



NIHON KOHDEN
CORPORATION

OPERATOR'S MANUAL

INK-WRITING RECORDER

Model WI-681G
WI-641G

GENERAL HANDLING PRECAUTIONS

**This device is intended for use only
by qualified medical personnel.**

**Please read these precautions thoroughly
before attempting to operate the instrument.**

1. To safely and effectively use the instrument, its operation must be fully understood.
2. When installing or storing the instrument, take the following precautions:
 - (1) Avoid moisture or contact with water, extreme atmospheric pressure, excessive humidity and temperatures, poorly ventilated areas, and dusty, saline or sulphuric air.
 - (2) The instrument should be placed on an even, level floor. Vibration and mechanical shock should be avoided even during moving.
 - (3) Avoid placing in an area where chemicals are stored or where there is danger of gas leakage.
 - (4) The power line source to be applied to the instrument should correspond in frequency and voltage to specifications, and have allowable current capacity.
 - (5) Choose a room where a proper grounding facility is available.

3. Before operation:

- (1) Check that the instrument is in perfect operating order.
- (2) Check that the instrument is grounded properly.
- (3) Check that all cords are connected properly.
- (4) Pay extra attention when the instrument is in combination with other instruments to avoid mis-diagnosis or other problems.
- (5) All circuitry used for direct patient connection must be doubly checked.
- (6) Check that battery voltage and battery condition are perfect when using battery-operated models.

4. During operation:

- (1) Both the instrument and the patient must receive constant and careful attention.
- (2) Turn power off or remove electrodes and/or transducers when necessary to assure the patient's safety.
- (3) Avoid direct contact between the instrument and the patient.

5. To shutdown after use:

- (1) Turn power off with all controls returned to their original positions.
- (2) Remove the cords gently; do not use force to remove them.
- (3) Clean the instrument together with all accessories to keep them ready for their next use.

6. The instrument must receive expert, professional attention for maintenance and repairs. When the instrument is not functioning properly, it should be clearly marked to avoid operation while it is out of order.

7. The instrument must not be altered or modified in any way.

8. Maintenance and inspection:

- (1) The instrument and parts should undergo regular maintenance inspections.
- (2) If stored for extended periods without being used, make sure prior to operation that the instrument is in perfect operating condition.

9. When the instrument is used with an electrosurgical instrument, careful attention should be paid to the application and/or location of electrodes and/or transducers to avoid possible burn to the patient.

10. When the instrument is used with a defibrillator, make sure that the instrument is protected against defibrillator discharge. If not, remove patient cables and/or transducers from the instrument to avoid possible damage.

C O N T E N T S

	page
INFORMATION	1
FEATURES	1
EXPLANATION OF CONTROLS AND SWITCHES	2
Top panel	2
Front and rear panels	5
PREPARATION	6
1.Cable connections	6
2.Recording paper loading	6
3.Supplying recording ink	9
4.Power switch ON	10
5.Operation check and adjustment	10
MEASUREMENT	11
MAINTENANCE	11
1.How to remove the pen	11
2.How to mount the pen	12
SPECIFICATIONS	13
STANDARD ACCESSORIES	14

INFORMATION

Exclusive recorders for the Nihon Kohden RM-6000 Series Polygraph, the rectilinear ink-writing recorders, WI-641G (up to 4 channels) and WI-681G (up to 8 channels), provide accurate waveform recordings.

With a frequency response of DC to 100Hz, it meets various kinds of waveform recording requirements in the medical and industrial fields.

The 4-channel recorder, WI-641G and the 8-channel recorder, WI-681G differ only in the number of channels. Therefore, information given in this manual applies to both models.

Please read this manual thoroughly before operating the recorder. Careful handling and operation will assure its optimum performance and long service life.

NOTE: Please specify the chart number printed on the recording paper when ordering.

FEATURES

1. A newly developed position feedback galvanometer and a rectilinear-writing mechanism provide clear, fine recording without waveform distortion. The frequency response, transient response, and linearity have also been improved.
2. The pen can be replaced easily with one hand operation without using any tools.
3. Remote control of the recorder is possible. The remote control box, RY-600G, controls the operation of the recorder remotely.
4. The recorder can be mounted on the Rack neatly. Using the Rack Mounting Kit, DR-680G, the recorder can be smoothly withdrawn from the Rack for use or can be accommodated in the Rack when not in use.
5. Weight of the recorder is reduced. By employing a DC motor, the gear mechanism is made compact. The pen galvanometer has also been made compact. Thus the total weight of the recorder has been reduced to approx. 2/3 of the previous model.

