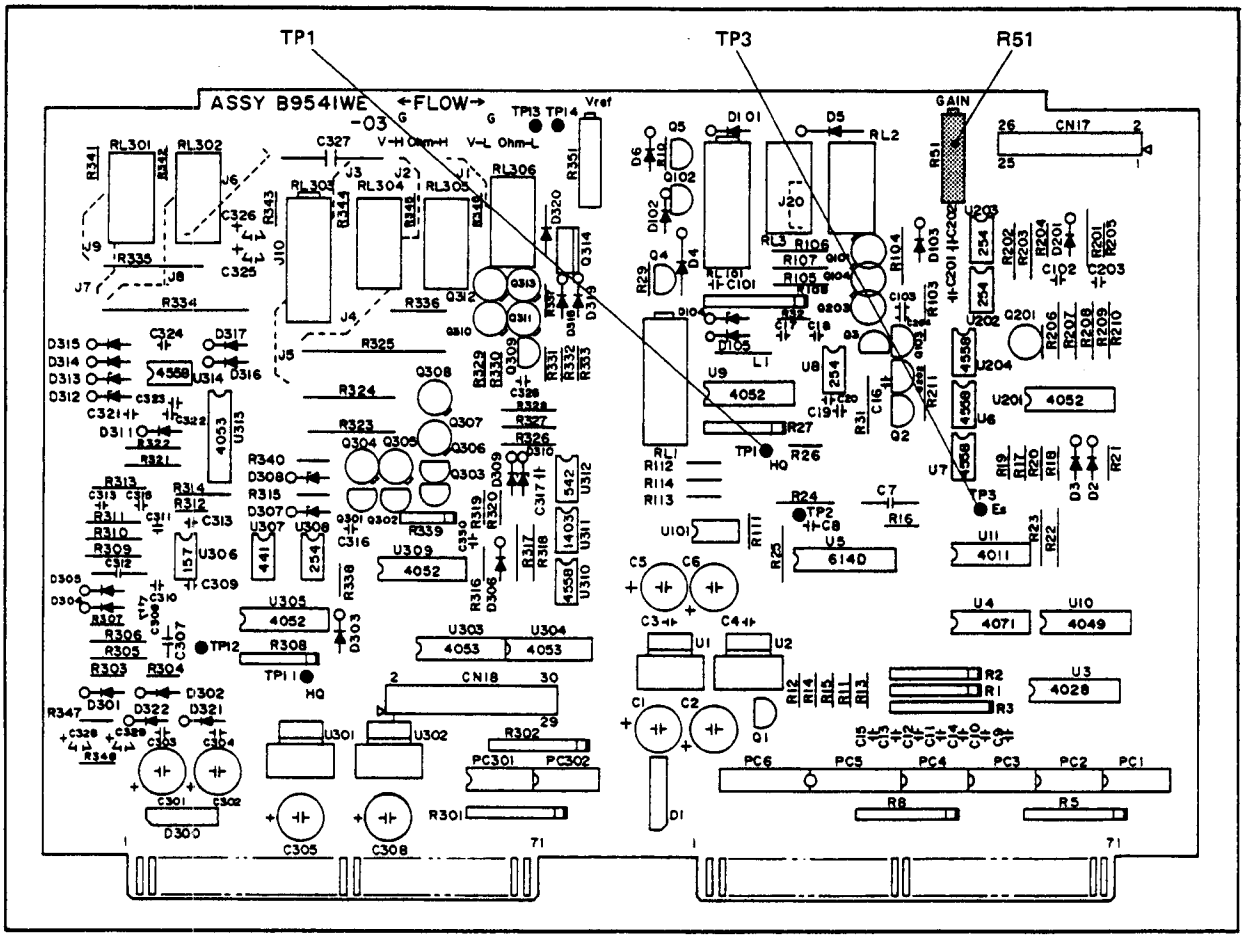


Figure 11-2. A/D Card Ass'y: B9541WE/WF/WG.

(2) A/D Converter Span Adjustment (RTD Input Version)

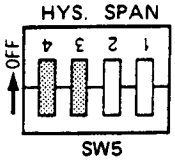
1) With the A/D Card Ass'y: B9541WF installed in the instrument, turn on the instrument power supply and allow the instrument to warm up for at least 15 minutes.
2) Connect a digital multimeter which is set to DC voltage measurement mode between test points TP3 (+Es) and TP1 (COM) on the A/D Card Ass'y (See Figure 11-2).
3) Adjust the GAIN adjustment potentiometer R51 on the A/D Card Ass'y so that the digital multimeter display is within the range 4.93 ± 0.01 V.

NOTE

Input connection is not required for this adjustment, and switch setting status of SW2 on the Main CPU Card Ass'y does not affect this adjustment.

(3) Recording Hysteresis Adjustment

1) Set switch SW2 on the Main CPU Card Ass'y shown in Figure 11-1 as per Table 11-1 "Recording Hysteresis" adjustment mode.
2) When the instrument is set to this mode, the instrument printer performs back and forth dot printing in the vicinity of 80% graduation on the chart with amplitude approximately 20% (printing color: purple).
3) Adjust the HYS, SPAN adjustment switch SW5-③ and ④ on the Main CPU Card so that the hysteresis width of this back and forth dot printing is 0.1 mm or less.



