Instruction Manual

Model 4151 1-Pen Model μR100
Model 4152 2-Pen Model
Model 4153 3-Pen Model
100mm Micro Recorders

YOKOGAWA
Yokogawa Electric Corporation

IM 4D2B1-01E
5th Edition

CONTENTS

FD No. 1019R (Cld: 5771A)

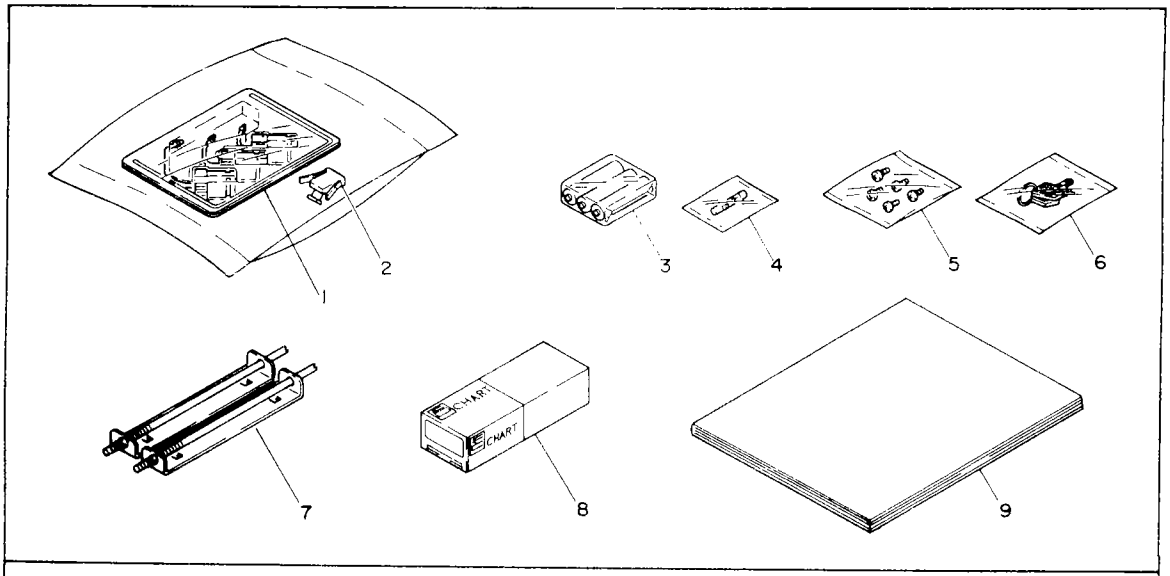
1. HANDLING CAUTIONS.

The Model μR100 Recorders are thoroughly factory-tested before shipment. When the instrument is received, however, check visually if any external damage has occurred during shipment. Confirm that all standard accessories were supplied.

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

1-1. Accessories.

The accessories shown in Figure 1-1 should be supplied with the instrument. Check that nothing is missing.



1. Disposable Felt-Tip Pen
   1-pen Model . . . 1 (red)
   2-pen Model . . . 2 (red, green)
   3-pen Model . . . 3 (red, green, blue)
2. Plotter Pen 1
3. 1.5 V Battery (JIS SUM-3, ANSI AA) . . . 3
4. Fuse 1
5. Terminal Screw (spare) 5
6. Key (for key lock) 2
7. Mounting Bracket . . . . . 1 box
8. Chart . . . . . 1 box
9. Instruction Manual . . . . . 1 copy

Figure 1-1. Accessories.

•Spares

Name	Part No.	Description
Felt-tip pen	**B9565AP**	red (3 pcs./unit), order q'ty: 1 unit
Felt-tip pen	**B9565AQ**	green (3 pcs./unit), order q'ty: 1 unit
Felt-tip pen	**B9565AR**	blue (3 pcs./unit), order q'ty: 1 unit
Plotter pen	**B9565AS**	purple (3 pcs./unit), order q'ty: 1 unit
Z-fold chart	**B9565AW**	approx. 16 m (1 box/unit), order q'ty: 6 units

1-2. Removing Shipping Lock Screw and Packings.

The internal assembly is secured in position by a lock screw and packing to safeguard it against damage during transit. When the recorder is unpacked, remove the lock screw and packing.

① The shipping lock screw is located on the rear panel of the internal assembly (see Figure 1-2). Use a phillips screwdriver to remove the lock screw. The lock screw removed should be kept in a safe place.

② Open the instrument front door by inserting fingertips into the recess on the right front and pull outwards pull out the internal assembly handle, located at the bottom front of the internal assembly, as far as possible. Swing open the display door by grasping the small tab located at the lower left front corner of the display cover, gently pull outwards, and remove all the packing as shown in Figure 1-3.

CAUTION

Use the handle to pull out the internal assembly, do not use the display panel as a handle to pull out the internal assembly as the recorder may be damaged.

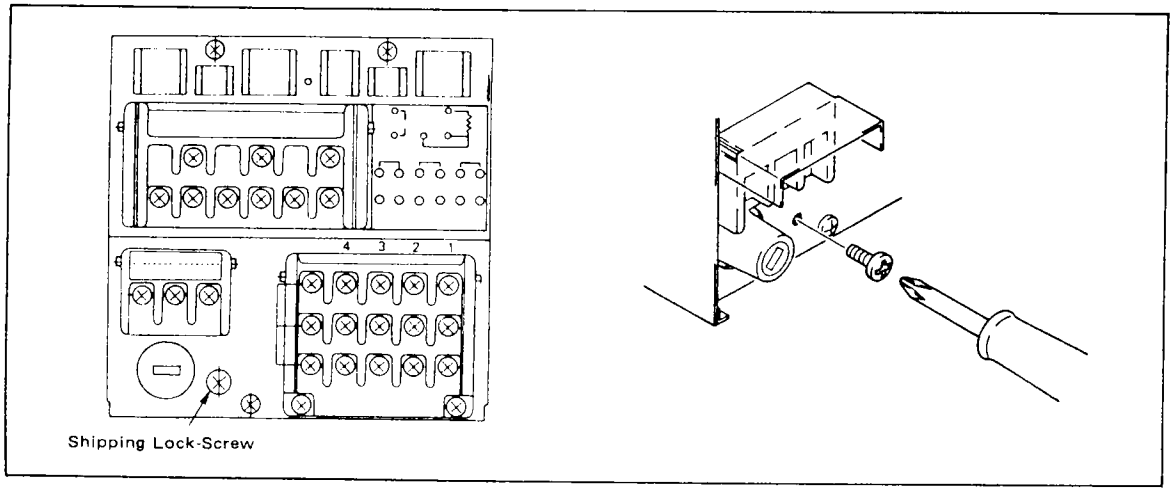


Figure 1-2.

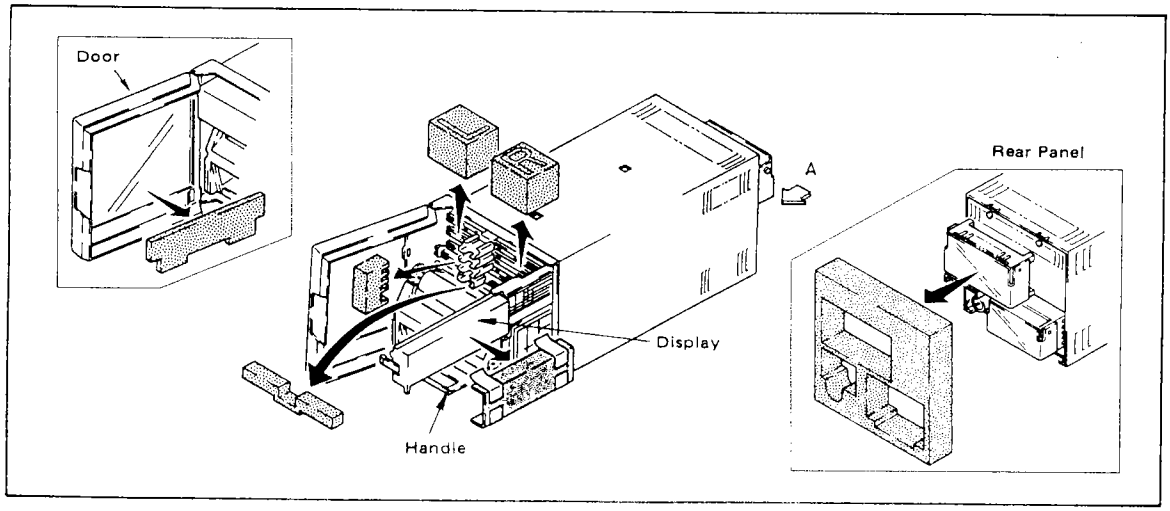


Figure 1-3.

1-3. Data Plate Check.

The recorder model name is indicated on the data plate*.

Verify that it is specified in the order. When enquiring about the recorder, provide the model name (MODEL), and serial number (NO.).

* The data plate is attached to inside (right side) the internal assembly (Figure 1-4) (Check the data plate with the chart paper compartment removed. Refer to Section 5-1 for removing the chart paper compartment.)

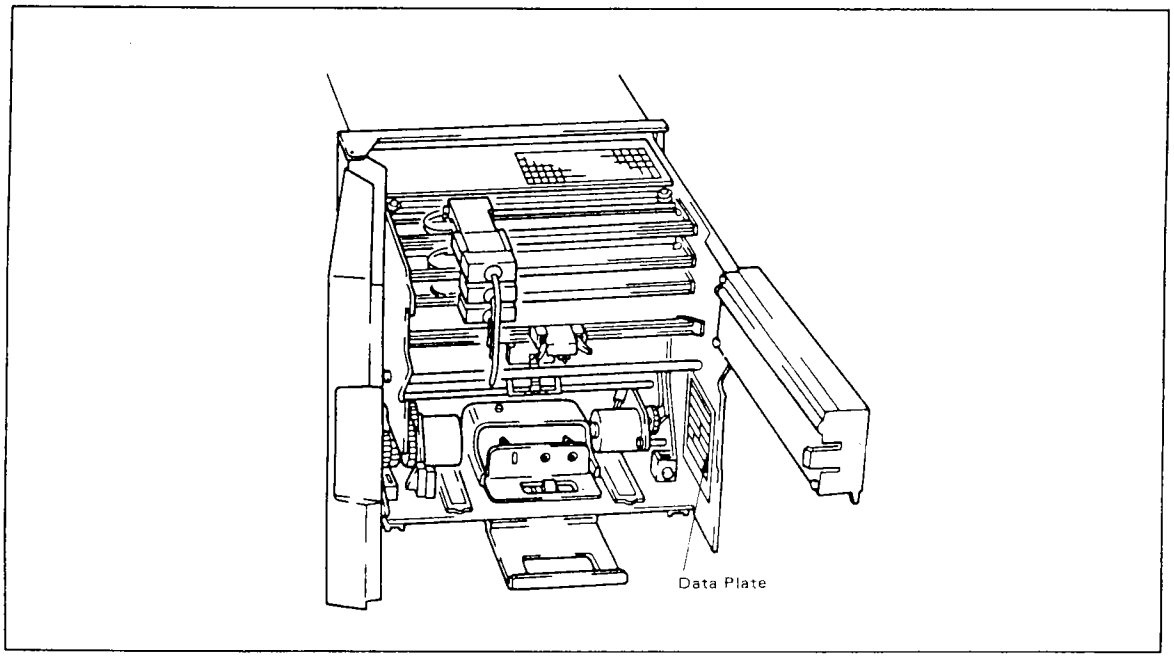


Figure 1-4.

2. GENERAL.

2-1. Description.

This manual describes the one-, two- and three-pen recorders in the μR100 series.*

The μR100 series recorders support a wide range of inputs: DC voltage, nine types of thermocouples and RTD (resistance temperature detector), and converters for pressure, differential pressure, flow rate, dewpoint, humidity and pH.

Full-scale range, chart speed and alarms can be programmed via the side-panel keyboard. In addition to analog data writing (or printout), the μR100 also provides both digital and analog (bar graph) monitoring displays, and digital monitoring printout. The recorder is easy-to-use.

* The μR100 series also includes a six-point dot printing model, which is covered in a separate manual.

2-2. Features.

(1) Input types and full-scale ranges may be programmed for each pen using the side-panel keyboard.
(2) Compact size – case depth is 230 mm (9-1/8″) or 290 mm (11-7/16″).
(3) Versatile digital printout functions.
Periodical data, program listings and alarms can be printed out.
(4) Internal illumination (standard).
An internal fluorescent lamp is provided for quick chart reading even in low ambient light conditions.
(5) A wide range of input types – 9 types of TC's (types R, S, B, K, E, J, T, N, W), RTD (pt 100 ohms), or DC voltage inputs (span 5 mV to 50 V). These inputs may be selected and combined.
(6) Clear, distinct color traces.
The pen models use disposable felt-tip pen cartridges.
(7) Temperature difference ($\triangle$T) recording, linear scaling, and square rooting functions.
(8) Versatile recorder with a wide range of standard and optional features.
Other standard features include channel skip, battery-backup memory and bar graph analog display.

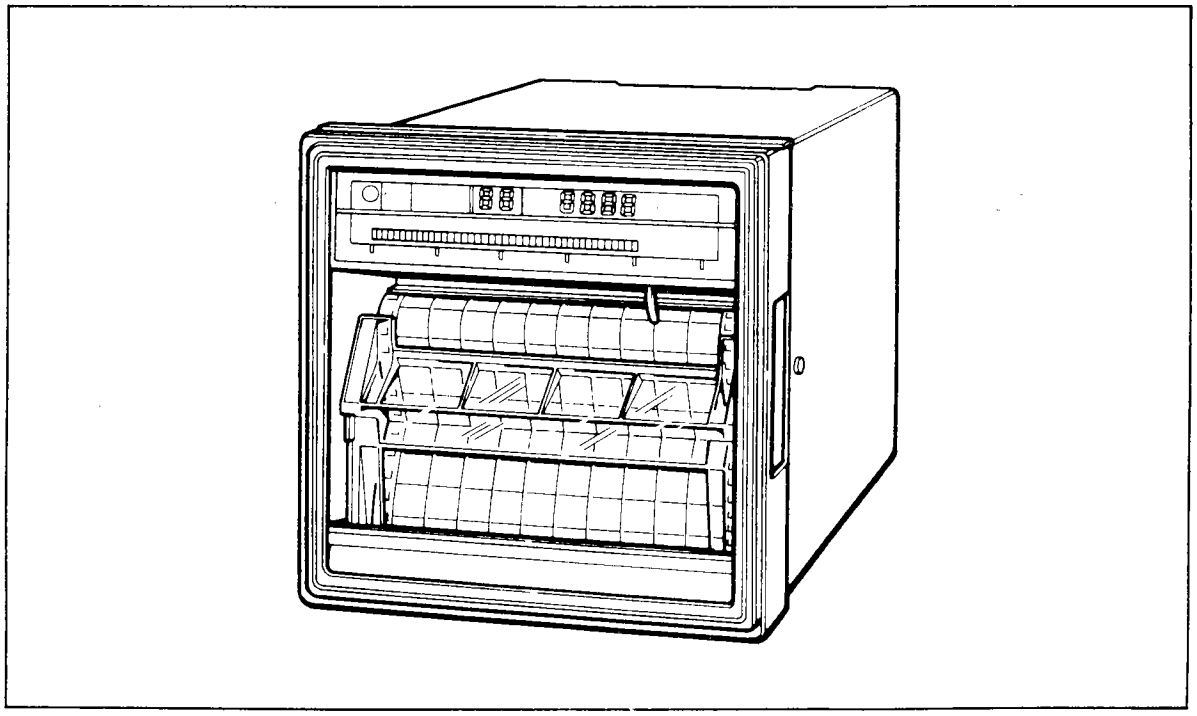


Figure 2-1. External View.

2-3. Specifications.

Model: 1-, 2-, or 3-pen 100mm "Micro Recorder."

Input

Number of Inputs: 1, 2 or 3 (continuous-wiring pen models).

Type of Input Circuit: Floating, channels are isolated from each other.

Scan Cycle Time (or Rate): 125 ms/input channel.

Input Signal Levels: DC V...5 mV span to 50V, TC...more than 100°C span (and 3 mV), RTD...more than 50°C span (Pt 100Ω).

Full-Scale Range Setting: Programmable via keyboard. (Using Range Code)

Measuring Range: ANSI, JIS (°C) model...

Input type	Range code	Range	Measuring range	Remarks
DCV	00		−20.00 to 20.00mV	
	01		−200.0 to 200.0mV	
	02		−2.000 to 2.000V	
	03		−6.000 to 6.000V	
	04		−20.00 to 20.00V	
	05		−50.00 to 50.00V	
TC (JIS ANSI)	10	Type R	0 to 1760°C	
	11	Type S	0 to 1760°C	
	12	Type B	400 to 1820°C	
	13	Type K	−200 to 1370°C	Former CA
	14	Type E	−200.0 to 800.0°C	Former CRC
	15	Type J	−200.0 to 1100°C	Former IC
	16	Type T	−200.0 to 400.0°C	Former CC
	17	**Type N	0 to 1300°C	NBS
	18	**Type W	0 to 2315°C	OMEGA
RTD	20	JPt100 Pt 100	−200.0 to 550.0°C	Measuring current 1mA
DCV (linear scaling) *mA	30		−20.00 to 20.00mV	
	31		−200.0 to 200.0mV	
	32		−2.000 to 2.000V	
	33		−6.000 to 6.000V	
	34		−20.00 to 20.00V	
	35		−50.00 to 50.00V	
DC (square rooting) *mA	40		−20.00 to 20.00mV	
	41		−200.0 to 200.0mV	
	42		−2.000 to 2.000V	
	43		−6.000 to 6.000V	
	44		−20.000 to 20.00V	
	45		−50.00 to 50.00V	

* μR100 can accept a current input when a current shunt is used.

** Type N (Nicrosil-Nisil), Type W (W5%Re-W26%Re) ..... not included in ANSI, DIN and JIS.

DIN (°C) model

Input type	Range code	Range	Measuring range	Remarks
TC (DIN)	10	Type R (Pt13Rh-Pt)	0.0 to 1760.0°C	DIN IEC 584-1
	11	Type S (Pt10Rh-Pt)	0.0 to 1760.0°C	
	12	Type B (Pt30Rh-Pt6Rh)	400.0 to 1820.0°C	
	13	Type K (NiCr-Ni)	−200.0 to 1370.0°C	
	14	Type E (NiCr-CuNi)	−200.0 to 800.0°C	
	15	Type L (Fe-CuNi)	−200.0 to 900.0°C	DIN 43710
	16	Type U (Cu-CuNi)	−200.0 to 400.0°C	DIN 43710
	17	Type N	0.0 to 1300.0°C	NBS
	18	Type W	0.0 to 2315.0°C	OMEGA
RTD	20	Pt 100	−200.0 to 550.0°C	Measuring current 1mA

Other ranges correspond to the ANSI, JIS (°C) model.

ANSI, DIN (°F) model

Input type	Range code	Range	Measuring range	Remarks
TC (ANSI)	10	Type R	32 to 3200°F	
	11	Type S	32 to 3200°F	
	12	Type B	752 to 3308°F	
	13	Type K	−328 to 2498°F	
	14	Type E	−328 to 1472°F	
	15	Type J	−328 to 2012°F	
	16	Type T	−328 to 752°F	
	17	Type N	32 to 2372°F	NBS
	18	Type W	32 to 4200°F	OMEGA
RTD	20	Pt 100	−328 to 1022°F	Measuring current 1 mA

Other ranges correspond to the ANSI, JIS (°C) model.
JPt 100: JIS C 1604-1989, JIS C 1606-1989
Pt 100 : JIS C 1604-1989, JIS C 1606-1989
DIN IEC 751, IEC 751

Maximum Allowable Input Voltage (Continuous): 10V DC for ranges of less than 2V DC, 100V DC for ranges of 6 to 50V DC.

Recording

Wiring System: Pen model...ink writing using disposable felt-tip pen cartridges (analog data) and plotter (digit data).

Recording Colors: 1st pen..... Red
2nd pen..... Green
3rd pen ..... Blue

Effective Recording Span: 100 mm (analog data).

Chart: Z-fold chart (16 m) with a calibrated width of 100 mm.

Step Response Time (90% step): 1 sec or less*
*Measuring method according to IEC TC65.

Chart Speed Setting: Any of 82 chart speeds can be set via keyboard within the range 5 to 12,000 mm/h (see paragraph 5-4-5 Chart Feed Speed Setting).

Display

Type of Display: LCD.

Digital Data Display:

- ○ Measured data
  DC V.....3-1/2 digits
  Temperature.....0.1°C
- ○ Alarm (H, L (h, l) and ALM)
- ○ Date
- ○ Time
- ○ Chart feed speed
- ○ BAT (replace battery!) display
- ○ Other information*

* When setting measuring range or span, various setting information may be displayed.

Bar Graph Display:

- ○ Measured data
- ○ Alarm set point
- ○ Alarm flashing display (2% resolution)

General Specifications

Reference Junction Compensation Accuracy: (At ambient temperature of 5 to 40°C and input terminal temperature equilibrium).
For R, S, B and W type thermocouples, within ±1°C.
For K, E, J, T and N type thermocouples, within ±0.5°C.

Recording Speed: Pen.....Step response time 1s or less (90% step).

Input Impedance: At least 10 MΩ on 20, 200 mV and 2V DC voltage input ranges.
At least 10 MΩ on thermocouple input ranges.
Approximately 1 MΩ on 6, 20, and 50V DC voltage input ranges.

Input Bias Current: 10 nA or less, however approx. 100 nA when BU/BD (see optional features) is specified for a thermocouple.

Chart Feed Accuracy: Within ±0.1% (value when at least 1000 mm of chart is fed continuously).

Clock Accuracy: Within ±50 ppm, however clock error of up to one second may occur each time power is switched ON or OFF.

Insulation Resistance: More than 20 MΩ at 500V DC between terminals and case (ground terminal).

Dielectric Strength: 1,500V AC (50/60 Hz) for one minute between power supply and ground terminals, leakage current 2 mA or less.
1000V AC (50/60 Hz) for one minute between input and ground terminals, leakage current 2mA or less.

Accuracy and Resolution (Dead Band)

The following specifications apply to recorders operating under standard operating conditions (temperature: 23 ± 2°C humidity: 55 ± 10%, power supply voltage and power supply frequency: Rated power supply voltage (or frequency) ±1%, warmup time: at least 30 minutes, other ambient conditions should not adversely effect the recorder operation).

Table 2-2.

Input	Range	Measurement (Digital display)		Record (Analog recording)*1		Remarks
		Accuracy	Resolution	Accuracy	Dead band	
DC V 0□ 3□ 4□	20mV	±(0.2% of rdg*+3 digits)	10μV	±(0.2% of rdg+0.3% of SPAN)	Dead band 0.2% of recording span	*rdg: indication (reading) value
	200mV	±(0.2% of rdg+2 digits)	100μV			
	2V	±(0.1% of rdg+2 digits)	1mV	±(0.1% of rdg+0.3% of SPAN)		
	6V	±(0.3% of rdg+2 digits)	1mV	±(0.3% of rdg+0.3% of SPAN)		
	20V		10mV			
	50V		10mV			
TC (Reference junction compensation accuracy is not included) 1□	R S	±(0.15% of rdg+1°C) however R,S: 0 to 100°C±3.7°C More than 100 to 300°C±1.5°C B: 400 to 600°C±2°C	0.2°C	Or ±0.5% of SPAN whichever is greater		
	B			±(Measurement Accuracy + 0.3% of SPAN) or ±0.5% of SPAN whichever is greater		
	k	±(0.15% of rdg+0.7°C) however, −200 to −100°C ±(0.15% of rdg+1°C)	0.1°C			
	E J T	±(0.15% of rdg+0.5°C) however j: −200 to 100°C ±(0.15% of rdg +0.7°C)				
	N	±(0.15% of rdg+0.7°C)				
	W	±(0.15% of rdg+1°C)	0.2°C			
RTD	JPt 100 Pt 100	±(0.15% of rdg+0.3°C)	0.1°C			

*1 When recording span is set as follows. (in Table 2-2)

JPt100 : JIS C 1604-1989, JIS C 1606-1989
Pt 100 : JIS C 1604-1989, JIS C 1606-1989, DIN IEC 751, IEC 751

Range	Span
20mV	≧ 5mV
200mV	> 20mV
2V	> 200mV
5V	> 600mV
20V	> 5V
50V	> 20V
TC	100°C or more and 3mV or more
RTD	50°C or more

Digital Printout

(prints out with plotter pen in purple color.)

Digital Printout*:

- ○ Time tick (— sign)
- ○ Recording color (Red...1cH, Green...2cH and Blue...3cH)
- ○ Chart feed speed
- ○ Tag number (TAG. No.)
- ○ Scale markings (prints out on both 0 and 100% scale ends)
- ○ Engineering unit (mV, V, °C (°F) and arbitrary unit set by ASCII codes.
- ○ Time (hour and minute)
- ○ Date (year, month and day)

* See paragraph 2-5-1 Example of Digital Printout.

Alarm Printout*:

- ○ △ (Alarm ON, ▽ (Alarm OFF) signs
- ○ Channel No.
- ○ Mode (H and L/h and l)
- ○ Alarm output No.
  (○ *sign: prints out * sign when alarm memory capacity overflows)
- ○ Alarm ON/OFF time

* See paragraph 2-5-2 Example of Alarm Printout.

Program List Printout*:

- ○ Date (list printout starting point)
- ○ Time (list printout starting point)
- ○ Chart feed speed setting status
  (1st setting speed, 2nd setting speed)
  Effective when/REM is specified
- ○ Channel No.
- ○ Tag setting status
- ○ Measuring range setting status
- ○ Recording span setting status
- ○ Scaling factor setting status
- ○ Unit setting status
- ○ Alarm setting status

* See paragraph 2-5-4 Example of Program List Printout.

Digital Printout* when Chart Feed Speed is Changed

The chart feed speed can be switched between two values with a remote control signal. The time of chart feed speed change can be printed out when it occurs. However,/REM (optional feature) must be specified.

- ○ Speed 1 or 2
- ○ Chart feed speed change ON (remote control signal generation)/OFF time.

* See paragraph 2-5-3 Example of Printout in REM Setting.

Construction

Material: Case.....Steel plate.
Front door.....Aluminum die-cast.

External Dimensions: 1-pen model.....144(W) × 144(H) × 230(D) mm (5-11/16 × 5-11/16 × 9-1/8").
2- & 3-pen models.....144(W) × 144(H) × 290(D) mm (5-11/16 × 5-11/16 × 11-7/16").
(D expresses length from front panel to the rear of the instrument. Front door thickness 26 mm (common to 1-, 2- and 3-pen models) is not included. See Figure 3-1).

Finish: Both case and front door frame are black (Munsell N1.5).

Weight (Approx.): 1-pen model.....4.0 kg
2-pen model.....5.0 kg
3-pen model.....5.0 kg

Mounting: Flush panel mounting (Vertical panel).

Mounting Angle: May be inclined up to 30° backward from vertical. However, rear bottom edge must be horizontal.

Power Supply

Power Supply Voltage: 100, 115, 200, and 230V AC ±10% (must be specified).

Power Supply Frequency: 50 or 60 Hz (must be specified)

Power Consumption (Approx.):
1-pen model.....20 VA
2-pen model.....23 VA
3-pen model.....26 VA

Normal Operating Conditions

Ambient Temperature: 5 to 40°C.

Ambient Humidity: 45 to 85% relative humidity.

Vibration: 10 to 60 Hz, 0.02G or less.

Magnetic Field: 400 AT/m or less.

External Noise:

i) Allowable normal mode voltage (50/60 Hz)
DC V range.... Peak value including signal must be 1.2 × measuring range or less.
TC range ..... Peak value including signal must be 1.4 × thermoelectric emf corresponding to range or less.
RTD range .... 50 mV or less.

ii) Allowable common mode voltage (50/60 Hz)
100V or less on each range.

Warmup Time: At least 30 minute after the power is turned ON.

Memory Backup Power Source: Three 1.5V batteries (JIS SUM-3, ANSI AA).

Effect of Operating Conditions

Power Supply:

- ○ Effect of 10% variation in rated power supply voltage.
  Digital display ..... ± (0.1% of rdg + 1 digit)
  Recording ..... ±0.2% of span
- ○ Effect of 2 Hz variation in rated frequency.
  Digital display ..... ± (0.1% of rdg + 1 digit)
  Recording ..... ±0.1% of span

Ambient Temperature: Effect of 10°C variation in ambient temperature.
Digital display ..... ± (0.1% of rdg + 1 digit)
Recording ..... ±0.3% of span
Within the ambient temperature variation range is 5 to 40°C, the reference junction compensation error changes as follows
TC R, S, B or W ..... ±1°C.
K, E, J, T or N ..... ±0.5°C.
(however, reference junction compensation error of thermocouple input is not included).

External Magnetic Field: Effect of AC or DC 400 AT/m field
Digital display ..... ± (0.1% of rdg + 10 digits)
Recording ..... ±0.5% of span

Input Signal Source Resistance: Effect of signal source resistance 1 k

i) DC V range
20, 200 mV and 2V ranges ..... ±10 μV
6, 20 and 50V ranges −0.1% or less (change in span)

ii) TC range..... ±10 μV
however, approx. ±100 μV for models with optional TC burnout protection (/BU, /BD).

iii) RTD
Effect of 10Ω variation per wire
Digital display ..... ± (0.1% of rdg + 1 digit)
Recording ..... ±0.1% of span
(resistance values of three wires must be equal)

External Noise: For external noise of power supply frequency (50 or 60 ± 0.1 Hz as shown in the Normal Operating Conditions above);

- ○ Normal mode noise rejection ratio 40 dB or better
- ○ Common mode noise rejection ratio 120 dB or better

Operating Position: Effect of the recorder operating position (0 to 30° backwards inclination).
Digital display ..... ± (0.1% of rdg + 1 digit)
Recording ..... ±0.1% of span

Vibration: Effect when rectilinear motion of frequency 10 to 6 Hz and acceleration 0.02G is applied to the instrument in the direction of three axes.
Digital display ..... ± (0.1% of rdg + 1 digit)
Recording ..... ±0.1% of span

Alarms

Setting: Via keyboard.
Number of Set Points: Up to four set points/input channel (any H, L values).
Alarm Output: Four common outputs (relay output is optional feature).
Alarm Display: LCD (bar graph and "ALM").
Hysteresis: Approx. 0.5% of span (recording).

Standard Functions

Table 2-3.

Standard function	Description
Full-scale range setting	Programmable via keyboard for each channel.
Skip	Printout skips the programmed point (s)
Program listing printout	Contents of entire program memory (range, Tag No., engineering unit, alarm (output relay is optional feature), sensor combined, date and time and chart speed) are listed on the chart.
Digital printout	Date and time, Tag No., engineering unit, scale markings (0 and 100% sides) and chart speed are printed out on the chart at regular intervals.*-1
Display	Digital display: Date and time, Tag No., or each channel measured data is displayed. When setting range or other item, setting value is displayed. Bar graph display: Measured data, or alarm setting point is displayed. Flashes when alarm occurs.
Difference recording	On the same measuring range, difference between the reference and any other point can be recorded.*-2 (The reference channel may be selected arbitrarily).
Scaling (Linear & square root)	Scaling for DC V ranges of 5 mV span to 50V (−19999 to 20000, span up to 30000).*-3
Battery back up of memory	Three 1.5V batteries maintain setting data, date and time, when power is removed (battery life — approx. three months)

*-1 Refer to the ASCII code Table (see pages 5-34 and 5-47) for the characters that can be used for TAG NO. and engineering unit.
*-2 Reference channel No. must be smaller than measurement channel No. (see page 5-38).
*-3 Voltage span at scaling is less than 75% of measurement range (see page 5-28 or page 5-32).

Optional Features

The instrument can be provided with the following features listed in Table 2-4. Details of these optional features are described below.

Table 2-4.

Name		Optional code
Thermocouple burn-out protection	Up scale action	/BU
	Down scale action	/BD
Remote controls		/REM
Alarm output relay unit		/AK-04
Pen offset compensation		/PS
Portable type		/PBL

i) Thermocouple burnout detection (/BU/BD).
Indication scales out to 100% or 0% side on TC input burnout.
- ○ Burnout upscale action (/BU) common to all points.
- ○ Burnout downscale action (/BD) common to all points.

ii) Remote controls (/REM).
Recording start/stop (chart drive START/STOP) and chart feed speed changing.
- ① Recording can be started or stopped by external contact signal.
The same function as the RCD ON/OFF key on the keyboard. However, the remote contact signal oversides the key.
- ② The chart feed speed is changed from the 1st set point (normal chart feed speed) to the 2nd set point (chart feed speed in remote control mode) by an external contact signal. (See paragraph 2-5-3 Example of printout in REM mode.)

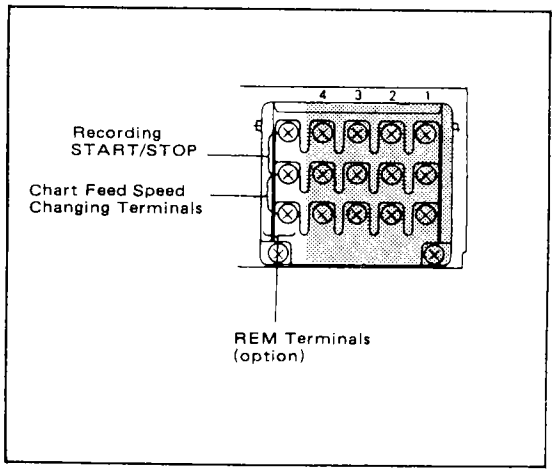


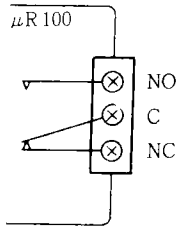
Figure 2-2.

iii) Alarm common outputs (relay) (/AK-04).
(installed in the recorder if ordered)
Number of Output Points: 4.
Relay Contact Rating: 100V AC, 01A or less or 24V DC, 1A or less (resistive load).
Terminal layout of the /AK-04 is shown in Figure 2-3.
NO, NC, C in the figure mean
- ○ Normally open
- ○ Normally closed
- ○ Common respectively.

Relay contact conditions depend on the instrument (μR100) conditions as follows:

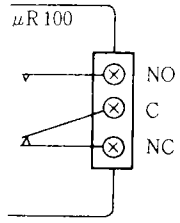
○ Excitation Alarm

1 Power "OFF" state

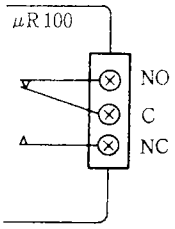


2 Power "ON" state

(a) No alarm (ALM) state



(b) Alarm (ALM) state



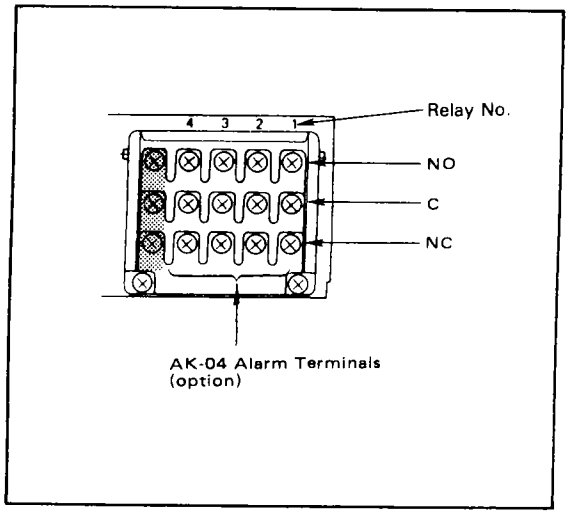


Figure 2-3.

The relay (/AK-04) operates when the measured value reaches the instruments alarm set point.
The operation of the 3-pen model is explained as an example below.
Assume that alarm points are set as follows:

Alarm output No. / CH.NO.	1	2	3	4
CH. 1	LL_1	L_1	H_1	HH_1
CH. 2	LL_2	L_2	H_2	HH_2
CH. 3	LL_3	L_3	H_3	HH_3

(LL: Low-Low limit, L: Low limit, H: High limit, HH: High-High limit).

In this case, with the alarm output No. 1, if one or more of alarms LL_1, LL_2 and LL_3 set for CH.1, CH.2 and CH.3 respectively occur, the relay operates as shown in 2 -(b) above.
That is the alarm output No. set on the μR100 is the same as the relay number, with the /AK-04 relay.
If the measured value goes outside any of the alarm set points, the corresponding relay operates.

iv) Pen offset compensation (/PS).
Pen offset compensation removes the time axis offset between pens.
(Pen offset compensation error ..... 1 mm max)
Let us take a 2-pen recorder (4152) as an example (3-pen recorder is similar).
Figure 2-4 shows a side view of the recording status.

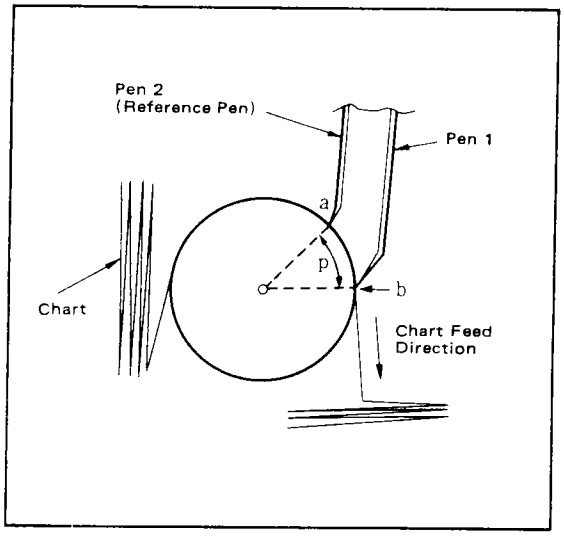


Figure 2-4.

Figure 2-4 shows that, in any pen recorder (to prevent collision between pens), the pens (1 and 2) must be offset by a distance p on the chart and, therefore, points recorded at the same time are separated on the chart time axis.
(Time offset $\Delta = P/V$
Where V: chart-feed speed)
Therefore, a delay memory is used to store measurement data compensate for pen offset.
After the chart has been fed by the time offset p, the pens record the stored (delayed) data.

Note: 1
The reference pen is:
Pen 2 for 4152
Pen 3 for 4153
The pen offset compensation switch is factory set to ON.

Note: 2
Pens other than the reference pen do not perform recording until the time corresponding to the phase difference elapses and, therefore, the pens may seem not to move accurately.
Measured values are still stored by the memory, so the recording pens do not move until the time corresponding to the time offset elapses.
Immediately after turning on power (POWER ON) only the reference pen operates normally.
The other pens do not work until the time corresponding to the time offset has elapsed, but this does not mean failure.

Note: 3
The pen offset compensation function is available only with 2- or 3-pen recorders.
When supplied, the pen offset compensation can be switched ON and OFF. The switch is located on the left side DIP switch (Figure 2-5).
The sitch cannot be changed with the POWER ON.

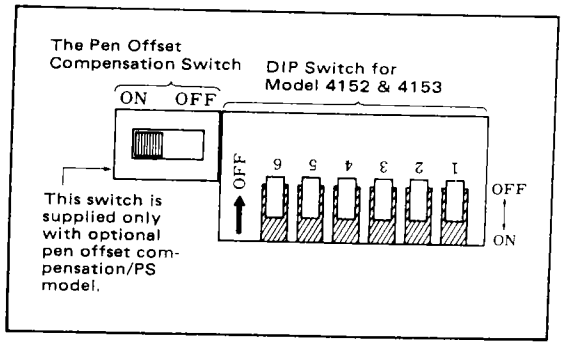


Figure 2-5.

2-4. Models and Suffix Codes.

Model Number	Suffix code	Description
4151	.....	1-pen continuous writing model
4152	.....	2-pen continuous writing model
4153	.....	3-pen continuous writing model
1st pen input for 1-, 2-, or 3-pen model	1	DC V & TC (ANSI, JIS), °C
	2	RTD (JPt 100), °C
	3	DC V & TC (ANSI, JIS), °C
	4	RTD (Pt 100), °C
	5	DC V & TC (ANSI), °F
	6	RTD (Pt 100), °F
	7	DC V & TC (DIN), °C
	8	RTD (Pt 100), °C
2nd pen input for 2- or 3-pen model	0	Specify "0" for 1-pen model
	1	DC V & TC (ANSI, JIS), °C
	2	RTD (JPt 100), °C
	3	DC V & TC (ANSI, JIS), °C
	4	RTD (Pt 100), °C
	5	DC V & TC (ANSI), °F
	6	RTD (Pt 100), °F
	7	DC V & TC (DIN), °C
	8	RTD (Pt 100), °C
3rd pen input for 3-pen model	0	Specify "0" for 1- or 2-pen model
	1	DC V & TC (ANSI, JIS), °C
	2	RTD (JPt 100), °C
	3	DC V & TC (ANSI, JIS), °C
	4	RTD (Pt 100), °C
	5	DC V & TC (ANSI), °F
	6	RTD (Pt 100), °F
	7	DC V & TC (DIN), °C
	8	RTD (Pt 100), °C
Power supply voltage	-1	100 V AC
	-3	115 V AC
	-5	200 V AC
	-7	230 V AC
Frequency	1	50 Hz
	2	60 Hz

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

Note: Input types are limited within the following combination of Suffix Codes:
Possible combination of suffix codes

1	3	5	7
2	4	6	8

Ordering Instructions

When ordering the recorder, specify the following items
(1) Models and suffix codes
(2) Optional features

2-5. Recording & Printout Examples.

2-5-1. Digital (Periodical) Printout.

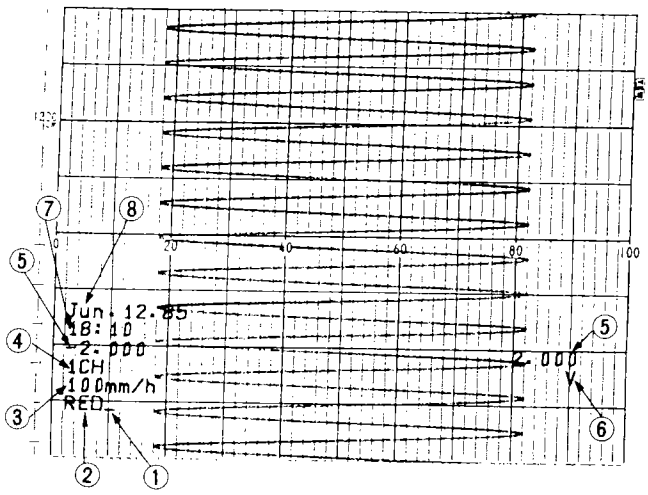


Figure 2-6.

Refer to Table 5-2 in "5-4-5 Chart Feed Speed Setting" for the digital printout interval.

Figure 2-6 shows a recording exaple for the 1-pen model. The digital printout is carried out (using the purple plotter pen). The printout items are as follows:

① Time tick
② Recording color (pen color)
③ Chart feed speed
④ Tag (TAG No.)
When tag is not specified, X CH is printed out (X: any of 1, 2 or 3)
⑤ Scale markings (prints out at 0 and 100% of chart)
⑥ Engineering unit (mV, V, °C (°F) and arbitrary unit set by ASCII codes)
⑦ Time
⑧ Date

2-5-2. Alarm Printout.

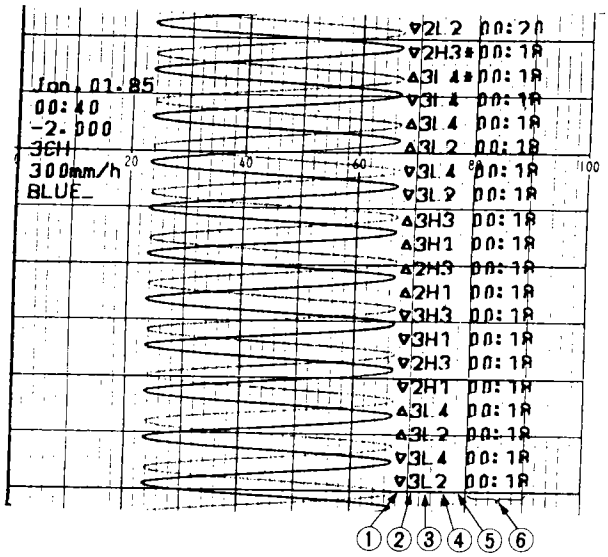


Figure 2-7.

(As the alarm printout is prior to the digital printout, the scale marking (digital printout) at 100% of chart is not printed out in the figure)

The figure shows an alarm printout example (printed using the purple plotter pen). The printout items are as follows:

Alarm ON: △ or OFF: ▽

② Channel No. (1 numeric digit)

③ Alarm mode (High: H, Low: L, ΔHigh: h, ΔLow: l)

④ Output No. (1 numeric digit)

⑤ * mark (printed out at alarm memory overflow) (See Note)

⑥ Time when alarm occurred or reverted to normal

Note) When * mark is printed out, some other alarms are not printed out. The alarm ON/OFF data are stored in a memory which can store up to 30 data, and the data are output sequentially as alarm printout. However, if alarm turns ON/OFF frequently as shown in the example, the alarm printout (output from memory) speed is slower than the alarm ON/OFF data generation speed, so memory overflow eventually occurs. The data generated on that time cannot be stored or printed out (data to printout in REM mode are included in the 30 data that can be stored).

2-5-3. Printout in REM (Remote) Mode.

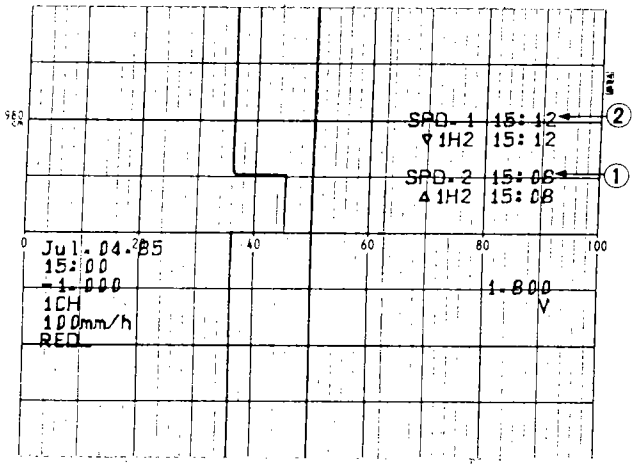


Figure 2-8.

It's possible to change between two chart feed speeds using a remote control (contact) signal; the times the remote control signal turns ON and OFF are printed out on the chart (using the purple plotter pen).

① Shows the time when the chart feed speed was changed to SPD2 (chart feed speed in remote control mode) by the remote control signal.

② Shows the time when the chart speed was reverted to SPD1 (normal chart speed) by the remote control signal turning OFF. (for the recording example, the remote control signal is generated by an alarm, so an alarm printout also occurs).

2-5-4. Program List Printout.

Prints out the settings for measurement and recording.

To print out a program listing, press the LIST key.

① Date (printout time)

Jul. 04. 85

② Time (printout time)

16:54

③ Chart feed speed for normal operation

CHART SP1 100mm/h

④ Chart feed speed for remote control mode.

CHART SP2 150mm/h

⑤ Channel No.

CH.NO
CH1 channel 1
CH2 channel 2
CH3 channel 3

⑥ Tag

Tag No. is required to be set by ASCII codes. If it is not set, the setting shown on the right is set as an initial status.

TAG.NO
1CH
2CH
3CH

⑦ Measuring range

Settings on the right show:

Channel 1: Absolute value measurement of −2 to 2V.

Channel 2: ΔV measurement with channel 1 as reference.

Channel 3: Absolute value measurement of −20 to 20mV.

RANGE
2V
H1=2V
20mV

⑧ Recording span:

Settings on the right shows:

Channel 1: Recording −1 to 1.5V range.

Channel 2: Recording −1 to 1V range.

Channel 3: Recording −10 to 6 mV.