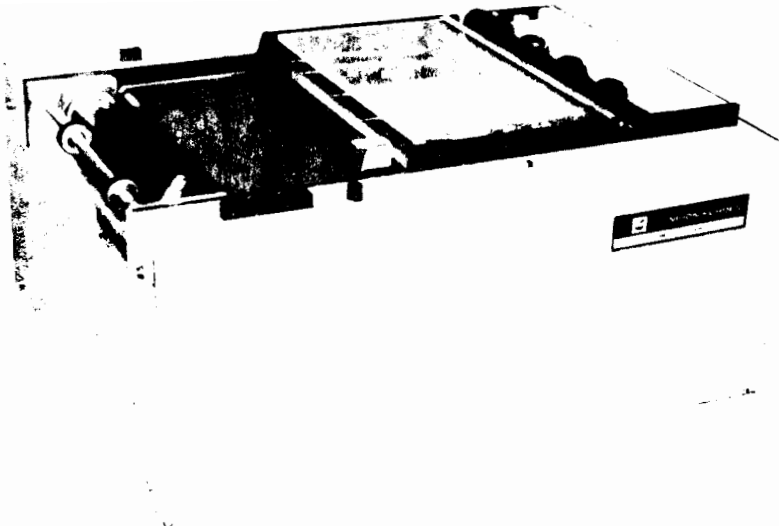


Figure 1

EXPLANATION OF CONTROLS AND SWITCHES

◇ TOP PANEL

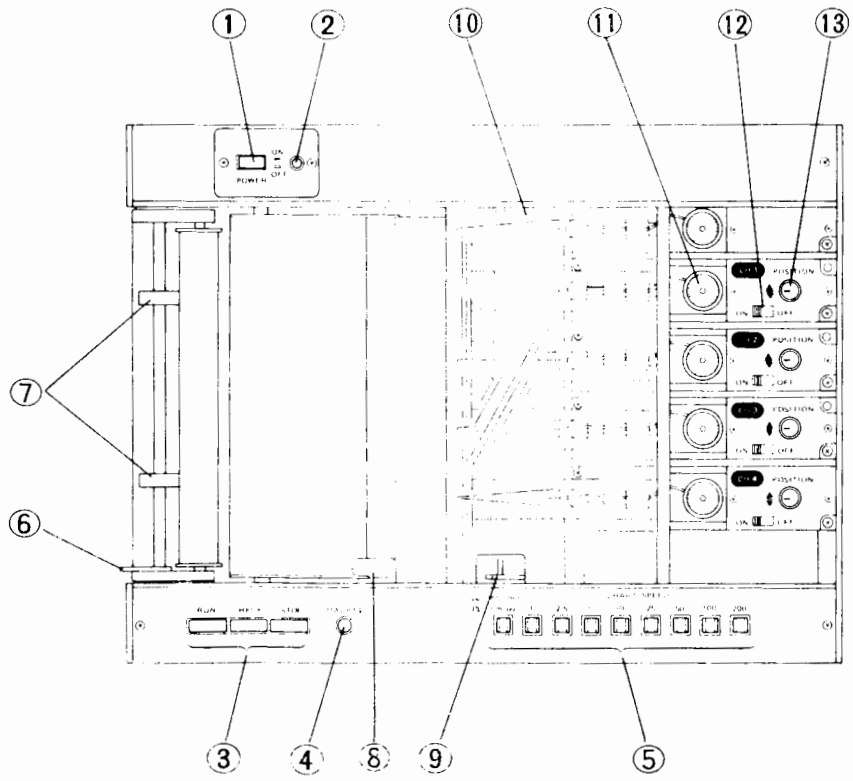


Figure 2

Items	Descriptions
(1) POWER	Pressing the POWER switch(1) lights the Power Lamp(2) and supplies power to the instrument. Pressing the switch again turns the power off.
(2) Power Lamp	Lights when the power is on.
(3) STOP-CHECK-RUN	Controls the chart drive mechanism and recording pen deflection in a single operation.
(4) MARKER	While this switch is pressed, a step identification mark is superimposed on the timing signal.
(5) CHART SPEED	<p>Selects the chart driving speeds with the combination of a black button and grey buttons.</p> <p>Black button: Selects the major chart driving speed modes of MM/SEC or MM/MIN. In MM/SEC, a timing mark is recorded every second. When the MM/MIN button is depressed, the speed mode changes to the MM/MIN and a timing mark is recorded every minute.</p> <p>Grey button: Press any desired button to select the chart driving speed in the speed mode(MM/SEC MM/MIN) selected by the black button.</p>
(6) Pressure Roller Release Lever	Releases the paper driving roller and the paper is stopped when the lever is turned to the right. When the lever is turned to the left, the paper is driven.
(7) Paper Pressure Roller	A method to apply a pressure to the recording paper. When loading narrow width recording paper, slide the roller to the desired position.
(8) Paper Loading Lever	Pull up the lever to open the paper magazine when loading the recording paper.
(9) Pen Lift Lever	Turn the lever to the right to lift all recording pens. An individual pen lifter is also provided to protect the recording pen tips from damage(See Fig. 3)

	RECORDING PEN	CHART DRIVE
STOP	Does not deflect	Stops
CHECK	Deflects	Runs Slowly
RUN	Deflects	Runs

NOTE: be sure to turn off the pen switches(12) when lifting the recording pens.