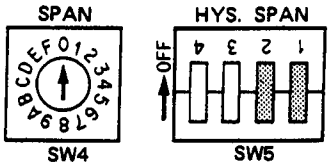
(4) Recording Zero Adjustment

1) Set the switch SW2 on the Main CPU Card Ass'y as per Table 11-1 "Recording Zero" adjustment mode.
2) When the instrument is set to this mode, the printer in the instrument performs continuous dot printing in the vicinity of 0% graduation on the chart (printing color: purple).
3) Adjust the **ZERO** adjustment switch **SW3** on the Main CPU Card shown in Figure 11-1 so that this printed point coincides with 0% graduation on the chart.

Every additional step the switch SW3 is turned clockwise shifts the recording point 0.1 mm to the right. However, switching from F to 0 shifts the recording point 1.5 mm to the left and vice versa. The switch may also be turned counterclockwise.

(5) Recording Span Adjustment

1) Set the switch SW2 on the Main CPU Card Ass'y as per Table 11-1 "Recording Span" adjustment mode.
2) When the instrument is set to this mode, the instrument printer performs continuous dot printing in the vicinity of 100% graduation on the chart (printing color: purple).
3) Adjust the **SPAN** adjustment switch **SW4** and **HYS, SPAN** adjustment switch **SW5**- ① and ② so that this printed point coincides with 100% on the chart graduation.
SW4 is the switch for fine adjustment, and the direction and amount of recording point shift are the same as for SW3 described above.



SW5 is the switch for course adjustment, and when
① is switched from
ON to OFF the recording point shifts 1.6 mm to the left
OFF to ON the recording point shifts 1.6 mm to the right
② is switched from
ON to OFF the recording point shifts 3.2 mm to the left
OFF to ON the recording point shifts 3.2 mm to the right

NOTE

When the adjustment is completed, transfer the switch SW2 on the Main CPU Card from adjustment mode to normal operating mode. This switching may be performed with the instrument power supply turned ON.

◆ **Reference**
Setting SW2 on Main CPU Card.

Table 11-2. Settings at Shipment (Normal Operating Mode).

	Specification \ SW2 bit		8	7	6	5	4	3	2	1	Description
At Shipment	Temperature unit	°C	←OFF→			X	X	X	X	OFF	St'd
		°F	←OFF→			X	X	X	X	ON	Must be specified
	Statistical computation & Recording	YES	←OFF→			X	X	X	OFF	X	St'd
		NO	←OFF→			X	X	X	ON	X	(Special order)
	Logger Format	column by column writing	←OFF→			X	X	OFF	X	X	St'd
		row by row writing	←OFF→			X	X	ON	X	X	(Special order)
	Input standard TC/RTD	ANSI	←OFF→			X	OFF	X	X	X	
		DIN									
		ANSI/DIN	←OFF→			X	ON	X	X	X	
		DIN/DIN									
	Burnout	Up scale	←OFF→			OFF	X	X	X	X	St'd
		Down scale	←OFF→			ON	X	X	X	X	(Special order)

X : Don't care

Table 11-3. Settings for Adjustment.

	Mode \ SW2 bit	8	7	6	5	4	3	2	1	Description
At Adjustment	A/D DC 2 V ADJ	ON	X	X	X	X	X	OFF	OFF	Input CH No. 7
	Recording Zero	ON	X	X	X	X	X	OFF	ON	
	Recording Span	ON	X	X	X	X	X	ON	OFF	
	Recording Hysteresis	ON	X	X	X	X	X	ON	ON	
	AUTO RANGE Setting	OFF	ON	OFF	X	X	X	X	X	RANGE, ZERO, and SPAN are set automatically as shown in Figure 10-3.*

X : Don't care

* : For mV·TC input version, this automatic range setting function is used for checking the recording format, resulting in a recording like that shown in Figure 10-3.

11-2. Adjustment of Each Assembly (Electrical Circuits).

11-2-1. Reference Voltage Adjustment for DMM Section on A/D Card.

1) Open the DMM input terminals on the instrument front panel.
2) Set the instrument to DMM mode and switch to resistance (Ω) measurement range.
3) Connect a digital multimeter – set for DC voltage measurement mode – between test points TP14 (1 V) and TP13 (R-COM) on the A/D Card Ass'y: B9541WE/WF/WG shown in Figure 11-3.
4) Confirm that the multimeter display value is within the range +1 ± 0.0001 V.
   If the display value is outside of the range described above, adjust the Vref adjustment potentiometer **R351** shown in the figure so that the display value is within the rated range.