ZERO FULL
1.500
-1.000
1.000
-10.00
6.00

⑨ Scaling

Settings on the right show that Scaling values are specified only for channel 3 as follows:

1000: (at 0% on the chart)

−200: (at 100% on the chart)

(Range code of channel 3 is "30").

SCALE
1000.0
-200.0

⑩ Engineering unit

As channels 1 and 2 do not carry out the scaling recording, the engineering unit: V of the measuring range (−2 to 2V) which has been set is printed out.

For channel 3, unit is set as "unit" by ASCII codes.

UNIT
V
V
unit

⑪ Alarm

The setting statuses shown in the below figure are as follows:

Channel 1: High alarm 1V: output relay No.1, and
Low alarm 0V: output relay No.2

Channel 2: High alarm for difference recording with channel 1 as reference
0.5V: output relay No.1
Low alarm for difference recording with channel 1 as reference
−1V: output relay No.2

Channel 3: High alarm 700 (scaling value): output relay No.3

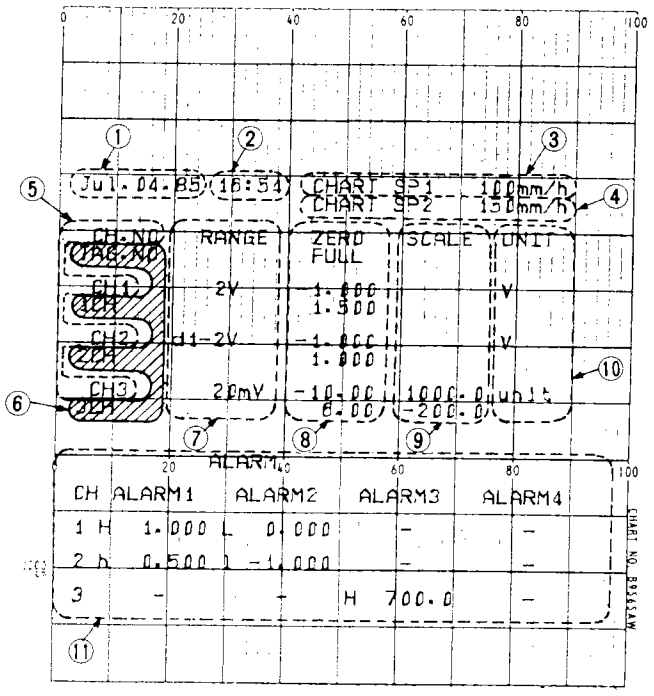


Figure 2-9.

2-6. Names of Components.

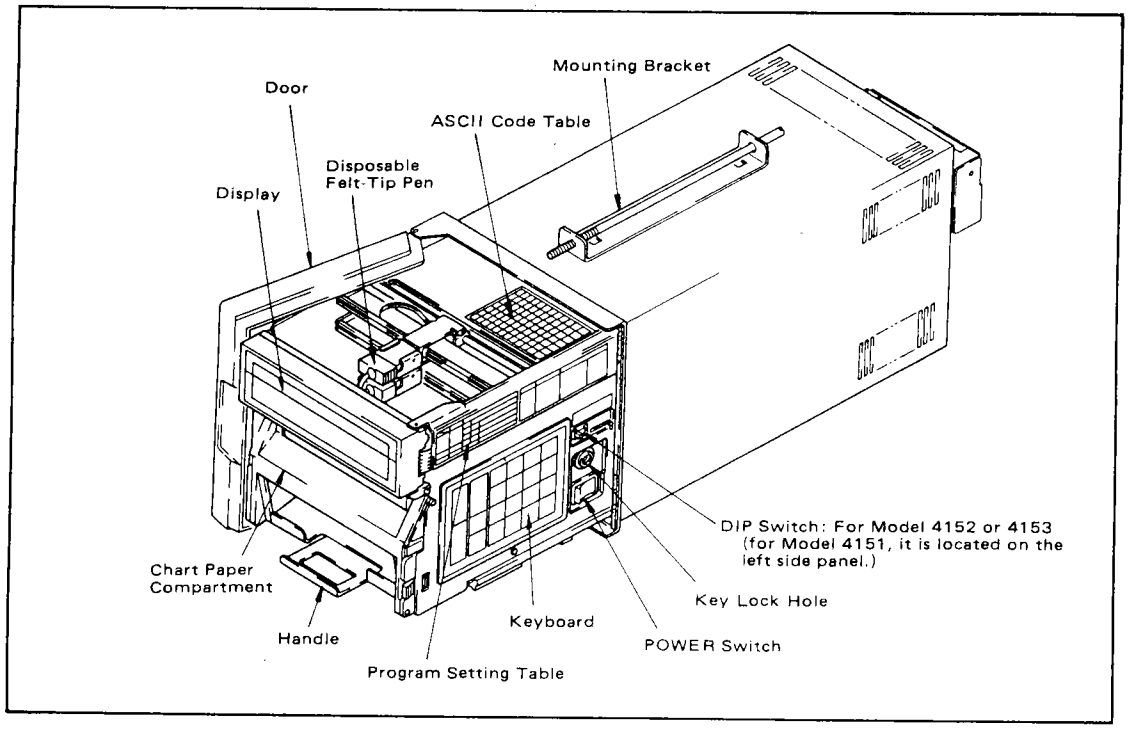


Figure 2-10. Names of Components.

3. INSTALLATION.

3-1. General.

The Model μR100 Recorder has been designed for flush panel mounting. In addition, a handle may be attached for portable use. If the handle is required, indicate so when ordering.

3-2. 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) is free from strong magnetic fields.
(6) has 40 to 85% relative humidity at all times.

3-3. External Dimensions and Panel Cutout.

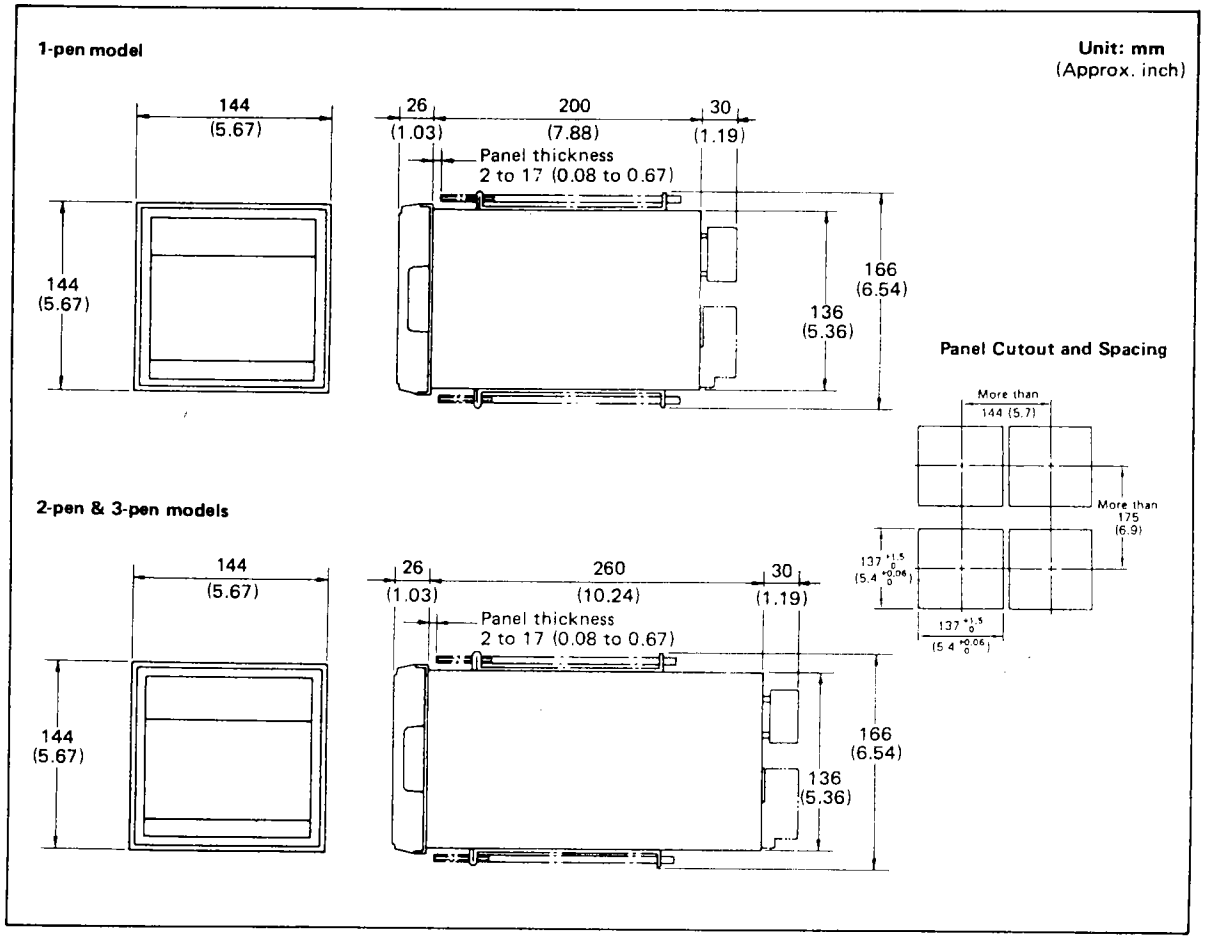


Figure 3-1. External and Panel Cutout Dimensions.

3-4. Mounting.

(1) The recorder should be mounted on a at least 2 mm thick steel panel.
(2) Insert the recorder into the panel cutout.
(3) Hold the bottom of the recorder and mouint it on the panel using the mounting bracket supplied with the recorder.

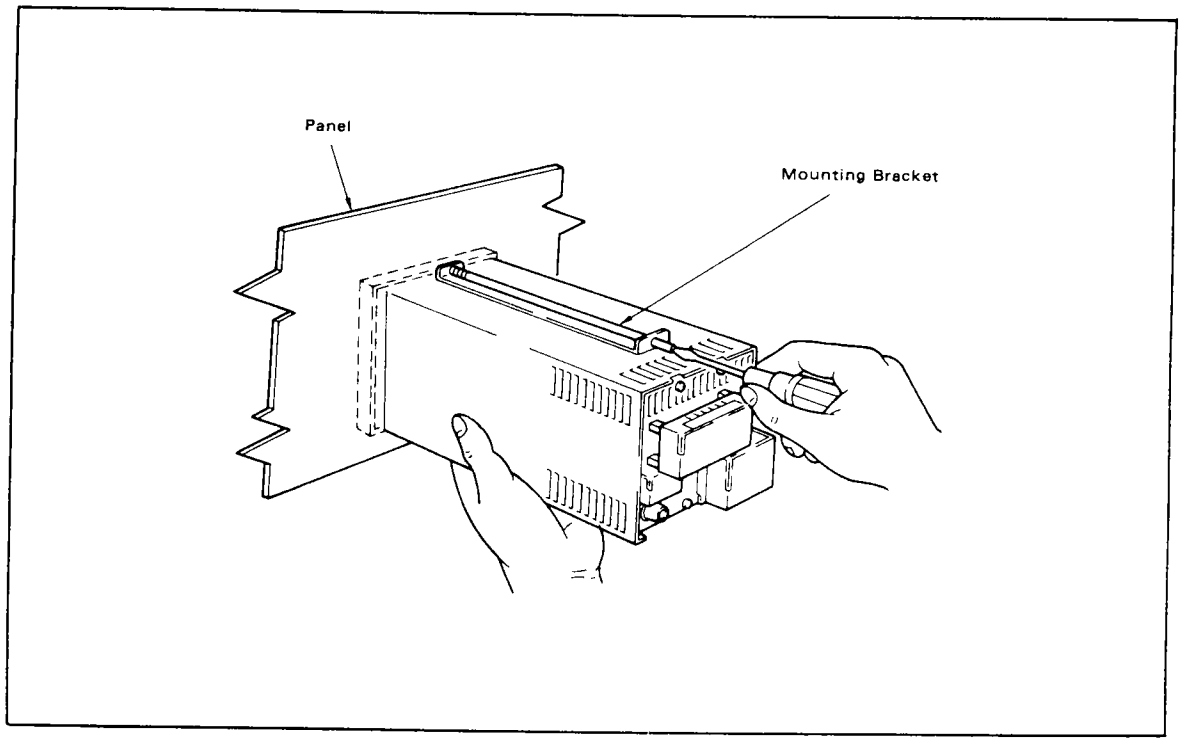


Figure 3-2. Mounting Recorder.

4. WIRING.

4-1. Wiring Instructions.

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

① Use 600V vinyl insulated wire (JIS C 3307) or equivalent or tough vinyl shocked cable.

② It is recommended that thermocouple wires be connected to the recorder terminals. However, where the distance between thermocouples and recorder is long, compensation lead wires can be used.*

* It is recommended that "crimp-on" lugs (for 4 mm screws) with insulation sleeves, be used for leadwire ends (see Figure 4-1).

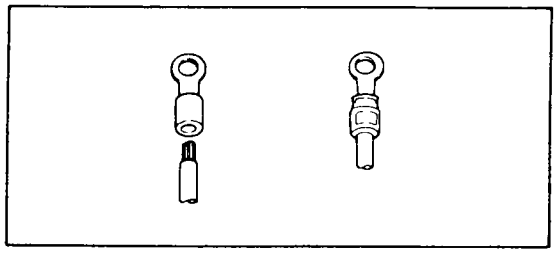


Figure 4-1. Solderless Lugs.

③ To minimize noise pickup:

(a) The measuring circuit wiring should be run as remote as possible from the power and ground lines.

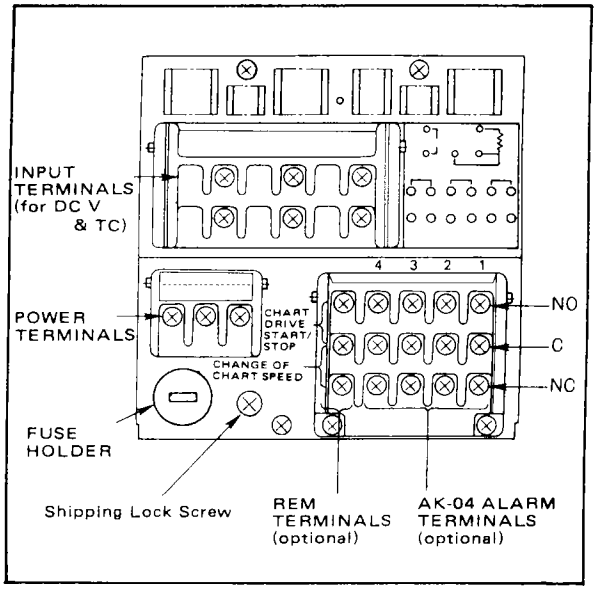
(b) It is recommended that shielded wires be used to minimize noise pickup from an electrostatic induction source. The shielding wire of the cable should be connected to the recorder ground terminal (only one ground line).

(c) To minimize noise from an electromagnetic induction source, twist measuring line cables in short and equal spaces.

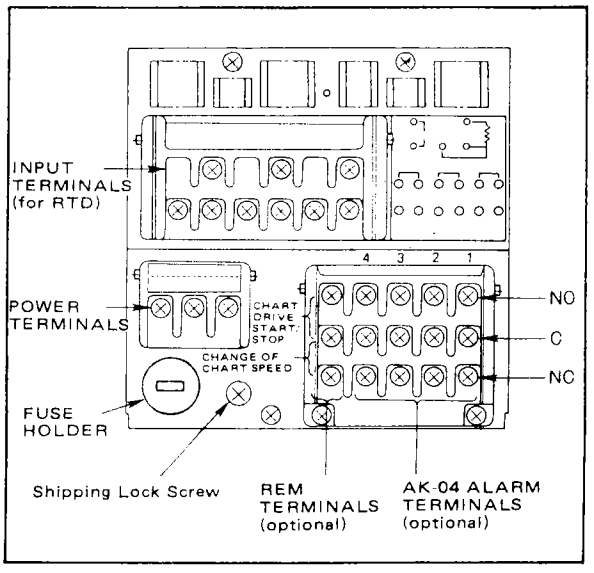
④ The ground terminal should be grounded with a low ground resistance.

4-2. Recorder Terminal Arrangement.

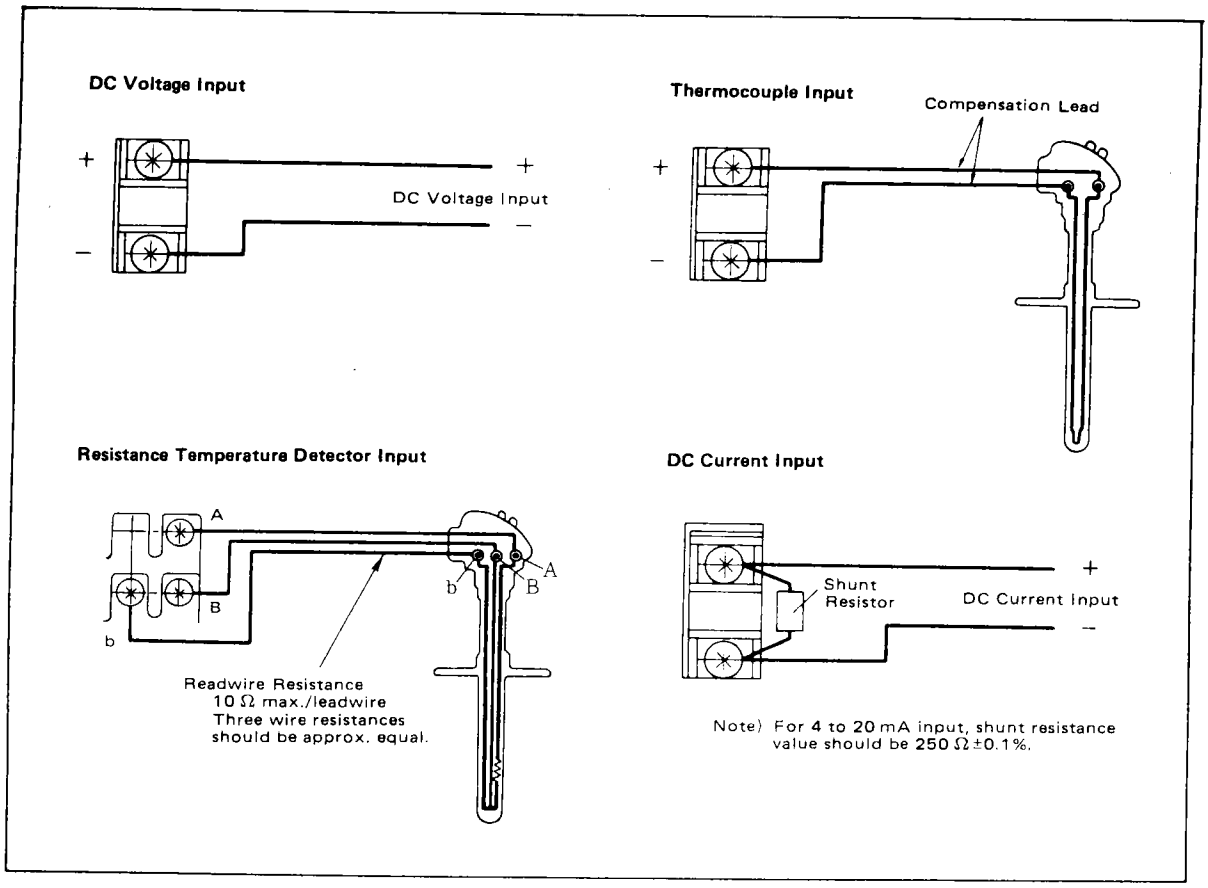
4-2-1. DC V and Thermocouple Input Models.



4-2-2. Resistance Temperature Detector Input Models.



4-3. Wiring Input Terminals.



5. OPERATION.

5-1. Preparation.

5-1-1. Loading Chart Paper (Replacing Paper).

(1) Fan chart paper thoroughly at both ends before loading. (See Figure 5-1.)
(Chart Part No.: B9565AW (contains three chart cartridges)).

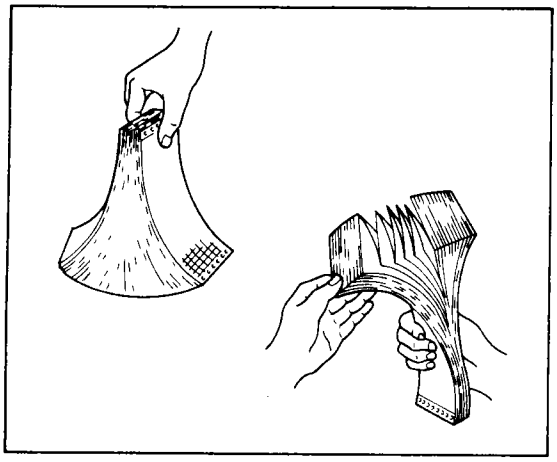


Figure 5-1.

(2) Open the unit front door by inserting fingertips into the recessed area on the right side near the front and pull outward. Grasp the internal unit handle located at the lower front of the unit and pull the internal assembly as far out as possible. (See Figure 5-2.)

CAUTION

When pulling the internal assembly out use the handle. Do not pull the internal assembly out using the display panel as a handle as the recorder may be damaged.

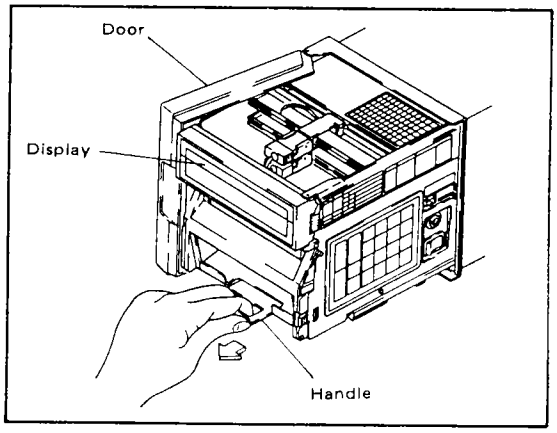


Figure 5-2.

(3) While gently pressing the chart paper compartment lock tab, located at the lower right front, in the direction of the arrow, swing and lift the compartment away from the unit. (See Figure 5-3.)

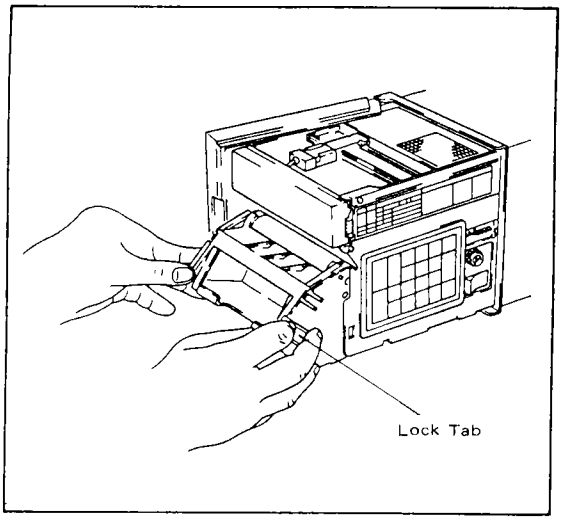


Figure 5-3.

(4) Press the sides of the chart guide plate at the top rear of the chart compartment and swing the guide plate up. (See Figure 5-4.)
(5) At the front, pull/swing the front transparent chart guide down. (See Figure 5-4.)

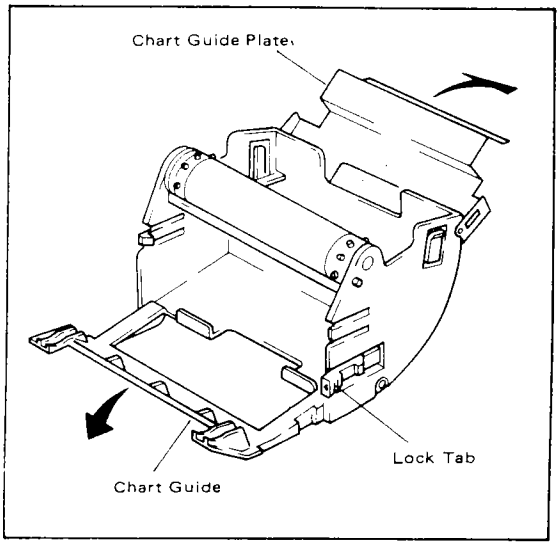


Figure 5-4.

(6) Load chart paper into the top hopper making sure that the sprocket teeth of the chart drive are properly engaged in the chart paper perforation holes. (Take care not to insert chart paper backwards.) (See Figure 5-5.)

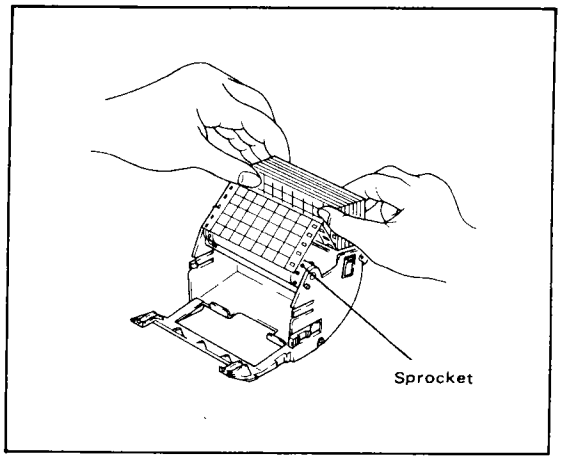


Figure 5-5.

(7) Place the rear chart guide plate back into position. Holding both right and left ends of the chart in your hands, use the middle finger of your right (left) hand, to press the rear chart guide plate down and towards you and load the chart.

(8) Place the front transparent chart guide back into position. (See Figure 5-6.)

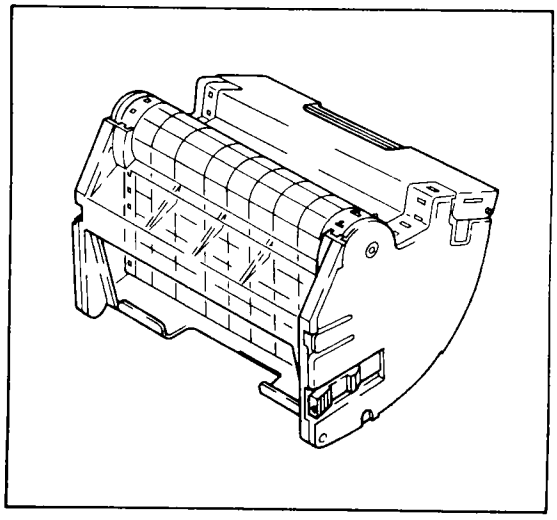


Figure 5-6.

(9) Replace the chart paper compartment back into the extended unit. Slide the protruding knurls of the chart paper compartment into the cutout grooves located on the support brackets. Push/swing the compartment into the extended unit until the lock tab clicks shut. (See Figure 5-7.)

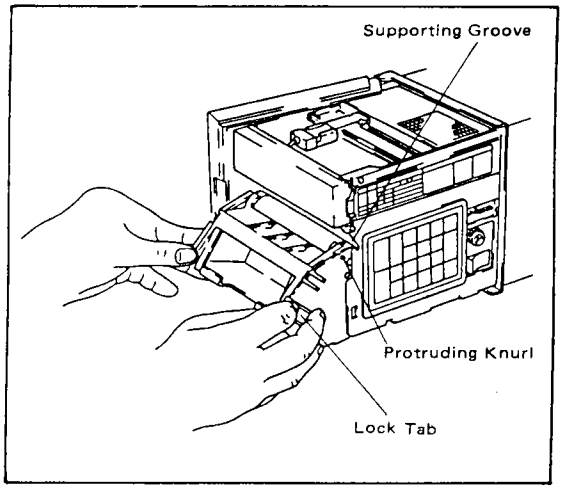


Figure 5-7.

(10) Press the Chart Feed key, and confirm that the chart is fed continuously*. (See Figure 5-8.)

* If the chart cannot be fed continuously, repeat the procedure from step (3).

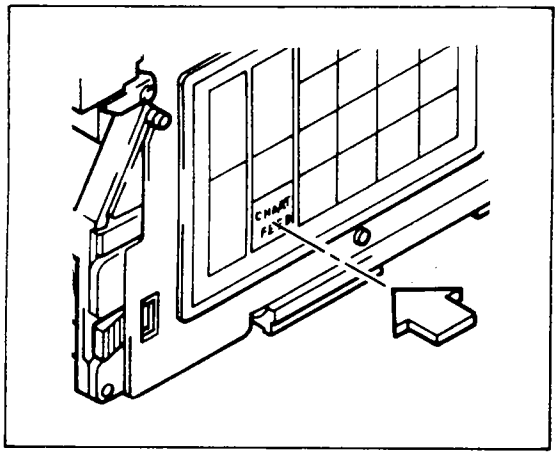


Figure 5-8.

5-1-2. Felt-Tip Pen Replacement.

(1) Open the unit front door by inserting fingertips into the recessed area on the right side near the front and pull outward. Grasp the internal unit handle located at the lower front of the unit and pull the internal assembly as far out as possible. (See Figure 5-9.)

CAUTION

When pulling the internal assembly out use the handle. Do not pull the internal assembly out using the display panel as a handle as the recorder may be damaged.

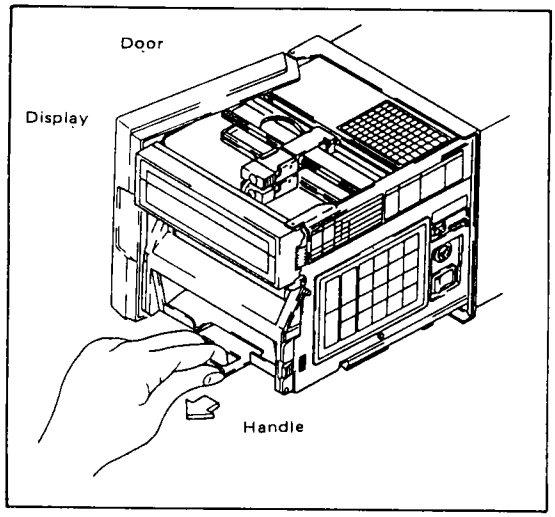


Figure 5-9.

(2) Switch power off by pressing the "POWER" switch to the "OFF" position. The power switch is located on the right side of the extended unit next to the key pad and just under the key lock. (See Figure 5-10.)

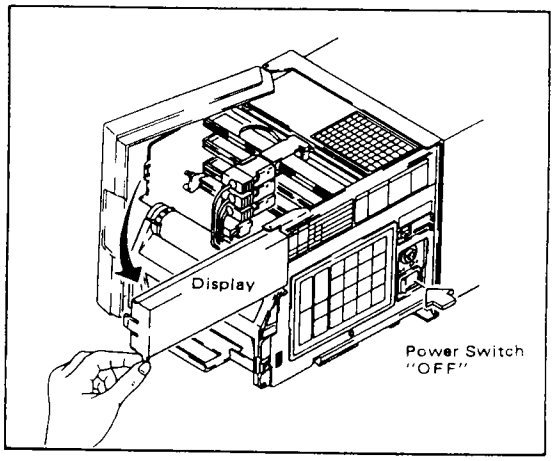


Figure 5-10.

(3) Swing open the display door by grasping the small tab located at the front lower left corner of the display cover and gently pull outward. (See Figure 5-10.)

(4) Grasp the protruding part of the felt-tip pen cartridge and gently pull/slide it out of the cartridge holder. (See Figure 5-11.)

(5) Insert a new felt-tip pen cartridge in the pen cartridge holder. (See Figure 5-11.)

1st pen – red (for 1-pen, 2-pen, and 3-pen types)

2nd pen – green (for 2-pen and 3-pen types)

3rd pen – blue (for 3-pen type only)

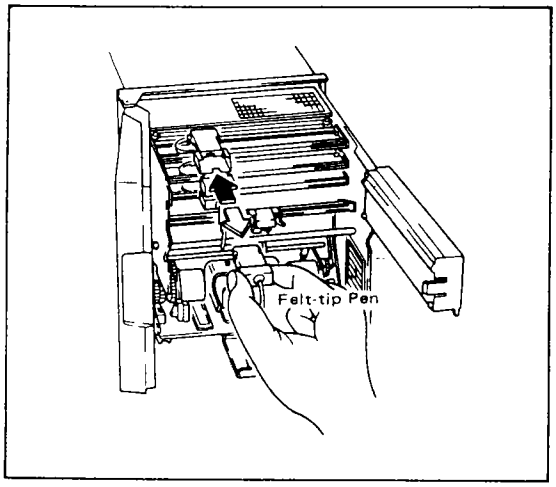


Figure 5-11.

Note 1: Remove the other pen cartridge if it disturb the replacement of objective pen.
Do not apply excessive force to the right and left direction of the cartridge holder. Mulfunction may occur in a writing function.

Note 2: Remove the pen cap before replacing the cartridge with a new one.

○ The part Nos. of the felt-tip pens are as follows:

- ○ 1st pen (red) ..... B9565AP (3 in one box)
- ○ 2nd pen (green) ..... B9565AQ (3 in one box)
- ○ 3rd pen (blue)..... B9565AR (3 in one box)

5-1-3. Digital Data Printout Plotter Replacement.

(1) Open the unit front door by inserting fingertips into the recessed area on the right side near the front and pull outward. Grasp the internal unit handle located at the lower front of the unit and pull the internal assembly as far out as possible. (See Figure 5-12.)

CAUTION

When pulling the internal assembly out use the handle. Do not pull the internal assembly out using the display panel as a handle as the recorder may be damaged.

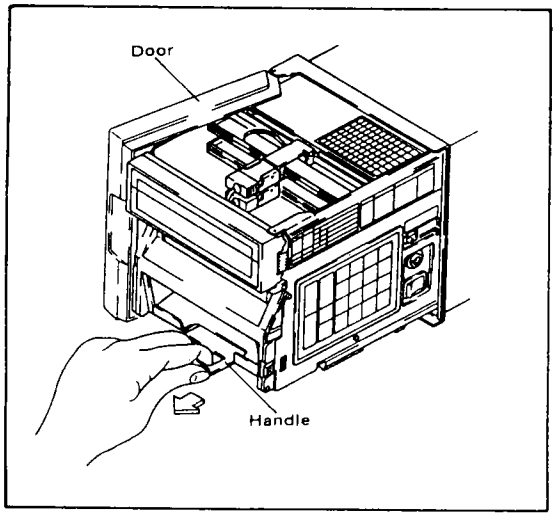


Figure 5-12.

(2) Switch power off by pressing the "POWER" switch to the "OFF" position. The power switch is located on the right side of the extended unit next to the key pad and just under the key lock. (See Figure 5-13.)

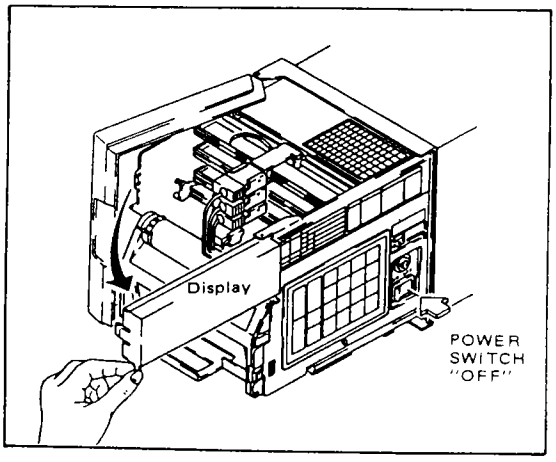


Figure 5-13.

(3) Swing open the display door by grasping the small tab located at the front lower left corner of the display cover and gently pull outward. (See Figure 5-13.)

(4) While grasping the plotter holder, gently slide the plotter out of the holder. (See Figure 5-14.)

(5) Insert a new plotter in the holder. (See Figure 5-14.)

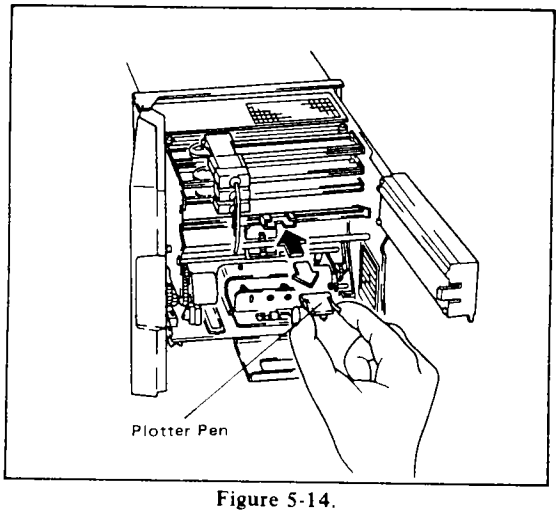


Figure 5-14.

Notes: 1. Remove the other pen cartridge if it disturb the replacement of plotter pen.
2. Do not apply excessive force to the right and left direction of the cartridge holder. Mulfunction may occur in a writing function.

○ The part No. of the plotter pen (purple color) is B9565AS (3 in one box).

5-1-4. Battery Replacement.

Replace the batteries with new ones if "BAT" (low battery) is displayed.

If the "POWER" is switched to "OFF" while "BAT" is displayed, the stored program may be erased.

The batteries (Three commercially available 1.5V batteries.) are shipped with the instrument; install them in the instrument as follows:

(1) Open the unit front door by inserting fingertips into the recessed area on the right side near the front and pull outward. Grasp the internal unit handle located at the lower front of the unit and pull the internal assembly as far out as possible. (See Figure 5-15.)

CAUTION

When pulling the internal assembly out use the handle. Do not pull the internal assembly out using the display panel as a handle as the recorder may be damaged.

(2) Switch power on by pressing the "POWER" switch to the "ON" position. Note that the stored program may be erased if the battery is replaced with the "POWER" switch set to OFF. The power switch is located on the right side of the extended unit next to the key pad and just under the key lock. (See Figure 5-15.)

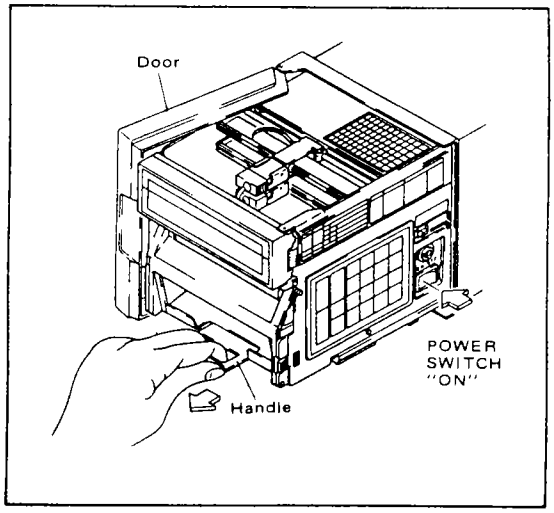


Figure 5-15.

(3) While gently pressing the chart paper compartment lock tab, located at the lower right front, in the direction of the arrow, swing and lift the compartment away from the unit. (See Figure 5-16.)

(4) Remove the battery cartridge by pressing the lock tab down and pulling the cartridge out of the internal assembly by the handle. The battery cartridge holder lock tab is located just under the middle battery under the cartridge handle. (See Figure 5-17.)

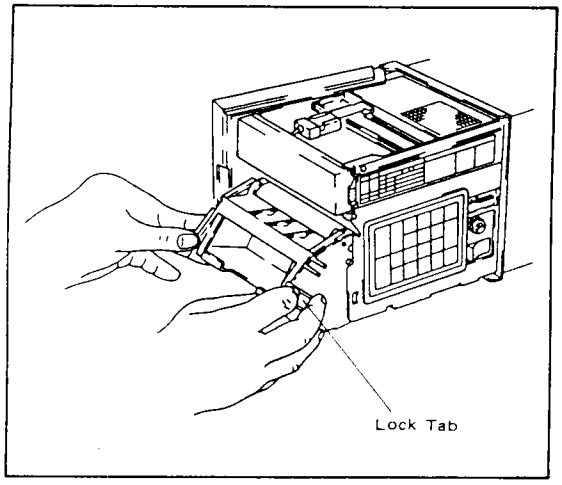


Figure 5-16.

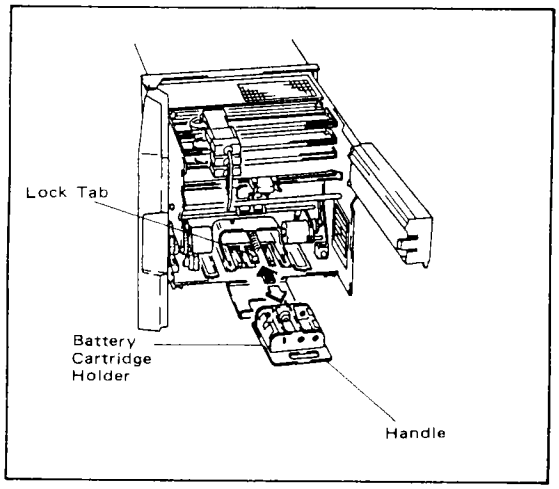


Figure 5-17.

(5) Remove the old batteries from the holder. (See Figure 5-18.)

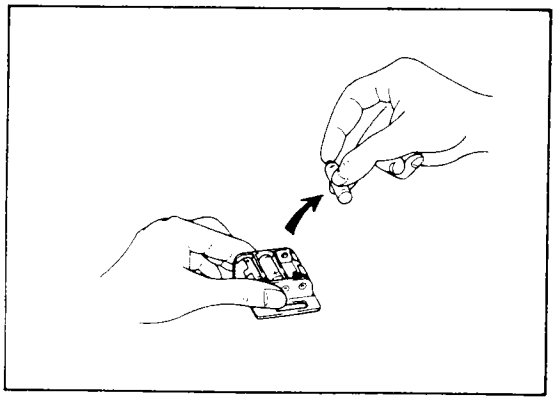


Figure 5-18.

(6) Insert new batteries. Be sure to insert the new batteries with the polarity (+ and −) the same as indicated inside the cartridge case. (See Figure 5-19.)

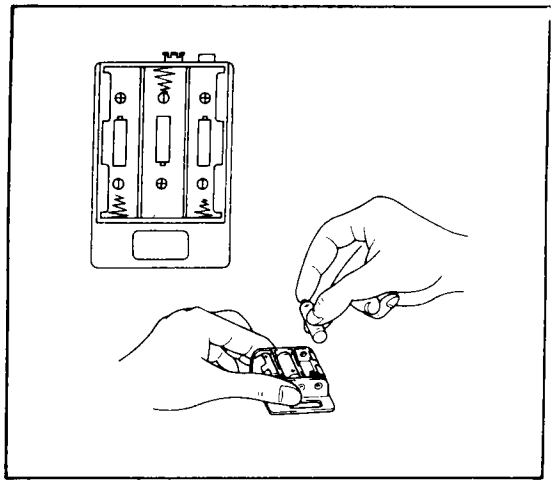


Figure 5-19.

(7) Insert the battery cartridge back into the unit confirming that the lock tab is in the locked position. (See Figure 5-20.) Confirm that "BAT" display does not light.

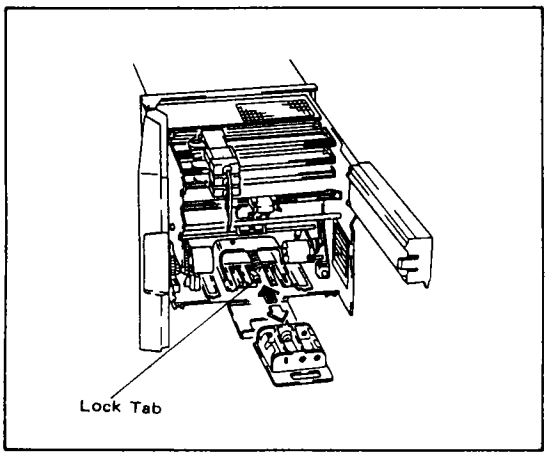


Figure 5-20.

(8) Replace the chart paper compartment back into the extended unit. Slide the protruding knurls of the chart paper compartment into the cutout grooves located on the support brackets. Push/swing the compartment into the extended unit until the lock tab clicks locked. (See Figure 5-21.)

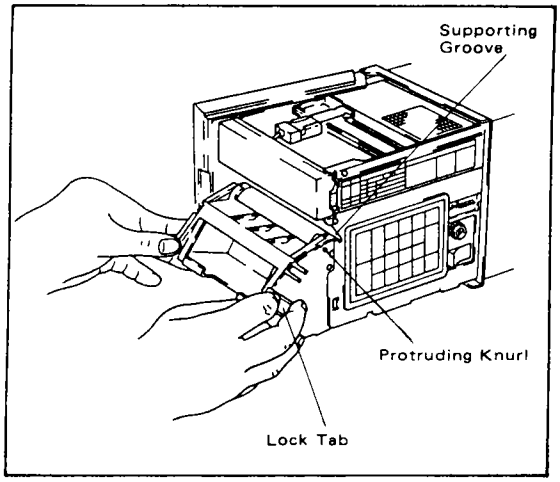
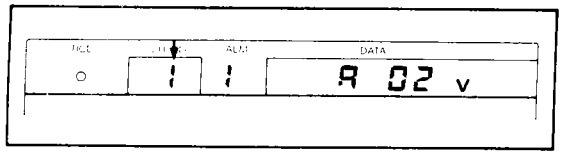


Figure 5-21.

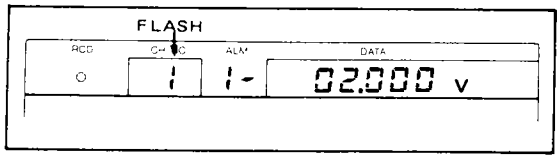
5-2. Status Settings with Power Switch "ON".

5-2-1. Initial Setting Status*.
(When the Recorder is not Backed up by Batteries.)

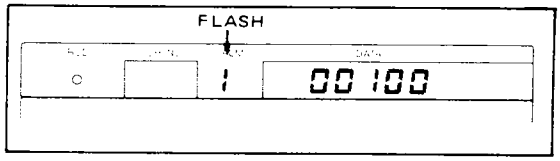
(1) RNG (range): ±2V
(for RTD input ... −200 to 550°C (or −328 to 1,022°F))



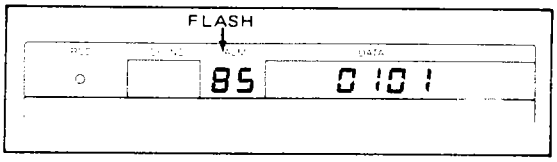
(2) ALM (alarm): All points "OFF"



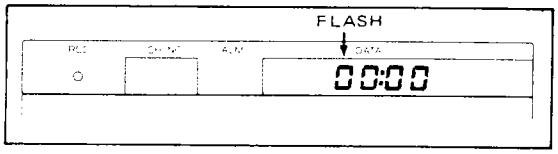
(3) mm/h (chart feed speed): 100 mm/h



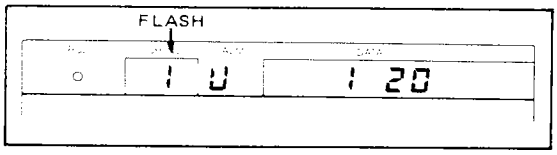
(4) DATE (date): 85.01.01



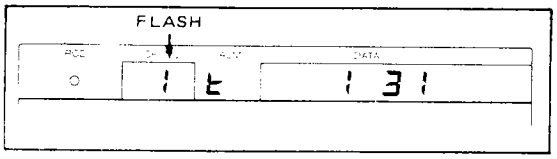
(5) CLK (time): 00:00
(When power is turned on, time is displayed first of all.)



(6) UNIT (unit): ------ (to be set by ASCII codes) (six spaces)



(7) TAG (tag number): 1CH ----
(1CH and four spaces)
(to be set by ASCII codes)



* These initial settings shown above were carried out at the factory before shipment.
After the instrument has been set according to the procedures described in "Section 5-4 Setting", the setting status will be held even when the power supply is turned off temporarily and then restored.
However, if the instrument is not backed up by batteries, the setting status will be erased and will revert to initial setting status when power is switched off.

5-2-2. Operating Statuses with Power Switch "ON". (When the Recorder is Backed up by Batteries.)

