

# **HIOKI**

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INSTRUCTION MANUAL

## **EPR-3000 Series**

### **EPR-3011**

### **EPR-3021**

## **ELECTRONIC POLYRECORDER**

HIOKI E. E. CORPORATION

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## Beginning

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Thank you very much for your purchasing of our portable recorder.

To correctly use this unit, read this manual well and utilize it.

Please keep this manual with care.



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## 1. Caution on handling

### 1.1 Fully take care since the following operations are dangerous.

- 1) Don't apply the more than 50V.
- 2) A fuse is replaced with the power source of the unit turned off.

### 1.2 The following operation might damage the instrument.

- 1) Insert the internal cells so that polarity of + & - is not mistakened.
- 2) To prevent the corrosion by leakage of internal cells, take out them when in use for a long period.
- 3) Insertion of pen
  - ◇ Inserts the pen under condition that the pen is surely in UP position.
  - ◇ Inserts the pen after "MEAS. ZERO" switch is set to ZERO.
  - ◇ Inserts the pen after removing the pen cap.

### 1.3 Some cautions to guarantee the stable recording

- 1) Do not lubricate in the pen running portion. (Wipe off the dirt on the pen running portion with dry clothe.)
- 2) When used at the chart speed of less than 120mm/H, be sure to use the roll chart paper or ink pen for low speed. (Blot or scratching at folded section can be prevented.)
- 3) When not in use for a long period, be sure to put the cap on. When putting the cap, put it back to the original pen. If another color cap is put, the color of ink might be mixed.
- 4) Use the our exclusive Z-fold chart paper (SE-10Z-2) or roll type chart paper(SE-10). Loading of other than ours does not guarantee the stable recording in the function of recording status, chart paper forwarding and folding.

### 1.4 Preparation prior to usage

#### 1.4.1. Initial inspection

When unpacking, confirm no damage occurs in transportation. Specifications of function are fully guaranteed before shipment, but check the instrument according to the specifications.

#### 1.4.2 Configuration

Standard configuration is as follows: Confirm all parts are included.

Main body	1
Instruction manual	1
Power cord	1
Ink pen	1 (1 pen) or 2(2 pens)
Plug for external DC battery	1
Chart paper	1

#### 1.5 Supply of power source

This is operated by A line(Mains), external DC power or internal dry cells.

AC line	100VAC, -10 to +10% Freq. covers 48 to 62Hz.
External DC power	Operates on nominal 12 to 27VDC.
Internal dry cell	6 pcs. of alkali or manganese 1.5V (UM-1, R20 or D size) cell

#### Caution

There is order priority between AC, external DC & Internal cell. Refer to (3-2-5).

#### 1.6 Grounding

When operated by AC power source, be sure to ground the unit using the earth terminal on the rear panel to protect the operator against electrical shock.

#### 1.7 Connecting cord for input

When connecting the input terminal of this unit to the circuit being measured, use the lead wire kept at hand.

When external control is used, 14 pins of amphenor plug is necessary.





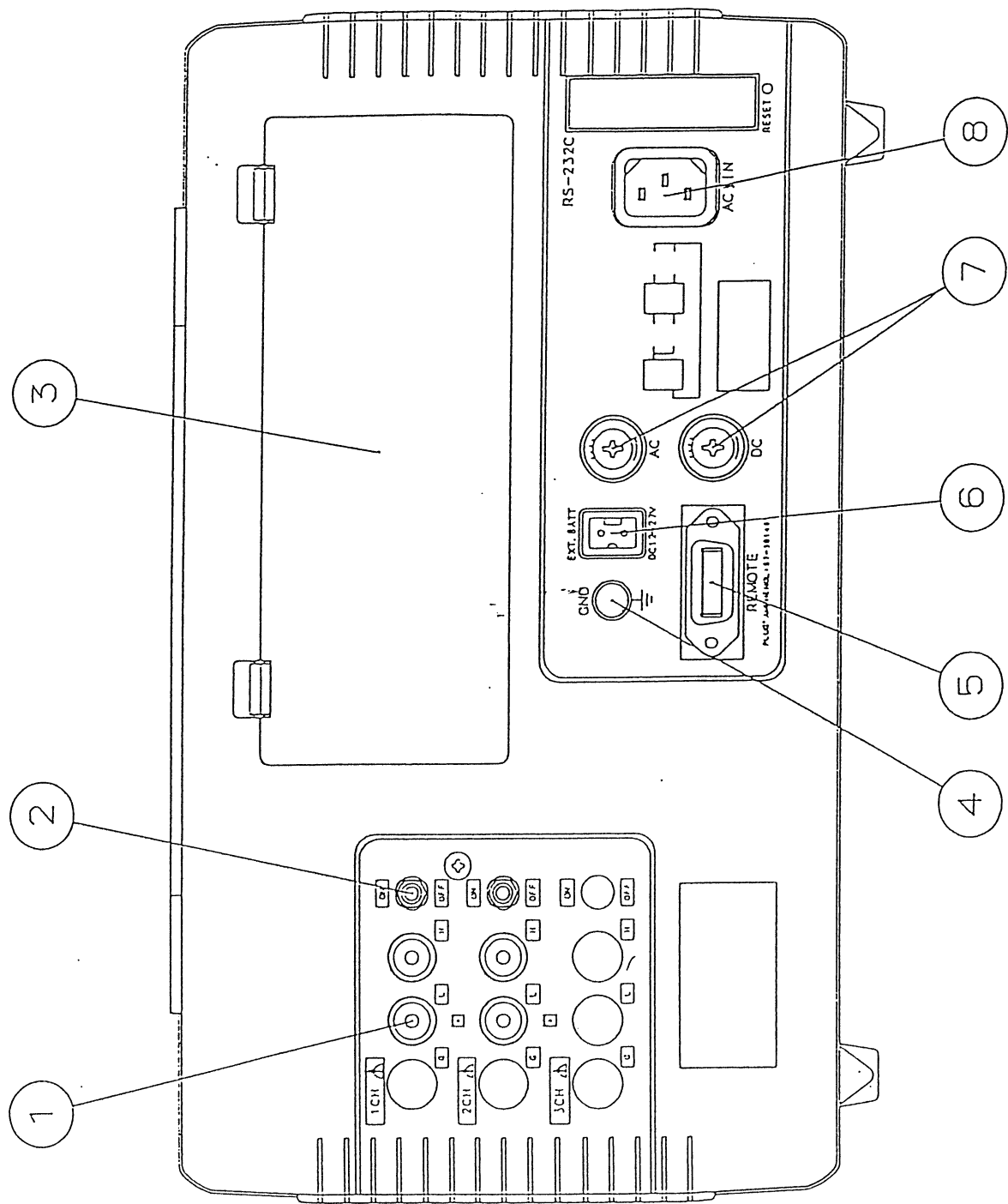


Fig. 2 - 2 Drawing of Rear Panel of EPR-3000 SERIES

## 2. Name of each part and its function

### 2.1 General Description

In this section, each switch, knob, lever & terminals are explained according to the Fig. 2-1 & 2-2.

### 2.2 Front panel(Refer to Fig. 2-1.)

- |                            |   |
|----------------------------|---|
| ① 「POWER」 Switch           | Switch to turn power supply ON or OFF.<br>Pressing this switch turns ON, one more pressing turns OFF  |
| ② 「POWER CHECK」 Switch     | Lit when the power is ON. Blinking announces the replacement time of internal battery cell.   |
| ③ 「START/STOP」 Switch      | Switch to activate the chart feeding<br>Pressing it turns ON. One more pressing OFF.  |
| ④ 「FEED」 Switch            | While pressing this switch, the chart is fed at the speed of approx. 360mm/min. Convenient for matching the pen tip to time axis.   |
| ⑤ 「CHART SPEED」 knob       | Knob to select the chart speed  |
| ⑥ 「RANGE」 Switch           | Knob to select the measuring full scale range of which indication is separated plus and minus in the center.  |
| ⑦ 「SPAN」 Volume            | When SPAN switch is set to On and turn this volume clockwise, the span is expanded by approx. 20%.<br>Reversely, turning it to counterclockwise reduces the sensitivity by max. 20%. It is convenient to adjust the span, matching the extension or contraction of the chart paper. |
| ⑧ 「SPAN」 switch            | Pressing this switch turns On which permits the operation of [SPAN] volume. Repressing turns OFF and restores to inner calibrated setting span.   |
| ⑨ 「DIP MARK」 switch        | Pressing this switch deflects the pen to left side by 2.5 divisions. Used when required to mark on the recording line.  |
| ⑩ 「CAL. ZERO MEAS.」 switch | Input change-over switch.<br>Setting to MEAS. side (down side) becomes a measuring condition by connecting input signal. Setting to ZERO position (medium) separates the input signal. Setting to CAL. side (upper side) generates the reference voltage for simplified calibration |