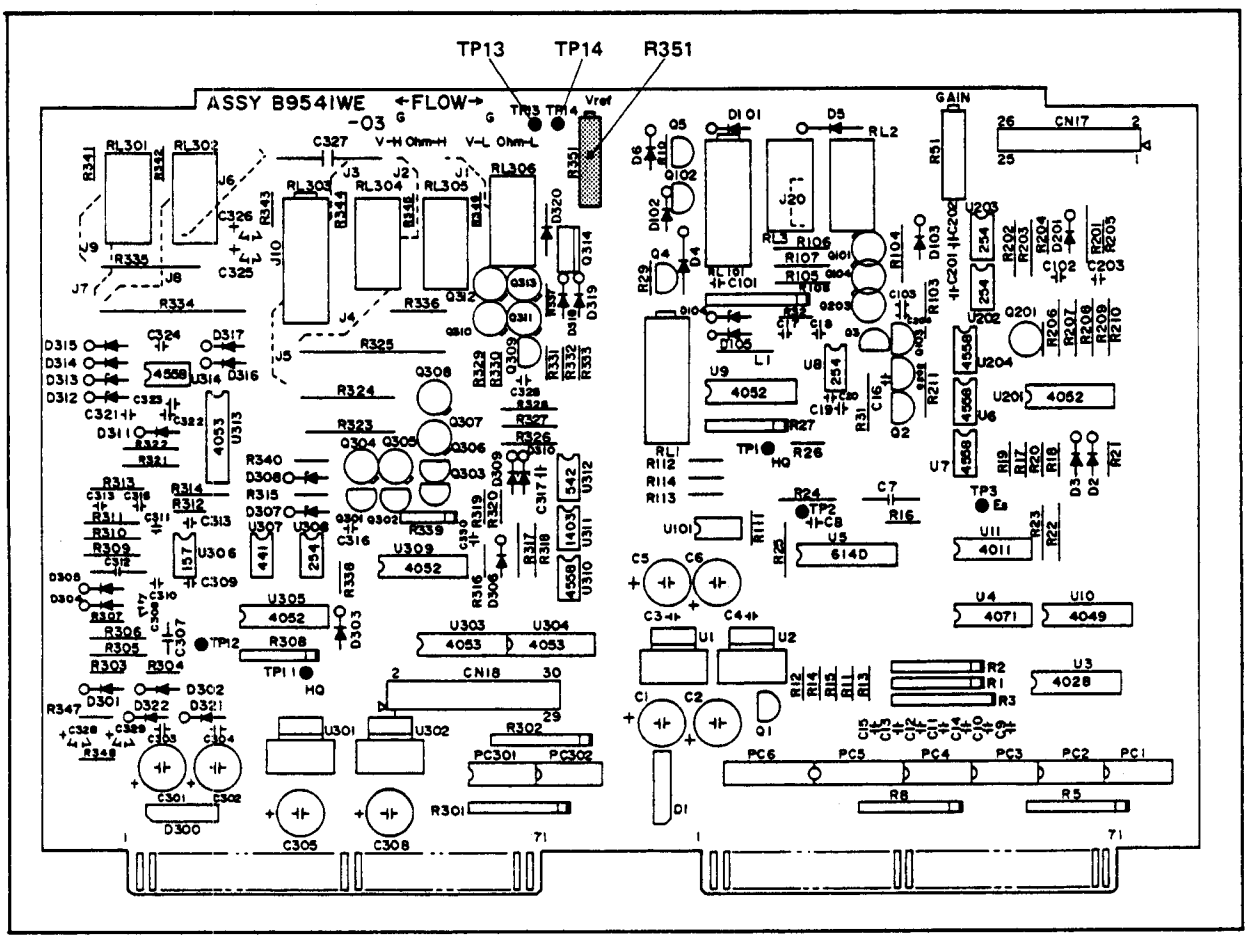


Figure 11-3. A/D Card Ass'y: B9541WE/WF/WG.

11-2-2. Adjustment of 5 V DC Power Supply for Logic Circuitry.

1) Using a digital multimeter – which is set to DC voltage measurement mode – measure the voltage between test points TP1 (+5 V) and TP3 (COM) on the Mother Board Ass'y: B9541WD shown in Figure 11-4 and confirm that the voltage measured is within the range 5.1 ± 0.1 V DC.
2) If the value is outside this range the power supply or a PCB Ass'y which is drawing current from the power supply may have failed. In this case, turn off the instrument power supply and unplug the A/D, Main CPU and Sub CPU Cards, which are drawing current from the power supply, from the Mother Board. Connect a load resistor between pins (99,100) and (97,98) of connector CN5 on the Mother Board as shown in Figure 11-4, and adjust **5 V ADJ** potentiometer **R51** so that the voltage between TP1 and TP3 is within the rated range.
   - When adjustment is possible
     One of the PCBs which is drawing current from the power supply may have failed. Remove the load resistor then mount the PCBs on the Mother Board one by one to find the failed PCB which is causing the power supply voltage to drop.
   - When adjustment is impossible
     5 V DC power supply circuit or 12 V AC power supply circuit may have failed. Whether the 12 V AC power supply has failed or not can be checked by using a multimeter which is set to AC voltage measurement mode to measure the voltage between pins 4 and 5 of connector CN6 on the Mother board.

11-2-3. Changing Power Transformer and Primary Coil Connection to Match Power Line Voltage.

The power transformer and appropriate primary coil tap to be used should be selected according to the power line voltage using Table 11-4.

If required, change the power transformer primary coil tap as per Figure 11-5. After changing the tap, metal terminals of the power transformer must be completely covered using heat-shrinkable tubing.

Table 11-4.

Power Supply Voltage	Transformer to be Used	Terminals to be Used
100	B9541FT	①, ②
110 115 118 120		①, ③
200	B9541FW	①, ②
220 230 240		①, ③

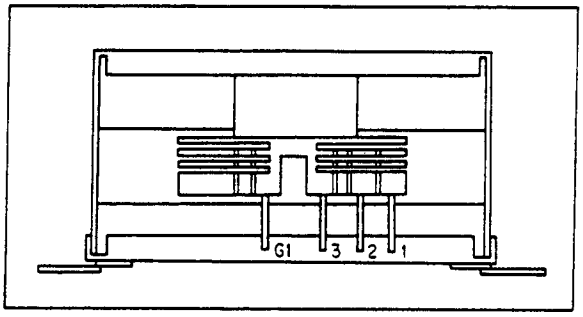


Figure 11-5.