The recorder operating status depends on the status when the power switch was switched "OFF" last. See the following tables.

	When the POWER Switch is Switched to "OFF"	Operating Status at POWER "ON"
1	Either of the display statuses, (a) data measured value display (AUTO/MAN DATA) or (b) data and time display (selected by display key).	If either of the display statuses listed at the left existed, when the power switch was switched "OFF" it is restored at power ON.
2	Setting status (see page 5-11 and on).	Initiates the measured value display, measured values of each channel are displayed sequentially at three second intervals. (AUTO DATA)

5-3. Keyboard.

This section describes functions of keys which are used to set parameters.

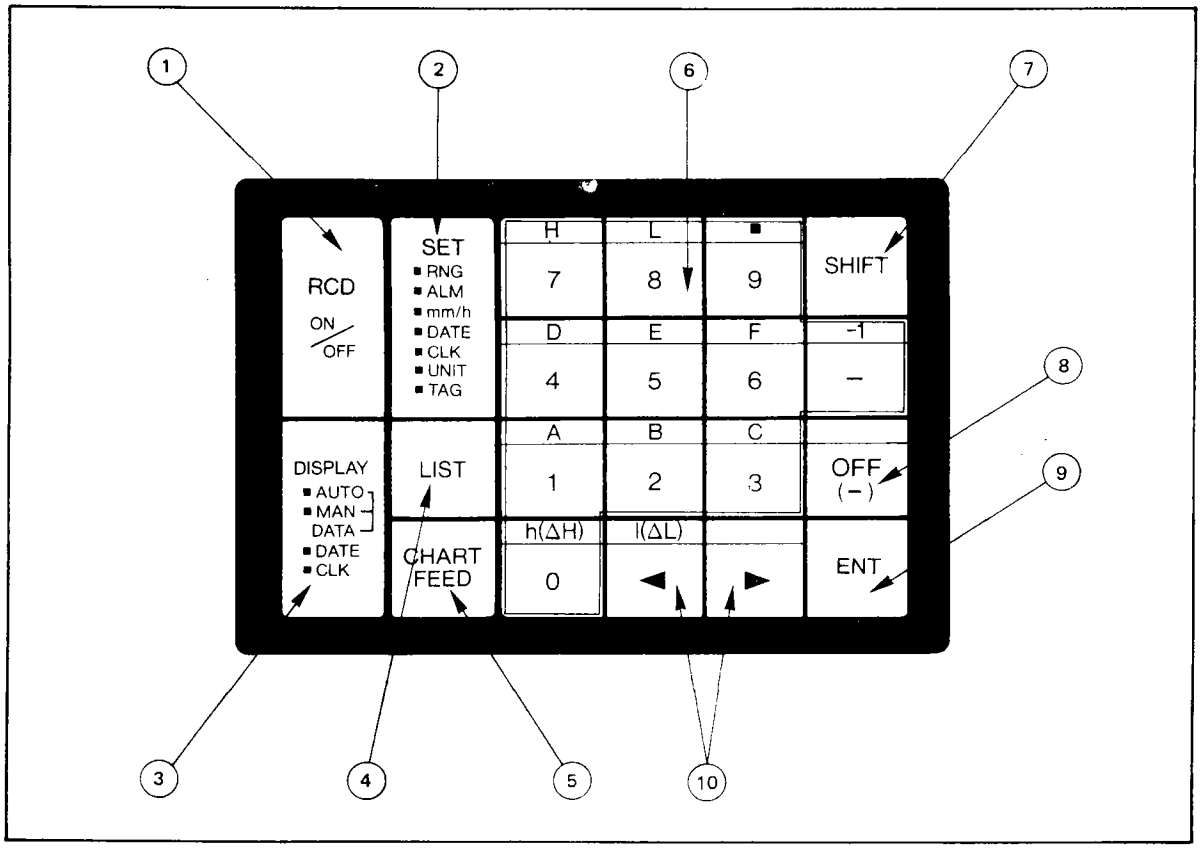
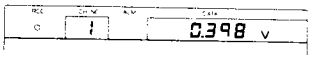
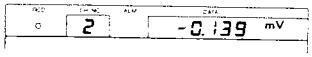
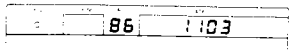


Figure 5-22. Keyboard.

Keyboard description.

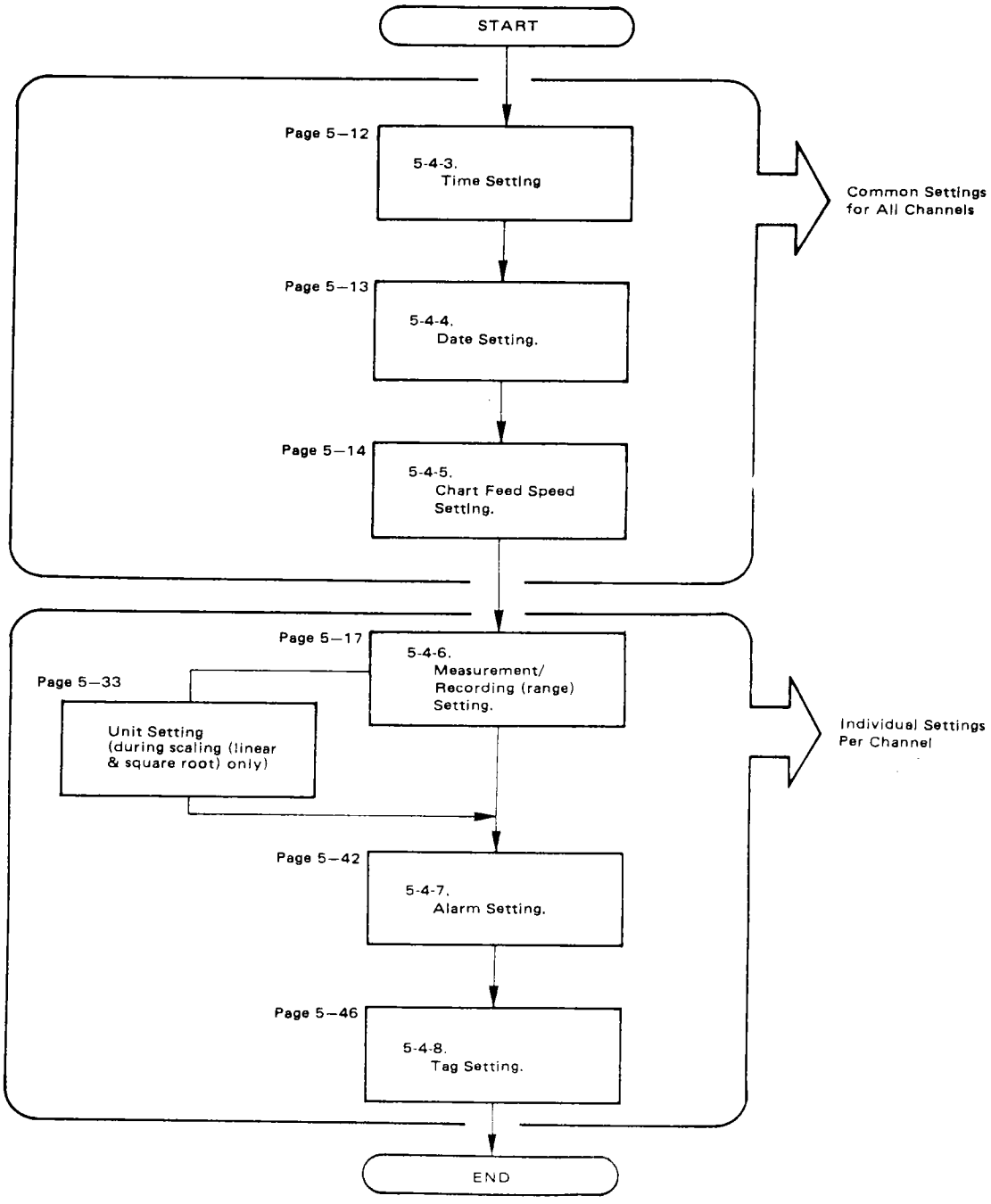
	Key	Description
1	RCD ON/OFF Recorder ("RCD") "ON"/ "OFF" key	This key turns the recorder mechanism "ON"/"OFF". Pressing this key once while recording data will stop the recorder.
2	SET RNG ALM mm/h DATE CLK UNIT TAG Set ("SET") key	This key selects and displays modes for which parameters are to be set. The modes are as follows: RNG: Range setting ALM: Alarm setting mm/h: Chart feed speed setting DATE: Date setting (YYMMDD) CLK: Time setting (HHMM) UNIT: Unit setting (possible only when scaling to be set by ASCII codes) TAG: Tag setting Every time the SET key is pressed, the read-out screen will display the next mode. Make sure that the desired mode is the one displayed before setting parameters.
3	DISPLAY AUTO MAN DATA DATE CLK "DISPLAY" mode select key	This key selects display mode. Modes are "DATE", "CLK" (clock), "AUTO DATA" or "MAN DATA". "AUTO DATA" Displays collected data one channel after another, at 3 second intervals.  "MAN DATA" Displays measurement for a particular channel.  Pressing the ► key calls the next channel, in ascending order, for data display. Pressing the ◄ key calls the next channel, in descending order, for data display. "DATE" Displays date  "CLK" (Clock) Displays hour/minute 

4	LIST "LIST" key	Lists channel parameters such as range, tag, unit, alarm (with its output relay as an option), date, and chart feed speed. (See 2-5-4 List Printout) (press again to stop list printout)
5	CHART FEED "CHART FEED" key	Feeds chart paper until the key is released.
6	H L ° 7 8 9 D E F -1 4 5 6 — A B C 1 2 3 MAN 0 Alphanumeric keys	These keys are used to enter measurement and recording values for each channel and also input date and time settings. To set a decimal point (.), press the SHIFT key then the 9 key. This is effective under the setting of scaling (low value). When a minus sign (−) is required, use the −1 key. If the SHIFT key is pressed and then the −1 key, the number -1 can be set with the minus sign (−) being displayed. (Effective only during the setting of scaling values.) (-1 : −1)
7	SHIFT "SHIFT" key	Sets alphabetic characters (above numerals) using the alphanumeric key pad. To set "A", for example, press SHIFT and then the A 1 key. SHIFT key is effective only for the key to be used successively).
8	◄ ► Cursor move keys	(1) These keys are used to move the cursor (flashing position) to the appropriate position when changing setting values, etc. ► : Move cursor to the right ◄ : Move cursor to the left (2) Access particular measurement data for a channel in "MAN DATA" mode. (3) These keys are used for chart speed setting.
9	ENT Enter ("ENT") key	Sets entered data Setting is effective when the key is pressed.
10	OFF (−) Skip ("-") key	(1) This key is used when no measurement is set for a particular channel. (SKIP) (2) Used for erasing the alarm points.

5-4. Setting.

This section describes how to set specifications for the μR100 recorder. To set specifications, follow the flowchart below. Each step indicates the related page number where a detailed explanation for that step may be found.

5-4-1. Setting Procedure Flowchart.

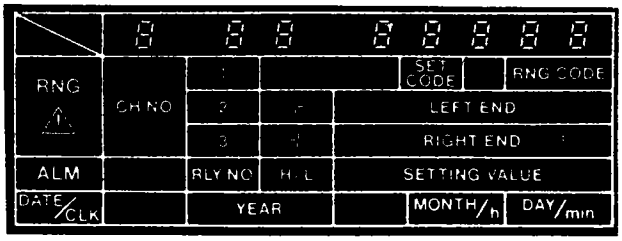


5-4-2. Setting Data Display Positions.

The following table lists the display positions for setting data. In actual setting operations, use this table to confirm correct data setting positions.*

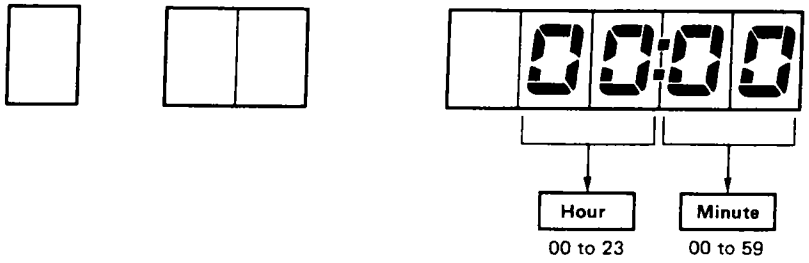
Display / Setting Item	8	88	88888			
Time Setting					Hour	Minute
Date Setting		Year			Month	Day
Chart Feed Speed setting		Normal or Alarm		Chart Feed Speed (mm/h)		
Range Code Setting	CH No.	Panel No.			SET CODE	RANGE CODE or Reference Channel No. (case d)
Range Setting	CH No.	Panel No.	SPAN	RANGE Setting Value (The first digit position may be filled by a minus sign "–")		
ALARM Setting	CH No.	ALARM Setting No.	ALARM Condition	ALARM Value		
Unit Setting	CH No.	U			Character No.	ASCII CODE
TAG Setting	CH No.	t			Character No.	ASCII CODE

* Program setting table is also attached to the instrument. Use it together with this table.



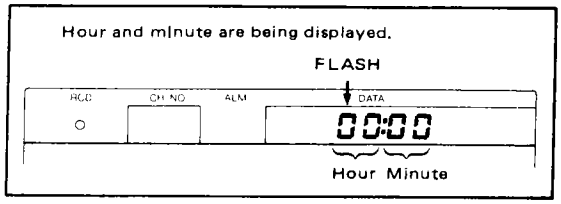
5-4-3. Time Setting.

Time Setting Table

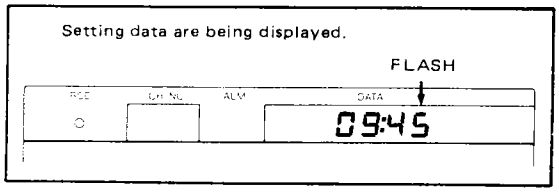


Time setting procedure:

1 Press the SET key as many times as required until the time panel is displayed.

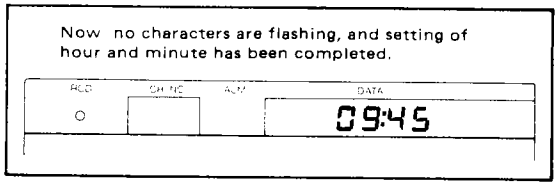


2 Set hour (HH) and minute (MM).
Example: To set time 9:45, press the numeric keys 0, 9, 4, 5.*



3 Press the ENT key to store the time. (and start the clock)

Setting completed



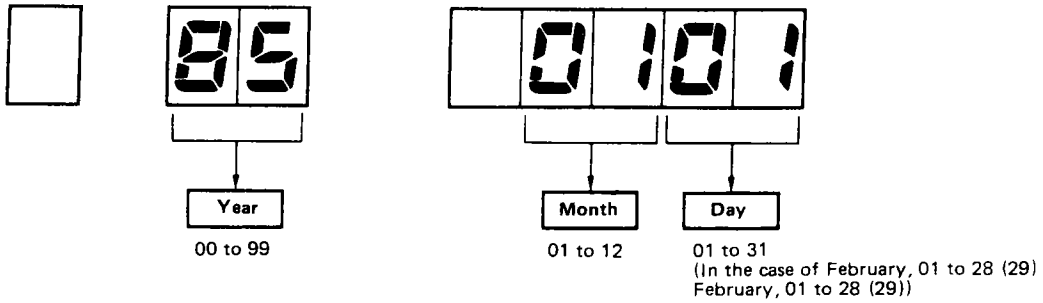
* Store the time as follows:
AM 9:45 → 09:45
PM 9:45 → 21:45

If data entry is invalid, refer to paragraph 5-4-9.

5-4-4. Date Setting.

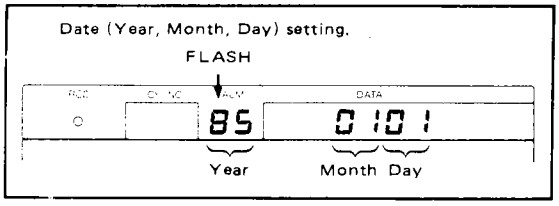
For leap year, 29 (February) is automatically provided.

Data Setting Table

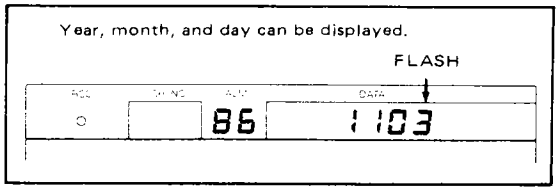


Date setting procedure:

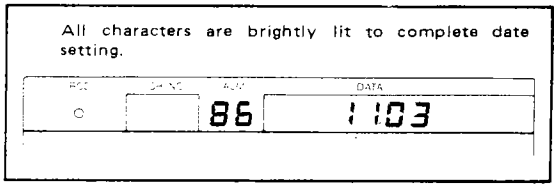
1 Press the SET key as many times as necessary until the year, month, and day are displayed. Check the display for accuracy and if necessary reset the date, or else proceed to Paragraph 5-4-5 "Chart feed speed setting".



2 Enter year (YY), month (MM), and day (DD).
Example: In the case for November 3, 1986, press the numeric keys 8, 6, 1, 1, 0, 3.



3 Press the enter ENT key to store the entered data.



Setting completed

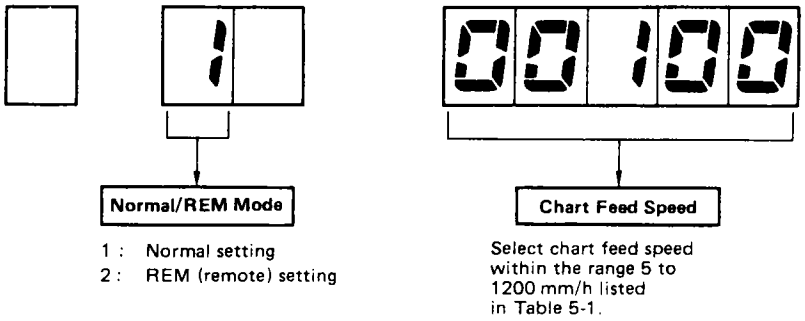
If data entry is invalid, refer to paragraph 5-4-9.

5-4-5. Chart Feed Speed Setting.

Although chart feed speed can be set within a range of 5 to 12,000 mm/h,* the optimum setting for producing digital data printouts is in the range of 10 to 1,500 mm/h.** (Note that the alarm printout is effective with the chart speeds in the range of 5 to 1,500 mm/h).

* Select chart feed speed listed in Table 5-1.
** See Table 5-2.

Chart Feed Speed Setting Table



1 : Normal setting
2 : REM (remote) setting

Select chart feed speed within the range 5 to 1200 mm/h listed in Table 5-1.

Table 5-1.

Unit: mm/h

5	30	80	240	600	1500	4320
6	32	90	250	675	1600	4500
8	36	96	270	720	1800	4800
9	40	100	300	750	2000	5400
10	45	120	320	800	2160	6000
12	48	125	360	900	2250	7200
15	50	135	375	960	2400	8000
16	54	150	400	1000	2700	9000
18	60	160	450	1010	2880	10800
20	64	180	480	1200	3000	12000
24	72	200	500	1350	3600	
25	75	225	540	1440	4000	

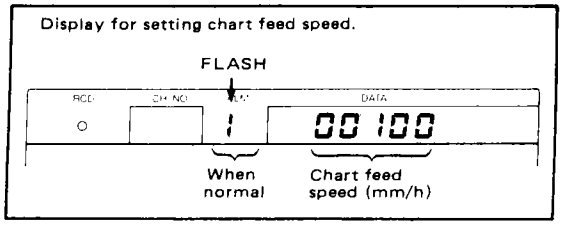
Table 5-2.

Chart feed speed (mm/h)	5 to 9	10 to 18	20 to 36	40 to 72	75 to 135	150 to 180	200 to 320	360 to 1500	1600 to 1200
Digital printout Interval	Not printed out	8 Hours	4 Hours	2 Hours	1 Hour	30 Minutes	20 Minutes	10 Minutes	Not printed out
Message printout*	Printed out corresponding to alarm or REM contact signal generation.								Not printed out

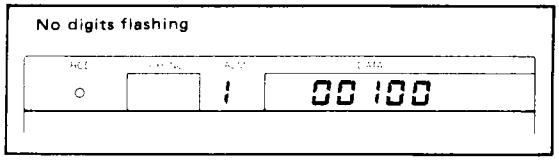
* Message printout: Printouts of alarm and chart feed speed change by REM (remote) signal.

Chart feed speed setting procedure:

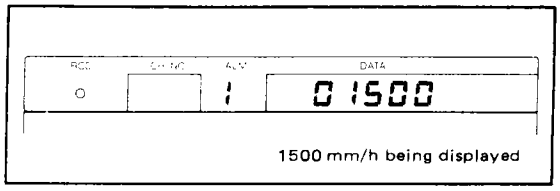
1 Press the SET key as many times as necessary until the required chart feed speed is displayed. (An initial value of 100 mm/h has been set.)



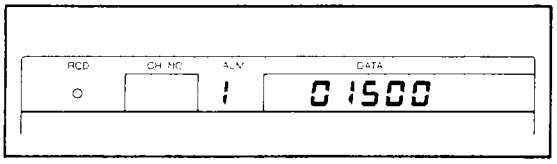
2 For normal setting, press the A/1 key.
[Normal: 1/(at REM: 2)]



3 To set chart feed speed (5 digits, fixed, unit mm/h), use the ◄ or ► key.
Example: To set a speed of 1,500 mm/h, keep pressing the ► key until a display of 1,500 mm/h is obtained.
(If the intended value is exceeded, use the ◄ key to decrease.)

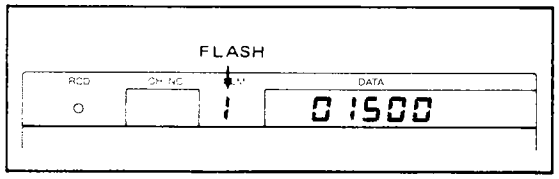


4 Press the ENT key to set chart feed speed. (Normal setting completed)

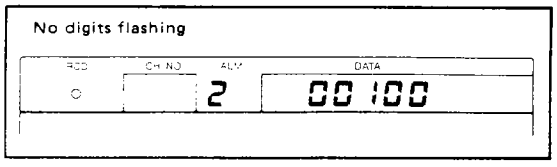


For setting normal chart feed speed, steps 1 through 4 are followed and setting is complete. To change the chart speed with REM input, set the chart speed on alarm in the following steps 5 through 7. Two chart feed speeds are selectable: normal and remote settings. Refer to paragraph 2-5-3 Example of Printout in REM Setting Mode.

5 Press the ENT key once again and the set chart feed speed is displayed.



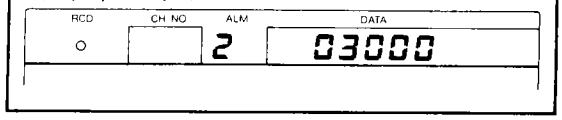
6 Press the B/2 key.
The initial value (100 mm/h) of chart feed speed in REM mode is displayed automatically.



If data entry is invalid, refer to paragraph 5-4-9.

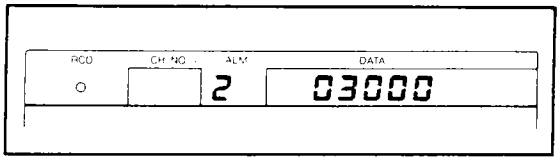
7 Set the intended chart feed speed alarm value using the ◄ or ► key and confirm the value by reading the display. (The example shows a setting of 3,000 mm/h.)

End of chart feed speed setting in REM mode (display example)



8 Press the ENT key to store the entered data.

(Setting at REM completed)



Note) /REM (remote) is optional.

If data entry is invalid, refer to paragraph 5-4-9.

5-4-6. Measurement and Recording (Range/Span) Setting.

There are several types of settings for measurement and recording (range) as shown below. Refer to the setting method required for a particular application.

* Absolute value recording denotes the recording of the measured value.

** Scaling function converts measured value (e.g. volts) to corresponding value in engineering unit.

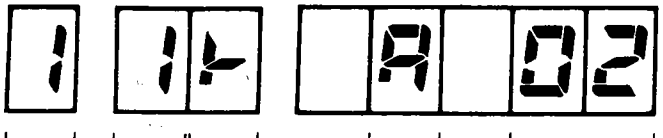
*** To be referred to even for measuring other types of input signals (such as temperature difference recording using thermocouple or RTD).

Note that some of the settings indicated above may not be available, depending on the type of μR100 (see Section 2-4 Models and Suffix Codes) recorder being used.

For example, for the model without RTD input terminals or channels with no RTD terminals, setting using RTD is disabled.

For the 1-pen model, setting for recording voltage differences is also disabled.

A list of measurement and recording (range) settings



CH No.

- 1: Channel number one (1) (each point separate)
- 0: Common to all channels

SET CODE

- A: NORMAL
- d: DELTA
- –: SKIP

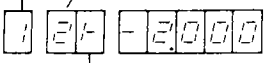
REFERENCE CHANNEL No.

- d: 01 to 02 only for setting DELTA (difference recording)
  1-pen model: not provided
  2-pen model: 01 only

PANEL No.

- 1: Measurement range setting panel
- 2: Scale minimum setting panel
- 3: Full scale value setting panel
- 4: Scale minimum setting panel (Converts data to the designated scale value)
- 5: Full scale value setting panel (Converts data to the designated scale value)

Panel No.
CH No.



Span setting value (arbitrary within the range)

SPAN

- 1–: Scale minimum (0%)
- –1: Full scale value (100%)
  (for panel numbers 2, 3, 4 and 5)

RANGE CODE

DC Voltage

- 00: –20 to 20 mV
- 01: –200 to 200 mV
- 02: –2 to 2 V
- 03: –6 to 6 V
- 04: –20 to 20 V
- 05: –50 to 50 V

DC Voltage (linear scaling)*

- 30: –20 to 20 mV
- 31: –200 to 200 mV
- 32: –2 to 2 V
- 33: –6 to 6 V
- 34: –20 to 20 mV
- 35: –50 to 50 V

* (Measurable range is not greater than 75% of each range shown above. Refer to Page 5–28 and 5–32.)

DC Voltage (square rooting)*

- 40: –20 to 20 mV
- 41: –200 to 200 mV
- 42: –2 to 2 V
- 43: –6 to 6 V
- 44: –20 to 20 V
- 45: –50 to 50 V

RTD

- 20: –200 to 550°C (JPt 100)
- 20: –328 to 1022°F (Pt 100)
- 20: –200 to 550°C (Pt 100)

(JPt 100: JIS C 1604-1989, JIS C 1606-1989
Pt 100 : JIS C 1604-1989, JIS C 1606-1989
DIN IEC 751, IEC 751)

TC [ANSI, JIS (°C)]

- 10: R (0 to 1760°C)
- 11: S (0 to 1760°C)
- 12: B (400 to 1820°C)
- 13: K (–200 to 1370°C)
- 14: E (–200 to 800°C)
- 15: J (–200 to 1100°C)
- 16: T (–200 to 400°C)
- 17: N (0 to 1300°C)
- 18: W (0 to 2315°C)

TC [ANSI, DIN (°F)]

- 10: R (32 to 3200°F)
- 11: S (32 to 3200°F)
- 12: B (752 to 3308°F)
- 13: K (–328 to 2498°F)
- 14: E (–328 to 1472°F)
- 15: J (–328 to 2012°F)
- 16: T (–328 to 752°F)
- 17: N (32 to 2372°F)
- 18: W (32 to 4200°F)

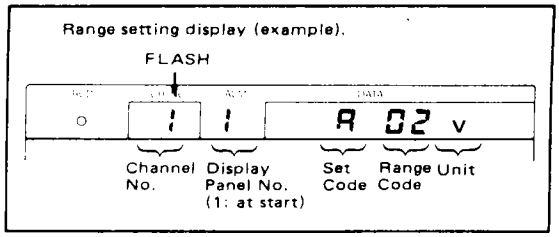
TC [DIN (°C)]

- 10: R (0 to 1760°C)
- 11: S (0 to 1760°C)
- 12: B (400 to 1820°C)
- 13: K (–200 to 1370°C)
- 14: E (–200 to 800°C)
- 15: L (–200 to 900°C)
- 16: U (–200 to 400°C)
- 17: N (0 to 1300°C)
- 18: W (0 to 2315°C)

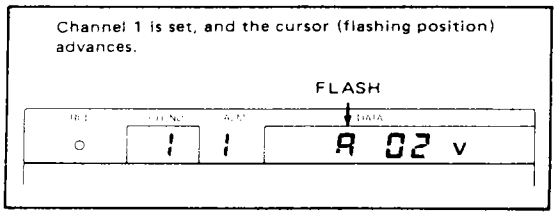
(1) Setting method for recording absolute value (1).
(DC voltage measurement/absolute value recording)

Proceed as follows.

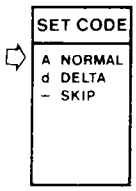
1 Press the SET key as many times as necessary until the range code is displayed for setting.

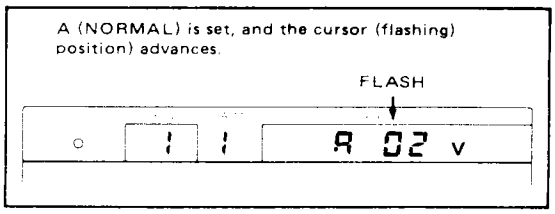


2 Set the channel number.
Example: To set channel 1, press the 1 key.

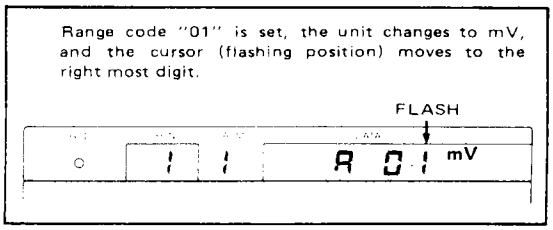


3 With A: NORMAL, chosen from SET CODE list, press the SHIFT and 1 keys.





4 Choose a measurement range from the RNG CODE list.
(DC voltage measurement.)
Example: To select the range of −200 mV to 200 mV, set "01" by pressing the 0 and 1 keys.



00 to 05

[ANSI, DIN(°F)]

RNG CODE		
00 −20-20mV	TC	16 T −328-752 F
01 −200-200mV	10 R 32-3200 F	17 N 32-2372 F
02 −2-2V	11 S 32-3200 F	18 W 32-4200 F
03 −6-6V	12 B 752-3308 F	
04 −20-20V	13 K −328-2498 F	RTD Pt100
05 −50-50V	14 E −328-1472 F	20 −328-1022 F
30-35 LIN SCALING	15 J −328-2012 F	
40-45 Δ		

[DIN, DIN (°C)]

RNG CODE		
00 −20-20mV	TC	15 L −200-900°C
01 −200-200mV	10 R 0-1760°C	16 U −200-400°C
02 −2-2V	11 S 0-1760°C	17 N 0-1300°C
03 −6-6V	12 B 400-1820°C	18 W 0-2315°C
04 −20-20V	13 K −200-1370°C	RTD Pt100
05 −50-50V	14 E −200-800°C	20 −200-550°C
30-35 LIN SCALING		
40-45 Δ		

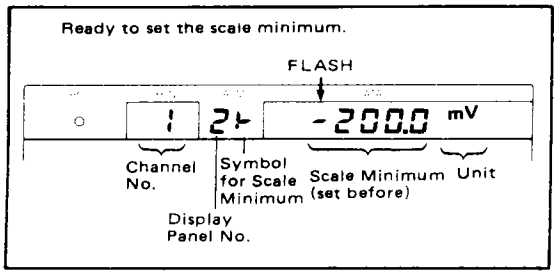
[ANSI/JIS, JIS/DIN (°C)]

RNG CODE		
00 −20-20mV	TC	16 T −200-400°C
01 −200-200mV	10 R 0-1760°C	17 N 0-1300°C
02 −2-2V	11 S 0-1760°C	18 W 0-2315°C
03 −6-6V	12 B 400-1820°C	
04 −20-20V	13 K −200-1370°C	RTD JPt100
05 −50-50V	14 E −200-800°C	Pt 100
30-35 LIN SCALING	15 J −200-1100°C	20 −200-550°C
40-45 Δ		

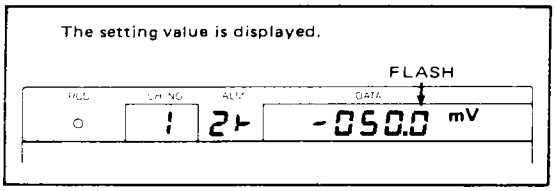
[RNG CODE list depends on the suffix code specified.]

If data entry is invalid, refer to paragraph 5-4-9.

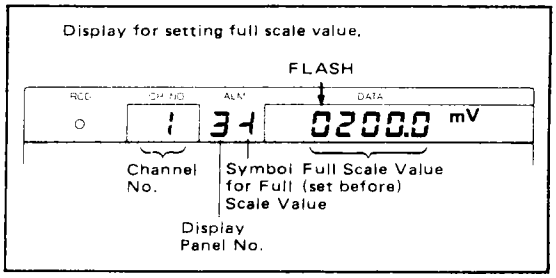
5 Press the ENT key to store the data.



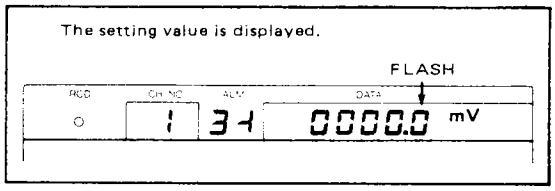
6 For setting the range, first set the scale minimum using the numeric keys.
Example: To set the scale minimum to −50 mV, press [−/1], [0], [5], [0] and [0] in turn.



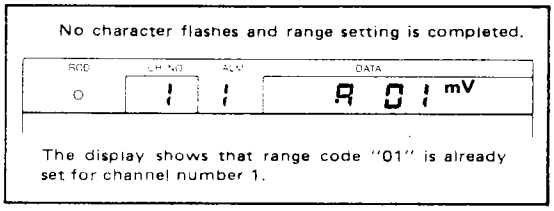
7 Press the ENT key to store the data.



8 Set the full scale value using the numeric keys.
Example: To set the full scale value (0 mV), press the [0], [0], [0], [0] and [0] keys in turn.



9 Press the ENT key to store the data.



Setting completed

The above procedures, 1 through 9, set the following data.

Channel number: 1
DC voltage absolute value recording
Measurement range: −200 mV to 200 mV
Recording range: −50 mV to 0 mV

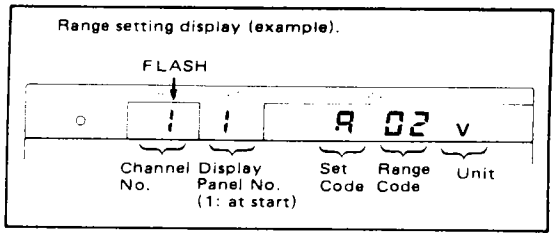
If data entry is invalid, refer to paragraph 5-4-9.

(2) Setting method for recording absolute value (2).

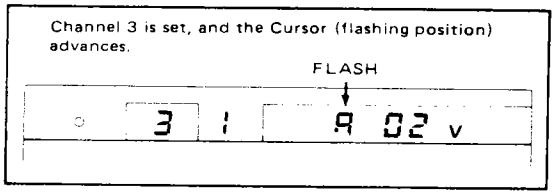
For temperature measurement by using TCs and absolute value recording.

To record temperature measurement the absolute values, proceed as follows:

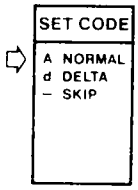
1 Press the SET key as many times as necessary until the range code is displayed for setting.

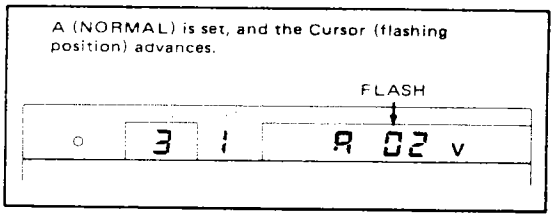


2 Set the channel number.
Example: To set channel 3, press the C 3 key.



3 With A: NORMAL, chosen from the SET CODE list, press the SHIFT and A 1 keys.





4 Choose a measurement range from the RNG CODE list.

10 to 18

[ANSI, DIN(°F)]

RNG CODE		
00 −20-20mV	TC	16 T −328-752 F
01 −200-200mV	10 R 32-3200 F	17 N 32-2372 F
02 −2-2V	11 S 32-3200 F	18 W 32-4200 F
03 −6-6V	12 B 752-3308 F	
04 −20-20V	13 K −328-2498 F	RTD Pt100
05 −50-50V	14 E −328-1472 F	20 −328-1022 F
30-35 LIN SCALING	15 J −328-2012 F	
40-45 ⚠		

[DIN, DIN (°C)]

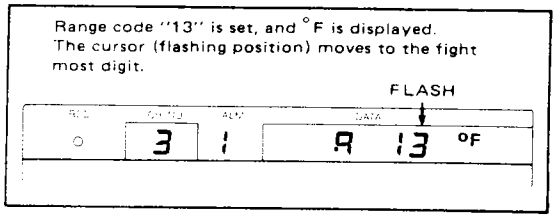
RNG CODE			
00 −20-20mV	TC	15 L −200-900°C	
01 −200-200mV	10 R 0-1760°C	16 U −200-400°C	
02 −2-2V	11 S 0-1760°C	17 N 0-1300°C	
03 −6-6V	12 B 400-1820°C	18 W 0-2315°C	
04 −20-20V	13 K −200-1370°C	RTD Pt100	
05 −50-50V	14 E −200-800°C	20 −200-550°C	
30-35 LIN SCALING			
40-45 ⚠			

[ANSI/JIS, JIS/DIN (°C)]

RNG CODE		
00 −20-20mV	TC	16 T −200-400°C
01 −200-200mV	10 R 0-1760°C	17 N 0-1300°C
02 −2-2V	11 S 0-1760°C	18 W 0-2315°C
03 −6-6V	12 B 400-1820°C	
04 −20-20V	13 K −200-1370°C	RTD JPt100
05 −50-50V	14 E −200-800°C	Pt 100
30-35 LIN SCALING	15 J −200-1100°C	20 −200-550°C
40-45 ⚠		

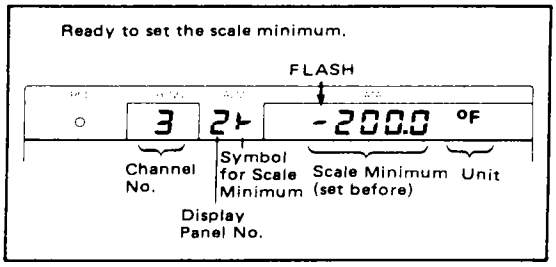
[RNG CODE list depends on the suffix code specified.]

Example: To select the thermocouple (type K) temperarure range of −328 to +2498°F, set "13" by pressing the A 1 and C 3 keys.

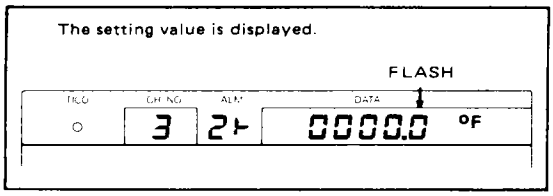


If data entry is invalid, refer to paragraph 5-4-9.

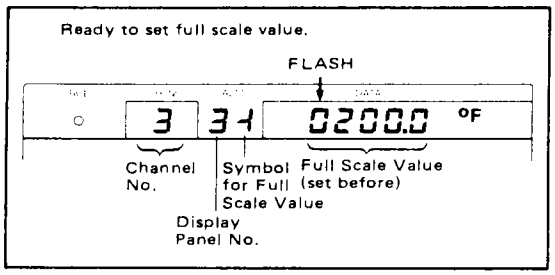
5 Press the ENT key to store the data.



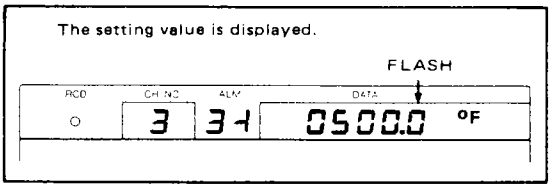
6 Set the scale minimum:
Example: To set 0°F, press 0, 0, 0, , and in turn.



7 Press ENT key to store the data.

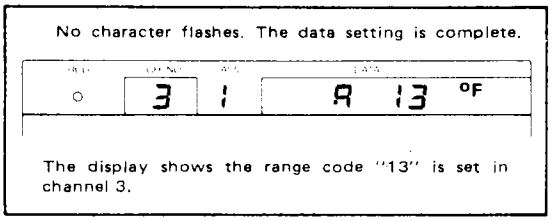


8 Set the full scale value using the numeric keys.
Example: To set 500°F, press 0, 5, 0, 0 and 0 keys in turn.



9 Press ENT key to store the data.

Setting completed



The above procedures, 1 through 9, set the following data.

Channel number: 3
TC type - K measurement, absolute value recording
Measurement range: −328°F to 2498°F
Recording range: 0°F to 500°F

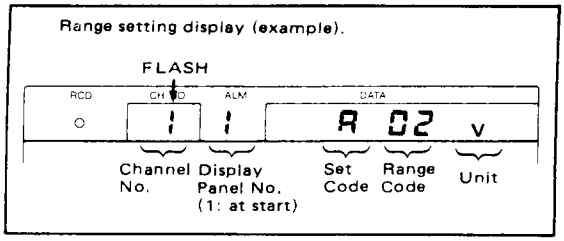
If data entry is invalid, refer to paragraph 5-4-9.

(3) Setting method for recording absolute value (3).

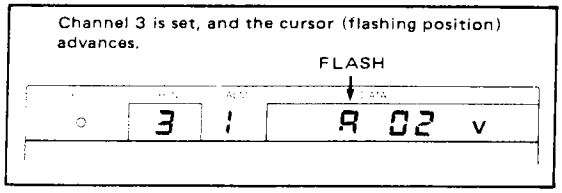
For temperature measurement using RTDs and temperature absolute value recording.

To record temperature measurement absolute values, proceed as follows:

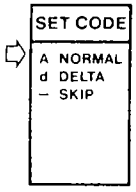
1 Press the SET key as many times as necessary until the range code is displayed for setting.

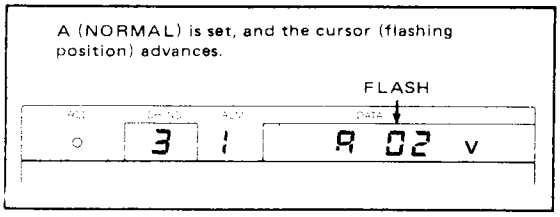


2 Set the channel number.
Example: To set channel 3, press the 3 key.

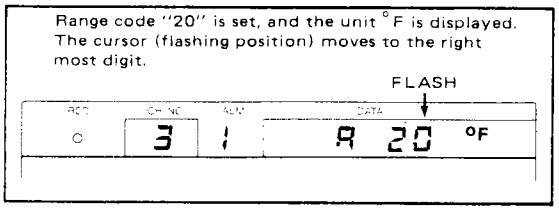


3 With A: NORMAL, chosen from the SET CODE list, press the SHIFT and 1 keys.





4 Chose a measurement range from the RNG CODE list. For RTD measurement, select 20 (range code). Press the 2 and 0 keys.



RTD: 20

[ANSI, DIN(°F)]

RNG CODE		
00 −20-20mV	TC	16 T −328-752 F
01 −200-200mV	10 R 32-3200 F	17 N 32-2372 F
02 −2-2V	11 S 32-3200 F	18 W 32-4200 F
03 −6-6V	12 B 752-3308 F	
04 −20-20V	13 K −328-2498 F	RTD Pt100
05 −50-50V	14 E −328-1472 F	20 −328-1022 F
30-35 LIN SCALING 40-45 △	15 J −328-2012 F	

[DIN, DIN (°C)]

RNG CODE		
00 −20-20mV	TC	15 L −200-900°C
01 −200-200mV	10 R 0-1760°C	16 U −200-400°C
02 −2-2V	11 S 0-1760°C	17 N 0-1300°C
03 −6-6V	12 B 400-1820°C	18 W 0-2315°C
04 −20-20V	13 K −200-1370°C	RTD Pt100
05 −50-50V	14 E −200-800°C	20 −200-550°C
30-35 LIN SCALING 40-45 △		

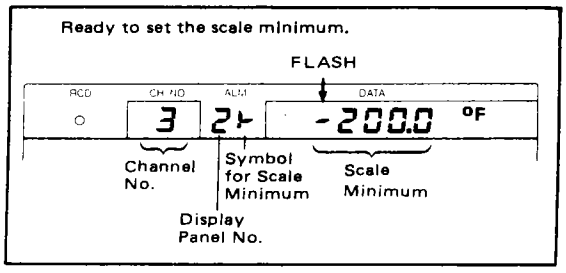
[ANSI/JIS, JIS/DIN (°C)]

RNG CODE		
00 −20-20mV	TC	16 T −200-400°C
01 −200-200mV	10 R 0-1760°C	17 N 0-1300°C
02 −2-2V	11 S 0-1760°C	18 W 0-2315°C
03 −6-6V	12 B 400-1820°C	
04 −20-20V	13 K −200-1370°C	RTD JPt 100
05 −50-50V	14 E −200-800°C	Pt 100
30-35 LIN SCALING 40-45 △	15 J −200-1100°C	20 −200-550°C

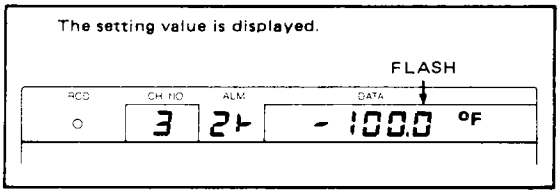
[RNG CODE list depends on the suffix code specified.]

If data entry is invalid, refer to paragraph 5-4-9.

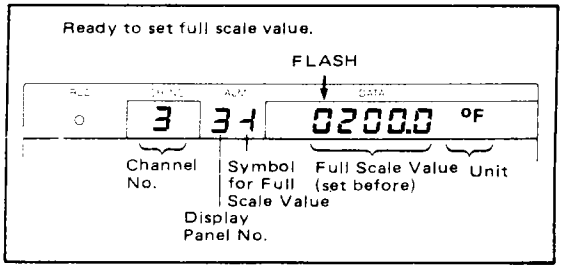
5 Press the ENT key to store the data.



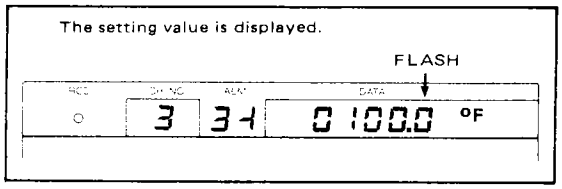
6 Set the scale minimum using the numeric keys.
Example: To set −100°F, press [−], [1], [0], [0], and [0] keys in turn.



7 Press the ENT key to store the data.

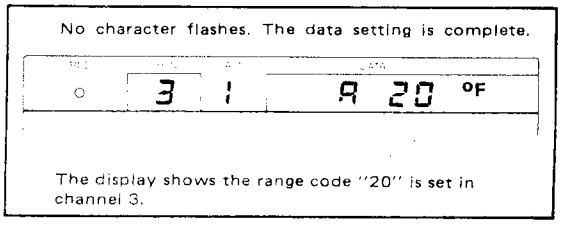


8 Set the full scale value using the numeric keys.
Example: To set 100°F, press [0], [1], [0], [0], and [0] keys in turn.



9 Press the ENT key to store the data.

Setting completed

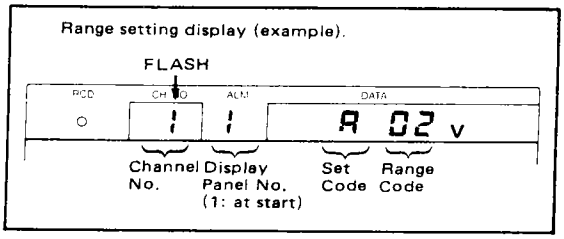


Steps 1 through 9 above set the following:
Channel number: 3
Temperature measurement using a RTD and temperature absolute value record.
Measurement range: −328°F to 1022°F
Recording range: −100 to +100°F.