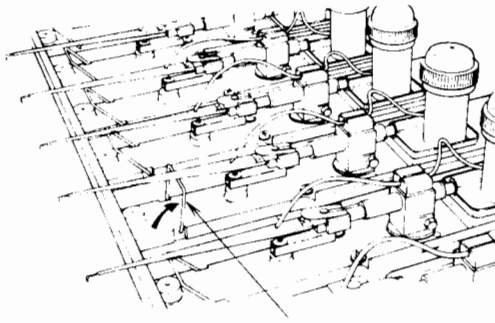


Figure 3

(10) Pen Cover

Protects the recording pens and the pen galvanometers from damage. Remove the pen cover when replacing the recording pen or adjusting the pen pressure, alignment and direction or when lifting the recording pen individually.

(11) Ink Reservoir

Holds the ink and distributes it to each recording pen. To load the recording ink, remove the rubber cup on the ink reservoir. Press the individual rubber cap until ink flows from the pen tip.

(12) Pen Switch

Controls the pen galvanometer ON/OFF. Turn off the switch of the channels which are not in use.

(13) POSITION

Centers the pens. The PEN ON/OFF switch must be ON. The POSITION control is operative even when the STOP-CHECK-RUN switch is set to STOP.

◇ FRONT AND REAR PANELS

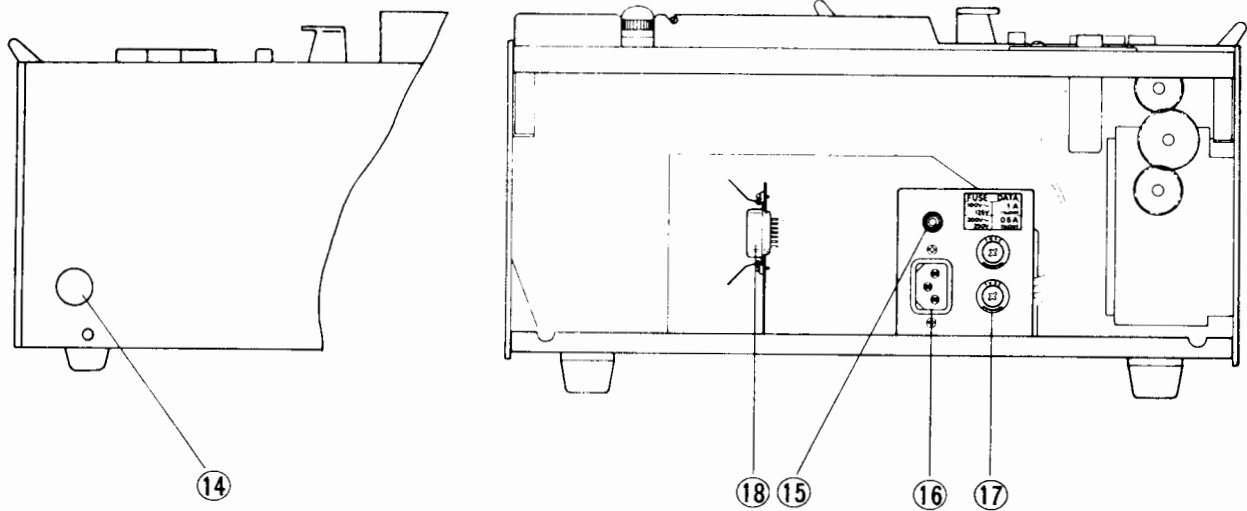


Figure 4

(14) Remote Connector Mounting Hole

When connecting the optional Remote Control box (Model RY-601G), the mating connector is mounted on this hole. Usually, this hole is blanked.

(15) Ground Terminal

Binding post that allows the ground lead to be connected to the recorder. When using a three-prong type power cord where one contact is grounded, no ground lead connection is needed.

(16) AC Receptacle

AC line input receptacle that allows the power cord to be connected to the recorder,

(17) Fuse Holders

Contain the power line protection slow-blow fuses (0.5A for 220 to 240V AC operation, 1A for 100 to 125V AC operation) inside the holders. For access to the fuses, remove the caps using a 4mm Philips screwdriver.