- |                       |   |
|-----------------------|---|
| ⑪ [POSITION] switch   | Knob to adjust the zero point of the pen or move the pen. With [CAL. ZERO. MEAS.] switch turned to ZERO, the pen can be moved over the whole range of effective recording width.                                    |
| ⑫ Chart holding cover | This cover presses the chart paper to the chart holding block, allowing stable chart feeding. Also used as supplementary plate when writing something on the paper.   |
| ⑬ [PEN] lever         | Lever to move the pen up or down  |
| ⑭ CHART SET lever     | Lever to let out the chart holding block forward when loading or changing the recording paper. If the lever is pushed up, the chart holding block will come out toward the front and recording paper can be loaded. |
| ⑮ Chart holding block | For holding the chart paper   |
| ⑯ Pen holder          | A pen is inserted into this holder.   |
| ⑰ Pen                 | Disposable cartridge type ink pen   |
| ⑱ SCALE PLATE         | 10 divided graduation of full scale is printed on the basis the center is standardized.   |

### 2.3 Rear Panel (Refer to Fig. -2-2.)

- |                            |   |
|----------------------------|---|
| ① Input terminal           | Terminal to connect the input leadwire. A Red (H) terminal is connected to high impedance against the earth, while a black (L) terminal to low impedance. |
| ② Power switch for channel | Switch to turn off the power of unused channel and save the power consumption.  |
| ③ Battery box cover        | A lid to encase the internal cells  |
| ④ [GND] terminal           | Terminal of ground the instrument   |
| ⑤ [REMOTE] connector       | Connector to control the chart speed externally<br>As to usage, refer to the article 3-4-6.   |
| ⑥ [EXT. BATT.] receptacle  | Receptacle to connect the external DC power (12 to 27VDC) and supply the power source, using an accessory plug.   |
| ⑦ FUSE HODLER              | Each specified fuse for AC power and DC power is inserted.  |
| ⑧ POWER RECEPTCLE          | Receptacle to connect an accessory power cord   |

### 3. How to use

#### 3.1 General Description

In this section, general item and fundamental usage are introduced.

#### 3.2 Connection of power and turning on the power

##### CAUTION

Following operation must be done after confirming the POWER switch is set to OFF position.

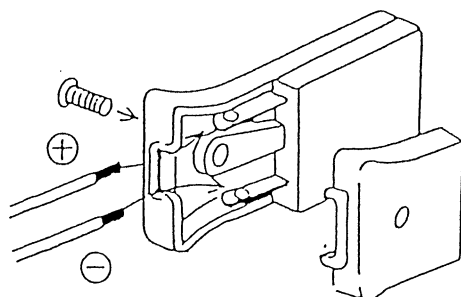
##### 3.2.1 Connection of AC power source (Mains)

- 1) After reading the article 1.5 of Caution on handling, measure the voltage of power source line.
- 2) A fuse in glass tube of selected voltage is inserted into the fuse holder.

Line power source	Fuse type
AC	0.5A slow-blow fuse
DC	1 A slow-blow fuse

- 3) Connect an accessory power cord to the receptacle to supply the power
- 4) Press the POWER switch. A lamp for POWERS CHECK is lit and indicates the power is supplied to the instrument.

##### 3.2.2 Connection of external DC power source



- 1) Solder the lead wires to an accessory 2P plug as shown Fig. 3-1, paying attention to the polarity.

Fig. 3 - 1

- 2) An assembled plug is inserted to EXT. BATT receptacle and connect the other end of the lead wire to external DC power source.

**CAUTION**

When connecting the lead wire to external DC power, pay the attention to the wrong connection of palarity.

Permissible (minimum) output current is as follows:

1-pen	0.4A or more
2-pen	0.6A or more

**CAUTION**

When external DC power source is not used, sure sure to pull out the plug.

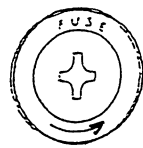
### 3.2.3 Connection of internal dry cell

- 1) Remove the battery cover on the rear panel.
- 2) Load the 6 pcs. of dry cell (UM-1, R20 or D size) into the cell holder without mistaking the polarity of + & -.
- 3) After loading the dry cell, put the cover back to the original position.

**CAUTION**

To protect against the corrosion by leakage of internal dry cell, remove the internal cell when the recorder is not used for a long period.

### 3.2.4. Replacement of fuse



AC



DC

The fuse for AC line and DC power source is inserted into respective FUSE holder on the rear panel. Remove the power source from the recorder, turn the fuse holder counter clockwise with a Philips (+) driver and replace it with new one.

Fig. 3 - 2

### 3.2.5 Priority usage order of AC line, external DC power and internal dry cell

If the external power voltage is over 14VDC , external power is used first , while lower than 14VDC, AC line used first. namely, When 27VDC battery is used, the battery is used first, while 12VDC used, AC line is used first.

Internal dry cell is lowest in priority usage order. If either AC line or external battery is connected, they have priority. An internal dry cell is used only when no external power is not connected.

( Order)

When external battery is less than 14VDC

1. AC line
2. external battery
3. internal dry cell

When external battery is more than 14VDC

1. external battery
2. AC line
3. internal dry cell

### 3.3 Preparation for measurement

#### 3.3.1 How to load the chart paper

Chart paper is loaded in the following order.

##### 1) Loading of Z-fold chart

- a) Pressing CHART SET lever upward opens the chart holding block to the front as shown in Fig. 3-3.

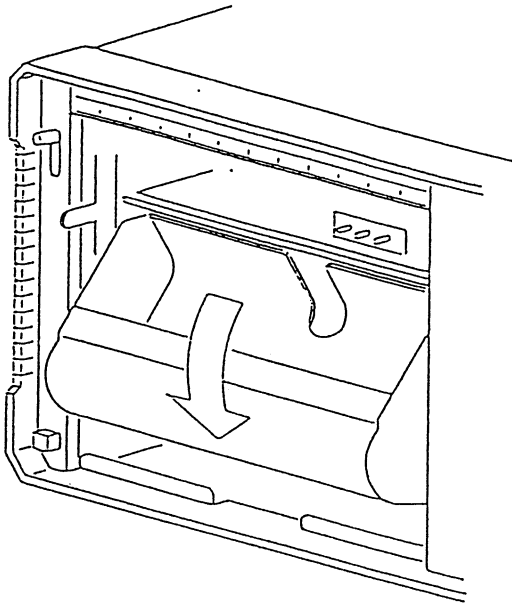


Fig. 3 - 3

- b) Shake the end of recording paper so that the folds become frayed completely. (Fig. 3-4)

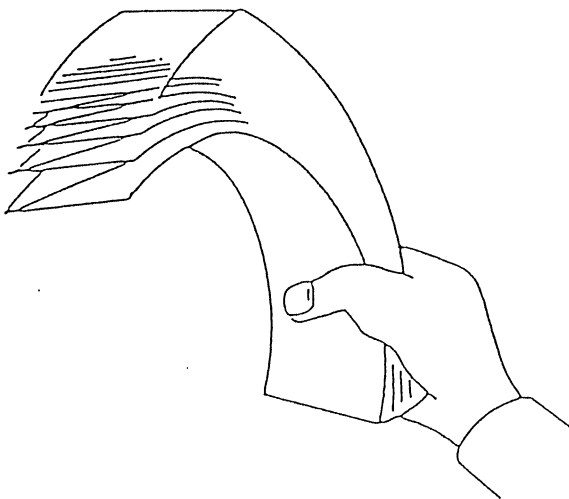


Fig. 3 - 4



- (c) Place the recording paper in the holder with the round perforations on the left, and pull out the tip of the recording paper by about 30cm.  
(Fig. 3 - 5)

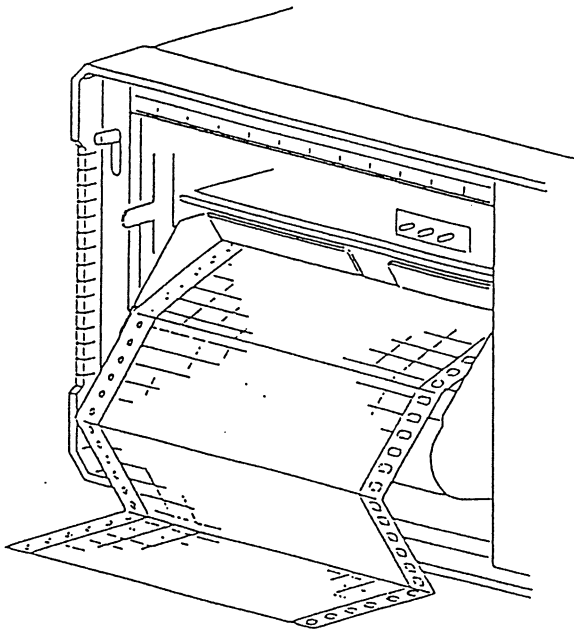


Fig. 3 - 5

- (d) Restore the recording paper holding block to the original position while pushing it up. At this time, the holder will be completely locked by returning to the original position in a little forcibly  
( Fig. 3- 6 )