If data entry is invalid, refer to paragraph 5-4-9.

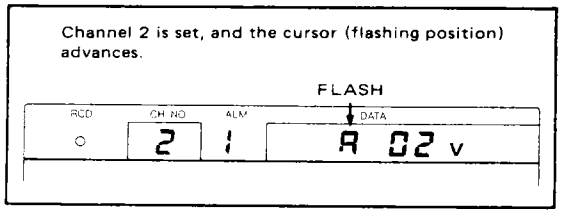
(4) Setting method for recording scaling.

To measure a DC voltage and make a linear scaling recording, proceed as follows:

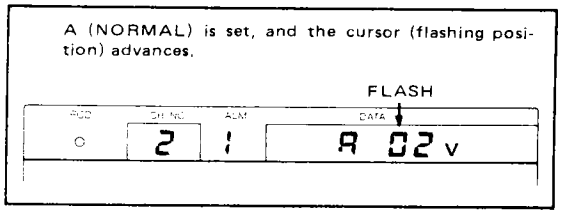


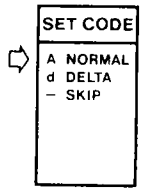
1 Press the SET key as many times as necessary until the range code is displayed for setting.

2 Set the channel number.
Example: To set channel 2, press the 2 key.



3 With A: NORMAL, chosen from the SET CODE list, press the SHIFT and 1 keys.





4 Select the range code for 30 to 35.
[DC Voltage Measurement Scaling.]

[ANSI, DIN(°F)]

RNG CODE		
00 −20-20mV	TC	16 T −328-752 F
01 −200-200mV	10 R 32-3200 F	17 N 32-2372 F
02 −2-2V	11 S 32-3200 F	18 W 32-4200 F
03 −6-6V	12 B 752-3308 F	
04 −20-20V	13 K −328-2498 F	RTD Pt100
05 −50-50V	14 E −328-1472 F	20 −328-1022 F
30-35 LIN SCALING	15 J −328-2012 F	
40-45 Δ		

[DIN, DIN (°C)]

RNG CODE		
00 −20-20mV	TC	15 L −200-900°C
01 −200-200mV	10 R 0-1760°C	16 U −200-400°C
02 −2-2V	11 S 0-1760°C	17 N 0-1300°C
03 −6-6V	12 B 400-1820°C	18 W 0-2315°C
04 −20-20V	13 K −200-1370°C	RTD Pt100
05 −50-50V	14 E −200-800°C	20 −200-550°C
30-35 LIN SCALING		
40-45 Δ		

[ANSI/JIS, JIS/DIN (°C)]

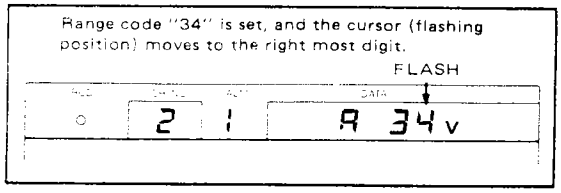
RNG CODE		
00 −20-20mV	TC	16 T −200-400°C
01 −200-200mV	10 R 0-1760°C	17 N 0-1300°C
02 −2-2V	11 S 0-1760°C	18 W 0-2315°C
03 −6-6V	12 B 400-1820°C	
04 −20-20V	13 K −200-1370°C	RTD JPt 100
05 −50-50V	14 E −200-800°C	Pt 100
30-35 LIN SCALING	15 J −200-1100°C	20 −200-550°C
40-45 Δ		

[RNG CODE list depends on the suffix code specified.]

Setting the range code "30 to 35" allows the DC voltage measurement in the range described below:

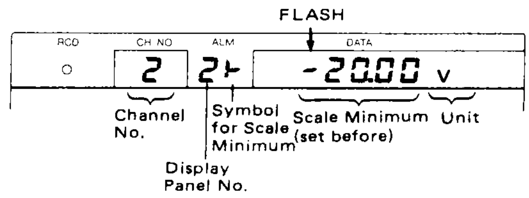
30: −20 to 20 mV
31: −200 to 200 mV
32: −2 to 2V
33: −6 to 6V
34: −20 to 20V
35: −50 to 50V

Example: To select the range of −20 to +20V, set "34" by pressing the 3 and 4 keys.



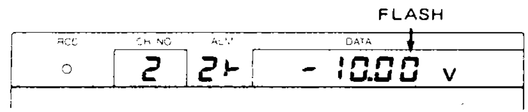
5 Press the [ENT] key to store the data.

Ready to set the scale minimum.



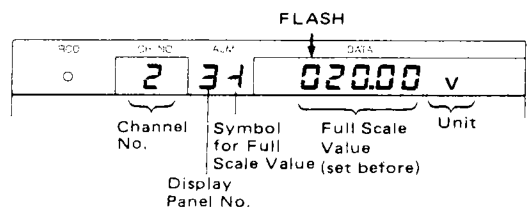
6 Set the scale minimum using the numeric keys.
Example: To set −10V, press the [–], [1], [0], [0], and [0] keys in turn.

The setting value is displayed.



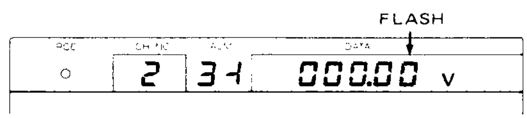
7 Press the [ENT] key to store the data.

Ready to set full scale value.



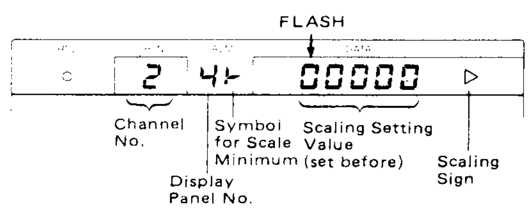
8 Set the full scale value using the numeric keys.
Example: To set 0V, press the [0], [0], [0], [0], and [0] keys in turn.

The setting value is displayed.



9 Press the [ENT] key to store the data.

The linear scaling set display appears.



If data entry is invalid, refer to paragraph 5-4-9.

10 Setting scaling values.

In the example, for step 6 , −10V was set as the minimum for the range (i.e. 0% chart recording). Furthermore, in the example, for step 8 , 0V was set as the maximum (100%).

Here, the setting of scaling values is carried out so that the measurement data is converted into units which are appropriate for use by the recorder. (Scaling values are to be set with a span of 30000 within the range of −19999 to +20000.)

Example: To set scaling values such as:

Measurement value		Recording value
−10V	⇨	0
0V		1000

i) Press keys

[0] , [0] , [0] , [0] and [0]

then press [ENT] to store the data.

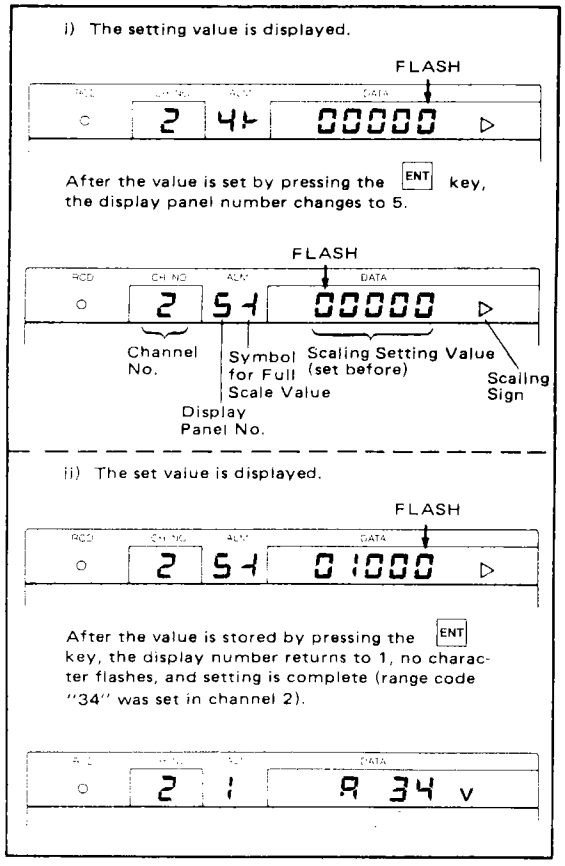
ii) Press keys

[0] , [1] , [0] , [0] and [0]

then press [ENT] to store the data.

Setting completed

After the scaling record setting is completed, roceed to (6) Unit (UNIT) setting method.



If data entry is invalid, refer to paragraph 5-4-9.

Note) In scaling record mode, the actual measurable range (measurement span) is up to 75% of the measurement range shown by each range code.
For example, for the example in step 4 , when the range code "34" is set, the measurement range is −20 to 20V with span of 40V. However, the actual measurable range can be derived from the following calculation:

40 (V) × 0.75 = 30 (V)

So the maximum span is 30V within the measurement range described above. (If 0V is the center of range, the maximum measurable range is −15V to 15V).
The measurable range (span) for the measurement range is expressed by shadowed portion shown in Figure 5-23.

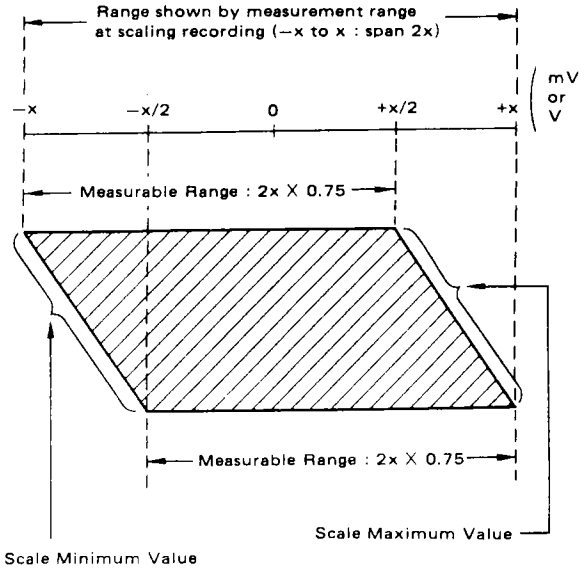
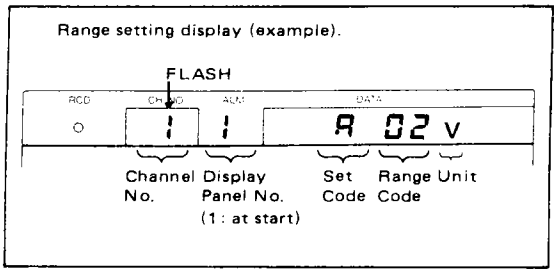


Figure 5-23.

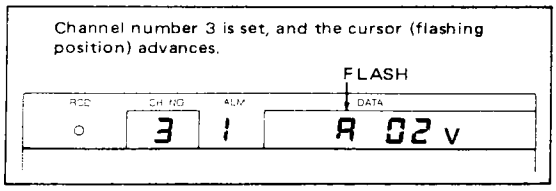
(5) Setting method for square rooting ($\sqrt{\ }$).

To measure a DC voltage and take a square root recording, proceed as follows:

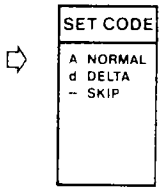
1 Press the SET key as many times as necessary until the range code is displayed for setting.

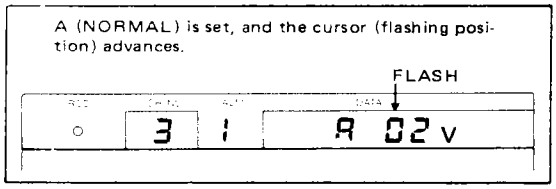


2 Set the channel number.
Example: To set channel 3, press the 3 key.



3 With A: NORMAL chosen, from the SET CODE list. press the SHIFT and 1 keys.





4 Select the range code for 40 to 45.

[ANSI, DIN(°F)]

RNG CODE		
00 −20-20mV	TC	16 T −328-752 F
01 −200-200mV	10 R 32-3200 F	17 N 32-2372 F
02 −2-2V	11 S 32-3200 F	18 W 32-4200 F
03 −6-6V	12 B 752-3308 F	
04 −20-20V	13 K −328-2498 F	RTD Pt100
05 −50-50V	14 E −328-1472 F	20 −328-1022 F
30-35 LIN SCALING	15 J −328-2012 F	
40-45 △		

[DIN, DIN (°C)]

RNG CODE		
00 −20-20mV	TC	15 L −200-900°C
01 −200-200mV	10 R 0-1760°C	16 U −200-400°C
02 −2-2V	11 S 0-1760°C	17 N 0-1300°C
03 −6-6V	12 B 400-1820°C	18 W 0-2315°C
04 −20-20V	13 K −200-1370°C	RTD Pt100
05 −50-50V	14 E −200-800°C	20 −200-550°C
30-35 LIN SCALING		
40-45 △		

[ANSI/JIS, JIS/DIN (°C)]

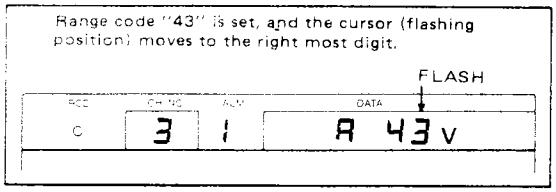
RNG CODE		
00 −20-20mV	TC	16 T −200-400°C
01 −200-200mV	10 R 0-1760°C	17 N 0-1300°C
02 −2-2V	11 S 0-1760°C	18 W 0-2315°C
03 −6-6V	12 B 400-1820°C	
04 −20-20V	13 K −200-1370°C	RTD JPt 100
05 −50-50V	14 E −200-800°C	Pt 100
30-35 LIN SCALING	15 J −200-1100°C	20 −200-550°C
40-45 △		

[RNG CODE list depends on the suffix code specified.]

Setting the range code "40 to 45" allows DC voltage measurement in the range described below:

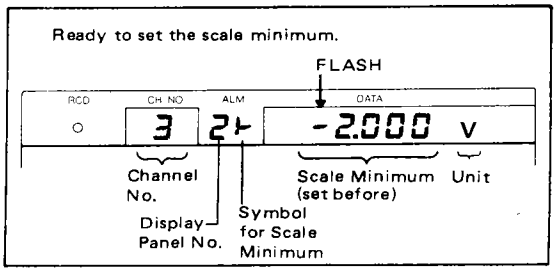
40: −20 to 20 mV	43: −6 to 6V
41: −200 to 200 mV	44: −20 to 20V
42: −2 to 2V	45: −50 to 50V

Example: To select the range of −6 to −6V set "43" by pressing the 4 and 3 keys.

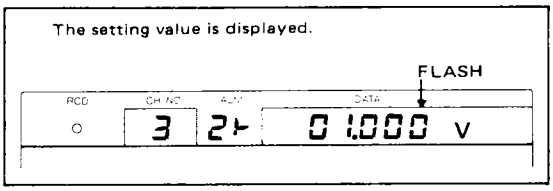


If data entry is invalid, refer to paragraph 5-4-9.

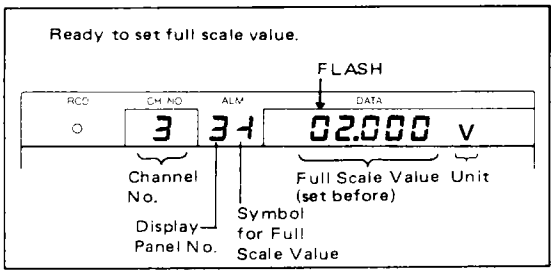
5 Press the ENT key to store the data.



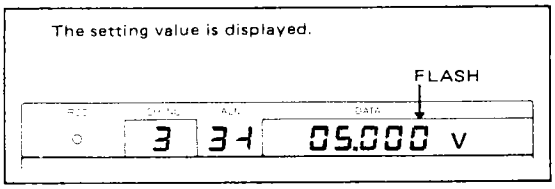
Set the scale minimum using the numeric keys.
Example: To set −10V, press the [0], [1], [0], [0], and [0] keys in turn.



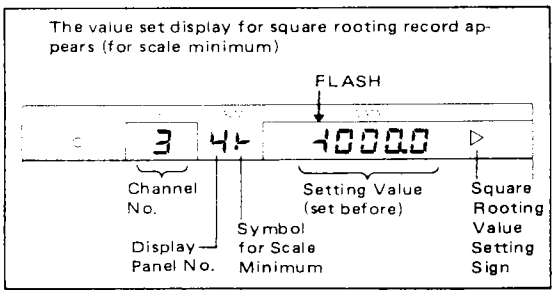
7 Press the ENT key to store the data.



8 Set the full scale value using the numeric keys.
Example: To set 0V, press the [0], [5], [0], [0], and keys in turn.



Press the ENT key to store the data.



If data entry is invalid, refer to paragraph 5-4-9.

[10] Setting scaling values for square root recording. In the example, for step 6 , 1V was set as the minimum for the range (i.e. 0% chart recording). Furthermore, in the example, for step 8 , 5V was set as the maximum. Here, the setting of scaling values is carried out so that the measurement data is made appropriate in the units which are actually managed for display and recording when subjecting them to display and recording. (Values are to be set with a span of 3000 within the range of −19999 to +20000.)

Example: Let us perform setting so that the recording value will be 0 → 10000 when the input is 1 → 5V.

i) Press keys

[0] , [0], [0], [0] and [0]

then press [ENT] to store the data.

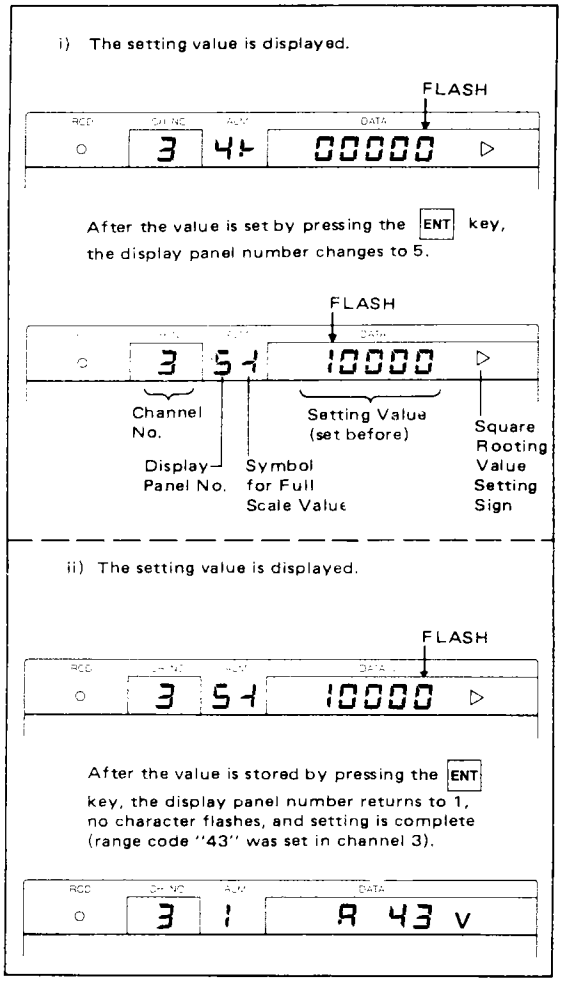
ii) Press keys

[1] , [0] , [0] , [0] and [0]

then press [ENT] to store the data.

Setting Completed

After the end of square root record setting, proceed to (6) Unit (UNIT) setting method.



If data entry is invalid, refer to paragraph 5-4-9.

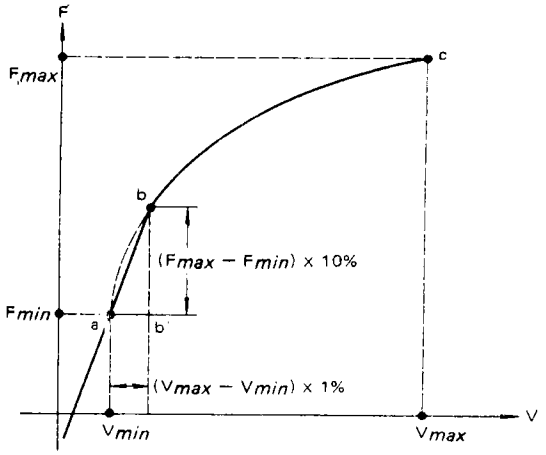
Square root

The square rooting method by this instrument is as follows:

Let us define the items as follows.

- ○ V*min* : scale minimum (see step 6)
- ○ V*max* : full scale value (see step 8)
- ○ F*min* : scaling minimum (see step 10 i))
- ○ F*max* : scaling full scale value (see step 10 ii))
- ○ V*x* : input voltage
- ○ F*x* : scaling value

The relationship between V*x* (input voltage) and F*x* (scaling value) of this instrument is expressed by the graph below. (The graph configuration is approximate.)



Between b and c on the graph, the following relation holds between F*x* and V*x*.

$$Fx = (Fmax - Fmin)\sqrt{\frac{Vx - Vmin}{Vmax - Vmin}} + Fmin$$

And, between a and b, the relation:

$$Fx = \frac{10\,(Fmax - Fmin)}{Vmax - Vmin}(Vx - Vmin) + Fmin$$

holds.

Measurement span settable range

When setting of the square rooting record is carried out, an actually measurable range (measurement span) is up to 75% of the measurement range indicated by a relevant range code.

When a measurement range code "43" is set (see step 4), for example, its measurement range is −6 to +6V, having a range of 12V, but the maximum range of actual measurement is

12 (V) × 0.75 = 9 (V)

If −4V is set for V*min* (see step 6),

V*max* ≦ 5V

holds. (6V cannot be set for V*max*.)

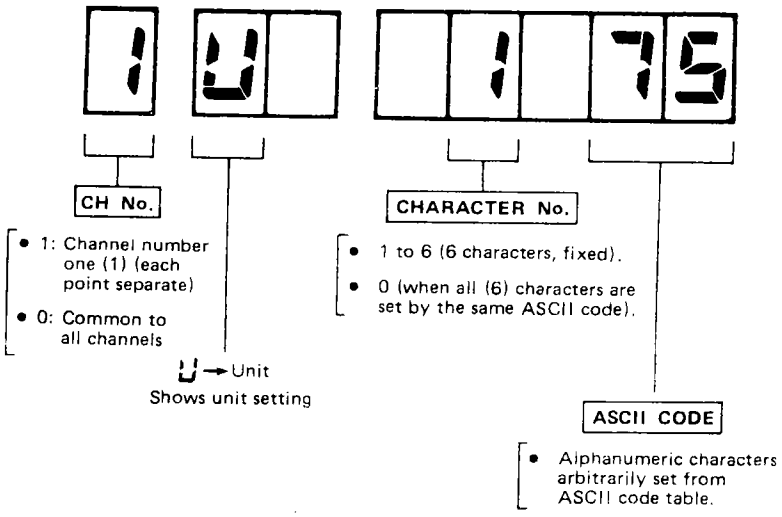
As shown in the examples for steps 6 and 8 , when V*min* = 1V and V*max* = 5V are set, the span is 4V, which is within the range of 9V, and is settable accordingly.

(6) Setting method for unit.

If scale recording is to be performed, it is convenient to set unit for the channel. (An appropriate unit is printed out on the chart).

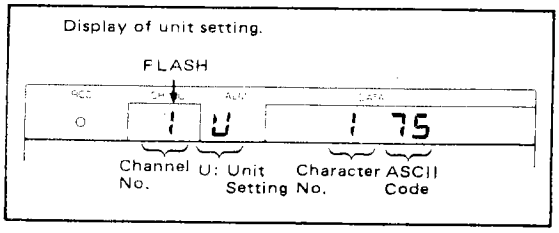
For channel not requiring scaling (linear scaling and square rooting ($\sqrt{\ }$)), no unit setting is required.

Even if units are set, they cannot be displayed or printed out (in this case, the unit corresponding to the measurement range code is displayed or printed out).

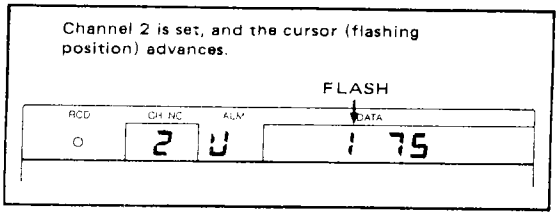


Proceed as follows:

1 Press the SET key as many times as necessary until the unit value is displayed for setting.

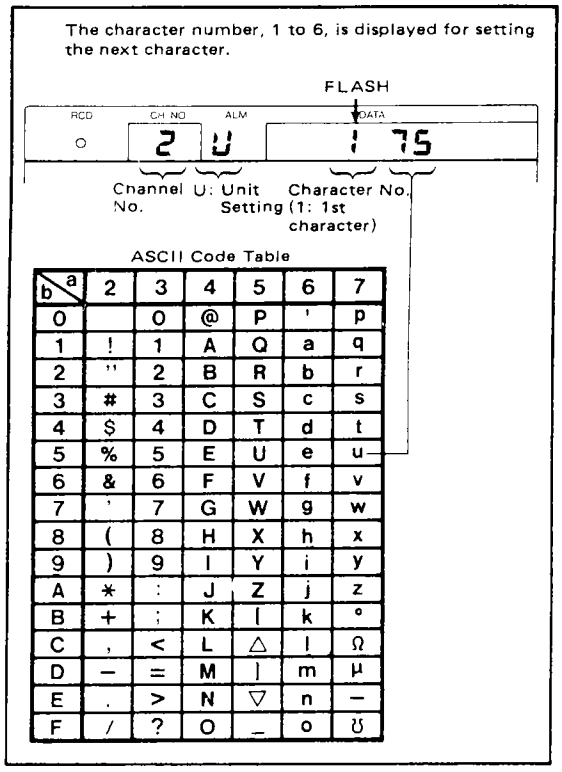


2 Set the channel number, using the numeric keys, for which the unit is to be set.
Example: To set channel number 2, press the 8/2 key.



If data entry is invalid, refer to paragraph 5-4-9.

3 Set the unit by entering up tp sox alphanumeric characters. The example below shows that ASCII code "75" has been entered for the first character (u).
As desired, set a new first character by entering the ASCII code and then pressing the ENT key. Then, the second character (with numeral 2 shown) is automatically displayed. Enter an ASCII code for the second character and press the ENT key. Thus, proceed until all of the 6 new characters are entered (by ASCII codes) and set. (one concrete example is shown on the next page for your reference).



ASCII Code Table

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

If data entry is invalid, refer to paragraph 5-4-9.

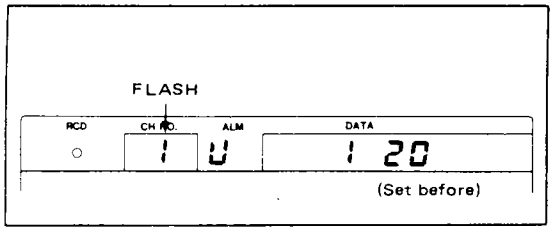
Unit (UNIT) setting example.

This example shows the setting of the unit (UNIT) KL/H..

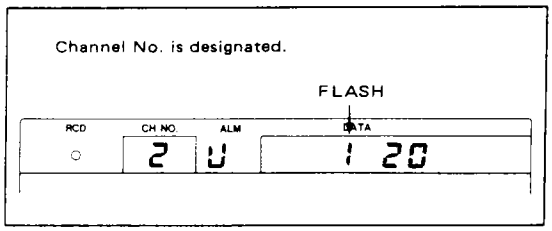
Set an Unit (UNIT) by entering six alphanumeric characters.

The unit example given above comprises five characters including a period, in such a case, enter six characters in total by adding a space (code 20).

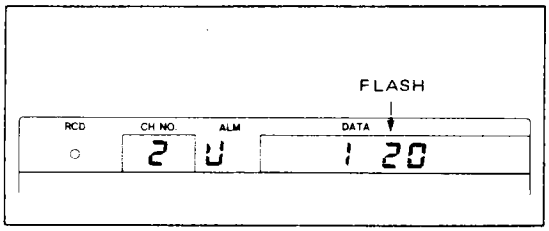
1 Press the SET key as many times as necessary to display the unit setting.



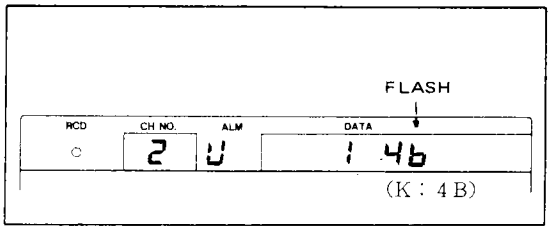
2 Select a channel number using the numeric keys for which the unit is to be set.
Example: To select channel number 2, press the 2 key.



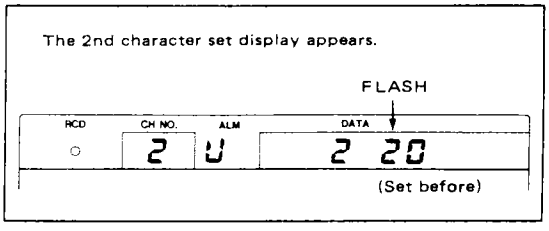
3 Select the 1st character press the 1 key.



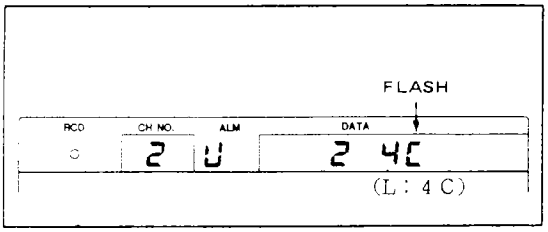
4 Select "K".
As K: 4B (ASCII code),
press the keys 4 , SHIFT and 2 in turn.



5 Press the ENT key to store "K".
(Now K is set as the 1st character).

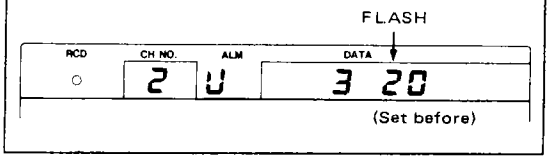


6 Select "L".
As L: 4C (ASCII code),
press the keys 4 , SHIFT and 3 in turn.

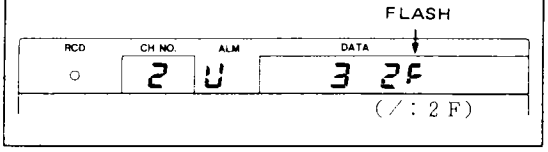


7 Press the ENT key to store "L".
(Now L is set as the 2nd character).

The 3rd character set display appears.

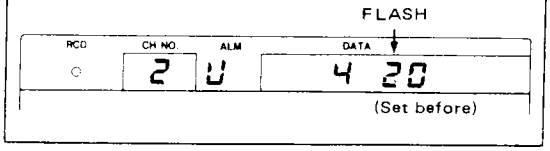


8 Select "/" (slash).
As / : 2F (ASCII code),
press the keys 2, SHIFT and 6 in turn.

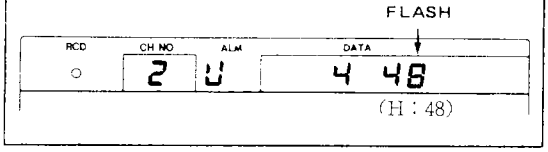


9 Press the ENT key to store "/".
(Now / is set as the 3rd character).

The 4th character set display appears.

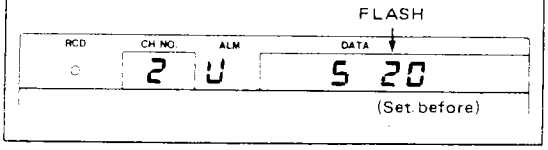


10 Select "H".
As H: 48 (ASCII code),
press the keys 4 and 8 in turn.

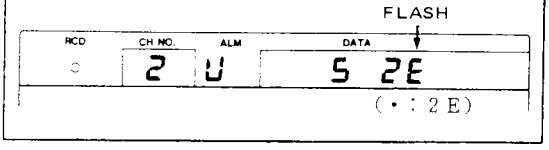


11 Press the ENT key to store "H".
(Now H is set as the 3rd character).

The 5th character set display appears.

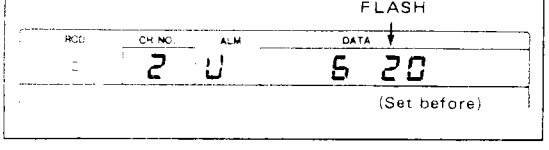


12 Select "·" (period).
As · : 2E (ASCII code),
press the keys 2, SHIFT and 5 in turn.

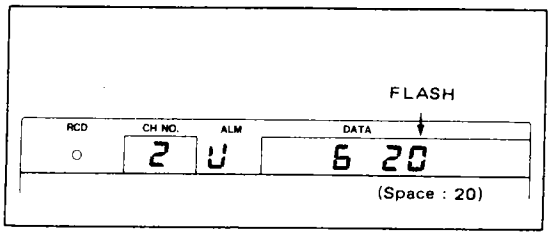


13 Press the ENT key to store "·".
(Now · is set as the 5th character).

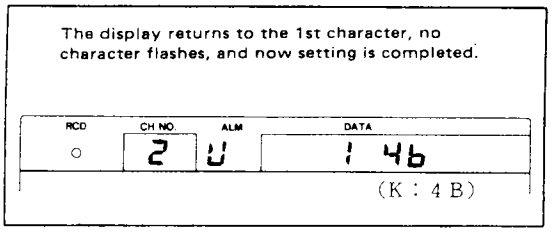
The 6th character set display appears.



14 Select "space".
As space: 20 (ASCII code),
press the keys [8/2] and [NAHR/0] in turn.



15 Press the [ENT] key to store "space".
(Now space is set as the 6th character).



Setting Completed

At this time, it can be confirmed by executing list printout whether the unit (UNIT) is set correctly to the desired measurement channel or not.

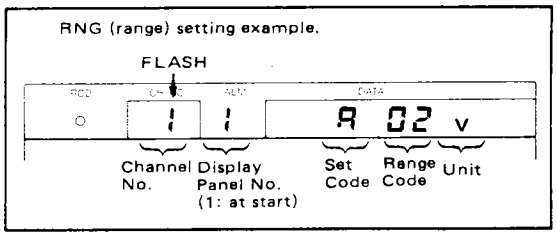
If data entry is invalid, refer to paragraph 5-4-9.

(7) Setting Method for Recording DC Voltage Differences.

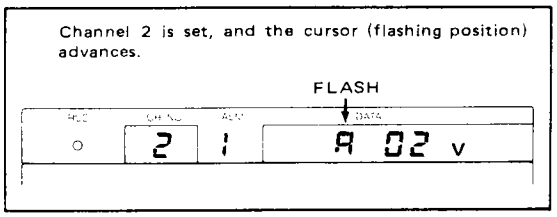
(Not available with Model 4151, 1-pen type recorder.)

For recording DC voltage/measurement differences (See Note 4.), proceed as follows.

1 Press the SET key as many times as necessary until the range code is displayed for setting.



2 Set the channel number.
Example: To select channel 2, press the 2 key.



Note 1: For a 2-pen model, this setting is only possible for channel number 2. (May not be possible depending on the model purchased.)
For a 3-pen model, this setting is possible for channel numbers 2 and 3. (May not be possible depending on the model purchased.)

Note 2: For recording a difference, a reference measurement must already be set on another channel.

Note 3: Make the value for the channel recording the difference larger than that of the reference channel. (See the table.)
For example, if channel number 2 is the reference channel, a recording difference cannot be set for channel number 1.

Note 4: For recording TC or RTD measurement/voltage differences follow steps (1) through (9). A combination of different inputs such as TC and RTD will not work.

Recording Difference Channel Number:

A: Reference channel number
B: Recording Difference Channel Number
○: Possible
×: Not possible

○ 2-pen type

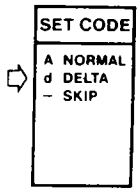
B \ A	1	2
1	×	×
2	○	×

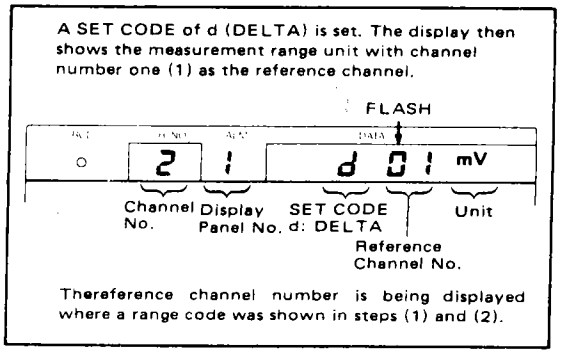
○ 3-pen type

B \ A	1	2	3
1	×	×	×
2	○	×	×
3	○	○	×

If data entry is invalid, refer to paragraph 5-4-9.

3 With d: DELTA, chosen from the SET CODE list, press the SHIFT and D/4 keys.

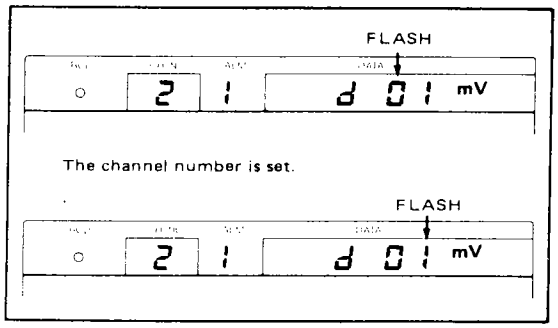




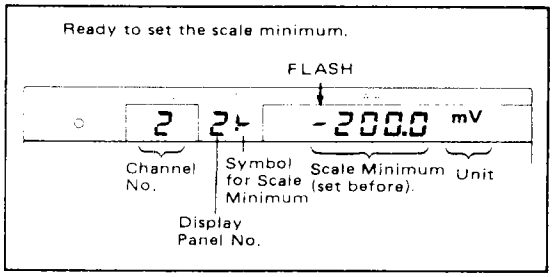
4 The display shows the unit of a measurement range with channel number 1 as the reference channel.
If d: DELTA was chosen in three 3, the setting condition for channel number one (1) is always displayed. (Both 2-pen and 3-pen types)
The example shows a DC voltage unit of mV. Assuming, for example, that channel number one (1) is the reference channel and recording difference is to be set for channel number two (2), the procedure is as follows.

Press 0, 1 keys.

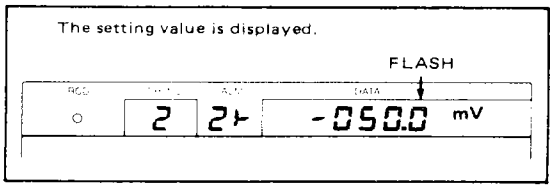
As the display shows channel number one (1) as the reference channel, this operation may seem unnecessary. However, be sure to do this in the sense that channel number one (1) is newly designated.



5 Press the ENT key to store the data.

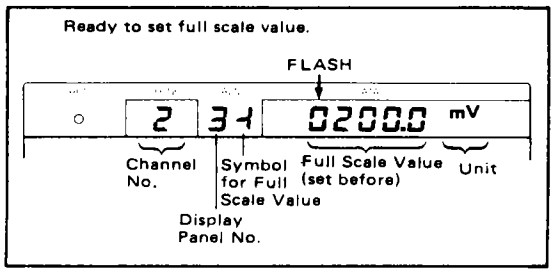


6 The span of difference for a measured voltage is set as follows. Set the scale minimum of the intended range using numeric keys.
Press –/–, 0, 5, 0 and 0 keys.

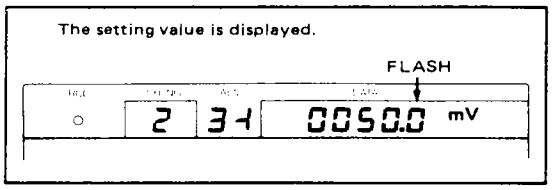


If data entry is invalid, refer to paragraph 5-4-9.

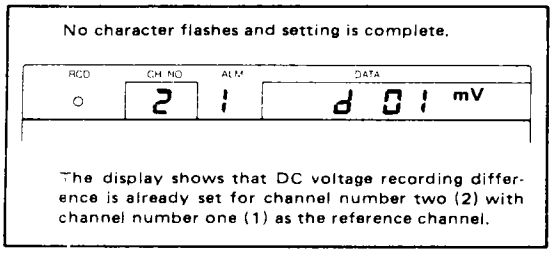
7 Press the ENT key to store the data.



8 Set the full scale value using the numeric keys.
Example: To set the full scale value (50 mV), press the NAH 0, NAH 0, E 5, NAH 0 and NAH 0 keys in turn.



9 Press the ENT key to store the data.
(Range setting completed.)



So far, by performing steps (1) through (9), the set data is as follows:

○ Recording DC voltage/measurement difference in relation to a reference value (measurement) set for channel number (1)

For recording TC or RTD measurement/voltage difference , follow the above procedure. (When recording measurement differences, do not combine different inputs such as TC and RTD.).

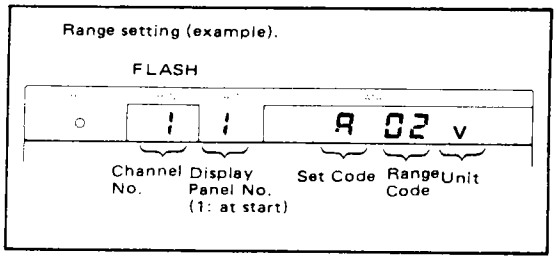
If data entry is invalid, refer to paragraph 5-4-9.

(8) Setting method for SKIP (when some channels are used).

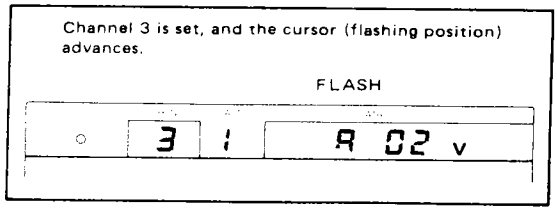
If any of the channels is not required for measurement, set "SKIP." (if "SKIP" is not set with the channel not being used, an unnecessary trace will be recorded on the chart, obstructing reading of other channels)

To set SKIP, proceed as follows:

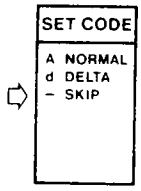
1 Press the SET key as many times as necessary until the range code is displayed for setting.

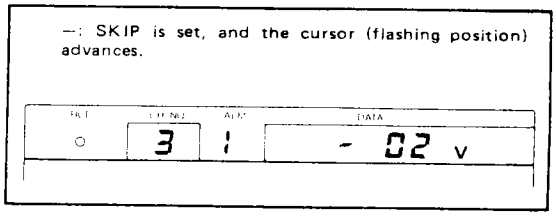


2 Set the desired channel number.
Example: To select channel 3, press the 3 key.



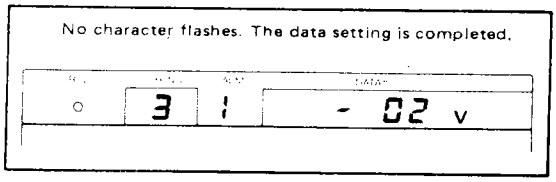
3 Select –: SKIP from the SET CODE list. Press OFF or – key.





4 Press the ENT key to set the channel SKIP.

Setting Completed.



○ It is recommended that you remove the felt-tip pen of the channel which is set as the SKIP channel.

If data entry is invalid, refer to paragraph 5-4-9.

5-4-7. Alarm Setting.

The procedure for setting alarms is explained below (if alarm setting is not required, omit this setting).

For each absolute value and difference recording, up to four alarm points per channel may be set.

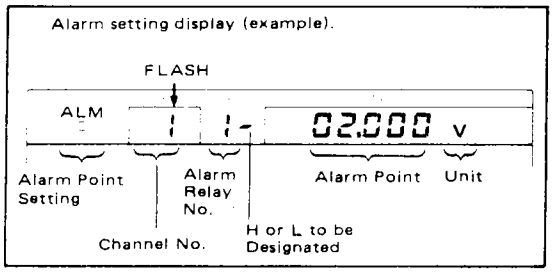
When an alarm point is set, if the measured value passes this point, the recorder displays "ALM" and performs alarm printout on the chart simultaneously (see the alarm printout example on page 2-10). Further, using the alarm output relay /AK-04*-1 (optional), alarm signal output at alarm ON is available, and by combining the /AK-04 with /REM (optional), the recorder chart feed speed can be changed when alarm turns ON*-2.

*-1: See page 2-7.
*-2: See pages 2-6, 2-10, 5-15.

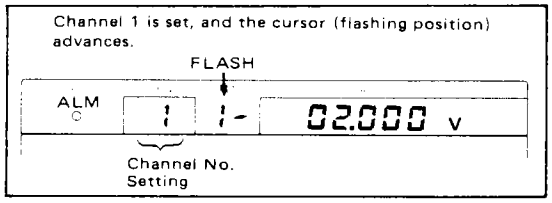
Alarm setting procedure for absolute value recording.

To set alarms, proceed as follows:

1 Press the SET key as many times as necessary until the alarm is displayed.

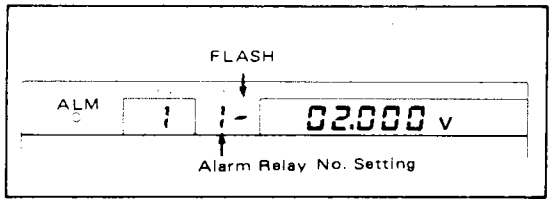


2 Set the channel number.
Example: To select channel 1, press the ▲ 1 key.



3 To set the first alarm point (i.e. alarm relay number), press the ▲ 1 key.

Note 1: Up to 4 alarm points can be set per channel.
Note 2: The above setting may start with other than "1".

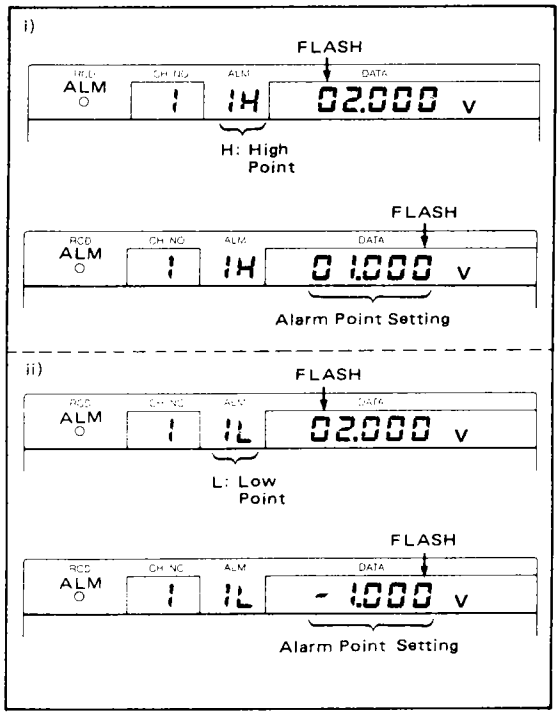


If data entry is invalid, refer to paragraph 5-4-9.

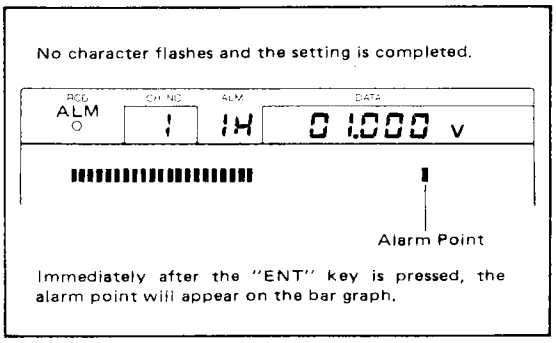
4 Assume for example, that a measurement range of −2 to 2V (RNG code: 02) is already set for channel number one (1).

i) To set a high alarm point (H) of 1V, press the SHIFT and 7 (H) keys, and then enter 0, 1, 0, 0, and 0

ii) Similarly, to set a low point alarm (L) of −1V, press the SHIFT and 8 (L) keys, followed by, −/−, 1, 0, 0, and 0



5 Press the ENT key to store the data.



For setting another alarm point, return to Step 2 above and designate the channel number again (See Note.). Then in 3 above, set the second alarm point (i.e. setting of another alarm relay number).