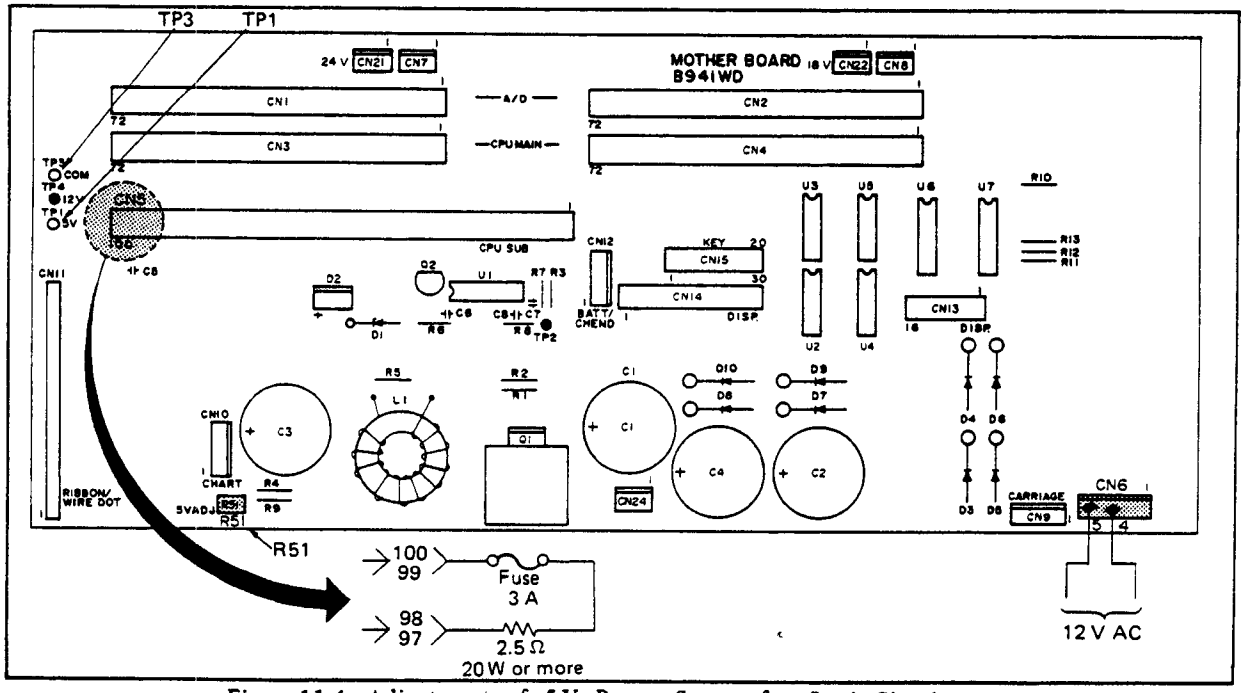


Figure 11-4. Adjustment of 5 V Power Source for Logic Circuitry.

11-2-4. Adjustment of RJC Board Ass'y: B9541WZ.

For the adjustment of this Ass'y, an RJC Board which has been calibrated and a special jig to thermally couple this standard to the RJC Board to be adjusted are required.

Thus, on-site adjustment of this Ass'y is impossible. If this Ass'y seems to have failed, it is recommended that it be replaced with a new one.

11-3. Adjustment (Mechanical Assembly).

11-3-1. Chart Lock Mechanism Adjustment.

1) Using two screws (Y9314LB), fix temporarily spring (B9541LG) and block (B9541LH) shown in Figure 11-6 to the bottom plate.
2) Insert chart drive assembly (B9541LA) into the mainframe guide, push part A of the chart drive assembly and part B of the spring shown in the figure into the mainframe simultaneously, and confirm that the side panel of the chart drive assembly closely contacts with the shaft fitting part C in the mainframe.
3) Insert a screwdriver through the hole D on the shaped frame, tighten the screws fixing temporary spring to fix the spring and block securely to the frame.
4) After adjustment, confirm that there is no "play" in the locking position (gap after adjustment must be 0.1 mm or less).