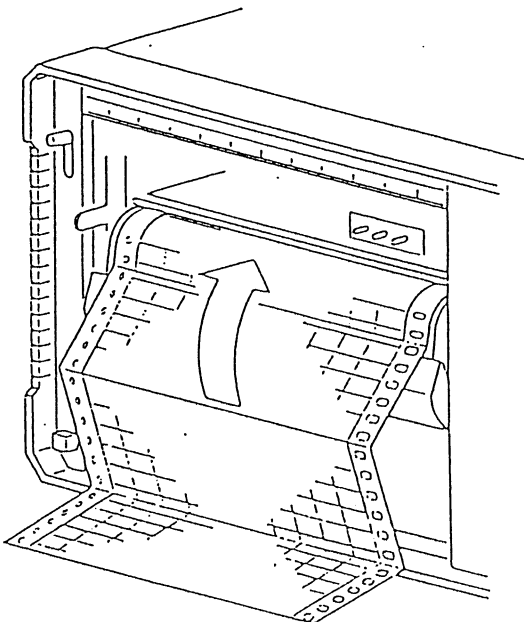
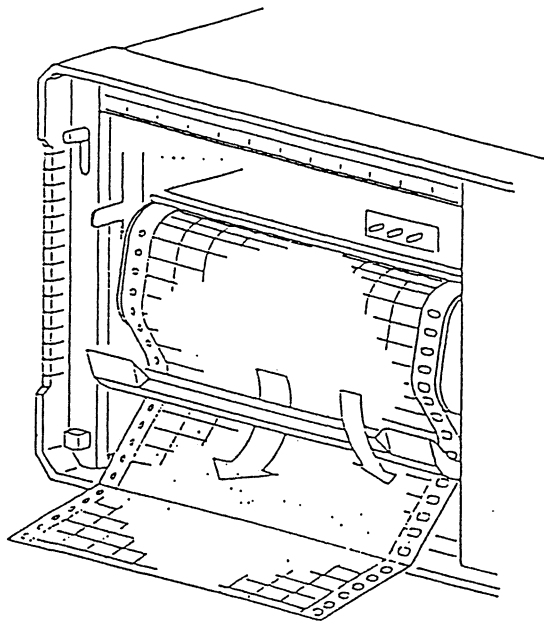
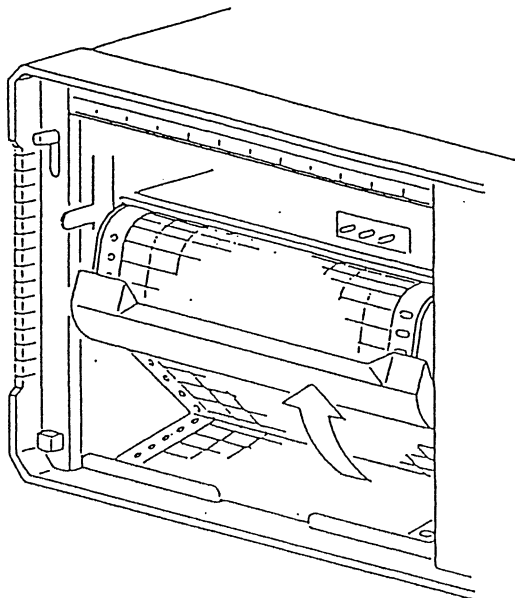


Fig. 3 - 6



- (e) Open the recording paper holding bar to the lower side. and pass the tip of the recording paper under the bar. (Fig. 3 -7)

Fig. 3 - 7



- (f) After setting the perforations of the recording paper in the gear with the sprocket, press the recording paper by lifting the recording paper holding rod.

( Fig. 3 - 8)

Fig. 3 - 8

## 2) Loading of roll recording chart paper

The load of roll recording chart is completed in the same operation as the folding type recording paper mentioned in the above, except the operation (b) of the folding type recording paper.

### CAUTION

Use our appointed Z-folding recording paper (SE-10Z-2) and roll type recording paper (SE-10). If other recording paper is used, we can not guarantee the stable recording in recording, chart speed, Z-folding.

### 3.2.2 Insertion of pen

#### CAUTION

Pen is inserted in the condition that the pen holder is up.

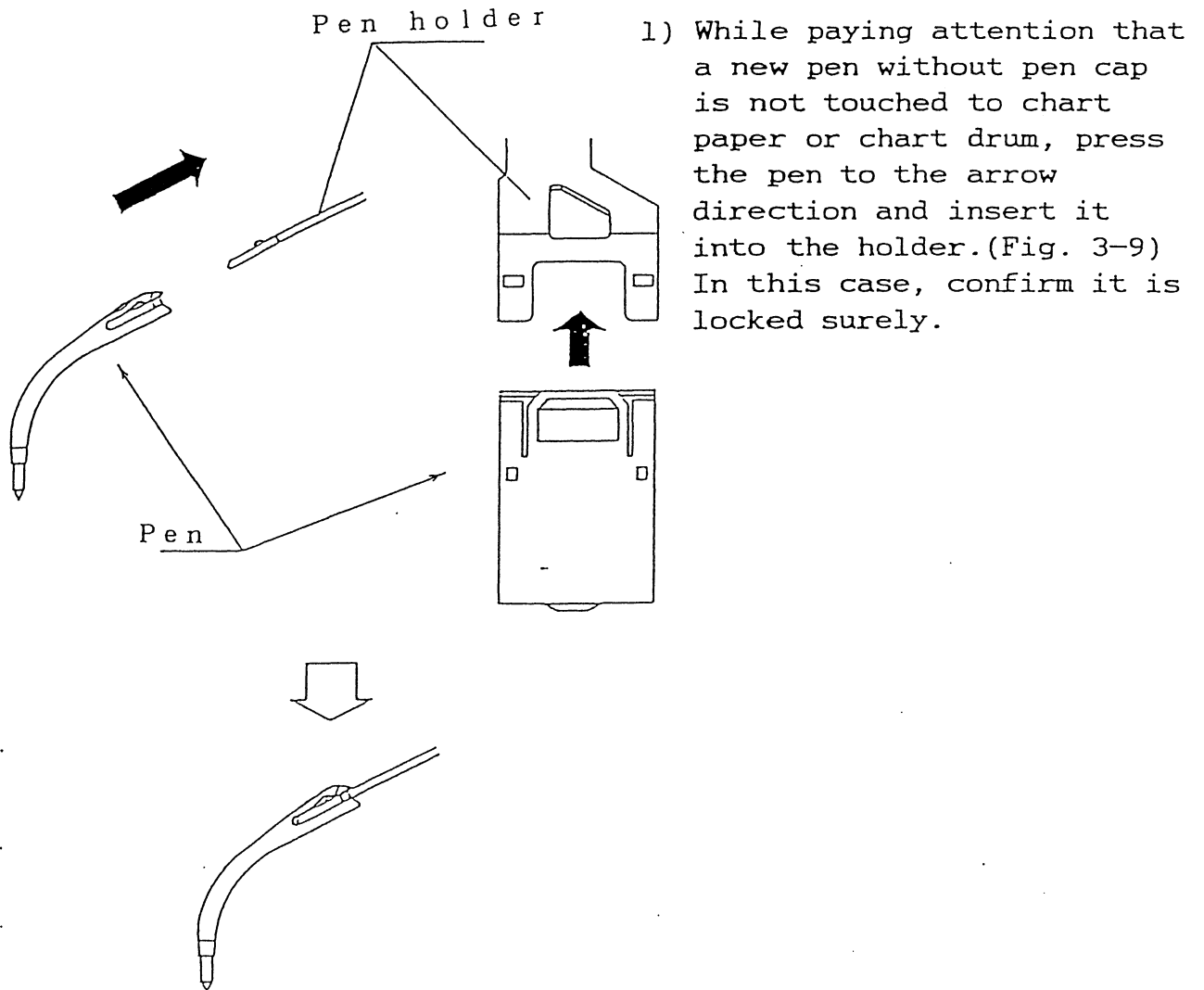


Fig. 3 - 9

- 2) When disassembling the pen, it can be disassembled easily by pulling it down.
- 3) Pen holder for 1st channel is arranged and next one for 2nd ch. arranged in turn.
- 4) The pen cap removing from pen is put to the receiver tip located at the inner part of front side not to loose it.  
When ink pen is not used, be sure to put the cap on.

### 3.4 Measurement

#### 3.4.1 Connection of input lead

Connect the circuit being measured to the input terminal on the rear side, using an adequate lead wire.

With + voltage applied to red(H) terminal, the pen defelct to right side.