(18) Input Connector

A multi-pin connector that receives the input signals from the amplifiers. The following shows the pin assignments of the Input connector.

Pin No.	Signal
1	Channel 1 input signal
2	Channel 2 input signal
3	Channel 3 input signal
4	Channel 4 input signal
8	Channel 5 input signal
9	Channel 6 input signal
10	Channel 7 input signal
11	Channel 8 input signal
5, 12	Signal earth
7	CAL
14	INST

Only for Model WI-681G

PREPARATION

1. CABLE CONNECTIONS.

After mounting the recorder on the rack, connect the power cord to the AC receptacle on the recorder rear panel. The power cord plug (3-prong type) should be connected to a 3-contact-outlet where one contact is properly grounded. If a 2-prong type power cord is used, connect one end of the ground lead to the rear panel Ground Terminal and the other end to a good electrical ground.

2. RECORDING PAPER LOADING.

2.1 Roll paper loading

- 1) Lift the paper loading lever (8) and take the paper shaft out of the paper magazine.

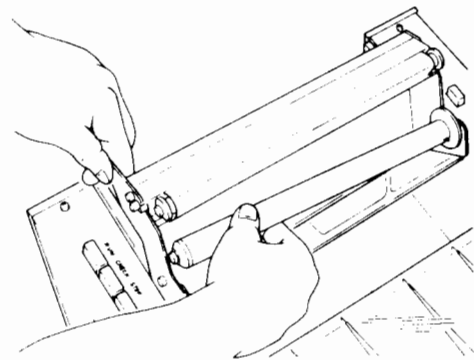


Figure 5

- 2) Insert the paper shaft into the hole of the roll paper until the paper shaft flange reaches the paper edge. The paper shaft flange is directed toward the first channel side.



Figure 6

- 3) Set the recording paper in the paper magazine.

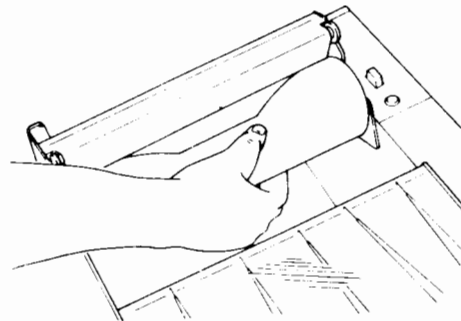


Figure 7

- 4) Pull out about 20cm of recording paper, shut the paper magazine.

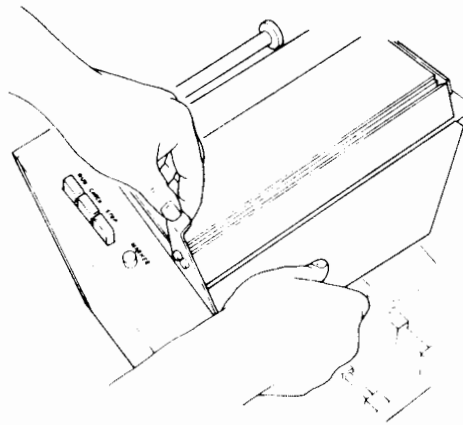


Figure 8

- 5) Set the pressure roller release lever(6) to the right; pass the recording paper under the roller(7).

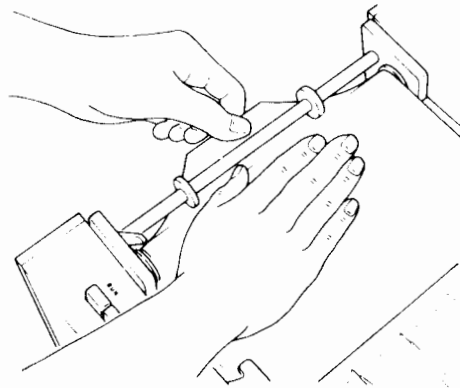


Figure 9

- 6) Return the lever(6) to its original position, taking care that the recording paper does not twist or wrinkle.

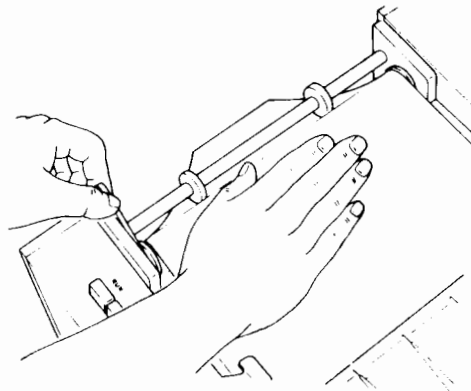


Figure 10

2.2 Z-fold paper loading

- 1) Place the Z-fold paper on the recording paper receiver. Move the paper toward the recorder until it reaches the guide plate.