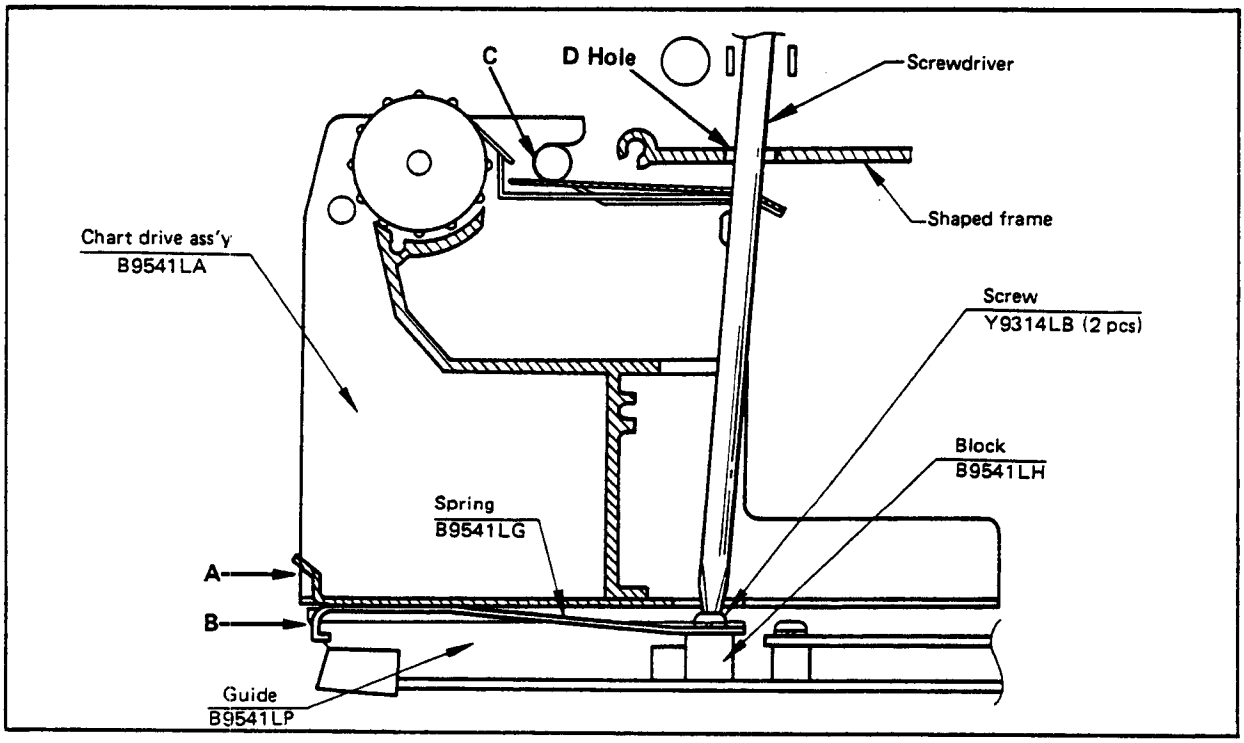


Figure 11-6.

11-3-2. **Chart Locating Collar Adjustment.**

1) Fit the chart locating collars (B9541MM) on the chart locating shaft (B9541BK) as shown in Figure 11-7.
2) After adjustment for chart lock mechanism described in paragraph 11-3-1, install the chart drive assembly in the mainframe.
3) While pressing the collars at both sides 0% and 100% lightly (0 to 50 g) to each side panel of the chart drive assembly installed, fix the collars securely to the shaft with each two setscrews (Y9303SJ).
   Tightening torque should be 7 kg·cm or more.
4) After adjustment, confirm that the chart drive assembly can be removed from and reinstalled in the mainframe smoothly.

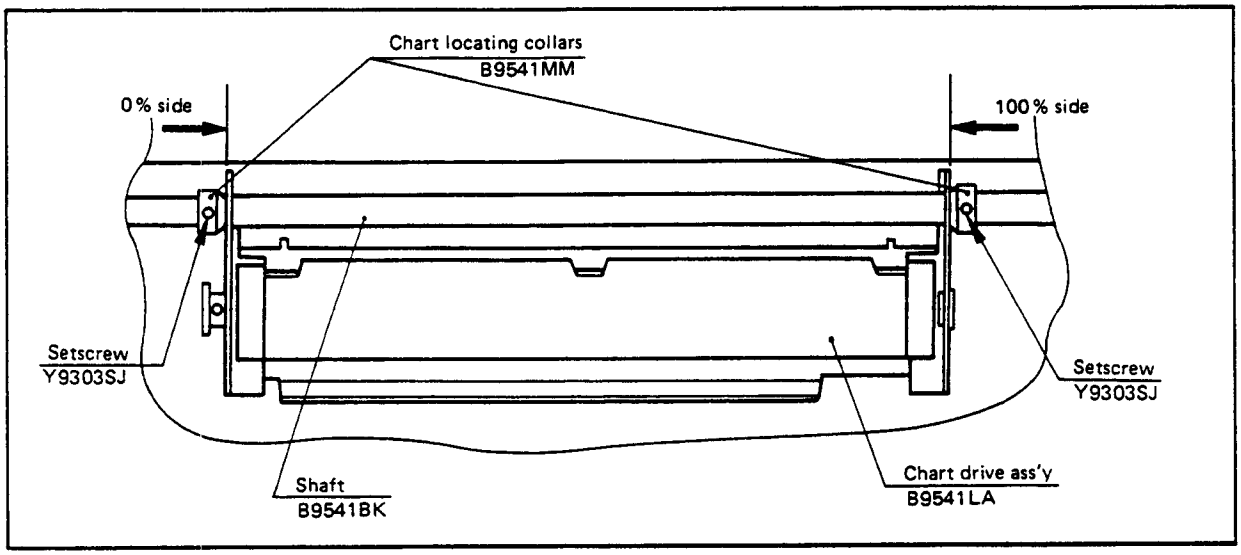


Figure 11-7.

11-3-3. **Attaching Belt, and Tension Adjustment.**

(1) Incorporation of Belt and Bracket

1) With the slotted side of the belt (B9541CR) facing you, insert the belt in the hole at the middle of the bracket (B9541CS) as shown in Figure 11-8. At this time, do not bend the belt sharply as shown in the right figure.