#### 3.4.2 Appointment of channel

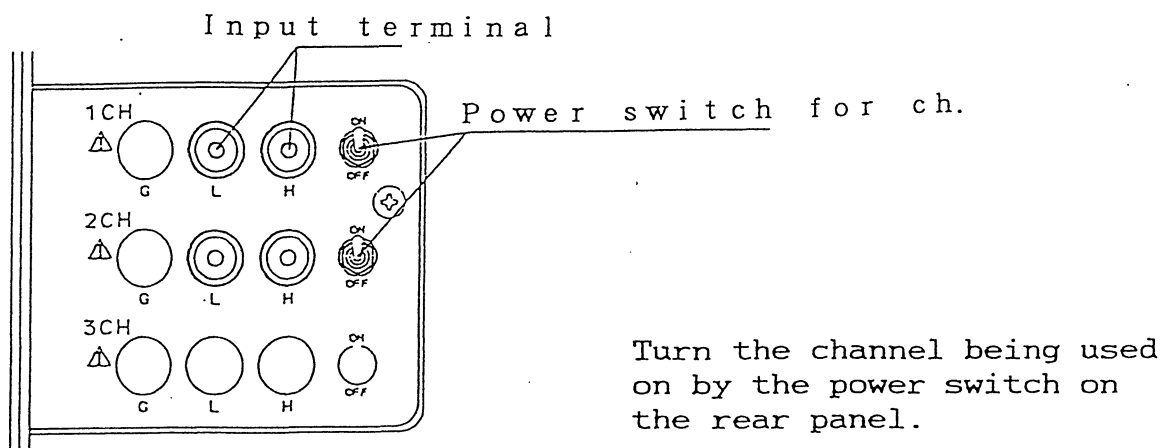


Fig. 3 - 10

When internal cell is used, the power of unused channel is recommended to be turned off for power saving.

#### CAUTION

Even if main power switch is turned on, the unit does not operates at all, with the power switch for channel turned off.

#### 3.4.3 Setting of measuring range

Set the optinum range matching the voltage being measured.

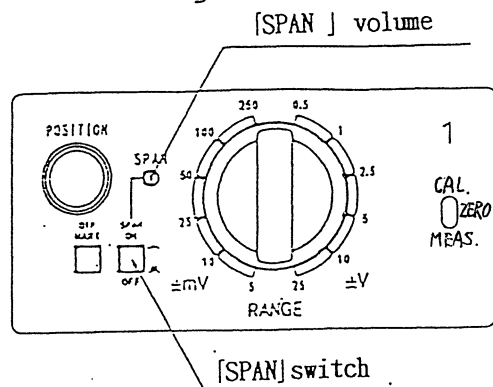
#### CAUTION

When unexpected singal voltage is measured, be sure to raise the sensitivity in turn from maximum voltage range. The maximum input voltage is 50VDC at V range & 30VDC at mV range.

### 3.4.4 Setting of chart speed

An adequate speed is set according to the movement of input signal.

### 3.4.5 ON/OFF setting of SPAN volume



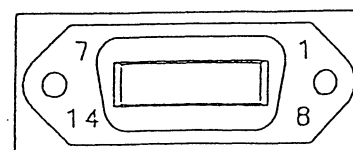
Normally, set SPAN switch off. When the span is adjusted accurately to the expansion or extraction of chart paper, or the span is optionally changed, set the SPAN volume to on and adjust it by +20% with the variable resistor.

Fig. 3 -11

### 3.4.6 REMOTE(External control)

Setting of chart speed can be remotely controlled by external TTL level signal.

Connect the amphenol 14-pin plug to the REMOTE connector to transmit or receive the control signal. Pin arrangement and function of REMOTE connector are shown in Fig.3-12.

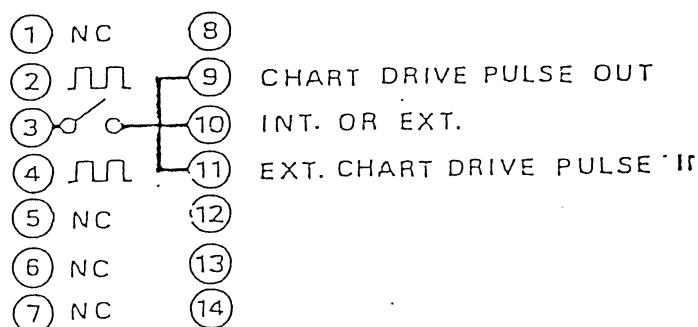


REMOTE

PLUG\* AMPHENOL:57-30140\*

- 1) INT. or EXT (Internal or external chart speed setting)

When terminals 3 - 10 are open, it becomes chart speed setting on the front panel. If they short-circuited, chart speed is controlled by external frequency.



- 2) EXT. CHART DRIVE PULSE IN (Synchronous input terminal of chart speed)

If 14-P connector is connected and make short between INT.or EXT. (3-10), chart speed is

controlled by the input 4-11 terminal, irrespective of setting of chart speed on the panel. If pulse voltage of TTL level is applied to this input terminal, chart is forwarded by 0.05mm per pulse.

The following relationship between desired chart speed L(mm/H or mm/min) and pulse frequency f (P.P.S).

$$L = 180f \text{ mm/h or } L = 3f \text{ mm/min.}$$

The upper frequency of pulse (f max.) is 120 P.P.S .

Fig. 3 - 12

3) CHART DRIVE PULSE OUT(synchronous output terminal of chart speed)

If INT. or EXT. is left open and CHART DRIVE PULSE OUT is set, normally pulse in frequency corresponding to chart speed set on the panel is output.

It is assumed that two recorder are used. One recorder is used as master which outputs char drive pulse from 2 and 9. The other is used as slave which receives the output from the master at 4 and 11 after 3 and 10 of INT. or EXT. are short-circuited. Thus , chart speeds of these two recorders perfectly coincides each other to be effective in synchronized recording of long hours. It is possible to increase the number of recorder to 2,3 or more in the same way.

### 3.4.7 Commencement of recording

1) Pull PEN lever down, move the zero point with a POSITION knob and press the FEED button to determine the start position.

2) Turn CHART ON/OFF switch ON, CAL./ZERO/MEAS.sw. to MEAS., the recording starts.

3) If zero point is required to confirm during measurement, the pen moves to zero point with CAL./ZERO MEAS. set to ZERO.

4) When you need the mark on recording waveform during measurement, the pen moves left side by approx. 2.5 divisions , with the DIP MARK switch pressed.

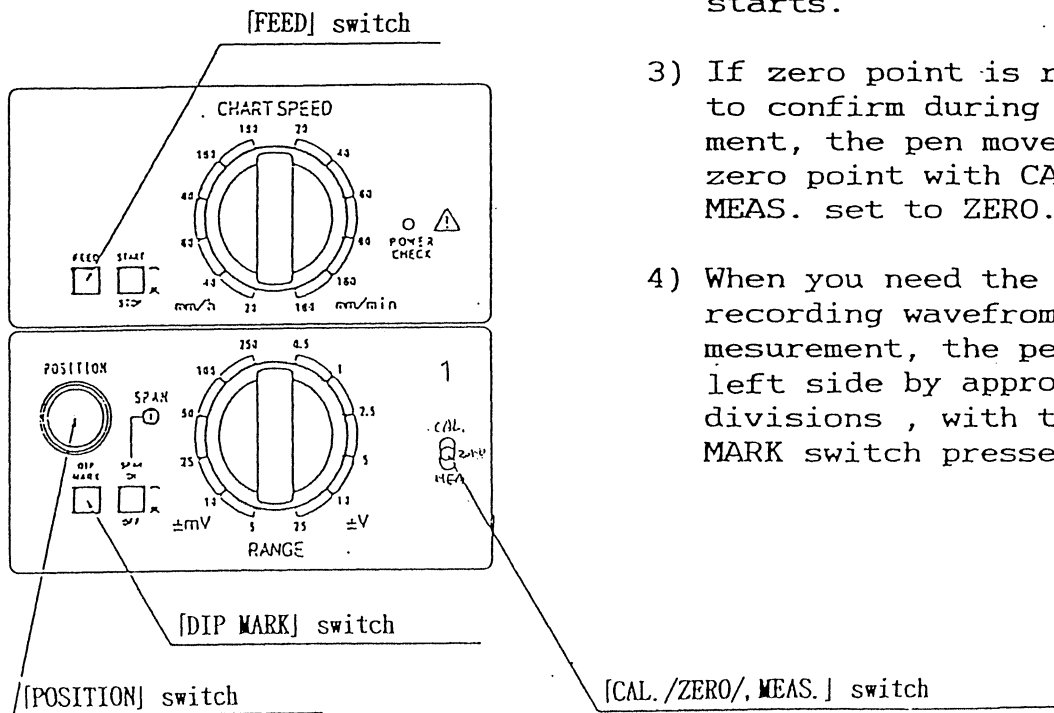


Fig. 3 - 18

### 3.5 Treatment after measurement finish

#### 3.5.1 Suspension of measurement

- (1) If necessary recording is finished, turn CHART ON/OFF switch OFF, turn the PEN lever upward, and feed the FEED button to feed the appropriate length of blank chart paper.
- (2) When using the Z-fold chart paper, cut folded sewing notch portion. When using roll chart paper, cut the paper, using the angle under the chart holding bar.
- (3) When used continuously, repeat the procedure of the item 3.4.7 Recording start.