Repeat Steps 4 and 5 for setting the second alarm point. The 3rd and 4th alarm relay numbers are set in the same manner.

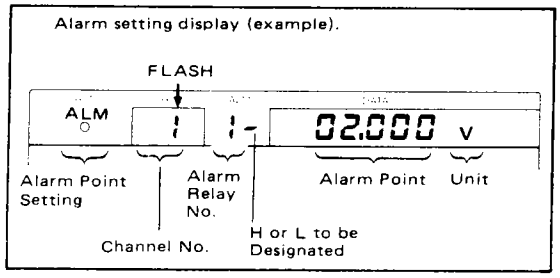
Note: It is possible to designate a new channel number here, and proceed to the setting of alarm points for the new channel.

If data entry is invalid, refer to paragraph 5-4-9.

Alarm setting for difference recording.

Proceed as follows.

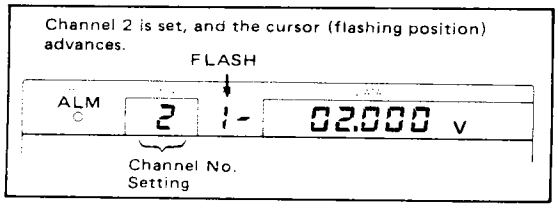
1 Press the SET key as many times as necessary until the alarm is displayed.



2 Set the channel number.

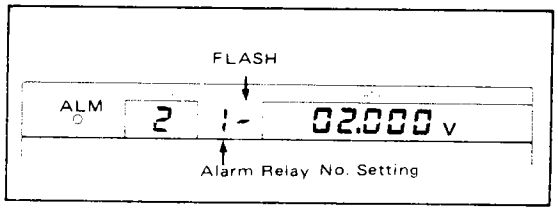
Note: It is assumed here that difference recording has already been set for the chosen channel number.

Example: To select channel 2 press the 2 key.



3 To set the alarm point (i.e. alarm relay number) for the first setting, press the 1 key.

Note 1: Up to 4 alarm points can be set per channel.
Note 2: The above setting may start with other than "1"

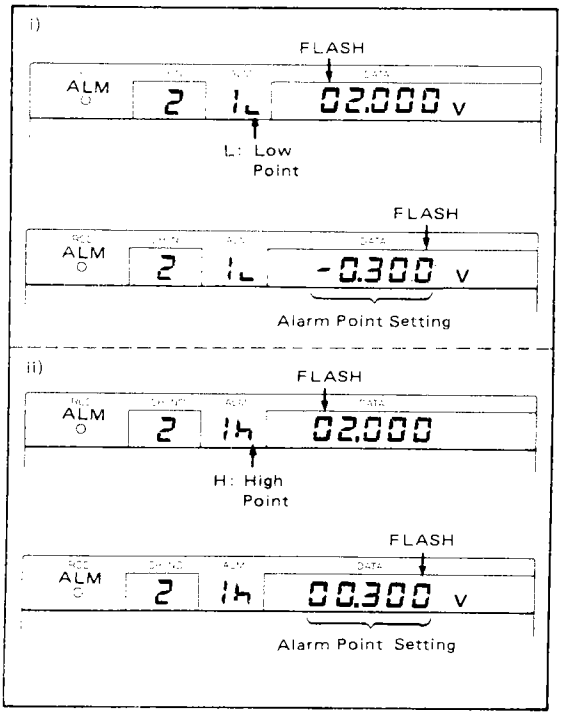


4 It is assumed here, as an example, that with channel number one (1) as its reference, channel number two (2) has been set as follows.

	Measurement range	Range	Recording method
CH. 1	−2 to 2V	0 to 1V	Absolute value recording
CH. 2	−2 to 2V	−0.5 to 0.5V	Difference recording

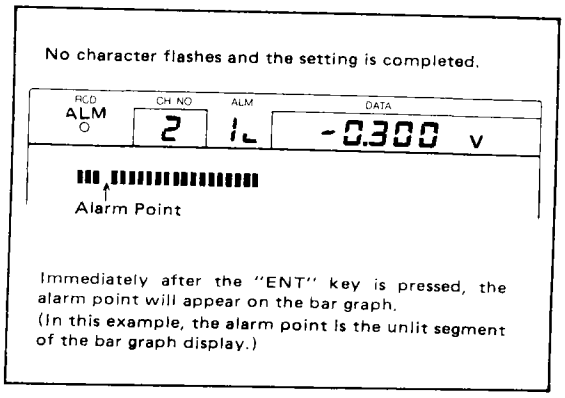
i) To set −0.3V as channel number two's low alarm point (L) recording difference, press the SHIFT and ◄ /(i.e. 1(L) for low) keys, and then enter −/1, 0, 3, 0 and 0.

ii) Similarly, to set a high alarm point (H) of 0.3V, press the SHIFT and 0 keys, followed by 0, 0, 3, 0 and 0.



If data entry is invalid, refer to paragraph 5-4-9.

5 Press the ENT key to store the data.



For setting another alarm point, return to Step 2 above and designate the channel number again (See Note.). Then in 3 above, set the second alarm point (i.e. setting of another alarm relay number).

Repeat Steps 4 and 5 for setting the second alarm point. The 3rd and 4th alarm relay numbers are set in the same manner.

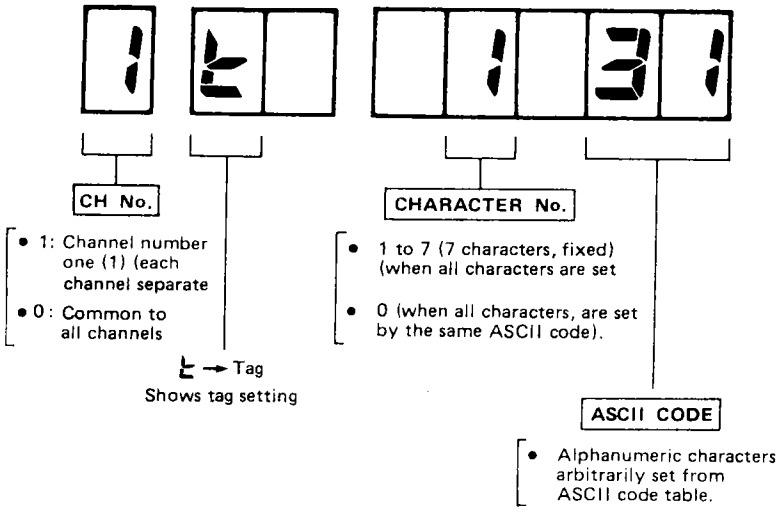
Note: It is possible to designate a new channel number here, and proceed to the setting of alarm points for the new channel.

If data entry is invalid, refer to paragraph 5-4-9.

5-4-8. Tag Setting.

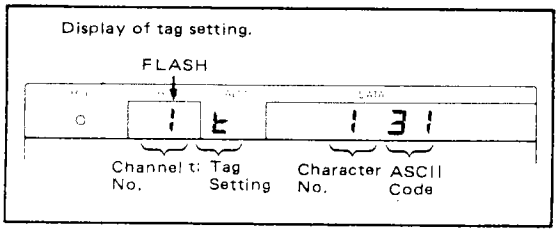
A tag is set to help identify the object being measured/recorded. A tag of 7 alphanumeric characters can be set for each channel.

Tag setting list

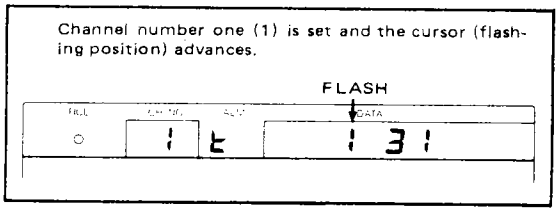


Proceed as follows.

1 Press the SET key as many times as necessary to display the tag setting.

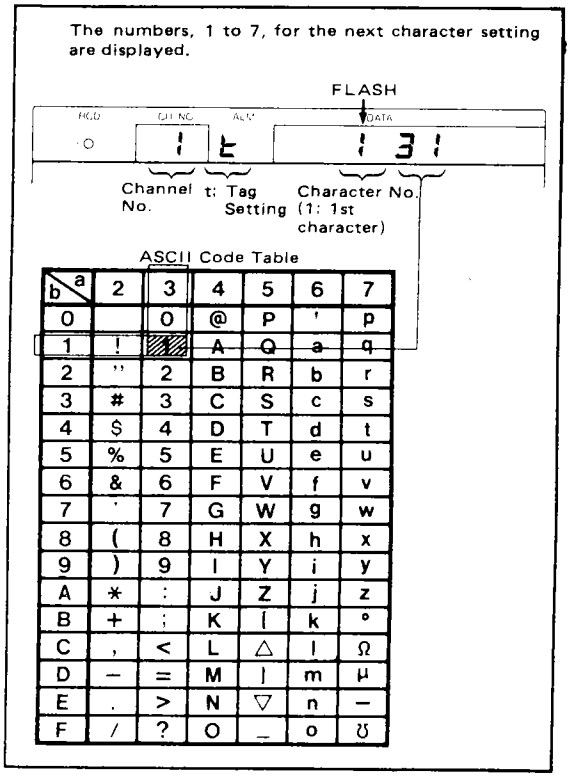


2 Set the channel number, using the numeric key for which tag is to be set.
Example: To set channel number 1, press the 1 key.



If data entry is invalid, refer to paragraph 5-4-9.

3 A tag is set by entering 7 alphanumeric characters. In the example the ASCII code "31" for the first character "1" is shown.
As required, set a new first character by entering an ASCII code and press the ENT key to store the new first character.
Then, the second (2nd) character (with a character number two (2) shown) will be displayed. Set a new second (2nd) character and press the ENT key. Proceed until all seven (7) characters are entered (by ASCII codes) and set.
An example of tag setting is given below.



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

If data entry is invalid, refer to paragraph 5-4-9.

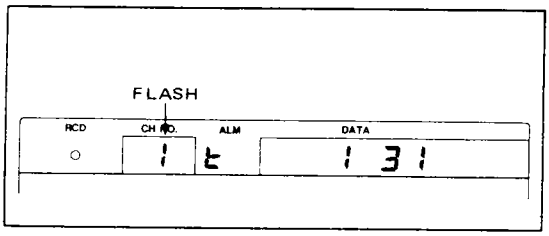
Tag (TAG) setting example.

This example shows the setting of the tag (TAG) STN-1A .

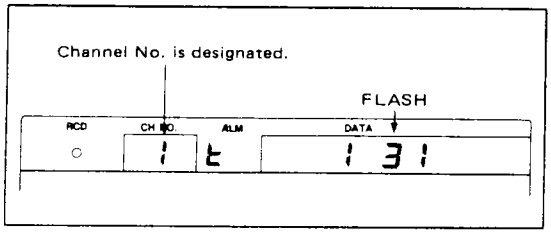
Set a tag by entering seven alphanumeric characters.

The tag example given above comprises six characters. In such a case, enter seven characters in total by adding a space (code 20).

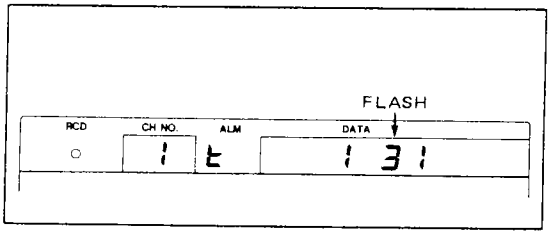
1 Press the SET key as many times as necessary to display the tag setting.



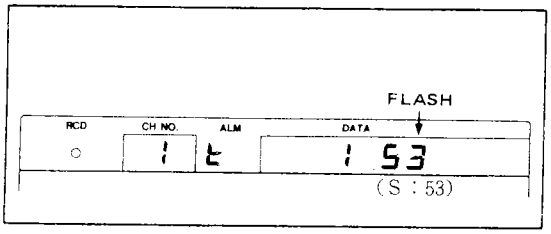
2 Use the numeric keys to set the channel number which is to be labelled with a tag number.
Example: To select channel No. 1, press the A/1 key.



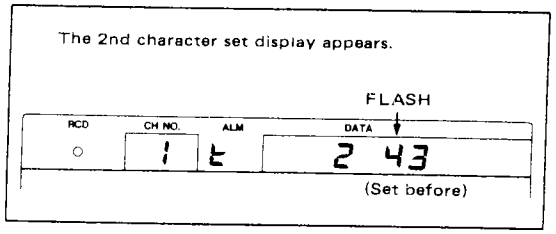
3 Select the 1st character, press the A/1 key.



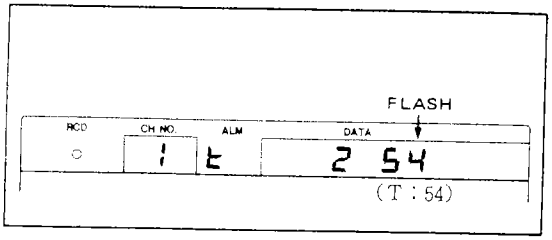
4 Select "S".
As S: 53 (ASCII code), press the E/5 and C/3 keys.



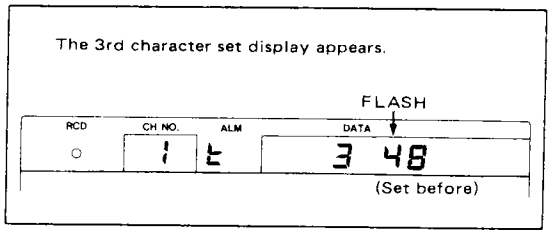
5 Press the ENT key to store "S".
*Now S is set as the 1st character).



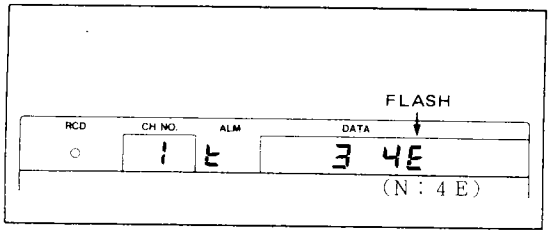
6 Select "T".
As T: 54 (ASCII code), press the E/5 and D/4 keys.



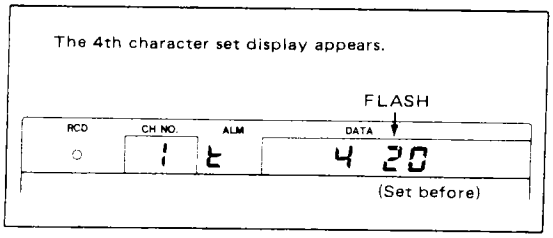
7 Press the ENT key to store "T".
(Now T is set as the 2nd character).



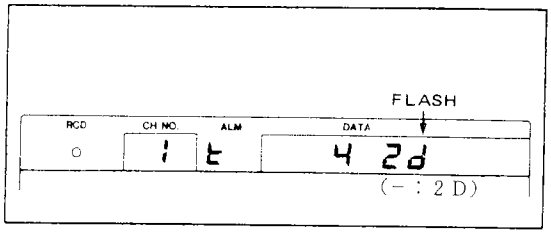
8 Select "N".
As N: 4E (ASCII code),
press the keys D/4, SHIFT and E/5 in turn.



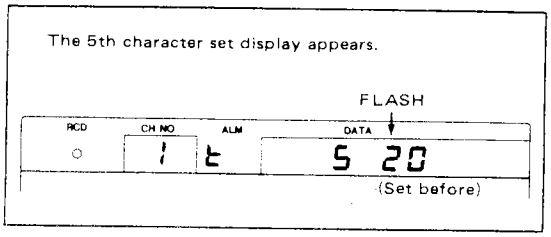
9 Press the ENT key to store "N".
(Now N is set as the 3rd character).



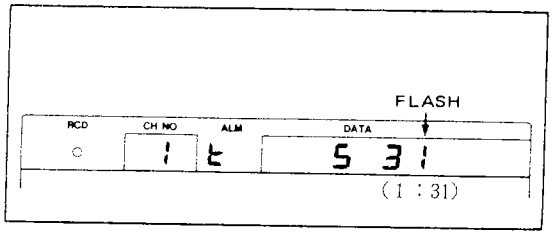
10 Select "-" (hyphen).
As -: 2D (ASCII code),
press the keys 2/B, SHIFT and D/4 in turn.



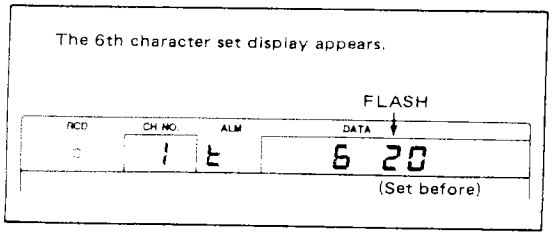
11 Press the ENT key to store "-".
(Now - is set as the 4th character).



12 Select "1".
As 1: 31 (ASCII code),
press the keys C/3 and A/1.

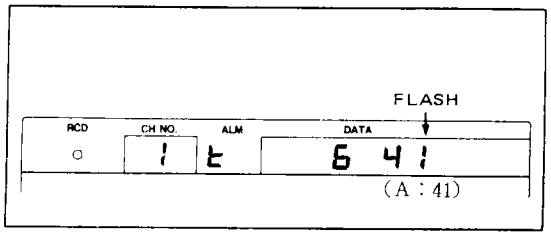


13 Press the ENT key to store "1".
(Now 1 is set as the 5th character).

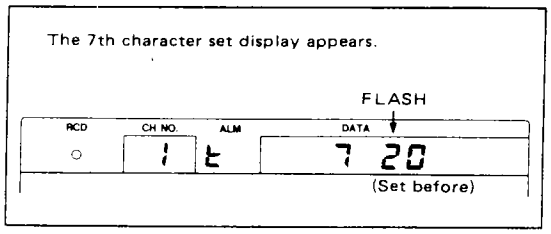


If data entry is invalid, refer to paragraph 5-4-9.

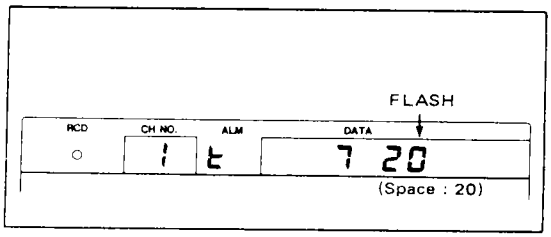
14 Select "A".
As A: 41 (ASCII codes),
press the keys [4] and [1].



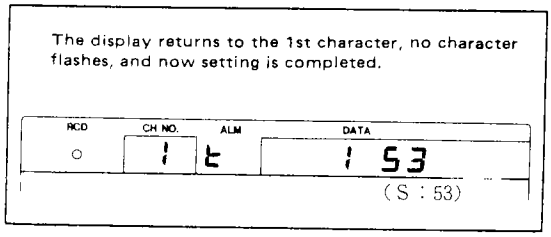
15 Press the [ENT] key to store "A".
(Now A is set as the 6th character).



16 Select "space".
As space: 20 (ASCII codes),
press the keys [2] and [0].



17 Press the [ENT] key to store "space".
(Now space is set as the 7th character).



Setting completed

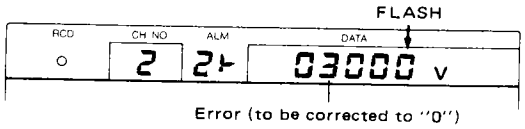
At this time, it can be confirmed by executing list printout whether the tag (TAG) is set correctly to the desired measurement channel or not.

If data entry is invalid, refer to paragraph 5-4-9.

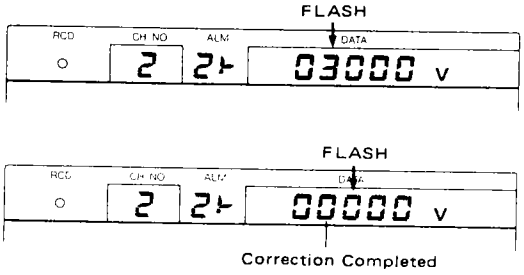
5-4-9. Incorrect Data Entry.

(1) If incorrect data has been displayed, but the [ENT] key has not been pressed, move the cursor (flashing position) to the incorrect data by pressing the [◄] or [►] key, correctly enter the data and then press the [ENT] key to store the new data.

Example: When 00.000 is correct.

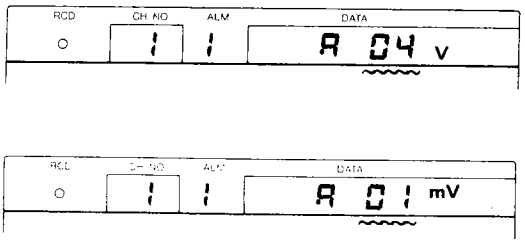


Press the [◄] key three times to position the cursor (flashing position) to the incorrect data ("3"). Correct the data by pressing the [0] key and then set the new data ("0") by pressing the [ENT] key.

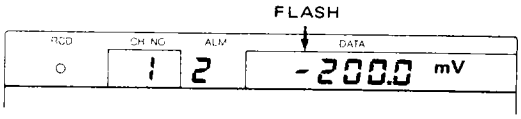


(2) If incorrect data has been entered and the [ENT] key was pressed (i.e. wrong data is already set), proceed as follows.

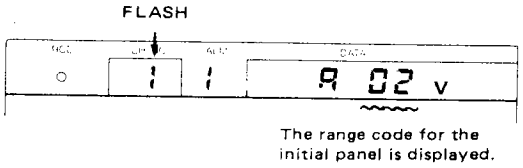
Example: For the setting of a range, code "01" (wrong) was set while the desired range code is "04".



Upon completion of the entry ("ENT") command, the display will show the range setting. (In this example, the code "01" was set and, so, the display is as shown below (i.e. range 01: −200 to 200 mV).



When the data to be corrected is not yet displayed, use the [SET] key to again call the initial display panel (for range setting in this example). (Repetitive "beep" sounds for incorrect key setting.)
Press the [SET] key (7 times for this example) and obtain the initial display panel (for range setting).



Position the cursor (flashing position) to the incorrect data using the [►] key, correctly enter the data, and then press the [ENT] key to set the new data.

5-5. Key Lock.

After the recorder setting has been completed, if the items set will not be required to be changed for a while, it is recommended that you lock the recorder with a key to prevent the set items from being changed by mistake. Insert the key supplied with the recorder in the keyhole on the recorder side panel and turn it clockwise to "lock" (POWER Switch may be turned "ON" or "OFF". However, when the power switch is turned "OFF", the memory backup using batteries is required).

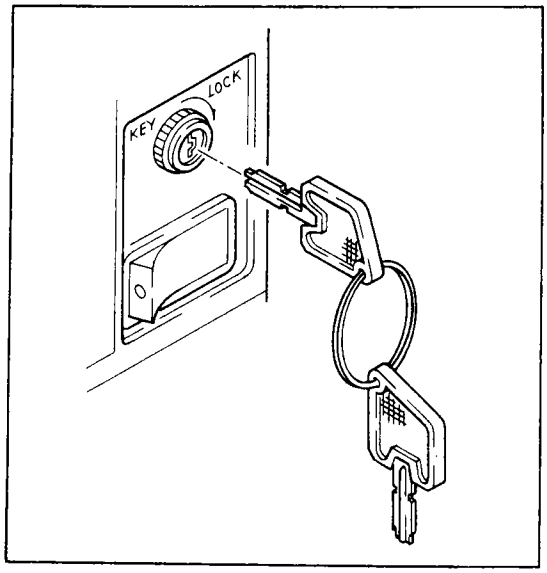


Figure 5-24.

After key lock, the  key is still effective.*

* After key lock, selection of measurement data Auto/manual display, and check for date and time are still available, but chart feed start/stop operation via the keyboard is disabled. In this case key Lock must be released.
However, the chart feed by REM (remote) control signal over rides the keyboard setting, so chart feed start/stop operation is available even in key lock state (/REM option is required).

CAUTION

After operating key lock, remove the key and keep it in a safe place.
If it is lost, setting cannot be changed.

6. MAINTENANCE.

6-1. Periodic Maintenance.

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

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

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

*1 If any blurred or broken sections are found, replace the relevant felt-tip pen or plotter pen. Refer to "paragraph 5-1-2 Felt-tip pen replacement" or "paragraph 5-1-3 Digital printout plotter pen replacement" for replacing pens.

*2 The numerals showing remaining chart paper length are printed on the chart left side margin at intervals of 20 centimeters (see Figure 6-1). When the internal assembly is pulled out, there is a window – through which you can see remaining chart in the chart paper compartment – on the left side panel of the internal assembly (see Figure 6-2).

Check these portions described above to estimate when chart replacement is due. Refer to "paragraph 5-1-1 Loading Chart Paper" for replacement method.

*3 If "BAT" is displayed, replace the batteries immediately. Refer to "paragraph 5-1-4 Battery Replacement" for replacement method.

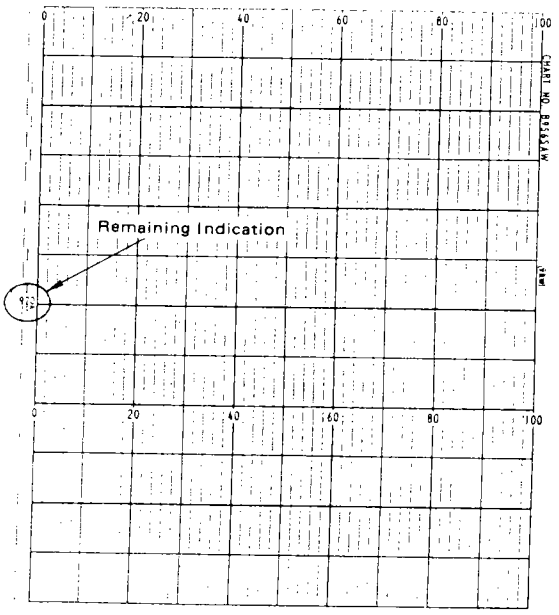


Figure 6-1. Chart Paper.

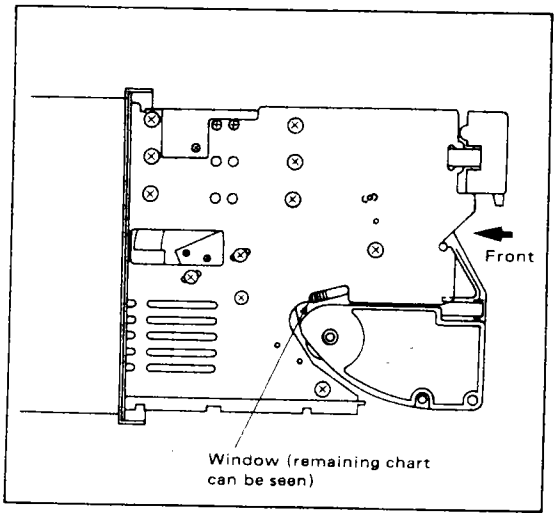


Figure 6-2. Remaining Chart Paper Check.

6-2. Parts Replacement.

6-2-1. Fuse Replacement.

Replace the fuse at least once every two years for preventive maintenance.

(1) Pull out the internal assembly (be sure to use the handle) and turn the power supply switch "OFF" (see Figure 6-3).

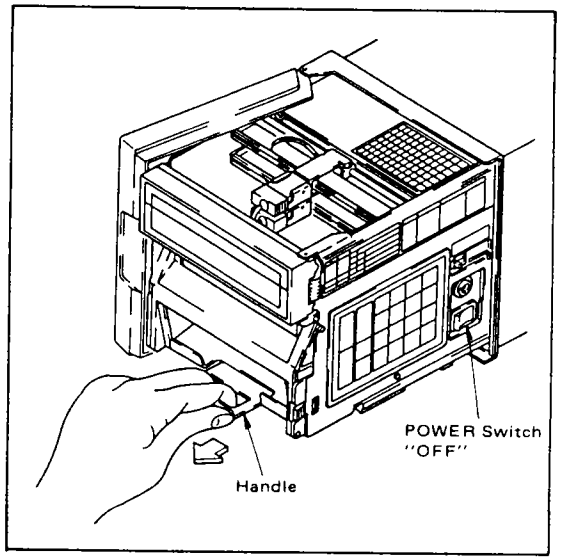


Figure 6-3. Handle.

(2) The fuse is mounted on the recorder rear panel (see Figure 6-4).
Turn the knob of the fuse holder counterclockwise, and the holder will slide out with the fuse (see Figure 6-5).

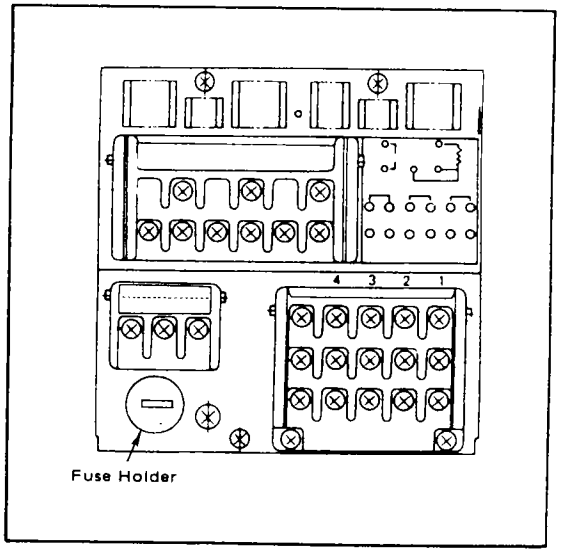


Figure 6-4.

(3) Make sure that the new fuse rating is correct, and mount the fuse by turning the knob clockwise (see Figure 6-5).

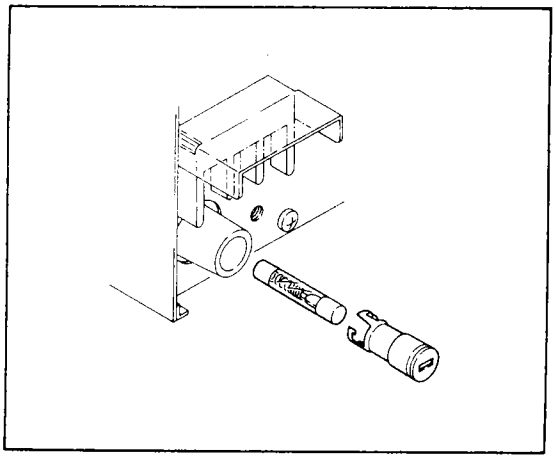


Figure 6-5.

6-3. Calibration.

6-3-1. Calibration Instruments Required.

With the recorder calibration, the following calibration instruments with necessary accuracies are required. For example, calibration instruments are as follows:

DC Voltage Standard: YOKOGAWA Model 2552 or equivalent.

Decade Resistance Box: YOKOGAWA Model 2793-01 or equivalent.

(When ordering the calibration instruments, contact the dealer from whom the recorder was purchased.)

6-3-2. Calibration Procedure.

(1) Connect calibration instrument to the input terminals as shown in Figures 6-6 to 6-8 and allow the instrument to warm up thoroughly.*

(2) Check that the ambient temperature and humidity are within the normal operating conditions (see Normal Operating Conditions on page 2-5).

(3) Apply input corresponding to 0, 50 and 100 percentage points on entered setting range, and calculate errors from reading on the recording chart.

Note) For a TC input, it is necessary to measure the temperature of the input terminals, and add a voltage corresponding to the reference temperature.
If the error at any point is outside the accuracy limits, adjust the recorder according to "Section 6-4 Adjustment".
* Warmup time necessary for the μR100 recorder is at least 30 minutes.

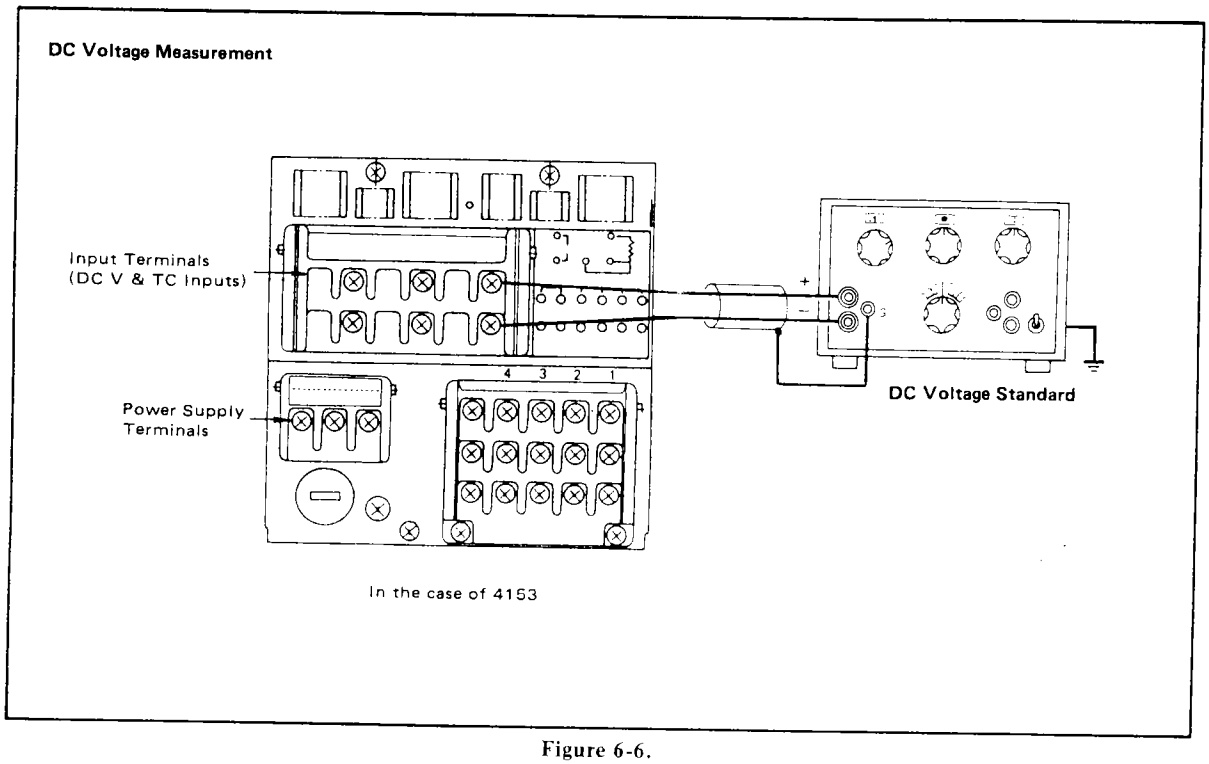


Figure 6-6.

Temperature Measurement Using RTD

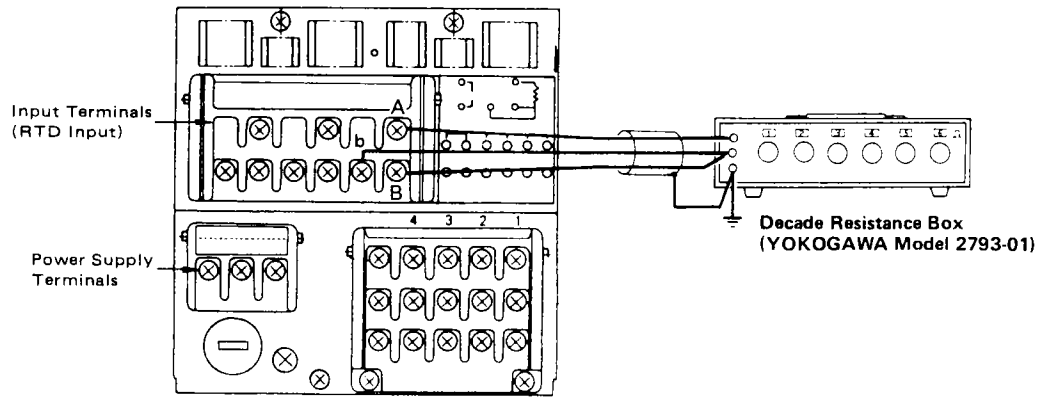
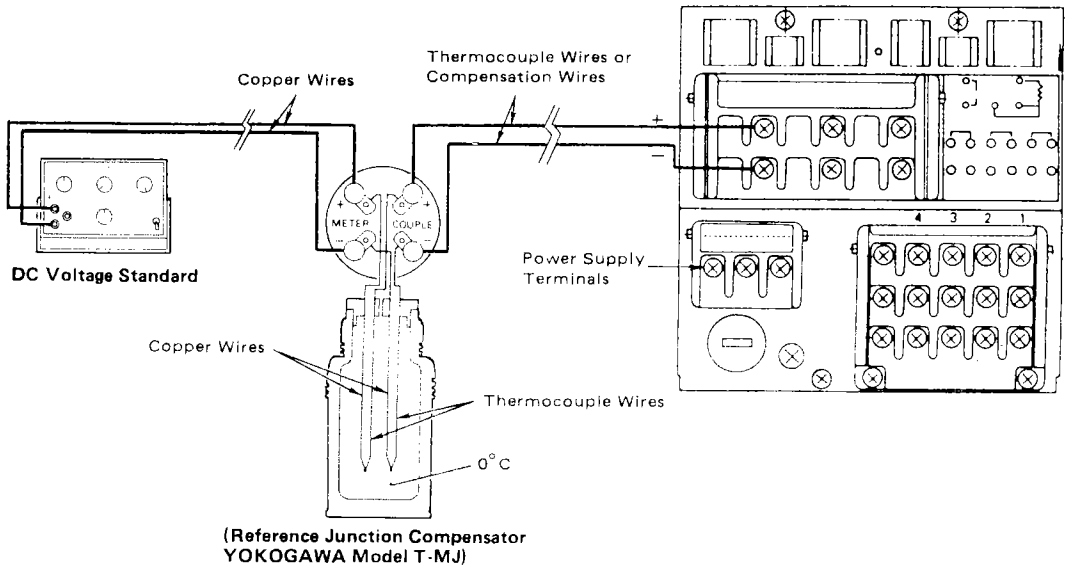


Figure 6-7.

Temperature Measurement Using TC



Reference Junction Compensation for Thermocouple Input

As the temperature of the recorder measurement terminal section is generally equal to the room temperature, a voltage is applied to inside the circuit so that equivalent 0°C is obtained. Therefore, when the measurement terminals are shorted (equivalent to 0°C at detector tip in the reference table) the room temperature (temperature of measurement terminals) is displayed. When calibrating the recorder, the input voltage subtracting compensation voltage should be applied (various methods are available for calibration. For example, use the YOKOGAWA Model T-MJ reference Junction compensator shown above).

Figure 6-8.

6-4. Adjustment.

(With the same wiring as in Section 6-3 Calibration, allow the instrument to warm up thoroughly.

Proceed as follows:

(1) Recorder front door removal.
Open the recorder front door by inserting fingertips into the recessed area on the right side near the front and pull outward.
While inserting a pointed tip (like a pen tip) into the shaft hole of the door, move the door to remove it. Be careful not to drop the door when it is removed.

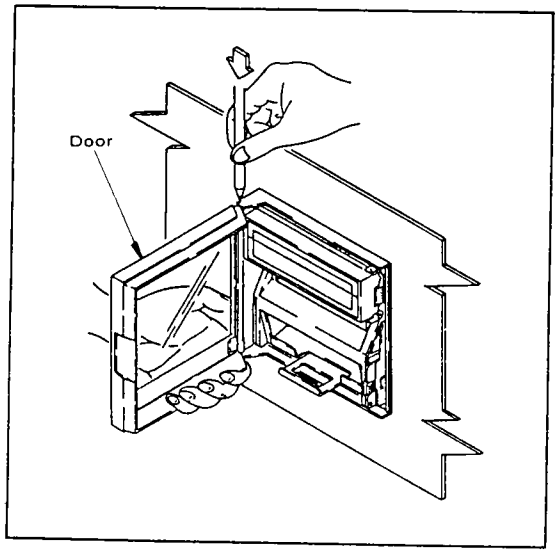


Figure 6-9.

(2) Pull out the internal assembly as far as possible.
(To pull out the internal assembly, be sure to use the internal assembly handle as shown in Figure 6-10).

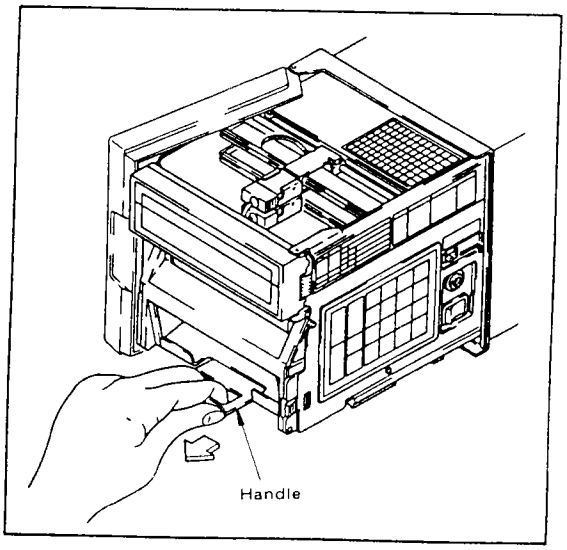


Figure 6-10.

(3) Turn the POWER switch ON.

(4) With the input applied, adjust the zero and span adjustments using a jewellers' screwdriver (see Figure 6-11).
The zero and span adjustments are located on the left side panel of the internal assembly (see Figure 6-12).

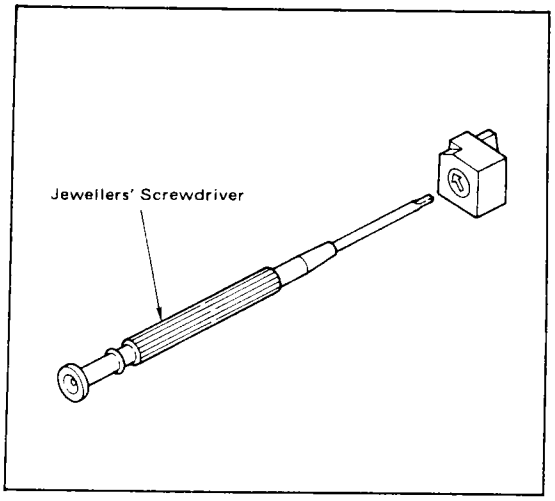


Figure 6-11.

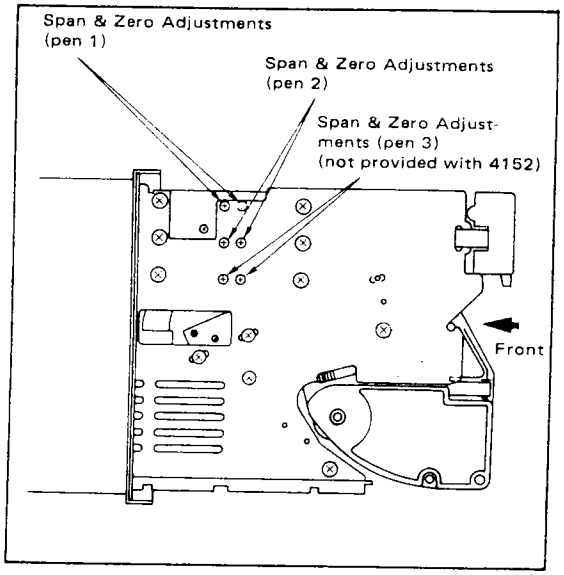


Figure 6-12.

(a) Zero adjustment.
Adjust the zero adjustment with a jewellers' screwdriver so that when an input corresponding to 0% of recording span is applied, the recording result indicates 0%. (Note that the 100% point will be moved by the same amount as the zero was shifted.)

(b) Span adjustment.
Adjust the span with a jewellers screwdriver so that when an input corresponding to 100% of recording span is applied, the recording result indicates 100%. (Note that the zero point is slightly affected by span adjustment.)
Repeat (a) and (b) until the error falls within tolerance for inputs of both 0% and 100%.

(5) Apply inputs of 0, 50 and 100% in increasing order (i.e. 0 to 100%) and, then in decreasing order (i.e. 100 to 0%) for each channel. Check error at each input value and make sure that the error falls within tolerance limits.

6-5. Power Supply Frequency.

Power supply frequency may be selected with a DIP switch (the location and shape of the DIP switch differ between 1-pen model and 2- and 3-pen models as shown in Figures 6-13 and 6-14).

Before switching frequency, turn the POWER switch OFF.*

* Power supply frequency cannot be changed with the POWER switch turned "ON".

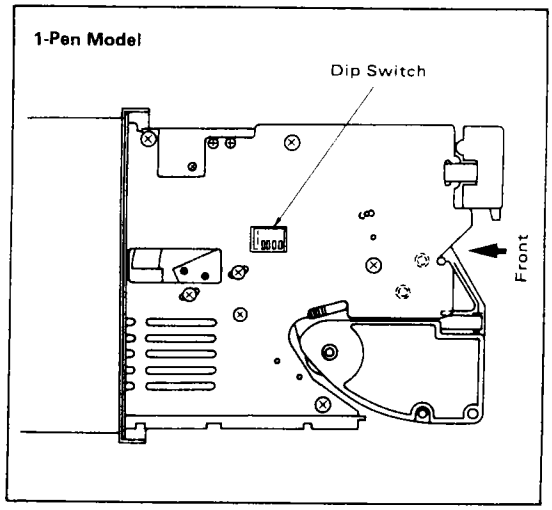


Figure 6-13.

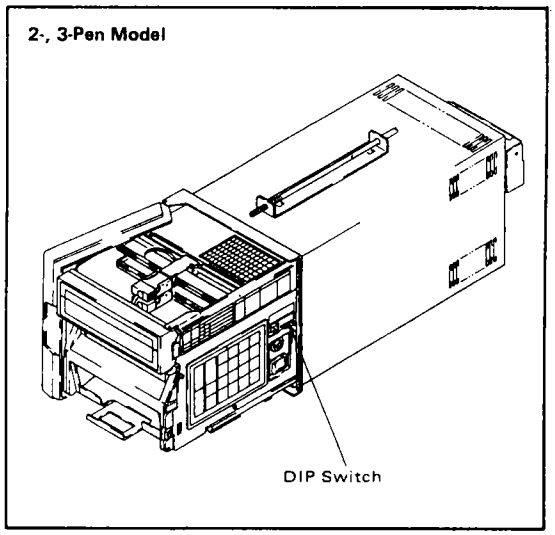


Figure 6-14.

(a) With the 1-pen model, first the recorder front door should be removed.
Open the recorder front door by inserting fingertips into the recessed area on the right side near the front and pull outward.
While inserting a pointed tip (like a pen tip) into the shaft hole of the door, move the door to remove it. Be careful not to drop the door when it is removed (see Figure 6-15).

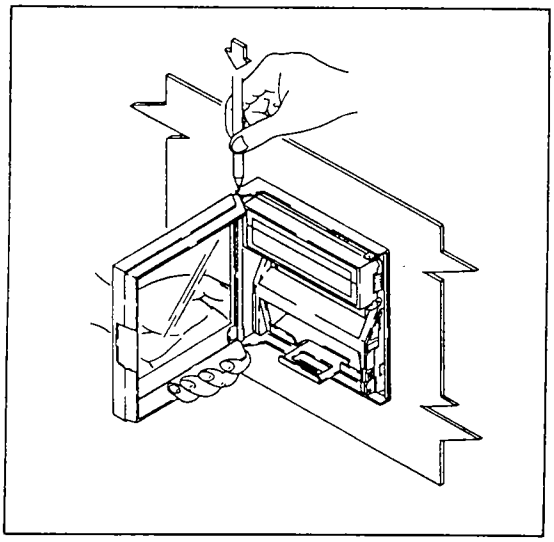


Figure 6-15.

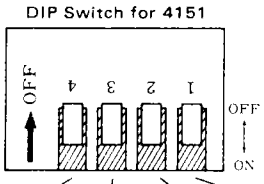
A four pole type DIP switch is provided with the 1-pen model (see Figure 6-16).
When the No. 1 switch is set to the ON position, a power frequency of 50 Hz is selected, and when it is set to the OFF position a power frequency of 60 Hz is selected.