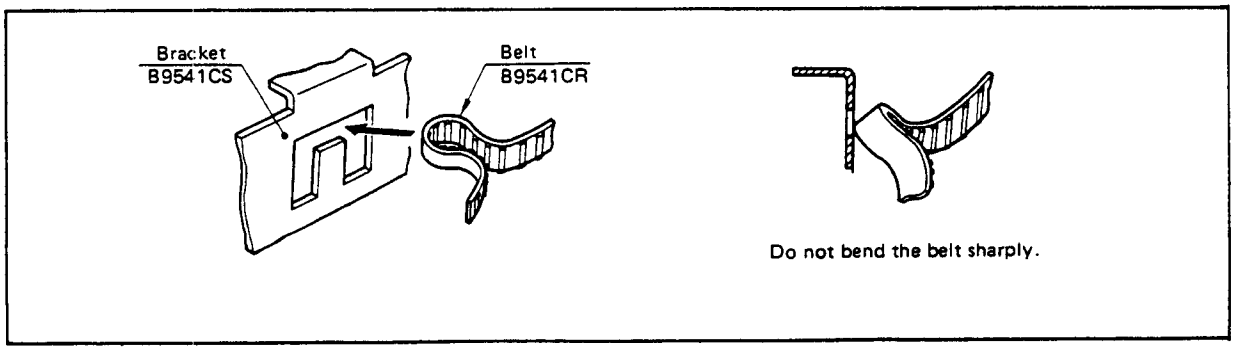


Figure 11-8.

2) Fully loosen the belt and pass it through the square notches at both ends of the bracket as shown in Figure 11-9.

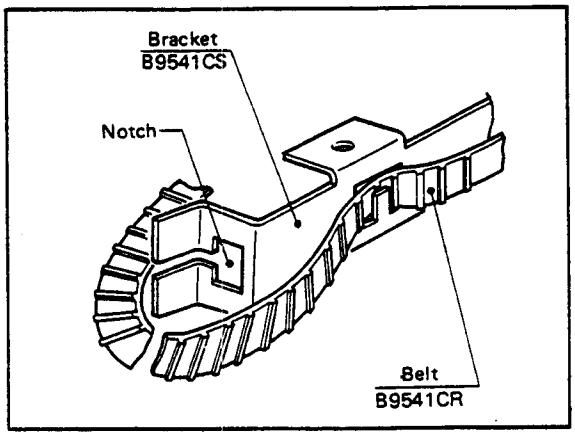


Figure 11-9.

3) Gently tighten the belt, a little at a time, as it may be damaged by excessive force, and stretch it taut as shown in Figure 11-10.

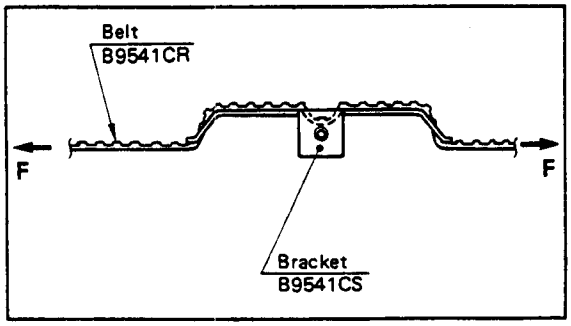


Figure 11-10.

(2) Mounting Belt Assembly on the Frame

Mount the belt assembled in (1) above on the carriage assembly frame (B9541EF) as per Figure 11-11.

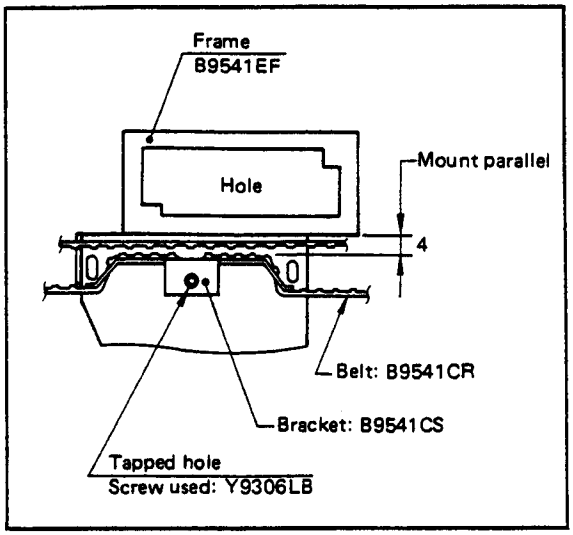


Figure 11-11.

(3) Belt Tension Adjustment

1) Move the printer carriage to 0% side until it is stopped by the stopper.
2) As shown in Figure 11-12, the belt tension is at the recommended value if a displacement of 5 mm occurs in a span of 100 mm when a load of 350 to 450 gf is applied.
3) If the load required to cause this displacement in the belt is outside the above range, loosen the two screws (Y9306LB) fixing the motor assembly (B9541CT), move the motor assembly parallel to the oval holes in the adapter plate in the direction of the arrow marks shown in the figure, and fix the motor position where the load required to give the rated displacement is 350 to 450 gf.
4) When the motor position is fixed, tighten the screws to clamp the motor securely to the adapter plate, and lock the screws with white enamel.