#### 3.5.2 When not recording

After operation of (1) & (2) of 3.5.1, turn the POWER switch OFF.

#### CAUTION

After completion of measurement, lift the pen lever up and remove the pen from pen holder, be sure to put the pen cap on the tip for storage.

### 4. Maintenance

#### 4.1 Replacement of chart paper

As the length of one sheaf of strip recording chart (SE-10Z-2) is approx. 15 m, while that of one roll of roll recording chart (SE-10) is approx. 20m, it is necessary to replace the chart with new one in accordance with following schedule.

When chart approaches near the end, there will appear a warning printed in red, "NEW PAPER REQUIRED".

chart speed	Running time		Chart speed	Running time	
	15m chart	20m chart		15m chart	20m chart
180 mm/min.	Abt. 80min.	1.8hrs.	180mm/h	Abt. 3.4days	4.6days
160 "	90 "	2 "	160 "	3.9 "	5.2 "
80 "	3 "	4 "	80 "	7.8 "	10.4 "
60 "	4 "	5.5 "	60 "	10 "	13 "
40 "	6 "	8 "	40 "	15.5 "	20 "
20 "	12 "	16.1 "	20 "	1 month	1.3months

Table 4 - 1

#### 4.2 Replacement of recording pen

Disposable ink pen are good for recording in a straight line, approximately 1,600 meters.

The pen, whose ink has been used up or having become too thick and too short, cannot be used any longer and must be replaced with a new one.

Storage period of the pen is approximately one year. Keep it in a polyvinyl chloride bag and store in a cool & dark place.

#### 4.3 Replacement of internal cell

While a lamp of POWER CHECK at the lower right on the front panel keeps lightning, the recorder operates normally.

If it becomes flickering, the cell is dead and must be replaced with a new one.

The life span of cell differs according to input signal, chart speed, type and manufacturer, etc., but the following example may be used as a guide.

Type of cell	Input signal	Chart speed	1-pen	2-pen
Alkaline dry cell	0.01Hz sine oscillating width:150 mm	- 80mm/hr.	70 hours	33 hours

#### 4.4 Calibration of sensitivity

At times, satisfactory accuracy of the recording result may not be obtained due to chart expansion and contraction. In such a case, follow the procedure described below to calibrate sensitivity.

- 1) Set the input selector switch to ZERO and turn the POSITION knob so that zero point moves to the left end.
  - 2) If the input selector switch to "CAL" position, the pen moves right side.
  - 3) After turning SPAN switch On, turn the variable volume so that the pen accurately moves right end.
- ◇ With above procedure, calibration of sensitivity is completed. With the SPAN switch turned to "OFF", the sensitivity changes to internal span having calibrated with no expansion/extraction paper.



## 5. General Description

This recorder is a high performance portable recorder designed to mainly use outdoor. It has features of small size, light weight, robust, and endures the usage in bad environmental condition such a light rain with drip-proof vinyl cover on.

It features 3-way power source which permits usage freely where commercial AC power is not available, calibration of sensitivity on the front panel, chart feed function which is convenient for time axis adjustment at recording start and supplementary plate for writing, allof which full up the operationabilty more.

## 6. Constitution

This recorder has some blocks of functions,i.e. input unit section for voltage-division/amplifier of input signal voltage, and main board section ,which consists of servo amp. section to drive the pen, power source section to supply the power and chart drive section to feed the chart paper.

Drawing of constitution

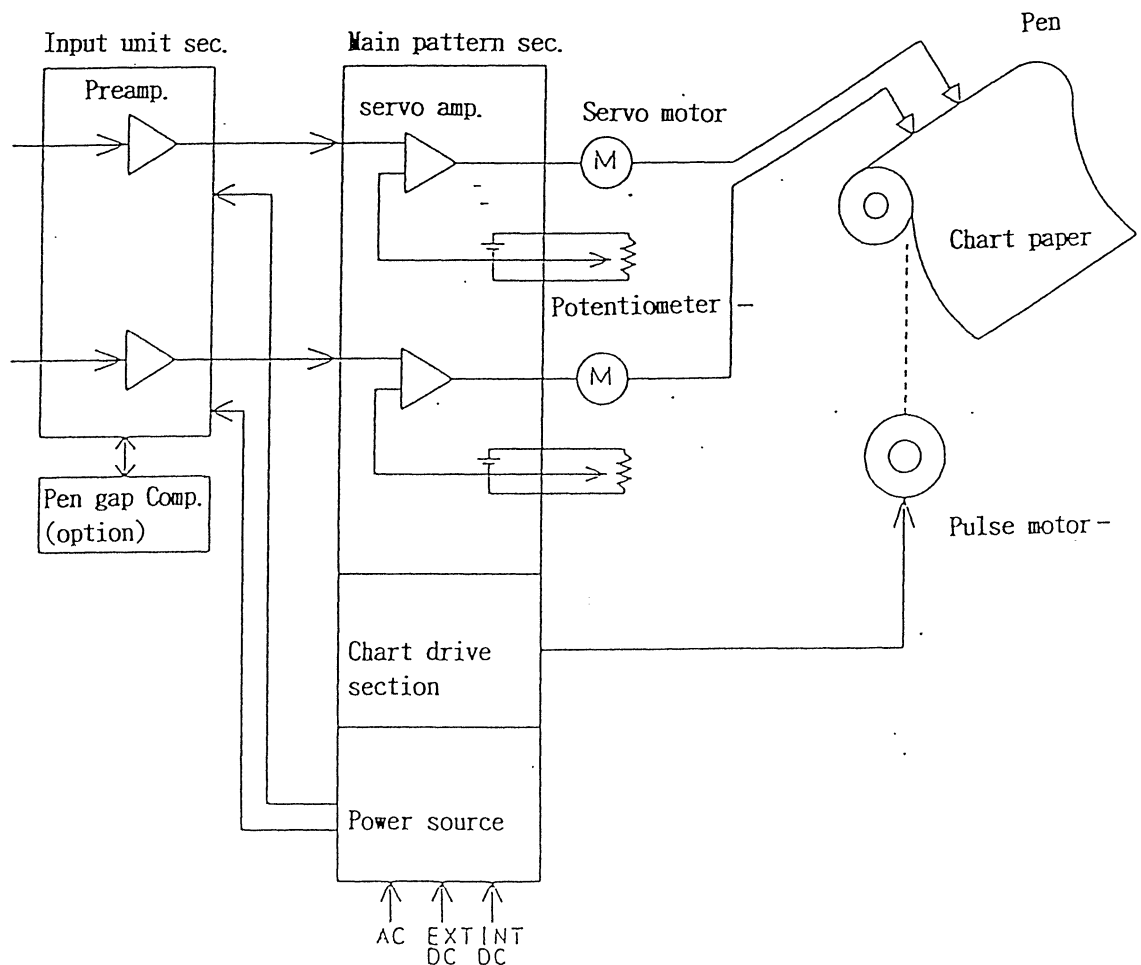


Fig. 6 - 1

## 7. Specifications

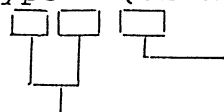
### 1) Standard constitution

Operating method	Self-balancing method
Pen number	1 or 2 pens
Input	rear panel fixed
Color of felt-tip pen	1st pen CH1 red (standard) 2nd pen CH1 red ,CH2 green (standard)
Measuring range	$\pm 5, 10, 25, 50, 100, 250\text{mV}, +0.5, 1, 2.5, 10, 25\text{V}$ , 12 ranges
Input resistance	Approx. $1\text{M}\Omega$
Permissible signal resistance	Less than $10\text{k}\Omega$
Recording accuracy	$\pm 0.5\%$ of effective recording width (including linearity at ref. range) Ref. range: $250\text{mV}$
Dead band	Less than $\pm 0.2\%$ of effective width
Error between ranges	$\pm 0.25\%$ of pen deflection width
Temp. coefficient	Zero: $0.6\mu\text{V}/^{\circ}\text{C}$ $+0.075\%$ of range/ $^{\circ}\text{C}$ FS : $0.075\%$ of range / $^{\circ}\text{C}$
Effective recording width	$150\text{mm}$
Pen interval	approx. $5\text{mm}$
Pen speed	approx. $700\text{mm}/\text{sec.}$ (at line)
Zero adjustment zone	Full range possible for each range
Span ADJ.	Approx. $\pm 20\%$ of full scale with OFF switch (on the front panel)
Span calibration	Self-calibration is possible by setting input selector switch to CAL. and turning the SPAN volume.
Zero check	Possible during measurement using the switch on the front panel
Recording paper	Effective recording width x length roll chart paper (SE-10) $150\text{mm} \times 20\text{m}$ Z-fold chart paper (SE-10Z-2) $150\text{mm} \times 15\text{m}$
Chart speed	$20, 40, 60, 80, 160, 180\text{mm}/\text{h}$ & $/\text{mm}$ , 12 ranges
Accuracy of chart feeding	$\pm 0.25\%$ (reference: crystal oscillator)
Pen lift up mechanism	Simultaneous lift up
Chart feeding	$360\text{mm}/\text{min}$ constant
Construction	Vertical
Ambient condition	$0$ to $40^{\circ}\text{C}$ , $40$ to $80\%\text{RH}$
Power source	Internal cell UM-1, 6F22 or D size ( $1.5\text{V}$ ) 6 pcs. AC line V, $50/60\text{Hz}$ External battery $12$ to $27\text{VDC}$
Power consumption	AC line 1 pen approx. $7\text{VA}$ at balance 2 pen approx. $9\text{VA}$ at balance
Dimensions	W: $355$ H: $200$ D: $212$
Weight	1 pen approx. $5.1\text{kgs}$ 2 pen approx. $5.4\text{kgs}$
External control	Synchronous input/output of chart feed
Battery check	Blicking of LED (for internal cell)
Dip marker	for each channel (approx. $2.5$ div.)