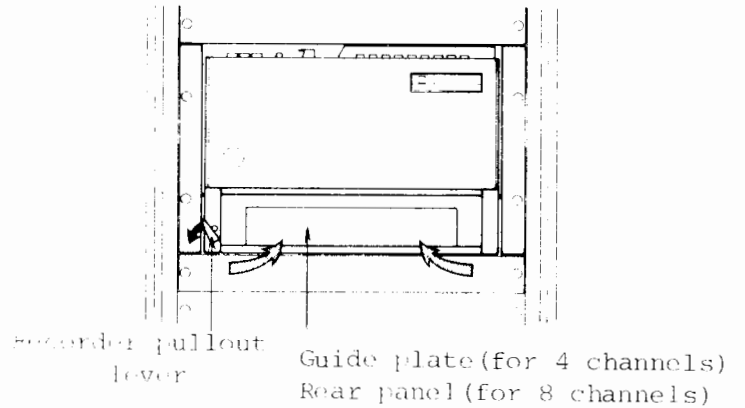


Figure 11

- 2) Lift the paper loading lever(8); take the paper shaft out of the paper magazine.

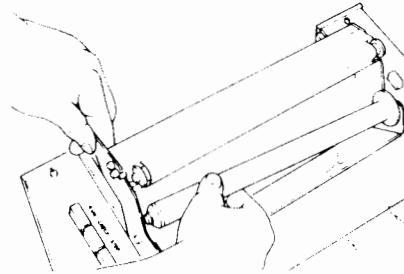


Figure 12

- 3) Pass the recording paper end through the slit at the bottom of the paper magazine.

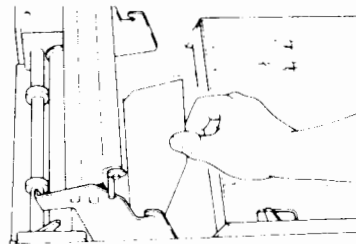


Figure 13

- 4) Pull out about 20cm of the recording paper. Set the paper shaft to the paper magazine as shown in Figure 14.

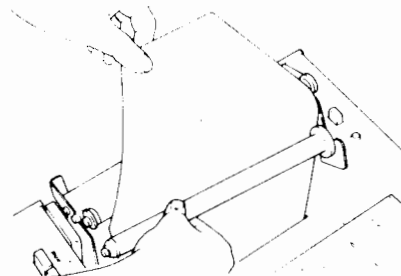


Figure 14

- 5) Gently close the paper magazine by holding the lever (6).

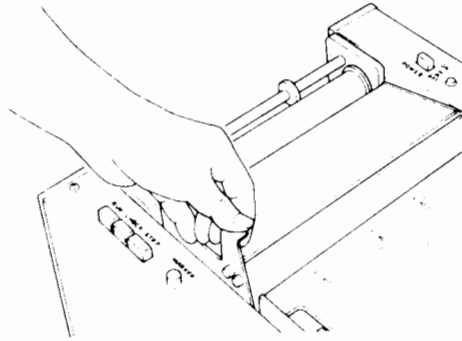


Figure 15

- 6) Set the pressure roller release lever (6) to the right; pass the recording paper under the roller (7); return the lever to its original position, taking care that the recording paper does not twist or wrinkle.

3. SUPPLYING RECORDING INK.

- 1) Remove the rubber cap from the ink reservoir (11).
- 2) Pour the recording ink into the ink reservoir.

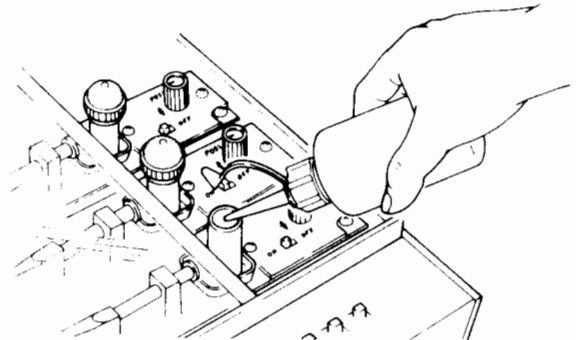


Figure 16

- 3) Replace the rubber cap. Press the rubber cap with a finger tip until ink flows into the pen tip.