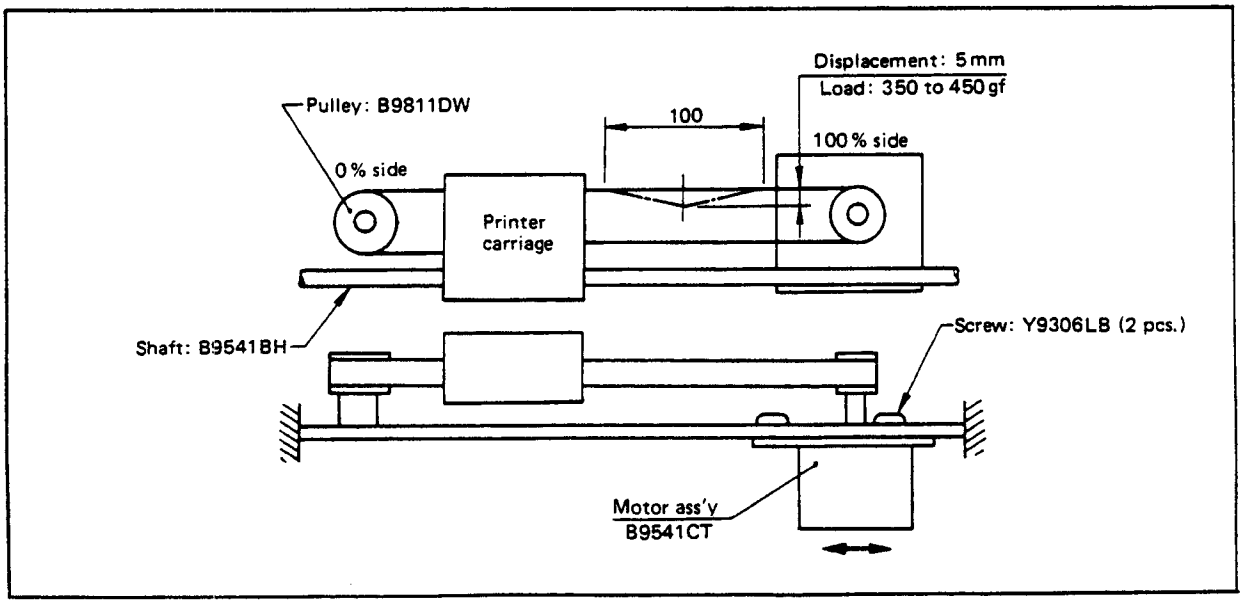


Figure 11-12.

11-3-4. Adjustment of Gap Between Printer Carriage and Platen.

Figure 11-13 shows the right side view of the carriage assembly when the ink ribbon cassette is removed.

By shifting the rail (B9541DR) mounted on the aluminum shaped frame (B9541DX) shown in the figure upward or downward, adjust the gap between the wire guide (B9541QX) of the wire dot printer mounted on the carriage and the platen (B9541MA) to the specified value.

This adjustment is essential for obtaining optimum printout quality. Note that there is a clearance of 0.1 to 0.2 mm between rail and bearing, so adjust as per the following procedure.

1) Using two screws (Y9306LB) shown in the figure, fix the carriage assembly temporarily to the shaped frame at nearly middle point of the oval holes on the rail.
2) Move the carriage to 0% side, and insert a spacer (thickness 0.7 mm) between wire guide and platen.
3) Press the carriage rear part downwards with a force of approximately 200 gf as shown in the figure, and tighten the 0% side screw temporarily.
4) Next, move the carriage to 100% side and proceed in the same manner as 2) and 3) mentioned above.
5) Return the carriage to 0% side and check the gap between wire guide and platen.
   With the carriage rear part depressed downwards confirm that the gap between wire guide and platen is 0.7 to 0.8 mm. Tighten screws securely, and lock the screws with white enamel.
   If the gap is outside of the specified value range, return to 2) and readjust the gap.
6) Return the carriage to 100% side, check the gap between wire guide and platen in the same manner as 5) above.