## 7.2 Standard accessories

Disposable felt-tip pen	each 1 (P-1201 to 1202A)
Chart paper(Z-fold)	1 (SE-10Z-2)
Power cord	1 pc.
External DC plug	1 pc.
Instruction manual	1 copy

## 7.3 Consumables

chart paper	Z-fold type (SE-10Z-2)
	Roll type (SE-10)
Disposable felt-tip pen	P - 12 

Disposable pen can be used according to application for standard or low speed.

Its standard is as follows:

Standard type : General recording

Low speed type: Recording at low chart speed of less than approx. 80mm/h.

## 8. Handling of Options

### 8.1 Chart reroll adapter

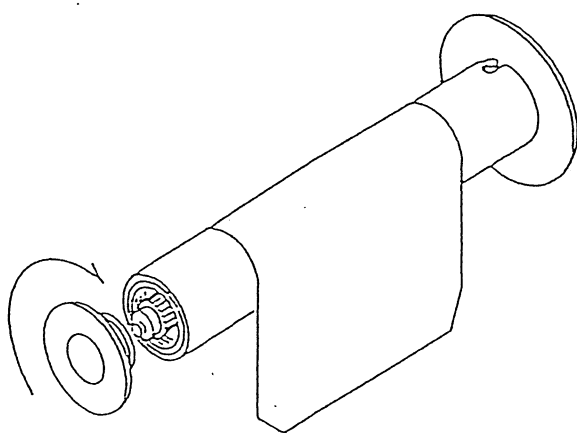
This is built in the recorder to reroll the recorded roll chart.

#### 8.1.1 Loading of chart

The roll chart is loaded into the recorder. (Refer to item 3-3-1 of this manual.

In this case, pull out the chart paper by approx. 30cm forward to reroll it to chart bobbin.

#### 8.1.2 Setting of chart bobbin to chart reroller

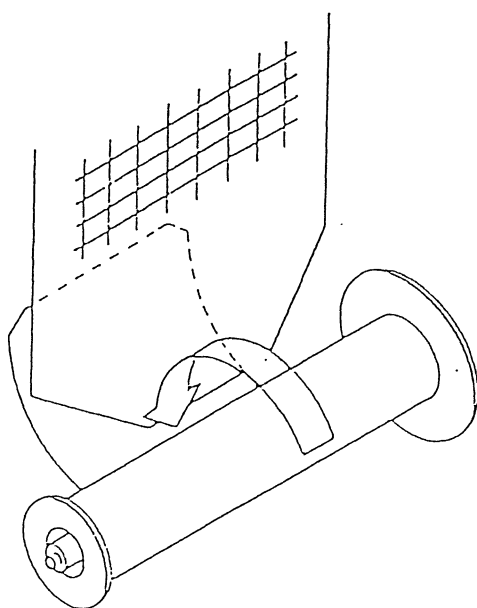


A left bobbin receiver of reroller is of screw in type and disconnected by turning it clockwise.

Insert the bobbin so that chart holding chart is set as shown in Fig. 8-1 and restore the left bobbin receiver to the original position.

In this case, a dent at the end of bobbin is set to the pin of right bobbin receiver.

#### 8.1.3. Setting of chart bobbin for chart



Insert the tip of chart loaded in the recorder, facing the printed side to outside, between chart bobbin and chart holding paper as shown in Fig. 8 - 2 and reroll it to arrow direction 4 or 5 times.

Fig. 8 - 2

#### 8.1.4 Insertion & removal of chart reroll adapter

Hold the center of the chart rolled bobbin , insert the right end (gear side) of it to the hole of spring plate and right end of it to the left axis receiver, while pressing it strongly right.

When removing it, unhook the left end , while pressing it to right side and then unhook the right end.

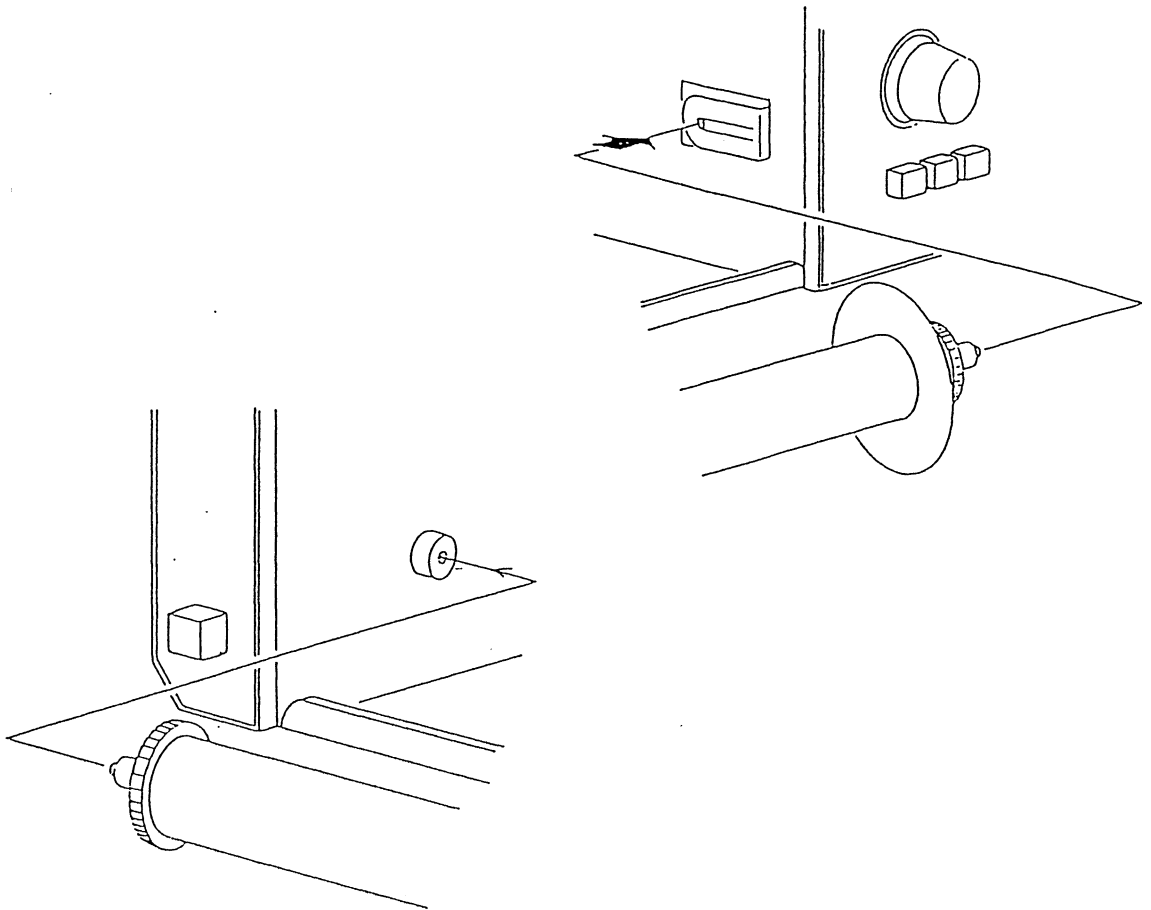


Fig. 8 - 3

#### CAUTION

- ◇ When loading to the recorder, confirm that the gear of reroller is securely engaged to that of the main body.
- ◇ Do not turn torque adjustment knob of the reroller.
- ◇ Opening or closing of chart holding block is made after unloading the chart reroller.  
The chart holding block can not be opened or closed with the reroller as it is loaded.

## 8.2 Acrylic door

This exhibits dust-proof effect when the recorder is used outdoor or at the place much dust exist.

### 8.2.1. Removal or attachment of the door

Open the door forward and remove the right door axis forward in the state that the slide pin located at right rotating section is slided left side. Next, while whole door is slided right side, unhook the left door axis from the axis receiver.