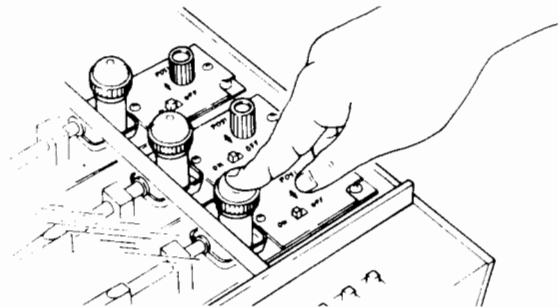


Figure 17

4) In the case that the paper is not under the pens or to avoid ink coming in contact with the paper, move the pen lift lever(9) to the right, lift all the pens and place the pen tray under the pen.

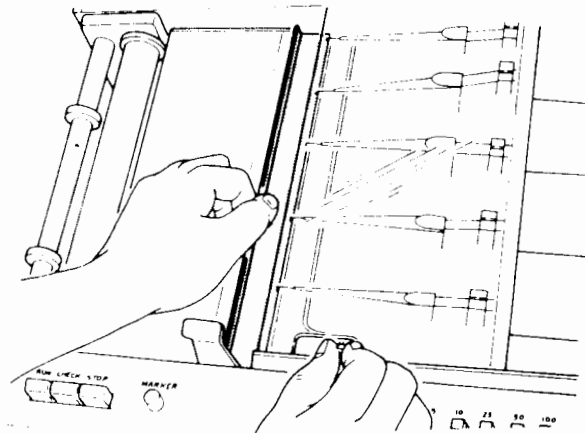


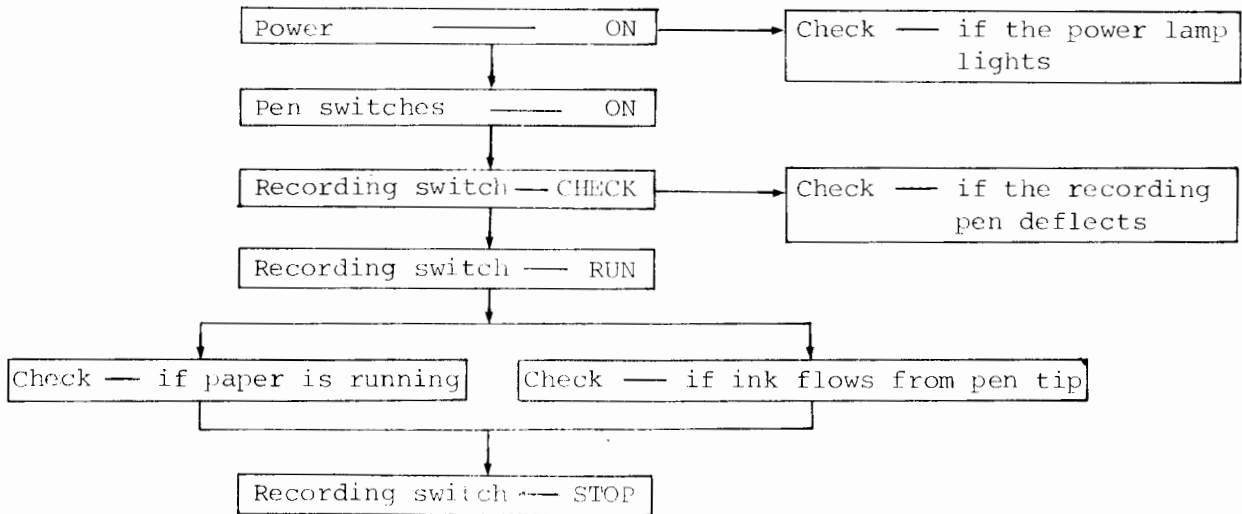
Figure 13

4. POWER SWITCH ON.

After confirming that the Polygraph is grounded to a proper ground, press the POWER switch(1) to turn it on.

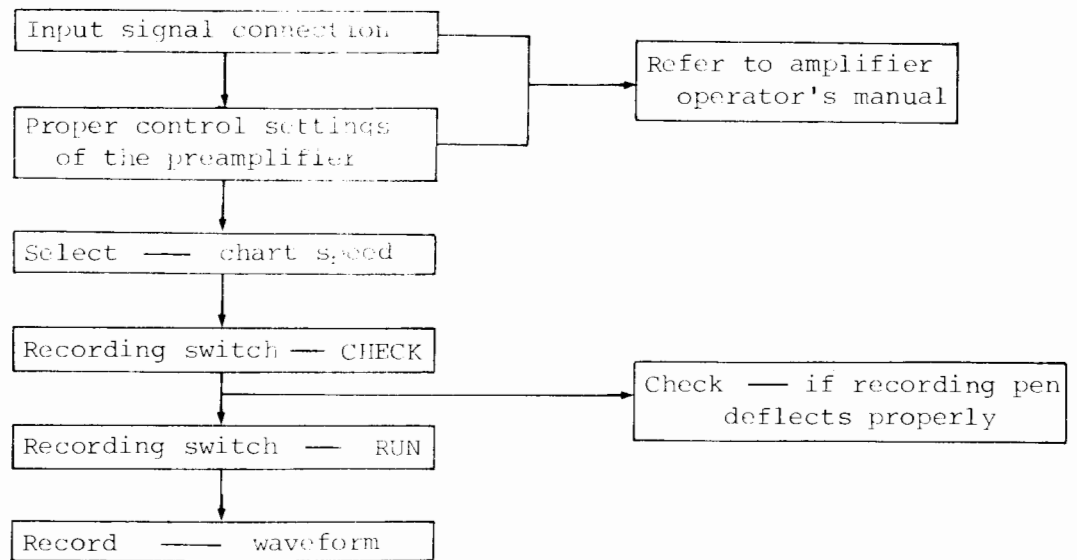
5. OPERATION CHECK AND ADJUSTMENT.