(b) A six pole type DIP switch is provided with the 2- and 3-pen models (see Figure 6-17).
When the No. 1 switch is set to the ON position, a power frequency of 50 Hz is selected, and when it is set to the OFF position, a power frequency of 60 Hz is selected.

The functions of each DIP switch are shown in Figures 6-16 and 6-17. When the DIP switch is to be changed, be sure to turn the POWER switch "OFF". When the POWER switch is turned "ON", the DIP switch cannot be changed (with switching between RTD and mV/TC, the measurement terminals must be rewired, so switching of RTD and mV/TC cannot be performed only by operating the DIP switch).

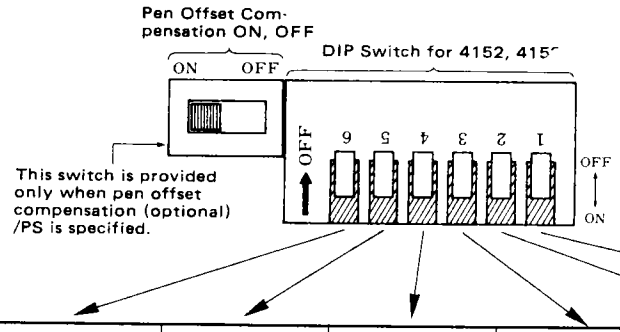
CAUTION

When changing the DIP switch, do not change switches other than the No. 1 switch, otherwise, the measurement and recording data entered (stored according to section 5-4 on) may be erased.



Switch	4	3	2	1
ON	RTD	TEST	°F	50 Hz
OFF	mV/TC	NORMAL	°C	60 Hz
Function	Input type	Operating mode selection	Unit for temperature measurement	Power frequency selection
When Shipping	ON when suffix code A is 2, 4, 6, or 8 and OFF when suffix code A is 1, 3, 5 or 7	OFF	ON when suffix code A is 5 or 6 and OFF when suffix code A is 1, 2, 3, 4 or 7 or 8	ON when suffix code D is 50 and OFF when suffix code D is 60

Figure 6-16.



Switch	6	5	4	3	2	1
ON	#3 RTD	#2 RTD	#1 RTD	TEST	°F	50 Hz
OFF	mV/TC	mV/TC	mV/TC	NORMAL	°C	60 Hz
Function	Input type for channel 3	Input type for channel 2	Input tupe for channel 1	Operating mode selection	Unit for temperature measurement	Power frequency selection
When Shipping	ON when suffix code C is 2, 4, 6 or 8 and OFF when suffix code C is 1, 3, 5 or 7	ON when suffix code B is 2, 4, 6 or 8 and OFF when suffix code B is 1, 3, 5 or 7	ON when suffix code A is 2, 4, 6 or 8 and OFF when suffix code A is 1, 3, 5 or 7	OFF	ON when all suffix code A B C are 5 or 6 and OFF when all suffix codes A B C are 1, 2, 3, 4 or 7, 8	ON when suffix code D is 50 and OFF when suffix code D is 60

Figure 6-17.

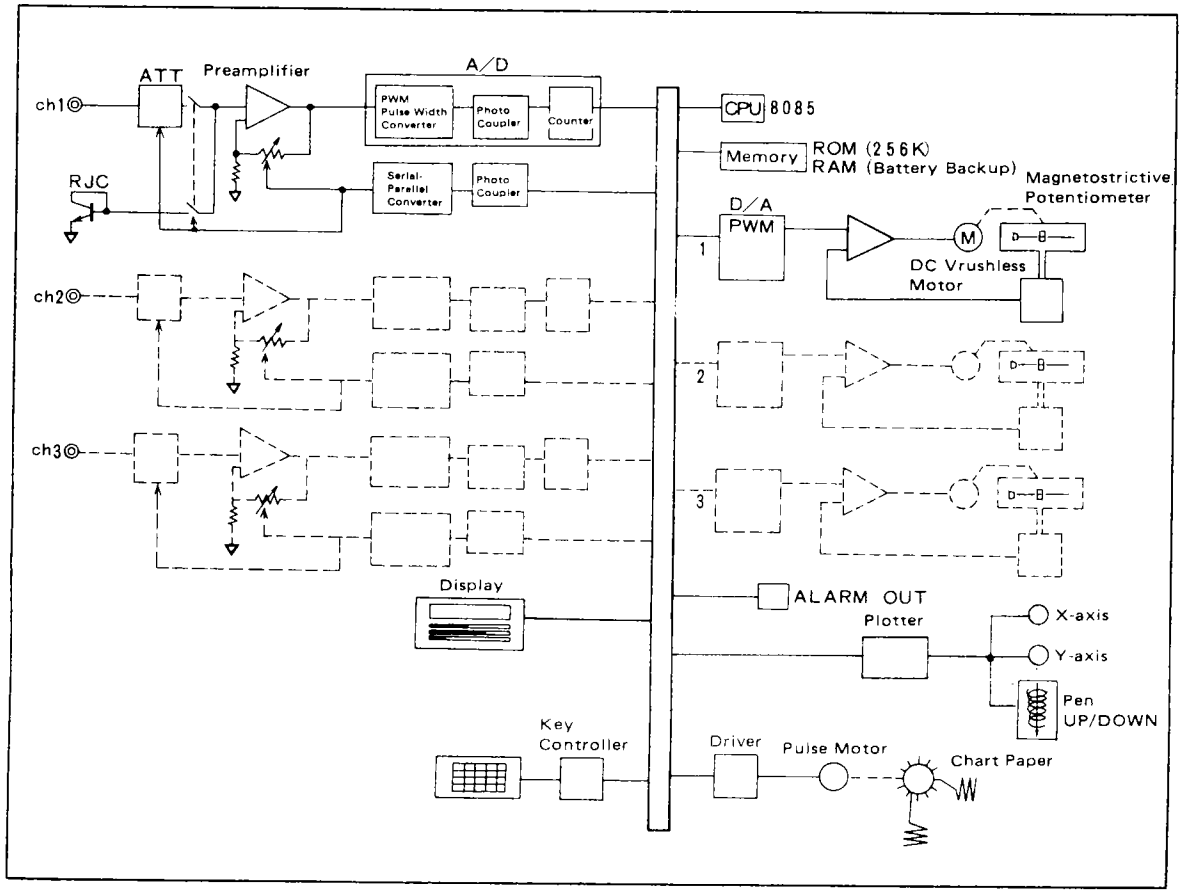
7. TROUBLESHOOTING.

When the recorder fails to operate properly, observe the fault conditions carefully, follow the troubleshooting flow sequence given in Section 7-2, and find a suitable remedy for the problem.

To further understand unusual phenomena which might occur, Section 7-1, describes recorder operating principles (block diagram).

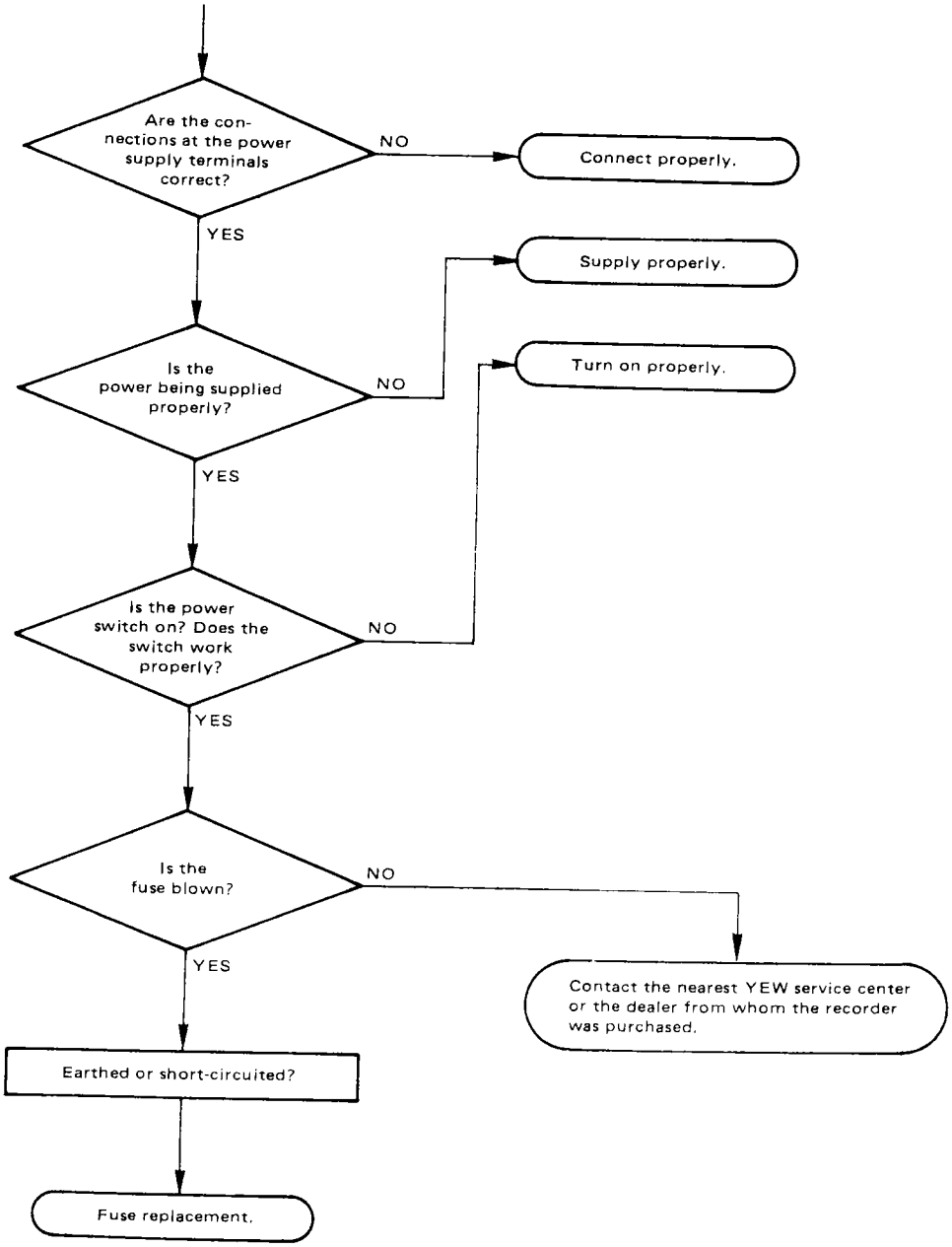
However, if a complicated problem does occur, please contact the dealer from whom the recorder was purchased or the nearest YOKOGAWA service center.

7-1. Block Diagram.

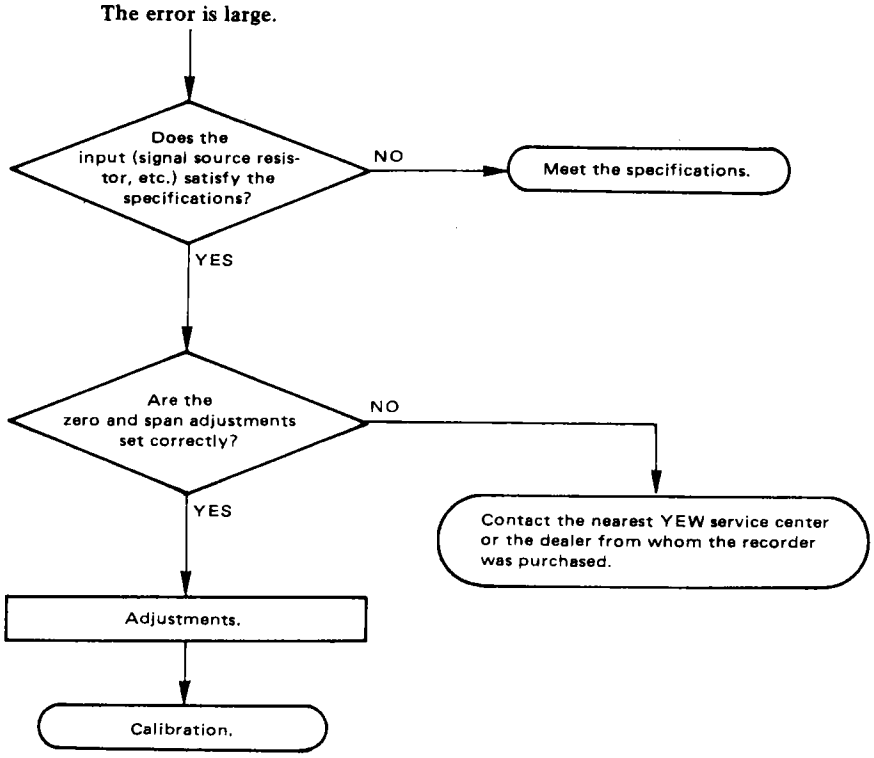


7-2. Troubleshooting Flow Sequence.

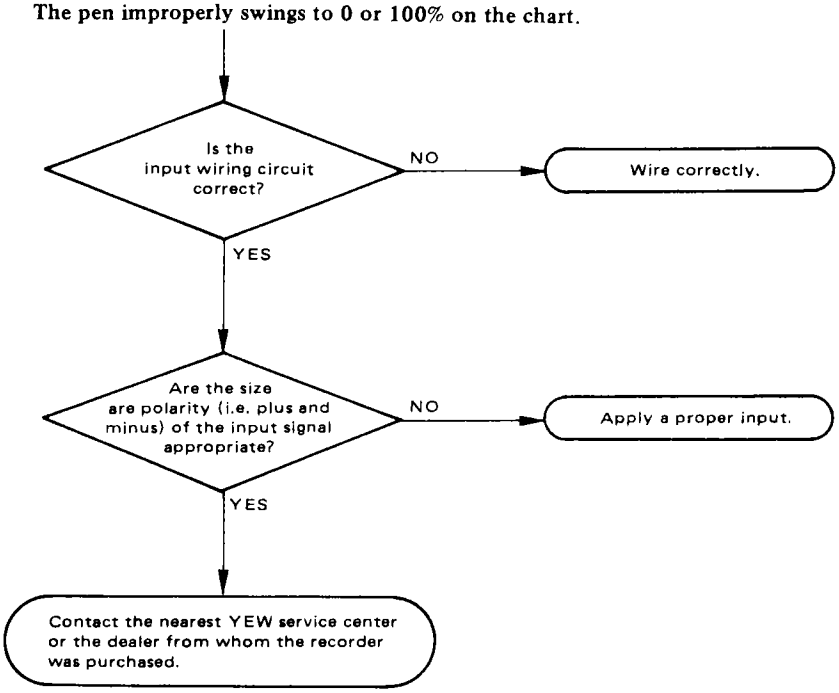
Neither the pen nor the chart moves.



The error is large.



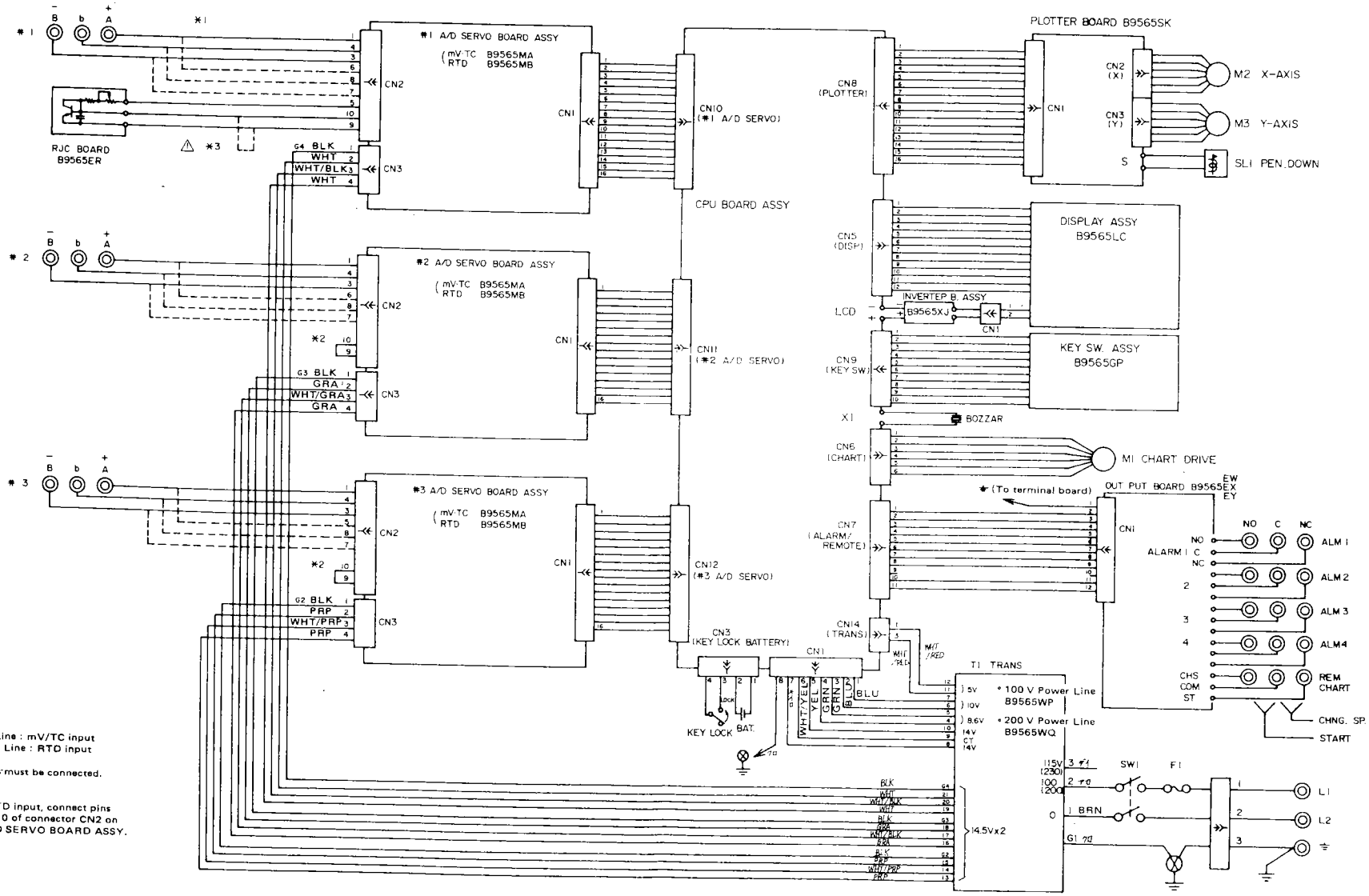
The pen improperly swings to 0 or 100% on the chart.



9. SCHEMATIC DIAGRAMS AND ELECTRONIC PARTS LISTS.

9-1. Wiring Diagrams .

- Wiring Diagram (4153 & 4152).

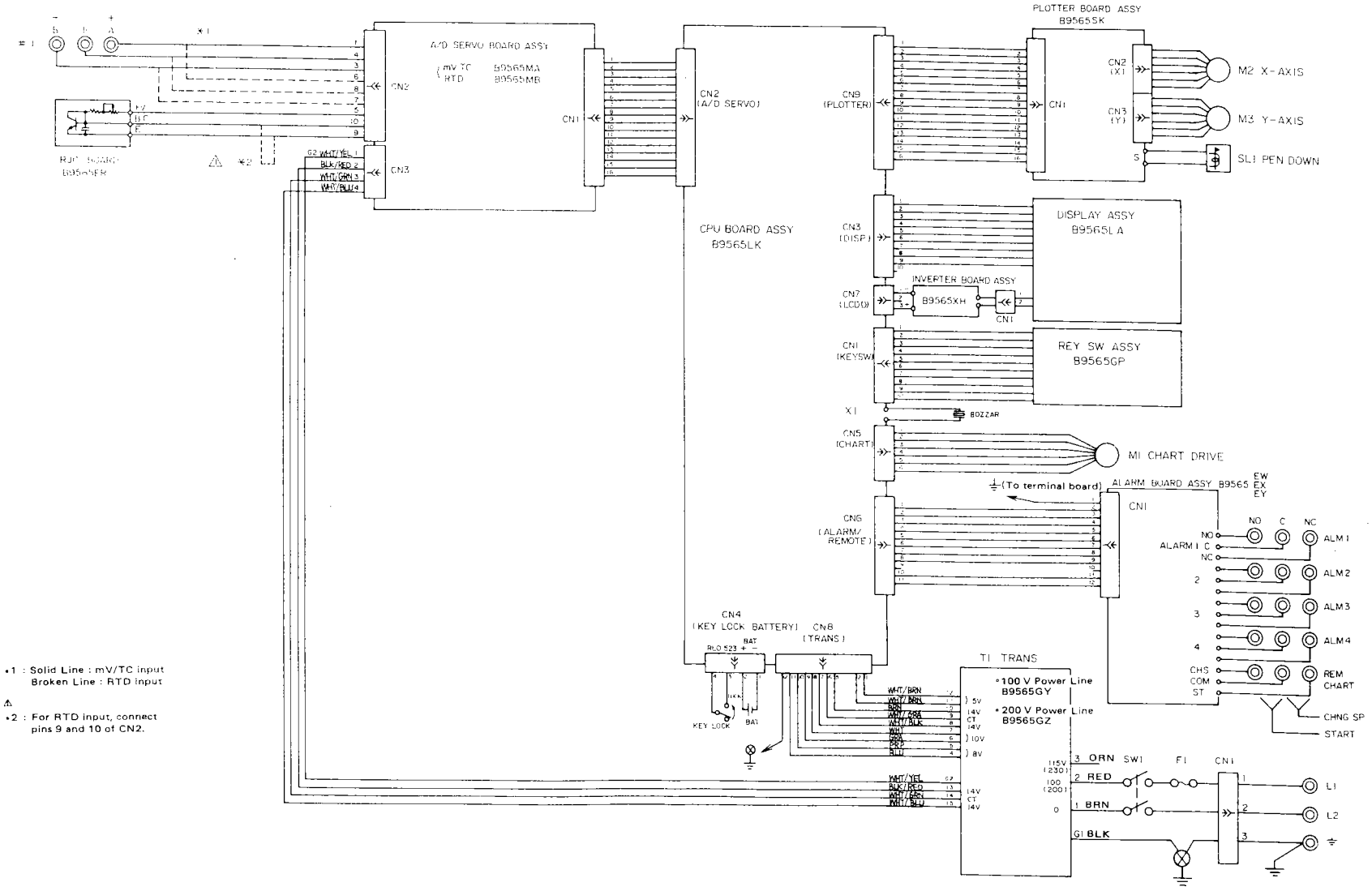


*1 : Solid Line : mV/TC input
Broken Line : RTD input

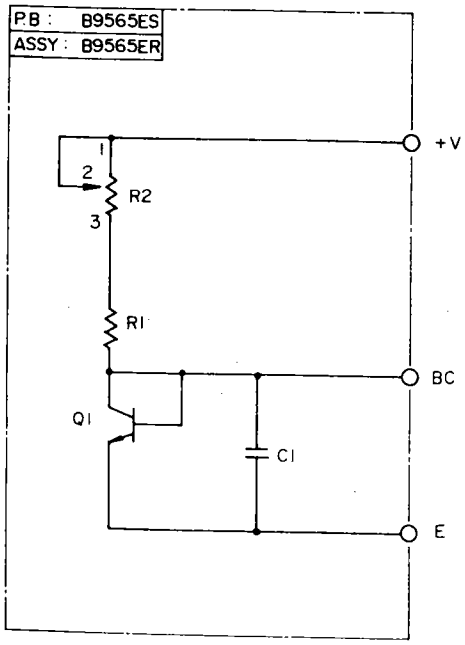
*2 : Always must be connected.

⚠
*3 : For RTD input, connect pins 9 and 10 of connector CN2 on #1 A/D SERVO BOARD ASSY.

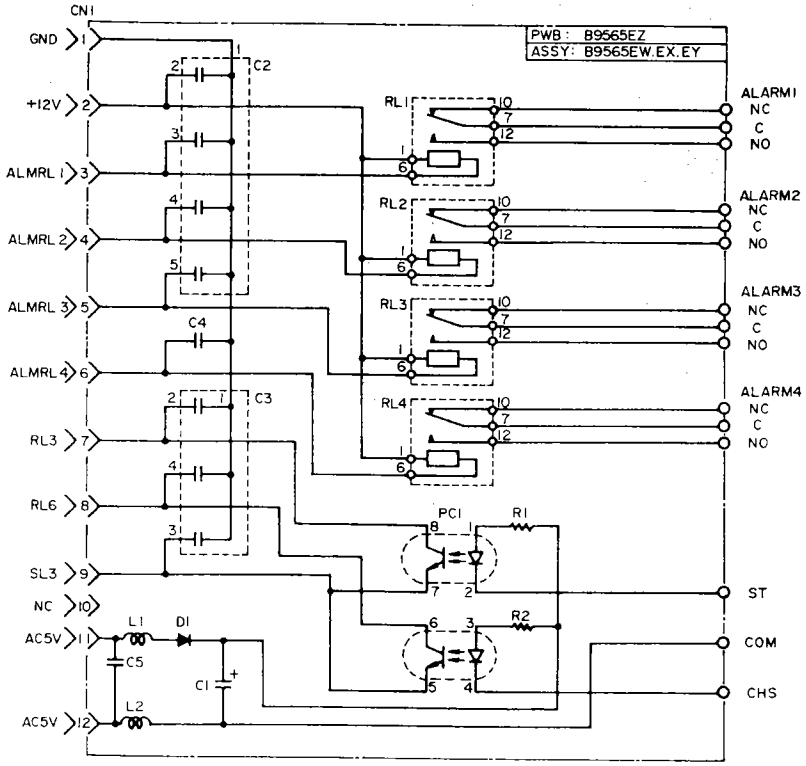
- Wiring Diagram (4151).



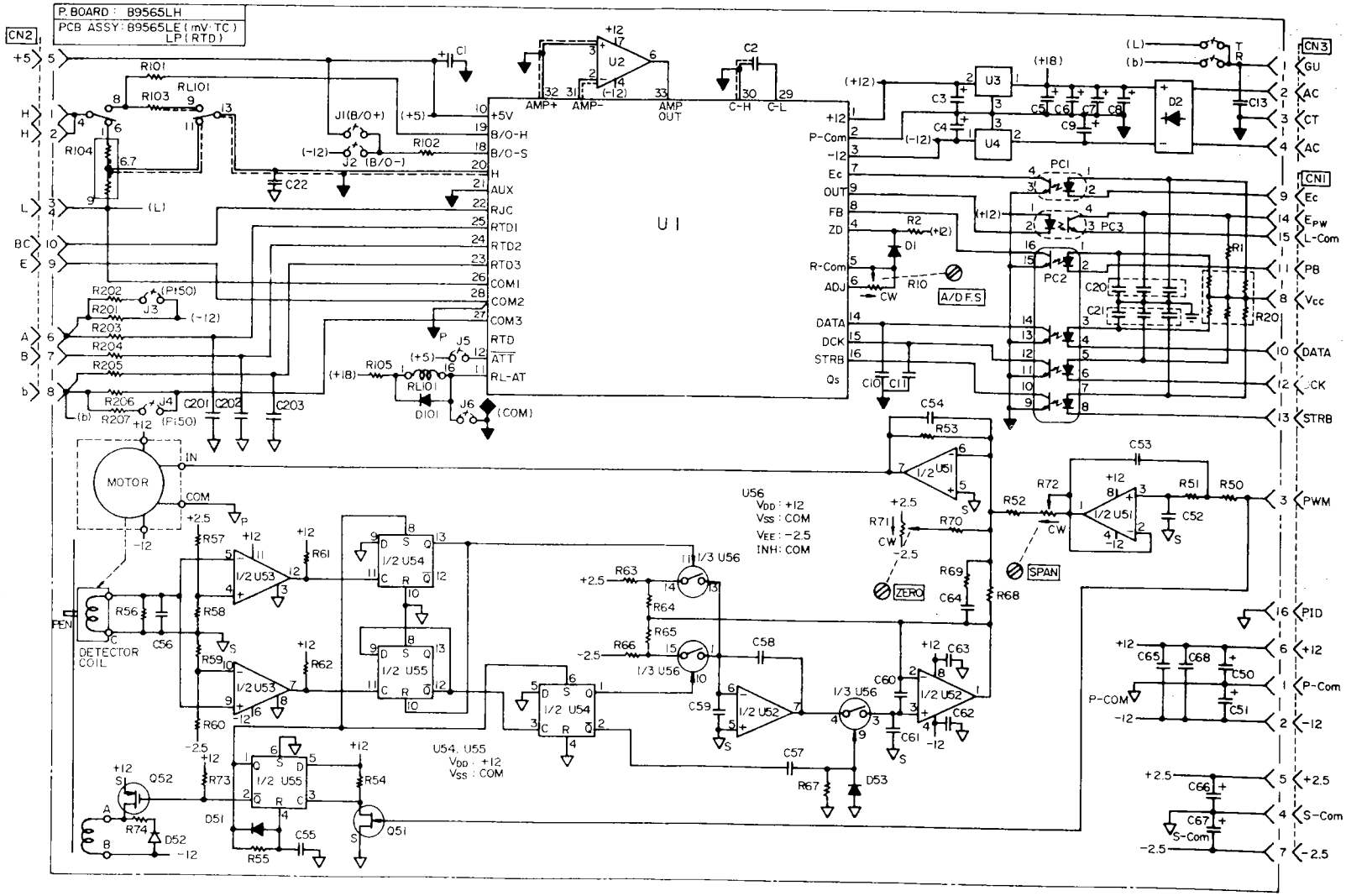
(1) RJC BOARD ASSY.



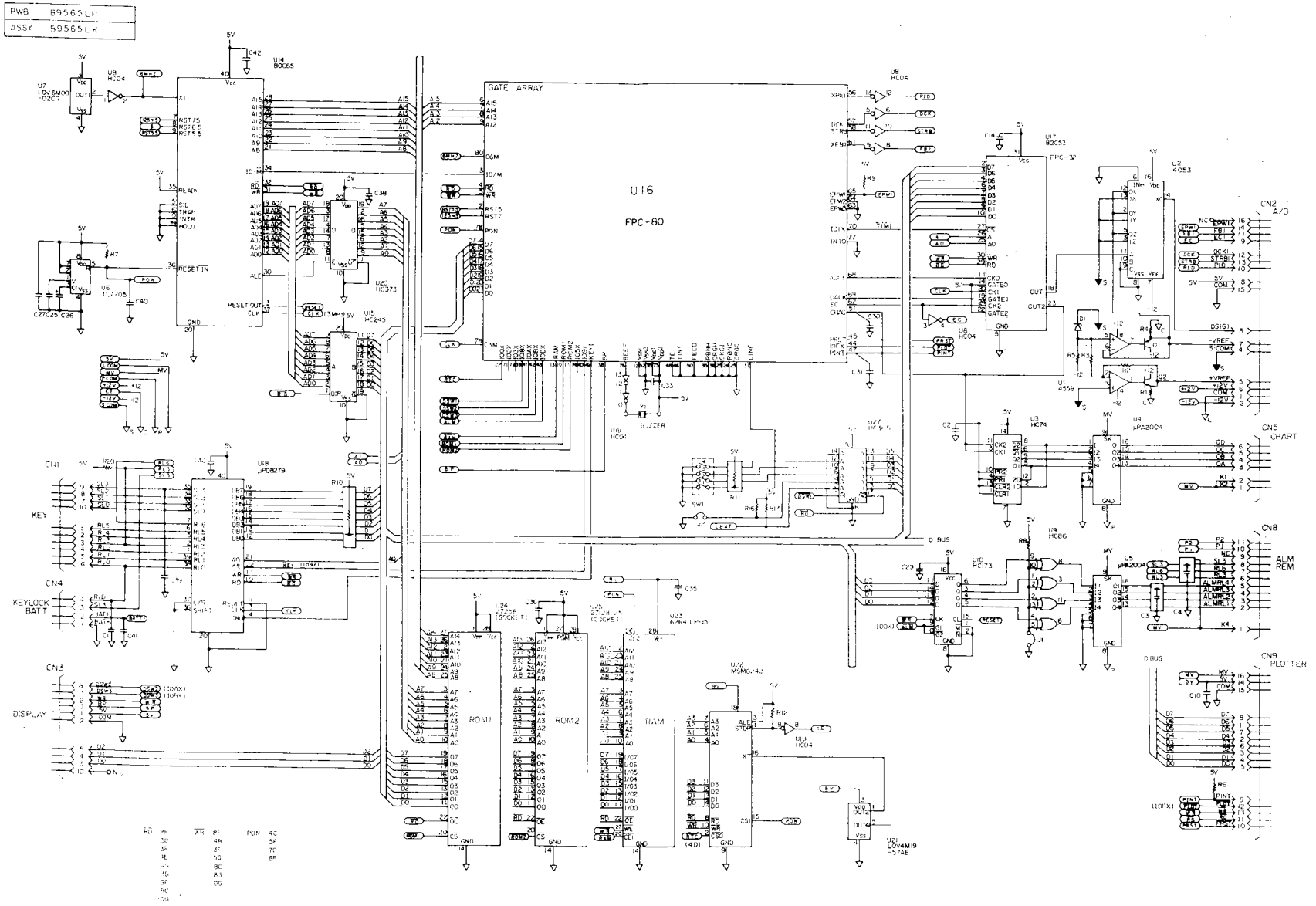
(2) ALARM BOARD ASSY.



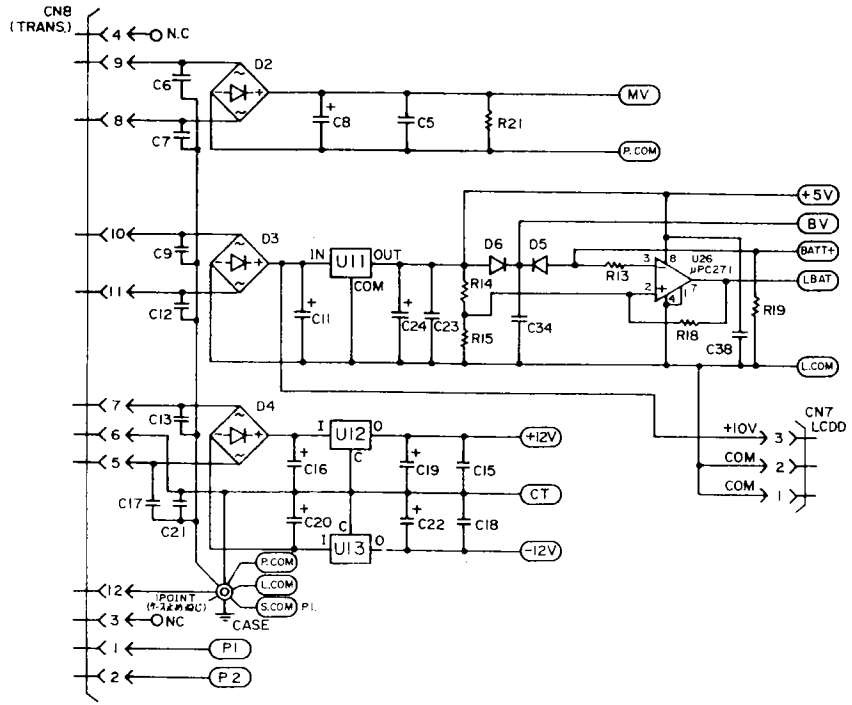
(3) A/D SERVO AMPLIFIER ASSY.

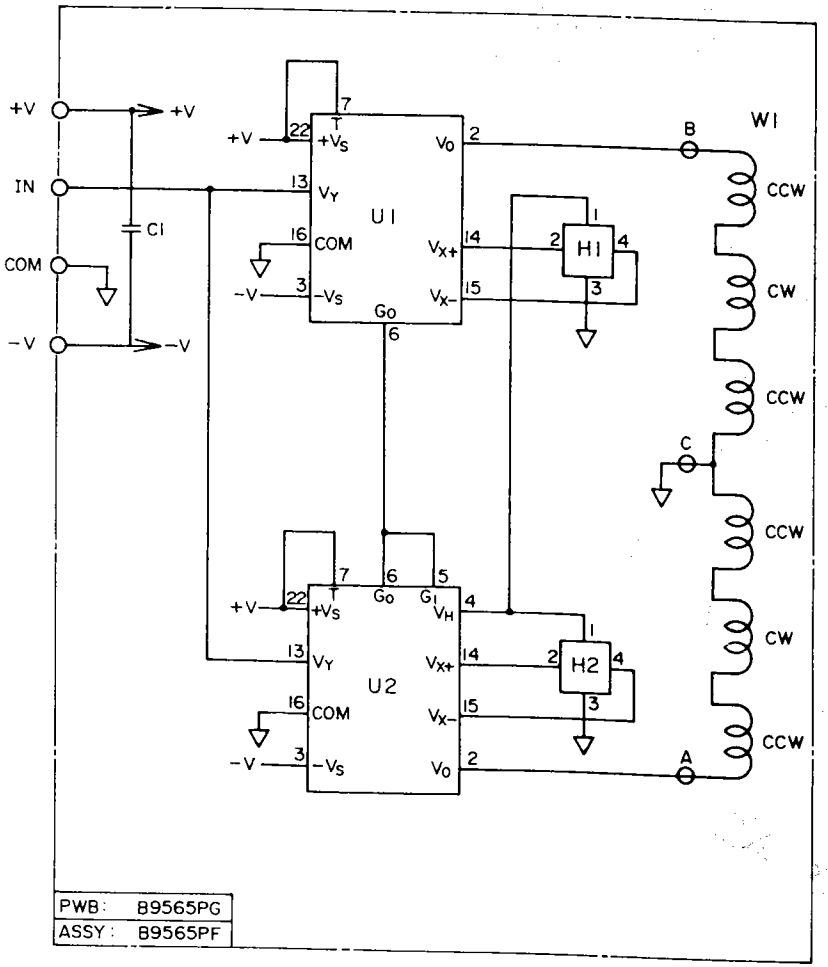


(4) 1 PEN CPU BOARD ASSY.

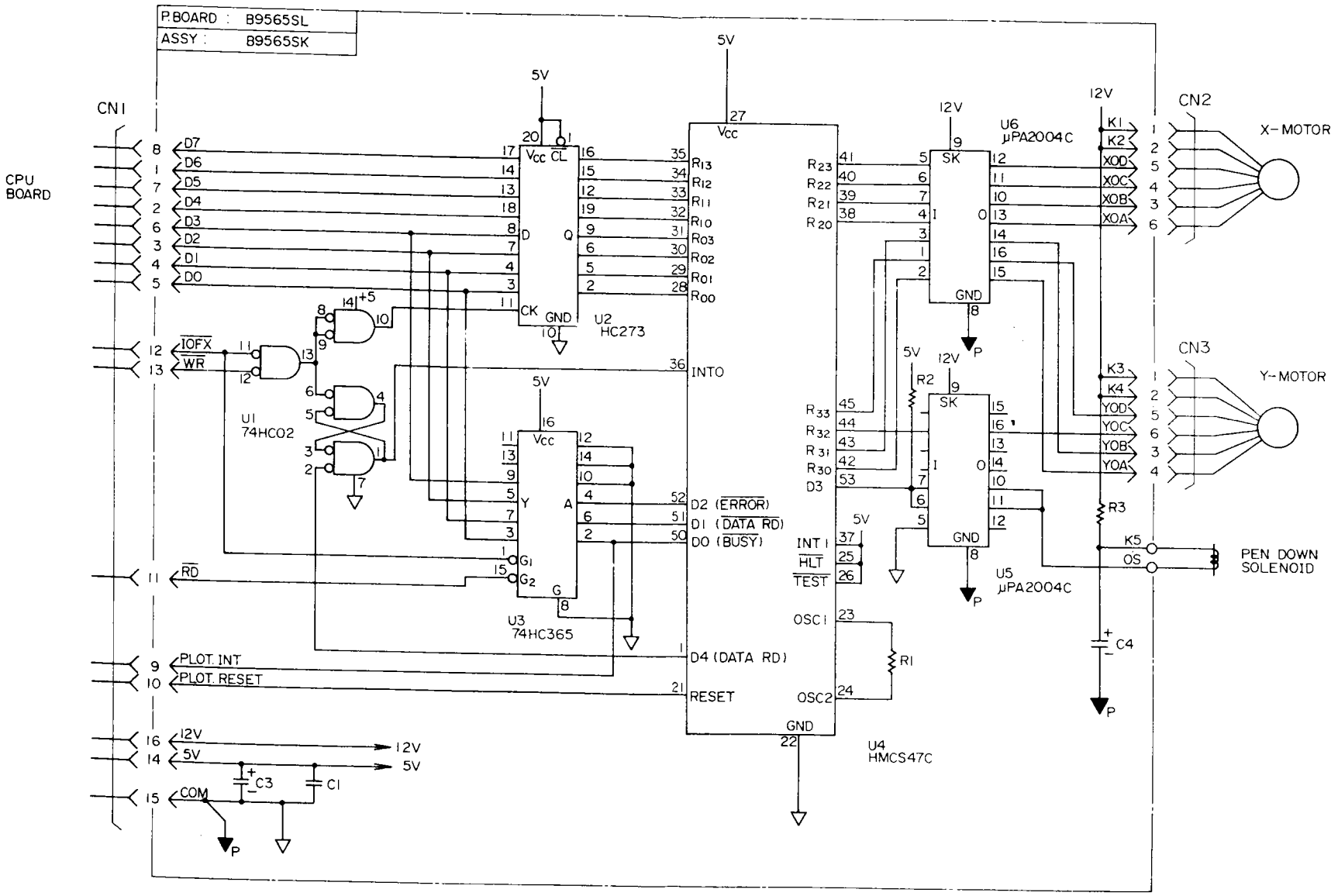


(5) P. BOARD ASSY (DC MOTOR).

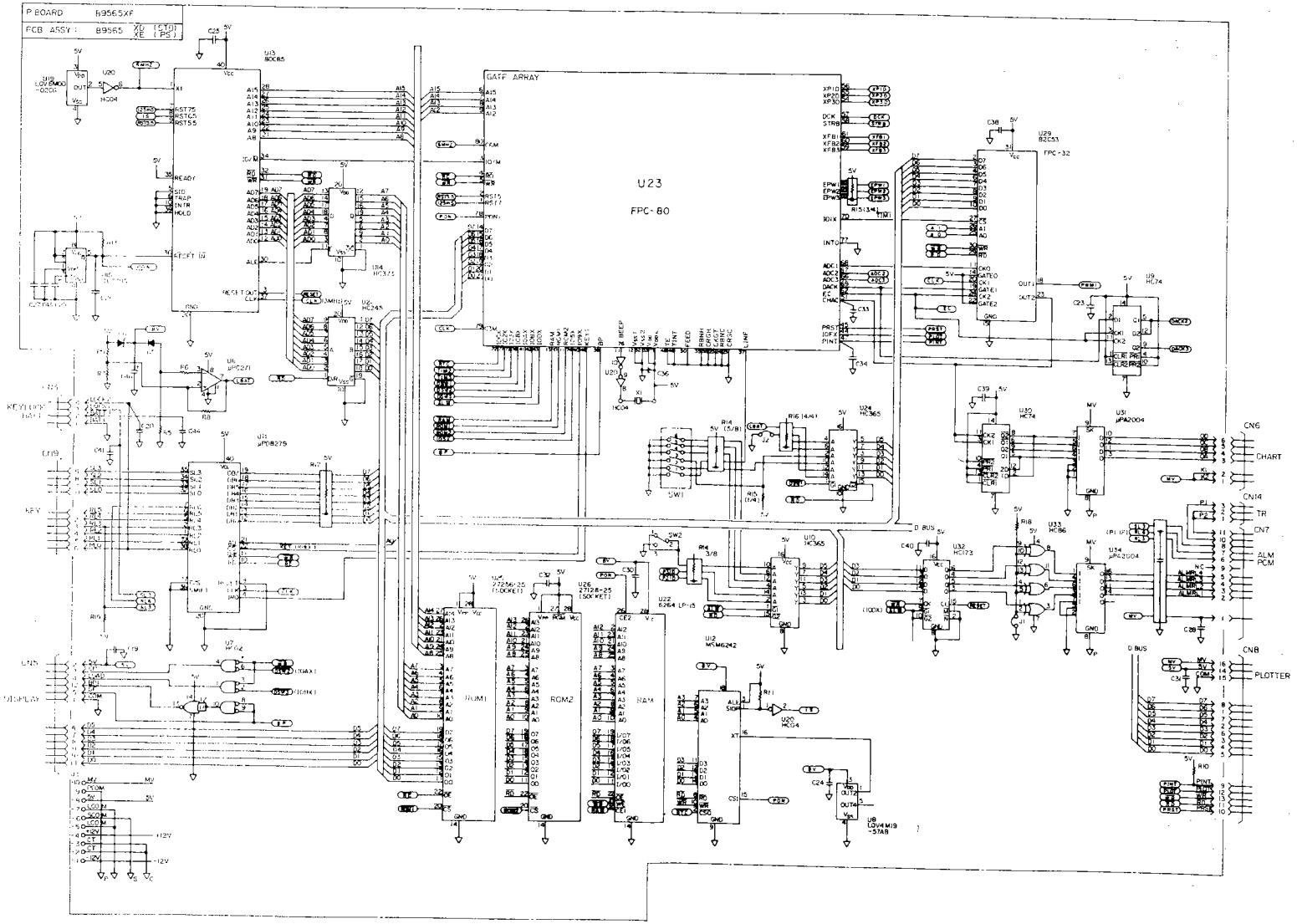


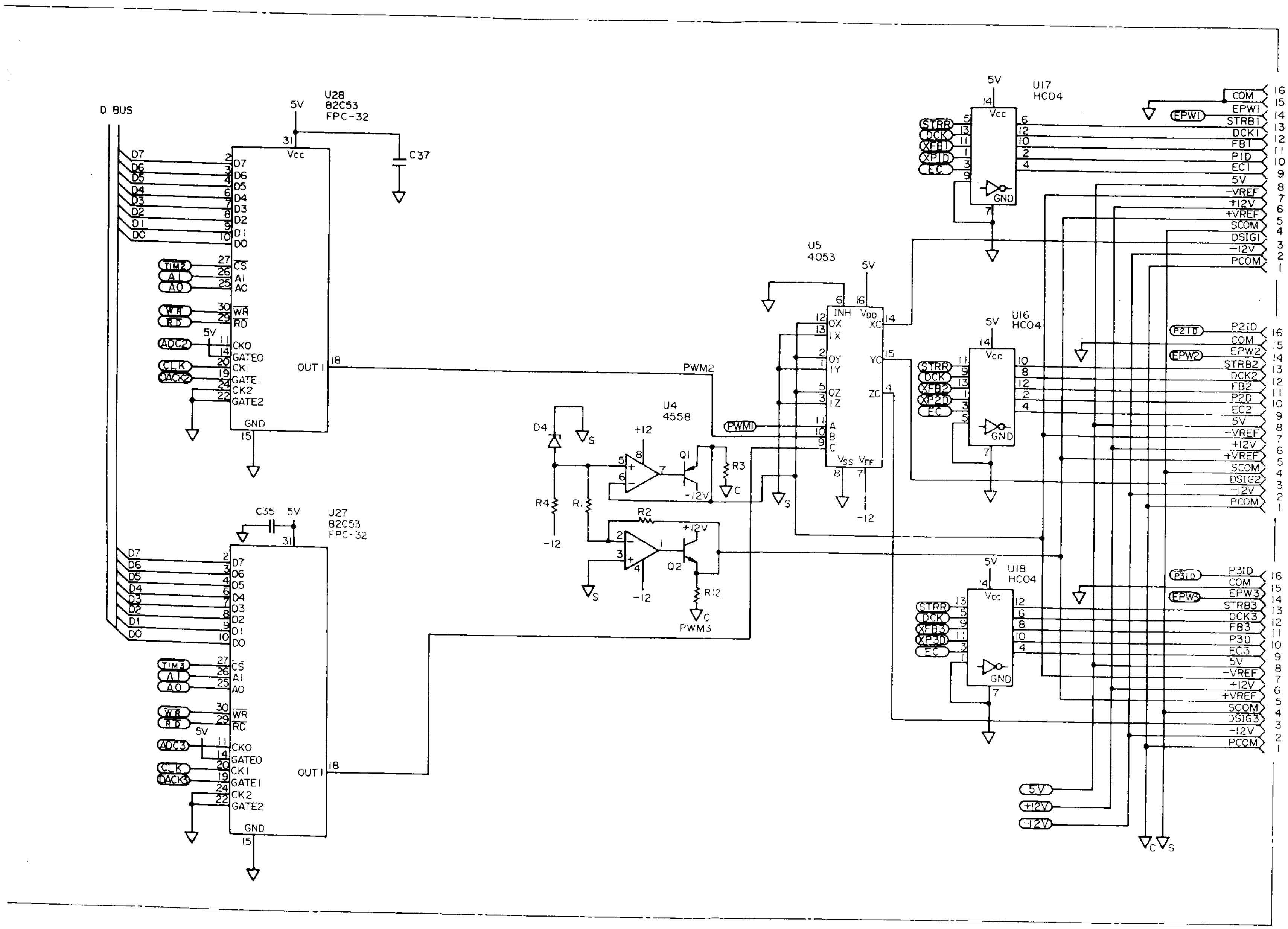


(6) PLOTTER BOARD ASSY.