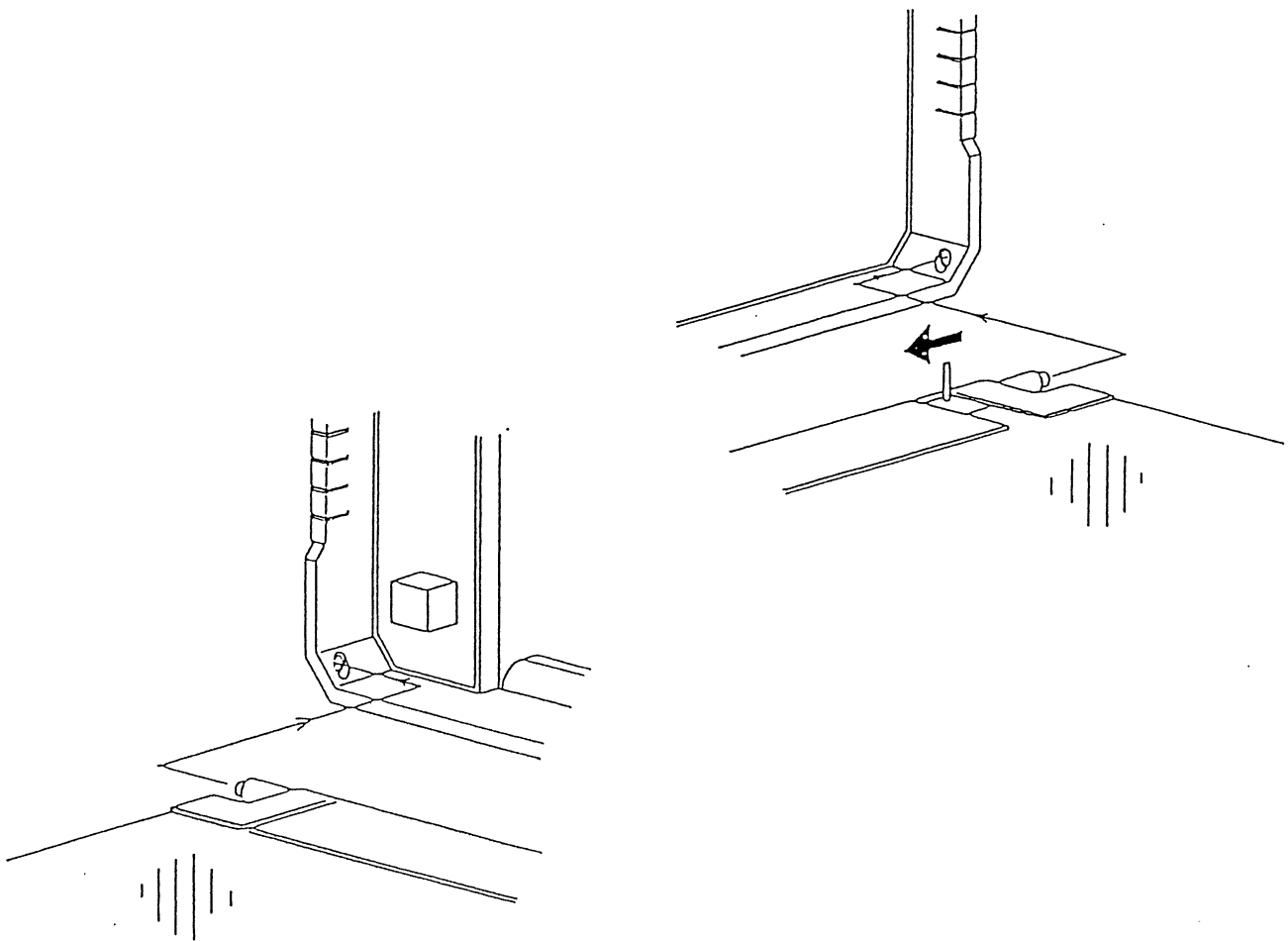


Fig. 8 - 4

For attachment, first of all, insert the left door axis into the left axis hole and insert the right door axis to the right axis hole, in the state right slide pin is slided to left side.

### 8.2.2 Opening and closing the door

With the PUSH OPEN label pushed, the lock is unlocked and the door can be opened. Pressing it again locks to close the door.

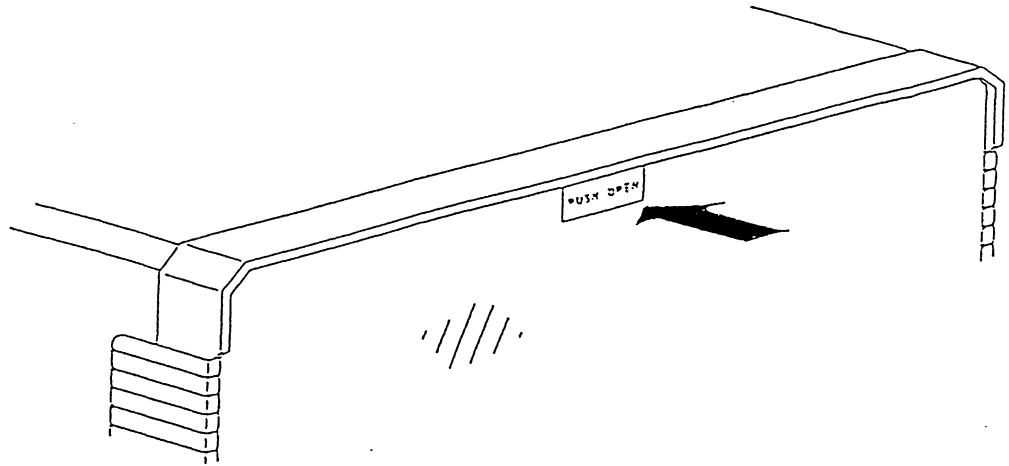


Fig. 8 - 5

#### CAUTION

Opening angle of door is  $90^{\circ}$ . If opens more or put the something on it, rotating section might be damaged.

### 8.3 Time axis compensation circuit (PGC : Pen Gap Compensation)

There is physically approx. 5mm distance between the each pen of EPR-3021. Even if the same waveform is applied to each channel at the same time, it seems that time difference signal is applied from the chart paper as shown in Fig. 8-6

Therefore, when the phenomenon is analyzed from the recording result, it is necessary to check the mutual relationship of recorded waveforms, always considering the approx. 5 mm distance exists between channels.

PGC resolves this trouble and changes the recording of Fig. 8-6 to Fig. 8-7, permitting understanding of mutual relationship of each waveform at a glance.

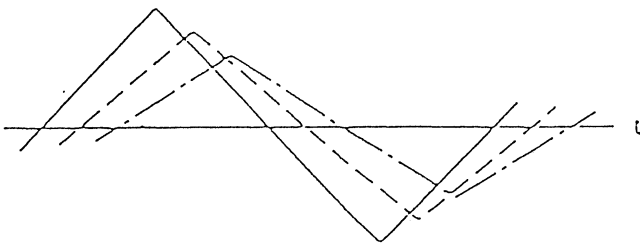


Fig. 8 - 6

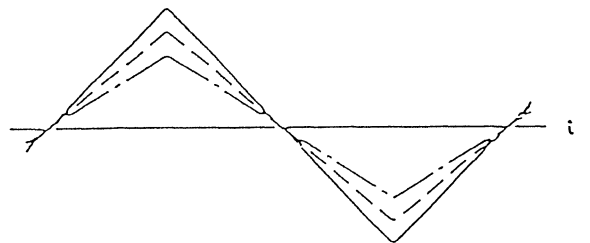


Fig. 8 - 7

### 8.3.1. PGC ON/OFF (Pen Gap Compensation)

As shown in Fig. 8-8 , PGC ON/OFF switch is located under the channel switches on the rear input terminal section. When PGC is not used, be sure to turn the switch OFF.

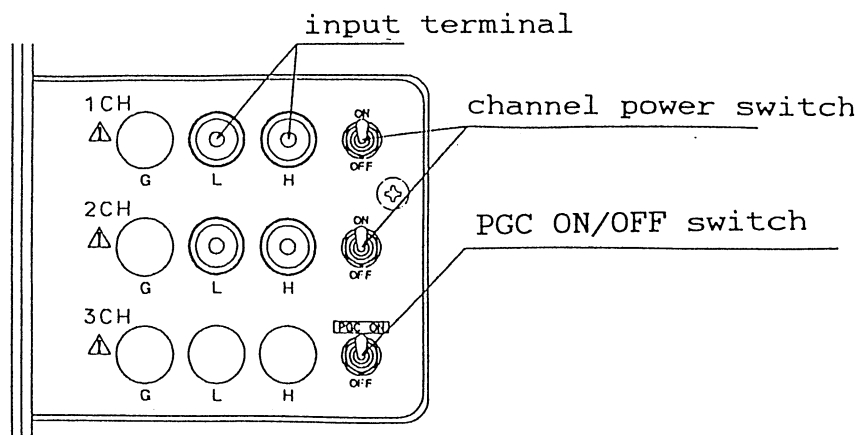


Fig. 8 - 8

### 8.3.2. Necessary number of PGC

	2 pen type
Necessary Number of PGC-3000	1



#### 8.4 Drip-proof vinyl cover

It protects the recorder itself and measuring recording data when the recorder is used in the bad environment such as in the rain (small rain), tunnel where water drips are dropped, etc. The recorder can be carried with the vinyl cover on. It is transparent vinyl with the zippers, so it is easy to open or close the front part and confirm the measured data easily.