When the recording paper is loaded and the ink is filled, check the operation of the recorder according to the following procedures.



MEASUREMENT

When the above operation check is finished, record the signal using the following procedures.



MAINTENANCE

Recording pens should be replaced when damage occurs to the tips.

1. HOW TO REMOVE THE PEN.

- 1) Remove the pen cover(10).
- 2) Set the pen switches(12) off.
- 3) Remove the ink tube from the recording pen.
If the removed tube end is inserted into the hole on the rubber cap, it will prevent the ink from leaking out.
- 4) Hold the pen at the base with one finger on each side and lift up pulling the pen towards its tip.

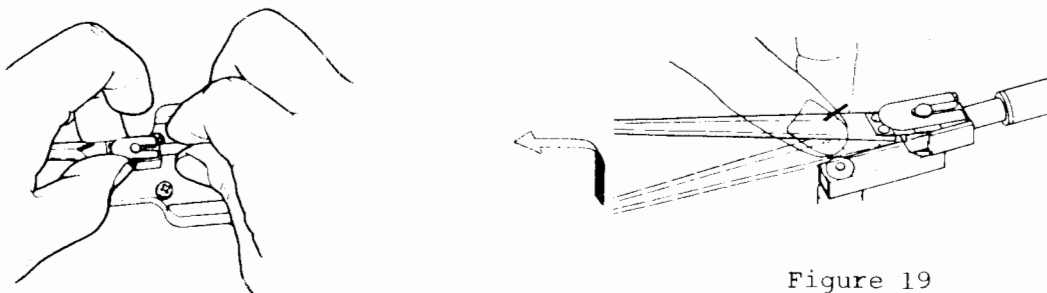
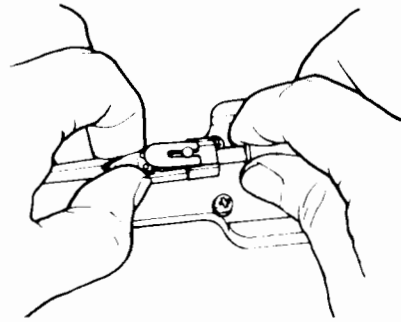


Figure 19

2. HOW TO MOUNT THE PEN.

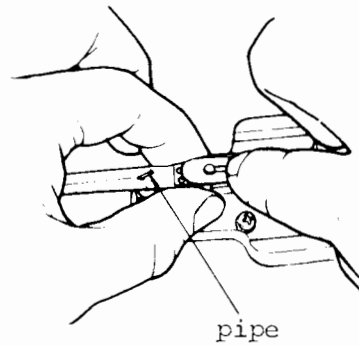
- 1) Insert the pen into the pen mounting base along the mount until the pen clicks.

Figure 20



- 2) Press down the bending part of the pen from above to firmly mount the pen on the base.