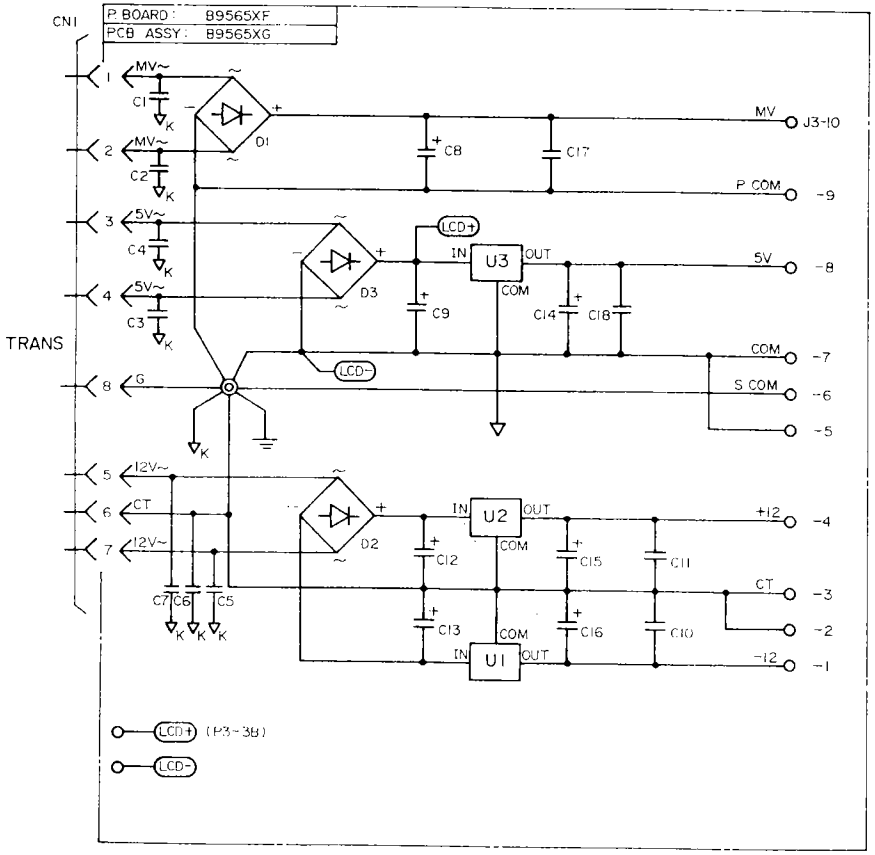


(7) 3 PEN BOARD ASSY.

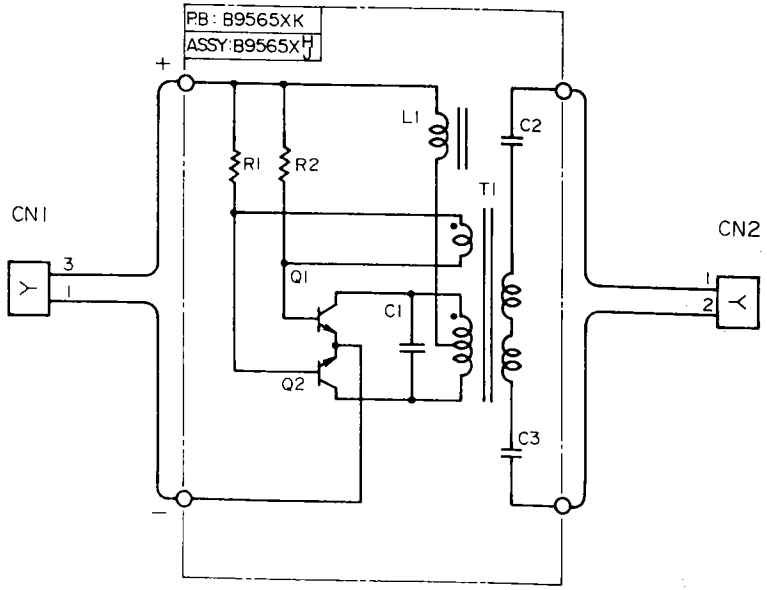



D BUS
U28
82C53
FPC-32
U27
82C53
FPC-32
C37
C35
U5
4053
U4
4558
U17
HC04
U16
HC04
U18
HC04
PWM2
PWM3
D4
R1
R2
R3
R4
R12
Q1
Q2
CN10
1 Pen
A/D SERVO
CN11
2 Pen
A/D SERVO
CN12
3 Pen
A/D SERVO

(8) POWER BOARD ASSY.



(9) INVERTER BOARD ASSY.



9-2. Electronic Parts Lists.

(1) RJC BOARD ASSY.

Item	Part No.	Description	
R1	B9566YM	Resistor: CB	50kΩ±50% 1/4W
R2	A9269RV	Resistor: VAR	50kΩ±20% 1/4W
C1	A9114CC	Capacitor: CERAMIC	0.1μF 50V
Q1	G9197HQ	Transistor: NPN	2SC943P

(2) ALARM BOARD ASSY.

Item	Part No.	Description	
R1	A9049RG	Resistor: MF	1kΩ±1% 1/4W
R2	A9049RG	Resistor: MF	1kΩ±1% 1/4W
C1	A9413CA	Capacitor: AL	47μF 25V
C2	A9008CL	Capacitor: CERAMIC	0.001μF×8 50V
C3	A9008CL	Capacitor: CERAMIC	0.001μF×8 50V
C4	A9244CY	Capacitor: FILM	0.001μF 50V
C5	A9114CC	Capacitor: CERAMIC	0.1μF 50V
D1	A9248HD	Diode	1S953
L1	A9009EC	Inductor	100μH
L2	A9009EC	Inductor	100μH
PC1	A9072HL	Photo Coupler	PC827
CN1	A9573KP	CONN: PLUG	5045-12A
RL1	A9251MR	Relay	DS1E-S-DC12V
RL2	A9251MR	Relay	DS1E-S-DC12V
RL3	A9251MR	Relay	DS1E-S-DC12V
RL4	A9251MR	Relay	DS1E-S-DC12V

(3) A/D SERVO AMPLIFIER ASSY.

Item	Part No.	Description	
R1	A9053RG	Resistor: MF	1.5kΩ±1% 1/4W
R10	A9383RV	Resistor: VAR	5kΩ±20% 1/4W
R20	A9125RL	Resistor: Module	470Ω±5% 1/8W
R101	A9630RK	Resistor: MG	47MΩ±5% 1/4W
R102	B9565YT	Resistor: CB	330kΩ±5% 1/4W
R103	A9535RG	Resistor: MF	10kΩ±1% 1/4W
R104	A9142RL	Resistor: Module	ATT.
R105	B9566YA	Resistor: CB	330Ω±5% 1/4W
R201	A9078RG	Resistor: MF	16kΩ±5% 1/4W
R203	A9041RG	Resistor: MF	470Ω±1% 1/4W
R204	A9041RG	Resistor: MF	470Ω±1% 1/4W
R205	A9041RG	Resistor: MF	470Ω±1% 1/4W
R206	A9344RQ	Resistor: MF	300Ω±0.05% 1/8W
C1	A9412CA	Capacitor: AL	22μF 16V
C2	A9248CY	Capacitor: FILM	0.0047μF 50V
C3	A9412CA	Capacitor: AL	22μF 16V
C4	A9412CA	Capacitor: AL	22μF 16V
C5	A9413CA	Capacitor: AL	47μF 25V
C6	A9413CA	Capacitor: AL	47μF 25V
C7	A9413CA	Capacitor: AL	47μF 25V
C8	A9413CA	Capacitor: AL	47μF 25V
C9	A9413CA	Capacitor: AL	47μF 25V
C10	A9244CY	Capacitor: FILM	0.001μF 50V
C11	A9244CY	Capacitor: FILM	0.001μF 50V
C13	A9114CC	Capacitor: CERAMIC	0.1μF 50V
C20	A9009CL	Capacitor: CERAMIC	0.001μF×4 50V
C21	A9009CL	Capacitor: CERAMIC	0.001μF×4 50V
D1	A9211LA	Diode: Band Gap	LT1009CZ
D2	A9092HL	Diode: Module	1G4B41
D101	A9248HD	Diode	1S953
U1	B9565LZ	IC: Hybrid	MC-5642
U2	A9188LA	IC	LT1012CN8
U3	A9212LA	IC	TA78L012
U4	A9213LA	IC	NJM79L12
PC1	B9566ZG	Photo Coupler	TPL 521-1-GB
PC2	B9566ZJ	Photo Coupler	TPL 521-4-GB
PC3	B9566ZG	Photo Coupler	TPL 521-1-GB
RL101	A9250MR	Relay	DS2VE-S-DC12V
CN1	A9643KP	Connector	HLEM 16R-1
CN2	A9131KP	Connector	RS-10PA-D4LT1-PN1-K
CN3	A9398KP	Connector	5046-04A
R50	B9566YQ	Resistor: CB	120kΩ±5% 1/4W
R51	B9566YQ	Resistor: CB	120kΩ±5% 1/4W
R52	A9077RG	Resistor: MF	15kΩ±1% 1/4W
R53	A9127RG	Resistor: MF	1.8MΩ±2% 1/4W
R54	B9566YH	Resistor: CB	10kΩ±5% 1/4W
R55	A9080RG	Resistor: MF	20kΩ±1% 1/4W
R56	B9566YE	Resistor: CB	3.9kΩ±5% 1/4W
R57	A9080RG	Resistor: MF	20kΩ±1% 1/4W
R58	A9037RG	Resistor: MF	330Ω±1% 1/4W
R59	A9036RG	Resistor: MF	300Ω±1% 1/4W
R60	A9080RG	Resistor: MF	20kΩ±1% 1/4W
R61	B9566YD	Resistor: CB	2.2kΩ±5% 1/4W
R62	B9566YD	Resistor: CB	2.2kΩ±5% 1/4W
R63	A9080RG	Resistor: MF	20kΩ±1% 1/4W
R64	A9093RG	Resistor: MF	68kΩ±1% 1/4W
R65	A9093RG	Resistor: MF	68kΩ±1% 1/4W
R66	A9080RG	Resistor: MF	20kΩ±1% 1/4W
R67	B9566YL	Resistor: CB	47kΩ±5% 1/4W
R68	A9090RG	Resistor: MF	51kΩ±1% 1/4W
R69	B9566YZ	Resistor: CB	6.2kΩ±5% 1/4W
R70	B9566YY	Resistor: CB	470kΩ±5% 1/4W
R71	A9383RV	Resistor: VAR	5kΩ20% 1/4W
R72	A9544RV	Resistor: VAR	2kΩ±20% 1/4W
R73	B9566YH	Resistor: CB	10kΩ±5% 1/4W
	A9474RK	Resistor: MF	30Ω±1%
C50	A9413CA	Capacitor: AL	47μF 25V
C51	A9413CA	Capacitor: AL	47μF 25V
C52	A9365CY	Capacitor: FILM	0.068μF 63V
C53	A9372CY	Capacitor: FILM	0.15μF 63V
C54	A9244CY	Capacitor: FILM	0.001μF 50V
C55	A9025CN	Capacitor: MICA	100pF 100V
C56	A9024CN	Capacitor: MICA	82pF 100V
C57	A9363CY	Capacitor: FILM	0.01μF 63V
C58	A9244CY	Capacitor: FILM	0.001μF 50V
C59	A9025CN	Capacitor: MICA	100pF 100V
C60	A9025CN	Capacitor: MICA	100pF 100V
C61	A9366CY	Capacitor: FILM	0.1μF 63V
C62	A9114CC	Capacitor: CERAMIC	0.1μF 50V
C63	A9114CC	Capacitor: CERAMIC	0.1μF 50V
C64	A9370CY	Capacitor: FILM	1μF 50V
C22	A9245CY	Capacitor: FILM	1500pF 50V
C201	A9114CC	Capacitor: CERAMIC	0.1μF 50V
C202	A9114CC	Capacitor: CERAMIC	0.1μF 50V
C203	A9114CC	Capacitor: CERAMIC	0.1μF 50V

Item	Part No.	Description		
C65	A9128CC	Capacitor: CERAMIC	1μF	50V
C66	A9412CA	Capacitor: AL	22μF	16V
C67	A9412CA	Capacitor: AL	22μF	16V
C68	A9114CC	Capacitor: CERAMIC	0.1μF	50V
D51	A9248HD	Diode	1S953	
D52	A9249HD	Diode	1S954	
D53	A9248HD	Diode	1S953	
Q51	A9413HQ	TSTR: FET	2SK117-BL	
Q52	A9466HQ	TSTR: FET	VP0808L	
U51	A9208LA	IC	μPC 822G	
U52	A9208LA	IC	μPC 822G	
U53	A9210LA	IC	μPC 272G	
U54	A9191LM	IC	μPD 4013BG	
U55	A9191LM	IC	μPD 4013BG	
U56	A9192LM	IC	μPD 4053BG	

(4) 1 PEN CPU BOARD ASSY.

Item	Part No.	Description		
R1	B9566YF	Resistor: CB	4.7kΩ±5%	1/4W
R2	A9080RG	Resistor: MF	20kΩ±1%	1/4W
R3	A9080RG	Resistor: MF	20kΩ±1%	1/4W
R4	B9566YF	Resistor: CB	4.7kΩ±5%	1/4W
R5	B9566YH	Resistor: CB	10kΩ±5%	1/4W
R6	B9566YH	Resistor: CB	10kΩ±5%	1/4W
R7	B9566YH	Resistor: CB	10kΩ±5%	1/4W
R8	B9566YH	Resistor: CB	10kΩ±5%	1/4W
R9	B9566YH	Resistor: CB	10kΩ±5%	1/4W
R10	A9093RL	Resistor: Module	3kΩx8	1/8W
R11	A9029RL	Resistor: Module	10kΩx4	1/8W
R12	B9566YH	Resistor: CB	10kΩ±5%	1/4W
R13	B9566YP	Resistor: CB	100kΩ±5%	1/4W
R14	B9566YH	Resistor: CB	10kΩ±5%	1/4W
R15	B9566YJ	Resistor: CB	15kΩ±5%	1/4W
R16	B9566YH	Resistor: CB	10kΩ±5%	1/4W
R17	B9566YH	Resistor: CB	10kΩ±5%	1/4W
R18	B9566YR	Resistor: CB	200kΩ±5%	1/4W
R19	A9137RG	Resistor: MF	4.7MΩ±1%	1/4W
C1	A9244CY	Capacitor: FILM	0.001μF	50V
C2	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C3	A9009CL	Capacitor: CERAMIC	0.001μFx8	50V
C4	A9009CL	Capacitor: CERAMIC	0.001μFx8	50V
C5	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C6	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C7	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C8	A9424CA	Capacitor: AL	1000μF	25V
C9	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C10	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C11	A9419CA	Capacitor: AL	3300μF	16V
C12	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C13	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C14	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C15	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C16	A9422CA	Capacitor: AL	220μF	25V
C17	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C18	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C19	A9421CA	Capacitor: AL	100μF	25V
C20	A9422CA	Capacitor: AL	220μF	25V
C21	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C22	A9421CA	Capacitor: AL	100μF	25V
C23	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C24	A9415CA	Capacitor: AL	100μF	16V
C25	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C26	A9411CA	Capacitor: AL	10μF	16V
C27	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C28	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C29	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C30	A9247CY	Capacitor: FILM	0.0033μF	50V
C31	A9247CY	Capacitor: FILM	0.0033μF	50V
C32	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C33	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C34	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C35	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C36	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C37	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C38	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C39	A9244CY	Capacitor: FILM	0.001μF	50V
C40	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C41	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C42	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C43	A9415CA	Capacitor: AL	100μF	16V
D1	A9211LA	Diode	LT1009CZ	
D2	A9136HL	Diode	2D4B41	
D3	A9092HL	Diode	1G4B41	
D4	A9092HL	Diode	1G4B41	
D5	A9248HD	Diode	1S953	
D6	A9392HD	Diode	S1S3M	
Q1	A9338HQ	TSTR: PNP	2SA 1015	
Q2	A9340HQ	TSTR: NPN	2SC 1815	
U1	A9082LA	IC	μPC4558	
U2	A9062LM	IC	TC4053	
U3	A9014LN	IC	74HC74	
U4	A9096HL	IC	μPA2004	
U5	A9096HL	IC	μPA2004	
U6	A9438LB	IC	TL7705	
U7	A9105EX	IC	LQV6M00-02CG	
U8	A9003LN	IC	74HC04	
U9	A9018LN	IC	74HC86	
U10	A9082LN	IC	74HC173	
U11	A9215LA	IC	LM2940CT-5.0	
U12	A9104LA	IC	μPC14312	
U13	A9105LA	IC	μPC16312	
U14	A9030LC	IC	MSM80C85 (SOCKET)	
U15	A9052LN	IC	74HC245	
U16	B9565LS	IC	MB63H156 GATE ARRAY	
U17	A9047LC	IC	MSM82C53	
U18	A9145LM	IC	μPD8279	
U19	A9003LN	IC	74HC04	
U20	A9066LN	IC	74HC373	
U21	A9104EX	IC	LQV4M19-57AB	
U22	A9046LC	IC	MSM6242	
U23	A9031LD	IC	6264 LP-15	
U26	A9085LA	IC	μPC271	
U27	A9062LN	IC	74HC365	
X1	A9009ER	Buzzer	PB2215-BC	
SW1	A9130SS	Switch	DNP4	

Item	Part No.	Description	
–	A9628KP	IC Socket	DIP 28 pin For U24
–	A9628KP	IC Socket	DIP 28 pin For U26
–	A9629KP	IC Socket	DIP 40 pin For U14
CN1	A9641KP	Connector	HLEM 10S-1
CN2	A9642KP	Connector	HLEM 16S-1
CN3	A9153KP	Connector	PS10PA-D4T1-PN1-K
CN4	A9295KP	Connector	5045-04A
CN5	A9303KP	Connector	5045-06A
CN6	A9360KP	Connector	5045-11A
CN7	A9244KP	Connector	5045-03A
CN8	A9573KP	Connector	5045-12A
CN9	A9642KP	Connector	HLEM 16S-1

(5) P. BOARD ASSY (DC MOTOR).

Item	Part No.	Description	
C1	A9114CC	CAP: CERAMIC	0.1μF 50V
U1	H9206LA	IC	YEW A05 (chip carrier)
U2	H9206LA	IC	YEW A05 (chip carrier)
H1	B9565PY	Hole	HW-300B-C
H2	B9565PY	Hole	HW-300B-C
	B9565PH	BOBBIN ASSY	

(6) PLOTTER BOARD ASSY.

Item	Part No.	Description		
R1	A9090RG	Resistor: MF	51kΩ±1%	1/4W
R2	A9066RG	Resistor: MF	5.1kΩ±1%	1/4W
R3	A9323RK	Resistor	10Ω±5%	2W
C1	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C3	A9414CA	Capacitor: AL	47μF	16V
C4	A9424CA	Capacitor: AL	1000μF	25V
U1	A9002LN	IC	74HC02	
U2	A9081LN	IC	74HC273	
U3	A9062LN	IC	74HC365	
U4	B9565SM	IC	HMCS47C	
U5	A9096HL	IC	μPA2004	
U6	A9096HL	IC	μPA2004	
CN1	A9643KP	Connector	HLEM 16R-1	
CN2	A9303KP	Connector	5045-06A	
CN3	A9303KP	Connector	5045-06A	

(7) 3 PEN CPU BOARD ASSY.

Item	Part No.	Description		
R1	A9080RG	Resistor: MF	20kΩ±1%	1/4W
R2	A9080RG	Resistor: MF	20kΩ±1%	1/4W
R3	B9566YF	Resistor: CB	4.7kΩ±5%	1/4W
R4	B9566YH	Resistor: CB	10kΩ±5%	1/4W
R5	B9566YW	Resistor: CB	4.7MΩ±5%	1/4W
R6	B9566YP	Resistor: CB	100kΩ±5%	1/4W
R7	B9566YJ	Resistor: CB	15kΩ±5%	1/4W
R8	B9566YS	Resistor: CB	220kΩ±5%	1/4W
R9	B9566YH	Resistor: CB	10kΩ±5%	1/4W
R10	B9566YH	Resistor: CB	10kΩ±5%	1/4W
R11	B9566YH	Resistor: CB	10kΩ±5%	1/4W
R12	B9566YF	Resistor: CB	4.7kΩ±5%	1/4W
R13	B9566YH	Resistor: CB	10kΩ±5%	1/4W
R14	A9095RL	Resistor: MODULE	10kΩx8	1/8W
R15	A9029RL	Resistor: MODULE	10kΩx4	1/8W
R16	A9029RL	Resistor: MODULE	10kΩx4	1/8W
R17	A9093RL	Resistor: MODULE	3.0kΩx8	1/8W
R18	B9566YH	Resistor: CB	10kΩ±5%	1/4W
R19	B9566YH	Resistor: CB	10kΩ±5%	1/4W
C19	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C20	A9244CY	Capacitor: FILM	0.001μF	50V
C23	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C24	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C25	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C26	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C27	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C28	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C29	A9411CA	Capacitor: AL	10μF	16V
C30	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C31	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C32	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C33	A9247CY	Capacitor: FILM	0.0033μF	50V
C34	A9247CY	Capacitor: FILM	0.0033μF	50V
C35	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C36	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C37	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C38	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C39	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C40	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C41	A9244CY	Capacitor: FILM	0.001μF	50V
C43	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C44	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C45	A9008CL	Capacitor: CERAMIC	0.001μFx8	50V
C46	A9413CA	Capacitor: AL	47μF	25V
D4	A9211LA	Diode	LT1009CZ	
D5	A9248HD	Diode	1S953	
D6	A9392HD	Diode	S1S3M	
Q1	A9338HQ	TSTR: PNP	2SA1015	
Q2	A9340HQ	TSTR: NPN	2SC1815	
U4	A9082LA	IC	μPC4558	
U5	A9062LM	IC	TC4053	
U6	A9085LA	IC	μPC271	
U7	A9002LN	IC	74HC02	
U8	A9104EX	IC	LQV4M19-57AB	
U9	A9014LN	IC	74HC74	
U10	A9062LN	IC	74HC365	
U11	A9145LM	IC	μPD8279	
U12	A9046LC	IC	MSM6242	
U13	A9030LC	IC	MSM80C85 (SOCKET)	
U14	A9066LN	IC	74HC373	
U15	A9438LB	IC	TL7705	
U16	A9003LN	IC	74HC04	
U17	A9003LN	IC	74HC04	
U18	A9003LN	IC	74HC04	
U19	A9105EX	IC	LQV 6M00-02CG	
U20	A9003LN	IC	74HC04	
U21	A9052LN	IC	74HC245	
U22	A9031LD	IC	6264LP-15	
U23	B9565LS	IC	MB63H156	

Item	Part No.	Description	
U24	A9062LN	IC	74HC365
U27	A9047LC	IC	MSM82C53-5GS
U28	A9047LC	IC	MSM82C53-5GS
U29	A9047LC	IC	MSM82C53-5GS
U30	A9014LN	IC	74HC74
U31	A9096HL	IC	μPA2004
U32	A9082LN	IC	74HC173
U33	A9018LN	IC	74HC86
U34	A9096HL	IC	μPA2004
CN9	A9641KP	Connector	HLEM10S-1
CN10	A9642KP	Connector	HLEM16S-1
CN11	A9642KP	Connector	HLEM16S-1
CN12	A9642KP	Connector	HLEM16S-1
CN5	A9640KP	Connector	PS12PA-D4T1-PN1-K
CN3	A9295KP	Connector	5045-04A
CN4	A9244KP	Connector	5045-03A
CN6	A9303KP	Connector	5045-06A
CN7	A9360KP	Connector	5045-11A
CN8	A9642KP	Connector	HLEM-16S-1
J3	B9565XP	Wire	
	A9629KP	IC Socket	40 Pin
	A9628KP	IC Socket	28 Pin
	A9628KP	IC Socket	28 Pin
SW1	A9146SS	Switch	DNP-6
SW2	A9070SM	Switch	AS-12AH
X1	A9009ER	Buzzer	PB2215-BC

(8) POWER BOARD ASSY.

Item	Part No.	Description		
R20	B9566YP	Resistor: CB	100kΩ±5%	1/4W
C1	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C2	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C3	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C4	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C5	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C6	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C7	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C8	A9424CA	Capacitor: AL	1000μF	25V
C9	A9419CA	Capacitor: AL	3300μF	16V
C10	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C11	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C12	A9423CA	Capacitor: AL	470μF	25V
C13	A9423CA	Capacitor: AL	470μF	25V
C14	A9416CA	Capacitor: AL	220μF	16V
C15	A9421CA	Capacitor: AL	100μF	25V
C16	A9421CA	Capacitor: AL	100μF	25V
C17	A9114CC	Capacitor: CERAMIC	0.1μF	50V
C18	A9114CC	Capacitor: CERAMIC	0.1μF	50V
D1	A9136HL	Diode	2D4B41	
D2	A9092HL	Diode	1G4B41	
D3	A9092HL	Diode	1G4B41	
U1	A9105LA	IC	μPC16312	
U2	A9104LA	IC	μPC14312	
U3	A9215LA	IC	LM2940CT-5.0	
CN1	A9305KP	Connector	5045-08A	

(9) INVERTER BOARD ASSY.

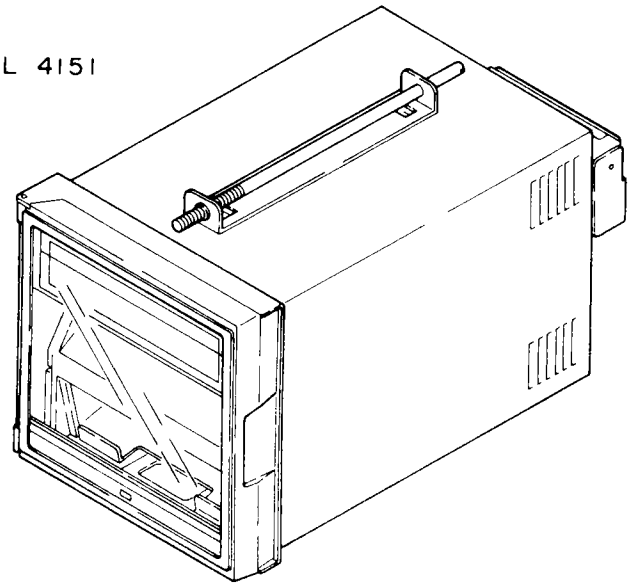
Item	Part No.	Description		
C1	A9365CY	CAP: FILM	0.068μF	63V
C2	B9566ZQ	CAP: CERAMIC	470pF	1kV
C3	B9566ZQ	CAP: CERAMIC	470pF	1kV
CN1	A9243KP	Connector	5051-03	
CN1	A9374KP	Contact	5159T	
CN2	A9566ZC	Connector	1625-02R	
CN2	A9566ZF	Contact	1855TL	
L1	B9565XL	Inductor		
T1	B9565XM	Trans		
Q1	A9452HQ	Tester: NPN	2SC2235 O, Y	
Q2	A9452HQ	Tester: NPN	2SC2235 O, Y	
R1	A9053RG	Resistor: MF	1.5kΩ±1%	1/4W
R2	A9053RG	Resistor: MF	1.5kΩ±1%	1/4W
	G9012VN	Wire		
	A9426XK	Tube		

Parts List

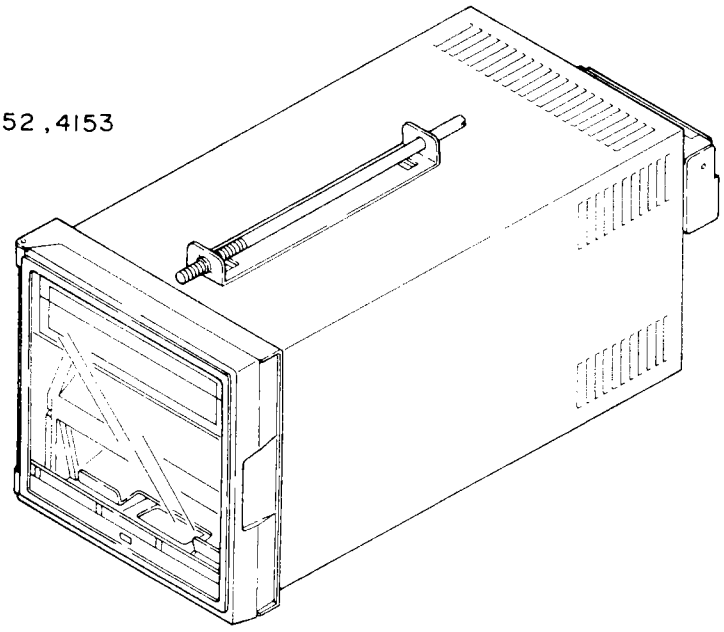
μR100

Model 4151
Model 4152
Model 4153
100 mm MICRO RECORDERS

MODEL 4151



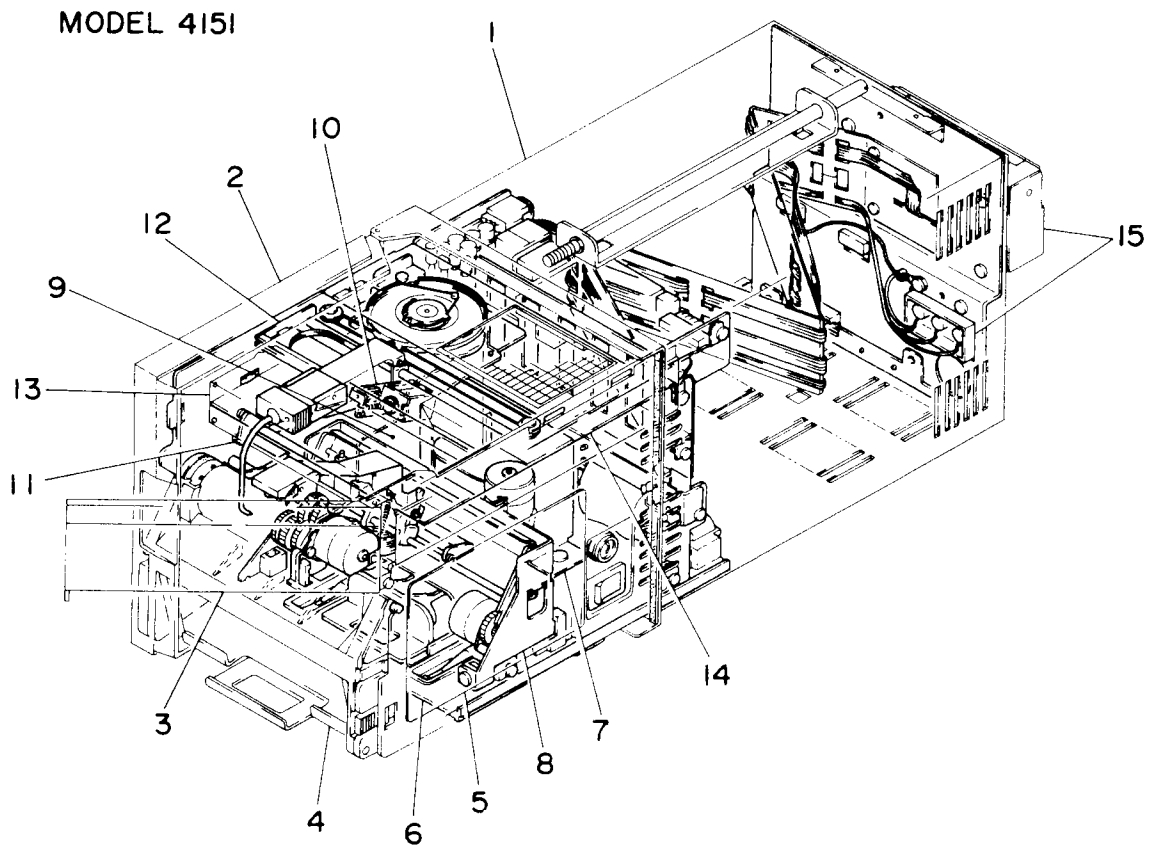
MODELS 4152, 4153



YOKOGAWA ◆
Yokogawa Electric Corporation

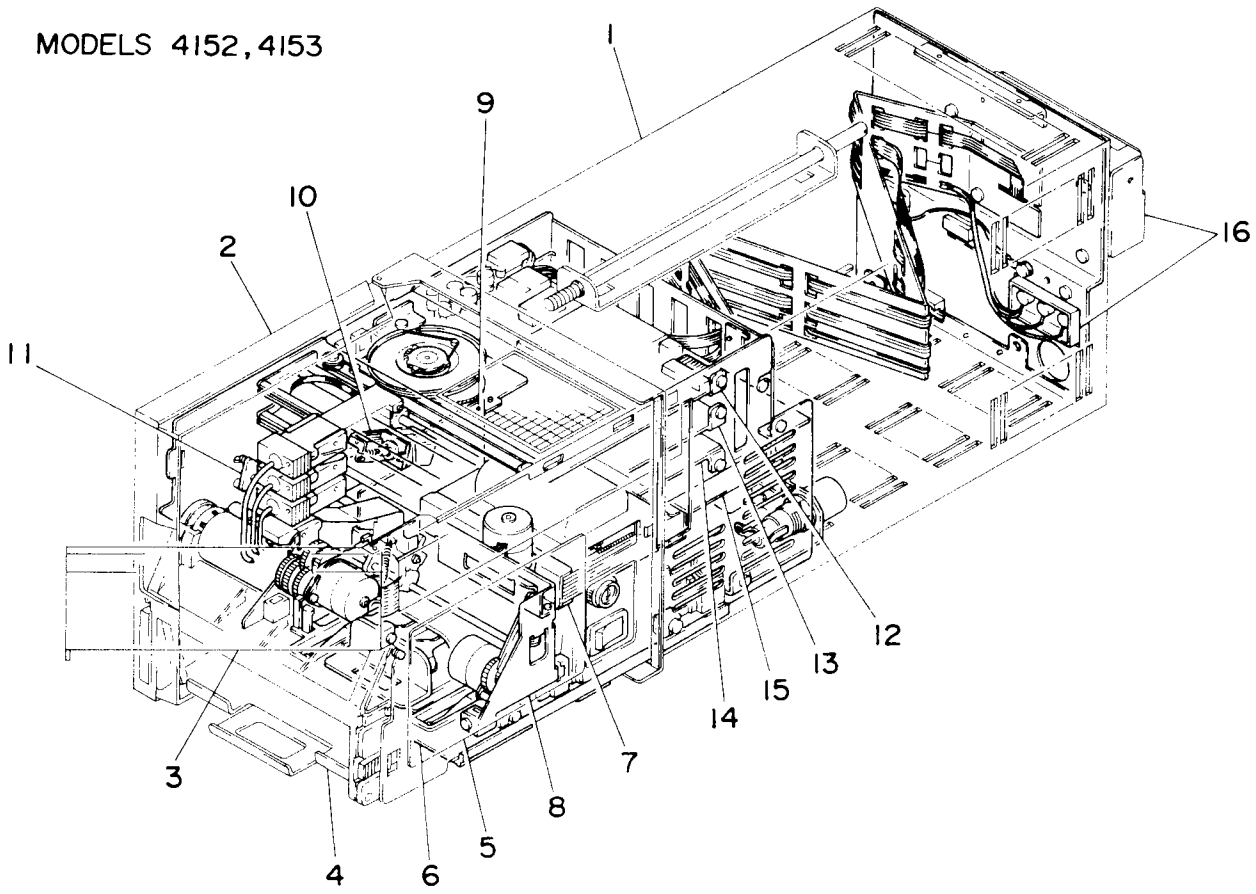
PL 4D2B1-01

Complete Set



Item	Description	
1	Case Assembly	(see page 4)
2	Door Assembly	
3	Display Assembly	(see page 7)
4	Chart Cassette Assembly	
5	Keyboard Assembly	
6	Chassis Assembly	(see page 8)
7	Transformer Assembly	
8	Plotter Assembly	(see page 12)
9	Plotter Board Assembly	
10	Solenoid Assembly	
11	Lever	
12	Servo Assembly	(see page 14)
13	Cover	
14	CPU Board Assembly	
15	Terminal Assembly (see page 18)	
—	Portable Type (see page 20)	
—	Standard Accessory (see page 21)	

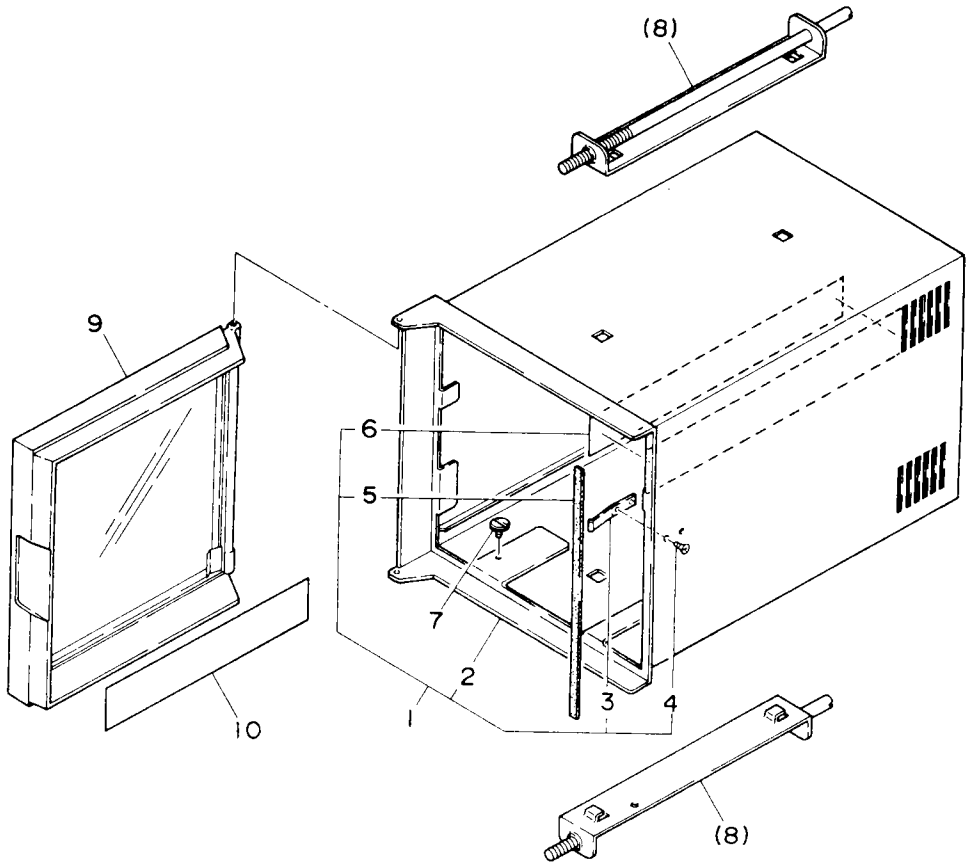
Complete Set



Item	Description	
1	Case Assembly	(see page 5)
2	Door Assembly	
3	Display Assembly	(see page 6)
4	Chart Cassette Assembly	
5	Keyboard Assembly	
6	Chassis Assembly	(see page 10)
7	Transformer Assembly	
8	Plotter Assembly	(see page 12)
9	Plotter Board Assembly	
10	Solenoid Assembly	
11	Lever	
12	Servo Assembly (for 1st pen)	(see page 16)
13	Servo Assembly (for 2nd pen)	
14	Servo Assembly (for 3rd pen)	
15	Main PCB Assembly	
16	Terminal Assembly (see page 18)	
—	Portable Type (see page 20)	
—	Standard Accessory (see page 21)	

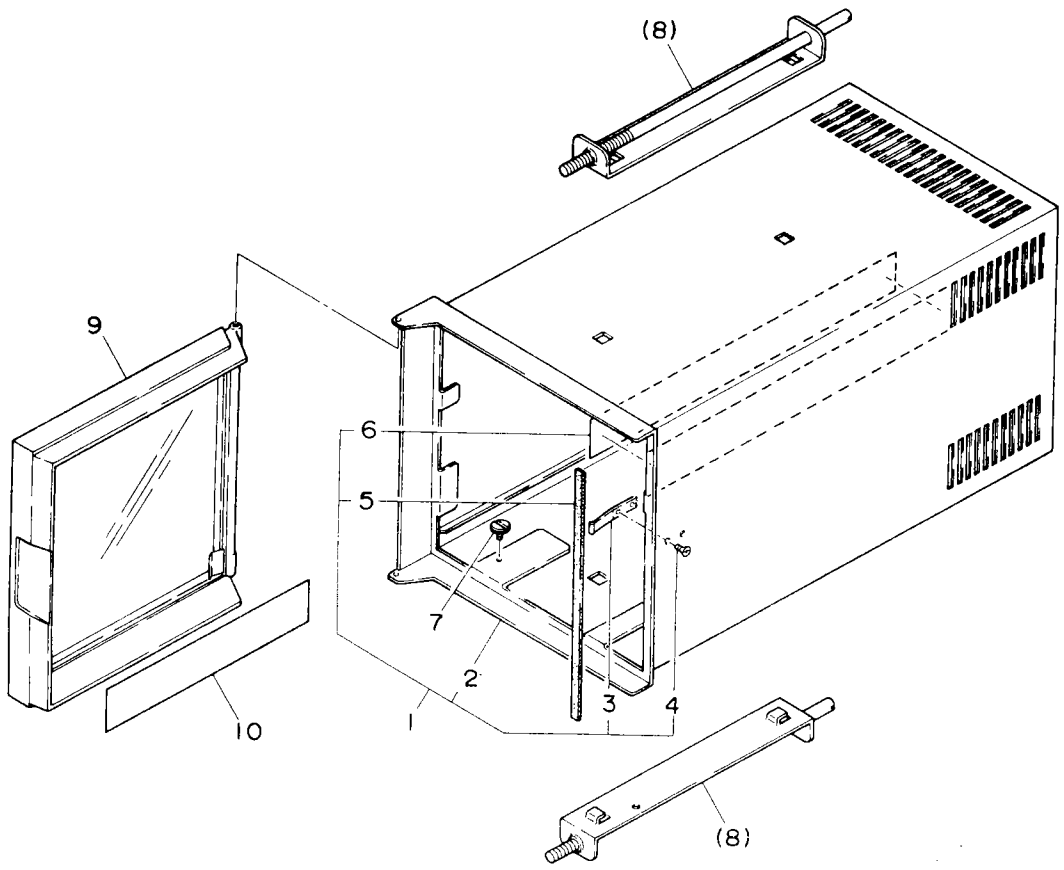
Case and Door Assemblies

Model 4151



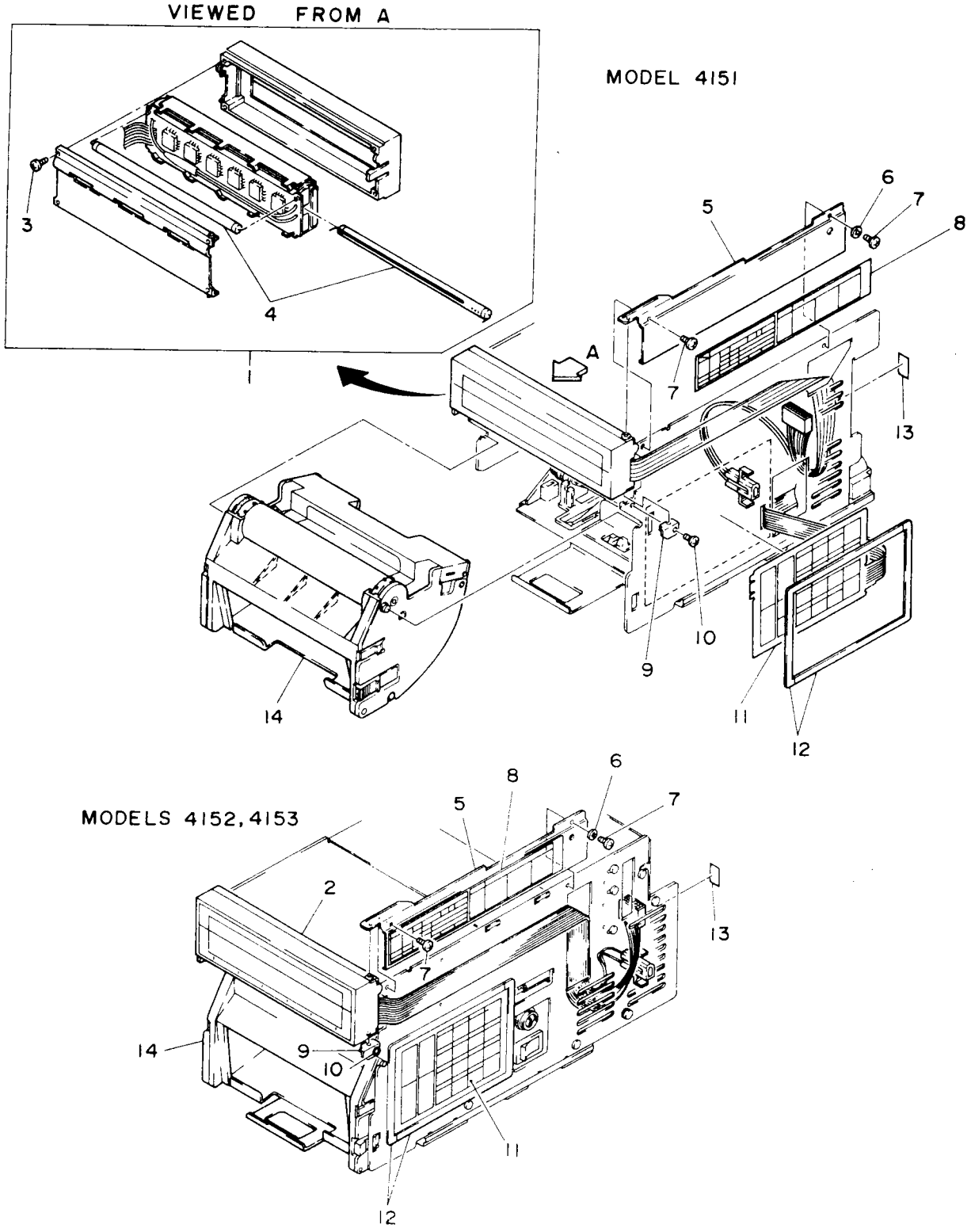
Item	Part No.	Qty	Description
1	B9567AA	1	Case Assembly
2	B9565CE	1	Case Assembly
3	B9565CD	1	Spring
4	B9565CW	2	Screw
5	B9565CB	1	Gasket
6	B9565CQ	1	Tape (length : 160 mm)
7	B9565AJ	1	Screw (for internal mechanism stopper)
(8)	B9565CR	2	Bracket Assembly (accessory)
9	B9567AF	1	Door Assembly
10	B95658W	1	Nameplate