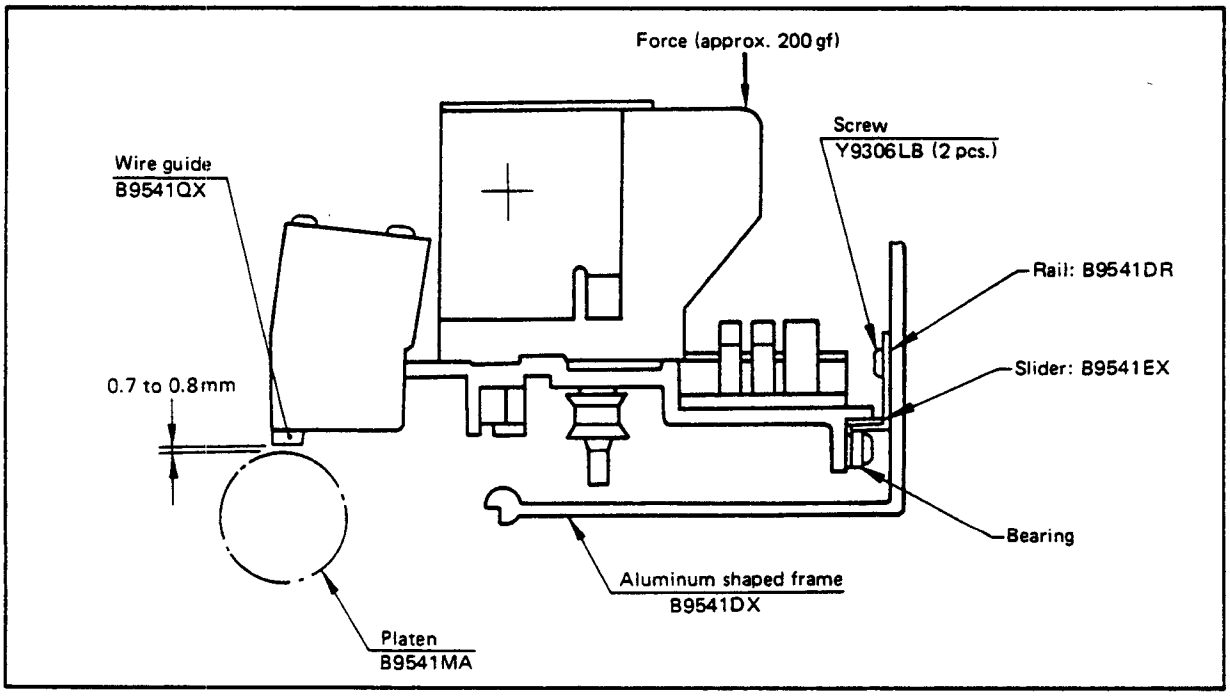


Figure 11-13.

11-3-5. Zero Detector Mechanism Mounting Position Adjustment.

1) After the printer carriage is reassembled, attach F.P.C assembly (B9541RP) which includes the zero detector mechanism to the frame.
2) Using two screws (Y9306LB), attach this assembly to the frame so that the position of the assembly relative to aluminum shaped frame (B9541DX) and bracket (B9541CD) is as shown in Figure 11-14.
3) When F.P.C assembly mounting position adjustment is completed, lock the screws with white enamel.

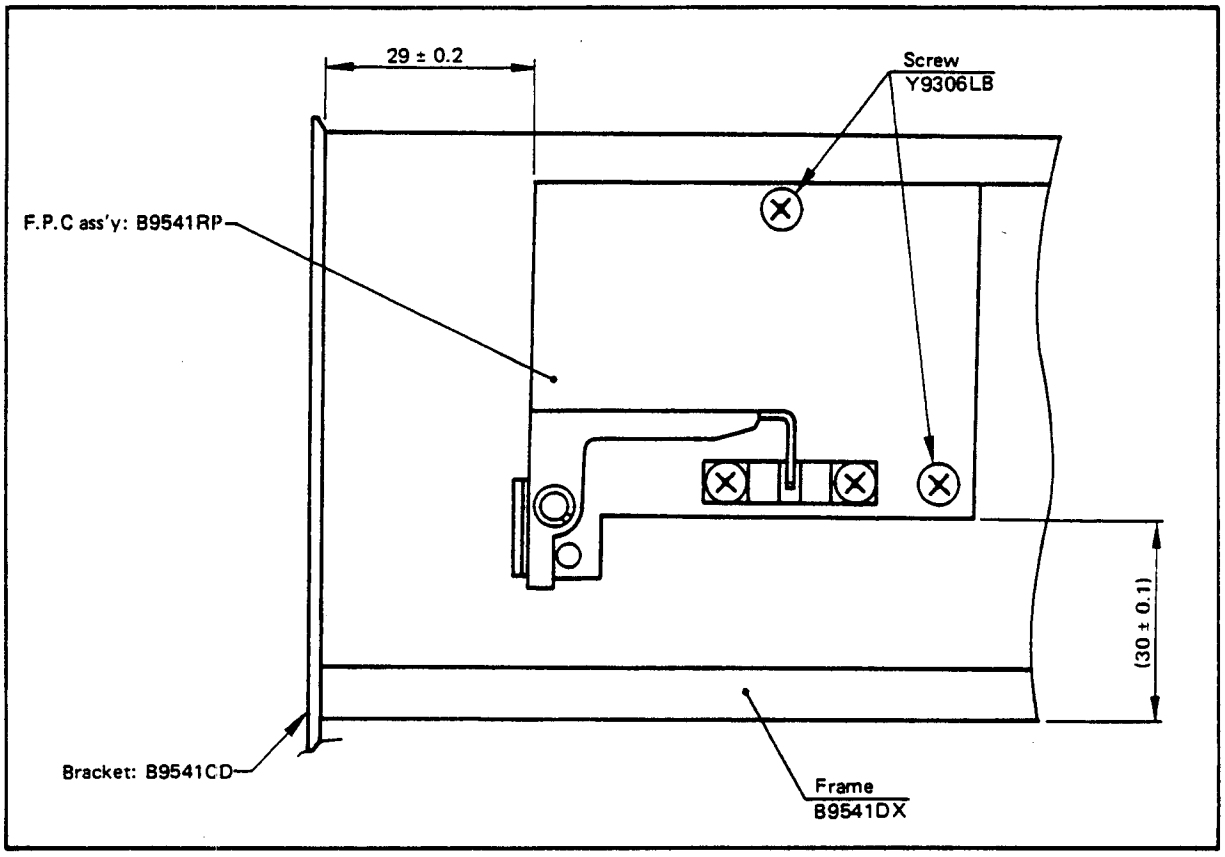


Figure 11-14.