Figure 21



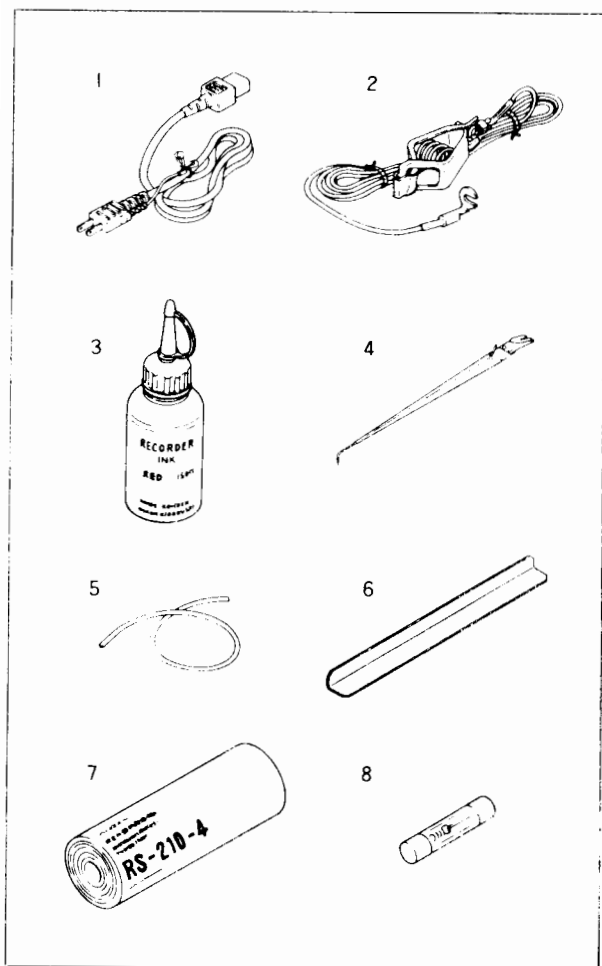
- 3) Insert the ink tube into the pen pipe.
- 4) Press the rubber cap to send the ink into the pen tip.
- 5) Turn the Pen Switch(12) on.
- 6) Adjust pen position with the POSITION controls(13) if necessary.

SPECIFICATIONS

Sensitivity	Fixed 10mm/V $\pm 3\%$ (Medium pen-amplitude galvanometer) 20mm/V $\pm 3\%$ (Wide pen-amplitude galvanometer)
Input Circuit	Single-ended, input impedance: 100K Ω or higher
Frequency Response	Referred to 10Hz signal: Medium pen-amplitude galvanometer; 100Hz (-3dB) or higher at a 10mm pen amplitude. Wide pen-amplitude galvanometer; 40Hz (-3dB) or higher at 20mm pen amplitude.
Overshoot	Within $\pm 3\%$
Maximum Amplitude	Medium pen-amplitude galvanometer; +25mm (WI-641G) +20mm (WI-681G) Wide pen-amplitude galvanometer; +40mm
Linearity	Medium pen amplitude galvanometer; Within $\pm 0.5\%$ over a 40mm-p-p pen amplitude range. Wide pen amplitude galvanometer; Within $\pm 0.5\%$ over a 80mm-p-p pen amplitude range.
Crosstalk between Channels	-46dB or less at 10Hz
Recording Paper Width	WI-681G 380mm WI-641G 210mm
Power Requirements	WI-681G: approx. 75VA WI-641G: approx. 55VA
Paper Speed	Standard speeds: 1, 2.5, 5, 10, 25, 50, 100, 200mm/sec and mm/min, 16 steps, accuracy within $\pm 2\%$ Option (Special order): 2.5, 5, 10, 15, 25, 30, 50, 60, 100mm/sec and mm/min. Accuracy within $\pm 2\%$
Timer	Provides a timing mark every second or every 10 seconds at the mm/sec position or a signal every one minute at the mm/min position. accuracy within $\pm 2\%$
Event Marker	An event mark is superimposed on the timing mark when the MARK button is pressed.
Drift	within $\pm 0.5\%$ Baseline change during 10 seconds after a 10 second start-up

Drift due to Line Voltage Variation	Line voltage variation of rating voltage $\pm 10\%$ causes within $\pm 1\text{mm}$ base line change in amplitude.
Sensitivity variation due to Line Voltage variation	Line voltage variation of rating voltage $\pm 10\%$ causes within $\pm 1\%$ change in sensitivity.
Drift due to Temperature	Less than 0.2mm for 1°C change
Insulation Resistance	100M Ω or greater between line terminals and chassis (measured by a DC 500V megger).
Leakage Current	Leakage current from chassis to ground is less than 100 μA when AC 100V is applied to line terminals.
Withstand Voltage	The instrument withstands AC 1500V applied between line terminals and chassis for one minute.
Dimensions	WI-681G : 407W x 205H x 507D mm, approx. 24kg. WI-641G : 407G x 205H x 342D mm, approx. 16kg.

STANDARD ACCESSORIES



	Q'ty	Code number
1. Power cord	1	5500218
2. Ground lead	1	5510403
3. Recording ink, red 150cc	1	4990029
4. Recording pen, LS-120D	1 (WI-641G) 2 (WI-681G)	
5. Pen tube (100mm)	2	6500956
6. Pen tray	1	1114-103174 (WI-681G) or 1114-103414 (WI-641G)
7. Recording paper	2	RS380-A (WI-681G) RS210-4 (WI-641G)
8. Fuse	2	