Case and Door Assemblies
Models 4152 and 4153



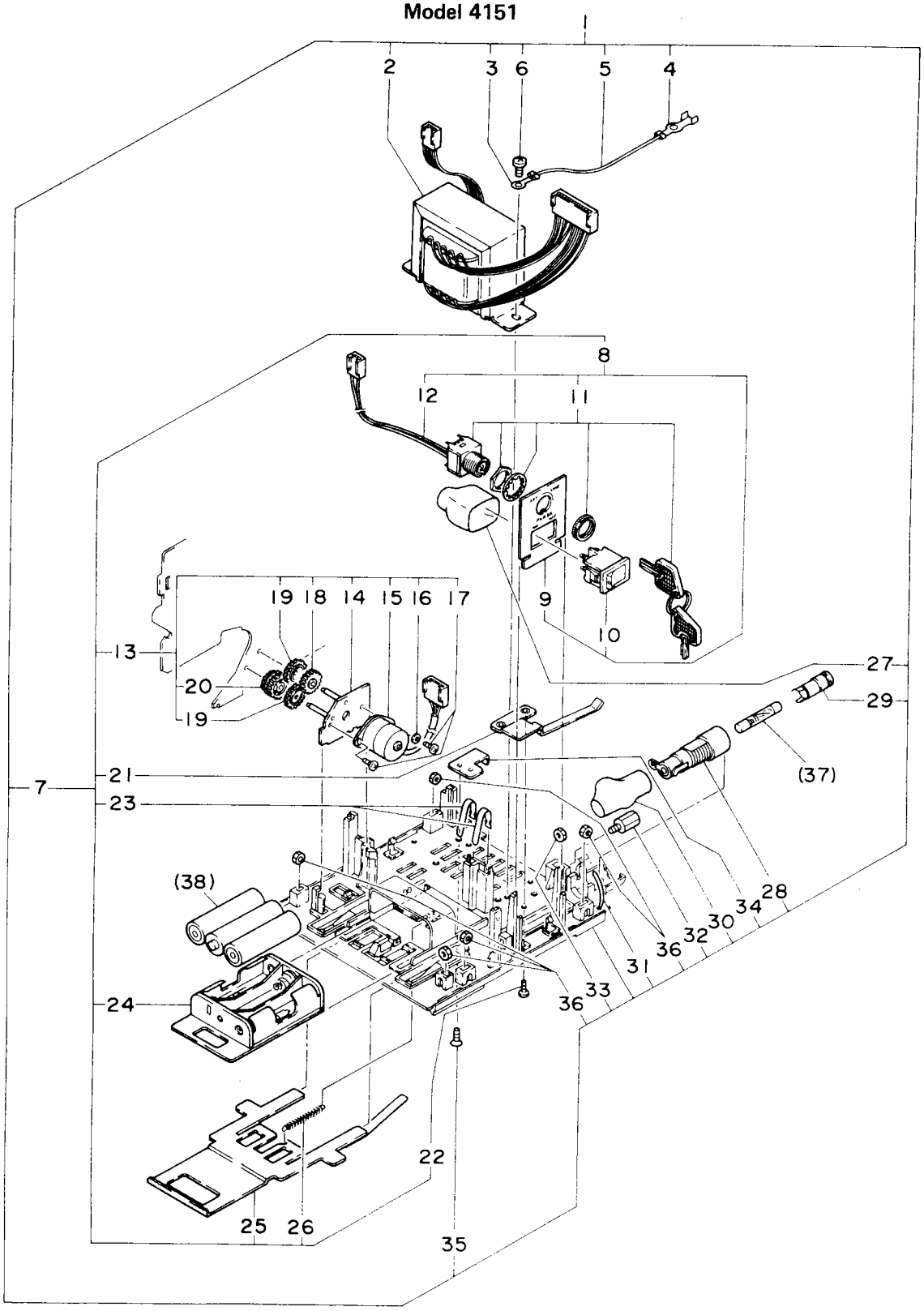
Item	Part No.	Qty	Description
1	B9567AD	1	Case Assembly
2	B9565CM	1	Case Assembly
3	B9565CD	1	Spring
4	B9565CW	2	Screw
5	B9565CB	1	Gasket
6	B9565CQ	1	Tape (length : 192 mm)
7	B9565AJ	1	Screw (for internal mechanism stopper)
(8)	B9565CR	2	Bracket Assembly (accessory)
9	B9567AF	1	Door Assembly
10	B9565BX	1	Nameplate (for Model 4152)
	B9565BY	1	Nameplate (for Model 4153)

Chart Cassette and Display Assemblies



Item	Part No.	Qty	Description
1	B9565LA	1	Display Assembly (for Model 4151)
2	B9565LC	1	Display Assembly (for Models 4152 and 4153)
3	B9567AZ		Tapping Screw
4	B9565LD		Cold Cathode Fluorescent Lamp
5	B9565GJ	1	Cover
6	Y9231WL	1	Washer (with toothed lockwasher)
7	Y9203KE	2	B.H. Screw, M2.3 x 3
8	B9565GN	1	Nameplate (for °C) }
	B9565GR	1	Nameplate (for °F) } (select)
	B9565GT	1	Nameplate (for DIN/DIN) }
9	G9565GH	1	Bracket
10	Y9203KE	1	B.H. Screw, M2.3 x 3
11	B9565GP	1	Keyboard
12	B9565GM	2	Bezel
13	B9565CY	1	Nameplate
14	B9565KA	1	Chart Cassette Assembly

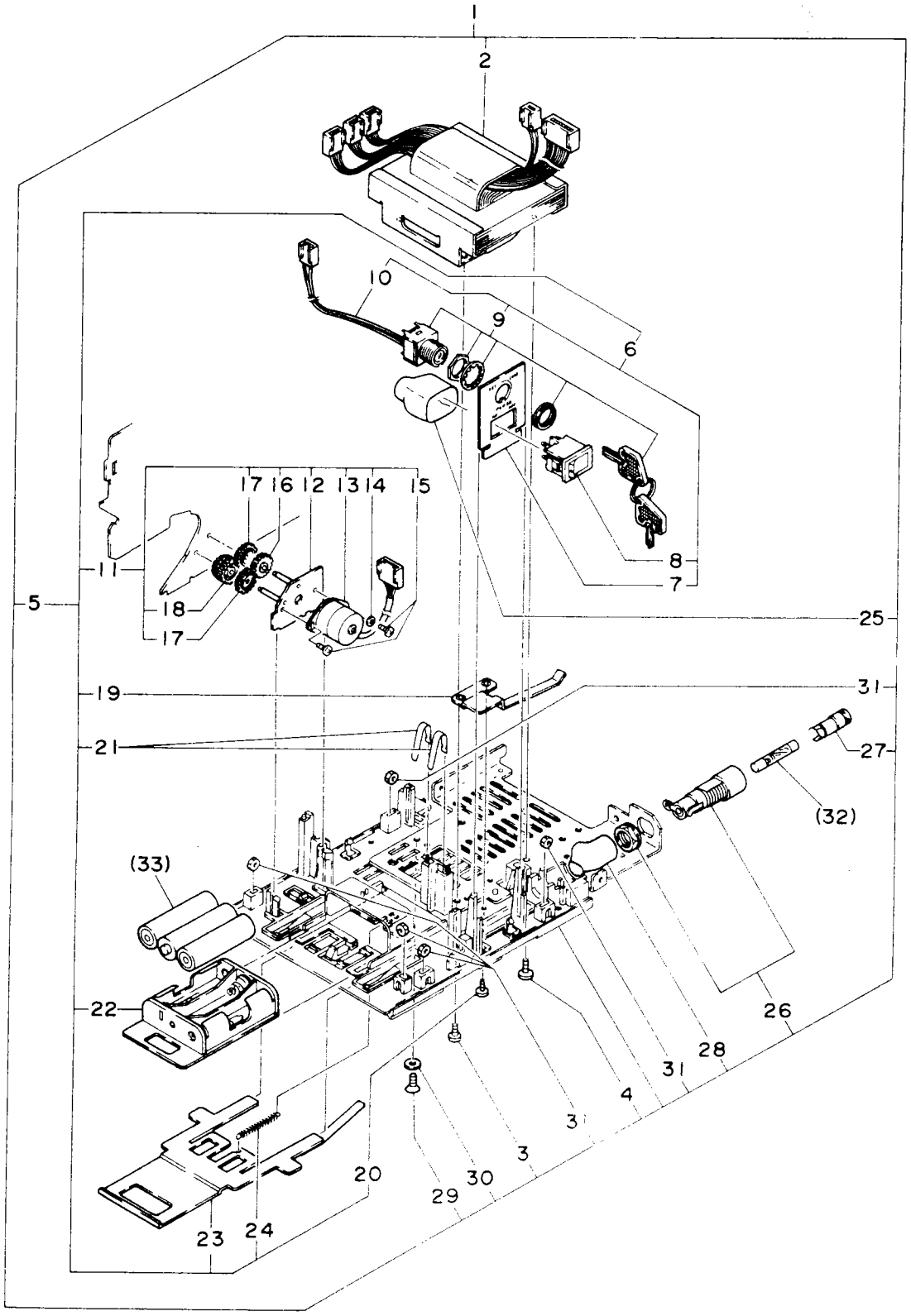
Chassis Assembly
Model 4151



Item	Part No.	Qty	Description
1	B9565GW	1	Chassis Assembly (100 V AC, series) }
	B9565GX	1	Chassis Assembly (200 V AC, series) }
2	B9565GY	1	Transformer (100 V AC, series) } select
	B9565GZ	1	Transformer (200 V AC, series) }
3	Y9401TP	1	Tip
4	Y9302TP	1	Tip
5	A9181WW	1	Wire
6	Y9406TS	2	Tapping Screw, M4 x 6
7	B9565HA	1	Chassis Assembly
8	B9565HN	1	Switch Assembly
9	B9565HP	1	Panel
10	B9708FH	1	Switch
11	B9544ZA	1	Key Switch
12	B9565HG	1	Wire Assembly
13	B9565JA	1	Chart Drive Assembly
14	B9565JE	1	Plate Assembly
15	B9565JH	1	Motor Assembly
16	Y9201WB	1	Washer
17	Y9203JB	2	Pan H. Screw, M2.3 x 3
18	B9565JD	1	Gear
19	B9565JC	2	Gear
20	B9565JB	1	Gear
21	B9567AJ	1	Spring
22	B9565AY	2	Screw
23	B9565HF	2	Contact
24	B9565HK	1	Battery Assembly
25	B9565HW	1	Bracket Assembly
26	A9023KN	1	Spring
27	A9426XK	1	Tube
28	A9072KF	1	Fuse Holder
29	A9073KF	1	Fuse Carrier
30	A9425XK	1	Tube
31	B9565HE	1	Band
32	B9565GS	1	Rod
33	Y9401BB	1	Nut
34	B9567AK	1	Bracket
35	Y9305EB	1	F.H. Screw, M3 x 5
36	Y9301BB	4	Nut
(37)	A9049KF	1	Fuse (100 V AC series, 0.5 A time lag) }
	A9078KF	1	Fuse (200 V AC series, 0.315 time lag) } select (accessory)
(38)	A9024ED	3	Battery (accessory)

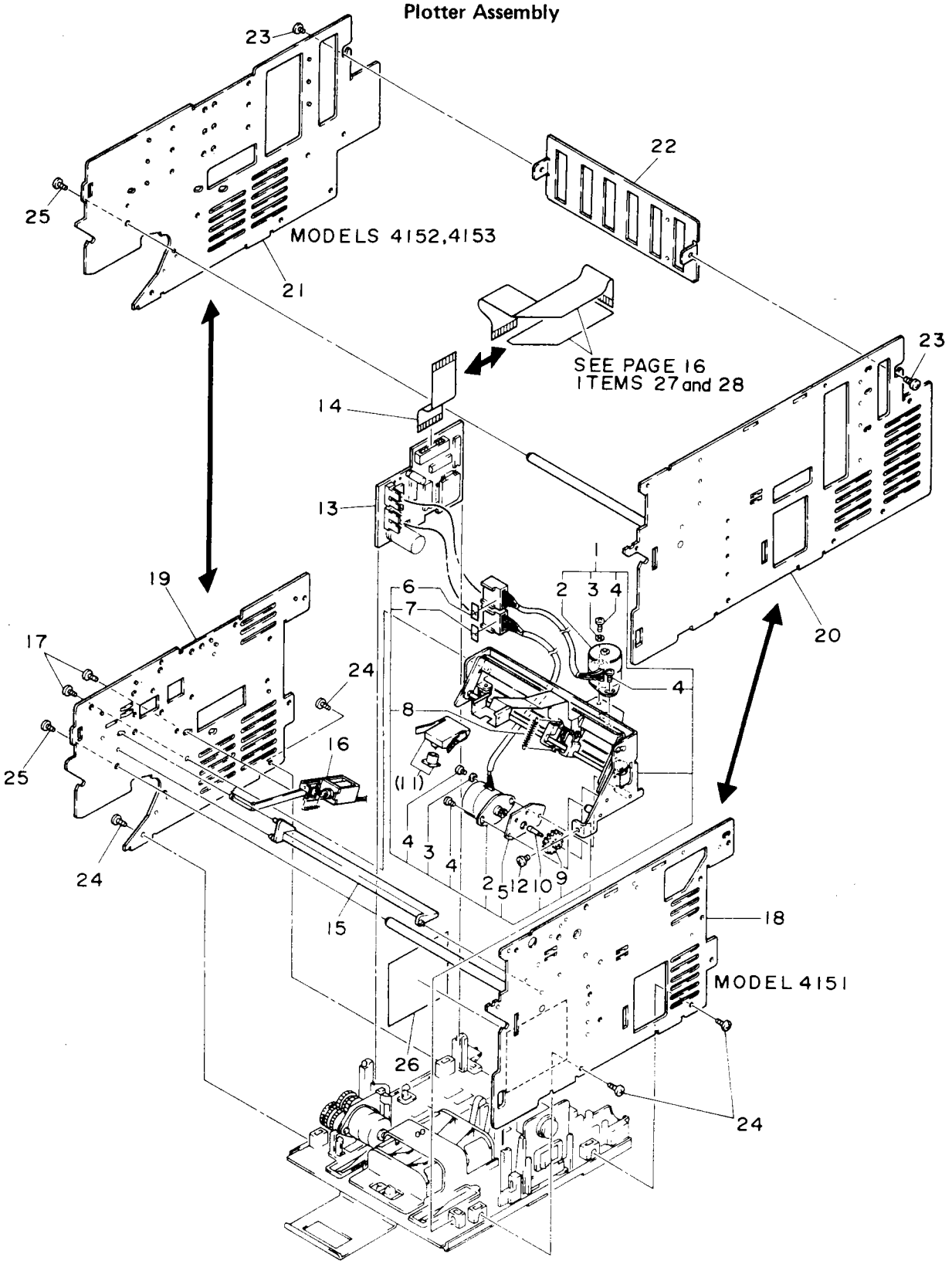
Chassis Assembly

Models 4152 and 4153



Item	Part No.	Qty	Description
1	B9565WL	1	Chassis Assembly (100 V AC series) }
	B9565WM	1	Chassis Assembly (200 V AC series) } select
2	B9565WP	1	Transformer (100 V AC series) } select
	B9565WQ	1	Transformer (200 V AC series) } select
3	Y9410TS	2	Tapping Screw, M4 x 10
4	Y9406TS	3	Tapping Screw, M4 x 6
5	B9565HA	1	Chassis Assembly
6	B9565HN	1	Switch Assembly
7	B9565HP	1	Panel
8	B9708FH	1	Switch
9	B9544ZA	1	Key Switch
10	B9565HG	1	Wire Assembly
11	B9565JA	1	Chart Drive Assembly
12	B9565JE	1	Plate Assembly
13	B9565JH	1	Motor Assembly
14	Y9201WB	1	Washer
15	Y9203JB	2	Pan H. Screw, M2.3 x 3
16	B9565JD	1	Gear
17	B9565JC	2	Gear
18	B9565JB	1	Gear
19	B9567AJ	1	Spring
20	B9565AY	2	Screw
21	B9565HF	2	Contact
22	B9565HK	1	Battery Assembly
23	B9565HW	1	Bracket Assembly
24	A9023KN	1	Spring
25	A9426XK	1	Tube
26	A9072KF	1	Fuse Holder
27	A9073KF	1	Fuse Carrier
28	A9425XK	1	Tube
29	Y9410TQ	1	Tapping Screw, M4 x 10
30	Y9400WB	1	Washer
31	Y9301BB	5	Nut
(32)	A9049KF	1	Fuse (100 V AC series, 0.5 A time lag) } select (accessory)
	A9078KF	1	Fuse (200 V AC series, 0.315 A time lag) } select (accessory)
(33)	A9024ED	3	Battery (accessory)

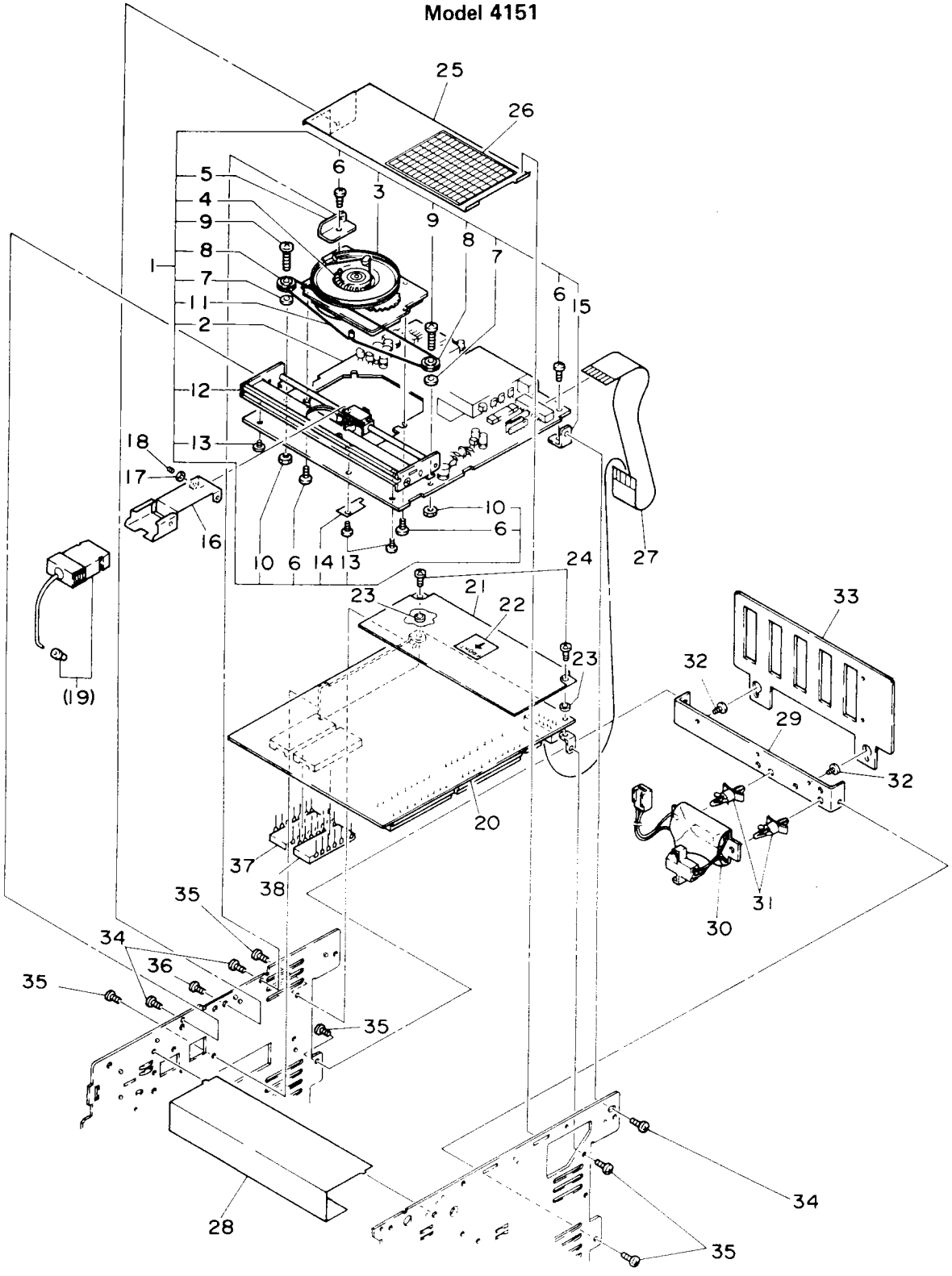
Plotter Assembly



Item	Part No.	Qty	Description
1	B9565SR	1	Plotter Assembly
2	B9565JH	2	Motor Assembly
3	Y9201WB	2	Washer
4	Y9203JB	4	Pan H. Screw, M2.3 x 3
5	B9565TJ	1	Plate
6	G9325DF	1	Nameplate [X]
7	G9325DG	1	Nameplate [Y]
–	B9565ST	1	Carriage Assembly
8	A9025KN	1	Spring
–	B9565TA	1	Bracket Assembly
9	B9565TD	1	Gear
10	B9565TF	1	Shaft
(11)	B9565ZA	1	Pen Assembly (accessory)
12	Y9305LE	1	B.H. Screw, M3 x 5
13	B9565SK	1	P. Board Assembly (plotter board)
14	B9565XS	1	Wire *1 (plotter board ↔ C.P.U. board)
15	B9565SC	1	Lever
16	B9565SD	1	Solenoid Assembly
17	Y9304LE	3	B.H. Screw, M3 x 4
18	B9565GC	1	Frame Assembly *1
19	B9565GB	1	Frame *1
20	B9565WD	1	Frame Assembly *2
21	B9565WC	1	Frame *2
22	B9565WF	1	Bracket *2
23	B9565AY	2	Screw *2
24	Y9306LE	4	B.H. Screw, M3 x 6
25	B9565AY	1	Screw
26	B9565BF	1	Nameplate (data plate)

Note:
*1: For Model 4151
*2: For Models 4152 and 4153

Servo, CPU Board and Inverter Assemblies
Model 4151



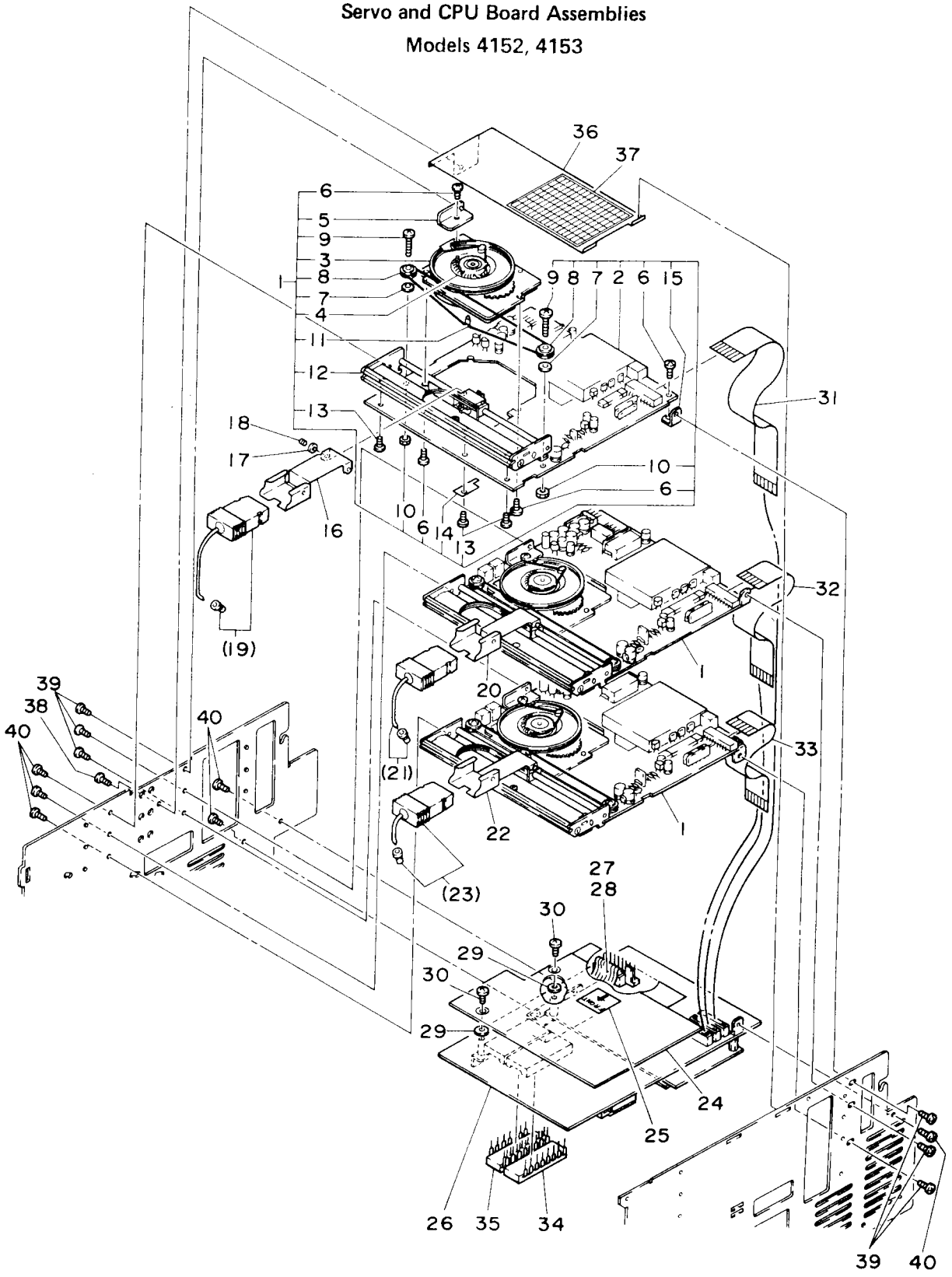
Item	Part No.	Qty	Description
1	B9565MA	1	Servo Assembly (mV and TC inputs) } (select)
	B9565MB	1	Servo Assembly (RTD input) }
2	B9565LE	1	A/D Servo AMP Assembly (mV and TC inputs) } (select)
	B9565LF	1	A/D Servo AMP Assembly (RTD input) }
3	B9565PA	1	Motor Assembly
4	A9026KN	1	Spring
5	B9565PT	1	Bracket
6	Y9304LB	5	B.H. Screw, M3 x 4
7	Y9720YA	2	Spacer
8	B9565TW	2	Bearing
9	Y9310LB	2	B.H. Screw, M3 x 10
10	Y9301CB	2	Nut
11	B9565QM	1	String Assembly
12	B9565MR	1	Servo Carriage Assembly
13	Y9204KB	3	B.H. Screw, M2.3 x 4
14	B9565NY	1	Plate (for clamp)
15	B9565LL	1	Bracket
16	B9565ME	1	Pen Arm Assembly
17	B9565MQ	1	Nut
18	Y9204SB	1	Setscrew
(19)	B9565YA	1	Pen Assembly
20	B9565LK	1	CPU Board Assembly
21	B9565LN	1	Plate (for insulator)
22	B9565LQ	1	Nameplate
23	Y9902YA	2	Spacer
24	Y9306LB	2	B.H. Screw, M3 x 6
25	B9565GG	1	Cover
26	B9565GQ	1	Nameplate
27	B9565XR	1	Wire (servo assembly ↔ C.P.U board)
28	B9565GK	1	Cover
29	B9565GL	1	Bracket
30	B9565XH	1	INV Assembly (for inverter power supply)
31	G9320KH	2	Stud
32	Y9306LE	2	B.H. Screw, M3 x 6
33	B9565GF	1	Bracket
34	Y9304LE	2	B.H. Screw, M3 x 4
35	B9565AY	5	Screw
36	B9565CX	1	Screw
37	See Note	1	ROM Assembly (1)
38	See Note	1	ROM Assembly (2)

Note:

Model Code	Suffix Code	Inputs Types	ROM Part No.	ROM No.
4151	- 1 0 0	DC V & TC (ANSI & JIS), °C	B9565RA	1
	- 2 0 0	RTD (JIS), °C		
	- 3 0 0	DC V & TC (ANSI), °C		
	- 4 0 0	RTD (DIN), °C	B9565RB	2
	- 5 0 0	DC V & TC (ANSI), °F		
	- 6 0 0	RTD (DIN), °F		
	- 7 0 0	DC V & TC (DIN), °C	B9565RC	1
	- 8 0 0	RTD (DIN), °C	B9565RD	2

Servo and CPU Board Assemblies

Models 4152, 4153

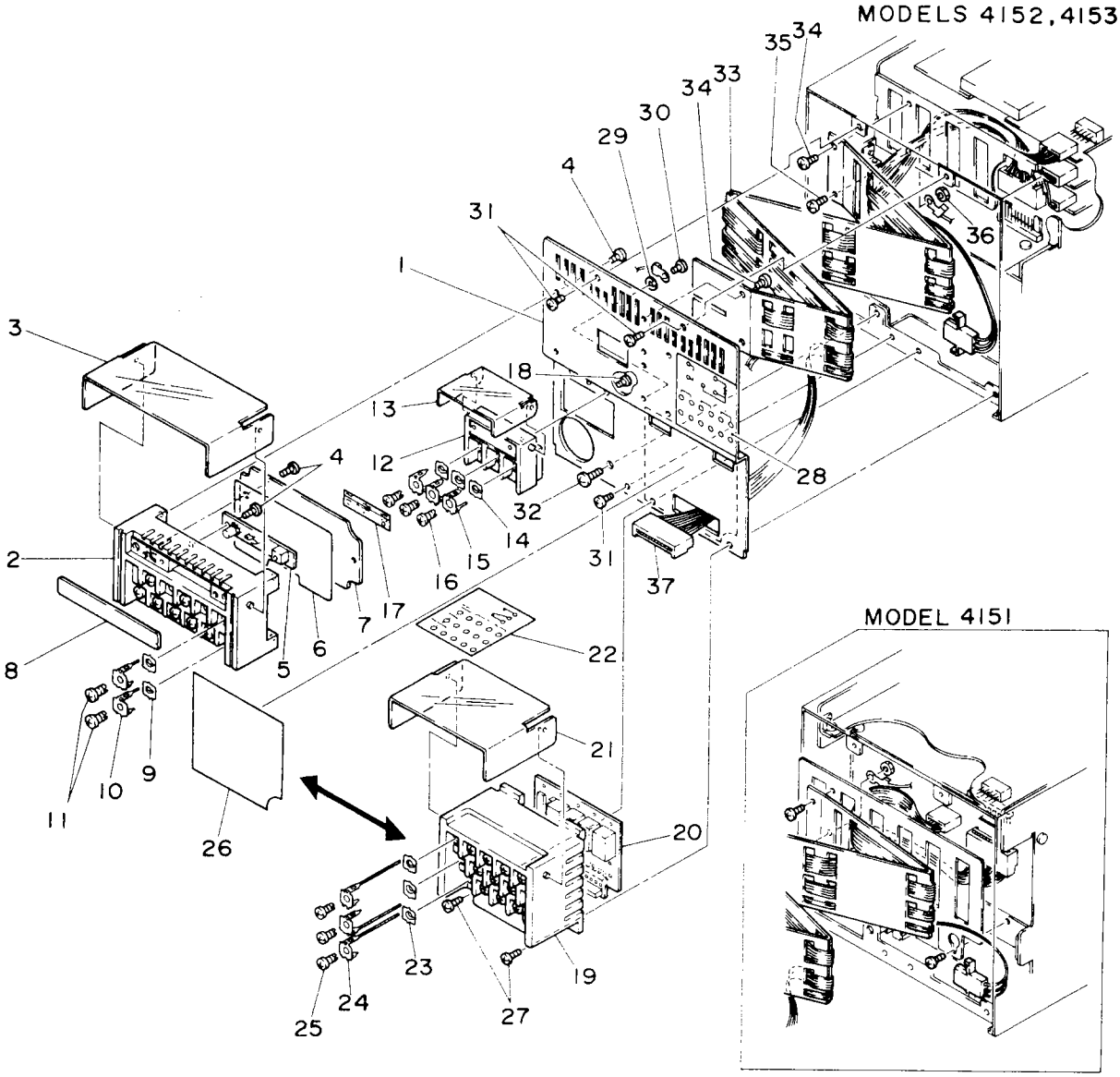


Item	Part No.	Qty Model 4152	Qty 4153	Description
1	B9565MA	1 to 2	1 to 3	Servo Assembly (mV and TC inputs) } (select)
	B9565MB	1 to 2	1 to 3	Servo Assembly (RTD Input) } (select)
2	B9565LE	1	1	A/D Servo AMP Assembly (mV and TC inputs) } (select)
	B9565LF	1	1	A/D Servo AMP Assembly (RTD input) } (select)
3	B9565PA	1	1	Motor Assembly
4	A9026KN	1	1	Spring
5	B9565PT	1	1	Bracket
6	Y9304LB	5	5	B.H. Screw, M3 x 4
7	Y9720YA	2	2	Spacer
8	B9565TW	2	2	Bearing
9	Y9310LB	2	2	B.H. Screw, M3 x 10
10	Y9301CB	2	2	Nut
11	B9565QM	1	2	String Assembly
12	B9565MR	1	1	Servo Carriage Assembly
13	Y9204KB	3	3	B.H. Screw, M2.3 x 4
14	B9565NY	1	1	Plate (for clamp)
15	B9565LL	1	1	Bracket
16	B9565ME	1	1	Pen Arm Assembly
17	B9565MQ	2	3	Nut
18	Y9204SB	2	3	Setscrew
(19)	B9565YA	1	1	Pen Assembly (accessory) (1st pen)
20	B9565MJ	1	1	Pen Arm Assembly
(21)	B9565YB	1	1	Pen Assembly (accessory) } (2nd pen)
22	B9565MM		1	Pen Arm Assembly } (2nd pen)
(23)	B9565YC		1	Pen Assembly (accessory) } (3rd pen)
24	B9565XC	1	1	Plate (for insulator) } (3rd pen)
25	B9565LQ	1	1	Nameplate
26	B9565XA	1	1	Main PCB Assembly } (select)
	B9565XB	1	1	Main PCB Assembly*1 } (select)
27	B9565XW	1	1	Wire } (plotter board ↔ C.P.U board)
28	B9565WW	1	1	Plate } (plotter board ↔ C.P.U board)
29	Y9902YA	2	2	Spacer
30	Y9306LB	2	2	B.H. Screw, M3 x 6
31	B9565XR	1	1	Wire (1st pen servo ↔ Main PCB)
32	B9565XS	1	1	Wire (2nd pen servo ↔ Main PCB)
33	B9565XT		1	Wire (3rd pen servo ↔ Main PCB)
34	See Note	1	1	ROM Assembly (1)
35	See Note	1	1	ROM Assembly (2)
36	B9565GG	1	1	Cover
37	B9565GQ	1	1	Nameplate
38	B9565CX	1	1	Screw
39	Y9304LE	4	6	B.H. Screw, M3 x 4
40	B9565AY	5	6	Screw

Note •1: For Model 415□ · · · ·/PS (option)

Model Code	Suffix Code				Description	ROM Part No.	ROM No.
	□	□	□· · ·/□□				
4152	1 to 6	1 to 6	0		ANSI/JIS, DIN	B9565RE	1
	1 to 6	1 to 6	0			B9565RF	2
	1 to 6	1 to 6	0	/PS		B9565RJ	1
	1 to 6	1 to 6	0	/PS		B9565RK	2
	7 or 8	7 or 8	0		DIN/DIN	B9565RG	1
	7 or 8	7 or 8	0			B9565RH	2
	7 or 8	7 or 8	0	/PS		B9565RL	1
	7 or 8	7 or 8	0	/PS		B9565RM	2
4153	1 to 6	1 to 6	1 to 6		ANSI/JIF, DIN	B9565RE	1
	1 to 6	1 to 6	1 to 6			B9565RF	2
	1 to 6	1 to 6	1 to 6	/PS		B9565RJ	1
	1 to 6	1 to 6	1 to 6	/PS		B9565RK	2
	7 or 8	7 or 8	7 or 8		DIN/DIN	B9565RG	1
	7 or 8	7 or 8	7 or 8			B9565RH	2
	7 or 8	7 or 8	7 or 8	/PS		B9565RL	1
	7 or 8	7 or 8	7 or 8	/PS		B9565RM	2

Terminal Assembly

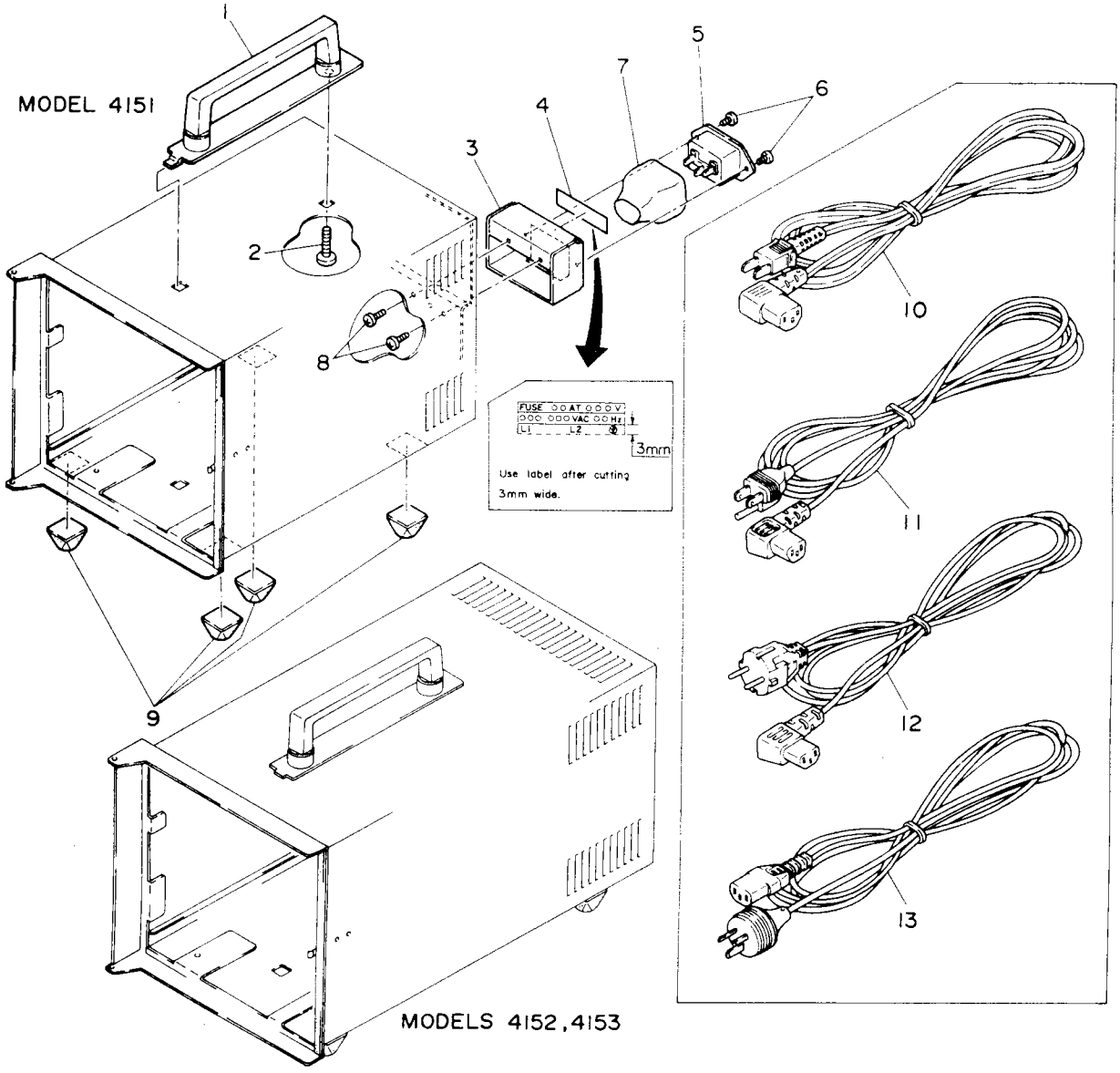


Item	Part No.	Qty	Description
1	B9565EN	1	Panel
2	B9565FA	1	Terminal
3	B9565FP	1	Cover
4	Y9310TS	3	Tapping Screw, M3 x 10
5	B9565ER	1	PCB Assembly (for RJC) (mV and TC inputs)
6	B9565FW	1	Plate (for insulator)
7	B9565FH	1	Plate
8	B9565FJ	1	Plate (mV and TC inputs)
9	B9565FB	4 to 9	Nut
10	B9565FC	4 to 9	Bracket
11	B9565AZ	4 to 9	Screw
12	B9565FD	1	Terminal
13	B9565FK	1	Cover
14	B9565FB	3	Nut
15	B9565FC	3	Bracket
16	B9565AZ	3	Screw
17	Below	–	Nameplate
	B9565BK	1	100 V AC 50 Hz }
	B9565BL	1	100 V AC 60 Hz }
	B9565BM	1	115 V AC 50 Hz }
	B9565BN	1	115 V AC 60 Hz } select)
	B9565BP	1	200 V AC 50 Hz }
	B9565BQ	1	200 V AC 60 Hz }
	B9565BR	1	230 V AC 50 Hz }
	B9565BS	1	230 V AC 60 Hz }
18	Y9310TS	2	Screw
19	B9565ET	1	Terminal
20	B9565EW	1	PCB Assembly*1 }
	B9565EY	1	PCB Assembly*2 }
	B9565EX	1	PCB Assembly*3 }
21	B9565FQ	1	Cover }
22	B9565FM	1	Nameplate }
23	B9565FB	3	Nut*2 } (option)
	B9565FB	12	Nut*1 }
24	B9565FE	3	Bracket*2 }
	B9565FE	12	Nut*1 }
25	B9565AZ	3	Screw*2 }
	B9565AZ	12	Screw*1 }
26	B9565EP	1	Plate (for recorder without option terminal)
27	Y9306LE	2	B.H. Screw, M3 x 6
28	B9565FL	1	Nameplate
29	Y9301WL	1	Washer (with toothed lockwasher)
30	Y9304LE	1	B.H. Screw, M3 x 4
31	B9565AY	3	Screw
32	Y9406LB	1	B.H. Screw, M4 x 6 (for shipping stop)
33	B9565FF	1	Guide
34	Y9304LE	3	B.H. Screw, M3 x 4
35	Y9308LE	1	B.H. Screw, M3 x 8
36	Y9301BB	1	Nut
37	B9565FT	1	Wire Assembly (Model 415□ □□□· · · /AK-04/REM) (option)

Note
*1: For Model 415□ □□□· · /AK-04
*2: For Model 415□ □□□· · · · · · /REM
*3: For Model 415□ □□□· · /AK-04/REM

Portable Type (option)

Model 415□·····/PBL



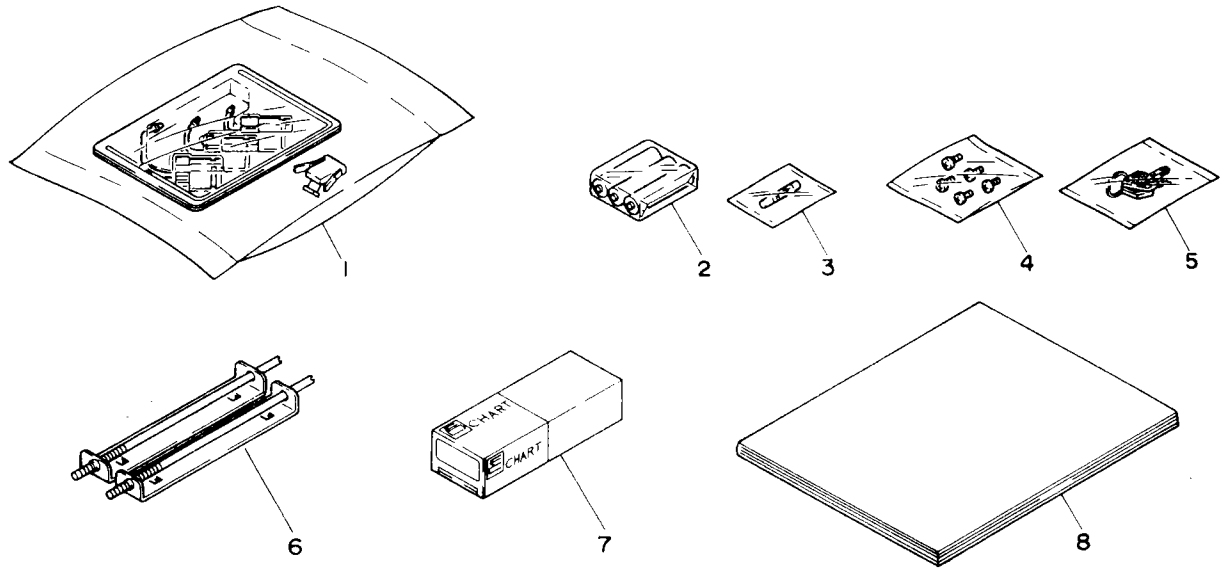
Item	Part No.	Qty	Description
1	B9567BA	1	Handle Assembly
2	Y9518LB	1	B.H. Screw, M5 x 18
3	B9567BG	1	Bracket
4	Below	–	Nameplate
	B9565BK	1	100 V AC 50 Hz
	B9565BL	1	100 V AC 60 Hz
	B9565BM	1	115 V AC 50 Hz
	B9565BN	1	115 V AC 60 Hz
	B9565BP	1	200 V AC 50 Hz
	B9565BQ	1	200 V AC 60 Hz
	B9565BR	1	230 V AC 50 Hz
	B9565BS	1	230 V AC 60 Hz

(select)

Item	Part No.	Qty	Description
5	A9172KC	1	Connector
6	Y9306LE	2	B.H. Screw, M3 x 6
7	A9425XK	1	Tube
8	Y9306LK	2	B.H. Screw, M3 x 6
9	B9529LM	4	Bumper
10	A9009WD	1	Power Code (other than below)
11	A9008WD	1	Power Code (UL standard)
12	A9011WD	1	Power Code (VDE standard)
13	A9015WD	1	Power Code (SAA standard)

(select)

Accessory



Item	Part No.	Model	Qty 4151	Qty 4152	Qty 4153	Description	
1	—		1			Pen Assembly (1st pen & plotter pen)	*1
	—			1		Pen Assembly (1st, 2nd pens & plotter pen)	*1
	—				1	Pen Assembly (1st, 2nd, 3rd pens & plotter pen)	*1
2	A9024ED		3	3	3	Battery	
3	A9049KF		1	1	1	Fuse (100 V AC series, 0.5 A time lag)	(select)
	A9078KF		1	1	1	Fuse (200 V AC series, 0.315 A time lag)	(select)
4	B9565AZ		5	5	5	Screw (for terminal)	
5	—		1	1	1	Key (see page 8)	
6	B9565CR		2	2	2	Bracket Assembly (for panel mounting)	
7	—		1	1	1	Chart *2	
8	—		1	1	1	Instruction Manual	

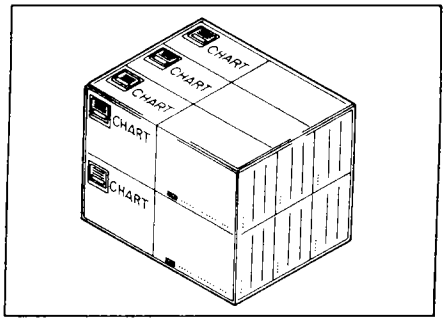
Note

*1: Pen package is supplied in packs of 3 pcs — order part number see below.

Part No.	Qty	Description
B9565AP	3	1st Pen (red)
B9565AQ	3	2nd Pen (green)
B9565AR	3	3rd Pen (blue)
B9565AS	3	Plotter Pen (purple)

(one pack is the minimum order quantity)

*2: Chart paper is supplied in packs of 6 sheaves — order part number B9565AW (one pack is the minimum order quantity).



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