##### 8.4.1 Attachment of drip-proof vinyl cover

- (1) While inserting the strap cover of vinyl cover to the arrow direction as shown in Fig. between the case of recorder and the strap, put the vinyl cover on the recorder.

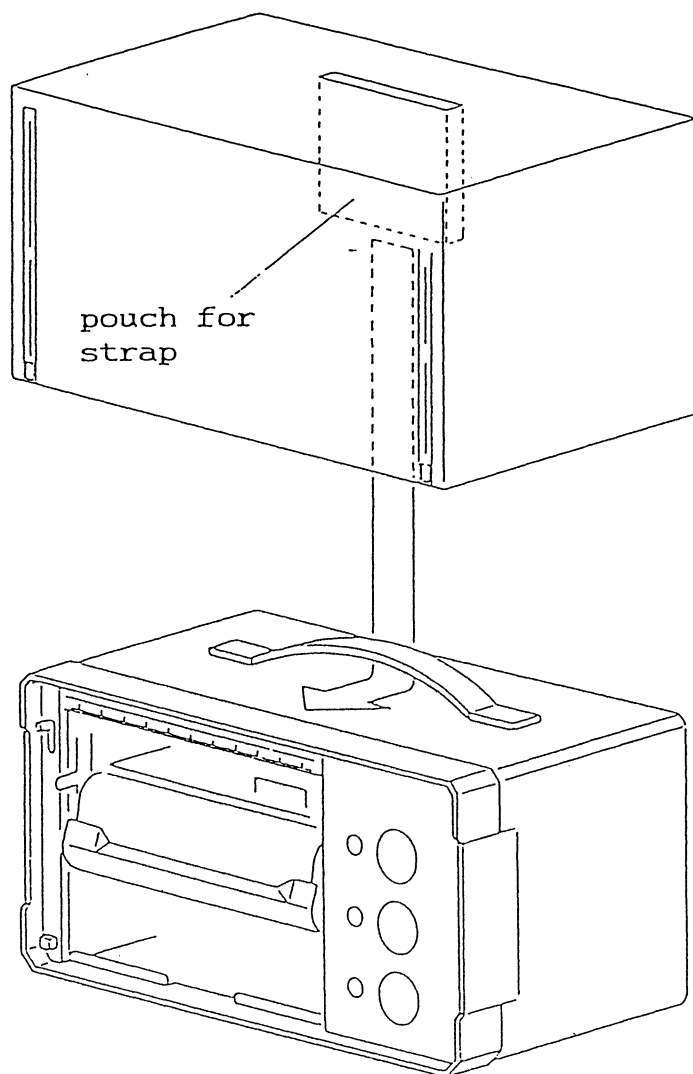
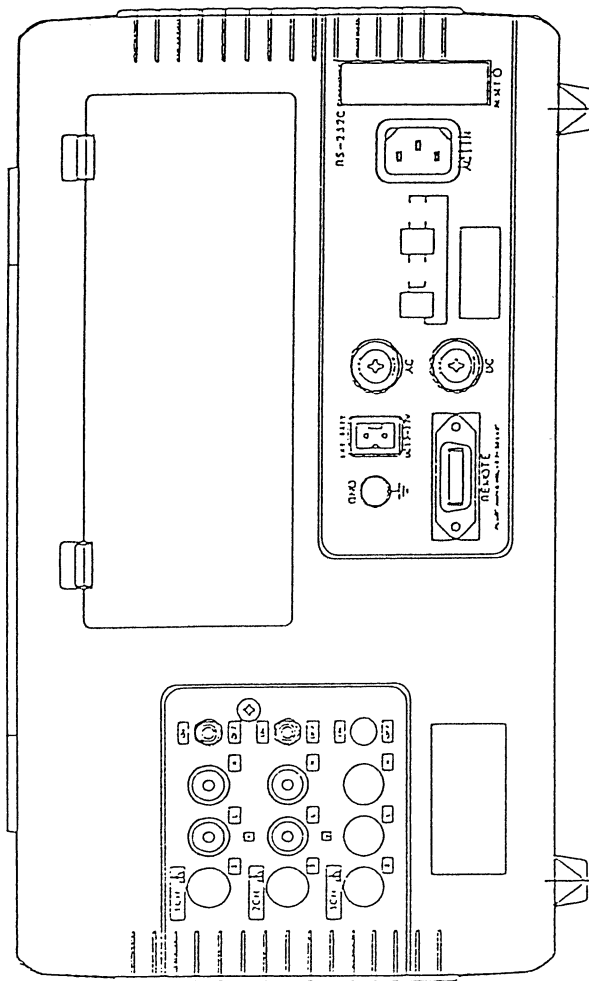
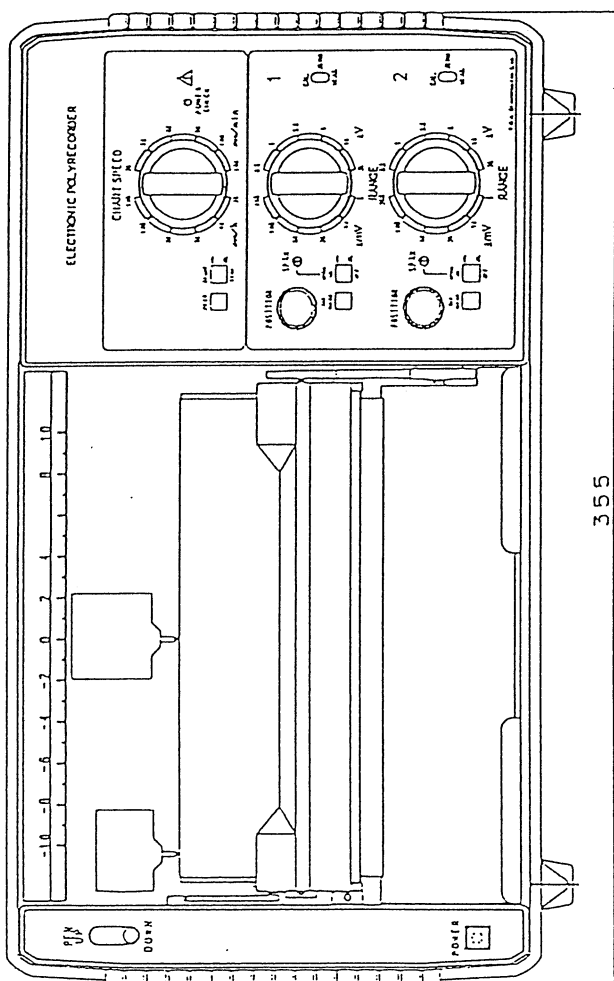
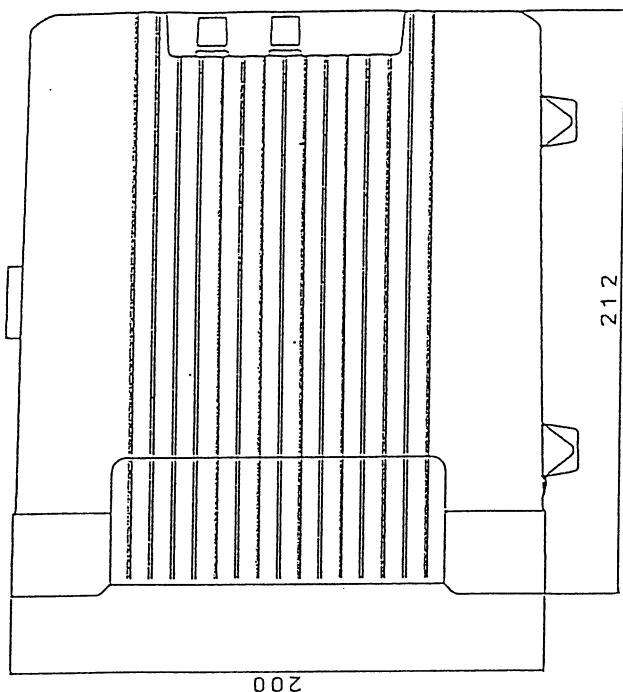


Fig. 8 - 9

# 9. External View (EPR-3000 SERIES)



HIOKI EPR-3000 Series (EPR-3011, 3021)  
ELECTRONIC POLYRECORDER  
Instruction Manual

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